

**EFFICIENT AND ADEQUATE STANDARDS
FOR BUILDING SPECIFICATIONS FOR THE
CONSTRUCTION OF SCHOOLS
(23 Ill. Adm. Code 175)**

*This is the maintenance code for school facilities constructed
between July 1, 1965 through March 24, 1995.*

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STATE BOARD OF EDUCATION

NOTICE OF CODIFICATION WITH NO SUBSTANTIVE CHANGES

Heading of Part and Code Citation: Efficient and Adequate Standards for the Building Specifications for the Construction of Schools (23 Ill. Adm. Code 175)

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Conversion Table of Present & Codified Rules:

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EFFICIENT AND ADEQUATE STANDARDS FOR
THE BUILDING SPECIFICATIONS FOR THE CONSTRUCTION
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TABLE A Fire Resistance Ratings of Structural Elements, in Hours**TABLE B Height and Area Limits**

AUTHORITY: Implementing and authorized by Section 2-3.25 of The School Code (Ill. Rev. Stat. 1981, ch. 122, par. 2-3.25).

SOURCE: Amended July 16, 1965; codified at 8 Ill. Reg. 13740.

SUBPART A: GENERAL REQUIREMENTS

Section 175.10 Scope

- a) These specifications establish efficient and adequate standards for the physical plant, heating, lighting, ventilation, sanitation and safety for all new school buildings and additions to existing schools whose contracts are awarded on or after July 1, 1965. This issue and subsequent supplements shall become applicable to those school buildings whose construction contracts are awarded ninety or more days after date of issuance. Where subsequent modifications reduce requirements, schools, where applicable, may apply them retroactively.
- b) These specifications were prepared for normal school children during regular classroom hours. Boarding schools and schools and/or classrooms for the handicapped, such as mentally and physically handicapped, should be given special consideration. Facilities accessible to and usable by the physically handicapped shall be provided in accordance with the Facilities for the Handicapped Act (Ill. Rev. Stat. 1981, ch. III 1/2, pars. 3701 et seq.).

Section 175.20 Freedom of Design

While it is the intent to allow the architect or engineer all possible freedom in providing educational facilities, which conform to modern concepts of instruction, it is not practical from an enforcement standpoint to issue a document which is not specific in certain aspects. However, nothing in these standards shall be construed as prohibiting alternate arrangements and new developments, provided that the architect or engineer submit with his plans a letter explaining the nonconformance and certifying that in his opinion these facilities will provide protection equal to that herein specified and further that the State Superintendent of Education is satisfied that public safety, health and welfare are not endangered thereby.

Section 175.30 Submission of Plans

Prior to the erection of any school building, complete plans shall be submitted to the enforcing authorities having jurisdiction for approval. Such plans shall be certified to be in compliance with these specifications by an architect and/or engineer registered as required by the State of Illinois.

Section 175.40 Safety Reference Plans

Safety Reference Plans, showing as-built conditions, shall be prepared for each school and kept up to date as required in Section 175.60. A complete set of such plans shall include a site plan at a scale of not less than 1 in. = 200 ft. and a floor plan of each story (including basement and occupied attic) at a scale of not less than 1 in. = 32 ft. The following information should be shown on the plans:

- a) Site plan: Streets bordering the site; outline and identification of each building; outline and identification of each building on adjacent sites if less than 75 ft. from a school building; location of hydrants, fire alarm boxes, fences, driveways, parking areas and playgrounds; location and identification of water, gas and electric services leading to each school building; and any unusual terrain conditions.
- b) Floor plans; Wall, floor and roof construction of each fire area; elevation of basement and street floor in relation to outside grade level; location and construction of interior partitions and walls; identification and population capacity of each room and space; areas protected by automatic sprinklers and automatic fire detection systems; location of fire alarm boxes, fire alarm horns, exit and emergency lights, and fire alarm control panel; doors with direction of swing and fire resistance rating, if any, indicated; location of stairs, corridors, passageways, and other exitways; tunnels and crawl spaces; and location and identification of heating equipment and ventilating equipment.

Section 175.50 Advisory Board for School Safety

An advisory board will meet upon call by the State Superintendent to provide advice and counsel on any matters or controversies relating to these standards and to assist in keeping these standards up to date by evaluating new techniques, methods and procedures. The board will consist of representatives of the State Superintendent, State Fire Marshal, Supervising Architect and Director of Public Health and, in addition, a registered architect experienced in school design, a registered professional engineer experienced in electrical and mechanical systems for schools, a registered professional engineer experienced in school fire safety, a member of the Illinois Association of School Boards, an educational service region superintendent, a public school superintendent and additional members as deemed necessary by the State Superintendent.

Section 175.60 Continual Compliance

- a) Each school board shall be held responsible for maintaining and operating the schools under its jurisdiction in full and continual compliance with these standards in effect at the date of construction contract award. All repairs and alterations to buildings constructed under these standards and all additions to buildings shall be made in conformance with these standards.
- b) Each school board shall keep on file a certificate for each school building under its jurisdiction, prepared by an architect or engineer, listing the maximum number of persons regularly permitted on each story of each fire area and in each assembly area, based on its exit capacity as established by these standards in effect at date of construction contract award.
- c) Each school superintendent shall include in his/her annual report to the State Superintendent of Education the maximum regular occupancy and the maximum capacity of each story of each fire area and of each assembly area.

SUBPART B: USE OF MODEL BUILDING CODES AND STANDARDS

Section 175.110 Automatic Sprinklers

Buildings equipped with approved automatic sprinkler systems may be designed with the area limitations, reduced fire resistance requirements and distance-to-exit limitations provided for such buildings by any one of the accepted model codes listed herein.

Section 175.120 Distance Separation

The provisions of these standards contemplate that new school construction will be adjoining streets or other open spaces not less than 30 ft. wide or will be separated from an adjoining building by an approved fire wall and that it will be not less than 30 ft. from interior lot lines. Lesser separations will subject the building to special considerations, including percentage reductions in maximum floor areas, protection of exterior walls, and other measures as prescribed by any one of the accepted model codes listed herein.

Section 175.130 Accepted Standards

The editions of the nationally recognized standards listed below have been accepted as standards to be followed in situations not specifically covered herein and/or where specifically referred to.

ABMA - Standard Test Procedure for Packaged Fire Tube Boilers, 1959
American Insurance Association Code for Installation of Heat Producing Appliances, 1967
ASHRAE Standard 34-57-Designation of Refrigerants, 1957
ASHRAE Standard 45-Heavy Duty Furnaces, 1964
ASHRAE Standard 53-Unit Ventilators, 1934
ASME -- Miniature Boilers, 1965
ASME -Section IV -- Rules for Construction of Low Pressure Heating Boilers, 1966
ASME -Section I--Rules for Construction of Power Boilers, 1965
ASME --Section VIII, Unfired Pressure Vessels, 1965
ASTM E-84-66--American Society for Testing and Materials Test for Surface Burning Characteristics of Building Materials
CS 101.43 -- Vaporizing Oil Burners, 1943
CS 104 -- Vaporizing Oil Burners and Furnaces, 1963
CS 109 -- Stoker-fired Furnaces, 1944
CS 113 -- Vaporizing Burners and Floor Furnaces, 1963
CS 195 -- Pressure and Rotary Oil Burners and Furnaces, 1960
CS R157 -- Steel Boilers, 1950
IBR-SBI -- Net Ratings
IBR -- Testing and Rating Code for Low Pressure Cast Iron Boilers, 1964
IIA - Incinerator Institute of America, 1963
IUHA - AMCA Bulletin 10 - Steam Unit Heaters 1950
IUHA - AMCA Bulletin 11 - Hot Water Unit Heaters, 1942
MCAA (Mechanical Contractors Association of America) - Net Load Recommendations, 1965
NEMA-WHI-1949 - Electric Water Heaters
NFPA 10 - Portable Fire Extinguishers, Installation, 1967
NFPA 13 - Sprinkler Systems, Installation, 1966
NFPA 14 - Standpipe and Hose Systems, 1963
NFPA 20 - Centrifugal, Fire Pumps, 1967
NFPA 30 - Flammable and Combustible Liquids Code, 1966
NFPA 31 - Oil Burning Equipment, 1965
NFPA 37 - Stationary Combustion Engines and Gas Turbines, 1967
NFPA 40 - Cellulose Nitrate Motion Picture Film, 1967
NFPA 54 - Gas Appliances and Gas Piping, Installation of, 1964
NFPA 58 - Liquefied Petroleum Gases, Storage, and Handling, 1967

- NFPA 60 - Pulverized Fuel System, 1961
- NFPA 70 - Electrical Code, 1968
- NFPA 72A - Local Protective Signaling Systems, 1967
- NFPA 728 - Auxiliary Signaling Systems, 1967
- NFPA 72C - Remote Station Signaling Systems, 1967
- NFPA 72D - Proprietary Signaling Systems, 1967
- NFPA 78 - Lightning Protection Code, 1965
- NFPA 80 - Fire Doors and Windows, 1967
- NFPA 82 - Incinerators, 1960
- NFPA 89M - Clearances, Heat Producing Appliances, 1966
- NFPA 86A - Ovens and Furnaces, 1966
- NFPA 90A - Air Conditioning and Ventilating Systems, 1967
- NFPA 96 - Restaurant Cooking Equipment, Ventilation, 1964
- NFPA 101 - Life Safety Code, 1967
- NFPA 102 - Tents, Grandstands and Air Supported Structures Used for Places of Assembly, 1967
- NFPA 255 - Building Materials, Tests of Surface Burning Characteristics, 1966 ASTM E-84
- NFPA 701 - Flame-resistant Textiles and Films, Fire Tests for, 1966
- NFPA 703 - Fire Retardant Treatments, Building Materials, 1961
(Same as ASTM E-84, 1966, above)
- SBI - Steel Boiler Institute - Testing and Rating Code for Steel Boilers, 1965
- SMACNA Manual - Sheet Metal Construction
- USASI A117.1 Specifications for Making Buildings and Facilities Accessible and Usable by the Physically Handicapped, 1961
- USASI B9.1 - Safety Code for Mechanical Refrigeration, 1964.
- USAI B53.1 - Refrigeration terms and definitions, 1958
- USASI C72.1- 1949 - Electric Water Heaters
- USASI Z21.10.1-62 Gas-Fired Water Heaters
- USASI Z21.13 -- Steam and Hot Water Gas Boiler, 1964, with addenda Z21.13A. 1965 and Z21.13b, 1966
- USASI Z21.47 -- Gravity and Forced Air Gas Furnaces, 1964 with addendum Z21.47a, 1965
- USASI Z21.16 -- Gas Unit Heaters, 1964, with addendum Z21.16a, 1965
- State of Illinois -- Sanitary Requirements for Swimming Pools.
 - Illinois State Plumbing Code, Circular 829, 1959.
 - Illinois Water Well Construction Code, 1965.
 - Illinois Water Well Pump Installation Code, 1965.
- USBS Division of Trade Standard T - 3443.

Section 175.140 Accepted Model Codes

Where exceptions to these standards are permitted by specific reference to accepted model codes, title sheet shall indicate which code was used. The same code shall be used for all exceptions.

- a) Basic Building Code, 1965, with 1966 and 1967 supplement, Building Officials Conference of America, 1313 E. 60th St., Chicago, Illinois 60637
- b) National Building Code, 1967, American Insurance Association successor to National Board of Fire Underwriters, 120 S. LaSalle, Chicago, Illinois 60603
- c) Southern Standard Building Code, 1965, with 1967 revisions, Southern Building Code Congress, Brown-Marx Building, Birmingham, Alabama
- d) Uniform Building Code, 1967 International Conference of Building Officials, 50 S. Los Robles, Pasadena, California 91101

Section 175.150 Accepted Nationally Recognized Testing Laboratories -- Fire and Safety

The following named nationally recognized testing laboratories are accepted:

- a) American Gas Association Laboratories, 1032 East 62nd St., Cleveland, Ohio
- b) Bureau of Mines, U.S. Department of Interior, Central Experiment Station, 4800 Forbes Street, Pittsburgh, Pennsylvania
- c) Factory Mutual Laboratories, (Factory Mutual Engineering Division) 1151 Boston-Providence Turnpike, Norwood, Massachusetts
- d) Forest Products Laboratory, U.S. Department of Agriculture, North Walnut Street, Madison, Wisconsin
- e) National Bureau of Standards, U.S. Department of Commerce, Washington, D.C.
- f) Ohio State University, Engineering Experiment Station, 156 West 19th Avenue, Columbus, Ohio
- g) Southwest Research Institute. 8500 Culebra Road, San Antonio. Texas
- h) Underwriters' Laboratories, Incorporated, 207 East Ohio Street, Chicago, Illinois
- i) Underwriters' Laboratories of Canada, 7 Crouse Street, Scarboro, Ontario, Canada

Section 175.160 Lead Paints and Other Surface Coating Materials

- a) Lead paints, varnishes, lacquers and other surface coating materials, containing more than .06 of 1% of lead content by weight of non-volatile materials shall not be used for decorating or re-decorating exposed interior surfaces of schools.
- b) Loose or peeling paint shall be removed and repainted if tested in accordance with ANS. No. C66.1, dated January 1973, and determined that the quantity of lead or its compounds is less than 1.0 milligram per square centimeter.

SUBPART C: CONSTRUCTION REQUIREMENTS

Section 175.210 Structural Stability and Materials

The structural design of buildings and foundations shall be in accordance with any of the accepted model codes. Structural design and erection shall be under the supervision of a registered architect or structural engineer where required by the State of Illinois. Materials and methods of construction, including quality and workmanship, shall be in accordance with nationally recognized practice.

Section 175.220 Fire Resistance Ratings

The fire resistance ratings in Table A shall be considered minimum unless additional protection is required for fire walls, occupancy separation, corridor partitions, smoke-stop partitions, etc.

Section 175.230 Height and Area Limits

- a) The minimum average ceiling heights in all educational, special educational and assembly occupancy rooms shall be not less than 8 ft. in rooms less than 200 sq. ft.; 9 ft. in rooms over 200 sq. ft. and less than 2000 sq. ft.; 10 ft. in rooms over 2000 sq. ft. and less than 5000 sq. ft.; and 12 ft. in rooms over 5000 sq. ft.
- b) Height and area limits for all buildings shall not exceed the values listed in Table B except as specifically permitted elsewhere herein.

Section 175.240 Direct Exterior Exiting

A school shall be considered to have direct exterior exiting when every room occupied by more than 10 persons has a direct exit to the outside. Auditoriums and other assembly occupancies shall be considered to have direct exterior exiting when 2/3 of the required exit capacity is direct to the outside. Area limits may be increased 50% for one and two-story buildings with direct exterior exiting.

Section 175.250 Open Plan Buildings and Areas Thereof

- a) In open plan buildings, undivided areas shall be limited to 20,000 sq. ft. (30,000 sq. ft. with direct exiting), limiting walls to have not less than a one hour fire resistance rating. All ceilings shall be noncombustible and have a flamespread rating not exceeding 25 or may be of exposed heavy timber construction within the limits established elsewhere.
- b) Buildings or areas of buildings which do not have corridor partitions complying with Section 175.275 shall be considered as open plan buildings or areas.

Section 175.255 Fire Walls

Fire walls shall be noncombustible with a 2-hour fire resistance rating. Walls shall be continuous, except that 2-hour fire resistive offsets are permitted. Walls shall extend to the underside of noncombustible roofs and shall extend at least 2 feet above combustible roofs. Portions of schools separated by fire walls shall be considered as separate buildings.

Section 175.260 Occupancy Separations

Portions of a school occupied for purposes listed below shall be separated from other portions of the building by construction as specified herein:

Occupancy	Fire Resistance Rating
a) Assembly with over 600 capacity	1 hour
b) Stages equipped with fly galleries, gridirons, and rigging; adjacent dressing rooms, storerooms, workshops (See NFPA #101 for proscenium curtain)	1 hour
c) Special educational (shops other than those included under d.), science laboratories, arts and crafts, home economics and kitchens	3/4 hour
d) Storage, ventilating and electrical equipment rooms; farm, automotive and woodworking shops; industrial arts rooms	1 hour
e) Boiler rooms with high-pressure boilers, (over 15 psi steam) or in basement	2 hours
f) All other boiler, furnace, fuel storage, trash collection and incinerator rooms except as follows:	1 hour
1) Unitary factory-assembled, packaged-type, fuel burning unit heaters, unit ventilators, furnaces and boilers each with input capacity not more than 200,000 Btu/hr. for each unit may be located within other rooms or spaces, provided such fuel-burning units do not provide an exposure to an exit, a corridor, a primary egress aisle or other required paths of travel to an exit; are adequately protected against physical damage or tampering by pupils; and are installed and operated in full compliance with the applicable provisions of Subpart F.	

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- 2) Unitary factory-assembled, packaged-type, fuel-burning water heaters may be installed in kitchens, home economics classrooms, locker-rooms, toilets and other similar rooms or spaces provided such heaters comply with the provisions of the preceding paragraph.
- g) Occupancies under (d) and (f), if sprinklered 3/4 hour
- h) Occupancies of similar hazard not specified above shall be protected according to nearest classification.

Section 175.265 Enclosures for Stairs, Vertical Openings, Exitways

All stairs and other vertical openings shall be enclosed except as specifically permitted hereinafter. The fire resistance rating of enclosures for exit stairs and other vertical openings shall be 1 hour when piercing not more than 4 floors, 2 hours when over 4 floors, except that 3/4 hour enclosures are permitted between corridors and stairways piercing not more than 2 floors. Like fire resistance is required for enclosures around other portions of exitways in the same building.

Section 175.270 Stair Enclosure Exceptions

Stair enclosures may be omitted:

- a) In 1 and 2-story buildings with direct exterior exiting.
- b) In the basement of a 1-story building, provided required exits from the first floor do not pass through the stair enclosures.

Section 175.275 Corridor Partitions

- a) Partitions separating corridors from classrooms and other spaces where a higher occupancy separation is not specified shall have a fire resistance rating of not less than 1/2 hour except that no fire resistance is required under any of the following conditions:
 - 1) When there is direct exterior exiting.
 - 2) On the first floor of a 1-story building wherein the flame-spread ratings of the ceiling and wall finishes do not exceed 75 and wherein at least one window in each classroom is readily available for exiting to the outside.
- b) Corridor partitions and doors having a fire resistance rating of 1/2 hour or less may have louvers up to 18 inches above the floor. No other louvers or openable transoms shall be permitted in corridor partitions.
- c) Corridor partitions requiring a fire resistance rating of 1/2 hour and doors therein may have fixed panels of 1/4 inch wired glass without size limitation.
- d) Buildings or areas of buildings having corridor partitions not complying with this Section shall be classified as open plan buildings or areas (See Section 175.250).

Section 175.280 Smoke-Stop Partitions

Any interior corridor 300 or more feet in length shall be divided into sections not to exceed 300 feet in length by smoke-stop partitions having a 1/2 hour fire resistance rating. Wired glass in metal frames is acceptable.

Section 175.285 Opening Protectives

- a) Wherever a fire resistance rating is required, all interior openings shall be protected by an approved automatic or self-closing device, consisting of doors, shutters, windows, etc., complete including frame, hardware, closing device and their anchors, in accordance with NFPA #80. Unless door, shutter, window, etc. and the frame are labeled, the manufacturer shall supply a certificate to be kept on file in the school, stating that construction complies with the specifications for applicable labeled construction. The fire resistance rating and class of the opening protective shall be not less than the following:

- | | | |
|----|-----------------------------------------------------------------|--------------------|
| 1) | Fire walls | Single Class A |
| 2) | Occupancy separations, | |
| | A) 2-hour construction | Single Class A |
| | B) 1-hour construction | 1 hour Class B |
| | C) 3/4-hour construction | 3/4 hour Class C* |
| 3) | Enclosures for vertical openings and exitways, | |
| | A) 2-hour construction | 1 1/2 hour Class B |
| | B) 1-hour construction | 1 hour Class B |
| | C) 3/4-hour construction | 3/4 hour Class C* |
| 4) | Limiting walls of open plan building areas, 1-hour construction | 3/4 hour Class C* |
| 5) | Corridor and smoke-stop partitions 1/2 hour construction** | |

- b) Interior doors to boiler and heater rooms shall open into the rooms.

* 1 3/4 inch solid, core-wood doors with 1,296 sq. in. wired-glass panel are permitted.

** Hollow or filled metal doors and 1 3/4 inch solid, corewood doors are permitted. Door frames of metal or of min. 2-inch nominal lumber.

Section 175.287 Latches Omitted

Stair enclosure and smoke barrier doors may use push-pull hardware in lieu of latching hardware required for labeled doors.

Section 175.290 Closing Devices

Smoke-stop doors and opening protectives requiring a fire resistance rating of 3/4 hour or more shall be self-closing or shall be automatic in operation, except as follows:

- a) Opening protectives in enclosures for vertical openings, horizontal exits, limiting wall of open plan buildings and smoke-stop partitions shall be self-closing and be closed at all times while the building is occupied or shall be arranged to close automatically upon actuation of the building fire alarm system. Device for accomplishing this function shall be approved for the service, shall have means for manually releasing the door by a normal pull on the door, and shall be connected to the fire alarm system through a "fail-safe" electrical circuit. A fusible-link or rate-of-rise release may be used in addition to but not in lieu of, the automatic operation specified.
- b) Closet doors, etc., which are normally locked and open only when a responsible person is in attendance, need not be self-closing or automatic.

Section 175.295 Firestopping

- a) Combustible construction, including walls, partitions, wainscoting, paneling, floors, etc., shall be firestopped in accordance with any one of the accepted model codes.
- b) Attics and other concealed spaces above ceilings, when containing combustible materials, shall be firestopped with noncombustible materials so as to limit areas to 5,000 sq. ft. and the maximum dimension to 150 feet.

SUBPART D: SPECIAL OCCUPANCIES

Section 175.310 Places of Assembly

- a) All rooms or spaces with a capacity of 200 or more are designated assembly occupancies, except such areas in open plan schools only if partitions, lockers or equipment are installed and fixed in place so as to prevent use of the areas for assembly purposes.
- b) For places of assembly, the number and location of exits; types of exits; location of places of assembly; protection of exits and vertical openings; decorations; aisles, railings, turnstiles; waiting space, and stage and auditorium vents shall comply with the provisions of NFPA #101.
- c) Seating arrangements shall comply with the provisions of NFPA #101, except that the number of seats in a row may be increased to 100 where seats are so spaced that there is an unobstructed space of not less than 18 in. horizontal projection between the rows of seats, and doorways leading directly to exit corridors are provided along each side of the place of assembly at the rate of one doorway for every three rows of seats.
- d) Grandstands, indoor and outdoor, and other places of outdoor assembly shall comply with the requirements of NFPA #102 and NFPA #101.
- e) Every stage located in a Class A or B Assembly Occupancy which is equipped with fly galleries, gridirons, and rigging for movable theater-type scenery shall be protected by sprinklers. Such protection shall also be provided in auxiliary spaces such as dressing rooms, storerooms, and workshops. The proscenium opening shall be provided with a noncombustible or flameproofed curtain. Doors in the proscenium wall shall be of the self-closing type and of metal or solid core wood construction.
- f) Other stages--
 - 1) Requirements of this rule shall apply to all stages not falling within the scope of subparagraph (e) above.
 - 2) Unenclosed platform-type stages (stages without proscenium

wall and opening) shall be excluded from any special protection requirements except for those applicable to under stage spaces as set forth under 23 Ill. Adm. Code 185. Such stages, however, shall be so arranged and constructed as to avoid introducing any conditions which unnecessarily jeopardize life safety and shall have fire detection if not sprinklered.

- 3) Every stage having a proscenium wall and opening shall comply with the requirements established for theater-type stages, as set forth in 23 Ill. Adm. Code 185, except that fire detection may be substituted for the required sprinkler protection for stages located in unsprinklered buildings. Understage spaces shall comply with the applicable provisions of 23 Ill. Adm. Code 185.

Section 175.320 Projection Rooms

In assembly rooms having a capacity over 600, projection rooms, if provided, shall be of noncombustible construction; and interior finish shall have a flamespread rating not to exceed 25. Projection room doors opening into the auditorium shall be metal and self-closing, and other openings shall have fusible-link released metal shutters. A sign shall be posted reading "Film not marked SAFETY FILM prohibited by law" unless the entire projection booth complies in full with NFPA #40.

Section 175.330 Unoccupied Spaces

Attics, utility tunnels, and similar unoccupied spaces shall be used for combustible storage only if provided with occupancy separations and automatic sprinklers or automatic fire detection as provided herein.

SUBPART E: PROTECTION REQUIREMENTS

Section 175.410 Exits

- a) Exits shall be arranged so that it will be possible to egress from any normally occupied part of the building without passing through an enclosure or other space within the building open to another story.
- b) Every floor, section, or room shall have exits sufficient to provide for the capacity thereof, allowing 100 persons per 22 in. unit of exit width through level exits such as doors and Class A ramps and 60 persons per 22 in. unit of exit width for stairs and Class 8 ramps.
- c) Subject to the special requirements of these standards, all exit details shall conform in every respect to the requirements of NFPA #101. This will include, but not be limited to, widths, distances, headroom, and access; aisles, corridors, and passageways; exterior balconies and walkways; doors, stairs, ramps, and horizontal exits.
- d) The capacity for exit purposes of any building, story, or individual section thereof shall be the maximum number calculated as follows:
 - 1) One person for each 40 sq. ft. of gross floor area.
 - 2) The sum of the capacities of individual rooms or spaces to be used simultaneously within the building, story or section being considered.
 - 3) The exit capacity of any individual room or space. The capacity shall be the actual number of occupants anticipated to use the space; or it can be calculated by dividing the net floor area (sq. ft. of such room or space by the applicable figure in the following table, whichever is greater:

A) Assembly Occupancies	
i) Cafeterias	15
ii) Kitchens associated with cafeterias	50
iii) Auditoriums and theaters (fixed seats)	6

iv)	Bleacher areas	4
v)	Gymnasiums, playrooms, multi-purpose and other assembly rooms using fixed or movable seats	6
vi)	Standing room areas (foyers, entranceways, etc.)	3
vii)	Study halls (capacity over 200)	12
B)	Educational and Special Educational Occupancies	
i)	Cafeterias (capacity under 200)	15
ii)	Study halls (capacity under 200)	12
iii)	Normal classrooms	18
iv)	Libraries	25
v)	Food-cooking rooms, science laboratories, arts and crafts rooms	30
vi)	Industrial arts rooms and student shops and garages with student occupancy	50
vii)	Locker rooms	10
viii)	Offices, clinics, and counseling rooms	20
4)	The capacity of mechanical- and storage-occupancy rooms and spaces and of basements not subject to occupancy by pupils shall be calculated on the basis of one person per 100 sq. ft. of net floor area.	
e)	Every room or space having an occupancy of more than 10 and not more than 60 persons and having an area not exceeding 1200 sq. ft. shall be provided with a doorway leading directly into a corridor or an exit. If occupancy is over 60 or area exceeds 1200 sq. ft., at least two doorways located as far from each other as practicable and leading directly into a corridor or an exit shall be provided.	
f)	Exits shall be so located that at least one door opening to an exit stairway or other exit will be within 150 ft. (measured along the line of travel) of any point in any room, except that in open plan buildings, exits shall be within 100 ft.	

- g) Exits or exit stairs shall be provided at both ends of any corridor except that dead end corridors requiring travel of not more than 20 feet from the door of the room to the exit shall be permitted.
- h) Horizontal exits may be used for up to one-half the required exit capacity of any fire area. Horizontal exiting from fire areas on both sides of the fire wall shall not be permitted unless independent alarm systems are provided for each area.
- i) Doors subject to use for exit purposes by 20 or more persons shall swing only in the direction of exit travel and when subject to use by 100 or more persons shall be equipped with approved panic hardware or shall be without latches or locks. Double acting doors are not permitted. Dead-bolt locks without spring latches, are permitted in lieu of panic hardware on main entrance doors to individual rooms. In all such cases, at least one door must be openable at all times from the inside without a key.
- J) Types of stairs and ramps shall be Class A or B only as defined by NFPA #101.
- k) Fire escapes and slide escapes are prohibited, and revolving doors are not to be used for required exits.
- 1) The minimum clear width of corridors shall be not less than 8 ft. where serving as required path of travel to an exit for more than 200 persons; 7 ft. where serving more than 100 persons, but not more than 200 persons; 6 ft. where serving more than 50 persons, but not more than 100 persons; and 44 in. where serving not more than 50 persons. Doors from occupied rooms and/or spaces shall not encroach on the clear widths herein specified during the opening process or in the fully opened position.
- m) The hanging of clothing in corridors should be avoided. Where this is done, the width of the corridor shall be increased 15 inches on each side where cloaks are hung.

Section 175.420 Interior Finish

- a) Interior finish materials for walls and ceilings, unless otherwise limited herein, shall have a flamespread rating no greater than that indicated as follows:

Space	Flamespread Rating Wall and Ceiling
Exitways and stairs, corridors, lobbies, etc., open thereto	25
Corridors not part of exitways	75
Classrooms, laboratories, shops, Etc., not over 1,000 sq. ft.	200*
Heating, ventilating, boiler, furnace, incinerator, and trash rooms	25
Auditoriums, cafeterias, and other assembly spaces for over 200 persons	75*
All other	75*

- b) All flamespread ratings shall be based on the standard tunnel test (NFPA #255, ASTM E-84). Materials that give off smoke or gases more dense or more toxic than that given off by untreated wood or untreated paper under comparable exposure to heat or flame shall not be permitted as interior finish.
- c) Exceptions to the above requirements not to exceed 10% of the aggregate wall and ceiling areas of any room or space may have a flamespread rating not exceeding 200.

*Exposed, heavy timber-roof construction permitted.

Section 175.430 Decorative Materials

- a) No furnishings, decorations, wall coverings, paints, etc., shall be used which are of a highly flammable character or which, in the amounts used, will endanger egress due to rapid spread of fire or formation of heavy smoke or toxic gases.
- b) The flamespread rating of interior wall and ceiling surfaces is not considered to be affected by ordinary paint and wall coverings applied thereto. Highly flammable finishes such as lacquer and shellac are not considered as ordinary.
- c) Draperies, curtains, loosely attached wall coverings, cloth hangings, and similar materials shall be noncombustible or flameproofed in corridors, exitways, and assembly occupancies. In other areas, up to 10% of the wall area may have combustible coverings and hangings.
- d) Methods of flameproofing, tests, and acceptability shall be in accordance with NFPA #701. A flameproofing certificate, identifying agent used, and material protected shall be kept on file in the school.

Section 175.440 Automatic Sprinklers--Where Required

Automatic sprinkler protection shall be provided:

- a) In trash collection and incinerator rooms and areas, heads of dust chutes, heads of trash chutes, and wood-shaving or sawdust rooms and areas;
- b) In flammable paint and flammable liquid storage rooms and areas, unless storage is in UL or FM approved cabinets;
- c) Over stages and in adjacent stage dressing room, in storage areas (including storage space under the stage unless only for chair storage) and workshops if stage is in an assembly room with fixed seating for over 600 persons or in an assembly room with a capacity over 600 in a school with classroom capacity over 600;
- d) In other spaces with special hazards, except that hazardous areas in individual rooms or spaces need not be sprinklered if the room or space is a separate building (or cut off by a two-hour occupancy separation with a 1 1/2 hour Class B fire door) and has exiting from classroom portions without passing through shop areas.

Section 175.450 Automatic Sprinkler Standards

- a) Design and installation of automatic sprinkler systems shall comply with NFPA #13, except as specified herein. Devices and materials shall be approved for sprinkler system service. The system control valve shall be an outside-stem-and-yoke or post-indicator gate valve painted red and marked "Sprinkler valve-keep open."
- b) Water supplies, size of supply piping, and the need for a fire department connection shall be determined by the number of sprinkler heads in a sprinklered area. All sprinkler heads on any story shall be considered to be in the same sprinklered area unless separated by fire walls or other masonry walls without openings or are so separated that no fire will simultaneously fuse the sprinkler heads in the separated rooms or spaces being considered.
- c) The minimum amount of water available solely to supply automatic sprinklers shall be the total required to supply all of the heads in the largest sprinklered area, computed at 20 gallons per minute per head, but need not be more than any of the following amounts at the stated residual pressure at the highest sprinkler head:
 - 1) 300 gpm for 30 minutes at 15 psi residual pressure
 - 2) 250 gpm for 30 minutes at 20 psi residual pressure
 - 3) 200 gpm for 30 minutes at 25 psi residual pressure.
 - 4) 2,000 gallons total at 30 psi residual pressure in schools having a classroom capacity not exceeding 600.
- d) The residual pressure available at the highest sprinkler head with full required flow shall be not less than 15 psi, neglecting system friction loss.
- e) Where there are not more than 5 heads in a local sprinklered area, the sprinkler water supply may be taken from nearby domestic water service or stand-pipe hose lines (with labeled lock shield OS & Y shut-off valve in sprinkler water supply), provided waterline size and capacity are adequate to comply with the preceding paragraphs. One or more rooms or spaces, or adjoining rooms or spaces, may make up such a local sprinklered area, providing there are no other sprinklers in same or adjacent rooms. All other sprinklers shall be supplied from a separate sprinkler water supply system, with water flow switch, having its own water supply or connected on the supply side of the valve and meter for the domestic system.

- f) Where there is a separate water system for sprinklers, a 2 1/2 inch fire department connection shall be provided when there are more than 10 heads in any sprinklered area or more than 30 heads total; and a 2 1/2 in. x 2 1/2 in. x 4 in. siamese connection shall be provided when there are more than 50 heads in any sprinklered area or more than 100 heads total.
- g) Waterflow switches shall be installed to actuate the building fire alarm system wherever 5 or more sprinklers are on a single sprinkler water connection. Supervisory switches shall be provided on valves controlling the water to 5 or more sprinklers, on water outlets from supply tanks used for sprinkler service, and on the air side of dry pipe systems to signal abnormal conditions.

Section 175.460 Automatic Fire Detection - Where Required

- a) Unless sprinklered, automatic fire detection shall be required in the following locations in buildings required to have a fire alarm system:
- 1) Special educational rooms (science labs, industrial arts, arts and crafts, home economics, cooking rooms, etc.) and kitchens.
 - 2) Printing, automotive, woodworking, electrical, foundry, painting, finishing, forge, kiln, agricultural, and similar shops.
 - 3) Permanent stages and adjacent dressing rooms.
 - 4) Rooms over 10 sq. ft. in floor area if used for storage of mechanical and electrical equipment, janitor's equipment and supplies, or book and paper storage.
 - 5) Crawl spaces, tunnels, and attics or spaces above ceilings (with space height more than 6 inches to bottom of solid joists), if there are combustible materials therein.
 - 6) Boiler, furnace, incinerator, kiln, fuel-storage rooms, and areas of other rooms used for direct-fired equipment.
 - 7) Any enclosed room over 10 sq. ft. in open plan areas.
 - 8) Penthouses and enclosures for rooftop heating, cooling, heating and cooling equipment.
- b) Required detection devices shall be wired as part of the school fire system. Automatic sprinkler protection may be substituted wherever automatic fire detection is required.

Section 175.470 Fire Alarm Systems

- a) Every building with over 5,000 sq. ft. gross area or with more than one occupied floor level shall have a manual fire alarm system complying with NFPA #72A and these standards.
- b) Systems shall be electrically operated, shall have electrical supervision of both operating and supervisory circuits (double supervision), and shall have distinctive, non-coded fire alarm signals sounding in the building protected. Direct connections to the fire department, police department or central stations service are encouraged and should transmit both alarm and trouble signals from the school system.
- c) A "power on" light for the operating circuits and audible trouble signals for both operating and supervisory circuits shall be placed at each of at least two locations, one of which should be in or near the chief custodian's office and the other in or near the principals office (or similar location attended during school hours). Trouble signal silencing switches, if used, shall be self-restoring or shall have a ring-back feature; they shall be supplemented by a conspicuous signal lamp which shall remain lighted until the fault is cleared. Switches and lamps shall be permanently labeled as to function.
- d) Materials and devices shall be UL or FM approved for fire alarm service. Required fire detection devices wired as part of the fire alarm system shall be of types sensitive to rate-of-rise of temperature, to heat, to smoke, or to ionized products of combustion and shall be spaced so that area and distance limits for which they are approved will not be exceeded.
- e) Alarm signals shall be horns with a decibel rating of not less than 90 at 10 ft. and shall be distributed so as to be clearly heard in all occupied parts of the building. (This, generally, will require signals not more than 200 ft. apart on each story and in boiler rooms, auditorium, gymnasium, play room, wrestling room, recreation room, cafeteria, swimming pool rooms, locker rooms, shower rooms, music practice rooms, and similar areas with high noise level.) The same signal shall be used for drills as for actual alarms.
- f) Manual stations shall be located so as to be readily visible and accessible and shall be of the same general type throughout the building. Stations shall be near each main exit and in the natural path of escape from fire and shall be so located that not more than

100 ft. of corridor (or main aisle in an open plan school) have to be traversed to reach a station on the same story or 50 ft. and one flight of stairs to reach a station on another story in the natural path of escape. In addition, a station shall be provided on the auditorium side of the proscenium wall in assembly rooms and in, or adjacent to, boiler rooms.

- g) Coded signals and pre-signal systems shall not be used. Annunciator panels may be used for the purpose of locating the source of an alarm.
- h) Electrical power for the fire alarm system shall be as provided in Subpart G of this Part.
- i) See Section 175.580 for the requirement on stopping the ventilating equipment in connection with fire alarm systems.

Section 175.480 Emergency and Exit Sign Lighting

- a) Illuminated exit signs and directional exit signs shall be installed at every required exit doorway subject to use by 100 or more persons to clearly indicate exit opening. One or more exit or directional signs must be visible from any point in each lobby, passage, or corridor serving occupied rooms. Exit signs exposed to impact or damage shall be properly protected. Units over doorways and stairs shall have glass or open bottom to permit down lighting. General requirements for signs shall comply with NFPA #101.
- b) Assembly occupancies, lobbies, corridors and exitways serving more than 200 persons shall be provided with approved emergency lighting. All rooms or spaces with a largest dimension of 100 feet or greater shall have all paths of egress to exits provided with approved emergency lighting.
- c) Fixtures used for emergency lighting purposes may also be used for exit sign illumination and vice versa.
- d) Electric power for exit signs, directional signs and emergency lighting shall comply with the emergency lighting provisions of Subpart G of this Part.

Section 175.490 Standpipe Systems

- a) Buildings more than 4 stories or 60 ft. in height shall be provided with standpipes and hose connections for large (2 1/2 in.) hose in compliance with class I or III of NFPA #14. Dry standpipes having no permanent water supply are not permitted.
- b) Each hose connection shall have an approved 2 1/2 in. hose valve with threads matching those used by the fire department. No hose or nozzles need be installed. A 2 1/2 in. x 4 in. fire department siamese connection shall be provided.
- c) Water supplies and fire department connections serving both sprinkler and standpipe systems are permitted, provided the supplies are adequate for sprinkler requirements plus standpipe requirements per NFPA #14.

Section 175.495 Fire Extinguishers

- a) Approved portable fire extinguishers shall be installed to comply with NFPA #10. Additional units shall be provided for special hazards and on each side of stages equipped with movable scenery.
- b) Extinguishers using toxic chemicals such as carbon tetrachloride or chlorobromomethane are prohibited.
- c) Small (1 1/2 in.) hose lines supplied from standpipes in accordance with NFPA #14 or from sprinkler systems in accordance with NFPA #13 may be substituted for Class A extinguishers in the area protected.

Section 175.498 Welding and Cutting Processes

- a) Welding, cutting and other processes using electric arcs or oxygen-fuel gas flames shall be used only in areas or rooms which meet the occupancy separation requirements of Section 175.260(d), and where other physical conditions of the room or space meet the requirements of NFPA No. 51B, 1971 edition. Oxygen-fuel gas systems for welding, cutting, etc., shall be installed in accordance with Chapters 1, 2, 3, 4, 5 and 8 of NFPA No. 51, 1969 edition, including the use of other fuel gases when used with oxygen for welding, cutting, heating, and heat treating operations.
- b) Storage of acetylene cylinders and generators and calcium carbide is prohibited within rooms or spaces, but may be stored in outside generator houses or storage buildings in conformity with Chapters 6 and 7 of NFPA No. 51, 1969 edition. Ventilation shall be in accordance with Section 175.552.
- c) Electric arc welding, resistance welding and similar welding and cutting equipment shall comply with Article 630 of the National Electric Code, 1971 edition.

SUBPART F: HEATING, VENTILATING AND INCINERATORS

Section 175.505 General

Where there is conflict between the specific, spelled-out requirements given herein and the standards referred to, the specific, spelled-out requirements shall govern.

Section 175.507 Heating of Outdoor Air

Outdoor air supply equipment provided to avoid negative pressure at fuel burners, to supply ventilation air, or to replace exhausted air (make-up air or heating coil in wall provided to heat outdoor air drawn through it) serving assembly, educational, and special educational occupancies shall be designed to continuously heat the full volume of incoming outdoor air to be introduced when the outdoor temperature is at the design outdoor temperature when room cooling by outdoor air is not required, and rooms or spaces are occupied, from design outdoor temperature to room design temperature, and to introduce it without notice-able drafts, as modified by Section 175-552.

Section 175.510 Heating Capacities

- a) Each heating and ventilating system shall be so installed and of such capacity as required to maintain the following minimum room temperatures during all periods of occupancy:
- | | |
|-------------------------------------------------------------------|-------|
| 1) Gymnasiums, playrooms, shops | +65°F |
| 2) Kitchens | +68°F |
| 3) Toilet rooms | +70°F |
| 4) Shower rooms, drying rooms, natatoriums or swimming pool rooms | +75°F |
| 5) All other spaces and rooms | +72°F |
- b) Room temperatures shall be measured at the center of each room, 5 ft. above the floor.

Section 175.512 Heat Losses

- a) Heat losses shall be calculated on the basis of the lowest recorded outdoor temperature for the past ten years as scheduled in Col. 5 "Median of Extremes," Table 1, Chapter 26, page 471 of ASHRAE Guide, 1965-66.
- b) Heat losses shall be calculated on the basis of a 15 mph wind.
- c) Heat losses shall be calculated for each occupied room or space using the heat infiltration loss methods as outlined in Chapter 26 of the ASHRAE Guide, 1965-66. No allowances shall be made for heat gain from pupils, lighting, motors, equipment, or solar radiation.

Section 175.515 Methods of Heating

- a) Heat for schools shall be provided by systems utilizing forced circulation hot water, low pressure steam, forced circulation warm air, radiant panels, gravity or forced circulation space heaters, electric heating units or panels, direct-fired unit heaters, unit ventilators, or space heaters.
- b) Heating systems (and system controls) serving any occupied room or space (other than storage, boiler, furnace, incinerator, trash, transformer, and mechanical equipment and electrical equipment rooms or spaces) having a capacity of 10 or more persons and class-rooms, assembly rooms, auditoriums, stages, gymnasiums, all-purpose rooms, multi-purpose rooms, dressing rooms, shops, corridors, vestibules, lobbies, entrances, laboratories, garages, offices, conference rooms, etc., shall be so arranged that the temperature in each such room or space may be individually controlled, independent of all other rooms or spaces. Each room or space with ceiling height of less than 12' shall have thermostats for each 2,000 sq. ft. (or less) of floor area, except gymnasiums, shops, cafeterias or auditoriums.
- c) Exposed surface of heating and/or ventilating equipment which may be touched by occupants shall not exceed 180°F, except in boiler, furnace, incinerator, kiln, equipment, transformer and utility rooms, tunnels, manholes, etc.
- d) All direct-fired heating and/or ventilating equipment units shall be of the "blow-through" type so designed and installed as to assure that any leakage in the combustion chamber shall be into the combustion chamber itself, regardless of location or arrangement of combustion chamber.

Section 175.517 Unit Ventilators and Unit Heaters

Unit ventilators and unit heaters and their installations shall conform to all applicable requirements of the following:

- a) ASA Z21.16 (gas unit heaters).
- b) IUHA-AMCA Bulletin 10 (steam unit heaters) and Bulletin 11 (hot water unit heaters).
- c) ASHRAE Standard 45 (direct-fired unit heaters).
- d) ASHRAE Standard 53 (unit ventilators).

Section 175.520 Space Heaters

- a) Solid fuel space heaters shall have an output of not more than 95,000 BTUH and shall be tested and rated in accordance with the provisions of USBS Division of Trade Standards #T-3443 and shall be modified as approved for the use of wood, bituminous coal, or coke. Combustible flooring under and within 12 in. of the outside of the heater casing shall be protected by a metalbound pad, made of noncombustible material, equivalent in fire resistivity to 1/2 in. cement asbestos board.
- b) Oil-fired space heaters shall burn No. 1 or lighter oil and shall comply with the provisions of CSD 101.43 (vaporizing oil burners).
- c) Gas-fired space heaters shall comply with the provisions of NFPA 54.
- d) The maximum temperature of the exposed surfaces of the space heater casings or shields shall not be permitted to exceed 180°F.

Section 175.523 Furnaces and Safety Controls

- a) Furnaces and their installations shall conform to all applicable requirements for boilers and the following, except as otherwise noted herein:
 - 1) NFPA 90A (warm air heating and ventilating).
 - 2) CSD 195 (pressure and rotary oil burners and furnaces).
 - 3) CSD-113 (vaporizing burners and floor furnaces).
 - 4) NFPA 54 (gas appliances).
 - 5) ASA Z21.34 (duct furnaces).
 - 6) ASA Z21.13.2 (gravity and forced-air gas furnaces).
 - 7) CSD 109 (solid fuel, forced air furnaces).
 - 8) ASHRAE Standard 45 (heavy duty furnaces).
 - 9) CSD 104 (vaporizing oil burners and furnaces).
- b) Fire dampers shall not be required unless otherwise specified in these standards.
- c) Each furnace of a multiple furnace installation shall have a manually or automatically controlled heated air outlet damper with exterior indicating quadrant. Each manual damper shall have an exterior means for locking damper blades in any position.
- d) Furnace combustion chambers must be air tight, must expand and contract noiselessly, and may be of cast iron, steel or steel alloy, or alloy-protected steel.
- e) Every warm air furnace shall be provided with the following minimum safety devices:
 - 1) The safety astat shall be set at a point not more than 20% higher than setting of operating control and so installed as to automatically stop its associated burner or burners serving individual furnaces.

- 2) For multiple furnace installations where the operating astat or astats are separated from each furnace by a damper, each furnace shall be provided with two (2) astats.
- 3) Each astat or group of astats shall have an adjacent insertion type of duct air thermometer. All must be accessible and lighted for ease of reading.
- 4) All dampers and controls shall be accessible for ease of servicing, setting, and replacement.

Section 175.525 Boilers and Safety Controls

- a) Low pressure steam and hot water boilers and boiler installations shall conform to all applicable requirements of ASME "Low Pressure Boiler Code," except as follows:
 - 1) Return loop connections, as much as 10 in. below the water line, shall be permitted where a "Y" connection or a very short horizontal connection is used.
 - 2) Oil heaters of the submerged or external type shall be permitted for use in preheating fuel oil.
- b) Low pressure boilers and boiler installations shall also comply with all applicable requirements of the following, unless exception thereto is otherwise set forth in these specifications:
 - 1) USASI Z21.13.1 (steam and hot water gas boilers).
 - 2) ABNA "Standard Test Procedure for Packaged Fire Tube Boilers."
 - 3) SBI "Steel Boiler Institute Rating Code for Steel Boilers."
 - 4) SCS R157 (steel boilers).
 - 5) ASME "Miniature Boilers."
- c) Every steam and every hot water boiler shall be provided with the following minimum safety devices:
 - 1) A low water cut-off, which automatically stops fuel supply to the burner when the water level falls below pre-established minimum level. Such cut-off system shall be mounted in the boiler or exterior chamber, with the chamber provided with at least a 1" valved drain. Piping for cut-offs, water columns, gauge glasses, etc., shall be full size with crosses used at all turns, with unused openings closed with brass plugs. For steam boilers, a second, lower mounted, low water cut-off shall be provided wired in series with upper cut-off. For hot water boilers, the low water cut-off shall be installed as high as possible, except that it may be installed slightly below normal water line in those instances where the upper portion of the boiler drum is used as an expansion chamber.

- 2) Safety pressurestat (steam), or safety thermostat, or aquastat (hot water) set at 200°F or at a point not more than 20% higher than the setting of the operating control and so installed to automatically stop its associated fuel burner when the operating control fails to function. Operating and safety pressurestats, thermostats, or aquastats shall not have cocks or shut-offs. For multiple boiler installations, each boiler shall have inlet and outlet valves; and where points of connection for operating pressurestats or aquastats are separated from each boiler by a line valve, each boiler shall be provided with two (2) pressurestats (steam), or thermostats, or aquastats (hot water).
 - 3) Each hot water boiler shall have a safety pressurestat set 1 psi below maximum working pressure of boiler and so installed as to automatically stop its associated fuel burner with high, pressure. Each hot water boiler or group of boilers shall have an expansion tank of sufficient capacity so that safety valves will not open when the entire system is heated from 70°F to maximum operating temperature.
 - 4) Valve drain or drains at all low points of boilers and/or piping, each piped full size and separately to floor drains.
 - 5) Each boiler shall be provided with three (3) equal size ASME Code safety valves with any two safety valves large enough to dissipate at full capacity as required by the ASME Boiler Code, or each boiler shall be provided with two (2) equal size ASME Code safety valves with each safety valve large enough to dissipate at full capacity as required by the ASME boiler code. The discharge from safety or safety-relief valves shall be so arranged that there will be no danger of scalding attendants. The safety or safety-relief valve discharge shall be piped away from the boiler to a point of safe discharge. and there shall be provisions made for properly draining the discharge piping.
 - 6) Each boiler aquastat or group of aquastats shall have an adjacent water thermometer (at same level and close to aquastat). Each boiler pressurestat or group of pressurestats shall have an adjacent water or steam gauge. All must be accessible and lighted for ease of reading.
- d) Boilers may be of steel or cast iron construction.
- e) All controls, including automatic and manual valves, shall be accessible for ease of servicing, setting, and replacement.

Section 175.527 Boiler and Fuel Burner Capacities

- a) The boiler and associated fuel burner (for a one-boiler installation) shall have a net total heating capacity in Btu/hr. equal to the sum of the following:
- 1) Total of calculated heat losses (in Btu/hr.) for all rooms and spaces, at design indoor and outdoor conditions.
 - 2) Total calculated heating capacity required to heat swimming pool water and any outdoor air supply which will be in operation before entire building is brought up to indoor design temperature.
 - 3) Allowance for heating of domestic hot water varying from full calculated heating capacity in Btu/hr. for instantaneous heaters to $\frac{1}{2}$ of full calculated heating capacity for storage heaters having a storage capacity of at least $\frac{1}{2}$ hour supply of hot water.
 - 4) Total of calculated heating capacity for processing and cooking loads which will be in operation before the entire building is brought up to indoor design temperature.
 - 5) For large buildings with large areas which will not be heated to full temperatures at times of maximum heating load, $\frac{1}{2}$ of calculated heat loss for such areas may be deducted; but final total for (1) above shall not be reduced more than 20%.
- b) The boiler capacity should equal or exceed the capacity required by the total of "1" through "5" above, based on one of the following standard rating methods:
- 1) IBR Net Load Rating.
 - 2) SBI Net Rating.
 - 3) AGA Gross Rating, after net total heating capacity as calculated above has been increased by 25%.
 - 4) MCAA Net Load Recommendations.
 - 5)

- A) IBR-SBI Rating, in accordance with schedule I, II or III as listed in the Testing and Rating Code for Steel Boilers. This may be as a result of a specific operating test in accordance with the Code; or it may be as a result of calculations in which the gross output of the boiler is not greater than 5,440 Btu/hr. per sq. ft. of fireside heating surface for natural draft boilers or 6,695 Btu/hr. per sq. ft. for mechanical draft boilers.
- B) Each boiler for oil or gas shall be capable of operating constantly at a minimum of 125% of its normal input rating, and each boiler and associated stoker shall be capable of operating at 150% of input rating for 45 minutes of each hour.
- c) For a two-boiler installation each boiler shall be selected for not less than 2/3 of total net load; for a three-boiler installation, each boiler shall be selected for not less than 1/2 of total net load.

Section 175.530 Furnace and Fuel Burner Capacities

- a) Furnace and associated fuel burner (for a one-furnace installation) should have a net total heating capacity, in Btu/hr., calculated the same as for boiler load, with proper allowance for duct losses.
- b) Gas-fired furnaces shall be selected on the basis of AGA gross, output rating at bonnet after total net heating load calculated in Btu/hr. has been increased by 25%.
- c) Oil-fired furnaces shall be selected on basis of Commercial Standard CS-195 (for maximum UL listing) after total net heating load calculated in Btu/hr. has been increased by 40%.
- d) Hand and stoker-fired furnaces shall be selected on basis of Commercial Standard CS-109, with 70% efficiency after total net heating load calculated in Btu/hr. has been increased by 50%.
- e) Furnace and associated fuel burner for oil or gas shall be capable of operating constantly at 125% or higher of the above net rating, without overloading or overheating of any part; and each furnace and associated stoker shall be capable of operating at 150% of the above net rating for 45 minutes of each hour, without overloading or overheating of any part.
- f) For a two-furnace installation each furnace shall be selected for not less than $\frac{2}{3}$ of total net load; for a three-furnace installation each furnace shall be selected for not less than $\frac{1}{2}$ of total net load; for a four or more furnace installation, one furnace (same size or larger than others) shall be a spare and shall not be required at full load.

Section 175.532 Fuel Burners, Fuel-Burning Installations and Heating Installations

- a) Fuel burners, fuel-burning installations, heating installations and all oil and gas storage and piping installations shall comply with all applicable provisions called for elsewhere and the following, unless exception thereto is specifically set forth in these specifications:
- 1) American Insurance Association Code for Installation of Heat Producing Appliances.
 - 2) NFPA 30 (flammable liquids)
 - 3) NFPA 31 (oil burning equipment)
 - 4) NFPA 54 (gas piping, appliances)
 - 5) NFPA 58 (LP-gas storage)
 - 6) NFPA 59 (LP-gas utility plants)
 - 7) NFPA 60 (pulverized fuel)
 - 8) NFPA 90A (air conditioning, heating)
- b) Fuel-burning equipment and all associated standard controls shall be AGA, UL, or FM approved; and all additional controls and devices as required by this Part shall have similar approval. (See Section 175.584 for specific incinerator requirements.)
- c) Fuel-burning equipment located outdoors, on roofs or on balconies, in other outdoor locations, or in any indoor spaces where accessible to occupants (other than boiler, furnace or incinerator rooms and where permitted under these standards) shall be fully enclosed in a locked metal cabinet so arranged that no moving part, control, burner, or device is accessible without first unlocking the cabinet unless lowest point of fuel-burning equipment is 8'0" or more above floor, no part is accessible except by means of a ladder, and all valves, coils, controls, regulators, etc., are protected so that they cannot be prankishly or accidentally operated or damaged.

- d) Such equipment shall further comply with all other applicable provisions of these standards. Where located outdoors, such equipment shall be wind-and rain-tight and either stainless steel, non-ferrous or galvanized steel specially weatherproofed to resist the elements: it shall operate properly and must be accessible for servicing under these conditions; all accessible bolts or screws must be tamperproof; unit shall be accessible for servicing without injury to roofing by walking thereon; and unit shall be grounded.

Section 175.536 Fuel Burners and Other Heat Sources

- a) Fuel burners and other heat sources shall be of the following types:
- 1) Coal stokers.
 - 2) Oil burners.
 - 3) Gas burners.
 - 4) Combination oil and gas burners.
 - 5) Hand-firing grates.
 - 6) Electric heating elements.
 - 7) Heat pump.
 - 8) Solar heating.
 - 9) Total energy systems.
- b) Each fuel burner (other than burners for incinerators and kilns; or packaged, factory-assembled, interior or exterior unitary equipment with oil input of 1.5 gph or less or gas input of 200,000 Btu/hr. or less, or for burners with oil input of 1.5 gph or less or gas input of 200,000 Btu/hr. or less) shall be provided with the minimum operating and safety controls and associated devices listed below, unless otherwise noted.
- 1) There shall be a relay and thermal protection or magnetic starter for each I phase motor; disconnect for each motor, control wiring (and all controls) shall be 120 volts or less in conduit, with one line grounded, with all controls wired in the hot line.
 - 2) Each boiler or furnace shall have an aluminum-, steel-, or plastic-finished, noncombustible control panel mounted within sight of the associated burner, including but not limited to:
 - A) "On-off" switch;
 - B) re-set button;

- C) alarm gongs, pilot lights, and silencing switches;
 - D) engraved or etched, rigid, bolted- or screwed-in-place identifying plate for each device;
 - E) framed under glass or plastic, wiring diagrams, piping diagrams, control diagrams and operating instructions (permanently mounted on panel or separate from panels). One panel may be used for multiple burners, with an identified section for each burner within sight of the burner. Panels or panel sections shall be lighted by room lighting fixtures or by a light fixture provided as part of the panel.
- 3) A manual emergency fuel-burner switch shall be installed in each boiler room, furnace room, kiln room, and incinerator room and on exterior or cabinet of each fuel burning unit located outdoors to stop all fuel burners located therein. The emergency switch shall be located adjacent to primary entrance door, between 6 ft. and 7 ft. above the floor; shall be painted red; and shall be labeled "Emergency Fuel Burner Switch."
 - 4) An operating aquastat set at 240°F or less (hot water), an operating pressurestat set at 14 psi or less (steam), or an operating air stat set at 160°F or less (warm air) of narrow differential type for each burner or group of burners.
 - 5) A safety aquastat plus a safety pressurestat (hot water boiler), a safety pressurestat (steam boiler), or a safety air stat (warm air furnace or kiln) wired in series with operating devices shall be provided on each boiler or furnace.
 - 6) For multiple boiler installations with operating aquastats (hot water) or operating pressurestats (steam) in headers, each boiler shall be provided with two (2) aquastats plus a safety pressurestat (hot water) or two (2) pressurestats (steam) to provide two (2) or more means of safe shut-down of the associated fuel burner when the associated boiler valve is closed.
 - 7) For multiple furnace installations with an operating air stat in the header duct, each furnace shall be provided with two (2) air stats to provide two (2) means of safe shutdown of the associated fuel burner when the associated furnace outlet damper is closed.

- 8) Where a separate oil pump is used to provide oil pressure, a safety pressurestat shall stop all burners served by a separate oil pump when oil pressure is below safe point. All oil lines shall be valved at each burner and each pump, with an oil gauge at each oil safety pressurestat and at the burner.
- 9) Where oil is heated before being burned, a safety thermostat shall stop all burners when oil temperature is below proper point for safe, efficient burning, with adjacent oil thermometer.
- 10) When any burner is shut off because of flame failure, pilot failure, excessive temperature over burner, or because of excessive air temperature, steam pressure, hot water pressure or hot water temperature as sensed by safety devices, manual resetting shall be required, and a common identified red pilot light mounted on the burner control panel shall be lighted, a common signal gong (4" or larger in diameter) with adjacent associated silencing switch on the fuel-burner panel shall sound; and a common conspicuous signal light in an administrative office of the building shall be lighted. For all other types of safety shutdown, resetting shall be automatic, unless otherwise noted.
- 11) When any burner is shut down because of low oil pressure or temperature, low air flow, high or low gas pressure to burner and pilot and low water, a yellow or amber pilot light (on panel) shall be lighted; and a common gong on the fuel burner panel shall sound. The common light in the office shall be lighted as in (b)(10) above.
- 12) When any burner is shut down by any other safety device, operation shall be the same as for (b)(11) above, except that pilot light shall be blue or green.
- 13) Each hot water boiler shall have a safety pressurestat to stop burner and sound alarm (same as for (b)(10) above) if pressure rises to within 1 psi of maximum water working pressure of boiler.
- 14) A non-electric, self-closing valve (such as a lever operated check valve installed in reversed position) shall be provided in the common gas or oil fuel line to all burners (in same room or enclosure), held open by a fusible link (at ceiling over one burner) arranged to permit valve to close and to stop all burners in the room or enclosure and sound alarm (as in (b)(10) above) when temperature over and/or adjacent to burner rises to 212°F. This requirement may be satisfied by a

spring-loaded, self-closing electric valve or if one of the motorized or solenoid valves on each burner is a fail-safe, self-closing valve wired through a non-recycling (manual reset), temperature-sensitive device located at ceiling over burner and to sound specified common alarm when temperature over and/or adjacent to burner rises to 212°F. Where no individual burner has an input in excess of 1.5 gph of oil or 200,000 Btu/hr. of gas, this valve may be omitted.

- 15) Except as otherwise noted, each gas burner, each gas pilot for each gas burner, and each gas pilot for each oil burner shall have separate manual shut-off valves and separate gas pressure regulators. The main gas supply line to each burner shall have a common low pressure safety pressurestat switch after the main burner manual valve. For gas burners, both main burner line and pilot line shall have a gas pressurestat or pressure switch arranged to stop the associated gas burner in case of high gas pressure and to sound alarm as in (b)(11) above. For oil burners, high-limit gas pressurestat shall be for gas pilot alone, otherwise same as for gas burners. High pressure shut-offs or pressurestats may be omitted when maximum gas pressure in the street main serving the building (as given in writing by local gas utility) is not too high for proper burner operation.
- 16) Higher setting of operation and safety aquastats, thermostats, air stats and pressurestats may be used for high-temperature, high-pressure systems designed and installed in keeping with limitations outlined under "Methods of Heating." Adjacent to each group of one or more pressurestats provide a gauge with cock; for aquastats provide a water thermometer; for air stats, provide an air thermometer.
- 17) When a fuel burner is stopped by any safety control, all fuel-feeding devices (other than oil-circulating pumps) directly associated with a burner which is malfunctioning shall be stopped.
- 18) Vents from all gas regulators shall terminate outdoors through a screened elbow turned down 18" above roof or 6" from wall and 8'-0" above grade and at least 5'-0" to either side of any window, door, or air intake. If common vent pipe is used, it shall have area equal to the total area of all connected vents. For a continuous gas pilot, the vent may terminate in combustion chamber or stack.

- 19) Except as noted, each gas burner with an input of more than 200,000 Btu/hr. and each gas pilot (for gas or oil burners) with a pilot input of more than 120,000 Btu/hr. and each oil burner with an input of more than 1.5 gph shall be supplied with fuel through two (2) automatic fuel valves piped in series and wired in tandem or parallel, one or more of which shall be motorized or solenoid, arranged to be operated together on a recycling basis. These valves shall be normally closed; shall close on current failure; shall close when burner is shut off; shall be open when associated burner is operating and closed at all other times. A lever handle manual test cock vent (1/4" or larger) to room and 1/4" brass plug for future test gauge shall be provided between the automatic gas valves. For smaller fuel inputs, (200,000 Btu/hr. or less of gas, 1.5 gph or less of oil for burners, and 120,000 Btu/hr. or less of gas for pilots) a single automatic fuel valve may be used.
- 20) During pre-purge operation, all combustion and uptake dampers shall be opened to insure maximum purging.
- 21) When overfire draft control is called for, it shall include, but shall not be limited to:
 - A) close fitting uptake or smoke damper (with suitable air-cooled bearings) which shall be wide open before burner can start;
 - B) uptake damper which shall be modulated to maintain constant overfire draft during burner operation;
 - C) uptake damper which shall be normally open. shall open before pre-purge, and shall remain open until after post-purge;
 - D) maximum draft switch (forced draft burner) or minimum draft switch (natural or induced draft burner) which will stop burner with automatic reset (and sound alarm as in (b)(11) above) in case of inadequate draft or failure of control system;
 - E) alarm system including common 4" dia. gong, identified amber or yellow pilot light, and silencing switch on fuel-burner panel and within sight of burner;
 - F) local uptake thermometer, reading up to 800°F; and
 - G) "damper open-automatic" switch on associated fuel-burner panel.

- 22) Pilots for liquid petroleum gas (LPG) shall provide 100% shut-off.
- 23) All safety controls shall be automatically reset, except as called for by applicable reference codes, in (b)(10) above, and as otherwise specifically noted.
- 24) Controls and devices called for above are mandatory within given fuel-input limitations. Do not duplicate controls and devices called for under specific burner requirements.
- 25) Direct-fired gas or oil water heaters, furnace-burner units, boiler-burner units, space heaters, unit ventilators, unit heaters, and similar room-, exterior- or rooftop-installed, packaged, unitary, factory-assembled equipment (not including kilns and incinerators) with input of 200,000 Btu/hr. or less of gas or 1.5 gph or less of oil and conversion or separate burners with input of 200,000 Btu/hr. or less of gas or 1.5 gph or less of oil shall have full safety devices called for above, except with separate, manual oil valve for main oil burner, separate manual gas valve and regulator for main gas burner, separate manual gas valve for gas pilot, and one (1) or two (2) main automatic fuel safety and control valves as required for AGA approval and/or UL listing.
- 26) Incinerators and kilns with input of 400,000 Btu/hr. or less of gas or 3.0 gph or less of oil shall also conform to paragraph (b)(25) above but must have adjustable timers. Post-purge and pre-purge cycles are not required.
- 27) The following requirements (of Section 175.536) apply to gas or oil-fired incinerators and kilns with fuel burner inputs in excess of 3.0 gph of oil or over 400,000 Btu/hr. of gas: (b)(1) relays, magnetic starter, controls and control wiring; (b)(2) fuel-burner panels; (b)(3) emergency switch; (b)(5) safety air stat; (b)(8) oil pump, valves; (b)(9) oil heating; (b)(10)(11)(12) type of controls and resetting, (b)(14) non-electric valve; (b)(15) shut-offs, pressurestats, regulators; (b)(16) settings; (b)(17) shut-off of associated equipment; (b)(18) gas vents; (b)(19) two automatic fuel valves; (b)(22) pilots for LPG; (b)(23) resetting. Adjustable timers are required. Post-purge and pre-purge cycles are not required.

- C) Each fuel burner shall be provided with the primary controls for safe start and stop, modulating, or step operation thereof in compliance with the above requirements, applicable provisions of all referenced Codes and Chapter 24, ASHRAE Guide, 1967, and with the following:
- 1) Stoker-hold fire controls of the recycling type with operating devices, safety devices, etc., as called for above.
 - 2) Oil burner (vaporizing or pot type not to exceed 4 gph capacity, #2 and lighter oil) -- controls designed and installed so as to:
 - A) Meter the correct amount of oil into burner to maintain pilot flame.
 - B) Regulate the required amount of oil into the burner for its high flame operation.
 - C) Shut off completely the flow of oil in event of a flame, pilot failure with manual reset required, low water level, high pressure, or high temperature.
 - D) Provide one (1) or two (2) automatic oil valves, non-electric fuel valves, or equivalent, as previously described. (See Section 175.536(b)(19), 175.536(b)(25), 175.536(b)(26), and 175.536(b)(27).)
 - E) Start, modulate, step control and stop burner as required by all operating and safety controls described above.
 - 3) Oil burner (pressure-atomizing type and vertical rotary type, not to exceed 7 1/2 gph capacity, for #4 and lighter oil) -controls designed and installed so as to:
 - A) Energize the burner motor and electric ignition circuits.
 - B) Provide a 30-second or more pre-ignition purge before energizing ignition spark.
 - C) Prove proper air flow with Underwriters approved airflow switch and test for establishment of main burner flame.
 - D) Stop the burner and ignition if flame has not been established within a pre-set time of 15 seconds or less; with manual reset.
 - E) Monitor the flame continuously during burner operation.

- F) Stop the burner and pilot within 15 seconds or less in event of pilot or flame failure.
 - G) Provide one (1) or two (2) automatic oil non-electric fuel valve, or equivalent, as previously described. (See Section 175.536(b)(19), 175.536(b)(25), 175.536(b)(26), and 175.536(b)(27).)
 - H) Start, modulate, step control and stop burner as required by all operating and safety controls described above.
- 4) Oil burners (pressure atomizing type, over 7½ gph capacity, for #4 and lighter oils) -- controls designed and installed so as to:
- A) Achieve the same control functions as required in the preceding paragraph (3) for oil burners of the same type, except that response to flame failure shall be:
 - i) 15 seconds or less for burners burning 33 gph or less; may be electric or gas-electric ignition.
 - ii) 4 seconds or less for burners burning more than 33 gph; shall be gas-electric ignition with electronically proved pilot.
 - B) Provide approved pre-ignition purge of 30 seconds or more and post-purge of 15 seconds or more; timed ignition; safety solenoid oil cut-off valve; and low fire start.
 - C) Provide two (2) automatic oil valves and non-electric fuel valve, or equivalent, as previously described.
 - D) Start, modulate, step control and stop burner as required by all operating and safety controls described above.
 - E) With natural draft, each burner having an input of 75 gph or more shall have a smoke-uptake damper and fully automatic over-fire draft control.
- 5) Oil burners (horizontal rotary type or steam, air or mechanical atomizing type, for #6 and lighter oils) --controls designed and installed so as to:
- A) Achieve similar functions as called for on pressure atomizing type in paragraph (3) above.

- B) Provide a 30-second or more pre-ignition purge period before energizing the spark ignited gas pilot.
 - C) Prove the presence of proper ignition conditions before permitting the flow of oil to the burner.
 - D) Prove proper air flow with Underwriters approved air flow switch and prove the existence of a stable burner flame within the pre-set timed ignition trial period.
 - E) Monitor the main burner-flame during its entire period of operation.
 - F) Shut off the main fuel supply within 4 seconds or less after flame failure.
 - G) Prevent the flow of oil, but providing for burner operation, for a pre-set, pre-ignition purge period, followed by the opening of the main fuel valve.
 - H) Shut off the flow of oil when so required by actuation of the operating or safety controls but providing for the continuation of the burner operation for pre-set, post-purging period of 15 seconds following the closing of the main fuel valve.
 - I) Lock out in the event of flame or pilot failure shutdown.
 - J) Provide two (2) automatic oil valves and a non-electric fuel valve or equivalent as previously described.
 - K) Start, modulate, step control and stop burner as required by all operating and safety controls described above.
 - L) With natural draft, each burner having an input of 75 gph or more shall have a smoke uptake damper and fully automatic over-fire draft control.
- 6) Gas burners (400,000 Btu/hr. input and smaller) -- controls designed and installed so as to:
- A) Prevent opening of the automatic gas valve or valves in main gas supply until the pilot is proved to be operating properly.
 - B) Stop the flow of gas through pilot and burner whenever safe ignition conditions do not prevail.

- C) Maintain a continuously burning gas pilot monitored by a thermocouple or electronic pilot, or provide an AGA approved pilot system.
 - D) Provide one (1) or two (2) automatic gas valves for inputs of 200,000 Btu/hr. or less and two (2) automatic gas valves for larger inputs and a non-electric fuel valve or equivalent as previously described. (See Sections 175.536(b)(19), 175.536(b)(25), 175.536(b)(26), and 175.536(b)(27).)
 - E) Start, modulate, step control and stop burner as required by all operating and safety controls described above.
- 7) Gas burners (atmospheric type, over 400,000 Btu/hr. input) -controls designed and installed so as to:
- A) Achieve similar control functions called for in (c)(6) above.
 - B) Provide fully automatic operation with a continuously burning, electrically ignited gas pilot with automatic component check of electronic flame-safeguard programming system at beginning and end of each burning cycle.
 - C) Provide a complete electronic flame-safeguard system which will function in the following described sequence. Upon receiving a call for burner operation from operating controls, a proper pilot shall be proved before permitting the main fuel valve to open. With flame failure during burning cycle, provide closing of the main gas automatic valves within 4 seconds after flame failure.
 - D) Provide two (2) automatic gas valves and a group non-electric fuel valve or equivalent as previously described.
 - E) Start, modulate, step control and stop burner as required by all operating and safety controls described above.
- 8) Gas burner (power or forced draft type, over 400,000 Btu/hr. input) -- controls designed and installed so as to:
- A) Achieve similar control functions as called for in (c)(7) above.
 - B) Provide fully automatic operation and pre-ignition purge of at least 30 seconds with electronic flame-safeguard programming system and either an intermittent or an interrupted electronically proved gas pilot.

- C) Establish and prove the existence of the proper pilot or automatically cause a safety shutdown with manual reset. Trial for the pilot shall not exceed 15 seconds.
 - D) Open the main gas valves upon proof of the existence of the proper pilot.
 - E) Close gas valves within four seconds following a flame failure occurrence.
 - F) Maintain at least a 15 second post-purge burner running period following closing of the automatic gas safety valves at the end of the burner operating cycle.
 - G) Cause a safe 100% shutdown of the burner with manual reset in the event of flame failure occurrence. Re-establishment of a safe pilot, including a constant pilot, is permissible, providing it is accomplished within 15 seconds after flame failure.
 - H) Provide two (2) automatic gas valves and a non-electric fuel valve as previously described.
 - I) Start, modulate, step control and stop burner as required by all operating and safety controls described above.
 - J) With natural draft, each burner having an input of 100 therms/hr. or more shall have a smoke-uptake damper and fully automatic and sequenced over-fire draft control and low-draft switch.
 - K) If a power burner is equipped with an electrically ignited constant pilot, pre-purging or post-purging will not be required.
- 9) Combination oil-gas burners shall have primary controls as required for both fuels.
- d) Burners for No. 6 oil shall have oil heaters and primary oil pumps separate from burner. Every gas or oil fuel line serving as supply to a fuel burner or pilot shall be provided with a manual shut-off valve. Where fuel gas is provided by a local utility, each gas fuel burner installation shall be approved for connection to its gas mains by the local gas utility.

Section 175.538 Flue Pipes, Vent Pipes, Smoke Pipes and Draft Controls

- a) Each oil, gas or coal-fired boiler, furnace, space heater, unit heater, unit ventilator, or other fuel-burning device (other than incinerator) shall have a flue pipe, vent pipe, smoke pipe, or breaching and stack or vertical vent in compliance with the American Insurance Association Code for the Installation of Heat-Producing Appliances, NFPA 89M, NFPA 90A and these standards. Draft must be sufficient for required fuel burner operation; metal stacks must be grounded.
- b) Breechings, smoke pipe-, and vents shall be of the following materials and minimum thickness:
- c) Coal or oil-20 gauge black steel, 22 gauge stainless steel.
- d) Gas-24 gauge stainless steel, 22 gauge terneplate, or galvanized, cement asbestos, or 22 gauge aluminum, or AGA and or Underwriters approved double wall aluminum and/or stainless steel flue pipe and/or masonry lined pipe.
- e) Barometric draft adjusters with area not less than 100% of the required breaching area shall be provided for all natural-draft and induced-draft stoker, oil-burner installations. For natural draft, draft adjuster shall be of double-acting type. For natural draft, draft adjusters shall be close to roof or to chimney. For installations with induced draft, draft adjusters shall be on inlet side of induced-draft fan. Draft adjusters shall be provided for forced draft if they are required or recommended by burner manufacturer.
- f) AGA approved draft diverters without moving parts shall be provided for all gas-burner installations where required by the local gas utility.

Section 175.540 Combustion Air Supply

- a) Each room or space housing a fuel-burning device of any kind shall be provided with a supply of air (make-up air) adequate for combustion purposes and to eliminate the possibility of negative pressure conditions, in the form of an opening arranged to permit air to be drawn into the room or space, or a combustion air-supply fan.
- b) All outdoor combustion air openings shall be protected by rainproof roof hoods, fall louvers or door louvers, and bird screens and tight-closing dampers. Where input for any burner exceeds 200,000 Btu/hr. of gas or 1.5 gph of oil, dampers shall be arranged to automatically open when (or-before) the fuel-burning equipment is started and to automatically close when (or after) the fuel-burning equipment is stopped and shall be wired so that fuel burner cannot operate unless damper is wide or proportionately open. For smaller fuel inputs, openings may be permanently open or provided with automatic dampers same as above.
- c) Unless otherwise specified, the net free area of required outdoor combustion air openings (excluding that area taken up by screens, louvers, grilles, or frames) shall be not less than 1 1/2 times the required natural draft stack area recommended by the burner manufacturer or not less than 1 sq. in. for each 10,000 Btu/hr. fuel input to the fuel burner.
- d) The outdoor air supply as required herein shall be direct from the exterior into the room or space housing the fuel-burning equipment.
 - 1) Exception A: This exception shall apply only to combustion air supplies for fuel-burning equipment with input totaling 200,000 Btu/hr. or less for gas and 1.5 gph or less for oil located in a room having a gross floor area of more than 200 sq. ft. and which has no possibility of a negative pressure due to the operation of any fan or to the natural stack action of the building. The combustion air supply for such equipment may be obtained through infiltration around movable windows or other openings to the exterior of sufficient size to provide adequate combustion air, and having a minimum openable area of not less than 1 sq. in. for each 100 Btu/hr. of fuel input to the burner.

- 2) Exception B: This exception shall apply only to combustion air supplies for fuel-burning equipment with an input totaling 200,000 Btu/hr. or less for gas and 1.5 gph or less for oil which is located in a small room having gross floor area of not more than 200 sq. ft. and which has no possibility of a negative pressure due to the operation of any fan or to the natural stack action of the building. The combustion air supply for such equipment may be obtained through wall openings from an adjacent large room or space, which room or space meets all requirements of the room described for Exception A. Wall openings (between the small and large rooms) shall have:
 - A) Not less than 1 sq. in. of net free open area (excluding area taken up by screens, frames, louvers, grilles, etc.) for each 1000 Btu/hr. of fuel input in each of two separate grilles or louvers.
 - 8) One grille or louver located with bottom not more than 8" above the floor and the second grille or louver of equivalent size located not less than 4 ft. above floor.
- 3) Exception C: This exception shall apply only to "enclosed furnace" equipment as approved by AGA, with combustion air conveyed directly to burner or combustion chamber. Area of such combustion air openings shall be not less than 1 1/2 times free area of associated natural draft stack recommended by furnace manufacturer or not less than 1 sq. in. of free area for each 4,000 Btu/hr. fuel input, whichever is larger. A combustion air damper is not required.
- 4) Exception D: This exception shall apply only to "sealed combustion chamber" equipment as approved by AGA, with combustion air conveyed directly from outdoors to burner and sealed combustion chamber with products of combustion conveyed directly to outdoors, with no opening by which combustion air or products of combustion can enter the room or space.
- e) Regardless of arrangement used, where there is evidence of insufficient air supply for combustion where fuel-burning equipment is operating at full capacity additional outdoor combustion air openings, or increased combustion air fan capacity, or a positive make-up outdoor air supply system shall be provided for the room or space until no such negative pressure exists.
- f) Where it is impractical to provide sufficient outdoor combustion air by means of combustion air openings, a combustion air fan shall

be provided of sufficient capacity to deliver heated or unheated outdoor air into room or space to provide air required for combustion for all burners, including required excess air plus 10% or more as may be required for pressurizing the room. The combustion air fan shall automatically start and damper shall open before any burner is started. The fan shall automatically stop, and damper shall close after all burners are stopped. Fuel burners must not operate unless the combustion air fan is running and the combustion air damper is open.

- g) Where a direct-fired water heater, furnace-burner unit, boiler-furnace unit, unit heater, unit ventilator, space heater of any kind, or a fuel-burning device of any kind is installed in a room or space of any kind which may experience a negative pressure because of the operation of any fan, because of exhaust from the room, because of exhaust from adjacent rooms, or because of the natural stack action of the building, an approved induced draft fan shall be provided on each fuel-burning device or group of devices and shall be sized and operated to assure proper draft and freedom from downdrafts or backdrafts. Such induced draft fans shall be capable of overcoming any negative pressure, which may exist in the room and shall be automatically started before start of the fuel-burning device. Individual, forced-draft fans, controlled and operated in same manner, may be used, providing equipment is designed for forced-draft operation, forced-draft fans are capable of overcoming any negative pressure which may exist in the room, and means are provided to prevent products of combustion from entering the room when one or more fuel burners are not operating.

Section 175.543 Type of Ventilating Systems

- a) Outdoor air supply ventilating systems shall be designed to introduce outdoor air, mix it with recirculated air as required, heat mixture, and control mixture temperature gradually and smoothly as required to avoid rapid or steep fluctuations in air outlet temperature and distribute it so as to avoid objectionable drafts in occupied rooms.
- b) All outdoor air shall be drawn in, from locations where it will not be contaminated by soot, smoke, products of combustion, odors, exhaust fumes, gas or oil fumes, or other obnoxious or toxic vapors, through wall louvers with bottoms at least 12" above grade or roof hoods with inlets at least 12" above the roof, all with removable (1/2" mesh) bird screens. (See Section 175.547(e).)
- c) Air for heating and/or cooling and/or ventilating and/or make-up air introduced into an occupied space shall be discharged in such a manner as to avoid drafts and to avoid blowing directly on any occupant.
- d) Exhaust air ventilating systems shall be of the following types:
 - 1) Propeller, axial flow or centrifugal type, in wall, in duct, or in room, discharging to outdoors, either directly or indirectly through duct system, with self-closing or automatic motor-operated (normally closed) discharge dampers which close automatically when fan is not operating.
 - 2) Roof-mounted propeller, axial flow or centrifugal type, with or without duct system, with self-closing or automatic motor-operated (normally closed) discharge dampers which close automatically when the fan is not operating.
 - 3) Central, axial flow or centrifugal type, with inlet or discharge ducts, with self-closing or automatic motor-operated (normally closed) discharge dampers which close automatically when the fan is not operating.
- e) Exhaust fans and exhaust ducts for all services shall discharge to locations where the exhaust air will not contact humans; where air will not re-enter the building through combustion air openings, windows, or outdoor air intakes for ventilating equipment; and where it will not blow on any required means of exit. All exhaust air shall be discharged through weatherproof wall louvers or roof hoods, both provided with removable bird screens.

Section 175.545 Guards

- a) Belts, drives, pulleys, shaft couplings, etc., shall have rigid steel or steel-bound mesh removable guards, arranged to cover all moving belts, parts, shafts, etc.
- b) Fans of every type drawing directly from any room or space shall have wire-mesh or equivalent removable guards in all inlets; fan outlets discharging directly into rooms or spaces shall have similar guards.

Section 175.547 Duct Construction and Design

- a) All materials used in duct construction, inside of ducts, in contact with ducts, hangers, joints, etc., must be noncombustible.
- b) Duct Lining, duct connectors, duct covering, adhesives, vapor barriers, etc., must be noncombustible and must have a flame spread rating of 25 or less. Vapor barriers must be provided on the warm side of the duct so that condensation will not occur in the duct lining or duct covering in any location.
- c) The integrity of all fire rated ceilings shall be maintained by the use of ducts and/or fire dampers as required by the NFPA.
- d) Ducts passing through fire walls shall be provided with a single approved Class A automatic fire door at each opening, except that for small openings not exceeding 18 in. in diameter, 3/8 in. steel plates may be used in lieu of fire doors; or fire dampers listed by a nationally recognized testing laboratory may be used in accordance with the conditions of the listing.
- e) Ducts which draw from steam-collecting hoods, shower rooms, swimming pool rooms, sauna rooms, or other damp rooms and all ducts, hangers, supports, bolts, etc., in such rooms or in suspended ceilings over such rooms and all grilles, registers, dampers, frames, and exhaust fans serving such rooms shall be of nonferrous or stainless steel construction, or hot dip galvanized inside and outside after fabrication, or of galvanized steel painted with two (2) or more heavy coats of special corrosion-resisting paint, inside and outside, to provide corrosion-proof surfaces. Exterior ducts, fans, cabinets, air intake and discharge wall louvers, roof hoods and bird screens shall be of the same construction as above. Roof-mounted metal equipment, metal cabinets, metal stacks, metal vents, hoods, etc. must be grounded.
- f) Ducts shall have tight, hinged, latched, steel access doors in steel frames where required to make all valves, controls, dampers, devices, operators, linkages, bearings, etc., accessible for servicing, inspection and operation with access panels in building construction for access to such doors and devices.

Section 175.550 Kitchens

- a) For schools serving 150 or more meals per day, an overhead ceiling or wall-hung kitchen range hood shall be provided over all cooking, broiling, frying, baking, deep fat-frying surfaces, shall extend a minimum of 6" beyond such surfaces in all directions, and shall conform to NFPA #96 (Cooking Ventilation) and to the following:
- 1) Exhaust shall be equal to 100 cfm for each net square foot of hood opening of 150 cfm per foot of total exposed perimeter of hood, or 100 cfm per each square foot of cooking, broiling, or baking surface, whichever is the greater. Increase required hood exhaust to 200 cfm per square foot of total hood opening for heavy broiling and deep fat frying. Ceiling hoods must overlap cooking services by at least 6" on all sides.
 - 2) Exhaust air shall be filtered by 2" thick or thicker cleanable range filter units at a face velocity of 200 fpm or less through the filter units.
 - 3) Filter units shall be tilted, arranged, and located so that drippage from filters will not drop to the floor or to a cooking surface but will be caught by gutters provided on the sides of the hood and elsewhere as required. Filters shall be located so that they can be readily removed for cleaning, but they need not be in sight.
 - 4) Gutter on total perimeter of range hood shall be 6'-6" above the floor, shall have no dirt-catching corners or cracks, shall have smooth round corners, and shall be readily cleanable. The central portion of the hood shall be higher as required by high cooking equipment.
 - 5) Hood and exhaust ducts shall be constructed of substantial, tight-fitting noncombustible non-absorbent, smooth materials capable of withstanding a fire within, with no 90° corners, and with all parts accessible for cleaning and conforming to requirements of NFPA #96.
 - 6) Exhaust fan must have motors, belts and bearings outside of air stream; shall be of axial-flow or squirrel-cage type or a power roof exhauster with same type fan; shall be selected for a minimum static pressure 1/4" WG; and shall discharge through 180° elbow on roof, roof hood, roof vent, or wall louvers, all with 1/2" mesh removable bird screen.

- b) Overhead hood described above may be replaced by a factory-built and guaranteed, specially designed, horizontal flow, wall mounted, special-fume canopy, hood or air inlet, arranged to draw air horizontally over the cooking surface at a rate of 100 cfm or more per sq. ft. of cooking surface, or 100 cfm or more per sq. ft. of vertical area from cooking surface to top of canopy, or 250 cfm per linear foot of canopy or ventilator, whichever is the greater, and conforming to all other requirements given above for overhead hoods.
- c) For school kitchens serving less than 150 meals per day, the kitchen range canopy or hood required for larger schools may be used, or it may be replaced by an exhaust register having a net free area of 0.17 sq. ft. or more per 100 cfm of air exhausted located in the wall or ceiling directly over the main cooking surface. Air volume exhausted shall be equal to 100 cfm per sq. ft. of cooking surface. All other requirements of cfm exhausted, construction of exhaust duct, exhaust fan arrangement, and static and discharge outlets shall be the same as for larger schools.
- d) Make-up air for the kitchen may be drawn from an adjacent lunchroom, dining room, cafeteria, or similar adjacent spaces. Such air shall be replaced by a unit system or central fan system introducing outdoor air at the rate required to avoid negative pressure at any fuel burner.

Section 175.552 Welding and Painting Booths, Hoods, Rooms

- a) Air exhausted from each welding booth must be equal to: 100 cfm per sq. ft. of booth face opening measured from top of work surface to top of opening; or 100 cfm per sq. ft. of booth floor area (whichever is the greater); or 600 cfm drawn from-within 12" of each welding arc. Air is to be drawn from above the work location.
- b) Air exhausted from each spray painting booth must be equal to:
 - 1) 125 cfm per sq. ft. of booth face opening measured from top of work surface to top of opening; or
 - 2) 125 cfm per sq. ft. of booth floor area (whichever is the greater); or
 - 3) 800 cfm drawn from within 16" of each spray nozzle. Air is to be drawn from-above the work location.
- c) Air exhausted from each welding or brush painting overhead hood perimeter (whichever is the greater). The edge of the hood must be sq. ft. of net hood opening; or 100 cfm per linear foot of exposed hood perimeter (whichever is greater). Edge of hood must be as low as possible and not more than 6'-6" above the floor.
- d) Air exhausted from each welding or painting location without hood or booth or local nozzle must be at least 1400 cfm for welding and 1600 cfm for painting. Air is to be drawn from slightly above the work location.
- e) Make-up air shall be provided from adjacent rooms or from automatically operated wall or roof openings where such a system would insure adequate make-up air to allow proper exhaust of noxious fumes without discomfort to room occupants and to prevent undue negative pressure at any fuel burner or at any exhaust opening. Manually operated windows and doors will not satisfy this requirement.

Section 175.554 Swimming Pool Rooms

Air exhausted must be at least equal to 2.0 cfm per sq. ft. of pool and floor area. Exhaust amount may be 100% or may be automatically varied from 10% to 100% as required to reduce room humidity. Outdoor make-up air equal to 90% or more of exhaust shall be supplied by an automatically controlled room heating and ventilating system. Make-up air must not be introduced far enough below room temperature to cause drafts or fog. Air exhaust and supply systems shall be operated constantly and the room maintained at a specified temperature whenever the pool is filled, being drained or cleaned, or the room is being cleaned with water.

Section 175.556 Toilet Rooms, Projection Booths

Air exhausted must be at least equal to 2.0 cfm per sq. ft. of floor area. Make-up air may be drawn from an adjacent locker room, corridor, or swimming pool room.

Section 175.558 Shower Rooms

Air exhausted must be at least equal to 2.0 cfm per sq. ft. of floor area. Make-up air may be drawn from an adjacent locker room, corridor, or swimming pool room. Where the adjacent connected locker room is exhausted through an associated shower room, total air to be exhausted from shower room shall be

- a) cfm as calculated above or
- b) cfm calculated for locker room under Section 175.560, whichever is the largest.

Section 175.560 Locker Rooms

Air may be exhausted directly from the locker room or drawn out through an adjacent connected toilet and/or shower room and must be at least equal to 1.5 cfm per sq. ft. of floor area of locker room. Make-up air may be supplied from outdoors (at least 75% of exhausted air) or from adjacent corridors, gymnasium, or auditorium (at least 100% of exhausted air). Where an adjacent connected locker room is exhausted wholly or partially through associated toilet rooms, total cfm to be exhausted from locker room may be decreased by the cfm exhausted from connected, associated toilet rooms.

Section 175.562 Special Exhaust Systems

- a) Stationary industrial-type equipment (as distinguished from hand-held equipment), such as wheel grinders, buffers, polishers, kilns, grinders, automobile, tractor, and other internal-combustion engines, wood planers, saws, jointers, etc., located in assembly, educational, and special educational occupancies shall have a central system with special local exhaust connections as required to prevent objectionable lint, dust, sparks, shavings, sawdust, odors, fumes, etc., from entering shop, room, or space in which they are located.
- b) Make-up air shall be from a shop or room and replaced the same as for welding and painting booths.

Section 175.564 Special Laboratories Producing Objectionable Odors or Fumes, Animal Rooms, Student Cooking Rooms and Kilns

- a) Air exhausted, including exhaust from fume hoods and ceiling grilles, must total at least 1.25 cfm per sq. ft. of floor area, unless otherwise noted. Outdoor make-up air equal to 33 1/3% of exhaust shall be supplied by a room ventilating system before the room is up to temperature and 75% or more after the room is up to temperature.
- b) Where a ceiling hood is used, it must conform to the ceiling hood called for in Section 175.550 (a) (1) and (5), overlapping work surface by 6" or more on all sides and exhausting 100 cfm per sq. ft. of total hood area or 150 cfm per foot of total exposed hood perimeter, whichever is the largest.
- c) Where a laboratory producing objectionable odors or fumes is located in a larger room or area, as in an "open plan area," the cfm exhaust shall be based on the gross area occupied by the laboratory equipment, tables and aisles.
- d) Each kiln must be provided with a non-combustible, rigid, "non-spill" hood, with air removed by a separate exhaust fan, of cfm capacity as required to prevent all "spill."
- e) Animal rooms with live animals must be exhausted same as in paragraph (a) above, except at rate of 2.00 cfm per sq.-ft.

Section 175.568 Laboratory Fume Hoods

- a) Where laboratory fume hoods are provided, the exhaust register may be in top of or in the wall near the top of the hood and connected to an individual or a group exhaust fan by exhaust ducts. Total air exhausted shall be at least 150 cfm per foot of length of hood opening.
- b) Make-up air for hoods shall be drawn from the associated laboratory.

Section 175.570 Exhaust Fans

All exhaust fans shall be of squirrel-cage or axial-flow type, mounted indoors, on roof, in duct, or in **power** roof exhauster; shall be selected for a minimum static pressure of **1/4** WG; and shall discharge through 180° elbow on roof, or roof hood, or roof vent, or **wall** louver and screen, all with 1/2" removable mesh bird screen and self-closing dampers. (See Section 175.547(e) and 175.572.)

Section 175.572 Special Notes on Exhaust and Supply Systems

- a) All motors, switches, starters, wiring, controls, devices, lighting, etc., in paint-spraying rooms, brush-painting rooms, paint-drying areas, or in paint-drying rooms and in other rooms or areas where explosive air mixtures might be produced must be explosion proof. All fans supplying air to, or exhausting air from, these rooms must be spark proof; and motors, controls, wiring, and belts must be outside of air stream or room.
- b) A separate exhaust system-with a separate exhaust fan shall be provided for each type of room usage where exhausted air carries laboratory hood fumes, paint fumes, welding fumes, explosive mixtures, or grease from cooking operations. Other types of rooms for which exhaust is required may be served by one or more common exhaust systems, with each exhaust inlet provided with an automatic, aluminum or fabric damper provided behind each register to prevent backflow. Each exhaust opening shall include a register (face plus manual damper).
- c) Exhaust systems included in Section 175.550, 175.552, 175-562, 175.568, and others handling fire-supporting or explosive grease, fumes, spray, or dust shall have spark-proof fans with motors, belts, controls, and wiring outside of the air stream; and ducts shall be arranged for ease of cleaning.
- d) Exhaust systems included in Section 175.554, 175.558, and others handling damp air or water spray shall have fans, housings, and ducts of rustproof construction with motors, belts, controls, and wiring outside of air stream.
- e) For exterior and damp air construction, see Section 175.547(e).

Section 175.574 Minimum Room Circulation and Minimum Outdoor Air Required

- a) The occupancy of any room or space (for determining cfm for ventilating and circulating of air) shall be: (a) design occupancy or (b) 60% of exit occupancy calculated by Section 175.410 (whichever is the larger). See paragraph (c) and (d) under this Section for exceptions.
- b) Each assembly, educational or special educational occupancy room or space having a capacity of 10 or more persons shall be provided with a mechanical supply ventilating system circulating room air and/or outdoor air, when occupied, conforming to the following minimum requirements:
 - 1) Unless otherwise specifically noted, minimum total air turn-over, air change, or air rotation shall be 6.0 air changes per hour (based on lowest 12'-0" of room) or 1.0 cfm per square foot of floor area or 20 cfm per person (based on room occupancy), whichever is greater, except as noted.
 - 2) Minimum outdoor air supply shall be introduced as soon as room is up to thermostat setting (except as noted) and shall be 5 cfm per person (based on room occupancy). The percentage of outdoor air supply shall be gradually increased to 100% as required to minimize overheating of occupied ventilated rooms unless other mechanical means are provided to minimize overheating.
 - 3) In cafeterias and associated kitchens, domestic science rooms, cooking rooms, home economics rooms, laboratories, other rooms where odors are produced, and in locker rooms, with make-up air drawn from outdoors, the minimum outdoor air supply shall be introduced as soon as the room is up to thermostat setting and shall be 50% of total cfm circulated by the supply ventilating system, with the percentage increased to 100%, same as for paragraph (b)(2) above. In all such rooms and spaces, minimum make-up air and the minimum percentage of outdoor air shall be increased as required to avoid negative room pressures at fuel burners.
 - 4) In rooms covered by Sections 175.550, 175.552, 175.556, 175.558, 175.560, 175.562, 175.564, 175.568, the minimum outdoor air supply shall be introduced whenever exhaust fans

are running (regardless of room temperature). In all such rooms and spaces, minimum make-up air and the minimum percentage of outdoor air shall be increased as required to avoid negative room pressures at fuel burners.

- 5) In swimming pool rooms, the minimum outdoor air supply shall be introduced whenever exhaust fans are running; and minimum total air circulated by the supply ventilating system shall be 90% or more of the amount exhausted at any time, regardless of room temperature.
 - 6) In gymnasiums, outdoor air supply may be drawn in through windows, with window-ventilating window openings having an area of not less than 3% of floor area, unless mechanical air supply is required to avoid negative room pressure at fuel burners.
- c) For gymnasiums and similar rooms which are to be used largely for instruction and exercise purposes, and rarely used for assemblies, the total air turnover, air change or air rotation shall be 6.0 air changes per hour (based on lowest 12'-0" of room), or 1 cfm per sq. ft. of floor area, whichever is greater. The requirement of 20 cfm per person does not apply.

Variable air volume (VAV) systems shall comply with all applicable requirements, with the following exceptions:

- 1) The total room air supply may be automatically revised down to 5 cfm per actual pupil in keeping with room temperature requirements.
- 2) Special means of air diffusion must be employed which will permit the above reduction in air change without objectionable noise, drafts or "spills."
- 3) The minimum amount of outdoor air supplied by the total system must be not less than 5 cfm per pupil under all conditions for the total occupancy of the building.
- 4) The air supply and air return fans must be controlled to keep the air supply and the air return in balance.
- 5) Variable air volume (VAV) systems must not be used where constant air circulation is required to replace air removed by exhaust fans or where constant air supply is required.

Section 175.576 Operation of Ventilating Systems

- a) Make-up air and exhaust systems for kitchens must be operated when cooking is being done.
- b) Exhaust fans for welding and painting booths, hood, kilns, and similar areas, and for other special exhaust systems must be operated whenever such work is in progress. Local make-up air systems must be operated whenever air is being exhausted from the room or space.
- c) Make-up air systems must be operated whenever a fuel burner is in operation in rooms or spaces they serve.

Section 175.578 Refrigeration Equipment

- a) Refrigeration equipment used for air conditioning, refrigerators, or cooled storage rooms must not employ any refrigerant which is toxic or in any way injurious to health. R12 and R22 are acceptable refrigerants.
- b) Refrigeration installations and equipment must meet all applicable requirements of ASHRAE, Standard 34-57, and USASI B9.1, ASME Code, Section VII for "Unfired Pressure Vessels."

Section 175.580 Stopping of Ventilating Equipment

- a) Where a fire alarm system is installed to comply with other sections of this standard, the following mechanical ventilating systems shall be arranged to be automatically stopped upon actuation of the building fire alarm system and to require manual restarting:
 - 1) Any system, which employs partial, variable, or full re-circulation, serving rooms or spaces with a combined capacity of 200 or more.
 - 2) Any air system which returns or exhausts through stairwells, corridors, or other means of egress, including exhausts from toilets, showers and locker rooms.
- b) The above rule does not apply to:
 - 1) Rooms with direct exiting.
 - 2) Systems which normally provide 100% mechanical make-up and push-pull systems which automatically provide 100% mechanical exhaust and make-up when the fire alarm system is activated.

Section 175.582 Pipe, Boiler, Duct, Furnace Insulation

All pipe, boiler, furnace, smoke pipe and duct insulation, duct covering and lining, and vapor barriers must be noncombustible and, where exposed, must have a flame-spread rating of 25 or less.

Section 175.584 Incinerators

- a) Incinerators shall be fired, controlled, and protected as called for in Section 175.536(b)(26), and 175.536(b)(27), except as otherwise noted. They may be in boiler or furnace rooms or in separate incinerator rooms.
- b) Incinerators and their installations shall conform to applicable requirements of IIA or NFPA #82, except the net opening for combustion air supply shall be not less than 150% for the natural draft (300% for draft-inducing fans which induce draft by handling air from room) of the area or the natural draft stack recommended by the incinerator manufacturers and shall conform to all requirements specified for similar openings for boilers.
- c) Combustion air openings, combustion air fans, makeup air fans etc., shall be provided the same as specified under "Combustion Air Supply," except of sufficient size and capacity to comply with the paragraph above.
- d) Incinerators and refuse accumulation areas shall be separated from other areas as provided under "Occupancy Separations."
- e) Natural draft incinerators having a refuse-burning capacity of 200 lbs./hr. or less may be served by a natural draft stack, which also serves other natural draft fuel-burners, with stack built for gases up to 1700°F. Larger natural draft incinerators must be served by a separate, individual, natural draft stack built for gases up to 1700°F. Incinerators of any size with draft-inducing fan (which mixes room and/or outdoor air products of combustion) may be served by a stack built for gases up to 800°F. Where an induced draft fan handles products of combustion without mixture with other air, it may be served by a stack which serves other induced draft or forced draft fuel-burners, with a stack built for gases up to 1700°F. Each incinerator smoke outlet must have a barometric draft adjuster.
- f) For natural draft incinerators, the breaching and the stack must be constructed of materials suitable for operation with 1700° flue gases. Breechings 10 in. in diameter and smaller may be unlined, sectional, bolted cast iron. Steel breechings of all sizes shall be a minimum of 12 gauge and shall be lined with the equivalent of 2 inches or more of first-grade mesh, reinforced plastic firebrick, or firebrick. Steel stacks shall be a minimum of 12 gauge

(increased in thickness and/or gayed or braced as required) and shall be lined as described above for breechings. Stacks and breechings shall be spaced from construction in keeping with NFPA-90A, NFPA-89M, and American Insurance Association Code for Installation of Heat Producing Appliances. Metal stacks must be grounded. Incinerator stacks (not kiln stacks) must have a non-corroding metal screen outlet arranged to catch partially burned materials.

- g) For a draft inducing installation, an arrangement which mixes products of combustion at 1700° and outdoor air or boiler room air to produce a mixture at 800° or less must be employed, with breaching and draft adjuster on inlet side of draft-inducing fan constructed for operation at 1700°, as outlined for natural draft incinerator breechings, and the stack on the outlet side of the draft-inducing fan constructed the same as normal breaching for operation at 800°.

Section 175.586 Gas Piping

- a) Gas piping shall comply with the applicable requirements of NFPA 54 and NFPA 58, except as otherwise specified herein and except that only Type L or K copper pipe with sweated joints and black steel or wrought iron pipe with welded joints or threaded malleable iron fittings may be used, unless otherwise noted. Cast iron fittings are prohibited for use in gas piping.
- b) Piping, valves, cocks and fittings shall be suitable for 125 psi working pressure.
- c) Underground, exterior gas piping shall be Type K copper with cooper or brass valves, fittings, etc., and sweated joints or welded black wrought iron or steel, with all valves, valve trim, piping, fittings, etc., of ferrous materials. All ferrous materials shall be heavily coated with bituminous material and spirally wound kraft paper or tape to form a continuous "holiday-free" bituminous insulation over all underground surfaces. Polyethylene protected pipe or its equivalent may be used.
- d) No gas piping shall be located in basement, in below-grade rooms, in furred spaces, in attics, above furred ceilings, in underfloor spaces, in crawl spaces, or in tunnels unless such spaces are adequately and permanently vented. Such a space, if not mechanically vented, must be vented to the outdoors, either directly or through a vented or ventilated room above, by having open-screened vents (which cannot be closed) to the outdoors, (or to ventilated or vented rooms above) from the top of the room or space, equal to one sq. ft. of free area for each 2,000 cubic feet of space. Vented air must flow continuously upward or horizontally to the outdoors or ventilated or vented room above. Gas piping may be run in concrete slabs on the ground, providing it is bare Type K copper pipe with wrought fittings and sweated joints, using 95-5 solder or silver solder or, if under the concrete slab, it is in tight bell and spigot vitrified clay tile or concrete tile, with watertight cement joints, with tile vented to the outside or to the vented room above at each end and 50'-0" o.c. by means of steel pipe sleeves, open to the outside or room above with venting area at each sleeve the same as the cross sectional area of gas pipe, or larger. Other gas piping must be installed where exposed to view and must not be concealed.
- e) No material except clean concrete, sand, gravel, or clay shall be permitted within 6" of any underground or underfloor piping or tile which encloses piping.

- f) No gas piping which has been de-activated or is no longer in use shall remain connected to in-service piping even though such is separated therefrom by a closed valve. Such piping, where de-activated or taken out of service, shall be purged in an approved manner and shall be disconnected from any service gas piping.
- g) Every building's main gas supply line shall be provided with a conspicuously marked or located, identified, readily accessible, tight-closing shut-off valve located on the outside of the building. The marking of locations must be permanent steel or concrete posts or non-ferrous or stainless steel plaques on adjacent walls which are conspicuous, visible and readable with snow 3'-0" deep. Marker posts must be painted red and must not interfere with use of ground area for its intended use. The valve or valve box must be painted red and must be tamper proof, with three (3) keys or operators delivered to the school board and one (1) key or operator delivered to the local fire station, permanently labeled as to the school. The valve must be located at least 5'-0" from building, if underground.
- h) Gas piping must not be located in and must not pass through air plenums or ventilating ducts of any kind unless the gas piping in the duct or plenum (and 2" beyond the duct or plenum at ends) is installed in an airtight metal pipe sleeve, vented to the outdoors, or into a room in which bare gas pipe is permissible.

Section 175.588 Heavier-Than-Air Gaseous Fuels

- a) Special precautions shall be taken to prevent the accumulation of heavier-than-air gaseous fuels, such as propane, butane, certain mixtures of LPG and natural gas, etc., in low spots where such gases are used. No piping, appliances, devices, or controls shall be located in rooms or spaces having their floors below grade or having openings to below-grade spaces or in other rooms or spaces where the gas could pocket unless positive ventilation means are provided to the outdoors. Where fans or other mechanical devices are used to establish this ventilation, they shall be of non-sparking construction, with motors, controls, bolts, and wiring outside of air stream. These fans or devices shall be interlocked with a fail-safe device to shut-off the fuel supply when ventilation stops before fuel line enters the space under consideration and to sound an alarm as called for in Section 175.536(E). Manually operated windows or doors will not satisfy this ventilation requirement. Precautions shall be taken to prevent negative pressure at all fuel-burning equipment. All electrical work in such fuel-burning rooms must be explosion proof.
- b) Except for self-contained pieces of equipment whose gas container has a maximum water capacity of 2 1/2 lbs., no cylinder or tank containing a heavier-than-air fuel gas shall be installed, stored, or used inside any school building. Outdoor installations, including valves, regulators, relief valves, etc., and storage of cylinders shall comply with NFPA #58.

Section 175.590 Gas Meters

- a) Gas meters shall be located outdoors as directed by the local utility or in a ventilated interior space, accessible and protected from tampering.
- b) Main gas reducing valves and main regulators shall be located outside of the building, in the boiler, incinerator, furnace, or fuel-burning rooms, or in a separate gas meter room, separated from the remainder of the building by the same construction as required for boiler room without openings, containing no other equipment, and provided with adequate ventilation.
- c) All main gas regulators shall be vented individually or in groups to the outdoors with vent terminating (in elbow turned down) at least 10' 0" above grade, and 5'-0" below or above, and 5' 0" horizontally from any exterior window, door, air intake, air outlet, or exit.

Section 175.592 Maximum Gas Pressure

Natural and manufactured gas pressure must not exceed 10 psi in gas meter, furnace, boiler, incinerator or fuel-burning rooms, (except that inlet pressure may be 20 psi if pressure regulator is 20 psi to 10 lb. or less) located indoors at the wall where the main enters building and 1 psi in any other part of the building. LPG pressure must not exceed 11" WG in any part of any building. Gas boosters or gas compressors shall not be installed, except in gas meter, boiler, furnace, incinerator, or fuel-burning rooms. Lower maximum gas pressures shall be used if recommended by the local utility.

Section 175.594 Tanks for Liquid Petroleum Gas (LPG)

- a) Tanks for LPG must be outdoors, above grade, and otherwise conforming to NFPA-58.
- b) Vents from regulators must terminate (in elbow turned down) at least 10'-0" above grade, 5'-0" below or above, and 5'-0" horizontally from any window, door, exit, air intake or air outlet. The entire system must be grounded.

Section 175.595 Kilns

- a) Gas or oil-fired kilns shall, in general, comply with all requirements for incinerators (See section 175.584), with a manual fuel control valve plus automatic valve or valves controlled by an operating furnace stat (if used) and a safety furnace stat.
- b) Where kiln has a direct flue connection through the roof, breaching and flue shall be built the same as for incinerators. Total room exhaust, including draft-inducing fan, shall comply with Section 175.564. Where air supply to room prevents negative pressure due to room exhaust and natural draft will suffice for kiln, a draft-inducing fan in kiln flue may be omitted and breaching constructed as per Section 175.584(f).
- c) Where kiln does not have a direct flue connection, it shall be provided with an exhaust hood overlapping the kiln, as required in Section 175.550 for cooking hoods. The hood and exhaust opening shall be so arranged that no "spills" occur between the perimeter of the hood and the top of the kiln.
- d) Provide adequate, permanently open or automatically opened combustion air opening into a room or space from outdoors, adjacent rooms, or a corridor. Space the kiln from construction the same as for incinerators. Kiln must comply with NFPA-86A.

Section 175.596 Steam Pressure Reducing Valves

Pressure reducing valves shall be provided to reduce steam pressure in one or more stages, as required for installation. At the outlet of the final stage of pressure reduction, safety or relief valves (same as for steam boilers) shall be provided and sized to prevent build-up of pressure on the low side in excess of a safe working pressure at the weakest part in case of malfunctioning of any pressure-reducing valve or because of human error. Pressure-reducing valves shall have a strainer ahead of first stage; steam gauges before and after each-stage; a valve before (globe or angle valve) and after (gate valve) each stage; a proper size bypass with angle or globe valve for each stage; a 3/4" pop safety valve to serve as a signal of high pressure at the outlet of the final stage. Provide a readable steam gauge with a cork at the inlet and outlet of each stage of pressure reduction. Pressure-reducing valves must be inaccessible to building occupants but must be readily accessible for servicing by maintenance personnel.

Section 175.598 High Pressure Boilers and Safety Controls

- a) Any steam boiler designed to operate at more than 15 psi or any hot water boiler designed to operate at more than 250°F or more than 160 psi is considered to be a high pressure boiler and must conform to ASME Boiler and Pressure Vessel Code, Section I, Power, 1965, for pressure used, with welds x-rayed and stress relieved in furnace at 1200°F.
- b) High pressure boilers shall comply with all requirements specified for low pressure boilers, except varied to conform to the higher temperatures and pressures used, including, but not limited to, Section 175.525 to 175.540 inclusive, except that when coal is used as fuel or the furnace has a large amount of heated refractory, safety shut-down devices shall be so arranged as to avoid the overheating of furnaces, grates, etc., by quick shut-down and safety valves that must discharge to outdoors.
- c) High pressure boilers shall have ASME tandem blow-off valves, extra heavy or Schedule 80 Blow-off piping, and ASME blow-off tank, or equivalent device, with a vent through the room and drain to the floor drain or outdoors.

Section 175.599 Roof Top or Roof Mounted Heating, Cooling and Heating-Cooling Air Supply Units

- a) Rooftop or roof-mounted units or equipment of all types shall comply with all applicable NFPA, UL or AGA requirements, all applicable requirements of Subpart F, and applicable requirements for indoor units of same type and fuel input.
- b) Devices shall include, but shall not be limited to,
 - 1) multiple fuel valves,
 - 2) an emergency disconnect switch controlling all power to convenience outlets (disconnect switch located in a weathertight tamperproof electrical compartment),
 - 3) a non-electric fuel valve (or equivalent) to close with high temperature over burner,
 - 4) one operating airstat set 160°F or less (mounted downstream of furnace),
 - 5) two safety arstats wired in series with operating devices (one mounted downstream of furnace and one mounted in the return air compartment) wired in series with operating devices and to shut down unit as called for in Section 175.536(b)(10).
- c) Each unit shall have an approved smoke detector located (mounted in the field) in the return air opening to the unit and wired to shut down the unit as called for in Section 175.536(b)(10) and to sound the building fire alarm system.
- d) Each unit will have an associated operating control panel (OCP) (located inside on its associated master control panel (MCP) for multi-unit installations, and on or adjacent to the building alarm panel (BAP) for individual unit installations with at least the following items shown on its face, wired into its control circuit:
 - 1) name plate showing the unit number it controls,
 - 2) system manual "off-auto" switch and white pilot light,
 - 3) refrigeration "off-auto" switch and alarm light indicating refrigeration failure,

- 4) alarm light indicating dirty filter,
 - 5) alarm light indicating heat failure,
 - 6) alarm lights for abnormal temperature As called for in Section 175.536(b)(10), (11) and (12).
- e) A single unit installation shall have a (4" or larger dia.) signal gong and associated silencing switch mounted on or adjacent to the building alarm panel (SAP), functioning as called for in Section 175.536(b)(10) and a seven-day-operating time clock mounted in the rooftop unit. The building alarm panel (BAP) shall be the same as described for multi-unit installations.
- f) For multi-unit installations, each operating control panel (OCP) with its required controls as called for in (d)(1) through (6) above shall be mounted on a master control panel (MCP) (or panels) which shall be built of finished steel, painted, and shall have the following additional items:
- 1) hinged and key locked tight front door with all associated unit operating control panels (OCP) mounted on its face;
 - 2) common signal gong (4" dia. or larger) wired into the alarm circuit of each unit operating control panel (OCP);
 - 3) associated silencing switch for common signal gong;
 - 4) system power "on-off" light;
 - 5) seven-day time clock mounted inside the master control panel;
 - 6) terminals and circuitry for wiring the master control panel (MCP) into the building fire alarm system;
 - 7) terminals and circuitry for wiring the master control panel (MCP) to the common building remote alarm panel (RAP) located in the administrative office area as directed.
- g) Each master control panel (MCP) shall be wired to the common remote alarm panel (RAP). The remote alarm panel (RAP) shall have alarm lights (white) for each associated master control panel (MCP) to indicate when any unit on each master panel (MCP) is shut off because of an alarm function. The remote alarm panel (RAP) shall be neatly finished steel, painted, with
- 1) hinged key locked door;

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- 2) one alarm light (white) and one name plate on its face for each master control panel (MCP) and for each fuel burning device with an input of 200,000 btu/hr. or over.

 - h) Cabinets of rooftop units and of roof-mounted units or equipment must be of tamperproof, vandal-proof and weathertight construction, with an electrical outlet providing continuous power mounted in the interior main electrical compartment. Each unit shall be provided with a self-contained cabinet, or such a cabinet plus penthouse or auxiliary housing, with entire unit so arranged that all devices of all kinds may be serviced without exposing servicemen to the elements when snow or rain are falling and so that there is no possibility of admission of wind-blown rain or snow; and shall be securely anchored to the roof structure and electrically grounded. Penthouse and auxiliary housing may be of portable design, of non-corrosive construction, sufficiently strong and anchored so that penthouse or housing will not be damaged or detached during use under any weather condition. Main oil or gas valves must be tamper and vandal proof, painted red, and located 5'-0" or more from outside of cabinet, penthouse, or housing where readily accessible.

 - i) Each cabinet must be provided with flush, hinged, locked, tamperproof, vandalproof, weatherproof, labeled (as to functions enclosed) access doors of sufficient number and size to provide complete access to all areas and devices requiring attention or service, with restraining chains on all doors.

 - j) Provision must be made to prevent transmission of vibrations to the building structure and sound to the interior of the building.

SUBPART G: ELECTRICAL SYSTEMS

Section 175.610 General Requirements

- a) Where there is conflict between the specific, spelled-out requirements given herein and the standards referred to, the specific, spelled-out requirements shall govern.
- b) Electrical equipment and installations shall comply with all applicable requirements of the National Electric Code (NFPA 70), unless-specific exception thereto is set forth in these specifications, except that reference to buildings other than school buildings, school office buildings, and school bus garages shall be disregarded.
- c) Fire alarm and fire detection systems and their installations shall comply with the requirements of NFPA 72A, with devices labeled for designated use by UL or FM.

Section 175.620 Branch Circuits

- a) The total connected load shall not exceed 80% of the branch circuit rating.
- b) Each motor branch circuit shall have a minimum capacity of 125% full load current rating of the motor.
- c) The rating or setting of an overcurrent device for each branch circuit shall not be in excess of the rated capacity of the circuit conductor, and such device shall be suitable for maintaining overloads such as imposed when motors are started.

Section 175.630 Feeders

- a) Feeders shall be of adequate size to serve the total connected load at a demand factor of at least 80% for lighting, 100% for heating and 100% for motors which may operate simultaneously.
- b) The entire lighting load shall be considered as being "connected." The connected receptacle load shall be included in the lighting load and shall be computed on the basis of the equipment thereby served but, in no case, less than 1 1/2 amp. per outlet.

Section 175.640 Overcurrent Protection

- a) No overcurrent devices shall be permitted in any permanently grounded conductor.
- b) Conductors shall be protected in accordance with their current-carrying capacity, except as otherwise permitted by the National Electric Code (NFPA 70).
- c) Fuse holders for plug fuses shall be provided with an adapter to limit the size of the fuse that can be used therein. The capacity of such adapter and fuse size shall not be greater than the current-carrying capacity of the conductor served.

Section 175-650 Wiring Methods

- a) Wiring design, protective methods, and materials shall be in accordance with National Electric Code - 1971 (NFPA No. 70-1971), Article 800, Communication Circuits, except that
 - A) open wiring on insulators (Article 320),
 - B) concealed knob-and-tube work (Article 324),
 - C) nonmetallic sheathed cable (Article 366) shall not be used,
 - D) all exposed wiring must be installed in conduit, and
 - E) all concealed wiring must be accessible for inspection and servicing, or installed in conduit. Class 1 and Class 2 remote control, low-energy power, low-voltage power, and signal circuits may be designed, installed and use materials in accordance with Article 725 of the National Electric Code.
- b) All interior wiring shall have a grounded conductor, except as otherwise permitted for fire detection systems under NFPA 72A, special swimming pool systems, and others listed as exceptions in the National Electric Code.

Section 175.660 Lighting Fixtures

- a) Equipment used with electric discharge lighting systems having an open-circuit voltage of not more than 2,000 volts shall be of a type approved for such service in the National Electric Code.
- b) Transformers with an open-circuit voltage of more than 2,000 volts shall not be used for lighting fixtures.
- c) Lighting fixtures used in walls of swimming pools shall be 24 volts or less or 120 volts or less supplied from an ungrounded system complete with ground detector.
- d) Vapor proof lighting fixtures, devices, controls, receptacles, and raceway systems shall be used in shower rooms, swimming pool rooms, pool equipment rooms, in range and dishwasher hoods or canopies, and in the path of air exhausted from above kitchen equipment.
- e) Weatherproof lighting fixtures, devices, controls, and raceway systems shall be used outdoors.
- f) Explosion-proof lighting fixtures, devices, controls, and raceway systems shall be used in, or adjacent to, paint spray booths, hoods, or rooms and in every other explosive atmosphere.
- g) Fixtures installed in fire rated ceilings must meet all requirements of the NFPA.

Section 175.670 Exit Lighting

- a) Exit and directional exit signs shall be provided where called for in Section 175.480.
- b) Current for exit and directional exit signs shall be supplied from a separate emergency panel such as the one connected on the line side of the main entrance switch or connected to the emergency lighting system.

Section 175.680 Emergency Lighting

Emergency lighting shall be provided where called for in Section 175.480 and shall be supplied from an emergency lighting system as specified herein.

Section 175.690 Emergency Wiring and Systems

- a) Wiring for exit lights, emergency lights, fire alarms and for other emergency purposes may be run in the same raceway or conduit, provided each conductor is properly, permanently identified, but shall not be run in the same raceway or conduit with general lighting or power wiring.
- b) Emergency lighting systems shall be supplied by a normal power source(s) of approved voltage, in combination with an approved auxiliary power source(s). A complete separate, central, or unitary wiring system shall be provided for each emergency lighting system.
- c) Normal source(s) of power supply shall be considered as that which supplies current for general lighting purposes.
- d) An approved, automatic, self-restoring transfer switch or switches shall be provided for each emergency lighting system which shall automatically and instantly disconnect the system from its one source of supply and connect it to the other supply source upon the failure of the first current supply.
- e) The auxiliary supply source shall provide a safe and dependable standby power source in the event of the failure of the normal supply service and shall be considered as meeting the requirements of the specification when in compliance with one of the following:
 - 1) Where the normal lighting and power supply is from an isolated indoor local or private plant with no exposed exterior wiring or equipment, the auxiliary source may be taken from an approved overhead or underground separate service which is supplied from a separate source (i.e. public utility).
 - 2) Where light and power services are supplied by a common source consisting of a completely underground, three-phase network system, which, in turn, is fed from more than one generating station or distribution substation, the requirement for an auxiliary supply shall be considered as having been complied with. If the normal supply service is taken from the line side of the main service switch no transfer switch will be required.

- 3) Where the source of current is common to both light and power, is of the "spot network" type (two separate primaries, two utility company transformers, and all switch-gear necessary to accomplish automatic switching), and the entire service is underground, the normal supply service may be tapped on the line side of the main building service switch. No auxiliary supply or transfer switch will be required.
 - 4) Central, automatically charged battery(s) or local packaged emergency lighting units with individual batteries and individual automatic charges shall be acceptable as auxiliary power sources.
 - 5) A generator driven by some form of prime mover, using liquid or gaseous fuel, which has sufficient capacity and proper rating to supply exit and emergency lighting circuits plus such other emergency power as is desired and which is equipped with suitable means for starting the prime mover automatically upon failure of the normal source of current supply shall be acceptable as an auxiliary power source. Installation shall comply with NFPA 37, "Installation and Use of Combustion Engines and Gas Turbines."
- f) The installation of a separate transformer for the purpose of obtaining proper voltage for emergency lighting systems shall not be required when the utility service company's power supply has a mid-point ground on one phase with a resultant 115 voltage from phase to mid-point ground.
- g) Fire pumps, fuel burners, fans, pumps, elevators, etc., may be, but are not required to be, connected to emergency power systems. For fire pump installations, refer to NFPA #20.

Section 175.692 Fire Alarm Systems and Automatic Fire Detection

Fire alarm systems and automatic fire detection complying with the provisions of this and other sections shall be provided for each building where required by Section 175.460 and 175.470. Current supply for the fire alarm system and associated supervisory and monitoring systems shall be from the emergency generator system or from automatically charged batteries.

Section 175.694 Minimum Levels of Illumination

The following minimum average levels of illumination at the desk or bench level shall be maintained.

- a) Classrooms, study halls, stages and other spaces used for study, laboratories, counseling rooms, offices -- 50 foot candles.
- b) Vocational shops, etc. -- 100 foot candles on benches, tables, machines; 50 foot candles in general areas.
- c) Sight-saving rooms, drafting rooms, art rooms, sewing rooms -- 100 foot candles.
- d) Gymnasiums, band rooms, choral rooms, playrooms, multi-purpose rooms -- 50 foot candles if used for study; 30 foot candles for other uses.
- e) Auditoriums, etc. -- 50 foot candles if used for study; 15 foot candles for other uses.
- f) Toilet rooms, lounges, shower rooms, locker rooms, meter and transformer rooms, boiler, furnace, incinerator, meter, and trash rooms -- 10 foot candles.
- g) Interior corridors, stairs, stairwells, other interior paths of exit -- 15 foot candles on floor.
- h) Exterior stairs and stair platforms -- 5 foot candles.
- i) Store rooms -- 5-foot candles.
- j) Fire escapes, exterior balconies, exterior walkways used for exit purposes, other exterior paths of exit -- 1-foot candle.

Section 175.696 Exterior Lighting

Exterior stairs, balconies, platforms, and door thresholds shall be illuminated by suitably located, weatherproof, or weather-protected fixtures.

Section 175.698 Lightning Protection

All structures providing an unusual risk shall be protected against lightning in keeping with the requirements and recommendations of NFPA 78, "Lightning Code."

SUBPART H: PLUMBING

Section 175.710 General

Where there is conflict between the specific, spelled-out requirements given herein and the standards referred to, the specific spelled-out requirements shall govern.

Section 175.720 Water Supply-Sprinklers and Standpipes

Water supplies for sprinkler systems and standpipe installations shall comply with the applicable provisions of Sections 175.440, 175.450, 175.490 and with those provisions of this Subpart which establish the requirements for the connection of such supplies to portable water systems.

Section 175.730 Water Supply-General Requirements

- a) All water in schools subject to human consumption or use shall be supplied from an approved public water supply and distribution system wherever such a system is available in compliance with the applicable provisions of the Illinois State Plumbing Code.
- b) Where an approved public water supply and distribution system is not available as a supply source, all water subject to human consumption and use shall be supplied by a system which complies with all applicable requirements of the Illinois State Plumbing Code, the Illinois Water Well Construction Code, the Water Well Pump Installation Code, and, in addition, with all applicable recommendations and requirements of Circular No. 829-published by the Department of Public Health, State of Illinois, and of the Committee Report of the Great Lakes-Upper Mississippi River Board of State Sanitary Engineers, dated January 1951, and titled "Policy for the Review and Approval of Plans and Specifications for Public Water Supplies,"-including all tentative revisions through 1960, subject to the following interpretations, deviations, or exception:
 - 1) Reports, plans, specifications, etc as may be required by the referenced publications shall be submitted to the Enforcing Authority for approval.
 - 2) The required treatment of water shall be limited to that necessary to produce the quality of water specified in this Subpart..

Section 175.740 Quality of Water Supply

- a) All water supplied to a school or to a fixture therein shall have a bacteriological quality as determined by the coliform group of not more than 1 per 100 ml during any one month. Such quality shall be determined in accordance with the applicable provisions of Circular #829 of the Department of Public Health, State of Illinois.
- b) The chemical quality of all water provided to a school or to the fixtures installed therein shall not exceed the following limiting figures:
 - 1) Chloride (CL)-250ppm
 - 2) Fluoride (F)-1.5 ppm
 - 3) Sulfate (SO)-250 ppm
 - 4) Nitrate nitrogen (N)-20 ppm
 - 5) Total Solids-500 ppm
 - 6) Turbidity-10 ppm (silica scale)
 - 7) Color-20 (Standard Cobalt Scale)

No objectionable taste or odors shall be permitted.

Section 175.750 Water Delivery Pressures and Quantities

- a) Each school's water supply and distribution system shall be capable, at all times, of maintaining not less than 15 psi pressure at every fixture.
- b) Each school's water supply and distribution system shall be capable of delivering not less than 10 gpd per occupant thereof in every primary school (kindergarten up to and including 8th grade), and not less than 20 gpd per occupant thereof in every secondary school (9th grade and higher). Where a cafeteria is provided, these minimum quantities shall be increased not less than one gpd per occupant. Where other than normal conditions exist (i.e. swimming pools, air conditioning, water-wash type paint booths, etc.), these figures shall be increased in an amount sufficient to accommodate the added supply demand.

Section 175.760 Swimming Pools

All swimming pools shall comply with all applicable requirements of "Sanitary Requirements for Swimming Pools," published by the State of Illinois, Department of Public Health, Division of Sanitary Engineering.

Section 175.770 Plumbing and Sewage Disposal Requirements

- a) The occupancy of any room or space (for determining plumbing fixture requirements) shall be equal to (1) design occupancy or (2) 60% of exit occupancy calculated by tables under Section 175.410, whichever is the larger. Only those rooms which will be used simultaneously shall be included in fixture calculations.
- b) Toilet, plumbing and sewage disposal installations shall conform to all applicable requirements of the "Advisory Code of Minimum Standards of Good Plumbing Practice," known as the "Illinois State Plumbing Code," published by the State of Illinois, Department of Public Health, Division of Sanitary Engineering, except as noted below:
 - 1) "Administrative Authority" and "Plumbing Inspector," as referred to therein, shall be considered as meaning "Enforcing Authority" for the purpose of these specifications.
 - 2) For the purpose of these standards, the following parts of the referenced "Illinois State Plumbing Code" shall be disregarded:
 - A) Specific references to building; other than schools.
 - B) Pages "v to ix" inclusive.
 - C) Section 2.26, "Ventilation Ducts."
 - D) Section 14.17.2, "Requirements for Plumbing Permits."
 - E) Section 14.17.3, "Enforcement."

(Editor's Note: The references in paragraph (b)(2) of this Section to the Illinois State Plumbing Code (77 Ill. Adm. Code 890) refer to versions rescinded many years ago. Thus, no cross-references to the codified version can be given. The State Board of Education will amend this Section to update these references.)
- c) In all buildings, accessible and identified shut-off or isolating valves shall be installed, where necessary, to permit the domestic water supply, hot, tempered, and cold, to fixtures and equipment to be shut off in groups consisting of not more than 20 plumbing fixtures with two (2) back-to-back fixtures considered as one fixture.

- d) Each water connection to each fixture shall have an approved air gap or vacuum breaker and accessible stop; each fixture shall have a trap with an accessible cleanout vented to prevent siphonage.
- e) No solid piping connections shall be made between domestic water supply and any closed heating, cooling, condensing or other system or any system with a submerged outlet.
- f) All fixtures or valves with hose thread outlets shall have an approved vacuum breaker on outlet side of valve, except sill cocks.

Section 175.780 Domestic Water Heaters-With Fuel Burners

- a) Gas-fired water heaters and their installation shall comply with applicable requirements of NFPA 54, NFPA 58, USA I-Z21.10.1.
- b) Each main gas supply to a gas burner shall have a separate manual shut-off cock or valve and regulator; each main oil supply to an oil burner and each gas supply to a pilot for gas or oil burners shall have a separate manual shut-off cock or valve.
- c) Each cold water supply or hot water return to a tank or heater shall have an accessible shut-off valve.
- d) Oil-fired water heaters and their installation shall comply with the applicable requirements of NFPA 31. Each oil connection to each burner shall be valved.
- e) In addition to the above codes, fuel burners, breechings, smoke pipes, gas vents, multiple thermostats, pressurestats, other safety requirements, combustion air openings, precautions to prevent negative pressures in fuel-burning rooms, multiple relief valves, AGA approved draft divertor, etc., shall comply with all requirements for like hot water boiler heating installations for the same fuel input called for in Subpart F.
- f) Each gas, oil, gas and oil, and solid fuel fired heater shall be provided with a smoke pipe, stack, vent or breaching, multiple ASME Boiler Code safety relief valves, valved drain, fuel burner, operating and safety water thermostat, safety pressurestat, draft divertor or barometric draft adjuster, and adequate and reliable combustion air supply (to avoid negative pressure at fuel burner), complying with all applicable requirements of Subpart F, except as noted herein. Each heater shall be controlled by automatic devices which will automatically shut off the fuel supply in the event of pilot or flame failure or in the event of operating current or air pressure failure.
- g) Each water heater shall have a full size barometric draft adjuster provided in the smoke pipe, vent or breaching. Or, if a draft divertor is used, it shall be AGA approved, without moving parts.

- h) The temperature of water supplied to footbath, lavatories, sinks, and other facilities used by students shall not be more than 130°F. The temperature of hot or tempered water supplied to showers and baths shall be automatically controlled, in groups or at individual showers or baths, at 100° to 130° (adjustable).
- i) Each hot water heater (or hot water outlet from heater) and outlet of each main mixing valve supplying tempered or mixed water to fixtures shall be provided with a water thermometer of such type and so located as to permit it to be easily read.
- j) Each hot water mixing valve shall automatically close to hot water in the event of diaphragm, current, or air pressure failure; and each supply to such a mixing device and each supply to a fixture trim which could permit a cross-flow of water between hot and cold water connections shall have a stop and check valve to prevent cross-flow from one supply line to the other.

Section 175.790 Domestic Water Heaters-Boiler Water, Steam or Electric Heated

- a) Each indirect, below-the-water-line, hot water-heated, steam-heated, or electric-heated hot water heater shall be provided with thermometers, multiple ASME Boiler Code safety valves, valved drains operating and safety water thermostats, safety pressurestat and inlet water or steam valves complying with all applicable requirements for hot water boiler heating installations with the same heat input as outlined in Subpart F. Electric hot water heat shall be controlled by an approved multiple thermostatic device. Each hot water- or steam-heated hot water heater shall be provided with a control system which will automatically close all control valves and stop control pumps on the heating supply side, thereby stopping the heat supply in the event of current or air pressure failure.
- b) The temperature of water supplied to footbaths, lavatories, sinks, and other facilities used by students shall not be more than 130°F. The temperature of hot or tempered water supplied to showers and baths shall be automatically controlled, in groups or at individual showers or baths, at 100° to 130° (adjustable).
- c) Each hot water heater (or hot water outlet from heater) and outlet of each main mixing valve supplying tempered or mixed water to fixtures shall be provided with a water thermometer of such type and so located as to permit it to be easily read.
- d) Each hot water mixing valve shall automatically close to hot water in the event of diaphragm. current, or air pressure failure; and each supply to such a mixing device and each supply to a fixture trim which could permit a cross-flow of water between hot and cold water connections shall have a stop and check valve to prevent cross-flow from one supply line to the other.
- e) Steam or water coil heaters and their installations shall comply with ASME Code, Section VIII, Unfired Vessels, 1966.
- f) Electric water heaters and their installations shall comply with USASI-C72.1; NEMA-WHI; and UL-174.

Section 175.TABLE A Fire Resistance Ratings of Structural Elements, in Hours

STRUCTURAL ELEMENT	TYPE OF CONSTRUCTION				
	IA (1) Timber Fire Resistive	IB (1) 2-hour Protected Fire Resistive	II (1) 1-hour Noncombustible	III Unprotected	IV Heavy Ordinary
1. Bearing walls and their supports	2	1	NC	2(I)	2(I) (2).
2. Non-bearing walls	NC(2)	NC(3)	NC	NC(4)	NC(4)
3. Floors and floor supports 1st and below	2	2	1	HT	I
Other	2	1	NC	1	3/4
4. Columns supporting roofs and roofs less than 20 ft. to lowest member	1	3/4	NC	HT	3/4(5)
Roofs 20 ft. or more to lowest member	NC	NC	NC	HT	3/4(5)

NOTES FOR TABLE A

HT-Heavy timber construction

NC-Noncombustible

AGENCY NOTE 1: Materials for structural elements shall be noncombustible.

AGENCY NOTE 2: Masonry veneered, and wood stud exterior walls permitted for 1-story buildings not over 20,000 sq. ft. gross area (no increase permitted for direct exterior exiting).

AGENCY NOTE 3: Half hour combustible partitions may be substituted for up to 50% of partition area on any story provided lumber is fire retardant treated in accordance with Note 5.

AGENCY NOTE 4: One-half hour combustible partitions permitted.

AGENCY NOTE 5: Construction using approved fire retardant lumber and heavy timber construction may be substituted. Fire retardant treated lumber must bear seal of an approved testing laboratory, must not show flame-spread rating over 25 when tested under NFPA #255 for 30 minutes, and must not be used when directly exposed to the weather or high humidity conditions.

Section 175.TABLE B Height and Area Limits

Construction Type	Maximum Gross Floor Area Per Story			
	I story	2 stories	3 stories	over 3 stories
IA 2-hr. Fire Resistive	nl	nl	nl	nl
IB 1-hr. Fire Resistive II Unprotected	nl	50,000	35,000	NP
Noncombustible	40,000	30,000	NP	NP
III Heavy Timber	40,000	30,000*	16,000	NP
IV Protected Ordinary	40,000	30,000	NP	NP

nl-not limited

NP-not permitted

*Two-story Type II construction not permitted for Open Plan buildings. Insulated metal roof deck, if used on two-story Type II construction, to be tested and UL or FM (Class I) approved assembly, and all ceilings to be noncombustible and have a flamespread rating not exceeding 25.