

BUILDING CODE

**INDUSTRIAL COMMISSION
OF WISCONSIN
1914**

INDUSTRIAL COMMISSION OF
WISCONSIN
MADISON

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BUILDING CODE

INTRODUCTION.

Chapter 588, laws of 1913, contains the following provisions (sections 2394—41 to 2394—71):

"Every employer and every owner of a place of employment or a public building now or hereafter constructed shall so construct, repair or maintain such place of employment or public building, and every architect shall so prepare the plans for the construction of such place of employment or public building, as to render the same safe." It shall be the duty of the Industrial commission "to ascertain, fix and order such reasonable standards, rules or regulations for the construction, repair and maintenance of places of employment and public buildings, as shall render them safe."

"The term 'safe' or 'safety' as applied to an employment or a place of employment or a public building, shall mean such freedom from danger to the life, health, safety or welfare of employes or frequenters, or the public, or tenants, and such reasonable means of notification, egress and escape in case of fire, as the nature of the employment, place of employment, or public building, will reasonably permit."

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PART I.

SCOPE OF BUILDING CODE

SECTION 1. NEW BUILDINGS AND ADDITIONS.

Order 5000. This code shall apply to all new buildings and additions (except those exempted in order 5006) for which contracts have not been let before October 15, 1914.

SECTION 2. ALTERATIONS.

Order 5001. This code shall apply to all alterations which affect the structural strength, fire hazard, exits, lighting or sanitary condition of any building (except those exempted in order 5006) for which contracts have not been let before October 15, 1914. This does not include ordinary repairs necessary for the maintenance of any building.

SECTION 3. CHANGE OF USE.

Order 5002. This code shall apply as far as possible to all buildings which are to be devoted to a new use for which the requirements of this code are in any way more stringent than the requirements covering the previous use of the building.

SECTION 4. EXISTING BUILDINGS.

Order 5003. Obstruction of Aisles, Exits, etc.—All provisions of this code relating to the obstruction of aisles, corridors, passageways, doors, fire escapes, stairways, and other means of egress shall apply to existing buildings as well as to new buildings.

Order 5004. Fire Escapes.—The specifications for fire escapes, fire ladders, and standpipes, contained in orders 5121-5135, shall apply to all fire escapes hereafter constructed on existing buildings as well as on new buildings.

Note. General orders covering the number and size of fire escapes required on existing buildings will be drawn

"The term 'public building' as used in sections 2394—41 to 2394—71 shall mean and include any structure used in whole or in part as a place of resort, assemblage, lodging, trade, traffic, occupancy, or use by the public, or by three or more tenants."

"The term 'owner' shall mean and include every person, firm, corporation, state, county, town, city, village, manager, representative, officer, or other person having ownership control or custody of any place of employment or public building, or of the construction, repair or maintenance of any public building, or who prepares plans for the construction of any place of employment or public building. Said sections 2394—41 to 2394—71, inclusive, shall apply, so far as consistent, to all architects."

Existing laws on fire escapes, exits, etc., are repealed.

In accordance with this statute, a Building Code was formulated by the following committee:

A. C. Eschweiler, architect, Milwaukee.
C. F. Ringer, former Inspector of Buildings, Milwaukee.
Howland Russel, architect, Milwaukee.
C. A. Halbert, civil engineer, Railroad Commission.
Sidney J. Williams, deputy, Industrial Commission.

Valuable assistance was also received from the following:

George B. Ferry, architect, Chairman Milwaukee Building Code Commission.
Gustave Kahn, Sterling Engineering Co., member Milwaukee Building Code Commission.
W. D. Harper, Inspector of Buildings, Milwaukee.
Chief Thos. A. Clanc, Milwaukee Fire Department.
Van Ryn & DeGelleke, Milwaukee (schools).
Kirchoff & Rose, Milwaukee (theaters).
Milwaukee & Wisconsin Hotel Men's Associations and traveling men's organizations (hotels).
J. E. Florin, Supt. of Inspection, State Fire Marshal's Department.
J. R. Sullivan, Milwaukee Board of Fire Underwriters.
Geo. Sayle, Chairman, Board of Public Works, Madison.
F. L. Kronenberg, architect, Madison.
L. W. Claude, Claude and Starck, architects, Madison.
Chas. E. Marks, architect, Madison.
Philip Dean, Building Commissioner, Madison.
National Fire Protection Association, and scores of other architects, builders, fire chiefs, etc.

All of these gentlemen, and especially the original committee, have given very freely of their time to this work, for which the Industrial commission acknowledges its deep obligation. Cop-

ious use was made of the best existing municipal and state legislation, including the new Milwaukee ordinances prepared by the Milwaukee Building Code Commission.

The tentative code thus prepared was printed and sent to every architect and fire chief in the state, to commercial organizations, and to many other interested parties, both in and out of the state. The newspapers gave much space to the subject. Public hearings on the code were held in Superior, Eau Claire, Oshkosh, La Crosse, Janesville, Madison, and Milwaukee, which were attended by city officials, architects, builders, and property owners. In short every effort was made to secure publicity commensurate with the importance and far-reaching effect of a state building code. The criticism thus received, relating mostly to matters of detail, resulted in a revision of many sections of the code. After finally leaving the hands of the committee, the code was submitted to and approved by the Industrial commission's general committee on safety and sanitation, composed of the following:

Representing Wisconsin State Federation of Labor:
Geo. Muller, machinist, Milwaukee.
Fred French, pattern maker, Milwaukee.
Representing Milwaukee Merchants and Manufacturers' association:
Charles P. Bossert, Pfister & Vogel Leather company.
Edward J. Kearney, Kearney & Tucker company, chairman of committee.
Representing Milwaukee Health department:
Joseph Derfus, chief sanitary inspector.
Representing Wisconsin Manufacturers' association:
Thomas McNeill, Sheboygan Chair company, Sheboygan.
H. W. Bolens, Gilson Manufacturing company, Port Washington.
Representing Employers' Mutual Liability company, Wausau:
W. C. Landon, Wausau.
Representing Industrial Commission of Wisconsin:
John W. Mapel, Pfister & Vogel Leather company.
Fred W. McKee, Fairbanks-Morse company, Deloit.
Ira L. Lockney, deputy to the Industrial commission.
C. W. Price, assistant to the Industrial commission.

Purpose of the Code.

A state building code, if it is to be efficient without being unduly restrictive, must confine itself to broad general requirements of fire protection, sanitation, and structural safety. Technical details must be avoided except where they are needed to give meaning to the general requirement. In other words, the code should specify results only, giving free rein

to the originality of the architect or engineer to secure such results by the most economical and efficient means. Even such matters of detail as are properly included in city building ordinances must often be excluded from the state code. This refers especially to details of engineering design, which it would be useless to include in a state code because they could not be enforced by local officials without technical training.

The experience of other states, where a multiplicity of detail in building laws has antagonized designers and defeated its own purposes, has proven that these dangers are real. The Wisconsin code has sought to avoid them.

It has been the especial aim of the framers of this code to include only such requirements as are based on actual experience and standard practice. The code is not put forth as an ideal standard of building construction, but simply as the best standard which can reasonably be enforced throughout Wisconsin at the present time. The desirability of such a code is indicated by the large loss of life through fire or panic in different parts of the country in recent years. The Iroquois theater fire in Chicago, the Collinwood school fire in Ohio, the Triangle Waist company fire in New York, to quote only the most prominent instances, have caused legislation along these particular lines, in their respective localities and elsewhere, which is much more drastic than the requirements here proposed. It is hoped that the moderate requirements of this code will prevent or at least minimize the possibility of such catastrophes in Wisconsin.

The code attempts to protect life by means which will at the same time protect property. Such protection is not a burden but a sound business investment.

Administration.

The building code will be enforced in co-operation with local officials, who are required by law to enforce all orders of the commission which are germane to their respective duties (Sect. 2394-70). With the state code as a foundation, city ordinances may go more into detail, if desired, or may contain more stringent requirements than those of the state code.

To secure the best results, plans should be filed with and approved by a city building inspector. This is now required in Milwaukee, Superior, and Madison, and for buildings with-

in the fire limits in other cities. The Industrial commission strongly recommends all cities to require such building permits and thus prevent the construction of buildings which will endanger the lives of citizens and increase the possibility of a disastrous general conflagration.

When local permits are not required, the commission will be glad to examine any plans which may be submitted by architects or owners who wish to protect themselves against the possibility of having to make future changes to conform to the code. This is especially suggested in the case of theaters, schools, and other large buildings. If a building is erected in violation of the code, the owner may be required to correct the defect, and may also be held for a penalty of from ten to one hundred dollars for each day of violation.

Appeal.

Any person who considers any part of the building code, or any local official's interpretation of the code, to be unreasonable, may appeal to the commission to interpret, modify, or suspend the same. As the building code is not a statute but an administrative order of the commission, it may be so interpreted, modified, or suspended by the commission at any time. The subject of building design is so complex, and the situations which may arise are so various, that such exceptions will doubtless have to be made from time to time. The same procedure applies to the recognition of new building materials or systems of construction.

Bulletins.

Education is more potent than regulation. The building code, though regulatory in form, aims simply to present to the people of Wisconsin the accumulated experience of the state and the United States as to what precautions are necessary to make buildings reasonably safe. The commission intends to supplement this by issuing bulletins from time to time describing new developments in building design and construction, and also describing any important fires or collapses which occur. The commission believes that every owner wants to make his building as safe as possible and that he only asks to be shown what safeguards have been proven necessary by experience.

up by the Industrial commission in the near future. In the meantime, special orders will be issued where necessary.

Order 5005. Miscellaneous. Every new installation, and every repair exceeding 50 per cent, of any

Roof covering

Toilet room

Boiler, furnace, or stove

Chimney or smokepipe

Motion picture machine or booth

shall comply with the corresponding requirements of this code.

See also Orders 5001, 5002.

SECTION 5. BUILDINGS NOT INCLUDED.

Order 5006. This code does not apply to the following buildings:

(1) Private residences, and outbuildings in connection therewith, such as barns, garages, etc.

(2) Flat buildings used as the residence of two families only, provided not more than six persons are accommodated who are not members of the family.

(3) Buildings used for agricultural purposes which are not within the corporate limits of a city or village.

(4) Temporary buildings or sheds used for construction purposes only.

SECTION 6. LOCAL REGULATIONS.

Order 5007. This code shall not be understood to limit the power of cities, villages and towns to make or enforce additional or more stringent regulations provided the same do not conflict with this code, or with any other order of the Industrial commission.

Note. Every municipality is recommended to adopt, for its own benefit:

(1) Definite fire limits, and regulations prohibiting the construction of frame buildings within such limits.

(2) Regulations governing the construction of private residences and other buildings not covered by this code, especially with a view to fire prevention.

(3) Other fire-preventive and sanitary regulations which cannot reasonably be included in a state code.

PART II.

DEFINITIONS AND STANDARDS

Note. The following definitions (Orders 5100, 5101, 5102) apply to buildings which are **required** to be fireproof, mill or ordinary construction. See orders 5201-5202, 5502-5503, 5602, 5702-5703.

SECTION 1. FIREPROOF CONSTRUCTION.

Order 5100. A building is of fireproof construction if all the walls, partitions, piers, columns, floors, ceilings, roof and stairs are built of incombustible material; and if all metallic structural members are protected by an incombustible fire resisting covering of low heat conductivity, of not less than 2 inches thickness of concrete, or 3 inches thickness of other approved material, for columns; not less than 2 inches thickness for girders; and not less than 1½ inches thickness for other structural parts. This thickness shall be outside of the extreme edges of structural members. Such covering shall consist of Portland cement concrete, brick, terra cotta, or tile, laid in cement mortar, or other approved material and shall be properly reinforced, bonded, wired or otherwise secured in place. Steel reinforcement shall be protected as in order 5313. The plastering shall not be applied to wood lath or wood furring strips.

The trimmings and finished floor may be of wood, provided all spaces behind or below same are filled with incombustible material. Partitions entirely contained within a private apartment may be non-fireproof provided the partitions enclosing such apartment are fireproof.

A wood roof with incombustible roof covering will be permitted on a fireproof building not more than 85 feet high, provided the ceiling of the uppermost story is of fireproof construction not suspended from the roof.

For outside windows and doors see order 5201.

Note (a). A "fireproof" floor, ceiling, or wall is one of "fireproof construction." A "standard fire wall," "fireproof partition," etc., are defined in orders 5108-5113. "Incombustible" includes any material which will not burn or support combustion.

Note (b). To secure the best protection against a severe fire, the finish floors, trim, doors, windows, etc., should be made entirely of incombustible material.

The fireproof covering of exterior columns should be at least 4 inches thick to resist a severe fire.

SECTION 2. MILL CONSTRUCTION.

Order 5101. A building is of mill construction if all walls are built of incombustible material, and if all wood girders and joists are at least $5\frac{1}{2}$ inches thick. No wood girder or joist shall measure less than 63 square inches and no wood post less than 90 square inches in sectional area, except that $7\frac{1}{2} \times 7\frac{1}{2}$ inch (or larger) posts may be used in the top story only. All structural steel or iron (not including post caps, bases, and joist hangers) shall be fireproofed with not less than one inch of incombustible material or with metal lath and cement or gypsum plaster. The lower thickness of each floor shall be not less than $2\frac{3}{8}$ inch lumber with grooves and splines at the joints; this shall be covered with felt or building paper, and with a separate finished floor not less than $\frac{12}{16}$ inch thick.

Note. Floor joists should be at least $7\frac{1}{2}$ inches thick.

The roof shall be at least $2\frac{1}{2}$ inches thick and shall have an incombustible roof covering; if an airtight roof covering (such as felt or tin) is not used, then the roof planking shall be in two thicknesses, with felt or building paper between.

There shall be no openings in the floor unless protected by standard fire doors, and no concealed air spaces except such as are enclosed by incombustible material.

All stairways and elevators shall be enclosed with standard fireproof enclosures.

For outside windows and doors see order 5201.

SECTION 3. ORDINARY CONSTRUCTION.

Order 5102. A building is of ordinary construction if all enclosing walls consist of incombustible material, and the roof has an incombustible covering, but other requirements for fireproof or mill construction are not complied with. No joist, rafter, or stud shall be less than $1\frac{5}{8}$ inches thick. Floor and roof joists shall not be supported by combustible stud partitions, but shall be supported by incombustible walls or partitions, or by semi-fireproof partitions (order 5112) or by columns and girders.

For outside windows and doors see order 5201.

SECTION 4. FRAME BUILDINGS.

Order 5103. A frame building is a building whose structural parts and enclosing walls consist of wood. If such enclosing walls are veneered, encased or faced with stone, brick, tile, concrete, plaster or metal whose stability or rigidity depends upon the frame wall, the building is also termed a frame building.

SECTION 5. HEIGHT OF A BUILDING.

Order 5104. The height of a building is measured at the center line of its principal front, from the street grade (or, if setting back from the street, from the grade of the ground adjoining the building) to the highest part of the roof, if a flat roof, or to a point $\frac{2}{3}$ the height of the roof, if a gabled or hipped roof. If the grade of the lot or adjoining street in the rear or alongside of the building falls below the grade at the front, the height shall be measured at the center of the lowest side.

SECTION 6. BASEMENT: FIRST FLOOR: NUMBER OF STORIES.

Order 5105. A basement is a story whose floor line is below the grade at the main entrance and whose ceiling is not more than 9 feet above such grade. The first floor is the floor next above the basement, or the lowest floor if there is no basement. The number of stories of a building includes all stories except the basement.

SECTION 7. INCOMBUSTIBLE ROOF COVERING.

Order 5106. A roof covering shall be considered incombustible if made of three thicknesses of roofing felt with tar and gravel, or if made of tin, corrugated iron or other approved fire resisting material.

SECTION 8. STREET, ALLEY, COURT.

Order 5107. A street is any public thoroughfare 30 feet or more in width. An alley is any public thoroughfare less than 30 feet but not less than 10 feet in width. Any space less than 10 feet wide is a court.

For required size of courts see order 5204.

SECTION 9. STANDARD FIRE STOPS.

Order 5108. Standard Fire Wall. A standard fire wall shall be built of brick or concrete not less than 12 inches in solid thickness, or of reinforced concrete not less than 6 inches thick. Every standard fire wall shall extend either from the foundation or from a fireproof floor, to a fireproof ceiling; or if the roof is not fireproof, such wall shall extend at least 3 feet above the highest adjoining roof line of the same building and shall be capped with stone, tile, or other indestructible material. Every opening in a standard fire wall shall be closed with a standard fire door or a fixed standard fire window.

Note. Windows in a fire wall should be avoided if possible, because even a wire glass window permits an intense radiation of heat and may melt in a hot fire. Windows are not permitted in a division wall. (Order 5201).

Order 5109. Standard Fireproof Enclosure or Partition. A standard fireproof enclosure or partition shall be made either of wired glass in metal frame, or of solid plaster not less than 2 inches thick on metal lath and metal frame, or of brick, concrete or tile of sufficient thickness to give rigidity. The windows in a fireproof enclosure or partition shall be standard fire windows and the doors shall be standard fire doors; except that the doors may contain wired glass as specified for standard fire windows.

Note. A wired glass enclosure does not offer as high a degree of protection as the other types mentioned, be-

cause of the radiation of heat through the glass, and the tendency of the exposed metal frame to buckle when heated.

Order 5110. Standard Fire Door. A standard fire door shall consist of a wooden core encased with tin, or shall be entirely of metal; and shall be of design approved by the Industrial commission. The door frame shall be metal. The door shall close automatically in case of fire.

Order 5111. Standard Fire Window. A standard fire window shall have a metal frame, metal sash, and wired glass, of design approved by the Industrial commission. No pane shall be less than $\frac{1}{4}$ inch thick nor of greater area than 720 square inches. The window shall be either fixed or shall close automatically in case of fire.

Order 5112. Semi-Fireproof Partition. A semi-fireproof partition shall be constructed of not less than $1\frac{5}{8} \times 3\frac{5}{8}$ inch studding, spaced not more than 16 inches center to center, with the $3\frac{5}{8}$ inch dimension at right angles with the plane of the wall, and having the following protection on both sides of the partition:

- (1) metal lath and at least $\frac{3}{4}$ inch of Portland cement or gypsum plaster; or
- (2) good quality plaster board at least $\frac{1}{2}$ inch thick, covered with sheet metal or
- (3) $\frac{1}{4}$ inch asbestos board, covered with at least $\frac{1}{2}$ inch Portland cement or gypsum plaster, or with sheet metal; or two layers of $\frac{1}{4}$ inch asbestos board, breaking joints; or
- (4) the spaces between studding may be filled with approved incombustible material, the partition being plastered with Portland cement or gypsum plaster on metal lath; or
- (5) other equivalent approved fire resisting construction.

Below every hollow semi-fireproof partition, whether bearing or non-bearing, the spaces between floor joists shall be fire stopped as provided in order 5318.

Every doorway in a semi-fireproof partition shall be protected with a standard fire door or with a self-closing wooden

door at least $\frac{7}{8}$ inch thick in its thinnest part. The glass in such partitions and doors shall be wire glass.

Note. A fire door is of course much better than an unprotected wooden door. Many types of ornamental fire doors are now on the market. Wooden doors if used should preferably be at least $1\frac{1}{2}$ inches thick.

Order 5113. Semi-Fireproof Ceiling. A semi-fireproof ceiling shall be constructed of not less than $1\frac{5}{8}$ inch joists, spaced not more than 16 inches center to center, protected on the under side the same as specified for a semi-fireproof partition (order 5112). The spaces between the joists shall be fire stopped as provided in order 5318, at intervals not greater than 25 feet.

Order 5114. Combustible Partitions or Ceiling. Every partition, ceiling or wall which is not fireproof or semi-fireproof is considered combustible.

SECTION 10. STANDARD EXITS.

Note. The following orders contain specifications for various types of exits (means of ingress and egress).

Exits may be classified as follows:

Stair Exits:

Exterior enclosed stairway, or smoke proof tower.

Interior enclosed stairway.

Horizontal Exits.

The foregoing types of exits are now generally agreed to be the most efficient. Enclosed stair shafts, and fireproof dividing partitions, prevent the spread of fire and protect both life and property. The exterior enclosed stairway, or smokeproof tower, is the safest possible form of stair exit and also furnishes a protected position from which firemen can attack a fire on any floor.

The following types of exits have a limited value and are permitted under certain conditions:

Open or unenclosed stairways:

Interior.

Exterior.

Fire escapes:

"A" fire escapes.

"B" fire escapes.

Unenclosed stairways and outside fire escapes are not reliable for the protection of life, except in low buildings, and are no protection for property.

To secure the best possible fire protection in a building accommodating a considerable number of persons, the building should be divided by a fireproof wall or partition, the two sections being connected by horizontal exits through or around the dividing wall, and each section being provided with one or more enclosed stairways; one stairway should be an exterior enclosed stairway, if possible. In case of fire in one section of such a building, the occupants can escape by the horizontal exits to the other section, and thence leave the building by means of the stairways without panic. The same protection can be secured in the case of two adjoining buildings, by connecting the two buildings with horizontal exits, each building being provided with one or more enclosed stairways. Where only a moderate number of persons are accommodated, the dividing partition is not so essential, but the stairways should be enclosed.

Exits of the types just mentioned are required by law in many states and cities and are recommended by all fire protection experts. Such exits afford the best protection for both life and property and are much more efficient than the outside fire escape.

Fire drills are of great value in lessening the danger of panic and loss of life.

For the number, size, type, and location of exits in buildings of various classes, see the orders on exits in Parts V to VIII (orders 5401-5, 5507-14, 5605-6, 5710-12).

Order 5115. Exterior Enclosed Stairway. (Smokeproof Tower). An exterior enclosed stairway shall be an enclosed stairway which is entirely cut off from the building and which is reached by means of open balconies or platforms. The entire stair enclosure, stairway balconies and balcony railings shall be made of incombustible material throughout. The wall separating the stairway from the building shall not be pierced by any door, window, or other opening. In a fireproof building this wall shall be built as prescribed for a standard fireproof enclosure (order 5109) but without glass; in a non-fireproof building, this wall shall be built as prescribed for an

outside wall (orders 5304-5311). The doors leading from the building to the balconies and from the balconies to the stairway shall be standard fire doors, and all openings within 10 feet of any balcony shall be protected with standard fire windows or standard fire doors. Each balcony shall be covered at the top and shall be open on at least one side, with a railing on all open sides not less than 3 feet high. See orders 5117-5119.

Order 5116. Interior Enclosed Stairway. An interior enclosed stairway shall be completely enclosed with a standard fireproof enclosure (order 5109); except that in buildings of not more than three stories, such stairways may be enclosed with semi-fireproof partitions (order 5112). In any case, such enclosure shall include at each floor level a portion of such floor which shall be at least as wide as the stairway; and such enclosure shall also include the passageway (if any) leading from the stairway to an outside door; so as to afford uninterrupted passage from the uppermost floor to such outside door, without leaving the enclosure. If windows are placed in such enclosure (excepting in the outside wall), such windows shall be fixed.

Note. Such windows permit an intense radiation of heat and should be avoided if possible. Where unavoidable, they should be placed at least six feet above the stairs or platforms.

See also the following orders.

Order 5117. All Stair Exits: Width. Every required stairway, whether enclosed or not, shall be at least 3 feet 8 inches wide, of which not more than 4 inches on each side may be occupied by a handrail. Every platform shall be at least as wide as the stairway, measuring at right angles to the direction of travel. Every straight-run platform shall measure at least 3 feet in the direction of travel. Wherever a door opens onto a stairway, a platform shall be provided extending the full width of the door.

The width of any stairway shall be the clear distance between walls or stringers, of which not more than 4 inches on each side may be occupied by a handrail.

Note: If other stairways are provided in addition to those required by this code, such additional stairways need not conform to these orders.

Order 5118. All Stair Exits: Handrails. All stairways and steps of more than three risers shall have at least one handrail. Stairways and steps 5 feet or more in width, or open on both sides, shall have a handrail on each side. Stairways more than 8 feet wide shall be divided by center rails into widths not more than 8 feet nor less than 3 feet 8 inches. Center rails shall have upper newel post at least 5 feet 6 inches high, or rail may be turned down to the floor in a manner to prevent hindrance. Rails shall be not less than 2 feet 6 inches vertically above nose of treads or 3 feet above platform.

For theaters and assembly halls, see also order 5508.

Order 5119. All Stair Exits: Risers and Treads. All stairways and steps used by the public or by more than 20 persons, shall have a uniform rise of not more than $7\frac{3}{4}$ inches and a uniform tread of not less than $9\frac{1}{2}$ inches, measuring from tread to tread, and from riser to riser; no winders shall be used; there shall not be more than 18 risers between platforms or between floor and platform, or not more than 22 risers from floor to floor with no platform; in stairs used by the public (theaters, public assembly halls, retail stores, schools, hotels, and similar buildings) there shall not be less than 3 risers between platforms or between floor and platform. Stairways or steps not used by the public or by more than 20 persons, shall have a uniform rise of not more than 8 inches and a uniform tread of not less than 9 inches; if winders are used, the tread shall be at least 7 inches wide at a point one foot from the narrow end.

For theaters and public assembly halls, see also order 5509.

Order 5120. Horizontal Exit. A horizontal exit shall be an opening through a standard fireproof partition (order 5109) or wall which separates two buildings or two divisions of a building; or an exterior balcony or bridge not less than 3 feet 8 inches wide, connecting two buildings or two divisions of a building. Every such opening shall be protected by a standard fire door on each side of the wall, and the door on one side shall be self-closing; the opening shall not exceed 48 square feet in area.

Note: A self-closing door is a door which is normally closed. An automatic door closes only in case of fire.

Every such balcony or bridge, together with its railings and its supporting brackets or beams, shall be constructed the same as specified for fire escapes, (orders 5123-5125, 5128) except that the floor may be solid if the balcony or bridge is covered by an incombustible roof. The floor shall not have a slope of more than one foot in five. All doors and windows which open onto the balcony or bridge, or which are within 10 feet of the same, shall be standard fire doors or standard fire windows; but if such doors and windows are in walls which are in the same plane, then this requirement shall apply only to those doors and windows which are within 5 feet of the dividing wall.

The floor on each side of a horizontal exit shall contain at least 3 square feet of unobstructed floor space per person, for all persons accommodated on both sides of such exit; and shall contain at least one stairway, which shall be enclosed if the building is more than two stories high.

See also order 5132.

Order 5121. Fire Escapes: Location. Every fire escape shall be so located as to lead directly to a street, alley, or open court connected with a street.

Every fire escape shall be placed against a blank wall if possible. If such location is not possible, then every wall opening which is less than 6 feet distant from any riser of the fire escape shall be protected by a standard fire door or standard fire window, except in the top story.

Note. For the number, size, and location of fire escapes on new buildings of various classes, see the orders on exits in Parts V to VIII (orders 5401-5405, 5512-5514, 5605-5606, 5710-5712).

General orders covering the number, size and location of fire escapes on existing buildings will be issued in the near future. Meanwhile, special orders will be issued where necessary.

The following orders define two sizes of fire escapes, called "A" and "B". Where not otherwise stated, the orders apply to both sizes.

Order 5122. Exits to fire escapes. Every fire escape shall be accessible from a public passageway through a standard

exit door (order 5132) except that a door to an "A" fire escape may be not less than 2 feet 6 inches wide; and except as follows:

For "A" fire escapes on existing buildings the door sill may be not more than 8 inches above the inside floor level, or may be higher if a stair leads from the floor to the sill; or two windows may take the place of such door if approved by the Industrial commission. The sills of such windows shall be not more than 18 inches above the fire escape platform and shall be not more than 2 feet above the inside floor level unless a stair shall lead from the floor to the sill. Every such window shall have the lower sash hinged so as to swing out, or hung to raise, so as to provide a clear opening not less than 2 feet 6 inches wide nor less than 2 feet 10 inches high. Hinged sash shall have hardware the same as prescribed for doors (order 5132). Sliding sash shall have at least one bar sash lift.

Order 5123. Fire Escapes: Material and Strength. No other material than wrought iron or soft or medium steel shall be used for any part of a fire escape, except for weights, separators, and ornaments. Each part of every fire escape (except counterweights for balanced stairways) shall be designed and constructed to carry a live load of 100 pounds per square foot of horizontal area over the entire fire escape. Each part of every fire escape shall be designed and constructed in accordance with the requirements on Structural Design (order 5316) except that the unit stresses therein specified shall be reduced by one-fourth. The minimum sections and sizes specified below shall be increased whenever necessary so that under full load the allowable unit stresses will not be exceeded.

Order 5124. Fire Escapes: Platforms. Each platform of an "A" standard fire escape shall be at least 28 inches wide; each platform of a "B" standard fire escape shall be at least 3 feet 4 inches wide. Such widths shall be the clear distance between stringers, measuring at the narrowest point. Each platform shall extend at least 4 inches beyond the jambs of exit openings. The above minimum widths and lengths shall be increased, wherever necessary, so that no exit door or window will, when open, block any part of the required width of the fire escape.

Every platform shall consist of either

(1) Flat bars on edge, not less than $1\frac{1}{4}$ inch; but not less

than $1\frac{1}{4} \times \frac{1}{4}$ inch where bolts and separators are used; bars shall be not more than $1\frac{1}{4}$ inches center to center.

(2) $\frac{1}{2}$ inch or $\frac{5}{8}$ inch square bars with sharp edge up, not more than $1\frac{1}{2}$ inches center to center.

(3) $\frac{5}{8}$ inch round bars, not more than $1\frac{1}{2}$ inches center to center.

The platform frame shall consist of not less than $2 \times 3\frac{3}{8}$ inch flat bars on edge or equivalent, provided the brackets are not more than 4 feet apart. If brackets are more than 4 feet apart, the frame shall be correspondingly stronger and stiffer. Every platform wider than 30 inches, if made of square or round bars, shall have a third frame bar through the center; if made of flat bars, the platform shall have separators and bolts through the center.

There shall be a platform at each story above the first and intermediate platforms if floors are more than 18 feet apart vertically.

Platforms shall not be more than 8 inches below the door sill, or not more than 18 inches below the sill of exit windows; see order 5122.

Order 5125. Fire Escapes: Brackets. Brackets for a 28 inch or 30 inch platform, when spaced not more than 4 feet apart, shall be made of not less than $7\frac{1}{8}$ inch square bars or $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{4}$ inch angles; such bars or angles shall be larger if the platform is wider or if the brackets are farther apart. Each bracket shall be fastened at the top, to the wall, by a through bolt (at least $\frac{7}{8}$ inch diameter), nut, and washer (at least 4 inch diameter). The slope of the lower bracket bar shall be not less than 30 degrees with the horizontal. The lower bar shall have a washer or shoulder to give sufficient bearing against the wall.

Note. In applying the requirements for Structural Design (order 5316) to the design of a bracket, the lower bracket bar must be designed according to the column formula. According to this formula (for example), brackets made of 1 inch square wrought iron, 4 feet apart, carrying a 3 feet 4 inch platform, are just within the limit of stiffness. If the brackets were over 4 feet apart, a heavier bar or an angle would have to be used.

The strength of the wall to which brackets are to be attached shall be carefully considered in determining the spacing, shape, and inside connection of brackets, so that under full load the wall will not be unduly strained.

Order 5126. Fire Escapes: Stairways. Each stairway of an "A" standard fire escape shall be at least 24 inches wide between stringers; such stairway shall have a uniform rise of not more than 8 inches, and a uniform run of not less than 8 inches.

Each stairway of a "B" standard fire escape shall be at least 3 feet four inches wide between stringers; such stairway shall have a uniform rise of not more than 8 inches, and a uniform run of not less than 9 inches.

Note. The rise is the vertical distance from the extreme edge of any step to the corresponding extreme edge of the next step. The run is the horizontal distance between the same points.

Stairway stringers shall consist of either

- (1) A 5 inch channel or larger.
- (2) Two angles $2 \times 2 \times 1\frac{1}{4}$ inch or larger.
- (3) Two flat bars $2 \times 3\frac{3}{8}$ inch or larger.
- (4) One flat bar $6 \times 1\frac{1}{4}$ inch or larger.

If two angles or two flat bars are used, they shall be properly tied together by lattice bars, vertical as well as horizontal. If flat bars are used, every stairway of more than 10 risers shall have lateral bracing. The connection of stringers to platform, at top and bottom, shall be at least equal in strength to the stringers and shall safely carry the full live and dead loads. If stringers are carried by intermediate brackets, the stringers shall have a horizontal bearing on the brackets and shall be properly and securely connected thereto.

Treads shall consist of either flat or square bars, (not round), of the size and spacing specified for platforms. An "A" standard tread shall consist of at least six such bars. A "B" standard tread shall consist of at least seven such bars. A "B" standard tread made of flat bars shall have separators and bolt through the center. A "B" standard tread made of square bars shall be trussed.

Order 5127. Fire Escapes: Balanced Stairway. A balanced stairway shall be provided for every fire escape which

does not reach to the ground, excepting "A" standard fire escapes which have a platform at least 3 feet long, not more than 10 feet about the ground. The balanced stairway shall conform to the requirements for other stairways except that the stringers and the top rail may be lighter if they are properly trussed. The counterbalancing device shall be attached to both sides of the stairway equally, or a special attachment shall be used to prevent warping or twisting. The counterbalancing device shall operate gradually and easily as the live load is applied.

Note. The use of cables and sheaves will be permitted only under exceptional conditions, as rust is almost sure to interfere with their proper operation. In such cases the sheaves shall turn on a brass pin or in brass bearings and shall be protected from the weather at the top and on all sides.

Order 5128. Fire Escapes: Railings. Railings shall be provided on all open sides of platforms and stairways, and on both sides of balanced stairways. Railings shall be at least 3 feet high, measuring vertically from floor of platform or from nose of step.

Every railing shall have posts, not more than 5 feet apart, made of not less than $1\frac{1}{2} \times 1\frac{1}{2} \times \frac{1}{4}$ inch angles or tees, or $1\frac{1}{4}$ inch pipe; top rail not less than $1\frac{1}{4} \times 1\frac{1}{4} \times \frac{1}{4}$ inch angle or equivalent; center rail not less than $1\frac{1}{4} \times \frac{3}{16}$ flat bar or equivalent. All connections shall be such as to make the railing stiff; two bolts ($\frac{3}{8}$ inch or larger) shall be used at the foot of each post wherever possible, or at least one $\frac{1}{2}$ inch bolt shall be used. Railings shall be continuous. No projections on the inside of the railing shall be permitted. Where a railing returns to the wall, it shall be fastened thereto with a through bolt (at least $\frac{5}{8}$ diameter), nut, and washer; or (in reinforced concrete) with an approved insert; or the railing shall be made equally secure with a diagonal brace extending at least 3 feet horizontally and 3 feet vertically.

All outside railings which are more than 60 feet above grade shall be at least 6 feet high, measuring vertically from floor of platform or from nose of step. Such railings shall be of special design approved by the Industrial commission, having not less than four longitudinal rails, and vertical lattice

bars not more than eight inches apart, and proper stiffening braces or brackets.

Order 5129. Fire Escapes: Ladder to Roof. Every standard fire escape shall be provided with a standard fire ladder (order 5134) leading from the upper platform to the roof, unless the fire escape stairway leads to the roof.

For standpipes see order 5135.

Order 5130. Other Types of Fire Escape. Sliding or chute fire escapes may be used, upon the approval of the Industrial commission, in place of standard "A" or "B" fire escapes. Every sliding fire escape shall be provided with a standard fire ladder extending from 5 feet above grade, to 4 feet above the roof coping, and securely fastened to the platforms of the sliding fire escape.

Order 5131. Outside Stairways. An outside stairway with solid platforms and treads may serve as a fire escape if it is covered by a roof. Such stairways shall be built of incombustible material and be protected as specified in order 5121, except as otherwise provided (orders 5403, 5710). See also orders 5117-5119.

Order 5132. Standard Exit Doors. Every door which serves as a required exit from a public passageway or stairway, or which forms a horizontal exit, shall be a standard exit door. See also orders 5406, 5515, 5607, 5712.

Every standard exit door shall swing outward or toward the natural means of egress (except as below and as in orders 5406, 5712). It shall be level with the floor (except for "A" fire escapes on existing buildings). It shall be so hung that, when open, it will not block any part of the required width of any other door way, passageway, stairway, or fire escape. No revolving door, (unless collapsible) and no sliding door, (except where it opens onto a stairway enclosure, or serves as a horizontal exit) shall be considered as a standard exit door.

Note. Where revolving doors are used, it is recommended that swinging doors also be provided.

For doorways opening into a stairway enclosure, swinging doors are recommended, especially where used by more than 20 persons.

A standard exit door shall have such fastenings or hardware that it can be opened from the inside without using a key, by pushing against a single bar or plate, or turning a single knob or handle; it shall not be locked, barred, or bolted at any time while the building is occupied.

Note. For theaters, schools, large factories and hotels, etc., the "panic bolt" which operates by pressure against a bar or plate is recommended.

A standard exit doorway shall not be less than 6 feet 4 inches high by 3 feet 4 inches wide, except where especially provided (orders 5512, 5607, 5712). No such doorway or group of doorways shall be more than 6 inches narrower than the required width of the stairway or passageway leading thereto.

Over every emergency exit door, and over every exit door where other doors or openings may cause confusion, a sign shall be placed bearing the word "Exit" or "Out" in plain letters not less than 5 inches high. Red lights shall be provided over all such exits which are liable to be used at night.

Order 5133. All Exits: Location and Obstructions. Every exit mentioned in orders 5115-5132 shall lead to a street, alley or open court connected with a street. All such exits, and all passageways leading to and from the same, shall be kept unobstructed at all times.

SECTION 11. STANDARD FIRE LADDER.

Order 5134. A standard fire ladder leading to the roof shall be provided on every building of more than three stories, unless

- (1) There is a fire escape or an exterior enclosed stairway leading to the roof; or
- (2) The building is of fireproof construction and is provided with an approved automatic sprinkler system.

A standard fire ladder shall have stringers of not less than 1½ inch pipe, or not less than 2x3½ inch flat bars, at least 17 inches apart in the clear. The rungs shall be not less than 1½ inch square or ¾ inch round bars, 14 inches center to center. The stringers shall be securely tied together at intervals no greater than every fifth rung.

A platform shall be provided at each story above the first, placed about 18 inches below the window sill. The ladder shall be securely fastened on the outside of the platform. The platform, brackets and railing shall be built as specified for standard fire escapes, except that the platform bars may be not more than 2 inches center to center. Each platform shall be at least 28 inches wide, and shall be long enough to give access to two windows wherever possible, but in no case shall the platform be less than 5 feet long.

The top rung of each ladder shall be not less than 4 feet above the roof coping, and the ladder shall return within 2 feet of the roof if the coping is more than 2 feet above the roof. The bottom rung of each ladder shall be not more than 8 feet above the ground, unless the ladder starts at the upper platform of a fire escape or stairway.

Note. Fire ladders are primarily for the use of the fire department and are not accepted as fire escapes, except for theater fly galleries.

SECTION 12. STANDPIPES, FIRE EXTINGUISHERS, AND SPRINKLERS.

Order 5135. Exterior Standpipes. If water supply of sufficient pressure is available, a standard exterior standpipe shall be attached to every fire escape, fire ladder, or exterior enclosed stairway, on every building of more than three stories not having an automatic sprinkler system; except that theater buildings requiring more than one fire escape on any side thereof, shall be provided with at least one standard standpipe on each side.

Every standpipe shall extend from a point within 5 feet of the ground to a point 3 feet above the roof or cornice, and shall be securely fastened to and accessible from each platform. The standpipe shall be made of not less than 3 inch wrought pipe, with 2½ inch outlet hose valve at each floor and at roof, and a double Siamese valve at the base of the pipe. All connections shall conform to the size and pattern used by the local fire department, and the entire standpipe shall conform to all requirements of such department.

Order 5136. Interior Standpipes. For the number and location of interior standpipes required in buildings of various

classes, see the sections on standpipes in Parts V to VIII (orders 5411, 5537, 5619, 5722). Where no other ratio is stated, one standard interior standpipe shall be installed for each 10,000 square feet of floor area or fraction thereof.

Standpipes shall connect with city water mains or with an elevated tank of approved design and capacity, and shall be provided with hose and valve at each story, located not more than 5 feet above the floor.

The hose shall be not less than 1½ inches in diameter, and shall be kept connected, in good repair and working order, and ready for immediate use at all times.

The size of pipes and other details of installation, shall be as approved by the Industrial commission.

An approved automatic sprinkler system will be accepted as a substitute for interior standpipes, except in theaters (orders 5537, 5539).

Note. The Industrial commission will ordinarily approve any sprinkler or standpipe installation which is approved by the Underwriters.

Order 5137. Fire Extinguishers. Where standard chemical fire extinguishers are required, they shall be of a capacity of three gallons and of a type approved by the Industrial commission, and shall be discharged and recharged at least once a year.

Order 5138. Automatic Sprinklers. Where an automatic sprinkler system is required throughout the building (orders 5412, 5539), such system shall be supplied either from the city water mains or from a gravity or pressure tank. If city water supply of adequate volume and pressure is not available, a tank shall be provided.

Where automatic sprinklers are required in the basement only (orders 5412, 5723) they shall be supplied from the city water mains. If there is no city water supply, such basement sprinklers will not be required. If in the future a city supply becomes available, then the basement sprinklers shall be installed.

Note. It is better to install the basement sprinklers anyway, so as to be ready when the city water becomes available.

Every basement sprinkler system shall also include sprinklers in all shafts (except elevator shafts) leading upward from the basement.

Every sprinkler system shall also have a suitable connection for the fire department. Where a complete sprinkler system is provided (whether required or not) exterior and interior standpipes may be omitted, except interior standpipes in theaters. The number and location of sprinklers, size of pipe, size and location of tank (if any), and all other details of equipment, shall conform to the best standard practice.

Note. The Industrial commission will ordinarily approve any sprinkler system which is approved by the Fire Underwriters.

The commission reserves the right to order a sprinkler system in any building, regardless of its height or number of persons, if the occupancy is especially hazardous.

Automatic sprinklers probably give the best fire protection for the least cost, for both life and property. They are recommended for use in hotels throughout the building, in basement of schools and public halls and theaters, and in most mercantile and factory buildings.

GENERAL NOTE.

The word "approved," as used in defining the foregoing standards, or in any other part of this code, means "approved by the Industrial commission"; and any other discretionary power required or implied by any part of this code, lies with the Industrial commission.

PART III.

GENERAL REQUIREMENTS

Note. For general requirements on stairways, doors, fire ladders, standpipes, etc., see the definitions of these terms, orders 5115-5135.

SECTION 1. DESIGN AND SUPERVISION OF BUILDINGS.

Order 5200. Every building should be designed by a competent architect, engineer, or builder, in accordance with this code; and shall be constructed under the supervision of a competent superintendent or inspector, in accordance with the plans and specifications of the designer. The designer may also act as superintendent. No material change from the original plans and specifications shall be made except with the knowledge and consent of the designer. No owner shall construct any building or permit any building to be constructed except in accordance with this section.

Note. This requirement of a competent designer and a competent superintendent is in the best interests of the owner, the workman and the community. Proper supervision, either by the designer or by someone else, is quite as important as proper design. The record of building collapses in the United States shows that a large proportion of these accidents are caused by failure to follow plans.

This section does not in any way prevent a responsible contractor or builder from acting as designer or superintendent or both, if the owner so desires. This section simply makes it the duty of the owner to see that some competent person or persons are definitely responsible for the design and construction of the building in accordance with this code and with standard building practice.

SECTION 2. HEIGHT AND CLASS OF CONSTRUCTION.

Order 5201. See also orders 5502-3, 5602, 5702-3. In a fireproof building exceeding 160 feet in height, all stairway and corridor windows and doors shall be standard fire windows and standard fire doors, except that the doors may contain glass as specified for standard fire windows. The stairway and corridor finish and floors shall be made entirely of incombustible material.

Note. This code sets no limit to the height of a fireproof building, as it is felt that this is a matter of general community welfare rather than of the safety of the individual occupants. The Industrial commission strongly recommends that each municipality adopt such a limit before the rise in central land values makes such action a hardship to the property owner.

Buildings of mill construction shall not be higher than 85 feet above the grade.

Buildings of ordinary construction shall not be higher than 60 feet above the grade.

Frame or veneered buildings shall not be higher than 40 feet above the grade.

Roof appendages such as dormer windows, domes, towers, tanks, turrets, spires, skylights, monitors, penthouses or other projections above the main roof of a building shall not exceed in total area 20 per cent of the main roof, otherwise the building height limit shall apply to the roof of such appendage.

No appendage on the roof of a building of mill construction shall exceed a height of 110 feet above the grade.

No appendage on the roof of a building of ordinary construction shall exceed a height of 80 feet above the grade.

No appendage on the roof of any frame or veneered building shall exceed a height of 50 feet above the grade; the walls and roof of all such appendages shall be covered with incombustible material.

Pent houses containing elevator machinery shall be constructed as required by the general orders on Elevators issued by the Industrial commission.

In every building more than two stories high which is required to be of fireproof, mill or ordinary construction, all out-

side doors and windows shall be standard fire doors and standard fire windows if they are less than 15 feet away from any adjoining lot line or from the center of an adjoining alley, or if they are less than 30 feet away from any other building; but this shall not apply to walls, windows and doors which lie in the same or parallel planes facing in the same direction.

SECTION 3. FLOOR AREAS.

Order 5202. The maximum undivided floor area in any building more than one story in height shall be as follows:

Fireproof construction	18,000 square feet
Mill construction	10,000 square feet
Ordinary construction	7,500 square feet
Frame buildings	5,000 square feet

The areas in the foregoing table may be increased as follows:

In two story buildings, by 50 per cent.

In buildings equipped with an approved automatic sprinkler system, by 30 per cent.

In buildings fronting on at least three streets, or two streets and an alley, by 20 per cent.

Every such increase shall be computed on the original maximum area. The increases are cumulative.

Where a dividing wall is required in any building, such wall shall be of solid incombustible fire resisting material of the same thickness as required for enclosing walls (orders 5304-5310); and shall be continuous from the foundation to the roof, in a fireproof building, or to 3 feet above the roof in a non-fireproof building. Each opening in a division wall shall have a standard fire door on each side of the wall.

Note (a). This code does not limit the area of one story buildings, as such limitation is not strictly necessary for the safety of the occupants. Such buildings should be limited by municipal regulation, as a fire preventive measure.

Note (b). Special cases may arise where the above limitations of height and area would be unduly restrictive. The Industrial commission will, on application, make a special ruling in any case where any part of this code would operate unreasonably. See under "Appeal", p. 5.

SECTION 4. WINDOWS AND COURTS.

Order 5203. Windows. Every room in which one or more persons live, sleep, or are employed, (except storage rooms or other rooms where the nature of the occupancy will not permit) shall be lighted by a window or windows opening directly upon a street or alley or upon a court on the same lot with the building. The windows shall be so constructed and distributed as to afford proper light and ventilation. Every building more than 40 feet deep (measuring at right angles to the windows) shall have windows on at least two sides.

Note. For toilet room windows see order 5207.

Order 5204. Courts. By inner court is meant an open air shaft or court surrounded on all sides by walls.

By inner lot line court is meant a court bounded on one side and both ends by walls and on the remaining side by a lot line.

By outer court is meant a court extending to a street, alley, or open space not less than 15 feet wide.

By outer lot line court is meant a court with one side on a lot line and opening to a street or open space not less than 15 feet wide.

In applying the following requirements, a building from 30 to 43 feet high shall be considered as having at least three stories, and each additional 13 feet shall be considered an additional story.

No outer lot line court, measured from the lot line to the wall of the building, shall be less than 3 feet wide for a court two stories or less in height. For courts more than two stories in height, the width of such courts shall be increased one foot for each additional story.

Where an outer court is situated between wings or parts of the same building or between different buildings on the same lot, the width of said court measured from wall to wall shall not be less than 6 feet, provided the court does not exceed 36 feet in length, and provided the court does not exceed four stories in height; for each additional story in height such court shall be increased one foot in width; and for each additional 10 feet of increase or fraction thereof in the length of such court, the entire width shall be increased one foot; and the increase in width shall be cumulative.

No inner lot line court shall be less than 6 feet in width, or less than 60 square feet in area, for courts two stories or less in height; no inner court shall be less than 10 feet in width nor less than 150 square feet in area for courts two stories or less in height; and for every additional story every such inner court or inner lot line court shall be increased by at least one lineal foot in its length and one lineal foot in its width.

No court shall be covered by a roof or skylight but the entire required area shall be open and unobstructed from the bottom thereof to the sky. No fire escape or stairway shall be constructed in any court unless the court be enlarged proportionately.

All walls of inner courts whose least horizontal dimension is less than one fourth the height, shall be faced with material with a permanent white surface or shall be painted white at least every two years.

At the bottom of every shaft or inner court there shall be sufficient access to such shaft or court to enable it to be properly cleaned out. Every inner court shall have an intake for fresh air, leading from the street or other open space. The area of such intake in square feet shall equal at least two one thousandths of the number of cubic feet contained in said court; but such area need not be more than 50 square feet. Every intake shall be constructed of fireproof material and unless said intake is used as a passageway for persons, there shall be no openings into the same other than the inlet and outlet.

No buildings shall be altered or enlarged to encroach upon space reserved under this code for light and air on the lots or parcels of ground on which such building is erected.

SECTION 5. TOILET ROOMS.

Note. The subject of *sanitation in places of employment* has already been covered by the Industrial commission's General Orders on Sanitation. The following section is substantially the same as these General Orders; but to avoid confusion, the owner or designer of a factory or other place of employment should consult the General Orders on Sanitation for places of employment.

For the number of closets and urinals required in buildings of various classes (other than places of employment) see orders 5536, 5618, 5721.

For detailed requirements regarding fixtures, piping, etc., see State Plumbing Code issued by the State Board of Health.

Order 5205. Separate Toilet Rooms Required. In every building accommodating persons of both sexes (except apartment houses), separate toilet rooms shall be provided. Toilet rooms for the two sexes, when adjoining, shall be separated by a sound proof partition of material which cannot be easily cut or defaced. Each toilet room shall be distinctly marked with respect to the sex which uses it and no person shall be allowed to use a toilet room assigned to the opposite sex.

Order 5206. Toilet Rooms: Construction. The floor and base of every toilet room (except in a private apartment) shall be constructed of material (other than wood) which does not readily absorb moisture and which can be easily cleaned. The walls and ceiling shall be completely covered with smooth Portland cement or gypsum plaster, glazed brick, metal, or other smooth, non-absorbent material. Each toilet room shall be completely enclosed.

Exception. The provisions of the two preceding orders are recommended, but not required, for rooming or lodging houses which accommodate less than 12 persons not members of the family.

Note. In toilet rooms of private apartments it is recommended that at least a portion of the floor, under and around the closet, be constructed as above specified.

Order 5207. Toilet Rooms: Location, Light, Ventilation. Every toilet or bathroom shall be lighted by a window or windows opening directly upon a street, alley, court, or vent shaft. Every such court or vent shaft shall have an area of at least one square foot for each water closet or urinal which it ventilates, but the least dimension of any such vent shaft shall not be less than 3 feet; except that for a single closet used by not more than four persons, a vent flue may be used at least one square foot in area.

No toilet room shall have movable windows or ventilators opening on any court which contains windows of sleeping or living rooms above; except that a toilet room containing not more than two closets may have such movable windows or ventilators, provided such room has a ventilating flue or pipe running above the roof.

The window space for a toilet room containing one closet shall be at least 4 square feet, with 2 square feet additional for each additional closet. These windows shall be so constructed that they can be opened to give adequate ventilation to the room.

If outside windows are impracticable, the facts may be laid before the Industrial commission.

Every toilet room shall have at least 10 square feet of floor area, and at least 100 cubic feet of air space, for each water closet and each urinal.

Every toilet room (except in a private apartment) shall be artificially lighted during the entire period that the building is occupied, wherever and whenever adequate natural light is not available, so that all parts of the room are easily visible.

Order 5208. Water Closets. Individual water closets made of porcelain or vitreous chinaware shall be used. Every closet shall be equipped with a trap located above the floor and with adequate flushing device which uses not less than 3 gallons of water for each flush. The trap shall be properly ventilated. The seat of each water closet shall be made of wood or other non-heat-absorbing material and shall be finished with varnish or other substance which will make it impervious to water.

Every closet shall hold a sufficient quantity of water and be of such shape and form that no fecal matter will collect on the surface of the bowl.

Order 5209. Urinals. Each urinal shall be made of impervious material and shall be properly flushed and kept in clean condition. If iron is used in the construction of a urinal, it shall have fired enamel on the inside of the trough or bowl.

Order 5210. Partitions for Water Closets and Urinals. Each water closet shall be separated by a partition not less than 5 feet in height. Each individual urinal or urinal trough shall be provided with a partition at each end and at the back, to give privacy. Where individual urinals are arranged in batteries, a partition shall be placed at each end and at the back of the battery. A space of 6 to 12 inches shall be left between the floor and the bottom of the partition.

Note. It is recommended that the partitions between water closets and urinals be made of material (other than wood) which does not readily absorb moisture.

Order 5211. Water Closets Where no Sewage System is Available. Each water closet, urinal, lavatory or slop sink located in a toilet room, shall be connected with a sewer system, where a sewer system is available. In localities where a sewer system is not available, or cannot be made available, the disposal of human waste may be accomplished in one of the following three ways:

1. Bacterial or septic tank.
2. Double-compartment cess-pool.

Note. For detailed requirements on septic tanks and cess-pools, see State Plumbing Code.

3. Where the local conditions are such that the above installations are impractical, the following installation may be made with the consent of the Industrial commission:

Direct discharge into a tight masonry privy vault extending not less than 12 inches above the surface of the surrounding ground, and provided with a shelter house having all openings in doors, and all windows and ventilating openings protected by metal screens to prevent the entrance of flies. The doors shall be self closing.

SECTION 6. BOILERS, FURNACES AND STOVES.

Order 5212. Fireproof Room. Every boiler operating with more than 15 pounds steam pressure per square inch shall, together with furnace and breeching, be enclosed with a standard fireproof enclosure and fireproof ceiling and floor, or be located in a separate building, or be separated from the remainder of the building by a division wall as described in order 5202.

See also orders 5531, 5616, 5719.

Order 5213. Protection of Floor. Every boiler, furnace, or oven shall be placed on a fireproof floor projecting at least two feet on all sides. Such floor shall also be provided for every stove or range which is more than 16 square feet in horizontal area or which has a flame at the bottom. If any such floor rests on or is in contact with any combustible material, then the fire proof floor layer shall be at least 5 inches thick and shall be hollow, with air spaces running horizontally through the same. The air spaces shall be open at both ends

and shall be so placed that air can circulate through them; their horizontal area shall equal at least $\frac{1}{2}$ the horizontal area of the fireproof slab.

Note. The purpose of these air spaces is to permit air to circulate through the fireproof slab and keep down its temperature; thus preventing the gradual heating of the wood floor or beams below, which takes place through a solid slab even of considerable thickness.

The air spaces may be secured by using hollow tile placed end to end: or by imbedding wrought or sheet iron pipes (say 2 inch diameter, or larger) in a layer of concrete. The air spaces should run parallel to the short dimension of the slab.

If the stove, range, etc., is raised at least 6 inches above the floor and such air space is not enclosed, then the fireproof floor layer may be reduced to not less than 2 inch solid thickness, without air spaces, provided it is covered with sheet metal.

Every stove or range not more than 16 square feet in horizontal area and not having a flame at the bottom shall, if placed on a combustible floor, be raised at least 6 inches above the floor, and such air space shall not be enclosed. Such floor shall be protected with a stove board of sheet metal or asbestos, projecting at least one foot on all sides.

Note. A double-shell heating furnace or stove, located in the room which it is designed to heat, is considered a "stove."

Order 5214. Protection of Walls and Ceiling. No boiler, furnace, oven, stove, or range, whether encased or not, shall be placed less than 24 inches away from any non-fireproof wall, partition or ceiling; except that such distance may be reduced to 12 inches if the wall, partition, or ceiling is protected with at least $\frac{1}{4}$ inch asbestos board covered with galvanized sheet metal, or with equivalent protection as specified in order 5112.

For stoves and ranges less than 16 sq. ft. in area the above distances may be reduced one half.

The top of every boiler, furnace or oven, shall be covered

with asbestos, sand, or other heat resisting material, or the required distance above same shall be increased 100 per cent.

Any non-fireproof ceiling above a stove or range more than 16 square feet in horizontal area, shall be protected by a metal hood, which shall be at least 6 inches clear distance below the ceiling and shall project at least one foot (or to the wall) on all sides. The hood shall have a ventilating pipe placed and protected the same as required for a smoke pipe, and connected with a chimney flue.

SECTION 7. SMOKE PIPES.

Order 5215. No metal smoke pipe shall pass through any combustible roof or floor or any combustible outside wall, or outside window or door.

Every smoke pipe passing through a non-fireproof partition shall be encased with incombustible material at least 4 inches thick or with a double safety thimble made of two concentric rings of sheet metal with at least one inch open air space between and with outer ring covered with at least $\frac{1}{4}$ inch asbestos.

Note. The double thimble is of no value unless it is kept free from dirt. The best protection is a casing of solid masonry, with $\frac{1}{4}$ inch space between the masonry and the pipe.

No part of any smoke pipe shall be placed nearer to any non-fireproof partition or wall than the diameter of the pipe, nor nearer to any non-fireproof ceiling than one and one-half times the diameter, and the minimum distance in either case shall be 12 inches; but the above distances may be reduced by one-half, if the wall or ceiling is covered with not less than $\frac{1}{4}$ inch asbestos board covered with galvanized sheet metal, or with equivalent protection as specified in order 5112.

SECTION 8. STEAM PIPES.

Order 5216. No steam pipe shall be placed within one inch of any woodwork. Every steam pipe passing through a combustible floor, ceiling or partition, shall be protected by a metal tube one inch larger in diameter than the pipe, and shall be provided with a metal cap. All wooden boxes or casings enclosing steam pipes, or wooden covers to

recesses in walls in which steam pipes are placed, shall be lined with metal.

Note. A careful investigation has shown that steam pipes in contact with wood or similar material form a real fire hazard. There are a large number of cases on record where steam pipes, even under low pressure, have gradually caused the formation of charcoal and eventually a fire has resulted. The fatal Collinwood school fire probably started in this way.

SECTION 9. HOT AIR PIPES AND REGISTERS.

Order 5217. Every hot air pipe contained in or passing through a combustible partition shall be placed inside another pipe arranged to maintain a 1/2-inch air space between the two pipes on all sides; or the pipe shall be securely covered with 1/2-inch of corrugated asbestos. The bend at the bottom of the vertical pipe shall be kept at least 2 inches from any woodwork.

Note. Where a hot air pipe is placed in a 4 inch partition, metal lath over the pipe is recommended.

Every hot air furnace shall have at least one register without valve or louvres.

All register boxes shall be of metal and shall be double; the distance between the two shall be not less than 1 inch; or they may be single if covered with asbestos not less than 1/8 inch in thickness, and if all woodwork within 2 inches is covered with tin.

SECTION 10. CHIMNEYS.

Order 5218. Construction and Foundation. Every chimney shall be built of brick or other fireproof material. No chimney shall rest upon a flooring of wood nor shall any wood be built into or in contact with any chimney. The foundation of every chimney, flue, or stack, shall be designed and built in conformity with the requirements for foundations of buildings. In no case shall a chimney be corbeled out more than 8 inches from the wall, and in every such case the corbeling shall consist of at least five courses of brick. Portland cement mortar shall be used above the roof line.

Order 5219. Minimum Thickness and Height. Every non-metallic chimney shall have walls at least 6 inches thick, unless a terra cotta, fire clay, concrete or other approved flue lining is used for the full height of the chimney, in which case the walls shall not be less than 4 inches thick. No smoke flue shall be less than 8x8 inches.

The top of every chimney shall be at least 5 feet above the top of the building of which it is a part, if the roof is flat, or at least 2 feet above the ridge if the roof is pitched. Every chimney shall be provided with a cleaning-out door at its base.

Order 5220. Flues of More than 260 square inches. Chimneys with flues larger than 260 square inches shall have surrounding walls not less than 3 inches thick. The top of such a chimney shall be at least 8 feet above the roof.

Order 5221. Minimum Thickness to be Increased. Every chimney shall be designed throughout (the above minimum thicknesses being increased where necessary) in accordance with the requirements for the structural design of buildings and with the best engineering practice.

Order 5222. Metallic Chimneys. No metallic chimney shall pass through any non-fireproof floor, ceiling, or roof, unless encased or lined with brick or other fireproof material of the same character and thickness as prescribed for non-metallic chimneys; or in place thereof, where such metallic chimney passes through the roof only, the chimney may be separated from the roof by a 12-inch air space.

Order 5223. Wind Pressure. Every chimney shall be designed to withstand a wind pressure of at least 30 pounds per square foot. In circular chimneys such pressure shall be assumed to act over not less than one-half of the diametral area.

Note. Metal chimneys held by cable guys should have at least four (preferably five) guys. The following example will illustrate the size of cables needed.

Assume a chimney 70 feet high and 30 inches in diameter; guys attached 20 feet below top of chimney; slope of guys, 30 degrees with the horizontal (that is, guys reach the ground about 85 feet from the chimney). The guys should then be not less than one-half inch galvanized cables or two sets of 3/8 inch cables could be used. Proper anchors must be provided which will develop the full strength of the cable.

It is important that guys be so arranged that they will not become weakened by chafing. If the guy is fastened to an eyebolt it should be protected by a steel shield which will take the wear.

SECTION 11. LIGHTS.

Order 5224. Oil lamps shall not be used when gas or electricity is available, except in private apartments.

Gas and oil lights shall be placed at least 6 feet above the floor level, at least one foot from any combustible partition or wall, and at least 3 feet below any combustible ceiling unless properly protected by a metal hood. Every such light shall be rigidly supported. In aisles and public passageways, every such light shall be protected by an incombustible guard unless the light is at least 6 feet 6 inches above the floor.

Note. Especial care should be taken to prevent curtains or draperies from coming into contact with a flame. Gas and oil lights should be kept at least two feet away from any door or window where curtains are used.

Every gas supply main shall have a service cock outside of the building, so placed and maintained that it can be shut off at any time without entering the building.

See also orders 5410, 5533-5, 5714.

Note. Most large cities now require a specially designed cock which does not become clogged with rust or ice, and which can easily be located and shut off by the firemen. This is very desirable as many small fires have become serious through the breaking of gas pipes in the building.

SECTION 12. ELECTRICAL WORK.

Order 5225. All electrical work shall conform to the "1913 National Electrical Code" (on file at the office of the Industrial commission) except where the same conflicts with any order of the Industrial commission.

See also order 5448 (moving picture booths).

Note. Conduit work is strongly recommended for schools, public halls, hotels, etc.

PART IV.

STRUCTURAL DESIGN

Note. Only the most general features of structural design are touched on in this code. Detailed requirements may be adopted by cities if they desire. Such details are beyond the scope of this code and would be of no particular benefit. "Rules cannot produce or supersede judgment; on the contrary, judgment should control the interpretation and application of rules," whether the rules are general or detailed.

Either safety or economy, and often both, will be sacrificed unless both the designer and the builder have a competent knowledge of building construction in general and of the particular kind of construction which is being used.

Such details as are given in the following orders are typical, not restrictive. The Industrial commission will, on application, approve any other type of design which affords equal strength and security in accordance with standard practice. See under "Appeals," p. 5.

SECTION I. FLOOR AND ROOF LOADS.

Order 5300. The minimum stresses to be resisted by any structure shall be calculated by adding to the weight of the structure, called dead load, the following superimposed live loads uniformly distributed in pounds per square foot of horizontal area.

Theaters, Assembly Halls, and other places of assemblage:—

Auditorium with fixed seats.....	70
Lobbies, passageways, stairways and auditoriums or places of assemblage without fixed seats....	120
Dance halls	120
Theater stage	150

School Buildings, Libraries, and Museums:—	
Class rooms and rooms for similar use	60
Corridors, laboratories, and similar public parts of the building	80
Hotels, Apartment and Tenement Houses, Clubhouses, Hospitals, and Places of Detention:—	
Private rooms and apartments	50
Public corridors, offices, lobbies, dining rooms, etc.	80
Office Buildings:—	
First floor	100
Upper floors	60
Stables	80
Grand stands	100
Garages	100
All stairs	100
Workshops, factories and mercantile establishments	100

In warehouses, workshops, factories and mercantile establishments used for the sale, storage or manufacture of heavy merchandise or machinery the floors shall be designed to carry all loads safely, including an allowance of at least 25 per cent for vibration where such occurs.

Roofs	30
Sidewalks	150

In any building where the floor load on any floor is taken as more than 150 pounds per square foot, the sidewalk load shall be taken equal to the maximum floor load.

The foregoing floor loads (but not the roof or sidewalk loads) may be decreased by 20 pounds in buildings of fireproof construction.

Note. This reduction is permitted because (1) a fireproof floor suffers little or no deterioration; (2) a fireproof floor is not weakened by a fire below; (3) the greater dead load of a fireproof floor means that any accidental overload is a smaller proportion of the total dead and live load.

Partial and eccentric loading shall also be provided for.

The joists, beams, girders, columns, and walls supporting the roof shall be designed to carry the full loads.

Floor girders and trusses over 30 feet long shall be designed to carry not less than 85 per cent of the live load besides the dead load; except that in hotels, apartment and tenement houses, hospitals, club houses, and office buildings they shall be designed to carry not less than 75 per cent of the live load besides the dead load.

In a factory, store, warehouse or similar commercial building, the live load to be supported by walls, columns and foundations, shall be assumed at not less than 85 per cent of the full live load of the top floor, 80 per cent of the next lower floor and 75 per cent for each succeeding lower floor.

In all other buildings the live loads to be supported by walls, columns, and foundations, shall be assumed at not less than 85 per cent of the full live load of the top floor and 5 per cent less for each succeeding lower floor until a ratio of 50 per cent is reached, which shall be used for all succeeding lower floors.

SECTION 2. WIND PRESSURE.

Order 5301. Every building shall be designed to resist a horizontal wind pressure of 30 pounds for every square foot of exposed surface, in addition to the dead loads and the live loads specified above.

If the overturning moment due to wind pressure exceeds 75 per cent of the moment of stability of the structure due to dead load only, the structure shall be anchored to its foundations, which shall be of sufficient weight to insure the stability of the structure; and sufficient diagonal bracing or rigid connections between uprights and horizontal members shall be provided to resist distortion.

The overturning moment may be disregarded in a structure less than 100 feet in height if the height does not exceed twice the width.

When the stress due to wind in any member is not greater than 50 per cent of the stress due to the dead and live loads, it may be neglected. When the wind stress is greater than 50 per cent of the dead and live load stresses, then the sum of all these stresses shall not exceed 150 per cent of the stresses hereinafter provided.

SECTION 3. FOUNDATIONS.

Order 5302. The permissible loads on natural earth shall not be more than the following, in tons per square foot:

Quick sand and alluvial soils.....	1/2
Soft clay	1
Ordinary clay and sand together in layers, wet and spongy.....	2
Clay or fine sand, firm and dry.....	3
Sand, compact and well cemented.....	4
Gravel and coarse sand, well packed.....	5
Hard pan or shale.....	6

The maximum load on a timber pile shall not exceed 500 pounds per square inch, and shall be determined by the following formula:

$$L = \frac{2WH}{S + 1/2} \text{ for steam hammer.}$$

$$L = \frac{2WH}{S + 1} \text{ for drop hammer.}$$

in which formula

- L = safe load in pounds.
 W = weight of hammer in pounds.
 H = fall of hammer in feet.
 S = penetration under last blow in inches, assumed to be sensible at an approximately uniform rate.

SECTION 4. MASONRY CONSTRUCTION.

Order 5303. Unit Stresses. The following unit compressive stresses (pounds per square inch) shall not be exceeded:

Kind of Mortar.....	Lime. 1:3	Lime and Portland Cement. 1: 2: 3	Portland Cement. 1: 3
Standard common brick (crushing strength 1800).....	100	125	175
Hard or select brick (crushing strength 3000).....	150	180	270
Rubble, well bonded.....	30	100	150
Hollow tile or concrete blocks (see order 5309).....			60
gross area.....			
Concrete—See order 5312.			

For any other type of masonry the unit stress shall be calculated on the basis of a factor of safety of 10 or more, in accordance with standard practice.

Order 5304. Brick Bearing Walls. For all non-fireproof buildings except office buildings and buildings of the apartment house and hotel class, the outside, party, division and

other bearing walls shall be not less than 12 inches thick in the upper two stories increasing four inches in thickness for each two stories (or fraction) below, except as hereinafter provided; no such two story height shall exceed 30 feet. But the first story side walls of a three story building may be 12 inches thick if laid in Portland cement mortar and if the second floor joists are supported by wall hangers.

For all fireproof buildings, and for non-fireproof office buildings and buildings of the apartment house and hotel class, the outside, party, division and other bearing walls shall be not less than 12 inches thick in the upper three stories, increasing 4 inches in thickness for each 3 stories (or fraction) below, except as hereinafter provided; no such three story height shall exceed 45 feet.

A building not more than three stories in height may have 8 inch walls in the upper story, provided such story is not more than 10 feet high in the clear, and the span is not more than 20 feet, and the wall is not more than 60 feet long between cross walls, offsets or pilasters. But no such 8 inch wall shall serve as a party wall.

Note (a). To secure proper protection against a severe fire it is recommended that division and fire walls, and outside walls of fireproof or mill buildings, be made at least 12 inches thick of brick or plain concrete, or of reinforced concrete as described in order 5315.

Note (b). In the case of long spans or heavy floor loads, the thickness of walls must be increased if necessary so that the allowable unit stresses will not be exceeded.

Every wall shall be bonded with header courses extending through the wall at intervals no greater than every sixth course.

If any horizontal section of any bearing wall shows more than 40 per cent reduction of area on account of flues, openings or recesses, the wall shall be proportionally increased in thickness.

Order 5305. Curtain Walls. Curtain walls supported at every floor level shall be not less than 8 inches thick, provided the vertical height between beams is not more than 12 feet. For the first story the unsupported height may be not more

than 18 feet provided the pilasters or columns are not more than 20 feet apart. See note (a), preceding order.

All other walls shall be not less than 12 inches thick.

Order 5306. Stone Walls. Stone walls shall be 4 inches thicker than required for brick walls and shall be similarly bonded.

Order 5307. Stone or Terra Cotta Facing. Stone facing not less than 4 inches thick, and architectural terra cotta which extends not less than 4 inches into the wall and which is filled solid with concrete or with brick and mortar, may be considered as part of the required thickness of a wall if substantially bonded to the backing as required for brickwork. No such wall shall be less than 12 inches thick.

Order 5308. Hollow Walls. In all walls that are built hollow, the same quantity of material shall be used as if they were built solid, and the parts of such hollow wall shall be connected with proper ties placed not more than 24 inches apart.

Order 5309. Hollow Building Blocks. In buildings not over three stories and not more than 45 feet high, hollow tile or concrete blocks may be used for outside walls and inside bearing walls, as well as for nonbearing partitions. Such blocks (except for nonbearing partitions) shall have an ultimate compressive strength of not less than 700 pounds per sq. in. of gross area. In computing the gross area, no deduction shall be made for hollow spaces.

Note. Hollow tile should be of shape and material especially suitable for outside walls and should have undergone tests to prove its fire and weather resisting qualities; such walls should be further protected with $\frac{3}{4}$ inch of cement plaster on the outside. Concrete blocks should be made of good coarse aggregate, with at least 15 per cent of good Portland cement, properly mixed, moulded, and cured. With fine sand more cement is necessary. Hollow tile or concrete blocks of inferior quality will often not withstand weather or fire and should not be used for outside or bearing walls.

The hollow spaces shall not exceed 52 per cent in the case of terra cotta or clay tile, or 33 per cent in the case of concrete blocks. The absorption shall not exceed 10 per cent in

Such walls shall be laid in Portland cement mortar; hollow tile if laid with cells vertical shall have all horizontal beds reinforced with metal fabric. The thickness of such walls shall be the same as required for brick walls.

Brick facing may be considered as part of a hollow tile or concrete block wall (or vice versa) if the two materials are properly bonded with header courses of brick not more than 12 inches apart vertically.

Note. This requires a size of tile which will work out properly with the brick courses. A tile 12 inches high is not suitable for bonding with brick of the usual size.

Order 5310. Parapet Walls. All exterior, division and party walls of non-fireproof buildings shall have parapet walls not less in thickness than the wall below, carried to 3 feet above the roof and capped with incombustible material.

Order 5311. Recesses. Recesses for water, sewer or other pipes shall not be deeper than one-third the thickness of the wall and the recesses around such pipes shall be filled up with solid masonry for a space of one foot at the top and bottom of each story.

Order 5312. Old Walls. Walls heretofore built as party walls but which are not in accordance with the requirements of this section may be used if in good condition provided the height of the same be not increased.

In case it is desired to increase the height of an existing party or independent wall, which is less in thickness than required under this section, the same shall be done in one of the following ways:

(1) By a lining of brick work, supported on a proper foundation, and forming a combined thickness with the old wall of not less than 4 inches more than the thickness required for a new wall; no lining shall be less than 8 inches in thickness; all lining shall be laid up in cement mortar, and thoroughly anchored to the old wall with suitable iron anchors, placed not over 2 feet apart, the old wall being first cleaned of plaster or other coating; or

(2) Such old wall may be increased in height if the new live and dead loads are uniformly distributed over the entire old wall by means of a distributing girder and

if the total load does not exceed the allowable unit stresses; or

(3) The new wall may be carried by steel or concrete columns.

SECTION 5. CONCRETE CONSTRUCTION.

Order 5313. Unit Stresses and Reinforcement. The following unit stresses (pounds per square inch) shall not be exceeded. Reinforced Concrete, 1:2:4 mix:—

Compression in concrete, extreme fiber, (assuming a straight line stress distribution).....	700
Tension in concrete.....	none
Compression in steel—15 times the compression in concrete at the same point.....	
Tension in steel.....	16,000
Bond between concrete and steel.....	80
Shear in concrete.....	40
Compression on net core area of concrete column, with longitudinal and transverse reinforcement each equal to at least 1 per cent of the core volume.....	800
Compression on net core area of a similar column but with concrete of a 1:1½:3 mix.....	900
Compression on net core area of a column with less reinforcement than the above.....	500

Plain Concrete:—

	Com- pression.	Shear.	Tension due to bending.
1:2:4 mix.....	400	40	35
1:2½:5 mix.....	300	35	30
1:3:6 mix.....	250	30	25

Note. The foregoing are maximum stresses, suitable for concrete which will develop a crushing strength of at least 2,000 pounds per square inch in 28 days, with a 1:2:4 mix. Where fine sand (very common in Wisconsin) or soft stone is used, the stresses should be decreased or the proportion of cement increased. The following table indicates what strength may be expected with different aggregates, with good coarse sand and good workmanship:

Aggregate	1:1:2	1:1½:3	1:2:4	1:2½:5	1:3:6
Granite, trap rock.....	3500	2800	2200	1800	1400
Gravel, hard limestone and hard sandstone.....	3000	2500	2000	1600	1300
Soft limestone and sandstone.....	2500	1800	1500	1200	1000
Cinders.....	800	700	600	500	400

The minimum longitudinal reinforcement of a column or beam shall be four ½ inch round rods. The minimum transverse reinforcement of a column or beam shall be the equivalent of ¼ inch round rods, averaging not more than 12 inches apart. The steel shall be protected by at least 1½ inches of concrete for columns, one inch for beams, and ½ inch for slabs; but this protection shall not be less than the diameter of the rod in any case. In any column longer than 15 times its least diameter the unit stresses shall be properly decreased. The transverse reinforcement shall not be considered in calculating the strength of a column.

Every concrete structure shall be designed in accordance with this code and with the rules and principles of standard practice.

Note (a). For proper fire-resistance the protection of reinforcement is recommended to be at least ½ inch greater than required above.

Note (b). "Standard practice" is well illustrated in the report of the Joint Committee on Concrete and Reinforced Concrete.

See the note on page 43. "The use of concrete and reinforced concrete involves the exercise of good judgment to a greater degree than for any other building material."

Order 5314. Materials and Supervision. Only Portland cement shall be used which conforms to the Standard Specifications of the American Society for Testing Materials in force Oct. 1, 1914. (Furnished on request.)

Steel shall be used for reinforcement which shall conform to the Standard Specifications of the American Society for Testing Materials in force Oct. 1, 1914. (Furnished on request.)

The supervision required by order 5200, includes, in the case of concrete structures, a close personal supervision by an experienced superintendent or inspector of the placing of reinforcement, mixing and placing of concrete, and removal of falsework or forms. Especially close supervision is necessary when the temperature falls below 40° F.

Order 5315. Concrete Walls. Plain concrete walls of 1:3:6 mix or better, may be built of the same thickness as re-

quired for brick walls. Basement walls of 1:2½:5 mix or better, may be built 4 inches less in thickness than required for brick walls but not less than the wall above.

Concrete walls may be of less thickness than required for brick walls if properly reinforced in accordance with the preceding orders. If such a wall serves as a required division or fire wall, or as the outside wall of a building which is required to be of fireproof or mill construction, such wall shall be of 1:2½:5 mix or better, not less than 6 inches thick, and reinforced with steel weighing not less than ½ pound per sq. ft., properly distributed. Such thickness and reinforcement shall be increased where necessary in accordance with standard practice.

SECTION 6. STEEL AND IRON CONSTRUCTION.

Order 5316. The following unit stresses (pounds per square inch) shall not be exceeded:

	Rolled Steel	Cast Steel	Wrought Iron	Cast Iron
Tension on net section.....	16,000	16,000	12,000	
Compression on gross section (max.) (See formula below).....	12,000	12,000	10,000	8,000
Tension on extreme fiber.....	16,000	16,000	12,000	10,000
Compression on extreme fiber.....	16,000	16,000	12,000	10,000
Extreme fiber of pins.....	25,000			
Shear:				
Pins and power driven rivets.....	16,000			
Hand driven rivets.....	8,000			
Machine bolts.....	7,000			
Rolled steel shapes.....	12,000			
Plate girder webs, net section.....	10,000			
Brackets.....				2,000
Bearing:				
Pins and power driven rivets.....	20,000			
Hand driven rivets.....	16,000			
Machine bolts.....	14,000			
Compression:				
Steel.....			17,100	57
Wrought iron.....			12,000	60
Cast iron.....			10,000	60

Where L = length in inches.
 R = radius of gyration in inches.

Every steel or iron structure shall be designed in accordance with this code and with the rules and principles of standard practice.

All steel or iron shall conform to the standard specifications of the American Society for Testing Materials in force Oct. 1, 1914. (Furnished on request.)

SECTION 7. WOOD CONSTRUCTION.

Order 5317. Unit Stresses. The following unit stresses (pounds per square inch) shall not be exceeded:

	Tension.		Compression.		Transverse.	Shear.
	With grain.	Across grain.	With grain.	Across grain.	Extreme fiber.	With grain.
White oak.....	1,200	125	1,100	500	1,500	150
White pine.....	700	50	900	200	1,000	80
Long leaf yellow pine.....	1,200	50	1,500	350	1,700	150
Short leaf yellow pine.....	1,000	50	1,100	300	1,400	100
Douglas fir.....	1,000	50	1,300	35	1,600	110
Norway pine.....	800	50	1,000	250	1,200	100
Eastern spruce and fir.....	800	50	800	200	1,000	80
Hemlock.....	600		900	200	700	80

The stress in compression members shall not exceed $C \left(1 - \frac{L}{60D} \right)$ where

C = compression with grain
 L = length in inches
 D = least width in inches.

Note. The above are maximum stresses, suitable for timber which is free from injurious defects and of sufficient density.

Defects include decay, knots, shakes, checks, etc. Decay is dangerous because it tends to spread and because it is difficult to determine the extent to which the timber is weakened. Knots and cross grain in the center half of beams near the bottom edge are especially serious. Deep checks and ring shakes are of importance when they occur in the middle half of the height of the beam or when they run diagonally across the faces; for beams containing such checks, the allowable stress in horizontal shear should be decreased.

The density of the wood is important because the strength of timber increases with the density; this in turn is in proportion to the per cent of "summerwood" (i. e. the hard, dark part of the ring). In yellow pine and Douglas fir the summerwood should form at least 25 per cent of the total if the above stresses are to be used.

These stresses should be decreased at least 20 per cent for timber exposed to moisture.

For further details on the strength and grading of tim-

bers, see Bulletin 108 and other publications of the U. S. Forest Service.

Order 5318. Stud Partitions. Studs in a bearing wall shall be not less than $1\frac{5}{8} \times 3\frac{5}{8}$ inches, with the $3\frac{5}{8}$ inch dimension at right angles with the plane of the wall. Wooden stud partitions in any building of more than two stories, shall not pass through from floor to floor; all bearing partitions and all stud partitions directly over each other shall run down between the floor beams or joists and rest upon plates, beams or girders below, and shall have the studding filled in solid with incombustible material between the uprights and around all pipes to the underside of the flooring.

Outside studding walls of such buildings shall be similarly fire stopped at each floor level, except that such incombustible material may be supported by blocks cut in between the studs. In such case the studs need not be cut at each floor level.

Non-bearing stud partitions shall have plates at top and bottom, equal in width to the studs. No lath shall extend through from room to room.

For "semi-fireproof" stud partitions see order 5112.

Order 5319. Furring for Walls. When walls are furred, unless the wall between joists is built out to face of lath, there shall be a continuous horizontal strip placed close to the joists at top and bottom; and before the plastering is done, the wall shall be plastered with a coat of mortar at least 6 inches wide and of the full thickness of the strip, just above or below each horizontal strip. Wooden lath or furring shall not be used in any building of fireproof or mill construction.

Order 5320. Floor and Roof Beams. The ends of all wooden floor or roof beams or joists which rest on a masonry wall shall enter the wall to the depth of 4 inches, unless wall hangers are used, or unless the wall is properly corbeled out 4 inches, in which case the corbeling shall extend to top of joists.

Walls shall be anchored to the floor and roof construction with iron or steel wall anchors placed not more than 8 feet apart.

The ends of all such beams or joists shall be so shaped or arranged that in case of any deflection, or breaking, they may fall out without doing much injury to the brick wall. All joists entering any brick or stone wall shall be splayed approximately 3 inches shorter at top edge.

No wooden beam or other timber shall be built into a party wall nearer than 2 inches to the center of the wall.

PART V.

FACTORIES, OFFICE AND MERCANTILE BUILDINGS.

The requirements of the following sections apply to buildings of this classification only.

For other general requirements see Parts I to IV.

SECTION 1. CLASSIFICATION.

Order 5400. Under this classification are included all factories and workshops (including all places where manual labor is employed), office buildings, telegraph and telephone offices, mercantile establishments where commodities are bought or sold, restaurants, warehouses, railroad stations, and exhibition buildings.

SECTION 2. EXITS.

Order 5401. Type of Exits Required. At least one-half of the exits hereinafter required, in building of more than one story, shall be exterior or interior enclosed stairways (orders 5115-5119), except that in two-story buildings such stairways need not be enclosed. The remaining exits shall be either such stairways, or horizontal exits (order 5120); or fire escapes (orders 5121-5131) may be used as exits from floors which are not more than 60 feet above grade, and also from floors which are not more than 90 feet above grade in the case of fireproof office buildings or fireproof buildings where such floors are used for storage only. Every fire escape which accommodates more than 50 persons on any floor above the second shall be a "B" fire escape. Every building which accommodates more than 50 persons above the second floor shall have at least two exits other than fire escapes, excepting fireproof office buildings and other fireproof buildings whose

Order 5402. EXITS: NUMBER, LOCATION.

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contents are entirely or almost entirely incombustible, providing such building does not exceed 7000 square feet in floor area at the third floor.

Note. In high buildings it is recommended that one exit be an exterior enclosed stairway.

One stairway may serve as an exit for two divisions of a building provided each section has a door opening directly into the stairway enclosure; provided each division shall have at least two means of reaching the ground, either directly or indirectly.

The basement shall have at least one exit leading directly to the outside.

Order 5402. Number and Location. The number and location of exits shall be such that each part of every building will be not more than 75 feet distant from an exit, measuring along public passageways and aisles; but such distance may be increased to 100 feet in the following buildings, provided no hazardous condition exists therein:

- (1) Fireproof buildings whose contents are entirely or almost entirely incombustible;
- (2) fireproof office buildings;
- (3) fireproof storage warehouses with fireproof individual compartments;
- (4) fireproof or mill constructed buildings having an approved automatic sprinkler system, provided the contents are not especially inflammable.

Exits shall be so located as to afford the best possible egress.

Order 5403. Minimum Number. Each story of every building or division of a building shall have at least two exits placed as far apart as practicable, with the following exemptions:

- (1) First and second story rooms used only for storage and not more than 2,000 sq. ft. in area;
- (2) A two story office and mercantile building not larger than 2,000 sq. ft. in ground area; provided the second floor is used only for offices and is not more than 16 feet above the grade; and there is no special hazard in the first floor or basement; and the stairway leads directly to

the outside, is enclosed with fireproof or semi-fireproof partitions, has no connection with the basement, and is not over or near any boiler or furnace unless separated therefrom by fireproof construction.

(3) In any two-story building of this classification, not greater than 2000 square feet in area at the second floor, one inside stairway and one outside covered wooden stairway will be considered to comply with this order. (This forms an exception to order 5131, where outside stairways are required to be incombustible.)

Order 5404. Total Width. In a building not provided with horizontal exits, the total width of stairways shall be not less than the following:

In ordinary or frame buildings, 60 inches per 100 persons.
In fireproof and mill buildings:

	Fire-proof sprinklered.	Fire-proof not sprinklered.	Mill sprinklered.	Mill not sprinklered.	
.....	30	50	40	60	in. per 100 persons on 2nd floor.
plus.....	15	25	20	30	" " " " " 3rd "
plus.....	12	20	16	24	" " " " " 4th "
plus.....	9	15	12	18	" " " " " 5th "
plus.....	6	10	8	12	" " " " " 6th "
plus.....	3	5	4	6	" " " " " 7th "
plus.....	0	0	0	0	" " " " " 8th " and above.
but in no case shall such total width be less than					
	30	50	40	60	in. per 100 persons on any one floor.

Standard fire escapes (orders 5121-5131) may be substituted for stairways to the extent of not more than one-third of the required total width, subject to the provisions of order 5401.

If horizontal exits (order 5120), are provided for any floor, the number of persons accommodated on such floor may be increased at the rate of 100 persons for each 40 inches width of such exits, provided such increase shall not exceed 100 per cent of the number of persons accommodated by the stairways.

Note. As examples of calculations under this order where the same number of persons are to be accommodated on each floor, the following table shows the number accommodated by two stairways of minimum width (each 44 inches wide):

Frame and ordinary buildings, 147 persons total, above

Fireproof and mill buildings:

Height of building.	Fire-proof sprinklered.	Fire-proof not sprinklered.	Mill sprinklered.	Mill not sprinklered.	Persons on each floor.
2 stories.....	293	175	220	147
3 ".....	195	117	147	98
4 ".....	154	92	116	71
5 ".....	133	80	100	61
6 ".....	122	73	92	61
More than 6 stories.....	117	70

Where one minimum stairway and one "A" fire escape are provided, take $\frac{3}{4}$ of the above numbers; subject to the limitations of order 5401.

See the Note on Standard Exits, p. 16.

Order 5405. Capacity of Buildings. In calculating the aggregate width of exits, the capacity of buildings shall be established as follows:

In wholesale mercantile establishments and warehouses, by the number of persons employed therein plus an equal number of customers.

In dining rooms, cafes, and lunch rooms, by allowing 15 square feet of floor per person. If the room accommodates more than 100 persons see order 5501.

In railroad stations, by allowing 15 square feet of floor per person in all parts of the building used by the public; and in private parts of the building, by the actual number of persons engaged therein.

In retail mercantile establishments and exhibition halls, the capacity shall be determined by the architect or owner and it shall be unlawful to accommodate a greater number than the number so established; but such number shall in no case be less than one person per 50 square feet of gross floor area excluding elevators and stairways.

In all other buildings, the capacity shall be determined by the actual number of persons liable to be engaged therein, and no greater number of persons shall be permitted therein. See order 5415.

Order 5406. Exit Doors. Every door which serves as an exit from a room accommodating more than ten persons (as well as doors which are exits from public passageways or stairways) shall be a standard exit door as defined in order 5132; except that such exit door need not swing outward if it accommodates less than 25 persons and is not located at the foot of a stairway, and is not more than four risers above the outside grade.

Order 5407. Passageways. Every public passageway or aisle leading to or from a stairway, fire escape, or exit door, shall conform in width to the rule for width of stairways. (order 5404). The required width shall be kept clear and unobstructed at all times. Where loose chairs or seats would be liable to cause confusion or obstruction, such chairs or seats must be fastened.

SECTION 3. SCUTTLE.

Order 5408. Every building or section of a building two stories or more in height shall have a permanent means of access to the roof from the inside. The opening shall be not less than 20 by 30 inches and there shall be a permanent ladder or stairway leading thereto.

NOTE ON ELEVATORS AND ELEVATOR ENCLOSURES.

See general orders on Elevators issued by the Industrial commission.

SECTION 4. TRAP DOORS AND FLOOR OPENINGS.

Order 5409. Every opening through any floor shall be guarded by a substantial enclosure or rail, at least 3 feet high. Floor openings in buildings of more than two stories, unless enclosed with standard fireproof enclosures, shall be protected by standard fire doors, except that two stories may be connected by openings without fire doors if their combined floor area does not exceed the permissible floor area according to order 5202.

SECTION 5. LIGHTING.

Order 5410. All passageways and stairways when used at night shall have lights at the head and foot of each flight of stairs, and at the intersections of all corridors and passageways. Where "B" fire escapes are required, such fire escapes shall be lighted whenever the stairways are required to be lighted. For red exit lights see order 5132.

All gas jets or gas lights in factories or workshops where combustible material is used, shall be properly enclosed by globes or wire cages, or otherwise properly guarded. See also orders 5224-5225.

Note. For further requirements on **LIGHTING**, and also on **VENTILATION** and **TOILET ROOMS**, see the general orders on sanitation issued by the Industrial commission.

SECTION 6. STANDPIPES, FIRE EXTINGUISHERS, AND SPRINKLERS.

Order 5411. Standpipes and Extinguishers. For exterior standpipes see order 5135.

Standard interior standpipes (order 5136) shall be provided in all buildings of more than two stories where inflammable material or any other hazardous condition is present, unless an approved automatic sprinkler system is provided.

Note. The term "inflammable" is applied to objects which are not only combustible (i. e., can be burned) but which will burn readily and rapidly.

Wherever water supply of sufficient pressure is not available, two standard fire extinguishers (order 5137) shall be provided on each floor in place of each required interior standpipe.

Order 5412. Automatic Sprinklers. A complete automatic sprinkler system (order 5138) shall be provided in every building of this classification (except office buildings not used for mercantile purposes) where more than 50 persons are employed or accommodated above the third floor, except as provided below.

In every such building where more than 50 persons are accommodated above the second floor, an automatic sprinkler system shall be provided in the basement and sub-basements, except where there is no city water supply.

An office building in which one or more of the lower floors is used for mercantile purposes, shall be classed as a mercantile building, except that no sprinklers will be required in such portions of the building as are used for offices only.

No sprinklers will be required in a building of fireproof construction whose contents are not readily combustible.

See also Notes following order 5138.

SECTION 7. FIRE ALARM:

Order 5413. A proper alarm or gongs, which can be operated from any floor and can be heard throughout the building, shall be provided in every building of more than two stories, except the following (provided no hazardous condition exists therein): (1) fireproof buildings whose contents are (entirely or almost entirely) incombustible; (2) fireproof office buildings; (3) three-story non-fireproof office buildings; (4) fireproof storage warehouses with fireproof individual compartments. Every alarm system shall be tested at least once each week.

SECTION 8. NOTICE OF LOADS AND PERSONS ACCOMMODATED.

Order 5414. Floor Loads. In every factory, workshop, warehouse, or other building where material is piled, notices of a permanent character shall be painted or otherwise prominently displayed, stating the live load (pounds per square foot) which the floor is designed to carry. Such notices shall be in plain letters at least 8 inches high and shall be placed in full view, on each floor, near each stairway and elevator.

Note. In many cases, where floors are used for the storage of some particular material, additional safety may be secured by marking on the wall the height to which the material may be piled without exceeding the safe load.

Order 5415. Number of Persons. In all buildings of this classification where 50 or more persons are accommodated on any floor above the second, notices shall be prominently displayed stating the maximum number of persons on each floor for whom stairways and other exits have been provided according to orders 5401-5405. The size and location of such notices shall be the same as required for floor load notices.

PART VI.

THEATERS AND ASSEMBLY HALLS.

The requirements of the following sections apply to buildings of this classification only.

For other general requirements see Parts I to IV.

For assembly halls in schools, see also order 5614.

SECTION 1. CLASSIFICATION.

Order 5500. Theatres. Under this classification are included all buildings or parts of buildings used for theatrical or operatic purposes which contain a stage with more than 1,500 square feet of scenery including all curtains, or where transient scenery is used; also all buildings or parts of buildings where motion pictures are thrown upon a surface.

Order 5501. Assembly Halls. Under this classification are included all buildings or parts of buildings not included under "theaters," where 100 or more persons assemble for entertainment, instruction, worship or dining purposes.

A private assembly hall is one built in connection with a school, club, church, or society building, and used only by the members for private gatherings, and not rented for public use. Every other assembly hall is a public assembly hall.

SECTION 2. HEIGHT AND CLASS OF CONSTRUCTION.

Order 5502. Theaters. The main entrance or entrances shall not be at a higher level than 3 steps of 6 inches each, above the sidewalk at that point. The floor level at the highest row of seats, on the main floor, shall not be more than 6 feet above the sidewalk level at the main entrance; and the floor level at the lowest row of seats, on said floor, shall not be more than 6 feet below the level of the adjoining sidewalk.

But this requirement shall not apply to a "general purpose building" or village hall, in which the first story is used for

village offices, fire department, etc., and the second story is used as an assembly hall and also for motion picture performances; provided

(1) The building shall not be nearer than 20 feet to any other building or lot line;

(2) Not more than 300 persons shall be accommodated in the hall or theater;

(3) The width of exits shall be 50 per cent greater than hereafter provided (i. e., entrance doors and stairways at least 30 inches per 100 persons, emergency exits at least 30 inches per 100 persons):

(4) If the building is not fireproof, then the first story ceiling shall be semi-fireproof, (order 5113), and the stairways shall lead directly to the street and shall be enclosed with unpierced fireproof or semi-fireproof partitions (orders 5109-5112) so that there will be no opening connecting the first and second stories.

All theaters with a seating capacity of more than 600 persons, and all theaters having one or more balconies, shall be of fireproof construction: except that part of the stage floor from the curtain line to the rear wall of the stage, and as wide as the proscenium opening, which shall be of fireproof construction or mill construction protected from below by fireproof material, leaving no hollow spaces.

Theaters with a seating capacity of 600 persons or less and containing no balcony shall be built of fireproof, mill or ordinary construction, except the entire stage and auditorium floor, which shall be of fireproof or mill construction as above.

Order 5503. Assembly Halls. All assembly halls accommodating more than 1,000 persons, and all assembly halls with one or more balconies accommodating more than 150 persons, shall be of fireproof construction. All other assembly halls shall be of fireproof, mill, or ordinary construction, except as follows:

Assembly halls accommodating not more than 750 persons may be built of frame construction provided the following conditions are complied with:

(1) There shall be no balcony.

(2) The highest point of the auditorium floor shall not be more than 5 feet above the grade line at the main entrance.

(3) The floor area of the entire building shall not exceed 6,000 square feet.

(4) The foundation walls and piers shall be of incombustible construction.

(5) The building shall be at least 20 feet away from any other building or adjoining lot line.

Every assembly hall accommodating more than 750 persons shall have the highest point of the main auditorium floor not more than 8 feet above, and in no case below, the grade line at the main entrance: except that in a building of fireproof construction, the highest point of such auditorium floor shall not be more than 15 feet above such grade.

An assembly hall accommodating not more than 750 persons and with not more than one balcony, may be placed in the second story of a building of fireproof construction provided the highest point of the main auditorium floor is not more than 22 feet above the grade at the main entrance of the building.

An assembly hall accommodating not more than 400 persons and with not more than one balcony, may be placed in the third story of a building of fireproof construction, provided the highest point of the main auditorium floor is not more than 25 feet above the grade at the main entrance of the building.

An assembly hall accommodating not more than 400 persons and with no balcony may be placed on the second floor of a building of ordinary or mill construction, provided the highest point of the floor is not more than 22 feet above the grade at the main entrance of the building.

An assembly hall accommodating not more than 200 persons and with no balcony, may be placed in the third story of a building of ordinary or mill construction, provided the floor level is not more than 35 feet above the grade at the main entrance of the building: or may be placed in any story of a building of fireproof construction. See also order 5614.

In the case of a private assembly hall, each of the above numbers of persons may be increased 25 per cent.

SECTION 3. EXPOSURE AND COURTS.

Order 5504. The wall containing the main entrance to any theater or public assembly hall shall abut on a street. The lobby or passageway leading from the main entrance to the main

auditorium doors shall not be longer than 50 feet nor longer than three times its width, unless it is enclosed with unpierced fireproof ceiling and floor and with an unpierced standard fire wall on each side. Every theater or public assembly hall seating not more than 300 persons shall also have the rear or one side wall abutting on a street, alley, or open court not less than 5 feet in unobstructed width.

Every theater or public assembly hall seating more than 300 persons shall have at least three walls abutting on streets, alleys, or open courts. The width of every such court shall be at least 7 feet if the total seating capacity is not over 1000 persons, and shall be increased at the rate of one foot per 500 persons additional. But if the building is not more than 80 feet long, and each aisle leads in a straight line to an exit at the rear, then no side court will be required.

Every such court shall lead to a public thoroughfare, either directly, or through a passageway of equal width, not less than 8 feet high, and having unpierced standard fire walls, and fireproof ceiling and floor designed for a live load of at least 150 pounds per square foot. No such court or passageway shall be used for storage or any other purpose whatsoever, except for egress and ingress.

SECTION 4. BUILDINGS USED FOR OTHER PURPOSES.

Order 5505. No sleeping room or apartment shall be placed over a theater unless the entire building is of fireproof construction.

No assembly hall shall be placed over a garage, unless separated therefrom by an unpierced fireproof floor.

Every theater or assembly hall built in connection with or as a part of a building used for other purposes, shall be separated from such other parts of the building by standard fire walls, except in the following cases:

- (1) fireproof private assembly halls.
- (2) non-fireproof private assembly halls accommodating not more than 400 persons.
- (3) halls in fireproof hotels accommodating not more than 400 persons.
- (4) in non-fireproof buildings, standard fireproof partitions (order 5109) may be used instead of fire walls,

SECTION 5. CAPACITY.

Order 5506. The capacity of a theater or assembly hall shall be established by the actual number of permanently fixed seats, plus an allowance of one person for every 3 sq. ft. where "standing room" is provided. Such "standing room" shall not include any aisle, passageway, or lobby. Where permanently fixed seats are not provided, the capacity shall be established by allowing 15 sq. ft. of clear floor space per person in halls used as dining or dance halls only, or 6 sq. ft. per person in all other halls. See order 5516.

No greater number of persons than the number thus established shall be permitted in any theatre or assembly hall.

SECTION 6. STAIRWAYS AND OTHER MEANS OF INGRESS.

Order 5507. Width. The width of stairways, passageways, doors, and other usual means of ingress and egress, shall be not less than 20 inches per hundred persons accommodated; but the aggregate width shall not be less than 6 feet.

See also order 5117.

Note. For theatres, the width of regular and emergency exits combined, as required in this order and in order 5512, is 40 inches per 100 persons. This requirement is conservative. The Standard of the National Fire Protection Association is 60 inches per 100 persons. This standard is recommended for theatres where full protection is desired.

Order 5508. Handrails. Stairways and steps which have more than three risers, or which are open on both sides, shall have handrails on both sides. See order 5118.

Order 5509. Risers and Treads. Every stairway used by the public in a theatre or public assembly hall, shall have a uniform rise of not more than 7½ inches and a uniform tread of not less than 10 inches, measuring from tread to tread and from riser to riser; no winders shall be used; there shall not be less than three nor more than sixteen risers in any run. For other stairs see order 5119.

Order 5510. Gallery Stairs. Every balcony or gallery in a theater or public assembly hall, shall have a separate stairway leading to the sidewalk level; and no door from a lower balcony or gallery shall open onto such stairway. Every balcony

or gallery accommodating more than 400 persons shall have at least two such stairways. The fly gallery shall have a fireproof stairway to the stage.

Order 5511. Stairway Enclosures. Every stairway in a theater or public assembly hall or non-fireproof private assembly hall shall be an exterior or interior enclosed stairway (orders 5115, 5116), except that no door will be required at the head of the stairway; but in a fireproof building open stairways from the foyer to the first balcony will be permitted.

Every stairway leading directly from the stage to the basement shall be enclosed with 8 inch brick or 5 inch reinforced concrete walls, and shall have standard fire doors protecting all openings into the basement. All basement stairways shall be separated by such walls and doors from any part of the basement which is used for general storage or storage of inflammable material.

No storage closet shall be placed under any stairway.

For emergency stairways see the following orders.

SECTION 7. EMERGENCY EXITS.

Order 5512. Theaters. In addition to the usual means of ingress and egress, emergency exits shall be provided as follows. The minimum total width of such exit doorways, and also of the steps, stairways, fire escapes or inclines leading therefrom, shall be at the rate of 20 inches per 100 persons.

The main auditorium floor shall have a separate exit door for each 300 persons or fraction, with incombustible steps, or incline, to grade. If the doorsill is below grade, an incline shall be used. No part of any incline shall have a rise of more than one foot in five. Each balcony or gallery shall have a separate exit door for each 200 persons or fraction, opening to a separate incombustible outside covered stairway or to a separate "B" standard fire escape or fireproof passageway leading to a street, alley, or open court. All exit doors shall be apportioned as nearly equally as possible on open sides of the building, and shall be so placed as to afford the best possible egress.

Note. Outside covered stairways are recommended instead of fire escapes. Such stairways may be used as regular exits: this adds to the comfort of the audience by

eliminating the usual crowding after every performance, and at the same time decreases the danger of panic.

The stage shall have two exit doors, placed at least as far apart as the width of the proscenium opening; the basement under the stage shall have an exit door placed as far as possible from the usual entrance. Such doors shall have incombustible steps to grade, and the doors and steps shall be at least 3 feet wide. Each fly gallery shall have an exit door at least 2 feet 6 inches wide, located at the opposite end of the gallery from the usual means of ingress, and leading to a standard fire ladder or to a part of the building other than the stage section. Each dressing room section and employe's room shall have an emergency exit with incombustible steps or standard fire escape to grade.

Fire escapes accommodating more than 20 persons shall be "B" standard fire escapes and exits thereto shall be exit doors.

Order 5513. Assembly Halls: Non-fireproof. Every non-fireproof assembly hall shall have (in addition to the requirements of order 5507) a separate emergency exit for each 300 persons or fraction thereof. Each exit shall be standard exit door opening directly from the auditorium to a separate incombustible outside covered stairway or to a separate "B" fire escape. This order shall apply separately to the main floor and to each balcony or gallery which accommodates more than 100 persons.

All exits shall be placed as far apart as possible.

Order 5514. Assembly Halls: Fireproof. For fireproof assembly halls, no emergency exits or fire escapes will be required, provided the regular entrances and stairways have an aggregate width 50 per cent greater than the requirements of order 5507. Or, emergency exits as described in the preceding order may be substituted for any part of this additional width. In any case the total number of exits (including both the usual and emergency exits) shall be at least two where not more than 400 persons are accommodated, and one additional for each additional 400 persons or fraction. This requirement shall apply separately to the main floor and to each balcony and gallery which accommodates more than 150 persons.

SECTION 8. EXIT DOORS.

Order 5515. Every required exit door (whether usual or emergency) shall be a standard exit door (order 5132) and shall also be of width required under orders 5507-5514.

No single door or leaf to a double door, shall be more than 4 feet wide. No two doors shall be hinged together.

No rolling, sliding or revolving door shall be considered as a required exit from any theater or assembly hall, nor shall any such door be permitted in any theater where it would be liable to be used by the public as an exit.

Sills at all exits shall be level and flush with adjacent inside floors, and such floors shall extend without break in the level or gradient for a distance not less than the width of the adjacent aisle.

For exit lights and signs see order 5534.

SECTION 9. SEATS.

Order 5516. All seats, chairs and benches shall be placed not less than 2 feet 8 inches for adults, or 2 feet 6 inches for minors, from back to back measured horizontally. All seats shall average at least 20 inches in width, and no seat shall be less than 18 inches wide. If benches without arms between seats are used, the seating capacity shall be established by allowing one sitting or seat to each 18 inches of length.

All seats, chairs and benches, except chairs in boxes or loggias, shall be securely fastened to the floor; or if the floor is level, the seats and chairs may be fastened together in sections and each section securely fastened to the floor at each end.

Note. Loose chairs or seats must not be used unless a special permit is secured from the Industrial commission, or from the Fire Chief acting as a deputy of the commission.

There shall not be more than 12 seats in a row between aisles, nor more than 5 seats in a row which has an aisle on one side only.

No seat, bench or platform on which seats are placed shall be more than 22 inches in height of riser. No such seat bench shall be nearer the ceiling than 8 feet.

SECTION 10. AISLES AND PASSAGEWAYS.

Order 5517. Width of Aisles. Aisles having seats on both sides shall not be less than 2 feet 10 inches wide at the beginning and shall increase in width toward the exits at the rate of $\frac{1}{4}$ inch per foot of run; or the aisle may have a uniform width not less than the average width of the foregoing calculation; but no wall aisle shall be less than 3 feet wide and no other straight aisle shall be less than 3 feet 6 inches wide.

Where main aisles are longer than 40 feet, there shall be a cross aisle leading to each required side exit. Cross aisles shall not be less than 4 feet wide.

Order 5518. Passageways and Foyers. Passageways and foyers shall be of width required under order 5507, and in no case less than 5 feet wide, and shall be so designed and apportioned as to prevent congestion and confusion. Passageways and foyers which serve as means of egress (whether usual or emergency) shall be at least equal in combined width to the required width of the stairways, passageways, or doors leading to them.

Order 5519. Inclines and Aisles Steps. To overcome any difference in level between courts, corridors, lobbies or passageways on the ground floor, inclines shall be employed. Inclines shall not exceed one foot of rise to 12 feet of run except in the main aisles of auditoriums, where gradients of one foot rise to 5 feet of run may be used.

Steps in balcony aisles shall extend the full width of the aisle.

Order 5520. Obstruction. All aisles and passageways shall be kept free from camp stools, chairs and other obstructions, and no person except an employe shall be allowed to stand in or occupy any of the aisles, foyers or passageways during any performance or public gathering.

SECTION 11. SCUTTLE.

Order 5521. Over the stage and auditorium there shall be permanent means of access to the roof from the inside. Each opening shall be not less than 20x30 inches and there shall be a permanent ladder or stairway leading thereto.

SECTION 12. ELEVATORS.

Order 5522. All elevators shall be enclosed with standard fireproof enclosures. (See orders on elevators issued by the Industrial commission.)

SECTION 13. PROSCENIUM WALL AND CURTAIN.

Order 5523. Wall. The stage of every theater shall be separated from the auditorium by a brick or monolithic concrete wall at least 12 inches thick. If the wall is more than 16 feet high or more than 40 feet long without proper lateral bracing, it shall be at least 16 inches thick. The wall shall start at the basement floor, except in a fireproof building with unpierced fireproof stage floor. The wall shall extend upward to a roof or floor in a fireproof building; or, in a non-fireproof building, to a point at least 4 feet above the highest adjoining roof.

There shall be not more than two openings (excluding the proscenium opening) in the proscenium wall. Such openings shall not exceed 21 square feet superficial area each, and shall be provided with standard fire doors.

Above the proscenium opening there shall be a fireproofed girder or other fireproof support of sufficient strength to safely carry the load above.

Order 5524. Curtain. The proscenium opening in every theater where scenery is used shall be provided with a rigid fireproof curtain or a curtain of asbestos conforming to the following specifications, or of equivalent approved construction.

Curtains of the rigid steel type shall consist of a rigid steel frame covered on the audience side with not less than No. 16 U. S. gauge sheet steel, and on the stage side with vitrified cellular asbestos boards at least one inch thick. The curtain shall overlap the proscenium wall not less than 12 inches at each side and 24 inches at the top, and shall slide vertically between rolled steel guides not less than $\frac{1}{4}$ inch thick.

Curtains of asbestos cloth shall be substantially woven of asbestos fiber not less than 95 per cent pure and shall weigh not less than $21\frac{1}{2}$ pounds per square yard. All seams shall be lapped not less than one inch and sewed in two rows with not less than $\frac{1}{8}$ inch pure asbestos twine. At the top and bottom of the curtain a $1\frac{1}{2}$ inch (or larger) pipe shall be placed and shall be securely fastened in and covered by the curtain. The curtain shall overlap the proscenium wall not less than 18 inches at each side and 24 inches at the top, and shall be guided at each side by metallic loops or rings sliding on a steel cable. No combustible paint shall be used.

For curtains of any type, the connections between curtain and wall shall be made as nearly smoke-proof as possible. Provision shall be made to prevent the curtain from leaving or binding on the guides under any conditions. No part of a curtain or any of the curtain guides shall be supported by, or fastened to any combustible material.

The hoisting apparatus for the curtain shall be designed with a factor of safety of 8 or more. The device for controlling the curtain shall be simple in design and capable of convenient operation from both sides of the stage and from the fly galleries.

Besides the regular operating mechanism there shall be an emergency device which will allow the curtain to drop by gravity. The device shall be so arranged that it can be easily operated by hand from each side of the stage and from the fly galleries, and also that its operation will be controlled by fusible links placed on each side of the stage and in the fly galleries, and when thus operated it shall descend at its normal rate of speed.

The curtain and its operating mechanism shall be so designed and constructed at all points, whether specifically mentioned or not, as to form an efficient and reliable barrier against fire and smoke, according to the best practice.

Note. It is recommended that this curtain be raised at the commencement and lowered at the close of each performance.

Rigid steel curtains, insulated with asbestos, are recommended as giving the best protection, especially in large theatres.

SECTION 14. STAGE:—VENTILATOR, etc.

Order 5525. Automatic Ventilators. Every stage which contains moveable scenery shall be provided with one or more automatic ventilators placed near the center and above the highest part of the stage, extending at least 10 feet above the roof, and having a combined area equal to at least 8 per cent of the area of the stage floor. The vertical louvre openings shall be not less than twice the sectional area of the shaft. The ventilator shall be designed and constructed so as to open by gravity, and so as to effectively overcome the effects of neglect, rust, dirt, frost, snow, heat, twisting, or warping of the frame

work. The louvres or dampers in the openings shall be held closed by cotton or hemp cords running to the stage floor close to each stage door. Fusible links shall be inserted in each cord: one close to the ventilator, one 10 feet above the stage floor, and one midway between these two.

Order 5526. Stage Vestibules. All entrances to the stage shall be vestibuled in such manner as to protect the curtain, scenery, and auditorium from draughts of air.

Order 5527. Foot Light Trough. The foot light trough shall be made of incombustible material.

Order 5528. Fireproof Paint. All stage scenery, curtains, and decorations made of combustible material, and all wood-work in or about the stage, shall be painted or saturated with some incombustible material or otherwise rendered safe against fire.

SECTION 15. WORK SHOP, STORAGE AND GENERAL PROPERTY ROOMS.

Order 5529. No work shop, storage room or scenery dock, shall be placed above or below the stage or auditorium of any theater, or in any fly gallery. Work shops, storage and general property rooms and scenery docks, shall be separated from the rest of the building by fireproof walls at least 8 inches thick (or 5 inches thick if of reinforced concrete), and by fireproof ceilings and floors; and all openings in such walls, ceilings and floors shall be provided with standard fire doors on each side of the wall.

SECTION 16. DRESSING ROOMS.

Order 5530. The section containing the dressing rooms shall be separated from the stage or other parts of the building, by fireproof walls at least 8 inches thick, (or 5 inches thick if of reinforced concrete); and all openings connecting this section with the stage or other parts of the building, shall be protected by standard self-closing fire doors. The partitions dividing the dressing rooms, and the partitions and ceilings of all passageways from the dressing rooms to the stage, shall be incombustible.

No dressing room nor employes' room shall be placed more than one story below the grade line, and no dressing room shall be placed above or below the auditorium.

SECTION 17. BOILER AND FURNACE ROOMS.

Order 5531. Every boiler or furnace room, including breaching, shall be enclosed with standard fire walls and with fireproof ceiling and floor each designed to carry a live load of at least 150 pounds per square foot; except that in the case of a private assembly hall accommodating not more than 300 persons, the floors and walls of the boiler or furnace room shall be incombustible, but fire doors and fireproof ceiling will not be required.

See also orders 5212-5223, and the following order.

Note. If possible, the boiler or furnace room should not be located below the stage, auditorium, foyer, or exits.

SECTION 18. HEATING AND VENTILATING.

Order 5532. Every theater and assembly hall shall be provided with a ventilating system which will furnish at least 1200 cubic feet of fresh air per hour, for each person accommodated, and which will change the air at least six times per hour, in all parts of the building other than the auditorium. The fresh air shall be taken from the outside of the building and no vitiated air shall be re-heated unless it has been washed by a mechanical air washer of approved design. No floor register for heating or ventilating shall be placed in any aisle or passageway unless such register is reinforced with suitable wrought iron or steel ribs not more than 12 inches apart. Radiators in passageways or auditoriums shall be recessed, or elevated at least 7 feet above the floor.

SECTION 19. LIGHTS.

Order 5533. Oil and Gas. (See also order 5524.) No oil lamp shall be used in or about any stage containing scenery.

No gas lighting of any kind shall be used on any stage containing scenery, nor in any property room, storage room, scene dock or fly gallery, except in localities where electricity is not available. Gas fire used for heating water, etc. shall be enclosed in iron jackets.

Note. For theaters where outside electric current is not available, a private electric plant is strongly recommended.

Order 5534. Exit Lights. Under "exit lights" are included lights over all doors and over the entrances to all stairways and passageways leading from the auditorium, balconies or galleries to streets, alleys, or open courts; and any other lights which may be necessary to lead or direct the audience from the auditorium, balconies, galleries or other public parts of the building to streets, alleys or open courts; also such lights as may be necessary to lead or direct all performers and stage employes (including all persons on or about the stage) to public streets, alleys or open courts.

Exit lights shall be either:

(1) Electric lights, fed independently of the stage lighting and controlled only from the lobby or other convenient place in the front of the building; such control shall be accessible to authorized persons only; this circuit shall not pass through or near the stage or moving picture booth; see order 5535 below: or

(2) Candles, or oil lamps using non-volatile oil and floating wick; such lights shall be properly shielded from drafts and from adjacent woodwork or other combustible material.

Note. The latter type of exit lights is the only type that is absolutely safe against general interruption. If such candles or oil lights are used, the management must of course be particularly careful to see that the lights are properly maintained and lighted before every performance.

Every portion of the theater devoted to the use or accommodation of the public except the general auditorium, also all outlets leading to the streets and including all open courts, passageways, stairways, doors, and fire escapes shall be kept well and properly lighted during every performance and the same shall remain lighted until the entire audience has left the premises.

Every exit light over an exit door, or over the entrance to a stairway or passageway, or other means of egress (whether usual or emergency) shall have a red illuminated sign bearing the word "exit" or "out" in plain letters at least 5 inches high, or a similar sign placed below a red light.

Order 5535. Separate Service. In theaters, and in assembly halls in which the auditorium is not kept lighted during the entire performance or entertainment, there shall be two

sources of supply as follows if electricity is used for exit lights:—

Where the source of supply is outside of the building, there shall be at least two separate and distinct services where practicable, fed from separate street mains; one service shall be of sufficient capacity to supply current for the entire building, while the other service shall be at least of sufficient capacity to supply current for all exit lights.

Where only one supply from a street main is available, the feed connection used exclusively for such exit lights shall be taken from a point outside of the main building and outside of the main service fuses.

Where the source of supply is a private plant, within or in connection with the building, an auxiliary service of at least sufficient capacity to supply the exit lights shall be installed from an outside source or from a suitable storage battery.

Every electric switchboard shall be made of incombustible, non-absorbent material and shall be enclosed in a fireproof cabinet.

See also orders 5225, 5548.

SECTION 20. TOILET ROOMS.

Order 5536. Separate toilet rooms in connection with the auditorium shall be provided for males and females. One closet shall be installed for each 100 females or fraction and one closet and one urinal for each 200 males or fraction. The above number of fixtures shall be based upon the maximum seating capacity, assuming the audience to be equally divided between males and females.

Water closets in connection with the stage shall be provided in every theater which accommodates more than 300 persons. There shall be separate closets for males and females.

Separate drinking fountains shall be provided for the stage and auditorium, wherever water supply is available.

See also orders 5205-5211.

SECTION 21. FIRE PROTECTION.

Order 5537. Standpipes. For exterior standpipes see order 5135.

Where water supply of sufficient pressure is available the following standard interior standpipes (order 5136) with lines of 1½ inch hose shall be installed:

Every theater or public assembly hall accommodating not more than 300 persons shall have at least one standpipe in the balcony, one at the rear of the auditorium, one on the stage, and one under the stage.

Every theater or public assembly hall accommodating more than 300 persons shall have at least one standpipe in the auditorium, one in each balcony and gallery, one on each side of the stage, near exit, one in each fly gallery, near stairway, and one on each side of basement under the stage, near exit.

The above lines of hose shall not be more than 75 feet long and where such lines of hose will not reach the extreme parts of such portions of the building, additional standpipes and hose shall be installed. These pipes shall be filled with water at all times while the building is in use.

Order 5538. Fire Extinguishers. Where water supply of sufficient pressure and quantity is not available, and also in private assembly halls where interior standpipes are not provided, standard chemical fire extinguishers (order 5137) shall be provided as follows:

Every theater or assembly hall accommodating not more than 300 persons shall have at least one standard fire extinguisher in the boiler or furnace room, two on the stage, two under the stage, one in dressing room section, two in auditorium, two in balcony and one in box office.

Every theater or assembly hall accommodating more than 300 persons shall have at least two standard fire extinguishers on each side of stage, two in each fly gallery, one in each property room, one in each scene dock, one in every four dressing rooms or less, one in each foyer, one in each toilet room, and one in each auditorium balcony and gallery for each 2,000 square feet of area, or fraction.

All extinguishers shall be properly exposed to view and always accessible.

Order 5539. Automatic Sprinklers. Every theater accommodating more than 600 persons (except theaters used only for motion pictures and having no stage or scenery) shall be provided with an approved automatic sprinkler system (order 5138), to be installed throughout the theater, except in the auditorium, foyers, lobbies, public stairways and passages, over dynamos and switchboards, and those parts of the stage ventilator which are above the roof line.

Order 5540. Hooks and Axes. Every stage which contains scenery shall be provided with at least one fireman's axe and one 12 foot hook.

Every stage which contains scenery and which is more than 30 feet wide shall have at least one 14 foot hook and one fireman's axe in each fly gallery, and one on each side of the stage, and one fireman's axe on each side of the basement.

All hooks and axes shall be prominently exposed to view and always accessible.

Order 5541. Fire Alarm Box. In cities having a public fire alarm system there shall be a box at each theater or public assembly hall.

Note. A private alarm is recommended as being less liable to cause panic.

SECTION 22. MIRRORS: FALSE OPENINGS.

Order 5542. No false opening giving the appearance of a door or window, where none exists, shall be placed in any part of a theater or assembly hall used by the public.

No mirror shall be placed in any part of a theater or assembly hall used by the general public except in the women's and men's retiring and toilet rooms.

SECTION 23. MOTION PICTURE MACHINES AND BOOTHS.

Note. This section is in accord with the specifications already issued by the State Fire Marshal, except that the size of angle iron is slightly increased. This change is made with the approval of the Fire Marshal.

Order 5543. Definition. By the term "picture machine" as used in this code is meant any device used to project upon a surface moving pictures of any character which an audience is admitted to view.

Order 5544. Construction of Booth. Every picture machine shall, before being operated, be installed in a booth constructed entirely of fire resisting material, including brick, tile, concrete, two inch plaster on metal lath and metal frame, or of sheet iron or asbestos sheathing as specified below. The size of the booth (for one machine) shall be not less than 5 feet by 5 feet by 6 feet high.

Note. Booths at least 6 by 6 by 7 feet are recommended.

Every booth made of sheet iron or asbestos sheathing shall have its frame constructed of not less than $1\frac{1}{4}$ by $1\frac{1}{4}$ by 3-16 inch steel angles or tees, spaced not more than two feet apart, properly braced to secure rigidity, and securely riveted or bolted at joints. The sheathing shall be not less than No. 20 U. S. gauge sheet iron or $\frac{1}{4}$ inch hard asbestos board, securely riveted or bolted to the frame. The floor shall be constructed of the same material as the sides and top, riveted or bolted to the frame, and covered with a rubber or cork matting. No sheet metal booth shall be placed nearer to any combustible partition, wall, or ceiling, than 2 feet.

Order 5545. Door. The door shall be not larger than 2 by 5 feet, and shall either be of the same construction as the booth, or be at least $\frac{3}{4}$ inch thick and clad with metal not less than No. 28 U. S. gauge. The door shall swing outward, and close automatically, either by means of a spring on the outside or by a metal rope and weight. Two metal latches shall be provided, one about 12 inches below the top and the other about 12 inches above the bottom of the door, so connected that one operation opens both latches.

Order 5546. Openings. The openings for the operator's view, or for the picture, shall not be larger than 12 inches square, and shall be provided with a gravity door, of the same construction as specified for the booth, held open by fusible links placed in series, so arranged that one of the links is suspended directly over the film when it is in the slide of the apparatus; or the door shall be so arranged as to be closed, except when held open by pressure of the operator. Such door shall not be blocked or held open in any manner except as here described.

Order 5547. Ventilation. Each booth shall be provided with a metal ventilating pipe not less than 12 inches in diameter, extending outside of the building.

Note. If a 12 inch outlet pipe is impracticable, a smaller pipe may (if approved by the Industrial commission) be used if provided with an efficient rotary power fan.

A fresh air opening shall also be provided near the rear end of the booth, in or near the floor, connecting with a metal duct of not less than 120 square inches area leading from the outside, and having a damper operating automatically by fusible

links, and a damper operated at the will of the operator. If a standard fire window is provided not less than 4 square feet in area, connecting with the outside air, and opening not less than one-half, then the ventilating pipes (both inlet and outlet) may be omitted.

Order 5548. Electric Wiring. All electric wiring in the booth shall have an approved slow burning insulation. Each lamp connected with a picture machine shall be provided with a separate switch located within the booth, where there shall also be a switch controlling the lights in the exhibition room.

Note. Motion picture theaters are, of course, subject to all the requirements of Part VI, in respect to lighting as well as in all other respects.

Order 5549. Machine. Every machine shall be provided with feed and takeup reels in metal receiving boxes with riveted or flanged joints. A shutter shall be placed in front of the condenser, arranged so as to be closed except when held open by the operator, or by some other device that will insure the immediate dropping of the shutter when operation of the machine is stopped.

Order 5550. Films, etc. Magazines shall be used for receiving and delivering the films during the operation of the machine. Films not in the machine shall be kept in metal boxes with tight fitting covers when in the booth. No combustible substance of any sort shall be permitted in the booth, except the films used in operation.

Note. It is suggested that, between pictures, a bulletin be thrown on the screen, stating the precautions taken to reduce danger from fire, and giving advice as to the dangers which might arise from panic.

Order 5551. Temporary Booth. Every temporary booth shall be of approved design, conforming as far as possible to the requirements for permanent booths. Every booth used for more than three consecutive performances in one location will be considered a permanent booth.

Note. The Industrial commission suggests that plans of motion picture booths, both permanent and temporary, be submitted for approval.

PART VII.

SCHOOL BUILDINGS, LIBRARIES AND MUSEUMS.

The requirements of the following sections apply to buildings of this classification only.

For other general requirements see Parts I to IV.

SECTION 1. CLASSIFICATION.

Order 5600. Under this classification are included all public, parochial, and private schools, colleges, academies, seminaries, libraries, museums and art galleries; including all buildings or parts of buildings used for the purpose of acquiring knowledge.

SECTION 2. HEIGHT AND CLASS OF CONSTRUCTION.

Order 5601. Maximum Height. No building which accommodates primary or grammar grades, or pupils averaging 14 years old or less, shall be more than three stories high, nor shall the topmost floor level be more than 35 feet above the grade at any outside door.

No building which is used as a high school, or which accommodates pupils averaging 18 years old or less, shall be more than four stories high, nor shall the topmost floor level be more than 48 feet above the grade at any outside door.

Order 5602. Class of Construction. Every building which is more than two stories high, shall be of fireproof construction, except that in a three story building ordinary construction may be used above the third floor.

All other buildings of this classification shall be of ordinary, mill, or fireproof construction; except that a one-story building whose floor level is not more than 4 feet above the grade, may be of frame construction, if it is not within the fire limits of any city or village, and if it is at least 30 feet away from any

other building and from any adjoining lot line or opposite alley line.

Note. The laws of the state compel children to attend school, regardless of the wishes of either children or parents. School buildings therefore surely require the highest degree of fire protection. Fireproof construction is strongly recommended for all school buildings. Many such schools have been built at a cost of only about 10 per cent more than for combustible construction. In such a case the saving in fire insurance alone will yield nearly 5 per cent return on the additional cost; when decreased depreciation is considered, it is evident that fireproof construction is a good investment.

SECTION 3. EXPOSURE AND COURTS.

Order 5603. No wall containing windows which light a school or class room shall be less than 30 feet away from any opposite building, structure or lot line, or opposite court wall; except that the distance from such opposite court wall may be reduced to not less than 20 feet provided light rays at an angle of 45 degrees are not thereby obstructed from entering the entire upper half of any such window.

SECTION 4. SUBDIVISIONS AND FIRE STOPS.

Order 5604. Every building of this classification which is built in connection with a building of a lower grade of construction, shall be separated from such other building by standard fire walls, and all communicating openings shall be protected by standard fire doors. If such openings are used as a means of egress, they shall be kept normally open during the occupancy of the building. All rooms or apartments used for general storage, carpenter shops, repairing, paint shops or other equally hazardous purposes shall be enclosed with standard fire walls and fireproof ceilings and floors.

SECTION 5. EXITS.

Order 5605. Number, Location, and Type. The number and location of exits shall be such that, in case any exit or passageway is blocked at any point, some other exit will still be accessible, through public passageways, from every class

room, and from every other room used by the public or by the occupants generally.

Note. According to this requirement, every school building, however small, must evidently have at least two exits. Furthermore, there must evidently be an exit at the end of every corridor.

At least one-half of such exits, in buildings of more than one story, shall be stairways (orders 5117-5119). The remaining exits shall be either such stairways, or horizontal exits (order 5120); or fire escapes may be used as exits from floors which are not more than 40 feet above grade. In non-fireproof buildings at least one fire escape or incombustible outside covered stairway shall be provided unless the stairways are enclosed (orders 5115-5116). All fire escapes on buildings which accommodate more than 100 persons above the first floor shall be "B" fire escapes.

In every building which accommodates more than 120 persons above the first floor, there shall be at least two stairways. In buildings of more than two stories, the stairways shall be enclosed as in orders 5115-5116, unless the stairs and the corridor floors are incombustible.

Note. In the case of stairways used by children, the rise should be less than the maximum permitted by order 5119. For primary grades the rise should not be more than 7 inches. Stairs in school buildings should have a handrail on each side. Closets should not be placed below stairways.

Basement stairways which lead to the first floor shall be separated by standard fireproof enclosures (order 5109) from all parts of the basement which are used for general storage or for the storage of inflammable materials. One basement exit shall open directly to the outside.

Order 5606. Total Width. The total width of exits from any floor shall be at not less than the following rates, based on the total number of persons accommodated on such floor and on the floors above:

Non-fireproof buildings, 40 inches per 100 persons.

Fireproof buildings, 30 inches per 100 persons. If the stairways are enclosed and an approved automatic sprinkler

system is provided in the basement, such width may be reduced as in order 5404.

Standard fire escapes (orders 5121-5131) may be used for not to exceed one-third of the above total widths, subject to the limitations of the preceding order.

The capacity of a school building shall be established by the actual number of seats in rooms where such are used, or by the number of persons accommodated. The capacity of a library, museum, or art gallery shall be established by allowing to each person 100 square feet of the total floor area of the building, excluding stairways and elevators.

Order 5607. Exit Doors. Exit doors shall be as required in order 5132, except that they shall be not less than 2 feet 8 inches wide if used by children under 14 years. The aggregate width of exit doors shall be as required in order 5606. No single door or leaf of a double door shall be more than 4 feet wide. No revolving door shall be considered as a required exit from a building used by persons under 18 years of age.

Note. Single doors are better than double doors for school buildings.

Order 5608. Passageways. Corridors and passageways shall be so designed as to prevent congestion and confusion.

The minimum unobstructed width of corridors and passageways which are used by the public or by the occupants generally shall be determined the same as the width of stairways (order 5606) and shall in no case be less than 4 feet. Corridors and passageways serving as a means of egress shall be at least equal in combined width to the required width of the stairways or passageways leading to them.

SECTION 6. SCUTTLE.

Order 5609. Every building more than one story in height shall have a permanent means of access to the roof from the inside. The opening shall be not less than 20 x 30 inches and there shall be a permanent ladder or stairway leading thereto.

SECTION 7. ELEVATORS.

Order 5610. All elevators shall be enclosed with standard fireproof enclosures. (See general orders on elevators issued by the Industrial commission.)

SECTION 8. ROOMS AND WINDOWS.

Order 5611. Floor Space and Height. The minimum floor space of school or class rooms shall be:

For primary grades, 12 square feet per person.

For grammar grades, 14 square feet per person.

All others, 16 square feet per person.

Note. These are minimum requirements. A more liberal allowance of floor space (16 to 20 square feet per person), is recommended.

All class, recitation and study rooms shall be at least 12 feet high in the clear. Toilet, play and recreation rooms shall be at least 8 feet high in the clear.

See also the following order.

Order 5612. Windows. In study, class, recitation and laboratory rooms, there shall be at least one square foot of glass surface (windows or skylights) for every 6 square feet of floor surface.

Note. One square foot of glass surface for every 5 square feet of floor surface is recommended.

For toilet room windows see order 5207.

Windows shall be placed either at the left or at the left and rear of pupils when seated. The tops of windows (except in libraries, museums and art galleries) shall not be placed more than 8 inches below the minimum ceiling height as established in order 5611.

The width of all class and recitation rooms (measuring at right angles to the glass surface) when lighted from one side only shall not exceed two and one-fourth times the height of the window head above the floor.

All windows shall be placed in the exterior wall of the building; except that halls, corridors, stock and supply closets may be lighted by ventilated skylights or by windows placed in interior walls or partitions. Museums, libraries and art galleries may be lighted by skylights.

See also order 5603.

Note. The object of the above order is to secure proper light in rooms used for long continued studying or reading. In college and university buildings where a literal compliance with this order is impracticable and

unnecessary, reasonable modifications in accordance with standard practice will be permitted on application. See under "Appeal", p. 5.

Order 5613. Basement Rooms. No class, recitation, or study room shall be placed in any basement if the floor level of such room is more than 2 feet below the adjoining grade. The walls and floor of every basement room used by pupils or students, shall be waterproof and dampproof.

SECTION 9. ASSEMBLY HALLS.

Order 5614. A room seating or accommodating 100 or more persons is governed by the requirements of Part VI, Theaters and Assembly Halls, except as follows:

No assembly hall in a non-fireproof building used by pupils or students who average 18 years old or less, shall be located above the second story.

The minimum width of any exit doorway used by children under 14 years of age may be 2 feet 8 inches (instead of 3 feet 4 inches); but in any case the aggregate width of such doorways shall be in accordance with Part VI.

Note. It is recommended that assembly halls in schools, especially when used by children under 14, be placed on the first floor so as to avoid the danger of panic.

SECTION 10. SEATS, DESKS, AND AISLES.

Order 5615. Seats, chairs and desks (except those used by teachers) in class recitation or study rooms seating more than 50 persons shall be securely fastened to the floor.

Class and school rooms shall have aisles along all walls.

In primary rooms, intermediate aisles shall be not less than 17 inches, and wall aisles not less than 2 feet 4 inches in width.

In grammar rooms, intermediate aisles shall be not less than 18 inches and wall aisles not less than 2 feet 6 inches in width.

In high school rooms and in all other class and school rooms, intermediate aisles shall be not less than 20 inches and wall aisles not less than 3 feet in width.

Assembly hall seats and aisles shall conform to the requirements for assembly halls (orders 5516-5520).

SECTION 11. BOILER AND FURNACE ROOMS.

Order 5616. Every boiler or furnace room, if not located in a separate building, shall be enclosed (together with

breaching) with fireproof floor and ceiling and with solid incombustible walls at least 8 inches thick (or 5 inches thick if of reinforced concrete) with all openings protected by standard fire doors. Such boiler or furnace shall be separated as effectively as possible, either by distance or by partitions and doors, from all stairways leading to the first floor, and especially from stairways which lead continuously to the upper floors.

Note. Boilers and furnaces are strongly recommended to be placed in separate buildings. This will eliminate the most frequent cause of school fires.

SECTION 12. VENTILATION.

Order 5617. All parts of the building generally used by the public or the occupants, except the corridors, passageways and stairways, shall be provided with fresh air at the rate of at least 1,200 cubic feet per person per hour. The fresh air shall be taken from the outside of the building and no vitiated air shall be reheated unless washed by a mechanical air washer of approved design; in such case not less than one-third of the required air shall be taken from the outside.

SECTION 13. TOILET ROOMS.

Order 5618. School buildings shall have the following sanitary equipment:

One water closet for every 20 females or fraction, except for grammar and primary grades, where there shall be one water closet for every 15 females or fraction.

One water closet and one urinal for every 40 males or fraction, except for grammar and primary grades, where there shall be one water closet and one urinal for every 30 males or fraction.

Toilet accommodations for males and females shall be placed in separate rooms with doors not less than 20 feet apart.

A drinking fountain and sink shall be installed in each story and basement, for each 6,000 square feet of floor area, or fraction.

Libraries, museums and art galleries shall have the following sanitary equipment:

One water closet for every 100 females or fraction.

One water closet and one urinal for every 200 males or fraction.

The capacity shall be established in order 5606.

See also orders 5205-5211. Where privy vaults are permitted, the building containing the same shall be placed at least 20 feet from any other occupied building.

SECTION 14. STANDPIPES AND FIRE EXTINGUISHERS.

Order 5619. For standard exterior standpipes see order 5135.

In all buildings not provided with interior standpipes, standard chemical fire extinguishers (order 5137) shall be provided in the proportion of one extinguisher to each 2,000 square feet of floor area or fraction in non-fireproof buildings, or one to each 6,000 square feet of floor area or fraction in fireproof buildings; but there shall be at least one fire extinguisher on each floor. All fire extinguishers shall be prominently exposed to view and always accessible.

Note. Automatic sprinklers (order 5138) are recommended for all parts of the basement where combustible material is liable to be stored.

SECTION 15. FIRE ALARMS.

Order 5620. Every building two stories or more in height shall be provided with a proper alarm or gongs which can be operated from any story and can be heard throughout the building. Such alarm system shall be tested at least once a week.

In cities having a public fire alarm system there shall be a box at each school building.

PART VIII.

APARTMENT HOUSES, HOTELS AND PLACES OF DETENTION.

The following requirements apply to buildings of this classification only.

For other general requirements see Parts I to IV. For rooms which accommodate more than 100 persons, see Part VI, Theaters and Assembly Halls.

Note. This code in no way affects the validity of sections 1636—180 to 1636—201 of the statutes, known as the Tenement House Law for cities of the first class (i. e. Milwaukee). On all points where the requirements of the Tenement House Law are more stringent than the requirements of this code, the Tenement House Law must of course be complied with for buildings in Milwaukee. All requirements of this code which are not covered in the Tenement House Law will apply in Milwaukee the same as elsewhere.

SECTION 1. CLASSIFICATION.

Order 5700. Apartment (Tenement) Houses. Under this classification is included every building or part of a building occupied as the residence of three or more families living independently, or occupied by two such families and also used for business purposes.

Order 5701. Hotels and Places of Detention. Under this classification are included all hotels, lodging and boarding houses, club houses, dormitories, convents, hospitals, asylums, jails and other places of detention, including every building or part of a building used for sleeping or lodging purposes by six or more persons not members of a family.

Note. Where the following requirements refer to "families" or "apartments", the requirement applies to apart-

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ment houses; where they refer to "persons" or "rooms", the requirement applies to hotels and places of detention.

SECTION 2. HEIGHT AND CLASS OF CONSTRUCTION AND FIRE STOPS.

Order 5702. Fireproof Construction. Buildings of five or more stories shall be of fireproof construction.

All places of detention where persons are confined by locked doors or barred windows, shall be of fireproof construction.

Order 5703. Ordinary Construction. Apartment houses more than three stories in height, and all other buildings of this classification more than two stories in height, shall be of fireproof, mill, or ordinary construction.

Note. It is strongly recommended that four story buildings be of fireproof construction. See note on cost of fireproof construction, order 5602.

Order 5704. First Floor Fireproof. In three or four story buildings, the first floor and all members supporting the same shall be of fireproof construction; except that in a three-story building which accommodates not more than four families or 30 persons above the first story, the basement ceiling shall be either fireproof or semi-fireproof (order 5113).

Order 5705. First Floor Used for Business Purposes. In a building whose first story is used for business purposes, the first story ceiling shall either be fireproof or semi-fireproof (order 5113).

Order 5706. Room Containing Inflammable Material. Every room or apartment which is used for a carpenter or paint shop, or other equally hazardous purpose, or which contains other equally inflammable material shall be enclosed with fireproof ceiling and floor and with incombustible walls at least 8 inches thick (or 5 inches thick if of reinforced concrete) with all openings protected by standard fire doors.

Order 5707. Corridor and Dividing Partitions. Public passageways shall be enclosed with fireproof or semi-fireproof partitions in all buildings where the stairways are required to be enclosed (order 5710). In such buildings where there is more than one apartment on any floor, such apartments shall be separated by fireproof or semi-fireproof partitions. Where there are more than eight rooms on any floor, they shall be di-

vided by fireproof or semi-fireproof partitions into groups of not more than eight rooms each.

SECTION 3. YARDS.

Order 5708. Behind every apartment house, the rear of which does not abut on an alley or street, there shall be a yard across the entire width of the lot, open and unobstructed from the ground to the sky. The width of the yard behind a two-story building shall be either

- (1) At least 5 feet of unobstructed width; or
- (2) At least 10 feet from the rear lot line to the building line, of which at least 3 feet shall be unobstructed, and the remainder may be occupied by an open (or screened) porch.

For apartment houses of more than two stories, the unobstructed width of the entire yard shall be increased one foot for each additional story, except in the case of corner lots.

SECTION 4. COURTS AND SHAFTS.

Order 5709. All courts and shafts for light, air, or dumbwaiter, shall be completely enclosed with fireproof or semi-fireproof partitions or walls (orders 5109, 5112) except as provided below. Dumbwaiter shafts shall have fireproof enclosures.

In the case of a semi-fireproof partition enclosing a court or shaft in a building of not more than three stories, the fire-resisting material will only be required on the side of the partition toward the court or shaft.

In a fireproof building, an open well piercing the second (mezzanine) floor only, will be permitted. The mezzanine floor will be considered as a full story.

Walls of outer courts and lot line courts shall be constructed the same as required for outside walls.

For elevator shafts see General Orders on Elevators.

For minimum size, etc., of courts and shafts see orders 5203-5204.

SECTION 5. EXITS.

Order 5710. Number, Location, Type. The number and location of exits shall be such that in case any exit or passageway is blocked at any point, some other exit will still be accessible, through public passageways, from every room or apart-

ment; also that the entrance to each room or apartment will be not more than 50 feet distant from an exit (measuring along public passageways) if in a non-fireproof building, or 75 feet in a fireproof building.

Note. This evidently requires at least two exits from every building (except as in order 5712) and also requires an exit at the end of every corridor.

At least one half of such exits, in buildings of more than one story, shall be stairways (orders 5117-5119). The remaining exits shall be either such stairways, or horizontal exits (order 5120); or fire escapes may be used as exits from floors which are not more than 40 feet above grade.

In three story buildings which accommodate not more than two families or 12 persons above the first floor, the stairways need not be enclosed, if an outside covered stairway or fire escape is provided. In all other buildings of three or more stories, the stairways shall be enclosed as in orders 5115-5116 and there shall be at least two stairways from the uppermost floor to grade.

In all buildings of more than two stories, in which the first story is used for business purposes, at least one stairway shall be enclosed in the first story with an unpiereed fireproof enclosure (order 5109) and such stairway shall not connect with the basement.

Every outside stairway shall be covered by a roof. If more than two families or 12 persons are accommodated above the first story, the stringers and other supporting members of outside stairs and platforms shall be of incombustible material; the treads and flooring, if of wood, shall be at least 1 $\frac{3}{8}$ inches thick. If more than four families or 24 persons are accommodated above the first story, the adjoining doors and windows shall be protected as in order 5121.

Note. Outside rear stairways have been found satisfactory on many apartment houses. They serve the purpose of a rear stairway and fire escape combined.

In high buildings one or more exterior enclosed stairways (order 5115) should be provided.

Order 5711. Aggregate Width. The aggregate width of exits shall be as provided in order 5404.

Note. Stairways and doors of minimum width will be

found sufficient to comply with this order except in large hotels.

Order 5712. Exceptions. One stairway only, and no other exit, will be required in a two or three story building which accommodates not more than two families or 12 persons above the first floor, provided;

(1) The first floor is of fireproof construction; and

(2) The stairway and stairhall are fireproof and are entirely separated from the basement and first story by unpierced fireproof floors and partitions, and are enclosed in the second story by a standard fireproof enclosure (order 5109); and

(3) Each apartment or floor has an outside balcony not opening from the stairhall.

The minimum width of stairways and doors which accommodate not more than 6 families or 30 persons, may be not less than 3 feet instead of the widths specified in orders 5117-5132, and such doors will not be required to swing outward.

For other exit door requirements see order 5132.

Order 5713. Passageways. Every public passageway leading from an exit shall be at least as wide as the required width of such exit. Every public passageway leading to an exit shall be at least 3 feet wide. The required width shall be kept clear and unobstructed at all times.

SECTION 6. LIGHTS.

Order 5714. In every building which accommodates more than 4 families or 24 persons, and in every building which accommodates transients, irrespective of their number, and in every hospital, asylum, or other place of detention, the public passageways and stairways and exit doors shall be illuminated from one hour after sunset to one hour before sunrise. This illumination shall include lights at all intersections of passageways, at all exit doors, and at the head and foot of every stairway. The lights at exit doors shall be red lights and shall be accompanied by a sign bearing the words "exit" or "out", in plain letters.

See also orders 5224-5225.

SECTION 7. SCUTTLE.

Order 5715. Every building more than one story in height which accommodates more than 6 families or 30 persons shall have a permanent means of access to the roof from the inside. The opening shall be not less than 20 x 30 inches and there shall be a permanent ladder or stairway leading thereto.

NOTE ON ELEVATORS AND ELEVATOR ENCLOSURES.

See General Orders on Elevators issued by the Industrial commission.

SECTION 8. ROOMS AND WINDOWS.

Order 5716. Size of Rooms. Every sleeping room shall be of sufficient size to afford at least 400 cubic feet of air space for each occupant over twelve years of age, and 200 cubic feet for each occupant under twelve years. No greater number of occupants than the number thus established, shall be permitted in any such room.

Order 5717. Basement Rooms. Every basement living or sleeping room shall be at least 8 feet high from floor to ceiling. The ceiling shall be at least 4 feet above the outside grade. The walls and floor shall be dampproof and waterproof.

Order 5718. Windows. The outside windows in every sleeping or living room shall have a total area of at least one-tenth of the floor area of the room. The top of at least one such window shall be not less than 7 feet above the floor, and the upper half of it shall be made so as to open the full width.

See also orders 5203-5204.

SECTION 9. BOILER AND FURNACE ROOMS.

Order 5719. All boiler and furnace rooms, including breaching, and all laundries and drying rooms, in all buildings accommodating transients and in hospitals, asylums and other places of detention, shall be enclosed with standard fireproof enclosures and fireproof floor and ceiling.

See also orders 5212-5223.

SECTION 10. VENTILATION.

Order 5720. Pure air shall be provided at the rate of 1800 cubic feet per hour per person: provided the air in every pub-

lie part of the building shall be changed at least twice each hour.

Note. In rooms having sufficient window space, the above standard of ventilation can be secured if the windows are opened at top and bottom and a board is placed at the bottom to prevent drafts. This holds true in winter as well as in summer.

SECTION 11. TOILET ROOMS.

Order 5721. Every apartment shall have a water closet in a bathroom or separate compartment; except that where there are apartments consisting of but one or two rooms, there shall be at least one water closet for every two such apartments.

Every building shall have at least one water closet for every 15 rooms or fraction thereof.

See also orders 5205-5211.

Note. Rooms with private water closets shall not be considered in counting either the number of rooms or the number of water closets.

SECTION 12. STANDPIPES AND FIRE EXTINGUISHERS.

Order 5722. For exterior standpipes see order 5135.

Standard interior standpipes (order 5136) shall be provided in every building which is more than two stories high and accommodates 20 or more transients, and in all hospitals, asylums and other places of detention. Not more than 75 feet of hose (order 5136) shall be attached to each standpipe at each floor level. The number and location of interior standpipes shall be such that the hose will reach at least two feet inside of each room.

In the above buildings where adequate water supply is not available, and in buildings accommodating less than 20 transients where interior standpipes are not provided, a standard fire extinguisher (order 5137) shall be placed on each floor at the head of each stairway and at each elevator or group of elevators.

SECTION 13. AUTOMATIC SPRINKLERS.

Order 5723. Where city water supply is available, an automatic sprinkler system (order 5138) shall be provided in the basement and sub-basements of all buildings of this classification, except apartment houses.

In addition to the sprinkler system, every room containing an ammonia machine or tank shall be provided with a 3-inch water pipe; the inner end of which shall be hung from the ceiling of the room and shall be perforated; and the outer end of which shall be located outside of the building with connection for the fire department, and shall also be connected with the city water supply.

Note. The purpose of the latter provision is to permit flooding the ammonia room in case of a leak; the ammonia fumes would then be largely absorbed by the water.

SECTION 14. FIRE ALARM.

Order 5724. In every building accommodating 20 or more transients there shall be a proper alarm or gongs which can be operated from any story and can be heard throughout the building. Every such alarm system shall be tested at least once every week.

SECTION 15. DIRECTIONS FOR ESCAPE.

Order 5725. In every room liable to be used by transients a notice shall be conspicuously posted giving complete and plain directions for reaching at least two exits.

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