

WISCONSIN STATE BUILDING CODE

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Industrial Commission of Wisconsin



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Building Code

for the

State of Wisconsin

Effective April 16, 1931

Reprinted 1934

The following orders have been amended since 1931 and are included in this Reprint:

Order 5300—effective June 25, 1931
Order 5305—effective July 17, 1931
Order 5314—effective Sept. 12, 1932
Order 5532—effective July 30, 1933
Order 5752—effective Sept. 12, 1932
Order 5307—effective March 14, 1934

The following order has been added since 1931:

Order 5410½—effective July 30, 1933

Issued by

Industrial Commission of Wisconsin

MADISON

STATE PUBLICATIONS COVERING LAWS RELATIVE TO BUILDINGS AND BUILDING WORK

Issued by the Industrial Commission

Building Code
 State Electrical Code
 Elevator Code
 Boiler Code
 Flammable Liquids Code
 Industrial Lighting Code
 General Orders on Existing Buildings
 General Orders on Safety in Building Construction
 General Orders on Fire Prevention
 General Orders on Sanitation
 General Orders on Safety
 Refrigerator Code
 General Orders on Spray Coating
 General Orders on Tunnel, Caisson and Trench Construction
 General Orders on Dusts, Fumes, Vapors and Gases.

State Board of Health

Plumbing Code
 Code for Rural School Privies
 Rules for Sanitary Care of Schools
 Construction and Operation of Slaughterhouses
 Sewage Systems for Farm Homes
 Wisconsin Waterworks Sewage and Refuse Disposal Code
 Wisconsin Public Comfort Station Code
 Chemical and Dry Closet Code
 Septic Toilet Code

Department of Public Instruction

Rural School Requirements for Special State Aid
 Fire Protection and Safety in Schools

Any of the above bulletins will be furnished or sent on request.

**CONSULT OR WRITE RESPECTIVE DEPARTMENTS AS FOL-
LWS:**

1. Building Construction, Safety, Sanitation, etc., Industrial Commission.
2. Schools, Assistance in Layout, Economy and Administration, Supervisor of Buildings, Department of Public Instruction.
3. Electrical Work, Industrial Lighting, etc., Industrial Commission.
4. Fire Prevention, Fire Protection, etc., Industrial Commission.
5. Heating, Ventilating, etc., Industrial Commission.
6. Plumbing, State Board of Health. (Plumbing Division).
7. Water Supply, Sewage Disposal, etc., State Board of Health. (Plumbing Division).
8. Industrial Waste, Sanitary Engineer, State Board of Health.
9. Asylums and Places of Detention, State Board of Control.
10. Food Industries, Special Sanitary Requirements, Dairy and Food Commission.

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INDUSTRIAL COMMISSION OF WISCONSIN

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BUILDING CODE

INTRODUCTION

The Building Code has been adopted by the Industrial Commission in discharge of its duties under Sections 101.01 to 101.28, inclusive, of the statutes of Wisconsin. It supplements the requirement of Section 101.06, to the effect that "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."

The orders contained in this code are binding alike upon every employer and every owner of a place of employment or a public building, upon builders, and upon architects, who prepare plans for the construction of places of employment or public buildings.

The terms "owner", "employer", "place of employment" and "public building" are herein used as defined in the statutes.

The term "owner" includes "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."

By "employer" is meant "every person, firm or corporation, agent, manager, representative or other person having control or custody of any employment, place of employment, or any employe."

By "place of employment" is meant "every place where, either temporarily or permanently, any industry, trade, or business is carried on, or where any person is directly or indirectly employed by another for direct or indirect gain or profit, but not including private domestic service or agricultural pursuits which do not involve the use of mechanical power."

The term "public building" is defined to 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 original Building Code, effective September 15, 1914, was prepared by the Industrial Commission with the advice and assistance of a Building Code Advisory Committee composed of the following named persons:

A. C. Eschweiler, Architect, Milwaukee.
 C. F. Ringer, former Inspector of Buildings, Milwaukee.
 Howland Russell, Architect, Milwaukee.
 C. A. Halbert, Civil Engineer, Madison.
 Sidney J. Williams, Deputy, Industrial Commission.

All of the original members of the Building Code Advisory Committee have since 1914 resigned their membership. The present membership of the Building Code Advisory Committee is as follows:

Mr. Peter Brust, Milwaukee, Chm., American Institute of Architects
 Mr. E. W. Burgess, Milwaukee, Wisconsin Manufacturers' Assn.
 Mr. Frank Daniel, Milwaukee, Wisconsin Inspection Bureau
 Mr. Wm. F. Eichfeld, Milwaukee, Milwaukee Association of Commerce
 Mr. J. H. Findorff, Madison, Master Builders' Assn. of Wisconsin
 Mr. Henry A. Foeller, Green Bay, Architect
 Mr. Leon M. Gurda, Milwaukee, City of Milwaukee
 Mr. Henry Keefe, Racine, Wisconsin Real Estate Dealers Assn.
 Mr. W. C. Muehlstein, Madison, Secretary, Industrial Commission
 Mr. Arthur Peabody, Madison, State Architect
 Mr. Herman Seide, Milwaukee, Wisconsin State Federation of Labor
 Mr. Charles S. Thurber, Milwaukee, Wisconsin St. Federation of Labor

During the past fifteen years the Industrial Commission, with the aid and advice of the Building Code Advisory Committee, has sought to develop the Building Code requirements in a manner to meet, in the most practical and

reasonable manner, the need for protective measures as applied to the many phases of design, construction, equipment and maintenance of public buildings and places of employment. So far as possible, the knowledge gained from experience in the enforcement of the Building Code, progress in construction methods and devices, and research data, has been incorporated in the code periodically. Since the original data was printed in 1914, revised Building Codes have been issued in 1915, 1918, 1920, 1921, 1925 and 1927. Some of the editions contained only minor changes, but the present issue, effective April 16, 1931, has been extensively revised and augmented. In every case, proposed amendments have been submitted to the public for criticism and suggestions at one or more public hearings before they were considered for adoption by the commission. Order 5300 was further amended, effective June 27, 1931, to meet advisory committee recommendations and standard practice.

ADMINISTRATION

The Building Code is enforced by the Industrial Commission in cooperation with municipal and other local officials, who are required by law to enforce all orders of the commission which are germane to their respective duties (Wisconsin Statutes, Section 101.28). With the Building 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, but this Building Code contains minimum standards and requirements which apply to cities and the state generally, and no local ordinance or code may be less stringent.

APPEAL

Any person who considers any part of the Building Code, or any official's interpretation of the code, to be unreasonable, may appeal to the commission to interpret, modify, or suspend the same. (Wisconsin Statutes, Sections 101.15 to 101.17).

Chapter 1

SCOPE OF BUILDING CODE

SECTION 1. APPLICATION OF CODE REQUIREMENTS.

Order 5000. New Buildings and Additions. This code shall apply to all new buildings, structures and additions thereto, except as in order 5003.

Order 5001. Alterations. This code shall apply to all alterations which affect the structural strength, fire hazard, exits, lighting or sanitary condition of any new or existing building or structure, except as in order 5003, and except sanitary appliances that are governed by the provisions of the State Plumbing Code issued by the State Board of Health. This does not include ordinary repairs necessary for the maintenance of any building or structure.

Except as in order 5003 this code shall apply to every new installation, and every repair exceeding 50 per cent, of any roof covering, toilet room, boiler, furnace, or stove, chimney or smoke pipe, motion picture machine or booth, fire escape, or any other complete part of a building or structure, fixture or device.

Order 5002. Change of Use. This code shall apply to all buildings and structures 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 2. EXEMPTION FROM CODE REQUIREMENTS.

Order 5003. This code does not apply to the following buildings:

- (1) Dwellings, and outbuildings in connection therewith, such as barns and private garages.
- (2) Apartment buildings used exclusively as the residence of not more than two families.

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

(4) Temporary buildings or sheds used exclusively for construction purposes, not exceeding two stories in height, and not used for living quarters.

SECTION 3. LOCAL REGULATIONS.

Order 5004. Local Regulations. This code shall not 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.

Chapter 2

ENFORCEMENT OF CODE

SECTION 1. APPROVAL OF PLANS AND SPECIFICATIONS.

Order 5010. Approval of Plans and Specifications. Complete plans and specifications for all buildings and structures under this code shall be submitted to the Industrial Commission for approval before letting contracts or commencing work, except that plans and specifications for factories, office and mercantile buildings which have floor or roof spans not greater than 30 feet, or which are not more than two stories in height and are not more than 5,000 square feet in area, need not be submitted for approval, but such buildings shall be built in accordance with the requirements of this code. All plans shall be submitted in duplicate.

The location of adjoining streets, alleys, and lot lines, and of other buildings on the same lot, shall be shown on the plans. All plans and specifications shall be signed by the architect, engineer or other chief designer.

This requirement shall apply to additions and alterations, as well as to new buildings, and shall also apply as far as possible to all cases where there is a change in occupancy or use of a building.

This requirement need not apply in cities where plans are examined, and building permits are issued, by a city building official in a manner approved by the Industrial Commission.

This requirement shall not apply to sanitary appliances, such as water supply and sewage disposal systems, chemical and septic toilets, and similar equipment, which shall be submitted for approval, and installed, in accordance with the regulations of the State Board of Health.

After being approved by the Industrial Commission, plans and specifications shall not be changed in any respect

which may affect the safety of the occupants, or which is covered by this code, except with the written consent of the Industrial Commission.

Note. The approval of a plan or specification by the Industrial Commission does not include the assumption of any part of the responsibility for the design.

Order 5011. Evidence of Approval. If plans for any building or structure are approved by the Industrial Commission, or by a city building official, as in order 5010, the architect or builder shall keep at the building either the plans which were approved, or a copy thereof, and shall mark on such plans, in ink, the person or department which gave the approval, and the date thereof.

SECTION 2. APPROVAL OF MATERIALS, METHODS AND DEVICES.

Order 5012. Approval of Materials, Methods and Devices. All materials, methods of construction and devices designed for use in the construction, alteration or equipment of buildings or structures under this code and not specifically mentioned in this code shall not be so used until approved in writing by the Industrial Commission, except sanitary appliances, which shall be approved in accordance with the provisions of the State Plumbing Code issued by the State Board of Health. The data, tests and other evidence necessary to prove the merits of such material, method of construction or device shall be determined by the Industrial Commission.

SECTION 3. RESPONSIBILITIES, PENALTIES AND APPEAL.

EXTRACT FROM THE WISCONSIN STATUTES

Responsibility of owner or employer.

101.06. Employer's duty to furnish safe employment and place. Every employer shall furnish employment which shall be safe for the employes therein and shall furnish a place of employment which shall be safe for employes therein and for frequenters thereof and shall furnish and use safety devices and safeguards, and shall adopt and use methods and processes reasonably adequate to render such employment and places of employment safe, and shall do every other thing reasonably necessary to protect the life,

health, safety, and welfare of such employes and frequenters. 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.

PENALTIES FOR VIOLATION OF CODE REQUIREMENTS.

101.28. **Penalty for violations.** If any employer, employe, owner, or other person shall violate any provisions of sections 101.01 to 101.13, inclusive, of the statutes, or shall do any act prohibited in sections 101.01 to 101.29, inclusive, or shall fail or refuse to perform any duty lawfully enjoined, within the time prescribed by the commission, for which no penalty has been specifically provided, or shall fail, neglect or refuse to obey any lawful order given or made by the commission, or any judgment, or decree made by any court in connection with the provisions of sections 101.01 to 101.29, inclusive, for each such violation, failure or refusal, such employer, employe, owner or other person shall forfeit and pay into the state treasury a sum not less than ten dollars nor more than one hundred dollars for each such offense. It shall be the duty of all officers of the state, the counties and municipalities, upon request of the industrial commission, to enforce in their respective departments, all lawful orders of the industrial commission, insofar as the same may be applicable and consistent with the general duties of such officers.

101.18. **Per diem unit of violations.** Every day during which any person, persons, corporation or any officer, agent or employe thereof, shall fail to observe and comply with any order of the commission or to perform any duty enjoined by sections 101.01 to 101.29, inclusive, shall constitute a separate and distinct violation of such order, or of said sections as the case may be.

APPEAL ON REASONABLENESS OF CODE REQUIREMENTS.

101.15. **Petition and hearing on reasonableness of orders.**

(1) Any employer or other person interested either because of ownership in or occupation of any property af-

ected by any such order, or otherwise, may petition for a hearing on the reasonableness of any order of the commission in the manner provided in sections 101.01 to 101.29, inclusive.

(2) Such petition for hearing shall be by verified petition filed with the commission, setting out specifically and in full detail the order upon which a hearing is desired and every reason why such order is unreasonable, and every issue to be considered by the commission on the hearing. The petitioner shall be deemed to have finally waived all objections to any irregularities and illegalities in the order upon which a hearing is sought other than those set forth in the petition. All hearings of the commission shall be open to the public.

(3) Upon receipt of such petition, if the issues raised in such petition have theretofore been adequately considered, the commission shall determine the same by confirming without hearing its previous determination, or if such hearing is necessary to determine the issues raised, the commission shall order a hearing thereon and consider and determine the matter or matters in question at such times as shall be prescribed. Notice of the time and place of such hearing shall be given to the petitioner and to such other persons as the commission may find directly interested in such decision.

(4) Upon such investigation, if it shall be found that the order complained of is unjust or unreasonable the commission shall substitute therefor such other order as shall be just and reasonable.

(5) Whenever at the time of the final determination upon such hearing it shall be found that further time is reasonably necessary for compliance with the order of the commission, the commission shall grant such time as may be reasonably necessary for such compliance.

Note. Blank forms for petition for modification of an order may be secured from the Industrial Commission.

Chapter 3

DEFINITIONS AND STANDARDS

SECTION 1. TYPE OF CONSTRUCTION.

Order 5100. Fireproof Construction. 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 resistive covering of low heat conductivity, of not less than 2 inches thickness of concrete, or equivalent thickness of other approved material, for columns and girders; and not less than 1½ inches thickness for other structural parts, except as in order 5319. 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 5315. The plastering shall not be applied to wood lath or wood furring strips.

The trimmings and finished floor may be of wood.

Partitions entirely contained within a private apartment may be non-fireproof provided the partitions enclosing such apartment are fireproof.

Accoustical materials shall not support combustion.

A wood roof with fire resistive 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.

Note. For requirements applying to outside windows see order 5201.

Order 5101. Mill Construction. A building is of mill construction if all walls are built of incombustible material, and if all wood girders and joists are at least 5½ inches thick. No wood girder or joist shall measure less than

63 square inches, and no wood posts shall measure less than 90 square inches, in sectional area, except that posts having a minimum dimension of 7½ inches 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 2⅝ inch lumber with groove and spline, or groove and tongue, at the joints; this shall be covered with felt or building paper, and with a separate finished floor not less than 13/16 inch thick.

The roof shall be at least 2½ inches thick and shall have a fire resistive roof covering (order 5107); 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.

Note. For requirements applying to outside windows and doors see order 5201.

Order 5102. Ordinary Construction. A building is of ordinary construction if all enclosing walls consist of incombustible material, and the roof has a fire resistive covering (order 5107), but other requirements for fireproof or mill construction are not complied with. No joist, rafter, or stud shall be less than 1⅝ inches thick. In buildings of more than one story, floor and roof joists shall be supported by incombustible walls or partitions, or by semi-fireproof partitions (order 5112) or by columns and girders. If a bearing partition is supported by a steel beam or girder, such beam or girder shall be covered with metal lath and plaster or other approved fireproofing.

Note. For requirements applying to outside windows and doors see order 5201.

Order 5103. Frame Construction. A building is of frame construction if structural parts and enclosing walls consist of wood. If such enclosing walls are veneered, en-

cased 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 2. BUILDING HEIGHT AND STORIES.

Order 5104. Height of Building. 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.

Order 5105. Basement: First Floor: Number of Stories. A basement is a story whose floorline is below grade at any entrance or exit and whose ceiling is not more than 5 feet above grade at any such entrance or exit. 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 3. MISCELLANEOUS DEFINITIONS.

Order 5106. Street: Alley: Court.

1. Street. A street is any public thoroughfare 30 feet or more in width.
2. Alley. An alley is any public thoroughfare less than 30 feet, but not less than 10 feet, in width.
3. Court. Any space less than 10 feet in width is a court.

Note. For required size of courts, see order 5205.

SECTION 4. ROOF COVERING.

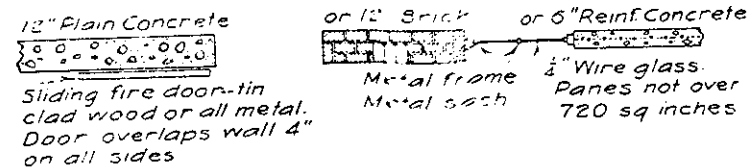
Order 5107. Fire Resistive Roof Covering. A roof covering is considered fire resistive if made of three or more thicknesses, or ply, of approved asphalt saturated asbestos felt, or three or more thicknesses, or ply, of approved asphalt or tar saturated rag-felt with gravel, or equal

surfacing, or if made of approved asphalt composition shingles, approved asbestos shingles, tin, sheet iron, clay tile, concrete tile, concrete or other approved incombustible material.

Note. Roof coverings having a fire resistance rating of properties equivalent to class "C" of the Underwriters' Laboratories classification are acceptable under this standard.

SECTION 5. 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



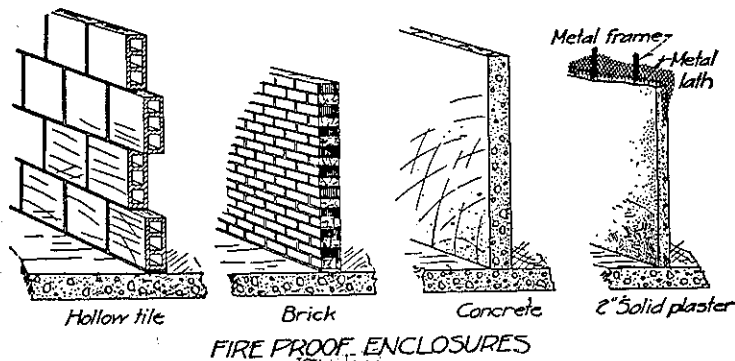
STANDARD FIRE WALLS

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 5202).

Order 5109. Standard Fireproof Enclosure or Partition. A standard fireproof enclosure or partition shall be made either of wired glass in metal frame, or solid plaster not less than 2 inches thick on metal lath and metal frame (all metal of lath and frame to be well covered), or of brick, concrete or tile of sufficient thickness to give rigidity. A standard fireproof enclosure or partition must rest on a masonry foundation or a fireproof floor, and must extend to a fireproof or semi-fireproof roof or ceiling. The wired glass in a fireproof enclosure or partition shall conform to

the requirements for 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.



Order 5110. Standard Fire Door. A standard fire door or standard fire shutter shall consist of metal throughout or shall consist of a solid wooden core fully encased in fire resistive metal, properly vented, and shall be of design approved by the Industrial Commission. The door frame shall be of metal throughout, or shall consist of solid wooden core encased in fire resistive metal. Wood frames in contact with masonry shall be encased to a line not less than one inch from the outer edge of the wood. Every standard fire door shall be self-closing, or shall close automatically in case of fire.

Note. Doors that are the equivalent of those listed by the Underwriters' Laboratories for various uses will be approved for such use by the Industrial Commission.

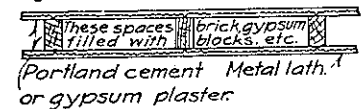
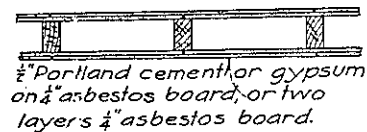
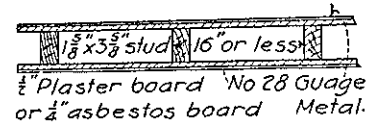
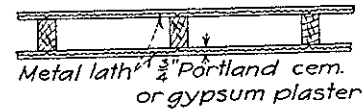
Fire insurance rating authorities generally give credit only for doors which bear the Underwriters' Laboratories label.

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

Note. Windows that are the equivalent of those listed by the Underwriters' Laboratories for various uses will be approved for such use by the Industrial Commission.

Fire insurance rating authorities generally give credit only for windows which bear the Underwriters' Laboratories label.

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



SEMI-FIREPROOF PARTITIONS

(1) Metal lath and at least 3/4 inch of Portland cement or gypsum plaster, or gauged plaster containing one-half part lime, one-half part (or more) Portland cement, and not over four parts sand; or

(2) Good quality plaster board at least 1/2 inch thick, covered with sheet metal; or

(3) 1/4 inch asbestos board, covered with at least 1/2 inch Portland cement or gypsum plaster, or with sheet metal; or two layers of 1/4 inch asbestos board breaking joints; or

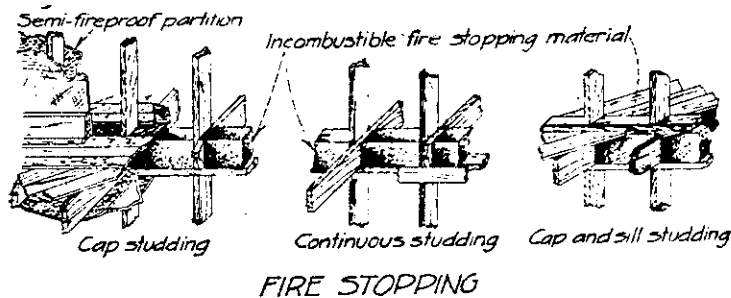
(4) The spaces between studding may be filled with approved incombustible material, the partition being plastered with Portland cement or gypsum plaster on metal lath; or

(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 with incombustible material extending the full height of the joists and the full thickness of the partition.

Every doorway in a semi-fireproof partition shall be protected with a standard fire door or with a self-closing wooden door at least 7/8 inch thick in its thinnest part. The glass in such partitions and doors shall be wire glass.

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); but gypsum plaster shall not be used for basement ceilings. The spaces between the joists shall be firestopped, at intervals not greater than 25 feet, with incombustible material extending the full height of the joists.



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

SECTION 6. EXITS.

Order 5115. Standard Exit. 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.

Note. For required exits see orders 5405, 5511, 5608 and 5709.

Every standard exit door shall swing outward or toward the natural means of egress (except as below and in orders 5405, 5709). It shall be level with the floor, and shall be so hung that, when open, it will not block any part of the required width of any other doorway, 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.

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.

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 5608, 5709). 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.

In every building which is used at night, a red exit light shall be placed over every emergency exit door and also over every exit door where other doors or openings may cause confusion.

Note. For exit light requirements see orders 5405, 5512 and 5711.

Order 5116. Stairway Exits.

1. **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.

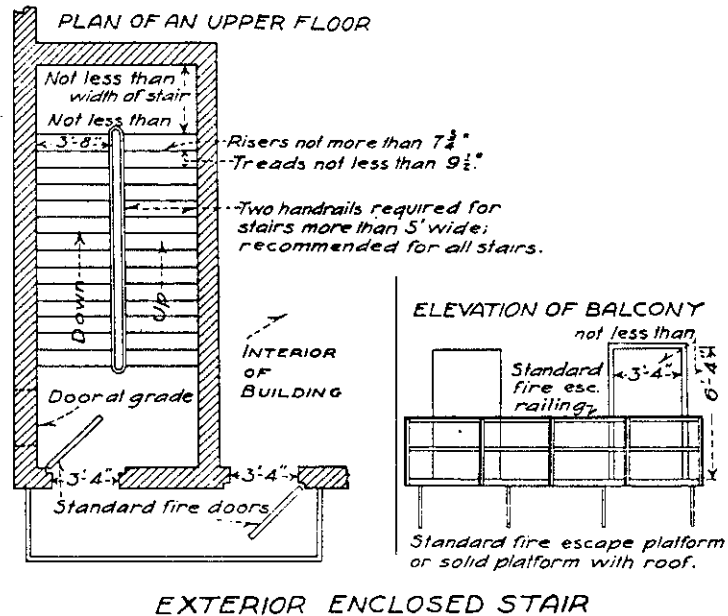
Note. If other stairways are provided in addition to those required by this code, such additional stairways need not conform to this order.

2. **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 which are required to be 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.

Note. For handrail requirements in theatres and assembly halls see order 5509.

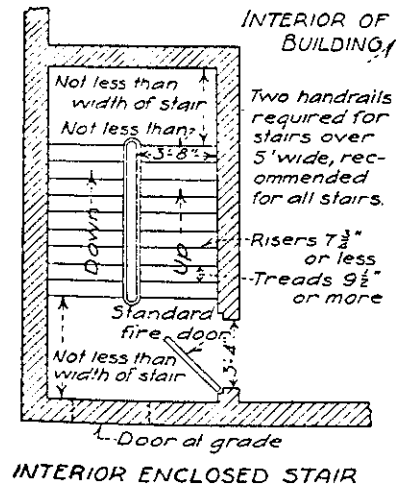
3. Risers and Treads. All stairways and steps used by the public or by more than 20 persons, shall have a uniform rise of not more than $7\frac{3}{4}$ inches and a uniform tread of not less than $9\frac{1}{2}$ inches, measuring from tread to tread, and from riser to riser; no winders shall be used; there 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.



The edges of all treads, and the edges of stairway landings shall be finished with a non-slippery surface.

Order 5117. Exterior Enclosed Stairway. (Smoke Proof 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 fire proof 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 5303-5313). The doors leading from the buildings to the balconies and from the balconies to the stairways shall be standard fire doors (order 5110), and all openings within 10 feet of any balcony shall be protected with standard fire windows (order 5111) 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.

Order 5118. Interior Enclosed Stairway. An interior enclosed stairway shall be completely enclosed with a stand-



ard 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 theaters and assembly halls, the door at the top of the stairway may be omitted.

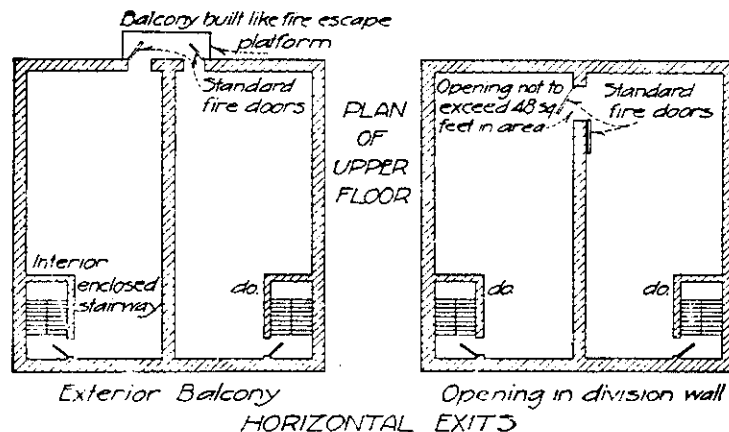
The enclosure shall include at each floor level a portion of such floor which shall be at least as wide as the stairway; and such enclosure shall also include

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.

Order 5119. Horizontal Exit. A horizontal exit shall be either:

(1) An opening through a fireproof wall or partition (order 5109) which separates 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; or

(2) An exterior balcony or bridge which connects two buildings or two divisions of a building. Every such balcony or bridge, including its railings, its supporting brackets or beams, and the exits thereto, shall be constructed the same as specified for fire escapes, (order 5120).



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 (order 5110) or standard fire windows (order 5111); 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.

If a horizontal exit takes the place of an "A" standard fire escape, it shall be at least 2 feet 4 inches wide; if it takes the place of a "B" standard fire escape, it shall be at least 3 feet 4 inches wide.

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.

Order 5120. Fire Escapes.

1. 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 a 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 (order 5110) or standard fire window (order 5111), except in the top story, and excepting two story buildings other than theaters and assembly halls.

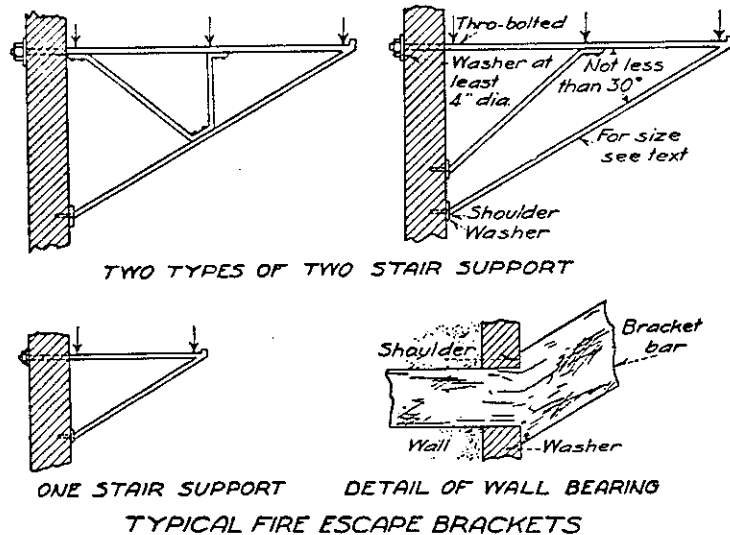
2. Exits to fire escapes. Every fire escape shall be accessible from a public passageway or shall be directly accessible from each occupied room. Exits to fire escapes shall be standard exit doors (order 5115) except that doors to "A" fire escapes may be not less than 2 feet 6 inches wide.

3. Design and fabrication. 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 of order 5318, 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.

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.

5. 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 $\frac{7}{8}$ 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.

6. Stairways. Each stairway of an "A" 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" fire escape shall be at least 3 feet 4 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.

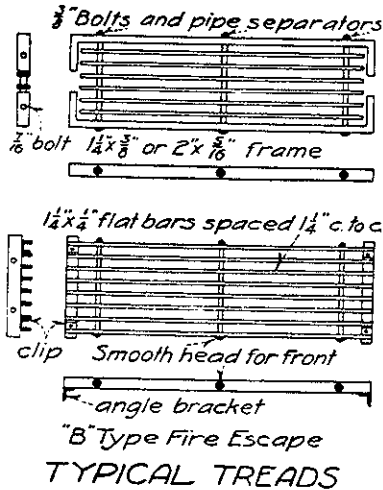
Note. The rise is the vertical distance from the extreme edge of any step to the corresponding extreme edge of the next step. The run is the horizontal distance between the same points.

Stairway stringers shall consist of either

- (1) A 5 inch channel or larger.
- (2) Two angles $2 \times 2 \times \frac{1}{4}$ inch or larger.
- (3) Two flat bars $2 \times \frac{3}{8}$ inch or larger.
- (4) One flat bar $6 \times \frac{1}{4}$ 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" tread shall consist of at least six square bars, or seven flat bars. A "B" tread shall consist of at least seven square bars, or eight flat bars. A "B" tread made of flat bars shall



have separators and bolt through the center. A "B" tread made of square bars shall be trussed.

Treads and platforms may be solid if covered by a roof.

7. Balanced Stairway. All "B" fire escapes, and all fire escapes on schools, theaters, and assembly halls, either shall reach to the ground or shall have a balanced stairway reaching to the ground. "A" fire escapes which are not on schools, theaters, or

assembly halls, may terminate in a platform at least 3 feet long, located not more than 10 feet above the ground.

Every balanced stairway shall conform to the requirements for other stairways except that the stringers and 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. Cable counterweights are not permitted.

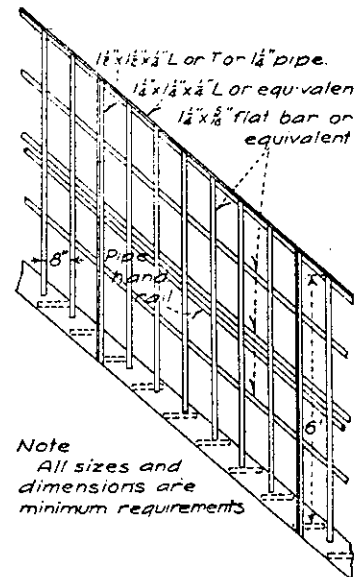
Treads for "A" balanced stairways may be made as follows: two 1 1/4 x 1 1/4 x 1/4 inch angles at front and back; two 1 1/4 x 1/4 inch bars between, lying flatwise; one inch space between bars. Treads for "B" balanced stairways may be made as follows: two 1 1/2 x 1 1/2 x 1/4 inch angles at front and back; two 1 1/2 x 1/4 inch bars between, lying flatwise; one inch space between bars. All such treads shall be strongly fastened together with cross bars not more than 14 inches apart.

8. Railings. Railings shall be provided on all open sides of platforms and stairways, and on both sides of balanced stairways. Either a railing or a handrail fastened to wall shall be provided on each side of all "B" fire escape stair-

ways. 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 1/2 x 1 1/2 x 1/4 inch angles or tees, or 1 1/4 inch pipe; top rail not less than 1 1/4 x 1 1/4 x 1/4 inch angle or equivalent; center rail not less than 1 1/4 x 5/16 flat bar or equivalent. All connections shall be such as to make

the railing stiff; two bolts (3/8 inch or larger) shall be used at the foot of each post wherever possible, or at least one 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 5/8 inch 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.



RAILING FOR HIGH BUILDINGS

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.

9. Ladder to Roof. Every fire escape which extends higher than the second floor shall be provided with a ladder leading from the upper platform to the roof, unless the fire escape stairway leads to the roof. The ladder shall have stringers not less than 1 1/4 inch pipe, or not less than 2 x 3/8

inch flat bars, at least 17 inches apart in the clear. The rungs shall be not less than $\frac{1}{2}$ inch square or $\frac{5}{8}$ inch round bars, 14 inches center to center. The stringers shall be securely tied together at intervals no greater than every fifth rung. 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.

10. Standpipe. A standpipe shall be attached to every fire escape on every building of more than three stories not having an automatic sprinkler system; except that buildings requiring more than one fire escape on any side thereof, shall be provided with at least one standpipe on each side.

Every standpipe shall extend from a point within 6 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 approved pipe, with $2\frac{1}{2}$ inch outlet hose valve at each floor and at roof, and a 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.

11. Other types of Fire Escapes. Sliding or chute fire escapes may be used, upon the approval of the Industrial Commission, in place of "A" or "B" fire escapes. Every sliding fire escape shall be provided with a ladder constructed as in order 5120-9, extending from 5 feet above grade, to 4 feet above the roof coping.

SECTION 7. FIRE PROTECTION EQUIPMENT.

Order 5121. Interior Standpipes. 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 $1\frac{1}{2}$ inches in diameter, and shall be kept connected, in good repair and working order, and ready for immediate use at all times.

Note. Unlined hose is recommended in buildings where such hose will not be used except in a rare emergency. Unlined hose is cheaper and does not deteriorate so rapidly. It is not suitable for continuous or frequent use.

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 theatres (orders 5533, 5535).

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

Order 5122. Fire Extinguishers. Where chemical fire extinguishers are required, they shall be of the $2\frac{1}{2}$ gallon soda-acid type, or other type approved by the Industrial Commission. Soda-acid extinguishers shall be discharged and recharged at least once a year; others shall be charged as required.

Note. The Industrial Commission will ordinarily approve any extinguisher which bears the Underwriters' label. For the type best adapted to any particular situation, consult the local Fire Chief, or Underwriters, or the Industrial Commission.

Order 5123. Automatic Sprinklers. Where an automatic sprinkler system is required throughout the building (orders 5412, 5535), 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 (order 5412), 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.

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 for interior standpipes in theaters. The number and location of sprink-

lers, size of pipes, 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 Wisconsin Inspection Bureau.

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 basements of schools, public halls and theatres, and in most mercantile and factory buildings.

Chapter 4

GENERAL REQUIREMENTS

SECTION 1. DESIGN OF BUILDINGS AND SUPERVISION OF CONSTRUCTION.

Order 5200. Design and Supervision. Every building, addition to a building, or structural alteration, shall be designed by a competent architect, engineer, or other designer, in accordance with the provisions of 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. No material change from the original plans and specifications shall be made except with the knowledge and consent of the designer and as provided in order 5010 of this code.

No owner shall construct or alter any building, or portion of a building, or permit any building to be constructed or altered, except in accordance with the provisions of this section.

Note. By the terms "architect" and "engineer" above are meant "registered architect" and "registered engineer."

See Section 101.31, Chapter 486, Laws of 1931, for statute requirements covering the practice of architecture and engineering.

SECTION 2. HEIGHT OF BUILDINGS AND CLASS OF CONSTRUCTION.

Order 5201. Height and Class of Construction. In fire-proof buildings exceeding 160 feet in height, all stairway and corridor windows and doors shall be approved fire windows and approved 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. See Chapter 343.461 of the Wisconsin Statutes for statute law regulating height of buildings throughout the state of Wisconsin.

In every building more than four stories in height, all doors, windows and other openings in outside walls shall be protected with standard fire doors (order 5110), standard fire shutters (order 5110), or standard fire windows (order 5111), unless such openings are on streets, alleys or approved courts (order 5205), are not nearer to the lot line between premises than the minimum required width of the court, and are not nearer to other buildings on the same lot or premises than two times the minimum court width.

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.

Buildings of frame construction shall not be higher than 40 feet above the grade.

Roof appendages, such as dormer windows, domes, towers, tanks (other than sprinkler 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, except sprinkler tanks, on the roof of a building of mill construction shall exceed a height of 110 feet above the grade.

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

No appendage, except sprinkler tanks, 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.

A spire which does not exceed in total area 20 per cent of the main roof will be excepted from the above limitations of height provided the following requirements are met with:

(1) The spire shall be supported by masonry foundations and walls designed to support it independent of the rest of the building.

(2) The masonry wall of the spire shall extend above the adjoining roof of the buildings.

(3) The spire shall be protected against lightning.

Penthouses containing elevator machinery shall be constructed as required by the Elevator Code issued by the Industrial Commission.

SECTION 3. LIMITATION OF FLOOR AREAS.

Order 5202. Limitation of Floor Areas. 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 frame buildings, and in buildings of ordinary and mill construction, equipped with an approved automatic sprinkler system, by 66⅔ per cent. In buildings of fireproof construction, equipped with an approved automatic sprinkler system there shall be no limit in floor area.

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 above limits of area for two-story buildings shall also apply to one-story buildings within the corporate limits of any city or village, unless both the building and its contents are practically incombustible.

Where the floor areas in a building are such that a dividing wall is required such wall shall be a standard fire wall (order 5108).

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 street or alley or upon a court (order 5204) 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 5253.

EXTRACT FROM GENERAL ORDERS ON SAFETY

Order 56. Window Cleaners. In all public buildings and places of employment, every window above the first story, or where the top of the window is more than 20 feet from the ground, except windows which are cleaned from within, must be provided with an efficient safety device to protect the window cleaner. Such safety device must consist of:

(a) A safety belt must be provided for each window cleaner, which belt must be fastened at each end to a permanent attachment which must be bolted through the window frame and be secured by a nut and washer on the inside; or

(b) A substantial, movable platform which is projected through the window for the window cleaner to stand upon and which is provided with a substantial railing; or

(c) Other equally efficient device.

Order 5204. Definitions of 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.

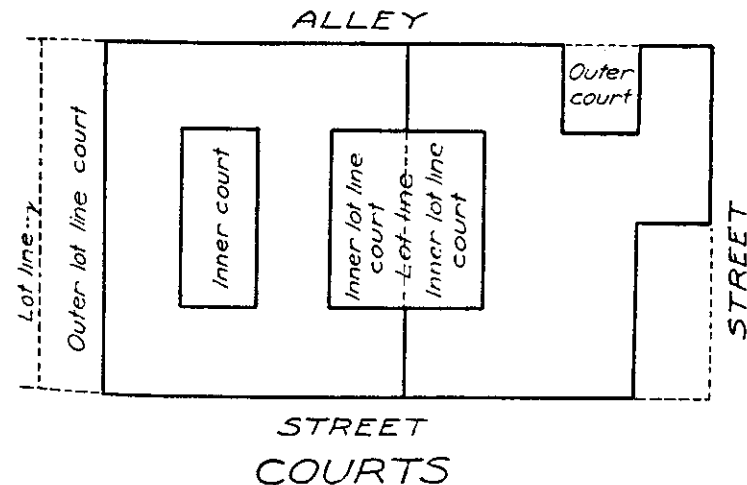
By outer lot line court is meant a court with one side on a lot line and opening to a street or open space not less than 15 feet wide.

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.

Order 5205. Size of Courts. 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 and 40 feet or less in length. For each additional story in height, the width of such court shall be increased one foot; and for each additional 15 feet or fraction thereof in length, the width of such court shall be further increased one foot.

No outer court between wings or parts of the same building, or between different buildings on the same lot, shall be less than 6 feet wide for a court two stories or less in height and 40 feet or less in length. For each additional story in height, the width of such court shall be increased one foot; and for each additional 10 feet or fraction thereof in length, the width of such court shall be further increased one foot.

In the case of an outer court or an outer lot line court which is open at each end to a street or open space not less than 15 feet wide, the above lengths may be doubled.



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, except that an inner lot line court one story high shall be not less than 4 feet wide and not less than 40 square feet in area; and for every additional story every such inner lot line court shall be increased by at least one lineal foot in its length and one lineal foot in its width.

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 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.

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.

Order 5206. Ventilation of Courts. 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 which is required under order 5203 and which is more than one story in height 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.

SECTION 5. FIRE PROTECTION WITHIN BUILDINGS.

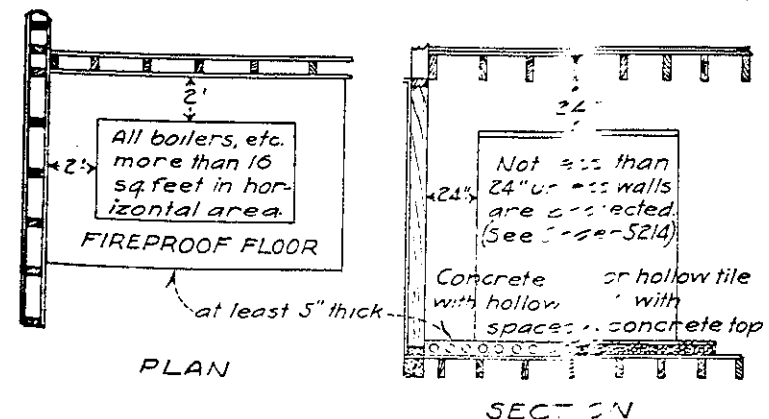
Order 5210. Isolation of Hazards in Buildings.

1. High Pressure Boilers. Every boiler operating with more than 15 pounds steam pressure per square inch shall, together with breaching and fuel room, be completely enclosed with 8 inch masonry walls, with standard fire door protection for all interior openings, fireproof floor and ceiling, or be located in a separate building, or be separated from the rest of the building by a standard fire wall (order 5108).

2. Other Hazards in Buildings. Boilers operating at less than 15 pounds per square inch steam pressure, furnaces, fuel rooms, laundry drying rooms, laundries, storage vaults for lumber, paints, oils and similar combustibles, and similar hazards in a building shall be isolated from the rest of the building by a standard fireproof enclosure (order 5109), or better, except as otherwise provided under occupancy requirements in this code.

Note. See the State Plumbing Code issued by the State Board of Health for blow-off arrangement.

Order 5211. 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 coal, wood, or oil 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 fireproof 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; the 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. When a range or a heater rests on a solid layer of brick or concrete, it has been found that after several months the heat strikes through to the wood below. Many fires have been caused in this way.

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 coal, wood, or oil 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 designated to heat, is considered a "stove".

Gas stoves shall be protected as above specified, except that

(1) a three inch solid fireproof floor layer, projecting at least 6 inches on all sides, shall be sufficient protection if the stove has a false bottom at least 3 inches above such fireproof floor; and

(2) if the stove is less than 16 square feet in horizontal area and has a false bottom at least 5 inches above the floor, no fireproof floor shall be required.

Order 5212. 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.

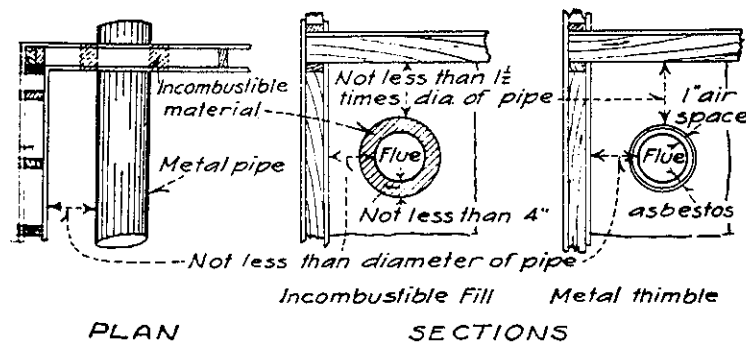
The above distances may be reduced one-half in the case of stoves and ranges less than 16 square feet in area, and also in the case of gas ranges of greater area if proper insulation is incorporated in the back of the range.

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.

Order 5213. Smoke Pipes. No smoke pipe shall pass through any floor, outside window or door, nor through any combustible roof or combustible outside wall, nor through any closet, attic or similarly concealed space.

Every smoke pipe passing through a non-fireproof partition shall be encased with incombustible material at least $\frac{1}{4}$ 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 the 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.



METAL SMOKEPIPE INSULATION

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; 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.

Order 5214. Steam Pipes. 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.

Order 5215. Hot Air Pipes. Every hot air pipe contained in or passing through a combustible partition or floor shall be placed inside another pipe arranged to maintain a $\frac{1}{4}$ inch air space between the two pipes on all sides; or the pipe shall be securely covered with $\frac{1}{4}$ inch 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 sheath over the pipe is recommended.

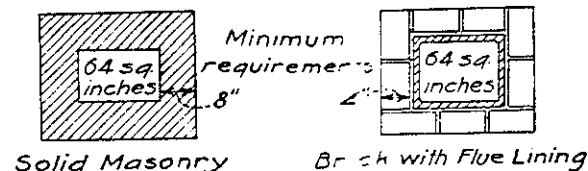
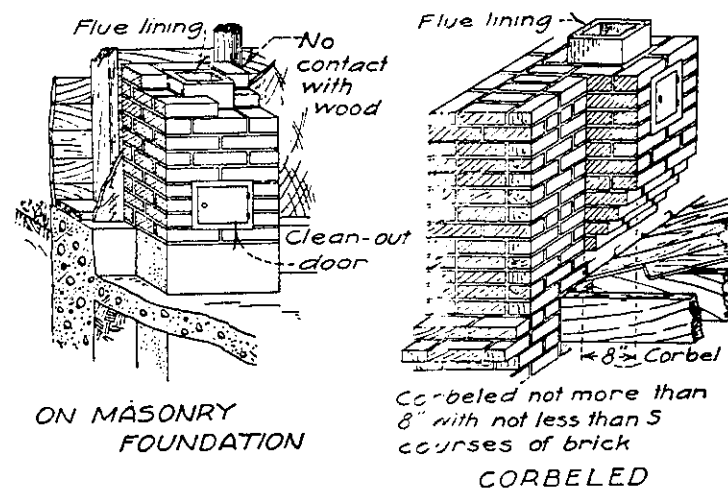
Order 5216. Registers. All register boxes shall be of metal, and shall either be double or be covered with asbestos not less than $\frac{1}{8}$ inch thick.

Order 5217. Hot Air and Ventilating Flues. Every vertical hot air and fresh air flue, or group of flues, in buildings included in the theater, school and hotel classifications (Chapter 7, 8 and 9) shall be enclosed with, or constructed of, incombustible material at least 2 inches thick, lined with metal or smoothly finished on the inside; except that frame buildings not more than two stories in height may have

metal flues if protected as in order 5215. Horizontal ducts for hot air and fresh air, and all vent flues shall be constructed as in order 5215, or better.

Order 5218. Chimneys.

1. Construction and Foundations of Chimneys. Every chimney shall be built of brick or other approved fire resistant 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 case the corbeling shall consist of at least five courses of brick. Lime-cement or cement mortar shall be used in the laying of chimney masonry above the roof line.



CHIMNEYS

2. **Minimum Thickness, Height and Flue Requirements for Chimneys.** Every masonry chimney shall have walls at least 8 inches in solid thickness, except that in a chimney with flue not larger than 260 square inches where a fire clay or other approved flue lining is used for the full height of the chimney the walls shall be not less than 4 inches in solid thickness. Every chimney shall be designed throughout (the above minimum thicknesses being increased where necessary) in accordance with the requirements of the structural design of buildings and with the best engineering practice in chimney construction.

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. The top of every chimney having a flue larger than 260 square inches shall be at least 8 feet above the roof, or at least 3 feet above the ridge if the roof is pitched. No smoke flue shall have a cross sectional area less than 64 square inches, except that flue linings 7 inches by 7 inches inside, or 8 inches in diameter inside, may be used.

3. **Clean-Out Door.** Every chimney shall be provided with a cleaning-out door at its base.

4. **Vents from Gas Stoves.** Vent pipes from gas stoves and heaters shall be as required for smoke pipes and shall be not less than 4 inches inside diameter.

5. **Metallic Smoke Stacks.** No metallic smoke stack shall pass through any non-fire resistive floor, ceiling, or roof, unless encased or lined with brick or other fire resistive material of the same character and thickness as prescribed for masonry chimneys; or in place thereof, where such metallic chimney passes through the roof only, the chimney shall be not less than 12 inches from all combustible construction.

6. **Piercing of Chimney Walls Prohibited.** The walls of chimneys and smoke stacks shall not be pierced at any point except to permit of the entrance of the smoke pipe or breeching from the combustion chamber of a furnace, boiler or similar heating unit.

7. **Wind Pressure.** Every chimney shall be designed to withstand the following wind pressure in pounds per square foot over the diametrical area:

Square chimneys -----	30
Polygonal chimneys -----	25
Round chimneys -----	20

Order 5219. Gas and Oil Lamps: Gas Service. Oil lamps shall not be used when gas or electricity is available, except in private apartments.

Gas and oil lamps shall be placed at least 6 feet above the floor level, at least 6 inches from any combustible partition or wall, and at least 2 feet (measured from top of flame) below any combustible ceiling unless properly protected by a metal shield with at least 2 inches of air space above. Swinging brackets shall be provided with a guard or stop so that the light cannot come nearer to the partition or wall than one foot. 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.

Note. For requirements applying to various occupancies see orders 5410, 5512, 5530 and 5711.

Order 5220. Electrical Work. All electrical work shall conform to the Wisconsin State Electrical Code, comprising General Orders 1000-1499, inclusive, of the Industrial Commission.

Note. For special requirements applying to motion picture booths see order 5546.

SECTION 6. EXITS.

Order 5221. Location and Maintenance of Exits. Every exit mentioned in orders 5115-5120 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 in good repair and unobstructed at all times.

SECTION 7. GENERAL SANITATION REQUIREMENTS.

Note. These orders are enforced jointly by the Industrial Commission and the State Board of Health.

For the number of fixtures required in buildings of various classes see orders 5532, 5616, 5714, 2203.

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

Order 5250. Toilet Rooms Required. Every place of employment and public building shall have adequate toilet rooms, completely enclosed, and so arranged as to insure privacy; except that where no dust prevails in foundries, rolling mills, blast furnaces, tanneries, and such other similar buildings as are specified by the Industrial Commission, partitions enclosing toilet rooms shall be at least seven feet high but need not be carried to the ceiling nor enclosed at the top, provided such ceiling is at least fifteen feet high, and provided such toilets are located in rooms which females are not allowed to enter.

Exception. The above exception will be permitted even though the ceiling is lower than 15 feet, if local ventilation is provided in a manner approved by the Industrial Commission and the State Board of Health.

Order 5251. Toilet Rooms for the Two Sexes. Where the two sexes are accommodated, separate toilet rooms shall be provided except

(1) In apartment houses;

(2) If approved in writing by the Industrial Commission or the State Board of Health, or their authorized agents, in buildings accommodating not more than five persons of both sexes, provided the door of such toilet room is kept locked and the key is kept in a place accessible to all such persons. But whenever the number of such persons shall exceed five, separate toilet rooms shall be provided.

Entrances to toilet rooms for the two sexes shall be properly separated, by screens or otherwise, and shall, wherever possible, be at least twenty feet apart.

Order 5252. Sex Designated. Wherever women are employed or accommodated, each toilet room shall be distinctly

marked with regard to the sex which uses it, and no person shall be allowed to use a toilet room assigned to the other sex, except as provided in order 5251. The door or room labels shall be the words MEN, or WOMEN, respectively, in letters not less than 1 inch in height.

Order 5253. Location, Light, Ventilation. Every toilet or bathroom shall be so located as to open to outside light and air, by windows and skylights opening directly upon a street, alley or court, except as provided in order 5254.

The glass area for a toilet room containing one closet or urinal shall be at least 4 square feet, with 2 square feet additional for each additional closet or urinal.

No toilet room shall have a movable window or ventilator opening on any elevator shaft, or on any court which contains windows of sleeping or living rooms above.

Every toilet room having more than one fixture (closets and urinals) shall be ventilated in accordance with the provisions of order 5848 of the Heating and Ventilation Code issued by the Industrial Commission, except that this requirement shall not apply to chemical or septic toilets which are installed in accordance with the provisions of the Chemical Toilet Code or the Septic Toilet Code issued by the State Board of Health.

Note. The size of gravity vent ducts, if surmounted with effective siphon type hoods, may be determined as follows:

$$A \times 2 = \text{net cross sectional area of vent duct in square feet.}$$

300

Where A = floor area in the toilet room in square feet.

The following are minimum vents as calculated for toilet rooms of average size:

<i>Number of fixtures</i>	<i>Diameter round pipe duct</i>
One or two -----	6 inches
Three or four -----	8 inches
Five or six -----	9 inches
Seven -----	10 inches
Eight to ten -----	12 inches

Order 5254. Location Without Outside Windows: When Permitted. If a location with outside windows is impracticable, a different location will be permitted, as follows:

(1) For toilets installed and used only in connection with a private room or apartment, if equipped with approved vents in accordance with the provisions of the Heating and Ventilation Code issued by the Industrial Commission.

(2) For a toilet in a new building, used by more than three persons, only with the written approval of the Industrial Commission or the State Board of Health, or their authorized agents.

(3) For a new toilet in an existing building, used by more than three persons, only with the written approval of the Industrial Commission or the State Board of Health, or their authorized agents.

Approval of interior location for toilet rooms shall be granted only where a location with outside windows is not reasonably possible.

Note. For minimum size of gravity vent ducts from toilet rooms see note under order 5253.

Order 5255. Artificial Light. Every toilet room, except toilets installed and used only in connection with private rooms or apartments, 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, especially the toilet compartments, are easily visible.

Order 5256. Size. 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.

Order 5257. Floor. The floor and base of every toilet room shall be constructed of material (other than wood) which does not readily absorb moisture and which can be easily cleaned; except that wood floors may be used.

(1) In private apartments;

(2) If approved in writing, by the Industrial Commission or the State Board of Health, or their authorized agents, in existing buildings where there is an existing wood floor in good condition and where such

toilet will be used by not more than five persons, provided further that such room must have an outside window or skylight.

Note. To make a concrete floor non-absorbent, the concrete must be a dense, rich mix, finished smooth and should be kept painted.

Order 5258. Walls and Ceilings. The walls and ceilings of every toilet room shall be completely covered with smooth plaster, glazed brick or tile, galvanized or enameled metal, or other smooth, non-absorbent material. Wood may be used only if it is smooth and well covered with two coats of body paint and one coat of enamel paint or spar varnish. But wood shall not be used for partitions between toilet rooms, nor for partitions which separate a toilet room from any room used by the opposite sex. All such partitions shall be made soundproof.

Note. The above is not intended to prohibit the use of ordinary stud partitions between rooms if partitions are lathed and plastered on both sides.

The interior surface of walls and partitions shall be of light color to improve illumination and facilitate cleaning.

Order 5259. Enclosure of Fixtures. The fixtures (closets and urinals) in every toilet room shall be arranged to secure privacy in use. Water closets shall be enclosed with partitions. Urinals shall be placed against walls and arranged individually; except that in the case of trough urinals the stalls shall be not more than 30 inches, nor less than 24 inches, in width, and shall be equipped with division shields not less than 8 inches in depth. Individual floor type urinals shall be placed not less than 24 inches center to center, and in no case less than 2 inches apart to permit of proper waterproof fill or seal between fixtures.

Exception. The above requirements need not apply to toilet rooms accommodating only a single closet or urinal.

A space of 6 to 12 inches shall be left between the floor and the bottom of each partition. The top of the partition shall be from 5½ to 6 feet above the floor. Doors with the top 5½ to 6 feet above the floor, and the bottom 6 to 12 inches above the floor, shall be provided for all water-closet compartments. All partitions and doors shall be of material and finish required for walls and ceilings under order 5258.

The water-closet compartments in toilet rooms shall be not less than 30 inches in width, and shall be not less than 54 inches in depth with a clearance of not less than 24 inches between the fixture and the compartment door when closed. Compartment doors which are hung to swing inward shall clear the fixture not less than 2 inches.

Note. Section 146.085 of the Wisconsin Statutes provides that not more than fifty per cent of the toilet compartments in any public toilet may be kept locked, such as pay toilets.

Order 5260. Fixtures. Only individual water-closets of porcelain or vitreous chinaware shall be used. Water-closet seats shall be of wood or other non-heat-absorbing material, and shall be finished with varnish or other substance so as to be impervious to water.

Urinals shall be made of material impervious to moisture, and of such design, materials, and construction that they may be properly flushed and kept in a sanitary condition.

In all new installations in schools, theatres, hotels, office buildings, mercantile buildings, libraries and museums, or similar public buildings, only individual urinals shall be used. Such individual urinals shall be of porcelain or vitreous china, set into the floor, the floor graded toward the urinal, and shall be equipped with an effective automatic tank or valve or satisfactory foot operating flushing device.

Note. See the State Plumbing Code, Sections 51-54, for further details of fixture requirements, also for type of frost-proof closets permitted.

Order 5261. Protection from Frost. All water-closets and urinals and the pipes connecting therewith shall be properly protected against frost, either by a suitable insulating covering, or by providing and operating a suitable heating apparatus, or in some other approved manner; so that such water-closets and urinals will be in proper condition for use at all times.

Note. Toilets should be adequately heated in cold weather. Heating equipment should be arranged to permit cleaning of floors and walls.

Order 5262. Disposal of Sewage. Each water-closet and urinal, and each lavatory or slop sink, located in a toilet room shall be connected with a sewer system, where a sewer system is available. In locations where a sewer system is not available, or cannot be made available, the disposal of human waste may be accomplished as follows:

(1) Sewage treatment tank and disposal system.

Note. For detailed requirements on such systems see State Plumbing Code.

(2) Where the local conditions make it impractical to install such system, outdoor toilets, as described in order 5263, or other facilities, such as chemical or septic toilets installed in accordance with the provisions of the Chemical Toilet Code or the Septic Toilet Code issued by the State Board of Health, may be used; provided that in the case of places of employment for more than ten persons, schools larger than two rooms, and apartment houses, water flush toilets as herein described shall be provided, unless outdoor toilets or other facilities are permitted in writing by the Industrial Commission or the State Board of Health. In every case where chemical or septic toilets are installed, the approval of plans and specifications therefor by the State Board of Health shall be secured before work is started.

Order 5263. Outdoor Toilets. Outdoor toilets shall comply with orders 5250 to 5259, inclusive, and in addition:

(1) No privy, with or without a leaching pit or other container, shall be erected or maintained within 50 feet of any well, 10 feet of the line of any street or other public thoroughfare, 5 feet of the property line between premises or 25 feet of the door or window of any building.

(2) Located on ground that is well drained, and where there is no possibility of contaminating any drinking water supply.

(3) Provided with suitable approach, such as concrete, gravel or cinder walk.

(4) The foundations shall be of concrete or other masonry.

(5) The vault shall extend at least 6 inches above ground, be as dark as possible, and be proof against entrance by flies, rats, or other vermin. The upper portion shall be of concrete, or of brick or stone laid in

cement mortar. If in poorly drained soil, the entire vault shall be of concrete, or brick, or stone, laid in cement mortar.

(6) All windows, ventilators and other openings shall be screened to prevent the entrance of flies, and all doors shall be self-closing. A separate ventilator shall be provided for the vault and shall extend from the vault to not less than one foot above the roof and be provided with an effective ventilating hood.

(7) The entire installation shall be kept clean and sanitary. Milk of lime (freshly slaked lime) or other equally effective disinfectant shall be used in the vault and in the urinal trough in sufficient quantities, and at frequent intervals. The floors, seats and urinals shall be scrubbed as often as necessary. The vault shall be cleaned out at proper intervals.

Note. See the Wisconsin Code for Rural School Privies issued by the State Board of Health.

Order 5264. Maintenance and Housekeeping.

1. Maintenance of Toilets. Every toilet room, and every part thereof, including walls, floor, ceiling and fixtures therein, shall be kept clean, efficient, and in good repair.

In every toilet room, sufficient toilet paper made of material which will not interfere with the operation of the system, or obstruct the fixtures, shall be provided.

Indecent or suggestive marks, pictures, or words are forbidden in toilet rooms, and such defacement when found shall be at once removed.

2. Service Closet. Where practical, a service closet conforming with requirements for construction of toilet rooms shall be provided and supplied with mop, broom, bucket, soap, toilet paper, and toweling necessary for sanitary upkeep of toilet rooms.

Chapter 5

STRUCTURAL REQUIREMENTS

SECTION 1. DESIGN LOADS.

Order 5300. Floor, Roof and Sidewalk Loads. All buildings and structures, and parts thereof, shall be designed and constructed to support the following minimum superimposed live loads uniformly distributed in pounds per square foot of horizontal area, in addition to the dead load:

Theaters, and assembly halls with fixed seats	
Auditorium, sloping or stepped floor-----	50
Auditorium, level floor-----	70
Lobbies, corridors and passageways-----	70
Stairways -----	80
Assembly halls without fixed seats	
Auditorium (hall) -----	100
Lobbies, corridors and passageways-----	70
Stairways -----	80
School, library, museum classification	
Instruction rooms, study rooms, reading rooms, exhibition rooms, display rooms, laboratories -----	50
Library book stacks -----	100
Lobbies, corridors and passageways-----	60
Stairways -----	80
Apartment, hotel, place of detention classification	
Living rooms, sleeping rooms-----	40
Lobbies, corridors, passageways, offices and similar areas -----	60
Stairways -----	80
Dining rooms (if suitable for dancing) -----	100
Office buildings	
Offices, throughout -----	50
Commercial -----	100
Stairways -----	80

Mercantile establishments	
All floor areas and stairways.....	100
Reduced loading will be permitted upon submission of evidence of actual load by competent designers or engineers.	
Workshops	
All floor areas and stairways.....	100
Reduced loading will be permitted upon submission of evidence of actual load by competent designers or engineers.	
Grandstands	
Seat areas, passageways, stairways and all other crowded areas.....	80
Stages, in theaters and assembly halls.....	150
Roofs	30
Sidewalks	150

The above live load requirements shall be considered only as a minimum. In every case where the loading is greater than this minimum, the design of a building or structure, or part thereof, shall be for the actual load and loading conditions.

In the design of girders in fireproof buildings, the proportion of live load transmitted to girders supporting offices (except storage area), places of abode and assembly areas shall be not less than the following:

If supporting 400 square feet, or more, of floor area	60 percent
If supporting less than 400 square feet, but not less than 200 square feet, of floor area ..	80 percent
If supporting not more than 200 square feet of floor area.....	100 percent

In the design of girders in buildings of ordinary or mill construction, the proportion of live load transmitted to girders supporting offices (except storage areas), places of abode and assembly areas shall be not less than the following:

If supporting 400 square feet, or more, of floor area	80 percent
If supporting less than 400 square feet of floor area	100 percent

In factory, mercantile, storage and similar buildings of fireproof construction, the proportion of live load transmitted to walls, columns, piers and other vertical supports shall be as follows:

Roof	100 percent
Top floor	90 percent
Next floor below top floor.....	85 percent
Second and succeeding floors below top floor	80 percent

In buildings of fireproof construction, other than factory, mercantile and storage buildings, the proportion of live load transmitted to the walls, columns, piers and other vertical supports shall be as follows:

Roof	100 percent
Top floor	80 percent
Next floor below top floor	70 percent
Second floor below top floor	60 percent
Third floor below top floor	50 percent
Fourth floor below top floor	40 percent
Succeeding floors below the top floor, except the first floor	40 percent
First floor	80 percent

In factory, mercantile, storage and similar buildings of ordinary or mill construction, the proportion of live load transmitted to walls, columns, piers and other vertical supports shall be as follows:

Roof	100 percent
Top floor	100 percent
Next floor below top floor	90 percent
Second and succeeding floors below top floor	80 percent

In buildings of ordinary or mill construction, other than factory, mercantile and storage buildings, the proportion of live load transferred to walls, columns, piers and other vertical supports shall be as follows:

Roof	100 percent
Top floor	90 percent
Next floor below top floor	80 percent
Second and succeeding floors below top floor	70 percent

The proportion of total live load, computed in accordance with the above requirements, which shall be considered as transmitted to the foundations shall be as follows:

Where the total dead load is three, or more, times the total live load	50 percent
Where the total dead load is from two to three times the total live load	75 percent
Where the total dead load is less than two times the total live load	100 percent

Order 5201. Wind Pressure. Every building shall be designed to resist a horizontal wind pressure of 20 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.

Note. For wind pressure on chimneys see order 5218.

SECTION 2. 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:

$$L = \frac{2WH}{S + 1/10} \text{ for steam hammer}$$

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

in which formula

W = weight of hammer in pounds.

L = safe load 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 3. MASONRY CONSTRUCTION.

Order 5303. General Requirement. The requirements of orders 5303 to 5313, inclusive, herein shall apply to the construction of all masonry footings, foundations, walls, piers and similar work under this code.

Order 5304. Natural Building Stone.

1. Rubble Masonry. The stresses in rubble stone masonry, due to all dead and live loads, shall not exceed 100 pounds per square inch where lime mortar is used, or 140 pounds per square inch when approved cement mortar is used.

2. Ashlar Masonry. The stresses in ashlar or carefully coursed masonry, due to all dead and live loads shall not exceed the following at any point:

With Lime Mortar		With Lime-Cement Mortar	With Cement Mortar
Granite	275	640	800
Limestone	170	400	500
Marble	170	400	500
Sandstone	100	320	400

In every case where the ultimate crushing strength of a stone is less than 5000 pounds per square inch, the above unit stresses shall be reduced to not more than 4 per cent of the crushing strength when used with lime mortar, or not more than 5 per cent of the crushing strength where used with lime-cement or cement mortar.

3. Weather Resistance of Stone. All natural building stone to be used in masonry exposed to the weather or frost action shall be such that the strength and structure of the stone will not be affected by the weathering or frost action.

Note. Where the weather resistance of a stone is questioned this will require freezing and thawing tests as prescribed under the specification of the American Society for Testing Materials.

Order 5305. Artificial Solid Building Units.

1. Definitions.

(a) By SOLID BUILDING UNITS is meant incombustible material artificially molded to solid form with not more than 10 per cent of hollow spaces or voids, which voids are designed to reduce the total weight of such units used in masonry construction in buildings and structures.

(b) By BUILDING BRICK is meant solid building units conforming in size and shape to the requirements of order 5305-2. All solid building units which do not conform in size and shape to the requirements of building brick shall be classified as solid building block.

2. Building brick.

(a) Size and Structure. All solid building units not more than 3 by 5 by 8 inches in dimension, or equivalent in volume, shall be designated as brick.

All building brick shall be rectangular in form, free from cracks and other defects which may interfere with proper laying of the brick or impair the strength or permanence of the construction.

(b) Identification. All building brick shall be of distinctive design or appearance, or marked so that the identity of the manufacturer may be known at any time.

3. Solid Building Block.

(a) Shape and Structure. All solid building block shall be made so as to be individually stable, rectangular in form, and free from cracks and other defects which may interfere with proper setting, or impair the strength or permanence of the construction.

(b) Identification. All solid building block shall be of distinctive design or appearance, or marked so that the identity of the manufacturer may be known at any time.

"4. Strength Requirements. The strength of all solid building units used in masonry construction shall be not less than the following:

Minimum Compressive Strength in pounds per square inch of Mean Gross Area Unit laid flatwise		Minimum Modulus of Rupture in pounds per square inch of Gross Area Unit laid flatwise	
Minimum Average	Minimum Individual	Minimum Average	Minimum Individual
2000	1600	450	300

5. Tests. Typical specimens of all sizes and designs of all solid building units shall be tested for compressive strength and modulus of rupture in an approved manner, to prove compliance with the requirements of this code, at intervals of not more than one year. Further tests may be

demanding at any time there is reasonable suspicion of non-conformance to the requirements of this code.

Note. The Industrial Commission insists that all tests be made in accordance with the specification for compression and flexure test for building brick as recommended by the American Society for Testing Materials in Tentative Standard Serial Designation C67-27T. The same test is required of all material, including clay, shale, concrete, sand-lime, etc., units.

Order 5306. Hollow Building Units.

1. Definitions.

(a) By HOLLOW BUILDING UNITS is meant incombustible material artificially molded to the form of tile, or block, with more than 10 per cent of hollow spaces or voids, which hollow spaces or voids are designed to reduce the weight of such units used in masonry construction in buildings and structures.

(b) By TILE or HOLLOW BLOCK is meant hollow building units having cells, shell and webs predetermined in number, size and shape to secure dependability and uniformity in characteristics.

2. Clay Tile Used in Bearing and Exterior Walls.

(a) Weight. The weight of hollow clay tile used in exterior or bearing walls shall be not less than the following:

Cells Vertical			No. Cells	Standard Weights
Dimension				
3¾ x 12 x 12	-----	3	20	
6 x 12 x 12	-----	6	30	
8 x 12 x 12	-----	6	36	
10 x 12 x 12	-----	6	42	
12 x 12 x 12	-----	6	48	
12 x 12 x 12	-----	9	52	

Cells Horizontal			No. Cells	Standard Weights
Dimension				
3¾ x 5 x 12	-----	1	9	
5 x 8 x 12	-----	2	16	
5 x 8 x 12	-----	3	16	
5 x 8 x 12	-----	4	16	
5 x 8 x 12 (L-Shaped)	-----	4	16	
6¼ x 8 x 12 (T-Shaped)	-----	6	24	
7¾ x 8 x 12	-----	6	32	
8 x 10¼ x 12 (H-Shaped)	-----	7		

No such individual tile shall vary more than 5 per cent under the weights given above.

(b) Shape and Structure. All clay tile used in exterior or bearing walls shall be well burned and free from cracks and other defects which interfere with the proper setting of the tile, or impair the strength or permanence of the construction.

The depth of curvature or warpage of any face or web shall not exceed 3 per cent of the greatest dimension of such face or web, but in no case more than ¼ inch.

The dimensions of clay tile shall be within 3 per cent of the dimensions given in the above table of sizes and weights of standard tile.

(c) Strength. All clay tile used in exterior or bearing walls shall have compressive strength as follows:

When tested with cells horizontal not less than 700 pounds per square inch gross area of bearing face.

When tested with cells vertical not less than 1200 pounds per square inch gross area of bearing face.

The average strength of any group of specimens of clay tile shall be not less than the above requirements. The strength of individual tile shall not vary more than 5 per cent below the above requirements.

Where one or more vertical faces of a tile are scored, the gross area of a bearing face is determined by measuring from out to out of plain shell faces and ridges.

(d) Absorption and Durability. Clay tile used in bearing walls and in walls exposed to the weather shall absorb moisture in the one hour boiling test not to exceed 16 per cent of the dry weight of the specimen.

(e) Branding. All clay tile shall be branded with a distinctive indentation on the shell. Clay tile which comply with all requirements for exterior construction and bearing walls shall have the word BEARING impressed on them.

All clay tile shall bear the name, initials or trade-mark of the manufacturer.

(f) Tests. Typical specimens of all sizes and designs of clay tile used in exterior or bearing walls shall be tested in an approved manner, originally to prove compliance with the requirements of this code, and thereafter as directed by the Industrial Commission.

Note. A list of clay tile which have been approved, also specification describing the approved manner of making tests, may be obtained from the Industrial Commission.

3. Concrete Block Used in Bearing and Exterior Walls.

(a) Strength. All concrete blocks used in exterior or bearing walls shall have a compressive strength of not less than 700 pounds per square inch gross area as laid in the wall.

The average strength of any group of test specimens of concrete block shall be not less than the above requirements. The strength of individual test specimens shall not vary more than 5 per cent below the above requirements. These compressive strength values shall be developed in a proper atmosphere and in a curing period of not more than 28 days from the date of manufacture.

(b) Absorption of Moisture and Durability. Concrete block used in walls directly exposed to the weather shall absorb moisture in the immersion test not to exceed 12 per cent of the dry weight of the specimen, except that where the net weight of a concrete block is less than 140 pounds per cubic foot the absorption of moisture in per cent of dry weight shall not exceed the quotient of 12 times 140 divided by the net weight of the concrete block in pounds per cubic foot.

(c) Branding. All concrete blocks used in exterior or bearing walls shall be branded with a distinctive indentation or waterproof stencilled mark, and shall bear the name, initials or trade-mark of the manufacturer.

(d) Tests. Typical specimens of all sizes and designs of concrete block used in exterior or bearing walls shall be tested in an approved manner, originally to prove compli-

ance with the requirements of this code, and thereafter at intervals of not more than one year. Further tests may be demanded at any time there is reasonable suspicion of non-conformance to the requirements of this code.

Note. A list of concrete blocks which have been approved, also a specification describing the approved manner of making tests, may be obtained from the Industrial Commission.

4. Use of Clay Tile and Concrete Blocks in Bearing and Exterior Walls. Approved clay tile and concrete blocks may be used in bearing and exterior walls of buildings not more than 3 stories, or 45 feet in height, or in panel walls in buildings of any height.

Note. Consider the basement or foundation wall as a story in this calculation.

Concentrated loads shall be transmitted to clay tile or concrete block masonry by plain concrete, reinforced concrete, or solid masonry.

Where clay tile or concrete blocks are used in party walls, there shall be not less than two such units used in making up the thickness of the wall unless solid masonry is used for building all chases, recesses, framing of all openings, and for the support, anchorage and protection of all joists and beams carried into such wall.

Where a single unit of masonry does not constitute the full thickness of the wall, the bonding of units shall be by masonry only. Where a brick facing, or backing, is used, the bond shall consist of a full header course of brick every sixth course of brick, or equivalent. Where the facing or backing is also of clay tile, or concrete block, the bond courses shall be placed at intervals of not more than 16 inches.

Clay tile and concrete blocks used in bearing walls shall be well bedded in mortar. The net bearing area of all clay tile and concrete blocks as laid in the wall shall be such that the allowable unit stress on the mortar is not exceeded.

All clay tile laid with cells vertical shall be laid in Portland cement or natural cement mortar. All clay tile laid with cells horizontal and all concrete blocks shall be laid in cement-lime, or better, mortar.

5. Clay Tile Used in Non-Bearing Partitions.

(a) Weight. The weight of hollow clay tile used in non-bearing partitions shall be not less than the following:

Dimension	No. Cells	Standard Weights
3 x 12 x 12-----	3	15
4 x 12 x 12-----	3	16
6 x 12 x 12-----	3	22
8 x 12 x 12-----	4	30
10 x 12 x 12-----	4	36
12 x 12 x 12-----	4	40

No individual tile shall vary more than 5 per cent under the weight given above.

(b) Shape and Structure. All hollow clay tile used in non-bearing partitions shall be well burned and reasonably free from defects which would interfere with the proper setting of the tile, or impair the permanence or fire protection value of the construction.

The depth of curvature or warpage of any face, shall not exceed 3 per cent of the greatest dimension of such face, but in no case more than 1/4 inch.

The dimensions of hollow clay tile used in non-bearing partitions shall be within 3 per cent of the table of sizes and weight of standard partition tile.

(c) Branding. All hollow clay tile used in non-bearing partitions shall be branded with a distinctive indentation. All hollow clay tile not suitable for use in bearing and exterior walls but used in non-bearing partitions shall have the word PARTITION impressed on them.

All hollow clay tile used in partition work shall bear the name, initials or trade-mark of the manufacturer.

6. Concrete Block Used in Non-Bearing Partitions. All concrete blocks used in non-bearing partitions shall comply with the requirements for use in bearing and exterior walls, or shall be branded with a distinctive impression to identify them for use only in non-bearing partitions.

7. Clay Tile and Concrete Blocks Used in Floor Construction.

(a) General Requirements. Where hollow clay tile or concrete blocks are used in concrete floor construction in a way that the whole or any portion of a tile or block is subjected to a load, the requirements which apply to tile or block used in exterior and bearing construction shall be complied with.

Where hollow clay tile or concrete blocks are used in concrete floor construction in a way that no portion of a tile is subjected to a load, the requirements which apply to tile used in partitions shall be complied with.

(b) Branding. All clay tile or concrete blocks used in floor construction shall bear the name, initials or trade-mark of the manufacturer.

Order 5307. Allowable Unit Stresses in Masonry. The compressive stresses in masonry walls, partitions, piers and similar bearing masonry shall not exceed the following in pounds per square inch:

Kind of Masonry	Kind of Mortar		
	Lime	Lime-Portland Cement	Portland Cement
Brick	90	130	170
Solid Block	90	130	170
Concrete Tile and Hollow Concrete Block	—	60	75
Clay Tile	—	60	75

Where a combination of two or more building units is used, the minimum requirements shall apply to the masonry.

Where tile or hollow block are designed and laid so that all vertical shells and webs of successive courses are in alignment, the above values for unit stresses may be increased 20 per cent. The above unit compressive stresses are based on good workmanship and full embedment, full horizontal and vertical joints, for all masonry units.

Order 5308. Mortar. All cement and lime used in the making of mortar for embedding masonry and other structural purposes under this code shall conform to the standards of good practice or as specified by the Industrial Commission.

Note. Cement and lime which conform to the requirements of the standard specifications for these materials issued by the American Society for Testing Materials will be approved under this code. The current standard specifications are as follows:

Quicklime for Structural Purposes.....	C5-26
Hydrated Lime for Structural Purposes.....	C6-24
Specifications for Tests of Portland Cement.....	C9-26

Lime putty for mortar shall be made by slaking quicklime to a smooth paste, and shall be stored in suitable containers for a period of not less than forty-eight hours before being used in the making of mortar.

Hydrated lime shall be considered the equivalent of lime putty for all uses hereunder.

Lime mortar shall consist of one part of lime putty, or dry hydrated lime, to not more than three parts of approved sand, all measurements by volume.

Lime-cement mortar shall consist of one part of lime putty, or dry hydrated lime, and one part of Portland cement added to not more than six parts of approved sand, all measurements by volume.

In lime or lime-cement mortars any desired part of the lime may be replaced with an equal volume of Portland cement.

Cement mortar consists of one part of Portland cement to not more than three parts of approved sand, except that lime putty, or dry hydrated lime, in volume equal to not more than 15 per cent of the volume of Portland cement may be added to the mortar.

Order 5309. Bearing Masonry Walls, Partitions and Piers.

1. General Requirements. All masonry units used in the building of bearing walls and piers shall conform in all respects to the requirements for bearing units.

The unit stresses in bearing masonry walls and piers shall not exceed those specified in order 5307.

All bearing masonry units shall be well embedded in mortar; except that where the requirements for hollow walls are complied with the vertical joints may be unfilled.

Cement mortar shall be used for all masonry which will have one or more faces in contact with soil or other moist material. Lime-cement or cement mortar shall be used for all masonry in parapet walls, chimneys where exposed to the weather, standard fire walls, standard division walls, and for all hollow masonry units.

2. Masonry Bond. The units in all bearing masonry shall be arranged, by overlapping, so that uniform horizontal distribution, and uniform vertical transmission, of all loading is secured; the use of metal ties is not approved, except where masonry is anchored to steel or reinforced concrete frame members of a building, and except for interior veneer used in addition to the required thickness of a bearing wall.

In brick masonry, or in combination brick and other masonry units, the bonding of each tier of units to that adjoining shall be secured by means of a full header course of brick every sixth course of brick, or equivalent.

Note. By equivalent is meant that one-sixth of the volume of a wall shall be header, or bond, units.

Where masonry units are larger than brick, the bond courses shall be separated not more than the minimum total thickness of the wall or pier, or equivalent.

Low strength brick shall not be used as bond units in a wall unless the wall or pier is built throughout of such brick.

3. Height and Thickness. All bearing masonry exterior walls, party walls, standard division walls and other bearing walls, except as hereinafter provided, shall be not less than 12 inches thick in the upper three stories, increasing 4 inches in thickness for each three stories, or fraction, below, except that no such three story height shall exceed 40 feet.

A building not more than three stories in height may have 8 inch bearing 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. A building not more than one story in height may have 8 inch bearing walls, provided the clear story height is not more than 12 feet, the roof span is not more than 25 feet, and distance between cross walls, offsets or pilasters is not more than 60 feet. All other one story buildings shall have all bearing walls not less than 12 inches thick.

All bearing masonry walls shall have substantial lateral support at right angles to the wall face at intervals, measured either vertically or horizontally, not exceeding eighteen times the wall thickness.

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 increased in thickness 4 inches for each additional 10 per cent reduction, unless the requirements for pier construction are complied with in such wall.

All masonry walls which are in contact with the soil in any story shall be increased 4 inches in thickness in that story.

Rubble and rough cut stone walls shall be 4 inches thicker than walls of artificially formed units or ashlar masonry.

Stone and similar solid facing not less than 4 inches thick 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.

In all buildings, the section of masonry supporting trusses or girders shall be considered as isolated piers, the least dimension of which, in inches, shall be not less than one-thirtieth of the span of the truss, or girder, in inches, and the height shall not exceed twelve times the minimum horizontal dimension.

The height of masonry piers which are not built into, and as a part of bearing walls, shall be not more than ten times the minimum horizontal dimension.

Order 5310. Non-Bearing Masonry Walls.

1. General Requirements. All masonry units used in positions where they will be exposed to the weather, and all masonry units which are not protected from the weather by at least 4 inches of approved weather resistive covering, shall conform in all respects to the requirements which apply to bearing units. Masonry units used in positions where they will not be exposed to the weather, and masonry units which are protected from the weather by at least 4 inches of weather resistive covering, need conform only to the requirements of non-bearing units.

Note. By weather resistive covering is meant masonry veneer, plaster, or similar protection.

Lime, lime-cement or cement mortar shall be used for all non-bearing masonry, except as follows:

- (a) Lime mortar shall not be used in habitually wet or damp locations.
- (b) Gypsum shall be used for gypsum masonry.
- (c) Gypsum may be used for clay tile masonry.

2. Masonry Bond and Anchorage. The bonding of all masonry in exterior walls shall be as required for bearing masonry. The bonding of units in non-bearing masonry partitions shall be by means of substantial metal ties (not sheet metal), or as required for bearing masonry.

All exterior and interior non-bearing walls and partitions shall be securely anchored to columns, walls and supports.

3. Height and Thickness. Interior non-bearing walls which are supported on incombustible foundation or fireproof construction, and extend upward to tight contact with fireproof construction, shall be not more than thirty-six times their thickness in clear height. Such non-bearing walls which have non-fireproof lateral support at the top shall be not more than twenty-four times their thickness in clear height. The thickness of exterior non-bearing walls shall be not less than one-twenty-fourth of the clear height, and not less than one-thirtieth of the horizontal distance between vertical supports, but in no case less than 8 inches.

Order 5311. Hollow Walls. In all bearing or non-bearing walls that are built hollow, the same quantity of material and number of units shall be used as if they were built solid, except in the case of special types of hollow walls approved by the Industrial Commission. The parts of hollow walls shall be bonded together as required for bearing masonry.

Order 5312. Parapet Walls. All exterior, division and party walls of non-fireproof buildings shall have parapet walls not less than 8 inches in thickness, extended not less than 2 feet above the roof, and capped with incombustible material in a manner to protect the masonry against moisture; but this order shall not apply:

- (1) To buildings where frame construction would be permitted under the provisions of this code,
- (2) To walls which face streets or alleys,
- (3) To walls where not less than 10 feet of vacant space is maintained between the wall and the boundary line between premises,
- (4) To walls which are not less than 10 feet from other buildings on the same premises.

Order 5313. Recesses in Masonry Walls. Recesses for water, sewer or other pipes in exterior walls and party walls 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 not less than one foot at each floor line.

In every case where a pipe recess passes from one story to the next the recess shall be fire-stopped as above.

Standard fire walls and standard division walls shall not be reduced in minimum thickness by recesses.

The minimum specified thickness of a wall, partition or enclosure for reasons of fire protection shall not be reduced by recessing or other manner.

Recesses in walls of hollow units shall not be cut in, but shall be built in.

SECTION 4. CONCRETE CONSTRUCTION.

Order 5314. Concrete Materials.

1. **Portland Cement.** Portland cement shall conform to the Standard Specifications and Tests for Portland Cement, Serial Designation C9-26, of the American Society for Testing Materials.

2. **Concrete Aggregates.** Concrete aggregates shall consist of natural sands and gravels, crushed rock, crushed air-cooled blast furnace slag, or other inert materials having clean, uncoated grains of strong and durable minerals. Aggregates containing soft, friable, thin, flaky, elongated, or laminated particles totaling more than 3 per cent, or containing shale in excess of 1½ per cent, or silt and crusher dust finer than the No. 100 standard sieve in excess of 2 per cent, shall not be used. These percentages shall be based on the weight of the combined aggregates as used in the concrete. When all three groups of these deleterious materials are present in the aggregates, the combined amounts shall not exceed 5 per cent by weight of the combined aggregate.

Aggregates shall not contain strong alkali, or organic materials which give a color darker than the standard color when tested in accordance with the Standard Method of Test for Organic Impurities in Sands for Concrete, Serial Designation C40-22, of the American Society for Testing Materials.

The maximum size of the aggregate shall be not larger than one-fifth of the narrowest dimension between forms of the member for which the concrete is to be used, nor larger than three-fourths of the minimum clear spacing between reinforcing bars. By maximum size of aggregate is meant the clear space between the sides of the smallest square opening through which 95 per cent by weight of the material can be passed.

3. **Water.** Water used in mixing concrete shall be clean, and free from strong acids, alkalis, or organic materials.

4. **Metal Reinforcement.** Metal reinforcement shall conform to the requirements of the Standard Specifications for

Billet-Steel Concrete Reinforcement Bars, Serial Designation A15-30, or for Rail-Steel Concrete Reinforcement Bars, Serial Designation A16-14, of the American Society for Testing Materials. The provision in these specifications for machining deformed bars before testing shall be eliminated.

Wire for concrete reinforcement shall conform to the requirements of the Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement, Serial Designation A82-27, of the American Society for Testing Materials.

5. Storage of Materials. Cement and aggregates shall be stored at the work in a manner to prevent deterioration or the intrusion of foreign matter. Any material which has deteriorated or has been damaged shall be immediately and completely removed from the work.

Order 5315. Unit Stresses and Design in Concrete Construction.

1. Allowable Unit Stresses in Concrete. The unit stresses in pounds per square inch on the concrete in the design of reinforced concrete shall not exceed the following values, where f equals the minimum ultimate strength at 28 days, and n equals the ratio of the modulus of elasticity of the reinforcing steel to the modulus of elasticity of the concrete:

	$f =$ 2000 lb. $n = 15$	$f =$ 2500 lb. $n = 12$	$f =$ 3000 lb. $n = 10$
Flexure:			
Extreme fibre stress in tension	0	0	0
Extreme fibre stress in compression	0.40f	800	1200
Extreme fibre stress in compression adjacent to supports of continuous or fixed beams, or of rigid frames	0.45f	900	1350
Shear:			
Beams with no web reinforcement and without special anchorage of longitudinal steel	0.02f	40	60
Beams with no web reinforcement, but with special anchorage of longitudinal steel	0.03f	60	90
Beams with properly designed web reinforcement, but without special anchorage of longitudinal steel	0.06f	120	180
Beams with properly designed web reinforcement and with special anchorage of longitudinal steel	0.09f	180	270
Flat slabs at distance d from edge of column cap or drop panel	0.03f	60	90
Footings where longitudinal bars have no special anchorage	0.02f	40	60
Footings where longitudinal bars have special anchorage	0.03f	60	90

	$f =$ 2000 lb. $n = 15$	$f =$ 2500 lb. $n = 12$	$f =$ 3000 lb. $n = 10$
Bond:			
In beams and slabs and one-way footings:			
Plain bars	0.04f	80	100
Deformed bars	0.05f	100	125
In two-way footings:			
Plain bars	0.03f	60	75
Deformed bars	0.0375f	75	94
Exception: Where special anchorage is provided double the above values in bond may be used.			
Bearing:			
Where a concrete member has an area at least twice the area in bearing	0.25f	500	625
Axial Compression:			
In piers or pedestals whose height does not exceed three times their least lateral dimension	0.25f	500	625

Reinforced concrete used under this code shall have a compressive strength of not less than 2000 pounds per square inch, nor shall credit be given for concrete having a compressive strength of more than 3000 pounds per square inch.

2. Column Design.

(a) In columns with lateral ties

$$P = 0.225f A_g [1 + (n - 1)p]$$

in which P equals the safe axial load, A_g equals the gross area of the column, and p equals the ratio of area of reinforcing steel to the total area of concrete in any section.

The ratio (p) of longitudinal reinforcement shall not be less than 0.005, nor shall the ratio considered in the calculations be more than 0.02, of the total area of the column. The longitudinal reinforcement shall consist of not less than four bars of minimum diameter of $\frac{5}{8}$ inch, placed with clear distance from the face of the column not less than 2 inches, nor more than 3 inches. Splices in longitudinal reinforcement shall provide a lap of 24-bar diameters for deformed bars, and 30 diameters for plain bars.

Lateral ties shall be at least $\frac{1}{4}$ inch in diameter spaced not more than 12 inches apart.

(b) In columns with continuous spirals enclosing a circular core,

$$P = A_c [1 + (n - 1)p] f_c$$

in which A_c is the area within the outer circumference of the spiral hooping, and the values of f_c are as given by the formula $f_c = [300 + (0.10 + 4p) f]$.

The longitudinal reinforcement shall consist of at least six bars of minimum diameter of $\frac{1}{2}$ inch, and of an effective cross sectional area not less than 0.01, nor more than 0.06, of that of the core. The amount of steel concentrated in any one ring shall not exceed 0.04 of the core area. The inner ring shall be stayed at intervals of 24 inches, and shall not be nearer to the outer ring than one-fifth of the core diameter. Splices in longitudinal reinforcement shall provide a lap of 24-bar diameters of deformed bars, and 30 diameters for plain bars.

The ratio of the spiral reinforcement shall be not less than one-fourth the ratio of the longitudinal reinforcement. Spiral reinforcement shall consist of evenly spaced continuous spirals held firmly in place and true to line by at least three vertical spacer bars. At the ends of all spirals, and at points of splice, the outside diameter shall be maintained. The spacing of the spirals shall not be greater than one-sixth of the diameter of the core, and in no case more than 3 inches.

3. Unit Stresses in Reinforcing Steel. Tension in intermediate grade billet-steel or rail-steel shall not exceed 18,000 pounds per square inch. Compression in intermediate grade billet-steel or rail-steel shall not exceed nf_c , where f_c equals the allowable compressive stress, in pounds per square inch, in the extreme fiber of the concrete.

4. Protection of Steel. All reinforcement shall be protected by a covering of concrete, cast monolithic with the core, having a minimum thickness of $1\frac{1}{2}$ inches for columns and girders, 1 inch for beams, and $\frac{3}{4}$ inch for slabs; but this protection shall in no case be less than the diameter of the reinforcement. The concrete protection for steel in footings shall be not less than 3 inches.

5. Ordinary Anchorage. Tensile negative reinforcement in continuous, restrained, or cantilever beams shall have a length of anchorage beyond the face of the support sufficient to develop the full maximum tension at an average bond stress not greater than $0.04f$ for plain bars, or $0.05f$ for deformed bars. In continuous or restrained beams, negative reinforcement shall be carried to, or beyond, the point of inflection.

Of the positive reinforcement in continuous beams, not less than one-fourth of the area shall extend along the same face of the beam into the support to provide an embedment of ten or more bar diameters beyond the face of the support.

For non-continuous beams not less than one-half the area of positive reinforcement shall extend along the same face of the beam into the support to provide an embedment of ten or more bar diameters beyond the face of the support.

6. Special Anchorage. Where increased shearing or bond stresses on account of special anchorages are permitted, anchorage of all reinforcement in addition to that required above shall be provided as follows:

In continuous and restrained beams, anchorage beyond points of inflection of at least one-third the area of the negative reinforcement, and beyond the face of the support of at least one-third the area of the positive reinforcement, shall be provided to develop one-third of the allowable working stress in tension at average bond stresses not to exceed $0.04f$ for plain bars, nor $0.05f$ for deformed bars.

In simple beams, or in the outer ends of freely supported end spans of continuous beams, at least one-half of the tensile reinforcement shall extend along the tension side of the beam to provide an anchorage to a point beyond the face of the support, to develop one-third of the allowable working stress in tension at an average bond stress not to exceed $0.04f$ for plain bars, nor $0.05f$ for deformed bars.

Order 5316. Concrete Walls and Piers.

1. Plain Concrete Walls and Piers. By plain concrete is meant concrete containing less than two-tenths of one per

cent of steel reinforcement. Plain concrete in walls and piers shall have a compressive strength of not less than 1500 pounds per square inch when aged 28 days.

The thickness and design of plain concrete walls and piers shall be the same as for masonry construction, except that where the compressive strength of plain concrete is not less than 2000 pounds per square inch when aged 28 days the walls may be reduced twenty per cent in thickness, but shall in no case be less in thickness than the wall it supports.

2. Reinforced Concrete Walls and Piers. Walls, partitions, piers and similar construction of reinforced concrete shall be designed in accordance with the requirements of order 5315.

Order 5317. Structural Gypsum.

1. Materials. Gypsum used under the provisions of this code shall conform to the Standard Specifications for Gypsum issued by the American Society for Testing Materials, serial designation C22-25.

Neat gypsum used for structural purposes shall be that produced by the second settle, or aridization, process and shall develop an ultimate compressive strength of not less than 1800 pounds per square inch when thoroughly dry.

Aggregates, metal reinforcement and water used in making gypsum concrete shall be as required for Portland cement concrete, except as otherwise provided in this order.

2. Strength and Modulus of Elasticity. The minimum strength and modulus of elasticity, in pounds per square inch, developed by gypsum concrete used in structural members shall be as follows:

Gypsum without aggregate:

Compressive strength	1,800
Modulus of elasticity	1,000,000

Gypsum and not more than 3 per cent by weight of wood chips, excelsior, vegetable or mineral fibre:

Compressive strength	1,000
Modulus of elasticity	600,000

Gypsum and other aggregates as for Portland cement concrete:

Compressive strength	800
Modulus of elasticity	200,000

Gypsum and not more than 12½ per cent by weight of wood chips, excelsior, vegetable or mineral fibre:

Compressive strength	500
Modulus of elasticity	200,000

3. Unit Stresses and Design. The unit stresses in pounds per square inch in neat gypsum or gypsum concrete used in structural design shall not exceed the following values where f is the minimum ultimate strength in pounds per square inch when thoroughly dry:

Flexure, tension in extreme fibre.....	0
Flexure, compression in extreme fibre.....	.25f
Direct bearing, compression.....	.16f
Bond, plain reinforcing bars.....	.02f
Bond, deformed reinforcing bars.....	.04f
Shear, straight reinforcing bars.....	.02f
Shear, hooked reinforcing bars.....	.03f

SECTION 5. STEEL AND IRON CONSTRUCTION.

Order 5318. Design, Fabrication and Erection of Structural Steel for Buildings.

Note. The requirements contained in this order were adapted from the Standard Specification for Structural Steel for Buildings of the American Institute of Steel Construction.

1. Scope. This order applies to the design, fabrication and erection of all structural steel for buildings and structures under this code.

Note. Wrought iron, cast iron and cast steel are excluded from the scope of this order.

2. General. In the design of buildings, structures, portions of structures and structural members, only forms which are possible of rigid analysis shall be used.

3. Material. Structural steel shall be manufactured by the open hearth process and shall conform to the Standard

Specifications of the American Society for Testing Materials for Structural Steel for Buildings, Serial Designation A9-29.

4. Loading.

(a) Dead and Live Loads. Steel structures shall be designed to sustain the dead weight imposed upon them, including the weight of the steel frame itself, and, in addition, the maximum live load as specified in each particular case. Proper provision shall be made for temporary stresses caused by erection.

(b) Impact. In cases where live loads have the effect of producing impact or vibration, a proper percentage shall be added to the static live load stresses to provide for such influences, so that the total stress found in any member is an equivalent static stress.

(c) Wind Pressure. Proper provision shall be made for stresses caused by wind pressure of 20 pounds per square foot of exposed surface during erection and after completion of the building.

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.

(d) Anchorage. Proper provision shall be made to securely fasten the reaction points of all steel construction and transmit the stresses to the foundations of the structure.

5. Allowable Stresses. All parts of the structure shall be so proportioned that the sum of the maximum static stresses in pounds per square inch shall not exceed the following:

(a) Tension. Rolled Steel, on net section	18,000
Rivets	13,500

(b) Compression. Rolled Steel, on short lengths or where lateral deflection is prevented -----18,000

On gross section of columns,

$$\frac{18,000}{1 + \frac{l^2}{18,000r^2}}$$

with a maximum of ----- 15,000, in which l is the unsupported length of the column, and r is the corresponding least radius of gyration of the section, both in inches.

For main compression members, the ratio $\frac{l}{r}$ shall not exceed 120, and for bracing and other secondary members, 200.

(c) Bending. On extreme fibres of rolled shapes, and built up sections net section, if lateral deflection is prevented -----18,000. When the unsupported length l exceeds 15 times b , the width of the compression flange, the stress in pounds per square inch in the latter shall not exceed

$$\frac{20,000}{1 + \frac{l^2}{2,000b^2}}$$

The laterally unsupported length of beams and girders shall not exceed 40 times b , the width of compression flange.

On extreme fibers of pins, when the forces are assumed as acting at the center of gravity of the pieces -----27,000

(d) Shearing. On pins	13,500
On power-driven rivets	13,500
On turned bolts in reamed holes with a clearance of not more than 1/50 of an inch	13,500
On hand-driven rivets	10,000
On unfinished bolts	10,000

On the gross area of the webs of beams and girders, where h , the height between flanges in inches, is not more than 60 times t , the thickness of the web in inches, ----- 12,000.

On the gross area of the webs of beams and girders if the web is not stiffened where h , the height between flanges in inches, is more than 60 times t , the thickness of the web, the maximum shear per square inch, $\frac{S}{A}$ shall not exceed

$$\frac{18,000}{1 + \frac{h^2}{7,200t^2}}$$

In which S is the total shear, A is gross area of web in square inches.

(e) Bearing	Double Shear	Single Shear
On pins -----	30,000	24,000
On power-driven rivets -----	30,000	24,000
On turned bolts in reamed holes -----	30,000	24,000
On hand-driven rivets -----	20,000	16,000
On unfinished bolts -----	20,000	16,000
On expansion rollers per lineal inch 600 times the diameter of the roller in inches.		

(f) Combined Stresses. For combined stresses due to wind and other loads, the permissible working stress may be increased 33½ per cent, provided the section thus found is not less than that required by the dead and live loads alone.

(g) Members Carrying Wind Stress Only. For members carrying wind stress only, the permissible working stresses may be increased 33½ per cent.

6. Symmetry of Members. Structural members shall preferably be symmetrical. Where single angles have but one leg connected only 40 per cent of the area of the out-standing leg shall be considered as taking stress.

7. Beams and Girders.

(a) Rolled beams shall be proportioned by the moment of inertia of their net sections. Plate girders with webs fully spliced for tension and compression shall be so proportioned that the unit stress on the net section does not exceed the stresses specified in Section 5 as determined by the moment of inertia of the net section.

(b) Plate Girder webs shall have a thickness of not less than $\frac{1}{160}$ of the unsupported distance between the flanges.

(c) Web splices shall consist of a plate on each side of the web capable of transmitting the full stress through the splice rivets.

(d) Stiffeners. Stiffeners shall be required on the web of rolled beams and plate girders at the ends and at points of concentrated loads, and at other points where h the clear distance between flanges is greater than

$85 t \sqrt{18,000 \left(\frac{A}{S}\right) - 1}$, in which t is the thickness of the web. When stiffeners are required, the distance in inches between them shall not be greater than

$85 t \sqrt{18,000 \left(\frac{A}{S}\right) - 1}$, but in no case greater than 6 feet.

When h is greater than 60 times t , the thickness of the web of a plate girder, stiffeners shall be provided at distances not greater than 6 feet apart. Stiffeners under or over concentrated loads shall be proportioned to distribute such loads into the web.

Plate girder stiffeners shall generally be in pairs, one on each side of the web, and shall have a close bearing against the flange angles at points of concentrated loading; stiffeners over the end bearings shall be on plate fillers. The pitch of rivet in stiffeners shall not exceed 6 inches.

(e) Flange plates of all girders shall be limited in width so as not to extend more than 6 inches or more than 12 times the thickness of thinnest plate beyond the outer row of rivets connecting them to the angles.

(f) Crane runway girders and the supporting framework shall be proportioned to resist the greatest horizontal stresses caused by the operation of the cranes.

(g) Rivets connecting the flanges to the web at points of direct load on the flange between stiffeners shall be proportioned to carry the resultant of the longitudinal and transverse shears.

(h) Rivets connecting the flanges to the webs of plate girders and of columns subjected to bending shall be so spaced as to carry the increment of the flange stress between the rivets.

8. Column Bases.

(a) Proper provision shall be made to distribute the column loads on the footings and foundations.

(b) The top surface of all column bases shall be planed for the column bearing.

(c) Column bases shall be set true and level, with full bearing on the masonry, and be properly secured to the footings.

9. Eccentric Loading. Full provisions shall be made for stresses caused by eccentric loads.

10. Combined Stresses.

(a) Members subject to both direct and bending stresses shall be so proportioned that the greatest combined stresses shall not exceed the allowed limits.

(b) All members and their connections which are subject to stresses of both tension and compression due to the action of live loads shall be designed to sustain stress giving the largest section, with 50 per cent of the smaller stress added to it. If the reversal of stress is due to the action of wind, the member shall be designed for the stress giving the largest section and the connections proportioned for the largest stress.

11. Abutting Joints. Compression members when faced for bearings shall be spliced sufficiently to hold the connecting members accurately in place. Other joints in riveted

work, whether in tension or compression, shall be fully spliced.

12. Net Sections.

(a) In calculating tension members, the net section shall be used, and in deducting the rivet holes they shall be taken $\frac{1}{8}$ inch greater in diameter than the nominal diameter of the rivets.

(b) Pin-connected tension members shall have the section through the pinhole 25 per cent in excess of the net section of the member, and a net section back of hole equal to 75 per cent of that required through the pinhole.

13. Rivets and Bolts.

(a) In proportioning rivets the nominal diameter of the rivet shall be used.

(b) Rivets carrying calculated stresses, and whose grip exceeds five diameters, shall have their number increased 1 per cent for each additional $\frac{1}{10}$ inch in the rivet grip. Special care shall be used in heating and driving such rivets.

(c) Rivets shall be used for the connections of main members carrying live loads which produce impact, and for connections subject to reversal of stresses.

(d) Finished bolts in reamed holes may be used in shop or field work where it is impracticable to obtain satisfactory power-driven rivets. The finished shank shall be long enough to provide full bearing, and washers shall be used under the nuts to give full grip when turned tight.

Unfinished bolts may be used in shop or field work for connections in small structures used for shelters, and for secondary members of all structures such as purlins, girts, door and window framing, alignment bracing and secondary beams in floor.

14. Rivet Spacing.

(a) The minimum distance between centers of rivet holes shall be three diameters of the rivet; but the distance shall preferably be not less than $4\frac{1}{2}$ inches for $1\frac{1}{4}$ inch

rivets, 4 inches for $1\frac{1}{8}$ inch rivets, $3\frac{1}{2}$ inches for 1 inch rivets, 3 inches for $\frac{7}{8}$ inch rivets, $2\frac{1}{2}$ inches for $\frac{3}{4}$ inch rivets, 2 inches for $\frac{5}{8}$ inch rivets, and $1\frac{3}{4}$ inches for $\frac{1}{2}$ inch rivets. The maximum pitch in the line of stress of compression members composed of plates and shapes shall not exceed 16 times the thickness of the thinnest outside plate or shape, nor 20 times the thickness of the thinnest enclosed plate or shape with a maximum of 12 inches, and at right angles to the direction of stress the distance between lines of rivets shall not exceed 30 times the thickness of the thinnest plate or shape. For angles in built sections with two gage lines, with rivets staggered, the maximum pitch in the line of stress in each gage line shall not exceed 24 times the thickness of the thinnest plate with a maximum of 18 inches.

(b) In tension members composed of two angles, a pitch of 42 inches will be allowed, and in compression members, 24 inches, but the ratio $\frac{l}{r}$ for each angle between rivets shall not be more than $\frac{3}{4}$ of that for the whole member.

(c) The pitch of rivets at the ends of built compression members shall not exceed four diameters of the rivets for a length equal to $1\frac{1}{2}$ times the maximum width of the member.

(d) The minimum distance from the center of any rivet hole to a sheared edge shall be $2\frac{1}{4}$ inches for $1\frac{1}{4}$ inch rivets, 2 inches for $1\frac{1}{8}$ inch rivets, $1\frac{3}{4}$ inches for 1 inch rivets, $1\frac{1}{2}$ inches for $\frac{7}{8}$ inch rivets, $1\frac{1}{4}$ inches for $\frac{3}{4}$ inch rivets, $1\frac{1}{8}$ inches for $\frac{5}{8}$ inch rivets, and 1 inch for $\frac{1}{2}$ inch rivets. The maximum distance from any edge shall be 12 times the thickness of the plate, but shall not exceed 6 inches.

15. Connections.

(a) Connections carrying calculated stresses, except for lacing, sag bars, angles, hand rails, or beam connections, shall have not less than 2 rivets or bolts.

(b) Members meeting at a joint shall have their lines of center of gravity meet at a point if practicable; if not, provision shall be made for any eccentricity.

(c) The rivets at the ends of any member transmitting the stresses into that member shall have their centers of gravity in the line of the center of gravity of the member; if not provision shall be made for the effect of the resulting eccentricity. Pins may be so placed as to counteract the effect of bending due to dead load.

(d) When a beam or girder "A" is connected to another member in such a manner that "A" acts as a continuous or fixed end beam, proper provision shall be made for the bending moments at such a connection.

(e) Where stress is transmitted from one piece to another, through a loose filler, the number of rivets shall be properly increased, tight-fitting fillers shall be preferred.

(f) Welded Connections. Fusion welding may be substituted for riveting, bolting or other requirements already prescribed, for connecting together or assembling the component parts of the structural frame or any individual member. The methods, workmanship, design and allowable stresses shall conform to the best practice, and shall be subject to the approval of the Industrial Commission. Welded structures shall be specially designed and supervised by persons who are skilled and experienced in such work. All welding shall be done by skilled workmen who shall give satisfactory proof of their skill and ability with the process to be used on the proposed work.

16. Lattice.

(a) The open sides of compression members shall be provided with lattice having tie plates at each end and at the intermediate points if the lattice is interrupted. Tie plates shall be as near the ends as practicable. In main members carrying calculated stresses the end tie plates shall have a length of not less than the distance between the lines of rivets connecting them to the flanges, and intermediate ones of not less than one-half of this distance. The thickness of tie plates shall not be less than one-fiftieth of the distance between the lines of rivets connecting them to the segments of the members and the rivet pitch shall not be more than four diameters. Tie plates shall be sufficient

in size and number to equalize the stress in the parts of the members.

(b) Lattice bars shall have neatly finished ends. The thickness of lattice bars shall be not less than one-fortieth for single lattice and one-sixtieth for double lattice of the distance between end rivets; their minimum width shall be as follows:

For 15 inch channels, or built sections with $3\frac{1}{2}$ inch and 4 inch angles— $2\frac{1}{4}$ inches where $\frac{3}{4}$ inch rivets are used, or $2\frac{1}{2}$ inches where $\frac{7}{8}$ inch rivets are used.

For 12 inch, 10 inch and 9 inch channels, or built sections with 3 inch angles— $2\frac{1}{4}$ inches where $\frac{3}{4}$ inch rivets are used.

For 8 inch and 7 inch channels, or built sections with $2\frac{1}{2}$ inch angles, 2 inches where $\frac{5}{8}$ inch rivets are used, or $2\frac{1}{4}$ inches where $\frac{3}{4}$ inch rivets are used.

For 6 inch and 5 inch channels, or built sections with 2 inch angles, $1\frac{1}{2}$ inches where $\frac{1}{2}$ inch rivets are used, or $1\frac{3}{4}$ inches where $\frac{5}{8}$ inch rivets are used.

(c) The inclination of lattice bars to the axis of the members shall generally be not less than 45 degrees but when the distance between the rivet lines in the flanges is more than 15 inches, the lattice shall be double and riveted at the intersection if bars are used, or else shall be made of angles.

(d) Lattice bars shall be so spaced that the ratio $\frac{l}{r}$ of the flange included between their connections shall be not over $\frac{3}{4}$ of that of the member as a whole.

17. Expansion. Proper provision shall be made for expansion and contraction.

18. Minimum Thickness. No steel less than $\frac{5}{16}$ inch thick shall be used for exterior construction, nor less than $\frac{1}{4}$ inch for interior construction, except for linings or fillers and rolled structural I-beams and channels.

These provisions apply to primary members and skeleton frame construction, but do not apply to secondary members.

such as the structural supports of floor panels, or to light structures, such as skylights, marquees, fire escapes, light one-story buildings, or light miscellaneous steel work.

Note. For requirements applying to fire escape construction see order 5120.

For trusses having end reactions of 35,000 pounds or over, the gusset plates shall be not less than $\frac{3}{8}$ inch thick.

19. Adjustable Members. The initial stress in adjustable members shall be assumed as not less than 5,000 pounds.

20. Workmanship.

(a) All workmanship shall be equal to the best practice in modern structural shops.

(b) Drifting to enlarge unfair holes shall not be permitted.

(c) The several pieces forming built sections shall be straight and fit close together; and finished members shall be free from twists, bends, or open joints.

(d) Rolled sections, except for minor details, shall not be heated, or bent cold unless the section is otherwise fully developed in an approved manner.

(e) Wherever steel castings are used, they shall be properly annealed.

(f) Punching. Material may be punched $\frac{1}{16}$ inch larger than the nominal diameter of the rivets, whenever the thickness of the metal is equal to or less than the diameter of the rivets, plus $\frac{1}{8}$ inch. When the metal is thicker than the diameter of the rivet, plus $\frac{1}{8}$ inch, the holes shall be drilled, or sub-punched and reamed.

(g) Rivets shall be heated uniformly, to a light cherry red, but in no case to more than 1950 degrees (light yellow color), and shall be driven, and the heads formed, with a proper sized die while hot. By hot is meant heated to a temperature of not less than 1000 degrees Fahrenheit (blood red color). When heated and ready for driving, rivets shall be free from slag, scale and carbon deposit. When driven, they shall completely fill the holes. Loose, burned or

otherwise defective rivets shall be replaced after driving. The rivet head shall be full, neatly made, concentric with the rivet hole and in full contact with the surface of the member.

(h) Compression joints depending upon contact bearing shall have the bearing surfaces truly faced after the members are riveted. All other joints shall be cut or dressed true and straight, especially where exposed to view.

(i) The use of a cutting torch is permissible if the metal being cut is not carrying any stress during the operation. Stresses shall not be transmitted through a flame cut surface. The radius of reëntrant flame cut fillets shall be as large as possible, but never less than one inch. To determine the net area of a member so cut, $\frac{1}{8}$ inch shall be deducted from the flame cut edges.

Note. This prohibits the cutting or enlarging of rivet holes, bolt holes and similar openings in structural steel.

21. Painting.

(a) Parts not in contact, but inaccessible after assembling, shall be properly protected by paint.

(b) All steel work, except where encased in concrete, shall be thoroughly cleaned and given one coat of acceptable metal protection well worked into the joints and open spaces.

(c) Machine finished surfaces shall be protected against corrosion.

(d) Unless otherwise properly protected, all steel work shall after erection be protected by a field coat of good paint applied by a competent painter.

22. Erection.

(a) The frame of all steel skeleton buildings shall be carried up true and plumb, and temporary bracing shall be introduced wherever necessary to take care of all loads to which the structure may be subjected, including erection equipment, and the operation of same. Such bracing shall be left in place as long as may be required for safety.

(b) As erection progresses the work shall be securely bolted up to take care of all dead load, wind and erection stresses.

(c) Wherever piles of material, erection equipment, or other loads are carried during erection, proper provision shall be made to take care of stresses resulting from the same.

(d) No riveting shall be done until the structure has been properly aligned.

(e) Rivets driven in the field shall be heated and driven with the same care as those driven in the shop.

Order 5319. Steel Joist Construction.

1. DEFINITIONS. By steel joist is meant any horizontal rolled or fabricated steel member supporting a share of the floor or roof structure between walls, girders, beams or trusses.

A rolled steel joist is a steel joist that is made in the mill roll as a complete structural shape.

A fabricated steel joist is a steel joist in which the process of manufacture requires one or more operations on rolled steel shapes, bars or strips.

Note. The welding or riveting together of parts, the expanding of a section, the bending or shaping in any way after the rolling is completed, constitute extra operations and brings the manipulated member under the "fabricated" classification.

2. MATERIAL. All steel joists shall be of new billet steel conforming to the standard specifications for structural steel for buildings as recommended by the American Society for Testing Materials, serial designation A9-24.

All steel joists shall receive a protective covering of suitable paint before leaving the shop or exposure to weathering.

3. DESIGN AND MANUFACTURE. The design of all steel joists shall be such that the stresses in any needed member may be accurately determined by analysis for any load condition.

Fabricated connections between separate members of a fabricated steel joist shall be by means of rivets or electric welding in an approved manner.

All parts of a steel joist shall be so proportioned that the sum of maximum stresses will not exceed those specified under order 5318. The unit stress in any welded connection, or any portion thereof, shall not exceed 9000 pounds per square inch of sound metal.

Steel joists used in floor construction shall be so designed that within the range of live loading from zero to full maximum rated live load there will be no permanent deformation and the deflection in inches in any joist will not exceed:

$$\frac{L}{D + L} \left(\frac{1}{360} \right) \times \text{span in inches}$$

where L = live load per square foot of floor
D = total weight per square foot of floor system not including live load

4. Use of Steel Joists.

(a) General. In all fireproof floor or roof panel construction the steel joists shall be well braced, either by means of substantial bridging or through the proper design and construction of floor panel assembly, to secure rigidity such that not less than one-half of the live load on any joist will be transmitted to the adjoining joist or joists. If bridging struts are used they shall be designed as structural members.

Note. The use of strut bridging will introduce new loading conditions; the lines of bridging will need to be considered intermediate reactions, or points of support, for partial or concentrated loads.

All steel joists shall be securely anchored to bearings in an approved manner. In buildings more than four stories in height anchorage shall be by means of rivets, bolts or welding.

The top slab, or floor construction resting on the steel joists, shall be of approved concrete reinforced with approved steel bar or fabric reinforcement fastened to the joists and designed in conformance with the requirements of order 5315. The thickness of the reinforced slab shall not be less than one-twelfth of the joist spacing for floor construction and not less than one-fifteenth of the joist spacing for roof construction. In no case shall there be less than 1 inch of reinforced concrete protection between the tops of the steel joists and combustible nailing strips.

Exception. The metal lath which has ordinarily been used for the forming and reinforcing of the top slab will not be considered as a part of the concrete reinforcement except in roof construction.

The underside of steel joist assembly shall be protected with not less than $\frac{3}{4}$ inch of approved fire resistive material, such as approved plaster on incombustible base or reinforced concrete.

Note. By approved plaster is meant Portland cement plaster, lime-Portland cement (not to exceed 50 per cent lime putty by volume) plaster or gypsum plaster.

The top floor slab and the protection for the underside of steel joists shall create air space, or spaces, between or around the steel joists completely isolated from the open atmosphere.

Steel joists shall not be used in first floor panels having less than 5 feet of well ventilated air space below, nor in floor panels over damp basements.

Piping installed in the enclosed space between the top slab and the protection for the under side of steel joists shall be limited to water supply and waste pipes and electric conduit; all such pipes conveying liquids shall be insulated to prevent the condensation of moisture on the pipes. Pipes conveying steam, gases, chemicals and similar active fluids shall not be installed in enclosed spaces with steel joists; where such pipes in any way pierce the top or bottom protection for steel joists they shall be isolated from the joists by fire resistive construction the equivalent of that required for the protection of the underside of the joists.

Steel joists having a span of more than 4 feet shall not be used as headers for the support of beams or joists unless they are designed as structural shapes under order 5318. Headers shall not bear on steel joists (trimmers) unless provision is made to properly transmit loads from header to trimmers.

(b) Steel Joist Fireproof Floor Construction. All beams, girders and columns supporting steel joists in fireproof floor construction shall be fully fireproofed as required under order 5100, including that portion of the members in the sealed space between the planes of the tops and bottoms of the steel joists.

(c) **Steel Joists Protected Floor Construction.** By protected floor construction is meant steel joist floor construction complying with all of the requirements of this order 5319 except that the beams, girders and columns supporting steel joists are protected with approved incombustible base and approved plaster not less than 3/4 inch in thickness, a continuation of the under joist protection. That portion of the beams or girders in the sealed space between the planes of the tops and bottoms of the steel joists need not be protected. There shall be not less than 1 inch of air space between the metal of such beams, girders and columns and the reinforced plaster protection.

(d) **Steel Joist Ordinary Construction.** Steel joists may be used in any building or floor construction on the same basis as wood joists.

5. **Test of Steel Joists.** All steel joists, including all rolled and fabricated joists that cannot be classified as structural steel, shall be tested in an approved manner, originally to prove compliance with this code, and thereafter as requested by the Industrial Commission in case there is reasonable suspicion of non-conformance to the requirements of this code.

6. **Construction Methods.** Steel joists floor systems shall be placed and constructed in such manner that the individual joist will not be overstressed or disarranged during construction.

Note. This will require the provision of rigid bracing continuous between joists.

Order 5320. Wrought Iron. The requirements for design, fabrication and erection of steel for buildings and structures under order 5318 shall apply to wrought iron, except that the following stresses in pounds per square inch shall not be exceeded:

Tension on net section ----- 12,000
 Compression, on short lengths or where lateral deflection is prevented ----- 10,000
 on gross section of columns
 $12,000 - 60 \frac{L}{r}$

in which L = length in inches
 r = radius of gyration in inches
 Bending. On extreme fibres if lateral deflection is prevented ----- 12,000

Wrought iron shall conform to the Standard Specifications for Refined Wrought Iron Plates, Serial Designation A42-18.

Order 5321. Cast Iron. The following unit stresses in pounds per square inch shall not be exceeded in cast iron:

Tension on net section ----- 0
 Compression, on short lengths or where lateral deflection is prevented ----- 10,000
 on gross section of columns
 $10,000 - 40 \frac{L}{r}$

in which L = length in inches
 r = radius of gyration in inches
 Tension in the extreme fibre if lateral deflection is prevented ----- 3,000

The material and workmanship of cast iron members shall be equal in all respects to that described in the American Society for Testing Materials Specifications for Gray-Iron Castings, Serial Designation A48-29.

All columns resting on, or supporting, other columns shall have their ends machine faced to a plane surface perpendicular to the axis.

SECTION 6. WOOD CONSTRUCTION.

Order 5322. Material and Design in Wood Construction. The quality and design of all wood used in the construction of all buildings and structures or parts thereof, shall conform to the minimum standards under this section.

All members shall be so framed, anchored, tied and braced together as to develop the maximum strength and rigidity necessary for the purpose for which they are used. No member shall be stressed in excess of the strength of its details and connections.

Workmanship in fabrication, preparation, and installation of material shall conform throughout to good engineering practice.

In the design and construction of structures and structural members of wood the following unit stresses, in pounds per square inch, shall not be exceeded:

Species of Timber	American Lumber Standard Grade	Modulus of Elasticity	Compression		Transverse, Extreme Fibre	Shear Parallel to Grain	Direct Tension
			Parallel to grain where L is 10 or less	Perpendicular to Grain			
Douglas Fir, Coast Type	Dense	1,600,000	1285	380	1750	105	1285
	Select		1175	345	1600	90	1175
	Common		880	325	1200	72	880
Douglas Fir, Rocky Mountain Type	Select	1,200,000	800	275	1100	85	800
	Common		640	880	880	68	640
Balsam Fir	Select Common	1,000,000	700 560	150	900 720	70 56	700 560
White Fir	Select Common	1,100,000	700 560	300	1100 880	70 56	700 560
Eastern Hemlock Including Wisconsin Hemlock	Select Common	1,100,000	700 560	300	1100 880	70 56	700 560
Western Hemlock	Select Common	1,400,000	900 720	300	1300 1040	75 60	900 720
Norway Pine	Select Common	1,200,000	800 640	300	1100 880	85 68	800 640
Southern Yellow Pine	Dense	1,600,000	1285	380	1750	128	1285
	Select		1175	345	1600	110	1175
	Common		880	325	1200	88	880
White Pine	Select Common	1,000,000	750 600	250	900 720	85 68	750 600
Engelman Spruce	Select Common	800,000	600 480	175	750 600	70 56	600 480
Sitka Spruce	Select Common	1,200,000	800 640	250	1100 880	85 68	800 640
White Cedar Northern & Southern	Select Common	800,000	550 440	175	750 600	70 56	550 440
Red Cedar Western	Select Common	1,000,000	700 560	200	900 720	80 64	700 560
Cypress	Select Common	1,200,000	1100 880	350	1300 1040	100 80	1100 880
Oak	Select	1,500,000	1000	500	1400	125	1000

Where the wood or lumber does not conform to the American Lumber Standards as described in Simplified Practice Recommendations Number 16, issued by the Bureau of Standards, United States Department of Commerce, revised draft effective July 1, 1925, the values in the above table shall be decreased in proportion to the reduction in quality.

In compression members where the ratio of length to smallest lateral dimension is more than ten, the stress shall not exceed $C \left(1 - \frac{L}{60D}\right)$,

in which C = unit stress in compression parallel to grain taken from the above table

L = unsupported length of member in inches

D = smallest lateral dimension of member in inches

Where structural members are to be exposed to the weather, the above unit stresses shall be reduced 25 per cent.

Wood shall not be used in parts of a building or structure habitually exposed to moisture unless efficiently ventilated to prevent decay, in which case the unit stresses in the above table shall be reduced 40 per cent.

Order 5323. Timber Framework.

1. General Requirements. Wood shall not be used as permanent construction in contact with soil, unless properly treated.

In all framing, the planes of contact in joints shall be such that the tendency of one member to slip on the other is a minimum.

2. Columns, Posts and Studs. All wood columns, posts and studs shall be cut true to the bearing surfaces which receive them. Columns and posts which are built in sections with ends abutting, at the floorline or elsewhere, shall have inserted between the squared ends approved transition plates which are designed to prevent checking, splitting and slipping of the ends.

When column, post or stud bearings are exposed to moisture, such as on the ground or on a grade floor, the founda-

tion or bearing shall be of non-absorbent material and the plane of bearing shall be not less than 2 inches above the finished floor.

3. Girders, Beams and Joists. Every girder and beam which enters, or rests on, a masonry wall shall have a bearing of at least 4 inches thereon, with the under surface of the girder or beam protected by a piece of asphalt saturated felt or a metal bearing plate, or the ends may be protected with creosote.

Wood members entering masonry party or fire walls shall be separated from the opposite side of the wall and from beams entering the opposite side of the wall by 4 inches of masonry. The ends of the joists, beams and girders shall be splayed or fire-cut to a bevel of not less than 3 inches in their depth.

Where girders and beams enter masonry they shall be provided with wall plates, boxes or anchors of an approved self-releasing type so arranged as to leave an air space of not less than 1 inch at sides of member. Rigid boxes shall be provided in concrete walls. The ends of girders shall not be sealed in; provided, that where ends of timbers are well treated with creosote or other approved preservative, they may be sealed in.

Anchors for each tier of joists shall be provided where they enter masonry walls, and also when they are parallel to masonry walls. Such anchors shall be $\frac{3}{4}$ inch round iron, or equal, not less than 36 inches long, fitted with a $\frac{1}{4}$ inch by 10 inch pin at the wall end, and shall be spaced not more than 6 feet apart. The pin shall be placed vertically in the wall and 4 inches from the opposite face of such wall. Such anchors shall in all cases occur on the opposite ends of the same run of joists, and where the length of joists is less than the distance across a building, the ends of joists shall be lapped and spiked so as to form a continuous tie across the building. Anchors shall be placed across the top of joists that run parallel to the wall, and shall be fastened to the ends of joists below the neutral axis.

The minimum permissible thickness of joists, rafters and studs shall be $1\frac{5}{8}$ inches.

Floor joists shall be supported by beams or bearing partitions or walls. Where entering exterior stud walls, the joists shall be supported by a ribbon let into the studs if no plate is provided. Joists shall be well nailed to the supporting studs. Studs shall be doubled under the ends of doubled joists.

Header joists over 6 feet long, and tail joists over 12 feet long, shall be hung in approved stirrup irons or joist hangers.

Joists under bearing partitions and running parallel thereto shall be doubled and well spiked, or separated by solid bridging not more than 16 inches on centers to permit the passage of pipes.

Wood cross bridging shall be placed between joists if the span is over 8 feet. The distance between bridging or between bridging and bearing shall not exceed 8 feet. Wood cross bridging shall be not less than 6 square inches in cross sectional area, except that the floor of living or sleeping rooms shall have bridging not less than 3 square inches in cross sectional area.

Metal cross bridging of equal or greater strength may be used in place of the wood cross bridging.

Solid bridging shall be placed between floor joists which cross bearing partitions. Solid bridging shall be placed between joists at the edge of flooring where the attic space is only partially covered.

Cutting of wood girders, beams or joists shall be limited to cuts and bored holes not deeper than one-fifth the beam depth below the top and located not further from the beam end than three times the beam depth.

4. Stud Framework. Where the partition studs do not rest on walls or beams, or do not pass through the floor to the top plate of the partition below, stud partitions shall be provided with sills or plates with dimensions not less than the studs.

In bearing partitions the top plate shall be doubled, and lapped at each intersection. Joints in the upper and lower members of the top plate shall be staggered not less than 2 feet.

Studs in bearing walls and bearing partitions shall be not less than $1\frac{5}{8}$ x $3\frac{5}{8}$ inches in size, with the $3\frac{5}{8}$ inch dimension at right angles with the plane of the wall or partition.

Where studs pass through from floor to floor they shall be fire-stopped at the point of passage through floors.

Angles at corners where stud walls or partitions meet shall be framed solid so no lath can extend from one room to another.

Stud partitions containing plumbing, heating or other pipes shall be framed to accommodate such equipment.

Openings in stud partitions and walls shall be framed around with double studs at each side and double headers across the top resting on the short stud at each end. The double header shall be placed on edge and shall be trussed above for all openings over 4 feet in width or where more than two studs are cut away.

Wood lath, furring or framing shall be placed not less than 2 inches from any chimney and not less than 4 inches from the back of any fireplace.

5. Wooden Trusses and Built-Up Members. Wood trusses and similar framing shall have all joints accurately cut and fitted together so that each bearing is true and drawn tightly to full bearing.

All wood trusses shall be securely fastened to the supports and each truss shall be secured in position laterally by bracing the top and bottom chords at points not more than 25 feet apart.

All girders and beams built-up of strips, boards or dimension lumber shall be fastened together by nailing, spiking and bolting in a manner to develop the full strength of the parts. The stiffness of all members, and the strength of all joints, splices and laps, shall be fully developed by means of bolts.

6. Fire Stopping. Fire stops shall be provided at all intersections of interior and exterior walls with floors, ceilings and roof in such manner as to effectively cut off com-

munication by fire through hollow concealed spaces and prevent both vertical and horizontal drafts.

Furred walls shall have fire stopping placed immediately above and below the junction of any floor construction with the walls, or shall be fire-stopped the full depth of the joist.

All spaces between chimneys and wood framing shall be solidly filled with refuse mortar, loose cinders or other incombustible material placed in incombustible supports.

All fire stopping as required in this section shall be not less than 2 inches in thickness and not less in width than the enclosed space within the partition except as provided for chimneys.

Chapter 6

FACTORIES, OFFICE AND MERCANTILE BUILDINGS

SECTION 1. CLASSIFICATION.

Order 5400. This Classification includes 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, warehouses, railroad stations, exhibition buildings, and places where less than 100 persons assemble for entertainment, worship, or dining purposes.

SECTION 2. EXITS.

Order 5401. Number and Location. Every building and every story thereof shall have at least two exits, with the following exceptions:

- (1) First and second story storage rooms not over 3,000 square feet in area;
- (2) The second story of a two story building, provided such story is used only for offices; is not over 3,000 square feet in area; and has a stairway enclosed with fireproof or semi-fireproof partitions, leading directly to the outside and not leading to the basement.

Additional exits shall be provided, if necessary, so that no part of the building will be 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 noncombustible;
- (2) Fireproof office buildings;
- (3) Fireproof storage warehouses with fireproof individual compartments;

(4) 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 5402. Type of Exits. At least one-half of the exits above required shall be stairways (orders 5116-5118). The other exits shall be either stairways, or horizontal exits (order 5119), or fire escapes (order 5120). But no fire escape shall be accepted as an exit from any floor which is more than 60 feet above the grade at the point where such fire escape is located, except that such height may be increased to 90 feet in the case of fireproof office buildings or fireproof buildings where such floors are used for storage only. In a two story building, an outside wooden stairway may be used as an exit.

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 contents are entirely or almost entirely incombustible, provided such building does not exceed 7,000 square feet in floor area at the third floor.

Order 5403. 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; if sprinklered, 40 inches per 100 persons.

In fire proof 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	in. per 100 persons on 3rd floor
plus	12	20	10	24	in. per 100 persons on 4th floor
plus	9	15	12	18	in. per 100 persons on 5th floor
plus	6	10	8	12	in. per 100 persons on 6th floor
plus	3	5	4	6	in. per 100 persons on 7th floor
plus	0	0	0	0	in. per 100 persons on 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 (order 5120) 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 5402.

If horizontal exits (order 5119), 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 of width of such exits, provided such increase shall not exceed 100 per cent of the number of persons accommodated by the stairways.

Example. 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 first story; if sprinklered, 220 persons.

Fireproof and mill buildings:

Height of building	Fire-proof Sprinklered	Fire-proof not Sprinklered	Mill Sprinklered	Mill not Sprinklered	
2 stories.....	293	175	220	147	Persons on each floor
3 stories.....	195	117	147	98	Persons on each floor
4 stories.....	154	92	116	77	Persons on each floor
5 stories.....	133	80	100	67	Persons on each floor
6 stories.....	122	73	92	61	Persons on each floor
More than 6 stories.....	117	70			Persons on each floor

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 5402.

Order 5404. Capacity of Buildings. In calculating the aggregate width of exits, the capacity of building 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 retail mercantile establishments and exhibition halls, the capacity shall be determined by the architect or owner and no greater number of persons shall be permitted therein; but such number shall in no case be less than one person per 60 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.

Order 5405. Exit Doors. Every door which serves as an exit from a room accommodating more than ten persons, or which is an exit from a public passageway or stairway, shall be a standard exit door (order 5115), except that such exit door need not swing outward if it accommodates less than 25 persons, is not located at the foot of a stairway, and is not more than four risers above the outside grade.

Every exit doorway from each floor, other than the principal entrance, and every exit doorway where other doorways or openings may cause confusion in egress, shall be indicated by an approved illuminated sign bearing the word EXIT or OUT in plain letters not less than 5 inches in height.

Order 5406. 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 5403). The required width shall be kept clear and unobstructed at all times. Where loose chairs or seats in space adjoining a passageway would be liable to cause confusion or obstruction, such chairs or seats shall be fixed.

SECTION 3. PROTECTION OF VERTICAL COMMUNICATION.

Order 5407. Enclosure of Stairways and Shafts.

1. Stairways. In all buildings having a greater number of stories than the number given in the following table, all stairways shall be enclosed as specified in orders 5117 or 5118:

	Non-fire-proof, not sprinklered	Either fire-proof or sprinklered	Fireproof and sprinklered
Office buildings, and other buildings whose contents are practically incombustible.	3	4	5
All other factories, stores, and other business buildings.	2	3	4

Exceptions. (1) A three story mercantile building having at least two stairways may have one stairway unenclosed provided such stairway does not lead to the basement.

(2) A building of fireproof construction having at least two stairways may have one stairway unenclosed in the first and second stories provided such stairway does not lead to the basement.

(3) Stairways shall be enclosed in all buildings of more than two stories where inflammable material or any other especially hazardous condition is present.

A fire escape shall be provided on every building of more than two stories which does not have at least two enclosed stairways, or one enclosed stairway and a horizontal exit.

One enclosed stairway may serve as an exit for two divisions of a building if each division 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.

2. Shafts. In buildings more than two stories in height every elevator shaftway, dumbwaiter shaftway, pipe shaft and other similar vertical shaft shall be enclosed as follows:

(1) In buildings not more than three stories in height the enclosure shall consist of semi-fireproof partitions (order 5112), or better.

(2) In buildings more than three stories in height the enclosure shall consist of standard fireproof partitions (order 5109), or better.

The basement enclosure shall in no case be less than a standard fireproof enclosure (order 5109).

Every shaftway adjoining, or located in the same room or area with, an enclosed stairway shall be enclosed as required for the stairway, but in no case shall the enclosure be less than a semi-fireproof partition (order 5112).

Order 5408. Opening to Roof. 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.

Where such access consists of a scuttle in the roof, the opening shall be not less than 20 by 30 inches and there shall be a permanent ladder or stairway leading thereto.

Order 5409. Trap Doors and Floor Openings. 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 (order 5110), 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.

NOTE ON ELEVATORS AND ELEVATOR ENCLOSURES

For requirements governing the installation and operation of elevators, and the construction and protection of elevator shaftways, see the Elevator Code issued by the Industrial Commission, which code applies to all public buildings and places of employment.

SECTION 4. 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.

Note. For general requirements applying to exit lights see order 5115.

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.

Note. For general requirements applying to gas and oil lighting see order 5219.

For detailed requirements applying to the lighting of places of employment see the Industrial Lighting Code issued by the Industrial Commission.

SECTION 5. SANITATION.

Order 5410½. Sanitary Equipment.

1. TOILETS.

(a) Toilets Required. Toilet facilities shall be provided and maintained in connection with every public building and place of employment under this classification (see order 5400).

(b) Toilets in Public Buildings. In all public buildings under this classification, separate toilet rooms shall be provided for males and females, except as in order 5251 and as otherwise provided hereunder.

In public places where stimulating drinks, such as beer, wines and similar alcoholic beverages, are served for consumption on the premises, except in dining rooms, restaurants and similar places where the serving of such drinks is only incidental to the regular food service, toilet fixtures shall be provided in connection with the area served, for the sex (or sexes) served, as follows:

One water-closet for every 40 females, or fraction;

One water-closet for every 75 males, or fraction, and

Where there are more than 25 males accommodated there shall be one urinal for every 50 males, or fraction, in excess of 25.

The number of persons herein refers to the number of persons that may be accommodated at the same time, and shall be determined as for assembly halls under order 5506.

In toilet rooms (required above) used by males, all water-closets shall have projecting lip (or so-called elongated pattern) and open front self-rising (counter-weighted) seat without cover. In toilet rooms used by females, all water-closets shall have open front seat, without cover. All urinals shall be of the type (individual) and construction as under order 5260.

Note. Existing fixtures (water-closets and urinals) which are in serviceable and sanitary condition may be reused, or continued in use on the same premises under this order.

In public occupancies other than those where stimulating drinks (as defined above) are served for consumption on the premises, one water-closet shall be provided in connection therewith for each sex accommodated.

Exception. Under this classification, a small mercantile establishment where normally not more than ten patrons are expected to be on the premises at the same time need have in connection therewith only a toilet room to accommodate both the public and employes. Adequate public toilets may be provided in connection with a group of such small establishments under this exception.

(c) Toilets in Places of Employment. See order 2203.

(d) General Requirements. For general toilet room requirements (location, construction, ventilation, fixtures, etc.) see orders 5250 to 5264, inclusive.

Where toilet rooms used by males and females adjoin, the wall between such toilet rooms, if of studding with lath and plaster, the lath shall be of metal.

2. Drinking Water. Sufficient pure drinking water piped from mains or in sanitary containers shall be provided in connection with every public building under this classification, served by drinking fountains separate from other plumbing fixtures, or individual drinking cups, of a type approved by the State Board of Health, except in places where food or drink is served, and except in public buildings where normally not more than ten patrons are expected to be on the premises at the same time. Drinking fountains shall not be placed in toilet rooms.

For drinking water requirements as applied to places of employment, see order 2117.

See also Section 146.07 of the statutes of Wisconsin which prohibits the use of common drinking cups.

3. Washing Facilities. In every public building and place of employment, washbowls shall be provided in connection with toilet rooms, one for every two fixtures (water-closets and urinals), or fraction. Clean individual cloth or paper towels and soap shall be provided in connection with every laboratory installation. The installation of a towel for common use or the use of any common towel is not permissible.

See also orders 2213 to 2216, inclusive.

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Note. The following orders 2203, 2213, 2214, 2215, 2217, and 2218 are taken from the General Orders on Sanitation issued by the Industrial Commission. For further requirements on sanitation see that publication.

Order 2203. Number of Closets and Urinals. In every place of employment, whether heretofore or hereafter constructed, one water-closet shall be provided for every 20 persons, or fraction thereof, of either sex.

In addition thereto, where more than 10 males are employed, one urinal shall be provided for every 40 males, or fraction. Where not more than 10 males are employed, either a urinal shall be provided or the water-closet shall have a projecting lip and self-rising seat. Where trough urinals are used, each two feet of trough shall constitute one urinal.

Note. For general requirements applying to toilet rooms see orders 5250 to 5264, inclusive.

Order 2213. Toilet Room, Lavatories. Adequate washing facilities shall be provided in or near every toilet room. In new installations there shall be at least one lavatory for every five fixtures (closets and urinals) or fraction.

Note. One lavatory for every two or three fixtures is recommended.

Order 2214. Shop Lavatories. Adequate washing facilities shall be provided (1) in all industries where lead, arsenic or other poisonous or injurious materials are handled by the employes, and (2) in industries where food is prepared or manufactured, and (3) in glue factories, foundries, machine shops and other industries where the employes' hands become dirty or greasy, except that in industries of the last mentioned class, located in small towns, where employes go home at noon, this requirement may be waived by the Industrial Commission. In new installations there shall be at least one lavatory for every ten employes, or fraction, and hot water shall be provided. Basins or troughs for common use are prohibited.

Notes. (1) Washing facilities where the employe must necessarily wash in running water, are recommended. A large trough without stopper, where each person washes in running water from an individual faucet, is generally better than separate bowls.
(2) One lavatory or faucet for every five employes is recommended.
(3) Adequate washing facilities are recommended for all industries.
(4) Wash rooms should be constructed according to the requirements for toilet rooms, as far as possible.

Order 2215. All lavatories must be made of porcelain, enameled iron, or other impervious material.

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Order 2217. Drinking Water. Each place of employment must be supplied with sufficient pure drinking water and the faucets or outlets for same must be placed convenient to the employes. Common drinking cups are prohibited. Sanitary drinking fountains must be installed or individual cups must be provided by the employer.

Order 2218. Dressing Rooms. Dressing rooms shall be provided where women are employed in factories, stores, laundries, restaurants, and telephone, telegraph, express and railroad offices. Every dressing room shall be properly lighted, ventilated, and heated.

HEATING AND VENTILATION

For heating and ventilation in factories, office and mercantile buildings, etc., see the Heating and Ventilation Code issued by the Industrial Commission, which code applies to all public buildings and places of employment.

SECTION 6. FIRE PROTECTION EQUIPMENT.

Order 5411. Standpipes and Extinguishers. For exterior standpipes see order 5120.

Standard interior standpipes (order 5121) shall be provided in all buildings of more than two stories and more than 3,000 square feet undivided floor area, where inflammable material or any other hazardous condition is present, unless an approved automatic sprinkler system is provided. The hose shall be long enough to reach to all parts of the building, but no longer than 100 feet.

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 5122) shall be provided on each floor in place of each required interior standpipe.

Order 5412. Automatic Sprinklers. A complete automatic sprinkler system (order 5123) 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 story except as provided below.

In every such building where more than 50 persons are accommodated above the second story, 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.

Order 5413. Fire Alarm. An approved fire alarm system shall be provided in every factory or workshop where more than 10 persons are employed above the second story, except buildings which are provided with a complete automatic sprinkler system, and except fireproof buildings whose contents are practically incombustible.

SECTION 7. FLOOR CAPACITY.

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 placed in full view, on each floor.

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. Such notices shall be placed in full view, on each floor.

Chapter 7

THEATERS AND ASSEMBLY HALLS

SECTION 1. SCOPE AND CLASSIFICATION.

Order 5500. Theaters. In the theater classification, are included all buildings, or parts of buildings, used for theatrical, operatic or motion picture performances of a public nature.

Order 5501. Assembly Halls. In the assembly hall classification, are included all buildings, or parts of buildings, other than theaters, in which persons gather for entertainment, instruction, worship or dining purposes. Every assembly hall which has a capacity of not more than 100 persons as determined under order 5506 are exempt from the provisions of Chapter 7 (Theaters and Assembly Halls) of this code, but shall conform to the requirements of Chapter 6 (Factories, Office and Mercantile Buildings) and other general provisions of this code. Every assembly hall which has a capacity of more than 100 persons as determined under order 5506 shall comply with the requirements of Chapter 7 (Theaters and Assembly Halls) and all general provisions of this code.

Every assembly hall which is used for theatrical, operatic or motion picture performances of a public nature shall comply in all respects with the requirements for theaters.

SECTION 2. HEIGHT AND CLASS OF CONSTRUCTION.

Order 5502. Theaters. The entrance lobby of any theater shall not be at a higher level than three 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; the floor level at the lowest row of seats on the main floor shall not be more than 6 feet below, or above, the grade at the nearest exit.

Theaters which accommodate not more than 500 persons shall be of ordinary construction (order 5102), or better.

Theaters which accommodate more than 500 persons shall be of fireproof construction (order 5100) throughout, except as follows:

1. Structural steel supporting the roof only need not be fireproofed.

2. Structural steel balcony support need not be fireproofed in the enclosed space between the fireproof balcony floor, the fireproof ceiling under the balcony, and the walls, provided that if this enclosed space is used for ventilation ducts or chambers the interior shall be finished smooth and the floor shall be designed and built so that it can be walked on.

3. The roof shall be of incombustible construction throughout.

4. In theaters which do not accommodate more than 1,000 persons, the following exceptions apply:

(a) A wood floor not less than $1\frac{3}{8}$ inches in thickness may be placed over fireproof floor construction if there are no open spaces between the wood and fireproof floor, and provided further there is no balcony.

(b) The stage floor opposite the proscenium opening may be of mill construction wherein steel beams need not be fireproofed.

(c) The roof may be of wood construction, but shall have a fire resistive roof covering (order 5107).

In any theater, balconies which accommodate more than 100 persons shall be of fireproof construction.

Order 5503. Assembly Halls. Assembly halls which accommodate more than 1,000 persons shall be of fireproof construction (order 5100), except as follows:

1. Structural steel supporting the roof only need not be fireproofed.

2. Structural steel balcony support need not be fireproofed in the enclosed space between the fireproof balcony floor, the fireproof ceiling under the balcony, and

the walls, provided that if this enclosed space is used for ventilation ducts or chambers the interior shall be finished smooth and the floor shall be designed and built so that it can be walked on.

3. The roof shall be of incombustible construction throughout.

Assembly halls which accommodate not more than 1,000 persons shall be of ordinary construction (order 5102) or better, except that assembly halls accommodating not more than 750 persons may be built of frame construction (order 5103) provided the following conditions are complied with:

(1) The building shall not be more than one story in height nor more than 6,000 square feet in area.

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

(3) The building shall be at least 10 feet away from any other building or adjoining lot line.

(4) There shall be no balcony.

(5) There shall be no basement, other than boiler (or furnace) and fuel rooms of fireproof construction, except in places of worship.

(6) A frame assembly hall may be more than 6,000, but not more than 10,000, square feet in area if the floor is not below grade and not more than two feet above grade at any point, the building is not less than 100 feet from all buildings used for dwelling purposes and not less than 30 feet from all lot lines and other buildings, and the building complies in all other respects with the requirements applying to frame assembly halls.

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 fire proof 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 35 feet above the grade at the main entrance to the building.

In a one story assembly hall with not more than one tier of balconies, the roof and ceiling may be of combustible construction.

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.

Where not less than two smokeproof stair towers, or one smokeproof stair tower and one horizontal exit, are provided, assembly halls accommodating not more than 1000 persons (on basis of order 5506) may be placed in the fourth story of a building of fireproof construction, and in higher stories in such buildings if the capacity is reduced 100 persons for every story above the fourth.

A roof garden accommodating not more than 1,000 persons, and used for dining or dancing purposes only, may be placed on the roof of a fireproof building if not less than two widely separated and plainly designated smokeproof stair towers are provided.

A roof garden is an assembly hall located on the roof of any building having at least one half of the floor area either

open to the sky or covered with glass and metal skylight construction.

In any assembly hall, balconies which accommodate more than 150 persons shall be of fireproof construction (order 5100).

An assembly hall may be placed in the basement of a building under the following conditions:

1. In a building of ordinary or mill construction, if the capacity does not exceed 400 persons, provided that the floor level at not less than one-half of the required exit width is not more than 7 feet below grade and the highest exit level at such exits.
2. In a fireproof building if the capacity does not exceed 2500 persons.

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 door 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, but if the theater or assembly hall accommodates not more than 500 persons, such passageway shall be enclosed with unpierced fireproof or semi-fireproof ceiling, floor and partitions.

Every theater or public assembly hall which accommodates more than 300 persons shall have at least three walls abutting on streets, alleys, or open courts, except as follows:

- (1) If the building is not more than 100 feet long, and each aisle leads directly to an exit at the rear, then no side court will be required.
- (2) If the building is not more than 40 feet wide, and there is a cross aisle leading to a side exit at intervals no greater than every fifteenth row, then only one side court will be required.
- (3) If the first floor is fireproof and not more than 500 persons are accommodated, then only one side or rear court will be required.

The width of every exit court shall be at least 6 feet if the total seating capacity is not over 500 persons, and shall be increased at the rate of one foot per 500 persons additional. 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. SEPARATION FROM OTHER OCCUPANCIES.

Order 5505. Every theater or assembly hall built in connection with, or as a part of, any building used for other purposes shall be separated from such other parts of the building as follows:

(1) Theaters and assembly halls in fireproof buildings shall be isolated by unpierced masonry walls not less than 8 inches in thickness.

(2) Theaters and assembly halls in non-fireproof buildings shall be isolated by unpierced masonry walls designed as bearing walls.

There shall be no extra-hazardous occupancy, such as garage, chemical laboratory, storage of highly inflammable liquids and gases, or similar hazards, in the same building with a theater or assembly hall.

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

SECTION 5. CAPACITY.

Order 5506. Capacity. The capacity of a theater or assembly hall having fixed seats shall be established by the actual number of permanently fixed seats. Where fixed seats are not provided, the capacity shall be established by allowing 15 square feet of clear floor space per person in halls used as dining or dance halls only, or 6 square feet per person in all other halls. The seating capacity of assembly

halls having a combination of fixed seats and open floor spaces shall be established by the actual number of fixed seats, plus an allowance of 6 square feet per person for the open floor space.

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

SECTION 6. EXITS.

Order 5507. Number and Location of Exits. Every theater and assembly hall shall have two or more exits, placed as far apart as practicable, and so located that if any exit is blocked, some other exit will still be accessible from every part. Theater exits shall be distributed on all sides which adjoin streets, alleys or open courts.

When necessary, exits shall be increased in number to meet the requirements for minimum total width and distribution of exits.

This order shall apply separately to the following:

(1) The main floor of every theater and assembly hall.

(2) Each balcony which seats more than 50 persons if in a theater or assembly hall of non-fireproof construction.

(3) Each balcony which seats more than 150 persons if in a theater or assembly hall of fireproof construction.

(4) The stage, dressing room section and similar employe areas in every theater and assembly hall, except that access to a public portion of the building will be accepted as one of the required exits.

Order 5508. Type of Exits. The exits from any part of a theater or assembly hall shall be exit doorways, stairways or inclines.

All exits to grade from a higher or lower level shall be stairways or approved inclines. In all theaters, and in assembly halls having a capacity of more than 400 persons,

where the exit rise from sub-grade, or to a higher level, is not more than 3 feet, approved inclines shall be used. By approved incline is meant an incline located inside the building and having a slope of not more than 1 foot of rise in 6 feet. This requirement does not apply to the inclined floors of open courts.

Stairway exits shall be interior stairways or exterior enclosed stairways (order 5117); except that fire escapes may be used as exits from balconies for not exceeding one-half the required exit width.

Order 5509. Stairways. Every stairway in a theater or assembly hall, except stairways from the main floor to the first balcony, shall be enclosed as in orders 5117 and 5118. No storage closet shall be placed under any stairway.

Stairways and steps which have more than three risers shall have handrails on both sides.

Every stairway used by the public in a theater 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.

Note. For general stairway requirements see order 5116.

Order 5510. Fire Escapes. All fire escapes shall be "B" fire escapes (order 5120) except that "A" fire escapes may be used for balconies which accommodate not more than 100 persons.

Note. Fire escape stairways with solid platforms and treads, and covered by a roof, are recommended. Such stairways may be used as regular exits, thus adding to the comfort of the audience and also decreasing the danger of panic.

Order 5511. Exit Doorways and Doors. Every required exit doorway shall accommodate a standard exit door. The door in every required exit doorway shall be a standard exit door (order 5115).

No single door, or leaf of a double door, shall be more than 42 inches wide. No two doors shall be hinged together.

No rolling, sliding or revolving door shall be counted as an 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 exit doorways shall be level and flush with adjacent inside floors and inclines. Where an aisle or passageway leads to an exit from either side of the exit doorway there shall be a level floor space at the doorway subtending the width of the aisle and the doorway.

Order 5512. Exit Lights. In every theater and assembly hall, except assembly halls occupied only for purposes of worship, exit lights shall be provided over all exit doorways and in such other places as may be necessary to direct the audience, performers, and employes to exit doorways and to a street or alley. Such exit lights shall be either:

(1) Electric lights which comply with the requirements of the Wisconsin State Electrical Code shall be installed where electric current is available.

(2) Where electric current is not available approved fixed gas lights, or oil lamps using non-volatile oil and floating wick, properly shielded from drafts and from adjacent woodwork or other combustible material, shall be provided.

Every light over an exit doorway shall be a red illuminated sign bearing the word EXIT or OUT in plain letters not less than 5 inches in height.

All exit lights shall remain lighted throughout every performance and until the audience has left the building.

Order 5513. Width of Exits. The total width of exits from every theater and assembly hall, and from every part thereof, shall be not less than the following:

Theaters and assembly halls, non-fireproof, 40 inches per 100 persons.

Theaters and assembly halls, fireproof (except roof), 36 inches per 100 persons.

In theaters, the width of the front entrance, or entrances, shall be not less than one-third of the total required exit width.

In buildings of fireproof construction where the exit doorways from the auditorium lead into isolated foyers, lobbies, or other approved enclosed passageways, the above exit width requirements as applied to such space, and the exits leading therefrom, may be reduced 25 per cent. The foyers, lobbies and passageways in such case shall be isolated from the auditorium by standard fireproof partitions, or better, and from other occupancies by approved unpierced 8 inch masonry walls, and the floor space therein shall be not less than one square foot for each seat in the auditorium.

SECTION 7. SEATING.

Order 5514. Seating. All seats, chairs and benches shall be placed not less than 32 inches from back to back measured horizontally. 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 or chairs may be fastened together in groups of four or more.

Loose chairs or seats shall not be used unless a special permit is secured from the Industrial Commission.

The requirements of this order do not apply to restaurants, dining or dance halls.

There shall not be more than 12 seats in a row between aisles, nor more than 6 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 seat bench, or other platform or floor area on which seats are placed, shall be nearer the ceiling than 8 feet.

SECTION 8. AISLES AND PASSAGEWAYS.

Order 5515. 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 5516. Passageways and Foyers. Passageways and foyers shall be of width required under order 5513, 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 shall be at least equal in combined width to the required width of the stairways, passageways, aisles or doorways leading to them, except as in order 5513.

Order 5517. Inclines and Aisled Steps. To overcome any difference in level between courts, corridors, lobbies, passageways or aisles required, or used, in egress from an assembly hall, approved inclines (order 5508) shall be employed where the difference in elevation does not exceed 3 feet, except that this requirement need not apply to balconies.

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

Order 5518. Obstruction. All lobbies, aisles, passageways and doorways shall be kept free from furniture, drapes, display equipment, merchandise, vending devices and other obstructions, and no person except an employe shall be allowed to stand in, or occupy, any of the aisles, passageways, corridors or lobbies during any performance or public gathering; except that in entrance lobbies the space may be divided by rails set up in the direction of travel in an approved manner for the regulation of ingress and egress; and except that any excess space in lobbies, foyers and passageways may be set off by rails and used as waiting space, or for other approved purposes.

Order 5519. Mirrors, False Openings. No mirror shall be placed in any part of the theater or assembly hall used by the general public except in the retiring or toilet rooms for men or women.

No false opening or decorative device 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.

SECTION 9. ELEVATORS.

Order 5520. All elevators shall be enclosed with standard fireproof enclosures (order 5109). (See elevator code issued by the Industrial Commission).

SECTION 10. STAGES.

Order 5521. Stage Separation. In every theater, and in every assembly hall having a capacity of more than 300 persons, the stage shall be separated from the auditorium by an incombustible wall, designated as the proscenium wall, except as follows:

1. In a theater or assembly hall an open stage or platform not more than 12 feet in total depth of floor will be permitted without a proscenium wall separation from the auditorium, provided the stage or platform is not more than 6 feet higher or wider than the proscenium opening, and the rear wall, side walls and the ceiling are of semi-fireproof construction (orders 5112 and 5113).

2. In assembly halls built in connection with schools, churches or lodge and similar society buildings, an open stage or platform will be permitted without the proscenium wall separation from the auditorium, provided the stage, or platform, is not more than 6 feet higher or wider than the proscenium opening.

3. In theaters and assembly halls having a capacity not exceeding 500 persons, the proscenium wall shall be a semi-fireproof partition (order 5112) or better.

Order 5522. Proscenium Wall. The proscenium wall shall be built of materials and workmanship required for bearing walls, shall extend from incombustible foundation, or the lowest fireproof floor below the stage floor, to the boards or sheathing of the highest adjoining roof, and shall completely separate the stage from the auditorium. If of masonry, the proscenium wall shall be not less than 8 inches in thickness and shall extend not less than 2 feet above the highest adjoining roof. There shall not be more than two openings in the proscenium wall below the level of the auditorium floor, and there shall not be more than two openings, other than the proscenium opening, in the proscenium wall above the auditorium floor level, except that in addition to the above openings there may be one opening to provide access through the proscenium wall to the orchestra pit. Each such opening shall not exceed 21 square feet in area, and shall be protected by an approved standard fire door.

Order 5523. Proscenium Curtain. Where a proscenium wall is required for the separation of a stage from an auditorium, the proscenium opening shall be provided with a rigid fireproof curtain or a curtain of asbestos conforming to the following specifications, or of equivalent approved construction. Detailed plans and specifications for such curtains and their operating mechanism shall be submitted to the Industrial Commission for approval before installation.

Asbestos curtains shall be substantially woven of asbestos fiber not less than 95 per cent pure, and shall weigh not less than $2\frac{1}{2}$ pounds per square yard. All seams shall be vertical, shall be lapped not less than one inch and shall be sewed in two rows with not less than $\frac{1}{16}$ inch pure asbestos twine. At the top and bottom of the curtain a $2\frac{1}{2}$ inch (or larger) steel 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 12 inches at each side and at the top, and shall be guided at each side by metallic loops or rings sliding on a $\frac{3}{8}$ inch steel cable or No. 6 U. S. Standard gauge wire. No combustible paint shall be used on proscenium curtains.

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. Appropriate limit chains shall be provided to stop the downward travel of the top of the curtain at a line not less than 12 inches above the top of the proscenium opening. No part of a curtain, nor any of the curtain guides or equipment, 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.

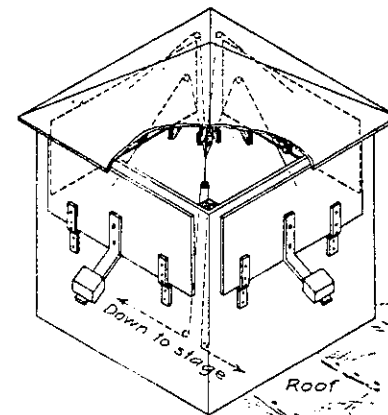
Besides the regular operating mechanism, there shall be an emergency device which will allow the curtain to drop by gravity. The device shall be so arranged that it can be easily operated by hand from each side of the stage and from the fly galleries, and also that its operation will be controlled by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

Order 5524. Automatic Smoke Outlet. Where a fire-proof proscenium curtain is required, or provided, the stage shall be provided with one or more automatic smoke outlets placed near the center and above the highest part of the stage, with the bottom of the opening at least 3 feet above the roof, and having a combined area equal to not less than 8 per cent of the area of the stage floor. Vertical louvre openings shall be not less than twice the sectional area of the shaft. The smoke outlet 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, or other approved heat release devices, shall be inserted in each cord near the outlets.



VIEW OF WOODEN STRUCTURE

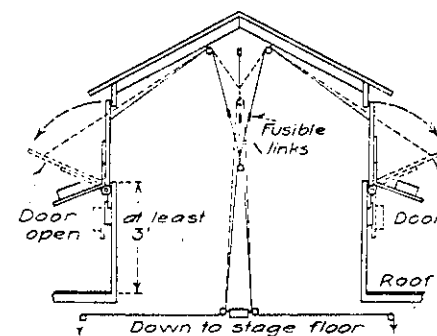
Total area of openings not less than area of shaft.

Doors held closed by cords (shown dotted).

Fusible links release doors in case of fire.

This structure may be made of wood, or of corrugated iron on metal frame (see below).

If door is made of wood, it must close against the frame, not into it, so as to prevent binding.



SECTION OF WOODEN STRUCTURE

AUTOMATIC SMOKE OUTLET

Frame of structure

Clearance

Door

Clearance

METAL STRUCTURE

Order 5525. Stage Vestibules. All entrances to the stage shall be vestibuled in such manner as to protect the curtain, scenery, and auditorium from drafts of air.

Order 5526. Footlight Trough. The footlight trough shall be made of incombustible material.

Order 5527. Fireproof Paint. All stage scenery, curtains, and decorations made of combustible material, and all woodwork in or about the stage, shall be painted or saturated with some incombustible material or otherwise rendered safe against fire.

SECTION 11. STAGE ACCESSORY ROOMS.

Order 5528. All dressing rooms, property rooms, and other storage or workrooms shall be built of incombustible material throughout, and shall be separated from the stage by standard fireproof enclosures (order 5109), or better.

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 unless separated therefrom by unpierced 8 inch masonry walls and unpierced fireproof floors and ceilings.

SECTION 12. FIRE PROTECTION.

Order 5529. Isolation of Hazards.

1. **Boiler and Furnace Rooms.** Every boiler or furnace room, including breeching and fuel room, shall be enclosed with brick walls not less than 8 inches in thickness, or equivalent, fireproof ceiling and floor, except that in the case of an assembly hall accommodating not more than 300 persons, the floor of the boiler or furnace room shall be incombustible and the walls and ceiling shall be of semi-fireproof construction (orders 5112 and 5113), or better.

2. **Sound-Producing Equipment.** Sound-producing equipment shall be housed by means of wall, floor and ceiling construction, and protected openings, as required for motion picture booth construction. Where sound-producing, or similar equipment, is housed in the motion picture booth the arrangement of all equipment in the booth shall be such as to permit of free movement around all moving parts.

Note. For general fire protection requirements see orders 5210 to 5220, inclusive.

SECTION 13. LIGHTS AND LIGHTING.

Order 5530. Electricity, Oil and Gas. Electric lights shall be used for lighting where electric current is available. 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.

In all theaters and assembly halls, all stairways, passageways, and exit doors shall be properly lighted and shall remain lighted throughout every performance or entertainment and until the audience has left the building.

SECTION 14. SANITATION.

Order 5532. Sanitary Equipment.

1. **Toilets.** Separate toilet rooms in connection with the auditorium shall be provided for males and females. One closet shall be installed for each 200 females or fraction, and one closet and one urinal for each 300 males or fraction, assuming the audience to be equally divided between males and females; except that in dance halls there shall be provided one water-closet for each 100 females or fraction, one urinal for each 150 males or fraction and one water-closet for each 300 males or fraction. Where stimulating drinks, such as beer, wines and similar alcoholic beverages, are served for consumption on the premises, there shall be provided one water-closet for every 40 females, or fraction, one water-closet for every 75 males, or fraction, and one urinal for every 50 males, or fraction; except that where the capacity in such places exceeds 300 persons, the ratio of number of fixtures to number of persons accommodated in excess of 300 need be only one-half of the above.

There shall be separate water-closets provided for males and females in connection with the stage of every theater which accommodates more than 500 persons.

Note. In theaters where motion picture machines are run continuously for a period of more than two hours without at least ten minutes intermission for the motion picture machine operator for each two hour period, toilets should be provided in direct connection with the motion picture booth. The operator should always be where the machines are in plain view, with control so arranged, direct and remote, that the power may be cut off instantly in emergency.

Consult the Industrial Commission for alternate where toilets cannot be installed.

For general toilet room requirements see orders 5250 to 5264, inclusive.

2. **Drinking Water.** Separate drinking fountains of a type approved by the State Board of Health shall be provided for the stage and auditorium where water supply is available. Drinking fountains shall not be placed in toilet rooms.

3. **Washing Facilities.** Washbowls shall be provided in connection with toilet rooms, one for every two closets and urinals, or fraction.

NOTE ON HEATING AND VENTILATING.

For heating and ventilation in theatres, assembly halls, etc., see the Heating and Ventilation Code, issued by the Industrial Commission, which applies to all public buildings and places of employment.

SECTION 15. FIRE PROTECTION EQUIPMENT.

Order 5533. Standpipes. If proper water supply is available, one or more standard interior standpipes (order 5121) shall be provided on the stage of every theater and every assembly hall which has a stage. Each hose shall be not more than 75 feet long, and where such hose will not reach all parts of the stage section (including dressing, property, storage and work rooms) additional hose connections and hose, or additional standpipes, shall be provided.

Order 5534. Fire Extinguishers. Standard fire extinguishers (order 5122) shall be provided as follows:

All theaters, including motion picture theaters:

Two on stage (if more than 1,500 square feet of scenery is used).

One on stage or platform (if not more than 1,500 square feet of scenery is used).

One in motion picture booth, or in ticket office if there is no booth.

One in dressing room section.

Assembly halls:

One on or near stage or platform.

One in or near ticket office (if capacity of hall is more than 500 persons).

Extinguishers shall be properly exposed to view and always accessible.

Order 5535. Automatic Sprinklers. Where the capacity is more than 600 persons, approved automatic sprinklers (order 5123) shall be provided on the stage, under the stage, under the fly galleries, and under the stage roof, but not in the automatic smoke outlet, as follows:

1. In every theater.

2. In every assembly hall where proscenium curtain is required.

Order 5536. Fire Alarm. In every case where an automatic sprinkler system is required in connection with the stage in a theater or assembly hall, an automatic alarm shall be installed in a manner so that there will be immediate warning of the release of any sprinkler head. Where a regular fire department is maintained in the community the alarm shall be connected to a fire department station.

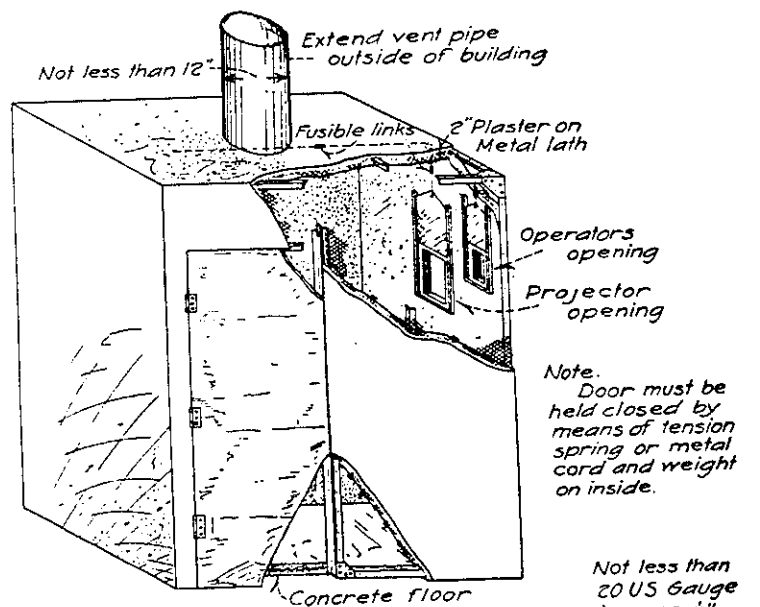
SECTION 16. MOTION PICTURE MACHINES AND BOOTHS.

Order 5540. Definitions. By the term MOTION PICTURE MACHINE as used in this code is meant any projection apparatus using flammable film.

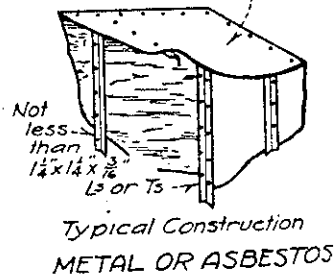
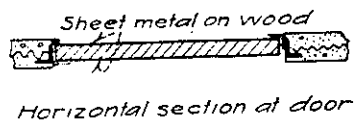
By the term BOOTH is meant the housing or room in which motion picture machines and equipment are placed to confine flames, smoke, fumes and gases which may be produced by the accidental ignition of combustible film or other cause within such housing or room.

Order 5541. Construction of Booth. Every picture machine using a nitro-cellulose or other inflammable film shall, before being operated, be installed in a booth constructed entirely of fire resisting material, such as brick, tile, concrete, two inch plaster on metal lath and metal frame or of

sheet iron or asbestos sheathing as specified below; provided that approved types of portable motion picture machines may be used without a booth in factories and offices where employes are assembled for instructional purposes, or in assembly halls having a floor area of not more than 1,200 square feet, where not more than two exhibitions are given each month. In every case where a booth is not used a tight metal cabinet shall be provided and used for storing metal containers of films not in use.



METAL FRAME-PLASTER BOOTH



MOTION PICTURE BOOTHS

Note. No portable motion picture machine will be approved which does not have an incombustible housing (metal or asbestos board or equivalent) and which does not provide for automatically insulating or cutting off the light and heat from the film and operating mechanism when the same is not in motion for projection purposes. The exception permitting approved portable motion picture machines to be used without booths, under the restrictions given above, is made in favor of educational exhibitions. If such machines are used without observing these restrictions, the parties responsible will be held liable for the full penalty provided by statutes. Should experience demonstrate that the restrictions are frequently violated, the exception will be repealed.

Every booth made of sheet iron or asbestos sheathing shall have its frame constructed of not less than $1\frac{1}{4}$ x $1\frac{1}{4}$ by $\frac{3}{16}$ inch steel angles or tees, properly braced to secure rigidity, 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 lumber, securely riveted or bolted to the frame. No sheet metal booth shall be placed nearer to any combustible partition, wall, or ceiling, than 12 inches.

The floor shall be constructed of the same material as the sides and top, or of concrete. If the floor is made of sheet metal, it must be well riveted, or bolted to frame, and covered with a rubber or cork matting.

The ceiling height in a motion picture booth shall in no case be less than 7 feet.

Order 5542. Doors. The door to the motion picture booth shall not be larger than required for safe and proper use and maintenance of the booth and equipment, but in no case larger than 3 feet by 7 feet, and except that the top of the door shall be not less than 12 inches below the ceiling of the booth. The door shall be either of the same construction as the booth walls, or shall be not less than $\frac{3}{4}$ inch in thickness and clad on both sides with fire resistive metal not less than No. 28 U. S. Standard gauge. The door shall swing outward, and shall be self-closing, either by means of a metal rope and weight or by an approved door closer.

Order 5543. Openings. The openings for the operator's view, for the projection apparatus and for similar purposes, shall not be larger than required for the proper operation of the equipment in the booth. All openings in booth walls, other than the entrance or exit doors, and openings in exterior walls of the building, shall be provided with gravity shutters of not less than No. 12 U. S. Standard gauge

metal. The gravity shutters shall be arranged to operate easily and quickly in substantial guides consisting of No. 12 U. S. Standard gauge metal for cover plates and No. 8 U. S. Standard gauge metal filler plates, or equivalent construction. The shutters shall be held open by cords and fusible links so arranged that if one of the shutters is caused to be released under heat action every shutter will drop by gravity action alone and automatically and effectively close the openings. The cords and fusible links shall be so arranged that there will be at least one link in each shutter support and at least one link at, or directly over, each possible source of heat or flame. The shutters shall not be blocked or held open in any manner except as herein described or approved in writing by the Industrial Commission.

Order 5544. Ventilation of Booths.

1. Ventilation. Every booth or room housing projection, sound or any other equipment which vitiates good air conditions or requires the attention of an attendant shall be ventilated as required under the provisions of order 5841 of the Heating & Ventilation Code, issued by the Industrial Commission.

2. Exhaust Ventilation. Fumes, gases and other harmful contamination shall be effectively removed by mechanical exhaust ventilation direct from the source, including projectors, spotlight, stereopticon and similar equipment, and discharged to the outside air or to an approved disposal system. A single exhaust system, including the exhaust unit and connecting ducts, shall be arranged to serve all the sources of harmful contamination in a booth or area, and there shall not be more than one exhaust system in such booth or area.

3. Air Supply. In every booth or room which is required to have mechanical exhaust ventilation, provision shall be made for a supply of fresh tempered air to replace the vitiated air exhausted. The supply of air to a booth or room shall be accomplished in one of, or a combination of, the following methods:

(a) The ventilation system for the building may be arranged to supply air for the booth or room if the inlet opening is protected with an approved shutter having quick acting fusible links, or other approved heat release devices, which will automatically and quickly close the inlet opening simultaneously with the openings in the front of the booth.

(b) A separate supply system, such as a unit ventilator, if the equipment is arranged so that the air supply will be stopped automatically and simultaneously with the closing of the openings in the front of the booth.

(c) Gravity intake, from a source of fresh air, arranged so that the air will be properly tempered before it reaches the booth or room.

(d) Where approved in writing by the Industrial Commission, the air supply may be taken by infiltration through openings in the booth walls, from the auditorium or other space adjoining the booth.

Note. For general requirements applying to ventilation of motion picture booths see order 5841 of the Heating and Ventilation Code issued by the Industrial Commission.

Order 5545. Relief Outlets. Every booth or room housing projection, sound or any other equipment which constitutes a fire, smoke, explosion or fuming hazard shall be equipped with one or more gravity outlets extending from the ceiling vertically through the roof. The net area of such gravity relief outlets shall be not less than one per cent of the room or booth floor area. Such outlets shall be constructed as sheet metal ducts having double walls with $\frac{1}{2}$ inch air space between, or better construction, and shall not be nearer than 18 inches to any combustible material. The relief outlets shall be equipped, at the booth or room outlets, with a gravity shutter which will open automatically under excessive heat conditions. The automatic shutter shall normally be tightly closed where mechanical exhaust ventilation is required in the same room.

Note. The purpose of the relief outlet is to afford an outlet for smoke, fumes and burning gases in case of fire. The relief outlet should in no case be designed as a fresh air intake or gravity vent.

Order 5546. 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.

Order 5547. Motion Picture Machine. Every motion picture machine shall be provided with feed and take-up 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 5548. Fire Protection in Booth. Incombustible magazines shall be used for receiving and delivering the films during the operation of the motion picture 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, except the films used in operation, shall be permitted in the booth.

No smoking shall be permitted in any booth.

Order 5549. Portable Booths. Every portable booth used to confine the fire hazards of a motion picture machine shall be of approved design conforming to the requirements for permanent booths.

Every booth used for more than three consecutive performances in one location will be considered a permanent booth.

Chapter 8

SCHOOLS AND OTHER PLACES OF INSTRUCTION

SECTION 1. SCOPE.

Order 5600. The requirements of this chapter, orders 5600 to 5618, inclusive, shall apply to 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 one story, but not more than two stories, in height, and every one story building within the fire limits of a city or village, shall be of ordinary construction (order 5102), or better.

Every building which is more than two stories in height shall be of fireproof construction (order 5100), except that in a three story building ordinary construction (order 5102) may be used above the third floor level.

Order 5603. First Floor Fireproof. In all two-story buildings having more than four class, study, or recitation rooms of ordinary size (500 square feet in area) on any floor, the first floor shall be of fireproof construction

(order 5100) unless all of the stairways and corridors throughout the building, including stairs, walls, ceilings and floors, are of fireproof construction. In all other two-story buildings, the basement ceiling shall be of semi-fireproof construction (order 5113) or better.

Order 5604. Subdivisions and Fire Stops. 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 (order 5108), and all communicating openings shall be protected by standard fire doors (order 5110). If such openings are used as a means of egress, they shall be kept normally open during the occupancy of the building.

In primary and grammar schools, the girls' and boys' portions of the basement shall be separated by a standard fireproof partition (order 5109) in which there shall be no opening except a door for the use of the janitor, kept normally closed.

SECTION 3. EXPOSURE AND COURTS.

Order 5605. No wall containing windows which light a school or classroom 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. EXITS.

Order 5606. Number, Location, and Type of Exits. 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 classroom, and from every other room used by the public or by the occupants generally.

Exception. In a high school, college, library or museum building, not more than two classrooms may be placed between the exit and the end of the corridor.

In a one-room building, only one exit will be required. In a one-story two-room building, only one exit will be required, provided all basement partitions are of incombustible material and the boiler, or furnace, room door is a standard fire door (order 5110).

At least one-half of the required exits, in buildings of more than one story, shall be stairways as described in order 5116. The remaining exits shall be either stairways or horizontal exits (order 5119); fire escapes may be used as exits from the temporary end of incomplete or unit type buildings, or as approved in writing by the Industrial Commission. 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 story, there shall be at least two stairways. In buildings of more than two stories, the stairways shall be enclosed as in orders 5117-5118, unless the stairs and the corridors (including finish floors) are incombustible.

Closets shall not be placed below stairways.

Handrails shall be provided on both sides of all exit stairs used by pupils.

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

Order 5607. Total Width. The total width of exits from any floor shall be 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 building, 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 5403.

Standard fire escapes (order 5120) 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 5608. Exit Doors. Exit doors shall be as required in order 5115, 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 5607. 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 5609. Passageways. Corridors and passageways shall be so designed as to prevent congestion and confusion and shall be provided with windows and artificial light so as to be kept well lighted while building is occupied.

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 the stairways (order 5607) 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 5. SCUTTLE.

Order 5610. Access to Attic and Roof. Every building more than one story in height shall have permanent means of access to the roof and attic space from inside the building. Where a scuttle opening is provided the opening shall be not less than 20 x 30 inches, and there shall be a permanent enclosed stairway or ladder leading thereto.

SECTION 6. ROOMS.

Order 5611. Floor Space and Height of Ceiling. The minimum floor space of any schoolroom shall be:

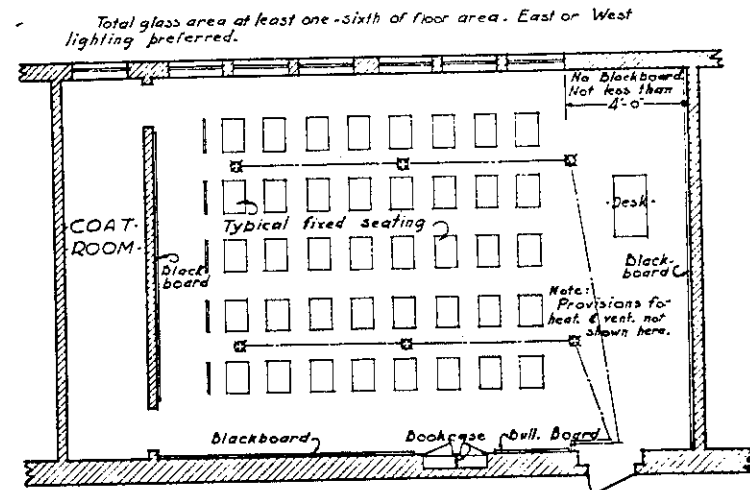
For primary grades, to and including fifth grade, 14 square feet per person.

For all other schoolrooms, 16 square feet per person.

All class, recitation and study rooms, not including manual training, domestic science and other vocational rooms, shall be not less than 12 feet high in the clear. Manual training, domestic science and other vocational rooms shall be not less than 10 feet high in the clear. All other rooms shall be not less than 8 feet high in the clear.

Note. The following are recommended by the Department of Public Instruction:

- (1) Each classroom should be large enough to accommodate forty-five pupils and should be at least 23 feet wide by 32 feet long.
- (2) Eight feet should be reserved at the end of the room for the use of the teacher. The corresponding wall space may conveniently be provided with a blackboard to contain programs, etc. The teacher's desk



A · TYPICAL · GRADE · CLASS · ROOM · 23x32 ·

should always be placed at the end of the room and not on the long side. At the front of the room, eight feet of blank wall should be left between the front corner and the first window.

In classrooms lighted from the side only, the blank wall just mentioned may be reduced to four feet; the first window should then be

vided with a shade for use on bright days. Windows should extend as close as possible to the rear corner. The ceiling height should be 12½ or 13 feet so as to give a glass ratio of at least 1:5½. This amount of glass area is especially necessary where electric current is not available.

(3) Blackboards should be from 24 inches (for primary grades) to 30 inches (for upper grades) above the floor, and from 36 to 48 inches high. Slate blackboards are best. A wide aisle should be provided next to all blackboards.

Note on Windows. For window requirements see orders 2175 to 2180, inclusive, of the School Lighting Code issued by the Industrial Commission.

Order 5612. Basement Rooms. No class, recitation, or study room (not including manual training or domestic science rooms) shall have its floor more than 2 feet below the adjoining grade. Manual training and domestic science rooms, toilet rooms, and other rooms used by pupils (not including play rooms) shall have ceilings at least 4 feet above grade. The walls and floor of every basement room used by pupils or students, shall be waterproof and damp-proof.

SECTION 7. ASSEMBLY HALLS.

Order 5613. A room which seats or accommodates 100 or more persons shall be governed by the requirements of Chapter 7 (Theaters and Assembly Halls) of this code, except as follows:

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 Chapter 7.

SECTION 8. SEATS, DESKS AND AISLES.

Order 5614. 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; or seats shall be fastened together in groups of four or more, or in groups of two seats and two desks.

Class and schoolrooms shall have aisles along all walls.

In primary rooms, intermediate aisles shall be not less than 18 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 schoolrooms, intermediate aisles shall be not less than 20 inches and wall aisles not less than 3 feet in width.

Where rooms are used for public assembly, seats and aisles shall conform to the requirements for assembly halls as in orders 5513-5517.

SECTION 9. BOILER AND FURNACE ROOMS.

Order 5615. In every building more than one story in height, every boiler room, furnace room, fuel room and laundry shall have fireproof floors and ceilings, walls of substantial incombustible material not less than 8 inches in thickness, and all openings shall be protected by standard fire doors (order 5110). All such rooms shall be effectively separated from all stairways and other vertical communication leading to one or more upper floors.

SECTION 10. SANITATION.

Order 5616. Sanitary Equipment.

1. Toilets. School buildings shall have the following toilet equipment.

(a) In high schools, one water-closet for every 20 females or fraction.

One water-closet for every 35 males or fraction and one urinal for every 20 males or fraction.

(b) In junior high and elementary schools, one water-closet for every 15 females or fraction, one water-closet for every 30 males or fraction and one urinal for every 20 males or fraction.

2. Drinking Water. A drinking fountain shall be installed in each story and basement, for each 6,000 square feet of floor area, or fraction. Drinking fountains shall not be installed in toilet rooms.

3. Washing Facilities. Lavatories shall be provided in connection with toilet rooms in the ratio of one lavatory for every two fixtures (closets and urinals).

4. Cloakrooms and Wardrobes. In every school building, there shall be provision for the placing and storage of the wraps of occupants. Such provision shall consist of wardrobes, lockers, cloakrooms, or other facilities, constructed and arranged in a manner to insure and facilitate the ventilation and sanitation of contents.

Note. For general toilet requirements see orders 5250-5264, inclusive.

NOTE ON HEATING AND VENTILATION.

For heating and ventilation in schools, libraries, etc., see the Heating and Ventilation Code, issued by the Industrial Commission, which code applies to all public buildings and places of employment.

SECTION 11. LIGHTING.

Order 5617. Artificial Lighting. Each classroom of standard size (32 feet long by 23 feet wide) shall be equipped with at least six artificial lighting units symmetrically spaced.

Where electric service is available at least one circuit of 15 amperes capacity (see Wisconsin State Electrical Code) shall be supplied to each standard classroom.

Note. For general requirements which apply to the natural and artificial lighting of schools, see order 2175 to 2189, inclusive, of the School Lighting Code issued by the Industrial Commission.

SECTION 12. FIRE PROTECTION EQUIPMENT.

Order 5618. Fire Extinguishers. In every building, standard chemical fire extinguishers (order 5122) shall be provided in the proportion of one extinguisher to each 3,000 square feet, or fraction, of floor area in non-fireproof buildings, or one to each 8,000 square feet, or fraction, of floor area in fireproof buildings; but there shall be at least one fire extinguisher on each floor including basement. In addition to the fire extinguishers for general protection, there shall be at least one extinguisher of appropriate type

and size in each laboratory, shop or other vocational room. Every fire extinguisher shall be prominently exposed to view and always accessible.

Order 5619. Fire Alarms. Every building two stories or more in height shall be provided with a proper alarm or gongs which can be operated from any story, including basement, and can be heard throughout the building. Such alarm system shall be tested at least once a week.

Chapter 9

APARTMENT BUILDINGS, HOTELS AND PLACES
OF DETENTION

SECTION 1. SCOPE.

Order 5700. Scope. The requirements of this chapter, orders 5700 to 5726, inclusive, shall apply to all apartment buildings, rooming houses, hotels, club-houses, dormitories, convents, hospitals, asylums, jails and other places of abode or detention.

By PLACE OF ABODE is meant a building, or part of a building, such as an apartment building, rooming house, hotel, club-house, dormitory, convent, hospital, as follows:

- (1) Occupied as the residence of three or more families living independently, or occupied by two such families and also used for business purposes, or
- (2) Occupied for sleeping or lodging purposes by three or more persons not members of the same family.

By PLACE OF DETENTION is meant a building, or part of a building, used as a place of abode and wherein persons are confined by locked or barred doors or windows, such as asylums and jails.

SECTION 2. CLASS OF CONSTRUCTION AND FIRE STOPS.

Order 5701. Class of Construction. All places of abode which are more than three stories in height shall be of fireproof construction (order 5100).

All places of detention shall be of fireproof construction (order 5100).

Hospitals of three or more stories shall be of fireproof construction (order 5100).

All three story places of abode, other than hospitals and places of detention, shall be of ordinary construction (order 5102), or better, except that a three story apartment building which accommodates only one family on each floor may be of frame construction (order 5103), except as in order 5702, if not within the fire limits of any municipality.

Order 5702. First Floor Fireproof. In three story buildings, the first floor and all members supporting the same shall be of fireproof construction (order 5100); 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 (order 5100) or semi-fireproof (order 5113); in such cases the spaces between floor joists, below or above stud partitions, shall be fire-stopped with incombustible material extending the full height of the joists and the full thickness of the partition.

Order 5703. Garage and Business Separation. In every building in which a lower story is used for garage purposes, the ceiling over the garage shall be of unpierced fireproof construction (order 5100).

In a building more than two stories in height where a lower story is used for business purposes, other than the hazards listed in Chapter 10 of this code, the ceiling shall be semi-fireproof (order 5113) or better.

Order 5704. Corridor and Dividing Partitions. In every building which is more than two stories high and which has more than one apartment or light rooms on any floor, the public passageways shall be enclosed with fireproof or semi-fireproof partitions (orders 5109, 5112); if there is more than one apartment on any floor, such apartments shall be separated by such partitions; if there are more than eight rooms on any floor, they shall be divided by such partitions into groups of not more than eight rooms each.

Doors in corridor partitions which are permitted to be of semi-fireproof construction need not be self-closing.

Order 5705. Court Walls. The walls of courts and similar shafts for light and air shall be standard fireproof enclosures (order 5109), or better, except that when the build-

ing is permitted to be of ordinary construction the court walls shall be semi-fireproof (order 5112) or better.

SECTION 3. YARDS.

Order 5706. 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.

No apartment house shall be placed behind any other building. Every apartment house shall abut on a street and the front wall shall be at least 25 feet from the center of the street.

Note. For minimum size, etc., of courts, see orders 5203-5206, inclusive.

SECTION 4. EXITS.

Order 5707. Number, Location and Type of Exits. There shall be at least two exits accessible from each room or apartment, and such exits shall be at least 30 feet apart, measuring along the shortest line but not piercing any fireproof partition or wall. 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 apartment; 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.

Exceptions. In a fireproof building, or in a two-story non-fireproof building, not more than four double rooms, or any arrangement of rooms not exceeding 800 square feet in area, may be placed between an exit and the end of the corridor.

At least one-half of the required exits, in buildings of more than one story, shall be stairways (order 5116).

The remaining exits shall be either stairways, or horizontal exits (order 5119); or fire escapes may be used as exits from floors which are not more than 40 feet above grade. Every building which accommodates more than one family or eight persons above the second story shall have at least two stairways.

Fire escapes for hospitals and asylums shall be "B" fire escapes.

Order 5708. Aggregate Width of Exits. The aggregate width of exits shall be as provided in order 5403.

Note. Stairways and doors of minimum width will be found sufficient to comply with this order except in large hotels.

Order 5709. Exit Doors. Exit doors shall be as specified in order 5115; except that a door which is used by not more than six families or 40 persons, shall be not less than 3 feet wide and shall not be required to open outward.

Order 5710. 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.

Order 5711. Lighting of Exits. In every building which accommodates more than 4 families or 30 persons, and in every building which accommodates transients, 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 exits, and at the head and foot of every stairway. The lights at emergency exit doors shall be red lights and shall be accompanied by a sign bearing the words "exit" or "out", in plain letters.

Note. For general requirements applying to gas and oil lighting see order 5219.

SECTION 5. PROTECTION OF VERTICAL COMMUNICATION.

Order 5712. Enclosure of Stairways and Shafts.

1. Enclosure of Stairways. In three-story buildings, all stairways shall be enclosed, as in order 5117 or 5118, with semi-fireproof partitions (order 5112), or better, unless the building is either of fireproof construction or equipped throughout with automatic sprinklers. The doors may be omitted in the stories above the basement in one stairway enclosure. In all three-story buildings accommodating more than two families or 15 persons above the first story, all basement stairways shall be enclosed with standard fireproof partitions (order 5109).

In buildings more than three stories in height, all stairways shall be enclosed with standard fireproof partitions (order 5109); except that in buildings of fireproof construction one stairway may be unenclosed in the first and second stories, provided such stairway does not lead to the basement.

In all buildings more than two stories in height in which the first story is used for business purposes, at least one stairway shall be enclosed in the first story with an unpierced 8 inch masonry wall and such stairway shall not connect with the basement.

In apartment houses, outside stairways may be counted as exits if covered by a roof. If more than one family is accommodated above the second 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 two families are accommodated above the second story, the adjoining doors and windows shall be protected as in order 5120-1.

2. Enclosure of Shafts. In buildings more than two stories in height, every elevator shaftway, dumbwaiter shaftway, pipe shafts and other similar vertical shafts shall be enclosed as follows:

(a) In buildings not more than three stories in height, with semi-fireproof partitions (order 5112), or better.

(b) In buildings more than three stories in height, with standard fireproof partitions (order 5109).

That portion of a required shaftway enclosure which passes through a business portion shall be an 8 inch masonry wall.

The basement enclosure shall in no case be less than a standard fireproof partition (order 5109).

Every shaftway adjoining, located in the same room or area with, an enclosed stairway shall be enclosed as required for the stairway, but in no case shall the enclosure be less than a semi-fireproof partition (order 5112).

Note. For other requirements which apply to elevator enclosures see the Elevator Code issued by the Industrial Commission.

SECTION 6. SANITATION.

Order 5713. Toilet Rooms. 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 if shown on approved plans.

All other buildings of this classification shall have at least one water-closet for every 15 rooms or fraction thereof.

Rooms with private toilets shall not be considered in counting either the number of rooms or the number of fixtures.

Water-closets and urinals, and the pipes connecting therewith, shall be protected against frost as provided in order 5261.

Note. For general requirements applying to toilet rooms see orders 5250 to 5264, inclusive.

Order 5714. Washing Facilities. In every building of this classification where city water supply is available or can be made available, there shall be at least one proper sink or washbowl with running water. In apartment houses there shall be such a sink or washbowl in each apartment.

Order 5715. Repairs. Every building of this classification, and all parts thereof, shall be kept in good repair and

the roof shall be kept so as not to leak and all rainwater shall be so drained and conveyed therefrom as not to cause dampness in the walls or ceilings.

Order 5716. Cleanliness. Every building shall be kept clean and shall also be kept free from any accumulation of dirt, filth, rubbish, garbage, or other matter in or on the same or in the yards, courts, passages, areas or alleys connected with or belonging to the same.

Order 5717. 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 5718. 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 damp proof and waterproof.

No rooms wherein persons are forcibly confined shall be located in a basement.

Order 5719. 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, but not less than 12 square feet. The top of at least one such window shall be not less than 6½ feet above the floor, and the upper half of it shall be made so as to open the full width.

Note. For court requirements see orders 5203 to 5206, inclusive.

SECTION 7. FIRE PROTECTION.

Order 5720. Isolation of Hazards. All boiler and furnace rooms, including fuel rooms and breeching, all laundries, drying rooms, carpenter shops, paint shops, and other hazardous work rooms and storage rooms in all buildings accommodating transients, and in hospitals, asylums and other places of detention, shall be enclosed with 8 inch masonry walls, with standard fire door protection for all interior openings, and with fireproof floor and ceiling.

In all other buildings under this classification, such rooms shall be enclosed with standard fireproof partitions (order 5109), fireproof ceilings and floors, except that in buildings permitted to be of frame construction, other than hospitals, the enclosure shall be semi-fireproof partitions (order 5112), fireproof floor and semi-fireproof ceiling (order 5113), or better.

Note. For general fire protection requirements see orders 5210 to 5220, inclusive.

SECTION 8. FIRE PROTECTION EQUIPMENT.

Order 5721. Standpipes and Fire Extinguishers.

1. Standpipes. Standard interior standpipes (order 5121) 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 5121) 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.

Note. For exterior standpipes see order 5120-10.

2. Fire Extinguishers. 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 5122) shall be placed on each floor at the head of each stairway and at each elevator or group of elevators.

Order 5722. Fire Alarm. In every building which accommodates 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.

Order 5723. Scuttle. Every building more than one story in height which accommodates more than 4 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.

Order 5724. Directions for Escape. 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.

Chapter 10

HAZARDOUS OCCUPANCIES

Order 5750. Garages.

1. **Definitions.** A GARAGE is a building which accommodates or houses self-propelled vehicles. For the purpose of this code the term vehicle includes land, air and water vehicles.

A PRIVATE GARAGE is a garage used in connection with a private residence for the purpose of housing self-propelled vehicles owned by the occupant of the residence and used only for personal or family service.

A PUBLIC GARAGE is a garage, other than a private garage, which is more than 500 square feet in area.

2. **Construction Requirements.** All public garages shall have walls and roof of ordinary construction (order 5102) or better.

All floors of storage rooms, salesrooms, and repair shops in public garages shall be of fireproof construction (order 5100).

Where public garages are built in connection with buildings used for other purposes, they shall be separated therefrom by means of standard fire walls (order 5108), and unpierced fireproof floors and ceilings, except that where the second floor consists of only one apartment covering not more than 1,000 square feet of floor area the ceilings of garages shall be semi-fireproof (order 5113), or better.

All walls, or parts of walls, nearer than 5 feet to a boundary line between premises or to any other building shall be unpierced; all walls, or parts of walls, nearer than 10 feet, but not nearer than 5 feet, to a boundary line between premises or to any other building shall have all openings therein protected by means of standard fire windows (order 5111) or standard fire doors (order 5110).

Note. For parapet wall requirement see order 5312.

See also General Orders on Fire Prevention issued by the Industrial Commission.

Where a private garage is built in connection with a public building or place of employment under this code, the garage shall have walls and ceiling of semi-fireproof (orders 5112-5113), or better construction, the floor shall be incombustible, and the openings to adjoining parts of the building shall be protected by means of standard fire doors (order 5110).

3. Fire Protection. Boilers, furnaces and all open flame equipment within garages shall be effectively separated from other areas by standard fireproof partitions (order 5109) and fireproof floors and ceilings. Such enclosures in basements shall be unpierced below the first floor level. Where the enclosure of boilers, furnaces and similar open flame equipment in garages rests on a fire resistive floor at, or above, grade level, all interior openings shall be protected by means of standard fire doors (order 5110).

4. Floor Pits. There shall be no pits or other depressions in the floor of any garage area, except that this requirement shall not apply to the shallow depressions formed to secure floor drainage, nor to catch basins installed in compliance with the provisions of the Plumbing Code issued by the State Board of Health, nor to floor openings to regular basements.

Order 5751. Dry Cleaning Establishments. Every dry cleaning establishment shall be of fireproof construction (order 5100), and shall not be more than three stories in height. A building not more than one story in height shall be either a separate building, or a separate portion of a building isolated by means of standard fire walls (order 5108), all openings in which are protected by standard fire doors (order 5110) with the door sills not less than 6 inches above the floor. In every case, the roof shall be of light incombustible construction throughout.

All walls, floors, ceilings and other structural parts of a dry cleaning room, or group of such rooms, shall be of solid

masonry, solid concrete or other solid incombustible construction without any hollow enclosed spaces in any part thereof.

A building more than one story in height shall be occupied exclusively by the dry cleaning establishment.

The lowest floor of any building used for dry cleaning shall be above grade and there shall be no basement or other open or air space below such floor line. All windows, doors and other openings shall be protected by standard fire doors (order 5110), standard fire windows (order 5111), or standard fire shutters (order 5110). Doors in outside walls shall have sills flush with floor level.

Note. See Section 167.21 of the Wisconsin Statutes, regulating the construction and equipment of cleaning and dyeing plants in Wisconsin.

Order 5752. Filling Stations; Buildings and Structures.

1. DEFINITIONS.

(a) By filling station is meant one or more pumps, tanks and other pieces of equipment used in the storage and dispensing of liquid fuels arranged for convenient delivery of such liquid fuels to the public on the premises.

(b) The term "erected in connection with" used in this order as applied to any structure means located so that any part, including eaves and canopy, is less than 15 feet distant from pumps or other dispensing equipment on the same premises.

2. All buildings or structures, including canopies, erected in connection with a filling station shall be of incombustible construction throughout, except as follows:

(a) Where the building is not more than one story in height, occupies an area not exceeding 500 square feet and no part of the building is less than 10 feet from the dispensing equipment, from the boundary lines between premises, and from other buildings on the same premises, such building may be of frame construction (except that the roof shall have a fire resistive covering as in order 5107), or better.

(b) Where the building occupies an area more than 500 square feet and any part of the building is less than 10 feet

from the dispensing equipment, such buildings shall comply with the requirements which apply to public garages in addition to the requirements of this order.

(c) Where the building is used as an office building, exclusively, or in connection with other non-hazardous occupancy, is not more than one story in height and is located not less than 30 feet from other buildings on the same premises and from the boundary lines between premises, such buildings may be of frame construction, or better.

Buildings or structures housing pumps and similar equipment used to dispense liquid fuel shall be of incombustible construction throughout, but no pumps or similar equipment used to dispense liquid fuel to the public, except where all of the discharge equipment is located outside the plane of the outside walls, shall be located or installed within or under any occupied part of any building or structure.

All openings in walls which are less than 10 feet, but not less than 5 feet, from the boundary lines between premises and other buildings on the same premises shall be protected by means of standard fire doors (order 5110), standard fire windows (order 5111), or standard fire shutters (order 5110); all walls which are less than 5 feet from the boundary lines between premises and from other buildings on the same premises shall be unpierced.

The main floor level of any building built in connection with equipment used to dispense liquid fuel shall not be below the level of the driveway or grade at such equipment, nor below the level of the lowest outflow level from the dispensing area.

There shall be no basement or other open space under the floor of the dispensing area outside of the building. There shall be no basement or other open space under the floor of any filling station building, unless:

(1) the main floor level is not less than 6 inches above the driveway or grade at the dispensing equipment and the lowest outflow level from the dispensing area, and

(2) there is no outside entrance, window or other opening (in walls) to such under floor space, except fuel chutes or similar vertical openings having a tight fitting cover, the bottom of which opening shall be not less than 6 inches above the driveway or grade at the dispensing equipment and the lowest outflow level, and

(3) the floor and enclosure of the under floor space is of fireproof construction (order 5100), and

(4) the under floor space is effectively vented by gravity means.

By basement or open space under a floor or dispensing area is meant any space that does not have an outlet, at or above grade, from the lowest level.

For requirements which apply to garages, including pits in garage areas, see order 5750.

For requirements which apply to storage, handling, etc. of liquid fuels, see the Flammable Liquids Code issued by the Industrial Commission.

Order 5753. Automobile Tire or Battery Shops. Any building, or portion of a building, in which tires are repaired or fitted to vehicles shall be constructed, equipped and maintained as a public garage under order 5750.

Any building, or portion of a building in which electric storage batteries are charged, repaired, or are installed in vehicles shall be constructed, equipped and maintained as a public garage under order 5750.

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