

AMENDMENTS
TO THE
BUILDING CODE

Changes Affecting the Design and Use of Steel Joists

EFFECTIVE DECEMBER 29, 1929

ISSUED BY THE
INDUSTRIAL COMMISSION OF WISCONSIN

MADISON, WISCONSIN

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AMENDMENTS TO THE BUILDING CODE

On the following pages are included changes in the Building Code reprinted by the Industrial Commission in 1927, as follows:

Orders 5100-A and 5100-B have been repealed.

Orders 5100, 5240, 5603, 5702 and 5705 have been amended.

New Order 5316-A has been added.

The above changes became effective as a part of the Building Code on December 29, 1929.

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 resisting covering of low heat conductivity, of not less than 2 inches thickness of concrete, or 3 inches thickness of other approved material, for columns; not less than 2 inches thickness for girders; and not less than 1½ inches thickness for other structural parts. This thickness shall be outside of the extreme edges of structural members. Such covering shall consist of Portland cement concrete, brick, terra cotta, or tile, laid in cement mortar, or other approved material and shall be properly reinforced, bonded, wired or otherwise secured in place. Steel reinforcement shall be protected as in order 5313. The plastering shall not be applied to wood lath or wood furring strips.

The trimmings and finished floor may be of wood, provided all spaces behind or below same are filled with incombustible

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

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

A room or a portion of a building is of fireproof construction if it complies with all of the above requirements, and is separated from the rest of the building by means of fireproof walls, floors and ceilings, in which all openings are protected by means of fire doors or fixed standard fire windows.

For outside windows and doors see order 5201.

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

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

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

Note (c). The fireproofing of steel roof trusses may, if approved by the Industrial Commission, be omitted in cases where no increased hazard will result.

Order 5240. Public Garages. A public garage is any building which accommodates more than two automobiles, motorcycles, tractors or other motor driven vehicles designed to use volatile inflammable liquid for fuel or power, except that buildings in which such new motor vehicles which do not contain oil, volatile inflammable liquid or storage batteries are stored, need not be included in this classification.

Note. The exception in the last half of the above paragraph was adopted by the Commission when certain automobiles were shipped knockdown and so stored in warehouses until needed for display or sale. The exception applies only to such partially unassembled vehicles and does not apply to cars on display.

All public garages shall have walls and roof of ordinary construction or better.

All floors of storage rooms, sales rooms, and repair shops in public garages shall be of fireproof construction; except that the floors of garages not more than 3 stories in height may have floor panels of protected construction. See order 5316-A.

Where public garages are built in connection with buildings used for other purposes they shall be separated there-

from by means of standard fire walls, 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 ceiling of garages may be semi-fireproof.

All walls, or parts of walls of public garages nearer than 5 feet to any other building or boundary line between premises shall be unpierced; all walls, or parts of walls nearer than 10 feet to any other building or boundary line between premises shall have all openings protected by means of standard fire windows and standard fire doors.

Parapet walls shall be provided as described in order 5310.

For parapet wall requirement see Order 5310.

For electrical wiring see Order 5225.

See also General Orders on Fire Prevention issued by the Industrial Commission.

For private garages see Order 5006.

Order 5316-A. 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 or 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 5316. 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. All Steel Joist Fireproof Floor Construction. 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 5313. 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 mailing 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 5316. 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 5316-A except that the beams, girders and columns supporting steel joists are protected with approved incombustible base and approved plaster not less than $\frac{3}{4}$ 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 joist floor systems shall be placed and constructed in such a manner that the individual joist will not be overstressed or disarranged during construction.

Note. This will require the provision of rigid strut bracing continuous between joists, or continuous tension bridging between the building framework and the joist system and the building framework. This will not permit of the use of tension bridging for temporary staying of joists in connection with masonry bearing walls unless special anchorage to such walls is assured. Also the metal fabric ordinarily used for top slab reinforcement and self centering is not acceptable for strut bracing under this order.

Order 5603. First Floor Fireproof. In all two-story buildings having more than four class, study, or recitation

rooms of ordinary size on any floor, the first floor shall be of fireproof construction, except that floor panels may be of steel joist protected construction. See Order 5316-A. In all other two-story buildings the basement ceiling shall be of semi-fireproof construction or better.

Order 5702. Fireproof Construction. Buildings of four or more stories shall be of fireproof construction, except that hotels and apartment houses not more than 4 stories in height may have floor panels of steel joist protected construction. See order 5316-A.

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

Hospitals of three or more stories shall be of fireproof construction; except that hospitals not more than three stories in height may have floor panels of steel joist protected construction. See order 5316-A.

Order 5705. First Floor Used for Business Purposes. In all buildings whose first story is used for a garage, the first story ceiling shall be of fireproof construction; except that in buildings not more than three stories in height floor panels may be of steel joist protected construction. See order 5316-A.

In a building more than two stories high whose first story is used for business purposes, the ceiling shall be either fireproof or semi-fireproof (order 5113).