AMENDMENTS TO THE

BUILDING CODE

EFFECTIVE MARCH 15, 1926

ISSUED BY THE

INDUSTRIAL COMMISSION OF WISCONSIN

MADISON, WISCONSIN

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DEMOCRAT PRINTING COMPANY
MADISON, WISCONSIN

INDUSTRIAL COMMISSION OF WISCONSIN

AMENDMENTS TO THE BUILDING CODE

The following orders 5316 and 5330 to 5336 inclusive were adopted by the Industrial Commission January 30, 1926, published in the official newspaper February 13, 1926, and became effective as a part of the Building Code March 15, 1926.

STRUCTURAL STEEL

Order 5316. 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 Constructon.

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 conform to the Standard Specifications of the American Society for Testing Materials for Structural Steel for Buildings, Serial Designation A—9-24, as printed in the appendix to this code.

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 partcular 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

(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 the compression flange.

On extreme fibres 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 in. 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.

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

In which S is the total shear, and 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 33⅓ per 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 stresses only, the permissible working stresses may be increased 33⅓ 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 outstanding 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 section. 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 webs 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 provision 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 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 4½ inches for 1¼ inch rivets, 4 inches for 1⅛ inch rivets, 3½ inches for 1 inch rivets, 3 inches for ⅞ inch rivets, 2½ inches for ¾ inch rivets, 2 inches for ⅝ inch rivets, and 1¾ inches for ½ 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 ¾ 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 1½ times the maximum width of the member.

(d) The minimum distance from the center of any rivet hole to a sheared edge shall be 2¼ inches for 1¼ inch rivets, 2 inches for 1⅛ inch rivets, 1¾ inches for 1 inch rivets, 1½ inches for ⅞ inch rivets, 1¼ inches for ¾ inch rivets, 1⅛ inches for ⅝ inch rivets, and 1 inch for ½ 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 shall be designed and used only for the transmission of shear stresses.

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 3½ inch and 4 inch angles—2¼ inches where ¾ inch rivets are used, or 2½ inches where ⅞ inch rivets are used.

For 12 inch, 10 inch and 9 inch channels, or built sections with 3 inch angles—2¼ inches where ¾ inch rivets are used.

For 8 inch and 7 inch channels, or built sections with 2½ inch angles, 2 inches where ⅝ inch rivets are used, or 2¼ inches where ¾ inch rivets are used.

For 6 inch and 5 inch channels, or built sections with 2 inch angles, 1½ inches where ½ inch rivets are used, or 1¾ inches where ⅝ 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 ¾ 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 5/16 inch thick shall be used for exterior construction, nor less than ¼ inch for interior construction, except for linings or fillers and rolled structural I-beams and channels.

These provisions do not apply to light structures such as skylights, marquees, fire escapes, light one-story buildings, or light miscellaneous steel work.

Note: For minimum requirements for fire escapes construction, see orders 5121 to 5131 inclusive of this code.

For trusses having end reactions of 35,000 pounds or over, the gusset plates shall be not less than ⅜ 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 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 ⅛ inch. When the metal is thicker than the diameter of the rivet, plus ⅛ inch, the holes shall be drilled, or sub-punched and reamed.

(g) Rivets are to be driven hot, and wherever practicable, by power. Rivet heads shall be of hemispherical shape and uniform size throughout the work for the same size rivet, full, neatly finished, and concentric with the holes. Rivets, after driving, shall be tight, completely filling the holes, and with heads in full contact with the surface.

(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 burning torch is permissible if the burned metal is not carrying stresses during the burning. Stresses shall not be transmitted into the metal through a burned surface.

21. Painting. (a) Parts not in contact, but inacessible 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.

CLAY TILE AND CONCRETE BLOCK

Order 5330—Definitions.

1. **By Clay Tile** is meant hollow clay or shale building units having parallel cells.

2. **By Concrete Block** is meant hollow building units, including concrete block, concrete tile and similar units, made of Portland cement concrete.

3. **The Shell** of clay tile or concrete block is the four outer walls of the unit.

4. **The Webs** of the clay tile or concrete block are the partitions within the shell dividing the unit into cells.

5. **The Cells** are the open or hollow spaces in a clay tile or concrete block.

6. **The Scoring** is the grooving in the outer face of the shells made to secure bond with mortar, concrete or other covering.

Order 5331—Clay Tile Used in Bearing and Exterior Walls.

1. **Weight.**

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

Cells Vertical

Dimension	No. Cells	Standard Weights
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

Dimension	No. Cells	Standard Weights
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 (L-Shaped)	4	16
6¼ x 8 x 12 (T-Shaped)	4	16
7⅝ x 8 x 12	6	24
8 x 10¼ x 12 (H-Shaped)	7	32

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

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

3. **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.

4. **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.

5. **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.

6. **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.

Order 5332—Concrete Block Used In Bearing and Exterior Walls.

1. **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.

2. **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.

3. **Branding.**

All concrete block 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.

4. **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 compliance 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.

Order 5333—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.

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.

Order 5334—Clay Tile Used In Non-Bearing Partitions.

1. **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.

2. **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 curavture or warpage of any face, shall not exceed 3 per cent of the greatest dimension of such face, but in no case more than ¼ inch.

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

3. **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.

Order 5335—Concrete Block Used in Non-Bearing Partitions.

1. **General Requirements.**

All concrete block 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.

Order 5336—Clay Tile and Concrete Block Used in Floor Construction.

1. **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.

2. **Branding.**

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

APPENDIX

AMERICAN SOCIETY FOR TESTING MATERIAL

STANDARD SPECIFICATIONS FOR STRUCTURAL STEEL FOR BUILDINGS

Serial Designation: A 9—24

Adopted, 1901; Revised, 1909, 1913, 1914, 1916, 1921, 1924

I. MANUFACTURE

1. (a) Structural steel, except as noted in Paragraph (b), shall be made by either or both the following processes: Bessemer or open-hearth.

(b) Rivet steel, and steel for plates or angles over ¾ in. in thickness which are to be punched, shall be made by the open-hearth process.

II. CHEMICAL PROPERTIES AND TESTS

2. The steel shall conform to the following requirements as to chemical composition:

		Structural Steel	Rivet Steel
Phosphorus	Bessemer	not over 0.10 per cent	.....
	Open-hearth	" " 0.06 " "	not over 0.06 per cent
Sulfur			" " 0.045 " "

TABLE I.—Permissible Variations of Rectangular Plates Ordered to Weight.

Ordered Weight, lb. per sq. ft.	Permissible Variations in Average Weights per Square Foot of Plates for Widths Given, Expressed in Percentages of Ordered Weights																		Ordered Weight, lb. per sq. ft.
	Under 48 in.		48 to 60 in. excl.		60 to 72 in. excl.		72 to 84 in. excl.		84 to 96 in. excl.		96 to 108 in. excl.		108 to 120 in. excl.		120 to 132 in. excl.		132 in. or over		
	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	Over	Under	
Under 5	5	3	5.5	3	6	3	7	3											Under 5
5 to 7.5 excl.	4.5	3	5	3	5.5	3	6	3											5 to 7.5 excl.
7.5 to 10 excl.	4	3	4.5	3	5	3	5.5	3	6	3	7	3	8	3					7.5 to 10 excl.
10 to 12.5 excl.	3.5	2.5	4.	3	4.5	3	5	3	5.5	3	6	3	7	3	8	3	9	3	10 to 12.5 excl.
12.5 to 15 excl.	3	2.5	3.5	2.5	4	3	4.5	3.	5	3	5.5	3	6	3	7	3	8	3	12.5 to 15 excl.
15 to 17.5 excl.	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	6	3	7	3	15 to 17.5 excl.
17.5 to 20 excl.	2.5	2.	2.5	2.5	3.	2.5	3.5	2.5	4.	3	4.5	3	5.	3	5.5	3	6	3	17.5 to 20. excl.
20 to 25 excl.	2	2	2.5	2	2.5	2.5	3	2.5	3.5	2.5	4	3	4.5	3	5	3	5.5	3	20 to 25 excl.
25 to 30 excl.	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3	4.5	3	5	3	25 to 30 excl.
30 to 40 excl.	2	2	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3	4.5	3	30 to 40 excl.
40 or over	2	2	2	2	2	2	2	2	2.5	2	2.5	2.5	3	2.5	3.5	3	4	3	40 or over

Note—The weight per square foot of individual plates shall not vary from the ordered weight by more than 1 ½ times the amount given in this table.

TABLE II.—Permissible Overweights of Rectangular Plates Ordered to Thickness.

Ordered Thickness, in.	Permissible Excess in Average Weights per Square Foot of Plates for Widths Given, Expressed in Percentages of Nominal Weights									Ordered Thickness, in.
	Under 48 in.	48 to 60 in. excl.	60 to 72 in. excl.	72 to 84 in. excl.	84 to 96 in. excl.	96 to 108 in. excl.	108 to 120 in. excl.	120 to 132 in. excl.	132 in. or over	
Under ⅛	9	10	12	14						Under ⅛
⅛ to 3/16 excl.	8	9	10	12						⅛ to 3/16 excl.
3/16 to ¼ excl.	7	8	9	10	12					3/16 to ¼ excl.
¼ to 5/16 excl.	6	7	8	9	10	12	14	16	19	¼ to 5/16 excl.
5/16 to ⅜ excl.	5	6	7	8	9	10	12	14	17	5/16 to ⅜ excl.
⅜ to 7/16 excl.	4.5	5	6	7	8	9	10	12	15	⅜ to 7/16 excl.
7/16 to ½ excl.	4	4.5	5	6	7	8	9	10	13	7/16 to ½ excl.
½ to 9/16 excl.	3.5	4	4.5	5	6	7	8	9	11	½ to 9/16 excl.
9/16 to ¾ excl.	3	3.5	4	4.5	5	6	7	8	9	9/16 to ¾ excl.
¾ to 1 exlc.	2.5	3	3.5	4	4.5	5	6	7	8	¾ to 1 excl.
1 or over	2.5	2.5	3	3.5	4	4.5	5	6	7	1 or over

3. (a) A carbon determination shall be made of each melt of Bessemer steel, and determinations for manganese, phosphorus and sulfur representing the average of the melts applied for each 12-hour period.

(b) An analysis of each melt of open-hearth steel shall be made for carbon, manganese, phosphorus and sulfur.

(c) These analyses shall be made by the manufacturer from test ingots taken during the pouring of each melt. The chemical composition thus determined shall be reported to the purchaser or his representative and shall conform to the requirements specified in Section 2.

4. Analyses may be made by the purchaser from finished material representing each melt. The phosphorus and sulfur content thus determined shall not exceed that specified in Section 2 by more than 25 per cent.

III. PHYSICAL PROPERTIES AND TESTS

5. (a) The material shall conform to the following requirements as to the tensile properties:

Properties Considered	Structural Steel	Rivet Steel
Tensile strength, lb. per sq. in.	55 000–65 000	46 000–56 000
Yield point min., lb. sq. in.	0.5 tens. str.	0.5 tens. str.
But in no case less than	30 000	25 000
Elongation in 8 in., min., per cent	1 400 000 Tens. str.	1 400 000 Tens. str.
Elongation in 2 in., min., per cent	22	---

(b) The yield point shall be determined by the drop of the beam of the testing machine.

6. (a) For structural steel over ¾ in. in thickness, a deduction from the percentage of elongation in 8 in. specified in Section 5 (a) of 0.25 per cent shall be made for each increase of 1/32 in. of the specified thickness above ¾ in., to a minimum of 18 per cent.

(b) For structural steel under 5/16 in. in thickness, a deduction from the percentage of elongation in 8 inch. specified in Section 5 (a) of 1.25 per cent shall be made for each decrease of 1/32 in. of the specified thickness below 5/16 in.

7. (a) Bend test specimens, except as specified in Paragraph (b), shall stand being bent cold through 180 deg. without cracking on the outside of the bent portion, as follows: For material ¾ in. or under in thickness, flat on itself; for material over ¾ in. to and including 1¼ in. thickness, around a pin the diameter of which is equal to the thickness of the specimen; and for material over 1¼ in. in thickness, around a pin the diameter of which is equal to twice the thickness of the specimen.

(b) Bend test specimens for rivet steel shall stand being bent cold through 180 deg. flat on themselves without cracking on the outside of the bent portion.

8. (a) Test specimens shall be prepared for testing from the material in its rolled or forged condition, except as specified in Paragraphs (b) and (c).

(b) Test specimens for annealed material shall be prepared from the material as annealed for use, or from a short length of a full section similarly treated.

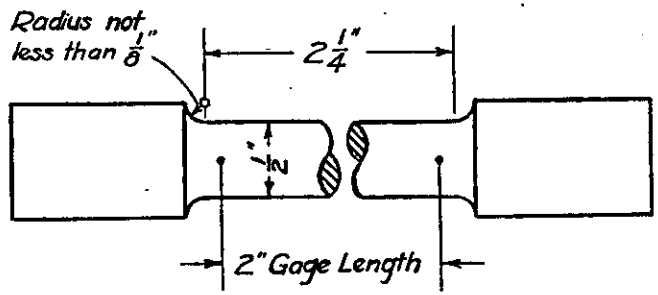
(c) Test specimens for rivet bars which have been cold-drawn shall be normalized before testing.

(d) Test specimens shall be taken longitudinally and, except as specified in Paragraphs (f), (g), and (h), shall be of the full thickness or section of material as rolled.

(e) Test specimens for plates, shapes and flats may be machined to the form and dimensions shown in Fig. 1, or with both edges parallel.

(f) Tension test specimens for material over 1½ in. in thickness or diameter, except pins and rollers, may be machined to a thickness or diameter of at least ¾ in. for a length of at least 9 in, or they may conform to the dimensions shown in Fig. 2.

(g) Bend test specimens for material over 1½ in. in thickness or diameter, except pins and rollers, may be machined to a thickness or diameter of at least ¾ in. or to 1 by ½ in. in section.



(Figure I)

(h) Tension test specimens for pins and rollers shall conform to the dimensions shown in Fig. 2, and bend test specimens shall be 1 by ½ in. in section.

(i) Test specimens for pins and rollers shall be taken so that the axis is 1 in. from the surface.

(j) The machined sides of rectangular bend test specimens may have the corners rounded to a radius not over 1/16 in.

9. (a) One tension and one bend test shall be made from each melt; except that if material from one melt differs ⅜ in. or more in thickness, one tension and one bend test shall be made from both the thickest and the thinnest material rolled.

(b) If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

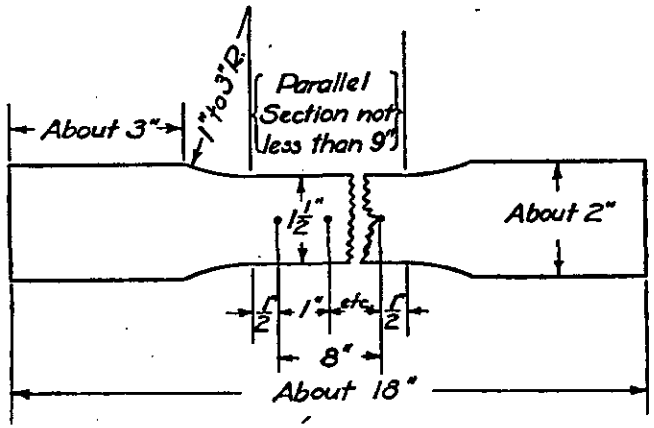
(c) If the percentage of elongation of any tension test specimen is less than that specified in Section 5 (a) and any part of the fracture

is more than ¾ in. from the center of the gage length of a 2-in. specimen or is outside the middle third of the gage length of an 8-in. specimen, as indicated by scribe scratches marked on the specimen before testing a retest shall be allowed.

IV. PERMISSIBLE VARIATIONS IN WEIGHT AND THICKNESS

10. (a) The cross-section or weight of each piece of steel shall not vary more than 2.5 per cent from that specified; except in the case of sheared plates, which shall be covered by the permissible variations specified in Paragraphs (b) and (c). (One cubic inch of rolled steel is assumed to weigh 0.2833 lb.)

(b) Sheared Plates, When Ordered to Weight per Square Foot: The weight of each lot in each shipment shall not vary from the weight ordered more than the amount given in Table I.



(Figure II)

(c) Sheared Plates, When Ordered to Thickness: The thickness of each plate shall not vary more than 0.01 in. under that ordered.

The overweight of each lot in each shipment shall not exceed the amount given in Table II.

V. FINISH

11. The finished material shall be free from injurious defects and shall have a workmanlike finish.

VI. MARKING

12. The name or brand of the manufacturer and the melt number shall be legibly stamped or rolled on all finished material, except that rivet and lattice bars and other small sections shall, when loaded

for shipment, be properly separated and marked for identification. The identification marks shall be legibly stamped on the end of each pin and roller. The melt number shall be legibly marked, by stamping if practicable, on each test specimen.

VII. INSPECTION AND REJECTION

13. The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, without charge, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. All tests (except check analyses) and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

14. (a) Unless otherwise specified, any rejection based on tests made in accordance with Section 4 shall be reported within five working days from the receipt of samples.

(b) Material which shows injurious defects subsequent to the acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

15. Samples tested in accordance with Section 4, which represent rejected material, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

SPECIFICATIONS FOR TESTING OF CLAY TILE AND CONCRETE BLOCKS

1. Selection of Test Specimens.

Specimens of hollow clay tile or concrete block to be tested shall be representative of a lot being sampled.

Full size hollow clay tile or concrete block shall be used in every test.

Not less than three specimens of any size, shape or grade of hollow clay tile or concrete blocks shall be tested in the determination of any property of a product.

2. Weight Determinations.

To determine the weight of a specimen of hollow clay tile or concrete block it shall be dried to constant weight at a temperature of 100 degrees C (212°F), weighed and the weight recorded to within one-half of one per cent of the weight of the unit.

3. Strength Test.

The bearing surfaces of test specimens of hollow clay tile and concrete block shall be coated with shellac. When shellac is dry a quantity of plastic mortar made of either neat gypsum or a mixture of three parts (by volume) of Portland cement and one part of gypsum mixed with sufficient water to spread evenly shall be placed on a plain surface (plate glass, steel, etc.) which has been coated with oil and allowed to set sufficiently to keep the specimen from touching the plain surface. The surface to be capped shall be placed on this mortar, and while holding the specimen so that its axis is at right angles to the capping surface it shall be given a single firm pressure.

The average thickness of the cap shall be about ⅛ inch. Imperfect caps shall be removed and replaced with new ones. Patching of caps shall not be permitted.

Where neat gypsum is used the cap shall be allowed to set for a period of 30 minutes, but not more than one hour, before the specimen is tested. Where a mixture of Portland cement and gypsum is used the cap shall be allowed to set for a period of at least 3 days before the specimen is tested.

Trim neatly all extended edges of capping material.

All tile shall be tested in the position in which they are to be used.

A spherical bearing block of proper design shall be placed on the moving head of the testing machine.

The speed of the moving head of the testing machine shall be not more than 0.05 inch per minute.

4. Absorption Tests.

The test for absorption may be made on full size specimens before crushing, or on pieces of clay tile or concrete block after crushing. If pieces of crushed specimens are used not less than three representative pieces shall be taken from each unit, two from the shell and one from a web, each weighing not less than 227 grams (½ pound) when ready for test. The pieces shall be reasonably sound and free from the effects of crushing failure, and all rough edges and loose particles shall be ground off.

Where pieces of a tile or concrete block are tested for absorption each piece shall be marked so that it may be at any time identified with the tile or block from which it was taken. Markings shall not cover more than 5 per cent of the total superficial area of the piece.

Specimens, whether whole or pieces thereof, shall be dried to constant weight in a drier or oven at a temperature of 100° C (212° F) and immediately weighed. Record the weight to within one-half of one per cent of the dry weight of the unit.

(a) Boiling Test. After weighing, specimens shall be immersed in soft or distilled water at ordinary room temperature, raised to the boiling temperature and boiled continuously for one hour, then allowed to cool in water to room temperature. When cool remove specimen from water. Allow to drain for not more than one minute, wipe off surplus water with a damp cloth, weigh and record the weight to within .5 per cent of the dry weight of the unit.

Calculate the per cent of absorption of moisture on the basis of dry weight to nearest first decimal place for each specimen and for average of all specimens.

(b) Immersion Test. After weighing specimens shall be immersed in soft or distilled water at ordinary room temperature and allowed to remain for a period of 48 hours. At the expiration of this period remove specimens from water, allow to drain for not more than one minute, wipe off surplus water with a damp cloth, weigh and record weight to within .5 per cent of the dry weight of the specimen.

Calculate the per cent of absorption of moisture on the basis of dry weight to nearest first decimal place for each specimen and for average of all specimens.