Designation: A 67 – 00

Standard Specification for Steel Tie Plates, Low-Carbon and High-Carbon-Hot-Worked[1]

This standard is issued under the fixed designation A 67; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers steel tie plates for use in railroad track.

1.2 Two grades of tie plates are described: Grade 1, low-carbon, and Grade 2, high-carbon-hot-worked.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values in parentheses are for information only.

2. Referenced Documents

2.1 *ASTM Standards:*

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipping[2]

2.2 *American Railway Engineering and Maintenance of Way Association (AREMA):*

Specification for Steel Tie Plates[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *eccentricity*—the distance from the shoulder to the edge of the tie plate at right angles to the shoulder is larger on the field side than the gage side to compensate for the greater tendency of the field end to cut into the tie; the horizontal distance from middle of the rail seat to middle of the tie plate is the eccentricity.

3.1.2 *field side*—end of tie plate designed to be located on the opposite side of the rail from the centerline of track.

3.1.3 *gage side*—end of tie plate designed to be located closest to the centerline of track.

3.1.4 *hold down holes*—located on the plate away from the rail seat, these holes do not allow spikes to contact the edge of the rail base. Also called *anchor spike holes*.

3.1.5 *length*—overall dimension of the plate at right angles to the rail it supports.

3.1.6 *Discussion*—Tie plates of different length can be used with a given rail section with the length chosen based on the traffic density of the track on which it is to be used.

3.1.7 *line holes*—located at the edge of the rail seat, these holes allow the spikes to contact the edge of the rail base.

3.1.8 *rail seat*—the portion of the tie plate that supports the rail.

3.1.9 *rail seat cant*—tie plates are generally rolled with the rail seat not parallel to the base of the plate so that the rail head is tilted toward the centerline of track to help offset lateral thrust and provide better wheel bearing on the rail head; the AREA recommended cant is a ratio of 1:40.

3.1.10 *rolled width*—the dimension of the finished section as it leaves the rolls and is equal to the length of the tie plate.

3.1.11 *sheared length*—the dimension to which the finished section is cut and is equal to the width of the tie plate.

3.1.12 *shoulder*—a ridge parallel to the rail designed to assist in holding the rail in position.

3.1.13 *Discussion*—The height of the shoulder is about equal to the thickness of the edge of the rail base. If a plate has a *single shoulder*, the shoulder is located on the field side of the rail seat to resist the outward thrust of the rail. A *double shoulder* plate has an additional shoulder on the gage side of the rail seat. Single shoulder plates may accommodate a desired rail section by adjusting the punching of the spike holes on the gage side to match the width of the rail base. Double shoulder plates are limited to a single rail base width.

3.1.14 *tie plate*—a part of the track structure placed under the rail to distribute the wheel load to the tie, cant the rail to the desired angle, assist in maintaining the track to gage and protect the tie.

3.1.15 *Discussion*—The tie plate has a rail seat, either flat or canted, either a single or double shoulder parallel to the rail it supports, and is punched with holes for spikes or other fasteners. The bottom of the tie plate is usually flat, but ribbed or other designs may be used.

3.1.16 *width*—overall dimension of the plate parallel to the rail it supports.

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[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys, and is the direct responsibility of Subcommittee A01.01 on Steel Rails and Accessories.

Current edition approved September 10, 2000. Published November 2000. Originally published as A 67 – 16 T. Last previous edition A 67 – 92.

[2] *Annual Book of ASTM Standards*, Vol 01.05.

[3] *Manual of Railway Engineering*, Chapter 5, Part 1, and is available from American Railway Engineering and Maintenance of Way Assn., 8201 Corporate Drive, Suite 1125, Landover, MD 20785.

3.1.17 *Discussion*—Tie plates are generally from 7 to 8 in. wide.

4. Ordering Information

4.1 Orders for tie plates under this specification shall include the following information:

4.1.1 Quantity: number of pieces.

4.1.2 ASTM designation and year of issue.

4.1.3 Grade: 1, low-carbon, or 2, high-carbon-hot-worked (see Table 1 and Table 2).

4.1.4 Design: AREMA plan number,[3] or other design including drawings if required.

4.1.5 Any variation in location and shape of holes, etc., from the plan, with dimensional drawing if necessary.

5. Materials and Manufacture

5.1 *Melting Practice*—The steel shall be made by any of the following processes: basic-oxygen or electric-furnace.

5.2 The steel may be cast by a continuous process, or in ingots.

5.3 *Discard*—A sufficient discard shall be made to secure freedom from injurious segregation and piping.

5.4 Steel accumulated in the form of ingots or blooms, possibly from various heats, that conforms to the requirements of this specification may be used in the manufacture of either Grade 1 or Grade 2 tie plates.

5.5 Grade 1 tie plates may be sheared, punched, or slotted either hot or cold, at the option of the manufacturer.

5.6 Grade 2 tie plates shall be sheared, punched, or slotted hot, at a temperature best suited to the process, and thereafter placed into an enclosure to assure proper cooling.

6. Chemical Composition

6.1 The steel shall conform to the requirements for chemical composition specified in Table 1.

6.2 *Heat or Cast Analysis*:

6.2.1 An analysis of each heat or cast shall be made by the manufacturer to determine the percentages of the elements specified in Table 1. The analysis shall be made from a test sample taken preferably during the pouring of the heat. The chemical composition thus determined shall conform to the requirements in Table 1.

6.2.2 Steel accumulated in the form of ingots or blooms may be applied on the basis of the original heat or cast analysis recorded in the mill records.

6.3 When ladle tests are not available, finished material representing the heat may be product tested. The product analysis allowance beyond the limits of the specified ladle analysis shall be within the limits for product analyses specified in Table 2.

TABLE 1 Chemical Requirements

	Grade 1 Low-Carbon	Grade 2 High-Carbon-Hot-Worked
Carbon	0.15 min	0.35 to 0.85
Phosphorus, max	0.040	0.040
Sulfur, max	0.050	0.050

TABLE 2 Product Analysis Allowance Beyond Limits of Specified Chemical Analysis

	Under Maximum Limit, %	Over Maximum Limit, %
Carbon	0.04	. . .
Phosphorus	. . .	0.008
Sulfur	. . .	0.008

7. Bend Requirements

7.1 *Bend Test*:

7.1.1 Grade 1 or Grade 2 bend test specimens prepared as required in 7.1.2 shall withstand the respective bend test described in Table 3 without cracking on the outside of the bent portion.

7.1.2 The specimens for bend tests specified in 7.1.1 shall be taken from finished tie plates, longitudinally with the direction of rolling. They shall be rectangular in section, not less than ½ in. (13 mm) in width between machined sides, and shall have two faces as rolled. Where the tie plate design is such that a specimen cannot be taken between the ribs or projections, the ribs or projections shall be removed to the plane of the plate surface as part of the specimen preparation.

7.2 *Optional Bend Test*:

7.2.1 If preferred by the manufacturer, the following full-size bend test may be substituted for that described in 7.1.

7.2.2 A finished Grade 1 or Grade 2 tie plate shall withstand the respective optional bend test described in Table 3 without cracking on the outside of the bent portion.

7.3 *Number of Tests*:

7.3.1 One bend test shall be made from each identified heat, or from each 25 tons (23 Mg) where heats are not identified.

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

7.4 *Retest*:

7.4.1 High carbon tie plates represented by bend tests failing to meet the requirements prescribed in 7.1 or 7.2 may be annealed not more than twice and resubmitted for testing. If tie plates fail to meet the third test, they shall be rejected.

8. Permissible Variations in Dimension, Weight, and Other Physical Attributes

8.1 The tie plate shall conform to the dimensions specified by the purchaser, subject to the permissible variations indicated in Table 4.

TABLE 3 Bend Test Requirements

	Grade 1	Grade 2
Bent test, cold	180° around pin of diameter not greater than specimen thickness	30° around pin of diameter not greater than three times specimen thickness
Optional bend test, cold	90° around pin of diameter not greater than section thickness[A] at bend	30° around pin of diameter not greater than three times section thickness[A] at bend

[A] Thickness includes vertical height of ribs and shoulders where they are transverse to pin direction.

TABLE 4 Permissible Variations from Specified Dimensions (Shoulders parallel to rolling direction)

	Over		Under	
	in.	(mm)	in.	(mm)
Thickness	0.030	(0.76)	0.030	(0.76)
Rolled width	0.125	(3.17)	0.125	(3.17)
Sheared length	0.188	(4.76)	0.188	(4.76)
Flatness, rail seat	0.025	(0.64)	0.025	(0.64)
Flatness, tie seat	0.060	(1.58)	0.060	(1.58)
Dimension between shoulders	0.060	(1.58)	none	none
Height of shoulders	0.015	(0.40)	0.030	(0.76)
Location of spike holes	0.030	(0.76)	0.030	(0.76)
Size of spike holes (length of sides)	0.030	(0.76)	0.030	(0.76)
Skewness of holes—horizontally	0.030	(0.76)	0.030	(0.76)

9. Workmanship, Finish, and Appearance

9.1 The tie plates shall be free from injurious warp, projecting fins and other imperfections that would prevent (*a*) proper rail seating, and (*b*) proper seating of the spikes or screws.

9.1.1 *Flatness of the Rail Seat*—shall be measured with an appropriate gage over length, width and diagonals. Concavity or convexity shall not exceed 0.025 in. (0.64 mm). Measurement shall avoid the shear deformation at the edge of the plate.

9.1.2 *Flatness of the Tie Seat*—shall be measured with an appropriate gage over the length, width and diagonals. Concavity or convexity shall not exceed 1 / 16 in. (1.6 mm). Measurement shall avoid the shear deformation at the edge of the plate.

9.1.3 *Spike Holes*—Measurement for size and location shall be determined from the punch entering surface, which is typically the bottom of the plate. Measurement of the hole location shall be in relationship of the spike holes to each other. Measurement of the skewness of spike holes shall be in relationship to the design location of the rail base for line holes and to the sheared edge for hold down holes.

9.1.4 *Spike Hole Tolerances*—The following limits on spike hole punching shall apply:

9.1.4.1 Holes shall not be punched closer than 1⅝ in. (41.4 mm) center to center.

9.1.4.2 Outer edge of any hole shall not be closer than in. (12.7 mm) to the rolled edge for plates up to ⅜ in. (9.6 mm) in end thickness; or closer than in. (16 mm) to the rolled edge for plates greater than ⅜ in. up to ½in. in end thickness.

9.1.4.3 Outer edge of any hole shall not be closer than 1 in. to the sheared edge.

10. Inspection

10.1 The manufacturer shall afford the purchaser's inspector all reasonable facilities necessary to satisfy him that the material is being produced and furnished in accordance with this specification. Mill inspection by the purchaser shall not interfere unnecessarily with the manufacturer's operations. All tests and inspections shall be made at the place of manufacture, unless otherwise agreed to.

11. Rejection and Rehearing

11.1 Material that fails to conform to the requirements of this specification may be rejected. Rejections shall be reported to the manufacturer or supplier promptly and in writing. In case of dissatisfaction with the test results, the manufacturer or supplier may make claim for a rehearing.

12. Certification

12.1 When specified in the purchase order or contract, a manufacturer's certification shall be furnished to the purchaser that the material was produced and tested in accordance with this specification and has been found to meet the requirements.

12.2 When specified in the purchase order or contract, a report of the chemical and mechanical test results shall be furnished.

12.3 A Material Test Report, Certificate of Inspection or similar document printed from or used in electronic from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI transmitted document must meet the requirements of the invoked ASTM standard(s) and conform to any existing EDI agreement between the purchaser and the supplier.

12.4 Notwithstanding the absence of a signature, the organization submitting either a printed document (Material Test Report, Certificate of Inspection or similar document) or an EDI transmission is responsible for the content of the report.

13. Product Marking

13.1 The tie plate design designation, the name or brand of the manufacturer, the last two digits of the year of manufacture, and in the case of Grade 2, high-carbon-hot-worked tie plates, the letters "HW" shall be rolled in raised letters and figures on the top of the plate to the outside of the shoulders, and a portion of this marking shall appear on each finished tie plate.

13.2 *Bar Coding*:

13.2.1 The Automotive Industry Action Group (AIAG) Bar Code Standard for Primary Metals for Steel Products may be considered as an auxiliary method of identification. Use of this test method shall be by agreement between purchaser and supplier.

14. U.S. Government Procurement

14.1 When specified in the contract or purchase order, material shall be prepared from shipment and storage in accordance with the requirements of A 700.

15. Keywords

15.1 rails; railway applications; steel rails; steel tie plates