Designation: A 49 – 01 (Reapproved 2006)

Standard Specification for Heat-Treated Carbon Steel Joint Bars, Microalloyed Joint Bars, and Forged Carbon Steel Compromise Joint Bars[1]

This standard is issued under the fixed designation A 49; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification covers heat-treated carbon steel joint bars, microalloyed joint bars, and forged compromise joint bars for general use in standard railroad track.

1.2 The joint bars may be used for the production of insulated joints.

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

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 29/A 29M Specification for Steel Bars, Carbon and Alloy, Hot-Wrought, General Requirements for

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Shipment

2.2 *American Railway Engineering and Maintenance of Way Association Manual for Railway Engineering*[3]

3. Ordering Information

3.1 Orders for joint bars under this specification shall include the following information as appropriate:

3.1.1 *Quantity*—number of pairs of bars,

3.1.2 *Type*—design or type bar along with section designation and weight of rails being joined,

3.1.3 *Dimension*—overall length,

3.1.4 *Punching*—type (elliptical, oval, round, or combinations), size, number, location, spacing and elevation of punched holes, with dimensional drawing if necessary,

3.1.5 *Head Easement*—if required, and

3.1.6 *Certification and Test Report Requirements* (see 11.1).

4. Manufacture

4.1 The steel shall be made by one or both of the following processes: basic-oxygen or electric-furnace.

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

4.2 *Heating and Quenching*—Quenched carbon-steel joint bars and forged compromise joint bars shall be uniformly heated for punching, slotting, shaping, and forging and subsequently quenched. Maximum depth of decarburized layer of forged bars shall not exceed 0.040 in.

4.3 Microalloyed joint bars shall be produced from hot rolled steel sections. Bars shall be sheared or sawed cold, and holes shall be drilled. No reheating and quenching is required.

5. Chemical Requirements

5.1 The chemical composition of the quenched carbon-steel joint bars and forged compromise joint bars determined as prescribed in 5.3 shall be within the limits shown in Table 1.

5.2 The chemical composition of the microalloyed joint bars shall be agreed upon by the purchaser and the manufacturer. Microalloying shall be accomplished with columbium, vanadium, and nitrogen, or combinations thereof.

5.3 *Heat or Cast Analysis*—Separate analysis shall be made from test samples representing one of the first three and one of the last three ingots or continuously cast blooms preferably taken during the pouring of the heat. Determinations may be made chemically or spectrographically. Any portion of the heat

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Railway Engineering and Maintenance of Way Assn., 10003 Derekwood Lane, Suite 210, Lanham, MD 20706.

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TABLE 1 Chemical Requirements

Element	Composition, %
Carbon	0.35–0.60
Manganese, max	1.20
Phosphorus, max	0.04
Sulfur, max	0.050

meeting the chemical analysis requirements of Table 1 may be applied. The first heat analysis shall be recorded as the official heat analysis, but the purchaser shall have access to all ladle analyses. Additionally, any material meeting the product analysis limits shown in Table 2 may be applied after testing such material in accordance with Specification A 29/A 29M.

5.4 *Product Analysis*—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.

5.4.1 An analysis may be made by the purchaser from a sample taken from a finished joint bar representing each heat or cast. The chemical composition thus determined shall conform to the requirements in Table 2.

6. Tensile Requirements

6.1 *Properties*:

6.1.1 The material as represented by a tension test specimen shall conform to the tensile properties prescribed in Table 3.

6.1.2 The yield point prescribed in Table 3 may be determined by the drop of the beam or halt of the gage of the testing machine, or by use of dividers. Where a definite yield point is not exhibited, the yield strength method defined in 6.1.3 shall be used.

6.1.3 The yield strength prescribed in Table 3 shall be determined by a strain gage or extensometer reading to 0.0002 in. (0.005 mm). Yield strength may be defined as the stress at 0.5 % total strain under load or as the stress at 0.2 % offset. The method described in Test Methods and Definitions A 370 shall be followed. After the yield point has been passed, the extensometer may then be removed and the test continued to determine the tensile strength.

6.2 *Test Specimens*—The tension test specimen shall be taken from the middle of the head at the center of a finished joint bar, and shall be machined to the form and dimensions for a standard round tension test specimen with 2-in., or 50-mm gage length as described in Test Methods and Definitions A 370.

6.3 *Number of Tests*—One tension test shall be made from each lot of 1000 bars or less, but not less than one test from each heat or cast on each day in which bars are heated and quenched. For microalloyed bars, one tension test shall be made from each heat or cast.

TABLE 3 Tensile Requirements

	ksi	MPa
Tensile strength, min	100	690
Yield point or yield strength, minimum[A]	70	485
Elongation in 2 in. or 50 mm, min, %	12	
Reduction in area, min, %	25	

[A] Determination by either the 0.2 % offset method or the 0.5 % extension-under-load method.

6.4 *Retests*:

6.4.1 If the results of the tension test of any test lot for quenched bars do not conform to the specified requirements, the manufacturer may retreat such lot not more than twice, in which case two additional tension tests shall be made from such lot, and both shall conform to the requirements specified in Table 3.

6.4.2 If the results of the tension test for microalloyed bars do not conform to the specified requirements, a retest may be made on two random samples from the heat or cast, and both shall conform to the requirements specified in Table 3.

6.4.3 If any test specimen fails because of mechanical reasons such as failure of testing equipment or improper specimen preparation, it may be discarded and another specimen taken.

7. Dimensions and Permissible Variations

7.1 The joint bars shall be true to template and shall accurately fit the rails for which they are intended.

7.2 The joint bars shall be either sheared or sawed to length, punched to the dimensions specified by the purchaser and alignment adjusted, all subject to the permissible variations prescribed in 7.3 and Table 4.

7.3 Any variation from a straight line in a vertical plane shall be such as will make the bars high in the center.

8. Workmanship, Finish, and Appearance

8.1 The joint bars shall be straight subject to the variation prescribed in 7.3 and Table 4.

8.2 The general appearance with respect to soundness and surface finish shall be consistent with good commercial practice as determined by ordinary visual inspection.

9. Inspection

9.1 The manufacturer shall afford the purchaser's inspector all reasonable facilities necessary to satisfy that the material is

TABLE 2 Product Analyses

	Allowance Beyond Limits of Specified Chemical Analysis	
	Percent under min limit	Percent over max limit
Carbon	0.04	0.04
Manganese	0.06	0.06
Phosphorus	. . .	0.008
Sulfur	. . .	0.008

TABLE 4 Permissible Variations in Dimensions

	in. (mm)
Specified size of holes	± 1/32 (0.8)
Specified location of holes	± 1/16 (1.6)
Specified length of bar	± 1/8 (3.2)
Maximum camber in either plane (see 7.3)	
24-in. (610-mm) bars	1/32 (0.8)
36-in. (914-mm) bars	1/16 1.6)

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being produced and furnished in accordance with the 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 upon.

10. Rejection and Rehearing

10.1 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.

11. Certification and Test Report

11.1 When specified in the purchaser 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.

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

11.3 A Material Test Report, Certificate of Inspection, or similar document printed from or used in electronic form 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.

11.4 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.

12. Product Marking

12.1 The name or brand of the manufacturer, the section designation, and the year of manufacture shall be either rolled in raised letters and figures on the side of the rolled bars, and a portion of this marking shall appear on each finished joint bar or hot stamped.

12.2 For quenched bars, a serial number representing the heat or cast shall be hot stamped on the outside of the web of each bar, near one end.

12.3 Each compromise joint bar shall also have the rail sections shown at each end along with the word "gage" or "out" to indicate on which side of the rail the bar is to be used. (If the compromise joint bars are interchangeable, the words "gage" and "out" shall be omitted.)

12.4 *Bar Coding*:

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

13. U. S. Government Procurement

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

14. Keywords

14.1 joint bars; rails; railway applications; steel rails

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