Designation: A 696 – 90a (Reapproved 2006)

Standard Specification for Steel Bars, Carbon, Hot-Wrought or Cold-Finished, Special Quality, for Pressure Piping Components[1]

This standard is issued under the fixed designation A 696; 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[2] covers hot-wrought and cold-finished special quality carbon steel bars, in straight lengths only, subject to mechanical property requirements and intended for use in manufacturing components for pressure piping and other pressure-containing applications.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

2. Referenced Documents

2.1 *ASTM Standards:* [3]

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

3. Classification

3.1 The bars are furnished in two grades as follows:

3.1.1 *Grade B*—Tensile strength 60 000 psi (415 MPa), minimum; yield strength 35 000 psi (240 MPa), minimum.

3.1.2 *Grade C*—Tensile strength 70 000 psi (485 MPa), minimum; yield strength 40 000 psi (275 MPa), minimum.

3.2 The bars are intended for machining, welding, hot forming, and threading by machining or cold rolling.

4. Ordering Information

4.1 Orders for material under this specification should include the following information:

4.1.1 Quantity (weight or number of bars),

4.1.2 Name of material (carbon steel bars),

4.1.3 Condition: hot wrought or cold finished (5.4.1),

4.1.4 Finish (if descaled required, so state) (9.1),

4.1.5 Dimensions (diameter, thickness, width, and length),

4.1.6 Cross section (round, square, hexagon),

4.1.7 ASTM designation and date of issue,

4.1.8 Grade (Table 1 and Table 2),

4.1.9 End use, and

4.1.10 Additions to the specification and supplementary requirements, if required.

NOTE 1—A typical ordering description is as follows: 10 000 lb, Carbon Steel Bars, Hot Wrought, Descaled, 1.000-in. diameter by 10 ft, Round, ASTM A 696 dated _____, Grade B; Supplementary Requirement S1 Straightness 0.125 in. in any 5 ft.

5. Materials and Manufacture

5.1 *Melting Practice*—The steel shall be made by one or more of the following primary processes: open-hearth, basic-oxygen, or electric-furnace. The primary melting may incorporate separate degassing or refining, and may be followed by secondary melting using electroslag remelting or vacuum arc remelting. Where secondary melting is employed, the heat shall be defined as all of the ingots remelted from a single primary heat.

5.2 *Deoxidation*—The steel shall be fully killed.

5.3 *Quality*—The bars shall be special quality.

5.4 *Hot or Cold Working*:

5.4.1 The bars shall be hot wrought or cold finished as specified by the purchaser.

5.4.2 Cold-finished bars reduced in cross-sectional area more than 10 % by cold drawing or rolling shall be heat treated as specified in 5.5.2.

5.5 *Heat Treatment*:

5.5.1 Except as provided in 5.5.2, the bars shall be furnished as-hot wrought or as-cold finished.

5.5.2 Cold-finished bars cold worked in excess of 10 % (see 5.4.2) shall be stress relief annealed at not less than 1200°F (649°C), normalized, or fully annealed. The specific heat treatment shall be at the option of the manufacturer.

[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 A01.15 on Bars.

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[2] For ASME Boiler and Pressure Vessel Code Applications, see related Specification SA-696 in Section II of that Code.

[3] 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.

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TABLE 1 Chemical Requirements (Heat Analysis), %

	Grades B and C
Carbon, max[A]	0.32
Manganese, max	1.04
Phosphorus, max	0.035[B]
Sulfur, max	0.045[B]
Silicon	0.15 to 0.35
Lead	[B]

[A] For each reduction of 0.01 % below the specified carbon maximum, an increase of 0.06 % manganese above the specified maximum will be permitted up to a maximum of 1.35 %.

[B] Phosphorus, sulfur, or lead, or a combination thereof, shall not be added.

TABLE 2 Tensile Requirements

	Grade B	Grade C
Tensile strength, min, ksi (MPa)	60 (415)	70 (485)
Yield strength, min, ksi (MPa)	35 (240)	40 (275)
Elongation in 2.0 in. or 50 mm, min, %	20.0	18.0
Elongation in 8.0 in. or 200 mm, min, %[A]	17.0	15.0

[A] Applicable to bars 1½ in. (38 mm) in diameter tested full size.

6. Chemical Composition

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

6.2 A product analysis of the steel may be made by the purchaser and shall conform to the requirements of Table 1 subject to the product analysis tolerances specified in Specification A 29/A 29M.

7. Tensile Requirements

7.1 *Requirements*:

7.1.1 The material, as represented by the test specimens, shall conform to the tensile requirements specified in Table 2.

7.1.2 A deduction from the percentage of elongation specified in Table 2 of 1.0 % shall be made for each 1.0 in. (25.4 mm) of specified diameter over 2.0 in. (51 mm) or fraction thereof to a maximum of 3 %.

7.2 *Specimens*:

7.2.1 Tension test specimens shall be taken longitudinally from a position midway between the center and the surface of the bar or as close as practical to this location for small sizes.

7.2.2 When it is impractical to remove specimens in accordance with 7.2.1, they shall be taken in accordance with Test Methods and Definitions A 370.

7.3 *Number of Tests*—One tension test shall be made from each lot. A lot shall consist of all bars of one size from one heat processed at one time and subjected to the same heat treatment when heat treated.

7.4 *Test Methods*—Tension tests shall be made in accordance with Test Methods and Definitions A 370. The yield strength shall be determined by the 0.2 % offset or 0.5 % extension under load methods.

8. Workmanship, Finish, and Appearance

8.1 *Descaling*—When descaled bars are required, Supplementary Requirement S7 must be specified.

8.2 The bars shall be free of visible pipe and conditioned as necessary to remove injurious surface imperfections.

9. General Requirements

9.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 29/A 29M unless otherwise provided herein.

10. Certification and Test Reports

10.1 A manufacturer's certification that the material was manufactured and tested in accordance with this specification together with a report of the heat analysis and tension test results shall be furnished at the time of shipment. The report shall include the name of the manufacturer, ASTM designation number and grade, shape, size, and finish.

11. Packaging and Package Marking

11.1 Bars less than 2.0 in. (51 mm) in diameter or thickness shall be tightly banded with a sufficient number of bands of adequate strength to minimize bundle breakage during handling and shipping. Larger sizes shall be packaged in accordance with Specification A 29/A 29M.

11.2 For bars less than 2.0 in. (51 mm) in diameter or thickness, each bundle shall bear a weather-resistant tag showing the purchase order number, ASTM designation number and grade, heat number, size, and name of manufacturer.

11.3 Bars 2.0 in. (51 mm) and larger in diameter or thickness shall have the heat number steel stamped on one end.

12. Keywords

12.1 pressure piping components; special quality steel bars; steel bars

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SUPPLEMENTARY REQUIREMENTS

One or more of the following supplementary requirements shall be applied only when specified by the purchaser in the inquiry, contract, or order. Details of these supplementary requirements shall be agreed upon in writing by the manufacturer and purchaser. Supplementary requirements shall in no way negate any requirement of the specification itself.

S1. Special Straightness

S1.1 Bars shall be within the tolerances for special straightness.

S2. Stress Relief Anneal

S2.1 Bars shall be stress relief annealed (may be specified for bars that have been ordered to special straightness tolerance).

S3. Surface Quality

S3.1 Bars shall be produced to special surface quality requirements which shall be negotiated between the purchaser and the supplier.

S4. Special Internal Soundness

S4.1 Bars shall be produced with special internal soundness to be verified by one or more macro-etch samples. Acceptance limits shall be negotiated between the purchaser and the seller.

S5. Fine Grain Practice

S5.1 The steel shall conform to the fine austenitic grain size requirement of Specification A 29/A 29M.

S6. Restricted Size Tolerances for Hot-Wrought Bars

S6.1 Bars shall be furnished with tolerances on dimensions more restrictive than specified in Specification A 29/A 29M. Tolerance requirements to apply shall be negotiated between the purchaser and the manufacturer.

S7. Descaling

S7.1 Bars shall be furnished descaled and oiled.

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