



Designation: A489 – 18^{ε1}

Standard Specification for Carbon Steel Eyebolts¹

This standard is issued under the fixed designation A489; 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 U.S. Department of Defense.

^{ε1} NOTE—A value in Table 2 was editorially corrected in May 2018.

1. Scope*

1.1 This specification covers chemical, physical and mechanical requirements for forged, carbon steel threaded eyebolts intended for overhead lifting.

1.2 The specification includes two types denoting shank pattern and two styles denoting shank length (both defined in ASME B 18.15) as follows:

- 1.2.1 *Type 1*—Plain pattern (straight shank).
- 1.2.2 *Type 2*—Shoulder pattern.
- 1.2.3 *Style A*—Long length.
- 1.2.4 *Style B*—Short length.

1.3 The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 The terms used in this specification are defined in Terminology **F1789** unless otherwise defined herein.

1.5 The following safety hazard caveat pertains to the test methods portion of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

¹ This specification is under the jurisdiction of ASTM Committee **F16** on Fasteners and is the direct responsibility of Subcommittee **F16.02** on Steel Bolts, Nuts, Rivets and Washers.

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2. Referenced Documents

2.1 *ASTM Standards*:²

- A751** Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
- F541** Specification for Alloy Steel Eyebolts
- F606/F606M** Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets
- F1470** Practice for Fastener Sampling for Specified Mechanical Properties and Performance Inspection
- F1789** Terminology for F16 Mechanical Fasteners
- F1941/F1941M** Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric
- F2329/F2329M** Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

2.2 *ASME Standards*:³

- B1.1** Unified Inch Screw Threads (UN and UNR Thread Form)
- B1.3** Screw Thread Gaging Systems for Acceptability: Inch and Metric Screw Threads (UN, UNR, UNJ, M, and MJ)
- B18.15** Forged Eyebolts
- B18.24** Part Identifying Number (PIN) Code System Standard for B18 Fastener Products

3. Ordering Information

3.1 Orders for eyebolts under this specification should include the following information:

- 3.1.1 ASTM specification number and date of issue.

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 Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

*A Summary of Changes section appears at the end of this standard

- 3.1.2 Name of product (carbon steel eyebolt).
- 3.1.3 Nominal Size.
- 3.1.4 Type and style (see 1.2).
- 3.1.5 Number of pieces.
- 3.1.6 Coating, if required (see 9.4).
- 3.1.7 Supplementary requirements, if required.
- 3.1.8 Certification, if required (see Section 13).
- 3.1.9 Drawing, if nonstandard eyebolts are required (see 7.2).
- 3.1.10 Other special requirements.
- 3.1.11 Size, nominal thread diameter and threads.
- 3.1.12 Part Identifying Number (PIN), if required (see ASME B18.24).

4. Materials and Manufacture

4.1 *Melting Process*—The steel shall be made by the open-hearth, basic-oxygen, or electric-furnace process and shall be made to a fine-grain practice.

4.2 *Forging*—The eyebolts shall be forged without welds.

4.3 *Heat Treatment*—The eyebolts shall be liquid quenched and tempered prior to machining the threaded end.

4.4 *Machining*—The eyebolts shall be machined after the quench and temper operation.

4.5 *Threads*—The eyebolts shall be threaded. Threads may be rolled, cut, or ground.

5. Chemical Composition

5.1 *Limits*—The eyebolts shall be manufactured from steels having a heat analysis conforming to the requirements in **Table 1**.

5.2 *Product Analysis:*

5.2.1 Analyses of finished eyebolts may be made by the purchaser or may be requested to be made by the manufacturer. The composition thus determined shall conform to the product analysis requirements specified in **Table 1**.

5.3 Chemical analyses shall be performed in accordance with **A751** Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products.

6. Mechanical Properties

6.1 *Proof Load*—The lifting eyes shall withstand the proof load specified in **Table 2**.

6.1.1 The proof load is defined as the load that can be applied to the eyebolt without causing permanent deformation. Prick punch marks shall be applied at opposite ends of the diameter across the eye. The proof load shall be applied by screwing the eyebolt to the full thread engagement into a block secured in one jaw of the testing machine and held to the other

TABLE 2 Breaking Strength and Proof Load Requirements, Types 1 and 2

| Nominal Thread Size | Thread Size | Tensile Stress Area ^A | Breaking Strength, min ^B | Proof Load, min ^C |
|---------------------|-------------|----------------------------------|-------------------------------------|------------------------------|
| in. | in. | in. ² | lbf | lbf |
| ¼ | ¼ –20 | 0.0318 | 2 100 | 800 |
| ⅝ | ⅝ –18 | 0.0524 | 3 400 | 1 400 |
| ¾ | ¾ –16 | 0.0775 | 5 000 | 2 000 |
| 7/16 | 7/16 –14 | 0.1063 | 6 900 | 2 800 |
| ½ | ½ –13 | 0.1419 | 9 200 | 3 700 |
| 9/16 | 9/16 –12 | 0.182 | 11 800 [†] | 4 700 |
| ⅝ | ⅝ –11 | 0.226 | 14 700 | 5 900 |
| ¾ | ¾ –10 | 0.334 | 21 700 | 8 700 |
| 7/8 | 7/8 –9 | 0.462 | 30 000 | 12 000 |
| 1 | 1 –8 | 0.606 | 39 400 | 15 800 |
| 1 ⅛ | 1 ⅛ –7 | 0.763 | 49 600 | 19 800 |
| 1 ¼ | 1 ¼ –7 | 0.969 | 63 000 | 25 200 |
| 1 ½ | 1 ½ –6 | 1.405 | 91 300 | 36 500 |
| 1 ¾ | 1 ¾ –5 | 1.90 | 123 500 | 49 400 |
| 2 | 2 –4 ½ | 2.50 | 162 500 | 65 000 |
| 2 ½ | 2 ½ –4 | 4.00 | 260 000 | 104 000 |

^A The stress area is calculated as follows:

$$A_s = 0.7854 [D - (0.9743/n)]^2$$

Tabulated values agree with ASME B1.1, Table 6.

where:

- A_s = stress area, in.²,
- D = nominal bolt size, and
- n = threads per inch.

^B Based on tensile strength of 65 000 psi. Values are rounded to the nearest 100 lbs.

^C Proof load is defined as 200 % of the 0 degree rated capacity specified in ASME B18.15 for Type 1 plain pattern eyebolts. Note that the rated capacity in ASME B18.15 is defined as 20 % of the A489 breaking strength. Values are rounded to the nearest 100 lbs.

[†] Editorially corrected in May 2018.

jaw by means of a mandrel passing through the eye. The round mandrel shall have a diameter equal to one half of the inside diameter of the eye. The proof load shall be applied at a maximum cross head speed of 0.12 in. per minute, held for 10 s. and then released. Permanent deformation of the eyebolt exceeding 0.01 in. between the prick punch marks constitutes a failure.

6.2 *Breaking Strength*—The lifting eyes shall conform to the breaking strength specified in **Table 2**.

6.2.1 The breaking strength shall be determined by screwing the eyebolt to the full thread engagement into a block secured in one jaw of the testing machine and held to the other jaw by means of a mandrel passing through the eye. The round mandrel shall have a diameter equal to one half of the inside diameter of the eye. The load shall be applied at a maximum crosshead speed of 0.12 in. per minute until fracture. Fracture of the eyebolt below the specified breaking strength or stripping of the threads constitutes a failure

6.3 *Tensile Test*—A specimen machined from a finished eyebolt shall conform to the tensile requirements specified in **Table 3**.

6.3.1 When the eyebolt is too small to have a tensile bar machined from it, a test specimen from the same heat of steel and same heat treatment lot or charge as the eyebolts to be tested shall be used to establish the tensile properties of the material in accordance with 6.3.

TABLE 1 Chemical Composition

| Element | Heat Analysis | Product Analysis |
|------------|---------------|------------------|
| Carbon | 0.48 max | 0.51 max |
| Manganese | 1.00 max | 1.06 max |
| Phosphorus | 0.040 max | 0.048 max |
| Sulfur | 0.050 max | 0.058 max |
| Silicon | 0.15–0.35 | 0.12–0.38 |