



Designation: **A489 – 12 A489 – 18**

## Standard Specification for Carbon Steel Lifting Eyes Eyebolts<sup>1</sup>

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 reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

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

### 1. Scope\*

1.1 This specification covers ~~weldless forged, quenched, and tempered~~ chemical, physical and mechanical requirements for forged, carbon steel threaded lifting eyes (formerly eyebolts) eyebolts intended for overhead lifting.

~~NOTE 1—Lifting eyes carrying this specification number even though they are liquid quenched and tempered may be processed from carbon steel which, in the composition range permitted by this specification, could have a fracture appearance transition temperature (50 % shear) higher than operating temperatures. Therefore, in order to minimize the possibility of a brittle cleavage failure, these lifting eyes should never be loaded above the proof load, and should not be used when surface discontinuities exist on the lifting eyes.~~

1.2 The specification includes two types denoting shank pattern and ~~one style~~ 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 ~~Terms~~—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.*

### 2. Referenced Documents

2.1 *ASTM Standards:*<sup>2</sup>

~~A370 Test Methods and Definitions for Mechanical Testing of Steel Products~~

~~A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products~~

~~E112 F541 Test Methods for Determining Average Grain Size~~ Specification for Alloy Steel Eyebolts

~~F606 F606/F606M Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets (Metric) F0606 F0606M 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~~

<sup>1</sup> 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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<sup>2</sup> 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.

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

2.2 ASME Standards:<sup>3</sup>

~~B-1.1~~[B1.1 Unified Inch Screw Threads \(UN and UNR Thread Form\)](#)

[B1.3 Screw Thread Gaging Systems for Acceptability: Inch and Metric Screw Threads \(UN, UNR, UNJ, M, and MJ\)](#)

~~B-18.15~~[B18.15 Forged Lifting Eyes/Eyebolts](#)

~~B-18.24~~[B18.24 Part Identifying Number \(PIN\) Code System Standard for B18 Fastener Products](#)

### 3. Ordering Information

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

3.1.1 ASTM specification number and date of issue.

3.1.2 Name of ~~product, that is lifting eyes~~ product (carbon steel eyebolt).

3.1.3 Nominal Size.

3.1.4 Type and style (see ~~1.2, Type 1 Style B~~) will be furnished when a Type and Style is not specified.

3.1.4 ~~Drawing, if nonstandard lifting eyes are required (see 8.3).~~

3.1.5 Number of pieces.

3.1.6 ~~Size, nominal thread diameter and threads.~~

3.1.6 Certification, Coating, if required (see Section ~~149.4~~).

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 ~~For establishment of a part identifying system, see ASME B18.24.~~ 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*—~~Lifting eyes~~ The eyebolts shall be forged without welds.

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

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

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

### 5. Chemical Composition

5.1 *Limits*—The ~~lifting eyes~~ 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 ~~lifting eyes~~ 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 ~~A751~~ for Chemical Analysis of Steel Products.

**TABLE 1 Chemical Composition**

Element	Heat Analysis	Product Analysis
<del>Carbon, max</del>	<del>0.48</del>	<del>0.51</del>
<u>Carbon</u>	<u>0.48 max</u>	<u>0.51 max</u>
<del>Manganese, max</del>	<del>1.00</del>	<del>1.06</del>
<u>Manganese</u>	<u>1.00 max</u>	<u>1.06 max</u>
<del>Phosphorus, max</del>	<del>0.040</del>	<del>0.048</del>
<u>Phosphorus</u>	<u>0.040 max</u>	<u>0.048 max</u>
<del>Sulfur, max</del>	<del>0.050</del>	<del>0.058</del>
<u>Sulfur</u>	<u>0.050 max</u>	<u>0.058 max</u>
<u>Silicon</u>	<u>0.15–0.35</u>	<u>0.12–0.38</u>

<sup>3</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

**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 shall be defined as the load that can be applied to the eyebolt without causing permanent deformation exceeding 0.01 in. (0.255 mm) between prick punch marks deformation. Prick punch marks shall be applied at opposite ends of the diameter across the eye. The proof load shall be applied through a mandrel having a diameter of one half the nominal 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

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

Nominal Thread Size	Tensile Stress Area <sup>A</sup>	Breaking Strength, min	Proof Load, min <sup>B</sup>
Inch-Pound Units			
in.	in. <sup>2</sup>	lbf	lbf
1/4-20	0.0318	2 100	800
5/16-18	0.0524	3 400	1 360
3/8-16	0.0775	5 000	2 000
7/16-14	0.1063	6 900	2 760
1/2-13	0.1419	9 200	3 680
9/16-12	0.182	11 830	4 740
5/8-11	0.226	14 700	5 880
3/4-10	0.334	21 700	8 680
7/8-9	0.462	30 000	12 000
1-8	0.606	39 400	15 760
1 1/8-7	0.763	49 600	19 840
1 1/4-7	0.969	63 000	25 200
1 1/2-6	1.41	91 600	36 520
1 3/4-5	1.90	123 500	49 400
2-4	2.50	162 500	65 000
2 1/2-4	4.00	260 000	104 000

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

Nominal Thread Size	Thread Size	Tensile Stress Area <sup>A</sup>	Breaking Strength, min <sup>C</sup>	Proof Load, min <sup>C</sup>
in.	in.	in. <sup>2</sup>	lbf	lbf
1/4	1/4-20	0.0318	2 100	800
5/16	5/16-18	0.0524	3 400	1 400
3/8	3/8-16	0.0775	5 000	2 000
7/16	7/16-14	0.1063	6 900	2 800
1/2	1/2-13	0.1419	9 200	3 700
9/16	9/16-12	0.182	11 830	4 700
5/8	5/8-11	0.226	14 700	5 900
3/4	3/4-10	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 1/8	1 1/8-7	0.763	49 600	19 800
1 1/4	1 1/4-7	0.969	63 000	25 200
1 1/2	1 1/2-6	1.405	91 300	36 500
1 3/4	1 3/4-5	1.90	123 500	49 400
2	2-4 1/2	2.50	162 500	65 000
2 1/2	2 1/2-4	4.00	260 000	104 000

<sup>A</sup> 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.<sup>2</sup>,
- $D$  = nominal bolt size, and
- $n$  = threads per inch.

<sup>B</sup> Based on tensile strength of 65 000 psi. Values are rounded to the nearest 100 lbs.

<sup>C</sup> Proof load is calculated defined as 2-times the rated capacity in straight pull (0 degrees) specified in ASME B18.15-200 % 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.