



# Standard Specification for Turnbuckles, Swaged, Welded, Forged<sup>1</sup>

This standard is issued under the fixed designation F1145; 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 ( $\epsilon$ ) 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.*

## 1. Scope

1.1 This specification covers swaged welded, cast, or forged turnbuckles with and without jam nuts.

1.2 A turnbuckle is an internally threaded loop or sleeve intended for assembly with a threaded stud, eye, hook, or jaw at each end, used for applying tension to rods, wire rope, and so forth.

1.3 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.

1.4 *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.*

1.5 *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>

[A29/A29M Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought](#)

[A153/A153M Specification for Zinc Coating \(Hot-Dip\) on Iron and Steel Hardware](#)

[B633 Specification for Electrodeposited Coatings of Zinc on Iron and Steel](#)

[D3951 Practice for Commercial Packaging](#)

### 2.2 AWS Standards:<sup>3</sup>

[AWS A5.1 Covered Carbon Steel Arc Welding Electrodes](#)

[AWS A5.2 Iron and Steel Oxyfuel Gas Welding Rods](#)

[AWS A5.5 Low Alloy Steel Covered Arc Welding Electrodes](#)

### 2.3 ASME Standards:<sup>4</sup>

[ASME B1.1 Unified Inch Screw Threads \(UN, UNR, and UNJ Thread Forms\)](#)

[ASME B18.2.2 Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts \(Inch Series\)](#)

### 2.4 Military Standards:<sup>5</sup>

[MIL-STD-1186 Cushioning, Anchoring, Bracing, Blocking, and Waterproofing; with Appropriate Test Methods](#)

[MIL-STD-2073-1 DoD Material Procedures for Development and Application of Packaging Requirements](#)

### 2.5 Military Specification:<sup>5</sup>

[MIL-L-19140 Lumber and Plywood, Fire-Retardant Treated](#)

[MIL-P-116 Preservation, Methods of](#)

### 2.6 Federal Specifications:<sup>4</sup>

[PPP-B-636 Boxes, Shipping, Fiberboard](#)

[PPP-F-320 Fiberboard: Corrugated and Solid Sheet Stock \(Container Grade\) and Cut Shapes](#)

### 2.7 Federal Standard:<sup>5</sup>

[FED-STD-123 Marking for Shipment \(Civil Agencies\)](#)

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.07 on General Requirements.

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

<sup>3</sup> Available from American Welding Society (AWS), 8669 NW 36 St., #130, Miami, FL 33166-6672, <http://www.aws.org>.

<sup>4</sup> Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

<sup>5</sup> Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

3.1.2 *Type II*—Pipe turnbuckle bodies (see 5.2.8).

3.1.3 *Type III*—Rigging turnbuckle bodies (see 5.2.9).

3.2 Turnbuckles covered under this specification shall be of the following classes and sizes, as specified (see 4.1.3):

3.2.1 *Classes*:

A—turnbuckle, body only without end pulls, heads not drilled.

B—turnbuckle, body only without end pulls, heads threaded right and left hand.

C—turnbuckle with stub and stub end pulls, complete.

D—turnbuckle with eye and eye end pulls, complete.

E—turnbuckle with hook and hook end pulls, complete.

F—turnbuckle with hook and eye end pulls, complete.

G—turnbuckle with jaw and jaw end pulls, complete.

H—turnbuckle with jaw and eye end pulls, complete.

3.2.1.1 The arrangement of turnbuckle bodies and end pulls for Classes C, D, E, F, G, and H shall be similar to Fig. 1.

3.2.2 *Sizes*—Shall be as listed in Table 1 and Table 2.

4. Ordering Information

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

4.1.1 ASTM designation and year of issue,

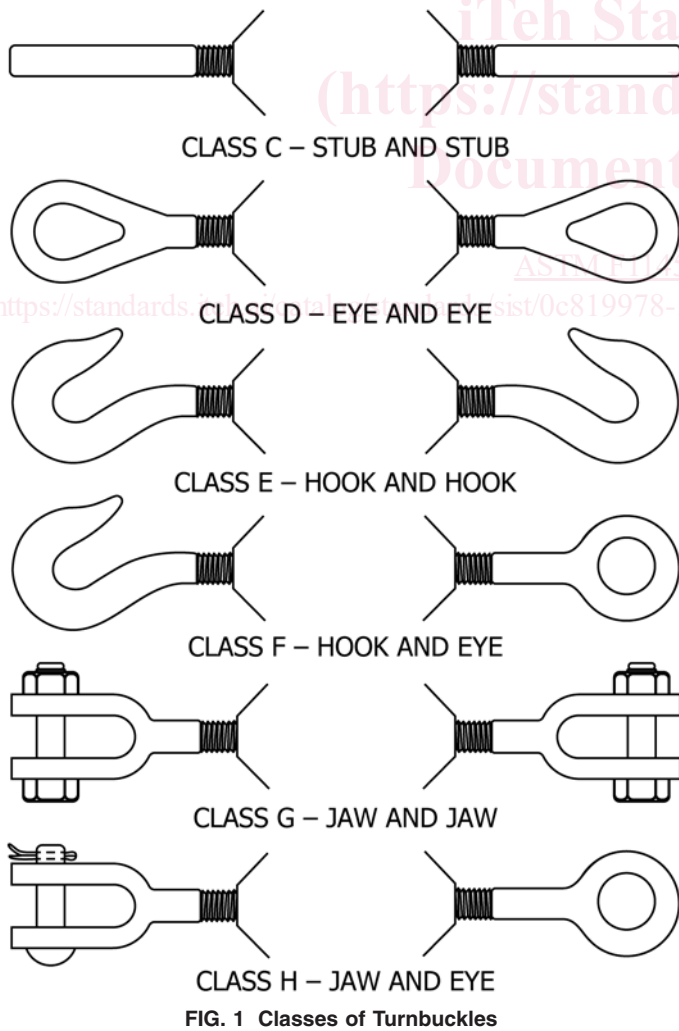


FIG. 1 Classes of Turnbuckles

TABLE 1 Turnbuckle Bodies, Classes A and B, and Turnbuckles, Class C

NOTE 1—1 in. = 25.4 mm.

Thread, Nominal Outside Diameter, in.	Size								
	Clear Opening Between Head, in.								
	4	4½	6	9	12	18	24	36	48
¼	X	...	...	...	...	...	...	...	...
5/16	...	X	...	...	...	...	...	...	...
3/8	...	...	X	...	...	...	...	...	...
½	...	...	X	X	X	...	...	...	...
5/8	...	...	X	X	X	X	...	...	...
¾	...	...	X	X	X	X	X	...	...
7/8	...	...	X	...	X	X	X	...	...
1	...	...	X	...	X	X	X	X	...
1¼	...	...	X	...	X	X	X	X	...
1¾	...	...	X	...	...	...	...	...	...
1½	...	...	X	...	X	X	X	X	X
1¾	...	...	X	...	...	X	X	X	X
2	...	...	X	...	...	...	X	X	X
2¼	...	...	X	...	...	...	X	X	X
2½	...	...	X	...	...	...	X	X	X
2¾	...	...	X	...	...	...	...	...	X
3	...	...	X	...	...	...	...	...	X
3½	...	...	X	...	...	...	...	...	X
4	...	...	X	...	...	...	...	...	X

TABLE 2 Turnbuckles, Classes D, E, F, G, and H

NOTE 1—1 in. = 25.4 mm

Thread, Nominal Outside Diameter, in.	Size								
	Clear Opening Between Heads, in.								
	4	4½	6	9	12	18	24	36	48
¼	X	...	...	...	...	...	...	...	...
5/16	...	X	...	...	...	...	...	...	...
3/8	...	...	X	...	...	...	...	...	...
½	...	...	X	X	X	...	...	...	...
5/8	...	...	X	X	X	X	...	...	...
¾	...	...	X	X	X	X	X	...	...
7/8	...	...	...	...	X	X	X	...	...
1	...	...	...	...	X	X	X	X	...
1¼	...	...	...	...	X	X	X	X	...
1½	...	...	...	...	X	X	X	X	X
1¾	...	...	...	...	...	X	X	X	X
2	...	...	...	...	...	...	X	X	X
2¼	...	...	...	...	...	...	X	X	X
2½	...	...	...	...	...	...	X	X	X

- 4.1.2 Quantity required,
- 4.1.3 Type, class, and size (see 3.1, 3.2, and 8.1),
- 4.1.4 Material, if different (see 5.1.1),
- 4.1.5 Type thread required (see 7.3),
- 4.1.6 Type finish required (see 9.3),
- 4.1.7 Grade required, if Type I is specified (see 3.1.1),
- 4.1.8 Optional requirements, if any (see Supplementary Requirements S1 and S2).

5. Materials and Manufacture

5.1 *Materials*:

5.1.1 Unless otherwise specified (see 4.1.4), turnbuckle and end pulls shall be made from steel of a grade which will meet the requirements of Table 3.

TABLE 3 Breaking Strength of Turnbuckles (Complete With End Pulls)

NOTE 1—1 in. = 25.4 mm.

NOTE 2—1 lb = 0.45 kg.

Size, Nominal Outside Diameter of Thread, in.	Strength Breaking, min, lbf (kN)				Recommended Working Loads, lbf (kN)			
	Type I, Grade 1		All Others		Type I, Grade 1		All Others	
	Jaw, Eye, or Stub End Pulls	Hook End Pulls	Jaw, Eye, or Stub End Pulls	Hook End Pulls	Jaw, Eye, or Stub End Pulls	Hook End Pulls	Jaw, Eye, or Stub End Pulls	Hook End Pulls
1/4	2 500 (11)	1 500 (7)	1 550 (7)	1 050 (5)	500 (2)	300 (1.3)	310 (1.4)	210 (0.9)
5/16	3 500 (16)	2 500 (11)	2 700 (12)	1 650 (7.3)	700 (3)	500 (2.2)	540 (2.4)	330 (1.5)
3/8	5 200 (23)	3 500 (16)	4 100 (18)	2 300 (10)	1 040 (4.6)	700 (3.1)	820 (3.6)	460 (2)
1/2	9 000 (40)	5 200 (23)	7 550 (34)	3 700 (16.4)	1 800 (8)	1 040 (8)	1 500 (7)	740 (3.3)
5/8	13 500 (60)	8 000 (36)	12 100 (54)	5 400 (24)	2 700 (12)	1 600 (7.1)	2 400 (11)	1 080 (4.8)
3/4	20 000 (89)	10 000 (44)	18 100 (81)	7 500 (33)	4 000 (18)	2 000 (9)	3 600 (16)	1 500 (7)
7/8	29 000 (129)	12 000 (53)	25 100 (112)	10 000 (44)	5 800 (26)	2 400 (11)	5 000 (22)	2 000 (9)
1	38 000 (169)	14 500 (64)	33 100 (147)	12 800 (57)	7 600 (34)	2 900 (13)	6 600 (29)	2 560 (11.4)
1 1/4	60 000 (267)	23 000 (102)	53 600 (238)	20 600 (92)	12 000 (53)	4 600 (20)	10 700 (48)	4 120 (18.3)
1 3/8	72 000 (320)	29 000 (129)	63 400 (282)	24 300 (108)	14 400 (64)	5 800 (26)	12 600 (56)	4 860 (22)
1 1/2	85 000 (378)	36 000 (160)	77 700 (345)	29 300 (130)	17 000 (76)	7 200 (32)	15 500 (69)	5 860 (26.1)
1 3/4	115 000 (511)	...	105 000 (467)	...	23 000 (102)	...	21 000 (93)	...
2	150 000 (667)	...	138 000 (614)	...	30 000 (133)	...	27 600 (122)	...
2 1/4	197 000 (876)	...	181 000 (805)	...	39 400 (175)	...	36 200 (161)	...
2 1/2	242 000 (1076)	...	223 000 (992)	...	48 400 (215)	...	44 600 (198)	...
2 3/4	304 000 (1352)	...	277 000 (1232)	...	60 800 (270)	...	55 400 (246)	...
3	350 000 (1556)	...	337 000 (1499)	...	70 000 (311)	...	67 400 (300)	...
3 1/4	400 000 (1779)	...	400 000 (1779)	...	80 000 (356)	...	80 000 (356)	...
3 1/2	475 000 (2112)	...	475 000 (2113)	...	95 000 (423)	...	95 000 (423)	...
3 3/4	550 000 (2446)	...	550 000 (2446)	...	110 000 (489)	...	110 000 (489)	...
4	635 000 (2824)	...	635 000 (2824)	...	127 000 (565)	...	127 000 (565)	...

5.1.2 For materials used for welded turnbuckle bodies, eye and jaw end pulls, the carbon shall be 0.25 % maximum, sulfur 0.05 % maximum, and phosphorus 0.05 % maximum.

5.1.3 Heavy jam nuts shall be right-hand or left-hand threaded, as required, and made of carbon steel of a type selected from Groups 1016 to 1020, inclusive in accordance with Specification A29/A29M.

5.1.4 Jaw end pulls 5/8 in. (16 mm) and smaller shall be provided with a steel hexagon head bolt and nut of commercial quality. Jaw end pulls 3/4 in. (19 mm) and larger shall be provided with a round head steel pin and cotter of commercial value.

5.2 Manufacture:

5.2.1 Eye End Pulls—Eye end pulls shall be forged, resistance welded, or arc or gas welded, at the option of the producer, except that when forged bodies are specified, forged-eye end pulls shall be required.

5.2.1.1 Each forged-eye end pull shall be forged at elevated temperature to final shape and size and shall be similar to Fig. 2. The shape of the eye may be either oval or round.

5.2.1.2 Resistance-welded eye end pulls shall be similar to Fig. 3. They shall be fabricated from one piece of material by bending the material to form the eye and joined by resistance welding process.

5.2.1.3 Arc- or gas-welded eye end pulls shall be similar to Fig. 4. They shall be fabricated from one piece of material by bending the material to form the eye and joined by welding. The cross-sectional area through the weld shall be not less than the cross-sectional area of the bar.

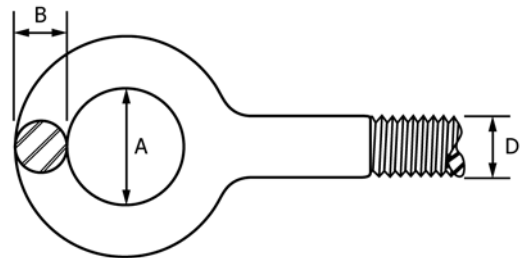
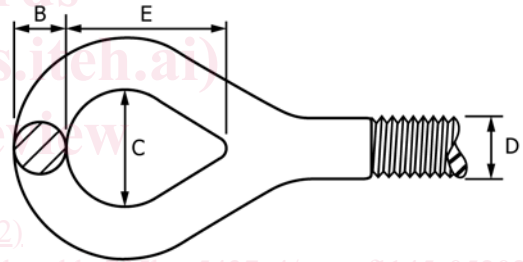


FIG. 2 Forged-Eye End Pull

5.2.2 Jaw End Pulls—Jaw end pulls shall be forged, arc or gas welded, or upset, at the option of the producer, except that if forged bodies are specified, forged-jaw end pulls shall be provided.

5.2.2.1 Forged-jaw end pulls shall be similar to Fig. 5.

5.2.2.2 Arc- or gas-welded end pulls shall be similar to Fig. 6.

5.2.2.3 Upset jaw end pulls shall be similar to Fig. 7.

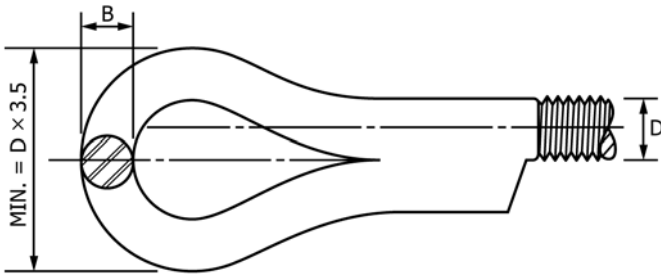


FIG. 3 Resistance-Welded-Eye End Pull

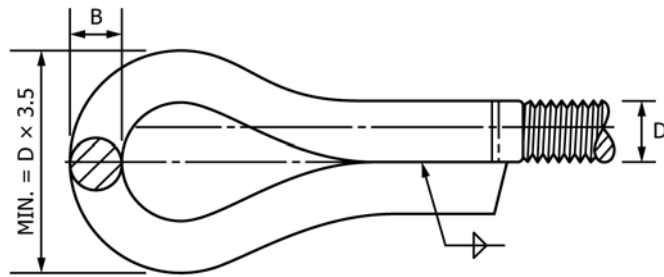


FIG. 4 Arc or Gas Welded-Eye End Pull

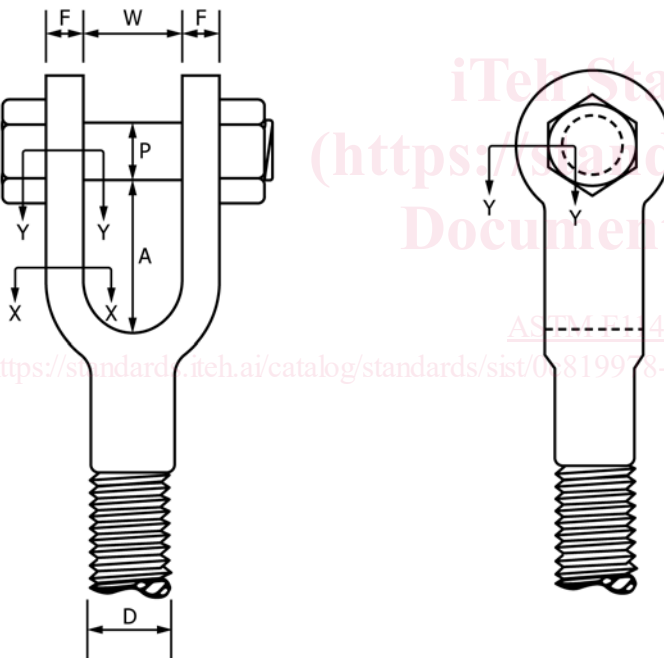
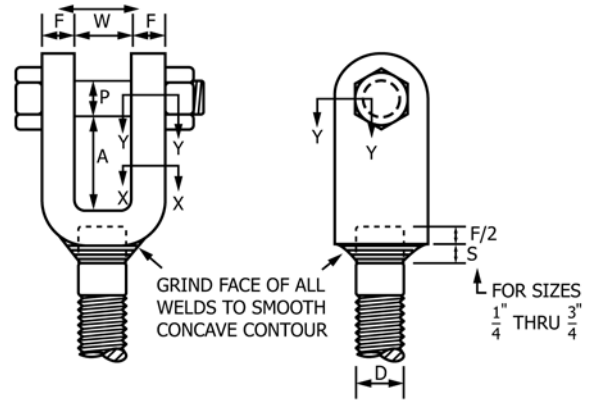


FIG. 5 Forged-Jaw End Pull

5.2.3 Hook End Pulls—Hook end pulls shall be forged and be similar to Fig. 8.

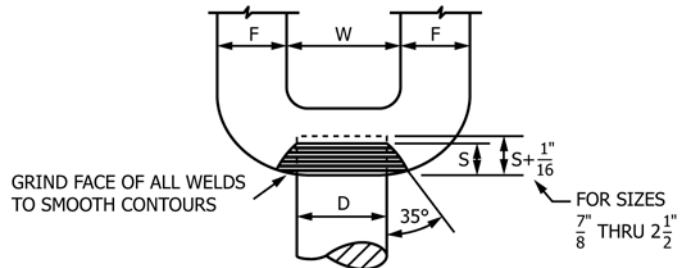
5.2.4 Type I, Grade 1 Turnbuckles—Each forged turnbuckle body shall be forged at elevated temperature to final shape and size and shall be similar to Fig. 9. The shape of the head of the turnbuckle shall be either round or hexagonal.

5.2.5 Type I, Grade 2 Turnbuckles—For each spread turnbuckle body, one piece of material shall be cut lengthwise from near one end to the other end by any suitable means, such as an oxyacetylene cutting torch; the resulting reins shall then be spread apart at elevated temperatures to final shape and size.



GRIND FACE OF ALL WELDS TO SMOOTH CONCAVE CONTOUR

FOR SIZES 1/4" THRU 3/4"



GRIND FACE OF ALL WELDS TO SMOOTH CONTOURS

FOR SIZES 7/8" THRU 2 1/2"

FIG. 6 Arc or Gas Welded-Jaw End Pull

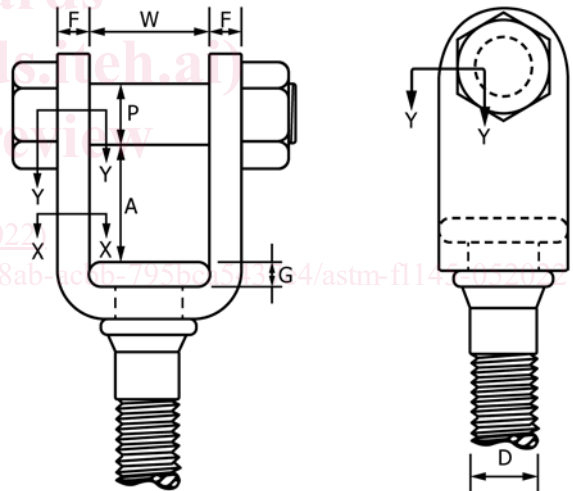


FIG. 7 Upset Jaw End Pull

The bodies shall be similar to Fig. 10. The shape of the cross section of the material shall be at the option of the producer.

5.2.6 Type I, Grade 3 Turnbuckles—Each resistance-welded turnbuckle body shall be fabricated by joining two formed pieces of material by either the flash or upset welding process. The welds shall be parallel to the long axis of the piece. The surfaces to be joined shall be held in intimate contact by external forces, an electric current passed through the surfaces, and the weld consolidated by the forces. The bodies shall be similar to Fig. 11. The shape of the cross section of the pieces shall be at the option of the producer.

5.2.7 Type I, Grade 4 Turnbuckles—The welds shall be either electric arc or oxyacetylene (gas) at the option of the producer. Arc- or gas-welded turnbuckle bodies shall be

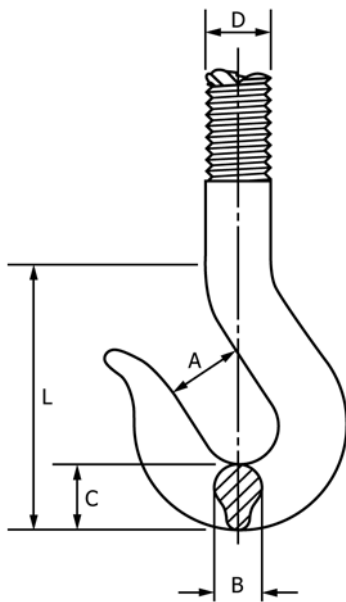


FIG. 8 Hook End Pull

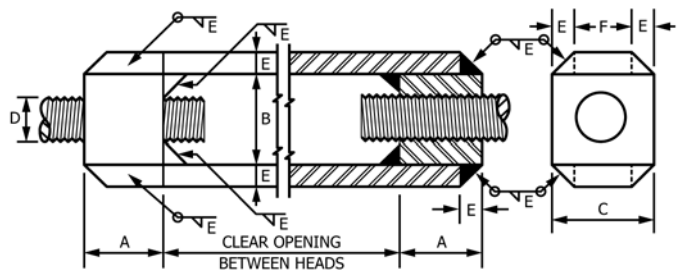


FIG. 12 Type I, Grade 4, Open Turnbuckle Body, Arc or Gas Welded

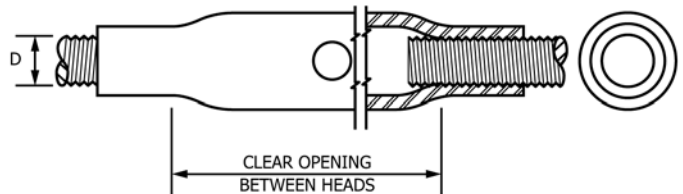


FIG. 13 Type II, Pipe Turnbuckle Body

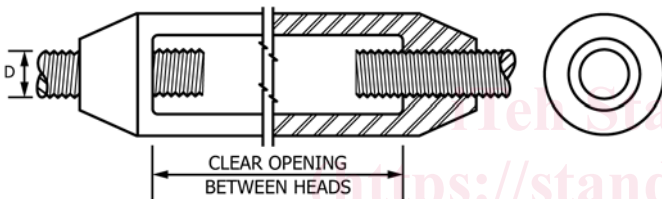


FIG. 9 Type I, Grade 1, Open Turnbuckle Body, Forged

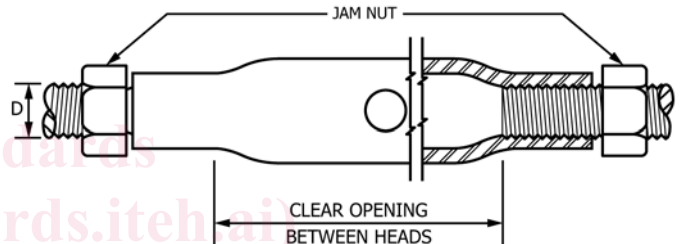


FIG. 14 Type III, Rigging Turnbuckle Body

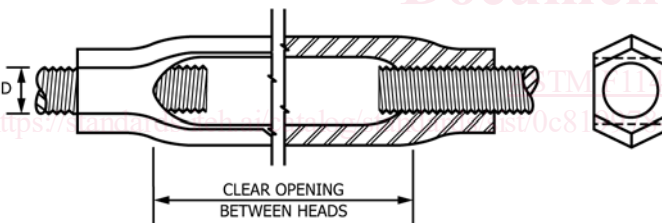


FIG. 10 Type I, Grade 2, Open Turnbuckle Body, Spread

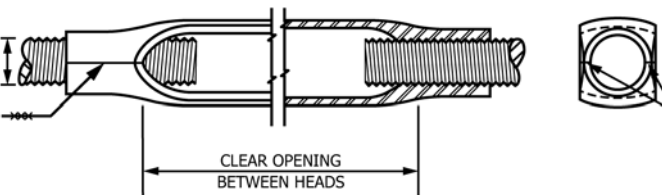


FIG. 11 Type I, Grade 3, Open Turnbuckle Body, Resistance Welded

jam nut (see 5.1.3) of a type which does not depend upon deformation of the threads for security.

## 6. Mechanical Properties

6.1 The breaking strength of turnbuckles, equipped with end pulls, shall be not less than the value given in Table 3 for the required size, type, and grade of end pull specified.

6.2 End pulls shall be capable of bending through an angle of 90° around a pin twice the nominal major diameter of the end pull without either crack or rupture.

6.3 End pulls for Classes D, E, F, G, and H shall be capable of supporting a load equal to one half of the specified breaking strength without permanent deformation.

## 7. Other Requirements

7.1 All arc-welded bodies, eyes, and jaws shall be welded with Type 7015, 7016, 8015, or 8016 electrodes of AWS A5.1 or AWS A5.5, as applicable.

7.2 All gas-welded bodies, eyes, and jaws shall be welded with welding rods in accordance with AWS A5.2.

7.3 Turnbuckle bodies and end pulls shall be threaded after fabrication to final size and shape. The threads in the heads of the turnbuckle bodies and on the end pulls shall comply with ASME B1.1 (see 4.1.5). Unified threads in the coarse (UNC) and fine (UNF) standard series should be used. If neither is specified, the threads will be in the UNC series. If the standard

fabricated by joining four pieces of material by welds similar to Fig. 12. The faces of the welds shall not be concave but may be somewhat convex.

5.2.8 *Type II, Pipe*—Pipe turnbuckle bodies shall be forged, swaged, spun, drawn, or upset in way of the threaded ends, and shall be similar to Fig. 13.

5.2.9 *Type III, Rigging*—Rigging turnbuckle bodies shall be forged, similar to Fig. 14, and shall be provided with a heavy

diameter-pitch combinations are not suitable, the UNS threads with dimensions in accordance with ASME B1.1 should be used.

7.3.1 Threads on the finished turnbuckle shall not be looser than class 1A/1B fit. If coated turnbuckles are specified, the male threads on the end pulls may be undercut, as necessary, so that after coating they will properly mate (not looser than 1A/1B fit) with the standard size female threads of the turnbuckle bodies.

7.3.2 The thread in one head of each turnbuckle body shall be right-hand and in the other head, left-hand.

7.3.3 The threads on the end pulls shall be right-hand on one end pull and left-hand on the other. The length of the thread on the two end pulls shall be great enough so that the ends of the end pull can be brought into contact with each other at the middle of the body length when jam nuts are not used.

## 8. Dimensions and Tolerances

8.1 Turnbuckles covered by this specification shall be furnished in the sizes shown in **Table 1** and **Table 2**, as specified (see 4.1.3).

8.1.1 The size of turnbuckle bodies and turnbuckles shall be the nominal major diameter of the threads in the heads and the clear opening between heads (which is approximately equal to the take up); thus, for a ¾ by 6-in. (19 by 152-mm) turnbuckle body, the heads shall be threaded for a ¾-in. (19-mm) nominal major diameter end pull, and the clear opening between heads shall be 6 in. (152 mm). The difference between the actual clear opening in the turnbuckle body and the nominal value given in **Table 1** or **Table 2** for the size specified shall not exceed 5 % of the nominal value.

8.1.2 The lengths of the heads of the turnbuckle bodies shall not be less than 1½ times the nominal outside diameter of the end pull for sizes up to 1¼ in. (32 mm), and 1¼ times for sizes 1¼ in. (32 mm) and above.

8.2 Type I, Grade 4 turnbuckle bodies shall comply with the dimensional requirements given in **Table 4** for the size specified.

8.3 For Types II and III turnbuckle bodies, holes in body shall be ¼ in. (6 mm) in diameter for sizes up to and including ⅝ in. (16 mm); holes in body for sizes larger than ⅝ in. (16 mm) shall be ½ in. (13 mm) in diameter (see **Fig. 13** and **Fig. 14**, respectively).

8.4 Minimum dimensions for forged-eye end pulls are as shown in **Table 5** (**Figs. 2-4**).

8.5 For arc- or gas-welded and resistance-welded eye end pulls, the outside diameter of the eye shall be not less than 3½ times the nominal diameter of the end pull. Nominal dimensions “D” and “B” (see **Fig. 3** and **Fig. 4**) shall be in accordance with **Table 5**.

8.6 Forged-jaw end pulls shall comply with the dimensional requirements of **Table 6** (**Figs. 5-7**).

8.6.1 In **Fig. 5**, the area of the cross section X-X shall be not less than 0.75 of the area corresponding to the nominal diameter. The area of the cross section Y-Y shall be not less than 0.40 of the area corresponding to the nominal diameter.

8.7 Arc- or gas-welded jaw end pulls shall comply with the dimensional requirements of **Table 7** (**Fig. 6**).

8.7.1 In **Fig. 6**, the area of the cross section X-X shall be not less than 0.75 of the area corresponding to the nominal diameter. The area of the cross section Y-Y shall be not less than 0.40 of the area corresponding to the nominal diameter.

8.8 Upset jaw ends shall comply with the dimensional requirements of **Table 8** (**Fig. 7**).

8.8.1 In **Fig. 7**, the area of the cross section X-X shall be not less than 0.75 of the area corresponding to the nominal diameter. The area of the cross section Y-Y shall be not less than 0.40 of the area corresponding to the nominal diameter.

8.9 Hook end pulls shall comply with the dimensional requirements of **Table 9** (**Fig. 8**).

8.10 Heavy jam nuts (see 5.1.3) shall conform to the dimensional requirements in accordance with ASME B18.2.2.

**TABLE 4 Type I, Grade 4 Dimensions of Open Turnbuckle Bodies Fabricated by Arc or Gas Welding, in. (mm)**

Size, D, Nominal, in.	Head			Rein		Size of All Fillet Welds, min
	Length, A, min	Thickness, B, min	Width, C, min	Thickness, E, min	Width, F, min	
¼	⅞ (11.11)	½ (12.7)	⅞ (14.3)	⅛ (3.1)	⅝ (7.9)	⅛ (3.17)
⅕	⅞ (15.8)	⅞ (17.5)	⅞ (20.6)	⅜ (4.7)	⅞ (11.11)	⅜ (4.76)
⅜	1⅞ (17.5)	¾ (19)	⅞ (22.2)	⅜ (4.7)	½ (12.7)	⅜ (4.76)
½	⅞ (22.2)	1 (25.4)	1⅞ (28.6)	¼ (6.35)	⅝ (15.8)	¼ (6.35)
⅝	1⅞ (28.6)	1¼ (31.7)	1⅞ (36.5)	⅜ (7.9)	⅞ (20.6)	⅝ (7.93)
¾	1⅞ (34.9)	1½ (38.1)	1¾ (44.4)	⅝ (9.5)	1 (25.4)	⅝ (9.52)
⅞	1⅞ (39.7)	1¾ (44.4)	2 (50.8)	⅞ (11.11)	1⅞ (28.5)	⅞ (11.11)
1	1¾ (44.4)	2 (51)	2¼ (57.1)	½ (12.7)	1¼ (31.7)	½ (12.7)
1¼	2⅞ (54)	2½ (63.5)	2¾ (70)	⅝ (15.8)	1½ (38.1)	⅝ (15.8)
1⅝	2⅞ (60.3)	2¾ (70)	3⅞ (77.7)	1⅞ (17.4)	1⅞ (42.8)	1⅞ (17.4)
1½	2⅞ (65.1)	3 (76.2)	3⅞ (84.1)	¾ (19.05)	1⅞ (46)	¾ (19.05)
1¾	2⅞ (71.4)	3⅞ (85.7)	3⅞ (92.1)	⅞ (20.6)	2 (50.8)	1⅞ (20.6)
2	3⅞ (81)	3⅞ (98.4)	4⅞ (104.8)	1⅞ (23.8)	2¼ (57.1)	1⅞ (23.8)
2¼	3⅞ (89)	4¼ (108)	4½ (114.3)	1 (25.4)	2½ (63.5)	1 (25.4)
2½	3⅞ (100)	4¾ (120.6)	5⅞ (128.6)	1⅞ (28.5)	2⅞ (71.4)	1⅞ (28.5)
2¾	4⅞ (111)	5¼ (133.4)	5⅞ (142.9)	1¼ (31.7)	3⅞ (79.3)	1¼ (31.7)
3	4⅞ (122)	5¾ (146)	6⅞ (157.2)	1⅞ (34.9)	3⅞ (87.3)	1⅞ (34.9)
3½	5⅞ (141)	6¾ (171.5)	7⅞ (182.5)	1⅞ (41.2)	3⅞ (100)	1⅞ (41.2)
4	6⅞ (160)	7⅞ (193.7)	8⅞ (206.3)	1⅞ (46)	4½ (114.3)	1⅞ (46)

**TABLE 5 Dimensions of Eye End Pulls, in. (mm)**

D, Nominal, in.	A, min	B, min	C, min	E, min
1/4	1/2 (12.7)	7/32 (5.56)	11/32 (8.73)	11/16 (17.4)
5/16	5/8 (7.93)	9/32 (7.14)	7/16 (11.11)	13/16 (20.6)
3/8	3/4 (19)	11/32 (8.73)	17/32 (13.4)	15/16 (23.8)
1/2	1 (25.4)	7/16 (11.11)	23/32 (18.2)	13/8 (30.1)
5/8	1 1/4 (31.7)	1/2 (12.7)	7/8 (22.2)	1 3/8 (34.9)
3/4	1 1/2 (38.1)	5/8 (15.8)	1 (25.4)	1 5/8 (41.2)
7/8	1 3/4 (44.4)	3/4 (19)	1 1/4 (31.7)	1 7/8 (47.6)
1	2 (50.8)	7/8 (22.2)	1 7/16 (36.5)	2 1/4 (57.1)
1 1/4	2 1/8 (53.9)	1 1/16 (26.9)	1 11/16 (42.8)	2 9/16 (65)
1 1/2	2 1/4 (57.1)	1 1/4 (31.7)	2 1/8 (53.9)	3 1/4 (82.5)
1 3/4	2 1/2 (63.5)	1 7/16 (36.5)	2 3/8 (60.3)	3 3/4 (95.2)
2	3 (76.2)	1 5/8 (41.2)	2 11/16 (68.2)	4 3/8 (111.1)
2 1/4	3 1/4 (82.5)	1 13/16 (46)	2 15/16 (74.6)	5 3/16 (131.7)
2 1/2	3 1/2 (88.9)	2 (50.8)	3 1/8 (79.3)	6 (152.4)

**TABLE 6 Dimensions of Forged-Jaw End Pulls, in. (mm)**

D, Nominal, in.	A, min	F, min	P, min	W, min
1/4	5/8 (15.8)	1/8 (3.17)	1/4 (6.35)	3/8 (9.52)
5/16	23/32 (18.2)	1/8 (3.17)	1/4 (6.35)	15/32 (11.9)
3/8	13/16 (20.6)	3/16 (4.76)	5/16 (7.93)	1/2 (12.7)
1/2	1 1/32 (26.1)	1/4 (6.35)	3/8 (9.52)	5/8 (15.8)
5/8	1 1/4 (31.7)	5/16 (7.93)	1/2 (12.7)	3/4 (19)
3/4	1 1/2 (38.1)	3/8 (9.52)	5/8 (15.8)	15/16 (23.8)
7/8	1 3/4 (44.4)	7/16 (11.11)	3/4 (19)	1 1/8 (28.5)
1	2 (50.8)	1/2 (12.7)	7/8 (22.2)	1 3/16 (30.1)
1 1/4	2 3/8 (60.3)	5/8 (15.8)	1 1/8 (28.5)	1 3/4 (44.4)
1 1/2	2 3/4 (69.8)	1 1/16 (17.4)	1 3/8 (34.9)	2 1/16 (52.3)
1 3/4	3 (76.2)	3/4 (19)	1 5/8 (41.2)	2 3/8 (60.3)
2	3 3/4 (95.2)	13/16 (20.6)	1 7/8 (47.6)	2 1/2 (63.5)
2 1/4	4 (101.6)	7/8 (22.2)	2 1/16 (52.3)	2 5/8 (66.6)
2 1/2	4 1/4 (107.9)	1 (25.4)	2 1/4 (57.1)	2 7/8 (73)

**9. Workmanship, Finish, and Appearance**

9.1 Turnbuckles and end pulls shall be finished in a workmanlike manner. All parts shall be properly shaped and shall be free from fins, cracks, flaws, seams, and other injurious defects.

9.1.1 Screw threads shall be true to form, clean cut, and free from injurious defects.

9.2 Turnbuckles and end pulls shall be finished by grinding the flash and excess weld metal smooth, where required, and the loose scale removed.

9.3 Turnbuckles shall be furnished self-colored, black, or zinc-coated, as specified (see 4.1.6).

9.3.1 If zinc-coated turnbuckles are specified, the coating may be applied by the hot-dip (galvanizing) process or the electrodeposition process at the manufacturer’s option.

9.3.1.1 If the hot-dip process is used, the coating shall be applied in accordance with Specification A153/A153M and shall be adherent, smooth, and free from injurious lumps, blisters, dross, or flux.

9.3.1.2 If the electrodeposition process is used, it shall conform to Type II finish, Class Fe/Zn 12 in accordance with Specification B633.

9.3.2 Coating shall be done on the end pulls after threading; coating for turnbuckle bodies shall be done after tapping.

**10. Sampling**

10.1 All turnbuckles of the same type, grade, class, and size, not exceeding 1000 and presented at one time, shall be considered a lot.

10.2 A random sample of turnbuckles shall be selected from each lot in accordance with Table 10 for the examination specified in 12.2.

10.3 A random sample of turnbuckles shall be selected from each lot in accordance with Table 11 for the breaking strength, proof, bending, and galvanizing tests specified in Section 11.

10.3.1 End pull samples for bending tests shall be selected prior to threading.

10.3.2 Failure of any sample in any test shall be cause for rejection of the lot represented by the sample.

10.3.3 Specimens used for the breaking strength and bend tests may also be used for the galvanizing tests.

**11. Test Methods**

11.1 *Proof Test*—Each sample selected in accordance with 10.3 shall be subjected to a proof test of one half the specified breaking strength (see Table 11) for the end pull. Test loads shall be applied at end pulls.

11.2 *Breaking Strength Test*—Each sample turnbuckle selected in accordance with 10.3 shall be tested to failure. Loads shall be applied at end pulls.

11.3 *Bending Test*—Each end pull sample selected in accordance with 10.3 shall be bent cold through an angle of 90° around a pin twice the nominal diameter of the end pull.

11.4 *Galvanizing Test*—If the hot-dip zinc-coating method is used, no thickness test will be required. If the electrodeposition method is used, the thickness shall be determined as specified in Specification B633.

11.5 Possible test failures are defined as follows:

11.5.1 *Proof Test*—Evidence of deformation or signs of incipient cracks in turnbuckle body or end pull as a result of specified proof test.

11.5.2 *Breaking Strength Test*—Breaking strength or turnbuckles equipped with end pulls less than the required minimum value.

11.5.3 *Bending Test*—Evidence of cracks or rupture when the unthreaded end pull is bent cold as required.

11.5.4 *Galvanizing Test*—Coating nonconformant; nonadherent, evidence of coat flaking off, or separating from basic metal; thickness less than the allowable minimum.

**12. Inspection**

12.1 The purchaser reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure that supplies and services conform to prescribed requirements.

12.2 Each sample turnbuckle selected in accordance with Table 10 shall be examined to verify compliance with the requirements of this specification. Examination shall be conducted as specified in Table 12.

12.2.1 Any turnbuckle in the sample containing one or more defects shall be rejected. If any defects are noted in the original