



**Designation: A 394 – 9300**

# Standard Specification for Steel Transmission Tower Bolts, Zinc-Coated and Bare<sup>1</sup>

This standard is issued under the fixed designation A 394; 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 the chemical and mechanical requirements of hexagon and square-head zinc-coated steel bolts and atmospheric corrosion-resistant bolts, in nominal thread diameters of 1/2, 5/8, 3/4, 7/8 and 1 in. for use in the construction of transmission towers, substations, and similar steel structures. The various types of bolts covered in this specification are:

1.1.1 *Type 0*—Zinc-coated bolts made of low or medium carbon steel.

1.1.2 *Type 1*—Zinc-coated bolts made of medium carbon steel, quenched and tempered.

1.1.3 *Type 2*—Zinc-coated bolts made from what is generally described as low-carbon martensite steel, quenched and tempered.

1.1.4 *Type 3*—Bare (uncoated), quenched and tempered bolts made of steel having atmospheric corrosion-resistance and weathering characteristics comparable to that of the steel covered in Specifications A 242/A 242M, A 588/A 588M, and A 709/A 709M. The atmospheric corrosion resistance of these steels is substantially better than that of carbon steel with or without copper addition (see 5.4). When properly exposed to the atmosphere, these steels can be used bare (uncoated) for many applications.

1.1.5 For applications requiring improved low-temperature characteristics, use of Types 1, 2, or 3 bolts is recommended.

1.2 Annex A1 of this specification covers zinc-coated steel ladder bolts, step bolts, and support-equipment bolts.

1.3 Unless otherwise specified, all nuts used on these bolts shall be hex style and conform to the requirements of Specification A 563 as follows:

Bolt Type	Nut Grade	Finish
0	A	Zinc-coated
1 and 2	DH	Zinc-coated
3	DH3	Plain

1.4 Suitable washers for use with Type 0 are zinc-coated carbon-steel washers with dimensions that are in accordance with Specification F 436. Suitable washers for use with Type 1 and Type 2 bolts are zinc-coated Type 1 hardened-steel washers that are in accordance with Specification F 436. Suitable washers for use with Type 3 bolts are Type 3 hardened-steel washers that are in accordance with Specification F 436.

1.5 Nuts and washers that are supplied under this specification that are zinc coated shall be in accordance with 4.4.

1.6 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:*

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F-16 on Fasteners and is the direct responsibility of Subcommittee F16.02 on Steel Bolts, Nuts, Rivets, and Washers.

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

- A 90 Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles<sup>2</sup>  
A 153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware<sup>2</sup>  
A 242/A 242M Specification for High-Strength Low-Alloy Structural Steel<sup>3</sup>  
A 563 Specification for Carbon and Alloy Steel Nuts<sup>4</sup>  
A 588/A 588M Specification for High-Strength Low-Alloy Structural Steel with 50 ksi [345 MPa] Minimum Yield Point to 4 in. [100 mm] Thick<sup>3</sup>  
A 709/A 709M Specification for Structural Steel for Bridges<sup>3</sup>  
B 6 Specification for Zinc (Slab Zinc)<sup>5</sup>  
B 244 Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments<sup>6</sup>  
B 499 Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals<sup>6</sup>  
B 695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel<sup>6</sup>  
D 3951 Practice for Commercial Packaging<sup>7</sup>  
F 436 Specification for Hardened Steel Washers<sup>4</sup>  
F 606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets<sup>4</sup>  
F 788/F 788M Specification for Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series<sup>4</sup>  
G 101 Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels<sup>8</sup>  
2.2 *ANSI/ASME Standards:*  
B1.1 Unified Screw Threads<sup>9</sup>  
B18.2.1 Square and Hex Bolts and Screws<sup>9</sup>  
B 18.24.1 Part Identifying Number (PIN) Code System<sup>10</sup>  
2.3 *Military Standard:*  
MIL-STD-105 Single Sampling Plan for Normal Inspection<sup>11</sup>

### 3. Ordering Information

- 3.1 Orders for products under this specification shall include the following:
- 3.1.1 Quantity (number of bolts and accessories).
  - 3.1.2 Name of products, including accessories such as A 563 nuts and F 436 washers when desired.
  - 3.1.3 Dimensions, including nominal bolt diameter and length. For bolts other than transmission-tower bolts, complete dimensions are required (see Annex A1).
  - 3.1.4 Type of bolt (for example, Type 0, 1, 2, or 3).
    - 3.1.4.1 When non-zinc-coated atmospheric corrosion-resistant steel is required, Type 3 bolts shall be specified by the purchaser.
  - 3.1.5 For Type 0 and Type 1 bolts specify the zinc-coating process required, such as, “hot dip,” “mechanically deposited,” or “no preference.” Type 2 bolts shall have only mechanically-deposited zinc coatings.
  - 3.1.6 ASTM designation and year of issue. When year of issue is not specified, bolts shall be furnished to the latest issue.
  - 3.1.7 Additional requirements, if any, are to be specified on the purchase order:
    - 3.1.7.1 Shear-strength testing (see 6.2.1 and 6.2.2). Include type of test required.
    - 3.1.7.2 Additional tests (see 10.2).
    - 3.1.7.3 Inspection (see 12.1 and 12.2).
    - 3.1.7.4 Certification (see 14.1).
    - 3.1.7.5 Test reports (see 14.2).

NOTE 1—Examples of ordering description:

- (I) 1000 square-head transmission-tower bolts, ½ by 2 in. Type 1, hot dip zinc coated, shear testing required, ASTM A 394 – XX, with hot-dip

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 01.06.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 01.04.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 01.08.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 02.04.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 02.05.

<sup>7</sup> *Annual Book of ASTM Standards*, Vol 15.09.

<sup>8</sup> *Annual Book of ASTM Standards*, Vol 03.02.

<sup>9</sup> Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

<sup>10</sup> Available from ~~Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS:~~ American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

<sup>11</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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zinc-coated hex nuts, Grade DH, ASTM A 563 – XX,

( 2) 1000 transmission tower bolts, ½ by 2 in. Type 0, mechanically zinc coated, ASTM A 394 – XX, with mechanically zinc-coated hex nuts, Grade A, ASTM A 563 – XX.

(3) 1000 transmission tower bolts, ½ by 2 in. Type 3, Supplementary Requirement S2, ASTM A 394 – XX, with hex nuts, Grade DH3 weathering steel, ASTM A 563 – XX and with 2 circular washers, Type 3, ASTM F 436 – XX.

3.1.8 For establishment of a part identifying system, see ASME B18.24.1.

#### 4. Materials and Manufacture

4.1 Steel for the manufacture of bolts shall be made by any of the following processes: open-hearth, electric-furnace, or basic-oxygen.

4.1.1 Cold-headed Type 0 bolts shall be stress relief annealed before zinc coating to remove cold work effects such that hardness measured anywhere on the surface or through the cross section shall meet the requirements in 6.1.

4.2 Types 1, 2 and 3 bolts shall be heat treated by quenching in a suitable liquid medium from above the austenitizing temperature and then tempering to the required finished hardness.

4.3 Slab zinc when used for coating shall be any grade of zinc conforming to Specification B 6.

4.4 *Zinc Coatings, Hot Dip and Mechanically Deposited.*

4.4.1 Type 0 and Type 1 bolts shall be zinc coated. The purchaser shall specify the zinc-coating process, that is “hot dip,” “mechanically deposited,” or “no preference.”

4.4.2 Type 2 bolts shall be zinc coated by the mechanical-deposition process.

4.4.3 When “hot dip” is specified, the bolts shall be zinc coated by the hot-dip process in accordance with the requirements of Class C of Specification A 153, except as specified in 4.4.6.

4.4.4 When “mechanically deposited” is specified, the bolts shall be zinc coated by the mechanical-deposition process in accordance with the requirements of Class 50 of Specification B 695, except as specified in 4.4.6.

4.4.5 When “no preference” is specified, the supplier may furnish either a hot-dip zinc-coating in accordance with Specification A 153 Class C, or a mechanically deposited zinc-coating in accordance with Specification B 695 Class 50, except as specified in 4.4.6. Threaded components (bolts and nuts) shall be coated by the same zinc-coating process and the supplier’s option is limited to one process per item with no mixed processes in a lot.

4.4.6 The minimum average weight of a zinc coating shall be 1.65 oz/ft<sup>2</sup>. The minimum weight of a zinc coating on any one item shall be 1.50 oz/ft<sup>2</sup>.

4.4.7 Bolt threads shall not be cut, rolled, or otherwise finished after galvanizing.

4.4.8 Hot-dip zinc-coated nuts furnished under Specification A 563 shall be tapped after galvanizing.





#### 5. Chemical Composition

5.1 Type 0 bolts shall conform to the chemical composition requirements specified for low-carbon steel bolts outlined in Table 1.

5.2 Type 1 bolts shall conform to the chemical composition requirements specified for medium carbon steel bolts in Table 1.

5.3 Type 2 bolts shall conform to the chemical composition requirements specified for low-carbon martensite steel bolts in Table 1.

**TABLE 1 Chemical Requirements and Head Markings**

Head Marking	Bolt Type	Element, %				
		Carbon	Manganese	Phosphorus	Sulphur	Boron
	0	0.55 max	...	0.048 max	0.058 max	...
	1	0.28/0.55	0.60 min	0.048 max	0.058 max	...
	2	0.15/0.25	0.74 min	0.048 max	0.058 max	0.0005 min
	3	...				See Table 2

5.4 Type 3 bolts shall conform to one of the chemical compositions specified in Table 2. The selection of the chemical composition A, B, C, D, E, or F shall be at the option of the bolt manufacturer. See Guide G 101 for methods of estimating the atmospheric corrosion resistance of low alloy steels.

**TABLE 2 Chemical Requirements for Type 3 Bolts**

Element Product Analysis	Type 3 Bolts Composition, % <sup>A</sup>					
	A	B	C	D	E	F
Carbon	0.31–0.42	0.36–0.50	0.14–0.26	0.14–0.26	0.18–0.27	0.19–0.26
Manganese	0.86–1.24	0.67–0.93	0.76–1.39	0.36–1.24	0.56–1.04	0.86–1.24
Phosphorus	0.045 max	0.06–0.125	0.040 max	0.045 max	0.045 max	0.045 max
Sulfur	0.055 max	0.055 max	0.045 max	0.055 max	0.045 max	0.045 max
Silicon	0.13–0.32	0.25–0.55	0.13–0.32	0.20–0.55	0.13–0.32	0.13–0.32
Copper	0.22–0.48	0.17–0.43	0.17–0.53	0.27–0.53	0.27–0.63	0.17–0.43
Nickel	0.22–0.48	0.47–0.83	0.22–0.53	0.47–0.83	0.27–0.63	0.17–0.43
Chromium	0.42–0.68	0.47–0.83	0.27–0.53	0.45–1.05	0.55–0.95	0.42–0.68
Vanadium	...	...	0.010 min	...	...	...
Molybdenum	...	0.07 max	...	0.11 max	...	...
Titanium	...	...	...	...	...	...

<sup>A</sup> A, B, C, D, E, and F are classes of material used for Type 3 bolts. Selection of a class shall be at the option of the bolt manufacturer.

5.5 Bolts are customarily furnished from stock and individual heats of steel cannot be identified.

## 6. Mechanical Properties

6.1 *Tension Test*—Types 0, 1, 2, and 3 bolts having a length equal to or more than 3 diameters shall be wedge tension tested as specified in 11.1 and shall conform to the tensile strength requirements in Table 3. Zinc-coated bolts shall be tested after coating. Bolts too short for full size testing or for other reasons not subject to tension tests, shall meet the following hardness requirements:

	Min	Max
Type 0—Rockwell B	80	100
Types 1, 2, and 3—Rockwell C	25	34

### 6.2 Shear Strength:

6.2.1 When specified in the original inquiry and order, bolts, except as excluded in 6.2.2, shall be shear strength tested in accordance with 11.2 and shall meet the requirements given in Table 4.

6.2.2 Bolts with unthreaded body lengths shorter than two times the nominal bolt diameter, are subject to shear strength testing only upon agreement between the purchaser and supplier as to testing method and shear strength values.

## 7. Dimensions

7.1 Bolt threads, before zinc coating, shall be the unified coarse thread series and Class 2A tolerance as defined in the latest issue of ANSI/ASME B1.1. Threads may be rolled or cut.

7.2 Bolts shall be full-size body in conformance with the latest issue of ANSI/ASME B18.2.1, except that the full-body length listed in Table 5 shall be the basis of manufacture and inspection. Unless otherwise specified, hex bolts shall be furnished. Ends of bolts need not be chamfered or pointed.

7.3 Zinc-coated bolts must assemble with a nut tapped oversize as described in Specification A 563. In case of dispute, a calibrated go and not go thread-ring gage of the same diameter, thread class, and tolerance plus the amount of overtap shall be used. Assembly of the gage, or the nut described above, shall be possible with hand effort following application of light machine oil to prevent galling and damage to the gage. These inspections, when performed to resolve disputes, shall be performed at the frequency and acceptability specified in Table 6.

**TABLE 3 Tensile Strength<sup>A</sup>**

Nominal Size, in.	Minimum Load, lbf	
	Type 0, Tensile Strength, lbf <sup>B</sup>	Types 1, 2, and 3, Tensile Strength, lbf <sup>C</sup>
1/2	10 500	17 050
5/8	16 700	27 100
3/4	24 700	40 400
7/8	34 200	55 450
1	44 850	72 700

<sup>A</sup> Tensile strength based on the thread stress area,  $A_s$ , is calculated as follows:  

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

where:

$D$  = nominal diameter, and

$N$  = threads per inch.

<sup>B</sup> Based on 74 000 psi unit tensile strength.

<sup>C</sup> Based on 120 000 psi unit tensile strength.

**TABLE 4 Shear Strengths**

Nominal Size, in.	Minimum Load, lbf			
	Type 0		Types 1, 2, and 3	
	Single Shear Strength Through Threads, lbf <sup>A</sup>	Single Shear Strength Through Body, lbf <sup>B</sup>	Single Shear Strength Through Threads, lbf <sup>C</sup>	Single Shear Strength Through Body, lbf <sup>D</sup>
12-1/2	6 950	9 000	9 350	14 600
1/2	6 950	9 000	9 350	14 600
5/8	11 150	14 100	15 050	22 850
3/4	16 650	20 250	22 450	32 850
7/8	23 450	27 600	31 150	44 750
1	30 400	36 050	41 000	58 450

<sup>A</sup> Based on 55 200 psi unit shear strength across the area at root of threads.

<sup>B</sup> Based on 45 880 psi unit shear strength across the nominal area.

<sup>C</sup> Based on 74 400 psi unit shear strength across the area at root of threads.

<sup>D</sup> Based on 74 400 psi unit shear strength across the nominal area.

**TABLE 5 Length of Full Body for Bolts**

NOTE—Full body is the distance from the underside of the head to the first scratch of thread for bolts with machine-cut threads or to top of the extrusion angle for bolts with rolled threads with a tolerance of  $\pm 1/32$  in. for sizes  $1/2$  in. through  $3/4$  in., inclusive, and  $\pm 1/16$  in. for size  $7/8$  in. and 1 in.

Length of Bolt, L, in.	Bolt Diameter, in.				
	12-1/2	5/8	3/4	7/8	1
1	332-3/32	116-1/16	...	...	...
1	3/32	1/16	...	...	...
1 1/4	532-5/32	116-3/16	116-1/16	...	...
1 1/4	5/32	1/16	1/16	...	...
1 1/2	1332-13/32	14-1/4	18-1/8	316-3/16	...
1 1/2	13/32	1/4	1/8	3/16	...
1 3/4	2132-21/32	12-1/2	38-3/8	14-1/4	316-3/8
1 3/4	21/32	1/2	3/8	1/4	3/16
2 and longer in 1/4-in. increments	L minus 1332-3/32	L minus 114-1/4	L minus 138-3/8	L minus 112-1/2	L minus 158-5/8
2 and longer in 1/4-in. increments	L minus 13/32	L minus 1/4	L minus 1-3/8	L minus 1-1/2	L minus 1-5/8

**TABLE 6 Sample Sizes and Acceptance Numbers for Inspection of Zinc-Coated Threads**

Lot Size	Sample Size <sup>A,B</sup>	Acceptance Number <sup>A</sup>	Rejection Number
2 to 90	13	1	2
91 to 150	20	2	3
151 to 280	32	3	4
281 to 500	50	5	6
501 to 1 200	80	7	8
1 201 to 3 200	125	10	11
3 201 to 10 000	200	14	15
10 001 and over	315	21	22

<sup>A</sup> Sample sizes and acceptance numbers are extracted from "Single Sampling Plan for Normal Inspection," Table IIA, MIL-STD-105.

<sup>B</sup> Inspect all bolts in the lot if the lot size is less than the sample size.

## 8. Workmanship

8.1 Surface discontinuity limits of Types 1, 2, and 3 shall be in accordance with Specification F 788/F 788M.

## 9. Sampling

9.1 Paragraphs 9.2 and 9.3 describe routine production tests performed by the fastener manufacturer. Identification of treatment lots is not retained after tests are performed and found to be acceptable. As described in 5.5, heats are not kept separate in stock and only the test reports described in 14.2 can be furnished.

9.2 Sample bolts shall be taken from each heat treatment or stress-relief-annealing lot and subjected to the required tests described in 6.1. Bolts that are not heat treated in any way are not subject to this test.

9.2.1 *Lot Size*—A lot, in the case of batch processing for the purposes of 9.2, shall be all bolts of the same type, head configuration, nominal thread diameter, length, and heat treated at the same time.

9.3 Samples for tests of each lot of Types 0, 1, and 2 zinc-coated bolts shall be taken as specified in 10.3 and subjected to the tests described in 11.1 and 11.3. A lot of zinc-coated bolts shall be all bolts of the same type, head configuration, nominal thread diameter, length, and the same continuous production run not to exceed an 8-h duration.

9.4 Samples for tests of each lot of Type 3 bolts shall be taken as specified in 10.3 and subjected to the tests described in 11.1. A lot shall be all bolts of the same head configuration, nominal thread diameter, length, and the same continuous production run not to exceed an 8-h duration.

## 10. Number of Tests and Retests

10.1 The requirements of this specification shall be met in continuous mass production for stock. Additional tests of individual shipments are not ordinarily contemplated.

10.2 When additional tests are specified on the purchase order, a lot, for purposes of selecting test samples, shall consist of all material offered for inspection at one time, of the same type, head configuration, nominal thread diameter, and length.

10.3 From each lot as described in Section 9, the number of samples for the mechanical tests and for the coating-thickness tests shall be in accordance with Table 7.

10.4 If the results of the mechanical tests of any test lot do not conform to the requirements because a flaw developed in the test specimen during testing, a retest shall be allowed. If the retest is satisfactory, the lot is acceptable.

## 11. Test Methods

11.1 Tests for hardness and tensile strength shall be conducted in accordance with Test Methods F 606. Bolts tested full size shall be tested using the wedge tension test. Fracture shall be in the threaded portion of the bolt without any fracture at the junction of the head and body.

### 11.2 Shear Test:

11.2.1 Bolts shall be single shear tested either through the unthreaded portion of the shank or through the threads as specified in the order. Holes in the shear plates shall be  $\frac{1}{16}$  in. larger than the nominal thread diameter of the test bolt and the holes shall be chamfered  $\frac{1}{32}$  in. to relieve sharp edges. Shear plates shall be prevented from separating by means of a suitable jig or by using a nut on the test bolt tightened finger tight.

11.2.2 Mount the test specimen in a tensile-testing machine capable of applying load at a controllable rate. Use self-aligning grips and take care when mounting the specimen to assure that the load will be transmitted in a straight line transversely through the test bolt. Apply load and continue until failure of the bolt. Speed of testing as determined with a free running cross head shall be no less than  $\frac{1}{4}$  in. nor greater than  $\frac{1}{2}$  in./min.

11.2.3 The maximum load applied to the specimen coincident with or prior to bolt failure, shall be recorded as the shear strength of the bolt.

11.2.4 Tests need not be continued to destruction provided that the specimen supports, without evidence of bolt failure, the minimum shear load specified in Table 4.

### 11.3 Weight and Thickness of Coating:

11.3.1 Weight of coating or thickness of coating shall be determined by the methods described in either 11.3.2 or 11.3.3 at the option of the manufacturer.

11.3.2 The weight of the coating for pieces whose areas can be readily calculated shall be determined by stripping the entire piece, or suitable representative section thereof, in accordance with the hydrochloric acid-antimony chloride method as described in Test Method A 90.

11.3.3 The thickness of coating may be determined by the use of a magnetic thickness gage. Several magnetic or electromagnetic types of thickness gages are commercially available and are satisfactory for inspection when properly calibrated just prior to inspection use as described in Test Methods B 499 and B 244, respectively. For purposes of conversions from coating thickness to weight of coating, 0.0025-in. coating thickness shall be considered to be equivalent to 1.5 oz/ft<sup>2</sup>. The test for thickness of coating shall be made on a portion of the bolt that does not include any threads.

## 12. Inspection

12.1 If the inspection described in 12.2 is required by the purchaser, it shall be specified in the inquiry and contract or order.

12.2 The inspector representing the purchaser shall have free entry to all parts of the manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector all reasonable facilities to satisfy him that the

**TABLE 7 Sample Sizes and Acceptance Numbers for Mechanical and Coating-Thickness Tests**

Number of Pieces in Lot	Mechanical Tests	Coating Tests	Acceptance Number	Rejection Number
800 and under	1	3	0	1
801 to 8 000	2	3	0	1
8 001 to 35 000	3	3	0	1
35 001 to 150 000	8	5	0	1
150 001 and over	13	8	0	1

material is being furnished in accordance with this specification. All tests and inspection required by the specification that are requested by the purchaser's representative shall be made prior to shipment, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

### **13. Rejection and Rehearing**

13.1 Bolts that fail to conform to the requirements of this specification may be rejected by the purchaser. Rejection shall be reported to the supplier promptly and in writing. In case of dissatisfaction with the results of tests or inspections authorized by the purchaser, the supplier may make claim for a rehearing.

### **14. Certification**

14.1 When specified on the order, the manufacturer's certification shall be furnished to the purchaser stating that the bolts were manufactured, sampled, tested, and inspected in accordance with this specification and have met the requirements.

14.2 When specified on the order, the manufacturer shall furnish the purchaser with a test report certifying to the last set of tests for each bolt type and size in the shipment.

### **15. Responsibility**

15.1 The party responsible for the fastener shall be the organization that supplies the fastener to the purchaser and certifies that the fastener was manufactured, sampled, tested and inspected in accordance with this specification and meets all of its requirements.

### **16. Product Marking**

16.1 Bolt heads shall be marked to identify the bolt type as specified in Table 1, the manufacturer or private label distributor, as appropriate, and the nominal length in inches and fractions.

16.2 The manufacturer may add additional distinguishing marks to the bolt head.

16.3 All markings shall be located on the top of the bolt head and may be raised or depressed at the option of the manufacturer.

16.4 Type and manufacturer's or private label distributor's identification shall be separate and distinct. The two identifications shall preferably be in different locations and, when on the same level, shall be separated by at least two spaces.

### **17. Packaging and Package Marking**

#### *17.1 Packaging:*

17.1.1 Unless otherwise specified, packaging shall be in accordance with Practice D 3951.

17.1.2 When hot dip zinc-coated nuts and bolts are ordered together, they shall be shipped assembled unless otherwise specified.

17.1.3 When nuts and bolts are ordered together, they shall be shipped in the same container.

17.1.4 When special packaging requirements are required, they shall be defined at the time of the inquiry and order.

#### *17.2 Package Marking:*

17.2.1 Each shipping unit shall include or be plainly marked with the following information:

17.2.1.1 ASTM designation and type,

17.2.1.2 Size,

17.2.1.3 Name and brand or trademark of the manufacturer,

17.2.1.4 Number of pieces,

17.2.1.5 Purchase order number, and

17.2.1.6 Country of origin.

### **18. Keywords**

18.1 bolts; carbon steel; steel; transmission tower; weathering steel

**ANNEX**

**(Mandatory Information)**

**A1. LADDER BOLTS, STEP BOLTS, AND EQUIPMENT-SUPPORT BOLTS**

- A1.1 Dimensions of ladder bolts, step bolts, and equipment-support bolts shall be specified by the purchaser.
- A1.2 Bolts shall be Type 0 unless otherwise agreed upon between the manufacturer and the purchaser.
- A1.3 All other requirements relating to processing, properties, testing, and inspection shall be in accordance with Specification A 394.

**SUMMARY OF CHANGES**

This section identifies the location of selected changes to this standard that have been incorporated since the –93 issue. For the convenience of the user, Committee F16 has highlighted those changes that impact the use of this standard. This section may also include descriptions of the changes or reasons for the changes, or both.

- (1) Added 3.1.8, providing for optional use of ASME B18.24.1, Part Identifying Number (PIN) Code System.

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