



# 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 approval. 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*—Hot-dip zinc-coated bolts made of low or medium carbon steel.

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

1.1.3 *Type 2*—Withdrawn in 2005.

1.1.4 *Type 3*—Bare (uncoated), quenched and tempered bolts made of weathering steel.

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

1.3 Nuts and washers that are supplied under this specification that are hot-dip zinc coated shall be in accordance with **4.4**.

1.4 Terms used in this specification are defined in Terminology **F 1789**.

1.5 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 The following safety hazards caveat pertains only to the test methods portion, Section **11**, 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 and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

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

**A 563** Specification for Carbon and Alloy Steel Nuts

**D 3951** Practice for Commercial Packaging

**F 436** Specification for Hardened Steel Washers

**F 606** Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets

**F 788/F 788M** Specification for Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series

**F 1470** Guide for Fastener Sampling for Specified Mechanical Properties and Performance Inspection

**F 1789** Terminology for F16 Mechanical Fasteners

**F 2329** Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

**G 101** Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels

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

**B1.1** Unified Screw Threads

**B18.2.1** Square and Hex Bolts and Screws

**B18.24** Part Identifying Number (PIN) Code System Standard for B 18 Fastener Products

## 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.

<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](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 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.

3.1.3 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, 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 ASTM designation and year of issue. When year of issue is not specified, bolts shall be furnished to the latest issue.

3.1.6 Additional requirements, if any, are to be specified on the purchase order:

3.1.6.1 Shear-strength testing (see [6.2.1](#) and [6.2.2](#)). Include type of test required.

3.1.6.2 Additional tests.

3.1.6.3 Inspection (see [12.1](#) and [12.2](#)).

3.1.6.4 Certification (see [14.1](#)).

3.1.6.5 Test reports (see [14.1](#)).

3.1.6.6 Other finishes, specify other protective finish, if required.

NOTE 1—Examples of ordering description:

(1) 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 zinc-coated hex nuts, Grade DH, ASTM A 563 – XX,

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

(3) 1000 transmission tower bolts, ½ by 2 in. Type 3, 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.

3.1.7 For establishment of a part identifying system, see [ASME B18.24](#).

3.2 *Recommended Nuts:*

3.2.1 Unless otherwise specified, all nuts 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	hot-dip zinc-coated
1	DH	hot-dip zinc-coated
3	DH3	plain

3.3 *Recommended Washers:*

3.3.1 Suitable washers for use with Type 0 are hot-dip zinc-coated carbon-steel washers with dimensions that are in accordance with [Specification F 436](#). Suitable washers for use with Type 1 bolts are hot-dip 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](#).

## 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.

4.2 *Heat Treatment:*

4.2.1 Type 1 bolts produced from medium carbon steel shall be quenched in a liquid medium from above the austenizing temperature. Type 1 bolts produced from medium carbon steel to which chromium, nickel, molybdenum, or boron were intentionally added shall be quenched only in oil from above the austenizing temperature.

4.2.2 Type 3 bolts shall be quenched only in oil from above the austenizing temperature.

4.2.3 Type 1 bolts, regardless of the steel used, and Type 3 bolts shall be tempered by reheating to not less than 800°F.

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

4.3 Threads may be rolled or cut.

4.4 *Zinc Coatings, Hot Dip:*

4.4.1 Type 0 and Type 1 bolts shall be hot-dip zinc-coated accordance with the requirements of [Specification F 2329](#), except that the minimum average weight (thickness) of zinc coating shall be 1.65 oz/ft<sup>2</sup> (0.0028 in.) and the minimum weight of zinc coating on any one item shall be 1.50 oz/ft<sup>2</sup> (0.0025 in.).

4.4.2 Bolt threads shall not be cut, rolled, or otherwise finished after zinc coating.

4.4.3 Hot-dip zinc-coated nuts furnished under [Specification A 563](#) shall be tapped after zinc coating.

4.4.4 Hot-dip zinc-coated nuts and washers supplied for use with bolts under this specification shall be zinc-coated in accordance with [4.4.1](#).

4.5 *Protection of Uncoated Surfaces*—When hot-dip zinc-coated nuts are ordered, the cutting oil or some other suitable substance shall be left on the uncoated surface to inhibit rusting during shipment and storage. It is recommended that the additional lubricant be clean and dry to the touch.

4.6 *Secondary Processing:*

4.6.1 If any processing which can affect the mechanical properties or performance of the bolts is performed after the initial testing, the bolts shall be retested for all specified mechanical properties and performance requirements affected by the reprocessing.

4.6.2 When the secondary processing is heat treatment, the bolts shall be tested for all specified mechanical properties. Hot-dip zinc-coated bolts shall be tested for all specified mechanical properties.

## 5. Chemical Composition




5.1 Type 0 and Type 1 bolts shall conform to the chemical composition requirements specified in [Table 1](#).

5.2 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.

## 6. Mechanical Properties

6.1 *Tension Test*—Types 0, 1, 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

**TABLE 1 Chemical Requirements and Head Markings**

Head Marking	Bolt Type	Element, %				
		Carbon	Manganese	Phosphorus	Sulfur	Boron
	0	0.55 max	...	0.48 max	0.058 max	...
	1	0.28/0.55	0.60 min	0.48 max	0.058 max	...
	3	...	...	...	See <a href="#">Table 2</a>	...

**TABLE 2 Chemical Requirements for Type 3 Heavy Hex Structural Bolts<sup>A</sup>**

Element	Composition, %					
	Type 3 Bolts <sup>A</sup>					
	A	B	C	D	E	F
<b>Carbon:</b>						
Heat Analysis	0.33–0.40	0.38–0.48	0.15–0.25	0.15–0.25	0.20–0.25	0.20–0.25
Product Analysis	0.31–0.42	0.36–0.50	0.14–0.26	0.14–0.26	0.18–0.27	0.19–0.26
<b>Manganese:</b>						
Heat Analysis	0.90–1.20	0.70–0.90	0.80–1.35	0.40–1.20	0.60–1.00	0.90–1.20
Product Analysis	0.86–1.24	0.67–0.93	0.76–1.39	0.36–1.24	0.56–1.04	0.86–1.24
<b>Phosphorus:</b>						
Heat Analysis	0.035 max	0.06–0.125	0.035 max	0.035 max	0.035 max	0.035 max
Product Analysis	0.040 max	0.06–1.25	0.040 max	0.040 max	0.040 max	0.040 max
<b>Sulfur:</b>						
Heat Analysis	0.040 max	0.040 max	0.040 max	0.040 max	0.040 max	0.040 max
Product Analysis	0.045 max	0.045 max	0.045 max	0.045 max	0.045 max	0.045 max
<b>Silicon:</b>						
Heat Analysis	0.15–0.35	0.30–0.50	0.15–0.35	0.25–0.50	0.15–0.35	0.15–0.35
Product Analysis	0.13–0.37	0.25–0.55	0.13–0.37	0.20–0.55	0.13–0.37	0.13–0.37
<b>Copper:</b>						
Heat Analysis	0.25–0.45	0.20–0.40	0.20–0.50	0.30–0.50	0.30–0.60	0.20–0.40
Product Analysis	0.22–0.48	0.17–0.43	0.17–0.53	0.27–0.53	0.27–0.63	0.17–0.43
<b>Nickel:</b>						
Heat Analysis	0.25–0.45	0.50–0.80	0.25–0.50	0.50–0.80	0.30–0.60	0.20–0.40
Product Analysis	0.22–0.48	0.47–0.83	0.22–0.53	0.47–0.83	0.27–0.63	0.17–0.43
<b>Chromium:</b>						
Heat Analysis	0.45–0.65	0.50–0.75	0.30–0.50	0.50–1.00	0.60–0.90	0.45–0.65
Product Analysis	0.42–0.68	0.47–0.83	0.27–0.53	0.45–1.05	0.55–0.95	0.42–0.68
<b>Vanadium:</b>						
Heat Analysis	<i>B</i>	<i>B</i>	0.020 min	<i>B</i>	<i>B</i>	<i>B</i>
Product Analysis	<i>B</i>	<i>B</i>	0.010 min	<i>B</i>	<i>B</i>	<i>B</i>
<b>Molybdenum:</b>						
Heat Analysis	<i>B</i>	0.06 max	<i>B</i>	0.10 max	<i>B</i>	<i>B</i>
Product Analysis	<i>B</i>	0.07 max	<i>B</i>	0.11 max	<i>B</i>	<i>B</i>
<b>Titanium:</b>						
Heat Analysis	...	...	...	...	...	...
Product Analysis	<i>B</i>	<i>B</i>	<i>B</i>	0.05 max	<i>B</i>	<i>B</i>
Product Analysis	<i>B</i>	<i>B</i>	<i>B</i>	0.06 max	<i>B</i>	<i>B</i>

<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.

<sup>B</sup> These elements are not specified or required.

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 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

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

Nominal Size, in.	Minimum Tensile Load, lbf	
	Type 0 <sup>B</sup>	Types 1 and 3 <sup>C</sup>
1/2	10 500	17 050
5/8	16 700	27 100
3/4	24 700	40 100
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 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>
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	23 150	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.

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 ASME B1.1.

7.2 Bolts shall be full-size body in conformance with the latest issue of 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 Threads:

7.3.1 *Uncoated*—There shall be the Unified Coarse Thread Series as specified in ASME B1.1, and shall have Class 2A tolerances.

7.3.2 *Coated*—Unless otherwise specified, zinc-coated bolts to be used with zinc-coated nuts or tapped holes that are tapped oversize, in accordance with Specification A 563, shall have Class 2A threads before hot-dip zinc-coating. After zinc-coating, the maximum limits of pitch and major diameter shall not exceed the Class 2A limit by more than the following amounts:

Nominal Bolt Diameter, in.	Oversize Limit, in. <sup>A</sup>
	Hot-Dip Zinc
1/2	0.018
5/8, 3/4	0.020
7/8	0.022
1	0.024

<sup>A</sup> Hot-dip zinc-coated nuts are tapped oversize after coating.

7.3.3 The gaging limit for bolts shall be verified during manufacture. In case of dispute, a calibrated thread ring gage of the same size as the oversize limit in 7.3.2 (Class X tolerance, gage tolerance plus) shall be used to verify compliance. The gage shall assemble with hand effort following application of light machine oil to prevent galling and damage to the gage. These inspections, when performed to resolve controversy, shall be conducted at the frequency specified in the quality assurance provisions of ASME B18.2.1.

## 8. Workmanship

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

## 9. Sampling

### 9.1 Testing Responsibility:

9.1.1 Each lot shall be tested by the manufacturer prior to shipment in accordance with the lot identification control quality assurance plan in 9.2-9.4.

9.1.2 When bolts are furnished by a source other than the manufacturer, the responsibly party as defined in Section 15 shall be responsible for assuring all tests have been performed and the bolts comply with the requirements of this specification (see 4.6).

9.2 *Purpose of Lot Inspection*—The purpose of a lot inspection program is to ensure that each lot conforms to the requirements of this specification. For such a plan to be fully effective, it is essential that secondary processors, distributors, and purchasers maintain the identification and integrity of each lot until the product is installed.

9.3 *Lot Method*—All bolts shall be processed in accordance with a lot identification-control quality assurance plan. The manufacturer, secondary processor, and distributors shall identify and maintain the integrity of each production lot of bolts from raw-material selection through all processing operations and treatments to final packaging and shipment. Each lot shall be assigned its own lot-identification number, each lot shall be tested, and the inspection test reports for each lot shall be retained.

9.4 *Lot Definition*—A lot shall be a quantity of uniquely identified bolts of the same nominal size and length produced consecutively at the initial operation from a single mill heat of material and processed at one time, by the same process, in the same manner so that statistical sampling is valid. The identity of the lot and lot integrity shall be maintained throughout all subsequent operations and packaging.

**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.				
	1/2	5/8	3/4	7/8	1
1	3/32	1/16	...	...	...
1 1/4	5/32	1/16	1/16	...	...
1 1/2	13/32	1/4	1/8	3/16	...
1 3/4	2 1/32	1/2	3/8	1/4	3/16
2 and longer in 1/4-in. increments	L minus 1 3/32	L minus 1 1/4	L minus 1 3/8	L minus 1 1/2	L minus 1 5/8

## 10. Number of Tests and Retests

10.1 The number of tests and retests from each lot for the tests specified shall be as follows:

Test	Number of Tests in Accordance With
Hardness and tensile strength	Guide <b>F 1470</b>
Shear strength	Guide <b>F 1470</b> applies only if shear strength is specified on purchase order
Coating weight/thickness	Specification <b>F 2329</b>
Surface discontinuities	Specification <b>F 788/F 788M</b>
Dimensions and thread fit	ASME <b>B18.2.1</b>

## 11. Test Methods

### 11.1 *Hardness and Tensile:*

11.1.1 Tests for hardness and tensile strength shall be conducted in accordance with Test Methods **F 606**.

11.1.2 Bolts tested full size shall be tested using the wedge tension test. Fracture shall be in the body or threads of the bolt without any fracture at the junction of the head and body.

11.1.3 For bolts on which both hardness and tension tests are performed, acceptance based on tensile requirements shall take precedence in the event of low hardness readings.

### 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./min. 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 Specification **F 2329**. For purposes of conversions from coating thickness to weight of coating, 1.0 oz/ft<sup>2</sup> of hot-dip shall be considered equivalent to 0.0017 in. 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 purchaser's representative shall have free entry to all parts of the manufacturer's works, or supplier's place of

business, that concern the manufacture or supply of the material ordered. The manufacturer or supplier shall afford the purchaser's representative all reasonable facilities to satisfy him that the material is being furnished in accordance with this specification. All tests and inspections required by the specification that are requested by the purchaser's representative shall be made before shipment, and shall be conducted as not to interfere unnecessarily with the operation of the manufacturer's works or supplier's place of business.

## 13. Rejection and Rehearing

13.1 Disposition of nonconforming bolts shall be in accordance with the section on Disposition of Nonconforming Lots of Guide **F 1470**.

## 14. Certification

14.1 When specified on the purchase order, the manufacturer or supplier, whichever is the responsible party as defined in Section **15**, shall furnish the purchaser a test report that includes the following:

14.1.1 Heat analysis and heat number,

14.1.2 Results of hardness and tensile tests, and shear tests when specified on the purchase order,

14.1.3 Zinc coating measured coating weight/thickness for coated bolts,

14.1.4 Statement of compliance of visual inspection for surface discontinuities (Section **9**),

14.1.5 Statement of compliance with dimensional and thread fit requirements,

14.1.6 Lot number and purchase order number,

14.1.7 Complete mailing address of responsible party, and,

14.1.8 Title and signature of the individual assigned certification responsibility by the company officers.

14.1.9 Failure to include all the required information on the test report shall be cause for rejection.

## 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.

16.5 *Acceptance Criteria*—Bolts which are not marked in accordance with these provisions shall be considered nonconforming and subject to rejection.

## 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

Committee F16 has identified the location of selected changes to this standard since the last issue, A 394 – 05<sup>e1</sup>, that may impact the use of this standard.

(I) Changed the reference hot dip zinc coating Specification **F 2329** from Specification A 153/A 153M Gr. C, to Specification

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