Standard Specification for
Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners

This standard is issued under the fixed designation A354; 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 quenched and tempered alloy steel bolts, studs, and other externally threaded fasteners 4 in. and under in diameter for application at normal atmospheric temperatures, where high strength is required and for limited application at elevated temperature (Note 1). Any alloy steel capable of meeting the minimum mechanical and chemical properties set forth in this specification may be used.

NOTE 1—For bolts, studs, or other externally threaded fasteners, to be used at elevated temperatures, refer to Specification A193/A193M.

1.2 Two levels of bolting strength are covered, designated Grades BC and BD. Selection will depend upon design and the stresses and service for which the product is to be used.

NOTE 2—Quenched and tempered alloy steel bolts for structural steel joints up through 1 1/2 in. in diameter are covered in Specification A490. Alloy steel bolts, studs, and other externally threaded fasteners (that is, heavy hex-structural bolts over 1 1/2 in., hex bolts, anchor bolts, and countersunk bolts) exhibiting similar mechanical properties to bolts conforming to Specification A490 shall be covered by Grade BD of this specification.

When bolts of Grade BD of this specification are considered for pretensioned applications in excess of 50% of the bolt tensile strength, the additional requirements of head size, maximum tensile strength, nut size and strength, washer hardness, tests, and inspections contained in Specification A490 should be carefully considered.

1.3 Nuts are covered in Specification A563. Unless otherwise specified, the grade and style of nut for each grade of fastener shall be as follows:

<table>
<thead>
<tr>
<th>Grade of Fastener and Surface Finish</th>
<th>Nut Grade and Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC, plain (or with a coating of insufficient thickness to require over-tapped nuts)</td>
<td>C, heavy hex</td>
</tr>
<tr>
<td>BC, zinc-coated (or with a coating thickness requiring over-tapped nuts)</td>
<td>DH, heavy hex</td>
</tr>
<tr>
<td>BD, all finishes</td>
<td>DH, heavy hex</td>
</tr>
</tbody>
</table>

* Nuts of other grades and styles having specified proof load stresses (Specification A563, Table 3) greater than the specified grade and style of nut are suitable.

1.4 The values stated in inch-pound units are to be regarded as the standard.

1.5 Terms used in this specification are defined in Terminology F1789 unless otherwise defined herein.

2. Referenced Documents

2.1 ASTM Standards:

A193/A193M Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
A490 Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
A563 Specification for Carbon and Alloy Steel Nuts
A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
B695 Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
D3951 Practice for Commercial Packaging
F436 Specification for Hardened Steel Washers
F606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners,

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

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3. Ordering Information

3.1 Orders for bolts and studs (including nuts and accessories) under this specification shall include the following:

3.1.1 ASTM designation and year of issue,
3.1.2 Name of product (that is, bolt or stud),
3.1.3 Grade (that is, BC or BD),
3.1.4 Quantities (number of pieces by size, including nuts),
3.1.5 Size and length,
3.1.6 Washers—Specify quantity and size (separate from bolts) (4.3).
3.1.7 Zinc Coating—When zinc-coated Grade BC fasteners are required, specify the zinc-coating process required, for example hot-dip, mechanically deposited, or no preference (see 4.4).
3.1.8 Other Finishes—Specify other protective finish, if required.
3.1.9 Specify if inspection at point of manufacture is required.
3.1.10 Specify if Certification (Section 14) is required, and
3.1.11 Specify additional testing (Section 9) or special requirements.
3.1.12 For establishment of a part identifying system, see ASME B18.24.

4. Materials and Manufacture

4.1 The steel shall be made by the open-hearth, electric-furnace, or basic-oxygen process.

4.2 All fasteners shall be heat-treated. At the option of the manufacturer, heat treatment may be performed on the raw material, during the manufacturing operations, or after final machining. Heat treatment shall consist of quenching in a liquid medium (except Grade BD sizes 1½ in. and smaller shall be quenched in oil) from above the transformation temperature and then tempering by reheating to a temperature of not less than 800°F (427°C) for Grade BC and for Grade BD.

4.3 When used, suitable hardened washers shall be quenched and tempered (non-carburized) in accordance with Specification F436.

4.4 Zinc Coatings, Hot-Dip and Mechanically Deposited:

4.4.1 When zinc-coated fasteners are required, the purchaser shall specify the zinc coating process, for example, hot-dip, mechanically deposited, or no preference.

4.4.2 When “hot-dip” is specified, the fasteners shall be zinc coated by the hot-dip process in accordance with the requirements of Specification F2329.

4.4.3 When mechanically deposited is specified, the fasteners shall be zinc-coated by the mechanical-deposition process in accordance with the requirements of Class 55 of Specification B695.

4.4.4 When no preference is specified, the supplier may furnish either a hot-dip zinc coating in accordance with Specification F2329, or a mechanically deposited zinc coating in accordance with Specification B695, Class 55. 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.

NOTE 3—When the intended application requires that assembled tension exceeds 50 % of minimum bolt proof load, an anti-galling lubricant may be needed. Application of such a lubricant to nuts and a test of the lubricant efficiency are provided in Supplementary Requirement S1 of Specification A563 and should be specified when required.

4.5 Zinc-coated bolts and nuts shall be shipped in the same container unless specifically requested otherwise by the purchaser.

NOTE 4—Research conducted on bolts of similar material and manufacture indicates that hydrogen-stress cracking or stress cracking corrosion may occur on hot-dip galvanized Grade BD bolts.

5. Chemical Composition

5.1 All fasteners shall be made from alloy steel conforming to the chemical composition requirements in accordance with Table 1. The steel shall contain sufficient alloying elements to qualify it as an alloy steel.

NOTE 5—Steel is considered to be alloy, by the American Iron and Steel Institute, when the maximum of the range given for the content of alloying elements exceeds one or more of the following limits: manganese, 1.65 %; silicon, 0.60 %; copper, 0.60 %; or in which a definite range or a definite minimum quantity of any of the following elements is specified or required within the limits of the recognized field of constructional alloy steels: aluminum, chromium up to 3.99 %; cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, or any other alloying elements added to obtain a desired alloying effect.

5.2 Product analysis may be made by the purchaser from finished material representing each lot of fasteners. The chemical composition thus determined shall conform to the requirements given in Table 1. Choice of alloy steel composition necessary to ensure meeting the specified mechanical requirements shall be made by the manufacturer and shall be reported to the purchaser for information purposes only.

5.3 Application of heats of steel to which bismuth, selenium, tellurium, or lead has been intentionally added shall not be permitted.

5.4 Chemical analyses shall be performed in accordance with Test Methods, Practices, and Terminology A751.

6. Mechanical Properties

6.1 Fasteners shall not exceed the maximum hardness specified in Table 2. Fasteners less than three diameters in length
TABLE 1 Chemical Requirements

<table>
<thead>
<tr>
<th>Element</th>
<th>Heat Analysis, %</th>
<th>Product Analysis, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For sizes through 1½ in.</td>
<td>0.30 to 0.53</td>
<td>0.28 to 0.55</td>
</tr>
<tr>
<td>For sizes larger than 1½ in.</td>
<td>0.35 to 0.53</td>
<td>0.33 to 0.55</td>
</tr>
<tr>
<td>Manganese, min</td>
<td>0.60</td>
<td>0.57</td>
</tr>
<tr>
<td>Phosphorus, max</td>
<td>0.035</td>
<td>0.040</td>
</tr>
<tr>
<td>Sulfur, max</td>
<td>0.040</td>
<td>0.045</td>
</tr>
<tr>
<td>Alloying Elements</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Element</th>
<th>Heat Analysis, %</th>
<th>Product Analysis, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For sizes through 1½ in.</td>
<td>0.30-0.48</td>
<td>0.28-0.50</td>
</tr>
<tr>
<td>For sizes larger than 1½ in.</td>
<td>0.35-0.53</td>
<td>0.35-0.55</td>
</tr>
<tr>
<td>Manganese, min</td>
<td>0.60</td>
<td>0.57</td>
</tr>
<tr>
<td>Phosphorus, max</td>
<td>0.040</td>
<td>0.045</td>
</tr>
<tr>
<td>Sulfur, max</td>
<td>0.040</td>
<td>0.045</td>
</tr>
<tr>
<td>Boron</td>
<td>0.0005-0.003</td>
<td>0.0005-0.003</td>
</tr>
<tr>
<td>Alloying Elements</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

*Steel, as defined by the American Iron and Steel Institute, shall be considered to be alloy when the maximum of the range given for the content of alloying elements exceeds one or more of the following limits: Manganese, 1.65 %; silicon, 0.60 %; copper, 0.60 % or in which a definite range or a definite minimum quantity of any of the following elements is specified or required within the limits of the recognized field of constructional alloy steels: aluminum, chromium up to 3.99 %, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, or any other alloying elements added to obtain a desired alloying effect.

TABLE 2 Hardness Requirements for Full-Size Fasteners

<table>
<thead>
<tr>
<th>Size, in.</th>
<th>Grade</th>
<th>Brinell Minimum</th>
<th>Brinell Maximum</th>
<th>Rockwell C Minimum</th>
<th>Rockwell C Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼ to 2½</td>
<td>BC</td>
<td>255</td>
<td>331</td>
<td>26</td>
<td>36</td>
</tr>
<tr>
<td>Over 2½</td>
<td>BC</td>
<td>235</td>
<td>311</td>
<td>22</td>
<td>33</td>
</tr>
<tr>
<td>¼ to 2½</td>
<td>BD</td>
<td>311</td>
<td>363</td>
<td>33</td>
<td>39</td>
</tr>
<tr>
<td>Over 2½</td>
<td>BD</td>
<td>293</td>
<td>363</td>
<td>31</td>
<td>39</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diameter, in.</th>
<th>Oversize Limit, in. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>¼</td>
<td>0.016</td>
</tr>
<tr>
<td>⅜, ⅜, ⅜</td>
<td>0.017</td>
</tr>
<tr>
<td>⅜ to ¾, incl.</td>
<td>0.018</td>
</tr>
<tr>
<td>⅜</td>
<td>0.020</td>
</tr>
<tr>
<td>⅜ to 1⅝, incl.</td>
<td>0.022</td>
</tr>
<tr>
<td>⅞ to 1⅜, incl.</td>
<td>0.024</td>
</tr>
<tr>
<td>1⅛ to 1⅝, incl.</td>
<td>0.027</td>
</tr>
<tr>
<td>1⅛</td>
<td>0.050</td>
</tr>
</tbody>
</table>

*These values are the same as the overtapping required for zinc-coated nuts in Specification A563.

and studs less than four diameters in length shall have hardness values not less than the minimum nor more than the maximum hardness limits required in Table 2, as hardness is the only requirement.

6.2 Fasteners 1½ in. in diameter or less for Grade BC and 1⅛ in. in diameter or less for Grade BD, other than those excepted in 6.1, shall be tested full size and shall conform to the tensile strength and either the proof load or the yield strength requirements in accordance with Table 3.

6.3 Fasteners larger than 1⅛ in. in diameter for Grade BC and fasteners larger than 1⅛ in. in diameter for Grade BD, other than those excepted in 6.1, shall preferably be tested full size and when so tested, shall conform to the tensile strength and either the proof load or yield strength requirements in accordance with Table 3. When equipment of sufficient capacity for full-size testing is not available, or when the length of the fastener makes full-size testing impractical, machined specimens shall be tested and shall conform to the require-

ments in accordance with Table 4. In the event that fasteners are tested by both full-size and by the machined test specimen methods, the full-size test shall govern if a controversy between the two methods exists.

6.4 For fasteners on which both hardness and tension tests are performed, acceptance based on tensile requirements shall take precedence in the event that there is controversy over low readings of hardness tests.

7. Dimensions

7.1 Bolts—Unless otherwise specified, the bolts shall be Hex Head with dimensions conforming to the latest issue of ASME B18.2.1.

7.2 Studs—Studs shall have dimensions conforming to those specified by the purchaser.

7.3 Threads:

7.3.1 Unless otherwise specified, threads shall be the Unified National Coarse Thread Series as specified in B1.1, and shall have Class 2A tolerances.

7.3.2 When specified, threads shall be the Unified National Fine Thread Series, 8-Pitch Thread Series for sizes over 1 in. or 14-Pitch UNS on 1 in. size as specified in ANSI B1.1 and shall have Class 2A tolerances.

7.3.3 Unless otherwise specified, bolts and studs to be used with nuts or tapped holes that have been tapped oversize, in accordance with Specification A563, shall have Class 2A threads before hot dip or mechanically deposited zinc coating. After zinc coating, the maximum limit of pitch and major diameter may exceed the Class 2A limit by the following amount:

8. Workmanship

8.1 Surface discontinuity limits shall be in accordance with Specification F788/F788M.

9. Number of Tests

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 through 9.6.

9.1.2 When fasteners are furnished by a source other than the manufacturer, the responsible party as defined in 12.1 shall be responsible for ensuring that all tests have been performed and the fasteners comply with the requirements of this specification.
### TABLE 3 Tensile Requirements for All Full-Size Fasteners—Inch-Pound Units

<table>
<thead>
<tr>
<th>Bolt Size, in.</th>
<th>Threads per inch</th>
<th>Stress Area,(^a) in.(^2)</th>
<th>Grade BC</th>
<th>Grade BD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Tensile Strength, min, lbf(^b)</td>
<td>Proof Load, min, lbf(^c)</td>
<td>Yield Strength (0.2 % offset), min, lbf(^d)</td>
</tr>
<tr>
<td>1/4</td>
<td>20</td>
<td>0.0318</td>
<td>4 000</td>
<td>3 350</td>
</tr>
<tr>
<td>1/4</td>
<td>28</td>
<td>0.0364</td>
<td>4 550</td>
<td>3 820</td>
</tr>
<tr>
<td>3/16</td>
<td>18</td>
<td>0.0524</td>
<td>6 550</td>
<td>5 500</td>
</tr>
<tr>
<td>3/16</td>
<td>24</td>
<td>0.0480</td>
<td>7 250</td>
<td>6 750</td>
</tr>
<tr>
<td>5/32</td>
<td>16</td>
<td>0.0775</td>
<td>9 700</td>
<td>8 150</td>
</tr>
<tr>
<td>3/16</td>
<td>24</td>
<td>0.0878</td>
<td>11 000</td>
<td>9 220</td>
</tr>
<tr>
<td>7/32</td>
<td>14</td>
<td>0.1063</td>
<td>13 300</td>
<td>11 150</td>
</tr>
<tr>
<td>7/32</td>
<td>20</td>
<td>0.1187</td>
<td>14 840</td>
<td>12 470</td>
</tr>
<tr>
<td>1/2</td>
<td>13</td>
<td>0.1419</td>
<td>17 750</td>
<td>14 900</td>
</tr>
<tr>
<td>5/32</td>
<td>20</td>
<td>0.1599</td>
<td>19 990</td>
<td>16 790</td>
</tr>
<tr>
<td>9/64</td>
<td>12</td>
<td>0.182</td>
<td>22 750</td>
<td>19 100</td>
</tr>
<tr>
<td>3/16</td>
<td>18</td>
<td>0.203</td>
<td>25 400</td>
<td>21 400</td>
</tr>
<tr>
<td>3/16</td>
<td>22</td>
<td>0.226</td>
<td>28 250</td>
<td>23 750</td>
</tr>
<tr>
<td>3/16</td>
<td>18</td>
<td>0.256</td>
<td>32 000</td>
<td>28 600</td>
</tr>
<tr>
<td>5/32</td>
<td>10</td>
<td>0.334</td>
<td>41 750</td>
<td>35 050</td>
</tr>
<tr>
<td>5/32</td>
<td>16</td>
<td>0.373</td>
<td>46 600</td>
<td>39 100</td>
</tr>
<tr>
<td>3/16</td>
<td>9</td>
<td>0.462</td>
<td>57 750</td>
<td>48 500</td>
</tr>
<tr>
<td>1/2</td>
<td>14</td>
<td>0.509</td>
<td>63 600</td>
<td>53 400</td>
</tr>
</tbody>
</table>

\(^a\) Stress Area, \(\text{in.}^2 = 0.7854 \cdot \frac{D}{2} \cdot \frac{D}{2n} \) where \(D\) is nominal diameter, in., and \(n\) is threads/in.

\(^b\) Based on 125 000 psi for sizes ¼ to 2½ in., inclusive, and on 110 000 psi for sizes over 2½ to 4 in., inclusive.

\(^c\) Based on 105 000 psi for sizes ¼ to 2½ in., inclusive, and on 95 000 psi for sizes over 2½ to 4 in., inclusive.

\(^d\) Based on 100 000 psi for sizes ¼ to 2½ in., inclusive, and on 90 000 psi for sizes over 2½ to 4 in., inclusive.
TABLE 4 Mechanical Requirements for Machined Specimens

<table>
<thead>
<tr>
<th>Grade</th>
<th>Size, in.</th>
<th>Tensile Strength min, psi</th>
<th>Yield Strength (0.2 % offset), min, psi</th>
<th>Elongation in 2 in. to min, %</th>
<th>Reduction of Area, min, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC</td>
<td>1⁄4 to 21⁄2, incl</td>
<td>125 000</td>
<td>109 000</td>
<td>16</td>
<td>50</td>
</tr>
<tr>
<td>BC</td>
<td>Over 21⁄2</td>
<td>115 000</td>
<td>99 000</td>
<td>16</td>
<td>45</td>
</tr>
<tr>
<td>BD</td>
<td>1⁄4 to 21⁄2, incl</td>
<td>150 000</td>
<td>130 000</td>
<td>14</td>
<td>40</td>
</tr>
<tr>
<td>BD</td>
<td>Over 21⁄2</td>
<td>140 000</td>
<td>115 000</td>
<td>14</td>
<td>40</td>
</tr>
</tbody>
</table>

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 Processing—All fasteners shall be processed in accordance with a lot identification-control quality assurance plan. The manufacturer, secondary processors, and distributors shall identify and maintain the integrity of each lot of fasteners from raw-material selection through all processing operations and treatments to final packing 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 is a quantity of a uniquely identified fastener product of the same nominal size and length produced consecutively at the initial operation from a single mill heat of material and heat treatment lot and processed at one time, by the same process, in the same manner so that statistical sampling is valid. The identity of the lot is maintained throughout all subsequent operations and packaging.

9.5 Number of Tests—The minimum number of tests from each production lot for the tests specified below shall be in accordance with Guide F1470.

- Hardness
- Tensile
- Coating Weight/Thickness
- Workmanship (Surface Discontinuities Section 8)
- Proof Load

9.5.1 The number of tests for dimensional and thread fit compliance shall be in accordance with the quality assurance provisions of the referenced dimensional standards.

9.6 If any test specimen shows defective machining it may be discarded and another specimen substituted.

10. Test Methods

10.1 Test methods shall be conducted in accordance with Test Methods F606.

10.2 Proof load, rather than yield strength determination is preferred and shall be the arbitration method for fasteners 11⁄4 in. and under in diameter.

10.3 Hexagon bolts shall be tested by the wedge tension method. Fracture shall be in the body or threads of the bolt without any fracture at the junction of the head and body.

10.3.1 At the option of the manufacturer, the yield strength test (Method 2, Yield Strength paragraph of Test Methods F606) and the wedge tension test (Wedge Tension Testing of Full-Size Product paragraph, both from the Test Method section of Test Methods F606) may be accomplished concurrently to satisfy 10.2 and 10.3.

10.4 Studs and bolts other than those in 10.3 shall be tested by the axial tension method.

10.4.1 At the option of the manufacturer, the yield strength test and the axial tension test may be accomplished concurrently to satisfy 10.2 and 10.4.

10.5 The speed of testing determined with a free running crosshead shall be a maximum of 1⁄8 in. (3.2 mm)/min for the bolt proof load (or yield strength) determination and a maximum of 1 in. (25.4 mm)/min for the tensile strength determination.

11. Inspection

11.1 If the inspection described in 11.2 is required by the purchaser, it shall be specified in the inquiry and contract or purchase order.

11.2 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 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 works.

12. Responsibility

12.1 The party responsible for the fastener shall be the organization that supplies the fastener to the purchaser.

13. Rejection and Rehearing

13.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

14. Certification

14.1 When specified on the purchase order, the manufacturer or supplier, whichever is the responsible party in accordance with Section 12, shall furnish the purchaser a test report which includes the following:

14.1.1 Product description, grade, quantity, ASTM Specification Number and issue date,
14.1.2 Alloy grade (AISI, SAE, UNS, etc.), heat analysis, and heat number, and type of quench,
14.1.3 Results of hardness, tensile, and proof load tests, as applicable,
14.1.4 Statement of compliance to Protective Coating Specification (if applicable),
14.1.5 Statement of compliance with the surface discontinuity requirements of Specification F788/F788M,
14.1.6 Statement of compliance dimensionally,
14.1.7 Report, describe, or illustrate manufacturer’s mark-
ings and their location,
14.1.8 Lot number, purchase order number, and date
shipped,
14.1.9 Country of origin, and
14.1.10 Title and signature of the individual assigned certi-
cification responsibility by the company officers, with complete
mailing address.
14.2 Failure to include all the required information on the
test report shall be cause for rejection.

15. Product Marking

15.1 Manufacturers Identification — All products shall be
marked by the manufacturer with a unique identifier to identify
the manufacturer or private label distributor, as appropriate.

15.2 Grade Identification:
15.2.1 All Grade BC products shall be marked “BC”.
15.2.2 All Grade BD products shall be marked “BD”. In
addition to the “BD” marking, the product may be marked with
6 radial lines 60° apart if manufactured from alloy steel
conforming to the requirements of this specification.

15.3 Marking Location and Methods:
15.3.1 Bolts shall be marked on the top of the bolt head.
15.3.2 Where studs have both coarse and fine threads, all
markings shall appear on the coarse thread end or, if preferred,
the manufacturer’s identification shall appear on the fine thread
end and the grade marking on the coarse thread end.

16. Packaging and Package Marking

16.1 Packaging:
16.1.1 Unless otherwise specified, packaging shall be in
accordance with Practice D3951.
16.1.2 When special packaging requirements are required,
they shall be defined at the time of the inquiry and order.

16.2 Package Marking:
16.2.1 Each shipping unit shall include or be plainly marked
with the following information:
16.2.1.1 ASTM designation and grade,
16.2.1.2 Size,
16.2.1.3 Name and brand or trademark of the manufacturer,
16.2.1.4 Number of pieces,
16.2.1.5 Purchase order number, and
16.2.1.6 Country of origin.

17. Keywords

17.1 alloy steel; bolts; steel; studs

SUPPLEMENTARY REQUIREMENTS

S1. Marking

S1.1 Studs that are continuously threaded with the same
class of thread shall be marked on each end with the marking
in accordance with Section 15.

S1.2 Marking small sizes (customarily less than 0.375 in.
(9.525 mm) may not be practical. Consult the producer for the
minimum size that can be marked.

SUMMARY OF CHANGES

Committee F16 has identified the location of selected changes to this standard since the last issue (A354-07a)
that may impact the use of this standard. (Approved Dec. 15, 2011.)

(1) Revised—Table 1.