

Designation: F594 – 09

# Standard Specification for Stainless Steel Nuts<sup>1</sup>

This standard is issued under the fixed designation F594; 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 ( $\varepsilon$ ) 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 requirements for stainless steel nuts 0.25 to 1.50 in., inclusive, in nominal diameter in a number of alloys in common use and intended for service applications requiring general corrosion resistance.

1.2 Seven groups of stainless steel alloys are covered, including ten austenitic, two ferritic, four martensitic, and one precipitation hardening.

| Group | Alloys <sup>A</sup>                               |      | Condition <sup>B</sup>   |
|-------|---|------|--------------------------|
| 1     | 304, 305, 304L<br>384, 18–9LW, 302HQ <sup>c</sup> | (CW) | cold worked <sup>D</sup> |
| 2     | 316, 316L   | (CW) | cold worked <sup>D</sup> |
| 3     | 321, 347  | (CW) | cold worked <sup>D</sup> |
| 4     | 430 <sup>E</sup>                                  | (CW) | cold worked <sup>D</sup> |
| 5     | 410 <sup>F</sup>                                  | (H)  | hardened and tempered    |
| 6     | 431   | (H)  | hardened and tempered    |
| 7     | 630   | (AH) | aged hardened            |
|       |   |      |                          |

<sup>A</sup> Unless otherwise specified on the inquiry and order, the choice of an alloy from within a group shall be at the discretion of the fastener manufacturer (see 6.1). <sup>B</sup> See 4.2 for options.

 $^{\it C}\,{\rm When}$  approved by the purchaser, alloys 303, 303Se, or XM1 may be furnished.

<sup>D</sup> Sizes 0.75 in. and larger may be hot worked and solution annealed.

<sup>E</sup> When approved by the purchaser, alloy 430F may be furnished.

<sup>F</sup> When approved by the purchaser, alloy 416 or 416Se may be furnished.

1.3 Supplementary requirements of an optional nature are provided, applicable only when agreed upon by the manufacturer and the purchaser at the time of the inquiry and order.

1.4 Suitable bolts, hex cap screws, and studs for use with nuts included in this specification are covered by Specification F593. Unless otherwise specified, all bolts, hex cap screws, and studs used with these nuts shall conform to the requirements of Specification F593 and shall be of the same alloy group.

1.5 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.

1.6 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 appro-

priate safety and health practices and determine the applicability of regulatory limitations prior to use.

#### 2. Referenced Documents

- 2.1 ASTM Standards:<sup>2</sup>
- A262 Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels
- A342/A342M Test Methods for Permeability of Feebly Magnetic Materials
- A380 Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
- A493 Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging
- A555/A555M Specification for General Requirements for Stainless Steel Wire and Wire Rods
- A564/A564M Specification for Hot-Rolled and Cold-
- Finished Age-Hardening Stainless Steel Bars and Shapes A582/A582M Specification for Free-Machining Stainless Steel Bars
- A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products
- D3951 Practice for Commercial Packaging
- E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
- F593 Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
- F606 Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, Direct Tension Indicators, and Rivets
- E1470 Test Method for Characterization of Proteins by Electrophoretic Mobility
- 2.2 ASME Standards:<sup>3</sup>
- **B1.1** Unified Inch Screw Threads
- B18.2.2 Square and Hex Nuts

NOTE 1—The following ASTM standards are noted for information only as suitable sources of material for the manufacture of nuts to this

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

<sup>&</sup>lt;sup>3</sup> Available from Global Engineering Documents, 15 Inverness Way, East Englewood, CO 80112-5704, http://www.global.ihs.com.

specification:

Specifications A493, A564/A564M, and A582/A582M.

#### 3. Ordering Information

3.1 Orders for nuts under this specification shall include the following:

3.1.1 Quantity (number of pieces of each item and size),

3.1.2 Name of item,

3.1.3 Size (diameter and threads per inch),

3.1.4 Alloy group number (see 6.2.1), and

3.1.5 Condition (see 4.2).

3.1.6 Orders for nuts under this specification may include the following optional requirements:

3.1.6.1 Forming (see 4.1.1),

3.1.6.2 Composition (see 6.2),

3.1.6.3 Corrosion resistance (see 8.1),

3.1.6.4 Thread class (see 9.2),

3.1.6.5 Finish (see 10.3),

3.1.6.6 Test report (see 17.2),

3.1.6.7 Rejection (see 16.1),

3.1.6.8 Test rejection (see 16.1), and

3.1.6.9 Special packaging (see 19.2).

3.1.7 Supplementary requirements, if any, to be specified on the order (see S1 through S8), and

3.1.8 ASTM specification and date of issue. When date of issue is not specified, fasteners shall be furnished to the latest issue.

NOTE 2—*Example:* 10 000 pieces, Hex Nut, 0.250 in. –20, Alloy Group 1, Condition CW, Furnish Test Report, Supplementary Requirement S3.

#### 4. Manufacture

4.1 Manufacture:

4.1.1 *Forming*—Unless otherwise specified, the nuts shall be hot formed, cold formed, or machined from suitable material, at the option of the manufacturer.

4.2 *Condition*—The fasteners shall be furnished in the following conditions, unless specified to be furnished in one of the optional conditions:

| Alloy Group | Condition Furnished<br>Unless Otherwise<br>Specified | Optional Conditions<br>(must be specified) |
|-------------|--|--|
| 1, 2, 3     | CW   | AF, A, SH                                  |
| 4           | CW   | А  |
| 5           | Н  | HT   |
| 6           | Н  | HT   |
| 7           | AH   | none                                       |

A— Machined from annealed or solution annealed stock thus retaining the properties of the original material; or hot formed and solution annealed.

AF— Annealed after all threading is completed.

AH— Solution annealed and age hardened after forming. CW— Annealed and cold worked. Sizes 0.75 in. and large

CW— Annealed and cold worked. Sizes 0.75 in. and larger may be hot worked and solution annealed.

H— Hardened and tempered at 1050°F (565°C) minimum. HT— Hardened and tempered at 525°F (274°C) minimum.

HI— Hardened and tempered at 525°F (274°C) minimum SH— Machined from strain hardened stock.

## SH— Machined from strain hardened stock.

### 5. Heat Treatment

5.1 Alloy Groups 1, 2, and 3 (Austenitic Alloys 303, 303Se, 304, 304L, 305, 316, 316L, 321, 347, 384, XM1, 18–9LW, and 302HQ) :

5.1.1 Condition A—When Condition A is specified, the austenitic alloys shall be heated to  $1900 \pm 50^{\circ}$ F (1038  $\pm 28^{\circ}$ C), at which time the chromium carbide will go into the solution, be held for a sufficient time, and then be cooled at a rate sufficient to prevent precipitation of the carbide and to provide the specified properties.

5.1.2 *Condition CW*—When Condition CW is specified, the austenitic alloys shall be annealed as specified in 5.1.1 and then cold worked to develop the specified properties.

5.1.3 *Condition AF*—When Condition AF is specified, the austenitic alloys shall be annealed as specified in 5.1.1 after all cold working, including forming and threading.

5.2 Alloy Group 4 (Ferritic Alloys 430 and 430F):

5.2.1 Condition A—The ferritic alloys shall be heated to a temperature of  $1450 \pm 50^{\circ}$ F (788  $\pm 28^{\circ}$ C), held for an appropriate time, and then air cooled to provide the specified properties.

5.2.2 Condition CW—When Condition CW is specified, the ferritic alloys shall be annealed in accordance with 5.2.1, generally by the raw material manufacturer, and then cold worked to develop the specified properties.

5.3 Alloy Group 5 (Martensitic Alloys 410, 416, and 416Se): 5.3.1 Condition H—When Condition H is specified, the martensitic alloys 410, 416, and 416Se shall be hardened and tempered by heating to  $1850 \pm 50^{\circ}$ F ( $1010 \pm 28^{\circ}$ C) sufficient for austenitization, held for at least  $\frac{1}{2}$  h and rapid air- or oil-quenched, then reheating to  $1050^{\circ}$ F ( $565^{\circ}$ C) minimum for at least 1 h and air cooled to provide the specified properties. 5.3.2 Condition HT—When Condition HT is specified, the martensitic alloys 410, 416, and 416Se shall be hardened and tempered by heating to  $1850 \pm 50^{\circ}$ F ( $1010 \pm 28^{\circ}$ C) sufficient for austenitization, held for at least  $\frac{1}{2}$  h and rapid air- or oil-quenched, then reheating to  $525^{\circ}$ F ( $274^{\circ}$ C) minimum for at least 1 h and air cooled to provide the specified properties.

5.4 Alloy Group 6 (Martensitic Alloy 431):

5.4.1 *Conditions H and HT*—The martensitic alloy 431 shall be hardened and tempered as specified in 5.3.1 and 5.3.2 as applicable.

5.5 Alloy Group 7 (Precipitation Hardening Alloy 630):

5.5.1 *Condition AH*—The precipitation hardening alloy 630 shall be solution annealed and aged by heating to  $1900 \pm 25^{\circ}$ F (1038  $\pm 14^{\circ}$ C) for at least ½ h and rapid air or oil quenched to 80°F (27°C) maximum, then reheating to a temperature of 1150  $\pm 15^{\circ}$ F (621  $\pm 8^{\circ}$ C) for 4 h and air cooled to provide the specified properties.

#### 6. Chemical Composition

6.1 *Alloy Groups*—It is the intent of this specification that fasteners shall be ordered by alloy group numbers that include alloys considered to be chemically equivalent for general purpose use. The alloy groupings are as shown below. When required, however, a specific alloy may be specified as permitted by 6.2.2.

| Alloy Group | Alloys  |
|-------------|---|
| 1           | 304, 305, 304L<br>384, 18–9LW, 302HQ <sup>A</sup> |
| 2           | 316, 316L   |

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| 4 430 <sup>B</sup><br>5 410 <sup>C</sup><br>6 431<br>7 630 | 6 |
|--|---|
|--|---|

 $^{\rm A}\,\rm When$  approved by the purchaser, alloys 303, 303Se, or XM1 may be furnished.

<sup>B</sup> When approved by the purchaser, alloy 430F may be furnished.

<sup>c</sup> When approved by the purchaser, alloys 416 or 416Se may be furnished.

6.2 Chemical Composition Limits:

6.2.1 Ordering by Alloy Group—Unless otherwise specified on the inquiry and order (see Supplementary Requirement S4), the choice of an alloy from within a group shall be at the discretion of the fastener manufacturer as required by his method of fastener fabrication and material availability. The specific alloy used by the fastener manufacturer shall be clearly identified on any certification required by the order and shall have a chemical composition conforming to the requirements of Table 1 for the specific alloy.

6.2.2 *Ordering by Specific Alloy*—When ordered by a specific alloy number, the fasteners shall conform to the chemical composition limits of Table 1 for the specific alloy.

6.3 Product Analysis:

6.3.1 Product analysis may be made by the purchaser from finished nuts representing each lot. The chemical composition thus determined shall conform to the requirements of Table 1

| TABLE 1 | Chemical | Requirements |
|---------|----------|--------------|
|---------|----------|--------------|

| UNS Composition, % maximum except as shown |                  |              |              |                |                 |                   |              |                                    |                 |                 |                       |                          |
|--|------------------|--------------|--------------|----------------|-----------------|-------------------|--------------|------------------------------------|-----------------|-----------------|-----------------------|--------------------------|
| Alloy<br>Group                             | Desig-<br>nation | Alloy        | Carbon       | Manga-<br>nese | Phos-<br>phorus | Sulfur            | Silicon      | Chromium                           | Nickel          | Copper          | Molybdenum            | Others                   |
|  |                  |              |              |                |                 | Austenitic Alloy  | /S           |                                    |                 |                 |                       |                          |
| 1  | S30300           | 303          | 0.15         | 2.00           | 0.20            | 0.15 min          | 1.00         | 17.0 to<br>19.0                    | 8.0 to<br>10.0  |                 | 0.60 max <sup>A</sup> |                          |
| 1  | S30323           | 303Se        | 0.15         | 2.00           | 0.20            | 0.060             | 1.00         | 17.0 to<br>19.0                    | 8.0 to<br>10.0  |                 |                       | Se 0.15<br>min           |
| 1  | S30400           | 304          | 0.08         | 2.00           | 0.045           | 0.030             | 1.00         | 18.0 to<br>20.0                    | 8.0 to<br>10.5  | 1.00            |                       |                          |
| 1  | S30403           | 304L         | 0.03         | 2.00           | 0.045           | 0.030             | 1.00         | 18.0 to 20.0                       | 8.0 to<br>12.0  | 1.00            |                       |                          |
| 1  | S30500           | 305          | 0.12         | 2.00           | 0.045           | 0.030             | 1.00         | 17.0 to<br>19.0                    | 10.5 to<br>13.0 | 1.00            |                       |                          |
| 1  | S38400           | 384          | 0.08         | 2.00           | 0.045           | 0.030             | 1.00         | 15.0 to<br>17.0                    | 17.0 to<br>19.0 |                 |                       |                          |
| 1  | S20300           | XM1          | 0.08         | 5.0 to 6.5     | 0.040           | 0.18 to<br>0.35   | 1.00         | 16.0 to<br>18.0                    | 5.0 to<br>6.5   | 1.75 to<br>2.25 | 0.50 max <sup>A</sup> |                          |
| 1  | S30430           | 18–9LW       | 0.10         | 2.00           | 0.045           | 0.030             | 1.00         | 17.0 to<br>19.0                    | 8.0 to<br>10.0  | 3.0 to 4.0      |                       |                          |
| 1  | S30433           | 302HQ        | 0.03         | 2.00           | 0.045           | 0.030             | 1.00         | 17.0 to<br>19.0                    | 8.0 to 10.0     | 3.0 to 4.0      |                       |                          |
| 2  | S31603           | 316L         | 0.03         | 2.00           | 0.045           | F 0.030_0         | 9 1.00       | 16.0 to<br>18.0                    | 10.0 to<br>14.0 |                 | 2.00–3.00†            |                          |
| h <b>2</b> tps://                          | S \$31600        | S. 1.316 1/0 | at 0.08      | star 2.00 ds/  | 0.045           | 0.030             | 9 1.00       | 2_16.0 to<br>18.0                  | 14.0            | le9f/astr       | 2.00-3.00             |                          |
| 3  | S32100           | 321          | 0.08         | 2.00           | 0.045           | 0.030             | 1.00         | 17.0 to<br>19.0                    | 9.0 to<br>12.0  |                 |                       | Ti 5 $\times$ 0 min      |
| 3  | S34700           | 347          | 0.08         | 2.00           | 0.045           | 0.030             | 1.00         | 17.0 to<br>19.0                    | 9.0 to<br>13.0  |                 |                       | Cb + Ta<br>10 × C<br>min |
|  |                  |              |              |                |                 | Ferritic Alloys   |              |                                    |                 |                 |                       |                          |
| 4  | S43000<br>S43020 | 430<br>430F  | 0.12<br>0.12 | 1.00<br>1.25   | 0.040<br>0.060  | 0.030<br>0.15 min | 1.00<br>1.00 | 16.0 to<br>18.0<br>16.0 to<br>18.0 |                 |                 | 0.60 max <sup>4</sup> |                          |
|  |                  |              |              |                |                 | Martensitic Allo  | ys           |                                    |                 |                 |                       |                          |
| 5  | S41000           | 410          | 0.15         | 1.00           | 0.040           | 0.030             | 1.00         | 11.5 to<br>13.5                    |                 |                 |                       |                          |
| 5  | S41600           | 416          | 0.15         | 1.25           | 0.060           | 0.15 min          | 1.00         | 12.0 to<br>14.0                    |                 |                 | 0.60 max <sup>A</sup> |                          |
| 5  | S41623           | 416Se        | 0.15         | 1.25           | 0.060           | 0.060             | 1.00         | 12.0 to<br>14.0                    |                 |                 |                       | Se 0.15<br>min           |
| 6  | S43100           | 431          | 0.20         | 1.00           | 0.040           | 0.030             | 1.00         | 15.0 to<br>17.0                    | 1.25 to<br>2.50 |                 |                       |                          |
|  |                  |              |              |                | Precip          | pitation Hardeni  | ng Alloy     |                                    |                 |                 |                       |                          |
| 7  | S17400           | 630          | 0.07         | 1.00           | 0.040           | 0.030             | 1.00         | 15.0 to<br>17.5                    | 3.0 to 5.0      | 3.0 to 5.0      |                       | Cb + Ta<br>0.15–0.4      |

<sup>A</sup> At manufacturer's option, determined only when intentionally added.

†Editorially corrected.

for the specific alloy subject to the Product Analysis Tolerance in Specification A555/A555M.

6.3.2 In the event of discrepancy, a referee chemical analysis of samples from each lot shall be made in accordance with 14.1.

#### 7. Mechanical Properties

7.1 The finished fasteners shall meet the applicable mechanical properties of Table 2 for the specified alloy group and condition when tested in accordance with the mechanical property requirements as specified herein (see also Table 3).

#### TABLE 3 Mechanical Test Requirements on Nuts

| Product                      | Broof Stroop, poi | Tests Conducte<br>Size Pre | 0        |
|------------------------------|-------------------|----------------------------|----------|
| FIOUUCI                      | Proof Stress, psi | Hardness                   | Proof    |
|                              |                   |                            | Load     |
| Jam, slotted,<br>castle nuts | all               | A                          | В        |
| All other nuts               | up to 120 000     | А                          | Α        |
|                              | Over 120 000      | option A <sup>A</sup>      | option B |

<sup>*A*</sup> Denotes mandatory tests; where options are given, all the tests under an option shall be performed. Option B tests should be made whenever feasible. Option B is the referee test in case of arbitration. <sup>*B*</sup> Tests that are not mandatory.

TABLE 2 Mechanical Property Requirements<sup>A</sup>

| 305, 384,<br>XM1, 18-9UW,<br>302HQ, 303Se)     CW2     F594D     9/4 to 1/4, incl     85     92     B80 to C35, incl       302HQ, 303Se)     SH2     F594B     1/4 to 1/4, incl     110     119     C20 to C32, incl       SH3     F594C     1/4 to 1/4, incl     100     108     B95 to C38, incl       SH4     F594F     1/4 to 1/4, incl     85     92     B90 to C28, incl       S161     CW2     A     F594F     1/4 to 1/4, incl     70     76     B85 max       3161     CW2     F594F     1/4 to 1/4, incl     70     108     B95 to C38, incl       3161     CW2     F594F     1/4 to 1/4, incl     70     76     B85 max       SH1     F594F     1/4 to 1/4, incl     100     108     B95 to C38, incl       SH1     F594F     1/4 to 1/4, incl     100     108     B95 to C38, incl       SH1     F594F     4/4 to 1/4, incl     100     108     B95 to C38, incl       SH1     F594F     4/4 to 1/4, incl     100     108     B95 to C38, incl <th>Stainless Alloy<br/>Group</th> <th>Condition<sup>B</sup></th> <th>Alloy Mechanical<br/>Property Marking</th> <th>Nominal Diam-<br/>eter, in.</th> <th>Proof Stress,<br/>Hex Nuts<br/>ksi, min</th> <th>Proof Stress,<br/>Heavy Hex Nuts<br/>ksi, min<sup>C</sup></th> <th>Rockwell<br/>Hardness</th>  | Stainless Alloy<br>Group | Condition <sup>B</sup> | Alloy Mechanical<br>Property Marking | Nominal Diam-<br>eter, in.                         | Proof Stress,<br>Hex Nuts<br>ksi, min | Proof Stress,<br>Heavy Hex Nuts<br>ksi, min <sup>C</sup> | Rockwell<br>Hardness |
|--|--------------------------|------------------------|--------------------------------------|--|---------------------------------------|--|----------------------|
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$  |                          |                        |                                      | Austenitic Alloys                                  |                                       |  |                      |
| (303, 304, 304L     CW1     F594C     1/4 to 1/4, incl     100     108     B95 to 35, incl       XM1, 18-9UW,     SH1     E594A     1/4 to 1/4, incl     100     108     B95 to 35, incl       305, 384,     CW2     E594B     1/4 to 1/4, incl     100     108     B95 to 33, incl       302HQ, 303Se)     SH2     E594B     1/4 to 1/4, incl     100     108     B95 to 23, incl       302HQ, 303Se)     SH2     E594D     1/4 to 1/4, incl     100     108     B95 to 23, incl       SH3     E594D     1/4 to 1/4, incl     100     108     B95 to 23, incl       2     A     F594F     1/4 to 1/4, incl     70     76     B85 max       316L     CW2     F594H     1/4 to 1/4, incl     70     76     B85 to 33, incl       SH3     F594F     1/4 to 1/4, incl     70     76     B85 max       SH2     F594H     1/4 to 1/4, incl     100     108     B95 to 33, incl       SH4     F594H     1/4 to 1/4, incl     100     108     B95 to 33, inc  |                          | AF                     | F594A                                | 1/4 to 11/2, incl                                  | 70                                    | 76   | B85 max              |
| 305, 384, CW2 F594D % to 1/4, incl 85 92 B80 to C35, inc<br>302HQ, 303Se) SH2 F594B % to 1, incl 110 119 C20 to C36, inc<br>SH3 F594E % to 1/4, incl 100 108 B95 to C36, inc<br>SH4 F594E % to 1/4, incl 85 92 B90 to C28, inc<br>AF F594F % to 1/4, incl 75 81 B85 to 95, incl<br>316L CW2 F594F % to 1/4, incl 75 81 B85 to 95, incl<br>SH3 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C32, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C32, inc<br>SH3 F594K S4 to 1/4, incl 85 92 B90 to C32, inc<br>SH3 F594K S4 to 1/4, incl 85 92 B90 to C32, inc<br>SH4 F594K S4 to 1/4, incl 85 92 B90 to C32, inc<br>SH3 F594K S4 to 1/4, incl 85 92 B90 to C32, inc<br>SH3 F594K S4 to 1/4, incl 85 92 B90 to C32, inc<br>SH3 F594K S4 to 1/4, incl 85 92 B90 to C32, inc<br>SH3 F594K S4 to 1/4, incl 10 119 C20 to C32, inc<br>SH3 F594K S4 to 1/4, incl 10 110 119 C20 to C32, inc<br>SH3 F594K S4 to 1/4, incl 10 10 B8 B95 to C30, inc<br>SH4 F594M % to 1/4, incl 10 10 B8 B95 to C30, inc<br>SH3 F594K % to 1, incl 110 119 C20 to C32, inc<br>SH3 F594K % to 1, incl 110 119 C20 to C32, inc<br>SH3 F594K % to 1, incl 110 119 C20 to C32, inc<br>SH3 F594K % to 1, incl 110 119 C20 to C32, inc<br>SH3 F594K % to 1, incl 10 10 108 B95 to C30, inc<br>SH4 F594H % to 1/4, incl 85 92 B80 to C35, inc<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, inc<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, incl<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, incl<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, incl<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, incl<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, incl<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, incl<br>SH4 F594H % to 1/4, incl 100 104 C40, to 30, incl<br>6  | 1                        | А                      | F594B                                |  | 75                                    | 81   | B65 to 95, incl      |
| 305, 384, CW2 F594D % to 1/4, incl 85 92 B80 to C35, inc<br>302HQ, 303Se) SH2 F594B % to 1, incl 110 119 C20 to C36, inc<br>SH3 F594E % to 1/4, incl 100 108 B95 to C36, inc<br>SH4 F594E % to 1/4, incl 85 92 B90 to C28, inc<br>AF F594F % to 1/4, incl 75 81 B85 to 95, incl<br>316L CW2 F594F % to 1/4, incl 75 81 B85 to 95, incl<br>SH3 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C35, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C32, inc<br>SH4 F594F % to 1/4, incl 85 92 B90 to C32, inc<br>SH3 F594K S4 to 1/4, incl 85 92 B90 to C32, inc<br>SH3 F594K S4 to 1/4, incl 85 92 B90 to C32, inc<br>SH4 F594K S4 to 1/4, incl 85 92 B90 to C32, inc<br>SH3 F594K S4 to 1/4, incl 85 92 B90 to C32, inc<br>SH3 F594K S4 to 1/4, incl 85 92 B90 to C32, inc<br>SH3 F594K S4 to 1/4, incl 85 92 B90 to C32, inc<br>SH3 F594K S4 to 1/4, incl 10 119 C20 to C32, inc<br>SH3 F594K S4 to 1/4, incl 10 110 119 C20 to C32, inc<br>SH3 F594K S4 to 1/4, incl 10 10 B8 B95 to C30, inc<br>SH4 F594M % to 1/4, incl 10 10 B8 B95 to C30, inc<br>SH3 F594K % to 1, incl 110 119 C20 to C32, inc<br>SH3 F594K % to 1, incl 110 119 C20 to C32, inc<br>SH3 F594K % to 1, incl 110 119 C20 to C32, inc<br>SH3 F594K % to 1, incl 110 119 C20 to C32, inc<br>SH3 F594K % to 1, incl 10 10 108 B95 to C30, inc<br>SH4 F594H % to 1/4, incl 85 92 B80 to C35, inc<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, inc<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, incl<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, incl<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, incl<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, incl<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, incl<br>SH4 F594H % to 1/4, incl 100 108 B95 to C30, incl<br>SH4 F594H % to 1/4, incl 100 104 C40, to 30, incl<br>6  | (303, 304, 304L          | CW1                    | F594C                                | 1/4 to 5/8 , incl                                  | 100                                   | 108  | B95 to C35, inc      |
| 302HQ, 303Se)     SH2     FE94E<br>F594E     94 to 1, incl     110     119     C 20 to C32, incl<br>C33, incl<br>SH4       2     AF     F594E     1% to 1½, incl     85     92     B90 to C28, incl<br>SH3       2     A     F594F     1% to 1½, incl     75     81     B65 to 95, incl<br>SH3     B65 to 95, incl<br>SH3     B65 to 95, incl<br>SH3     B95 to C35, incl<br>SH3     B95 to C35, incl<br>SH3     B95 to C35, incl<br>SH3     B95 to C35, incl<br>SH4     B95 to C35, incl<br>SH3     B65 to 95, incl<br>SH3     B95 to C35, incl<br>SH4     B95 to C36, incl<br>SH4 <td< td=""><td>305, 384,</td><td>CW2</td><td>F594D</td><td></td><td>85</td><td>92</td><td>B80 to C35, inc</td></td<>   | 305, 384,                | CW2                    | F594D                                |  | 85                                    | 92   | B80 to C35, inc      |
| SH3     F594C<br>F594D     11% to 11%, incl     100     108     B95 to C30, incl       2     A     F594D     11% to 11%, incl     85     92     B90 to C28, incl       2     A     F594F     11% to 11%, incl     85     92     B90 to C28, incl       316L     CW1     F594F     11% to 11%, incl     70     76     B85 max       316L     CW2     F594H     11% to 11%, incl     70     76     B85 mox C35, incl       SH1     F594F     11% to 11%, incl     110     119     C20 to C35, incl       SH2     F594F     11% to 11%, incl     100     108     B95 to C30, incl       SH2     F594F     11% to 11%, incl     100     108     B95 to C30, incl       SH3     F594H     11% to 11%, incl     100     108     B95 to C30, incl       SH2     F594F     11% to 11%, incl     75     81     B65 to 95, incl       SH4     F594H     11% to 11%, incl     75     81     B65 to 95, incl       SH2     F594H     11% to 11%, in  | XM1, 18–9LW,             | SH1                    | <u>F594A</u>                         | 1/4 to 5/8 , incl                                  | 120                                   | 130  | C24 to C36, inc      |
| SH4     F594D     1% to 1½, incl     85     92     B90 to C28, inc       2     A     F594F     ½ to 1½, incl     75     81     B65 to 95, ind       316L     CW1     F594F     ½ to 1½, incl     75     81     B65 to 95, ind       316L     CW2     F594F     ½ to ½, incl     100     108     B95 to C35, inc       SH1     F594F     ½ to 1½, incl     100     108     B95 to C35, inc       SH2     F594F     ½ to 1½, incl     100     108     B95 to C35, inc       SH2     F594F     ½ to 1½, incl     100     108     B95 to C35, inc       SH3     F594F     ½ to 1½, incl     100     108     B95 to C30, inc       SH4     F594F     ½ to 1½, incl     70     76     B85 max       SH3     F594F     ½ to 1½, incl     70     76     B85 max       SH3     F594H     ½ to 1½, incl     75     81     B65 to 95, incl       SH4     F594H     ½ to 1½, incl     76     85     92 <t< td=""><td>302HQ, 303Se)</td><td>SH2</td><td><u>F594B</u></td><td>3/4 to 1, incl</td><td>110</td><td>119</td><td>C20 to C32, inc</td></t<>   | 302HQ, 303Se)            | SH2                    | <u>F594B</u>                         | 3/4 to 1, incl                                     | 110                                   | 119  | C20 to C32, inc      |
| AF     F594F     X to 1½, incl     70     76     B85 max       (316)     CW1     F594F     ½ to 1½, incl     75     81     B65 to 55, incl       (316)     CW2     F594F     ½ to ½, incl     76     B85 max       SH1     F594F     ½ to ½, incl     76     B85 max       SH2     CW2     F594F     ½ to ½, incl     85     92     B80 to C35, incl       SH2     SH2     F594F     ½ to ½, incl     100     108     B95 to C35, incl       SH2     SH3     D     F594F     ½ to ½, incl     10     100     108     B95 to C35, incl       SH4     F594H     1½ to ½, incl     70     76     B85 max       SH4     F594H     ½ to ½, incl     70     76     B85 to C35, incl       (321, 347)     AF     F594L     SH4     ½ to ½, incl     70     76     B85 to C35, incl       (321, 347)     AF     F594L     1½ to 1½, incl     70     76     B85 to C35, incl       (321, 347)     AF </td <td></td> <td>SH3</td> <td><u>F594C</u></td> <td>11/8 to 11/4, incl</td> <td>100</td> <td>108</td> <td>B95 to C30, inc</td>   |                          | SH3                    | <u>F594C</u>                         | 11/8 to 11/4, incl                                 | 100                                   | 108  | B95 to C30, inc      |
| 2     A     F594F     1/4 to 1/2, incl     75     81     B65 to 95, incl       (316)     CW1     F594G     1/4 to 1/2, incl     100     108     B95 to C35, incl       316L     CW2     F594G     1/4 to 1/2, incl     110     119     C20 to C32, incl       SH1     F594F     1/4 to 1/2, incl     110     119     C20 to C32, incl       SH3     F594F     1/4 to 1/2, incl     100     108     B95 to C33, incl       SH3     F594F     1/4 to 1/2, incl     100     108     B95 to C33, incl       SH4     F594F     1/4 to 1/2, incl     70     76     B85 max       SH4     F594H     1/4 to 1/2, incl     70     76     B85 max       G21, 347)     A     F594H     1/4 to 1/2, incl     75     81     B65 to 55, incl       SH1     F594H     1/4 to 1/2, incl     70     76     B85 max       G21, 347)     GW2     F594M     4 to 1/2, incl     85     92     B90 to C35, incl       SH1     F594J     4 to   |                          | SH4                    | F594D                                | 13/8 to 11/2, incl                                 | 85                                    | 92   | B90 to C28, inc      |
| 2     A     F594F     1/4 to 1/2, incl     75     81     B65 to 95, incl       (316)     CW1     F594G     1/4 to 1/2, incl     100     108     B95 to C35, incl       316L     CW2     F594G     1/4 to 1/2, incl     110     119     C20 to C32, incl       SH1     F594F     1/4 to 1/2, incl     110     119     C20 to C32, incl       SH3     F594F     1/4 to 1/2, incl     100     108     B95 to C33, incl       SH3     F594F     1/4 to 1/2, incl     100     108     B95 to C33, incl       SH4     F594F     1/4 to 1/2, incl     70     76     B85 max       SH4     F594H     1/4 to 1/2, incl     70     76     B85 max       G21, 347)     A     F594H     1/4 to 1/2, incl     75     81     B65 to 55, incl       SH1     F594H     1/4 to 1/2, incl     70     76     B85 max       G21, 347)     GW2     F594M     4 to 1/2, incl     85     92     B90 to C35, incl       SH1     F594J     4 to   |                          |                        |                                      |  |                                       |  |                      |
| (316)<br>316L     CW1<br>CW2     F594B<br>F594F     CW4 to 1½, incl     St 160<br>85, incl     100<br>85, incl     100<br>85, incl     100<br>82, incl     100<br>84, incl <td></td> <td>AF</td> <td></td> <td></td> <td></td> <td></td> <td>B85 max</td>  |                          | AF                     |                                      |  |                                       |  | B85 max              |
| $\begin{array}{c ccccc} & SH1 \\ SH2 \\ SH2 \\ SH3 \\ SH4 \\ \hline F594E \\ F594E \\ F594E \\ SH4 \\ \hline F594H \\ H^{5} to 112, incl \\ F594H \\ H^{5} to 112, in$ |                          |                        |                                      | 1/4 to 11/2 , incl                                 | 75                                    |  | B65 to 95, incl      |
| $\begin{array}{c ccccc} & SH1 \\ SH2 \\ SH2 \\ SH3 \\ SH4 \\ \hline F594E \\ F594E \\ F594E \\ SH4 \\ \hline F594H \\ H^{5} to 112, incl \\ F594H \\ H^{5} to 112, in$ | (316)                    |                        |                                      | 1/4 to 5/8 , incl                                  | 100                                   |  | B95 to C35, inc      |
| SH2<br>SH3<br>SH4     D     F594F<br>F594A<br>F594H     *** to 1, ind<br>1% to 1/2, ind     110<br>100     119<br>108     C20 to C32, ind<br>B95 to C30, ind<br>B95 to C35, ind<br>CW2       AF     F594K     ASTM 1/4 to 1/2, ind<br>F594K     75     81     B85 to 95, ind<br>B95 to C35, ind<br>B95 to C35, ind<br>CW2       SH1     F594K     1/4 to 1/2, ind     85     92     B80 to C32, ind<br>B95 to C35, ind<br>CW2       SH2     F594M     3/4 to 1/2, ind     85     92     B80 to C35, ind<br>CW2       SH1     F594L     1/4 to 1/2, ind     85     92     B90 to C28, ind<br>C20 to C32, ind<br>SH4       SH2     F594M     3/4 to 1/2, ind     85     92     B90 to C28, ind<br>B95 to C30, ind<br>SH4       SH3     F594L     1/4 to 1/4, ind     100     108     B95 to C30, ind<br>SH4       4     A     F594N     1/4 to 1/2, ind     55     59     85 max       (430, 430F)     CW1     F594P     1/4 to 1/2, ind     55     59     B65 to 95, ind       4     F594H  | 316L                     |                        | <b>F594H</b>                         | 3/4 to 11/2, incl                                  | 85 6                                  | 92   | B80 to C35, inc      |
| SH3<br>SH4     D F 594G<br>E 594H     M C 1½ to 1½ to 1½, incl     100<br>85     108<br>92     B95 to C30, incl<br>B90 to C28, incl       3<br>h (321, 347) nd ards into 1 10 (321, 347) nd ards into 2 10 (321, 347) nd ards into 2 10 (321, 347) nd ards into 2 10 (321, 347) nd ards into 1 10 (321, 347) nd ards into 2 10 (321, 347) nd 100 (321, 347) nd 100 (321, 347) nd 100 (321, 347) nd 100 (321, 351, 351 (322, 551, 322, ind 140, 142, ind 160 (321, 351 (324, 514) nd 142, ind 160 (324, 514) nd 144, ind 144, in   |                          | SH1                    | F594E                                | 1⁄4 to 5⁄8 , incl                                  | 120                                   | 130  | C24 to C36, inc      |
| SH4     F594H     1% to 1½, incl     85     92     B90 to C28, incl       3     AF     F594K     ASTM ½ to 1½, incl     70     76     B85 max       4     F594K     Y4 to 1½, incl     70     76     B85 max       663 to 954H     F594K     Y4 to 1½, incl     75     81     B95 to C35, incl       CW2     F594M     %4 to 1½, incl     85     92     B80 to C35, incl       SH1     F594L     Y4 to %6, incl     120     130     C24 to C36, incl       SH2     F594M     %4 to 1½, incl     100     108     B95 to C35, incl       SH2     F594L     1% to %, incl     120     130     C24 to C36, incl       SH4     F594H     1% to 1½, incl     100     108     B95 to C35, incl       SH4     F594M     1% to 1½, incl     55     59     85 max       sH4     F594M     1% to 1½, incl     55     59     85 max       (430, 430F)     CW1     F594P     ½ to 1½, incl     55     59     86 to 95, incl   |                          | SH2                    |                                      | 3/4 to 1, incl                                     | 110                                   | 119  | C20 to C32, inc      |
| AF     F594J     ASTM ½ to 1½, incl     70     76     B85 max       3     A     F594K     ½ to 1½, incl     75     81     B65 to 95, incl       (321, 347)     CW1 at log star     F594K     ½ to 1½, incl     75     81     B65 to 95, incl       CW2     F594M     % to 1½, incl     85     92     B80 to 35, incl       SH1     F594L     1½ to 5%, incl     120     130     C24 to C36, incl       SH2     F594L     1½ to 5%, incl     120     130     C24 to C36, incl       SH3     F594L     1½ to 1½, incl     100     108     B95 to C30, incl       SH4     F594N     ½ to 1½, incl     85     92     B90 to C28, incl       V     SH4     F594V     1½ to 1½, incl     100     108     B95 to C30, incl       SH4     F594N     ½ to 1½, incl     5     59     85 max       (430, 430F)     CW1     F594N     ½ to 1½, incl     5     59     85 max       410, 416, 416Se)     H     F594P     ½ to 1½, inc  |                          | SH3                    | <u>F594G</u>                         | 11/8 to 11/4, incl                                 | 100                                   | 108  | B95 to C30, inc      |
| 3     A     F594K     1/4 to 1/2, incl     75     81     B65 to 95, incl       (321, 347)     CW1 attalog star     F594L     St4/4 d 1/4 to %, incl     40/4 to 1/2, incl     75     81     B65 to 95, incl       CW2     F594M     % to 1/2, incl     85     92     B80 to C35, incl       SH1     F594J     1/4 to 1/2, incl     85     92     B80 to C35, incl       SH2     F594K     % to 1/4, incl     110     119     C20 to C32, incl       SH3     F594L     1/% to 1/4, incl     100     108     B95 to 23, incl       SH4     F594M     1% to 1/2, incl     85     92     B90 to C28, incl       V     F594M     1% to 1/2, incl     85     92     B90 to C28, incl       4     A     F594N     1/4 to 1/2, incl     5     59     85 max       (430, 430F)     CW1     F594V     1/4 to 1/2, incl     55     59     B65 to 95, incl       2     F594W     1/4 to 1/2, incl     100     108     C20 to 30, incl       (430, 430F)  |                          | SH4                    | <u>F594H</u>                         | 1% to $1%$ , incl                                  | 85                                    | 92   | B90 to C28, inc      |
| 3     A     F594K     1/4 to 1/2, incl     75     81     B65 to 95, incl       (321, 347)     CW1 attalog star     F594L     St4/4 d 1/4 to %, incl     40/4 to 1/2, incl     75     81     B65 to 95, incl       CW2     F594M     % to 1/2, incl     85     92     B80 to C35, incl       SH1     F594J     1/4 to 1/2, incl     85     92     B80 to C35, incl       SH2     F594K     % to 1/4, incl     110     119     C20 to C32, incl       SH3     F594L     1/% to 1/4, incl     100     108     B95 to 23, incl       SH4     F594M     1% to 1/2, incl     85     92     B90 to C28, incl       V     F594M     1% to 1/2, incl     85     92     B90 to C28, incl       4     A     F594N     1/4 to 1/2, incl     5     59     85 max       (430, 430F)     CW1     F594V     1/4 to 1/2, incl     55     59     B65 to 95, incl       2     F594W     1/4 to 1/2, incl     100     108     C20 to 30, incl       (430, 430F)  |                          |                        |                                      |  | 70                                    | 70   | D05 mov              |
| H (321, 347)   H and boy stance F594L / sist/4 c4 at //a to %, incl/d-408/2 - 100   L and 2 Uoel 9 de 108 astm- 59   B95 to C35, incl     CW2   F594M   % to 11/2, incl   85   92   B80 to C35, incl     SH1   F594L   ½ to %, incl   120   130   C24 to C32, incl     SH2   F594L   11/6 to 11/4, incl   110   119   C20 to C32, incl     SH3   F594L   11/6 to 11/4, incl   100   108   B95 to C35, incl     SH4   F594M   % to 11/2, incl   85   92   B90 to C28, incl     SH4   F594M   1% to 11/2, incl   85   92   B90 to C28, incl     (430, 430F)   CW1   F594N   1/4 to 11/2, incl   55   59   85 max     (430, 430F)   CW1   F594V   1/4 to 11/2, incl   55   59   86 to 95, incl     Martensitic Alloys   Martensitic Alloys   Martensitic Alloys   5   100   108   C20 to 30, incl     6   H   F594S   1/4 to 11/2, incl   160   173   C34 to 45, incl     6   H   F594S   1/4 to 11/2, incl   180 <t< td=""><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td></t<>   | 2                        |                        |                                      |  |                                       |  |                      |
| CW2     F594M     ¾ to 1½, incl     85     92     B80 to C35, incl       SH1     F594J     ¼ to 5%, incl     120     130     C24 to C36, incl       SH2     F594K     ¾ to 1, incl     110     119     C20 to C32, incl       SH3     F594L     1½ to 1¼, incl     100     108     B95 to C30, incl       SH4     F594M     1½ to 1½, incl     85     92     B90 to C28, incl       SH4     F594M     1½ to 1½, incl     85     92     B90 to C38, incl       sH4     F594M     1½ to 1½, incl     85     92     B90 to C28, incl       stH4     F594M     1½ to 1½, incl     55     59     85 max       (430, 430F)     CW1     F594N     ½ to 1½, incl     55     59     85 to 95, incl       stMatensitic Alloys     Matensitic Alloys     Matensitic Alloys     100     108     C20 to 30, incl       6     H     F594S     ½ to 1½, incl     160     173     C34 to 45, incl       (431)     HT     F594S     ½ to 1½, incl <td< td=""><td>0</td><td>ls itehowcatalo</td><td></td><td></td><td></td><td></td><td></td></td<>  | 0                        | ls itehowcatalo        |                                      |  |                                       |  |                      |
| $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$   | (521, 547)               |                        |                                      |  |                                       |  | ,                    |
| SH2     F594K     ¾ to 1, incl     110     119     C20 to C32, incl       SH3     F594L     1½ to 1¼, incl     100     108     B95 to C30, incl       SH4     F594M     1½ to 1½, incl     85     92     B90 to C28, incl       4     A     F594N     1½ to 1½, incl     55     59     85 max       (430, 430F)     CW1     F594V     ½ to 1½, incl     55     59     85 max       (430, 430F)     CW1     F594V     ½ to 1½, incl     55     59     85 max       (430, 430F)     CW1     F594V     ½ to 1½, incl     55     59     865 to 95, incl       CW2     F594W     ¾ to 1½, incl     100     108     C20 to 30, incl       410, 416, 416Se)     HT     F594P     ¼ to 1½, incl     160     173     C34 to 45, incl       6     H     F594S     ¼ to 1½, incl     180     194     C40 to 48, incl       (431)     HT     F594T     ¼ to 1½, incl     180     194     C40 to 48, incl       7     A   |                          |                        |                                      |  |                                       |  | ,                    |
| SH3<br>SH4     F594L<br>F594M     11/6 to 11/2 , incl     100     108<br>85     B95 to C30, incl<br>B90 to C28, incl       Ferritic Alloys       4     A     F594N     1/4 to 11/2 , incl     55     59     85 max       (430, 430F)     CW1<br>CW2     F594N     1/4 to 11/2 , incl     55     59     85 max       (430, 430F)     CW1<br>CW2     F594V     1/4 to 11/2 , incl     60     65     B75 to 98, incl       (430, 430F)     CW1<br>CW2     F594W     3/4 to 11/2 , incl     55     59     B65 to 95, incl       6     H     F594F     1/4 to 11/2 , incl     100     108     C20 to 30, incl       6     H     F594F     1/4 to 11/2 , incl     160     173     C34 to 45, incl       6     H     F594S     1/4 to 11/2 , incl     180     194     C40 to 48, incl       Precipitation Hardening Alloys       7     AH     F594U     1/4 to 11/2 , incl     135     146     C28 to 38, incl  |                          |                        |                                      |  |                                       |  |                      |
| SH4     F594M     1¾ to 1½, incl     85     92     B90 to C28, incl       Ferritic Alloys       4     A     F594N     ½ to 1½, incl     55     59     85 max       (430, 430F)     CW1     F594V     ½ to ½, incl     55     59     85 max       CW2     F594W     ½ to ½, incl     55     59     B65 to 95, incl       Martensitic Alloys       5     H     F594P     ½ to 1½, incl     100     108     C20 to 30, incl       410, 416, 416Se)     HT     F594P     ½ to 1½, incl     160     173     C34 to 45, incl       6     H     F594S     ½ to 1½, incl     180     194     C40 to 48, incl       Precipitation Hardening Alloys       Precipitation Hardening Alloys       7     AH     F594U     ½ to 1½, incl     135     146     C28 to 38, incl  |                          |                        |                                      |  |                                       |  |                      |
| A     F594N     1/4 to 11/2, incl     55     59     85 max       (430, 430F)     CW1     F594V     1/4 to 5%, incl     60     65     B75 to 98, incl       (430, 430F)     CW2     F594V     1/4 to 5%, incl     60     65     B75 to 98, incl       CW2     F594W     3/4 to 11/2, incl     55     59     B65 to 95, incl       Martensitic Alloys       5     H     F594P     1/4 to 11/2, incl     100     108     C20 to 30, incl       410, 416, 416Se)     HT     F594R     1/4 to 11/2, incl     160     173     C34 to 45, incl       6     H     F594S     1/4 to 11/2, incl     180     194     C40 to 48, incl       (431)     HT     F594T     1/4 to 11/2, incl     180     194     C40 to 48, incl       Precipitation Hardening Alloys       7     AH     F594U     1/4 to 11/2, incl     135     146     C28 to 38, incl   |                          |                        |                                      |  |                                       |  |                      |
| (430, 430F)     CW1<br>CW2     F594V<br>F594W     ½ to 5%, incl<br>34 to 1½, incl     60<br>55     65<br>59     B75 to 98, incl<br>B65 to 95, incl       Martensitic Alloys       5     H     F594P     ½ to 1½, incl     100     108     C20 to 30, incl       410, 416, 416Se)     HT     F594P     ½ to 1½, incl     100     173     C34 to 45, incl       6     H     F594S     ½ to 1½, incl     125     135     C25 to 32, incl       (431)     HT     F594S     ½ to 1½, incl     180     194     C40 to 48, incl       Precipitation Hardening Alloys       7     AH     F594U     ½ to 1½, incl     135     146     C28 to 38, incl   |                          |                        |                                      |  |                                       |  | ,                    |
| (430, 430F)     CW1<br>CW2     F594V<br>F594W     ½ to 5%, incl<br>34 to 1½, incl     60<br>55     65<br>59     B75 to 98, incl<br>B65 to 95, incl       Martensitic Alloys       5     H     F594P     ½ to 1½, incl     100     108     C20 to 30, incl       410, 416, 416Se)     HT     F594P     ½ to 1½, incl     100     173     C34 to 45, incl       6     H     F594S     ½ to 1½, incl     125     135     C25 to 32, incl       (431)     HT     F594S     ½ to 1½, incl     180     194     C40 to 48, incl       Precipitation Hardening Alloys       7     AH     F594U     ½ to 1½, incl     135     146     C28 to 38, incl   | 4                        | Α                      | F594N                                | •  | 55                                    | 59   | 85 max               |
| CW2     F594W     ¾ to 1½, incl     55     59     B65 to 95, incl       Martensitic Alloys       5     H     F594P     ¼ to 1½, incl     100     108     C20 to 30, incl       410, 416, 416Se)     HT     F594P     ¼ to 1½, incl     160     173     C34 to 45, incl       6     H     F594S     ¼ to 1½, incl     125     135     C25 to 32, incl       (431)     HT     F594S     ¼ to 1½, incl     180     194     C40 to 48, incl       Precipitation Hardening Alloys       7     AH     F594U     ¼ to 1½, incl     135     146     C28 to 38, incl  |                          |                        |                                      |  |                                       |  |                      |
| 5     H     F594P     ½ to 1½, incl     100     108     C20 to 30, incl       410, 416, 416Se)     HT     F594R     ½ to 1½, incl     160     173     C34 to 45, incl       6     H     F594S     ½ to 1½, incl     125     135     C25 to 32, incl       (431)     HT     F594T     ½ to 1½, incl     180     194     C40 to 48, incl       Precipitation Hardening Alloys       7     AH     F594U     ½ to 1½, incl     135     146     C28 to 38, incl   |                          |                        |                                      |  |                                       |  |                      |
| 410, 416, 416Se)     HT     F594R     ½ to 1½, incl     160     173     C34 to 45, incl       6     H     F594S     ½ to 1½, incl     125     135     C25 to 32, incl       (431)     HT     F594T     ½ to 1½, incl     180     194     C40 to 48, incl       Precipitation Hardening Alloys       7     AH     F594U     ½ to 1½, incl     135     146     C28 to 38, incl   |                          |                        |                                      | Martensitic Alloys                                 |                                       |  |                      |
| 6<br>(431)     H<br>HT     F594S<br>F594T     ½ to 1½ , incl<br>¼ to 1½ , incl     125<br>180     135<br>194     C25 to 32, incl<br>C40 to 48, incl       Precipitation Hardening Alloys       7     AH     F594U     ½ to 1½ , incl     135     146     C28 to 38, incl   |                          |                        |                                      |  |                                       |  | C20 to 30, incl      |
| (431)     HT     F594T     ½ to 1½, incl     180     194     C40 to 48, incl       Precipitation Hardening Alloys       7     AH     F594U     ½ to 1½, incl     135     146     C28 to 38, incl   | (410, 416, 416Se)        |                        | F594R                                | 1/4 to 11/2, incl                                  | 160                                   | 173  | C34 to 45, incl      |
| Precipitation Hardening Alloys       7     AH     F594U     ½ to 1½, incl     135     146     C28 to 38, incl  |                          |                        |                                      |  |                                       |  | C25 to 32, incl      |
| 7     AH     F594U     ½ to 1½, incl     135     146     C28 to 38, incl   | (431)                    | HI                     |                                      |  |                                       | 194  | C40 to 48, incl      |
|  |                          |                        |                                      |  |                                       |  |                      |
|  |                          | AH                     | F594U                                | $^{1\!\!/_{\!\!4}}$ to $1^{1\!\!/_{\!\!2}}$ , incl | 135                                   | 146  | C28 to 38, incl      |

<sup>A</sup> Minimum values except where shown as maximum or as a range.

<sup>B</sup> Legend of conditions:

A-Machined from annealed or solution annealed stock thus retaining the properties of the original stock; or hot formed and solution annealed.

AF—Annealed after all threading is completed.

AH-Solution annealed and age hardened after forming.

CW-Annealed and cold worked. Sizes 0.75 in. and larger may be hot worked and solution annealed.

H—Hardened and tempered at 1050°F (566°C) min.

HT—Hardened and tempered at 525°F (274°C) min.

SH—Machined from strain hardened stock.

<sup>C</sup>Proof stress values for heavy hex nuts are based on 1.08 times the value for corresponding hex nuts.