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# ASTM, SAE AND ISO BOLTING MATERIAL

| **Identification** Grade Mark | **Specification** | **Fastener** Description | **Material** | **Nominal Size** Range (in.) | **Mechanical Properties** | | |
|---|---|---|---|---|---|---|---|
| | | | | | **Proof Load** (psi) | **Yield Strength** Min (psi) | **Tensile Strength** Min (psi) |
|  No Grade Mark | SAE J429Grade 1 | Bolts, Screws, Studs | Low or Medium Carbon Steel | 1/4 thru 1-1/2 | 33,000 | | 60,000 |
| | ASTM A307Grades A&B | | Low Carbon Steel | 1/4 thru 4 | – | – | |
| | SAE J429Grade 2 | | Low or Medium Carbon Steel | 1/4 thru 3/4 Over 3/4 to 1-1/2 | 55,000 33,000 | 57,000 36,000 | 74,000 60,000 |
|  No Grade Mark | SAE J429Grade 4 | Studs | Medium Carbon Cold Drawn Steel | 1/4 thru 1-1/2 | – | 100,000 | 115,000 |
|  B5 | ASTM A193Grade B5 | – | AISI 501 | 1/4 thru 4 | – | 80,000 | 100,000 |
|  B6 | ASTM A193Grade B6 | | AISI 410 | | – | 85,000 | 110,000 |
|  B7 | ASTM A193Grade B7 | | AISI 4140, 4142, OR 4105 | 1/4 thru 2-1/2 Over 2-1/2 thru 4 | – | 105,000 95,000 75,000 | 125,000 115,000 100,000 |
|  B16 | ASTM A193Grade B16 | | CrMoVa Alloy Steel | Over 4 thru 7 | – | 105,000 95,000 85,000 | 125,000 115,000 100,000 |
|  B8 | ASTM A193Grade B8 | | AISI 304 | 1/4 and larger | – | 30,000 | 75,000 |
|  B8C | ASTM A193Grade B8C | | AISI 347 | | – | | |
|  B8M | ASTM A193Grade B8M | | AISI 316 | | – | | |
|  B8T | ASTM A193Grade B8T | Bolts, Screws, Studs for High-Temperature Service | AISI 321 | 1/4 and larger | – | 30,000 | 75,000 |

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| | | | | | **Proof Load** (psi) | **Yield Strength** Min (psi) | **Tensile Strength** Min (psi) |
|  B8 | ASTM A193Grade B8 | Bolts, Screws, Studs for High-Temperature Service | AISI 304Strain Hardened | 1/4 thru 3/4<br>Over 3/4 thru 1<br>Over 1 thru 1-1/4<br>Over 1-1/4 thru 1-1/2 | – | 100,000<br>80,000<br>65,000<br>50,000 | 125,000<br>115,000<br>105,000<br>100,000 |
|  B8C | ASTM A193Grade B8C | | AISI 347Strain Hardened | | – | | |
|  B8M | ASTM A193Grade B8M | | AISI 316Strain Hardened | | – | 95,000<br>80,000<br>65,000<br>50,000 | 110,000<br>100,000<br>95,000<br>90,000 |
|  B8T | ASTM A193Grade B8T | | AISI 321Strain Hardened | | – | 100,000<br>80,000<br>65,000<br>50,000 | 125,000<br>115,000<br>105,000<br>100,000 |
|  L7 | ASTM A320Grade L7 | Bolts,Screws, Studs for Low-Temperature Service | AISI 4140,4142 or 4145 | 1/4 thru 2-1/2 | – | 105,000 | 125,000 |
|  L7A | ASTM A320Grade L7A | | AISI 4037 | | – | | |
|  L7B | ASTM A320Grade L7B | | AISI 4137 | | – | | |
|  L7C | ASTM A320Grade LC7 | | AISI 8740 | | – | | |
|  L43 | ASTM A320Grade L43 | | AISI 4340 | 1/4 thru 4 | – | | |
|  B8 | ASTM A320Grade B8 | | AISI 304 | 1/4 and larger | – | 30,000 | 75,000 |
|  B8C | ASTM A320Grade B8C | | AISI 347 | | – | | |
|  B8T | ASTM A320Grade B8T | | AISI 321 | | – | | |

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|---|---|---|---|---|---|---|---|
| | | | | | **Proof Load** (psi) | **Yield Strength** Min (psi) | **Tensile Strength** Min (psi) |
|  B8T | ASTM A320 Grade B8T | Bolts,Screws, Studs for Low-Temperature Service | 1/4 thru 3/4<br>Over 3/4 thru 1<br>Over 1 thru 1-1/4<br>Over 1-1/4 thru 1-1/2 | 1/4 and larger | – | 30,000 | 75,000 |
|  B8F | ASTM A320 Grade B8F | | | | – | | |
|  B8M | ASTM A320 Grade B8M | | | | – | | |
|  B8 | ASTM A320 Grade B8 | | AISI 304 | 1/4 thru 3/4<br>Over 3/4 thru 1<br>Over 1 thru 1-1/4<br>Over 1-1/4 thru 1-1/2 | – | 100,000<br>80,000<br>65,00<br>50,00 | 100,000<br>80,000<br>65,00<br>50,00 |
|  B8C | ASTM A320 Grade B8C | | AISI 347 | | – | | |
|  B8F | ASTM A320 Grade B8F | | AISI 303or 303Se | | – | | |
|  B8M | ASTM A320 Grade B8M | | AISI 316 | | – | | |
|  B8T | ASTM A320 Grade B8T | | AISI 321 | | – | | |
|  | SAE J429 Grade 5 | Bolts, Screws, Studs | Medium Carbon Steel, Quenched and Tempered | 1/4 thru 1Over 1 to 1-1/2 | 85,000<br>74,000 | 92,000<br>81,000 | 120,000<br>105,000 |
| | ASTM A449 | | | 1/4 thru 1Over 1 to 1-1/2<br>Over 1-1/2 thru 3 | 85,000<br>74,000<br>55,000 | 92,000<br>81,000<br>58,000 | 120,000<br>105,000<br>90,000 |
|  | SAE J429 Grade 5.1 | Sems | Low or Medium Carbon Steel, Quenched and Tempered | No. 6 thru 3/8 | 85,000 | – | 120,000 |
|  | SAE J429 Grade 5.2 | Bolts, Screws, Studs | Low Carbon Martensitic Steel, Quenched and Tempered | 1/4 thru 1 | 85,000 | 92,000 | 120,000 |

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|---|---|---|---|---|---|---|---|
| | | | | | **Proof Load** (psi) | **Yield Strength** Min (psi) | **Tensile Strength** Min (psi) |
|  A325 | ASTM A325 Type 1 | High Strength Structural Bolts | Medium Carbon Steel, Quenched and Tempered | 1/2 thru 11-1/8 thru 1-1/2 | 85,000<br>74,000 | 92,000<br>81,000 | 120,000<br>105,000 |
|  A325 | ASTM A325 Type 2 | | Low Carbon Martensitic Steel, Quenched and Tempered | 1/2 thru 1 | 85,000 | 92,000 | 120,000 |
|  A325 | ASTM A325 Type 3 | | Atmospheric Corrosion Resisting Steel, Quenched and Tempered | 1/2 thru 11-1/8 thru 1-1/2 | 85,000<br>74,000 | 92,000<br>81,000 | 120,000<br>105,000 |
|  | ASTM A354 Grade BB | Bolts, Studs | Alloy Steel, Quenched and Tempered | 1/4 thru 2-1/22-3/4 thru 4 | 80,000<br>75,000 | 83,000<br>78,000 | 105,000<br>100,000 |
|  | ASTM A354 Grade BC | | | | 105,000<br>95,000 | 109,000<br>99,000 | 125,000<br>115,000 |
|  | SAE J429 Grade 7 | Bolts, Screws | Medium Carbon Alloy Steel, Quenched and Tempered[4] | 1/4 thru 1-1/2 | 105,000 | 115,000 | 133,000 |
|  | SAE J429 Grade 8 | Bolts, Screws, Studs | Medium Carbon Alloy Steel, Quenched and Tempered | 1/4 thru 1-1/2 | 120,000 | 130,000 | 150,000 |
| | ASTM A354 Grade BD | | Alloy Steel, Quenched and Tempered[4] | | | | |
|  No Grade Mark | SAE J429 Grade 8.1 | Studs | Medium Carbon Alloy or SAE 1041 Modified Elevated Temperature Drawn Steel | 1/4 thru 1-1/2 | 120,000 | 130,000 | 150,000 |
|  A490 | ASTM A490 | High Strength Structural Bolts | Alloy Steel, Quenched and Tempered | 1/2 thru 1-1/2 | 120,000 | 130,000 | 150,000 min<br>170,000 max |
|  No Grade Mark | ISO R898 Class 4.6 | Bolts, Screws, Studs | Medium Carbon Steel, Quenched and Tempered | All Sizes thru 1-1/2 | 33,000 | 36,000 | 60,000 |

# ASTM, SAE AND ISO BOLTING MATERIAL

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|---|---|---|---|---|---|---|---|
| | | | | | **Proof Load** (psi) | **Yield Strength** Min (psi) | **Tensile Strength** Min (psi) |
|  No Grade Mark | ISO R898 Class 5.8 | Bolts, Screws, Studs | Medium Carbon Steel, Quenched and Tempered | All Sizes thru 1-1/2 | 55,000 | 57,000 | 74,000 |
|  8.8 or  88 | ISO R898 Class 8.8 | | Alloy Steel, Quenched and Tempered | | 85,000 | 92,000 | 120,000 |
|  10.9 or  109 | ISO R898 Class 10.9 | | | | 120,000 | 130,000 | 150,000 |

**NOTES:**

1. ASTM Specifications:
   - A193 – Alloy-Steel Bolding Materials for High-Temperature Service
   - A307 – Low-Carbon Steel Externally and Internally Threaded Standard Fasteners
   - A320 – Alloy-Steel Bolding Materials for Low-Temperature Service
   - A325 – High-Strength Bolds for Structural Steel Joints, Including Suitable Nuts and Plain Hardened Washers
   - A354 – Quenched and Tempered Alloy Steel Bolts and Studs with Suitable Nuts
   - A449 – Quenched and Tempered Steel Bolts and Studs
   - A490 – Quenched and Tempered Alloy Bolts for Structural Steel Joints

2. SAE Specification:
   - J429 – Mechanical and Quality Requirements for Externally Threaded Fasteners

3. ISO Recommendations:
   - No. R898 – Mechanical Properties of Fasteners
   - Part 1 – Bolts, Screws and Studs

4. Grade 7 bolds and screws are roll threaded after heat treatment.

# ASTM, SAE AND ISO BOLTING MATERIAL

| Grade Identification Marking | Specification | Material | Nominal Size Range (in.) | Proof Load Stress (ksi) | Hardness Rockwell | | See Note |
|---|---|---|---|---|---|---|---|
| | | | | | Min | Max | |
|  No Mark | ASTM A563 Grade 0 | Carbon Steel | 1/4 thru 1-1/2 | 69 | B55 | C32 | 3, 4 |
| | ASTM A563 Grade A | | | 90 | B68 | | |
| | ASTM A563 - Grade B | | 1/4 thru 1 | 120 | B69 | | |
| | | | Over 1 thru 1-1/2 | 105 | | | |
|  | ASTM A563 Grade C | Carbon Steel May Be Quenched and Tampered | 1/4 thru 4 | 144 | B78 | C38 | 5 |
|  | ASTM A563 Grade C3 | Atmospheric Corrosion Resistant Steel May be Quenched and Tampered | 1/4 thru 4 | 144 | B78 | C38 | 5, 9 |
|  | ASTM A563 Grade D | Carbon Steel Maybe Quenched and Tampered | 1/4 thru 4 | 150 | B84 | C38 | 6 |
|  | ASTM A563 Grade DH | Carbon Steel Quenched and Tampered | 1/4 thru 4 | 175 | C24 | C38 | 6 |
|  | ASTM A563 Grade DH3 | Atmospheric Corrosion Resistant Steel May be Quenched and Tampered | 1/4 thru 4 | 175 | C24 | C38 | 5, 9 |
|  | ASTM A194 Grade 1 | Carbon Steel | 1/4 thru 4 | 130 | B70 | -- | 7 |
|  | ASTM A194 Grade 2 | Medium Carbon Steel | 1/4 thru 4 | 150 | 159 | 352 | 7, 8 |
|  | ASTM A194 Grade 2H | Medium Carbon Steel Quenched and Tampered | 1/4 thru 4 | 175 | C24 | C38 | 7 |

# ASTM, SAE AND ISO BOLTING MATERIAL

| Grade Identification Marking | Specification | Material | Nominal Size Range (in.) | Proof Load Stress (ksi) | Hardness Rockwell | | See Note |
|---|---|---|---|---|---|---|---|
| | | | | | Min | Max | |
|  | ASTM A194 Grade 2HM | Medium Carbon Steel Quenched and Tampered | 1/4 thru 4 | 150 | 159 | 237 | 7, 8 |
|  | ASTM A194 Grade 4 | Medium Carbon Alloy Steel Quenched and Tampered | 1/4 thru 4 | 175 | C24 | C38 | 7 |
|  | ASTM A194 Grade 7 | Medium Carbon Alloy Steel Quenched and Tampered | 1/4 thru 4 | 175 | C24 | C38 | 7 |
|  | ASTM A194 Grade 7M | Medium Carbon Alloy Steel Quenched and Tampered | 1/4 thru 4 | 150 | 159 | 237 | 7 |

**NOTES:**

1. In addition to the indicated grade marking, all grades, except A563 grades O, A and B, must be marked for manufacturer identification.
2. The markings shown for all grades of A194 nuts are for cold formed and hot forged nuts. When nuts are machined from bar stock the nut must be additionally marked with the letter “B.”
3. Nuts are not required to be marked unless specified by the purchaser. When marked, the identification marking shall be the grade letter O, A or B.
4. Properties shown are those of nonplated or noncoated coarse thread hex nuts.
5. Properties shown are those of coarse thread heavy hex nuts.
6. Properties shown are those of coarse thread heavy hex nuts.
7. Properties shown are those of coarse 8-pitch thread heavy hex nuts.
8. Hardnesses are Brinell Hardness Numbers.
9. The nut manufacturer, at his option, may add other markings to indicate the use of atmospheric corrosion resistant steel.
10. Specifications:

    ASTM A563 – Carbon and Alloy Steel Nuts.

    ASTM A194/A194M – Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service.