



# ASTM A193

Scope - This specification is heavily utilized in petroleum and chemical construction applications and covers alloy steel and stainless steel bolting materials for high temperature or high-pressure service. This specification is intended for use in pressure vessels, valves, flanges, and fittings.

|               |                    |  |
|---------------|--------------------|--|
| <b>Grades</b> | <b>B7</b>          | Alloy steel, AISI 4140/4142 quenched and tempered                    |
|               | <b>B8 Class 1</b>  | Stainless steel, AISI 304, carbide solution treated                  |
|               | <b>B8M Class 1</b> | Stainless steel, AISI 316, carbide solution treated                  |
|               | <b>B8 Class 2</b>  | Stainless steel, AISI 304, carbide solution treated, strain hardened |
|               | <b>B8M Class 2</b> | Stainless steel, AISI 316, carbide solution treated, strain hardened |

| <b>Mechanical Properties</b> | Grade              | Markings     | Size           | Tensile ksi, min | Yield, ksi, min | Elong, %, min | RA, %, min | Hardness Max |
|------------------------------|--------------------|--------------|----------------|------------------|-----------------|---------------|------------|--------------|
|                              | <b>B7</b>          | <b>B7</b>    | Up to 2-½      | 125              | 105             | 16            | 50         | C35          |
|                              |                    |              | 2-5/8 to 4     | 115              | 95              | 16            | 50         | C35          |
|                              |                    |              | 4-1/8 to 7     | 100              | 75              | 18            | 50         | C35          |
|                              | <b>B8 Class 1</b>  | <b>B8</b>    | All            | 75               | 30              | 30            | 50         | B96          |
|                              | <b>B8M Class 1</b> | <b>B8M</b>   | All            | 75               | 30              | 30            | 50         | B96          |
|                              | <b>B8 Class 2</b>  | <b>B8SH</b>  | Up to ¾        | 125              | 100             | 12            | 35         | C35          |
|                              |                    |              | 7/8 to 1       | 115              | 80              | 15            | 35         | C35          |
|                              |                    |              | 1-1/8 to 1-1/4 | 105              | 65              | 20            | 35         | C35          |
|                              |                    |              | 1-3/8 to 1-1/2 | 100              | 50              | 28            | 45         | C35          |
|                              | <b>B8M Class 2</b> | <b>B8MSH</b> | Up to ¾        | 110              | 95              | 15            | 45         | C35          |
|                              |                    |              | 7/8 to 1       | 100              | 80              | 20            | 45         | C35          |
|                              |                    |              | 1-1/8 to 1-1/4 | 95               | 65              | 25            | 45         | C35          |
| 1-3/8 to 1-1/2               |                    |              | 90             | 50               | 30              | 45            | C35        |              |

| <b>Chemical Properties</b> | Element         | B7 (AISI 4140) | B8 (AISI 304) | B8M (AISI 316) |
|----------------------------|-----------------|----------------|---------------|----------------|
|                            | Carbon          | 0.37 - 0.49    | 0.08 max      | 0.08 max       |
|                            | Manganese       | 0.65 - 1.10    | 2.00 max      | 2.00 max       |
|                            | Phosphorus, max | 0.035          | 0.045         | 0.045          |
|                            | Sulfur, max     | 0.04           | 0.03          | 0.03           |
|                            | Silicon         | 0.15 - 0.35    | 1.00 max      | 1.00 max       |
|                            | Chromium        | 0.75 - 1.20    | 18.0 - 20.0   | 16.0 - 18.0    |
|                            | Nickel          |                | 8.0 - 11.0    | 10.0 - 14.0    |
| Molybdenum                 | 0.15 - 0.25     |                | 2.00 - 3.00   |                |

| <b>Recommended Mating Materials</b> | Bolt Grade  | Nuts Spec/Grade | Washers Spec/Grade |
|-------------------------------------|-------------|-----------------|--------------------|
|                                     | B7          | A194 Grade 2H   | F436               |
|                                     | B8 Class 1  | A194 Grade 8    | SS304              |
|                                     | B8M Class 1 | A194 Grade 8M   | SS316              |
|                                     | B8 Class 2  | A194 Grade 8    | SS304              |
|                                     | B8M Class 2 | A194 Grade 8M   | SS316              |