



SURFACE VEHICLE STANDARD



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Mechanical and Material Requirements for Metric Externally Threaded Steel Fasteners

RATIONALE

Current requirements for Mechanical and Quality Requirements for Metric Externally Threaded Steel Fasteners are contained in ISO 898-1 Mechanical properties of fasteners made of carbon steel and alloy steel - Bolts, screws, and studs. SAE J1199 contains useful information and may have current users. However, several of the references have been cancelled or superseded.

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1. *Scope*

- 1.1 This SAE Standard covers the mechanical and material requirements for eight property classes of steel, externally threaded metric fasteners in sizes M1.6 through M36, inclusive, and suitable for use in automotive and related applications.
- 1.2 Products included are bolts, screws, studs, U-bolts, preassembled screw and washer assemblies (sems), and products manufactured the same as sems except without washer.
- 1.3 Products not covered are tapping screws, thread-rolling screws, and self-drilling screws. Mechanical and material requirements for these products are covered in other SAE documents.
- 1.4 The term stud as referred to herein, applies to a cylindrical rod of moderate length, threaded on either one or both ends or throughout its entire length. It does not apply to headed, collared, or similar products which are more closely characterized by requirements shown herein for bolts.
- 1.5 For specification purposes, this document treats U-bolts as studs. Thus, wherever the word studs appears, U-bolts is also implied. U-bolts covered by this document are those used primarily in the suspension and related areas of vehicles. (Designers should recognize that the U configuration may not sustain a load equivalent to two bolts or studs of the same size and grade; thus actual load-carrying capacity of U-bolts should be determined by saddle load tests.)

2. *References*

- 2.1 **Applicable Publications**—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.
 - 2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J121M—Decarburization in Hardened and Tempered Metric Threaded Fasteners
SAE J123—Surface Discontinuities on Bolts, Screws, and Studs in Fatigue Applications
SAE J429—Mechanical and Material Requirements for Externally Threaded Fasteners
SAE J1061—Surface Discontinuities on General Application Bolts, Screws, and Studs

- 2.1.2 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.
- ASTM A 307—Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile
 - ASTM A 354—Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners
 - ASTM A 449—Specification for Quenched and Tempered Steel Bolts and Studs
 - ASTM F 606M—Standard Test Methods for Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets
- 2.1.3 ASME PUBLICATION—Available from ASME, 345 East 47 Street, New York, NY 10017-2330.
- ASME B18.2.1

3. Designations

- 3.1 Property classes are designated by numbers where increasing numbers generally represent increasing tensile strengths. The designation symbol consists of two parts:
- a. The first numeral of a two-digit symbol or the first two numerals of a three-digit symbol approximates 1/100 of the minimum tensile strength in MPa.
 - b. The last numeral approximates 1/10 of the ratio expressed as a percentage between minimum yield stress and minimum tensile stress.
- 3.2 For specification purposes (on engineering drawings, purchase orders, etc.) all property class designations are used in combination with a single basic specification number as follows:

- SAE J1199 (4.6)
- SAE J1199 (4.8)
- SAE J1199 (5.8)
- SAE J1199 (8.8)
- SAE J1199 (9.8)
- SAE J1199 (10.9)

3.3 Property Classes

- 3.3.1 Machine screws are normally available only in classes 4.8 and 9.8; other bolts, screws, and studs are available in all classes within the specified product size limitations given in Tables 1A and 1B.
- 3.3.2 Screw and washer assemblies (sems) are covered by classes 4.8 and 9.8 and allowable deviations from normal 9.8 requirements are stated in footnotes throughout the document.
- 3.3.3 At the option of the manufacturer, class 5.8 may be supplied with either class 4.6 or 4.8 is ordered, and class 4.8 may be supplied when class 4.6 is ordered.

3.4 Conversion Guidance

- 3.4.1 For guidance purposes only, to assist designers in selecting a property class:
- a. Class 4.6 is approximately equivalent to SAE J429, Grade 1 and ASTM A 307, Grade A.
 - b. Class 5.8 is approximately equivalent to SAE J429, Grade 2.
 - c. Class 8.8 is approximately equivalent to SAE J429, Grade 5, and ASTM A 449.
 - d. Class 9.8 has properties approximately 9% stronger than SAE J429, Grade 5, and ASTM A 449.
 - e. Class 10.9 is approximately equivalent to SAE J429, Grade 8, and ASTM A 354, Grade BD.