



Standard Practice for Steel Bars, Selection Guide, Composition, and Mechanical Properties¹

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This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This practice covers the selection of steel bars according to section and to the mechanical properties desired in the part to be produced. This is not a specification for the procurement of steel. Applicable procurement specifications are listed in Section 5.

1.2 Several steel compositions intended for various sections and mechanical property requirements are presented in **Tables 1-6**. The criteria for placing a steel composition in one of the three general class designations, Classes P, Q, and R (described in Section 4) are as follows:

1.2.1 *Classes P and Q* should be capable of developing the mechanical properties shown in **Tables 1-4** by liquid quenching from a suitable austenitizing temperature, and tempering at 800°F (427°C) or higher. A hardness indicated by tests made at a location shown in **Fig. 1**, A, B, or C, is taken as evidence that a composition is capable of meeting other equivalent mechanical properties shown in the tables. Normal good shop practices are assumed, with control of austenitizing and tempering temperatures, and mild agitation of the part in the quenching bath.

1.2.2 *Class R* should be capable of developing the mechanical properties shown in **Tables 5 and 6** as hot rolled, by cold drawing, or by cold drawing with additional thermal treatment. The locations for obtaining tension tests are described in **6.2**.

1.3 It is not implied that the compositions listed in the tables are the only ones satisfactory for a certain class and mechanical property requirement. Steels with lower alloy contents are often satisfactory through the use of special processing techniques.

1.4 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 This practice is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.15 on Bars.

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2. Referenced Documents

2.1 ASTM Standards:²

A108 Specification for Steel Bar, Carbon and Alloy, Cold-Finished

A304 Specification for Carbon and Alloy Steel Bars Subject to End-Quench Hardenability Requirements

A311/A311M Specification for Cold-Drawn, Stress-Relieved Carbon Steel Bars Subject to Mechanical Property Requirements

A322 Specification for Steel Bars, Alloy, Standard Grades
A633/A633M Specification for Normalized High-Strength Low-Alloy Structural Steel Plates

A675/A675M Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties

3. Significance and Use

3.1 If the desired mechanical properties are as described in **4.1.1** for material identified as Classes P-1 through P-7, or in **4.1.2** for material identified as Classes Q-1 through Q-7, the strength level desired can be based on hardness or the equivalent tensile or yield strength as shown in **Tables 1-4**. If the desired mechanical properties are as set forth in **4.1.3** for material identified as Classes R-1 through R-6, the strength level is based on yield strength as shown in **Tables 5 and 6**.

3.2 The user, after determining the mechanical property requirements of the critical section (that carrying the greatest stress) of the part, should select the composition or compositions from **Tables 1-6** that fulfills these requirements and is most suitable for processing.

4. Classification

4.1 Steel bar compositions under this practice are classified according to mechanical property requirements and the critical section size of the part to be produced, as follows:

4.1.1 *Classes P-1 through P-7* comprise bars for parts to operate under severe service conditions requiring high yield

² 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.