

SURFACE VEHICLE RECOMMENDED PRACTICE

Submitted for recognition as an American National Standard



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(R) HIGH-STRENGTH, QUENCHED, AND TEMPERED STRUCTURAL STEELS

Introduction—The steels covered by this SAE Recommended Practice have enhanced mechanical properties obtained by quench and temper treatment. Grade Q550 is a carbon-manganese steel, while grades Q550B, Q620B, and Q690B are carbon-manganese boron steels. Other grades (designated by suffix A) represent steels containing one or more additional alloying elements as required to achieve higher strengths and to accommodate greater thicknesses. These steels are produced fully deoxidized and to fine grain practice.

Since these steels are characterized by their mechanical properties, care must be exercised in the selection of grade, especially where fabrication by welding or forming is required. Special procedures may be applicable to varying compositions and section sizes, as produced by a given supplier; therefore, the purchaser should consult with the producer in order to be aware of these variables.

1. **Scope**—This SAE Recommended Practice covers three strength levels of quenched and tempered carbon-manganese, carbon-manganese-boron, and alloy steel plates for structural use.

2. References

2.1 **Applicable Documents**—The following publication forms a part of this specification to the extent specified herein.

2.1.1 **ASTM PUBLICATION**—Available from ASTM, 1916 Race Street, Philadelphia, PA 19103-1187.

ASTM A 6/A 6M—Specification for General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use

3. **Application**—These steels, because of their high strength-to-weight ratio, abrasion resistance and, in the case of certain compositions, improved atmospheric corrosion resistance, are adapted particularly for use in mobile equipment and other structures where substantial weight savings are desirable. Typical applications are truck bodies, frames, structural members, scrapers, truck wheels, cranes, shovels, booms, chutes, and conveyors.

4. **General Requirements**—Material furnished under this report shall conform to the applicable requirements of the current edition of ASTM A 6/A 6M.

5. **Mechanical Properties**—The mechanical properties of these steels shall be as shown in Table 1. Producers should be consulted concerning requirements for plate thicknesses greater than those shown in the table and for all sheets and rolled shapes. Consultation with suppliers on availability and characteristics is also suggested.

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TABLE 1—MECHANICAL PROPERTIES

Grade and Thickness	Strength Yield ¹ , min MPa	Strength Yield ¹ , min ksi	Strength Tensile MPa	Strength Tensile ksi	Elongation ² in 50 mm or 2 in min %	Bend ³ Test	Typical Hardness Range HB
Q550 To 20 mm (3/4 in) incl	550	80	655-795	95-115	18	2T	200-235
Q550B To 32 mm (1-1/4 in) incl	550	80	655-795	95-115	18	2T	200-235
Q550A To 38 mm (1-1/2 in) incl	550	80	655-795	95-115	18	2T	200-235
Q620B To 38 mm (1-1/2 in) incl	620	90	690-895	100-130	18	3T	217-285
Q620A To 25 mm (1 in) incl	620	90	690-895	100-130	18	2T	217-285
Over 25 to 50 mm (1 to 2 in) incl	620	90	690-895	100-130	18	3T	217-285
Over 50 to 100 mm (2 to 4 in) incl	620	90	690-895	100-130	18	4T	217-285
Q690B To 25 mm (1 in) incl	690	100	760 min	110 min	18	2T	223 min
Over 25 to 32 mm (1 to 1-1/4 in) incl	690	100	760 min	110 min	18	3T	223 min
Q690A To 25 mm (1 in) incl	690	100	760-895	110-130	18	2T	223-285
Over 25 to 65 mm (1 to 2-1/2 in) incl	690	100	760-895	110-130	18	2T	223-285

¹ Yield strength to be measured at 0.2% offset or 0.5% extension under load.

² Minimum percent elongation for all material under 6.35 mm (1/4 in) thick shall be 15%.

³ Bend test not required unless specified. Test shall be conducted in accordance with ASTM A 6/A 6M Supplement S14.

6. **Chemical Compositions**—Chemical composition of steels furnished to this specification shall conform to Table 2 and note concerning alloying elements.

TABLE 2—CHEMICAL COMPOSITION (HEAT ANALYSIS), MAX, % BY WEIGHT

Grade	C	Mn	P	S	B	Other
Q550	0.20	1.35	0.035	0.040		See note
Q550B	0.20	1.50	0.035	0.040	0.0005-0.005	
Q550A	0.20	1.10	0.035	0.040		
Q620B	0.20	1.50	0.035	0.040	0.0005-0.005	
Q620A	0.20	1.50	0.035	0.040		
Q690B	0.20	1.50	0.035	0.040	0.0005-0.005	
Q690A	0.21	1.50	0.035	0.040		

NOTE—Choice and use of alloying elements, combined with carbon, manganese, phosphorus, and sulfur within the limits of Table 2 to give the mechanical properties prescribed in Table 1, shall be made by the manufacturer and included and reported in the heat analysis to identify the type of steel applied.

7. General Information

- 7.1 **Formability**—The high strength level of these steels reduces the formability; however, moderate forming may be performed by using proper radii, preferably by forming transverse to the final rolling direction. Recommended minimum inside radii for cold bending (perpendicular to rolling direction) are as follows in Table 3:

TABLE 3—RECOMMENDED MINIMUM INSIDE RADII FOR COLD BENDING

Thickness mm	Thickness in	Inside Radii, min
To 20 incl	To 3/4 incl	2T
20 thru 40	3/4 thru 1-1/2	3T
Over 40	Over 1-1/2	Cold bending not recommended

NOTE—For some grades of material, some applications, and bends parallel to rolling direction, it may be necessary to increase the minimum radii shown.

7.2 Recommended Welding Practices—These high-strength steels are weldable. It is common practice to use low hydrogen metal arc processes for welding these quenched and tempered steels. (Proper consideration must be given to any structure and/or property changes which might occur in the base metal as a result of the welding process.) The producer should be consulted for those special procedures applicable to the material which will be supplied against any given requirement.

8. Notes

8.1 Marginal Indicia—The (R) is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. If the symbol is next to the report title, it indicates a complete revision of the report.

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