

WELDED LOW CARBON STEEL TUBING

1. **Scope**—This SAE Standard covers welded single wall low carbon steel tubing intended for general automotive applications and other similar uses.
2. **References**
 - (R) 2.1 **Applicable Documents**—The following publications form a part of this specification to the intent specified herein. The latest issue of SAE publications should apply.
 - 2.11 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.
SAE J533—Flares for Tubing
 3. **Manufacture**—The tubing shall be made from a single strip of steel shaped into a tubular form, the edges of which are joined and sealed by a suitable butt welding process. After welding, the bead shall be removed from the outside to provide a smooth round surface and the tubing shall be processed in such a manner as to produce a finished product which will meet all requirements of this document.
 - (R) 4. **Dimensions and Tolerances**—The standard nominal diameters and the applicable dimensions and tolerances are shown in Table 1.
 5. **Quality**—Finished tubing shall be clean, smooth, and round, both inside and outside; and shall be free from scale and injurious defects. A slight weld bead and splatter on the inside surface shall be permissible but must be held to the minimum consistent with good welding practice. Surface imperfections such as handling marks, die marks, or shallow pits shall not be considered injurious defects provided such imperfections are within the tolerances specified for diameter and wall thickness.

The inside of tubing shall be clean and free from any contamination which will impair the processing or serviceability of the tubing.
 6. **Material**—Tubing shall be made from low carbon steel, such as UNS G10080 or UNS G10100.
 - (R) 7. **Mechanical Properties**—The finished tubing shall have mechanical properties as tabulated in Table 2.
 8. **Performance Requirements**—The finished tubing shall satisfactorily meet the following performance tests. As designated therein, test specimens having minimum lengths equivalent to two times the tubing outside diameter or 50 mm (2 in), whichever is greater, shall be taken from tubing which has not been subjected to cold working after the final processing of the finished size tubing.
 - 8.1 **Flaring Test**—A test specimen having squared and deburred ends shall withstand being double flared at one end to the requirements of SAE J533 without evidence of splitting or flaws. The test

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specimen shall be held firmly and squarely in the die, and the punch, while being forced down gradually, shall be guided parallel to the axis of the tubing.

TABLE 1—TUBING DIMENSIONS AND TOLERANCES¹

Dash Size	Nominal Tubing OD		Outside Diameter ² Basic		Outside Diameter ² Tolerance		Wall Thickness ³ Basic		Wall Thickness ³ Basic	
	mm	in	mm	in	± mm	± in	mm	in	mm	in
-2	3.18	1/8	3.18	0.125	0.002	0.05	0.025	0.64	0.005	0.13
-3	4.76	3/16	4.78	0.188	0.003	0.08	0.028	0.71	0.005	0.13
-4	6.35	1/4	6.35	0.250	0.003	0.08	0.028	0.71	0.003	0.08
-5	7.94	5/16	7.92	0.312	0.003	0.08	0.028	0.71	0.003	0.08
-6	9.53	3/8	9.53	0.375	0.003	0.08	0.028	0.71	0.003	0.08
-7	11.11	7/16	11.13	0.438	0.004	0.10	0.030	0.76	0.003	0.08
-8	12.70	1/2	12.70	0.500	0.004	0.10	0.030	0.76	0.003	0.08
-8	12.70	1/2	12.70	0.500	0.004	0.10	0.035	0.89	0.0035	0.09
-9	14.29	9/16	14.27	0.562	0.004	0.10	0.030	0.76	0.003	0.08
-10	15.88	5/8	15.88	0.625	0.004	0.10	0.035	0.89	0.0035	0.09

¹ Other sizes may be specified by agreement between the supplier and the user.

² The actual outside diameter shall be the average of the maximum and minimum outside diameters as determined at any one cross section through the tubing.

³ The tolerances listed represent the maximum permissible deviation at any point.

TABLE 2—MECHANICAL REQUIREMENTS

Yield Strength, min (0.2% offset)	170 MPa (25 000 psi)
Tensile Strength, min	290 MPa (42 000 psi)
Elongation in 50 mm (2 in)	14-40%
Hardness (Rockwell 30 T scale), max	65

8.2 Hardness Test—The hardness test shall not be required, it being recognized that hardness will be satisfactory if the tubing meets all other mechanical properties and performance requirements set forth in this document.

8.3 Bending Test—The finished tubing shall withstand bending on a centerline radius equal to three times the tubing outside diameter without undue reduction of area or flattening where proper bending fixtures are used.

(B) 8.4 Pressure Proof Test—Unless otherwise specified, the finished tubing shall withstand a hydrostatic proof test, with no evidence of failure, at a pressure¹ which will subject the material to a hoop (circumferential) stress of 140 MPa (20 000 psi). Test pressures shall be as determined by Barlow's formula for thin hollow cylinders under pressure.

¹ No tube shall be tested beyond a hydrostatic pressure of 35 MPa (5000 psi) unless so specified.

$$P = \frac{2TS}{D} \quad (\text{Eq.1})$$

where:

D = outside diameter of tubing, mm (in)

P = hydrostatic pressure, MPa (psi)

S = allowable unit stress of material = 140 MPa (20 000 psi)

T = minimum wall thickness of tubing, mm (in)

8.5 Nondestructive Electric Test—In lieu of the hydrostatic test, where mutually agreed upon by the purchaser and manufacturer, all tubing shall be tested by passing it through an electric eddy current tester which is capable of detecting defects that would prevent the tubing from passing the hydrostatic pressure proof test.

9. Corrosion Protection—The inside and outside of the finished tubing shall be protected against corrosion during shipment and normal storage. If a corrosion preventive compound is applied, it shall be such that after normal storage periods it can readily be removed by cleaning agents normally used in manufacturing.

(R) 10. Notes

10.1 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.