Welded Flash Controlled Low Carbon Steel Tubing Normalized for Bending, Double Flaring, and Beading —SAE J356 JAN80

SAE Standard
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LAND SEA AIR SPACE

PREPRINT

WELDED FLASH CONTROLLED LOW CARBON STEEL TUBING NORMALIZED FOR BENDING, DOUBLE FLARING, AND BEADING—SAE J356 JAN80

SAE Standard

Report of the Tube, Pipe, Hose, and Lubrication Fittings Committee, approved July 1968, last revised by the Fluid Conductors and Connectors Technical Committee January 1980.

Scope—This standard covers normalized electric resistance welded flash controlled single wall low carbon steel pressure tubing intended for use as pressure lines and in other applications requiring tubing of a quality suitable for bending, double flaring, beading, and brazing.

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 electric resistance welding. After forming and welding, the outside flash shall be removed to provide a smooth surface. The inside flash shall be of uniform contour, free from saw tooth peaks, and controlled in height by seam welding techniques or by cutting, but not by hammering or rolling. The inside flash height shall conform to the following:

Nominal Wall Thickness			Nominal Tubing Outside Diameter			
			Thru 1.000 (25.4 mm)		Over 1.000 (25.4 mm)	
			Maximum Flash Height[a]			
	in	mm	in	mm	in	mm
Thru	0.035	0.90	0.005	0.13	0.010	0.25
Over	0.035 thru 0.065	0.90 thru 1.65	0.008	0.20	0.010	0.25
Over	0.065	1.65	0.010	0.25	0.010	0.25

[a]For tubes having an ID greater than 0.312 in (8 mm), the height of the inside weld flash shall be measured with a ball micrometer having an 0.156 ± 0.016 in (3.96 ± 0.41 mm) radius on the anvil or ball point. For tubes having an ID 0.312 in (8 mm) or less, screw thread micrometers shall be used. The height of the flash shall be the difference between the thickness of the tubing wall at the point of maximum height of the flash and the average of the wall thickness measured at points adjacent to both sides of the flash.

The tubing shall be normalized to produce a finished product which will meet all requirements of this standard.

Dimensions and Tolerances—The tolerances applicable to tubing outside diameter are shown in Table 1. The tolerances applicable to tubing wall thickness are shown in Table 2. Particular attention shall be given to areas adjacent to the weld to insure against thin spots and/or sharp indentations.

Quality—Lengths of finished tubing shall be reasonably straight and have smooth ends free from burrs. Finished tubing shall be free from scale and injurious imperfections and shall have a workmanlike finish. Outside surface imperfections such as handling marks, straightening marks, light die marks, or shallow pits shall not be considered injurious, provided the imperfections are not detrimental to the function of the tubing. The removal of such surface imperfections shall not be required.

The inside surface shall be free of weld splatter, pits, and all other injurious imperfections detrimental to the function of the tubing.

Material—Tubing shall be made from low carbon hot or cold rolled steel conforming to the chemical composition shown in Table 3. If rimmed steel is used, it shall be single strand. The steel shall be made by the open hearth, basic oxygen, or electric furnace process. A ladle analysis of each heat shall be made to determine the percentages of the elements specified. The chemical composition thus determined shall be reported to the purchaser, or his representative, if requested, and shall conform to the requirements specified. If a check analysis is required, the tolerances shall be as specified in SAE J409, Table 3.

Mechanical Properties—The finished tubing shall have mechanical properties as tabulated below:

Yield Strength, min	25,000 psi (170 MPa)
Ultimate Strength, min	45,000 psi (310 MPa)
Elongation in 2 in (50 mm), min	35%[a]
Hardness (Rockwell B), max	65[b]

[a]For tubing having nominal outside diameter of 0.375 in (9.5 mm) or less, and/or wall thicknesses of 0.035 in (0.9 mm) or less, a minimum elongation of 25% is permissible.

[b]The hardness test shall not be required on tubing with a nominal wall thickness of less than 0.065 in (1.65 mm). Such tubing shall meet all other mechanical properties and performance requirements.

Performance Requirements—The finished tubing shall satisfactorily meet the following performance tests. As designated therein, test specimens having minimum length equivalent to two times the tubing outside diameter or 2 in. (50 mm), whichever is greater, shall be taken from finished tubing, as manufactured. All tests shall be conducted at room temperature.

Flattening Test—A test specimen shall be taken from every shipment or every 1500 ft (460 m), whichever is smaller, of finished tubing and flattened between parallel plates to a distance equal to three times the actual wall thickness of the specimen under test without any cracking or flaws. The weld shall be placed at 90 deg from the direction of applied force. Superficial ruptures resulting from minor surface imperfections shall not be considered cause for rejection.

Reverse Flattening Test—A test specimen shall be taken from every shipment or every 1500 ft (460 m), whichever is smaller, of finished tubing and split longitudinally 90 deg on each side of the weld. The section containing the weld shall be opened and flattened with the weld at the point of maximum bend. There shall be no evidence of cracks or metal flaking, or lack of weld penetration or overlaps resulting from flash control or flash removal in the weld.

Expansion Test—A test specimen shall be taken from every shipment or every 1500 ft (460 m), whichever is smaller, of finished tubing and subjected to expansion over a hardened tapered plug having a slope of 0.1:1.0 until the outside diameter has been expanded 25% without evidence of cracking or flaws.

The tubing shall be capable of being double flared as shown in SAE J533 without evidence of cracking or flaws. Refer to footnote b of Table 1 for tubing OD and wall thickness subject to this capability requirement. Double flaring tests shall not be required.

Hardness Test—One hardness test shall be made on a specimen from each production lot of tubing. The hardness test shall be made on the inside surface of the specimen. The hardness test shall not be required on tubing with a nominal wall thickness less than 0.065 in. (1.7 mm). Such tubing shall meet all other mechanical properties and performance requirements.

Tensile Test—One tension test, in accordance with ASTM A 370, shall be made on a specimen from each production lot of tubing. If the percentage of elongation of the test specimen is less than that specified and/or any part of the fracture is more than 0.75 in. (19 mm) from the center of the gage length, as indicated by scribe marks on the specimen before testing, a retest shall be allowed.

Table 1—Tubing Outside Diameter Tolerance

Nominal Tubing OD[ab]		Tolerance ±	
in	mm	in	mm
Thru 0.375	9.50	0.0025	0.06
Over 0.375–0.625	9.50–15.88	0.003	0.08
Over 0.625–1.125	15.88–28.57	0.0035	0.09
Over 1.125–2.000	28.57–50.80	0.005	0.13
Over 2.000–2.500	50.80–63.50	0.006	0.15
Over 2.500–3.000	63.50–76.20	0.008	0.20
Over 3.000–3.500	76.20–88.90	0.009	0.23
Over 3.500–4.000	88.90–101.60	0.010	0.25

[a]OD measurements shall be taken at least 2.0 in (50 mm) from the end of the tubing.

[b]Refer to SAE J514 for nominal tubing OD to be used in conjunction with standard hydraulic tube fittings and SAE J533 for recommended max nominal wall thickness for double flaring.

The ϕ symbol 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.