

# AEROSPACE

## MATERIAL SPECIFICATIONS

# AMS 6390

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc. 485 Lexington Ave., New York 17, N.Y.

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Revised

STEEL TUBING, SEAMLESS  
0.95Cr - 0.2Mo (0.38 - 0.43C) (SAE 4140)  
Special Quality

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. APPLICATION: Primarily for high strength structural applications where magnetic inspection of both machined and unmachined surfaces is required.
3. COMPOSITION:

Carbon	0.38 - 0.43
Manganese	0.75 - 1.00
Silicon	0.20 - 0.35
Phosphorus	0.040 max
Sulfur	0.040 max
Chromium	0.80 - 1.10
Molybdenum	0.15 - 0.25

- 3.1 Check Analysis: Composition variations shall meet the requirements of the latest issue of AMS 2259.
4. CONDITION: In a machinable condition and, unless otherwise specified, cold finished.
5. TECHNICAL REQUIREMENTS:
  - 5.1 Hardenability: The hardenability shall be J50 = 6 min and J44 = 9 min when determined by the standard end-quench test specimen in accordance with the SAE Method of Determining Hardenability published in the latest issue of the SAE Handbook, except that the steel shall be normalized at 1700 F + 10 (926.7 C + (926.7 C + 5.6) and the test specimen austenitized at 1500 F + 10 (843.3 C + 5.6 (843.3 C + 5.6). The hardenability test is not required on tubing which will not yield a suitable specimen but the steel from which the tubing is made shall conform to the hardenability specified in this paragraph.
  - 5.2 Grain Size: Predominantly 5 or finer with occasional grains as large as 3 permissible, ASTM E112-61, Appendix III, Section A1, Treatment (1) (McQuaid-Ehn test).
  - 5.3 Decarburization:
    - 5.3.1 Tubing ordered ground, turned, or polished shall be free from decarburization on the ground, turned, or polished surfaces. Inside decarburization shall not exceed the maximum depth specified in 5.3.3.

- 5.3.2 Allowable decarburization of pierced billets, of tubing for redrawing or forging, and of tubing ordered to specified microstructural requirements, shall be as agreed upon by purchaser and vendor.
- 5.3.3 Decarburization of tubing to which 5.3.1 or 5.3.2 is not applicable shall be not greater than the following:

Nominal Wall Thickness Inches	Depth of Decarburization, Inch	
	Inside	Outside
0.109 and under	0.008	0.015
Over 0.109 to 0.203, incl	0.010	0.020
Over 0.203 to 0.400, incl	0.012	0.025
Over 0.400 to 0.600, incl	0.015	0.030
Over 0.600 to 1.000, incl	0.017	0.035
Over 1.000	0.020	0.040

- 5.3.4 Unless otherwise agreed upon by purchaser and vendor, decarburization shall be measured by the microscopic method, or by Rockwell Superficial 30-N scale hardness method, or equivalent hardness testing method, on hardened specimens. Depth of decarburization, when measured by a hardness method, is defined as the depth below which there is no further increase in hardness; such measurements shall be far enough away from any adjacent surface to be uninfluenced by any decarburization or lack of decarburization thereon.
- 5.3.5 When determining the depth of decarburization, it is permissible to disregard local areas provided the decarburization of such areas does not exceed the above limits by more than 0.005 in. and the width is 0.065 in. or less.
6. QUALITY: Steel shall be of quality conforming to the latest issue of AMS 2301. Tubing shall be capable of passing magnetic particle inspection, both before and after machining. Tubing shall be uniform in quality and condition and shall have a good workmanlike finish conforming to the best practice for high quality material. It shall be smooth, clean, and free from heavy scale or oxide, burrs, seams, tears, grooves, laminations, slivers, pits, and other injurious defects. Surface imperfections such as handling marks, straightening marks, light mandrel and die marks, shallow pits, and scale pattern will not be considered as injurious defects, provided the imperfections are removable within the tolerances specified for diameter and wall thickness. The removal of surface imperfections is not required.
7. TOLERANCES: Unless otherwise specified, tolerances shall conform to all applicable requirements of the latest issue of AMS 2253; tolerances for diameter shall conform to Table V and for wall thickness to 4.3.
8. REPORTS:
- 8.1 Unless otherwise specified, the vendor of the product shall furnish with each shipment three copies of a report of the results of tests for chemical composition, hardenability, and grain size of each heat in the shipment. This report shall include the purchase order number, heat number, material specification number, size, and quantity from each heat.