

AEROSPACE MATERIAL SPECIFICATIONS

AMS 6299

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Revised

STEEL BARS, FORGINGS, AND TUBING 0.45Cr - 1.75Ni - 0.25Mo (0.16 - 0.23C) (SAE 4320)

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. FORM: Bars, forgings, mechanical tubing, and forging stock.
3. APPLICATION: Primarily for carburized parts which require high minimum core hardness and allow wide core hardness range in sections 3/8 in. and less in thickness. The core may or may not be machinable after hardening.

4. COMPOSITION:

	min	max
Carbon	0.17	0.23
Manganese	0.40	0.70
Silicon	0.20	0.35
Phosphorus	--	0.025
Sulfur	--	0.025
Chromium	0.35	0.65
Nickel	1.55	2.00
Molybdenum	0.20	0.30

- 4.1 Check Analysis: Composition variations shall meet the requirements of the latest issue of AMS 2259, paragraph titled "Low Alloy Steels".

5. CONDITION:

- 5.1 Bars: Unless otherwise ordered, in a machinable condition and hot finished having hardness not higher than Brinell 229 or equivalent, except that bars ordered cold finished may have hardness as high as Brinell 248 or equivalent.
- 5.2 Forgings: As ordered.
- 5.3 Mechanical Tubing: In a machinable condition and hot finished, unless otherwise specified.
- 5.4 Forging Stock: As ordered by the forging manufacturer.

6. TECHNICAL REQUIREMENTS: When ASTM methods are specified for determining conformance to the following requirements, tests shall be conducted in accordance with the issue of the ASTM method listed in the latest issue of AMS 2350.

Section 8.3 of the SAE Technical Board rules provides that: "All technical reports including standards approved and practices recommended, are advisory only. Their use by anyone engaged in industry or trade is entirely voluntary. There is no obligation to adhere to any SAE standard or recommended practice, and no commitment to conform to or be guided by any technical report. In formulating and approving technical reports, the Board and its Committees will not investigate or consider patents which may apply to the subject matter. Prospective users of the report are responsible for protecting themselves against infringement of patents."

- 6.1 Hardenability: Material shall conform to the hardenability in 6.1.1, unless purchaser stipulates that the hardness in 6.1.2 shall apply.
- 6.1.1 The hardenability shall be J48=1 max and J24=4 min when determined on 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 $1675\text{ F} \pm 10$ ($912.8\text{ C} \pm 5.6$) and the test specimen austenitized at $1500\text{ F} \pm 10$ ($815.6\text{ C} \pm 5.6$). The hardenability test is not required on a product which will not yield a suitable specimen but the steel from which the product is made shall conform to the hardenability specified in this paragraph.
- 6.1.2 Specimens with sections 0.125 in. and 0.375 in. in thickness and not greater than 2 sq in. in area shall be cut from the product after normalizing at $1675\text{ F} \pm 10$ ($912.8\text{ C} \pm 5.6$). The specimens shall be ground and then protected by suitable means, or treated in an atmosphere, to minimize scaling and eliminate either carburization or decarburization during heat treatment. The specimens shall be placed in a furnace which is at $1500\text{ F} \pm 10$ ($815.6\text{ C} \pm 5.6$), allowed to heat to $1500\text{ F} \pm 10$ ($815.6\text{ C} \pm 5.6$), held 25 min., and quenched in commercial paraffin oil (100 SUS at 100 F (37.8 C)), at room temperature. Each specimen when tested shall have an average hardness of Rockwell C 35 - 50.
- 6.2 Grain Size: Predominantly 5 or finer with occasional grains as large as 3 permissible, ASTM E112, Appendix III, Section A1, Treatment (1) (McQuaid-Ehn Test).
7. QUALITY: Steel shall be aircraft quality and shall conform to the requirements of the latest issue of AMS 2301. The product shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts.
8. TOLERANCES: Unless otherwise specified, tolerances shall conform to all applicable requirements of the following:
- 8.1 Bars: The latest issue of AMS 2251; for all hexagons, tolerances for cold finished shall apply.
- 8.2 Mechanical Tubing: The latest issue of AMS 2253.
9. REPORTS:
- 9.1 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, grain size, and cleanliness rating for each heat in the shipment. This report shall include the purchase order number, heat number, material specification number, size, and quantity from each heat. If forgings are supplied, the part number and size of stock used to make the forgings shall also be included.