

AERONAUTICAL MATERIAL SPECIFICATION

Society of Automotive Engineers, Inc.
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Revised

STEEL, CORROSION AND HEAT RESISTANT
20Cr - 9Ni - 1.6Mo - 1.4W - Ti

1. **ACKNOWLEDGMENT:** A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.
2. **FORM:** Bars, forgings, and forging stock.
3. **APPLICATION:** Parts and assemblies, such as bolts, dowels, fittings, turbine rotor wheels and discs, and turbine nozzle assemblies, requiring high strength up to 1200 F.
4. **COMPOSITION:**

	Check Analysis		
		Under Min	or Over Max
Carbon	0.28 - 0.35	0.02	0.02
Manganese	0.75 - 1.50	0.04	0.04
Silicon	0.30 - 0.80	0.05	0.05
Phosphorus	0.040 max	-	0.005
Sulfur	0.030 max	-	0.005
Chromium	18.00 - 21.00	0.25	0.25
Nickel	8.00 - 11.00	0.15	0.15
Molybdenum	1.25 - 2.00	0.05	0.05
Tungsten	1.00 - 1.75	0.05	0.05
Titanium	0.40 - 0.75	0.05	0.05
Copper	0.50 max	-	0.03

5. CONDITION:

- 5.1 **Bars and Forgings:** Hot worked, with final working done at a temperature not lower than 1400 F and stress relieved at not lower than 1200 F for not less than 4 hours.
- 5.2 **Forging Stock:** As ordered by the forging manufacturer.

6. TECHNICAL REQUIREMENTS:

6.1 Bars:

6.1.1 Tensile Properties:

Tensile Strength, psi	100,000 min
Yield Strength at 0.2% Offset or at 0.0088 in. in 2 in. Extension Under Load (E=29,000,000) psi	70,000 min
Elongation, % in 4D	20 min
Reduction of Area, %	40 min

- 6.1.2 **Hardness:** Bars shall have hardness of Brinell 228-277 or equivalent.

Section 7C 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 is entirely voluntary. There is no agreement 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 liability for infringement of patents."

6.1.3 Stress-Rupture Test at 1200 F: Specimens taken from bars shall be capable of meeting the following requirements:

6.1.3.1 A tensile test specimen, maintained at $1200\text{ F} \pm 3$ while an axial load of 43,000 psi is applied continuously, shall not rupture in less than 100 hours. The test shall be continued after the 100 hr, until the specimen ruptures, either maintaining the same load or increasing the load to not over 60,000 psi as necessary to produce rupture. In either case, the elongation after rupture, measured at room temperature, shall be not less than 15% in 4D.

6.2 Forgings:

6.2.1 Hardness: Forgings shall have hardness of Brinell 228-269 or equivalent.

6.2.2 Stress-Rupture Test at 1200 F: Forgings shall be capable of meeting the following requirements:

6.2.2.1 A tensile test specimen, maintained at $1200\text{ F} \pm 3$ while an axial load of 31,000 psi when axis of specimen is across the forging flow lines, or 40,000 psi when axis of specimen is approximately parallel to the forging flow lines, is applied continuously, shall not rupture in less than 100 hours. The test shall be continued after the 100 hr, until the specimen ruptures, either maintaining the same load or increasing the load to not over 60,000 psi as necessary to produce rupture. In either case, the elongation after rupture, measured at room temperature, shall be not less than 12% in 4D.

6.2.3 Inspection standards and procedures shall be as agreed upon by purchaser and vendor.

7. QUALITY: Material shall be uniform in quality and condition, clean, sound, and free from foreign materials and from internal and external defects detrimental to fabrication or to performance of parts.

8. TOLERANCES: Unless otherwise specified, tolerances shall conform to the latest issue of AMS 2241 as applicable to hot finished.

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 of each heat in the shipment. This report shall include the purchase order 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.

9.2 Unless otherwise specified, the vendor of finished or semi-finished parts shall furnish with each shipment three copies of a report showing the purchase order number, material specification number, contractor or other direct supplier of material, part number, and quantity. When material for making parts is produced or purchased by the parts vendor, that vendor shall inspect each lot of material to determine conformance to the requirements of this specification, and shall include in the report a statement that the material conforms, or shall include copies of laboratory reports showing the results of tests to determine conformance.