

AEROSPACE

MATERIAL SPECIFICATIONS

AMS 5391A

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

Issued 6-30-60

Revised 2-15-65

ALLOY CASTINGS, INVESTMENT, CORROSION AND HEAT RESISTANT
Nickel Base - 13Cr - 4.5Mo - 0.75Ti - 6Al - 2.3(Cb + Ta)
Vacuum Melted

1. **ACKNOWLEDGMENT:** A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.
2. **APPLICATION:** Primarily for parts such as turbine blades or buckets requiring high strength up to 1800 F (982 C) and oxidation resistance up to 2000 F (1093 C).
3. **COMPOSITION:** Castings shall conform to the following:

	min	max
Carbon	0.08	0.20
Manganese	--	0.25
Silicon	--	0.50
Sulfur	--	0.015
Chromium	12.0	14.0
Molybdenum	3.8	5.2
Columbium + Tantalum	1.8	2.8
Titanium	0.50	1.0
Aluminum	5.5	6.5
Boron	0.005	0.015
Zirconium	0.05	0.15
Iron	--	2.5
Copper	--	0.50
Nickel + Cobalt	remainder	
Cobalt (1)	--	1.0

(1) Determination not required for routine acceptance.

4. **CONDITION:** As cast, unless otherwise specified.
5. **TECHNICAL REQUIREMENTS:**
 - 5.1 **Casting:** Castings shall be produced from master heat metal remelted and poured under vacuum without loss of vacuum between melting and pouring. When permitted by purchaser, protective atmosphere may be used in lieu of vacuum for pouring of castings. A master heat is metal of a single furnace charge melted and cast into ingot under vacuum. Gates, sprues, risers, and rejected castings shall be used only in preparation of master heats; they shall not be remelted directly for pouring of castings.
 - 5.1.1 **Temperature of Metal for Pouring:** The temperature of the metal for pouring of castings shall be held within ± 50 F (± 28 C) of that agreed upon by purchaser and vendor.
 - 5.1.2 **Temperature of Molds:** The temperature of the mold cavities at time of receiving metal from the furnace or ladle shall be held within ± 50 F (± 28 C) of that agreed upon by purchaser and vendor.

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 on the part of the Board or its Committees 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."

5.2 Test Specimens:

5.2.1 Separately Cast Specimens: Unless otherwise specified, tensile test specimens shall be cast to represent each master heat of metal in castings and, when requested, shall be supplied with the castings. The specimens shall be of standard proportions with 0.25 in. diameter at the reduced parallel section, shall be cast to size in molds made of the same refractory and heated to the same temperature as the molds for castings, and shall be cooled at approximately the same rate as the castings. Center gating may be used but, if specimens are so gated, the gate shall be completely removed before testing. If the metal for castings is given any treatment such as fluxing or cooling and reheating, metal for the specimens shall be so treated. If grain refining techniques are used for castings, similar techniques shall be used for producing test specimens.

5.2.2 Specimens Machined from Castings: When agreed upon by purchaser and vendor, tensile test specimens may be machined from castings selected at random from the shipment. Size and specific locations of such specimens shall be as shown on the drawing or as agreed upon by purchaser and vendor.

5.3 Hardness: Castings shall have hardness of Rockwell C 30 - 42 or equivalent.

5.4 Tensile Properties: Unless otherwise agreed upon by purchaser and vendor, tensile test specimens produced in accordance with 5.2.1 or 5.2.2 and tested at room temperature shall conform to the following requirements.

Ø	Tensile Strength, psi	110,000 min
	Yield Strength at 0.2% Offset, psi	100,000 min
	Elongation, % in 4D	3 min

5.5 Stress-Rupture Test at 1800 F (982.2 C): Unless otherwise agreed upon by purchaser and vendor, tensile test specimens produced in accordance with 5.2.1 or 5.2.2, maintained at 1800 F ± 5 (982.2 C ± 2.8) while an axial stress of 22,000 psi is applied continuously shall not rupture in less than 30 hours. The test shall be continued until the specimen ruptures. The elongation after rupture, measured at room temperature, shall be not less than 5% in 4D.

6. QUALITY:

6.1 Castings shall be uniform in quality and condition, sound, and free from foreign materials and from internal and external imperfections detrimental to fabrication or to performance of parts. Castings shall have smooth surfaces and shall be well cleaned. Unless otherwise specified, metallic shot or grit shall not be used for final cleaning.

6.2 When castings are broken for fracture test, the fracture shall have uniform color and be substantially free from oxides and other defects.

6.3 Radiographic and other quality standards shall be as agreed upon by purchaser and vendor.

6.4 Unless otherwise specified, castings shall be produced under radiographic control. This shall consist of radiographic examination of castings until proper foundry technique, which will produce castings free from harmful internal imperfections, is established for each part number, and of production castings as necessary to ensure maintenance of satisfactory quality.

6.5 Castings shall not be repaired by plugging, welding, or other methods, without written permission from purchaser.