Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE MATERIAL SPECIFICATION

AMS 5339

Issued 11-1-69
Revised

STEEL CASTINGS, INVESTMENT, MARAGING
17Ni - 10Co - 4.6Mo - 0.30Ti - 0.06Al

SAE Technical Board rules provide 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 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."

1. ACKNOWLEDGMENT: A vendor shall mention this specification number in all quotations and when acknowledging purchase orders.

2. APPLICATION: Primarily for heat treated parts requiring ultra high strength at temperatures up to 600 F (316 C).

3. COMPOSITION: Castings shall conform to the following:

	min	max
Carbon	--	0.03
Manganese	--	0.10
Silicon	--	0.10
Phosphorus	--	0.010
Sulfur	--	0.010
Nickel	16.00	17.50
Cobalt	9.50	11.00
Molybdenum	4.40	4.80
Titanium	0.15	0.45
Aluminum	0.02	0.10
Iron	remainder	

4. CONDITION: Homogenized, overaged, and solution heat treated, unless otherwise specified.

5. TECHNICAL REQUIREMENTS:

5.1 Casting: Castings shall be poured either from remelted metal from a master heat or master heat lot or directly from a master heat. In either case, metal for casting shall be qualified as in 5.3. A master heat is refined metal of a single furnace charge. Gates, sprues, risers, and rejected castings shall be used only in preparation of master heats; they shall not be remelted directly, without refining, for pouring of castings.

5.1.1 Unless prohibited by purchaser, metal from two or more master heats may be blended to form a master heat lot provided that the composition of each master heat to be blended is within the limits of Section 3 above and the total weight of metal in the master heat lot does not exceed 10,000 pounds. Ingot and pig may be blended together, shot may be blended, but shot shall not be blended with ingot or pig.

5.2 Heat Treatment: Castings and tensile test specimens shall be heat treated as follows:

5.2.1 Homogenization Heat Treatment:

5.2.1.1 Maximum Section Thickness up to 1 In., Excl: Heat to 1800 F ± 25 (982.2 C ± 14), hold at heat for 4 hr, and air cool to room temperature.

5.2.1 2 Maximum Section Thickness 1 to 3 In., Excl: Heat to 2100 F ± 25 (1148.9 C ± 14), hold at heat for 4 hr, and air cool to room temperature.

SAENORM.COM : Click to view the full PDF of ams5339

Copyright 1969 by Society of Automotive Engineers, Inc.

Printed in U.S.A.

5.2.2 Overaging Heat Treatment: Heat to 1100 F ± 25 (593.3 C ± 14), hold at heat for 4 hr, and air cool to room temperature.

5.2.3 Solution Heat Treatment: Heat to 1500 F ± 25 (815.6 C ± 14), hold at heat for 1 hr per inch of section thickness but in no case less than 1 hr, and air cool.

5.3 Master Heat Qualification: Each master heat and master heat lot shall be qualified by evaluation of chemical analysis and tensile test specimens conforming to 5.3.1 and 5.3.2, respectively. A master heat or master heat lot may be considered conditionally qualified if vendor's test results show conformance to all applicable requirements of this specification. However, except when purchaser waives confirmatory testing, final qualification shall be based on purchaser's test results. Conditional qualification of a master heat or master heat lot shall not be construed as a guarantee of acceptance of castings poured therefrom.

5.3.1 Chemical Analysis Specimens: Shall be of any convenient size, shape, and form for vendor's tests; when chemical analysis specimens are required by purchaser, specimens shall be cast to a size, shape, and form agreed upon by purchaser and vendor. Composition of specimens shall conform to Section 3.

5.3.2 Tensile Test Specimens: Shall be cast from remelted metal from each master heat or master heat lot except that when castings are poured directly from a master heat, the tensile test specimens shall also be poured directly from the master heat. Tensile test specimens shall be of standard proportions with 0.25 in. diameter at the reduced parallel section. They shall be cast to size or shall be cast oversize and subsequently machined to 0.25 in. diameter. Center gating may be used. When requested, tensile test specimens shall be supplied to the purchaser for confirmatory evaluation. Tensile test specimens shall conform to the following requirements:

5.3.2.1 Properties As Solution Heat Treated: Tensile specimens as solution heat treated shall have hardness not higher than Rockwell C 36 or equivalent.

5.3.2.2 Properties After Maraging: Tensile specimens produced as in 5.3.2 and heat treated as in 5.2 shall conform to the following requirements when heated to 900 F ± 25 (482.2 C ± 14), held at heat for 3 hr, and air cooled to room temperature.

5.3.2.2.1 Tensile Properties:

Tensile Strength, psi	240,000 min
Yield Strength at 0.2% Offset, psi	220,000 min
Elongation, % in 4D	6 min
Reduction of Area, %	20 min

5.4 Properties of Castings:

5.4.1 Properties As Solution Heat Treated: Castings as solution heat treated shall have hardness not higher than Rockwell C 36 or equivalent.

5.4.2 Properties After Maraging: When specified on the drawing or purchase order, castings heat treated as in 5.2 and then heated to 900 F ± 25 (482.2 C ± 14), held at heat for 3 hr, and cooled in air to room temperature shall exhibit the following tensile properties:

	Designated Area	Any Area
Tensile Strength, psi	240,000 min	210,000 min
Yield Strength at 0.2% Offset, psi	220,000 min	180,000 min
Elongation, % in 4D	5 min	4 min
Reduction of Area, %	20 min	10 min

SAENORM.COM : Click to view the full PDF of ams5339

5.5 Resampling and Retesting: In event any test specimen fails to meet the specified requirements, at least two additional test specimens shall be tested for each non-conforming specimen. All such additional specimens shall conform to specified requirements. Failure of any retest specimen to conform to specified requirements shall be cause for rejection of the master heat or master heat lot in the case of qualification test specimens, or of the castings from that shipment in the case of tests on castings or specimens cut from castings. Results of all tests shall be reported.

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 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 insure maintenance of satisfactory quality.

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

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

7. REPORTS:

7.1 Unless otherwise specified, the vendor of castings shall furnish with each shipment three copies of a report of the results of tests for chemical composition of at least one casting from each master heat or master heat lot represented and the results of tests on each master heat or master heat lot to determine conformance to the technical requirements of this specification. When properties of test specimens cut from castings are specified, the report shall include the results of tests to determine conformance to such requirements. This report shall include the purchase order number, master heat or master heat lot number (and code symbol if used), material specification number, part number, and quantity from each master heat or master heat lot.

7.2 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 castings, part number, and quantity. When castings for making parts are produced or purchased by the parts vendor, that vendor shall inspect castings from each master heat or master heat lot represented to determine conformance to the requirements of this specification, and shall include in the report a statement that the castings conform, or shall include copies of laboratory reports showing the results of test to determine conformance.

8. IDENTIFICATION: Unless otherwise specified, each casting shall be identified as to part number and master heat or master heat lot number or code symbol. Methods of applying identifying characters shall be as agreed upon by purchaser and vendor. Marking materials shall have no deleterious effect on the castings or their performance.

SAENORM.COM : Click to view the full PDF of ams5339