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AEROSPACE MATERIAL SPECIFICATION

AMS 2759/4

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Revised

HEAT TREATMENT OF AUSTENITIC CORROSION RESISTANT STEEL PARTS

1. SCOPE: This specification, in conjunction with the general requirements for steel heat treatment covered in AMS 2759, establishes the requirements for annealing, stress relieving, and stabilizing heat treatment of austenitic corrosion-resistant steel parts. Parts are defined in AMS 2759.

1.1 Application: This specification is applicable to parts made from the following corrosion-resistant steels: 201, 202, 301, 302, 303, 304, 305, 308, 309, 309C, 310, 314, 316, 318, 321, 347, and 348.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications and Aerospace Recommended Practices shall apply. The applicable issue of other documents shall be as specified in AMS 2350.

2.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096.

2.1.1 Aerospace Material Specifications:

AMS 2350 - Standards and Test Methods
AMS 2759 - Heat Treatment of Steel Parts, General Requirements

2.1.2 Aerospace Recommended Practices:

ARP 1820 - Chord Method of Evaluating Surface Microstructural Characteristics

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2.2 ASTM Publications: Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM E3 - Preparation of Metallurgical Specimens

2.3 U.S. Government Publications: Available from Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120.

2.3.1 Federal Specifications:

QQ-P-35 - Passivation Treatments for Corrosion-Resisting Steel

3. TECHNICAL REQUIREMENTS:

3.1 Heat Treatment: Shall conform to AMS 2759 and the requirements specified herein.

3.2 Equipment: Shall conform to AMS 2759. Furnace temperature uniformity requirements for annealing, stress relieving, and stabilizing shall be ±25°F (±15°C).

3.3 Heating Environment: Parts shall be heat treated in either air or protective atmosphere. Acceptable protective atmospheres include argon, helium, nitrogen, hydrogen, nitrogen-hydrogen blends, neutral salt, vacuum, and exothermic. Use of nitrogen from dissociated ammonia is prohibited. For scale-free or discoloration-free parts, an air atmosphere and air cooling should be avoided.

3.3.1 Atmospheres: Shall be controlled so as not to react with the parts being heat treated. Furnaces used to heat treat other classes of steel using environments which could contaminate austenitic corrosion-resistant steel parts, such as endothermic, nitrogen base, etc, shall have purge cycles run and then shall be tested to ensure that the surfaces of parts are not contaminated beyond the limits specified in 3.5.1. Materials which could attack or contaminate metal shall not contact parts. Composition and maintenance of salt baths shall be such as to prevent contamination of the parts. Salt baths shall be tested in accordance with AMS 2759. Heat treating performed in air shall be in the natural atmosphere of a muffle furnace.

3.3.2 Protective Coatings: A supplemental coating is permitted to minimize oxidation on finished machined surfaces, when approved by the cognizant engineering organization.

3.4 Procedure:

3.4.1 Passivation: Parts shall be passivated in accordance with QQ-P-35 prior to all thermal treatments above 1350°F (730°C) and prior to all thermal treatments subsequent to forming with dies made from lead, kirksite, or other low melting temperature materials.

3.4.2 Soaking: Heating shall be controlled, as described in AMS 2759, in such a manner that either the heating medium or the part temperature, as applicable, is maintained at the set temperature in Table I for the soak time in Table II. Soaking shall commence when all control, indicating, and recording thermocouples reach the specified set temperature or, if load thermocouples as defined in AMS 2759 are used, when the part temperature reaches the minimum of the furnace uniformity tolerance at the set temperature. In all cases, the parts shall be held for sufficient time to ensure that the center of the most massive section has reached temperature and the necessary transformation and diffusion have taken place.

3.4.3 Anneal, Stress Relief, and Dimensional Stabilization: Shall be accomplished by heating, soaking, and cooling as specified in Tables I and II.

3.4.4 Straightening: When approved by the cognizant engineering organization, straightening shall be accomplished at ambient temperature with a post-straightening stress relief as specified in Table I or at the elevated temperature specified in Table I without a subsequent stress relief. For parts subject to excessive warpage, dimensional stabilization may be substituted for stress relief, when approved by the cognizant engineering organization.

3.5 Properties:

3.5.1 Surface Contamination: The atmospheric protection medium in furnaces used for heating parts above 1350°F (730°C), when any surface is not machined after heat treatment, shall be controlled to produce no carburization or nitriding (See 3.5.1.1). Intergranular oxidation shall not exceed 0.0007 in. (0.018 mm). Parts shall have no salt contamination.

3.5.1.1 Unless specifically informed that the parts will be machined all over, the heat treating processor shall heat treat the parts as if some surfaces will not have subsequent metal removal and, therefore, shall heat treat using controlled atmosphere which will conform to the surface contamination requirements.

3.6 Test Methods: Shall be in accordance with AMS 2759 and as follows:

3.6.1 Surface Contamination: Testing shall be by metallurgical examination at 500X magnification of etched specimens prepared in accordance with ASTM E3. The chord method in ARP 1820 may be used to enhance this examination.

4. QUALITY ASSURANCE PROVISIONS: The responsibility for inspection, classification of tests, sampling, approval, entries, records, and reports shall be in accordance with AMS 2759 and as specified in 4.1.

4.1 Classification of Tests: The classification of acceptance, periodic, and preproduction tests shall be as specified in AMS 2759 and as specified in 4.1.1, 4.1.2, and 4.1.3.

4.1.1 Acceptance Tests: None required.

4.1.2 Periodic Tests: In addition to the tests specified in AMS 2759, tests to determine conformance to requirements for surface contamination (3.5.1) are classified as periodic tests. Surface contamination tests shall be performed on each piece of equipment, both monthly and after purging cycles are run, whenever the equipment has been used previously to heat treat other types of steel using environments, such as endothermic, nitrogen base, etc, which could contaminate austenitic corrosion-resistant steel.

4.1.3 Preproduction Tests: In addition to the tests specified in AMS 2759, tests to determine conformance to requirements for surface contamination (3.5.1) are classified as preproduction tests and shall be performed prior to any production heat treating for each piece of equipment and kind of atmosphere to be used.

5. PREPARATION FOR DELIVERY: See AMS 2759.

6. ACKNOWLEDGMENT: See AMS 2759.

7. REJECTIONS: See AMS 2759.

8. NOTES: See AMS 2759.

This specification is under the jurisdiction of AMS Committee "B".

TABLE I

Annealing, Stress Relieving, and Dimensional Stabilizing Treatments for Austenitic Corrosion-Resistant Steel Parts

Treatment	Alloy (2)	Set Temperature °F	Set Temperature °C	Soaking Time Minutes	Quench or Cooling Method
Annealing (1)	201, 202, 301, 302, 303, 304 305, 308 309, 310	1950	1065	Table II	Water (3)
	314, 316	2000	1095		
	309C, 318	2000	1095		
	321	1800	980	Table II	Air, Oil, or Water (4)
	347, 348	1900	1040		
Stress Relieving (1)	201, 202, 301, 302, 303, 304, 305, 308, 309, 310, 314, 316	1650	900(5)	Table II	Water (3)
	309C, 318 321, 347, 348	1650	900(5)	Table II	Air or Water (4)
Dimensional Stabilizing (1)	All	800	425(6)	60 (7) (8)	Air

Notes: See Page 6