



AEROSPACE MATERIAL SPECIFICATION

AMS2759™/1

REV. J

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Superseding AMS2759/1H

Heat Treatment of Carbon and Low-Alloy Steel Parts
Minimum Tensile Strength Below 220 ksi (1517 MPa)

RATIONALE

AMS2759/1J adds clarification to surface contamination (3.5.2.1) and to periodic test (4.2) regarding Type 1 parts; adds reference to a new note 8.6 in surface contamination (3.5.2.1); separates hardness and surface contamination in acceptance tests (4.1); adds reference to new note 8.7 in acceptance tests (4.1); adds new notes 8.6 and 8.7; updates Tables 2 and 3 to include specific alloys that were listed in Table 6, but inadvertently left out; corrects Table 4 to delete a line separating alloys that should not have been there; corrects Table 6 by moving 4137 to be in line with 4135 and 8735.

NOTICE

ORDERING INFORMATION: In addition to that listed in AMS2759, the purchaser shall supply the following information to the heat treating processor.

- AMS2759/1J
- Whether the parts are “damage tolerant,” “maintenance critical,” or “fracture critical” (see 3.4.7). These designations have been previously used to designate parts requiring additional inspection (see 4.1).
- Tensile strength or hardness if other than that stated in Tables 3 and 4 (see 3.4.8 and 3.5.1).
- Cognizant engineering organization approval if dimensions at heat treatment exceed Table 6 size limits.

1. SCOPE

This specification, in conjunction with the general requirements for steel heat treatment covered in AMS2759, establishes the requirements for heat treatment of carbon and low-alloy steel parts to minimum ultimate tensile strengths below 220 ksi (1517 MPa). Parts are defined in AMS2759. Due to limited hardenability in these materials, there are size limits in this specification.

- 1.1 The provisions of this specification revision shall become effective 90 days after publication.

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<https://www.sae.org/standards/content/AMS2759/1J>

2. APPLICABLE DOCUMENTS

The issue of the following documents in effect on the date of the purchase order forms a part of this specification to the extent specified herein. The supplier may work to a subsequent revision of a document unless a specific document issue is specified. When the referenced document has been cancelled and no superseding document has been specified, the last published issue of that document shall apply.

2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

| | |
|---------|-----------------------------------------------------|
| AMS2418 | Plating, Copper |
| AMS2424 | Plating, Nickel, Low-Stressed Deposit |
| AMS2750 | Pyrometry |
| AMS2759 | Heat Treatment of Steel Parts, General Requirements |

3. TECHNICAL REQUIREMENTS

3.1 Heat Treatment

Shall conform to AMS2759 and the requirements specified herein.

3.2 Equipment

Equipment shall conform to AMS2759. Equipment specifically used for tempering of H-11, D6AC, and 9Ni-4Co steels shall conform to AMS2750, Class 2.

3.3 Heating Environment

Parts shall be controlled by type and heat treated in the class of atmosphere permitted in Table 1 for that type when heating above 1250 °F (677 °C). When heating parts at 1250 °F (677 °C) or below, Class A, B, or C atmosphere may be used (see 8.2). Atmosphere class and part type are described in AMS2759.

Table 1 - Atmospheres

| Part Type | Atmosphere Classification | | |
|-----------|---------------------------|---------------------------|------------|
| | Class A | Class B | Class C |
| Type 1 | Permitted | Permitted | Permitted |
| Type 2 | Permitted | PROHIBITED ⁽¹⁾ | PROHIBITED |

NOTES:

⁽¹⁾ Permitted provided the atmosphere is controlled to meet the surface contamination requirements in 3.5.2.

3.3.1 Protective Coatings

A supplemental coating or plating is permitted when approved by the cognizant engineering organization. Fine grain copper plating in accordance with AMS2418 or nickel plating in accordance with AMS2424 may be used without approval, but the surface contamination specimens in AMS2759 shall not be plated.

3.4 Procedure

3.4.1 Preheating

Preheating until furnace stabilization in the 900 to 1200 °F (482 to 649 °C) range is recommended before heating parts above 1300 °F (704 °C) if the parts have previously been heat treated to a hardness greater than 35 HRC, have abrupt changes of section thickness, have sharp reentrant angles, have finished machined surfaces, have been welded, have been cold formed or straightened, have holes, or have sharp or only slightly rounded notches or corners.

3.4.2 Soaking

The start of soaking time shall be in accordance with AMS2759.

3.4.2.1 Parts coated with copper plate or similar reflective coatings that tend to reflect radiant heat shall have their soak time increased by at least 50% unless load thermocouples are used. This increase does not apply to salt bath heat treating, tempering, or sub-zero processing.

3.4.3 Annealing

3.4.3.1 When required, annealing shall be accomplished by heating to the set temperature specified in Table 2, soaking for the time specified in Table 5, and cooling to below the temperature specified in Table 2 at the rate shown in Table 2 followed by air cooling to ambient temperature. Isothermal annealing treatments may be used provided equivalent hardness is obtained.

3.4.3.2 Isothermal annealing shall be accomplished by heating to the annealing set temperature specified in Table 2, soaking for the time specified in Table 5, cooling to a temperature below the critical, holding for sufficient time to complete transformation, and air cooling to ambient temperature.

3.4.4 Subcritical Annealing

When required, subcritical annealing shall be accomplished prior to hardening by heating to a set temperature between 1150 and 1250 °F (621 and 677 °C), soaking for the time specified in Table 5, and cooling to ambient temperature. Steel parts of the 9Ni-4Co type shall be subcritical annealed as specified in Table 2.

3.4.5 Pre-Hardening Stress Relief

When required, pre-hardening stress relieving shall be done in accordance with AMS2759/11 prior to hardening by heating to a set temperature between 1000 and 1250 °F (538 to 677 °C), soaking for not less than the time specified in Table 5 and cooling to ambient temperature.

3.4.6 Normalizing

When required, normalizing shall be accomplished by heating to the set temperature specified in Table 2, soaking for the time specified in Table 5, and cooling in air or atmosphere to ambient temperature. Circulated air or atmosphere is recommended for thicknesses greater than 3 inches (76 mm). Normalizing may be followed by tempering or subcritical annealing.

3.4.7 Hardening (Austenitizing and Quenching)

3.4.7.1 When required, hardening shall be accomplished by heating to the set temperature stated in Table 2, soaking for the time stated in Table 5, and quenching as stated in Table 2. The parts shall be cooled to or below the quenchant temperature, or to a temperature low enough to achieve complete transformation, before tempering. Parts may be gas quenched provided they have been qualified per Appendix A or in accordance with another procedure approved by the cognizant engineering organization. The alloy, part size, and load size shall be qualified prior to processing hardware. Prior to initial tempering parts may be snap tempered for 2 hours minimum at a temperature, usually 400 °F (204 °C), that is lower than the tempering temperature (see 8.4.1).

3.4.7.2 As steel parts hardened to this specification have limited hardenability, which varies by alloy, the size limits in Table 6 shall apply. Parts exceeding size limitations shall be machined to within 0.125 inch (3.2 mm) of the final dimensions prior to hardening. With cognizant engineering organization approval, parts may be greater than 0.125 inch (3.2 mm) of the final dimensions prior to hardening.

3.4.7.3 Welded parts, and brazed parts with a brazing temperature above the normalizing temperature, shall be normalized before hardening. For welded or brazed alloys that are not normalized (for example H-11; see Table 2), the parts shall be annealed. Welded parts should be preheated in accordance with 3.4.1. Parts identified as damage tolerant, maintenance critical, or fracture critical shall be in the normalized condition before hardening, unless the alloy is not normalized (see Table 2), in which case the part shall be annealed.