



AEROSPACE MATERIAL SPECIFICATION

AMS2759™/8**REV. B**Issued 1992-01
Revised 2018-06

Superseding AMS2759/8A

(R) Ion Nitriding

RATIONALE

AMS2759/8B results from a Five-Year Review and general revision of AMS2759 and its slash specifications.

NOTICE

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

- AMS2759/8B
- Size of parts if engineering drawing is not provided
- Incoming core hardness (see 3.8.3.1)
- Incoming part heat treat condition (see 3.1)
- Prior heat treatment information (see 3.1)
- Stress relieving if other than AMS2759/11 (see 3.2)
- Total case depth if applicable
- Effective case depth if applicable
- Case (surface) hardness (see 3.8.3.2 and 8.3.3)
- Areas to be nitrided, areas to be masked, areas to be optional
- Whether parts or representative specimens are to be used for testing (see 4.4.2)
- Compound zone layer depth (thickness) (see 3.8.1.2)
- Compound zone removal requirements if applicable
- Grind stock allowances to be reflected in case depth measurements if applicable
- Optional - Phase composition of the compound layer (see 3.8.1.3)

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1. SCOPE

1.1 Purpose

This specification establishes the requirements and procedures for producing a hard, wear resistant ion nitrided surface on steel parts.

1.2 Application

The ion nitriding process is typically applied to increase surface hardness, increase wear resistance, and reduce the coefficient of friction of alloy steels, tool steels, nitriding steels, corrosion resistant steels, carbon steels, ferrous powder metal products, and other ferrous alloys but usage is not limited to such applications.

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

1.4 Classifications

Processes covered by this specification are classified as follows:

Class 1: 0.0005 inch (0.013 mm) maximum white layer thickness permitted

Class 2: 0.001 inch (0.025 mm) maximum white layer thickness permitted

If no class is specified, Class 2 will apply.

2. APPLICABLE DOCUMENTS

In addition to those listed in AMS2759, 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

AMS2429 Plating, Bronze, Nitriding Stop-Off, 90Cu - 10Sn

AMS2759 Heat Treatment of Steel Parts, General Requirements

3. TECHNICAL REQUIREMENTS

3.1 Prior Heat Treatment

When heat treatment is specified for parts to be nitrided, it shall be performed as specified prior to nitriding. If a heat treatment document is not called out, then it shall be performed in accordance with AMS2759 and to applicable slash specifications. Prior heat treatment information shall be provided. Certifications of prior heat treatment are recommended but not required when the purchase order has complete prior heat treatment information.

3.2 Stress Relieving

3.2.1 Unless otherwise specified parts which have been ground, straightened, finish machined, or otherwise mechanically worked after hardening, shall be stress relieved prior to nitriding in accordance with AMS2759/11.

3.3 Pyrometry

Pyrometric equipment shall conform to AMS2759 except that temperature uniformity survey and system accuracy test requirements do not apply. The temperature range shall be 50 °F (28 °C) or less at nitriding temperatures determined by a minimum of four thermocouples during processing of each production load.

3.3.1 Thermocouples

3.3.1.1 The thermocouples shall be placed in parts or representative specimens in locations that represent the projected extremes and mid-range temperatures of the load. A control thermocouple and/or over-temp thermocouple may be used as one of the four thermocouples required by 3.3.

3.3.1.2 If any thermocouple fails or has a suspect reading during processing, supplier's engineering and quality departments shall review the run to determine if product conforms to specified requirements. Results of the analysis and any additional evaluation shall be documented, including assessment of corrective actions or improvement to prevent recurrence.

3.3.2 Infrared Pyrometry

Infrared pyrometers may be used for controlling and monitoring temperature when acceptable to the cognizant engineering organization. Calibration shall be yearly and in accordance with the manufacturer's instructions.

3.4 Equipment

Vessels, associated equipment, and controls shall be maintained in accordance with the manufacturer's recommendations or the processor's internal procedures.

3.4.1 Vessels may be equipped with radiation shields and/or auxiliary resistance heating.

3.4.2 Pressure Control

Equipment shall have calibrated recording instruments for sensing, measuring, controlling, and recording pressure during the entire nitriding cycle. The control equipment shall be capable of maintaining the operating pressure level at any setpoint within the equipment operating range with sufficient accuracy to meet the processing requirements of the parts being treated.

3.4.3 Nitriding Atmosphere

The nitriding gas composition shall be selected to produce a compound layer or a pure diffusion zone. Guidelines on gas composition effects on compound layer formation are found in 8.2.5.

3.4.4 Atmosphere Control

Equipment for mixing gases shall be calibrated and capable of providing a measured ratio of the components of the mixed gas within $\pm 3\%$ by volume of the selected value. For example, if the gas contains 25% nitrogen, the concentration can range from 22 to 28%. Alternatively, a premixed gas of certified composition may be used.

3.4.5 Vessel Rise in Pressure (Leak Rate)

The vessel pressure rise (leak rate), expressed in microns per hour shall be measured before each treatment cycle. The vessel shall not exceed 90 μm per hour. Pressure rise shall be determined, before starting the heat cycle, after loading and closing the vessel, evacuating to 75 μm (10 Pa) or lower, and closing all valves to the vessel chamber to isolate the pumps. The initial pressure is recorded, and a second reading taken at least 15 minutes after the first reading. Pressure rise shall be calculated by subtracting the first reading from the second, dividing the result by the time interval, and multiplying the resultant number by 60. Other methods may be used when approved by the cognizant engineering organization.

3.4.6 Initial Evacuation of Vessel

Once the vessel pressure rise test has been completed and found acceptable, but before admitting nitriding gas and turning on power for heating, the vessel shall be below a pressure of 150 μm (20 Pa).

3.5 Nitriding Requirements

3.5.1 Surface Condition

Surfaces to be ion nitrided shall be in a finish ground condition free from oxidation products, decarburization, grease, oil or other contaminants. Parts requiring cleaning shall be cleaned in a suitable solvent and/or lightly grit blasted. Care should be exercised after cleaning to prevent re-contamination.

3.5.2 Selective Ion Nitriding

The preferred method of selective nitriding is by mechanical masking. When acceptable to the purchaser pastes, paints, and plating may be used.

3.5.2.1 Areas of the part that are not required to be nitrided shall be specified by the purchaser (see Ordering Information).

3.6 Ion Nitriding Procedure and Processing

3.6.1 Establishment of Processing Procedure for Production Parts

The following items shall be established and documented for each part number: maximum number of parts allowed per load, loading layout (sketch, diagram, or photograph of part locations and thermocouple locations), masking/fixtures, processing parameters, specimen type and locations, and testing practice consisting of number of pieces per load to be tested, number of pieces per layer to be tested.

3.6.1.1 Previously Approved Procedure

It is permissible for specific parts to use equipment, practices and test methods which conformed to previous revisions of AMS2759/8.

3.6.1.2 For parts expected to be nonrecurring (see 8.12.1) the processing procedure may be limited to vessel log/recorder entries. Different nonrecurring parts that require the same process parameters may be combined and processed together in the same load if testing in accordance with 4.2.1 verifies that the requirements of 3.7 are attained on each part number.

3.6.1.3 Sufficient test specimens (see 4.3.2) shall be placed in each load at locations representing the projected extremes and mid-range of work temperature established in 3.2.1 or by other analysis or test data.

3.6.2 Processing Parameters

The following processing parameters shall be followed and documented in the procedure:

3.6.2.1 Temperature Range

It is recommended that the ion nitriding set temperature be between 750 °F (399 °C) and 1110 °F (599 °C). The set temperature selected shall be a minimum of 50 °F (28 °C) below the final tempering or aging heat treatment temperature. The set temperature tolerance shall be such that the four thermocouples noted in 3.3.1.1 shall be within 50 °F (28 °C) of each other with the operating set temperature being anywhere within this range.

3.6.2.2 Processing Pressure

The vessel pressure shall be sufficient to produce the specified depth of case.