

# AEROSPACE MATERIAL SPECIFICATION

Submitted for recognition as an American National Standard

**AMS 2775A**

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**Superseding AMS 2775**

## CASE HARDENING OF TITANIUM AND TITANIUM ALLOYS

### 1. SCOPE:

1.1 Form This specification covers the engineering requirements for producing a carbon-oxygen-nitrogen-bearing case on titanium and titanium alloys by means of a liquid salt bath, and the properties of the case.

1.2 Application: To increase the resistance to galling and wear of titanium and titanium alloys. This process is not recommended for use on alloys having an actual tin content greater than 3%.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications 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 2430 - Shot Peening

2.1.2 SAE Standards and Recommended Practices:

J423 - Methods of Measuring Case Depth

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

ASTM E384 - Microhardness of Materials

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

**2.3.1 Military Standards:**

MIL-STD-794 - Parts and Equipment, Procedures for Packaging and Packing of

**3. TECHNICAL REQUIREMENTS:**

**3.1 Materials:**

**3.1.1 Bath Content:** The bath shall consist of sodium cyanide and other salts.

**3.1.2 Salt Bath:** The cyanide, cyanate, titanium oxide, and carbonate contents of the bath (See 8.2) shall be controlled within the following percentages by weight:

	min	max
Cyanide as NaCN	65	70
Cyanate as NaCNO	--	2
Titanium as TiO <sub>2</sub>	3	--
Carbonate as Na <sub>2</sub> CO <sub>3</sub>	25	30

**3.2 Preparation:** Parts shall be free of grease, oil, and dirt and shall be completely dry prior to immersion in the salt bath.

**3.3 Procedure:**

**3.3.1 Preheating :** If preheating is necessary because of part configuration, parts shall be heated in an air furnace at 750° - 800°F (400° - 425°C).

**3.3.2 Case Formation:** Parts shall be immersed in the salt bath maintained at 1480°F ± 10 (805°C ± 5) for 1 - 3 hr followed by quenching in water. Alternate cooling methods shall be as agreed upon by purchaser and vendor.

**3.3.3 Shot Peening:** Parts shall be glass bead peened in accordance with 2430 to an intensity of 11N.

**3.4 Properties:** Case shall conform to the following requirements:

**3.4.1 Depth of Case:** Shall be 0.0015 - 0.0018 in. (0.038 - 0.045 mm), determined by microscopic method in accordance with SAE J423.

**3.4.2 Case Hardness:** Shall be 55 - 60 HRC or equivalent at a distance of 001 in. (0.02 mm) below the surface, determined by microhardness testing accordance with ASTM E384 on a cross section of a test specimen.

#### 4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of treated parts shall supply all  
0 samples for vendor's tests and shall be responsible for performing all required tests. Results of such tests shall be reported to the purchaser as required by 4.5. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the parts conform to the requirements of this specification.

#### 4.2 Classification of Tests:

4.2.1 Acceptance Tests: Tests to determine conformance to requirements for  
0 case depth (3.4.1) and case hardness (3.4.2) are classified as acceptance tests and shall be performed to represent each lot.

4.2.2 Periodic Tests: Tests to determine conformance requirements for bath  
0 composition (3.1.2) are classified as periodic tests and shall be performed at a frequency selected by the vendor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: Tests to determine conformance to all technical  
0 requirements of this specification are classified as preproduction tests and shall be performed prior to or on the initial shipment of the product to a purchaser, when a change in material, processing, or both requires reapproval as in 4.4.2, and when purchaser deems confirmatory testing to be required.

4.2.3.1 For direct U.S. Military procurement, substantiating test data and, when  
0 requested, preproduction test material shall be submitted to the cognizant agency as directed by the procuring activity, the contracting officer, or the request for procurement.

4.3 Sampling: Sufficient samples shall be prepared to provide for duplicate tests for each requirement of 3.4.

4.3.1 Test specimens for determining case depth and case hardness shall be of the same material as the parts represented and processed with the parts.

#### 4.4 Approval:

4.4.1 Sample case hardened parts shall be approved by purchaser before parts for  
0 production use are supplied, unless such approval be waived by purchaser. Results of tests on production parts shall be essentially equivalent to those on the approved sample parts.

4.4.2 Vendor shall use manufacturing procedures, processes, and methods of inspection on production parts which are essentially the same as those used on the approved sample parts. If necessary to make any change in established limits of the case or in case-hardening procedures, vendor shall submit for reapproval of the process a statement of the proposed changes in processing and, when requested, sample cased parts. Production parts cased by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Reports: The vendor of case-hardened parts shall furnish with each shipment a report showing the results of tests to determine conformance to the acceptance test requirements of this specification. This report shall include the purchase order number, AMS 2775A, lot number, part number, and quantity.

4.6 Resampling and Retesting: If any specimen used in the above tests fails to meet the specified requirements, disposition of the parts may be based on the results of testing three additional specimens for each original nonconforming specimen. Failure of any retest specimen to meet the specified requirements shall be cause for rejection of the parts represented and no additional testing shall be permitted. Results of all tests shall be reported.

5. PREPARATION FOR DELIVERY:

5.1 Identification: Each container of parts shall be legibly marked with not less than AMS 2775A, purchase order number, vendor's identification, part number, and quantity.

5.2 Packaging:

5.2.1 Packaging shall be accomplished in such a manner as to ensure that case-hardened parts, during shipment and storage, will not be permanently distorted and will be protected against damage from exposure to weather or any other normal hazard.

5.2.2 Packages of processed parts shall be prepared for shipment in accordance with commercial practice and in compliance with applicable rules and regulations pertaining to the handling, packaging, and transportation of the parts to ensure carrier acceptance and safe delivery. Packaging shall conform to carrier rules and regulations applicable to the mode of transportation.

5.2.3 For direct U.S. Military procurement, packaging shall be in accordance with MIL-STD-794, Level A or Level C, as specified in the request for procurement. Commercial packaging as in 5.2.1 and 5.2.2 will be acceptable if it meets the requirements of Level C.

6. ACKNOWLEDGMENT: A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.