SAE Aerospace
An SAE International Group

AEROSPACE MATERIAL SPECIFICATION

SAE AMS 2775B

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Superseding AMS 2775A

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 molten salt bath, and the properties of the case.

1.2 Application:

This process has been used typically 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 percent.

1.3 Safety - Hazardous Materials:

While the materials, methods, applications, and processes described or referenced in this specification may involve the use of hazardous materials, this specification does not address the hazards which may be involved in such use. It is the sole responsibility of the user to ensure familiarity with the safe and proper use of any hazardous materials and to take necessary precautionary measures to ensure the health and safety of all personnel involved.

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.

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or www.sae.org.

AMS 2430 Shot Peening

J423 Methods of Measuring Case Depth

2.2 ASTM Publications:

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or www.astm.org.

ASTM E 384 Microhardness of Materials

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 as shown in Table 1.

TABLE 1 - Bath Composition

Ingredient	min	max
Cyanide as NaCN	65	70
Cyanate as NaCNO	--	2
Titanium as TiO_2	3	--
Carbonate as Na_2CO_3	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 °F to 800 °F (399 °C to 427 °C).

3.3.2 Case Formation: Parts shall be immersed in the salt bath maintained at 1480 °F ± 10 (804 °C ± 6) for 1 to 3 hours followed by quenching in water. Alternative cooling methods shall be acceptable to the purchaser.

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

3.3.4 Logs: A record (written or electronic storage media), traceable to temperature recording information (chart(s) or electronic storage media) and to shop travelers or other documentation, shall be kept for each salt bath furnace and load. The information on the combination of documents shall include: equipment identification, approved personnel's identification, date; part number or product identification, number of parts, alloy, lot identification, AMS 2775 or other applicable specification, actual thermal processing times and temperatures used. When applicable, atmosphere, quench delay, quenchant type, polymer concentration and quenchant temperature shall also be recorded. The maximum thickness, when process parameters are based on thickness, shall be recorded and shall be taken as the minimum dimension of the heaviest section of the part. The log data shall be recorded in accordance with the case hardening processor's documented procedures.

3.4 Properties:

Case shall conform to the following requirements:

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

3.4.2 Case Hardness: Shall be 650 Knoop minimum or equivalent Vickers using a 100 gram load at a distance of 0.001 inch (25 µm) below the surface, determined by microhardness testing accordance with ASTM E 384 on a cross section of a test specimen.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection:

The processor of treated parts shall supply all samples for processor's tests and shall be responsible for the performance of all required tests. Parts, if required for tests, shall be supplied by the purchaser. Purchaser reserves the right to sample and to perform any confirmatory testing deemed necessary to ensure that the parts conform to specified requirements.

4.2 Classification of Tests:

4.2.1 Acceptance Tests: Case depth (3.4.1) and case hardness (3.4.2) are acceptance tests and shall be performed to represent each lot.

4.2.2 Periodic Tests: Bath composition (3.1.2) tests (See 8.7) are classified as periodic tests and shall be performed at a frequency selected by the processor unless frequency of testing is specified by purchaser.

4.2.3 Preproduction Tests: All technical requirements of this specification are 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.

4.3 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 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 Processor 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, processor shall submit for reapproval of the process a statement of the proposed changes in processing and, when requested, sample case hardened parts. Production parts case hardened by the revised procedure shall not be shipped prior to receipt of reapproval.

4.5 Report/Certification:

The case hardening processor shall furnish with each shipment of parts, a certified quality assurance report, traceable to the case hardening lot control number(s), stating that the parts were processed in accordance with the requirements of AMS 2775 (or other applicable specification). The report shall include: purchase order number, part number or product identification, alloy, temper/strength designation, quantity of parts in the shipment, identification of salt bath furnace(s) used, actual thermal processing times and temperatures used. When applicable, the report shall also include: atmosphere type, quenchant (including polymer concentration range), hot straightening temperature and method of straightening (e.g. press, fixtures), actual test results, (e.g., hardness, conductivity, tensile, shear etc.) and a statement of their conformance/nonconformance to requirements. This data shall be reported in accordance with the case hardening processor's documented procedures.

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. 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 2775B, purchase order number, processor’s identification, part number, and quantity.