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400 COMMONWEALTH DRIVE WARRENDALE PA 15096

AEROSPACE MATERIAL SPECIFICATION

AMS 2755C

Superseding AMS 2755B

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LIQUID SALT BATH NITRIDING

1. SCOPE:

1.1 Purpose: This specification covers the engineering requirements for producing a thin carbide-bearing nitride case on parts by means of a low-temperature, aerated, molten salt bath process, and the properties of the case.

1.2 Application: Primarily for increasing the resistance to wear on ferrous alloys including oil- and air-hardening tool steels, corrosion-resistant steels, and cast irons.

2. APPLICABLE DOCUMENTS: The following publications form a part of this specification to the extent specified herein. The latest issue of Aerospace Material Specifications (AMS) 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

2.1.2 SAE Standards and Recommended Practices:

J423 - Methods of Measuring Case Depth

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

ASTM E384 - Microhardness of Materials

3. TECHNICAL REQUIREMENTS:

3.1 Material:

3.1.1 Nitriding Salts: Shall consist of a mixture of sodium and potassium cyanide and other salts.

3.1.2 Salt Bath: The cyanate, cyanide, and iron contents of the bath shall be controlled within the following percentages by weight:

	min		max
Cyanate, determined as KCNO	42	-	50
Cyanide, determined as KCN	45	-	50
Iron, determined as $Na_4Fe(CN)_6$	--		0.20

3.2 Preparation:

3.2.1 Hardening: Parts, where core hardening is specified, shall be heat treated to the required core hardness before processing as in 3.3.2. Tempering to attain core hardness shall be at a temperature not lower than 1075°F (580°C).

3.2.2 Stress Relief: Parts in which residual stresses may cause cracking or excessive distortion because of thermal shock or dimensional change because of metallurgical transformations during nitriding shall be stress relieved prior to final machining. Stress relieving shall be performed at a temperature not lower than 1075°F (580°C).

3.2.3 Cleaning: Parts shall be clean at the time of nitriding; shall be free of scale, entrapped sand, core material, metal particles, oil, and grease; and shall be completely dry.

3.3 Procedure:

3.3.1 Preheating: Parts shall be preheated in air at 750° - 900°F (400° - 480°C) to maintain bath temperature and avoid thermal shock prior to immersion in the cyanide-cyanate bath.

3.3.2 Nitriding: Parts shall be immersed in an aerated cyanide-cyanate bath as follows (See 8.2):

Material	Recommended Time min	Recommended Time max	Temperature °F	Temperature (°C)
Carbon and Low-Alloy Steels	1 hr	2 hr	1060 ± 10	(570 ± 5)
Tool and Die Steels (Structural)	30 min.	3 hr	1000 - 1060	(540 - 570)
Tool Steels (Cutting)	5 min.	1 hr	1000 - 1060	(540 - 570)
Corrosion and Heat Resistant Steels	1 hr	2 hr	1060 ± 10	(570 ± 5)
Ductile, Malleable, and Gray Cast Iron	1 hr	4 hr	1060 ± 10	(570 ± 5)
Powder Metal Products (Ferrous)	30 min.	2 hr	1060 ± 10	(570 ± 5)

3.3.3 Quenching: Following treatment, the parts shall be quenched in water, oil, soluble oil solution, or air. Parts, except those made of air-hardening tool steels, may be cooled to 550° - 750°F (290° - 400°C) prior to actual quenching, when permitted by purchaser.

3.4 Properties: Nitrided case shall conform to the following requirements:

3.4.1 Depth of Case: Shall be as follows, unless otherwise specified, determined in accordance with SAE J423, microscopic method, at 500X magnification:

	Case Depth Inch min	Case Depth Inch max	Case Depth (Millimetre) min	Case Depth (Millimetre) max
Plain carbon and low-alloy steels	0.00015	0.001	(0.004	0.03)
Tool and die steels (structural)	0.0001	0.0005	(0.003	0.012)
Tool and die steels (cutting)	--	0.0001	(--	0.003)
Corrosion and heat resistant steels	0.00015	0.001	(0.004	0.03)
Ductile, malleable, and gray cast iron	0.00015	0.001	(0.004	0.03)
Powder metal products (ferrous)	0.00015	0.001	(0.004	0.03)

3.4.2 Case Quality: Any surface porosity present shall not extend deeper than one-half the observed depth of the compound layer, determined by examining specimens metallographically at 500X magnification (See 8.3 and 8.4).

3.4.3 Case Hardness: Shall be as follows, determined by microhardness measurements in accordance with ASTM E384 on the nitrided surface or on metallographically prepared cross-sections of the nitrided case using Vickers, Knoop, or other appropriate hardness tester agreed upon by purchaser and vendor:

	Hardness, min (HK200)
Plain carbon steels	300
Low-alloy steels	450
Tool and die steels	700
Corrosion and heat resistant steels	900
Ductile, malleable, and gray cast iron	600
Powder metal products (ferrous)	600

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for Inspection: The vendor of treated parts shall supply all samples for vendor's tests and shall be responsible for performing all Ø 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 case Ø depth (3.4.1), case quality (3.4.2), and case hardness (3.4.3) are classified as acceptance tests and shall be performed on each lot.

4.2.2 Periodic Tests: Tests to determine conformance to requirements for bath Ø 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 Ø requirements of this specification are classified as preproduction tests and shall be performed prior to or on the first-article shipment of a part to a purchaser, when a change in material and/or processing 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 Ø 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.