

AEROSPACE

MATERIAL SPECIFICATIONS

AMS2755A

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc.

485 Lexington Ave., New York, N.Y. 10017

Issued 1-15-63

Revised 3-15-66

LIQUID SALT BATH NITRIDING

1. **ACKNOWLEDGMENT:** A vendor shall mention this specification number and its revision letter in all quotations and when acknowledging purchase orders.
2. **APPLICATION:** To increase resistance to wear and fatigue on ferrous alloys including oil and air hardening tool steels, corrosion resistant steels, and cast irons. This process is not recommended for use on parts which have been plated with silver, copper, zinc, or cadmium, or on parts having copper base alloy inserts.
3. **PROCESS REQUIREMENTS:**
 - 3.1 **Preparation:** Parts requiring core hardening shall be heat treated to the required core hardness prior to processing as in 3.5. Tempering to attain core hardness shall be at a temperature not lower than 1060 F (571.1 C).
 - 3.2 **Stress Relief:** Parts in which residual stresses may cause cracking, excessive distortion, or dimensional change during nitriding shall be stress relieved.
 - 3.3 Parts shall be free of scale and decarburization, clean, and completely dry prior to immersion in the liquid nitriding salt bath or prior to preheating.
 - 3.4 **Preheating:** Parts shall be preheated in air at 550 - 800 F (287.8 - 426.7 C) prior to immersion in the cyanide-cyanate bath, unless otherwise specified.
 - 3.5 **Nitriding:** Parts shall be immersed in an aerated cyanide-cyanate bath as determined by the properties and the type of material, as follows:

Material	Time		Temperature	Compound Layer Thickness, Inch	
	min	max		min	max
Carbon & Low Alloy Steels	1 hr	2 hr	1060 F $\pm$ 10 (571.1 C $\pm$ 5.6)	0.0002	0.001
Tool & die Steels (Structural)	30 min	3 hr	1000 - 1060 F (537.8 - 571.1 C)	0.0001	0.0005
Tool Steels (Cutting)	5 min	30 min	1000 - 1060 F (537.8 - 571.1 C)	--	0.0001
Corrosion & Heat Resistant Steels	1 hr	2 hr	1060 F $\pm$ 10 (571.1 C $\pm$ 5.6)	0.0002	0.001
Ductile, Malleable & Gray Cast Iron	2 hr	4 hr	1060 F $\pm$ 10 (571.1 C $\pm$ 5.6)	0.0002	0.001

- 3.6 Quenching: Following treatment, the parts shall be quenched in water, oil solution, soluble oil solution, or air, as determined by the application and the properties desired.

Note. Parts may be cooled to 550 - 750 F (287.8 - 398.9 C) prior to actual quenching when specified by the purchaser, except those made of air hardening tool steels.

4. TECHNICAL REQUIREMENTS:

- 4.1 Bath Analysis: The bath shall be analyzed as required to maintain control of the cyanide at 45 - 50% and the cyanate at 40 - 50% of the total bath content.
- 4.2 Depth of Case: Shall be as specified in 3.5. Unless otherwise permitted, metallographic examination shall be used to reveal the depth of the compound layer.

Note. A visible diffusion in plain carbon steels under microscopic examination has an acicular appearance after the sample has been heated at 570 F (298.9 C) for not less than 1 hr, when nital etched. The acicular zone represents 1/3 to 1/2 of the total nitrogen penetration. Alloy steels, when etched with nital, will reveal a dark zone which represents approximately 1/4 of the total nitrogen diffusion. Acicular structure is not apparent in alloy steels. Epsilon FeN and nitrogen bearing Fe_3C , with no Fe_2N , can be determined by X-Ray diffraction techniques.

- 4.3 Case Hardness: Shall be as follows, unless otherwise specified. Micro-hardness measurements shall be taken on the nitrided surface or on metallographically prepared cross sections of the nitrided case using Vickers, Knoop, or other appropriate hardness tester, as agreed upon by purchaser and vendor.

Hardness, Knoop, min

Plain carbon steels	300
Low alloy steels	450
Tool & die steels	700
Corrosion & heat resistant steels	900
Ductile, malleable, and gray cast irons	600

5. QUALITY:

- 5.1 Bend Test: A 1 in. x 8 in. x approximately 0.063 in. panel cut from SAE 1010 aluminum killed, annealed, extra deep drawing quality sheet, after being treated for 90 min. in the nitride salt bath at 1060 F $\pm$ 10 (571.1 C $\pm$ 5.6) and water quenched, shall be capable of being bent 180 deg around a 0.5 in. diameter with no visible signs of cracking.

- 5.1.1 Test pins or specimens of the same analysis shall be processed with the work when requested by the purchaser.

6. APPROVAL:

- 6.1 To assure adequate performance characteristics, nitrided parts shall be approved by purchaser before parts for production use are supplied, unless such approval be waived.