METRIC

MIL-STD-1876A(AT)
3 December 1991
SUPERSEDES
MIL-STD-1876(AT)
29 April 1983

MILITARY STANDARD

NITRIDING, GASEOUS ATMOSPHERE PROCESSING FOR

AMSC N/A

ARRA MFFP

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

FOREWORD

1. This Military Standard is for use by the U.S. Army Tank-Automotive Command, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48397-5000, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document, or by letter.

3. The procedure covered in this standard provides acceptance criteria for the process of gaseous atmosphere nitriding. The requirements are presented in a self-contained form.

CONTENTS

CONTENTS

CONTENTS

1. SCOPE

1.1 Purpose. The purpose of this document is to ensure procedures and parts meet prescribed nitriding, machining, and heat treatment requirements. Nitriding is intended for use where high surface hardness and high wear resistance is required on parts.

1.2 Scope. This standard covers the requirements for gaseous atmosphere nitriding of aircraft quality steel parts and in-process heat treatment and machining operations.

1.2.1 Limitations. This standard does not deal with glow discharge or pressure nitriding nor the nitriding of stainless steels.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

MILITARY

MIL-H-6875 - Heat Treatment of Steel.

STANDARDS

MILITARY

MIL-STD-1949 - Magnetic Particle Inspection.
MIL-STD-40002 - Heat Treatment Coding System, General.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Commanding Officer, Navy Publishing and Printing Service Office, Code NPM M/F DODSSP, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

M1PD-M-6061 - Metal Texturizing, Process for.
M1PD-G-6920 - Gears, Material Acceptance Criteria for.

(Copies of M1PD specifications and standards may be obtained from the U.S. Army Tank-Automotive Command, ATTN: AMSTA-GDS, Warren, MI 48937-5000.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)

SAE Standards and recommended practices

SAE J415	- Definitions of Heat Treating Terms, Information Report.
AMS 2418	- Copper Plating.
AMS 2480	- Phosphate Treatment, Paint Base.
AMS 2485	- Block Oxide Coating.
AMS 2750	- Pyrometry.
AMS 6322	- Steel Bars, Forgings, and Rings 0.50Cr-0.55Ni-0.25Mo (0.38-0.43C) (SAE 8740).
AMS 6415	- Steel Bars, Forgings and Tubing 0.80Cr-1.8Ni-0.25Mo (0.38-0.43C) (SAE 4340).
AMS 6470	- Steel Bars, Forgings and Tubing, Nitriding Steel 1.6Cr-0.35Mo-1.1Al (0.38-0.43C).
AMS 6471	- Steel Bars, Forgings and Tubing, Nitriding Grade 1.6Cr-0.35Mo-1.2AL (0.38-0.43C) Consumable Electrode Vacuum Melted.
AMS 6475	- Steel Bars, Forgings and Tubing, Nitriding 1.1Cr-3.5Ni-0.25Mo-1.25AL (0.21-0.26C).

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.)

AMERICAN SOCIETY FOR METALS (ASM)

Properties and Selection of Metals, Volume 1, 9th Edition.
Heat Treating, Volume 4, 9th Edition.

(Application for copies should be addressed to the American Society for Metals, Metals Park, OH 44073.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM E3	- Standard Methods of Preparation of Metallographic Specimens.
ASTM E18	- Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials.
ASTM E44	- Standard Definitions of Terms Relating to Heat Treatment of Metals.
ASTM E384	- Standard Test Method for Microhardness of Materials.
ASTM E407	- Standard Test Methods for Microetching Metals and Alloys.

(Application for copies should be addressed to American Society for Testing and Materials, 1416 Race Street, Philadelphia, PA 19103-1137.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

3.1 Dissociation. Dissociation is the process by which a chemical compound decomposes into the simpler components of the chemical compound.

For example:

$$2 \text{ Volumes } NH_3 + \text{Heat} \longrightarrow 1 \text{ Volume } N_2 + 3 \text{ Volumes } H_2$$
(25% by volume) (75% by volume)

3.2 Continuous grain boundary nitride network. Continuous grain boundary nitride network is a continuous film of nitrides enveloping a grain.

3.3 Terms. Definitions of terms relating to heat treatment (gas nitriding) are covered in numerous documents. The most appropriate sources are those shown in SAE-J415, ASTM-E44, and ASM Volume 1, 9th Edition.

4. GENERAL REQUIREMENTS

4.1 Equipment.

4.1.1 Nitriding furnace. The nitriding furnaces shall consist of suitable furnaces equipped with sealed retorts to contain the gaseous atmosphere and suitable devices to adequately maintain control of the dissociated ammonia. The nitriding furnace shall be capable of heating all parts of the nitriding load uniformly within a tolerance of ±10 degree Centigrade (°C) and producing a nitrided case of uniform depth and nitrogen content to all parts of the load. The furnace shall provide means for adequate circulation of furnace and retort atmospheres at all times. The furnace shall be capable of meeting the requirements of MIL-H-6875 and shall be equipped with a suitable protective atmosphere to inhibit the oxidation of copper plated parts.

4.1.2 Dissociator. The dissociator shall be capable of producing high ammonia dissociations at reasonable flow rates. Ammonia dissociation measurement shall be controlled to an accuracy of 3 percent (1% cannot be maintained).

4.1.3 Temperature controls. All nitriding and heat treatment furnaces shall be equipped with automatic indicating and recording controllers. Thermocouples shall be covered with suitable protective tubes.

4.1.4 Abrasive blast cleaning equipment. An air pressure source providing an air pressure of 140 to 210 kPa shall be required for dry abrasive blasting operations.

4.1.5 Fixtures. Fixtures shall be of suitable design to support parts and minimize distortion. Materials selected for fabrication of fixtures shall be capable of withstanding cyclic conditions of gas nitriding process. Typical alloys selected are type 330 Inconnel or 35-15 cast alloy.

4.2 Materials.

4.2.1 Forgings and barstock. Unless otherwise specified, all forgings to be processed shall be in the annealed condition as defined in the applicable material instruction sheet contained in MIL-STD-40002. All barstock delivered for processing shall be in the condition specified in the applicable material specification.

4.2.2 Test coupons or test samples. Test coupons shall be made of the same material and be in the same heat treated condition and shall have received the same surface preparation (see 4.4.b, c, d) as the nitrided parts which the test coupons represent. Simulated gear test coupons and test coupons for other parts which have nitrided surfaces adjoining each other to form an edge (e.g.; apex) shall be in accordance with figure 1. Test coupons for all other part configurations shall be in accordance with figure 2. Sufficient quantity of test samples or test parts shall be distributed within the load to represent nitriding conditions of the parts.

4.2.2.1 Sample material. Unless otherwise specified, samples shall be of the same material as the parts being processed.

4.2.2.2 Sample configuration. Unless otherwise specified, samples shall be approximately the same cross sectional area and shape of parts being processed.

4.2.3 White layer etching solution. The white layer etching solution shall be made fresh and used within 24 hours. The solution shall be prepared with 3 percent nital.

4.2.4 Copper stripping solution. The copper stripping solution shall be prepared at room temperature and shall consist of 1.8 kilogram of chromic acid (technical grade) and 141.7 grams of sulphuric acid (technical grade) to 3.78 liters of water.

4.2.5 Nital etch (2 percent). Nital etch ASTM-E407, #98 shall consist of 98 percent methyl alcohol (reagent grade) and 2 percent by volume of concentrated nitric acid (reagent grade).

4.2.6 Ferricyanide etch. The ferricyanide etch ASTM-E407, #98 shall be made fresh and used within 15 minutes at 52° to 65°C. The solution shall consist of 10 grams potassium ferricyanide (reagent grade) and 10 grams of potassium hydroxide (reagent grade) and sufficient water to make 100 ml of solution.

4.2.7 Dry abrasive. Aluminum oxide, Al_2O_3, 220 mesh shall be used for dry abrasive blasting operations.

4.3 Required procedures and operations.

4.3.1 Prenitride surface condition. Carburization, decarburization, or oxidation shall not be acceptable.

4.3.2 Nitride surfaces. Surfaces to be nitrided shall be as specified in the engineering drawing.

4.3.3 Case depth. Case depth shall be as specified in the engineering drawing. The maximum case depth range for gears may be exceeded by 0.076 meters (m) on the top land midway between the two-tooth profiles. The case depth range shall not apply to the radius between the top land and the tooth profile providing the gear tooth has acceptable dimensions. Other areas of the tooth shall meet the engineering drawing case depth requirements. Refer to figure 3 for tooth nomenclature.

4.3.4 Case and core hardness. Case and core hardness shall be as specified in the engineering drawing.

4.3.5 Identification control (serialized parts only). For purposes of traceability, permanent marking shall be performed at all stages of operation from receipt of raw material to completion of the finished part.

4.4 Preparatory machining and heat treatment:

a. Rough machining. Parts shall be rough machined from forgings and barstock (see 4.2.1).
b. Heat treatment. Rough machined parts shall be heat treated to the requirements of table I as defined in the applicable material instruction sheet contained in MIL-STD-40002.
c. Semifinish machining. Heat treated parts shall be semifinish machined to render parts free from carburization, decarburization, and oxidation.
d. Stress relief (optional). An optional stress relief may be given to parts to eliminate residual machining stresses and subsequent distortion during nitriding. Stress relief shall be to condition L5, MIL-STD-40002.
e. Finish machining. Parts shall be finish machined to engineering drawing dimensions leaving a stock allowance for final grinding operations. Stock allowance shall be in accordance with table II for the applicable range into which the maximum engineering drawing case depth dimension falls.

4.5 Surface preparation (pre-nitride).

4.5.1 Masking (selective nitriding). Part surfaces which are not to be nitrided shall be masked by copper plating in accordance with AMS 2418. The plate thickness shall be 0.025 to 0.050 millimeter (mm).

Note: When plating prior to machining is a practicable procedure, all part surfaces may be plated.

4.5.2 Cleaning.

4.5.2.1 Abrasive blast. Vapor degrease and abrasive blast with dry aluminum oxide (see 4.2.7).

4.5.2.2 Alternate phosphate treatment. Phosphate treatment shall be performed in accordance with AMS 2480 to activate the surface on areas requiring nitriding. Areas not responding to treatment indicates the presence of residual copper which must be removed prior to nitriding.

4.5.2.2.1 Liquid honing. The parts shall be prepared for phosphate treatment by liquid honing in accordance with MIPD-STD-6061 (skipping the requirement to slush in oil). Care shall be exercised not to erode copper plated surfaces during the liquid honing process.

Caution: Care shall be exercised to ensure all burnished areas (to be nitrided) resulting from polishing, lapping, or fine grinding (e.g. breakages) are treated in accordance with 4.5.2.2.1.

4.5.2.2.2 Phosphate treatment. Phosphate treatment shall be performed in accordance with AMS 2480 to activate the surface on areas requiring nitriding. Areas not responding to treatment indicates the presence of residual copper which must be removed prior to nitriding.

4.6 Nitriding. Nitriding shall be performed as follows:

a. Parts placement. Parts and samples (see 4.2.2) to be nitrided shall be placed in the furnace in such a manner that the nitriding medium shall have free access to all areas to be nitrided.
b. Air displacement. All air in the nitriding container shall have been displaced by ammonia prior to heating the parts over 204°C. An air-free atmosphere shall be maintained during the nitriding period, and during cooling to below 204°C.
c. Nitride cycle. It shall be the responsibility of the contractor to designate the proper nitriding process (single or double (flow) stage) and desired total case depth for the applicable material. Although table III shows the double stage process recommended for the three aluminum bearing steels specified therein, the nitriding processor could, unless otherwise instructed, proceed to use the single stage process. The two remaining alloy steels AMS 6322, and AMS 6415 shall be single stage processed to the required case depth, unless other-wise specified.

Note: The time required to go from the first stage to the second stage temperature shall not be counted as time for either stage.

4.7 Copper stripping. Copper plate shall be stripped from parts by immersing in copper stripping solution (see 4.2.4) and rinsing thoroughly in water.

Note: Stripping shall never be performed by reversing the current in the copper plating bath nor shall a periodic reverse cleaner or acid pickle be used after the nitriding operation.

4.8 Bake. All parts shall be baked at 190° ± 14°C for 2 hours as soon as possible after stripping.

4.9 White nitride layer removal. White layer shall be evenly removed from the nitrided surfaces by abrasive blasting or other approved means. The process shall have sufficient control to produce a smooth surface with uniform white layer removal. When subsequent machining will remove all of the white nitride layer, the parts need not be abrasive blasted.

4.10 Final (grinding) machining. Parts shall be final ground to engineering drawing dimensions.

Note: Total stock removal from nitrided surfaces, including white nitride layer removal (see 4.9), shall not exceed the stock allowance specified in 4.4.e.

4.11 Stress relief. Immediately after final machining, parts may be stress relieved by heating to 190° ± 14°C, holding for 2 hours, and followed by air cooling.

4.12 Black oxide. When specified in the engineering drawing, black oxide treatment shall be done in accordance with the requirements of AMS 2485.

Caution: Unless otherwise approved by the acquisition activity, when black oxide is reworked, the black oxide shall only be stripped by mechanical methods.

4.13 Responsibility for inspection. The contractor is responsible to conduct complete and sufficient inspection to ensure:

a. Compliance with all of the requirements in this standard.
b. That adequate traceability exists for the Government to verify that the requirements of this standard have been met.
c. That the manufacturing facility/supplier has the capability to nitriding the item in conformance with the process procedures/techniques of this standard.

5. DETAILED REQUIREMENTS

5.1 Approvals. Sources, materials, equipment facilities, and any changes shall be subject to approval by the acquisition activity. Each facility shall require separate approval for any given configuration.

5.1.1 Production in process control. The contractor shall ensure that the nitriding supplier is supplying material that is nitrided in accordance with this standard and the applicable engineering drawing. Evidence of such compliance shall be based on the following criteria:

a. Correlation of part number and serial number to the original material lot number, material heat number and nitriding load number.
b. Heat treating and nitriding supplier.
c. Case depth.
d. Case and core hardness.
e. Case and core microstructure.

5.2 Standardization and monitoring of equipment.

5.2.1 Furnace load temperature. Furnace load temperature shall be checked by inserting a calibrated thermocouple within 76.20 mm of the control thermocouple and comparing temperatures to that of the controlling and recording pyrometers. Care shall be exercised to prevent the leakage of gas from the furnace during the test. Checks shall be made at least once every 3 months at normal working temperatures with normal charges in the furnace.

5.2.2 Pyrometers. Pyrometers shall be checked at regular intervals by measuring the temperature (see AMS 2750) of the working thermocouple with a potentiometer of known accuracy.

5.2.3 Hardness testing facilities. The accuracy of test equipment used to determine the microhardness traverse and the case and core hardness shall be checked as often as necessary in accordance with ASTM E18 and ASTM E384 to ensure the equipment is operating properly and is calibrated as required.

5.3 Tests. The following tests shall be conducted on the test coupons submitted for the approval of each furnace load of nitrided parts.

5.3.1 Case depth (as-nitride). The case depth shall be measured by either of the two following methods. The micro-hardness survey method shall be used in case of any dispute.

5.3.1.1 Micro-hardness survey method. Test coupons or part shall be sectional in accordance with figure 5 and prepared for evaluation in accordance with ASTM E3. Hardness survey shall be conducted in accordance with ASTM E384 from surface to core using indentations. First impression shall be taken at 0.005 mm from the surface and progressing in increments of 0.10 mm until the case has been traversed. The case depth is the distance from the nitrided surface to the point where the maximum of the core hardness specified on the engineering drawing is obtained. Recommended load is 500 grams.

5.3.1.2 Chemical etch method. The surface of the applicable test coupon (prepared in accordance with 5.3.1.1) shall be etched in 2 percent nital etch (ASTM E407) solution see 4.2.5 for a time sufficient to reveal a microstructure. The case depth shall be determined by measuring the distance from the surface to the edge of the dark band (case material) in the location specified in figure 4 using a Brinell glass or equivalent.

5.3.2 General metallurgical structure. With the test slice etched in 2 percent nital etch solution as specified, the test slice shall be subjected to a micro-examination of the general metallurgical structure.

5.3.2.1 White nitride layer. The white nitride layer shall have a maximum depth of 0.0127 mm.

5.3.2.2 Case structure. The case structure shall be tempered martensite plus uniformly dispersed nitrides.

5.3.2.2.1 Continuous grain boundary nitride network. The remaining slice of the test coupon prepared in accordance with 5.3.1.1 (see ASTM E3) shall be immersed in ferricyanide solution (see 4.2.6) for approximately 15 minutes with occasional agitation. The test slice shall be examined to determine the presence of continuous grain boundary nitride network.

a. Continuous grain boundary nitride network is acceptable at the crest of the tooth to the distance D below the crest on simulated gear test coupons and at the corners of flat test coupons (see figure 4).
b. Continuous grain boundary nitride network is not acceptable in areas below the distance D for simulated gear test coupon or in areas more than 1.59 mm from a corner on flat test coupons (see figure 4). Isolated grains displaying this condition may be accepted provided not more than three such grains are visible in a 0.50 mm diameter field when viewed at 200 x mag. and not more than two such grains are adjacent to each other.

5.3.2.3 Core structure. The core structure shall be tempered martensite.

5.4 Test methods. The following tests shall be conducted on finished parts to verify conformance to the requirements of this standard and the applicable engineering drawing.

5.4.1 Hardness (case and core). Case and core hardness shall be determined to verify conformance to the engineering drawing requirements (see 5.4.4).

5.4.1.1 Hardness check. The location for taking hardness checks shall be as specified in the engineering drawing. Checks shall be made in locations not detrimental to part integrity when hardness check locations are not specified.

5.4.1.2 Hardness determination. Unless otherwise specified in the engineering drawing, Rockwell 30N shall be used to determine the case hardness. Rockwell HRA shall be used to determine core hardness. Rockwell HRC shall be used as a reference hardness and shall not be used to determine part conformance.

5.4.2 Imperfections and indications. Gears shall be magnetic particle inspected in accordance with MIL-STD-1949 to verify acceptance limits in M1PD-G-6920. All other part configurations shall be magnetic particle inspected in accordance with MIL-STD-1949 to verify the acceptance limits specified in other specifications related to the engineering drawing.

5.4.3 White nitride layer. Parts shall be prepared and inspected for presence of white nitride layer, as follows:

a. White layer etchant (see 4.2.3) shall be applied to all nitrided areas with a camel hair brush or by immersion for a period of 5 to 15 seconds.
b. The etchant shall be removed by washing with water.
c. All nitrided areas shall be examined for presence of white nitride layer. Surfaces free from white nitride layer shall react with the etchant to produce a smutty black surface.
d. Unless otherwise specified in the engineering drawing, there shall be no evidence of white layer except as follows (see 4.9).

(1) Class 1 gears. After abrasive blasting, traces of white layer shall be permissible only on the top land area excluding the radius between the top land area and the tooth profile.
(2) Class 2 and 3 gears. After abrasive blasting, traces of white layer shall be permissible only in the following areas:

(a) On the top land area excluding the radius between the top land area and the tooth profile.
(b) On the root fillet area provided the areas of the root fillet adjacent to the end faces are free from white layer for a distance equal to 10 percent of the tooth length.

(3) Splines. White layer shall be permissible on the unloaded tooth profile, top land area, and the root fillet areas.

e. Etching stain shall be removed by barrel finishing when specified in the engineering drawing.

5.4.4 Destructive analysis. When destructively evaluated for metallurgical parameters of nitrided case and core, finished parts shall conform to the applicable requirements specified herein.

5.5 Rework. Prior approval from the acquisition activity shall be obtained before performing any rework.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The procedures covered by this standard are intended to be used to ensure parts meet prescribed nitriding, machining and heat treatment requirements. Nitriding is intended for use where high surface hardness and high wear resistance is required on parts.

6.2 Issue of DODISS. When this standard is used in acquisition, the applicable issue of the DODISS must be cited in the solicitation (see 2.1.1 and 2.2).

6.3 Data requirements. Although this standard does not include any requirements for data, it does not exclude contractors from obtaining data from its suppliers as required to ensure compliance to this standard and to verify conformance to the applicable engineering drawings.

6.4 Supersession data. This standard supercedes Textron Lycoming specification P8031L, dated 12 May 1988 and MIL-STD-1876(AT), dated 29 April 1983.

6.5 Subject term (key word) listing.

Case depth
Case and core hardness
Case and core microstructure
Heat treating
Neutralizer
Nitriding
Surface preparation
Copper stripping
Quantity

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

TABLE I. Heat treat cycles prior to nitriding.

Material specification	Core hardness Rockwell HRA scale	Heat treatment required
AMS 6322	63.5-66.5	MIL-STD-40002 L234D
AMS 6415	63.5-66.5	MIL-STD-40002 L234D
AMS 6470	67.5-70.5	MIL-STD-40002 L234A
AMS 6471	67.5-70.5	MIL-STD-40002 L234A
AMS 6475	63.5-66.5*	MIL-STD-40002 L234

* Core hardness after nitriding is HRA 69.5-71.5

TABLE II. Nitrided case depth stock allowance.

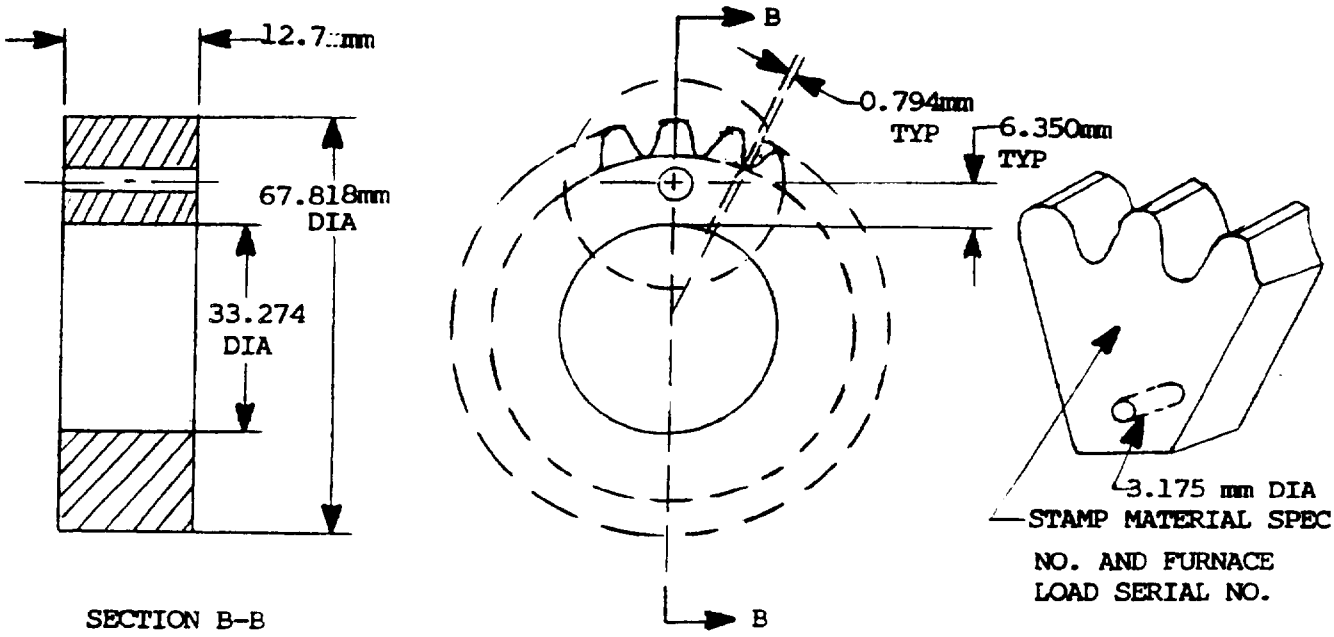
Diametral pitch	Case depth range (mm) (1)	Maximum grinding stock allowance (mm)
----	0.127 - 0.203	0.025
----	0.203 - 0.305	0.038
508 - 634.746	0.254 - 0.381	0.063
406.4 - 319.840	0.305 - 0.451	0.076
304.80 - 406.146	0.356 - 0.533	0.102
----	0.406 - 0.610	0.114
228.6 - 304.546	0.457 - 0.711	0.127

Note:

(1) The maximum case depth on unground splines (class 1 and 2) may exceed the table value by an amount equal to the maximum grinding stock allowance rounded to the nearest 0.XXX millimeter.

TABLE III. Double cycle processing for nitriding.

Material	As-Nitrided case depth (mm)	First stage (524°C ± 5.5)		Second stage (557°C ± 8.5)	
		Time (hours)	Percent dissociation	Time (hours)	Percent dissociation
AMS 6470, AMS 6471	0.152-0.203	6	20-35	-	--
	0.228-0.305	5	20-35	5	83-86
	0.305-0.381	5	20-35	20	83-86
	0.381-0.457	6	20-35	26	83-86
	0.457-0.533	6	20-35	36	83-86
	0.508-0.610	8	20-35	50	83-86
	0.559-0.711	8	20-35	60	83-86
AMS 6475	0.279-0.381	5	20-35	25	83-86



GEAR TOOTH DATA (FULL GEAR)

DIAMETRAL PITCH	304.8 mm STD DEPTH
NUMBER OF TEETH	30
PRESSURE ANGLE	20
PITCH DIAMETER	63.500 mm
MEASUREMENT OVER (3.657 mm DIA) WIRES	68.402 - 68.656
CIR. TOOTH THICKNESS OF 63.5 mm PD	3.324 BASIC

NOTE:

1. Full gear to be sectioned into segments consisting of 3 teeth each (ref detail A).
2. Material AMS 6470; Heat Treat per MIL-STD-40002: L234A.
3. Surface finish of surfaces marked with √ shall be finished to 1.6 micrometer (um).
4. Gear teeth to be as cut (grinding not required).
5. Break all edges 0.121 to 0.381 mm.

FIGURE 1. Simulated gear test coupon.

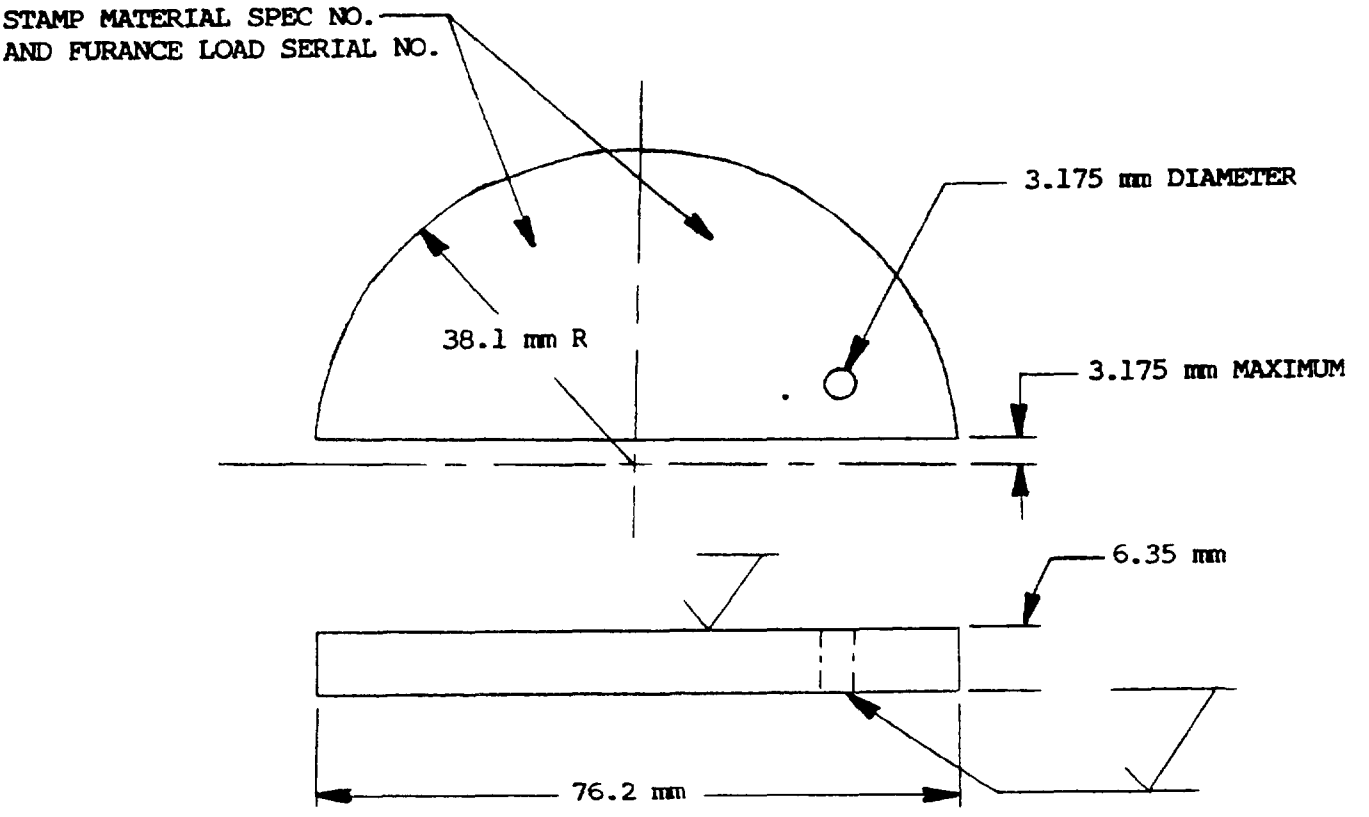


FIGURE 2. Flat test coupon.

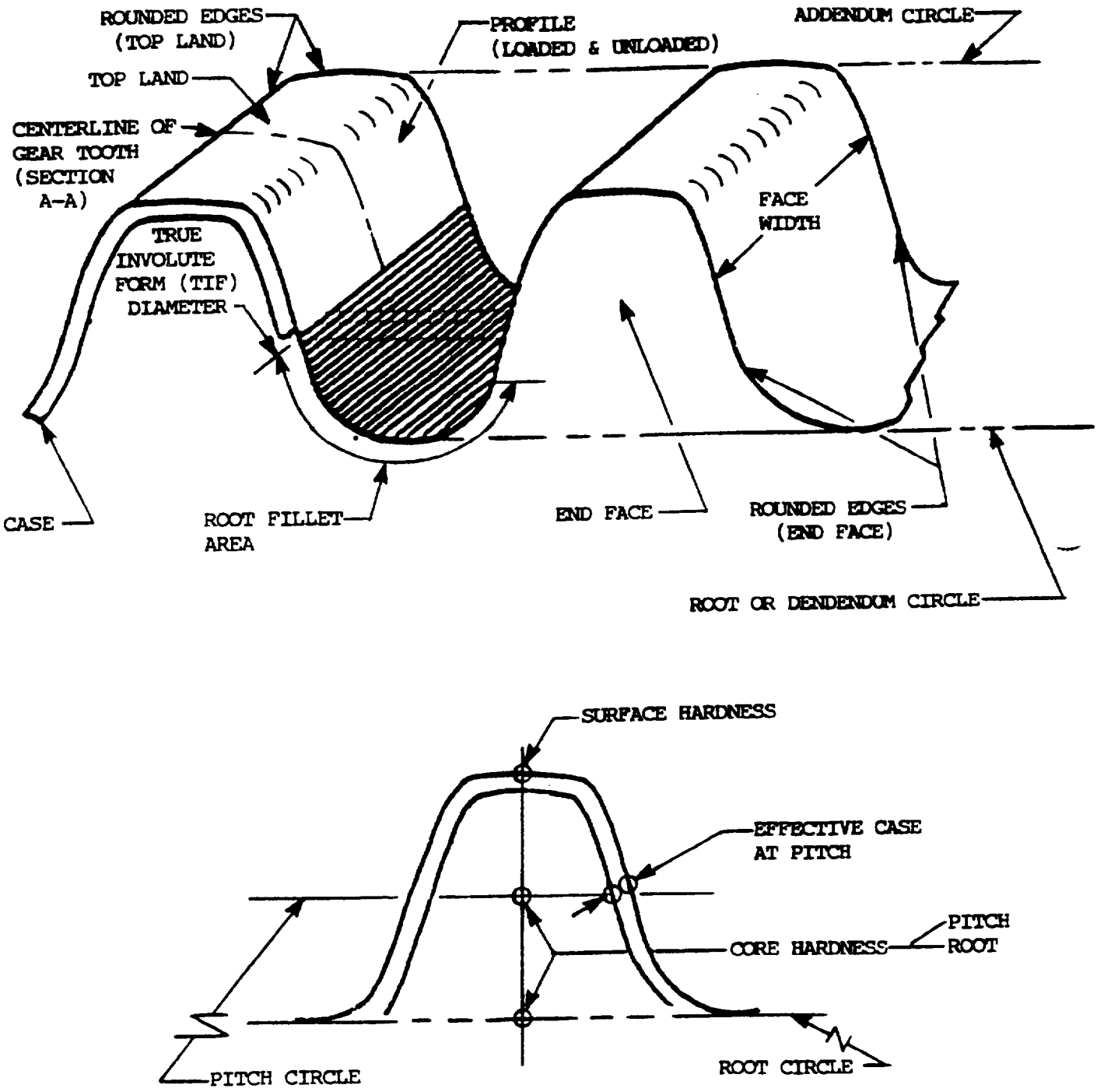
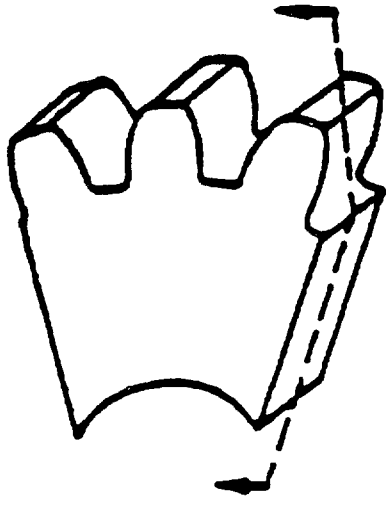
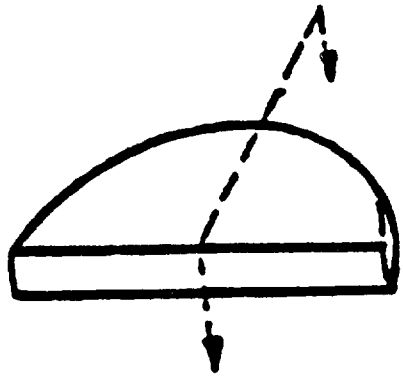


FIGURE 3. TOOTH NOMENCLATURE



SIMULATED GEAR COUPON PER FIGURE 2.

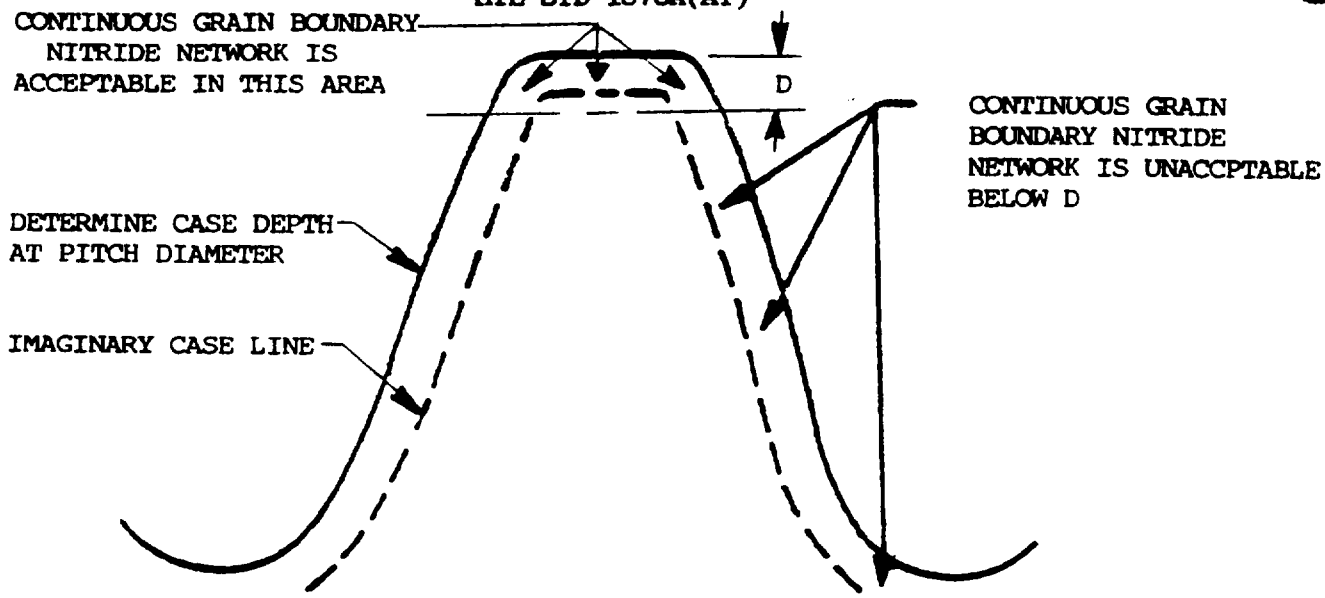
BISECT THE COUPON AT A PLANE PERPENDICULAR TO THE LINEAR TOOTH PROFILE.



FLAT TEST COUPON PER FIGURE 3.

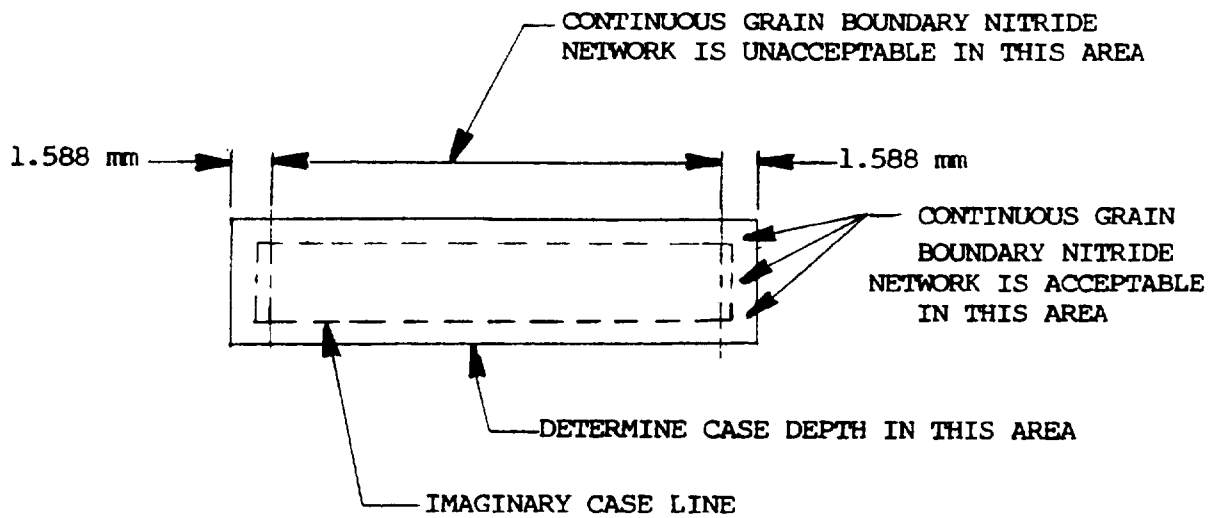
BISECT THE COUPON AT A PLANE PERPENDICULAR TO THE PARALLELED SURFACES.

FIGURE 4. Method of sectioning test coupons.



"D" = 1.3 TIMES ACTUAL CASE DEPTH

CROSS SECTION OF SIMULATED GEAR COUPON



CROSS SECTIONS OF FLAT TEST COUPON

FIGURE 5. Cross sections of test coupons for metallographic examination of grain boundary network acceptance criteria.

Custodian:
Army - AT

Preparing activity:
Army - AT

(Project MFFP-A480)

FOLD

U.S. ARMY TANK - AUTOMOTIVE COMMAND
ATTN: AMSTA-GDS
WARREN, MICHIGAN 48397-5000

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID

COMMANDER
U.S. ARMY TANK - AUTOMOTIVE COMMAND
ATTN: AMSTA-GDS
WARREN, MICHIGAN 48397-5000

FOLD

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS: This form is provided to solicit beneficial comments which may improve this document and enhance its use. DoD contractors, government activities, manufacturers, vendors, or other prospective users of the document are invited to submit comments to the government. Fold on lines on reverse side, staple in corner, and send to preparing activity. Attach any pertinent data which may be of use in improving this document. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity. A response will be provided to the submitter, when name and address is provided, within 30 days indicating that the 1426 was received and when any appropriate action on it will be completed.

NOTE: This form shall not be used to submit requests for waivers, deviations or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements. FSC MFFP

DOCUMENT IDENTIFIER *(Number)* AND TITLE MIL-STD-1876A(AT); Nitriding, Gaseous Atmosphere, Processing for

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

☐ VENDOR ☐ USER ☐ MANUFACTURER

1. ☐ HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? ☐ IS ANY PART OF IT TOO RIGID, RESTRICTIVE, LOOSE OR AMBIGUOUS? PLEASE EXPLAIN BELOW.

A. GIVE PARAGRAPH NUMBER AND WORDING

B. RECOMMENDED WORDING CHANGE

C. REASON FOR RECOMMENDED CHANGE(S)

2. REMARKS

SUBMITTED BY *(Printed or typed name and address — Optional)*

TELEPHONE NO.

DATE

DD FORM 1 OCT 76 1426 EDITION OF 1 JAN 72 WILL BE USED UNTIL EXHAUSTED.