

NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)		NUMBER: MPAPS A-52
		Former Designation: CEMS A-52
TITLE: Classification of Grinding Microstructural Alterations		CURRENT REV No.: 1512
		DATE: December 2015
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<i>This specification may involve hazardous materials, equipment, and procedures. This specification does not purport to address all of the safety issues associated with its use. The user is responsible to consult appropriate safety and health practices and to determine the applicability of regulatory limits prior to use.</i>		
Change Notice: Combined with CEMS A-52 appendix and updated to MPAPS format; editorial changes.		

1.0 APPLICATION

To satisfy final dimensional requirements after a heat treating process a final grinding operation is often required on components such as gears, bearings, and crankshafts. The grinding process can produce excessive localized surface heating if not done correctly. The excessive localized heating can cause surface tempering, grinding burns, re-hardening and cracking which can be detrimental to the part. The microstructural alterations resulting from the grinding process have been found to have a significant impact on the durability of the part.

2.0 SCOPE

This specification provides a means of specifying the surface metallurgical quality, as related to grinding temper of steel parts, primarily heat treated parts such as gears, bearings and crankshafts. It is intended to be used at the discretion of the design and materials engineers in applications acknowledged to be sensitive to material alterations resulting from grinding temper and should not be used indiscriminately for all ground parts. Reference section 7.0 (method of test) for evaluating this quality.

2.1 RESTRICTED CHEMICAL SUBSTANCES

Effective January 1, 2007, all product supplied to the requirements of this specification must comply with the requirements of the MPAPS B-50 specification.

3.0 REFERENCE DOCUMENTS

Unless otherwise specified, the latest issue of all referenced standards shall apply. The following Specifications, Standards, and Regulations are referenced in this specification.

Quality System Standard ISO 9001 or TS-16949	NAVISTAR MPAPS B-50	
CFR Title 29, Part 1910	ASTM E 709	
NAVISTAR Manufacturing Std. MS-D-13	ASTM E 165	
NAVISTAR Engineering Design Std A-16		

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DECEMBER 2015



Documents

Page 1 of 9
Document Sharing Hub

NUMBER: MPAPS A-52	TITLE: Classification of Grinding Microstructural Alterations	REVISION: 1512
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4.0 CLASSIFICATION

4.1 The surface metallurgical quality with respect to grinding temper of ground steel parts may be specified by classes per this standard. Classification of quality is based on the extent to which grinding temper is permitted.

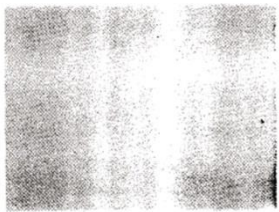
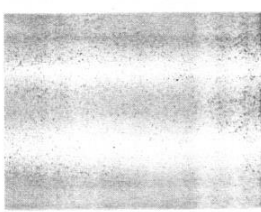
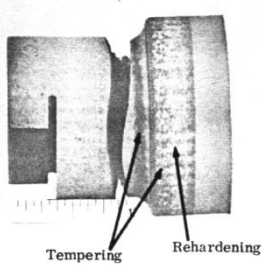
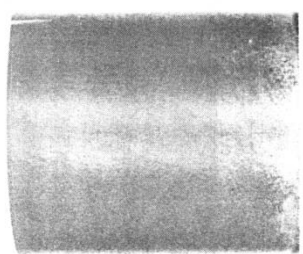
4.2 Table 1 lists several classes of grinding temper for specifying the extent permitted for an application. In specifying a selected class from Table I, the designated area of the part to which this class applies be clearly shown on the part drawing.

TABLE I
CLASSIFICATION OF METALLURGICAL QUALITY OF GROUND SURFACES*

CLASS	REFERENCE QUALITY**	Allowable Degree of Grinding Temper
A	Figure 1	No grinding temper permitted; uniform light gray color after etching.
B	Figure 2	Randomly distributed lightly tempered areas (slightly darker etching) not exceeding a total of 1% of the designated ground surface area with each indication being no more than 0.5 mm (0.02 inch) square.
C	Figure 2	Distributed tempered areas (darker gray to black etching), not exceeding a total of 10% of the designated ground surface area with each indication being no more than 3.2 mm (0.12 inch) square.
D	Figure 2	Tempered areas (dark etching) not exceeding 30% of the designated ground surface area.
E	Figure 3	Same as "D" except with randomly distributed rehardened areas (white etching) not exceeding a total of 5% of the designated ground surface area.

* Classification is based on visual appearance after the surface has been etched (see "Methods of Test" in MPAPS AT_4). In case of disagreement on classification of grinding temper between user and supplier, the plant metallurgist of the using International plant and/or the controlling design engineering department will have the final decision.

** Definitions of degree of temper are shown below in Figures 1 through 4.
The figures are not intended to depict any one class, but to illustrate the visual appearance of grinding temper.

Examples of Grinding Temper			
			
Figure 1 No Grinding Temper (Uniform Light Gray Color after Etching)	Figure 2 Randomly Distributed Tempering (Darker Etching Areas)	Figure 3 Tempering & Rehardening Rehardening (White Etching Areas) in combination with tempering (Darker Etching Areas).	Figure 4 Severe tempering, rehardening & cracking. NOT PERMITTED (shown as reference only)

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DECEMBER 2015



Documents

Page 2 of 9
Document Sharing Hub

NUMBER: MPAPS A-52	TITLE: Classification of Grinding Microstructural Alterations	REVISION: 1512
------------------------------	---	--------------------------

5.0 REQUIREMENTS

The surface quality of ground steel parts specified to this standard will meet the requirements of the class indicated on the design drawing or the parts will be subject to rejection.

6.0 QUALITY

Cracking due to grinding operations is not permitted and is unacceptable for all parts.

7.0 METHODS OF TEST

7.1 APPARATUS

7.1.1 CRACK INSPECTION

Apparatus per ASTM E709 or ASTM E165.

7.1.2 TEMPERING AND REHARDENING INSPECTION

Nitric acid, hydrochloric acid, distilled water, alcohol, acetone, cotton Swab for etching.

Sodium bicarbonate, ammonia, distilled water for neutralizing.

Microscope or magnifier capable of magnification up to 10X.

7.2 PROCEDURE

7.2.1 INSPECTION FOR CRACKING

7.2.1.1 Use Wet Magnetic Particle Inspection procedure per ASTM E709 or Liquid Penetrant Inspection procedure per ASTM E165.

7.2.2 INSPECTION FOR TEMPERING AND REHARDENING

7.2.2.1 Clean the sample/part to be inspected so it is free of dirt, oil, grease, finger marks, protective coatings, etc..

7.2.2.2 Etch the sample by immersing it for 15 seconds in a 4% solution (by volume) of nitric acid in distilled water or alcohol. Uniformly agitate the solution to avoid a spotty etching condition. If immersion is not convenient, etch with a cotton swab.

7.2.2.3 Rinse the sample in water (warm water preferable).

7.2.2.4 Rinse in acetone or alcohol.

7.2.2.5 Re-etch the sample by immersing it for 15 seconds in a 2% solution (by volume) of hydrochloric acid in acetone or alcohol. Uniformly agitate the solution to avoid a spotty etching condition. If immersion is not convenient, etch with a cotton swab.

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DECEMBER 2015



Documents

Page 3 of 9

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