

NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)		NUMBER: MPAPS E-7
		Former Designation: CEMS E-7
TITLE: Malleable Iron Castings		CURRENT REV No.: 1802
		DATE: Feb. 2018
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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>		

1.0 APPLICATION

Malleable iron castings provide good ductility and machinability. They are similar to nodular iron castings except that the graphite in malleable castings is present as temper carbon nodules.

2.0 SCOPE

This specification covers the Corporation's requirements for malleable iron castings.

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.

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4.0 REFERENCE DOCUMENTS

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

ISO 9001/TS 16949 – Quality Management Systems-- Requirements
 CFR Title 29, Part 1910 – Occupational Safety and Health Standard
 NAVISTAR D-13 – Supplier Packing and Shipping Standard

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NAVISTAR EDS-A16 – Key Control Characteristics (KCC)
 NAVISTAR EPS-143 – Brand Identity Standards
 NAVISTAR EPS-91 – Date Code
 NAVISTAR MPAPS B-50 – Restricted Chemical Substances
 SAE J158 Automotive Malleable Iron Castings
 ASTM A247 Standard Test Method for Evaluating the Microstructure of Graphite in Iron Castings
 ASTM A602 Standard Specification for Automotive Malleable Iron Castings
 ASTM E10 Standard Test Method for Brinell Hardness of Metallic Materials

5.0 CLASSIFICATION

Malleable iron grades are classified on the basis of strength and hardness.

6.0 GRADES AND REQUIREMENTS

Requirements for the grades defined in this specification cover castings of ferritic, pearlitic and tempered martensitic malleable iron. These requirements as shown in Table I are in close agreement with such National standards as SAE J158 and ASTM A602. Additional casting requirements or limitations such as chemical composition and tensile properties may be agreed upon by the purchaser and supplier. Typical properties are shown in the "Appendix - General Information" section. Any additional product requirements must appear on the casting drawing.

TABLE I - CASTING REQUIREMENTS

Designation			Condition	Casting Hardness, BHN
International grade	Obsolete grade	SAE J158 or ASTM A602		
M3210	32510 per E-7	M3210	ferritic	163 max
M4504	Type B per E-8	M4504	pearlitic-ferritic or tempered martensite	163-217
M5003	-	M5003		187-241
M6003	-	M5503	tempered martensite	187-241
Q & T	-	-		range as specified*

*See Appendix - General Information" for recommended ranges.

6.1 Property Requirements

Castings regarded as critical by engineering should be noted as such on the part drawing with the critical sections and required minimum properties clearly indicated. When specific tensile properties are required, they will be applicable to a standard test specimen machined from the casting at the section indicated. For hardness requirements at critical sections, alternate locations may be checked provided adequate correlation with the required areas has been established. It is the foundry's responsibility to meet all requirements on part drawings or to initiate negotiations with the purchasing plant and the controlling design engineering department to amend the requirements.

6.2 Microstructure All Grades

The graphite present will be in the form of nodules of temper carbon. The structure will be free from massive primary cementite and primary flake graphite. A total decarburized zone at the surface will not

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exceed 0.050 inch (1.27 mm). Oxidation and scale will be 0.002 inch (0.05 mm) maximum. No intergranular-oxidation is permitted.

6.3 Grade M3210

The matrix will be primarily ferrite with traces of pearlite allowed. A surface layer or rim containing some coarse pearlite may be present due to a reaction with the annealing furnace atmosphere. This rim or surface layer will not exceed 0.050 inch (1.27 mm).

6.4 Grades M4504 And M5003

For normalized castings or annealed alloy iron, the matrix will be primarily lamellar pearlite with small amounts of ferrite allowed. For liquid quenched and tempered castings, the matrix will be primarily tempered martensite. Surface decarburized layer (total + partial) max depth, is 0.045 inch (1.15 mm).

6.5 Grades M6003 And Q&T

The matrix will be essentially tempered martensite with a maximum of 10% other transformation products. Surface decarburized layer (total + partial) will not exceed 0.045 inch (1.15 mm) in depth.

6.6 Heat Treatment

Castings and accompanying test specimens for the appropriate grades will be heat treated as follows to produce the specified mechanical properties.

6.6.1 Grade M3210 - Annealed

6.6.2 Grades M4504 and M5003 - Normalized, interrupted annealed or liquid quenched and tempered or for alloyed irons, annealed.

6.6.3 Grades M6003 and Q&T - Liquid quenched and tempered.

6.6.4 Castings will be coined and straightened, if necessary. Reheat treatment is permissible.

7.0 QUALITY

Castings will be made to good commercial quality substantially free from defects which would be detrimental to subsequent processing or to the service for which the castings were designed. Machined surfaces and tapped holes will be free of casting defects. Gates, runners, risers, fins and other extraneous cast-on parts will be removed, unless otherwise agreed to by the using manufacturing plant.

Casting surfaces will be reasonably smooth, free of burned in sand and clean when inspected for the intended use. Castings will not be rusted or covered with any substance which would hide defects. Castings will not be painted unless specified.

7.1 With the exception of cosmetic repairs of obviously noncritical areas, repair welding is not permitted without prior approval by the controlling design engineering department.

8.0 METHODS OF TEST

8.1 Hardness Test

Measurements will be made at significant locations or indicated locations on castings after sufficient material has been removed from the casting surface to insure representative hardness reading.

The Brinell method of hardness testing in accordance with ASTM E 10 will be the standard hardness test.

8.2 Metallurgical Evaluation

Determination of graphite morphology will be in accordance with ASTM A 247.

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Note: Engineering Procedural Standards and Manufacturing Standards are available from Corporate Technical Standards,

9.0 SOURCE APPROVAL AND QUALITY CONTROL

9.1 Supplier Requirements

All suppliers to NAVISTAR are subject to the requirements defined in ISQ-001-QM- NAVISTAR Integrated Supplier Quality Requirements. Suppliers must be compliant with ISO 9001 or TS 16949 and fulfill all AIAG PPAP (Production Part Approval Process) documentation and all approval requirements as indicated in NAVISTAR ISQ-001-QM.

9.2 Approval

Parts supplied against contracts or purchase orders citing this specification shall be equivalent in all respects to those samples which were approved by the purchaser. No changes in formulation or processing practices are permitted without approval. In the event that changes in material, properties, processing practices, construction, color, or labeling of the product are required, the supplier shall notify NAVISTAR Integrated Supplier Quality (ISQ) of the proposed change(s) by contacting their Navistar Supplier Quality representative or sending an email to ISQ@navistar.com. Test data indicating conformance to all requirements of this specification, test samples, and new or amended or updated SDS Safety Data Sheet(s) (formerly MSDS) in accordance with CFR Title 29, Part 1910, shall be submitted with the request for change.

9.3 Process Control

The supplier shall either, perform and report results of tests on specific lots of parts produced using ISO 9001 or TS-16949 guidelines, or provide statistical evidence of the lot having been produced in a state of statistical control and with a process capable of providing all required properties. The part supplier and the quality control manager of the using NAVISTAR plant may determine testing and reporting requirements on specific products.

10.0 DESIGNATION ON DRAWINGS AND PURCHASE ORDERS

Material designation on drawings and purchase orders will show the NAVISTAR grade and other special requirements.

Examples: Malleable Iron, Grade M4504, MPAPS E-7
Malleable Iron, Grade Q&T, MPAPS E-7
Quench and Temper to BHN ___ to ___

10.1 Identification Of Castings

Castings will be identified by the foundry with the following information where possible:

10.1.1 NAVISTAR part number

10.1.2 NAVISTAR trademark shown in Engineering Procedural Standard EPS-143

10.1.3 Identification mark of the producing foundry.

10.1.4 The following letters will be used to identify the various grades:

BA = M3210
BN = M4504
BP = M5003
BT = M6003

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