

NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)		NUMBER: MPAPS A-43
		Former Designation: CEMS A-43
TITLE: High Strength Low Alloy (HSLA) Steel Plate/Bar		CURRENT REV. No.: 1801
		DATE: Jan. 2018
WRITTEN/REVIEWED BY: W. Cook	APPROVED BY: R. Goluch	SUPERSEDES: MPAPS A-43 - April 2014
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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

This specification applies to high strength low alloy (HSLA) steel products having 0.25inch (6.35mm) minimum thickness. This includes HSLA plate, flat bar, bar shapes (channels, angles, tees and zees), and structural shapes (shapes with dimensions over 3 inches are classified as structural shapes). Refer to MPAPS A-6, Part I, for HSLA sheet/strip under 0.25 in. (6.35mm) thick. HSLA steels are a class of hot rolled steel having higher mechanical properties than low carbon structural steels. They are generally alloyed with micro additions of niobium (Nb) (columbium), vanadium (V), titanium (Ti), nitrogen (N), or combination thereof, in conjunction with controlled rolling temperatures. The lower carbon content improves weldability

2.0 SCOPE

This Specification covers Navistar's HSLA steel classification system and general requirements for chemistry, mechanical properties. It also includes quality expectations and specifies methods of test.

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 standards, specifications and regulations are referenced in this specification.

Quality System Standard ISO-9001 or TS-16949

CFR Title 29, Part 1910

NAVISTAR Supplier Packing and Shipping Std. D-13

NAVISTAR MPAPS B-50: Restricted Chemical Substances

NAVISTAR MPAPS A-6 Part I: Low Carbon Steel, Flat Rolled and Structural Shapes

ASTM A6: Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

ASTM A370: Standard Test Methods and Definitions for Mechanical Testing of Steel Products

ASTM A572: Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

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ASTM A635: Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability,

ASTM A656: Standard Specification for Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability

ASTM A1018: Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

ASTM E208: Standard Test Method for Conducting Drop-Weight Test to Determine Nil-Ductility Transition Temperature of Ferritic Steels

ASTM E290: Standard Test Methods for Bend Testing of Material for Ductility

SAE J1392: Steel, High Strength, Hot Rolled Sheet and Strip, Cold Rolled Sheet, and Coated Sheet

AWS D1.1/D1.1M: Structural Welding Code – Steel

AWS D1.3/D1.3M: Structural Welding code - Sheet Steel

4.0 CLASSIFICATION

These steels are classified on the basis of yield strength. Suffix letters are used to denote killing practice or to indicate additional requirements affecting steel cleanliness, grain size, and/or inclusion control.

5.0 GENERAL REQUIREMENTS

5.1 Chemical Composition

Product supplied to this specification will meet the chemical requirements as given in Table 1 for the specified Navistar type. The choice of alloys and limits, other than those specified in Table 1, which are necessary to produce the required mechanical properties, will be subject to agreement between the supplier and the Plant Quality Control Manager.

5.2 Mechanical Properties

Required mechanical properties, unless otherwise specified, will be as shown in Table 2.

5.2.1 Impact Test Requirements (Types 50A and 50R Only)

Types 50A and 50R steel will meet the specified impact test requirements. See “Methods of Test,” Section 8.0.

5.2.1.1 Charpy V-Notch

The requirements for standard and sub-size Charpy V-Notch specimens are shown in Table 3. The standard size specimen will be used except where the section thickness does not permit machining a 10mm specimen. In such cases, sub-size specimens as listed will be used. The sub-size specimen selected will be as large as the particular section thickness permits.

5.2.1.2 Nil Ductility Transition Temperature (NDTT) – Optional Method

Type 50R will have a maximum nil ductility transition temperature (NDTT) of -30°F (-35°C) and for Type 50A, -10°F (-23°C). This requirement may be used in lieu of the Charpy V-Notch impact requirement for material with section thickness of 0.625 inch (16.0 mm) and greater.

5.2.2 Bending Requirements

MPAPS A-43 Appendix provides recommendations for minimum cold bend radii for the various types of materials covered in this specification. If specific formability or bending requirements are needed for a given design, those requirements should be specified on the engineering drawing.

5.3 Material Thickness and Dimensional Tolerances

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The nominal values for preferred thickness and associated tolerances for plate products are shown in Table 4. Preferred thickness should be used in all designs and specified on engineering drawings. The tolerances for “soft metric conversion” design (Table 4A) are not the same as the tolerances shown herein for “hard metric” design (Table 4B). The tolerances for each design practice are different and they should not be interchanged. The dimensional tolerances of the basic/general ASTM specification applicable to the type of product will apply unless otherwise specified.

5.4 Welding Grades

For parts to be structurally welded per AWS D1.1/D1.1M or D1.3/D1.3M, the recommended ASTM Grades listed in Table 1 should be ordered to satisfy following Navistar types: 42X, 45X, 50X, 60X, 65X and 70X. All other Navistar Types and the commercially available grades of steels recommended, if welded, must be qualified per Clause 4 in AWS D1.1/D1.1M or D1.3/D1.3M.

6.0 QUALITY

All product supplied shall be of uniform composition and will be free of defects harmful to fabrication or performance of parts. Products covered by this specification will meet the more general requirements of ASTM A635 or ASTM A6, as applicable.

7.0 METHODS OF TEST

7.1 Tensile Properties

Test according to ASTM A370. Machined surfaces of test specimens will have a roughness not greater than that produced by finish milling [63 microinches (1.6 µm) AA, maximum].

7.2 Impact Properties

7.2.1 Charpy V-Notch: Test according to ASTM A370.

7.2.2 Nil Ductility Transition Temperature: Test in accordance with ASTM E 208.

7.3 Bending Properties

Test according to ASTM E 290.

8.0 SOURCE APPROVAL AND QUALITY CONTROL

8.1 Supplier Requirements

All suppliers to NAVISTAR are required to be registered to ISO 9001 Quality System Requirements. NAVISTAR will also accept TS-16949 registration as long as the supplier can also fulfill all AIAG PPAP (Production Part Approval Process) documentation and approval requirements. Suppliers must maintain their certification with an accredited registrar and must furnish copies of registration certificates to their Corporate Buyer upon request.

8.2 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 Materials Engineering and Purchasing and Supplier Development of the proposed change(s). Test data indicating conformance to all requirements of this specification, test samples, and new or amended or updated Material Safety Data Sheet(s) (MSDS), in accordance with CFR Title 29, Part 1910 shall be submitted with the request for change.

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8.3 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.

9.0 DESIGNATION ON DRAWINGS AND PURCHASE ORDERS

Material designation on engineering drawings will consist of the NAVISTAR Type designation and reference this specification. For example,

Steel, Type 42X, MPAPS A-43

Steel, Type 80F, MPAPS A-43

10.0 PACKAGING AND SHIPPING

Packing and shipping will be in accordance with Navistar Supplier Packing and Shipping standard D-13.

11.0 TECHNICAL INFORMATION

For further information related to the technical content of this specification, contact:	Suppliers may purchase controlled copies of this specification by contacting:
Materials Engineering and Technology Dept. 10400 W. North Ave. Melrose Park, IL 60160 E-mail: MaterialsEngineering@Navistar.com	IHS Markit Inc. 15 Inverness Way East Englewood CO 80112-5776 Phone: 1-800-854-7179 E-mail: Automotive@IHS.com Website: http://global.ihs.com

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TABLE 1. CHEMICAL REQUIREMENTS (HEAT ANALYSIS)

NAVISTAR Type	Recommended equivalent ASTM designation†	% C (max)	% Mn (max)	% P (max)	% S (max)	% Si (max)	Description
42X	A572 Gr 42	0.21	1.35	0.04	0.05	0.40*	Killed or semi killed; may be treated with Cb/Nb, V, or N, or combination thereof.
45X	A1018 Gr 45	0.15	1.50	0.04	0.04	--	
50X	A572 Gr 50	0.23	1.35	0.04	0.05	0.40*	
60X	A572 Gr 60	0.26	1.35	0.04	0.05	0.40	
65X	A 572 Gr 65	0.23	1.65	0.04	0.05	0.40	
70X	A1018 Gr 70	0.15	1.65	0.04	0.04	--	
50A** 50R**		0.23	1.50	0.04	0.05	0.90	Fully killed only, fine grain, may be treated with Cb/Nb, V, N, or other alloying elements
50F 60F 70F 80F	A656, Gr 50 A656, Gr 60 A656, Gr 70 A656, Gr 80	0.18	1.65	0.025	0.035	0.60	Fully killed, improved formability, inclusion controlled, fine ferritic grain size, treated with A1, Cb/Nb, V, Ti, N or combination thereof.
90XF 100XF 110XF	A1018, Gr 90 A1018, Gr 100	0.15 0.15 0.12	2.00 2.00 2.10	0.020 0.020 0.025	0.025 0.025 0.010	0.60	Ultra-high strength steels – fully killed, fine grain practice, microalloyed with Cb/Nb, Ti, V, Mo, etc.

* Applies to plates up to 1.5 in thick, shapes having leg/flange thickness to 3 in, and all bar and bar shapes; for plates over 1.5 in thick and shapes over 3 in bars, silicon range can be 0.15-0.40%.

** See footnote 2 in Table 2 below.

† May also refer to SAE J1392 for requirements of HSLA grades.

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