

NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)		NUMBER: MPAPS A-0 PART I
		Former Designation: CEMS A-0 PART I, SEC. A
TITLE: Chemical Composition of Standard Steels – Part I	CURRENT REV. No.: 1606	DATE: June 2016
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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

SAE wrought steels in general use by the Corporation when specified as raw materials for manufactured parts, including forged products. MPAPS A-0 consists of three major sections:

- Part I – Chemical Composition of Standard Steels
- Part II – System of Steel Classification for Standard Steels
- Part III – Classification System for Heat Treated Steels

2.0 SCOPE

This specification describes requirements for chemical composition of common wrought steel grades, including residual element restrictions, and steel quality and cleanliness requirements. ***Ferrous castings are not to be considered an acceptable alternate for steel specified to this specification. If ferrous cast products are desired, they must be specified as such on the drawing per the applicable casting specification (refer to MPAPS/CEMS Section E for cast product specifications, such as steel castings, ductile iron, gray iron, etc.).***

Requirements for specific types of wrought steel products such as bar, structural shapes, sheet/strip/plate, and tubing, are shown in the individual Navistar specifications, examples of which are shown below:

Low Carbon Steel and HSLA Flat Rolled Products up to ¼ in. thick	MPAPS A-6
Steel Wire	MPAPS A-8
Steel Spring Wire	MPAPS A-9
Mechanical Steel Tubing	MPAPS A-10
High Strength Low Alloy Steel (HSLA) (over ¼ in. thick)	MPAPS A-43
Heat Treated Constructional Steels	MPAPS A-44
Welded and Seamless Steel Pipe	MPAPS A-18
Automotive Steel Tubing	MPAPS A-45
Stainless/Heat Resistant Steels and Finish Requirements	MPAPS A-37

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2.1 NOTE: 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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CARBON STEELS FOR STRUCTURAL SHAPES, PLATE, SHEET AND STRIP

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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.

Quality System Standard ISO 9001 or TS-16949	CFR Title 29, Part 1910	ASTM A 751
NAVISTAR Manufacturing Standard MS-D-13	ASTM A 29	SAE J1081
NAVISTAR MPAPS B-50	ASTM E 45	SAE J1249
NAVISTAR MPAPS AT-2	ASTM E 112	SAE J422
NAVISTAR MPAPS A-6	ASTM A 568	SAE J421
ASTM A 534	SAE J1268	SAE J403
ASTM A 295	SAE J437a	SAE J404

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SAE J438b

5.0 GENERAL NOTES APPLICABLE TO COMPOSITION

5.1 Restrictive Requirement Quality

Restriction of one specified element to a chemistry range closer than the standard range is obtainable at an extra cost. Restriction of more than one element is subject to negotiation with the steel producer.

5.2 Residual Elements

Small quantities of certain elements, which are not specified or required, are present in steel. These elements are considered as incidental or residual.

5.2.1 Alloy Steels: Unless otherwise specified, the following maximum limits on residual elements are permissible for all alloy steels. Ni 0.25%, Cr 0.20%, Mo 0.06%, Cu 0.35%.

5.2.2 Carbon Steels: Max limits on residual elements are not applicable to carbon steels except as follows:

5.2.2.1 When special restrictions on residual elements are needed for end use, they must be negotiated with the steel producer.

5.2.2.2 When restrictive requirement quality steel is ordered, the following maximum limits on residual elements are permissible for carbon steels: Ni 0.10%, Cr 0.07%, Mo 0.04%, Cu 0.10%.

5.3 Silicon Content

Unless otherwise specified, maximum silicon content will be 0.35%. When silicon is required, the following ranges and limits are commonly used: 0.10% max, 0.07-0.15%, 0.10-0.20%, 0.15-0.35, 0.20-0.40%, 0.30-0.60%. When the end use requires a coarse grain steel, a maximum silicon content of 0.10%, or range of 0.10-0.20% should be specified.

5.4 Aluminum Content

Unless otherwise specified, aluminum-killed fine grain steel will contain min 0.02% Al.

5.5 Sulfur Content

Unless otherwise specified, maximum sulfur content will be 0.05% for all carbon steels and 0.04% for all alloy steels. Where special steel cleanliness is required, lower sulfur contents may be negotiated with the steel supplier. Minimum sulfur content aims will be 0.015% for steels with less than 0.30% nominal carbon and 0.02% for steels with 0.30% and over nominal carbon. When special practice requiring low sulfur additions are specified, the sulfur content range will be 0.04-0.07%. These limitations are not applicable to conventional resulfurized steels.

5.6 Phosphorus Content

Unless otherwise specified, maximum phosphorus content will be 0.035% for all carbon steels and 0.03% for all alloy steels.

5.7 “E” Electric Furnace Steel Practice

This steel practice may be specified for any standard alloy steel grade by using the prefix letter “E” with the SAE alloy designation or the suffix (6) in the UNS system. The use of this special steel practice generally involves an extra cost. Phosphorus and sulfur content each will be 0.025% maximum when the practice is specified.

5.8 “H” Steels

These are steels made to guaranteed hardenability specifications. The permissible variation in content of individual elements is greater than that of the standard steels specified by chemical composition only. However, closer control of the total content of all hardening elements, including residual elements (and boron content), is required to assure that any given heat of steel will be within the hardenability limits

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specified for that steel grade. All “H” steels covered herein will be made to fine grain practice (SAE J1268).

5.9 Austenitic Grain Size

Austenitic grain size will be 5 or finer as determined by McQuaid-Ehn, MPAPS Test Method AT-2 or other suitable tests. Occasional grains as large as 3 are permissible. In the event of controversy, the McQuaid-Ehn test per ASTM E 112, Appendix III, will be the referee method.

6.0 CLASSIFICATION BY CHEMICAL COMPOSITION

6.1 CARBON STEELS FOR BARS, RODS, WIRE, AND SEMIFINISHED PRODUCTS

6.1.1 GROUP 1 –CARBON STEEL

Designation		Chemical Composition (%)*		Designation		Chemical Composition, (%)*	
UNS No.	SAE J403	Carbon	Manganese	UNS No.	SAE J403	Carbon	Manganese
G10060	1006	0.08 max	0.25-0.40	G10400	1040	0.37-0.44	0.60-0.90
G10080	1008	0.10 max	0.30-0.50	G10420	1042	0.40-0.47	0.60-0.90
G10090	1009	0.15 max	0.60 max	G10430	1043	0.40-0.47	0.70-1.00
G10100	1010	0.08-0.13	0.30-0.60	G10440	1044	0.43-0.50	0.30-0.60
G10120	1012	0.10-0.15	0.30-0.60	G10450	1045**	0.43-0.50	0.60-0.90
G10130	1013	0.11-0.16	0.30-0.60	G10460	1046	0.43-0.50	0.70-1.00
G10150	1015	0.13-0.18	0.30-0.60	G10490	1049	0.46-0.53	0.60-0.90
G10160	1016	0.13-0.18	0.60-0.90	G10500	1050	0.48-0.55	0.60-0.90
G10170	1017	0.15-0.20	0.30-0.60	G10530	1053	0.48-0.55	0.70-1.00
G10180	1018	0.15-0.20	0.60-0.90	G10550	1055	0.50-0.60	0.60-0.90
G10200	1020	0.18-0.23	0.30-0.60	G10600	1060	0.55-0.65	0.60-0.90
G10210	1021	0.18-0.23	0.60-0.90	G10650	1065	0.60-0.70	0.60-0.90
G10220	1022	0.18-0.23	0.70-1.00	G10700	1070	0.65-0.75	0.60-0.90
G10230	1023	0.20-0.25	0.30-0.60	G10740	1074	0.70-0.80	0.50-0.80
G10250	1025	0.22-0.28	0.30-0.60	G10750	1075	0.70-0.80	0.40-0.70
G10260	1026	0.22-0.28	0.60-0.90	G10780	1078	0.72-0.85	0.30-0.60
G10290	1029	0.25-0.31	0.60-0.90	G10800	1080	0.75-0.88	0.60-0.90
G10300	1030	0.28-0.34	0.60-0.90	G10840	1084	0.80-0.93	0.60-0.90
G10330	1033	0.30-0.36	0.70-1.00	G10850	1085	0.80-0.93	0.70-1.00
G10350	1035	0.32-0.38	0.60-0.90	G10860	1086	0.80-0.93	0.30-0.50
G10370	1037	0.32-0.38	0.70-1.00	G10900	1090	0.85-0.98	0.60-0.90
G10380	1038**	0.35-0.42	0.60-0.90	G10950	1095	0.90-1.03	0.30-0.50
G10390	1039	0.37-0.44	0.70-1.00				

* See General Notes, page 3. Where no silicon is specified, a semikilled rimmed, or capped steel may be supplied at the producer's option. Where a rimmed or capped steel is desired, it should be shown on the order and will require special quality.

** Can be specified as an “H” steel by adding the suffix “H” to the SAE designation or replacing the prefix “G” with an “H” in the UNS designation. See SAE J1268 for requirements.

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6.1.2 GROUP 2 – HIGH MANGANESE CARBON STEEL

Designation		Chemical Composition, %*	
UNS No.	SAE J403	Carbon	Manganese
G15150	1515	0.13-0.18	1.10-1.40
G15210	1521	0.18-0.23	1.10-1.40
G15220	1522 **	0.18-0.24	1.10-1.40
G15240	1524 **	0.19-0.25	1.35-1.65
G15260	1526 **	0.22-0.29	1.10-1.40
G15270	1527	0.22-0.29	1.20-1.50
G15360	1536	0.30-0.37	1.20-1.50
G15410	1541 **	0.36-0.44	1.35-1.65
G15470	1547	0.43-0.51	1.35-1.65
G15480	1548	0.44-0.52	1.10-1.40
G15520	1552	0.47-0.55	1.20-1.50
G15660	1566	0.60-0.71	0.85-1.15

* See General Notes, page 3.

** Can be specified as an “H” steel by adding the suffix “H” to the SAE designation or replacing the prefix “G” with an “H” in the UNS designation. Refer to SAE J1268 for requirements.

6.1.3 GROUP 3 - HIGH MANGANESE BORON CARBON STEEL

Designation			Chemical Composition, %*			
UNS No.	SAE J1268	Navistar Special	Carbon	Manganese	Silicon	Boron
H15211	15B21H	-	0.17-0.24	0.70-1.20	0.15-0.35	0.0005-0.003
H15281	15B28H	-	0.25-0.34	1.00-1.50	0.15-0.35	0.0005-0.003
H15301	15B30H	-	0.24-0.35	0.70-1.20	0.15-0.35	0.0005-0.003
H15351	15B35H	-	0.31-0.39	0.70-1.20	0.15-0.35	0.0005-0.003
H15371	15B37H	-	0.30-0.39	1.00-1.50	0.15-0.35	0.0005-0.003
H15411	15B41H	-	0.35-0.45	1.25-1.75	0.15-0.35	0.0005-0.003
H15481	15B48H	-	0.43-0.53	1.00-1.50	0.15-0.35	0.0005-0.003
H15621	15B62H	-	0.54-0.67	1.00-1.50	0.40-0.60	0.0005-0.003

* See General Notes, page 3.

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