

NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)		NUMBER: MPAPS S-C-1.101-GS/PL
		Former Designation: ESP-C-1.101-GS
TITLE: Machine Screws – English Series (Noun Code 7450)		CURRENT REV No.: 1506
		DATE: June 2015
WRITTEN/EDITED BY: Materials Engineering	APPROVED BY: Materials Engineering	SUPERSEDES: ESP-C-1.101-GS - May 2007
PRINTED COPIES OF THIS DOCUMENT MUST BE VERIFIED FOR CURRENT REVISION		
<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: Changed to New MPAPS format; Combined GS, PP, NPP, NR.		

- 1.0 GENERAL:** This standard conforms essentially with the American National Standard B-18.6.3 for various types of slotted and recessed head machine screws.
Truss Head, Round Head and Binding Head Machine Screws are not approved for new design and should be replaced in new design by Pan Head Machine Screws.
- 2.0 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 CONTENTS:**

	Page
General	1
Restricted Chemical Substances	1
Policy for Selecting Parts for New Design	2
Service Parts Substitution Policy	2
Bearing Surface	3
Eccentricity	3
Head Height	3
Protrusion of Head	3
Slot Depth	4
Depth of Recess	4
Length	4
Threads	4
Length of Thread	4
Diameter of Body	5
Material	5
Finishes	5
Short Length Screws	5
Points	6
Workmanship	6

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JUNE 2015



Documents

Page 1 of 17
Document Sharing Hub

NUMBER: MPAPS S-C-1.101- GS/PL	TITLE: Machine Screws	REVISION: 1506
---	--	---------------------------------

Flat Head Cross Recess Machine Screws	7
Flat Head Slotted Machine Screws	8
Oval Head Cross Recess Machine Screws	9
Oval Head Slotted Machine Screws	10
Pan Head Cross Recess Machine Screws	11
Pan Head Slotted Machine Screws	12
Fillister Head Cross Recess Machine Screws	13
Round Head Slotted Machine Screws	14
Hexagon Head Machine Screws	16
Technical Information	17

4.0 POLICY FOR SELECTING PARTS FOR NEW DESIGN: Approved parts are so designated to reduce variety of parts and assure maximum availability, interchangeability and cost savings in volume buying.

For new design, parts shall be selected from "Approved" part list only.

Head Types:	Flat, Oval, Pan, Hex
Drive:	Cross Recess, ANSI Type 1, (Phillips), and Hex
Diameters:	6, 8, 10, 1/4, 5/16, 3/8
Threads:	Coarse
Finishes:	Zinc with Chromate (ZND), Phosphate Coated (PHC)
Lengths:	As shown below:

Dimensions in inches:		Nominal Size				
Length	6	8	10	1/4	5/16	3/8
1/8						
1/4						
3/8						
1/2						
5/8						
3/4						
7/8						
1						
1-1/4						
1-1/2						
1-3/4						
2						
2-1/4						
2-1/2						
3						

PREFERRED PARTS

Length

Preferred Sizes

Up to 1 Inch

1/8 Inch Increments

Over 1 Inch to 2-1/2 Inches

1/4 Inch Increments

Over 2-1/2 Inches to 3 Inches

1/2 Inch Increments

5.0 SERVICE PARTS SUBSTITUTION POLICY: In the event that engineering does not indicate a "Do not substitute" in engineering specifications, the following substitutions may be implemented in service. This policy is the result of a proposal circulated April 20, 1981, and subsequently approved by engineering departments worldwide.

5.1 Flat Head Machine Screws

To Be Replaced	Service Replacement
Slotted or Cross Recess, plain (PLN) finish	Zinc with chromate (ZN6A) cross recess or (ZN6A) slotted (if cross recess is not set up for service.
Slotted, phosphate coated (PHC) finish	Cross Recess, phosphate coated (PHC) finish
Slotted, zinc with chromate (ZN6A) finish	Cross Recess, zinc with chromate (ZN6A) finish

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JUNE 2015

NUMBER: MPAPS S-C-1.101- GS/PL	TITLE: Machine Screws	REVISION: 1506
---	--	---------------------------------

5.2 Pan Head Machine Screws

To Be Replaced	Service Replacement
Slotted or Cross Recess, plain (PLN) finish	Zinc with chromate (ZN6A) cross recess or (ZN6A) slotted (if cross recess is not set up for service.
Slotted, phosphate coated (PHC) finish	Cross Recess, phosphate coated (PHC) finish
Slotted, zinc with chromate (ZN6A) finish	Cross Recess, zinc with chromate (ZN6A) finish

5.3 Fillister Head Machine Screws

To Be Replaced	Service Replacement
Slotted or Cross Recess, plain (PLN) finish	Zinc with chromate (ZN6A) cross recess or (ZN6A) slotted (if cross recess is not set up for service.
Slotted, zinc with chromate (ZN6A) finish	Cross Recess, zinc with chromate (ZN6A) finish

5.4 Round Head Machine Screws

To Be Replaced	Service Replacement
Slotted, plain finish	Pan head, cross recess, zinc dichromate (ZN6A) finish or slotted (if cross recess is not set up for service).

6.0 BEARING SURFACE: The bearing surface of flat bearing surface type machine screw heads will be at right angles to the axis of the screw shank within 2 degrees.

7.0 ECCENTRICITY: Heads will not be eccentric with the machine screw bodies by more than 3 percent of the maximum head diameters. Slots will not be eccentric with machine screw bodies by more than 6 percent of the maximum body diameter of .010 inch whichever is greater. Eccentricity is defined as one-half of the full indicator movement (FIM).

8.0 HEAD HEIGHT: All dimensions pertaining to head height specified in the dimensional tables will be measured parallel to the axis of screw and those relating to the top of head will represent a metal to metal measurement. In other words, any truncation of rounded head contours due to the slot or recess will not be considered part of the head height.

Total or overall head heights will be measured from the top of the head to the plane of the bearing surface for flat bearing surface type heads, to the plane of the undercut for undercut countersunk heads, and to the junction of conical bearing surface with the basic screw diameter for countersunk heads.

Head side heights will be measured from the intersection of the top surface of head with the head diameter to the plane of the bearing surface for flat bearing surface type heads, to the plane of the undercut for undercut countersunk heads, and to the junction of conical bearing surface with the basic screw diameter for countersunk heads.

On countersunk heads, the junction of conical bearing surface with the basic screw diameter may not necessarily be the same as the actual junction of head with shank and the head height delineating the conical bearing surface is a reference dimension.

9.0 PROTRUSION OF HEAD: Except for the 0 and 1 size undercut heads, suitability of flat head screws for application in countersinks may be determined by checking the "T" dimension in a protrusion gage. Protrusion gages will have a hardness of not less than Rockwell C60. Sharpness of

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JUNE 2015

NUMBER: MPAPS S-C-1.101- GS/PL	TITLE: <i>Machine Screws</i>	REVISION: 1506
---	---	---------------------------------

gaging edge will be that which is obtained by lapping the hole and the top surface of the gage. Variation in gaging diameter from the value given in the table will require proportional correction of protrusion gaging values.

10.0 SLOT DEPTH: The depth of slot in slotted head screws will be measured parallel to the axis of screw from the top of the head to the intersection of the bottom of the slot with the head surface or bearing surface.

11.0 DEPTH OF RECESS: The depth of recess will be measured parallel to the axis of the screw from the intersection of the maximum diameter of the recess with the head surface to the bottom of the recess.

Recess penetration gaging depth values are included in the dimensional tables and the method of gaging and specifications for gages are covered in MPAPS S- C- 90.101-GS/PL

Nominal Screw Length	Nominal Screw Size	
	0 thru 12	1/4 thru 3/4
	Tolerance on Length	
Up to 1/2 in, Incl	-.02	-.03
Over 1/2 to 1 in, Incl	-.03	-.03
Over 1 to 2 in, Incl	-.06	-.06
Over 2 in	-.09	-.09

12.0 LENGTH: The length of screw will be. measured, parallel to the axis of screw, from the extreme point to the plane of the bearing surface for screws having flat bearing surface type heads, and to the intersection of the top surface of head with the head diameter for screws having countersunk type heads.

13.0 THREADS: Threads will be Unified Standard, Class 2A, UNC or UNF series or UNRC or UNRF series with radius root, optional with manufacturer. Class 2A limits will apply to plain finish (unplated or uncoated) screws and to plated or coated screws before plating or coating. For screws with additive finish the maximum diameters of Class 2A may be exceeded by the amount of the allowance, that is, the basic diameters (the Class 2A maximum diameters plus the allowance) will apply to plated or coated screws after plating or coating. The major diameter of plated or coated screws may approach, but will not be less than the Class 2A minimum limit.

14.0 LENGTH OF THREAD:

Sizes No. 5 and Smaller. Screws of nominal lengths equal to 3 diameters and shorter will have full form threads extending to within one pitch (thread) of the bearing surface of the head, or closer, if practicable. Nominal lengths greater than 3 diameters, up to and including 1-1/8 inch, will have full form threads extending to within two pitches (threads) of the bearing surface of the head, or closer if practicable. Screws of longer normal lengths will, unless otherwise specified, have a minimum length of full form thread of 1.00 inch.

Sizes No. 6 and Larger. Screws of nominal lengths equal to 3 diameters and shorter will have full form threads extending to within one pitch (thread) of the bearing surface of the head, or closer, if

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JUNE 2015

NUMBER: MPAPS S-C-1.101- GS/PL	TITLE: Machine Screws	REVISION: 1506
---	--	---------------------------------

practicable. Nominal lengths greater than 3 diameters, up to and including 2 inch, will have full form threads extending to within two pitches (threads) of the bearing surface of the head, or closer if practicable. Screws of longer nominal lengths will, unless otherwise specified, have a minimum length of full form thread of 1.50 inch.

15.0 DIAMETER OF BODY: The diameter of body on machine screws will not be less than the Class 2A thread minimum pitch diameter no greater than the basic major diameter of the thread.

16.0 MATERIAL:

Material Code	Material Type	Material Specification	Remarks
CST	Carbon steel	SAE 1010-1020	
BRS	Brass, Alloy C36000	CEMS C-3	
SST-304*	Stainless Steel, Type 18-8	MPAPS A-37	Used for decorative exterior applications. Excellent corrosion resistance. Nonmagnetic.
SST-410*	Stainless Steel, Type 410	MPAPS A-37	Higher strength/hardness obtained through heat treatment. Moderate corrosion resistance. Magnetic.

* Stainless steels will be passivated per MPAPS A-37, finish type 5.

17.0 FINISHES: As designated by part number, screws will be furnished plain, plated or coated in accordance with the NAVISTAR MPAPS and class listed below:

Zinc Trivalent, Class 6A (ZN6A) - G-20, Class 6A.

Phosphate Coating (PHC) - G-1, Class B2.

Chromium Bright (CRB) - G-19, Part III, Class 3 CRB or Class 5 CRB as dictated by threads per inch.

Chromium Dull (CRD) - G-19, Part III, Class 3 CRD or Class 5 CRD as dictated by threads per inch.

Nickel Bright (NIB) - G-19, Part III, Class 3 NIB, or Class 5 NIB as dictated by threads per inch.

Nickel Dull (NID) - G-19, Part III, Class 3 NID or Class 5 NID as dictated by threads per inch.

Black Enamel (BLE) - Standard with manufacturer.

Black Oxide (BLO) - Standard with manufacturer.

Blued (BLU) - Standard with manufacturer.

18.0 SHORT LENGTH SCREWS: As shown in Table 1, Flat or Oval head screws having lengths equal to or less than the length listed will have head undercut by an amount which reduces the head height to 70 percent of "E." A corresponding reduction will also apply to slotted or recess depths. Radius dimensions shown will also apply.

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JUNE 2015

NUMBER: MPAPS S-C-1.101- GS/PL	TITLE: Machine Screws	REVISION: 1506
---	--	---------------------------------

TABLE 1 - DIMENSIONS FOR UNDERCUT HEAD

Dimensions in inches:

Nominal Size	Nominal Screw Length Equal to or Less Than	E ¹		R ¹	FLAT HEAD						OVAL HEAD					
		Head Height		Radius	H ¹				M ¹		H ¹				M ¹	
					Slot Depth		Cross Recess Depth		Cross Recess Depth		Slot Depth		Cross Recess Depth		Cross Recess Diameter	
		Max	Min	Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Min	Max
0	1/8	.025	.018	.009	.011	.007	.043	.027	.069	.056	.028	.022	.045	.027	.074	.061
1	1/8	.031	.023	.011	.014	.009	.051	.035	.077	.064	.034	.027	.048	.030	.077	.064
2	1/8	.036	.028	.013	.016	.011	.056	.040	.095	.082	.040	.033	.069	.052	.112	.099
3	1/8	.042	.033	.015	.019	.012	.063	.047	.102	.089	.047	.038	.081	.064	.124	.111
4	3/16	.047	.038	.017	.022	.014	.078	.062	.117	.103	.053	.043	.094	.077	.136	.123
5	3/16	.053	.043	.019	.024	.016	.089	.073	.128	.115	.059	.048	.085	.061	.158	.145
6	3/16	.059	.048	.021	.027	.017	.078	.055	.146	.133	.065	.053	.105	.080	.178	.165
8	1/4	.070	.058	.025	.032	.021	.106	.083	.174	.161	.078	.064	.119	.095	.192	.179
10	5/16	.081	.068	.028	.037	.024	.121	.098	.189	.176	.090	.074	.137	.113	.209	.196
12	3/8	.092	.078	.032	.043	.028	.121	.098	.233	.220	.103	.085	.152	.128	.270	.257
1/4	7/16	.107	.092	.038	.050	.032	.136	.113	.250	.237	.119	.098	.173	.148	.290	.277
5/16	1/2	.134	.116	.047	.062	.041	.168	.146	.317	.304	.149	.124	.226	.202	.381	.368
3/8	9/16	.161	.140	.056	.075	.049	.216	.194	.365	.352	.179	.149	.245	.221	.400	.387
7/16	5/8	.156	.133	.066	.072	.045	.245	.223	.393	.380	.184	.154	.257	.233	.410	.397
1/2	3/4	.156	.130	.075	.072	.046	.261	.242	.409	.396	.204	.169	.269	.245	.422	.409

19.0 POINTS: Machine screws are regularly supplied with a plain sheared end, not pointed. However, for specific applications and under separate part number, screws up to certain lengths may be obtained with header points, see Table 2. Pointing of longer lengths will require machining.

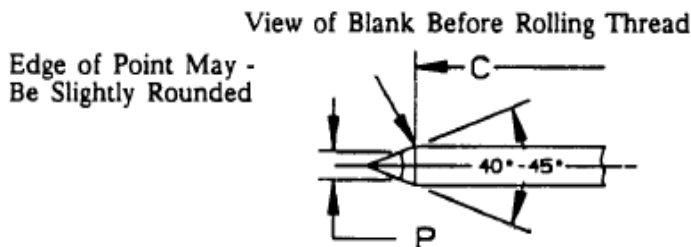


TABLE 2 – DIMENSIONS FOR HEADER POINTS

Dimensions in inches:

Nominal Size	Threads Per Inch	P		C	Nominal Size	Threads Per Inch	P		C
		Point Diameter		Nom Screw Length			Point Diameter		Nom Screw Length
		Max	Min	Max			Max	Min	Max
4	40	.074	.065	1/2	12	28	.156	.141	1-3/8
4	48	.079	.070	1/2	1/4	20	.170	.153	1-1/2
5	40	.086	.076	1/2	1/4	28	.187	.169	1-1/2
5	44	.088	.079	1/2	5/16	18	.221	.200	1-1/2
6	32	.090	.080	3/4	5/16	24	.237	.215	1-1/2
6	40	.098	.087	3/4	3/8	16	.270	.244	1-1/2
8	32	.114	.102	1	3/8	24	.295	.267	1-1/2
8	36	.118	.106	1	7/16	14	.316	.287	1-1/2
10	24	.125	.112	1- 1/4	7/16	20	.342	.310	1-1/2
10	32	.138	.124	1- 1/4	1/2	13	.367	.333	1-1/2
12	24	.149	.134	1- 3/8	1/2	20	.399	.362	1-1/2

20.0 WORKMANSHIP: Machine screws will not contain imperfections which affect usability or serviceability such as excessive amounts of burrs, seams, laps, loose scale or irregular surfaces.

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