

NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)		NUMBER: MPAPS S-C-28.101-GS/PL
		<i>Former Designation:</i> ESP-C-28.101-GS
TITLE: Hexagon Socket Head Cap 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-28.101-GS - August 2006
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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: Changed to New MPAPS format; Combined GS, PP, NPP.		

1.0 GENERAL: This standard conforms essentially with the American National Standard B18.3 for Hexagon Socket Head Cap screws (1960 Series). All but nominal dimensions are shown in decimal inch.

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3.0 HEADS: The top of screw heads will be flat, perpendicular to the axis of the screw and chamfered at the periphery. The edge between the flat and chamfer may be slightly rounded.

The plane of the bearing surface will be perpendicular to the axis of the screw within 1 degree. The edge between the bearing surface and the side of the head may be chamfered or rounded providing the degree of chamfer or rounding measured along the bearing face is within the tabulated limits for "S."

The head will be at true position with respect to the axis of screw within a tolerance zone having a diameter equal to one percent of the basic screw diameter (J max) two percent total runout or .006 inch, whichever is greater, regardless of feature size.

Unless otherwise specified, knurling on heads will be optional with the manufacturer providing the diameter across the tops of the knurl and the diameter of the head before knurling or of the unknurled portion are within the tabulated maximum and minimum head diameter limits, respectively. The minimum head diameter will be measured on the side of the head adjacent to the chamfer or rounding at periphery of bearing face.

4.0 SOCKET: Where hexagon sockets are chamfered or relieved, the depth of chamfer or relief will not exceed the equivalent of 10 percent of the nominal socket size for sizes up to and including 1/16 inch and 7.5 percent for larger socket sizes. For broached sockets which are at or near the maximum limit of size, the overcut resulting from predrilling will not exceed 20 percent of the length of any flat of the socket on sizes up to and including 1 inch, and 30 percent of the length of any flat on larger sockets.

Suitability of sockets up to and including 1 inch nominal size will be checked in accordance with the functional limits for runout of head, body, and thread paragraph and the chart specified in the Gages and Gaging portion of this document.

Socket will be at true position with respect to the axis of screw within a tolerance zone having a diameter equal to three percent of the basic screw diameter or .005 inch, whichever is greater, for screws up to and including 1/2 inch; and of a diameter equal to 6 percent of the basic screw diameter for larger screw sizes; regardless of feature size.

5.0 UNDERHEAD FILLET: For all lengths of screws, the form of the fillet at junction of head and shank will be optional, providing it fairs into the bearing surface of head within the limits established by "E" maximum plus "Q" maximum and "E" minimum plus "Q" minimum, and is a smooth and continuous curve having a bearing surface juncture radius of not less than "R."

6.0 POSITION OF HEAD, BODY AND THREAD: Positional relationship of head, body and threads on screws will be such that screws will meet functional limits specified within the "Functional Limits for Runout of Head, Body, and Thread" paragraph.

7.0 BODY: The diameter of body on screws for which the body length "LB" is applicable will be within the limits tabulated. For screws threaded full length, the diameter of the unthreaded shank under the head will not exceed the specified maximum body diameter nor be less than the minimum pitch diameter of the thread.

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8.0 LENGTH: The length of capscrews will be measured, parallel with the axis of screw, from the plane of the bearing surface of the head to the plane of the flat of the point. The tolerance on screw length will be as tabulated below:

Nominal Size	0 thru 3/8	7/16 thru 3/4	7/8 thru 1-1/2	Over 1-1/2
Nominal Length	Tolerance on Length			
Up to 1 inch, Incl	-.03	-.03	-.05	-
Over 1 inch to 2-1/2, Incl	-.04	-.06	-.10	-.18
Over 2-1/2 to 6, Incl	-.06	-.08	-.14	-.20
Over 6	-.12	-.12	-.20	-.24

9.0 THREADS: Unified external threads with radius root: Class 3A, UNRC and UNRF Series for screw sizes 1 inch and smaller; and Class 2A, UNRC and UNRF Series for sizes over 1 inch, to and including 1 1/2 inches. Acceptance gaging of Class 3A threads will be on the basis of thread ring gages.

10.0 LENGTH OF THREAD: On socket head capscrews, the length of thread, except on short length screws, will be controlled by the grip gaging length "LG" and the body length "LB." The applicable "LG" and "LB" dimensions for standard nominal lengths in screw sizes up to and including 1 inch are specified in Table 1. For screw sizes and lengths not covered in Table 1, the control on length of thread will be as described below.

Grip gaging length "LG" is maximum and will be measured, parallel to the axis of screw, from the bearing surface of the head to the face of a noncounterbored or noncountersunk standard GO thread ring gage assembled by hand as far as thread will permit. It represents the minimum design grip length of the screw and will be used as the criterion for inspection and for determining thread availability when selecting screw lengths even though usable threads may extend beyond this point, on some products.

Body length "LB" is a minimum and will be measured, parallel to the axis of screw, from the bearing surface of the head to the last scratch of thread or the top of the extrusion angle. It also will be used as a criterion for inspection. The tabulated values are equal to "LG" minus 5 times the pitch of the UNRC thread for the respective screw size.

For screws having nominal lengths which fall between the lengths shown in Table 1, the "LG" and "LB" dimensions will conform with those specified for the next shorter length for the respective screw size. For example: On a 1/4 inch size screw of 1-7/8 nominal length, "LG" would be .50 inch and "LB" would be .25 inch.

Screws having nominal lengths which fall above heavy horizontal line in Table 1 and, in sizes 1 inch and larger, lengths which are shorter than "LT" plus 5 times the pitch of the UNRC thread; will be threaded for full length. On these screws the complete (full form) threads, as measured with a noncountersunk or noncounterbored standard GO ring gage, will extend to within two pitches (threads) of the bearing surface of the head for sizes up to and including 5/8 inch (see "U" in tabulation below), and as close to the bearing face as is practicable for all larger sizes.

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For screws having longer nominal lengths than those shown in Table 1 and for screw sizes over 1 inch, the maximum grip gaging length "LG" and minimum body length "LB" will be determined as follows:

$$LG = L - LT$$

$$LB = L - LTT$$

Dimensions in inches:

Nominal Size	LT	LTT	U		Nominal Size	LT	LTT	U	
	Thread Length	Total Thread Length	Unthreaded Length			Thread Length	Total Thread Length	Unthreaded Length	
			Max					Max	
			Min	Max				Coarse Thread	Fine Thread
0	.50	.62		.025	3/8	1.25	1.94	.125	.083
1	.62	.77	.031	.028	7/16	1.38	2.17	.143	.100
2	.62	.80	.036	.031	1/2	1.50	2.38	.154	.100
3	.62	.83	.042	.036	5/8	1.75	2.82	.182	.111
4	.75	.99	.050	.042	3/4	2.00	3.25	-	-
5	.75	1.00	.050	.045	7/8	2.25	3.69	-	-
6	.75	1.05	.062	.050	1	2.50	4.12	-	-
8	.88	1.19	.062	.056	1-1/8	2.81	4.65	-	-
10	.88	1.27	.083	.062	1-1/4	3.12	5.09	-	-
1/4	1.00	1.50	.100	.071	1-3/8	3.44	5.65	-	-
5/16	1.12	1.71	.111	.083	1-1/2	3.75	6.08	-	-

The minimum thread length "LT" and maximum total thread length "LTT" are reference dimensions included herein for calculation purposes only. The minimum thread length "LT" represents the distance, measured parallel to the axis of screw, from the extreme point to the last complete (full form) thread. The maximum total thread length "LT-r" represents the distance, parallel to the axis of screw, from the extreme point to the last scratch of thread or the top of the extrusion angle. The tabulated "LTT" values include the minimum thread length plus a factor of 5 times the UNRC pitch, to provide for incomplete threads and a tolerance on grip length, plus an allowance which will permit the use of common tooling for more than one screw length.

11.0 POINTS: The end of screw will be flat or slightly concave and chamfered. The plane of the point will be approximately normal to the axis of the screw. The chamfer will extend slightly below the root of the thread and the edge formed by the flat and chamfer may be slightly rounded. The included angle of the point should be approximately 90° and will produce a length of chamfered or partial thread equivalent to .75 to 1.25 times the pitch of the thread. Chamfering of points on screw sizes up to and including size 8 (.164) will be optional.

12.0 SURFACE ROUGHNESS: For alloy steel, screws of sizes up to and including 5/8 inch and nominal lengths equal to or less than 8 times the basic screw diameter, the surface roughness before plating will not exceed 63 microinches (arithmetical average) on the fillet and head bearing surfaces, nor exceed 32 microinches (arithmetical average) on the threads. For larger sizes, longer lengths and corrosion resistant steel screws, the surface roughness prior to plating will not exceed 125 microinches (arithmetical average) on the body, fillet and head bearing surfaces.

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