

NAVISTAR, INC.		
Material, Parts, and Process Specifications (MPAPS)		NUMBER: MPAPS S-BM-1.101-GS/PL
		<i>Former Designation:</i> ESP-BM-1.101-GS
TITLE: Hex Head Bolts – Metric Series	CURRENT REV No.: 1604	DATE: April 2016
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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 referenced page numbers in sections 1.0, 7.0, 22.0 and 24.0 to reference section numbers.		

1.0 GENERAL:

Implementation of this standard must be in accordance with the policies and procedures outlined in MPAPS S-A-0.101. There may also be supplemental group instructions in regard to use of metric standards that should be taken into account. Some segments of the ISO and national standards encompassed by this general specification may differ. In recognition of these possible differences, the sizes and tolerance ranges used were established in an effort to enable the use of commercially available items, dimensionally interchangeable worldwide.

This specification contains the essentials of the following standards:

International Organization for Standardization: ISO/4014
American National Standards Institute: ANSI B18.2.3.1M
German Institute of Standards: DIN 931

For M10, M12 and M14 sizes, across flats, across corners and head height dimensions on page 11, reflect the latest ISO/TC2 decisions. Many bolts presently being manufactured and used, will be to the old ISO dimensions (1 mm larger across flats). It is recommended that locations, such as European operations sourcing to old ISO dimensions, continue to do so until a complete and cost effective transition to the new dimensions is accomplished. Locations sourcing to the new ANSI/ISO dimensions (as stated in this standard), are urged to monitor stock and procurement practices to assure consistent production availability of the latest bolts. For M22 size, dimensions across flats and corners are shown per latest ISO/TC2 decisions. The previous width across flats and corners, which are shaded in gray, will be deleted from the standard on its next issue.

Letter symbols designating dimensional characteristics are in accord with those used in ANSI and ISO standards.

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3.0 DESIGN CONSIDERATION: The use of thru hardened washers (MPAPS S-FM-16.101-GS/PL) is recommended in high strength bolted connections and in any Class 8.8 application involving oversize or slotted holes.

Coarse thread series only will be considered as part of this standard, because of the following advantages:

Less tendency to cross thread.

Resists nicking and has less stress concentration at the thread roots.

Less likely to be seriously affected by decarburization and oversize minor diameter of internal threads.

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- 4.0 METRIC-INCH RELATED SIZES:** During the inch to metric design transition period, the following chart of related sizes can be used for reference. This information is not to be considered as a recommendation for substitutions but only as a means of determining approximate dimensional equivalents.

Metric Series mm	Approximate Inch Series
6	1/4
8	5/16
10	3/8, 7/16
12	1/2
14	9/16
16	5/8
18	
20	3/4
22	7/8
24	1
27	1
30	1-1/8, 1-1/4
36	1-1/2

- 5.0 THREADS:** The ISO basic profile is essentially the same geometric configuration as the unified screw thread basic form. The threads will be coarse series, tolerance class 6g.
- 6.0 THREAD TOLERANCES:** The ISO medium class of fit 6H (int)/6g (Ext) is approximately the same as the 2A(Ext)/2B(Int) allowance in the U.S. unified thread series for comparable size. For Example:

Thread	Allowance
M10 x 1.5 - 6H(Int)/6g(Ext)	0.032 mm (.00126 in)
3/8-16 UNC 2A(Ext)/2B(Int)	.0013 in (0.033 mm)

- 7.0 THREAD LENGTH FORMULA:** The thread lengths shown in section 22.0 are based on the formulas shown

Millimeters		
Nominal Length		Formula for Thread Length
Over	To	
-	125	2d + 6
125	200	2d + 12
200	-	2d + 25

d = Nominal Diameter of the Bolt

- 8.0 PROPERTY CLASS:** The property class designation symbol for steel bolts of two parts, the first is approximately one-hundredth of the minimum tensile strength in megapascals (MPa)¹, and the second is one-tenth of the ratio between the minimum yield stress and the minimum tensile strength, expressed as a percentage. The multiplication of the figures will approximate 1/10 the minimum yield stress in megapascals (MPa).
- 9.0 COLOR CODING:** Not recommended except in cases where adequate insurance is needed to prevent mixing of "metric parts" with look-alike "inch parts." The color blue is standard identifier used in some industries. This must be handled internally at individual plants where needed and is

¹ MPa = 1 N/mm²

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meant to be supplemental to the normal finish and easily deleted when the need for supplemental identification no longer exists. The supplemental blue color should not be used on finishes such as chromium bright which are specified for cosmetic purposes or phosphate coating which causes a loss of color identity.

10.0 METHOD OF DESIGNATION: Hex head bolts are designated by the following data, preferably in the sequence shown: product name, nominal diameter, nominal length, steel property class or material identification, special feature, if any, and part number as shown in the following examples:

Hex Head Bolt, M10 x 50, Class 10, PHC, Part Number

Hex Head Bolt, M6 x 25, Class 8.8, Drilled, ZN8F, Part Number

NOTE: It is common practice in ISO Standards to omit thread pitch from the product size designation when screw threads are the metric coarse thread series, e.g., M10 is M10 x 1.5.

11.0 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.

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

Material: Class 10.9 (all sizes)

Finishes: Phosphate Coating (PHC)

Nominal Size and Length Incrementation:

Dimensions in millimeters:

Lengths mm	Nominal Diameters								
	M6	M8	M10	M12	M16	M20	M24	M30	M36
12	x	x							
16	x	x							
20	x	x	x						
25	x	x	x	x					
30	x	x	x	x	x				
35	x	x	x	x	x	x			
40	x	x	x	x	x	x			
45	x	x	x	x	x	x			
50	x	x	x	x	x	x	x		
60	x	x	x	x	x	x	x	x	
70	x	x	x	x	x	x	x	x	x
80	x	x	x	x	x	x	x	x	x
90	x	x	x	x	x	x	x	x	x
100		x	x	x	x	x	x	x	x
110		x	x	x	x	x	x	x	x
120			x	x	x	x	x	x	x
130			x	x	x	x	x	x	x
140			x	x	x	x	x	x	x
150			x	x	x	x	x	x	x
160				x	x	x	x	x	x
180				x	x	x	x	x	x

2 mm Increments Under 12 mm

20 mm Increments Over 180 mm

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12.0 HEAD: The top of the head will be full form and chamfered or rounded. The diameter of the chamfer circle or the start of rounding will be equal to the maximum width across flats within a tolerance of minus 15 percent.

13.0 CORNER FILL: The rounding due to lack of fill at the six corners of the head will be reasonably uniform.

14.0 TRUE POSITION OF HEAD: The axis of the hex head will be located at true position with respect to the axis of the bolt (determined over a distance under the head equal to one bolt diameter) within a tolerance zone of diameter specified below.

Dimensions in millimeters.

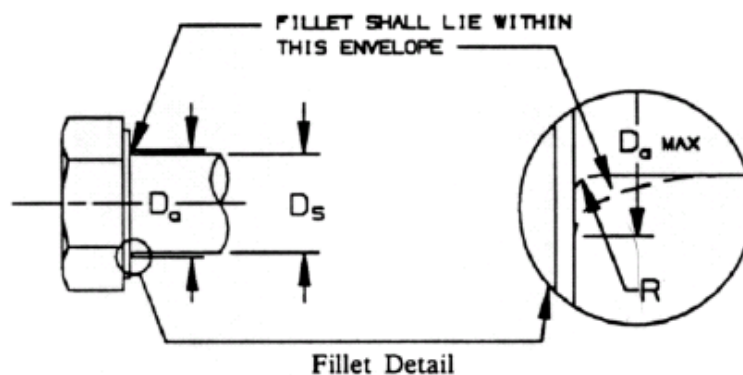
Nominal Sizes	M6	M8	M10	M12	M14	M16	M20	M24	M30	M36
Total Run out	0.44	0.56	0.70	0.84	0.98	1.12	1.40	1.68	2.10	2.52

15.0 BEARING SURFACE: The bearing surface will be flat and washer faced. Diameter of bearing surface will not exceed the width across flats nor be less than the specified minimum washer face diameter. For referee purposes, measurement of bearing surface diameter will be taken at mid thickness of the washer face. The plane of the bearing surface will be perpendicular to the axis of the body within the total run out specified below. The measurement of bearing face run out will be made as close to the periphery of the washer face as possible while the bolt is held in a collet or other gripping device at a distance equal to one bolt diameter from the underside of the head.

Dimensions in millimeters.

Nominal Size	M6	M8	M10		M12	M14	M16	M18	M20	M22	M24	M27	M30	M36
Total Run out	0.25	0.28	0.32		0.35	0.39	0.43	0.48	0.53	0.58	0.63	0.71	0.78	0.93

16.0 FILLET: The fillet configuration at the junction of the head and shank will be as shown below, and will have limits is specified below. The fillet will be a smooth and continuous curve fairing smoothly into the underhead bearing surface and the shank within the limits specified. No radius in the fillet contour will be less than R minimum.



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