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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------|
| <b>NAVISTAR, INC.</b>                                                                                                                                                                                                                                                                                                                   |                                                     |                                                            |
| <b>Material, Parts, and Process Specifications<br/>(MPAPS)</b>                                                                                                                                                                                                                                                                          |                                                     | <b>NUMBER:</b><br><b>MPAPS S-C-32.101-GS/PL</b>            |
|                                                                                                                                                                                                                                                                                                                                         |                                                     | <i>Former Designation:</i> <b>ESP-C-32.101-GS</b>          |
| <b>TITLE: Headless Hex Socket Set Screws – English Series<br/>(Noun Code 7450)</b>                                                                                                                                                                                                                                                      |                                                     | <b>CURRENT REV No.:</b><br><b>1506</b>                     |
|                                                                                                                                                                                                                                                                                                                                         |                                                     | <b>DATE:</b><br><b>June 2015</b>                           |
| <b>WRITTEN/EDITED BY:</b><br><b>Materials Engineering</b>                                                                                                                                                                                                                                                                               | <b>APPROVED BY:</b><br><b>Materials Engineering</b> | <b>SUPERSEDES:</b><br><b>ESP-C-32.101-GS - August 2006</b> |
| <b>PRINTED COPIES OF THIS DOCUMENT MUST BE VERIFIED FOR CURRENT REVISION</b>                                                                                                                                                                                                                                                            |                                                     |                                                            |
| <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> |                                                     |                                                            |
| <b>Change Notice: Changed to New MPAPS format; Combined GS, PP, NPP.</b>                                                                                                                                                                                                                                                                |                                                     |                                                            |

**1.0 GENERAL:** This standard conforms essentially with the SAE Standard and the American National Standard for Hexagon Socket Set Screws.

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**3.0 MISCELLANEOUS DIMENSIONS:** The socket end of screw will be flat, normal to the axis of the screw, and on screws longer than lengths tabulated in Table 1, the face will be chamfered. The chamfer will extend slightly below the root diameter of the thread and the angle of chamfer will be 30° to 45°. The edge between the flat and the chamfer may be slightly rounded. On screws of lengths equal to-or shorter than those listed in Table 1, the chamfering will be optional with the manufacturer and, where chamfered, the angle will not exceed 45°.

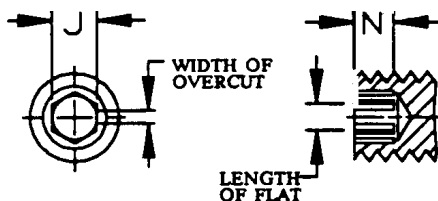
**3.1 Sockets:** The minimum key engagements specified will apply only to screws having nominal lengths equal to or greater than those listed in Table 1 on 3. Sockets in screws of shorter lengths will be as deep as is practicable.

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|-------------------------------------------------|--------------------------------------------------------|---------------------------------|

For broached sockets which are at or near the maximum size limit, the overcut resulting from dulling will not exceed 20 percent of the length of any hexagon flat.



**BROACHED SOCKET**

Suitability of sockets in set screws may be determined by use of hexagon socket gages specified in MPAPS S-C- 28.101-GS/PL.

- 4.0 POINTS:** The point angle for flat and cup point screws of lengths equal to or longer than those listed in Table 1 will be 45° to 50°. On screws of shorter length, the minimum point angle may be reduced to 30°.

The external point angles specified will apply only to those portions of the angles which lie below the thread root diameter, it being recognized the angle within the thread profile may vary due to manufacturing processes.

The tolerance on oval point radius will be plus .015 inch for screw sizes up to and including No. 5, and plus .031 inch for larger sizes.

The axis of half dog points will not be eccentric with the axis of the thread by more than 3 percent of the basic screw diameter or .005 inch, for sizes up to and including 3/4 inch; or .010 inch, for larger sizes; whichever is the smaller. (Eccentricity is defined as one-half of the total or full indicator reading.)

Acceptance of style variations on the standard cup point, produced by some manufacturers, under part numbers for cup points shown herein, will be at the discretion of user.

- 5.0 LENGTH:** The length of set screws will be measured overall on a line parallel to the axis of the screw. The tolerance on length of set screws will be as tabulated below.

| Nominal Screw Length | Tolerance on Length |
|----------------------|---------------------|
| Up to 5/8, Incl      | ± .01               |
| Over 5/8 to 2, Incl  | ± .02               |
| Over 2 to 6, Incl    | ± .03               |
| Over 6               | ± .06               |

- 6.0 THREADS:** Unified Series, Class 3A. Acceptance gaging of Class 3A threads will be on the basis of thread ring gages.

Since standard gages provide only for lengths of engagement up to 1-1/2 diameters, changes in pitch diameter of either or both external or internal thread may be required for longer lengths of engagement.

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**7.0 MATERIAL:** Socket set screws will be made from steel or corrosion resistant steel conforming to the specifications below:

Steel set screws will be fabricated from an alloy steel having one or more of the following alloying elements: chromium, nickel, molybdenum, or vanadium, in sufficient quantity to assure that the hardness range at the surface of Rockwell C45 to 53 is met when the screws are hardened by quenching from austenitizing temperature and tempered.

Corrosion resistant steel set screws will be fabricated from austenitic corrosion resistant steel of type 304 per MPAPS A-37.

**8.0 FINISH:** Screws will be furnished plain, plated, or coated in accordance with the Navistar Engineering Material Specification and class listed below:

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

Phosphate Coated (PHC) – MPAPS G-1, Class B2.

Blued (BLU) - Standard with manufacturer.

**9.0 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.

**10.0 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.

Sizes: 6, 8, 10, 1/4, 5/16, 3/8, 1/2, 5/8, 3/4

Point: Cup

Thread: UNC 3A

Material: Alloy Steel

Finish: Plain (PLN), Zinc Trivalent, Class 6A (ZN6A), and Phosphate Coating (PHC)

|                        |                    |      |
|------------------------|--------------------|------|
| Length Incrementation: | 0 to 1/2 inch      | 1/16 |
|                        | Over 1/2 to 1 inch | 1/8  |
|                        | Over 1 to 2 inches | 1/4  |
|                        | Over 2 inches      | 1/2  |

**11.0 WORKMANSHIP:** Set screws will be free from burrs, loose scale, and other defects affecting their serviceability; threads will be free from slivers, splits, laps, or defects due to imperfections of thread rolling dies.

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