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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|------------------------------------------------------------|
| <b>NAVISTAR, INC.</b>                                                                                                                                                                                                                                                                                                                   |                                                     |                                                            |
| <b>Material, Parts, and Process Specifications<br/>(MPAPS)</b>                                                                                                                                                                                                                                                                          |                                                     | <i>NUMBER:</i><br><b>MPAPS S-FM-1.101-GS/PL</b>            |
|                                                                                                                                                                                                                                                                                                                                         |                                                     | <i>Former Designation:</i> <b>ESP-FM-1.101-GS</b>          |
| <i>TITLE:</i><br><b>Helical Spring Lock Washers–Metric Series</b>                                                                                                                                                                                                                                                                       |                                                     | <i>CURRENT REV No.:</i><br><b>1506</b>                     |
|                                                                                                                                                                                                                                                                                                                                         |                                                     | <i>DATE:</i><br><b>June 2015</b>                           |
| <i>WRITTEN/EDITED BY:</i><br><b>Materials Engineering</b>                                                                                                                                                                                                                                                                               | <i>APPROVED BY:</i><br><b>Materials Engineering</b> | <i>SUPERSEDES:</i><br><b>ESP-FM-1.101-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, GI, PP.</b>                                                                                                                                                                                                                                                                 |                                                     |                                                            |

**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 divisional supplemental instructions in regard to use of metric standards that should be taken into account.

This standard may differ in some respects with certain segments of ISO and national standards. 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:

|                                      |         |
|--------------------------------------|---------|
| British Standards Institution:       | BS 4464 |
| German Institute of Standardization: | DIN 127 |
| Standards Association of Australia:  | AS 1968 |

Helical spring lock washers are Form B per DIN 127 or Type B per BS 4464.

The word "Lock" appearing in the names of the products in this standard is a generic term historically associated with their identification and is not intended to imply an indefinite permanency of fixity in attachments where they are used.

The inclusion of dimensional data is not intended to imply that all the washers described are stock production sizes.

Inch dimensioned standard helical spring lock washers may be found in MPAPS S-F-1.101-GS/PL

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JUNE 2015

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

## 2.0 CONTENTS:

|                                           | Page |
|-------------------------------------------|------|
| General                                   | 1    |
| Design Consideration                      | 2    |
| Metric-Inch Related Sizes                 | 2    |
| Hardness comparison                       | 3    |
| Color Coding                              | 3    |
| Method of Designation                     | 3    |
| Policy for Selecting Parts for New Design | 3    |
| Shape                                     | 3    |
| Manufacturing Detail                      | 3    |
| Material                                  | 3    |
| Finishes                                  | 4    |
| Restricted Chemical Substances            | 4    |
| Short Load Test                           | 4    |
| Prolonged Load Test                       | 4    |
| Torsion Test                              | 5    |
| Workmanship                               | 5    |
| Dimensions                                | 6    |
| Part List                                 | 7    |
| Technical Information                     | 7    |

### 3.0 **DESIGN CONSIDERATION:** Helical spring lock washers are not recommended for use on soft materials, oversize, or elongated holes. For high strength joints where there is sufficient clearance and proper pre-load can be applied, hardened plain washers should be used.

Metric helical spring lock washers in this standard approximate the "Inch Regular Series" (formerly designated Medium).

### 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.

| <b>Metric Series<br/>mm</b> | <b>Approximate<br/>Inch Series</b> |
|-----------------------------|------------------------------------|
| 3                           | #4, #5                             |
| 4                           | #6, #8                             |
| 5                           | #10                                |
| 6                           | #12, 1/4                           |
| 8                           | 5/16                               |
| 10                          | 3/8, 7/16                          |
| 12                          | 1/2                                |
| *14                         | 9/16                               |
| 16                          | 5/8                                |
| 20                          | 3/4                                |
| *24                         | 7/8, 1                             |
| *30                         | 1-1/8, 1-1/4                       |
| *36                         | 1-1/2                              |

\* Non-Preferred

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JUNE 2015

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## 5.0 **HARDNESS COMPARISON:**

| Hardness           | Metric Series | Inch Series |
|--------------------|---------------|-------------|
| Max (Rockwell)     | C51           | C53         |
| Min (Rockwell)     | C44           | C45         |
| Range (Max to Min) | 7             | 8           |

**6.0 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 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 material such as stainless steel when specified for cosmetic purposes, or phosphate coating which may cause a loss of color identity.

**7.0 METHOD OF DESIGNATION:** Washers will be designated on purchase orders by nominal diameter, word description, material, finish and part number.

5 mm, Helical Spring Lock Washer, Steel, ZN6A, Part Number

**8.0 POLICY FOR SELECTING PARTS FOR NEW DESIGN:** Approved parts are so designated to reduce the variety of parts and assure maximum availability, interchangeability, and cost savings.

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

Nominal Sizes: 3, 4, 5, 6, 8, 10, 12, 16, 20 mm  
Material: Hardened Spring Steel (STL)  
Finish: Zinc Trivalent (ZN6A)

**9.0 SHAPE:** The helical spring lock washers will be evenly wound with uniform pitch and during use the washers will remain circular and their section will be such as not to cause them to spread when set down by a nut, under normal service conditions.

**10.0 MANUFACTURING DETAIL:** Washers will be coiled such that the free height is approximately twice the thickness of the washer section. The flat faces and inner and outer peripheries will be smooth and free from knurling, serration, die marks, deep scratches, etc., although slight feed roll marks will be permissible.

**11.0 MATERIAL:** Carbon steel washers will be made from lock washer wire meeting the limits of decarburization shown below. They will be heat treated to a Rockwell Hardness of C 44-51. The washers will be prepared for checking material hardness by grinding both sides flat and parallel to assure the removal of a decarburized or plated surface. During the grinding operation, care must be exercised to prevent the temperature of the washer from exceeding 120° C.

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