**FASTENER FINISH, ELECTROPLATED ZINC, TRIVALENT CHROMIUM PASSIVATE, SILVER IRIDESCENT** — **WSS-M21P52-A1**

**FASTENER FINISH, ELECTROPLATED ZINC, TRIVALENT CHROMIUM PASSIVATE, LUBRICATED TOPCOAT SEALER, SILVER** — **WSS-M21P52-A2**

**FASTENER FINISH, MECHANICAL ZINC, TRIVALENT CHROMIUM PASSIVATE, LUBRICATED TOPCOAT SEALER, SILVER-GREY** — **WSS-M21P52-A3**

**FASTENER FINISH, ELECTROPLATED ZINC, TRIVALENT CHROMIUM PASSIVATE, LUBRICATED TOPCOAT SEALER, ENHANCED LUBRICITY, SILVER** — **WSS-M21P52-A4**

## 1. SCOPE

The materials defined by these specifications are corrosion protective coatings over steel and iron substrates. All consist of electrolytic or non-electrolytic zinc plating with trivalent chromium passivate. A2, A3 and A4 are also coated with a clear sealer to increase corrosion resistance and/or to provide consistent torque-tension control.

## 2. APPLICATION

These specifications were released for materials used as corrosion protective coatings for fasteners and other standard parts used throughout the vehicle. Some of the processes used to produce these coatings may induce hydrogen embrittlement in parts with high hardness. Parts identified as being at risk for hydrogen embrittlement shall meet the requirements of WSS-M99A3-A.

A1: Corrosion resistance for non-threaded fasteners which subsequently receive an adhesive coating, and for non-threaded standard parts with lower corrosion requirements
A2: Corrosion resistance plus lubrication for threaded fasteners
A3: Corrosion resistance plus lubrication for threaded fasteners with high hardness and the risk of hydrogen embrittlement
A4: Corrosion resistance plus enhanced lubrication for threaded fasteners such as thread forming screws for metal

### 2.1 SERVICE APPLICATION

2.1.1 The recommended maximum continuous service temperature is 120°C for optimal corrosion performance.

2.1.2 These coatings exhibit electrical continuity to the substrate and may be used for electrical grounding fasteners in body-in-white or interior applications.

2.1.3 These coatings are effective for slowing galvanic corrosion associated with the use of steel fasteners in direct contact with aluminum components, or in indirect contact with magnesium components.

2.1.4 These coatings are not recommended for high visibility applications, severe abrasion conditions or where chip resistance is required.

| Date | Action | Revisions | Rev 01 |
|---|---|---|---|
| | | | |
| 2018 05 25 | Revised | See Summary of Revisions | G. Weber, NA |
| 2013 03 22 | Released | | G. Weber, NA |

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# 3. REQUIREMENTS

## 3.1 APPROVED MATERIALS

This specification requires the use of approved sources. Only the sources identified on the Ford Approved Source List (ASL) can be used when this specification is listed on the drawing, CAD file, or other documents. The list of approved sources is located within Ford at www.mats.ford.com or available externally through a Ford Materials Engineer.

## 3.2 EMBRITTLEMENT

Parts coated to this specification shall be free from the detrimental effects of hydrogen embrittlement or other factors which result in part brittleness. All parts shall meet the requirements of WSS-M99A3-A.

## 3.3 COATING APPLICATION

3.3.1 Applicators shall follow material supplier procedures and recommendations for chemical usage, equipment, analysis, and processing. Applicators must have documentation to show that procedures and recommendations are being followed.

3.3.2 Part cleanliness prior to coating is critical in achieving optimal adhesion of the coating. The substrate shall be free of oil, dirt, and similar foreign materials. If a cleaning process is necessary, it shall have no detrimental effect on the substrate, including freedom from embrittlement. This is especially important for parts with hardness greater than HRC 35. See WSS-M99A3-A.

3.3.3 The sealers used under this specification do not require curing. The sealers shall be dried in place using hot air, typically in a spin dryer. Drying on a conveyer and other drying methods may be appropriate.

3.3.4 The applicator shall follow the material supplier's recommendations concerning the drying temperature and spin speeds suitable for the basket diameter being used.

3.3.5 The temperatures associated with de-embrittlement heat treatments can cause degradation of the passivates and sealers. Parts with hardness greater than HRC 35, for example washers, requiring an electroplated finish should be passivated and sealed after de-embrittlement heat treatment.

## 3.4 COATING APPEARANCE

3.4.1 The finishes will be smooth, fine grained, adherent, and free from blisters, pits, nodules, indications of burning, and other defects. All details of workmanship shall conform to the best practice for high quality plating.

3.4.2 Parts coated to A1 will have a silver iridescent color, A2 and A4 will have a silver color, and A3 will have a silver-grey color.

3.4.3 The sealers used for A2, A3 and A4 will be a translucent film free from discontinuities.

3.4.4 The sealers used for A2, A3 and A4 have a UV light visible tracer.

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## 3.5 COATING PROPERTIES

3.5.1 Thickness
(ASTM B659 / ASTM B487)

3.5.1.1 The zinc layer shall have a thickness of 8 to 14 micrometers measured on flat surfaces. In case of dispute, the thickness measurement umpire method shall be metallographic sectioning per ASTM B487.

3.5.1.2 The passivate layer thickness is not subject to measurement but will be less than 500 nanometers and greater than 200 nanometers.

3.5.1.3 The sealer layer thickness is not subject to measurement but will be less than 2 micrometers and greater than 0.5 micrometers. The thickness shall be sufficient to meet the corrosion requirements of the substrate material as well as the friction requirements.

3.5.1.4 The typical overall thickness of these coatings is 10 to 12 micrometers.

3.5.2 Adhesion
(ASTM B 571)

The coating shall withstand normal handling, storage, and installation without flaking or peeling or other loss of adhesion. In addition, there shall be no blistering or flaking after baking for hydrogen de-embrittlement.

Adhesion of the plating to the base metal must conform to the requirements of one of the following test methods per ASTM B 571 unless otherwise indicated.

3.5.2.1 Heat Quench Test

There shall be no blistering or chipping of the finish after heating coated parts to 220 +/- 5°C for 30 +/- 5 minutes and quenching in water at room temperature.

3.5.2.2 Burnishing Test

No blistering, lifting, or peeling of the finish from the substrate is permitted following the burnishing test.

3.5.3 Torque Tension Performance
(WZ101, Test Program B, M10x1.5 PC 8.8 surrogate bolt, S437-coated nut, WX100 washer, 25.3 kN tension)

When tested in accordance with Ford Worldwide Fastener Standard WZ101, coated fasteners shall have a friction coefficient within +/- 0.03 μ of the nominal value below:

| | |
|---|---|
| WSS-M21P52-A2 | 0.15 μ |
| WSS-M21P52-A3 | 0.15 μ |
| WSS-M21P52-A4 | 0.08 μ |

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