FASTENER FINISH, ELECTROPLATED ZINC-NICKEL, TRIVALENT CHROMIUM PASSIVATE, SILVER — **WSS-M21P51-A1**

FASTENER FINISH, ELECTROPLATED ZINC-NICKEL, TRIVALENT CHROMIUM PASSIVATE, LUBRICATED SEALER, SILVER — **WSS-M21P51-A2**

FASTENER FINISH, ELECTROPLATED ZINC-NICKEL, TRIVALENT CHROMIUM PASSIVATE, LUBRICATED SEALER, ENHANCED LUBRICITY, SILVER — **WSS-M21P51-A3**

FASTENER FINISH, ELECTROPLATED ZINC-NICKEL, TRIVALENT CHROMIUM PASSIVATE, LUBRICATED SEALER, DURABLE LUBRICITY, SILVER — **WSS-M21P51-A4**

FASTENER FINISH, ELECTROPLATED ZINC-NICKEL, TRIVALENT CHROMIUM PASSIVATE, LUBRICATED SEALER, BLACK — **WSS-M21P51-A5**

FASTENER FINISH, ELECTROPLATED ZINC-NICKEL, TRIVALENT CHROMIUM PASSIVATE, LUBRICATED SEALER, ENHANCED LUBRICITY, BLACK — **WSS-M21P51-A6**

1. SCOPE

The materials defined by these specifications are corrosion protective coatings over steel and iron substrates. All consist of an alkaline zinc nickel alloy and trivalent chromium passivate. A2, A3, A4, A5 and A6 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 standard parts
A2 – Corrosion resistance plus lubrication for threaded fasteners such as self tapping screws, thread forming screws for plastic and those with ISO metric screw threads; can be used in grounding applications
A3 – Corrosion resistance plus enhanced lubrication for threaded fasteners such as thread forming screws for metal; can be used in grounding screw applications
A4 – Corrosion resistance plus a special lubricant specifically designed for conical wheel nuts
A5 – Class A black appearance with corrosion resistance plus lubrication for threaded fasteners such as self tapping screws, thread forming screws for plastic and those with ISO metric screw threads
A6 – Class A black appearance with corrosion resistance plus enhanced lubrication for fasteners such as thread forming screws for metal

Date	Action	Revisions	Rev 01
2018 05 25	Revised	See Summary of Revisions	G. Weber, NA
2011 06 28	Activated		D. Drobnich, FNA

Copyright © 2018, Ford Global Technologies, LLC.

Documents Document Sharing Hub
Copyright Ford Motor Company
Provided by IHS Markit under license with FORD
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: FORD WSS-M21P51-A5 2018

2.1 SERVICE APPLICATION

2.1.1 The recommended maximum continuous service temperature is 310°C.

2.1.2 A2 and A3 exhibit electrical continuity to the substrate and are suitable for most electrical grounding applications.

3. REQUIREMENTS

3.1 APPROVED SOURCES

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 Prior to 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. 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.

3.4 COATING APPEARANCE

3.4.1 The base zinc-nickel plating will have a metallic silver appearance prior to passivate application.

3.4.2 The passivate layer for A1, A2, A3 and A4 will have an appearance of slight iridescence and color variation consistent with interference films (e.g. yellow, orange, green, blue, purple variegation).

3.4.3 The passivate layer for A5 and A6 will be black.

3.4.4 The sealers used for A2, A3, A5 and A6 will be a translucent film free from discontinuities.

Copyright © 2018, Ford Global Technologies, LLC.

Documents
Document Sharing Hub

Copyright Ford Motor Company
Provided by IHS Markit under license with FORD
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: FORD WSS-M21P51-A5 2018

3.4.5 The sealer used for A4 will be a translucent film but may contain some discontinuities in the form of touch marks or blemishes; however, they shall not adversely affect the mechanical performance or corrosion resistance of the part.

3.4.6 The sealers used for A2 and A3 may have additional color ID of green or blue.

3.5 COATING PROPERTIES

3.5.1 Composition

The alkaline base zinc-nickel plating shall have a nickel content of 12 to 17% as measured by calibrated X-ray fluorescence spectrometers in accordance with the supplier's requirements. The plating shall be a uniform, homogeneous alloy of zinc and nickel throughout the thickness of the deposit and across the high and low current densities of the part.

Zinc-nickel alloy is the only deposit to be applied directly to the base. The use of a zinc strike is not permitted.

The composition of the zinc-nickel plating, passivate, and water soluble lubricated sealer shall all be in accordance with the chemical supplier's requirements.

3.5.2 Thickness
(ASTM B659 / ASTM B487)

3.5.2.1 The electroplated zinc-nickel 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.

3.5.2.2 The passivate layer thickness is not subject to measurement but will be less than 500 nanometers and greater than 50 nanometers.

3.5.2.3 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.

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

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

Copyright © 2018, Ford Global Technologies, LLC.

Documents
Document Sharing Hub
Copyright Ford Motor Company
Provided by IHS Markit under license with FORD
No reproduction or networking permitted without license from IHS
Licensee=/, User=,
Not for Resale,
Full document details: FORD WSS-M21P51-A5 2018