

**FINISH SPECIFICATION****1. SCOPE**

The following specifications cover requirements for finishes used on Worldwide Standard and Utility Parts.

NOTE: Obsolete finish specifications are not shown in this standard. If a finish is referenced that is not shown in this standard, the user should contact the local Fastener Engineering Office for direction.

2. APPLICATION

Recommended usage included in the description of individual finishes is intended for information only.

2.1 RECOMMENDED USAGE

Fastener finishes should be selected per the Global Fastener Finish Strategy. See link below:

[https://www.tc2.ford.com/ts/pdfastenerandjointengineering/Shared%20Documents/Strategy/Finish/Master Global Finish Strategy.mht](https://www.tc2.ford.com/ts/pdfastenerandjointengineering/Shared%20Documents/Strategy/Finish/Master%20Global%20Finish%20Strategy.mht)

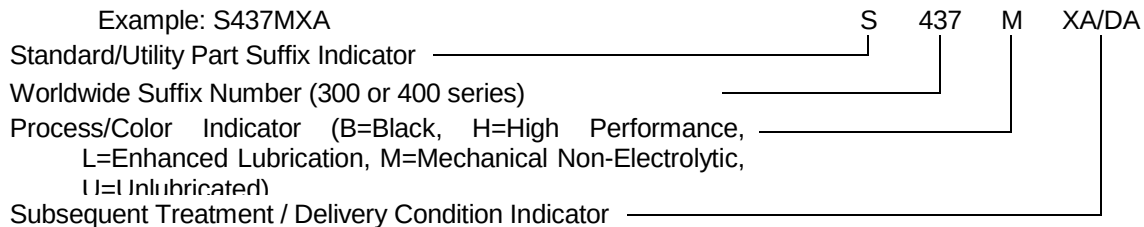
Please review with the appropriate fastener engineering department when releasing finishes not per the Global Fastener Finish Strategy.

3. DESIGNATION

The finish required on a standard or utility part is designated by adding the appropriate Finish Code to the Part Number as a suffix when a part is released. FINISH CODES SHALL NOT BE INCLUDED IN THE PART NUMBER BLOCK ON A UTILITY PART DRAWING.

The Finish Code is obtained from Clause 6, DETAILED FINISH DESCRIPTIONS AND REQUIREMENTS. The Finish Code consists of letter 'S' followed by a number and designation alpha codes (except "SSW").

The release for a standard or utility part is incomplete without the addition of a finish code to the Part Number. WORLDWIDE PART NUMBERS MUST BE RELEASED WITH A WORLDWIDE FINISH NUMBER.

3.1 DESIGNATION EXAMPLE (NOT TO EXCEED 8 CHARACTERS)

NOTE: In the past, a number "1" after the S was used to indicate that the part was to be used in an automatic assembly application. This convention is no longer used.

SUBSEQUENT TREATMENTS are treatments such as the addition of waxes for sealing on sheet metal screws or wax on hose clamps to lower the friction between the clamp and hose. These subsequent treatments are specified in WSS-M21P27-A1/A2/A3/A4/A5. See (Table 1) and link below:

http://www.mats.ford.com/cgi-bin/mtl/MTL_101p2.cgi?specstdnumber=WSS-M21P27&title=&loc=&specfromdate=&control=&specstartdate=&respect=&usingact=&status=A&statusfromdate=&statustodate=&recycling=&requestor=&sourcetype=

DELIVERY CONDITIONS are conditions as to how the parts are received from the manufacture and how they are fed into the assembly machine during the manufacturing process. These delivery conditions are specified in (Table 2).



Table 1 Subsequent Treatment Indicator Table

Treatment Indicator	Description	Material Spec/ Standard Number	Log Status	Approved Suppliers	Trade Name
XA	Wax sealer applied to threads.	WSS-M21P27-A1	I	Bi Wax Corp.	A-6576 Wax Sealer
XB	Wax applied to the inside diameter of hose clamps to lower friction.	WSS-M21P27-A2	A	Edwald Dorken & Co.	Delta Wachsemulsion (130640)
XC	Fluorocarbon polymer based coating used on fasteners to reduce the adhesion of electrodeposited primers.	WSS-M21P27-A3	A	Forest City Technologies Inc.	Forest city PTFE
				Nylok Fastener Corp.	NYCOTE
				OmniTECKNIK	OmniMASK
XD	Water based wax lubricant applied to lead threads of thread rolling screws to reduce the torque required to form threads.	WSS-M21P27-A4	A	Forest City Technologies Inc.	FCMS402
				ND Industries	EZ-DRIVE
				Nylok Fastener Corp.	NYTORQ
				OmniTECHNIK	Precote Top 300
XE	Non-metallic sealer compound applied to the bearing surface of fasteners.	WSS-M21P27-A5	A	ND Industries	ND500
				Nylok Fastener Corp.	NYSEAL

Table 2 Delivery Condition Indicator Table

Condition Indicator	Title	Description
No Suffix	Bulk	Fasteners are received in a container in loose condition via normal methods.
DA	Reel	Fasteners are received on a returnable reel or spool collated by tape, wire, or similar means.
DB	Cassette	Fasteners are received in small quantities via a cassette, magazine, or similar means.
DC	Bottle	Fasteners are received in a loose condition contained by a returnable bottle or container.
DD	Reel	Fasteners are received on a disposable reel or spool collated by tape, wire, or similar means.



4. REFERENCES

ISO 261	ISO general-purpose metric screw threads - General plan
ISO 898-1	Mechanical properties of fasteners - Part 1: Bolts, screws and studs
ISO 898-2	Mechanical properties of fasteners - Part 2: Nuts with specified proof load values
ISO 965-1	ISO general-purpose metric screw threads - Tolerances
ISO 4042 Clause 10	Threaded components - Electroplated coatings
ISO 6157-3	Fasteners - Surface discontinuities - Bolts, screws and studs for special requirements
ISO 4599	Plastics, Determination of resistance to environmental stress cracking, Bent strip method
QS-9000	Quality System Requirements
SAE/USCAR-1	Salt Spray Testing and Evaluation of Fastener Finishes
CETP 00.00-L-467	Global Laboratory Accelerated Cyclic Corrosion Test
WSD-M13P7-A	Lubricant-Torque/Clamping Force Control
WSS-M99A3-A	Embrittlement Avoidance
WSS-M99P9999-A1	Restricted Substance Management Standard
WD 950	Material and Performance Requirements for Spaced Thread Tapping Screws
WD 951	Mechanical and Performance Requirements of Case Hardened Thread Rolling Screws
WD 952	Mechanical and Performance Requirements of Through Hardened and Carbon Restored Thread Rolling Screws with Induction Hardened Points
WD 953	Material and Performance of Screws for Use in Plastics
WD 954	Material and Performance Requirements for Screws Used in Thermoplastic Materials
WE 950	Prevailing Torque-Type Steel Hex Nuts and Hex Flange Nuts
WE 953	Mechanical and Performance Requirements for Single Thread Spring Nuts
WX 200	Threaded Fasteners with Dry Film Microencapsulated Adhesive Applied to the Threads
WX 201	Threaded Fasteners with Sealer Compound Applied to the Threads
WZ 100/101	Steel ISO Metric Threaded Fasteners Torque/Clamping Force Performance.

5. GENERAL REQUIREMENTS.

5.1 SUMMARY

All parts must comply with Engineering Material Specification WSS-M99P9999-A1 to help safeguard health, safety and the environment.

5.2 PART CONDITION

Parts as supplied to Ford locations shall be completely covered with the finish specified. Parts shall also be commercially clean and shall be free from corrosion, chips, loosely adherent metal oxides, dirt, abrasives or other foreign material. Handling, storage, packaging, preservation, and delivery shall be in accordance with QS-9000.

5.3 EMBRITTLEMENT AVOIDANCE

All components shall comply with the requirements of WSS-M99A3-A. Spaced thread tapping screws per WD 950 or WD 954 may be electroplated. Thread rolling screws per WD 952 used in grounding applications may be electroplated only in accordance with S450 or S450L.

5.4 PROTECTIVE FINISHES ON THREADS

Bolt threads with relatively thick coatings (e.g. greater than 8 micrometres) may require additional allowance to accommodate the coating. The thread dimensions before coating shall be determined by the Supplier and shall be manufactured within tolerance class 6g limits. The thread allowance shall be limited by the upper deviation of tolerance class 6g (es) and the lower deviation of tolerance class 6e (ei). Note: This allows the manufacturer to size the parts anywhere within the total tolerance span of class 6g (es) through 6e (ei). To minimize deviation within a lot, the lot shall be limited to a tolerance grade 6. See ISO 965-1 for information regarding thread tolerances.





After plating/coating the threads shall meet the requirements of tolerance class 6h using a solid GO screw ring gauge. Based upon ISO 6157-3 for acceptability of thread damage after plating/coating, the torque applied to the solid GO screw ring gauge shall not exceed $0.001d^3$ Nm, except for dip spin coatings which shall not exceed $0.0015d^3$ Nm.

Nut threads shall be manufactured to 6H tolerance. When coated with zinc flake type coatings tightness to thread inspection gauges may be experienced, however, the coating thickness shall not adversely affect the mechanical performance of the nut or have an adverse effect on normal installation practices. Zinc flake coated nuts shall be tested using an uncoated (or zinc plated) 6g bolt. The nut shall engage on the bolt by hand, the maximum prevailing torque measured over a minimum of 1.5d of rotations shall not exceed 1Nm.

5.5 TEST METHODS - SPECIAL REQUIREMENTS FOR FASTENERS

Requirements defined in this protective finish specification apply to parts as received by Ford and shall be evaluated using the following test methods and definitions as applicable.

5.5.1 SIGNIFICANT SURFACES

Significant surfaces are those surfaces visible on a part as normally assembled, or surfaces that can be a source of corrosion products visible on an assembled vehicle. Significant surfaces are used when assessing corrosion.

5.5.2 COATING THICKNESS

Threads, sharp edges, crevices, holes, slots and recesses shall not be used for coating thickness measurement. The measurement of coating thickness shall be in accordance with ISO 4042 Clause 10.

5.5.3 SALT SPRAY TEST

Salt spray tests shall be conducted in accordance with SAE/USCAR-1, which supersedes any salt spray requirements stated in the specified material/performance specifications. It is not intended for salt spray testing to be conducted on every lot. Salt spray testing is intended to be used to monitor the process and shall be conducted in accordance with QS-9000.

5.5.4 CYCLIC CORROSION TESTING

Cyclic corrosion testing shall be conducted in accordance with CETP 00.00-L-467.

5.5.5 WASHER ADHESION

The washer component of nut and washer assemblies and bolt and washer assemblies shall be free to rotate so that installation is not affected by spinning of the washer component. The washer may not be free spinning initially, when heavy finishes are applied. Acceptable initial washer component adhesion shall become loose after a $0.0015d^3$ [Nm] breakaway torque is applied.

5.6 DIP SPIN APPLIED COATINGS - RECESS FILL AND OTHER POTENTIAL ISSUES

5.6.1 Some finishes are applied by: a) depositing the fasteners into a perforated basket; b) immersing the basket into a tank of the uncured material; c) elevating the basket above the tank; and e) spinning the basket above the tank. The basket's rotational speed overcomes the centripetal force, shedding excess material to provide the desired coating thickness. Material viscosity, fastener geometry, fastener orientation in the basket, load size, and rotational speed are major factors in the application of these finishes.

5.6.2 Internally driven fasteners (recess drive), fasteners with internal cavities such as nuts, rivets, parts with extruded, closed-end holes, parts with through-holes, fasteners with fine pitch threads, and other similar features trap excess material in the cavities, which the spinning process does not completely remove.

5.6.3 CAUTION: If the dip spin process is used to apply coatings to fasteners with these design features, a percentage of the fasteners will have recess fill, clogged holes, bubbled coating, and/or thread



bridging. As a result, fasteners with these finishes and designs may experience issues with form, fit, and function at the assembly plants.

- 5.6.4 To avoid these issues, consider applying the dip spin finish using a different process method such as spray, tumble spray, and planetary rotary systems. These processes may significantly reduce recess fill, but will still yield some recess fill. Alternatively, consider externally driven fastener designs, non-dip spin finishes, and plated finishes.

Note: Dip Spin coatings are identified under their respective finish descriptions within this specification.

5.7 MECHANICALLY DEPOSITED PLATINGS – BEAD ENTRAPMENT

- 5.7.1 Mechanical plating, also known as peen plating, mechanical deposition, or impact plating, is a plating process that imparts the coating by cold welding fine metal particles to a workpiece. It is commonly used to overcome the potential for hydrogen embrittlement. The process involves tumbling the workpieces with a mixture of water, metal powder, media, and additives. The media material is usually soda lime glass or a ceramic and is usually spherical in form. Common coating materials are zinc, tin, copper, and aluminum.

- 5.7.2 Internally threaded fasteners and fasteners with an integrated or free-spinning assembled washers such as nut and washer assemblies (KEPS) or screw and washer assemblies (SEMS) have the potential for bead entrapment in the thread form, between the assembled washer or other part cavities, which the mechanical plating process does not completely remove. To prevent the potential from impeding the assembly process or functionality of the fastener, mechanical plating shall not be released on these parts. This provision applies to all thread sizes and forms.

6. DETAILED FINISH DESCRIPTIONS AND REQUIREMENTS

SSW IN WHITE (COLOR KEYED) PARTS

When Standard or Utility parts are designated "In White" and are therefore required to comply with a color chart or master sample, they shall be released with the suffix SSW.

S300 PLAIN: No supplementary finish required other than the finish considered the normal result of manufacturing processes for the material and product involved.

Total Thickness:	Not applicable
Lubricant:	ISO general purpose metric screw threaded steel fasteners whose thread form is in accordance with ISO 261 and/or whose material and performance requirement reference ISO 898-1 or 898-2 shall be lubricated per WSD-M13P7-A. Not applicable on plastic parts.
Color:	Not applicable
Specifications:	Not applicable
Corrosion Protection:	See paragraph 5.2 (part condition) for FCSD requirements
Service Temperature:	Not applicable
Coating Process:	Not applicable
Friction Coefficient:	$\mu=0.15 \pm 0.03$ per WZ101 Program B using test surfaces per WZ100.
Approved Source:	Not Applicable
Tox Number:	Not Applicable

Special Requirements: Lubricated parts shall meet the requirements for torque/clamping force specified in WZ 100 or the requirements of the individual product specification, e.g., Prevailing Torque Nuts WE 950. Weld, Pierce, Clinch and non-metallic fasteners shall not be lubricated. All other fasteners that do not fully conform to the aforementioned requirements shall not be lubricated, e.g., Tapping Screws WD 950/953, Single Threaded Spring Nuts WE 953.

Recommended Usage: Generally used on weld, pierce or clinch bolts and/or nuts for "Body in White" applications, aluminum rivets, and plastic fasteners. For recommended usage see Global Finish Strategy referenced in paragraph 2.0.

**S303 BLACK ORGANIC CORROSION PROTECTION COATING:**

This finish is a black organic protective coating 35 units' sub-gloss. It is low temperature heat cured from organic media.

Total Thickness:	5.0 micrometres, min.; 15 – 20 micrometres typical
Lubricant:	Integral friction modifiers in topcoat. No additional waxes, lubricants or torque tension fluids are necessary.
Color:	Black
Specifications:	WSD-M21P10-B2 FLTM BI 110-1
Corrosion Protection:	120 hour salt spray
Service Temperature:	175 °C
Coating Process:	If applied by a Dip Spin method, see Section 5.6 on recess fill.
Friction Coefficient:	$\mu=0.15 \pm 0.03$ per WZ101 Program B using test surfaces per WZ100.
Approved Source:	Many (See MATS approved source list)
Tox Number:	IRB030 (all)
Special Requirements:	ISO general purpose metric screw threaded steel fasteners whose thread form is in accordance with ISO 261 and/or whose material and performance requirement reference ISO 898-1 or 898-2 shall meet the requirements for torque/clamping force specified in WZ 100 or the requirements of the individual product specification, e.g., Thread Rolling Screws WD 951/952, Prevailing Torque Nuts WE 950. If a lubrication process is required to satisfy this requirement, it will be an integral dry self-lubrication system.
Recommended Usage:	Generally used on externally driven screws for interior applications. Not recommended for nuts or recessed drive screws. For recommended usage see Global Finish Strategy referenced in paragraph 2.0.

S306 BLACK ORGANIC CORROSION PROTECTION COATING: (NOT FOR NEW DESIGN)

This finish is a black organic protective coating 35 units' sub-gloss.

Total Thickness:	5.0 micrometres, min.; 15 – 20 micrometres typical
Lubricant:	Integral friction modifiers in topcoat. No additional waxes, lubricants or torque tension fluids are necessary.
Color:	Black
Specifications:	WSD-M21P10-B3 FLTM BI 110-1
Corrosion Protection:	240 hour salt spray
Service Temperature:	200 - 230 °C Intermittent, 150 - 180 °C Continuous
Coating Process:	If applied by a Dip Spin method, see Section 5.6 on recess fill.
Friction Coefficient:	$\mu=0.15 \pm 0.03$ per WZ101 Program B using test surfaces per WZ100.
Approved Source:	Whitford Plastics Ltd. – Xylan 5230
Tox Number:	IRB030
Special Requirements:	ISO general purpose metric screw threaded steel fasteners whose thread form is in accordance with ISO 261 and/or whose material and performance requirement reference ISO 898-1 or 898-2 shall meet the requirements for torque/clamping force specified in WZ 100 or the requirements of the individual product specification, e.g., Thread Rolling Screws WD 951/952, Prevailing Torque Nuts WE 950. If a lubrication process is required to satisfy this requirement, it shall be an integral, dry, self lubrication system.
Recommended Usage:	Generally used on externally driven screws for interior applications. Not recommended for nuts or recessed drive screws. Not recommended for new design.

S307 BLACK ZINC ORGANIC CORROSION PROTECTION COATING:

This finish is a black organic protective coating 35 units sub-gloss.

