

New Finish Development Document

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NEW FINISH DEVELOPMENT DOCUMENT

1. SCOPE:

This standard lists variables that shall be investigated and reported as an initial investigation into new or revised surface finishes intended for use on fasteners. This standard provides instruction for producing a final report that will be used to determine if further investigation of a surface finish is justified. Further investigation may include tests and evaluations specific to an individual OEM prior to introduction/approval of the surface finish. The final report shall include the results, observations, and conclusions for all of the variables. The final report may be made up of several individual reports covering each variable. In all cases the laboratory performing the test, the test date and the report approver shall be included in the final report.

2. REFERENCES:

ASTM B571
ASTM D1735
ASTM D523
SAE J2334
SAE/USCAR5
SAE/USCAR7
SAE/USCAR10/11
SAE/USCAR26
ISO 4599

3. REQUIREMENTS:

All of the following requirements shall be recorded in a final report.

3.1 Rationale:

Based upon current industry supply and usage, the rationale, (business case), for the introduction of a new finish shall be specified. It is not intended to limit the scope of this rationale, it can be based on new materials, new technology, improved quality, improved availability, lower costs improved environmental stewardship etc. The approximate cost of the surface finish shall be recorded. It is understood that finishing costs will vary based upon many factors such as geographic location, transportation quantities etc. It is not intended for this cost to be related to any specific type or size of fastener, or quantity. The cost or cost ratio provided is not intended to be used for purchasing prototype or production quantities, it is solely intended to determine the need to further investigate potential use of the surface finish. The recorded cost may be a comparison of surface finishes currently used in the fastener industry. The approximate cost may be recorded as a percentage or ratio of current surface finishes.

The research data, analysis, conclusion, opinions and other contents of this document are solely the product of the authors. Neither SAE International nor the United States Council for Automotive Research (USCAR) certifies the compliance of any products with the requirements of nor makes any representations as to the accuracy of the contents of this document nor to its applicability for purpose. It is the sole responsibility of the user of this document to determine whether or not it is applicable for their purposes.

3.2 Availability:

The geographical location where the finish chemicals are manufactured and distributed, and a list of applicators or potential applicators, shall be included in the final report.

3.3 License agreements:

In many cases the manufacturer of finishing materials require applicators to obtain a license and comply with a license agreement. These license agreements often include a agreement that the manufacturer be provided with regular reports, finishing parameters and samples for on-going finish quality verification tests. A section shall be included in the final report covering licensing, if licensing is not a requirement of the chemical supplier this shall be stated. It is not intended for the complete licensing agreement to be included in the final report, the final report should contain a synopsis of the license requirements and any verification tests that are used by the chemical supplier to gain assurance of applicator quality.

3.4 Restricted Substances

Supplier will review compliance with any substance that has restrictions. Comment on IMDS compliance. List any occupational hazards for example fumes caused by welding. List heavy metals and other materials that may impact environmental stewardship.

3.5 Appearance

Describe the appearance characteristics of the coating. For example, uniform, tightly adherent, hard and dry, free from tears and consistent in color. For coatings intended for appearance fasteners the gloss level of the coating shall be recorded using a 20 degree gloss meter in accordance with ASTM D523.

3.6 Corrosion Protection:

Corrosion testing shall be conducted per SAE J2334 (Cyclic Corrosion Test) and SAE/USCAR – 1 (Salt Spray Testing and Evaluation of Fastener Finishes). The percentage of white and red corrosion products shall be reported at the end of the tests. The percentage of red corrosion product shall not exceed 10%. Color photographs must be taken at the end of the test and submitted along with the test data and tested parts.

3.7 Galvanic Compatibility:

The galvanic protection against aluminum, magnesium and stainless steel must be demonstrated by assembling 30 randomly selected coated fasteners into one test panel of each material. Assemblies shall be subjected to testing per SAE J2334 for the same length of time as the unassembled parts. After testing, all of the fasteners shall be removed from the test panels, and the area under the fastener shall be photographed. There shall be no pitting, exfoliation or localized corrosion of the test panel in the vicinity of the fastener. Color photographs must be taken at the end of the test and submitted along with the test data and tested parts.

Recommended test panel materials are:

Materials Designations

Aluminum UNS A95252 or A95657 or A96010 or A03560 or A96061

Magnesium AZ91 or AM50 or AM60

Stainless steel UNS S30400 or S43400 or S43600

Copper Alloy UNS C11000 or C11300

Body sheet steel, E-coated

3.8 Torque-Tension / Coefficient of Friction

Parts shall be tested for torque-tension characteristics and coefficient of friction. M10x1.5 Hexagon headed bolts shall be processed using the normal process techniques recommended by the manufacturer. The bolts shall be tested for torque tension characteristics in accordance with SAE/USCAR11 except the tightening speed shall be 30 +/- 3 RPM. The coefficient of total friction shall be calculated using ISO 16047. High speed tests shall also be conducted.

3.9 Service Temperature

Determine the temperature that the finish can be held at for 4 hours without degradation of corrosion protection or appearance. The chemical manufacturer/applicator is to identify the maximum operating temperature range. USCAR prefers that the coating shall not lose its ability to protect against corrosion when subjected to a temperature of 150 deg. C after installation. High temperature resistance shall be demonstrated by soaking 30 randomly selected coated fasteners in an oven at 150 deg. C for 24 hours. Heat-soaked fasteners and non-heated fasteners from the same lot shall be salt spray tested per USCAR - 1 until onset of red rust. The performance of the heated parts shall be at least as good as the performance of the non-heat treated parts. All tested parts shall be submitted for examination along with the number of hours they were in the salt spray test.

3.10 Adhesion/Cohesion Performance.

Perform test to evaluate adhesion and cohesion:

Scribe and Tape test

Ericson ball extrusion.

Bend tests.

Also refer to See ASTM B571 or ASTM D1735

3.11 Coating Thickness and Ability to Gauge. Size and Geometry Recommendations

Include maximum, minimum and typical thicknesses for every coating layer in the system. Comment on the ability to meet gauging requirements when applied to standard 6g/6H tolerance fasteners. Comment on the recommended tolerance prior to coating if under-sizing is recommended. Comment on the size and geometry limitations where the typical performance properties will be met or reduced.

3.12 Embrittlement

A statement shall be included in the report covering all material and process parameters that may lead to a higher susceptibility for brittle fracture. Any process employed to reduce the susceptibility shall also be included. See SAE/USCAR5 and SAE/USCAR7 for further information.

3.13 Compatibility with 'Subsequent Treatments':

Many fasteners employ subsequent treatments to enhance performance characteristics. These treatments include the addition of products such as 'microencapsulated adhesives', 'non-metallic sealer patches' and PTFE type patches. The finish chemical supplier and/or finish applicator shall work with subsequent treatment applicators to investigate the performance of the subsequent treatment when applied to the subject finish.

The performance of subsequent treatment are controlled by OEM and Industry Standards. Because of the variety of materials and performance standards, it is not intended to require specific tests to be performed. However, a variety of microencapsulated adhesives, sealer patches and PTFE type materials shall be applied to the subject finish. Testing shall be performed and recorded to show that the subsequent treatment can be applied and that the finish does not cause any degradation in the normal performance expectations.

Some subsequent treatments employ heat or chemical reaction to adhere to the surface finish. A statement shall be included in the final report regarding degradation of any surface finish property caused through normal subsequent treatment application techniques.

If the application of the subsequent treatment requires a change to the normal process sequence this shall be noted in the report.

3.14 Paintability

Determine the ability of the finish to be able to pass through a typical Automotive paint system. Comment on the ability of the coating to be painted without contamination of the paint system.

3.15 Resistance to standard Automotive fluids:

3.15.1 Water Resistance

Shall not blister or show any signs of red rust when subjected to immersion in de-ionized water for 240 hours at 23 +/- 2°C.

3.15.2 Gasoline Resistance

Shall not blister or show any signs of softening or dulling when subjected to immersion in gasoline for 24 hours at 23 +/- 2 °C.

3.15.3 E-85 Fuel Resistance

Shall not blister or show any signs of softening or dulling when subjected to immersion in E85 for 24 hours at 23 +/- 2 °C.

3.15.4 Hot Oil Resistance

Shall not blister or show any signs of softening or dulling when subjected to immersion in engine oil for 24 hours at 66 +/- 3 °C.

3.15.5 Ethylene Glycol Resistance

Shall not blister or show any signs of softening or dulling when subjected to immersion in a 50% solution of water and long life coolant concentrate (engine coolant) for 24 hours at 23 +/-2 °C.

3.15.6 Brake Fluid Resistance

Shall not blister or show any signs of softening or dulling when subjected to immersion in currently approved brake fluid for 24 hours at 23 +/-2 °C.

3.15.7 Power Steering Fluid

Shall not blister or show any signs of softening or dulling when subjected to immersion in power steering for 24 hours at 66 +/-3 °C.

3.15.8 Transmission Fluid

Shall not blister or show any signs of softening or dulling when subjected to immersion in transmission fluid for 24 hours at 66 +/-3 °C.

3.16 Conductivity:

The chemical manufacturer/applicator must furnish information and test data as evidence that the coating is electrically conductive in a corrosive environment per SAE/USCAR -26 (Test Procedure for Electrical Ground Attachments).

3.17 Weldability:

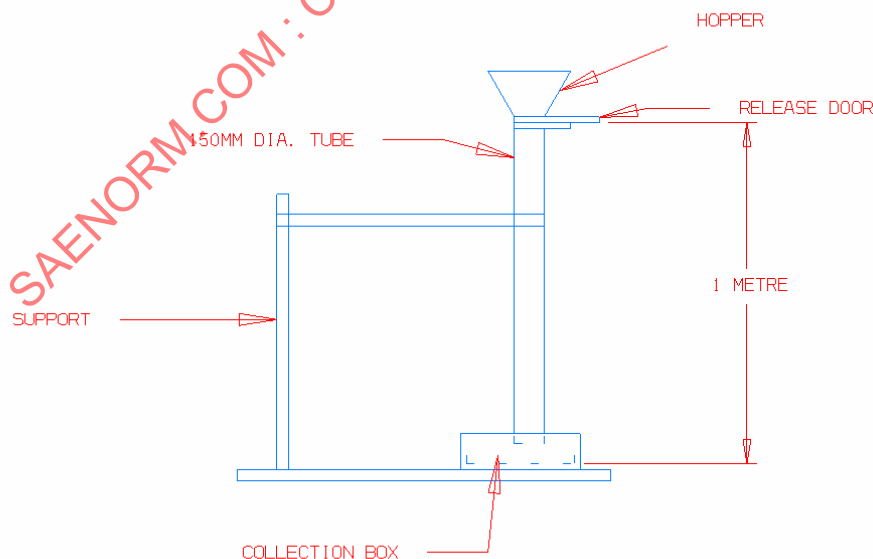
The chemical manufacturer/applicator must provide documentation of Toxicology approval for welding vapors when the coating can be used on fasteners intended for welding. Any finish chemicals that may impact the weld properties shall be listed in the report.

3.18 Dry to the touch

Whatman Paper Filter Test # 41 (Cat No 1441 090) One fastener wrapped in Whatman paper, squeezed in the palm of the hand for 5 to 10 seconds. No visual stain should appear on the Whatman paper when viewed without using supplementary magnification. For referee purposes this test shall be carried out using a force of 10N.

3.19 Drop Test

The drop test is intended to provide guidance as to the finishes ability to withstand shipping handling and abrasion from automatic feeding equipment. The equipment consists of a round or square shaped hopper connected to a non-metallic tube of approximately 150mm diameter. A sliding release door is fitted between the hopper and the top of the tube. 1 Kilogram of finished fasteners are loaded into the hopper. The sliding trap door is opened allowing the test fasteners to drop 1 metre into a non-metallic collection box. The procedure is repeated three times. Test for corrosion resistance – compare to non-dropped parts.



3.20 Dry Rag Test – Rub-Off –Soilability/Cleanability

Use one white glove, pick up 50 handfuls of screws (~ ½ of the box). Using the same white glove, handle a vinyl, ABS, soft touch painted part, carpet and cloth components (Optional colors to test: Grey, Light Blue and Light Tan). Wipe the glove clean using a dry cotton towel, use a simple statement to evaluate how easy it is to clean the glove). If samples are still dusty/dirty, use EOM approved interior cleaner. (rate how easy it is to remove the dust)

3.21 Compatibility in Plastics

Evaluate and comment on the suitability of the finish for use in contact with plastics.

3.22 Weathering Characteristics.

Finishes intended for high visibility applications shall be tested to 112.8 kJ/m² in Xenon arc per SAE J1885 as well as to 1316.7 kJ/m² in Xenon arc per SAE J1960. Parts shall be evaluated for blistering, peeling, cracking, loss of adhesion, discoloration and red rust after each test. For appearance type coatings report the gloss level using 20 degree gloss meter per ASTM D523 after each test.

3.23 Loosening Test at elevated Temperatures

Determine the ability of the finish to retain the coefficient of friction at 150°C. Test fasteners shall be assembled in a test block with a bearing surface ground to Ra 0.8 to 1.6 micrometres. Record the loosening torque on test parts at room temperature and on parts heated to, and tested at a temperature of 150°C.

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FINISH	DESCRIPTION

GLOBAL CORPORATE REQUIREMENTS	1. METHOD	2. RESULTS
1. Rationale	Improvement in quality, cost, delivery, sourcing, or availability. Potential usage, areas where this finish may resolve issues, close 'gaps'	
2. Global Availability	Supplier will confirm global availability of finish materials and applicators	
3. Patents Licensing	Patents Special licensed applicator approval process	
4. Restricted Substance Compliance	Supplier will review compliance with any substance that has restrictions. Comment on IMDS compliance Metric: Pass/Fail	
Occupational Health & Safety	List any occupational hazards for example fumes caused by welding.	
Environmental Stewardship	List heavy metals and other materials that may impact environmental stewardship	

USAGE REQUIREMENTS	METHOD	RESULT
5. Appearance	Describe the appearance characteristics of the coating. For example, uniform, tightly adherent, hard and dry, free from tears and consistent in color	
6. Corrosion Resistance	SAE J2334 SAE/USCAR 1	
7. Galvanic Compatibility	Tests shall be run against aluminum, stainless steel, magnesium	