



DECORATIVE CHROME ELECTROPLATED PART PERFORMANCE REQUIREMENTS, POLYMERIC/PLASTIC SUBSTRATES, GENERAL INTERIOR USE

WSS-M1P83-F1

1. SCOPE

This specification defines the performance requirements for copper, nickel, and chromium electroplated acrylonitrile butadiene styrene (ABS), polycarbonate/acrylonitrile butadiene styrene blend (PC/ABS) and polyamide (PA) parts for interior applications.

2. APPLICATION

This specification was released originally where a decorative chrome finish is required for interior applications, including, but not limited to, handles, finish panels, bezels, knobs and buttons.

2.1 LIMITATIONS

No coating (paint, ink, etc.) may be applied over chrome plating unless approved by Materials Engineering.

This specification does not cover non-electro plated metalized surfaces.

2.2 REFERENCES

Appendix A: PPAP Report Template
Appendix B: Reference Images

3. REQUIREMENTS

This specification is performance based and does not have approved sources.

All requirements identified for this specification must be met to achieve acceptable field durability. No one requirement, exclusive of others, is capable of insuring satisfactory performance. Any deviations to the requirements of this specification may be subject to additional performance requirements.

Testing at Design Verification (DV), Material Color Durability/Compliance Certification (MCDCC), and Process Validation (PV) must be conducted per Table 3. For MCDCC approval, parts from DV and/or PV testing may be submitted in lieu of separate test parts, as long as the quantity of parts per Table 3 is met.

Additional routine testing for process control may be required and if so, would be in the Special Characteristics Communication and Agreement Form (SCCAF). The SCCAF will define the required number and frequency of samples agreed to by Ford Design and Release Engineering (D&R) and Supplier Technical Assistance (STA).

3.1 APPEARANCE

The plated parts shall be free from surface imperfections and must conform to the color requirements defined by Ford Design Quality, the Ford Color Harmony Team Styling Master and the Approved Boundary Sample.

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2017 12 13	Released		S. Draheim and Global Team

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3.2 MOLDED SUBSTRATES

Ford recommends using substrate materials approved to the following specifications:

WSS-M4D836-B2/latest for ABS
WSS-M4D813-B2/latest for PC/ABS
WSS-M4D667-B2/Latest for PA

The decision to use either ABS, PC/ABS or PA shall be directed by Ford D&R engineering

Part geometry influences the capability of the plating process. Designs should be optimized to ensure the plating process is capable of meeting this specification.

The use of regrind or recycled material for substrates in plated applications is prohibited.

Material must be processed per Global Manufacturing Standard W-IMMS - Control of Plastic Injection Molding Processes, located on the Ford Supplier Portal, STA Global Technical Services, Plastic Molding, https://web.qpr.ford.com/sta/Ford_GTS.html.

The parts shall be smooth and without flow lines, knit lines, visible porosity, cracks, sink marks, or other molding defects, which may detract from the part appearance or performance. Molded substrates must also be free of any residual stresses which would impact electroplate adhesion, dimensional stability, or appearance. Mold flow analysis should be conducted to minimize residual stress in molded substrates.

Parting lines, flash and other characteristics of molding may impact part durability and must be minimized. Any rework of parting lines prior to plating must be reviewed and approved by STA before use in the production process. Testing to this standard must be completed on parts with the rework process and submitted to STA for approval.

3.3 FINISHED PARTS

Design Verification testing must be completed on program specific part geometry plated with the production representative process. Production Validation testing must be done on actual production level parts. Where part dimensions limit testing, or other exceptions exist, substitution of surrogate parts or plaques requires approval of D&R, STA, and Ford Materials Engineering.

All visible surfaces of the component, including terminating exterior edges visible after assembly, shall conform to the full requirements of this specification, unless otherwise specified in the SCCAF or on the engineering drawing.

Plated test specimens prepared for investigations according to this specification must be aged a minimum of 2 hours at 23 +/- 2 °C prior to testing.

3.4 PROCESS OPTIMIZATION

Process development is to be completed prior to any qualification testing to this specification (DV, PV, etc.). Repetition of these tests may be necessary in order to optimize molding and plating parameters for successful part performance. Once optimization of all parameters is complete, all testing, including tests in Section 3.4, must be conducted at the production parameter levels. Only results of the final tests, with production levels of all parameters, are required to be submitted as part of the PPAP package.



The use of SEM analysis of the part surface after the etching process is recommend. This can indicate under etching, over etching, and/or elongation of bond sites. All witch can decrease adhesion performance. See reference pictures in appendix B Figures 3 through 6.

3.4.1 Residual Stress Test and Identifying Adhesion points

No cracking

Residual stresses in molded plastic parts are areas of potential weak electroplate adhesion

Residual Stress Test is not required for PA (Nylon) substrate material but see below for Identifying Adhesion points (A-points)

The results of this test will identify the test location for the adhesion grind – saw test in paragraph 3.5.1

Testing for residual stress must be conducted for new parts, when any molding parameter changes, or when adhesion issues may be due to molding stress. Repetition of this test may be necessary in order to optimize molding parameters for reduction of molded-in stresses before all additional testing is completed.

Test Procedure:

Completely immerse the unplated part in glacial acetic acid, 99% purity, at 23o C +/- 3 °C for 30 seconds. Remove and immediately rinse the part with water to remove acid from the surface and allow to dry at room temperature. Review and photograph the part, noting any areas of uneven whitening.

Return the part to the glacial acetic acid bath for up to the duration indicated by Table 1 below.

Table 1: Glacial Acetic Acid Test Time

Substrate	Time
ABS	120 seconds
PC/ABS	180 seconds

After the specified time has elapsed, immediately rinse the part with water to remove acid from the part surface and allow to dry at room temperature. Review and photograph the part again, noting any areas of uneven whitening.

Identifying Adhesion points (A-points)

Areas with the highest contrast between light and dark indicate locations of the highest molded-in stress (Appendix B, Figures 1 and 2). The highest stress areas should be documented as “adhesion points” or “A-points”. A minimum of two “A-points” per part must be indicated.

For parts that do not show obvious areas of high contrast, the minimum two “A-points” will be: 1) at a point on the significant surface closest to the gate, 2) at a knit line. If no knit line exists, the second point should be at a location on the significant surface at end of flow or along a narrow channel if one exists.

For Nylon parts, the A-points should be identified using the same method as parts that do not show obvious areas of high contrast.



Report must include photos of the part before testing, after 30 seconds, after 120-180 second durations. These Photos must be of high enough resolution and quality to show no color change or to show where high contrast locations exist. Photos must also be provided identifying the selected A-points. These photos must be retained for process control validation of the optimized molding process.

3.4.2 Minimum Plating Thickness (ASTM B487, ASTM B504, ASTM B568)

Minimum plating thicknesses are defined in Table 2. For typical plating construction, refer to Appendix B, Figure 7.

Plating thickness should be met for all DV tested parts and optimized prior to PV testing to ensure all requirements of the specification are met.

The use of auxiliary anodes is recommended, where applicable.

Thickness measurement locations should be at the high and low thickness locations across the rack. A picture must be provided of a full rack of parts showing the following 3 items:

- 1) High and Low current density areas identified
- 2) Part with low thickness location circled (This most likely will be in low current density area and the farthest point from the anode)
- 3) Part with High thickness location circled (This most likely will be in the high current density area and the closest point to the anode)

Copper and nickel layer thickness to be determined by Microscopic Examination (ASTM B487). Chromium layer thickness to be determined by Coulometric Method (ASTM B504), or X-Ray Spectrometry (ASTM B568).

Table 2: Plating Layer Minimum Thickness Requirements

Plating Layer	Interior Minimum thickness (µm)
Copper	13
Semi Bright Nickel	Not Required
Decorative Nickel	5
Microporous Chromium	Not required
Microcrack Chromium	Not required
Continuous Chromium	0.18

3.5 PLATING ADHESION

All adhesion testing must be completed on the part at the "A-points" as indicated by Section 3.4.1 Residual Stress Test and Identifying Adhesion points, unless otherwise noted. Where a single part is produced by multiple cavities, testing at PV must be completed on parts molded from the tool cavity that produces the highest stress conditions, as determined by Section 3.4.1.

3.5.1 Grind-Saw Test (ASTM B571, with modifications below)

Testing will be performed using a handheld hacksaw with 6-8 teeth/cm, cutting from the substrate toward the plating. The cut will be made with the plane of the saw 90 degrees to