**ENAMEL, (3 WET) COMPLIANCE VOC, HIGH SOLIDS THERMOSET PRIMER, PROCESSED WITH WSS-M33J10-A2/WSS M33J10-A4, EXTERIOR** **WSS-M33J10-A1**

**ENAMEL, (3 WET) COMPLIANCE VOC, HIGH SOLIDS THERMOSET BASECOAT, PROCESSED WITH WSS-M33J10-A1/WSS-M33J10-A4, EXTERIOR** **WSS-M33J10-A2**

**ENAMEL, (3 WET) COMPLIANCE VOC, HIGH SOLIDS THERMOSET MIDCOAT, PROCESSED WITH WSS-M33J10-A1/WSS-M33J10-A2/WSS-M33J10-A4, EXTERIOR** **WSS-M33J10-A3**

**ENAMEL, (3 WET) COMPLIANCE VOC, HIGH SOLIDS THERMOSET CLEARCOAT, PROCESSED WITH WSS-M33J10-A1/WSS-M33J10-A2, EXTERIOR** **WSS-M33J10-A4**

**ENAMEL, (3 WET) COMPLIANCE VOC, HIGH SOLIDS THERMOSET TINTED CLEARCOAT, PROCESSED WITH WSS-M33J10-A1/WSS-M33J10-A2, EXTERIOR** **WSS-M33J10-A5**

**ENAMEL, (3 WET) COMPLIANCE VOC, HIGH SOLIDS THERMOSET PRIMER, PROCESSED WITH WSS-M33J10-B2/WSS-M33J10-B4, REDUCED VISCOSITY, EXTERIOR** **WSS-M33J10-B1**

**ENAMEL, (3 WET) COMPLIANCE VOC, HIGH SOLIDS THERMOSET BASECOAT, PROCESSED WITH WSS-M33J10-B1/WSS-M33J10-B4, REDUCED VISCOSITY, EXTERIOR** **WSS-M33J10-B2**

**ENAMEL, (3 WET) COMPLIANCE VOC, HIGH SOLIDS THERMOSET MIDCOAT, PROCESSED WITH WSS-M33J10-B1/WSS-M33J10-B2/WSS-M33J10-B4, REDUCED VISCOSITY, EXTERIOR** **WSS-M33J10-B3**

**ENAMEL, (3 WET) COMPLIANCE VOC, HIGH SOLIDS THERMOSET CLEARCOAT, PROCESSED WITH WSS-M33J10-B1/WSS-M33J10-B2, REDUCED VISCOSITY, EXTERIOR** **WSS-M33J10-B4**

**ENAMEL, (3 WET) COMPLIANCE VOC, HIGH SOLIDS THERMOSET TINTED CLEARCOAT, PROCESSED WITH WSS-M33J10-B1/WSS-M33J10-B2, REDUCED VISCOSITY, EXTERIOR** **WSS-M33J10-B5**

## 1 SCOPE

The materials defined by these specifications are coatings, which consist of primer surfacers over which is applied a pigmented thermoset basecoat enamel and a clear or tinted clear thermoset clearcoat in a wet-on-wet-on-wet (3 Wet) process. These materials are monobaked. Unique tricoat colors are also included in this specification. Tricoat colors consist of a pigmented basecoat followed by a non-hiding midcoat over which is applied a clear or tinted clear. Tricoat colors may be processed wet-on-wet-on-wet-on-wet application and monobaked or in a wet on bake operation.

| Date | Action | Revisions | Rev. 0 |
|---|---|---|---|
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| | | | |
| 2010 04 29 | Activated | T. Wengartz, NA | |

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## 2 APPLICATION

These specifications were released originally for materials used as the combined primer surfacer (guidecoat), basecoat, and clearcoat finish when applied wet-on-wet-on-wet (3 Wet) and mono baked on automobile bodies, hoods, fenders and other exterior parts, and shall be satisfactory for use over previously baked enamel, as in paint repair or two toning operations. These materials have been formulated to provide windshield bonding without the use of flange primer (direct glazing) and allow for flush glass designs. The basecoat portion is used alone, without clearcoat, as an interior baking enamel for some applications.

## 3 REQUIREMENTS

Tests shall be made on the basis of comparison with approved production material, to be chosen by the approving materials engineer.

Note: For purposes of the specification, paint systems which utilize a standard primer surfacer /basecoat/clearcoat, a primer surfacer/basecoat/midcoat/clearcoat and/or a system with tinted clearcoat shall be considered the "complete enamel system". For basecoat only applications refer to section 3.11.

### 3.1 STANDARD REQUREMENTS FOR PRODUCTION MATERIALS

Material suppliers and part producers must conform to the company's standard requirements for production materials (WSS-M99P1111-A). For the materials described within this specification those requirements include but are not limited to the performance specification and the system design specification.

### 3.2 COMPOSITION

3.2.1 Resin

3.2.1.1 Primers shall be modified polyester and/or modified polyurethane crosslinkable resin(s), with melamine and/or reactive urethane crosslinker(s) or equivalent.

3.2.1.2 Basecoats and traditional tricoat midcoat shall be thermosetting, synthetic resins with a melamine crosslinking system or equivalent.

3.2.1.3 Clearcoats will be thermosetting, acrylic-modified synthetic resins with a hybrid crosslinking system or equivalent.

Each will be appropriately fortified so as to meet the durability requirement of 10 years. The primer composition will meet all performance expectations in terms of stone chip damage and adhesion.

3.2.2 Pigments

Pigments are exterior quality automotive grade selected to meet durability requirements.

3.2.3 Solvents

The volatility of the solvents will be such that there shall be no paint sagging, roughness or dry spray at specified film thicknesses. Solvents shall be HAPS compliant if it is required by local government regulations.

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3.2.4 Ultra Violet Light Absorber(s) (UVA) and Hindered Amine Light Stabilizers (HALS)

All approved materials shall include with the initial Sample Report an Ultra-Violet/Visible spectroscopic analysis. This shall be recorded and filed by the approving Paint Material Engineering Laboratory of the Ford Motor Company as a reference standard for future use and recertification.

The coating system shall contain sufficient fortification of suitable UVA and HALS to provide 10 year long term durability.

3.2.5 Flash Point

The flash point shall conform to the safety regulations applicable to the plant and/or country where the materials are used.

## 3.3 PHYSICAL PROPERTIES LIQUID STATE

The following evaluation must be conducted at as shipped and application viscosity. Over the application viscosity range, material shall be in compliance with local emissions regulations.

| | | |
|---|---|---|
| 3.3.1 | Non-Volatile Content, range<br>(ASTM D 2369-07 for North America)<br>(FLTM BI 102-01 for Europe) | See initial sample +/- 2% |
| 3.3.2 | Volatile Organic Content, range<br>(ASTM D 3960) | See initial sample +/- 1.5% |
| 3.3.3 | Weight per Volume, range<br>(ASTM D 1475) | See initial sample +/- 0.025 g/ml |
| 3.3.4 | Volume Solids, range at Application Viscosity<br>(ASTM D 2697 or FLTM BI 154-02) | See initial sample +/-1.3%<br>Primer 42% minimum<br>Basecoat 37% minimum<br>Clearcoat 49% minimum |
| 3.3.5 | Pigment Content in Tinted Clearcoat, max<br>(ASTM D 2471, max weight % [on total formula] of colored pigment) | 0.25% |

3.3.6 Viscosity
(ASTM D 1200)

Supplier shall report value at application reduction.

3.3.7 Stability
(ASTM D 1849)

3.3.7.1 Shelf Stability 90 days

No more than 30% increase in viscosity permitted.

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3.3.7.2 Accelerated Stability (60 °C, 16 h)

No more than 30% increase in viscosity permitted.

After the accelerated stability test, the material shall pass all specification requirements. Critical testing must include; solvent pop, sag resistance, appearance, direct to glass bonding, intercoat adhesion, repair paint system wetting, and tape/label adhesion.

3.3.8 Resistivity (ASTM D 5682) — 0.05 to 2.00 megohms

Volatile solvents and other components affecting electrical conductivity shall be adjusted such that the resistivity at application viscosity shall be within specified limits.

## 3.4 PREPARATION OF TEST PANELS

Substrate: All current production substrates, including but not limited to, pretreated galvanized steel, pretreated electro galvaneal steel, pretreated aluminum, unpolished pretreated cold rolled steel and current production primed exterior thermosetting plastic. Record all substrate information. See para 4.1.

Electrocoat: Current Ford production approved medium build gray cathodic electrocoat, applied at 20 - 23 micrometers and baked utilizing the appropriate bake schedule. Record electrocoat and oven type used.

Primer: Within a wet-on-wet-on-wet application process apply primer surfacer to required dry film thickness (22.5 – 30 microns) by spray under conditions appropriate for primes, and flash prime coat 180 seconds or as specified, prior to basecoat application. Record primer application information and include with the submission data package for system approval.

Basecoat: Apply basecoat, directly to the just flashed primer, to the required dry film thickness (typical color dependent range – 15- 30 microns) by spray under (OEM) conditions appropriate for basecoats, and flash 180 seconds or as required. Record basecoat application information and include with the submission data package for system approval.

Clearcoat: Apply clearcoat to required dry film thickness (40-55 microns) and flash 10 minutes or as required. Bake for 20 minutes at 140 degrees centigrade metal temperature with 10 minute ramp-up. Bake target is obtained using appropriate bake schedule as defined by paragraph 3.5. Record clearcoat application information and oven type used and include with the submission data package for system approval.

Catalyzed Low Bake Repair: LBR For catalyzed low-bake repair, a current production basecoat/clearcoat system from the same manufacturer that has been (LBR) approved for use may be substituted, provided that it meets all the catalyzed repair systems criteria. Catalyze enamel as per manufacturer's recommendations. Prepare (OEM) panels at target conditions. Wipe panels using naphtha and mask half of panel vertically. Apply low bake system, remove masking, flash and bake 10 minutes at 100 °C metal temperature

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See para 4.2 Table 1 for Topcoat Processing Matrix, Table 2 and 3 for New Resin Technology Test Matrices, and Table 4 for New Pigments/New Colors Test Matrix. Process application and coating thickness optimization including target ranges are to be defined within para 3.5 process window.

## 3.5 PROCESS WINDOW DEFINITION - NEW RESIN TECHNOLOGIES ONLY

The supplier shall perform a Design of Experiments (DOE) (Response Surface Analysis is recommended) to determine the process window of the control and candidate materials. The four variables/parameters to be included in the design are bake temperature, bake time, primer and clearcoat film thickness (basecoats applied at hiding). An initial screening experiment should be run to determine what levels should be tested for the variables/parameters. This screening experiment should be reviewed with the materials engineer to set up the final DOE. Responses to the response surface DOEs will be based on the materials tested and will be chosen from tests listed within the specification. Minimal critical performance testing required: cross-hatch adhesion, condensing humidity, acid/alkali resistance, scratch resistance, stone chip (SAE J400 and Erichsen), intercoat adhesion (ICA), and quick knife glass bonding adhesive adhesion. The candidate coating system versus a control will also be required to be evaluated for application robustness utilizing DOEs agreed upon by the Ford responsible Approving Engineer. Information will be used by materials engineer to determine acceptable plant processing conditions. See also para 4.2.

## 3.6 APPEARANCE

Note: Appearance panels will be sprayed using standard plant processing parameters. Consideration should be given to an application process window DOE to assess impact of key process variables/parameters on final appearance. The appearance target values herein listed should be consistent with the fourth quartile values defined by the process window, and should be used as directional targets for production.

3.6.1 Color
(FLTM BI 109-01)
(SAE J1545 X-Rite MA68II Multi-Angle Spectrophotometer or equivalent)

Shall match the Master Appearance Standard color panel.

3.6.2 Wave Scan CF, min (Appearance is to be measured with a reliable instrument such as Byk Gardner Wave Scan.) — equal or better than control

| Target Values: | Horizontal | Vertical |
|---|---|---|
| Dark Solids (L15 <50) | 65 | 55 |
| Medium Solid (L15 89-50) | 65 | 55 |
| Light Solids (L15 >90) | 65 | 55 |
| Dark Metallic (L15 <50) | 65 | 55 |
| Medium Metallic (L15 89-50) | 65 | 55 |
| Light Metallic (L15 >90) | 60 | 50 |
| Tricoat | 60 | 45 |

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3.6.3 Gloss, min 92
(ASTM D 523, 20 degree Glossmeter)

3.6.3.1 Gloss After Rebake, max 4 unit decrease

Rebake panel at target bake conditions.

3.6.4 Leveling

The surface of material(s) under test shall be equal to or better than currently approved production material for smoothness when applied and baked under identical conditions. Orange peel values taken from Wavescan data shall be reported.

3.6.5 Sanding

3.6.5.1 Holdout

There shall be no evidence of dulling, gloss loss or change of image clarity when the 3 Wet paint system is applied over sanded (P400 and P800 grit sand-paper) and unsanded ecoat, OEM repaired topcoat, and plastic substrate. There shall be no prominence of sand scratches.

3.6.5.2 Telegraphing

There shall be no evidence of color shift when the 3 Wet paint system is applied over sanded (P400 and P800 grit sandpaper) and unsanded ecoat OEM repaired topcoat, and plastic substrate.

3.6.6 General

The material system shall cure to a presentable, serviceable, mar-resistant film showing no craters, seediness, abnormal roughness or excessive metallic mottling. It shall have reasonable tolerance for ordinary cleaning (such as automatic car washes) and exhibit excellent polishing characteristics when wheel polished with a wide range of various compounds and cleaners.

## 3.7 FILM PROPERTIES

3.7.1 Film Thickness
(ASTM D 1186)

Target values shall be defined from process window (para 3.5).

3.7.2 Dry Hiding - Pigmented Basecoat 15 - 30 micrometers
(FLTM BI 158-01)

The basecoat is required to provide complete visual hiding over black and gray hiding chart.

When an exception to this hiding requirement is needed for special colors, concurrence must be obtained from all affected Ford activities.

3.7.2.1 Pigmented Midcoat

The pigmentation of the midcoat shall be such that hiding of the basecoat does not occur. The max allowable pigment to binder ratio (P:B) is 0.15.

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3.7.3 Ultraviolet Light Transmittance

Max light transmission through basecoat applied at 80% of dry hiding shall be no more than 0.1% at 360 nm and 5% at 400 nm. The complete primer/basecoat/clearcoat system shall at 80% of minimum film builds (e.g. Primer 18 mircrons, Basecoat 80% of dry hiding, & Clearcoat 28 microns) have 0.05% light transmission 290 nm – 470 nm and < 0.5% light transmission 470 – 550 nm. All primer surfacers used are to be free of aromatic epoxy resins. The equipment used for this measurement is an integrating sphere spectrophotometer or equivalent. Non-fortified (without UV package) clearcoat is used for this evaluation.

| | | |
|---|---|---|
| 3.7.4 | Bleeding of Pigments<br>(ASTM D 279)<br>New Pigments Only | None Permitted |
| 3.7.5 | Hardness<br>(ASTM D 1474) | >/= 7.0 KHN |

Record value at target film and bake conditions. Coating shall be sufficiently cured after baking so that it can meet the polishing requirements of para 3.7.7.

3.7.6 Adhesion

| | | |
|---|---|---|
| 3.7.6.1 | Scratch Test<br>(FLTM BI 106-01, Part A) | No chipping or loss of adhesion permitted |
| 3.7.6.2 | Scribe Test, max<br>(FLTM BI 106-01, Part B) | Grade 1 |

3.7.7 Polishing

Shall be capable of being sanded with 1200 grit sandpaper and polished in accordance with current plant processes to minimize orange peel or to remove defects. No noticeable change in gloss or appearance except for a min of swirl marks is permitted. Deep polishing lines or swirl marks are unacceptable.

3.7.8 Glass Bonding / Paint System Compatibility/Cataplasma Testing

Shall meet all requirements of Ford Automotive Operations Procedure No. AVP-T118-001, latest revision and WSK M11P57-A1-5

Prior to making any changes in properties and/or composition of originally approved paint, the supplier must certify compliance to a ll requirements of Direct Glazing Systems specification (test values, not nominal values) and obtain approval from the responsible Materials Engineering activity. For approved Direct Glazing System contact the responsible materials Engineering activity.

**3.8 RESISTANCE PROPERTIES**

(Resistance properties are measured with the complete primer/basecoat/clearcoat system applied.)

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