



Hot Stamp Foils

1 Scope

1.1 Material Description. This specification covers the performance requirements for hot stamp foils applied to painted or unpainted parts. Four classes of performance are established to cover the different requirements of first surface and second surface applications on interior or exterior parts, see Table 1.

Foils generally consists of a thin carrier strip of acetate, cellophane, or polyester film (depending on the application), a release coat, a color, or metallized coat, and a sizing coat (adhesive). When applied to parts, such products are sometimes called hot stamped coatings or finishes, or just “hot stamps”.

Table 1: Hot Stamp Foils Performance Classes

Class	Typical Application	Basic Specification Number and Suffix Symbol ^{Note 1}
A1	Vehicle Interior: First surface (unprotected)	GMWXXXXX Class A1
A2	Vehicle Interior: Second surface (protected by glass or transparent plastic)	GMWXXXXX Class A2
E1	Vehicle Exterior: First surface (unprotected)	GMWXXXXX Class E1
E2	Vehicle Exterior: Second surface (protected by glass or transparent plastic)	GMWXXXXX Class E2
E3	Vehicle Exterior: Post Applied Clearcoat	GMWXXXXX Class E3

Note 1: Suffix symbols shown (1.2.1) indicate basic test requirements are applicable. See Section 8 for textual example.

1.2 Symbols.

1.2.1 Other Suffix Symbols.

1.2.1.1 Suffix P. Perspiration Resistance, see 3.16.

1.2.1.2 Suffix T. Protective Tape, see 3.17.

1.3 Applicability. For interior and exterior decorative trim.

1.4 Remarks. No exterior first surface hot stamp foil, meeting the requirements of Class E1, has been found to meet exterior durability requirements. Class E1 requirements can be used for future material development. Class E3 must be used for exterior applications utilizing a clearcoat approved to GMW17896.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ISO 2808

SAE J1545

SAE J2527

2.2 GM Standards/Specifications.

GMW3059	GMW14333	GMW14797	GMW16853
GMW3208	GMW14334	GMW14829	GMW17103
GMW3221	GMW14444	GMW14873	GMW17138
GMW3417	GMW14445	GMW15891	GMW17896
GMW14124	GMW14650	GMW15919	
GMW14162	GMW14700	GMW16745	
GMW14270	GMW14729	GMW16847	

2.3 Additional References.

- Safety and Industrial Hygiene (S&IH) Technical Standard (TS), S&IH TS 3.4-160-02
- Statement of Requirements (SOR)

3 Requirements

3.1 Sample Preparation.

3.1.1 Unless otherwise specified, test panels shall be representative of production intent substrates and coatings. Second surface hot stamp foils shall be applied to the "B" surface or behind transparent production intent substrate. First surface hot stamp foils shall be applied to the "A" surface of production intent substrate.

See Appendix A, Table A1 and A2 for test conditions and requirements for each class of hot stamp foil. Fill out Appendix A, Data Sheet A1 and submit to responsible materials engineer.

3.1.2 Pre-test Conditioning. After application of the hot stamp to substrate, condition for at least 72 h at GMW3221, Code A conditions unless otherwise specified.

3.1.3 Post Environmental Exposure Conditioning. After environmental exposure, all samples, unless otherwise specified, shall be conditioned for 4 h to GMW3221, Code A conditions prior to testing.

3.1.4 Test Conditions. Unless otherwise specified, the hot stamps shall be tested at GMW3221, Code A conditions.

3.2 Tape Adhesion. GMW14829 hot stamps bonded to a representative production substrate, shall have a maximum rating of 1 after the environmental conditions in Table 2. Allow 1 h room temperature (RT) dwell before testing.

Table 2: Environmental Conditions

Environments
72 h RT aging
Heat aging per 3.7
Thermally cycled per 3.8
Humidity Resistance/Exposure per 3.9
After Xenon per 3.12 or 3.13, 2500 kJ/m ²

3.3 Appearance Durability. Samples shall not show any surface deterioration, objectionable shrinkage, objectionable color or gloss change, delamination, edge lifting, cracking, visible adhesion loss, pitting, blistering, or any other degradation after exposure to any of the following tests:

- Heat Aging
- Thermal Cycling
- Humidity
- Florida Exposure
- Xenon Arc Exposure

- High Temperature

Note: When accelerated test results and Florida exposure results are in disagreement, the Florida exposure results shall overrule.

Florida exposure samples may be washed with a mild detergent and water (ratio 5:95 by volume).

3.4 Abrasion Resistance. Test samples shall show no loss of pattern (wear through clearcoating (if applicable), and subsequent color or metalized coating) when tested per GMW3208 with a 500 g load using CS-17 abrading wheels for exterior Class E1 and CS-10 for interior Class A1 to the following minimum number of cycles:

- Class A1 40 cycles per nominal 1 μm topcoat thickness
- Class E1 300 cycles minimum

3.5 Chip Resistance GMW14700, Method B and C. Exterior Class E1 and Class E3 only. Condition samples and expose to the thermal cycle per 3.8. Run GMW14700, Method B for high chip areas (typically forward facing front of vehicle). Run GMW14700, Method C for all other areas. These areas can vary by vehicle design. Contact materials engineering if unsure which method to run.

3.6 Cleaning Solvent Resistance (GMW14334). Prepare samples per 3.1. Samples shall exhibit no loss of adhesion, color or gloss change, and shall meet rating of 3.

3.7. Heat Aging. Samples are oven aged for Class A1, A2 per Installation Temperature in GMW14444 and at 168 h at 80 °C for Class E1, E2, and E3.

3.8 Thermal Cycling (GMW14124). Condition samples and expose to one (1) cycle of Cycle D (interior), or two (2) cycles of Cycle C (exterior).

3.9 Humidity Resistance (GMW14729, Either Option A or B). Condition samples and expose for 24 h Class A1 and A2 and 168 h for Class E1 and E2. Expose Class E3 for 240 h.

3.10 Florida Exterior Open Rack Direct Weathering Exposure (GMW14873). Separate samples shall be subjected to 12 months and 24 months at 5 degrees facing south in Florida. There shall be no mildew/fungus growth observed after 24 months of Florida exposure. Engineering approval is granted after 24 months. Gloss loss requirements specified in Appendix A, Table A2. The following exposure times are optional and shall be run at the discretion of materials engineering:

- 36 months
- 48 months
- 60 months

3.10.1 Visual Examination. Wash weathered specimens prior to making measurements and observations. Wash with scrubbing action using a sponge that is saturated with a solution consisting of soap and deionized water at 23 °C $\pm$ 3 °C. Exposed parts shall not exhibit any indications of surface tackiness or embrittlement, change in hardness, blooming, blistering or other factors that might affect the function or appearance of the part. The color change shall not exceed a ΔE of ≤ 3.0 units.

The color change shall be measured per SAE J1545 (CIELAB color space, 10 degrees observer, metering orifice ≤ 10 mm, Illuminant D65, specular component included). Visual color change that is considered objectionable shall override the ΔE measurement.

The hot stamp must not exhibit objectionable color change.

Note: Completion of Florida testing is not required for initial Engineering approval. The testing, however, shall be ongoing (with a minimum of 24 months Florida, and 4500 kJ/m² Xenon exposures completed) before an approval is granted.

3.10.2 Natural Weathering Test Location Areas. Alternative locations may be considered for outdoor weathering exposure. Refer to GMW16847 for details. Obtain agreement from the regional GM Engineering group prior to sending test samples out for exposure.

3.11 Interior Natural Weathering (GMW3417, L1, F2, G1, and T5). There shall be no surface tackiness, loss of adhesion, objectionable color, or gloss change, blooming, blistering, or other objectionable change in appearance.

3.12 Xenon Arc Weatherometer Exterior (SAE J2527) Extended Ultraviolet (UV) Filter Combination. Samples shall be exposed to 2500 kJ/m² and 4500 kJ/m² per SAE J2527 extended UV filters. Gloss retention

after 2500 kJ/m² and 4500 kJ/m² is to be; Unpolished gloss: 75% retention minimum. Polished gloss: 80% minimum. See 3.10.1 for visual examination requirements. Optional: Run one (1) sample to failure or 5500 kJ/m².

3.13 Xenon Arc Weatherometer Interior (GMW14162). There shall be no objectionable surface deterioration, loss of adhesion, or objectionable color or gloss change after exposure to GMW14162, Cycle D, 1240 kJ/m².

3.14 High Pressure Wand Car Wash Resistance Water Jet (GMW16745 Method "A"). For class E1 systems. Run on production intent substrate. the paint system considered the most difficult to adhere to. (Contact Materials Engineering for information on the system and where to purchase test panels.) Run test at room temperature. Testing at other temperatures (hot, cold) may be run at the discretion of Engineering. Do not make razor cuts in the test sample. Allow 72 h room temperature dwell between application and test. Increase spray duration to 30 s. Use a 1504, non-stabilized nozzle. There shall be no adhesion loss.

3.14 Water Jet (GMW16745, Method B). For class E3 systems. Maximum Paint Removal of 60 mm².

3.15 Interior Emissions (GMW16853). Test per GMW16853, Table 4 "Emission Requirements for Interior Material/Parts/Assembly List" part code D6 "Self-Adhesive Foils."

3.16 Perspiration Resistance (GMW14334, Code C). The surface finish must not show any objectionable staining or discoloration when in contact with both acid and alkaline synthetic perspirant solutions. Suffix P to be called out on the drawing.

3.17 Protective Tape Compatibility (Applicable to Class A1, E1, and E3). Production intent protective tape is applied to production intent substrate(s). After exposures, the samples are allowed to return to room temperature. The tape is removed and the samples evaluated. There shall be no objectionable change in appearance of the hot stamp foil upon removal foil following exposures in Table 3 or any adhesive mass transfer after tape removal. Suffix T to be called out on the drawing.

Table 3: Environmental Conditions

Test	Class A1	Class E1 and E3
7 d in an air circulating oven at Installation Temperature (GMW14444, Table 1)	X	
2 cycles of GMW14124, Cycle M and high temperature per the Installation Temperature (GMW14444, Table 1)	X	
Artificial weathering of 112 kJ/m ² according to GMW14162, Cycle D, or 14 mJ/m ² according to GMW14162, Cycle B, at 100 °C	X	
7 d at 85 °C in an air circulating oven		X
Thermal cycling per GMW14650, "Dimensional Stability"		X
252.8 kJ Xenon exterior exposure per SAE J2527, extended UV filters		X

3.18 Sunscreen and Insect Repellent Resistance (GMW14445).

3.19 All tests are required to be run for initial approval on production run Number 1. Annual certification requirements will be documented in the material approval.

3.20 In addition, the full pigment library for inks (solid and metallic) with 24 months exposure in Florida (5 degrees facing south) shall also be reviewed. If requested by Materials Engineering.

3.21 Paint film thickness per ISO 2808 on each plaque for Class E3 applications only. Paint thickness minimum is 38 µm (1.5 mils). Refer to GMW17896 for specific technology approval.

3.22 All materials supplied to this standard must comply with GMW3059, **Restricted and Reportable Substances**, including the requirement to obtain a GM-approved International Material Data System (IMDS) submission.

4 Manufacturing Process

Not applicable.