GM	WORLDWIDE ENGINEERING STANDARDS	General Specification	GMW14444

Materials Related Interior Part Performance

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This standard covers the material related part performance requirements for all interior parts, e.g., Instrument Panel (IP) trim, side trim, floor trim, seat, console, etc.

1.2 Applicability. This standard is applicable for all regional and global supplied parts.

This standard is applicable for interior parts with and without appearance attributes (color, grain, and/or gloss designation). Interior parts without appearance attributes do not need to comply with requirements specified in 4.4. This engineering standard shall be used in conjunction with the appropriate GM raw material specifications including, but not limited to: GMW3026, GMW3262, GMW14122, GMW14231, GMW15340, and GMW16717. The preceding list is not intended to be comprehensive of all possible, appropriate or relevant raw material specifications used on interior parts.

In addition to the GMW14444 requirements, the following part performance specifications may also be applicable:

- GMW14573 Interior Labels
- GMW14668 Chrome Plate
- GMW14797 Painted Plastic Parts

1.3 Remarks. This standard defines minimal material related performance requirements for global parts. Additional specific requirements are called out in other documentation, e.g., Statement of Requirements (SOR), drawing, material specification, etc. Table A1 in Appendix A will serve as a check list for the tests required within this specification and is provided as a handy reference; however it does not include all the detail contained in nor supercede the corresponding paragraph in Section 4.

1.4 Classification. See 4.2.

2 References

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

2.1 External Standards/Specifications.

AATCC 23	ISO 105-A02	ISO 3537	ISO 12219-4
ASTM D1003	ISO 105-A03	ISO 4577	ISO 22088-3
ASTM D1044	ISO 105-G02	ISO 9001	ISO/IEC 17025
ASTM D3012	ISO 527-2	ISO 12219-2	

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2.2 GM Standards/Specifications.

GMW3026	GMW3417	GMW14334	GMW15625
GMW3059	GMW6992	GMW14364	GMW15634
GMW3116	GMW14093	GMW14573	GMW15635
GMW3136	GMW14102	GMW14668	GMW15651
GMW3205	GMW14122	GMW14688	GMW16440
GMW3232	GMW14124	GMW14777	GMW16717
GMW3235	GMW14130	GMW14797	GMW16853
GMW3259	GMW14131	GMW14892	GMW16895
GMW3262	GMW14132	GMW15340	GMW17084
GMW3402	GMW14162	GMW15432	
GMW3414	GMW14231	GMW15548	

2.3 Additional References.

- CG3475
- GM Materials File (available at www.supplypower.com)
- Statement of Requirements (SOR)
- Subsystem Technical Specification (SSTS)

3 Test Preparation and Evaluation

3.1 Resources.

3.1.1 Facilities.

3.1.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.1.2 Equipment. As stated in each standard noted per test procedure in Section 4 including any deviations noted in the procedure paragraph itself.

3.1.3 Test Vehicle/Test Piece. As stated in each standard noted per test procedure in Section 4 including any deviations noted in the procedure paragraph itself.

3.1.4 Test Time. As stated in each standard noted per test procedure in Section 4 including any deviations noted in the procedure paragraph itself.

3.1.5 Test Required Information. As stated in each standard noted per test procedure in Section 4 including any deviations noted in the procedure paragraph itself.

3.1.6 Personnel/Skills. Personnel trained in accordance with the laboratory accreditation and Standard Operating Procedure requirements.

3.2 Preparation. As stated in each standard noted per test procedure in Section 4 including any deviations noted in the procedure paragraph itself.

3.3 Conditions.

3.3.1 Environmental Conditions. As stated in each standard noted per test procedure in Section 4 including any deviations noted in the procedure paragraph itself.

3.3.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

3.4 Instructions. Execute each test per the applicable paragraph instructions for each test within section 4.

3.5 Data. Not applicable.

3.6 Safety.

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the

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responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

3.7 Documentation. Samples of components or material released to this standard shall be tested for conformity with the requirements of this standard and approved by the responsible GM Department prior to the start of delivery of production level components or materials.

Any change to the component or material, e.g., design, function, properties, manufacturing process and/or location of manufacture requires a new release of the product. It is the sole responsibility of the supplier to provide the customer, unsolicited, with documentation of any change or modification to the product/process, and to apply for a new release.

If not otherwise agreed to, the entire verification test shall be repeated and documented by the supplier prior to start of delivery of the modified or changed product. In some cases, a shorter test can be agreed to between the responsible GM department and the supplier.

3.7.1 Test Results. Test Report shall be supplied to the responsible GM Engineer, in the case of subjective evaluation criteria or unclear test outcome provide the tested specimen, in addition to the report.

4 Requirements and Procedure

4.1 Laboratory Accreditations. Laboratory testing shall be performed by a laboratory that conforms to ISO/IEC 17025 or ISO 9001 or other 3rd party accreditation and is acceptable to the GM Materials Engineer. Supplier shall submit documentation showing proof of accreditation.

4.2 Classification. The requirements are classified by:

4.2.1 Installation Position (see Table 1). A selected material shall support the part performance for all environmental conditions defined by the Code which is based on the components location in the vehicle and is referred to as the Installation Position. Materials shall be tested to the worst case environmental scenario for their installation position, e.g., direct sunlight exposure for upper IP materials.

Note: The temperatures in Table 1 are measured under solar glass (GMW3136 Type 4). If non-solar glass (GMW3136 Type 1 or 2) is used, temperatures up to 15 °C higher will occur and the requirements shall be adjusted accordingly.

Table 1: Installation Position

Code	Description
1	Position within vehicle is exposed to direct sunlight (exposed positions), such as horizontal surfaces above glass line. These parts are exposed to temperatures up to 105 °C in the car including, but not limited to the following typical parts: Package shelf, IP upper horizontal, rear seat back upper to rear window trim panel, rear seat head restraint/roll over (car only), load floor hatch back area (if designed without load compartment lid).
2	Position within vehicle is exposed to direct sunlight at lower temperatures than Code 1. These parts are exposed to temperatures up to 95 °C in the car, including, but not limited to the following typical parts: side trim above door glass line, steering wheel rim, garnish moldings - upper, horizontal portion ((A and C pillar for car, D pillar for truck, hatch back car quarter trim), seat cushion, back, remaining head restraints, belt guide loops, seat shoulder and armrests), open rear cargo area vertical glass (truck only) at or just below the glass line.
3	Position within vehicle is not exposed to direct sunlight. These parts are exposed to temperatures up to 85 °C in the car including, but not limited to the following typical parts: Floor carpet, overhead consoles, IP vertical surfaces below door glass line, steering wheel face, steering column and shroud, garnish upper without horizontal features and all other garnish, seat upper, truck 2nd and 3rd row seats (no open or transparent roof configuration and not in the back window), door trim panel complete, center (floor) console assembly and components, overhead parts, open rear cargo area vertical glass (truck only) floor level, floor level parts.

4.2.2 Customer Usage (see Table 2). A selected material shall support customer comfort and usage during the part's lifetime. The material shall be tested with respect to customer usage, e.g., visible material surfaces for appearance.

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Table 2: Customer Usage

Code	Description
A	All parts in contact with customer hands, e.g., steering wheel, driver airbag cover and trim, grip handle, door handle, shift knob.
B	All parts in contact with customer body, e.g., seat, arm rest.
C	All parts in contact with customer feet (foot kick area), e.g., floor mat, lower door trim, carpet retainer.
D	All parts in visible area.
E	All parts that are in contact with refreshable air in the occupant compartment, the trunk and all parts having an air flow to the interior including Heating, Ventilation, Air Conditioning (HVAC) ducts, trunk trim, insulations, etc. For clarification refer to responsible material engineer. All parts having air flow to the interior with an area of > 50 cm^2 or a weight of > 10 g. Polyoxymethylene (POM) parts shall be tested independent on area or weight. For parts < 50 cm^2 or have weight < 10 g that will be used several times in a vehicle, the following rule applies: The area or weight of the part shall be multiplied by the number of parts. If the resulting weight is > 10 g or the area is > 50 cm^2 the part shall be tested.

4.3 Flammability (GMW3232).

Note: Certification may be accomplished at part or material level. Parts that meet the definition of a composite shall be certified at the composite level. The interpretation by the GM Flammability Regulatory Engineer takes precedence regarding application or interpretation of the standard.

4.3.1 Application. All parts. All color variants.

4.3.2 Requirement. See GMW3232.

4.3.3 Procedure. Test to GMW3232. Parts < 100 mm in largest direction shall use material approval as surrogate data of all components. Additionally, parts not changed through processing can use material testing as surrogate.

4.4 Optics/Color/Appearance. All parts with surfaces visible to the customer. All color variants.

4.4.1 Visual Evaluation of Automotive Trim (GMW6992).

4.4.1.1 Application. Table 2, Code D. All parts with surfaces visible to the customer. All color variants.

4.4.1.2 Requirement. The color, pattern, aesthetics and other related qualities shall be approved by the appropriate engineering department as an acceptable match to the standard (master sample) when viewed under conditions set forth in GMW6992.

4.4.1.3 Procedure. Test to GMW6992.

4.4.2 Colorfastness to Artificial Light (GMW14162).

Note: Parts with a surface covering material using 100% polyester fabrics approved for colorfastness via the GMW3414 test method shall be tested per this methodology. Prior to testing parts, confirm this detail with the appropriate raw material specification for that material.

4.4.2.1 Application. Table 2, Code D. All parts with surfaces visible to the customer. All color variants.

4.4.2.2 Requirement.

Visual evaluation of the test panel by the responsible GM engineer shall override measured values in cases of disagreement.

Natural Weathering performance shall override the Xenon-Arc results specified in GMW14162.

There shall be no more than a noticeable change in hue or chroma, and no objectionable tackiness, blotchiness, loss of grain, wrinkling, or other undesirable effects. Samples should be evaluated for these conditions prior to cleaning.

Objectionable color change shall be defined as a measured color change ΔE of > 3.0 or < rating 3 to 4 according to ISO 105-A02 grey scale.

Color reading shall be measured in the same location on the sample before and after exposures per CIE 1976 (L*, a*, b*) color space (or CIELAB), 10 degree observer, illuminant D65 specular included. Exposed samples

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may be wiped with a solution of water and mild detergent and blotted dry with a clean white cloth before the color reading is taken.

A noticeable value (lightness) and/or chroma (saturation) change with minimum hue change is acceptable. Evaluate specimens as specified in GMW6992.

4.4.2.3 Procedure. Preferred procedure(s) is GMW14162, but per regional discussions, other methods may be used and defined in the relevant requirement documentation.

Parts and composites shall be tested to the method and duration defined in the surface material's raw material specification. Selection of procedure and exposure level is defined by the approving engineer in accordance with existing agreements per other part performance or material specifications and included in the relevant requirement documentation.

If none of the preceding applies, the part shall be tested according to Table 3 referencing the part's installation position.

Table 3: Procedure and Exposure Levels [Note 1]

Surface Raw Material Specification Overrides this Direction if Available	Xenon-Arc Test per GMW14162
Code 3	Cycle D: 263 kJ/m^2 **or:** Cycle B: 100 °C, 22 MJ/m²
Code 2	Cycle D: 601 kJ/m^2 **or:** Cycle B: 100 °C, 44 MJ/m²
Code 1	Cycle D: 1240 kJ/m^2 **or:** Cycle C: 115 °C, 26 MJ/m²

Note 1: Parts and composites shall be tested to the method and duration defined in the surface material's raw material specification and this table is to be used only if the raw material is not available.

4.4.3 Natural Weathering (GMW3417 L1, Fx, Gx, Tx).

Parts using 100% polyester fabrics approved for color fastness via GMW3414 are exempt from evaluation to this requirement for solar fade; however are still required to be tested for all other parameters.

Garnish trim that is fabric covered shall not have horizontal surfaces, and is only tested to 1600 MJ/m^2 (37 500 TNR Langleys) at 85 °C for Natural Weathering.

Test durations in Table 4 are established for vehicles using solar glass (GMW3136 Type 4). Vehicles using other glass types will need to adjust the test duration up to twice that of Table 4. Determination of test duration will be made between the GM Responsible Material and Validation Engineers.

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Table 4: Test Temperature/Duration for Natural Weathering

Group	Part Description Note 1	Accumulated Light Exposure in TNR Langleys (TNR MJ/m^2)	GMW3417 Coding System L1 – Arizona F2 – Under Glass, Temp Limited Tracking Fixture G1 – Clear Tempered G2 – Clear Laminated T5 = 102 °C, T4 = 93 °C, T3 = 85 °C
1	Entire IP tested, as an assembly, IP Uppers.	100 000 (4200)	GMW3417-L1-F2-G2-T5
2	Rear Seat to Window Trim Panel and Associated Components. Rear Seat Rollover at glass line or edge of rear seat to window trim panel.	105 000 (4400)	GMW3417-L1-F2-G1-T5
3	Horizontal component (if any) of A-Pillars. Horizontal component of C-Pillars.	75 000 (3200)	GMW3417-L1-F2-G2-T4
4	Mid IP trim panels, inserts and components, transitional between vertical and horizontal orientation.	60 000 (2500)	GMW3417-L1-F2-G2-T4
5	Steering Wheels tested as a unit, Steering Wheel Rim. Drivers Air Bag (DAB) surfaces perpendicular to plane of steering wheel.	55 000 (2300)	GMW3417-L1-F2-G2-T4
6	Garnish Trim at or above sidewall glass line (A, B, C, D Pillars, Quarter Panels, Sport Utility Vehicle (SUV) or Wagon Rear Window Trim Panels (vertical rear glass orientation)).Door Panels tested as a unit, Door Armrests and Door Rollover areas. Rear Hatchback Horizontal Surfaces, Cargo Shade and assembled components.	50 000 (2100)	GMW3417-L1-F2-G1-T3
7	Seats (except rear seat rollover at glass line or edge of rear seat to window trim panel).	40 000 (1700)	GMW3417-L1-F2-G1-T4
8	Consoles Tested as a unit, Console Armrests. IP Vertical Parts (at or above sidewall glass line, but not at all angled away from the occupants) when tested separately. Load Floors of vehicles with vertical glass in rear area	30 000 (1250)	GMW3417-L1-F2-G1-T3
9	IP Vertical Parts (below sidewall glass line) when tested separately. Console Sides tested separately Steering Wheel Horn Pad, DAB (surfaces parallel to plane of steering wheel) when tested separately. Overhead Parts, Seat Support Parts, Door Bolsters (vertical) when tested separately. Carpet Retainers, Garnish Trim below sidewall glass line.	10 000 (420)	GMW3417-L1-F2-G1-T3

Note 1: Must use orientation of part to greenhouse and tumble home to select duration. Requires interpretation of part orientation within specific vehicle geometry. Consult with Materials Engineer or Validation Engineer to determine appropriate level.

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4.4.3.1 Application. Table 2, Code D. All parts with surfaces visible to the customer. All color variants.

4.4.3.2 Requirement.

Visual evaluation of the tested part by the responsible GM engineer shall override measured valued in case of disagreement or need to interpret test outcome due to the nature of the test part.

The assembly shall not show any objectionable surface deterioration, color or gloss mismatches, warpage, sag, staining, delamination or other undesirable effects after exposure. No objectionable change is defined as a rating of six (6) or greater on the Degradation Rating Scale in GMW3417. Samples should be evaluated for these conditions prior to cleaning; end of test evaluation also will include an observation after cleaning with mild soap and water. Gloss change should not be evaluated if the part is not the correct design gloss at the start of test; especially important if test part is ungrained while the design intent includes grain.

Exudation that can clean off and is dusty-like is acceptable, while “sweaty” exudation or droplets are not. Many plastics are tacky to touch when hot and this is only unacceptable if accompanied by “sweaty” exudation or droplets.

For plastic components only, objectionable color change shall be defined as a measured color change ΔE of > three (3). Color reading shall be measured in the same location on the sample before and after exposures per CIELAB color space, 10 degree observer, illuminant D65 specular included. Exposed samples may be wiped with a solution of water and mild detergent and blotted dry with a clean white cloth before the color reading is taken.

For textile covered components, acceptable color change is defined as a noticeable value (lightness) and/or chroma (saturation) change with minimum hue change and/or pattern appearance change. For guidance, textiles shall exhibit a rating of three (3) or greater per ISO 105-A02 grey scale.

4.4.3.3 Procedure. Test part/assemblies to GMW3417 L1, F2, Gx and Tx for test temperatures and durations shown in Table 4. IPs and steering wheels tested to G2 – Laminated glass, all other parts tested to G1 – Tempered glass, unless otherwise specified on the engineering drawing.

Fully Trimmed Assemblies shall be tested. The assembly shall be tested attached to a fixture to simulate the production intent assembly.

Note: Recommend one (1) to five (5) interim evaluations depending on total exposure level; consult the Materials Engineer or the Validation Engineer for additional considerations.

4.4.4 Scuff and Mar Resistance (GMW14130).

Final arbiter for the evaluation shall be the GM Materials Engineer in cases of disagreement.

Note: Not for fabric or carpet covered parts.

4.4.4.1 Application. Table 2, Code D. All parts with surfaces visible to the customer made of soft materials. Examples: Plastic rolled goods, cast skins, soft Mold in Color (MIC), Thermoplastic Elastomer (TPE), Polyvinylchloride (PVC), painted soft skins. All color variants.

4.4.4.2 Requirement. Grained parts shall exhibit no more than a slight marring and no scuffing when tested per GMW14130.

4.4.4.3 Procedure. Test per GMW14130.

4.4.5 Resistance to Scratching (GMW14688-Method A, Code 2 (10 N)).

Final arbiter for the evaluation shall be the GM Materials Engineer in cases of disagreement.

If the part is too small or not configured such that it can be tested appropriately, consult the GM Materials Engineer to determine if grained plaque test data may be substituted.

A part with a technical grain may have a requirement that will be documented on the part drawing/math for that specific part and program.

4.4.5.1 Application. Table 2, Code D. MIC rigid plastic panels only. All color variants.

4.4.5.2 Requirement Grained part to meet requirement of corresponding raw material specification with a plus ΔL 0.5 allowance up to a maximum of ΔL 2.0 for polypropylene based materials. For example: GMW15340 materials require $\Delta L \leq 0.5$, GMW15548 Type 6 requires $\Delta L \leq 0.5$ or Type 2 and Type 4 require $\Delta L \leq 1.5$. Therefore a GMW15340 production grained PART could exhibit a ΔL of up to 1.0 and still meet the requirement. Always confirm requirement within raw material specification. If there is no specific requirement documented in

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