



Gravel/Abrasion Resistant Functional Films

1 Scope

1.1 Material Description. This specification covers the performance requirement of gravel/abrasion resistant films (foils) with a pressure sensitive adhesive and protected with a release liner. These films may include a premask for ease of application, and alignment proposes. These films may also be decorative, i.e., pigmented or screen printed.

1.1.1 Gravel/abrasion resistant films shall be designated as follows:

1.1.1.1 Type I; Decorative Surface Protection Films. This film is primarily used in visible exterior applications. It is a clear film, clear coated, and may be pigmented or screen printed. It is typically found on fascias, rocker moldings, and lower wheelhouse areas.

- **Grade A;** films are polyurethane based.
- **Grade B;** films are other types of polymers.

1.1.1.2 Type II; Non-visible Surface Protection Films. This film (without a clear coat) is designed for non-visible surface protection from closure over slam conditions, or separating two (2) dissimilar metals.

- **Grade A;** films are polyurethane based.
- **Grade B;** films are other types of polymers.

1.2 Symbols. Not applicable.

1.3 Applicability. Grade A films are available in 0.147 mm (6 mil), 0.196 mm (8 mil) and 0.294 mm (12 mil) base film thicknesses. Additionally, 0.196 mm (8 mil) films are typically used in rocker areas; 0.147 mm (6 mil) films are typically used in horizontal applications; and 0.294 mm (12 mil) films are typically used in rocker areas with severe stone impingement.

1.4 Remarks. None.

2 References

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

2.1 External Standards/Specifications.

ISO 105-A03	SAE J1545	SAE J1847	SAE J2527
ISO 8510-2			

2.2 GM Standards/Specifications.

GMW3010	GMW14270	GMW14700	GMW16853
GMW3059	GMW14333	GMW14729	
GMW3221	GMW14334	GMW14829	
GMW3390	GMW14444	GMW14873	
GMW14124	GMW14501	GMW15777	

2.3 Additional References.

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

3 Requirements

3.1 Requirements on Test Specimens. Reference GMW3221.

3.2 Emissions Testing of Interior Materials and Parts. For all Code E designated parts per GMW14444, reference GMW16853 for emissions testing of interior materials and parts.

3.3 Type I materials (see 1.1.1.1) must meet the requirements in 3.4 through 3.24 for initial qualification and annual testing. Type II materials (see 1.1.1.2) must meet the requirements in 3.4 through 3.24 except do not need to meet requirements in: 3.15 Xenon Exposure, 3.16 Florida Exposure, 3.21 Clearcoat Adhesion, 3.22 Asphalt Stain Resistance, and 3.23 Appearance.

3.4 Sample Conditioning. All samples are to be conditioned at $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ prior to each requirement.

3.5 Sample Preparation. All tests shall be performed under ambient conditions $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$, unless otherwise specified. A 72 h ambient dwell at $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ after fabrication and bonding is required prior to testing.

3.5.1 Baseline testing is done on painted panels with Axalta 8211 over white basecoat, unless otherwise specified by materials engineering. Reference Appendix A for panel information.

3.5.2 Unless otherwise specified, the films shall be tested at $23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$. Squeegees shall be used to apply films to painted test panels. Use the manufacturer's recommended application solution (if wet application) and procedure.

3.6 Appearance Durability. Samples prepared per 3.5 shall not show objectionable shrinkage of >0.5% maximum or a visible line of adhesive on the edge of the film. No more than slight gloss change (see Table 1) is allowed. No objectionable color change, delamination, edge lifting, cracking, visible adhesion loss, yellowing, mildew/fungus growth in the clearcoat, film or adhesive, pitting, blistering, after exposure to any of the following tests.

- Xenon Arc Exposure Test, (see 3.15).
- Florida Exposure Test, (see 3.16).
- Humidity Test, (see 3.17).
- Heat Aging Test, (see 3.18).
- Thermal Cycling Test, (see 3.19).
- High Temperature Test, (see 3.20).

Note: When accelerated test results and exterior exposure results are not in agreement, the exterior exposure results shall overrule.

Table 1: Appearance Requirements

Appearance Attribute		Description	Measurement	Condition	Criteria			
					Zone A	Zone B	Zone C	Zone D
1	Gloss	Shininess of film surface	60 degree gloss meter see GMW15777		Minimum 80 Gloss	Minimum 80 Gloss	Minimum 80 Gloss	Not Specified
2	Distinctness of Image (DOI)	DOI reflected by film	DOI meter see GMW15777		Minimum 70 DOI	Minimum 60 DOI	Minimum 60 DOI	Not Specified
3	Air Bubbles	Small air bubbles (micro bubbles) under the film	Visual evaluation and comparison to boundary samples		Up to 4 bubbles of $\leq 1\text{ mm}$ diameter separated by 100 mm	Up to 4 bubbles of $\leq 1\text{ mm}$ diameter separated by 100 mm	Up to 4 bubbles of $\leq 1\text{ mm}$ diameter separated by 100 mm	Up to 5 bubbles of $\leq 1\text{ mm}$ diameter
4	Die Lines, Machine Lines	Displaced material in a linear fashion along the extruded axis of the film	Visual evaluation and comparison to boundary samples		None	None	None	None

Appearance Attribute		Description	Measurement	Condition	Criteria			
					Zone A	Zone B	Zone C	Zone D
5	Gels, Bumps, Dirt	Foreign object or contaminant in the film, or clear coat	Visual evaluation and comparison to boundary samples	Non-contrasting gels, bumps, and dirt	Up to 4 bumps of ≤ 1 mm diameter separated by 100 mm	Up to 4 bumps of ≤ 1 mm diameter separated by 100 mm	Up to 4 bumps of ≤ 1 mm diameter separated by 100 mm	Up to 5 bumps of ≤ 1 mm diameter
6	Gels, Bumps, Dirt	Foreign object or contaminant in the film, or clear coat	Visual evaluation and comparison to boundary samples	Contrasting gels, bumps, and dirt	None	None	1 bump of < 10 mm diameter	1 bump of < 30 mm diameter
7	Fibers, Hairs	A thread-like particle in the clear coat, or under the film	Visual evaluation and comparison to boundary samples		None	None	None	Not specified
8	Peeling	Loss of adhesion between film and substrate	Visual evaluation and comparison to boundary samples		None	None	None	None
9	Wrinkles	Creases in the film	Visual evaluation and comparison to boundary samples		None	None	None	None
10	Scratches	Scratches on the surface of the film, or clear coat	Visual evaluation and comparison to boundary samples	Seen or felt with fingernail	None	None	Not specified	Not specified
11	Pits, Porosity	Small holes in film, or clear coat (permanent, not temporary in nature, see Table 1, 12 Cracks, Voids)	Visual evaluation and comparison to boundary samples		None	1 pit of ≤ 1 mm diameter	2 pits of ≤ 2 mm diameter	2 pits of ≤ 2 mm diameter
12	Cracks, Voids	Clearcoat fractures and/or voids	Visual Evaluation		None	None	None	None