



Transit Coating - Film Generic Qualification

1 Scope

This standard covers the requirements for films designed to protect exterior paint from damage caused by iron particles that fall on the vehicle during rail shipment and other environmental damage. These films may or may not be adhesive backed. This film is typically an adhesive-backed, white-colored or clear film. It is applied at ambient temperatures on clean, dry surfaces.

1.1 Material Description. Materials qualified to this standard must meet the performance shown in Appendix A, Table A1. Suppliers must demonstrate the technology as being production capable to reduce undue risk prior to release in a production facility. Any material development issues, such as chemical or performance values that fall outside of specified ranges, shall be discussed with the appropriate materials engineer for resolution. Material must successfully complete a production trial in a target facility prior to release for other facilities.

1.2 Symbols. Not applicable.

1.3 Applicability. This standard applies to films designed to protect painted surfaces on finished vehicles from environmental fallout damage.

1.4 Remarks. None.

2 References

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

2.1 External Standards/Specifications.

ASTM D882 ASTM D6862 SAE J2527

2.2 GM Standards/Specifications.

GMW3002 GMW3059 GMW14729 GMW16625
GMW3008 GMW14124 GMW14873
GMW3011 GMW14270 GMW16170

2.3 Additional References.

S&IH TS 3.4-160.02 Material Safety Data Sheet guidance documents (available at www.gmsupplypower.com)

3 Requirements

The transit coating film shall apply easily without bubbles or wrinkles. Air entrapment areas shall not permit moisture leaks that whiten the paint film. Edge areas shall not show creep, moisture, or whitening. Trimming or cutting shall be demonstrated. The film color should be white or other if deemed acceptable by the approving region. If applicable, the adhesive system must not transfer or disturb the paint film or low bake reprocess areas. There shall be no damage to any current production paints or to any other components of the vehicle (glass, rubber, plastics, etc..) from contact with properly applied coating film.

3.1 All materials supplied to this standard must comply with **GMW3059, Restricted and Reportable Substances**, including the requirement to submit a full material composition disclosure to GM via the International Material Data System (IMDS) or via a completed GMW3059 report form.

3.2 Initial Submission Requirements. As part of the initial submission package, the following information shall be provided.

3.2.1 Complete material identification by code, batch, general chemical composition, and physical description.

3.2.2 Material Safety Data Sheets (MSDS).**3.2.3 Film thickness range and the recommended method for measuring the film for testing and quality control.**

Note: The minimum film specified must be $\geq 40 \mu\text{m}$ ($\geq 1.5 \text{ mil}$) thick. Maximum film thickness is the thickest film that can be removed easily after six (6) months Florida exposure. If using an adhesive-backed film, there shall be no transfer of adhesive to the paint.

3.2.4 Material disposal requirements and all other health and safety concerns/control methods.**3.2.4.1 Prohibited Ingredients.** Silicone and benzene are prohibited ingredients.**3.3 Physical Requirements.**

3.3.1 Chemical Fingerprint. GM may conduct analysis of the materials supplied to this specification. Analysis may also be performed on representative panels. The analysis established for initial approval shall constitute a reference standard and shall be part of the submission package. Information on the technology's ingredient formulation ranges and key manufacturing control characteristics shall be provided as part of the submission package. If a product change is proposed that is outside the technology formulation limits, the responsible engineer shall be notified. All ingredient ranges, key manufacturing control limits, and certificate of analysis ranges must pass standard gage repeatability and reproducibility requirements.

3.3.2 Delivery Documentation. The supplier shall be responsible for submitting a certificate of analysis with each batch of material arriving at the point of use.

3.3.3 Mini-submissions. Some approvals will require mini-submissions when only minor changes are made to previously approved film materials. Tests may be added or deleted according to the type and amount of material modifications. These shall be determined prior to testing by agreement between the supplier and responsible engineers.

3.3.4 Sample Size. The number of samples for each test shall be one unless the responsible engineer and the supplier agree on a different number for specific tests prior to the start of testing. All substrates, pretreatments, and coating layers shall be fully identified with source, product code, batch number, bake description, and film build.

3.3.5 Storage Requirements. The materials approved to this standard shall be stable for 365 days at 10°C to 30°C (50°F to 85°F) as defined by the ability to pass all initial test requirements after 365 days storage in the application facility (i.e., assembly plant). If there is any disagreement with these requirements, the supplier must contact the responsible engineer.

3.4 Processing Requirements.

3.4.1 The application temperature shall be 15°C to 30°C (60°F to 85°F). Application surface must be dry and clean.

3.4.2 Recommended application and removal equipment and methods shall be provided.

3.5 Performance Requirements. Performance is measured by protection from environmental contaminants on the film and ease of removal of the film after environmental conditioning (see requirements as defined in Appendix A, Table A1).

3.5.1 Test Panels. Test panels will have two (2) film strips per panel, one (1) to be removed and evaluated by the test laboratory and one (1) to be removed and evaluated by the responsible engineer.

3.5.1.1 Alternative sample preparation shall be agreed upon with the responsible engineer.

3.5.1.2 Film application shall include wrinkles and bubbles.

3.5.1.3 There shall be no cracking, paint swelling, hazing, discoloration, distortion, adhesion loss to the paint finish, or pronounced edge effects caused by the transit coating film. The degree of protection is measured by a subjective scale. See Table 1.

Table 1: Degree of Protection Scale

Scale	Protection from Contaminants
0	No Effect (Etching) From Contaminants
1	Trace/Slight Effect
2	Moderate Effect
3	Pronounced/Severe Effect

3.5.1.4 Reversibility of Damage.

3.5.1.4.1 All tests outlined in 3.4.

3.5.1.4.2 Twenty four (24) h $\pm$ 1 h at room temperature, if necessary.

3.5.1.4.3 Two (2) h $\pm$ 5 minutes at 60 °C $\pm$ 3 °C (140 °F $\pm$ 5 °F), if necessary.

3.5.1.4.4 Thirty (30) minutes $\pm$ 5 minutes at 80 °C $\pm$ 3 °C (176 °F $\pm$ 5 °F), if necessary.

3.5.2 The film material shall conform to the requirements shown in Appendix A, Table A1 when evaluated at 23 °C $\pm$ 5 °C (75 °F $\pm$ 10 °F).

3.5.3 Tensile strength of the film should be determined according to ASTM D882 or agreed upon equivalent. For this application, it is critical that the film not shatter or break under stress. Target cross-web strength as defined in Appendix A, Table A1.

3.5.4 Elongation at yield of the film should be determined according to ASTM D882 or agreed upon equivalent as defined in Appendix A, Table A1.

3.5.5 Adhesion peel strength according to ASTM D6862 of the film as indicated in Appendix A, Table A1. In addition, a trial shipment with a minimum of eight (8) wrapped vehicles over a minimum of 300 km (180 mi) shall be performed to ensure sufficient peel strength during transport. Shipment by train shall be preferred.

3.5.6 Humidity Resistance (GMW14729). Evaluate condition of film after 144 h $\pm$ 0.5 h exposure at 100% relative humidity (RH), at 38 °C (100 °F), plus a 24 h recovery period. Measure adhesion peel strength. Evaluation requirements are shown in Appendix A.

3.5.7 Heat Age. Test duration of 336 h at 80 °C $\pm$ 2 °C (175 °F $\pm$ 5 °F) and check for removability. Evaluation requirements are shown in Appendix A, Table A1.

3.5.8 Spotting Resistance. Apply drops of the solutions, see 3.5.8.1 and 3.5.8.2, to horizontal test panels and expose the test panels to the following test conditions, see Table 2. Evaluation requirements are shown in Appendix A, Table A1.

Table 2: Test Condition for Test Panel Exposure

Condition	Exposure
1	24 h at Room Temperature
2	144 h at Room Temperature
3	2 h (or until drops are dry) at 60 °C $\pm$ 3 °C (140 °F $\pm$ 5 °F)
4	2 h (or until drops are dry) at 80 °C $\pm$ 3 °C (175 °F $\pm$ 5 °F)

3.5.8.1 Solution three (3) pH and four (4) pH acid rain according to GMW16625.

3.5.8.2 Solution Battery Acid: 38.0% solution with deionized (DI) water by weight using 96% minimum concentration of sulfuric acid by weight.

3.5.9 Rust Resistance. Iron filings/powder, 150 mesh to 200 mesh, 99.5% purity, such as Brand: JT Baker 2226 or agreed upon equivalent. Apply the iron filings/powder over white panels (approximately 1.2 mL (¼ tsp) per 100 mm x 300 mm panel). Mist with 4 pH acid rain solution (according to GMW16625) on half