



Ultraviolet/Visible Light Transmission Through Cured Paint Film

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 describes the test procedure to determine the percent transmission of ultraviolet/visible (UV/VIS) light through free paint films.

1.2 Applicability. All vehicles.

1.3 Remarks. None.

2 References

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

2.1 External Standards/Specifications.

ISO 17025

2.2 GM Standards/Specifications.

GMW3005

2.3 Additional References. None.

3 Resources

3.1 Facilities. Accredited to ISO 17025.

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

3.1.2 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.

3.2 Equipment. An ultraviolet/visible (UV/VIS) spectrophotometer equipped with an integrating sphere is required for this procedure. A 150 mm integrating sphere is the recommended accessory for measurement of total solar reflectance and transmittance of cured paint material samples in the automotive industry. Sampling modes include total and diffuse reflectance at an incident angle of 8 degree and total and diffuse transmittance at normal (0 degree) incidence.

3.2.1 PerkinElmer Lambda 650, 850, 950, (www.perkinelmer.com) or equivalent can be used.

3.2.2 Paint samples are to be prepared by spray application. Drawdowns are not acceptable. Spraymation equipment or other automatic paint application, is required to apply a uniform layer (film build) of the paint material.

3.2.3 Substrates for Paint Material Application. The paint material source may select the substrate to which the paint is applied. The substrate may be glass; non-primed, non-UV stabilized thermoplastic polyolefin (TPO); Tedlar TTR10SG4 film; or other substrate if it is not chemically reactive during the paint sample separation process and the paint sample is capable of being removed from the substrate as a free film build sample. The substrate is to be documented and reported by the paint material sample preparation source.

3.2.3.1 If a Tedlar or other flexible plastic film substrate is used, it is to be preshrunk by wrapping a 150 mm x 355 mm piece around a 100 mm x 300 mm panel. Tape all edges on the back to prevent distortion

during bake. Place the substrate on top of another steel panel to prevent tape from coming off when hot. Bake for 15 minutes at 150 °C. Pre-baked sheets taped to steel panels can be stored for later use.

3.2.4 Film build Gage. A gage capable of providing a 99% confidence level such that the average of no more than ten (10) readings is accurate to $\pm 0.63 \mu\text{m}$.

3.2.5 Calibration Standard. As specified by the manufacturer of the spectrophotometer.

3.3 Test Vehicle/Test Piece. Prepared substrate with required material.

3.4 Test Time. Reference the laboratory test procedure(s) in Section 4 for timing details.

3.5 Test Required Information. See 5.3.

3.6 Personnel/Skills. Trained laboratory technicians in the preparation of paint samples and the operation of equipment.

4 Procedure

4.1 Preparation. Place the selected and prepared substrate on an aluminum (or steel) panel with hiding tabs onto the sprayman bar.

4.1.2 Preparation of Paint Layers For a New Basecoat (BC) or Basecoat Color.

4.1.2.1 Primer Surfacers. Spray the primer paint material to achieve minimum film build as noted in Table 1, using the metal panel with hiding tabs as a visual guide. Spraying one (1) end of the film build to a heavy layer of approximately 6.0 mils of primer surfacer may help with removal of paint from the substrate.

4.1.2.2 Basecoat or Monocoat. Spray the basecoat paint material to achieve minimum film build as noted in Table 1 (see responsible GM Color Engineer), using the metal panel with hiding tabs as a visual guide. Spraying one (1) end of the film build to a heavy layer of approximately 6.0 mils of basecoat or monocoat may help with removal of paint from the substrate.

4.1.2.3 Clearcoat (CC). Spray the clearcoat paint material to achieve minimum film build as noted in Table 1, using the aluminum panel with hiding tabs as a film build guide. Spraying one (1) end of the film build to a heavy layer of approximately 12.0 mils of clearcoat may help with the removal of paint from the substrate.

4.1.3 All samples and layers should be flashed and baked at target bake (T) conditions, per specific paint material technology requirements.

4.1.4 Scribe the paint film build sample with a razor or scalpel 3 mm from all edges. If using a Tedlar type substrate, cut all the way through the substrate. Turn the sample over and peel the paint film build sample from the substrate, starting at the high film build end, to yield the "free" film. If panels are prepared over glass or metal and a water soak is required for removal, thoroughly dry the samples prior to running on the spectrophotometer for 1 h minimum.

4.1.5 Check for pinholes visually, by holding the free film sample in front of a light source. Avoid any sections with pinholes when taking film build or transmission measurements.

4.1.6 Place the free film sample on top of a bare steel/aluminum panel and check film build of each paint layer along both edges of the sample. Avoid the center, which will be the actual area tested for UV/Vis transmission. When desired film builds are found, mark the paint sample on both sides of the probe and write the film build on the edge of the sample with a permanent marker. Marks should be approximately 32 mm apart, with the desired film build centered in the sample (see Figure 1, Layering Combination A).

4.1.7 Cut a test piece straight across the width of the sample using film build probe markings as guides. The piece, (test piece) cut from this sample can be prepared for the UV/VIS test (see Figure 1, Layering Combination B).

4.1.8 The paint samples/free films for the UV/VIS test must be mounted free of wrinkles in a plastic 35 mm slide frame or equivalent. The test piece must be placed in the slide as illustrated in Figure 1, Layering Combination A. The paint surface normally in contact with the air when sprayed is identified as the front of the slide. This orientation is necessary for correct readings. The test piece area is approximately 6.2 mm x 19.2 mm.

4.1.9 Read and record the percent transmittance (%T) per the procedure recommended by the spectrophotometer equipment manufacturer and per 4.3.

4.1.10 Paint film builds of the test piece are read after the UV/VIS test to avoid errors due to distortion that may be caused by the film build gage probe. Ten (10) readings are typically required when using a Fisher

Permascope, but the supplier must determine gage repeatability and reproducibility (R&R) of the instrument and the number of readings required for a given thickness range within 6.5 µm statistical accuracy. Report the average film build and the deviation.

Table 1: Layering Combinations and Film Build Parameters Note 2, Note 3

A (Layering Combinations)		B (Layering Combinations)		C (Layering Combinations)	
Conventional		Integrated Process		Monocoat (MC)	
Baked PS + BC + CC + Bake	Film Build (mils)	BCP + BC + CC	Film Build (mils)	Baked PS + MC + Bake	Film Build (mils)
Primer Surfacer (PS)		Basecoat Primer (BCP)		Primer Surfacer (PS)	
Waterbase	0.60	Waterbase	0.60	Waterbase	0.60
Solventbase	0.80	Solventbase	0.70	Solventbase	0.80
Powder	1.50	Not applicable	Not applicable	Other	Technology Specific
Basecoat (BC)		Basecoat (BC)		Monocoat (MC)	
Waterbase	Note 1	Waterbase	Note 1	Waterbase	Note 1
Solventbase	Note 1	Solventbase	Note 1	Solventbase	Note 1
Clearcoat (CC)		Clearcoat (CC)		Not applicable	
One (1) Component (1K)	1.50	1K	1.50	Not applicable	
Two (2) Component (2K)	1.50	2K	1.50	Not applicable	

Key: Primer Surfacer (PS), Basecoat Primer (BCP),

Note 1: Film build is to be minimum to achieve the color as specified by the GM Color Development Engineer.

Note 2: If a **new primer** technology or primer color is used, prepare a primer wedge sample and hold the basecoat and clearcoat film builds to the minimums in Table 1.

Note 3: If a **new clearcoat** technology or clearcoat color, prepare the wedge sample for clearcoat and hold the primer and basecoat layers to the minimums in Table 1.