



Quality Inspection Guidelines for Exteriors

3M™ Graphic Films Installation for Railcars

Quality Control and Inspector Introduction

1. This person must have the correct understanding/training to inspect the visual criteria, using this document as a reference. These are the recommended guidelines provided by 3M for railcars.
2. The quality inspection should be performed after the graphic installation is completed following the Standard Operating Procedure (SOP) for 3M™ Graphic Films Installation for Railcars.

Inspection Conditions for Graphic Films / Inspection Environment

Inspect the film finished effect on the production site or inspection station. The site or station should meet the following conditions:

1. Unaided Eye

The visual inspection must be conducted with the naked eye, with visual corrections if necessary. The use of a magnifying glass is not allowed. If a defect is detected by the inspector, it shall be identified by applying a “defect” stamp in order to point out the defect.

2. Luminosity

Outdoor, cloudy, natural light or the artificial light source of appropriate brightness in the room similar to the above lighting conditions with a minimum of 400 lux.

Inspections shall be carried out, as far as possible, outdoor under daylight. If inspections have to be carried out indoors, luminosity of the surrounding area shall be, as near as possible, minimum 400 lux ± 20 measured at 2m (6.56') from the platform inspection spot.

3. Distance

A distance of 1–1.5m (3.28–4.92') from the platform inspection location.

4. Walking Speed and Height

Inspection shall be carried out at station platform height, walking along the aisle at continuous pace 1m (3.28') per second.

Allowed Measurement Equipment (if required)

Gloss and Color should be specified before final inspection with the use of gloss meter and colorimeter.

The final inspection must be conducted with the naked eye, with visual corrections if necessary. The use of a magnifying glass or other measuring tools should not be allowed.




Aesthetic Acceptance Criteria for Graphic Films — Exterior Surfaces Excluding Glass

Aesthetic acceptance criteria relevant to finished film-coated surfaces are listed below. This content details the minimum acceptable criteria as defined by 3M Commercial Solutions Division. Other criteria may be integrated if some difference is required by the contract; these variations should be described in a separate document written for the project by the engineering department.

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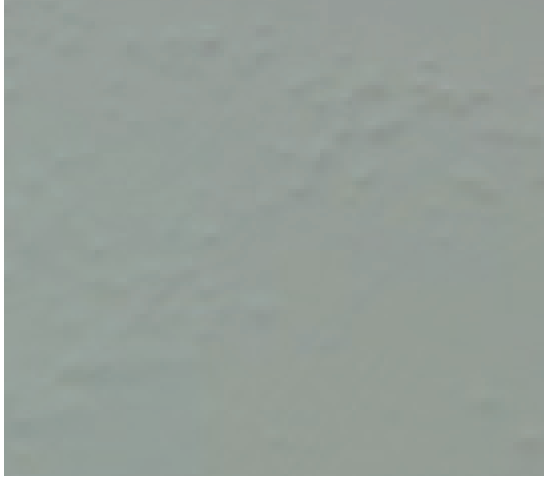




Criteria	Description	Example of Visual Defect
<p>Color fading</p>	<p>A visual difference or inconsistencies in color can be seen by the naked eye between one or more films that are supposed to be the same color as determined by the specification.</p>	 <p>Acceptable Unacceptable</p>
<p>Gloss and dullness</p>	<p>A visual difference or inconsistencies in gloss can be seen by the naked eye between one or more films that are supposed to be the same gloss as determined by the specification.</p> <p>If gloss is visually different by the naked eye, a gloss measurement should be performed using a gloss meter to determine if the film meets the specification. If a failure is found, it is considered unacceptable.</p>	 <p>Unacceptable</p>
<p>Bubbles</p>	<p>Visual air or moisture entrapment under the film that occurred during installation.</p> <p>Acceptable — No more than 5 bubbles (bubble diameter <math><2\text{mm}</math> [.08"]) in a circle of diameter 500mm (19.69").</p>	 <p>Unacceptable</p>

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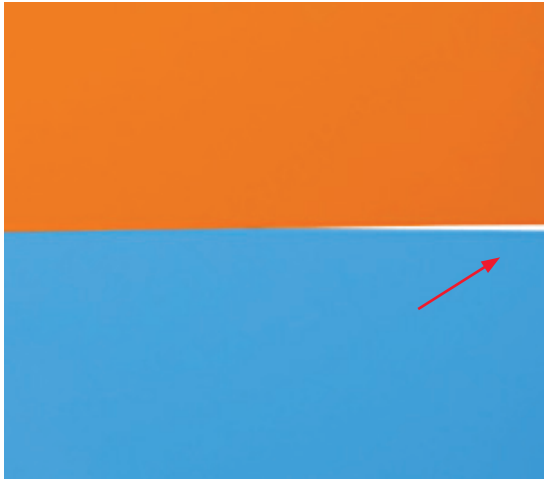




Criteria	Description	Example of Visual Defect
<p>Debris under film</p>	<p>Visual defects caused by small dust, debris and/or particles trapped between film and car body.</p> <p>Unacceptable — Not more than 5 visual defects in a circle of diameter 500mm (19.69"). The number of particles in any 1 SQM (10.76 SQF) area should not be more than 3.</p>	 <p>Unacceptable</p>
<p>Scratches and marks</p>	<p>Visual defects caused by small dust, debris and/or particles trapped between film and car body.</p> <p>Unacceptable — Needs to be replaced.</p>	 <p>Unacceptable</p>
<p>Wrinkles</p>	<p>Folds or creases in the film.</p> <p>Unacceptable — Needs to be replaced.</p>	 <p>Unacceptable</p>

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Criteria	Description	Example of Visual Defect
<p>Film overlaps dimensions</p>	<p>The overlap of two film layers is between 6mm (.24") and 10mm (.39").</p> <p>If overlap is not meeting the visual requirements by the naked eye, a measurement should be performed to determine if the film meets the specification. If a failure is found, it is considered unacceptable.</p>	 <p>Unacceptable</p>
<p>Film overlaps orientation</p>	<p>For horizontal and vertical overlaps, the uppermost film should cover the lower film with the dimensions stated above to prevent moisture from collecting.</p>	 <p>Unacceptable</p>
<p>Cut edges</p>	<p>Cut edges of the film should be smooth and uniform.</p> <p>If the cut does not meet the visual description, the cut should be fixed to ensure a smooth and uniform edge.</p>	 <p>Unacceptable</p>

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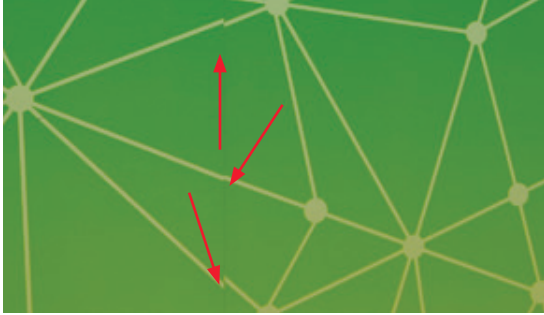

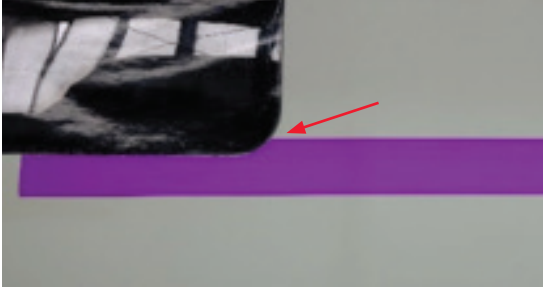


Criteria	Description	Example of Visual Defect
<p>Edge gaps</p>	<p>Distance of the adhesive film from the joint sealing and the edge of the car.</p> <p>The distance between edge of film and sealant is at least 1–3mm (.04–.12") depending on the shape of the sealant.</p>	<p>Acceptable Unacceptable</p>
<p>Edge sealing</p>	<p>The application of edge tape or sealant to the finished edges of the graphic.</p> <p>The coating or tape application should be uniform with 50% on either side of the seam without bubbles or drips.</p>	<p>Unacceptable</p>
<p>Lifting / peeling</p>	<p>The visual appearance of film not fully adhered to the surface.</p> <p>Unacceptable — Needs to be repaired.</p>	<p>Unacceptable</p>

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Criteria	Description	Example of Visual Defect
Cracking	<p>Visual splitting of the film or ink.</p> <p>Unacceptable — Needs to be replaced.</p>	 <p>Unacceptable</p>
Misaligned	<p>Misalignment between two films belonging to two separate adjacent elements.</p> <p>Acceptable — The error shall be less than 2mm (.08") between the two adjacent films.</p>	 <p>Unacceptable</p>
Incorrect placement	<p>The installed graphic does not follow the layout/design.</p> <p>Unacceptable — Needs to be replaced.</p>	 <p>Design Layout</p>
		 <p>Unacceptable</p>



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