



Reflective Sheeting Sign Base Surface Preparation

Information Folder 1.7

August 2013

Replaces Information Folder 1.7 dated November 2005

Follow the Instructions

3M recommends only the standard practice outlined in this information folder. Procedures and materials which do not conform to these instructions are excluded. See Terms and Conditions of Sale.

Important: *A complete understanding of these instructions is recommended before sheeting application.*

Introduction

Proper application surfaces and preparation methods outlined in this folder are essential for applications of 3M™ Reflective Sheeting. Always consult the appropriate product bulletin and information folder prior to application. If additional information is needed, contact 3M Technical Service at 1-800-553-1380 extension 4 or visit www.3M.com/roadwaysafety

Many clean, smooth, relatively non-porous, flat, rigid and weather resistant surfaces are satisfactory for proper application of sheeting. Those found to be most reliable and durable are properly prepared aluminum sheets and extrusions. **Users are urged to carefully evaluate all other substrates.**

Substrate Warranty Clarification

3M Traffic Safety and Security Division's warranty is in effect on properly applied reflective sheeting. This applies to all substrates unless functional sign failure is the result of the substrate or its preparation. 3M is only responsible for materials we manufacture when they are applied according to our recommended procedures.

To help our customers evaluate new substrates when they are uncertain as to what constitutes a substrate failure, we provide the following examples.

1. Poor adhesion and visual defects such as wrinkles, bubbles, and rough sheeting texture due to substrate roughness.
2. Poor adhesion due to inadequate or improper degreasing, etching, or conversion coating of aluminum substrates.
3. Poor adhesion caused by substrate surface. Some examples include inadequate cleaning, particulate contamination, low surface energy, under-cured coating, etc.
4. Adhesion loss caused by substrate degradation, outgassing and moisture absorption.
5. Loss of functional sheeting performance due to substrate instability, such as dimensional change, warpage, stress fatigue or flexing.
6. Sheeting distortion due to substrate buckling or extension due to moisture absorption.

**Guidelines for
Substrate Evaluation**

For traffic sign use, substrates found to be most reliable and durable are properly prepared aluminum sheets and extrusions. **Users are urged to carefully evaluate all other substrates for adhesion and sign durability.** Other substrates that may be satisfactory for proper application of sheeting will have the following characteristics:

1. Clean
2. Smooth
3. Flat
4. Rigid
5. Dimensionally stable
6. Weather resistant
7. Non-porous
8. High surface energy (passes water break test)

**Surface Preparation
Methods**

- A. Aluminum**
1. Aluminum flat sheets and guide sign extrusions must be 5052-H38 or 6061-T6 alloy.
 2. Before sheeting application, aluminum sheets and extrusions must be degreased, etched and free of aluminum oxide (white rust).
 3. An acid bath utilizing a solution of six to eight percent (6-8%) phosphoric acid has produced reliable surface etching results. Commercially available etching solutions may also be considered.
 4. While degreasing and etching is all that is required by 3M for aluminum blank preparation, agencies may require the use of conversion coating. Follow agency specifications for conversion coating requirements. The conversion coating must not interfere with sheeting adhesion. Substrates that have been conversion coated must pass the water break and tape snap tests.
 5. Reclaimed aluminum blanks may be used if they satisfy the above mentioned requirements for surface preparation. Mechanically reclaimed (abrasive grinding) aluminum must have a surface finish equivalent to 100 grit abrasive or finer and be completely free of surface contamination prior to sheeting application. Hydro stripping (high pressure water removal) can also be used to provide a satisfactory substrate surface. Reclaimed substrates must pass the water break and tape snap tests.

**Surface Preparation
Methods (continued)**

B. Plywood and Wood Products

If a plywood product is required as a permanent sign substrate, the sign fabricator must pay particular attention to the wood substrate choice. Many high density overlay (HDO) plywood products are intended for concrete framing and have a release agent applied to them and therefore are not suitable as permanent signing substrates. Olympic Panel Highway HDO signing grade plywood is manufactured specifically for the production of traffic signage.

Procedures provided are based on technical information provided by the American Plywood Association. Surfaces must be smooth, impermeable, and weatherproof. Edge sealing is very important. All voids must first be filled with wood filler or other suitable sealer, then sanded and completely coated with a quality edge-sealing coating. Multiple coatings of exterior house paint are a suitable edge sealer.

Users are urged to carefully evaluate any sheeting applications to such surfaces under actual use conditions to determine suitability and performance life for the intended use.

1. Olympic Panel Highway

- a. Panel surfaces should be clean and free of contaminants.
- b. Seal all edges with exterior house paint.
- c. Refer to Olympic Panel's website for HDO substrate preparation recommendations, instructions, and warranty statement (<http://www.olypanel.com>).

2. Other Wood Products

Medium Density Overlay (MDO) plywood, exterior grade plywood, hardboard, lumber, and other wood products are generally only suitable for construction work zone substrates and temporary signage applications. Due to the variation and inconsistent nature of these wood products, users must carefully consider their use. General preparation instructions include:

- a. Application surfaces must be completely dry, clean, and free of contaminants.
- b. Seal all edges with exterior grade house paint.
- c. Prime application surfaces with exterior grade primer. Ensure primer is completely cured prior to sheeting application. Refer to primer manufacturer's instructions for drying time. **House paint is not a suitable surface preparation media as many paints are stain resistant and may repel sheeting adhesive.**

C. Galvanized Steel

Galvanized steel must be clean, and free of oxidation and loose or flaking coating. Galvanized steel substrates must pass the water break test. **Stainless steel is not recommended as a signing substrate.**

D. Plastics

Plastics substrates, including polyolefins, fiberglass, recycled plastic sheets, transparent acrylic/polycarbonate panels, etc., may vary by composition and manufacturing process. Their use as a signing substrate requires cautious consideration. Successful applications have been made; however, many plastics may outgas or contain substances that may migrate to the surface of the substrate and affect adhesion. Follow substrate manufacturer's recommendations for substrate preparation prior to sheeting application. Note: Consult with substrate manufacturer regarding warranty policy.

Surface Preparation Methods (continued)**E. Surface Preparation for Plastic (Polymer) and Low Surface Energy Substrates**

One or more of the following steps are required to obtain maximum adhesion.

1. Solvent wipe

Low energy surfaces may be improved by wiping with suitable solvent prior to sheeting application. Solvent considerations should include quick drying, no residual oily film and non-damaging to the substrate. Isopropyl alcohol is often a good choice. Be sure to use appropriate personal protection equipment when using solvents.

2. Flame Treating

Many low surface energy plastic substrate materials benefit from flame treatment. Flame treating is an oxidative process at the polymer surface that increases the surface energy to improve adhesion. Proper flame treating involves an oxygen-rich flame plasma (blue flame) exposed to the surface at a proper distance and duration, typically one-quarter to two (¼ to 2) inches of separation and a speed of ≥ 1 inch/second. Proper distance and duration must be determined for any given substrate or device.

The surface to be flame treated must be clean and free of dirt and oil prior to flame treatment. For effective flame treatment, the flame should be adjusted to produce a highly oxygenated blue flame. A poorly oxygenated (yellow) flame will not effectively treat the surface. Flame treating is **not** heat treating. Heat is an unwanted by-product of the process that does not contribute to improved surface properties. The surface that is properly flame treated will not be exposed to a significant rise in temperature. Improper flame treating operations that overheat the plastic may soften or deform the substrate.

Hand-held torches may be suitable for small volume flame treatment. For best results, commercially available flame treaters are available from a number of manufacturers, including the ones listed below and others.

FlynnBurner www.flynnburner.com

FTS Technologies www.ftstechnologies.com

Enercon Industries Corporation www.enerconind.com

The following substrates will benefit from flame treatment.

- a. Polyethylene
- b. Polypropylene
- c. Fiberglass
- d. Polyvinyl Chloride (PVC)
- e. Many recycled plastic substrates

Other unspecified plastic substrates may also benefit from flame treatment.

Please contact substrate supplier for more information.

F. Applications to Polycarbonate and Acrylics

Internally illuminated signs may require the use of clear panels as the signing substrate. These substrates may outgas and cause bubbling or delamination of the reflective sheeting. To test for outgassing, apply a small piece of vinyl film and oven bake at 150°F (65°C) for two hours. If bubbles appear under the film, outgassing is occurring. Follow substrate manufacturer's recommendation for substrate preparation prior to sheeting application.

Note: Defects caused by an outgassing substrate are not a sheeting failure. Be sure to clarify warranty policy of substrate supplier prior to sign fabrication.

General Surface Testing

Properly treated sign blanks must be clean before application. Blanks should not be dusty or contact greases, oils or other contaminants before application of sheeting. The following two tests may be used to detect surface contamination:

A. “Tape Snap” Test

A tape snap test can be used to detect particulate contamination (e.g. dirt, dust, white rust) or loose conversion coating. Transparent packaging tape should be firmly applied to the surface and snapped up at a right angle to the substrate. Any loose material on the tape indicates a contaminated surface or a poorly bonded surface treatment. Substrates that fail a tape snap test are unsatisfactory for sheeting or film application.

B. “Water Break” Test

A water break test may be used to detect surface contamination of oils, soaps, or improper conversion coating residues. Surface energy levels on non aluminum substrates can also be verified by the water break test. Apply a fine mist of water from a spray bottle (e.g. window cleaner bottle) onto the surface. The water should NOT bead up, but should flow out to form a uniform film on the surface. Varying levels of water flow out can be expected.

C. Dyne Testing

Surface energy levels can also be verified with the use of dyne solution or dyne pens. Dyne testing will verify the effectiveness of substrate surface preparation and suitability for sheeting application. A minimum level of 50 dynes is required for predictable adhesion to aluminum. The shelf life of dyne solutions and dyne pens is typically six months. Follow application instructions supplied dyne solution or dyne pens.

Health and Safety Information

Read all health hazard, precautionary, and first aid statements found in the Material Safety Data Sheet (MSDS), and/or product label of chemicals prior to handling or use. Also refer to MSDS for information about the volatile organic compound (VOC) content of chemical products. Consult local regulations and authorities for possible restrictions on product VOC content and/or VOC emissions.

**FOR INFORMATION OR ASSISTANCE
CALL: 1-800-553-1380**

**IN CANADA CALL:
1-800-265-1840**

**Internet:
www.3M.com/roadwaysafety**

3M assumes no responsibility for any injury, loss or damage arising out of the use of a product that is not of our manufacture. Where reference is made in literature to a commercially available product, made by another manufacturer, it shall be the user's responsibility to ascertain the precautionary measures for its use outlined by the manufacturer.

Important Notice

All statements, technical information and recommendations contained herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed, and the following is made in lieu of all warranties, or conditions express or implied. Seller's and manufacturer's only obligation shall be to replace such quantity of the product proved to be defective. Neither seller nor manufacturer shall be liable for any injury, loss or damage, direct, special or consequential, arising out of the use of or the inability to use the product. Before using, user shall determine the suitability of the product for his/her intended use, and user assumes all risk and liability whatsoever in connection therewith. Statements or recommendations not contained herein shall have no force or effect unless in an agreement signed by officers of seller and manufacturer.

3M is a trademark of 3M. Used under license in Canada.



Traffic Safety and Security Division
3M Center, Building 0235-3A-09
St. Paul, MN 55144-1000
1-800-553-1380
www.3M.com/roadwaysafety

3M Canada Company
P.O. Box 5757
London, Ontario N6A 4T1

3M México, S.A. de C.V.
Av. Santa Fe No. 55
Col. Santa Fe, Del. Alvaro Obregón
México, D.F. 01210

© 3M 2013. All rights reserved.
Electronic Only