3M Science. Applied to Life.™

Traffic Safety and Security Division

3M™ High Intensity Prismatic Digital Sheeting 3930DS (White)

Product Bulletin 3930DS
February 2016

Description

3M™ High Intensity Prismatic Digital Sheeting 3930DS (White) is a microprismatic retroreflective sheeting designed to optimize UV ink jet digital imaging of traffic control signs that are exposed vertically in service. UVIJ and TT printing are the only imaging methods that can be used with High Intensity Prismatic Digital Sheeting. Screen printing or solvent printing are not suitable methods and are not covered by this 3M warranty. When laminated with 3M™ ElectroCut™ Film 1170C Clear and applied to properly prepared sign substrates High Intensity Prismatic Digital Sheeting provides long-term retroreflectivity and durability. Digital sheeting is not suitable for a sign application without 1170C Clear overlaminate film.

Photometrics

Daytime Color (x, y, Y)

The chromaticity coordinates and total luminance factor of the retroreflective Digital sheeting, when laminated with 3M ElectroCut Film 1170C Clear, conform to Table A.

Table A - Daytime Color Specification Limits[1]

Color	x	y	x	Y	x	y	x	y	Daytime Luminance Limit (Y%)	
									Min.	Max.
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329	27	

[1] The four pairs of chromaticity coordinates determine the acceptable color in terms of the CIE 1931 Colorimetric System.

Color Test – Ordinary Colored Sheeting

Conformance to standard chromaticity (x, y) and luminance factor (Y %) requirements shall be determined by instrumental method in accordance with ASTM E 1164 on sheeting applied to smooth aluminum test panels cut from Alloy 6061-T6 or 5052-H38. The values shall be determined on a HunterLab ColorFlex 45/0 spectrophotometer. Computations shall be done for CIE Illuminant D65 and the 2° standard observer[2].

Coefficients of Retroreflection (R_A)

When laminated with 3M™ ElectroCut™ Film 1170C Clear, the values in Table B are minimum coefficients of retroreflection expressed in candelas per lux per square meter (cd/lux/m^2) for unprinted areas.

Test for Coefficients of Retroreflection

Conformance to coefficient of retroreflection requirements shall be determined by instrumental method in accordance with ASTM E-810 "Test Method for Coefficient of Retroreflection of Retroreflective Digital Sheeting", and per E-810 the values of 0° and 90° rotation are averaged to determine the R_A in Table B.

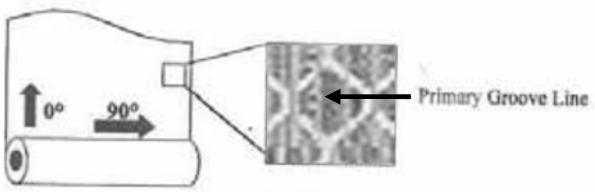
Table B - Minimum Coefficient of Retroreflection R_A for new sheeting (cd/lux/m^2)

	Observation Angle[3]	
	0.2°	0.5°
-4° Entrance Angle[4]	360	150
30° Entrance Angle[4]	170	72

Entrance Angularity Performance in Regard to Orientation

High Intensity Prismatic Digital Sheeting is designed to be an effective wide angle reflective sheeting regardless of its orientation on the substrate or ultimate orientation of the sign after installation. However, because the efficiency of light return from cube corner reflectors is not equal at all application orientations, especially with increasing entrance angles, it is possible to get the widest entrance angle light return when the sheeting is oriented in a particular manner. When high entrance angle (>50°) performance is required for given signs (e.g. Keep Right Symbols), it can be obtained easily by specifying the application orientation of the completed signs. In these situations the completed sign should have the sheeting positioned at the 0° orientation (downweb direction perpendicular to the road). When the flat side of the diamond (direction of diamond chain links) is vertical in the completed sign, sheeting is said to be at a 0° orientation. When the "primary groove line" (or, flat side of the diamond shape) is horizontal in the completed sign, the sheeting is said to be at a 90° orientation. (Figure 1)

Figure 1 - Primary Groove Line



Unless the sign location and/or position calls for extra-wide entrance angularity performance or a specific installation direction is required by customer specification, signs and applied copy (letters, arrows, borders and shields) can be fabricated and installed using the application orientation that most efficiently utilizes the reflective sheeting.

[2] The instrumentally determined color values of retroreflective sheeting can vary significantly depending on the make and model of colorimetric spectrophotometer as well as the color and retroreflective optics of the sheeting (David M. Burns and Timothy J. Donahue, Measurement Issues in the Color Specification of Fluorescent Retroreflective Materials for High Visibility Traffic Signing and Personal Safety Applications, Proceedings of SPIE: Fourth Oxford Conference on Spectroscopy, 4826, pp. 39- 49, 2003). For the purposes of this document, the HunterLab ColorFlex 45/0 spectrophotometer shall be the referee instrument.

[3] Observation Angle – The angle between the illumination axis and the observation axis.

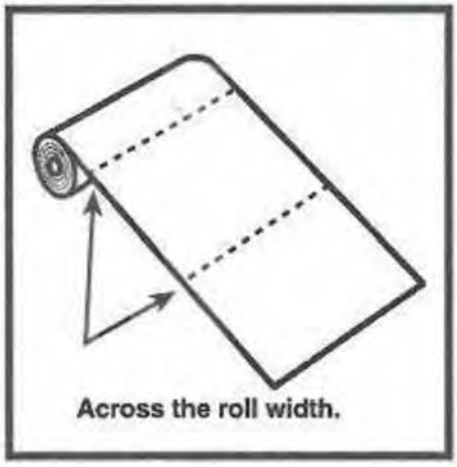
[4] Entrance Angle – The angle from the illumination axis to the retroreflector axis. The retroreflector axis is an axis perpendicular to the retroreflective surface.

Note: *For multi-panel signs it is recommended that all background panels be sheeted such that the sheeting direction is the same for all panels.*

Fabrication Lines

The manufacture of prismatic sheeting results in lines being present in the product. In High Intensity Prismatic Digital Sheeting these lines are slightly thicker than the seal pattern legs. Fabrication lines are noticeable in shop light but are not observable on the road either in daylight or at night under typical use conditions (Figure 2).

Figure 2 - Fabrication Lines



Adhesive

High Intensity sheeting has a pressure sensitive adhesive that is recommended for application at temperatures of 65°F (18°C) or higher.

Digital Printing Process

Prior to printing regulated traffic sign images on High Intensity Prismatic Digital Sheeting 3930DS, the printing file must use only spot color swatches defined with the 3M™ naming convention. These files may then be printed using only 3M™ Piezo Inkjet Series 8900UV Ink with an EFI H1625-RS printer.

Overlamination Process

High Intensity Prismatic Digital Sheeting 3930DS must be laminated with 3M™ ElectroCut Film 1170C Clear with a pneumatically adjusted, heated top roll laminator. The laminator roll must be a minimum of 48 inches in width. Due to high variations in the available laminator market, individual equipment and applications should be evaluated by the customer for suitability and to identify optimal settings. Always follow manufacturer's instructions and safety recommendations. Optimal settings will eliminate defects such as bubbling, silvering, curling and optics damage. Recommended settings vary by make and model. See examples below.

Table C

Make/Model	AGL/64T	AGL/Patriot
Nip Roll Temperature (°F)	155	155
Nip Roll Pressure (PSI)	65	20
Laminate Unwind Roll Pressure (PSI)	20	50
Laminate Liner Wind Up Roll Pressure (PSI)	5	50
Speed (ft/min)	2	3

Sign Fabrication Methods

Application

High Intensity Prismatic Digital Sheeting 3930DS incorporates a pressure sensitive adhesive and should be applied to the sign substrate at temperature of 65°F/18°C or higher by any of the following methods:

Mechanical squeeze roll applicator – refer to 3M Information Folder (IF) 1.4. Application to extrusions that are edge wrapped requires sufficient softening of the sheeting. This can be accomplished by directing additional heat to the "next to last" edge roller. This practice will increase productivity and minimize cracking.

Hand squeeze roll applicator – refer to 3M IF 1.6.

Application of High Intensity Prismatic Digital Sheeting 3930DS (White) for complete signs or backgrounds must be done with a roll laminator, either mechanical or hand driven.

Hand Application

Hand application is recommended for legend and copy only. Refer to 3M Information Folder 1.5 for more details. Hand applications will show some visual irregularities, which are objectionable to aesthetically critical customers. These are more noticeable on darker colors. To obtain a close-up uniform appearance, a roll laminator must be used. All direct applied copy and border MUST be cut at all metal joints and squeegeed at the joints.

Splices

High Intensity Prismatic Digital Sheeting 3930DS must be butt spliced when more than one piece of sheeting is used on one piece of substrate. The sheeting pieces should not touch each other. This is to prevent buckling as the sheeting expands in extreme temperature and humidity exposure.

Double Faced Signs

The sheeting on the bottom side of a double faced sign can be damaged if rolled through a squeeze roll applicator with an unprotected steel bottom roller. The use of a semi-soft flat sheet between the steel roller and the applied sign face will provide protection from damage. A material such as a rubber mat, tag board or cardboard is recommended.

Substrates

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:
– Clean
– Smooth
– Flat
– Rigid
– Dimensionally stable
– Weather resistant
– Non-porous
– High surface energy (passes water break test)

Refer to Information Folder 1.7 for surface preparation recommendations. Substrates with low surface energy may require additional preparation such as flame treatment, mechanical abrasion or use of adhesion promoters prior to sheeting application. Guide sign extrusions may be edge wrapped. Flat panels or unwrapped extrusions are to be carefully trimmed so that sheeting from adjacent panels does not touch on assembled signs. High Intensity Prismatic Digital Sheeting 3930DS is designed primarily for applications to flat substrates. Any use that requires a radius of curvature of less than five inches should also be supported by rivets or bolts. Plastic substrates are not recommended where cold shock performance is required. **Sign failures caused by the substrate or improper surface preparation are not the responsibility of 3M.**

Applying Cut-Out Copy

3M™ High Intensity Prismatic Digital Sheeting 3930DS (White) may be processed into traffic signs by applying cut-out copy as described below. 3M assumes no responsibility for failure of sign face legends or backgrounds that have been processed with materials other than the matched component imaging materials listed in Table D.

Table D – Matched Component Materials compatible with High Intensity Prismatic Digital Sheeting 3930DS

Matched Components	
ElectroCut™ Film	1170C Clear
Digital Imaging	8900UV
Slipsheet	SCW 568
Prespacing Tape	SCPS-2
Premasking Tape	SCPM-3
Transfer Tape	TPM-5

Applied Cut-Out Copy

High Intensity cut letters may be applied to High Intensity Prismatic Digital Sheetig 3930DS to create a sign legend. Direct applied copy must be cut at all panel seams and carefully trimmed back so that sheeting from adjacent panels do not touch each other on assembled signs. Refer to Information Folder 1.10 for more information.

Storage and Packaging

High Intensity Prismatic Digital Sheeting 3930DS (White) should be stored in a cool, dry area, preferably at 65-75°F (18-24°C) and 30-50% relative humidity and should be applied within one year of purchase. Rolls should be stored horizontally in the shipping carton. Partially used rolls should be returned to the shipping carton or suspended horizontally from a rod or pipe through the core. Unprocessed sheets should be stored flat. Finished signs and applied blanks should be stored on edge.

Avoid banding, crating, or stacking signs. Package for shipment in accordance with commercially accepted standards to prevent movement and chafing. Store sign packages indoors on edges.

Panels or finished signs must remain dry during shipment and storage. If packaged signs become wet, unpack immediately and allow signs to dry. Refer to Information Folder 1.11 for instructions on packing for storage and shipment.

Installation

Nylon washers are required when twist style fasteners are used to mount the sign.

Cleaning

Signs that require cleaning should be flushed with water, and then washed with a detergent solution and soft bristle brush or sponge. Avoid pressure that may damage the sign face. Flush with water following washing. Do not use solvents to clean signs. Refer to 3M Information Folder 1.10 for more information.

Health and Safety Information

Read all health hazard, precautionary, and first aid statements found in the Safety Data Sheets (SDS) for important health, safety and environmental information. To obtain SDS sheets for 3M products, go to 3M.com/SDS, or by mail, or in case of an emergency, call 1-800-364-3577.

Warranty Information

Warranty Coverage Overview

The durability of 3M™ High Intensity Prismatic Digital Sheeting 3930DS (White) and finished signs will depend upon substrate selection and preparation, compliance with recommended application procedures, geographic area, exposure conditions, and maintenance. Maximum durability of 3930DS (White) sheeting can be expected in applications subject to vertical exposure on stationary objects when processed and applied to properly prepared aluminum according to 3M recommendations provided in Information Folder 1.7 on Sign Substrate Surface Preparation. The user must determine the suitability of any nonmetallic sign backing for its intended use. **Sign failures caused by the substrate or improper surface preparation are not the responsibility of 3M.** Applications to unprimed, excessively rough or non-weather-resistant surfaces, or exposure to severe or unusual conditions can shorten the performance of such applications. Signs in mountainous areas that are covered by snow for prolonged periods may also have reduced durability. Atmospheric conditions in certain geographic areas may result in reduced durability.

Periodic sign inspection and regular sign replacement are strongly recommended in order for agencies to establish their own effective service life expectation.

3M Basic Product Warranty

3M High Intensity Prismatic Digital Sheeting 3930DS ("Product") is warranted ("Basic Warranty") to be free of defects in materials and manufacture at the time of shipment and to meet the specifications stated in this product bulletin. If the Product is proven not to have met the Basic Product Warranty on its shipment date, then a buyer's exclusive remedy, and 3M's sole obligation, at 3M's option, will be refund or replacement of the Product.

3M MCS™ Warranty, MCS Warranty for Traffic, and Limited Remedy

For the MCS Warranty, MCS Warranty for Traffic, and limited remedies applicable to the Product, refer to the 3M™ Digitally-Imaged Sign Warranty Bulletin.

Limitations of Liability

3M WILL NOT UNDER ANY CIRCUMSTANCES BE LIABLE TO A BUYER FOR DIRECT (other than the applicable Limited Remedy previously stated), SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES (INCLUDING, WITHOUT LIMITATION, LOSS OF PROFITS) IN ANY WAY RELATED TO A PRODUCT OR THIS PRODUCT BULLETIN, REGARDLESS OF THE LEGAL OR EQUITABLE THEORY ON WHICH SUCH DAMAGES ARE SOUGHT.

Additional Limitations

See the 3M™ Digitally-Imaged Sign Warranty Bulletin for terms, additional limitations of your warranty, if any, and limitations of liability.

Other Product Information

Always confirm that you have the most current version of the applicable Product Bulletin, Information Folder or other product information from the 3M Website at **mmm.com/tss**.

IF 1.4 Instructions for Interstate Squeeze Roll Applicator
IF 1.5 Hand Application Instructions
IF 1.6 Hand Squeeze Roll Applicator
IF 1.7 Sign Base Surface Preparation
IF 1.10 Cutting, Premasking, and Prespacing
IF 1.11 Sign Maintenance Management
PB 1170 ElectroCut™ Film Series

Traffic Safety and Security Division
3M Center, Building 0225-04-N-14
St. Paul, MN 55144-1000 USA