Science.
Applied to Life.™

Transportation Safety Division

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

Product Bulletin 3930DS

October 2020

1 Description

3M™ High Intensity Prismatic Digital Sheeting 3930DS (White) is a microprismatic retroreflective digital sheeting designed to optimize digital imaging of traffic control signs that are exposed vertically in service with UV ink jet inks. UVIJ and TT printing are the only imaging methods that can be used with High Intensity Prismatic Digital Sheeting. Use of screen or solvent printing voids the warranty. When laminated with 3M™ Protective Overlay Film 1170 (Clear) and applied to properly prepared sign substrates, High Intensity Prismatic Digital Sheeting provides long-term retroreflectivity and durability. Digital sheeting is compatible only with the UV Inkjet inks and overlay films listed in section 9. Use of any other inks or overlay films voids the warranty. Digital sheeting is not suitable for a sign application without Protective Overlay Film 1170 (Clear) as overlaminate. Sheeting 3930DS comprises solventless adhesive[1], coated without the use of organic solvents.

CE

3M™ High Intensity Prismatic Digital Sheeting 3930DS (White) is certified for the manufacturing of signfaces for traffic signs with a European Technical Assessment (ETA).

All provisions concerning the assessment and verification of constancy of performance described in the ETA 17/0491 were applied and the product fulfills all the prescribed requirements (see the Declaration of Performance at the end of this document for more details).

2 Photometric Properties

The initial minimum coefficient of retro-reflection of High Intensity Prismatic Digital Sheeting 3930DS, when laminated with 3M™ Protective Overlay Film 1170 (Clear), measured in accordance with the procedure specified in CIE Publication No. 54.2 using CIE standard illuminant A, conforms to the values in Table A. The angular definitions apply for the CIE Goniometer system (co-planar geometry). The sheeting shall be mounted in 0° orientation on the goniometer (as shown below). Table A conforms to the requirements for Class RA2 in EN 12899-1:2007.

[1] Due to the use of ancillary organic materials in the manufacturing of the adhesive, traces of organic solvent can be found in the product

Geometry of measurements $\beta_2 = 0, \varepsilon = 0$	$\alpha = 0.2°$			$\alpha = 0.33°$			$\alpha = 2°$		
	$\beta_1 =$			$\beta_1 =$			$\beta_1 =$		
	5°	30°	40°	5°	30°	40°	5°	30°	40°
White	250	150	110	180	100	95	5	2.5	1.5

*Table A: Minimum Coefficient of Retroreflection [cd / (lx * m^2)] for Class RA2*

The initial chromaticity coordinates and luminance factors conform to the colorbox of Table B, when illuminated with CIE standard illuminant D65 and measured with 45/0 geometry. The colorbox is similar to CR2 of EN 12899-1 for Class RA 2 materials. The luminance factor for white is exceeding Class CR2 requirements to demonstrate superior daytime performance.

Color	1		2		3		4		Luminance factor Class B2
	x	y	x	y	x	y	x	y	β
White	0,305	0,315	0,335	0,345	0,325	0,355	0,295	0,325	$\geq$ 0,40

Table B: Chromaticity and luminance factors

For printed transparent color areas on white sheeting, when processed according to 3M™ recommendations, the coefficients of retroreflection shall not be less than 70% of the requirements for the corresponding color. For white sheeting, covered with 3M™ Protective Overlay Film 1170 (Clear), when processed according to 3M recommendations, the coefficients of retroreflection shall not be less than 100% of the value in Table A. The chromaticity coordinates and luminance factors shall conform to table B. This complies with respective requirements in EN 12899-1 and ETA 17/0491.

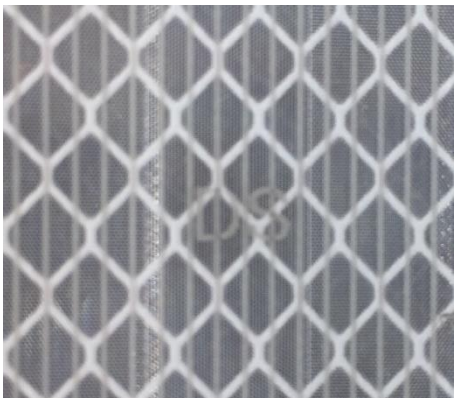
3 Digital Printing Process

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 Ink Series 8900UV with an Durst Rho 163TS or EFI H1625-RS printer.

High Intensity Prismatic Digital Sheeting 3930DS must be laminated with 3M™ Protective Overlay Film 1170 (Clear) with a pneumatically adjusted, heated top roll laminator. The laminator roll must be a minimum of 1220 mm 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.

Detailled information about the digital print settings can be found in the Product Bulletin 8900UV for the 3M™ Piezo Inkjet Ink Series 8900UV.

4 Orientation



The High Intensity Prismatic sheeting is differentiated from other prismatic or encapsulated lens sheeting by the distinctive surface pattern, permanently integrated in the sheeting.
High Intensity Prismatic Digital Sheeting 3930DS has integrated 'DS' marks to allow differentiation from regular High Intensity Prismatic Series 3930 Sheeting.

Figure 1 – Sheeting is positioned at 0° orientation

High Intensity Prismatic is designed to be an effective wide angle reflective sheeting regardless of the orientation on the substrate or ultimate application orientation after installation. However, because the efficiency of light return from cube corner reflectors is not equal at all rotation angles, the sheeting should be positioned in 0° or 90° application orientation on the completed sign when wide entrance angle performance is important for a given sign type or situation.

5 Fabrication Lines

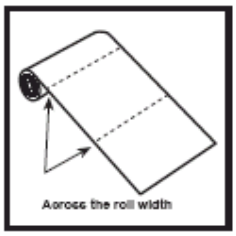


Figure 2 - Tooling Lines

The manufacturing of prismatic sheeting results in fabrication lines being present in the product. In High Intensity Prismatic 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 (Figure 2).

6 Application

High Intensity Prismatic Sheeting should be conditioned prior to application to the substrate to provide a minimum sheeting temperature of 18°C throughout the roll or sheeting stack.

The sheeting should be applied with mechanical squeeze roll applicators to properly prepared substrates.

Application of High Intensity Prismatic Sheeting for complete signs or backgrounds must be done with a roll laminator, either mechanical or hand. For further information refer to Information Folder IF 1.4 and IF 1.6.

7 Splices

High Intensity Prismatic Sheeting should 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. A splice gap of up to 1,5 mm is acceptable. This is to prevent buckling as the sheeting expands in extreme temperature and humidity exposure.

8 Substrates

For traffic sign use, product application is limited to properly prepared aluminum (see Information Folder 1.7). The substrate should be conditioned prior to application to provide a minimum surface temperature of 15°C.

Extrusions and Flat panel signs are to be carefully trimmed, so that sheeting from adjacent panels do not touch on assembled signs. Users are urged to carefully evaluate all other substrates for adhesion and sign durability. High Intensity Prismatic Sheeting is designed primarily for applications to flat substrates. Rivets or bolts should also support any use that requires a radius of curvature of less than 130 mm.

Sign failures caused by the substrate or improper surface preparation are not the responsibility of 3M.

9 Compatible Products

Digital Printing Applications

- 3M™ Piezo Inkjet Ink Series 8900UV (for Durst Rho 163TS and EFI H1625-RS printer)
- 3M™ Protective Overlay Film 1170 (Clear)
- 3M™ Premium Protective Overlay Film 1160

10 Health and Safety Information

Read all health hazard, precautionary and first aid statements found in the Material Safety Data Sheets and/or product label of chemicals prior to handling or use.

11 General Performance Considerations

The performance and durability of 3M™ High Intensity Prismatic Digital Sheeting 3930DS (White) will depend upon a number of factors including (but not limited to):

- Application procedures
- Geographic area
- Exposure and atmospheric conditions (e.g. snow, frost)

- Correct combination of sheeting, piezo inkjet ink and overlay film
- Ink drying/UV curing methods
- Cleaning and maintenance methods

11.1 Warranty

3M™ High Intensity Prismatic Digital Sheeting 3930DS (White) sold by 3M to be used for traffic control signs and devices in Europe is warranted for a period up to 10 years from date of application (concrete definition of the period is subject to the terms of sale) to be free of defects in material and workmanship, subject to the following provisions:

If Digital Sheeting 3930DS is processed and applied to a vertical 10° surface in accordance with all 3M application and fabrication procedures provided in 3M's product and information folders, technical memos (which will be furnished to the agency upon request), including the exclusive use of 3M matched component systems, process colors, overlay films and recommended application equipment.

11.2 Important Notice to Purchaser

All statements, technical information and recommendations herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed. Before using, user shall determine the suitability of the product for its intended use, and user assumes all risk and liability whatsoever in connection therewith. All questions of warranty and liability relating to this product are governed by the terms of the sale subject where applicable to the prevailing law.

No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by authorized personnel of seller and manufacturer.

11.3 Disclaimer

THE 3M WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE, OR ANY IMPLIED WARRANTY ARISING OUT OF A COURSE OF DEALING OR OF PERFORMANCE, CUSTOM OR USAGE OF TRADE.

11.4 Limitation of Liability

Except for the limited remedy stated above, and except where prohibited by law, 3M will not be liable for any loss or damage arising from the Signs or any 3M product, whether direct, indirect, special, incidental or consequential damages (including but not limited to lost profits, business or revenue in any way), regardless of the legal theory asserted including warranty, contract, negligence or strict liability.

11.5 Other Product Information

Always confirm that you have the most current version of the applicable product bulletin, information folder or other product information from 3M's Website at http://www.mmm.com/roadsafety.

11.6 Literature References

Instructions for Squeeze Roll Applicator	IF 1.4
Instructions for Hand Squeeze Roll Applicator	IF 1.6
Sign Base Materials	IF 1.7
Storage and Packaging	IF 1.11
3M Piezo Inkjet Ink Series 8900UV	PB 8900UV

For Further Assistance

For help on specific questions relating to 3M™ reflective products, please contact your local 3M Application Engineer or contact:

3M Deutschland GmbH
Transportation Safety Laboratory
Carl-Schurz-Straße 1
41453 Neuss
Tel: 02131/14 3394
Fax: 02131/14 3694

Declaration of Performance/ Leistungserklärung 3M High Intensity Prismatic 3930DS

Construction Product Code / Bezeichnung des Bauproduktes

Microprismatic Retroreflective Sheeting

1. 3M High Intensity Prismatic Digital Sheeting 3930DS + 3M Piezo Inkjet Ink + 3M Protective Overlay Film 1170
2. 3M High Intensity Prismatic Digital Sheeting 3930DS + 3M Piezo Inkjet Ink + 3M Protective Overlay Film 1170 + 3M Premium Protective Overlay Film 1160

Intended Use / Verwendungszweck

The construction product is used to manufacture sign faces for permanent traffic signs. The intended use includes, for example:

- Retro-reflective signs, retro-reflective and transilluminated signs (see also EN 12899-1)
- Variable message signs (see also EN 12966-1)

Das Bauprodukt wird für die Herstellung von Signalbildern von ortsfesten, vertikalen Verkehrszeichen verwendet. Der Verwendungszweck schließt z.B. ein:

- Retroreflektierende Verkehrszeichen, retroreflektierende und innenbeleuchtete Verkehrszeichen (siehe EN 12899-1)
- Wechselverkehrszeichen (siehe EN 12966-1)

Manufacturer / Hersteller

3M Deutschland GmbH
Carl-Schurz-Str.1
D – 41453 Neuss

Assessment and Verification of Constancy of Performance / Bewertung und Überprüfung der Leistungsbeständigkeit

System 1

StrAus-Zert, notified body 0913, Fleyer Str. 204, D-58097 Hagen performs the continuous surveillance, assessment and evaluation of the factory production control under system 1 and issued the certificate of constancy of performance 0913-CPR-2017/03.
/
StrAus-Zert, notifizierte Stelle Nr. 0913, Fleyer Str. 204, D-58097 Hagen führt die laufende Überwachung, Beurteilung und Anerkennung der werkseigenen Produktionskontrolle nach System 1 durch und hat das Zertifikat der Leistungsbeständigkeit 0913-CPD-2017/03 ausgestellt.

UBAtc, Rue du Lombard 42, B-1000 Brussels, performed the initial type testing and initial inspection of the factory and the FPC under system 1 and issued ETA 17/0491 on the basis of EAD 120001-01-0106.
/
UBAtc, Rue du Lombard 42, B-1000 Brussels, führte die Erstprüfung und Erstinspektion des Werks und der werkseigenen Produktionskontrolle nach System 1 durch und hat ETA 17/0491 auf der Basis von EAD 120001-01-0106 ausgestellt.

Declared Performance / erklärte Leistung (ETA 17/0491 Version 2)

Safety in Use / Nutzungssicherheit

Essential Characteristics / Wesentliche Merkmale	**Performance / Leistung**	**Technical Specification / Technische Spezifikation**
Visibility Characteristics		
Daylight Chromaticity and Luminance Factor	Table 1.2 (see Amendment)	EAD 120001-01-0106 (sept 2016) ETA 17/0491 Version 2
Coefficient of Retro-reflection	Table A.1 (see Amendment)	
Rotational Symmetry	Ratio > 1:2.5	
Durability		
Impact Resistance	No apparent cracking or delamination	EAD 120001-01-0106 (sept 2016) ETA 17/0491 Version 2
Visibility after accelerated artificial weathering		
Daylight Chromaticity and Luminance Factor	Table 1.3 (see Amendment)	
Coefficient of Retro-reflection	Values > 80% of Table A.1 (see Amendment)	

The performance of the construction product identified above is in conformity with the declared performance. This declaration of performance is issued under the sole responsibility of the manufacturer. /
Die Leistung des oben genannten Bauproduktes entspricht der erklärten Leistung. Verantwortlich für die Erstellung dieser Leistungserklärung ist allein der Hersteller.

Neuss, September 2019

ppa. Dr. Chris Howitt
Technical Director
3M EMEA Area

Amendment to the Declaration of Performance
'3M High Intensity Prismatic 3930DS'

This declaration covers the product 'Microprismatic retroreflective sheeting'.
Sign plates or complete assemblies of fixed vertical road traffic signs according to EN 12899-1:2007 can be manufactured with the following products and product combinations, according to ETA 17/0491 Version 2 and respective Evaluation Reports.

Components	***Trade name***	***Colours/code***
Micro-prismatic retroreflective sheeting	3M™ High Intensity Prismatic Digital Sheeting 3930DS	White 3930DS
Process Colour for digital printing	3M™ Piezo Inkjet Ink Series 8800UV or 8900 UV	Yellow Red Blue Green Orange Brown Grey Dark Green
Overlay Film	3M™ Protective Overlay Film	Clear 1170
Overlay Film	3M™ Dew Resistant Overlay Film	1180 I
Overlay Film	3M™ Premium Protective Overlay Film	1160

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
White Tolerance Sphere	x y	0.305 0.315	0.335 0.345	0.325 0.355	0.295 0.325	≥0.40
Yellow Tolerance Sphere	x y	0.494 0.505	0.470 0.480	0.513 0.437	0.545 0.454	≥0.24
Red Tolerance Sphere	x y	0.735 0.265	0.700 0.250	0.610 0.340	0.660 0.340	≥0.03
Blue Tolerance Sphere	x y	0.130 0.090	0.160 0.090	0.160 0.140	0.130 0.140	≥0.01
Green Tolerance Sphere	x y	0.110 0.415	0.170 0.415	0.170 0.500	0.110 0.500	≥0.03
Orange Tolerance Sphere	x y	0.631 0.369	0.560 0.360	0.506 0.404	0.570 0.429	≥0.14
Brown Tolerance Sphere	x y	0.455 0.397	0.523 0.429	0.479 0.373	0.558 0.394	0.03-0.09
Grey Tolerance Sphere	x y	0.305 0.315	0.335 0.345	0.325 0.355	0.295 0.325	0.11-0.18
Dark Green Tolerance Sphere	x y	0.313 0.682	0.313 0.453	0.248 0.409	0.127 0.557	0.01-0.07

Table 1.2: Manufacturer's specification for initial daylight chromaticity and luminance factor

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
White Tolerance Sphere	x y	0.355 0.355	0.305 0.305	0.285 0.325	0.335 0.375	≥0.40
Yellow Tolerance Sphere	x y	0.545 0.454	0.487 0.423	0.427 0.483	0.465 0.534	≥0.24
Red Tolerance Sphere	x y	0.735 0.265	0.674 0.236	0.569 0.341	0.655 0.345	≥0.03
Blue Tolerance Sphere	x y	0.078 0.171	0.150 0.220	0.210 0.160	0.137 0.038	≥0.01
Green Tolerance Sphere	x y	0.007 0.703	0.248 0.409	0.177 0.362	0.026 0.399	≥0.03
Orange Tolerance Sphere	x y	0.631 0.369	0.560 0.360	0.506 0.404	0.570 0.429	≥0.14
Brown Tolerance Sphere	x y	0.455 0.397	0.523 0.429	0.479 0.373	0.558 0.394	0.03-0.09
Grey Tolerance Sphere	x y	0.350 0.360	0.300 0.310	0.285 0.325	0.335 0.375	0.11-0.18
Dark Green Tolerance Sphere	x y	0.313 0.682	0.313 0.453	0.248 0.409	0.127 0.557	0.01-0.07

Table 1.3: Manufacturer's specification for daylight chromaticity and luminance factor 'in-use'

Geometry of measurement		Colour								
α	β_1 ($\beta_2 = 0$)	White	Yellow	Red	Green	Dark Green	Blue	Brown	Orange	Grey
12'	+5°	250	170	45	45	20	20	12	100	125
	+30°	150	100	25	25	15	11	8.5	60	75
	+40°	110	70	15	12	6	8	5.0	29	55
20'	+5°	180	120	25	21	14	14	8	65	90
	+30°	100	70	14	12	11	8	5	40	50
	+40°	95	60	13	11	5	7	3	20	47
2°	+5°	5	3	1	0.5	0.5	0.2	0.2	1.5	2.5
	+30°	2.5	1.5	0.4	0.3	0.3	#	#	1	1.2
	+40°	1.5	1.0	0.3	0.2	0.2	#	#	#	0.7

# Indicates "Value greater than zero but not significant or applicable"

NOTE Coloured areas of signs created by digital or screen printing or using overlay film will need to meet 70% of the values in the table.

Table A.1
Manufacturer's Specification for the Minimum Initial Coefficient of Retro-reflection R_A value
(Values are identical to EN 12899-1:2007 Class RA2)