

EUROPEAN TECHNICAL ASSESSMENT

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Technical Assessment Body issuing the European Technical Assessment: UBAtc.
UBAtc has been designated according to Article 29 of Regulation (EU) No 305/2011
and is member of EOTA (European Organisation for Technical Assessment)

Trade name of the construction product:

3M™ Advanced Engineer Grade Prismatic Reflective Sheeting Series 7930,

3M™ Advanced Engineer Grade Prismatic Reflective Sheeting Series 7930 printed with "3M™ Process Color Series 880 N or I"

3M™ Advanced Engineer Grade Prismatic Reflective Sheeting Series 7930 + 3M™ Piezo Inkjet Ink Series 8800UV + 3M™ Protective Overlay Film 1140

Product family to which the construction product belongs:

Micro-prismatic retro-reflective sheeting for traffic signs

Manufacturer:

3M Deutschland GmbH
Carl Schurz Strasse 1
D- 41453- Neuss - Deutschland

Manufacturing plant(s):

3M Brownwood
4501 Highway 377 South
Brownwood, Texas 76801
USA

Website:

www.mmm.com

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:

European Assessment Document (EAD): 120001-00-0106

This European Technical Assessment contains:

16 pages, comprising 3 annexes.



**European Organisation
for Technical Assessment**

Legal bases and general conditions

- 1 This European Technical Assessment is issued by UBAtc (Union belge pour l'Agrément technique de la construction, i.e. Belgian Union for technical Approval in construction), in accordance with:
 - Regulation (EU) No 305/2011¹ of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC
 - Commission Implementing Regulation (EU) No 1062/2013² of 30 October 2013 on the format of the European Technical Assessment for construction products
 - European Assessment Document (EAD) : 120001-00-10106
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- 14 This European Technical Assessment was first issued by UBAtc on: 2016-03-03.

¹ OJEU, L 88 of 2011/04/04

² OJEU, L 289 of 2013/10/31

Technical Provisions

1 Description of the construction product

1.1 General

The product consists in a micro-prismatic retro-reflective sheeting made of optical prismatic lenses elements formed in a transparent synthetic resin, sealed and backed with a pressure sensitive adhesive to form a durable bond to the sign substrates. The sheeting has a smooth surface with a distinctive interlocking seal pattern and may or may not have orientation marks, visible from the face.

The product is supplied as a single coloured sheet whose trade name is "3M™ Advanced Engineer Grade Prismatic Series 7930". Alternatively, the product can be supplied as "3M™ Advanced Engineer Grade Prismatic Series 7930" printed with "3M™ Process Colour Series 880 I or N" or "3M™ Advanced Engineer Grade Prismatic Series 7930 + 3M™ Piezo Inkjet Ink Series 8800UV + 3M™ Protective Overlay Film 1140".

1.2 Components of 3M™ Advanced Engineer Grade Prismatic Reflective Sheeting Series 7930 + 3M™ Advanced Engineer Grade Prismatic Reflective Sheeting Series 7930 printed with "3M™ Process Colour Series 880 N or I" + "3M™ Advanced Engineer Grade Prismatic Series 7930 + 3M™ Piezo Inkjet Ink Series 8800UV + 3M™ Protective Overlay Film 1140"

The complete set of Micro-prismatic retro-reflective sheeting is given in table 1.1.

The manufacturer's specification of the initial daylight chromaticity and luminance factor is given in table 1.2 by means of a colour box in the 1931 CIE (2°) system.

The manufacturer's specification of the daylight chromaticity and luminance factor 'in-use' (or after the durability test) is given in table 1.3 by means of a colour box in the 1931 CIE (2°) system.

Components	Trade name	Colours/code	Characteristics
Micro-prismatic retro-reflective sheeting	3M™ Advanced Engineer Grade Prismatic Reflective Sheeting Series 7930	White	7930
		Yellow	7931
		Red	7932
		Blue	7935
		Orange	7934
		Green	7937
		Brown	7939
Process Colour	3M™ Process Colour Series 880 I or N	Yellow	884 I or N
		Red	882 I or N
		Blue	883 I or N
		Green	888 I or N
		Brown	887 I or N
Process Colour for digital printing	3M™ Piezo Inkjet Ink Series 8800 UV	Yellow	18-20 mg/l
		Red	
		Blue	
		Green	
		Brown	
3M™ Protective Overlay Film	Clear	1140	Combined Thickness: 0,4 mm

Table 1.1: Complete set of Micro-prismatic retro-reflective sheeting covered by this ETA

Colours		Chromaticity Coordinates				Luminance Factor β
		1	2	3	4	
White Colour Box	x	0.305	0.335	0.325	0.295	≥ 0.40
	y	0.315	0.345	0.355	0.325	
Yellow Colour Box	x	0.494	0.470	0.513	0.545	≥ 0.24
	y	0.505	0.480	0.437	0.454	
Red Colour Box	x	0.735	0.700	0.610	0.660	≥ 0.03
	y	0.265	0.250	0.340	0.340	
Blue Colour Box	x	0.130	0.160	0.160	0.130	≥ 0.01
	y	0.090	0.090	0.140	0.140	
Green Colour Box	x	0.110	0.170	0.170	0.110	≥ 0.03
	y	0.415	0.415	0.500	0.500	
Orange Colour Box	x	0.631	0.560	0.506	0.570	≥ 0.14
	y	0.369	0.360	0.404	0.429	
Brown Colour Box	x	0.455	0.523	0.479	0.558	0.04-0.06
	y	0.397	0.429	0.373	0.394	

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

Colours		Chromaticity Coordinates				Luminance Factor β
		1	2	3	4	
White Colour Box	x	0.355	0.305	0.285	0.335	≥ 0.40
	y	0.355	0.305	0.325	0.375	
Yellow Colour Box	x	0.545	0.487	0.427	0.465	≥ 0.24
	y	0.454	0.423	0.483	0.534	
Red Colour Box	x	0.735	0.674	0.569	0.655	≥ 0.03
	y	0.265	0.236	0.341	0.345	
Orange Colour Box	x	0.631	0.560	0.506	0.570	≥ 0.14
	y	0.369	0.360	0.404	0.429	
Blue Colour Box	x	0.078	0.150	0.210	0.137	≥ 0.01
	y	0.171	0.220	0.160	0.038	
Green Colour Box	x	0.007	0.248	0.177	0.026	≥ 0.03
	y	0.703	0.409	0.362	0.399	
Brown Colour Box	x	0.455	0.523	0.479	0.558	0.04-0.06
	y	0.397	0.429	0.373	0.394	

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

2 Information on the intended use of the construction product

2.1 Intended uses

The construction product is used to manufacture sign faces for traffic signs.

The intended use includes, for example:

- retro-reflective signs,
- retro-reflective and trans-illuminated signs,
- variable message signs.

The envisaged substrates or structures are commonly, but not only, based on aluminium, galvanised steel or processed polymers.

The assumed intended working life of the product is 7 years, provided that it is subjected to appropriate use and maintenance. The indications given as to the working life of the product cannot be interpreted as a guarantee given by the manufacturer or by the Technical Assessment Body.

2.2 Assumptions under which the fitness of the product(s) for the intended use was favourably assessed

2.2.1 Manufacturing directives

The “3M™ Advanced Engineer Grade Prismatic Reflective Sheeting Series 7930” and “3M™ Advanced Engineer Grade Prismatic Reflective Sheeting Series 7930” printed with “3M™ Process Colour Series 880 N or I” components, shall correspond, as far as their composition and manufacturing process is concerned, to the products subject to the assessment tests. A manufacturing process has been deposited with UBAtc.

2.2.2 Installation

2.2.2.1 General

It is the responsibility of the ETA holder to guarantee that the information about design and installation of the systems as described in clause 1 of this ETA, are effectively communicated to the concerned people. This information may be given using reproductions of the respective parts of this ETA. Besides, all the data concerning the execution shall be indicated clearly on the packaging and/or the enclosed instruction sheets using one or several illustrations.

In any case, it is suitable to comply with national regulations and particularly concerning national traffic code.

Only the components described in clause 1.1 of this ETA may be used for the systems 3M™ Advanced Engineer Grade Prismatic Reflective Sheeting Series 7930 printed with “3M™ Process Colour Series 880 N or I”.

2.2.2.2 Design

Users are urged to carefully evaluate all substrates for adhesion and sign durability. “3M™ Advanced Engineer Grade Prismatic Reflective Series 7930” is designed primarily for application to flat substrates.

2.2.2.3 Application

“3M™ Advanced Engineer Grade Prismatic Reflective Series 7930”

The recognition and preparation of the substrate as well as the generalities about the application of this product series, which is fully described in the current version of the ETA holder catalogue, its technical bulletins and web site www.3M.com/TSS, shall be carried out in compliance with national regulations, if any.

“3M™ Advanced Engineer Grade Prismatic Reflective Series 7930” sheeting incorporate a pressure sensitive adhesive and shall be applied to the sign substrate at room temperature (18°C) or higher by any of the following methods: mechanical squeeze roll applicator, hand squeeze roll applicator, hand application. If the heater is needed to warm to the minimum application temperature of 18°C, it shall be directed at the substrate only.

Users are urged to carefully evaluate all substrates for adhesion and sign durability. “3M™ Advanced Engineer Grade Prismatic Reflective Series 7930” sheeting are designed primarily for application to flat substrates. Sign failures caused by the substrate due to improper surface preparation are not the responsibility of the ETA holder.

3M™ Process Colour Series 880 I or N

Series 880 I and N inks only differ based on the solvent package. The active component packages in both series are identical. Series I inks should not be blended with Series N inks. Both series should not be blended with any other series process colours by 3M or any other manufacturer.

For screen processing, the equipment and set-up are the following: proper colour and durability is achieved by using a high grade polyester, monofilament screen fabric mesh size P.E. 157. Other size screen fabrics do not produce satisfactory colour and durability. Screen printing should be accomplished using the off-contact screening method. Direct contact screen printing should not be used. Be sure that screens, sheeting, plus screening and drying areas are dust, dirt and lint free.

For the mixing and thinning, it is important that the colours and sheeting be brought to normal ambient room temperature and humidity of the screen printing area before processing. Thin sparingly using 3M™ Thinner of the same series as the process colours. Do not use extenders, drying agents, or other materials as they will adversely affect performance life.

3M™ Process Colour Series 880 transparent or opaque colours need to be clear coated.

Edge sealing is not recommended.

Air Drying: processed sheeting for air drying must be placed on open racks to allow adequate air circulation. High volume fans must be directed through the racks. Drying times will be increased by high humidity, low temperature, poor air circulation, heavy colour coat, and excessive thinning. Addition of drying agents is not recommended.

Sheeting processed with Series 880 inks shall be air dried for a minimum of 3 hours per colour.

Oven drying: Processed sheeting for oven drying shall be placed on open racks individually with sufficient open space for unobstructed air flow.

3M™ Piezo Inkjet Ink Series 8800 UV

3M Piezo Ink Jet Ink Series 8800UV is designed as part of the 3M MCS™ (Matched Component System) for application using the Durst Rho 161TS / 162TS Printer onto 3M Advanced Engineer Grade Prismatic Reflective Sheeting Series 7930 before mounting the sheeting onto a sign substrate. These UV-curable inks are durable, weather-resistant, and have excellent colour retention when used in combination with 3M Protective Overlay Film 1140 as an overlamine.

Detailed printing guidelines in order to achieve traffic sign colours according to this ETA may be obtained in the latest Product Bulletin for 3M Piezo Ink Jet Ink Series 8800UV.

Above mentioned overlaminates shall always be applied, following below instructions:

To avoid a silvering artifact (trapped air between ink layer and overlamine), the lamination process should be conducted under a controlled set of conditions.

Recommended laminator specifications and set-up:

- Roll diameter: max. 350 mm;
- Roll weight: approximately 80 kg;
- Roll width: 1400-1600 mm
- Core size: 3 inches; 2 Take-up shafts; 2 Supply shafts
- Heatable top roller: min. 45°C; Pressure: > 8 bar

3M Piezo Ink Jet Ink Series 8800UV should not be stored at elevated temperatures. It shall be used within the indicated shelf life.

2.3 Recommendations

2.3.1 Recommendations on packaging, transport and storage

The sheeting shall be stored in a cool, dry area, preferably at 18-24°C and 30-50% RH, and should be applied within one year from delivery. Rolls should be stored horizontally in the shipping carton. Partially used rolls should be returned to the shipping carton or suspended horizontally on a rod or pipe through the core.

Unprocessed sheets should be stored flat. Finished signs and applied blanks should be stored on edge.

Package for shipment must prevent movement and chafing. Store sign packages indoors on edges. Panels or finished signs must remain dry during shipping and storage. If packaged signs become wet, unpack immediately and allow to dry.

The Series 880 inks should not be stored at elevated temperatures and have to be used within one year after the date of production.

3 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

3.1 3M Advanced Engineer Grade Prismatic Series 7930

3.1.1 Daylight Chromaticity and Luminance Factor

The characteristics of daylight chromaticity and luminance factor have been determined according to EAD120001-00-0106, clause 2.2.1, and have been specified in Annex 1, clause A1.1, of this ETA.

3.1.2 Night-time colour

No performance assessed

3.1.3 Coefficient of Retro-reflection

The Coefficient of Retro-reflection has been determined according to EAD120001-00-0106, clause 2.2.3.

α	β_1 ($\beta_2 = 0$)	Result White
0,2°	+5°	132
	+30°	73
	+40°	37
0,33°	+5°	85
	+30°	44
	+40°	24
2°	+5°	5.3
	+30°	4.0
	+40°	3.6

α	β_1 ($\beta_2 = 0$)	Result Yellow
0,2°	+5°	99
	+30°	53
	+40°	24
0,33°	+5°	64
	+30°	33
	+40°	15.8
2°	+5°	4.1
	+30°	2.8
	+40°	2.3

α	β_1 ($\beta_2 = 0$)	Result Red
0,2°	+5°	32
	+30°	17.6
	+40°	8.3
0,33°	+5°	21
	+30°	10.9
	+40°	5.5
2°	+5°	1.3
	+30°	0.7
	+40°	0.6

α	β_1 ($\beta_2 = 0$)	Result Blue
0,2°	+5°	9.4
	+30°	4.7
	+40°	2.3
0,33°	+5°	5.9
	+30°	2.7
	+40°	1.4
2°	+5°	0.3
	+30°	0.2
	+40°	0.2

α	β_1 ($\beta_2 = 0$)	Result Green
0,2°	+5°	15.9
	+30°	8.1
	+40°	3.9
0,33°	+5°	10.1
	+30°	4.7
	+40°	2.4
2°	+5°	0.7
	+30°	0.5
	+40°	0.4

α	β_1 ($\beta_2 = 0$)	Result Brown
0,2°	+5°	30
	+30°	14.6
	+40°	2.4
0,33°	+5°	18.1
	+30°	8.9
	+40°	1.6
2°	+5°	0.8
	+30°	0.8
	+40°	0.3

α	β_1 ($\beta_2 = 0$)	Result Orange
0,2°	+5°	58
	+30°	31
	+40°	14.7
0,33°	+5°	38
	+30°	19
	+40°	9.9
2°	+5°	2.2
	+30°	1.4
	+40°	1.2

3.1.4 Rotational symmetry

The rotational symmetry has been determined according to EAD120001-00-0106, clause 2.2.3 "Rotational symmetry".

α	β_1	ϵ	Result White 7930	Min / Max	Ratio
0,33°	+ 5°	- 75°	66		1:1.44
		- 50°	59	59	
		- 25°	73		
		0°	85	85	
		25°	72		
		50°	59	59	

α	β_1	ϵ	Result Yellow 7931	Min / Max	Ratio
0,33°	+ 5°	- 75°	46		1:1,56
		- 50°	42		
		- 25°	55		
		0°	64	64	
		25°	51		
		50°	41		

α	β_1	ε	Result Red 7932	Min / Max	Ratio
0,33°	+ 5°	- 75°	12,8	12,7	1:1,65
		- 50°	12,7		
		- 25°	17,4		
		0°	21	21	
		25°	17,4		
		50°	12,8		

α	β_1	ε	Result Blue 7935	Min / Max	Ratio
0,33°	+ 5°	- 75°	4,9		1:1,51
		- 50°	3,9	3,9	
		- 25°	4,8		
		0°	5,9	5,9	
		25°	4,8		
		50°	3,9	3,9	

α	β_1	ε	Result Green 7937	Min / Max	Ratio
0,33°	+ 5°	- 75°	8,7	6,9	1:1,46
		- 50°	6,9		
		- 25°	8,2		
		0°	10,1	10,1	
		25°	8,5		
		50°	7,0		

α	β_1	ε	Result Orange 7934	Min / Max	Ratio
0,33°	+ 5°	- 75°	26		1:1,58
		- 50°	24	24	
		- 25°	32		
		0°	38	38	
		25°	31		
		50°	24	24	

α	β_1	ε	Result Brown 7939	Min / Max	Ratio
0,33°	+ 5°	- 75°	15,5	13,9	1:1,30
		- 50°	13,9		
		- 25°	16,4		
		0°	18,1	18,1	
		25°	17,3		
		50°	15,2		

3.1.5 Impact resistance

The Impact resistance has been determined according to EAD120001-00-0106, clause 2.2.4.

Sample	Test Result
White 7930	No apparent cracking or delamination observed
Yellow 7931	
Red 7932	
Blue 7935	
Green 7937	
Orange 7934	
Brown 7939	

3.1.6 Temperature resistance

No performance assessed

3.1.7 Visibility after weathering

3.1.7.1 Daylight Chromaticity and Luminance Factor after accelerated artificial weathering

The Daylight chromaticity and luminance factor, verified according to EAD120001-00-0106, clause 2.2.1, tested after accelerated artificial weathering test, have been specified in Annex 1, clause A1.2 of this ETA.

The weathering has been done according to EAD120001-00-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer.

3.1.7.2 Coefficient of Retro-reflection after accelerated artificial weathering

The Coefficient of Retro-reflection after accelerated artificial weathering tests has been determined according to EAD 120001-00-0106, clause 2.2.6.4, with an observation angle $\alpha = 0.33^\circ$ and $\beta_1 = 5^\circ$ and 30° .

The weathering has been done according to EAD 120001-00-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer.

Geometry of measurements		Colour	Results (cd · lx ⁻¹ · m ²)
α	β		
0.33°	5°	White 7930	119
	30°		75
0.33°	5°	Yellow 7931	50
	30°		37
0.33°	5°	Red 7932	16,6
	30°		14,6
0.33°	5°	Blue 7935	8,3
	30°		5,0
0.33°	5°	Green 7937	5,9
	30°		3,3
0.33°	5°	Orange 7934	27
	30°		15,8
0.33°	5°	Brown 7939	11,8
	30°		6,9

3.1.8 Adhesion test

No performance assessed

3.2 3M™ Advanced Engineer Grade Prismatic Series 7930 printed with 3M™ Process Colour Series 880 I or N

3.2.1 Daylight Chromaticity and Luminance Factor

The characteristics of daylight chromaticity and luminance factor have been determined according to EAD120001-00-0106, clause 2.2.1, and have been specified in Annex 2, clause A2.1, of this ETA.

3.2.2 Night-time colour

No performance assessed

3.2.3 Coefficient of Retro-reflection

The Coefficient of Retro-reflection has been determined according to EAD120001-00-0106, clause 2.2.3.

α	β_1 ($\beta_2 = 0$)	Result Yellow
0,2°	+5°	85
	+30°	65
	+40°	52
0,33°	+5°	44
	+30°	44
	+40°	42
2°	+5°	5.9
	+30°	2.4
	+40°	2.2

α	β_1 ($\beta_2 = 0$)	Result Red
0,2°	+5°	46
	+30°	29
	+40°	14.8
0,33°	+5°	31
	+30°	17.5
	+40°	9.5
2°	+5°	1.3
	+30°	0.6
	+40°	0.5

α	β_1 ($\beta_2 = 0$)	Result Blue
0,2°	+5°	21
	+30°	12.6
	+40°	6.8
0,33°	+5°	12.7
	+30°	6.3
	+40°	3.6
2°	+5°	0.5
	+30°	0.3
	+40°	0.3

α	β_1 ($\beta_2 = 0$)	Result Brown
0,2°	+5°	19.2
	+30°	10.5
	+40°	5.0
0,33°	+5°	12.5
	+30°	6.1
	+40°	3.1
2°	+5°	0.7
	+30°	0.3
	+40°	0.2

α	β_1 ($\beta_2 = 0$)	Result Green
0,2°	+5°	46
	+30°	28
	+40°	15.3
0,33°	+5°	28
	+30°	14.2
	+40°	8.4
2°	+5°	1.2
	+30°	0.6
	+40°	0.6

3.2.4 Rotational symmetry

The rotational symmetry has been determined according to EAD120001-00-0106, clause 2.2.3 "Rotational symmetry".

α	β_1	ε	Result Ink Yellow 884 I or N on white 7930	Min / Max	Ratio
0,33°	+ 5°	- 75°	87	87	1:2,29
		- 50°	51		
		- 25°	38	38	
		0°	44		
		25°	38	38	
		50°	49		

α	β_1	ε	Result Ink Red 882 I or N on white 7930	Min / Max	Ratio
0,33°	+ 5°	- 75°	13,5	13,5	1:2,30
		- 50°	14,9		
		- 25°	25		
		0°	31	31	
		25°	24		
		50°	14,8		

α	β_1	ε	Result Ink Green 888 I or N on white 7930	Min / Max	Ratio
0,33°	+ 5°	- 75°	6,6	5,3	1:2,40
		- 50°	5,3		
		- 25°	9,4		
		0°	12,7	12,7	
		25°	8,9		
		50°	5,3		

α	β_1	ε	Result Ink Blue 883 I or N on white 7930	Min / Max	Ratio
0,33°	+ 5°	- 75°	13,3	11,7	1:2,39
		- 50°	11,7		
		- 25°	21		
		0°	28	28	
		25°	11,8		
		50°	11,8		

α	β_1	ε	Result Ink Brown 887 I or N on white 7930	Min / Max	Ratio
0,33°	+ 5°	- 75°	5,6	5,3	1:2,36
		- 50°	5,3		
		- 25°	9,2		
		0°	12,5	12,5	
		25°	10,0		
		50°	6,0		

3.2.5 Impact resistance

The Impact resistance has been determined according to EAD120001-00-0106, clause 2.2.4.

Sample	Test Result
Ink Yellow 884 I or N on white 7930	No apparent cracking or delamination observed
Ink Red 882 I or N on white 7930	
Ink Green 888 I or N on white 7930	
Ink Blue 883 I or N on white 7930	
Ink Brown 887 I or N on white 7930	

3.2.6 Temperature resistance

No performance assessed

3.2.7 Visibility after weathering

3.2.7.1 Daylight Chromaticity and Luminance Factor after accelerated artificial weathering

The Daylight chromaticity and luminance factor, verified according to EAD120001-00-0106, clause 2.2.1, tested after accelerated artificial weathering test, have been specified in Annex 2, clause A2.2 of this ETA.

The weathering has been done according to EAD120001-00-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer.

3.2.7.2 Coefficient of Retro-reflection after accelerated artificial weathering

The Coefficient of Retro-reflection after accelerated artificial weathering tests has been determined according to EAD 120001-00-0106, clause 2.2.6.4, with an observation angle $\alpha = 0.33^\circ$ and $\beta_1 = 5^\circ$ and 30° .

The weathering has been done according to EAD 120001-00-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer.

Geometry of measurements		Colour	Results (cd lx ⁻¹ m ⁻²)
α	β		
0.33°	5°	Ink Yellow 881 I or N on white 7930	63
	30°		54
0.33°	5°	Ink Red 882 I or N on White 7930	25
	30°		17,6
0.33°	5°	Ink Green 888 I or N on White 7930	15,0
	30°		8,1
0.33°	5°	Ink Blue 883 I or N on White 7930	6,2
	30°		3,9
0.33°	5°	Ink Brown 887 I or N on White 7930	6,9
	30°		3,6

3.2.8 Adhesion test

No performance assessed

3.3 3M™ Advanced Engineer Grade Prismatic Series 7930 + 3M™ Piezo Inkjet Ink Series 8800UV + 3M™ Protective Overlay Film 1140

3.3.1 Daylight Chromaticity and Luminance Factor

The characteristics of daylight chromaticity and luminance factor have been determined according to EAD120001-00-0106, clause 2.2.1, and have been specified in Annex 3, clause A3.1, of this ETA.

3.3.2 Night-time colour

No performance assessed

3.3.3 Coefficient of Retro-reflection

The Coefficient of Retro-reflection has been determined according to EAD120001-00-0106, clause 2.2.3.

α	β_1 ($\beta_2 = 0$)	Result White
0,2°	+5°	100
	+30°	73
	+40°	37
0,33°	+5°	74
	+30°	55
	+40°	48
2°	+5°	8.9
	+30°	5.5
	+40°	5.0

α	β_1 ($\beta_2 = 0$)	Result Yellow
0,2°	+5°	81
	+30°	46
	+40°	22
0,33°	+5°	55
	+30°	28
	+40°	14.7
2°	+5°	4.9
	+30°	3.5
	+40°	2.9

α	β_1 ($\beta_2 = 0$)	Result Red
0,2°	+5°	27
	+30°	14.8
	+40°	7.2
0,33°	+5°	19.0
	+30°	9.6
	+40°	4.9
2°	+5°	2.2
	+30°	1.6
	+40°	1.2

α	β_1 ($\beta_2 = 0$)	Result Green
0,2°	+5°	16.2
	+30°	8.6
	+40°	4.3
0,33°	+5°	10.7
	+30°	5.1
	+40°	2.7
2°	+5°	1.0
	+30°	0.7
	+40°	0.5

α	β_1 ($\beta_2 = 0$)	Result Blue
0,2°	+5°	7.8
	+30°	4.2
	+40°	2.2
0,33°	+5°	5.0
	+30°	2.3
	+40°	1.2
2°	+5°	0.3
	+30°	0.2
	+40°	0.2

α	β_1 ($\beta_2 = 0$)	Result Brown
0,2°	+5°	13.3
	+30°	7.0
	+40°	3.1
0,33°	+5°	9.1
	+30°	4.5
	+40°	2.1
2°	+5°	0.9
	+30°	0.6
	+40°	0.5

α	β_1 ($\beta_2 = 0$)	Result Orange
0,2°	+5°	45
	+30°	25
	+40°	11.8
0,33°	+5°	31
	+30°	15.5
	+40°	7.8
2°	+5°	3.1
	+30°	2.2
	+40°	1.7

3.3.4 Rotational symmetry

The rotational symmetry has been determined according to EAD120001-00-0106, clause 2.2.3 "Rotational symmetry".

α	β_1	ε	Result White 7930 + 1140 Clear	Min / Max	Ratio
0,33°	+ 5°	- 75°	81	81	1:1,50
		- 50°	63		
		- 25°	64		
		0°	74		
		25°	59	54	
		50°	54		

α	β_1	ε	Result White 7930 + Inkjet Yellow + 1140 Clear	Min / Max	Ratio
0,33°	+ 5°	- 75°	35	33	1:1,67
		- 50°	33		
		- 25°	46		
		0°	55	55	
		25°	45		
		50°	34		

α	β_1	ϵ	Result White 7930 + Inkjet Red + 1140 Clear	Min / Max	Ratio
0,33°	+ 5°	- 75°	12,4	11,9	1:1,64
		- 50°	11,9		
		- 25°	15,9		
		0°	19,5	19,5	
		25°	16,1		
		50°	12,3		

α	β_1	ε	Result White 7930 + Inkjet Blue + 1140 Clear	Min / Max	Ratio
0,33°	+ 5°	- 75°	3,8	2,9	1:1,86
		- 50°	2,9		
		- 25°	3,9		
		0°	5,4		
		25°	4,1		
		50°	3,2		

α	β_1	ϵ	Result White 7930 + Inkjet Green + 1140 Clear	Min / Max	Ratio
0,33°	+ 5°	- 75°	7,6	6,4	1:1,75
		- 50°	6,4		
		- 25°	8,6		
		0°	11,2	11,2	
		25°	8,7		
		50°	6,7		

α	β_1	ϵ	Result White 7930 + Inkjet Brown + 1140 Clear	Min / Max	Ratio
0,33°	+ 5°	- 75°	5,9	5,7	1:1,67
		- 50°	5,7		
		- 25°	7,7		
		0°	9,5	9,5	
		25°	7,5		
		50°	5,7		

α	β_1	ε	Result White 7930 + Inkjet Orange + 1140 Clear	Min / Max	Ratio
0,33°	+ 5°	- 75°	19,9	18,8	1:1,65
		- 50°	18,8		
		- 25°	26		
		0°	31	31	
		25°	25		
		50°	19,4		

3.3.5 Impact resistance

The Impact resistance has been determined according to EAD120001-00-0106, clause 2.2.4.

Sample	Test Result
White 7930 + 1140 Clear	No apparent cracking or delamination observed
White 7930 + Inkjet Yellow + 1140 Clear	
White 7930 + Inkjet Red + 1140 Clear	
White 7930 + Inkjet Green + 1140 Clear	
White 7930 + Inkjet Blue + 1140 Clear	
White 7930 + Inkjet Brown + 1140 Clear	
White 7930 + Inkjet Orange + 1140 Clear	

3.3.6 Temperature resistance

No performance assessed

3.3.7 Visibility after weathering

3.3.7.1 Daylight Chromaticity and Luminance Factor after accelerated artificial weathering

The Daylight chromaticity and luminance factor, verified according to EAD120001-00-0106, clause 2.2.1, tested after accelerated artificial weathering test, have been specified in Annex 3, clause A3.2 of this ETA.

The weathering has been done according to EAD120001-00-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer.

3.3.7.2 Coefficient of Retro-reflection after accelerated artificial weathering

The Coefficient of Retro-reflection after accelerated artificial weathering tests has been determined according to EAD 120001-00-0106, clause 2.2.6.4, with an observation angle $\alpha = 0.33^\circ$ and $\beta_1 = 5^\circ$ and 30° .

The weathering has been done according to EAD 120001-00-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer.

Geometry of measurements		Colour	Results ($\text{cd} \cdot \text{lx}^{-1} \cdot \text{m}^{-2}$)
α	β		
0.33°	5°	White 7930 + 1140 Clear	113
	30°		57
0.33°	5°	White 7930 + Inkjet Yellow + 1140 Clear	36
	30°		26
0.33°	5°	White 7930 + Inkjet Red + 1140 Clear	11,8
	30°		8,0
0.33°	5°	White 7930 + Inkjet Green + 1140 Clear	10,1
	30°		5,9
0.33°	5°	White 7930 + Inkjet Blue + 1140 Clear	5,7
	30°		3,3
0.33°	5°	White 7930 + Inkjet Brown + 1140 Clear	8,5
	30°		5,4
0.33°	5°	White 7930 + Inkjet Orange + 1140 Clear	26
	30°		17,8

3.3.8 Adhesion test

No performance assessed

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with Regulation (EU) N° 305/2011, Article 65, Directive 89/106/EEC is repealed, but references to the repealed Directive shall be construed as references to the Regulation.

The system of assessment and verification of constancy of performance, specified in the Decision of the Commission 1996/579/EC of 1996/06/24³, as amended by Commission Decision 1999/453/EC of 1999/06/18⁴, is specified in the following Table.

Table 2 – System of assessment and verification of constancy of performance

Product(s)	Intended use(s)	Level(s) or class(es)	Assessment and verification of constancy of performance system(s)*
Road traffic signs	For circulation areas	Any	1
* See Annex V to Regulation (EU) N° 305/2011			

³ see OJEU L 254, 8.10.1996, p. 52

⁴ see OJEU L 178, 14.7.1999, p. 50

5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

5.1 Tasks for the ETA-holder

The cornerstones of the actions to be undertaken by the manufacturer of the product in the process of assessment and verification of constancy of performance are laid down in clause 3.2 of the European Assessment Document 120001-00-0106.

The manufacturer is allowed to use similar test or control methods, using different equipment and test samples under different conditions, as long as the manufacturer ensures constant product performances, but the frequency of control shall be respected.

5.2 Tasks of notified bodies

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance for corrugated bitumen tiles are laid down in clause 3.3 of the European Assessment Document 120001-00-0106.

6 Reference documents

See clause 4 of the European Assessment Document 120001-00-0106.

NOTE: The editions of reference documents given above are those which have been adopted by the UBAtc for its specific use when establishing this ETA. When new editions become available, these supersede the editions mentioned only when confirmed by the UBAtc.

UBAtc asbl is a non-profit organization according to Belgian law. It is a Technical Assessment Body notified by the Belgian notifying authority, the Federal Public Services Economy, SMEs, Self-Employed and Energy, on 17 July 2013 in the framework of Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC and is member of the European Organisation for Technical Assessment, EOTA (www.eota.eu).

This European Technical Assessment has been issued by UBAtc asbl on the basis of the technical work carried out by the Assessment Operator, COPRO.

On behalf of UBAtc asbl,



Peter Wouters,
director



Benny De Blaere,
director

On behalf of the Assessment Operator,
COPRO, responsible for the technical
content of the ETA,



Erik Barbé,
director

The most recent version of this European Technical Assessment may be consulted on the UBAtc website (www.ubatc.be).

Annex 1: 3M Advanced Engineer Grade Prismatic Series 7930
Daylight Chromaticity and Luminance Factor, initial and after accelerated artificial weathering

A1.1 Daylight Chromaticity and Luminance Factor, initial

Colours		Chromaticity Coordinates				Luminance Factor β
		1	2	3	4	
White <i>Tolerance Sphere /Level</i>	x y	0.305 0.315	0.335 0.345	0.325 0.355	0.295 0.325	Level: ≥ 0.40
White 7930	x* y*	0.316 0.329				0.724
Yellow <i>Tolerance Sphere /Level</i>	x y	0.494 0.505	0.470 0.480	0.513 0.437	0.545 0.454	Level: ≥ 0.24
Yellow 7931	x* y*	0.487 0.481				0.358
Red <i>Tolerance Sphere /Level</i>	x y	0.735 0.265	0.700 0.250	0.610 0.340	0.660 0.340	Level: ≥ 0.03
Red 7932	x* y*	0.638 0.316				0.610
Blue <i>Tolerance Sphere / Level</i>	x y	0.130 0.090	0.160 0.090	0.160 0.140	0.130 0.140	Level: ≥ 0.01
Blue 7935	x* y*	0.147 0.096				0.047
Green <i>Tolerance Sphere / Level</i>	x y	0.110 0.415	0.170 0.415	0.170 0.500	0.110 0.500	Level: ≥ 0.03
Green 7937	x* y*	0.144 0.471				0.069
Orange <i>Tolerance Sphere / Level</i>	x y	0.631 0.369	0.560 0.360	0.506 0.404	0.570 0.429	Level: ≥ 0.14
Orange 7934	x* y*	0.5751 0.3957				0.212
Brown <i>Tolerance Sphere /Level</i>	x y	0.455 0.397	0.523 0.429	0.479 0.373	0.558 0.394	Level: 0.04-0.06
Brown 7939	x* y*	0.473 0.394				0.050
* Average of three test results (historical data)						

A1.2 Daylight Chromaticity and Luminance Factor, after accelerated artificial weathering

Colours		Chromaticity Coordinates				Luminance Factor β
		1	2	3	4	
White <i>Tolerance Sphere/Level</i>	x y	0.355 0.355	0.305 0.305	0.285 0.325	0.335 0.375	Level: ≥ 0.40
White 7930	x* y*	0.312 0.331				0.678
Yellow <i>Tolerance Sphere/Level</i>	x y	0.545 0.454	0.487 0.423	0.427 0.483	0.465 0.534	Level: ≥ 0.24
Yellow 7931	x* y*	0.487 0.483				0.354
Red <i>Tolerance Sphere/Level</i>	x y	0.735 0.265	0.674 0.236	0.569 0.341	0.655 0.345	Level: ≥ 0.03
Red 7932	x* y*	0.637 0.319				0.065
Orange <i>Tolerance Sphere/Level</i>	x y	0.631 0.369	0.560 0.360	0.506 0.404	0.570 0.429	Level: ≥ 0.14
Orange 7934	x* y*	0.582 0.396				0.213
Blue <i>Tolerance Sphere/Level</i>	x y	0.078 0.171	0.150 0.220	0.210 0.160	0.137 0.038	Level: ≥ 0.01
Blue 7935	x* y*	0.148 0.106				0.050
Green <i>Tolerance Sphere/Level</i>	x y	0.007 0.703	0.248 0.409	0.177 0.362	0.026 0.399	Level: ≥ 0.03
Green 7937	x* y*	0.128 0.446				0.064
Brown <i>Tolerance Sphere/Level</i>	x y	0.455 0.397	0.523 0.429	0.479 0.373	0.558 0.394	Level: 0.04-0.06
Brown 7939	x* y*	0.487 0.397				0.051
* Average of three test results (historical data)						

**Annex 2: 3M™ Advanced Engineer Grade Prismatic Series 7930 printed with
3M™ Process Colour Series 880 I or N
Daylight Chromaticity and Luminance Factor, initial and after accelerated artificial weathering**

A2.1 Daylight Chromaticity and Luminance Factor, initial

Colours		Chromaticity Coordinates				Luminance Factor β
		1	2	3	4	
Yellow <i>Tolerance Sphere/Level</i>	x	0.494	0.470	0.513	0.545	Level: ≥ 0.24
	y	0.505	0.480	0.437	0.454	
White 7930 + 884 I or N Ink	x* y*	0.528 0.454				0.390
Red <i>Tolerance Sphere/Level</i>	x	0.735	0.700	0.610	0.660	Level: ≥ 0.03
	y	0.265	0.250	0.340	0.340	
White 7930 + 882 I or N Ink	x* y*	0.659 0.311				0.074
Green <i>Tolerance Sphere/Level</i>	x	0.110	0.170	0.170	0.110	Level: ≥ 0.03
	y	0.415	0.415	0.500	0.500	
White 7930 + 888 I or N Ink	x* y*	0.133 0.468				0.116
Blue <i>Tolerance Sphere/Level</i>	x	0.130	0.160	0.160	0.130	Level: ≥ 0.01
	y	0.090	0.090	0.140	0.140	
White 7930 + 883 I or N Ink	x* y*	0.138 0.120				0.064
Brown <i>Tolerance Sphere / Level</i>	x	0.455	0.523	0.479	0.558	Level: 0.04-0.06
	y	0.397	0.429	0.373	0.394	
White 7930 + 887 I or N Ink	x* y*	0.527 0.410				0.047
* Average of three test results (historical data)						

A2.2 Daylight Chromaticity and Luminance Factor, after accelerated artificial weathering

Colours		Chromaticity Coordinates				Luminance Factor β
		1	2	3	4	
Yellow <i>Tolerance Sphere</i>	x y	0.545 0.454	0.487 0.423	0.427 0.483	0.465 0.534	Level: ≥ 0.24
Ink Yellow 881 I or N on white 7930	x* y*	0.518 0.456				0.354
Red <i>Tolerance Sphere</i>	x y	0.735 0.265	0.674 0.236	0.569 0.341	0.655 0.345	Level: ≥ 0.03
Ink Red 882 I or N on White 7930	x* y*	0.649 0.313				0.065
Blue <i>Tolerance Sphere</i>	x y	0.078 0.171	0.150 0.220	0.210 0.160	0.137 0.038	Level: ≥ 0.01
Ink Blue 883 I or N on White 7930	x* y*	0.134 0.124				0.050
Green <i>Tolerance Sphere</i>	x y	0.007 0.703	0.248 0.409	0.177 0.362	0.026 0.399	Level: ≥ 0.03
Ink Green 888 I or N on White 7930	x* y*	0.143 0.453				0.126
Brown <i>Tolerance Sphere</i>	x y	0.455 0.397	0.523 0.429	0.479 0.373	0.558 0.394	Level: 0.04-0.06
Ink Brown 887 I or N on White 7930	x* y*	0.517 0.407				0.050
* Average of three test results (historical data)						

**Annex 3: 3M™ Advanced Engineer Grade Prismatic Series 7930 + 3M™ Piezo Inkjet Ink Series 8800UV +
3M™ Protective Overlay Film 1140
Daylight Chromaticity and Luminance Factor, initial and after accelerated artificial weathering**

A3.1 Daylight Chromaticity and Luminance Factor, initial

Colours		Chromaticity Coordinates				Luminance Factor β
		1	2	3	4	
White <i>Tolerance Sphere /Level</i>	x	0.305	0.335	0.325	0.295	Level: ≥ 0.40
	y	0.315	0.345	0.355	0.325	
White 7930 + 1140 Clear	x*	0.312				0.710
	y*	0.330				
Yellow <i>Tolerance Sphere/Level</i>	x	0.494	0.470	0.513	0.545	Level: ≥ 0.24
	y	0.505	0.480	0.437	0.454	
White 7930 + Inkjet Yellow + 1140 Clear	x*	0.481				0.429
	y*	0.477				
Red <i>Tolerance Sphere/Level</i>	x	0.735	0.700	0.610	0.660	Level: ≥ 0.03
	y	0.265	0.250	0.340	0.340	
White 7930 + Inkjet Red + 1140 Clear	x*	0.624				0.113
	y*	0.331				
Green <i>Tolerance Sphere/Level</i>	x	0.110	0.170	0.170	0.110	Level: ≥ 0.03
	y	0.415	0.415	0.500	0.500	
White 7930 + Inkjet Green + 1140 Clear	x*	0.161				0.052
	y*	0.466				
Blue <i>Tolerance Sphere/Level</i>	x	0.130	0.160	0.160	0.130	Level: ≥ 0.01
	y	0.090	0.090	0.140	0.140	
White 7930 + Inkjet Blue + 1140 Clear	x*	0.139				0.048
	y*	0.130				
Brown <i>Tolerance Sphere/Level</i>	x	0.455	0.523	0.479	0.558	Level: 0.04-0.06
	y	0.397	0.429	0.373	0.394	
White 7930 + Inkjet Brown + 1140 Clear	x*	0.499				0.052
	y*	0.402				
Orange <i>Tolerance Sphere/Level</i>	x	0.631	0.560	0.506	0.570	Level: ≥ 0.14
	y	0.369	0.360	0.404	0.429	
White 7930 + Inkjet Orange + 1140 Clear	x*	0.578				0.191
	y*	0.389				
* Average of three test results (historical data)						

A3.2 Daylight Chromaticity and Luminance Factor, after accelerated artificial weathering

Colours		Chromaticity Coordinates				Luminance Factor β
		1	2	3	4	
White <i>Tolerance Sphere/Level</i>	x	0.355	0.305	0.285	0.335	Level: ≥ 0.40
	y	0.355	0.305	0.325	0.375	
White 7930 + 1140 Clear	x*	0.313				0.711
	y*	0.333				
Yellow <i>Tolerance Sphere/Level</i>	x	0.545	0.487	0.427	0.465	Level: ≥ 0.24
	y	0.454	0.423	0.483	0.534	
White 7930 + Inkjet Yellow + 1140 Clear	x*	0.505				0.353
	y*	0.460				
Red <i>Tolerance Sphere/Level</i>	x	0.735	0.674	0.569	0.655	Level: ≥ 0.03
	y	0.265	0.236	0.341	0.345	
White 7930 + Inkjet Red + 1140 Clear	x*	0.643				0.081
	y*	0.324				
Green <i>Tolerance Sphere/Level</i>	x	0.007	0.248	0.177	0.026	Level: ≥ 0.03
	y	0.703	0.409	0.362	0.399	
White 7930 + Inkjet Green + 1140 Clear	x*	0.152				0.081
	y*	0.459				
Blue <i>Tolerance Sphere/Level</i>	x	0.078	0.150	0.210	0.137	Level: ≥ 0.01
	y	0.171	0.220	0.160	0.038	
White 7930 + Inkjet Blue + 1140 Clear	x*	0.137				0.047
	y*	0.138				
Brown <i>Tolerance Sphere/Level</i>	x	0.455	0.523	0.479	0.558	Level: 0.04-0.06
	y	0.397	0.429	0.373	0.394	
White 7930 + Inkjet Brown + 1140 Clear	x*	0.509				0.051
	y*	0.402				
Orange <i>Tolerance Sphere/Level</i>	x	0.631	0.560	0.506	0.570	Level: ≥ 0.14
	y	0.369	0.360	0.404	0.429	
White 7930 + Inkjet Orange + 1140 Clear	x*	0.574				0.187
	y*	0.391				
* Average of three test results (historical data)						