

# EUROPEAN TECHNICAL ASSESSMENT

**ETA 10/0118**

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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:**

**Product family to which the  
construction product belongs:**

**Manufacturer:**

**Manufacturing plant:**

**Website:**

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

**This version replaces:  
This European Technical  
Assessment contains:**

3M™ Engineer Grade Prismatic ("EGP") Reflective Sheeting  
Series 3430

3M™ Engineer Grade Prismatic Reflective Sheeting Series  
3430 + "3M™ Electrocut Series 1170"

3M™ Engineer Grade Prismatic Reflective Sheeting Series  
3430 printed with "3M™ Process Color Series 880 N or I"

Microprismatic retro-reflective sheetings

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16 pages, comprising three 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 305/2011<sup>1</sup> 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, as amended
  - Commission Implementing Regulation (EU) No 1062/2013<sup>2</sup> of 30 October 2013 on the format of the European Technical Assessment for construction products
  - European Assessment Document (EAD): 120001-00-0106 (adopted version 2015-05)
- 2 Under the provisions of Regulation (EU) No 305/2011, UBAtc is not authorized to check whether the provisions of this European Technical Assessment are met once the ETA has been issued.
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- 13 Subject to the application introduced, this European Technical Assessment is issued in English and may be issued by the UBAtc in its official languages. The translations correspond fully to the English reference version circulated in EOTA.
- 14 A European Technical Approval was issued by UBAtc on 30 June 2013. Compared with this European Technical Approval, version 1 of this European Technical Assessment comprised artificial replaced by natural weathering (see clauses 3.1.7, 3.2.7 and 3.3.7). Version 2 comprises editorial changes bringing the references in this European Technical Assessment in line with EAD 120001-00-0106. Use has been made of the evaluation report accompanying the original European Technical Approval, issued in 2010, as historical data.

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<sup>1</sup> OJEU, L 88 of 2011/04/04

<sup>2</sup> OJEU, L 289 of 2013/10/31

## Technical Provisions

### 1 Technical description of the product

#### 1.1 General

The product consists of 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™ Engineer Grade Prismatic Series 3430", or as a single coloured sheet with a coloured overlay film whose trade name is "3M™ Engineer Grade Prismatic Series 3430 + 3M™ Electrocut Film series 1170". Alternatively, the product can be supplied as "3M™ Engineer Grade Prismatic Series 3430" printed with "3M™ Process Colour Series 880 I or N".

#### 1.2 Components of 3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430, 3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430 + "3M™ Electrocut Series 1170" and 3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430 printed with "3M™ Process Colour Series 880 N or I"

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

Components	Trade name	Colours/code	Characteristics
Micro-prismatic retro-reflective sheeting	3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430	White 3430 Red 3432 Yellow 3431 Green 3437 Blue 3435	Thickness: 0,32 - 0,49 mm Rolls in various length and widths
Coloured overlay film	ELECTROCUT FILM series 1170	Yellow 1171 Red 1172 Blue 1175 Green 1177 Brown 1179 Green 2 (Dark Green) 1176	Thickness: 0,549 mm Rolls in various length and widths
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 French Red 889 I or N	20-25 mg/l

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

## 2 Specification of the intended use(s) in accordance with the applicable EAD

### 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 10 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

The European technical assessment is issued for the product on the basis of agreed data/information, deposited with the Technical assessment body, which identifies the product that has been assessed.

Changes to the product or production process, which could result in this deposited data/information being incorrect, should be notified to the Technical Assessment Body enabling the ETA to be adapted accordingly.

#### 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™ Engineer Grade Prismatic Reflective Sheeting Series 3430" + "3M™ Electrocut Series 1170" and 3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430 printed with "3M™ Process Colour Series 880 N or I".

##### 2.2.2.2 Design

The commonly envisaged substrates are aluminium, galvanised steel or melded thermoplastic or thermo setting polymers. The product shall comply with national regulations.

### 2.2.2.3 Application

#### 2.2.2.3.1 "3M™ Engineer Grade Prismatic "EGP" Reflective Series 3430"

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's catalogue, its technical bulletins and website [www.3M.com/TSS](http://www.3M.com/TSS), shall be carried out in compliance with national regulations, if any.

"3M™ Engineer Grade Prismatic "EGP" Reflective Series 3430" 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 or 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™ Engineer Grade Prismatic "EGP" Reflective Series 3430" 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.

#### 2.2.2.3.2 "3M™ Electrocut film Series 1170"

These overlay films have a transparent film release liner designed to aid the cutting process and the removal of the film weed after cutting. The rolls of film are supplied edge weeded on punched rolls to prevent adhesive build-up of sprocket fed cutters. It is recommended that inside radius corner fonts be used when cutting film. Moreover the ETA holder recommends the following steps:

- Adjust knife pressure to cut cleanly through the film without cutting into the liner. A 30° blade works best. Spacing between the letters or numbers should be adjusted to the aesthetic preference of the user. Consult the operating manual for instructions on how to regulate spacing. Do not cut at high speed on variable speed machines.
- Avoid sharp bends when cutting and handling film as this may cause film to release from the liner.
- After cutting has been completed, lay sheets flat, face to face, back to back. Always store sheets in this manner until the sheeting has been weeded and transfer tape has been applied.
- Use a stripping tool designed for weeding films that has a blunt (not sharp) edge.
- After weeding has been completed, store sheets flat, face to face, and back to back, until transfer tape has been applied.
- Transfer tape may be applied either by hand using a plastic squeegee or through a hand squeeze roll laminator. If applying the transfer tape by hand, care shall be taken to always squeeze from the centre to the outside in all directions.

Series 1170 film may be applied to the sheeting either before or after the sheeting has been applied to a substrate. The use of a hand squeeze roll laminator is recommended to ensure satisfactory results. Use the "split liner method" – Start in the middle of the sheet and remove half the liner to ensure proper alignment.

After Series 1170 film and sheeting have been applied, remove the transfer tape by carefully removing the tape at as low angle as possible

- When the tape has been removed, re-roll the sign through the laminator to ensure good adhesion. Adequate pressure is a key factor relating to the ultimate strength and durability of the sheeting - to - substrate adhesion.
- A clean cutting blade is required. To remove the adhesive build-up use soft cloth damped with mineral spirits, isopropyl alcohol or 3M™ Natural Cleaner.

### 2.2.2.3.3 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 shall be placed on open racks to allow adequate air circulation. High volume fans shall 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 must 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.

### 2.3 Recommendations on packaging, transport and storage

The sheeting should 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.

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

Coloured overlay film should be stored in a cool, dry area 18-24°C and 30 – 50 % RH, and should be used within one year from date of purchase.

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

## 3 Performance of the product and references to the methods used for its assessment

### 3.1 3M Engineer Grade Prismatic Series 3430

#### 3.1.1 Daylight Chromaticity and Luminance Factor

The characteristics of Daylight chromaticity and Luminance Factor have been determined according to EAD 120001-00-0106, 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  $R_A$  has been determined according to EAD 120001-00-0106, clause 2.2.3. The level is referred to in EN 12899-1:2007, clause 4.1, as Class RA1.

$\alpha$	$\beta_1$	Result 3430 White	White Min level $R_A$
0,2°	+ 5	142	70
	+ 30	61.2	30
	+ 40	40.1	10
0,33°	+ 5	140	50
	+ 30	60.3	24
	+ 40	32.9	9
2°	+ 5	9.2	5
	+ 30	7.0	2.5
	+ 40	6.0	1.5

$\alpha$	$\beta_1$	Result 3431 Yellow	Yellow Min level $R_A$
0,2°	+ 5	97.2	50
	+ 30	40.4	22
	+ 40	25.7	7
0,33°	+ 5	105	35
	+ 30	39.6	16
	+ 40	20.6	6
2°	+ 5	6.2	3
	+ 30	4.5	1.5
	+ 40	3.7	1

$\alpha$	$\beta_1$	Result 3432 Red	Red Min level $R_A$
0,2°	+ 5	30.2	14.5
	+ 30	12.7	6
	+ 40	8.1	2
0,33°	+ 5	33.2	10
	+ 30	11.4	4
	+ 40	6.3	1.8
2°	+ 5	2.1	1
	+ 30	1.4	0.5
	+ 40	1.1	0.5

$\alpha$	$\beta_1$	Result 3435 Blue	Blue Min level $R_A$
0,2°	+ 5	9.0	4
	+ 30	3.2	1.7
	+ 40	2.0	0.5
0,33°	+ 5	8.7	2
	+ 30	3.6	1
	+ 40	1.9	#
2°	+ 5	0.9	#
	+ 30	0.5	#
	+ 40	0.4	#

# Value greater than zero, but insignificant or applicable

$\alpha$	$\beta_1$	Result 3437 Green	Green Min level $R_A$
0,2°	+ 5	14.9	9
	+ 30	5.6	3.5
	+ 40	3.6	1.5
0,33°	+ 5	14.3	7
	+ 30	6.3	3
	+ 40	3.3	1.2
2°	+ 5	1.3	0.5
	+ 30	0.8	0.3
	+ 40	0.7	0.2

### 3.1.4 Rotational symmetry

The rotational symmetry has been determined according to EAD 120001-00-0106, clause 2.2.3, "Rotational symmetry".

$\alpha$	$\beta_1$	$\epsilon$	Result 3430 White	Min / Max	Ratio
0,33°	+ 5°	- 75°	132	132	1:1.1
		- 50°	134		
		- 25°	142		
		0°	140		
		25°	143		
		50°	141		

$\alpha$	$\beta_1$	$\epsilon$	Result 3431 Yellow	Min / Max	Ratio
0,33°	+ 5°	- 75°	99	99	1:1.1
		- 50°	102		
		- 25°	106		
		0°	105		
		25°	108		
		50°	101		

$\alpha$	$\beta_1$	$\epsilon$	Result 3432 Red	Min / Max	Ratio
0,33°	+ 5°	- 75°	28.8	28.8	1:1.2
		- 50°	30.4		
		- 25°	32.4		
		0°	33.2		
		25°	31.8		
		50°	32.2		

$\alpha$	$\beta_1$	$\epsilon$	Result 3435 Blue	Min / Max	Ratio
0,33°	+ 5	- 75°	7.8	7.8	1:1.2
		- 50°	8.6		
		- 25°	8.3		
		0°	8.7		
		25°	9.3		
		50°	8.9		

$\alpha$	$\beta_1$	$\epsilon$	Result 3437 Green	Min / Max	Ratio
0,33°	+ 5	- 75°	13.8	13.8	1:1.1
		- 50°	14.1		
		- 25°	14.0		
		0°	14.3		
		25°	14.5		
		50°	14.0		

### 3.1.5 Impact resistance

The Impact resistance has been determined according to EAD 120001-00-0106, clause 2.2.4.

Sample	Result of the assessment
White 3430	No apparent cracking or delamination observed
Yellow 3431	
Red 3432	
Blue 3435	
Green 3437	

### 3.1.6 Temperature resistance

No performance assessed

### 3.1.7 Visibility after weathering

#### 3.1.7.1 Daylight Chromaticity and Luminance Factor after natural weathering

The Daylight chromaticity and luminance factor, verified according to EAD 120001-00-0106, clause 2.2.1, tested after natural weathering test have been specified in Annex 1, clause A1.2, of this ETA.

The weathering has been performed according to EAD 120001-00-0106, clause 2.2.6.2.

#### 3.1.7.2 Coefficient of Retro-reflection after natural weathering

The Coefficient of Retro-reflection after natural weathering tests has been determined according to EAD 120001-00-0106, clause 2.2.3, with an observation angle  $\alpha = 0.33^\circ$  and  $\beta_1 = 5^\circ$  and  $30^\circ$ .

The weathering has been performed according to EAD 120001-00-0106, clause 2.2.6.2.

Geometry of measurements		Colour	Results ( $\text{cd} \cdot \text{lx}^{-1} \cdot \text{m}^2$ )	Level
$\alpha$	$\beta$			
0.33°	5°	White	174	$\geq 40$
	30°		90	$\geq 19.2$
0.33°	5°	Yellow	108	$\geq 28$
	30°		56	$\geq 12.8$
0.33°	5°	Red	29	$\geq 8$
	30°		14.4	$\geq 3.2$
0.33°	5°	Blue	10.5	$\geq 1.6$
	30°		4.5	$\geq 0.8$
0.33°	5°	Green	12.9	$\geq 5.6$
	30°		7.7	$\geq 2.4$

### 3.1.8 Adhesion test

No performance assessed



### 3.2 3M™ Engineer Grade Prismatic Series 3430 printed with 3M™ Processing 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 EAD 120001-00-0106, 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  $R_A$  has been determined according to EAD 120001-00-0106, clause 2.2.3. The level is referred to in EN 12899-1:2007, clause 4.1, as Class RA1.

$\alpha$	$\beta_1$	Result 884i Yellow	Yellow Min level $R_A$
0,2°	+ 5°	149	35
	+ 30°	55.2	15.4
	+ 40°	38.4	4.9
0,33°	+ 5°	175	24.5
	+ 30°	62.0	11.2
	+ 40°	34.5	4.2
2°	+ 5°	5.1	2.1
	+ 30°	3.8	1.1
	+ 40°	2.7	0.7

$\alpha$	$\beta_1$	Result 882i Red on white	Red Min level $R_A$
0,2°	+ 5°	42.2	10.2
	+ 30°	16.9	4.2
	+ 40°	10.9	1.4
0,33°	+ 5°	58.0	7
	+ 30°	16.8	2.8
	+ 40°	8.7	1.3
2°	+ 5°	1.6	0.7
	+ 30°	1.0	0.4
	+ 40°	0.8	0.4

$\alpha$	$\beta_1$	Result 889i French red on white	Red Min level $R_A$
0,2°	+ 5°	48.7	10.2
	+ 30°	21.8	4.2
	+ 40°	13.8	1.4
0,33°	+ 5°	62.9	7
	+ 30°	20.3	2.8
	+ 40°	10.6	1.3
2°	+ 5°	1.5	0.7
	+ 30°	1.1	0.4
	+ 40°	0.8	0.4

$\alpha$	$\beta_1$	Result 888i Green	Green Min level $R_A$
0,2°	+ 5°	49.8	6.3
	+ 30°	17.6	2.5
	+ 40°	12.5	1.1
0,33°	+ 5°	46.6	4.9
	+ 30°	21.5	2.1
	+ 40°	12.3	0.8
2°	+ 5°	1.7	0.4
	+ 30°	1.2	0.2
	+ 40°	0.8	0.1

$\alpha$	$\beta_1$	Result 883i Blue	Blue Min level $R_A$
0,2°	+ 5°	27.8	2.8
	+ 30°	9.1	1.2
	+ 40°	6.3	0.4
0,33°	+ 5°	23.1	1.4
	+ 30°	12.2	0.7
	+ 40°	6.8	#
2°	+ 5°	0.8	#
	+ 30°	0.6	#
	+ 40°	0.4	#

# Value greater than zero, but insignificant or applicable

$\alpha$	$\beta_1$	Result 882i Red on yellow	Red Min level $R_A$
0,2°	+ 5°	27.2	10.2
	+ 30°	11.4	4.2
	+ 40°	7.9	1.4
0,33°	+ 5°	37.8	7.0
	+ 30°	10.9	2.8
	+ 40°	6.3	1.3
2°	+ 5°	1.4	0.7
	+ 30°	1.0	0.4
	+ 40°	0.7	0.4

$\alpha$	$\beta_1$	Result 889i French red on yellow	Red Min level $R_A$
0,2°	+ 5°	34.9	10.2
	+ 30°	14.4	4.2
	+ 40°	9.1	1.4
0,33°	+ 5°	46.2	7.0
	+ 30°	15.8	2.8
	+ 40°	8.0	1.3
2°	+ 5°	1.6	0.7
	+ 30°	1.0	0.4
	+ 40°	0.9	0.4

#### 3.2.4 Rotational symmetry

The rotational symmetry has been determined according to EAD 120001-00-0106, clause 2.2.3, "Rotational symmetry".

$\alpha$	$\beta_1$	$\epsilon$	Result 884i Yellow	Min / Max	Ratio
0,33°	+ 5°	- 75°	174	167	1:1.1
		- 50°	167		
		- 25°	176		
		0°	175		
		25°	179		
		50°	168		

$\alpha$	$\beta_1$	$\epsilon$	Result 882i Red on white	Min / Max	Ratio
0,33°	+ 5°	- 75°	51.6	50.5	1:1.1
		- 50°	50.5		
		- 25°	55.2		
		0°	58.0		
		25°	53.3		
		50°	51.4		

$\alpha$	$\beta_1$	$\epsilon$	Result 889i French red on white	Min / Max	Ratio
0,33°	+ 5°	- 75°	57.4	56.6	1:1.1
		- 50°	56.6		
		- 25°	62.7		
		0°	62.9		
		25°	63.2		
		50°	58.3		

$\alpha$	$\beta_1$	$\epsilon$	Result 883i Blue	Min / Max	Ratio
0,33°	+ 5°	- 75°	20.8	20.8	1:1.3
		- 50°	23.4		
		- 25°	26.4		
		0°	23.1		
		25°	23.9		
		50°	24.1		

$\alpha$	$\beta_1$	$\epsilon$	Result 888i Green	Min / Max	Ratio
0,33°	+ 5°	- 75°	46.2	46.2	1:1.2
		- 50°	51.5		
		- 25°	54.8		
		0°	46.6		
		25°	51.1		
		50°	52.8		

$\alpha$	$\beta_1$	$\epsilon$	Result 882i Red on yellow	Min / Max	Ratio
0,33°	+ 5°	- 75°	35.0	37.8	1:1.2
		- 50°	33.8		
		- 25°	36.7		
		0°	37.8		
		25°	36.3		
		50°	32.4		

$\alpha$	$\beta_1$	$\epsilon$	Result 889i French red on yellow	Min / Max	Ratio
0,33°	+ 5°	- 75°	43.4	41.6	1:1.1
		- 50°	41.6		
		- 25°	43.5		
		0°	46.2		
		25°	47.1		
		50°	42.2		

### 3.2.5 Impact resistance

The Impact resistance has been determined according to EAD 120001-00-0106, clause 2.2.4.

Sample	Result of the assessment
Yellow 884 I or N on White 3430	No apparent cracking or delamination observed
Red 882 I or N on White 3430	
French Red 889 I or N on White 3430	
Green 888 I or N on White 3430	
Blue 883 I or N on White 3430	
Red 882 I or N on Yellow 3431	
French Red 889 I or N on Yellow 3431	

### 3.2.6 Temperature resistance

No performance assessed

### 3.2.7 Visibility after weathering

#### 3.2.7.1 Daylight Chromaticity and Luminance Factor after natural weathering

The Daylight chromaticity and luminance factor, verified according to EAD 120001-00-0106, clause 2.2.1, tested after natural weathering test have been specified in Annex 2, clause A2.2, of this ETA.

The weathering has been performed according to EAD 120001-00-0106, clause 2.2.6.2.

#### 3.2.7.2 Coefficient of Retro-reflection after natural weathering

The Coefficient of Retro-reflection after natural weathering tests has been determined according to EAD 120001-00-0106, clause 2.2.3, with an observation angle  $\alpha = 0.33^\circ$  and  $\beta_1 = 5^\circ$  and  $30^\circ$ .

The weathering has been performed according to EAD 120001-00-0106, clause 2.2.6.2.

Geometry of measurements		Colour	Results ( $\text{cd} \cdot \text{lx}^{-1} \cdot \text{m}^2$ )	Level
$\alpha$	$\beta$			
0,33°	5°	Yellow	164	$\geq 28$
	30°		96	$\geq 12.8$
0,33°	5°	French red (889)	54	$\geq 8$
	30°		38	$\geq 3.2$
0,33°	5°	Red (882)	40	$\geq 8$
	30°		21	$\geq 3.2$
0,33°	5°	Blue	18.7	$\geq 1.6$
	30°		13.1	$\geq 0.8$
0,33°	5°	Green	39	$\geq 5.6$
	30°		32	$\geq 2.4$

### 3.2.8 Adhesion test

No performance assessed

### 3.3 3M™Engineer Grade Prismatic Series 3430" + 3M™Electrocut Film Series 1170

#### 3.3.1 Daylight Chromaticity and Luminance Factor

The characteristics of daylight chromaticity and luminance factor have been determined according to EAD 120001-00-0106, 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

Minimum Coefficient of Retro-reflection, performance according to requirements of EAD 120001-00-0106, Table 2.2. The level is referred to in EN 12899-1:2007, clause 4.1, as Class RA1.



$\alpha$	$\beta_1$	Result 1171 Yellow	Yellow Min level $R_A$
0,2°	+ 5°	187	50
	+ 30°	70.6	22
	+ 40°	49.5	7
0,33°	+ 5°	229	35
	+ 30°	83.3	16
	+ 40°	46.6	6
2°	+ 5°	6.0	3
	+ 30°	4.3	1.5
	+ 40°	3.1	1

$\alpha$	$\beta_1$	Result 1172 Red	Red Min level $R_A$
0,2°	+ 5°	49.2	14.5
	+ 30°	21.0	6
	+ 40°	13.5	2
0,33°	+ 5°	64.9	10
	+ 30°	21.4	4
	+ 40°	11.2	1.8
2°	+ 5°	1.9	1
	+ 30°	1.2	0.5
	+ 40°	1.0	0.5

$\alpha$	$\beta_1$	Result 1177 Green	Green Min level $R_A$
0,2°	+ 5°	35.4	9
	+ 30°	11.1	3.5
	+ 40°	8.0	1.5
0,33°	+ 5°	35.9	7
	+ 30°	14.8	3
	+ 40°	8.3	1.2
2°	+ 5°	1.1	0.5
	+ 30°	0.9	0.3
	+ 40°	0.5	0.2

$\alpha$	$\beta_1$	Result 1175 Blue	Blue Min level $R_A$
0,2°	+ 5°	27.8	4
	+ 30°	7.7	1.7
	+ 40°	5.3	0.5
0,33°	+ 5°	24.6	2
	+ 30°	10.7	1
	+ 40°	5.7	#
2°	+ 5°	0.9	#
	+ 30°	0.5	#
	+ 40°	0.3	#

# Value greater than zero, but insignificant or applicable

$\alpha$	$\beta_1$	Result 1179 Brown	Brown Min level $R_A$
0,2°	+ 5°	17.1	1
	+ 30°	5.0	0.3
	+ 40°	2.9	#
0,33°	+ 5°	22.8	0.6
	+ 30°	5.4	0.2
	+ 40°	2.6	#
2°	+ 5°	0.8	#
	+ 30°	0.3	#
	+ 40°	0.2	#

# Value greater than zero, but insignificant or applicable

$\alpha$	$\beta_1$	Result 1176 Dark green	Dark green Min level $R_A$
0,2°	+ 5°	18.5	#
	+ 30°	5.9	#
	+ 40°	4.1	#
0,33°	+ 5°	17.8	#
	+ 30°	8.4	#
	+ 40°	4.6	#
2°	+ 5°	0.9	#
	+ 30°	0.6	#
	+ 40°	0.3	#

# Value greater than zero, but insignificant or applicable

$\alpha$	$\beta_1$	Result 1172 Red on Yellow	Red Min level $R_A$
0,2°	+ 5°	55.0	14.5
	+ 30°	23.5	6
	+ 40°	15.6	2
0,33°	+ 5°	70.1	10
	+ 30°	24.0	4
	+ 40°	13.1	1.8
2°	+ 5°	2.0	1
	+ 30°	1.2	0.5
	+ 40°	1.0	0.5

### 3.3.4 Rotational symmetry

The rotational symmetry has been determined according to EAD 120001-00-0106, clause 2.2.3, "Rotational symmetry".

$\alpha$	$\beta_1$	$\epsilon$	Result 1171 Yellow	Min / Max	Ratio
0,33°	+ 5°	- 75°	220	220	1:1.1
		- 50°	228		
		- 25°	235		
		0°	229		
		25°	241		
		50°	227		

$\alpha$	$\beta_1$	$\epsilon$	Result 1177 Green	Min / Max	Ratio
0,33°	+ 5°	- 75°	33.9	33.9	1:1.2
		- 50°	37.7		
		- 25°	40.4		
		0°	35.9		
		25°	38.3		
		50°	35.4		

$\alpha$	$\beta_1$	$\epsilon$	Result 1179 Brown	Min / Max	Ratio
0,33°	+ 5°	- 75°	20.6	18.2	1:1.3
		- 50°	18.2		
		- 25°	20.3		
		0°	22.8		
		25°	22.1		
		50°	17.5		

$\alpha$	$\beta_1$	$\epsilon$	Result 1172 Red	Min / Max	Ratio
0,33°	+ 5°	- 75°	60.7	68.5	1:1.1
		- 50°	62.3		
		- 25°	68.5		
		0°	64.9		
		25°	63.4		
		50°	59.8		

$\alpha$	$\beta_1$	$\epsilon$	Result 1175 Blue	Min / Max	Ratio
0,33°	+ 5°	- 75°	23.0	23.0	1:1.1
		- 50°	23.9		
		- 25°	25.5		
		0°	24.6		
		25°	25.8		
		50°	23.7		

$\alpha$	$\beta_1$	$\epsilon$	Result 1176 Dark green	Min / Max	Ratio
0,33°	+ 5°	- 75°	17.3	17.3	1:1.1
		- 50°	18.8		
		- 25°	19.3		
		0°	17.8		
		25°	19.1		
		50°	19.2		

$\alpha$	$\beta_1$	$\epsilon$	Result 1172 Red on yellow	Min / Max	Ratio
0,33°	+ 5°	- 75°	64.2	70.1	1:1.1
		- 50°	65.3		
		- 25°	69.2		
		0°	70.1		
		25°	69.3		
		50°	63.7		

### 3.3.5 Impact resistance

The Impact resistance has been determined according to EAD 120001-00-0106, clause 2.2.4.

Sample	Result of the assessment
Yellow EC Film 1171 on White 3430	No apparent cracking or delamination observed
Red EC Film 1172 on White 3430	
Green EC Film 1177 on White 3430	
Blue EC Film 1175 on White 3430	
Brown EC Film 1179 on White 3430	
Dark green EC Film 1176 on White 3430	
Red EC Film 1172 on Yellow 3431	

### 3.3.6 Temperature resistance

No performance assessed

### 3.3.7 Visibility after weathering

#### 3.3.7.1 Daylight Chromaticity and Luminance Factor after natural weathering

The Daylight chromaticity and luminance factor, verified according to EAD 120001-00-0106, clause 2.2.1, tested after natural weathering test have been specified in Annex 3, clause A3.2, of this ETA.

The weathering has been performed according to EAD 120001-00-0106, clause 2.2.6.2.

### 3.3.7.2 Coefficient of Retro-reflection after natural weathering

The Coefficient of Retro-reflection after natural weathering tests has been determined according to EAD 120001-00-0106, clause 2.2.3, with an observation angle  $\alpha = 0.33^\circ$  and  $\beta_1 = 5^\circ$  and  $30^\circ$ .

The weathering has been performed according to EAD 120001-00-0106, clause 2.2.6.2.

Geometry of measurements		Colour	Results (cd · lx <sup>-1</sup> · m <sup>-2</sup> )	Level
$\alpha$	$\beta$			
0.33°	5°	Yellow	201	≥ 28
	30°		109	≥ 12.8
0.33°	5°	Red	51	≥ 8
	30°		25	≥ 3.2
0.33°	5°	Blue	17.1	≥ 1.6
	30°		11.8	≥ 0.8
0.33°	5°	Green	38	≥ 5.6
	30°		23	≥ 2.4
0.33°	5°	Brown	30	≥ 0.5
	30°		13	≥ 0.2
0.33°	5°	Dark green	25	-
	30°		15.9	-

### 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 1996/06/24<sup>3</sup>, as amended by Commission Decision 1999/453/EC of 1999/06/18<sup>4</sup>, is specified in the following Table.

### 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

<sup>3</sup> see OJEU L 254, 8.10.1996, p. 52

<sup>4</sup> 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 EAD 120001-00-0106, clause 3.2.

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 EAD 120001-00-0106, clause 3.3.

## 6 References

EN 12899-1:2007 Fixed, vertical road traffic signs - Fixed signs

Evaluation report accompanying the original European Technical Approval 10/0118, issued in 2010, as historical data

Evaluation report accompanying this version of the European Technical Assessment

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](http://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,

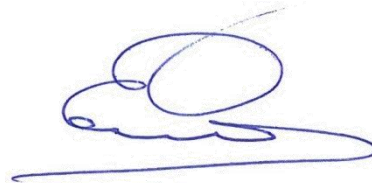


Peter Wouters,  
director



Benny De Blaere,  
director

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



Erik Barbé,  
director general

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

## Annex 1: 3M Engineer Grade Prismatic Series 3430

### Daylight Chromaticity and Luminance Factor, initial and after natural weathering

#### A1.1 Daylight Chromaticity and Luminance Factor, initial

Colours		Chromaticity Coordinates				Luminance Factor $\beta$
		1	2	3	4	
White Tolerance sphere	x	0.305	0.335	0.325	0.295	Level: $\geq 0.40$
	y	0.315	0.345	0.355	0.325	
Results White 3430	x*	0.3027				0.58
	y*	0.3210				
Yellow Tolerance sphere	x	0.494	0.470	0.513	0.545	Level: $\geq 0.24$
	y	0.505	0.480	0.437	0.454	
Results Yellow 3431	x*	0.5056				0.34
	y*	0.4731				
Red Tolerance sphere	x	0.735	0.700	0.610	0.660	Level: $\geq 0.03$
	y	0.265	0.250	0.340	0.340	
Results Red 3432	x*	0.6316				0.07
	y*	0.3194				
Green Tolerance sphere	x	0.110	0.170	0.170	0.110	Level: $\geq 0.03$
	y	0.415	0.415	0.500	0.500	
Results Green 3437	x*	0.1353				0.06
	y*	0.4463				
Blue Tolerance sphere	x	0.130	0.160	0.160	0.130	Level: $\geq 0.01$
	y	0.090	0.090	0.140	0.140	
Results Blue 3435	x*	0.1407				0.05
	y*	0.1099				

The samples also meet the requirements of classes CR1 and CR2, as defined in EN 12899-1:2007 (Clause 4.1)  
 \* Average of three test results (historical data)

#### A1.2 Daylight Chromaticity and Luminance Factor, after natural weathering

Colours		Chromaticity Coordinates				Luminance Factor $\beta$
		1	2	3	4	
White Tolerance sphere	x	0.355	0.305	0.285	0.335	Level: $\geq 0.40$
	y	0.355	0.305	0.325	0.375	
Results White 3430	x*	0.3029				0.6064
	y*	0.3221				
Yellow Tolerance sphere	x	0.545	0.487	0.427	0.465	Level: $\geq 0.24$
	y	0.454	0.423	0.483	0.534	
Results Yellow 3431	x*	0.4876				0.4175
	y*	0.4803				
Red Tolerance sphere	x	0.735	0.674	0.569	0.655	Level: $\geq 0.03$
	y	0.265	0.236	0.341	0.345	
Results Red 3432	x*	0.6013				0.0654
	y*	0.3150				
Green Tolerance sphere	x	0.007	0.248	0.177	0.026	Level: $\geq 0.03$
	y	0.703	0.409	0.362	0.399	
Results Green 3437	x*	0.1548				0.0659
	y*	0.4348				
Blue Tolerance sphere	x	0.078	0.150	0.210	0.137	Level: $\geq 0.01$
	y	0.171	0.220	0.160	0.038	
Results Blue 3435	x*	0.1487				0.0527
	y*	0.1208				

The samples also meet the requirements of class CR1, as defined in EN 12899-1:2007 (Clause 4.1)  
 \* Average of three test results (historical data)

## Annex 2: 3M™ Engineer Grade Prismatic Series 3430 printed with 3M™ Processing Colour Series 880 I or N

### Daylight Chromaticity and Luminance Factor, initial and after natural weathering

#### A2.1 Daylight Chromaticity and Luminance Factor, initial

Colours		Chromaticity Coordinates				Luminance Factor $\beta$
		1	2	3	4	
Yellow on white Tolerance sphere	x	0.494	0.470	0.513	0.545	Level: $\geq 0.24$
	y	0.505	0.480	0.437	0.454	
Results white 3430 + 884 I or N Ink	x*	0.5180				0.33
	y*	0.4267				
Red on white Tolerance sphere	x	0.735	0.700	0.610	0.660	Level: $\geq 0.03$
	y	0.265	0.250	0.340	0.340	
Results white 3430 + 882 I or N Ink	x*	0.6502				0.06
	y*	0.3108				
French red on white Tolerance sphere	x	0.735	0.700	0.610	0.660	Level: $\geq 0.03$
	y	0.265	0.250	0.340	0.340	
Results French red on white 3430 + 889 I or N Ink	x*	0.6561				0.07
	y*	0.3196				
Green on white Tolerance sphere	x	0.110	0.170	0.170	0.110	Level: $\geq 0.03$
	y	0.415	0.415	0.500	0.500	
Results green on white 3430 + 888 I or N Ink	x*	0.1337				0.10
	y*	0.4400				
Blue on white Tolerance sphere	x	0.130	0.160	0.160	0.130	Level: $\geq 0.01$
	y	0.090	0.090	0.140	0.140	
Results blue on white 3430 + 883 I or N Ink	x*	0.1432				0.06
	y*	0.1182				
Red on yellow Tolerance sphere	x	0.735	0.700	0.610	0.660	Level: $\geq 0.03$
	y	0.265	0.250	0.340	0.340	
Results red on yellow 3431 + 884 I or N Ink	x*	0.6528				0.06
	y*	0.3179				
French red on yellow Tolerance sphere	x	0.735	0.700	0.610	0.660	Level: $\geq 0.03$
	y	0.265	0.250	0.340	0.340	
Results French red on yellow 3431 + 889 I or N Ink	x*	0.6549				0.07
	y*	0.3246				

The samples also meet the requirements of classes CR1 and CR2, as defined in EN 12899-1:2007 (Clause 4.1)  
 \* Average of three test results (historical data)

#### A2.2 Daylight Chromaticity and Luminance Factor, after natural weathering

Colours		Chromaticity Coordinates				Luminance Factor $\beta$
		1	2	3	4	
Yellow Tolerance sphere	x	0.545	0.487	0.427	0.465	Level: $\geq 0.24$
	y	0.454	0.423	0.483	0.534	
Results 884I ink Yellow on white	x*	0.4878				0.3758
	y*	0.4592				
Red Tolerance sphere	x	0.735	0.674	0.569	0.655	Level: $\geq 0.03$
	y	0.265	0.236	0.341	0.345	
Results 889I ink French Red on White	x*	0.6128				0.0724
	y*	0.3197				
Results 882I ink Red on White	x*	0.6173				0.0709
	y*	0.3233				
Green Tolerance sphere	x	0.007	0.248	0.177	0.026	Level: $\geq 0.03$
	y	0.703	0.409	0.362	0.399	
Results 888I ink Green on White	x*	0.1454				0.1073
	y*	0.4219				
Blue Tolerance sphere	x	0.078	0.150	0.210	0.137	Level: $\geq 0.01$
	y	0.171	0.220	0.160	0.038	
Results 883I ink Blue on White	x*	0.1452				0.0742
	y*	0.1405				

\* Average of three test results (historical data)

## Annex 3: 3M™ Engineer Grade Prismatic Series 3430™ + 3M™ Electrocut Film Series 1170

### Daylight Chromaticity and Luminance Factor, initial and after natural weathering

#### A3.1 Daylight Chromaticity and Luminance Factor, initial

Colours	Chromaticity Coordinates				Luminance Factor $\beta$	
	1	2	3	4		
Yellow Tolerance sphere	x	0.494	0.470	0.513	0.545	Level: $\geq 0.24$
	y	0.505	0.480	0.437	0.454	
Results Yellow EC Film 1171 on White 3430	x*	0.5323				0.39
	y*	0.4616				
Red Tolerance sphere	x	0.735	0.700	0.610	0.660	Level: $\geq 0.03$
	y	0.265	0.250	0.340	0.340	
Results Red EC Film 1172 on White 3430	x*	0.6650				0.05
	y*	0.3060				
Green Tolerance sphere	x	0.110	0.170	0.170	0.110	Level: $\geq 0.03$
	y	0.415	0.415	0.500	0.500	
Results Green EC Film 1177 on White 3430	x*	0.1329				0.08
	y*	0.4459				
Blue Tolerance sphere	x	0.130	0.160	0.160	0.130	Level: $\geq 0.01$
	y	0.090	0.090	0.140	0.140	
Results Blue EC Film 1175 on White 3430	x*	0.1446				0.06
	y*	0.1110				
Brown Tolerance sphere	x	0.455	0.523	0.479	0.558	Level: 0.03 – 0.09
	y	0.397	0.429	0.373	0.394	
Results Brown EC Film 1179 on White 3430	x*	0.4987				0.05
	y*	0.3969				
Dark green Tolerance sphere	x	0.313	0.313	0.248	0.127	Level: 0.01 - 0.07
	y	0.682	0.453	0.409	0.557	
Results Dark Green EC Film 1176 on White 3430	x*	0.1909				0.04
	y*	0.5307				
Red Tolerance sphere	x	0.735	0.700	0.610	0.660	Level: $\geq 0.03$
	y	0.265	0.250	0.340	0.340	
Results Red EC Film 1172 on Yellow 3431	x*	0.6767				0.05
	y*	0.3131				

The samples also meet the requirements of classes CR1 and CR2, as defined in EN 12899-1:2007 (Clause 4.1)  
 \* Average of three test results (historical data)

#### A3.2 Daylight Chromaticity and Luminance Factor, after natural weathering

Colours	Chromaticity Coordinates				Luminance Factor $\beta$	
	1	2	3	4		
Yellow Tolerance sphere	x	0.545	0.487	0.427	0.465	Level: $\geq 0.24$
	y	0.454	0.423	0.483	0.534	
Results Yellow on White	x*	0.5199				0.3890
	y*	0.4598				
Red Tolerance sphere	x	0.735	0.674	0.569	0.655	Level: $\geq 0.03$
	y	0.265	0.236	0.341	0.345	
Results Red on White	x*	0.6060				0.0459
	y*	0.3081				
Green Tolerance sphere	x	0.007	0.248	0.177	0.026	Level: $\geq 0.03$
	y	0.703	0.409	0.362	0.399	
Results Green on White	x*	0.1503				0.1014
	y*	0.4348				
Blue Tolerance sphere	x	0.078	0.150	0.210	0.137	Level: $\geq 0.01$
	y	0.171	0.220	0.160	0.038	
Results Blue on White	x*	0.1513				0.0641
	y*	0.1208				
Brown Tolerance sphere	x	0.455	0.523	0.479	0.558	Level: 0.03 – 0.09
	y	0.397	0.429	0.373	0.394	
Results Brown on White	x*	0.4589				0.0643
	y*	0.3940				
Dark green Tolerance sphere	x	0.313	0.313	0.248	0.127	Level: 0.01 – 0.07
	y	0.682	0.453	0.409	0.557	
Results Dark Green on White	x*	0.2091				0.0556
	y*	0.4766				

\* Average of three test results (historical data)