UBAtc
Union belge pour l'Agrément technique de la construction
member of EOTA and UEAtc

EUROPEAN TECHNICAL ASSESSMENT

ETA 13/0044
Version 02
Date of issue: 2020-04-17

UBAtc Assessment Operator:
COPRO
Z.1 Researchpark, Kranenberg 190
B-1731 ZELLIK (Asse)
www.copro.eu – info@copro.eu

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:	1. 3M™ Diamond Grade™ VIP Series 3990 2. 3M™ Diamond Grade™ VIP Series 3990 + 3M™ Electrocut Film Series 1170 3. 3M™ Diamond Grade™ VIP Series 3990 printed with 3M™ process colour Series 880 I or N 4. 3M™ Diamond Grade™ VIP 3990DS + 3M™ Piezo Inkjet Ink Series 8800UV or 8900UV + 3M™ Electrocut Film 1170
Product family to which the construction product belongs:	Microprismatic retro-reflective sheetings
Manufacturer:	3M Deutschland GmbH Carl Schurz Strasse 1, D- 41453- Neuss - Deutschland
Manufacturing plants:	3M Deutschland GmbH Plant Hilden Düsseldorfer Str. 121-125 D-40705 Hilden 3M Innovation Singapore Pte Ltd. 2 Tuas Link 4 Singapore 63732 1SG – Singapore 3M Brownwood 4501 Highway 377 South Brownwood, Texas 76801 USA
Website:	www.3m.com
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	European Assessment Document (EAD): 120001-01-0106 September 2016
This version replaces:	ETA 13/0044 issued on 6 June 2018
This European Technical Assessment contains:	21 pages, without any 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[1] 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 1062/2013[2] of 30 October 2013 on the format of the European Technical Assessment for construction products
- European Assessment Document (EAD) : 120001-01-0106

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.

3 The responsibility for the conformity of the performances of the products with this European Technical Assessment and the suitability of the products for the intended use remains with the holder of the European Technical Assessment.

4 Depending on the applicable Assessment and verification of constancy of performance (AVCP) system, (a) notified body(ies) may carry out third-party tasks in the process of assessment and verification of constancy of performance under this Regulation once the European Technical Assessment has been issued.

5 This European Technical Assessment allows the manufacturer of the construction product covered by this ETA to draw up a declaration of performance for the construction product.

6 CE marking should be affixed to all construction products for which the manufacturer has drawn up a declaration of performance.

7 This European Technical Assessment is not to be transferred to other manufacturers, agents of manufacturers, or manufacturing plants other than those indicated on page 1 of this European Technical Assessment.

8 The European Technical Assessment holder confirms to guarantee that the product(-s) to which this assessment relates, is/are produced and marketed in accordance with and comply with all applicable legal and regulatory provisions, including, without limitation, national and European legislation on the safety of products and services. The ETA-holder shall notify the UBAtc immediately in writing of any circumstance affecting the aforementioned guarantee. This assessment is issued under the condition that the aforementioned guarantee by the ETA-holder will be continuously observed.

9 According to Article 11(6) of Regulation (EU) No 305/2011, when making a construction product available on the market, the manufacturer shall ensure that the product is accompanied by instructions and safety information in a language determined by the Member State concerned which can be easily understood by users. These instructions and safety information should fully correspond with the technical information about the product and its intended use, which the manufacturer has submitted to the responsible Technical Assessment Body for the issuing of the European Technical Assessment.

10 Pursuant to Article 11(3) of Regulation (EU) No 305/2011, manufacturers shall adequately take into account changes in the product-type and in the applicable harmonised technical specifications. Therefore, when the contents of the issued European Technical Assessment do not any longer correspond to the product-type, the manufacturer should refrain from using this European Technical Assessment as the basis for their declaration of performance.

11 All rights of exploitation in any form and by any means of this European Technical Assessment is reserved for UBAtc and the ETA-holder, subject to the provisions of the applicable UBAtc regulations.

12 Reproduction of this European Technical Assessment including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of UBAtc. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European Technical Assessment.

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 This European Technical Assessment was first issued by UBAtc on 6 June 2018 and replaced European Technical Approval 13/0044. Compared with that document, the assessment results after artificial weathering were replaced with natural (3 years) weathering.
In this 2nd version of the European Technical Assessment, issued on 17 April 2020, the following changes were introduced:
The following combinations were added:

- 3M™ Diamond Grade™ VIP Series 3990 + 3M™ Electrocut Film Series 1170
- 3M™ Diamond Grade™ VIP Series 3990 printed with 3M™ process colour Series 880 I or N
- 3M™ Diamond Grade™ VIP 3990DS + 3M™ Piezo Inkjet Ink Series 8800UV or 8900UV + 3M™ Electrocut Film 1170

[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 of a microprismatic 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™ Diamond Grade™ VIP Reflective Sheeting Series 3990" or "3M™ Diamond Grade™ VIP Reflective Sheeting 3990DS" with various combinations of Process Colour and Overlay Film as outlined in table 1.1.

1.2 Components of "3M™ Diamond Grade™ VIP Series 3990" and Combinations with Process Colour and Overlay Film

An overview of the complete set of components of "3M™ Diamond Grade™ VIP Series 3990", and combinations with Process Colour and Overlay Film is presented in Table 1.1. The mixing ratio of the Piezo Inkjet Ink for the various traffic colours has been deposited with UBAtc.

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
Microprismatic retro-reflective sheeting	3M™ Diamond Grade™ VIP Reflective Sheeting Series 3990	White	3990	Thickness: 0.32 – 0.49 mm Rolls in various length and width
		White	3990DS**	
		Red	3992	
		Yellow	3991	
		Green	3997	
		Blue	3995	
		Fluorescent Yellow	3981	
		Fluorescent Yellow Green	3983	
Overlay film	3M™ Electrocut Film Series 1170	Clear	1170	Combined Thickness: 0.549 mm Rolls in various length and width
		Yellow	1171	
		Red	1172	
		Blue	1175	
		Green	1177	
		Brown	1179	
Process colour	3M™ Process Colour Series 880 I or N*	Yellow	884 I or N	20 - 25 m²/l
		Blue	883 I or N	
		Green	888 I or N	
		Red	882 I or N	
		Orange	886 I or N	
		Brown	887 I or N	
Process colour for digital printing	3M™ Piezo Inkjet Ink Series 8800 UV or 8900**	Yellow		18 - 20 m²/l
		Red		
		Blue		
		Green		
		Orange		
		Brown		
		Grey		
		Dark Green		

*3M™ Process Colour Series 880I and 880N are variations of the same basic ink formulations. Both ink series use identical pigments. The difference between 880I and 880N is the solvent package, providing different drying characteristics. 3M sells and markets both ink series as equal alternatives with the same durability and warranty provisions. The basis for this ETA has been generated with version 880I.

** 3M Piezo Ink Jet Ink Series 8800 UV and 8900 UV are variations of the same basic ink formulations. The difference between Series 8800 and 8900 are the dispersant and stabilizer packages to make the ink suitable for the different printer models and printheads. The curable components are identical. 3M markets both ink series as equal alternatives with the same performance.
3M Piezo Ink Jet Ink Series 8800 UV and 8900 UV to be used on VIP 3990DS sheeting, see clause 3.4

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

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
White	x	*0.305*	*0.335*	*0.325*	*0.295*	*≥ 0.40*
*Tolerance Sphere**	y	*0.315*	*0.345*	*0.355*	*0.325*	
Yellow	x	*0.494*	*0.470*	*0.513*	*0.545*	*≥ 0.24*
*Tolerance Sphere**	y	*0.505*	*0.480*	*0.437*	*0.454*	
Red	x	*0.735*	*0.700*	*0.610*	*0.660*	*≥ 0.03*
*Tolerance Sphere**	y	*0.265*	*0.250*	*0.340*	*0.340*	
Red on Yellow, Fluorescent Yellow or Fluorescent Yellow Green	x	*0.735*	*0.700*	*0.610*	*0.660*	*≥ 0.03*
*Tolerance Sphere**	y	*0.265*	*0.250*	*0.340*	*0.340*	
Blue	x	*0.130*	*0.160*	*0.160*	*0.130*	*≥ 0.01*
*Tolerance Sphere**	y	*0.090*	*0.090*	*0.140*	*0.140*	
Green	x	*0.110*	*0.170*	*0.170*	*0.110*	*≥ 0.03*
*Tolerance Sphere**	y	*0.415*	*0.415*	*0.500*	*0.500*	
Orange	x	0.631	0.560	0.506	0.570	*≥ 0.12*
Tolerance Sphere	y	0.369	0.360	0.404	0.429	
Brown	x	*0.455*	*0.523*	*0.479*	*0.558*	*0.03-0.09*
*Tolerance Sphere**	y	*0.397*	*0.429*	*0.373*	*0.394*	
Grey	x	*0.305*	*0.335*	*0.325*	*0.295*	*0.11-0.18*
*Tolerance Sphere**	y	*0.315*	*0.345*	*0.355*	*0.325*	
Dark Green	x	*0.313*	*0.313*	*0.248*	*0.127*	*0.01-0.07*
Tolerance Sphere	y	*0.682*	*0.453*	*0.399*	*0.557*	
Fluorescent yellow	x	*0.521*	*0.557*	*0.479*	*0.454*	*≥ 0.38*
reference	y	*0.424*	*0.442*	*0.520*	*0.491*	
Fluorescent yellow green	x	*0.387*	*0.460*	*0.570*	*0.376*	*≥ 0.70*
reference	y	*0.610*	*0.540*	*0.429*	*0.568*	

* Chromaticity Coordinates are similar to EN 12899-1:2007 Class CR2

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

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
White	x	0.355	0.305	0.285	0.335	*≥ 0.40*
*Tolerance Sphere**	y	0.355	0.305	0.325	0.375	
Yellow	x	0.545	0.487	0.427	0.465	*≥ 0.24*
*Tolerance Sphere**	y	0.454	0.423	0.483	0.534	
Red	x	0.735	0.674	0.569	0.655	*≥ 0.03*
*Tolerance Sphere**	y	0.265	0.236	0.341	0.345	
Red on Yellow, Fluorescent Yellow or Fluorescent Yellow Green	x	0.735	0.674	0.569	0.655	*≥ 0.03*
*Tolerance Sphere**	y	0.265	0.236	0.341	0.345	
Blue	x	0.078	0.150	0.210	0.137	*≥ 0.01*
*Tolerance Sphere**	y	0.171	0.220	0.160	0.038	
Green	x	0.007	0.248	0.177	0.026	*≥ 0.03*
*Tolerance Sphere**	y	0.703	0.399	0.362	0.399	
Orange	x	0.631	0.560	0.506	0.570	*≥ 0.12*
Tolerance Sphere	y	0.369	0.360	0.404	0.429	
Brown	x	*0.455*	*0.523*	*0.479*	*0.558*	*0.03-0.09*
*Tolerance Sphere**	y	*0.397*	*0.429*	*0.373*	*0.394*	
Grey	x	0.350	0.300	0.285	0.335	*0.11-0.18*
*Tolerance Sphere**	y	0.360	0.310	0.325	0.375	
Dark Green	x	*0.313*	*0.313*	*0.248*	*0.127*	*0.01-0.07*
*Tolerance Sphere**	y	*0.682*	*0.453*	*0.399*	*0.557*	
Fluorescent yellow	x	*0.521*	*0.557*	*0.479*	*0.454*	*≥ 0.38*
reference	y	*0.424*	*0.442*	*0.520*	*0.491*	
Fluorescent yellow green	x	*0.387*	*0.460*	*0.570*	*0.376*	*≥ 0.70*
reference	y	*0.610*	*0.540*	*0.429*	*0.568*	

* Chromaticity Coordinates are similar to EN 12899-1:2007 Class CR1

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,
- trans-illuminated traffic bollards,
- road delineators with retro-reflective devices,
- variable message signs.

The envisaged substrates or structures are commonly, but not only, based on aluminium, galvanised steel or processed polymers. The test specimens for this ETA have been prepared on smooth aluminium panels, according to EAD 120001-01-0106, Annex 1.

The assumed intended working life of the product is 12 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 Diamond Grade VIP series 3990" and combinations with Process Colour and Overlay Film, 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 this ETA, clause 1.1, 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 this ETA, clause 1, may be used for the systems.

2.2.2.2 Design

Users are urged to carefully evaluate all substrates for adhesion and sign durability. "3M Diamond Grade VIP Series 3990" is designed primarily for application to flat substrates. Most clean, smooth, relatively non-porous, flat, rigid, weather resistant surfaces are satisfactory for proper application of Diamond Grade sheeting. Those found to be most reliable and durable are properly prepared aluminium sheets and extrusions. Users are urged to carefully evaluate all other substrates for adhesion and sign durability, including impact resistance.

2.2.2.3 Application

"3M™ Diamond Grade™ VIP Series 3990"

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 Diamond Grade VIP Series 3990" incorporates 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 Diamond Grade VIP Series 3990" is 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™ Electrocut Film Series 1170

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

These overlay films have a transparent film release liner designed to aid the cutting process and the removal of the film weed after cutting. 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 is complete, 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 is complete, 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 center 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 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 application 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™ Adhesive Remover.

3M™ Process Colour Series 880 I or N

3M Process Colour Series 880 I and 880 N are variations of the same basic ink formulations. Both ink series use identical pigments. The difference between 880I and 880N is the solvent package, providing different drying characteristics.

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.

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. Processed sheetings 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.

All inks should not be stored at elevated temperatures and shall be used within one year after the date of purchase or within the indicated shelf life.

3M™ Piezo Inkjet Ink Series 8800 UV or 8900 UV

3M Piezo Ink Jet Ink Series 8800 UV or 8900 UV are designed as part of the 3M MCS™ (Matched Component System) for application using the Durst Rho 161TS / 162TS / 163TS and EFI H1625RS Printer onto 3M Diamond Grade VIP Prismatic Digital Sheeting 3990DS 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 an overlaminate of 3M Protective Overlay Film 1170.

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 or 8900 UV.

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

To avoid a silvering artefact (trapped air between ink layer and overlaminate), 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 should not be stored at elevated temperatures. It shall be used within the indicated shelf life.

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

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

Essential Characteristics of the product Basic Works Requirement 4: Safety and accessibility in use			
No	**Essential Characteristic**	**Clause**	**Product Performance**
	Visibility Characteristics		
1	Daylight Chromaticity and Luminance Factor	3.X.1	Value (average of three samples)
2	Night-time colour	3.X.2	No performance assessed
3	Coefficient of Retro-reflection	3.X.3	Value (average of three samples)
4	Rotational symmetry	3.X.4	Value (Ratio)
	Durability		
5	Impact resistance	3.X.5	EN 12899-1:2007
6	Temperature resistance	3.X.6	Value (average of three samples)
7	Daylight Chromaticity and Luminance Factor after accelerated artificial or natural weathering	3.X.7.1	Value (average of three samples)
8	Coefficient of Retro-reflection after accelerated artificial or natural weathering	3.X.7.2	Value (average of three samples)
9	Adhesion	3.X.8	No performance assessed

3.1 3M™ Diamond Grade™ VIP Series 3990

3.1.1 Daylight Chromaticity and Luminance Factor

The characteristics of initial daylight chromaticity and luminance factor have been determined according to EAD120001-01-0106, clause 2.2.1

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
White reference	***x***	***0.305***	***0.335***	***0.325***	***0.295***	***≥ 0.40***
	y	***0.315***	***0.345***	***0.355***	***0.325***	
White results	x	0.310				0.46
	y	0.328				
Yellow reference	***x***	***0.494***	***0.470***	***0.513***	***0.545***	***≥ 0.24***
	y	***0.505***	***0.480***	***0.437***	***0.454***	
Yellow results	x	0.530				0.26
	y	0.463				
Red reference	***x***	***0.735***	***0.700***	***0.610***	***0.660***	***≥ 0.03***
	y	***0.265***	***0.250***	***0.340***	***0.340***	
Red results	x	0.663				0.04
	y	0.312				
Green reference	***x***	***0.110***	***0.170***	***0.170***	***0.110***	***≥ 0.03***
	y	***0.415***	***0.415***	***0.500***	***0.500***	
Green results	x	0.130				0.06
	y	0.424				
Blue reference	***x***	***0.130***	***0.160***	***0.160***	***0.130***	***≥ 0.01***
	y	***0.090***	***0.090***	***0.140***	***0.140***	
Blue results	x	0.153				0.04
	y	0.098				
Fluorescent yellow reference	***x***	***0.521***	***0.557***	***0.479***	***0.454***	***≥ 0.38***
	y	***0.424***	***0.442***	***0.520***	***0.491***	
Fluorescent yellow results	x	0.516				0.75
	y	0.477				
Fluorescent yellow/ green reference	***x***	***0.387***	***0.460***	***0.570***	***0.376***	***≥ 0.70***
	y	***0.610***	***0.540***	***0.429***	***0.568***	
Fluorescent yellow/ green results	x	0.406				0.90
	y	0.574				

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 EAD120001-01-0106, clause 2.2.3. The rotation angle ε has been set to 0° according to the manufacturer's specification. The result of the test is given as average of three samples.

Geometry of measurements		Colour						
α	β_1 ($\beta_2 = 0$)	White	Yellow	Red	Blue	Green	Fluorescent yellow	Fluorescent Yellow Green
0.1°	+5°		663	181	67	154	555	771
	+15°		631	165	60	142	521	707
	+20°		590	151	54	130	487	654
	+30°		453	112	38	95	373	501
	+40°		105	22	10,2	24	81	121
0.20°	+5°	486	413	114	37	91	347	479
	+15°	441	368	100	32	79	308	423
	+20°		331	90	28	69	278	379
	+30°	312	252	66	20	48	209	280
	+40°	87	68	14,9	6,9	57	52	75
0.33°	+5°	370	321	82	30	74	268	377
	+15°	338	282	72	26	66	234	347
	+20°	303	247	62	22	57	204	310
	+30°	215	158	39	14,3	36	129	199
	+40°	55	36	7,7	4,2	8,6	102	42
1.0°	+5°	123	96	23	10,9	21	77	99
	+15°	119	94	22	10,4	22	76	97
	+20°	110	85	19,5	8,9	18,6	71	87
	+30°	89	62	15,2	5,6	12,3	52	65
	+40°	30	19	4,5	2,1	4,1	15,3	22
1.5°	+5°	41	32	7,0	3,5	6,3	26	30
	+15°		28	6,4	3,1	5,6	23	26
	+20°	34	25	6,1	2,8	5,2	21	24
	+30°	26	19,3	5,0	2,3	4,1	16,6	20
	+40°	10.2	7,2	1,7	0,7	1,4	5,7	7,8
2.0°	+5°		11,2	2,2	1,0	2,0	8,5	11,3
	+15°		8,7	1,8	0,8	1,5	6,7	7,8
	+20°		7,2	1,6	0,7	1,2	5,8	6,8
	+30°		6,1	1,5	0,5	1,0	5,3	6,3
	+40°		2,5	0,5	0,3	0,6	1,9	2,9

3.1.4 Rotational symmetry

The rotational symmetry has been determined according to EAD120001-01-0106, clause 2.2.3 "rotational symmetry". The rotation angle ε has been set to 0° according to the manufacturer's specification.

Rotational symmetry	
#	Ratio
White	
Average of three Samples	1 : 1,22
Yellow	
Average of three Samples	1 : 1,18
Red	
Average of three Samples	1 : 1,16
Blue	
Average of three Samples	1 : 1,38
Green	
Average of three Samples	1 : 1,23
Fluorescent Yellow Green	
Average of three Samples	1 : 1,15
Fluorescent Yellow	
Average of three Samples	1 : 1,18

3.1.5 Impact resistance

The Impact resistance has been determined according to EAD120001-01-0106, clause 2.2.4.

Sample		Test result
White	3990	No apparent cracking or delamination observed
Yellow	3991	
Red	3992	
Blue	3995	
Green	3997	
Fluorescent Yellow	4081	
Fluorescent Yellow Green	4083	

3.1.6 Temperature resistance

No performance assessed.

3.1.7 Visibility after weathering

The natural weathering has been done according to EAD 120001-01-0106, clause 2.2.6.2 on the white sample.

The accelerated artificial weathering has been done according to EAD 120001-01-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer on all samples, except white. The size of the specimens is 5,5 x 10 cm.

3.1.7.1 Daylight Chromaticity and Luminance Factor after natural weathering

The daylight chromaticity and luminance factor, verified according to EAD120001-01-0106, clause 2.2.1, tested after the weathering test.

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
White reference	**x** **y**	**0.355** **0.355**	**0.305** **0.305**	**0.285** **0.325**	**0.335** **0.375**	***≥0.40***
White results	x y	0.306 0.324				*0.52*
Yellow reference	**x** **y**	***0.545*** ***0.454***	***0.487*** ***0.423***	***0.427*** ***0.483***	***0.465*** ***0534***	***≥0.24***
Yellow results	x y	0.525 0.463				*0.28*
Red reference	**x** **y**	***0.735*** ***0.265***	***0.674*** ***0.236***	***0.569*** ***0.341***	***0.655*** ***0.345***	***≥0.03***
Red results	x y	0.649 0.313				*0.04*
Green reference	**x** **y**	***0.007*** ***0.703***	***0.248*** ***0.399***	***0.177*** ***0.362***	***0.026*** ***0.399***	***≥0.03***
Green results	x y	0.138 0.418				*0.06*
Blue reference	**x** **y**	**0.078** **0.171**	**0.150** **0.220**	**0.210** **0.160**	**0.137** **0.038**	***≥0.01***
Blue results	x y	0.154 0.101				*0.04*
Fluorescent yellow reference	**x** **y**	***0.521*** ***0.424***	***0.557*** ***0.442***	***0.479*** ***0.520***	***0.454*** ***0.491***	***≥0.38***
Fluorescent yellow results	x y	0.509 0.480				*0.69*
Fluorescent yellow/ green reference	**x** **y**	***0.387*** ***0.610***	***0.460*** ***0.540***	***0.570*** ***0.429***	***0.376*** ***0.568***	***≥0.70***
Fluorescent yellow/ green results	x y	0.415 0.562				0.81

3.1.7.2 Coefficient of Retro-reflection after natural weathering

The Coefficient of Retro-reflection after weathering tests has been determined according to EAD 120001-01-0106, clause 2.2.6.4, with an observation angle α = 0.33° and α = 1.0° and entrance angle β_1= 5° and 30°. The rotation angle ε has been set to 0° according to the manufacturer's specification. The result of the test is given as average of three samples.

Colours	Geometry of Measurements α = 0,33° β_1 = 5°	α = 0,33° β_1 = 30°	α = 1.0° β_1 = 5°	α = 1.0° β_1 = 30°
White	338	215	95	73
Yellow	290	143	90	59
Red	81	39	22	13,6
Blue	32	15,2	9,3	4,6
Green	66	30	19,9	11,8
Fluorescent yellow	252	122	76	50
Fluorescent yellow/green	338	158	95	64

3.1.8 Adhesion

No performance assessed.

3.2 3M™ Diamond Grade™ VIP Series + 3M™ Electrocut Film Series 1170

3.2.1 Daylight Chromaticity and Luminance Factor

The characteristics of initial daylight chromaticity and luminance factor have been determined according to EAD120001-01-0106, clause 2.2.1

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
Yellow reference	***x*** ***y***	***0.494*** ***0.505***	***0.470*** ***0.480***	***0.513*** ***0.437***	***0.545*** ***0.454***	***≥ 0.24***
Yellow on White results	x y	0.530 0.463				0.30
Red reference	***x*** ***y***	***0.735*** ***0.265***	***0.700*** ***0.250***	***0.610*** ***0.340***	***0.660*** ***0.340***	***≥ 0.03***
Red on White results	x y	0.654 0.308				0.04
Green reference	***x*** ***y***	***0.110*** ***0.415***	***0.170*** ***0.415***	***0.170*** ***0.500***	***0.110*** ***0.500***	***≥ 0.03***
Green on White results	x y	0.135 0.418				0.06
Blue reference	***x*** ***y***	***0.130*** ***0.090***	***0.160*** ***0.090***	***0.160*** ***0.140***	***0.130*** ***0.140***	***≥ 0.01***
Blue on White results	x y	0.156 0.103				0.04
Brown reference	***x*** ***y***	***0.455*** ***0.397***	***0.523*** ***0.429***	***0.479*** ***0.373***	***0.558*** ***0.394***	***0.03-0.09***
Brown on White results	x y	0.493 0.397				0.06

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 EAD120001-01-0106, clause 2.2.3. The rotation angle ε has been set to 0° according to the manufacturer's specification. The result of the test is given as average of three samples.

Geometry of measurements		Colour				
α	β_1 ($\beta_2 = 0$)	Yellow	Red	Blue	Green	Brown
0.1°	+5°	694	212	63	136	58
	+15°	654	196	57	124	53
	+20°	613	180	52	113	47
	+30°	470	133	37	83	32
	+40°	114	25	10,4	18,9	6,0
0.2°	+5°	439	134	37	85	36
	+15°	388	118	32	72	31
	+20°	350	106	28	62	27
	+30°	260	77	20	43	18,4
	+40°	72	16,7	6,8	11,3	4,1
0.33°	+5°	350	100	31	72	26
	+15°	309	87	27	63	22
	+20°	271	76	23	55	18,3
	+30°	169	46	14,9	33	10,7
	+40°	38	8,5	4,2	6,7	2,1
0.5°	+5°	283	85	24	55	22
	+15°	265	81	22	49	19,9
	+20°	248	75	19,6	44	18,0
	+30°	189	54	14,1	33	11,8
	+40°	43	8,7	4,3	8,3	1,9
1.0°	+5°	88	29	10	17,8	8,5
	+15°	86	27	9,4	18,0	7,7
	+20°	79	25	8,2	16,2	6,8
	+30°	60	19,3	5,6	11,5	4,7
	+40°	21	5,3	2,0	4,1	1,1
1.5°	+5°	25	9,6	2,8	5,3	2,5
	+15°	22	8,8	2,4	4,4	2,2
	+20°	20	8,3	2,1	3,9	2,0
	+30°	17,8	6,9	1,8	3,4	1,5
	+40°	7,4	2,2	0,6	1,4	0,4
2.0°	+5°	8,7	3,8	0,9	2,0	0,9
	+15°	6,4	3,1	0,7	1,5	0,7
	+20°	5,8	2,9	0,6	1,4	0,6
	+30°	5,2	2,7	0,4	1,1	0,5
	+40°	2,5	0,9	0,3	0,6	0,2

3.2.4 Rotational symmetry

The rotational symmetry has been determined according to EAD120001-01-0106, clause 2.2.3 "rotational symmetry". The rotation angle ε has been set to 0° according to the manufacturer's specification.

Rotational symmetry	
#	Ratio
Yellow	
Average of three Samples	1 : 1,17
Red on White	
Average of three Samples	1 : 1,13
Blue	
Average of three Samples	1 : 1,26
Green	
Average of three Samples	1 : 1,25
Brown	
Average of three Samples	1 : 1,19

3.2.5 Impact resistance

The Impact resistance has been determined according to EAD120001-01-0106, clause 2.2.4.

Sample	Test result
Yellow	No apparent cracking or delamination observed
Red	
Blue	
Green	
Brown	

3.2.6 Temperature resistance

No performance assessed.

3.2.7 Visibility after weathering

The accelerated artificial weathering has been done according to EAD 120001-01-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer. The size of the specimens is 5,5 x 10 cm.

3.2.7.1 Daylight Chromaticity and Luminance Factor after artificial weathering

The daylight chromaticity and luminance factor, verified according to EAD120001-01-0106, clause 2.2.1, tested after accelerated artificial weathering test.

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
Yellow Reference	***x*** ***y***	***0.545*** ***0.454***	***0.487*** ***0.423***	***0.427*** ***0.483***	***0.465*** ***0.534***	***≥0.24***
Yellow on While results	x y	0.524 0.461				*0.31*
Red reference	***x*** ***y***	***0.735*** ***0.265***	***0.674*** ***0.236***	***0.569*** ***0.341***	***0.655*** ***0.345***	***≥0.03***
Red on While results	x y	0.639 0.308				*0.03*
Green reference	***x*** ***y***	***0.007*** ***0.703***	***0.248*** ***0.399***	***0.177*** ***0.362***	***0.026*** ***0.399***	***≥0.03***
Green on White results	x y	0.134 0.422				*0.06*
Blue reference	***x*** ***y***	***0.078*** ***0.171***	***0.150*** ***0.220***	***0.210*** ***0.160***	***0.137*** ***0.038***	***≥0.01***
Blue on White results	x y	0.154 0.106				*0.04*
Brown reference	***x*** ***y***	***0.455*** ***0.397***	***0.523*** ***0.429***	***0.479*** ***0.373***	***0.558*** ***0.394***	***0.03-0.09***
Brown on White results	x y	0.502 0.395				*0.06*

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 120001-01-0106, clause 2.2.6.4, with an observation angle α = 0.33° and α = 1.0° and entrance angle $\beta 1$= 5° and 30°. The rotation angle ε has been set to 0° according to the manufacturer's specification. The result of the test is given as average of three samples.

Colours	Geometry of Measurements α = 0,33° β_1 = 5°	α = 0,33° β_1 = 30°	α = 1.0° β_1 = 5°	α = 1.0° β_1 = 30°
Yellow	321	163	80	53
Red	90	44	24	15,7
Blue	39	17,7	9,9	6,3
Green	73	35	17	10,4
Brown	31	12,7	9,4	5,1

3.2.8 Adhesion

No performance assessed.

3.3 3M™ Diamond Grade™ VIP Series 3990 printed with 3M™ process colour series 880 I or N

3.3.1 Daylight Chromaticity and Luminance Factor

The characteristics of initial daylight chromaticity and luminance factor have been determined according to EAD120001-01-0106, clause 2.2.1

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
Yellow Reference	**x** **y**	**0.494** **0.505**	**0.470** **0.480**	**0.513** **0.437**	**0.545** **0.454**	***≥ 0.24***
Yellow on While results	x y	0.523 0.457				*0.24*
Red reference	**x** **y**	**0.735** **0.265**	**0.700** **0.250**	**0.610** **0.340**	**0.660** **0.340**	***≥ 0.03***
Red on While results	x y	0.655 0.310				*0.04*
Green reference	**x** **y**	**0.110** **0.415**	**0.170** **0.415**	**0.170** **0.500**	**0.110** **0.500**	***≥ 0.03***
Green on White results	x y	0.132 0.451				*0.07*
Blue reference	**x** **y**	**0.130** **0.090**	**0.160** **0.090**	**0.160** **0.140**	**0.130** **0.140**	***≥ 0.01***
Blue on White results	x y	0.144 0.115				*0.04*
Orange reference	**x** **y**	**0.631** **0.369**	**0.560** **0.360**	**0.506** **0.404**	**0.570** **0.429**	***≥ 0.12***
Orange on White results	x y	0.569 0.390				*0.19*
Brown reference	**x** **y**	***0.455*** ***0.397***	***0.523*** ***0.429***	***0.479*** ***0.373***	***0.558*** ***0.394***	***0.03-0.09***
Brown on White results	x y	0.505 0.407				*0.04*

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 EAD120001-01-0106, clause 2.2.3. The rotation angle ε has been set to 0° according to the manufacturer's specification. The result of the test is given as average of three samples.

Geometry of measurements		Colour					
α	β_1 ($\beta_2 = 0$)	Yellow	Red	Blue	Green	Orange	Brown
0.1°	+5°	451	144	53	134	326	38
	+15°	435	137	49	125	308	34
	+20°	409	128	46	116	288	31
	+30°	314	97	34	88	219	22
	+40°	68	18,8	9,3	23	46	4,5
0.2°	+5°	282	91	33	85	207	24
	+15°	253	82	29	74	185	21
	+20°	229	74	25	66	168	18,4
	+30°	176	55	18,4	51	130	12,7
	+40°	46	12,5	6,1	15,4	32	3,1
0.33°	+5°	227	67	31	78	165	19,6
	+15°	195	59	26	65	140	16,3
	+20°	170	50	22	55	121	13,8
	+30°	108	31	13,7	35	77	8,1
	+40°	25	5,9	3,6	8,9	17,4	1,7
0.5°	+5°	187	59	23	59	139	16,4
	+15°	173	56	20	54	128	14,6
	+20°	160	52	18,2	49	116	13,1
	+30°	119	36	13,8	36	83	8,8
	+40°	23	5,7	4,0	8,9	15,0	1,6
1.0°	+5°	68	20	9,6	25	53	5,7
	+15°	69	19,8	8,8	24	54	5,3
	+20°	63	17,9	8,0	23	51	4,8
	+30°	45	12,8	5,5	15,5	36	3,3
	+40°	13,3	3,4	1,9	4,4	10,0	1,1
1.5°	+5°	25	7,4	3,3	9,0	19,5	1,9
	+15°	22	6,5	2,7	8,1	17,2	1,6
	+20°	20	6,0	2,4	6,9	15,9	1,4
	+30°	15,7	4,3	2,0	5,8	12,6	1,1
	+40°	4,8	1,2	0,7	1,7	3,3	0,4
2.0°	+5°	8,5	2,4	1,1	3,0	6,2	0,6
	+15°	6,9	1,9	0,8	2,2	5,1	0,4
	+20°	6,0	1,6	0,7	2,0	4,5	0,4
	+30°	5,2	1,4	0,5	1,6	4,0	0,3
	+40°	2,1	0,5	0,3	0,9	1,5	0,14

3.3.4 Rotational symmetry

The rotational symmetry has been determined according to EAD120001-01-0106, clause 2.2.3 "rotational symmetry". The rotation angle ε has been set to 0° according to the manufacturer's specification.

Rotational symmetry	
#	Ratio
Yellow	
Average of three Samples	1 : 1,21
Red	
Average of three Samples	1 : 1,18
Blue	
Average of three Samples	1 : 1,25
Green	
Average of three Samples	1 : 1,25
Orange	
Average of three Samples	1 : 1,22
Brown	
Average of three Samples	1 : 1,22

3.3.5 Impact resistance

The Impact resistance has been determined according to EAD120001-01-0106, clause 2.2.4.

Sample	Test result
Yellow	No apparent cracking or delamination observed
Red	
Blue	
Green	
Orange	
Brown	

3.3.6 Temperature resistance

No performance assessed.

3.3.7 Visibility after weathering

The accelerated artificial weathering has been done according to EAD 120001-01-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer. The size of the specimens is 5,5 x 10 cm.

3.3.7.1 Daylight Chromaticity and Luminance Factor after artificial weathering

The daylight chromaticity and luminance factor, verified according to EAD120001-01-0106, clause 2.2.1, tested after accelerated artificial weathering test.

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
Yellow reference	**x** **y**	**0.545** **0.454**	**0.487** **0.423**	**0.427** **0.483**	**0.465** **0.534**	***≥0.24***
Yellow on White results	x y	0.514 0.462				*0.25*
Red reference	**x** **y**	**0.735** **0.365**	**0.674** **0.236**	**0.569** **0.341**	**0.655** **0.345**	***≥0.03***
Red on White results	x y	0.651 0.311				*0.04*
Green reference	**x** **y**	**0.007** **0.703**	**0.248** **0.399**	**0.177** **0.362**	**0.026** **0.399**	***≥0.03***
Green on White results	x y	0.133 0.449				*0.07*
Blue reference	**x** **y**	**0.078** **0.171**	**0.150** **0.220**	**0.210** **0.160**	**0.137** **0.038**	***≥0.01***
Blue on White results	x y	0.144 0.117				*0.04*
Orange reference	**x** **y**	**0.631** **0.369**	**0.560** **0.360**	**0.506** **0.404**	**0.570** **0.429**	***≥0.12***
Orange on White results	x y	0,563 0,387				*0,18*
Brown reference	**x** **y**	***0.455*** ***0.397***	***0.523*** ***0.429***	***0.479*** ***0.373***	***0.558*** ***0.394***	***0.03-0.09***
Brown on White results	x y	0,491 0,410				*0,05*

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 120001-01-0106, clause 2.2.6.4, with an observation angle α = 0.33° and α = 1.0° and entrance angle $\beta 1$= 5° and 30°. The rotation angle ε has been set to 0° according to the manufacturer's specification. The result of the test is given as average of three samples.

Colours	Geometry of Measurements α = 0,33° β_1 = 5°	 α = 0,33° β_1 = 30°	 α = 1.0° β_1 = 5°	 α = 1.0° β_1 = 30°
Yellow	243	114	72	46
Red	66	30	20	12,7
Blue	33	15,3	9,8	5,9
Green	78	35	25	14,2
Orange	173	77	54	34
Brown	24	9,8	6,9	3,8

3.3.8 Adhesion

No performance assessed.

3.4 3M™ Diamond Grade™ VIP 3990DS + 3M™ Piezo Inkjet Ink Series 8800 UV or 8900 UV + 3M™ Electrocut Film 1170

3.4.1 Daylight Chromaticity and Luminance Factor

The characteristics of initial daylight chromaticity and luminance factor have been determined according to EAD120001-01-0106, clause 2.2.1

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
White reference	***x***	***0.305***	***0.335***	***0.325***	***0.295***	***≥ 0.40***
	y	***0.315***	***0.345***	***0.355***	***0.325***	
White results	x	0.306				0.43
	y	0.324				
Yellow Reference	***x***	**0.494**	**0.470**	**0.513**	**0.545**	***≥ 0.24***
	y	**0.505**	**0.480**	**0.437**	**0.454**	
Yellow on While results	x	0.484				*0.25*
	y	0.472				
Red reference	***x***	**0.735**	**0.700**	**0.610**	**0.660**	***≥ 0.03***
	y	**0.265**	**0.250**	**0.340**	**0.340**	
Red on While results	x	0.637				*0.07*
	y	0.331				
Green reference	***x***	**0.110**	**0.170**	**0.170**	**0.110**	***≥ 0.03***
	y	**0.415**	**0.415**	**0.500**	**0.500**	
Green on White results	x	0.161				*0.06*
	y	0.434				
Blue reference	***x***	**0.130**	**0.160**	**0.160**	**0.130**	***≥ 0.01***
	y	**0.090**	**0.090**	**0.140**	**0.140**	
Blue on White results	x	0.143				*0.04*
	y	0.118				
Brown reference	***x***	**0.455**	**0.523**	**0.479**	**0.558**	***≥ 0.03 – 0.09***
	y	**0.397**	**0.429**	**0.373**	**0.394**	
Brown on White results	x	0.525				*0.04*
	y	0.397				
Orange reference	***x***	**0.631**	**0.560**	**0.506**	**0.570**	***≥ 0.12***
	y	**0.369**	**0.360**	**0.404**	**0.429**	
Orange on White results	x	0,559				*0,14*
	y	0,398				
Dark Green reference	***x***	***0.313***	***0.313***	***0.248***	***0.127***	***0.01-0.07***
	y	***0.682***	***0.453***	***0.399***	***0.557***	
Dark Green on White results	x	0,226				*0,05*
	y	0,530				
Grey reference	***x***	***0.305***	***0.335***	***0.325***	***0.295***	***0.11-0.18***
	y	***0.315***	***0.345***	***0.355***	***0.325***	
Grey on White results	x	0,314				*0,13*
	y	0,330				

3.4.2 Night-time colour

No performance assessed.

3.4.3 Coefficient of Retro-reflection

The Coefficient of Retro-reflection has been determined according to EAD120001-01-0106, clause 2.2.3. The rotation angle ε has been set to 0° according to the manufacturer's specification. The result of the test is given as average of three samples.

Geometry of measurements		Colour								
α	β_1 ($\beta_2 = 0$)	White	Yellow	Red	Blue	Green	Brown	Orange	Dark Green	Grey
0.1°	+5°	777	364	130	67	85	104	277	68	388
	+15°	748	326	116	61	76	94	247	60	357
	+20°	703	294	105	54	68	84	222	53	328
	+30°	547	211	75	39	48	60	160	37	246
	+40°	161	46	15	11	12	13	35	8	58
0.2°	+5°	479	236	85	43	55	68	178	44	242
	+15°	426	205	74	37	47	59	154	38	213
	+20°	386	183	66	33	42	53	136	33	191
	+30°	296	131	47	23	29	37	98	23	143
	+40°	106	31	10	7	8	9	24	6	38
0.33°	+5°	392	199	68	39	49	56	147	39	197
	+15°	336	177	60	35	44	50	130	34	173
	+20°	290	156	53	30	39	44	114	30	151
	+30°	184	102	34	20	24	28	74	19	98
	+40°	55	20	7	5	6	6	15	4	22
0.5°	+5°	313	174	63	32	42	51	130	35	163
	+15°	291	163	59	29	38	47	122	31	152
	+20°	266	151	54	27	35	43	112	28	140
	+30°	196	110	38	20	25	31	80	20	103
	+40°	54	22	7	6	6	6	16	4	22
1.0°	+5°	109	80	31	13	19	25	57	17	61
	+15°	112	77	30	12	18	23	55	16	60
	+20°	102	72	28	11	17	22	52	15	56
	+30°	77	55	22	9	13	17	41	11	43
	+40°	28	16	6	3.2	4.4	5	12	3.3	14
1.5°	+5°	34	31	13	4.3	7.4	10	21	7.1	19
	+15°	30	30	12	4.0	7.0	9	21	6.7	18
	+20°	27	28	11	3.7	6.5	9	19	6.2	16
	+30°	24	23	8	3.1	5.4	6.9	16	5.0	14
	+40°	10	8	2.8	1.4	2.3	2.4	6	1.9	5
2.0°	+5°	10	12	4.9	1.5	2.8	3.8	8	3.0	6.1
	+15°	9	11	4.7	1.3	2.6	3.6	8	2.8	5.3
	+20°	8	11	4.4	1.3	2.6	3.4	7	2.7	4.8
	+30°	7	10	3.9	1.1	2.2	3.0	6.8	2.3	4.2
	+40°	4	4	1.4	0.6	1.1	1.2	2.9	1.1	2.0

3.4.4 Rotational symmetry

The rotational symmetry has been determined according to EAD120001-01-0106, clause 2.2.3 "rotational symmetry". The rotation angle ε has been set to 0° according to the manufacturer's specification.

Rotational symmetry	
#	Ratio
White	
Average of three Samples	1 : 1,22
Yellow	
Average of three Samples	1 : 1,09
Red	
Average of three Samples	1 : 1,07
Blue	
Average of three Samples	1 : 1,09
Green	
Average of three Samples	1 : 1,05
Orange	
Average of three Samples	1 : 1,07
Brown	
Average of three Samples	1 : 1,07
Dark Green	
Average of three Samples	1 : 1,04
Grey	
Average of three Samples	1 : 1,13

3.4.5 Impact resistance

The Impact resistance has been determined according to EAD120001-01-0106, clause 2.2.4.

Sample	Test result
White	No apparent cracking or delamination observed
Yellow	
Red	
Blue	
Green	
Brown	
Orange	
Dark Green	
Grey	

3.4.6 Temperature resistance

No performance assessed.

3.4.7 Visibility after weathering

The accelerated artificial weathering has been done according to EAD 120001-01-0106, clause 2.2.6.1, with the use of a (non-insulated) black-panel thermometer. The size of the specimens is 5,5 x 10 cm.

3.4.7.1 Daylight Chromaticity and Luminance Factor after artificial weathering

The daylight chromaticity and luminance factor, verified according to EAD120001-01-0106, clause 2.2.1, tested after accelerated artificial weathering test.

Colours		Chromaticity Coordinates 1	2	3	4	Luminance Factor ß
White reference	***x*** ***y***	***0.305*** ***0.315***	***0.335*** ***0.345***	***0.325*** ***0.355***	***0.295*** ***0.325***	***≥ 0.40***
White results	x y	0.305 0.323				0.44
Yellow reference	***x*** ***y***	***0.494*** ***0.505***	***0.470*** ***0.480***	***0.513*** ***0.437***	***0.545*** ***0.454***	***≥ 0.24***
Yellow results	x y	0.478 0.475				0.26
Red reference	***x*** ***y***	***0.735*** ***0.265***	***0.700*** ***0.250***	***0.610*** ***0.340***	***0.660*** ***0.340***	***≥ 0.03***
Red results	x y	0.624 0.333				0.06
Green reference	***x*** ***y***	***0.110*** ***0.415***	***0.170*** ***0.415***	***0.170*** ***0.500***	***0.110*** ***0.500***	***≥ 0.03***
Green results	x y	0.162 0.423				0.06
Blue reference	***x*** ***y***	***0.130*** ***0.090***	***0.160*** ***0.090***	***0.160*** ***0.140***	***0.130*** ***0.140***	***≥ 0.01***
Blue results	x y	0.144 0.126				0.04
Brown reference	***x*** ***y***	**0.455** **0.397**	**0.523** **0.429**	**0.479** **0.373**	**0.558** **0.394**	***≥ 0.03 – 0.09***
Brown on White results	x y	0.516 0.398				*0.04*
Orange reference	***x*** ***y***	**0.631** **0.369**	**0.560** **0.360**	**0.506** **0.404**	**0.570** **0.429**	***≥ 0.12***
Orange on White results	x y	0,548 0,401				*0,13*
Dark Green reference	***x*** ***y***	***0.313*** ***0.682***	***0.313*** ***0.453***	***0.248*** ***0.399***	***0.127*** ***0.557***	***0.01-0.07***
Dark Green on White results	x y	0,228 0,521				*0,05*
Grey reference	***x*** ***y***	***0.350*** ***0.360***	***0.300*** ***0.310***	***0.285*** ***0.325***	***0.335*** ***0.375***	***0.11-0.18***
Grey on White results	x y	0,314 0,330				*0,13*

3.4.7.2 Coefficient of Retro-reflection after accelerated artificial weathering

The Coefficient of Retro-reflection after accelerated artificial weathering tests has been determined according to EAD 120001-01-0106, clause 2.2.6.4, with an observation angle α = 0.33° and α = 1.0° and entrance angle $\beta 1$= 5° and 30°. The rotation angle ε has been set to 0° according to the manufacturer's specification. The result of the test is given as average of three samples.

Colours	Geometry of Measurements			
	α = 0,33° β_1 = 5°	α = 0,33° β_1 = 30°	α = 1.0° β_1 = 5°	α = 1.0° β_1 = 30°
White	397	188	108	73
Yellow	205	104	80	55
Red	69	34	30	21
Blue	43	21	14	9
Green	55	28	20	13
Brown	54	26	21	14
Orange	157	78	58	41
Dark Green	42	21	18	12
Grey	189	90	56	34

3.4.8 Adhesion

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[3], as amended by Commission Decision 1999/453/EC of 1999/06/18[4], 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			

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 European Assessment Document 120001-01-0106, 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 are laid down in European Assessment Document 120001-01-0106, clause 3.3.

6 Reference documents

See European Assessment Document 120001-01-0106, clause 4.

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, in Sint-Stevens-Woluwe, 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,

Dirk Van Loo, CEO COPRO

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

[3] see OJEU L 254, 8.10.1996, p. 52

[4] see OJEU L 178, 14.7.1999, p. 50