

European Technical Approval**ETA 10/0118****Trade names**

1. 3M™ Engineer Grade Prismatic (“EGP”) Reflective Sheeting Series 3430,
2. 3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430 printed with “3M™ Process Color Series 880 N or I “
3. 3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430 + “3M™ Electrocut Series 1170”

Holder of approval

3M Deutschland GmbH
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Generic type and use of construction product

Micro-prismatic retro-reflective sheeting for traffic signs

**Validity from/
to**

2013-06-30
2015-06-27

Manufacturing plant

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**This European Technical Approval
replaces:**

ETA 10/0118, issued on 28 June 2010 and valid until 27 June 2015

**This European Technical Approval
contains:**

21 pages, including 1 Annex



European Organisation for Technical Approvals
Organisation Européenne pour l'Agrément Technique
Europäische Organisation für Technische Zulassungen

I LEGAL BASES AND GENERAL CONDITIONS

1. This European Technical Approval is issued by UBAtc in accordance with:
 - Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products¹, modified by Council Directive 93/68/EEC² and Regulation (EC) N° 1882/2003 of the European Parliament and of the Council³;
 - Belgian law of 25 March 1996 concerning the adaptation of legislative and administrative provisions of Member States to the Construction Products Directive (89/106/EEC) for construction products⁴ and Belgian Royal Decree of 18 August 1998 concerning construction products⁵
 - Common Procedural Rules for Requesting, Preparing and the Granting of European Technical Approvals set out in the Annex to Commission Decision 94/23/EC⁶;
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8. Compared with the previous version, corrections were introduced in tables on pages 7, 10, 13 and 16 and in §3.3, last paragraph.

¹ Official Journal of the European Communities N° L 40, 11.2.1989, p. 12

² Official Journal of the European Communities N° L 220, 30.8.1993, p. 1

³ Official Journal of the European Union N° L 284, 31.10.2003, p. 1

⁴ Belgian Law Gazette, 21.05.1996

⁵ Belgian Law Gazette, 11.09.1998

⁶ Official Journal of the European Communities N° L 17, 20.1.1994, p. 34

II. Specific Conditions of the European Technical Approval (ETA)

1. Definition of Product and Intended Use

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

The product is supplied as a single coloured sheet whose trade name is “3M™ 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”.

1.1. 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

1.2. Intended Use

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

With reference to the Use Options envisaged in Table 1 of endorsed CUAP 01.06.04, the manufacturer declares to use Option 1 (see Annex 1). This means the product will be tested for following visibility aspects: Initial daytime colour, luminance factor, coefficient of retro-reflection and impact resistance. After durability testing, daytime colour, luminance factor and coefficient of retro-reflection will be tested again. In this ETA, the durability after accelerated artificial weathering is presented.

2. Characteristics of Product

2.1. General

The identification tests and the assessment of fitness for use of the 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 Color Series 880 N or I “ were carried out.

The ETA is issued for the product on the basis of information/data deposited at UBAtc, which identify the product that was assessed and judged. Changes to the production process of the product or to its components which could result in deposited information/data being incorrect, shall be notified to UBAtc before they are introduced and UBAtc will assess whether or not such changes affect the ETA and, if so, whether further assessment and/or modification to the ETA shall be necessary.

The characteristics of the product not mentioned nor in this ETA nor in the annexes shall correspond to the respective values laid down in the Technical Documentation of this ETA, checked by UBAtc.

2.2. 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 “

2.2.1. Hygiene, health and the environment

2.2.1.1 Release of dangerous substances

The product complies with the provisions of Guidance Paper H (“A harmonized approach relating to Dangerous substances under the construction products directive”, Edition 2002) about dangerous substances.

A written declaration of conformity in this respect was made by the manufacturer. In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

2.2.2 Safety in use of “3M Engineer Grade Prismatic Series 3430”

According to what envisaged in § 4.4.0 of CUAP 01.06/04 the manufacturer chose one Use Option. The assessment of the product was performed according to the content of the Use Option 1 (See clause 1.2 in this ETA: Intended Use)

Details of test results are included in the related Evaluation Report.

2.2.2.1 Visibility of “3M Engineer Grade Prismatic Series 3430”

2.2.2.1.1 Day-time colour and Luminance Factor

The characteristics of Day-time colour and Luminance Factor have been determined according to clause 3.2.1 in this ETA

Colours		Chromaticity Coordinates				Luminance Factor β	
		1	2	3	4	Class B1	Class B2
White reference	x	0.305	0.335	0.325	0.295	≥ 0.27	≥ 0.40
	y	0.315	0.345	0.355	0.325		
White 3430		pass				pass	
Yellow reference	x	0.494	0.470	0.513	0.545	≥ 0.16	≥ 0.24
	y	0.505	0.480	0.437	0.454		
Yellow 3431		pass				pass	
Red reference	x	0.735	0.700	0.610	0.660	≥ 0.03	≥ 0.03
	y	0.265	0.250	0.340	0.340		
Red 3432		pass				pass	
Green reference	x	0.110	0.170	0.170	0.110	≥ 0.03	≥ 0.03
	y	0.415	0.415	0.500	0.500		
Green 3437		pass				pass	
Blue reference	x	0.130	0.160	0.160	0.130	≥ 0.01	≥ 0.01
	y	0.090	0.090	0.140	0.140		
Blue 3435		pass				pass	

The samples also meet the requirements of classes CR1 and CR2, as defined in EN 12899-1:2007 (Clause 4.1)

2.2.2.1.2 Coefficient of Retro-reflection

The Coefficient of Retro-reflection R' - Case A has been determined according to Table 15 of CUAP 0106/04, amendment 1:2009 (table reproduced below), also see clause 3.2.2 in this ETA.

Minimum Coefficient of Retro-reflection, performance according to requirements in Class RA1, also referenced in EN 12899-1:2007, Clause 4.1.

Geometry of measurements		Colour							
α	β_1 ($\beta_2 = 0$)	White	Yellow	Red	Green	Blue	Brown	Orange	Grey
12'	+5°	70	50	14,5	9	4	1	25	42
	+30°	30	22	6	3,5	1,7	0,3	10	18
	+40°	10	7	2	1,5	0,5	#	2,2	6
20'	+5°	50	35	10	7	2	0,6	20	30
	+30°	24	16	4	3	1	0,2	8	14,4
	+40°	9	6	1,8	1,2	#	#	2,2	5,4
2°	+5°	5	3	1	0,5	#	#	1,2	3
	+30°	2,5	1,5	0,5	0,3	#	#	0,5	1,5
	+40°	1,5	1,0	0,5	0,2	#	#	#	0,9

indicates "Value greater than zero but not significant or applicable".

CUAP Table 15: Minimum coefficient of Retro-reflection, Performance class RA1

Coefficient of retroreflexion ($\text{cd} \cdot \text{lx}^{-1} \cdot \text{m}^{-2}$)	
Sample	Pass/Fail
White 3430	Pass for table 15 (RA1)
Yellow 3431	Pass for table 15 (RA1)
Red 3432	Pass for table 15 (RA1)
Blue 3435	Pass for table 15 (RA1)
Green 3437	Pass for table 15 (RA1)
* It concerns Table 15 of the relevant CUAP (reproduced in this ETA)	

2.2.2.1.3 Rotational symmetry

The rotational symmetry has been determined according to clause 3.2.3. in this ETA.

For the observation angle $\alpha = 0.33^\circ$ and entrance angle $\beta_1 = 5^\circ$ ($\beta_2 = 0^\circ$), the ratio between the minimum and the maximum coefficient of Retro-reflection when rotating from $\varepsilon - 75^\circ$ to $+ 50^\circ$ in 25° steps, shall not be greater than 2.5:1. The product complies with this requirement.

Coefficient of retroreflexion ($\text{cd} \cdot \text{lx}^{-1} \cdot \text{m}^{-2}$) Rotational symmetry		
	Ratio	Pass/Fail
White 3430	1.1:1	Pass
Yellow 3431	1.1:1	Pass
Red 3432	1.2:1	Pass
Blue 3435	1.2:1	Pass
Green 3437	1.1:1	Pass

2.2.2.1.4 Impact resistance

The Impact resistance has been determined according to clause 3.2.4. in this ETA, on the product in all the colours quoted in Table 1.1 of this ETA.

Sample	Test Result	Conclusion
White 3430	No apparent cracking or delamination observed	Pass
Yellow 3431	No apparent cracking or delamination observed	Pass
Red 3432	No apparent cracking or delamination observed	Pass
Blue 3435	No apparent cracking or delamination observed	Pass
Green 3437	No apparent cracking or delamination observed	Pass

2.2.3 Durability of "3M™ Engineer Grade Prismatic Series 3430"

According to § 2.2.2.1.2 (CUAP, Table 15), the accelerated weathering tests have been done. In case of further issue of the ETA, then these tests shall be carried out after the accelerated outdoor exposure.

2.2.3.1 Day-time colour and Luminance factor after accelerated weathering test of "3M Engineer Grade Prismatic Series 3430"

The Day-time colour and luminance, verified according to clause 3.2.1, tested after accelerated artificial weathering test. The weathering has been done according to clause 3.3. in the ETA.

Colours		Chromaticity Coordinates				Luminance Factor β	
		1	2	3	4	Class B1	Class B2
White reference	x	0.355	0.305	0.285	0.335	≥ 0.27	≥ 0.40
	y	0.355	0.305	0.325	0.375		
White 3430		pass				pass	
Yellow reference	x	0.545	0.487	0.427	0.465	≥ 0.16	≥ 0.24
	y	0.454	0.423	0.483	0.534		
Yellow 3431		pass				pass	
Red reference	x	0.735	0.674	0.569	0.655	≥ 0.03	≥ 0.03
	y	0.265	0.236	0.341	0.345		
Red 3432		pass				pass	
Green reference	x	0.007	0.248	0.177	0.026	≥ 0.03	≥ 0.03
	y	0.703	0.409	0.362	0.399		
Green 3437		pass				pass	
Blue reference	x	0.078	0.150	0.210	0.137	≥ 0.01	≥ 0.01
	y	0.171	0.220	0.160	0.038		
Blue 3435		pass				pass	

The samples also meet the requirements of classes CR1, as defined in EN 12899-1:2007 (Clause 4.1)

2.2.3.2 Coefficient of Retro-reflection Case A after accelerated artificial weathering tests of "3M™ Engineer Grade Prismatic Series 3430"

The Coefficient of Retro-reflection Case A after accelerated artificial weathering tests has been determined according to clause 3.2.2., with an observation angle $\alpha = 0.33^\circ$ and $\beta_1 = 5^\circ$ and 30° . The results have been checked with the values required for new materials under clause 2.2.2.1.2 (CUAP table 15 : RA1) and they resulted $\geq 80\%$.

Colours	Pass/Fail (pass: $\geq 80\%$ of the required values for new materials)
White 3430	Pass
Yellow 3431	Pass
Red 3432	Pass
Blue 3435	Pass
Green 3437	Pass

2.2.4 **Safety in use of "3M™ Engineer Grade Prismatic Series 3430 printed with 3M Processing Colour Series 880 I or N"**

2.2.4.1 Visibility of "3M™ Engineer Grade Prismatic Series 3430 printed with 3M™ Processing Colour Series 880 I or N"

2.2.4.1.1 Day-time colour and Luminance Factor

The characteristics of day-time colour and luminance factor have been determined according to clause 3.2.1 in this ETA.

Colours		Chromaticity Coordinates				Luminance Factor β	
		1	2	3	4	Class B1	Class B2
<i>Yellow reference</i>	x	0.494	0.470	0.513	0.545	≥ 0.16	≥ 0.24
	y	0.505	0.480	0.437	0.454		
White 3430 + 884 I or N Ink		pass				pass	
<i>Red reference</i>	x	0.735	0.700	0.610	0.660	≥ 0.03	≥ 0.03
	y	0.265	0.250	0.340	0.340		
White 3430 + 882 I or N Ink		pass				pass	
<i>French Red reference</i>	x	0.735	0.700	0.610	0.660	≥ 0.03	≥ 0.03
	y	0.265	0.250	0.340	0.340		
White 3430 + 889 I or N Ink		pass				pass	
<i>Green reference</i>	x	0.110	0.170	0.170	0.110	≥ 0.03	≥ 0.03
	y	0.415	0.415	0.500	0.500		
White 3430 + 888 I or N Ink		pass				pass	
<i>Blue reference</i>	x	0.130	0.160	0.160	0.130	≥ 0.01	≥ 0.01
	y	0.090	0.090	0.140	0.140		
White 3430 + 883 I or N Ink		pass				pass	
<i>Red reference</i>	x	0.735	0.700	0.610	0.660	≥ 0.03	≥ 0.03
	y	0.265	0.250	0.340	0.340		
Yellow 3431 + 882 I or N Ink	x y	pass				pass	
<i>French Red reference</i>	x	0.735	0.700	0.610	0.660	≥ 0.03	≥ 0.03
	y	0.265	0.250	0.340	0.340		
Yellow 3431 + 889 I or N Ink	x y	pass				pass	

The samples also meet the requirements of classes CR1 and CR2, as defined in EN 12899-1:2007 (Clause 4.1)

2.2.4.1.2 Coefficient of Retro-reflection Case A

For material processed with process colours, with or without clear overlay film, the minimum value of the coefficient of Retro-reflection shall not be less than 70% of the values specified in table 15 of the relevant CUAP (reproduced in this ETA) (RA1). For material processed with red process color or red overlay film over yellow microprismatic sheeting, the coefficient of Retro-reflection shall not be less than 50% of the values specified in table 15 of the relevant CUAP (RA1). Measurements have been done according to clause 3.2.2. in this ETA.

Colours	Pass/ Fail
Ink Yellow 884 I or N on white 3430	Pass
Ink Red 882 I or N on white 3430	Pass
Ink French Red 889 I or N on white 3430	Pass
Ink Green 888 I or N on white 3430	Pass
Ink Blue 883 I or N on white 3430	Pass
Ink Red 882 I or N on Yellow 3431	Pass
Ink French Red 889 I or N on Yellow 3431	Pass

2.2.4.1.3 Rotational symmetry

The rotational symmetry has been determined according to clause 3.2.3. in this ETA. For the observation angle $\alpha = 0.33^\circ$ and entrance angle $\beta_1 = 5^\circ$ ($\beta_2 = 0^\circ$), the ratio between the minimum and the maximum coefficient of Retro-reflection when rotating from $\varepsilon - 75^\circ$ to $+50^\circ$ in 25° steps, shall not be greater than 2.5:1.

Colours	Coefficient of retro-reflection ($\text{cd} \cdot \text{lx}^{-1} \cdot \text{m}^{-2}$) Rotational symmetry	
	Ratio	Pass/Fail
Yellow 884 I or N on White 3430	1.1:1	Pass
Red 882 I or N on White 3430	1.1:1	Pass
French Red 889 I or N on White 3430	1.1:1	Pass
Green 888 I or N on White 3430	1.2:1	Pass
Blue 883 I or N on White 3430	1.3:1	Pass
Red 882 I or N on Yellow 3431	1.2:1	Pass
French Red 889 I or N on Yellow 3431	1.1:1	Pass

2.2.4.1.4. Impact resistance

The Impact resistance has been determined according to clause 3.2.4. in this ETA

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

2.2.5. Durability of “3M™ Engineer Grade Prismatic Series 3430” printed with “3M™ Process Colour Series 880 I or N”

2.2.5.1 Day-time colour and Luminance factor after accelerated artificial weathering test.

The Day-time colour and luminance after accelerated weathering test have been determined according to clause 3.2.1. Aging test has been performed according to clause 3.3. in this ETA.

Colours		Chromaticity Coordinates				Pass/ fail	Luminance Factor β
		1	2	3	4		Class
Ink Yellow 884 I or N on white 3430	x	0.545	0.487	0.427	0.465	Pass	B2 ≥ 0.24
	y	0.454	0.423	0.483	0.534		
Ink Red 882 I or N on White 3430	x	0.735	0.674	0.569	0.655	Pass	B2 ≥ 0.03
	y	0.265	0.236	0.341	0.345		
Ink French Red 889 I or N on White 3430	x	0.735	0.674	0.569	0.655	Pass	B2 ≥ 0.03
	y	0.265	0.236	0.341	0.345		
Ink Green 888 I or N on White 3430	x	0.007	0.248	0.177	0.026	Pass	B2 ≥ 0.03
	y	0.703	0.409	0.362	0.399		
Ink Blue 883 I or N on White 3430	x	0.078	0.150	0.210	0.137	Pass	B2 ≥ 0.01
	y	0.171	0.220	0.160	0.038		
Ink Red 882 I or N on Yellow 3431	x	0.735	0.674	0.569	0.655	Pass	B2 ≥ 0.03
	y	0.265	0.236	0.341	0.345		
Ink French Red 889 I or N on Yellow 3431	x	0.735	0.674	0.569	0.655	Pass	B2 ≥ 0.03
	y	0.265	0.236	0.341	0.345		

2.2.5.2 Coefficient of Retro-reflection
Case A after artificial accelerated
weathering tests

The Coefficient of Retro-reflection after accelerated weathering tests has been determined according to clause 3.2.2. with an observation angle $\alpha = 0.33^\circ$ and $\beta_1 = 5^\circ$ and 30° . The results have been checked with the values required for new materials according to table 15 of the relevant CUAP (reproduced in this ETA) (RA1) and they resulted $\geq 80\%$.

Aging was performed according to clause 3.3. in this ETA

Colours	Pass/ Fail
Ink Yellow 884 I or N on white 3430	Pass
Ink Red 882 I or N on white 3430	Pass
Ink French Red 889 I or N on white 3430	Pass
Ink Green 888 I or N on white 3430	Pass
Ink Blue 883 I or N on white 3430	Pass
Ink Red 882 I or N on Yellow 3431	Pass
Ink French Red 889 I or N on Yellow 3431	Pass

2.2.6 Safety in use of “3M™ Engineer Grade Prismatic Series 3430” + “3M™ Electrocut Film Series 1170”

2.2.6.1 Visibility of “3M™ Engineer Grade Prismatic Series 3430” + 3M™ Electrocut Film Series 1170”

2.2.6.1.1 Day-time colour and Luminance Factor

The characteristics of Day-time colour and Luminance Factor have been determined according to clause 3.2.1 in this ETA.

Colours		Chromaticity Coordinates				Luminance Factor β	
		1	2	3	4	Class B1	Class B2
Yellow reference	x	0.494	0.470	0.513	0.545	≥ 0.16	≥ 0.24
	y	0.505	0.480	0.437	0.454		
Yellow EC Film 1171 on White 3430		pass				pass	
Red reference	x	0.735	0.700	0.610	0.660	≥ 0.03	≥ 0.03
	y	0.265	0.250	0.340	0.340		
Red EC Film 1172 on White 3430		pass				pass	
Green reference	x	0.110	0.170	0.170	0.110	≥ 0.03	≥ 0.03
	y	0.415	0.415	0.500	0.500		
Green EC Film 1177 on White 3430		pass				pass	
Blue reference	x	0.130	0.160	0.160	0.130	≥ 0.01	≥ 0.01
	y	0.090	0.090	0.140	0.140		
Blue EC Film 1175 on White 3430		pass				pass	
Brown reference	x	0.455	0.523	0.479	0.558	0.04 – 0.06	0.03 – 0.09
	y	0.397	0.429	0.373	0.394		
Brown EC Film 1179 on White 3430		pass				pass	
Green reference	x	0.110	0.170	0.170	0.110	0.01 - 0.07	0.01 - 0.07
	y	0.415	0.415	0.500	0.500		
Green 2 (Dark Green) EC Film 1176 on White 3430		pass				pass	
Red reference	x	0.735	0.700	0.610	0.660	≥ 0.03	≥ 0.03
	y	0.265	0.250	0.340	0.340		
Red EC Film 1172 on Yellow 3431		pass				pass	

All samples also meet the requirements of Classes CR1 and CR2, as specified in EN 12899-1:2007 (Clause 4.1)

2.2.6.1.2 Coefficient of Retro-reflection Case A

For material processed with overlay film, the minimum value of the coefficient of Retro-reflection shall not be less than 70% of the values specified in table 15 of the relevant CUAP (reproduced in this ETA) (RA1) . For material processed with red overlay film over yellow micro-prismatic sheeting, the coefficient of retro-reflection shall not be less than 50% of the values specified in table 15 of the relevant CUAP (RA1) Measurements have been done according to clause 3.2.2. in this ETA.

Sample	Conclusion
Yellow EC Film 1171 on White 3430	Pass
Red EC Film 1172 on White 3430	Pass
Green EC Film 1177 on White 3430	Pass
Blue EC Film 1175 on White 3430	Pass
Brown EC Film 1179 on White 3430	Pass
Green 2 (Dark green) EC Film 1176 on White 3430	Pass
Red EC Film 1172 on Yellow 3431	Pass

2.2.6.2.3. Rotational symmetry

The rotational symmetry has been performed according to clause 3.2.3 in this ETA. For the observation angle $\alpha = 0.33^\circ$ and entrance angle $\beta_1 = 5^\circ$ ($\beta_2 = 0^\circ$), the ratio between the minimum and the maximum coefficient of Retro-reflection when rotating from $\varepsilon - 75^\circ$ to $+50^\circ$ in 25° steps, shall not be greater than 2.5:1.

Sample	Ratio	Conclusion
Yellow EC Film 1171 on White 3430	1.1:1	Pass
Red EC Film 1172 on White 3430	1.2:1	Pass
Green EC Film 1177 on White 3430	1.1:1	Pass
Blue EC Film 1175 on White 3430	1.1:1	Pass
Brown EC Film 1179 on White 3430	1.3:1	Pass
Green 2 (Dark green) EC Film 1176 on White 3430	1.1:1	Pass
Red EC Film 1172 on Yellow 3431	1.1:1	Pass

2.2.6.2.4. Impact resistance

The Impact resistance has been determined according to clause 3.2.4. in this ETA.

Sample	Test Result	Conclusion
Yellow EC Film 1171 on White 3430	No apparent cracking or delamination observed	Pass
Red EC Film 1172 on White 3430	No apparent cracking or delamination observed	Pass
Green EC Film 1177 on White 3430	No apparent cracking or delamination observed	Pass
Blue EC Film 1175 on White 3430	No apparent cracking or delamination observed	Pass
Brown EC Film 1179 on White 3430	No apparent cracking or delamination observed	Pass
Green 2 (Dark green) EC Film 1176 on White 3430	No apparent cracking or delamination observed	Pass
Red EC Film 1172 on Yellow 3431	No apparent cracking or delamination observed	Pass

2.2.7 Durability of “3M™ Engineer Grade Prismatic Series 3430” + “3M™ Electrocut Film Series 1170”

2.2.7.1 Day-time colour and Luminance factor after artificial accelerated weathering test

According to clause 3.3, the accelerated artificial weathering tests have been done. In case of further issue of the ETA, then these tests shall be carried out after the artificial outdoor exposure.

The Day-time colour and luminance factor, after accelerated artificial weathering tests, have been determined according to clause 3.2.1.

Colours		Chromaticity Coordinates				Luminance Factor β	
		1	2	3	4	Class B1	Class B2
Yellow reference	x	0.545	0.487	0.427	0.465	≥ 0.16	≥ 0.24
	y	0.454	0.423	0.483	0.534		
Yellow EC Film 1171 on White 3430		pass				pass	
Red reference	x	0.735	0.674	0.569	0.655	≥ 0.03	≥ 0.03
	y	0.265	0.236	0.341	0.345		
Red EC Film 1172 on White 3430		pass				pass	
Green reference	x	0.007	0.248	0.177	0.026	≥ 0.03	≥ 0.03
	y	0.703	0.409	0.362	0.399		
Green EC Film 1177 on White 3430		pass				pass	
Blue reference	x	0.078	0.150	0.210	0.137	≥ 0.01	≥ 0.01
	y	0.171	0.220	0.160	0.038		
Blue EC Film 1175 on White 3430		pass				pass	
Brown reference	x	0.455	0.523	0.479	0.558	0.04 – 0.06	0.03 – 0.09
	y	0.397	0.429	0.373	0.394		
Brown EC Film 1179 on White 3430		pass				pass	
Green reference	x	0.313	0.313	0.248	0.127	0.01 - 0.07	0.01 - 0.07
	y	0.682	0.453	0.409	0.557		
Green 2 (Dark Green) EC Film 1176 on White 3430		pass				pass	
Red reference	x	0.735	0.674	0.569	0.655	≥ 0.03	≥ 0.03
	y	0.265	0.236	0.341	0.345		
Red EC Film 1172 on Yellow 3431		pass				pass	

All samples also meet the requirements of Classes CR1, as specified in EN 12899-1:2007 (Clause 4.1)

2.2.7.2 Coefficient of Retro-reflection Case A after artificial accelerated weathering tests

The Coefficient of Retro-reflection after artificial accelerated weathering tests has been determined according to clause 3.2.2. with an observation angle $\alpha = 0.33^\circ$ and $\beta_1 = 5^\circ$ and 30° .

The results have been checked with the values required for new materials according to table 15 of the relevant CUAP (reproduced in this ETA) (RA1) and they resulted $\geq 80\%$.

Ageing was performed according to clause 3.3. in this ETA

Sample	Conclusion
Yellow EC Film 1171 on White 3430	Pass
Red EC Film 1172 on White 3430	Pass
Green EC Film 1177 on White 3430	Pass
Blue EC Film 1175 on White 3430	Pass
Brown EC Film 1179 on White 3430	Pass
Green 2 (Dark green) EC Film 1176 on White 3430	Pass
Red EC Film 1172 on Yellow 3431	Pass

3. Verification Methods for determining the relevant characteristics of the construction product.

3.1 Hygiene, health and the environment

3.1.1. Release of dangerous substances

The product/kit complies with all relevant European and national provisions applicable for the uses for which it is brought to the market. The attention of the applicant should be drawn on the fact that for other uses or other Member States of destination there may be other requirements which would have to be respected. For dangerous substances contained in the product but not covered by an ETA, the NPD option (no performance determined) is applicable.

3.2 Safety in use

3.2.1. Day-time colour and Luminance Factor

The chromaticity coordinates (x, y) and the luminance factor (β) are measured in accordance with CIE Publication 15.2 Colourimetry – 1986 using 45/0 geometry and shall be calculated from the total spectral radiance factors computed for CIE illuminant D65 for the CIE 1931 (2°) standard colorimetric observer.

The position of the sample in the measuring system will be indicated by an orientation mark. The orientation mark has to be adjusted 90° to the incident plane. The incident plane is formed out of the rectangle on the sample surface and the incoming light beam.

The chromaticity coordinates shall be within the colour boxes and the Luminance factor shall comply with values in Table 3.2.1.

Colour	Chromaticity Coordinates				Luminance Factor β		
		1	2	3	4	Class B1	Class B2
White	x	0.305	0.335	0.325	0.295	≥ 0.27	≥ 0.40
	y	0.315	0.345	0.355	0.325		
Yellow	x	0.494	0.470	0.513	0.545	≥ 0.16	≥ 0.24
	y	0.505	0.480	0.437	0.454		
Red	x	0.735	0.700	0.610	0.660	≥ 0.03	≥ 0.03
	y	0.265	0.250	0.340	0.340		
Orange	x	0.631	0.560	0.506	0.570	≥ 0.14	≥ 0.14
	y	0.369	0.360	0.404	0.429		
Green	x	0.110	0.170	0.170	0.110	≥ 0.03	≥ 0.03
	y	0.415	0.415	0.500	0.500		
Green 2 (Dark green)	x	0.313	0.313	0.248	0.127	0.01 – 0.07	0.01 – 0.07
	y	0.682	0.453	0.409	0.557		
Brown	x	0.455	0.523	0.479	0.558	0.04 – 0.06	0.03 – 0.09
	y	0.397	0.429	0.373	0.394		
Blue	x	0.130	0.160	0.160	0.130	≥ 0.01	≥ 0.01
	y	0.090	0.090	0.140	0.140		

Table 3.2.1 – Permitted colour area in CIE 1931 diagram and Luminance factors for daylight appearance of new materials

3.2.2. Coefficient of Retroreflection

The coefficient of retro-reflection R' is measured in accordance with CIE Publication No. 54.2, Retro-reflection using CIE Standard Illuminant A. Any of the recommended apertures may be used. Measurements shall be taken at the specified observation angle α, entrance angle β, rotation angle ε, and orientation angle ω_S. The entrance angle β shall be set by its first component β₁ with the second component β₂ = 0°, the rotation angle ε shall be ε = 0° and the orientation angle shall be ω_S = 0°.

The requirements of minimum coefficient of Retro-reflection R' are specified in Table 15 of the relevant CUAP (reproduced in this ETA). RA1. Also specified in EN 12899-1: 2007, Clause 4.1.

Geometry of measurements		Colour							
α	β_1 ($\beta_2 = 0$)	White	Yellow	Red	Green	Blue	Brown	Orange	Grey
12'	+5°	70	50	14,5	9	4	1	25	42
	+30°	30	22	6	3,5	1,7	0,3	10	18
	+40°	10	7	2	1,5	0,5	#	2,2	6
20'	+5°	50	35	10	7	2	0,6	20	30
	+30°	24	16	4	3	1	0,2	8	14,4
	+40°	9	6	1,8	1,2	#	#	2,2	5,4
2°	+5°	5	3	1	0,5	#	#	1,2	3
	+30°	2,5	1,5	0,5	0,3	#	#	0,5	1,5
	+40°	1,5	1,0	0,5	0,2	#	#	#	0,9

indicates "Value greater than zero but not significant or applicable".

CUAP, Table 15: Minimum coefficient of Retro-reflection, Performance class RA1

For material processed with process colours, with or without clear overlay film, the minimum value of the coefficient of Retro-reflection shall not be less than 70% of the values specified in the tables. For material processed with red process colour or red overlay film over yellow microprismatic sheeting, the coefficient of Retro-reflection shall not be less than 50% of the values specified in the tables. The material will be evaluated against the values in Table 15 of the relevant CUAP (reproduced in this ETA) (RA1).

3.2.3. Rotational symmetry

When measured according to clause 3.2.2, rotational symmetry, for the observation angle $\alpha = 0.33^\circ$ and entrance angle $\beta_1 = 5^\circ$ ($\beta_2 = 0^\circ$), the ratio between the minimum and the maximum coefficient of Retro-reflection when rotating from $\epsilon - 75^\circ$ to $+ 50^\circ$ in 25° steps, shall not be greater than 2.5.1.

3.2.4. Impact resistance

The test is carried out according to EN 12899-1 using a hard body having a mass of 450 g with a contact radius of 50 mm. The hard body is dropped from a height of 220 mm on a sample that shall be supported over an open area 100 mm x 100 mm.

3.3. Visibility after accelerated artificial weathering

The apparatus shall be either an air cooled or water cooled Xenon arc weathering device capable of exposing samples in accordance with ISO 4892-2: 1994.

Preparation of test specimens should be in accordance with the general guideline given in ISO 4892-2: 1994.

The samples shall be exposed in accordance to ISO 4892-2: 1994 using the parameters given in the following table, for a period of 2000 hours.

Exposure parameters	Air cooled lamp	Water cooled lamp
Light/dark/water spray cycle	Continuous light with water spray on specimens for 18 minutes every 2 hours	Continuous light with water spray on specimens for 18 minutes every 2 hours
Black standard temperature during light only periods	(65 ± 3) °C using a black standard thermometer	(65 ± 3)°C using a black standard thermometer
Relative humidity	(50 ± 5) %	(50 ± 5) %
Irradiance (W/m ²) controlled at		
- over 300-400 nm range	60	60
- over 300-800 nm range	550	630

Table 3.3 – Artificial weathering test parameters

Note 1 – Water used for specimen spray should contain no more than 1 ppm silica. Higher levels of silica may produce spotting on samples and variability in results. Water of the required purity may be obtained by distillation or by a combination of deionisation and revers osmosis.

Note 2 – Whilst irradiance levels should be set at the above levels, variations in filter ages and transmissivity, and in calibration variations, will be generally mean that irradiance error will be in the order of ± 10%.

After exposure the chromaticity co-ordinates and Luminance factor measured according to clause 3.2.1, shall comply with the requirements specified in Table 3.4, as appropriate.

Colour		Chromaticity Coordinates				Luminance Factor β	
		1	2	3	4	Class B1	Class B2
White	x	0.355	0.305	0.285	0.335	≥ 0.27	≥ 0.40
	y	0.355	0.305	0.325	0.375		
Yellow	x	0.545	0.487	0.427	0.465	≥ 0.16	≥ 0.24
	y	0.454	0.423	0.483	0.534		
Red	x	0.735	0.674	0.569	0.655	≥ 0.03	≥ 0.03
	y	0.265	0.236	0.341	0.345		
Green	x	0.007	0.248	0.177	0.026	≥ 0.03	≥ 0.03
	y	0.703	0.409	0.362	0.399		
Green 2 (Dark green)	x	0.313	0.313	0.248	0.127	0.01 – 0.07	0.01 – 0.07
	y	0.682	0.453	0.409	0.557		
Brown	x	0.455	0.523	0.479	0.558	0.04 – 0.06	0.03 – 0.09
	y	0.397	0.429	0.373	0.394		
Blue	x	0.078	0.150	0.210	0.137	≥ 0.01	≥ 0.01
	y	0.171	0.220	0.160	0.038		

Table 3.4 – Permitted colour area in CIE 1931 diagram and Luminance factors for daylight appearance after accelerated weathering test or after outdoor exposure

After exposure the coefficient of retro-reflection measured at an observation angle $\alpha = 0.33^\circ$ (or $\alpha = 0.2^\circ$) ($\alpha = 1^\circ$ can be omitted as it is not specified for table 15 – RA1) and entrance angle $\beta_1 = 5^\circ$ and 30° ($\beta_2 = 0^\circ$), shall not be less than 80% of the values required for new material under table 15 (RA1).

4. Evaluation of Conformity and CE Marking

4.1 Attestation of conformity system

The system of attestation of conformity is System 1 as described in Council Directive 89/106/EEC. Annex III, Clause 2 "Certification of Conformity of the product by an Approved Body and is detailed as followed :

a) Task for the manufacturer

(1) Factory Production Control (FPC), including further testing of samples taken at the factory by the manufacturer in accordance with the prescribed test plan.

b) Tasks of the approval body

- (2) Initial Type Testing (ITT) of the product
- (3) Initial inspection of the factory and of the Factory Production Control (FPC)
- (4) Continuous surveillance, assessment and approval of the FPC.

4.2 . Responsibilities

4.2.1. Tasks of the manufacturer

4.2.1.1. Factory Production Control (FPC)

The ETA holder has a FPC system in his plants and exercises permanent internal control of the production, including test samples in accordance with his control plan.

The control plan and the provisions taken by the ETA holder for components not produced by him have been agreed with the Approval Body and deposited with UBAtc where it is only made available to Notified Bodies involved in the conformity attestation procedure.

This control plan will be given to the Notified Body chosen by the ETA holder to perform the foreseen tasks on attestation of conformity.

The manufacturer only uses raw materials supplied with the relevant inspection documents as laid down in the control plan. The incoming raw materials are subjected to verifications by the manufacturer before acceptance.

All the elements, requirements and provisions adopted by the manufacturer are documented in a systematic manner in the form of written processes and procedures. This production control system ensures that "3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430", "3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430" + "3M™ Electrocute Series 1170" and 3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430 printed with " 3M™ Process Colour Series 880 N or I ", and their components are in conformity with this ETA.

The results of FPC are recorded and evaluated. The records include:

- Designation of the product, raw materials and components.
- Type of control or testing
- Date of the product's manufacture and date of testing of the product or raw materials and components.
- Results of controls and testing and, if appropriate, comparison with requirements.
- Signature of person responsible for FPC.

The records shall be presented to the inspection body during the continuous surveillance. On request, they shall be presented to UBAtc.

Details of the extent, nature and frequency of testing and controls to be performed with FPC shall correspond to the control plan which is part of the technical documentation of this ETA.

4.2.1. Task of the Notified Body.

4.2.1.1. Initial Type Testing (ITT)

For ITT, the results of the test performed as part of the assessment for this ETA shall be used unless there are changes in the production line or plant. In such cases, the necessary new ITT has been agreed between UBAtc and the Notified Body involved. These tests could be taken over by the manufacturer for Declaration of Conformity.

4.2.1.2. Initial Inspection of factory and Factory Production Control (FPC)

The Notified Body shall ascertain that, in accordance with the control plan the factory (in particular, employees and equipment) and the FPC are suitable to ensure continuous and orderly manufacturing of the components according to specifications mentioned in clause 2 of this ETA.

4.2.1.3. Continuous surveillance, assessment and approval of FPC.

The Notified Body should visit the factory at least once a year for surveillance. It has to be verified that the system of FPC and the specified manufacturing process are maintained, taking into account the deposited control plan. Continuous surveillance and assessment of FPC have to be performed in accordance to the control plan.

During each visit, the Notified Body shall utilize an ad-hoc check list and shall examine, among others:

- the control registers of raw materials, semi-finished products and finished products.
- The document attesting the respect of the control frequencies.
- The conformity of the products subjected to this ETA.

In cases where the provisions of the ETA and the control plan are no longer fulfilled, the conformity certificate should be withdrawn.

4.3. CE Marking

The CE marking shall be affixed on the packaging or on the transport documents (DDT) accompanying the components of the product. The symbol "CE" shall be followed by identification number of the Notified Body involved and shall be accompanied by the following information:

- Name or identification mark of the ETA holder and name of his manufacturing plant.
- Legal address of the ETA holder
- The last 2 digits of the year in which the CE marking was affixed.
- The number of the CE certificate of conformity of FPC
- The number of the ETA
- 3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430, or 3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430 + "3M™ Electrocut Series 1170", or , 3M™ Engineer Grade Prismatic Reflective Sheeting Series 3430 printed with "3M™ Process Colour Series 880 N or I "

5. Assumptions under which the fitness of the products for the intended use was favourably assessed.

5.1. Manufacturing

The "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" components, shall correspond, as far as their composition and manufacturing process is concerned, to the products subject to the approval tests. A manufacturing process has been deposited with UBAtc.

5.2. Installation

5.2.1. 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 2.1 of this ETA, are effectively communicated to the concerned people. This information can 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 can 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 "

5.2.2. Design

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

5.2.3. Application

5.2.3.1. “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 catalogue, its technical bulletins and web site 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, hand application. If the heater is needed to warm to the minimum application temperature of 18°C, it must 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.

5.2.3.2. “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 on sprocket fed cutters. It is recommended that inside radius corner fonts be used when cutting film. More over the ETA holder recommend 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 can be applied either by hand using a plastic squeegee or through a hand squeeze roll laminator. If applying the transfer tape by hand, care must 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 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.

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

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

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

6. Recommendations

6.1. Packaging, Transport and Storage

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

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

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

Coloured overlay 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.

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

CUAP 01.06/04, Table 1 – Use options

VISIBILITY		USE OPTIONS												
		Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9	Option 10	Option 11	Option 12	
Daytime Colour		Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	
Luminance factor		Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	Tm 4.4.2.1 Lv 5.4.1	
Fluorescence Luminance factor		NOT TO BE TESTED	NOT TO BE TESTED	Tm 4.4.2.2 Lv 5.4.2	NOT TO BE TESTED	Tm 4.4.2.2 Lv 5.4.2	NOT TO BE TESTED	NOT TO BE TESTED	Tm 4.4.2.2 Lv 5.4.2	NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED	
Night-time colour		NOT TO BE TESTED	Tm 4.4.2.3 Lv 5.4.3	Tm 4.4.2.3 Lv 5.4.3	Tm 4.4.2.3 Lv 5.4.3	Tm 4.4.2.3 Lv 5.4.3	Tm 4.4.2.3 Lv 5.4.3	NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED	Tm 4.4.2.3 Lv 5.4.3	NOT TO BE TESTED	
Coefficient of Retro-reflection-Case A or Case B		Tm 4.4.2.4 Lv 5.4.4	Tm 4.4.2.4 Lv 5.4.4	Tm 4.4.2.4 Lv 5.4.4	Tm 4.4.2.4 Lv 5.4.4	Tm 4.4.2.4 Lv 5.4.4	Tm 4.4.2.4 Lv 5.4.4	Tm 4.4.2.4 Lv 5.4.4	Tm 4.4.2.4 Lv 5.4.4	Tm 4.4.2.4 Lv 5.4.4	Tm 4.4.2.4 Lv 5.4.4	Tm 4.4.2.4 Lv 5.4.4	Tm 4.4.2.4 Lv 5.4.4	
Colour Contrast Factors		NOT TO BE TESTED	Tm 4.4.2.5 Lv 5.4.5	NOT TO BE TESTED	Tm 4.4.2.5 Lv 5.4.5	NOT TO BE TESTED	Tm 4.4.2.5 Lv 5.4.5	Tm 4.4.2.5 Lv 5.4.5	NOT TO BE TESTED	Tm 4.4.2.5 Lv 5.4.5	NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED	
Total luminous transmittance		NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED	Tm 4.4.2.6 Lv 5.4.6	NOT TO BE TESTED	Tm 4.4.2.6 Lv 5.4.6	NOT TO BE TESTED	NOT TO BE TESTED	Tm 4.4.2.6 Lv 5.4.6	NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED	
Impact resistance		Tm 4.4.2.7 Lv 5.4.7	Tm 4.4.2.7 Lv 5.4.7	Tm 4.4.2.7 Lv 5.4.7	Tm 4.4.2.7 Lv 5.4.7	Tm 4.4.2.7 Lv 5.4.7	Tm 4.4.2.7 Lv 5.4.7	Tm 4.4.2.7 Lv 5.4.7	Tm 4.4.2.7 Lv 5.4.7	Tm 4.4.2.7 Lv 5.4.7	Tm 4.4.2.7 Lv 5.4.7	Tm 4.4.2.7 Lv 5.4.7	NOT TO BE TESTED	
DURABILITY														
Temperature resistance		NOT TO BE TESTED	Tm 4.7.1 Lv 5.7.1	Tm 4.7.1 Lv 5.7.1	Tm 4.7.1 Lv 5.7.1	NOT TO BE TESTED	NOT TO BE TESTED	Tm 4.7.1 Lv 5.7.1	Tm 4.7.1 Lv 5.7.1	Tm 4.7.1 Lv 5.7.1	Tm 4.7.1 Lv 5.7.1	Tm 4.7.1 Lv 5.7.1	NOT TO BE TESTED	
Visibility after accelerated weathering test	Day-time colour (*)	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	
	Luminance factor (*)	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	Tm 4.7.2 + 4.4.2.1 Lv 5.7.2	
	Fluorescence Luminance factor (*)	NOT TO BE TESTED	NOT TO BE TESTED	Tm 4.7.2 + 4.4.2.2 Lv 5.7.3	NOT TO BE TESTED	Tm 4.7.2 + 4.4.2.2 Lv 5.7.3	NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED	4.7.2 + 4.4.2.2 Lv 5.7.3	NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED
	Coefficient of Retro-reflection (*)	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4	Tm 4.7.2 + 4.4.2.4 Lv 5.7.4
Visibility after outdoor exposure	Day-time colour	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	
	Luminance factor	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	
	Coefficient of Retro-reflection	Tm 4.7.3 + 4.4.2.1 Lv 5.7.2	Tm 4.7.3 + 4.4.2.4 Lv 5.7.4	Tm 4.7.3 + 4.4.2.4 Lv 5.7.4	Tm 4.7.3 + 4.4.2.4 Lv 5.7.4	Tm 4.7.3 + 4.4.2.4 Lv 5.7.4	Tm 4.7.3 + 4.4.2.4 Lv 5.7.4	Tm 4.7.3 + 4.4.2.4 Lv 5.7.4	Tm 4.7.3 + 4.4.2.4 Lv 5.7.4	Tm 4.7.3 + 4.4.2.4 Lv 5.7.4	Tm 4.7.3 + 4.4.2.4 Lv 5.7.4	Tm 4.7.3 + 4.4.2.4 Lv 5.7.4	Tm 4.7.3 + 4.4.2.4 Lv 5.7.4	
	Fluorescence Luminance factor	NOT TO BE TESTED	NOT TO BE TESTED	Tm 4.7.3 + 4.4.2.2 Lv 5.7.3	NOT TO BE TESTED	Tm 4.7.3 + 4.4.2.2 Lv 5.7.3	NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED	Tm 4.7.3 + 4.4.2.2 Lv 5.7.3	NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED	NOT TO BE TESTED