

Trade name

1. **3M™ Diamond Grade™ DG³ Series 4000**
2. **3M™ Diamond Grade™ DG³ Series 4000 + 3M™ Electrocut Film Series 1170**
3. **3M™ Diamond Grade™ DG³ Series 4000 printed with 3M™ process colour series 880 I or N**

Approval holder

**3M Deutschland GmbH
Carl-Schurz-Str. 1
D- 41453 Neuss, Germany**

Website

www.3m.com

Generic type and use
of construction system

Micro-prismatic retro-reflective sheeting for traffic signs

Validity from:

2013-06-27

To :

2018-06-26

Manufacturing plant(s) :

**3M Deutschland GmbH Plant Hilden, Düsseldorferstr.
121-125, D-40705 Hilden, Germany
3M Brownwood, Texas 76801 - US**

This version replaces

ETA 11/0521 valid from 2011-12-23 until 2016-12-22

This European Technical
Approval contains :

22 pages including 1 annex which forms an integral part of the document



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 ETA 07/0272, the performance after outdoor exposure (use option 10, see Annex 1) was added through ETA 11/051. ETA 07/0272 covered 880I ink but was designated as 880 ink series to demonstrate that both 880I and 880N series were covered.
9. Compared with the previous version of this ETA, red ink 882 has been added as a new combination.

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 and scope of product and intended use

1.1 General

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

The product is supplied as a single coloured sheet whose trade name is "3M™ DIAMOND GRADE™ DG³ series 4000", or as a single coloured sheet with a coloured overlay film whose trade name is "3M DIAMOND GRADE DG³ series 4000 + Electrocut Film series 1170" or as a single coloured sheet printed with process colour whose trade name is "3M DIAMOND GRADE DG³ series 4000" printed with "PROCESS COLOUR SERIES 880I or 880N".

This ETA contains:

Extension of ETA 07/0272;	1.) 3M™ Diamond Grade™ DG ³ Series 4000
Addition of performance after outdoor exposure	2.) 3M™ Diamond Grade™ DG ³ Series 4000 + 3M™ Electrocut Film Series 1070
Use option 10, see Annex 1	3.) 3M™ Diamond Grade™ DG ³ Series 4000 printed with 3M™ process colour series 880 I or N

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. ETA 07/0272 covered 880I ink but was designated as 880 ink series to demonstrate that both 880I and 880N series are covered.

1.2 Components

An overview of the complete set of components of "3M™ Diamond Grade™ DG³ series 4000", and combinations with or without "3M™ Electrocut Film series 1170" or "Process Colour Series 880 I & N", is presented in Table 1.

Components		Trade name	Colours/code	Characteristics	
Micro-prismatic retro-reflective sheeting		3M™ Diamond Grade™ DG ³ Reflective Sheeting Series 4000	White	4090	Thickness: 0,32 - 0,49 mm Rolls in various lengths and widths
			Red	4092	
			Yellow	4091	
			Green	4097	
			Blue	4095	
			Fluorescent Yellow	4081	
			Fluorescent Orange	4084	
			Fluorescent Yellow/Green	4083	
Overlay film		3M™ Electrocut Film Series 1170	Yellow	1171	Combined Thickness: 0,549 mm Rolls in various length and widths
			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 m ² /l
			Blue	883 I or N	
			Green	888 I or N	
			Red*	882 I or N	
			French Red	889 I or N	

This ETA introduces Red 882 ink as a new combination and covers both initial and after outdoor exposure data.

Table 1 - Components of the product

1.3 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 (See also EN 12899-1)
- trans-illuminated traffic bollards (See also EN 12899-2)
- road delineators with retro-reflective devices (See also EN 12899-3)
- variable message signs (See also EN 12966-1)

The intended use excludes road-markings as defined in EN 1436. 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 Approval Body.

2 Characteristics of product(s) and methods of verification

2.1 General

The identification tests and the assessment of fitness for use of the "3M Diamond Grade DG³ series 4000", and combinations with or without "3M Electrocut Film series 1170" or "Process Colour Series 880 I & N" were carried out according to the verification methods in clause 3 of this ETA.

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 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.

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

2.2 Characteristics of the product "3M Diamond Grade DG³ series 4000", and combinations with or without "3M Electrocut Film series 1170" or "Process Colour Series 880 I & N"

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 Diamond Grade DG³ series 4000"

2.2.2.1 Visibility of "3M Diamond Grade DG³ series 4000"

2.2.2.1.1 Day-time colour and Luminance Factor

The characteristics of Day-time colour and Luminance Factor (see Table 2) have been determined according to clause 3.2.1

Colours		Chromaticity Coordinates				Pass/fail	Luminance Factor β
		1	2	3	4		Class
White	x	0.305	0.335	0.325	0.295	Pass	B2
	y	0.315	0.345	0.355	0.325		≥ 0.40
Yellow	x	0.494	0.470	0.513	0.545	Pass	B2
	y	0.505	0.480	0.437	0.454		≥ 0.24
Red	x	0.735	0.700	0.610	0.660	Pass	B2
	y	0.265	0.250	0.340	0.340		≥ 0.03
Green	x	0.110	0.170	0.170	0.110	Pass	B2
	y	0.415	0.415	0.500	0.500		≥ 0.03
Blue	x	0.130	0.160	0.160	0.130	Pass	B2
	y	0.090	0.090	0.140	0.140		≥ 0.01
Fluorescent yellow	x	0.521	0.557	0.479	0.454	Pass	B2
	y	0.424	0.442	0.520	0.491		≥ 0.38
Fluorescent orange	x	0.595	0.645	0.570	0.531	Pass	B2
	y	0.351	0.355	0.429	0.414		≥ 0.20
Fluorescent yellow/green	x	0.387	0.460	0.438	0.376	Pass	B2
	y	0.610	0.540	0.508	0.568		≥ 0.70

Table 2 - Day-time colour and Luminance Factor

2.2.2.1.2 Coefficient of Retro-reflection Case A

The Coefficient of Retro-reflection R' - Case A (see Table 3) has been determined according to clause 3.2.2.

The tested samples pass for all corresponding colours in tables 7 to 15 of clause 3.2.2.

Colour	Class RA1	Class RA2	Class R3A Germany	Class R3B Germany	Class R3B Belgium	Class R3B Greece	Class 3A Belgium
White	pass	pass	pass	pass	pass	pass	
Yellow	pass	pass	pass	pass	pass	pass	
Red	pass	pass	pass	pass	pass	pass	
Blue	pass	pass	pass	pass	pass	pass	
Green	pass	pass	pass	pass	pass	pass	
Fluorescent Yellow			pass*	pass*	pass*	pass*	
Fluorescent Orange			pass*	pass*			pass
Fluorescent Yellow/Green			pass*	pass*	pass	pass*	

* Requirements of regular yellow are used for assessing fluorescent yellow and fluorescent yellow/green. Requirements of regular orange are used for assessing fluorescent orange.

Table 3 - Coefficient of Retro-reflection R'

2.2.2.1.3 Rotational symmetry

The rotational symmetry (see Table 4) has been determined according to clause 3.2.3

	Pass/Fail
White	Pass
Yellow	Pass
Red	Pass
Blue	Pass
Green	Pass
Fluorescent Yellow	Pass
Fluorescent Yellow/Green	Pass
Fluorescent Orange	Pass

2.2.2.1.4 Impact resistance

The Impact resistance (see Table 5) has been determined according to clause 3.2.4

Tabel 4 - Rotational symmetry

Product	Colours	Pass/fail
"3M DIAMOND GRADE DG ³ series 4000"	White 4090	Pass: no cracking has been observed outside the impact area.
	Red 4092	
	Yellow 4091	
	Green 4097	
	Blue 4095	
	Fluorescent Yellow 4081	
	Fluorescent Orange 4084	
	Fluorescent Yellow/Green 4083	

Tabel 5 - Impact resistance

2.2.3 Durability of "3M Diamond Grade DG³ serie 4000"

2.2.3.1 Temperature resistance

The temperature resistance (see Table 6) has been determined according to clause 3.5.

Product	Colours	Class
"3M DIAMOND GRADE DG ³ series 4000"	White 4090	1 [80°C (± 2)]
	Red 4092	
	Yellow 4091	
	Green 4097	
	Blue 4095	
	Fluorescent Yellow 4081	
	Fluorescent Orange 4084	
	Fluorescent Yellow/Green 4083	

Tabel 6 - Temperature resistance

2.2.3.2 Visibility after outdoor exposure of "3M DIAMOND GRADE DG³ Series 4000"

2.2.3.2.1 Day-time colour and Luminance factor after outdoor exposure test of "3M DIAMOND GRADE DG³ series 4000"

Day-time colour and Luminance factor (see Table 7) after outdoor exposure have been determined according to clause 3.4.

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 results		Pass				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 results		Pass				Class B2	
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 results		Pass				Class B2	
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 results		Pass				Class B2	
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 results		Pass				Class B2	
Fluorescent yellow reference	x	0.521	0.557	0.479	0.454	≥ 0.38	≥ 0.38
	y	0.424	0.442	0.520	0.491		
Fluorescent yellow results		Pass				Class B2	
Fluorescent orange reference	x	0.595	0.645	0.570	0.531	≥ 0.25	≥ 0.20
	y	0.351	0.355	0.429	0.414		
Fluorescent orange results		Pass				Class B2	
Fluorescent yellow/green reference	x	0.387	0.460	0.438	0.376	≥ 0.50	≥ 0.50
	y	0.610	0.540	0.508	0.568		
Fluorescent yellow/green results		Pass				Class B2	

Tabel 7 - Day-time colour and Luminance factor

2.2.3.2.2 Coefficient of retro-reflection Case A (see Table 8) after outdoor exposure test of "3M DIAMOND GRADE DG³ series 4000"

The tests were performed according to 3.4. The values shall not be less than 80% of the values required for new material under clause 3.2.2, as appropriate.

Colour	Class RA1	Class RA2	Class R3A Germany	Class R3B Germany	Class R3B Belgium	Class R3B Greece	Class 3A Belgium
White	Pass	Pass	Pass	Pass	Pass	Pass	
Yellow	Pass	Pass	Pass	Pass	Pass	Pass	
Red	Pass	Pass	Pass	Pass	Pass	Pass	
Blue	Pass	Pass	Pass	Pass	Pass	Pass	
Green	Pass	Pass	Pass	Pass	Pass	Pass	
Fluorescent Yellow			Pass*	Pass*	Pass*	Pass*	
Fluorescent Orange			Pass*	Pass*			Pass
Fluorescent Yellow/Green			Pass*	Pass*	Pass	Pass*	

* Requirements of regular yellow are used for assessing fluorescent yellow and fluorescent yellow/green. Requirements of regular orange are used for assessing fluorescent orange.

Tabel 8 - Coefficient of retro-reflection

2.2.4 Safety in use of “3M Diamond Grade DG³ series 4000 + Electrocut Film series 1170”

2.2.4.1 Visibility of “3M Diamond Grade DG³ series 4000 + Electrocut Film series 1170”

2.2.4.1.1 Day-time colour and Luminance Factor

The characteristics of Day-time colour and Luminance Factor (see Table 9) have been determined according to clause 3.2.1.

Colours		Chromaticity Coordinates				Pass/ fail	Luminance Factor β
		1	2	3	4		Class
Yellow on white	x	0.494	0.470	0.513	0.545	Pass	B2
	y	0.505	0.480	0.437	0.454		≥ 0.24
Red on White	x	0.735	0.700	0.610	0.660	Pass	B2
	y	0.265	0.250	0.340	0.340		≥ 0.03
Green on White	x	0.110	0.170	0.170	0.110	Pass	B2
	y	0.415	0.415	0.500	0.500		≥ 0.03
Brown on White	x	0.455	0.523	0.479	0.558	Pass	B2
	y	0.397	0.429	0.373	0.394		0.03 – 0.09
Blue on White	x	0.130	0.160	0.160	0.130	Pass	B2
	y	0.090	0.090	0.140	0.140		≥ 0.01

Tabel 9 - Day-time colour and Luminance Factor

2.2.4.1.2 Coefficient of Retro-reflection Case A

The Coefficient of Retro-reflection R' - Case A (see Table 10) has been determined according to clause 3.2.2.

Colour	Class RA1	Class RA2	Class R3A Germany	Class R3B Germany	Class R3B Belgium	Class R3B Greece
Yellow on white	pass	pass	pass	pass	pass	pass
Red on White	pass	pass	pass	pass	pass	pass
Green on White	pass	pass	pass	pass	pass	pass
Brown on White	pass	pass	pass	pass	pass	pass
Blue on White	pass	pass	pass	pass	pass	pass

Tabel 10 - Coefficient of Retro-reflection R' - Case A

2.2.4.1.3 Rotational symmetry

The rotational symmetry (see Table 11) has been determined according to clause 3.2.3.

Colours	Pass/fail
Brown on White	Pass
Yellow on White	Pass
Red on White	Pass
Blue on White	Pass
Green on White	Pass

Tabel 11 - Rotational symmetry

2.2.4.1.4 Impact resistance

The Impact resistance (see Table 12) has been determined according to clause 3.2.4.

Product	Colour of the sheeting	Colour of the film		Pass/fail
"3M DIAMOND GRADE DG ³ series 4000 + Electrocut Film Series 1170"	White 4090	Yellow	1171	Pass: no cracking has been observed outside the impact area.
		Red	1172	
		Blue	1175	
		Green	1177	
		Brown	1179	

Tabel 12 - Impact resistance

2.2.5 Durability "3M Diamond Grade DG³ series 4000 + Electrocut Film series 1170"

2.2.5.1 Temperature resistance

The temperature resistance (see Table 13) has been determined according clause 3.5.

Product	Colours of the sheeting	Colours of the film		Class
"3M DIAMOND GRADE DG ³ series 4000 + Electrocut Film Series 1170"	White 4090	Yellow	1171	1 [80°C (± 2)]
		Red	1172	
		Blue	1175	
		Green	1177	
		Brown	1179	

Tabel 13 – Temperature resistance

2.2.5.2 Visibility after outdoor exposure test of "3M DIAMOND GRADE DG³ series 4000 + Electrocut Film Series 1170"

2.2.5.2.1 Day-time colour and Luminance factor after outdoor exposure test of "3M DIAMOND GRADE DG³ series 4000 + Electrocut Film Series 1170"

Day-time colour and Luminance factor (see Table 14) after outdoor exposure have been determined according to clause 3.4.

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 on White		Pass				Class B2	
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 on White results		Pass				Class B2	
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 on White results		Pass				Class B2	
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 on White results		Pass				Class B2	
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 on White results		Pass				Class B2	

Table 14 - Day-time colour and Luminance factor

2.2.5.2.2 Coefficient of retro-reflection Case A (see Table 15) after outdoor exposure test of "3M DIAMOND GRADE DG³ series 4000 + Electrocut Film Series 1170"

The tests were performed according to clause 3.4. The values shall not be less than 80% of the values required for new material under clause 3.2.2, as appropriate.

Colour	Class RA1	Class RA2	Class R3A Germany	Class R3B Germany	Class R3B Belgium	Class R3B Greece
Yellow	Pass	Pass	Pass	Pass	Pass	Pass
Red	Pass	Pass	Pass	Pass	Pass	Pass
Blue	Pass	Pass	Pass	Pass	Pass	Pass
Green	Pass	Pass	Pass	Pass	Pass	Pass
Brown	Pass	Pass				

Table 15 - Coefficient of retro-reflection Case A

2.2.6 Safety in use of "3M Diamond Grade DG³ series 4000 printed with "PROCESS COLOUR series 880"

2.2.6.1 Visibility of "3M Diamond Grade DG³ series 4000 printed with "PROCESS COLOUR series 880"

2.2.6.1.1 Day-time colour and Luminance Factor

The characteristics of Day-time colour and Luminance Factor (see Table 16) have been determined according to clause 3.2.1.

Colours		Chromaticity Coordinates				Pass/ fail	Luminance Factor β
		1	2	3	4		Class
Yellow on white	x	0.494	0.470	0.513	0.545	Pass	B2
	y	0.505	0.480	0.437	0.454		≥ 0.24
Red on White	x	0.735	0.700	0.610	0.660	Pass	B2
	y	0.265	0.250	0.340	0.340		≥ 0.03
Green on White	x	0.110	0.170	0.170	0.110	Pass	B2
	y	0.415	0.415	0.500	0.500		≥ 0.03
Blue on White	x	0.130	0.160	0.160	0.130	Pass	B2
	y	0.090	0.090	0.140	0.140		≥ 0.01

Tabel 16 - Day-time colour and Luminance Factor

2.2.6.1.2 Coefficient of Retro-reflection Case A

The Coefficient of Retro-reflection - Case A (see Table 17) has been determined according to clause 3.2.2.

Colour	Class RA1	Class RA2	Class R3A Germany	Class R3B Germany	Class R3B Belgium	Class R3B Greece
Yellow on white	pass	pass	pass	pass	pass	pass
Red on White	pass	pass	pass	pass	pass	pass
Green on White	pass	pass	pass	pass	pass	pass
Blue on White	pass	pass	pass	pass	pass	pass

Tabel 17 - Coefficient of Retro-reflection - Case A

2.2.6.1.3 Rotational symmetry

The rotational symmetry (See Table 18) has been determined according to clause 3.2.3.

Colours	Pass/fail
Yellow on White	Pass
Red on White	Pass
Blue on White	Pass
Green on White	Pass

2.2.6.1.4 Impact resistance

The Impact resistance (see Table 19) has been determined according to clause 3.2.4.

Tabel 18 - Rotational symmetry

Product	Colour of the sheeting	Colour of the ink	Observations after the test	
"3M DIAMOND GRADE DG ³ series 4000" printed with "PROCESS COLOUR SERIES 880"	White	4090	Pass: no cracking has been observed outside the impact area.	
		Yellow		884
		Red		889
		Red		882
		Blue		883
		Green	888	

Tabel 19 - Impact resistance

2.2.7 Durability "3M Diamond Grade DG³ series 4000" printed with "PROCESS COLOUR SERIES 880 I or N"

2.2.7.1 Temperature resistance

The temperature resistance (see Table 20) has been determined according to clause 3.5.

Product	Colours of the sheeting	Colours of the ink	Class
"3M DIAMOND GRADE DG ³ series 4000" printed with "PROCESS COLOUR SERIES 880"	White 4090	Yellow 884	1 [80°C (± 2)]
		Red 889	
		Red 882	
		Blue 883	
		Green 888	

Tabel 20 - Temperature resistance

2.2.7.2 Visibility after outdoor exposure of "3M DIAMOND GRADE DG³ series 4000" printed with "PROCESS COLOUR SERIES 880"

2.2.7.2.1 Day-time colour and Luminance factor (see Table 21) after outdoor exposure test of "3M DIAMOND GRADE DG³ series 4000" printed with "PROCESS COLOUR SERIES 880"

The tests were performed according to clause 3.4.

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 on White results		Pass				Class B2	
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 on White results		Pass				Class B2	
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 on White results		Pass				Class B2	
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 on White results		Pass				Class B2	

Tabel 21 - Day-time colour and Luminance factor

2.2.7.2.2 Coefficient of retro-reflection Case A (see Table 22) after outdoor exposure test of "3M DIAMOND GRADE DG³ series 4000" printed with "PROCESS COLOUR SERIES 880 I or N"

The tests were performed according to clause 3.4. The values shall not be less than 80% of the values required for new material under clause 3.2.2, as appropriate.

Colour	Class RA1	Class RA2	Class R3A Germany	Class R3B Germany	Class R3B Belgium	Class R3B Greece
Yellow	Pass	Pass	Pass	Pass	Pass	Pass
Red	Pass	Pass	Pass	Pass	Pass	Pass
Blue	Pass	Pass	Pass	Pass	Pass	Pass
Green	Pass	Pass	Pass	Pass	Pass	Pass

Tabel 22 - Coefficient of retro-reflection Case A

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 shall comply 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 23.

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	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		
Fluorescent Yellow	x	0.521	0.557	0.479	0.454	≥ 0.38	≥ 0.38
	y	0.424	0.442	0.520	0.491		
Fluorescent Orange	x	0.595	0.645	0.570	0.531	≥ 0.25	≥ 0.20
	y	0.351	0.355	0.429	0.414		
Fluorescent Yellow/Green	x	0.387	0.460	0.438	0.376	≥ 0.60	≥ 0.70
	y	0.610	0.540	0.508	0.568		

Table 23 – 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 and entrance angle β . The entrance angle β shall be set by its first component β_1 with the second component $\beta_2 = 0^\circ$, the rotation angle ε shall be $\varepsilon = 0^\circ$ and the orientation angle ω_s shall be $\omega_s = 0^\circ$.

The requirements of minimum coefficient of Retro-reflection R' are specified in the following tables 24 to 32.

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

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

Table 24 - Minimum Coefficient of Retroreflection, Performance Class RA2 Europe (EN 12899-1)

Observation Angle α [°]	Entrance Angle β_1 [°]	White	Yellow	Red	Orange	Blue	Green	Green2 ¹	Brown ²
0.1	5	850	550	170	425	55	85	68	42.5
0.2	5	625	400	125	310	40	60	50	31.25
0.33	5	425	275	85	210	28	40	34	21.25
0.1	20	600	390	120	300	40	60	48	30
0.2	20	450	290	90	225	30	45	36	22.5
0.33	20	300	195	60	150	20	30	24	15
0.1	30	425	275	85	210	28	40	34	21.25
0.2	30	325	210	65	160	20	30	26	16.25
0.33	30	225	145	45	110	15	20	18	11.25
0.1	40	275	175	55	135	18	25	22	13.75
0.2	40	200	130	40	100	13	20	16	10
0.33	40	150	95	30	75	10	15	12	7.5

(1) calculated as 8% of white
(2) calculated as 5% of white

Table 25 - Minimum Coefficient of Retroreflection, Performance Class R3A for Germany

Observation Angle α [°]	Entrance Angle β_1 [°]	White	Yellow	Red	Orange	Blue	Green
0.1	5	900	720	250	450	45	90
0.2	5	720	600	195	360	40	75
0.5	5	180	140	40	110	9	18
0.1	30	495	405	135	315	22	45
0.2	30	360	310	90	225	18	30
0.5	30	90	75	23	50	4	9
0.1	40	340	270	85	180	13	27
0.2	40	180	155	45	70	7	15
0.5	40	70	55	16	40	2.5	5

Tabel 26 - Minimum Coefficient of Retroreflection, Performance Class R3A for Greece

Geometry of measurement		Colours						
Observation Angle α [°]	Entrance Angle β_1 [°]	White	Yellow	Red	Blue	Green	Fluore-scent yellow (*)	Fluore-scent orange (**)
0.33	5	300	195	60	19	30	195	150
1.0	5	35	23	7	2.5	3.5	23	18
1.5	5	15	10	3	1	1.5	10	7.5
0.33	20	240	155	48	16	24	155	120
1.0	20	30	20	6	2	3	20	15
1.5	20	13	8	2.5	-	1	8	6.5
0.33	30	165	110	33	11	17	110	83
1.0	30	20	13	4	1.5	2	13	10
1.5	30	9	6	2	-	-	6	4.5
0.33	40	30	20	6	2	3	20	15
1.0	40	3.5	2	1	-	-	2	2
1.5	40	1.5	1	-	-	-	1	1

(*) For Fluorescent yellow the values of simple yellow have been used, in addition to reference in CUAP 01.06/04
(**) For Fluorescent orange the values of simple orange have been used, in addition to reference in CUAP 01.06/04

Tabel 27 - Minimum Coefficient of Retroreflection, Performance Class R3B for Germany

Geometry of measurement		Colours					
Observation Angle α [°]	Entrance Angle β_1 [°]	White	Yellow	Red	Blue	Green	Fluore-scent yellow (*)
0.2	5	400	300	80	20	45	300
0.33	5	300	250	75	15	33	250
1.0	5	70	55	13	3.5	8	55
0.2	30	150	105	30	11	24	105
0.33	30	130	90	30	7	18	90
1.0	30	45	35	10	2	4.5	35
0.2	40	45	35	9	3	7	35
0.33	40	30	25	7	1.4	4	25
1.0	40	13	10	4.5	-	1.8	10

(*) For Fluorescent yellow the values of simple yellow have been used

Tabel 28 - Minimum Coefficient of Retroreflection, Performance Class R3B for Greece

Geometry of measurement		Colours					
Observation Angle α [°]	Entrance Angle β_1 [°]	White	Yellow	Red	Blue	Green	Fluore-scent yellow (*)
0.2	5	430	350	110	25	45	350
0.33	5	300	250	75	17	35	250
1.0	5	80	65	20	5	10	65
0.2	15	350	270	90	20	35	270
0.33	15	250	200	65	15	25	200
1.0	15	60	45	16	3.5	7	45
0.2	30	235	190	60	11	24	190
0.33	30	150	130	35	7	18	130
1.0	30	50	40	13	2.5	5	40
0.2	40	55	40	12	3	7	40
0.33	40	30	25	7	2	4	25
1.0	40	15	13	5	1	2	13

(*) For Fluorescent yellow the values of simple yellow have been used

Tabel 29 - Minimum Coefficient of Retroreflection, Performance Class R3B for Belgium

Observation Angle α [°]	Entrance Angle β_1 [°]	Sheeting Colours
		Fluorescent orange
0.2	5	200
0.33	5	150
1.0	5	7,5
0.2	15	175
0.33	15	130
1.0	15	5
0.2	30	120
0.33	30	90
1.0	30	2,5
0.2	40	80
0.33	40	60
1.0	40	2,5

Tabel 30 - Minimum Coefficient of Retroreflection for Type 3A for Belgium

Observation Angle α [°]	Entrance Angle β_1 [°]	Sheeting Colours
		Fluorescent yellow/green
0.2	5	375
0.33	5	270
1.0	5	70
0.2	30	200
0.33	30	140
1.0	30	43
0.2	40	36
0.33	40	24
1.0	40	9

Tabel 31 - Minimum Coefficient of Retroreflection, Performance Class R3B for Belgium

Geometry measurements of		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".								

Table 32 - Minimum Coefficient of Retroreflection, Performance Class RA1 Europe (EN 12899-1)

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.

3.2.3 Rotational symmetry

Additional requirement for performance class 3A and 3B: 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 $\varepsilon - 75^\circ$ 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 of 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 EN ISO 4892-2:1994.

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

The samples shall be exposed in accordance to EN 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 33 - 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 reverse 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 weathering, following test shall be carried out

- day time colour (according to clause 3.2.1)
- Luminance factor (according to clause 3.2.1)
- Coefficient of Retroreflection – (according to clause 3.2.2)

After exposure the coefficient of retro-reflection measured at an observation angle $\alpha = 0.33^\circ$ (or $\alpha = 0.2^\circ$) and $\alpha = 1^\circ$ (if specified for new materials) 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 in 3.2.2.

3.4 Visibility after accelerated natural (outdoor) exposure

The retro-reflective sheeting surface of the test specimens of a minimum of 20 cm x 20 cm in dimension shall be subjected to 3 years unprotected outdoor exposure, facing the equator (South) and inclined 45° from the vertical, taking into account the different European climatic conditions in term of temperature, UV and RH, in accordance with ISO 877:1994, using method A.

After the exposure period, the test specimens shall be washed in a 5% HCl solution for 45 seconds and then in water, using a soft brush or sponge to avoid scratching, and given a final flush with de-ionized water.

After weathering, following test shall be carried out

- day time colour (according to clause 3.2.1)
- Luminance factor (according to clause 3.2.1)
- Coefficient of Retroreflection – (according to clause 3.2.2)

After exposure the coefficient of retro-reflection measured at an observation angle $\alpha = 0.33^\circ$ (or $\alpha = 0.2^\circ$) and $\alpha = 1^\circ$ (if specified for new materials) 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 in 3.2.2.

3.5 Temperature resistance

The photometric properties of the test specimens are determined by measuring the coefficient of Retro-reflection R' according to test method under 3.2.2. Measurements shall be taken only for the observation angle $\alpha = 0.33^\circ$ and entrance angle $\beta_1 = 5^\circ$ ($\beta_2 = 0^\circ$; $\varepsilon = 0^\circ$).

The test specimens shall be then exposed in an air circulating oven for a period of 24 hours according to one of the temperature specified in Table 34.

Class	Temperature
-------	-------------

1	80°C (± 2)
2	65°C (± 2)
3	50°C (± 2)

Tabel 34 – Temperatures

After exposure the test specimens shall be conditioned according ISO 139 "Standard atmospheres for conditioning and testing".

The photometric properties of the test specimen shall be re-determined by re-measuring the coefficient of Retro-reflection R' according to this clause.

When tested, the coefficient of Retro-reflection of the specimen shall be between 85% and 115% of the corresponding actual value measured before exposure.

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 of 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 Task 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 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.

4.2.2 Tasks of the Notified Body.

4.2.1.2 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 to be agreed between UBAtc and the Notified Body involved.

4.2.1.3 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 and 3 of this ETA.

4.2.1.4 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, products in course of manufacture 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 product or 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.
- Legal address of the ETA holder and the manufacturing plants
- 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 this ETA
- Product identification
- Product Performance referring to this ETA

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

5.1 Manufacturing

3M Diamond Grade DG³ series 4000, and combinations with or without 3M Electrocut Film series 1170 or Process Colour Series 880 I & N, Series 4700 or Piezo Inkjet Ink Series 8800 UV, and with or without 3M Dew Resistant Overlay Film 1180 or 3M Premium Protective Overlay Film 1160 or 3M Protective Overlay Film 1150, 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.

5.2.2 Design

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.

5.2.3 Application

5.2.3.1 3M Diamond Grade DG³ Reflective Sheeting Series 4000

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.

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 in effect, if any.

"3M Diamond Grade DG³ Reflective Sheeting Series 4000" sheeting 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 must be directed at the substrate only.

Users are urged to carefully evaluate all substrates for adhesion and sign durability. "3M Diamond Grade DG³ Reflective Sheeting Series 4000" is designed primarily for application to flat substrates. Sign failures caused by the substrate or improper surface preparation are not the responsibility of the ETA holder.

5.2.3.2 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. 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 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 dampened with mineral spirits, isopropyl alcohol or 3M Natural Cleaner.

5.2.3.3 3M Process Colour Series 880 and 3M Process Colour Series 4700

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 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. Processed sheetings 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.

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

Annex 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 + 4.4.2.1 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	
	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

Tm = Test method

Lv = Limit values

(*) = The tests after accelerated exposure can be carried out for the first issue of the ETA in order not to delay the issuing process. In case of further issue of the ETA, then these tests shall be carried out after the outdoor exposure.

Table 1 – Use options

Note: The assessment of the product is performed according to the content of the Option chosen by the manufacturer. Details concerning the characteristics foreseen by the chosen Option as well as test results will be included in an Annex of the ETA.