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Transportation Safety Division

3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4090

Product Bulletin Series 4090

October 2020

1 Description

3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4090 is a super-high efficiency, full cube retroreflective sheeting designed for the production of traffic control signs and delineators that are exposed vertically in service. Diamond Grade DG³ is designed to have the highest retroreflective characteristics at medium and short road distances as determined by the RA value at 0.5°, 1.0 and 1.5° observation angle in Table B. The performance at this angle represents the most common viewing geometries encountered by the driving public. Diamond Grade DG³ also provides brightness at high entrance angles shown by the values at 40° in Table B. During the daytime, Diamond Grade DG³ Fluorescent Reflective Sheeting provides higher visibility than ordinary (non-fluorescent) colored sheetings. Applied to properly prepared sign substrates, Diamond Grade DG³ provides long-term reflectivity and durability. Series 4090 comprises solventless adhesive[1], coated without the use of organic solvents.

Sheeting	Color
4090	White
4091	Yellow
4092	Red
4095	Blue
4097	Green
4081	Fluorescent Yellow – FY
4083	Fluorescent Yellow Green – FYG
4084	Fluorescent Orange – FO

CE 3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4090 is approved for the manufacturing of signfaces for traffic signs with a European Technical Assessment (ETA).

All provisions concerning the attestation of conformity and the performances described in the ETA 18/0405 were applied and the product fulfills all the prescribed requirements (see the EC-declaration of performance at the end of this document for more details).

[1] Due to the use of ancillary organic materials in the manufacturing of the adhesive, traces of organic solvent can be found in the product

2 Photometric Properties

The initial minimum coefficient of retro-reflection of Diamond Grade DG³, when measured in accordance with the procedure specified in CIE Publication No. 54.2 using CIE standard illuminant A, conforms to the values in Table A and B. The angular definitions apply for the CIE Goniometer system (co-planar geometry). The sheeting shall be mounted in 0° orientation on the goniometer (as shown below). Table A conforms to the requirements for Class RA3A in DIN 67520:2013, intended for long distance performance.

Geometry of measurements $\beta_2 = 0, \varepsilon = 0$	$\alpha = 0.1°$			$\alpha = 0.2°$			$\alpha = 0.33°$		
	$\beta_1 =$			$\beta_1 =$			$\beta_1 =$		
Color	5°	20°	30°	5°	20°	30°	5°	20°	30°
White	850	600	425	625	450	325	425	300	225
Yellow	550	390	275	400	290	210	275	195	145
Red	170	120	85	125	90	65	85	60	45
Blue	55	40	28	40	30	20	28	20	15
Green	85	60	40	60	45	30	40	30	20
Fl. Yellow	550	390	275	400	290	210	275	195	145
Fl. YG	700	480	340	500	360	260	340	240	180
Fl. Orange	260	130	95	140	100	70	95	65	49

*Table A: Minimum Coefficient of Retroreflection [cd / (lx * m^2)] for Long Distance Performance Class RA3A*

Table B characterizes the sheeting for the medium and short distance range. This is relevant for the sign action distance when traffic signs become legible. This is also the range when larger entrance angles are encountered. All values exceed the respective requirements in DIN 67520:2013 Class RA3B and Class R3C-UK.

Geometry of measurements $\beta_2 = 0, \varepsilon = 0$	$\alpha = 0.5°$				$\alpha = 1.0°$				$\alpha = 1.5°$			
	$\beta_1 =$				$\beta_1 =$				$\beta_1 =$			
Color	5°	20°	30°	40°	5°	20°	30°	40°	5°	20°	30°	40°
White	420	135	150	70	120	65	50	15	15	13	9	1.5
Yellow	315	100	110	55	90	50	40	13	10	8	6	1
Red	63	30	23	16	20	16	13	5	3	2.5	2	-
Blue	19	6	7	2.5	5	3.5	2.5	1	1	-	-	-
Green	42	13	15	5	12	7	5	2	1.5	1	-	-
Fl. Yellow	250	100	90	55	72	50	40	9	10	8	6	1
Fl. YG	145	110	80	60	70	55	43	9	12	10	7	1
Fl. Orange	125	40	45	21	36	18	15	4	4.5	4	2.5	-

*Table B: Minimum Coefficient of Retroreflection [cd / (lx * m^2)] for the sign action distance*

The initial chromaticity coordinates and luminance factors conform to the color boxes of Table C, when illuminated with CIE standard illuminant D65 and measured with 45/0 geometry. The colorboxes comply with ETA 18/0405 (similar to CR2 of EN 12899-1:2007 for Class RA 2 materials for ordinary colors except orange. The luminance factors for white and yellow are exceeding Class CR2 requirements to demonstrate superior daytime performance).

Color	1		2		3		4		Luminance factor Class B2
	x	y	x	y	x	y	x	y	β
White	0,305	0,315	0,335	0,345	0,325	0,355	0,295	0,325	≥ 0,40
Yellow	0,494	0,505	0,470	0,480	0,513	0,437	0,545	0,454	≥ 0,24
Red	0,735	0,265	0,700	0,250	0,610	0,340	0,660	0,340	≥ 0,03
Green	0,110	0,415	0,170	0,415	0,170	0,500	0,110	0,500	≥ 0,03
Blue	0,130	0,090	0,160	0,090	0,160	0,140	0,130	0,140	≥ 0,01
FY	0,521	0,424	0,557	0,442	0,479	0,520	0,454	0,491	≥ 0.38
FYG	0,387	0,610	0,460	0,540	0,438	0,508	0,376	0,568	≥ 0.70
FO	0,595	0,351	0,645	0,355	0,570	0,429	0,531	0,414	≥ 0.20

Table C: Chromaticity and luminance factors

3 Printed Colors and Overlay Films

For printed transparent color areas on white sheeting, when processed according to 3M™ recommendations, the coefficients of retroreflection shall not be less than 70% of the value for the corresponding color in table A and B. For white sheeting, covered with 3M™ Electrocut™ Film Series 1170, when processed according to 3M recommendations, the coefficients of retroreflection shall not be less than 100% of the value for the corresponding color in Table A and B. The chromaticity coordinates and luminance factors shall conform to table C. This complies with respective requirements in EN 12899-1.

4 Orientation

Diamond Grade DG³ is designed to be an effective wide angle reflective sheeting regardless of the orientation on the substrate or ultimate application orientation after installation. However, because the efficiency of light return from cube corner reflectors is not equal at all rotation angles, the sheeting should be positioned in 0° or 90° application orientation on the completed sign when wide entrance angle performance is important for a given sign type or situation.

Only if high entrance angle performance beyond 40° is a requirement for your signs, the completed sign should have the sheeting positioned at the 0° application orientation.

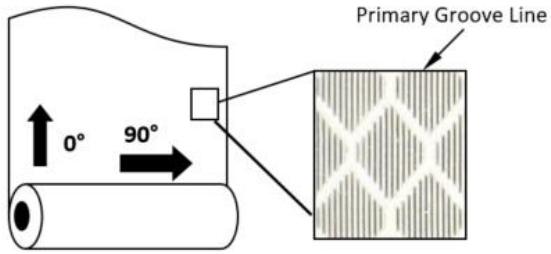

Figure 1 – Sheeting is positioned at 0° orientation

When the “primary groove line” is vertical in the completed sign, sheeting is said to be at a 0° application orientation. When the “primary groove line” is horizontal in the completed sign, the sheeting is said to be at a 90° application orientation.

5 Fabrication Lines

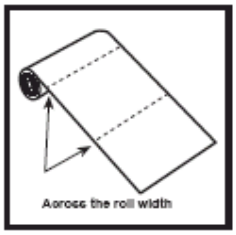

Figure 2 - Tooling Lines

The manufacturing of prismatic sheeting results in fabrication lines being present in the product. In Diamond Grade DG³ sheeting these lines are slightly thicker than the seal pattern legs. Fabrication lines are noticeable in shop light but are not observable on the road either in daylight or at night (Figure 2).

6 Application

Diamond Grade DG³ sheeting should be conditioned prior to application to provide a minimum sheeting temperature of 18°C throughout the roll or sheeting stack.

The sheeting should be applied with mechanical squeeze roll applicators to properly prepared substrates.

Hand application is recommended for legend and copy only. Use firm pressure with a rubber roller or equivalent to obtain maximum initial adhesion. Use multiple, heavy overlapping strokes. Re-roll all edges.

Application of Diamond Grade sheeting for complete signs or backgrounds must be done with a roll laminator, either mechanical or hand. For further information refer to Information Folder IF 1.4, IF 1.5 and IF 1.6.

7 Splices

Diamond Grade DG³ sheeting should be butt spliced when more than one piece of sheeting is used on one piece of substrate. The sheeting pieces should not touch each other. A splice gap of up to 1,5mm is acceptable. This is to prevent buckling as the sheeting expands in extreme temperature and humidity exposure.

8 Substrates

For traffic sign use, product application is limited to properly prepared aluminum (see Information Folder 1.7). The substrate should be conditioned prior to application to provide a minimum surface temperature of 15°C.

Extrusions are to be wrapped and flat panel signs are to be carefully trimmed, so that sheeting from adjacent panels do not touch on assembled signs. Users are urged to carefully evaluate all other substrates for adhesion and sign durability. Diamond Grade DG³ sheeting is designed primarily for applications to flat substrates. Rivets or bolts should also support any use that requires a radius of curvature of less than 130mm.

Sign failures caused by the substrate or improper surface preparation are not the responsibility of 3M.

9 Compatible Products

Screenprint Applications

- 3M™ Process Color Series 880I
- 3M™ Process Color Series 880N

Digital Printing Applications

- 3M™ Piezo Inkjet Ink Series 8800UV (for Durst Rho 161TS and 162TS printer)
- 3M™ Protective Overlay Film 1170

Copy Part Applications

- 3M™ Scotchcal™ ElectroCut Film 100-12

(other colors of Scotchcal™ Opaque Graphic Film Series 100 are compatible, regional warranties apply)

- 3M™ ElectroCut Film Series 1170
- 3M™ TFEC 260 D

All Applications

- 3M™ Dew Resistant Overlay Film 1180I
- 3M™ Premium Protective Overlay Film 1160
- Selected 3M application tapes

Important: Screen-printed sign faces must be sufficiently ventilated during the filling of the rack or immediately run through a conveyor. If the print is not ventilated properly, the solvents may damage the top film of the sheeting. Refer to Product Bulletin 880I and Information Folder 1.8 for more details. Care should be taken to avoid flexing Series 4090 sheeting before and especially after screening. Convert from series 880I to series 880N when ink triggered cracking first appears in your shop.

10 Health and Safety Information

Read all health hazard, precautionary and first aid statements found in the Material Safety Data Sheets and/or product label of chemicals prior to handling or use.

11 General Performance Considerations

The performance and durability of 3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4090 will depend upon a number of factors including (but not limited to):

- Selection, preparation and temperature of the substrate
- Application procedures
- Geographic area
- Exposure and atmospheric conditions (e.g. snow, frost)
- Correct combination of sheeting, ink and overlay film
- Ink formulation
- Ink drying/curing methods
- Cleaning and maintenance methods

11.1 Warranty

3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4090 sold by 3M to be used for traffic control signs and devices in Europe is warranted for a period up to 12* years from date of application (concrete definition of the period is subject to the terms of sale) to be free of defects in material and workmanship, subject to the following provisions:

If Sheeting Series 4090 is processed and applied to a vertical 10° surface in accordance with all 3M application and fabrication procedures provided in 3M's product and information folders, technical memos (which will be furnished to the agency upon request), including the exclusive use of 3M matched component systems, process colors, overlay films and recommended application equipment.

*(10 years for Fluorescent Yellow and Yellow Green, 3 years for Fluorescent Orange)

11.2 Important Notice to Purchaser

All statements, technical information and recommendations herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed. Before using, user shall determine the suitability of the product for its intended use, and user assumes all risk and liability whatsoever in connection therewith. All questions of warranty and liability relating to this product are governed by the terms of the sale subject where applicable to the prevailing law.

No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by authorized personnel of seller and manufacturer.

11.3 Disclaimer

THE 3M WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE, OR ANY IMPLIED WARRANTY ARISING OUT OF A COURSE OF DEALING OR OF PERFORMANCE, CUSTOM OR USAGE OF TRADE.

11.4 Limitation of Liability

Except for the limited remedy stated above, and except where prohibited by law, 3M will not be liable for any loss or damage arising from the Signs or any 3M product, whether direct, indirect, special, incidental or consequential damages (including but not limited to lost profits, business or revenue in any way), regardless of the legal theory asserted including warranty, contract, negligence or strict liability.

11.5 Other Product Information

Always confirm that you have the most current version of the applicable product bulletin, information folder or other product information from 3M's Website at http://www.mmm.com/roadsafety.

11.6 Literature References

Instructions for Squeeze Roll Applicator	IF 1.4
Hand Application Instructions	IF 1.5
Instructions for Hand Squeeze Roll Applicator	IF 1.6
Sign Base Materials	IF 1.7
Instructions for using 3M Process Colors	IF 1.8
Cutting, Matching, Premasking and Prespacing Instructions	IF 1.10
Storage and Packaging	IF 1.11
3M Process Color Series 880I	PB 880I
3M Process Color Series 880N	PB 880N
3M Piezo Inkjet Ink Series 8800UV	PB 8800UV

For Further Assistance

For help on specific questions relating to 3M™ reflective products, please contact your local 3M Application Engineer or contact:

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Declaration of Performance/ Leistungserklärung 3M Diamond Grade DG³

Construction Product Code / Bezeichnung des Bauproduktes

Microprismatic Retroreflective Sheeting

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 orN
4. 3M Diamond Grade DG³ Series 4000 + 3M Piezo Inkjet Ink Series 8800UV + 3M Electrocut Film 1170
5. 3M Diamond Grade DG³ Series 4000 + 3M Piezo Inkjet Ink Series 8800UV + 3M Dew Resistant Overlay Film 1180
6. 3M Diamond Grade DG³ Series 4000 + 3M Dew Resistant Overlay Film 1180
7. 3M Diamond Grade DG³ Series 4000 + 3M Premium Protective Overlay Film1160
8. 3M Diamond Grade DG³ 4090 + 3M Electrocut Film 1176 with or without 3M Protective Overlay Film
9. 3M Diamond Grade DG³ Series 4000 + 3M Piezo Inkjet Ink Series 8800UV + 3M Premium Protective Overlay Film 1160
10. 3M Diamond Grade DG³ Series 4000 + 3M Electrocut Film Series 1170 + 3M Dew Resistant Overlay Film 1180
11. 3M Diamond Grade DG³ 4081&4091 + 3M™ Piezo Inkjet Ink Series 8800UV + 3M™ Electrocut Film Film 1170
12. 3M Diamond Grade Translucent DG³ 4090T + 3M Electrocut Film Series 1170
13. 3M Diamond Grade Translucent DG³ 4090T printed with 3M Process Colour Series 880 I or N

Intended Use / Verwendungszweck

The construction product is used to manufacture sign faces for permanent traffic signs. The intended use includes, for example:

- Retro-reflective signs, retro-reflective and transilluminated signs (see also EN 12899-1)
- Variable message signs (see also EN 12966-1)

Das Bauprodukt wird für die Herstellung von Signalbildern von ortsfesten, vertikalen Verkehrszeichen verwendet. Der Verwendungszweck schließt z.B. ein:

- Retroreflektierende Verkehrszeichen, retroreflektierende und innenbeleuchtete Verkehrszeichen (siehe EN 12899-1)
- Wechselverkehrszeichen (siehe EN 12966-1)

Manufacturer / Hersteller

3M Deutschland GmbH
Carl-Schurz-Str.1
D – 41453 Neuss

Assessment and Verification of Constancy of Performance / Bewertung und Überprüfung der Leistungsbeständigkeit

System 1

StrAus-Zert, notified body 0913, Fleyer Str. 204, D-58097 Hagen performs the continuous surveillance, assessment and evaluation of the factory production control under system 1 and issued the certificate of constancy of performance 0913-CPR-2018 / 04.
/
StrAus-Zert, notifizierte Stelle Nr. 0913, Fleyer Str. 204, D-58097 Hagen führt die laufende Überwachung, Beurteilung und Anerkennung der werkseigenen Produktionskontrolle nach System 1 durch und hat das Zertifikat der Leistungsbeständigkeit 0913-CPR-2018 / 04 ausgestellt.

UBAtc, Rue du Lombard 42, B-1000 Brussels, performed the initial type testing and initial inspection of the factory and the FPC under system 1 and issued ETA 18/0405.
/
UBAtc, Rue du Lombard 42, B-1000 Brussels, führte die Erstprüfung und Erstinspektion des Werks und der werkseigenen Produktionskontrolle nach System 1 durch und hat ETA 18/0405 ausgestellt.

Declared Performance / erklärte Leistung (ETA 18/0405)

Safety in Use / Nutzungssicherheit

Essential Characteristics / Wesentliche Merkmale	**Performance / Leistung**	**Technical Specification / Technische Spezifikation**
Visibility Characteristics		
Daytime Colour and Luminance Factor	Table 1.2 (see Amendment)	EAD 120001-01-0106 (sept 2016) ETA 18/0405
Coefficient of Retroreflection	Table A.1, A.2, A.3 (see Amendment)	
Rotational Symmetry	Ratio > 1:2.5	
Durability		
Temperature Resistance (only combination 1-3 of above product code list)	85% - 115% at 80°C	EAD 120001-01-0106 (sept 2016) ETA 18/0405
Impact Resistance	No apparent cracking or delamination	
Daytime Colour and Luminance Factor:	Table 1.3 (see Amendment)	
Coefficient of Retroreflection	Values > 80% of Table A.1, A.2, A.3 (see Amendment)	

The performance of the construction product identified above is in conformity with the declared performance. This declaration of performance is issued under the sole responsibility of the manufacturer. /
Die Leistung des oben genannten Bauproduktes entspricht der erklärten Leistung. Verantwortlich für die Erstellung dieser Leistungserklärung ist allein der Hersteller.

Neuss, August 2020

ppa. Dr. Chris Howitt
Technical Director
3M EMEA Area

Amendment to the Declaration of Performance '3M Diamond Grade DG³'

This declaration covers the product 'Microprismatic retroreflective sheeting'.

Sign plates or complete assemblies of fixed vertical road traffic signs according to EN 12899-1:2007 can be manufactured with the following products and product combinations, according to ETA 18/0405 and respective Evaluation Reports.

Components	Trade name	Colours/code		Characteristics
Microprismatic retro-reflective sheeting	3M™ Diamond Grade™ DG³ Reflective Sheeting Series 4000	White	4090	Thickness: 0,32 – 0,49 mm Rolls in various length and width
		White Translucent	4090T	
		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	Clear	1170	Combined Thickness: 0,549 mm Rolls in various length and width
		Yellow	1171	
		Red	1172	
		Blue	1175	
		Worboys (Dark) Green	1176	
		Green	1177	
		Brown	1179	
Process colour	3M™ Process Colour Series 880 I or N	Yellow	884 I or N	20 - 25 m²/l
		Blue	883 I or N	
		Green	888 I or N	
		Red	882 I or N	
		Dark Green	886 I or N	
Process colour for digital printing	3M™ Piezo Inkjet Ink Series 8800 UV	Yellow Red Blue Green Brown		18 - 20 m²/l
Overlay film	3M™ Premium Protective Overlay Film 1160	Clear		Combined Thickness: 0,549 mm Rolls in various length and width
Overlay film	3M™ Dew Resistant Overlay Film 1180	Clear		Combined Thickness: 0,549 mm Rolls in various length and width
Overlay film	3M™ Protective Overlay Film 1150	Clear		Combined Thickness: 0,549 mm Rolls in various length and width

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

Colours		Chromaticity Coordinates				Luminance Factor ß
		1	2	3	4	
*White Tolerance Sphere**	x y	0.305 0.315	0.335 0.345	0.325 0.355	0.295 0.325	≥0.40
*White Translucent Tolerance Sphere**	x y	0.305 0.315	0.335 0.345	0.325 0.355	0.295 0.325	≥0.27
*Yellow Tolerance Sphere**	x y	0.494 0.505	0.470 0.480	0.513 0.437	0.545 0.454	≥0.24
*Yellow Translucent Tolerance Sphere**	x y	0.494 0.505	0.470 0.480	0.513 0.437	0.545 0.454	≥0.16
*Red Tolerance Sphere**	x y	0.735 0.265	0.700 0.250	0.610 0.340	0.660 0.340	≥0.03
*Red on Yellow, Fluorescent Yellow or Fluorescent Yellow Green Tolerance Sphere**	x y	0.735 0.265	0.700 0.250	0.610 0.340	0.660 0.340	≥0.03
*Blue Tolerance Sphere**	x y	0.130 0.090	0.160 0.090	0.160 0.140	0.130 0.140	≥0.01
*Green Tolerance Sphere**	x y	0.110 0.415	0.170 0.415	0.170 0.500	0.110 0.500	≥0.03
Orange Tolerance Sphere	x y	0.631 0.369	0.560 0.360	0.506 0.404	0.570 0.429	≥0.14
*Brown Tolerance Sphere**	x y	0.455 0.397	0.523 0.429	0.479 0.373	0.558 0.394	0.03-0.09
*Grey Tolerance Sphere**	x y	0.305 0.315	0.335 0.345	0.325 0.355	0.295 0.325	0.11-0.18
Dark Green Tolerance Sphere	x y	0.313 0.682	0.313 0.453	0.248 0.409	0.127 0.557	0.01-0.07
Fluorescent yellow reference	x y	0.521 0.424	0.557 0.442	0.479 0.520	0.454 0.491	≥0.38
Fluorescent orange reference	x y	0.595 0.351	0.645 0.355	0.570 0.429	0.531 0.414	≥0.25
Fluorescent yellow green reference	x y	0.387 0.610	0.460 0.540	0.438 0.508	0.376 0.568	≥0.70
* Chromaticity Coordinates are similar to EN 12899-1:2007 Class CR2						

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

Colours		Chromaticity Coordinates				Luminance Factor ß
		1	2	3	4	
White *Tolerance Sphere**	x y	0.355 0.355	0.305 0.305	0.285 0.325	0.335 0.375	*≥0.40*
White Translucent *Tolerance Sphere**	x y	0.355 0.355	0.305 0.305	0.285 0.325	0.335 0.375	*≥0.27*
Yellow *Tolerance Sphere**	x y	0.545 0.454	0.487 0.423	0.427 0.483	0.465 0.534	*≥0.24*
Yellow Translucent *Tolerance Sphere**	x y	0.545 0.454	0.487 0.423	0.427 0.483	0.465 0.534	*≥0.16*
Red *Tolerance Sphere**	x y	0.735 0.265	0.674 0.236	0.569 0.341	0.655 0.345	*≥0.03*
Red on Yellow, Fluorescent Yellow or Fluorescent Yellow Green *Tolerance Sphere**	x y	0.735 0.265	0.674 0.236	0.569 0.341	0.655 0.345	*≥0.03*
Blue *Tolerance Sphere**	x y	0.078 0.171	0.150 0.220	0.210 0.160	0.137 0.038	*≥0.01*
Green *Tolerance Sphere**	x y	0.007 0.703	0.248 0.409	0.177 0.362	0.026 0.399	*≥0.03*
Orange *Tolerance Sphere*	x y	0.631 0.369	0.560 0.360	0.506 0.404	0.570 0.429	*≥0.14*
Brown *Tolerance Sphere**	x y	*0.455* *0.397*	*0.523* *0.429*	*0.479* *0.373*	*0.558* *0.394*	*0.03-0.09*
Grey *Tolerance Sphere**	x y	0.350 0.360	0.300 0.310	0.285 0.325	0.335 0.375	*0.11-0.18*
Dark Green *Tolerance Sphere**	x y	*0.313* *0.682*	*0.313* *0.453*	*0.248* *0.409*	*0.127* *0.557*	*0.01-0.07*
Fluorescent yellow reference	x y	*0.521* *0.424*	*0.557* *0.442*	*0.479* *0.520*	*0.454* *0.491*	*≥0.38*
Fluorescent orange reference	x y	*0.595* *0.351*	*0.645* *0.355*	*0.570* *0.429*	*0.531* *0.414*	*≥0.25*
Fluorescent yellow green reference	x y	*0.387* *0.610*	*0.460* *0.540*	*0.438* *0.508*	*0.376* *0.568*	*≥0.70*
* Chromaticity Coordinates are similar to EN 12899-1:2007 Class CR1						

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

Geometry of measurement		Colour								
α	β_1 ($\beta_2 = 0$)	White	Yellow	Red	Green	Dark Green ‡	Blue	Brown ‡	Orange	Grey ‡
20'	+5°	300	195	60	30	24	19	9	150	150
	+20°	240	155	48	24	19	16	7.2	120	120
	+30°	165	110	33	17	13	11	5.0	83	82
	+40°	30	20	6	3	2.4	2	#	15	15
1°	+5°	35	23	7	3.5	2.8	2.5	1.1	18	17
	+20°	30	20	6	3	2.4	2	#	15	15
	+30°	20	13	4	2	1.6	1.5	#	10	10
	+40°	3.5	2	1	#	#	#	#	2	1.8
1.5°	+5°	15	10	3	1.5	1.2	1	#	7.5	7.5
	+20°	13	8	2.5	1	1.0	#	#	6.5	6.5
	+30°	9	6	2	#	#	#	#	4.5	4.5
	+40°	1.5	1	#	#	#	#	#	1	#

‡ Indicates additional colours required by UK national legislation

# Indicates "Value greater than zero but not significant or applicable"

NOTE Coloured areas of signs created by digital or screen printing or using overlay film will need to meet 70 % of the values in the table.

Table A.1

Manufacturer's Specification for the Minimum Initial Coefficient of Retro-reflection R_A value

(see UK National Annex to EN 12899-1:2007 Class R3B-UK; DIN 67520:2013-10 Class RA 3B; Önorm V 2050:2006-01-01 Typ 3; TLP VZ Class RA3)

Table NA.1C — Minimum coefficient of retroreflection for high-performance materials (Class R3C-UK) (unit: $cdlx^{-1}m^{-2}$)

Geometry of measurement		Colour								
α	$\beta 1$ ($\beta 2 = 0$)	White	Yellow	Red	Green	Dark Green	Blue	Brown	Fluorescent Yellow	Fluorescent Orange
0.2°	+5°	580	435	87	58	42	26	17	350	175
	+30°	220	165	33	22	16	10	7	130	66
0.33°	+5°	300	250	75	35	29	17	10	180	90
	+30°	140	128	30	18	11	7	5	90	42
0.5°	+5°	420	315	63	42	21	19	13	250	125
	+30°	150	110	23	15	7.5	7	5	90	45
1.0°	+5°	120	90	18	12	6	5	4	72	36
	+30°	45	34	7	5	2	2	1	27	14

NOTE 1 When material is sampled, processed and tested per manufacturer's Declaration of Performance and EAD 120001-00-0106, Section 2.2.3.

NOTE 2 The requirements of Class R3C-UK are based on ASTM Type XI.

Table A.2

Manufacturer's Specification for the Minimum Initial Coefficient of Retro-reflection R_A value

(see UK National Annex to EN 12899-1:2007 Class R3C-UK; Coloured areas of signs created by digital or screen printing will need to meet 70% of the values in the table)

Geometry of measurements		Colour							
α	β_1 (β_2 = 0)	White	Yellow	Red	Blue	Green	Fluorescent yellow	Fluorescent orange	Fluorescent Yellow Green
0.1°	+5°	850	550	170	55	85			
	+20°	600	390	120	40	60			
	+30°	425	275	85	28	40			
	+40°	200	140	40	10	20			
0.2°	+5°	625	400	125	40	60		200	375
	+15°	350	270	90	20	35		175	
	+20°	450	290	90	30	45			
	+30°	325	210	65	20	30		120	200
	+40°	160	112	32	8	16		80	36
0.33°	+5°	425	275	85	28	40		150	270
	+15°	250	200	65	15	25		130	
	+20°	300	195	60	20	30			
	+30°	225	145	45	15	20		90	140
	+40°	110	77	22	5.5	11		60	24
1.0°	+5°	80	65	20	5	10		7.5	70
	+15°	60	45	16	3.5	7		5	
	+20°								
	+30°	50	40	13	2.5	5		2.5	43
	+40°	15	13	4	1	2		2.5	9

Table A.3

Manufacturer's Specification for the Minimum Initial Coefficient of Retro-reflection R_A value

(see Belgium PTV Nr. 662: Class PTV-3A; PTV-3B; PTV-3C; DIN 67520:2013-10 Class RA 3A;
Coloured areas of signs created by digital or screen printing will need to meet 70% of the values in the table)