Deutsches Institut für Bautechnik

Approval body for construction products and types of construction

Bautechnisches Prüfamt

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European Technical Assessment

ETA-16/0580 of 20 October 2016

English translation prepared by DIBt – Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	ORALITE® 6710 Engineer Prismatic Grade screen printed with ORALITE® 5018 Screen Printing Ink
Product family to which the construction product belongs	Microprismatic retro-reflective sheetings
Manufacturer	ORAFOL Europe GmbH Orafolstraße 2 16515 Oranienburg DEUTSCHLAND
Manufacturing plant	ORAFOL Europe GmbH Orafolstraße 2 16515 Oranienburg DEUTSCHLAND
This European Technical Assessment contains	21 pages including 4 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	European Assessment Document (EAD) 120001-01-0106

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Specific Part

1 Technical description of the product

The product consists of retro-reflective sheeting on the basis of microprisms, which consist of optical elements, where the retro-reflection is created by total internal reflection on prisms. The microprisms are moulded in a transparent polymer enclosed in air capsules and provided with an adhesive, which can connect the sheeting with a substrate. The sheeting has a smooth surface and a regular structure visible on the surface forming the air capsules and serving to identify the orientation.

The product is delivered as reflective sheeting, the types of which are stated in Table 1.

Trade name	Component	Colour/Code	Properties
ORALITE® 6710 Engineer Prismatic Grade	Self-adhesive retro-reflective sheeting on the basis of microprisms	White 6710-010	Sheeting thickness (without protective paper and adhesive): 0,23 mm Dimension of the roll: 1,22 m x 50 m or customized
ORALITE® 5018 Screen Printing Ink	Printing ink for screen printing	Yellow 5018-020 Red 5018-030 Blue 5018-050 Green 5018-060 Black 5018-070	Solvent based, quick curing one-component ink-system Consumption: appr. 800ml / 55 m² full covered surface

Tab. 1: Types of reflective sheeting "ORALITE® 6710 Engineer Prismatic Grade screen printed with ORALITE® 5018 Screen Printing Ink"

The indications of the manufacturer regarding the definition of the colours comply with the colour boxes of the CIE system (according to class CR2 of EN 12899-1) and are shown in Table 2.

Colour		Daylight chromaticity				Luminance factors
		1	2	3	4	
Yellow	x	0,494	0,470	0,513	0,545	≥ 0,27
	y	0,505	0,480	0,437	0,454	
Red	x	0,735	0,700	0,610	0,660	≥ 0,05
	y	0,265	0,250	0,340	0,340	
Green	x	0,110	0,170	0,170	0,110	≥ 0,04
	y	0,415	0,415	0,500	0,500	
Blue	x	0,130	0,160	0,160	0,130	≥ 0,01
	y	0,090	0,090	0,140	0,140	
Black*	x	0,385	0,300	0,260	0,345	≤ 0,03
	y	0,355	0,270	0,310	0,395	

Tab. 2: Daylight chromaticity and luminance factors according to the indications of the manufacturer which comply with class CR2 of EN 12899-1
* Class NR1 of EN 12899-1 for Black

2 Specification of the intended use in accordance with the applicable European Assessment Document

The construction product described here is used to manufacture signal aspects of fixed, vertical traffic signs (see also EN 12899-1:2007). The further intended applications are all other traffic signs and traffic installations, route guidance with retro-reflective elements and variable message signs.

However, the intended use excludes the manufacture of road marking elements according to EN 1436. The intended sign support material is aluminium, galvanised steel, polycarbonate or other materials. Tests within the framework of this assessment were carried out on aluminium-based samples.

The performances given in section 3 are only valid if the conditions laid down in the accompanying product data sheets and in the processing instructions given by the manufacturer have been respected throughout the production, processing, packaging, transport and storage of "ORALITE® 6710 Engineer Prismatic Grade screen printed with ORALITE® 5018 Screen Printing Ink" (essential specifications acc. to manufacturer's instructions are given in Annex 4).

The verifications and assessment methods as well as the product information of the manufacturer on which this European Technical Assessment is based lead to the assumption of a working life of this product of at least 10 years. The indications given on the working life cannot be interpreted as a guarantee given by the manufacturer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

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

3.1 Safety and accessibility in use (BWR 4)

For the preparation of the specimens, the test pieces of the reflective sheeting were applied by the manufacturer on a plane aluminium plate with a thickness of 2,0 mm (± 0,05 mm).

Essential characteristic	Performance
Visibility of "ORALITE® 6710 Engineer Prismatic Grade screen printed with ORALITE® 5018 Screen Printing Ink"	
Daylight chromaticity and luminance factors	See Annex 1
Night-time colour	No performance assessed
Coefficient of retro-reflection and rotational symmetry	See Annex 2
Durability of "ORALITE® 6710 Engineer Prismatic Grade screen printed with ORALITE® 5018 Screen Printing Ink"	
Impact resistance	Passed according to EN 12899-1
Temperature resistance	No performance assessed
Visibility after artificial weathering	See Annex 3
Visibility after natural weathering	No performance assessed
Adhesion	No performance assessed

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No 120001-01-0106, the applicable European legal act is: Decision 96/579/EC.

The system(s) to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

6 Reference list

This European Technical Assessment is based on the following test report:

– Interims test report No. V3-031/2015 of 29 April 2016 by Federal Highway Research Institute (Bundesanstalt für Straßenwesen - BASt) on the testing of microprismatic reflective sheetings

Issued in Berlin on 20 October 2016 by Deutsches Institut für Bautechnik

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beglaubigt:
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Deutsches Institut für Bautechnik DIBt

Annex 1

Daylight chromaticity and luminance factors according to clause 2.2.1 of the EAD

Colour	Sample	x	y	β
Yellow	**1**	0,508	0,476	0,36
	2	0,508	0,476	0,36
	3	0,508	0,476	0,36
Red	**1**	0,665	0,316	0,05
	2	0,663	0,316	0,05
	3	0,666	0,316	0,05
Blue	**1**	0,136	0,107	0,03
	2	0,136	0,105	0,03
	3	0,136	0,105	0,03
Green	**1**	0,138	0,483	0,08
	2	0,136	0,484	0,08
	3	0,136	0,484	0,08
Black	**1**	0,288	0,309	0,00
	2	0,287	0,308	0,00
	3	0,287	0,309	0,00

Annex 2

Coefficient of retro-reflection and rotational symmetry according to clause 2.2.3 of the EAD

Coefficient of retro-reflection for "Yellow" (Part 1)

Colour / Sample				Yellow Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	0°	117	189	133	146	50
	30°			38	58	41	46	22
	40°			12,2	14,9	12,7	13,3	7,0
0,33°	5°			76	111	82	90	35
	30°			33	48	35	39	16,0
	40°			10,8	13,0	10,7	11,5	6,0
2°	5°			13,3	11,6	13,1	12,7	3,0
	30°			8,7	9,8	9,3	9,3	1,5
	40°			3,5	3,4	3,9	3,6	1,0

Coefficient of retro-reflection started at ε=0° [cd m^{-2} lx^{-1}]

Colour / Sample				Yellow Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	30°	108	180	122	137	50
	30°			35	63	40	46	22
	40°			17,2	27	18,1	21	7,0
0,33°	5°			64	103	69	79	35
	30°			30	50	33	38	16,0
	40°			15,7	24	16,4	18,7	6,0
2°	5°			9,8	8,8	9,6	9,4	3,0
	30°			8,9	7,6	8,5	8,3	1,5
	40°			3,8	4,0	3,9	3,9	1,0

Coefficient of retro-reflection started at ε=30° [cd m^{-2} lx^{-1}]

Colour / Sample				Yellow Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	45°	109	178	122	136	50
	30°			56	94	65	72	22
	40°			8,3	12,2	9,2	9,9	7,0
0,33°	5°			65	104	70	80	35
	30°			47	69	51	56	16,0
	40°			7,5	10,3	8,1	8,6	6,0
2°	5°			9,3	8,1	8,8	8,7	3,0
	30°			6,2	5,2	5,2	5,5	1,5
	40°			3,4	3,0	3,2	3,2	1,0

Coefficient of retro-reflection started at ε=45° [cd m^{-2} lx^{-1}]

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Coefficient of retro-reflection and rotational symmetry according to clause 2.2.3 of the EAD	

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Colour		Sample		Yellow Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	60°	111	181	125	139	50
	30°			38	67	46	50	22
	40°			20	35	25	27	7,0
0,33°	5°			68	106	74	83	35
	30°			33	54	39	42	16,0
	40°			19,0	31	23	24	6,0
2°	5°			12,2	9,6	10,8	10,9	3,0
	30°			7,4	5,9	6,9	6,7	1,5
	40°			4,3	4,6	4,3	4,4	1,0

Coefficient of retro-reflection started at ε=60° [cd m^{-2} lx^{-1}]

Colour		Sample		Yellow Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	90°	122	191	139	151	50
	30°			36	58	41	45	22
	40°			11,3	17,7	11,8	13,6	7,0
0,33°	5°			84	117	92	98	35
	30°			33	50	37	40	16,0
	40°			10,3	15,9	10,5	12,2	6,0
2°	5°			17,5	13,3	16,4	15,7	3,0
	30°			9,7	9,9	10,6	10,1	1,5
	40°			3,4	5,0	3,3	3,9	1,0

Coefficient of retro-reflection started at ε=90° [cd m^{-2} lx^{-1}]

ORALITE® 6710 Engineer Prismatic Grade screen printed with ORALITE® 5018 Screen Printing Ink

Coefficient of retro-reflection and rotational symmetry according to clause 2.2.3 of the EAD

Annex 2

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Rotational symmetry for "Yellow" (Part 1)

α	β_1	β_2	Colour Sample ε	Yellow 1	2	3
0,33	5	0	-75	97	130	105
			-50	105	143	117
			-25	94	132	106
			0*	76	111	82
			25	64	103	70
			50	65	105	71
			Ratio	**1,64**	**1,39**	**1,67**

* Rotational symmetry started at ε=0° [cd m^{-2} lx^{-1}]

α	β_1	β_2	Colour Sample ε	Yellow 1	2	3
0,33	5	0	-75	87	124	97
			-50	70	106	76
			-25	64	103	70
			0*	68	106	74
			25	81	114	87
			50	100	136	112
			Ratio	**1,56**	**1,32**	**1,60**

* Rotational symmetry started at ε=60° [cd m^{-2} lx^{-1}]

α	β_1	β_2	Colour Sample ε	Yellow 1	2	3
0,33	5	0	-75	104	143	117
			-50	91	128	101
			-25	72	108	78
			0*	64	103	69
			25	67	105	72
			50	78	112	83
			Ratio	**1,63**	**1,39**	**1,70**

* Rotational symmetry started at ε=30° [cd m^{-2} lx^{-1}]

α	β_1	β_2	Colour Sample ε	Yellow 1	2	3
0,33	5	0	-75	67	105	74
			-50	64	103	70
			-25	70	106	76
			0*	84	117	92
			25	102	140	116
			50	104	146	120
			Ratio	**1,63**	**1,42**	**1,71**

* Rotational symmetry started at ε=90° [cd m^{-2} lx^{-1}]

α	β_1	β_2	Colour Sample ε	Yellow 1	2	3
0,33	5	0	-75	98	136	110
			-50	79	115	87
			-25	66	103	71
			0*	65	104	70
			25	72	107	78
			50	89	121	96
			Ratio	**1,51**	**1,32**	**1,57**

* Rotational symmetry started at ε=45° [cd m^{-2} lx^{-1}]

ORALITE® 6710 Engineer Prismatic Grade screen printed with ORALITE® 5018 Screen Printing Ink

Coefficient of retro-reflection and rotational symmetry according to clause 2.2.3 of the EAD

Annex 2

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Coefficient of retro-reflection for "Red" (Part 2)

Colour / Sample				Red Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	0°	35	35	35	35	14,5
	30°			10,5	10,2	10,6	10,4	6,0
	40°			2,9	3,0	3,1	3,0	2,0
0,33°	5°			24	24	23	24	10,0
	30°			9,5	9,3	9,6	9,5	4,0
	40°			2,9	2,7	2,9	2,8	1,8
2°	5°			5,7	5,6	5,9	5,7	1,0
	30°			3,2	2,9	3,2	3,1	0,5
	40°			1,0	1,1	1,1	1,1	0,5

Coefficient of retro-reflection started at ε=0° [cd m^{-2} lx^{-1}]

Colour / Sample				Red Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	30°	31	32	32	32	14,5
	30°			10,1	9,9	10,4	10,1	6,0
	40°			4,4	4,3	4,7	4,5	2,0
0,33°	5°			19,2	19,5	19,3	19,3	10,0
	30°			8,6	8,4	8,9	8,6	4,0
	40°			4,2	4,1	4,4	4,2	1,8
2°	5°			3,6	3,6	3,8	3,7	1,0
	30°			2,4	2,6	2,7	2,6	0,5
	40°			1,1	1,1	1,2	1,1	0,5

Coefficient of retro-reflection started at ε=30° [cd m^{-2} lx^{-1}]

Colour / Sample				Red Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	45°	31	32	31	31	14,5
	30°			13,7	14,5	14,4	14,2	6,0
	40°			1,8	1,9	1,9	1,9	2,0
0,33°	5°			18,3	18,9	18,5	18,6	10,0
	30°			11,7	12,2	12,2	12,0	4,0
	40°			1,7	1,8	1,8	1,8	1,8
2°	5°			3,1	3,2	3,3	3,2	1,0
	30°			2,6	2,4	2,6	2,5	0,5
	40°			1,0	1,0	1,1	1,0	0,5

Coefficient of retro-reflection started at ε=45° [cd m^{-2} lx^{-1}]

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Coefficient of retro-reflection and rotational symmetry according to clause 2.2.3 of the EAD

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Colour				Red Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
Sample				1	2	3		
α	β_1	β_2	ε					
0,2°	5°	0°	60°	31	32	31	31	14,5
	30°			7,9	9,3	8,8	8,7	6,0
	40°			3,9	4,6	4,5	4,3	2,0
0,33°	5°			18,3	19,1	18,7	18,7	10,0
	30°			6,9	8,0	7,7	7,5	4,0
	40°			3,7	4,2	4,2	4,0	1,8
2°	5°			3,7	3,8	4,0	3,8	1,0
	30°			2,2	2,2	2,3	2,2	0,5
	40°			1,1	1,2	1,2	1,2	0,5

Coefficient of retro-reflection started at ε=60° [cd m^{-2} lx^{-1}]

Colour				Red Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
Sample				1	2	3		
α	β_1	β_2	ε					
0,2°	5°	0°	90°	34	35	34	34	14,5
	30°			8,8	9,9	9,3	9,3	6,0
	40°			2,6	2,8	2,7	2,7	2,0
0,33°	5°			22	23	22	22	10,0
	30°			8,0	8,9	8,6	8,5	4,0
	40°			2,4	2,6	2,5	2,5	1,8
2°	5°			5,4	5,6	5,7	5,6	1,0
	30°			2,6	3,0	3,0	2,9	0,5
	40°			0,8	0,9	0,9	0,9	0,5

Coefficient of retro-reflection started at ε=90° [cd m^{-2} lx^{-1}]

ORALITE® 6710 Engineer Prismatic Grade screen printed with ORALITE® 5018 Screen Printing Ink

Coefficient of retro-reflection and rotational symmetry according to clause 2.2.3 of the EAD

Annex 2

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Rotational symmetry for "Red" (Part 2)

α	β_1	β_2	Colour Sample ε	Red 1	Red 2	Red 3
0,33	5	0	-75	26	27	26
			-50	31	31	30
			-25	29	29	28
			0*	24	24	23
			25	19,6	19,9	19,6
			50	18,2	18,9	18,5
			Ratio	**1,70**	**1,64**	**1,62**

* Rotational symmetry started at ε=0° [cd m^{-2} lx^{-1}]

α	β_1	β_2	Colour Sample ε	Red 1	Red 2	Red 3
0,33	5	0	-75	27	27	26
			-50	21	22	21
			-25	18,8	19,3	18,9
			0*	18,3	19,1	18,7
			25	21	22	22
			50	28	29	28
			Ratio	**1,53**	**1,52**	**1,50**

* Rotational symmetry started at ε=60° [cd m^{-2} lx^{-1}]

α	β_1	β_2	Colour Sample ε	Red 1	Red 2	Red 3
0,33	5	0	-75	31	31	30
			-50	28	28	27
			-25	23	23	22
			0*	19,2	19,5	19,3
			25	18,2	19	18,6
			50	20	21	21
			Ratio	**1,70**	**1,63**	**1,61**

* Rotational symmetry started at ε=30° [cd m^{-2} lx^{-1}]

α	β_1	β_2	Colour Sample ε	Red 1	Red 2	Red 3
0,33	5	0	-75	21	21	21
			-50	18,6	19,1	18,7
			-25	18,7	19,5	19
			0*	22	23	22
			25	29	30	29
			50	31	32	31
			Ratio	**1,67**	**1,68**	**1,66**

* Rotational symmetry started at ε=90° [cd m^{-2} lx^{-1}]

α	β_1	β_2	Colour Sample ε	Red 1	Red 2	Red 3
0,33	5	0	-75	30	30	29
			-50	25	25	24
			-25	20	20	20
			0*	18,3	18,9	18,5
			25	19,1	20	19,3
			50	24	25	24
			Ratio	**1,64**	**1,59**	**1,57**

* Rotational symmetry started at ε=45° [cd m^{-2} lx^{-1}]

ORALITE® 6710 Engineer Prismatic Grade screen printed with ORALITE® 5018 Screen Printing Ink

Coefficient of retro-reflection and rotational symmetry according to clause 2.2.3 of the EAD

Annex 2

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Coefficient of retro-reflection for "Blue" (Part 3)

Colour / Sample				Blue Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	0°	8,1	9,3	9,4	8,9	4,0
	30°			2,9	3,5	3,3	3,2	1,7
	40°			0,9	1,7	1,4	1,3	0,5
0,33°	5°			5,9	6,7	6,5	6,4	2,0
	30°			3,1	3,4	3,3	3,3	1,0
	40°			0,7	1,4	1,2	1,1	#
2°	5°			1,5	1,2	1,3	1,3	#
	30°			1,1	1,1	1,2	1,1	#
	40°			0,3	0,5	0,5	0,4	#

Coefficient of retro-reflection started at ε=0° [cd m^{-2} lx^{-1}]
# Indicates "Value greater than zero but not significant or applicable"

Colour / Sample				Blue Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	30°	6,6	7,8	7,7	7,4	4,0
	30°			2,2	3,2	2,9	2,8	1,7
	40°			1,3	1,6	1,4	1,4	0,5
0,33°	5°			3,8	4,6	4,4	4,3	2,0
	30°			2,2	3,0	2,7	2,6	1,0
	40°			1,2	1,5	1,3	1,3	#
2°	5°			1,0	1,0	0,9	1,0	#
	30°			1,2	1,0	1,1	1,1	#
	40°			0,5	0,5	0,5	0,5	#

Coefficient of retro-reflection started at ε=30° [cd m^{-2} lx^{-1}]
# Indicates "Value greater than zero but not significant or applicable"

Colour / Sample				Blue Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	45°	6,4	7,5	7,5	7,1	4,0
	30°			3,4	4,2	3,9	3,8	1,7
	40°			0,5	0,7	0,6	0,6	0,5
0,33°	5°			3,7	4,4	4,2	4,1	2,0
	30°			3,3	3,9	3,6	3,6	1,0
	40°			0,5	0,6	0,6	0,6	#
2°	5°			0,9	1,0	0,9	0,9	#
	30°			0,5	0,4	0,4	0,4	#
	40°			0,3	0,3	0,3	0,3	#

Coefficient of retro-reflection started at ε=45° [cd m^{-2} lx^{-1}]
# Indicates "Value greater than zero but not significant or applicable"

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Coefficient of retro-reflection and rotational symmetry according to clause 2.2.3 of the EAD	

Colour / Sample				Blue Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	60°	6,6	7,7	7,6	7,3	4,0
	30°			2,1	2,5	2,3	2,3	1,7
	40°			1,2	1,4	1,3	1,3	0,5
0,33°	5°			3,9	4,5	4,3	4,2	2,0
	30°			2,2	2,3	2,2	2,2	1,0
	40°			1,2	1,3	1,2	1,2	#
2°	5°			1,1	1,1	0,9	1,0	#
	30°			0,9	1,0	1,0	1,0	#
	40°			0,5	0,4	0,4	0,4	#

Coefficient of retro-reflection started at ε=60° [cd m^{-2} lx^{-1}]
# Indicates "Value greater than zero but not significant or applicable"

Colour / Sample				Blue Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	90°	8,1	9,4	9,3	8,9	4,0
	30°			2,6	3,1	2,8	2,8	1,7
	40°			1,6	1,0	1,0	1,2	0,5
0,33°	5°			5,9	6,7	6,4	6,3	2,0
	30°			2,7	3,0	2,8	2,8	1,0
	40°			1,5	0,9	1,0	1,1	#
2°	5°			1,4	1,5	1,4	1,4	#
	30°			1,1	1,0	1,1	1,1	#
	40°			0,5	0,3	0,4	0,4	#

Coefficient of retro-reflection started at ε=90° [cd m^{-2} lx^{-1}]
# Indicates "Value greater than zero but not significant or applicable"

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Rotational symmetry for "Blue" (Part 3)

α	β1	β2	Colour Sample ε	Blue 1	2	3
0,33	5	0	-75	7,8	8,5	8,5
			-50	9,6	10,2	10,6
			-25	8,7	9,3	9,5
			0*	5,9	6,7	6,5
			25	4	4,7	4,5
			50	3,8	4,4	4,2
			Ratio	**2,53**	**2,32**	**2,52**

* Rotational symmetry started at ε=0° [cd m^{-2} lx^{-1}]

α	β1	β2	Colour Sample ε	Blue 1	2	3
0,33	5	0	-75	7,7	8,3	8,4
			-50	4,9	5,7	5,3
			-25	3,8	4,5	4,3
			0*	3,9	4,5	4,3
			25	5,4	6,2	6,0
			50	8,3	9,2	9,2
			Ratio	**2,18**	**2,04**	**2,14**

* Rotational symmetry started at ε=60° [cd m^{-2} lx^{-1}]

α	β1	β2	Colour Sample ε	Blue 1	2	3
0,33	5	0	-75	9,7	10,3	10,7
			-50	8,2	8,8	9
			-25	5,4	6,2	5,8
			0*	3,8	4,6	4,4
			25	3,8	4,4	4,2
			50	4,9	5,7	5,4
			Ratio	**2,55**	**2,34**	**2,55**

* Rotational symmetry started at ε=30° [cd m^{-2} lx^{-1}]

α	β1	β2	Colour Sample ε	Blue 1	2	3
0,33	5	0	-75	4,5	5,2	5,1
			-50	3,7	4,4	4,2
			-25	4,1	4,7	4,5
			0*	5,9	6,7	6,4
			25	8,9	9,7	9,8
			50	9,8	10,4	10,9
			Ratio	**2,65**	**2,36**	**2,60**

* Rotational symmetry started at ε=90° [cd m^{-2} lx^{-1}]

α	β1	β2	Colour Sample ε	Blue 1	2	3
0,33	5	0	-75	9,1	9,7	10,1
			-50	6,5	7,2	7,1
			-25	4,2	5	4,7
			0*	3,7	4,4	4,2
			25	4,3	5	4,7
			50	6,6	7,3	7,1
			Ratio	**2,46**	**2,20**	**2,40**

* Rotational symmetry started at ε=45° [cd m^{-2} lx^{-1}]

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Coefficient of retro-reflection and rotational symmetry according to clause 2.2.3 of the EAD

Annex 2

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Coefficient of retro-reflection for "Green" (Part 4)

Colour / Sample				Green Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	0°	30	29	30	30	9,0
	30°			10,0	9,3	9,5	9,6	3,5
	40°			4,1	3,4	3,9	3,8	1,5
0,33°	5°			21	21	20	21	7,0
	30°			9,8	9,2	9,5	9,5	3,0
	40°			3,7	3,0	3,4	3,4	1,2
2°	5°			5,2	5,7	5,1	5,3	0,5
	30°			3,8	3,5	3,6	3,6	0,3
	40°			1,6	1,3	1,4	1,4	0,2

Coefficient of retro-reflection started at ε=0° [cd m^{-2} lx^{-1}]

Colour / Sample				Green Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	30°	24	24	25	24	9,0
	30°			7,9	7,3	7,5	7,6	3,5
	40°			4,3	4,0	4,3	4,2	1,5
0,33°	5°			14,1	13,6	13,6	13,8	7,0
	30°			7,5	6,9	7,4	7,3	3,0
	40°			4,1	3,8	4,0	4,0	1,2
2°	5°			3,6	3,8	3,6	3,7	0,5
	30°			3,8	3,7	3,8	3,8	0,3
	40°			1,6	1,6	1,6	1,6	0,2

Coefficient of retro-reflection started at ε=30° [cd m^{-2} lx^{-1}]

Colour / Sample				Green Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	45°	24	23	24	24	9,0
	30°			10,9	10,7	11,1	10,9	3,5
	40°			1,7	1,6	1,7	1,7	1,5
0,33°	5°			13,2	13,1	13,3	13,2	7,0
	30°			10,8	10,7	10,9	10,8	3,0
	40°			1,7	1,6	1,7	1,7	1,2
2°	5°			3,2	3,6	3,2	3,3	0,5
	30°			1,9	2,0	1,8	1,9	0,3
	40°			1,2	1,1	1,2	1,2	0,2

Coefficient of retro-reflection started at ε=45° [cd m^{-2} lx^{-1}]

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Coefficient of retro-reflection and rotational symmetry according to clause 2.2.3 of the EAD

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Colour / Sample				Green Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	60°	24	24	25	24	9,0
	30°			6,1	6,1	6,9	6,4	3,5
	40°			3,5	3,6	3,9	3,7	1,5
0,33°	5°			13,8	13,9	14,2	14,0	7,0
	30°			5,9	5,8	6,5	6,1	3,0
	40°			3,4	3,4	3,7	3,5	1,2
2°	5°			3,7	4,1	4,0	3,9	0,5
	30°			3,3	3,1	3,4	3,3	0,3
	40°			1,3	1,3	1,4	1,3	0,2

Coefficient of retro-reflection started at ε=60° [cd m^{-2} lx^{-1}]

Colour / Sample				Green Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	90°	30	29	31	30	9,0
	30°			8,6	8,4	9,5	8,8	3,5
	40°			2,9	2,8	3,2	3,0	1,5
0,33°	5°			21	21	22	21	7,0
	30°			8,5	8,3	9,4	8,7	3,0
	40°			2,5	2,6	3,0	2,7	1,2
2°	5°			5,4	5,9	5,7	5,7	0,5
	30°			3,1	3,2	3,7	3,3	0,3
	40°			1,0	0,9	1,1	1,0	0,2

Coefficient of retro-reflection started at ε=90° [cd m^{-2} lx^{-1}]

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Coefficient of retro-reflection and rotational symmetry according to clause 2.2.3 of the EAD

Annex 2

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Rotational symmetry for "Green" (Part 4)

α	β_1	β_2	Colour Sample ε	Green 1	Green 2	Green 3
0,33	5	0	-75	27	27	29
			-50	34	33	36
			-25	30	30	31
			0*	21	21	20
			25	14,6	14,1	14,0
			50	13,2	13,1	13,4
			Ratio	**2,58**	**2,52**	**2,69**

* Rotational symmetry started at ε=0° [cd m^{-2} lx^{-1}]

α	β_1	β_2	Colour Sample ε	Green 1	Green 2	Green 3
0,33	5	0	-75	27	27	27
			-50	17,5	17,2	17,2
			-25	13,6	13,3	13,4
			0*	13,8	13,9	14,2
			25	19,1	19,3	20
			50	29	29	31
			Ratio	**2,13**	**2,18**	**2,31**

* Rotational symmetry started at ε=60° [cd m^{-2} lx^{-1}]

α	β_1	β_2	Colour Sample ε	Green 1	Green 2	Green 3
0,33	5	0	-75	34	34	36
			-50	29	28	29
			-25	18,9	18,8	18,7
			0*	14,1	13,6	13,6
			25	13,5	13,4	13,7
			50	17,5	17,7	18,5
			Ratio	**2,52**	**2,54**	**2,65**

* Rotational symmetry started at ε=30° [cd m^{-2} lx^{-1}]

α	β_1	β_2	Colour Sample ε	Green 1	Green 2	Green 3
0,33	5	0	-75	16,6	15,6	15,6
			-50	13,4	13,2	13,2
			-25	14,4	14,6	15
			0*	21	21	22
			25	31	31	33
			50	34	34	36
			Ratio	**2,54**	**2,58**	**2,73**

* Rotational symmetry started at ε=90° [cd m^{-2} lx^{-1}]

α	β_1	β_2	Colour Sample ε	Green 1	Green 2	Green 3
0,33	5	0	-75	32	32	33
			-50	23	22	23
			-25	15,3	14,9	14,9
			0*	13,2	13,1	13,3
			25	15,1	15,3	15,9
			50	23	23	25
			Ratio	**2,42**	**2,44**	**2,48**

* Rotational symmetry started at ε=45° [cd m^{-2} lx^{-1}]

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Coefficient of retro-reflection and rotational symmetry according to clause 2.2.3 of the EAD

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Annex 3

Visibility after accelerated artificial weathering according to clause 2.2.6.1 of the EAD:

Acc. to ISO 4892-2:1994 samples have been artificially weathered 2000 hours by using a non-insulated black panel thermometer.

Sample size: 5,5 x 11 cm.

Daylight chromaticity and luminance factors after accelerated artificial weathering

Colour	Sample	x	y	β
Yellow	1	0,504	0,480	0,39
	2	0,504	0,480	0,38
	3	0,503	0,481	0,38
Red	1	0,661	0,317	0,05
	2	0,660	0,317	0,05
	3	0,660	0,317	0,05
Blue	1	0,135	0,108	0,03
	2	0,135	0,107	0,03
	3	0,135	0,107	0,03
Green	1	0,138	0,482	0,08
	2	0,137	0,484	0,08
	3	0,137	0,485	0,08
Black	1	0,289	0,309	0,00
	2	0,288	0,309	0,00
	3	0,288	0,308	0,00

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Coefficients of retro-reflection after accelerated artificial weathering

Colour / Sample				Yellow Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	0°	214	148	247	203	40
	30°			65	43	83	64	17,6
0,33°	5°			117	84	133	111	28
	30°			51	36	65	51	12,8

Coefficient of retro-reflection after accelerated artificial weathering started at ε=0° [cd m^{-2} lx^{-1}]

Colour / Sample				Red Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	0°	46	57	40	48	11,6
	30°			13,2	16,6	14,5	14,8	4,8
0,33°	5°			28	34	25	29	8,0
	30°			11,0	13,6	9,3	11,3	3,2

Coefficient of retro-reflection after accelerated artificial weathering started at ε=0° [cd m^{-2} lx^{-1}]

Colour / Sample				Blue Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	0°	15,5	13,1	13,4	14	3,2
	30°			4,2	7,1	4,1	5,1	1,4
0,33°	5°			7,6	6,9	7,2	7,2	1,6
	30°			3,5	4,9	3,7	4,0	0,8

Coefficient of retro-reflection after accelerated artificial weathering started at ε=0° [cd m^{-2} lx^{-1}]

Colour / Sample				Green Single test result of each sample			Average of the three samples tested	Minimum values acc. to the specification of the manufacturer
α	β_1	β_2	ε	1	2	3		
0,2°	5°	0°	0°	45	50	52	49	7,2
	30°			13,9	16,0	15,7	15,2	2,8
0,33°	5°			25	27	27	26	5,6
	30°			12,0	13,8	13,1	13,0	2,4

Coefficient of retro-reflection after accelerated artificial weathering started at ε=0° [cd m^{-2} lx^{-1}]

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Visibility after accelerated artificial weathering according to clause 2.2.6.1 of the EAD

Annex 3

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Annex 4

Essential specifications concerning manufacturing, packaging, transport and storage according to manufacturer's instruction:

Application

The envisaged substrates are aluminium, galvanized steel, polycarbonate or other.

Surfaces to which the material will be applied must be thoroughly cleaned from dust, grease or any contamination, which could affect the adhesion of the material. Freshly lacquered or painted surfaces should be completely cured. The compatibility of selected lacquers and paints should be tested by the user, prior to application of the material.

For the application of the retro-reflective film and its additional components described in Chapter 1 detailed information have been published by the manufacturer. In the following only some most important aspects of the application are given:

Cutting, die cutting, plotting

The product can be cut by means of a commercial stack cutter. The holding-down clamp should be set to very low pressure and, as an additional measure, the film be protected from compression. It is recommended limiting the stacking height 40 sheets to 50 sheets.

Commercial cutting plotters with tangential blades, preferably of the flatbed type, should be used as plotter systems.

Adhesive bonding and laminating

The self-adhesive retro-reflective material can only be used for dry application.

Bonding should not be carried out at air and material temperatures of less than 15 ºC. The optimum bonding temperature is about 21 ºC. The films should be stored for a period of at least 48 hours in the premises designated for their processing.

In order to achieve good adhesion of the films, the substratum must be dry and free of dust, oil, fats, silicon or other contamination. If the substratum needs to be treated with a solvent, the next processing step cannot be carried out until the solvent is completely evaporated. When bonding films to metallic substrata, slight grinding of the surfaces is advantageous.

When several film webs need to be bonded side by side, they should always overlap. Depending on the format, the overlap should be 3 mm to 5 mm. Please make sure that a right side of the film web is always bonded to a left side, thus ensuring the uniform orientation of the film's honeycomb structure.

Packaging, transport and storage

The product should be stored in a cool and dry place (temperature range from 20 ºC to 24 ºC; relative air humidity of 40 % to 60 %) that is protected from direct sunlight.

Rolled material should be handled and stored in the original carton. The rolls have standard spacers that prevent contact between the roll surface and the carton and thus the formation of pressure marks and surface damage. Please make sure that partly processed rolls, too, are never stored or handled without spacer.

When making the rolls available for processing, it is advisable to use a horizontal suspension system (such as a paternoster system or a rack). Even if the rolls are stored in a vertical, freestanding position, a negative influence on the film's characteristics is generally not expected. Here again, it is crucial to place the roll on the spacer so as to avoid breakage of the edges. In practice it was shown, however, that this type of storage complicates the handling of the films.

Blank or printed film sheets are supplied in cartons that have been designed especially for the sheet dimensions, 50 sheets per carton. If the sheets are stored outside the carton, please make sure to put individual sheets on a flat and stable support so that they do not adjoin or overlap at the edges. Sheets may be stacked. In order to limit the weight load, not more than 40 sheets to 50 sheets should be stacked.

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Essential specifications concerning manufacturing, packaging, transport and storage according to manufacturer's instruction	