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EUROPEAN TECHNICAL ASSESSMENT



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Technical Assessment Body issuing the European Technical Assessment: UBAtc. UBAtc has been designated according to Article 29 of Regulation (EU) No 305/2011 and is member of EOTA (European Organisation for Technical Assessment)

Trade name of the construction product:

Product family to which the construction product belongs:

Manufacturer:

Manufacturing plant:

Website:

This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:

This European Technical Assessment contains:

3M[™] Connected Roads All Weather Elements Series Dry, 50, 90 and Wet.

Retro-reflective drop-on elements for road markings.

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www.mmm.com/tsd

European Assessment Document (EAD): 230064-00-0106

9 pages, without any annexes



European Organisation for Technical Assessment

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 - Regulation (EU) No 305/2011¹ of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC
 - Commission Implementing Regulation (EU) No 1062/2013² of 30 October 2013 on the format of the European Technical Assessment for construction products
 - European Assessment Document (EAD): 230064-00-0106
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- 14 This European Technical Assessment was first issued by UBAtc on 30 November 2018.

¹ OJEU, L 88 of 2011/04/04

² OJEU, L 289 of 2013/10/31

1 Description of the construction product

1.1 General

Retro-reflective elements (RRE) are composed of a layer of small glass-ceramic spherical beads build around a core of clustered glass beads.

A resin is used to build the core and adhere the outer layer of the high refractive index beads.

This resin will also serve as the reflective mirror. Retro-reflective elements may have different dimensions, colours and performances. Where traditional glass beads have a refractive index range from 1,5 to 1,7, the refractive index of the exterior glass-ceramic beads used for these products will be 1,9 or 2,4. These finished RRE are called Connected Roads All Weather Elements (in short AWE). One AWE only contains 1 type of bead, either RI 1,9 (Dry) or 2,4 (Wet). Also blends of AWE Dry and Wet will be commercialized.



The refractive index can only be measured before the beads are processed into an RRE. The refractive index of exterior beads will determine if the element provides retro-reflective performance in dry or wet weather conditions (see 1.2).

1.2 3M™ Connected Roads All Weather Elements Series Dry and Wet

Currently two types of AWE are produced: AWE with glassceramic beads RI 1,9, providing retro-reflection of the light during dry weather conditions, or shortly after rainfall, and AWE with glass-ceramic beads RI 2,4, providing retroreflection of the light during continuous rain conditions, or when the road marking is fully covered with water.

AWE with only RI 1,9 beads are indicated as Series Dry, while AWE with only RI 2,4 beads are indicated as Series Wet

All AWE are available in white and yellow colour. At this moment no extra surface treatments will be applied.

The Series Wet and Dry will also be commercialized in 50/50 or 80/20 blends

Figure 1 - Retro Reflective Elements (RRE)

Trade Name	Series	Colours	Characteristics
	Dry	White	100% AWE based on RI 1,9 beads - Dry weather only.
	Dry	Yellow	100% AWE based on RI 1,9 beads – Dry weather only
-	50	White	50/50 blend AWE Series Dry and Wet White – Balanced both dry and rainy weather performance
- 3M™ Connected Roads _	51	Yellow	50/50 blend AWE Series Dry and Wet Yellow - Balanced both dry and rainy weather performance
All Weather Elements	90	White	80/20 blend AWE Series Wet and Dry White – High degree of rainy weather performance
	91	Yellow	80/20 blend AWE Series Wet and Dry Yellow – High degree of rainy weather performance
	Wet	White	100% AWE based on RI 2,4 beads – Rainy weather performance only
-	Wet	Yellow	100% AWE based on RI 2,4 beads – Rainy weather performance only

Table 1.1: Complete set of All Weather Elements (AWE) covered by this ETA

2 Information on the intended use of the construction product

2.1 Intended uses

AWE are intended to be used primarily as drop-on material to be included in permanent and or temporary road markings systems; typically in products defined according to EN 1871.

The manufacturer shall specify whether the elements have been designed to perform during dry weather or continuous rain. AWE with 100% RI 1,9 beads are effective only during dry weather or after rain, while AWE with 100% RI 2,4 beads are only effective when covered with a water layer or during continuous rainfall (in brief, rainy conditions). Blends of AWE with RI 1,9 and AWE with RI 2,4 beads are effective in all weather conditions.

This is typically done in combination with the initial application of a binder system (paint or thermo/cold plastic) sprayed or extruded on the road surface, followed by a "double drop" application: first the AWE and secondly the glass beads (commonly mixed with anti-skid aggregates).

ETA 18/0222 Page 3 of 9 The objective of this application is to achieve a road marking with a specified performance level according to EN 1436 (Performance characteristics of road markings). The AWE aim at improving the nighttime visibility of the final road marking in various weather conditions, expressed in R, RW and RR luminance values.

2.2 Assumptions under which the fitness of the product(s) for the intended use was favourably assessed

2.2.1 Manufacturing directives

The Connected Roads All Weather Elements (AWE) shall correspond, as far as their composition and manufacturing process is concerned, to the products specified in this ETA.

The assessment methods included or referred to in this ETA, and corresponding EAD, have been written based on the manufacturer's request to take into account a working life of the product for the intended use of 1 to 4 years when installed in the works (pavement marking), provided that the product is subject to appropriate installation (see 2.1). These provisions are based upon the current state of the art and the available knowledge and experience.

When assessing the product the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works. The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by the Technical Assessment Body issuing this ETA based on the EAD 230064-00-0106, but are regarded only as a means for expressing the expected economically reasonable working life of the product

2.2.2 Use as drop-on material for road markings

It is the responsibility of the ETA holder to guarantee that the information about application as described in clause 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 provided instruction sheets using one or several illustrations. In any case, it is suitable to comply with national regulations and particularly concerning national traffic code.

2.3 Recommendations on packaging, transport and storage

The AWE shall be stored in a cool, dry area, preferably at 18-24°C and 30-50% RH, and should be applied within one year from delivery. Package for shipment shall be kept dry, prevent shifting, shaking and chafing.

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

	Essential Characteristic of the product Basic Works Requirement 3 : Hygiene, health and the environment					
No	Essential characteristic	Clause	Product Performance (*)			
1	Content and/or release of dangerous substances	3.1	Value (ppm)			
Essential Characteristics of the product and blends Basic Works Requirement 4: Safety and accessibility in use						
No	Essential Characteristic	Clause	Product Performance			
1	Granulometry	3.2.1	Value (Cumulative % retention/sieve)			
2	Colour – Daylight Chromaticity	3.2.2	(x,y) values or colourbox coordinates			
3	Coefficient of Retro-reflection (night time performance)	3.2.3	Value (cd.Lux ⁻¹ .m ⁻²)			
4	Adhesion of the external beads on the element	3.2.4	Value (%)			
5	Coefficient of Retro-reflection for blends only (*)	3.3	Value			
	(*) Criteria for verifying the essential characteristics of blends.					

3.1 Overview

3.2 Hygiene, health and the environment: Content and/or release of dangerous substrates

In order to check the content of arsenic, lead and antimony, the AWE was tested in accordance with EN 1423:2012, Annex I.

AWE	As (Arsenic)	Sb (Antimony)	Pb (Lead)
Series Dry White		5 ppm	Not detected (< 1 ppm)
Series Wet White	Not detected	5 ppm	2 ppm
Series Dry Yellow	(< 1 ppm)	6 ppm	1 ppm
Series Wet Yellow	-	7 ppm	3 ppm

AWE Series Sieve (Cumulative % retention) test results	Dry White	Dry Yellow	Wet White	Wet Yellow
2,0 mm	0,12	0,18	0,27	0,24
1,7 mm (*)	19,95	31,90	20,13	26,97
1,4 mm	73,20	73,16	72,03	71,03
1,18 mm (*)	97,15	96,70	96,62	95,43
850 µm	99,71	99,19	99,71	99,91
600 µm (*)	99,73	99,25	99,71	99,92
Pan (**)	0,27	0,75	0,29	0,08

As this involves a multi-step production process – additional rules as set by EN 1423:2012, clause 4.3.3, related to granulometry cannot be applied for this ETA. The choice of sieves is limited between 0,5 and 2 mm: 500 μ m – 600 μ m – 710 μ m – 850 μ m – 1 mm – 1,18 mm – 1,4 mm – 1,7 mm and 2 mm.

3.3 Safety and accessibility in use

3.3.1 Granulometry

The granulometry of the final AWE, not to be confused with the glass-ceramic or glass beads, shall be described following the methods of verification indicated in EN 1423:2012, Clause 4.1.3, by specifying the minimum and the maximum percentages by mass of the cumulative retained AWE on metal wire cloth test sieves. The sieves shall be selected in accordance with the rules given in EN 1423:2012, clause 4.1.3. Manufacturing Process Yield: The manufacturer shall specify the max % of residual, un-attached beads that are tolerated in the final product. These beads will pass all the sieves and reach the pan at the bottom.

Manufacturing specifications for all Connected Roads All Weather Elements (AWE)				
Sieve (US mesh)	Sieve (micron)	% cumulative retention		
10	2000	0-5		
14	1410	60-100		
20	850	95-100		
Pc	่าก	5%		

(*) As indicated during the initial audit, these 3 sieves are not essential to charactize these products and may be considered optional.

(**) The % of unattached beads is determined by : 100 – cumulative % retained elements on smallest sieve used

3.2.2 Day light chromaticity (colour)

The daylight chromaticity coordinates (x,y) shall be measured in accordance with CIE Publication 15 Colourimetry using a "45° a:0° geometry" (45°= illumination angle, 0°= observer angle, a= annular) and shall be calculated from the total spectral radiance factors computed for the CIE standard Illuminant D65, EN ISO 11664-2, for the CIE 1931 (2°) standard colorimetric observer in accordance with EN ISO 11664-1:2011, Chapter 5.

The colour measurements shall be performed on the final elements, as the colour is influenced by both the colour of the beads and the adhesive.

The chromaticity co-ordinates CIE (x,y) of the glass-ceramic AWE shall be reported as a single (x,y) value falling within a defined colour box with 4 (x,y) cornerstones (production tolerances)

AWE Series	Dry Wł	nite	Wet W	/hite	Dry Ye	ellow	White	Yellow
Measured (x,y) coordinates	(0,338, 0	,353)	(0,341,	0,356)	(0,451,	0,417)	(0,440,	0,409)
Colourbox		W	/hite			Yello	w Y1	
Product manufacturing specs: Cornerpoints (x,y)	(0,355, 0,355)	(0,305, 0,305)	(0,285, 0,325)	(0,335, 0,375)	(0,443, 0,399)	(0,545, 0,455)	(0,465, 0,535)	(0,389, 0,375)

3.2.3 Coefficient of retro-reflection (night time performance)

As AWE are composed of beads and a binder resin, also performing as a mirror, retro-reflectivity can be measured on the product itself prior to application on the road marking. According to the refractive index of the beads, the elements will only show relevant R_A values when dry, or immerged in water. Depending on the type of AWE selected, only wet or dry measurements need to be executed.

A coefficient of retro-reflection is measured in accordance with CIE Publication No. 54.2, Retro-reflection using CIE Standard Illuminant A and expressed in cd.Lux⁻¹.m⁻²

The "immerged in water" value is recorded when all air around the AWE has been replaced by the liquid and the measured value remains stable. Any of the retro-luminometers (photometer) according to CIE publication N° 54.2 may be used. Further details on the test method may be found in the EAD 230064-00-0106.

Note : To determine if an unknown product is a blend, clause 3.3 should be consulted.

Series White	Dry	Dry Min 27	39,6	NA
Series Yellow	Dry	Dry Min 20	21,9	NA
Series White	Wet	Wet Min 10	NA	10,8
Series Yellow	Wet	Wet Min 5	NA	6,75
NA = No	ot app	licable or intended.		

3.2.4 Adhesion of the external beads on the element

A test sample is made by a mono-layer of AWE cured onto thick layer of resin. The resulting coin shaped sample is submitted to a controlled jet stream of abrasive elements (similar to a sandblasting process). The retro-reflectivity of the sample is tested according 3.2.3, before and after the blasting process with 400g of glass-ceramic beads (RI 1,9). Any damage to the AWE, resulting in a loss of gloss or glassceramic beads releasing from the core of the AWE will automatically result in a loss of retro-reflection.

The % of loss or % retained retro-reflectivity shall be reported. The manufacturer shall specify or report the min % of retention guaranteed by the production process followed

According to the intended use of the AWE, the retroreflectivity tests shall be done dry or immerged in water

Note: The reference value (sample measured before the adhesion test) will be different compared with the value measured and reported in 3.2.3, for the same type of AWE, due to the impact of the resin to fix a monolayer of AWE.

See EAD 230064-00-0106 for a more detailed sample preparation and test procedure.

Series Dry White	30,1	23,2	77,0
Series Dry Yellow	19,3	14,1	72,9
Series Wet White	8,58	6,05	70,5
Series Wet Yellow	5,95	5,5	92,4

3.3 Co-efficient of Retroreflection for blends (night time performance)

AWE blends are typically produced by physically blending 2 fully finished and retro-reflective elements (different RI beads, same colour)

If above tests (3.1 and 3.2) are performed on the individual types, only a final retro-reflectivity validation, according to 3.2.3, is made on the blend. Both "dry" and "immerged in water" are tested on the same sample. The dry sample is completely flooded with the water/detergent liquid, without removing it from under the photometer. The "immerged in water" value is recorded when all air around the AWE has been replaced by the liquid and the measured value remains stable.

Series 50	50/50 blend Series Wet White / Dry White	8	21,0	3	5,64
Series 90	80/20 Blend Series Wet White / Dry White	3,5	9,23	6	8,30
Series 51	50/50 blend Series Wet Yellow / Dry Yellow	6	12,0	3	3,56
Series 91	80/20 blend Series Wet Yellow / Dry Yellow	2,5	4,88	5	5,43

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

In accordance with Regulation (EU) N° 305/2011, Article 65, Directive 89/106/EEC is repealed, but references to the repealed Directive shall be construed as references to the Regulation.

The system of assessment and verification of constancy of performance, specified in the Decision of the Commission 1996/579/EC of 1996/06/24³, as amended by Commission Decision 1999/453/EC of 1999/06/18⁴, is specified in the following Table.

Road	For circulation	Δηγ	1
Markings	areas	ЛЦУ	I

* See Annex V to Regulation (EU) N° 305/2011

³ see OJEU L 254, 8.10.1996, p. 52 ⁴ see OJEU L 178, 14.7.1999, p. 50

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

5.1 Tasks of the manufacturer

The corner stones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in the following Table.

N°	Subject/type of control	Test or control method	Criteria	Minimum number of samples	Minimum frequency of control
	[includir	ng testing of samples to	Factory production control (FPC) aken at the factory in accordance wi	ith a prescribed test p	lan]
1	Glass Ceramic Beads	EN1423 or alternative due to high refractive indices	Verification of the purchasing specification documentation, given by the manufacturer or calibration certificate of the refractive index test method used	3 samples per AWE at ITT stage + according to the QS manual of the manufacturer	According to the QS manual of the manufacturer
2	Other Raw material	Incoming raw material to be tested according to the QS manual of the manufacturer	Verification of the purchasing specification documentation, given by the manufacturer	Sample verification according to the QS manual of the manufacturer	_
3	Production process (all necessary steps)	According to the QS manual of the manufacturer	According to the QS manual of the manufacturer	According to the QS manual of the manufacturer	_
4	Content and/or release of dangerous substances, other than those referred to below	Chemical analysis according to the specifications in the QS manual of the manufacturer	Verification of the material specification given by the raw material supplier	Sample verification according to the QS manual of the manufacturer	-
5	Content of Sb, As and Pb	See 2.2.1	EN 1423	1 sample per production lot. Reduced to 1 sample per type per year, if < 25 ppm	
6	Granulometry	See 2.2.2	-		- All samples in each
7	Colour: Daytime Chromaticity	See 2.2.3	_	Min I sample per production lot, but generally 1 time/hr	batch lot shall meet the requirements of
8	Retro-Reflectivity	See 2.2.4	- Verification and documentation	_ · ·	-
9	Adhesion of the beads on the AWE	See 2.2.5	of the calibration certificate of the instrument	Min 1 sample per lot	
10	Verification of the AWE blends	See 2.3	-	Min 1 sample per lot	-
11	Storage	Storage condition according to the provisions of the manufacturer. Measuring the ambient room temperature and relative humidity	According to the QS manual of the manufacturer	Inspection of the storage condition during the yearly FPC	One time per year during the factory production control (FPC)

The cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance are laid down in the following Table.

1	The notified body or the Technical Assessment Body shall a with the control plan, the manufacturing plant of the manu personnel and equipment, and the factory production cor continuous and orderly manufacturing of the high refractiv elements according the European Technical Assessment.	scertain that in accord ufacturer, in particular ntrol are suitable to ens re index, retro-reflective	dance Sure a e Start of certification, new production facility or a significant modification of the production line
1	It shall be verified that the system of factory production commonufacturing process are maintained taking account of	ntrol and the specified the control plan	To be determined by the Notified Body but minimum once a year
6	Reference documents	EN 1871	Road marking materials - Physico
For	undated references, the latest edition of the referenced	EN ISO 11664-1:2011	Colorimetry - Part 1: CIE standard
doc refe	cument (including any amendments) applies. For dated erences only the specified edition applies.	EN ISO 11664-2	colorimetric observers Colorimetry - Part 2: CIE standard illuminants
EN EN	 1423:2012 (+ AC:2013) Road marking materials: Road marking materials – Drop-on materials - Glass beads, antiskid aggregates and mixtures of the two 1436 Road marking materials - Road marking performance for road users 1790 Road marking materials - Preformed road markings 		
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	This European Technical Assessment has been issued by UBA work carried out by the Assessment Operator, COPRO.	tc asbl, in Sint-Stevens-	-Woluwe, on the basis of the technical
	On behalf of UBAtc asbl,	On behalf o COPRO, re c	of the Assessment Operator, esponsible for the technical content of the ETA,