
Test report No: **55 0240 07, Vers. 0**
Manufacturer: MIRACLE IND.CO., LTD
507-17 mok2-dong
Yangcheon-kuseoul, Korea

Phone: +82 2 2643 703/4
Fax: +82 2 2643 7035
EUT description : Reflective road stud
Model : MS 100 / MS 200



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TEST REPORT

N° 55 0240 07, Vers. 0

Tests carried out in accordance to ASTM D 4280 – 04

issued by

TÜV Rheinland Italia S.r.l. - Via Gavardina, 42 I-25010 Ponte S. Marco (BS)

1. General information

- | | |
|---|--|
| 1.0. <u>Equipment under test:</u> | reflective road stud (pavement marker) |
| 1.1. <u>Trade mark:</u> | MIRACLE IND.CO., LTD. |
| 1.2. <u>Model</u> | MS 100 (yellow)
MS 200 (yellow) |
| 1.3 <u>Type:</u> | n.a. |
| 1.4 <u>Manufacturer's name and address:</u> | MIRACLE IND.CO., LTD
507-17 mok2-dong
Yangcheon-kuseoul, Korea |
| 1.5 <u>Date of performance tests:</u> | 09.07.2007 until 13.07.2007 |

The test results and observations indicated in this test report refer exclusively to the samples tested. It is not permitted to transfer the results to other systems or configurations.

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2. Tests and results:

2.1 Type of tests

Description of test	Standard reference	Performance criteria	Result
Lens impact strength	ASTM D 4280 point 6.2.5.1	No more than 2 radial cracks longer than 6.4mm, no delamination	PASSED
Temperature cycling	ASTM D 4280 point 6.2.5.2	No cracking or delamination	PASSED
Compressive strength	ASTM D 4280 point 6.2.3.2	No breakage or significant deformation	PASSED
Color	ASTM D 4280 point 6.2.4	The color of the retroreflected light shall fall within the color gamuts given by the regulation	PASSED

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2.2 Summary of performance criteria

Lens impact strength: When impacted in accordance with point 9.4.1 (ASTM D 4280), the face of the lens shall show no more than two radial cracks longer than 6.4mm. There shall be no radial cracks extending to the edge of the abrasion resistant area. There shall be no delamination.

Temperature cycling: When subjected to temperature cycling in accordance with 9.4.2 (ASTM D 4280), there shall be no cracking or delamination.

Compressive strength: When tested in accordance with 9.2.2 (ASTM D 4280), a marker shall support a load of 2727 kg without breakage or significant deformation of the marker. Significant deformation shall be understood to be 3.3mm.

Color: When the retroreflector is illuminated by CIE Standard Source A and when measured in accordance with 9.3 (ASTM D 4280), the color of the retroreflected light shall fall within the color gamuts given by the corner points in Fig.1 (ASTM D 4280).

2.4 Remarks to the test

This document contains 5 annexes

The Responsible for the test

A handwritten signature in blue ink, appearing to read "C. Seyring".

Ing. Carsten Seyring
Ponte S. Marco, 19.07.2007

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Annex 1

Test protocol for Lens impact strength

Model:	Reflective road stud	Test sample No.:	0755.123 0755.133
Applicant:	MIRACLE IND.CO.,LTD		
Regulations:	Verification in accordance to ASTM D 4280 point 6.2.5.1		
Requirements:	There shall be no more than 2 radial cracks longer than 6.4mm, no delamination		
Used test equipment:	Manufacturer	TÜV Internal Reg. No.:	
Climatic chamber	WEISS	55500044	
Measurement uncertainty:	Not determined		
Test-Setup:	Conditioning of the markers in a convection oven at 55°C for 1 hour. Impact the reflective face of the marker by allowing a 0.19kg dart, fitted with a 6.4mm radius semi-spherical head to drop 457mm perpendicular onto the approximate center of the reflective surface. 		
Performance criteria:	see requirements		
Test results :	Passed		
Date of test:	Start: 09.07.2007	End: 09.07.2007	
Tested by:	Ing. C. Seyring		

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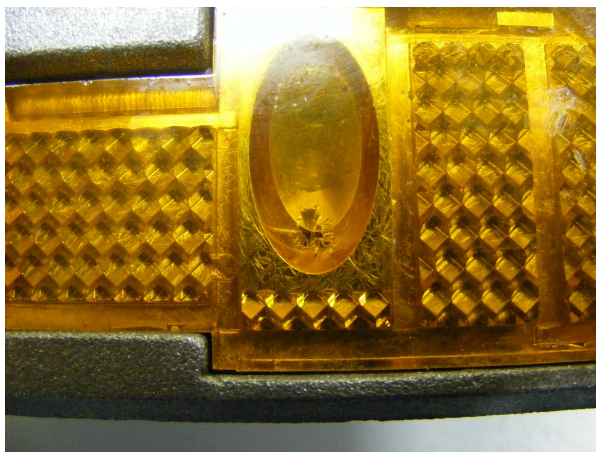


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Annex 2

Test protocol for Temperature cycling			
Model:	Reflective road stud	Test sample No.:	0755.124 0755.130
Applicant:	MIRACLE IND.CO.,LTD		
Regulations:	Verification in accordance to ASTM D 4280 point 6.2.5.2		
Requirements:	There shall be no cracking or delamination		
Used test equipment:	Manufacturer	TÜV Internal Reg. No.:	
Thermal shock chamber	VOETSCH	55500094	
Measurement uncertainty:	Not determined		
Test-Setup:	The samples were subjected to three cycles of 60°C for 4 hours followed by −7°C for 4 hours.		
Performance criteria:	see requirements		
Test results :	Passed (*)		
Date of test:	Start: 11.07.2007	End: 12.07.2007	
Tested by:	Ing. C. Seyring		

(*) after the test, delamination was visible, but just in the area of the additional LED's
 this delamination won't affect the behavior of the retroreflecting parts, therefore the test is passed
 (see attached the photographs)



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Annex 3

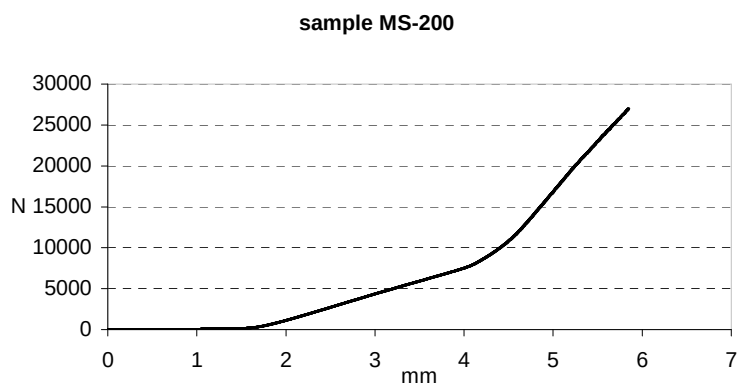
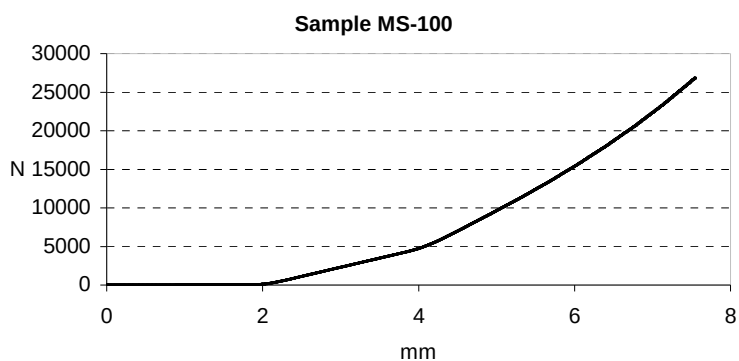
Test protocol for Compressive strength			
Model:		Reflective road stud	Test sample No.: 0755.125 0755.126
Applicant:		MIRACLE IND.CO.,LTD	
Regulations:		Verification in accordance to ASTM D 4280 point 6.2.3.2	
Requirements:		no breakage or significant deformation	
Used test equipment:		Manufacturer	TÜV Internal Reg. No.:
Compression machine		FRANK	55500019
Measurement uncertainty:		Not determined	
Test-Setup:		The markers were preconditioned at 23°C for 4 hours prior to testing. The markers were positioned with the base down at the center of a flat steel plate larger than the marker, a 9.5mmthick elastomeric pad with a shore A durometer of 60 on top, and on the top of the pad a 13mm thick flat steel plate. A load at a rate of 2.5mm/min was applied. 	
Performance criteria:		see requirements	

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Test results :



Passed

Date of test:	Start: 09.07.07	End: 09.07.07
Tested by:	Ing. C.Seyring	

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Annex 4

Test protocol for Color measurement		
Model:	Reflective road stud	Test sample No.: 0755.120 0755.122 0755.127 0755.129
Applicant:	MIRACLE IND.CO.,LTD	
Regulations:	Verification in accordance to ASTM D 4280 point 6.2.4	
Requirements:	The color of the retroreflected light shall fall within the color gamuts given by the regulation	
Used test equipment:	Manufacturer	TÜV Internal Reg. No.:
Goniophotometer GOH 1300	LMT	55500117
RETRO 2000	LMT	55500115
Spectrometer	Sentronic	55500135
Measurement uncertainty:	Not determined	
Test-Setup:	The samples were mounted on the Goniophotometertable with the base of the markers lying on a plane parallel to the illumination axis and perpendicular to the observation half-plane. The sample was illuminated with Standard Illuminant A in an entrance angle of 0°, the color was measured with a Spectrometer in an observation angle of 0.2°.	
Performance criteria:	see requirements	

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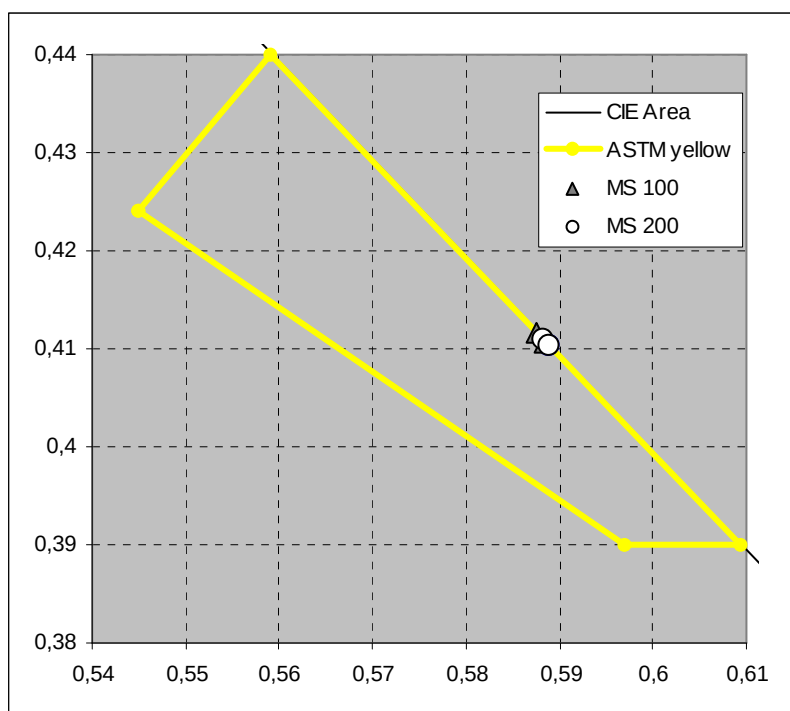


Test results :

	sample	x	y
MS100	0755.120	0,588	0,410
MS100	0755.122	0,587	0,411
MS200	0755.127	0,588	0,410
MS200	0755.129	0,588	0,410

Color area: (yellow)

Point No	x	y
1	0,545	0,424
2	0,559	0,439
3	0,609	0,390
4	0,597	0,390



Classification:

Passed

Date of test:

Start: 13.07.2007

End: 13.07.2007

Tested by:

Ing. C. Seyring

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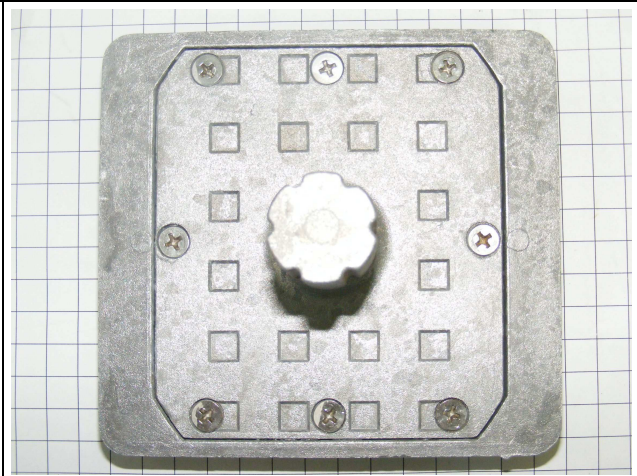
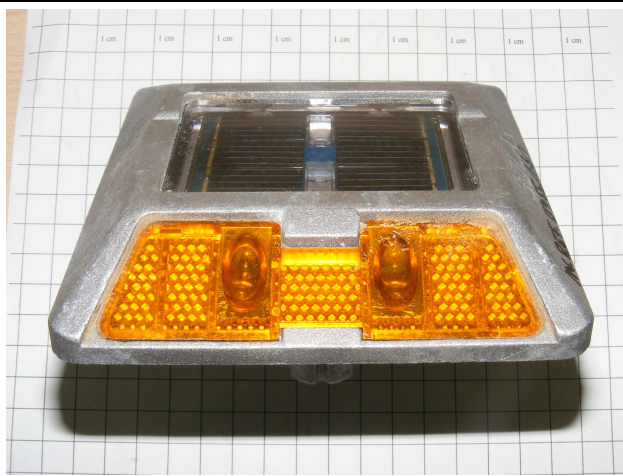


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Annex 5

Pictures of the samples

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