

# Testing of Visibility Equipment

Test item(s): **Reflective equipment**  
- ENFREN (TPU)  
- AGR (PVC)

Type: **Protective clothing – Enhanced visibility equipment for medium risk situations,  
Type B1 – Free hanging devices and Type B2 – Equipment for limbs**

Customer: **Softreflector LLC**  
**Järve 35A**  
**11314 Tallinn**  
**Estonia**

Applied method(s): **EN 17353:2020**

*Heidi Soili*

**Heidi Soili**  
Specialist

*Päivi Kautonen*

**Päivi Kautonen**  
Testing Engineer



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## 1. Description and identification of test item(s)

Following sample(s) were submitted and identified by the customer as:

Tested item(s):                      Reflective equipment

- ENFREN (TPU)
- AGR (PVC)

Following features were observed by a technician of SGS Fimko:

Pictures of reflective equipment:

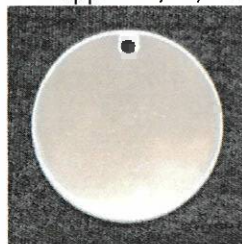
Type B1: ENFREN

size approx. (3,7 x 7,1) cm



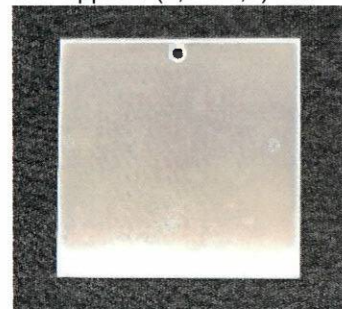
AGR A

size approx.  $\varnothing$  4,8 cm



AGR B

size approx. (7,0 x 7,0) cm



Type B2: AGR Slap wrap, size approx (3,0 x 34,0) cm



(pictures are not in scale)

## 2. Scope of testing

Testing dates:                      2021-09-14 - 2021-09-28

Tests were performed at the PPE laboratory of SGS Fimko Oy under accreditation scope.

Following tests were requested by the customer:

Requirement		Test method
Minimum area	EN 17353:2020, 4.2, table 2	
Retroreflective performance of new material - Type B1	EN 17353:2020, 6.3.2, table 6	EN 17353:2020, 7.3 and CIE pub. No. 54.2
Retroreflective performance of new material - Type B2	EN 17353:2020, 6.3.3, table 7	EN 17353:2020, 7.3 and CIE pub. No. 54.2
Retroreflective performance after test exposures	EN 17353:2020, 6.4.1, table 6	EN 17353:2020, 7.3 and CIE pub. No. 54.2
- abrasion	EN 17353:2020, 6.4.2	EN ISO 12947-2:2016
	EN 17353:2020, 7.4.1	
- folding at cold temperatures	EN 17353:2020, 7.4.2	ISO 4675:2017
- exposure to temperature variation	EN 17353:2020, 7.4.3	EN 17353:2020, 7.4.3

Measuring uncertainty of test equipment: 15 % (k=2)

## 2.1 Sampling and conditioning

Receiving dates: 2021-06-14 and 2021-08-27

Condition: Intact.

Sampling method: The customer supplied all reflective samples.

Conditioning: Samples were conditioned at least 24 hours in an atmosphere having a temperature of  $(20 \pm 2) ^\circ\text{C}$  and a relative humidity of  $(65 \pm 5) \%$  before testing the retroreflective performance as new and after test exposures.

Testing position: Type B1: Free hanging reflectors were tested in one position, as in picture. Retroreflective values for material AGR was tested from smallest reflector area (AGR A).  
Type B2: Retroreflective values were measured as flat, approximately 10 cm of slap wrap was visible.

## 3. Test results

### 3.1 Minimum area

Reflector	Retroreflective material m <sup>2</sup>	Thickness mm
Type B1- Total area of both sides of a single device, measured flat $\geq 0,003 \text{ m}^2$ , thickness $\leq 10 \text{ mm}$		
AGR A	0,0032 (32 cm <sup>2</sup> )	2
AGR B	0,0098 (98 cm <sup>2</sup> )	2
ENFREN	0,0046 (46 cm <sup>2</sup> )	4
Type B2 - Total area of two devices, measured flat $\geq 0,0180 \text{ m}^2$		
AGR Slap Wrap	0,0204 (204 cm <sup>2</sup> )	

### 3.2 Retroreflective performance of new material – Type B1

ENFREN							
Entrance angle		Observation angle					
		0,2° (12')		0,33° (20')		1,5° (1°30')	
$\beta_1$	$\beta_2$	Results	Requirement	Results	Requirement	Results	Requirement
0	5	1442	560	902	400	75	20
0	-5	1381	560	860	400	73	20
10	0	1293	350	887	250	74	10
-10	0	1356	350	919	250	66	10
0	20	1081	280	574	200	56	10
0	-20	880	280	474	200	60	10

AGR A							
Entrance angle		Observation angle					
		0,2° (12')		0,33° (20')		1,5° (1°30')	
$\beta_1$	$\beta_2$	Results	Requirement	Results	Requirement	Results	Requirement
0	5	1035	560	747	400	68	20
0	-5	1039	560	749	400	68	20
10	0	1046	350	753	250	63	10
-10	0	1074	350	774	250	57	10
0	20	1077	280	777	200	68	10
0	-20	519	280	376	200	34	10

### 3.3 Retroreflective performance of new material – Type B2

AGR Slap wrap								
Retroreflective luminous intensity in cd/(lx m <sup>2</sup> )								
Angle of illumination								
Observation angle	5°		20°		30°		40°	
	Results	Requirement (min)	Results	Requirement (min)	Results	Requirement (min)	Results	Requirement (min)
12'	690	330	664	290	497	180	372	65
20'	318	250	328	200	303	170	294	60
1°	97	25	104	15	75	12	40	10
1°30'	31	10	31	7	28	5	30	4

When measured at two rotation angles  $\varepsilon_1 = 0^\circ$  and  $\varepsilon_2 = 90^\circ$ , the coefficient of retroreflection of this material did not differ by more than 15 %. Therefore, this material is defined as not orientation sensitive.

### 3.4 Retroreflective performance after test exposures – Type B1

ENFREN - After exposure to temperature variation							
Entrance angle		Observation angle					
$\beta_1$	$\beta_2$	0,2° (12')		0,33° (20')		1,5° (1°30')	
		Results	Requirement	Results	Requirement	Results	Requirement
0	5	1527	560	969	400	46	20
0	-5	1554	560	968	400	47	20
10	0	1488	350	1050	250	53	10
-10	0	1526	350	1016	250	51	10
0	20	996	280	559	200	41	10
0	-20	1058	280	560	200	40	10

### 3.5 Retroreflective performance after test exposures – Type B2

AGR Slap wrap		
Exposure	Result cd/(lx m <sup>2</sup> )	spec. min
After abrasion	679	100
After folding at cold temperatures	773	100
After exposure to temperature variation	769	100

#### 4. Summary

Test	Acceptance criteria according to	Comments
Minimum area requirement – Type B1 and B2	EN 17353:2020, 4.2, table 2 Type B1 – Total area of both sides of a single device $\geq 0,003 \text{ m}^2$ Type B2 – Total area of two devices, measured flat $\geq 0,018 \text{ m}^2$	Reflective equipment AGR and ENFREN <b><i>meet the requirement</i></b>
Retroreflective performance of new material – Type B1	EN 17353:2020, 6.3.2, table 6 Minimum coefficient of luminous intensity	Reflective equipment AGR and ENFREN <b><i>meet the requirement</i></b>
Retroreflective performance of new material – Type B2	EN 17353:2020, 6.3.3, table 7 Minimum coefficient of retroreflection for separate performance retroreflective material	Reflective equipment AGR <b><i>meets the requirement</i></b>
Retroreflective performance after test exposures – Type B1 - temperature variation	EN 17353:2020, 6.4.1, table 6 Minimum coefficient of luminous intensity	Reflective equipment ENFREN <b><i>meets the requirement</i></b>
Retroreflective performance after test exposures – Type B2 - abrasion - folding at cold temperatures - temperature variation	EN 17353:2020, 6.4.2 Minimum $100 \text{ cd}/(\text{lx m}^2)$ coefficient of retroreflection for separate performance retroreflective material	Reflective equipment AGR <b><i>meets the requirement</i></b>

The statement of conformity in this test report is only based on measured values by the laboratory and does not take their uncertainties into consideration. The relevant uncertainty value is obtainable upon request from the laboratory.

#### End of test report