

Client: Zhejiang Lanxiang Reflective Materials Co.
No. 566, Huatai Road
Jinpan New Development Zone
Jinhua City
Zhejiang Province
China

Att: Shirley Sun

Technical Report

Subject: Limited testing to EN ISO 20471:2013
Your Ref: Reflective Material – LX
Our Ref: SPC0214451/1320/1, Issue 1
Replaces SPC0214451/1320, dated 18th July 2013
Date: 25th November 2013

Conditions of Issue:

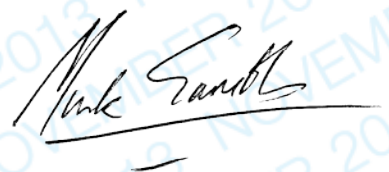
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Results given in this report refer only to the samples submitted for analysis and tested by SATRA. Comments are for guidance only.

Tests marked † fall outside the UKAS Accreditation Schedule for SATRA. All interpretations of results of such tests and the comments based upon them are outside the scope of UKAS accreditation and are based on current SATRA knowledge.

A satisfactory test report in no way implies that the product tested is approved by SATRA and no warranty is given as to the performance of the product tested. SATRA shall not be liable for any subsequent loss or damage incurred by the client as a result of information supplied in the report.

Report signed by: M Gamble
Position: PPE Technologist
Department: Safety Product Centre



INTRODUCTION

A sample of retro-reflective material, as described below, was submitted for testing. The material was received by SATRA on the 13/05/13 for testing to EN ISO 20471:2013, as indicated below.

CONCLUSIONS

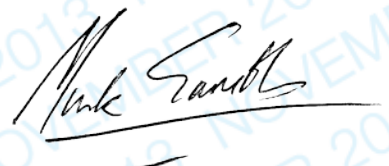
Sample Reference	EN ISO 20471:2013	Result
LX Retro-reflective Material	Clause 6.1 Retro-reflective performance of new materials	PASS Separate
	Clause 6.2 Retro-reflectivity after pre-treatment	PASS
	Clause 6.2 Retro-reflectivity after washing, (ISO6330) 50 cycles, 60°C	PASS
	Clause 6.2 Retro-reflectivity after dry cleaning, (ISO3175, normal) 10 cycles	PASS

TESTING

The sample was treated as a separate performance material. Testing was completed on the 15/07/2013. The results are presented without any consideration of the effects of Uncertainty of Measurement (UoM).

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TEST REQUIREMENTS

EN ISO 20471:2013 Minimum coefficient of retro-reflection in $\text{cd}/(\text{lx}\cdot\text{m}^2)$ for separate performance retroreflective material.

Observation angle	Entrance angle β_1 ($\beta_1 = 0$)							
	5°		20°		30°		40°	
	See Note 1	See Note 2	See Note 1	See Note 2	See Note 1	See Note 2	See Note 1	See Note 2
12'	330	247.5	290	217.5	180	135	65	48.8
20'	250	187.5	200	150	170	127.5	60	45
1°	25	18.9	15	11.3	12	9	10	7.5
1° 30'	10	7.5	7	5.25	5	3.75	4	3

Note 1: Requirements for materials that are not considered to be orientation sensitive, or for the strongest direction when the materials are considered to be orientation sensitive.

Note 2: Requirements for the weakest direction when materials are considered to be orientation sensitive.

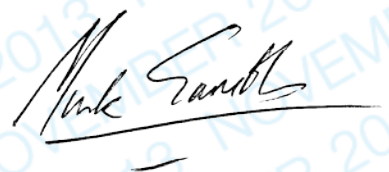
EN ISO 20471:2013 Requirements for retroreflective performance after test exposure $\text{cd}/(\text{lx}\cdot\text{m}^2)$

Exposure	Observation angle 12', Entrance angle 5° See note 1		Observation angle 12', Entrance angle 5° See note 2	
	Separate Performance	Combined Performance	Separate Performance	Combined Performance
Abrasion	100	30	75	22.5
Flexing	100	30	75	22.5
Folding at cold temperatures	100	30	75	22.5
Temperature variation	100	30	75	22.5
Rainfall	100	15	75	11.25
Washing	100	30	75	22.5
Dry cleaning	100	30	75	22.5

Separate performance retro-reflective material and combined performance material must also meet minimum specified requirements after being exposed to various pre-treatments and also under the influence of rainfall. After exposure a separate performance material, which is measured at the measurement condition of observation angle 12' and entrance angle 5°, must achieve a minimum coefficient of retro-reflection value of $100\text{cd}/(\text{lx}\cdot\text{m}^2)$. A combined performance material, measured under the same conditions, must meet the minimum requirements of $30\text{cd}/(\text{lx}\cdot\text{m}^2)$, and under the influence of rainfall it must be $15\text{cd}/(\text{lx}\cdot\text{m}^2)$.

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RESULTS

Results: Material as received – x orientation

Observation angle	Entrance angle				UoM (%)
	5°	20°	30°	40°	
12'	[330] 541	[290] 538	[180] 522	[65] 461	± 8.0 (See note 3)
20'	[250] 386	[200] 384	[170] 374	[60] 338	
1°	[25] 41.8	[15] 45.5	[12] 46.7	[10] 36.2	
1° 30'	[10] 28.2	[7] 28.2	[5] 29.0	[4] 27.8	

All measurements in $cd/(lx \cdot m^2)$ Minimum requirements for separate perf. material shown in [square brackets]

Results: Material as received – y orientation

Observation angle	Entrance angle				UoM (%)
	5°	20°	30°	40°	
12'	[330] 540	[290] 532	[180] 513	[65] 464	± 8.0 (See note 3)
20'	[250] 382	[200] 377	[170] 367	[60] 340	
1°	[25] 42.9	[15] 49.9	[12] 51.8	[10] 37.8	
1° 30'	[10] 27.3	[7] 28.0	[5] 31.4	[4] 29.3	

All measurements in $cd/(lx \cdot m^2)$ Minimum requirements for separate perf. material shown in [square brackets]

Orientation Sensitive Check Test

Sample direction	Observation angle	Entrance angle	UoM (%)	Sensitive/ Non-sensitive If the difference between the x and y values is less than 15% the sample is not considered orientation sensitive.
		5°		
x - direction	12'	541	± 8.0 (See note 3)	
y - direction	12'	540		
Difference between x & y direction		1	-----	Non-sensitive
Difference expressed as a percentage (%)		<0.5		

RESULTS

EN ISO 20471:2013 Clause	Pre-Treatment	Observation angle 12', Entrance angle 5° x orientation cd/(lx·m ²)	Observation angle 12', Entrance angle 5° y orientation cd/(lx·m ²)	UoM % (See note 3)	PASS / FAIL	
7.4.1	Abrasion	543	537	±8.0	PASS	
7.4.2	Flexing	498	496		PASS	
7.4.3	Folding @ Cold Temperature	517	518		PASS	
7.4.4	Exposure to Temperature Variation	531	533		PASS	
7.4.5	Retro-reflective Performance in Rainfall	198	---		PASS	
7.5.2	Washing: 60°C: 05 cycles	516	511		PASS	
7.5.2	Washing: 60°C: 10 cycles	439	440		PASS	
7.5.2	Washing: 60°C: 25 cycles	458	455		PASS	
7.5.2	Washing: 60°C: 40 cycles	386	385		PASS	
7.5.2	Washing: 60°C: 50 cycles	315	315		PASS	
7.5.3	Dry Cleaning: 05 cycles	530	528		PASS	
7.5.3	Dry Cleaning: 10 cycles	521	521		PASS	
Domestic washing according to ISO6330, Method 2A, 60°C. ISO3175, normal cycle, no restrictions, tetrachloroethylene (perchloroethylene)						

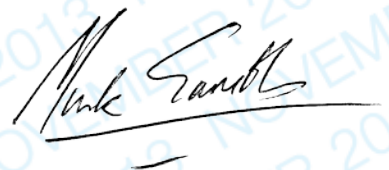
ADDITIONAL INFORMATION / NOTES

Note 3: 'UoM' denotes estimated Uncertainty of Measurement for stated test results. This uncertainty value is based on a standard uncertainty multiplied by a coverage factor k = 2, which provides for a confidence level of approximately 95%

***** END OF REPORT *****

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TERMS AND CONDITIONS OF BUSINESS

1. **GENERAL**
Work done or services undertaken are subject to the terms and conditions detailed below and all other conditions, warranties and representations, expressed or implied are hereby excluded.
2. **PRICES**
Prices are based on current material and production costs, exchange rates, duty and freight and are subject to change without notice.
3. **DELIVERY ESTIMATES**
Delivery estimates are made in good faith and date from receipt of a written order and full information to enable us to proceed. While SATRA or its subsidiaries (hereafter referred to as "SATRA") make every effort to fulfil them, such estimates are subject to unforeseen events and if not maintained, cannot give rise to any claim. Offers "ex stock" are subject to prior sale.
4. **CANCELLATION AND RETURNS**
Cancellation of orders for goods, services, training or consultancy is only acceptable by prior agreement of SATRA and a charge will normally be made.
5. **CLAIMS**
Claims for errors, shortages etc should be notified within 10 days of date of receipt. In the event of goods damaged in transit, packing materials should be retained for examination; otherwise no liability can be accepted.
6. **PAYMENT TERMS**
Payment terms are net 21 days from date of invoice. Failure to comply with the terms of payment may result in delayed delivery of goods and services and a review of the Customer's credit account. Should the customer become subject to an administration order, or becomes bankrupt or goes into liquidation, SATRA has a right to cancel any contract and discontinue any work. SATRA reserves the right to adjust US Dollar and Euro sales price where customer exceeds credit terms and where the exchange rate has moved more than 10% since invoicing.
7. **RETENTION OF TITLE**
All goods remain the property of SATRA until paid in full. Under no circumstances will a customer's purchase order override SATRA's Retention of Title clause. In the case of software, the ownership of the software remains with SATRA. Payment of invoices in full will entitle the customer to use the software under licence until (a) they cease to be a member of SATRA or (b) they cease trading. In both instances, the licence shall then revert to SATRA.
8. **GUARANTEE**
All goods manufactured by SATRA are guaranteed both as regards material and workmanship. Any part returned carriage paid, within twelve months from date of supply and found defective, will be repaired or replaced at SATRA's option free of charge. SATRA admits no liability for loss, damage or delay consequent on any defect in any goods supplied by SATRA.
9. **TEST REPORTS**
Results given in test reports refer only to samples submitted for analysis and tested by SATRA. A satisfactory test report in no way implies that the product tested is approved by SATRA and no warranty is given as to the performance of the product tested. SATRA shall not be liable for any subsequent loss or damage incurred by the Customer as a result of information supplied in a test report.
10. **TEST SAMPLES**
Unless otherwise agreed in advance, test samples will be disposed of 6 weeks after the date of the final report. If required, samples can be returned at the Customer's expense.
11. **RESPONSIBILITY**
Every effort is made to ensure accuracy in description, drawings and other information in correspondence, catalogues, etc but no warranty is given in this respect and SATRA shall not be liable for any error therein. SATRA carries out all tests and/or advises only on the basis that the same are carried out, made or given without any responsibility whether for negligence or otherwise. SATRA and its servants or agents will not be liable for any damage or loss direct or indirect of whatsoever kind, whether or not the same results directly or indirectly from negligence on the part of SATRA or its servants or agents.
12. **CONFIDENTIALITY**
Unless specifically excluded in the terms of an individual contract between SATRA and its Customer, the following shall apply to all reports, advice, drawings, photographs, specifications or data:
 - i. The above shall not be disclosed to third parties or used in litigation without the consent of SATRA.
 - ii. Where SATRA has given consent to disclosure, the Customer shall draw the attention of the third party to these terms of business and the basis on which SATRA undertakes test, reporting and advising. The Customer shall indemnify SATRA for any failure to do so.
 - iii. The above items are submitted to the Customer as confidential documents. Confidentiality shall continue to apply after completion of the business, but shall cease to apply to information or knowledge which may come into the public domain.
13. **CONSTRUCTION AND ARBITRATION**
The laws of England shall govern all contracts and the parties submit to exclusive jurisdiction of the courts of England, unless otherwise agreed.

Issue Date: 1st October 2009

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