



**VCA Headquarters**  
1 The Eastgate Office Centre  
Eastgate Road  
Bristol, BS5 6XX  
United Kingdom

Switchboard: +44 (0) 117 951 5151  
Direct line: +44 (0) 117 952  
Main Fax: +44 (0) 117 952 4103  
Email: [enquiries@vca.gov.uk](mailto:enquiries@vca.gov.uk)  
Web: [www.vca.gov.uk](http://www.vca.gov.uk)

THE UNITED KINGDOM VEHICLE APPROVAL AUTHORITY

Rev 1/03



COMMUNICATION CONCERNING THE APPROVAL GRANTED OF A TYPE  
OF ADVANCE-WARNING TRIANGLES, PURSUANT TO REGULATION  
NO 27.03

Approval No: 27R-033909

1. Trade name or mark of the advance-warning triangle:   
*FuDing*
2. Manufacturer's name: NINGBO FUDING INDUSTRIAL AND TRADING CO., LTD.
3. Address: DINGJIASHAN, XIAOGANG, BEILUN DISTRICT, NINGBO CITY, ZHEJIANG PROVINCE, P.R.CHINA
4. If applicable, name and address of the manufacturer's representative: Not applicable
5. Address: Not applicable
6. Brief description of the advance-warning triangle: Hard retro-reflective outer strip and flexible fluorescent inner strip with four stems of metal support.
7. Submitted for approval on: 1 March 2006
8. Technical service responsible for conducting approval tests: Vehicle Certification Agency
9. Date of test report issued by that service: 18 March 2006
10. Number of test report issued by that service: KSF073892(3909)

An executive agency in the UK Department for Transport



11. Approval GRANTED

12. Remarks : None

13. Place: BRISTOL

14. Date: 24 MARCH 2006

15. Signature:



M J MULVANEY

16. The following documents, bearing the approval number shown above, are annexed to this communication:

- Dimensioned drawings
- Photographs

KSF073892





Vehicle Certification Agency, 5<sup>th</sup> floor, Samsung Life Insurance  
Building, 108-76, Siheung-Dong, Keumcheon-Ku,  
Seoul, Korea (153-839)  
Tel: 82-2-802-0657  
Fax: 82-2-802-0658  
E-mail address: vcakorea@chol.com

**TEST REPORT: Advance-warning triangles**

**Report/Job Number: KSF073892(3909)**

**Page: 1 of 9**

**TEST DETAILS**

Subject	Advance-warning triangles
EC Directive	-
ECE Regulation	ECE Regulation 27.03
Location of Test	National Automobile Quality Supervision Test Center (Xiangfan, Hubei)
Date of Test	1-3 March 2006, 15-18 March 2006
VCA Representative	N.S.CHUN
Manufacturer's Representative	Mr. DING SHIHAI
Reason for Test	New Approval

**MANUFACTURER DETAILS**

Manufacturer's Name	NINGBO FUDING INDUSTRIAL AND TRADING CO., LTD.
Manufacturer's Address	DINGJIASHAN, XIAOGANG, BEILUN DISTRICT, NINGBO CITY, ZHEJIANG PROVINCE, P.R.CHINA
Model Type & description	RT088
Category	Component

**CONCLUSION**

The above mentioned vehicle was tested in accordance with ECE Regulation 27.03 Advance-warning triangles was found to comply in all respects.



Signature:

Name: N.S.CHUN

Position: Type Approval Engineer

Date: 18 March 2006

**LIST OF ANNEXES**

ANNEX	No of PAGES	SUBJECT
1	1	Colour test result of fluorescent material

**TEST REPORT: Advance-warning triangles**

<i>Paragraph</i>	<i>Parameter</i>	<i>Complies</i>
------------------	------------------	-----------------

**TEST SPECIFICATION/ WORST CASE RATIONALE:**

Three models (RT201, RT511 and RT088) are applied at the same time that has same illuminating surface and material but different mechanical support. Colour test are carried out only for RT201 and Photometric (CIL) test is chosen from maximum inclination, RT088. All other mechanical and temperature tests are carried out for each type.

Manufacturer's documentation complete

(Dimensional drawings, brief technical descriptions of material, instructions)

Y

**Laboratory**

Retro-reflector measuring equipment

Make: KOHZU Type: ALT-1  
(RRM-12M, PTS-M2)  
Serial: 95557, 95558 Cal date: 2005.3.25

Colorimeter

Make: TOPCON Type: BM-7  
Serial: 00824804 Cal date: 2005.5.17

Temperature test equipment

Make: Lec (BOGNOR REGIS ENGLAND) Type: XMT-7000  
Serial: - Cal date: 2005.4.26

Colour fastness (ISO 105-B02): Xenon Weather-Ometer

Make: ATLAS Type: Ci4000  
Serial: 15730 Cal date: 2005.11.29

Calipers


Make: MC Type: 979653, 03000002  
Serial: - Cal date: -

Force gauge: Electronic Force Gauge

Make: SALTER Type: FG002  
Serial: - Cal date: 2005.11.18



**TEST REPORT: Advance-warning triangles**

<i>Paragraph</i>	<i>Parameter</i>	<i>Complies</i>
	Test fuel (n-heptane, toluene) Make: SCR Type: -	
	Wind Speed Meter Make: PROVA Instruments Inc Type: AVM-03 Serial: 04261014 Cal date: 2005.10.19	
		
<b>GENERAL REQUIREMENTS</b>		
4.1, 4.2	Advanced-warning triangle and protective cover(if any) shall bear  Trade name /trade mark* marked clearly and indelibly	Y _____
	Sufficient space reserved to incorporate the approval mark, on the product and on the drawing	Y _____
6.1 & Annex 3	Advance-warning triangles shall be constituted as, Open at centre, Red border of retro-reflective outer strip, Inner fluorescent strip, Bounded by concentric equilateral triangular contour	Y _____
6.2	Advance-warning triangles shall be retaining the performance in normal use (vibrations etc.)	Y _____
6.3	Advance-warning triangles shall not be easily disassembled and movable parts shall not be detachable	Y _____
6.4	The front face of triangle shall be vertical to ground( within ±5°): -0.84° (Arc tangent method used)	Y _____
6.5	The front face of advance-warning triangles shall be easily cleaned	Y _____
6.6	The advance-warning triangles shall not present sharp edges and corners	Y _____
6.7	The advance-warning triangles shall have protective covers(if any),	Y _____

**TEST REPORT: Advance-warning triangles**

Paragraph	Parameter	Complies
	<del>OR other means of protection from external agents:</del>	
6.8	The advance-warning triangles shall be accompanied by instructions of use: Inscribed on the protective cover	Y

**Shape and dimensions (Annex 3)**

Items	Limits	#1	# 2	# 3	# 4
7.1.1.1	Theoretical side of triangle	500 ± 50mm	457		
7.1.1.2	Width of unvarying retro-reflective strip	25~50mm	30		
7.1.1.3	Between outer edge and retro-reflective strip	≤ 5mm	3.2		
7.1.1.5	Surface area of red fluorescent material	≥ 315cm <sup>2</sup>	321.7		
	Between retro-reflective strip and fluorescent strip	≤ 5mm	3.2		
7.1.1.6	Side of open centre triangle	≥ 70mm	186		
	Roundness(outer retro-reflective strip)	15 ± 5mm	15		
	Roundness(inner retro-reflective strip)	≤ 20mm	0 (Sharp)		
	Roundness(inner fluorescent strip)	≤ 5mm	4.5		
7.1.2.1	Distance between ground and lower side of advance-warning triangle ( <b>Support</b> )	≤ 300mm	70 (RT088)		
7.1.1.4,	In case of retro-reflecting strip is not contiguous, free area of the supporting				
7.2.1.1	material must be red				Y
7.1.1.5	The fluorescent surface shall be contiguous to the retro-reflecting units				Y



Annex 5, 1.2 **TEST OF HEAT AND LOW-TEMPERATURE RESISTANCE(all samples)**

Annex 5, 7.1 Advance-warning triangle shall be kept dry atmosphere at 60±2°C for 12 hour (in \_\_\_\_\_)

**TEST REPORT: Advance-warning triangles**

<i>Paragraph</i>	<i>Parameter</i>	<i>Complies</i>
	the protective cover, if provided)	Y
Annex 5, 7.2	Visual inspection: No crack, distortion, cover shall have normal operation	Y
Annex 5, 7.3	After the heat resistance test, device shall be kept at 25±5°C for 12 hour. And kept at -40±2°C for 12 hour	Y
Annex 5, 7.4	Immediately cold resistance test: No crack, distortion, cover shall have normal operation	Y

Annex 5, 1.3 **CIL MEASUREMENT OF RETRO-REFLECTING DEVICES**

Annex 5, 4. CIL values for four samples (measurement shall be taken at least after one hour after the heat resistance test)

Divergence angle	Illuminating angle		Limit (mcd/lx)	# 1	# 2	# 3	# 4
	H	V					
20'	+5°	0°	≥ 8000	14349	14442	13736	14916
	-5°	0°		13801	13940	13763	14972

Annex 5,1.4 Two triangles shows minimum and maximum CIL values shall be visibly compared with 100mm x 100mm fluorescent material at a distance of 30m and daylight. No noticeable difference of colour or luminance shall be permitted

Y

Annex 5,1.5 **Two** triangles shows **minimum** and **maximum CIL** values shall be tested as next procedure

Annex **PHOTOMETRIC SPECIFICATIONS**

5,1.5.1

7.3.1.1

Retro-reflective devices

Divergence angle	Illuminating angle		Limit (mcd/lx)	Min CIL Sample	Max CIL Sample
	H	V			
20'	+40°	0°	≥ 600	1036	910
	+30°	0°	≥ 1750	2555	2295
	+5°	0°	≥ 8000	13801	14953
	0°	0°	≥ 8000	14219	15315



**TEST REPORT: Advance-warning triangles**



Paragraph	Parameter				Complies
1°30'	0°	+20°	≥ 4000	9126	10037
	0°	-20°	≥ 4000	6514	7555
	-5°	0°	≥ 8000	13856	14860
	-30°	0°	≥ 1750	2044	2657
	-40°	0°	≥ 600	828	1076
	+40°	0°	≥ 50	82	91
	+30°	0°	≥ 100	252	274
	+5°	0°	≥ 600	1352	1429
	0°	0°	≥ 600	1453	1506
	0°	+20°	≥ 200	778	736
	0°	-20°	≥ 200	521	566
	-5°	0°	≥ 600	1342	1383
	-30°	0°	≥ 100	165	185
	-40°	0°	≥ 50	65	65

7.3.1.2

CIL measured on random slices of 50mm length, **ratio** between **extremes shall not exceed 3**

Y

Divergence angle	Illuminating angle		min	max	ratio
	H	V			
20'	+5°	0°	816	1187	1.45
	0°	+20°	583	749	1.29
	0°	-20°	448	646	1.44
	0°	0°	877	1262	1.44
	-5°	0°	833	1193	1.43

7.3.1.3,

Triangular shape shall be clearly recognized for an angle of divergence 20' and an

7.3.1.4

illumination of 1 lux at

Y

Divergence angle	Illuminating angle		Min CIL Sample	Max CIL Sample	Visibility
	H	V			
20'	+40°	0°			Ok
	+30°	0°			Ok
	-30°	0°			Ok
	-40°	0°			Ok

\*Note: If visibility are met then photometric divergence shall be allowed, and min CIL sample is tested for visibility.



**TEST REPORT: Advance-warning triangles**

<i>Paragraph</i>	<i>Parameter</i>	<i>Complies</i>
------------------	------------------	-----------------

Annex5, **COLORIMETRIC SPECIFICATION**

1.5.2

7.2.1 Colour of retro-reflective devices

7.2.1.2, Visual comparison test with standard illuminant A, all samples comply with limit

7.2.1.3

N/A

OR trichromatic coordinate was measured for most doubtful sample

Y

Divergence angle	Illuminating angle		Limit	Trichromatic coordinate
	H	V		
1/3°	0°	0°	y ≤ 0.335	y= 0.3092 , z= 0.0061
1/3° <sup>1)</sup>	0°	±5°	z ≤ 0.008	y= 0.3136 , z= 0.0031

1) In case of colourless surface reflection

Annex5, **TEST OF CLEARANCE TO GROUND**

1.5.3

5. 1) The apparatus on Annex 3, Figure 2 is inverted on a horizontal plane :

Outer rectangle= 320mm, Inner rectangle=50mm, Inner height=15.9mm

2) Individual support shall be placed one after another

All supports are resting simultaneously on the base plane:

Y

The distance between support and test apparatus base plane is at least 50mm:

Warning triangle supports do not touch the test apparatus, i.e. the distance

between base plane and illuminating surface is same as quoted in 7.1.2.1

Y

Annex5, **MECHANICAL SOLIDITY TEST**

1.5.4

6. 1) Set up a warning triangle as manufacturer's specification

2) Apply a force 2N at the apex of triangle (highest point), parallel to the ground

The apex of triangle shall not move more than 5cm, when the force is applied:

RT088=20mm

(Apply a force front/rear ward and record maximum displacement)

Y

After the test the position of device shall not significantly different from origin

Y

Annex5, 1.6 **TEST OF RESISTANCE TO PENETRATION OF WATER**

11.1

(One sample other than tested in 1.5)

1) The retro-reflecting device assembled as triangle and



**TEST REPORT: Advance-warning triangles**

<i>Paragraph</i>	<i>Parameter</i>	<i>Complies</i>
	2) immersed apex of illuminating surface of triangle to 20mm for 10 minute at 50±5°C water	
	3) immersed apex of illuminating surface of triangle to 20mm for 10 minute at 25±5°C water	
	Visual inspection: No presence of water	Y
Annex5, 1.7.1	<b>WATER TEST</b>	
8.	(One sample other than tested in 1.5, or 1.6)	
	1) The retro-reflecting device assembled as triangle and	
	2) immersed as flat, reflective surface is upward, under 5cm of surface of water, for 2 hour at 25±5°C water	
	3) dry the triangle	
	Visual inspection: No presence of water	Y
Annex5, 1.7.2	<b>TEST OF RESISTANCE TO FUELS</b>	
9.	1) Triangle and protective cover immersed separately in a tank containing mixture of 70% n-heptane and 30% toluene for 60 second	
	2) place the triangle into the protective cover and laid it flat area	
	3) wait until completely dried	
	Visual inspection: No visually noticeable change (slight crack is acceptable)	Y
Annex5, 1.7.3	<b>TEST OF STABILITY AGAINST WIND</b>	
10.	1) Advance triangle shall be placed in a wind tunnel, on base 1.50m×1.2m	
	2) Geometric roughness (According to Annex 4.) HS=0.5mm±0.05mm: *Mean depth of ground measured before the test, HS=0.509mm	
	3) 3 min at 180Pa dynamic air pressure (about 60km/h under normal condition), wind will be applied for <b>front/rear ward</b> direction	
	Visual inspection: No overturn, Shift (≤5cm on ground): No move. Rotation(≤10°): No rotation.	Y
	* Note : weight measured after the test : 1.5kg	
Annex5, 1.8.1	<b>COLOUR TEST OF FLUORESCENT MATERIAL</b>	



**TEST REPORT: Advance-warning triangles**

Paragraph	Parameter	Complies
-----------	-----------	----------

(Two samples of fluorescent material 100mm x 100mm, submitted acc. to 3.5)

7.2.2.2 Visual comparison test with standard illuminant C, all samples comply with limit N/A  
 OR trichromatic coordinate was measured for most doubtful /highest CIL\* sample Y

Divergence angle	Illuminating angle		Limit	Trichromatic coordinate
	H	V		
1/3°	0°	0°	*	x= 0.6284 , y= 0.3423

\*Note: Trichromatic limit is bounded by following four points quadrangle,

Point	1	2	3	4
x	0.690	0.595	0.569	0.655
y	0.310	0.315	0.341	0.345

Annex5, **DETERMINATION OF LUMINANCE FACTOR OF THE FLUORESCENT MATERIAL**  
 1.8.2

7.3.2.1, With CIE illuminant C and incidence angle of 45° and observed at an angle of 45°,  
 Annex5, 3. tristimulus value Y shall not be less than 30%

$\beta=39.7\%$  ( $L=31.10\text{cd/m}^2$ ,  $L_0=79.18\text{cd/m}^2$ )

\* $\beta_0=1.011$



Annex5, **TEST OF WEATHER RESISTANCE OF FLUORESCENT MATERIAL**  
 1.8.3

12. 1) One of fluorescent material 100mm x 100mm shall be subjected to a temperature and irradiation test described ISO 105 of 1978 until the contrast No. 4 of the grey scale has been reached for the reference sample No.5

2) After the test colour coordinate Y

Divergence angle	Illuminating angle		Limit	Trichromatic coordinate
	H	V		
1/3°	0°	0°	*	x= 0.5944 , y= 0.3267

\*Note: Trichromatic limit is bounded as shown 7.2.2.2 quadrangle

3) The luminance factor shall be at least 30%:

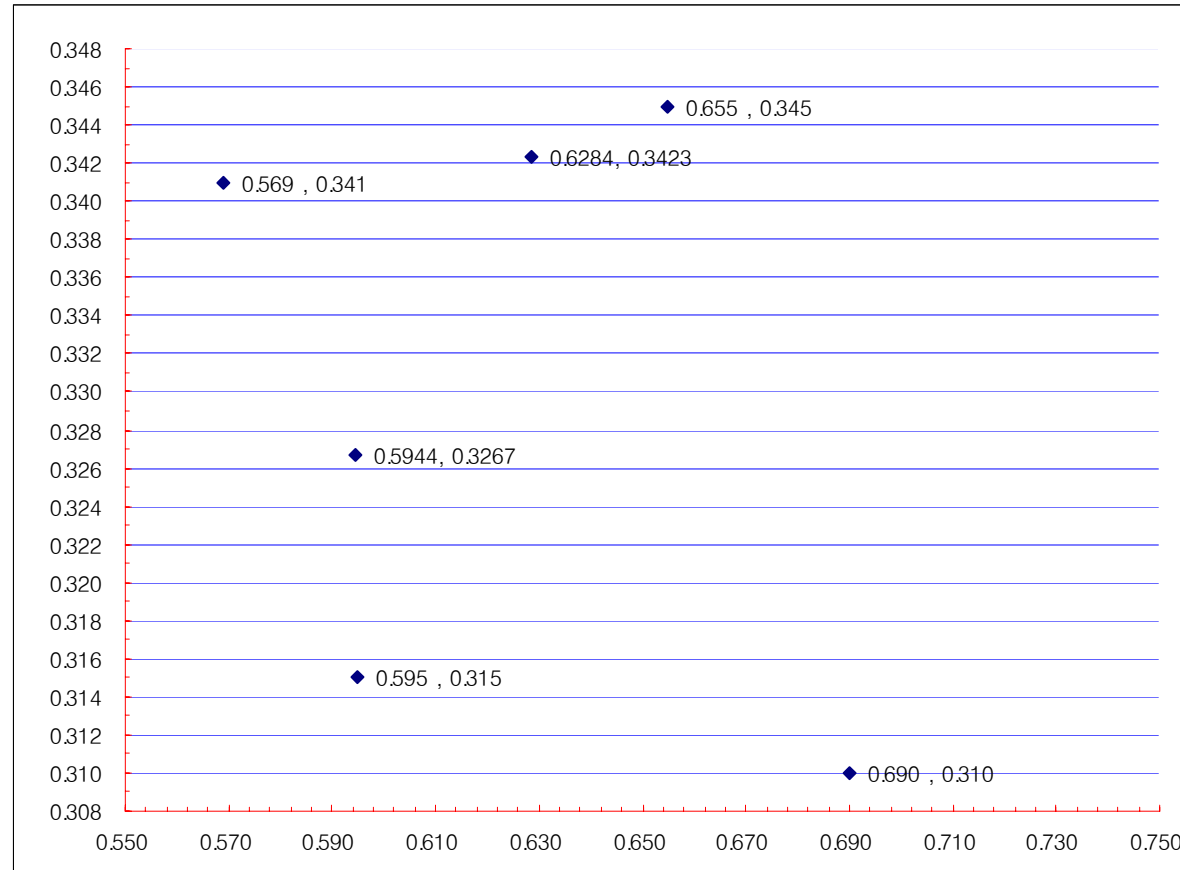
$\beta=34.8\%$  ( $L=27.26\text{cd/m}^2$ ,  $L_0=79.18\text{cd/m}^2$ ) Y

And not increased by more than 5% compared to before weather resistance test

result: 4.9% decreased Y


Annex 1, Colour test result of fluorescent material

	x	y
1	0.690	0.310
2	0.595	0.315
3	0.569	0.341
4	0.655	0.345
before weather test	0.6284	0.3423
after weather test	0.5944	0.3267



First application date: 8 January 2006

1. Specification data

Type		RT088
Function		Advance-warning triangles
Emitted colour		Red
Applicable Regulation (ECE)		R27.03
Location of marking	Rated voltage & wattage	-
		-
	Trade mark	
		Marked on Retro-reflective device lens
Approval Mark	Marked on Retro-reflective device lens	

2. Construction and material

Construction	Material	Remarks
Lens	PMMA POLYESTER	-
Housing	ABS POLYESTER	-
Reflector	PMMA POLYESTER	-
Fluorescent	PVC POLYESTER	-
Protective cover	PP POLYESTER	INSTRUCTIONS OF USE INSCRIBED ON THE COVER

3. Name and address of manufacturer : NINGBO FUDING INDUSTRIAL AND TRADING CO., LTD.

DINGJIASHAN, XIAOGANG, BEILUN DISTRICT, NINGBO CITY, ZHEJIANG PROVINCE, P.R. CHINA

4. Name and address of representative of manufacturer : Not applicable

This information document consists of 3 pages.

