International Standard 7591

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Road vehicles — Retro-reflective registration plates for motor vehicles and trailers — Specification

Véhicules routiers — Plaques d'immatriculation rétroréfléchissantes pour véhicules à moteur et leurs remorques — Spécifications

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 7591 was developed by Technical Committee ISO/TC 22, *Road vehicles*, and was circulated to the member bodies in April 1981.

It has been approved by the member bodies of the following countries :

Austria	Iraq	Romania
Brazil	Italy	Spain
China	Japan	Sweden
Czechoslovakia	Korea, Rep. of	Switzerland
Egypt, Arab Rep. of	Netherlands	United Kingdom
Germany, F.R.	New Zealand	USA
Iran	Poland	USSR

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Belgium
France

Printed in Switzerland

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1 Scope and field of application

This International Standard specifies the provisions applicable to retro-reflective registration plates for motor vehicles and their trailers.

2 References

ISO 105, *Textiles — Tests for colour fastness.*

CIE Publication, *General recommendations for reflex-reflector photometry*; Proceedings 14th CIE session (Brussels, 1959), Volume D, pages 566-571.

3 Retro-reflective material

The retro-reflective outer background of the finished plate shall be flat and smooth. Where retro-reflection is achieved by means of an applied coating or sheeting, the retro-reflective material shall be applied to a corrosion resistant substrate to form a durable bond with the substrate and resist impacts and bending; the reflective material shall be embossable to a minimum height of 1 mm to form letters and digits in relief.

4 Specification compliance

Compliance with national regulations for dimensions, shape, letters and numerals shall be checked on a completely finished plate by the competent authorities.

Compliance with this specification shall be determined by laboratory testing of representative samples of the plates (see the annex).

5 Test samples

The sample plates shall be representative of current production, produced in accordance with the recommendations of the manufacturer of retro-reflective material. Test samples shall have a minimum area of 100 cm^2 of continuous flat background area to facilitate photometric measurements and other testing (see the annex). All test samples shall be conditioned for 24 h at 23 ± 5 °C and 50 ± 10 % relative humidity prior to testing.

6 Photometric properties

6.1 Minimum values of coefficient of retro-reflection

The retro-reflective area of the plate shall have, in a new condition, the minimum values of coefficient of retro-reflection expressed in candelas per lux per square metre ($cd.lx^{-1}.m^{-2}$), given in table 1 when illuminated with a CIE Standard Illuminant A and measured as recommended by the CIE with the entrance and observation angles in the same plane (see the CIE Publication referred to in clause 2). (The angular subtense of the sample shall not be larger than 80′.)

NOTE — The adjustment of the entrance angle shall be such that the entrance and observation angles are on opposite sides of the line joining the light source to the centre of the sample.

Table 1

Colour	Observation angle	Entrance angle			
		5°	30°	40°	Maximum
White	0° 12′	45	18	8	250
	0° 20′	30	12	6	
	1° 30′	3,5	2	0,7	
Yellow	0° 12′	30	12	5	250
	0° 20′	20	8	4	
	1° 30′	2,3	0,8	0,4	

When subjected to a simulated rainfall, the reflectivity of the retro-reflective surface of the plate shall not be less than 90 % of the values specified above.

6.2 Uniformity of retro-reflection

If local variations in luminance are apparent when a sample plate having a retro-reflective background, but no legend, is observed under retro-reflective viewing conditions, photometric measurements shall be made at an observation angle of 20′ and an entrance angle of 5° to check the amount of variation.

Relative measurements shall be made, in the region of the observed variation, of the coefficient of luminous intensity of several adjacent areas, each 5 × 5 cm. The ratio of the highest to the lowest reading shall not exceed 2.

7 Colorimetric properties

7.1 By day

When measured in accordance with the provisions of the CIE document No. 15 (1971) and illuminated with the CIE Standard Illuminant D_{65}, at 45° to the normal and viewed along the normal (45/0 geometry), the colour of the retro-reflective surface (in a new condition) shall be located within the area defined by the chromaticity co-ordinates in table 2 and comply with the luminance factor.

Table 2

Colour		1	2	3	4	Luminance factor
White	x	0,355	0,305	0,285	0,335	⩾ 0,35
	y	0,355	0,305	0,325	0,375	
Yellow	x	0,465	0,427	0,487	0,545	⩾ 0,27
	y	0,534	0,483	0,423	0,454	

7.2 At night

When illuminated with CIE Standard Illuminant A at an entrance angle of 5° and an observation angle of 0° 20′, the colour of the retro-reflective surface (in a new condition) shall be located within the area defined by the chromaticity co-ordinates in table 3.

Table 3

Colour		1	2	3	4
White	x	0,450	0,548	0,417	0,372
	y	0,513	0,404	0,359	0,405
Yellow	x	0,585	0,610	0,520	0,505
	y	0,385	0,390	0,480	0,465

NOTE — The question of the night-time colours of retro-reflective materials is presently being studied by CIE TC 1.6; the above limits are therefore only provisional and will be revised later after CIE TC 1.6 has completed its work.

8 Temperature resistance

A test sample is subjected to the following conditions in sequence :

a) 7 h consecutively at a temperature of 65 ± 2 °C with a relative humidity of 10 ± 5 %;

b) 1 h at a temperature of 23 ± 5 °C and 50 ± 10 % relative humidity;

c) 15 h consecutively at a temperature of −20 °C.

At the end of this test, the reflective material, the letters and digits shall show no peeling off the substrate, no cracking, blistering or appreciable discoloration.

9 Adhesion to the substrate (in the case of reflective sheeting or coating)

Condition the test sample for 1 h at −20 °C. Immediately after taking the sample out of the cold store, it shall not be possible to remove the retro-reflective material physically in one piece from the substrate at the adhesive/plate interface.

10 Impact resistance (in the case of reflective sheeting or coating)

Condition the test sample for 1 h at −20 °C. Immediately after being taken out of the cold storage, place the sample plate with the reflective side up on a solid support base such as concrete or a 12,5 mm steel plate and allow a steel ball of 25 mm diameter to drop from a height of 2 m onto a flat section of the sample.

The retro-reflective material shall show no cracking or separation from the substrate outside of a distance of 5 mm from the impacted area.

11 Bending resistance (in the case of applied reflective sheeting or coating)

Bend the flat area of the test plate within a period of 2 s over a mandrel of 50 mm diameter to an included angle of 90° with the retro-reflective material facing outwards, at a temperature of 23 ± 5 °C.

There shall be no cracking. To facilitate bending, any embossed border shall be cut from the top and bottom of the test plate.

12 Water resistance

Immerse the test plate for a period of 24 h consecutively in deionized water at 23 ± 5 °C and then allow it to dry for 48 h at normal room temperature.

Following completion of this test, the sample shall show no evidence of deterioration which could reduce its efficiency.

13 Cleanability

A test sample smeared with a mixture of lubricating oil and graphite shall be easily cleaned without damage to the reflective surface when wiped with a mild aliphatic solvent such as heptane, followed by washing with a neutral detergent.

14 Resistance to fuel

Immerse a portion of the sample plate, including letters and numerals, for 1 min in a test fuel composed of 70 % *n*-heptane and 30 % toluol (by volume).

After removal, inspect the surface which shall not show any visible change which would reduce its efficiency.

15 Resistance to saline mist

Subject a sample plate to the action of a saline mist for two cycles of 22 h each, separated by an interval of 2 h at room temperature during which the sample is allowed to dry.

The saline mist shall be produced by atomizing, at a temperature of 35 ± 2 °C, a saline solution obtained by dissolving 5 parts (*m*/*m*) of sodium chloride in 95 parts (*m*/*m*) of deionized water.

After completion of the test, wash the sample plate with water, dry with a cloth, then examine it. There shall be no corrosion which would reduce its efficiency.

16 Durability

Subject a sample plate to a source of illumination in accordance with the ISO 105, until blue standard No. 7 has faded to No. 4 contrast of the grey scale.

After this test, the colour shall still meet the chromaticity requirements in table 2 and the coefficient of retro-reflection shall not be less than 50 % of the values in table 1 at the 0° 20′ observation and 5° entrance angles.

The luminance factor shall not be lower than 80 % of the values in table 2.

Annex

(This annex forms part of the standard.)

A.1 Sampling

Nine test samples of each colour shall be submitted to the laboratory for approval testing.

One of the samples shall be a completely finished plate ready to be mounted on a vehicle and representative of current production. It shall be used for checking the dimensions, shape, letters and numerals for compliance with the existing regulations by the competent national authority.

A second sample shall be a completely finished plate but with no legend, to be used for the check on uniformity of retro-reflection.

The seven other test samples shall be finished plates representative of current production but with only one letter and two numerals located in the centre and leaving on the sides free areas of at least 100 cm^2 for the various tests. Where clear-coating of the outer surface of the plate is necessary, the test samples must be clear-coated.

A.2 Tests

Sample No. 1 shall be checked for compliance with the photometric and colorimetric characteristics given in clauses 6 and 7. This sample shall be retained by the laboratory for future reference.

Sample No. 2 shall be cut into two parts of equal size; tests for compliance with clauses 8 and 9 shall be made, each separate test to be carried out on one of the parts.

Sample No. 3 shall be tested for compliance with clauses 10 and 11. For each test, a different part of the plate shall be used.

Sample No. 4 shall be tested for compliance with clause 12.

Sample No. 5 shall be tested for compliance with clauses 13 and 14. For each test, a different part of the plate shall be used.

Sample No. 6 shall be tested for compliance with clause 15.

Sample No. 7 shall be tested for conformance to clause 16.

Sample No. 8 shall be the completely finished plate.

Sample No. 9 shall be the completely finished plate but without legend, to be checked for uniformity of retro-reflection.

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