



## **DREFT TANZANIA STANDARD**

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**MEDC9 (5685) P3 - Road vehicles — Retro-reflective registration plates for motor vehicles and trailers — Specifications (Rev. TZS 300: 2010)**

**TANZANIA BUREAU OF STANDARDS**

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- \* Ministry of Infrastructure Development
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- Weights and Measures Agency
- Tanzania Industrial Research and Development Organization
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- Surface and Marine Transport Regulatory Authority (SUMATRA)
- Transport Resource Centre
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Tanzania Bureau of Standards  
P O Box 9524  
Dar es Salaam  
Tel: 022 2450206/2450298/2450949  
Fax: 022 2450959  
E-mail: info@tbs.go.tz



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

## 0 Foreword

.In avoiding the manufacturing of the sub-standard registration number plates and promoting use of uniform plate numbers, the first edition of this Tanzania Standard was published in 1987 and revised on 2008. The standard has been revised to take into account size of the number plates, minimum values of coefficient of retro-reflection  $R_A$  and chromaticity co-ordinates and luminance factor for green, red, blue and black colour of the number plates

This fourth edition cancels and replaces the third edition (TZS 300: 2008) which has been technically revised.

The performance of retro-reflective number plates at night depends in general, on their area and photometric properties. Other factors include the age of the number plate and its location in relation to vehicle paths.

The specified test conditions for photometric, mechanical and durability performance simulate as far as practicable the most common in service conditions and requirement. It should be stressed here that the maintenance practice drastically should not affect the retro-reflective performance and render the device ineffective.

In the preparation of this Tanzania Standard, reference was made to the following publication:

ISO 7591: 2008, *Road vehicles — Retro-reflective registration plates for motor vehicles and trailers* — Specifications, published by the International Organization for Standardization

For the purpose of deciding whether a particular requirement of this Tanzania Standard is complied with, the final value, observed or calculated, expressing the result of a test shall be rounded off in accordance with TZS 4 (see clause 2). The number of significant places retained in the rounded off value should be the same as that of the specified value in this Tanzania Standard.

## 1 Scope

This Tanzania Standard specifies the minimum requirements for retro-reflective registration number plates for motor vehicles and their trailers.

In particular, this Tanzania Standard specifies the photometric and colorimetric characteristics required and also the test specifications applicable to registration number plates.

NOTE — Retro-reflecting number plates may be manufactured from any material which performs satisfactorily in service, providing the requirements of this Tanzania Standard are met.

## 2 References

The following referenced standards are indispensable for the application of this Tanzania Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies:

TZS 4: 2009, *Rounding off numerical values*

TZS 23: 1979, *Textiles — Test for colour fastness — Colour fastness to light: Xenon arc*

## 3 Terms and definitions

For the purposes of this Tanzania Standard, the following terms and definitions apply:

### 3.1 Registration plate

Rigid support with retro-reflective properties designed to bear the vehicle registration number

### 3.2 Retro-reflective material

Material in which the reflected rays are preferentially returned in directions close to the opposite of the direction of the incident rays.

### 3.3 Coefficient of retro-reflection ( $R_A$ )

Quotient of the coefficient of light intensity  $R$  of the retro-reflective surface of surface area  $A$ . The symbol is  $R_A$  ( $R_A = I/E_{\text{perpendicular. } A}$ ). Coefficient  $R_A$  is expressed in candelas per lux per square metre ( $\text{cd.lx}^{-1}.\text{m}^{-2}$ ).

### 3.4 Observation angle ( $\alpha$ )

The angle between the straight lines joining the centre of a test piece to the centre of the receptor and the centre of the illumination (see annex D).

### 3.5 Entrance angle ( $\beta$ )

The angle between the normal at the centre of a test piece and the straight line joining the centre of that test piece to the source of illumination (see fig. D.1). Both the observation and entrance angles are always in the same plane and on the same side of the line joining the centre of the source of illumination (see annex D).

### 3.6 Rotation angle ( $\epsilon$ )

The angle measured from arbitrary starting point, through which the retro-reflective device is rotated, during the photometric testing, about an axis normal to, and passing through the centre of the test piece.

### 3.7 Illuminance at the retro-reflective device

The expression used conventionally to designate the illuminance produced by the source of and passing through the centre of the test piece.

### 3.8 Coefficient of luminous intensity (CLI)

The quotient expressed in candela per lux (cd/lx) obtained by dividing the luminous intensity, in the direction considered, by the illuminance at the retro-reflective surface for given observation, entrance and rotation angles. It is referred to as the 'CLI' value.

### 3.9 Angular substance of the retro reflective device

The angle subtended by the greatest dimension of the visible area of the effective reflex surface from a specified reference point.

## 4 Photometric specifications

### 4.1 Minimum values of coefficient of retro-reflection

The minimum values of the coefficient of retro-reflection of the retro-reflective part of the sample subjected to testing as per 4.3 shall comply with table 1.

**Table 1 – Minimum values of coefficient of retro-reflection  $R_A$**

Values in candelas per lux per square metre

Colour	Observation Angle ( $\alpha$ )	Entrance angle ( $\beta$ )		
		4°	30°	$R_A$ Maximum
White	0.2°	140	60	250
	0.5°	50	28	
Yellow	0.2°	100	36	250
	0.5°	33	20	
Green	0.2°	60	22	45
	0.5°	20	12	
Red	0.2°	30	12	45
	0.5°	10	6	
Blue	0.2°	10	4	20
	0.5°	3	2	
Black	0.2°	-	-	20
	0.5°	-	-	

### 4.2 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 0.2° and an entrance angle of 0.5° to check the amount of variation.

Relative measurements shall be made, in the region of the observed variation, of the coefficient of retro-reflection of 3 areas, each 50 mm x 50 mm. The ratio of the highest to the lowest reading shall not exceed 2.

### 4.3 Test specifications

Samples shall be measured with CIE standard illuminant A at the required geometries defined in the CIE goniometer system in the co-planar geometry.

NOTE – The entrance angle shall be oriented in such a way that the entrance angle and observation angle are on opposite sides of a line between the illuminant and the centre of the sample.

## 5 Colorimetric specifications

### 5.1 By day

The colour of the retro-reflective surface of the sample subject to testing as per 5.2 shall be contained within the area defined by the chromaticity co-ordinates and comply with the luminance factor as shown in table 2.

**Table 2 — Chromaticity co-ordinates in daylight and luminance factor**

Colour	Axes	Co-ordinates				Luminance factor
		1	2	3	4	
White	X	0.303	0.368	0.340	0.274	≥15
	Y	0.300	0.366	0.393	0.329	
Yellow	X	0.498	0.557	0.479	0.438	≥12
	Y	0.412	0.442	0.520	0.472	
Green	X	0.026	0.166	0.286	0.207	≥7.0
	Y	0.399	0.364	0.446	0.771	
Red	X	0.648	0.735	0.629	0.565	≥2.5
	Y	0.351	0.265	0.281	0.346	
Blue	X	0.140	0.244	0.190	0.065	≥1.0
	Y	0.035	0.210	0.255	0.216	
Black	X	-	-	-	-	≥1.0
	Y	-	-	-	-	

The colour of the retro-reflective surface of the sample subject to testing as per 5.2 shall be contained within the area defined by the chromaticity co-ordinates in table 3.

**Table 3 – Chromaticity co-ordinates at night**

Colour	Axes	Co-ordinates			
		1	2	3	4
White	X	0.45	0.348	0.417	0.372
	Y	0.513	0.404	0.359	0.405
Yellow	X	0.513	0.500	0.545	0.572
	Y	0.487	0.470	0.425	0.425
Green	X	0.007	0.200	0.322	0.193
	Y	0.570	0.500	0.590	0.782
Red	X	0.650	0.620	0.712	0.735
	Y	0.348	0.348	0.255	0.265
	X	0.140	0.244	0.190	0.065



Blue	Y	0.035	0.210	0.255	0.216
Black	X	-	-	-	-
	Y	-	-	-	-

## 5.2 Test specifications

### 5.2.1 Daylight conditions

The test sample shall be illuminated by CIE standard illuminant D65 with the illuminating and viewing conditions for the 45°/0° geometry or the 0°/45° geometry.

### 5.2.2 Night conditions

The test sample shall be illuminated by CIE standard illuminant A at an entrance angle of 4° and the measurement shall be taken at an observation angle of 0° 20'.

## 6 Security features

The genuineness of the number plate shall be controlled by adding security features which are not easy to duplicate by unauthorized manufacturers. The following features shall be included in the manufacturing process of the registration number plates.

### 6.1 Hologram

The registration number plate shall have a hologram with hidden text inside which reads the manufactures name and/or registration trade mark and shall be hot stamped and minimize the possibility of forgery.

### 6.2 Watermark

The hidden watermark shall indicate two letters "TZ" to represent the national symbol. This shall be simulated by use of an angled watermark.

### 6.3 Embossing

The number plate shall be embossed and the reflective sheeting applied to flat metal shall be able to permit embossing. The embossing shall be up to 2 mm.

## 7 Resistance to heat and low temperature

7.1 The sample subjected to testing as per 7.2 shall show no appreciable cracking or distortion of the surfaces.

7.2 The test sample must be exposed to the following conditions in the order shown:

- a) 12 hours consecutively at a temperature of  $(65 \pm 2)$  °C with a relative humidity of  $(10 \pm 5)$  %;
- b) hour at a temperature of  $(23 \pm 2)$  °C and  $(50 \pm 10)$  % relative humidity;
- c) 15 hours consecutively at a temperature of  $- 20$  °C.

7.3 The sample is examined after resting for 4 hours under normal laboratory conditions.

## **8 Adhesion to the substrate (in the case of reflective sheeting or coating)**

After the test of resistance to heat and low temperature the sample plate has to return to  $(23 \pm 2)$  °C for one hour before carrying out the test.

The adhesion of applied or bonded retro-reflective products is verified as follows:

- a) It should only be possible to remove products that were applied by any method, in pieces without using a tool thus preventing their re-use on any other vehicle.
- b) It shall be impossible to remove bonded products (adhesive films) from any substrate without applying a force of at least 10 N per 25 mm of width exerted at a speed of 300 mm per minute perpendicularly to the plate.

## **9 Impact resistance (in the case of reflective sheeting or coating)**

**9.1** Three sample units shall be tested in accordance with annex B using a 1 kg mass which shall impact on the background material as near as possible to the geometric centre of the number plate.

**9.2** The sample unit shall be conditioned for 2 h and then tested in accordance with annex B at a temperature of  $(23 \pm 2)$  °C and a relative humidity of 35 % to 50 %. The impact energy shall be 7.5 J. Any crack on either face of the sample unit shall be limited to within a radius of 20 mm of the centre of impact. No part of the registration number plate shall become detached, otherwise the unit shall have been deemed to fail. All three sample units shall meet these requirements.

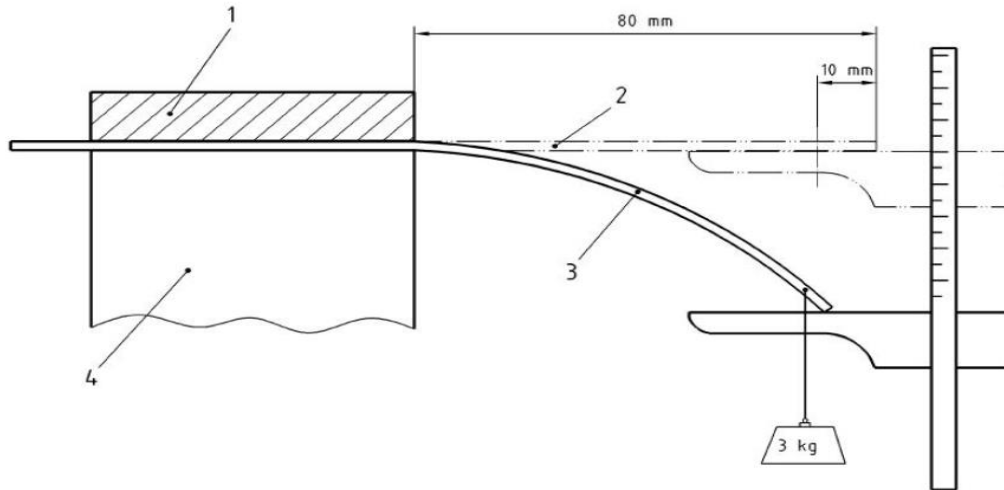
**9.3** In cases of doubt, after the tests the value of R for the retro-reflective background shall be measured in accordance with 4.3. The measurements shall be taken over an area of 25 mm radius around the impacted area at an observation angle of  $0^{\circ} 20'$  and at entrance angles of  $5^{\circ}$  left and  $5^{\circ}$  right only and shall be not less than 80 % of the values given in table 1 in 4.1.

## **10 Bending resistance**

**10.1** After 60 seconds under the test conditions described in 10.2, maximum deflection shall not exceed 25 mm.

**10.2** The sample shall be conditioned prior to testing at a temperature of  $(23 \pm 2)$  °C for at least 2 hours and shall be tested at a temperature of  $(23 \pm 2)$  °C. The test sample shall be positioned as shown in figure 1. One end shall be embedded to secure it and the other left free. The free end shall be 80 mm from the embedded position. 10 mm from the edge of the free end, weight M shall be suspended and attached at a point in the longitudinal axis of the plate. The total weight (including weight M and the suspension system with its fastener) must be 3 kg.

A vertical gauge shall be placed at the end of the sample to measure its deflection when the weight of 3 kg is applied.



**Key:**

- 1 – Weight and shapes ensuring positioning of the plate without crushing of the borders
- 2 – Plate before strain
- 3 – Plate weighted with 3 kg mass
- 4 – Positioning table

NOTE – The diagram is not scale.

**Figure 1 — Bending test — Arrangement of apparatus**

**11 Resistance to water**

11.1 After the test as per 11.2, the sample shall show no signs of deterioration that could reduce its efficiency.

11.2 Submerge the test plate for a period of 24 h consecutively in deionized water at  $(23 \pm 2)$  °C, and then allow it to dry for 48 hours at normal room temperature.

**12 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.

**13 Resistance to fuel**

13.1 The sample subject to testing as per 13.2 shall show no visible change that could reduce its efficiency.

13.2 Submerge a portion of the sample for 1 minute in test fuel composed of 70 % *n*-heptane and 30 % toluol (by volume). Examine the sample on removal from the bath.

**14 Resistance to saline mist**

14.1 The sample subjected to testing as per 14.2 shall show no corrosion that could reduce its efficiency.

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

The saline mist shall be produced by atomizing, at a temperature of  $(35 \pm 2)$  °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.

## **15 Durability**

**15.1** After this test as per 15.2, the color 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.

**15.2** Subject a sample plate to a source of illumination in accordance with the TZS 23 (see clause 2) until blue standard No. 7 has faded to No. 4 contrast of the grey scale.

## **16 Marking**

The registration plates shall be marked with manufacturers name or registration trade mark.

The plates shall be marked with the TBS Standards Mark of Quality.

NOTE – The TBS Standards Mark of Quality shall be used by the manufacturers only under licence from TBS. Particulars of conditions under which the licences are granted may be obtained from TBS.

## **Annex A (Normative)**

### **Sampling procedures**

#### **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.

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 10 cm<sup>2</sup> 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 4 and 5. 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 clause 7.

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

Sample No.4 shall be tested for compliance with clause 11.

Sample No.5 shall be tested for compliance with clauses 12 and 13. For each test, a different part of the plate shall be used.

Sample No.6 shall be tested for compliance with clause 14.

Sample No.7 shall be tested for compliance with clause 15.

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.

## **Annex B (Normative)**

### **Method of test for impact resistance**

#### **B.1 Apparatus**

##### **B.1.1 General**

The apparatus shall be as shown in figure A.1.

##### **B.1.2 The number plate holding fixture**

The number plate holding fixture shall consist of a piece of steel channel 400 mm x 250 mm x 75 mm on which two sample supports of 75 mm x 10 mm are located in a vertical position, resting on the long cross section edge, across the width of the flat face of the steel channel. The spacing of the support plates shall be equidistant from the centre of the steel channel. The distance between the inside faces of the support plates shall be 250 mm (see figure A.2).

Clamping of the test sample to each support shall be by means of a 9 mm square bar. The bar is the same length as the support plate and shall be retained in alignment by a pair of vertical steel bars attached to each end of the support plate. A 20 mm square steel bar shall be attached to the top of the alignment plates, in a horizontal position, to form a bridge over the support plate and clamping bar. The M8 set screws located in the threaded holes positioned in the centre of the span of each bridge bar shall be used to apply pressure to the clamp bars.

##### **B.1.3 Falling mass**

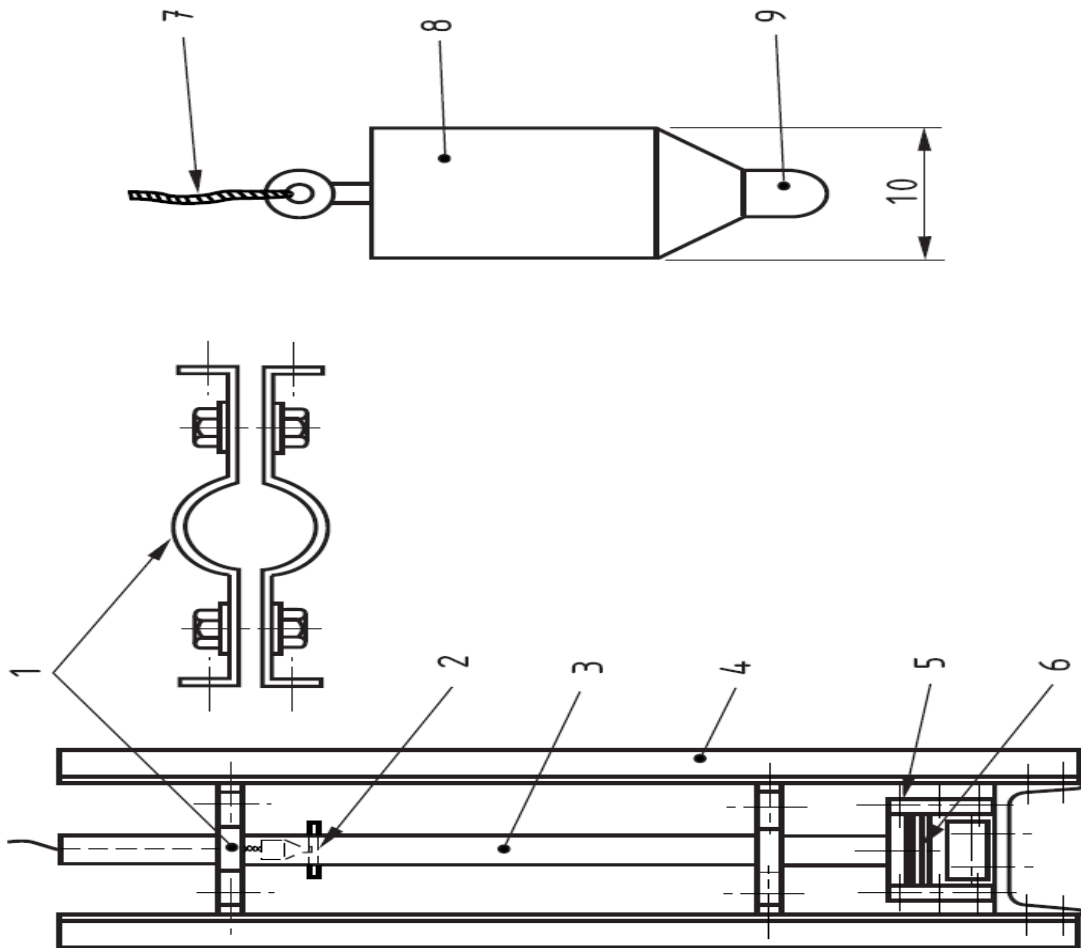
The falling mass (striker) shall be constructed from steel rod and shall have a spherical striking nose of 6.5 mm radius. It shall be used with a drop tube of any suitable material which is straight and which has an inside diameter slightly larger than the falling mass and does not restrict its free fall.

#### **B.2 Determination of impact resistance**

The impact resistance value shall be calculated by multiplying the height of the fall by the mass used.

#### **B.3 Method**

Lay the test sample flat with the front surface uppermost and with an equal overhang at each end. Tighten the set screws to a torque of 7 Nm to secure the test sample. Raise the mass to the required height and retain it by the location pin. When the number plate and apparatus have attained the required conditions, remove the pin and allow the mass to fall freely.



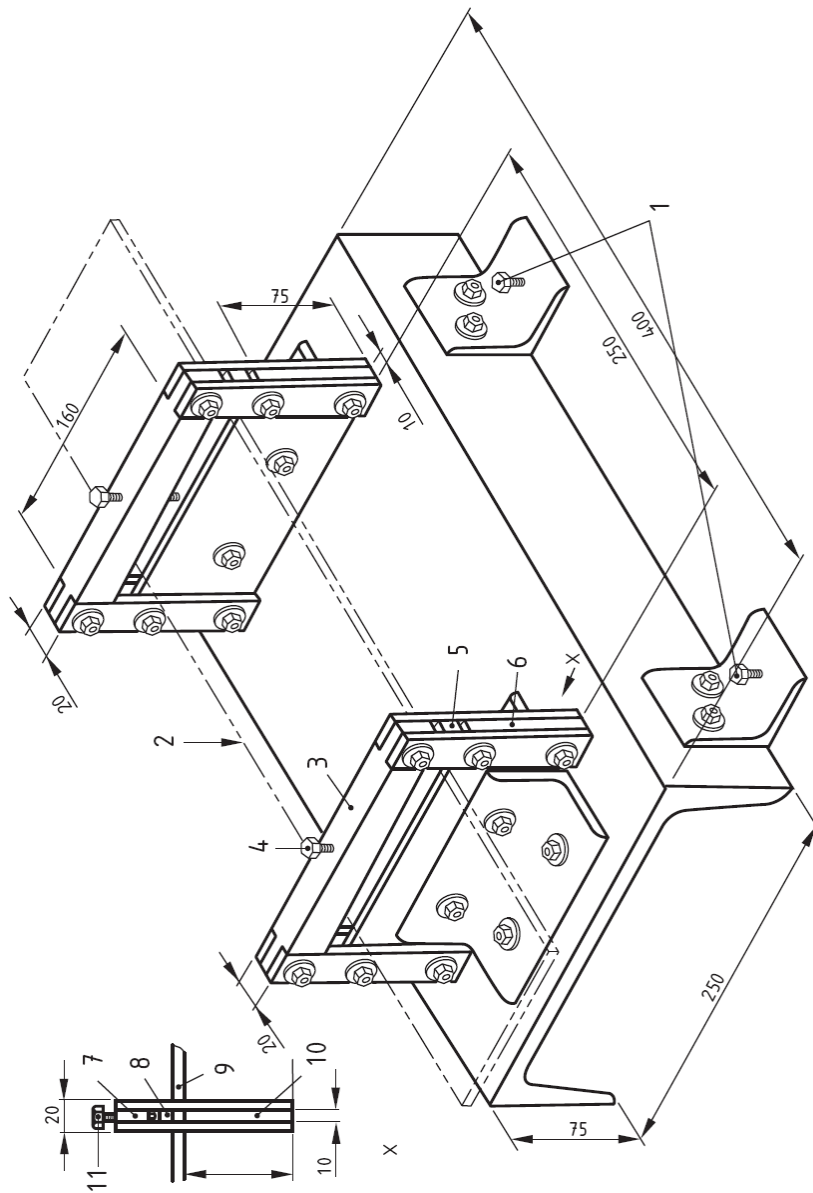
NOTE 1 – All dimensions are in millimetres.

NOTE 2 – The diagram is not scale.

**Key:**

- 2 – Hole drilled through tube for height of location pin
- 3 – Steel or plastic tube (30 to 35 internal diameter)
- 4 – Steel angle section (indicative)
- 5 – Number plate holding fixture (see figure A.2)
- 6 – Tube end shall be no more than 10 mm above the number plate. A hard rubber pad is placed under the sample in the striking area to prevent damage to the spherical radius of the falling weight, should breakage of the number plate occur
- 7 – Length of string attached to eye ball for raising the weight in the tube
- 8 – Striker of an appropriate mass of 1 kg
- 9 – 6.5 radius
- 10 – Diameter of falling weight should be approximately 1.0 mm less than internal diameter of tube

**Figure A.1 – Apparatus for impact resistance test**



NOTE 1 – All dimensions are in millimetres.

NOTE 2 – The diagram is not scale.

**Key:**

- 1 – Level Adjustment
- 2 – Number plate sample
- 3 – Bridge bar
- 4 – Screw (M8)
- 5 – Clamping bar
- 6 – Support plate
- 7 – Bridge bar
- 8 – Clamp bar
- 9 – Sample plate
- 10 – Support plate
- 11 – Bolt (M6)

**Figure A.2 – Number plate holding fixture**



## Annex C (Normative)

### Requirements for letters and numerals

#### C.1 Sizes

All letters and numerals shall have the height of  $70 \pm 1$  mm. The letters and numerals shall be uniform and shall have thickness of  $12 \pm 2$  mm.

#### C.2 Space and margin

The space between adjoining letters and between adjoining numerals must be not less than  $10 \pm 2$  mm and there must be a margin between the nearest part of any letter or numeral and the top and bottom of the plate of at least  $12 \pm 2$  mm. The distance between the centers of adjoining letters and numerals shall be  $45 \pm 2$  mm. The border thickness shall be  $6 \pm 1$  mm.

#### C.3 Plate Size

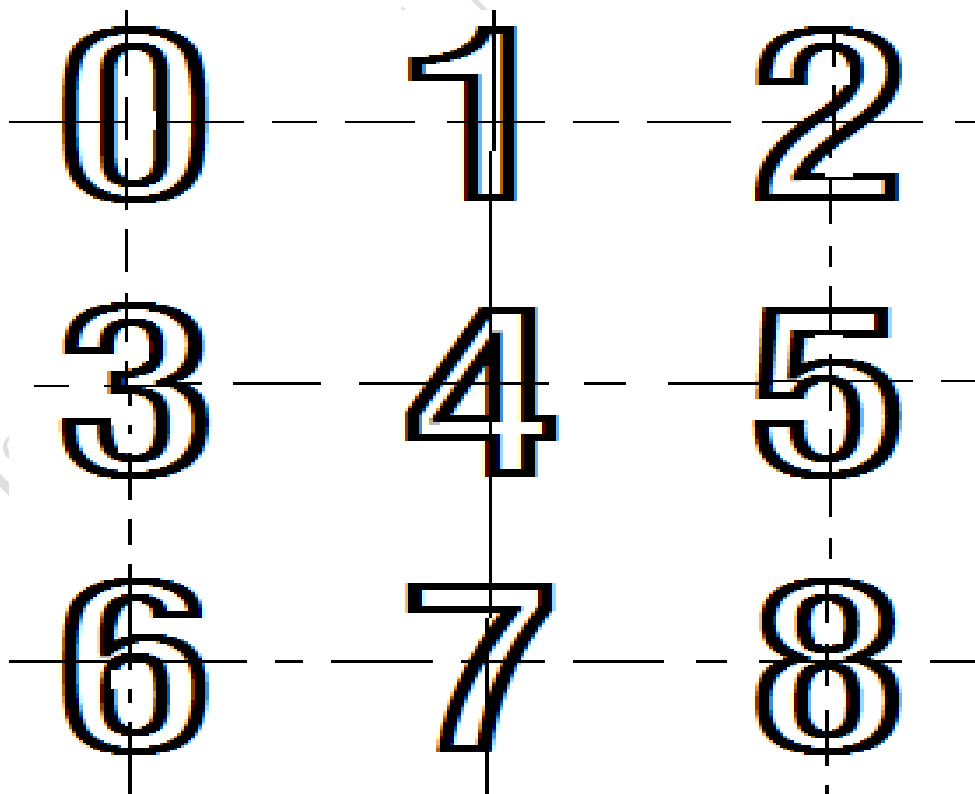
For single line plate size shall be  $(520 \pm 5 \times 110 \pm 5)$  mm

For double line plate size shall be  $(340 \pm 5 \times 180 \pm 5)$  mm

#### C.4 Motorcycles

Sizes of letters and numerals and their corresponding space requirements for motorcycles shall not be less than half the dimensions prescribed for motor cars.

#### C.5 Recommended shapes of numerals and letters



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B

C

D

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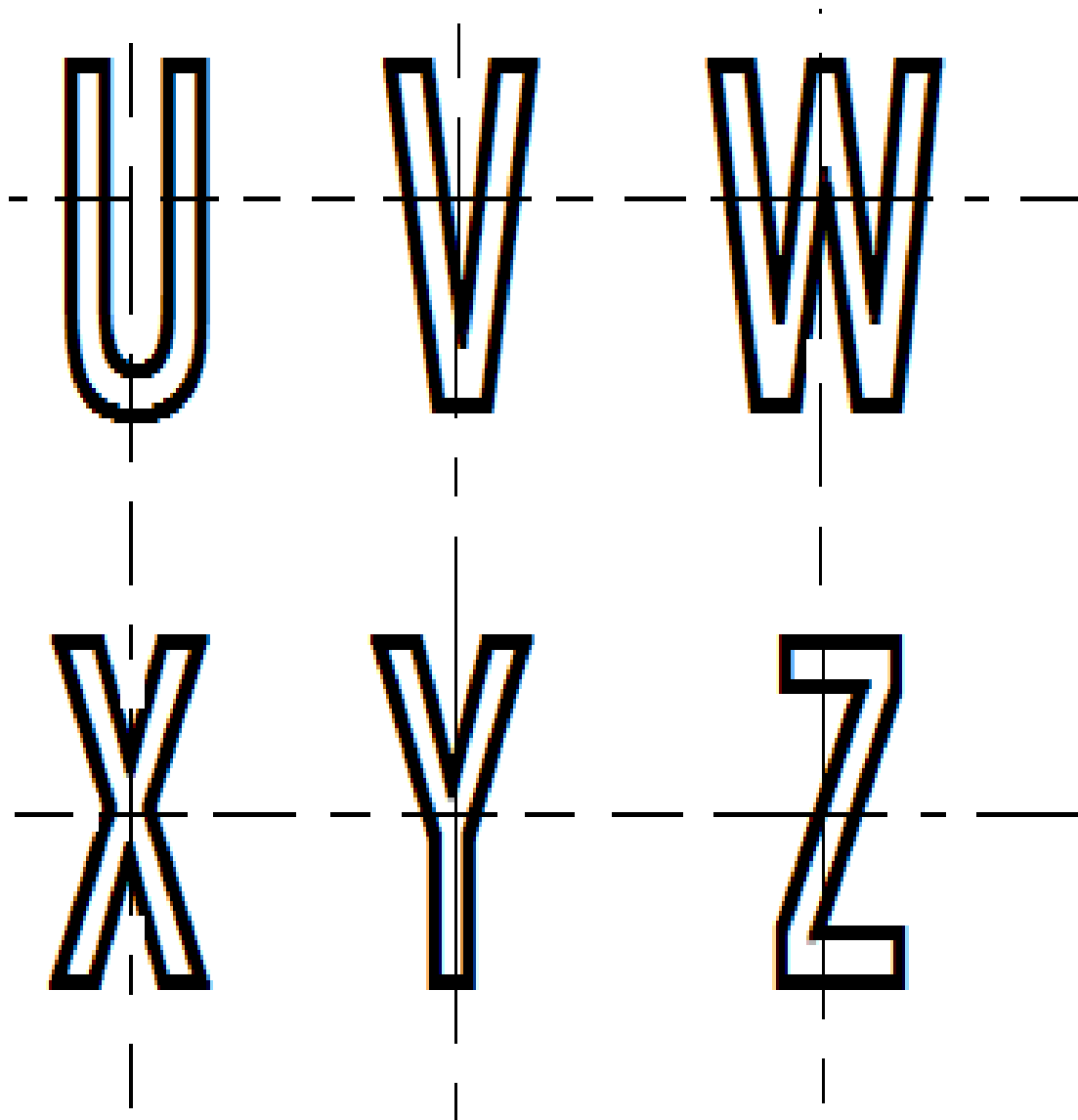
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Annex D  
(normative)

Optical layout for photometric test

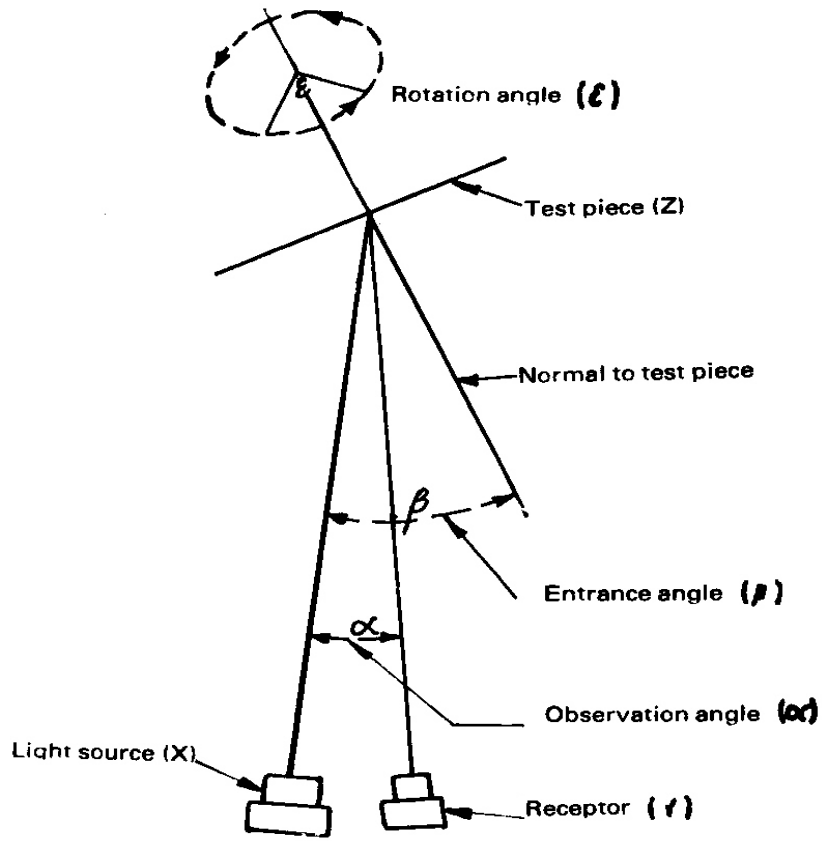


Figure D 1- Optical layout for photometric test



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