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EAST AFRICAN STANDARD

**Retro-reflective and fluorescent warning signs for road vehicles —
Specification — Part 4: Retro-reflective chevron signs**

EAST AFRICAN COMMUNITY

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

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Contents

1	Scope	1
2	Normative references.....	1
3	Definitions.....	1
4	Requirements	2
5	Packing, marking and labeling.....	4
5.1	Packing.....	4
5.2	Marking.....	5
5.3	Labelling	5
6	Inspection and methods of test	5
6.1	Inspection	5
6.2	Test specimens.....	5
6.3	Rigidity tests	5
6.4	Coefficient of retro-reflection test	6
6.5	Colour and luminance factor test	6
6.6	Test for resistance to impact.....	6
6.7	Test for resistance of coatings to scratching.....	6
6.8	Test for resistance to salt fog.....	6
6.9	Test for resistance to artificial weathering.....	7
6.10	Test for strength of adhesion of pressure-sensitive adhesive material.....	7
	Annex A (normative) Notes to purchasers	9
	Annex B (informative) Quality verification of chevron signs	10
	Annex C (informative) Bibliography.....	11

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Retro-reflective and fluorescent warning signs for road vehicles — Specification — Part 4: Retro-reflective chevron signs

1 Scope

This standard specifies requirements for retro-reflective chevron signs that incorporate a substrate and that are intended for use on motor vehicles that operate on public roads.

NOTE Both the chevron signs and the motor vehicles have to comply with the relevant regulations of the Traffic Act.

2 Normative references

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

CIE 15, *Colorimetry*

CIE 54, *Retro-reflection: definition and measurement*

ISO 4892-2, *Plastics — Methods of exposure to laboratory light sources — Part 2: Xenon-arc lamps*

ISO 1518, *Paints and varnishes — Scratch test*

CIE 72, *Guide to the properties and uses of retroreflectors at night*

CIE 144, *Road surface and road marking reflection characteristics*

ISO 3575, *Continuous hot-dip zinc-coated carbon steel sheet of commercial, lock-forming and drawing qualities*

ISO 4998, *Continuous hot-dip zinc-coated carbon steel sheet of structural quality*

EAS 85-13:2000, *Paints, varnishes, lacquers and enamels — Methods of test — Part 13: Falling weight test (Impact test)*

ISO 7253, *Paints and varnishes — Determination of resistance to neutral salt spray (fog)*

3 Definitions

For the purposes of this standard, the following definitions shall apply:

3.1

chevron sign

a warning sign on which retro-reflective stripes are arranged in a chevron pattern and which is intended to be displayed on the rear of a vehicle

3.2

non-stiffened sign

a chevron sign that has no supports fitted; it relies totally on its own stiffness in order to resist bending

3.3

retro-reflective surface

a surface from which light is reflected in directions close to the direction of incidence within a wide range of angles of incidence at the reflecting surface

**3.4
stiffened sign**

a chevron sign that has been fitted with supports to give the sign an increased bending resistance

**3.5
warning face**

the surface of a warning sign that is intended to be displayed when the sign is in use

4 Requirements

4.1 Type

A sign shall be a retro-reflective chevron sign of type J (see Figure 1).

4.2 Warning face materials

4.2.1 General

Red retro-reflective materials (see 4.2.2) or retro-reflector units (see 4.2.3), as required, shall be applied in the widths and at the angles given in Figure 1, with a yellow retro-reflective background, which is dimensioned as shown in Figure 1.

4.2.2 Adhesion of retro-reflective materials

When retro-reflective material that is in the form of a pressure-sensitive or heat-sensitive adhesive material is tested in accordance with 6.10, on no specimen shall

- a) the liner break or tear or remove any of the adhesive backing during the removal of the liner from the retro-reflective material, and
- b) the distance of peeling exceed 40 mm.

4.2.3 Retro-reflector units

NOTE See also 4.6.2.

When retro-reflective units are used for the red parts of a sign, the retro-reflective part of a retro-reflector unit shall be red and each retro-reflector shall comply with the relevant requirements given in CIE 72.

4.2.4 Deleted by amendment No. 2.

4.3 Construction

A sign shall be rectangular and shall be generally in accordance with Figure 1 although the corners of a sign may be rounded. A sign that requires stiffening, shall be so constructed that it is suitable for attaching to a vehicle.

4.4 Application of materials and of protective coatings to warning faces

4.4.1 General

Before the application of any material to the warning face, both surfaces of a sign shall have been cleaned of all grease, oil, corrosion products and other foreign matter, and dried. The edges of a substrate shall be adequately protected from weathering and corrosion.

4.4.2 Corrosion protection

Corrosion protection for a substrate shall consist of the following, except that the finishing coat in (c) below need be applied only to the warning face:

- a) a galvanized coating applied by a continuous hot-dip galvanizing process in accordance with the requirements given in ISO 3575 or ISO 4998;
- b) an epoxy primer of minimum dry film thickness 3 μm and of maximum dry film thickness 5 μm ; and
- c) a finishing coat of siliconized polyester paint of minimum thickness 20 μm , applied by a continuous coil coating process and oven cured.

4.5 Workmanship

The boundaries between the different areas on the warning face of a sign shall be clearly defined. Surfaces covered with retro-reflective material and protective and other coatings shall be free from creases, cracks, blisters, discoloration and lack of adhesion. A sign shall be free from sharp and jagged edges, and the edges of a sign shall be free from corrosion.

4.6 Performance

4.6.1 Rigidity

4.6.1.1 Stiffened signs

When a stiffened sign is tested in accordance with 6.3.1,

- a) the deflection of the sign shall not exceed 2.5 % of the distance between the supports, and
- b) the residual deflection shall not exceed 20 % of the deflection under load.

4.6.1.2 Non-stiffened signs

When a non-stiffened sign is tested in accordance with 6.3.2, the substrate material

- a) shall not deflect by more than 4.0 mm, and
- b) shall show no permanent deflection after removal of the test load.

4.6.2 Coefficient of retro-reflection

When measured in accordance with 6.4 at angles of observation and incidence of 0.33° and 5° , respectively, the coefficient of retro-reflection shall be at least

- a) in the case of a red retro-reflective surface, 36 $\text{cd}/\text{lx}/\text{m}^2$, and
- b) in the case of a yellow retro-reflective surface, 35 $\text{cd}/\text{lx}/\text{m}^2$.

In the case of approved material taken at random from normal production, the coefficient of retro-reflection may deviate by -20 % from the values given above.

4.6.3 Colour of red retro-reflective surfaces

When the retro-reflective surface of a sign is tested in accordance with 6.5 both before and after the weathering test given in 6.9, the chromaticity co-ordinates of the surface shall be within the area on the chromaticity diagram bounded by the limits given in table 1 and table 2, relevant to the colour.

Table 1 – Chromaticity co-ordinates of the points of intersection of the boundary lines of the limiting area on the chromaticity diagram, before and after weathering, for red surfaces

1	2	3	4	5
Co-ordinate		Value of co-ordinate		
X	0.735	0.674	0.569	0.655
y	0.265	0.236	0.341	0.345

4.6.4 Luminance factor of retro-reflective surfaces

When the retro-reflective surface of a sign is tested in accordance with 6.5 both before and after the weathering test given in 6.9, the luminance factor shall be at least

- a) in the case of a red retro-reflective surface, 0.03, and
- b) in the case of a yellow retro-reflective surface, 0.16.

Table 2 — Chromaticity co-ordinates of the points of intersection of the boundary lines of the limiting area on the chromaticity diagram, before and after weathering, for yellow surfaces

1	2	3	4	5
Co-ordinate		Value of co-ordinate		
X	0.545	0.487	0.427	0.465
y	0.454	0.423	0.483	0.534

4.6.5 Resistance to impact

When a sign is tested in accordance with 6.6, coatings on surfaces and coverings of retro-reflective material shall show no evidence of cracking or loss of adhesion further than 5 mm from the impacted area.

4.6.6 Resistance of coatings to scratching

When the warning face and other coated surfaces of a sign are tested in accordance with 6.7, the scratch produced shall be free from jagged edges and shall not have penetrated to the substrate.

4.6.7 Resistance to salt fog

When a sign is tested in accordance with 6.8,

- a) there shall be no sign of cracking, blistering or loss of adhesion on any paint coating or retro-reflective material,
- b) there shall be no sign of corrosion or lack of adhesion on any retro-reflector or its fastener(s),
- c) in the case of other coated surfaces, there shall be no sign of corrosion of the substrate, except at the scribe mark where corrosion, creep or blisters (or any combination of these) shall not extend further than 2 mm on each side of the mark, and
- d) there shall be no sign of deterioration of surfaces or of edges.

4.6.8 Resistance to artificial weathering

When a sign is tested in accordance with 6.9,

- a) surfaces shall show no sign of cracking, blistering, lack of adhesion, chalking or checking,
- b) the coefficient of retro-reflection of red or yellow retro-reflective surfaces at angles of observation and incidence of 0.33° and 5°, respectively, shall be at least 80 % of the value specified in 4.6.2, relevant to the colour, and
- c) uncoated surfaces and edges shall show no sign of deterioration.

5 Packing, marking and labeling

5.1 Packing

Signs shall be so packed that they are protected from damage during normal transportation and storage.

5.2 Marking

Each sign shall bear, in legible and indelible marking on the warning face, the manufacturer's name, trade name or trade mark. The space occupied by this marking shall be of height and length approximately 5 mm and 25 mm, respectively. The quality of the marking shall be such that, when the sign is artificially weathered as in 6.9 and tested in accordance with 6.7 and 6.8, there is no loss of integrity of the marking.

5.3 Labelling

Each sign shall bear, on the reverse face, a securely attached label that provides, in legible and indelible printing, at least the following information:

- a) a caution that the sign should not be fastened by any means that interferes with or diminishes its visibility or, when relevant, its legibility;
- b) a caution that steel surfaces that become exposed during the fitting of a sign will corrode unless they are adequately protected from corrosion, e.g. by being coated with a zinc chromate primer, and
- c) a caution that attaching parts (screws, bolts, rivets) shall not be fitted through the red retro-reflective materials.

6 Inspection and methods of test

6.1 Inspection

Visually examine and then measure each sign in the sample for compliance with all the relevant requirements of this standard for which tests to assess compliance are not given in 6.3 to 6.10 (inclusive).

6.2 Test specimens

From the signs in the sample, prepare the following test specimens:

- a) coefficient of retro-reflection; colour and luminance factor: two test specimens of size approximately 70 mm × 150 mm, one of which has a red retro-reflective surface only, and the other specimen has a yellow retro-reflective surface only.
- b) Deleted by amendment No. 2.
- c) resistance to weathering: a test specimen of size approximately 70 mm × 150 mm, that includes as much of the red and yellow surfaces and any other coating, edges, marking (see 5.2) and, when relevant, holes (for attachment) as is practicable. Seal the newly cut edges;
- d) resistance to impact: a test specimen of any convenient size;
- e) resistance to scratching: a test specimen of size approximately 55 mm × 100 mm, that includes as much of the red and yellow material and any other coating as is practicable; and
- f) resistance to salt fog: two test specimens, each being similar to the specimens described in (c), but of size approximately 100 mm × 150 mm.

6.3 Rigidity tests

Carry out the tests in an ambient temperature of 20 °C ± 3 °C.

6.3.1 Stiffened signs

6.3.1.1 Place the test sign face upwards on two knife-edge supports positioned parallel to the short edges of the test sign and not more than one-tenth of the sign length from the ends. Ensure that the supports extend across the full width of the test sign.

6.3.1.2 Apply a uniformly distributed load of 1.5 kN/m^2 , using bags of shot or dry sand.

6.3.1.3 Measure the mid-point deflection. Check for compliance with 4.6.1.1 (a).

6.3.1.4 Remove the load and measure the mid-point residual deflection. Check for compliance with

6.3.2 Non-stiffened signs

6.3.2.1 Cut a specimen of the substrate material, of length 150 mm and of width 70 mm.

6.3.2.2 Place the specimen, warning face upwards, on two supports, each positioned parallel to, and 10 mm from, the short ends of the specimen. Ensure that the supports extend across the full width of the specimen.

6.3.2.3 Apply a force of $20 \text{ N} \begin{matrix} +1 \\ 0 \end{matrix}$ vertically downwards at the centre point of the specimen and hold for at least 5 s.

6.3.2.4 Measure the mid-point deflection. Check for compliance with 4.6.1.2(a).

6.3.2.5 Remove the force and measure the mid-point residual deflection. Check for compliance with 4.6.1.2(b).

6.4 Coefficient of retro-reflection test



Determine the coefficient of retro-reflection in accordance with CIE 54. On each specimen, take the average of two readings at rotation angles (about the reference axis) that are 90° apart. Check for compliance with 4.6.2.

6.5 Colour and luminance factor test



Determine the chromaticity co-ordinates and luminance factor of the specimen (see 6.2(a)) by means of a spectrophotometer or other equally suitable colour measuring device in accordance with the method given in CIE 54, using 45/0 geometry and Standard Illuminant D_{65} as defined in CIE 15. Check for compliance with 4.6.3 and 4.6.4. Repeat the test after the specimen has been weathered in accordance with 6.9, and again check for compliance with 4.6.3 and 4.6.4. If the colorimetric characteristics have been calculated in the XYZ system, determine the luminance factor by applying the ratio $Y:Y_0$, where Y is the tristimulus value of the sample and Y_0 is that of a perfect diffuser observed under the same conditions.

NOTE The test reports may contain the following information:

- a) the type of instrument used (spectrophotometer, tristimulus colorimeter, etc.);
- b) its designation (manufacturer and type); and
- c) lighting and viewing angles.

6.6 Test for resistance to impact

Use the apparatus and procedure described in EAS 85-13 to subject each coating and covering (see 4.6.5) of each test specimen (see 6.2(d)) to an impact energy of 2.25 J. Check for compliance with 4.6.5.

6.7 Test for resistance of coatings to scratching

Use the apparatus and procedure described in ISO 1518, with the needle loaded with mass-pieces to a total mass of 1 000 g, to test the coating on each specimen (see 6.2(e)). Check for compliance with 4.6.6.

6.8 Test for resistance to salt fog

With the cutting edge of the cutting tool held at an angle of about 30° to the surface and the plane of the blade perpendicular to the surface, scribe on each coated surface a mark of length about 75 mm and that penetrates through the coating to the substrate. Then, using the apparatus described in ISO 7253, subject the test

specimen(s) (see 6.2(f)) to the test for a period of 240 h. After a 24 h recovery period, examine the specimen for compliance with the applicable requirements of 4.6.7 and 5.2.

6.9 Test for resistance to artificial weathering

6.9.1 Examine the relevant test specimen for any defects such as checking, cracking, blistering, delamination, discoloration, shrinking and loss of adhesion. Record any such defects.

NOTE This test is carried out on test specimens as described in 6.2(a) and 6.2(c).

6.9.2 Using the apparatus and procedure given in ISO 4892-2, expose the specimens accordingly using the parameters given in table 3, for the appropriate period given in table 3.

Table 3 — Artificial weathering test parameters

1	2	3
Exposure parameters	Air cooled lamp	Water cooled lamp
Light/dark/water spray cycle	Continuous light with water spray on specimens for 1 8 min every 2 h (18/102)	Continuous light with water spray on specimens for 1 8 min every 2 h (18/102)
Black standard temperature during light only periods	(65 ± 3) °C using a black standard thermometer	(63 ± 2)°C using a black panel temperature
Relative humidity	(50 ± 5) %	(50 ± 5) %
Irradiance (W/m ²) controlled at over a 300 nm - 400 nm range over a 300 nm - 800 nm range	60 550	60 630
NOTE 1 Water used for specimen spray should contain no more than 1 ppm silica. Higher levels of silica could produce spotting on samples and variability in results. Water of the required purity can be obtained by distillation or by a combination of deionisation and reverse osmosis.		
NOTE 2 Whilst irradiance levels should be set at the above levels, variations in filter ages and transmissivity, and in calibration variations, will generally mean that irradiance error will be in the order of ± 10%.		

6.9.3 Examine the test specimen for defects (ignoring those defects previously recorded), and check for compliance with the relevant of 4.6.3, 4.6.4 and 4.6.8.

6.10 Test for strength of adhesion of pressure-sensitive adhesive material

6.10.1 Apparatus

6.10.1.1 Oven, maintained at 70 °C ± 2 °C.

6.10.1.2 Two clean metal test panels, each of size 50 mm × 150 mm × 1 mm.

6.10.1.3 Flat metal sheet, of size at least 100 mm × 150 mm and of mass at least 225 g.

6.10.1.4 Two 750 g masspieces.

6.10.2 Test specimens

Two pieces of adhesive material each of size 50 mm × 150 mm.

6.10.3 Procedure

- a) Pressure-sensitive material: Place the specimens side by side in the oven at 70 °C ± 2 °C. Cover them with the metal sheet. Leave for 4 h. Then remove the specimens from the oven and condition them at 25 °C ± 2 °C for 24 h. Cut a test piece of nominal size 25 mm x 150 mm from each specimen. From each test piece, remove the liner by hand, without the use of water or other solvent(s). Examine the liner and adhesive backing for compliance with 4.2.2(a).

- b) Heat-sensitive material: Cut two 25 mm × 150 mm specimens from the material, remove the liner by hand without the use of water or other solvent(s), and examine the liner and the adhesive backing for compliance with 4.2.2(a).
- c) All materials: Take the remainder of each specimen (now of size 25 mm × 150 mm) and apply a section of size 25 mm × 75 mm of each to a test panel. Condition at 25 °C ± 2 °C for 24 h. Suspend the panels horizontally, with the specimens facing downwards. Attach a masspiece to the free end of each specimen and allow the masspiece to hang freely for 5 min. Measure the distance of peeling, and check for compliance with 4.2.2(b).

NOTE The length L shall be such that the sign extends to within 400 mm of each side of the vehicle, e.g. the length shall be at least 1.70 m for a 2.5 m wide vehicle and at least 1.80 m for a 2.6 m wide vehicle.

Dimensions in millimetres

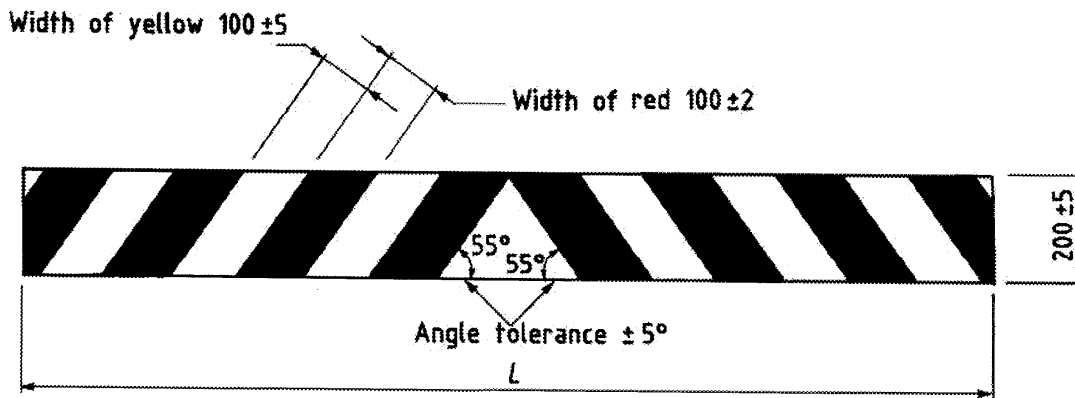


Figure 1 — Retro-reflective chevron sign (type J)

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Annex A
(normative)

Notes to purchasers

The following requirements shall be specified in tender invitations and in each order or contract:

- a) the material to be used for the re4 retro-reflective and other surfaces (see 4.2.1);
- b) whether a sign is to be stiffened and whether the corners are to be rounded (see 4.3); and
- c) the size of the sign (see figure 1).

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Annex B
(informative)

Quality verification of chevron signs

When a purchaser requires ongoing verification of the quality of chevron signs, it is suggested that, instead of concentrating solely on evaluation of the final product, he also direct his attention to the manufacturer's quality system. In this connection it should be noted that SANS 9001 covers the provision of an integrated quality system.

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Annex C
(informative)

Bibliography

SANS 9001/ISO 9001, *Quality management systems — Requirements*

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