



CD/K/020:2008
ICS 93.080.30

EAST AFRICAN STANDARD

Roadstuds — Specification

EAST AFRICAN COMMUNITY

Draft for comments only — Not to be cited as East African Standard

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.

© East African Community 2010 — All rights reserved*

East African Community

P O Box 1096

Arusha

Tanzania

Tel: 255 27 2504253/8

Fax: 255-27-2504481/2504255

E-Mail: eac@eachq.org

Web: www.each.int

Contents

1	Scope	1
2	Normative references	1
3	Definitions.....	1
4	Requirements	2
5	Marking.....	5
6	Inspection and methods of test.....	5
	Annex A (informative) Performance of roadstuds under traffic conditions	8
	Annex B (informative) Categories of roadstuds	9
	Annex C (normative) Quality evaluation of roadstuds produced to the requirements laid down in this specification	10

Draft for comments only — Not to be cited as East African Standard

Draft for comments only — Not to be cited as East African Standard

Roadstuds — Specification

1 Scope

1.1 This specification covers three categories of retro-reflective roadstuds intended to be fitted onto or into road surfaces for use as supplementary road marking.

1.2 This specification does not cover

- a) temporary roadstuds;
- b) the method of securing the roadstuds to the road surface;
- c) the positioning of roadstuds; or
- d) the use of roadstuds of different colours to convey information to road users.

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.

EAS 381, *Sampling procedures for inspection by attributes*

CIE Publication 54, *Retroreflection — Definition and measurement*

EAS 392, *Quality management systems — Requirements*

3 Definitions

For the purposes of this specification the following definitions shall apply:

3.1

acceptable

Acceptable to the parties concluding the purchase contract, but in relation to the standardization mark, acceptable under the provisions of EAC SQMT Act 2006

category

The category of a roadstud (see Annex A).

Coefficient of luminous intensity (CIL)

The quotient obtained by dividing the luminous intensity of the light reflected by the roadstud in the direction of observation by the illuminance at the retro-reflecting surface on a plane perpendicular to the direction of incidence.

NOTE The coefficient of luminous intensity is expressed in candelas per lux (cd/lx).

Colour

The colour of the light retro-reflected by the road-stud, defined in terms of its chromaticity coordinates, using the trichromatic system recommended by the International Commission on Illumination (CIE).

Entrance angle (illumination angle)

The angle between the illumination axis and the reference axis.

Illumination axis

A line segment from the reference centre to the centre of the light source.

Observation angle

The angle between the illumination axis and the observation axis.

NOTE In the context of retro-reflection, the observation angle is always restricted to small acute angles.

Observation axis

A line segment from the reference centre to the receiver (photocell or eye).

Reference axis

A designated line segment originating on the reference centre and used in describing the position of the entrance and observation angles of the roadstud

Reference centre

A point on or near a retro-reflecting surface, which is designated to be the centre of the surface for the purpose of specifying its performance.

Retro-reflection

Reflection in which light is preferentially reflected in directions close to the opposite of the direction of incidence, this property being maintained over wide variations of the direction of incidence.

Roadstud

A retro-reflective device that can be fixed onto or into a road surface to warn, guide or inform road users.

4 Requirements

4.1 Construction

4.1.1 General

A roadstud shall be of acceptable construction and the enveloping profile of the part of a roadstud that is intended to protrude above the road surface shall be smooth and shall not present any sharp edges that could be hazardous to traffic. The retro-reflecting portions of the roadstud shall be free from crevices or ledges in which dirt might accumulate. Any removable part(s) shall only be removable by the use of a special tool.

4.1.2 Depressible roadstuds

- a) The retro-reflecting surfaces of a depressible roadstud shall be self-wiping and the roadstud shall revert to its original form after being traversed by a vehicle.
- b) When a roadstud is tested in accordance with 6.3, the depressing action or the self-wiping action shall show no signs of breakdown nor shall the roadstud show permanent set of such an extent that the retro-reflecting portion is either wholly or partially obscured.

4.2 Dimensions

The height of the part of the roadstud that is intended to protrude above the road surface shall be 15-22 mm.

4.3 Colour

The chromaticity co-ordinates of the retro-reflected light of roadstuds for Standard Illuminant A, measured in accordance with 6.4, shall be within the relevant region on the chromaticity diagram (see Figure 1). The co-ordinates of the corners of the regions on the diagram are given in Table 1.

NOTE The colour of the body of a roadstud shall be either neutral or substantially the same as that of the retro-reflecting portion, and shall be retained throughout the life of the roadstud.

Draft

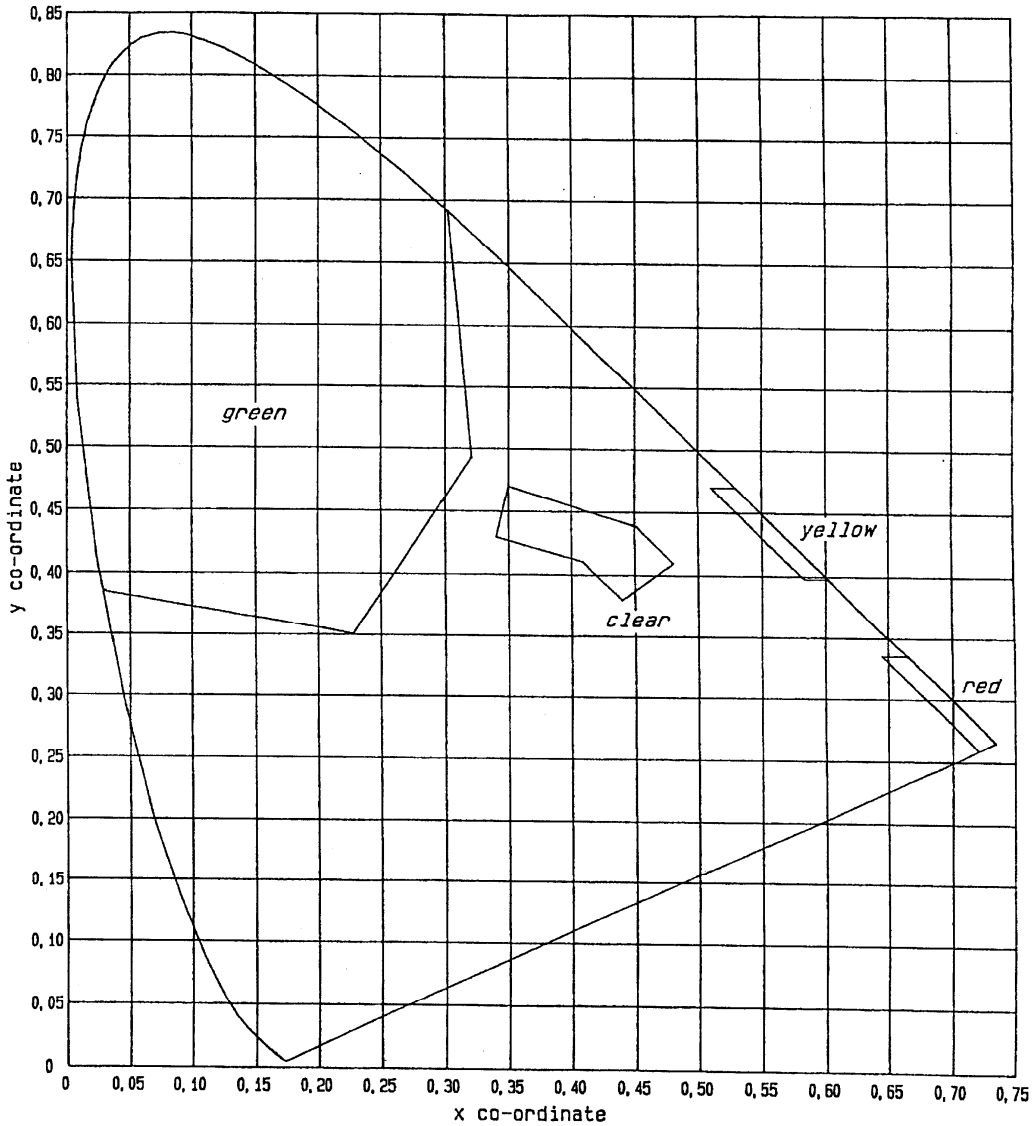


Figure 1 — Boundaries for Retro-reflective colours

Table 1 — Chromaticity coordinates

1	2	3	4	5	6	7	8
Colour	Co-ordinates of the corners of the colour regions (see Figure 1) (Standard illuminant A, entrance angle $V=0^\circ$, $H=5^\circ$, observation angle 0.33°)						
	Co-ordinate	Corner					
		1	2	3	4	5	6
Red	X	0.665	0.645	0.721	0.734	-	-
	y	0.335	0.335	0.259	0.266	-	-
Yellow	X	0.529	0.510	0.583	0.602	-	-
	y	0.470	0.470	0.398	0.398	-	-
Clear	X	0.440	0.480	0.451	0.350	0.340	0.409
	y	0.380	0.410	0.439	0.470	0.430	0.411
Green	X	0.030	0.228	0.321	0.302	-	-
	y	0.385	0.351	0.493	0.692	-	-

Draft

4.4 Category and photometric requirements

A roadstud shall be of one of the categories given in Table 2. When tested in accordance with 6.5, a roadstud shall have, for each retro-reflecting surface and for each entrance angle, a coefficient of luminous intensity (CIL) at least equal to the product of the CIL value given in Table 2 as appropriate to the relevant category, and the appropriate colour factor given in Table 3.

NOTE A roadstud shall be considered not to have failed to comply with the photometric requirements if the measured CIL at any one position of measurement is less than the value specified, provided that

- the measured CIL is at least equal to 80 % of the specified minimum value; and
- the average of the measured CIL values at the two horizontal angles (see Table 2) exceeds the specified minimum value.

Table 2 — CIL values for roadstuds

1		2		3	4	5	6
Entrance angle, degrees		Horizontal		Observation angle, degrees	GIL, mcd/lx, min.		
Vertical	Horizontal				Category A	Category B	Category C
0	+15 and -15			2	2.5	2	2
0	+10 and -10			1	25	10	2
0	+10 and -10			0.5	120	15	2
0	+5 and -5			0.33	220	20	2

NOTE The entrance angle of 0° vertical corresponds to a direction parallel to the road surface.

Table 3 — Colour factors

1	2
Colour	Colour factor
Clear	1.0
Yellow	0.5
Red	0.2
Green	0.2

4.5 Resistance to penetration of water

When a roadstud is tested in accordance with 6.6, no water shall penetrate to the retro-reflecting surface of the roadstud.

4.6 Resistance to heat

When a roadstud is tested in accordance with 6.7,

- there shall be no visible sign of cracking or distortion; and
- the GIL (at an entrance angle of 0° vertical and $\pm 5^\circ$ horizontal and an observation angle of 0.33°) shall be at least the appropriate value given in 4.4.

4.7 Resistance to motor fuel

When a roadstud is tested in accordance with 6.8,

- the outer surface and in particular the front surface(s) of the retro-reflector(s) shall show no visible sign of deterioration; and

- b) the GIL of the roadstud (at an entrance angle of 0° vertical and $\pm 5^\circ$ horizontal and an observation angle of 0.33°) shall be at least the appropriate value given in 4.4.

4.8 Resistance to lubrication oil

When a roadstud is tested in accordance with 6.9, the GIL (at an entrance angle of 0° vertical and $\pm 5^\circ$ horizontal and an observation angle of 0.33°) shall be at least the appropriate value given in 4.4.

4.9 Resistance to corrosion

When a roadstud is tested in accordance with 6.10, no metal part of the roadstud shall show any visible sign of excessive corrosion that is liable to impair the efficiency of the roadstud.

4.10 Resistance to compression (glass roadstuds)

When a glass roadstud is tested in accordance with 6.11, it shall not break.

5 Marking

5.1 The following information shall be so legibly and permanently marked on each roadstud that the marking is still visible after the roadstud has been installed on the road:

- The manufacturer's name or trade name or trade mark.
- The category of the roadstud shall be marked either on the roadstud or on the packaging.

6 Inspection and methods of test

NOTE The definitions, sampling procedure and criteria of compliance given in Annex C.2 shall apply.

6.1 Conditioning

Condition the roadstud at $25 \pm 2^\circ\text{C}$ for 24 h before testing.

6.2 Inspection

Examine (and, where relevant, measure) the roadstud for compliance with the appropriate requirements of 4.1, 4.2, 4.3 and 5.1.

6.3 Mechanical test (depressible roadstuds)

Mount the roadstud securely on a baseplate and subject the depressible portion of the roadstud to 900 000 depressions at a rate of 300 — 360 depressions per minute. The depth of depression shall be to the extent to which that portion is depressed by normal traffic and the load shall be the minimum required to achieve that depth of depression. Examine the roadstud for compliance with the requirements of 4.1.2(b).

6.4 Colour test

Determine the chromaticity co-ordinates of the roadstud by means of a spectrophotometer or other equally suitable colour-measuring device in accordance, with CIE Publication 54, using Standard Illuminant A, an entrance angle of 0° vertical and $\pm 5^\circ$ horizontal and an observation angle of 0.33°, and check for compliance with the requirements of 4.3.

6.5 Photometric test

Determine the coefficients of luminous intensity in accordance with CIE Publication 54, and check for compliance with the requirements of 4.4.

6.6 Test for resistance to penetration of water

Place the road-stud in an oven or in water maintained (in either case) at a temperature of 50 ± 5 °C, and keep the roadstud at this temperature for a period of 10 min. Remove the roadstud and submerge it for 10 min at a depth of at least 20 mm in water maintained at a temperature of 25 ± 5 °C. Then wipe the road-stud dry and inspect it for compliance with the requirement of 4.5.

6.7 Test for resistance to heat

Place the roadstud for 12 h in an oven maintained at a temperature of 65 ± 2 °C. Remove the roadstud from the oven, allow it to cool, and examine it for compliance with the requirement of 4.6(a). If the roadstud complies with this requirement, repeat the photometric test (see 6.5) at the angles given in 4.6 and check for compliance with the requirement of 4.6(b).

6.8 Test for resistance to motor fuel

Lightly wipe the outer surfaces of the roadstud with a cotton cloth that has been soaked in a freshly prepared 7:3 mixture (V/V) of n-heptane and toluene. After a period of approximately 5 min, wipe the surfaces with a clean cotton cloth and then examine the roadstud for compliance with the requirement of 3.7(a). If the roadstud complies with this requirement, repeat the photometric test (see 5.5) at the angles given in 3.7 and check for compliance with the requirement of 3.7(b).

6.9 Test for resistance to lubricating oil

Lightly wipe the outer surfaces of the roadstud with a cotton cloth that has been soaked in a detergent lubricating oil. After a period of approximately 5 min, wipe the surfaces with a clean cotton cloth and repeat the photometric test (see 6.5) at the angles given in 4.8. Check for compliance with the requirement of 4.8.

6.10 Test for resistance to corrosion (salt fog test)

Suitably mount the roadstud and then, using the apparatus, salt solution, test conditions and subject the roadstud to salt fog for two periods of 24 h each, separated by an interval of 2 h during which the roadstud is allowed to dry. Then inspect the roadstud for compliance with the requirement of 4.9.

6.11 Compression test (glass roadstud)

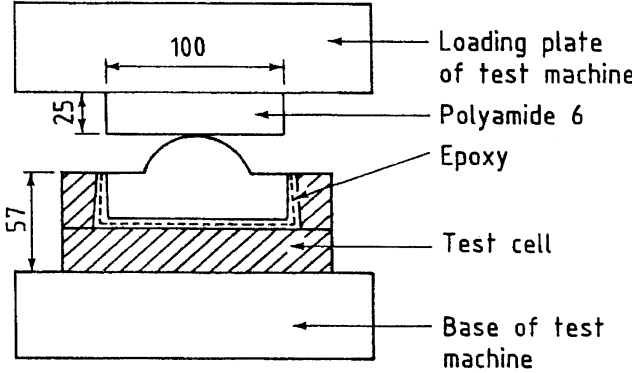
Coat the walls of a test cell of mild steel (see Figure 2) with a releasing agent such as silicone spray, and place epoxy into the cell. Press the roadstud into the cell and remove excess epoxy. Allow the epoxy to cure in accordance with the manufacturer's instructions.

Place the test cell with roadstud between the plates of a suitable compression machine. Apply the force to the tip surface of the roadstud through a disc of polyamide 6 that has a diameter of 100 mm and a thickness of 25 mm. The polyamide 6 has a shore hardness of D80 to D85 and has an addition of a low percentage of molybdenum disulfide (MoS_2).

Increase the force (at a rate not exceeding 4 kN/s) to a value of 60 kN and then release the force suddenly. Check for compliance with the requirement of 4.10.

Draft for comment

ward



Dimensions in millimetres

Figure 2 — Compression test apparatus

Draft for comments only — Not to be cited as EAC

Annex A
(informative)

Performance of roadstuds under traffic conditions

Standard

If so requested by the purchaser, roadstuds that comply with all the relevant requirements of the specification may be tested under traffic conditions as follows:

Select a suitable test site, after taking into consideration conditions of climate and traffic density, and reach agreement on the test site with the purchaser and the relevant Road and Traffic Authorities. Install at least 25 roadstuds at each test site, together with a number of control roadstuds of similar design that have been proved to be acceptable to the purchaser.

Place the test roadstuds and the control roadstuds alternately on the road surface, and affix them to the road surface in accordance with the respective manufacturers' instructions.

Expose the roadstuds to traffic conditions for 12 calendar months.

Terminate the test earlier if the roadstuds are found to perform unsatisfactorily or if they present a safety hazard.

After the test, the roadstuds shall still comply with the colour and photometric requirements of the specification (see 4.3 and 4.4).

Comparative assessments of the performance of the roadstuds may also be made on the test site. Aspects not covered by this specification, e.g. the adhesive quality of bonded roadstuds, may be evaluated simultaneously.

Draft for comments only — Not to

Annex B
(informative)

Categories of roadstuds

Standard

B.1 The photometric characteristics of retro-reflecting components used in roadstuds were determined and these characteristics form the basis for the requirements given in Table 2.

For the different categories of roadstuds, the following retro-reflectors were used:

Category A roadstuds: Corner cube retro-reflectors

Category B roadstuds: Biconvex retro-reflectors

Category C roadstuds: Omnidirectional retro-reflectors, i.e. retro-reflectors capable of providing retro-reflection of light from many directions

B.2 However, a roadstud that incorporates a retro-reflecting component associated with a specific category of roadstud, will not necessarily comply with the requirements for that specific category.

B.3 Within a small range of viewing directions, a Category A roadstud will be visible over longer distances than will studs of Category B or C, and a Category C roadstud will be visible over a wider range of viewing directions than will studs of Category A or B.

Draft for comments only — Not to be

Annex C
(normative)

Quality evaluation of roadstuds produced to the requirements laid down in this specification

Standard

C.1 Quality verification

C.1.1 When a purchaser requires quality verification on an ongoing basis of roadstuds produced to this specification, it is suggested that, rather than to evaluation of the final product only, he also direct his attention to the quality management system applied by the manufacturer. In this connection it should be noted that EAS 392 covers the provision of an integrated quality management system.

C.1.2 If the roadstuds do not bear the standardization mark and no information about the implementation of quality control or testing during manufacture is available to help in assessing the quality of a lot, and a purchaser wishes to establish, by inspection and testing of samples of the final product, whether a lot (as defined in C.2.1) of the roadstuds produced to this specification complies with its requirements, use the sampling plan given in C.2.

It must be noted that

- a) such a sampling plan applies to fully manufactured roadstuds only; and
- b) a lot that, in terms of the plan, is deemed to comply with the specification could contain defective roadstuds to an extent proportional to that permitted by the relevant acceptance numbers given in the sampling table.

C.2 Assessment of compliance with the specification

Acceptable quality level (AQL)

The maximum percentage defectives that for the purpose of sampling inspection can be considered satisfactory as a process average.

Defective

A roadstud that fails in one or more respects to comply with the; relevant requirements of the specification.

Lot

Not less than 26 and not more than 10 000 roadstuds of the same design, size, category and colour and bearing the same marking, from one manufacturer, submitted at any one time for inspection and testing.

C.2.2 Sampling

Use the following sampling procedure to determine whether a lot complies with the specification, and deem the sample so taken to represent the lot for the respective properties:

From the lot draw at random the number of roadstuds given in Column 2 of Table C.1, relative to the appropriate lot size given in Column 1.

Draft for CC

Table C.1 — Sample sizes

1	2	3
Lot size, roadstuds	Sample for inspection and testing*	
	Sample size, roadstuds	Acceptance No. (AQL = 6.5)
26 — 150	8	1
151 — 500	13	2
501 — 1200	20	3
1201 — 10 000	32	5

*Based on EAS 381 for Special Inspection Level S-4.

C.2.3 Criteria of compliance

Deem the lot to comply with the relevant requirements of the specification if, on inspection and testing of the sample taken in accordance with C.2.2, the number of defectives found does not exceed the relevant acceptance number given in Column 3 of Table C.1.

Draft for comments only — Not to be cited as E&S Standard

Draft for comments only — Not to be cited as East African Standard

Draft for comments only — Not to be cited as East African Standard