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ICS 43.040.60

EAST AFRICAN STANDARD

**Retro-reflective registration plates for motor vehicles —
Specification — Part 2: Metal**

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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Retro-reflective registration plates for motor vehicles — Specification — Part 2: Metal

1 Scope

This part of CD/K/024 specifies requirements for metal number plates that are intended for use on motor vehicles (including motor cycles and tricycles) and trailers.

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.

ASTM G 154, *Standard practice for operating fluorescent light apparatus for UV exposure of non-metallic materials*

CIE 15, *Colorimetry*

CIE 54.2, *Retroreflection — Definition and measurement*

3 Definitions

For the purposes of this part of CD/K/024, the following definitions apply.

3.1 blank

aluminium plate of a size specified in 4.2, that has on one side an embossed border with retro-reflective material covering the face, for use in the manufacture of a number plate

3.2 embossing

process by which a character or a set of characters is applied to a plate in relief, on the retro-reflective surface side of a number plate

3.3 expiry decal

decal containing the expiry date of the number plate or the information prescribed by the relevant Provincial Authority

3.4 illuminant

illuminant D65 as defined by the International Commission on Illumination (see CIE 15)

3.5 licence number

combination of non-self-radiating letters and numerals as prescribed by the relevant national regulations (see foreword)

3.6 luminance factor

ratio of the luminance of the material to that of a perfect reflecting diffuser identically illuminated

3.7 number plate

plate that displays the licence number of a motor vehicle or trailer

3.8

retro-reflection

reflection in which light is reflected in directions close to the direction of incidence, irrespective of the angle of incidence at the reflecting surface

4 Requirements**4.1 Materials****4.1.1 Aluminium**

4.1.1.1 A blank shall be manufactured from aluminium with minimum thickness of 0.9 mm.

4.1.1.2 A blank constitutes the total combination of all the materials necessary to produce a number plate.

4.1.1.3 A blank shall be free of protruding material detrimental to the proper functioning of a number plate.

4.1.2 Retro-reflective material**4.1.2.1 General**

The colour of retro-reflective material for number plates shall be yellow, white, or white with graphics. The retro-reflective material shall be such that, when it is applied to an aluminium substrate, the colour, luminance factor and coefficients of retro-reflection comply with the relevant requirements of 4.1.2.2, 4.1.2.3 and 4.1.2.4.

NOTE The above colours and combinations are applicable to the Republic of South Africa.

4.1.2.2 Colour and luminance factor

4.1.2.2.1 When determined in accordance with 5.3, the colour of the retro-reflective material, without graphics, shall be yellow or white and the chromaticity co-ordinates shall be within the area on a chromaticity diagram defined by the lines joining the points of the appropriate values given in table 1.

4.1.2.2.2 The retro-reflective material with graphics shall be tested as specified in 5.3.

4.1.2.2.3 When determined in accordance with 5.3, the luminance factor of the retro-reflective material, without graphics, shall be at least the appropriate value given in table 1.

Table 1 — Chromaticity co-ordinates and luminance factors

1	2	3	4	5	6	7
Colour	Co-ordinate	Value of co-ordinate				Luminance factor min.
		1	2	3	4	
Yellow	X	0.545	0.487	0.427	0.483	0.27
	y	0.454	0.423		0.534	
White	X	0.355	0.305	0.285	0.325	0.35
	y	0.355	0.305		0.375	

4.1.2.3 Coefficients of retro-reflection

When the coefficients of retro-reflection of the material (with graphics, if provided) are determined in accordance with 5.4, they shall be at least the relevant values given in Table 2.

Table 2 — Coefficients of retro-reflection

1	2	3	4	5
Observation angle degrees	Entrance angle degrees	Coefficient of retro-reflection when measured with standard illuminant A cd/(lx·m ²) min.		
		Graphic ^{b)}	Yellow	White
0.33 ^{a)}	5 ^{a)}	35	35	50
1.5	30	1.5	1.5	2.0

^{a)} The coefficient of retro-reflection at an angle of observation and an entrance angle of 0.33° and 5° respectively, shall not exceed 100 cd/(lx·m²) for yellow material and 160 cd/(lx·m²) for white material.

^{b)} The total retro-reflection per unit area of a full number plate including graphics without characters. Graphics shall be printed on a white retro-reflective material and shall have a retro-reflective value as given in table 2, column 3.

4.1.2.4 Markings of retro-reflective material

When examined in accordance with 5.1, the retro-reflective material shall bear a legible and indelible validation mark that forms an integral part of the material, that identifies the manufacturer of the material, and the manufacturer's batch number and the year of manufacture. The validation mark shall not interfere with the legibility of the number plate. The size of the mark shall be contained within a minimum space of 9 mm ± 9 mm and a maximum space of 17 mm × 17 mm and appear at least eight times interspersed evenly on the retro-reflective material. A provincial identity may also be incorporated in the same way.

4.2 Shape and dimensions

When measured in accordance with 5.1, number plates shall be rectangular, with corners rounded to a radius of 15 mm ± 3 mm, be free from sharp edges and burrs, and shall be of one of the following sizes:

- 440 mm (± 1 mm) × 120 mm (± 1 mm);
- 250 mm (± 1 mm) × 205 mm (± 1 mm);
- 520 mm (± 1 mm) × 113 mm (± 1 mm);
- 305 mm (± 1 mm) × 165 mm (± 1 mm); or
- 250 mm (± 1 mm) × 165 mm (± 1 mm) (permitted for category "L" motor vehicles only).

4.3 Licence number, border and graphic

4.3.1 General

When measured in accordance with 5.1, the licence number and the border shall be raised to a height of not more than 2 mm above the retro-reflective background. The embossed border, the letters and numbers (characters) shall be coloured in terms of the provincial requirement by hot stamping foils or any other method excluding the use of inks, solvents, paints or thinners.

4.3.2 Colour and luminance factor

4.3.2.1 Colour

The licence number and the border shall be black, blue, red or green.

4.3.2.2 Luminance factor

When the luminance factor of the colours black, blue, red or green is determined in accordance with 5.3, it shall not exceed 0.07.

4.3.3 Form and dimensions of characters of licence numbers

4.3.3.1 General

When examined and measured in accordance with 5.1, dependent upon the number plate size, the number of characters in the licence number and the height of the characters, the form and dimensions of the characters of the licence number shall be as prescribed in 4.3.3.2 for 75 mm high characters, or 4.3.3.3 for 60 mm high characters.

4.3.3.2 The 75 mm high characters of a licence number

The characters shall consist of:

- a) not more than nine characters in one line on a plate of size 520 mm × 113 mm (± 1 mm) (see Figures 4(c) and 5(b)); or
- b) not more than nine characters in one line on a plate of size 440 mm × 120 mm (see figures 4(a) and 5(a)); or
- c) not more than nine characters in two lines on a plate of size 250 mm × 205 mm (see figures 4(b), 5(c) and 5(d));
- d) in the case of a plate bearing a single row of characters including six numerals there shall be a dash of length 25 mm ± 1 mm and a width of 10 mm ± 1 mm between the third and fourth numerals; and
- e) shall be of height 75 mm ± 1.0 mm and shall have shapes that conform to those of the appropriate characters given in Figure 1 or Figure 2.

4.3.3.3 The 60 mm high characters of a licence number

The characters shall consist of:

- a) not more than five characters per line in two lines on a plate of size 305 mm × 165 mm (see figure 4(d)); or
- b) not more than five characters per line in two lines on a plate of size 250 mm × 165 mm (see figure 4(e)); and
- c) height 60 mm ± 1.0 mm and shall have shapes that conform to those of the appropriate characters given in Figure 3.

4.3.4 Setting out the characters of a licence number

When measured in accordance with 5.1, the characters shall be placed as follows:

- a) Width of space between adjacent characters and graphics (not of a background graphic)..... 10 mm, min.
- b) Width of spaces between outside edges of the plate and the first and last character..... 15 mm, min.
- c) Width of space between rows of characters on a plate that bears a double row of characters..... 10 mm ± 1 mm
- d) Width of space that separates adjacent groups of letters and numerals..... 10 mm, min.
- e) Width of space between adjacent letters in groups of letters, and width of space between adjacent numbers in groups of numbers shall be equal, subject to a tolerance of ± 1 mm.

NOTE The spacing of characters and numerals on personalized plates should comply with the requirements specified by the relevant provincial authority provided that the characters are symmetrically placed.

4.3.5 Border

When examined in accordance with 5.1, the border of a plate shall be as shown in figure 6 and shall extend around the four edges of the plate.

4.3.6 Graphics

When examined in accordance with 5.1, graphics shall be of not more than four colours, and shall not negatively affect the legibility of the licence number or be of such a design as to be mistaken for a letter or numeral.

NOTE Where applicable a non-background graphic should not exceed a width of 45 mm and a height of 75 mm.

4.3.7 Workmanship

4.3.7.1 When examined in accordance with 5.1, the retro-reflective material, licence number and border of a plate shall be free of creases, chips, blisters, discolouration and spots.

4.3.7.2 The licence number shall be clearly defined.

4.3.7.3 A plate shall be of such flatness that, when it is laid (with the licence number upwards) on a flat surface, no part, except raised characters or a border, is more than 3 mm from the surface.

4.4 Luminance factor ratio of character to background colours

When determined in accordance with 5.3, the ratio of the luminance factor values between the character colour and the adjacent retro-reflective background and, if applicable, between the character colour and adjacent graphic background colour, shall not be less than 5:1.

4.5 Performance

4.5.1 Resistance to weathering

When tested in accordance with 5.5,

- a) the chromaticity co-ordinates shall remain within the area on the appropriate chromaticity diagram as given in table 1;
- b) the coefficient of retro-reflection at an angle of observation and an entrance angle of 0.33° and 5° respectively, shall be at least 80 % of the minimum values given in Table 2;
- c) the retro-reflective material and the licence number or border shall show no sign of cracking, blistering or loss of adhesion that would affect the functionality of the plate when viewed from a distance of approximately 250 mm under a standard light source, providing 400 lx; and
- d) the coated character and border surface shall show no sign of chalking or cracking that would affect the functionality of the plate.

4.5.2 Resistance to impact

When tested in accordance with 5.6, and where applicable, the retro-reflective material, character, border, the coated surface of the character and border, and the base material, shall show no cracking or separation from the substrate outside a distance of 5 mm from the impacted area.

4.5.3 Resistance to abrasion

When tested in accordance with 5.7, and, when applicable, when viewed from a distance of approximately 250 mm under a standard light source (providing 400 lx), there shall be no sign of penetration through the coating on the surfaces of the characters to the substrate that would affect the functionality of the plate.

4.5.4 Resistance to scratching

When tested in accordance with 5.8, the scratch

- a) produced on the retro-reflective surface shall not have penetrated the material surface, and
- b) produced on the coated surface of the characters and border, shall be free from jagged edges and where applicable shall not have penetrated through to the reflective material.

5 Inspection and methods of test

5.1 Inspection

Visually examine and then measure each plate in the sample for compliance with all the relevant requirements for which tests to assess compliance are not given in 5.3 to 5.8 (inclusive).

5.2 Test specimens

From the sample number plates, including the expiry decal if applicable, prepare the following test specimens:

- a) resistance to weathering: one complete number plate;
- b) resistance to impact: one complete number plate;
- c) resistance to abrasion: one complete number plate;
- d) resistance to scratching: one test specimen of width 50 mm and of length 110 mm.

5.3 Colour and luminance factor test (white and yellow)

5.3.1 Chromaticity co-ordinates and luminance factors

Determine the chromaticity co-ordinates and luminance factors of the relevant areas of the specimen by means of a spectrophotometer or other equally suitable colour measuring device in accordance with CIE 15, using standard illuminant D65 and 45/0 geometry. Check for compliance with 4.1.2.2, 4.3.2.2 and 4.4.

5.3.2 Graphics

Select specimens of size 70 mm x 45 mm from those areas of graphics of the plate that might affect the legibility of the licence number. Determine the luminance factor by means of a spectrophotometer or other equally suitable colour measuring device in accordance with CIE 15, using standard illuminant D65 and 45/0 geometry. Check for compliance with 4.3.2.2 and 4.4.

5.4 Photometric test

5.4.1 Test specimens

5.4.1.1 White and yellow plates: test panel of size 120 mm x 150 mm.

5.4.1.2 Plate with graphics: full plate divided transversely into three equal sized sections.

5.4.2 Method

Determine the coefficients of retro-reflection in accordance with CIE 54.2, using the values of observation angle and entrance angle given in table 2.

In the case of plates with graphics, calculate the total retro-reflection of the three sections and express as candelas/(lx·m²). Check for compliance with 4.1.2.3.

5.5 Resistance to weathering

Mount the specimen (see 5.2(a)) with the test surface facing the lamps, and subject it to artificial weathering using the apparatus and method given in ASTM G 154 for 240 h, using a cycle of 4 h UV exposure at 60 °C and then 4 h condensation exposure at 50 °C.

Check for compliance with 4.5.1 after completion of the test.

5.6 Resistance to impact

5.6.1 Apparatus

5.6.1.1 Striker: a steel ball of diameter 25 mm.

5.6.1.2 Base: a solid support base such as concrete or a steel plate of thickness 12.5 mm.

5.6.2 Procedure

5.6.2.1 So place the specimen (see 5.2(b)) on the base that the striker will fall onto a central flat section of the specimen.

5.6.2.2 Raise the striker 2 m above the specimen and allow it to fall.

5.6.2.3 Repeat 5.6.2.1 and 5.6.2.2, but with the point of impact being on part of the coated surface of a character.

5.6.2.4 Examine the specimen for compliance with 4.5.2.

5.7 Resistance to abrasion

5.7.1 Apparatus

5.7.1.1 Washability testing apparatus (see figure 7), that consists of a brush with stiff black butt-cut Chinese hog bristles securely wired into an aluminium brush block of size approximately 90 mm × 40 mm × 13 mm. There are 60 holes in the brush block, each of diameter about 4 mm, solidly filled with bristle. The abrading surface of the bristles (which extend 20 mm below the block) is dressed down with sandpaper or, if necessary, so levelled on a hotplate that it is as nearly plane as possible. The brush is held in a metal frame on which masspieces are symmetrically loaded to bring the total mass of the brush assembly to 450 g^{+5}_0 g.

5.7.1.2 Suitable drawing mechanism that does not exert a vertical force on the brush and enables the brush to be moved back and forth over the specimen under test at a constant speed of 35 oscillations per minute to 40 oscillations per minute (70 strokes to 80 strokes). The length of each stroke is adjusted to approximately 330 mm. The apparatus is mounted on a horizontal table that has means for securing the specimen under test. A supply of cleaning solution is so arranged as to drip onto the specimen, and there is suitable means for collecting excess solution and for ensuring that the specimen is at no time completely immersed in the cleaning solution. Replace the brush when the bristles have become so worn that they extend less than 16 mm from the block.

5.7.1.3 Detergent solution, a mass fraction of 0.5 % solution, in distilled water, of a detergent that has the following composition:

	mass fraction %
Sodium pyrophosphate.....	51
Sodium sulfate, anhydrous.....	16
Sodium dodecyl benzene sulfonate, 80 %	23
Sodium metasilicate, soluble.....	8.5
Sodium carbonate.....	1.5

5.7.2 Procedure

5.7.2.1 Immerse the brush bristles to a depth of about 13 mm in water at 25 °C to 30 °C for 30 min.

Shake the brush vigorously to remove excess water and then soak it for 5 min in the specified detergent solution.

5.7.2.2 Mount the specimen (see 5.2(d)) firmly in the washability testing apparatus. So place the wet brush on the surface to be tested that its 90 mm dimension is in the direction of motion. Wet the surface of the specimen, and start oscillating the brush immediately. During the test, allow additional cleaning solution to drip in the path of the brush in sufficient quantities to keep the test surface wet.

Run the apparatus for 10 000 oscillations.

5.7.2.3 Remove the specimen, wash it immediately with warm water, and examine the test surface within the middle 100 mm of the brush path for compliance with 4.5.3.

5.8 Resistance to scratching

5.8.1 Apparatus

5.8.1.1 Needle and arm: a needle with a hardened steel hemispherical point of diameter 1 mm, fixed vertically, point downwards, to the end of a counterpoised horizontal arm. The horizontal arm provides for the loading of masspieces above the needle direct, and it may be set in equilibrium on its fulcrum by adjustment of the counter-mass before masspieces are loaded above the needle.

5.8.1.2 Masspieces: a set of 30 masspieces of 50 g each.

5.8.1.3 Base with sliding specimen holder: a sliding specimen holder that moves freely and automatically on its base under the loaded needle (which is perpendicular to the specimen holder).

5.8.1.4 Electric current supply and ammeter: The needle and specimen holder are connected in series with an ammeter and an electric current supply that, when the coated surface of a specimen is penetrated, the needle makes electrical contact with the underlying aluminium, and this penetration is indicated by a flow of current through the ammeter.

5.8.2 Procedure

5.8.2.1 In the case of a retro-reflective surface, set the horizontal arm in equilibrium, with the electric current supply and ammeter in use. Clamp the specimen (see 5.2(d)) to the specimen holder, with the material to be tested facing upwards. Load the needle with 20 masspieces (i.e. to a total mass of 1 000 g) and lower the needle carefully onto the material surface while starting to slide the holder.

Alternatively, so put the end of the needle on a razor blade on the material surface that the needle can slide off the sharp edge of the blade onto the surface. Slide the holder at a uniform speed of approximately 30 mm/s for a distance of about 90 mm.

5.8.2.2 Examine the edges of the groove under 10 x magnification.

5.8.2.3 Check for compliance with the relevant requirements of 4.5.4.

5.8.2.4 Repeat 5.8.2.1 to 5.8.2.3 on two other parts of the material surface.

5.8.2.5 In the case of a coated surface, carry out the test as given in 5.8.2.1 to 5.8.2.4, but with the electric current supply and ammeter in use.

6 Packing

The plates shall be so packed as to ensure that they are not damaged during normal handling, transportation and storage.

7 Marking

7.1 No marking other than the licence number, the graphics (when applicable), the marking required in terms of 4.1.2.4, 7.2, and Clause 8, and the border shall appear on the front surface of a number plate. The marking shall not interfere with the legibility of the licence number.

7.2 The front surface of the plate shall bear, in legible and indelible marking, the trade name or trade mark and the batch number of the manufacturer of the blank in the left front bottom corner, in a space of height approximately 5 mm and of length approximately 50 mm.

8 Expiry decal

8.1 When required by legislation, the front surface of the plate shall permit the application of a retro-reflective expiry decal, of size approximately 10 mm * 40 mm.

8.2 If applied, the expiry decal shall be affixed on the bottom right hand corner, with the right hand border not less than 100 mm from the border of the plate.

NOTE The size and position of the expiry decal should be in accordance with the requirements of the relevant Provincial Authority.



Figure 1 — Shapes of 75 mm high letters and numerals — FE font (Nominal width — 40 mm)

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Figure 2 — Shapes of 75 mm high letters and numerals — FE modified font (Nominal width — 34 mm)

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Figure 3 — Shapes of 60 mm high letters and numerals — FE modified font (Nominal width — 37 mm)

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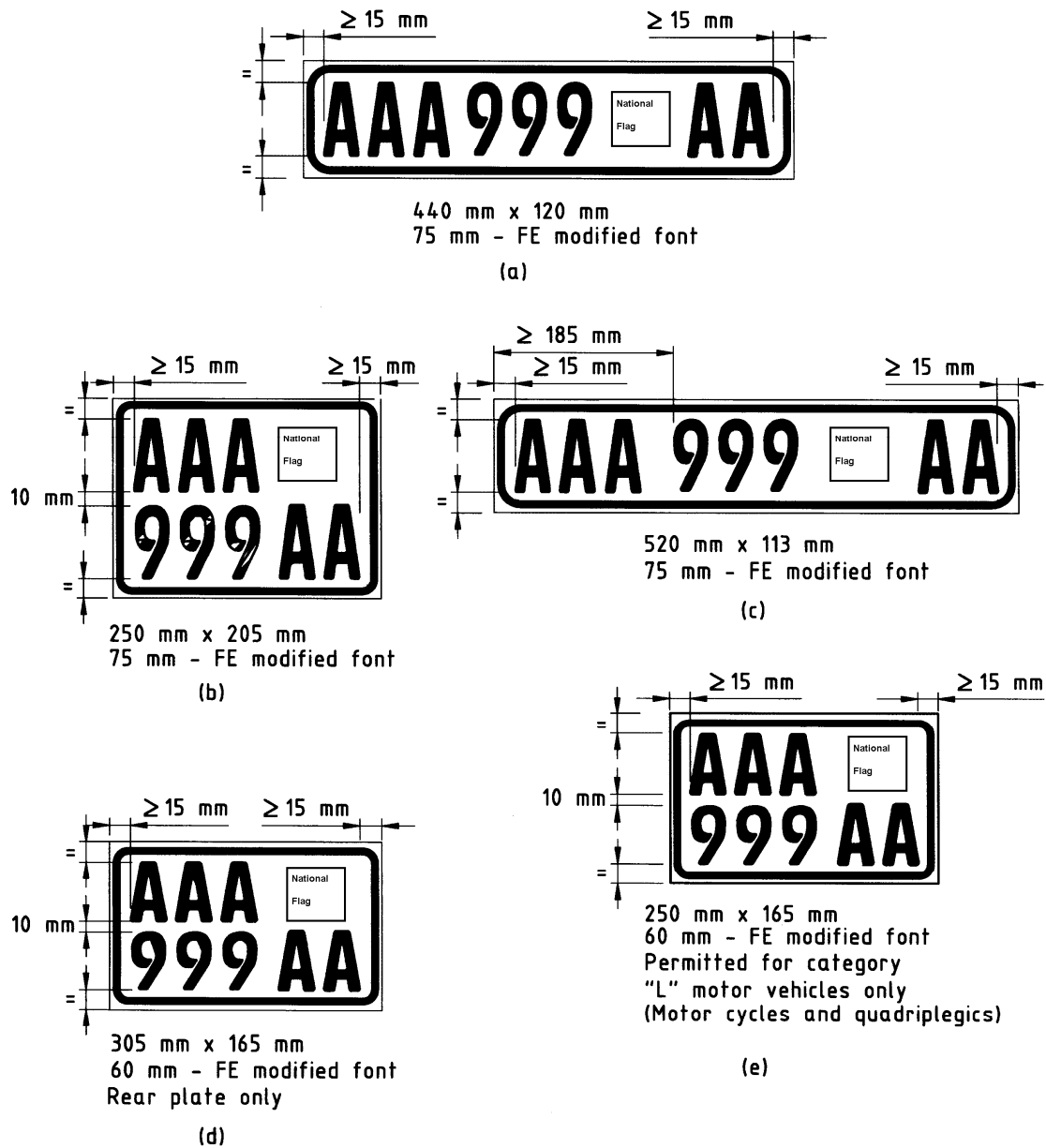
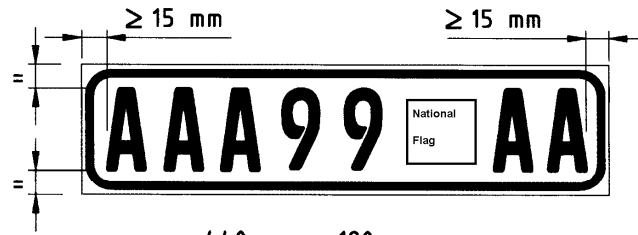


Figure 4 — Examples of layout of characters on a licence plate — FE modified font

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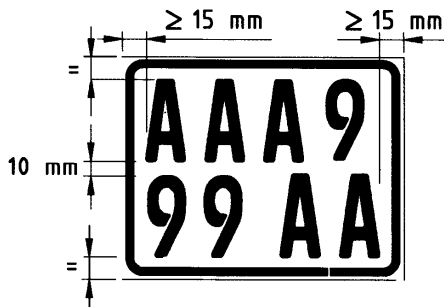
440 mm x 120 mm
75 mm - FE font

(a)



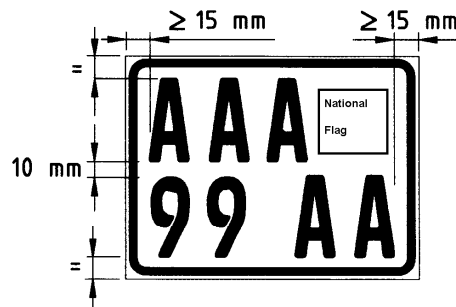
520 mm x 113 mm
75 mm - FE font

(b)



250 mm x 205 mm
75 mm - FE font

(c)



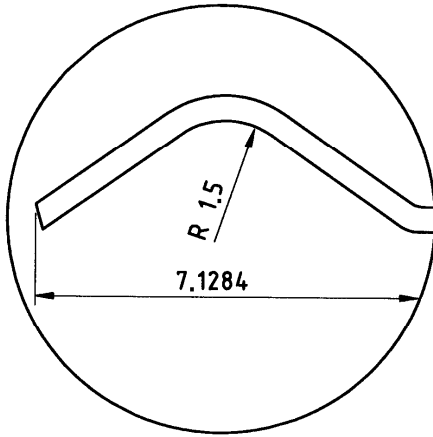
250 mm x 205 mm
75 mm - FE font

(d)

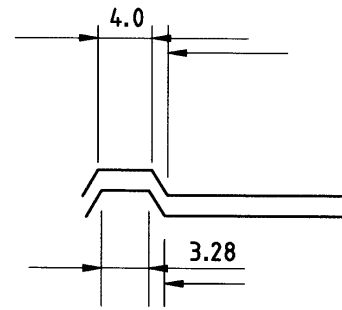
Figure 5 — Examples of layout of characters on a licence plate —FE font

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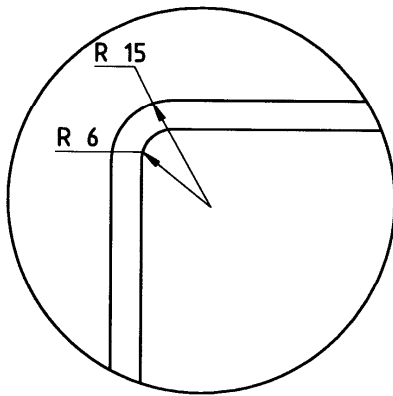
Dimensions in millimetres



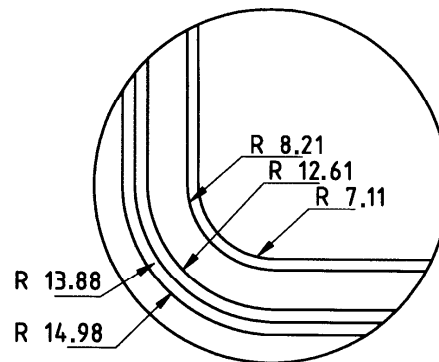
(a)



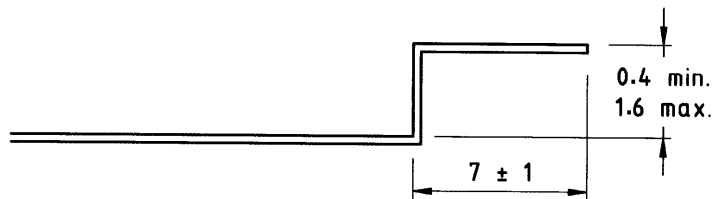
(b)



(c)



(d)



(e)

Figure 6 — Borders of plates

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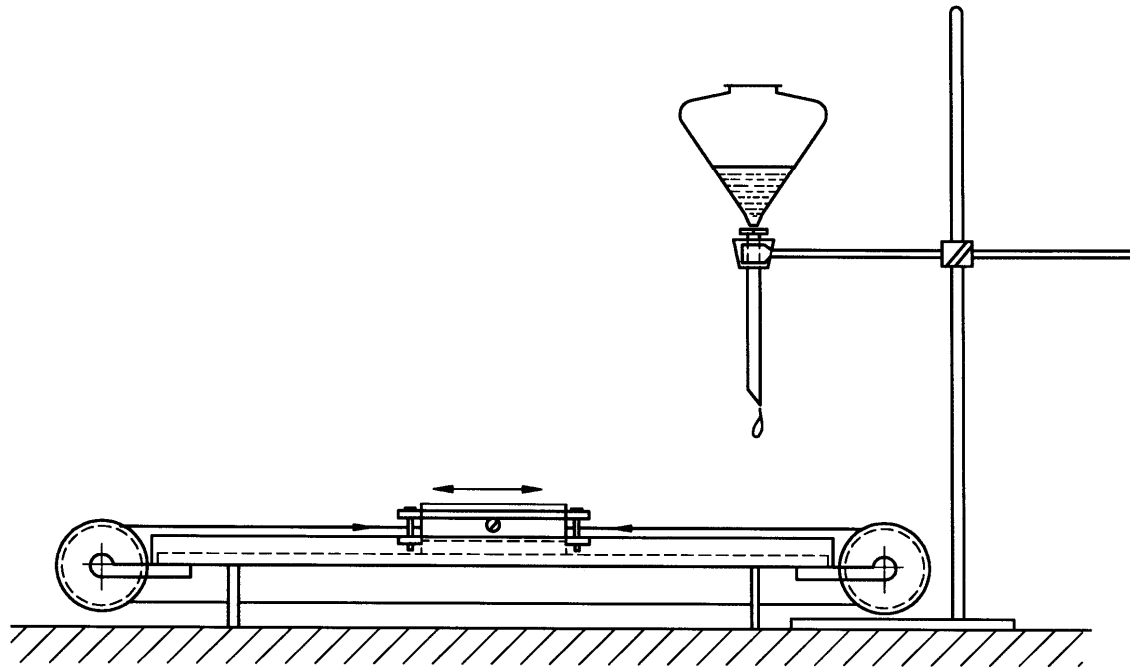


Figure 7 — Apparatus for resistance to abrasion testing

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