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



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Requests for permission to reproduce this document should be addressed to

The Executive Director
Uganda National Bureau of Standards
P.O. Box 6329
Kampala
Uganda
Tel: 256 414 505 995
Fax: 256 414 286 123
E-mail: unbs@infocom.co.ug
Web: www.unbs.go.ug

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Foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Tourism, Trade and Industry established under Cap 327, of the Laws of Uganda. UNBS is mandated to co-ordinate the elaboration of standards and is

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The work of preparing Uganda Standards is carried out through Technical Committees. A Technical Committee is established to deliberate on standards in a given field or area and consists of representatives of consumers, traders, academicians, manufacturers, government and other stakeholders.

Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

Committee membership

The following organisations were represented on the Technical Committee for Transport and Communication standards, UNBS/TC 8, in the development of this standard:

- Arnold Brooklyn & Co Ltd
- GM Tumpeco Ltd
- Makerere University Kampala
- Ministry of Works and Transport
- Uganda Revenue Authority
- Uganda Manufacturers Association (UMA)
- Uganda National Bureau of Standards

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

1 Scope

This Uganda Standard specifies requirements for metallic registration 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 document. 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 nonmetallic materials*

CIE 15, *Colorimetry*

CIE 54.2, *Retro-reflection – Definition and measurement*

ISO 7591 *Road vehicles — Retro-reflective registration plates for motor vehicles and trailers — Specification*
Traffic and Road Safety Act, 1998

US 775-1, *Retro-reflective registration plates for motor vehicles — Specification — Part 1: Blanks (metal)*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions together with terms and definitions in Part 1 shall 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

illuminant

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

3.4

hot stamping foil

foil, which is used for colouring of embossed portion of the registration plate

3.5

licence number

non-self-radiating letters, symbols and numerals either in combination or not as prescribed by the relevant national regulations

3.6

luminance factor

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

3.7

optical variable device (OVD)

device which allows easy verification and derivative of holographic security features with the naked eye

3.8

registration number plate

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

3.9

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

3.10

retro-reflective sheeting

a multi-layer film with small retro-reflective elements very near the exposed 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 1.0 mm ± 0.1 mm.

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

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

4.1.1.4 The mechanical properties shall allow embossing and shall have a tensile strength of 90 N/mm² to 115 N/mm² and a minimum elongation of 6 %.

4.1.2 Retro-reflective material

4.1.2.1 General

The colour of the retro-reflective material for registration number plates shall be yellow, white, blue, red or green.

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

The plate shall have the whole of its front surface covered with retro-reflective sheeting suitable for embossing. The sheeting shall be applied to form a durable bond with the aluminium metal substrate and shall form the background surface of the registration plate.

The retro-reflective surface shall be flat, smooth without cracks and shall exhibit uniformity of retro-reflection over its entire surface. The retro-reflective sheeting shall bear a mark that identifies the manufacturer of the material.

The optical properties of the retro-reflective material shall be as specified in ISO 7591.

The Uganda flag shall be hot stamped with excellent durability concerning abrasion and UV-resistance and shall be 50 mm x 30 mm in dimension.

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

Colour	Co-ordinate	Value of co-ordinate				Luminance factor, min.
		1	2	3	4	
Yellow	x	0.465	0.427	0.487	0.545	0.27
	y	0.454	0.483	0.423	0.534	
White	x	0.355	0.305	0.285	0.335	0.35
	y	0.355	0.305	0.325	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

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 $cd/(lx.m^2)$ for yellow material and 160 $cd/(lx.m^2)$ 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,.

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 serial number.

4.1.3 Hot stamp foil

The colour of the hot stamp foil shall be black, red, white, green or blue to ink the embossed legend. The foil shall meet the requirements as specified in ISO 7591. The inking/colouring of the embossed registration plate shall be done via hot stamping.

4.1.4 Optical variable security hologram

Application of the hologram shall be via hot stamping on to the retro-reflective sheeting. The hologram size shall be 20 mm x 20 mm and it shall be well designed for long term exterior use and shall be easy to verify.

The hologram shall be made of chrome. It shall withstand hard test conditions for registration plates according to ISO 7591.

4.2 Shape and dimensions

When measured in accordance with 5.1, number plates shall be rectangular, with corners rounded to a radius of 13 mm, be free from sharp edges and burrs, and shall be of one of the following sizes as shown in Tables 3 and 4 below:

Table 3 — Dimensions for motor vehicle plates

Vehicle	Size
Public vehicle plates:	
Front	(520 mm x 110 mm) ± 3 mm
Back	(230 mm x 205 mm) ± 3 mm
Diplomat/CD vehicle plates:	
Front	(520 mm x 110 mm) ± 3 mm
Back	(340 mm x 205 mm) ± 3 mm
Government vehicle plates:	
Front	(520 mm x 110 mm) ± 3 mm
Back	(340 mm x 205 mm) ± 3 mm
Duty free vehicle plates:	
Front	(520 mm x 110 mm) ± 3 mm
Back	(340 mm x 205 mm) ± 3 mm
Personalized vehicle plates:	
Front	(520 mm x 110 mm) ± 3 mm
Back	(340 mm x 205 mm) ± 3 mm

Table 4 — Dimensions for category “L” motor vehicle

Vehicle	Size
Public motor cycle plates	
Front	(255 mm x 135 mm) ± 3 mm
Back	(255 mm x 135 mm) ± 3 mm
Government motor cycle plates	
Front	(255 mm x 135 mm) ± 3 mm
Back	(255 mm x 135 mm) ± 3 mm
Duty free vehicle plates	
Front	(240 mm x 135 mm) ± 3 mm
Back	(240 mm x 135 mm) ± 3 mm

4.3 License number, border and graphic

4.3.1 General

When measured in accordance with 5.1, the registration number and the border shall be raised to a height of not more than 1.6 ± 0.3 mm above the retro-reflective background. The registration plate shall have embossed digits and embossed letters. The registration plate shall have an embossed border of an inner width of $4 \text{ mm} \pm 1 \text{ mm}$.

The registration plate shall have a chrome based OVD hologram. The OVD shall be an integral part of the registration plate and shall be hot stamped.

4.3.2 Colour and luminance factor

4.3.2.1 Colour

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

4.3.2.2 Luminance factor

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

4.3.3 Form and dimensions of characters of registration 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 registration number and the height of the characters, the form and dimensions of the characters of the registration number shall be as prescribed in 4.3.3.2 for 75 mm high characters and 4.3.3.3 for 49 mm high characters.

4.3.3.2 The 75 mm high characters of a registration number

The characters shall consist of:

- a) not more than seven characters in one line on a plate of size (520 mm × 110 mm) ± 3 mm (see Figure 5); or
- b) not more than seven characters in one line on a plate of size (340 mm × 205 mm) ± 3 mm (see Figure 6); or
- c) not more than seven characters in two lines on a plate of size (230 mm × 205 mm) ± 3 mm (see Figure 7)
- d) 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 49 mm high characters of a registration number

The characters shall consist of:

- a) not more than seven characters in two lines on a plate of size (255 mm × 135 mm) ± 3 mm (see Figure 3); or
- b) not more than seven characters in two lines on a plate of size (240 mm × 135 mm) ± 3 mm (see Figure 4)
- c) shall be of height 49 mm ± 1.0 mm and shall have shapes that conform to those of the appropriate characters given in Figure 1 or Figure 2.

4.3.4 Setting out the characters of a registration number

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

- a) Width of space between outside edge of the plate and Uganda flag, (not of a background graphic)..... 12.9 mm ± 2 mm.
- b) Width of spaces between inside edge of the embossed border of the plate and the last character and between the first character and Uganda flag 11 mm ± 2 mm
- c) Width of space between rows of characters on a plate that bears a double row of characters for 75 mm characters..... 15 mm ± 1 mm
- d) Width of space between rows of characters on a plate that bears a double row of characters for 49 mm characters..... 12 mm ± 1 mm
- e) Width of space that separates adjacent groups of letters and numerals..... 8 mm ± 2 mm
- f) 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 national authority provided that the characters are symmetrically placed.

4.3.5 Graphics

When examined in accordance with 5.1, graphics shall be of not more than five colours, and shall not negatively affect the legibility of the registration 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.

4.3.6 Workmanship

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

4.3.6.2 The registration number shall be clearly defined.

4.3.6.3 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 registration 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 is not given in 5.3 to 5.8 (inclusive).

5.2 Test specimens

From the sample number plates, 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; and
- 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 × 45 mm from those areas of graphics of the plate that might affect the legibility of the registration 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 × 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 $cd/(lx.m^2)$. 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 and reagents

5.7.1.1 Washability testing apparatus (see Figure 9), that consists of a brush with stiff black buttcut 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 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 (that is, 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 registration number, the graphics (when applicable), the marking required in terms of 4.1.2.4 and 7.2 and the border shall appear on the front surface of a registration number plate. The marking shall not interfere with the legibility of the registration number.

7.2 The front surface of the plate shall bear in legible and indelible marking, the serial number of the blank, Uganda flag and security hologram.

7.3 The back surface of the plate shall bear in legible and indelible marking the trade name or trade mark of the manufacturer of the plate.



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



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

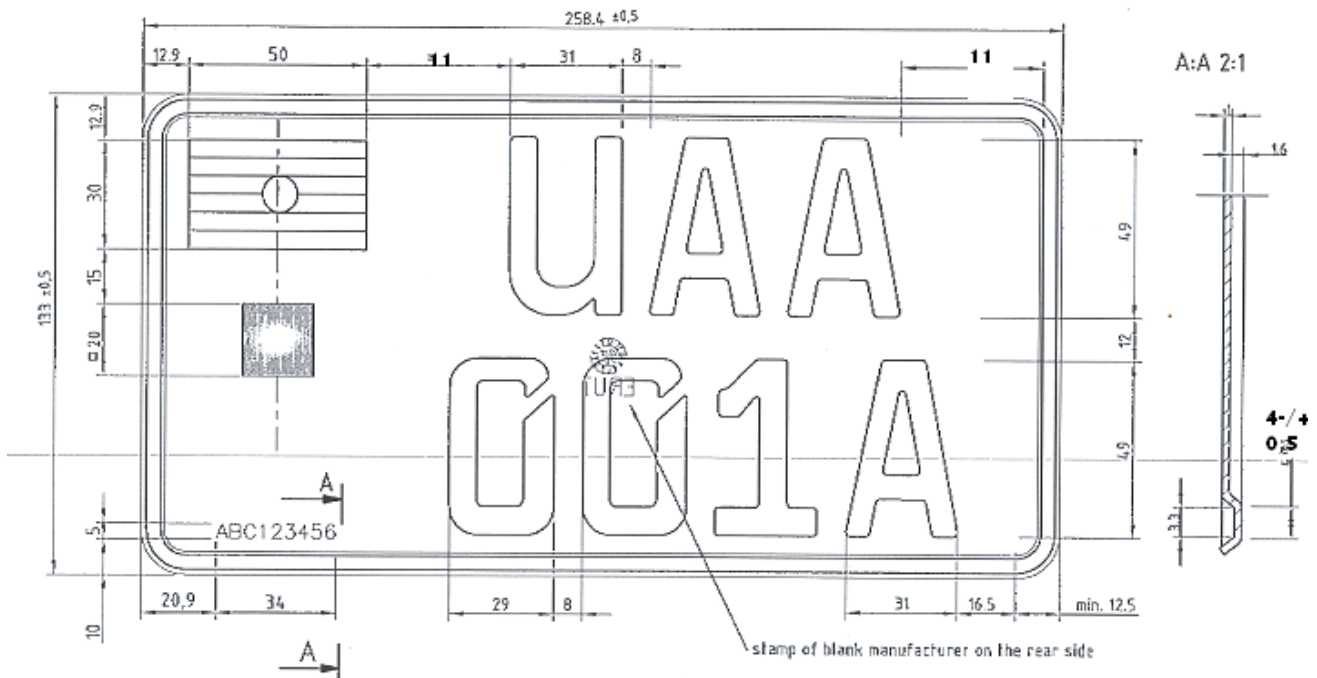


Figure 3— Plate: 255 x 135 x 1R13

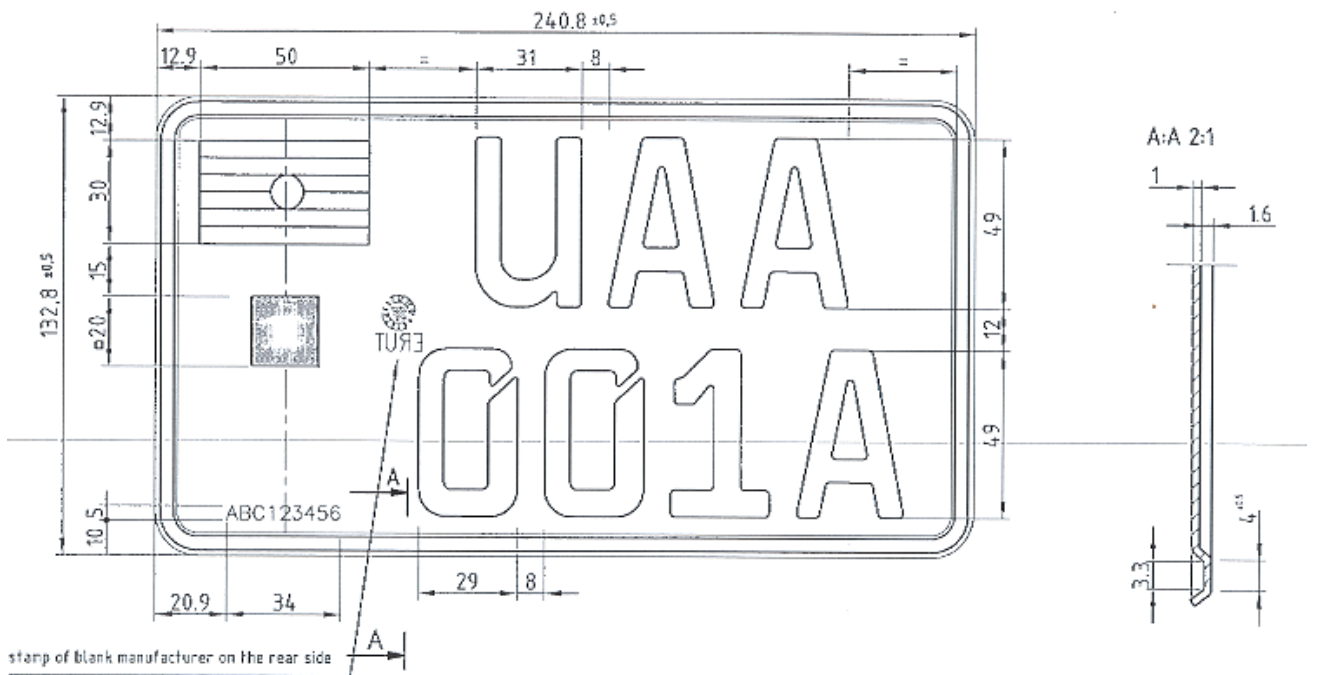


Figure 4 — Plate: 240x 135 x 1 R13

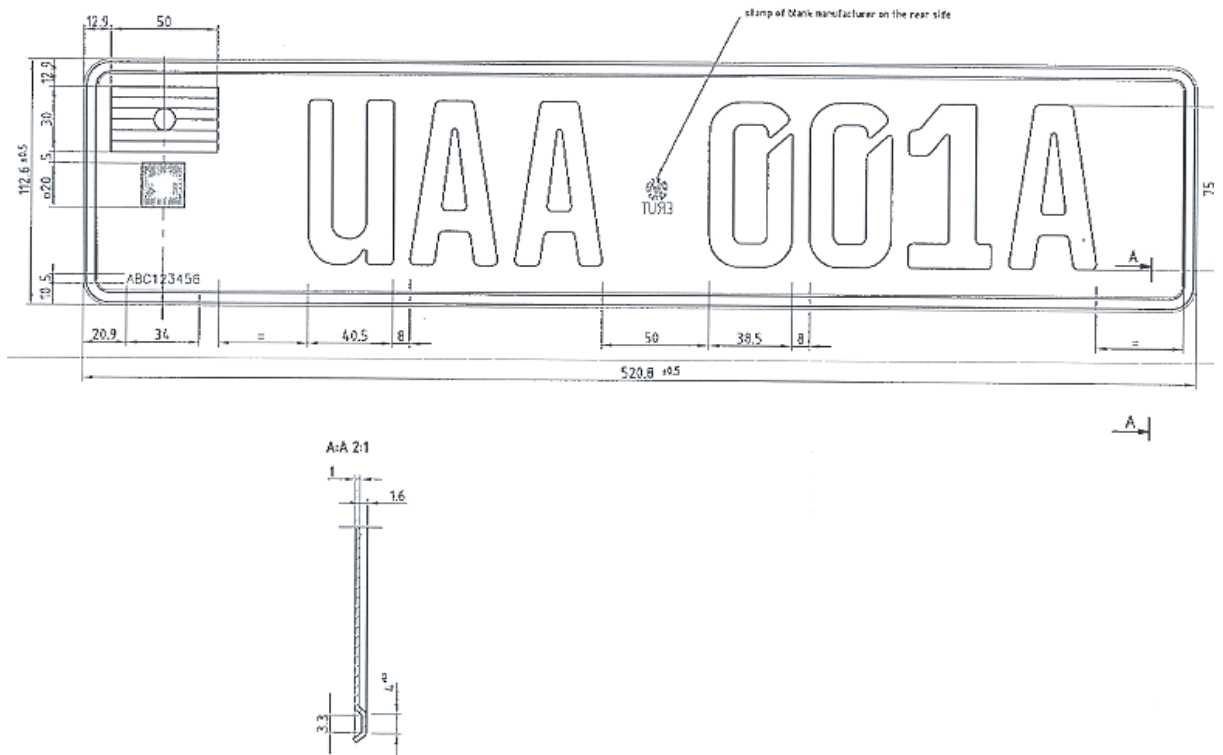


Figure 5 — Plate: 520 x 110 R13

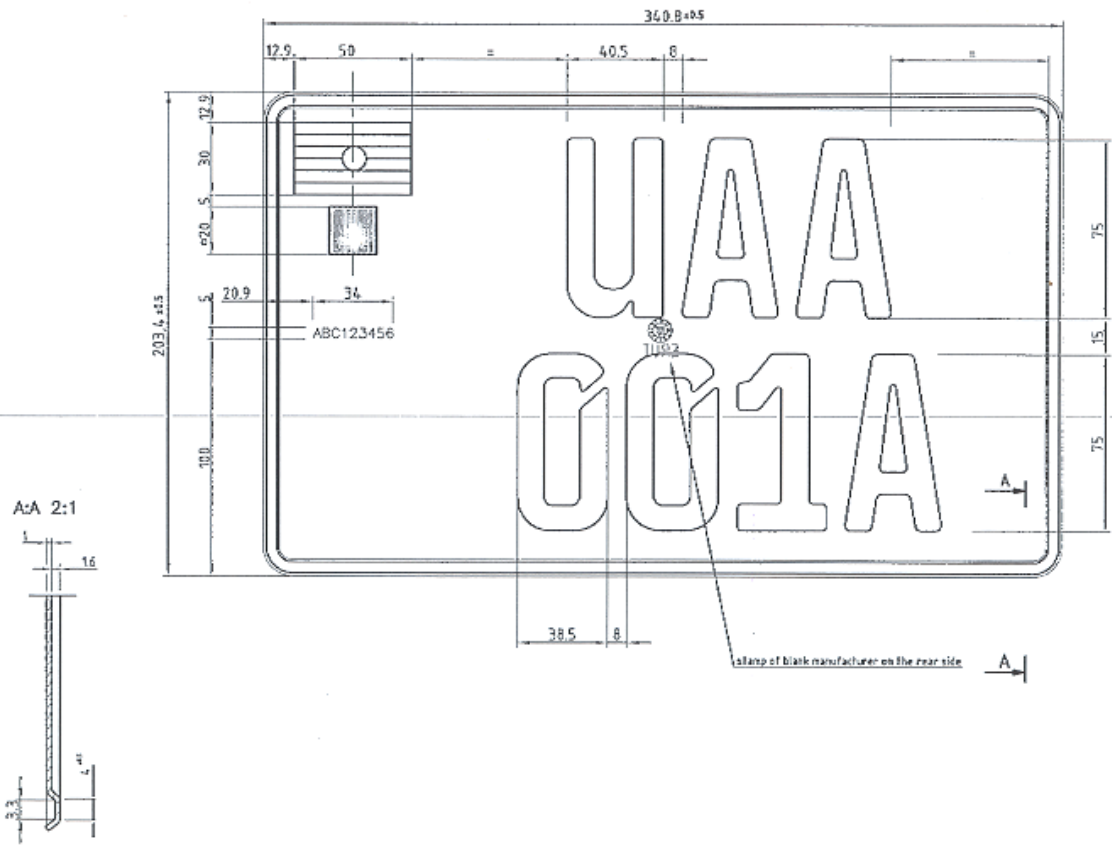


Figure 6 — Plate: 340 x 205 x R13

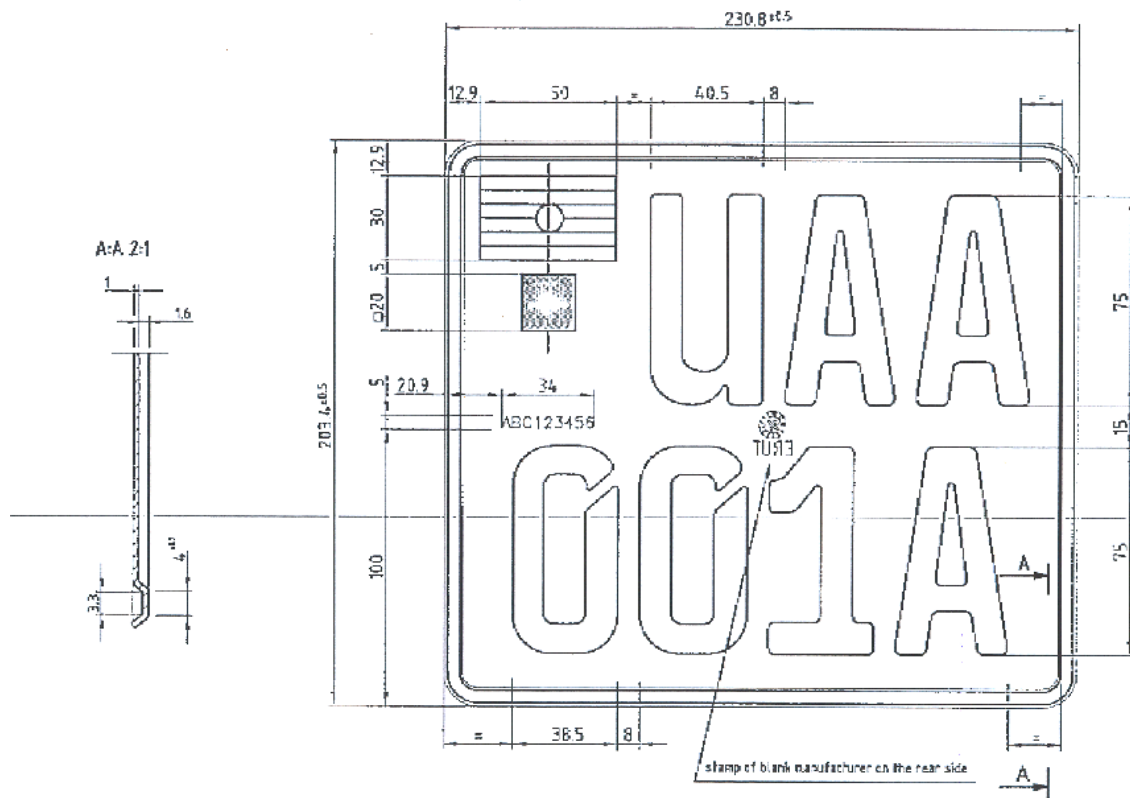


Figure 7 — Plate: 230 x 205 R13

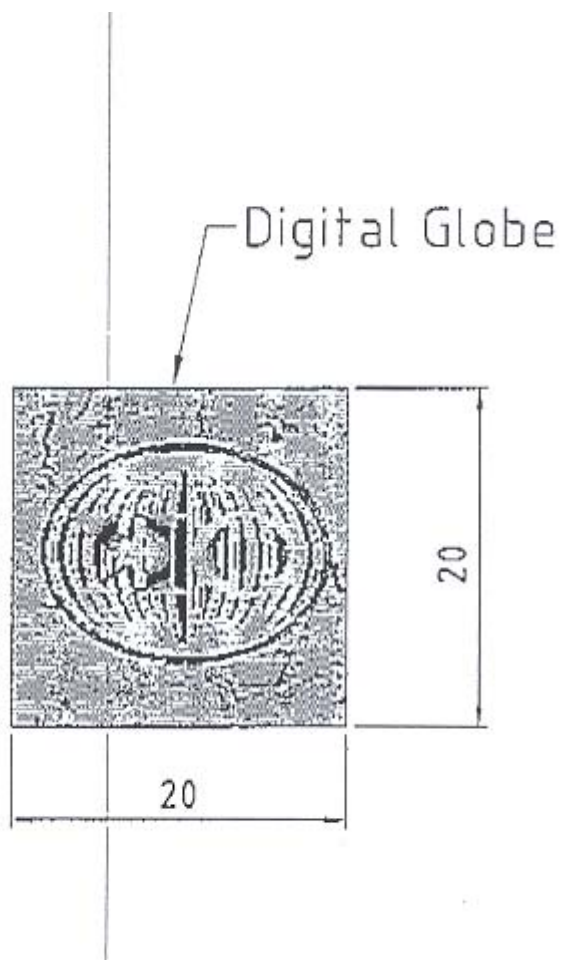


Figure 8 — Security hologram for plates

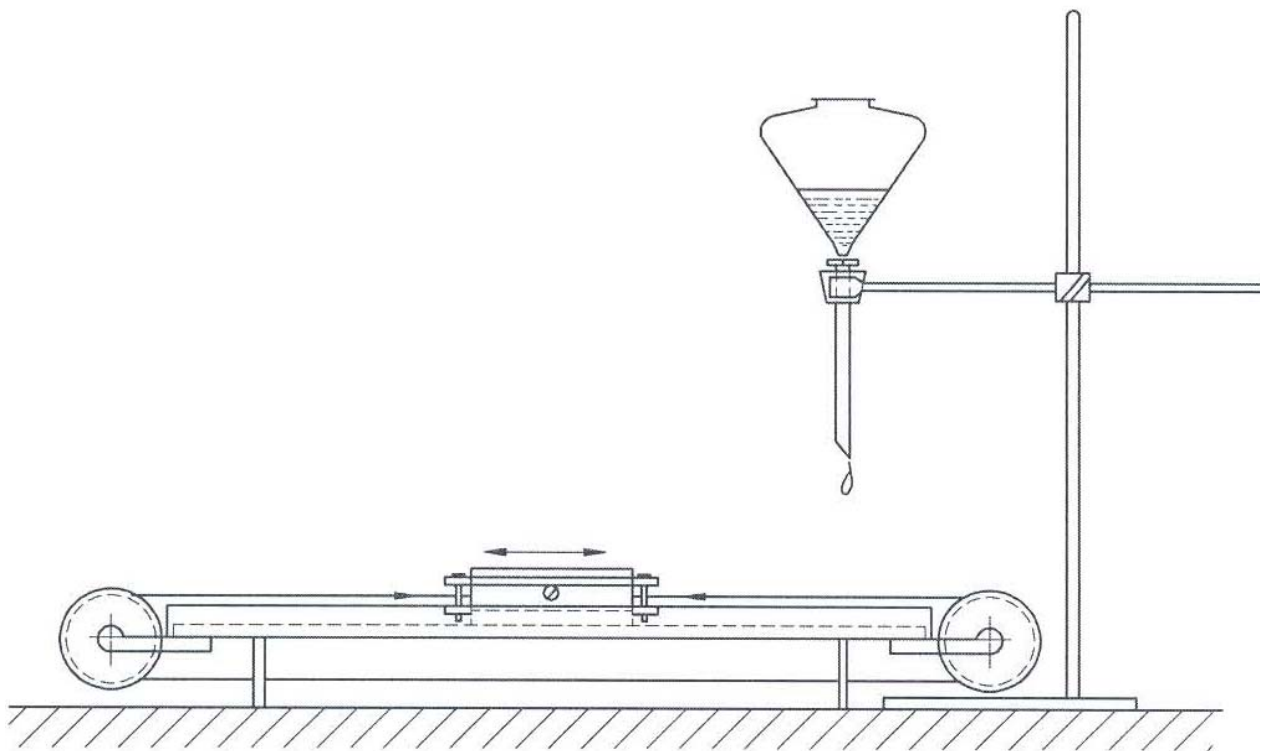


Figure 9 — Apparatus for resistance to abrasion testing

Certification marking

Products that conform to Uganda standards may be marked with Uganda National Bureau of Standards (UNBS) Certification Mark shown in the figure below. The mark may be inscribed on outer packaging.

The use of the UNBS Certification Mark is governed by the Standards Act, and the Regulations made thereunder. This mark can be used only by those licensed under the certification mark scheme operated by the Uganda National Bureau of Standards and in conjunction with the relevant Uganda Standard. The presence of this mark on a product or in relation to a product is an assurance that the goods comply with the requirements of that standard under a system of supervision, control and testing in accordance with the certification mark scheme of the Uganda National Bureau of Standards. UNBS marked products are continually checked by UNBS for conformity to that standard.

Further particulars of the terms and conditions of licensing may be obtained from the Director, Uganda National Bureau of Standards.



