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Retro – reflective registration plates for motor vehicles — Specification — Part 1: Blanks (metal)

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Foreword

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

- Arnold Brooklyn and Company Ltd
- GM Tumpeco Ltd
- Makerere University
- 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 1: Blanks (metal)

1 Scope

1.1 This part of US 775 specifies requirements for the type of blank intended for use in the production of the embossed registration plates that are covered by US 775-2.

1.2 Except under the certification mark scheme, a special agreement between the manufacturer and the purchaser is required for assessment of compliance with the requirements of US 775-1 of those blanks on which the retro-reflective material is applied during the process of embossing the registration number.

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.

CIE Publication 15 (E.1.3.1), *Colorimetry*

CIE Publication 54, *Retro-reflection: Definitions and measurement*

ISO 7591 *Road vehicles — Retro-reflective registration plates for motor vehicles and trailers — Specification*

Traffic and Road Safety Act, 1998

US 775-2, *Retro-reflective registration plates for motor vehicles — Specification — Part 2: Metallic registration number plates*

US ISO 9001, *Quality management systems — Requirements*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions shall apply.

3.1
blank
flat metal plate that has, on one side, an embossed border and at least the area within this border covered with retro-reflective material, the material being supplied as a loose sheet if it is intended to be subsequently applied as part of the embossing process of the registration number

3.2
category L motor vehicle
motor vehicle that has fewer than four wheels

3.3
embossing
process by which a raised border is embossed onto a plate (to form a blank) or by which characters are so embossed onto a blank that they stand out in relief on the retro-reflective surface of a registration plate

3.4
illuminants A and D65
illuminants A and D65 as defined by the International Commission on illumination (CIE) in Publication 15 (E.1.3.1)

3.5
luminance factor (at a point on the surface of a non-self-radiating body, in a given direction, and under specific conditions of illumination)
ratio of the luminance of the material to that of a perfect reflecting diffuser identically illuminated

3.6
registration mark/registration number
combination of letters and numerals as prescribed by the Traffic and Road Safety Act, 1998

3.7
registration plate; plate
plate that displays the registration mark of a motor vehicle or trailer (see Figures 3 - 7 of US 775-2)

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

3.9
retro-reflective sheeting
multi-layer film with small retro-reflective elements very near the exposed surface

4 Requirements

4.1 Type of blank

A blank shall be of a type in which the front face is completely covered with retro-reflective material and is intended for use in an embossing process in which the raised surfaces of the characters and the embossed border are coated.

4.2 Materials

4.2.1 Metal

The metal base of a blank shall be of aluminium sheet material of thickness at least 1.0 mm ± 0.1 mm and shall be suitable for the embossing process.

4.2.2 Retro-reflective material

4.2.2.1 Colour and luminance factor

4.2.2.1.1 When determined in accordance with 5.8, the colour of the retro-reflective material shall be yellow, blue, red or white and the chromaticity co-ordinates shall be within the area on a chromaticity diagram defined by the points of the appropriate values given in Table 1.

4.2.2.1.2 When determined in accordance with 5.8, the luminance factor of the material 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	0.545	0.487	0.427	0.465	
	y	0.454	0.423	0.483	0.534	0.27
White	X	0.355	0.305	0.285	0.335	
	y	0.355	0.305	0.325	0.375	0.35
NOTE For legislation regarding the colour of registration plates, see Road Traffic Safety Act (Act of 1998)						

4.2.2.2 Coefficients of retro-reflection

When the coefficients of retro-reflection of the material are determined in accordance with 5.9, 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, cd/(lx.m^2) min.	
		1	2
0.33*	5*	35	50
2	30	1.5	2.5
* 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.			

4.2.2.3 Flexibility

After wrapping a piece of retro-reflective material of size 200 mm x 100 mm, complete with protective lining for surface outwards, lengthways around a mandrel of diameter 20 mm and length at least 250 mm (that is, the retro-reflective material has been wrapped with its longer axis parallel to that of the mandrel), there shall be no evidence of cracking of the retro-reflective material.

4.2.2.4 Validation mark

The blank material shall bear a serial number and a validation mark that identifies the manufacturer of the material.

4.3 Embossed border colour and luminance factor

4.3.1 Colour of embossed border

The colour of the embossed border shall be black, blue, red, green or white.

4.3.2 Luminance factor

When the luminance factor of the colours blue, red, green and white is determined in accordance with 5.8, it shall be less than 0.12.

4.4 Shape and dimensions

Blanks shall be rectangular and shall be of one of the following sizes as shown in Tables 3 and 4.

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 plate:	
Front	(520 mm x 110 mm) ± 3 mm
Back	(340 mm x 205 mm) ± 3 mm
Personalized vehicle plate:	
Front	(520 mm x 110 mm) ± 3 mm
Back	(340 mm x 205 mm) ± 3 mm

Table 4 — Dimensions for category “L” motor vehicles

Vehicle	Size
Public motor cycles 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

4.5 Preparation of the plate

4.5.1 Cleanliness

The surface of the metal base to which the retro-reflective material is applied shall be dry and free from grease, oil, corrosion and any form of contamination before the retro-reflective material is applied (see 4.6) and, when relevant, before it is coated (see 4.5.2).

4.5.2 Coating of aluminium

4.5.2.1 Aluminium blanks

The surfaces of each blank that have an aluminium base and that are coated [before the application of the retro-reflective material see 4.6)] shall be coated with

a) a powder coating of dry film thickness at least 35 µm, or

b) a suitable surface-conversion coating, followed by a coat (of a dry film thickness at least 20 µm) of a baking enamel.

4.6 Application of retro-reflective material

Blanks, other than those on which the retro-reflective material is intended to be applied during the process of embossing the registration number, shall have the material applied to the front surface. The retro-reflective material shall be of such a size that, the retro-reflective material covers the entire surface of the blank so that at no part is the width of the retro-reflective material less than the width of the blank by more than 2 mm, and at no part is the distance between the edges of the retro-reflective material and the adjacent edges of the blank more than 1.3 mm.

4.7 Embossed border

The embossed border of a blank shall be of curved or flat cross-section, generally as given in Figure 1. The embossing shall extend around the periphery of the blank and shall have an overall width of 5 mm ± 1 mm and a height above the surface of the blank of, not less than 1 mm and not more than 2 mm.

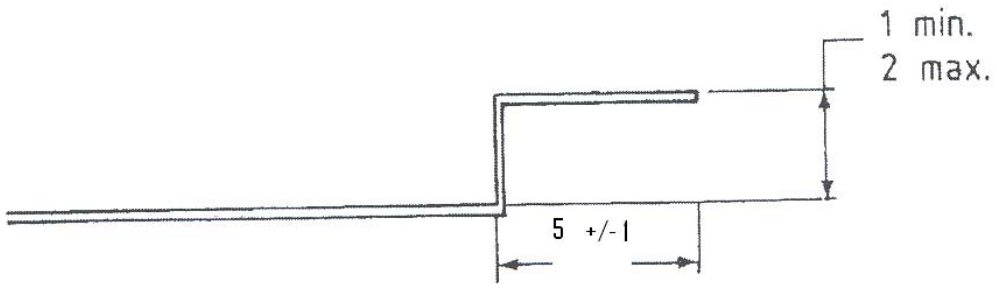

Figure 1 — Typical embossed border

4.8 Workmanship

Blanks shall be free from creases, crevices and sharp or jagged edges, and retro-reflective and coated surfaces shall be free from creases, cracks, chips, blisters, discoloration and spots.

4.9 Performance tests

4.9.1 Resistance to weathering

When blanks are tested in accordance with 5.4,

a) the chromaticity co-ordinates shall remain within the area on the appropriate chromaticity diagram as defined in 4.2.2.1;

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 shall show no sign of cracking, blistering, or loss of adhesion; and

d) when relevant, the painted or powder-coated surface shall show no sign of chalking or checking.

4.9.2 Resistance to impact

When blanks are tested in accordance with 5.5, the retro-reflective material and (when relevant) the painted or powder-coated surface shall show no sign of cracking or loss of adhesion.

4.9.3 Resistance to scratching

When blanks are tested in accordance with 5.6, the scratch produced

a) on the retro-reflective surface shall not have penetrated the material surface, and

b) on the painted or powder-coated surface (when relevant), shall be free from jagged edges and shall not have penetrated through to the substrate.

4.9.4 Resistance to salt fog

When blanks are tested in accordance with 5.6, no surface shall show any sign of delamination, edge lifting or loss of adhesion. In the case of a retro-reflective surface, there shall be no sign of corrosion or blistering. In the case of a painted or powder-coated surface, any blister or creep (or both) or corrosion shall not extend further than 2 mm on each side of the scribe mark.

4.9.5 Resistance to bending

When blanks are tested in accordance with 5.8, there shall, after each bending operation, be no sign of cracking of the metal, or of cracking or loss of adhesion of the retro-reflective material or (when relevant) of the paint or powder coating.

5 Inspection and methods of test

5.1 General

In the case of blanks where the retro-reflective material is intended to be applied as part of the embossing process of the registration number, inspection and tests shall be carried out on test specimens on which the retro-reflective material has been permanently applied using the registration number embossing process but without a number having been embossed.

5.2 Inspection

Visually examine and measure each blank in the sample for compliance with all the appropriate requirements of this standard for which tests to assess compliance are not given in 5.4 to 5.8 (inclusive).

5.3 Test specimens

From sample blanks, cut the following test specimens:

a) **resistance to weathering**: one test specimen of width at least 70 mm and of length at least 150 mm, and that has not more than one cut edge;

b) **resistance to impact**: one test specimen of any convenient size; the test may be carried out on an end of the specimen cut in terms of (e) below before it is subjected to bending;

c) **resistance to scratching**: one test specimen of width at least 55 mm and of length at least 100 mm;

d) **resistance to salt fog**: one test specimen in the case of a blank without any paint or powder coating on the rear surface, and two test specimens in other cases, each of width at least 100 mm and of length at least 100 mm and that have not more than two cut edges;

e) **bending test**: one test specimen of width between 100 mm and 120 mm and of length at least 250 mm, and that has embossed on it one character of a registration mark that complies with the appropriate requirements of US 775-2.

5.4 Resistance to weathering

5.4.1 Apparatus

A weathering unit, that has the following features:

a) **Test chamber** constructed of corrosion-resistant materials enclosing eight fluorescent UV lamps, a heated water pan, test specimen racks that constitute the side walls of the chamber, and provisions for controlling and recording operating times and temperatures

b) **Lamps,** of type UVB 313 fluorescent UV lamps or equivalent, the spectral energy distribution curve having a maximum at a wavelength of 313 nm with less than 1 % of the peak intensity at 280 nm. The lamps are of length 1 220 mm and of nominal rating 40 W when operated from a ballast that provides a controlled current of 430 mA at 102 V.

c) **Lamp and test specimen arrangement** with the lamps mounted in two banks of four lamps each to provide a uniform distribution of irradiance. The lamps in each bank are mounted parallel to each other at 70 mm centres. The test specimens are mounted in two stationary racks each of height 300 mm and of width 1 154 mm, the test surface being in each case parallel to the plane of one bank of lamps and at a distance of 50 mm from the nearest surface of the lamps.

d) **Condensation mechanism** where water vapour is generated by the heating of a water pan that extends under the entire specimen area and contains water of depth 25 mm. The back surface of each specimen is exposed to the cooling effect of the ambient room air. The resulting heat transfer causes water vapour, saturated with air, to condense on the test surface. The specimens are so arranged that condensate runs off the test surface by gravity and is replaced by fresh condensate in a continuous process. Vents along the bottom of the test chamber are provided to admit ambient air and so prevent oxygen depletion of the condensate.

e) **Water supply** with an automatic control to regulate the level in the water pan. Distilled, de-ionized, or potable tap water may be used.

f) **Cycle timer** that is continuously operating provided to program the selected cycle of UV radiation periods and condensation periods. An hour meter is provided to record the total time of operation and total time of UV exposure.

5.4.2 Temperature measurement

5.4.2.1 The temperature is measured by means of a thermometer, the bulb of which is inserted in a black aluminium panel of size 75 mm x 100 mm x 2.5 mm. The thermometer is accurate to 1 °C through a range of 30 °C to 80 °C. The indicator of the thermometer is located outside the test chamber.

5.4.2.2 The black aluminium panel and thermometer bulb are so positioned in the centre of the exposure rack that they are subjected to the same conditions as the specimens.

5.4.3 Temperature control

5.4.3.1 During UV exposure, the selected equilibrium temperature is maintained within 3 °C by the supply of heated air to the test chamber.

5.4.3.2 During condensation exposure, the selected equilibrium temperature is maintained within 3 °C by the heating of the water in the pan.

5.4.3.3 The UV and condensation temperature controls are independent of each other.

5.4.3.4 Doors are located on the room air side of the specimen rack, to act as insulation during the UV exposure and to minimize draughts. The doors do not interfere with the room air cooling of the specimen during the condensation exposure.

5.4.4 Procedure

5.4.4.1 Seal the cut edge of each specimen [see 5.3 (a)].

5.4.4.2 Mount the test specimens in the specimen racks, with the test surfaces facing the lamps.

5.4.4.3 Select the following cycle conditions:

a) 4 h UV exposure at 60 °C; and then

b) 4 h condensation exposure at 50 °C.

5.4.4.4 Except for servicing the apparatus and inspecting the specimens, repeat the cycle continuously for 240 h.

5.4.4.5 At regular intervals during the specified exposure period, examine the specimens under 10x magnification.

5.4.4.6 Check for compliance with 4.9.1.

5.5 Resistance to impact

5.5.1 Apparatus

5.5.1.1 **Striker,** a cylindrical piece of steel of length and diameter approximately 230 mm and 25 mm respectively, that has a hardened steel ball of diameter 12.7 mm ± 0.1 mm mounted at its bottom end and a total mass of 900 g ± 10 g

5.5.1.2 **Drop tube,** a slotted or split vertical tube graduated in millimetres, of approximate length 500 mm and of diameter large enough to enable the striker to drop freely through it

5.5.1.3 **Base plate,** a horizontal steel plate that has a hole of diameter 16 mm, the plate being so placed that the hole is concentric with the opening of the tube

5.5.2 Procedure

5.5.2.1 So place the specimen [see 5.3 (b)] over the hole in the base plate that the striker will fall onto a part of a retro-reflective surface of the specimen.

5.5.2.2 Raise the striker to the appropriate height and allow it to fall with an energy of 1.15 J for aluminium blanks.

5.5.2.3 When relevant, repeat 5.5.2.1 and 5.5.2.2, but with the point of impact being on a part of a painted or powder-coated surface.

5.5.2.4 Examine the dented part(s) of the specimen under 10x magnification for compliance with 4.9.2.

5.6 Resistance to scratching

5.6.1 Apparatus

5.6.1.1 **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 countermass before masspieces are loaded above the needle.

5.6.1.2 **Masspieces**, a set of forty 50 g masspieces

5.6.1.3 **Base with sliding specimen holder**, that moves freely and automatically on its base under the loaded needle (which is perpendicular to the specimen holder)

5.6.1.4 **Electric current supply and ammeter**. The needle and specimen holder are so connected in series with an ammeter and an electric current supply that, when the painted or powder-coated surface of a specimen is penetrated, the needle makes electrical contact with the underlying metal, and this penetration is indicated by a flow of current through the ammeter.

5.6.2 Procedure

5.6.2.1 In the case of a retro-reflective surface, set the horizontal arm in equilibrium, with the electric current supply and ammeter not in use. Clamp the specimen [see 5.3 (c)] to the specimen holder, with the material to be tested facing upwards. Load the needle with masspieces of total mass 2 000 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.

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

5.6.2.3 Check for compliance with the relevant requirements of 4.9.3.

5.6.2.4 Repeat 5.6.2.1 to 5.6.2.3 on two other parts of the material surface.

5.6.2.5 In the case of a painted or powder-coated surface, carry out the test as given in 5.6.2.1 to 5.6.2.4, but with the electric current supply and ammeter in use.

5.7 Resistance to salt fog

5.7.1 Apparatus

A fog cabinet, that has the following features:

a) **Exposure chamber**, made from, or coated with, a corrosion-resistant material and, so constructed that the salt fog circulates freely and equally about all specimens, and that has baffles to prevent the salt fog from striking the specimens direct

b) **Racks for supporting the specimens**, removable and made from, or coated with, a corrosion-resistant material and so constructed that the specimens are held without touching one another or any other metal and that salt solution will not drip from one specimen onto another.

c) **Salt solution reservoir**, of adequate size to produce the required quantity of salt fog and made from, or coated with, corrosion-resistant material. It is so constructed that there is no recirculation of the salt solution

d) **Atomizing nozzles**, plastics nozzles so designed that they will produce a finely divided salt solution fog

e) **Air supply**: a compressed air supply for the atomizing nozzles, filtered to remove all impurities. Means are provided to humidify and heat the compressed air as necessary. The air pressure is constant to within 700 Pa and sufficient to produce a finely divided salt solution fog.

f) **Heating of chamber and temperature control**: the exposure chamber is heated and its temperature is controlled by means of a thermostat.

NOTE – An immersion heater should not be used.

5.7.2 Salt solution

The salt solution is made up as follows:

a) **Salt**: sodium chloride containing sodium iodide not exceeding 1 g/kg of salt and total impurities not exceeding 3 g/kg of salt, calculated on the dry basis

b) **Water** that contains total solids not exceeding 200 mg/kg of water

c) **T**he salt solution is prepared by dissolving 5 parts ± 0.5 parts (by mass) of salt in 95 parts (by mass) of water and filtering the solution.

5.7.3 Conditions of test

5.7.3.1 Temperature

Maintain the temperature in the exposure zone at 33 °C to 36 °C.

5.7.3.2 Salt fog

Ensure that the degree of atomization of the salt solution is such that suitable fog collectors placed at any point in the exposure zone will collect, over an average running period of at least 16 h, 65 mL to 375 mL of solution per hour per square metre of horizontal collecting area. Ensure that the solution so collected has a pH value of 6.5 to 7.2 when measured electrometrically.

5.7.4 Procedure

5.7.4.1 In the case of specimens [see 5.2(d)] that have a paint or powder coating, use a suitable cutting tool and carefully make (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 that surface) a scribe mark of length about 75 mm, by cutting through the coating to the base.

5.7.4.2 Establish the test conditions in the exposure chamber. Mount the specimens on the supporting racks and insert the racks in the exposure chamber.

5.7.4.3 Close the exposure chamber and operate the cabinet continuously for 24 h.

5.7.4.4 After the test period, remove the specimens and rinse them thoroughly with distilled water. Examine the following for compliance with the applicable requirements of 4.9.4:

a) when relevant, the paint or powder coating, immediately after removal of the specimens from the exposure chamber; and

b) the retro-reflective material, after a 24 h recovery period has elapsed.

5.8 Bending test

So place the unlaminated surface of the test specimen [see 5.2(e)] against a mandrel of diameter 50 mm ± 1 mm that the line of maximum bending coincides with the vertical centre-line of the letter or numeral. Taking about 3 s, bend the specimen through an angle of 90° ± 2° over the mandrel, and then examine it for compliance with 4.9.5. Immediately following this procedure, and taking about 3 s, so bend the specimen back through the same angle that it is in approximately its original alignment and again examine it for compliance with 4.9.5.

5.9 Colour and luminance factor test

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 Publications 15 (E.1.3.1) and 54, using Standard Illuminant D65 and 45/0 geometry.

Check for compliance with 4.2.2.1.

5.10 Photometric test

Determine the coefficients of retro-reflection in accordance with CIE Publication 54, using the values of observation angle and entrance angle given in Table 2. On each specimen, take the average of two readings at rotation angles (about the reference axis) that are 90° apart. Check for compliance with 4.2.2.2.

6 Packing and marking

6.1 Packing

The blanks and, when relevant, the retro-reflective material shall be so packed as to ensure that they are not damaged during normal handling, transportation and storage.

6.2 Marking

Each blank shall bear the manufacturer’s trade name or trade mark, serial number, Uganda flag and security hologram in legible and indelible marking, on the surface covered or not covered by the retro-reflective material. The Uganda flag, security hologram and serial number shall be on the left hand side of plate covered by the retro-reflective material. The Uganda flag shall be on top, security hologram in the middle and serial number at the bottom in that order.

Annex A
(normative)

Quality verification of metal blanks for retro-reflective registration plates

When a purchaser requires ongoing verification of the quality of metal blanks for retro-reflective registration plates, it is suggested that, instead of concentrating solely on evaluation of the final product, he also directs his attention to the manufacturer's quality system. In this connection it should be noted that US ISO 9001 covers the provision of an integrated quality system.

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 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.

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