

79 Rear marking plates for heavy and long vehicles

Refer to: R70 01-S9

79.1 Effective date and Scope:

79.1.1 Effective date from 2017/1/1, new types of rear marking plates for heavy and long vehicles using in vehicles as below, and from 2018/1/1 all types of rear marking plates for heavy and long vehicles using in vehicles as below, shall comply with this regulation.

79.1.1.1 Vehicles of categories N2 with a maximum mass exceeding 7.5 tonnes and N3, except tractors for semi-trailers.

79.1.1.2 Vehicles of category O1, O2 and O3 exceeding 8.0 m in length.

79.1.1.3 Vehicles of category O4.

79.2 Definitions:

79.2.1 "Rear marking plate for heavy and long vehicles", a plate conform to 79.2.1.1 Specifications marked, and faced with retro-reflective and fluorescent material or devices intended to increase the visibility and permit easy identification of heavy and long vehicles;

79.2.1.1 Specifications marked

79.2.1.1.1 Means the marks shall be clearly legible on the outside of the marking material and shall be indelible to include below:

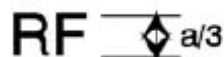
79.2.1.1.1.1 The trade name or mark of the applicant;

79.2.1.1.1.2 On the plates whose retro-reflective system is not omni-rotational, the word "TOP" is inscribed horizontally on the part of the plates which is intended to be the highest part of the plate when mounted on the vehicle.

79.2.1.1.1.3 If rear marking plates that comply with this regulation:

(a) "RF" in case of classes 1 and 2 (retro-reflective and fluorescent materials)

(b) "RR" in the case of class 3 and 4 (retro-reflective only materials). (figure as below , "a" is at least 5 mm)



79.2.2 "Sample unit", a complete, finished marking plate ready to be mounted on a vehicle and representative of current production.

79.2.3 Classes of rear marking plates

Class 1: Rear marking plates for heavy motor vehicles (trucks and tractors) with red fluorescent and yellow retro-reflective alternative stripes.

Class 2: Rear marking plates for long vehicles (trailers and semi-trailers) with red fluorescent border and yellow retro-reflective centre.

Class 3: Rear marking plates for heavy motor vehicles (trucks and tractors) with red retro-reflective and yellow retro-reflective alternative stripes.

Class 4: Rear marking plates for long vehicles (trailers and semi-trailers) with red retro-reflective border and yellow retro-reflective centre.

Class 5: Rear marking plates for motor vehicles or trailers with red and white retroreflective alternative stripes.

79.2.4 Retro-reflection

Reflection in which radiation is returned in directions close to the direction from which it came, this property being maintained even over wide variations of the direction of the incident radiation:

79.2.4.1 "Retro-reflective material", a surface or device from which, when directionally irradiated, a relatively large portion of the incident radiation is retro-reflected.

79.2.4.2 "Retro-reflecting device", an assembly ready for use and comprising one or more retro reflecting optical units.

79.2.5 Geometric definitions

79.2.5.1 "Reference centre", a point on or near a retro-reflective area which is designated to be the centre of the device for the purpose of specifying its performance.

79.2.5.2 "Illumination axis", a line segment from the reference centre to the light source.

79.2.5.3 "Observation axis", a line segment from the reference centre to the photometer head.

79.2.5.4 "Observation angle (symbol α)", the angle between the illumination axis and the observation axis. The observation angle is always positive and, in the case of retro reflection, is restricted to small angles. Maximum range: $0^\circ \leq \alpha \leq 180^\circ$ degrees .

79.2.5.5 "Observation half-plane", the half-plane which originates on the illumination axis and which contains the observation axis.

79.2.5.6 "Reference axis", a designated line segment originating on the reference centre which is used to describe the angular position of the retro-reflector.

79.2.5.7 "Entrance angle (symbol β)", the angle from the illumination axis to the reference axis. The entrance angle is usually not larger than 90 degrees but, for completeness, its full range is defined as $0^\circ \leq \beta \leq 180^\circ$ degrees In order to specify the orientation in full, this angle is characterized by two components, β_1 and β_2 .

79.2.5.8 "First axis", an axis through the reference centre and perpendicular to the observation half-plane.

- 79.2.5.9 "First component of the entrance angle (symbol β_1)", the angle from the illumination axis to the plane containing the reference axis and the first axis. Range: -180 degrees \square β_1 \square 180 degrees.
- 79.2.5.10 "Second component of the entrance angle (symbol β_2)", the angle from the plane containing the observation half-plane to the reference axis. Range: -90 degrees \square β_2 \square 90 degrees .
- 79.2.5.11 "Second axis", an axis through the reference centre and perpendicular to both the first axis and the reference axis. The positive direction of the second axis lies in the observation half-plane when $-90 \text{ degrees} < \beta_1 < 90 \text{ degrees}$; as shown in Annex 1, figure 1.
- 79.2.5.12 "Angle of rotation epsilon", angle through which the sample is turned about its mean vertical from any arbitrarily established position counterclockwise (+epsilon) or clockwise (-epsilon) viewed in the direction of illumination. If retro-reflective materials or devices have a marking (e.g. TOP), this marking governs the starting position. The angle of rotation epsilon lies in the range $-180 \text{ degrees} < \epsilon < 180 \text{ degrees}$.

79.2.6 Photometric

- 79.2.6.1 "Coefficient of retro-reflection (R')", the quotient of the coefficient of luminous intensity R of a plane retro-reflecting surface by its area A. The symbol is R'

$$(R' = \frac{I}{E_{\perp} \cdot A}).$$

The coefficient (R') is expressed in candelas per lux per m² (cd.lx⁻¹.m⁻²);

- 79.2.6.2 "Angular diameter of the retro-reflector sample (symbol η)", the angle subtended by the greatest dimension of the retro-reflective sample, either at the centre of the source of illumination or at the centre of the receiver.
- 79.2.6.3 "Luminance factor", the ratio of the luminance of the body considered to the luminance of a perfect diffuser under identical conditions of illumination and observation.
- 79.2.6.4 "Colour of the reflected light of the device" The definitions of the colour of the reflected light are given in "The installation of lighting and light-signaling devices" of this Direction .

79.2.7 Fluorescence

- 79.2.7.1 When certain substances are brought near to a source of ultraviolet or blue radiations, they emit radiations which are nearly always of longer wave-length than those producing the effect. This phenomenon is called fluorescence. By day and in twilight, fluorescent colours are brighter than normal colours because they reflect part of the light falling upon them, and in addition they emit light. At night they are not brighter than ordinary colours.

79.2.7.2 "Colour of the fluorescent light of the device" The definitions of day-time colour of the fluorescent are given in "The installation of lighting and light-signaling devices" of this Direction.

79.3 Rear marking plates for heavy and long vehicle shall according to suitable variant and range of principle :

- 79.3.1 The same brand.
- 79.3.2 The same characteristics of the retro-reflective material.
- 79.3.3 The same characteristics of the fluorescent material.
- 79.3.4 The same parts affecting the properties of the retro-reflective material or devices.
- 79.3.5 Differences in the shape and dimensions of the rear marking shall not constitute a different type.

79.4 General provisions

79.4.1 The applicant shall provide at least number of representative rear marking plates in paragraph 79.5.1 requirement (or the essential part of the vehicle for technical services) and submit the documents as below to technical services, confirmed the actual vehicle and documentation are consistency.

79.4.1.1 Drawings, in triplicate, sufficiently detailed to permit identification of the type. The drawings shall show geometrically the position in which the marking plate is to be fitted to the rear end of the vehicle.

79.4.1.2 A brief description giving the technical specifications of the materials of which the retroreflective areas are made.

79.4.1.3 A brief description giving the technical specifications of the materials of which the fluorescent areas are made.

79.4.2 Retro-reflective/fluorescent or retro-reflective only marking plates shall be so constructed that they function satisfactorily and will continue to do so in normal use. In addition, they shall not have any defect in design or manufacture that is detrimental to their efficient operation or to their maintenance in good condition.

79.4.3 The components of retro-reflective/fluorescent or retro-reflective only marking plate(s) shall not be capable of being easily dismantled.

79.4.4 The means of attachment of the rear marking plate must guarantee a stable and durable connection between the rear marking plate and the rear end of vehicles, for instance by screws, rivets or adhesives.

79.4.5 The outer surface of the retro-reflective/fluorescent or retro-reflective only marking plate(s) shall be easy to clean. The surface shall therefore not be rough and any protuberances it may exhibit shall not prevent easy cleaning.

79.5 Test procedure

79.5.1 Two large chevron rear marking plates for trucks shall be supplied to the testing laboratory; two large rear marking plates for trailers and semi-trailers (or their equivalent in smaller plates) shall be supplied to the testing laboratory for the various tests to be conducted.

- 79.5.2 The test samples shall be representative of current production, fabricated in accordance with the recommendations of the manufacturer of the retro-reflective or retro-reflective/fluorescent materials or devices.
- 79.5.3 After verification of the general specifications (paragraph 79.4.) and the specifications of shape and dimensions (paragraph 79.6.) the samples shall be subjected to the heat resistance test described in paragraph 79.10., prior to the tests described in paragraph 79.7, 79.8 and 79.9.
- 79.5.4 The photometric and colorimetric measurements may be made on the same sample.
- 79.5.5 For the other tests, samples which have not undergone any testing should be used.
- 79.6 Specifications of shape and dimensions
- 79.6.1 Shape
The plates shall be rectangular in shape for mounting at the rear of vehicles.
- 79.6.2 Pattern
For mounting on trailers and semi-trailers, the plates shall have a yellow retro-reflective background with a red fluorescent or retro-reflective border.
For mounting on non-articulated vehicles (tractors or trucks), the plates shall be of the chevron type with alternate, oblique stripes of yellow retro-reflective and red fluorescent or retro-reflective materials or devices.
For mounting of Class 5 devices on non-articulated vehicles, the retro-reflective material shall be made with alternate, oblique stripes of white and red colour.
- 79.6.3 Dimensions
The minimum total summarized length of a set of rear marking plates consisting only of one, two or four marking plates with retro-reflective and fluorescent materials shall be 1,130 mm, the maximum total length shall be 2,300 mm.
- 79.6.3.1 The width of a rear marking plate shall be:
For trucks and tractors: 140 +/- 10 mm.
For trailers and semi-trailers: 200^{+30}_{-5} mm.
- 79.6.3.2 The length of each rear marking plate in a set consisting of two plates for trucks and tractors, as illustrated in figures 2(b) and (c) of Annex 12, may be reduced, to a minimum of 130 mm, provided that the width is increased such that the area of each marking is at least 735 cm², does not exceed 1,725 cm² and the marking plates are rectangular.
Class 5 devices shall incorporate a minimum of 9 standard areas as described in paragraph 79.6.3.4. below on large vehicles with available mounting space, but may be reduced to a minimum of 4 standard areas on vehicles with limited

mounting space.

79.6.3.3 The width of the red fluorescent border of the rear marking plates for trailers and semitrailers shall be 40 mm +/- 1 mm.

79.6.3.4 The slope of the oblique stripes of the chevron band shall be 45 degrees +/- 5 degrees. The width of the stripes shall be 100 mm +/- 2.5 mm. Prescribed shapes, patterns and dimensional features are illustrated in figures 2 and 3.

Class 5 retro-reflective materials shall consist of red and white diagonal stripes each 100 mm wide sloping outwards and downwards at 45 deg. The basic standard area is a square of 141 mm in length subdivided diagonally into a white half and red half, which represents one standard area.

Prescribed shapes, patterns and dimensional features of Class 5 devices are illustrated in figure 4-1.

79.6.3.5 Rear marking plates or Class 5 devices supplied in sets shall form matching pairs.

79.7 Colorimetric specifications

79.7.1 Rear marking plates for heavy vehicles and trailers shall be composed of yellow retro reflective and red retro-reflective or yellow retro-reflective and red fluorescent materials or devices.

79.7.2 Yellow, red or white retro-reflective material

79.7.2.1 When measured with a spectrophotometer in accordance with the provisions of CIE document No. 15 (1971) and illuminated with the CIE Standard illuminant D65 at an angle of 45 degrees to the normal and viewed along the normal (45/0 geometry), the colour of the material in new condition shall be within the limits according to day-time colour of the light reflected of "The installation of lighting and light-signaling devices" of the "Directions".

Table 1: Chromaticity co-ordinates x and y

| Colour | | 1 | 2 | 3 | 4 | Luminance factor beta |
|--------|---|-------|-------|-------|-------|--------------------------|
| Yellow | x | 0.545 | 0.487 | 0.427 | 0.465 | ≥ 0.16 |
| | y | 0.454 | 0.423 | 0.483 | 0.534 | |
| Red | x | 0.690 | 0.595 | 0.569 | 0.655 | ≥ 0.03 |
| | y | 0.310 | 0.315 | 0.341 | 0.345 | |

79.7.2.1.1 Luminance factor for
(a) Yellow colour shall be ≥ 0.16 .

(b) Red colour shall be $\Delta 0.03$.

(c) White colour shall be $\Delta 0.25$.

79.7.2.2 When illuminated by the CIE Standard Illuminant A at an entrance angle $\beta_1 = \beta_2 = 0$ degrees or, if this produces a colourless surface reflection, an angle $\beta_1 = \pm 5$ degrees, $\beta_2 = 0$ degrees, and measured at an observation angle of 20° , the colour of the material in new condition shall be within the limits according to night-time colour of the light retro-reflected of "The installation of lighting and light-signaling devices" of the "Directions".

Table 2: Chromaticity co-ordinates x and y

| Colour | | 1 | 2 | 3 | 4 |
|--------|---|-------|-------|-------|-------|
| Yellow | x | 0.585 | 0.610 | 0.520 | 0.505 |
| | y | 0.385 | 0.390 | 0.480 | 0.465 |
| Red | x | 0.720 | 0.735 | 0.665 | 0.643 |
| | y | 0.258 | 0.265 | 0.335 | 0.335 |

79.7.3 Red fluorescent material

79.7.3.1 When measured with a spectrophotometer in accordance with the provisions of CIE document No. 15 (1971) and illuminated polychromatically with the CIE Standard Illuminant D65 at an angle 45 degrees to the normal and viewed along the normal (geometry 45/0), the colour of the material in new condition shall be within the limits according to day-time colour of the fluorescent of "The installation of lighting and light-signaling devices" of the "Directions".

Table 3

| Colour | | 1 | 2 | 3 | 4 | Luminance factor |
|--------|---|-------|-------|-------|-------|------------------|
| Red | x | 0.690 | 0.595 | 0.569 | 0.655 | ≥ 0.30 |
| | y | 0.310 | 0.315 | 0.341 | 0.345 | |

79.7.3.1.1 "Luminance factor for red colour shall be ≥ 0.30 ."

79.7.4 Compliance with the colorimetric specification shall be verified by a visual comparison test.

If any doubt remains after this test, conformity with the colorimetric specification shall be verified by determining the trichromatic co-ordinates of the most doubtful sample.

79.8 Photometric specifications

79.8.1 Photometric properties

79.8.1.1 Devices of class 1 and class 2 shall fulfil the values in table 4, devices of class 3 and class 4 those in table 5, devices of class 5 those in table 6.

Table 4 Coefficient of retro-reflection R' [cd.m⁻².lx⁻¹]

| Observation angle alpha [°] | Entrance angle beta [degrees] | | | | |
|--|-------------------------------|-----------|------------|------------|------------|
| 20' | beta ₁ | 0 degrees | 0 degrees | 0 degrees | 0 degrees |
| | beta ₂ | 5 degrees | 30 degrees | 40 degrees | 60 degrees |
| Coefficient R' [cd.m ⁻² .lx ⁻¹] | Colour: Yellow | 300 | 180 | 75 | 10 |

Table 5 Coefficient of retro-reflection R' [cd.m⁻².lx⁻¹]

| Observation angle alpha [°] | | Entrance angle beta [degrees] | | | | |
|---|-------------------|-------------------------------|-----------|------------|------------|------------|
| 20' | beta ₁ | | 0 degrees | 0 degrees | 0 degrees | 0 degrees |
| | beta ₂ | | 5 degrees | 30 degrees | 40 degrees | 60 degrees |
| Coefficient R' [cd.m ⁻² .lx ⁻¹] | Colour: | Yellow | 300 | 180 | 75 | 10 |
| | | Red | 10 | 7 | 4 | - |

Table 6: Coefficient of retro-reflection R' [cd.m⁻².lx⁻¹]

| Observation angle alpha [°] | | Entrance angle beta [deg.] | | | | |
|--|-------------------|------------------------------|--------|---------|---------|---------|
| 20' | beta ₁ | | 0 deg. | 0 deg. | 0 deg. | 0 deg. |
| | beta ₂ | | 5 deg. | 30 deg. | 40 deg. | 60 deg. |
| Coefficient R' [cd.m ⁻² .lx ⁻¹] | Colour: | White | 450 | 200 | 90 | 16 |
| | | Red | 120 | 30 | 10 | 2 |

79.8.1.2 The subtended angle at the sample shall not be larger than 80'.

79.8.1.3 The luminance factor beta shall be at least as indicated in table 7

Table 7: Luminance factor beta

| Colour | Luminance factor beta |
|--------|-----------------------|
| Red | ≥ 0.03 |
| Yellow | ≥ 0.16 |
| White | ≥ 0.25 |

79.9 Environmental test

79.9.1 Resistance to weathering

79.9.1.1 For each test, two specimens of a sample unit are taken. One specimen shall be stored in a dark and dry container for subsequent use as "reference unexposed specimen."

The second specimen shall be subjected to a source of illumination in accordance with ISO Standard 105 - B02 - 1978, Section 4.3.1; the retro-reflective material shall be exposed until blue standard No. 7 has faded to No. 4 on the grey scale and the fluorescent material until blue standard No. 5 has faded to No. 4 on the grey scale. After the test, the specimen shall be washed in a dilute neutral detergent solution, dried and examined for conformity with the requirements specified in paragraphs 79.9.1.2. to 79.9.1.4.

79.9.1.2 Visual appearance - No area of the exposed specimen shall show any evidence of cracking, scaling, pitting, blistering, delamination, distortion, chalking, staining or corrosion.

There shall be no shrinkage in excess of 0.5 per cent in any linear direction and no evidence of adhesion failure such as edge lifting from the substrate.

79.9.1.3 Colour fastness - The colours of the exposed specimen shall still meet the requirements specified in table1, table 2 and table 3.

79.9.1.4 Effect on the coefficient of retro-reflection of the retro-reflective material:

79.9.1.4.1 For this check, measurement shall be made only at an observation angle of 20' and an entrance angle of 5 degrees by the method given in paragraph 79.8.

79.9.1.4.2 The coefficient of retro-reflection of the exposed specimen when dry shall be not less than 80 per cent of the value in table 4.

79.9.1.4.3 The specimen shall then be subjected to simulated rainfall as described in paragraph 7.7. of EN 13422(2004) and its coefficient of retroreflection under this condition shall be not less than 90 per cent of the value obtained when measured in dry condition, as explained in paragraph 79.9.1.4.2. above.

It is possible to use nozzles other than those described in paragraph 7.7. of EN 13422(2004) provided that the same performance (e.g. water distribution on the surface of the test sample) of the simulated rainfall is achieved.

79.9.2 Resistance to corrosion(ISO Standard 3768)

79.9.2.1 A specimen of the sample unit shall be subjected to the action of a saline mist for 48 hours comprising two periods of exposure of 24 hours each, separated by an interval of 2 hours during which the specimen is allowed to dry.

The saline mist shall be produced by atomizing at a temperature of 35 +/- 2 degrees C a saline solution obtained by dissolving 5 parts by weight of sodium chloride in 95 parts of distilled water containing not more than 0.02 per cent of impurities.

79.9.2.2 Immediately after completion of the test, the sample shall show no sign of corrosion liable to impair the efficiency of the device. The coefficient of 'Retro-reflection R' of the retro-reflective areas, when measured after a recovery period of 48 hours as specified in paragraph 79.8, at an entrance angle of 5 degrees and an observation angle of 20', shall be not less than the value in table 4. Before measuring, the surface shall be cleaned to remove salt deposits from the saline mist.

79.9.3 Resistance to fuels: A section of a sample unit not less than 300 mm long shall be immersed in a mixture of n-heptane and toluol, 70 per cent and 30 per cent by volume, for one minute. After removal, the surface shall be wiped dry with a soft cloth and shall not show any visible change which would reduce its effective performance.

79.9.4 Bonding strength (in the case of adhesive materials)

79.9.4.1 The adhesion of retro-reflective materials shall be determined after 24 hours curing time by utilizing a 90-degree peel on a tensile strength testing machine.

79.9.4.2 The adhesion of laminated or coated retro-reflective and fluorescent materials shall be determined.

79.9.4.3 The coated materials, of whatever kind, shall not be removable without tools or without damaging the material.

79.9.4.4 The laminated materials (adhesive films) shall need a force of at least 10 N per 25 mm width, at a speed of 300 mm per minute, to be removed from the substrate.

79.9.5 Resistance to water

A section of a sample unit not less than 300 mm long shall be immersed in distilled water at a temperature of 23 +/- 5 degrees C for a period of 18 hours; it shall then be left to dry for 24 hours under normal laboratory conditions.

After completion of the test, the section shall be examined. No part inside 10 mm from the cut edge shall show evidence of

deterioration which would reduce the effectiveness of the plate.

79.9.6 Resistance to impact (except for plastics corner-cube reflectors)

When a 25 mm diameter solid steel ball is dropped from a height of 2 m onto the retroreflective and fluorescent surfaces of a supported plate, at an ambient temperature of 23 +/- 2 degrees C, the material shall show no cracking or separation from the substrate at a distance of more than 5 mm from the impacted area.

79.9.7 Resistance to cleaning

79.9.7.1 Manual cleaning: A test sample smeared with a mixture of detergent lubricating oil and graphite shall be easily cleaned without damage to the retro-reflective surface or fluorescent surface when wiped with a mild aliphatic solvent such as n-heptane, followed by washing with a neutral detergent.

79.9.7.2 Power washing: When subjected to a continuous spraying action for 60 seconds on the test component in its normal mounting conditions, a test sample shall show no damage to the retroreflective surface or delamination from the substrate or separation from the sample mounting surface under the following set-up parameters.

79.9.7.2.1 Water/wash solution pressure 8 +/- 0.2 MPa;

79.9.7.2.2 Water/wash solution temperature 60 degrees - 5 degrees C;

79.9.7.2.3 Water/wash solution flow rate 7 +/- 1 l/min;

79.9.7.2.4 The tip of the cleaning wand to be positioned at distance of 600 +/- 20 mm away from the retro-reflective surface;

79.9.7.2.5 Cleaning wand to be held at no greater angle than 45 degrees from perpendicular to the retro-reflective surface;

79.9.7.2.6 40 degree nozzle creating wide fan pattern.

79.10 Test of resistance to heat

79.10.1 Resistance to heat :A section of a sample unit not less than 300 mm long shall be kept for 12 hours (in the case of moulded plastics reflectors this time shall be 48 hours) in a dry atmosphere at a temperature of 65 +/- 2 degrees C, after which the sample shall be allowed to cool for 1 hour at 23 +/- 2 degrees C. It shall then be kept for 12 hours at a temperature of - 20 +/- 2 degrees C.

79.10.1.1 The sample shall be examined after a recovery time of 4 hours under normal laboratory conditions.

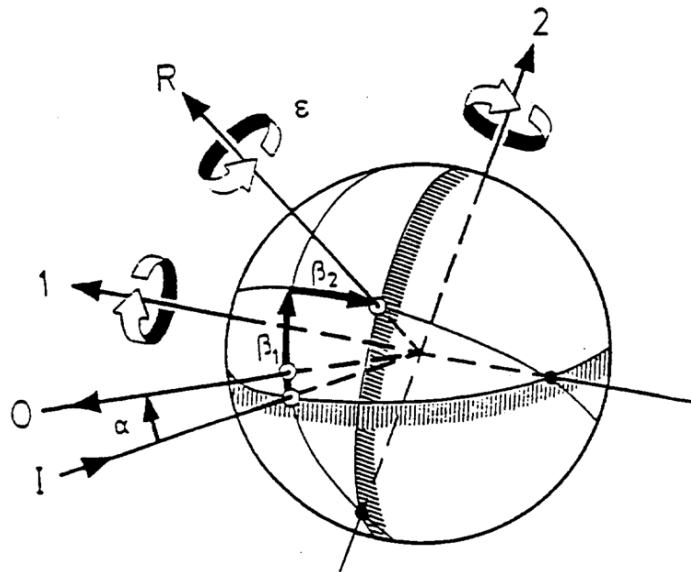
79.10.2 After this test, no cracking or appreciable distortion of the surfaces, particularly of the optical units, shall be evident.

79.11 Rigidity of the plates

79.11.1 The rear marking plate shall be placed on two supports in such a way that the supports are parallel to the shorter edge of

the plate and the distance from either support to the adjacent edge of the plate shall not exceed $L/10$, where L is the greater overall dimension of the plate. The plate shall then be loaded with bags of shot or of dry sand to a uniformly distributed pressure of 1.5 kN/m^2 . The deflection of the plate shall be measured at a point midway between the supports.

79.11.2 When tested as described in paragraph 1. above, the maximum deflection of the plate under the test load shall not exceed one twentieth of the distance between the supports in paragraph 1. and the residual deflection after removal of the load shall not exceed one fifth of the measured deflection under load.



- 1: First axis
- 2: Second axis
- I: Illumination axis
- O: Observation axis
- R: Reference axis
- alpha: Observation angle
- beta1, beta2: Entrance angles
- epsilon: Rotation angle

Figure 1 The CIE angular system

The official directions are written in Chinese, this English edition is for your reference only

79 Rear marking plates for heavy and long vehicles

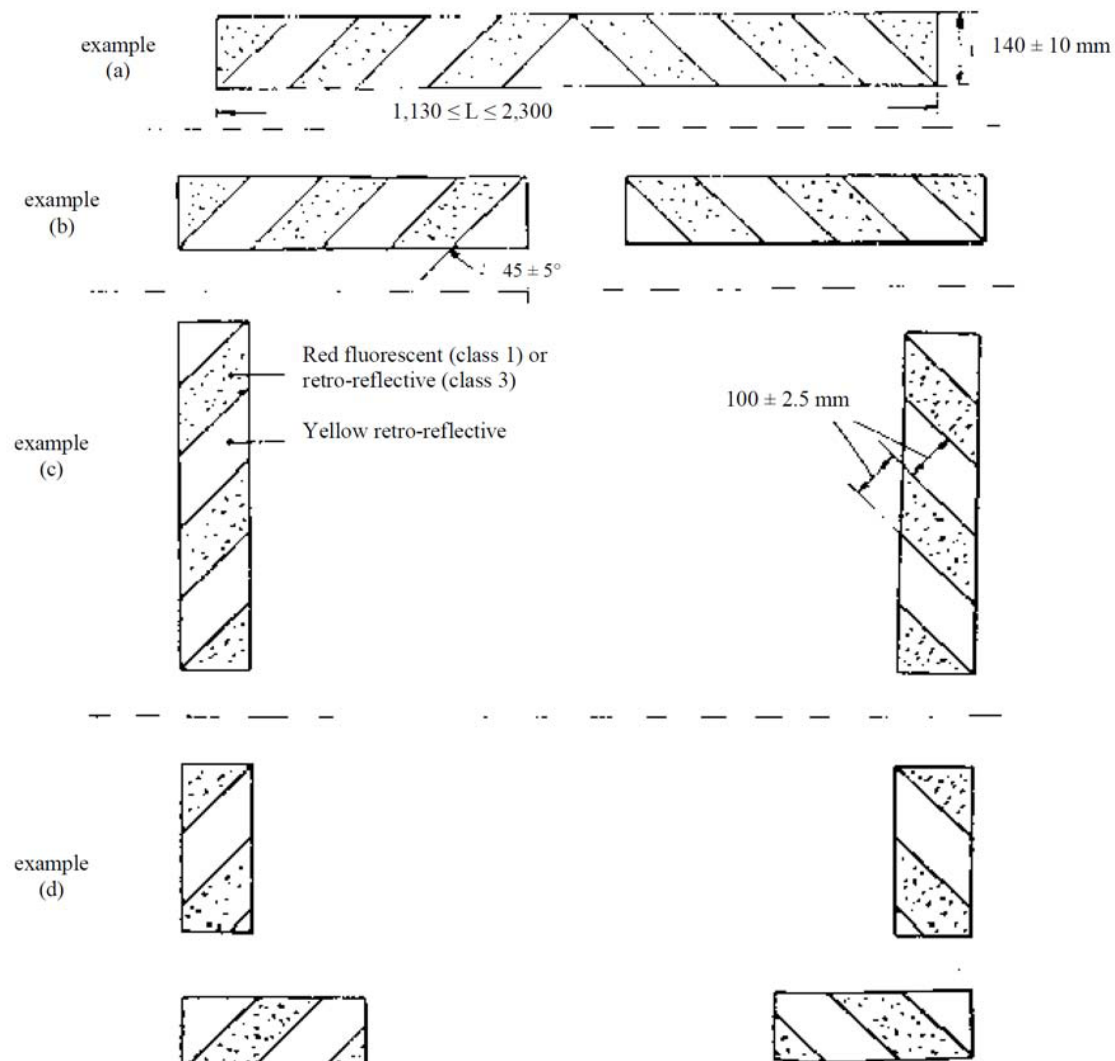


Figure 2 rear marking plates (class 1 and class 3)

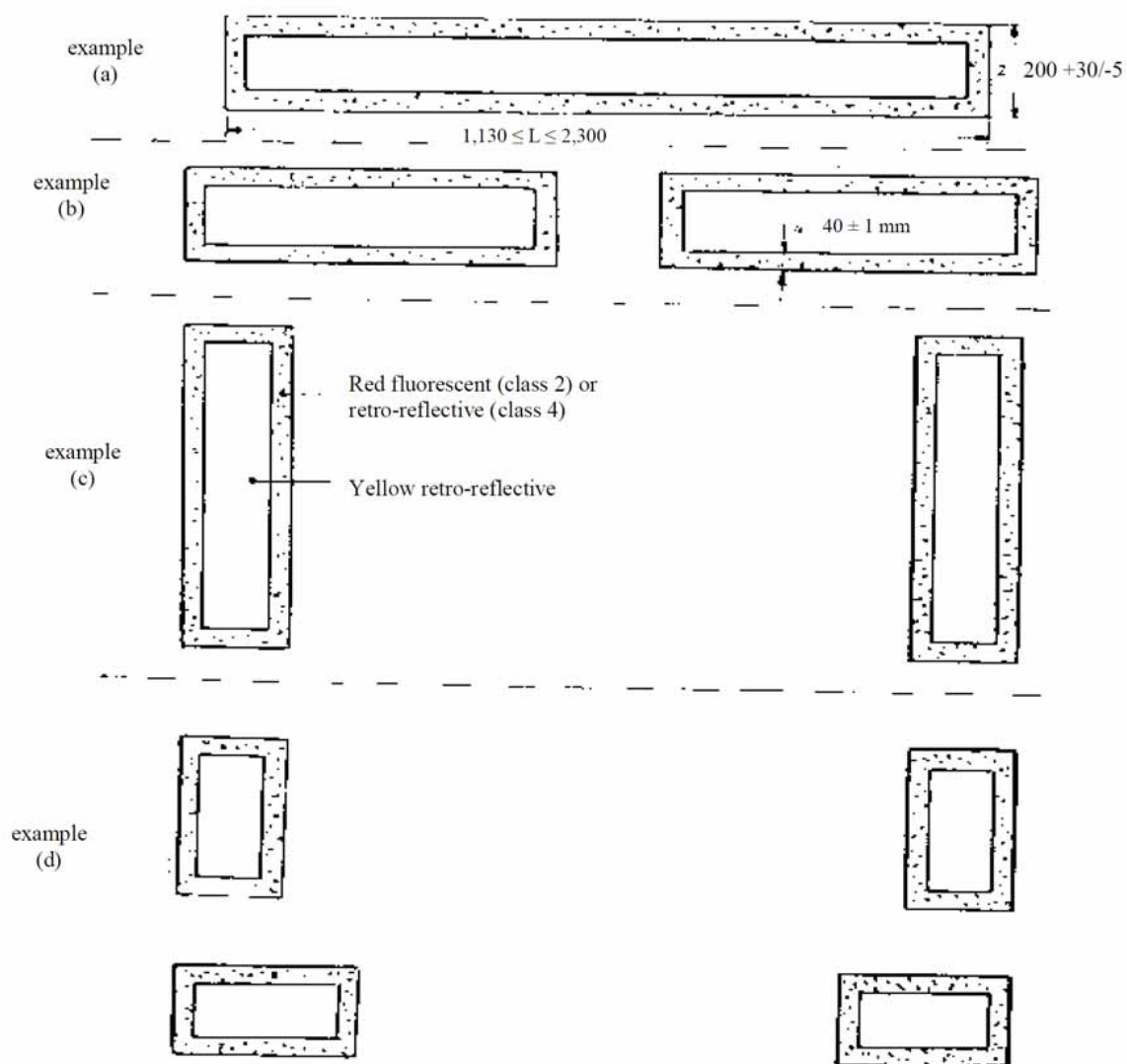


Figure 3 rear marking plates (class 2 and class 4)

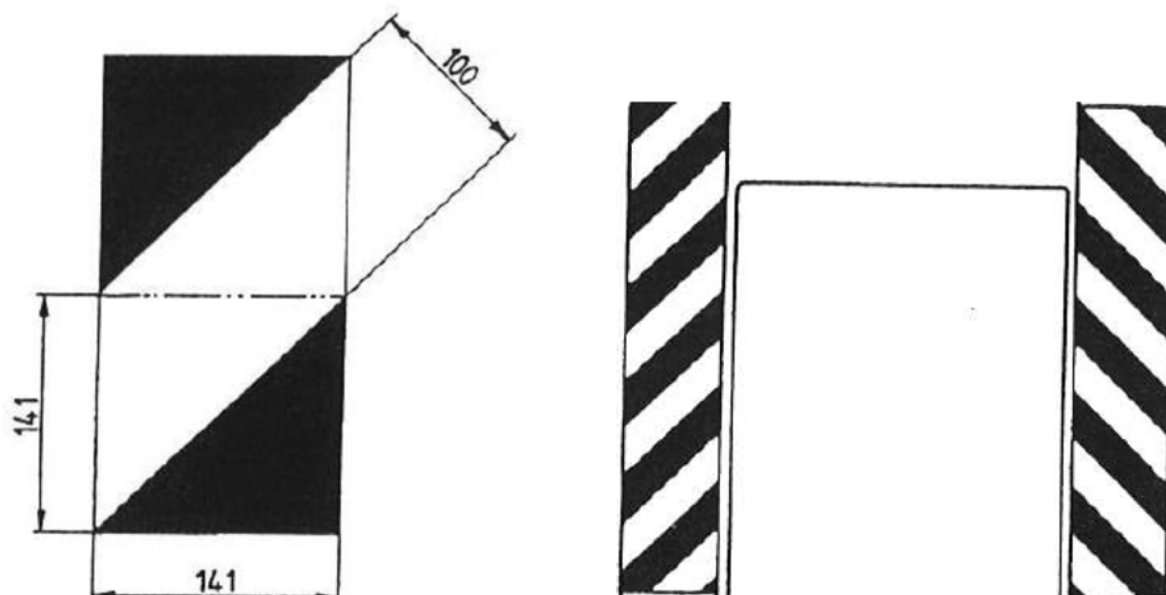


Figure 4-1: Example for a plate design

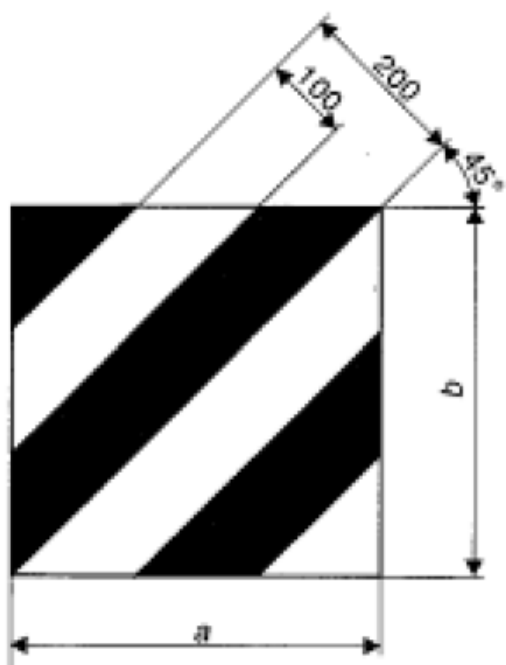


Figure 4-2.: Example for a plate design