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Retroreflective sheeting for traffic control

道路交通反光膜

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Retroreflective sheeting for traffic control

1 Scope

This Standard specifies the classification, technical requirements, test methods, inspection rules and requirements for marking, packaging, transportation and storage of retroreflective sheeting for traffic control (hereinafter referred to as retroreflective sheeting).

This Standard applies to the retroreflective sheeting used for traffic management and operation facilities such as road traffic signs, contour marks, traffic cones, traffic pillars, anti-collision barrels (pads), and road barriers. It also applies – as a reference – to the retroreflective sheeting used in water transportation, aviation, railway and other transportation.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies to this document. For undated references, the latest edition (including any amendment) applies to this document.

GB/T 2918, Plastics - Standard atmospheres for conditioning and testing

GB/T 3681, Plastics - Methods of exposure to direct weathering, to weathering using glass-filtered daylight, and to intensified weathering by daylight using Fresnel mirrors

GB/T 3978, Standard illuminants and geometric conditions

GB/T 3979, Methods for the measurement of object color

GB/T 10125, Corrosion tests in artificial atmospheres - Salt spray tests

GB/T 16422.2, Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps

JT/T 685, Measurer for adhesion performance of retroreflective sheeting

JT/T 686, Measurer for impact resistance of retroreflective sheeting

JT/T 687, Measurer for liner removal performance of retroreflective sheeting

JT/T 688-2007, Retroreflection vocabulary

JT/T 689, Test method for coefficient of retroreflection of utilizing the coplanar geometry

JT/T 690, Test method for photometric characteristics of retroreflectors

JT/T 692, Test method for colorimetric characteristics of retroreflectors under nighttime conditions

JT/T 693, Test method for daytime colorimetric properties of fluorescent retroreflective sheeting and marking materials

JT/T 762, Measurer for flexibility of retroreflective sheeting

3 Terms and definitions

Terms and definitions determined by JT/T 688 and the following are applicable to this document. For ease of use, some of the terms and definitions in JT/T 688 are repeated below.

3.1 Retroreflection

A reflection in which the reflected light returns from the opposite direction to that of the incident light. This property can still be maintained when the direction of incident light changes in a large range.

[JT/T 688-2007, definition 2.1]

3.2 Retroreflective sheeting

A retroreflective material – which has been made into a thin film – that can be directly applied.

[JT/T 688-2007, definition 2.4]

3.3 Retroreflector

A reflective surface or device with retroreflective properties.

[JT/T 688-2007, definition 2.5]

3.4 Retroreflector axis

A specific ray emanating from the retroreflector center (as shown in Figure 1).

Note: The retroreflector axis is usually the centerline of the direction of illumination. When the retroreflector is axisymmetric, the retroreflector axis generally coincides with the symmetry axis of the retroreflector.

[JT/T 688-2007, definition 2.10]

3.6 Illumination axis

A ray – emitted from the retroreflector center – passing through the point of the light source (as shown in Figure 1).

[JT/T 688-2007, definition 2.11]

3.7 Observation axis

A ray – emitted from the retroreflector center – passing through the observation point (as shown in Figure 1).

[JT/T 688-2007, definition 2.12]

3.8 Datum mark

A mark on the retroreflector, emitted from the retroreflector axis, indicating where the datum axis is pointing.

[JT/T 688-2007, definition 2.15]

3.9 Entrance angle

β

The angle between the illumination axis and the retroreflector axis.

Note: The entrance angle is usually not greater than 90°, but it is specified as $-180° \leq \beta \leq 180°$ in consideration of completeness. In the goniometer system, β is decomposed into two components, β_1 and β_2.

[JT/T 688-2007, definition 2.21]

3.10 Observation angle

α

The angle between the illumination axis and the observation axis.

Note: The observation angle is not negative, and is usually less than 2°.

[JT/T 688-2007, definition 2.24]

3.11 Rotation angle

ε

Note 2: The degree of rotationally uniform can be expressed numerically.

[JT/T 688-2007, definition 2.41]

3.15 Fluorescence

A material characteristics, that absorbs short wavelengths of visible or ultraviolet light during the day and reradiates them at longer wavelengths to produce visible light in a narrow emission band.

3.16 Nighttime color

Retroreflective color

The color of the retroreflective material observed from a direction close to the incident light under nighttime conditions, that is, when the standard A light source is used.

4 Classification

4.1 Retroreflective sheeting can be divided into glass bead type and micro-prism type according to its retroreflection principle.

4.2 Retroreflective sheeting can be divided into the following seven types according to its luminosity, structure and use:

a) Type I – usually a lens-embedded glass bead structure, called engineering-grade retroreflective sheeting; with a service life of 7 years in general; can be used for permanent traffic signs and work area facilities;

b) Type II – usually a lens-embedded glass bead structure, called super-engineering grade retroreflective sheeting; with a service life of 10 years in general; can be used for permanent traffic signs and work area facilities;

c) Type III – usually a sealed capsule glass bead structure, called high-strength retroreflective sheeting; with a service life of 10 years in general; can be used for permanent traffic signs and work area facilities;

d) Type IV – usually a micro-prism structure, called ultra-high strength retroreflective sheeting; with a service life of 10 years in general; can be used for permanent traffic signs, work area facilities and contour marks;

e) Type V – usually a micro-prism structure, called large-angle retroreflective sheeting; with a service life of 10 years in general; can be used for permanent traffic signs, work area facilities and contour marks;

f) Type VI – usually a micro-prism structure, with metal coating; with a service life of 3 years in general; can be used for contour marks and traffic columns, and can

also be used for work area facilities and traffic signs with fewer characters when there is no metal coating;

g) Type VII – usually a micro-prism structure, of flexible material; with a service life of 3 years in general; can be used for temporary traffic signs and work area facilities.

Note 1: The structures of various types of retroreflective sheeting are typical structures commonly used, and the existence of other structures cannot be ruled out. For example, prism-type engineering-grade retroreflective sheeting is a Type I retroreflective sheeting.

Note 2: The service life of various types of retroreflective sheeting is the period generally promised by the manufacturer, and the actual service life is related to its material and use. For example, fluorescent retroreflective sheeting and retroreflective sheeting used for temporary traffic signs and work area facilities generally have a service life of 3 years.

5 Technical requirements

5.1 General requirements

5.1.1 Retroreflective sheeting shall be supplied in rolls in general. The retroreflective sheeting shall be evenly, flatly and tightly wound on a rigid circular core, and shall be free from defects such as deformation, defect, uneven edge or inclusion of irrelevant materials.

5.1.2 Generally, the length of each roll of retroreflective sheeting shall not be less than 45.72 m. The entire roll of retroreflective sheeting cannot be spliced in the width direction, and shall have no more than 3 joints in the length direction, which shall be visible at the edge of the rolled sheeting. A margin of 0.5 m of retroreflective sheeting shall be reserved for each splicing. The continuous length of each retroreflective sheeting shall not be less than 10 m.

5.1.3 The retroreflective sheeting shall be provided with the printing performance of color. Under normal temperature, the retroreflective sheeting shall be printed in various colors by using inks and printing methods that match the retroreflective sheeting.

5.1.4 The retroreflective sheeting of various colors other than white can also be formed by pasting a colored transparent sheeting (called “electro-etched sheeting”) on the white retroreflective sheeting.

5.2 Appearance quality

The retroreflective sheeting shall have a smooth and clean outer surface, and shall be free from defects such as obvious scratches, streaks, bubbles, uneven color and

▨Fill area of the chromaticity coordinates of fluorescent yellow green, fluorescent yellow, fluorescent orange.

Figure 4 – Chromaticity diagram of various colors of retroreflective sheeting (nighttime color)

5.5 Shock resistance

The retroreflective sheeting shall be provided with shock resistance. After the test according to the method in 6.6, there shall be no cracks, interlayer detachment or other damage outside the impacted surface.

5.6 Bending resistance

The retroreflective sheeting shall be able to withstand moderate bending. After the test according to the method in 6.7, there shall be no damage such as cracks, peeling or interlayer separation on the surface.

5.7 Adhesion performance

The gum of the retroreflective sheeting shall have sufficient adhesion, and the bonding between the structural layers shall be firm. After the test according to the method in 6.8, the peeling length after 5 minutes shall not be greater than 20 mm.

5.8 Shrinkage performance

After the test according to the method in 6.9, the retroreflective sheeting shall not shrink significantly, and the shrinkage of any side shall not exceed 0.8 mm within 10 min, and shall not exceed 3.2 mm within 24 h.

5.9 Liner removal performance of release paper

After the test according to the method in 6.10, without wetting the retroreflective sheeting with water or other solvents, the release paper shall be easily peeled off manually without damage such as breakage, tearing or adhesive stripping from the retroreflective sheeting.

5.10 Tensile load

After the test according to the method in 6.11, the tensile load value of Type I and Type II retroreflective sheeting shall not be less than 24 N.

5.11 Solvent resistance

After being soaked in gasoline and ethanol according to the method in 6.12, the surface of the retroreflective sheeting shall not be softened, wrinkled, leaked, foamed, cracked or dissolved.

5.12 Salt spray corrosion resistance

b) From the entire roll of retroreflective sheeting test specimen, randomly cut 1 m of retroreflective sheeting along the width; cut the retroreflective sheeting test specimen from the left, middle and right positions along the diagonal; make the datum mark on the back according to the manufacturer's instructions.

c) Prepare test specimens according to the method specified in this Standard.

6.2 Test conditions

6.2.1 Before the test, the test specimens shall be placed in an environment where the temperature is 23 °C ± 2 °C and the relative humidity is 50% ± 10% for more than 24 hours according to the provisions of GB/T 2918, and then subjected to various tests.

6.2.2 The test should be carried out in an environment where the temperature is 23 °C ± 2 °C and the relative humidity is 50% ± 10%.

6.3 Appearance quality

In an environment where the illuminance is not less than 150 lx, place the retroreflective sheeting freely on a platform, and conduct a visual inspection in front of the retroreflective sheeting or release paper within a distance of 1 m.

6.4 Luminosity

6.4.1 Cut a 150 mm × 150 mm monochromatic retroreflective sheeting test specimen, and test the coefficient of retroreflection of the retroreflective sheeting according to the ratio method, substitution method or direct luminous intensity method specified in JT/T 690.

6.4.2 During the arbitration test, the coefficient of retroreflection of the retroreflective sheeting shall be tested according to the method specified in JT/T 689.

6.4.3 In general, the rotation angle ε during the test is taken as 0° or 90°. A different rotation angle can also be selected for testing according to the requirements of the manufacturer or the entrusting party.

6.5 Chromaticity

6.5.1 Cut out a 150 mm × 150 mm test specimen of monochrome retroreflective sheeting; adopt the CIE standard illuminant D_{65} light source specified in GB/T 3978; take the geometric condition of 45°a:0°; according to the methods stipulated in GB/T 3979 and JT/T 693 respectively, measure the chromaticity coordinates and luminance factors of the daytime color of various types of retroreflective sheeting.

6.5.2 Cut out a 150 mm × 150 mm test specimen of monochrome retroreflective sheeting; use the CIE standard illuminator A light source specified in GB/T 3978, and the illumination and observation conditions with an entrance angle of 0° and an observation angle of 0.2°; according to the method specified in JT/T 692, measure the

-- when the old product is transferred to another factory for production;

-- when the products that have been discontinued for 1 year or more is reproduced;

-- every time when a product in normal production goes through one year of production;

-- when changes in product design, process or materials affect product performance;

-- when requested by the purchaser or the quality supervision and inspection department.

7.3.2 Samples shall be randomly selected for type inspection, and all performance tests shall be carried out according to the test methods in Chapter 6 (the weather resistance test can be carried out once every four years).

7.4 Determination rules

7.4.1 For each performance test in this Standard, at least 3 samples shall be taken. On the basis that all the test results of the samples are qualified, take the arithmetic mean of the test results of 3 (or more than 3) samples as the test result.

7.4.2 If the test result of a certain sample does not meet the standard requirements, double the number of samples shall be taken from the same batch of products for retesting of the unqualified item. If the retest results are all qualified, the whole batch of products shall be qualified; if the retest results (including any index required by the test) have unqualified items, the entire batch of products shall be unqualified.

8 Marking, packaging, transportation and storage

8.1 Marking

8.1.1 On the front of the retroreflective sheeting or the back of the release paper, there shall be clear and durable name, trademark or other representative symbols of the manufacturer. If it is difficult to identify after removing the release paper, it shall be properly marked on the front of the retroreflective sheeting; product identification such as the category and batch number of the retroreflective sheeting can also be added.

8.1.2 There shall be a description in Chinese on the outside of each roll of retroreflective sheeting packaging box, indicating the type, quantity, color, production date, batch number, etc. of the retroreflective sheeting contained in the box.

8.2 Packaging

8.2.1 For the retroreflective sheeting packaged in rolls, each roll shall be packaged with materials that meet environmental protection requirements, and then placed in the carton by hanging in the air through the bracket.

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