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Retro-reflective markings for trucks and trailers

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Foreword

Clauses 4, 5 and 6 of this Standard are mandatory, whilst the rest are recommended.

Appendix A to this Standard is a normative annex.

This Standard is proposed by China National Development and Reform Commission.

This Standard is under the jurisdiction of the National Automobile Standardisation Technical Committee.

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This is the first edition of this Standard.

Retro-reflective markings for trucks and trailers

1 Scope

This Standard specifies the requirements (including material requirements and pasting requirements), test methods, inspection rules, packaging, labelling and storage for retro-reflective markings of carriage.

This Standard applies to trucks and trailers; it does not apply to vehicles for road transportation of explosive products and highly toxic chemical products.

2 Normative References

The provisions of the following documents become provisions of this Standard after being referenced. For dated reference documents, all later amendments (excluding corrigenda) and versions do not apply to this Standard; however, the parties to the agreement are encouraged to study whether the latest versions of these documents are applicable. For undated reference documents, the latest versions apply to this Standard.

GB/T 2423.17 Basic environmental testing procedures for electric and electronic products. Test ka: salt mist;

GB/T 3681 Plastics – Test methods of exposure to weathering (GB/T 3681-2000. neq ISO 877:1994);

GB/T 3730.1 Motor vehicles and trailers – Types – Terms and definitions;

GB/T 3978 Standard illuminants and illuminating-viewing conditions;

GB/T 3979 Methods of measuring the colour of materials;

GB/T 4785 Installation requirements for external lighting and light signalling devices for motor vehicles and their trailers;

GB/T 11564 Retro-reflector for motor vehicles;

GB/T 18833-2002 Retro-reflective sheeting for road traffic signs.

3 Terms and definitions

The terms and definitions set out in GB/T 3730.1, GB/T 11564 and GB/T 18833-2002 and below apply to this Standard.

3.1 *Retro-reflective markings of carriage*

The combination of retro-reflective materials installed or pasted onto vehicle carriages for the purpose of increasing the identification of the vehicle.

3.2 *Luminance factor*

Under the circumstances of the same illumination and viewing, the ratio between the luminance of the sample and the luminance of the perfect reflecting diffuser.

4 Requirements

4.1 Material requirements

4.1.1 Classification

On the basis of the different materials that form the retro-reflective markings of carriages, the markings are divided by retro-reflector type of retro-reflective markings of carriage (hereinafter referred to as retro-reflector type) and retro-reflective sheeting type of retro-reflective markings of carriage (hereinafter referred to as the retro-reflective sheeting type).

On the basis of different coefficients of retro-reflection, retro-reflective sheeting is classified as either first class (Class I) or second class (Class II).

4.1.2 Retro-reflector type

Retro-reflectors are divided into white elements and red elements, the entire characteristics shall comply with the requirements set out in IVA of GB 11564.

4.1.3 Retro-reflective sheeting type

4.1.3.1 Shapes and appearance requirements

Retro-reflective sheeting is constructed by alternatively arranged white element bars and red element bars.

The white elements of the retro-reflective sheeting shall display the markings of the manufacturer, the markings of the materials classification and other markings prescribed by relevant national departments, which are made by printing, water marking, cut stencils and print seal carving, moulding press or other appropriate methods, and the markings shall be easily identified. Markings made by printing shall be on the subsurface of the reflective surface.

The surface of the retro-reflective sheeting shall be smooth, bright and clean, with no faults or damage such as noticeable scratches, bubbles, cracks or uneven colour, etc.

4.1.3.2 Dimension requirements

The continuous section length of any one colour element shall not be longer than 450 mm, and shall not be shorter than 150mm; the ratio between the length of these two colour elements shall not be greater than 2, and shall not be smaller than 0.5.

The width of the retro-reflective sheeting shall be selected from the following data: 50 mm, 75 mm, 100 mm. Where a width of 50mm retro-reflective sheeting is unable to be pasted onto the vehicle, the width of the retro-reflective sheeting is allowed to be 25mm.

4.1.3.3 Chromaticity characteristics

The chromaticity coordinate and luminance factor of the white, red retro-reflective sheeting shall be within the range stipulated in Table 1. See Diagram 1 for the chromaticity diagram.

Table 1 Chromaticity coordinate and luminance factor for each corner point of the retro-reflective sheeting colour (D₆₅ light source)

Table 1 Chromaticity coordinates and luminance factor for each corner point of retro-reflective sheeting colours (D65 light source)									
Colour	Chromaticity Coordinates								Luminance Factor Y
	①		②		③		④		
	x	y	x	y	x	y	x	y	
White	0.350	0.360	0.300	0.310	0.285	0.325	0.335	0.375	≥0.15
Red	0.690	0.310	0.658	0.342	0.569	0.341	0.595	0.315	0.03 ~ 0.15

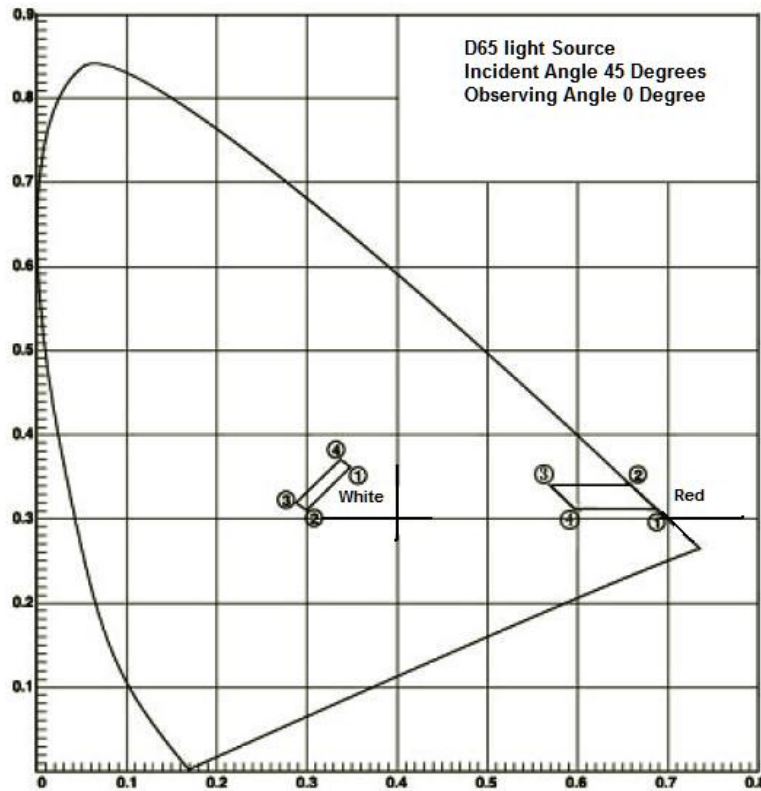


Diagram 1 Chromaticity diagram of retro-reflective sheeting colours (D65 light source)

4.1.3.4 Reflection characteristics

4.1.3.4.1 Coefficient of retro-reflection

The coefficient of retro-reflection(R') of the retro-reflective sheeting (direction of 0° and 90°) shall not be less than the values set out in Table 2.

Table 2 Minimum coefficient of retroreflection of retro-reflective sheeting

Item		Class I cd/(lx•m ²)				Class II cd/(lx•m ²)			
		12'		30'		12'		30'	
Colour		White	Red	White	Red	White	Red	White	Red
Incident Angle	-4°	500	120	130	30	250	60	65	15
	30°	375	90	100	25	250	60	65	15
	45°	90	25	30	8	60	15	15	4

4.1.3.4.2 Uniformity of retro-reflection characteristics

Select 5 each of the red and white elements arbitrarily, in which the coefficient of retro-reflection (R') of any one element of the same colour, shall be neither less than 80% nor greater than 120% of the mean value of the coefficients of retro-reflection of the entire elements with the same colour.

4.1.3.4.3 Retro-reflection under humid conditions

When the observing angle is 12', the incident angle is -4°, the coefficient of retro-reflection (R') of the retro-reflective sheeting in humid conditions shall not be less than 80% of the values set out in Table 2.

4.1.3.5 Weather resistance characteristics

After the atmospheric exposure test and accelerated artificial weathering test, the surface of the retro-reflective sheeting shall not have any noticeable cracks, scratches, hollowing, bubbles, wrinkles, corrosion, peeling, pulverisation or deformation, on no side shall there be over 1mm shrinkage or expansion, and there shall be no de-gumming from baseboard edges; if the observing angle is 12' and the incident angle is -4°, the coefficient of retro-reflection (R') of the retro-reflective sheeting shall not be less than 70% of the values set out in Table 2 and the chromaticity coordinates shall still be in the range of values set out in Table 1.

In cases in which there are discrepancies between the results of the atmospheric exposure test and the results of the accelerated artificial weathering test, take the result from the atmospheric exposure test as the reference.

4.1.3.6 Adhesive characteristics

After the adhesiveness test, the 180° peel strength of the adhesive layer of the retro-reflective sheeting shall not be smaller than 25N.

4.1.3.7 Salt mist corrosion resistance characteristics

After the salt mist test, the retro-reflective sheeting shall not be softened, bubbled, wrinkled, dissolved, shall not lose its colour or change in colour or show any signs of corrosion. Under the circumstance of observing angle is 12', incident angle is -4°, the coefficient of retro-reflection (R') of the retro-reflective sheeting shall not be less than 70% of the values set out in Table 2, and the

180° peel strength of the adhesive layer of the retro-reflective sheeting measured with the method specified in 5.2.7 shall not be smaller than 20N.

4.1.3.8 Solvent resistance characteristics

After the solvent resistance test, the surface of the retro-reflective sheeting shall not be softened, wrinkled, shall not have bubbles, shall not lose its colour or change in colour, there shall be no cracks or signs of dissolution on the surface edges, if the observing angle is 12', incident angle is -4°, the coefficient of retro-reflection (R') of the retro-reflective sheeting shall not be less than 80% of the values set out in Table 2, and the chromaticity coordinate shall still be in the range of values set out in Table 1.

4.1.3.9 Impact resistance characteristics

After the falling-weight test, on the surface of the retro-reflective sheeting, the areas outside of the circle which with the impact point as the circle centre with a 6mm radius, there shall be no cracks, interlayer detachment or any other damage.

4.1.3.10 Temperature resistance characteristics

After the temperature resistance test, there shall be no wrinkles, bubbles, cracks, peeling, fragmentation or any signs of warping on the retro-reflective sheeting, when the observing angle is 12', incident angle is -4°, the coefficient of retro-reflection (R') of the retro-reflective sheeting shall not be less than 80% of the values set out in Table 2, and the chromaticity coordinate shall still be in the range of values set out in Table 1.

4.1.3.11 Bending resistance characteristics

After the bending test, there shall be no cracks, peeling, or any signs of interlayer detachment on the retro-reflective sheeting.

4.1.3.12 Water resistance characteristics

After the water resistance test, none of the components shall be able to be peeled open by hand. If, by performing a visual inspection, it cannot be found or be certain if there any water has entered, then the measurement of the coefficient of retro-reflection (R') shall be taken; when the observing angle is 12' and incident angle is -4°, the result shall not be less than the values set out in Table 2.

4.1.3.13 Flushing resistance characteristics

After the flushing resistance test, there shall be no damage, colour-falling, wrinkles and edge bending or peeling of the retro-reflective sheeting.

4.2 Installation and pasting requirements

4.2.1 Common requirements

4.2.1.1 On the basis of different locations where the retro-reflective markings of carriage are installed or pasted on the vehicle, the retro-reflective markings of carriage can be divided as rear retro-reflective markings of carriage and side retro-reflective markings of carriage.

4.2.1.2 The retro-reflective markings of carriage shall be installed or pasted on the outer surface of the rear and sides of the vehicle, where they are not covered and where they are clearly visible.

4.2.1.3 The retro-reflective markings of carriage shall not replace the retro-reflector specified in GB 4785, the device which is required to be installed on motor vehicle.

4.2.1.4 At the rear or sides of the vehicle, different types or different classifications of retro-reflective markings of carriage may be installed or pasted, but for the rear and sides of the vehicle, the same type or classification of retro-reflective markings of carriage should be selected

respectively.

4.2.1.5 When installing or pasting the retro-reflective markings of carriage onto a vehicle, the retro-reflective markings of carriage for the rear of the vehicle and the sides of the vehicle shall both start and end with a white element.

4.2.1.6 Retro-reflective markings of carriage that have been installed or pasted onto a vehicle shall not affect the performances of other lighting or signalling devices.

4.2.1.7 After the vehicle been installed or pasted with retro-reflective markings of carriage, any drilling or grooving on the retro-reflective markings of carriage shall not be permitted.

4.2.2 Requirements for the installation and pasting of retro-reflective markings of carriage at the rear of a vehicle

4.2.2.1 General requirements

Under permissible circumstances from the structure, the retro-reflective markings of carriage on the rear of the vehicle shall be arranged as bilateral symmetry, and shall reflect the rear width and the outline of the vehicle as much as possible. The total length (intermission parts are excluded) for horizontal installation or pasting of the retro-reflective markings of carriage shall not be shorter than 80% of the vehicle rear width. For vans, after meeting the abovementioned requirements, the retro-reflective markings of carriage shall show the outline of the carriage rear. For other vehicles, if the pasting area does not meet the stipulated requirements, first reflect the outline of the rear of the vehicle, and then use the outline showing method to make up.

The height from the retro-reflective markings of carriage to the ground shall be at least 380mm.

4.2.2.2 Retro-reflective sheeting type

When Class I retro-reflective sheeting is selected, then the total area of the retro-reflective sheeting and the rear reflector shall not be less than 0.1m^2 ; when Class II retro-reflective sheeting is selected, then the total area of the retro-reflective sheeting and the rear reflector shall not be less than 0.2m^2 .

Pasting break-off is permitted, but each continuous section shall not be shorter than 300mm, and shall contain at least one each element of red and white retro-reflective markings of carriage. Under special circumstances, red and white elements pasted separately shall be permitted; however, these red and white elements should be arranged alternatively, and each continuous section shall not be shorter than 150mm.

4.2.2.3 Retro-reflector type

When a retro-reflector is selected, the retro-reflector shall be arranged horizontally, with the red and white elements arranged alternatively and with a balanced number of elements. The gap between the edges of any two adjacent retro-reflectors shall not be greater than 100mm.

4.2.2.4 If the retro-reflective markings of carriage are covered up, as a minimum a piece of 2000 mm x 150 mm flexible marking shall be horizontally fixed at the covered rear part of the vehicle.

4.2.3 Requirements for the installation and pasting of retro-reflective markings of carriage on the sides of a vehicle

4.2.3.1 General requirements

The retro-reflective markings of carriage on the sides of a vehicle shall be installed or pasted as continuously as possible; where break-off installation or pasting are adopted, the total length (intermission part is excluded) shall not be shorter than 50% of the vehicle length; if the installation or pasting length does not meet the stipulated requirements, the outline showing method shall be adopted to make up.

4.2.3.2 Retro-reflective sheeting type

When retro-reflective sheeting is selected, breaks-off at the sides of retro-reflective markings of carriage are permitted, but each of the continuous section lengths shall not be shorter than 300mm and shall contain at least one of each element of red and white retro-reflective markings of carriage. The gaps between the pastings shall not be wider than 100mm, and the pastings shall be arranged vertically and as evenly as possible. Under special circumstances, the red and white elements are permitted to be pasted separately, but the alternative arrangement of red and white elements shall be maintained, and the length of each continuous section shall not be shorter than 150mm.

4.2.3.3 Retro-reflector type

When a retro-reflector is selected, the retro-reflector shall be horizontally and evenly arranged, the red and white elements shall be alternatively arranged and the number of elements shall be balanced. The gap between the edges of any two adjacent retro-reflectors shall not be greater than 150mm.

4.2.3.4 If the retro-reflective markings of carriage are covered up, as a minimum a piece of 2000 mm x 150 mm flexible marking shall be horizontally fixed at the covered rear part of the vehicle.

4.2.4 Supplementary requirements for installation and pasting for typical operational vehicles

For certain typical operational vehicles, with the exception of the driver's cab, where there is no other continuous plane on the vehicle body, and the requirements set out in 4.2.2 cannot be met, then the total length of the retro-reflective markings of carriage installed or pasted on the rear of the vehicles is permitted to be shorter than 80% of the rear width of the vehicle, but shall reflect the rear width of the vehicle as much as possible; if the requirements set out in 4.2.3 cannot be met, then the total length of the retro-reflective markings of carriage pasted on the vehicle can be shorter than 50% of the vehicle length; they shall not, however, be shorter than 30% of the length of the vehicle, and the break-off intermission shall not be limited.

The retro-reflective markings of carriage for this type of vehicle shall be pasted as best as possible on the protective equipment or on the fixed components of the vehicles.

4.2.5 Other installation or pasting requirements

The pasting position of the retro-reflective markings of carriage on a vehicle shall be the most level location possible. Before pasting, a cleaning treatment of the pasting location shall be carried out.

The retro-reflective sheeting shall be pasted on the vehicle surface firmly and reliably. After being pasted onto the vehicle, the sheeting shall be coordinated with the appearance of the vehicle and, where permitted by the vehicle structure, shall be pasted horizontally or vertically as far as possible. If the retro-reflective sheeting cannot be pasted directly onto the surface of the vehicle, then the retro-reflective sheeting shall be pasted onto a bar-shaped board with a certain stiffness, strength, and anti-ageing ability, then this bar-shaped board shall be firmly pasted or attached to the body of the vehicle. The riveting holes for fixing the bar-shaped board shall be subject to water resistance and dust resistance measures.

After pasting, the retro-reflective sheeting edges shall be subject to treatment for water resistance and dust resistance.

4.2.6 Pasting example

Appendix A shows the pasting styles of retro-reflective sheeting for some typical vehicles. For the installation or pasting of a retro-reflector onto a vehicle, refer to these examples.

5 Test methods

5.1 Retro-reflector type

The characteristics test for retro-reflectors shall be conducted in accordance with the requirements specified in GB 11564.

5.2 Retro-reflective sheeting type

5.2.1 Test preparation

The test sample of the retro-reflective sheeting shall be constructed as per the following method: peel the anti-stick paper off the retro-reflective sheeting, and stick the sheeting onto a base-board of the same size; after being pressed down tight to make it stick firmly, the test sample is made. The base-board shall be an aluminium alloy board with a thickness of 2 mm, and the surface of the aluminium alloy board shall be alkaline degreasing treated. Under normal conditions, cut out a piece of 50 mm x 150 mm of the retro-reflective sheeting sample, special dimension requirements are checked on specific test items. See Table 3 for sample numbering and sample distribution.

The test sample shall be left in an environment with a temperature range of $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, and where the relative humidity is not greater than 75% for 24 hours, after which the tests can be conducted. Unless specially indicated, otherwise general tests shall be conducted in such environment with the temperature range of $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$, where the relative humidity is not greater than 75%.

5.2.2 Appearance inspection

In an indoor (or outdoor) environment with a luminance intensity that is greater than 150lx, at a location that is 0.3m ~ 0.5m away from the surface of the test sample, facing the sample, perform a visual inspection to check the sample.

5.2.3 Dimension measurement

Use a length gauge with a precision of 1mm to measure the dimensions of the retro-reflective markings of carriage.

5.2.4 Chromaticity characteristics test

When illuminated with the Standard luminance D65 light source (colour temperature is 6,500k) specified in GB/T3978, under the geometry conditions of $45^{\circ}/0^{\circ}$ or $0^{\circ}/45^{\circ}$, in accordance with the method specified in GB/T 3979, measure the chromaticity coordinate and the luminance factor of each colour.

5.2.5 Reflection characteristics test

5.2.5.1 Test theory and equipment

See Diagram 1 and Diagram 5 in GB/T 18833-2002 for the test theory and equipment, in which:

- a) the Standard light source A specified in GB/T 3978 shall be selected as the test light source, the unevenness of the vertical luminance on the entire illuminated area of the test sample shall not be greater than 5%;
- b) the light detector is the luxmeter which has been corrected by spectral luminous efficiency curve;
- c) the light detector shall be portable in order to ensure the change of the observing angle within a certain range.

5.2.5.2 Test method

According to the luminance viewing geometry conditions set out in Table 1, and in accordance with the method specified in Section 7.4.1 of GB/T18833-2002, take the measurements of the coefficient of retro-reflection (R') on the directions of 0° and 90°. Evenly select at least 5 measuring zones or measuring points per each colour element; the mean value calculated shall be the coefficient of retro-reflection (R') of that colour element on the directions of 0° and 90°.

5.2.5.3 Retro-reflection uniformity test

In accordance with the previously mentioned method, if the observing angle is 12' and the incident angle is -4°, test the coefficient of retro-reflection (R') of 5 red, white elements and calculate the mean value of the coefficient of retro-reflection (R') of the entire same colour elements.

5.2.5.4 Retro-reflection test under humid conditions

Conduct the test in accordance with the equipment and methods specified in Section 7.4.2 of GB/T 18833-2002.

5.2.6 Weather resistance test

5.2.6.1 Atmospheric exposure test

According to GB/T3681, install 2 test samples of both red and white elements on the sun-scorching frame, which is at least 1m height from the ground, with the test samples facing south and forming an angle of 45° with horizontal plane. The surface of the test sample shall not be sheltered from the sun by any other articles, shall not be able to gather water, the exposure location selected shall be as similar as possible to the actual operating environment or a place which can represent the most difficult type of weather.

The period of atmospheric exposure test shall be 2 years. After the test sample has been scorched in the sun, carry out one surface check every month. After one year, carry out surface checking every three months, until the test is complete. After the atmospheric exposure test is complete, check and record the test results.

5.2.6.2 Accelerated artificial weathering test

Place 2 test samples of both red and white elements into a weather ageing chamber. The chamber uses a xenon lamp as its light source; the front of the test samples shall be radiated by light with 300nm - 800nm wavelength, and the radiation intensity shall be $1000\text{W}/\text{m}^2 + 50\text{W}/\text{m}^2$. When the wavelength of the light is lower than 300nm, then the radiation intensity of the light shall not be greater than $1\text{W}/\text{m}^2$. Within the overall area of the test sample, the deviation of the radiation intensity shall not be greater than 10%. During the test process, use continuous lighting, the temperature of the black-board shall be $63^\circ\text{C} \pm 3^\circ\text{C}$, the relative humidity shall be $(50 \pm 5)\%$, and the water spray cycle shall be 18min/102min (water spray time /non-water spray time). The length of time taken for the accelerated artificial weathering test shall be 1200 hours.

After the accelerated artificial weathering test is complete, use a hydrochloric acid solution with a concentration of 5% to clean the sample surface for 45s, then use clean water to rinse the sample completely and wipe it dry with a piece of clean soft cloth. After leaving the sample in an environment with a temperature of $20^\circ\text{C} \pm 5^\circ\text{C}$ and relative humidity not greater than 65% for 24 hours, and then re-examine the sample and record the test results.

5.2.7 Adhesiveness test

5.2.7.1 Samples

Cut out each of the red and white retro-reflective sheeting for 50mm x 150mm, peel off 100mm length of anti-stick paper, and paste on baseboard as stipulated in 5.2.1. After treatment in

accordance with the requirements specified in 5.2.1, carry out the test.

5.2.7.2 Test method

Firmly fix the test sample onto the tensile testing machine, and clip the retro-reflective sheeting at the part where the anti-stick paper is still on with the clip of the tensile testing machine, enabling it to make an angle of 180° with the base-board. The load distributed on the sample width shall be even. Then, measure the peel strength of the adhesive layer of the retro-reflective sheeting with a rate of 300mm/min.

5.2.8 Salt mist corrosion test

5.2.8.1 Samples

According to 5.2.1, make 2 test samples of both red and white elements.

Next, cut out 50mm x 150mm each of the red and white retro-reflective sheeting, peel off 100mm length anti-stick paper, and paste onto the base-board as stipulated in 5.2.1.

5.2.8.2 Test requirements

In accordance with the requirements specified in GB/T 2423.17, dissolve pure chemical sodium chloride into distilled water, and make it to $(5\pm 0.1)\%$ (mass percentage) sodium chloride solution; the PH value shall be between the range of 6.5- 7.2 ($35\pm 2^{\circ}\text{C}$). Make this solution continuously atomising inside the salt-mist chamber; the salt-mist precipitation shall be $(1.0-2.0)\text{ml}/(\text{h}\cdot 80\text{cm}^2)$, inside the chamber, the temperature shall be maintained at $35^{\circ}\text{C} \pm 2^{\circ}\text{C}$. Place the test samples in the salt-mist chamber and make an angle of 30° between the test surface and the vertical direction - there shall be a certain gap between any two adjacent samples - the row spacing shall not be smaller than 10cm. The test sample shall be continuously exposed in the salt-mist environment for 10 test cycles; for each cycle, continuously spray salt-mist for 23 hours, then dry for 1 hour. The test shall be completed during the drying stage. After the test is completed, use running water to gently clean the salt precipitation articles off the sample surfaces, then use distilled water to rinse again, the temperature of the rinse water shall not exceed 35°C , then leave the samples in room temperature to recover for 2 hours, then examine and record the test results.

5.2.9 Solvent resistance test

Soak the test sample boards into No 93 lead-free gasoline, No 0 diesel oil and motor vehicle engine lubricants respectively. Remove the samples after 15minutes, wipe dry, and leave the samples at room temperature to recover for 2 hours, then examine and record the test results.

5.2.10 Falling-weight test

Place each of the red and white test samples horizontally on a steel board of 20mm thickness, with the front of the test samples facing upwards. From 2m above the top of the samples, allow a solid steel ball of 0.25kg mass to fall freely and dash against the centre part of the test sample. Check and record the test results.

5.2.11 Temperature resistance test

Place each of the red and white test samples into an environment with a temperature of $70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for 24 hours. Remove the samples and leave in an environment with a temperature of $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 2 hours to recover, then place the samples into an environment with a temperature of $-40^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for 24 hours. Remove the samples, leave in an environment with a temperature of $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for 2 hours to recover again, then check and record the test results.

5.2.13 Bending test

Cut out each of the red and white element retro-reflective sheeting of 25mm x 150mm, peel off the

anti-stick paper, and spray a sufficient layer of talcum powder onto the surface of the adhesive layer. Revolve the sample 90° round onto a round stick with a diameter of 3.2mm, and make the adhesive layer of the sample touch the outer surface of the round stick, then release the sample and check and record the test results.

5.2.13 Water soaking test

Soak each of the red and white test samples in water with a temperature range of 50°C± 5°C for 24 hours, the highest point on the upper reflective surface shall be 20mm underneath the water, turn the test sample over 180°, soak again for 24 hours, then remove and check the sample and record the test results.

5.2.14 Flushing resistance test

5.2.14.1 Sample

Paste 50mm x 1000mm red and white alternatively arranged retro-reflective sheeting onto the centre location of the painted surface of a steel board; the dimension of the steel board shall be 1200mm x 500mm x 2mm, the thickness of the coating on the steel board shall be 45µm - 55µm. Conduct the test after the sample has been placed in the environment specified in 5.2.1 for 24 hours.

5.2.14.2 Test method

Use a high pressure water gun to flush the sample from all angles. The spray pressure of the water gun shall be 5MPa, the flushing distance 1m, and the flushing time 10 minutes. Check the sample after the test.

6 Inspection rules

6.1 Types of inspection

Types of inspections of retro-reflective markings for carriages are divided as inspection for type approval and inspection for conformity of production.

The inspection for type approval and inspection for conformity of production for retro-reflectors shall be conducted in accordance with the provisions specified in GB11564; the inspection for type approval and inspection for conformity of production for retro-reflective sheeting shall be conducted in accordance with the provisions below.

6.2 Inspection for type approval

6.2.1 The requirements of inspection for type approval

The inspection for type approval shall be conducted in the following circumstances:

- Trial production for new design product;
- Change in production line or factory;
- If production is discontinued then restarted;
- If major changes are made to structures, materials or technology;
- Every two years after normal production;
- Contracts, agreements etc.

6.2.2 Sample requirements

Retro-reflective markings of carriage having no differences in factors such as product type, trademark, luminous intensity, chromaticity intensity and specific materials, geometric dimensions, product structures, shall be regarded as the same type of retro-reflective markings.

Select 50mm x 5000mm retro-reflective markings of carriage from the same type as the sample; the sample shall contain both red and white elements.

6.2.3 Inspection items, methods

See Table 3 for inspection items, requirements, test methods, sample numbering and distribution for inspection for type approval.

Table 3 Test Items, requirements and methods for type approval of retro-reflective sheeting

Serial Number	Test Item	Claimed Provisions	Test Method Provisions	Sample Number
1	Appearance Determination	4. 1. 3. 1	5. 2. 2	#1~#13
2	Dimension Measurement	4. 1. 3. 2	5. 2. 3	#1
3	Chromaticity Characteristics test	4. 1. 3. 3	5. 2. 4	#1
4	Reflection Characteristic Test	Coefficient of retroreflection	5. 2. 5	#1
		Uniformity of retroreflection		#1
		Humidity condition retroreflection		#1
5	Accelerated Artificial Weathering Test	4. 1. 3. 5	5. 2. 6	#1、#2
6	Adhesiveness Test	4. 1. 3. 6	5. 2. 7	#3
7	Salt-mist Corrosion Test	4. 1. 3. 7	5. 2. 8	#4、#5
8	Solvent Resistance Test	4. 1. 3. 8	5. 2. 9	#6、#7、#8
9	Falling-weight Impact Test	4. 1. 3. 9	5. 2. 10	#9
10	Temperature Resistance Test	4. 1. 3. 10	5. 2. 11	#10
11	Bending Test	4. 1. 3. 11	5. 2. 12	#11
12	Water Soaking Test	4. 1. 3. 12	5. 2. 13	#12
13	Flushing Resistance Test	4. 1. 3. 13	5. 2. 14	#13
Note: Every numbered sample shall contain both white and red element				

6.3 Inspection for conformity of production

For products that have qualified the inspection for type approval, the samples selected at random from mass-production shall be used to determine the conformity of production thereof. The materials, structures and dimensions shall conform to the specifications in the drawings which are used to apply for the inspection.

Select samples not less than 50mm x 5000mm at random (include both red and white elements) from at least 50mm x 10000mm (shall include both red and white elements) retro-reflective sheeting. The inspection items for checking the conformity of production shall include, as a minimum, aspects such as appearance, chromaticity characteristics, reflection characteristics, adhesiveness characteristics, solvent resistance characteristics, temperature resistance characteristics etc. The test for weather resistance characteristics must be conducted every four years, and the test results must conform to the corresponding requirements set out in Clause 4.

7 Packaging and labelling

7.1 Packaging

The packaging box for the materials of retro-reflective markings for carriage shall conform to the requirements of humidity resistance and dust resistance.

7.2 Labelling

The following contents shall be clearly indicated on the packaging box:

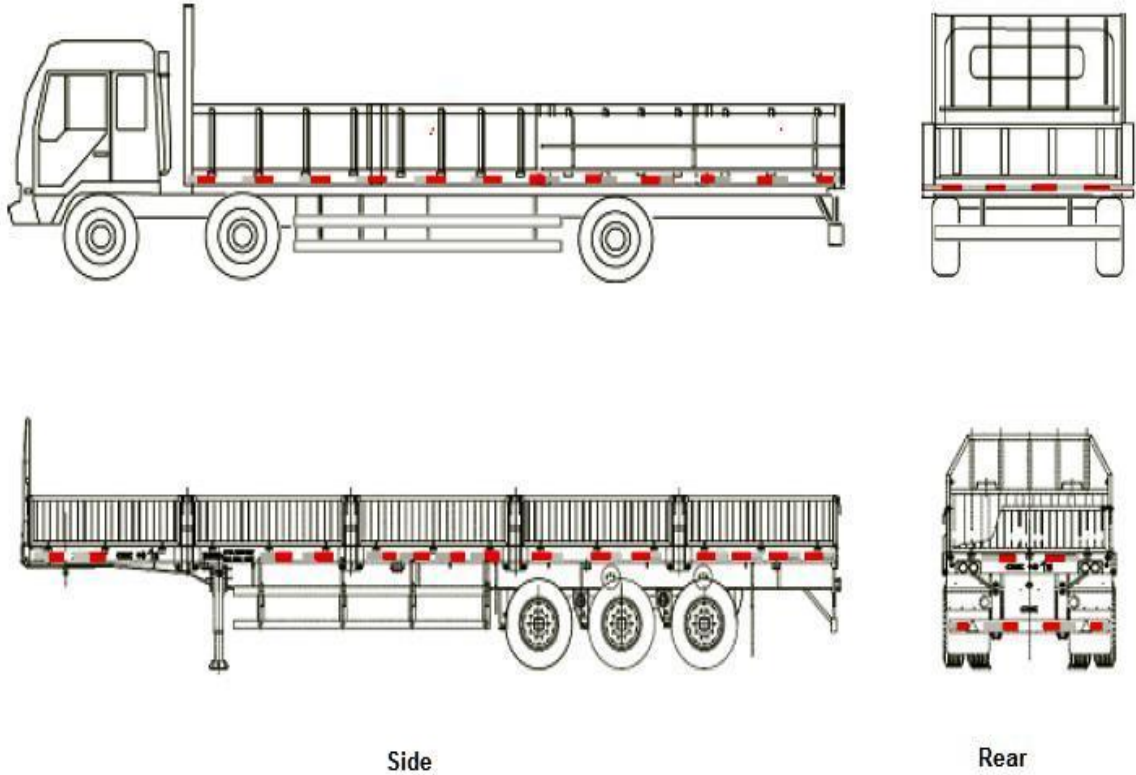
- 1) Product name, product standard number, trademark;
- 2) Name of manufacturer, detailed address;
- 3) Specification, type, grade, classification and quantity of the product;
- 1) Production date, batch number.

7.3 User manual and qualification certificate

There shall be a user manual written in Chinese, and qualification certificate in the single packaging box.

Appendix A
(Normative Annex)

Pasting Examples of Retro-reflective Sheeting Materials for Part of Typical Vehicle Types

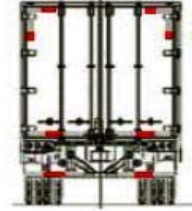
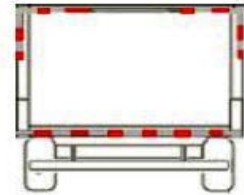
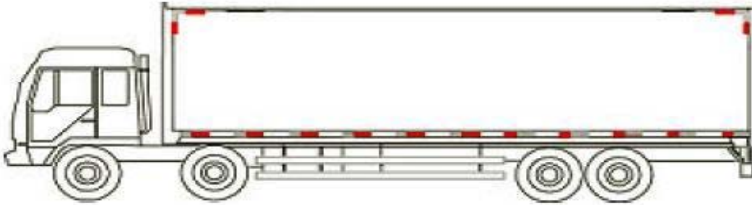


If the pasting area is not able to meet the required area, the contour edge of the gate of the cargo body shall be used to make up the outline drawing, see Diagram below.



Diagram A.1 Dropside truck and dropside semi-trailer

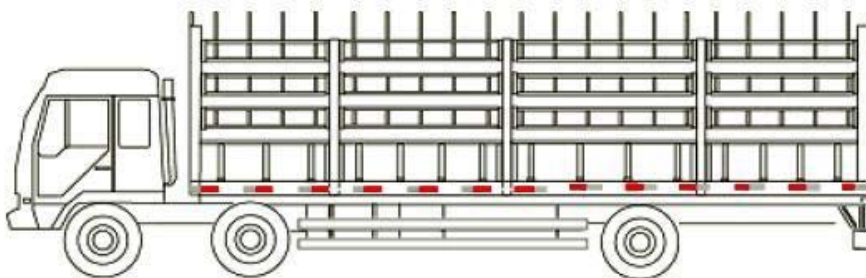
GB xxxx—xxxx



Side

Rear

Diagram2 Van and van semi-trailer



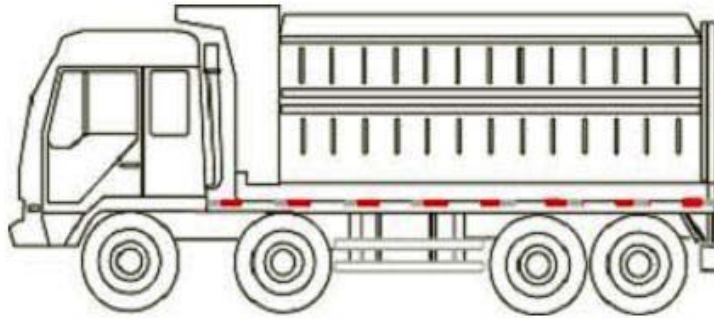
Side

Rear

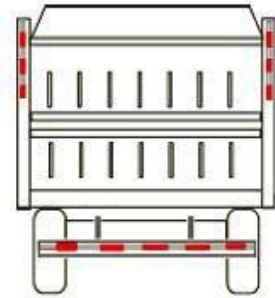
If the pasting area is not able to meet the required area, the contour edge of the gate of the cargo body shall be used to make up the outline drawing, see Diagram below.



Diagram A.3 Box/Stake truck and box/stake semi-trailer

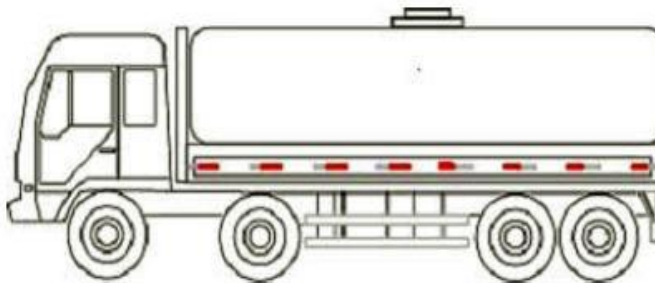


Side

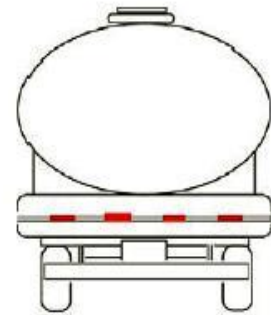


Rear

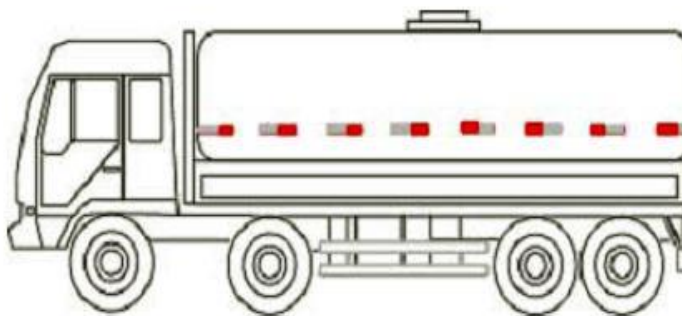
Diagram A.4 Dump truck and dumper semi-trailer



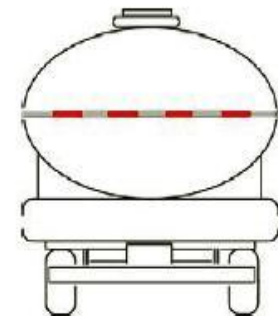
Side



Rear



Side



Rear

Diagram A.5 Tanker and tank semi-trailer

The pasting position of retro-reflective markings of carriage for this type of vehicles shall be at the middle part of the tank, in order to increase the visual cognition at night time. If the load bearing surface and the width of the chassis is basically identical with the width of the tank, then the retro-reflective markings of carriage can also be pasted on the edge of the load bearing surface of the chassis.

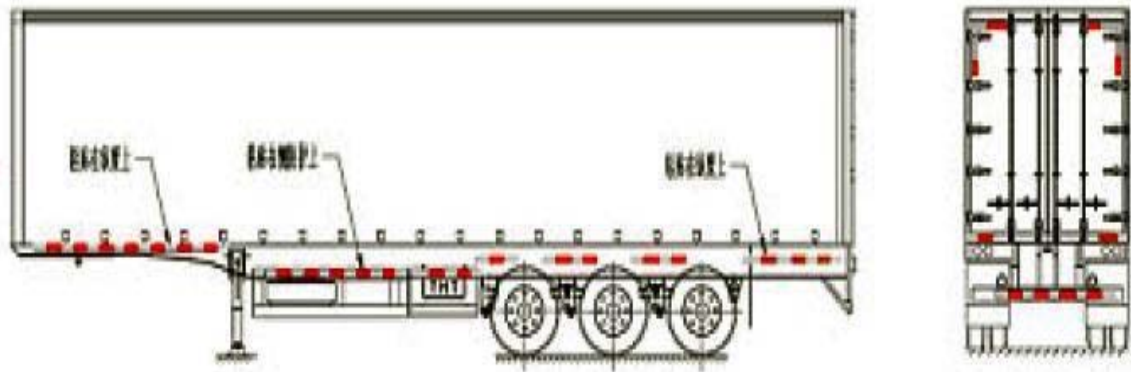


Diagram A.6 Curtain sider semi-trailer

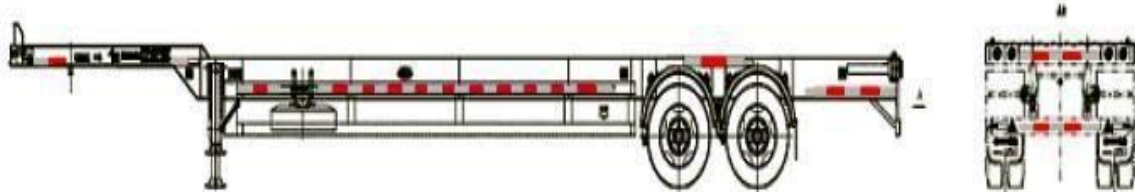


Diagram A.7 Skeletal container semi-trailer

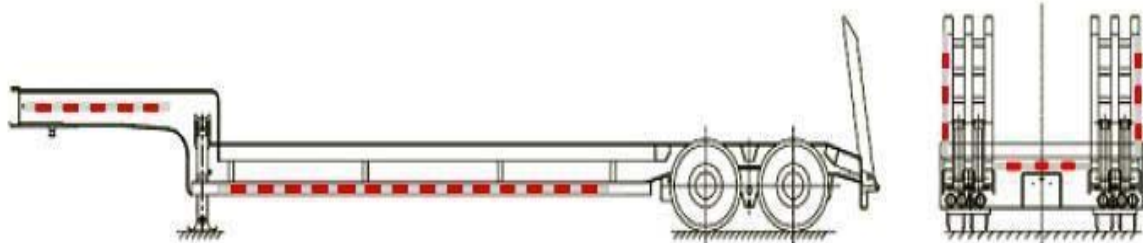
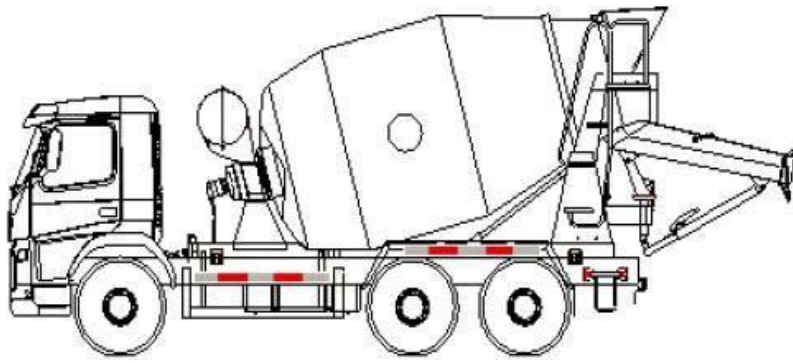
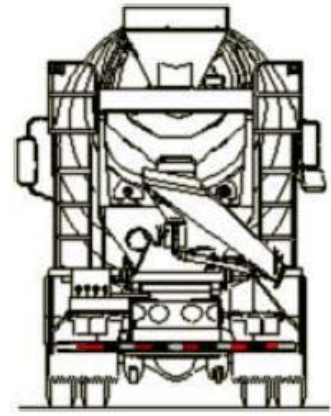


Diagram A.8 Low platform semi-trailer

Note: for low platform semi-trailers equipped with a ladder, carry out pasting as shown in the diagram. If no ladder is fitted, then pasting can be carried out at an appropriate rear location, in order to reflect the width of the rear of the vehicle. When pasting is carried out on the sides of the vehicle, reflect the complete length of the semi-trailer as far as possible.



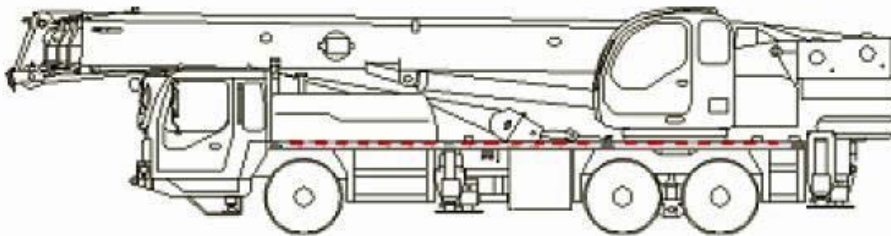
Side



Rear

Diagram A.9 Concrete mixer truck

Note: Markings for this type of vehicles shall be pasted as much as possible along the load bearing surface of the chassis, if specially required, the pasting can be replenished at the anti-collision guardrails.



Side



Rear

Diagram A.10 Truck crane