NO.: **TSM7515G**

TITLE: **Decorative black tape for body exterior**

CLASS: **C1**

Established/Revised: **Rev. 2 (Oct. 2010)**

This standard has been revised as a result of the following changes:
(1) criterion values for 180-degree-peeling strength have been reviewed;
(2) the tester for accelerated weather resistance test has been changed;
(3) shear retention has been deleted;
(4) pollen resistance has been added;
(5) test sample for minimum rolled-in amount test has been changed;
(6) test fluid for chemical resistance test has been changed; and
(7) a statement has been added to conform with prohibitions and restrictions for substances of environmental concern required per TSZ0001G.

Prepared and Written by:
Paint & Finishing Design Dept.
Vehicle Material Engineering Div.

Decorative black tape for body exterior

1. Scope

This standard covers material properties of the pressure-sensitive adhesive type black tape (hereinafter referred to as "tape") used to decorate inner/outer door sash, pillar, and hood. The parts made of materials provided by this standard shall conform to prohibitions and restrictions for substances of environmental concern in TSZ0001G. Exempt uses specified by EU ELV Directive shall conform to the latest version of the Directive.

2. Classification

The classification of tape, surface primer, and sealer blocker is shown in Table 1.

Table 1

Material classification			Material code	Type
Tape	Polyvinyl chloride	Class 1A1	TSM7515G-1A1	Normal glossy tape
		Class 1A2	TSM7515G-1A2	Air-purged glossy tape
		Class 1B1	TSM7515G-1B1	Normal mat tape
		Class 1B2	TSM7515G-1B2	Air-purged mat tape
	Non-polyvinyl chloride	Class 2A1	TSM7515G-2A1	Normal glossy tape
		Class 2A2	TSM7515G-2A2	Air-purged glossy tape
		Class 2B1	TSM7515G-2B1	Normal mat tape
		Class 2B2	TSM7515G-2B2	Air-purged mat tape
Surface primer		Class 3A	TSM7515G-3A	Isocyanate
		Class 3B	TSM7515G-3B	Isocyanate-less
		Class 3C	TSM7515G-3C	Acrylic
Sealer blocker		Class 4A	TSM7515G-4A	Isocyanate

Classification into normal tape and air-purged tape:

(1) Prepare a piece of tape having 50-mm length sides, a 70×150×0.8 mm coated panel, and an iron ball with a mass of 1.0 kg and a diameter of 6 cm.

(2) Drop the iron ball onto the coated panel from a height of 2 m to produce a depression with a diameter of about 10 to 13 mm on the surface (Fig. 1).

(3) Apply the tape in such a way that the depression is positioned at the center of the tape. Use a squeegee and apply the tape with a pressure of 30 N/cm^2 in the laboratory conditioned at 23±2 ℃ and 50±5 % RH. Leave the tape and coated panel to stand in the laboratory for 24 h before performing this step.

(4) After leaving the coated panel with tape to stand for 3 min at a temperature at which the tape was applied, press the air accumulated in the depression with a finger from above. If the air in the depression is purged without showing any appearance abnormalities, regard the tape as the air-purged tape. If the air is not purged, regard the tape as the normal tape.

Remark: The steps (1) and (2) above are one example of the preparation method for the coated panel as shown in Fig. 1.

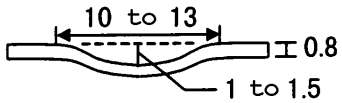

Fig. 1 (Unit: mm)

3. Components

An example of components of the tape is shown in Fig. 2.

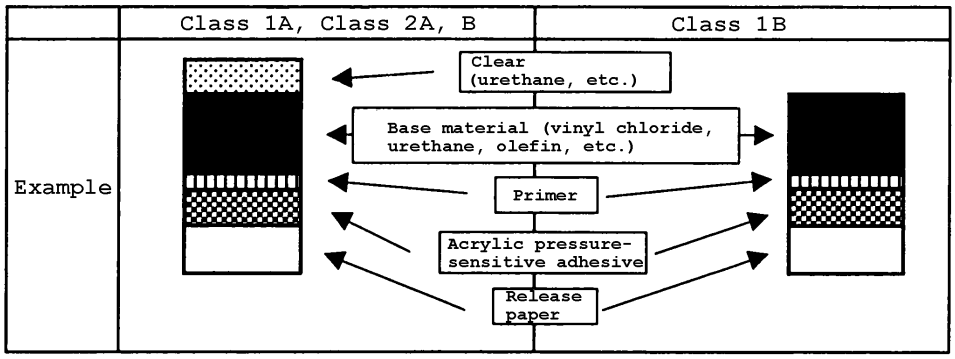

Fig. 2

Remarks:

1. Primer may not be used depending on types.
2. An application tape may be applied to the tape surface.
3. For the purpose of this standard, the "tape" refers to the one after the application tape and release paper are removed.

4. Decorative Features and Shape

Unless otherwise instructed, the color and gloss of the tape shall be as specified in Table 2. The shape and dimensions shall be as specified separately on the drawing.

Table 2

Type	Color	Gloss
Glossy tape	When values (X=0.33±0.1, Y=0.35±0.1, and Z=0.42±0.1) are given, ΔE shall be 2.5 or less and no color difference shall be visually observed.	Gloss: 90±5
Mat tape	When values (X=3.37±0.1, Y=3.57±0.1, and Z=3.97±0.1) are given, ΔE shall be 2.5 or less and no color difference shall be visually observed.	Gloss: 30±5

Remark: X,Y, and Z refer to tristimulus values of color

5. Quality

5.1 Appearance

The tape shall conform to the standard sample that is established separately. No irregularity in color or gloss, smudge, cracks, blushing or other abnormalities due to cutting shall be found on the tape. The surface primer and sealer blocker shall be light yellowish or yellowish clear liquid, and shall not include any foreign material.

5.2 Release Paper

The release paper shall be strong enough to protect the adhesive side of the tape, and shall be removed cleanly from the adhesive side without tear.

5.3 Application Tape

The application tape is used to protect the tape surface, indicate the location at which the tape is applied, suppress elongation, and prevent slippage when the tape is applied with pressure. When the release paper is removed, the application tape and the tape shall be removed while maintaining the adhesion state. The application tape shall be easily removed from the tape after the tape is adhered to the object, and stain, transfer of adhesive and other detrimental effects shall not be allowed.

5.4 Material Properties

Test the tape, the surface primer and the sealer blocker in accordance with Sections 6 and 7. These materials shall conform to the specification in Tables 3, 4, and 5. Unless otherwise noted, take the average value of three test samples as a test result.

Table 3 Material Properties of Tape

Item			Class 1A	Class 2A	Class 1B	Class 2B	Reference section
Thickness	Total thickness		Report.				6.5
	Each component						
Gloss	60 ° gloss		90±5		30±5		---
Tensile strength (N/cm) (tensile speed: 200 mm/min)			10 min.				6.6
Elongation (%)	At break		Report.				
	At a load of 10 N/cm		5 max.	Report.	5 max.	Report.	
180 ° -peeling (N/cm)	Initial state (1 h)		4 min. or tape material breakage				6.7
	Ordinary state (168 h)		6.4 min. or tape material breakage				
	After heat aging (80 ℃, 400 h)						
	After hot water aging (400 h in hot water at 40 ℃)						
	After low temperature aging (-30 ℃, 168 h)						
	After accelerated weather resistance test	Xenon method A (1250 MJ)					
		SWOM method A (2000 h)					
Dimensional change after heating (%)	Free state (lengthwise, widthwise) (80 ℃, 48 h)		Within ±0.6				6.8
	Adhesion state (lengthwise, widthwise) (80 ℃, 48 h)		Within ±0.2				
Heat aging resistance (80 ℃, 400 h)			No appearance change.				6.9
Hot water aging resistance (400 h in hot water at 40 ℃)							6.10
Humidity and thermal cycle aging resistance							6.11
Accelerated weather resistance	Xenon method A (1250 MJ)		ΔColor difference (ΔE*) of 3.0 or less and gloss retention of 80 % or more.				6.12
	SWOM method A (2000 h)						
	Metal halide (60 cycles)		---		No significant change in appearance including color and gloss.		
Outdoor weather resistance (1 year, 2 years)			No significant change in appearance including color and gloss.				6.13
Boiling water resistance (100 ℃, 5 min)			No appearance change.				6.14
Frictional migration (5 N/1000 strokes)			No appearance change.				6.15
Scratch resistance	Automatic vehicle washing		99 to 110 % gloss retention.				6.16
	Surface abrasion (9.8 N, 50 strokes)						

Table 3 (Continued)

Item			Class 1A	Class 2A	Class 1B	Class 2B	Reference section
Chemical resistance	Immersion	Windshield washer	No appearance change.				6.17
		Water repellent					
	Spot	Xylene resistance method B	No wrinkle, blister, or peeling.				
		Gasoline resistance					
		Resistance to discoloration by water	Color difference (ΔE^*) of 0.5 or less, and no significant scratch.				
		Resistance to discoloration by alkaline					
		Resistance to discoloration by acid					
Acid rain resistance			Better than or equal to black coating.				6.18
Pollen resistance			Report.				6.19
Sealer blocking property (N/cm)	Ordinary state (168 h)		6.4 min. or tape material breakage				6.20
	After heat aging (80 ℃, 400 h)						
Minimum rolled-in amount (mm)			2 max.				6.21
Stain by contacted object		After heat aging (80 ℃, 400 h)	No significant appearance change.				6.22
		After hot water aging (400 h in hot water at 40 ℃)					
		Xenon method A (750 MJ)					
		SWOM method A (1000 h)					
High pressure vehicle washing		Initial state (1 h)	No peeling.				6.23
		Ordinary state (168 h)					
		After heat aging (80 ℃, 400 h)					
		After hot water aging (400 h in hot water at 40 ℃)					
		After low temperature aging (-30 ℃, 168 h)					
Tape on tape	180 ° -peeling (N/cm)	Initial state (1 h)	4 min. or tape material breakage				6.24
		Ordinary state (168 h)	6.4 min. or tape material breakage				
		After heat aging (80 ℃, 400 h)					
		After hot water aging (400 h in hot water at 40 ℃)					
	High pressure vehicle washing resistance (mm)		2 max.				
Lap and wrinkle	Surface pressure 40 N/shear 7.5 N/with primer/80 ℃/200 h		No appearance change.				6.25
	Surface pressure 40 N/shear 7.5 N/without primer/80 ℃/24 h		Report.				
	Surface pressure 100 N/shear 10 N/with primer/80 ℃/200 h		No appearance change.				

Table 4 Material Properties of Surface Primer and Sealer Blocker

Item	Class 3A	Class 3B	Class 4A	Reference section
Solid content (%)	20 to 40	4 to 20	20 to 40	6.26
Viscosity (MPa・s)	3 to 30	5 to 80	3 to 30	6.27

Table 5 Door Application Properties

Item	Class 1A, 2A, 2B	Class 1B	Reference section
Heat resistance (80 ℃, 400 h)	No appearance change.		7.2
Humidity resistance (50 ℃, 95 % RH, 400 h)			7.3
Humidity and thermal cycle aging resistance			7.4
High pressure vehicle washing resistance	No peeling.		7.5

6. Test Methods

6.1 Ambient Conditions

Conduct the test indoors at 23±2 ℃ and 50±5 % RH unless otherwise specified (hereinafter referred to "room temperature"). Leave the tape and the object to stand at a room temperature for 24 h prior to the test.

6.2 Sash Black Coated Panel for Comparison

Prepare sash black coated panels that conform to TSH2308G for comparison in each evaluation. (For example, use a decorative black coated panel TP-65 (black) manufactured by Kansai Paint for comparison for Class 1A and Class 2A, and the sash black coated panel TP-65 (sash black) manufactured by Kansai Paint for comparison for Class 1B and Class 2B.)

6.3 Coated Panel for Evaluation

For the adhesion test, use the coated panel whose paint materials, material components, paint film thickness, and painting conditions are equivalent to the paint used for the actual automotive outer panel. If the test results vary depending on the types of paint, perform the test on all coated panels.

6.4 Tape Application Procedure

Apply the tape as shown in Fig. 3. When applying the tape, air bubble shall not come in between the tape and coated panel. Unless otherwise instructed later in this standard, follow the procedure shown in Fig. 3.

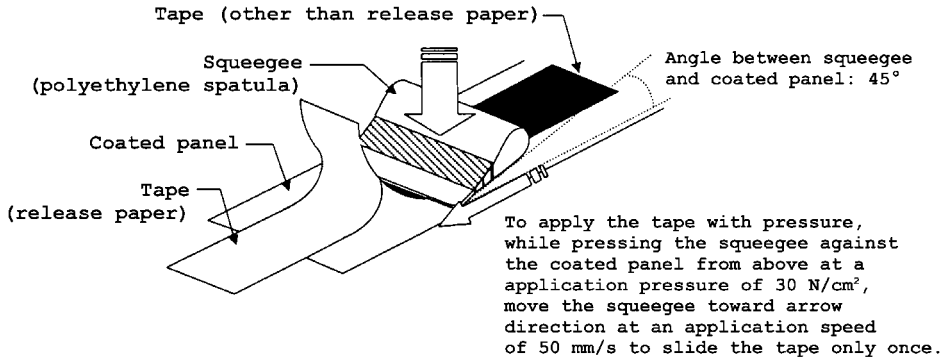

Fig. 3

6.5 Thickness Measurement

6.5.1 Total Thickness

Use a micrometer to measure the thickness at 10 points excluding the end of the tape which are taken arbitrarily at even intervals. It may be the case that the tape thickness including the release paper may be measured first, and then the thickness of the release paper is subtracted. Measure the thickness down to the micrometer, and obtain the average value of the measurement at 10 points.

6.5.2 Each Component

Use a pair of approx. 1000-power binoculars to measure the thickness of each component down to the micrometer.

6.6 Tensile Test

Prepare the tapes that have been cut lengthwise(1) and widthwise into one having a width of 10 mm and a length of 200 mm. Put marks at the center of the tape at a 100-mm interval in the lengthwise direction. Then, remove the release paper from the tape, and set the tape on the tensile tester with the free length between grips set at 100 mm. Pull the tape at a tensile speed of 200 mm/min, and measure the maximum tensile strength required for breakage, the elongation at break, and the elongation when the tensile strength reaches 10 N/cm. The elongation is obtained by the following equations (1) and (2). The result shall be the average value of 3 test samples.

Note (1): "Lengthwise" shall be defined as the roll direction of the tape.

$$\text{Elongation at break (\%)} = \frac{L_1 - L_0}{L_0} \times 100 \quad \text{- - - - - - - - (1)}$$

$$\text{Elongation at 10 N / cm load (\%)} = \frac{L_2 - L_0}{L_0} \times 100 \quad \text{- - - - - - - - (2)}$$

where,

L_0: distance between gage marks before test (mm)

L_1: distance between gage marks at break (mm)

L_2: distance between gage marks when the tensile strength reached 10 N/cm (mm)

6.7 180 ° Peeling Test

6.7.1 Preparation of Test Sample

Clean the surface of a 70×150 mm coated panel with isopropyl alcohol. Prepare tapes that have been cut into a width of 10 mm and a length of 240 mm. Remove the release paper only in the width of 100 mm from the end portion of the tape, and apply the tape onto the coated panel to prepare the test sample.

6.7.2 Test Procedure

Peel off the adhesive portion of the test sample for about 5 mm by hand, and set the sample on the tensile tester as shown in Fig. 4. Perform the test 180° at a tensile speed of 200 mm/min, and measure the peeling strength(2). The result shall be the average value of 3 test samples.
Check the peeling condition, and report in accordance with Table 6.

Note (2): The peeling strength shall be the average of peak values, excluding the maximum peak value and minimum peak value, in the test chart obtained as shown in Fig. 5.

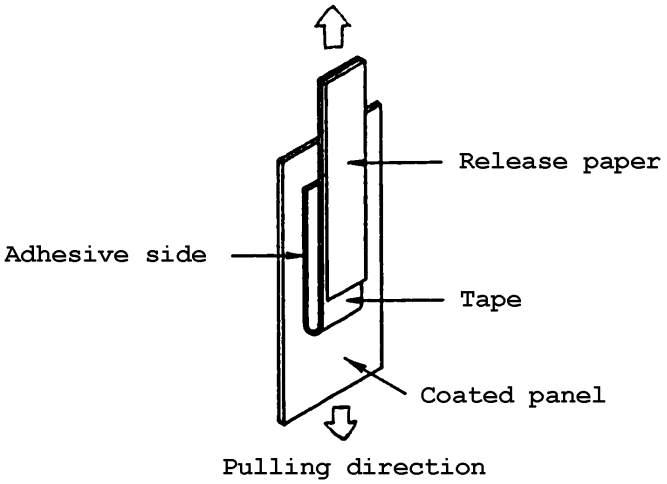

Fig. 4 180 ° Peeling Test Sample

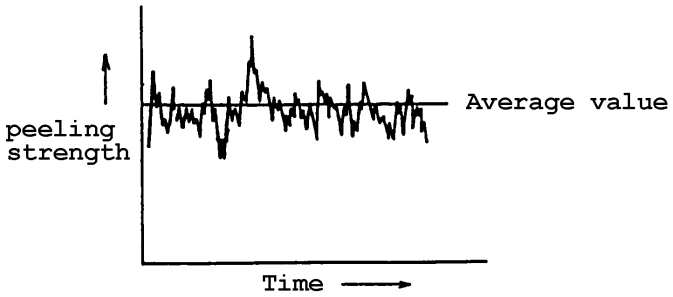

Fig. 5 Test Chart

Table 6 Peeling Condition

Code	Peeling condition
Cf (Cohesive Failure)	Cohesive failure of adhesive
Af (Adhesive Failure)	Interface peeling on adhesive side
B (Break)	Breakage of test sample

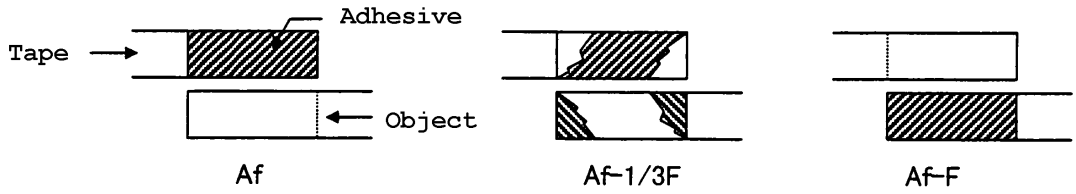

Fig. 6

Remarks:
1. Use suffix codes in addition to the code Af as shown in Fig. 6 depending on the peeling condition.
2. Use the suffix codes when the adhesive on the tape has been transferred to the object. The suffix represents the fraction that is the area where the adhesive is transferred with respect to the total area. The degree of transfer is obtained by visual estimation.

6.7.3 Type of Coated Panel

For preparation of the test sample, use the coated panel that has been prepared under the condition specified in Table 4 in TSH2705G.

6.7.4 Initial State

Leave the test sample prepared in accordance with Section 6.7.1 to stand at a room temperature for 1 h, and measure the peeling strength in accordance with Section 6.7.2.

6.7.5 Ordinary State

Leave the test sample prepared in accordance with Section 6.7.1 to stand at a room temperature for 168 h, and measure the peeling strength in accordance with Section 6.7.2.

6.7.6 After Heat Aging

Leave the test sample prepared in accordance with Section 6.7.1 to stand at a room temperature for 24 h, and place the test sample for 400 h in a thermostat conditioned at 80±2 ℃. After the test, remove the test sample from the thermostat and leave the test sample to stand at a room temperature for 24 h, and measure the peeling strength in accordance with Section 6.7.2.

6.7.7 After Hot Water Aging

Leave the test sample prepared in accordance with Section 6.7.1 to stand at a room temperature for 24 h, and immerse the test sample into water for 400 h in the constant-temperature water bath conditioned at 40±2 ℃. After the test, remove the test sample from the constant-temperature water bath, and thoroughly wipe off water with a soft cloth. Leave the test sample to stand at a room temperature for 24 h, and measure the peeling strength in accordance with Section 6.7.2.

6.7.8 After Low Temperature Aging

Leave the test sample prepared in accordance with Section 6.7.1 to stand at a room temperature for 24 h, and place the test sample for 168 h in a thermostat conditioned at -30±2 ℃. After the test, remove the test sample from the thermostat and leave the test sample to stand at a room temperature for 24 h, and measure the peeling strength in accordance with Section 6.7.2.

6.7.9 After Accelerated Weather Resistance Test

In principle, use the Xenon for the accelerating weather resistance test. SWOM can be selected if there are no Xenon weather resistance.

(1) Xenon method A

Leave the test sample prepared in accordance with Section 6.7.1 to stand at a room temperature for 24 h. Set the test sample on the Xenon Weatherometer (hereinafter referred to as "Xenon") specified in Section 2.1 or 2.3 in TSH1585G, and perform the test with 1250 MJ in accordance with Method A in Section 3.1, TSH1585G. After Xenon evaluation, leave the test sample to stand at a room temperature for 24 h, and measure the peeling strength in accordance with Section 6.7.2.

(2) SWOM method A

Leave the test sample prepared in accordance with Section 6.7.1 to stand at a room temperature for 24 h. Set the test sample on the Sunshine Carbon Weatherometer (hereinafter referred to as "SWOM") specified in TSH1582G, and conduct the evaluation for 2000 h in accordance with Method A specified in Section 3.1 of TSH1582G. After the evaluation with SWOM, leave the test sample to stand at a room temperature for 24 h, and measure the peeling strength in accordance with Section 6.7.2.

6.8 Dimensional Change after Heating

6.8.1 Free State

Draw reference lines on the tape with release paper, cut into 220×220 mm, that are parallel with each side of the tape at 10 mm from the side. Accurately measure the distance between 2 parallel lines at 3 points or more, and determine the average in the lengthwise(1) and widthwise direction, which shall be designated as the original dimension. Then, gently place the tape horizontally(3) in the thermostat conditioned at 80±2 ℃, and maintain the tape for 48 h. Remove the tape from the thermostat, and leave the tape to stand at a room temperature for 24 h. Measure the dimension at the same points, and find the rate of dimensional change after heating by using the equation (3).

Note (3): Place a heat insulator on the flat plate in the thermostat, and the tape over the heat insulator with the release paper side facing down.

$$\text{Rate of dimensional change after heating (\%)} = \frac{L_1 - L_0}{L_0} \times 100 \quad \text{- - - - -} \quad (3)$$

where,

L_0: distance between reference lines before test (mm)

L_1: distance between reference lines after test (mm)

6.8.2 Adhesion State

Apply the tape, which has been cut into 220×220 mm with the release paper removed, to a 250×250 mm coated panel. Leave the coated panel to stand at a room temperature for 24 h, and determine the rate of dimensional change after heating in accordance with Section 6.8.1.

6.9 Heat Aging Resistance Test

6.9.1 Preparation of Test Sample

As shown in Fig. 7, apply the tape, which has been cut into 50×100 mm, onto a 70×150 mm coated panel, whose surface has been cleaned with isopropyl alcohol. Leave the coated panel to stand at a room temperature for 24 h to prepare a test sample.

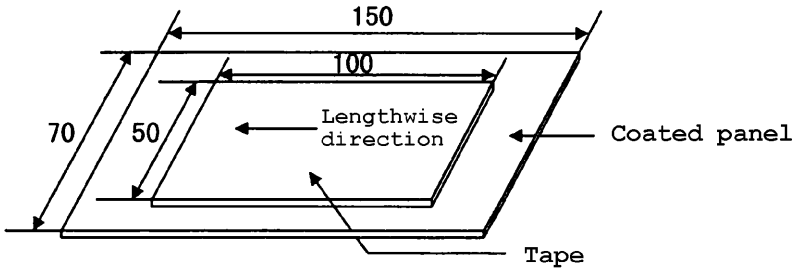

Fig. 7 (Unit: mm)

6.9.2 Test

Place the test sample prepared in accordance with Section 6.9.1 in a thermostat conditioned at 80±2 ℃ and maintain for 400 h, and remove the test sample from the thermostat. Then, leave the test sample to stand at a room temperature for 24 h, and check for any change in appearance including peeling, lifting, cracking, and discoloration.

6.10 Hot Water Aging Resistance Test

Immerse the test sample prepared in accordance with Section 6.9.1 into water in the constant-temperature water bath conditioned at 40±2 ℃ for 400 h, and remove the test sample from the water bath. After thoroughly wiping off moisture with a soft cloth, leave the test sample to stand at a room temperature for 24 h, and check for any change in appearance including peeling, lifting, cracking, and discoloration.

6.11 Humidity and Thermal Cycle Aging Resistance Test

The test cycle shown in Table 7 shall be designated as one cycle. Perform 3 cycles for the humidity and thermal cycle aging resistance test on the test sample prepared in accordance with Section 6.9.1. Then, leave the test sample to stand at a room temperature for 24 h, and check for any change in appearance including peeling, lifting, cracking, and discoloration.

Table 7 (Unit: h)

Low temperature (-30±2 ℃)	Room temperature	High temperature (80±2 ℃)	Room temperature	Low temperature	Room temperature	High humidity (50±2 ℃, 95 % RH)	Room temperature
7.5	0.5	15.5	0.5	7.5	0.5	15.5	0.5

6.12 Accelerated Weather Resistance Test

In principle, use Xenon for the accelerating weather resistance test. SWOM can be selected if there is no Xenon weather resistance.

6.12.1 Xenon Method A

Set the test sample prepared in Section 6.9.1 to the Xenon and evaluate it under the same conditions as those specified in Section 6.7.9. However, at 750 MJ, check the appearance once. After 1250 MJ, remove the test sample from the Xenon and leave it at room temperature for 24 h. Then check the changes in appearance such as peeling, lifting, cracks, color change, discoloration, etc.

6.12.2 SWOM Method A

Set the specimen prepared in accordance with Section 6.9.1 on the SWOM and perform the evaluation under the same conditions as in Section 6.7.9. Check for appearance change once after 1000 h. After the test, remove the specimen from the SWOM, leave the specimen to stand at a room temperature for 24 h, and check for any change in appearance including peeling, lifting, cracking, and discoloration, and fading.

6.12.3 Accelerated Weather Resistance Test Using Metal Halide Lamp Type Tester

Set the specimen prepared in accordance with Section 6.9.1 on the metal halide lamp accelerated weathering tester specified in TSH1583G (hereinafter referred to as "SUV") and perform the test. Perform the test for 60 cycles, and check for any appearance change every 10 cycles. After the test, remove the specimen from the SUV, and leave the specimen to stand at a room temperature for 24 h. Then, check for any change in appearance including peeling, lifting, cracking, discoloration, and fading.

6.13 Outdoor Weather Exposure Resistance

Use the test sample prepared in Section 6.9.1 for the test. The test shall be performed using the test apparatus I or II specified in Section 2.1 of TSH1581G under the standard condition of the exposure stand installation specified in Section 2.2 of TSH1581G. After the test, conduct evaluation using the method A specified in Section 3.1 of TSH1581G. However, no wax shall be applied. The exposure site shall be Okinawa, and the evaluation shall be continued up to 24 months. After the test, measure color difference, gloss retention and visually check any change in appearance including color fading, gloss fading, cracks, peeling and lifting.

6.14 Boiling Water Resistance Test

Immerse the test sample prepared in accordance with Section 6.9.1 in boiling water for 5 min. Remove the test sample and thoroughly wipe off moisture. Then, check for any appearance change.

6.15 Frictional Migration Test

Prepare the tape with release paper, which has been cut into a width of 30 mm and a length of 250 mm. Set the tape on the test plate of the gakushin-type rubbing tester shown in Fig. 8, and cover the contact surface of the abradant with a 50×50 mm white cotton cloth(4) and fix it. With 500 g of abradant, check the degree of staining on the white cotton cloth, while rubbing 1000 times going and back within a range of 100 mm on the tape at a rate of 30 times per minute.

Note (4): Cotton cloth shall be plain weave with a yarn count of 20 tex for warp and 16 tex for fill. A density shall be 141 threads/5 cm for warp and 135 threads/5 cm for fill, and the mass shall be about 100 g/m^2.

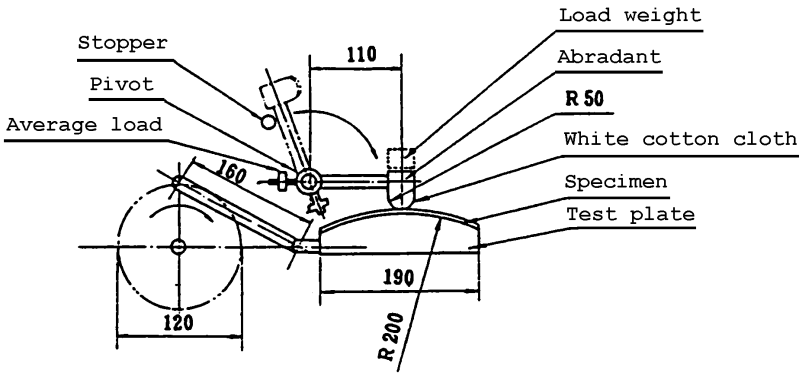

Fig. 8 Schematic Diagram of Gakushin-Type Rubbing Tester (Unit: mm)

6.16 Scratch Resistance Test

6.16.1 Automatic Vehicle Washing Test

Use the test sample prepared in accordance with Section 6.9.1 and perform the automatic vehicle washing test specified in TSH1527G. Evaluate in comparison with the results of the sash black coated panel that is tested simultaneously.

6.16.2 Surface Abrasion Test

Use the test sample prepared in accordance with Section 6.9.1. Set the test sample on the surface abrasion tester shown in Fig. 9, cover the abradant with a new glove and perform the test. Conduct the test 50 times with 1 kg of abradant. Evaluate in comparison with the results of the sash black coated panel that is tested simultaneously.

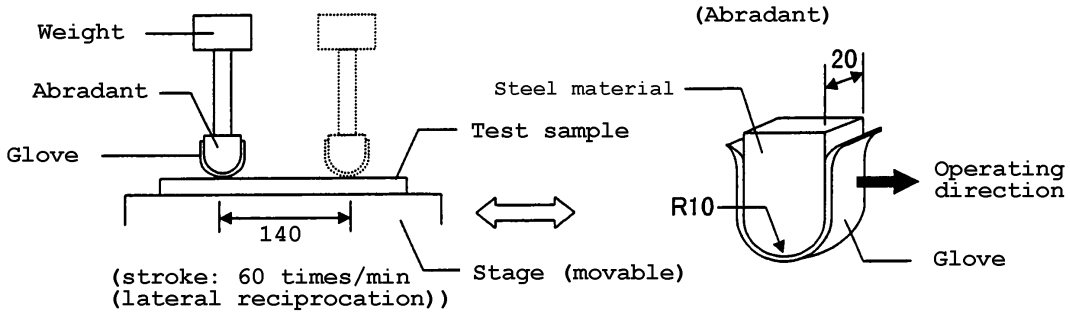

Fig. 9 (Unit: mm)

6.17 Chemical Resistance Test

6.17.1 Immersion Test

Immerse the test sample prepared in accordance with Section 6.9.1 in the test fluid shown in Table 8 for 30 min, and remove the test sample from the fluid. Check for appearance change after leaving the test sample to stand at a room temperature for 24 h and 168 h. Tests using test fluids other than those specified in Table 8 may be added as required by the parties concerned.
Remark: In principle, select the test fluid that is used at each location.

Table 8

No.	Test fluid	Application example
3	Windshield washer liquid	Genuine part
4	Water repellent	Rain X, etc.

6.17.2 Spot Test

Conduct the following evaluations using the test samples prepared in Section 6.9.1.

(1) Xylene resistance
As specified in Section 2.2.2 in TSH1508G.
(2) Gasoline resistance
As specified in Section 2.4 in TSH1508G.
(3) Resistance to discoloration by water
As specified in Section 2.1.1 in TSH1509G.
(4) Resistance to discoloration by alkaline
As specified in Section 2.1.2 in TSH1509G.
(5) Resistance to discoloration by acid
As specified in Section 2.1.3 in TSH1509G.

6.18 Acid Rain Resistance

Use the test sample prepared in accordance with Section 6.9.1, and perform the test in accordance with Section 2.1.2 in TSH1530G. After the test, check for any appearance change and check the degree of change. Evaluate in comparison with the results of the sash black coated panel that is tested simultaneously.

6.19 Pollen Resistance

Check the existence of problem on the surface of tape due to fallen cedar pollen. After that, check if the surface of the tape can return to normal state by applying heat load.

(1) Mix water, pectin (0.5 mass%) and glass beads (0.5 mass%) and use the mixture as a reagent.
Remark: Use glass beads with grain diameter of 45 to 90 μm.
(2) Spray the reagent prepared in (1) on the test sample prepared in Section 6.9.1 so that the entire surface of the test sample is covered by the reagent.
(3) Leave the test sample in a thermostat conditioned at 50±2 ℃ for 1 h and dry it. Then, remove it from the thermostat.
(4) Wash the surface of the test sample with water and wipe moisture, then check existence of dent on the surface.
(5) If a dent is observed, leave the test sample in the thermostat conditioned at 80±2 ℃ for 10 min, then check the existence of the dent again.

6.20 Sealer Blocking Test

If the coating is composed of 3 wet coatings without surfacer and inner panel, application of sealer blocker is not allowed. Check the possibility that tape is applied on the sealer. If this is the case, peeling will occur, therefore, discussion shall be made between the parties concerned so that the tape has a shape that can be applied over the sealer.

6.20.1 Preparation of Test Sample

Prepare the test sample in accordance with the following procedure:

(1) Apply body sealer used in the actual process to a 70×150 mm electrodeposited panel (hereinafter referred to as the "ED panel") at a thickness of 1 mm (Fig. 10).
(2) Apply intermediate coat and bake (maintain for 18 min at 140 ℃) under the same conditions as the actual process.
(3) Uniformly apply the sealer blocker(5) at a thickness of 10 μm.
(4) After leaving(6) for 2 min at a room temperature, apply topcoat under the same conditions as the actual process and bake.
(5) Apply the tape to the coated test panel above in the same manner as specified in Section 6.7.1 to prepare a test sample. The portions to which the tape is applied:
① Portion to which blocker is applied
② Portion without blocker
③ Portion without sealer

Notes:

(5) In principle, use the sealer blocker manufactured by same the manufacturer of the tape.
(6) Since the leaving time is not limited, evaluations shall be conducted with various leaving times that are agreed by the parties concerned.

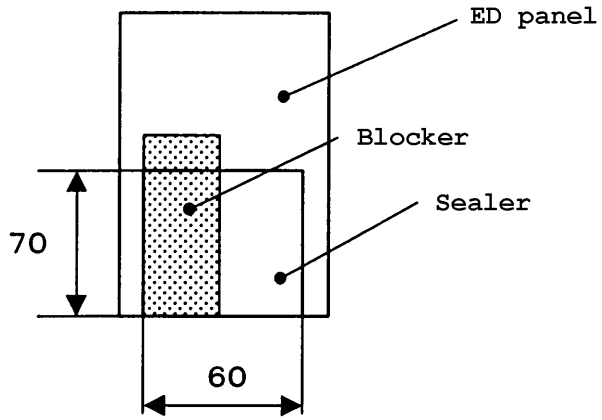

Fig. 10 (Unit: mm)

6.20.2 Ordinary State

Perform the test in accordance with Section 6.7.5 on the test sample prepared in accordance with Section 6.20.1.

6.20.3 After Heat Aging

Perform the test in accordance with Section 6.7.6 on the test sample prepared in accordance with Section 6.20.1.

6.21 Minimum Rolled-In Amount Measurement

6.21.1 Preparation of Test Sample

Wash the both surfaces of coated panel(7) (70×150 mm, top coat is applied on the surface and back side of the coated panel) with isopropyl alcohol. Prepare a tape that is cut into 25 mm in width and 40 mm in length, then apply the tape onto the rolled-in portion in a room at 23±2 ℃ (Fig. 11). Press with the forefinger cushion at 30 N/cm^2 to apply the tape by moving the finger in one. Prepare test samples with rolled-in amounts (L) of 1.0 mm, 1.5 mm, 2.0 mm, 2.5 mm, and 3.0 mm.

Note (7): The actual door frame may be used.

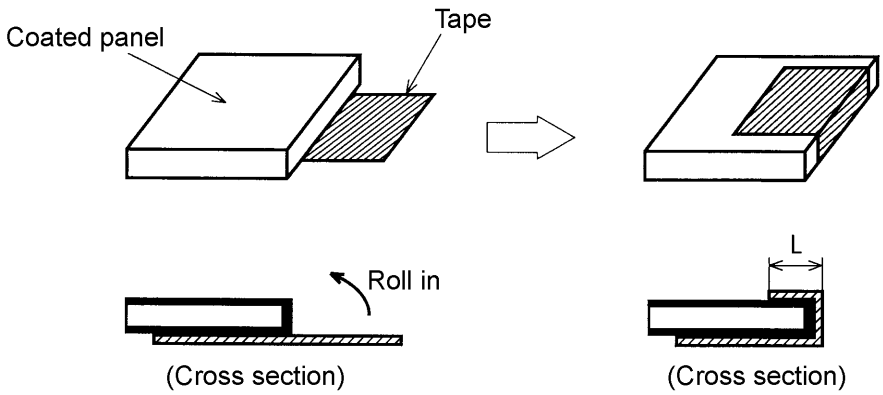

Fig. 11

6.21.2 Initial State Test

Leave the test sample prepared in accordance with Section 6.21.1 to stand at a room temperature for 1 h, and observe it to determine the rolled-in amount with no peeling and lifting in rolled-in and flat portions.

6.21.3 Heat Aging Test

Leave the test sample prepared in Section 6.21.1 to stand in a thermostat conditioned at 80±2 ℃ for 400 h and observe the rolled-in amount with no peeling and lifting of a tape.

6.21.4 After Hot Water Aging

Leave the test sample prepared in Section 6.21.1 to stand in a thermostat conditioned at 40±2 ℃ for 400 h and observe the rolled-in amount with no peeling and lifting of the tape.

6.21.5 Humidity and Terminal Cycle Aging Resistance Test

This test shall be conducted as specified in Section 6.11. After evaluation, observe the rolled-in amount with no peeling and lifting of the tape.

6.22 Staining by Contact Object

Conduct the test to check staining on the tape by the parts (glass run etc.) that contact the tape in the actual vehicle condition.

6.22.1 Preparation of Test Sample

Press the surface of the object that contacts the tape in the actual vehicle condition against the surface of the tape on the test sample prepared in accordance with Section 6.9.1, and fix it by using wire (Fig. 12), then use it as a test sample.

Remark: There are EPDM (Ethylene Propylene Diene Monomer) and TPO (Thermoplastic Olefin) as material of glass run.

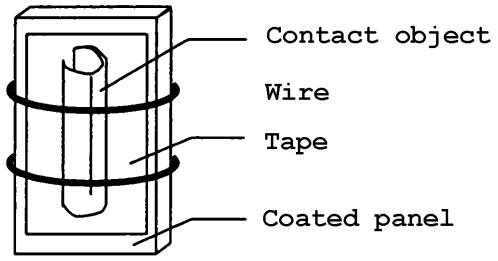

Fig. 12

6.22.2 After Heat Aging

Leave the test sample prepared in Section 6.22.1 in a thermostat conditioned at 80±2 ℃ for 400 h, and observe the rolled-in amount with no peeling and lifting of the tape.

6.22.3 After Hot Water Aging

Leave the test sample prepared in Section 6.22.1 in a thermostat conditioned at 40±2 ℃ for 400 h, and observe the rolled-in amount with no peeling and lifting of the tape.

6.22.4 After Accelerated Weather Resistance Test

Use a Xenon for the accelerated weather resistance test. If the Xenon is not available, it is possible to select SWOM.

(1) Xenon method A

Leave the test sample prepared in Section 6.22.1 to stand at a room temperature for 24 h. Set the test sample on the Xenon specified in Section 2.1 or 2.3 in TSH1585G, and conduct the1250 MJ evaluation with method A in Section 3.1, TSH1585G. After the evaluation, remove the contacting part and observe change in appearance on the surface of the tape.

(2) SWOM method A

Leave the test sample prepared in Section 6.22.1 to stand at a room temperature for 24 h. Conduct the evaluation for 1000 h in accordance with method A[(8)] in Section 3.1, TSH1582G. After the evaluation, remove the contacting part and observe change in appearance on the surface of the tape.

Note (8): Do not apply wax coating on the test sample for evaluation.

6.23 High Pressure Vehicle Washing

6.23.1 Preparation of Test Sample

Clean the surface of a 70×150 mm coated panel with isopropyl alcohol and apply the tape that has been cut into 25×50 mm to the coated panel to prepare a test sample.

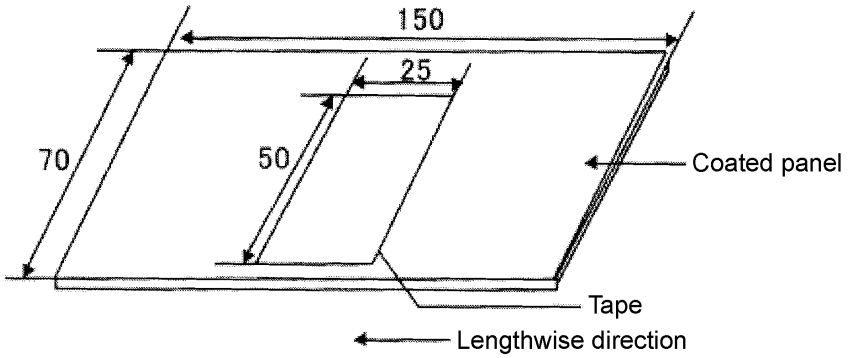

Fig. 13

6.23.2 Initial State

Leave the test sample prepared in Section 6.23.1 to stand at a room temperature for 1 h and conduct the high pressure vehicle washing as specified in Table 9, then check for peeling. Spray water aiming at the end of the 25 mm-wide tape.

6.23.3 Ordinary State

Leave the test sample prepared in Section 6.23.1 to stand at a room temperature for 168 h and conduct the high pressure vehicle washing as specified in Table 9, then check for peeling. Spray water aiming at the end of the 25 mm-wide tape.

6.23.4 After Heat Aging

Leave the test sample prepared in accordance with Section 6.23.1 to stand in a thermostat conditioned at 80±2 ℃ for 400 h and conduct the high pressure vehicle washing as specified in Table 9, then check for peeling. Spray water aiming at the end of the 25 mm-wide tape.

6.23.5 After Hot Water Aging

Leave the test sample prepared in Section 6.23.1 to stand in a thermostat conditioned at 40±2 ℃ for 400 h and conduct the high pressure vehicle washing as specified in Table 9, then check for peeling. Spray water aiming at the end of the 25 mm-wide tape.

Table 9 High Pressure Vehicle Washing Resistance Test Conditions

Item	Conditions
Water temperature (℃)	50±2
Water pressure at nozzle tip (MPa)	7
Spray duration (s)	30
Distance between nozzle tip and specimen (mm)	300
Angle between nozzle tip and specimen (°)	45

6.24 Tape on Tape Adhesion Strength

Conduct the tape on tape test to evaluate the adhesive property of the tape where multiple tapes are applied.

6.24.1 Preparation of Test Sample

Apply the tape to the test sample prepared in Section 6.9.1 and leave it to stand for 24 h. After that, apply the tape to it in the same manner as Section 6.7.1 to prepare a test sample.

6.24.2 Initial State

Leave the test sample prepared in Section 6.24.1 to stand at a room temperature for 1 h and measure peeling strength in accordance with Section 6.7.2.

6.24.3 Ordinary State

Leave the test sample prepared in Section 6.24.1 to stand at a room temperature for 168 h and measure peeling strength in accordance with Section 6.7.2.

6.24.4 After Heat Aging

Leave the test sample prepared in Section 6.24.1 to stand in the thermostat conditioned at 80±2 ℃ for 400 h and measure peeling strength in accordance with Section 6.7.2.

6.24.5 After Hot Water Aging

Leave the test sample prepared in Section 6.24.1 to stand in a thermostat conditioned at 40±2 ℃ for 400 h and measure peeling strength in accordance with Section 6.7.2.

6.24.6 High Pressure Vehicle Washing Resistance

Apply two tapes that have been cut into 25×50 mm to a 70×150 mm coated panel in such a manner that the ends of these tapes overlap (Fig. 14). Prepare 3 types of test samples with the overlap amount of 1 mm, 2 mm, and 3 mm respectively. Perform the initial state test, the ordinary state test, after heat aging test and after hot water aging test as in Section 6.24.2 to Section 6.24.5, and perform the high pressure vehicle washing resistance test under the conditions as specified in Table 10 to check for peeling. Spray water aiming at the overlapped end portion of the tapes. Report the test results as the minimum overlap amount without peeling.

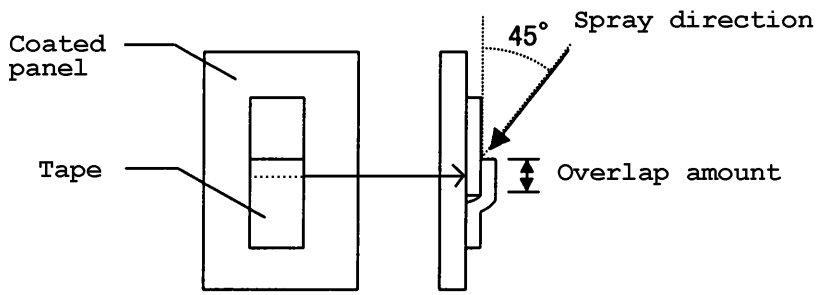

Fig. 14

6.25 Lap and Wrinkle Test

6.25.1 Preparation of Test Sample

As shown in Fig. 15, apply the tape that has been cut into 25×30 mm to a 30×50 mm coated panel whose surface has been cleaned with isopropyl alcohol. Leave the coated panel to stand (age) under the conditions specified in Section 6.25.2 to prepare a test sample.

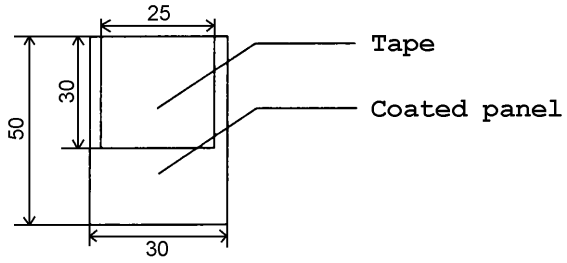

Fig. 15 (Unit: mm)

6.25.2 Tape Aging Conditions and Test Conditions

The tape aging conditions and the conditions to test each sample are as shown in Table 10.

Table 10 Lap and Wrinkle Test Conditions

Tape aging	Test load (N)	Surface primer(9)	Test temperature (℃)	Test duration (h)
Room temperature (23±2 ℃, 50±5 % RH), 3 h	Surface pressure at 40, shearing at 7.5	Yes	80	200
		No		24
	Surface pressure at 100, shearing at 10	Yes		200

Note (9): Apply the primer at a thickness of 1 to 10 μm and wait for 2 min. Then, apply the tape. (Report the coating thickness.) Use the surface primer manufactured by the same manufacturer of the tape.

6.25.3 Type of Coated Panel

In accordance with Section 6.7.3.

6.25.4 Test Procedure

Set the specimen prepared in Section 6.25.1 on the lap and wrinkle tester shown in Fig. 16, and start the test in accordance with the conditions specified in Section 6.25.2. After the test, check for any appearance change including lap and wrinkle (oblique wrinkle, lengthwise wrinkle), swelling, and peeling.

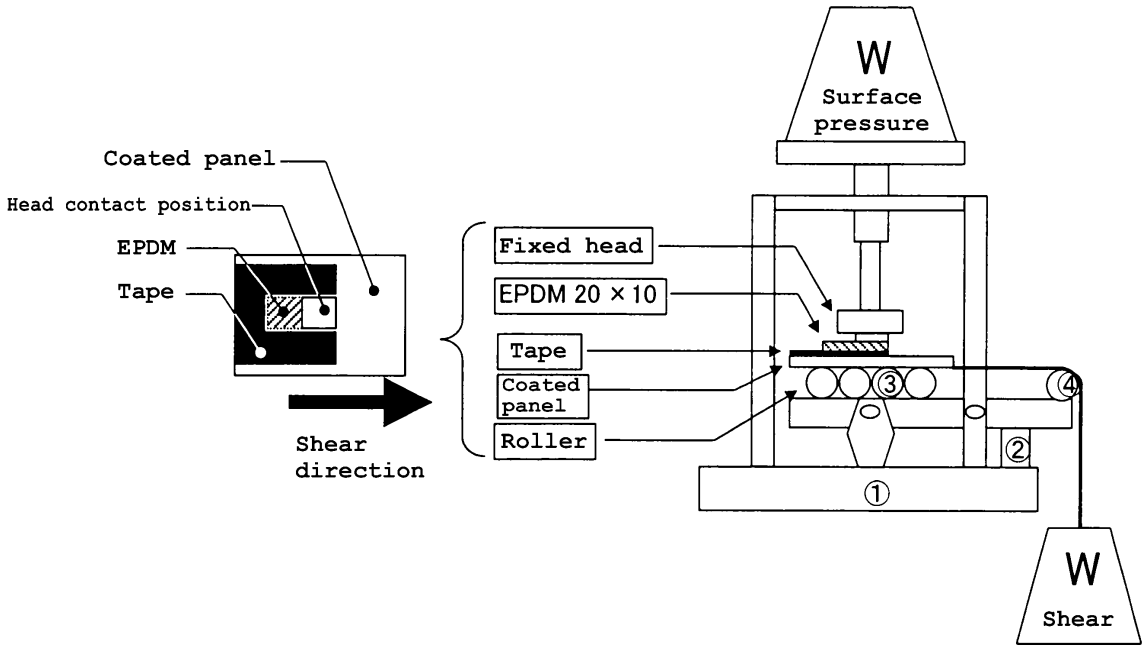

Fig. 16 Lap and Wrinkle Tester (Unit: mm)

Remark: ①: Tester body
②: Block for stage adjustment
③: Rollers (4)
④: Shear weight suspension block

6.26 Solid Content Measurement

Weigh out 3 to 5 g of the surface primer or sealer blocker into a lidded container of known mass (W_1), quickly put a lid on the container, and measure the mass (W_2) using a chemical balance. Then, remove the lid, and dry the container in the dryer conditioned at 105±2 ℃ for 30 min. After drying, leave the container to cool at a room temperature for 10 min. Then, put the lid, and measure the mass (W_3). Use the equation (4) to obtain the solid content.

$$\text{Solid content } (\%) = \frac{W_3 - W_1}{W_2 - W_1} \times 100 \quad \text{- - - - - - - - (4)}$$

where,
W_1: mass of lidded container (g)
W_2: mass of lidded container and sample before drying (g)
W_3: mass of lidded container and sample after drying (g)

6.27 Viscosity Measurement

Measure the viscosity of the surface primer and the sealer blocker in accordance with the viscosity measurement procedure specified in Section 2.3 in TSH1203G.

7. Tests for Items Applied to Door Panel

7.1 Preparation of Test Panel

Apply the tape, which has the shape as specified on the drawing, to the door panel that is equivalent to those used in the actual vehicle. The tape application method (tape temperature, tape end treatment, tape elongation, pressure application method, jig, with/without surface primer, and with/without sealer blocker, etc.) shall be those as used in the actual production process. Perform each test after leaving the test panel to stand at a room temperature for 24 h after the tape application.

7.2 Heat Resistance Test

Place the door panel to which the tape is applied in accordance with Section 7.1 in the thermostat conditioned at 80±2 ℃ for 400 h. After the test, leave the door panel to stand at a room temperature for 24 h, and check for appearance change including peeling, lifting, cracking, and discoloration.

7.3 Humidity Resistance Test

Place the door panel to which the tape is applied in accordance with Section 7.1 in the thermo-hygrostat conditioned at 50±2 ℃ and 50±5 % RH for 400 h. After the test, leave the door panel to stand at a room temperature for 24 h, and check for appearance change including peeling, lifting, cracking, and discoloration.

7.4 Humidity and Thermal Cycle Aging Resistance Test

Perform 3 cycles of the humidity and thermal cycle resistance test on the door panel to which the tape is applied in accordance with Section 7.1. One cycle consists of the test procedure shown in Table 7 in Section 6.11. Then, leave the test sample to stand at a room temperature for 24 h, and check for any change in appearance including peeling, lifting, cracking, and discoloration.

7.5 High Pressure Vehicle Washing Test

Perform the high pressure vehicle washing test after the tests specified in Sections 7.2 and 7.3, and check for peeling and lifting. The high pressure vehicle washing conditions are as shown in Table 9.

Applicable Standards

TSH1203G	Measurement method for viscosity of paint
TSH1508G	Test method for volatile solvent resistance of paint film
TSH1509G	Test method for chemical resistance of paint film
TSH1527G	Test methods for scratch resistance of paint films
TSH1530G	Test method for acid rain resistance of paint film
TSH1581G	Test methods for outdoor weather resistance of paint film
TSH1582G	Carbon arc lamp type test methods for accelerated weathering resistance of paint film
TSH1583G	Test method for metal halide lamp accelerated weather resistance of paint film
TSH1585G	Xenon-arc lamp type test methods for accelerated weathering resistance of paint film