

JIS

JAPANESE INDUSTRIAL STANDARD

**Testing methods for adhesives
for automobiles**

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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Testing methods for adhesives for automobiles

K 6829-1994

1. Scope This Japanese Industrial Standard specifies general testing methods of the adhesives (hereafter referred to as "adhesives") to be used for automobiles.

Remarks: The standards cited in this Standard are listed in Attached Table 1.

2. Definitions For the main terms used in this Standard the definitions in JIS K 6800 and JIS K 6900 apply, and the rest of the terms are as follows:

- (1) adhesives for constructive material Adhesives used at the joining place of a body frame, such as roof rail or pillar, and having high adhesive strength (adhesives with load-transmitting function).
- (2) adhesives for sub-constructive material Adhesives used for joining boards for reinforcing such as hood, trunk lid, or door panel, and having moderate strength.
- (3) adhesives for non-constructive material Adhesives used for joining such as plastics or rubber products in interior and exterior, and satisfying the practical conditions required by applied place.

3. Type of tests Types and items of tests shall be as follows:

- (1) Tests for general properties
 - (a) Density
 - (b) Non-volatile matter
 - (c) Viscosity
 - (d) Consistency
 - (e) pH
 - (f) Working life
 - (g) Storage stability
- (2) Test for workability
 - (a) Fluidity
 - (b) Oil-surface fixability

(3) Tests for basic characteristics

- (a) Tensile characteristics
- (b) Adhesive strength
- (c) Hardness
- (d) Softening temperature
- (e) Tack range
- (f) Low-temperature adhesive strength
- (g) High-temperature adhesive strength
- (h) Thermal aging-resisting adhesive strength
- (i) Moisture-resisting adhesive strength
- (j) Solution-resisting adhesive strength
- (k) Water-resisting adhesive strength
- (l) Salt spraying-resisting adhesive strength
- (m) Thermal-repeating adhesive strength
- (n) Volume change
- (o) Water absorption
- (p) Oil-surface adhesiveness
- (q) Staining
- (r) Over baking

4. General condition for test

4.1 Standard condition for test Temperature and humidity shall principally be the standard temperature condition grade 2 ($23 \pm 2^{\circ}\text{C}$) and standard humidity condition grade 2 [relative humidity (50 ± 5) %] specified in JIS K 7100.

When there is an agreement between the parties concerned, the standard temperature condition grade 5 ($20 \pm 5^{\circ}\text{C}$) and standard humidity condition grade 20 [relative humidity (65 ± 20) %] specified in JIS Z 8703 may be applied. In this case, the temperature and humidity which was adopted shall be recorded on the test result.

4.2 Sampling and handling of sample Follow the prescription in 5. of JIS K 6833.

4.3 Conditioning of sample and test-piece material Unless there is a special prescription in test item, the sample and test-piece material shall principally be those which have passed for 12 h or more after preparation and been stood under the conditions shown in 4.1 for one hour or more prior to test.

4.4 Kind of test-piece materials and surface treatment The kind of test-piece materials and surface treatment shall be as shown in Table 1. If there is an agreement between the parties concerned, follow it.

4.5 Coating method and spread amount of sample It shall be appropriate coating method and spread of sample depending on the type and shape of adhesives.

4.6 Test condition, number of test pieces, and rounding off of numerical value The test condition for each test item and the number of test pieces used in the same test item shall follow Table 4, and test results shall be rounded off to get the number of figures shown in Table 4 according to JIS Z 8401.

Table 1. Kind of test-piece materials and surface treatment

Kind of test-piece materials	Quality of material	Surface treatment
Steel plate	SPCCT-SD specified in JIS G 3141, cold-rolled steel plate measuring 0.8 mm or 1.6 mm in thickness.	1. Degrease with solvent ⁽¹⁾ , either polish with No. 240 abrasive paper specified in JIS R 6252 or sand-blast with No. 240 abrasive, and wash with solvent ⁽¹⁾ . Otherwise, degrease with only solvent ⁽¹⁾ . 2. Oil surface shall follow the agreement between the parties concerned.
Steel products	Rolled steel for general construction specified in JIS G 3101.	
Surface-treated steel plate	Depend on the agreement between the parties concerned.	
Aluminum plate	Al050P specified in JIS H 4000, aluminum plate measuring 2 mm in thickness.	
Aluminum-alloy plate	5000 series or 6000 series specified in JIS H 4000, aluminum-alloy plate measuring 2 mm in thickness.	
Coated steel plate	Depend on the agreement between the parties concerned.	
Glass plate	Float glass plate with 5 mm in thickness specified in JIS R 3202.	Clean the surface to be adhered with cotton cloth moistened with methanol or alcohol for industrial use, and dry it with the surface to be adhered upward until the odor of solvent disappears from the surface.

Table 1. (continued)

Kind of test-piece materials	Quality of material	Surface treatment
Vulcanized rubber ⁽²⁾	With 1.5 mm or 5.0 mm in thickness.	Clean the surface with solvent ⁽³⁾ .
Cotton canvas	Standard cotton canvas 1209 specified in JIS L 3102.	Principally, no surface treatment shall be carried out.
Polyvinyl-chloride coated fabric	Type 2 specified in JIS K 6772, polyvinylchloride coated fabric measuring 0.4 mm in thickness.	-
Foam plastics	Depend on the agreement between the parties concerned.	
Plastics	Depend on the agreement between the parties concerned.	
GFRP plate	GM-10 flat plate molded with sheet molding compound specified in JIS K 7011, measuring 3 mm in thickness.	Depend on the agreement between the parties concerned.
Hard fiberboards	Hard fiberboards with 5 mm in thickness specified in JIS A 5907.	Principally, no surface treatment shall be carried out.

Notes ⁽¹⁾ Employ trichloroethylene specified in JIS K 1508 as solvent.
Other suitable solvents are also serviceable.

⁽²⁾ Vulcanized rubber to be used shall principally be as shown in Table 2 and Table 3.

⁽³⁾ When making clean with solvent, employ toluene specified in JIS K 8680.

Remarks: The kind, quality of material, and surface treatment of surface-treated steel plate, aluminum-alloy plate, coated steel plate, vulcanized rubber, foam plastics, and plastics, shall follow the agreement between the parties concerned.

Table 2. SBR vulcanized rubber

Ingredients	Mass ratio	Remarks
SBR ⁽⁴⁾	100.0	
Zinc oxide	5.0	Specified in JIS K 1410.
Sulphur	2.0	Specified in JIS K 6222.
Stearic acid	1.5	Specified in JIS K 3331.
Dibenzothiazol disulfide	3.0	Specified in MBTS of JIS K 6202.
SRF carbon black	40.0	

Note ⁽⁴⁾ SBR stands for styrene-butadiene rubber.

Remarks: Vulcanization condition: $155 \pm 1.5^{\circ}\text{C}$, 15 min

Table 3. EPDM vulcanized rubber

Ingredients	Mass ratio	Remarks
EPDM ⁽⁵⁾	100.0	
Zinc oxide	5.0	Specified in JIS K 1410.
Sulphur	1.5	Specified in JIS K 6222.
Stearic acid	1.0	Specified in JIS K 3331.
HAF carbon black	80.0	
Process oil	50.0	
Tetramethylthiuram disulfide	1.0	Specified in TMTD of JIS K 6202.
2-mercaptobenzothiazol	0.5	Specified in MBT of JIS K 6202.

Note ⁽⁵⁾ EPDM stands for ethylene-propylene-dienmonomer.

Remarks: Vulcanization condition: $160 \pm 1.5^{\circ}\text{C}$, 15 min

Table 4. Main test items and test condition

Test item	Evaluation item	Test condition or test method	Type of adhesives			Unit	Rounding off of value	Frequency of measurements or number of test pieces	Applicable clause
			For non-constructive material	For sub-constructive material	For constructive material				
Density	Density	Specific-gravity cup method	○	○	○	g/cm ³	Two decimal places	3 times	5.
		In-water substitution method	○	-	-	g/cm ³	Two decimal places	3 test pieces	
Non-volatile matter	Non-volatile matter	105 ± 5°C, 180 ± 5 min	○	○	○	%	3 significant figures	2 times or more	6.
Viscosity	Solution viscosity	Single-cylinder rotational viscometer method A	○	○	○	mPa·s or Pa·s	2 significant figures	2 times or more	7.
		Pressure viscometer method B	-	○	○			Once	
	Fusion viscosity	Single-cylinder rotational viscometer 180 ± 1°C	○	-	-			3 test pieces	
Consistency	Penetration	Penetrator	-	○	-	-	Integral number	3 test pieces	8.
pH	pH	pH meter	○	-	-	-	One decimal place	3 times	9.

Table 4. (continued)

Test item	Evaluation item	Test condition or test method	Type of adhesives			Unit	Rounding off of value	Frequency of measurements or number of test pieces	Applicable clause
			For non-constructive material	For sub-constructive material	For constructive material				
Working life	Storage stability	50 g	○	○	○	min			10.
		50 ± 2°C, approx. 20 h	○	○	-	-	-	-	11.
		40 ± 2°C, approx. 20 h	-	-	○				
	Viscosity changing rate	Single-cylinder rotational viscometer	○	-	-	%	2 significant figures	2 times or more	
		Pressure viscometer	-	○	○				
	Adhesive-strength changing rate	180° peeling	○	-	-	%	2 significant figures	2 times or more	
		T-type peeling	-	○	-				
Fluidity	Length of flowing	Tensile shearing	-	-	○				
		45° or 90° of angle, at 23°C or after heating	-	○	○	mm	Integral number	3 test pieces	12.

Table 4. (continued)

Test item	Evaluation item	Test condition or test method	Type of adhesives			Unit	Rounding off of value	Frequency of measurements or number of test pieces	Applicable clause
			For non-constructive material	For sub-constructive material	For constructive material				
Oil-surface fixability	Existence of fixation	Quantity of oil 50 g/m ² , after 3 min, hold vertically 10 s	-	○	○	-	-	3 test pieces	13.
Tensile characteristics	Strength, elongation when breaking	Dumbbell shape pattern 2 punched	-	○	-	MPa %	One decimal place	3 test pieces	14.
Tensile adhesive strength	Tensile adhesive strength	Travelling speed of cross head 50 mm/min	○	○	○	MPa	Integral number	5 test pieces or more	15.
Tensile shearing adhesive strength	Tensile shearing adhesive strength	Travelling speed of cross head 50 mm/min	○	○	○	MPa	Integral number	5 test pieces or more	16.
Peeling adhesive strength	180°-peeling adhesive strength	Travelling speed of cross head 200 mm/min	○	-	-	kN/m	3 significant figures	5 test pieces or more	17.
	T-type peeling adhesive strength	Travelling speed of cross head 100 mm/min	-	○	○	kN/m	3 significant figures	5 test pieces or more	
Impact adhesive strength	Impact adhesive strength	Metal test piece, impact speed 3.5 m/s	-	-	○	J/cm ²	3 significant figures	5 test pieces or more	18.

Table 4. (continued)

Test item	Evaluation item	Test condition or test method	Type of adhesives			Unit	Rounding off of value	Frequency of measurements or number of test pieces	Applicable clause
			For non-constructive material	For sub-constructive material	For constructive material				
Hardness	Hardness	Spring-type hardness tester	-	○	-	-	Integral number	5 points per test piece	19.
Softening temperature	Temperature of dead-weight dropping	Mass of weight 500 ± 1 g, temperature raising rate approx. $2^{\circ}\text{C}/5$ min	○	-	-	$^{\circ}\text{C}$	Integral number	3 test pieces	20.
Tack range	180° -peeling adhesive strength	Standing period, 1, 3, 5, 10, 20, 40, 60, 80, 100 min	○	-	-	kN/m	3 significant figures	5 test pieces	21.
Low-temperature adhesive strength	180° -peeling adhesive strength	Holding time 48 h and 168 h, measuring at $-30 \pm 3^{\circ}\text{C}$	○	-	-	kN/m	3 significant figures	5 test pieces or more	22.
	T-type peeling adhesive strength	After hardening, measuring at $-30 \pm 3^{\circ}\text{C}$	-	○	○	kN/m	3 significant figures	5 test pieces or more	
	Tensile shearing adhesive strength	After hardening, measuring at $-30 \pm 3^{\circ}\text{C}$	-	○	○	MPa	Integral number	5 test pieces or more	

Table 4. (continued)

Test item	Evaluation item	Test condition or test method	Type of adhesives			Unit	Rounding off of value	Frequency of measurements or number of test pieces	Applicable clause
			For non-constructive material	For sub-constructive material	For constructive material				
High temperature adhesive strength	180°-peeling adhesive strength	Holding time 48 h and 168 h, measuring at $80 \pm 2^\circ\text{C}$	○	-	-	kN/m	3 significant figures	5 test pieces or more	23.
	T-type peeling adhesive strength	After hardening, measuring at $80 \pm 2^\circ\text{C}$	-	○	○	kN/m	3 significant figures	5 test pieces or more	
	Tensile shearing adhesive strength	After hardening, measuring at $80 \pm 2^\circ\text{C}$	-	○	○	MPa	Integral number	5 test pieces or more	
	180°-peeling adhesive strength	$80 \pm 2^\circ\text{C}$, 168 h	○	-	-	kN/m	3 significant figures	5 test pieces or more	
Thermal aging-resisting adhesive strength	T-type peeling adhesive strength	$80 \pm 2^\circ\text{C}$, 168 h, 720 h	-	○	○	kN/m	3 significant figures	5 test pieces or more	24.
	Tensile shearing adhesive strength	$80 \pm 2^\circ\text{C}$, 168 h, 720 h	-	○	○	MPa	Integral number	5 test pieces or more	