

JIS

JAPANESE INDUSTRIAL STANDARD

**Test Method of Weatherability
for Automotive Parts**

JIS D 0205—1987

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J I S

Test Method of Weatherability for
Automotive PartsD 0205-1987
(Reaffirmed: 1992)1. Scope

This Japanese Industrial Standard specifies the test methods for weatherability of automobile parts, hereinafter referred to as the "parts" made from plastics, synthetic leathers, textiles, vulcanized rubbers, etc. and of automotive parts processed with surface treatment of which weatherability is liable to deterioration.

- Remarks
1. The types of parts to which this Standard applies are as agreed between the parties concerned with acceptance.
 2. The units and numerical values given in { } in this Standard are based on the traditional unit system and are appended for informative reference.

2. Definitions

The meanings of the main terms used in this Standard shall be as defined below:

- (1) weatherability Resistivity against deteriorations mainly due, among the natural environments, to sunlight, rain and snow, temperature, humidity and ozone.
- (2) light resistance Resistivity, among the weatherabilities, against deteriorations due to sunlight, temperature and humidity.
- (3) ozone resistance Resistivity, among the weatherabilities, against cracking of rubber due to ozone.
- (4) outdoor exposure test The test in which weatherability, light resistance and ozone resistance are to be investigated under natural environmental conditions.
- (5) accelerated test The test in which weatherability, light resistance and ozone resistance are to be investigated under the conditions approximate to natural environments and capable of being accelerated.
- (6) migrating stain A property of discoloration of the outer surfaces of painted films, exterior parts, synthetic leathers, plastics and others caused by rubber parts, adhesives, plastics and others which are used in contact with these.
- (7) synthetic leather Generic term for surfacing materials, such as vinyl chloride leather and vinyl chloride sheet, having appearance and functions approximate to those of natural leathers.

Applicable Standards and Reference Standards: See pages 25 and 26.



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3. Types of Test

The types of tests shall be classified into the outdoor exposure test and the accelerated test, according to apparatus used and conditions, as given in Table 1.

Furthermore, these tests shall be applied as given in Table 2, according to the classification of service environments.

Table 1

Classification		Type of test	Symbol
Outdoor exposure test (WO)	Outdoor weatherability test (WON)	Direct exposure test	WON-S
		Black box exposure test	WON-H
	Outdoor light resistance test (WOL)	Under-glass exposure test	WOL-S
		Under-glass black box exposure test	WOL-H
	Outdoor ozone resistance test		WOS
Accelerated test (WA)	Accelerated weatherability test (WAN)	Sunshine carbon arc lamp weatherability test	WAN-1 S
			WAN-1 H
	Accelerated light resistance test (WAL)	Sunshine carbon arc lamp light resistance test	WAL-1 S
			WAL-1 H
		Ultraviolet rays carbon arc lamp light resistance test	WAL-2 S
			WAL-2 H
	Accelerated ozone resistance test		WAO

Informative Reference: Regarding the other test methods, refer to Informative Reference 1, Weatherability Test and Light Resistance Test

Table 2

Classification of service environment		Type of test to be applied		
		Outdoor exposure test	Accelerated test	
Environment in which parts are directly exposed to light	Standard	WON-S	WAN-1 S	Outside the vehicle
	High temperature	WON-H	WAN-1 H	
Environment in which parts are exposed to the light transmitted through glass	Standard	WOL-S	WAL-1 S WAL-2 S	Inside the vehicle
	High temperature	WOL-H	WAL-1 H WAL-2 H	
Environment in which parts are not exposed to light, but are subjected to influence of light		WOS	WAO	In engine room and the like

4. Test Units

The test units shall be as follows:

- (1) The test units shall generally be the parts.
- (2) In the case where circumstances are not favorable to the tests, test pieces given in Table 3 may be used. However, where these are to be cut out from the parts, their thicknesses shall be the same as those of the parts.
- (3) The number of units to be tested at one time should preferably be 3 pieces or over.
- (4) In case comparison before and after testing is required for the periodical observation and the measurement after the testing, one piece or more of parts taken from the same lot as the test part shall be set aside as preserved samples.

Table 3

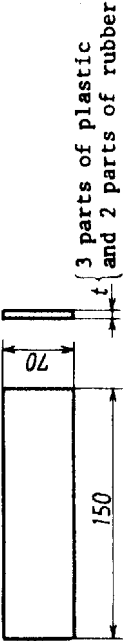
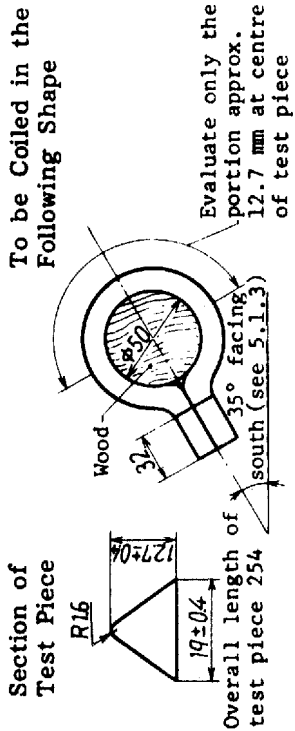
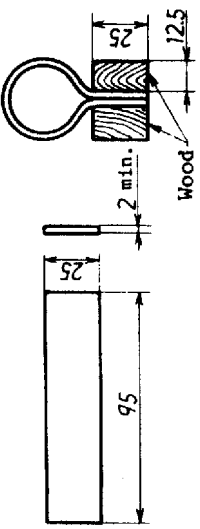
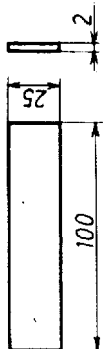
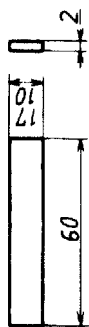
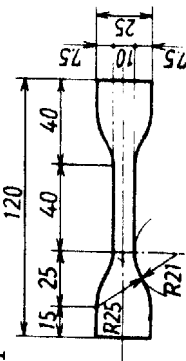
Material and surface treatment applied to parts	Type of test	Symbol of test piece	Shape and dimensions of test piece
Plastic Synthetic leather Textile Vulcanized rubber Surface treatment	WON WOL WAL WAN	a	
Vulcanized rubber	WOS WAO	b	Section of Test Piece 
		c	To be Attached in the Following Shape 
		d	

Table 3. (continued)

Material and surface treatment applied to parts	Type of test	Symbol of test piece	Shape and dimensions of test piece
Vulcanized rubber	WOS WAO	e	
		f	

Remarks 1. For investigating the migrating stain, materials to be evaluated shall be used in combination.

2. In the case where a test piece of plastics processed with adhesives or a blowing agent is to be used, its end rim portions and back faces should be provided, as needed, with durable covers of paint or with other coating films which are not harmful to the test piece.

3. Parts with optional application (for example lamp lenses) should be provided with coverings for keeping off dust on the reverse of the surface to be tested. The covering method shall be as agreed between the parties concerned with acceptance. However, this shall exclude the case of a test piece of "a".

5. Tests

5.1 Outdoor Weatherability Test

5.1.1 Environment of Test Location The environment of the test location for installing a test equipment shall be a well ventilated place with environmental conditions suited for a weatherability test on the test parts, and its surroundings shall also be free from trees, buildings and installations which will adversely affect the conditions of exposure of the test parts.

Remark: The annual mean temperature of the test location should preferably be 14°C or over.

5.1.2 Test Apparatus The test apparatus shall be as follows:

- (1) Respective members and hardware of the frame of the test apparatus shall be processed with appropriate anticorrosive treatment.
- (2) In the test apparatus, an integrating actinometer for measuring the quantity of solar radiation shall be installed in accordance with the following:
 - (a) An integrating actinometer which is capable of measuring the total radiant energy of sunlight shall be employed.
 - (b) The light receiving surface of the integrating actinometer shall be the same angle with the mounting surface of test parts.
 - (c) Dust adhering to the light accepting surface of the integrating actinometer shall generally be removed appropriately at a rate of once per day.
- (3) As mounting tools of the test parts, insulators, stopping pins made of plastic and the like shall generally be used.
- (4) The construction of the test apparatus shall be as follows:
 - (a) In the case of WON-S (direct exposure test), the test apparatus shall be a direct exposing apparatus specified in JIS Z 2381. A tentative example of the apparatus is given in Attached Fig. 1.
 - (b) In the case of WON-H (black box exposure test), use a box of which the inside temperature is adjustable and of which the upper part, being black-colour processed in inside and outside surfaces, serves as the mounting surface.

A box without an inside temperature adjusting device (the black box exposing apparatus specified in JIS Z 2381) may also be used. However, in that case it shall be provided with a black-panel thermometer. A tentative examples of the apparatus is given in Attached Fig. 2.

5.1.3 Test Method The test method shall be as follows:

- (1) Mount the test specimen on the test apparatus, and carry out testing under the following conditions:
 - (a) Make the exposing surfaces of the test parts face correctly south, allow it to slope at an angle of approximately 35 deg in respect to horizontal, and adjust the height of the test apparatus so that it becomes at least 50 cm or over from the installment or from the ground surface. However, the angle and height may be altered as agreed between the parties concerned.
 - (b) Any backing plate shall not be used in general. However, one may be allowed depending on the type or property of the part.
 - (c) Mount the test parts giving ample allowance for possible deformation. However, in the case where any particular stress is to be applied, this rule does not apply.
 - (d) In mounting or dismounting the test parts, caution should be exercised not to give injurious influence to the test parts.
 - (e) In the case of WON-H, place a test piece on the mounting surface closely to leave no space between them.
- (2) Protect the test parts from typhoon and flying agricultural chemicals and the like, and remove dust as required by way of maintenance.
- (3) After test parts have been exposed for a prescribed period, carry out measurements given in 7. to judge the degree of deterioration.

Remark: It should be preferable to arrange the exposing period between the spring and the summer.

5.2 Outdoor Light Resistance Test

5.2.1 Environment of Test Location The environment of the test location shall be as specified in 5.1.1.

5.2.2 Test Apparatus The test apparatus shall be as follows:

- (1) Appropriate anticorrosive treatment shall be processed on all members of the frame and hardware of the apparatus.
- (2) In the test apparatus, an integrating actinometer for measuring quantity of solar radiation shall generally be installed in accordance with the following:
 - (a) An integrating actinometer which is capable of measuring the total radiant energy of sunlight shall be used.

- (b) The light receiving surface of the integrating actinometer shall be the same angle with the mounting surface of the test parts.
- (c) The bottom surface of the glass surface of an integrating actinometer should preferably be utilized in measurements.
- (3) As the mounting tools of the test parts, insulators, stopping pins made of plastic and the like shall generally be used.
- (4) The construction of the test apparatus shall be in accordance with the following:
 - (a) In the case of WOL-S (Underglass exposure test), an underglass exposing apparatus of the natural ventilation type or forced ventilation type specified in JIS Z 2381 shall be used for the test. Both of them shall structurally be so well ventilated as to prevent temperature rise. Examples of respective apparatus are given in Attached Figs. 3 and 4.

Furthermore, the distance between the upper surface of the test part and the glass plate shall be 5 cm or over.

- (b) In the case of WOL-H (Underglass black box exposure test), a testing apparatus shall be a hermetically sealed box; the inside temperature shall be adjustable; both inside and outside surfaces are chromatically rendered black; the upper portion is covered with 3 mm polished plate glass specified in JIS R 3202; and the test parts shall be placed under the surface of the glass.

Furthermore, a box without inside temperature adjusting device (underglass exposure test apparatus, enclosed type specified in JIS Z 2381) may also be used. In this case, however, it shall be equipped with a black panel thermometer. A tentative example of the apparatus is given in Attached Fig. 5.

5.2.3 Test Method The test method shall be in accordance with 5.1.3. However, the item "e" shall be excluded.

- Remarks
1. Remove the adhering dust from the glass surface.
 2. Replace the glass, in general, once every 2 years.
 3. Exposure should preferably be started in the period between the spring and the summer.

5.3 Outdoor Ozone Resistance Test

5.3.1 Environment of Test Site The environment of the test site shall be in accordance with 5.1.1.

Remark: The mean ozone density of the test site should preferably be 1 to 2 pphm.

5.3.2 Test Apparatus A test apparatus shall be structurally provided with a shading roof or cover so arranged as to ward off the direct rays of the sun. A tentative example of the apparatus is given in Attached Fig. 6.

5.3.3 Test Method The test method shall be in accordance with the following:

- (1) Mount the test parts on the test apparatus, and carry out testing in accordance with the following conditions:
 - (a) Suspend the test parts from the upper part of apparatus so that the distance between the floor surface or the ground on which the test apparatus is installed and the lower ends of the test parts is 50 cm or over. However, it may be altered as agreed between the parties concerned.
 - (b) Unless otherwise specified, give an elongation of 20 % to parts and test pieces of "d", "e" and "f", in general.
- (2) Protect the test specimens from typhoon and flying agricultural chemicals and others, and remove dust, as required, by way of maintenance.
- (3) After exposing the parts for the prescribed period, carry out the measurements given in 7. and judge the degree of deteriorations.

5.4 Accelerated Weatherability Test

5.4.1 Conditions of Test Location A test site shall generally be placed under the standard temperature condition of 20°C grade 15 (20 ± 15°C) in accordance with JIS Z 8703.

5.4.2 Test Apparatus The test apparatus used shall be ones specified in JIS B 7753.

5.4.3 Test Method The test method shall be in accordance with the following:

- (1) Mount the test parts on the test apparatus, and carry out the tests in accordance with the conditions given in Table 4.
- (2) Carbons, glass filters and safety devices for electric discharge shall fit the test apparatus and be capable of correctly maintaining the performances of the test apparatus.

Table 4

Type of test		WAN-1 S (H)
Item of test condition	Type of test apparatus	Sunshine carbon arc system weatherability tester
	Construction of apparatus	See Reference Fig. 3 of JIS B 7753
Shape of arc lamp		Open system
Number of lamps		1
Carbon electrodes	Upper electrode mm	Copper coated sunshine carbon Approx. $\phi 36 \times 350$ Approx. $\phi 23 \times 305$
	Lower electrode mm	Copper coated sunshine carbon Approx. $\phi 23 \times 350$ Approx. $\phi 13 \times 305$
Continuous lightable hours h		60 or over 22 or over
Discharge voltage V	Range	48 to 52
	Central value	50 ($\pm 2\%$)
Discharge current A	Range	58 to 62
	Central value	60 ($\pm 2\%$)
Glass filter	Shape	Panel type
	Spectral transmission factor % (before use)	250 nm: 1 or under 302 nm: 68 or over 375 to 700 nm: 90 or over
	Limit hours for service h	2000
Relative spectral energy distribution		In accordance with Attached Fig. 7
Sample surface irradiance W/m^2 [wavelength range 300 to 700 nm]		255 ($\pm 10\%$)
Test radiant energy (kJ/m^2) [wavelength range 300 to 700 nm]		As agreed between the parties concerned
Black panel thermometer	Controlled temperature	63 $\pm$ 3 or 83 $\pm$ 3
	Dimensions	See Attached Fig. 2 of JIS B 7753
	Specification	The sensor of bimetal dial type thermometer (1°C scale, 3.5 mm in sensor diameter) closely attached to a stainless sheet (SUS 304) of 1 mm x 150 mm x 70 mm and processed with lightproof black enamel. Prepare a pair of black panel thermometers, one is for measurements to be used in the test, and the other is to be preserved for calibration. In a calibration, make two of them face towards a light source in parallel. When respective indicated temperatures have been read out, the indication for the measurement thermometer shall be within $\pm 2^\circ C$ of that of the correction one.
Humidity %		50 $\pm$ 5
Rotating frame of sample	Distance between the centre of arc and sample surface mm	477 to 483
	Diameter mm	960 $\pm$ 6
	Number of rotations (rpm)	Approx. 1

Table 4. (continued)

Type of test		WAN-1 S (H)
Type of test apparatus		Sunshine carbon arc system weatherability tester
Item of test condition		
Relations between arc lamp, sample frame and sample spray		See Reference Fig. 1 of JIS B 7753
Dimensions of nozzle		See Reference Fig. 2 of JIS B 7753
Spraying conditions of water	Pressure (MPa {kgf/cm ² })	0.08 to 0.13 {0.8 to 1.3}
	Quantity of water ml/min	2100 ± 100
	Spraying time	12 min during radiation for 60 min
	Quality of water	pH 5.8 to 8.6, 200 to 250 µS/cm or under
	Temperature of water	16 ± 5
Operating condition		Continuous radiation
Conditions in test tank		(1) In adjusting the temperature in the tank, care shall be taken so that the test parts in the tank are not directly exposed to the open air of 15°C or lower. (2) An apparatus shall be appended for warding off the influences of excessive heat generated in electric discharge and the harmful gases like ozone.
Mounting method of test parts		(1) The test parts shall be mounted so that they will not come in touch with each other. Furthermore, any test part having staining property shall not be tested together with other test parts. (2) The test parts shall generally be made to change place top and bottom at every replacement of carbons.

5.5 Accelerated Light Resistance Test

5.5.1 Conditions of Test Site The conditions of the test site shall be in accordance with 5.4.1.

5.5.2 Test Apparatus The test apparatus used shall be as specified in JIS B 7753 or JIS B 7751.

5.5.3 Test Method Mount the test parts on the test apparatus, and carry out the test under the conditions given in Table 5. Regarding the maintenance control, refer to (2) of 5.4.3. Select the test method, as agreed between the parties concerned.

Table 5

Type of test		WAL-1 S (H)		WAL-2 S (H)	
Item of test condition	Type of test apparatus	Sunshine carbon arc lamp system light resistance tester		Ultraviolet rays carbon arc lamp system light resistance tester	
	Construction of apparatus	See Reference Fig. 3 of JIS B 7753		See Reference Fig. 2 (intermittant blast system) or Reference Fig. 3 (continuous blast system) of JIS B 7751	
Shape of arc lamp		Open type		Enclosed type	
Number of lamps		1		1	
Carbon electrodes	Upper electrode mm	Copper coated sunshine carbon Approx. $\phi 36 \times 350$ Approx. $\phi 23 \times 305$		Cored carbon Approx. $\phi 23 \times 115$	Cored or coreless carbon Approx. $\phi 13 \times 305$
	Lower electrode mm	Copper coated sunshine carbon Approx. $\phi 23 \times 350$ Approx. $\phi 13 \times 305$		Coreless carbon Approx. $\phi 18.5 \times 105$	Coreless or cored carbon Approx. $\phi 13 \times 100$
Continuous dischargeable hours h		60 or over	22 or over	48 or over	24 or over
Discharge voltage V	Range	48 to 52		125 to 145	
	Central value	50 ($\pm 2\%$)		135 ($\pm 2\%$)	
Discharge current A	Range	58 to 62		15 to 17	
	Central value	60 ($\pm 2\%$)		16 ($\pm 2\%$)	
Glass filter	Type	Panel type		Globe type	
	Spectral transmittance factor % (before use)	250 nm: 1 or under 302 nm: 68 or under 375 to 700 nm: 90 or under		275 nm: 2 or under 400 to 700 nm: 90 or over	
	Service limit hours h	2000			
Relative spectral energy distribution		In accordance with Attached Fig. 7		In accordance with Attached Fig. 8	
Sample surface irradiance W/m^2 [wavelength range 300 to 700 nm]		255 ($\pm 10\%$)		500 ($\pm 10\%$)	
Test radiant energy kJ/m^2 [wavelength range 300 to 700 nm]		As agreed between the parties concerned			
Black panel thermometer	Controlled temperature	63 $\pm$ 3 or 83 $\pm$ 3			
	Dimensions	See Attached Fig. 2 of JIS B 7753		See Attached Fig. 3 of JIS B 7753	
	Specification	The sensor of bimetal dial type thermometer (1°C scale, 3.5 mm in sensor diameter) closely attached to a stainless sheet (SUS 304) of 1 mm x 150 mm x 70 mm and processed with light-proof black enamel. Prepare a pair of black panel thermometers, one is for measurements to be used in the test, and the other is to be preserved for calibration. In a calibration, make two of them face towards a light source in parallel. When respective indicated temperatures have been read out, the indication for the measurement thermometer shall be within $\pm 2^\circ C$ of that of the correction one.			

Table 5. (continued)

Type of test		WAL-1 S (H)	WAL-2 S (H)
Item of test condition	Type of test apparatus	Sunshine carbon arc lamp system light resistance tester	Ultraviolet rays carbon arc lamp system light resistance tester
Humidity %		50 ± 5	50 ± 5 (For one with humidity control device)
Rotating frame of sample	Distance between the centre of arc and sample surface mm	477 to 482	251 to 257
	Diameter mm	960 ± 6	508 ± 6
	Operation	Stop the sample spray circuit	—
	No. of rotation rpm	Approx. 1	Approx. 3
Relations between arc lamp, sample rotating frame and sample spray		See Reference Fig. 1 of JIS B 7753	See Reference Fig. 1 of JIS B 7751
Operating conditions		Continuous radiation	
Conditions in test tank		(1) In adjusting the temperature in the tank, caution shall be used not to directly expose the test parts in the tank to the open air of 15°C or under. (2) For the closed-circulation blowing type, an apparatus shall be attached for preventing the influence of excessive heat and harmful gases such as ozone and the like generated in electric discharge. (3) Shall be so constructed that the sample is protected from waterdrops.	
Mounting method of test parts		1. The test parts shall be mounted so as not to get in touch with each other. Furthermore, any test part with staining property shall not be tested together with other test parts. 2. The test parts shall generally be made to change places top and bottom at each replacement of carbons.	

5.6 Accelerated Ozone Resistance Test

5.6.1 Conditions of Test Location The conditions of the test site shall be in accordance with 5.4.1.

5.6.2 Test Apparatus The test apparatus specified in 16. of JIS K 6301 shall be used.

5.6.3 Test Method The test shall be carried out in accordance with the method given in JIS K 6301 under the conditions given in Table 6.