

Nissan Engineering Standard

N E S	Weatherability and Light Resistance Test Methods for Synthetic Resin Parts	M 0135 Revised 2001
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Applicable Standards: See on page 22.

3. CLASSIFICATION OF TEST APPLICATIONS

Test applications are classified into two methods and ten classes as shown in Table 1, according to the mounting location of parts and the amount of light received. Method 1 refers to the interior test application and method 2 refers to the exterior test application.

*Table 1 Classification of Test Applications

Test method classification		Applicable parts	Destination (³)	Application example	Test applications		
					Accelerated exposure test		Outdoor exposure test
					Sunshine weatherometer method	Xenon weatherometer method	
Method 1 (Interior parts)	Class 1-A	Interior parts located horizontally and above the beltline, strongly affected by sunlight.	S	Instrument panel upper surface, rear parcel shelf upper section, rear seatback upper section, outward shoulder sections of front seats (including headrests), steering wheel, inside rear-view mirror	1-I-1 method	1-II-1A method 1-II-1B method 1-II-2 method 1-II-3 method	1-III method
	Class 1-B		D				
	Class 2-A	Interior parts located above the beltline and strongly affected by sunlight	S	Instrument panel upper slope surface, door trim upper surface, front pillar, rear pillar, inside lock knob Class 2-B			
	Class 2-B		D				
	Class 3-A	Interior parts located in areas affected by sunlight	S	Instrument panel vertical surface, door trim center, seats, center pillars, sun visor, center console, seat-belts			
	Class 3-B		D				
	Class 4-A	Interior parts located in areas slightly affected by sunlight	S	Roof and floor			
	Class 4-B		D				
Method 2 (Exterior parts)	Class 1	Exterior parts located in horizontal areas affected by sunlight	All areas	Ornaments, cowtop grille, antenna cap, radiator grille, hood louver, wiper pivot cover, bumpers, outside mirrors, emblems, washer nozzles	2-I-1 method	2-II-1 method 2-II-2 method 2-II-3 method	2-III method
	Class 2	Exterior parts located in incline area affected by sunlight	All areas	Radiator grille, rear finisher, pillar side guard molding			
	Class 3	Exterior parts located in areas slightly affected by sunlight	All areas	Wheel covers, wheel caps, mud guard			

Note ⁽³⁾ S: North America, Australia, Middle and Near East, Africa, tropical zones of Southeast Asia
D: Japan, General Exports

Note ⁽⁴⁾ The following is just an example of part name. For an actual application, part shape and installation part shall be fully reviewed and application classification chosen.

4. WEATHER (LIGHT) RESISTANCE TEST METHOD CLASSIFICATION

For weather (light) resistance test, accelerated exposure test (I method: sunshine weatherometer method, II method: xenon weatherometer method), outdoor exposure test are prescribed.

5. ACCELERATED EXPOSURE TEST METHOD

5.1 Accelerated exposure tester setting location and testing conditions

The tester's setting location shall be as a rule, standard temperature 5th grade (20±5°C) of JIS Z 8703 (Standard atmospheric condition for testing).

5.2 I method sunshine weatherometer method

(1) Equipment

a. Light source

Lamp consists of formed arc between carbon electrodes in open air. Or radiation reaches to test sample through filter. Specification of light source and filter shall conform to Table 2.

d. Measurement of the degree of radiation exposure

The radiant flux density meter shall be mounted in such a way that the radiation exposure of the test piece's exposed surface can be indicated. Generally, exposure times shall be determined based on the selected wavelength range and shall be indicated in units of spectral radiant energy per unit surface area of the exposed surface (i.e., J/m²).

e. Removal of test pieces

After the required period of time, the test pieces shall be removed and evaluation shall be carried out in accordance with Section 7.5.

(5) Maintenance control during testing

Carbon arc replacement, filter replacement, and cleaning shall be carried out in an appropriate period of time and in accordance with the instructions of the manufacturer. For more precise details pertaining to actual usage, refer to appended document 1: Handling of the Sunshine Weatherometer.

Table 2 Sunshine weatherometer test equipment specification and condition

Test equipment			Sunshine weatherometer method	
Test conditions			1- I -1 method (1 method: Inside cabin condition)	2- I -1 method (2 method: Inside cabin condition)
Test equipment specification	Equipment structure		Refer to Reference Drawing 2.	
	Arc lamp shape		Open	
	No. of lamps		1	
	Carbon electrodes	Upper (mm)	Copper-covered sunshine carbon ① ϕ 23 × 305 (24 hrs) ② ϕ 36 × 350 (60 hrs) ③ ϕ 36 × 410 (78 hrs)	
		Lower (mm)	Copper-covered sunshine carbon ① ϕ 23 × 305 (24 hrs) ② ϕ 36 × 350 (60 hrs) ③ ϕ 36 × 410 (78 hrs)	
	Mean discharge voltage	(V)	50 (±2%)	
	Mean discharge current	(A)	60 (±2%)	
	Specimen rotating frame	Arc center-to-specimen surface (mm)	476 to 482	
		Diameter (mm)	960	
		Rotating speed	Approx. 1 rpm (min ⁻¹)	
	Light intensity on specimen surface (W/m ²)		255 (±10%) (300 to 700 nm) 78 (±10%) (300 to 400 nm)	
	Filter		I type (#255) Penetration 255 nm ≤ 1% 302 nm 71% to 86% ≥ 360 nm > 91%	
Operating condition	Black panel thermometer	Control temperature (°C)	83±3	63±3 (or 83±3) (*)
	Fresh water spray conditions	Pressure (kPa)	No spray specification	78 to 127
		Flow rate (ml/min)		2100±100
		Spray time		18 minutes during 120 minute irradiation cycle
		Water quality		Deionized water with a pH of 6.0 to 8.0 and electric conductivity of 5 μ S/cm or less
	Operation cycle		Continuous light irradiation	Continuous light irradiation (18 minutes during 120 minute irradiation cycle)

Note (*) Back panel thermometer control temperature 83±3°C shall be agreed between the concerned parties.

d. Measurement of the degree of radiation exposure

The radiant flux density meter shall be mounted in such a way that the radiation exposure of the test piece's exposed surface can be indicated. Exposure times shall be determined based on the selected wavelength range and shall be indicated in units of spectral radiant energy per unit surface area of the exposed surface (i.e., J/m²).

e. Removal of test pieces

After the required period of time, the test pieces shall be removed and evaluation shall be carried out in accordance with Section 7.5.

(5) Maintenance control during testing

Xenon arc replacement, filter replacement, and cleaning shall be carried out in an appropriate period of time and in accordance with the instructions of the manufacturer. For more precise details pertaining to actual usage, refer to appended document 2: Handling of the Xenon Weatherometer.

Details pertaining to the tester specifications and testing methods for the xenon weatherometer are indicated in Table 3 (vehicle-compartment interior conditions) and Table 4 (vehicle-exterior conditions).

Table 3 Xenon Weatherometer test equipment specifications and test conditions
(Type 1: inside cabin condition)

Test equipment		Xenon weatherometer			
		1- II -1A method	1- II -1B method ⁽⁵⁾	1- II -2 method	1- II -3 method
Test equipment specification	Light source	Water-cooled Xenon lamp	Air-cooled Xenon lamp	Water-cooled Xenon lamp	Air-cooled Xenon lamp
	No. of lamps/specimen rack	1		1	3
	Light filters	Inner: Quartz Intermediate: #320 Outer: #275 or Inner: Quartz Outer: #320		Inner: Boro silicate type S Outer: Soda lime	Inner: IR filter Intermediate: Quarz Outer: UV filter (3-partition)
	Rising wave length	320 nm		320 nm	320 nm
	Light intensity control	300 to 400 nm		300 to 400 nm	300 to 400 nm (280 to 800 nm)
	Light intensity on specimen surface	162 W/m ²		53 W/m ²	80 W/m ²
	Light uniformity	Within ±5%		Within ±5%	Within ±5%
	Specimen rotating frame (speed)	Approx. 2 rpm		Approx. 1 rpm	Approx. 2 rpm
Operating condition	Temperature control	(Black panel temperature) During light irradiation: 89 ± 3°C		(Black panel temperature) During light irradiation: 89 ± 2°C	(Black panel temperature) During light irradiation: 89 ± 2°C
	Humidity inside tank	During light irradiation: 50 ± 5%RH		During light irradiation: 50 ± 5%	During light irradiation: 50 ± 10%
	Wind velocity	Approx. 1 m/sec		—	—
	Operation cycle	Continuous light irradiation		Continuous light irradiation	Continuous light irradiation
(Reference test equipment type)		Suga test equipment Co. XEL-2WN SX-75F, SX2-75F	Wacom WT-341	Atlas Co. CI35, 65, 3000, 4000, 5000	Atlas Co. 1200CPS, 1200LM, BetaLM

Note ⁽⁵⁾: Method 1- II -1 B applies only to fabric tests.

6. OUTDOOR EXPOSURE TEST

6. 1 Environment for the outdoor exposure test

As a fundamental principle, Okinawa shall be the location for testing. Furthermore, said testing location shall be free of any items which would block sunlight in the ranges from due east to due south and from due south to due west, and over the period from 30 minutes after sunrise to 30 minutes before sunset. Said location also shall be free of dust, soot, sand, and the like. Note that consultation of the relevant parties will be required with regard to other testing locations.

6. 2 Methods for the outdoor exposure test

(1) Test equipment

a. Construction

The exposure equipment shall have a solid and durable construction. Furthermore, it shall be fitted with installation fittings which are matched to the type, shape, and dimensions of the test piece, and to the purpose of testing. The frame shall be of sturdy construction on a ground surface which is not adversely affected by storms, snow buildup or the like. Furthermore, said frame shall be correctly installed and all sections and fittings shall be provided with suitable rust-prevention treatment.

b. Glass plates

With regard to method 1-III (vehicle-compartment interior conditions), test pieces shall be covered and sealed using glass panels in order to prevent exposure to rain and snow (i.e., 4-mm polished plate glass in accordance with JIS R 3202: Float Plate Glass and Polished Plate Glass). The distance from the top surface of the test piece to the glass plate shall be 5 cm minimum.

c. Cumulative luminance meter

The exposure device shall be fitted with a cumulative luminance meter, the active surface of this meter's light-receiving section shall be oriented at the same angle as the exposure surface, and it shall be covered with an ultraviolet-transmitting glove.

(2) Test pieces

Test pieces are to conform with Section 3. 2 (2).

(3) Test conditions

The inclination of the exposure surface and the installation angles are set forth in Table 5. As a fundamental principle, the exposure surface shall be positioned at least 50 cm higher than the standard surface for mounting of the frame (i.e., floor or ground surface).

Table 5 Outdoor exposure test conditions

	Inclination of the exposure surface	Installation angle	Method 1-III (Conditions for inside the vehicle compartment)	Method 2-III (Conditions for outside the vehicle compartment)
April to Sept	Due South	20°-minus latitude with respect to horizontal	Indirect exposure using glass plates	Direct exposure
Oct to March	Due South	5°-minus latitude with respect to horizontal		

(4) Operations

a. Preparation of the test pieces

The sample name, test start and proposed finish dates, the control number, and any other required information shall be indicated on the rear of each test piece in such a way that they will not be removed during testing.

b. Test piece mounting

The test pieces shall be assembled to the exposure tester in such a way that they are not subjected to stress. Although it is a fundamental principle that the rear plate is not to be used for test piece mounting, this is permitted in situations where support is required as a result of shape and/or material conditions. An alloy of aluminum, stainless steel, or some other metal which does not oxidize shall be used.

c. Exposure

Exposure shall be carried out in accordance with the conditions of Table 5. In the case of test method 1-III, contamination adhering to the surface of the glass shall be removed at regular intervals.

7. 2 Methods and exposure conditions for exposure testing

(1) Selection of testing methods

Either accelerated exposure testing (light) or outdoor exposure testing shall be selected in accordance with Table 7 and based on material types and application locations. Testing methods for these tests shall conform with the details of Section 5 or Section 6 accordingly.

Table 7 Selection of testing methods

Part classification	Material		NES No.	Outdoor exposure test (Okinawa)	Selection of test method	
					Xenon weatherometer II	Sunshine weatherometer I
Method 1	Plastic material	PP	M8021	○	○	(○)
		PPC	M8012	○	○	(○)
		ABS	M8011	○	○	(○)
		POM	M8014	○	○	(○)
		PA	M8015	○	○	(○)
		PBT	M8016	○	○	(○)
		PMMA		○	○	(○)
		PVC		○	-	○
		Others		○	-	○
Method 1	Surface covering material	PVC		○	○	(○)
		Lether	M7081	○	○	(○)
		Sheer	M7083	○	○	(○)
		Slash	M8022	○	○	(○)
	Fabric	PVC/ABS	M7084	○	○	(○)
		Leather	M7100	○	○	(○)
		Carpet	M7102 M7103	○	-	○
Method 1	Others	Flocked fabrics		○	○	○
Method 2		PP	M8021	○	○	(○)
		PPC	M8012	○	○	(○)
		PVC		○	○	(○)
		POM	M8014	○	○	(○)
		PMMA	M8018	○	○	(○)
		PC	M8017	○	○	(○)
		PC/PET,PC/PBT		○	○	(○)
		AES,AAS		○	○	(○)
		Others		○	○	(○)
					-	○

Note 1: Details regarding the actual implementation of, and testing personnel for, outdoor exposure shall be determined through consultation with the relevant parties. Furthermore, this testing shall be carried out wherever so required.

Note 2: The priority sequence for the results of testing shall conform with the order of outdoor exposure, xenon weatherometer, sunshine weatherometer. Furthermore, this is the reason behind the addition of parentheses to the sunshine weatherometer for accelerated exposure testing in Table 8.

(2) Selection of test conditions

Test conditions shall be selected from Table 8 (Method 1: Vehicle-compartment interior conditions) or Table 9 (Method 2: Vehicle-exterior conditions) based on testing methods and material types.

Note 1: The testing energies have been calculated for the test durations and the exposure energies in the 300 to 400 nm range of wavelengths for each tester as indicated in Table 2, Table 3, and Table 4. Furthermore, the relationship between testing energies and testing times is as follows:
 Testing time (s) = Testing energy (J/m²) / Radiation exposure (W/m²) (W = J/s)
 Although the radiation exposure (MJ/m²) is generally used for the control of testing conditions, the specific details of the testers require that exposure time (hours) is used for this purpose in the case of Methods 1-I, 2-I, and 1-II-B.

Table 8 Each plastic accelerated light resistance load condition (method 1: inside cabin condition) cont'd

Test method			Exposure period							
			S (Hot areas)				D (Japan, General Eyport)			
			Type 1A	Type 2A	Type 3A	Type 4A	Type 1B	Type 2B	Type 3B	Type 4B
1- II -3 Xenon weather- ometer	Plastic material	PP	[590]/170	[399]/115	[295]/85	[191]/55	[399]/115	[278]/80	[208]/60	[122]/35
		PPC	[347]/100	[233]/70	[174]/50	[104]/30	[243]/70	[174]/50	[122]/35	[87]/25
		ABS POM	[556]/160	[382]/110	[278]/80	[174]/50	[382]/110	[260]/75	[191]/55	[122]/35
		PA	[799]/230	[538]/155	[399]/115	[243]/70	[538]/155	[365]/105	[278]/80	[174]/50
		PBT	[278]/80	[191]/55	[139]/40	[87]/25	[191]/55	[139]/40	[104]/30	[69]/20
	Surface covering material, Others	PVC leather, sheet	[556]/160	[382]/110	[278]/80	[174]/50	[382]/110	[260]/75	[191]/55	[122]/35
		PVC slash	[260]/75	[172]/50	[139]/40	[87]/25	[174]/50	[122]/35	[87]/25	[52]/15
		PVC/ ABS	[625]/180	[417]/120	[312]/90	[191]/55	[417]/120	[278]/80	[208]/60	[139]/40
		Fabrics Leather Carpet Flocked fabrics	[243]/70	[174]/50	[122]/35	[87]/25	[174]/50	[122]/35	[87]/25	[52]/15
1- III Outdoor exposure (Okinawa)	Plastic material	PP,PPC ABS POM PA PBT PMMA PVC	12 months							
	Surface covering material	PVC leather, sheet, slash PVC/ABS	12 months							
		Fabrics, Lether, Carpet	6 months							
	Others	Flocked fabrics	12 months							

Note (6): For physical property, Xenon cannot cope with the heat problem, only the sunshine-type shall be used.