

*Design*

# INVOICE FOR ISSUE OF TOYOTA ENGINEERING STANDARD

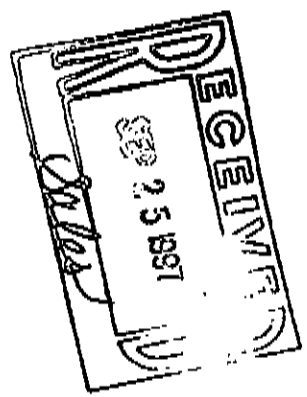
NO. : TS M0503G

TITLE : FOGGING TEST METHOD FOR NON-METALLIC MATERIALS

CLASS : **C**

### PUBLICATION RECORD

(Asterisk mark "\*" in this standard denotes the changed portion from previous issue.) :  
Revised ("M" omitted)  
Changed terms and explanation.



TOYOTA MOTOR CORPORATION  
ENGINEERING CENTER  
4150 YAMATO-CHO, KARIYA-CITY,  
AICHI-PREF., JAPAN  
TEL. (0565) 31-2111  
FAX (0565) 31-2111  
4-24-97

Date: **'97.7.08**  
Engineering Information  
Management Dept.  
Engineering Administration Div.  
TOYOTA MOTOR CORPORATION

NOTE: In the case of revision, the old standard which has been issued before should be discarded in proper manner  
(such as shredding or fire) to avoid possible use of obsolete standards information.



*(9)*



TOYOTA ENGINEERING STANDARD

TSM0503G

CLASS  
CFOGGING TEST METHOD FOR NON-METALLIC MATERIALS

## 1. Scope

This standard covers the standard fogging test method for non-metallic materials to be used chiefly for automobile interiors.

## 2. General Test Conditions

## 2.1 Conditioning

Test samples and test specimens shall be kept and dehumidified before the tests for at least 24 h in a desiccator in the atmosphere specified in Section 2.2.

## 2.2 Test Atmosphere

Tests shall be carried out indoors, as a rule, at a temperature of  $23 \pm 2^\circ\text{C}$  and a relative humidity of  $50 \pm 5\%$ . If it is not possible to create this condition, the actual test atmosphere shall be reported.

## 2.3 Quantity of Test Pieces

Three or more test pieces shall be used for each test.

## 3. Test Procedures

## 3.1 Cleaning and Storage of Glass Plates, Glass Bottles, Beakers, etc.

## (1) Cleaning

Glass plates, glass bottles, beakers, silicon rubber sealing materials, metal rings, etc. to be used for tests shall be completely cleared of oil and anything else adhering to them by the method described below.  
Wipe away the substances adhering to the glass plate surfaces, glass bottles, and beaker inner walls using acetone, ethyl acetate, or another appropriate solvent, and then rinse them in acetone. After gently wiping the residual acetone off the glass plates with a non-fluffy cloth or other material and rinsing the glass bottles and beakers, etc. for 2 to 3 min, dry them for 2 to 3 min in a dryer or the like.  
Do not use the same glass plate more than 10 times.

Prepared and Written by:

Organic Material Dept.

Material Engineering Div. II

Engineering Administration Div.

© TOYOTA MOTOR CORPORATION

Established / 8th

Revised:

Jul. 1997

NOTES - The copying of this standard shall undertake the following considerations: adjustment upon the scope of this standard.  
- The contents shall decided by checking or the or review in Toyota Motor Corporation if appropriate, the document contained in this standard when they are no longer accurate due to the improvement of the work content or the revision of current version of this standard.  
- This standard and the technical information related thereto are owned by and under sole control of Toyota Motor Corporation. They shall not be disclosed in whole or in part to any third party without prior written consent of Toyota Motor Corporation.


**TOYOTA ENGINEERING STANDARD** | **TS M0503G**
**(2) Storage**

As a rule, clean the above implements prior to testing, via the above method. If it is necessary to store the implements after cleaning, store them in a desiccator etc. to avoid the adherence of dust or dirt to the implements.

**3.2 Accelerated Fogging Test**
**3.2.1 Method A**
**(1) Test piece**

Dimensions of the test pieces shall be as specified in Table 1, according to the type of material. The test pieces may be sampled from either actual parts or material rolls. In any case, the source material of test pieces shall be reported. When the source material is powder, liquid, or paste, the amount of the test sample shall be  $10 \pm 0.2$  g.

**Table 1 Test Piece Dimensions**

Classification	Dimensions	Unit: mm
Skin material (1)	50 X 100 X Product thickness (report) (2)	
Plastic molding material	25 X 100 X Product thickness (report) X 2 pieces (3)	
Seat foam (4)	465 X 40 (5)	
Composite material (cut from actual product)	Seat (6)	See Fig. 1.
	Other than seat (7)	50 X 100 X Product thickness (8) (report)
Others (9)	50 X 100 X Product thickness (8) (report)	

Notes: (1) Such as vinyl chloride sheet, fabric, carpet, synthetic leather, and natural leather.

(2) If it is difficult to obtain 50 mm long, 100 mm wide test pieces, use test pieces of the same surface area (150 cm<sup>2</sup>).

(3) If it is difficult to obtain 25 mm long, 100 mm wide test pieces, use test pieces of the same surface area (150 cm<sup>2</sup>).

(4) Mainly urethane foam

(5) If the thickness is less than 40 mm, report the actual thickness.

(6) Such as a combination of laminated pad and seat foam, and seat cover and seat foam

NOTES: The engineer of the standard shall authorize the following conditionally additional items upon the request of the standard. The engineer shall demand by standard or etc. or items in Toyota Motor Corporation's approval. An amendment, comments in the standard version may be no longer necessary due to the introduction of the work. Comments of the approval or change version of the standard. The standard and the technical administration system shall be created by the member who created the Toyota Motor Corporation. They shall be approved in which was no part in any final party standard prior version created at Toyota Motor Corporation.

 Established / \$ 41  
 J n 1 . 1997

Revised :



## TOYOTA ENGINEERING STANDARD

TSM0503G

- Notes:(7) Such as safety pad, door trim, head lining, and coated plastic part. If it is difficult to obtain 50 mm long, 100 mm wide test pieces, use test pieces of the same surface area.
- (8) When product thickness exceeds 50 mm, measure the dimension 50 mm from the interior end.
- (9) Such as slab urethane foam and felt

Unit: mm

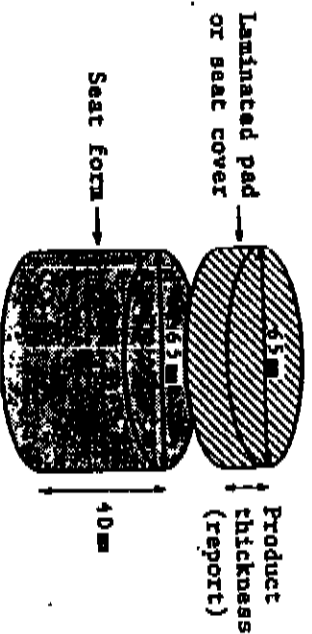


Fig. 1 Test Piece Dimensions for Composite Material (Seat)

## (2) Test equipment

For tests, use the accelerated fogging tester shown in Fig. 2. The glass containers(10) to be used for the tests shall have a capacity of about 500 mL, and their dimensions shall follow those shown in Fig. 2, as much as possible.

The glass plates shall be 47 x 47 mm in size, with a thickness of 3 mm. In addition, their original fogging rate shall be 0.5% max.

Note:(10) Such as a "pressure resistant, glass fogging measuring bottle" made by Sansho Co.

NOTES: The objective of this standard shall generally be following: conformity, design, quality, safety, and the amount of this standard. The engineer shall consult by JIS, or other as Toyota Motor Corporation. If equipment, or documents, mentioned in this standard which they are no longer necessary due to the improvement of the work, mentioned in the previous of this standard. The standard shall be subjected to additional technical documents prepared by and under the approval of Toyota Motor Corporation. They shall be included in order not to part to any new part, without prior written consent of Toyota Motor Corporation.

Established / 3 4th Revised :

Jul. 1997



Unit: mm

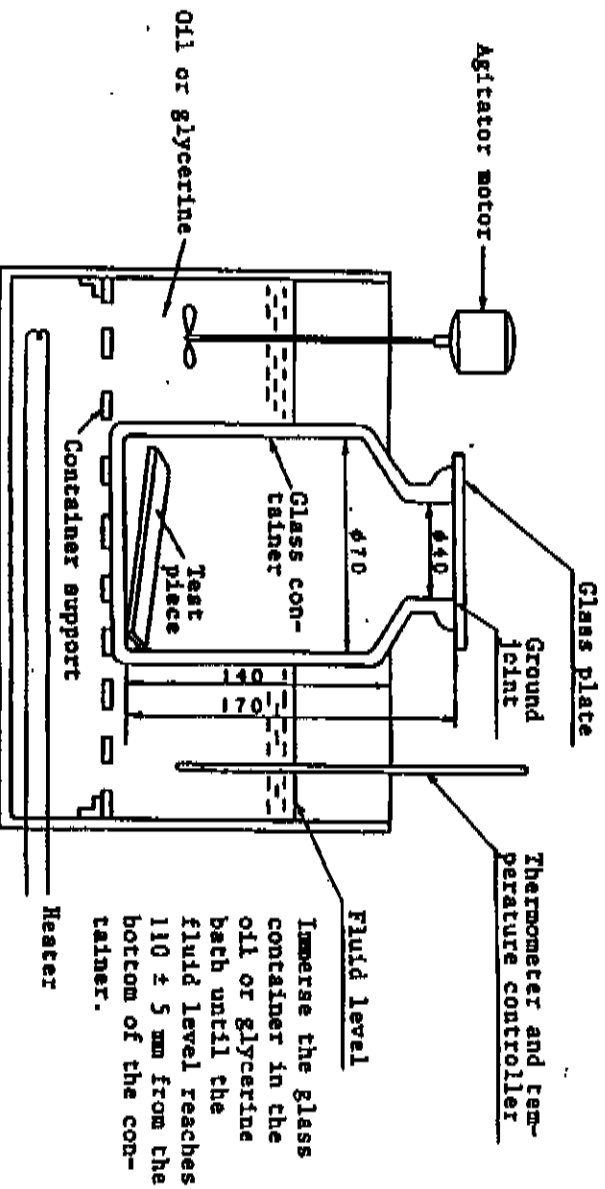


Fig. 2 Accelerated Fogging Tester

## (3) Test method

Place the test piece in the glass container in the test equipment shown in Fig. 2. Seal the container with a glass plate which also serves as the lid. In this procedure, fix the plate to the container at its four corners with tape. The glass container and glass plate shall be cleaned in advance, as specified in Section 3.1. After setting the oil or glycerine bath temperature as specified in Table 2, place the container in the bath so that the fluid level reaches 110 mm above the bottom of the container. Under this condition, heat the bath for the time period specified in Table 2.

After heating the bath for the specified time period, immediately remove the glass plate, and store in a desiccator until the measurement of fogging.

NOTES: The equipment of this standard shall maintain the following manufacturing tolerances upon the design of the standard. The designer shall design by consulting to JIS, or refer to Toyota Motor Corporation if appropriate. For dimensions, consult to the standard when they are no longer necessary due to the equipment of the work, equipment of the process of special process of the standard. The standard and the technical information related thereto are owned by and under sole control of Toyota Motor Corporation. They shall be disclosed in whole or in part to any third party without prior written consent of Toyota Motor Corporation.

Established / 3 th

Revised :

Jul. 1997



TOYOTA ENGINEERING STANDARD

TS M0503G

Table 2 Heating Temperature and Time

Location			Heating temp. ( $^{\circ}\text{C}$ )	Heating time (h)
Front and rear	With direct radiation (11)		100 $\pm$ 2	20
		Without direct radiation	80 $\pm$ 2	
		Above belt line (12) Below belt line (13)	70 $\pm$ 2	
Side	Above belt line (14)		80 $\pm$ 2	
	Below belt line (15)		70 $\pm$ 2	
Composite material (seat) (16)			80 $\pm$ 2	72

Notes:(11) This shall apply to skin materials for instrument panel safety pads, package trays, rear seat backs, etc.

(12) This shall apply to materials for the front and rear pillar garnishes, sun visors, etc.

Materials that do not appear on the surface, such as urethane foam for instrument panel safety pads, urethane foam for seats and slab urethane foam, shall be included in the scope of application.

(13) This shall apply to materials for carpets, etc. Materials for luggage compartment interiors are included in the scope of application.

(14) This shall apply to materials for door trims (skin materials, fabrics, and base materials, for example), head linings, etc.

(15) This shall apply to materials for door trim carpets, etc.

(16) For the test, place the combination of a laminated pad and seat foam or a seat cover and seat foam in a glass container as shown in Fig. 3.

NOTES: The impregnated of the standard shall undertake the following conformity obligations upon the receipt of the standard. The impregnated shall be made by standard or etc. or review in Toyota Motor Corporation of appropriate, and description contained in this standard shall be followed accordingly and in the statement of the used contents of the revision of contents of this standard. This standard shall be followed accordingly and in the statement of the used contents of the revision of contents of this standard. The standard shall be followed accordingly and in the statement of the used contents of the revision of contents of this standard. The standard shall be followed accordingly and in the statement of the used contents of the revision of contents of this standard. The standard shall be followed accordingly and in the statement of the used contents of the revision of contents of this standard.

Established / 3 ts Revised :

J n l . 1997

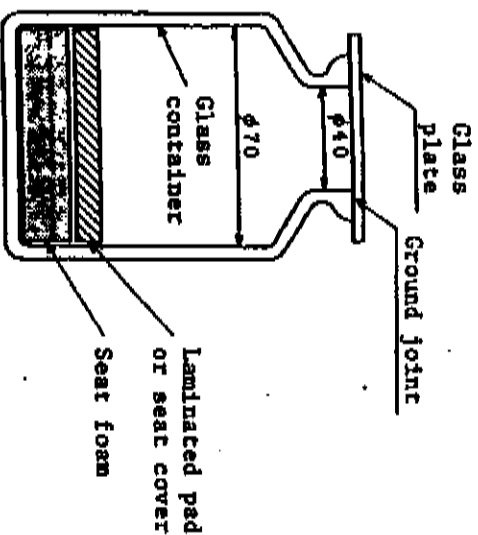


Fig. 3 Test for Composite Material (Seat)

## (4) Test results

After 1 h from the completion of the test, place the glass plate obtained in procedure (3) above in an integrating sphere type light permeability measuring instrument (17), shown in Fig. 4. Then measure the amount of light incident upon the glass plate  $T_1$ , the total amount of light transmitted through the glass plate  $T_2$ , the amount of light scattered by the instrument  $T_3$ , and the amount of light scattered by the instrument and test piece  $T_4$ . Calculate the glass fogging rate  $A$  (%) according to equation (1).

$$\text{Glass fogging rate } A (\%) = \frac{T_4}{T_t} \times 100 \dots\dots\dots (1)$$

where,  $T_t: \frac{T_2}{T_1} \times 100$  (total transmittance)

$$T_d: \frac{T_4 - T_3}{T_1} \left\{ \frac{T_2}{T_1} \right\} \times 100 \text{ (diffusion transmittance)}$$

Conduct the measurement at four or more points on the fogged area of the same glass plate, and report the maximum, minimum, and mean values. For the fogging rate to be reported, use the mean of the calculated values. (See Fig. 5.)

Note:(17) "Direct reading type haze computer" made by SUGA TEST DEVICE CO., for example.

NOTES - The content of this standard shall constitute the following modifications, additions, deletions, amendments, or changes to the original standard.  
 1) The required shall include by addition of the word "or" to the word "and" in the original standard.  
 2) The required shall include by deletion of the word "and" in the original standard.  
 3) The required shall include by deletion of the word "or" in the original standard.  
 4) The required shall include by deletion of the word "and" in the original standard.  
 5) The required shall include by deletion of the word "or" in the original standard.  
 6) The required shall include by deletion of the word "and" in the original standard.  
 7) The required shall include by deletion of the word "or" in the original standard.  
 8) The required shall include by deletion of the word "and" in the original standard.  
 9) The required shall include by deletion of the word "or" in the original standard.  
 10) The required shall include by deletion of the word "and" in the original standard.  
 11) The required shall include by deletion of the word "or" in the original standard.  
 12) The required shall include by deletion of the word "and" in the original standard.  
 13) The required shall include by deletion of the word "or" in the original standard.  
 14) The required shall include by deletion of the word "and" in the original standard.  
 15) The required shall include by deletion of the word "or" in the original standard.  
 16) The required shall include by deletion of the word "and" in the original standard.  
 17) The required shall include by deletion of the word "or" in the original standard.  
 18) The required shall include by deletion of the word "and" in the original standard.  
 19) The required shall include by deletion of the word "or" in the original standard.  
 20) The required shall include by deletion of the word "and" in the original standard.  
 21) The required shall include by deletion of the word "or" in the original standard.  
 22) The required shall include by deletion of the word "and" in the original standard.  
 23) The required shall include by deletion of the word "or" in the original standard.  
 24) The required shall include by deletion of the word "and" in the original standard.  
 25) The required shall include by deletion of the word "or" in the original standard.  
 26) The required shall include by deletion of the word "and" in the original standard.  
 27) The required shall include by deletion of the word "or" in the original standard.  
 28) The required shall include by deletion of the word "and" in the original standard.  
 29) The required shall include by deletion of the word "or" in the original standard.  
 30) The required shall include by deletion of the word "and" in the original standard.  
 31) The required shall include by deletion of the word "or" in the original standard.  
 32) The required shall include by deletion of the word "and" in the original standard.  
 33) The required shall include by deletion of the word "or" in the original standard.  
 34) The required shall include by deletion of the word "and" in the original standard.  
 35) The required shall include by deletion of the word "or" in the original standard.  
 36) The required shall include by deletion of the word "and" in the original standard.  
 37) The required shall include by deletion of the word "or" in the original standard.  
 38) The required shall include by deletion of the word "and" in the original standard.  
 39) The required shall include by deletion of the word "or" in the original standard.  
 40) The required shall include by deletion of the word "and" in the original standard.  
 41) The required shall include by deletion of the word "or" in the original standard.  
 42) The required shall include by deletion of the word "and" in the original standard.  
 43) The required shall include by deletion of the word "or" in the original standard.  
 44) The required shall include by deletion of the word "and" in the original standard.  
 45) The required shall include by deletion of the word "or" in the original standard.  
 46) The required shall include by deletion of the word "and" in the original standard.  
 47) The required shall include by deletion of the word "or" in the original standard.  
 48) The required shall include by deletion of the word "and" in the original standard.  
 49) The required shall include by deletion of the word "or" in the original standard.  
 50) The required shall include by deletion of the word "and" in the original standard.  
 51) The required shall include by deletion of the word "or" in the original standard.  
 52) The required shall include by deletion of the word "and" in the original standard.  
 53) The required shall include by deletion of the word "or" in the original standard.  
 54) The required shall include by deletion of the word "and" in the original standard.  
 55) The required shall include by deletion of the word "or" in the original standard.  
 56) The required shall include by deletion of the word "and" in the original standard.  
 57) The required shall include by deletion of the word "or" in the original standard.  
 58) The required shall include by deletion of the word "and" in the original standard.  
 59) The required shall include by deletion of the word "or" in the original standard.  
 60) The required shall include by deletion of the word "and" in the original standard.  
 61) The required shall include by deletion of the word "or" in the original standard.  
 62) The required shall include by deletion of the word "and" in the original standard.  
 63) The required shall include by deletion of the word "or" in the original standard.  
 64) The required shall include by deletion of the word "and" in the original standard.  
 65) The required shall include by deletion of the word "or" in the original standard.  
 66) The required shall include by deletion of the word "and" in the original standard.  
 67) The required shall include by deletion of the word "or" in the original standard.  
 68) The required shall include by deletion of the word "and" in the original standard.  
 69) The required shall include by deletion of the word "or" in the original standard.  
 70) The required shall include by deletion of the word "and" in the original standard.  
 71) The required shall include by deletion of the word "or" in the original standard.  
 72) The required shall include by deletion of the word "and" in the original standard.  
 73) The required shall include by deletion of the word "or" in the original standard.  
 74) The required shall include by deletion of the word "and" in the original standard.  
 75) The required shall include by deletion of the word "or" in the original standard.  
 76) The required shall include by deletion of the word "and" in the original standard.  
 77) The required shall include by deletion of the word "or" in the original standard.  
 78) The required shall include by deletion of the word "and" in the original standard.  
 79) The required shall include by deletion of the word "or" in the original standard.  
 80) The required shall include by deletion of the word "and" in the original standard.  
 81) The required shall include by deletion of the word "or" in the original standard.  
 82) The required shall include by deletion of the word "and" in the original standard.  
 83) The required shall include by deletion of the word "or" in the original standard.  
 84) The required shall include by deletion of the word "and" in the original standard.  
 85) The required shall include by deletion of the word "or" in the original standard.  
 86) The required shall include by deletion of the word "and" in the original standard.  
 87) The required shall include by deletion of the word "or" in the original standard.  
 88) The required shall include by deletion of the word "and" in the original standard.  
 89) The required shall include by deletion of the word "or" in the original standard.  
 90) The required shall include by deletion of the word "and" in the original standard.  
 91) The required shall include by deletion of the word "or" in the original standard.  
 92) The required shall include by deletion of the word "and" in the original standard.  
 93) The required shall include by deletion of the word "or" in the original standard.  
 94) The required shall include by deletion of the word "and" in the original standard.  
 95) The required shall include by deletion of the word "or" in the original standard.  
 96) The required shall include by deletion of the word "and" in the original standard.  
 97) The required shall include by deletion of the word "or" in the original standard.  
 98) The required shall include by deletion of the word "and" in the original standard.  
 99) The required shall include by deletion of the word "or" in the original standard.  
 100) The required shall include by deletion of the word "and" in the original standard.

Established / 3th Revised :

J u l . 1 9 9 7

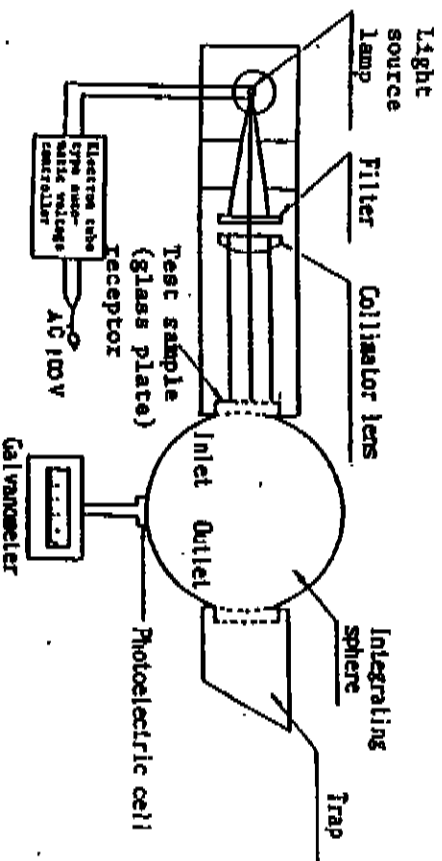


Fig. 4 Integrating Sphere Type Light Permeability Instrument

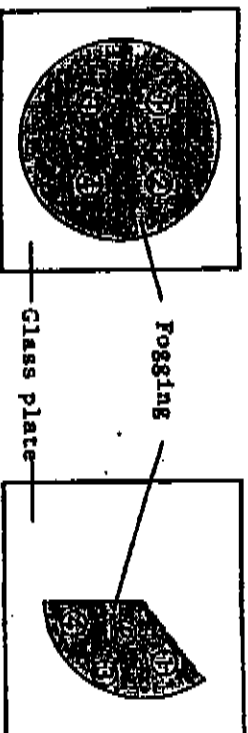


Fig. 5 Measurement Spots

3.2.2 Method B

(1) Test piece

Test pieces shall have the dimensions specified in Table 3 according to the type of material. They may be cut out from either actual parts or material rolls. In any case, report the source of the test pieces. For powder, liquid, and paste, take  $10 \pm 0.2$  g as a test sample.

NOTES: The assignment of the standard shall indicate the following conditions: designation given by name of the standard. The request shall describe by indicating or date, or name of Toyota Motor Corporation, an extension requested in the standard. This request may not be subject to the standard of the standard of the standard of the standard of the standard. The standard shall be subject to the standard of the standard of the standard of the standard of the standard. They shall be declared as subject to the standard of the standard of the standard of the standard of the standard.

Established / 3 th

Revised :

Jul. 1997





TOYOTA ENGINEERING STANDARD

TS M0503G

Table 3 Test Piece Dimensions

Unit: mm

Classification	Dimensions	
Skin material (18)	φ80 X Product thickness (report)	
Plastic molding material		
Seat foam (19)	φ80 X 40 (20)	
Composite material (cut from actual product)	Seat (21)	See Fig. 6.
	Other than seat (22)	φ80 X Product thickness (23) (report)
Others (24)	φ80 X Product thickness (23) (report)	

Notes: (18) Polyvinyl chloride skin material, fabric, carpet, synthetic leather, artificial leather, natural leather, for example

(19) Mainly urethane foam

(20) If the thickness is less than 40 mm, report the actual value.

(21) Combinations of laminated pad and seat foam, seat cover and seat foam, for example

(22) Safety pads, door trims, head linings, and coated plastic parts, for example

(23) If the product thickness exceeds 50 mm, measure the dimension 50 mm from the interior end.

(24) Slab urethane foams and felts, for example

Unit: mm

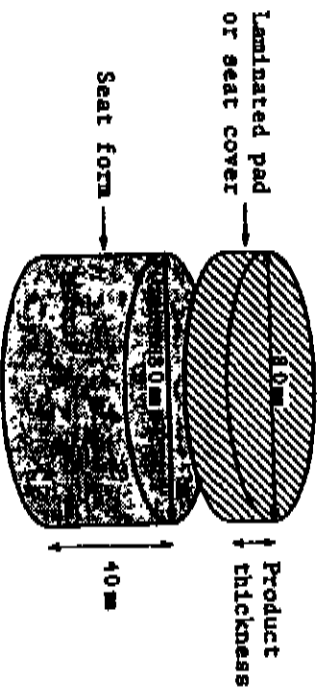


Fig. 6 Dimensions of Test Piece for Composite Material (Seat)

NOTES The recipient of this standard shall undertake the following responsibilities and actions with the receipt of this standard. The recipient shall instruct by advertising or any other means to Toyota Motor Corporation if appropriate, the distribution, marketing or the standard is not necessary due to the existence of the same standard or the presence of similar standards of the recipient. They shall also undertake the necessary measures to ensure that the standard is correctly implemented. This standard and the necessary supplementary technical documents are owned by and under the control of Toyota Motor Corporation. They shall be included in orders for in part to any third party, whether prior or subsequent to the receipt of Toyota Motor Corporation.

Established / 3 4/8 Revised :

J e l . 1 9 9 7



TOYOTA ENGINEERING STANDARD

TS M0503G

## (2) Test equipment

Use the accelerated fogging tester (25) shown in Fig. 7. The beaker to be used for the test shall have a flat bottom and its dimensions should conform to Fig. 7, as much as possible. The glass plate shall be 110 × 110 mm in size with a thickness of 3 mm, and a 60° reflection factor of 135% or more as determined via gloss measuring instrument.

Do not use the same glass plate more than 10 times.

Unit: mm

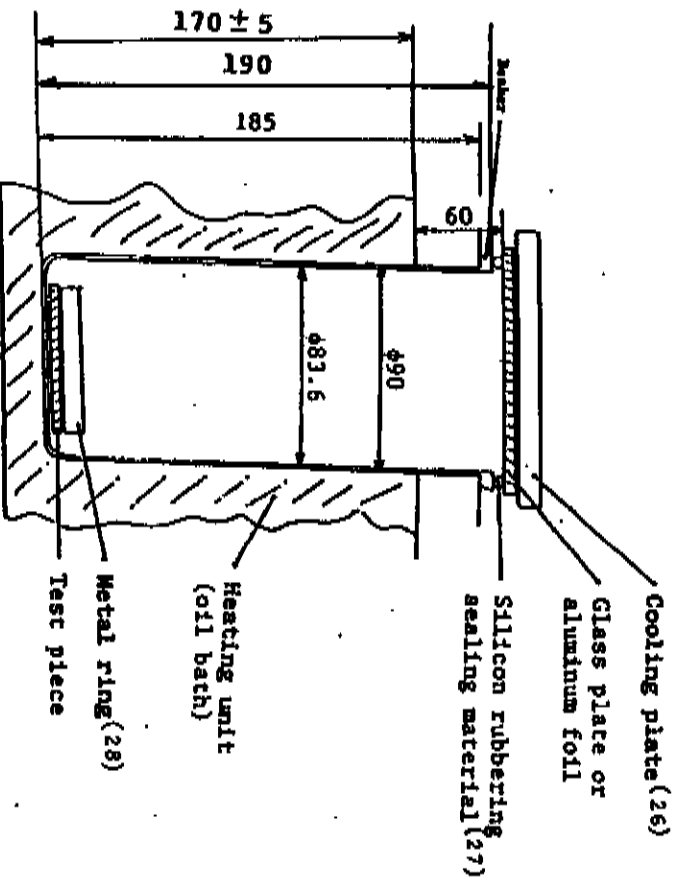


Fig. 7 Accelerated Fogging Tester

Notes: (25) "HAKE Temperature Control Unit for Fogging Test" made by HAKE Co., for example

(26) The cooling plate shall be hollow and made of aluminum or other rust resistant material. It shall be provided with a connection unit capable of feeding and draining cooling water. Its mass shall be at least 1 kg when measured together with cooling water in it.

The surface in contact with the glass plate shall be flat.

NOTE: The content of this standard shall maintain the following correspondence with previous versions of the standard. The differences are indicated by a shaded or hatched area. The content of the standard shall be the same as the previous version. The standard and the technical drawings related thereto are issued by the same name of Toyota Motor Corporation. They shall not be discussed in relation to any third party's content, since contents consist of Toyota Motor Corporation.

Established / 3 th

Revised:

Jul. 1997



## TOYOTA ENGINEERING STANDARD

TS M0503G

Notes:(27) Use a ring-form silicon rubber sealing material with an inside diameter of approximately 95 mm and a hardness of approximately 60 as measured with a Shore A tester.

(28) The mass of the metal ring shall be approximately 55 g, the outside diameter 80 mm, the inside diameter 74 mm, and the thickness 10 mm. It shall be made of rust resistant material.

## (3) Test method

## (a) For reflection factor measurement

Place the test piece flatly on the bottom of the beaker as shown in Fig. 7, with the decorated surface pointing upward. Place a metal ring on the test piece to prevent it from warping. The metal ring may be omitted when there is no possibility of the test piece warping. After setting the temperature of the heating unit (oil bath) as required in Table 4, dip the beaker in the oil bath so that the oil level reaches a point approximately 60 mm below the glass plate, as shown in Fig. 7. Then put the silicon rubber sealing material in and immediately seal the beaker with the glass plate that serves also as a lid. Thereafter place the cooling plate, in which cooling water is circulated at  $20 \pm 1^{\circ}\text{C}$ , on the glass plate and heat the beaker according to Table 4.

For this measurement, use a beaker, metal ring, glass plate, and silicon rubber sealing material that have been rinsed according to Section 3.1.

NOTES: The equipment of this standard shall include the following specifications, subject to the nature of the standard. The equipment shall include the following specifications, subject to the nature of the standard. The equipment shall include the following specifications, subject to the nature of the standard. The equipment shall include the following specifications, subject to the nature of the standard. The equipment shall include the following specifications, subject to the nature of the standard.

Established / 3 th

Revised:

J r l 1997



## (b) For attached mass measurement

Place the test piece flatly on the bottom of the beaker as shown in Fig. 7, with the decorated surface pointing upward.

Place a metal ring on the test piece to prevent it from warping.

The metal ring may be omitted when there is no possibility of the test piece warping.

After setting the temperature of the heating unit (oil bath) as required in Table 4, dip the beaker in the oil bath to a point where the oil level reaches approximately 60 mm below the glass plate, as shown in Fig. 7. Immediately after this, put a silicon rubber sealing material in and seal the beaker with a round piece of aluminum foil (29) 103 mm in diameter.

Then place a cooling plate, in which cooling water is circulated at  $20 \pm 1^\circ\text{C}$ , on the aluminum foil, and heat the beaker according to Table 4.

For this measurement, use a beaker, metal ring, and silicon rubber sealing material that have been rinsed as required in Section 3.1.

Note:(29) Aluminum foil (15 micron in thickness) made by KITSUBISHI ALUMINUM CO., for example.  
Make the glossy surface come in contact with the beaker.

Table 4 Heating Temperature and Time

Location	Heating temp. ( $^\circ\text{C}$ )	Heating time (h)	
		Reflection factor measurement	Attached mass measurement
Front and rear	With direct radiation (30)	100 $\pm$ 2	
	Without direct radiation	Above belt line (31)	80 $\pm$ 2
		Below belt line (32)	70 $\pm$ 2
Side	Above belt line (33)	80 $\pm$ 2	
	Below belt line (34)	70 $\pm$ 2	
Composite material (seat) (35)	80 $\pm$ 2	72	72

NOTES: The objectives of the standard shall not be construed as follows: (a) The standard is not intended to be used as a basis for the design of the test piece. (b) The standard is not intended to be used as a basis for the design of the test piece. (c) The standard is not intended to be used as a basis for the design of the test piece. (d) The standard is not intended to be used as a basis for the design of the test piece. (e) The standard is not intended to be used as a basis for the design of the test piece. (f) The standard is not intended to be used as a basis for the design of the test piece. (g) The standard is not intended to be used as a basis for the design of the test piece. (h) The standard is not intended to be used as a basis for the design of the test piece. (i) The standard is not intended to be used as a basis for the design of the test piece. (j) The standard is not intended to be used as a basis for the design of the test piece. (k) The standard is not intended to be used as a basis for the design of the test piece. (l) The standard is not intended to be used as a basis for the design of the test piece. (m) The standard is not intended to be used as a basis for the design of the test piece. (n) The standard is not intended to be used as a basis for the design of the test piece. (o) The standard is not intended to be used as a basis for the design of the test piece. (p) The standard is not intended to be used as a basis for the design of the test piece. (q) The standard is not intended to be used as a basis for the design of the test piece. (r) The standard is not intended to be used as a basis for the design of the test piece. (s) The standard is not intended to be used as a basis for the design of the test piece. (t) The standard is not intended to be used as a basis for the design of the test piece. (u) The standard is not intended to be used as a basis for the design of the test piece. (v) The standard is not intended to be used as a basis for the design of the test piece. (w) The standard is not intended to be used as a basis for the design of the test piece. (x) The standard is not intended to be used as a basis for the design of the test piece. (y) The standard is not intended to be used as a basis for the design of the test piece. (z) The standard is not intended to be used as a basis for the design of the test piece.

Established / 3 15  
J u l . 1 9 9 7  
Revised :



## TOYOTA ENGINEERING STANDARD

TS M0503G

- Notes:(30) This shall apply to skin materials for instrument panel safety pads, package trays, rear seat backs, etc.
- (31) This shall apply to materials for front and rear pillar garnishes, sun visors, etc. Materials that do not appear on the surface, such as urethane for instrument panel safety pads, urethane foam for seats, and slab urethane foam, shall be included in the scope of application.
- (32) This shall apply to materials for carpets, etc. Materials for luggage compartment interiors are included in the scope of application.
- (33) This shall apply to materials for door trims (skin materials, fabrics, and base materials, for example) and head linings, etc.
- (34) This shall apply to materials for door trim carpets, etc.
- (35) For the test, put a combination of laminated pad and seat foam or seat cover and seat foam in the beaker, as shown in Fig. 8.

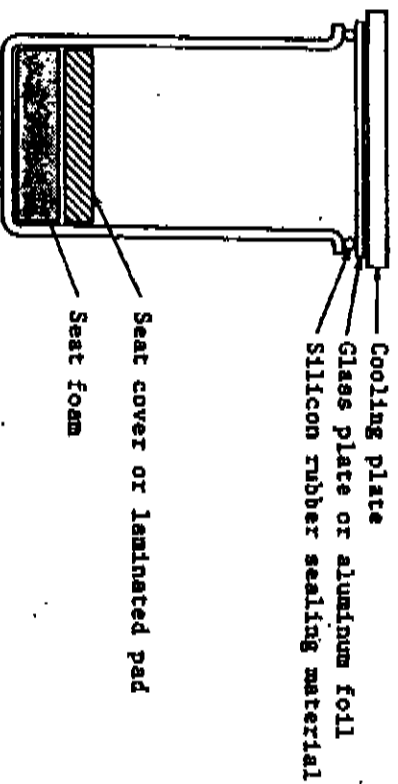


Fig. 8 Test for Composite Material (Seat)

NOTES: The recipient of this standard shall indicate the following conspicuously whenever copies are made of this standard. The recipient shall indicate by "Issued by" or "Revised by" the name of the organization of approval, the date, and the standard number. The recipient shall indicate by "Issued by" or "Revised by" the name of the organization of approval, the date, and the standard number. The recipient shall indicate by "Issued by" or "Revised by" the name of the organization of approval, the date, and the standard number. The recipient shall indicate by "Issued by" or "Revised by" the name of the organization of approval, the date, and the standard number. The recipient shall indicate by "Issued by" or "Revised by" the name of the organization of approval, the date, and the standard number.

Established / 3 45 Revised:

J u l . 1 9 9 7



(4) Test results

(a) Reflection factor measurement

To calibrate the gloss measuring instrument, set the 60° reflection factor at 94.6% using a black reference plate. Then, after 1 h from the completion of the test, measure the 60° reflection factor of the glass plate obtained in (3) above, using a gloss measuring instrument (35). Take the measurement thus obtained to be R<sub>1</sub>. Then, measure the 60° reflection factor at other points. Take the measurements thus obtained to be R<sub>2</sub>, R<sub>3</sub>, and R<sub>4</sub>. Using the reflection factor R<sub>0</sub> of a clean glass plate measured before the test, calculate the fogging rate B (%) according to equation (2). When measuring 60° reflection factors, place a matting black plate (37) free of cracks or dirt under the glass plate.

$$\text{Glass fogging rate B (\%)} = \frac{R_1 + R_2 + R_3 + R_4}{4} \times 100 \dots (2)$$

(b) Attached mass measurement

After 1 h from the completion of the test, measure the mass of the aluminum foil obtained in (3) above to the mg. Calculate the difference from the foil mass measured before the test to determine the attached mass G (mg).

$$\text{Attached mass G (mg)} = G_1 - G_0 \dots (3)$$

where, G<sub>1</sub> (mg): mass of aluminum foil after test  
 G<sub>0</sub> (mg): mass of aluminum foil before test

NOTES: The equipment of this standard shall maintain the following characteristics when the receipt of this standard is issued. The equipment shall be checked by measuring of 100% or more on Toyota Motor Corporation's equipment, for dimensions, accuracy in the reading of a scale and so on before its use. The equipment of this standard shall be checked by measuring of 100% or more on Toyota Motor Corporation's equipment. The standard and its technical information shall remain the same as of the date of issue of this standard. This standard shall be confirmed as valid and in force to new and old parts without prior written consent of Toyota Motor Corporation.

Established / 3 4/8  
 J u l . 1 9 9 7  
 Revised :



## TOYOTA ENGINEERING STANDARD

TSM0503G

## Notes:(36)

The gloss measuring instrument is schematically illustrated in Fig. 9. The aperture  $S_1$  of the light source shall be located at the focus point of the lens  $L_1$ , and shall be capable of forming a clear image of  $S_1$  at the center of the aperture  $S_2$  of the receptor, when a mirror is placed at the location of the test sample T. The angle of incidence  $\theta$  shall be the angle formed between the line going through the center of the aperture  $S_1$  and the center of the lens  $L_1$  (principal point of the lens) and the normal of the test sample T. The light receiving angle  $\theta$  shall be the angle formed between the line going through the center of the aperture  $S_2$  and the center of the lens  $L_2$  (principal point of the lens) and the normal of the test sample T. The open angles  $\alpha_1$  and  $\alpha_2$  shall be those of the apertures  $S_1$  and  $S_2$  respectively at the locations of the lenses  $L_1$  and  $L_2$ . The optical axis on the incidence side shall that on the light receiving side shall cross each other on the sample surface. The aperture  $S_1$  may be substituted for by the light source filament at its location.

The beam of the light source shall be the standard light C specified in ASTM E308. The spectral sensitivity of the receptor shall be the same as the spectral stimulation value  $\gamma_\lambda$  specified in ASTM E308, or a combination of an equivalent light source and receptor shall be used.

A "REFO 60" made by DR LANGE Co. is recommended.

- (37) Use a plate with the  $60^\circ$  reflection factor at  $0.5 \pm 0.2\%$

NOTES The recipient of this standard should understand the following considerations: Under no circumstances are the rights in this standard to be exercised by any individual or organization without the express written consent of the American Society of Testing and Materials, Inc. The recipient of this standard is advised that any individual or organization that reproduces or distributes this standard without the express written consent of the American Society of Testing and Materials, Inc. is liable for any damages or costs incurred by the American Society of Testing and Materials, Inc. as a result of such reproduction or distribution.

Established / 9 th

J n 1 . 1997

Revised :

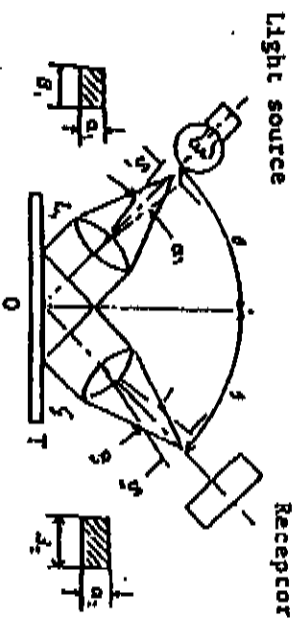


Fig. 9 Schematic of Gloss Measuring Instrument

#### 4. Test Report

Report the test results after analyzing the data according to Attached Table 1. If the fogging rate determined by method A exceeds 15% or if the fogging rate determined by method B is less than 85%, analyze the chemical composition of the substance adhering to the glass plate and include the result in the test report. Also report the condition of the adhering substance in the manner of indicating "particulate," "liquid," and so on.

#### Applicable Standard

ASTM E308 Test Method for Computing the Colors of Objects by Using the CIE System

**NOTE:** The recipient of this standard shall undertake the following responsibilities:—adoption, upon the request of the user, of the recipient shall depend by standard or non- or when in Toyota Motor Corporation of appropriate, all documents contained in this standard which they are no longer necessary due to the removal of the work contained in the recipient's scope of the standard. The standard and the technical information required therein are issued by and under the control of Toyota Motor Corporation. They shall be considered as valid only in part to any third party without prior written consent of Toyota Motor Corporation.

Established / 3<sup>th</sup> Revised :  
 Jun. 1997





TOYOTA ENGINEERING STANDARD

TS M0503G

Attached Table 1

**GLASS FOGGING TEST RESULTS**

Vehicle model \_\_\_\_\_ Date of test \_\_\_\_\_  
 Part No. \_\_\_\_\_ Test method   A/B    
 (Circle correct word.)  
 Part name \_\_\_\_\_ Test conditions \_\_\_\_\_ °C \_\_\_\_\_ h  
 Material   Painting Yes/No   Ambient conditions \_\_\_\_\_ °C   ZRH    
 (Circle correct word.)  
 Used/New (Circle correct word.) ⇒ Vehicle model \_\_\_\_\_

Date \_\_\_\_\_

Company name:		
Division:		

No.	Fogging rate (Z)			Adhering substance	Chemical composition (analysis method)	Attached mass (mg) [for method B only]
	Mean	Max.	Min.			
1						
2						
3						
Mean						

NOTE: The recipient of this standard shall indicate the following identification information upon the report of the standard. The recipient shall also indicate by handwriting the following information on the report of the standard. The recipient shall also indicate by handwriting the following information on the report of the standard: The recipient and the standard reference. The recipient shall indicate the date of the report of the standard. The recipient shall indicate the date of the report of the standard. The recipient shall indicate the date of the report of the standard.

Established / 84  
 J01. 1997  
 Revised: