

TOYOTA ENGINEERING STANDARD

NO.: TSM5608G

TITLE: HIGH PERFORMANCE POLYPROPYLENE RESIN MOLDING MATERIAL

CLASS: C2

Established/Revised: Rev. 7 (Feb. 2008)

This standard has been revised in consequence of deletion of statements about TSOP.

Prepared and Written by:
Organic Material Dept.
Material Engineering Div.2

Engineering Data Planning Dept.
Engineering Data Control and
Management Div.
©TOYOTA MOTOR CORPORATION

TOYOTA ENGINEERING STANDARD

TSM5608G

CLASS
C2

HIGH PERFORMANCE POLYPROPYLENE RESIN MOLDING MATERIAL

1. Scope
This standard covers the general properties of high performance polypropylene resin molding material (hereinafter referred to as "molding materials") used for automotive plastic parts.
Molding materials shall meet the part performance criteria and material specifications specified in separate standards. The parts made of materials provided by this standard shall conform to prohibitions and restrictions for substances of environmental concern in TSZ0001G. Exempt uses specified by EU ELV Directive shall conform to the latest version of the Directive.

2. Classification and Designation
The classification and designation of molding materials shall be as specified in Table 1.

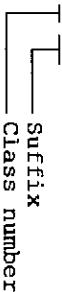
Table 1

Classification	Class 1	Class 2	Class 3	Class 5	Class 6	Class 7
Material code	TSM5608G-1	TSM5608G-2	TSM5608G-3	TSM5608G-5	TSM5608G-6	TSM5608G-7
Composition	Alloys composed of crystalline olefinic elastomer and polypropylene (co-polymer) resin, and compounded with talc for reinforcement					
Major application	Features: ultra-high impact resistance, low coefficient of linear expansion, and heat resistance when paint is baked at a temperature of 120 °C, applicable to products requiring high surface quality	Features: medium-high impact resistance, rigidity, low specific gravity, and good fluidity, applicable to thin products	Features: high impact resistance and high rigidity; applicable to products requiring resistance to heat and impact	Features: ultra-high impact resistance, high rigidity, and good fluidity; applicable to thin products requiring resistance to heat and impact	Features: ultra-high impact resistance, high rigidity, and good fluidity; applicable to thin products requiring resistance to heat and impact Procurement is available only in Japan.	Features: ultra-high impact resistance, high rigidity, and good fluidity; applicable to thin products requiring resistance to heat and impact Procurement is available globally.
Applicable parts	Bumper	Garnish, trim, console, and instrument panel lower	Instrument panel, door trim upper (for side impact), instrument panel lower (for U.S.), and cowl lower	Instrument panel, door trim (for side impact), instrument panel lower, cowl lower, and garnish	Bumper, over fender, and cladding panel	

If it is required to specify special performance for molding materials, the following letters shall be suffixed to the class number.

- L: light resistance
- P: paintability
- W: weather resistance
- S: antistatic property

Example: TSM5608G-3 LS



NOTES: The recipient of this standard shall undertake the following undeniably obligations upon the receipt of this standard.

The recipient shall liberally checkings or fine, or return to Toyota Motor Corporation if appropriate, the documents contained in this standard when they are no longer necessary, due to the termination of the work concerned 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.

Rev. 7

Feb. 2008

TOYOTA ENGINEERING STANDARD**TSM5608G****3. Quality**

The properties of molding materials may be evaluated in accordance with either TSM0506G or TSM0501G. Applicable Toyota standard is determined as follows:

New JIS or ISO standard → TSM0506G
Old JIS or ASTM standard → TSM0501G

Each material shall be tested under the conditions specified in Section 4 to verify that the material properties meet the requirements given in Table 2 or 3 and Table 4. The test result shall be evaluated by the method specified in Section 5. Note that TSM0506G shall be complied with unless otherwise specified.

Table 2 General Mechanical Property Requirement (Under ISO-Compliant Test Method)

Test item	Class 1		Class 2		Class 3		Class 5		Class 6		Class 7	
	Normal state	After heat aging	Normal state	After weathering	Normal state	After weathering	Normal state	After weathering	Normal state	After weathering	Normal state	After weathering
Specific gravity	0.99 ± 0.05		0.97 ± 0.04		1.05 ± 0.05		1.04 ± 0.03		1.04 ± 0.03		51 min.	
Rockwell hardness (R-scale)	Within ± 5 from the normal state		---		---		---		Within ± 5 from the normal state		---	
Tensile yield strength (MPa)	23 °C		16 min.		24 min.		20 min.		19 min.		17 min.	
Retention of tensile yield strength (%)	After heat aging (a) After weathering exposure		90 min.		---		---		---		90 min.	
Tensile strain at break (%)	23 °C		To be reported		To be reported		To be reported		To be reported		To be reported	
Retention of tensile elongation at break (%)	After heat aging After weathering exposure		90 min.		---		---		---		90 min.	
Tensile modulus (MPa)	23 °C		1190 to 1860		1900 min.		1820 to 2890		1820 to 2700		1760 to 2500	
Deflection temperature under load (°C)	1.8 MPa		51 min.		56 min.		60 min.		23 °C X 31% min.		56 min.	
	0.45 MPa		85 min.		108 min.		106 min.		102 min.		104 min.	
Brittleness temperature (°C)	23 °C		-25 max.		---		0 max.		-20 max.		---	
	-30 °C		14 min.		4.0 min.		13 min.		11 min.		17 min.	
Charpy impact value (kJ/m ²)	23 °C		2.5 min.		---		---		2.0 min.		2.2 min.	
	-30 °C		28 ± 8		25 min.		9 min.		28 ± 10		38 ± 16	

NOTES: The recipient of this standard shall undertake the following confidentiality obligations upon the receipt of this standard:

1) The recipient shall discard by shredding or fire, or return to Toyota Motor Corporation if appropriate, the documents contained in this standard when they are no longer necessary, due to the termination of the work concerned or the revision of current version of this standard.

2) 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.

Rev. 7

Feb. 2008

TOYOTA ENGINEERING STANDARD

TSM5608G

Table 3 General Mechanical Property Requirement (Under Old-JIS-Compliant Test Method)

Test item	Class 1	Class 2	Class 3	Class 5	Class 6	Class 7
	Specific gravity	0.99 ± 0.05	0.97 ± 0.04	1.05 ± 0.05	1.05 ± 0.05	1.04 ± 0.03
Rockwell hardness (R-scale)	Normal state	45 min.	90 min.	75 min.	63 min.	
	After heat aging After weathering exposure	Within ± 5 from the normal state				Within ± 5 from the normal state
Tensile yield strength (MPa)	23 °C	17 min.	27.4 min.		19 min.	17 min.
Retention of tensile yield strength (%)	After heat aging (a)	90 min.				90 min.
	After weathering exposure					
Tensile elongation at break (%)	23 °C	150 min.	50 min.		300 min.	100 min.
Retention of tensile elongation at break (%)	After heat aging (a)	90 min.				90 min.
	After weathering exposure					
Flexural strength (MPa)	23 °C	20.5 min.	39.2 min.	34 min.	30 min.	23 min.
	80 °C	8 min.			11 min.	6 min.
Flexural modulus (MPa)	23 °C	1600 ± 200	2350 min.	1960 to 3250	2350 ± 250	2300 ± 200
	80 °C	23 °C X 27% min.			23 °C X 31% min.	23 °C X 30% min.
Heat deformation temperature (°C)	1820 kPa	60 min.		70 min.	63 min.	
	455 kPa	110 min.	125 min.		120 min.	115 min.
Brittiness temperature (°C)	23 °C	-25 max.		0 max.	-20 min.	
	zod impact value (J/m)	150 min.	58.8 min.		145 min.	180 min.
Melt flow rate (g/10 min)	23 °C	45 min.		29 min.	40 min.	42 min.
	-30 °C					
		28 ± 8	25 min.	9 min.	28 ± 10	38 ± 16

Table 4 Other Property Requirements

Test item	Class 1	Class 2	Class 3	Class 5	Class 6	Class 7
	High speed impact test (J)	23 °C		24.5 min.		
	-30 °C		4.9 min.			
Heat aging test		No cracks, abnormally in appearance, or color fading/dis-coloration shall exist.				No cracks, abnormally in appearance, or color fading/dis-coloration shall exist.
	Weatherability or light resistance (With "W" or "L"-molding materials)	No micro-cracking or color fading/discoloration shall exist.	ΔE ≤ 3			
Paintability ⁽¹⁾ (With "P"-molding materials)		As per Section 4.3.4				As per Section 4.3.4
	Antistatic performance (With "S"-molding materials)		1 X 10 ¹³ max.			
Glass haziness ⁽²⁾	Method-A	10% max. (For materials with haziness higher than 10%, analyze the precipitate.)				
	Method-B	90% min. (For materials with haziness lower than 90%, analyze the precipitate.)				
Flammability ⁽²⁾	Intensity	100 mm/min max. (Results to be reported.)				
	Offensiveness	3.0 max.				
Odor ⁽²⁾	Fishiness	-1.5 min.				
	Pungency	1.0 max.				
Heat sag (mm)		8 max.				
Moldability			Note (3)			

- Notes:
- (1) Class 2 is not applicable to "With 'P'-molding materials."
 - (2) These requirements shall apply only to interior materials and not to exterior materials.
 - (3) Moldability (ex: tiger stripe performance, flow length, etc.) should be checked by divisions concerned.

NOTES: The recipient of this standard shall undertake the following confidentiality obligations upon the receipt of this standard:
 *The recipient shall be bound by, amend, or return to Toyota Motor Corporation if appropriate, the documents contained in this standard when they are no longer necessary due to the termination of the work contract or the rescission 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.

Rev. 7
Feb. 2008

TOYOTA ENGINEERING STANDARD

TSM5608G

4. Test Method

4.1 Tests Based on New JIS or ISO Standard

4.1.1 Preparation of Test Specimens

In principle, test specimens shall comply with Section 2, TSM0506G. Prepare test specimens by either injection molding or punching. For injection molding, use the conditions specified in TABLE 1 of Section 3.2, ISO 1873-2. If test specimens are to be produced by punching, prepare a punching flat plate by compression molding under the conditions specified in TABLE 2 of Section 3.3, ISO 1873-2. Carry out injection molding using a die specified in TSM0506G.

4.1.2 Conditioning

After molding, leave each test specimen for 168 h to stabilize crystallization. Then, immediately start and complete test. Prior to testing, condition each test specimen by the method specified in Section 2.4, TSM0506G, for at least 40 h in compliance with Section 4, ISO 1873-2. Conditioning time may be counted as a part of the time for which test specimen is left to stand.

4.1.3 Atmosphere

In accordance with Section 2.4, TSM0506G.

4.1.4 Sampling of Data

Sample test data in accordance with Section 2.5, TSM0506G. Along with the sampled data, specify the conditions used for preparing the test specimens in the test report.

4.1.5 Number of Test Specimens

Unless otherwise specified, use at least 10 test specimens for evaluation of each physical property.

4.1.6 Specific Gravity Test

In accordance with Section 3.1, TSM0506G.

4.1.7 Rockwell Hardness Test

In accordance with R-Scale, Section 3.8, TSM0506G.

4.1.8 Tensile Test

Carry out the test by the method specified in Section 3.2, TSM0506G. Table 5 shows the test conditions. For other specific conditions, such as the pulling speed, comply with Table 3 in ISO 1873-2.

Table 5

Item	Crosshead speed (mm/min)	Remark
Tensile stress at yield (MPa)	50	---
Tensile strain at break (%)		Set crosshead speed at 5 mm/min if strain at break is 10% or less.
Tensile modulus (MPa)	1	---

NOTES: The recipient of this standard shall undertake the following confidentiality obligations upon the receipt of this standard:

*The recipient shall abstain by stamping or fire, or return to Toyota Motor Corporation if appropriate, the documents contained in this standard when they are no longer necessary due to the termination of the work concerned 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.

Rev. 7

Feb. 2008

TOYOTA ENGINEERING STANDARD

TSM5608G

4.1.9 Charpy Impact Test
In accordance with Section 3.3, TSM0506G.

4.1.10 Brittle Temperature Test
Measure brittle temperature using the type B test specimens specified in Section 9.5, TSM0501G.

4.1.11 Deflection Temperature under Load Test
In accordance with Section 3.4, TSM0506G.

4.1.12 Melt Flow Rate Test
Carry out the test by the method A specified in Section 3.5, TSM0506G, at the temperature of 230 °C, using a load of 21.6 N.

4.2 Test Based on ASTM or Former JIS

4.2.1 General Conditions for Test
Unless otherwise specified, the test shall be conducted under the conditions specified in (1) to (4).

(1) Conditioning
After molding, leave each test specimen for 168 h to stabilize crystallization. Then, immediately start and complete test. Prior to testing, condition each test specimen by the method specified in Section 4, TSM0501G for at least 24 h. Conditioning time may be counted as a part of the time for which test specimen is left to stand.

(2) Atmosphere
In accordance with Section 5, TSM0501G

(3) Preparation of Test Specimens
In accordance with Section 3.1, TSM0501G

(4) Number of Test Specimens
In accordance with Section 6, TSM0501G

4.2.2 Specific Gravity Test
In accordance with Section 9.1, TSM0501G

4.2.3 Rockwell Hardness Test
In accordance with Section 9.9, TSM0501G. Conduct the test in the atmosphere of 23 ± 2°C and measure on R-Scale.
The measurement for Classes 1 and 6 materials shall be carried out under three conditions: in normal state, after heat aging, and after weathering exposure.

4.2.4 Tensile Test
In accordance with Section 9.2, TSM0501G. Conduct the test in the atmosphere of 23 ± 2°C. And then the tensile speed (crosshead speed) shall be in accordance with Table 6.

Table 6

Item	Class 1	Class 2	Class 3	Class 5	Class 6	Class 7
Crosshead speed (mm/min)	20			10		

NOTES: The recipient of this standard shall undertake the following confidentiality obligations upon the receipt of this standard.

*The recipient shall discuss by smoking or fire, or return to Toyota Motor Corporation if appropriate, the documents obtained in this standard when they are no longer necessary due to the termination of the work concerned or the mission 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.

Rev. 7

Feb. 2008

TOYOTA ENGINEERING STANDARD

TSM5608G

4.2.5 Flexural Test

In accordance with Section 9.3, TSM0501G. Conduct the test in the atmospheres of $23 \pm 2^\circ\text{C}$ and $80 \pm 2^\circ\text{C}$.

And then the flexural speed (crosshead speed) shall be in accordance with 2.0 mm/min.

4.2.6 Heat Deflection Test

In accordance with Section 9.6, TSM0501G. Conduct the test with flexure stresses of 1820 kPa and 455 kPa.

4.2.7 Brittle Temperature Test

In accordance with Section 9.5, TSM0501G

4.2.8 Izod Impact Test

In accordance with Section 9.4, TSM0501G. Conduct the test in the atmospheres of $23 \pm 2^\circ\text{C}$ and $-30 \pm 2^\circ\text{C}$.

4.2.9 Heat Sag Test

In accordance with Section 9.7, TSM0501G. Conduct the test for 1 h in the atmosphere of $120 \pm 2^\circ\text{C}$ for Classes 1 and 6 materials and $110 \pm 2^\circ\text{C}$ for Classes 2, 3 and 5 materials.

4.2.10 Melt Flow Rate Test

In accordance with Section 9.10, TSM0501G. Conduct the test at the set temperature of $230 \pm 1^\circ\text{C}$ and under a load of 21,168 N.

4.3 Other Physical Property Tests

4.3.1 High Speed Impact Test

For the test, use an instrumented impact tester. For the test specimen, prepare a $150 \times 150 \times 3$ mm flat plate. Install the test specimen in the jig shown in Fig. 1. Apply impact with an impact head 12.7 mm in diameter (with a spherical tip) and obtain the total energy. Conduct the test in the atmospheres of $23 \pm 2^\circ\text{C}$ and $-30 \pm 2^\circ\text{C}$, and with an impacting speed of 5 m/s.

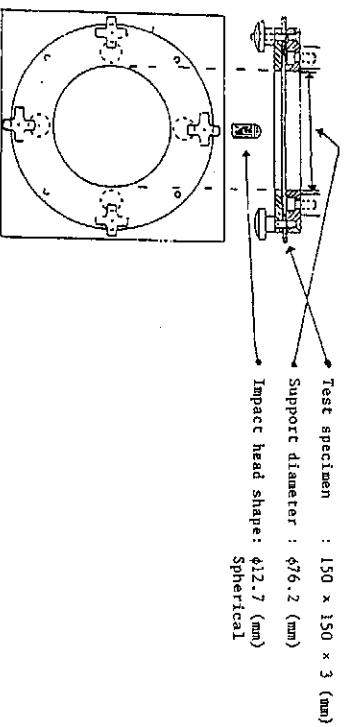


Fig. 1 Test Jig

NOTES: The revision of this standard shall undertake the following confidentiality obligations upon the receipt of this standard.

*The revision shall be made by standardizing or fine-tuning or return to Toyota Motor Corporation if appropriate, the documents contained in this standard when they are no longer necessary due to the termination of the work concerned 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.

Rev. 7

Feb. 2008

TOYOTA ENGINEERING STANDARD**TSM5608G****4.3.2 Heat Aging Test**

- (1) The test specimens shall be 50 mm long, 50 mm wide, and 3 mm thick.
- (2) For the test, use a Geer's Oven⁽⁵⁾ or an equivalent apparatus.

Note (5): The Geer's Oven shall be so designed that all air in the chamber is replaced at least once per hour. Temperature in the oven shall not deviate in excess of $\pm 2^\circ\text{C}$ with respect to the temperature at the oven center. Install an automatic temperature controller which can regulate the oven temperature within an accuracy of $\pm 1^\circ\text{C}$.

- (3) Age the test specimens for 200 h at $135 \pm 2^\circ\text{C}$.
- (4) Immediately after aging the test specimens, take them out of the oven. After storing them for 10 min in normal atmosphere, bend them 180° in one direction and then 360° in the other direction. Then check them for cracking.

Remarks:

- The mass of the specimens shall not exceed 1 g per 10 mL of oven capacity.
- Suspend and heat the specimens for aging in the oven. Take care not to let the test specimens contact each other or the oven wall.
Do not age test specimens of different materials together which may chemically affect each other in the oven.

4.3.3 Weather (Light) Resistance Test**(1) Test method**

This test is applicable to materials requiring weather (light) resistance, whose quality is specified by the suffix letter "L". Use the test method specified in Section 9.20, TSM0501G. One of the light resistance test apparatuses shown in Table 7 below shall be used depending on whether the suffix letter is "W" or "L". Details of these test apparatuses are described in Section 9.20, TSM0501G. Apply radiation as specified in Table 7.

(2) Judgment methods for test results

When test specimens have been tested according to the above-mentioned test method, judge the test results following the steps below.

(a) Visual judgment

Judge the degree of discoloration of test specimens according to the gray scale for change in color specified in ISO 105-A02 or JIS L 0804. Grade the degree of discoloration.

Check visually if there is any change of abnormal appearance.

(b) Color difference measurement

Measure the color difference ΔE^* and lightness difference ΔL^* between specimens before and after test with the colorimeter/color difference meter specified in Section 9.20, TSM0501G and using the CIELAB colorimetric system (L^{*}a^{*}b^{*} colorimetric system).

(c) Judgment by microscope

After the exposure, inspect the test specimen surfaces for existence of cracks using a microscope having a magnification of $\times 50$.

NOTES: The recipient of this standard shall undertake the following confidentiality obligations upon the receipt of this standard.

(1) The recipient shall discuss by checking or file, or return to Toyota Motor Corporation if any resale, the documents contained in this standard when they are no longer necessary due to the termination of the work concerned or the revision of current version of this standard.

(2) This standard and the technical information related thereto are owned by and under sole control of Toyota Motor Corporation. They shall not be checked in whole or in part to any third party without prior written consent of Toyota Motor Corporation.

Rev. 7

Feb. 2008

TOYOTA ENGINEERING STANDARD

TSM5608G

Table 7

Suffix	Test apparatus	Min. radiation requirement
W	Sunshine weatherometer	1000 h
	Xenon	470 MJ/m ²
	Atlas C14000	380 MJ/m ²
L	Carbon-arc fadeometer	1000 h
	Xenon	300 MJ/m ²
	Atlas C165AV Atlas C14000	2065 kJ/m ²

(3) The grades of color difference are shown in Table 8 for reference.

Table 8

Grade	Color difference (ΔE) ^⑥
5	0.7 max.
4	0.8 to 2.0
3	2.1 to 4.0
2	4.1 to 7.0
1	7.1 min.

Note (6): For the color difference of interior colors appearing after light resistance test, the quality requirements are specified in individual parts drawings.

4.3.4 Paintability Test

This test shall be performed on materials to be painted.

(1) Paintability evaluation of bumper/exterior materials
 The evaluation shall conform to TSH3311G or TSH3131G. Evaluation items are shown in Table 9. For all grades of paint adopted at the factories to which the materials are to be introduced, conduct evaluation on each item shown in Table 9. For the selection of paint grade, baking conditions and paint color, consult with Paint & Finishing Design Dept. (TOYOTA) as required.

Table 9

Paint film of primer coating only	Evaluation item	Criterion
Initial adhesion	24 ± 2 h after baking	No peeling
	24 ± 2 h after baking	
Initial adhesion	3 days after baking	No abnormalities in appearance
	3 days after baking	
Print resistance	70°C X 2 h	No conspicuous gauze marks
	3 days after baking	
Resistance to water adhesion	40°C X 240 h	No peeling
	40°C X 240 h	
Resistance to high-pressure washing		No abnormalities in appearance
Peel strength		Peeling 1 mm max.
Yellowing	Heat resistance (80°C X 240 h)	Equivalent or better than mass production material
	Moist heat resistance (50°C X 95%)	
Accelerated weatherability	Overbaking (130°C X 60 min)	Equivalent or better than mass production material
	SWQM (400 h/water resistance) X 3	
		Gloss retention rate ≧ 75%

NOTES: The recipient of this standard shall undertake the following confidentiality obligations upon the receipt of this standard.

① The recipient shall identify by stamping or line, or return to Toyota Motor Corporation if appropriate, the documents contained in this standard when they are no longer necessary due to the termination of the work concerned or the revision of current version of this standard.

② 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.

Rev. 7

Feb. 2008

TOYOTA ENGINEERING STANDARD**TSM5608G**

- (2) Paintability evaluation of interior materials
 The evaluation shall conform to TSH3130G. Evaluation items are shown in Table 10. For all grades of paint adopted at the factories to which the materials are to be introduced, conduct evaluation on each item shown in Table 10. For the selection of paint grade, baking conditions and paint color, consult with Paint & Finishing Design Dept. (TOYOTA) as required.

Table 10

Evaluation item	Criterion	
Appearance of paint film	No pinholes, sagging, mottling or other defects	
Specular glossiness (60°)	Same level as the applicable sample panel	
Hardness	Same or higher than the material hardness	
Adhesion	No peeling (0/100) 300 g X 20 cm min.	
Impact resistance	No peeling	
Resistance to moisture adhesion	No abnormalities in appearance (0/100)	
Print resistance	No gauze marks $\Delta E \leq 0.8$	
Resistance to chemicals	Resistance to water discoloration	No abnormalities on painted surface
	Resistance to alkali discoloration	$\Delta E \leq 1.5$
Glass haziness	Resistance to acid discoloration	No abnormalities on painted surface
	Method A	10% max.
Resistance to volatile oil	Method B	90% min.
		No considerable discoloration
Fastness to dry-cloth rubbing	Grade 4 or above	
Resistance to oil/fat staining	Beef tallow method	No peeling
	Bravas method	
Thermal cycle property	No abnormalities in appearance, 0/100 400 h	
Accelerated light resistance	$\Delta E \leq 3$ Gloss $\geq 80\%$	

4.3.5 Antistatic Property Measurement Test

Use an intrinsic surface electric resistance meter. Prepare the test specimens in accordance with the method actually employed for the production. Conduct the measurement one week after the molding.

4.3.6 Glass Haziness

In accordance with Method A and Method B specified in TSM0503G. Select a test temperature referring to Table 2 in TSM0503G since the temperature to be used differs with application portions.

4.3.7 Flammability

In accordance with TSM0500G. Use 350 to 355 mm long and 100 mm wide test specimens with the product thickness.

4.3.8 Odor Test

In accordance with TSM0505G. Evaluate the material using 30 mm long, 30 mm wide, and 2 mm thick (or 25 mm long, 40 mm wide, and 2 mm thick) test specimens. Select a test temperature referring to Table 3 in TSM0505G since the temperature to be used differs according to application portions.

NOTES: The recipient of this standard shall undertake the following confidentiality obligations upon the receipt of this standard.

*The recipient shall, directly by sending or fax, or return to Toyota Motor Corporation if appropriate, the documents contained in this standard when they are no longer necessary, due to the termination of the work concerned, or the revision of current version of this standard.

*This standard and the technical information related thereto are controlled, and under strict control of Toyota Motor Corporation. They shall not be checked in whole or in part to any third party without your written consent of Toyota Motor Corporation.

Rev. 7

Feb. 2008

TOYOTA ENGINEERING STANDARD

TSM5608G

5. Evaluation of Test Results

5.1 Numerical Values of Test Results

Calculate the mean value (\bar{X}) and the standard deviation (s) of the data obtained from the procedures given in Section 4. Rounding the numbers shall conform to Section 2.5, TSM0508G.

5.2 Evaluation of Test Results

Based on the values obtained in accordance with Section 5.1, judge the test results according to the following criteria.

(1) For lower limit values specified in Tables 2 to 4

Accept: ($S_L \leq \bar{X} - 2.00 \times s$)

Reject: ($S_L > \bar{X} - 2.00 \times s$)

S_L : lower limit value of specification

(2) For upper limit values specified in Tables 2 to 4

Accept: ($S_U \geq \bar{X} + 2.00 \times s$)

Reject: ($S_U < \bar{X} + 2.00 \times s$)

S_U : upper limit value of specification

where,

Mean value of test specimen:

$$\bar{X} = T/n$$

$$T = (X_1 + X_2 + X_3 + \dots + X_n)$$

Standard deviation of test specimen:

$$s = \sqrt{V}$$

$$V = S/(n - 1)$$

$$S = (X_1 - \bar{X})^2 + (X_2 - \bar{X})^2 + \dots + (X_n - \bar{X})^2$$

$$= \sum X_i^2 - (\sum X_i)^2/n$$

6. Indication of Material Marking to Part

Indicate the material marking to the parts which are made of the material covered by this standard, in accordance with TSZ6005G. Marking examples are shown in Table 11.

Table 11

Material	Material code	Marking method
High performance polypropylene resin molding material	TSM5608G-1	>PP+E/P-TD15<
	TSM5608G-2	>PP-TD10<
	TSM5608G-3	
	TSM5608G-5	
	TSM5608G-6	>PP+E/P-TD20<
	TSM5608G-7	

NOTES: The recipient of this standard shall undertake the following confidentiality obligations upon the receipt of this standard.

*The recipient shall abstain from revealing or disclosing the content of this standard to Toyota Motor Corporation if requested, the documents contained in this standard when they are no longer necessary due to the termination of the work concerned or the revision of current version of this standard.

*This standard and the technical information related thereto are owned by and under the 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.

Rev. 7

Feb. 2008

TOYOTA ENGINEERING STANDARD

TSM5608G

Applicable Standards

TSH3130G	Paint Quality for Interior Parts
TSH3131G	Coating Quality of Exterior Parts
TSH3311G	Top Coats and Coat Quality of Polypropylene Bumpers
TSM0500G	Flammability Test Method for Interior Non-Metallic Materials
TSM0501G	Standard Test Methods for Plastic Molding Materials
TSM0503G	Fogging Test Method for Non-Metallic Materials
TSM0505G	Smell Quality of Non-Metallic Materials
TSM0506G	Standard Test Methods for Plastic Molding Materials for Compliance with ISO
TSZ0001G	Control Method for Substances of Environmental Concern
TSZ6005G	Indication Method of Material Marking for Plastic Parts and Rubber Parts
ISO 105-A02	Textiles -- Tests for Colour Fastness -- Part A02: Grey Scale for Assessing Change in Colour
ISO 1873-2	Plastics -- Polypropylene (PP) Moulding and Extrusion Materials -- Part 2: Preparation of Test Specimens and Determination of Properties
JIS L 0804	Grey Scale for Assessing Change in Colour

NOTES: The recipient of this standard shall undertake the following confidentiality obligations upon the receipt of this standard:
 * This recipient shall, absent by stealing or fire, or return to Toyota Motor Corporation if appropriate, the documents contained in this standard when they are no longer necessary due to the completion of the work concerned 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.

Rev. 7
 Feb. 2008