NO.:	ISZ2205G
TITLE :	SYSTEM OF DIMENSIONAL TOLERANCES FOR PLASTIC PARTS

CLASS: C2

Established/Revised: Rev.5(Nov.2005)

This standard has been revised in consequence of the modification of terms and explanations in part.

Engineering Information
Planning Dept.
Engineering Administration Div.
TOYOTA MOTOR CORPORATION



TSZ2205G

CLASS C2

SYSTEM OF DIMENSIONAL TOLERANCES FOR PLASTIC PARTS

Scope

This standard covers the system of dimensional tolerances for finished parts of the thermosetting plastics and thermoplastics compounds produced by compression molding or injection molding. This standard applies to general dimensional tolerances as collectively specified on drawings. It is also applicable to individual dimensional tolerances directly indicated after a specific dimension. Note that those directly indicated dimensional tolerances may preferably be selected from the numerical values specified for tolerance classes established. The standard is also applicable to parts produced by extrusion molding, blow molding, foam molding, sintering and cutting.

Dimensions and dimensional tolerances control only the actual dimensions of features, as set forth in TS22001G, but not its form deviations. Unless otherwise specified, requirements on dimensional and form tolerances shall be treated independently.

Definitions

Definitions of terms referred to in this standard shall be as follows or as defined in TSZ2300G.

- Finished dimensions
 - Finished dimensions are the dimensions of a finished part specified in drawings or associated documents, when the part satisfies the standard environmental conditions set forth in Section 3. For parts requiring post-molding treatment (plating, hot stamping, vacuum metallizing, painting, etc.), "finished dimensions" refers to the dimensions of post-treatment
- (2) Dimensions directly related to mold forms Dimensions directly related to mold forms are the dimensions of a feature defined by the dimensions of the mold (dimension "a" in Fig. 1).
- (3) Dimensions not directly related to mold forms Dimensions not directly related to mold forms are the dimensions of a feature whose form is defined by components of a mold. Examples are the thickness of the bottom and wall of a unit (dimension "c" in Fig. 1), and such dimensions which are affected by inserts, moving slides and cores (dimension "b" in Fig. 11.

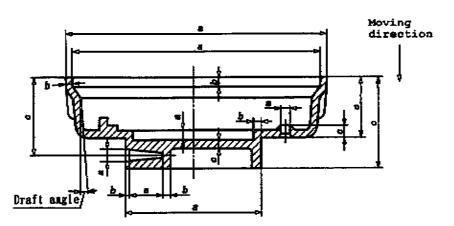
Engineering Administration Div. Prepared and Written by: TOYOTA MOTOR CORPORATION Engineering Information Planning Dept. Established/ 5 Revised: Engineering Administration Div. Nov.2005

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Explanatory notes:

- a: Dimensions directly related to mold forms
- D: Dimensions not directly related to mold formsc: Dimensions not directly related to mold (holding mold) forms in moving direction

Fig. 1 Dimensions of Plastic Parts

(4) Contraction factor

The contraction factor, K, shall be calculated by using the equation (1). The contraction factor shall be as indicated in Table 1.

$$K = A + |A - B| ---- (1)$$

where.

- A: contraction along the derection of flow in %
- B: contraction across the direction of flow in %

Table 1 Contraction Factors

Contraction factor (calculation)	Contraction factor (indication)
0 ≦ % ≦ 1	0 - 1
1 < K ≦ 2	1 - 2
2 < K ≦ 3	2 - 3
3 < K ≤ 4	3 - 4

(5) Dimensional tolerance groups

The dimensional tolerance groups indicate the ratios determined by materials, contraction factors and tolerance levels.

(6) Form defect propensity

The form defect propensity indicates the relative trend of a molded part to deviate from the geometry produced by the molding tool after being injection-molded, transfer-molded or compression-molded.

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3. Standard Environmental Conditions

The standard environmental conditions shall comprise the following:

- (1) Minimum of 24 h of time lapse following the molding and finishing of plastic part. If not reaching 24 h, however, temperature correction needs to be carried out.
- (2) Temperature of the plastic part shall be 23±3 ℃.
- (3) Ambient temperature shall be 23 \pm 3 $^{\circ}$ C and relative humidity 50 \pm 5 %.
- 4. Resin Classification and Dimensional Tolerance Groups

Classification of resins and corresponding tolerance groups (tolerance classes of PLTA, PLTB and PLTC) are as given in Table 2.

- (1) Tolerance class PLTC
 - Tolerance of this class is obtained under normal production conditions.
- (2) Tolerance class PLTB

This class has a smaller tolerance over the tolerance class PLTC. PLTB tolerance class can normally be attained through appropriate mold adjustment and production control, but generally by specially controlled production conditions.

(3) Tolerance class PLTA

This class has a smaller tolerance over the tolerance class PLTB. PLTA tolerance class is attained by specially controlled production conditions.

Note that carrying out mold adjustment and special production control can lead to an increase in costs.

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Table 2 Resin Classification and Dimensional Tolerance Groups

	Molding re	in Classificati					-
1	Molding re	81108	Contraction factor	Tolonia	lerance gr	oup	Poro defect
Code	Resi	n name	rector	class PLTC	Clase PLTB	Class PLTA	propensity
FF	Phenol	mineral- filled	0 to 1	130	120	110	Sug]]
	<u></u>	organic- filled	1 to 2	140	130	120	
UP	Urea, organi						
MP		neral-filled	0 to 1	130	120	110	
MP/PP	Amino/Phenol organic/mine	ral-filled	1 to 2	140	130	120	
UP	Unsaturated	polyester					
PE		, unfilled "	2 to 3	150	140	130	Large
["	Polypropyles (tale/chalk)		1 to 2	140	130	120	Medium
	Polypropylen reinforced						Large
PCTFE	Polychlore-t atbylene	rifluoro-	2 to 3	150	140	130	Medium
PEP	Perfluoro propyleme) r						
PA	12, unfilled		1 to 2	140	130	120	
	112. qlass-re	66, 610, 11, inforced	0 to 1	130	120	110	Large
POM	Polyacetal, unfilled	Molded length < 150 mm ⁽¹⁾		140	130	120	5mall
l		Molded length ≥ 150 ma ⁽¹⁾	7 to 3	150	140	130	Medium
	Polyacetal, reinforced	glass-	0 to 1	130	120	110	Large
PBT	Poly-butylen terephtalate	_	1 to 2	140	130	120	Medium
	Poly-butylen terephtalate reinforced	, glass-	0 to 1	110	120	110	Large
<u> </u>	amorphous	terephtalata,					Small
PET (k)	Polyetylene	Unfilled	1 to 2	140	130	120	Medium
	terephtalate crystalline	reinforced	0 to 1	130	120	110	Large
PP8	Polyphenylen	e eulfide	,	l			Smell
P\$ SAN	Polystyrene	 -	1		I	l	- 1
SB	Styrene-acry Polystyrene-		I	1	I		- 1
ABS	Acrylonitril			I	J	f	- 1
ADO	erale	2-Dac9016U0.	f	I	f		· ·
PHOLA	Polymethyl me	ethacrylate	į	I	l l		
PVC	Polyvinyl ch	oride, rigid		I	l l	-	Hedium
							766164

One level higher tolerance shall apply when the wall thickness is greater than 4 mm.

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Table 2 (Continued)

	Molding resins	Contraction	To	lerance gr	οup	Form defect
		factor				propensity
Code	Reain name	<u>. </u>	class PLTC	class PLTB	class PLTA	
CA	Cellulose acetate	1 to 2	140	130	120	Small
CAB	Cellulose acetate butylate			l		
CAP	Cellulose acetate propionate					
CP	Cellulose propionate					!
PSU	Polysulfone	0 to 1	130	120	110	
Mod. PPO	Modified polyphenyleneoxide					
PPE	Polyphenylene-ether, glass-reinforced					Medium
PC	Polycarbonate		!		}	Small
	Polycarbonate, glass- reinforced		Ĺ			Kedium

Remark:

For resins which can not be located in Table 2, refer to Section 5.

5. General Permissible Dimensional Deviation General permissible dimensional deviation and dimensional tolerance of each dimensional tolerance group that corresponds to tolerance class shall be as specified in Attached Table 1. For resins that are not listed in Table 2, determine the contraction coefficient first. Then, see Table 3 and determine the tolerance class of the dimensional tolerance group that has a dimensional tolerance required due to the function of the part.

Table 3 Tolerance Classes Corresponding to Resin Contraction Factor and Dimensional Tolerance

		~ <u>-</u>	
Contraction	Dimensio	nal toleran	ce group
	Tolerance class PLTC	Tolerance class PLTB	Tolerance class PLTA
0 - 1	130	120	110
1 - 2	140	130	120
2 - 3	150	140	130
3 - 4	160	150	140

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6. Tolerance for Angular Dimensions

Dimensional tolerance group is not applicable to angular dimensions (θ in Fig. 2) indicated for the features with inclined surfaces. The dimensional tolerance for the particular angular dimension shall be selected from Table 4 classifying the tolerance by classes of PLTA, PLTB and PLTC in combination with basic size (L in Fig. 2).

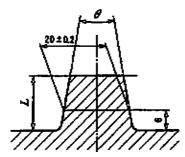


Fig. 2 Example of Angular Dimension Indication to Inclined Features

Table 4 Tolerance for Angular Dimensions

Basic size (L) range (mm)	Tolerance class PLTC	Tolerance class PLTB	Tolerance class PLTA
10 max.	±3 '	±1 30 '	±1 *
Over 10 to 50 incl.	±2 *	±0 50 '	±0 * 30 '
Over 50 to 120 incl.	±1 *	±0 ' 25 '	±0 ' 20 '
Over 120	±0 30 '	±0 15 '	±0 10

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7. Tolerances Related to Forms

7.1 Draft Angle

Unless otherwise specified, draft angles shall be 0 to 1 *. Specially required draft angle must be specified on the drawing. Since all dimensional tolerances apply to the basic size described on the drawing, the draft angle shall be added in principle (Fig. 4 (a)) to the basic form of the mold (Fig. 3). When specifying a negative draft angle applicable to the basic size, note as such clearly on the drawing (Fig. 4 (b)).

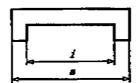
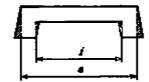
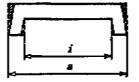


Fig. 3 Basic Form





(a) Positive Draft Angle (b) Negative Draft Angle

Fig. 4 Draft Angles

7.2 Mismatch

(1) For separate-type molds

Applicable to the maximum of all the dimensions, denoted as "Y", in a part (Fig. 5) and the allowable maximum value for mismatch of a separate-type mold shall be 0.1 mm.

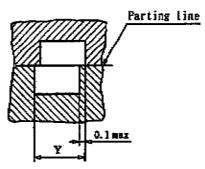


Fig. 5 Allowable Value for Mismatch (Separate-Type Hold) (Unit: mm)

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(2) For single-type molds

Applicable to the maximum of all the dimensions, denoted as "Y", in a part (Fig. 6) and the allowable maximum value for mismatch of a single-type mold shall be 0.05 mm.

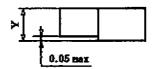


Fig. 6 Allowable Value for Mismatch (Single-Type Mold) (Unit: mm)

(3) For composite-type molds

Applicable to the maximum of all the dimensions, denoted as "Y", in a part (Fig. 7) and the allowable maximum value for mismatch of a composite-type mold shall be 0.15 mm.

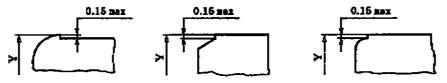


Fig. 7 Allowable Value for Mismatch (Composite-Type Mold) (Unit: mm)

7.3 Pin Holes

The allowable maximum value for pin hole depth shall be as follows determined in accordance with the thickness ratio, B/A, of a feature (Fig. 8).

B/A = 1: X = 0.1 mm (max.)

B/A = 2: X = 0.2 mm (max.)

B/A > 2: X = 0.3 mm (max.)

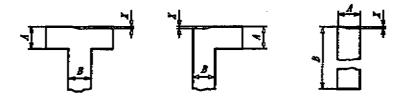


Fig. 8 Pin Hole

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7.4 General Geometrical Tolerances

7.4.1 Tolerance on Straightness

Unless individually specified, tolerance on straightness shall be as specified in TSZ2305G.

7.4.2 Tolerance on Flatness

Unless individually specified, tolerance on flatness shall be as specified in TSZ2305G.

7.4.3 Tolerance on Circularity

Unless individually specified, tolerance on circularity shall be equal to the numerical value of the diameter tolerance for a feature.

8. Indication on Drawings

8.1 General Dimensional Tolerances

General dimensional tolerances for molded plastic parts shall be indicated on drawings or associated specifications by the standards number of this standard, followed by the designation for the tolerance class. Only the designation for the tolerance class, however, shall be marked if indicating on the title block on the drawing.

Indication example for tolerance class PLTB: Drawing or related document: TS22205G-PLTB Drawing title block: PLTB

8.2 Dimensional Tolerance Individually Indicated for Basic Size

(1) A dimensional tolerance to be individually indicated to the basic size on a drawing shall preferably be selected from the permissible dimensional deviations given in Attached Table 1. The tolerances zone shall generally be symmetrically disposed with respect to a basic size, with one half on the positive side and one half on the negative side.

Example:

For a basic size directly determined by the mold of 55 mm (dimension "a") and dimension tolerance group 140 is applied, indicate as follows: 55±0.4

(2) Tolerances may also be asymmetrically disposed with respect to a basic size, on either the positive or negative side, with the tolerance zone unchanged.

Example:

For a basic size directly determined by the mold of 55 mm (dimension "a") and dimension tolerance group 120 is applied, indicate as follows: 55th or 55th

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(3) In the case where a tolerance that is smaller or larger than the dimensional tolerance group classified by a specified general dimensional tolerance is required for the basic size, such should be indicated in appropriate numerical values.

Applicable Standards

TSZ2001G Fundamental Tolerancing Principle

TSZ2300G Geometrical Tolerancing

TSZ2305G General Geometrical Tolerances

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Attached Table 1 Permissible Dimensional Deviation and Tolerance (Unit: mm)

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The symbol "a" is used for a dimension directly related to mold, "b" for a dimension not directly related to mold, and "c" for a dimension in the moving direction not directly related to mold.

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