

Polybutylene Terephthalate (PBT)

DURANEX®

7407

EF2001/ED3002

Low Warpage, HB,
Standard

Introduction

DURANEX® PBT is an engineering plastic that combines excellent physical properties with superior processability. It is utilized in numerous industrial fields, such as electrical and automotive, and its applications are steadily becoming more varied.

At Polyplastics, we offer many grades of **DURANEX** to cater for a diverse variety of applications. These are generally classified into filled reinforced and non-filled grades.

At the majority of applications require high strength, high stiffness, and heat resistance, the majority of grades are glass fiber-reinforced. When injection molded,

however, the glass fibers contained in such grades tend to orient themselves in the cavity, and this can cause the molded products to warp or otherwise deform in some cases.

We already supply grades that counter warp deformation, such as the glass beads-filled grade 6300B and the glass filler composite grade 7400W. However, while these grades exhibit low degrees of warping, they do suffer from a slight degradation in strength.

Through the compounded effect of various reinforcing fillers, **DURANEX grade 7407** maintains a strength that is close to that of the glass fiber-reinforced grade 3300, while being the optimum high strength grade that prevents.

General Properties of 7407

table1-1 General Properties (ISO)

Item	Unit	Test Method	Low Warpage, HB, Standard
			7407
			GF Reinforced, Super Low Warpage
Color			EF2001/ED3002
ISO(JIS)quality-of-the-material display:		ISO11469 (JIS K6999)	>PBT+PC-(GF+GS)40<
Density	g/cm ³	ISO 1183	1.57
Water absorption (23°C,24hrs,1mmt)	%	ISO 62	0.1
Tensile strength	MPa	ISO 527-1,2	117
Strain at break	%	ISO 527-1,2	2.5
Flexural strength	MPa	ISO 178	180
Flexural modulus	MPa	ISO 178	9,500
Charpy notched impact strength (23°C)	kJ/m ²	ISO 179/1eA	8.8
Temperature of deflection under load (1.8MPa)	°C	ISO 75-1,2	200
Coefficient of linear thermal expansion (23 - 55°C、Flow direction)	x10 ⁻⁵ /°C	Our standard	2
Coefficient of linear thermal expansion (23 - 55°C、Transverse direction)	x10 ⁻⁵ /°C	Our standard	5
Electric strength (3mmt)	kV/mm	IEC 60243-1	26
Volume resistivity	Ω・cm	IEC 60093	3 × 10 ¹⁵
Volume resistivity (Our standard)	Ω・cm		-
Tracking resistance (CTI)	V	IEC 60112	325
Rockwell hardness	M(Scale)	ISO2039-2	85
Flammability		UL94	HB
The yellow card File No.			E213445
Appropriate List number of Ministerial Ordinance for Export Trade Control			Item 16 of Appendix -1

All figures in the table are the typical values of the material and not the minimum values of the material specifications.

2. Warpage prevention effect of DURANEX® 7407

Duranex 7407 is widely used in automotive components and precision parts in the electrical, electronic, OA equipment, and other industries. As the molded parts used in these industries are of a diverse nature, here we show the effects of using 7407 through introducing one or two model

deformation experiments.

As shown in Tables 2-1 to 2-3, grade 7407 can achieve a far superior deformation prevention effect when compared with the glass fiber reinforced grade 3300.

Table 2-1 Flat plate warpage

(warpage extent: mm)

Grade	DURANEX® 7407	DURANEX® 3300
Max. warpage	2.3	24

Molded part: 120×120×2mm square plate

Gate: One side gate located at the mid point of one edge.

Table 2-2 Internal warpage in molded box

(warpage extent: mm)

Grade Warpage	DURANEX® 7407	DURANEX® 3300
$\Delta \ell_1$	0.24	0.34
$\Delta \ell_2$	1.01	1.78

Nominal dimensions of molded box

$$\begin{aligned} \ell_1 &= 76\text{mm} & \Delta \ell_1 &= \ell_1 - \ell_1' \\ \ell_2 &= 36\text{mm} & \Delta \ell_2 &= \ell_2 - \ell_2' \\ \text{Height} &= 40\text{mm} \\ \text{Thickness} &= 2\text{mm} \end{aligned}$$

Shape and dimensions of molded box

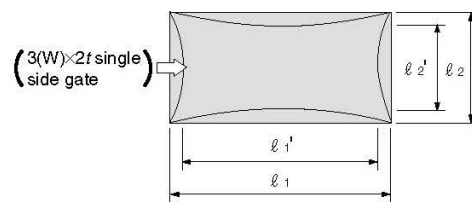
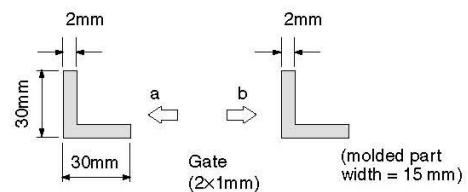


Table 2-3 L section angular deformation

(angle of deformation. unit: °C)

Grade Gate position	DURANEX® 7407	DURANEX® 3300
a	2.0	3.2
b	0.8	1.6

Shape and dimensions of molded part.



3. Processing characteristics of DURANEX® 7407

3.1 Points to consider when molding

As with other filled composite grades, **Duranex 7407** processability when injection molding is good.

However, hydrolysis and thermal breakdown in the injection cylinder cause degradation in the physical properties of the molded product, as is the case with other grades. Therefore, as is also the case with other grades, we recommend ample pre-drying and close attention to the cylinder temperature when molding.

3-3 Mold shrinkage ratio

Table 3-1 shows the mold shrinkage ratios for **7407**. The directional dependence of the mold shrinkage ratio (the difference between shrinkage in the flow direction and the transverse direction) for **7407** is improved dramatically compared with **3300**. This effect is particularly evident in the high injection pressure region.

3.2 Flow characteristics

Figure 3-1 show flowability data for **7407**. As **7407** is a filled composite grade, flowability is somewhat inferior to that of the glass fiber reinforced grade **3300**.

Figure 3-1 Flowability of DURANEX® 7407

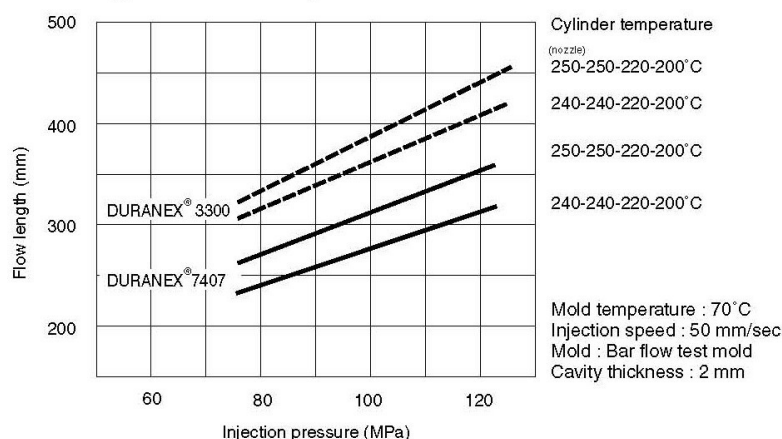


Table 3-1 Mold shrinkage ratio for DURANEX® 7407 (%)

Grade	Molded part thickness		2mm		3mm		4mm	
	Injection pressure Mpa	Flow direction	Flow direction	Transverse direction	Flow direction	Transverse direction	Flow direction	Transverse direction
DURANEX® 7407	49		0.3	0.6	0.3	0.5	0.4	0.5
	58		0.2	0.5	0.2	0.4	0.4	0.5
	68		0.2	0.3	0.2	0.4	0.4	0.5
DURANEX® 3300	49		0.3	1.1	0.3	1.0	0.5	0.9
	58		0.3	0.9	0.3	0.8	0.5	0.8
	68		0.3	0.8	0.3	0.8	0.5	0.8

Processing parameters

Cylinder temperature : 250-250-220-200°C (Nozzle)

Mold temperature : 70°C

Mold: 120×120mm flat plate

Gate sizes : $\begin{cases} 2t, 3t, 4t \\ 6(W) \times 3t \end{cases}$

Cycle : $\begin{cases} 2t & 20 + 10 \text{ s} \\ 3t & 20 + 15 \text{ s} \\ 4t & 30 + 15 \text{ s} \end{cases}$ (Injection Cooling)

4. Evaluation of actual parts molded using DURANEX® 7407

The high strength, low warpage grade 7407 is characterized well by the data presented in the preceding pages, but as complicated flow behavior is adopted that depends on the shape of the actual molded part, we recommend that the actual effects be ascertained in the actual part.

Table 4-1 summarizes dimensional precision (flatness and concentricity) and pipe strength (static flexural rupture strength and falling dart rupture strength) of a part molded using an actual tool for a valve used to control emissions from automotive exhaust.

Table 4-1 Example of actual physical properties of part molded from grade 7407 (automotive exhaust emission control valve)

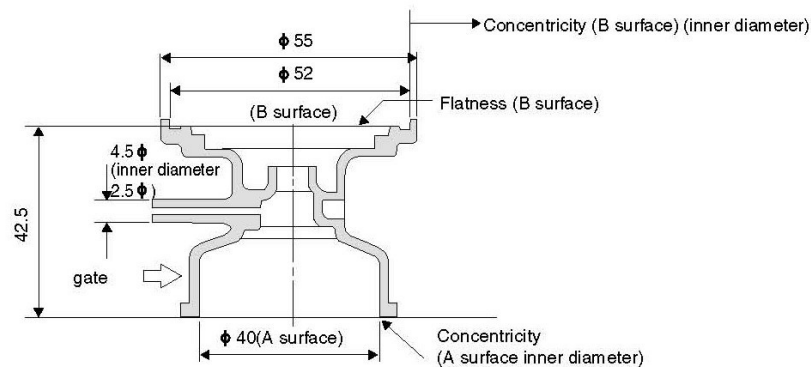
Property	Parameter	Unit	Grade	DURANEX® 7407	DURANEX® 3300
Warpage deformation	Flatness B surface	mm		0.053	0.182
	Concentricity A surface	mm		0.051	0.079
	B surface	mm		0.048	0.108
Pipe strength	Flexural rupture test*				
	Rupture load	N		166	162
	Extend of deformation at point of rupture	mm		2.1	1.7
	Falling dart impact test**				
	50% rupture height	m		0.41	0.45

* : Flexural rupture test (pipe strength 1)

The molded part is fixed, and a load is applied 3 mm from the pipe's edge at a rate of 100 mm/s. The maximum load at the point of rupture and the extent of deformation are measured.

** : Falling dart impact experiment (pipe strength 2)

The molded part is fixed, and a 73.5 x 10-2 N dart is dropped along a rail, whereby it impacts the pipe at a point 3 mm from the pipe edge. The 50% rupture height is sought.



(Consideration of test results)

The flatness of 7407 is superior to 3300 by a factor of approximately three. Concentricity is approximately twice as good. These results show the superior deformation prevention effects of 7407.

Moreover, in terms of strength, it can be seen that equivalent flexural rupture strength and falling dart impact values to 3300 can be achieved with 7407.



NOTES TO USERS

- All property values shown in this brochure are the typical values obtained under conditions prescribed by applicable standards and test methods.
- This brochure has been prepared based on our own experiences and laboratory test data, and therefore all data shown here are not always applicable to parts used under different conditions. We do not guarantee that these data are directly applicable to the application conditions of users and we ask each user to make his own decision on the application.
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(R240110-1403)