"TOYOLAC" PC//ABS Alloy
PX10

Technical Guide
for
Processing & Molding

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Molding Guide of PC/ABS "TOYOLAC" PX10 X06 & PX10 X07

1. Preliminary Drying

1) Preliminary drying under appropriate condition is necessary in order to obtain good molded part, hence the recommended moisture content of pellet is less than 0.05%, and more desirable is 0.03%.

Preliminary drying necessity becomes prominent for PC (Polycarbonate) type of resin since insufficient drying will induce hydrolysis and subsequently causing the decrease in property as well as appearance defects, thus unable to obtain the resin original performance. The dehumidification dryer is the best device for the preliminary drying of PC type of resin.

The recommended drying condition for "Toyolac" PX10-X06/ X07 is shown in Table 1.

Table 1. Recommended drying condition for "Toyolac" PX10-X06/ X07

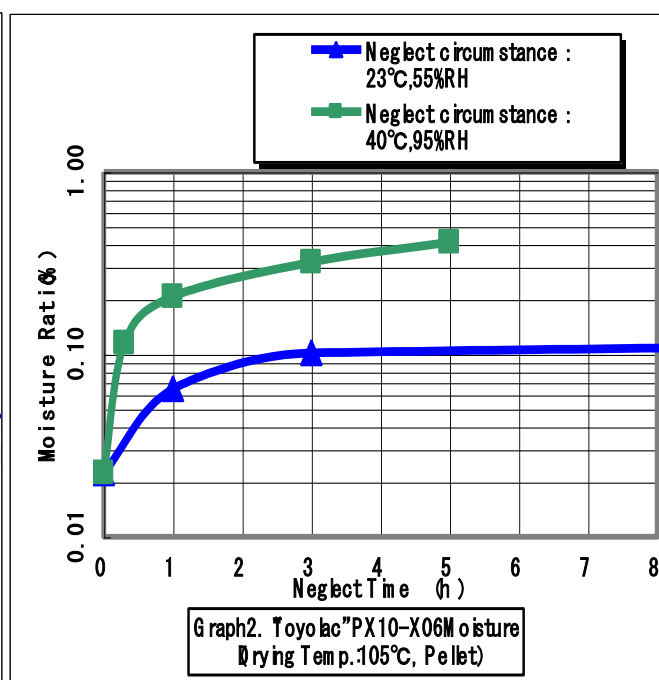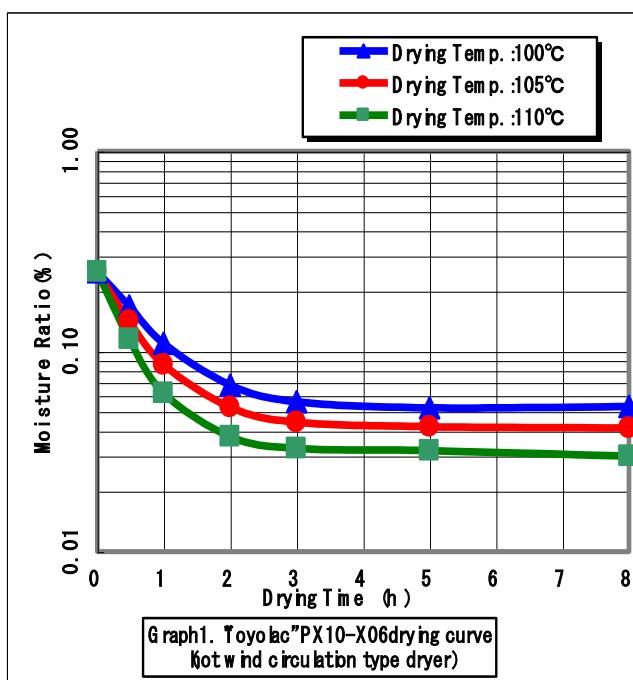| Drying Temperature (℃)	Drying Time (h)
105	4 ～ 10

2) Avoid drying at temperature higher than recommended condition since high temperature will cause agglomeration, deterioration and discoloration of pellet. Reversibly, drying at temperature lower than recommended will cause appearance defects such as silver streak.

3) Avoid drying time exceeding recommended time since long drying time will cause deterioration and discoloration of molded part. However, if drying time shorter than recommended, appearance defects such as silver streak will happen.

4) Ensure sufficient aeration when using hopper dryer. Be aware of filter blockage which will affect the aeration.

5) When using shelf type of hot air dryer, the pellet height should be <6 cm and must be uniformly laid to prevent under dried pellet at the tray bottom.

The drying curve and moisture absorption curve of "Toyolac" PX10-X06 are shown in Graph 1 and Graph 2 respectively.

Graph1. Toyolac"PX10-X06drying curve (hot wind circulation type dryer)

Graph2. Toyolac"PX10-X06Moisture (Drying Temp.105℃, Pellet)

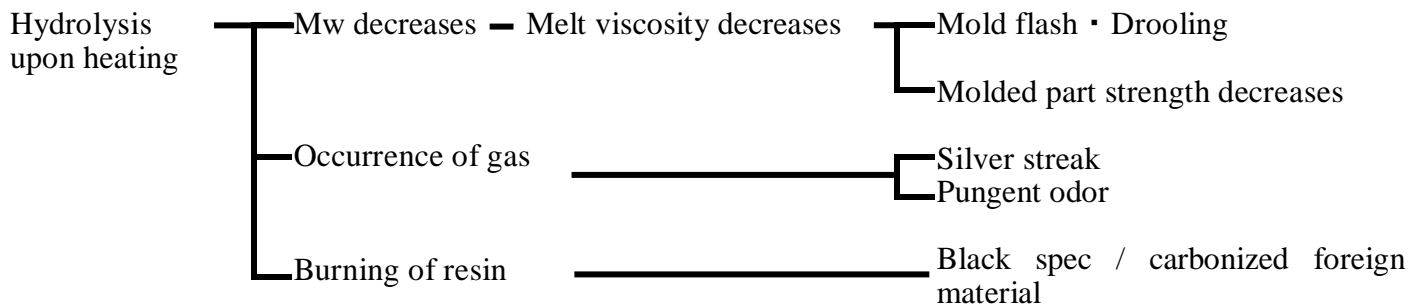The dryness of material is decided by relative humidity inside the dryer.

In order to achieve sufficient drying at high temperature and high humidity condition, it is necessary either to increase the drying temperature to lower down relative humidity or to use dried air.

Pellet agglomeration of "Toyolac" PX10-X06 during drying is shown in Table 2.

Table 2. Agglomeration of "Toyolac" PX10-X06

Drying Temperature (℃)	Drying Time (h)	Load Pressure (kPa)	Pellet Agglomeration	
100	60	0	○	No
"	"	4.4	○	No
"	"	8.8	○	No
105	15	0	○	No
"	"	4.4	○	No
"	"	8.8	○	No
105	30	0	○	No
"	"	4.4	○	No
"	"	8.8	△	Slightly
105	60	0	○	No
"	"	4.4	○	No
"	"	8.8	×	Yes
110	3	0	○	No
"	"	4.4	○	No
"	"	8.8	○	No
110	6	0	○	No
"	"	4.4	○	No
"	"	8.8	△	Slightly
110	9	0	○	No
"	"	4.4	○	No
"	"	8.8	×	Yes
110	12	0	○	No
"	"	4.4	△	Slightly
"	"	8.8	×	Yes
110	15	0	○	No
"	"	4.4	×	Yes
"	"	8.8	×	Yes
110	30	0	○	No
"	"	4.4	×	Yes
"	"	8.8	××	Overall Yes
110	60	0	○	No
"	"	4.4	×	Yes
"	"	8.8	××	Overall Yes

Defective examples due to insufficient preliminary drying of PC type resin

Hydrolysis upon heating
- Mw decreases — Melt viscosity decreases
  - Mold flash・Drooling
  - Molded part strength decreases
- Occurrence of gas
  - Silver streak
  - Pungent odor
- Burning of resin
  - Black spec / carbonized foreign material

Features of dryer

Hot Air Type (External Air Ventilation Type)
This method is heating up external air by direct heater followed by ventilating such low humidity air (using the principle of when the air contains equal amount of water, higher temperature reduces humidity) to dry resin, then exhausting such gas.
This is a simple and cheap structure but easily affected by the condition of external air since it is an open system. Thus, it is necessary to take precaution because it might cause molding defects.

Dehumidification Type
This method lowers down the dew point of steam to about -40℃ using catalyst, then air inside this close system is dehumidified. Dehumidified air is heat up to dry the resin.
Drying efficiency is high but is expansive and maintenance of catalyst, filter and others is necessary.

There is no drying capability difference between hot air type and dehumidification type at the early stage of drying, however the difference becomes prominent when drying for longer period of time. When drying equal amount of resin, large capacity is necessary for hot air type.

Calculation method for dryer capacity

$$\frac{3600}{\text{Cycle [s]}} \times \frac{\text{Injected weight [g] (*include nozzle, runner)}}{1000} = \text{Resin consumption per hour [kg / h]}$$

$$\frac{\text{Resin consumption per hour [kg / h]} \times \text{Necessary drying time [h]}}{\text{Assumed resin specific gravity [-]}} = \text{Dryer volume [L]}$$

Resin in the hopper is consumed from the center part, hence about 20% allowances are considered.

$$\text{Dryer volume [L]} \times 1.2 = \text{Required dryer volume [L]}$$

Resin quantity inside the dryer hopper

There is a warm air outlet inside the hopper dryer (this outlet looks like trumpet shape and attached at pipe downward), and it is necessary to always cover this outlet with resin. When the amount of resin is insufficient, the warm air is just blow through resin surfaces thus causing insufficient drying.

2. Injection Molding

1) When problem occurs during molding causing retention of resin, there are possibilities that heat generated will cause inferior property due to molecular weight (Mw) of PC decreases and appearance defects. Thus, 5～10 shots of purging is compulsory.

2) Injection volume around 30～70 % of the capacity of injection molding machine shall be selected and molding is carried out following the standard molding condition.

3) Mold temperature will improve molded part appearance as well as influencing thin molded part molding, thus it should be set as high as possible provided that it would not much affecting the molding cycle.

4) When high injection speed is applied, resin will pass through narrow areas such as nozzle, gate and other parts at high speed, subsequently heat is generated due to shearing. As a result, burnt and gas burnt at weld line happen. Thus, start condition setting from low speed.

The standard molding condition of "Toyolac" PX10-X06/ X07 is shown in Table 3.

Table 3. Standard molding condition of "Toyolac" PX10-X06/ X07

Item	Condition Setting
Molding Temperature	240～270℃
Mold Temperature	50～80℃
Screw rpm	40～80 rpm
Injection Pressure	60～120 MPa
Injection Speed	Medium
Back Pressure (resin pressure)	5～10 MPa

Please set molding condition during actual molding due to variation in molded part shapes.

3. Others

1) When gas venting of mold is insufficient, gas burnt, short shot and other problems cannot be solved by adjusting molding condition. Thus, much consideration is necessary during mold design.

2) Resin degradation is caused by long retention time inside injection machine cylinder.

3) Whenever stop molding, please change and clean with general purpose grade ABS to prevent burnt as well as to conserve injection molding machine.

"TOYOLAC" PC//ABS Alloy Grade Typical Properties

ALLOY 合金型						
Property 代表物性	Test Method 试验法	Test Condition 试验条件	Units 单位	PC//ABS		
				Type 型号	PX10	PX10
				Suffix 区分字符	X06	X07
ISO STANDARD						
Melt Flow Rate 流动系数	ISO 1133	240°C / 10 kg	g/10min		15	29
Charpy Impact Strength (notched) 缺口冲击强度	ISO 179/1eA	23°C / 50 %RH	kJ/m^2		48	60
Deflection Temperature Under Load 热变形温度	ISO 75	1.8 MPa / 120°C/hr	°C		116	101
Tensile Strength 引张强度;降伏点	ISO 527	50 mm/min	MPa		59	57
Tensile Elongation at Break 拉伸伸长率			%		>50	>50
Tensile Modulus 拉伸模数		1 mm/min	MPa		-	-
Flexural Strength 弯曲强度	ISO 178	2 mm/min	MPa		87	84
Flexural Modulus 弯曲模数					2140	2180
Density 比重	ISO 1183	23°C	kg/m^3		1150	1120
Flammability 燃烧性	UL94 File No. E41797				HB	HB

Note: The above values are typical data for the products under specific test conditions and not intended for use as limiting specifications.
「以上数据谨代表在特定条件下所得的测定值的代表例」