

"TOYOLAC" ABS// PC PX04 X50

Technical Guide for Processing & Molding

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Molding Guide of ABS/ PC & "TOYOLAC" PX04 X50

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" PX04 X50 is shown in Table 1.

Table 1. Recommended drying condition for "Toyolac" PX04 X50

Drying Temperature (°C)	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" PX04 X50 are shown in Graph 1 and Graph 2 respectively.





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" PX04 X50 during drying is shown in Table 2.

Drying Temperature	Drying Time	Load Pressure	Pellet Agglomeration
(°C)	(h)	(kPa)	
100	60	0	 No No No
''	''	4.4	
''	''	8.8	
105 '' ''	15 '' ''	$0 \\ 4.4 \\ 8.8$	 No No No
105	30	0	 ○ No ○ No △ Slightly
"	''	4.4	
"	''	8.8	
105	60	0	○ No
''	''	4.4	○ No
''	''	8.8	× Yes
110 " "	3 11 11	$\begin{matrix} 0\\ 4.4\\ 8.8 \end{matrix}$	 No No No
110	6	0	 ○ No ○ No △ Slightly
<i>''</i>	11	4.4	
<i>''</i>	11	8.8	
110	9	0	
<i>''</i>	11	4.4	
<i>''</i>	11	8.8	
110	12	0	 ○ No △ Slightly × Yes
<i>"</i>	''	4.4	
<i>"</i>	''	8.8	
110	15	0	
"'	''	4.4	
"	''	8.8	
110	30	0	○ No
<i>"</i>	''	4.4	× Yes
<i>"</i>	''	8.8	×× Overall Yes
110	60	0	
<i>''</i>	''	4.4	
<i>''</i>	''	8.8	

Table 2. Agglomeration of "Toyolac" PX04 X50



Defective examples due to insufficient preliminary drying of PC type resin



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° C 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

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

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

Resin consumption per hour $[kg / h] \times Necessary drying time [h]$

Assumed resin specific gravity [-]

= Dryer volume [L]

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

Dryer volume [L] $\times 1.2$ = 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, $5 \sim 10$ shots of purging is compulsory.
- 2) Injection volume around $30 \sim 70$ % 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" PX04 X50 is shown in Table 3.

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

Table 3. Standard molding condition of "Toyolac" PX04 X50

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

- 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.

^{3.} Others