PROCESSING

Tecotek® compounds can be processed in all commercial injection molding machinery.

Injection Molding Machine

Selecting the proper design injection molding machine is important to have economic and quality moldings.

As a general rule, capacity of an injection molding machine should have 0.40 – 0.60 tons of clamping force for every square centimeter of projected shot area.

General purpose screw designs with compression ratios between 2.0:1 – 2.5:1, and screw size of 18D to 22D are recommended. Standard nitride screws and barrels are not resistant to the abrasion of fillers, especially glass fibers. However, bi-metallic barrel liners and surface hardened screws show outstanding resistance to wear.

Due to reduced shear general purpose open nozzles that are as short as possible are suggested. The temperature control of the nozzle is very important in order to avoid thermal loss or overheating. In general nozzle diameters should be 3 to 6 mm depending on the size of the part.

It is important to have precise temperature control for processing PC compounds therefore several heating zones of the barrel are necessary.

Cooling system of the feed throat is important to prevent sticking of the granules and to have consistent feed of material to barrel. On the other hand, too low throat temperature will cause condensation, resulting hydrolysis and melt foaming. Temperatures between 60°C – 80°C are suggested.

When molding PC the shot size should be between 30% - 80% of barrel capacity. Shots larger than 80% may generate improper melting, where shots less than 30% will increase the residence time of the material in the machine that can cause degradation, brittleness and discoloration.

Residence time of Tecotek® compounds in the barrel at correct processing temperatures should not exceed 4 minutes.

Molding Conditions

For PC compounds, moisture content should be less than 0.02% before processing. Moisture causes immediate hydrolytic degradation during process which causes molecular weight reduction and also surface defects like . Therefore Tecotek® grades should be dried at 120 °C for 3 – 4 hours.

The recommended pre-drying method is using desiccant driers where drying is independent of atmospheric environment. Controlling the performance of drying in desiccant driers depends on the dew point that indicates the proportion of water in the air. In order to obtain proper drying, values below –20°C for the dew point is suggested.

When using air circulating ovens, the quality of the drying depends on the atmospheric conditions. High relative humidity of air reduces the quality of drying and therefore circulating air ovens are not suggested to pre-dry PC.

Some guide recommendations for processing parameters are presented in Table 1.

The temperature of the melt in injection molding depends on barrel temperature settings, material residence time, screw design and speed. As it is difficult to estimate the effect of each parameter on melt temperature, it is suggested to be measured periodically with a pyrometer from the purged molten polymer. Tecotek® compounds should always be molded in a temperature-controlled mold. Uniform mold temperature within the cavity is very important to have good quality parts.

	Grade	Feed Throat Temperature (°C)	Processing Temperature (°C)	Mold Temperature (°C)	Hold Pressure (MPa)
Tecotek® PC (PC)	Unreinforced	60 – 80	260 – 300	80 - 100	60 - 120
	Reinforced	60 – 80	270 - 310	80 - 120	60 - 120
	Flame Retardant	60 – 80	250 - 290	80 - 100	60 - 120

Table 1. Recommended processing parameters for Tecotek®

For PC the peripheral screw speed should be maximum 200 mm/s in order to minimize fiber breakage, material degradation and discoloring.

Back pressure should be as low as possible to protect material properties.

The actual required injection pressure depends on many variables, such as melt and mold temperatures, part thickness and flow length. It is only necessary to have enough injection pressure to fill the cavity of the mold.

It is required to use medium to fast injection rates. Slow injection rates can be used at the start-up of the injection to prevent jetting and burning of material.

The mold shrinkage of PC mostly depends on the holding pressure and the holding time. During this stage material melt is continuously pushed into the part cavity which compensates the shrinkage of the part during solidification. The level of holding pressures and time that depend mainly on the part thickness and runner geometry are generally 1:2 to 2:3 of the maximum injection pressure.

Effects of main processing parameters on material properties are shown in Table 2.

Processing Parameter	Weld Line Strength	Surface Quality	Cycle Time	Shrinkage	Sink Mark
Melt Temperature ↗	↗	↗	↗		
Mold Temperature ↗	↗	↗	↗	↗	
Hold Pressure ↗				↙	↙
Injection Speed ↗	↗	↗			

Table 2. Effect of processing parameters on material properties

Recycling

Regrind levels up to 25% can be reused depending on the application and requirements. However for flame retardant grades maximum 10% addition is recommended. Regrinds should be free of contamination, should not be thermally degradated and must be dried prior to reuse.