

PROCESSING

Tecolen® 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 0.3 – 0.5 tons of clamping force for every square centimeter of projected shot area.

General purpose screw designs with compression ratios between 2.5:1 – 3.0:1, and screw size of 16D to 24D 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.

Standard nozzles can be used, however reverse taper nozzles are accomplished to prevent both drool and freezing. 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 polypropylene 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. Temperatures less than 60°C are suggested.

When molding polypropylene the shot size should be between 30% - 70% of barrel capacity. Shots larger than 70% 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 Tecolen® compounds in the barrel at correct processing temperatures should not exceed 4 minutes.

Molding Conditions

Polypropylene compounds absorb very low amount of moisture and normally pre-drying is not necessary.

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. Tecolen® compounds should always be molded in a temperature-controlled mold. Uniform mold temperature within the cavity is very important to have good quality parts.

For un-reinforced polypropylene the peripheral screw speed should be maximum 400 mm/s where for reinforced types it should not exceed 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.

	Grade	Feed Throat Temperature (°C)	Processing Temperature (°C)	Mold Temperature (°C)	Hold Pressure (MPa)
Tecolen® HP (PPHP)	Un-reinforced	<60	200 - 240	20 - 50	40 - 80
	Impact Modified	<60	200 - 240	20 - 50	40 - 80
	Reinforced	<60	200 - 240	20 - 50	40 - 80
	Flame Retardant	<60	200 - 240	20 - 50	40 - 80
Tecolen® CP (PPCP)	Un-reinforced	<60	200 - 240	20 - 50	40 - 80
	Impact Modified	<60	200 - 240	20 - 50	40 - 80
	Reinforced	<60	200 - 240	20 - 50	40 - 80
	Flame Retardant	<60	200 - 240	20 - 50	40 - 80

Table 1. Recommended processing parameters for Tecolen®

The mold shrinkage of polypropylene 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 degraded and must be dry as molded, or be dried prior to reuse.