PROCESSING

Tecomid® 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 0.50 – 0.75 tons of clamping force for every square centimeter of projected shot area.

General purpose screw designs with compression ratios between 2.5:1 – 3.5:1, and screw size of minimum 20D 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.

Non return valves are necessary in order to obtain constant pressure and consistent moldings.

It is important to have precise temperature control for processing polyamides 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 polyamide the shot size should be between 25% - 75% of barrel capacity. Shots larger than 75% may generate improper melting, where shots less than 25% will increase the residence time of the material in the machine that can cause degradation, brittleness and discoloration.

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

Molding Conditions

For polyamide compounds, moisture content should be less than 0.2% before processing. Tecomid® compounded grades are manufactured with a maximum moisture content of 0.1%. Therefore products in moisture proof packs do not need pre-drying prior to processing.

As polyamides are hygroscopic and absorb moisture from the environment, materials stored in open packs or containers should be dried at 80°C for minimum 2 hours. Temperatures above 95°C will result in discoloration. In addition to that over drying will cause poor flow resulting molding problems and short shots.

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. Tecomid® 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 polyamides 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.

	Grade	Feed Throat Temperature (°C)	Processing Temperature (°C)	Mold Temperature (°C)	Hold Pressure (MPa)
Tecomid® NA (PA 6.6)	Un-reinforced	60-80	270-290	50-90	50-100
	Impact Modified	60-80	260-290	50-90	50-100
	Reinforced	60-80	270-300	70-110	50-100
	Flame Retardant	60-80	260-280	50-100	50-100
Tecomid® NB (PA 6)	Un-reinforced	60-80	240–260	40-80	50-100
	Impact Modified	60-80	230-260	40-80	50-100
	Reinforced	60-80	250-270	60–100	50-100
	Flame Retardant	60-80	230-250	40-90	50-100

Table 1. Recommended processing parameters for Tecomid®

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.

Due to crystalline nature of polyamides, it is required to use fast injection rates especially in reinforced grades. Slow injection rates can be used at the start-up of the injection to prevent jetting and burning of material.

The mold shrinkage of polyamide 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 dry as molded, or be dried prior to reuse.