



# Quick Guide to Injection Molding

## Long Fiber Thermoplastics

Long Fiber grades are easily processed on most standard injection molding machines.

### Storage and Pre-Drying

Long Fiber Thermoplastics (LFT) are supplied in octabins. It is recommended that the material be stored in a cool, dry place with no direct sunlight. Damage to the packaging should be avoided.

Polymer resins are hygroscopic. When exposed to humid air, they will absorb moisture. While the effects of moisture absorption on the properties and dimensions of molded parts are minimal, effects on the molding process can be significant: excessive fumes at the nozzle, drooling, dosing-phase stability, surface defect, fast-vent clogging. For these reasons, the pre-drying of these materials is essential; it is recommended that a dessicated air dryer be used. Drying time and temperature will depend on the moisture content of the resin as it is received. The following drying conditions are recommended:

- Amodel® LF: 4–8 hours at 120 °C
- Ixef® LF: 4–8 hours at 120 °C
- Omnix® LF: 4–8 hours at 80 °C
- Strator®: 4–8 hours at 80 °C

Preferably the material is to be dried directly on the molding machine; if conveying systems are used, measures must be taken to minimize damage of the granules. Damaged granules result in loose fibers, which can clog up the filtration system. It is therefore recommended that conveying speeds are kept to a practical minimum. Smooth bends are to be used for any change of direction in the flow of material, also keeping conveying distance as short as possible.

Most standard hoppers will work with LFT; however, the angle at the base of the hopper should be at 45° (preferably 60°) to ensure good feeding.

### Screw Design

In order to minimize damage to the fibers, it is important the amount of shear be kept to a minimum. Shear should therefore be kept to a minimum during plasticizing:

- a) The granules must be molten before they reach the compression zone. To achieve this, screws with a relatively long entry zone are preferred. Screws with an overall length of between 18D and 23D will work without a problem. For a 20D screw, the following geometry is preferred:
  - Intake zone: 9–12D
  - Compression zone: 4–5D
  - Metering zone: 4–5D
- b) Screw speed should be kept relatively low; lower screw speed to use as much of the available cooling time as possible.
- c) Back pressure should be kept low.
- d) Temperatures on the intake zones should be kept relatively high (see tables).

To ensure optimal properties in the end product, granule length should be carefully chosen.

- Machines 30–45 mm: 7 mm
- Machines 45–60 mm: 7 mm or 9 mm
- Machines >60 mm: 7, 9 or 11 mm

## Check Valve

For most machine components, there is no extra wear with LFT. The check valve appears to be the exception, having approx. 25 % more wear than with standard reinforced thermoplastics.

For the melt, ensure that the check valve has a large passage; this will keep wear to a minimum and ensure that fiber length is not unduly reduced.

## Gating

In general, the same rules apply as for any reinforced thermoplastic. Gates should preferably be placed on the thickest section of the part, but in such a way as to avoid jetting. Gating the part on a thin section will result in high shear rates, potentially causing fiber damage.

Gate diameter should be around 0,8 times the wall section so as to avoid premature freeze-off, which could potentially lead to porosity in the part. Gate sizes below around 0,8 mm should be avoided.

When deciding where to gate a part, it is essential to consider where the part will be positioned. If the weld line is located in a highly stressed area of the part then part-failure is almost certain.

## Injection Molding

Following temperature settings are recommended:

	Hopper Zone 1	Zone 2	Zone 3	Nozzle Zone 4
Amodel® LF	315–330 °C	320–335 °C	325–335 °C	325–345 °C
Ixef® LF	260–280 °C	260–290 °C	260–290 °C	260–290 °C
Omnix® LF	280–300 °C	280–310 °C	290–320 °C	295–320 °C
Strator®	280–300 °C	280–300 °C	280–300 °C	290–300 °C

In general, it is recommended that medium-to-fast injection speeds be used. Injection speeds which are too low have been found to reduce fiber length; similarly, extremely high injection speeds can also lead to fiber damage.

It is extremely important to ensure there is enough venting in the areas of a weld line.

## Tool Temperature

Tool temperature is a compromise between cycle time and the reaching of maximum properties. LFT has excellent stiffness at elevated temperatures, so these materials can be efficiently molded at high tool temperatures. The following temperatures are recommended:

- Amodel® LF: 135 °C–155 °C
- Ixef® LF: 120 °C–140 °C
- Omnix® LF: 80 °C–120 °C
- Strator®: 80 °C–120 °C

## Regrind

When using regrind, the mechanical performance of the part needs to be tested to ensure that the drop off in properties remains acceptable. As a general rule, regrind levels should be kept below 15 %. Moreover, the regrind is to be clean and pre-dried.



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