



Injection moulding guide for UPM ForMi GP

UPM ForMi is a new, high-quality and durable natural fibre composite for injection moulding. It enables designers to realise even their boldest ideas. Made from renewable wood fibres and plastic, UPM ForMi is a recyclable and odourless composite with consistent quality.

UPM ForMi granulates offer smooth and reliable processability. A specially selected mixture of virgin plastic completes the mouldability of granulates for a wide range of end products with precise details. In addition, UPM ForMi offers unlimited dyeing possibilities.

Storage

UPM ForMi granulates should be protected from UV-light and stored in closed packages in dry conditions at temperature below 50 °C. Air humidity can increase moisture content of the material and have negative impact on the end product properties.

Drying

UPM ForMi contains cellulose fibres which may absorb moisture if the package is open. Close the package at all times when possible. UPM ForMi composite should be dried for minimum of 3 hours at 115 °C (dehumidifying dryer preferred).

Processing Temperatures

UPM ForMi granulates offer smooth and reliable processability. A specially selected mixture of virgin plastic completes the mouldability of granulates for a wide range of end products with precise details. UPM ForMi should be processed using low or moderate temperatures due to limited temperature resistance of natural materials. The preferred barrel temperature profile is shown below.

| Rear Zone | Centre Zone | Front Zone | Nozzle | Melt | Mould |
|------------|-------------|------------|------------|----------|-----------|
| 170-180 °C | 175-185 °C | 180-190 °C | 190-195 °C | < 200 °C | 60..80 °C |

Please note that thermal degradation of cellulose fibre accelerates rapidly at temperatures exceeding 200 °C. It is not recommended to leave the material in the heated cylinder during production brakes.

Screw Speed

UPM ForMi contains cellulose fibres which can be broken if too high rotation speeds are used. Circumferential speed of the screw should be below 0.25 m/s.

| Screw Diameter \ Screw Speed | 40 mm | 30 mm | 25 mm | 20 mm |
|------------------------------|---------|---------|---------|---------|
| 0.15 m/s | 70 RPM | 95 RPM | 120 RPM | 145 RPM |
| 0.20 m/s | 95 RPM | 130 RPM | 160 RPM | 190 RPM |
| 0.25 m/s | 115 RPM | 155 RPM | 190 RPM | 230 RPM |
| 0.30 m/s | 145 RPM | 190 RPM | 240 RPM | 285 RPM |

Internal friction caused by high circumferential speed produces temperature rise in material and unwanted degradation of the material. Thus, the hold pressure should be adjusted as with pure polypropylene.

Injection Speed

Being a cellulosic material it is recommended that UPM ForMi is injected as fast as possible. Thick wall specimen requires high speed injection to reach high enough levels of shear to avoid fibre streaks. If speed is too high, diesel-effect or unfilled corners can be a problem. Sufficient mould ventilation is requested.

Thin wall specimen does not require as high speed as thick wall specimen, but do get a better surface quality with higher injection speed (shear speed).

Injection Pressure

In general, when the fibre content of UPM ForMi grows the injection pressure increases, up to 1200 bar.

Hold Pressure

60-85 per cent of the injection pressure which is just enough to fill up the part. Stop pressuring when the gate freezes.

Cooling

Cooling time depends on the wall thickness and temperatures. Cooling should be long enough to avoid ejection marks.

Cycle Time

Part dependent

Tips

General order of adjustments:

1. Injection speed
2. Mould temperature (max. 90 °C)
3. Screw speed and temperature
4. Hold pressure

For marmoreal finish it is suggested to slow down the injection.
 For thorough dyeing it is suggested to increase back pressure and screw speed and/or temperature.

Excess moisture causes visual and structural defects, such as gas bubbles, silver streaks, splay marks and splash marks.

| Defect | Causes |
|-------------------|--|
| Flash | Injection pressure too high Clamp pressure too low |
| Warping | Non-uniform cooling rate |
| Bubbles | Injection pressure too high Too much moisture in material Non-uniform cooling rate |
| Unfilled sections | Insufficient shot volume Flow rate of material too low |
| Sink marks | Injection pressure too low Non-uniform cooling rate |
| Ejection marks | Cooling time too short Ejection force too high |
| | |

Safety

Maximum recommended processing temperature is 200 °C. Overheating may cause risk for the thermal degradation. Auto-ignition of UPM ForMi material is possible after purging the injection moulding machine.