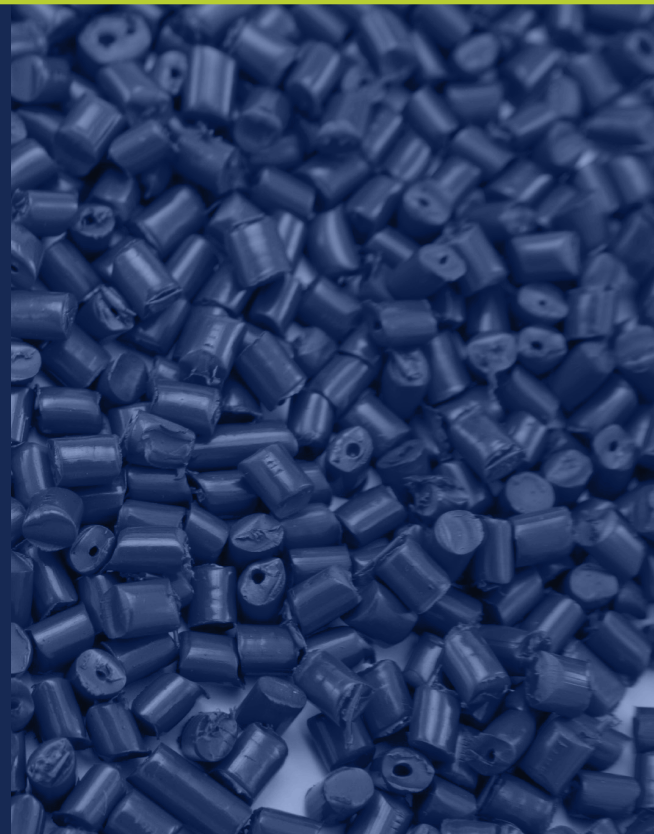


Polypropylene Processing Guidelines



AsahiKASEI
ASAHI KASEI PLASTICS NORTH AMERICA
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Safety

Asahi Kasei Plastics encourages its customers to review their manufacturing processes to ensure products are being made in accordance with health and environmental safety standards.

Material Handling

As polypropylene is not hygroscopic, it is unaffected by moisture content. Moisture contents up to 0.2% do not affect the physical properties of polypropylene in molded parts, so drying is not typically required.

However, high humidity, condensation, or storage conditions that cause excess surface moisture, can affect the visual aesthetics of molded parts. If the resin contains mineral or bio fillers, the likelihood of moisture absorption increases.

Drying is only recommended for highly cosmetic applications. If necessary, dry the resin at 75°C (167°F) for two (2) hours in a desiccant dryer.

Target Melt Temperature

Table A

Polypropylene Melt Temperature Range	Non-Reinforced (Neat)	Mineral/Talc	Glass Fiber
374 - 482°F	374 - 410°F	410 - 437°F	446 - 464°F
190 - 250°C	190 - 210°C	210 - 225°C	230 - 240°C

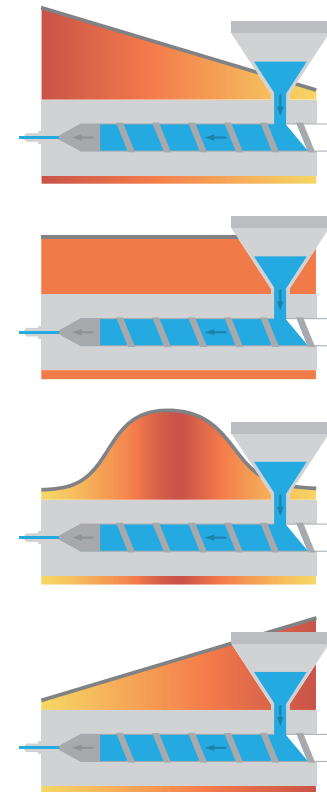
Barrel Heat Recommendations

A "Flat Heat Profile" is generally recommended when developing a molding process with a new resin. When molding a fiber-filled resin, a "Reverse Heat Profile" is suggested to reduce glass fiber attrition. Since the actual melt temperature is a result of several factors, including barrel size, screw design, RPM, residence time, etc., temperature settings cannot be specified.

It is recommended to set the front zone/nozzle temperature to the desired melt temperature. Utilize the barrel heat profile recommendation in Table B as a starting point, then adjust the temperature profile to reach the desired melt temperature.

Table B

% Shot Capacity	Residence Time (Minutes)	Profile Type
<25	2+	Ascending
<25	<2	Flat
25-35	2+	
25-35	<2	Hump
35 - 45	2+	
35 - 45	<2	Reverse
> 45	2+	
> 45	<2	



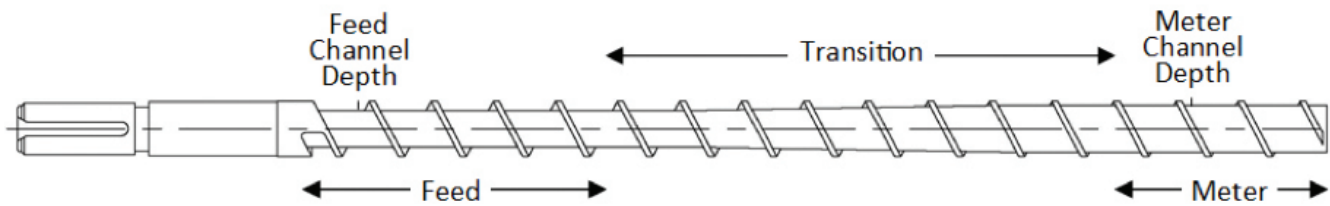
The above guidelines for initial heater band settings are for most injection molded parts. When setting a heat profile, consider residence time, screw RPM and filler type (see Table A).

Extruder Speed: Slow, recovery time to 90-95% of required cooling time.

Screw Design Guidelines

Table C

Meter Channel Depth	Transition Length	Compression Ratio
Medium	Medium	Medium



For PP formulations, including those containing short glass fiber and minerals, the suggested compression ratio should range from 2.4 – 4.0:1. The recommended compression ratio for long fiber PP should range from 1.8 – 2.5:1.

PP resins are semi-crystalline and have a specific transition temperature into the melt phase. The desired ramp of the transition zone is recommended to match that of the melt rate of the resin being molded. Verify that the feed, transition and metering zones are designed for semi-crystalline resins. Seek the advice of your screw or machine manufacturer for specific recommendations.

Purging Guidelines

Restarting production - If your machine has been left unattended at production settings for more than 30 minutes with resin in the barrel, purge 2x the barrel capacity to ensure all degraded resin is removed.

Color changes - Increase barrel temperature to the maximum value in Table A, and purge with unfilled PP/PE followed by purging compound, AsaClean UP. Please reference the AsaClean purging guide for additional use recommendations. Purge in new color and return barrel heats to original settings.

Shutting down (temporarily) - Introduce unfilled PP/PE resin and purge until the barrel is empty. Lower barrel temperatures by 38°C (100°F).

Important Note: Please follow your company’s procedures for all other situations.

Mold Temperature

Polypropylene can be processed over a wide range of mold temperatures; however, for applications where aesthetics are critical, a surface temperature of 80-95°C (176-203°F) is suggested. For thick wall sections or non-cosmetic parts, a surface temperature as low as 20°C (68°F) is preferred in order to reduce cycle time.

Pressures

Injection pressure controls the rate at which the material enters the mold. Based on the required fill pressure, an additional 10% should be available on high setting. This should be applied for 99% of ram travel during the filling phase to maintain control of fill velocity.

Packing pressure affects the final part aesthetics. When packing pressure is applied evenly, it controls sink marks and shrinkage. Packing pressure should be applied until the gate freezes off or when consistent part weight is achieved.

Back pressure settings are typically set to less than 20% of the injection unit capacity to prevent glass fiber breakage. This normally translates to 500 to 1,000 PPSI (Plastic Pressure per Square Inch). Back pressure settings should be kept as low as possible while maintaining melt uniformity.

Fill Rate

Fast fill rates are recommended to ensure uniform melt delivery to the cavity and to prevent premature polymer freezing. Surface appearance, shrink rates, and other defects can be affected by adjusting injection rates.

Venting

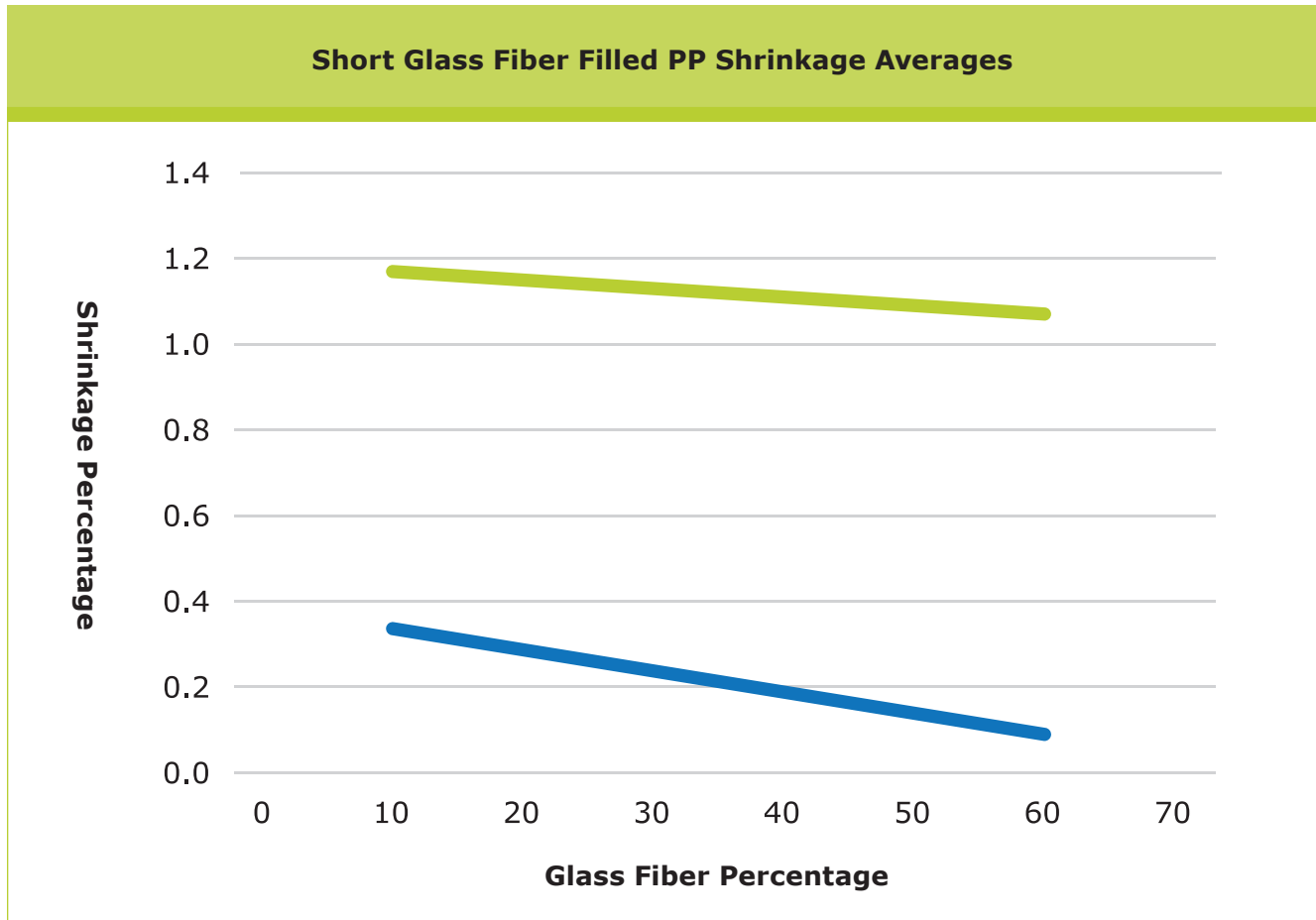
Perimeter Venting

Vent Width	Vent Depth	Vent Land
5.0-10.0 mm (0.197-0.394 in)	0.03-0.05 mm (0.001-0.002 in)	1.25-1.75 mm (0.049-0.069 in)

Boss Venting

Clearance at Pin	Clearance at Sleeve
0.03-0.05 mm (0.001-0.002 in)	0.07-0.1 mm (0.0028-0.0039 in)

Shrinkage



Note: Values are based on specimens with 1-3mm wall thickness.

Short Glass Fiber Filled PP Shrinkage Table Legend

Parallel to Flow $y = -0.0049x + 0.3869$	Perpendicular to Flow $y = -0.0061x + 1.3325$
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Parallel to flow direction shrink (slope) where Y = average linear shrinkage and X = % of short glass fiber

Note: The above data represent only the general shrinkage within each percentage of glass fiber incorporated into polypropylene. Most toolmakers choose the average of linear and transverse values for cutting tools. Use the above values as a guideline, but note that actual shrinkage varies based on wall thickness, fiber orientation (gating), and processing conditions. Conduct further shrinkage testing to get true shrinkage values before cutting tools. It is advisable to be "steel safe" when using these data to make tooling decisions. Seek advice from Technical Services, if needed.

Average shrinkage values for glass-filled grades of PP in flow and cross flow direction based on Autodesk Moldflow Database

The value for tooling is the average of these two flow directions, and a correction factor by subtracting 0.0-0.3% shrinkage for an isotropic value for tooling.

Table of shrinkage calculations

Percent short glass fiber	Parallel Average	Perpendicular Average	Isotropic Ave	Average Correction	Average Isotropic for tooling
5	0.362	1.302	0.832	-0.2	0.632
10	0.338	1.272	0.805	-0.2	0.605
15	0.313	1.241	0.777	-0.2	0.577
20	0.289	1.211	0.750	-0.2	0.550
25	0.264	1.180	0.722	-0.2	0.522
30	0.240	1.150	0.695	-0.2	0.495
35	0.215	1.119	0.667	-0.2	0.467
40	0.191	1.089	0.640	-0.2	0.440
45	0.166	1.058	0.612	-0.2	0.412
50	0.142	1.028	0.585	-0.2	0.385
55	0.117	0.997	0.557	-0.2	0.357
60	0.093	0.967	0.530	-0.2	0.330

1. Isotropic correction factor is in the range of 0.0 - 0.3% below the isotropic average for tooling.
2. If part 3d geometry aligns most of the flow paths in the direction of flow, then isotropic shrinkage would be less, so use (0.3%) correction.
3. If all flow is in perpendicular to part length, then the shrinkage would be higher and correction value lower at (-0.0%)

Note: The above data represent only the general shrinkage within each percentage of glass fiber incorporated into polypropylene. Most toolmakers choose the average of linear and transverse values for cutting tools. Use the above values as a guideline, but note that actual shrinkage varies based on wall thickness, fiber orientation (gating), and processing conditions. Conduct further shrinkage testing to get true shrinkage values before cutting tools. It is advisable to be "steel safe" when using these data to make tooling decisions. Seek advice from Technical Services, if needed.

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