

**PLEXIGLAS**<sup>®</sup>  
HT121  
BY ARKEMA

ACRYLIC COPOLYMER

# Applications Manual



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## INTRODUCTION

**Plexiglas® HT121 is a special acrylic copolymer that provides exceptional heat resistance in high temperature environments. It has excellent weatherability and optical properties that allow it to excel in high temperature applications that require outdoor stability, high quality surface appearance and/or precision optics. This excellent combination of properties makes Plexiglas® HT121 resin a perfect polymer for long-path length (LPL) applications in automotive lenses, and accent signature lighting.**

### DRYING CONDITIONS

All Plexiglas® acrylic polymers are somewhat hygroscopic. Proper drying time, temperature, and storage will minimize moisture related defects. While moisture in the resin does not affect the performance of the molded part, it can cause aesthetic defects such as splay or splash marks during processing. Because moisture will readily vaporize at processing temperatures, the resin must be dried prior to use.

Additional care is required when drying Plexiglas® HT121 resin because it is slightly more hygroscopic than traditional grades. The recommended moisture content depends on application process temperature. For example, molding at a relatively high temperature, around 500°F (260°C), requires the resin moisture content to be near 0.02% to avoid aesthetic defects. A moisture level of 0.05% is satisfactory when molding at lower temperatures, around 450°F (232°C).

To achieve the best possible drying, a dehumidified or desiccant drying system is recommended. Dew points of -20°F to -40°F (-29°C to -40°C) are recommended in these systems. The system should have good air distribution with sufficient velocity. A common rule of thumb is to have an air flow approaching 1 cfm, per pound of resin (0.062 m<sup>3</sup>/min/kg), in a hopper that is nearly full.

Plexiglas® HT121 resin should be dried for 2–4 hours at 195°F (90°C) using the drying conditions listed above. Typically, over-drying is not an issue for Plexiglas® HT121 resin. However, the time and temperature for drying should be kept at a minimum when the intended use of Plexiglas® HT121 resin is for long-path length, or thick lens applications. Slight discoloration, caused by the drying process, can be magnified in these optically sensitive applications.

After the Plexiglas® resin is dried, it must be kept in a dry environment to prevent moisture reabsorption. If exposed to ambient conditions for as little as 30 minutes, Plexiglas® HT121 resin can reabsorb enough moisture to generate aesthetic defects in molded parts.

### INJECTION MOLDING EQUIPMENT

To minimize cross contamination, the injection molder should be dedicated to processing Plexiglas® resin grades.

Reciprocating screw injection molding machines equipped with a general-purpose screw design are adequate for processing Plexiglas® HT121 resin. A floating check ring, rather than a ball check, is recommended. Nozzles should be of the tapered design, and as short as possible.

Shot capacity of the barrel should be 20–80% for standard applications. For optically critical, long-path length applications, or applications with long cycle times, the shot capacity should be 50–80%.

The barrel and screw should be chrome plated. Nitriding is not recommended, since it can cause polymer discoloration.

### MOLD REQUIREMENTS

Molds should have adequate coring to permit good water circulation, and efficient cooling. Mold temperatures should be adjustable from 150°F to 200°F (66°C to 93°C) to achieve the best balance of part appearance and cycle time. The surface of the mold cavity should be a stainless steel or high chrome tool steel with a minimum Rockwell C scale hardness value of 35. The mold surface should be highly polished to SPI-SPE mold finish #1 or #2 to achieve molded parts with maximum gloss. Most gating techniques are suitable including sprue, edge, tab, and tunnel.

Plexiglas® HT121 resin is an amorphous material, so part shrinkage in the mold is minimal. Mold shrinkage can range from 3 to 8 mils per inch (0.003 to 0.008 mm/mm), depending on the molding conditions used.

Adequate venting is required to eliminate trapped gases in the mold, and to prevent diesel burning. Vent depths should be 0.002 inch (0.05 mm) for sunburst or a continuous venting system.

### INJECTION MOLDING PARAMETERS

Plexiglas® HT121 resin has a large processing window. The following table lists recommended start-up parameters. Depending on the mold design, the specific part, and machine capabilities, adjustments may be necessary to achieve optimum processing conditions.

**TYPICAL START-UP INJECTION MOLDING CONDITIONS FOR PLEXIGLAS® HT121 RESIN  
FOR SINGLE STAGE, NON-VENTED BARREL MACHINES**

Grade	Rear Zone (°F/°C)	Center Zone (°F/°C)	Front Zone (°F/°C)	Nozzle (°F/°C)	Injection Speed	Screw Speed (RPM)	Back Pressure (PSI)	Mold Temp (°F/°C)
Plexiglas® HT121 resin	425 - 465/ 218 - 241	445 - 470/ 229 - 243	460 - 485/ 238 - 252	450 - 485/ 232 - 249	Slow - Medium	25 - 100	<100	175 - 195/ 80 - 91

The target melt processing temperature for Plexiglas® HT121 resin is 450°F–485°F (241°C–252°C).

To ensure minimal molded-in stress in the final parts, Plexiglas® HT121 resin should be processed at the upper end of the processing recommendations.

Fast injection speeds may be required to fill thin-walled parts. Slower injection speeds may be required for thicker wall parts, or long-path length optical parts.

Screw speed is dependent on screw diameter. The recommended screw speed is for small to mid-range size injection molding machines. Slower screw speeds should be employed for larger injection molding machines.

### INJECTION MOLDING CYCLE

Plasticizing/recovery should be started toward the end of the injection molding cycle, and it should finish just before the cooling time ends. This technique will minimize exposure of the polymer to heat. This technique is particularly important in long-path length and thick lens applications.

### PURGE PROCEDURE

1. Thoroughly clean the feed hopper after removing all of the resin.
2. Retract the injection unit carriage from the mold, leaving ample room for the purge to exit the nozzle.
3. Purge the resin from the barrel and thoroughly clean the nozzle, nozzle tip and sprue bushing.
4. Set injection barrel temperature profile to at least 500°F, but do not change the profile if it is >500°F. This temperature will ensure that the resident resin melts.
5. Load 5–10 times the barrel capacity of Plexiglas® V826 resin into the feed hopper. Material need not be dry.
6. Set the back pressure to 0 and the shot size >50% of the maximum allowable setting. Alternate the injection speed between high and low, and purge until polymer exiting the nozzle is free of contaminant.

Note: For additional cleaning, move the screw completely forward, and use the maximum safe screw speed and back pressure while purging. Alternatively, employ a purge compound such as Pekutherm® N at a 50/50 ratio with Plexiglas® V826 resin. This compound is a high molecular weight PMMA resin. Load 5–10 times the barrel capacity of this mixture into the feed hopper. Repeat step six until polymer exiting the nozzle is free of contaminant. Then load the feed hopper with 2–3 times the barrel capacity with 100% Plexiglas® V826 resin. Material need not be dry.

7. Set the barrel zone temperatures to the recommended temperature profile for Plexiglas® HT121 resin. With the back pressure set at 0 and the shot size >50% of the maximum allowable setting, purge Plexiglas® V826 resin once every 15 minutes until the barrel temperature profile stabilizes.
8. Remove Plexiglas® V826 resin from the feed hopper and replace with Plexiglas® HT121 resin and begin normal molding.

### START UP

If the application requires a mold utilizing a hot runner or hot manifold system, the hot runner /manifold heaters should remain off until after the barrel heaters have reached the desired set point. Remnant material can discolor while the barrel is heating.

### SHUTDOWN / DELAYS

For short delays (<15 minutes), actions may not be necessary. Prior to continuation of molding it may be necessary to perform a number of air shots to remove material that sat in the barrel.

For long delays (>15 minutes), the carriage should be retracted, the feed slide closed, and the screw and barrel emptied of material. Plexiglas® V826 resin should be used as a purge material to remove residual Plexiglas® HT121 resin from the screw and barrel. The barrel heaters can then be lowered to 300°F (149°C) for up to 18 hours. A voltage reduction switch for the heaters is suggested as a safety procedure.

For complete shutdowns, the barrel should be emptied and purged with Plexiglas® V826 resin, and the heaters should be turned off.



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