The Edgetek™ High Performance Formulations portfolio covers a broad range of standard and custom formulated materials. This portfolio includes high-temperature materials for elevated service temperature environments, high-modulus/structural materials for load-bearing and high-strength applications, and flame-retardant products. These materials are based on select engineering thermoplastic resins that are formulated with reinforcing additives such as carbon fiber, glass fiber and glass beads.

<table>
<thead>
<tr>
<th>Base Resin</th>
<th>PPA</th>
<th>PC</th>
<th>PSU</th>
<th>PES</th>
<th>PPS</th>
<th>Co-polymer Acetal</th>
<th>PEEK</th>
<th>PA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Barrel Temperatures</strong> °F (°C)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pack &amp; Hold Pressure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50%–75% of Injection Pressure</td>
</tr>
<tr>
<td><strong>Injection Velocity</strong> in/s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.0–3.0</td>
</tr>
<tr>
<td><strong>Back Pressure</strong> psi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50</td>
</tr>
<tr>
<td><strong>Screw Speed</strong> rpm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50–90</td>
</tr>
<tr>
<td><strong>Drying Parameters</strong> °F (°C)</td>
<td>6 hrs @ 175 (80)</td>
<td>4 hrs @ 250 (121)</td>
<td>4 hrs @ 275 (135)</td>
<td>4 hrs @ 250 (121)</td>
<td>3 hrs @ 300 (150)</td>
<td>2 hrs @ 200 (93)</td>
<td>3 hrs @ 275 (135)</td>
<td>4 hrs @ 180 (82)</td>
</tr>
<tr>
<td><strong>Cushion</strong> in</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.125–0.250</td>
</tr>
<tr>
<td><strong>Screw Compression Ratio</strong></td>
<td>2.5:1–3.5:1</td>
<td>2.0:1–2.5:1</td>
<td>2.5:1–3.5:1</td>
<td>2.5:1–3.5:1</td>
<td>2.5:1–3.5:1</td>
<td>2.5:1–3.5:1</td>
<td>2.5:1–3.5:1</td>
<td>2.5:1–3.5:1</td>
</tr>
<tr>
<td><strong>Nozzle Type</strong></td>
<td>General Purpose</td>
<td>General Purpose</td>
<td>General Purpose</td>
<td>General Purpose</td>
<td>General Purpose</td>
<td>General Purpose</td>
<td>General Purpose</td>
<td>Reverse Taper</td>
</tr>
<tr>
<td><strong>Clamp Pressure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5–6 Tons/in² of projected area of cavities and runner system</td>
</tr>
</tbody>
</table>

* Barrel temperatures should be elevated for compounds designed for electrical insulative properties.
<table>
<thead>
<tr>
<th>STARTUP &amp; SHUTDOWN</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purge Compound</td>
<td>HDPE or HIPS</td>
</tr>
<tr>
<td>Recycling</td>
<td>Recycling Edgetek™ up to 20% is permissible. Testing the application is highly recommended to determine the effect recycling has on the desired physical properties.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MOLD DESIGN</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
</table>
| Gates       | • Many different types of gates can be used such as pin, fan, tunnel, tab and edge gates. Gate type should be selected based on location and part geometry.  
• Gate diameters equivalent to 50% of the average wall thickness are recommended.  
• Land lengths of 0.020”–0.035” (0.50mm–0.90mm) are typically recommended. |
| Runners     | • Full-round runners or a modified trapezoid runner are the best designs. Half-round runners are not recommended.  
• Only naturally balanced runner systems ("H" pattern) are recommended.  
• Runner diameters larger than 0.150” (3.8mm) and not exceeding 0.375” (9.5mm) are recommended.  
• Step each 90° bend in the system down in size (from sprue to gate) approximately 1/16” (1.5mm) to reduce pressure drop.  
• Place vents at each 90° intersection and vent to atmosphere.  
• Hot runner molds are acceptable and should be sized by the manufacturer. |
| Cold Slug Wells | • Place these wells at the base of the sprue to capture the cold material first emerging from the nozzle.  
• Place wells at every 90° bend in the runner system.  
• Well depths approximately 1.5 times the diameter of the runner provide the best results. |
| Venting      | • Place vents at the end of fill and anywhere potential knit/weld lines will occur.  
• All vents need to be vented to atmosphere.  
• For circular parts, full perimeter venting is recommended.  
• Cut vent depths to:  
  - PPA Compounds: 0.0015”–0.0025” depth and 0.250” width  
  - PC Compounds: 0.002”–0.004” depth and 0.250” width  
  - PSU Compounds: 0.003”–0.004” depth and 0.250” width  
  - PES Compounds: 0.003”–0.004” depth and 0.250” width  
  - PPS Compounds: 0.002”–0.003” depth and 0.250” width  
  - Acetal Compounds: 0.0015” minimum depth and 0.250” width  
  - PEEK Compounds: 0.002”–0.004” depth and 0.250” width  
  - Nylon Compounds: 0.002” minimum depth and 0.250” width  
• Increase vent depth to 0.060” (1.5mm) at 0.250” (4.0mm) away from the cavity and vent to atmosphere. |
<p>| Draft Angle   | • Maintain a minimum draft angle of 1/2° per side. |</p>
<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>CAUSE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive Shrink</td>
<td>Too much orientation</td>
<td>• Increase packing time and pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase hold pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Decrease melt temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Decrease mold temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Decrease injection speed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Decrease screw rpm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase venting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase cooling time</td>
</tr>
<tr>
<td>Not Enough Shrink</td>
<td>Too little orientation</td>
<td>• Decrease packing pressure and time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Decrease hold pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase melt temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase mold temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase injection speed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase screw rpm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Decrease cooling time</td>
</tr>
<tr>
<td>Burning</td>
<td>Melt and/or mold temperature too hot</td>
<td>• Decrease nozzle and barrel temperatures</td>
</tr>
<tr>
<td></td>
<td>Mold design</td>
<td>• Clean, widen and increase number of vents</td>
</tr>
<tr>
<td></td>
<td>Moisture</td>
<td>• Verify material is dried at proper conditions</td>
</tr>
<tr>
<td>Nozzle Drool</td>
<td>Nozzle temperature too hot</td>
<td>• Decrease nozzle temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Decrease back pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase screw decompression</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Verify material has been dried at proper conditions</td>
</tr>
<tr>
<td>Weld Lines</td>
<td>Melt front temperatures too low</td>
<td>• Increase pack and hold pressure</td>
</tr>
<tr>
<td></td>
<td>Mold design</td>
<td>• Decrease injection speed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase gate size</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Perform short shots to determine fill pattern and verify proper vent location</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Add vents and/or false ejector pin</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Move gate location</td>
</tr>
<tr>
<td>Warp</td>
<td>Excessive orientation</td>
<td>• Increase cooling time</td>
</tr>
<tr>
<td></td>
<td>Mold design</td>
<td>• Increase number of gates</td>
</tr>
<tr>
<td>Sticking in Mold</td>
<td>Cavities are overpacked</td>
<td>• Decrease injection speed and pressure</td>
</tr>
<tr>
<td></td>
<td>Mold design</td>
<td>• Decrease pack and hold pressure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Decrease nozzle and barrel temperatures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Decrease melt temperature</td>
</tr>
<tr>
<td></td>
<td>Part is too hot</td>
<td>• Decrease nozzle and barrel temperatures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Decrease mold temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increase cooling time</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>CAUSE</td>
<td>SOLUTION</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Incomplete Fill         | Melt and/or mold temperature too cold| • Increase nozzle and barrel temperatures  
                          |                                       | • Increase mold temperature  
                          |                                       | • Increase injection speed  
                          |                                       | • Increase pack and hold pressure  
                          |                                       | • Increase nozzle tip diameter  
                          |                                       | • Check thermocouples and heater bands |
| Mold design             | Melt and/or mold temperature too cold| • Enlarge or widen vents and increase number of vents  
                          |                                       | • Check that vents are unplugged  
                          |                                       | • Check that gates are unplugged  
                          |                                       | • Enlarge gates and/or runners  
                          |                                       | • Perform short shots to determine fill pattern and verify proper vent location  
                          |                                       | • Increase wall thickness to move gas trap to parting line |
| Shot Size               | Melt and/or mold temperature too cold| • Increase shot size  
                          |                                       | • Increase cushion |
| Brittleness             | Melt temperature too low             | • Increase melt temperature  
                          |                                       | • Increase injection speed  
                          |                                       | • Measure melt temperature with pyrometer |
| Degraded/Overheated     | Melt temperature too low             | • Decrease melt temperature  
                          | Material                  | • Decrease back pressure  
                          |                                       | • Use smaller barrel/excessive residence time |
| Gate location and/or    | Melt temperature too low             | • Relocate gate to nonstress area  
                          | size                     | • Increase gate size to allow higher flow speed and lower molded-in stress |
| Fibers on Surface       | Melt temperature too low             | • Increase melt temperature  
                          | (Splay)                  | • Increase mold temperature  
                          |                                       | • Increase injection speed |
| Insufficient packing    | Melt temperature too low             | • Increase pack and hold pressure, and time  
                          |                           | • Increase shot size  
                          |                                       | • Increase gate size |
| Sink Marks              | Part geometry too thick              | • Reduce wall thickness  
                          |                           | • Reduce rib thickness |
| Melt temperature too    | Insufficient material volume         | • Increase shot size  
                          | hot                      | • Increase injection rate  
                          |                           | • Increase packing pressure  
                          |                           | • Increase gate size |
| Flash                   | Injection pressure too high          | • Decrease injection pressure  
                          |                           | • Increase clamp pressure  
                          |                           | • Decrease injection speed  
                          |                           | • Increase transfer position |
|                         | Excess material volume               | • Decrease pack pressure  
                          |                           | • Decrease shot size  
                          |                           | • Decrease injection speed |
|                         | Melt and/or mold temperature too hot | • Decrease nozzle and barrel temperatures  
                          |                           | • Decrease mold temperature  
                          |                           | • Decrease screw speed |