

# INJECTION MOLDING PROBLEMS & SOLUTIONS

Problem	Causes	Possible Solutions
<b>1. Sink Marks</b>	Part is under filled or has excessive shrinkage in thicker sections	<ul style="list-style-type: none"> <li>• Increase shot size</li> <li>• Maintain adequate cushion</li> <li>• Increase cavity or hold pressure</li> <li>• Melt or mold temperature too high (if gate freeze off too slow)</li> <li>• Increase hold time</li> <li>• Reduce fill rate</li> <li>• Cool sink area faster</li> <li>• Open gates</li> <li>• Reduce wall thickness of intersecting rib or boss</li> <li>• Improper gate locations or design</li> </ul>
<b>2. Voids</b>	Part is under filled or has excessive shrinkage	<ul style="list-style-type: none"> <li>• Incomplete mold fill (short shot)</li> <li>• Maintain adequate cushion</li> <li>• Poor venting</li> <li>• Improper gate location</li> <li>• Injection rate too high</li> <li>• Excessive part thickness (+ 0.25 in. or 0.64 cm)</li> </ul>
<b>3. Shrinkage</b>	Volume decreases as plastic cools and crystallizes or part is not fully packed out due to gates freezing off too soon or insufficient cooling time	<ul style="list-style-type: none"> <li>• Excessive shrinkage – Increase cavity pressure and hold time</li> <li>• Part oversized or not enough shrinkage – Decrease cavity pressure</li> <li>• Maintain adequate cushion</li> <li>• Increase hold time</li> <li>• Delay gate sealing to allow pack out (increase melt temperature)</li> <li>• Mold or melt temperature too high (gates not freezing off)</li> <li>• Improperly balanced cavity and core temperatures</li> <li>• Runners or gates too small</li> <li>• Wall thickness variation</li> </ul>
<b>4. Poor Weld Line Strength</b>	The convergence of flow fronts past an obstacle or merging flow fronts in multi-gated molds results in a weak, interfacial bond	<ul style="list-style-type: none"> <li>• Increase peak cavity pressure (fill faster)</li> <li>• Increase mold and melt temperatures</li> <li>• Increase hold pressure and time</li> <li>• Change gate location</li> </ul>
<b>5. Flash</b>	Insufficient clamp force, mold surface is deflecting, mold shutoff surfaces not seating properly	<ul style="list-style-type: none"> <li>• Decrease peak cavity pressure (decrease fill rate and/or use profile injection)</li> <li>• Decrease melt temperature</li> <li>• Increase clamp force</li> <li>• Clean mold surfaces</li> <li>• Check mold surface for flatness</li> <li>• Check integrity of mold shutoff</li> <li>• Change gate location</li> <li>• Use larger press</li> </ul>

Problem	Causes	Possible Solutions
6. <b>Burning</b>	Compressed air in the mold degrades resin	<ul style="list-style-type: none"> <li>• Decrease peak cavity pressure (decrease fill rate and/or use profile injection)</li> <li>• Clean vents, increase size or number of vents</li> <li>• Reduce melt temperature</li> </ul>
7. <b>Warp</b>	Non-uniform stress due to excessive orientation and/or shrinkage	<ul style="list-style-type: none"> <li>• Part ejected too hot (increase cycle time)</li> <li>• Mold at high temperatures, low pressures, and moderate fill rates</li> <li>• Decrease injection fill rate</li> <li>• Improperly balanced core and cavity temperature</li> <li>• Molded in stress due to low stock temperature and cold mold</li> <li>• Minimize hot spots in mold</li> <li>• Improperly balanced multiple gates</li> <li>• Flow too long, insufficient gates</li> <li>• Change gate location</li> </ul>
8. <b>Brittle Parts</b>	Excessive orientation, degradation of resin, over packing, contamination, or improper design	<ul style="list-style-type: none"> <li>• Increase injection fill rate</li> <li>• Increase melt temperature</li> <li>• Increase mold temperature and cool time</li> <li>• Over packing (decrease hold pressure and time)</li> <li>• Degraded material (excessive melt temperature or long residence time in barrel)</li> <li>• Contamination from other polymers</li> <li>• Use of incompatible carrier resins in color concentrates or other additives</li> <li>• Unintentional nucleation from pigments</li> <li>• Improper design; inadequate radii at corners, notches, or threads</li> </ul>
9. <b>Poor Appearance (Flow marks, low gloss, rough surface, jetting, orange peel, etc.)</b>	Flow front slips-sticks on mold surface, jets, or pulsates	<ul style="list-style-type: none"> <li>• Increase cavity pressure</li> <li>• Fill speed and/or packing time too low</li> <li>• Increase melt and/or mold temperature</li> <li>• Cool more slowly</li> <li>• Mold temperature non-uniform or too low</li> <li>• Insufficient lubrication (internal lubricant or on tool surface)</li> <li>• Excessive mold lubricant (e.g. grease bleeding out of the mold)</li> <li>• Dirty mold surface (clean and/or polish)</li> <li>• Poor pigment dispersion</li> <li>• Increase venting</li> <li>• Improper gate location or design</li> </ul>

### General Processing Guidelines

<b>Drying:</b> Generally unnecessary; however, may be required for aesthetic purposes or with highly filled products	<b>Barrel Temperature:</b> Rear – 390-440°F, 199-227°C Middle – 390-450°F, 199-232°C Front – 390-460°F, 199-238°C	<b>Mold Temperature:</b> 60-120°F, 15-49°C  <b>Cushion:</b> 0.25 in., 0.64 cm	<b>Pressures:</b> Boost – 500-1500 psi, 3.45-10.34 MPa Hold – 50-75% of Boost Back – 50-100 psi, .34-.69 MPa Screw RPM – medium to fast	<b>Times (sec):</b> Boost – 2-10 Hold – Adjust for gate freeze-off Cooling – Depends on part thickness
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Problem	Causes	Possible Solutions
<b>10. Sticking in Mold</b>	Over packing, excessive shrinkage, tool design causes physical attachment to the core or cavity	<ul style="list-style-type: none"> <li>• Over packing, injection pressure too high – reduce</li> <li>• Under packing, excessive shrinkage – see solutions to Short Shot</li> <li>• Improperly balanced mold temperatures (colder on movable half)</li> <li>• Reduce cycle time (sticking on cores)</li> <li>• Increase cycle time (sticking in cavities)</li> <li>• Insufficient knockouts</li> <li>• Remove undercuts</li> <li>• Increase draft angles</li> <li>• Surface irregularities in the mold (polish cavity surfaces)</li> <li>• Highly polished core surface (vacuum lock), polish to a coarser finish, apply a surface coating, or increase venting</li> </ul>
<b>11. Gate Blush, Delamination or Cracking at the Gate</b>	Melt fracture	<ul style="list-style-type: none"> <li>• Adjust injection speed (increase or decrease)</li> <li>• Modify gate geometry (e.g. gate too small, land too long)</li> <li>• Add cold slug wells in runners</li> <li>• Increase melt and/or mold temperature</li> </ul>
<b>12. Black Specks or Discoloration</b>	Degradation	<ul style="list-style-type: none"> <li>• Excessive melt temperature or residence time in barrel</li> <li>• Improper venting</li> <li>• Possible contamination</li> <li>• Excessive screw RPM</li> <li>• Excessive back-pressure</li> <li>• Excessive shear created by the use of a mixing screw</li> </ul>
<b>13. Short Shot</b>	Under filled part	<ul style="list-style-type: none"> <li>• Increase shot size</li> <li>• Inadequate cushion</li> <li>• Increase fill speed, pack pressure, and/or injection time</li> <li>• Increase melt and/or mold temperature</li> <li>• Plugged gates, runners, or vents</li> <li>• Inadequate melt flow rate (use higher MFR material)</li> <li>• Undersized gates, runners, and vents</li> </ul>
<b>14. Splay</b>	Streaks on surface caused by volatiles such as moisture or degraded material	<ul style="list-style-type: none"> <li>• Volatiles created by hot spot in manifold</li> <li>• Excessive moisture (dry resin)</li> <li>• Reduce melt temperature</li> </ul>
<b>15. Gate Stringing</b>	Plastic strings on parts located at the gates formed during ejection	<ul style="list-style-type: none"> <li>• Increase gate size (reduce orientation)</li> <li>• Decrease melt temperature, increase cooling time</li> <li>• Decrease drop tip temperature</li> <li>• Increase mold opening speed (break strings upon ejection)</li> <li>• Use valve gates</li> </ul>





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# Polypropylene

## Injection Molding Problems & Solutions

