

## Troubleshooting Guide for Thermoforming

Problem	Possible Causes	Possible Solutions
<b>1. Incomplete forming part</b>	Sheet too cool, not enough vacuum/pressure, or sheet not flat	<ul style="list-style-type: none"> <li>• Increase heat and heating time</li> <li>• Check lines</li> <li>• Check sheets</li> </ul>
<b>2. Webbing or bridging</b>	Mold corners too sharp, not enough vent holes, or sheet too hot	<ul style="list-style-type: none"> <li>• Round off corners</li> <li>• Add venting holes</li> <li>• Decrease heat and heating time</li> </ul>
<b>3. Warpage</b>	Sheet too cool when formed, poor design, mold temperature too low, or cooling time too short	<ul style="list-style-type: none"> <li>• Increase heat and heating time</li> <li>• Redesign the part</li> <li>• Increase mold temperature</li> <li>• Increase cooling time</li> </ul>
<b>4. Tearing</b>	Design exceeds maximum elongation, plug speed too fast, sheet too hot or too cold, or not enough clearance between mold and plug or bubble	<ul style="list-style-type: none"> <li>• Increase sheet thickness</li> <li>• Adjust process conditions</li> <li>• Optimize heating and heating time</li> <li>• Adjust plug path</li> </ul>
<b>5. Mold release difficult</b>	Draft insufficient, undercuts, rough mold surface, part shrinkage, part temperature too high, not enough cooling	<ul style="list-style-type: none"> <li>• Rework mold</li> <li>• Add appropriate draft angles to the design</li> <li>• Reduce undercuts/round off corners within undercut regions</li> <li>• Polish mold</li> <li>• Change processing conditions and timings</li> <li>• Increase cooling time</li> <li>• Adjust process conditions</li> </ul>
<b>6. Blister or bubbles</b>	Sheet too hot, excess moisture, or uneven heating	<ul style="list-style-type: none"> <li>• Decrease heat and heating time</li> <li>• Check relative humidity/dry base resin</li> <li>• Check individual heaters</li> </ul>
<b>7. Cracking</b>	Too sharp angles in mold, or too cool part molding	<ul style="list-style-type: none"> <li>• Round off corners</li> <li>• Increase heat and heating time</li> </ul>
<b>8. Blushing</b>	Sheet too cool, not high enough vacuum	<ul style="list-style-type: none"> <li>• Increase heat and heating time</li> <li>• Readjust process conditions</li> </ul>
<b>9. Pinhole or mold mark-off</b>	Vent holes too large, sheet temperature too high, vacuum or pressure too high	<ul style="list-style-type: none"> <li>• Rework mold</li> <li>• Reduce heating time</li> <li>• Readjust process conditions</li> </ul>
<b>10. Excessive shrinkage of part</b>	Residual stresses, insufficient cooling in mold, or incorrect molecular orientation of sheet	<ul style="list-style-type: none"> <li>• Increase heat and heating time</li> <li>• Extend cooling time</li> <li>• Rotate sheet with respect to mold</li> </ul>

**11. Part corners too thin**

Improper heating, part or plug design

- Readjust process conditions
- Reevaluate plug/mold design
- Increase plug speed
- Increase sheet thickness

**12. Mottled surface**

Entrapped air, moisture in sheet, too shiny mold surface, or oven too cold

- Check vent holes
- Add vent holes if needed
- Adjust process conditions
- Check relative humidity/dry base resin if needed
- Rework mold
- Increase heat

**13. Sheet scorched**

Outer surface of sheet too hot

- Reduce heat and lengthen heating time
- Heat both sides