



# Thermoforming Troubleshooting Guide For Thin Gauge Thermoplastic (Roll-Fed)

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This guide is provided to assist in determining the cause of the most common problems during the thermoforming process. It does not take into account problems that may occur as a result of defective or hard to form materials and it assumes that the equipment being used is up to modern standards. It is intended for this guide to be used by thermoforming professionals to assist in the training of operators, technicians and tooling personnel. There is no guarantee that the solutions in this guide will solve all problems encountered in the process.

Problem	Probable Cause	Course of Action	Problem	Probable Cause	Course of Action	Problem	Probable Cause	Course of Action
Poor Detail	Material too cold	<ul style="list-style-type: none"> <li>Increase heating time</li> <li>Increase oven temperature</li> <li>Check seal for air leak</li> <li>Check for uniform heat</li> <li>Preheat sheet</li> <li>Check for drafts</li> </ul>	Webbing, bridging, wrinkling	Too much vacuum and/or compressed air	<ul style="list-style-type: none"> <li>Plug holes and redrill with smaller bit</li> <li>Check vacuum system</li> </ul>	Plug Marks	Plug coming loose	Check and tighten plug
	Air Pressure too low; air leak in the seal, tool or sheet clamp	<ul style="list-style-type: none"> <li>Increase psi</li> <li>Check air timing</li> <li>Air eject holes clogged</li> <li>Check effect air pressure</li> <li>Timing on eject air</li> <li>Add air holes, increase injection pressure</li> <li>Check O ring imprint</li> </ul>		Uneven cooling	<ul style="list-style-type: none"> <li>Add water channels to mold</li> <li>Check for plugged water flow</li> </ul>		Plug depth too deep	Reduce plug depth
	Clamping frame too cold	Preheat clamp frame		Material too cold	<ul style="list-style-type: none"> <li>Increase heating time</li> <li>Increase oven temperature</li> <li>Check for uniform heat</li> <li>Preheat sheet</li> <li>Check for drafts</li> </ul>		Mold and plugs not aligned	Realign
Vacuum holes and insert lines are showing	Material too hot	<ul style="list-style-type: none"> <li>Reduce heating cycle</li> <li>Reduce heater temperature</li> <li>Increase heater distance</li> <li>Check for uniform heat</li> <li>Preheat sheet</li> <li>Screen center of sheet, allowing edges to heat first</li> </ul>	Warpage, distortion, excessive shrinking	Thin spot in sheet	Check with sheet supplier	Stress/Shrink marks, sheet whitening (PET/PPET)	Material too cold	<ul style="list-style-type: none"> <li>Increase heating time</li> <li>Increase oven temperature (number of heaters)</li> </ul>
	Too much vacuum and/or compressed air	<ul style="list-style-type: none"> <li>Check vacuum holes for clogging</li> <li>Increase number of vacuum holes</li> <li>Check vacuum system for minimum 25 inches of Hg pressure</li> <li>Remove any 90-degree angles in vacuum system</li> <li>Increase size of vacuum holes</li> <li>Check for vacuum or air leak</li> <li>Enlarge vacuum line and valves</li> </ul>		Incorrect platen speed	Check and adjust speed		Mold open before sheet advances	Delay sheet advance until sheet clears
	Air pressure too high	<ul style="list-style-type: none"> <li>Reduce air pressure (use 20-50 psi)</li> <li>Check timing</li> <li>Air eject holes clogged</li> <li>Check eject air pressure</li> <li>Timing on eject air</li> </ul>		Incorrect timing of form air	Check and adjust timing		Poor mold design	<ul style="list-style-type: none"> <li>Increase number of vacuum holes</li> <li>Check for plugged vacuum holes</li> <li>Mold radii should be at least the thickness of material</li> <li>Reduce depth of draw</li> <li>Increase draft (taper) of mold</li> </ul>
Webbing, bridging, wrinkling	Material too hot	<ul style="list-style-type: none"> <li>Reduce heating cycle</li> <li>Reduce heater temperature</li> <li>Check for proper ventilation</li> <li>Check for uniform heat</li> <li>Preheat sheet</li> </ul>	Poor material distribution	Bad sheet clamp spring	Check and replace as needed	Splits and tears	Part left on mold too long	Remove part from mold as soon as it stabilizes
	Melt strength of resin too low (sheet sag too low)	<ul style="list-style-type: none"> <li>Use lower melt index resin</li> <li>Use minimum sheet temperature possible</li> <li>Profile temperature of sheet</li> </ul>		Bad thermocouple, relay or blown fuse	Check and replace as needed		Mold surface too smooth	Grit blast mold surface with #30 grit
	Too much/too little sheet orientation	Reduce/increase orientation		Uneven part cooling	<ul style="list-style-type: none"> <li>Add water channels to mold</li> <li>Check for plugged water flow</li> <li>Check for plugged vacuum holes</li> </ul>		Part shrinking away	<ul style="list-style-type: none"> <li>If mold allows, apply 20-30 psi air pressure on part opposite mold surface</li> <li>Add moat to mold just outside trim line</li> </ul>
	Insufficient vacuum and/or compressed air	<ul style="list-style-type: none"> <li>Check vacuum holes for clogging</li> <li>Increase number of vacuum holes</li> <li>Increase size of vacuum holes</li> <li>Check for vacuum or air leak</li> <li>Check vacuum system for minimum 25 inches of Hg pressure</li> <li>Remove any 90-degree angles in vacuum system</li> </ul>		Poor part design	<ul style="list-style-type: none"> <li>Break up large flat surfaces with ribs where practical or make concave/convex</li> </ul>	Chill marks, mark-off lines, flow lines	Closing speed between mold and sheet	Reduce rate of closure
	Sheet clamps inadequate	Add sheet clamps if none present		Mold too cold	<ul style="list-style-type: none"> <li>Increase mold temperature</li> <li>Preheat mold</li> <li>Provide uniform heating of mold</li> <li>Check temperature control system</li> </ul>		Bad sheet (not complete, homogenous)	Check with sheet supplier
	Blank too small for mold	Leave minimum (2 inches) of material around mold		Mold too hot	<ul style="list-style-type: none"> <li>Reduce mold temperature</li> <li>Increase cooling cycle</li> <li>Lower surface temperature of sheet</li> </ul>		Incorrect timing of sheet advance	Adjust timing of sheet advance
							Poor detail on the trim locators	Repair or redesign as needed
							Plug assist temperature too low	<ul style="list-style-type: none"> <li>Increase plug assist temperature</li> <li>Use mold release</li> <li>Teflon-coat plug</li> <li>Use Syntactic foam plug assist</li> <li>Reduce plug height</li> </ul>
							Mold too cold	<ul style="list-style-type: none"> <li>Increase mold temperature</li> <li>Preheat mold (200-260 degrees)</li> <li>Provide uniform heating of mold</li> <li>Check temperature control system</li> <li>Polish plug surface</li> </ul>
							Inadequate mold temperature control	<ul style="list-style-type: none"> <li>Increase number of water cooling tubes or channels</li> <li>Check for plugged water flow</li> </ul>
							Material too hot	<ul style="list-style-type: none"> <li>Reduce heating cycle</li> <li>Reduce heater temperature</li> <li>Check for proper ventilation</li> <li>Increase heater distance</li> <li>Check for uniform heat</li> <li>Preheat sheet</li> </ul>
							Water leak	Locate and correct water leak
							Insufficient vacuum and/or compressed air	<ul style="list-style-type: none"> <li>Check vacuum holes for clogging</li> <li>Increase number of vacuum holes</li> <li>Increase size of vacuum holes</li> <li>Check for vacuum system for minimum 25 inches of Hg pressure</li> <li>Remove any 90-degree angles in vacuum system</li> <li>Enlarge vacuum line and valves</li> </ul>
							Sheet touching mold on the index	Check clearances
							Air leak blowing on sheet	Locate and correct air leak

# WHAT TYPE OF PLASTIC IS IT?

## A Quick and Easy Guide to Identifying Thermoforming Sheet

### 1. Determine Specific Gravity by weighing a sheet 12" x 12".

Weight (lbs) divided by gauge (in thousandths of an inch) x 5.28 = Specific Gravity

Specific Gravity of 16 common materials (will vary depending on source)

Polypropylene	0.9	Polycarbonate	1.2
HDPE	0.96	PETG	1.27
HMWPE	0.96	PET	1.33
HIPS	1.04	PVC	1.34
ABS	1.05	PVC/Acrylic	1.35
ABS/PVC	1.07	RPET	1.33
Cast Acrylic	1.18		
Extruded Acrylic	1.19		

### 2. Apply a flame to the corner of the sheet for a few seconds, then remove.

Material	Keeps Burning	Smell	Flame Color	Smoke	Drips	Other Tips
Polypropylene (b)	yes, slowly	like asphalt	blue	trace of white smoke	yes	Shows a transparent hot area when burning
HDPE (a)	yes, slowly	paraffin	blue, yellow tip	trace of white smoke	yes	Scratches easier than HMWPE. Floats in water. See below
HMWPE (a)	yes, slowly	paraffin	blue, yellow tip	trace of white smoke	yes	Feels harder than HDPE. Floats in water. See below
HIPS (b)	yes, rapidly	floral	yellow	dense+soot	yes	Illuminating gas when burned
ABS (b)	yes	acrid rubbery	yellow, blue edges	black+soot	yes	Bubbles when burning
ABS/PVC (b)	no	acrid	yellow, blue edges	black+soot	no	Burn rate depends on amount of PVC content. Heavier than ABS
Cast Acrylic	yes, slowly	fruity	blue at source predominantly yellow	grey	no	Flame may spurt if rubber modified
Extruded Acrylic	yes, slowly	fruity	blue at source predominantly yellow	grey	yes	Flame may spurt if rubber modified
Polycarbonate	no, chars	sweet faint smell	orange	dense black, soot	yes	Metal-like ring when struck with hard object
PETG	yes, rapidly		yellow, spurting	black no soot	no	Will crack and break under stress
PET	yes, rapidly		yellow, spurting	black no soot	no	Will crack and break under stress
RPET	yes, rapidly		yellow, spurting	black no soot	no	Imperfections in the clarity and transparency will be noticeable
PVC	no	acrid smell	yellow, green spurts	chars+melts	no	
PVC/Acrylic	no	fruity	blue, yellow tip		no	

### 3. Some other clues

- (a) HDPE vs HMWPE: Cut a sliver 6" long from edge of sheet. Try to stretch it. The HDPE will break. The HMWPE will stretch before breaking.  
 (b) Generally not available in transparent.



# Thermoforming

## Division

### THERMOFORMING TROUBLESHOOTING GUIDE

A probable cause and solution guide for **Thin Gauge/Roll Fed** thermoplastic