

Trouble Shooting Guide to Thermoforming

Problem : Blisters

Probable Cause

Heating Too Rapidly

Excess Moisture

Uneven Heating

Suggested Course of Action

Lower Heater Temperature

Use Slower Heating

Increase Distance Between Heater and Sheet

Predry Sheet

Preheat Sheet

Heat from Both Sides

Do Not Remove Moisture Barrier Film Until Ready to Use

Check Heater Output, Power Consumption

Use Pattern Heating

Problem : Incomplete Forming, Poor Detail

Probable Cause

Sheet too Cold

Clamp Frame Cold Prior to
Sheet Insertion

Insufficient Vacuum

Vacuum Not Applied Rapidly

Enough

Suggested Course of Action

Heat Sheet Longer

Raise Heater Temperature

Change to More Efficient Heater Design

If Problem is Localized, Check Heater Bank for Problems

Preheat Frame

Check Vacuum Holes for Obstruction

Increase Number of Vacuum Holes

Increase Diameter of Vacuum Holes

Use Vacuum Slots Rather than Holes

Surge Tank/Pump Too Small

Vacuum Line/Valves Too Small

Too Many Bends in Vacuum Line

Vacuum Leaks

Problem : Whitening

Probable Cause

Stretching Below Forming
Temperature

Suggested Course of Action

Increase Sheet Temperature

Increase Forming Speed

Problem : Webbing, Bridging, Wrinkling

<i>Probable Cause</i>	<i>Suggested Course of Action</i>
Sheet Too Hot	Shorten Heating Cycle Increase Heater Distance Lower Heater Temperature
Insufficient Vacuum	Check Vacuum System Add Vacuum Holes
Excess Draw Ratio/ Poor Mold Design/Layout	Redesign Mold Use Plug Assist Use Female Mold Rather Than Male Use Assist Blocks to Pull Out Wrinkles Increase Radii/Draft Angles For Many Parts on a Mold, Move Them Apart For Multi-Part Molds, Use Part Isolators Speed up Assist and/or Mold Travel Redesign Plug Assist

Problem : Nipples on Formed Part

<i>Probable Cause</i>	<i>Suggested Course of Action</i>
Sheet Too Hot	Shorten Heating Cycle Reduce Heater Temperature
Vacuum Holes Too Large	Plug Holes/Redrill

Problem : Chill Mark / Striation

<i>Probable Cause</i>	<i>Suggested Course of Action</i>
Plug Assist Temperature Too Low	Increase Plug Temperature Use Wood/Synthetic Plug Cover Plug with Wool/Felt/Fabric
Mold Temperature Too Low	Increase Mold Temperature
Poor Mold Temperature Control	Reconfigure Cooling/Heating Channels Add More Coolant Channels Increase Coolant Flow Rate Increase Coolant Channel Diameter

Sheet Too Hot
Inspect Flow Path for Debris, Plugging, Rust
Shorten Heating Cycle
Reduce Heater Temperature
Change Forming Rate

Problem : Surface Blemishes

Probable Cause

Suggested Course of Action

Indentations

Mold Surface Too Smooth, Roughen

Increase Vacuum Hole Area

Sheet Cast Against Smooth Roll, Air Trapping

Poor Vacuum

Increase Vacuum Hole Area

If Local, Check for Plugged Vacuum Holes

Mold Too Hot

Reduce Mold Temperature

Mold Too Cold

Increase Mold Temperature

Rough Mold Surface

Polish Mold

Use Aluminum Molds

Dirt

Clean Mold, Sheet

Atmospheric Dust

Clean Thermoforming Area

Enclose Former, Used Filtered Air

Scratched Sheet

Inspect Handling Procedures

Require Surface Film Protection

Problem : Shiny Streaks

Probable Cause

Suggested Course of Action

Local Overheating

Check Heater Temperature

Pattern Heat

Reduce Heating Cycle

Problem : Post-Forming Shrinkage / Distortion

Probable Cause

Suggested Course of Action

Time On Mold Too Short

Increase Cooling Time

Use Free-Surface Cooling

Mold Too Hot

Reduce Mold Temperature

Increase Coolant Flow

Problem : Warped Parts

Probable Cause

Uneven Part Cooling

Suggested Course of Action

Change Coolant Channel Configuration

Check for Blocked Coolant Channels

Direct Free-Surface Cooling to Warped Area

Poor Mold Design

Increase Vacuum Hole Area

Redesign Rim Area to Stiffen

Add Moat to Mold at Trim Line

Plugged Vacuum Holes

Poor material Distribution
in Part Wall

Use Prestretching or Plug Assist

Poor Temperature Uniformity

Vacuum Holes in Wrong Place

Poor Part Design

Large Flat Areas Should Include Ribs/Corrugations

Crown Large Radius Areas

Mold Temperature Too Low

Increase Mold Temperature to Just Below Material

Set Temperature

Part Remove Too Early

Part Must be Below Set Temperature

Part Cold Formed

Increase Sheet Temperature

Increase Hold-Down Pressure

Increase Vacuum Hole Area and Rate of Forming

Problem : Poor Material Allocation

Probable Cause

Improper Sheet Sag

Suggested Course of Action

Try Mounting Mold on Top Platen

Try Vacuum Snap-Back

Try Sag Bands

Use Sheet With Higher Orientation

Increase Speed of Forming

Hot/Cold Spots

Check Heater Elements

Pattern Heating

Periodic Drafts

Enclose Forming Area

Excessive Sag

Increase Sheet Orientation

Reduce Sheet Temperature

Use Sag Bands

Cold Mold	Pattern Heating Increase Mold Temperature Change Coolant Channel Configuration Check for Plugging
Sheet Pulls From Rails	Air-Cool Rails Prior to Heater Move Rails in to Grasp More Sheet Use Drag Bands at Rail Edge Increase Rail Tooth Bite
Sheet Slips From Frame	Adjust Frame Alignment Increase Frame Clamp Pressure Sheet Gage Variation Heat Frames Prior to Inserting Sheet If Retainer Springs Are Used, Change to High Temper Springs

Problem : Nonuniform Prestretch Bubble

<i>Probable Cause</i>	<i>Suggested Course of Action</i>
Uneven Heating	Check Heater Efficiency Change to More Efficient Heaters Improve Heater Temperature Control Pattern Heat
Periodic Drafts	Enclose Entire Forming Area
Non-Uniform Air Inflation	Check Air Flow Install Baffles if Necessary Preheat Air if Necessary

Problem : Shrink Marks

<i>Probable Cause</i>	<i>Suggested Course of Action</i>
Inadequate Vacuum	Vacuum Leaks Vacuum Surge Tank/Pump Inadequate Plugged Vacuum Holes Vacuum Hole Area Inadequate
Mold Surface Too Smooth	Roughen Mold Surface Change to Lower Conductivity Mold Material
Part Shrinking During Forming	Increase Forming Pressure

Inadequate Air Pressure	Increase Mold temperature
	Reduce Free-Surface Cooling
	Increase Air Flow Rate
	Increase Air Pressure
	Increase Cycle Time Under Pressure

Problem : Very Thin Corners

Probable Cause

Sheet temperature Variation

Variation in Mold Temperature

Suggested Course of Action

Check Sheet Allocation

Pattern Heating

Increase Rate of Forming

Change Coolant Line Configuration

Check Free-Surface Cooling

Problem : Parts Stick In mold

Probable Cause

Part Temperature Too High

Inadequate Draft

Mold Undercuts

Wooden Mold

Rough Mold Surface

Suggested Course of Action

Increase Cooling Cycle

Lower Mold Temperature

Reduce Heating Cycle Time

Rework Mold for More Draft

Use Female Mold

Remove Part Early, Then Fixture Until Cool

Remove Part Early, Then Fixture Until Cool

Consider More Sophisticated Ejection System

Use Stripping, Break Inadequate

Lubricate with Dry Mold Release

Polish, Especially Corners

Problem : Sheet Stick To Assist

Probable Cause

Assist Temperature Too High

Wooden Plug

Suggested Course of Action

Reduce Plug Temperature

Use Felt/Cloth/Fabric Cover

Coat with Lubricant

Use Felt/Cloth/Fabric Cover

Assist Speed Too High

Reduce Plug Penetration Rate

Increase Air Pressure Behind Plug

Decrease Air Pressure Ahead of Plug

Problem : Sheet Tears While Forming

Probable Cause

Suggested Course of Action

Mold Design

Increase Corner Radius

Sheet Too Hot

Decrease Sheet Temperature

Sheet Too Cold

Increase Heating Time

Forming Condition Improper

Decrease Assist Penetration Rate

Increase Inflation Rate

Increase Draw-Down Rate

Problem : Corner Cracking In Service

Probable Cause

Suggested Course of Action

Stress Concentration

Increase Corner Radius

Corner Too Cold During Forming

Increase Mold Temperature

Increase Sheet Temperature

Increase Forming Rate

Decrease Free-Surface Cooling

Decrease Assist Rate of Penetration