

Troubleshooting Thermoforming Problems

For information applicable to KYDEX® FST please refer to 300 series technical briefs.

TB - 140-E

Introduction

The most common problem in thermoforming KYDEX® thermoplastic sheet is one of trying to heat KYDEX® sheet too quickly. See the chart below for recommended heating times when sandwich heaters are used. If a problem still exists, review the troubleshooting section of this brief.

Approximate Heating Times

| Sheet Thickness | Time (Seconds) |
|-----------------|----------------|
| 1.00mm (0.040") | 15-35 |
| 1.50mm (0.060") | 50-70 |
| 2.00mm (0.080") | 65-85 |
| 2.40mm (0.093") | 80-100 |
| 3.20mm (0.125") | 100-130 |
| 4.70mm (0.187") | 180-200 |
| 6.40mm (0.250") | 240-285 |

Troubleshooting

| Problems | Causes | Remedies |
|-----------------------------------|----------------------------|---|
| Blister or Bubbles | Heating too Quickly | <ol style="list-style-type: none"> 1) Lower heater(s) temperatures. 2) Use slower heating. 3) Increase distance between heaters and sheet. |
| | Excessive Moisture | <ol style="list-style-type: none"> 1) Pre-dry material. 2) Heat material from both sides. 3) Lower heater(s) temperatures (more soak time). |
| | Uneven Heating | <ol style="list-style-type: none"> 1) Hot spots (install screening to deflect heat from overheated areas). 2) Check heaters for proper operation. 3) Adjust heater zones to balance sheet surface temperature. |
| Poor Detail in Formed Part | Sheet too Cold | <ol style="list-style-type: none"> 1) Increase dwell time to heat sheet longer. 2) Increase temperature of heaters. 3) Check heaters for proper operation. 4) Pre-heat clamping frame (cold frame can draw heat from sheet). 5) Check for air drafts across sheet (open doors, fans, etc.). |
| | Insufficient Vacuum | <ol style="list-style-type: none"> 1) Check vacuum holes for blockages. 2) Increase the number of vacuum holes. 3) Increase size of vacuum holes. 4) Check for vacuum leaks. |

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| Poor Detail in Formed Part | Vacuum not drawing Fast Enough | <ol style="list-style-type: none"> 1) Check the vacuum gauge for minimum of in. /Hg pressure. 2) Check for vacuum leaks. 3) Use slots instead of vacuum holes. 4) Increase the size of the vacuum surge tank or vacuum capacity. 5) Check vacuum hose for leaks or collapse. |
| Poor Detail in Formed Part (when pressure forming) | Improper pressure | <ol style="list-style-type: none"> 1) Use 20 - 50 psi (.137 - .345 Mpa) air pressure. |
| Sheet Scorched | Surface of the Sheet too Hot | <ol style="list-style-type: none"> 1) Reduce heating cycle (dwell time). 2) Lower heater(s) temperature (more soak time). |
| Blushing or Discoloration | Excessive Heat | <ol style="list-style-type: none"> 1) Reduce cycle time (poor detail may occur due to material being too cold). 2) Reduce heater temperatures (increasing dwell time may be required). 3) If problems exist in one area only, check heaters. |
| Whitening of Part in Corners | Sheet too Cold | <ol style="list-style-type: none"> 1) Increase the dwell time. 2) Reduce platen time delay. 3) Reduce vacuum delay. |
| Webbing, Bridging or Wrinkling | Sheet too Hot | <ol style="list-style-type: none"> 1) Reduce heating time. 2) Lower heater(s) temperatures. |
| | Insufficient Vacuum | <ol style="list-style-type: none"> 1) Check mold for proper vacuum. 2) Check vacuum lines for restrictions. |
| | Excessive Draw Ratio or Poor Mold Design | <ol style="list-style-type: none"> 1) Redesign mold. 2) Increase the draft and radii of the mold design. 3) Use a plug assist. 4) Add take-up blocks (web catchers) to pull material away from the corners. 5) Use recessed pockets (web moats) in web areas. 6) If tooling is multiple mold design, increase the distance between molds. |

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| Nipples on Mold Side of Formed Part | Sheet too Hot | <ol style="list-style-type: none"> 1) Reduce dwell time. 2) Reduce heater(s) temperatures. |
| | Vacuum Holes | <ol style="list-style-type: none"> 1) Plug vacuum holes and re-drill with smaller bit. |
| Excessive Sag After Heating | Sheet too Hot | <ol style="list-style-type: none"> 1) Reduce dwell time. 2) Reduce heater(s) temperatures. 3) Balance sheet surface temperature (increase the perimeter heat and lower center heat). |
| Chill Marks or "Mark-Off Lines" | Mold Temperature too Cold | <ol style="list-style-type: none"> 1) Increase the mold temperature (do not exceed 165°C) if the mold is water cooled. If the mold is not temperature controlled, pre-heat the mold with a torch. 2) Increase the pre-stretch to allow the mold to come in contact with the material later. |
| | Plug Assist Cold | <ol style="list-style-type: none"> 1) Use a syntactic foam plug assist. 2) Cover plug assist with flannel or felt. |
| | Sheet too Hot | <ol style="list-style-type: none"> 1) Reduce dwell time. 2) Reduce heater(s) temperatures. |
| Surface imperfections | Pock Marks on Smooth Mold Surface | <ol style="list-style-type: none"> 1) Air entrapment (sand blast mold texture with #30 shot grit). |
| | Dirt on Sheet or Mold | <ol style="list-style-type: none"> 1) Clean sheet and/or mold surface prior to forming. |
| Shiny Streaks or Spots | Sheet Overheated in Areas | <ol style="list-style-type: none"> 1) Adjust heaters in affected areas. 2) Hot spots (screen areas to deflect heat, if unable to do with zoning). |
| Distortion in Part after Removing Part from the Mold | Removing Part From Mold too Soon | <ol style="list-style-type: none"> 1) Increasing the cooling cycle. 2) Use temperature controlled mold. 3) Use fans or water mist. |
| | Uneven Cooling | <ol style="list-style-type: none"> 1) Cool part evenly by adding additional water coolings to mold and/or add fans. 2) Poor Material distribution (improve pre-stretch or plug assist). |
| | Mold Temperature | <ol style="list-style-type: none"> 1) Lower mold temperature 10° below HDT of material. |

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| Poor Wall Thickness Distribution | Improper Sag | <ol style="list-style-type: none"> 1) Heat sheet uniformly to allow material to flow properly. 2) Mount mold on top platen. 3) Use Billow Vacuum Snap-Back method. 4) Use plug assist. |
| | Hot or Cold Spots in Sheet | <ol style="list-style-type: none"> 1) Balance sheet heating. 2) Check heaters for proper operation. 3) Avoid air flow and drafts across sheet. |
| | Mold Too Cold | <ol style="list-style-type: none"> 1) Increase mold temperature 10° below HDT of material. |
| Shrink Marks in Corners | Poor Vacuum | <ol style="list-style-type: none"> 1) Check for vacuum leaks. 2) Check vacuum holes for blockages. 3) Add vacuum holes. 4) Increase the vacuum time to hold material tight to mold until material is cooled below HDT. |
| Thin Corners when Forming over a Female Tool | Improper Forming Techniques | <ol style="list-style-type: none"> 1) Use a Billow Forming technique. This will help by pre-stretching the sheet before forming. 2) Use a plug assist. |
| | Variation in Sheet Temperature | <ol style="list-style-type: none"> 1) Adjust the heating temperatures so the sheet is heated evenly. 2) Increase the perimeter (outer) heaters approximately 10% higher than the center. |
| Part Sticking to Mold | Mold Design | <ol style="list-style-type: none"> 1) Increase the draft angle of the mold. 2) Sand blast the mold with #30 grit to roughen the surface of the mold. 3) Use breakaway mold for undercuts. 4) Increase the air ejection pressure. 5) Use a mold release agent (silicone, talc, etc.) |
| Tearing of the Sheet When Forming | Mold Design | <ol style="list-style-type: none"> 1) Increase the radius in the corners. |
| | Sheet too Cold | <ol style="list-style-type: none"> 1) Increase heating cycle and temperatures. 2) Balance temperature across sheet. |
| | Vacuum Too Rapid | <ol style="list-style-type: none"> 1) Reduce the rate (speed) of the vacuum being pulled. |

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