Surlyn®
resin

Surlyn® Troubleshooting Guide and Mold Preparation Checklist

Surlyn® -- Troubleshooting Guide

Problems	Possible Causes	Possible Solutions
Sprues breaking off-sprues sticking, disrupting cycle	Short "hold" cycle Cold nozzle Poor cooling around sprue bushing Long Sprue with improper draft	Increase "hold" time Check heat source and controller for malfunction Increase cooling to plate containing sprue bushing Rework bushing to recommended size
Fastener failures on bending immediately after molding	Low melt temperature Excessive fill rate Thin wall thickness Weak weld lines on fastener	Increase "actual" melt temperature Decrease ram speed Rework tool to increase wall See weld line solutions
Fastener failures on installation	Sharp angles on internal ribs that create notch failure Weld line weakness in fastener wall Undersized hold Oversized fastener	Add radii to all internal comers See weld line solutions Check receptacle specification Check retainer specification
Flash on runners	Cavities too far above cavity plate "Rolled over" runner edges High injection pressure Low clamp pressure	Rework tool to lower inserts Rework cavity plates See parting line flash solutions See parting line flash solutions
Weld lines	Low melt temperature Poor venting Slow fill rate or flow restriction	Check heat source Clean existing vents Add vents to increase fill rate Check rate speed, increase gate size
Non-uniform wall dimension on fastener	Bent core pin Core pin misaligned with cavity Thin wall thickness	Replace, change to harder metal Retool Rework mold to increase wall thickness
Parts too shiny	Improper matte finish Low melt temperature Low mold temperature	Sandblast Check heat source Use recommended melt temperature Check mold heater Use recommended mold

		temperature

Problems	Possible Causes	Possible Solutions
Parts vary in size, shot to shot	Faulty check ring Interrupted cycles due to part sticking sprue sticking, nozzle freeze off	Measure ring for wear Spray mold and sprue with release agent, increase nozzle temperature
Excessive flash on fasteners	High injection pressure Poor tooling, worn mold Mold hot spot	Lower injection pressure Refer to recommended pressure Rework tool Check coring for circulation Replace inserts with high heat dissipating metal
Part weight varies shot to shot	Faulty check ring Faulty temperature controller Erratic screw feed (bridging) Poor tooling Wet or excessive regrind	Replace ring Repair or replace controller Check for cooling water on hopper Match fit to eliminate flashing Use regrind same shift Keep regrind ratio below 50%
Variation in part shrink-post molding (poor fit to standard fixture)	Melt temperature change Mold temperature change Unbalanced resin flow to multi-cavities	Check temperature controls Check mold cooler Standardize resin flow to cavities
Variation in dimension change	High injection pressure Low injection pressure Faulty check ring High melt temperature Low melt temperature	Check hydraulic controls Replace if worn Check heat source controllers Look for excessive back pressure Check heater bands and "actual" melt temperature
Shiny area on part surface	Condensation Contamination from mold release Cold spots in mold Poor venting	Raise mold temperature Clean mold cavity Check for uniform mold coring Open vent in trouble area
Splay on surface	Moisture in resin Contamination	Dry resin Purge until splay disappears Clean barrel if necessary

Problems	Possible Causes	Possible Solutions
Sink marks	Thick cross-section, low injection pressure Poor gate design Poor venting Inadequate ram forward time Not enough material	Retool-using ribs Check hydraulic controls Add foaming agent Recheck molding parameters Increase gate size Add vents to cavity ends or in vicinity of sink Clean existing vents Fill more slowly Add time-refer to checklist Adjust feed setting, check capacity of barrel
Excessive flash on parting line	Poorly tooled cavities Low clamp pressure Worn cavities High injection pressure Hot mold	Rework mold Check hydraulic setting Set relief valve higher Rework mold Check relief valve operation Check mold heater setting

Part deformation on ejection	Short "hold" cycle Cavities over-filled High mold temperature	Increase "hold" cycle Decrease pressure Use mold release spray Check relief mold heater Increase cooling water Check coring circulation Slow ejector pins
Warpage near gate area	Excessive gate area Excessive injection pressure High fill rate High melt temperature High mold temperature	Rework tool to recommended size Check pressure setting Decrease ram speed Check heat source and controllers Lower controller setting Check mold heater Increase cooling water Check coring circulation
Corrosion of equipment or tooling	Mild steel surface Wet resin	Stainless steel or other corrosion-resistant alloys are recommended Pre-dry resin if moisture content is above 0.1%

Surlyn® Mold Preparation Checklist

Introduction

The first and generally most critical step in molding parts of *Surlyn*® resins is proper tool design. This checklist is designed to provide a quick reference source in reviewing the plans of new or modified tool design. For more detailed information, see the PART AND MOLD DESIGN MANUAL for *Surlyn*® resin, available from your DuPont Industrial Polymers marketing representative or district office.

Sprue Bushing

- Should be as short as possible.
- Should have 0.75 in. taper/foot (6.2cm, taper/m.) (3° included angle) with sprue opening equal to main runner diameter.
- Should contain a generous radius into main runner.
- Should have all internal surfaces sandblasted for easier release.

Runners

- Should be full round, 0.200 in. (0.5cm.) diameter initially; add 0.062 in. (0.16cm.) for each right angle turn. Do not exceed 0.375 in. (1cm.)
- Should have all dead ends vented.
- Should have a radius at all intersections.
- Should be laid out so each cavity receives equal pressure to insure identical fill pattern.

Gates

- Should have a fan or edge for minimum warpage and shorter molding cycle. Both entrance and exit should flare into cavity Always cut with a minimum land of 0.050 in. (0.13 cm.) and set opening initially at 0.050 in. thick x 0.750 in. (1.9 cm.) wide. Increase as needed to fill cavity
- Should be located on cavity-end, when possible.
- If side-gated, should be cut into cavity wall at an angle to avoid jetting across cavity
- Should begin with a single gate, with option to cut in additional gates every 12 in. (30cm.).

Cavities

- Should be liquid or air-blasted with an abrasive (i.e. aluminum oxide) for matte finished parts. Grit size and total treatment time dependent on metal hardness.
- Should have maximum wall thickness no greater than 0.250 in. (0.6 cm.). Radius all intersections with a minimum of 0.015 in. (0.04 cm.).
- Should contain rib thickness of one-half to two-thirds of main wall thickness. Radius all intersections a minimum of 0.015 in. (0.04 cm.).
- Should have fastener walls with a minimum thickness of 0.060 in. (0.15 cm.) and supporting ribs from the cavity bottom. Radius all intersections.

Vents

- Vents are needed at all dead ends, opposite all gates, and in the vicinity of all weld lines. Preferably peripheral venting of cavity runner is suggested.
- Runners-size vents to 0.0015-0.002 in. (0.04-0.05 mm.) deep over runner width. Use land length of 0.032 in. (0.8 mm.) and increase vent depth beyond land ending to 0.032 in. (0.8 mm.). Carry channel to atmosphere.
- Cavities-size vents to 0.0015-0.002 in. (0.04--0.05 mm.) deep and 0.250 in. (0.6 cm.) wide. Same details for land. Carryout channel as runners.
- Pins-grind vents to 0.0015-0.002 in. (0.04-0.05 mm.) flat or slot on pin for 0.250 in. (0.6 cm.). Open to 0.032 in. (0.8 mm.) beyond and carry to atmosphere.

Mold Cooling

- Core the cavity side with a series of small channels, 0.437 in. (1.1 cm.) in diameter. Locate no further than one diameter distance from the cavity surface.
- Locate adequate cooling cores in the vicinity of all runners and the sprue bushing.
- Use high thermal conductivity metals (beryllium, copper, etc.) where coring is not possible, particularly in core pins that are not water cooled.

Materials of Construction

- Stainless steel or other corrosion-resistant alloys are recommended. Older machines may be attacked if they have mild steel parts.
- Use of excessively wet resin accelerates the corrosion rate of mild steel.

Surlyn® Checklist for Processing Conditions

Be sure to check the following:

- Water cooling on hopper throat is functioning
- Maximum rear zone temperature is 350°F (175°C)
- Melt temperature is 460°F (238°C)* (as verified by pyrometer)
- Injection Pressure is 10-12,000 psi nominal* (700-850kg/sq. cm.)
- Fill rate is 5 to 8 sec *
- Pad (positive cavity pressure) is 0.325 in. (8 mm)
- Injection forward time is 40 sec. ± 5 (For 0.125 in. (3 mm) part thickness)
- Hold cycle time is 20 sec. ± 10 (For 0.125 in. (3 mm) part thickness)
- Back pressure is 50-200 psi (3-14 kg/sq. cm.)
- Mold temperature is 60°F ± 10°(15°C ± 5°)
- Resin is dry

  * Adjust as needed-only guidelines

Safety

As with any hot material, care should be taken to protect the hands and other exposed parts of the body when handling molten polymer. At temperatures above 250°C (482°F), *Surlyn*® resins can evolve low concentrations of fumes. It is recommended that adequate ventilation be provided. For more detailed information on the safe handling and disposal of DuPont ethylene resins, OSHA material safety data sheets and a Product Safety Bulletin can be obtained from the sales representative serving you.

Protective covering should be worn since molten resin is very tacky and will stick to the skin.

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We welcome and respond promptly to e-mail.

CAUTION: Do not use in medical applications involving permanent implantation in the human body. For other medical applications, see "DuPont Medical Caution Statement", H-50102.