EASTMAN

Injection molding
Troubleshooting guide

Eastman™ copolyesters

Contents

Black specks

Possible cause	Corrective action
Previous material(s) in the screw, check ring, hot runner, etc.	Purge machine with Eastman™ copolyesters or commercial purge compounds. If necessary, remove screw and manually clean the screw and barrel. Take the nozzle and hot runner apart and clean out previous materials.
Regrind contamination	Shut off regrind and mold virgin to test source of specks. Allow sufficient time to clear the screw, barrel, check ring, and hot runner.
Raw material contamination	Ensure any open boxes are covered while in use. Examine pellets for possible contamination.

Brittleness

Possible cause	Corrective action
Poor drying	See processing guidelines for your copolyester formulations.
Excessive residence time	Calculate melt residence time by formula in molding guides. If >5 minutes, use smaller shot machine or reduce cycle time.
Melt temperature too high	Measure and reduce melt temperature.
Cracking when mold opens • Overpacking • Hot mold • Poor drying • Breakaway too fast • Needs vacuum break	 • Reduce either packing pressure or time. • Lower mold temperature or improve cooling uniformity. • See processing guidelines for your copolyester formulations. • Reduce mold-opening speed. • Install air poppet/vacuum break.

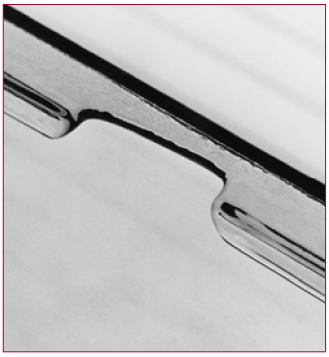
Discoloration

Possible cause	Corrective action
Overdrying	Follow recommended drying temperatures and times outlined on the product specification. If deviations are necessary, consult your Sales/Technical Representative.
Long melt residence time	If melt residence time (holdup time) is >5 minutes, purge machine before restarting, reduce cycle time, or use a smaller barrel capacity.
Contamination	Same as for haziness (see page 7).

Flashing

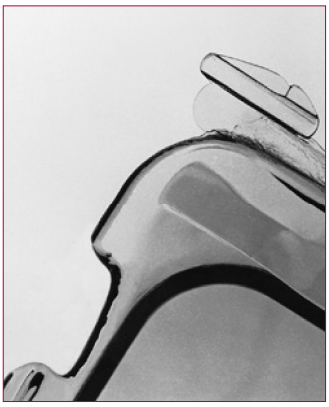
Possible cause	Corrective action
Poor mold spot	Spot mold to ensure fit and vent depths at ~0.025 mm (0.001 in.).
Injection pressures too high	Reduce pressure. This may require higher melt temperature or lower injection speed.
Boost time too long	Shorten boost time, lower boost pressure, or move transfer to an earlier position.
Insufficient clamp tonnage	Increase clamp pressure or move to machine with more tonnage.

Flash and short shot in different shots



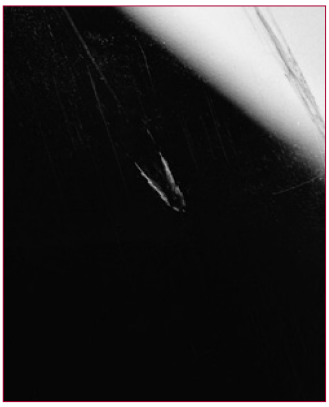
Possible cause	Corrective action
Check ring inconsistent; worn barrel	Check and replace assembly ring. Replace/reline barrel as needed.

Flash and short shot in the same shot



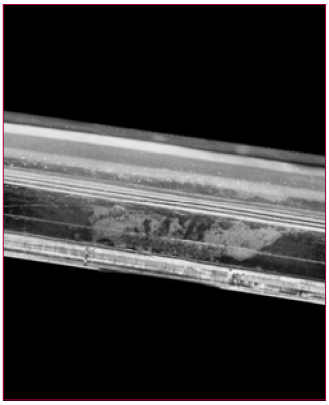
Possible cause	Corrective action
Core shift	Check wall thickness for core shift. Investigate for sources of core shift and repair mold.
Inadequate clamp tonnage	Increase clamp pressure or move to machine with more tonnage.
Fill speed or pressure too high	Reduce speed or fill pressure.
Melt temperature too low	Check and raise melt temperature if needed.
Sprue too long or too small, "0" dimension	Install correct size sprue.

Flowlines vs. seagulls, hooks, heat marks



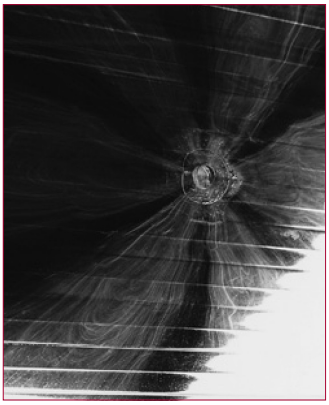
Possible cause	Corrective action
Gate and runner design	If marks are near the gate, locate and repair sharp edges and other high shear features. Increase gate size and radius all corners. In hot runners, look for hot and cold areas and cross-check temperature settings with a pyrometer when possible. Test the effects of raising and lowering individual temperature zones and reducing fill speed.
Temperature differences in the incoming material/flow path	Reduce temperature differences between the melt, nozzle, and runners. Ideally, take a melt temperature. Set nozzle and hot runner to that temperature, then adjust slightly. Check temperature inside the nozzle with a pyrometer.
Shear differences in the flow path	Eliminate shear differences caused by sharp corners, sharp edges, or abrupt changes anywhere in the flow path including the nozzle adapters, sprues and runners, gates, and part walls. Adjust and profile injection speed (slower when high shear defects are formed).
Part wall thickness, gate location, or fill pattern causing flow stoppage or hesitations	Mold a series of short shots to see how the defect forms. Measure wall thickness throughout the part to understand the causes of the filling pattern. Run mold filling analysis, if justified, to define sources of high shear and flow hesitations and to define solutions.

Gate blush



Possible cause	Corrective action
Fast injection speed	Use slower injection speed, especially at beginning of the shot.
Gate design	Increase gate size. Change gate geometry such as using a fan gate. Radius sharp edges. If hot runner, consult hot runner supplier.

Haziness

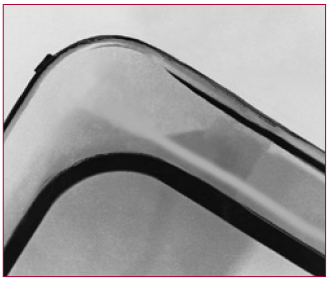


Possible cause	Corrective action
Contamination (typically throughout the part with some streaking)	Purge machine and check clarity of purge puddle. Run without regrind to determine whether regrind is the cause. Purge machine with commercial purge material or remove screw and clean barrel. Look for any contamination sources such as dead spots.
Crystallinity (typically streaks coming from hot areas such as the gate or nozzle)	Trace the streaks to their source, usually a hot spot in the nozzle, a hot runner hot spot, or weak mixing/melting in the screw.

Hot runners, hot sprues, valve gates

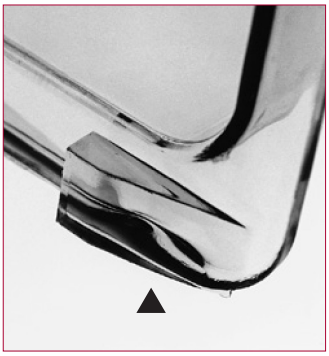
Possible cause	Corrective action
Custom design systems that require specific material, hot runner design, and part and mold design	Contact your Sales/Technical Representative along with the hot runner supplier for specific design suggestions.

Jetting



Possible cause	Corrective action
Plastic flow into the part channels or "snake flows"	Raise or lower fill speed to change filling pattern. Change the part or gate so that flow spreads evenly as the part is filled.

Sinks and voids

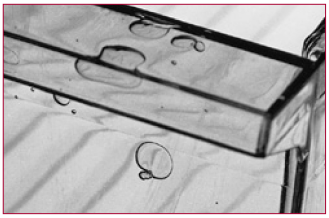


Possible cause	Corrective action
Insufficient packing	Increase packing time and/or pressure. Check gate, sprue, and tip dimensions to make sure size is adequate. Check part dimensions (packing thick sections through thin walls).
Walls, etc., too thick	Reduce thickness if possible.
Hot spots in mold	Improve cooling.
Injection speed too fast	Reduce speed to allow more uniform fill and pack.
Melt temperature too low	Check and adjust temperature upward if needed.

Splay

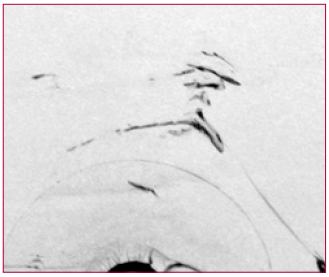
Splay is defined here to include any defects that appear as smeared material or bubbles on the part surface, usually oriented in the flow direction. Appearance alone cannot tell you which type of splay is present. To decide on the likely cause(s), test each to prove/disprove whether it is causing the splay, then take the corrective action indicated.

Air splay and decompression splay



Possible cause	Corrective action
Trapped air on screws	Decrease screw rpm. Increase back pressure. Check to ensure uniform recovery time; if not, decrease screw rpm or try reverse temperature profile. Review screw design with Eastman Technical Representative.
Trapped air in nozzle	Reduce decompression (suck back) or sprue break.
Trapped air in tool (foamy tail on bubbles)	Investigate (possibly using series of short shots) sources of air in tool such as weld line formation, inadequate venting, unusual shapes of pins where air remains after the flow passes, etc.

Contamination splay



Possible cause	Corrective action
Incompatible resins or thermally unstable contamination	Find and eliminate source (regrind, etc.).

Heat splay

Possible cause	Corrective action
Hot spots in barrel, nozzle, or hot runner	Check actual melt temperature. Check actual barrel, nozzle, and hot runner temperatures. Check heater bands, thermocouples, and controllers.
Residence time too long	Ensure shot size 25%–75% of barrel capacity. Maintain melt residence time at <5 minutes. Check for dead spots in hot runners and nozzles.

Moisture splay

Possible cause	Corrective action
Improperly dried material (Note: Moisture splay is visible only when material is *extremely* wet.)	Ensure good drying. See processing guidelines for your copolyester formulations.

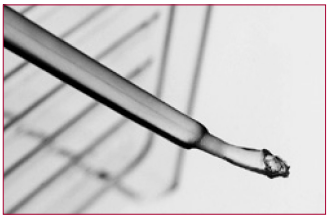
Shear splay

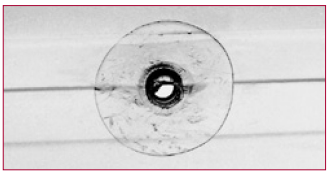
Possible cause	Corrective action
Gate design	Increase gate size. Change gate geometry such as using a fan gate. Radius sharp edges. If hot runner, consult hot runner supplier.
Screw speed too fast (either rpm or inject speed)	Reduce speed or profile as needed.
Screw slipping/spinning • Screw design • Worn barrel	 • Reduce screw rpm. • Measure compression ratio, flight depth, and zone lengths (typical range: 3:1 compression or more). Consult your Eastman Sales/ Technical Representative for suggestions. • Replace or reline barrel.
Part design	Radius sharp corners. Eliminate flow restrictions. Run series of short shots to determine flow pattern. Run mold filling analysis.

Other splay

Possible cause	Corrective action
Leaking check ring or high shear check ring or ball check	Repair or change check ring. Check for barrel wear.
Temperature differences in melt stream	Look for temperatures from check ring forward (cold slugs, nozzle drool, nonuniform nozzle temperature, hot runner internal temperature differences, etc.).
Cold slugs	Check nozzle, hot drop, and hot runner areas. Insulate or raise temperatures as appropriate.

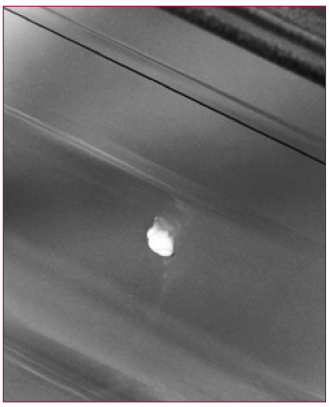
Sprue sticking





Possible cause	Corrective action
Sprue too small/diameter too long	Install correct size sprue.
Insufficient polish	Polish well in the draw direction.
Sprue bushing too hot	Ensure good thermal contact between sprue bushing and mold. Use alloy sprue bushing with ample water flow. Reduce injection speed, especially at the beginning of the shot.
Void at base of sprue	Use alloy sprue bushing with ample water flow. Increase nozzle tip diameter if too small. Reduce injection speed, especially at the beginning of the shot.

Unmelts



Possible cause	Corrective action
Melt temperature too low	Increase melt temperature.
Screw speed too low	Increase screw rpm.
Back pressure too low	Increase back pressure.
Shot size too large for machine	Switch to machine with appropriate size barrel.
Contamination	Find and eliminate source.

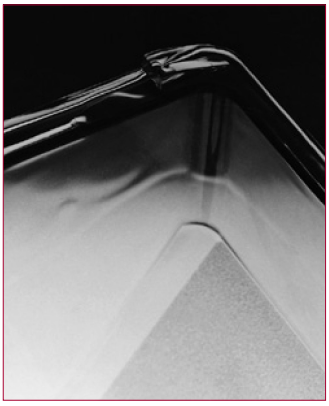
Warped or distorted parts as ejected from the mold

Possible cause	Corrective action
Hot spots or sticking during ejection	Locate hot spots (by pyrometer, etc.) and eliminate them by added cooling.
Undercuts	Locate undercuts (by finding part scratches or distortions) and eliminate them.
Insufficient ejector pins or lifters	Investigate part as it ejects to locate areas of weak ejection support and add ejectors.
Part overpacked	Reduce packing time/pressure.
Thick wall sections	Revise part wall thickness to be more uniform.

Warped parts after packing/shipping

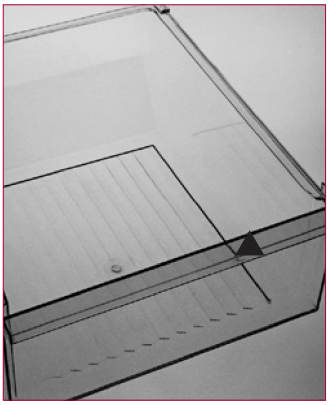
Possible cause	Corrective action
Parts hot when packed	Use cooling shelves to allow parts to completely cool before packing.
Hot parts warped by handling during trimming, hot stamping, etc.	Investigate steps in the process to find the cause of warp and revise the process as needed to eliminate warping. This may include fixturing during trimming, cooling racks to allow sufficient cooldown time before handling, etc.
Parts warped by packing so that they carry the load of parts, boxes, and pallets above them	Revise the packaging (such as adding interior partitions to carry the load) or revise the packing arrangement or process to eliminate load on each part.
Parts warped by final assembly step	Investigate to find the source of assembly forces and change process or design to reduce forces.

Wavy appearance



Possible cause	Corrective action
Mold surface too hot	Find hot (near the T_g of the plastic) areas and increase cooling.
Underpacking	Near the gate, increase packing time. Far from the gate, increase packing pressure.

Weld line defects



Possible cause	Corrective action
Air trapping (burning is the extreme) • Venting inadequate • Venting inadequate in ribs • Fill pattern causing backfilling or flow front freezing and restarting	Trapped air often shows bubbles with foamy tails. • Check and clean vents. Add vents near defect area. • Add vents in ribs, possibly with flat-sided ejector pins. • Run a series of short shots to see formation of the defect. Check wall thickness for uniformity or flow channeling. Check for uniform cooling/mold surface temperature uniformity. Correct wall thickness or other features causing the defect.
Flow hesitation marks	See flowlines vs. seagulls, etc.

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