Processing Guidelines for *Eastar* Copolyester DN011

EASTMAN

Contents

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Material Handling

- Clean the dryer hopper thoroughly before loading.
- Service all filters on the drying equipment.
- Clean the hopper drain port.
- Blow out the tramp metal trap and clean *all* hopper-loading hoses.
- Keep all opened material containers covered to keep the copolyester free of airborne contaminants.

Drying

Fifty percent of quality and processing problems are due to improper drying. The following is a list of things to use for proper drying.

- A pyrometer to check hopper air supply temperature.
- Portable dew point meter to check actual drying system dew point.
- Multibed desiccant drying systems.
- Dryers equipped with aftercoolers.

Four drying elements required for successful injection molding using *Eastar* copolyester DN011

- Drying temperature of 165°F (74°C).
- Dew point of –20°F (–30°C) or lower.
- Hopper residence time of 6 to 8 hours.
- Airflow of 1 cubic foot per minute per pound of material processed per hour.

Caution

- Drying is effective only when both adequate temperatures and dew points are reached.
- Overdrying beyond 24 hours can cause color shift.
- Avoid overdrying; lower the dryer temperature to 120°F (49°C). An hour before production continues, reset the dryer to the normal temperature.

Dryer Troubleshooting Checklist

- Is the drying system producing acceptable dew point? (Use a portable dew point meter to check actual drying system dew point.)
- Is the drying system sealed?
- Are all regeneration heaters functional?
- Have the process filters been serviced?
- Have the regeneration filters been serviced?
- Have the hoses been checked for holes, tears, or leaks?
- Has the desiccant dryer been serviced per the manufacturer's suggestions?
- Are the desiccant beds indexing as required?
- Is the hopper loader system functioning as designed?
- Is the drying system generating extreme temperature spikes during normal operation?

Start-up Procedure

- During barrel heat up and soak, set nozzle temperature to 250°F (121°C) to minimize black specks.
- Ten minutes before barrel soak is complete, raise nozzle temperature to correct set point.
- Purge nozzle onto cardboard or purging pan before production using undried clear polycarbonate. Do not use commercially available purging agents. They usually contain polystyrene, polyethylene, or acrylics. Purging with any agent containing these chemicals will cloud or streak your molded production parts.

Shutdown Procedure

- There is no need to idle barrel temperatures at shutdown.
- Purge the barrel until it's empty.
- Shut the heat off with the screw in the forward position.

Mold Design Requirements

- If an injection mold features a sprue gate configuration, a coolant circuit should be incorporated in the mold design around the sprue bushing.
- Aggressive coolant line spacing should be included in the mold cover half and injector half.
- Cooling circuits should be included in all slides and high-contact lifters.
- Aggressive venting should also be included in the mold design. If the loss of runner sprue creates long processing cycles, the standard steel screw bushing should be replaced with a sprue bushing made of an *Ampco* 940 alloy.

Nozzle Tip Suggestions

- Use either nylon or ABS-type tips.
- Avoid general-purpose nozzle tips because their use can cause defects as well as sprue sticking.
- Confirm that the nozzle tip for your application has the proper O and R dimensions for the mold sprue bushing.

Typical Process Setup

- Barrel set point of 520°F (271°C) will result in an actual melt temperature of approximately 530°F (277°C).
- Nozzle temperature set point is 485°F (252°C).
- Mold surface temperature should be around 70°F (21°C).
- Filling speed should be 1.7 in. per second.
- Back pressure should be 150 psi (11 bar).
- Extruder speed should be 50 rpm.
- Decompression should be 1.1 in. (2–3 mm).
- If screw slippage occurs, check the temperature of the machine feed throat platen. It should always be *below* 130°F (54°C).

Mold Cooling Requirements

- Mold moving half, 70°–80°F (21°–27°C)
- Mold fixed half, 80°–100°F (27°–38°C)
- Isolated cores, slides, and lifters, 60°–80°F (16°–27°C).

Checklist

- Has the coolant water been turned on?
- Are there an excessive number of loops in a single coolant circuit?
- Is there a "dead-end" loop in the coolant circuit?
- Is the chiller or tower not operating?
- Is the coolant supply to the mold running low?
- Are the coolant connections restricting flow?
- Are the supply hoses from the coolant manifold too long?

Barrel Temperature Set Points

- All three zones of the barrel should operate in the 500°–530°F (260°–277°C) zone.
- Adapter should be set between 520° to 540°F (271° to 282°C).
- Nozzle temperature set points should be between 500° to 540°F (260° to 282°C).

Checklist

- Is there a failed barrel thermocouple or a failed barrel heater band?
- Is the nozzle tip too small?
- Is there a high concentration of heater bands on the nozzle extension?
- Is the screw or barrel assembly worn?
- Is there a mixing button behind the nozzle extension?
- Is there a barrier or mixing-type screw on the molding machine?

Injection Process Pressures

- Boost pressures should be between 1,200 to 1,600 psi (83 to 110 bar).
- Pack pressures must be between 600 to 800 psi (41 to 55 bar).
- Back pressures should be between 100 to 200 psi (7 to 14 bar).

Checklist

- Is the machine oil cold or contaminated?
- Is the spool valve worn?
- Is the machine oil filter plugged?
- Is the machine low on oil?
- Is the pressure regulator malfunctioning?
- Is the high-pressure pump worn?
- Is the injection profile set up improperly?

Injection Speeds

- 1.4 to 2.0 in. per second.
- If gate aesthetics are critical, use this profile:
  - Set the first 10% of the shot at 0.7 in. per second.
  - Set the next 80% at 1.7 in. per second.
  - Set the final 10% at 0.7 in. per second.

Checklist

- Are barrel temperatures too low?
- Are injection processing pressures too low?
- Is there a sticking spool valve in the molding machine's hydraulic system?
- Is the oil in the molding machine's hydraulic system too cold?
- Is the barrel assembly worn?
- Is the check valve assembly in the machine barrel malfunctioning?
- Is the molding machine's hydraulic pump worn?
- Is the injection profile set incorrectly?
- Does the molding machine have a worn hydraulic pressure regulator?
- Is the nozzle "O dimension" too small?

Injection Timer Set Points

- Boost times between 3 to 7 seconds.
- Pack times between 2 to 4 seconds.
- Hold times between 4 to 16 seconds.
- Cure times between 16 to 40 seconds.
- When part aesthetics are critical, *fill* the *cavity* to 95% before transferring to pack-and-hold.

Checklist

- Is the molding machine's cycle timer not functioning?
- Is a relay in the cycle timer sticking?
- Is the cycle timer range unacceptable?

Injection Transfer Positions

- Transfer to pack and hold at 0.5 to 0.7 in. (12 to 17 mm).
- Cushion set points between 0.2 to 0.4 in. (5 to 10 mm).
- Decompression of 0.1 to 0.2 in. (2 to 5 mm).
- To maintain excellent part aesthetics, always service the mold cavity and vents at the end of each production shift.

Troubleshooting Part Appearance

Cloudy Parts, White Streaks

- Try purging the molding machine and/or the manifold system with *Eastar* copolyester DN011.
- Was the dryer cleaned before *Eastar* copolyester DN011 was loaded?
- If you're using regrind, is the regrind source contaminated?
- Has the open gaylord been contaminated?
- If the parts are cloudy or have white streaks, try purging the molding machine and/or manifold system with *Eastar* copolyester DN011.

Splay Defects

- Is the molding machine's barrel residence time too high?
- Is the polymer not dry?
- Is the injection speed too high?
- Is the nozzle temperature too high?
- Is the screw design unacceptable?
- Is there too much decompression?

Wavy Appearance

- Are the mold surface temperatures too high?
- Are hold times too short?
- Are hold pressures too low?
- Is the molded part wall section too heavy?
- Is the gate cross-sectional area too thin?

Part Distortion

- Are the parts being overpacked during processing?
- Was an undercut accidentally left in the ejector half of the mold?
- Is there a deep rib detail cut in the injector half of the mold without part ejection?
- Is the mold surface temperature too hot, thus causing parts to stick to the mold?

Brittle Parts

- Is the molding machine barrel too large?
- Are the melt temperatures too high?
- Are there any sharp corners on the molded part?
- Are the drying conditions poor?

Sprue Sticking

- Is there insufficient polish on the inner surface of the sprue bushing?
- Is the sprue bushing too hot because of the lack of a coolant circuit?
- Is there a void in the base of the screw? If so, this could be caused by heat accumulation in the steel screw bushing.
- Is the sprue bushing being overpacked during processing?
- Is the proper nozzle tip being used?
- Is the nozzle tip O dimension too small?
- If your production experiences long cycles because of sprue sticking or a void in the base of the sprue, replace the steel sprue bushing with one made of an *Ampco* 940 alloy.

Excessive Flash

- Are you operating with a poor mold spot?
- Are the injection filling speeds too slow?
- Are they too fast?
- Are melt temperatures too low?
- Is the injection transfer too early?
- Is it too late?
- Is there a low machine clamp tonnage?

Regrind Usage

In critical part applications, *regrind* levels up to 20% are acceptable *providing* the material has not been processed at high melt temperatures or without adequate drying *and* has not been contaminated with other resins.

For best production results, regrind from *Eastar* copolyester DN011 should be reprocessed as quickly as possible. This reduces the chances of drying and/or contamination of the regrind.

If you have any questions concerning your particular application or any information in this brochure, contact your Eastman marketing or technical service representative.

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