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Start-Up and Shut-Down Procedures to Minimize Oxidation of Polyethylene and Polypropylene

There are multitudes of methods for starting up and shutting down injection molding machines. Techniques for starting up a machine can include simply heating to operating temperature and molding or fully purging a barrel and then transitioning to your process material. Shutdown methods differ even more, ranging from just turning the machine off full of polymer, to completely emptying the barrel, to leaving the barrel semi-full of a purge compound. All of these methods may be valid, although arguments could be made that some methods are more effective than others.

Technical service engineers at Equistar have standardized some methods that have been found to work very well for running polyethylene and polypropylene. The nature of a technical center necessitates many start-ups and shutdowns of injection molding machines since we are not a 24-hour operation. This allows us to informally experiment and learn through trial-and-error which methods offer the most benefits. Equistar R&D injection molding engineers, with over 100 years of combined experience in the industry, agree that the following methods offer some advantages over other methods when molding PE and PP.

Prevention of oxidized material — the ubiquitous black and brown specks that cut into production time — is one of the primary considerations when starting up and shutting down an injection molder. The

following methods minimize the generation of oxidized material, allowing for improved processing of material and increasing time between screw cleanings. It should be noted that there are other steps that can be taken to reduce oxidation besides altering start-up and shut-down procedures.

Approximate Melting Temperatures

| | | |
|-------------|-------|-------|
| HDPE | 133°C | 270°F |
| LDPE | 115°C | 240°F |
| LLDPE | 125°C | 257°F |
| PP (Random) | 145°C | 293°F |
| PP (Other) | 165°C | 329°F |

The following steps are general start-up and shutdown guidelines, and should not be used as specific SOPs for your machinery. These steps are not optimal for heat-sensitive concentrates or polymers, such as EVA or blowing agents.

Shut-Down

- **Short-term shutdowns (up to three hours)**
 - Do not turn off the injection molding machine.
 - Stop the screw
 - Drop the barrel and hot runner temperatures to 30°F to 50°F above the melting point of the material. (See Table)
 - Turn off or reduce the flow of coolant to mold.
 - When restarting, raise temperatures and allow them to reach operating set-points before beginning to rotate the screw and turning on the mold coolant.

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- **Long-term shutdowns (over three hours)**
 - Retract extruder carriage.
 - Place drool pan under nozzle.
 - Turn off mold cooling water..
 - Bring screw all the way forward.
 - Close hopper gate.
 - Turn off injection molding machine and all auxiliary equipment.
- Fill screw.
- Turn on mold coolant.
- Make 3 to 5 shots to determine if black specks are present. More shots may be necessary if using a hot runner.
- If black specks or discolorations are present, try purging with 4 oz. of clean water to 1 pound of natural resin.

Maintain cooling water flow to the feed throat to prevent bridging.

Start-Up

- Turn on heats 45 to 60 minutes before processing.
- Allow heats to come to operating temperatures.
- Open hopper slide.
- Purge remaining shot from shut-down.
- **Note: Do not purge into a hot runner mold without confirming this technique with the hot runner manufacturer.**
If the black specks are not reduced/eliminated after three purging cycles, try a lower flow rate material or a commercial purging agent.
- If black specks are no longer present, cease purging and continue molding.

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