OSCO® inc.
RUNNERLESS MOLDING SYSTEMS
ISO-9001

2937 WATERVIEW DRIVE, ROCHESTER HILLS, MI 48309
TEL. 248-852-7310 • FAX 248-852-7183
www.oscosystems.com
USA

INSTALLATION INSTRUCTIONS

Color Change Procedure

COLOR CHANGE PROCEDURE

Many color changes can be made while the machine is running production, scrapping only 10 to 12 shots. Other materials may require full purging as noted in the following procedure.

1. Move back the nozzle of the machine.
2. Switch to manual mode.
3. Turn hot runner temperature down by 150°F for 15 minutes.
4. Completely purge the barrel using maximum screw speed and length, then introduce the new color.
5. Turn up the heat to the hot runner system by 75°F beyond processing temp.
6. When the barrel and the hot runner system temps have stabilized, bring the nozzle to the forward position and set screw speed and back pressure to their maximum.
7. Extrude through hot runner system with mold open. As material begins coming through the gates, increase the hot runner system temperature by about 25°F.
8. Continue extruding, slowly decreasing back pressure to let the screw recover, purging the old color out of the system using screw recovery.
9. Once the system seems to be clean of the old color, turn the barrel temperature and screw speed back to its normal set poir operation.
10. When there is an indication that purge is complete, decrease the hot runner system temperature to its original set points.
11. Continue extruding material until the hot runner system and barrel temperatures achieve desired set points.
12. Once achieved, let sit for 5 minutes
13. After 5 minutes proceed to regular operation using regular process parameters.

Notes: Due to colorant thermal conductivity, it may be necessary to adjust set point for the new color. Consult your resin supplier and colorant supplier for more details. You may have to reduce screw speed during operation. On a new system, it is suggested that a clear material is run first. This will aid in future color changes.

See attached internet article on "**The Evolving Dynamics of Hot Runner Color Changes**."

The Evolving Dynamics of Hot Runner Color Changes.

(Web search results. 6/12/10.)

If you're changing colors more often these days, follow these guidelines for selecting and operating a hot-runner system that will save you time and material.

Thanks to the growth of just-in-time manufacturing, color changes interrupt injection molding production runs more frequently than ever before. Switching colors sounds easy enough: Just use the new color to push out the old one. Yet removing all traces of the first color from the entire molding system--including the hot runner--is often easier said than done, especially when the second color is also a different type of resin from the first.

Given the flow characteristics of polymer melts in hot-runner systems, resident materials often do not leave without a fight. Making matters worse is the fact that hot-runner systems can contain a sizable quantity of polymer in relation to the part--sometimes as much as three times the part weight, but more often around one-fifth. Since each and every transitional shot during a color change represents lost production, changeover efficiency has become a critical cost factor.

When hot-runner designs and processing conditions have been tailored to applications needing frequent color swaps, we have seen changes take less than 10 shots. Unfortunately, we've also seen changes take hours--or days--when there has been no color-change optimization on an otherwise similar job.

To make sure your color changes go as quickly as possible, there are some concrete things you can do in terms of mold design, processing, and material selection. Bear in mind that there is no such thing as the perfect hot-runner solution, and choosing a system that is best for rapid color changes is a balancing act that may require tradeoffs in other areas.

UNDERSTAND YOUR MELT

The first step in optimizing the hot-runner system is understanding what goes on inside it during changeovers. As anyone who has witnessed a color change can attest, new material does not simply push out resident material. Instead, mixing occurs, and resident material may still turn up in your parts after a considerable volume of the second material has passed through the system.

This aggravating phenomenon is rooted in the fact that different polymers--and even different grades or colors of the same polymer--have different viscosities. This rheological variation, in turn, causes velocity differences as the two polymer melts move at different speeds through various positions in the bore. In general, the melt close to the runner wall tends to cling to the steel and not move as quickly as the melt in the center. This effect can be described by a velocity profile.

Since the material close to the wall of the bore moves less quickly, it naturally takes longer to purge. Purging at higher speeds can minimize this effect. How much higher? It depends on the material, runner design, and so forth. There is no rule of thumb. Just remember that you should use higher-speed purging to get faster color changes.

Also remember that it is always preferable to use a more viscous material to purge a less viscous one. If you attempt the reverse, the less viscous material tends to push through the center of the more viscous material, leaving a thick layer of the old material on the wall of the bore. Since that resident viscous layer erodes slowly, the old color will continue to contaminate the flow for some time afterward. Of course, it's not always possible to schedule production runs in order of increasing viscosity. But for the fastest possible changes, do so whenever possible.

TEMPERATURE EFFECTS

When setting up processing conditions, keep in mind that the viscosity of a polymer melt is highly dependent on its temperature. By affecting viscosity, temperature can influence color changes. If material already in the hot-runner system is colder than the material being introduced, it will most likely be more viscous and thus very difficult to push out. This phenomenon can also be used to your advantage: If the new material being introduced into the system is colder, it will be more viscous and thus more effective in achieving a color change. The temperature in the machine barrel should therefore be as low as the material can tolerate. Elevating the hot-runner system temperature also helps by reducing the viscosity of the resident material, making it easier to push out.

Finally, if all else fails--and sometimes it will--try a temporary shutdown of the hot-runner system. Sometimes the cooling will force the material to pull away from the hot-runner walls.

Though the processing guidelines presented here are intended to be helpful, it is not possible to prescribe a generic color-change procedure that will give the best performance in all circumstances. Some materials are just harder to change than others for no intuitive reason. For instance, some colorants seem to have a lubricating effect on the polymer, reducing the viscosity and thereby making those colors difficult to change. Sometimes the only way to identify these tricky materials and colorants is to go out and run some parts.

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