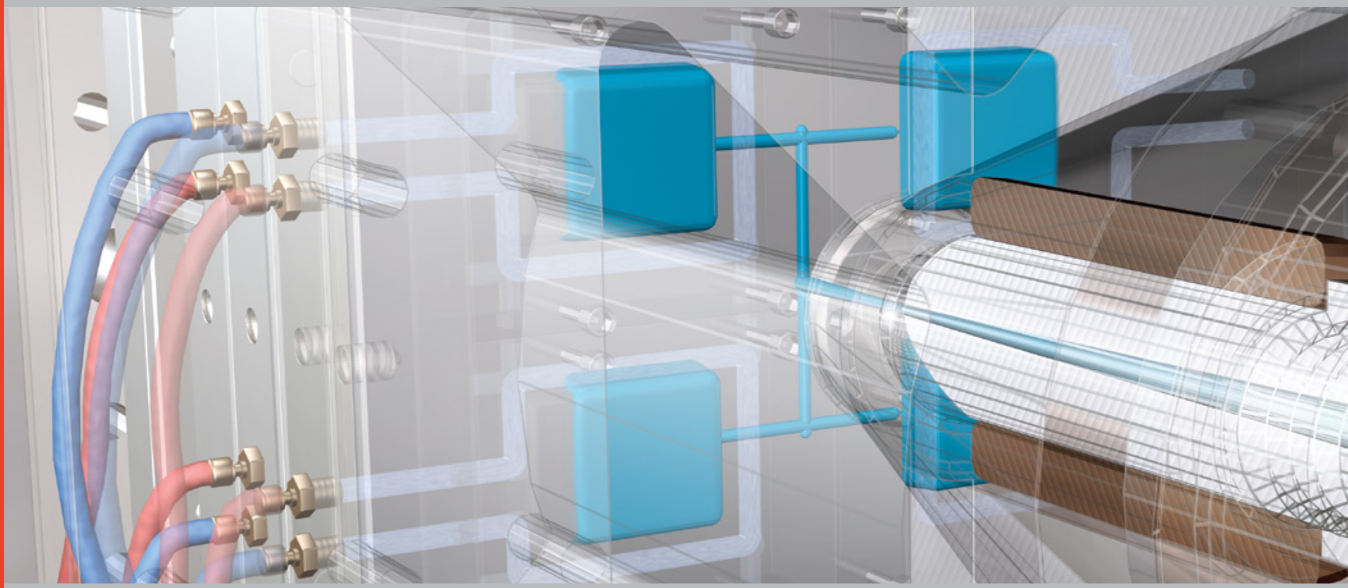
REFERENCE SERIES: PROCESSING

Scientific Troubleshooting: Flash



nexeo plastics

Created exclusively for **Nexeo Plastics** by Routsis Training, this free guide contains excerpts from Routsis's ***Scientific Molding Courses***.

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TROUBLESHOOTING FLASH

Flash is excessive, unwanted material located on the edges of a part. This is a result of material passing through the parting line or between mold components.

Flash can be caused by one of six major factors:

- Material Temperature
- 1st Stage Injection
- 2nd Stage Pressure
- Clamp Tonnage
- Mold Faults
- Machine Faults

*This free reference guide contains excerpts from Routsis Training's **Scientific Injection Molding** courses. Click here for more information.*

Material Temperature

First, let's look at material temperature as a potential cause of flash. Flash may be the result of a low Melt Temperature, a high Melt Temperature, or a high Back Pressure.

If the temperature of the melt is too low, the viscosity will increase and the pressure required to fill the mold may be too high. This high pressure can exceed the Clamp Tonnage resulting in flash near the center of the mold or near the gate.

Conversely, if the temperature of the melt is too high, the melt viscosity will drop – especially if the material degrades. This drop in viscosity may allow too much material to enter the mold during 1st Stage Fill, resulting in flash.

Excessive Back Pressure will cause shear heating, shear thinning, or material degradation. Any of these will reduce the material viscosity – possibly resulting in flash.

If you suspect a problem with the material temperature, it is best to test the Melt Temperature and compare the readings to the documented standard. Although a small temperature variation is normal, any temperature variation greater than 6 degrees Celsius, or 10 degrees Fahrenheit, should be addressed.

Although there are many ways to change the Melt Temperature, the most effective way is to adjust the middle and front temperature zones of the barrel. You should also ensure the Back Pressure setting is the same as the documented standard.

1st Stage Injection

1st Stage Injection issues may also result in flash. These include excessive material injection, high Injection Velocity, or a cavity filling imbalance.

If too much material is injected during 1st Stage, the part will start packing using 1st Stage Injection. This pressure often overcomes the clamping force and results in flash.

Some molders choose to establish a process in which the part is filled completely during 1st Stage Fill. Such a process is very inconsistent, and is often plagued by periods where the mold flashes and later produces short shots.

Excessive injection speed, or velocity, will cause the material viscosity to drop due to shear thinning. This drop in viscosity will often cause too much material to enter the mold during 1st Stage Fill – resulting in flash.

If you suspect a problem with 1st Stage Filling, it is recommended to begin troubleshooting by turning off 2nd Stage Packing. At this point, it is critical to verify the **1st Stage Fill-only Part Weight** and **1st Stage Injection Time** against the documented standard. It is imperative that both of these parameters be verified before any process corrections are made.

The most common filling adjustments are made to either **1st Stage Injection Speed** or **1st to 2nd Stage Transfer Position**. A decrease in Injection Velocity typically reduces 1st Stage Time and raises the 1st Stage Part Weight. An increase in Transfer Position reduces part weight with little change to the 1st Stage Injection Time.

Flash & Filling Imbalances

When processing with multi-cavity molds, a large filling imbalance can cause some filled mold cavities to begin packing while other cavities are still filling during 1st Stage. This imbalance causes some mold cavities to flash while other cavities may exhibit sinks or have short shots. Typically, a filling imbalance in excess of 6-7% will need to be addressed.

When a filling imbalance occurs, always check for inconsistencies, such as blocked or damaged vents and gates, which can cause a filling imbalance. It is not uncommon for material or contaminants to become lodged in the vents and gates and disrupt the balance of the tool.

Second, perform a **Dynamic Cavity Imbalance Test** which compares the part weight of each cavity using three different injection speeds. The objective of this test is to determine the fastest injection speed that provides an acceptable percentage of cavity imbalance.

Cavity balance aids, such as the **Melt Flipper™**, can also be installed in the mold. This technology, licensed by Beaumont Technologies Incorporated, uses strategically placed inserts at runner branches. The inserts rotate the polymer melt to help manage the imbalances resulting from runner turns.

Since narrow runners and gates restrict flow, the runner and gate sizes can be adjusted to modify the flow to different cavities. Changes in gate and runner dimensions should be avoided when possible, and the changes should be determined using advanced mold filling software programs.

2nd Stage Packing

Flash can be the result of excessive 2nd Stage Packing. If too much pressure is used during 2nd Stage Packing, the cavity pressure within the mold will exceed the clamping force holding the mold closed – resulting in flash.

The first step to correcting this is to turn off 2nd Stage Packing to ensure the flash is not occurring during mold filling. If flash is present on the produced short shot, then 2nd Stage Pressure is most likely not the cause of the flash.

Once it is determined that the flash occurs during 2nd Stage Packing, the next step is to drop the 2nd Stage Packing Pressure to the documented standard.

Clamp Tonnage

Flash may be the result of improper Clamp Tonnage. Once the pressures inside the mold exceed a low clamping force, the mold begins to open and material can flow through the parting line or between mold components.

Although uncommon, high Clamp Tonnage can also be the cause for flash. In this scenario, excessive clamp forces can compress the mold vents resulting in gas entrapment. If the trapped gas pressure becomes too high during 1st Stage Fill, the gas can force the mold open allowing both gas and material to escape.

This most often results in a thin flash on the parting line of the mold which remains in the mold and builds up on the parting line.

If you suspect Clamp Tonnage to be the cause of flash, the first step is to check the Clamp Tonnage setting and verify that it matches the documented standard. Over time, the platens, mold base, and toggle mechanisms will expand and contract and can often cause a change in the tonnage applied to the mold. For this reason, it is critical to reset the tonnage of the molding machine.

Mold Faults

A damaged mold may also cause flash to appear on molded parts. Dents and scratches, improper mold protect, poor mold handling, or excessive component wear are all potential culprits.

If a dent or scratch exists on a mold, a path can be created for the polymer melt to flow. This type of flash is usually on the parting line and will be evident in the same area of the part from shot to shot.

Much of the mold damage found in the industry is the result of carelessness. Any molder using hard tools, such as screwdrivers or pliers, to remove parts from the mold will usually cause damage.

Molds produced from aluminum and beryllium copper can even be scratched by softer tools made of brass.

Another cause of mold damage is the improper configuration of mold protection. Mold protect is a low pressure clamp closing that takes place before full tonnage is applied. When set properly, the machine will alarm if a body part, molded part, or automation gets in the way during mold closing.

If not set properly, the mold will clamp on anything that gets between the mold halves. As a result, drool, runners, and stuck parts will cause significant damage to the mold.

Before the mold is removed from the machine, it must be properly cleaned, and the mold surface should be sprayed with 'mold protectant' to help prevent rust and corrosion.

Even the best mold will exhibit wear over time, which will result in flash in specific areas – such as a shut off, or slide. The shut-off is the area where the two mold components meet, most commonly at the parting line.

The repetitive opening and closing of the mold will cause these shut-offs to wear. This wear will be most apparent in areas where angled, curved, and contoured shut-offs are used.

Moving actions, such as slides and lifters, use guide blocks and locks to direct and hold the action in place. These components are often manufactured using wear resistant materials, such as brass or graphite impregnated metals. When these components wear, you will often see flash begin to form around the action indicating these might require replacement.

If you suspect mold damage to be the cause for flash, the best course of action is to have the tool inspected by a toolmaker or a knowledgeable technician. Worn mold components should be brought to the attention of the engineers or toolmakers so they can evaluate the wear and determine the appropriate course of action.

When setting mold protection, you should configure the clamp so that it will not apply full tonnage if anything is in between the platens. One of the most common ways of testing this is to place a business card or piece of cardboard between the platens. Mold protect should prevent the machine from closing when the obstruction is present.

Machine Faults

Faults within the injection molding machine itself can result in flash. These include inconsistently performing check rings – as well as deflected platens.

Although all check rings exhibit some leakage, inconsistent leakage due to damage or a poor check ring seal can often cause flash. An inconsistent check ring will often create random filling related defects including flash, short shots and sinks.

If the stationary platen deflects too much, it can cause the mold to open, resulting in flash near the center of the mold.

Since a large hole and recess is cut in the center of the stationary platen to accommodate the injection unit, the largest amount of platen deflection typically occurs around the locating ring.

To evaluate the performance of the check ring, it is recommended that you perform the dynamic check ring repeatability test. This test consists of producing and weighing a series of ten short shots. The variation of the weights is then determined and represented as a percentage.

If your shot to shot variation is high, you may want to remove the screw and inspect the check ring for blockages, wear, or damage.

To evaluate the amount of platen deflection, a platen deflection test should be conducted. In this test, deflection at the center of the stationary platen is measured and averaged. If the measured deflection exceeds what is acceptable for the machine or application, then a correction may be necessary.

One of the simplest corrections you can try for excessive platen deflection is to increase the nozzle forward contact force. Another correction for platen deflection is to add a ring-shaped shim or spacer around the locating ring.

Adding a bolster plate to the mold for additional support is another option if necessary. Depending on the machine and manufacturer, some platens can also be replaced or re-surfaced as a last resort for correcting excessive platen deflection.