

# COMMON QUESTIONS AND ISSUES WITH GAS-ASSIST PARTS

## TYPES OF GAS-ASSIST

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### OVERVIEW

I will be answering questions and issues which have often come up in my analysis of gas-assist parts and in working with customers interested in or using gas-assist.

These topics may be of interest whether you have never used gas-assist or if you are an “old pro”. Maybe the explanations will be useful to your co-workers and customers who are not as familiar with gas-assist.

The first topic discusses types of gas-assist.

### TYPES OF GAS-ASSIST

Gas is used to enhance the injection molding process in several ways. I would categorize the most common forms of gas-assist as short-shot, spillover and gas-pack. So what are the differences and where do they apply?

Short-shot and spillover techniques are methods of filling and packing the part whereas gas-pack, as the name implies, only applies to the post-filling stage.

#### Short-Shot

With short-shot, the cavity is usually filled to between 95%-98% of a full shot. Gas injection can start near the end of filling or can be delayed for as long as 5-10 seconds depending on the material and part geometry.

Typically, gas pressure is around 25% of the maximum resin filling pressure. Due to the short shot and the lower pressure at the end of filling, machine and clamp tonnage requirements are reduced.

Many of the other effects on processing parameters are discussed in the paper by me and Paul Dier, “Stress Relief: Utilize Readily Available Tools to Reduce Stress in Your Parts (and Your Life)”.

The part can be single or multi-gated. Gas can be introduced through the nozzle or through one or more gas pins.

With multiple gas pins and the right controller, the gas pressures can be ramped up and down at different times and at different pressures. This will allow you to fine tune the process to get the best part.

#### Spillover

First of all, spillovers, overflow wells and overflow pockets are all the same so don't get confused.

Spillover gas-assist requires a license. There are certain applications which require the use of some sort of spillover. Spillover techniques work well when gate and gas inlet location prevent a fill pattern that will allow short-shot techniques.

There can be one or more spillovers. The part is filled using a full shot. Either imme-

diately or after a delay the path to the exit runner and spillover pocket is hydraulically opened. The gas is then injected, pushing the excess material out of the gas channel which exists between the inlet and outlet.

Since the part is completely filled and the path for the gas is well defined the gas path in the part is more predictable. It is often possible to get away with larger gas channels with spillover techniques.

Spillovers can take many shapes. My experience with the analysis has been that runner shaped spillovers, rectangular pockets, and puck shapes all work well as long as their volume is correct and not too thin or too thick.

Another good candidate for spillovers would be a situation where hesitation lines cannot be avoided or tolerated. Hesitation can be avoided with short-shot molding if no delay time is required. Part geometry and material choices may require that a distinct delay exists between the end of resin injection and the start of gas injection for the material to begin to solidify. This will often cause a hesitation line on the part with the short-shot method.

While I'm sure there are many elegant spillover designs, spillovers do allow a less well thought-out design. If you design the part and the tool for gas-assist upfront there are situations where spillovers and the associated licensing can be avoided.

Often with a short-shot, gas injection can start before the end of resin injection. Therefore, the material continues to move and no hesitation line will form.

Spillovers also seem to have a little less process sensitivity allowing more consistent results operator-to-operator. Non-spillover advocates would dispute this—if you know what you're doing spillover techniques are also very reproducible.

With short-shot designs, the gas will generally go from the gas inlet towards the last place to fill. Therefore, the fill pattern is critical to success. To get the gas to flow down the gas channel you must be pushing the gas in the same direction as the material.

#### Gas-Pack

Using gas only for packing also has its applications. Even in situations that use short-shot or spillover it is also possible to add gas pins as required to help pack out some heavy sections.

Gas-pack is particularly useful with a large shot size. In this case, once the cavity is filled, the screw can retract and recover while packing is taking place with the gas. This will save you money because it can significantly reduce cycle time on large machines.

The gas is primarily used to take up volumetric shrinkage. This can be accomplished with small gas channels and gas pins. Gas injected into the gas channel will only hollow a small portion near the gas inlet because it is a full shot and the gas has no place to go. It can also be accomplished strictly with gas pins, for example, located near heavy sections of the part.

Using gas-pack requires greater gas pressures than the other techniques. Depending on the number and location, however,

the pressure can still be significantly less than conventional packing.

With spillover and gas-pack techniques it is possible to supply conventional packing pressure prior to packing with gas. This allows packing to occur during any required delay.

### **SUMMARY**

Obviously there are pages that can be written about all of the particular pluses and minuses of the techniques as well as the exact how-to's. Hopefully, this has provided a good overview.

Although there are situations where short-shot or spillover techniques are clearly better, most parts will allow the use of either technique.

You should not be making this decision after the part is designed. Gate location(s), gas inlet location(s), gas channel location and sizing as well as material selection will have a large impact on your success. Think about it up-front.

Gas-packing can be useful for large shot sizes and for areas which need more targeted packing. This too should be thought about early on. Small design decisions may allow you to expand gas packing into actual short shot gas-assist.

Of course, gas-assist analysis will help you understand what you're getting yourself into. All of these methods are readily reproducible with analysis.

Over time I will be adding some figures to help clarify some of the above explanations. I will let you know when that has been completed.

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