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GAS ASSIST INJECTION MOLDING

AN OVERVIEW OF GAS ASSIST

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GAS ASSIST INJECTION MOLDING TECHNOLOGY

It is a fact that packing force must be applied and maintained to an injection molded part as it cools. With conventional injection molding processes, hydraulic pressure is exerted on the screw in the injection barrel, forcing molten resin through a runner system and material feed gates into the part. This generally results in relatively high pressure within the mold cavity, which can have unintended consequences such as flash and premature tool wear. With this conventional method of pressurizing a part, packing force will only be applied until the material feed gates freeze off. Once this occurs, additional packing pressure cannot be applied to the part. This is the major cause of sink marks in conventional injection molded parts.

Another cause of defects occurs when packing force is applied through the gates and freeze-off occurs in the part itself, usually in the areas of the part furthest from the gates. As material is forced into the cavity to replace volumetric shrinkage, areas nearest the gate will have more resin packed into them. As the part cools, areas of the part will shrink at different rates due to varying density of resin across the part. This causes defects such as warpage and stresses which can result in longer cycle times.

Gas assist injection molding is a low-pressure process, reducing the clamp tonnage required for molding. Gaseous nitrogen is applied to the part internally, either directly into thicker sections of the part or via a network of gas channels that are added to the part. Through proper tool and part design, this lower gas pressure is applied evenly throughout the part and can be sustained during the entire cooling phase. High-pressure differential within the mold cavity is avoided, thereby eliminating the associated defects.

There are many benefits associated with the gas assist process. These benefits include:

1. Clamp Tonnage Reduction

The gas assist molding process requires less clamp tonnage from your injection-molding press because the cavity of the mold is often less than completely filled. Unlike conventional molding, you are not pressurizing a local gradient area of the machine platen as you attempt to pack out the part. You will apply the lower gas pressure evenly throughout the entire part reducing the required clamp tonnage. In most cases, gas assist will lower the clamp tonnage requirements by 30% to 70%. Even in cases of what is referred to as full shot gas assist molding, there is a vacancy somewhere in the part that allows gas to penetrate, even if it is only to take up volumetric shrinkage within the cavity.

When clamp tonnage is reduced, significant cost savings can be realized. It is not uncommon for gas assist molders to place tools that would normally run in 1500-ton press into a 750-ton press. The machinery cost difference of a 1500-ton press ($700,000) versus a 750-ton press ($350,000) can make any project viable. Because of the substantial reduction in clamp requirements, it is also possible to quote jobs that are beyond your current tonnage capacity. Physical tool size is usually the limiting factor due to tie bar clearances. Imagine being at capacity in your single 750-ton press and your largest customer awarding you another 750-ton job. You can buy a new press, juggle capacity schedules and work more days per week, or go into your 600-ton or even your 450-ton with open capacity by employing gas assist technology.

2. Cycle Time Reduction

Another important benefit that gas assist technology offers is cycle time reduction. Anytime you can make a quality product faster, you can reduce production costs and increase the capacity of your plant.

Thick walled parts are obvious candidates for reductions in cycle times. The short shot process indicates that you will be reducing the amount of resin that is introduced to the part. Gas travels very easily through these thick walls. As gas travels through the part it extends the flow of resin, completing fill while evacuating resin from the thick areas. Without having the mass of material in thick areas of the part, cooling time – and therefore cycle time – is reduced. Some cycle times of thick walled parts have been reduced by more than 50%. When reducing the amount of material introduced to a mold, less time is required to cool the part internally and stresses are kept to a minimum.

On thin wall parts, the pack and hold phase of the process is replaced with gas pressure. As such, cycle times can be reduced as the screw is allowed to recover immediately after resin injection.

With all gas assist molding, cooling occurs inside the part as well as outside. This is due to the void in the part created by the displacement of resin within the gas channel or thick areas of the part.

In conventional molding, additional cycle time is added if parts have a tendency to warp, allowing the part to fully set-up. Warpage is not an issue with gas assisted injection molding as gas pressurized the part equally and eliminates stress when proper tool design is employed.

3. Resin Savings

With the cost of resins today, especially engineered grades, weight reduction of parts is important to molders.

The general consensus is that thick parts are the only viable gas assist candidates, and this is true: handles and similarly thick-sectioned parts are naturally conductive to the process and offer (in some cases) more than 50% weight reductions. However, it is also true that significant resin savings are possible in thin walled parts. In many instances, nominal wall thickness can be reduced when using gas assist and the part will actually be stronger.

Another major contributor to the resin savings is scrap reduction. With proper tool design, gas assist will allow you to experience scrap free start-ups and productions runs. The process is precisely controlled and the processing window is increased.

4. Improved Part Quality

Gas assist technology can improve the quality of products having certain dimensional criteria and appearance requirements. Many times a tool design limits the capability and quality of the finished product. More and more new designs have reduced nominal wall thickness and increased boss and mounting configurations. This typically results in added stresses and shrinkage, which can cause surface defects and imperfections. Thin walled parts with heavy bosses are susceptible to sink. When properly applied, gas assist will eliminate these quality concerns.

5. Design Freedom

The gas assist process will also offer certain design freedoms to part designers that are unavailable in conventional injection molding. Heavy wall sections can intersect thinner ones, ribs and bosses can actually be designed thicker than the nominal wall without fear of sinks, mechanical tool movements used for coring can be eliminated, and parts may be designed with thick sections that will become hollow.

Another benefit gas assist can offer a designer is the possible elimination of a hot runner system. When the runner system is designed within the part, there is no longer a need for the added expense and complication associated with hot manifold systems. This will also eliminate weld lines on the surface of the finished part.

CONCLUSION

If it were going to cost you money to use the gas assist process there would be no reason to do it. The fact is that gas assist will save you money. The cost savings in production are real and immediate. True there is a capital expenditure that will allow you to start a gas assist program, but with a Bauer gas assist system the payback will usually take less than one year, allowing you to enjoy the cost savings for years to come.

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