A E G I S

APPLICATION ENGINEERING GAS INJECTION SERVICES

TECHNOLOGY BULLETIN

Date: May 1, 2010, Rev. 5

RE: Advanced Resin Evacuation Techniques – The Facts
Priority: High

Substantial confusion and deliberate obfuscation has existed for approximately 20 years regarding resin evacuation methods involving gas assisted injection molding. Resin evacuation in gas-assisted molding has also casually been called "spillovers" or "overflows." The purpose of this document is to explain the various methods, clarify what is proprietary and what is not, explain the advantages and disadvantages of the various techniques, and to provide our recommendations for resin evacuation *when* it is necessary.

1) What is resin evacuation? (or spillovers, overflows)

Resin evacuation is an enhancement and additional step to conventional gas assisted molding where, following delivery of resin to the mold cavity, a portion of the resin is expelled from the cavity with nitrogen gas. (Or water, in the case of water assisted injection molding)

2) Why expel resin from the cavity?

There are limited circumstances when resin should to be evacuated from the cavity in gas-assisted molding:

A) When a "hesitation line" cannot be eliminated through process adjustment. A hesitation line is a visible surface defect that can occur when the resin flow-front stalls following the injection of a "short shot" of resin and before the gas injection phase continues the resin flow in the cavity. This is *not* as common of an occurrence with gas injection controllers marketed for the past 12 to 15 years.

B) When the part design results in a flow channel extending to the most distant location in the part cavity. This condition can sometimes be avoided by improving or modifying the part design.

C) When a reinforcing material in the base resin (glass fiber, calcium carbonate etc.) would appear on the Class A surface in the typically low-pressure gas assist process, or, when the base resin requires high pressure packing to achieve a Class A surface appearance.

3) Don't most gas assist molding programs using resin evacuation?

No, this is an occasionally heard misconception. Resin evacuation is *not* a routine gas molding processing technique, but is an option to be used when processing capabilities, part design and/or resin selection prevents acceptable results with conventional (short-shot) gas assist injection molding. We have seen *numerous* gas molding programs with evacuation wells in the mold when it was absolutely unnecessary. We believe most of

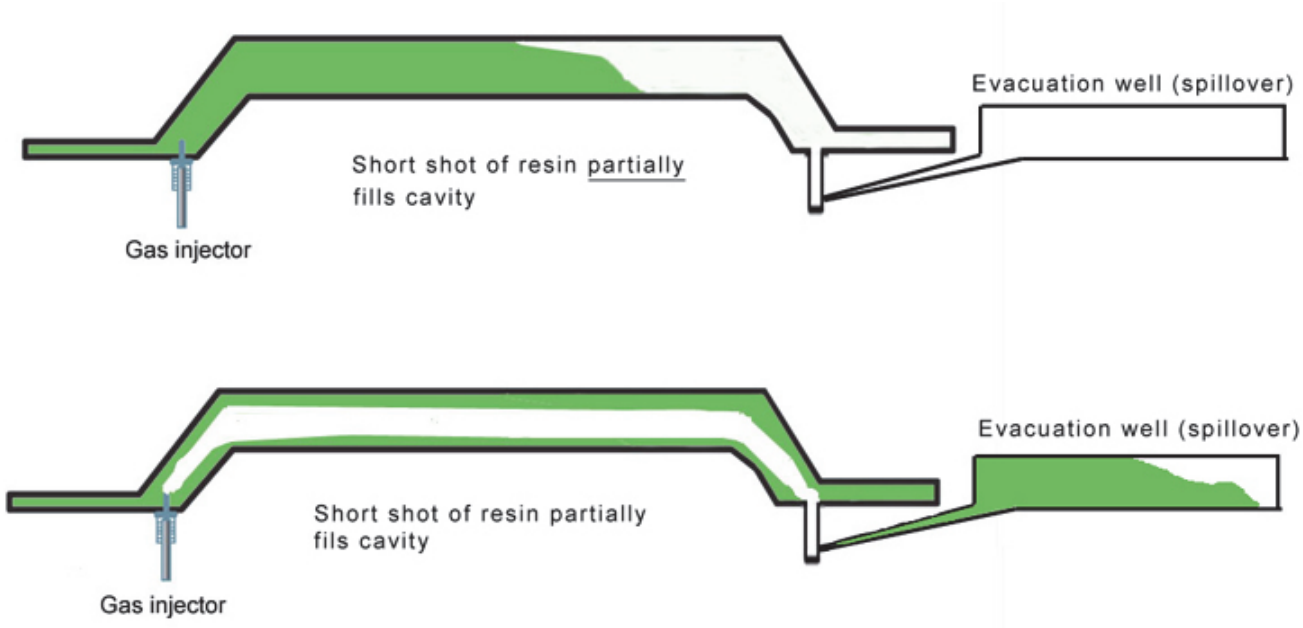
these unnecessary resin evacuation provisions were implemented so a "technology provider" can steer the molder toward a costly, unnecessary "license." In some circumstances, implementation is just a result of inadequate support from the molders or part designer's system or technology provider.

4) Isn't a license necessary from a gas assist technology provider when using resin evacuation/spillovers?

No, but there are some *very limited* implementations where it is legitimate (yet still unwarranted). There has been long-term misunderstanding, deliberate misinformation, lawsuits, illegitimate harassment of molders and a serious lack of accurate information regarding this subject. Many molders over the past 10 to 15 years have *voluntarily* paid for a license for resin evacuation regardless of how they were processing, due to a threat of litigation. We've even heard patent attorneys say to their clients "you need to decide whether you want to spend $25,000.00 for a license or pay $250,000.00 for litigation costs. (so much for ethics) *Too* often, we've seen molder paying for a "license" they did not need just to limit costs and make a threat go away. The confrontations were usually illegitimate, resulting on the ongoing, long-term confusion in the molding industry. As of the publication of this document, most of that problem has gone away.

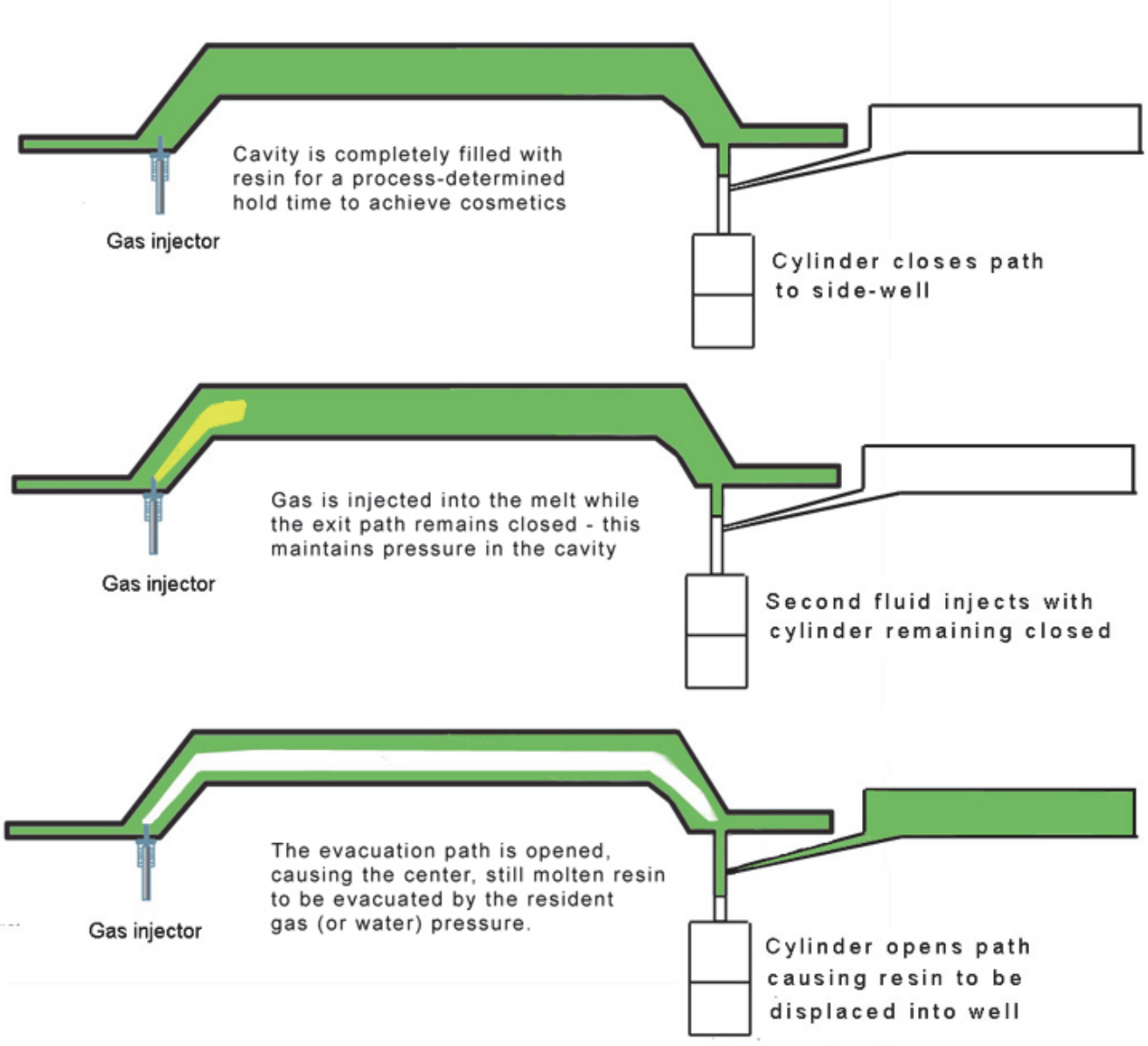
5) What basic types of resin evacuation are there?

a) The oldest resin evacuation technique is a two-step gas assist process: 1) Short-fill a cavity with an open aperture from the part cavity for resin evacuation, 2) inject gas, which evacuates some of the resin from the open aperture into a well outside of the parting line. This is a method that works only in the rarest circumstances due to the method's inconsistent results. It *was* a patented method, and the patent most commonly used for harassment of molders (even though the technique *was not being used*). This patent is now expired (in July 2008) in the U.S. We recommend avoiding this method in *any* circumstances due to its inferior, inconsistent results for resin evacuation. A similar patent in Europe was found, in 2009, to be invalid due to dubious filing of the application. If you paid for a "license" to practice this method, we suggest you *demand* a refund.



The first image above shows a cavity only partially filled with resin – short-filling was part of the patented gas assist process. Why a short shot? A short shot was necessary to prevent an uncontrollable amount of resin from exiting the flow path during the resin fill phase, or remaining in the part cavity. In the mid or late 1980's this was state-of-the-art, but has long since been replaced with far superior methods.

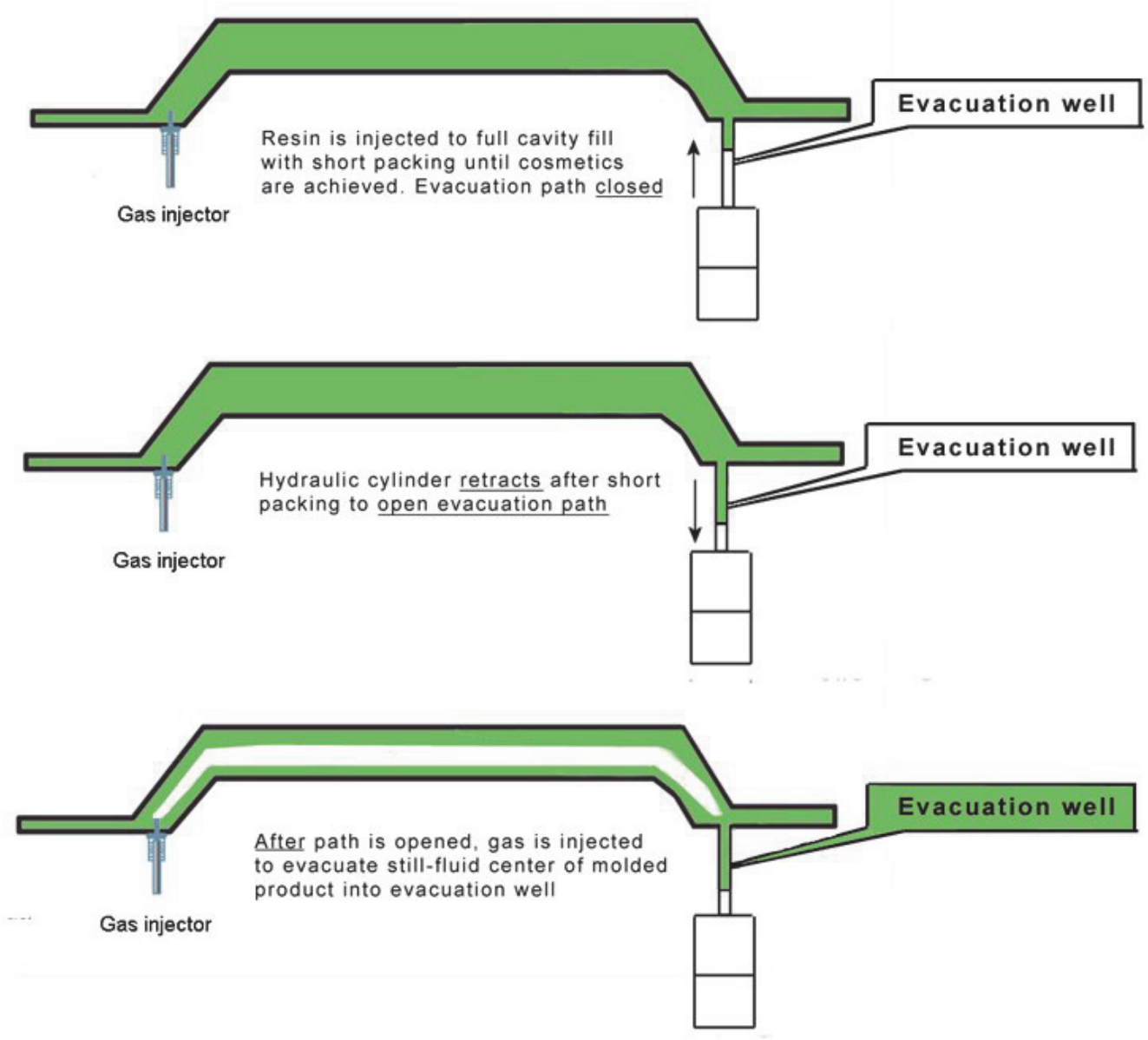
b) In April 2004, U.S. patent number 6,716,387 was issued, and assigned at that time, to Alliance Systems, a company owned by the same principals as Alliance Gas Systems. The methods defined in this patent greatly improved the resin evacuation process with numerous improved resin evacuation methods. The techniques per this patent involved injecting resin into a mold cavity with no *open* aperture, and with various methods for *selectively evacuating* resin *following* the injection of gas (or water). The technique also included resin evacuation from the resin runner, hence it was casually termed "Backspill." There have been a few minor variations to the methods described in this patent since 2004, but in no case do the methods include an *open* aperture during the resin injection phase. The various methods in the patent also require injection of gas (or water) before "selective" evacuation, meaning the opening of the discharge point from the part cavity remains closed during the gas, or water, injection phase. This technique can work, but still has a narrow processing window.



Please note that the method described *above*, if performed to the patent(s) specific process parameters, is a proprietary process. This should be taken into consideration prior to implementing these specific methods, as a costly license may be required.

C) The resin evacuation technique which achieves the *most consistent* results and highest-level quality of molded product:

Remember again that the most common reason for implementation of resin evacuation is to achieve superior Class A surface cosmetics. The method described below achieves the highest level of consistent results and surface quality, and is open to implementation by any gas assist molder *without* a license.



Note that in the above-described process, Class A cosmetics are achieved by using molding machine packing pressure to the resin-filled cavity prior to the gas injection phase. This hold phase timing is determined during process development – if a thicker remaining wall is desired, the hold time is increased; hold time is decreased if a thinner remaining wall is desired. The gas injection profile can also be adjusted to change the remaining wall thickness.

The method described immediately above is superior to all other resin evacuation methods – it affords the most consistent results with the widest processing window, and is a process that is available with no "patent license."

A note about the evacuation wells themselves: We frequently hear remarks such as "doesn't the evacuation well need to be gassed also?" or "doesn't the evacuation well need to be solid?" The proper answer is no to both questions. What is important is 1) the evacuation well is filled adequately to prevent the injected gas from escaping the parting line in the evacuation well, and 2) a *consistent* amount of resin is displaced, shot-to-shot, each molding cycle. If variable amounts of resin are displaced into the evacuation well, there are variable amounts of resin remaining in the part cavity. This condition is typically due to a faulty design of the evacuation path and should not occur with proper pre-tooling support.

The evacuation path to the evacuation well: There are various designs for the evacuation path to the evacuation well. For the best results, we recommend a sub gate to a post, with a hydraulic (not pneumatic!) cylinder in the extended (forward) position keeping the sub gate path to the post closed during resin injection. After the full-cavity packing stage, the hydraulic cylinder retracts, extending the length of the post and exposing the sub gate to the extended post, allowing the resin to easily flow, upon gas or water injection, to the evacuation well.

The recommendations in this document are generic to provide the basic concepts only. AEGIS' can assist with specific details for injector placement, evacuation point location, and the details of the post and evacuation well for your specific application. We'd be pleased to review your application and recommend the most efficient and cost effective method for new, or conversion gas assist molding program.

Please contact us for additional information and let us know how we can help you achieve the most efficient, cost effective gas molding process possible.

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