

# DIE CASTING ENGINEER

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## The Time Is Now for Vacuum-Assisted Die Casting

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Just now, immediately following the global economic meltdown, we are entering a period of unprecedented and virtually unlimited opportunity for the aluminum die casting industry. Automakers throughout the world are urgently redesigning and retooling to produce smaller, lighter vehicles that will cost less and use less fuel. The fact that if the weight of a vehicle is reduced by 10%, the fuel consumption is reduced by 6-8% means that the strength-to-weight ratio of steel, plastic and aluminum for every component of these new models is now being carefully compared. This will inevitably result in a much increased demand for die cast aluminum product. An additional factor is also involved in this equation.

A critical but as yet seldom articulated factor in the future use of aluminum products is the influence of "Generation Jones." This is a term used to describe the generation of people born between 1954 and 1965, right after the well-known post-war "Baby Boomers" who dominated our culture for so long. Just now, Generation Jones, aged 45 - 55, has a commanding presence in both industry and politics.

More than a quarter of all adults in North America and western Europe are Jonesers. To date, they have been a largely anonymous generation, but with some consistent and clearly defined characteristics. For the die cast industry, the most important of these is a strong sense of responsibility for the protection of our global environment. With regard to the use of aluminum in the automotive sector, for example, to a Joneser the fact that a lighter car using less fuel produces less greenhouse gas emission is almost as important as its reduced cost of operation. He will also be attracted by the recyclable potential of aluminum product. All of this influences the Joneser's support of anything that will increase the profitable use of aluminum.

The best time ever for die casters to improve their productivity and profit is now. The opportunity is immediate.

### Promoting Vacuum Again?

The use of vacuum is not new to die casters. It was first introduced a number of years ago. To date, the results have been rather inconsistent.

Every die caster knows the theory and advantages of vacuum-assisted casting. Because of the turbulence of the alloy as it is forced at a high pressure into the die cavity, and the complex shape of many casting molds, air and other gases are often trapped in the metal. This, of course, results in porosity in some parts of the casting. Porosity causes more rejected castings than anything else.

The real cost of rejected products is actually very high and, more often than not, underestimated by the die caster. The total value of the machine time that is lost while producing the rejected product is never recovered. It should be calculated as the selling price of good product made in an equal period, less only scrap recovery.

If the casting is to be chromed, painted or powder coated, or if any part of the casting is very thin, any air or gas inclusions usually result in rejection. Porosity also affects the mechanical properties of the product. In structural applications, it can act as a stress concentrator and, therefore, create a site where cracks may occur.

An additional problem is the fact that porosity in a casting may not always be immediately apparent. If discovered after subsequent secondary processing, customer dissatisfaction can be extreme. The only solution is vacuum assistance.

Before the injection shot occurs, a vacuum is drawn in both the shot sleeve and the mold cavity. The vacuum is maintained until the injection cycle is completed. Almost all of the air is positively evacu-



ated from the mold. A good vacuum in the mold cavity enables the alloy to flow into blind recesses in complex shapes. It also allows the fronts of the molten metal to merge freely without forming shuts. Whatever vacuum method is employed, if it works well, improved quality and reduced scrap can be guaranteed.

### Only If It Works Well...

There's the rub. Vacuum-assisted die casting is essential to any die caster who wants to eliminate porosity...who wants to make larger, thinner, more complicated parts, and with less pressure — but only if it works well.

When any new product or technology comes to market, it is often difficult to immediately use it effectively, especially if it is assumed that the system with which it works will support its use. This is precisely what occurred when vacuum was introduced in die casting several years ago. The die caster needed an extreme application to justify its use, because at that time, the vacuum valve required so much maintenance. The problem was compounded when the shot sleeve and plunger tip often did not work together well enough to create a secure seal. This, of course, resulted in air being pulled into the die cavity. This unfortunate situation was further worsened when the die caster introduced a heavy lubricant or grease in an ill-advised attempt to seal the gap. This was constantly being pulled into the valve, and was often a reason for its failure. Understandably, the amount of downtime was uncommonly high.

Just a few years ago, if the average die caster invested in a vacuum system, his downtime often offset his profit, and unless the requirements of his product were so stringent that they couldn't be satisfied without vacuum, he couldn't afford it.

Today, nearly any product can be profitably made with a vacuum-assisted die casting system. We now have a valve that is stronger, has fewer moving parts and requires minimal maintenance. Previously, most vacuum valves required maintenance after about 3,000 to 6,000 shots. With today's valve, a die caster can expect 20,000 to 40,000 shots or more before maintenance is required.

This much improved valve is now working very profitably, while supported by a thermally controlled shot sleeve and plunger tip combination that create a secure seal, using a minimal amount of a special benign lubricant.

### Resetting the Die Cast Industry

Our economy has been reset. That is a fact. We can't change it. We must accept it and manage to operate within the parameters of this newly reset business environment for an indefinite period.

How can the die casting industry best and most profitably reset itself?

The short answer has to be — by better die casting.

A huge and unexpected opportunity in a single market sector has developed almost overnight, and at the same time almost all other sectors are in sharp decline. Competition has suddenly become intense. Some die casting plants are already closed.

Vacuum-assisted die casting was introduced primarily to enable die casters to meet the demands of automakers and their Tier One vendors. Some die casters used it well and became very successful. Others didn't. The reason most often was that they didn't realize that the technology of the vacuum assist is so unforgiving. A die cast shot end system using vacuum either works very well or it is worse than useless.

Just now, the temperatures of both the plunger tip and the shot sleeve are being controlled better than ever before. Their interaction is improved and the integrity of the seal ensured. Also, the best vacuum valves now are infinitely more reliable than those of only a few years ago.

Yesterday, the choice was cheaper or better. There is no longer a choice. Today the product must be cheaper and better. It is fair to assume that in today's business climate, most die casters who do not embrace the vacuum assist will possibly fail.

The market is there. The improved technology is available. The time is now.

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#### About the Author

*Paul Robbins received his postgraduate degree at the Schulich School of Business and has worked in the light metal industry for more than 25 years. He is General Manager of Castool Tooling Systems. He is well-known for the articles that he has authored, and for the many technical papers he has presented. He is a committed advocate of the view that extrusion and die cast are both holistic processes, and therefore components of the production systems should never be considered in isolation, but always as an interconnected part of the whole system. For recreation he races motorcycles and skis.*



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