PERMOLD CASTING TUTORIAL

DEFINITION:

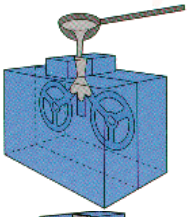
The Permold process, also known as Gravity Die-Casting, produces large number of castings via a non-destructible, metal mold. Specifically, molten metal is poured into a passageway leading to the part cavity whereupon solidifying, it is ejected from the Permold.

HISTORY:

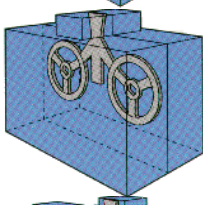
Since primitive times, man has found the need to make tools, weapons, and art from indestructible molds so they could be used repeatedly. Perhaps the earliest known example of Permold dates back to 2250 BC where Mesopotamians were using stone molds to mass produce utensils and weapons in bronze.

PROCESS AT A GLANCE:

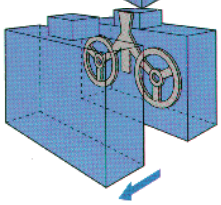
1. *Molten aluminum poured into Permold*



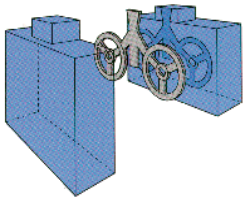
2. *Aluminum is allowed to solidify*



3. *Permold is opened*

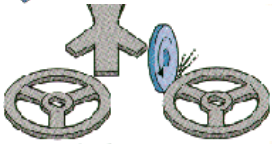


4. *Casting is ejected*

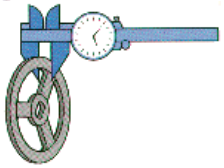


5. *"Hot" Inspection performed by molder*

6. *Gates and risers are trimmed*



7. *Final 100% inspection prior to packaging*



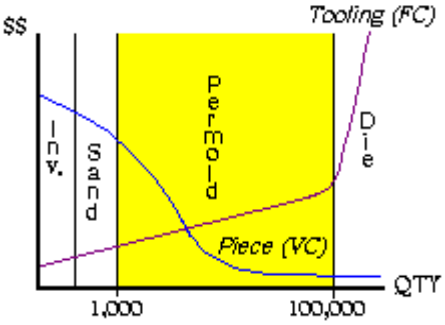
DESIGNING FOR PERMOLD:

Designing for the Permold process is intuitive. As in most casting processes, draft, radius, and wall thickness are the main design elements critical to good castability. Our engineering staff is available around the clock to help you get the most out of your investment. Gupta Permold fully meets and/or exceeds the Aluminum Association Standards for Permanent Mold Castings. Some highlights are:

- minimum 1/8 inch wall thickness increasing with increasing surface area
- typically 2° draft on all surfaces perpendicular to parting plane
- linear tolerance of ±.015 up to 6 inches

CASTING ECONOMICS:

Although characteristics such as part complexity and size enter the picture, quantity (or annual usage) basically defines the niche of each of the predominant casting processes. In other words, different processes are economically suitable for different jobs when the tradeoff between fixed cost (tooling) and variable cost (piece) is examined.



Sand casting involves temporary sand molds that are made from metal or wood patterns. Therefore, although up-front investment for tooling is low, piece prices are higher than Permold.

In pressure die casting, the metal is sprayed into the mold under high pressure. This leads to a lower cycle time and piece price, but the tooling cost ranges from 5 to 10 times the cost of Permold.

Thus, Permold's niche is a "middle-of-the-road" in terms of tooling and piece price. The range where Permold is often economically justifiable is between 1,000-100,000 pcs. annual usage. This range lends itself to most product life cycles as it allows for flexible quantities and the ability to ramp-up production without overwhelming fixed investment.

MOLDED INSERTS:

One of the most unique advantages of the Permold process is Molded Inserts. As is popular in the plastic injection industry, components of other materials can be integrally cast as part of the casting. In the photo above, a stainless steel stamping is integrally cast into the Speed Sensor Bearing Cap casting (shown above the golf ball). The advantage is an extra-hard steel surface where needed, but lightweight aluminum everywhere else. The Front End Cap casting (shown beside the golf ball) is cast with four threaded brass bushings in place, thereby eliminating drilling & tapping. Moreover, the brass threads are more durable over time than aluminum. In high volume situations, molded threaded inserts can be more economical than drilling/tapping. Either way, molded inserts are a potent design and cost advantage.

COMPARATIVE ADVANTAGES:

vs. Die Casting - In contrast to die casting, Permold produces a more dense casting with uniform strength throughout the cross-section (no skin-effect) and less brittleness. Permold castings can withstand higher temperatures without distortion and are fully machinable and weldable. Lead-times for tooling and production are also much shorter.

vs. Sand Casting - When compared to sand casting, Permold has much tighter dimensional control and thus requires less machining. Mechanical properties also emerge superior from the Permold process. Moreover, the surface finish is more appealing and reproducibility is much truer.

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