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PRESSURE DIE-CASTING INDUSTRY

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ABSTRACT :

This study focuses on pressure die casting which is a reliable, quick and a cost-effective manufacturing process for production of high volume, metal components. Pressure die casting involves injecting high pressure molten metal alloy into steel mold that gets solidified rapidly to form a net shaped component.

The data for this analysis paper has been collected from newspaper articles, varied websites, on-line portals.

KEYWORDS : *cost-effective manufacturing process , newspaper articles, varied websites.*

INTRODUCTION:

Types of Pressure Die Casting

There are 2 sorts of pressure die casting namely-:

- High Pressure Die Casting
- Low Pressure Die Casting

High Pressure Die Casting

The basic equipment consists of two vertical platens and the bolters are placed on these platens, this holds the die halves. One of the two platen is fixed and the other is movable which helps the die to open and close. Specific amount of metal is poured into the mold cavity using hydraulic driven piston. The metal then solidifies, the die opens and the casting is removed.

Hot Chamber Process

Hot chamber process is only applicable for low melting point alloys that do not affect and erode metal pots cylinders and plungers. E.g.- Zinc Working for hot chamber process is like. The molten metal for casting is placed in holding furnace at the required temperature adjacent to the machine. When pressure is transmitted by the injection piston, the metal is forced through the curve into the die. On the come stroke, the metal is drawn towards the gooseneck for the next shot.

The process safeguards minimum contact between air and metal to be infused.

Cold Chamber Process

The distinction of this method with the hot-chamber method is that the injection system isn't submerged in melted metal. On the contrary, metal gets transferred by ladle, manually or automatically, to the shot sleeve. The metal is pushed into the die by a hydraulically operated plunger. This process minimizes the contact time between the injector components and the molten metal. Which extends the life of the componentsHowever, the entrainment of air into the metal typically related to high-speed injection will cause gas consistence within the castings. In the cold chamber machine, injection pressures over 10,000 psi or 70,000 KPA is obtainable. Generally steel castings beside aluminum and copper primarily based alloys are made by this technique.

Low Pressure Die Casting

High quality castings, of Aluminium alloys, along with magnesium and other low melting point alloys are usually produced through this process.

The process works like this, first a metal die is positioned above a sealed furnace containing molten metal.A refractory-lined riser extends from the bottom of the die into the molten metal. Low pressure air is then introduced into the furnace.

This makes the molten metal rise up the tube and enter the die cavity with low turbulence. After the metal has solid, the air pressure is released.

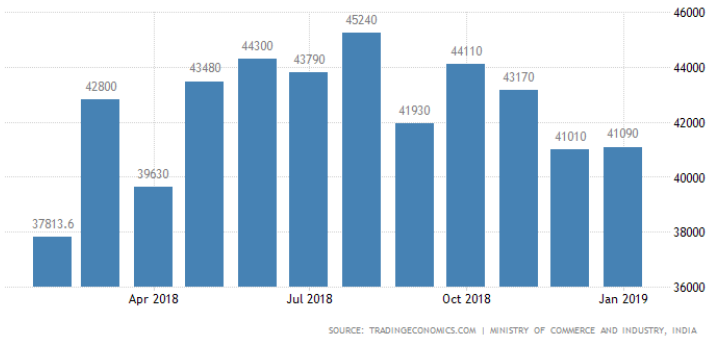
This makes the metal still within the melted state within the riser tube to fall back to the chamber.

After subsequent cooling, the die is opened and the casting extracted.With correct die style, it is possible to eliminate the need of the riser also.

This is as a result of the directional freeze of the casting.After the sequence has been established, the process can be controlled automatically using temperature and pressure controllers to oversee the operation of more than one die casting machine.

Application of Pressure Die Casting-:

- Automotive parts like wheels, blocks, cylinder heads, manifolds etc.
- Aerospace castings
- Electric motor housings
- Kitchen ware such as pressure cooker
- Cabinets for the electronics industry
- General hardware appliances, pump parts, plumbing parts.



Background Information

Die Casting:

The process of injecting a molten metal alloy into a die cast die to form a die cast part, or die casting.

Die Casting Die:

A tool specifically designed for use in the die casting process. A die casting die consists of 2 halves, associate degree ejector or moving 0.5 and a canopy or stationary 0.5.The die is usually created exploitation multiple steel alloys, counting on wherever the element fits within the die.The die forged method has vital thermal stresses thanks to the sport of hot metal across the face of the tool.Aluminum alloys additionally sharply attack the die steel with chemicals, inflicting wear.Due to these problems, the cavity section of the tool is formed from a premium steel alloy, such as H-13 to stand up to these stresses.

A die casting die has several parts to permit it to perform its perform. The ejector pins and plate area unit wont to push the coagulated half out of the die. Slide cores area unit wont to type internal passageways or extra pure mathematics on the outside of the half. Core pins area unit wont to produce holes within the die casting at exactness sizes and locations. Water lines area unit important to cool down the liquid metal in a good manner. All dies must be designed to fit the specific die casting machine they are going to be used in.

Die Casting Alloy:

An alloy used to make die castings. Basic utilizes metallic element alloys to suit the customer's finish want, such as 380 or 383.Different alloys have varied strength, fill and wear characteristics, depending on their chemical composition.

Die Casting Machine:

A large hydraulic press which closes the die, injects metal into the die, opens the die and then ejects the die casting. Die casting machines area unit sized by their closing tonnage duty. The higher the closing tonnage duty, the larger the die casting that can be made in that particular machine. This is a perform of the projected space of the die casting. Die casting machines with higher closing tonnages area unit larger, have larger gap strokes and area unit capable of injecting larger volumes of liquefied metal. Due to the larger cylinders and volumes needed to try and do this, larger machines cycle slower than little machines. Die casting machine cycle time is additionally wedged by half pure mathematics wherever thicker sections need longer to solidify.

Die Cast Injection: The act of forcing molten metal into a die casting die. Basic utilizes cold chamber machines where the molten metal is poured into a shot sleeve. A plunger tip then pushes the metallic element into the die.

This is done in several speed phases. A slow phase is used to cover the shot sleeve hole and fill the sleeve and runner system. A fast part is employed to inject metallic element into the die forged die cavity at a rate that properly fills the half pure mathematics. After the cavity is stuffed, the shot cylinder is taken to a higher pressure to squeeze the casting during solidification.

Trim Die: When a die casting is made, additional material exists on the part along the parting lines of the die. It is necessary to die trim the casting to get rid of the runners, gates, overflows, vents and flash along the periphery of the part to bring the die casting into size tolerances along these edges.

Finishing: Refers to processes performed on the die casting after the trim process. Many different processes could also be performed on the casting to satisfy the customer's product desires. These embody shot blasting, painting, machining, thread tapping and many more. See Basic's web page on our capabilities. In addition, many die castings can have additional components assembled onto or into them and delivered to the customer as a functional mechanism of a larger system or product.

Dimensional Tolerance: A die casting is capable holding precise tolerances, which is one of the advantages of the die casting process. Depending on the component and dimension, these tolerances can be 0.1mm or less. Precise tolerance necessities for the casting ought to be known before tool style to make sure that the tool is meant to satisfy necessities. See the North American Die Casting Association for specific tolerance guidelines.

Defects: May refer to a number of typical die casting failure modes including warping, blisters, cold shuts, porosity, solder and lamination. Failure mode sort is commonly a perform of the half pure mathematics and necessities. Thin walled elements area unit a lot of at risk of cold shuts than heavier sections which generally area unit vulnerable to body. In the planning process, the die casting company must evaluate the part and design the production process to prevent these failure modes.

Draft: This refers to the angle of walls, cores and other features in the part along the direction of die pull. In order for a casting to be removed from a die cast die, it must have positive draft along any side walls so that it can release from the die steel. Negative draft, or undercuts, will cause the part to hang on the die or be damaged upon removal.

Print: The part print is a critical input into the manufacture of die castings. Part prints establish feature tolerances necessary and significant and demanding} characteristics that area unit important to the perform of the die casting. Prints even have needed data regarding alloys, revision levels, finishing operations, trim necessities, etc. needed to define a functional casting.

CHALLENGES IN PRESSURE DIE-CASTING

- The use of advanced sensors to monitor the level of hydrogen and inclusions in the molten bath, as well as the temperature and volume both in the holding furnace and in the ladle during the melt transfer.
- The use of real-time sensors to control the position, acceleration, and velocities of the plunger and to correlate these parameters to the final product quality, on the basis of empirical or semi-empirical multivariable models.
- Specific sensors dedicated to real-time monitoring of the thermal–mechanical behavior of the die, including special reaction devices to modify the process in view of zero-defects self-adaptation by active gate section variation or venting valve modification.
- The prediction of the durability of the die by simulating the deterioration mechanisms. The control of the lubrication process by temperature, flux, and direction sensors, as well as of the thermoregulation by change in temperature, flux, and medium consistency.
- The efficient thermoregulation by temperature control of heating/cooling media and by time activation/deactivation, to optimize the heat balance of the die during the production or in warm-up phase.

CONCLUSION

- Leading to ‘zero-defect environment’
- Introducing real-time tools for process control.
- Monitoring and correlating all the main process variables.
- Making the process set up and optimization acknowledge-based issue.
- Implementing multidisciplinary R&D activities.
- Impacting on HPDC scenario.
- Performing these actions will allow HPDC foundries to achieve a more mature and efficient approach to large end users and to exploit their relevant potential.

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