Influence of Super Large Single Piece Die Casting Production to Automotive Industry

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Abstract: Under the motivation of the innovation idea from a new energy vehicle company in US, and the great jobs and cooperation of several parties, a new type of Super Large Single Piece die-casting production was established, which not only reduced production costs, but also accelerated production speed and further reduced the weight of the car body. In new energy vehicles, with continued explosive growth and the demand for energy conservation and emission reduction, lightweighting of new energy vehicles has become an inevitable trend, which has also promoted the faster development of Super Large Single Piece die-casting development.

Large aluminum alloy die-casting parts such as car front underbody, rear underbody, and battery trays used to be composed of up to 70+ small parts. With this new technology, they can be produced by die-casting in one shot. It is not just to amplify all the equipment can be done, but there involves many difficulties and challenges. This article starts from the perspective of the die-casting unit, through the design and process optimization of each step, and through on-site verification, to improve the performance and production efficiency of die-casting products.

The production process of the die-casting unit includes metal ladling, injection, die cooling, parts removal, spraying, parts cooling, trimming, marking, and output.

Keywords: Super Large Single Piece die-casting, new energy vehicles new production, underbody casting

1 Introduction

The automotive industry is constantly evolving, with technological advancements driving improvements in vehicle design, manufacturing efficiency, and overall performance. One such groundbreaking innovation is the introduction of super large single-piece die casting production. This technology has the potential to revolutionize the way vehicles are manufactured, offering numerous benefits in terms of cost, weight, strength, and production speed.

In the traditional method, the underbody of the vehicle was produced by jointing 70~100 pieces of small parts [1] together to form the whole underbody. This method has involved hundreds of robots and large space for building the assembly line. The time used is in hours basis.

On using the super large die casting machine, the front underbody, or the rear underbody can be produced in a single piece which take around 100 seconds. Space required is much less, only around 800~1000 square meter per die casting cell (around the size of two basket ball court).

Die casting is a manufacturing process that involves injecting molten metal into a die cavity under high pressure. Traditionally, this process has been used to create smaller components that are then assembled into larger structures. However, recent advancements have enabled the production of much larger components in a single piece, a process known as super large single-piece die casting. This is also called the Giga casting.

In 2019, there is 6000 ton die casting machine, and then in 2020, the 9000 ton die casting machine was announced. In 2021, the 12000 ton die casting machine was shown and in 2023 the 16000 ton die casting machine was displayed.

When the clamping force of the die casting machine become larger and larger, this has indicated that the size of a single piece casting can be bigger and bigger.

2 Experiments in using Single Piece casting

On using the Super Large Single piece die casting, there is a lot of advantages:

(1) Cost Efficiency: One of the most significant advantages of this technology is the reduction in manufacturing costs. By producing large components in a single piece, the need for multiple smaller parts and the associated assembly processes is eliminated. This leads to a decrease in labor costs, tooling costs, and overall production expenses.

(2) Weight Reduction: Super large single-piece die casting allows for the production of components with complex geometries and optimized material distribution. This results in lighter components without compromising strength or durability. Weight reduction is a critical factor in improving vehicle fuel efficiency and performance, making this technology highly attractive to automotive manufacturers.

(3) Enhanced Structural Integrity: Traditional methods of joining multiple smaller components can introduce points of weakness due to welds, bolts, or adhesives. By

producing a single large piece, these potential weak points are eliminated, leading to improved structural integrity and overall safety of the vehicle.

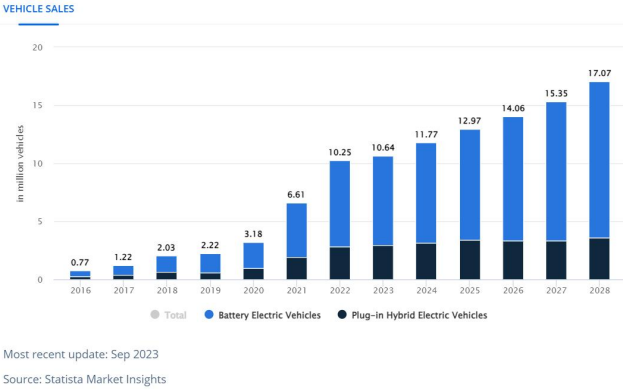
(4) Increased Production Speed: The ability to produce large components in a single casting cycle significantly reduces production time. This increased speed not only enhances manufacturing efficiency but also allows for quicker turnaround times, enabling manufacturers to respond more rapidly to market demands.

(5) Design Flexibility: Super large single-piece die casting offers greater design flexibility, allowing engineers to create more complex and innovative vehicle structures. This can lead to the development of new vehicle designs that were previously not feasible with traditional manufacturing methods.

3 Result and discussion

The adoption of super large single-piece die casting is poised to have a profound impact on the automotive industry. Some of the key areas of influence include:

(1) Electric Vehicles (EVs): The demand for electric vehicles is growing rapidly, driven by environmental concerns and government regulations [2]. Super large single-piece die casting is particularly beneficial for EVs, as it allows for the production of lightweight and structurally sound components that can accommodate battery packs and other electrical systems more efficiently.



(2) Manufacturing Efficiency: Automotive manufacturers are constantly seeking ways to improve efficiency and reduce costs. The integration of super large single-piece die casting into production lines can streamline manufacturing processes, reduce the number of required parts, and minimize assembly times. This, in turn, can lead to significant cost savings and higher profit margins.

(3) Supply Chain Simplification: By reducing the number of components needed for vehicle assembly, manufacturers can simplify their supply chains. This reduction in complexity can lead to fewer supply chain disruptions, improved inventory management, and a more streamlined production process.

(4) Sustainability: The automotive industry is under increasing pressure to adopt more sustainable practices. Super large single-piece die casting contributes to this goal by reducing material waste, energy consumption, and emissions associated with traditional manufacturing processes. The production of lighter vehicles also contributes to lower fuel consumption and reduced greenhouse gas emissions.

4 Conclusion

Super large single-piece die casting represents a significant advancement in automotive manufacturing technology. Its potential to reduce costs, improve efficiency, enhance vehicle performance, and contribute to sustainability makes it a highly attractive option for automotive manufacturers. As the industry continues to evolve, the adoption of this technology is likely to play a pivotal role in shaping the future of vehicle production and design.

Since the Super Large Single Piece die casting is not only used in EV, but also possible to used for producing traditional IC vehicles. It is believed that the technology can lower the production cost of the automotive industry and thus lower the vehicle price in the coming future.

References

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