Process technology of die-casting structural parts

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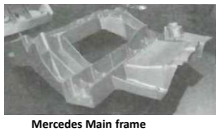
Content

1. Application of die-casting structural parts - Automotive die-casting structural parts


Audi A8 Aluminum alloy frame


BMW Shock tower

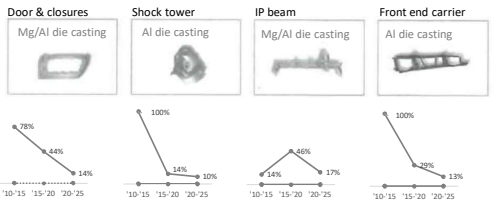

Mercedes Main frame


VW Door frame


Audi longitude member


Audi B pillar (picture left)

1. Application of die-casting structural parts - Automotive die-casting structural parts



Estimates of the growth rate of some automotive die-casting structural parts

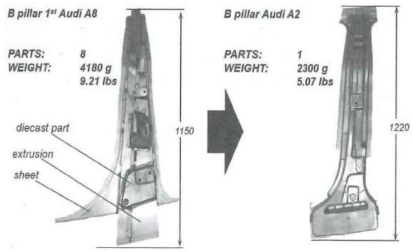
1. Application of die-casting structural parts - Automotive die-casting structural parts


Suzuki Motorcycle aluminum frame


Yamaha Scooter aluminum frame


Honda motorcycle aluminum frame

1. Application of die-casting structural parts - Advantages of using die-cast structural parts



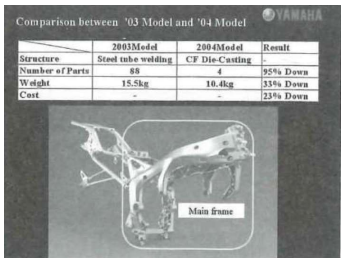
1. Application of die-casting structural parts - Advantages of using die-cast structural parts

BMW X5 shock tower

Original: It is welded from 5 steel plates and weighs 18 pounds

Current: High-vacuum die-casting in one piece and weighs 7.2 pounds

1. Application of die-casting structural parts - Advantages of using die-cast structural parts



2. Die casting alloy

In order to be applied to structural parts, new alloys with better toughness must be used.
The representative alloy is Silafont-36.

Comparison of mechanical properties between Silafont-36 and traditional die-casting aluminum alloy ADC12

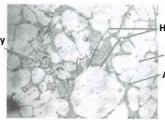
Item	Heat treatment	Yield strength N/mm²	Tensile strength N/mm²	Elongation %	Hardness HB
Silafont-36	F	120-150	250-290	5-11	75-95
	T5	155-245	275-340	4-9	80-110
	T4	95-140	210-260	15-22	60-75
	T6	210-280	290-340	7-12	90-110
	T7	120-170	200-240	15-20	60-75
ADC12	F	154	228	1.4	74.1

2. Die casting alloy

Composition comparison between Silafont-36 and traditional die-casting aluminum alloy ADC12

Item	Si	Fe	Cu	Mn	Mg	Zn	Ti	Other	Al
Silafont-36	9.5-11.5	0.15	0.03	0.5-0.8	0.1-0.5	0.07	0.13	Sr	balance
ADC12	9.5-12.0	1.3	1.5-3.5	0.5	0.3	1.0	-	-	balance

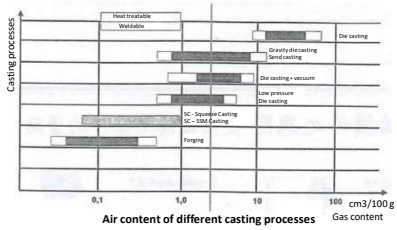
Iron compounds inhibited by the presence of manganese



Harmful iron compounds
Aluminum
Al-Si eutectic phase

Microstructure of traditional die-cast aluminum alloy

3. High vacuum die casting - Air content of various processes



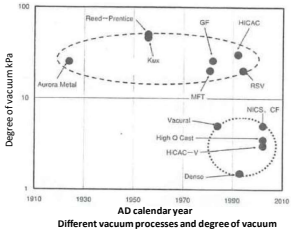
Air content of different casting processes

High vacuum die casting target: less than 3cc/100g Al

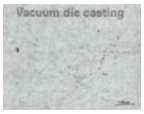
Before the die-cast test piece is heated

After the die-cast test piece is heated

3. High vacuum die casting - Vacuum die casting and high vacuum die casting

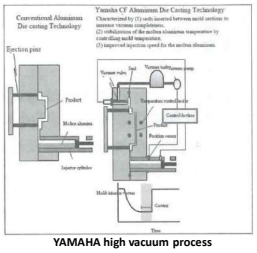


Different vacuum processes and degree of vacuum
(Source: Die and mould technology Nishi Naomi)



Metallographic structure of high vacuum aluminum die casting (Less gas holes and gas film, good mechanical properties)

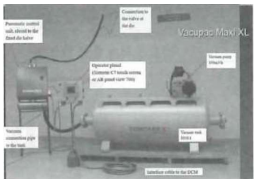
3. High vacuum die casting - Vacuum die casting equipment



YAMAHA high vacuum process

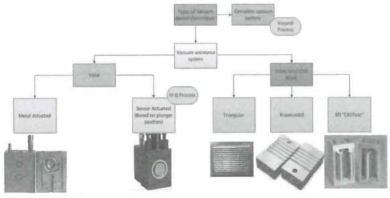
3. High vacuum die casting - Vacuum die casting equipment

· The vacuum die-casting equipment includes several parts: vacuum pump, vacuum drum, vacuum pipeline, controller, directional control valve, filter screen, vacuum valve.

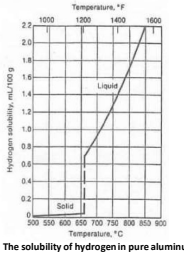


3. High vacuum die casting - Vacuum die casting equipment

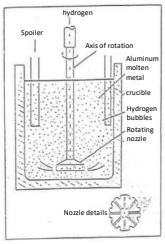
· Vacuum valves can be divided into 3 categories according to their operating methods.



4. Molten metal treatment



The solubility of hydrogen in pure aluminum

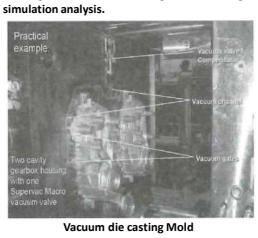


GBF degassing equipement

5. Mold design

Technical focus: runner system design, vacuum runner design, mold sealing design, mold flow and heat transfer simulation analysis.

Mold flow analysis



Vacuum die casting Mold

6. The capability of Metal Industries Research & Development Centre in die-casting structural parts

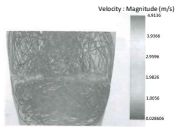
At present, with the support of the Science and Technology Program, the Metal Industries Research & Development Centre is developing related technologies for die-casting structural parts, including liquid aluminum clean technology, high-vacuum die-casting mold design technology, high-vacuum die-casting process technology...etc.

Die casting equipment in the Metal Industries Research & Development Centre

Hydrogen meter

6. The capability of Metal Industries Research & Development Centre in die-casting structural parts

Vacuum equipment



Simulation of inert gas rotating degassing flow field

Vacuum die casting filling simulation

7. Conclusion

- Die-casting structural parts have been used in many high-end vehicles, and it is expected to be used more and more.
- Die-casting parts should be used in the structure of automobiles and motorcycles. In addition to the use of vacuum extraction devices, careful control should be taken from material selection, molten metal treatment, mold design, cooling and release agent spraying.
- The Metal Industries Research & Development Centre is developing related technologies to assist domestic manufacturers to produce die-cast structural parts.