Maximising the advantages of low pressure diecasting

According to Rick Davies, Process Development Manager at Sarginsons Industries Ltd, low pressure diecasting is the most controllable and repeatable diecasting process. Here, he explains its distinct advantages.

More complex aluminium solutions are being considered as Sarginsons endeavours to exceed customer expectations.

With up to 800kg of molten aluminium held directly beneath the in-gate to the die, it is easy to see why low pressure diecasting is the optimum process for perfect directional solidification and consequently, why it holds superior diecasting properties.

The low pressure process unlike other diecasting processes, is the only one that takes material from the very heart of the melt. None of the material entering the die cavity has ever broken through surface oxides or been in contact with the external atmosphere. It is this that creates its special quiescent cavity fill characteristics.

The casting process is usually completed in three stages, using closed loop plc controls that supply negative dewpoint air into the furnace.

Process stages

- Raise material to the top of the riser tube at a fixed velocity of 70mm/sec.
- Fill the die cavity, maintaining a constant velocity of a component dependent value.
- Increase the pressure within five seconds of the solidification phase to 750 mbar.

Following the ejection of each casting, the volume of air injected into the furnace is increased to compensate for the reduction of mass in the furnace, therefore fully restoring each cavity fill characteristic. The temperature of the die is maintained using oil, air or water mist cooling media and climatic conditions are frequently analysed. Additional parameters are also monitored using 4mA to 20mA data logging and interrogated using Minitab.

Another distinct advantage of low pressure diecasting is the ability to use complex internal loose cores to create hollow sections within components, although sand cores do require further process control of vacuum evacuation for core resin gases from the die cavity during the die filling stages.

Low pressure casting also allows components to be fully heat treated, further enhancing their mechanical properties, doubling its tensile and 0.2% proof stress values. The homogenous grain structure and superior diecasting properties enable automotive chassis castings to be automatically welded to aluminium extrusions, creating full vehicle sub-frames.

Competitive advantage

One of the main challenges facing the majority of diecasting organisations is that of energy costs. The low pressure diecasting process constantly delivers casting yields up to 96%, which means minimal remelt and therefore melt losses. By operating fully enclosed 36kw thyrister-controlled holding furnaces, Sarginsons is able to ensure that energy consumption is minimised, resulting in a sustainable carbon footprint profile, lower CO_2 emissions and lower operating costs.

The exceptionally high yield also reduces the post casting finishing process, which lowers costs; and thanks to superior dimensional accuracy, single CNC machining passes can be achieved with machining stock allowances of less than 1.5mm. Low pressure diecasting also produces surface finishes of 3μm, meaning that paint applications can be added without additional preparation costs.

Low pressure diecasting is also exceptionally adept for casting thin wall sections. This is particularly so when using a sand core application, resulting in walls of 2mm-3mm and therefore greatly reduced material costs.

Technical advantage

The quality and technical team at Sarginsons, headed by Kevin Brierley, operates using the latest Magma casting simulation V5.2 non-ferrous programme. This enables the prediction of not only porosity issues but also anticipated mechanical properties within a casting design, meaning the company is moving ever closer to design engineers' FE analysis programmes.

By using LPM cells, Sarginsons can produce a distinct casting number, date and operator code that can be applied to each safety critical diecasting. If required, the company can also archive the data to customer requirements.

Sarginsons is also further extending its technological advantage after being selected as low pressure diecasting Industrial Partner for Brunel University's Advanced Material Casting Centre (AMCC). This move will open up opportunities, allowing the company to continue spearheading innovation.

Sarginsons future

Sarginsons Managing Director, Anthony Evans (shown below) is confident of achieving the company's ambition to create a low pressure diecasting centre of excellence, built on the cornerstones of research, leadership and best practice.

"By establishing a strategic partnership with LPM Group and teaming up with UK universities, we are beginning to see low pressure casting using aluminium silicon, aluminium copper, hypereutectic and magnesium alloys emerging with potential manufacturing capabilities.

"These alloy innovations, coupled with the continual development of aluminium matrix composites and alternative overcasting techniques, are allowing Sarginsons to consider more complex aluminium solutions as we endeavour to exceed our customers' expectations."