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KS Aluminium-Technologie GmbH

High-class casting refines downsized engines

Downsizing is “in” – it has long been common practice to replace high-performance six-cylinder engines with smaller turbocharged four-cylinder models – without sacrificing either engine performance or driving fun. From a technical standpoint, however, this replacement-related performance compensation and continual optimization of the combustion process lead to higher demands being placed on the combustion engine. By refining the most modern casting processes and launching a new coating facility, KS Aluminium-Technologie GmbH (ATAG) fulfils the high demands placed on smaller, exceedingly durable cylinder blocks. Also playing a key role is the global operating range of the supplier, who can develop products at the German headquarters and produce and deliver them via worldwide locations.

KS ATAG is currently manufacturing several four-cylinder blocks for well-known international OEMs, whereby the global activities of the casting specialists have an especially large impact in this case. Thus there are already production orders for four-cylinder series for 2012 and 2013. Here the cylinder blocks are developed at the German headquarters of KS ATAG in Neckarsulm and subsequently manufactured at the Chinese subsidiary Kolbenschmidt Pierburg Shanghai Nonferrous Components Co. Ltd. (KPSNC) in Shanghai, China. All in all, the company offers all steel-formative casting procedures, i.e. low pressure die casting, high pressure die casting and gravity die casting. It also produces cylinder heads: 3.6 million items in 2010; even more are expected to be produced this year.

A license agreement concluded with Jaya Hind Industries Ltd. (based in Pune, India) in 2008 further emphasizes the company's international market presence. This joint venture comprises the development and production of cylinder heads, cylinder blocks, bedplates and other cast parts for national and international automotive manufacturers as well as other automotive suppliers. High-tech products that were originally developed at the headquarters in Neckarsulm are cast and rough-machined in India within the context of the internationalisation strategy. This not only has a favourable effect on manufacturing costs, but also brings advantages in the growing Indian automotive market. For example, the cylinder head, the cylinder block and the bedplate were developed in Europe and are currently being produced in India for the four-cylinder engine of a global OEM. Additional products are being planned according to this development and manufacturing scheme.

Casting techniques improve material properties

Concerning the materials, the main focus in the last several years has especially been on further refining and improving their properties. The modern casting techniques specially developed by KS ATAG for this purpose generally have the advantage that they reduce oxides and porosity and are therefore well-suited for the construction of coatable cylinder blocks. For example, they include special techniques such as cylinder deck-sided gating or lateral gating in low-pressure die casting. By intensively cooling casting tools during the solidification process, the bearing bulkhead area can be cooled especially quickly, giving rise to a fine microstructure with low dendrite arm spacing. Using intelligent cooling systems, one can meanwhile also achieve local durability improvements at individually determined places located on the component part.

As regards the commonly used high pressure die casting, its short cycle times make it ideally suited for cost-effective mass production, but it often does not deliver the necessary component quality to meet today's continually increasing demands. Conventional high pressure die cast cylinder blocks made from aluminium moreover exhibit a comparatively high degree of porosity, which does not allow a solution annealing and the application of a cylinder liner bore surface coating. By contrast, ever more sophisticated high pressure die casting processes and new production procedures become necessary in order to achieve the required static and dynamic durability. In order to find a solution to this issue, KS ATAG employs techniques such as optimally degassed melting, a strongly evacuated die as well as the use of residual-free plunger lubrication in the filling chamber. Additional improvements bring innovations like an optimized high-pressure mould spraying technique combined with a wax-free spraying agent, a new casting tool coating as well as the uniformly intensive cooling of the casting mould. The basic requirement for achieving and improving high durability is a low degree of porosity. This makes cylinder liner coating possible – even in the case of high pressure die casting.

New cylinder bore surface coating facility goes into operation

In order to comply with the requirements of modern downsized cylinder blocks, it is technically crucial to create tribologically outstanding conditions. Here, internal frictional measurements show a significant advantage of iron-coated cylinder liner bore surfaces as compared to aluminum bore surfaces. KS Aluminium-Technologie therefore also relies on a coating process with mechanical roughening. A professional coating facility for coating the cylinder liner bore surfaces of aluminum engine blocks will furthermore go into operation in the manufacturing plant at the Neckarsulm headquarters in the second half of 2011. The spray-on coat is here processed into a tribologically suitable piston bearing surface by means of a honing procedure individually adapted to the cylinder crank case and its coat, whereby KS ATAG can utilize its many years of honing development competency to best advantage. The first coated prototypes are currently undergoing engine trials at a large OEM. Series production is expected to start in 2014.