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The Benefits of High Carbon Brake Disc Materials

Precision Disc Castings has pioneered the development of high carbon materials for brake disc application. The results bring substantial benefits to both producer and end user. As well as being cost effective, high carbon brake discs have superior casting and machining properties and help prevent brake judder as well as vehicle noise.

The generally held belief that satisfactory levels of brake disc performance, and component integrity, can only be achieved by employing high strength grey cast iron materials is rapidly changing.

High carbon disc materials have been used, very successfully in high performance racing environments since the late nineteen seventies. However, it is only in the last few years that the experiences gained from such applications have been transferred to the luxury high performance end of the automotive market.

A recent survey commissioned by Precision Disc Castings revealed that 30% of the cast iron brake discs found on European vehicles were manufactured in high carbon materials. Only 10% were found to be low carbon materials. Until recently very few, if any, high volume production discs were manufactured in high carbon cast iron. It is clear that high carbon low strength materials are becoming more acceptable for general automotive brakeing applications.

What is a high carbon material?

It is generally accepted that in order to be classified as a high carbon iron, the carbon content of the material has to fall within the range 3.6 - 3.9%. The use of such materials can provide manufacturers, both the foundry and the machinist, as well as the end user, the customer, with some distinct benefits.

Brake discs produced in high carbon cast irons have optimal thermal conductivity, this is achieved by optimising both carbon and silicon content. Casting performance is excellent, with good structural integrity and minimal variation in important features such as microstructure and hardness. As a result of their good thermal conductivity, high carbon discs have inherently good resistance to both distortion and thermal cracking, both significant performance related issues.

In spite of their high carbon content, the hardness levels of these materials are not much lower than those of the more traditionally used low - medium carbon irons. Consequently, if attention is paid to the selection of brake pad materials, wear performance is rarely an issue. The machinability of cast iron, especially at the rates necessary to machine brake discs economically, is dependent on both

the carbon content and the amount of alloy additions. Increasing carbon content has no detrimental effect on either machinability or surface finish, and indeed the machining of such materials in high volumes is common practice. The need to resort to alloy additions to improve thermal performance is rarely required, except in extreme circumstances. However, even when alloys are specified, the machinability of high carbon irons is still excellent.

High carbon iron discs also help to tackle performance related issues such as brake judder and vehicle noise. Due to the improved heat dissipation of the high carbon iron, the brake disc will suffer from less distortion thus reducing hot judder. In addition high carbon discs also reduce vehicle noise due to their increased damping capacity.

The use of high carbon, high performance irons has in the past been mainly limited to high performance vehicle applications. This is now changing. It can be very strongly argued that these materials present the automotive industry with a significant material development. If coupled with innovative brake disc designs, such a development will see the continued use of grey cast iron as the safest and most cost effective material for brake disc applications for many years to come.

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