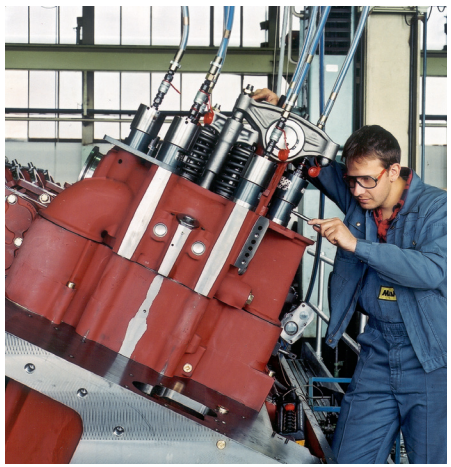
FAQ's (continued)

What is the REParts™ solution for welded cylinder heads?

As an alternative, the REParts™ program offers new or used cylinder heads at a competitive price level. Please contact your local MaK Dealer Representative who will be able to assist you.

Does Caterpillar Motoren offer any warranty on welded cylinder heads?

Due to the risks and complexities associated with such processes, Caterpillar Motoren does not recommend cylinder head welding and therefore will not guarantee reliability for any subsequent damage which arises as a result of this process.



MaK Repair Intelligence

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MaK

Cylinder Head Welding

MaK Repair Intelligence

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Introduction

Cylinder heads for four stroke engines are by nature a complex design. The passages for the inlet air, exhaust gas, and fuel injection are incorporated as are the cooling water passages. These are normally manufactured from spheroidal graphite or nodular cast iron. Although not as strong as cast steel it is easier to cast and maintain reasonable strength under load. Of all the common metals, cast iron is probably the most difficult to repair when it fractures. However it is ideal for engine cylinder blocks and heads because it is stable and relatively inexpensive.

Damage to cylinder heads may occur due to poor cooling which can cause thermal fatigue. Insufficient cooling can be the result of scale build up within the cooling spaces, due to inadequate water treatment. Cracks can form between the valve pockets and/or cooling water spaces. For cylinder heads damaged in this way, third parties offer welding as a repair solution. Use of this repair option requires approval from the relevant classification society for the procedure as well as for the cylinder head.

Certain crack repairs can be made cold (pinning) or hot (welding) and the method used will depend on the size of the component, as well as the length and position of the crack. In the end, the cost of repairing a cracked casting must be weighed against the cost of replacing it. Caterpillar Motoren does not recommend welding as a repair option for cylinder heads, due to the high mechanical stress of the areas and the risk of subsequent failure. Caterpillar Motoren provides an exchange solution through the REParts™ program.

What is the risk behind this procedure?

- Heat treating a cylinder head may cause thermal stress in the metal which could lead to subsequent micro cracking or severe residual or local stress if the metal cools too quickly.
- Porosity and other imperfections in the weld repair can be caused by surface contamination.
- On some castings the surface may contain excessive oxidation which can be trapped in the weld.
- The different materials used during the welding process can lead to significantly reduced strength throughout the welded area.
- For example: In the heat affected-zone hardening caused by martensite formation was found (Fig. 1b). This significantly reduces the ductility of the cylinder head and can possibly create further cracks. (see figures below)
- The different materials used during the welding process lead to uneven bonding, resulting in significantly lower strength throughout the welded area. Therefore, repair to valve seat areas (Fig. 1 c) by welding is not recommended.

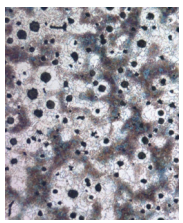

Fig. 1 a
Cast iron cylinder head material structure.

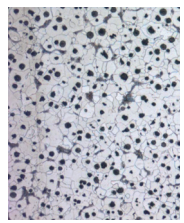

Fig. 1 b
Welded cylinder head.

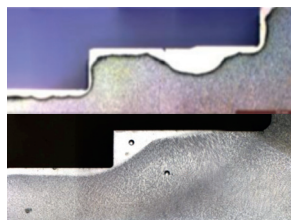

Fig. 1 c
Valve seat pockets.

Frequently Asked Questions

Can any crack or damage be repaired on cylinder heads using welding?

No, there are very few exceptions, such as the surface of the cylinder head is corroded. This means that the cylinder head material has many impurities. Therefore, the new cast iron material that is added may not bond to the original material. A second problem may be that the cylinder head is beyond the machining limits. This means that the cylinder head has been reworked too many times and the valve seat area has insufficient wall thickness.

What are the benefits of cylinder head welding to the owner?

The major benefit is usually lower costs compared to the exchange for a new cylinder head. However, there is a significant risk at the end of the process that the OEM tolerances are not achievable and/or laboratory examination shows that the material properties are out of specification.

What are the main difficulties with the process of welding cylinder heads?

Welding, as a repair to a casting, does not work well on components that experience cyclical temperature changes. As the temperature changes cause expansion and contraction of the metal which may cause the welded area to tear and the crack to reopen. Depending on what type of welding process is used the amount of experience required by the operator may vary significantly.

FAQ's continuing next page →