

## Issue No.: 3/2010 – Clear the Ring for the Replacement of Valve Seat Inserts

VALVE SEAT INSERTS ARE THE WEARING PRODUCTS IN ENGINE REPAIR. HERE A COUPLE OF TIPS – FROM THE PRACTICE FOR THE PRACTICE. They look just like any ring. But they can do a lot more. And that's what they need to do. They have to perform a very special task in the engine under accordingly high loads. Together with the valves, they must seal the combustion chamber. They have to prevent impacting of valves into the cylinder head. And they must absorb the combustion heat and transfer it to the cylinder head. Due to the different material properties of aluminium and steel alloys, valve seat inserts are indispensable for aluminium cylinder heads in order to assure sufficient sealing of the combustion chambers.

### REPLACEMENT: USING BRUTE FORCE – AND A GENTLER ALTERNATIVE

Before the new valve seat inserts can be fitted, the old inserts have to be removed. The method of welding an old valve to the worn valve seat inserts and then to knock the insert from its seat in the cylinder head with a hammer appears rather brutish – often causing unforeseeable consequential damage to the cylinder head. The gentler version: removing of the worn insert from its seat by milling (Figures 1 and 2), while the cutter head

is centered by the valve guide. Afterwards, the seat of the insert can be finished to the appropriate oversize of the new valve seat insert if necessary (Figure 3). After machining, the cylinder head is cleaned from chips in the washer.



Figure 3: The milling head for machining the seat of the valve seat insert.

### THE FITTING PROCESS – A HOT AND COLD AFFAIR

There exist several methods for fitting valve seat inserts to the cylinder head. The valve seat insert is pressed into its seat in the cylinder head at room temperature. A valve seat insert remains at room temperature and is pressed into a preheated cylinder head. The insert is cooled in liquid nitrogen (Figure 4) and is then pressed into the cylinder head which remains at room temperature. The cylinder head is heated and the valve seat insert is cooled down – the optimum joining method using almost no force.



Figure 1: Removing the valve seat insert by milling.



Figure 2: After milling a remainder of the insert can be seen.



Figure 4: The valve seat inserts are cooled down in liquid nitrogen to facilitate fitting.

## THE OVERLAP – AN IMPORTANT DETAIL IN THE REPAIR PROCESS

In order to fix the valve seat insert into the cylinder head, the correct overlap must exist between the valve seat insert and its seat in the cylinder head. If this overlap is too large, the strong deformation of the aluminium due to the pressing-in of the valve seat insert can lead to plastic deformations in the cylinder head – with the possible consequence of insufficient fixation of the insert. In addition, an excessive overlap can lead to stress cracks especially in the narrow area between the valve seat inserts (Figure 5). When the overlap is too small, there is a risk that the valve seat inserts fall out of the seat during operation.



Figure 5: The cracked partition – result of excessive overlap.

## THE FINAL STAGE: THE MACHINING PROCESS

After fitting, the inserts need to be machined. This is because the contact surface with the valve has to match exactly the angle of the valve (Figure 6). After the final machining process, the cylinder head needs to be cleaned carefully again – to prevent chips from getting into the engine during assembly afterwards.



Figure 6: The optimum fitting result with replaced valve seat insert.

## MAHLE ORIGINAL AND PERFECT CIRCLE VALVE SEAT INSERTS – A GOOD CHOICE

MAHLE Original and Perfect Circle offer you a wide range of high-quality valve seat inserts for many applications. You can find detailed information in the current catalogue “Valve train components”.