Valves are a classic example for workshop turnover due to neglected maintenance. This is because the reasons for valve damages are – apart from normal wear – in many cases old, torn timing belts, broken chains or belated oil changes. Another frequent reason for valve damage: driving errors such as inadvertent changing to a lower gear at high engine speeds – with the result of bent or even broken valves. And not to be ignored are the cases when valve damage occurs shortly after valve replacement – due to a (preventable) fitting error.
Valves must provide a perfect seal

Valves seal the combustion chamber and take care of optimal charge exchange. As they are constantly in motion – and this under difficult tribological conditions and under the effect of aggressive gases or exhaust gases – they are subject to natural wear. This can be accelerated due to extreme conditions such as mechanical or thermal overloads. Valves must therefore generally be replaced when any sign of damage is noticeable.

Why is it dangerous to recycle valves?

It is risky to “recondition” old valves. Often it is not possible to recognise the extent of valve damage with the unaided eye. The material of the valve may have been subjected to thermal overloads – or mechanical overloads have caused incipient cracks in the component. It is also often difficult to assess whether the seat facing and the hardened areas are strong enough for reworking (and whether the wear is then still permissible) or if the seat angle can really be ground correctly. This reconditioning makes no economical sense anyway – and any respectable workshop should not take the serious risk of engine damage due to old valves.

Disassembly – the right tool is important

In order to prevent irreparable damage to the cylinder head, the valve springs must be cushioned during dismantling – for instance, by using a valve spring compressor or valve spring tensioning device (fig. 1). The valve collets are best removed with a magnet rod.

Tip: to avoid fitting the wrong parts it is recommended to compare the disassembled valves with the new ones before disposal – with respect to stem diameter, overall length, valve head diameter and seat angle.

Assembly: also check valve guides and seat inserts!

The conditions of the valve guides and valve seat inserts should be checked before the new valves are fitted. If heavy wear marks are present, they either have to be reworked or must be replaced. The new valve is then inserted from below through the valve guide.

Replacement of valve guides, reaming of the bores

Is the slack between the valve shaft and valve guide too large? In that case, the valve guides have to be replaced together with the valves. After pressing or shrinking in the new valve guides it is recommended to ream the bores. Only this assures that they have the right diameter, are cylindrical and burr-free – and can provide good performance together with the new valves. Reaming is a highly accurate and fine finishing method that should only be carried out by hand – with the aid of cutting oil for lubrication (fig. 2).

Worn valve seat insert?

In that case, it should be reworked or replaced with a new valve seat insert. Guide and sealing surfaces of the valve seat insert must be perfectly aligned – only then can the new valve provide a good seal.

Seal and recess

After the new valve has been inserted, the correct valve recess must be checked. In the next step, the valve stem seals should be fitted with the aid of the assembly sleeve. (The assembly sleeve is provided by most seal manufacturers together with the valve stem seal and prevents damage to the very sensitive sealing lip of the seal.)

Valve spring not straight?

To continue the assembly, make sure that the valve spring is positioned correctly in the cylinder head. There is a risk that the valve springs are fitted at an angle due to the design of some engines. During start-up of the engine afterwards, the spring can move with one side onto the block. The resulting large bending moment on the valve spring retainer can lead to tear-off or breaking of the valve – with the result of engine damage (fig. 3).

New valves – new collets

A valve collet seats itself to the valve during operation. Old valve collets do therefore not fit exactly on new valves. Especially, when valve collets of individual valves are re-fitted randomly, there is a risk of uneven loads, bending stress, pressure peaks and therefore of broken valves in the groove area (fig. 4). In short: new valve collets protect from engine damage. To facilitate the work process in workshops and to assure even safer repairs, we are adding valve collets to our programme. MAHLE Original and Perfect Circle valves are then available with the matching collets.

Free to rotate

Valves with multiple grooves need to be able to rotate in their collets. The rotation of the valves during engine operation supports the seal and heat dissipation, reduces wear at the valve base and prevents build-up at the sealing surface. It should therefore be checked that the valves can rotate – a valve that cannot rotate can impact permanently into the cylinder head.

Are the valves really gas tight?

A vacuum test provides certainty. Alternatively, the seal of the valve can be checked using a liquid of low viscosity (e.g. petrol or brake cleaner). This is done by turning the cylinder head facing upward and then pouring the liquid onto the valve heads. If the liquid drips off, the valves are not sealing correctly (fig. 5).

Valves – supplied already ground

Today it is no longer necessary to grind-in the valves as was usual in the past. The sealing surfaces of the valves are produced with high precision by MAHLE – and thanks to accurate, pre-set tools, the valve seats are machined precisely to provide perfect seals with the valves.

Hydraulic valve clearance adjustment? Please wait!

If hydraulic valve lifters are used for valve actuation, it is recommended to leave the engine for 12 hours after assembly before it is started again. This time is necessary to allow any excess oil to drain from the hydraulic valve lifters. Alternatively, the hydraulic valve lifters can be emptied before fitting.

Full programme – as a set and solo

The MAHLE Original and Perfect Circle valve programme comprises numerous passenger car and commercial vehicle applications in different materials and designs according to the demands of the original equipment market. All valve types are also available individually – which provides a good basis for customer and demand oriented repairs.