Types and technical terms

Mono-metallic valves

are produced efficiently in a hot-extrusion process or stamping process.

Bi-metallic valves

make it possible to use the ideal combination of materials both for the stem and the head.

Hollow valves

on the one hand serve to reduce weight, and on the other hand to reduce the temperature. Filled with sodium (melting point 97.5°C), the shaker effect of the liquid sodium means that heat can travel from the valve head to the valve stem, and a temperature reduction of between 80°C and 150°C can be achieved.

Materials

S = Highly alloyed CrSi steel for intake valves that are subjected to high stress and exhaust valves that are not subjected to much stress; also used for stems of bi-metallic valves.

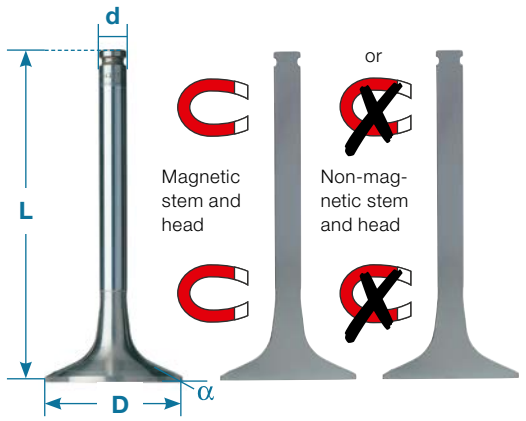
X = CrMoV steel with outstanding wear resistance and sliding attribute for intake valves with higher stress.

T = Austenitic CrMnNi steel with added nitrogen for intake and exhaust valves that are subjected to the highest mechanical and thermal stresses in petrol and diesel engines. Also used as material for the heads of bi-metallic valves.

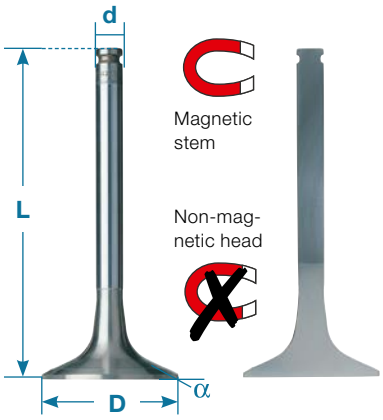
PT = Austenitic CrMnNiNb steel with excellent heat and wear resistance. Standard valve for trucks with and without strengthened seat. Also used for turbodiesel passenger cars.

I = Nickel superalloy (Nimonic 80A©) for exhaust valves subjected to the highest stress.

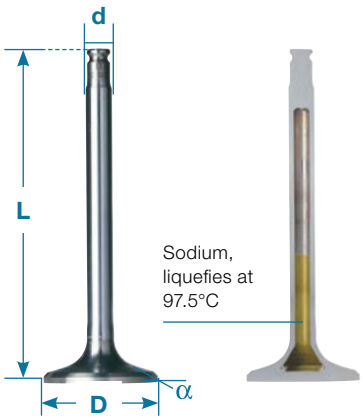
Mono-metallic valve



Bi-metallic valve

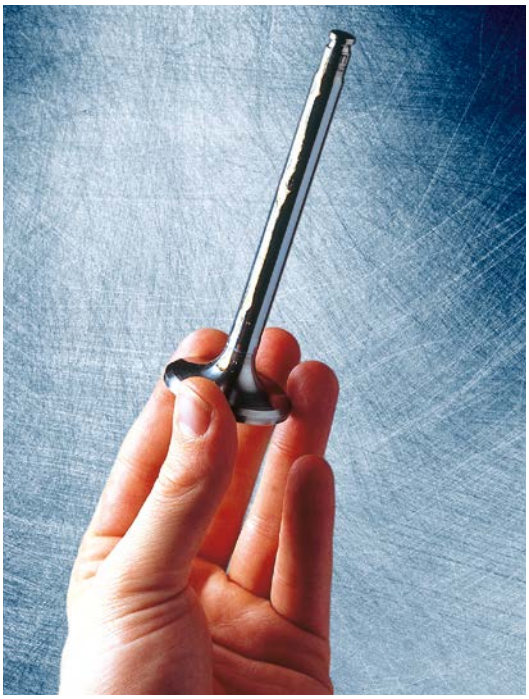


Sodium-filled hollow valve



Fitting recommendations

Valves are some of the components in the engine that are subjected to the greatest thermal and mechanical stresses. Their service life—and thus the service life of the engine—is strongly dependent on their correct installation.



MAHLE Original valves are supplied ready for installation and are individually packed.

Check the valves before installation to see if they have been damaged (e.g. if they have been knocked). Never install damaged or bent valves. Make sure that the valves are the right size for your engine.

MAHLE Original valves are only to be used in the application for which they were designed; under no circumstances may they be mechanically processed or altered.

Guide values for the valve clearance

Valve stem diameter	Intake valve	Exhaust valve
6–7 mm	10–40 µm	25–55 µm
8–9 mm	20–50 µm	35–65 µm
10–12 mm	40–70 µm	55–85 µm

Before installing the valve, check the inner cone of the valve spring head to see if it is worn or damaged. Check whether the valve spring power is still within the values prescribed by the engine manufacturer.

Always use new valve collets and valve stem seals when installing the valve.

The valve stem must be lubricated sufficiently with clean engine oil before it is inserted.

Information and installation guidelines from the engine manufacturer must be observed in all cases.

Technical terms

The valve guides centre the valves on the valve seat inserts—and compensate for the lateral forces acting on the valve stems. They are also relevant for the heat removal from the valve head via the valve stem to the cylinder head. Generally, a distinction is made between dedicated intake and exhaust valve guides and valve guides that are used for both the intake and exhaust side.

Materials

Valve guides are made from grey cast iron, brass, and sintered materials. The sliding, thermal, and wear characteristics are optimised by using special alloying components. The following materials are used:

B = CuZnAl alloy with good wear resistance as well as good fatigue and corrosion resistance. For applications with medium loads.

B1 = CuSn alloy with the addition of phosphorus for increased wear resistance. Suitable for applications with high loads.

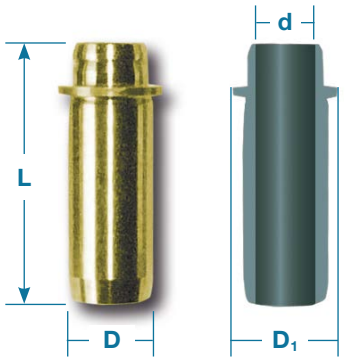
G1 = Grey cast iron alloy with perlitic microstructure and good wear resistance. For applications with normal loads.

G2 = Grey cast iron alloy with perlitic microstructure and increased phosphorus content. The reticular distribution in the material structure results in higher wear resistance and improved operation under marginal lubrication. Suitable for applications with high loads.

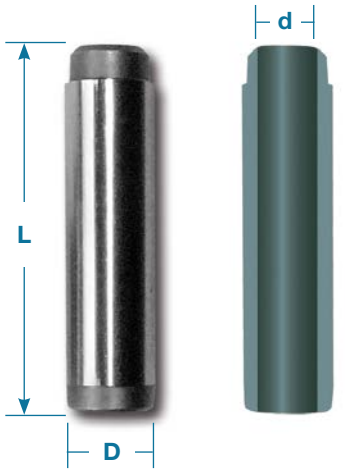
CN = CuNi alloy with increased hardness and thermal conductivity as well as wear and abrasion resistance. For high strength even in heavy-duty applications.

SM = Sintered metal alloy with high mechanical stability, which is even maintained at extremely high temperatures. Developed for high-performance engines.

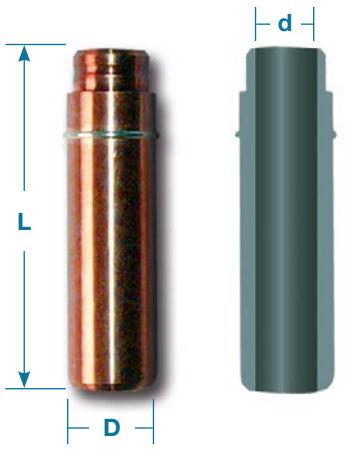
Valve guide made from non-ferrous metal



Valve guide made from grey cast iron



Valve guide made from copper



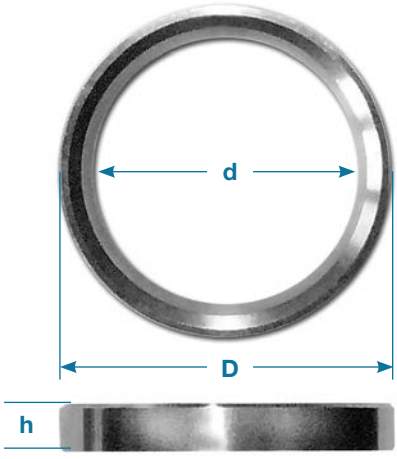
Technical terms

Valve seat inserts

In aluminium cylinder heads, the continuing performance of the complete valve train system is a central function of valve seat inserts. Along with the valves, the main function is to seal the combustion chamber and divert the arising heat to the cylinder head. As the material properties of the aluminium cylinder head and its alloys are not adequate for the function of a valve seat, the highly stressed valve seat inserts prevent the regression of the valves into the soft cylinder head material.

Valve seat inserts are precisely scaled to their load, material, and machinability to make them suitable for their function.

Valve seat insert



Main dimensions of a valve seat insert
D = Outer diameter
d = Inner diameter
h = Height

Materials

To meet the requirements of modern engines, MAHLE provides durable sintered metals along with different grey cast iron and cast steels.

ST = Cobalt-based material with high chromium and tungsten content. Valve seat inserts made of these extremely wear- and corrosion-resistant alloys are mostly used in engines powered by alternative energies, such as natural gas (CNG), biogas, and landfill gas.

GG1 = Good machinable gray cast iron alloys with a high carbon content. These stand out because of their high resistance and compressive strength, and are used in the intake area of petrol, turbo, and diesel engines.

SG1 = High-temperature cast steel with high chrome content (> 10%) and molybdenum. Along with their high resistance to heat, these valve seat inserts are characterised by their strong resistance to creep and outstanding resistance to corrosion. They are used in diesel and petrol engines.

SG2 = High-performance cast steel with very high chrome content (> 30%), which—together with molybdenum—is extremely resistant to corrosion and heat, and is mainly used in diesel and petrol engines.

SG3 = Highly alloyed cast steel material with high molybdenum and vanadium content, which is used for highly wear-resistant valve seat inserts in supercharged diesel and petrol engines, and also in combination with alternative energies such as natural gas (CNG) and liquefied petroleum gas (LPG).

SM1 = Extremely high-quality and high-performance sintered material for intake and exhaust valve seat inserts with outstanding resistance to wear. Developed for high-performance naturally aspirated and turbocharged engines using petrol, diesel, and gas.

Fitting recommendations

MAHLE valve seat inserts are pre-finished, i.e. finish machining of the seat is not necessary.

To fit the valve seat insert in the cylinder head, the correct interference fit should be observed between the valve seat insert and the cylinder head. If the seat insert is too tight, the additional pressure on the valve seat insert can cause deformation of the aluminium cylinder head. Stress fractures can also occur in the webs between the valve seat inserts.

The table below provides information on the correct measurement for the location hole in the cylinder head.

Guide values for the location hole

Outer diameter of seat insert	Cast iron cylinder head	Aluminium cylinder head
20–30 mm	0.050–0.090 mm	0.040–0.080 mm
30–40 mm	0.060–0.100 mm	0.050–0.090 mm
40–50 mm	0.070–0.110 mm	0.060–0.100 mm
50–60 mm	0.080–0.120 mm	0.070–0.110 mm
60–70 mm	0.900–0.130 mm	0.080–0.120 mm

After oiling the location hole, MAHLE valve seat inserts made of sintered metal are pressed with pressure-stable oil (transmission oil) at room temperature into the cylinder head, allowing for the correct interference fit.

The following methods can be used for installing the cast valve seat inserts:

- The valve seat insert is pressed into the location hole of the cylinder head at room temperature.
- A room-temperature valve seat insert is pressed into the pre-heated cylinder head.
- The insert is cooled in liquid nitrogen and then inserted into the room-temperature cylinder head.
- The cylinder head is heated and the valve seat insert is cooled—this is the optimum method for a virtually force-free assembly.

