CPMill ball track milling cutters
Easy handling and high precision
The new generation of MAPAL replaceable milling cutters for the machining of constant-velocity joints sets new standards. In intensive dialogue with the users, important features were redesigned or decisively further developed. The results are: Easy handling, high precision and excellent cost-effectiveness.

CPMill - Complete Performance Milling
Advantages of CPMill ball track milling cutters

- Easy handling for quick milling head changing
- Precision connection for perfect radial run-out
- High rigidity and stability for optimum power transmission
- Helically arranged blades for more performance
- Suitable PCBN grades for reduced cutting material costs

Handling

The new CFS (Complete Fitting System) connection ensures quick and easy changing of the milling heads and high repetition accuracy. Releasing and clamping is performed from the front so that the tool holder can remain on the machine. The proverbial MAPAL precision thereby guarantees that the radial run-out at the blades always remains < 3 µm even after tool changing. All the blades of the tool head are thus uniformly in contact with the workpiece. Together with the high stability of the connection, this is a precondition for the best possible performance and service life of the tools, and for a perfect geometry of the ball tracks in the workpiece.

Cost-effectiveness

The helically arranged blades allow an innovative milling concept to be employed additional to the increased performance thanks to the new connection. Particularly when milling, this cutting edge geometry ensures a smooth start of cutting and hence a quiet milling process. That results in significantly less wear on the blades compared with the straight blade arrangement. When using the CPMill ball track milling cutters, this results in a further increase in the tool life and an improved ball track geometry. A further positive effect of the helical blade arrangement is that higher feed rates can be used. The resulting shorter cycle times increase the productivity of the machine. Further savings are offered by the tool logistics. Since the milling heads are disposable heads, regrinding and the associated costs are eliminated.

Tool life

The right cutting material makes a major contribution to cost-effectiveness. MAPAL has vast experience in the use of PCBN (polycrystalline cubic boron nitride) as cutting material for hard machining. The most suitable grade can be selected from a wide variety of available materials. The cutting material can be fully utilised, as the disposable heads do not have to be reconditioned. Furthermore, a new, specially developed and very high-performance grade is available for the CPMill milling programme. Alongside connection and blade arrangement, the right PCBN and the careful processing of the cutting edge are thus the third success factor for the new CPMill ball track milling cutters.
CFS – Complete Fitting System
A perfect precision connection

The exact interplay of taper and face contact ensures maximum stability and rigidity.

Radial run-out less than 3 µm.

Releasing and damping is performed from the front so that the tool holder can remain on the machine.
The objective in the development of the new connection was to make the handling of the tipped tools as simple as possible. At the same time, maximum stability and rigidity were to be achieved, together with very high accuracy at tool changing.

Precise design

The most important elements of the new connection are the taper and face contact. The exact interplay of these elements ensures maximum stability and rigidity. Taper and face contact are complemented by a threaded journal directly adjoining the taper and connected to the taper in one piece. These three characteristics coordinated perfectly with one another ensure the highest changeover accuracy, high clamping force and very simple handling at the new connection. The positive interplay of face contact and taper has been known since the introduction of the HSK and HFS (Head Fitting System) by MAPAL, but only if these are manufactured with the highest precision. That means the concentricity has to be 100%. The direct connection of the clamping thread has no impact on the radial run-out of the system as long as it runs with the same absolute precision as the other elements.

Absolute quality

Modern production facilities allow face contact and taper to be manufactured with the highest accuracy, and hence to reliably achieve a radial run-out of better than 3 µm. The high stability of the system results from the pretension of the taper. When clamping completely, the taper expands slightly in the holder and the face connection has a perfect contact. Trials have also shown that the production of the thread as a flat thread also contributes to a high radial run-out precision.

Perfect fit

This new CFS connection perfectly meets the high demands of hard milling. The exact balancing of taper and face contact in the tool and in the holder guarantees maximum stability, and at the same time has a damping effect that ensures long tool lives of the tools. The use of carbide for the production of the holder also helps to reduce vibrations. The holders thus consist of a steel tool body and a shrink-fitted sold carbide shank with the new CFS connection.
Special PCBN grades for hard milling

Comparison of tool life - The helical form surpasses axially parallel blades

Process-reliable form and dimensional accuracy of the part

TOOL LIFE

Blades axially parallel

NEW Blades in helical form

+30%

Special PCBN grades for hard milling
The main challenge during ball track milling is to reliably achieve the demanded track clearance, fit and contact angle allowing for the adjustment angle. The tolerances here lie in the µ-range. In order to be able to meet these high geometric demands, ball track milling cutters have been made to date only with axially parallel soldered blades. MAPAL CPMill ball track milling cutters are now available in the new generation also with inclined (helically installed) blades. With specially developed 3D methods for the design, the latest production facilities and optimised measuring programmes, MAPAL can produce these replaceable heads also with the proven high accuracy. For the machining result that means higher milling quality, and at the same time improved cost-effectiveness.

Soft cutting

During the milling of ball tracks, the complete geometry of the tool is imaged in the workpiece. If vibrations occur during machining, these lead to deviations from the track form and to micro-structure cracking at the blades. The helically arranged blades of the new CPMill ball track milling cutters contact the workpiece with a soft cut. Vibrations are practically eliminated compared with axially parallel blades. The result is smoother running of the tool, and hence a better track form and surface quality. The smoother running also prevents microstructure cracking at the blades. The blade thus remains sharp for longer, and the tool life increases by up to 30% compared with tools with axially parallel blades.

Optimum cutting material

Of crucial importance for the tool life is the cutting material. In this respect, the MAPAL CPMill ball track milling cutters bring important further developments to the market. New PCBN grades optimised and developed specially for hard milling allow the machining costs to be further reduced. Particularly important for the choice of the grade is a detailed analysis of the material to be machined. MAPAL offers know-how and engineering for complete support – from the choice of the right PCBN grade through the optimisation of the existing production process right up to Tool Management.

Soft milling

MAPAL manufactures solid carbide milling heads from the CPMill Series also for soft milling, and thus offers a complete system for the machining of constant-velocity joints.
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