

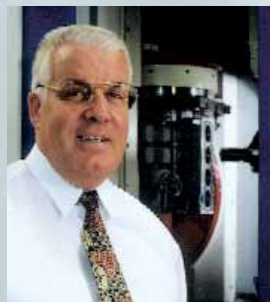
MAPAL Competence – Reaming and Fine Boring



... innovation guaranteed



Competence in Reaming and Fine Boring



To survive long-term as a reliable partner in today's industrial world, it is particularly important to expand and possess significant fields of competence with innovative products and customer services, with substantial product and technical knowledge. Only then can the customer and his business partners be certain in the long term to have come to the right place – in worldwide terms – for his increasingly complicated tasks in modern production processes. MAPAL has built up a whole range of such fields of competence, in dialogue with and for the use of their customers. As a initial and important member of our "competence teams", we should like to introduce you to the subject of reaming and fine boring with this brochure.

Dr. Dieter Kress
Managing Director



Index

Competence, reliability and quality:
Achieving the best boring results with MAPAL

4



Introduction

Successful tool solutions:
Optimum tool concepts for every material
Programme review
Product index

12

18

21



Tool solutions

The MAPAL Principle:
Tried and tested originals – diverse and standard

22



MAPAL Single-
bladed tools

The MAPAL Twin-bladed cutting tool:
Higher performance with two blades

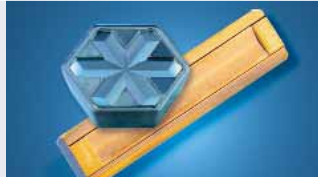
54



MAPAL Twin-
bladed tools

The MAPAL precision indexable blades:
Cutting leads, cutting materials, application areas

74



MAPAL
Indexable blades

The MAPAL High Performance Reamers:
New opportunities with multi-bladed tools

80



MAPAL HPR

Examples from practice – for use in practice

124



Competence
in practice



engineering



technology

products



service

Engineering

From production planning to production optimisation, a variety of service modules are available under the title CTS® – Complete Tooling Services. Competent technical advice from the first enquiry to the production process in operation is seen by MAPAL as a natural duty. Experience, specialist tool experts work out the best possible process for your part. Once the tools are delivered, MAPAL offers any support needed for commissioning and handling the tools.

Worldwide

The best product, the optimum tool and specific, rapid service are worth nothing if they are not offered or made constantly available where the customer actually needs them day to day. It is for this reason that for many years MAPAL has observed the motto "Wherever the customer is, you will find MAPAL". Following the principle of this company policy, more than 20 MAPAL sister manufacturing companies and service stations have been established worldwide and are available to customers in all the major industrial locations of the world, fully functional in daily operation with all MAPAL products and new customer services.

Technology

MAPAL actively grasps new and current production concepts, develops these to specific targets, tries them out in a comprehensive test phase and translates them into customer-orientated solutions. In close dialogue with the customer and starting with an example, the most suitable design for him is worked out and then continuously developed.

Products

The innovative tool designs from the MAPAL production line cover the whole area of precision machining. Precision machining tools, such as reaming, fine boring tools, gun boring tools, special tools with ISO elements, generating slide tools, plus PCD gun boring tools and circular milling tools, cutter heads and milling tools with tangential blades, together with the whole programme for the high precision HSK Clamping System – from the standard tool to the specific solution MAPAL offers the perfect product for your machining task.



Single-bladed Reamer



Twin-bladed Reamer



HPR Replaceable Reamer Head



MAPAL Competence – completed by the diversity of its products and technology

Today reaming and fine boring are the most widely used methods for precision machining bores. This produces highly economic machining results of the highest precision over the whole range of materials with reaming and fine boring tools with guide pads and with fixed multi-bladed reaming tools.

MAPAL tools with indexable blades and guide pads – constantly developed and often trendsetters – are in use throughout the world today in a wide variety of designs. According to the machining task, these tools allow bore geometry and surface finishes which frequently make it possible to save on additional machining operations which were previously needed, such as grinding or honing.

MAPAL WP Single-bladed Tools

The MAPAL Single-bladed reamers are designed to MAPAL's long-established principle. The cutting of the material and the guiding of the reamer in the bore is performed by the blades by means of precision grinding and guide pads located at the best geometric positions. The WP system is characterised by special cutting leads and exact adjustment in the diameter and also back tapering. The perfectly aligned adjustment and clamping system for the blade guarantees optimum, play-free seating for the blade and, as a result, long tool life.



MAPAL HX Single-Bladed Tools

Designed under the same principle as the WP single-bladed reamers, HX blades, with their six cutting edges, offer significant advantages for machining cast iron and steel. The HX cutting geometry is specially laid out for optimum chip flow and short chips. In standard series, as NC reamers and for special tools, the economic advantages of the HX blades are particularly applicable.

One important development of the single blade principle is the addition to the system of a further blade to make the MAPAL twin-bladed tool. The special arrangement of the two blades provides a micro-cutting function with which excellent surface finishes and outstanding tool life are achieved.

MAPAL WP Twin-Bladed Tools

The special performance features of the WP twin-bladed tools result from the position of the two blades in relation to one another. Because of the radial and axial offset, the follow-on blade only machines to a very small chip thickness. This produces noticeable increases in performance which is not only doubled but can be up to five times higher.

MAPAL HX Twin-Bladed Tools

The combination of the HX system with the special features of micro cutting opens up completely new opportunities for machining. By using the super cutting materials, PCBN and PCD for hard machining and for cutting cast materials, surface finishes and economic results are achieved which would have been unthinkable a short time ago. Honing and grinding qualities are even achieved using this economically superior method and make these operations superfluous.

MAPAL Multi-Bladed Tools

In addition to MAPAL tools with indexable blades, interesting new developments have also led to fixed multi-bladed reamers. With the new HFS® Head Fitting System, the MAPAL HPR High Performance Reamers achieve concentricity and changeover accuracy to micro-precision and as a result meet the requirements for new dimensions in modern high performance cutting operations. Simple construction, direct coolant supply onto the blade, and their consequent suitability for use with minimal lubrication and the large selection of cutting materials, make these MAPAL HPR reamers unique.



MAPAL Competence – completed by the diversity of products and technology

MAPAL Special Tools

MAPAL tools are primarily used for large batch production. The use of specially adapted tools often brings the economic solution for this.

Because of the full programme of cutting systems the tool can be designed so that the optimum solution can be found and the best results achieved. Combinations of systems with modern cutting materials can also be good solutions for complex tasks.

MAPAL Cutting Edges and Cutting Materials

In addition to the right selection and design of the tool's construction, the decision for the right cutting material is also of great significance to the quality and economic results of a cutting operation. MAPAL offers a wide selection of cutting materials here. Specially developed chipforming and chipbreaking structures produce the best possible chip flow. In various carbides and in Cermets in uncoated versions and a number of types of PCBN and PCD, optimum geometries are formed for chip control.



MAPAL Clamping Systems

The consistent use of modern clamping systems by MAPAL for high precision and perfect connections and interfaces bring the concentricity and changeover accuracy required in modern production. Whether HSK or HFS®, both systems guarantee the necessary precision and rigidity by means of the design features of the taper and the contact surface. Simple, precise and fast – plus flexible, safe and economic – these are the requirements placed on systems in modern production technology. In conjunction with the long-established MAPAL reaming and fine boring tools, these requirements are met to a high degree and guarantee the user maximum productivity and measurable economic advantages.

MAPAL HSK Clamping System

With the constantly increasing spread of the hollow taper shank in all industries of modern production technology, MAPAL has developed a complete clamping system. The range of applications for MAPAL HSK clamping elements extends from special machines and transfer units to machining centres and modern turning centres; whether for large batch production or for use in small and medium-size companies. In addition to the HSK clamping elements, MAPAL also offers a wide range of extensions and reducers, together with adaptors and flange adaptors.

This allows the combination drawn from high precision and high performance MAPAL HSK clamping elements with precision reaming and fine boring tools from MAPAL to be adapted to any type of machine. Detailed information on MAPAL HSK clamping technology can be found in our separate special catalogue.



MAPAL HFS® Head Fitting System

The advantages of the HFS® Head Fitting System and the opportunities this provides for manufacturing, use and preparation of reaming heads are decisive to the success of these new tool series. Simple, easy access handling when changing tool heads, high flexibility with regard to special designs, a variety of cutting materials and diameters from 4 mm in the standard programme provide a large range of possible applications. As a result of the direct coolant supply onto the blade, the system is also extremely well suited for use with minimal or micro lubrication (MLC).



MAPAL Competence – Machining Aluminium

In the car industry aluminium has special significance as a material for numerous components because of its low weight. Most components that are initially formed by casting often require complex bores with several steps, chamfers and surfaces. Production is mainly carried out on machining centres.

The aim is therefore to carry out all the operations, which are located concentrically on the spindle axis with one tool. With aluminium machining this is increasingly leading to special tools being used. The MAPAL system with indexable blades offers particular advantages for these requirements. As a result of the individual arrangement

and location of the guide pads, maximum accuracy in production can be achieved for interrupted bores.

Guide pads in PCD, with carefully allocated coolant channels, allow MAPAL tools to be used on modern high-speed machines and also very successfully with minimal lubrication.



The high requirements for surface finish and tool life are achieved by PCD blades. By using appropriate technology it is also possible with this super hard cutting material to introduce geometry for chip forming on the cutting edge.

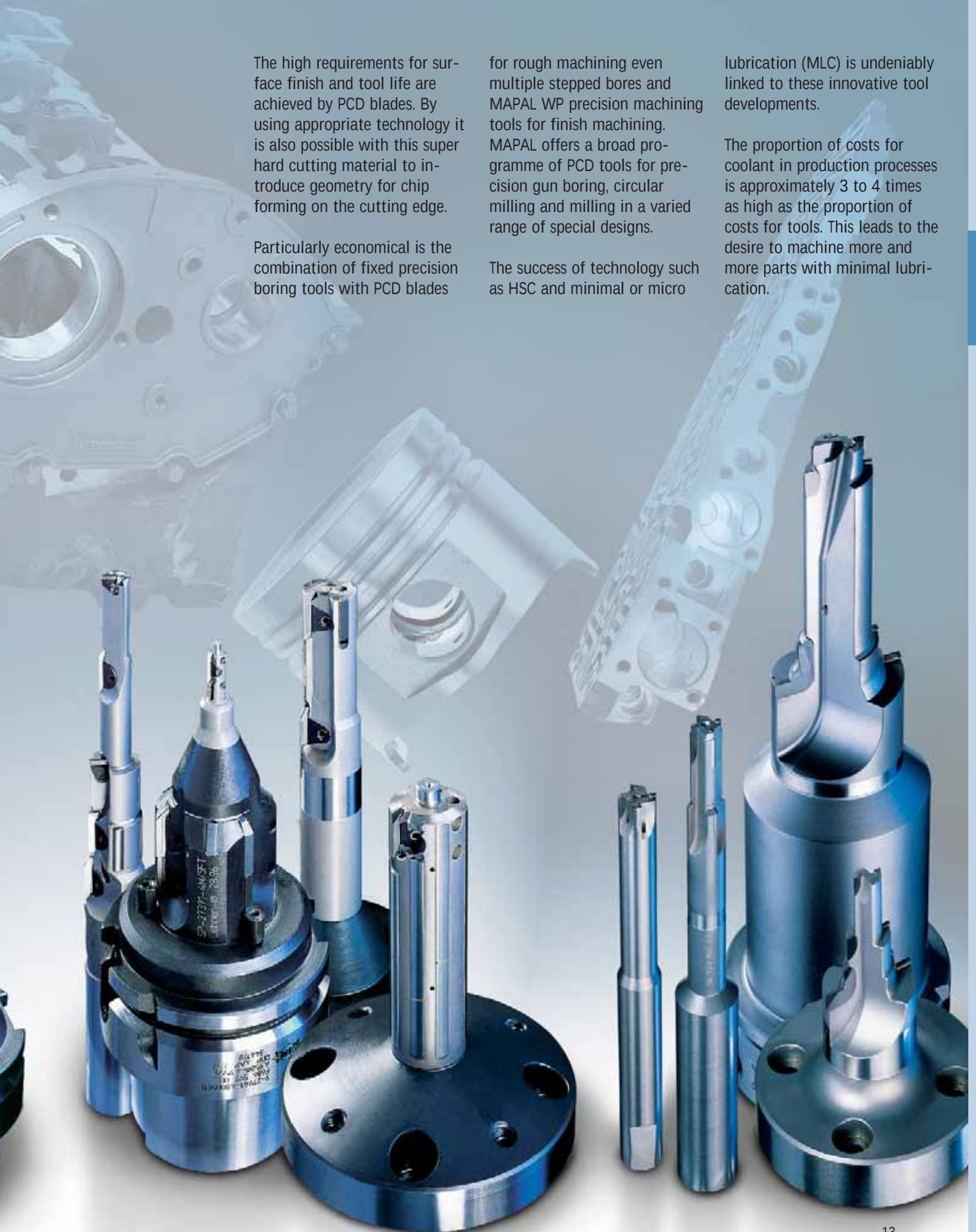
Particularly economical is the combination of fixed precision boring tools with PCD blades

for rough machining even multiple stepped bores and MAPAL WP precision machining tools for finish machining. MAPAL offers a broad programme of PCD tools for precision gun boring, circular milling and milling in a varied range of special designs.

The success of technology such as HSC and minimal or micro

lubrication (MLC) is undeniably linked to these innovative tool developments.

The proportion of costs for coolant in production processes is approximately 3 to 4 times as high as the proportion of costs for tools. This leads to the desire to machine more and more parts with minimal lubrication.



MAPAL Competence – Machining Cast Iron

While cutting speeds of more than 1.000 m/min are possible when machining aluminium, the “maximum speed” for cast iron is restricted by the material. In addition to single-bladed reamers, tools with several blades are used to obtain an economic production process for this material as well. For this MAPAL twin-bladed tools and HPR High Performance Reamers in particular are available. These achieve feed rates in the range 0,5 to 2 mm/rev. Because of

the highly abrasive nature of the cast iron materials, special wear-resistant PCD guide pads are the best solution for this type of use. Extremely resistant CVD coatings developed by MAPAL offer a good protection against wear for the blades.

Special requirements for geometry and finish are placed by bores in which pistons or cylinders have to move. The constant efforts to achieve surface finishes of less

than R_a 0,5 μm have led to a further MAPAL innovation. This new concept has been made possible by combining the principle of micro cutting with PCD as a cutting material. This allows surface finishes of R_a 0,3 μm to be reliably achieved in production. The decisive role with this technology is played by the temperature on the cutting edge. Using design features for the coolant supply and the blade geometry, it was possible to



prevent the critical temperature of 700° for PCD from being exceeded.

An important factor for economic precision machining when cutting cast iron is at the rough machining stage. Based on the use of ISO blades, MAPAL has developed a range of standard and special solutions for pre-machining tools.

An interesting aspect with this is the high precision of the arrangement of the blades. In many cases this even produces finish machined chamfers, surfaces and transitions. This simplifies finish machining considerably.

More recently even new cast materials such as CGI have been economically machined with MAPAL tools. One of the main demands is the machining of cylinder bores in crankcases.

In addition to the tool concept with measurement control and blade compensation, the principle of micro cutting is again available for this task. Because of the large diameters of these bores, more blades are used. A total of six blades, four for pre-machining and two for micro cutting, successfully carry out this work. Tool life of 1.300 bores for this machining task with CGI is a top class result.



MAPAL Competence – Machining Steel

Similar machining cast iron there is a limitation for steel for the maximum cutting speed possible. MAPAL offers a suitable concept for any steel. Solutions are available from structural steel to high-alloy high grade steel, both from the range of single and twin-bladed tools with guide pads and with multi-bladed reamers. Forged

steels, as for example with connecting rods or wheel mounts, are being machined highly successfully with MAPAL HX twin-bladed tools.

Taper reamers and form reamers for machining spherical seats are also frequently used for steel parts. Because of the precisely adjustable blades and guide

pads, a significant proportion of contact area of more than 90 % can be achieved for these applications.

To utilise the special advantages of the MAPAL principle for machining shafts, MAPAL has developed external machining tools. Blade and guide pads also guarantee that grinding qualities are



achieved with this innovative tool concept. Although a great many applications are in the steel area, these special tools are of course also used with other materials.

MAPAL innovations are primarily of great advantage for machining hardened steels. With tools with guide pads the twin-bladed tool with HX blades in PCBN are particularly impressive.

Three to four times the time life is achieved in comparison with standard turning in the example of machining bores in gearwheels. Fixed brazed HPR tools with PCBN blades have a significant effect with hard machining, especially when machining small bores.

Even when machining steel, MAPAL offers the appropriate pre-machining tools with ISO elements. To obtain optimum machining values, where possible multi-bladed tools are used. Various fitting and adjusting facilities for the ISO indexable blades guarantee exact concentricity for the blades, and as a result maximum tool life.



MAPAL Competence – Reaming and Fine Boring

A one off – the right technology for any tasks.



MAPAL WP Single-Bladed Reamers

MN 2000
Page 24-25

- Morse taper shank
- External coolant supply

MN 2001
Page 26-27

- Cylindrical shank with clamping surface
- External coolant supply

MN 2002
Page 28-29

- Cylindrical shank with clamping surface
- External coolant supply

MN 2003
Page 30-31

- Cylindrical shank with clamping surface
- Internal coolant supply

MN 2004
Page 32

- Cylindrical shank with clamping surface
- Internal coolant supply

MN 2034
Page 33

- Cylindrical shank with clamping surface
- Internal coolant supply

MN 2023
Page 34

- Cylindrical shank with NC clamping surface
- Internal coolant supply

MN 2024
Page 35

- Cylindrical shank with NC clamping surface
- Internal coolant supply

MN 2043
Page 36

- Cylindrical shank smooth
- Internal coolant supply

MN 2044
Page 37

- Cylindrical shank smooth
- Internal coolant supply



MAPAL HX Single-Bladed Reamers

MN 6023
Page 38

- Cylindrical shank with NC clamping surface
- Internal coolant supply

MN 6024
Page 39

- Cylindrical shank with NC clamping surface
- Internal coolant supply

MN 6043
Page 40

- Cylindrical shank smooth
- Internal coolant supply

MN 6044
Page 41

- Cylindrical shank smooth
- Internal coolant supply

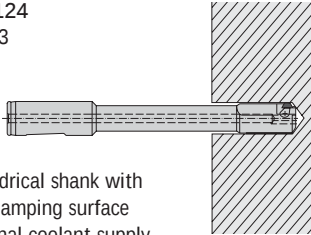
MN 6123
Page 42

- Cylindrical shank with NC clamping surface
- Internal coolant supply



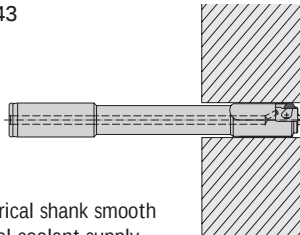
MAPAL HX Single-Bladed Reamers

MN 6124
Page 43



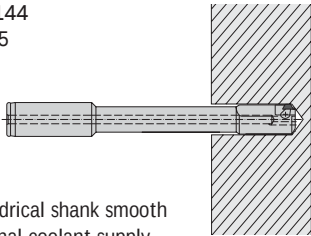
- Cylindrical shank with NC clamping surface
- Internal coolant supply

MN 6143
Page 44



- Cylindrical shank smooth
- Internal coolant supply

MN 6144
Page 45

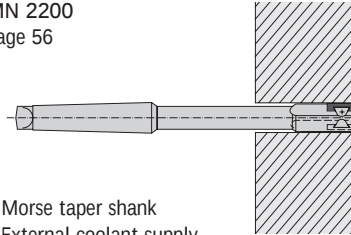


- Cylindrical shank smooth
- Internal coolant supply



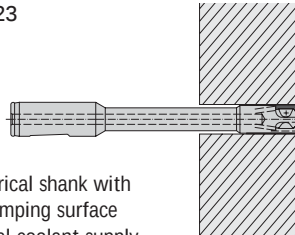
MAPAL WP Twin-Bladed Reamers

MN 2200
Page 56



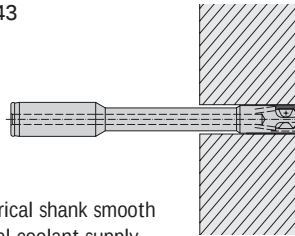
- Morse taper shank
- External coolant supply

MN 2223
Page 57



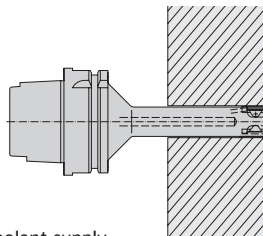
- Cylindrical shank with NC clamping surface
- Internal coolant supply

MN 2243
Page 58



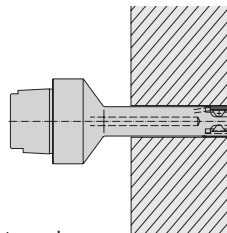
- Cylindrical shank smooth
- Internal coolant supply

MN 2225
Page 59



- HSK-A
- Internal coolant supply

MN 2227
Page 60

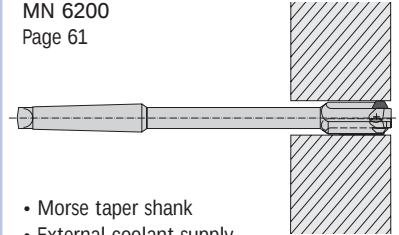


- HSK-C
- Internal coolant supply



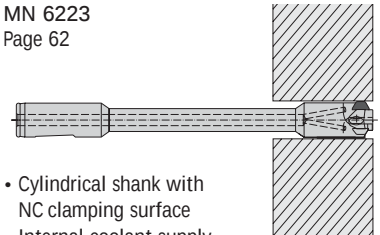
MAPAL HX Twin-Bladed Reamers

MN 6200
Page 61



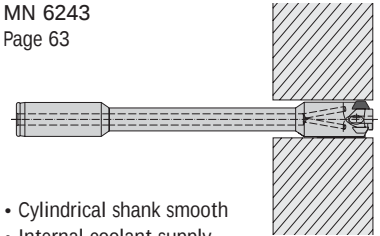
- Morse taper shank
- External coolant supply

MN 6223
Page 62



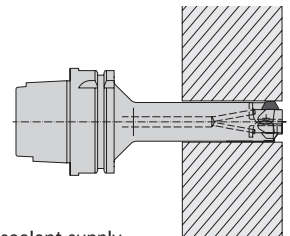
- Cylindrical shank with NC clamping surface
- Internal coolant supply

MN 6243
Page 63



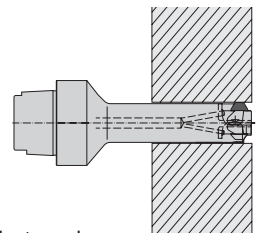
- Cylindrical shank smooth
- Internal coolant supply

MN 6225
Page 64

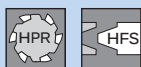


- HSK-A
- Internal coolant supply

MN 6227
Page 65

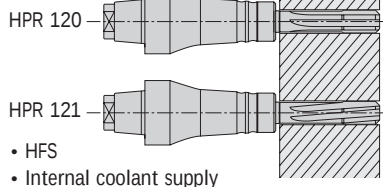


- HSK-C
- Internal coolant supply



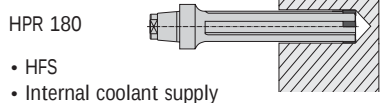
MAPAL HPR Replaceable Reamer Heads

HPR 120 and HPR 121
Page 86



- HFS
- Internal coolant supply

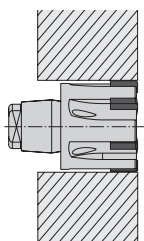
HPR 130, HPR 131
and HPR 180
Page 87-88
HPR 130/131



- HFS
- Internal coolant supply

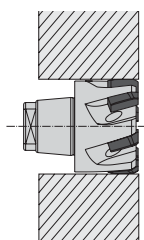
HPR 100
Page 89

- HFS
- Internal coolant supply



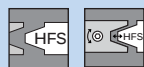
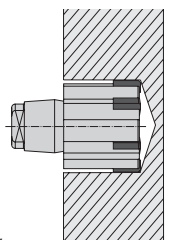
HPR 110
Page 91

- HFS
- Internal coolant supply



HPR 150
Page 91

- HFS
- Internal coolant supply

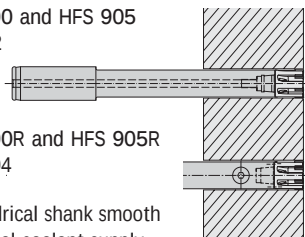


MAPAL HFS Holders

HFS 900 and HFS 905
Page 92

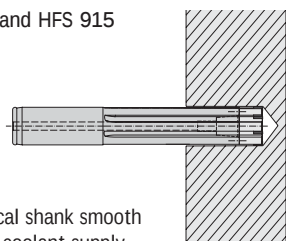
HFS 900R and HFS 905R
Page 104

- Cylindrical shank smooth
- Internal coolant supply



HFS 910 and HFS 915
Page 93

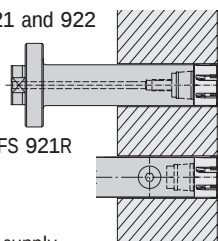
- Cylindrical shank smooth
- Internal coolant supply



HFS 920, HFS 921 and HFS 922
Page 94-95

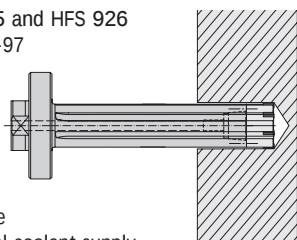
HFS 920R and HFS 921R
Page 105

- Module
- Internal coolant supply



HFS 925 and HFS 926
Page 96-97

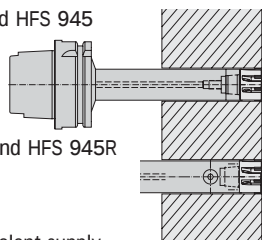
- Module
- Internal coolant supply



HFS 940 and HFS 945
Page 98

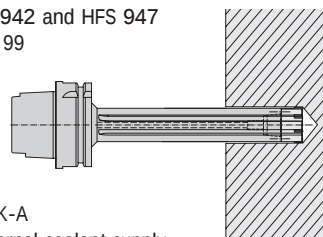
HFS 940R and HFS 945R
Page 106

- HSK-A
- Internal coolant supply



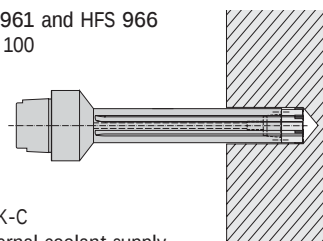
HFS 942 and HFS 947
Page 99

- HSK-A
- Internal coolant supply



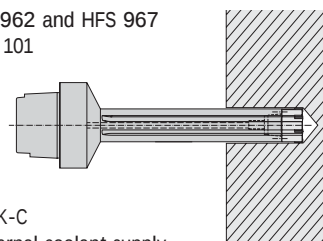
HFS 961 and HFS 966
Page 100

- HSK-C
- Internal coolant supply



HFS 962 and HFS 967
Page 101

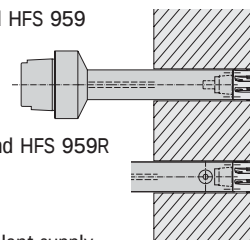
- HSK-C
- Internal coolant supply



HFS 964 and HFS 959
Page 102

HFS 964R and HFS 959R
Page 107

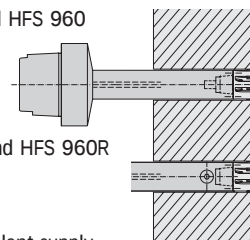
- HSK-C
- Internal coolant supply



HFS 965 and HFS 960
Page 103

HFS 965R and HFS 960R
Page 107

- HSK-C
- Internal coolant supply



Index

MAPAL Single-Bladed Reamers

22 - 53

MAPAL WP Single-Bladed Reamers		24 - 37
MN 2000	Morse taper shank (MT)	24 - 25
MN 2001	Cylindrical shank with clamping surface	26 - 27
MN 2002/MN 2003	Cylindrical shank with clamping surface	28 - 31
MN 2004/MN 2034	Cylindrical shank with clamping surface	32 - 33
MN 2023/MN 2024	Cylindrical shank with NC clamping surface	34 - 35
MN 2043/MN 2044	Cylindrical shank, smooth	36 - 37
MAPAL HX Single-Bladed Reamers		38 - 45
MN 6023/MN 6024	Cylindrical shank with NC clamping surface	38 - 39
MN 6043/MN 6044	Cylindrical shank, smooth	40 - 41
MN 6123/MN 6124	Cylindrical shank with NC clamping surface	42 - 43
MN 6143/MN 6144	Cylindrical shank, smooth	44 - 45
Machining Values – MAPAL Single-Bladed Reamers		46 - 49
Setting Notes – MAPAL Single-Bladed Reamers		50 - 52
MAPAL Setting Devices		53

MAPAL Twin-Bladed Reamers

54 - 73

MAPAL WP Twin-Bladed Reamers		56 - 60
MN 2200	Morse taper shank (MT)	56
MN 2223	Cylindrical shank with NC clamping surface	57
MN 2243	Cylindrical shank, smooth	58
MN 2225	HSK-A	59
MN 2227	HSK-C	60
MAPAL HX Twin-Bladed Reamers		61 - 65
MN 6200	Morse taper shank (MT)	61
MN 6223	Cylindrical shank with NC clamping surface	62
MN 6243	Cylindrical shank, smooth	63
MN 6225	HSK-A	64
MN 6227	HSK-C	65
Machining Values – MAPAL Twin-Bladed Reamers		66 - 69
Setting Notes – MAPAL Twin-Bladed Reamers		70 - 71
Accessories for Chuck HSK-A 63		72
Screwdriver for MAPAL Single-Bladed and Twin-Bladed Reamers		72
Order Example for MAPAL Single-Bladed and Twin-Bladed Reamers		73

MAPAL Blades

74 - 79

WP blades	76 - 77
HX blades	78 - 79

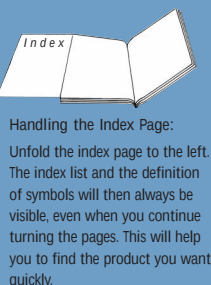
MAPAL HPR – High Performance Reamers

80 - 123

HFS® – Head Fitting System		82 - 83	
HPR Product Range		84 - 85	
MAPAL HPR Replaceable Reamer Heads		86 - 91	
HPR 120/HPR 121		86	
HPR 130/HPR 131		87	
HPR 180		88	
HPR 100/HPR 110		89 - 90	
HPR 150		91	
MAPAL HFS Holders		92 - 108	
HFS 900/905/910/915	Cylindrical shank, smooth	} with axial clamping	92 - 93
HFS 920/921/922/925/926	Module		94 - 97
HFS 940/945/942/947	HSK-A 63		98 - 99
HFS 961/966	HSK-C 50		100
HFS 962/967	HSK-C 63		101
HFS 964/959	HSK-C 50		102
HFS 965/960	HSK-C 63	} with radial clamping	103
HFS 900R/905R	Cylindrical shank, smooth		104
HFS 920R/921R	Module		105
HFS 940R/945R	HSK-A 63		106
HFS 964R/965R/959R/960R	HSK-C 50/HSK-C 63	107	
Holders for HPR Replaceable Reamer Heads HPR 120, 121, 130, 131, 180		108	
Accessories and spares for HFS and HSK-A 63		109 - 110	
Code for MAPAL HPR Replaceable Reamer Heads		111	
Order example for MAPAL HPR Replaceable Reamer Heads		111	
Recommendations for selecting the right lead geometry		112 - 114	
Cutting lead geometry and top rake for HPR Replaceable Reamer Heads		115	
HSC machining values for MAPAL HPR Replaceable Reamer Heads		116 - 119	
Semi-standard versions with configurable parameters		120 - 121	
Coolant supply		122	
Handling MAPAL HPR Replaceable Reamer Heads		123	

Use these symbols for fast access to the right tool:

	Systems MAPAL Single-Bladed Reamers
	MAPAL Twin-Bladed Reamers
	MAPAL HPR Reamers
	Blades WP blade
	HX blade
	Holders/Adaptors Morse taper shank (MT)
	Cylindrical shank with clamping surface
	Cylindrical shank with NC clamping surface
	Cylindrical shank, smooth
	HSK-A
	HSK-C
	Module
	MAPAL HFS® Replaceable Head Connection – with axial clamping
	Replaceable Head Connection – with radial clamping
	Coolants Internal coolant supply for through hole
	Internal coolant supply for blind hole
	External coolant supply
	Boring for through holes
	for blind holes







MAPAL

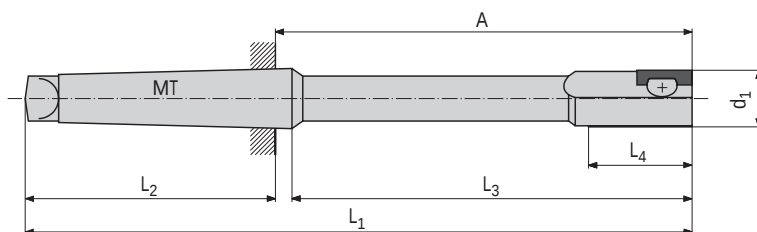
Single-Bladed Reamers

The constant development of the unmistakable MAPAL principle is the basis for the great success of MAPAL tools. In addition to the blade, with precision grinding for minimum surface roughness, the guide pads in particular contribute to the achievement of accurate machining results. By making full use of the sensitive adjustment system, the required diameters are produced to the highest precision from the very first part.

A feature of the MAPAL WP single-bladed tools is the indexable blade with two cutting edges. The cutting leads required for reaming have a double cutting lead with a flat ground section. Because of the adjustable back taper for the blade, the effect of the secondary cutting edge can be aligned with the machining task in question. The application of the series illustrated in this brochure is carried out subject to the machine, either on the floating holder or directly in a rigid holder. Standard tools are fitted with carbide guide pads.

For machining steel and cast iron, MAPAL HX tools are primarily used. The six cutting edges on HX blades guarantee excellent economic results. The arrangement of the cutting edge and the guide pads corresponds to the version with indexable blades. Various clamping and adjusting systems offer numerous options for use. With one system the HX blade is held by means of a swivel clamping jaw and can be adjusted with an adjusting screw to the exact diameter; with another the HX blade is held in a cartridge. Two adjusting elements mean that the back taper is also adjustable. The guide pads for HX standard reamers are in Cermet.

MAPAL WP Single-Bladed Reamers MN 2000



Dimensions							Accessories					
								Clamping		Adjusting		
$\varnothing d_1^*$	L_1	L_2	L_3	L_4	MT	Length A	Blade size	Torx screw/ Clamping screw Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)	
5,00-5,29	126**	62	60,5	15	1	64	(SP) 81	Torx screw	10036776 (M1,6x3,9)	30026285 (GR-1YN)	10036736 (M2x1,8)	30026239 (GR-06)
5,30-5,49	126**	62	60,5	15	1	64	(SP) 81		10036778 (M1,6x4,4)	30026285 (GR-1YN)	10036737 (M2x2)	30026239 (GR-06)
5,50-6,19	126**	62	60,5	15	1	64	(SP) 81		10036780 (M2x4)	30026286 (GR-1X)	10036737 (M2x2)	30026260 (GR-07)
6,20-6,90	126**	62	60,5	15	1	64	(SP) 81		10036781 (M2x5)	30026286 (GR-1X)	10036738 (M2x2,5)	30026260 (GR-07)
6,91-7,49	136**	62	70,5	15	1	74	90		10036783 (M2,5x4,8)	30026287 (GR-1W)	10036730 (M2,5x2,2)	30026261 (GR-08)
7,50-7,79	136**	62	70,5	15	1	74	90		10036784 (M2,5x5,2)	30026287 (GR-1W)	10036731 (M2,5x2,5)	30026262 (GR-09)
7,80-7,99	155	62	89,5	30	1	93	90	Clamping screw MN 618	10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036743 (M3x2,5)	30026238 (GR-0)
8,00-8,79	155	62	89,5	30	1	93	90		10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036743 (M3x2,5)	30026238 (GR-0)
8,80-9,29	160	62	94,5	30	1	98	90		10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036744 (M3x3)	30026238 (GR-0)
9,30-9,79	170	62	104,5	30	1	108	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036744 (M3x3)	30026238 (GR-0)
9,80-11,29	170	62	104,5	30	1	108	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036744 (M3x3)	30026263 (GR-1)
11,30-11,79	170	62	104,5	30	1	108	92		10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036751 (M4x3)	30026266 (GR-2)
11,80-12,29	170	62	104,5	30	1	108	92		10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036751 (M4x3)	30026266 (GR-2)
12,30-13,29	180	62	114,5	30	1	118	92		10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036752 (M4x4)	30026266 (GR-2)
13,30-14,29	180	62	114,5	30	1	118	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
14,30-15,29	180	62	114,5	30	1	118	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
15,30-16,29	200	75	120	30	2	125	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)	
16,30-18,29	210	75	130	30	2	135	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)	

Sizes in mm.

SP = blade cannot be turned.

The appropriate floating holder can be found in our special catalogue »MAPAL Competence - Clamping«.

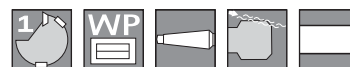
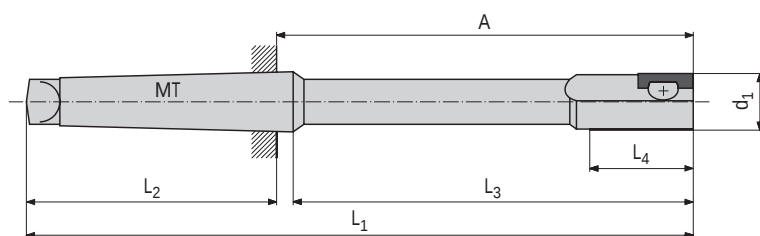
See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 2,5 mm long center spigot for d_1 , less than 7,8 mm.

MAPAL WP Single-Bladed Reamers MN 2000



Dimensions							Accessories				
$\emptyset d_1^*$	L ₁	L ₂	L ₃	L ₄	MT	Length A	Blade size	Clamping Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)
18,30-20,29	220	75	140	30	2	145	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
20,30-22,29	230	75	150	30	2	155	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
22,30-23,29	240	75	160	30	2	165	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
23,30-26,29	260	94	161	30	3	166	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
26,30-28,29	270	94	171	30	3	176	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
28,30-29,29	280	94	181	30	3	186	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
29,30-32,29	290	94	191	30	3	196	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
32,30-35,29	290	117,5	166	30	4	172,5	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
35,30-40,29	310	117,5	186	30	4	192,5	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
40,30-48,29	325	117,5	201	30	4	207,5	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)
48,30-59,79	340	117,5	216	30	4	222,5	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)
59,80-79,79	340	117,5	216	45	4	222,5	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)
79,80-	340	149,5	184	45	5	190,5	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)

Sizes in mm.

The appropriate floating holder can be found in our special catalogue »MAPAL Competence - Clamping«.

See page 50 for setting notes and fitting of accessories.

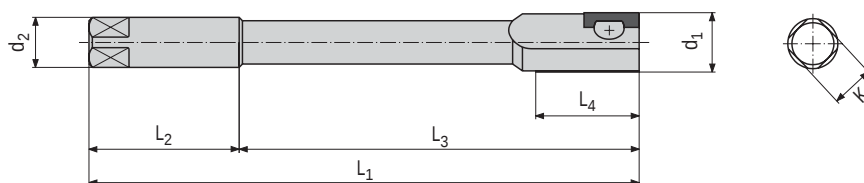
See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in carbide.

See page 76 for selection of indexable blades.

MAPAL WP Single-Bladed Reamers MN 2001



Dimensions							Accessories					
ø d ₁ *	ø d ₂ h9	L ₁	L ₂	L ₃	L ₄	K _{h12}	Blade size	Clamping		Adjusting		
								Torx screw/ Clamping screw Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)	
5,00-5,29	5	85**	25	60	15	-	(SP) 81	Torx screw	10036776 (M1,6x3,9)	30026285 (GR-1YN)	10036736 (M2x1,8)	30026239 (GR-06)
5,30-5,49	5	85**	25	60	15	-	(SP) 81		10036778 (M1,6x4,4)	30026285 (GR-1YN)	10036737 (M2x2)	30026239 (GR-06)
5,50-6,19	5	85**	25	60	15	-	(SP) 81		10036780 (M2x4)	30026286 (GR-1X)	10036737 (M2x2)	30026260 (GR-07)
6,20-6,90	6	85**	25	60	15	-	(SP) 81		10036781 (M2x5)	30026286 (GR-1X)	10036738 (M2x2,5)	30026260 (GR-07)
6,91-7,49	7	100**	28	72	15	-	90		10036783 (M2,5x4,8)	30026287 (GR-1W)	10036730 (M2,5x2,2)	30026261 (GR-08)
7,50-7,79	7	100**	28	72	15	-	90		10036784 (M2,5x5,2)	30026287 (1W)	10036731 (M2,5x2,5)	30026262 (GR-09)
7,80-7,99	8	120	28	92	30	-	90	Clamping screw MN 618	10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036743 (M3x2,5)	30026238 (GR-0)
8,00-8,29	8	120	28	92	30	-	90		10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036743 (M3x2,5)	30026238 (GR-0)
8,30-8,79	9	130	30	100	30	-	90		10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036744 (M3x3)	30026238 (GR-0)
8,80-9,29	9	130	30	100	30	-	90		10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036744 (M3x3)	30026238 (GR-0)
9,30-9,79	10	140	32	108	30	-	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036744 (M3x3)	30026238 (GR-0)
9,80-10,29	10	140	32	108	30	-	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036744 (M3x3)	30026263 (GR-1)
10,30-11,29	9	145	36	109	30	7	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036744 (M3x3)	30026263 (GR-1)
11,30-12,29	10	155	40	115	30	8	92		10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036751 (M4x3)	30026266 (GR-2)
12,30-13,29	11	160	45	115	30	9	92		10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036752 (M4x4)	30026266 (GR-2)
13,30-14,29	11	170	45	125	30	9	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
14,30-15,29	13	175	45	130	30	10	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
15,30-16,29	13	180	50	130	30	10	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)

Sizes in mm.

SP = blade cannot be turned.

The appropriate floating holder can be found in our special catalogue »MAPAL Competence - Clamping«.

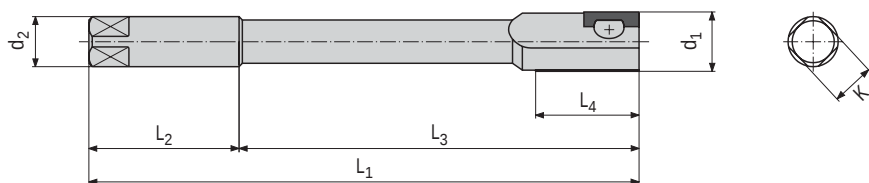
See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 2,5 mm long center spigot for d_1 , less than 7,8 mm.

MAPAL WP Single-Bladed Reamers MN 2001



Dimensions							Accessories				
$\varnothing d_1^*$	$\varnothing d_2$ h9	L ₁	L ₂	L ₃	L ₄	K _{h12}	Blade size	Clamping Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting Adjusting screw MN 620 Order No. (size)	Adjusting Adjusting wedge MN 619 Order No. (size)
16,30-17,29	14	190	50	140	30	11	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
17,30-18,29	14	195	50	145	30	11	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
18,30-19,29	16	205	56	149	30	12	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
19,30-20,29	16	210	56	154	30	12	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
20,30-21,29	18	215	56	159	30	14,5	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
21,30-22,29	18	225	63	162	30	14,5	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
22,30-23,29	18	230	63	167	30	14,5	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
23,30-24,29	20	240	63	177	30	16	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
24,30-25,29	20	245	63	182	30	16	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
25,30-26,29	20	250	70	180	30	16	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
26,30-27,29	22	260	70	190	30	18	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
27,30-29,29	22	270	70	200	30	18	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
29,30-30,29	24	280	80	200	30	18	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
30,30-32,29	24	290	80	210	30	18	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)

Sizes in mm.

The appropriate floating holder can be found in our special catalogue »MAPAL Competence - Clamping«.

See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

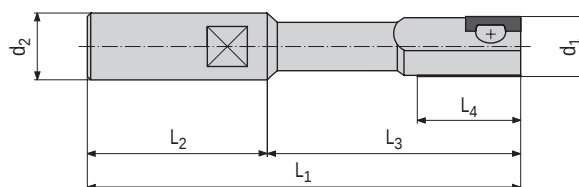
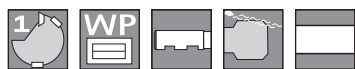
*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in carbide.

See page 76 for selection of indexable blades.

MAPAL WP Single-Bladed Reamers

MN 2002



Dimensions						Accessories					
							Clamping		Adjusting		
$\varnothing d_1^*$	$\varnothing d_{2\text{ h7}}$	L_1	L_2	L_3	L_4	Blade size	Torx screw/ Clamping screw Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)	
5,00-5,29	10	90**	30	60	15	(SP) 81	Torx screw	10036776 (M1,6x3,9)	30026285 (GR-1YN)	10036736 (M2x1,8)	30026239 (GR-06)
5,30-5,49	10	90**	30	60	15	(SP) 81		10036778 (M1,6x4,4)	30026285 (GR-1YN)	10036737 (M2x2)	30026239 (GR-06)
5,50-6,19	10	90**	30	60	15	(SP) 81		10036780 (M2x4)	30026286 (GR-1X)	10036737 (M2x2)	30026260 (GR-07)
6,20-6,90	10	90**	30	60	15	(SP) 81		10036781 (M2x5)	30026286 (GR-1X)	10036738 (M2x2,5)	30026260 (GR-07)
6,91-7,49	10	100**	30	70	15	90		10036783 (M2,5x4,8)	30026287 (GR-1W)	10036730 (M2,5x2,2)	30026261 (GR-08)
7,50-7,79	10	100**	30	70	15	90		10036784 (M2,5x5,2)	30026287 (GR-1W)	10036731 (M2,5x2,5)	30026262 (GR-09)
7,80-8,29	16	120	45	75	30	90	Clamping screw MN 618	10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036743 (M3x2,5)	30026238 (GR-0)
8,30-8,79	16	120	45	75	30	90		10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036744 (M3x3)	30026238 (GR-0)
8,80-9,29	16	120	45	75	30	90		10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036744 (M3x3)	30026238 (GR-0)
9,30-9,79	16	120	45	75	30	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036744 (M3x3)	30026238 (GR-0)
9,80-11,29	16	120	45	75	30	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036744 (M3x3)	30026263 (GR-1)
11,30-11,79	16	120	45	75	30	92		10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036751 (M4x3)	30026266 (GR-2)
11,80-12,29	16	120	45	75	30	92		10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036751 (M4x3)	30026266 (GR-2)
12,30-13,29	16	120	45	75	30	92		10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036752 (M4x4)	30026266 (GR-2)

Sizes in mm.

SP = blade cannot be turned.

The appropriate floating holder can be found in our special catalogue »MAPAL Competence - Clamping«.

See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

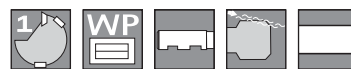
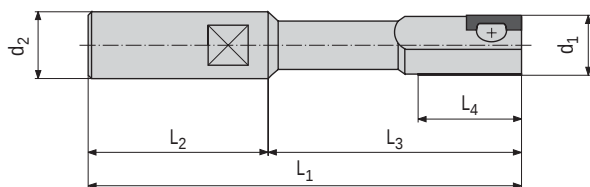
*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 2,5 mm long center spigot for d_1 , less than 7,8 mm.

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in carbide.

See page 76 for selection of indexable blades.

MAPAL WP Single-Bladed Reamers MN 2002



Dimensions						Accessories				
$\varnothing d_1^*$	$\varnothing d_{2\text{H}7}$	L_1	L_2	L_3	L_4	Blade size	Clamping Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)
13,30-14,29	16	120	45	75	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
14,30-18,29	20	130	55	75	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
18,30-19,79	20	130	55	75	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
19,80-20,29	20	150	55	95	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
20,30-26,29	20	150	55	95	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
26,30-40,29	25	160	65	95	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
40,30-59,79	25	180	65	115	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)
59,80-	25	180	65	115	45	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)

Sizes in mm.

The appropriate floating holder can be found in our special catalogue »MAPAL Competence - Clamping«.

See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

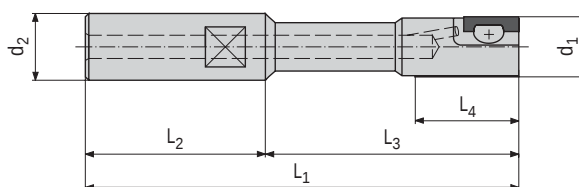
*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in carbide.

See page 76 for selection of indexable blades.

MAPAL WP Single-Bladed Reamers

MN 2003



Dimensions						Accessories					
							Clamping		Adjusting		
$\varnothing d_1^*$	$\varnothing d_{2\text{ h7}}$	L_1	L_2	L_3	L_4	Blade size	Torx screw/ Clamping screw Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)	
5,00-5,29	10	90**	30	60	15	(SP) 81	Torx screw	10036776 (M1,6x3,9)	30026285 (GR-1YN)	10036736 (M2x1,8)	30026239 (GR-06)
5,30-5,49	10	90**	30	60	15	(SP) 81		10036778 (M1,6x4,4)	30026285 (GR-1YN)	10036737 (M2x2)	30026239 (GR-06)
5,50-6,19	10	90**	30	60	15	(SP) 81		10036780 (M2x4)	30026286 (GR-1X)	10036737 (M2x2)	30026260 (GR-07)
6,20-6,90	10	90**	30	60	15	(SP) 81		10036781 (M2x5)	30026286 (GR-1X)	10036738 (M2x2,5)	30026260 (GR-07)
6,91-7,49	10	100**	30	70	15	90		10036783 (M2,5x4,8)	30026287 (GR-1W)	10036730 (M2,5x2,2)	30026261 (GR-08)
7,50-7,79	10	100**	30	70	15	90		10036784 (M2,5x5,2)	30026287 (GR-1W)	10036731 (M2,5x2,5)	30026262 (GR-09)
7,80-8,29	16	120	45	75	30	90	Clamping screw MN 618	10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036743 (M3x2,5)	30026238 (GR-0)
8,30-8,79	16	120	45	75	30	90		10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036744 (M3x3)	30026238 (GR-0)
8,80-9,29	16	120	45	75	30	90		10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036744 (M3x3)	30026238 (GR-0)
9,30-9,79	16	120	45	75	30	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036744 (M3x3)	30026238 (GR-0)
9,80-11,29	16	120	45	75	30	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036744 (M3x3)	30026263 (GR-1)
11,30-11,79	16	120	45	75	30	92		10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036751 (M4x3)	30026266 (GR-2)
11,80-12,29	16	120	45	75	30	92		10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036751 (M4x3)	30026266 (GR-2)
12,30-13,29	16	120	45	75	30	92		10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036752 (M4x4)	30026266 (GR-2)

Sizes in mm.

SP = blade cannot be turned.

The appropriate floating holder can be found in our special catalogue »MAPAL Competence - Clamping«.

See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

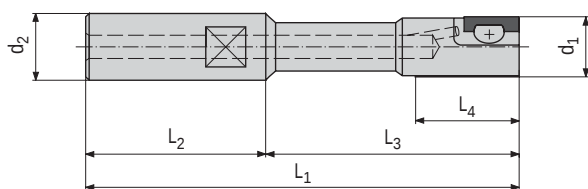
*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 2,5 mm long center spigot for d_1 , less than 7,8 mm.

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in carbide.

See page 76 for selection of indexable blades.

MAPAL WP Single-Bladed Reamers MN 2003



Dimensions						Accessories				
$\varnothing d_1^*$	$\varnothing d_{2\ h7}$	L_1	L_2	L_3	L_4	Blade size	Clamping Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)
13,30-14,29	16	120	45	75	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
14,30-18,29	20	130	55	75	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
18,30-19,79	20	130	55	75	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
19,80-20,29	20	150	55	95	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
20,30-26,29	20	150	55	95	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
26,30-40,29	25	160	65	95	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
40,30-59,79	25	180	65	115	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)
59,80-	25	180	65	115	45	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)

Sizes in mm.

The appropriate floating holder can be found in our special catalogue »MAPAL Competence - Clamping«.

See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

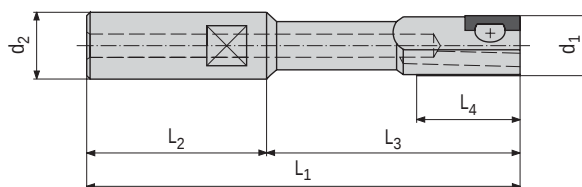
*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in carbide.

See page 76 for selection of indexable blades.

MAPAL WP Single-Bladed Reamers

MN 2004



Dimensions						Accessories					
ø d ₁ [*]	ø d ₂ h7	L ₁	L ₂	L ₃	L ₄	Blade size	Clamping		Adjusting		
							Torx screw/ Clamping screw Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)	
5,90-6,29	10	90**	30	60	15	(SP) 81	Torx screw	10036776 (M1,6x3,9)	30026285 (GR-1YN)	10036737 (M2x2)	30026239 (GR-06)
6,30-6,90	10	90**	30	60	15	(SP) 81		10036778 (M1,6x4,4)	30026285 (GR-1YN)	10036738 (M2x2,5)	30026239 (GR-06)
6,91-7,29	10	100**	30	70	15	(SP) 81		10036778 (M1,6x4,4)	30026285 (GR-1YN)	10036738 (M2x2,5)	30026239 (GR-06)
7,30-7,79	10	100**	30	70	15	(SP) 81		10036781 (M2x5)	30026286 (GR-1X)	10036739 (M2x3)	30026260 (GR-07)
7,80-8,29	16	120**	45	75	15	(SP) 81		10036781 (M2x5)	30026286 (GR-1X)	10036739 (M2x3)	30026260 (GR-07)
8,30-9,79	16	120	45	75	15	90		10036784 (M2,5x5,2)	30026287 (GR-1W)	10036732 (M2,5x3)	30026262 (GR-09)
9,80-10,29	16	120	45	75	15	90	Clamping screw MN 618	10036784 (M2,5x5,2)	30026287 (GR-1W)	10036733 (M2,5x4)	30026262 (GR-09)
10,30-11,29	16	120	45	75	30	90		10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036744 (M3x3)	30026263 (GR-1)
11,30-12,29	16	120	45	75	30	90		10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036745 (M3x4)	30026263 (GR-1)
12,30-14,29	16	120	45	75	30	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036745 (M3x4)	30026263 (GR-1)
14,30-16,29	20	130	55	75	30	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036747 (M3x6)	30026263 (GR-1)
16,30-17,29	20	130	55	75	30	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
17,30-19,79	20	130	55	75	30	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036754 (M4x6)	30026266 (GR-2)
19,80-26,29	20	150	55	95	30	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
26,30-40,29	25	160	65	95	30	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
40,30-59,79	25	180	65	115	30	93		10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)
59,80-	25	180	65	115	45	93		10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)

Sizes in mm.

The appropriate floating holder can be found in our special catalogue »MAPAL Competence - Clamping«.

See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

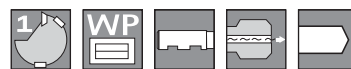
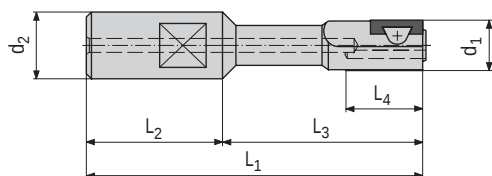
*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 1 mm long center spigot for d_1 , less than 8,3 mm.

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in carbide.

See page 76 for selection of indexable blades.

MAPAL WP Single-Bladed Reamers MN 2034



Dimensions						Accessories					
							Clamping		Adjusting		
$\varnothing d_1^*$	$\varnothing d_{2\ h7}$	L_1	L_2	L_3	L_4	Blade size	Torx screw/ Clamping screw Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)	
5,90-6,29	16	85**	27	58	15	(SP) 81	Torx screw	10036776 (M1,6x3,9)	30026285 (GR-1YN)	10036737 (M2x2)	30026239 (GR-06)
6,30-7,29	16	85**	27	58	15	(SP) 81		10036778 (M1,6x4,4)	30026285 (GR-1YN)	10036738 (M2x2,5)	30026239 (GR-06)
7,30-8,29	16	85**	27	58	15	(SP) 81		10036781 (M2x5)	30026286 (GR-1X)	10036739 (M2x3)	30026260 (GR-07)
8,30-9,79	16	85	27	58	15	90		10036784 (M2,5x5,2)	30026287 (GR-1W)	10036732 (M2,5x3)	30026262 (GR-09)
9,80-10,29	16	85	27	58	15	90		10036784 (M2,5x5,2)	30026287 (GR-1W)	10036733 (M2,5x4)	30026262 (GR-09)
10,30-11,29	16	85	27	58	30	90	Clamping screw MN 618	10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036744 (M3x3)	30026263 (GR-1)
11,30-12,29	16	85	27	58	30	90		10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036745 (M3x4)	30026263 (GR-1)
12,30-14,29	16	85	27	58	30	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036745 (M3x4)	30026263 (GR-1)
14,30-16,29	16	85	27	58	30	91		10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036747 (M3x6)	30026263 (GR-1)
16,30-17,29	16	85	27	58	30	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
17,30-19,79	16	85	27	58	30	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036754 (M4x6)	30026266 (GR-2)
19,80-20,29	16	85	27	58	30	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
20,30-26,29	20	90	30	60	30	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
26,30-40,29	25	95	35	60	30	92		10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)

Sizes in mm.

SP = blade cannot be turned

The appropriate floating holder can be found in our special catalogue »MAPAL Competence - Clamping«.

See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 1 mm long center spigot for d_1 , less than 8,3 mm.

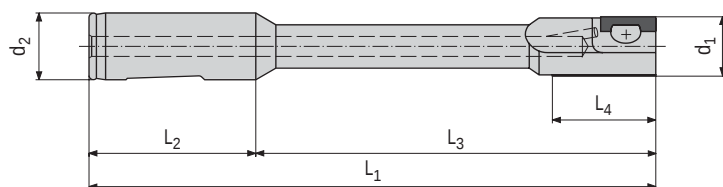
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in carbide.

See page 76 for selection of indexable blades.

MAPAL WP Single-Bladed Reamers

MN 2023

NC version



Dimensions						Accessories				
$\varnothing d_1^*$	$\varnothing d_{2(-0,003)}$	L_1	L_2	L_3	L_4	Blade size	Clamping Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)
7,80-8,29	16	133	48	85	30	90	10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036743 (M3x2,5)	30026238 (GR-0)
8,30-8,79	16	133	48	85	30	90	10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036744 (M3x3)	30026238 (GR-0)
8,80-9,29	16	133	48	85	30	90	10036711 (M3LH/RHx5)	30026289 (GR-0N)	10036744 (M3x3)	30026238 (GR-0)
9,30-11,29	16	133	48	85	30	91	10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036744 (M3x3)	30026263 (GR-1)
11,30-11,79	16	133	48	85	30	92	10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036751 (M4x3)	30026266 (GR-2)
11,80-12,29	16	168	48	120	30	92	10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036751 (M4x3)	30026266 (GR-2)
12,30-13,29	16	168	48	120	30	92	10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036752 (M4x4)	30026266 (GR-2)
13,30-14,29	16	168	48	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
14,30-15,79	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
15,80-17,79	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
17,80-18,29	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
18,30-19,79	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036754 (M4x6)	30026266 (GR-2)
19,80-24,79	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
24,80-28,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036761 (M6x10)	30026279 (GR-4)
28,80-31,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036762 (M6x12)	30026279 (GR-4)
31,80-37,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)
37,80-50,29	25	176	56	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)
50,30-80,29	40	190	70	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)

Sizes in mm.

See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

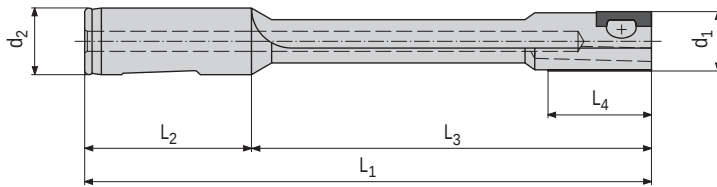
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in carbide.

See page 76 for selection of indexable blades.

MAPAL WP Single-Bladed Reamers

MN 2024

NC version



Dimensions						Accessories				
$\varnothing d_1^*$	$\varnothing d_{2(-0,003)}$	L_1	L_2	L_3	L_4	Blade size	Clamping Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)
7,80-8,29	16	133	48	85	30	90	10036711 (M3LH/RHx5)	30026291 (GR-0Z)	10036743 (M3x2,5)	30026238 (GR-0)
8,30-8,79	16	133	48	85	30	90	10036711 (M3LH/RHx5)	30026291 (GR-0Z)	10036744 (M3x3)	30026238 (GR-0)
8,80-9,29	16	133	48	85	30	90	10036711 (M3LH/RHx5)	30026291 (GR-0Z)	10036744 (M3x3)	30026238 (GR-0)
9,30-11,29	16	133	48	85	30	90	10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036744 (M3x3)	30026263 (GR-1)
11,30-11,79	16	133	48	85	30	90	10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036745 (M3x4)	30026263 (GR-1)
11,80-12,29	16	168	48	120	30	90	10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036745 (M3x4)	30026263 (GR-1)
12,30-14,29	16	168	48	120	30	91	10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036745 (M3x4)	30026263 (GR-1)
14,30-16,29	20	170	50	120	30	91	10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036747 (M3x6)	30026263 (GR-1)
16,30-17,29	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
17,30-19,79	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036754 (M4x6)	30026266 (GR-2)
19,80-24,79	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
24,80-27,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036761 (M6x10)	30026279 (GR-4)
27,80-28,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036761 (M6x10)	30026279 (GR-4)
28,80-31,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036762 (M6x12)	30026279 (GR-4)
31,80-37,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)
37,80-50,29	25	176	56	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)

Sizes in mm.

See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

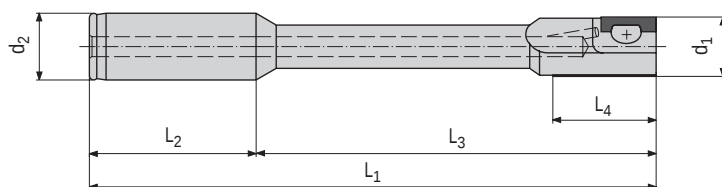
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in carbide.

See page 76 for selection of indexable blades.

MAPAL WP Single-Bladed Reamers

MN 2043

NC version



Dimensions						Accessories				
$\varnothing d_1^*$	$\varnothing d_2 \text{ h6}$	L_1	L_2	L_3	L_4	Blade size	Clamping Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)
7,80-8,29	16	133	48	85	30	90	10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036743 (M3x2,5)	30026238 (GR-0)
8,30-8,79	16	133	48	85	30	90	10036711 (M3LH/RHx5)	30026288 (GR-0F)	10036744 (M3x3)	30026238 (GR-0)
8,80-9,29	16	133	48	85	30	90	10036711 (M3LH/RHx5)	30026289 (GR-0N)	10036744 (M3x3)	30026238 (GR-0)
9,30-11,29	16	133	48	85	30	91	10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036744 (M3x3)	30026263 (GR-1)
11,30-11,79	16	133	48	85	30	92	10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036751 (M4x3)	30026266 (GR-2)
11,80-12,29	16	168	48	120	30	92	10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036751 (M4x3)	30026266 (GR-2)
12,30-13,29	16	168	48	120	30	92	10036724 (M4x0,5LH/RHx6,5)	30026294 (GR-2F)	10036752 (M4x4)	30026266 (GR-2)
13,30-14,29	16	168	48	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
14,30-15,79	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
15,80-17,79	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
17,80-18,29	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
18,30-19,79	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036754 (M4x6)	30026266 (GR-2)
19,80-24,79	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
24,80-28,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036761 (M6x10)	30026279 (GR-4)
28,80-31,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036762 (M6x12)	30026279 (GR-4)
31,80-37,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)
37,80-50,29	25	176	56	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)
50,30-80,29	40	190	70	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)

Sizes in mm.

See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

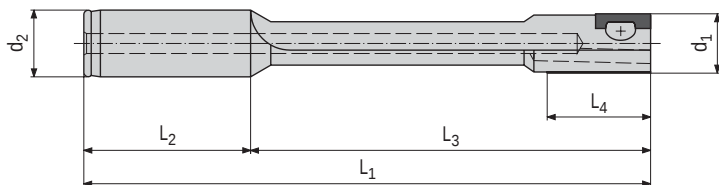
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in carbide.

See page 76 for selection of indexable blades.

MAPAL WP Single-Bladed Reamers

MN 2044

NC version



Dimensions						Accessories				
$\varnothing d_1^*$	$\varnothing d_2 \text{ h6}$	L_1	L_2	L_3	L_4	Blade size	Clamping Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)
7,80-8,29	16	133	48	85	30	90	10036711 (M3LH/RHx5)	30026291 (GR-0Z)	10036743 (M3x2,5)	30026238 (GR-0)
8,30-8,79	16	133	48	85	30	90	10036711 (M3LH/RHx5)	30026291 (GR-0Z)	10036744 (M3x3)	30026238 (GR-0)
8,80-9,29	16	133	48	85	30	90	10036711 (M3LH/RHx5)	30026291 (GR-0Z)	10036744 (M3x3)	30026238 (GR-0)
9,30-11,29	16	133	48	85	30	90	10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036744 (M3x3)	30026263 (GR-1)
11,30-11,79	16	133	48	85	30	90	10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036745 (M3x4)	30026263 (GR-1)
11,80-12,29	16	168	48	120	30	90	10036722 (M3LH/RHx6)	30026289 (GR-0N)	10036745 (M3x4)	30026263 (GR-1)
12,30-14,29	16	168	48	120	30	91	10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036745 (M3x4)	30026263 (GR-1)
14,30-16,29	20	170	50	120	30	91	10036722 (M3LH/RHx6)	30026292 (GR-1N)	10036747 (M3x6)	30026263 (GR-1)
16,30-17,29	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036753 (M4x5)	30026266 (GR-2)
17,30-19,79	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036754 (M4x6)	30026266 (GR-2)
19,80-24,79	20	170	50	120	30	92	10036725 (M4x0,5LH/RHx9)	30026296 (GR-2N)	10036755 (M4x8)	30026266 (GR-2)
24,80-27,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036761 (M6x10)	30026279 (GR-4)
27,80-28,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036761 (M6x10)	30026279 (GR-4)
28,80-31,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036762 (M6x12)	30026279 (GR-4)
31,80-37,79	20	170	50	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)
37,80-50,29	25	176	56	120	30	93	10036725 (M4x0,5LH/RHx9)	30026298 (GR-3N)	10036764 (M6x15)	30026279 (GR-4)

Sizes in mm.

See page 50 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

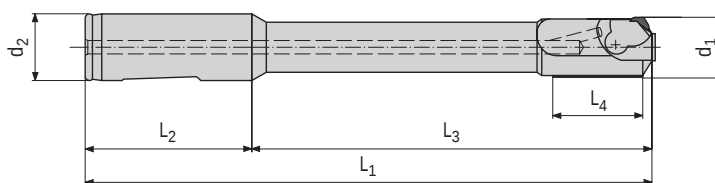
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in carbide.

See page 76 for selection of indexable blades.

MAPAL HX Single-Bladed Reamers

MN 6023

NC version



Dimensions						Accessories				
$\varnothing d_1^*$	$\varnothing d_{2(-0,003)}$	L_1	L_2	L_3	L_4	Blade size	Clamping Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)
13,83-14,49	16	168**	48	120	30	2	10036724 (M4x0,5LH/RHx6,5)	30026300 (PX25R)	10036743 (M3x2,5)	30026264 (GR-12)
14,50-14,82	20	170**	50	120	30	2	10036724 (M4x0,5LH/RHx6,5)	30026300 (PX25R)	10036743 (M3x2,5)	30026264 (GR-12)
14,83-16,49	20	170**	50	120	30	2	10036724 (M4x0,5LH/RHx6,5)	30026300 (PX25R)	10036744 (M3x3)	30026264 (GR-12)
16,50-16,82	20	170**	50	120	30	2	10036724 (M4x0,5LH/RHx6,5)	30026300 (PX25R)	10036745 (M3x4)	30026264 (GR-12)
16,83-17,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026300 (PX25R)	10036745 (M3x4)	30026264 (GR-12)
17,83-19,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026300 (PX25R)	10036751 (M4x3)	30026265 (GR-13)
19,83-21,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036752 (M4x4)	30026265 (GR-13)
21,83-24,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036754 (M4x6)	30026265 (GR-13)
24,83-37,82	20	170	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036755 (M4x8)	30026265 (GR-13)
37,83-50,16	25	176	56	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036755 (M4x8)	30026265 (GR-13)
50,17-80,16	40	190	70	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036755 (M4x8)	30026265 (GR-13)

Sizes in mm.

See page 51 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 1 mm long center spigot for d_1 , less than 22,50 mm.

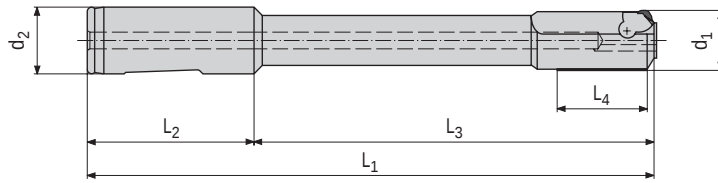
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 78 for selection of indexable blades.

MAPAL HX Single-Bladed Reamers

MN 6024

NC version



Dimensions						Accessories				
$\varnothing d_1^*$	$\varnothing d_{2(-0,003)}$	L_1	L_2	L_3	L_4	Blade size	Clamping Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)
14,83-16,49	20	170**	50	120	30	2	10036724 (M4x0,5LH/RHx6,5)	30026300 (PX25R)	10036744 (M3x3)	30026264 (GR-12)
16,50-16,82	20	170**	50	120	30	2	10036724 (M4x0,5LH/RHx6,5)	30026300 (PX25R)	10036745 (M3x4)	30026264 (GR-12)
16,83-17,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026300 (PX25R)	10036745 (M3x4)	30026264 (GR-12)
17,83-19,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026300 (PX25R)	10036751 (M4x3)	30026265 (GR-13)
19,83-21,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036752 (M4x4)	30026265 (GR-13)
21,83-24,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036754 (M4x6)	30026265 (GR-13)
24,83-37,82	20	170	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036755 (M4x8)	30026265 (GR-13)
37,83-50,16	25	176	56	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036755 (M4x8)	30026265 (GR-13)
50,17-80,16	40	190	70	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036755 (M4x8)	30026265 (GR-13)

Sizes in mm.

Guide pad quality: Cermet (CT)

See page 51 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

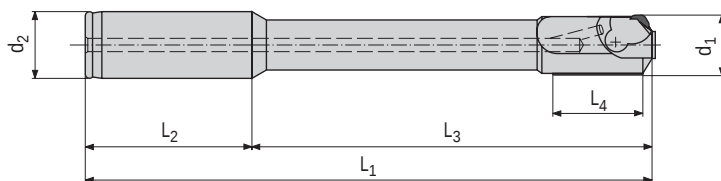
**With 1 mm long center spigot for d_1 , less than 22,50 mm.

See page 78 for selection of indexable blades.

MAPAL HX Single-Bladed Reamers

MN 6043

NC version



Dimensions						Accessories				
$\varnothing d_1^*$	$\varnothing d_2 \text{ h6}$	L_1	L_2	L_3	L_4	Blade size	Clamping Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)
13,83-14,49	16	168**	48	120	30	2	10036724 (M4x0,5LH/RHx6,5)	30026300 (PX25R)	10036743 (M3x2,5)	30026264 (GR-12)
14,50-14,82	20	170**	50	120	30	2	10036724 (M4x0,5LH/RHx6,5)	30026300 (PX25R)	10036743 (M3x2,5)	30026264 (GR-12)
14,83-16,49	20	170**	50	120	30	2	10036724 (M4x0,5LH/RHx6,5)	30026300 (PX25R)	10036744 (M3x3)	30026264 (GR-12)
16,50-16,82	20	170**	50	120	30	2	10036724 (M4x0,5LH/RHx6,5)	30026300 (PX25R)	10036745 (M3x4)	30026264 (GR-12)
16,83-17,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026300 (PX25R)	10036745 (M3x4)	30026264 (GR-12)
17,83-19,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026300 (PX25R)	10036751 (M4x3)	30026265 (GR-13)
19,83-21,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036752 (M4x4)	30026265 (GR-13)
21,83-24,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036754 (M4x6)	30026265 (GR-13)
24,83-37,82	20	170	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036755 (M4x8)	30026265 (GR-13)
37,83-50,16	25	176	56	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036755 (M4x8)	30026265 (GR-13)
50,17-80,16	40	190	70	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036755 (M4x8)	30026265 (GR-13)

Sizes in mm.

See page 51 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 1 mm long center spigot for d_1 , less than 22,50 mm.

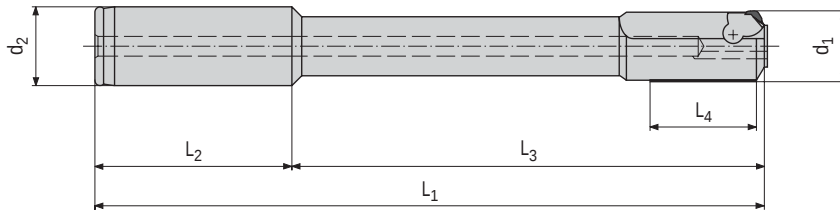
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 78 for selection of indexable blades.

MAPAL HX Single-Bladed Reamers

MN 6044

NC version



Dimensions						Accessories				
$\varnothing d_1^*$	$\varnothing d_2 \text{ h6}$	L_1	L_2	L_3	L_4	Blade size	Clamping Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)
14,83-16,49	20	170**	50	120	30	2	10036724 (M4x0,5LH/RHx6,5)	30026300 (PX25R)	10036744 (M3x3)	30026264 (GR-12)
16,50-16,82	20	170**	50	120	30	2	10036724 (M4x0,5LH/RHx6,5)	30026300 (PX25R)	10036745 (M3x4)	30026264 (GR-12)
16,83-17,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026300 (PX25R)	10036745 (M3x4)	30026264 (GR-12)
17,83-19,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026300 (PX25R)	10036751 (M4x3)	30026265 (GR-13)
19,83-21,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036752 (M4x4)	30026265 (GR-13)
21,83-24,82	20	170**	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036754 (M4x6)	30026265 (GR-13)
24,83-37,82	20	170	50	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036755 (M4x8)	30026265 (GR-13)
37,83-50,16	25	176	56	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036755 (M4x8)	30026265 (GR-13)
50,17-80,16	40	190	70	120	30	2	10036725 (M4x0,5LH/RHx9)	30026301 (PX26R)	10036755 (M4x8)	30026265 (GR-13)

Sizes in mm.

Guide pad quality: Cermet (CT)

See page 51 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

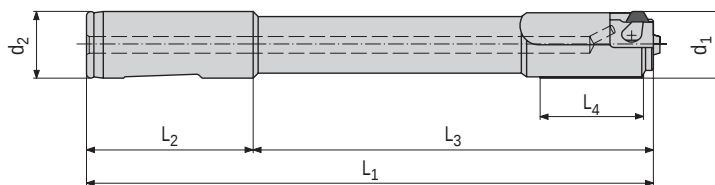
**With 1 mm long center spigot for d_1 , less than 22,50 mm.

See page 78 for selection of indexable blades.

MAPAL HX Single-Bladed Reamers

MN 6123

NC version



Dimensions						Accessories					
$\varnothing d_1^*$	$\varnothing d_{2(-0,003)}$	L_1	L_2	L_3	L_4	Blade size	Cartridge Order No. (size)	Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adj. wedge MN 619 Order No. (size)
13,83-14,49	16	168**	48	120	30	2	30026281 (KX25R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036743 (M3x2,5)	30026271 (GR-30)
14,50-14,82	20	170**	50	120	30	2	30026281 (KX25R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036743 (M3x2,5)	30026271 (GR-30)
14,83-16,49	20	170**	50	120	30	2	30026281 (KX25R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036744 (M3x3)	30026272 (GR-31)
16,50-17,82	20	170**	50	120	30	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036745 (M3x4)	30026272 (GR-31)
17,83-19,82	20	170**	50	120	30	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036747 (M3x6)	30026272 (GR-31)
19,83-21,82	20	170**	50	120	30	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036747 (M3x6)	30026272 (GR-31)
21,83-24,82	20	170**	50	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036752 (M4x4)	30026273 (GR-32)
24,83-29,82	20	170**	50	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036754 (M4x6)	30026273 (GR-32)
29,83-37,82	20	170**	50	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
37,83-39,82	25	176	56	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
39,83-44,82	25	176	56	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
44,83-50,16	25	176	56	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
50,17-54,29	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
54,30-59,79	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
59,80-64,79	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
64,80-69,79	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
69,80-74,49	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
74,50-80,16	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)

Sizes in mm.

See page 52 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 3 mm long center spigot for d_1 , less than 35,83 mm.

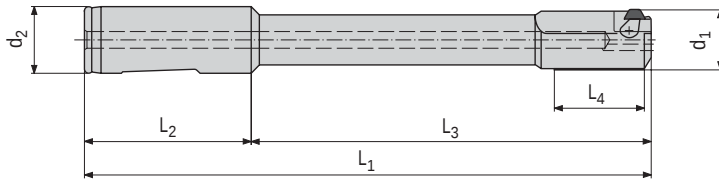
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 78 for selection of indexable blades.

MAPAL HX Single-Bladed Reamers

MN 6124

NC version



Dimensions						Accessories					
$\varnothing d_1^*$	$\varnothing d_2(-0,003)$	L_1	L_2	L_3	L_4	Blade size	Cartridge Order No. (size)	Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adj. wedge MN 619 Order No. (size)
14,83-16,49	20	170	50	120	30	2	30026281 (KX25R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036744 (M3x3)	30026272 (GR-31)
16,50-17,82	20	170	50	120	30	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036745 (M3x4)	30026272 (GR-31)
17,83-19,82	20	170	50	120	30	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036747 (M3x6)	30026272 (GR-31)
19,83-21,82	20	170	50	120	30	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036747 (M3x6)	30026272 (GR-31)
21,83-24,82	20	170	50	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036752 (M4x4)	30026273 (GR-32)
24,83-29,82	20	170	50	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036754 (M4x6)	30026273 (GR-32)
29,83-37,82	20	170	50	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
37,83-50,16	25	176	56	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
50,17-80,16	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)

Sizes in mm.

See page 52 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

When ordering, please state required guide pad grade (Carbide, Cermet or PCD).

Unless stated, the guide pads will be supplied in Cermet.

See page 78 for selection of indexable blades.

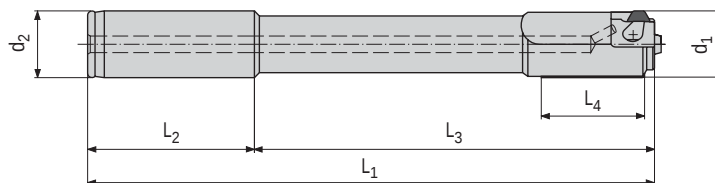
Important Note:
Diameter range d_1
from 14,83 - 37,82 mm
with center spigot:

$\varnothing d_1$	Pin length
14,83 - 16,49	3
16,50 - 17,82	2,5
17,83 - 21,82	1,5
21,83 - 25,82	3
25,83 - 27,82	2,5
27,83 - 37,82	1,5

MAPAL HX Single-Bladed Reamers

MN 6143

NC version



Dimensions						Accessories					
$\varnothing d_1^*$	$\varnothing d_2 \text{ h}_6$	L_1	L_2	L_3	L_4	Blade size	Cartridge Order No. (size)	Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adj. wedge MN 619 Order No. (size)
13,83-14,49	16	168**	48	120	30	2	30026281 (KX25R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036743 (M3x2,5)	30026271 (GR-30)
14,50-14,82	20	170**	50	120	30	2	30026281 (KX25R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036743 (M3x2,5)	30026271 (GR-30)
14,83-16,49	20	170**	50	120	30	2	30026281 (KX25R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036744 (M3x3)	30026272 (GR-31)
16,50-17,82	20	170**	50	120	30	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036745 (M3x4)	30026272 (GR-31)
17,83-19,82	20	170**	50	120	30	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036747 (M3x6)	30026272 (GR-31)
19,83-21,82	20	170**	50	120	30	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036747 (M3x6)	30026272 (GR-31)
21,83-24,82	20	170**	50	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036752 (M4x4)	30026273 (GR-32)
24,83-29,82	20	170**	50	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036754 (M4x6)	30026273 (GR-32)
29,83-37,82	20	170**	50	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
37,83-39,82	25	176	56	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
39,83-44,82	25	176	56	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
44,83-50,16	25	176	56	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
50,17-54,29	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
54,30-59,79	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
59,80-64,79	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
64,80-69,79	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
69,80-74,49	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
74,50-80,16	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)

Sizes in mm.

See page 52 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 3 mm long center spigot for d_1 , less than 35,83 mm.

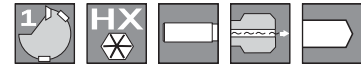
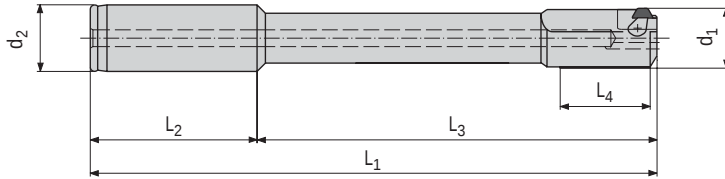
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 78 for selection of indexable blades.

MAPAL HX Single-Bladed Reamers

MN 6144

NC version



Dimensions						Accessories					
$\varnothing d_1^*$	$\varnothing d_2 \text{ h6}$	L_1	L_2	L_3	L_4	Blade size	Cartridge Order No. (size)	Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adj. wedge MN 619 Order No. (size)
14,83-16,49	20	170	50	120	30	2	30026281 (KX25R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036744 (M3x3)	30026272 (GR-31)
16,50-17,82	20	170	50	120	30	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036745 (M3x4)	30026272 (GR-31)
17,83-19,82	20	170	50	120	30	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036747 (M3x6)	30026272 (GR-31)
19,83-21,82	20	170	50	120	30	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036747 (M3x6)	30026272 (GR-31)
21,83-24,82	20	170	50	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036752 (M4x4)	30026273 (GR-32)
24,83-29,82	20	170	50	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036754 (M4x6)	30026273 (GR-32)
29,83-37,82	20	170	50	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
37,83-50,16	25	176	56	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)
50,17-80,16	40	190	70	120	30	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026273 (GR-32)

Sizes in mm.

See page 52 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

When ordering, please state required guide pad grade (Carbide, Cermet or PCD).

Unless stated, the guide pads will be supplied in Cermet.

See page 78 for selection of indexable blades.

Important Note:
Diameter range d_1
from 14,83 - 37,82 mm
with center spigot:

$\varnothing d_1$	Pin length
14,83 - 16,49	3
16,50 - 17,82	2,5
17,83 - 21,82	1,5
21,83 - 25,82	3
25,83 - 27,82	2,5
27,83 - 37,82	1,5



Machining Values for MAPAL WP Single-Bladed Reamers

The machining values given are guide-lines. The optimum data for the particular machining operation should be calculated from trials or during the operation.

The standard grades of guide pads for MAPAL reamers are carbide or Cermet. These require a sufficient film of lubricant. By using PCD guide pads the surface quality and life of the pads can be considerably improved.

Minimal lubrication

MAPAL reamers can be supplied on request in a special design for minimal lubrication.

Coolant

Any standard commercial emulsions with a 1:9 mixture are suitable for use with MAPAL reamers. When using PCD guide pads, the proportion of emulsion can be reduced. The best tool life is achieved with emulsions which contain mineral oil.

Guide line values for coolant pressure and quantity for reamers with internal coolant supply

Ø range	Quantity litre/min	Pressure bar
8 - 12	10 - 15	10 - 30
12 - 15	15 - 30	10 - 20
15 - 20	20 - 40	10 - 15
20 - 30	30 - 60	5 - 10
30 - 50	50 - 200	3 - 8
50 - 100	150 - 300	3 - 6

Material	Series with external coolant supply Cutting lead form AD + AS Cutting depth 0,05 - 0,25 mm												Series with internal coolant supply Cutting lead form AD Cutting depth 0,05 - 0,25 mm												
	R _m N/mm ²	Feed f* (mm/rev)	Top rake			Cutting speed for cutting material								Feed f* (mm/rev)	Top rake			Cutting speed for cutting material							
						1		2				3	4					1		2			3	4	
			0°	6°	12°	N	A	W	X	YE	CT3	YL	0°		6°	12°	N	A	W	X	YE	CT3	YL		
Unalloyed steel: structural-, cast-, free cutting-, case hardened steel	< 500	0,1 - 0,4		◦	•	20-40	20-40		20-40	30-50	< 60	< 60	0,1 - 0,4		◦	•	40-60	40-60		40-60	60-100	110-160	110-160		
Unalloyed/low alloyed steel: structural-, cast-, heat treat-, tool steel, case hardened steel	500 - 900	0,1 - 0,4		◦	•	20-40	20-40		20-40	30-50	< 60	< 60	0,1 - 0,4		◦	•	40-60	40-60		40-60	60-100	110-160	110-160		
Lead alloyed free cutting steel		0,1 - 0,4		◦	•	20-40	20-40		20-40	30-50	< 60	< 60	0,1 - 0,4		◦	•	40-60	40-60		40-60	60-100	110-160	110-160		
Unalloyed/low alloyed steel: temp. resisting structural-, heat treat-, nitride-, tool steel	> 900	0,1 - 0,4		◦	•	20-40	20-40		20-40	30-50	< 60	< 60	0,1 - 0,4		◦	•	40-60	40-60		40-60	60-100	110-160	110-160		
High alloyed steel: Tool steel		0,1 - 0,4		◦	•	20-30	20-30			20-40	< 50	< 50	0,1 - 0,4		◦	•	20-40	20-40			< 60	< 60	< 60		
Special alloyed steel, sintered materials						Please ask													Please ask						
Stainless steel	< 600	0,1 - 0,3		◦	•	20-30	20-30			20-40	< 60	< 60	0,1 - 0,3		◦	•	20-40	20-40			60	60	60		
Stainless steel	> 600	0,1 - 0,3		◦	•	20-30	20-30			20-40	< 60	< 60	0,1 - 0,3		◦	•	20-40	20-40			60	60	60		
Stainless/heat resisting steel	> 750	0,1 - 0,3		•	◦	20-30	20-30			20-40	< 60	< 60	0,1 - 0,3		•	◦	20-40	20-40			60	60	60		
Grey cast iron		0,2 - 0,4	•	◦		30-40	30-40	40-50					0,1 - 0,4	•	◦		40-60	40-60	60-100						
Alloyed grey cast iron		0,1 - 0,3	◦	•		30-41	30-41	40-50					0,1 - 0,3	◦	•		40-60	40-60	60-100						
Nodular iron ferritic/pearlitic; Malleable iron: GGG40 - GGG55, GTW35 - GTW55, GTS35 - GTS55	< 600	0,1 - 0,3		•	◦	30-42	30-42	40-50					0,1 - 0,3		•	◦	40-60	40-60	60-100						
Nodular iron pearlitic; Malleable iron: GGG60 - GGG80, GTW65, GTS65 - GTS70	> 600	0,1 - 0,3		•	◦	30-43	30-43	40-50					0,1 - 0,3		•	◦	40-60	40-60	60-100						
Alloyed nodular iron		0,1 - 0,3		•	◦	30-44	30-44	40-50					0,1 - 0,3		•	◦	40-60	40-60	60-100						
Titanium, titanium iron		0,08 - 0,2		◦	•	20-40	20-40				< 40		0,08 - 0,2		◦	•	< 30	< 30				< 40			
Copper alloy, brass, lead alloyed bronze with long chips		0,1 - 0,25		◦	•	30-40	30-40				< 60		0,1 - 0,25		◦	•	80-100	80-100							
Copper, copper alloy, alu-, manganese-, phosphorus bronze with short chips		0,1 - 0,3	•	◦		30-40	30-40				< 60		0,1 - 0,3	•	◦		80-100	80-100							
Alu wrought alloy, magnesium wrought alloy		0,1 - 0,3			•	30-40	30-40				< 60		Not recommended					160-180	160-180						
Alu-casting alloy Si-content < 10 %, magnesium alloy		0,1 - 0,3		◦	•	30-40	30-40				< 60		0,1 - 0,3		◦	•	160-180	160-180							
Alu-casting alloy Si-content > 10 %, magnesium alloy		0,1 - 0,3		•	◦	30-40	30-40				< 60		0,1 - 0,3		•	◦	180-230	180-230							
Plastics							Please ask													Please ask					
Reinforced plastics							Please ask													Please ask					

Pre-machining

The allowance for reaming should be selected so that the cutting depth for reaming is greater than the pre-machining depth. The most favourable value is a cutting depth of approx. 0,15 mm, i.e. with a 0,3 mm allowance in the diameter.

Cutting lead form

The double cutting lead WP-AD and WP-AS should preferably be used, which with roughing blade is 15° and 30° finishing blade 3°.

For details on the cutting lead forms, see Page 77.

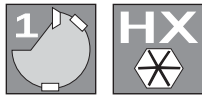
Cutting materials

MAPAL offers a broad-based selection of cutting materials so that the right cutting material can be used for every material.

- 1 Carbide
- 2 coated Carbide
- 3 Cermet
- 4 coated Cermet
- 5 PCD polycrystalline diamond
- 6 PCBN polycrystalline cubic boron nitride

- Preferred radial rake
- Alternative radial rake for special cases
- * For high cutting speeds and large cutting depth, select small feed rates
- ** Feed limited because of extremely short cutting lead length

			Series with internal coolant supply																																
			Cutting lead form AS + EK														Cutting lead form AZ																		
			Cutting depth AS 0,05 - 0,25 mm, EK 0,05 - 0,15 mm														Cutting depth 0,05 - 0,4 mm																		
			Feed for AS f*		Feed for EK f**		Top rake		Cutting speed for cutting material								Feed f*		Top rake		Cutting speed for cutting material														
5	6								1		2		3	4	5	6																			
D	FT01	FT02	(mm/rev)	(mm/rev)	0°	6°	12°	N	A	W	X	YE	CT3	YL	D	FT01	FT02	(mm/rev)	0°	6°	12°	N	A	W	CT3	D	FT01	FT02							
			0,1 - 0,3	0,08 - 0,2	◦	•	60-80	60-80		60-80	80-120	130-180	130-180					0,08 - 0,2	◦	•															
			0,1 - 0,3	0,08 - 0,2	◦	•	60-80	60-80		60-80	80-120	130-180	130-180					0,08 - 0,2	◦	•															
			0,1 - 0,3	0,08 - 0,2	◦	•	60-80	60-80		60-80	80-120	130-180	130-180					0,08 - 0,2	◦	•															
			0,1 - 0,3	0,08 - 0,2	◦	•	60-80	60-80		60-80	80-120	130-180	130-180					0,08 - 0,2	◦	•															
			0,1 - 0,3	0,08 - 0,2	◦	•	40-60	40-60			< 80	< 80	< 80					0,08 - 0,2	◦	•															
								Please ask												Please ask															
			0,1 - 0,2	0,08 - 0,2	◦	•	40-60	40-60			80	80	80					0,08 - 0,2	◦	•															
			0,1 - 0,2	0,08 - 0,2	◦	•	40-60	40-60			80	80	80					0,08 - 0,2	◦	•															
			0,1 - 0,2	0,08 - 0,2	•	◦	40-60	40-60			80	80	80					0,08 - 0,2	•	◦															
		Subject to discussion for cast iron or hard machining 400-700	0,1 - 0,3	0,08 - 0,2	•	◦	60-80	60-80	80-120						Subject to discussion for cast iron or hard machining 400-700		0,08 - 0,2	•	◦	60-80	60-80	80-120						Subject to discussion for cast iron or hard machining 400-700							
			0,1 - 0,3	0,08 - 0,2	◦	•	60-80	60-80	80-120								0,08 - 0,2	◦	•	60-80	60-80	80-120													
			0,1 - 0,3	0,08 - 0,2	•	◦	60-80	60-80	80-120								0,08 - 0,2	•	◦	60-80	60-80	80-120													
			0,1 - 0,3	0,08 - 0,2	•	◦	60-80	60-80	80-120								0,08 - 0,2	•	◦	60-80	60-80	80-120													
			0,1 - 0,3	0,08 - 0,2	•	◦	60-80	60-80	80-120								0,08 - 0,2	•	◦	60-80	60-80	80-120													
			0,08 - 0,15	0,08 - 0,15	◦	•	< 50	< 50				< 60						0,08 - 0,15	◦	•	< 50	< 50		< 60											
Subject to discussion > 200			0,1 - 0,25	0,08 - 0,2	◦	•	100-120	100-120							Subject to discussion > 200		0,08 - 0,2	◦	•	100-120	100-120						Subject to discussion > 200								
			0,1 - 0,3	0,08 - 0,2	•	◦	100-120	100-120									0,08 - 0,2	•	◦	100-120	100-120														
			0,08 - 0,2	0,08 - 0,2	◦	•	180-200	180-200									0,08 - 0,2	◦	•	180-200	180-200														
			0,1 - 0,3	0,08 - 0,2	◦	•	180-200	180-200									0,08 - 0,2	◦	•	180-200	180-200														
			0,08 - 0,3	0,08 - 0,2	◦	•	200-250	200-250									0,08 - 0,2	◦	•	200-250	200-250														
								Please ask												Please ask															
								Please ask												Please ask															



Machining Values for MAPAL HX Single-Bladed Reamers

The machining values given are guide-lines. The optimum data for the particular machining operation should be calculated from trials or during the operation.

The standard grades of guide pads for MAPAL reamers are carbide or Cermet. These require a sufficient film of lubricant. By using PCD guide pads the surface quality and life of the pads can be considerably improved.

Minimal lubrication
MAPAL reamers can be supplied on request in a special design for minimal lubrication.

Coolant
Any standard commercial emulsions with a 1:9 mixture are suitable for use with MAPAL reamers. When using PCD guide pads, the proportion of emulsion can be reduced. The best tool life is achieved with emulsions which contain mineral oil.

Guide line values for coolant pressure and quantity for reamers with internal coolant supply

Ø range	Quantity litre/min	Pressure bar
---------	--------------------	--------------

8 - 12	10 - 15	10 - 30
12 - 15	15 - 30	10 - 20
15 - 20	20 - 40	10 - 15
20 - 30	30 - 60	5 - 10
30 - 50	50 - 200	3 - 8
50 - 100	150 - 300	3 - 6

Material	R _m N/mm ²	HX blades for series with internal Cutting lead form R 0,8 and R 1,5 /								
		Feed f* (mm/rev)	Top rake			Cutting speed for cutting material				
						1		2		3
			0°	3°	6°	H	A	W	YE	CT3
Unalloyed steel: structural-, cast-, free cutting-, case hardened steel	< 500	0,1 - 0,25		◦	•	40 - 60	40 - 60		60 - 100	110 - 160
Unalloyed/low alloyed steel: structural-, cast-, heat treat-, tool steel, case hardened steel	500 - 900	0,1 - 0,25		◦	•	40 - 60	40 - 60		60 - 100	110 - 160
Lead alloyed free cutting steel		0,1 - 0,25		◦	•	40 - 60	40 - 60		60 - 100	110 - 160
Unalloyed/low alloyed steel: temp. resisting structural-, heat treat-, nitride-, tool steel	> 900	0,1 - 0,25		◦	•	40 - 60	40 - 60		60 - 100	110 - 160
High alloyed steel: Tool steel		0,1 - 0,25		◦	•	20 - 40	20 - 40		< 60	< 60
Special alloyed steel, sintered materials									Please ask	
Stainless steel	< 600	0,08 - 0,15		◦	•	20 - 40	20 - 40		60	60
Stainless steel	> 600	0,08 - 0,15		◦	•	20 - 40	20 - 40		60	60
Stainless/heat resisting steel	> 750	0,08 - 0,15			• ◦	20 - 40	20 - 40		60	60
Grey cast iron		0,1 - 0,25	•	◦		40 - 60	40 - 60	60 - 100		
Alloyed grey cast iron		0,1 - 0,25	◦	•		40 - 60	40 - 60	60 - 100		
Nodular iron ferritic/pearlitic; Malleable iron: GGG40 - GGG55, GTW35 - GTW55, GTS35 - GTS55	< 600	0,1 - 0,25			• ◦	40 - 60	40 - 60	60 - 100		
Nodular iron pearlitic; Malleable iron: GGG60 - GGG80, GTW65, GTS65 - GTS70	> 600	0,1 - 0,25			• ◦	40 - 60	40 - 60	60 - 100		
Alloyed nodular iron		0,1 - 0,25			• ◦	40 - 60	40 - 60	60 - 100		
Titanium, titanium iron		0,08 - 0,15		◦	•	< 30	< 30			< 40
Copper alloy, brass, lead alloyed bronze with long chips		0,1 - 0,2		◦	•	80 - 100	80 - 100			
Copper, copper alloy, alu-, manganese-, phosphorus bronze with short chips		0,1 - 0,25	•	◦		80 - 100	80 - 100			
Alu wrought alloy, magnesium wrought alloy		0,08 - 0,2		◦	•	160 - 180	160 - 180			
Alu-casting alloy Si-content < 10 %, magnesium alloy		0,1 - 0,25		◦	•	160 - 180	160 - 180			
Alu-casting alloy Si-content > 10 %, magnesium alloy		0,08 - 0,25		◦	•	180 - 230	180 - 230			
Plastics									Please ask	
Reinforced plastics									Please ask	

Pre-machining

The allowance for reaming should be selected so that the cutting depth for reaming is greater than the pre-machining depth. The most favourable value is a cutting depth of approx. 0,15 mm, i.e. with a 0,3 mm allowance in the diameter.

Cutting lead form

The HX blades can be supplied with radius cutting leads of R 0,8 and R 1,5 and for HX blades with clamping groove with radius R 0,8 only.

For details on the cutting lead forms, see Pages 78-79.

Cutting materials

MAPAL offers a broad-based selection of cutting materials so that the right cutting material can be used for every material. When machining steel with HX reamers, we recommend the use of Cermet or coated Cermet. This will produce excellent surfaces at high cutting speeds.

- 1 Carbide
- 2 coated Carbide
- 3 Cermet
- 4 coated Cermet
- 5 PCD polycrystalline diamond
- 6 PCBN polycrystalline cubic boron nitride

- Preferred radial rake
- Alternative radial rake for special cases
- * For high cutting speeds and large cutting depth, select small feed rates
- *** 1 = for steel and long-chip materials
2 = for cast iron and short-chip materials

without clamping groove
coolant supply
Cutting depth 0,05 - 0,25 mm

Cutting speed for cutting material			
4	5	6	
YL	D	FT01	FT02

HX blades with clamping groove
for series with internal coolant supply
Cutting lead form R 0,8 / Cutting depth 0,05 - 0,25 mm

Cutting speed for cutting material				Feed f* (mm/rev)	Chip form geometry		Cutting speed for cutting material								
							1		2		3	4	5	6	
4 YL	5 D	6 FT01 FT02			2	1	H	A	W	YE	CT3	YL	D	FT01	FT02
110 - 160				0,1 - 0,25	•		60 - 80	60 - 80		80 - 120	130 - 180	130 - 180			
110 - 160				0,1 - 0,25	•		60 - 80	60 - 80		80 - 120	130 - 180	130 - 180			
110 - 160				0,1 - 0,25	•		60 - 80	60 - 80		80 - 120	130 - 180	130 - 180			
110 - 160				0,1 - 0,25	•		60 - 80	60 - 80		80 - 120	130 - 180	130 - 180			
< 60				0,1 - 0,25	•		40 - 60	40 - 60		< 80	< 80	< 80			
										Please ask					
60				0,08 - 0,15	•		40 - 60	40 - 60		80	80	80			
60				0,08 - 0,15	•		40 - 60	40 - 60		80	80	80			
60				0,08 - 0,15	•		40 - 60	40 - 60		80	80	80			
		Subject to discussion for cast iron or hard machining 400-700		0,1 - 0,25	•		60 - 80	60 - 80	80 - 120					Subject to discussion for cast iron or hard machining 400-700	
				0,1 - 0,25	•		60 - 80	60 - 80	80 - 120						
				0,1 - 0,25	•		60 - 80	60 - 80	80 - 120						
				0,1 - 0,25	•		60 - 80	60 - 80	80 - 120						
				0,1 - 0,25	•		60 - 80	60 - 80	80 - 120						
				0,08 - 0,15	•		< 50	< 50			< 60				
	Subject to discussion > 200			0,1 - 0,2	•		100 - 120	100 - 120					Subject to discussion > 200		
				0,1 - 0,25	•		100 - 120	100 - 120							
				0,08 - 0,2	•		180 - 200	180 - 200							
				0,1 - 0,25	•		180 - 200	180 - 200							
				0,08 - 0,25	•		200 - 250	200 - 250							
										Please ask					
										Please ask					

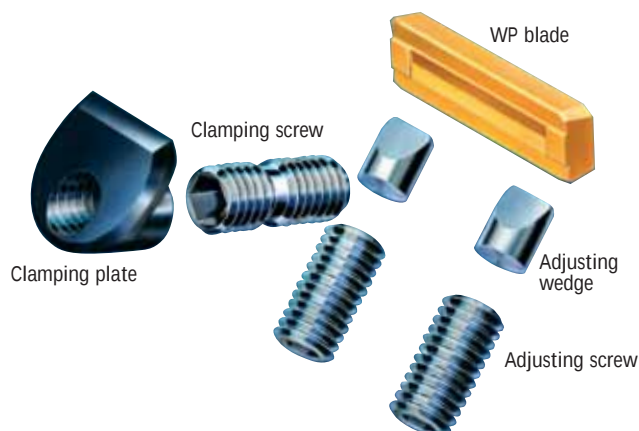
Setting Instructions for MAPAL WP Single-Bladed Reamers:

MN 2000 to MN 2004

MN 2023, MN 2024

MN 2034, MN 2043

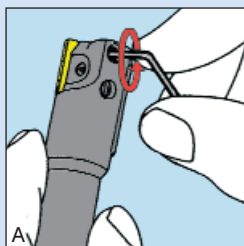
MN 2044



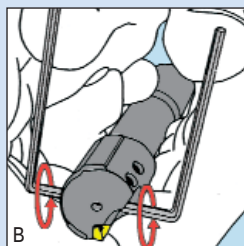
Accessories

Indexable blade	Torx screw/ Clamping screw MN 618	Clamping plate	Adjusting screw MN 620	Adjusting wedge MN 619
1 off	1 off	1 off	2 off	2 off

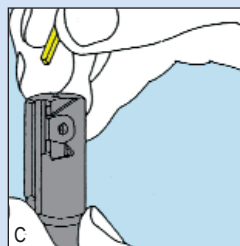
Changing and setting the blade



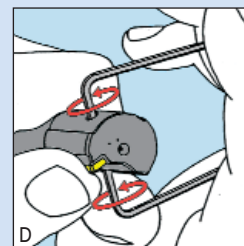
Turn the front and back adjusting screw 1/2 turn anti-clockwise.



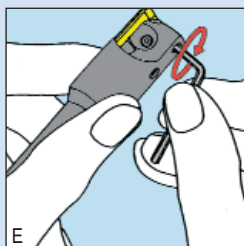
Turn torx screw or clamping screw anti-clockwise from the top and clockwise from the bottom. Two keys need to be used to open (as shown). The clamping plate will be loosened.



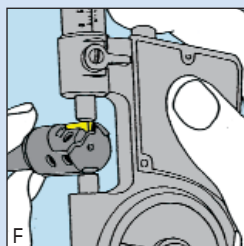
1. Remove blade.
2. Clean the blade and blade seat (do not use compressed air – note the adjusting wedge).
3. Turn the blade or insert new blade.



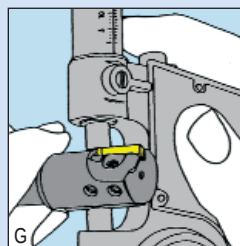
1. Press blade against back stop and adjusting wedge.
2. Turn torx screw or clamping screw clockwise from the top and anti-clockwise from the bottom. Two keys need to be used to open (as shown). The clamping plate will be tightened.



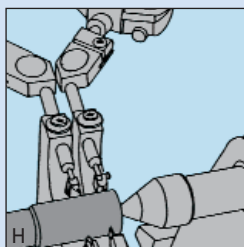
For rough adjustment, turn the front and back adjusting screw clockwise again 1/4 turn.



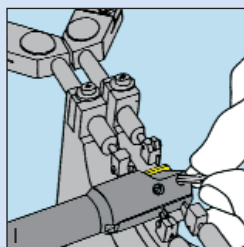
1. For measurement and precision setting we recommend a precision micrometer.
2. Set the front and rear setting dimension for varying intervals with the adjusting screw. Back tapering to rear approx. 0,01 to 0,015 mm.



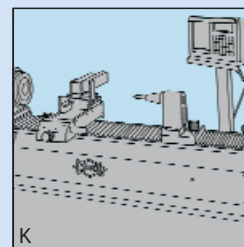
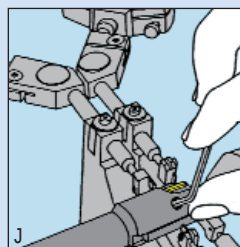
To make handling easier and ensure reliable setting, we recommend the use of a MAPAL setting device.



With the setting mandrel (must be ordered separately) calibrate the MASTERSET. Setting mandrel has the minimum dimension for the bore.



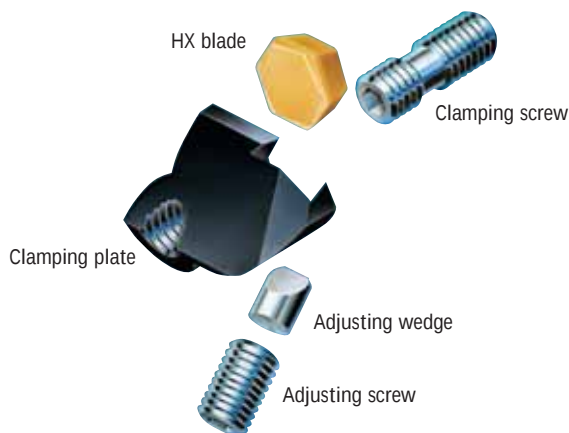
Set the front and rear setting dimension for varying intervals with the adjusting screw. Back tapering to rear approx. 0,01 to 0,015 mm.



MAPAL UNISET: For easy setting of reamers MAPAL supplies electronic setting devices in vertical and horizontal designs. Please ask for our special brochure on "Setting Devices".

Detailed setting notes can be found in the equipment's operating instructions.

Note: For setting with the fixed bridge method, see WP Twin-Bladed Reamers, Page 70.

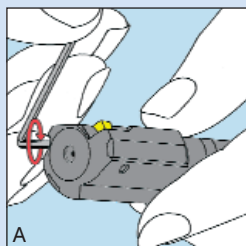


Setting Instructions for MAPAL HX Single-Bladed Reamers: MN 6023, MN 6024 MN 6043, MN 6044

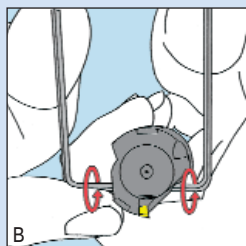
Accessories

Indexable blade	Clamping screw MN 618	Clamping plate	Adjusting screw MN 620	Adjusting wedge MN 619
1 off	1 off	1 off	1 off	1 off

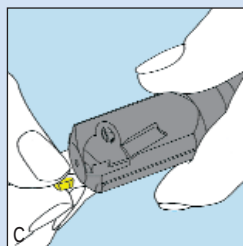
Changing and setting the blade



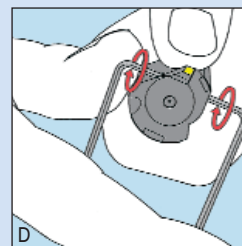
Turn the adjusting screw 1/2 turn anti-clockwise.



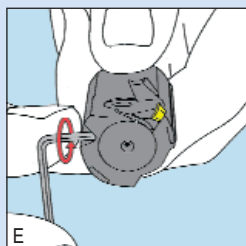
Turn clamping screw anti-clockwise from the top and clockwise from the bottom. Two keys need to be used to open (as shown). The clamping plate will be loosened.



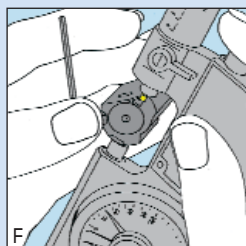
1. Remove blade.
2. Clean blade and blade seat (do not use compressed air – note the adjusting wedge).
3. Turn the blade 60° or insert new blade in cartridge.



1. Fit blade and press into pocket.
2. Turn clamping screw clockwise from the top and anti-clockwise from the bottom. Two keys need to be used to open (as shown). The clamping plate will be tightened.

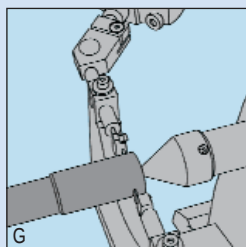


For rough adjustment, turn the adjusting screw clockwise again 1/4 turn.

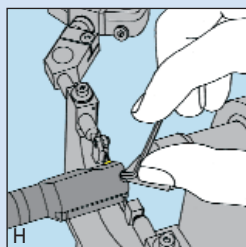


1. For measurement and precision setting we recommend a precision micrometer.
2. Set the required setting dimensions by turning the adjusting screw clockwise.

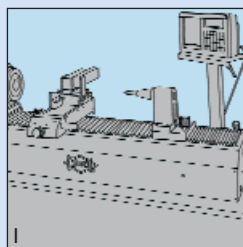
To make handling easier and ensure reliable setting, we recommend the use of a MAPAL setting device.



With the setting mandrel (must be ordered separately) calibrate the MASTERSET. Setting mandrel has the minimum dimension for the bore.



Set the required setting dimensions by turning the adjusting screw clockwise.

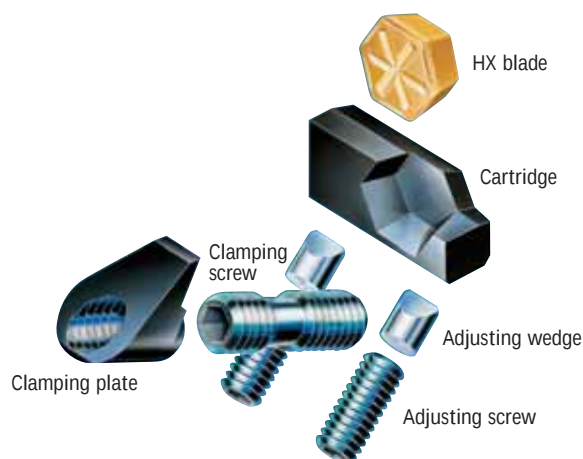


MAPAL UNISSET: For easy setting of reamers MAPAL supplies electronic setting devices in vertical and horizontal designs. Please ask for our special brochure on "Setting Devices".

Detailed setting notes can be found in the equipment's operating instructions.
Note: For setting with the fixed bridge method, see WP Twin-Bladed Reamers, Page 70.

Setting Instructions for MAPAL HX Single-Bladed Reamers Size 2 and Size 3:

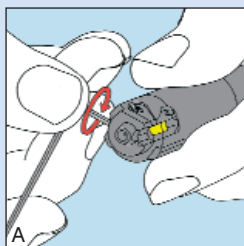
MN 6123, MN 6124
MN 6143, MN 6144



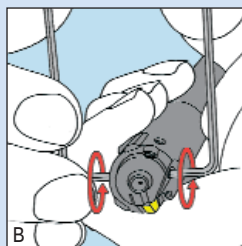
Accessories

Indexable blade	Cartridge	Clamping screw MN 618	Clamping plate	Adjusting screw MN 620	Adjusting wedge MN 619
1 off	1 off	1 off	1 off	2 off	2 off

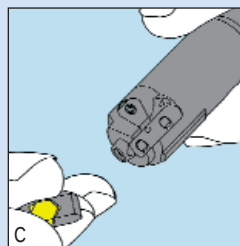
Changing and setting the blade



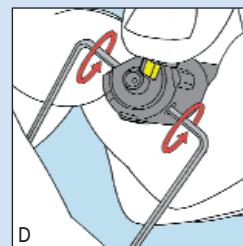
Turn the front and back adjusting screw 1/2 turn anti-clockwise.



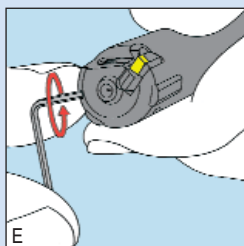
Turn clamping screw anti-clockwise from the top and clockwise from the bottom. Two keys need to be used to open (as shown). The clamping plate and cartridge will be loosened.



1. Remove blade and cartridge.
2. Clean blade, cartridge and blade seat (do not use compressed air – note the adjusting wedge).
3. Turn the blade 60° or insert new blade in cartridge.
4. Replace cartridge.

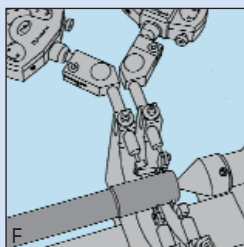


1. Press blade and cartridge against back stop and adjusting wedge.
2. Turn clamping screw clockwise from the top and anti-clockwise from the bottom. Two keys need to be used to open (as shown). The clamping plate will be tightened.

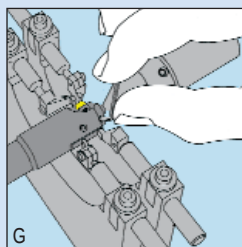


For rough adjustment, turn the front and back adjusting screw clockwise again 1/4 turn.

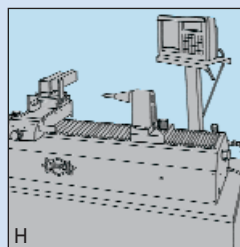
To make handling easier and ensure reliable setting, we recommend the use of a MAPAL setting device.



With the setting mandrel (must be ordered separately) calibrate the MASTERSET. Setting mandrel has the minimum dimension for the bore.



Set the front and rear setting dimension for varying intervals with the adjusting screw. Back tapering to rear approx. 0,005 to 0,010 mm.



MAPAL UNISET: For easy setting of reamers MAPAL supplies electronic setting devices in vertical and horizontal designs. Please ask for our special brochure on "Setting Devices".

Detailed setting notes can be found in the equipment's operating instructions.

Note: For setting with the fixed bridge method, see WP Twin-Bladed Reamers, Page 70.

MAPAL Setting Devices - Setting with maximum precision!

To allow the described setting procedures to be carried out easily, quickly and with high precision, MAPAL has a series of setting devices in its programme. From a mechanical to an electronic system with tool management, these setting devices offer the optimum solution for precision tool setting.



MAPAL MASTERSET

MAPAL MASTERSET

This mechanical setting device is designed for setting standard and simple special tools. Because of its modular construction, the basic device can be extended with numerous optional units. With a few simple hand movements, the MAPAL MASTERSET is converted into a vertical unit using the vertical stand. The advantages of this are the ability to hold heavy and long tools and hold tools directly in the HSK system.



MAPAL UNISET-H

MAPAL UNISET

The setting devices from the MAPAL UNISET series are distinguished by significant advantages with regard to universal use. In addition to precision tools for machining bores, milling tools can also be adjusted and measured. The basic equipment for these devices are two highly accurate scanning systems, with which the tools are set to an absolute measurement uncertainty of $\pm 1 \mu\text{m}$.

MAPAL UNISET-H

The MAPAL UNISET-H is the horizontal version of the UNISET setting devices. In the basic version, with a 600 or 900 mm centre width, these setting devices guarantee high precision and reliable setting for the precision tools. Optional equipment, such as spindle headstock and projector, also allow this to be used for a wider range of tools. The measurement results for the axes can be recorded with a printer.



MAPAL UNISET-V

MAPAL UNISET-V

The vertical version MAPAL UNISET-V has more application options and is very easy to use. In addition to the fact that tools of a high weight are best held vertically, this arrangement offers excellent access to adjusting elements and cutting edges. In addition to a precision spindle held in roller bearings for ISO and HSK shanks, the standard equipment also includes a projector with 20 x magnification and two motorised measuring slides.

Other options, such as extensive measuring software and a tool data management system, also increase user comfort on the equipment.





MAPAL Twin-Bladed Reamers

The MAPAL twin-bladed tools in the WP and HX versions are based on a development which retains the tried and tested element and adds a new one. The tried and tested element is the MAPAL single-blade principle, the new one is the second blade which is arranged in a specific position on the tool head.

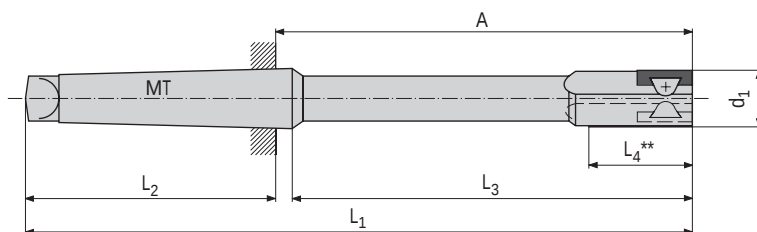
Both blades are ground to the highest precision, both are clamped and can be sensitively adjusted. However, the blades are not arranged in the same positions but offset radially and axially to one another. This means that the follow-on blade only machines to a very small chip thickness. This allows micro cutting, which ensures excellent surface finishes and outstanding tool life. When machining cast iron and steel materials in particular these tools often produce better results than the single-bladed reamers.

The principle of micro cutting is often advantageous for producing good, economical results under certain conditions. As a result hardened steels are machined with great success with MAPAL twin-bladed tools and with PCBN tipped blades. With this machining task it is advisable to fit the tools with PCD guide pads.



MAPAL WP Twin-Bladed Reamers

MN 2200



Dimensions						Accessories					
ø d ₁ *	L ₁	L ₂	L ₃	MT	Length A	Blade size	Clamping		Adjusting		
							Torx screw/ Clamping screw Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)	
14,30-15,29	180	62	114,5	1	118	90	Torx screw	10036784 (M2,5x5,2)	30026287 (GR-1W)	10036732 (M2,5x3)	30026274 (GR-33)
15,30-16,29	200	75	120	2	125	90		10036784 (M2,5x5,2)	30026287 (GR-1W)	10036733 (M2,5x4)	30026274 (GR-33)
16,30-18,29	210	75	130	2	135	90		10036722 (M3LH/RHx6)	30026290 (GR-0V)	10036733 (M2,5x4)	30026274 (GR-33)
18,30-19,29	220	75	140	2	145	91	Clamping screw MN 618	10036722 (M3LH/RHx6)	30026293 (GR-1V)	10036744 (M3x3)	30026272 (GR-31)
19,30-20,29	220	75	140	2	145	91		10036722 (M3LH/RHx6)	30026293 (GR-1V)	10036745 (M3x4)	30026272 (GR-31)
20,30-22,29	230	75	150	2	155	92		10036722 (M3LH/RHx6)	30026295 (GR-2KV)	10036745 (M3x4)	30026272 (GR-31)
22,30-23,29	240	75	160	2	165	92		10036722 (M3LH/RHx6)	30026295 (GR-2KV)	10036747 (M3x6)	30026272 (GR-31)
23,30-24,29	260	94	161	3	166	92		10036722 (M3LH/RHx6)	30026295 (GR-2KV)	10036747 (M3x6)	30026272 (GR-31)
24,30-26,29	260	94	161	3	166	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036753 (M4x5)	30026275 (GR-34)
26,30-28,29	270	94	171	3	176	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036754 (M4x6)	30026275 (GR-34)
28,30-29,29	280	94	181	3	186	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036755 (M4x8)	30026275 (GR-34)
29,30-32,29	290	94	191	3	196	93		10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036754 (M4x6)	30026273 (GR-32)
32,30-35,29	290	117,5	166	4	172,5	93		10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036755 (M4x8)	30026273 (GR-32)
35,30-40,29	310	117,5	186	4	192,5	93		10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036755 (M4x8)	30026273 (GR-32)

Sizes in mm.

External coolant supply requires low cutting speeds and short machining lengths for horizontal use.

See page 70 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate the adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**Pad length L₄ 15 mm.

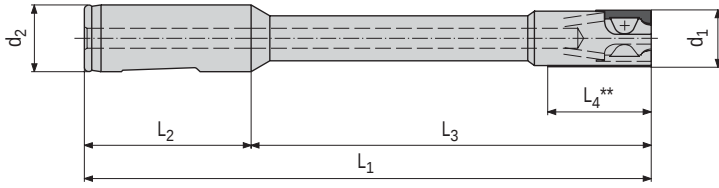
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 76 for selection of indexable blades.

MAPAL WP Twin-Bladed Reamers

MN 2223

NC version



Dimensions					Accessories					
ø d ₁ *	ø d _{2(-0,003)}	L ₁	L ₂	L ₃	Blade size	Clamping		Adjusting		
						Torx screw/ Clamping screw Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)	
14,30-15,29	20	170	50	120	90	Torx screw	10036784 (M2,5x5,2)	30026287 (GR-1W)	10036732 (M2,5x3)	30026274 (GR-33)
15,30-16,29	20	170	50	120	90		10036784 (M2,5x5,2)	30026287 (GR-1W)	10036733 (M2,5x4)	30026274 (GR-33)
16,30-18,29	20	170	50	120	90		10036722 (M3LH/RHx6)	30026290 (GR-0V)	10036733 (M2,5x4)	30026274 (GR-33)
18,30-19,29	20	170	50	120	91	Clamping screw MN 618	10036722 (M3LH/RHx6)	30026293 (GR-1V)	10036744 (M3x3)	30026272 (GR-31)
19,30-20,29	20	170	50	120	91		10036722 (M3LH/RHx6)	30026293 (GR-1V)	10036745 (M3x4)	30026272 (GR-31)
20,30-22,29	20	170	50	120	92		10036722 (M3LH/RHx6)	30026295 (GR-2KV)	10036745 (M3x4)	30026272 (GR-31)
22,30-24,29	20	170	50	120	92		10036722 (M3LH/RHx6)	30026295 (GR-2KV)	10036747 (M3x6)	30026272 (GR-31)
24,30-26,29	20	170	50	120	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036753 (M4x5)	30026275 (GR-34)
26,30-28,29	20	170	50	120	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036754 (M4x6)	30026275 (GR-34)
28,30-29,29	20	170	50	120	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036755 (M4x8)	30026275 (GR-34)
29,30-32,29	20	170	50	120	93		10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036754 (M4x6)	30026273 (GR-32)
32,30-37,79	20	170	50	120	93		10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036755 (M4x8)	30026273 (GR-32)
37,80-40,29	25	176	56	120	93	10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036755 (M4x8)	30026273 (GR-32)	

Sizes in mm.

See page 70 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate the adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**Pad length L_4 15 mm.

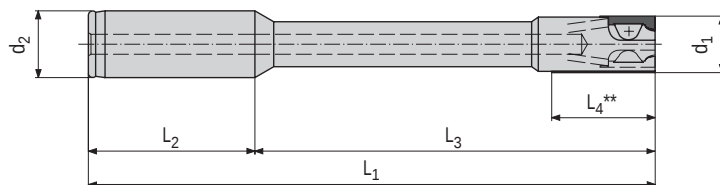
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 76 for selection of indexable blades.

MAPAL WP Twin-Bladed Reamers

MN 2243

NC version



Dimensions					Accessories					
					Blade size	Clamping Torx screw/ Clamping screw Order No. (size)	Clamping plate Order No. (size)	Adjusting		
Ø d ₁ *	Ø d ₂ h ₆	L ₁	L ₂	L ₃				Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)	
14,30-15,29	20	170	50	120	90	Torx screw	10036784 (M2,5x5,2)	30026287 (GR-1W)	10036732 (M2,5x3)	30026274 (GR-33)
15,30-16,29	20	170	50	120	90		10036784 (M2,5x5,2)	30026287 (GR-1W)	10036733 (M2,5x4)	30026274 (GR-33)
16,30-18,29	20	170	50	120	90		Clamping screw MN 618	10036722 (M3LH/RHx6)	30026290 (GR-0V)	10036733 (M2,5x4)
18,30-19,29	20	170	50	120	91	10036722 (M3LH/RHx6)		30026293 (GR-1V)	10036744 (M3x3)	30026272 (GR-31)
19,30-20,29	20	170	50	120	91	10036722 (M3LH/RHx6)		30026293 (GR-1V)	10036745 (M3x4)	30026272 (GR-31)
20,30-22,29	20	170	50	120	92	10036722 (M3LH/RHx6)		30026295 (GR-2KV)	10036745 (M3x4)	30026272 (GR-31)
22,30-24,29	20	170	50	120	92	10036722 (M3LH/RHx6)		30026295 (GR-2KV)	10036747 (M3x6)	30026272 (GR-31)
24,30-26,29	20	170	50	120	92	10036725 (M4x0,5LH/RHx9)		30026297 (GR-2V)	10036753 (M4x5)	30026275 (GR-34)
26,30-28,29	20	170	50	120	92	10036725 (M4x0,5LH/RHx9)		30026297 (GR-2V)	10036754 (M4x6)	30026275 (GR-34)
28,30-29,29	20	170	50	120	92	10036725 (M4x0,5LH/RHx9)		30026297 (GR-2V)	10036755 (M4x8)	30026275 (GR-34)
29,30-32,29	20	170	50	120	93	10036725 (M4x0,5LH/RHx9)		30026299 (GR-3V)	10036754 (M4x6)	30026273 (GR-32)
32,30-37,79	20	170	50	120	93	10036725 (M4x0,5LH/RHx9)		30026299 (GR-3V)	10036755 (M4x8)	30026273 (GR-32)
37,80-40,29	25	176	56	120	93	10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036755 (M4x8)	30026273 (GR-32)	

Sizes in mm.

See page 70 for setting notes and fitting of accessories.

See page 73 for order example.

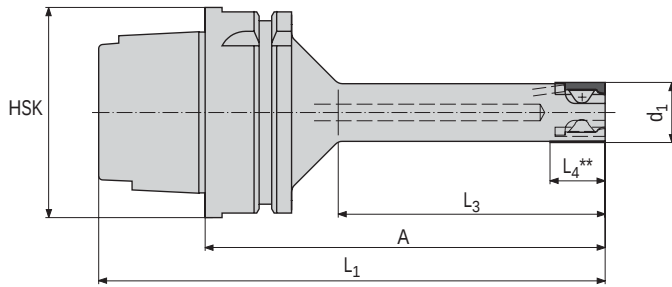
*Values do not indicate the adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**Pad length L_4 15 mm.

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 76 for selection of indexable blades.

MAPAL WP Twin-Bladed Reamers MN 2225



Dimensions					Accessories					
ø d ₁ *	L ₁	L ₃	HSK-A size	Length A	Blade size	Clamping		Adjusting		
						Torx screw/ Clamping screw Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)	
14,30-15,29	122	50	63	90	90	Torx screw	10036784 (M2,5x5,2)	30026287 (GR-1W)	10036732 (M2,5x3)	30026274 (GR-33)
15,30-16,29	132	60	63	100	90		10036784 (M2,5x5,2)	30026287 (GR-1W)	10036733 (M2,5x4)	30026274 (GR-33)
16,30-18,29	142	70	63	110	90		10036722 (M3LH/RHx6)	30026290 (GR-0V)	10036733 (M2,5x4)	30026274 (GR-33)
18,30-19,29	147	75	63	115	91	Clamping screw MN 618	10036722 (M3LH/RHx6)	30026293 (GR-1V)	10036744 (M3x3)	30026272 (GR-31)
19,30-20,29	152	80	63	120	91		10036722 (M3LH/RHx6)	30026293 (GR-1V)	10036745 (M3x4)	30026272 (GR-31)
20,30-22,29	157	85	63	125	92		10036722 (M3LH/RHx6)	30026295 (GR-2KV)	10036745 (M3x4)	30026272 (GR-31)
22,30-24,29	157	85	63	125	92		10036722 (M3LH/RHx6)	30026295 (GR-2KV)	10036747 (M3x6)	30026272 (GR-31)
24,30-25,29	162	90	63	130	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036753 (M4x5)	30026275 (GR-34)
25,30-26,29	167	95	63	135	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036753 (M4x5)	30026275 (GR-34)
26,30-27,29	167	95	63	135	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036754 (M4x6)	30026275 (GR-34)
27,30-28,29	172	100	63	140	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036754 (M4x6)	30026275 (GR-34)
28,30-29,29	172	100	63	140	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036755 (M4x8)	30026275 (GR-34)
29,30-31,29	177	105	63	145	93		10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036754 (M4x6)	30026273 (GR-32)
31,30-32,29	187	110	63	155	93		10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036754 (M4x6)	30026273 (GR-32)
32,30-37,29	187	110	63	155	93		10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036755 (M4x8)	30026273 (GR-32)
37,30-40,29	192	115	63	160	93	10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036755 (M4x8)	30026273 (GR-32)	

Sizes in mm.

See page 70 for setting notes and fitting of accessories.

See page 73 for order example.

For coolant hose and assembly key see page 72 (not included in the supply).

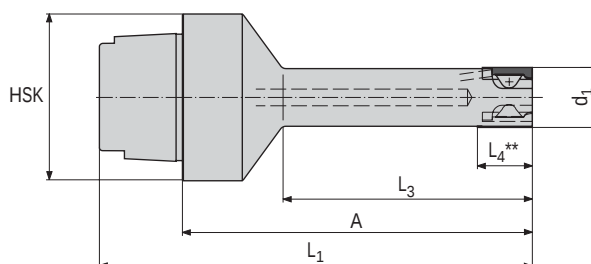
*Values do not indicate the adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**Pad length L_4 15 mm.

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 76 for selection of indexable blades.

MAPAL WP Twin-Bladed Reamers MN 2227



Dimensions					Accessories					
ø d ₁ *	L ₁	L ₃	HSK-C size	Length A	Blade size	Clamping		Adjusting		
						Torx screw/ Clamping screw Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adjusting wedge MN 619 Order No. (size)	
14,30-15,29	95	50	40	75	90	Torx screw	10036784 (M2,5x5,2)	30026287 (GR-1W)	10036732 (M2,5x3)	30026274 (GR-33)
15,30-16,29	105	60	40	85	90		10036784 (M2,5x5,2)	30026287 (GR-1W)	10036733 (M2,5x4)	30026274 (GR-33)
16,30-18,29	115	70	40	95	90	Clamping screw MN 618	10036722 (M3LH/RHx6)	30026290 (GR-0V)	10036733 (M2,5x4)	30026274 (GR-33)
18,30-19,29	120	75	40	100	91		10036722 (M3LH/RHx6)	30026293 (GR-1V)	10036744 (M3x3)	30026272 (GR-31)
19,30-20,29	125	80	40	100	91		10036722 (M3LH/RHx6)	30026293 (GR-1V)	10036745 (M3x4)	30026272 (GR-31)
20,30-22,29	140	85	50	115	92		10036722 (M3LH/RHx6)	30026295 (GR-2KV)	10036745 (M3x4)	30026272 (GR-31)
22,30-24,29	140	85	50	115	92		10036722 (M3LH/RHx6)	30026295 (GR-2KV)	10036747 (M3x6)	30026272 (GR-31)
24,30-25,29	145	90	50	120	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036753 (M4x5)	30026275 (GR-34)
25,30-26,29	150	95	50	125	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036753 (M4x5)	30026275 (GR-34)
26,30-27,29	150	95	50	125	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036754 (M4x6)	30026275 (GR-34)
27,30-28,29	155	100	50	130	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036754 (M4x6)	30026275 (GR-34)
28,30-29,29	172	100	50	130	92		10036725 (M4x0,5LH/RHx9)	30026297 (GR-2V)	10036755 (M4x8)	30026275 (GR-34)
29,30-31,29	160	105	50	135	93		10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036754 (M4x6)	30026273 (GR-32)
31,30-32,29	172	110	63	140	93		10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036754 (M4x6)	30026273 (GR-32)
32,30-37,29	172	110	63	140	93		10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036755 (M4x8)	30026273 (GR-32)
37,30-40,29	177	115	63	145	93		10036725 (M4x0,5LH/RHx9)	30026299 (GR-3V)	10036755 (M4x8)	30026273 (GR-32)

Sizes in mm.

See page 70 for setting notes and fitting of accessories.

See page 73 for order example.

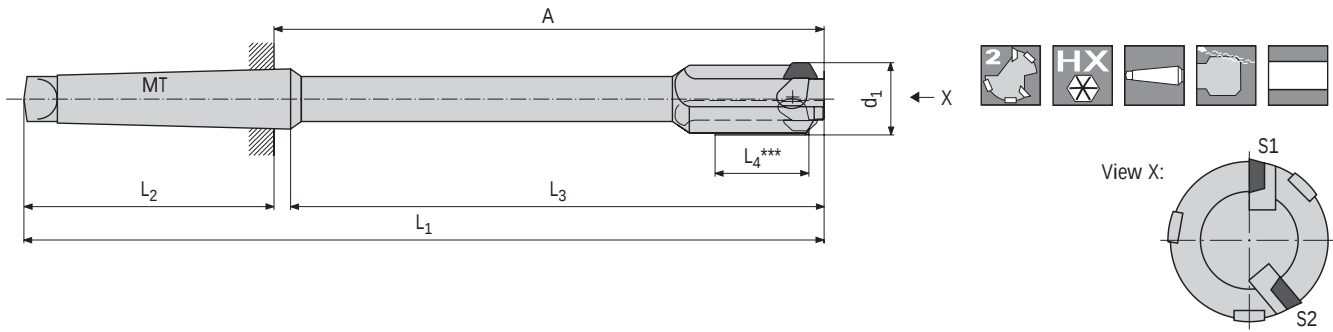
*Values do not indicate the adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**Pad length L_4 15 mm.

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 76 for selection of indexable blades.

MAPAL HX Twin-Bladed Reamers MN 6200



Dimensions						Accessories					
$\varnothing d_1^*$	L ₁	L ₂	L ₃	MT	Length A	Blade size	Cartridge Order No. (size)	Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adj. wedge MN 619 Order No. (size)
21,83-23,82	240**	75	160	2	165	2	30026280 (KX24R)	10036722 (M3LH/RHx6)	30026302 (SX22R)	10036744 (M3x3)	30026276 (GR-35/S2)
											30026278 (GR-37/S1)
23,83-25,82	260**	94	161	3	166	2	30026280 (KX24R)	10036722 (M3LH/RHx6)	30026302 (SX22R)	10036744 (M3x3)	30026276 (GR-35/S2)
											30026278 (GR-37/S1)
25,83-26,82	260**	94	161	3	166	2	30026282 (KX26R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036744 (M3x3)	30026276 (GR-35)
26,83-28,82	270**	94	171	3	176	2	30026282 (KX26R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036745 (M3x4)	30026276 (GR-35)
28,83-29,82	280**	94	181	3	186	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026305 (SX26R)	10036745 (M3x4)	30026276 (GR-35)
29,83-31,82	290**	94	191	3	196	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026305 (SX26R)	10036747 (M3x6)	30026276 (GR-35)
31,83-32,82	290**	94	191	3	196	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026305 (SX26R)	10036747 (M3x6)	30026276 (GR-35)
32,83-35,82	290**	117,5	166	4	172,5	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026305 (SX26R)	10036747 (M3x6)	30026276 (GR-35)
35,83-37,82	310**	117,5	186	4	192,5	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026305 (SX26R)	10036747 (M3x6)	30026276 (GR-35)
37,83-39,82	310	117,5	186	4	192,5	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036753 (M4x5)	30026277 (GR-36)
39,83-42,82	325	117,5	201	4	207,5	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036754 (M4x6)	30026277 (GR-36)
42,83-47,82	325	117,5	201	4	207,5	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026277 (GR-36)

Sizes in mm.

Can only be used for short bores in diameter range 21,83 mm to 25,82 mm under certain conditions.

Alternative: special version of tool with internal coolant supply.

See page 71 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate the adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 1,5 mm long center spigot for d_1 , less than 37,83 mm.

***Pad length L₄ 15 mm.

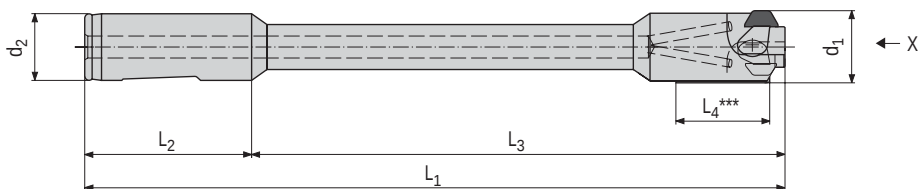
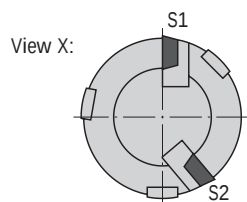
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 78 for selection of indexable blades.

MAPAL HX Twin-Bladed Reamers

MN 6223

NC version



Dimensions					Accessories					
$\varnothing d_1^*$	$\varnothing d_{2(-0,003)}$	L_1	L_2	L_3	Blade size	Cartridge Order No. (size)	Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adj. wedge MN 619 Order No. (size)
21,83-25,82	20**	170	50	120	2	30026280 (KX24R)	10036722 (M3LH/RHx6)	30026302 (SX22R)	10036744 (M3x3)	30026276 (GR-35/S2)
										30026278 (GR-37/S1)
25,83-29,82	20**	170	50	120	2	30026282 (KX26R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036745 (M3x4)	30026276 (GR-35)
29,83-31,82	20**	170	50	120	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026305 (SX26R)	10036747 (M3x6)	30026276 (GR-35)
31,83-37,82	20**	170	50	120	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036747 (M3x6)	30026276 (GR-35)
37,83-39,82	25	176	56	120	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036753 (M4x5)	30026277 (GR-36)
39,83-42,82	25	176	56	120	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036754 (M4x6)	30026277 (GR-36)
42,83-47,82	25	176	56	120	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026277 (GR-36)

Sizes in mm.

See page 71 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate the adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 1,5 mm long center spigot for d_1 , less than 37,83 mm.

***Pad length L_4 15 mm.

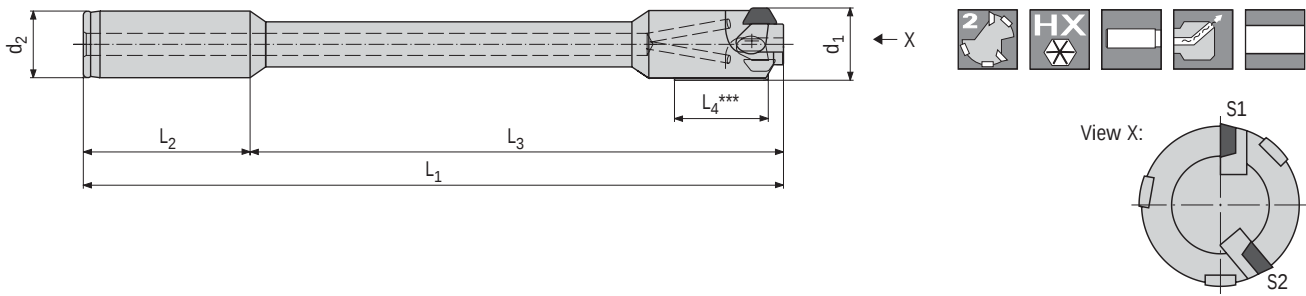
When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 78 for selection of indexable blades.

MAPAL HX Twin-Bladed Reamers

MN 6243

NC version



Dimensions					Accessories					
$\varnothing d_1^*$	$\varnothing d_2_{h6}$	L_1	L_2	L_3	Blade size	Cartridge Order No. (size)	Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adj. wedge MN 619 Order No. (size)
21,83-25,82	20**	170	50	120	2	30026280 (KX24R)	10036722 (M3LH/RHx6)	30026302 (SX22R)	10036744 (M3x3)	30026276 (GR-35/S2)
										30026278 (GR-37/S1)
25,83-29,82	20**	170	50	120	2	30026282 (KX26R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036745 (M3x4)	30026276 (GR-35)
29,83-31,82	20**	170	50	120	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026305 (SX26R)	10036747 (M3x6)	30026276 (GR-35)
31,83-37,82	20**	170	50	120	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036747 (M3x6)	30026276 (GR-35)
37,83-39,82	25	176	56	120	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036753 (M4x5)	30026277 (GR-36)
39,83-42,82	25	176	56	120	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036754 (M4x6)	30026277 (GR-36)
42,83-47,82	25	176	56	120	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026277 (GR-36)

Sizes in mm.

See page 71 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate the adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

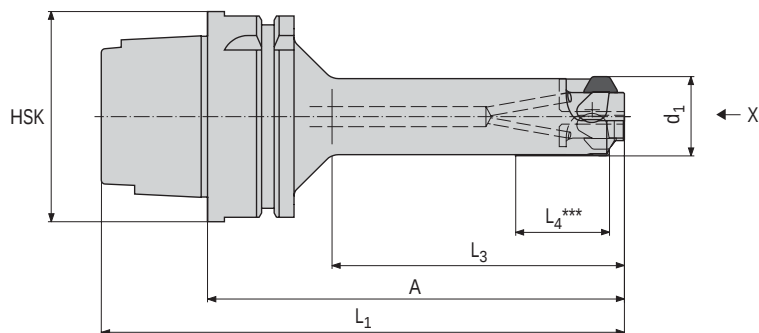
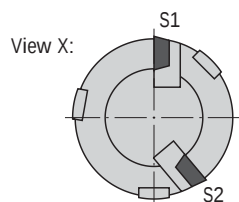
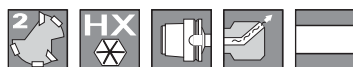
**With 1,5 mm long center spigot for d_1 , less than 37,83 mm.

***Pad length L_4 15 mm.

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 78 for selection of indexable blades.

MAPAL HX Twin-Bladed Reamers MN 6225



Dimensions					Accessories					
$\varnothing d_1^*$	L_1	L_3	HSK-A size	Length A	Blade size	Cartridge Order No. (size)	Clamping screw MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting screw MN 620 Order No. (size)	Adj. wedge MN 619 Order No. (size)
21,83-24,82	157**	85	63	125	2	30026280 (KX24R)	10036722 (M3LH/RHx6)	30026302 (SX22R)	10036744 (M3x3)	30026276 (GR-35/S2)
										30026278 (GR-37/S1)
24,83-25,82	162**	90	63	130	2	30026280 (KX24R)	10036722 (M3LH/RHx6)	30026302 (SX22R)	10036744 (M3x3)	30026276 (GR-35/S2)
										30026278 (GR-37/S1)
25,83-27,82	167**	95	63	135	2	30026282 (KX26R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036745 (M3x4)	30026276 (GR-35)
27,83-29,82	172**	100	63	140	2	30026282 (KX26R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036745 (M3x4)	30026276 (GR-35)
29,83-31,82	177**	105	63	145	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026305 (SX26R)	10036747 (M3x6)	30026276 (GR-35)
31,83-37,82	187**	110	63	155	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036747 (M3x6)	30026276 (GR-35)
37,83-39,82	192	115	63	160	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036753 (M4x5)	30026277 (GR-36)
39,83-42,82	197	120	63	165	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036754 (M4x6)	30026277 (GR-36)
42,83-47,82	202	130	63	170	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026277 (GR-36)

Sizes in mm.

See page 71 for setting notes and fitting of accessories.

See page 73 for order example.

For coolant hose and assembly key see page 72 (not included in the supply).

*Values do not indicate the adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

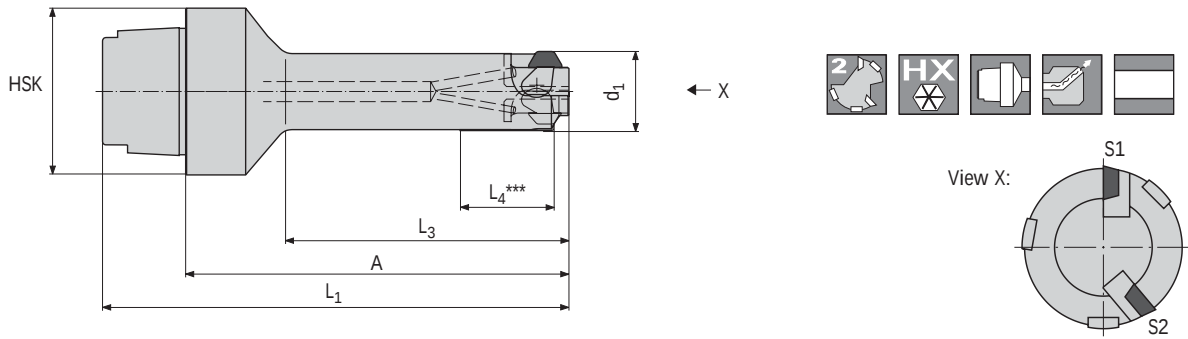
**With 1,5 mm long center spigot for d_1 , less than 37,83 mm.

***Pad length L_4 15 mm.

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 78 for selection of indexable blades.

MAPAL HX Twin-Bladed Reamers MN 6227



Dimensions					Accessories					
$\varnothing d_1^*$	L_1	L_3	HSK-C size	Length A	Blade size	Cartridge Order No. (size)	Clamping MN 618 Order No. (size)	Clamping plate Order No. (size)	Adjusting MN 620 Order No. (size)	Adj. wedge MN 619 Order No. (size)
21,83-24,82	140**	85	50	115	2	30026280 (KX24R)	10036722 (M3LH/RHx6)	30026302 (SX22R)	10036744 (M3x3)	30026276 (GR-35/S2)
										30026278 (GR-37/S1)
24,83-25,82	145**	90	50	120	2	30026280 (KX24R)	10036722 (M3LH/RHx6)	30026302 (SX22R)	10036744 (M3x3)	30026276 (GR-35/S2)
										30026278 (GR-37/S1)
25,83-27,82	150**	95	50	125	2	30026282 (KX26R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036745 (M3x4)	30026276 (GR-35)
27,83-29,82	155**	100	50	130	2	30026282 (KX26R)	10036722 (M3LH/RHx6)	30026303 (SX24R)	10036745 (M3x4)	30026276 (GR-35)
29,83-31,82	160**	105	50	135	2	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026305 (SX26R)	10036747 (M3x6)	30026276 (GR-35)
31,83-37,82	172**	110	63	140	3	30026282 (KX26R)	10036725 (M4x0,5LH/RHx9)	30026304 (SX25R)	10036747 (M3x6)	30026276 (GR-35)
37,83-39,82	177	115	63	145	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036753 (M4x5)	30026277 (GR-36)
39,83-42,82	182	120	63	150	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036754 (M4x6)	30026277 (GR-36)
42,83-47,82	187	128	63	155	3	30026283 (KX35R)	10036725 (M4x0,5LH/RHx9)	30026306 (SX35R)	10036755 (M4x8)	30026277 (GR-36)

Sizes in mm.

See page 71 for setting notes and fitting of accessories.

See page 73 for order example.

*Values do not indicate the adjustment range but the sizes for the various diameters (only adjustable within a tolerance field).

**With 1,5 mm long center spigot for d_1 , less than 37,83 mm.

***Pad length L_4 15 mm.

When ordering, please state required guide pad grade (Carbide, Cermet or PCD). Unless stated, the guide pads will be supplied in Cermet.

See page 78 for selection of indexable blades.



Machining Values for MAPAL WP Twin-Bladed Reamers

The machining values given are guidelines. The optimum data for the particular machining operation should be calculated from trials or during the operation.

Various factors are decisive in calculating the values exactly:

- rigidity of the whole system: machine, tool and holder
- rigidity of the component part and workpiece clamping, especially at high feed rates

- the quality specifications for the finished workpiece
- the type of guide pads: carbide, Cermet or PCD.

Under optimum conditions, feed rates of up to 1,0 mm can be achieved in steel and grey cast iron. In principle lower feed rates produce a better surface finish, while higher feed rates reduce any vibrations which may occur. By varying the cutting speed, the surface can be improved by an increase, while a reduction produces a positive effect on chip form and wear.

A change in the chip fracturing can be produced by a variation in the cutting depth.

The allowance for reaming should be selected so that the cutting depth in the reaming operation is greater than the rough depth for the pre-machining operation. The most favourable value is a cutting depth of approximately 0,15 mm, in other words 0,3 mm allowance in the diameter.

Material	R _m N/mm ²	Series with external coolant supply Cutting lead form AD + AS Cutting depth 0,05 - 0,25 mm											Series with internal coolant supply Cutting lead form AD Cutting depth 0,05 - 0,25 mm												
		Feed f* (mm/rev)	Top rake			Cutting speed for cutting material								Feed f* (mm/rev)	Top rake			Cutting speed for cutting material							
			0°	6°	12°	1		2			3	4	0°		6°	12°	1		2			3	4		
						N	A	W	X	YE	CT3 CT4	YL YG					N	A	W	X	YE	CT3 CT4	YL YG		
Unalloyed steel: structural-, cast-, free cutting-, case hardened steel	< 500	0,2 - 0,6	°	•	20-40	20-40		20-40	30-50	< 60	<60	0,2 - 0,6	°	•	40-60	40-60		40-60	60-100	110-160	110-160				
Unalloyed/low alloyed steel: structural-, cast-, heat treat-, tool steel, case hardened steel	500 - 900	0,2 - 0,6	°	•	20-40	20-40		20-40	30-50	< 60	<60	0,2 - 0,6	°	•	40-60	40-60		40-60	60-100	110-160	110-160				
Lead alloyed free cutting steel		0,2 - 0,6	°	•	20-40	20-40		20-40	30-50	< 60	<60	0,2 - 0,6	°	•	40-60	40-60		40-60	60-100	110-160	110-160				
Unalloyed/low alloyed steel: temp. resisting structural-, heat treat-, nitride-, tool steel	> 900	0,2 - 0,6	°	•	20-40	20-40		20-40	30-50	< 60	<60	0,2 - 0,6	°	•	40-60	40-60		40-60	60-100	110-160	110-160				
High alloyed steel: Tool steel		0,2 - 0,45	°	•	20-30	20-30		20-40	< 50	<50	0,2 - 0,45	°	•	20-40	20-40			< 60	< 60	< 60					
Special alloyed steel, sintered materials					Please ask													Please ask							
Stainless steel	< 600	0,2 - 0,6	°	•	20-30	20-30		20-40	< 60	< 60	0,2 - 0,6	°	•	20-40	20-40			60	60	60					
Stainless steel	> 600	0,2 - 0,6	°	•	20-30	20-30		20-40	< 60	< 60	0,2 - 0,6	°	•	20-40	20-40			60	60	60					
Stainless/heat resisting steel	> 750	0,2 - 0,6	°	•	20-30	20-30		20-40	< 60	< 60	0,2 - 0,6	°	•	20-40	20-40			60	60	60					
Grey cast iron		0,3 - 0,75	°	•	30-40	30-40	40-50				0,3 - 0,75	°	•	40-60	40-60	60-100									
Alloyed grey cast iron		0,25 - 0,6	°	•	30-41	30-41	40-50				0,25 - 0,6	°	•	40-60	40-60	60-100									
Nodular iron ferritic/pearlitic; Malleable iron: GGG40 - GGG55, GTW35 - GTW55, GTS35 - GTS55	< 600	0,25 - 0,6	°	•	30-42	30-42	40-50				0,25 - 0,6	°	•	40-60	40-60	60-100									
Nodular iron pearlitic; Malleable iron: GGG60 - GGG80, GTW65, GTS65 - GTS70	> 600	0,25 - 0,6	°	•	30-43	30-43	40-50				0,25 - 0,6	°	•	40-60	40-60	60-100									
Alloyed nodular iron		0,25 - 0,6	°	•	30-44	30-44	40-50				0,25 - 0,6	°	•	40-60	40-60	60-100									
Titanium, titanium iron		0,15 - 0,4	°	•	20-40	20-40				< 40	0,15 - 0,4	°	•	< 30	< 30				< 40						
Copper alloy, brass, lead alloyed bronze with long chips		0,2 - 0,5	°	•	30-40	30-40				< 60	0,2 - 0,5	°	•	80-100	80-100					Subject to discussion > 200					
Copper, copper alloy, alu-, manganese-, phosphorus bronze with short chips		0,15 - 0,6	°	•	30-40	30-40				< 60	0,15 - 0,6	°	•	80-100	80-100										
Alu wrought alloy, magnesium wrought alloy		0,2 - 0,5		•	30-40	30-40				< 60	Not recommended			160-180	160-180										
Alu-casting alloy Si-content < 10 %, magnesium alloy		0,25 - 0,6	°	•	30-40	30-40				< 60	0,25 - 0,6	°	•	160-180	160-180										
Alu-casting alloy Si-content > 10 %, magnesium alloy		0,25 - 0,6	°	•	30-40	30-40				< 60	0,25 - 0,6	°	•	180-230	180-230										
Plastics						Please ask												Please ask							
Reinforced plastics						Please ask												Please ask							

Subject to discussion
> 200

Central supply of lubricant through the tool is advisable in every case. The use of minimal lubrication should only be applied with PCD guide pads. When using the MN 2225 and MN 2227 versions, attention should be particularly paid to good concentricity on the tool head. A value of < 5 µm is recommended.

Cutting lead form

The double cutting lead WP-AD and WP-AS should preferably be used, which with roughing blade are 15° and 30° and the finishing blade 3°. For details on the cutting lead forms, see Page 77.

Cutting materials

MAPAL offers a broad-based selection of cutting materials so that the right cutting material can be used for every material.

- 1 Carbide
- 2 coated Carbide
- 3 Cermet
- 4 coated Cermet
- 5 PCD polycrystalline diamond
- 6 PCBN polycrystalline cubic boron nitride

- Preferred radial rake
- Alternative radial rake for special cases
- * For high cutting speeds and large cutting depth, select small feed rates
- ** Feed limited because of extremely short cutting lead length

			Series with internal coolant supply														Cutting lead form AZ													
			Cutting lead form AS + EK												Cutting lead form AZ															
			Cutting depth AS 0,05 - 0,25 mm, EK 0,05 - 0,15 mm												Cutting depth 0,05 - 0,4 mm															
			Feed		Top rake		Cutting speed for cutting material								Feed		Top rake		Cutting speed for cutting material											
5	6		f*	f**				1		2		3	4	5	6	f*				1		2	3	5	6					
D	FT01	FT02	(mm/rev)	(mm/rev)	0°	6°	12°	N	A	W	X	YE	CT3 CT4	YL YG	D	FT01	FT02	(mm/rev)	0°	6°	12°	N	A	W	CT3 CT4	D	FT01	FT02		
			0,2 - 0,6	0,15 - 0,4	◦	•	60-80	60-80		60-80	80-120	130-180	130-180					0,15 - 0,4	◦	•										
			0,2 - 0,6	0,15 - 0,4	◦	•	60-80	60-80		60-80	80-120	130-180	130-180					0,15 - 0,4	◦	•										
			0,2 - 0,6	0,15 - 0,4	◦	•	60-80	60-80		60-80	80-120	130-180	130-180					0,15 - 0,4	◦	•										
			0,2 - 0,6	0,15 - 0,4	◦	•	60-80	60-80		60-80	80-120	130-180	130-180					0,15 - 0,4	◦	•										
			0,2 - 0,45	0,15 - 0,4	◦	•	40-60	40-60			< 80	< 80	< 80					0,15 - 0,4	◦	•										
								Please ask												Please ask										
			0,2 - 0,6	0,15 - 0,4	◦	•	40-60	40-60			80	80	80					0,15 - 0,4	◦	•										
			0,2 - 0,6	0,15 - 0,4	◦	•	40-60	40-60			80	80	80					0,15 - 0,4	◦	•										
			0,2 - 0,6	0,15 - 0,4	•	◦	40-60	40-60			80	80	80					0,15 - 0,4	•	◦										
Subject to discussion for cast iron or hard machining 400-700			0,3 - 0,75	0,15 - 0,4	•	◦	60-80	60-80	80-120									0,15 - 0,4	•	◦	60-80	60-80	80-120							
			0,25 - 0,6	0,15 - 0,4	◦	•	60-80	60-80	80-120									0,15 - 0,4	◦	•	60-80	60-80	80-120							
			0,25 - 0,6	0,15 - 0,4	•	◦	60-80	60-80	80-120									0,15 - 0,4	•	◦	60-80	60-80	80-120							
			0,25 - 0,6	0,15 - 0,4	•	◦	60-80	60-80	80-120									0,15 - 0,4	•	◦	60-80	60-80	80-120							
			0,25 - 0,6	0,15 - 0,4	•	◦	60-80	60-80	80-120									0,15 - 0,4	•	◦	60-80	60-80	80-120							
			0,15 - 0,4	0,15 - 0,4	◦	•	< 50	< 50				< 60						0,15 - 0,4	◦	•	< 50	< 50		< 60						
			0,2 - 0,5	0,15 - 0,4	◦	•	100-120	100-120										0,15 - 0,4	◦	•	100-120	100-120								
			0,15 - 0,6	0,15 - 0,4	•	◦	100-120	100-120										0,15 - 0,4	•	◦	100-120	100-120								
			0,2 - 0,5	0,15 - 0,3	◦	•	180-200	180-200										0,15 - 0,3	◦	•	180-200	180-200								
			0,25 - 0,6	0,15 - 0,4	◦	•	180-200	180-200										0,15 - 0,4	◦	•	180-200	180-200								
			0,25 - 0,6	0,15 - 0,4	◦	•	200-250	200-250										0,15 - 0,4	◦	•	200-250	200-250								
								Please ask												Please ask										
								Please ask												Please ask										



Machining Values for MAPAL HX Twin-Bladed Reamers

The machining values given are guide-lines. The optimum data for the particular machining operation should be calculated from trials or during the operation.

Various factors are decisive in calculating the values exactly:

- rigidity of the whole system: machine, tool and holder
- rigidity of the component part and workpiece clamping, especially at high feed rates

- the quality specifications for the finished workpiece
- the type of guide pads: carbide, Cermet or PCD.

Under optimum conditions, feed rates of up to 1,0 mm can be achieved in steel and grey cast iron. In principle lower feed rates produce a better surface finish, while higher feed rates reduce any vibrations which may occur. By varying the cutting speed, the surface can be improved by an increase, while a reduction produces a positive effect on chip form and wear.

A change in the chip fracturing can be produced by a variation in the cutting depth.

The allowance for reaming should be selected so that the cutting depth in the reaming operation is greater than the rough depth for the pre-machining operation. The most favourable value is a cutting depth of approximately 0,15 mm, in other words 0,3 mm allowance in the diameter.

Material	R _m N/mm ²	HX blades for series with internal Cutting lead form R 0,8 and R 1,5 /								
		Feed f* (mm/rev)	Top rake			Cutting speed for cutting material				
						1		2		3
			0°	3°	6°	H	A	W	YE	CT3
Unalloyed steel: structural-, cast-, free cutting-, case hardened steel	< 500	0,2 - 0,6		○	●	40 - 60	40 - 60		60 - 100	110 - 160
Unalloyed/low alloyed steel: structural-, cast-, heat treat-, tool steel, case hardened steel	500 - 900	0,2 - 0,6		○	●	40 - 60	40 - 60		60 - 100	110 - 160
Lead alloyed free cutting steel		0,2 - 0,6		○	●	40 - 60	40 - 60		60 - 100	110 - 160
Unalloyed/low alloyed steel: temp. resisting structural-, heat treat-, nitride-, tool steel	> 900	0,2 - 0,6		○	●	40 - 60	40 - 60		60 - 100	110 - 160
High alloyed steel: Tool steel		0,2 - 0,45		○	●	20 - 40	20 - 40		< 60	< 60
Special alloyed steel, sintered materials									Please ask	
Stainless steel	< 600	0,2 - 0,6		○	●	20 - 40	20 - 40		60	60
Stainless steel	> 600	0,2 - 0,6		○	●	20 - 40	20 - 40		60	60
Stainless/heat resisting steel	> 750	0,2 - 0,6		●	○	20 - 40	20 - 40		60	60
Grey cast iron		0,3 - 0,75	●	○		40 - 60	40 - 60	60 - 100		
Alloyed grey cast iron		0,25 - 0,6	○	●		40 - 60	40 - 60	60 - 100		
Nodular iron ferritic/pearlitic; Malleable iron: GGG40 - GGG55, GTW35 - GTW55, GTS35 - GTS55	< 600	0,25 - 0,6		●	○	40 - 60	40 - 60	60 - 100		
Nodular iron pearlitic; Malleable iron: GGG60 - GGG80, GTW65, GTS65 - GTS70	> 600	0,25 - 0,6		●	○	40 - 60	40 - 60	60 - 100		
Alloyed nodular iron		0,25 - 0,6		●	○	40 - 60	40 - 60	60 - 100		
Titanium, titanium iron		0,15 - 0,4		○	●	< 30	< 30			< 40
Copper alloy, brass, lead alloyed bronze with long chips		0,2 - 0,5		○	●	80 - 100	80 - 100			
Copper, copper alloy, alu-, manganese-, phosphorus bronze with short chips		0,15 - 0,6	●	○		80 - 100	80 - 100			
Alu wrought alloy, magnesium wrought alloy		0,2 - 0,5		○	●	160 - 180	160 - 180			
Alu-casting alloy Si-content < 10 %, magnesium alloy		0,25 - 0,6		○	●	160 - 180	160 - 180			
Alu-casting alloy Si-content > 10 %, magnesium alloy		0,25 - 0,6		○	●	180 - 230	180 - 230			
Plastics									Please ask	
Reinforced plastics									Please ask	

Central supply of lubricant through the tool is advisable in every case. The use of minimal lubrication should only be applied with PCD guide pads. When using the MN 6225 and MN 6227 versions, attention should be particularly paid to good concentricity on the tool head. A value of < 5 µm is recommended.

Cutting lead form

The HX blades can be supplied with radius cutting leads of R 0,8 and R 1,5. For details on the cutting lead forms, see Page 79.

Cutting materials

MAPAL offers a broad-based selection of cutting materials so that the right cutting material can be used for every material.

When machining steel with HX reamers, it is advisable to use Cermet and coated Cermet. This will produce excellent surfaces at high cutting speeds.

- 1 Carbide
- 2 coated Carbide
- 3 Cermet
- 4 coated Cermet
- 5 PCD polycrystalline diamond
- 6 PCBN polycrystalline cubic boron nitride

- Preferred radial rake
- Alternative radial rake for special cases
- * For high cutting speeds and large cutting depth, select small feed rates
- *** 1 = for steel and long-chip materials
2 = for cast iron and short-chip materials

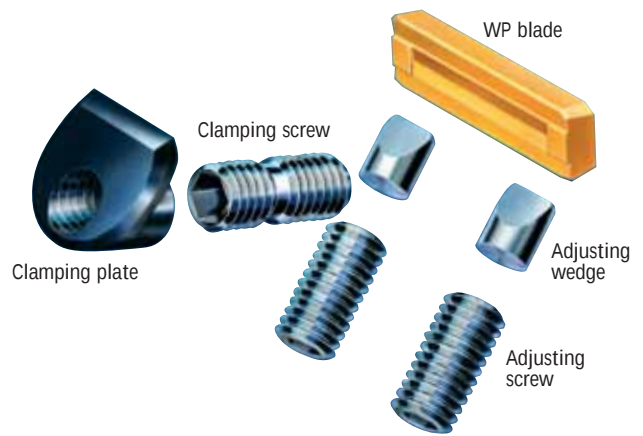
without chip groove coolant supply Cutting depth 0,05 - 0,25 mm				HX blades with chip groove for series with internal coolant supply Cutting lead form R 0,8 / Cutting depth 0,05 - 0,25 mm											
Cutting speed for cutting material				Feed f* (mm/rev)	Chip form geometry ***		Cutting speed for cutting material								
4	5	6					1		2		3	4	5	6	
YL	D	FT01	FT02				H	A	W	YE	CT4	YG	D	FT01	FT02
110 - 160				0,2 - 0,6	•	60 - 80	60 - 80		80 - 120	130 - 180	130 - 180				
110 - 160				0,2 - 0,6	•	60 - 80	60 - 80		80 - 120	130 - 180	130 - 180				
110 - 160				0,2 - 0,6	•	60 - 80	60 - 80		80 - 120	130 - 180	130 - 180				
110 - 160				0,2 - 0,6	•	60 - 80	60 - 80		80 - 120	130 - 180	130 - 180				
< 60				0,2 - 0,45	•	40 - 60	40 - 60		< 80	< 80	< 80				
									Please ask						
60				0,2 - 0,6	•	40 - 60	40 - 60		80	80	80				
60				0,2 - 0,6	•	40 - 60	40 - 60		80	80	80				
60				0,2 - 0,6	•	40 - 60	40 - 60		80	80	80				
		Subject to discussion for cast iron or hard machining 400 - 700		0,3 - 0,75	•	60 - 80	60 - 80	80 - 120					Subject to discussion for cast iron or hard machining 400 - 700		
				0,25 - 0,6	•	60 - 80	60 - 80	80 - 120							
				0,25 - 0,6	•	60 - 80	60 - 80	80 - 120							
				0,25 - 0,6	•	60 - 80	60 - 80	80 - 120							
				0,25 - 0,6	•	60 - 80	60 - 80	80 - 120							
				0,15 - 0,4	•	< 50	< 50			< 60					
	Subject to discussion > 200			0,2 - 0,5	•	100 - 120	100 - 120					Subject to discussion > 200			
				0,15 - 0,6	•	100 - 120	100 - 120								
				0,2 - 0,5	•	180 - 200	180 - 200								
				0,25 - 0,6	•	180 - 200	180 - 200								
				0,25 - 0,6	•	200 - 250	200 - 250								
									Please ask						
									Please ask						

Setting Instructions for MAPAL WP Twin-Bladed Reamers:

MN 2200, MN 2223

MN 2225, MN 2227

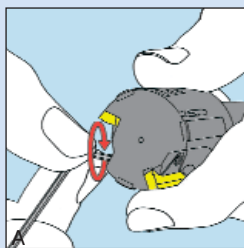
MN 2243



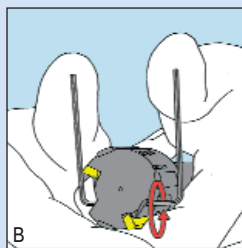
Accessories

Indexable blade	Torx screw/ Clamping screw MN 618	Clamping plate	Adjusting screw MN 620	Adjusting wedge MN 619
2 off	2 off	2 off	4 off	4 off

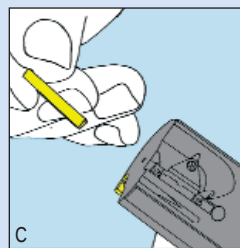
Changing and setting the blade



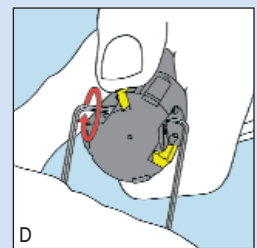
Turn the front and back adjusting screw 1/2 turn anti-clockwise.



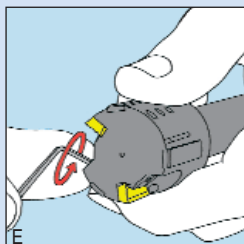
Turn torx screw or clamping screw anti-clockwise from the top and clockwise from the bottom. Two keys need to be used to open (as shown). The clamping plate will be loosened.



1. Remove blade.
2. Clean the blade and blade seat (do not use compressed air – note the adjusting wedge).
3. Turn the blade or insert new blade.



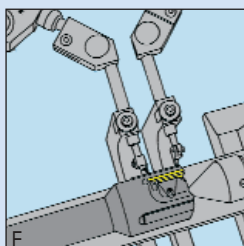
1. Press blade against back stop and adjusting wedge.
2. Turn torx screw or clamping screw clockwise from the top and anti-clockwise from the bottom. Two keys need to be used to open (as shown). The clamping plate will be tightened.



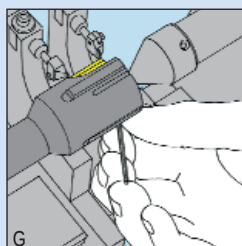
Note:
The same procedure (Fig. A-E) also applies for the second blade.

For rough adjustment, turn the front and back adjusting screw clockwise again 1/4 turn.

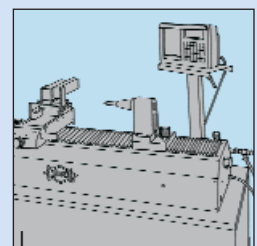
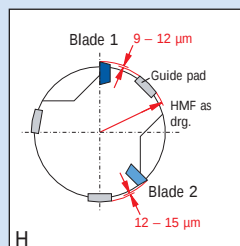
To make handling easier and ensure reliable setting, we recommend the use of a MAPAL setting device.



1. MAPAL MASTERSET: Set the spacing for the MASTERSET to the blade length.
2. Zero the dial indicator on the guide pad following the blade.

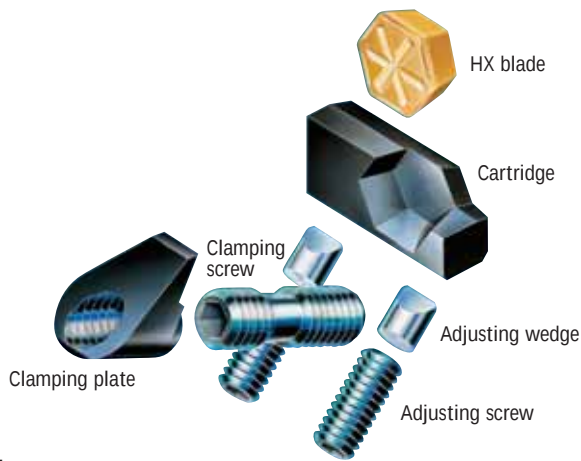


Setting Blade 1: Set the front and rear setting dimension for varying intervals with the adjusting screw.
Setting dimension: amount of the blade over the following guide pad as in setting instructions Fig. H. Back tapering to rear approx. 0,01 to 0,015 mm.
Setting Blade 2: Set the front and rear setting dimension for varying intervals with the adjusting screw.
Setting dimension: amount of the blade below the following guide pad as in setting instructions Fig. H. Back tapering to rear approx. 0,01 to 0,015 mm.



MAPAL UNISSET: For easy setting of reamers MAPAL supplies electronic setting devices in vertical and horizontal designs. Please ask for our special brochure on "Setting Devices". Detailed setting notes can be found in the equipment's operating instructions.

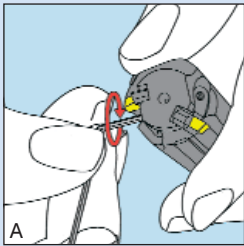
Setting Instructions for MAPAL HX Twin-Bladed Reamers: MN 6200, MN 6223 MN 6225, MN 6227 MN 6243



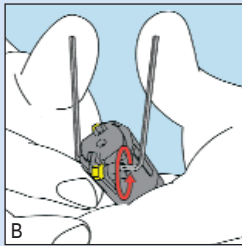
Accessories

Indexable blade	Cartridge	Torx screw/ Clamping screw MN 618	Clamping plate	Adjusting screw MN 620	Adjusting wedge MN 619
2 off	2 off	2 off	2 off	4 off	4 off

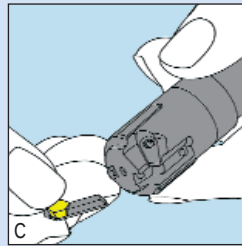
Changing and setting the blade



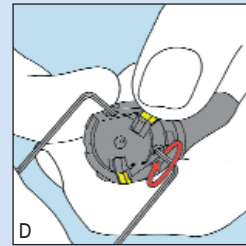
Turn the front and back adjusting screw 1/2 turn anti-clockwise.



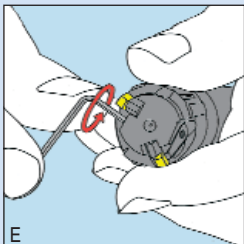
Turn clamping screw anti-clockwise from the top and clockwise from the bottom. Two keys need to be used to open (as shown). The clamping plate and cartridge will be loosened.



1. Remove blade and cartridge.
2. Clean blade, cartridge and blade seat (do not use compressed air – note the adjusting wedge).
3. Turn the blade 60° or insert new blade in cartridge.
4. Replace cartridge.



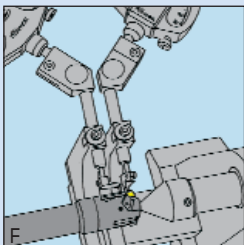
1. Press blade and cartridge against back stop and adjusting wedge.
2. Turn clamping screw clockwise from the top and anti-clockwise from the bottom. Two keys need to be used to open (as shown).



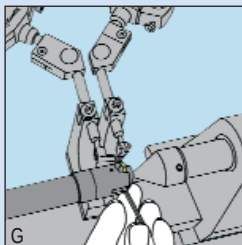
Note:
The same procedure (Fig. A-E) also applies for the second blade.

For rough adjustment, turn the front and back adjusting screw clockwise again 1/4 turn.

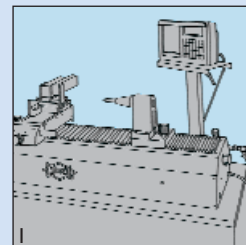
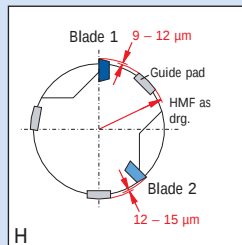
To make handling easier and ensure reliable setting, we recommend the use of a MAPAL setting device.



1. MAPAL MASTERSET: Set the spacing for the MASTERSET to the blade length.
2. Zero the dial indicator on the guide pad following the blade.

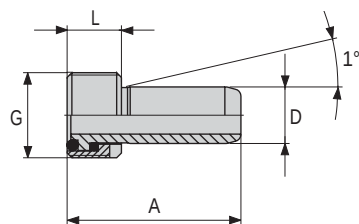


Setting Blade 1: Set the front and rear setting dimension for varying intervals with the adjusting screw.
Setting dimension: amount of the blade over the following guide pad as in setting instructions Fig. H. Back tapering to rear approx. 0,005 to 0,010 mm.
Setting Blade 2: Set the front and rear setting dimension for varying intervals with the adjusting screw.
Setting dimension: amount of the blade below the following guide pad as in setting instructions Fig. H. Back tapering to rear approx. 0,005 to 0,010 mm.



MAPAL UNISSET: For easy setting of reamers MAPAL supplies electronic setting devices in vertical and horizontal designs. Please ask for our special brochure on "Setting Devices". Detailed setting notes can be found in the equipment's operating instructions.

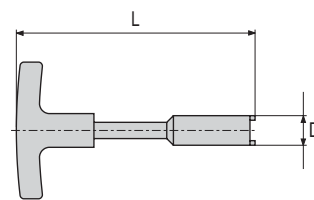
Accessories for HSK-A 63



Coolant tube

HSK-A size	A	L	G	D	Order No.
63	36,6	11,5	M18x1	12	MN5218-08

Supply includes: Coolant tube with two O rings and locking collar.
Design: Easy access angular movement 1° self-centering, axial – sealed.
Note: Design to DIN 69893.



Assembly key

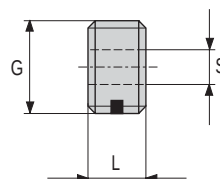
HSK-A size	L	D	Order No.
63	182	17	10040110

Use: For fitting and removing coolant tube.

Blanking plug

HSK-A size	L	S	G	Order No.
63	11,5	8	M18x1	SB63-08R

Use: For closing off threaded hole in HSK tool shanks when no coolant tube is used.
Design: With Nylok sleeve to hold plug securely.
Material: Stainless steel.



Screwdrivers/Keys for MAPAL Single- and Twin-Bladed Reamers

Screwdriver for MAPAL screw spindle MN 618

Screw spindle MN 618	Hexagonal key Key width	
	SW 1,5	SW 2,0
M3LH/RHx5	○	
M3LH/RHx6	○	
M4x0,5LH/RHx6,5		○
M4x0,5LH/RHx9		○

Screwdriver for Torx screw

Torx screw	Torx screwdriver size		
	TX 5	TX 6	TX 7
M1,6x3,9	○		
M1,6x4,4	○		
M2x4		○	
M2x5		○	
M2,5x4,8			○
M2,5x5,2			○

Note: The screwdrivers/keys are included in the supply when ordering reamers.

Screwdriver for MAPAL threaded pin MN 620

Adjusting screw MN 620	Hexagonal key/Key width			
	SW 0,9	SW 1,3	SW 2,0	SW 3,0
M2x1,8	○			
M2x2	○			
M2x2,5	○			
M2x3	○			
M2,5x2,2		○		
M2,5x2,5		○		
M2,5x3		○		
M2,5x4		○		
M3x2,5		○		
M3x3		○		
M3x4		○		
M3x6		○		
M4x3			○	
M4x4			○	
M4x5			○	
M4x6			○	
M4x8			○	
M6x10				○
M6x12				○
M6x15				○

Order Example for MAPAL WP and HX Reamers

Please provide the following details when ordering:

Example 1

Order details for MAPAL WP Reamers

Name	Guide pad grade	Production Ø	Tolerance	Cutting lead code (see page 77 for selection)
			IT or dimensions	
MN 2002	Carbide	12	H 6	AD

Example 2

Order details for MAPAL HX Reamers

Name	Guide pad grade	Production Ø	Tolerance	Cutting lead code (see page 79 for selection)
			IT or dimensions	
MN 6123	PCD	38	+0,009 -0,007	5

Note: If you are unable to provide details of cutting lead code and top rake, please give type of material to be machined.

Please state required guide pad grade (carbide, Cermet or PCD).

Order Example for MAPAL WP and HX Indexable Blades

Please provide the following details when ordering:

Example 1

Order details for MAPAL WP blade: AS92RON

Cutting lead form (see page 76 for selection)	Blade size	Cutting direction (see page 76 for selection)	Top rake (see page 77 for selection)	Cutting material (see page 77 for selection)
AS	92	R	0	N

Example 2

Order details for MAPAL HX blade: HX25RS3CT3

Blade form	Blade size	Cutting lead (see page 79 for selection)	Cutting direction (see page 79 for selection)	Cutting edge (see page 79 for selection)	Top rake (see page 79 for selection)	Cutting material (see page 78 for selection)
HX	2	5	R	S	3	CT3





MAPAL Indexable Blades

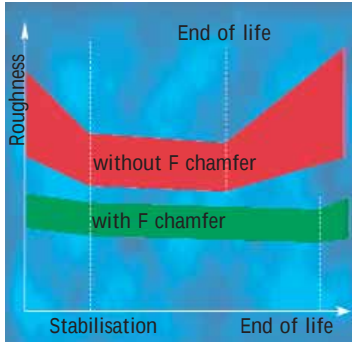
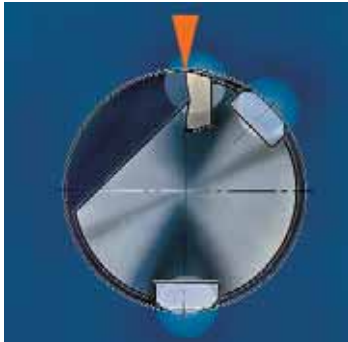
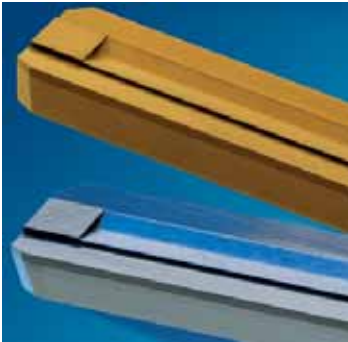
The basis for successful tools.

MAPAL tools with guide pads for precision machining bores, reamers and fine boring tools, attribute their outstanding efficiency to direct guiding in the bore by guide pads and the high quality of MAPAL blades. In precision machining bores extraordinary demands are made on cutting materials, coatings, blade geometry and grinding quality. The restricted space in the bore means that the chips must be easy to remove in form and length. With new technology, such as high speed machining or minimal lubrication, easy chip removal is becoming more and more significant. MAPAL blades are being constantly developed and optimised to meet these demands.

To ensure the MAPAL blades are safely held, a clamping groove is used which, when combined with the clamping plate and the adjustment elements, forms a highly positive system. This stability is an important requisite for long tool life and prevents the blades shifting. Typical of an important innovation with significant effect is the MAPAL F chamfer. This narrow chamfer, which runs over the whole area of the clearance angle, provides additional guiding and stabilising in the tools. In addition the MAPAL F chamfer prevents the strong initial wear which frequently appears and the loss in dimension which this causes.

Carbide, Cermet, coatings, PCD and PCBN – the whole range of modern cutting materials is available at MAPAL for every workpiece material and for every cutting task. The latest production technology for manufacturing blades today allows any chipformer and chipbreaker solution to be produced – even with super hard materials such as PCD and PCBN.

MAPAL Blades for WP Single-Bladed and WP Twin-Bladed Reamers



High speed clamping groove

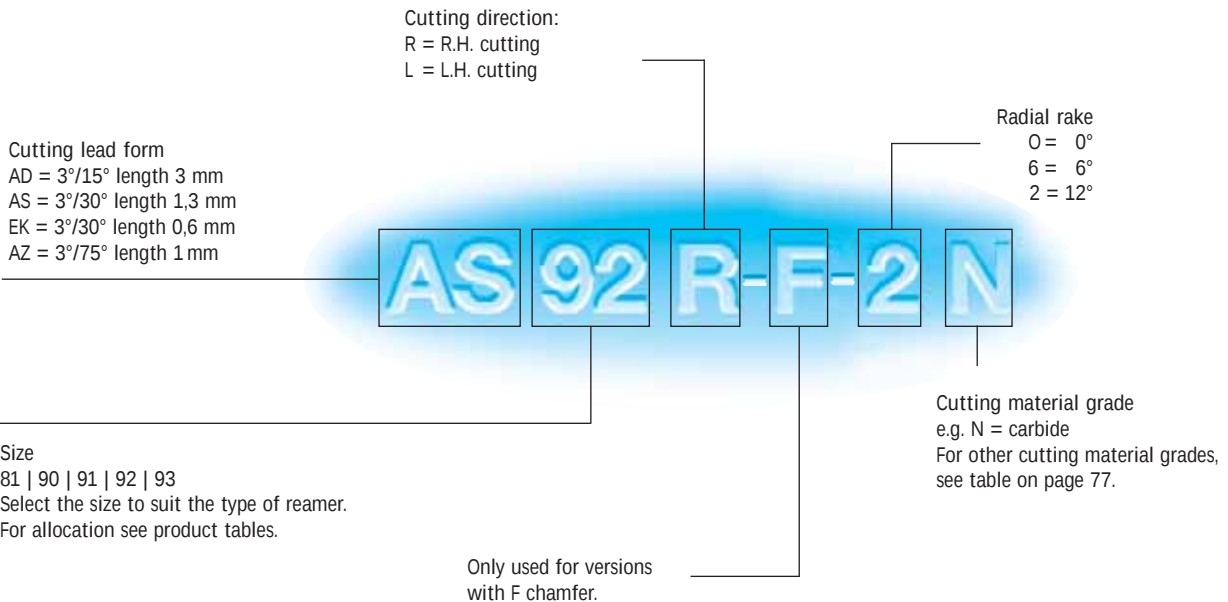
Even with high speed machining, the sintered clamping groove guarantees stable clamping by providing a positive connection between clamping plate and blade. This means the requirement is satisfied for meeting bore tolerances within a few microns – and not only for high speed machining.

The MAPAL F chamfer

The F chamfer is the name given by MAPAL to an additional stabilising and guide chamfer on the blade. This chamfer can be applied to all newly manufactured MAPAL indexable blades in any designs and with any cutting leads. The surface quality is improved by the F chamfer because of the controlled wear and is consistent right to the end of the blade life. Blades with F chamfer make a greater contribution to guiding the tool, which is extremely important, particularly where with high speed machining or unfavourable length and diameter situations. A further advantage of the F chamfer lies in the higher dimensional stability and clearly longer blade life. The normally strong loss in dimension at the start of the cutting process is avoided and is slower and more constant over the whole of the blade life.

The Key to Success

The blades are coded using the following system:



Cutting Leads for MAPAL WP Blades

	Cutting lead AD Universal cutting lead for high quality surface finishes also for low cutting speeds; note cutting lead length of 3 mm; not suitable for aluminium.	Max. cutting depth: 0,25 mm Radial rake: 0°, 6°, 12°
	Cutting lead AS (also end cutting available) Cutting lead suitable for all materials, high quality surface finish also for high cutting speeds; cutting lead length 1,3 mm.	Max. cutting depth: 0,25 mm Radial rake: 0°, 6°, 12°
	Cutting lead EK (end cutting) Only use where a low cutting length of 0,6 mm is required; for all materials; do not exceed max. feed of 0,2 mm/rev.	Max. cutting depth: 0,15 mm Radial rake: 0°, 6°, 12°
	Cutting lead AZ For high cutting speeds; especially suitable for machining aluminium.	Max. cutting depth: 0,4 mm Radial rake: 0°, 6°, 12°

Other cutting leads available on request

Cutting materials for MAPAL WP Blades

Cutting material code	Coating	Code – ISO 513	Application area															Material Group						Properties	
			Wear resistance Strength															P M K N S H							
			01	05	10	15	20	25	30	35	40	45	50	Steel	Stainless steel	Grey cast iron	Non-ferrous metals (Alu etc.)	High heat resistant	Hard materials						
N	–	HW-K10																						Uncoated carbide grade with wide range of applications; for general cutting tasks; suitable for use with low to medium cutting speeds.	
W	CVD	HC-K10																							Coated carbide grade; better wear resistance than grade N, for use with medium to upper cutting speed range.
X	CVD	HC-P15																							Coated carbide grade with top rake not coated; well suited to applications with high clearance angle wear; also with skiving angle for through holes.
YE	PVD	HC-P10																							Coated carbide grade with minimum wear compared to N grade; for use in upper to medium cutting speed range.
CT3	-	HT-P25																							Uncoated Cermet grade; note minimum speed; better surface finish because of high cutting speeds. Not with sintered clamping groove.
CT4	-	HT-P20																							Uncoated Cermet grade; note minimum speed; better surface finish because of high cutting speeds.
YG	PVD	HC-P10																							Coated Cermet grade, better wear resistance than CT4; increase in cutting speed; note minimum speed.
YL	PVD	HC-P10																							Coated Cermet grade, better wear resistance than CT3; increase in cutting speed; note minimum speed. Not with sintered clamping groove.
D	-	DP-K05																							PCD grade for machining non-ferrous metals.
FT01	-	BN-K05																							PCBN grade for machining hardened steel.
FT02	-	BN-K05																							PCBN grade for machining cast iron, also with heavily interrupted cut.

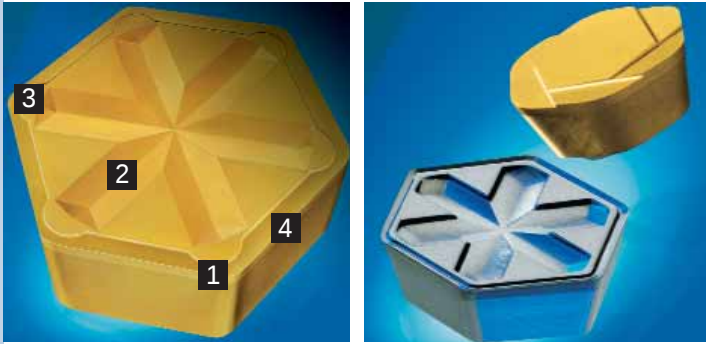
Cutting material code: N = carbide; W, X, YE = coated carbide, CT3/CT4 = Cermet; YL/YG = coated Cermet; D = PCD-polycrystalline diamond; FT01, FT02 = PCBN-polycrystalline cubic boron nitride

Application area

● Main application

○ Further application

MAPAL Blades for HX Single-Bladed and HX Twin-Bladed Reamers



The MAPAL HX system, which takes its name from the hexagonal form of the blades with 6 precision-ground cutting edges, sets the benchmark in economic terms for precision machining bores. Both with single-bladed and the multi-bladed reamers, the system has clear advantages because of the six-fold use of the HX blades:

1. Six precision-ground cutting edges for maximum economy in precision machining bores.
2. Better blade clamping with clamping grooves for a stable positioning, even for difficult cuts and high spindle speeds.

3. Chip breakers for controlled chip flow and achieving the required chip form.
 4. The guide chamfer on the periphery of the blade in conjunction with the adjustable back taper ensures maximum tool life.
- The force and positive connection of the blades guarantees they are safely held.
 - Held in finely adjustable cartridges.
 - The close allocation of the roughing and finishing blade produces the best possible surface quality with the twin-bladed tool in conjunction with the sensitive adjustment facility.

The HX blades with clamping groove are in special cartridges and can be adjusted with two adjusting wedges. They therefore produce the best results with regard to surface finish. The clamping plate grips directly into the clamping grooves on the blade, guaranteeing that the blade is held absolutely securely in the cartridges, even under difficult application conditions with extremely large allowances.

Cutting materials for MAPAL HX Blades

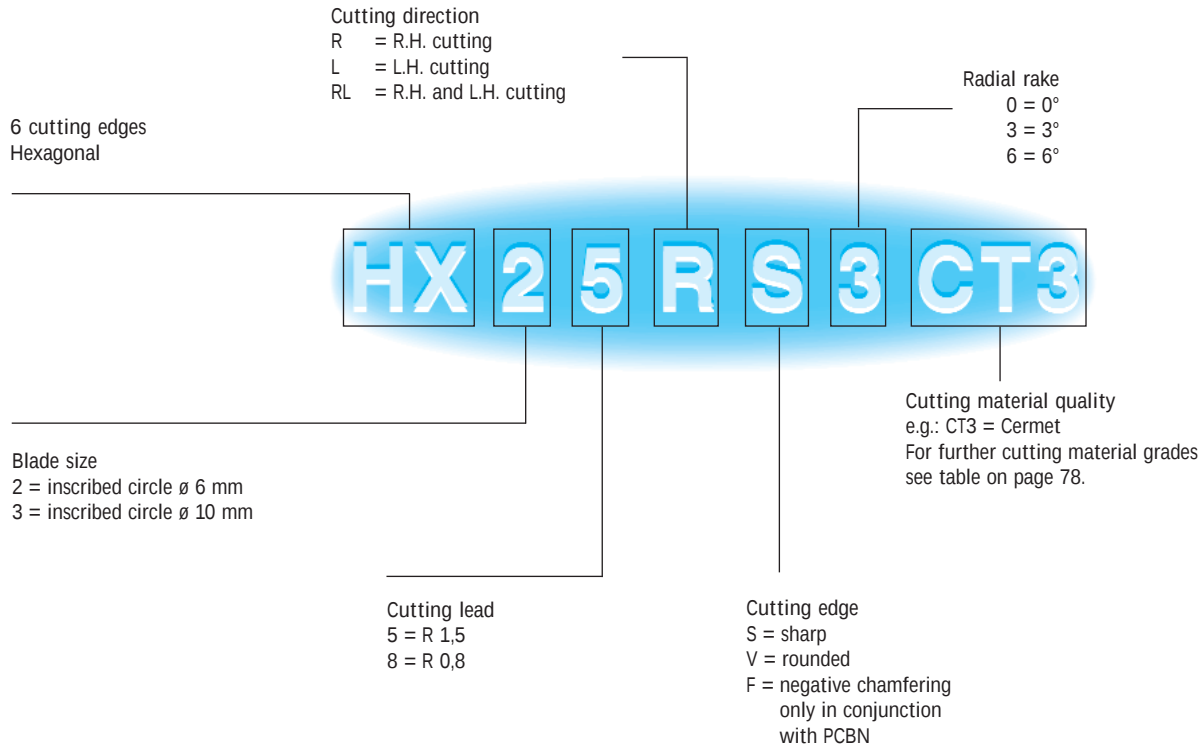
Cutting material code	Coating	Code – ISO 513	Application area															Material Group						Properties	
			Wear resistance Strength															P	M	K	N	S	H		
			01	05	10	15	20	25	30	35	40	45	50	Steel	Stainless steel	Grey cast iron	Non-ferrous metals (Alu etc.)	High heat resistant	Hard materials						
H	–	HW-K10																						Uncoated carbide grade with wide range of applications; for general cutting tasks; suitable for use with low to medium cutting speeds.	
W	CVD	HC-K10																							Coated carbide grade; better wear resistance than grade H, for use with medium to upper cutting speed range.
YE	PVD	HC-P10																							Coated carbide grade; with minimum wear resistance compared to grade H, for use with upper to medium cutting speed range.
CT3	-	HT-P25																							Uncoated Cermet grade; note minimum speed; better surface finish because of high cutting speeds. Not with sintered clamping groove.
CT4	-	HT-P20																							Uncoated Cermet grade; note minimum speed; better surface finish because of high cutting speeds.
YL	PVD	HC-P10																							Coated Cermet grade, better wear resistance than CT4; increase in cutting speed; note minimum speed. Not with sintered clamping groove.
YG	PVD	HC-P10																							Coated Cermet grade, better wear resistance than CT3; increase in cutting speed; note minimum speed.
D	-	DP-K05																							PCD grade for machining non-ferrous metals.
FT01	-	BN-K05																							PCBN grade for machining hardened steel.
FT02	-	BN-K05																							PCBN grade for machining cast iron, also with heavily interrupted cut.

Cutting material code: H = carbide; W, YE = coated carbide, CT3/CT4 = Cermet; YL/YG = coated Cermet; D = PCD-polycrystalline diamond; FT01, FT02 = PCBN-polycrystalline cubic boron nitride

Application area ● Main application ○ Further application

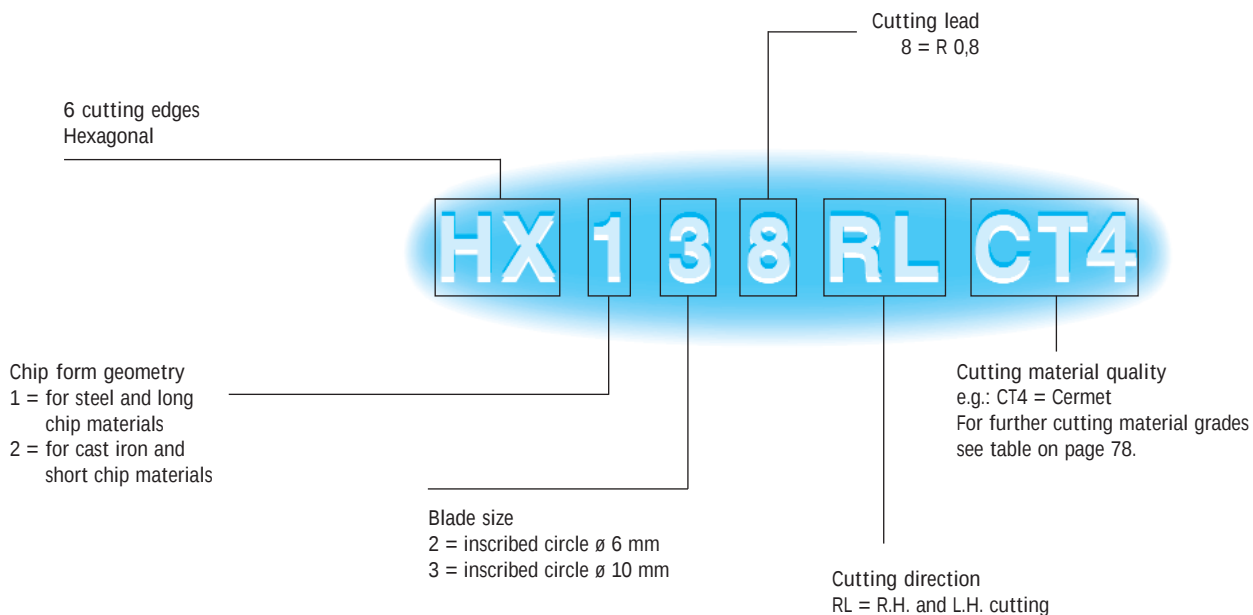
MAPAL HX Blades without Clamping Grooves

The blades are coded using the following system:



MAPAL HX Blades with Clamping Grooves

The blades are coded using the following system:







MAPAL High Performance Reamers

The step towards a new generation of tools.

High Performance Reamers from MAPAL are based on the new HFS® – Head Fitting System. This means that MAPAL offers a complete new standard series for fixed blade reamers.

With its precise tool change and repeatable concentricity and its safe and easy handling, MAPAL's HFS® principle is extremely impressive, particularly when mounting and dismantling the tool head. It is in this respect that it stands out from conventional replaceable head systems.

The internal coolant supply, enabled by the face contact of the HFS® holder and head, releases the coolant straight onto the cutting edges, thus providing it exactly where it is needed. Another important and economic factor is the consistent manufacturing quality which guarantees the same high precision and tool life in every tool head.

Because of the constant grinding quality and inherent stability of the whole system, it is possible to incorporate new geometry features, e.g. for chip control. As regrinding is normally no longer necessary with the tool heads, the best possible cutting edge geometry can be developed and applied without having to consider regrinding aspects.

In addition to tool heads from 4 mm in diameter and series for through hole and blind holes, the standard programme for MAPAL HPR reamers also includes a comprehensive range of holders with axial or radial clamping system.



MAPAL HFS® – Head Fitting System

The brilliant simple connection for simply brilliant tool concepts



The rapid establishment of the HSK Clamping System worldwide has provided a technological leap forward in the precision tool industry in issues of stability and concentricity. For tool head connections, however, there are still a large number of different connection systems.

With the HFS® Head Fitting System MAPAL has now brought a connection for tool heads onto the market which adapts elements of the HSK Clamping System to the particular needs of replaceable heads.

The principle features of the HFS connection are:

- Taper
- Face connection
- Positive drive
- Coolant supply onto the blade

HFS® guarantees high precision and performance with which changeover accuracy and concentricity of less than 3 µm can be reliably achieved in production, setting new standards in economy, user comfort and quality of machining results.

Tools with HFS connections are no weaker or less accurate than a monolith tool. On the contrary, a tool with HFS® is to some extent superior to a monolith tool since tools with HFS® have a higher rigidity than monolith tools because of the extraordinary precision of this type of connection. Despite this the tool head is also produced as a standard part and can therefore be manufactured in larger quantities and with maximum precision. For modern production set-ups the outstanding effect of consistency in performance, including tool life, is achieved to the best possible level with HFS®.

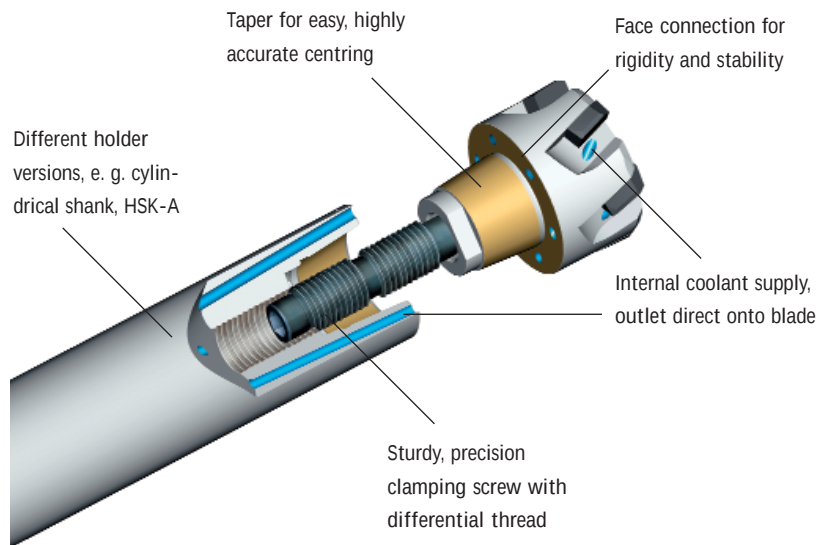
Universal combination options
The design of the MAPAL HFS offers the best possible conditions for the tool to be tailored precisely to specific requirements. This means that the whole tool can be made up of combinations of a variety of materials such as steel or carbide. In designing combination tools the precise concentricity can also be fully utilised and various cutting systems joined together — for example a brazed tool with a basic holder for inserts.

For tools with large steps between diameters, HFS® allows the components of the tool to be produced separately, on suitable production equipment and using the best possible clamping set-up for each one.

A brief summary of the advantages:

- Changeover accuracy and concentricity of less than 3 µm
- Simple, high precision centring with taper
- High rigidity and stability with optimised vibration damping properties
- Long tool life and excellent machining results as a result of vibration damping on material
- Extremely compact, rotationally symmetrical design; suitable for high spindle speeds
- Simple, direct coolant supply through the connection directly onto the blade, making it particularly suitable for minimal lubrication
- Modular design allows maximum universal use
- Easy handling when changing the tool head using clockwise/anti-clockwise screw and eccentric.

MAPAL HFS axial clamping system

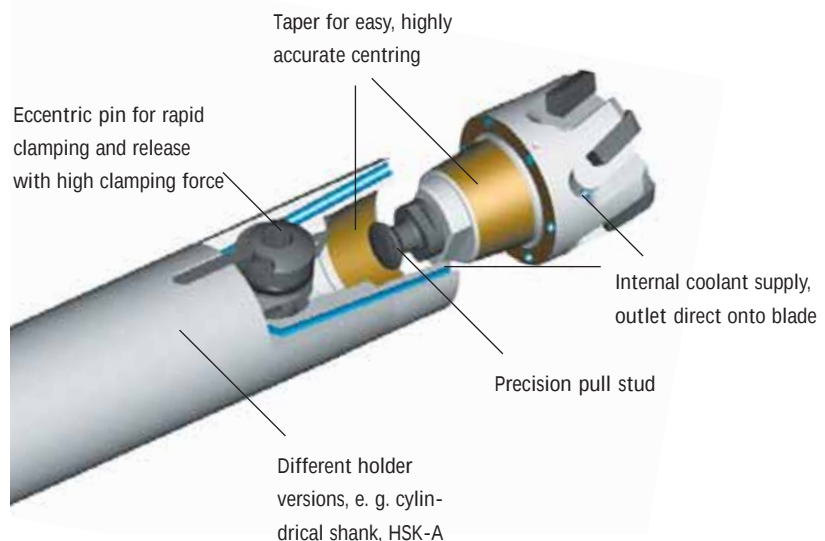


MAPAL HFS Holders available with two different clamping systems:

For adaptors with axial clamping the system is applied from the rear through the shank, away from the machine. The tool head is drawn in with a sturdy differential screw, radially aligned to high precision and held in the exact position. Releasing the tool head is also automatic and simple by turning in the reverse direction.

A further significant development in the holder system is radial clamping, which provides clear advantages with regard to tool change times and the amount of handling without any change in precision. The radial clamping system consists of an eccentric pin in the holder and a pull stud fitted on the head. The replaceable head is clamped or released by a quarter turn of the eccentric pin. Changing the heads can be carried out quickly, easily and on the machine.

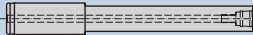
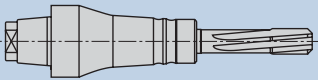
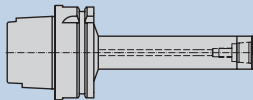
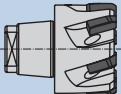
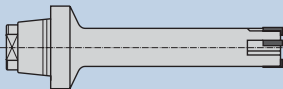
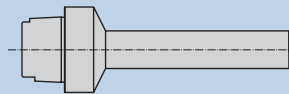
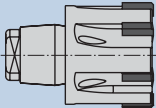
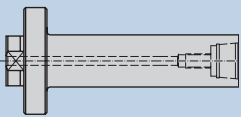
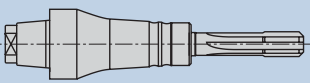
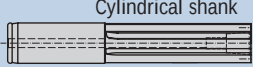
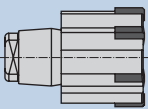
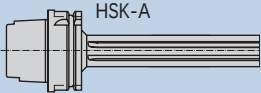
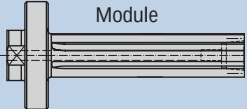
MAPAL HFS radial clamping system: Head change fast, easy and basically on the machine





MAPAL HPR Product Range

Allocation of HFS size to machining diameter

HFS holders		HPR Replaceable Reamer Heads																		
		Threaded spindle or pull stud	 For through holes		0				5					10					15	
Cylindrical shank				HPR 121 Page 86						HFS 12										
				HPR 131 Page 87																
HSK-A				HPR 110 Page 90																
				HPR 130 Page 87																
HSK-C				HPR 100 Page 89																
																				
		HPR Replaceable Reamer Heads																		
		Threaded spindle or pull stud	 For blind holes		0				5					10					15	
Module				HPR 120 Page 86						HFS 12										
				HPR 180 Page 88																
Cylindrical shank				HPR 150 Page 91																
																				
HSK-A																				
																				
HSK-C																				
																				
Module																				
																				

- = Threaded spindle or pull stud without through coolant
- = Threaded spindle or pull stud with through coolant

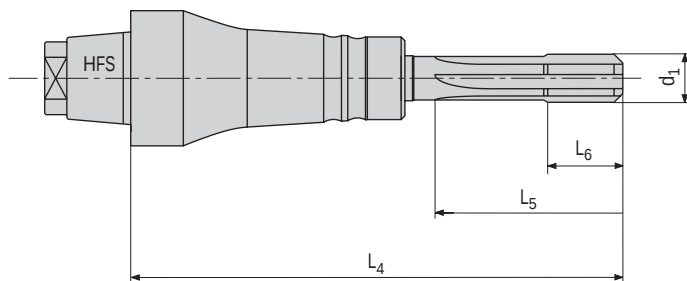
Note: For HFS holders with radial clamping system, pull studs must be used.

MAPAL HPR

MAPAL HPR Replaceable Reamer Head

HPR 120

Straight fluted reamer
shrunk in HFS precision holder.
Suitable for blind hole.



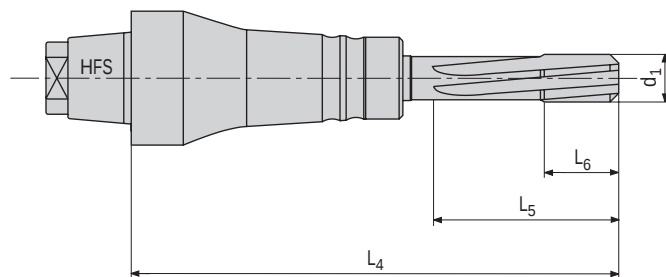
$\varnothing d_1$	HFS size	L_4	Working length L_5	Blade length L_6	Cutting edges	Carbide	Carbide coated	Cermet	Cermet coated
3,98 - 6,99	12	65	25	10	6	H	YF	CT5	VZ

Sizes in mm.

MAPAL HPR Replaceable Reamer Head

HPR 121

L.H. fluted reamer shrunk
in HFS precision holder.



$\varnothing d_1$	HFS size	L_4	Working length L_5	Blade length L_6	Cutting edges	Carbide	Carbide coated	Cermet	Cermet coated
3,98 - 6,99	12	65	25	10	6	H	YF	CT5	VZ

Sizes in mm.

Please provide the following informations with your order:

Order example:

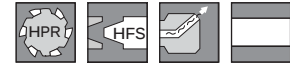
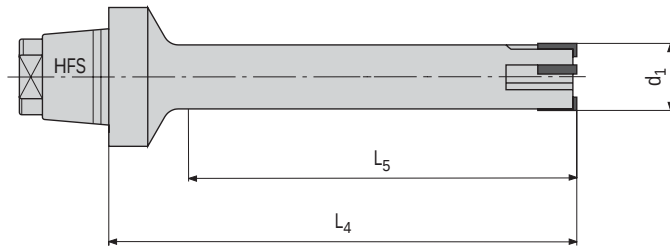
Designation	Diameter of bore	Tolerance (IT or allowance)	Lead code (see page 115 for selection)	Cutting material (see page 112-113 for selection)
HPR reamer HPR 120	5	H 7	MC1G	CT5

See page 108 for MAPAL HFS Holder.

Lead geometry for HPR 120 and HPR 121: MC/MG. Rake angle 1G/1N (see page 115 for details).

Please state diameter of bore and tolerance when ordering.

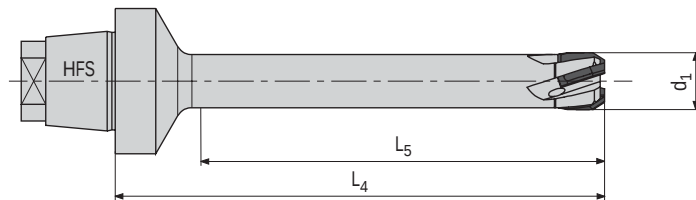
MAPAL HPR Replaceable Reamer Head HPR 130



$\varnothing d_1$	HFS size	L_4	Working length L_5	Cutting edges	Carbide	Carbide coated	Cermet	Cermet coated	PCBN	PCD	Solid carbide coated	Solid carbide coated
7,00 - 9,59	12	60	45	4	H	YF	CT4/CT5	YG/VZ	on request	D	W	W2
9,60 - 18,59	12	60	45	6	H	YF	CT4/CT5	YG/VZ	on request	D	W	W2

Sizes in mm.

MAPAL HPR Replaceable Reamer Head HPR 131



$\varnothing d_1$	HFS size	L_4	Working length L_5	Cutting edges	Carbide	Carbide coated	Cermet	Cermet coated
7,00 - 9,59	12	60	45	4	H	YF	CT4/CT5	YG/VZ
9,60 - 18,59	12	60	45	6	H	YF	CT4/CT5	YG/VZ

Sizes in mm.

Replaceable Reamer Heads HPR 131 available ex stock

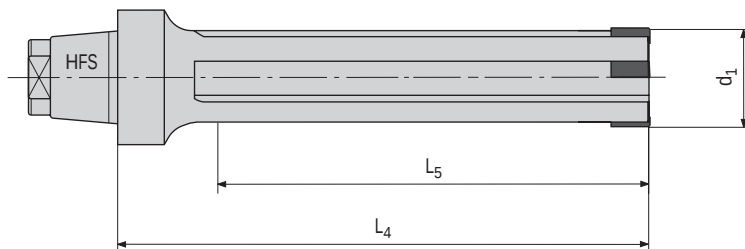
Diameter range	Order No.	Order reference code	Diameter range	Order No.	Order reference code
10,0H7	30043741	HPR131-10,0H7-ME1G-CT4-P	15,0H7	30039950	HPR131-15,0H7-ME1G-CT4-P
11,0H7	30087260	HPR131-11,0H7-ME1G-CT4-P	16,0H7	30047996	HPR131-16,0H7-ME1G-CT4-P
12,0H7	30041656	HPR131-12,0H7-ME1G-CT4-P	17,0H7	30087261	HPR131-17,0H7-ME1G-CT4-P
13,0H7	30057835	HPR131-13,0H7-ME1G-CT4-P	18,0H7	30048997	HPR131-18,0H7-ME1G-CT4-P
14,0H7	30082580	HPR131-14,0H7-ME1G-CT4-P			

See page 108 for MAPAL HFS Holder.

Please state diameter of bore and tolerance when ordering.

MAPAL HPR Replaceable Reamer Head

HPR 180



$\varnothing d_1$	HFS size	L_4	Working length L_5	Cutting edges	Carbide	Carbide coated	Cermet	Cermet coated	PCBN	PCD	Solid carbide coated	Solid carbide coated
7,00 - 14,59	12	60	40	4	H	YF	CT4/CT5	YG/VZ	on request	D	W	W2
14,60 - 21,29	12	60	40	6	H	YF	CT4/CT5	YG/VZ	on request	D	W	W2

Sizes in mm.

Please provide the following informations with your order:

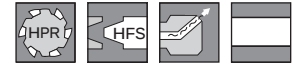
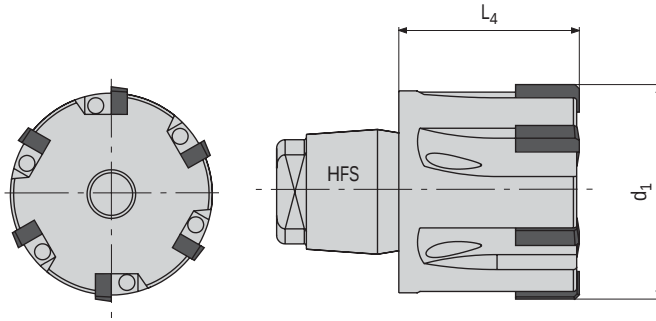
Order example:

Designation	Diameter of bore	Tolerance (IT or allowance)	Lead code (see page 115 for selection)	Cutting material (see page 114 for selection)
HPR reamer HPR 180	12	H 7	MC1G	CT4

See page 108 for MAPAL HFS Holder.
Please state diameter of bore and tolerance when ordering.

MAPAL HPR Replaceable Reamer Head

HPR 100



$\varnothing d_1^*$	HFS size	L_4	Cutting edges	Carbide	Carbide coated	Cermet	Cermet coated	PCBN	PCD	Solid carbide coated	Solid carbide coated
15,60 - 18,59	10	14	6	H	YF	CT4/CT5	YG/VZ	Acc. to application	D	W	W2
18,60 - 21,29	12	14,5	6	H	YF	CT4/CT5	YG/VZ		D	W	W2
21,30 - 23,99	14	15,5	6	H	YF	CT4/CT5	YG/VZ		D	W	W2
24,00 - 29,99	16	16	6	H	YF	CT4/CT5	YG/VZ		D	W	W2
30,00 - 39,99	20	17	8	H	YF	CT4/CT5	YG/VZ		D	W	W2
40,00 - 50,70	24	19	8	H	YF	CT4/CT5	YG/VZ		D	W	W2
50,71 - 65,00	24	25	8	H	YF	CT4/CT5	YG/VZ		D	W	W2

Sizes in mm.

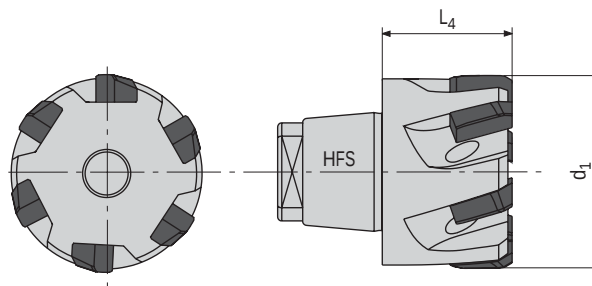
Please provide the following informations with your order:

Order example:				
Designation	Diameter of bore	Tolerance (IT or allowance)	Lead code (see page 115 for selection)	Cutting material (see page 112-113 for selection)
HPR reamer HPR 100	20	H 7	MC1G	CT4

* Diameter range for a specific HFS size.
Please state diameter of bore and tolerance when ordering.
See page 123 for handling notes.

MAPAL HPR Replaceable Reamer Head

HPR 110



$\varnothing d_1^*$	HFS size	L_4	Cutting edges	Carbide	Carbide coated	Cermet	Cermet coated
15,60 - 18,59	10	14	6	H	YF	CT4/CT5	YG/VZ
18,60 - 21,29	12	14,5	6	H	YF	CT4/CT5	YG/VZ
21,30 - 23,99	14	15,5	6	H	YF	CT4/CT5	YG/VZ
24,00 - 29,99	16	16	6	H	YF	CT4/CT5	YG/VZ
30,00 - 39,99	20	17	8	H	YF	CT4/CT5	YG/VZ
40,00 - 50,70	24	19	8	H	YF	CT4/CT5	YG/VZ
50,71 - 65,00	24	25	8	H	YF	CT4/CT5	YG/VZ

Sizes in mm.

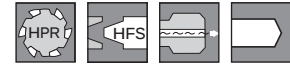
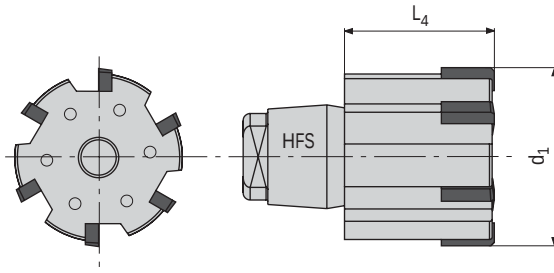
Replaceable Reamer Heads HPR 110 available ex stock

Diameter range	Order No.	Order reference code	Diameter range	Order No.	Order reference code
19,0H7	30077358	HPR110-19,0H7-ME1G-CT4-P	25,4H7	30087255	HPR110-25,4H7-ME1G-CT4-P
19,05H7	30087254	HPR110-19,05H7-ME1G-CT4-P	26,0H7	30045730	HPR110-26,0H7-ME1G-CT4-P
20,0H7	30040404	HPR110-20,0H7-ME1G-CT4-P	27,0H7	30087257	HPR110-27,0H7-ME1G-CT4-P
21,0H7	30039919	HPR110-21,0H7-ME1G-CT4-P	28,0H7	30046121	HPR110-28,0H7-ME1G-CT4-P
22,0H7	30081546	HPR110-22,0H7-ME1G-CT4-P	29,0H7	30087258	HPR110-29,0H7-ME1G-CT4-P
23,0H7	30085368	HPR110-23,0H7-ME1G-CT4-P	30,0H7	30045095	HPR110-30,0H7-ME1G-CT4-P
24,0H7	30080958	HPR110-24,0H7-ME1G-CT4-P	31,75H7	30087259	HPR110-31,75H7-ME1G-CT4-P
25,0H7	30076110	HPR110-25,0H7-ME1G-CT4-P			

* Diameter range for a specific HFS size.
Please state diameter of bore and tolerance when ordering.
See page 123 for handling notes.

MAPAL HPR Replaceable Reamer Head

HPR 150



$\varnothing d_1^*$	HFS size	L_4	Cutting edges	Carbide	Carbide coated	Cermet	Cermet coated	PCBN	PCD	Solid carbide coated	Solid carbide coated
16,60 - 19,39	10	14	6	H	YF	CT4/CT5	YG/VZ	Acc. to application	D	W	W2
19,40 - 21,29	10	14	6	H	YF	CT4/CT5	YG/VZ		D	W	W2
21,30 - 24,99	12	15,5	6	H	YF	CT4/CT5	YG/VZ		D	W	W2
25,00 - 28,99	14	15,5	6	H	YF	CT4/CT5	YG/VZ		D	W	W2
29,00 - 32,29	16	17	6	H	YF	CT4/CT5	YG/VZ		D	W	W2
32,30 - 36,99	16	17	6	H	YF	CT4/CT5	YG/VZ		D	W	W2
37,00 - 41,19	20	17	8	H	YF	CT4/CT5	YG/VZ		D	W	W2
41,20 - 44,99	20	17	8	H	YF	CT4/CT5	YG/VZ		D	W	W2
45,00 - 50,70	24	19	8	H	YF	CT4/CT5	YG/VZ		D	W	W2
50,71 - 65,00	24	25	8	H	YF	CT4/CT5	YG/VZ		D	W	W2

Sizes in mm.

Please provide the following informations with your order:

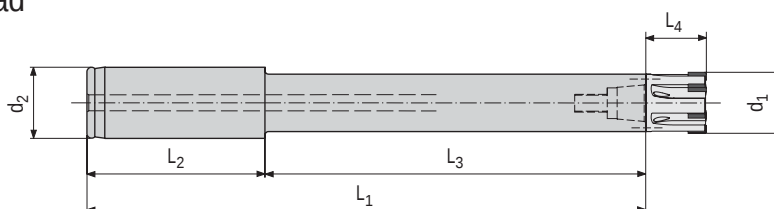
Order example:				
Designation	Diameter of bore	Tolerance (IT or allowance)	Lead code (see page 115 for selection)	Cutting material (see page 114 for selection)
HPR reamer HPR 150	20	H 7	MW1G	YF

* Diameter range for a specific HFS size.
Please state diameter of bore and tolerance when ordering.
See page 123 for handling notes.

MAPAL HFS Holder

HFS 900, 905 and 905C

for HPR Replaceable Reamer Head
HPR 100, HPR 110



HFS 900: Long version with cylindrical shank

Head $\varnothing d_1$	HFS size	$\varnothing d_2 h_6$	L_1	L_2	L_3	L_4	Code HFS holder	Order No.
15,60 - 18,59	10	20	160	50	110	14	HFS 900-10	30010248
18,60 - 21,29	12	20	179,5	50	129,5	14,5	HFS 900-12	30010249
21,30 - 23,99	14	20	180,5	50	130,5	15,5	HFS 900-14	30010250
24,00 - 29,99	16	25	211	60	151	16	HFS 900-16	30010251
30,00 - 39,99	20	25	210	60	150	17	HFS 900-20	30010252
40,00 - 50,70	24	32	266	60	206	19	HFS 900-24	30010253
50,71 - 65,00	24	32	266	60	206	25	HFS 900-24	30010253

HFS 905: Short version with cylindrical shank

Head $\varnothing d_1$	HFS size	$\varnothing d_2 h_6$	L_1	L_2	L_3	L_4	Code HFS holder	Order No.
15,60 - 18,59	10	20	99	50	49	14	HFS 905-10	30010256
18,60 - 21,29	12	20	118,5	50	68,5	14,5	HFS 905-12	30010257
21,30 - 23,99	14	20	119,5	50	69,5	15,5	HFS 905-14	30010258
24,00 - 29,99	16	25	150	60	90	16	HFS 905-16	30010259
30,00 - 39,99	20	25	149	60	89	17	HFS 905-20	30010260
40,00 - 50,70	24	32	167	60	107	19	HFS 905-24	30010261
50,71 - 65,00	24	32	167	60	107	25	HFS 905-24	30010261

HFS 905C: Extra short version with cylindrical shank

Head $\varnothing d_1$	HFS size	$\varnothing d_2 h_6$	L_1	L_2	L_3	L_4	Code HFS holder	Order No.
18,60 - 21,29	12	20	82	50	32	14,5	HFS 905C-12	30078683

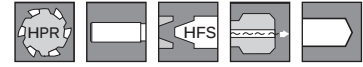
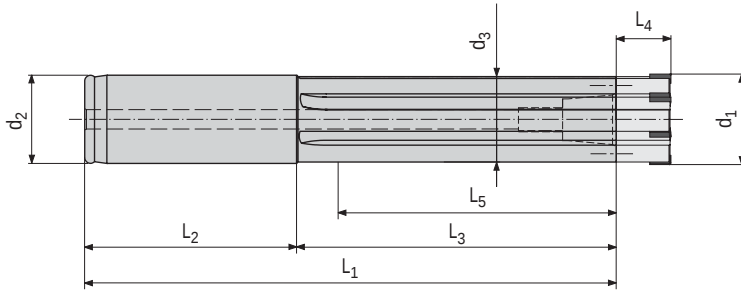
Sizes in mm.

Supply includes: Holder with threaded spindle and Hexagon T Key.
See page 109-110 for accessories and spares.
See page 123 for handling notes.
See page 111 for order example.

MAPAL HFS Holder

HFS 910 and 915

for HPR Replaceable Reamer Head
HPR 150



HFS 910: Long version with cylindrical shank

Head $\varnothing d_1$	HFS size	$\varnothing d_2$ h6	$\varnothing d_3$	L_1	L_2	L_3	L_4	Working length L_5	Code HFS holder	Order No.
16,60 - 19,39	10	20	16,0	160	50	110	14	94	HFS 910-10	30026380
19,40 - 21,29	10	20	18,6	160	50	110	14	94	HFS 910-10	30026488
21,30 - 24,99	12	20	20,5	180,5	50	130,5	15,5	114,5	HFS 910-12	30026489
25,00 - 28,99	14	25	24,2	211,5	60	151,5	15,5	132,5	HFS 910-14	30026510
29,00 - 32,29	16	25	28,2	210	60	150	17	131	HFS 910-16	30026511
32,30 - 36,99	16	25	31,5	210	60	150	17	131	HFS 910-16	30026512
37,00 - 41,19	20	25	36,2	210	60	150	17	140	HFS 910-20	30026513
41,20 - 44,99	20	25	40,2	210	60	150	17	140	HFS 910-20	30026514
45,00 - 50,70	24	32	44,0	266	60	206	19	195	HFS 910-24	30026515
50,71 - 65,00	24	32	44,0	266	60	206	25	205	HFS 910-24	30026515

HFS 915: Short version with cylindrical shank

Head $\varnothing d_1$	HFS size	$\varnothing d_2$ h6	$\varnothing d_3$	L_1	L_2	L_3	L_4	Working length L_5	Code HFS holder	Order No.
16,60 - 19,39	10	20	16,0	99	50	49	14	33	HFS 915-10	30026516
19,40 - 21,29	10	20	18,6	99	50	49	14	33	HFS 915-10	30026521
21,30 - 24,99	12	20	20,5	117,5	50	67,5	15,5	51,5	HFS 915-12	30026522
25,00 - 28,99	14	25	24,2	150,5	60	90,5	15,5	71,5	HFS 915-14	30026523
29,00 - 32,29	16	25	28,2	149	60	89	17	70	HFS 915-16	30026525
32,30 - 36,99	16	25	31,5	149	60	89	17	70	HFS 915-16	30026526
37,00 - 41,19	20	25	36,2	149	60	89	17	79	HFS 915-20	30026527
41,20 - 44,99	20	25	40,2	149	60	89	17	79	HFS 915-20	30026528
45,00 - 50,70	24	32	44,0	167	60	107	19	96	HFS 915-24	30026529
50,71 - 65,00	24	32	44,0	167	60	107	25	97	HFS 915-24	30026529

Sizes in mm.

Supply includes: Holder with threaded spindle and Hexagon T Key.

See page 109-110 for accessories and spares.

See page 123 for handling notes.

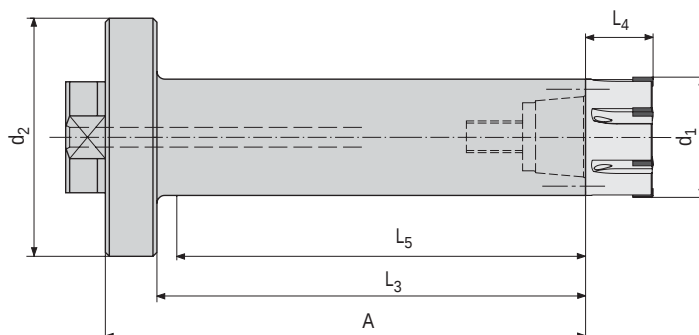
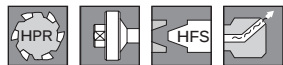
See page 111 for order example.

MAPAL HFS Holder

HFS 920

for HPR Replaceable Reamer Head

HPR 100, HPR 110

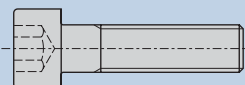
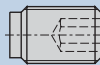


HFS 920: Long version with adaptor module (radially and angular adjustable)

Head $\varnothing d_1$	HFS size	Module size $\varnothing d_2$	L_3	L_4	Working length L_5	Overall length A	Code HFS holder	Order No.
15,60 - 18,59	10	60	68	14	61	81	HFS 920-10	30010264
18,60 - 21,29	12	60	87,5	14,5	80,5	100,5	HFS 920-12	30010265
21,30 - 23,99	14	60	88,5	15,5	79,5	101,5	HFS 920-14	30010266
24,00 - 29,99	16	60	109	16	104	122	HFS 920-16	30010267
30,00 - 39,99	20	60	108	17	103	121	HFS 920-20	30010268
40,00 - 50,70	24	60	120	19	116	133	HFS 920-24	30010269
50,71 - 65,00	24	60	120	25	116	133	HFS 920-24	30010269

Sizes in mm.

Spares for adaptor module

Module size $\varnothing d_2$	 Head Cap Screw* ISO 4762 (DIN 912)		 Trust Pad*		 Adjusting Screw*	
	Size	Order No.	Size	Order No.	Size	Order No.
60	M5x16-12.9	10003601	10,6x5	10040108	M8x1x8	10040109

*Quantity required: 4 each

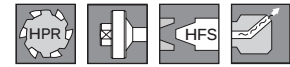
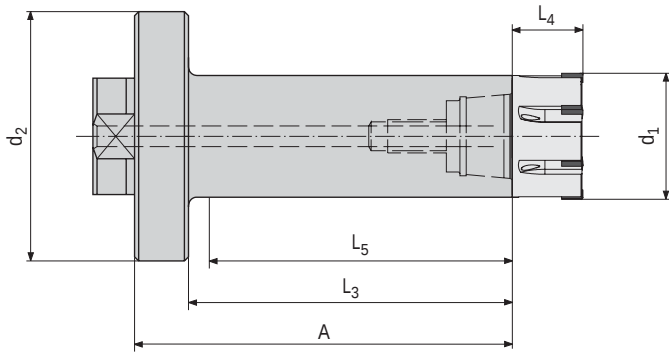
Supply includes: - Holder with threaded spindle
- Hexagon T Key
- Holding screw for modular adaptor
- Parts for angular adjustment of adaptor module

See page 109-110 for accessories and spares.

See page 123 for handling notes.

See page 111 for order example.

MAPAL HFS Holder HFS 921 and 922 for HPR Replaceable Reamer Head HPR 100, HPR 110

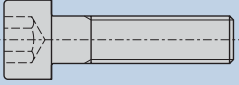


HFS 921/922: Short version with adaptor module (radially and angularly adjustable)

Head $\varnothing d_1$	HFS size	Module size $\varnothing d_2$	L_3	L_4	Working length L_5	Overall length A	Code HFS holder	Order No.
15,60 - 18,59	10	60	36	14	31	49	HFS 921-10	30027896
18,60 - 21,29	12	60	45,5	14,5	40,5	58,5	HFS 921-12	30027897
21,30 - 23,99	14	60	49,5	15,5	44,5	62,5	HFS 921-14	30027898
24,00 - 29,99	16	60	59	16	54	72	HFS 921-16	30027899
30,00 - 39,99	20	60	58	17	53	71	HFS 921-20	30027900
40,00 - 50,70	24	60	71	19	66	84	HFS 921-24	30027901
50,71 - 65,00	24	60	71	25	66	84	HFS 921-24	30027901
50,71 - 65,00	24	80	67	25	62	84	HFS 922-24	30152510

Sizes in mm.

Spares for adaptor module

Module size $\varnothing d_2$	 Head Cap Screw* ISO 4762 (DIN 912)		 Trust Pad*		 Adjusting Screw*	
	Size	Order No.	Size	Order No.	Size	Order No.
60	M5x16-12.9	10003601	10,6x5	10040108	M8x1x8	10040109

*Quantity required: 4 each

Supply includes: - Holder with threaded spindle
- Hexagon T Key
- Holding screw for modular adaptor
- Parts for angular adjustment of adaptor module

See page 109-110 for accessories and spares.

See page 123 for handling notes.

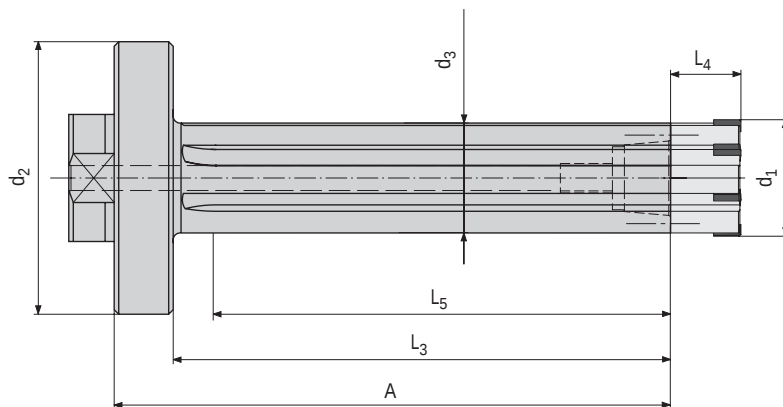
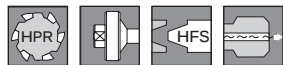
See page 111 for order example.

MAPAL HFS Holder

HFS 925

for HPR Replaceable Reamer Head

HPR 150

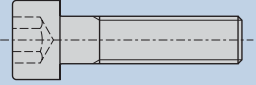
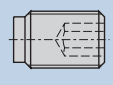


HFS 925: Long version with adaptor module (radially and angular adjustable)

Head $\varnothing d_1$	HFS size	Module size $\varnothing d_2$	$\varnothing d_3$	L_3	L_4	Working length L_5	Overall length A	Code HFS holder	Order No.
16,60 - 19,39	10	60	16,0	68	14	48	81	HFS 925-10	30026562
19,40 - 21,29	10	60	18,6	68	14	48	81	HFS 925-10	30026563
21,30 - 24,99	12	60	20,5	88,5	15,5	69,5	101,5	HFS 925-12	30026564
25,00 - 28,99	14	60	24,2	109,5	15,5	90,5	122,5	HFS 925-14	30026565
29,00 - 32,29	16	60	28,2	108	17	89	121	HFS 925-16	30026566
32,30 - 36,99	16	60	31,5	108	17	89	121	HFS 925-16	30026567
37,00 - 41,19	20	60	36,2	108	17	89	121	HFS 925-20	30026568
41,20 - 44,99	20	60	40,2	108	17	89	121	HFS 925-20	30026569
45,00 - 50,70	24	60	44,0	120	19	101	133	HFS 925-24	30026570
50,71 - 65,00	24	60	44,0	120	25	101	133	HFS 925-24	30026570

Sizes in mm.

Spares for adaptor module

Module size $\varnothing d_2$	 Head Cap Screw* ISO 4762 (DIN 912)		 Trust Pad*		 Adjusting Screw*	
	Size	Order No.	Size	Order No.	Size	Order No.
60	M5x16-12.9	10003601	10,6x5	10040108	M8x1x8	10040109

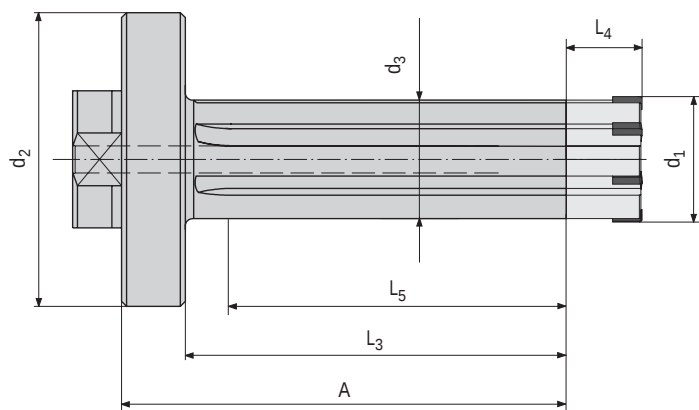
*Quantity required: 4 each

Supply includes: - Holder with threaded spindle
 - Hexagon T Key
 - Holding screw for modular adaptor
 - Parts for angular adjustment of adaptor module

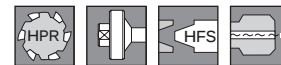
See page 109-110 for accessories and spares.

See page 123 for handling notes.

See page 111 for order example.



MAPAL HFS Holder HFS 926 for HPR Replaceable Reamer Head HPR 150

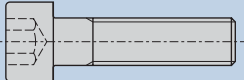


HFS 926: Short version with adaptor module (radially and angular adjustable)

Head $\varnothing d_1$	HFS size	Module size $\varnothing d_2$	$\varnothing d_3$	L_3	L_4	Working length L_5	Overall length A	Code HFS holder	Order No.
16,60 - 19,39	10	60	16,0	36	14	31	49	HFS 926-10	30027885
19,40 - 21,29	10	60	18,6	46	14	41	59	HFS 926-10	30027886
21,30 - 24,99	12	60	20,5	49,5	15,5	44,5	62,5	HFS 926-12	30027887
25,00 - 28,99	14	60	24,2	59,5	15,5	54,5	72,5	HFS 926-14	30027888
29,00 - 32,29	16	60	28,2	58	17	53	71	HFS 926-16	30027889
32,30 - 36,99	16	60	31,5	58	17	53	71	HFS 926-16	30027890
37,00 - 41,19	20	60	36,2	58	17	53	71	HFS 926-20	30027891
41,20 - 44,99	20	60	40,2	68	17	63	81	HFS 926-20	30027892
45,00 - 50,70	24	60	44,0	71	19	66	84	HFS 926-24	30027893
50,71 - 65,00	24	60	44,0	71	25	66	84	HFS 926-24	30027893

Sizes in mm.

Spares for adaptor module

Module size $\varnothing d_2$	 Head Cap Screw* ISO 4762 (DIN 912)		 Trust Pad*		 Adjusting Screw*	
	Size	Order No.	Size	Order No.	Size	Order No.
60	M5x16-12.9	10003601	10,6x5	10040108	M8x1x8	10040109

*Quantity required: 4 each

Supply includes: - Holder with threaded spindle
- Hexagon T Key
- Holding screw for modular adaptor
- Parts for angular adjustment of adaptor module

See page 109-110 for accessories and spares.

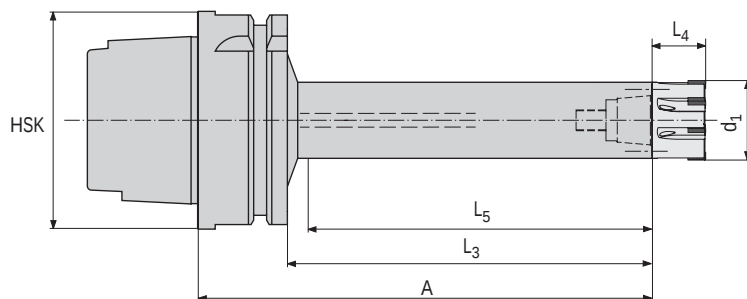
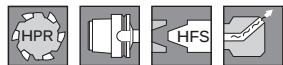
See page 123 for handling notes.

See page 111 for order example.

MAPAL HFS Holder

HFS 940 and 945

for HPR Replaceable Reamer Head
HPR 100, HPR 110



HFS 940: Long version with HSK-A 63

Head $\varnothing d_1$	HFS size	L_3	L_4	Working length L_5	HSK-A size	Overall length A	Code HFS holder	Order No.
15,60 - 18,59	10	91	14	86	63	117	HFS 940-10	30010272
18,60 - 21,29	12	106,5	14,5	100,5	63	132,5	HFS 940-12	30010273
21,30 - 23,99	14	105,5	15,5	99,5	63	131,5	HFS 940-14	30010275
24,00 - 29,99	16	137	16	129	63	163	HFS 940-16	30010276
30,00 - 39,99	20	162	17	158	63	188	HFS 940-20	30010280
40,00 - 50,70	24	181	19	176	63	207	HFS 940-24	30010286
50,71 - 65,00	24	181	25	176	63	207	HFS 940-24	30010286

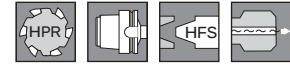
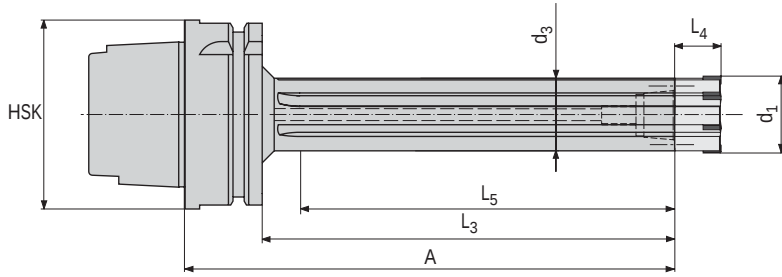
HFS 945: Short version with HSK-A 63

Head $\varnothing d_1$	HFS size	L_3	L_4	Working length L_5	HSK-A size	Overall length A	Code HFS holder	Order No.
15,60 - 18,59	10	51	14	46	63	77	HFS 945-10	30010283
18,60 - 21,29	12	66,5	14,5	60,5	63	92,5	HFS 945-12	30010285
21,30 - 23,99	14	65,5	15,5	59,5	63	91,5	HFS 945-14	30010287
24,00 - 29,99	16	86	16	79	63	112	HFS 945-16	30010288
30,00 - 39,99	20	85	17	78	63	111	HFS 945-20	30010289
40,00 - 50,70	24	83	19	76	63	109	HFS 945-24	30010291
50,71 - 65,00	24	83	25	76	63	109	HFS 945-24	30010291

Sizes in mm.

Supply includes: Holder with threaded spindle and Hexagon T Key.
See page 110 for coolant tube and key – (not included in supply).
See page 109-110 for accessories and spares.
See page 123 for handling notes.
See page 111 for order example.

MAPAL HFS Holder HFS 947 and 942 for HPR Replaceable Reamer Head HPR 150



HFS 947: Long version with HSK-A 63

Head $\varnothing d_1$	HFS size	$\varnothing d_3$	L_3	L_4	Working length L_5	HSK-A size	Overall length A	Code HFS holder	Order No.
16,60 - 19,39	10	16,0	91	14	71	63	117	HFS 947-10	30026586
19,40 - 21,29	10	18,6	91	14	71	63	117	HFS 947-10	30026587
21,30 - 24,99	12	20,5	105,5	15,5	86,5	63	131,5	HFS 947-12	30026588
25,00 - 28,99	14	24,2	137,5	15,5	118,5	63	163,5	HFS 947-14	30026589
29,00 - 32,29	16	28,2	162	17	143	63	188	HFS 947-16	30026590
32,30 - 36,99	16	31,5	162	17	143	63	188	HFS 947-16	30026591
37,00 - 41,19	20	36,2	162	17	152	63	188	HFS 947-20	30026592
41,20 - 44,99	20	40,2	162	17	152	63	188	HFS 947-20	30026593
45,00 - 50,70	24	44,0	207	19	197	63	233	HFS 947-24	30026594
50,71 - 65,00	24	44,0	207	25	197	63	233	HFS 947-24	30026594

HFS 942: Short version with HSK-A 63

Head $\varnothing d_1$	HFS size	$\varnothing d_3$	L_3	L_4	Working length L_5	HSK-A size	Overall length A	Code HFS holder	Order No.
16,60 - 19,39	10	16,0	51	14	31	63	77	HFS 942-10	30026574
19,40 - 21,29	10	18,6	51	14	31	63	77	HFS 942-10	30026575
21,30 - 24,99	12	20,5	65,5	15,5	46,5	63	91,5	HFS 942-12	30026576
25,00 - 28,99	14	24,2	86,5	15,5	67,5	63	112,5	HFS 942-14	30026577
29,00 - 32,29	16	28,2	85	17	66	63	111	HFS 942-16	30026578
32,30 - 36,99	16	31,5	85	17	66	63	111	HFS 942-16	30026579
37,00 - 41,19	20	36,2	85	17	75	63	111	HFS 942-20	30026580
41,20 - 44,99	20	40,2	85	17	75	63	111	HFS 942-20	30026581
45,00 - 50,70	24	44,0	83	19	73	63	109	HFS 942-24	30026582
50,71 - 65,00	24	44,0	83	25	73	63	109	HFS 942-24	30026582

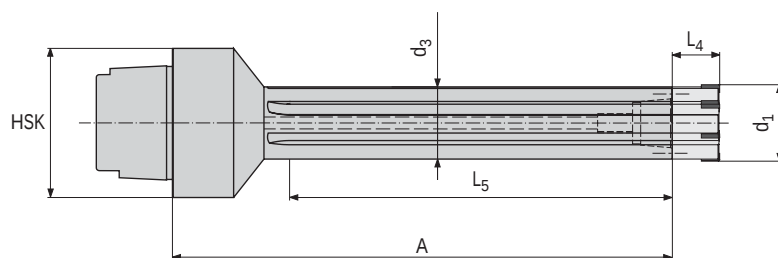
Sizes in mm.

Supply includes: Holder with threaded spindle and Hexagon T Key.
See page 110 for coolant tube and key – (not included in supply).
See page 109-110 for accessories and spares.
See page 123 for handling notes.
See page 111 for order example.

MAPAL HFS Holder

HFS 966 and 961

for HPR Replaceable Reamer Head
HPR 150



HFS 966: Long version with HSK-C 50

Head $\varnothing d_1$	HFS size	$\varnothing d_3$	L_4	Working length L_5	HSK-C size	Overall length A	Code HFS holder	Order No.
16,60 - 19,39	10	16,0	14	78	50	117	HFS 966-10	30026622
19,40 - 21,29	10	18,6	14	78	50	117	HFS 966-10	30026623
21,30 - 24,99	12	20,5	15,5	94,5	50	131,5	HFS 966-12	30026624
25,00 - 28,99	14	24,2	15,5	125,5	50	163,5	HFS 966-14	30026625
29,00 - 32,29	16	28,2	17	150	50	188	HFS 966-16	30026626
32,30 - 36,99	16	31,5	17	150	50	188	HFS 966-16	30026627
37,00 - 41,19	20	36,2	17	150	50	188	HFS 966-20	30026628
41,20 - 44,99	20	40,2	17	150	50	188	HFS 966-20	30026629
45,00 - 50,70	24	44,0	19	174	50	207	HFS 966-24	30026630
50,71 - 65,00	24	44,0	25	174	50	207	HFS 966-24	30026630

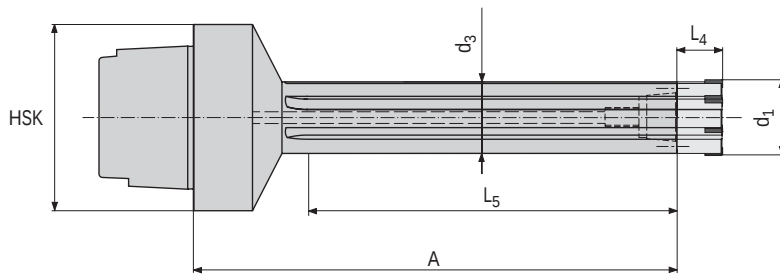
HFS 961: Short version with HSK-C 50

Head $\varnothing d_1$	HFS size	$\varnothing d_3$	L_4	Working length L_5	HSK-C size	Overall length A	Code HFS holder	Order No.
16,60 - 19,39	10	16,0	14	38	50	77	HFS 961-10	30026598
19,40 - 21,29	10	18,6	14	38	50	77	HFS 961-10	30026599
21,30 - 24,99	12	20,5	15,5	54,5	50	91,5	HFS 961-12	30026600
25,00 - 28,99	14	24,2	15,5	74,5	50	112,5	HFS 961-14	30026601
29,00 - 32,29	16	28,2	17	73	50	111	HFS 961-16	30026602
32,30 - 36,99	16	31,5	17	73	50	111	HFS 961-16	30026603
37,00 - 41,19	20	36,2	17	73	50	111	HFS 961-20	30026604
41,20 - 44,99	20	40,2	17	73	50	111	HFS 961-20	30026605
45,00 - 50,70	24	44,0	19	76	50	109	HFS 961-24	30026606
50,71 - 65,00	24	44,0	25	76	50	109	HFS 961-24	30026606

Sizes in mm.

Supply includes: Holder with threaded spindle and Hexagon T Key.
See page 109-110 for accessories and spares.
See page 123 for handling notes.
See page 111 for order example.

MAPAL HFS Holder HFS 967 and 962 for HPR Replaceable Reamer Head HPR 150



HFS 967: Long version with HSK-C 63

Head $\varnothing d_1$	HFS size	$\varnothing d_3$	L_4	Working length L_5	HSK-C size	Overall length A	Code HFS holder	Order No.
16,60 - 19,39	10	16,0	14	78	63	117	HFS 967-10	30026634
19,40 - 21,29	10	18,6	14	78	63	117	HFS 967-10	30026635
21,30 - 24,99	12	20,5	15,5	94,5	63	131,5	HFS 967-12	30026636
25,00 - 28,99	14	24,2	15,5	125,5	63	163,5	HFS 967-14	30026637
29,00 - 32,29	16	28,2	17	150	63	188	HFS 967-16	30026638
32,30 - 36,99	16	31,5	17	150	63	188	HFS 967-16	30026639
37,00 - 41,19	20	36,2	17	150	63	188	HFS 967-20	30026640
41,20 - 44,99	20	40,2	17	150	63	188	HFS 967-20	30026641
45,00 - 50,70	24	44,0	19	174	63	207	HFS 967-24	30026642
50,71 - 65,00	24	44,0	25	174	63	207	HFS 967-24	30026642

HFS 962: Short version with HSK-C 63

Head $\varnothing d_1$	HFS size	$\varnothing d_3$	L_4	Working length L_5	HSK-C size	Overall length A	Code HFS holder	Order No.
16,60 - 19,39	10	16,0	14	38	63	77	HFS 962-10	30026610
19,40 - 21,29	10	18,6	14	38	63	77	HFS 962-10	30026611
21,30 - 24,99	12	20,5	15,5	54,5	63	91,5	HFS 962-12	30026612
25,00 - 28,99	14	24,2	15,5	74,5	63	112,5	HFS 962-14	30026613
29,00 - 32,29	16	28,2	17	73	63	111	HFS 962-16	30026614
32,30 - 36,99	16	31,5	17	73	63	111	HFS 962-16	30026615
37,00 - 41,19	20	36,2	17	73	63	111	HFS 962-20	30026616
41,20 - 44,99	20	40,2	17	73	63	111	HFS 962-20	30026617
45,00 - 50,70	24	44,0	19	76	63	109	HFS 962-24	30026618
50,71 - 65,00	24	44,0	25	76	63	109	HFS 962-24	30026618

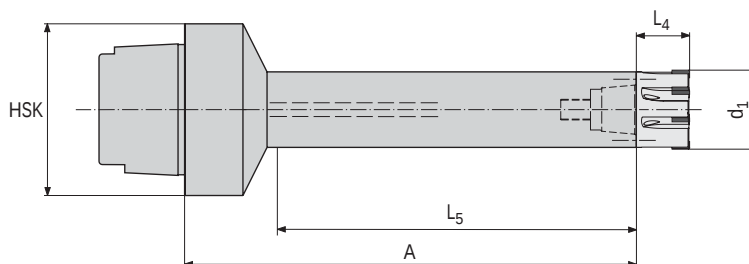
Sizes in mm.

Supply includes: Holder with threaded spindle and Hexagon T Key.
See page 109-110 for accessories and spares.
See page 123 for handling notes.
See page 111 for order example.

MAPAL HFS Holder

HFS 964 and 959

for HPR Replaceable Reamer Head
HPR 100, HPR 110



HFS 964: Long version with HSK-C 50

Head $\varnothing d_1$	HFS size	L_4	Working length L_5	HSK-C size	Overall length A	Code HFS holder	Order No.
15,60 - 18,59	10	14	91	50	117	HFS 964-10	30015319
18,60 - 21,29	12	14,5	105,5	50	132,5	HFS 964-12	30015320
21,30 - 23,99	14	15,5	104,5	50	131,5	HFS 964-14	30015321
24,00 - 29,99	16	16	139	50	163	HFS 964-16	30015322
30,00 - 39,99	20	17	163	50	188	HFS 964-20	30015323
40,00 - 50,70	24	19	186	50	207	HFS 964-24	30015324
50,71 - 65,00	24	25	186	50	207	HFS 964-24	30015324

HFS 959: Short version with HSK-C 50

Head $\varnothing d_1$	HFS size	L_4	Working length L_5	HSK-C size	Overall length A	Code HFS holder	Order No.
15,60 - 18,59	10	14	51	50	77	HFS 959-10	30015327
18,60 - 21,29	12	14,5	65,5	50	92,5	HFS 959-12	30015328
21,30 - 23,99	14	15,5	64,5	50	91,5	HFS 959-14	30015329
24,00 - 29,99	16	16	84	50	122	HFS 959-16	30015330
30,00 - 39,99	20	17	88	50	111	HFS 959-20	30015331
40,00 - 50,70	24	19	86	50	109	HFS 959-24	30015332
50,71 - 65,00	24	25	86	50	109	HFS 959-24	30015332

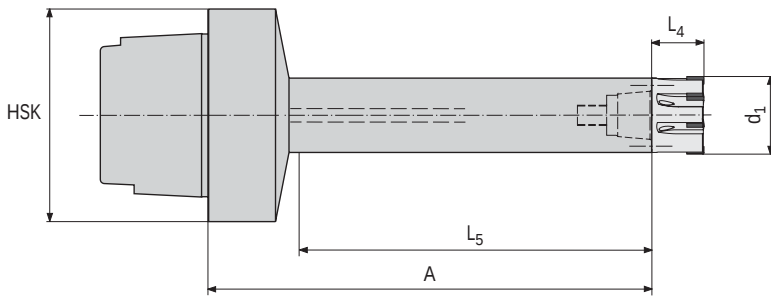
Sizes in mm.

Supply includes: Holder with threaded spindle and Hexagon T Key.
See page 109-110 for accessories and spares.
See page 123 for handling notes.
See page 111 for order example.

MAPAL HFS Holder

HFS 965 and 960

for HPR Replaceable Reamer Head
HPR 100, HPR 110



HFS 965: Long version with HSK-C 63

Head $\varnothing d_1$	HFS size	L_4	Working length L_5	HSK-C size	Overall length A	Code HFS holder	Order No.
15,60 - 18,59	10	14	91	63	117	HFS 965-10	30015335
18,60 - 21,29	12	14,5	105,5	63	132,5	HFS 965-12	30015336
21,30 - 23,99	14	15,5	104,5	63	131,5	HFS 965-14	30015337
24,00 - 29,99	16	16	139	63	163	HFS 965-16	30015338
30,00 - 39,99	20	17	163	63	188	HFS 965-20	30015339
40,00 - 50,70	24	19	186	63	207	HFS 965-24	30015340
50,71 - 65,00	24	25	186	63	207	HFS 965-24	30015340

HFS 960: Short version with HSK-C 63

Head $\varnothing d_1$	HFS size	L_4	Working length L_5	HSK-C size	Overall length A	Code HFS holder	Order No.
15,60 - 18,59	10	14	51	63	77	HFS 960-10	30015343
18,60 - 21,29	12	14,5	65,5	63	92,5	HFS 960-12	30015344
21,30 - 23,99	14	15,5	64,5	63	91,5	HFS 960-14	30015345
24,00 - 29,99	16	16	84	63	112	HFS 960-16	30015346
30,00 - 39,99	20	17	88	63	111	HFS 960-20	30015347
40,00 - 50,70	24	19	86	63	109	HFS 960-24	30015348
50,71 - 65,00	24	25	86	63	109	HFS 960-24	30015348

Sizes in mm.

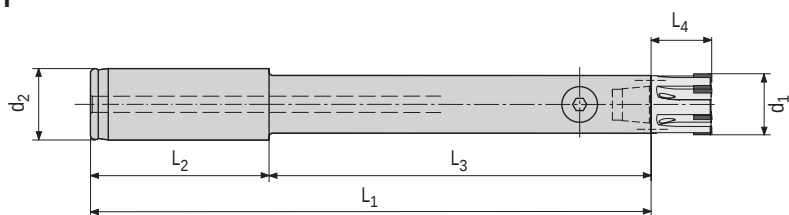
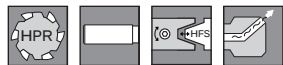
Supply includes: Holder with threaded spindle and Hexagon T Key.
See page 109-110 for accessories and spares.
See page 123 for handling notes.
See page 111 for order example.

MAPAL HFS Holder

HFS 900R, 905R and 905RC

with radial clamping system

for HPR Replaceable Reamer Heads



HFS 900R: Long version with cylindrical shank

Head $\varnothing d_1$	HFS size	$\varnothing d_2$	L_1	L_2	L_3	L_4	Code HFS holder	Order No.
18,60 - 21,29	12	20	179,5	50	129,5	14,5	HFS 900R-12	30078110
21,30 - 23,99	14	20	180,5	50	130,5	15,5	HFS 900R-14	30078115
24,00 - 29,99	16	25	211	60	151	16	HFS 900R-16	30078116
30,00 - 39,99	20	25	210	60	150	17	HFS 900R-20	30080112

HFS 905R: Short version with cylindrical shank

Head $\varnothing d_1$	HFS size	$\varnothing d_2$	L_1	L_2	L_3	L_4	Code HFS holder	Order No.
18,60 - 21,29	12	20	118,5	50	68,5	14,5	HFS 905R-12	30078117
21,30 - 23,99	14	20	119,5	50	69,5	15,5	HFS 905R-14	30078118
24,00 - 29,99	16	25	150	60	90	16	HFS 905R-16	30078119
30,00 - 39,99	20	25	149	60	89	17	HFS 905R-20	30080151

HFS 905RC: Extra short version with cylindrical shank

Head $\varnothing d_1$	HFS size	$\varnothing d_2$	L_1	L_2	L_3	L_4	Code HFS holder	Order No.
18,60 - 21,29	12	20	85	50	35	14,5	HFS 905RC-12	30115560

Sizes in mm.

Recommendation:

In order to enable a fast change of the reamers with the radial clamping system, at least 1 additional pull stud should be ordered.

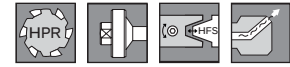
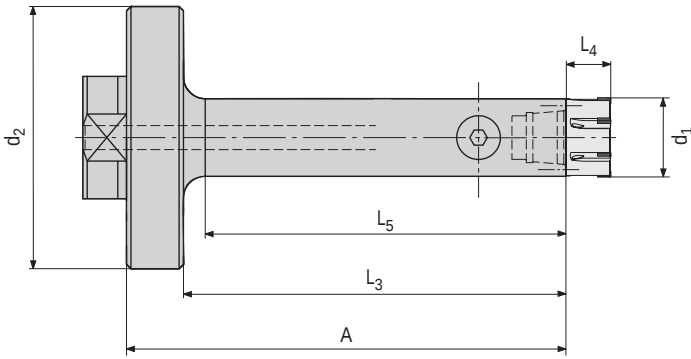
Supply includes: Holder with pull stud, Hexagon T Key and wrench for pull stud.

See page 109-110 for accessories and spares.

See page 123 for handling notes.

See page 111 for order example.

MAPAL HFS Holder HFS 920R and 921R with radial clamping system for HPR Replaceable Reamer Heads



HFS 920R: Long version with adaptor module (radially and angular adjustable)

Head $\varnothing d_1$	HFS size	Module size $\varnothing d_2$	L_3	L_4	Working length L_5	Overall length A	Code HFS holder	Order No.
18,60 - 21,29	12	60	87,5	14,5	80,5	100,5	HFS 920R-12	30078130
21,30 - 23,99	14	60	88,5	15,5	79,5	101,5	HFS 920R-14	30078131
24,00 - 29,99	16	60	109	16	104	122	HFS 920R-16	30078132
30,00 - 39,99	20	60	108	17	103	121	HFS 920R-20	30080152

HFS 921R: Short version with adaptor module (radially and angular adjustable)

Head $\varnothing d_1$	HFS size	Module size $\varnothing d_2$	L_3	L_4	Working length L_5	Overall length A	Code HFS holder	Order No.
18,60 - 21,29	12	60	45,5	14,5	40,5	58,5	HFS 921R-12	30078133
21,30 - 23,99	14	60	49,5	15,5	44,5	62,5	HFS 921R-14	30078134
24,00 - 29,99	16	60	59	16	54	72	HFS 921R-16	30078135
30,00 - 39,99	20	60	58	17	53	71	HFS 921R-20	30080154

Sizes in mm.

Spares for adaptor module

Module size $\varnothing d_2$	Head Cap Screw* ISO 4762 (DIN912)		Thrust Pad*		Adjusting Screw*	
	Size	Order No.	Size	Order No.	Size	Order No.
60	M5x16-12.9	10003601	10,6x5	10040108	M8x1x8	10040109

*Quantity required: 4 each

Supply includes: - Holder with pull stud
- Hexagon T Key
- Wrench for pull stud
- Holding screw for modular adaptor
- Parts for angular adjustment of adaptor module

Recommendation: In order to enable a fast change of the reamers with the radial clamping system, at least 1 additional pull stud should be ordered.

See page 109-110 for accessories and spares.

See page 123 for handling notes.

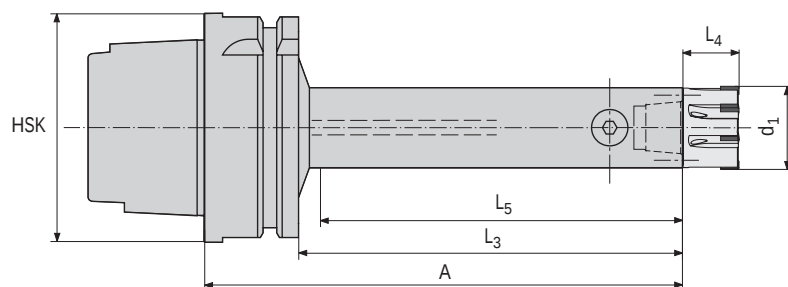
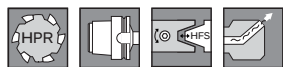
See page 111 for order example.

MAPAL HFS Holder

HFS 940R and 945R

with radial clamping system

for HPR Replaceable Reamer Heads



HFS 940R: Long version with HSK-A 63

Head $\varnothing d_1$	HFS size	L_3	L_4	Working length L_5	HSK-A size	Overall length A	Code HFS holder	Order No.
18,60 - 21,29	12	106,5	14,5	100,5	63	132,5	HFS 940R-12	30078136
21,30 - 23,99	14	105,5	15,5	99,5	63	131,5	HFS 940R-14	30078137
24,00 - 29,99	16	137	16	129	63	163	HFS 940R-16	30078138
30,00 - 39,99	20	162	17	158	63	188	HFS 940R-20	30080156

HFS 945R: Short version with HSK-A 63

Head $\varnothing d_1$	HFS size	L_3	L_4	Working length L_5	HSK-A size	Overall length A	Code HFS holder	Order No.
18,60 - 21,29	12	66,5	14,5	60,5	63	92,5	HFS 945R-12	30078139
21,30 - 23,99	14	65,5	15,5	59,5	63	91,5	HFS 945R-14	30078140
24,00 - 29,99	16	86	16	79	63	112	HFS 945R-16	30078141
30,00 - 39,99	20	85	17	78	63	111	HFS 945R-20	30080157

Sizes in mm.

Recommendation:

In order to enable a fast change of the reamers with the radial clamping system, at least 1 additional pull stud should be ordered.

Supply includes: Holder with pull stud, Hexagon T Key and wrench for pull stud.

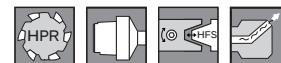
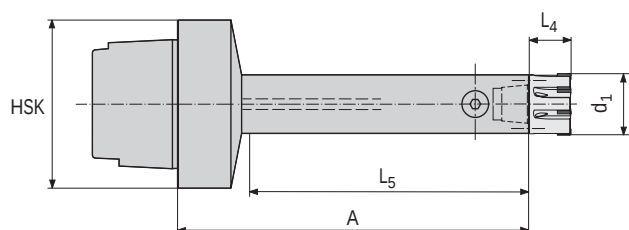
See page 110 for coolant tube and key – (not included in supply).

See page 109-110 for accessories and spares.

See page 123 for handling notes.

See page 111 for order example.

MAPAL HFS Holder HFS 964R and 965R HFS 959R and 960R with radial clamping system for HPR Replaceable Reamer Heads



HFS 964R: Long version with HSK-C 50 HFS 965R: Long version with HSK-C 63

Head $\varnothing d_1$	HFS size	L ₄	Working length L ₅	HSK-C size	Overall length A	Code HFS holder	Order No.
18,60 - 21,29	12	14,5	105,5	50	132,5	HFS 964R-12	30078142
21,30 - 23,99	14	15,5	104,5	50	131,5	HFS 964R-14	30078143
24,00 - 29,99	16	16	139	50	163	HFS 964R-16	30078144
30,00 - 39,99	20	17	163	50	188	HFS 964R-20	30080158
18,60 - 21,29	12	14,5	105,5	63	132,5	HFS 965R-12	30078148
21,30 - 23,99	14	15,5	104,5	63	131,5	HFS 965R-14	30078149
24,00 - 29,99	16	16	139	63	163	HFS 965R-16	30078150
30,00 - 39,99	20	17	163	63	188	HFS 965R-20	30080171

HFS 959R: Short version with HSK-C 50 HFS 960R: Short version with HSK-C 63

Head $\varnothing d_1$	HFS size	L ₄	Working length L ₅	HSK-C size	Overall length A	Code HFS holder	Order No.
18,60 - 21,29	12	14,5	65,5	50	92,5	HFS 959R-12	30078145
21,30 - 23,99	14	15,5	64,5	50	91,5	HFS 959R-14	30078146
24,00 - 29,99	16	16	84	50	112	HFS 959R-16	30078147
30,00 - 39,99	20	17	88	50	111	HFS 959R-20	30080159
18,60 - 21,29	12	14,5	65,5	63	92,5	HFS 960R-12	30078151
21,30 - 23,99	14	15,5	64,5	63	91,5	HFS 960R-14	30078152
24,00 - 29,99	16	16	84	63	112	HFS 960R-16	30078153
30,00 - 39,99	20	17	88	63	111	HFS 960R-20	30080172

Sizes in mm.

Recommendation:

In order to enable a fast change of the reamers with the radial clamping system, at least 1 additional pull stud should be ordered.

Supply includes: Holder with pull stud, Hexagon T Key and wrench for pull stud.

See page 109-110 for accessories and spares.

See page 123 for handling notes.

See page 111 for order example.

MAPAL HFS Holder

for HPR Replaceable Reamer Head

HPR 120, HPR 121, HPR 130, HPR 131, HPR 180



With axial clamping

HFS size	HFS holder version	Drawing see	Code HFS holder with axial clamping	Order No.
12	short version with cyl. shank	HFS 905 Page 92	HFS 905-12	30010257
12	extra short version with cyl. shank	HFS 905C Page 92	HFS 905C-12	30078683
12	long version with cyl. shank	HFS 900 Page 92	HFS 900-12	30010249
12	short version with module 60	HFS 921 Page 95	HFS 921-12	30027897
12	long version with module 60	HFS 920 Page 94	HFS 920-12	30010265
12	short version with HSK-A 63	HFS 945 Page 98	HFS 945-12	30010285
12	long version with HSK-A 63	HFS 940 Page 98	HFS 940-12	30010273
12	short version with HSK-C 50	HFS 959 Page 102	HFS 959-12	30015328
12	long version with HSK-C 50	HFS 964 Page 102	HFS 964-12	30015320
12	short version with HSK-C 63	HFS 960 Page 103	HFS 960-12	30015344
12	long version with HSK-C 63	HFS 965 Page 103	HFS 965-12	30015336

Sizes in mm.

Supply includes: Holder with 2 threaded spindles and Hexagon T Key.

With radial clamping

HFS size	HFS holder version	Drawing see	Code HFS holder with radial clamping	Order No.
12	short version with cyl. shank	HFS 905R Page 104	HFS 905R-12	30078117
12	extra short version with cyl. shank	HFS 905RC Page 104	HFS 905RC-12	30115560
12	long version with cyl. shank	HFS 900R Page 104	HFS 900R-12	30078110
12	short version with module 60	HFS 921R Page 105	HFS 921R-12	30078133
12	long version with module 60	HFS 920R Page 105	HFS 920R-12	30078130
12	short version with HSK-A 63	HFS 945R Page 106	HFS 945R-12	30078139
12	long version with HSK-A 63	HFS 940R Page 106	HFS 940R-12	30078136
12	short version with HSK-C 50	HFS 959R Page 107	HFS 959R-12	30078145
12	long version with HSK-C 50	HFS 964R Page 107	HFS 964R-12	30078142
12	short version with HSK-C 63	HFS 960R Page 107	HFS 960R-12	30078151
12	long version with HSK-C 63	HFS 965R Page 107	HFS 965R-12	30078148

Sizes in mm.

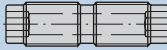
Supply includes: Holder with 2 pull studs and Hexagon T Key.

See page 109-110 for accessories and spares.

See page 123 for handling notes.

See page 111 for order example.

Accessories and Spares for HFS

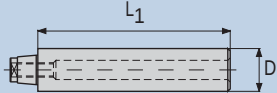
HFS size	Threaded spindle for axial clamping system	
	 without through coolant threaded spindle MN 618 Order No.	 with through coolant threaded spindle MN 618 Order No.
10	10024720	10025194
12	10024721	10025195
14	10024721	10025195
16	10024722	10025196
20	10024722	10025196
24	10024723	10025198

HFS size	Pull stud for radial clamping system	
	 without through coolant Order No.	 with through coolant Order No.
12	10059113	10059273
14	10059113	10059273
16	10059117	10059279
20	10059117	10059279

Recommendation: In order to enable a fast change of the reamers with the radial clamping system, at least 1 additional pull stud should be ordered.

HFS size	Hexagon T Key			
	short version		long version	
	Size	Order No.	Size	Order No.
10	SW2,5 x 100	10006233	SW2,5 x 200	10032722
12	SW3 x 100	10006234	SW3 x 200	10025313
14	SW3 x 100	10006234	SW3 x 200	10025313
16	SW4 x 100	10006235	SW4 x 200	10018010
20	SW4 x 100	10006235	SW4 x 200	10018010
24	SW5 x 100	10006236	SW5 x 200	10013349

HFS size	Taper cleaner for HFS internal taper
	Order No.
10	10029989
12	10029990
14	10030002
16	10030003
20	10030004
24	10030005

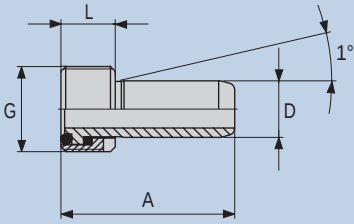
Test Arbors (Alignment Aid)				
HFS size				
	L_1	D	Code	Order No.
10	70	15	test arbor HFS-10	30036468
12	80	20	test arbor HFS-12	30036469
14	80	20,5	test arbor HFS-14	30036470
16	80	23,2	test arbor HFS-16	30036471
20	100	29,3	test arbor HFS-20	30036472
24	100	39	test arbor HFS-24	30036473

Design:
Permissible concentricity deviation for cyl. part to
HFS connection 0,002 mm max.

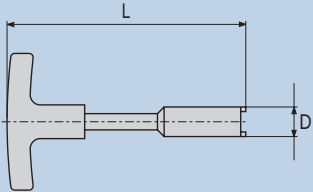
Accessories and Spares for HSK-A 63

		Torque wrench				Key and hexagonal inserts for torque wrench			
HFS size	Key width	Torque		Drive	Order No.	L mm	L ₁ mm	Drive	Order No.
10	2,5	4 Nm	fixed – with blade	–	10044842	175	70	Blade	10044839
12	3	6 Nm	adjustable - without insert	1/4"	10040125	55	30	Insert 1/4"	10040122
14	3	6 Nm	adjustable - without insert	1/4"	10040125	55	30	Insert 1/4"	10040122
16	4	15 Nm	adjustable - without insert	3/8"	10040126	60	35	Insert 3/8"	10040123
20	4	15 Nm	adjustable - without insert	3/8"	10040126	60	35	Insert 3/8"	10040123
24	5	20 Nm	adjustable - without insert	3/8"	10040126	70	45	Insert 3/8"	10040124

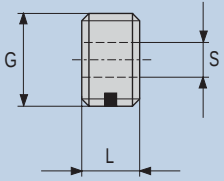
Torque wrench and hexagonal inserts only from HFS size 12 and SW 3 upwards.

Coolant tube					
					
HSK-A size	A	L	G	D	Order No.
63	36,6	11,5	M18x1	12	MN5218-08

Supply includes: Coolant tube with two O rings and locking collar.
Design: Easy access angular movement 1° self-centering, axial – sealed.
Note: Design to DIN 69893.

Assembly key			
			
HSK-A size	L	D	Order No.
63	182	17	10040110

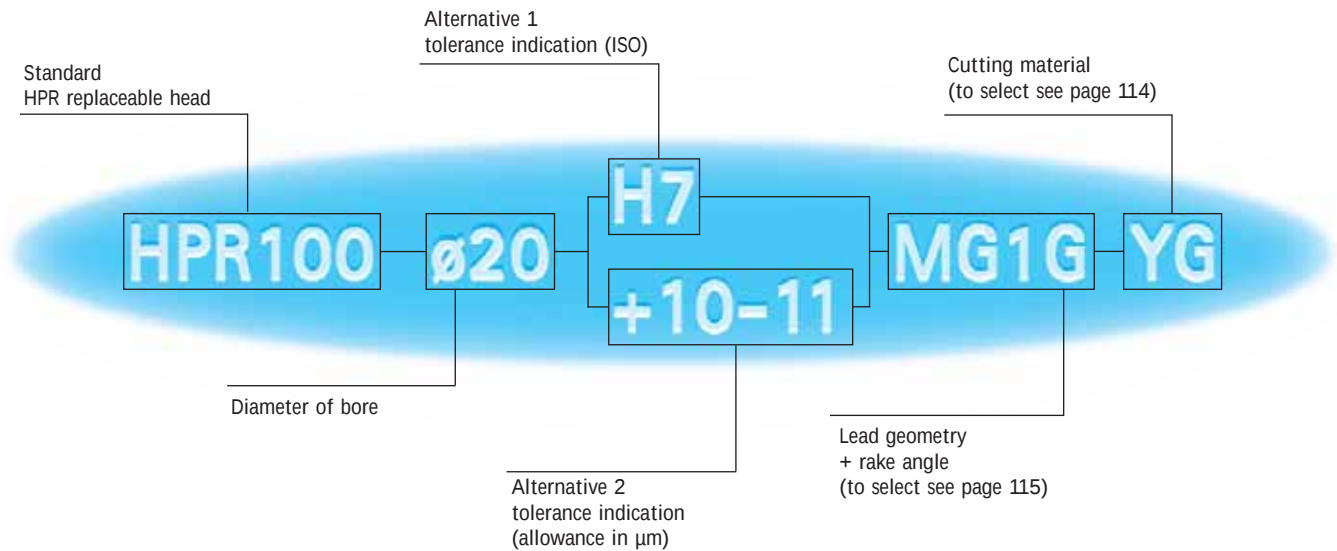
Use: For fitting and removing coolant tube.

Blanking plug				
				
HSK-A size	L	S	G	Order No.
63	11,5	8	M18x1	SB63-08R

Use: For closing off threaded hole in HSK tool shanks when no coolant tube is used.
Design: With Nylok sleeve to hold plug securely.
Material: Stainless steel.

Codes and Order Examples for HPR Replaceable Reamer Head

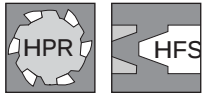
The codes of Replaceable Reamer Heads are based on the following systems:



Order example of a HPR Replaceable Reamer Head for finish machining of a through hole in steel.

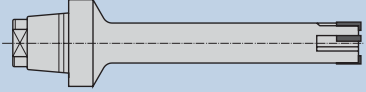
Material:	42CrMo4
Diameter of bore:	ø 18,78 mm
Tolerance indication (ISO or allowance in μm):	H7
Drill depth (machining):	$L_b = 20 \text{ mm}$
Required working length:	drill depth + interference contour (for example 85 mm)
Machine spindle/tool holder:	HSK-C 63
Order details:	
MAPAL HPR Replaceable Reamer Head:	HPR110 ø18.78H7 ME1G CT4
MAPAL HFS Holder:	HFS 964R-12

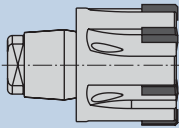
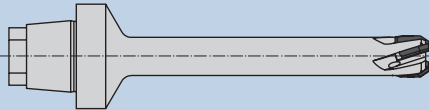
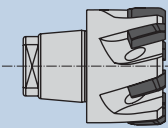
Note: If you are not able to give details for the lead geometry and cutting material codes, please state the type of material to be machined.

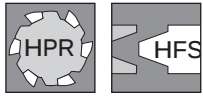


Recommendations for selecting the right lead geometry

Note: The figures given for selecting the lead geometry are recommendations which apply for most cases. For special applications and special materials a number of other cutting leads are available on request.

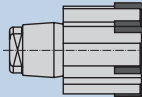
 For through holes Geometry of HPR Replaceable Reamer Heads			 HPR 130 Cutting lead	
			without extra requirement (standard)	with additional requirement for positional accuracy
Material to be machined	Cutting material	Cutting material code		
P Unalloyed/low alloyed steel, free cutting steel	Carbide coated	YF	MC	MA
	Cermet	CT4/CT5	MC	MA
	Cermet coated	YG/VZ	MC	MA
M High alloyed, stainless steel, special alloyed steel	Carbide coated	YF	After consultation	After consultation
	Cermet coated	YG	After consultation	After consultation
K Grey cast iron, alloyed grey cast iron Nodular iron, malleable iron, GGG40 – GGG55, GTW35 – GTW55, GTS35 – GTS55 Nodular iron, malleable iron, GGG60 – GGG80, GTW65, GTS65 – GTS70 Cast iron	Solid carbide coated	W2(W)	MG	MA
	Solid carbide coated	W2(W)	MG	MA
	Cermet	CT4/CT5	MG	MA
	Cermet coated	YG/VZ	MG	MA
	Solid carbide coated	W2(W)	MG	MA
	Cermet coated	YG/VZ	MG	MA
	-	-	-	-
N Copper, copper alloy Alu-casting alloy, magnesium alloy	PCBN	Acc. to application	After consultation	
	Carbide	H	MA	MA
	Cermet	CT4/CT5	MA	MA
	Carbide	H	MA	MA
	PCD	D	MA	MA

HPR 100 		HPR 131 				HPR 110 
recommendation		Cutting lead recommendation				
with additional requirement for surface finish/feed	with additional requirement for chip breaking	without extra requirement (standard)	positional accuracy	with additional requirement for surface finish/feed		chip control
MR	On request	ME	-	MD	-	
MR		ME	-	MD	-	
MR		ME	-	MD	-	
After consultation	On request	-	-	-	-	
After consultation		-	-	-	-	
MR	-	-	-	-	-	
MW	-	-	-	-	-	
MW	-	-	-	-	-	
MW	-	-	-	-	-	
MW	On request	-	-	-	-	
MW		ME	-	MD	-	
-		-	-	-	-	
	On request	-	-	-	-	
MW	On request	-	-	-	-	
MW		-	-	-	-	
MW	After consultation	-	-	-	-	
MW		-	-	-	-	



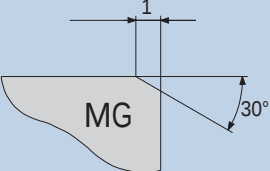
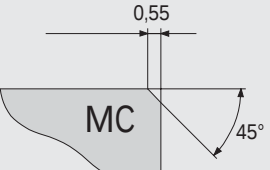
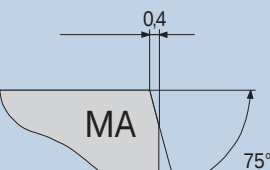
Recommendations for selecting the right lead geometry

Note: The figures given for selecting the lead geometry are recommendations which apply for most cases. For special applications and special materials a number of other cutting leads are available on request.

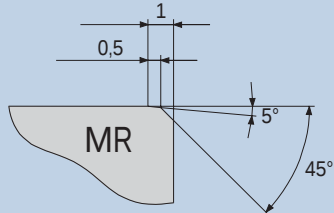
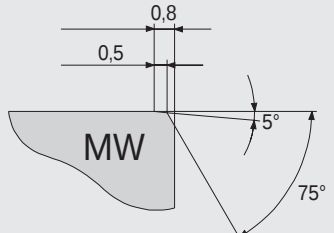
 For blind holes Geometry of HPR Replaceable Reamer Heads Note: The recommended values are shown in bold.			HPR 180		HPR 150			
								
			Cutting lead recommendation					
Material to be machined			Cutting material	Cutting material code	without extra requirement (standard)	with additional requirement for positional accuracy	surface finish/ feed	chip control
P	Unalloyed/low alloyed steel, free cutting steel		Carbide coated	YF	MC	MA	MW	ML
			Cermet	CT4/CT5	MC	MA	MW	ML
			Cermet coated	YG/VZ	MC	MA	MW	ML
M	High alloyed, stainless steel, special alloyed steel		Carbide coated	YF	After consultation			
			Cermet coated	YG	After consultation			
K	Grey cast iron, alloyed grey cast iron		Solid carbide coated	W2(W)	MW	MA	MW	-
	Nodular iron, malleable iron, GGG40 – GGG55, GTW35 – GTW55, GTS35 – GTS55		Solid carbide coated	W2(W)	MW	MA	MW	-
			Cermet	CT4/CT5	MW	MA	MW	-
			Cermet coated	YG/VZ	MW	MA	MW	-
	Nodular iron, malleable iron, GGG60 – GGG80, GTW65, GTS65 – GTS70		Solid carbide coated	W2(W)	MC	MA	MW	ML
			Cermet coated	YG/VZ	MC	MA	MW	ML
			-	-	-	-	-	-
Cast iron		PCBN	Acc. to application	After consultation				
N	Copper, copper alloy		Carbide	H	MA	MA	MW	ML
			Cermet	CT4/CT5	MA	MA	MW	ML
	Alu-casting alloy, magnesium alloy		Carbide	H	MA	MA	MW	After consultation
			PCD	D	MA	MA	MW	After consultation

Lead geometry and rake angle

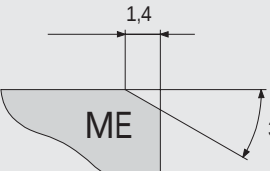
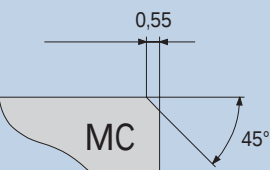
Lead geometries for HPR Replaceable Reamer Heads HPR 100, HPR 120*, HPR 121*, HPR 130, HPR 150 and HPR 180

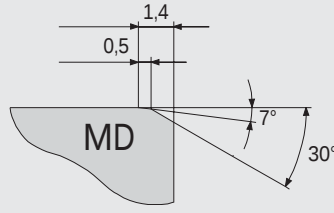
Geometry	Rake angle	Lead code
	6°	MG1G*
	6°	MC1G*
	0°	MA0A
	6°	MA1G
	12°	MA1N

* Leads available for HPR 120 and HPR 121. Lead length for HPR 120 and HPR 121 0,1 x D.

Geometry	Rake angle	Lead code
	6°	MR1G
	0°	MW0A
	6°	MW1G
	12°	MW1N

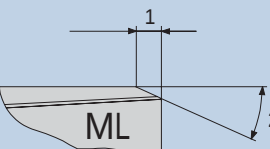
Lead geometry for HPR Replaceable Reamer Heads HPR 110 and HPR 131

	6°	ME1G
	6°	MC1G

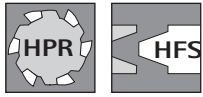
	6°	MD1G
--	----	------

MAPAL HPR

Special lead geometry for HPR Replaceable Reamer Heads HPR 150 and HPR 180

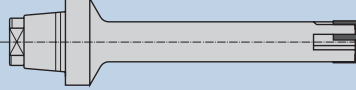
	6°	ML2G
---	----	------

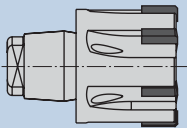
A number of other lead geometries and cutting leads with chip breaker are available on request.



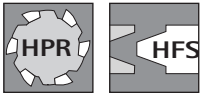
HSC Machining Values for HPR Replaceable Reamer Heads

The figures given are guidelines. The best values for the application in question should be calculated from trials or during the machining process as the effects of component geometry, clamping and machine stability cannot be taken into account here.

 For through holes Note: The recommended values are shown in bold. Lead code Lead geometry and rake angle			HPR 130 				
			MG	MC	MR	MA	
			MG1G 1 x 30° Rake angle 6°	MC1G 0,55 x 45° Rake angle 6°	MR1G 1 x 5°/45° Rake angle 6°	MA1G 0,4 x 75° Rake angle 6°	MA1N 0,4 x 75° Rake angle 12°
Material to be machined		R_m N/mm ²	Feed per tooth f_z in mm				
P	Unalloyed steel, structural-, cast-, free cutting-, case hardened steel	< 500		0,12 - 0,35	0,2 - 0,35	0,12 - 0,3	
	Unalloyed/low alloyed steel, structural-, cast-, heat treat-, tool steel, case hardened steel	500 - 900		0,12 - 0,35	0,2 - 0,35	0,12 - 0,3	
	Lead alloyed free cutting steel			0,12 - 0,35	0,2 - 0,35	0,12 - 0,3	
	Unalloyed/low alloyed steel, temp. resisting structural-, heat treat-, nitride-, tool steel	> 900		0,1 - 0,2	0,1 - 0,3	0,1 - 0,2	
M	High alloyed steel, tool steel			≤ 0,1	0,1 - 0,3	≤ 0,1	
	Special alloyed steel, Inconel, Hastelloy, Nimonic etc.		Recommendation of feed rate acc. to consultation				
	Stainless steel	≤ 600		≤ 0,1	0,1 - 0,3	≤ 0,1	≤ 0,1
	Stainless steel	> 600		≤ 0,1	0,1 - 0,3	≤ 0,1	≤ 0,1
K	Stainless/heat resisting steel	> 750		≤ 0,1	0,1 - 0,3	≤ 0,1	≤ 0,1
	Grey cast iron		0,05 - 0,3			0,05 - 0,3	0,05 - 0,2
	Alloyed grey cast iron		0,05 - 0,3			0,05 - 0,3	0,05 - 0,2
	Nodular iron ferritic/pearlitic, malleable iron, GGG40 - GGG55, GTW35 - GTW55, GTS35 - GTS55	≤ 600	0,15 - 0,4			0,1 - 0,25	
N	Nodular iron pearlitic, malleable iron, GGG60 - GGG80, GTW65, GTS65 - GTS70	> 600	0,15 - 0,3			0,1 - 0,25	
	Alloyed nodular iron		0,15 - 0,3			0,1 - 0,25	
	Copper alloy, brass, lead alloyed bronze, lead bronze very good free machining						
	Copper alloy, brass, bronze moderate free machining						
N	Copper, copper alloy, alu-, manganese-, phosphorus bronze hard free machining					0,15 - 0,5	0,15 - 0,5
	Alu wrought alloy					0,15 - 0,5	0,15 - 0,5
	Alu-casting alloy Si-content < 10 %, magnesium alloy					0,15 - 0,5	0,15 - 0,5
	Alu-casting alloy Si-content > 10 %					0,15 - 0,5	0,15 - 0,5
Cutting depth a_p in mm			0,1 - 0,2	0,1 - 0,2	0,1 - 0,2	0,1 - 0,2	0,1 - 0,2

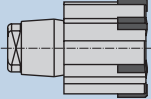
HPR 100						HPR 131			* Lead geometrie MA and MW in PCD on request also available with 6° rake angle								
						 HPR 110 											
MW			MG	MA		MC	ME	MD									
MW1G 8 x 5°/75° ke angle 6°	MW1N 0,8 x 5°/75° Rake angle 12°	MW0A 0,8 x 5°/75° Rake angle 0° (PCD) ★	MG3L 1 x 30° Negative chamfer (PCBN)	MA1N 0,4 x 75° Rake angle 12°	MA0A 0,4 x 75° Rake angle 0° (PCD) ★	MC1G 0,55 x 45° Rake angle 6°	ME1G 1,4 x 30° Rake angle 6°	MD1G 1,4 x 7°/30° Rake angle 6°									
Cutting speed v _C in m/min for cutting material									Carbide	Carbide coated	Cermet	Cermet coated	PCBN	PCD	Solide carbide coated		
Feed per tooth f _z in mm									H	YF	CT4/CT5	YG/VZ	Acc. to application	D	W2/W		
			Only for hard machining in connection with PCBN-tipped tools			0,1 - 0,35	0,15 - 0,3	0,2 - 0,4		80 - 100	120 - 150	240	Please consult for machining values for cast iron with PCBN-tipped tools or hard machining				
						0,1 - 0,35	0,15 - 0,3	0,2 - 0,4		80 - 100	120 - 150	210					
						0,1 - 0,35	0,15 - 0,3	0,2 - 0,4		80 - 100	120 - 150	240					
						0,1 - 0,3	0,1 - 0,2	0,1 - 0,3		100	120	150					
									35	35							
Recommendation of feed rate acc. to consultation					Recommendation of feed rate acc. to consultation		Recommendation of feed rate acc. to consultation										
									35	35 - 45							
									25	25 - 40							
									25	25 - 40							
										80 - 100							80-100
										80 - 100							80-100
0,1 - 0,2												180		240			80-100
0,1 - 0,2								0,15 - 0,3	0,2 - 0,4					120			
0,1 - 0,2								0,15 - 0,3	0,2 - 0,4					120			
0,05 - 0,2	0,15 - 0,5			0,1 - 0,25					150		240						
0,05 - 0,2	0,15 - 0,5			0,1 - 0,25					80		180						
0,05 - 0,2	0,15 - 0,5			0,1 - 0,25					40								
0,15 - 0,5	0,15 - 0,5	For tools with PCD blades, please consult			For tools with PCD blades, please consult									Please consult for machining values for PCD > 300			
0,15 - 0,5	0,15 - 0,5			0,1 - 0,25					> 250								
0,15 - 0,5	0,15 - 0,5			0,1 - 0,25					> 250								
0,1 - 0,2	0,15 - 0,5			0,1 - 0,2			0,1 - 0,2	0,1 - 0,2									

MADAM LBB



HSC Machining Values for HPR Replaceable Reamer Heads

The figures given are guidelines. The best values for the application in question should be calculated from trials or during the machining process as the effects of component geometry, clamping and machine stability cannot be taken into account here.

 For blind holes		HPR 150				
						
		MG	MC	MR	MA	
Note: The recommended values are shown in bold.	Lead code	MG1G	MC1G	MR1G	MA1G	MA1N
	Lead geometry and rake angle	1 x 30° Rake angle 6°	0,55 x 45° Rake angle 6°	1 x 5°/45° Rake angle 6°	0,4 x 75° Rake angle 6°	0,4 x 75° Rake angle 12°
Material to be machined		Feed per tooth f_z in mm				
	R_m N/mm ²					
P	Unalloyed steel, structural-, cast-, free cutting-, case hardened steel	< 500		0,12 - 0,35		0,12 - 0,3
	Unalloyed/low alloyed steel, structural-, cast-, heat treat-, tool steel, case hardened steel	500 - 900		0,12 - 0,35		0,12 - 0,3
	Lead alloyed free cutting steel			0,12 - 0,35		0,12 - 0,3
	Unalloyed/low alloyed steel, temp. resisting structural-, heat treat-, nitride-, tool steel	> 900		0,1 - 0,2		0,1 - 0,2
M	High alloyed steel, tool steel			≤ 0,1		≤ 0,1
	Special alloyed steel, Inconel, Hastelloy, Nimonic etc.		Recommendation of feed rate acc. to consultation			
	Stainless steel	≤ 600		≤ 0,1		≤ 0,1
	Stainless steel	> 600		≤ 0,1		≤ 0,1
K	Stainless/heat resisting steel	> 750		≤ 0,1		≤ 0,1
	Grey cast iron				0,05 - 0,3	0,05 - 0,2
	Alloyed grey cast iron				0,05 - 0,3	0,05 - 0,2
	Nodular iron ferritic/pearlitic, malleable iron, GGG40 - GGG55, GTW35 - GTW55, GTS35 - GTS55	≤ 600			0,1 - 0,5	
N	Nodular iron pearlitic, malleable iron, GGG60 - GGG80, GTW65, GTS65 - GTS70	> 600		0,1 - 0,2		0,1 - 0,5
	Alloyed nodular iron			0,1 - 0,2		0,1 - 0,5
	Copper alloy, brass, lead alloyed bronze, lead bronze very good free machining					
	Copper alloy, brass, bronze moderate free machining					
N	Copper, copper alloy, alu-, manganese-, phosphorus bronze hard free machining				0,15 - 0,5	0,15 - 0,5
	Alu wrought alloy				0,15 - 0,5	0,15 - 0,5
	Alu-casting alloy Si-content < 10 %, magnesium alloy				0,15 - 0,5	0,15 - 0,5
	Alu-casting alloy Si-content > 10 %				0,15 - 0,5	0,15 - 0,5
Cutting depth a_p in mm		0,1 - 0,2	0,1 - 0,2	0,1 - 0,2	0,1 - 0,2	0,1 - 0,2

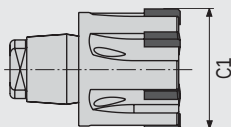
HPR 180							* Lead geometrie MA and MW in PCD on request also available with 6° rake angle						
MW			MG	MA		ML							
MW1G 8 x 5°/75° ke angle 6°	MW1N 0,8 x 5°/75° Rake angle 12°	MW0A 0,8 x 5°/75° Rake angle 0° (PCD) ★	MG3L 1 x 30° Negative chamfer (PCBN)	MA1N 0,4 x 75° Rake angle 12°	MA0A 0,4 x 75° Rake angle 0° (PCD) ★	ML2G 1 x 25° Rake angle 6° chip guide cut							
Cutting speed v _C in m/min for cutting material							Carbide	Carbide coated	Cermet	Cermet coated	PCBN	PCD	Solide carbide coated
Feed per tooth f _z in mm							H	YF	CT4/CT5	YG/VZ	Acc. to application	D	W2/W
0,1 - 0,3			Only for hard machining in connection with PCBN-tipped tools			0,1 - 0,2		120	120 - 150	240	Please consult for machining values for cast iron with PCBN-tipped tools or hard machining		
0,1 - 0,3						0,1 - 0,2		120	120 - 150	210			
0,1 - 0,3						0,1 - 0,2		120	120 - 150	240			
0,1 - 0,3						0,1 - 0,2		100	120	150			
0,1 - 0,3						≤ 0,1	35	35					
Recommendation of feed rate acc. to consultation				Recommendation of feed rate acc. to consultation									
0,1 - 0,3	0,1 - 0,3					≤ 0,1	35	35 - 45					
0,1 - 0,3	0,1 - 0,3					≤ 0,1	25	25 - 40					
0,1 - 0,3	0,1 - 0,3					≤ 0,1	25	25 - 40					
0,5 - 0,25	0,05 - 0,25							80 - 100					80 - 100
0,5 - 0,25	0,05 - 0,25							80 - 100					80 - 100
0,1 - 0,2								80 - 100	200	240			80 - 100
0,1 - 0,2						0,15 - 0,25		120	200	240			
0,1 - 0,2						0,15 - 0,25		90					
0,05 - 0,2	0,15 - 0,5			0,1 - 0,25		0,1 - 0,3	150		240				
0,05 - 0,2	0,15 - 0,5			0,1 - 0,25		0,1 - 0,3	80		180				
0,05 - 0,2	0,15 - 0,5			0,1 - 0,25		0,1 - 0,3	40						
0,15 - 0,5	0,15 - 0,5	For tools with PCD blades, please consult			For tools with PCD blades, please consult					Please consult for machining values for PCD > 300			
0,15 - 0,5	0,15 - 0,5			0,1 - 0,25			> 250						
0,15 - 0,5	0,15 - 0,5			0,1 - 0,25			> 250						
0,1 - 0,2	0,15 - 0,5			0,1 - 0,2		0,1 - 0,2							

MAPAL HPR Replaceable Reamer Heads with configurable parameters

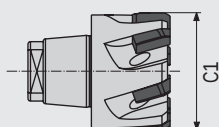
The standard versions of the HPR Replaceable Reamer Heads can be easily adapted individually with configurable parameters. These semi-standard items are based on a standardised design where one or more parameters can be configured. The coding for the different types which can be configured follow the coding for the normal version but is given an additional "C" (configurable).

1. Configurable parameters for Replaceable Heads HPR 100C, HPR 110C and HPR 150C

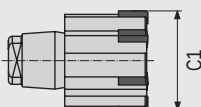
HPR 100C



HPR 110C



HPR 150C



- Blade diameter and grinding dimension can be configured (C1)

For HPR 100C, 110C and 150C versions the ground blade diameter and the grinding dimension for the Replaceable Reamer Head can be selected individually. This means the maximum dimension of the blade diameter is then determined. No adjustment supplement is charged for the configuration which deviates from the standard.

Order example for Replaceable Reamer Head HPR 110C

- diameter of bore: $\varnothing 20^{H7} (+21 \mu\text{m})$
- for use in steel
- layout for medium tolerance

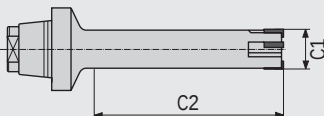
Order details:

HPR110C-20H7ME1GCT4

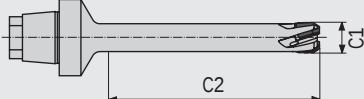
Maximum tool diameter: $\varnothing 20.011 \text{ mm}$

2. Configurable parameters for Replaceable Heads HPR 130C, HPR 131C and HPR 180C

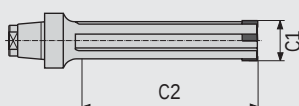
HPR 130C



HPR 131C



HPR 180C



- Blade diameter and grinding dimension can be configured (C1)
- Working length can be configured (C2)

For HPR 130C, HPR 131C and HPR 180C versions the ground blade diameter and the grinding dimension can be selected individually. This means that the maximum dimension of the blade diameter is then determined. No adjustment supplement is charged for the configuration which deviates from the standard.

In addition the working length can also be configured for these versions, with the exception of solid carbide designs W/W2. For Replaceable Heads for working lengths which are modified a supplement is charged depending on quantity.

Order example for Replaceable Reamer Head HPR 131C

- diameter of bore: $\varnothing 16^{H7}$
- for use in steel
- configured working length 50 mm (standard 45 mm)

Order details:

HPR131C-16H7ME1GCT4

Working length: 45 mm

MAPAL HFS Holders with configurable parameters

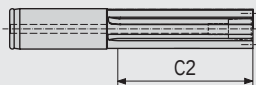
The standard versions of the HFS Holders can be easily adapted individually with configurable parameters. These semi-standard items are based on a standard holder design where the working length can be configured. The coding for the different types which can be configured follow the coding for the original design but is given an additional "C" (configurable).

Configurable parameters for HFS Holders

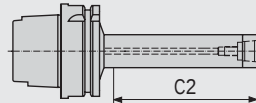
Cylindrical shank



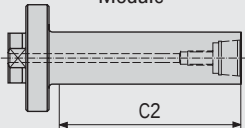
Cylindrical shank



HSK-A



Module



- Configurable working length (C2)

The working length (L₅ or L₃ for cylindrical shank holders) given in the individual tables can be configured for all the versions. A supplement is charged for these length modifications.

Order example for HFS Holder HFS 945RC-12
(HSK-A 63 holder with HFS 12)

- configured working length 85 mm (standard 75 mm)

Order details:
HFS945RC-12
Working length: 75 mm

Advantages:

- Simple, high precision adjustment of the tool diameter where there are difficult machining conditions caused by thin-walled components, difficult materials and the effects of component geometry or clamping.
- No special tools linked to drawings required for adjusting the working length for Replaceable Heads (only HPR 130, HPR 131 and HPR 180) or for HFS Holders.
- Because of the easy configuration using parameters, a tool system is supplied on request which is best suited to the machining task and consists of HPR Replaceable Reamer Head and HFS Holder.

Coolant supply

To make full use of the highly effective performance of the HPR reamers, the various series of Replaceable Heads each need the right coolant supply. The difference in the components lies in the threaded spindle and the pull studs. Depending on the type of head, these are used with coolant through the head or without coolant through the head to ensure direct coolant supply via the connection right onto the blades.

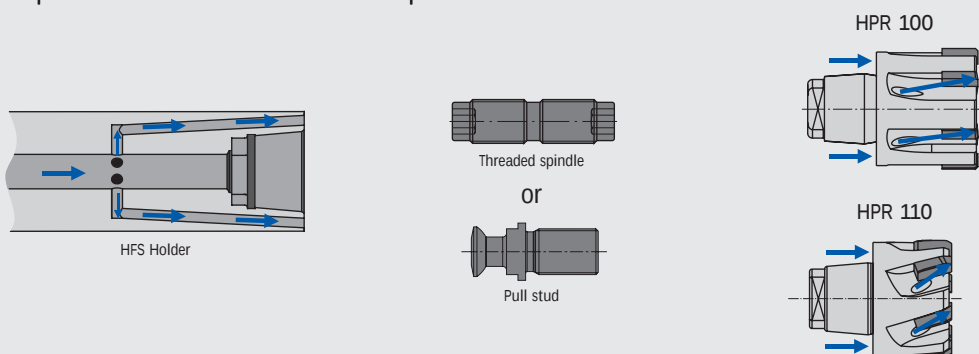
Note:

For all holders with HFS size 12 two versions are always included in the supply. When assembling care must be taken to select the right system for the Replaceable Head (see diagram below).

Coolant supply without central throughput

Reamers HPR 100 and HPR 110 must be fitted without central coolant supply.

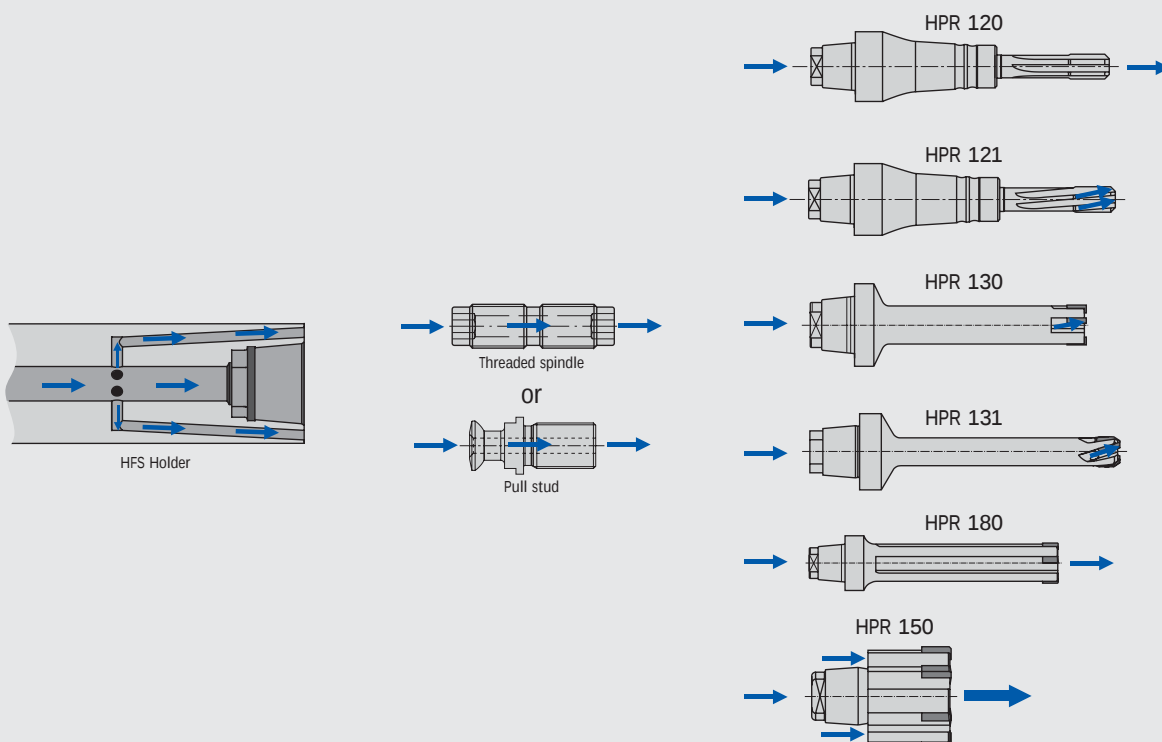
Coolant is passed from the holder onto the Replaceable Head over the face of the tool.



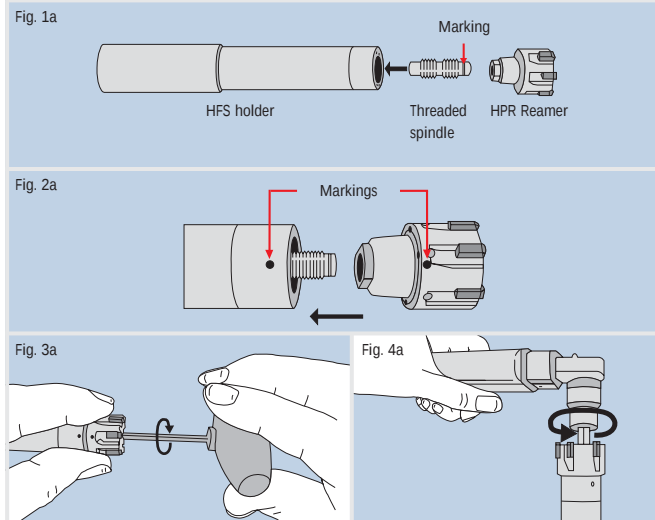
Coolant supply with central throughput

All reamers shown here must be fitted with central coolant throughput.

Coolant is supplied centrally and for HPR 150 also over the face of the tool.



MAPAL HFS® with axial clamping system



Cleaning

Clean all individual parts. Check that the internal and external taper and the surface of the HFS taper are free of foreign bodies (e.g. chips). To clean the internal taper on the HFS holder we recommend the special taper cleaner (see Accessories page 109).

Tightening

1. Introduce the end of the threaded spindle without any marking into the HFS holder. Do not screw on! (see Fig. 1a). Centering in the HFS holder is by means of the spigot at the end of the threaded spindle.
2. Place the HPR reamer on the threaded spindle. (see Fig. 2a).
3. Align the markings (see Fig. 2a) on the HPR reamer and the HFS holder: "Dot to Dot" and hold both parts.
4. Screw the HPR reamer and the HFS holder together with the hexagonal key and tighten firmly. Check that the markings are aligned and the face surface is correct. (see Fig. 3a).

Note: HPR 100, 110, 150 are tightened by the reamer. The direction of rotation is in the clockwise direction. HPR 120, 121, 130, 131, 180 are tightened by the holder. The direction of rotation is in the counter clockwise direction. The directions of rotation are indicated on the HFS holder.

5. Recommendation: Tighten the reamer with a torque wrench in clockwise direction. (see Fig. 4a). Recommended clamping torque:

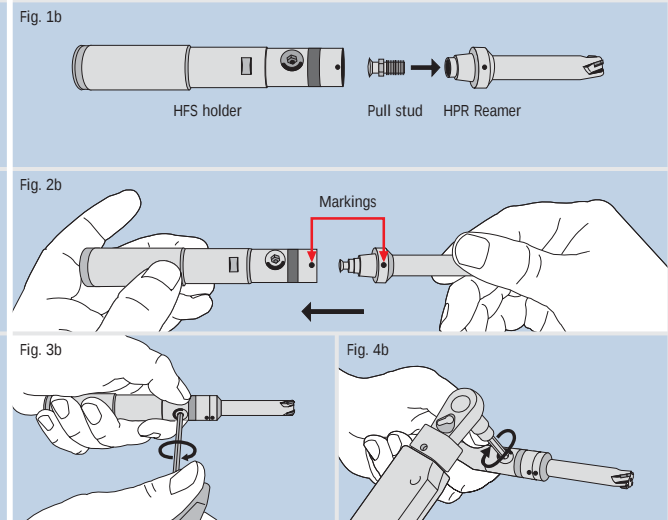
HFS 10	4 Nm
HFS 12 and 14	6 Nm
HFS 16 and 20	15 Nm
HFS 24	20 Nm

The holders are marked with the corresponding clamping torques.

Release

1. To release, turn in the opposite direction (see Fig. 4).

MAPAL HFS® with radial clamping system



Tightening

1. Screw in the pull stud with the threaded side into the reamer. (see Fig. 1b). Attention: Left-handed thread!
2. Introduce the reamer into the holder completely. (see Fig. 2b). In doing so, align the markings on the HPR reamer and the HFS holder: "Dot to Dot".
3. Screw the clamp bolt with the hexagonal key in clockwise direction. (see Fig. 3b). The direction of rotation is shown on the holder.
4. Recommendation: Tighten clamp bolt with torque wrench in clockwise direction (see Fig. 4b). Recommended clamping torque:

HFS 12 and 14	7 Nm
HFS 16 and 20	12 Nm

The holders are marked with the corresponding clamping torques.

Release

1. To release, turn the holding pin counter clockwise as far as it will go. The reamer will then be ejected.

MAPAL Competence in Practice

As a specialist in the precision machining of bores with decades of experience, MAPAL offers an unrivalled range of tool solutions. Based on tried and tested standard and special solutions, tool designs are optimised and innovations incorporated, with a constant focus on how the customer will use them. The result is the best possible machining concepts for the widest variety of cutting tasks.



Connecting Rods

When machining the small and large end of a steel connecting rod, the best possible, evenly formed surface finishes are required with high dimensional constancy within tight tolerances. The MAPAL fine boring tool with 2 HX blades in Cermet deals with this difficult task extremely reliably and economically. There is no need for an additional measurement control on the machine and a final finishing operation by honing.



Transmission Housings

Aluminium and magnesium pressure castings are increasingly used as a structural material in modern vehicles to achieve reductions in weight. Today's casting processes are very accurate and efficient, which also allows extremely complex workpiece geometry to be produced. One example of this is with transmission housings. The finish machining operation is carried out with combination tools with which several bores can be machined. The individual steps are designed with adjustable systems for the precision machining operation.

Performance details:

Transmission housing in AlSi9Cu3

Machining diameter 65 R7

Cutting speed $v_c = 2500$ m/min

Feed $f = 0,1$ mm

Performance details:

Cutting speed $v_c = 400 \text{ m/min}$

Feed $f = 0,16 \text{ mm}$

Surface finish max. $R_a = 0,5 \mu\text{m}$

Tool life 800 – 1000 parts



Wheel Brake Cylinder

The surface finishes required for machining wheel brake cylinders are extremely high, which makes finish machining by honing essential. An economic alternative here is to use a MAPAL twin-bladed tool with HX blades in PCD. The required surface quality of max. $R_a = 0,3 \mu\text{m}$ is achieved with a tool life of more than 1000 parts. The microstructure of the surface is even improved as this does not produce a superficial effect but a surface with a high percentage contact area and deposits of lubricant.

Performance details:

Wheel brake cylinder in GG25

Spindle speed $n = 2050 \text{ min}^{-1}$

Cutting speed $v_c = 120 \text{ m/min}$

Feed $f = 0,3 \text{ mm}$

Surface finish max. $R_a = 0,3 \mu\text{m}$

Tool life > 1000 parts



Engine Block

The requirements of new engine designs place demands on design engineers. Toxic and noise emissions need to be reduced, weight and also fuel need to be saved and at the same time performance and drive features have to be improved. Cast iron with vermicular graphite (CGI) is being increasingly used as a structural material. Compared with laminate and globular graphite materials, CGI has greater mechanical properties which as a consequence also have an effect on cutting results. MAPAL has developed a tool concept here which has also met the increased demands. A fine boring tool with 6 HX blades in coated carbide is being used in a 4 + 2 configuration (i.e. with 4 pre-machining blades and 2 finishing blades). This allows the cutting speed to be adjusted to prevent an excessive thermal effect on the blades. At the same time the feed rate can be increased because of the number of blades.

Performance details:

Cylinder bore in CGI

Cutting speed $v_c = 120 \text{ m/min}$

Feed $f = 1,5 \text{ mm}$

Allowance $a_p = 0,2 \text{ mm}$



One example for the application of HPR Replaceable Reamers is the machining of universal joint yokes in forged steel. These components provide the power transmission on the drive train in vehicles. The requirements for fine machining the bores on the yokes are extremely high, especially as machining is carried out with interrupted cut because of the shape of the component. Using the MAPAL HPR Replaceable Reamer in this example on a universal joint yoke in CK35 and C45, surface finish results of $R_z 5 \mu\text{m}$ are reliably obtained over a tool life of 6000 parts.

By changing over production from a conventional multi-bladed system to the MAPAL HPR system, it was possible to increase the tool life from 2000 to 6000 parts and, at the same time, the feed rates were increased from 1000 to 1500 mm/min and the spindle speed from 1300 to 1500 rpm.

Together with the fact that the HFS® system is extremely simple to handle, this means a significant improvement in economy and quality.

Universal Joint Yoke



Suspension Arm

Taper connections in machine manufacturing place the highest demands on surface finish, accuracy of pitch and concentricity deviations in order to ensure the decisive percentage contact area is achieved in the connection. In vehicle manufacture in particular, where safety-related components in steering or drive systems are mass produced, the necessary tolerances must be reliably met: a task which is predestined for the MAPAL taper reamers, as a result of the MAPAL principle of blade and guide pads which has also been applied in this context. Steering arms in vehicle manufacturing are an example of this.

Performance details:

Spindle speed $n = 150 \text{ min}^{-1}$

Feed speed $v_f = 67,5 \text{ mm/min}$

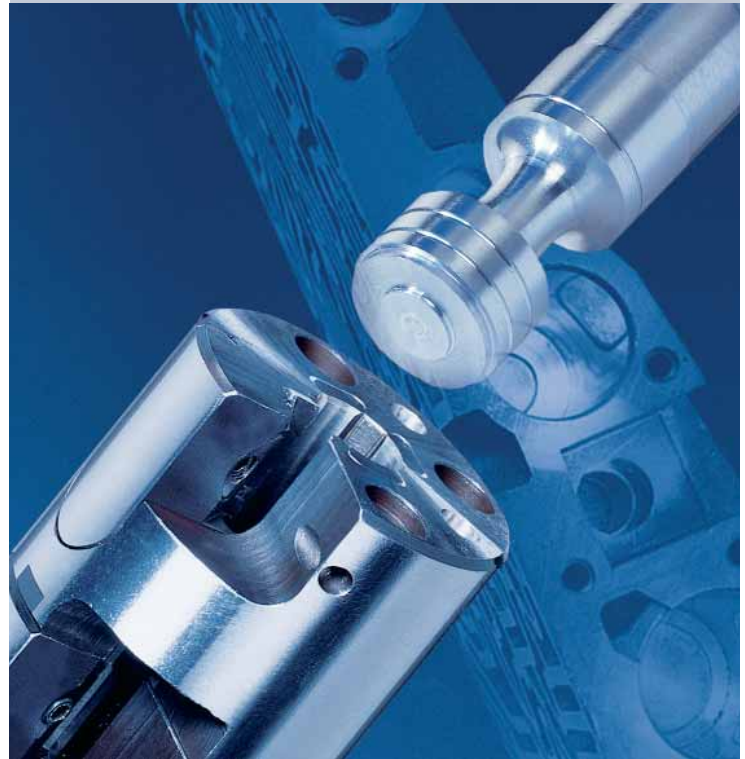
Feed $f = 0,45 \text{ mm}$

Cutting speed $v_c = 8 \text{ m/min}$



Slide Valves

for automatic transmission systems



One machining example of the extraordinary precision which can be achieved with MAPAL adjustable precision machining tools with guide pads are control bores in slide valve housings and the actuating pistons for automatic transmission which run inside these. Roundness and concentricity of $\leq 2 \mu\text{m}$ are achieved, with tool life of 200 000 parts per blade and more. The control bores are machined with multi-step, single-bladed precision machining tools so that the coaxial result is also in the high precision range.

For machining actuating pistons, MAPAL single-bladed external reamers are used. With these tools the MAPAL principle of blade and guide pads is practically reversed from external to internal, which also ensures optimum support during external machining operations.

A Review of MAPAL's Competence

Reaming and Fine Boring

From the wide range of single and twin-bladed reamers with guide pads, together with fine boring tools with guide pads and WP or HX blades, to the HPR High Performance Reamers combined with the MAPAL HFS® Head Fitting System for exact concentricity and accurate changeover – to give you a general view of our complete knowledge and experience in precision machining bores.

PCD Tools

For pre-machining and finish machining, MAPAL also offers an extensive programme of precision tools with fixed PCD (polycrystalline diamond) blades. This includes precision gun boring tools plus circular and end milling tools. The programme of face milling heads from the PowerMill and EcoMill series is characterised by simple, sturdy design and rapid, accurate blade setting.

ISO Tools

This aspect of MAPAL competence is made up of special tools with ISO elements for gun boring and milling. This includes precision ground blades in the widest variety of cutting materials and coatings. The use of MAPAL's tried and tested adjustment system ensures that the blades are accurately matched to the task. MAPAL offers particular knowledge and experience in tangential technology.

Generating Slide Tools

Generating slide tools offer a high potential for rationalisation and optimisation on special machines and machining centres. In addition to the conventional facing heads, MAPAL also supplies EAT and LAT performance-enhanced actuating systems for generating slide tools. MAPAL TOOLTRONIC® tools with their extraordinary range of functions are the latest development.

Drilling

Yet another area is the product programme for drilling. MAPAL offers the right tool concept for every task, whether for machining aluminium, steel or cast iron, hard machining or dry machining or for use in HSC areas. Specially developed coatings and PCD blades complete the broad-based drilling programme.

Clamping Systems

MAPAL's modern clamping systems, in conjunction with MAPAL's tried and tested reaming and fine boring tools, guarantee maximum productivity and economy. Whether HSK, ISO or HFS®, these high-precision connections and interfaces provide the concentricity and change-over accuracy essential to modern production.

Customer Services

Project planning, maintenance, management and optimisation – the complete CTS® service package from MAPAL will accompany you from process design to permanent process optimisation and will ensure optimum and cost-saving use of your tools with the best possible results.

REI-E-03-010-1206-MA Printed in Germany/Right of technical modifications reserved.



MAPAL Inc.

4032 Dove Road • Port Huron, MI 48060
Telephone (8 10) 3 64 80 20 • Fax (8 10) 3 64 47 50
info@us.mapal.com • www.mapal.com