BRYK
ADVANCED
TECHTOOLS

PCD
TOOLS

LEAVE A PRECISE **MARK**

CERT
POLSKA AKADEMIA JAKOŚCI

PN-EN ISO 9001:2015
PN-EN ISO 14001:2015
Certyfikat nr:
1409/04/2017/ZSZ/R

DIAMOND
IT SOUNDS PROUDLY

This amazing material, which is a polycrystalline diamond, has has been accompanied by Bryk company for a long time. Based on its properties and potential hidden in it, the tools we create carry the processing of non-ferrous materials and composites to a different, higher dimension. If you think about processes with aggressive cutting parameters, then there is only one choice - PCD - polycrystalline diamond.

Currently, producers of all industries put a huge emphasis on precision of details, its aesthetics, shortening production time, which in turn increases their competitiveness. The PCD implementation will help in the above.

Diamond tools developed by us in every detail meet the needs of the customer. A properly selected BRYK tool and correct cutting data will significantly reduce production costs. The long service life of the tools and, at the same time, short order time, allow customers to reduce their inventory to a minimum. Our company provides professional support before and after-sales, we offer not only the tool itself but also a proposal for machining tech nology. Support also includes extending tool life through regeneration or sharpening.

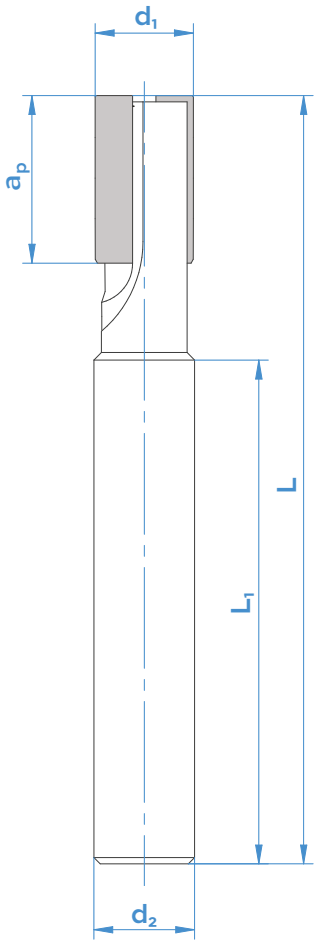
What characterizes our company is above all an individual approach and precision in action. The development of new methods of making tools from PCD by improving production efficiency are the elements that create the BRYK company. Our tools combine the highest quality and attractiveness of prices. Specialist team constantly improving their competences, modern machine park and pro-quality approach supported by the ISO9001: 2015 and ISO14001: 2015 quality certificate lead us to believe that we will be a permanent partner on the road to success.

BRYK continuously increases its production potential and the quality of the services it provides by investing in innovative technologies, machinery and equipment. A significant share of the company`s investments is made R&D, which allows it to keep up with major European players in the industry.

CHAPTER I
MILLING

END MILLING CUTTERS D10

End milling cutters of the D10 product group is the basic tool line with the PCD inserts. Through a variety of cutting edge lengths, they are widely used in machining.



Can be ordered as made on tungsten or steel body
Can be ordered with Weldon DIN6535-HB or Whistle Notch DIN 6535-HE shanks

Custom tool – Modify the parameters from the Table and more – see Page 43
Sample Order:
Catalogue No. D10.0400
Modification, Catalogue No. D10.0400 R0,25

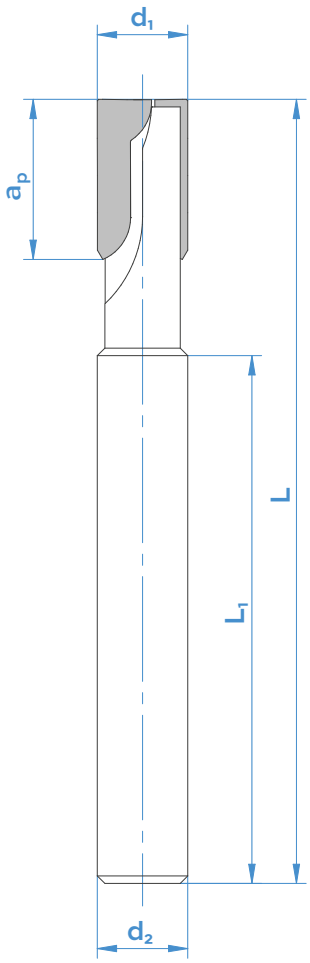
EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

END MILLING CUTTERS D10

d_1	d_2	L	a_p	L_1	z	Catalogue No.
4	6	82	8	55	1	D10.0400
5	6	82	10	55	1	D10.0500
6	6	82	12	55	2	D10.0600
6	6	82	15	55	2	D10.0601
8	8	82	12	55	2	D10.0800
8	8	82	15	55	2	D10.0801
10	10	82	12	55	2	D10.1000
10	10	82	17	55	2	D10.1001
10	10	82	23	55	2	D10.1002
12	12	82	15	55	2	D10.1200
12	12	82	18	55	2	D10.1201
12	12	82	25	45	2	D10.1202
12	12	100	15	65	2	D10.1203
12	12	100	18	65	2	D10.1204
12	12	100	25	65	2	D10.1205
14	14	82	15	55	2	D10.1400
14	14	82	20	55	2	D10.1401
14	14	82	25	45	2	D10.1402
14	14	100	15	65	2	D10.1403
14	14	100	20	65	2	D10.1404
14	14	100	25	65	2	D10. 1405
14	14	100	15	65	3	D10.1406
14	14	100	20	65	3	D10.1407
14	14	100	25	65	3	D10.1408
16	16	100	25	65	2	D10.1600
16	16	100	25	65	3	D10.1601
18	18	100	25	65	2	D10.1800
18	18	100	25	65	3	D10.1801
20	20	100	25	65	2	D10.2000
20	20	100	25	65	3	D10.2001

END MILLING CUTTERS WITH CENTRAL CUTTING EDGE D11

D11 end milling cutters with central cutting edge can be used in many machining operations. By placing the PCD insert in the mill axis, the tools offer the possibility of hole drilling. Slot milling operations or deburring of aluminum parts are some of the entire range of applications.



Can be ordered as made on tungsten or steel body
Can be ordered with Weldon DIN6535-HB or Whistle Notch DIN 6535-HE shanks

Custom tool – Modify the parameters from the Table and more – see Page 43
Sample Order:
Catalogue No. D11.0400
Modification, Catalogue No. D11.0400 r0,25

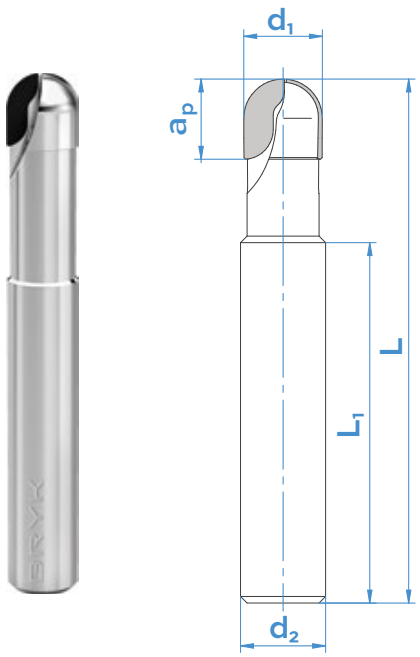
EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

END MILLING CUTTERS WITH CENTRAL CUTTING EDGE D11

d_1	d_2	L	a_p	L_1	z	Catalogue No.
4	6	82	8	55	1	D11.0400
5	6	82	10	55	1	D11.0500
6	6	82	12	55	2	D11.0600
6	6	82	15	55	2	D11.0601
8	8	82	12	55	2	D11.0800
8	8	82	15	55	2	D11.0801
10	10	82	12	55	2	D11.1000
10	10	82	17	55	2	D11.1001
10	10	82	23	55	2	D11.1002
12	12	82	15	55	2	D11.1200
12	12	82	18	55	2	D11.1201
12	12	82	25	45	2	D11.1202
12	12	100	15	65	2	D11.1203
12	12	100	18	65	2	D11.1204
12	12	100	25	65	2	D11.1205
14	14	82	15	55	2	D11.1400
14	14	82	20	55	2	D11.1401
14	14	82	25	45	2	D11.1402
14	14	100	15	65	2	D11.1403
14	14	100	20	65	2	D11.1404
14	14	100	25	65	2	D11. 1405
14	14	100	15	65	3	D11.1406
14	14	100	20	65	3	D11.1407
14	14	100	25	65	3	D11.1408
16	16	100	25	65	2	D11.1600
16	16	100	25	65	3	D11.1601
18	18	100	25	65	2	D11.1800
18	18	100	25	65	3	D11.1801
20	20	100	25	65	2	D11.2000
20	20	100	25	65	3	D11.2001

BALL NOSE END MILLING CUTTERS D12

D12 group of mills are characterized by high precision in reflection of a given radius. The tools are recommended for the formation of radiuses on the bottom of grooves or pockets. These end milling cutters have been used in the manufacture of moulds for the creation of complex curvatures.



d_1	d_2	L	a_p	L_1	z	Catalogue No.
4	6	82	8	55	1	D12.0400
6	6	82	10	55	1	D12.0600
8	8	82	10	55	2	D12.0800
10	10	82	10	55	2	D12.1000
12	12	100	12	55	2	D12.1200
14	14	100	12	55	2	D12.1400

Can be ordered as made on tungsten or steel body
Can be ordered with Weldon DIN6535-HB or Whistle Notch DIN 6535-HE shanks

Custom tool – Modify the parameters from the Table and more – see Page 43
Sample Order:
Catalogue No. D12.0400
Modification, Catalogue No. D12.0400 r0,25

EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

PROFILE END MILLING CUTTERS D13

D13 profile end milling cutters will satisfy even the most demanding shape creators with the way they work. Precise profiling of the PCD cutting edge will allow you to render every detail in the workpiece. Properties of the diamond make the repeatability of the process is maintained and given contour received without any distortions. These mills are made to individual order, where the customer, using the Tool Selection Sheet,
is able to provide all the necessary parameters, shapes and design features. Here are a few examples of our tools.

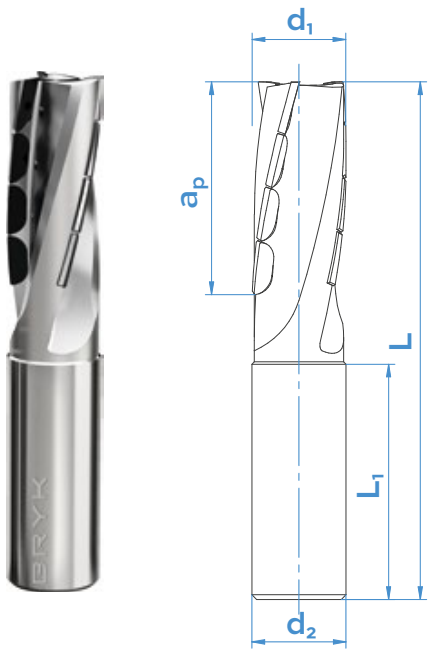
Can be ordered as made on tungsten or steel body
Can be ordered with Weldon DIN6535-HB or Whistle Notch DIN 6535-HE shanks

Custom tool – Modify the parameters from the Table and more – see Page 43

EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

HELICAL END MILLING CUTTERS D14

Group of mills with helical arrangement of the PCD inserts is characterized by high performance milling. They are perfect for roughing even with aggressive cutting parameters.



d_1	d_2	L	a_p	L_1	z	Nr. katalogowy
16	16	100	30	50	3	D14.1600
16	16	110	40	50	3	D14.1601
20	20	100	30	50	3	D14.2000
20	20	110	40	50	3	D14.2001
25	25	100	30	50	3	D14.2500
25	25	110	40	50	3	D14.2501

Can be ordered as made on tungsten or steel body
Can be ordered with Weldon DIN6535-HB or Whistle Notch DIN 6535-HE shanks

Custom tool – Modify the parameters from the Table and more – see Page 43
Sample Order:
Catalogue No. D14.0400
Modification, Catalogue No. D14.0400 r0,25

EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

TOOL SELECTION SHEET – END MILLING CUTTER

Customer _____
Address _____
Contact person _____
Tel. No. _____

TOOL PARAMETERS

Designation/Catalogue group _____ Qty _____
Machining process _____
Working dia., d1Ø _____ [mm]
Shank dia., d2Ø _____ [mm]
Cutting width ae _____ [mm]
Cutting depth ap _____ [mm]
Shank length L1 _____ [mm]
Total length L _____ [mm]
Qty of cutting edges z _____
Cutting edge angle:
◯ positive ◯ negative ◯ neutral
Corner:
◯ corner radius r _____ ◯ corner chamfer f _____
Helix angle _____

Cutting edge _____
Body _____
Type of shank:
◯ cylindrical ◯ Weldon ◯ Whistle notch
◯ other _____
Coolant supply:
◯ internal ◯ external
Type of machining:
◯ roughing ◯ finishing
Other information/dimensions :

SKETCH OF TOOL/WORKPIECE:

WORKPIECE

Type _____
No./Standard designation _____
Hardness/strength _____

MACHINE PARAMETERS

Manufacturer & type _____
Drive power _____
RPM _____
Qty of spindles _____ ◯ with internal cooling
Spindle orientation:
◯ vertical ◯ horizontal
Type of tool holder _____

Feed _____
Cooling/Lubrication:
◯ none ◯ compressed air ◯ emusion _____ %
◯ oil ◯ oil mist ◯ other _____
Coolant flow _____ [l/min]
Coolant pressure _____ [bar]

Developed by _____ Date & signature _____

SOLID MILLING HEADS D20

Design of PCD solid milling heads, often as multi-purpose tools, is focused on complex machining tasks. Due to the solid design, it is possible to balance the tool perfectly. Through the solid and robust design of the body, vibration issues have been reduced to a minimum. In the D20 group of tools, we can also find face milling heads, perfect in surface machining. To ordering a tool, you will need a technical drawing of the workpiece and completion of the Tool Selection Sheet will be very helpful. Below there are some sample design solutions.

Custom tool – Modify the parameters from the Table and more – see Page 43

EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

ARBOR MILLING HEADS D21

Arbor milling heads are a response to the requirements associated with machine tools mounting. On the other hand, due to the specificity of mounting, they allow changing the settings within the working part of the tool relative to the machine spindle. Arbor milling heads also feature more versatility due to the ability of adaptation to different types of clamping. Here are some examples of our designs.

ST N O

Custom tool – Modify the parameters from the Table and more – see Page 43

EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

MILLING CUTTERS WITH INDEXIBLE INSERTS

The BRYK company's offer includes PCD tools with indexable inserts . Milling cutters are offered in two options, as an end milling cutter with diameters, Ø32 z4 and Ø40 z6 and arbor milling cutters in the diameter range from Ø50 to Ø250. All tools have the ability to adjust the mounting height of the inserts in the body. Depending on the type of treatment, there are several types of inserts. The maximum ap of insert is 11mm.

End milling Cutters

Diameter Ø	Length L	Number of inserts	ap max	n max
32	125	4	11	25000
40	130	6	11	25000

Arbor Milling heads

Diameter Ø	Diameterof mounting	Height L	Number of inserts	ap max	n max
50	22	40	8	11	35100
63	22	40	10	11	30200
80	27	50	12	11	27500
100	32	50	16	11	23800
125	40	63	20	11	19100
160	40	63	24	11	14900
200	60	63	30	11	11900
250	60	63	36	11	9550

Custom tool – Modify the parameters from the Table and more – see Page 43

EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

MULTI-TASK SPECIAL TOOLS D30

In addition to the catalogue of the PCD tools, we manufacture special tools according to individual customer needs. Their design can be based on the tools included in the catalogue or can be created on the basis of supplied technical drawings of the workpiece. With modern CAD/CAM software, we are able to quickly submit a proposal of a special tool to our customer. Here are a few examples of the designs implemented
by our company.

VHM ST N O

Custom tool – Modify the parameters from the Table and more – see Page 43

TOOL SELECTION SHEET – END MILLING CUTTER

Customer _____

Address _____

Contact person _____

Tel. No. _____

TOOL PARAMETERS

Designation/Catalogue group _____ Qty _____

Machining process _____

Working dia., d1Ø _____ [mm]

Shank dia., d2Ø _____ [mm]

Cutting depth ap _____ [mm]

Shank length L1 _____ [mm]

Total length L _____ [mm]

Qty of cutting edges z _____

Cutting edge angle:

◯ positive ◯ negative ◯ neutral

Corner:

◯ corner radius r _____ ◯ corner chamfer f _____

Helix angle _____

Cutting edge _____

Body _____

Type of clamping:

◯ adaper ◯ solid ◯ other _____

Type of fixture:

◯ SK _____ DIN 69871 ◯ MAS 403-BT _____

◯ SK _____ DIN 2080 ◯ HSK _____ DIN 69893

◯ MT _____ DIN 228

◯ other _____

Coolant supply:

◯ internal ◯ external

Type of machining:

◯ roughing ◯ finishing

Other information/dimensions :

_____

_____

SKETCH OF TOOL/WORKPIECE:

WORKPIECE

Type _____

No./Standard designation _____

Hardness/strength _____

MACHINE PARAMETERS

Manufacturer & type _____

Drive power _____

RPM _____

Qty of spindles _____ ◯ with internal cooling

Spindle orientation:

◯ vertical ◯ horizontal

Type of tool holder _____

Feed _____

Cooling/Lubrication:

◯ none ◯ compressed air ◯ emusion _____ %

◯ oil ◯ oil mist ◯ other _____

Coolant flow _____ [l/min]

Coolant pressure _____ [bar]

Developed by _____

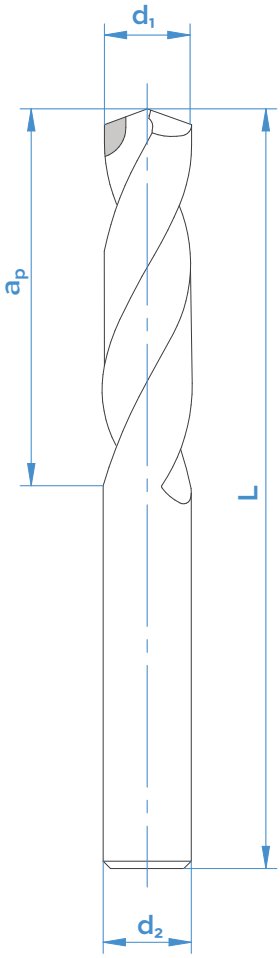
Date & signature _____

NOTES

CHAPTER II
MACHINING OF HOLES

FINISHING DRILL BITS D40

D40 finishing drills are a core group of drill bits in our company. By using a small amount of PCD, which is a fragment of the entire cutting edge, the major part of which is the body material of VHM, we obtain an affordable tool.
By placing a PCD cutting edge in the area where the drill wears mostly, we can greatly extend the life of the tool.
They are commonly used in drilling of non-ferrous metals.



Custom tool – Modify the parameters from the Table and more – see Page 43

EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

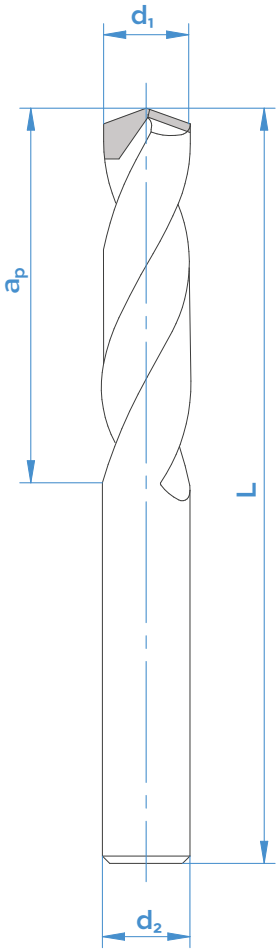
FINISHING DRILL BITS D40

d_1	d_2	a_p	L_1	Catalogue No.
4	4	20	75	D40.0400
4,5	5	25	75	D40.0401
5	5	25	75	D40.0500
5,5	6	30	75	D40.0501
6	6	30	80	D40.0600
6,5	7	35	80	D40.0601
7	7	35	85	D40.0700
7,5	8	38	85	D40.0701
8	8	38	85	D40.0800
8,5	9	43	85	D40.0801
9	9	43	90	D42.0900
9,5	10	48	90	D40.0901
10	10	48	90	D40.1000
10,5	11	52	90	D40.1001
11	11	52	95	D40.1100
11,5	12	56	95	D40.1101
12	12	56	95	D40.1200
14	14	64	100	D40.1400
16	16	68	100	D40.1600

Sample Order:
Catalogue No. D40.0400
Modification, Catalogue No. D40.0400 ap0,25

DRILL BITS WITH PCD INSERTS D42

The main feature of PCD drill bits is their long life. The tools, due to their ability to operate at increased cutting parameters, significantly increase productivity. Drilling holes with diamond blades allows for tight tolerances, and makes we can eliminate the process of reaming.



Custom tool – Modify the parameters from the Table and more – see Page 43

EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

DRILL BITS WITH PCD INSERTS D42

d_1	d_2	a_p	L_1	Catalogue No.
3	3	15	55	D42.0300
3,5	4	18	60	D42.0301
4	4	20	75	D42.0400
4,5	5	25	75	D42.0401
5	5	25	75	D42.0500
5,5	6	30	75	D42.0501
6	6	30	80	D42.0600
6,5	7	35	80	D42.0601
7	7	35	85	D42.0700
7,5	8	38	85	D42.0701
8	8	38	85	D42.0800
8,5	9	43	85	D42.0801
9	9	43	90	D42.0900
9,5	10	48	90	D42.0901
10	10	48	90	D42.1000
10,5	11	52	90	D42.1001
11	11	52	95	D42.1100
11,5	12	56	95	D42.1101
12	12	56	95	D42.1200
14	14	64	100	D42.1400
16	16	68	100	D42.1600

Sample Order:
Catalogue No. D42.0400
Modification, Catalogue No. D42.0400 ap0,25

MULTI-PURPOSE DRILL BITS D43

The main feature of PCD drill bits is their long life. The tools, due to their ability to operate at increased cutting parameters, significantly increase productivity. Drilling holes with diamond blades allows for tight tolerances, and makes we can Multi-purpose drill bits are the last group of machining tools in the section relating to the machining of holes. Also considered special tools, they are made according to the customer's individual needs. Solid structures consisting of two or more cutting stages, they allow for, with only one entrance into the workpiece, the precise implementation of the drilling sequence, and then such operations as counterboring, countersinking, shaping or champfering. With the multi-purpose drill bits, you can shorten production time significantly by eliminating the need to change or replace tools in the magazine of the machine. Tools are created on the basis of the supplied technical drawings of the workpiece. You can also use the Tool Selection Sheet, which you can find at the end of this chapter. Here are a few examples of the designs implemented by our company the process of reaming.

Custom tool – Modify the parameters from the Table and more – see Page 43

EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

TOOL SELECTION SHEET – DRILL BITS

Customer _____
Address _____
Contact person _____
Tel. No. _____

TOOL PARAMETERS

Designation/Catalogue group _____ Qty _____
Machining process _____
Working dia., d1Ø _____ [mm]
Shank dia., d2Ø _____ [mm]
Cutting depth ap _____ [mm]
Shank length L1 _____ [mm]
Total length L _____ [mm]
◯ Regular ◯ Left-handed
Hole tolerance _____ [mm]
◯ Trough hole ◯ Blind hole
Cross-hole: ◯ Yes ◯ No
Breaks: ◯ Yes ◯ No
Stepped hole: ◯ Yes ◯ No

Helix angle _____
Body _____
Type of shank:
◯ cylindrical ◯ Weldon ◯ Whistle notch
◯ other _____
Coolant supply:
◯ internal ◯ external
Type of machining:
◯ roughing ◯ finishing
Other information/dimensions :
_____
_____
_____
_____

SKETCH OF TOOL/WORKPIECE:

WORKPIECE

Type _____
No./Standard designation _____
Hardness/strength _____

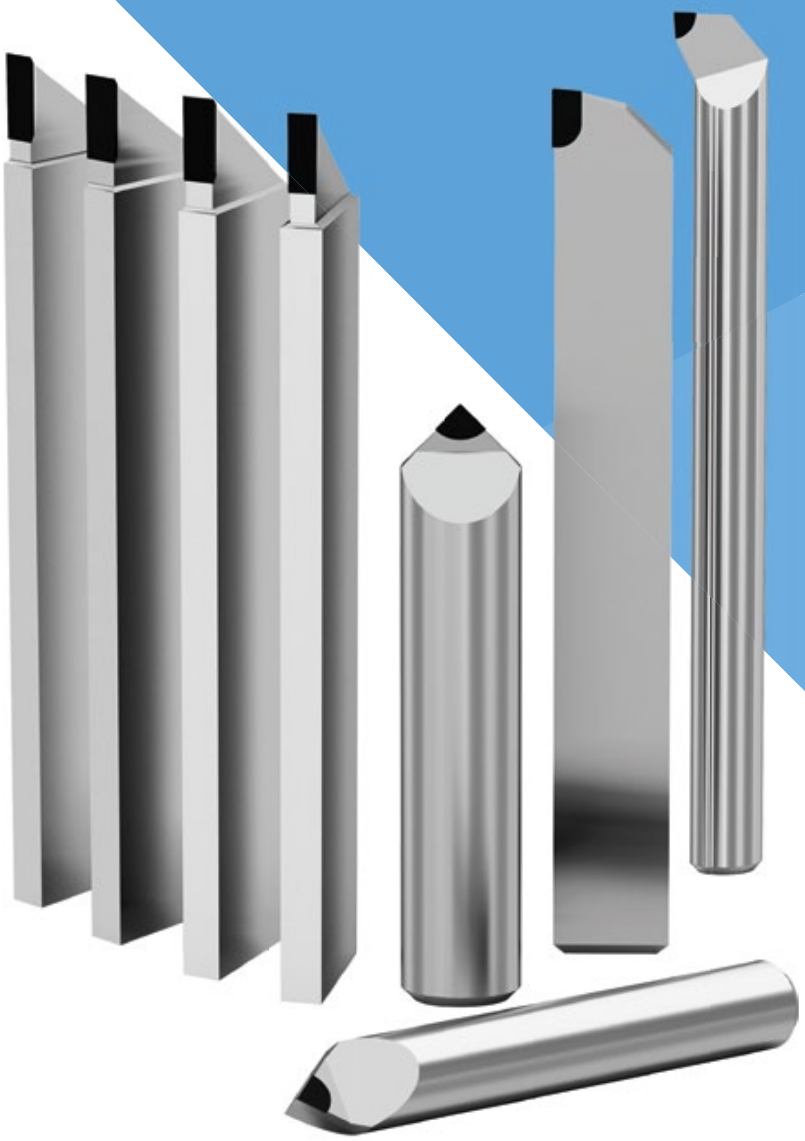
MACHINE PARAMETERS

Manufacturer & type _____
Drive power _____
RPM _____
Qty of spindles _____ ◯ with internal cooling
Spindle orientation:
◯ vertical ◯ horizontal
Type of tool holder _____

Feed _____
Cooling/Lubrication:
◯ none ◯ compressed air ◯ emusion _____ %
◯ oil ◯ oil mist ◯ other _____
Coolant flow _____ [l/min]
Coolant pressure _____ [bar]

Developed by _____
Date & signature _____

CHAPTER III
TURNING



TURNING TOOLS D50

PCD turning tools of group D50 are widely applied in the process of turning both a wide range of non-ferrous metals and non-metallic materials, i.e. fibre-reinforced plastics, graphite, ceramics and wood. The turning tools are made on individual order where the customer, by using the Tool Selection Sheet, is able to provide all the necessary design parameters and characteristics. Here are a few examples of our tools.

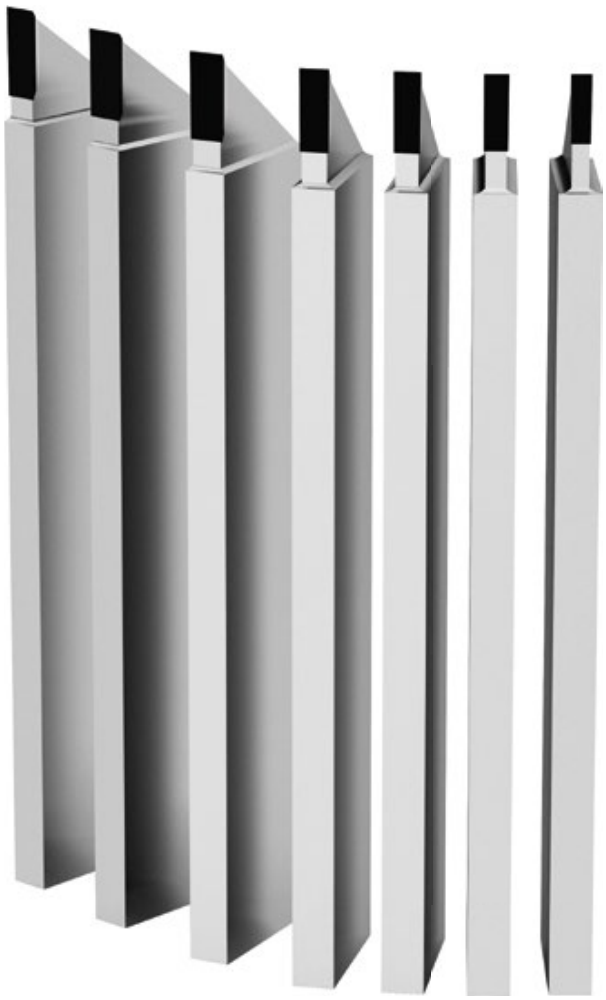
ST N O

Custom tool – Modify the parameters from the Table and more – see Page 43

EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

SLOTTING TOOLS D51

Slotting tools are extremely precise tools that can be found among all the tools of our company. Width range of the cutting portion is from 2 to 8 millimetres. High precision cutting can be achieved, inter alia, thanks to the tool design, where its whole body is made of VHM, which ensures high rigidity. Primary use of the tools from the group D51 is grooving aluminium pistons, cylinders, and many other grooving operations in non-ferrous metals and their alloys. The tools are made on individual order where the customer, by using the Tool Selection Sheet, is able to provide all the necessary design parameters and characteristics. Here are a few examples of our tools.



Custom tool – Modify the parameters from the Table and more – see Page 43

EXTEND THE LIFE OF TOOLS – REWORKING PROGRAMME

TOOL SELECTION SHEET – TURNING TOOLS

Customer _____

Address _____

Contact person _____

Tel. No. _____

TOOL PARAMETERS

Designation/Catalogue group _____ Qty _____

Machining process _____

Cutting depth ap _____ [mm]

Shank length L1 _____ [mm]

Total length L _____ [mm]

Corner:

◯ corner radius r _____ ◯ corner chamfer f _____

Body _____

Type of shank:

◯ cylindrical ◯ Weldon

Type of machining:

◯ roughing ◯ finishing

Other information/dimensions :

_____

SKETCH OF TOOL/WORKPIECE:

WORKPIECE

Type _____

No./Standard designation _____

Hardness/strength _____

MACHINE PARAMETERS

Manufacturer & type _____

Drive power _____

RPM _____

Qty of spindles _____ ◯ with internal cooling

Spindle orientation:

◯ vertical ◯ horizontal

Type of tool holder _____

Feed _____

Cooling/Lubrication:

◯ none ◯ compressed air ◯ emusion _____ %

◯ oil ◯ oil mist ◯ other _____

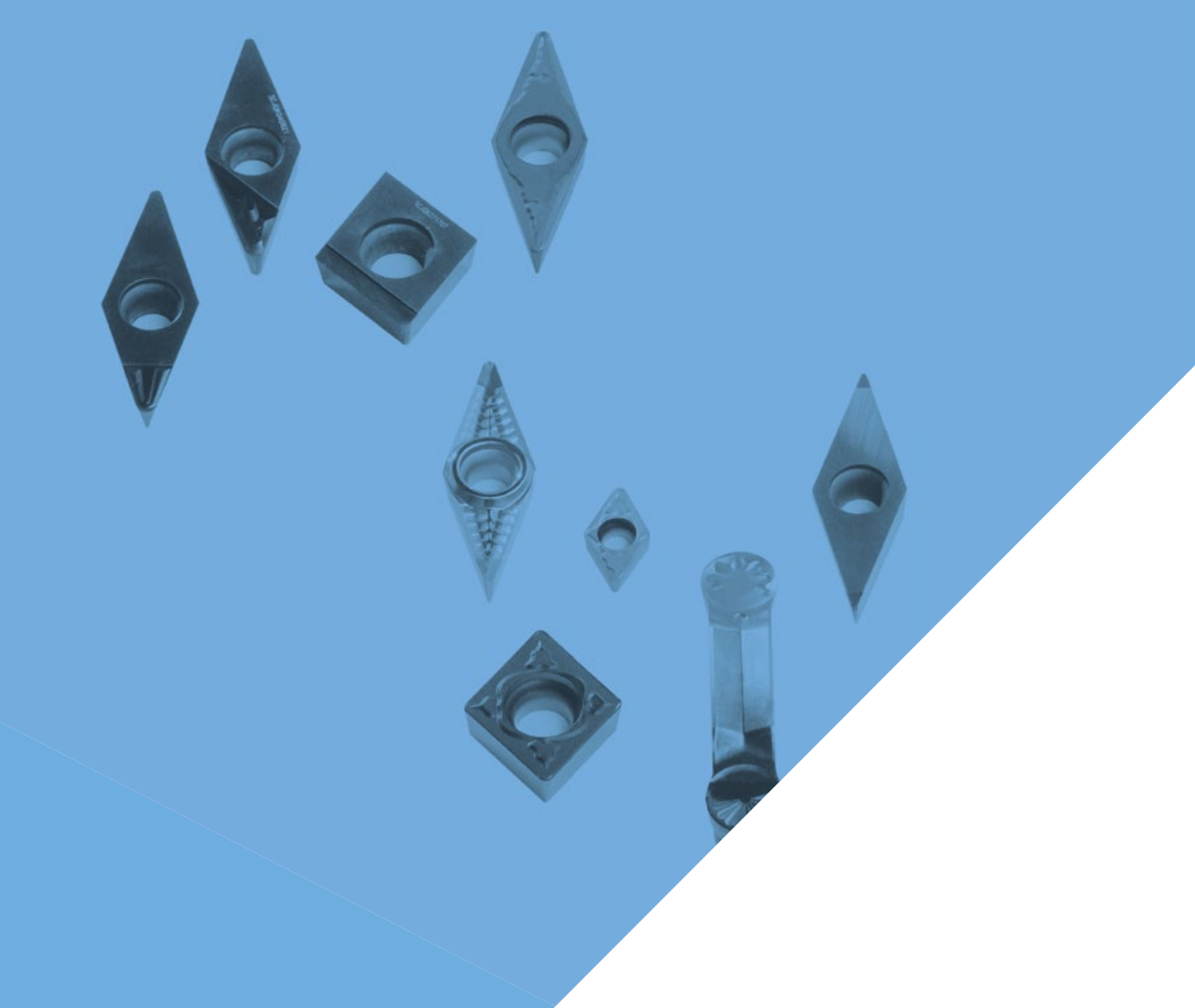
Coolant flow _____ [l/min]

Coolant pressure _____ [bar]

Developed by _____

Date & signature _____

NOTES



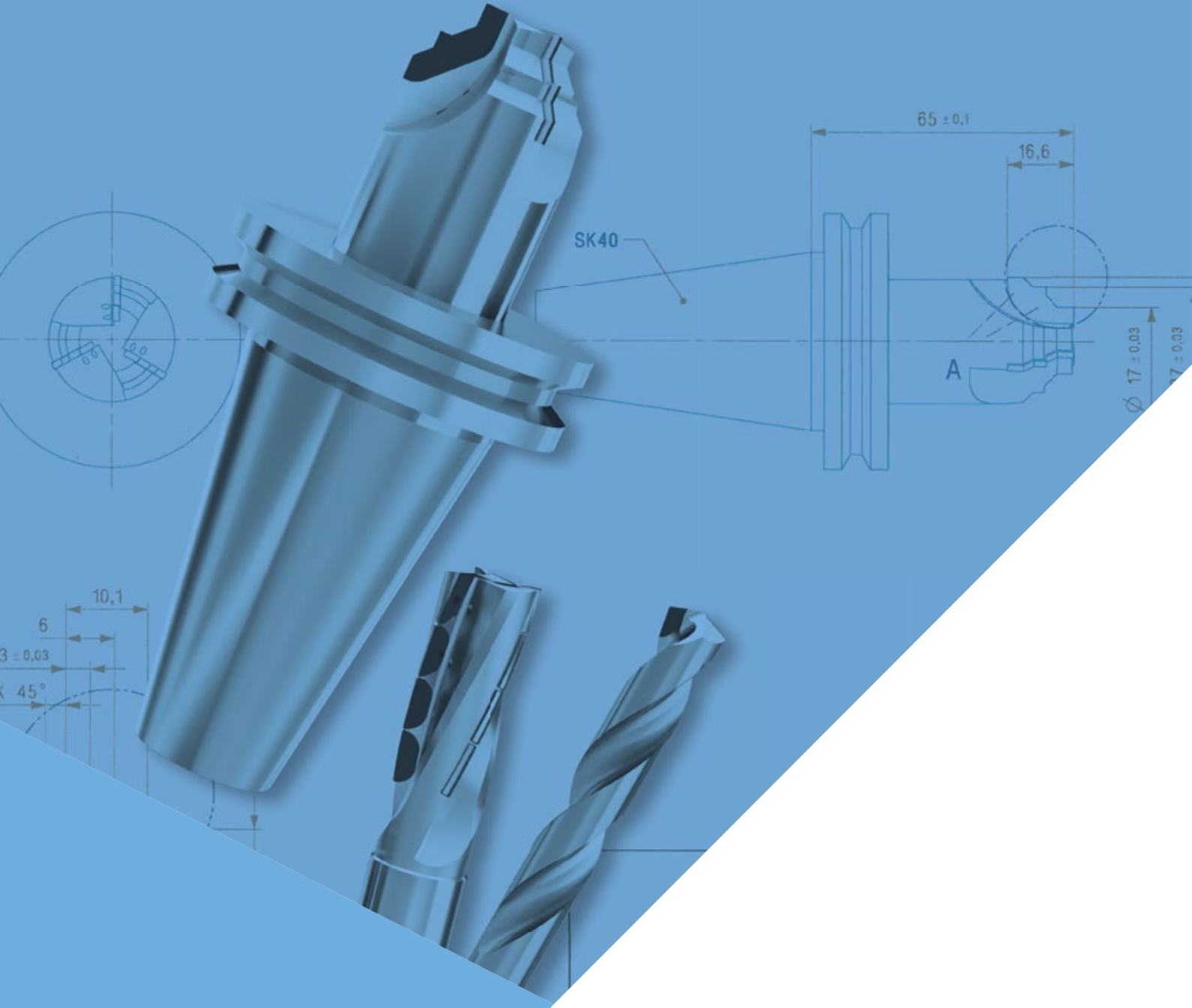
CHAPTER IV
INDEXABLE INSERTS

PCD, PCBN AND VHM INDEXABLE INSERTS

The offer of our company includes a whole range of indexable cutting inserts based on ISO codification. Depending on the application, we can offer inserts with brazed polycrystalline diamond PCD, polycrystalline cubic boron PCBN or standard solid carbide inserts.

We make special and profile inserts based on individual customer inquiries.

NOTES


65 ± 0,1
16,6
SK40
A
10,1
6
45°

CHAPTER V
INFORMATION SECTION

KEY

Cylindrical shank acc. to DIN 6535-HA

Whistle Notch pararell shank acc. to DIN 6535-HE

Weldon shank acc. to DIN 6535-HB


End milling cutter D10


End milling cutter with central cutting edge D11


Ball nose end milling cutter D12


Profile end milling cutter D13

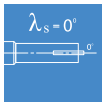

Helical end milling cutter D14


Finishing drill bit D40

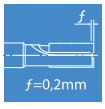

PCD face drill bit D42


Multi-purpose drill bit D43


Helix angle β



Cutting edge angle λ_s



Cutting edge chamfer f


External coolant supply


Internal coolant supply

Composite materials, graphite and others

Non-ferrous metals

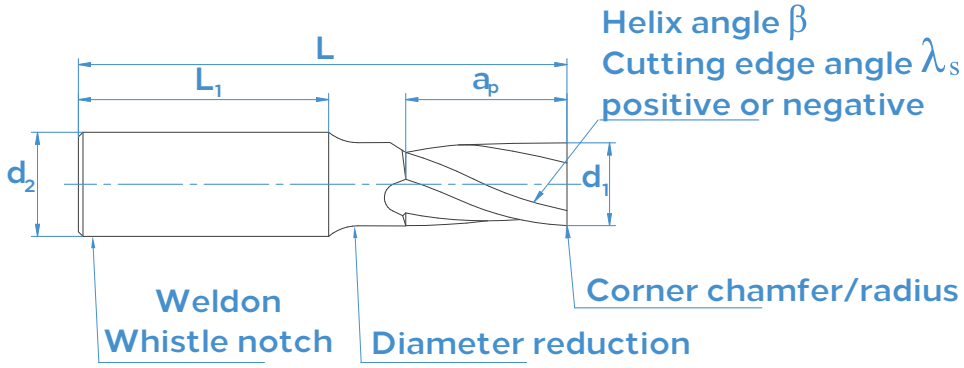
Fine-grained cemented carbide

Steel body

TOOL MODIFICATION

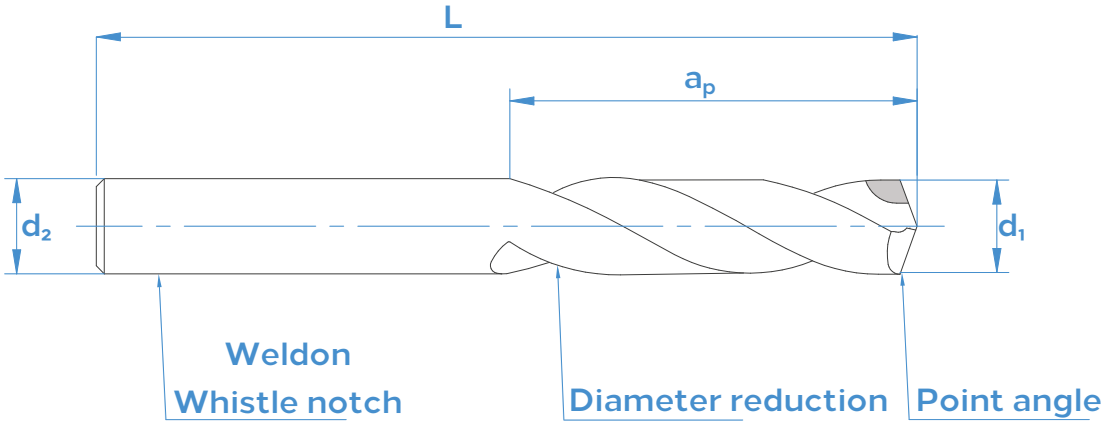
A significant part of the Bryk products are tools developed on individual orders. The designers of our company together with our customers create tools that meet specific requirements and machining tasks. The following figures provide additional tool parameters that can be modified

SHANK CUTTER



Sample modified order – Order No. D10.0400 z2 r0,25

DRILL BIT



Sample modified order – Order No. D40 .0400 ap22

If you are still not able to specify your expectations, then we propose to use the Tool Selection Sheet, which you can find at the end of each chapter. Sketch the desired detail and describe it as precise as possible. Our Technical and Sales Advisor will be happy to answer all your questions.

REWORKING PROGRAMME

Our company runs a Reworking Programme and is able to restore the original features of the tool. Sharpening or complete replacement of cutting edges makes the need to buy a new tool decreases, which significantly reduces the cost of production.

For details, please contact our Technical and Sales Advisor.

CUTTING CONDITIONS

Material	Machining conditions	Cutting speed V_c [m/min]	Feed per tooth f_z [mm]	Cutting depth a_p [mm]
Aluminium alloys Si up to 12 %	Basic Aggressive	500 4000	0,05 0,2	0,1 5,0
Aluminium alloys Si above to 12 %	Basic Aggressive	200 3000	0,03 0,2	0,1 3,0
Cermets	Basic Aggressive	400 1000	0,1 0,3	0,1 3,0
Copper alloys	Basic Aggressive	300 6000	0,03 0,4	0,05 3,0
Magnesium alloys	Basic Aggressive	300 6000	0,05 0,3	0,1 4,0
Bimetals	Basic Aggressive	90 400	0,08 0,2	0,25 1,0
Grey cast iron	Basic Aggressive	50 400	0,08 0,2	0,25 1,0
Composites	Basic Aggressive	400 4000	0,1 1,0	0,2 4,0
Graphite	Basic Aggressive	250 2500	0,05 0,2	0,1 3,0
Titanium alloys	Basic Aggressive	60 400	0,1 0,2	0,2 0,5

MATERIAL HARDNESS SCALES

HRC	HV	HB	Rm	HRB	HV	HB	Rm
85	2270	-	-	100	240	240	800
84	2190	-	-	99	234	234	785
83	2110	-	-	98	228	228	750
82	2030	-	-	97	222	222	715
81	1950	-	-	96	216	216	705
80	1865	-	-	95	210	210	690
79	1787	-	-	94	205	205	675
78	1710	-	-	93	200	200	650
77	1633	-	-	92	195	195	635
76	1556	-	-	91	190	190	620
75	1478	-	-	90	185	185	615
74	1400	-	-	89	180	180	605
73	1323	-	-	88	176	176	590
72	1245	-	-	87	172	172	580
71	1160	-	-	86	169	169	570
70	1076	-	-	85	165	165	565
69	1004	-	-	84	162	162	560
68	940	-	-	83	159	159	550
67	900	-	-	82	156	156	530
66	865	-	-	81	153	153	505
65	832	739	-	80	150	150	495
64	800	722	-	79	147	147	485
63	772	706	-	78	144	144	475
62	746	688	-	77	141	141	470
61	720	670	-	76	139	139	460
60	697	654	-	75	137	137	455
59	674	634	2420	74	135	135	450
58	653	615	2330	73	132	132	440
57	633	595	2240	72	130	130	435
56	613	577	2160	71	127	127	425
55	595	560	2070	70	125	125	420
54	577	543	2010	69	123	123	415
53	560	525	1950	68	121	121	405
52	544	512	1880	67	119	119	400
51	528	496	1820	66	117	117	395
50	513	482	1760	65	116	116	385
49	498	468	1700	64	114	114	-
48	484	455	1640	63	112	112	-
47	471	442	1580	62	110	110	370
46	458	432	1520	61	108	108	-
45	446	421	1480	60	107	107	-
44	434	409	1430	59	106	106	360
43	423	400	1390	58	104	104	-
42	412	390	1340	57	103	103	350
41	402	381	1300	56	101	101	-
40	392	371	1250	55	100	100	340
39	382	362	1220	54	-	-	-
38	372	353	1180	51	-	94	330
37	363	344	1140	49	-	92	320
36	354	336	1110				
35	345	327	1080				
34	336	319	1050				
33	327	311	1030				
32	318	301	1010				
31	310	294	970				
30	302	286	950				
29	294	279	930				
28	286	271	900				
27	279	264	880				
26	272	258	860				
25	266	253	850				
24	260	247	820				
23	254	243	810				
22	248	237	790				
21	243	231	770				
20	238	226	760				

HRC - Rockwell C hardness, diamond cone 120° at 150 Kgf

HRB - Rockwell B hardness, ball at 100 Kgf

HV - Vickers hardness, diamond pyramid 136° at 30 Kgf

HB - Brinell hardness, ball 10mm at 3000Kgf

Rm - Tensile strength in N/mm2 (MPa)

MACHINING TOLERANCES

Tolerance designation	Diameter [mm]							
	> 1≤ 3	> 3 ≤ 6	> 6 ≤ 10	> 10 ≤ 18	> 18 ≤ 30	> 30 ≤ 50	> 50 ≤ 80	> 80 ≤ 120
	Tolerance value [µm]							
e8	-14 / -28	-20 / -38	-25 / -47	-32 / -59	-40 / -73	-50 / -89	-60 / -106	-72 / -126
f6	-6 / -12	-10 / -18	-13 / -22	-16 / -27	-20 / -33	-25 / -41	-30 / -49	-36 / -58
f7	-6 / -16	-10 / -22	-13 / -28	-16 / -34	-20 / -41	-25 / -50	-30 / -60	-36 / -71
h6	0 / -6	0 / -8	0 / -9	0 / -11	0 / -13	0 / -16	0 / -19	0 / -22
h7	0 / -10	0 / -12	0 / -15	0 / -18	0 / -21	0 / -25	0 / -30	0 / -35
h8	0 / -14	0 / -18	0 / -22	0 / -27	0 / -33	0 / -39	0 / -46	0 / -54
h9	0 / -25	0 / -30	0 / -36	0 / -43	0 / -52	0 / -62	0 / -74	0 / -87
h10	0 / -40	0 / -48	0 / -58	0 / -70	0 / -84	0 / -100	0 / -120	0 / -140
h11	0 / -60	0 / -75	0 / -90	0 / -110	0 / -130	0 / -160	0 / -190	0 / -220
h12	0 / -100	0 / -120	0 / -150	0 / -180	0 / -210	0 / -250	0 / -300	0 / -350
k10	+40 / 0	+48 / 0	+58 / 0	+70 / 0	+48 / 0	+100 / 0	+120 / 0	+140 / 0
k12	+100 / 0	+120 / 0	+150 / 0	+180 / 0	+210 / 0	+250 / 0	+300 / 0	+350 / 0
m7	+2 / +12	+4 / +16	+6 / +21	+7 / +25	+8 / +29	+9 / +34	+11 / +41	+13 / +48
js14	+/- 125	+/- 150	+/- 180	+/- 215	+/- 260	+/- 310	+/- 370	+/- 435
js16	+/- 300	+/- 375	+/- 450	+/- 550	+/- 650	+/- 800	+/- 950	+/- 1100
H 7	+10 / 0	+12 / 0	+15 / 0	+18 / 0	+21 / 0	+25 / 0	+30 / 0	+35 / 0
H 8	+14 / 0	+18 / 0	+22 / 0	+27 / 0	+33 / 0	+39 / 0	+46 / 0	+54 / 0
H 9	+25 / 0	+30 / 0	+36 / 0	+43 / 0	+52 / 0	+62 / 0	+74 / 0	+87 / 0
H12	+100 / 0	+120 / 0	+150 / 0	+180 / 0	+210 / 0	+250 / 0	+300 / 0	+350 / 0
P9	-6 / -31	-12 / -42	-15 / -51	-18 / -61	-22 / -74	-26 / -86	-32 / -106	-37 / -124
S7	-13 / -22	-15 / -27	-17 / -32	-21 / -39	-27 / -48	-34 / 59	-42 / -72	-58 / -93

EXAMPLES OF MACHINED MATERIALS

Designation acc. to ISO	Material	Designation acc. to EN	No. acc. to EN	Designation acc. to DIN
N	Aluminium alloys with low Si content	AW-120	Al99	Al99
		AW-1050A	Al99.5	Al99.5
		AW-1070	Al99.7	Al99.7
		AW-1080	Al99.8	Al99.8
		AW-2011	AlCuBiPb	AlCuBiPb
		AW-2024	AlCuMg1	AlCuMg1
		AW-2014	AlCuSiMn	AlCuSiMn
		AW-5005A	AlMg1	AlMg1
		AW-6061	AlMg1SiCu	AlMg1SiCu
		AW-5052	AlMg2.5	AlMg2.6
		AW-5454	AlMg2.7Mn	AlMg2.7Mn
		AW-5251	AlMg2Mn0.3	AlMg2Mn0.3
		AW-5049	AlMg2Mn0.8	AlMg2Mn0.8
		AW-5754	AlMg3	AlMg4
		AW-5083	AlMg4.5Mn	AlMg4.5Mn
		AW-5086	AlMg4Mn	AlMg4Mn
		AW-6060	AlMgSi0.5	AlMgSi0.5
		AW-6063	AlMgSi0.7	AlMgSi0.7
		AW-6082	AlMgSi1	AlMgSi2
		AW-3105	AlMn0.5Mg0.5	AlMn0.5Mg0.5
		AW-3005	AlMn0.5Mg0.6	AlMn0.5Mg0.6
		AW-3103	AlMn1	AlMn2
		AW-3003	AlMn1Cu	AlMn1Cu
		AW-3004	AlMn1Mg1	AlMn1Mg2
		AW-7020	AlZn4.5Mg1	AlZn4.5Mg2
		AC-21100	AlCu4Ti	G-ALCu4Ti
		AC-21000	AlCu4TiMg	G-AlCu4TiMg
		AC-51100	AlMg3	G-AlMg3
		AC-51400	AlMg5(Si)	G-AlMg5
		AC-51200	AlMg9	G-AlMg9
		AC-43400	AlSi10Mg(Fe)	G-AlSi10Mg
		AC-45000	AlSi6Cu4	G-AlSi6Cu4
		AC-42100	AlSi7Mg	G-AlSi7Mg
		AC-46200	AlSi8Cu3(Si)	G-AlSi8Cu3
		AC-43200	AlSi9Mg	G-AlSi9Mg
		MG-P-62	MgAl3Zn	G-MgAl3Zn
		MC 21230	MgAl6Mn	G-MgAl6Mn
		MG-P-63	MgAl6Zn	G-MgAl6Zn
		MG-P-61	MgAl8Zn	G-MgAl8Zn
		MC 21110	MgAl8Zn1	G-MgAl8Zn1
		MC-21120	MgAl9Zn1	G-MgAl9Zn1
		MB 65110	MgSe3Zn2Zr1	G-MgSe3Zn2Zr1

EXAMPLES OF MACHINED MATERIALS

N	Aluminium alloys with high Si content	AC-43200	AlSi10Mg(Cu)	G-AlSi10Mg(Cu)
		AC-44200	AlSi12	GD-AlSi12
		AC-46100	AlSi11Cu2(Fe)	
		AC-47100	AlSi12Cu1(Fe)	
	Copper alloys	CW013A	CuAg0.1	CuAg0.2
		CW307G	CuAl10Ni5Fe4	CuAl10Ni5Fe4
		CW308G	CuAl11Ni6Fe6	CuAl11Ni6Fe5
		CW300G	CuAl5As	CuAl5As
		CW107C	CuFe2P	CuFe2P
		CW109C	CuNi1Si	CuNi1.5Si
		CW406J	CuNi12Zn30Pb1	CuNi12Zn30Pb1
		CW408J	CuNi18Zn19Pb2	CuNi18Zn19Pb2
		CW409J	CuNi18Zn20	CuNi18Zn20
		CW410J	CuNi18Zn27	CuNi18Zn27
		CW354H	CuNi30Mn1Fe	CuNi30Mn1Fe
		CW112C	CuNi3Si	CuNi3Si
		CW351H	CuNi9Sn2	CuNi9Sn2
		CW113C	CuPb1P	CuPb1P
		CW450K	CuSn4	CuSn4
		CW452K	CuSn6	CuSn6
		CW453K	CuSn8	CuSn8
		CW501L	CuZn10	CuZn10
		CW502L	CuZn15	CuZn15
		CW503L	CuZn20	CuZn20
		CW702R	CuZn20Al2	CuZn20Al2
		CW504L	CuZn28	CuZn28
		CW706R	CuZn28Sn1	CuZn28Sn1
		CW505L	CuZn30	CuZn30
		CW708R	CuZn31Si1	CuZn31Si1
		CW506L	CuZn33	CuZn33
		CW710R	CuZn35Ni2	CuZn35Ni2
		CW507L	CuZn36	CuZn36
		CW601N	CuZn35Pb2	CuZn35Pb1.5
		CW602N	CuZn36Pb3	CuZn36Pb3
		CW508L	CuZn37	CuZn37
		CW604N	CuZn37Pb0.5	CuZn37Pb0.5
		CW607N	CuZn38Pb1.5	CuZn38Pb1.5
		CW717R	CuZn38Sn1	CuZn38Sn1
		CW715R	CuZn38SnAl	CuZn38SnAl
		CW610N	CuZn39Pb0.5	CuZn39Pb0.5
		CW612N	CuZn39Pb2	CuZn39Pb2
		CW614N	CuZn39Pb3	CuZn39Pb3
		CW509	CuZn40	CuZn40
		CW723R	CuZn40Mn1	CuZn40Mn1
		CW720R	CuZn40Mn1Pb	CuZn40Mn1Pb
		CW612N	CuZn40Pb2	CuZn40Pb2
		CW622N	CuZn44Pb2	CuZn44Pb2
		CW500L	CuZn5	CuZn5

EXAMPLES OF MACHINED MATERIALS

Designation acc. to ISO	Material	Designation acc. to EN	No. acc. to EN	Specific name
S	Titanium alloys	TiCu2	3.7124	Ti 2Cu
		TiAl5Sn2.5		Ti 5Al-2.5Sn
		TiAl6V4	3.7164	Ti 6Al-4V
O	Duroplastics			Bakelit
				Resopal
				Pertinax
				Moltopren
	Thermoplastics			Plexiglas
				Hostalen
				Novodur
				Makralon
	Glass / carbon fibre reinforced composites			GFK
				CFK

FORMULAS

Machining parameter	Parameter designation	U/m	Formula
RPM	n	(min^{-1})	$n = \frac{v_c \cdot 1000}{d_1 \cdot \pi}$
Cutting speed	v_c	(m/min)	$v_c = \frac{d_1 \cdot \pi \cdot n}{1000}$
Feed per tooth	f_z	(mm)	$f_z = \frac{v_f}{z \cdot n} = \frac{f}{z}$
Feed per revolution	f	(mm)	$f = f_z \cdot z$
Feed speed	v_f	(mm/min)	$v_f = f_z \cdot z \cdot n$
Amount of chips produced	Q	(cm^3/min)	$Q = \frac{a_e \cdot a_p \cdot v_f}{1000}$

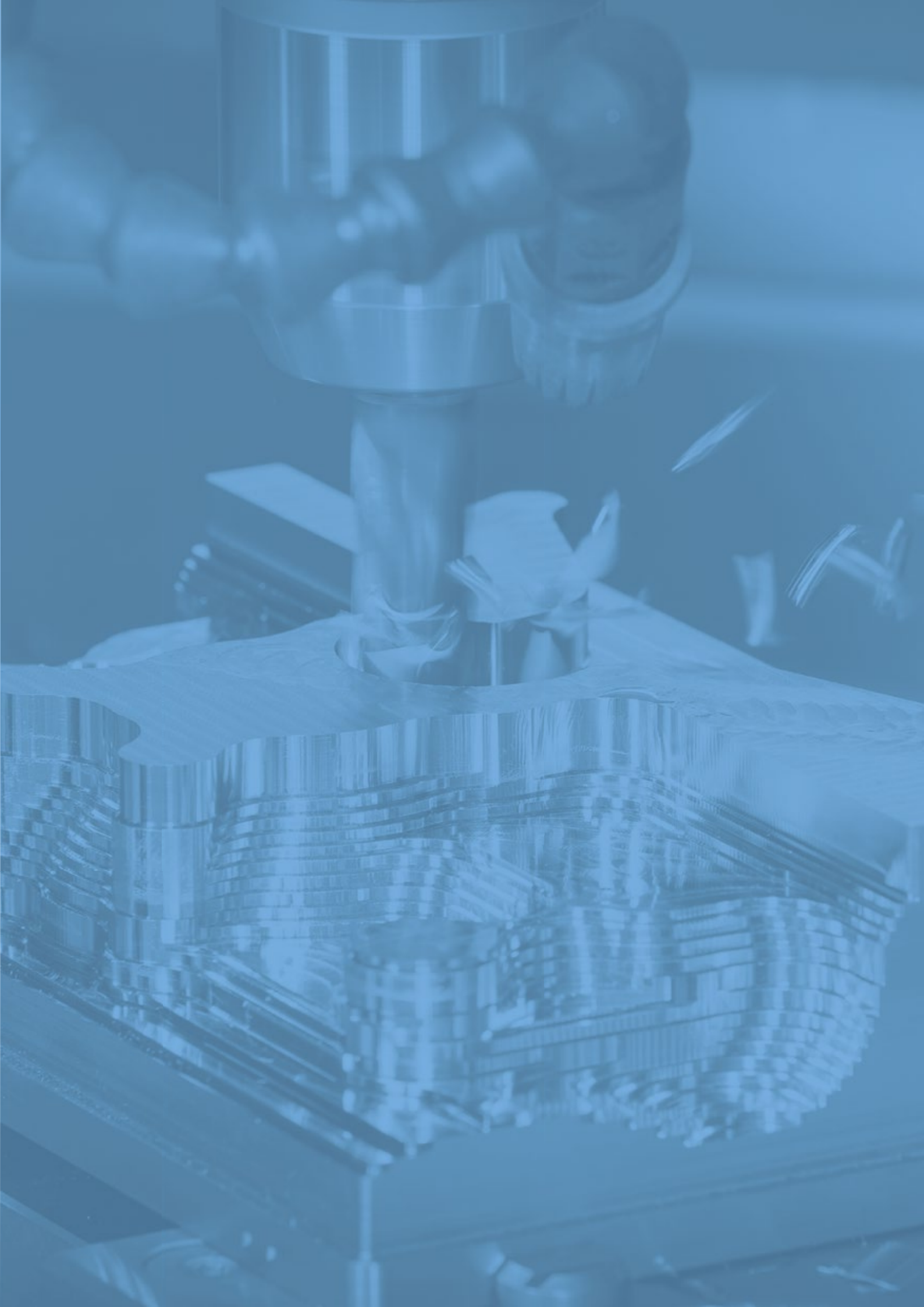
a_e cutting width [mm]

a_p cutting depth [mm]

d_1 tool diameter [mm]

π 3,14

z qty of teeth



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