WALTER PROTOTYP

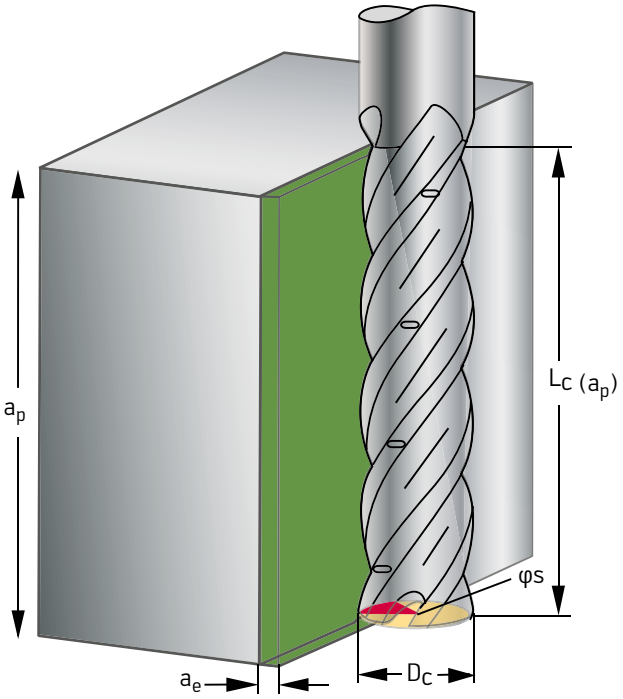
_DYNAMIC MILLING WITH THE MD133 SUPREME

Achieve perfect results more productively.

Maximum process reliability plus efficiency

Process reliability, productivity, cost efficiency … The demands made of metal machining are constantly increasing. At the same time, the result must be of guaranteed high quality. To achieve this, modern machine tools and CAD/CAM systems are making milling operations more and more efficient. Dynamic milling is a good example of this: It reduces machining times and simultaneously increases process reliability, tool life and metal removal rate.

THE MACHINING STRATEGY



Dynamic milling (High Dynamic Cutting – HDC) is based on the following factors:

- Maximum metal removal rates (Q_{max})
- Small radial cutting widths (a_e)
- Large axial depths of cut (a_p)
- Constant h_m = constant average chip thickness (h_m)
- Engagement angle (φ_s), adapted to the material to be machined

REQUIREMENTS

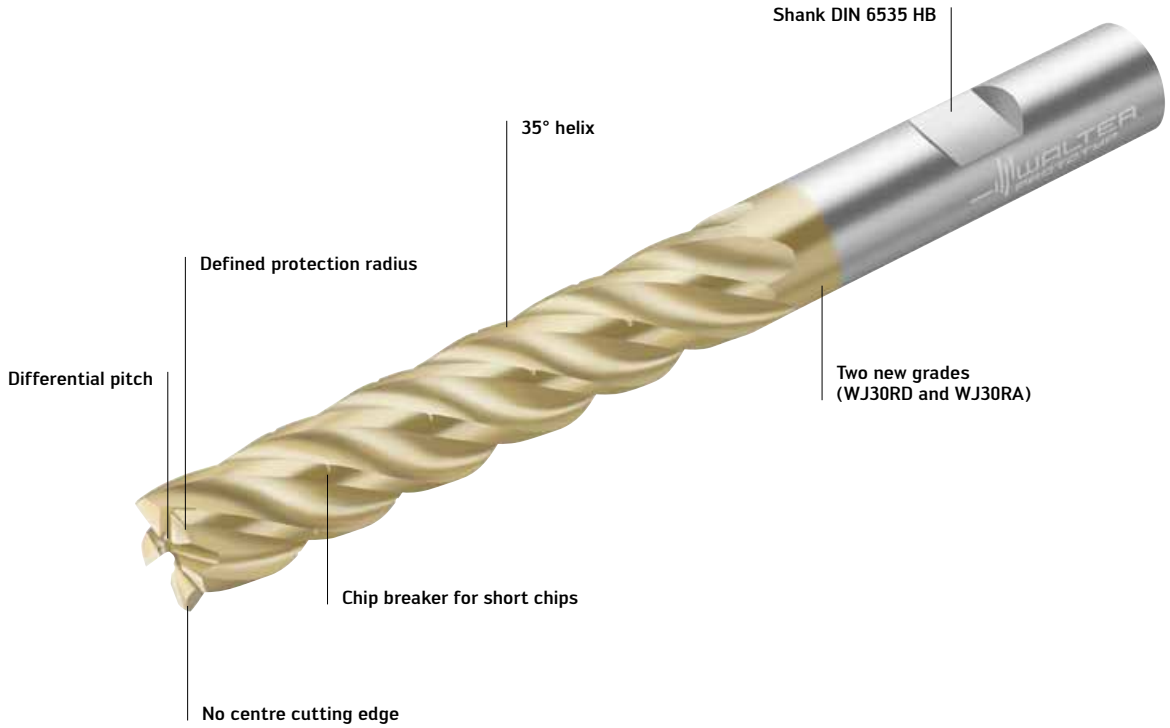
- Dynamic tools
- Dynamic machines
- CAM system for programming

BENEFITS FOR YOU

- High process reliability and metal removal rate
- Large depths of cut are possible
- Low thermal loading of the tool cutting edges
- Reduced tool wear
- Low power consumption, resulting in a longer service life for the machine spindle

Dynamic milling specialist: MD133 Supreme

The MD133 Supreme solid carbide cutter is specially designed for the requirements of dynamic milling. This means that it has a small cutting width a_e (depending on material), a high depth of cut a_p and a long cutting length L_c. It is ideally suited to a wide variety of materials: In grade WJ30RD for ISO P, secondary application ISO K; in grade WJ30RA for ISO M, secondary application ISO S and ISO N. Diameter ranges: With five teeth (z = 5) 6–12 mm, with six teeth (z = 6) 16–20 mm. Cutting lengths (L_c): $3 \times D_c$, $3 \times D_c$ (with neck for depths up to $4 \times D_c$) or $5 \times D_c$.



MD133 Supreme solid carbide milling cutter **Fig.:** WJ30RD

BENEFITS FOR YOU

- High process reliability in unmanned machining
- High productivity due to reduced machining times
- Maximum tool life as the entire cutting length is used and wear behaviour is uniform
- High flexibility in different cavities on the component thanks to machining with only one tool diameter
- No problems working with difficult-to-cut materials or under unstable conditions (machine, workpiece, clamping)

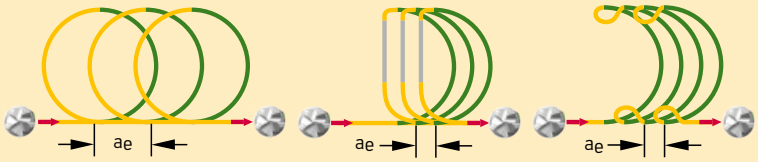
_STRATEGY

High metal removal rate with reduced tool wear

In comparison with conventional methods such as High Performance Cutting (HPC), High Dynamic Cutting (HDC) is impressive thanks to its extremely low constant mechanical load and reduced contact times between the cutting edge and the material. The result: Higher cutting parameters, higher metal removal rate, reduced tool wear.

Trochoidal milling avoids idling

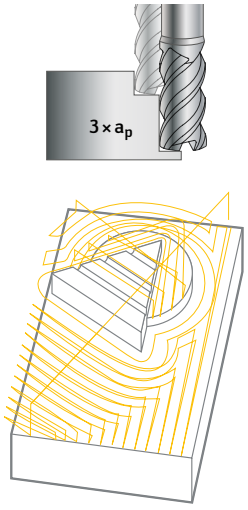
In static trochoidal milling operations (from "trochos" meaning "wheel"), the milling tool moves along circular (trochoidal) paths. The tool paths are optimally adapted to the workpiece in dynamic milling strategies and free travel is avoided, leading to an increase in the metal removal rate.



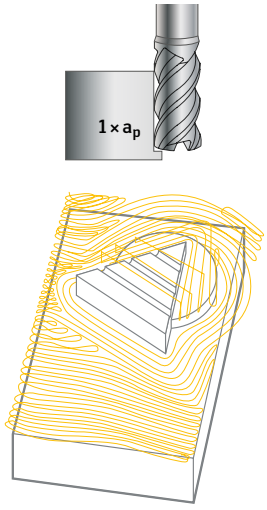
Static trochoidal milling **Dynamic trochoidal milling (1 + 2)**

Dynamic or conventional? A comparison of the strategies:

High Performance Cutting (HPC)

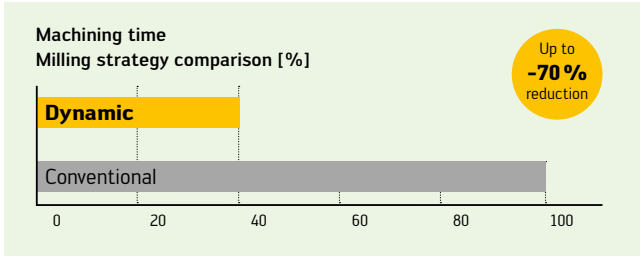


High Dynamic Cutting (HDC)



High Performance Cutting (HPC) and High Dynamic Cutting (HDC) are milling strategies for roughing operations. The task at hand and component geometry determine which strategy is used.

Features	HPC	HDC
Radial engagement (a_e)	Large	Low
Depth of cut (a_p)	Low	Large
Engagement angle	Large (up to 180°)	Low
Machining forces	High	Low
Machine	Powerful	Dynamic
Programming/software	Machine control unit	CAD/CAM system
Thermal load on the tool	High	Average



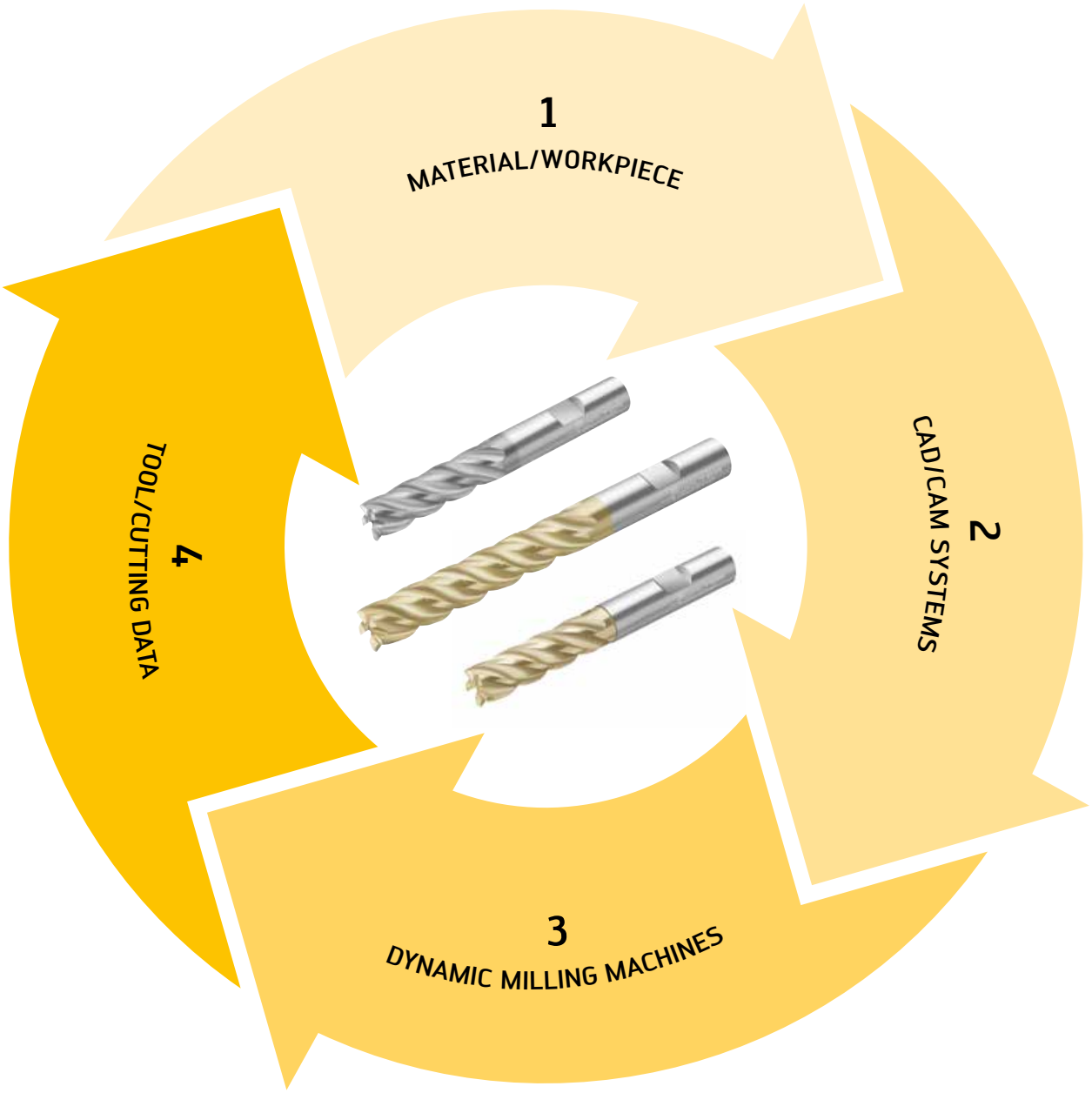
Dynamic milling can reduce the machining time by up to 70%!

Watch the product video:
www.youtube.com/waltertools

The four building blocks of dynamic milling

To be able to choose the optimum milling strategy and the ideal solid carbide milling cutter, the relevant factors for the machining operation must first be determined. To be able to mill dynamically, the following basic requirements need to be met:

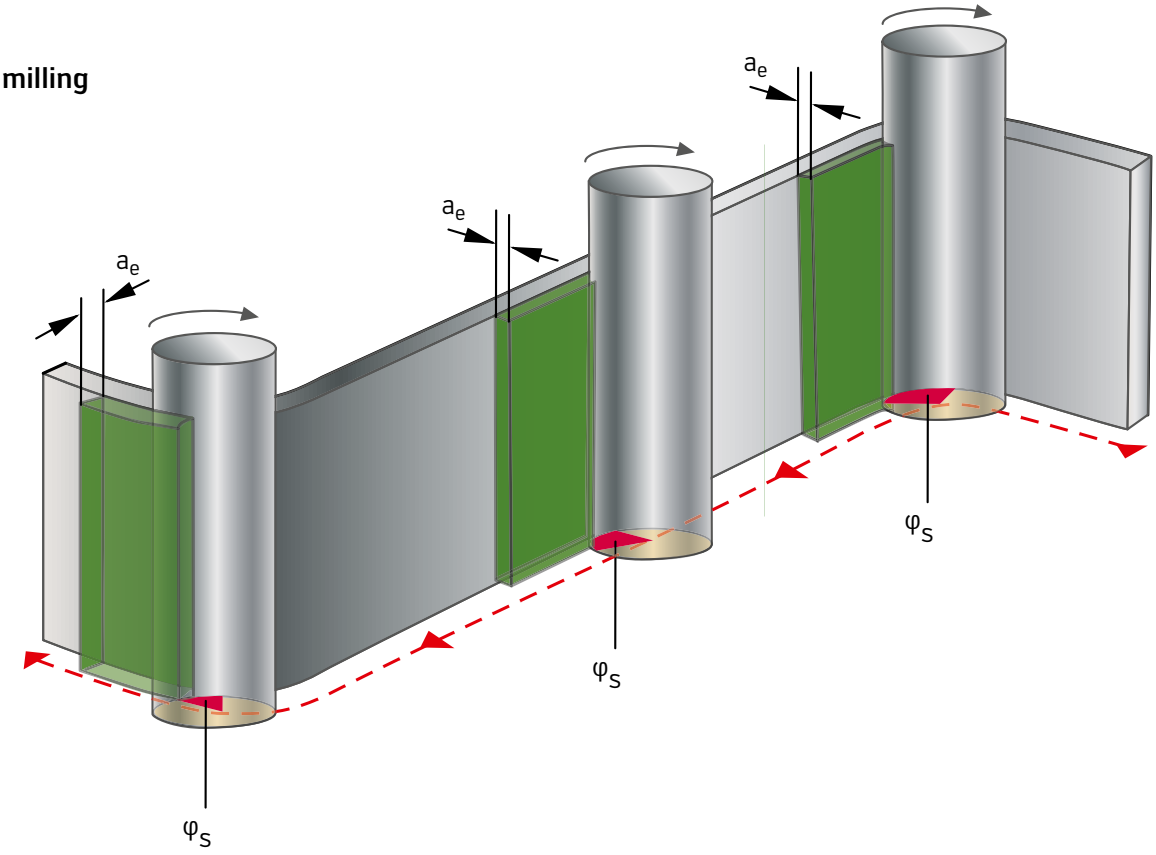
A workpiece or material which can be machined dynamically, an appropriate CAD/CAM system, a dynamic milling machine and a suitable tool.



_BUILDING BLOCK 1

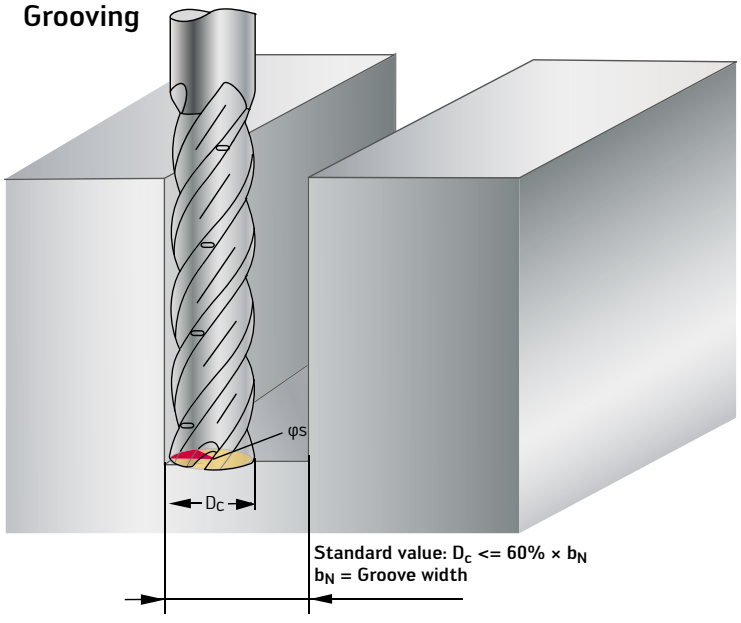
Material/workpiece

Lateral milling



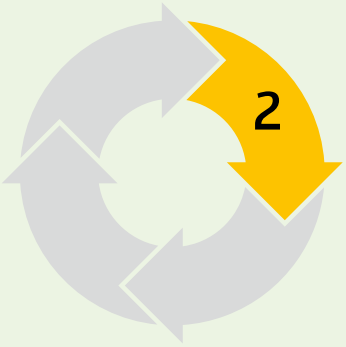
The material dictates the cutting values for the milling tools, i.e. the maximum permitted radial cutting width (a_e) and the engagement angle (φ_s). The workpiece profile determines the strategy, the cutting length (L_c) and the tool diameter (D_c), taking a maximum of 60% of the groove or pocket width to be produced as a standard value.

Grooving



_BUILDING BLOCK 2

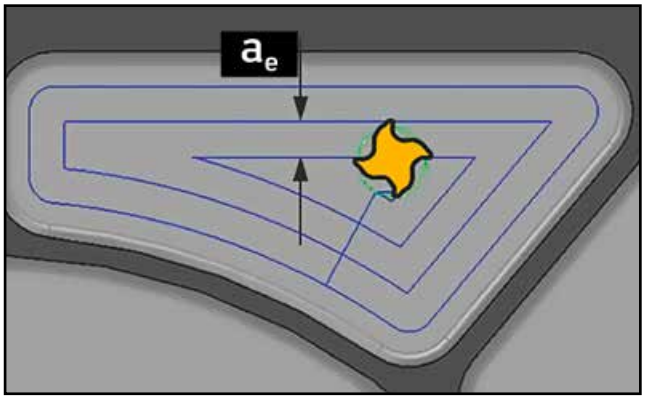
CAD/CAM systems

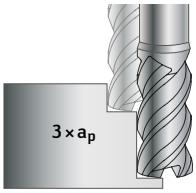


Most CAD/CAM systems feature the modules required for dynamic milling. The software avoids full-depth cuts and collisions, and calculates all of the key parameters such as the milling direction, optimal milling paths, speed (n), feed rate (v_f), adherence to the engagement angle (φ_s) and average chip thickness (h_m).

Comparison: Conventional vs. dynamic milling

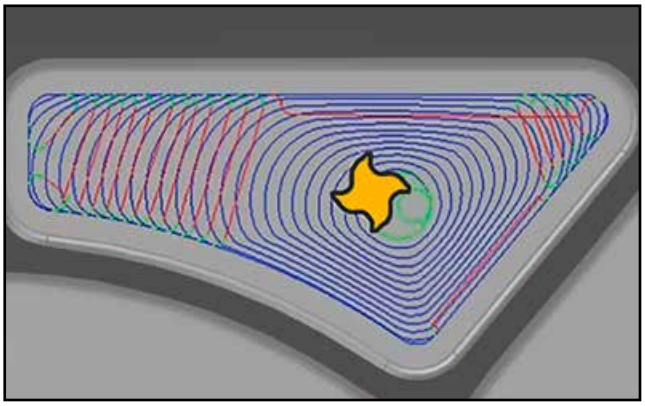
High Performance Cutting (HPC)

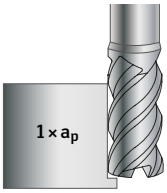




Milling paths, conventional:
a_e → large and constant
a_p → small

High Dynamic Cutting (HDC)





Milling paths, dynamic milling:
a_e → small and variable
a_p → large (max. cutting length)

IMPORTANT CAD/CAM SYSTEM FUNCTIONS:

- Plunging movement can be selected (preferably helical plunging or starting hole drilling)
- Milling paths parallel to the contour
- Choice of milling direction (preferably climb milling)
- Smooth start-up and shutdown movements
- Rounded roughing paths
- Residual material detection
- Reduction of a_e, a_p, v_c, f_z if necessary
- Avoids the use of full-depth cutting
- Collision monitoring and simulation
- Special milling geometry can be programmed

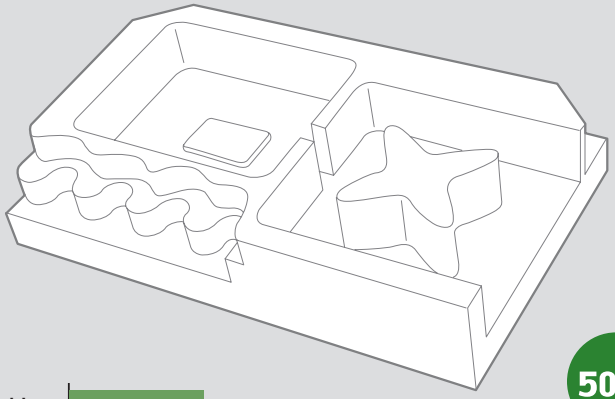
_BUILDING BLOCK 3

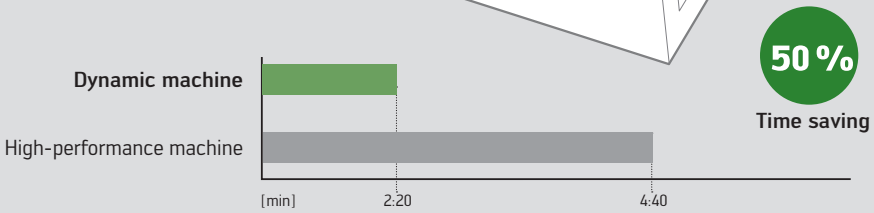
Dynamic milling machine

The term “dynamic milling machine” refers to the acceleration of the machine. In general, the machine has to have sufficient acceleration as well as excellent acceleration characteristics around corners.

Furthermore, it should have high rapid traverse and feed rates. Short calculation and switching times as well as a wide range of speeds are further fundamental requirements.

The advantages of horizontal machining, due to the high chip volumes, are not to be underestimated when it comes to the removal of chips.





SUITABLE CLAMPING SYSTEMS

Weldon chucks, because of their screw clamping design, protect the tool from being pulled out during the machining process. Modern hydro-expansion chucks achieve high retention forces and are distinguished by their excellent vibration damping qualities.

Weldon chuck

Most chucks can be used for dynamic milling. However, Walter recommends positive-locking type chucks and the MD133 Supreme solid carbide milling cutter with Weldon shank.

Hydro-expansion chuck AK182

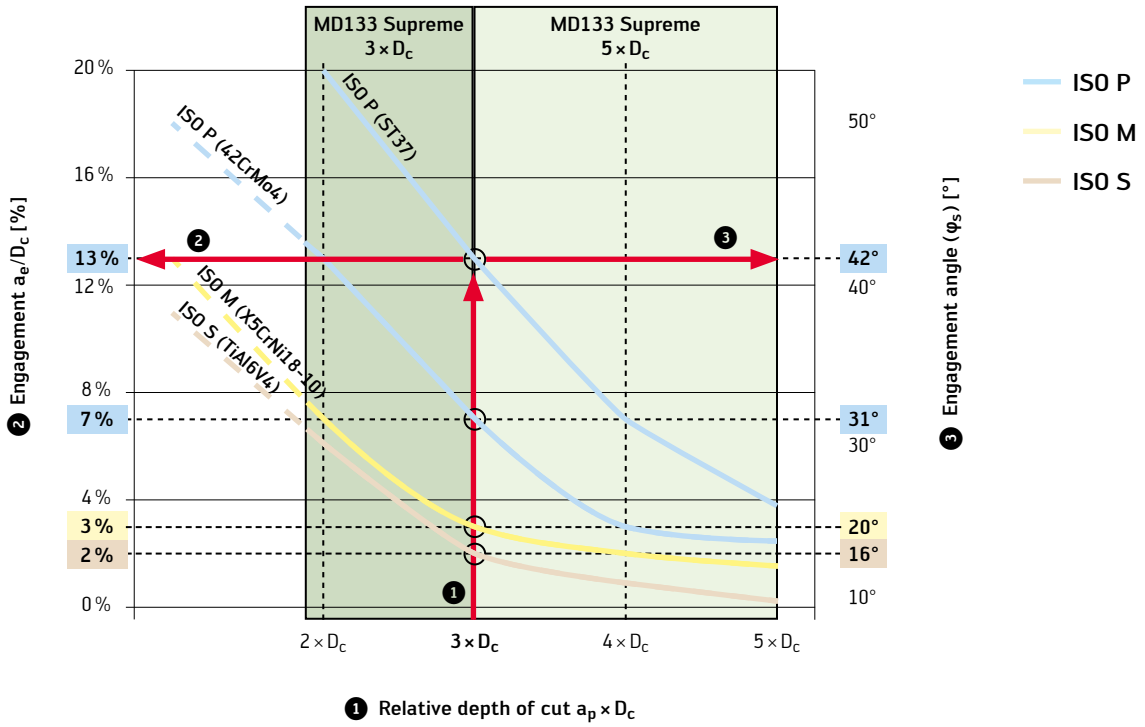
_BUILDING BLOCK 4

Tool/cutting data

The cutting length (L_c) and diameter (D_c) are defined by the profile of the workpiece. Optimally coordinated recommendations for tools and cutting data for each machine and task can be found with Walter GPS*. With usage recommendations for shoulder, face, slot and pocket milling, Walter GPS covers almost all milling operations that are conceivable in practice.

CUTTING DATA RECOMMENDATION

Recommendation for engagement angle (φ_s) and lateral feed for ISO P, ISO M and ISO S materials



Engagement angle (φ_s) ϕ [°] – application examples

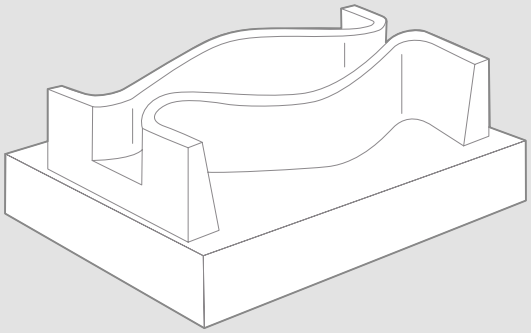
a_p	ISO P		ISO M	ISO S
	ST37 – 490 N/mm²	42CrMo4 – 1.000 N/mm²	1.4301 – 675 N/mm²	TiAl6V4 – 1.100 N/mm²
2 × D_c	53°	42°	31°	28°
3 × D_c	42°	31°	20°	16°
4 × D_c	31°	20°	16°	14°
5 × D_c	23°	18°	14°	11°

* For more detailed information on Walter GPS, see page 17. Or go to: walter-tools.com

Four examples that represent many other applications

As demonstrated by the following four machining examples, dynamic milling offers significant advantages in terms of productivity in a wide variety of applications. The main reasons for this are the reduction in free travel, and higher cutting parameters. At the same time, the constant mechanical load and shorter contact times lead to reduced tool wear.

Machining example 1:
Proto·max™ ST in ISO P
Component:
General mechanical engineering component



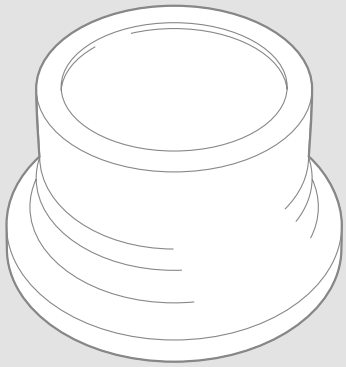
Machine: Hermle C30U
Adaptor: HSK63
Material: 42CrMo4 / 1.7225

Cutting data:

	Walter Proto·max™ ST H4137217-12-0.5
z	5
Chip breaker	No
$a_{e\ [variable]}$	Max. 2.93 mm
$\varphi_{s\ [variable]}$	Max. 60°
a_p	24 mm
v_c	433 m/min
$f_{z\ [variable]}$	Max. 0.2 mm (per tooth)
$h_{m\ [constant]}$	0.106 mm
v_f	Max. 4350 mm/min
Q	307 cm³/min
t	40 min

Standard Proto·max™ ST solid carbide end milling cutter with DIN 6527 L – the ideal tool for HDC and HPC milling in ISO P materials. Shown in the HDC (High Dynamic Cutting) machining example with optimised cutting data

Machining example 2:
MD133 Supreme in ISO P
Component:
Flange

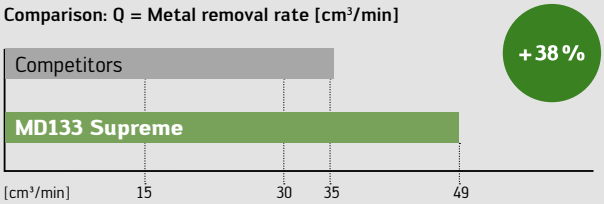


Machine: Okuma MU400
Adaptor: ISO 40
Material: Corrax [44 HRC]

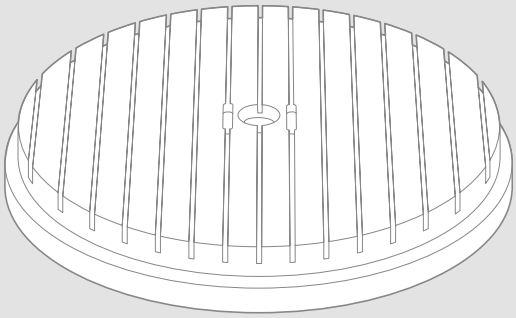
Cutting data:

	Competitors	Walter Prototyp MD133 Supreme 12.0W5L060J-WJ30RD
z	4	5
Chip breaker	No	Yes
a_e	0.8 mm	0.8 mm
φ_s	30°	30°
a_p	35 mm	35 mm
v_c	110 m/min	120 m/min
f_z	0.10 mm	0.11 mm
Q	35.5 cm³/min	49 cm³/min
t	33 min	99 min

Comparison: Q = Metal removal rate [cm³/min]



Machining example 3:
MD133 Supreme in ISO M
Component:
Machine table



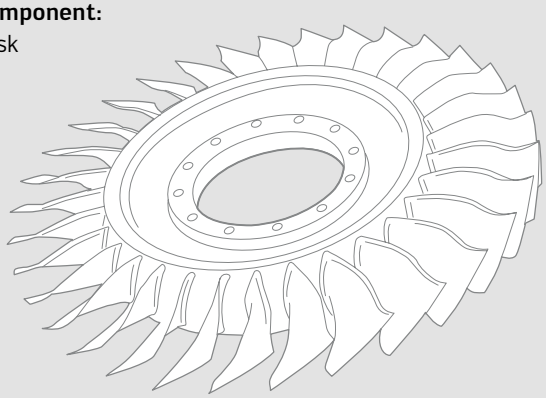
Machine: Reiden RX18
Adaptor: HSK100
Material: 1.4404 / X2 CrNiMo 17 13 2

Cutting data:

	Walter Prototyp MD133 Supreme 12.0W5X060L-WJ30RA
z	5
Chip breaker	Yes
a_e	0.5 mm
φ_s	24°
a_p	38 mm
v_c	157 m/min
f_z	0.117 mm
v_f	2440 m/min
Q	46.4 cm³/min
t	420 min

When milling dynamically with tools $L_c = 5 \times D_c$, it is particularly important to keep the tool clamping system (Weldon) stable and adhere to the maximum engagement angle.

Machining example 4:
Walter solid carbide special milling cutter in ISO S/Ti material
Component:
Blisk

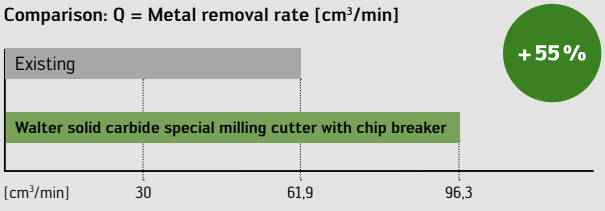


Machine: Deckel Maho
Adaptor: HSK63
Material: 1.4404 / TiAl6V4

Cutting data:

	Existing solid carbide milling cutter with roughing teeth Dia. 25 × 40 × 135 / internal cooling	**Walter solid carbide special milling cutter with chip breaker Ø 25 × 40 × 135**
z	8	8
Profile	Kordel	Chip breaker
a_e	3.817 mm	1.675 mm
a_p	32 mm	32 mm
v_c	60 m/min	96 m/min
f_z	0.083 mm	0.18 mm
v_f	507 mm/min	1797 mm/min
Q	61.9 cm³/min	96.3 cm³/min

Comparison: Q = Metal removal rate [cm³/min]



MD133 Supreme: Dynamic milling specialists

Dynamic milling specialists	Notes/areas of application	Material groups						
		P	M	K	N	S	H	O
MD133 WJ30RD 	– 5–6 cutting edges – Chip breaker – $L_c = 3 \times D_c$ and $5 \times D_c$ – No centre cutting edge – Weldon – 35° helix	••		•				
MD133 WJ30RA 			••		•	•		

Suitable for dynamic milling*	Notes/areas of application	Material groups						
		P	M	K	N	S	H	O
Proto·max™$_{ST}$ 	– 3, 4 and 5 cutting edges – z3 and z4 with centre cut – z5 without centre cut – 45°, 50° and 35° helix angle	••	•					
MC326 Supreme 	– 3–5 cutting edges – With centre cut – 50° helix angle	••	•	•				
MC122 Advance 	– 4–8 cutting edges – With centre cut – 45° helix angle	••	•	•		•		
Protostar® N50 	– 4–8 cutting edges – Without centre cut – 50° helix angle	••	•	•		•		
Proto·max™$_{Inox}$ 	– 4 cutting edges – With centre cut – 35°/38° helix angle – Internal coolant supply		••			•		
MC251 Advance 	– 4 cutting edges – With centre cut – 35°/38° helix angle		••			•		
MB265 Supreme 	– 3 cutting edges – With centre cut – 30° helix angle – Internal coolant supply				••			
Protostar® TI 	– 4–5 cutting edges – With centre cut – 45° helix angle		•			••		
MC187 Advance 	– 4–8 cutting edges – Without centre cut – 50° helix angle						••	

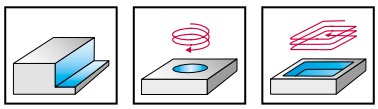
*** You can find our solid carbide standard tools in the Walter General Catalogue.**

Solid carbide shoulder milling cutters
MD133 Supreme mm

Z= 5–6

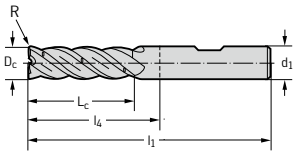
35°

– Chip breaker



	P	M	K	N	S	H	O
WJ30RA		●●		●	●		
WJ30RD	●●		●				

P STANDARD L



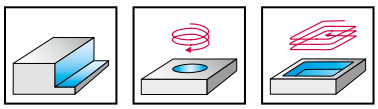
Designation	D_c h10 mm	r mm	L_C mm	l_1 mm	l_4 mm	d_1 h6 mm	Z	WJ30RA	WJ30RD
Shank DIN 6535 HB									
MD133-06.0W5L030J-	6	0,3	19	65	29	6	5	☺	☺
MD133-08.0W5L040J-	8	0,4	25	68	32	8	5	☺	☺
MD133-10.0W5L050J-	10	0,5	32	80	40	10	5	☺	☺
MD133-12.0W5L060J-	12	0,6	38	93	48	12	5	☺	☺
MD133-16.0W6L080J-	16	0,8	50	115	62	16	6	☺	☺
MD133-20.0W6L100J-	20	1	63	125	75	20	6	☺	☺

Shoulder milling $a_e \leq 0.10 \times D_c$ for ISO P
Shoulder milling $a_e \leq 0.03 \times D_c$ for ISO M and ISO S
Ordering example for the WJ30RD grade: MD133-06.0W5L030J-WJ30RD

Solid carbide shoulder milling cutters
MD133 Supreme mm / MD133 Supreme inch

Z= 5–6

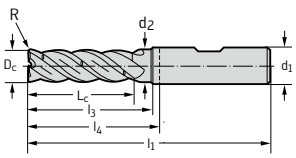
– Chip breaker



	P	M	K	N	S	H	O
WJ30RA		●●		●	●		
WJ30RD	●●		●				

P STANDARD L

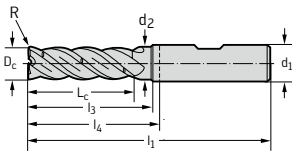
Designation	D_c h10 mm	r mm	L_C mm	l_3 mm	d_2 mm	l_1 mm	l_4 mm	d_1 h6 mm	Z	WJ30RA	WJ30RD
Shank DIN 6535 HB											
MD133-06.0W5L030D-	6	0,3	19	27	5,5	65	29	6	5	☺	😐
MD133-08.0W5L040D-	8	0,4	25	30	7,5	68	32	8	5	☺	😐
MD133-10.0W5L050D-	10	0,5	32	38	9,5	80	40	10	5	☺	😐
MD133-12.0W5L060D-	12	0,6	38	46	11,4	93	48	12	5	☺	😐
MD133-16.0W6L080D-	16	0,8	50	60	15,2	115	62	16	6	☺	😐
MD133-20.0W6L100D-	20	1	63	73	19	125	75	20	6	☺	😐



Shoulder milling $a_e \leq 0.10 \times D_c$ for ISO P
Shoulder milling $a_e \leq 0.03 \times D_c$ for ISO M and ISO S
Ordering example for the WJ30RD grade: MD133-06.0W5L030D-WJ30RD

P STANDARD L

Designation	D_c h10 inches/ no.	R inch	L_c inch	l3 inch	d_2 inch	l_1 inch	l_4 inch	d_1 h6 inch	Z	WJ30RA	WJ30RD
Shank DIN 6535 HB											
MD133.6.35W5L038D-	1/4"	0,015	0,875	1,000	0,237	2,500	1,437	0,250	5	☺	😐
MD133.9.53W5L038D-	3/8"	0,015	1,250	1,500	0,356	3,250	1,687	0,375	5	☺	😐
MD133.12.7W5L076D-	1/2"	0,030	1,750	2,125	0,475	4,000	2,217	0,500	5	☺	😐
MD133.15.9W6L076D-	5/8"	0,030	2,000	2,500	0,594	4,500	2,594	0,625	6	☺	😐
MD133.19.1W6L076D-	3/4"	0,030	2,500	3,000	0,713	5,500	3,469	0,750	6	☺	😐



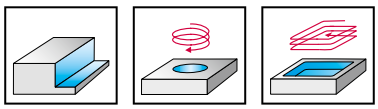
Shoulder milling $a_e \leq 0.10 \times D_c$ for ISO P
Shoulder milling $a_e \leq 0.03 \times D_c$ for ISO M and ISO S
Ordering example for the WJ30RD grade: MD133.6.35W5L038D-WJ30RD

Solid carbide shoulder milling cutters
MD133 Supreme mm / MD133 Supreme inch

Z= 5–6

35°

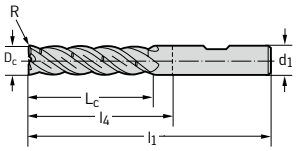
– Chip breaker



	P	M	K	N	S	H	O
WJ30RA		●●		●	●		
WJ30RD	●●		●				

P STANDARD XL

Shank DIN 6535 HB

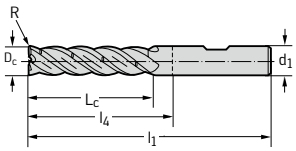


Designation	D_c h10 mm	r mm	L_C mm	l_1 mm	l_4 mm	d_1 h6 mm	Z	WJ30RA	WJ30RD
MD133-06.0W5X030L-	6	0,3	31	80	40	6	5	☺	☺
MD133-08.0W5X040L-	8	0,4	41	87	51	8	5	☺	☺
MD133-10.0W5X050L-	10	0,5	52	100	60	10	5	☺	☺
MD133-12.0W5X060L-	12	0,6	62	116	71	12	5	☺	☺
MD133-16.0W6X080L-	16	0,8	82	141	93	16	6	☺	☺
MD133-20.0W6X100L-	20	1	103	165	115	20	6	☺	☺

Shoulder milling $a_e \leq 0.03 \times D_c$ for ISO P
Shoulder milling $a_e \leq 0.015 \times D_c$ for ISO M and ISO S
Ordering example for the WJ30RD grade: MD133-06.0W5X030L-WJ30RD

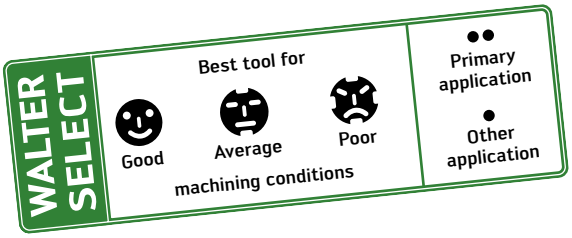
P STANDARD XL

Shank DIN 6535 HB



Designation	D_c h10 inches/ no.	R inch	L_c inch	l_1 inch	l_4 inch	d_1 h6 inch	Z	WJ30RA	WJ30RD
MD133.6.35W5X038L-	1/4"	0,015	1,375	3,000	1,937	0,250	5	☺	☺
MD133.9.53W5X038L-	3/8"	0,015	2,000	4,000	2,437	0,375	5	☺	☺
MD133.12.7W5X076L-	1/2"	0,030	2,750	5,000	3,217	0,500	5	☺	☺
MD133.15.9W6X076L-	5/8"	0,030	3,250	5,500	3,594	0,625	6	☺	☺
MD133.19.1W6X076L-	3/4"	0,030	3,875	6,500	4,469	0,750	6	☺	☺

Shoulder milling $a_e \leq 0.03 \times D_c$ for ISO P
Shoulder milling $a_e \leq 0.015 \times D_c$ for ISO M and ISO S
Ordering example for the WJ30RD grade: MD133.6.35W5X038L-WJ30RD



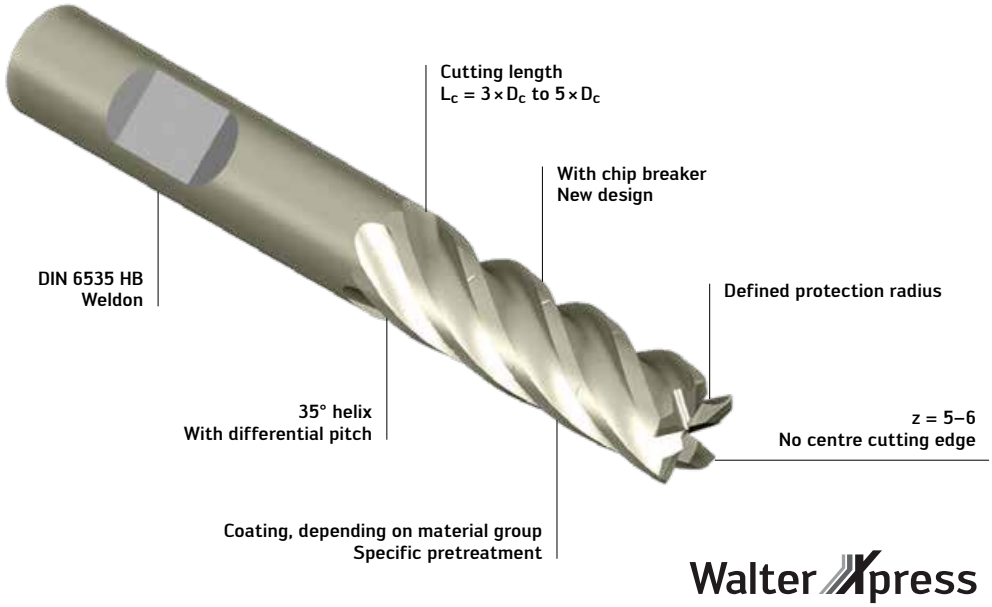
Quality high above average

Controlling the chip that is produced is one of the greatest challenges in metal machining – not just with dynamic milling. Walter offers you custom solutions for all your requirements.

The machining of deep rectangular and circular pockets is particularly demanding. The use of special tools with special chip breaker geometry is recommended here.

Standard tool: Long, smooth cutting edges result in long chips, which create chip build-up.

Walter special tool: New chip breaker design creates short chips which make chip evacuation easier.



Cutting edge diameter D_c = 6–20 mm, 1/4–3/4 inch **Fig.:** Walter solid carbide special milling cutter with chip breaker

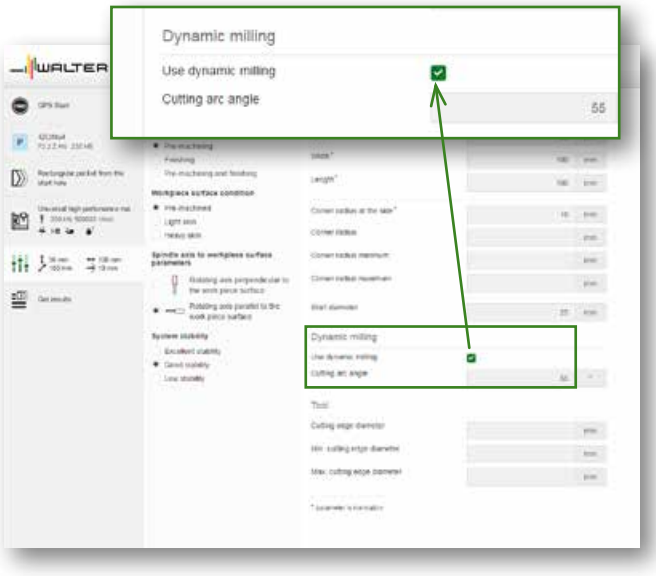
Walter Xpress

Design and calculation for special tools in minimum time. If the requests are within the specified range of parameters, the tool will be delivered in two to three weeks.

The right tool solution in just four clicks

In just four clicks of the mouse, Walter GPS takes you from defining your target to the most cost-efficient machining solution. Whether for drilling, threading or milling: All the information about Walter, Walter Titex and Walter Prototyp tools is instantly there for you to see.

You can find Walter GPS at:
walter-tools.com



This is the latest generation of tool navigation

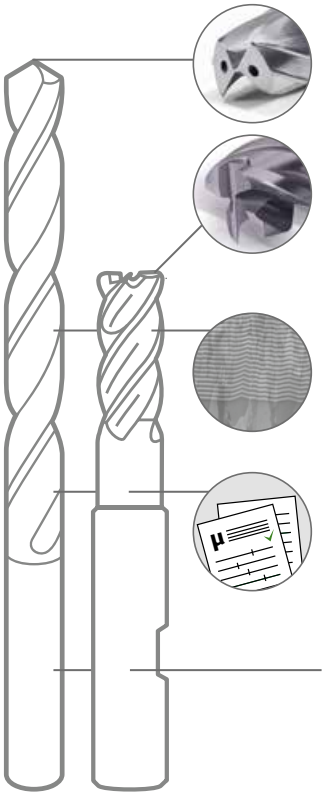
Access essential usage parameters, such as cutting data or cost-efficiency calculations, on your screen. With Walter GPS, it takes just a few steps for you to find the best machining solution, online and offline, by looking up a tool in our catalogue or by following our recommendations. Whether you are looking for certain applications, tools or a solution that suits your key data, it takes just a few steps.

BENEFITS FOR YOU

- Cutting data – individually tailored to your machine
- Optimised tool and cutting data recommendations perfectly adapted to suit your machining task
- Individual tool lives and cutting data for specified limit ranges
- Possibility of specifying tolerances
- Linking of related machining tasks (e.g. drilling and threading)
- Additional information about the machining strategy
- Display of costs

Reconditioning to the original manufacturer quality really pays off

The Reconditioning Service from Walter Multiply makes a significant contribution towards lowering your production costs. This service can provide you with Walter Titex and Walter Prototyp tools that are as good as new, to the original manufacturer quality standard and all at an attractive price-performance ratio.



ORIGINAL GEOMETRIES
Cutting edge geometries are extremely complex. During reconditioning, Walter calls upon its extensive manufacturing experience to return them to their original condition.

ORIGINAL COATING
When it comes to tool performance, the coating is key. Only Walter uses the original coating process during reconditioning.

ORIGINAL TOLERANCES
These marks of quality are just as important when reconditioning as when Walter manufactures a completely new tool. To achieve this, we only use the most up-to-date measuring methods.

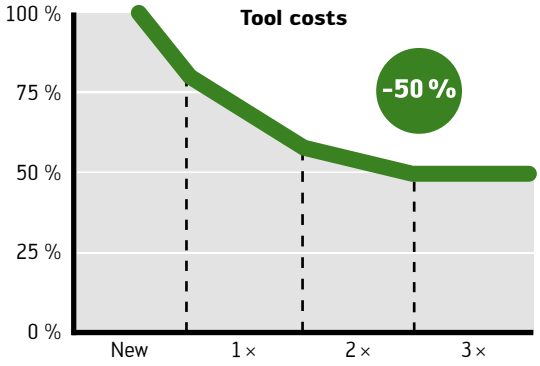
RECONDITIONING RANGE
- Solid carbide milling cutters and drills
- Solid carbide special milling cutters and special drills
- Solid carbide thread milling cutters
- HSS special tools and step drills
- High-performance HSS milling cutters and HSS-Co drills
- XD drills

OUR MARK OF 100% QUALITY
Look out for the “Original Walter Quality” label. It indicates that a tool has been reconditioned to original manufacturer quality, and even appears in the ordering documents, enabling you to see the tools for which we recommend our Reconditioning Service.

50% LOWER COSTS

Tools are often disposed of far too early, even though the Walter Reconditioning Service can restore the tool a number of times to original manufacturer quality. Benefit from reduced costs, reliable production processes and consistent tool life by having your tools reconditioned at our Reconditioning Centre, which is available worldwide. That’s how you save up to 50% on your tool costs!

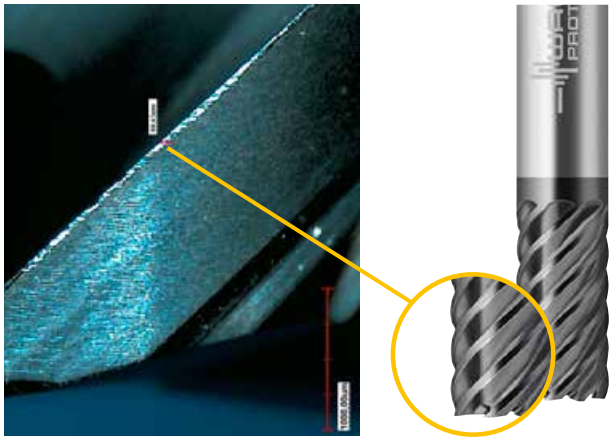
Find out more at: www.reconditioning.walter



Number of reconditioning operations

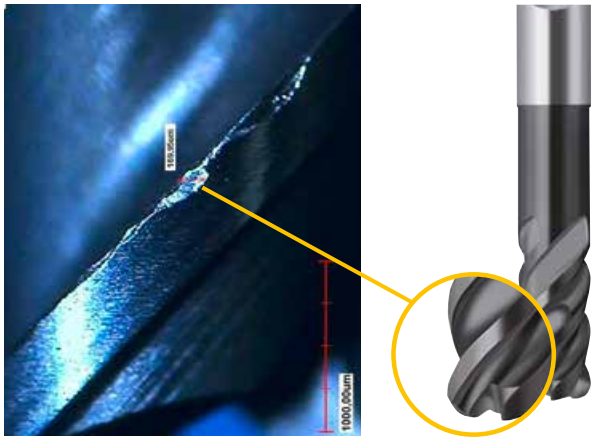
Regrinding of dynamically used milling cutters

High Dynamic Cutting (HDC)



Dynamic milling (HDC) uses the entire cutting length. This results in more even tool wear. The tool can be reground along the entire length of the cutting edge.

High Performance Cutting (HPC)

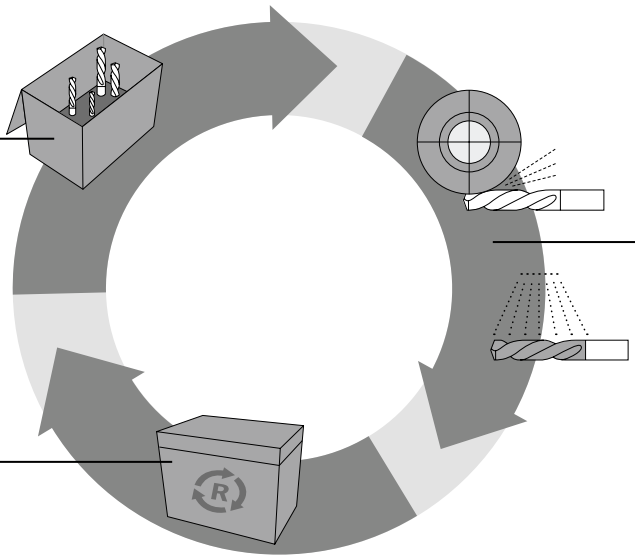


The corner and the peripheral cutting edge are put under extreme strain during high performance cutting (HPC). The result could be serious fractures along the cutting edge. This means that a large quantity of material (substrate) has to be removed during reconditioning.

WALTER RECONDITIONING – FOR THE TOUGHEST DEMANDS

Demanding customers require us to give 100% at all times. This is also true for reconditioning – especially for high-performance tools. Walter Multiply reconditions your tool to "almost new" condition. This has been proven in actual practice. The reconditioned tool impresses customers with its top performance. It's worth it! This is because the service life of a tool is extended each time it is reconditioned.

Reconditioning cycle:



1

The used tools are packed in the free-of-charge Walter reconditioning box and then the transport box is collected.

2

The original tool geometry and coating are reconditioned to the same quality requirements as a new tool.

3

The tools reconditioned to original manufacturer quality are delivered.

Walter AG

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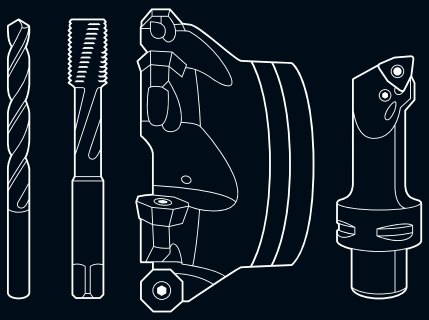
Postfach 2049, 72010 Tübingen
Germany

walter-tools.com



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