TOOLING SYSTEMS PROCESS OPTIMIZATION CONSULTING IN MILLING STRATEGIES

QUADWORX®

HIGH FEED RATES

pokolm
PREMIUMTOOLS. WE KNOW HOW.

HIGH FEED RATES

QUADWORX® – this new innovation from Pokolm enables a high feed milling in general application. This state of the art milling tool is engineerd for roughing operations for steel, tools steel, cast iron and stainless as well. QUADWORX®-milling cutters provides a high productivity. The cycle time for roughing will be reduced drastically.

The QUADWORX® cutters are available as screw-on and shell mill version. The stand alone and patented DuoPlug®-system for maximum stiffness and best run-our accuracy completed the program. All cutters are manufactured with internal coolant supply for best process reliability in deep cavities.

DuoPlug®

Screw-on type

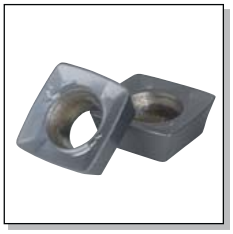
Shell type

The new designed **QUADWORX®** indexable inserts have 4 cutting edges and a special geometry, a combination of large corner radius and wiper edge. This ensured best performance in 2, 2 1/2 and 3D cutting. For increased tool life, all cutting edges were edge-treated and polished to reduce the friction between cutting material and insert.

All cutters have integrated pocket seat (embedded) for more rigidity and longer tool life of the cutter body. The result is higher chip volume and increased productivity. Our high accuracy inserts are available in grades HSC 05, P40, P25 and K10 as well as grade M40 with chip guide steps and our latest, modified coating PVST are highly economic through its no. of cutting edges and its increased tool life.

BRIGHT PROSPECTS...

M40 and PVST are features for efficient machining of stainless-, acid- and heat-resistant materials. Extremely tough and high-temperature-resistant carbide in combination with our modified AlTiN-coating layer reduce built-up edges, increase thermal stability and reduce friction between cutting edge and material at the same time. This results in a maximum process reliability, even with highest possible chip volume and results in lower costs per component.



M40 PVST

...FOR MILLING STAINLESS MATERIALS

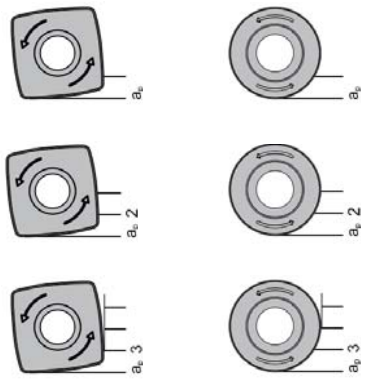
In case you need further information about our stainless range, you can download our current brochure from our homepage www.pokolm.com or ask by phone / e-mail under ⊖ contacts (see back page) for this brochure.

TECHNICAL INFORMATION

Due to the reduced arc of contact, when machining vertical moulds, less cutting forces influence milling cutters, inserts and machine spindle.

These following graphics explain the kind of geometry influence to those cutting forces. One further element is the reduced power consumption of the machine, which allows more careful treatment of the machine

Comparing different arcs of contact for increasing cutting depths (a_p up to a_p 3) illustrate the reason of better running smoothness. As soon as the ap-value has exceeded the size of our **QUADWORX®**-insert's minor cutting edge (a_p 3), the milling cutter gets a side clearance and thus it is cutting free and radial forces for milling cutter, inserts and machine spindle are decisively reduced.



Please take notice of the theoretical corner radius which has to be programmed. Also this type of milling cutters leaves a material stock, not pre-determinable. The r_p-values as well as operation data and measuring point diameter d_p will be mentioned on the following pages.

SUMMARY OF ADVANTAGES:

- 4 cutting edges per insert for extreme economic applications
- very high chip removal rates and very easy cutting actions
- thanks to the inserts positioning via its second clearance face and the orthogonal arranged insert seats in the cutter body, any twisting of the insert is avoided
- maximum process reliability specially in interrupted cutting applications
- wiper edge and large corner radius generate high accuracy surfaces, already in roughing operations

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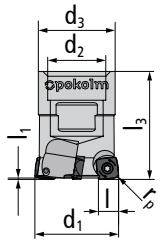
QUADWORX®

Size "S"

- 4 cutting edges per insert for extremely economic applications
- very high chip removal rates and very easy cutting actions
- all tools are provided with internal coolant supply and integrated pocket seats
- extremely high feed rates up to 1.5 mm feed per tooth (f_z)

DuoPlug®



Catalogue no.	d_1	l	r_p*	l_3	l_2	l_1	d_2	d_3	z	Accessories	Features
2 16 247 SG	16	7	1.3*	31	1	-	M 10	15	2	B, C, D, E, F	
3 18 247 SG	18	7	1.3*	31	1	-	M 10	15	3	A, C, D, E, F	
3 20 247 SG	20	7	1.3*	33	1	-	M 12	18.6	3	A, C, D, E, F	
4 25 247 SG	25	7	1.3*	35	1	-	M 16	23.5	4	A, C, D, E, F	


25 500
A > Page 10


25 500 K
B > Page 10

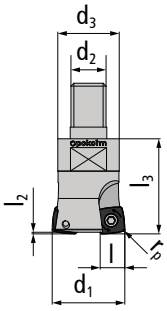
07 500
C > Page 10


TV 04-1
D > Page 10

T7 500
E > Page 10

T7 502
F > Page 10

Screw-on type



2 14 247	14	7	1.3*	28.5	1	-	M 8	13.8	2	B, C, D, E, F	
2 16 247	16	7	1.3*	28.5	1	-	M 8	13.8	2	B, C, D, E, F	
3 18 247	18	7	1.3*	28.5	1	-	M 8	13.8	3	A, C, D, E, F	
3 20 247	20	7	1.3*	28.5	1	-	M 10	18	3	A, C, D, E, F	
4 25 247	25	7	1.3*	32.5	1	-	M 12	21	4	A, C, D, E, F	


25 500
A > Page 10


25 500 K
B > Page 10

07 500
C > Page 10


TV 04-1
D > Page 10

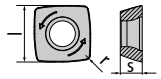
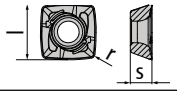
T7 500
E > Page 10

T7 502
F > Page 10

*corner radius to be programmed

internal coolant supply
DuoPlug®
incorporated inserts
clamping flat
latest items!
available as long as stock lasts
on request
stock item, subject to confirmation

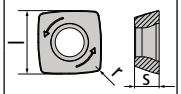
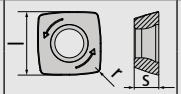
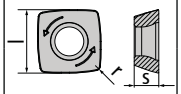
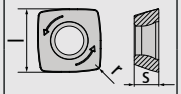
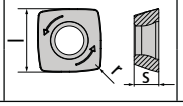
QUADWORX®-Inserts Size "S", ISO-Standard: SDMX / SDMT 07 02 05 SN

Inserts	Catalogue no.	ISO Standard	Carbide grade	Coating	l	s	r	M
	02 47 837	SDMX 07 02 05 SN	HSC 05	PVTi	7	2,38	0,5	M 2,5
	02 47 842	SDMX 07 02 05 SN	P40	PVTi	7	2,38	0,5	M 2,5
	02 47 896	SDMT 07 02 05 SN	M40	PVST	7	2,38	0,5	M 2,5

Cutting Speeds V_c in m/min

Material	Application	Insert radius	l	Machining rates	HSC05 PVTi	P40 PVTi	M40 PVST
Steel		0.5	7	roughing		100-200	
				finishing			
High temperature alloys		0.5	7	roughing			40-80
				finishing			60-120
Stainless steel		0.5	7	roughing			80-180
				finishing			110-250
Cast irons		0.5	7	roughing	160-300		
				finishing			
Hardened materials		0.5	7	roughing	100-180		
				finishing			

feed per tooth (f_z)) | d.o.c. (a_p)

Material	Insert	Insert radius	l	feed per tooth (f_z) d.o.c. (a_p)	HSC 05 PVTi	P40 PVTi	M40 PVST
Steel		0.5	7	f_z(mm)		0.3-1.5	
				a_p(mm)		0.2-0.7	
High temperature alloys		0.5	7	f_z(mm)			0.2-0.8
				a_p(mm)			0.1-0.5
Stainless steel		0.5	7	f_z(mm)			0.2-1.0
				a_p(mm)			0.1-0.5
Cast irons		0.5	7	f_z(mm)	0.3-1.5		
				a_p(mm)	0.2-0.7		
Hardened materials		0.5	7	f_z(mm)	0.3-1.0		
				a_p(mm)	0.2-0.5		

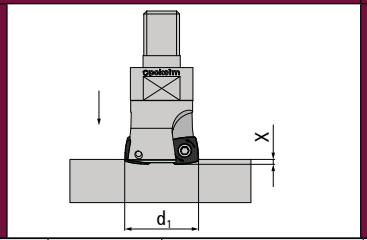
Major application roughing pre-finishing finishing

Minor application roughing pre-finishing finishing

EXTENDED OPERATION DATA

QUADWORX® Size "S"

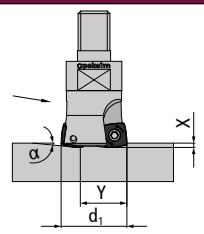
Plunging



Cutter diam. d_1 mm	diam. d_p mm	x max. mm
14	3.7	1
16	5.7	1
18	7.7	1
20	9.7	1
25	14.8	1

f_z see operation data table, but reduce value to 30%

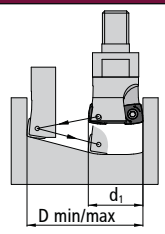
Ramping



α°	y mm
< 13.5	4
< 8.8	6
< 6.6	8
< 5.2	10
< 3.3	15

a_p | f_z see operation data table

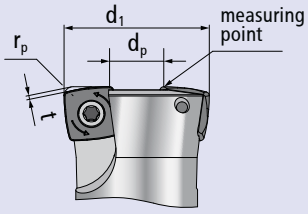
Helix



D_{min} mm	D_{max} mm
18	28
22	32
26	36
30	40
40	50

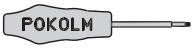
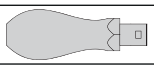
a_p | f_z see operation data table

Technical information



For the **CAD/CAM set-up** please program **1.3 mm** corner radius (r_p).
The **remainder of the material** is theoretically **0.51 mm** (t).
Please use „d_p" for **tool length measurement**.

QUADWORX® Size "S" –Accessories

Accessories	Catalogue No.	Description	Dimensions			
	25 500	Torxscrew M 1.8	M 2.5	L 5.0	T 7	
	25 500 K	Torxscrew M 1.8	M 2.5	L 4.5	T 7	
	07 500	Torx Screwdriver T 7	T 7			
	TV 04-1	Torque Screwdriver Vario® S with scale	from 0.4 Nm	up to 0.8 Nm	with scale	
	T7 500	Torx interchangable bit for Torque Vario®	T 7	L 175	max. 0.9 Nm	
	T7 502	Torx MagicSpring compatible bit for Torque Vario®	T 7	L 175	max. 0.9 Nm	

Starting torque for Torxscrews: M_d 1.28 Nm

Definitions and dimensions

a_p depth of cut in (mm)
f_z feed per tooth in (mm)
D_{max} = maximum bore diameter depending on cutter diameter in [mm]
x maximum plunge depth
D_{min} = minimum bore diameter depending on cutter diameter in [mm]
y minimum travel in [mm]
α angle of inclination in [°]

FROM PRACTICE TO PRACTICE

JOB TITLE:

Process optimizing of a component from material 1.4534 (X3CrNiMoAl13-8-2). This is equal to the US-alloy PH 13-8Mo, a high-tensile stainless steel with aircraft and space conditions. Previously, a slot was produced with a Pokolm threaded shank end mill body No. 3 15 235/12 (15 mm diam., r=3.5). The slot is curved and open on both ends. Dimensions are: 150 mm long, 20 mm wide and 70 mm deep. With this tool mentioned, the customer could produce 1 complete slot. After that, inserts had to be turned in order to secure continued process reliability. This additional downtime had significant influence on the component's costs. The customer had to find a solution to reduce machining time as well as down-time. The new tool QUADWORX® "S" was selected to be the right tool for this application. It was assumed that the milling cutter 2 16 247 (16 mm diam., r_p 1.3) together with our new insert 2 47 896 should be the correct selection for this job.

MACHINE	MATERIAL	PROGRAMMING SYSTEM
DMU 60 P	1.4534	MillPlus

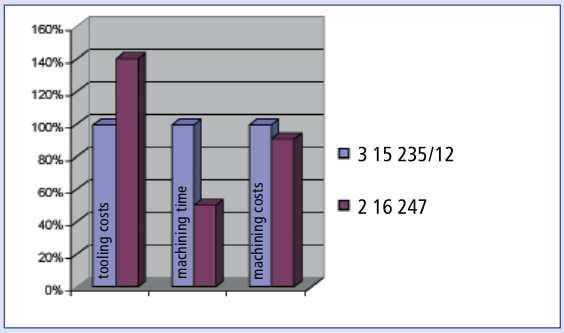
The slots of this component have been produced countour-parallel in z-constant cycle in climb milling as well as conventional milling. Regarding machining time, the feed rate and the chip volume have been more than doubled. This QUADWORX® "S" combination allows a 7-times increase of tooth load compared with the previous end mills with round inserts. The high tensile and forged component was machined using constant coolant supply in order to avoid any heating up of the component.

EXAMPLE FROM PRACTICE:

	PREVIOUSLY	NOW
machining:	slot	
material:	1.4534 (Alloy PH13-8)	
arbor:	00 16 750 S (16 mm diam., SK 40)	
extension:	40 08 601	
cutter body:	3 15 235/12 (15 mm diam. / r = 3.5)	2 16 247 (16 mm diam. / r_p = 1.3)
insert:	01 07 895	02 47 896, M40
coating:	PVGM	PVST
overhang:	73 mm	73 mm
v_c (speed):	170 m/min	170 m/min
v_f (feed rate):	900 mm/min	1,800 mm/min
S (revolutions):	3,400 1/min	3,400 1/min
f_z (feed per tooth):	0.083 mm	0.59 mm
a_p (depth of cut):	0.3 mm	0.3 mm
a_e (width of cut):	5 – 15 mm	4 – 16 mm
chip volume:	2.13 cm³/min = 0.13 cu. in./min	4.32 cm³/min = 0.264 cu. in./min
machining time:	**40 min**	**20 min**

RESULT:

Machining time of this component has been reduced from 40 to 20 minutes. At the same time, tool life increased to 2 components with these new inserts QUADWORX® "S" 02 47 896, without any insert change. Even the increased costs for using this new QUADWORX® "S"-combination has already payed itself off after machining only 1 component.



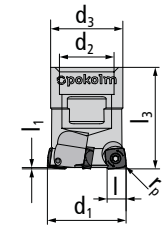
pokolm PREMIUMTOOLS. WE KNOW HOW.

QUADWORX®

Size "M"

- 4 cutting edges per insert for extremely economic applications
- very high chip removal rates and very easy cutting actions
- all tools are provided with internal coolant supply and integrated pocket seats
- extremely high feed rates up to 2.2 mm feed per tooth (f_z)
- NEW: Positive inserts P40 characterized by a smaller land and 10° rake angle. For tough materials like stainless steel, low carbon steel and cast steel.

DuoPlug®



Catalogue no.	d_1	l	r_p*	l_3	l_2	l_1	d_2	d_3	z	Accessories	Features
2 22 248 SG	22	9	1.5*	35.5	1.5	-	M 12	18.5	2	A, B, C, D, E	
3 25 248 SG	25	9	1.5*	40	1.5	-	M 16	23.5	3	A, B, C, D, E	

30 500	10 500	TV 1-5	T10 500	T10 502
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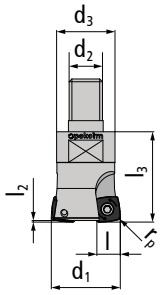
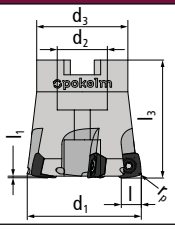
Screw-on type



Catalogue no.	d_1	l	r_p*	l_3	l_2	l_1	d_2	d_3	z	Accessories	Features
2 22 248	22	9	1.5*	29	1.5	-	M 10	18	2	A, B, C, D, E	
3 25 248	25	9	1.5*	33	1.5	-	M 12	21	3	A, B, C, D, E	
4 30 248	30	9	1.5*	42	1.5	-	M 16	29	4	A, B, C, D, E	
4 32 248	32	9	1.5*	42	1.5	-	M 16	29	4	A, B, C, D, E	
4 35 248	35	9	1.5*	42	1.5	-	M 16	29	4	A, B, C, D, E	
5 35 248	35	9	1.5*	42	1.5	-	M 16	29	5	A, B, C, D, E	
5 42 248	42	9	1.5*	42	1.5	-	M 16	29	5	A, B, C, D, E	

30 500	10 500	TV 1-5	T10 500	T10 502
A > Page 14	B > Page 14	C > Page 14	D > Page 14	E > Page 14

Shell type



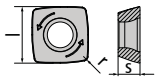
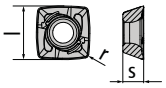
Catalogue no.	d_1	l	r_p*	l_3	l_2	l_1	d_2	d_3	z	Accessories	Features
5 42 348	42	9	1.5*	42.5	1.5	-	16	35	5	A, B, C, D, E	
6 52 348	52	9	1.5*	52.5	1.5	-	22	40	6	A, B, C, D, E	

30 500	10 500	TV 1-5	T10 500	T10 502
A > Page 14	B > Page 14	C > Page 14	D > Page 14	E > Page 14

* corner radius to be programmed

internal coolant supply
NEU latest items!
DuoPlug®
available as long as stock lasts
incorporated inserts
? on request
clamping flat
stock item, subject to confirmation

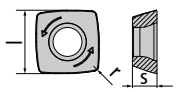
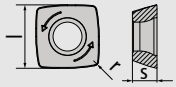
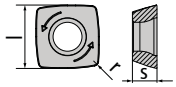
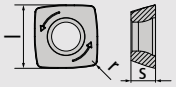
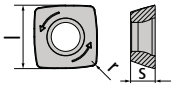
QUADWORX®-Inserts Size "M", ISO Standard: SDMX / SDHX / SDMT 09 T3 07 SN

Indexable insert	Catalogue No.	ISO Standard	Carbide grade	Coating	l	s	r	M
	03 48 842	SDMX 09 T3 07 SN	P40	PVTi	9	3.5	0.7	M 3
	03 48 846	SDMX 09 T3 07 SN	P40	PVGO	9	3.5	0.7	M 3
	03 48 852	SDMX 09 T3 07 SN	P25	PVTi	9	3.5	0.7	M 3
	03 48 860	SDHX 09 T3 07 SN	K10	PVTi	9	3.5	0.7	M 3
	03 48 848 NEW	SDMT 09 T3 07 SN	P40	PVGO	9	3.5	0.7	M 3
	03 48 896	SDMT 09 T3 07 SN	M40	PVST	9	3.5	0.7	M 3

Cutting Speeds V_c in m/min

Material	Application	Insert radius	l	Machining rates	K10 PVTi	P40 PVTi	P40 PVGO	P25 PVTi	M40 PVST
Steel		0.7	9	roughing		100-200		150-250	
				finishing					
Steel		0.7	9	roughing			100-200		
				finishing			160-250		
High-temperature alloys		0.7	9	roughing					40-80
				finishing					60-120
Stainless steel		0.7	9	roughing					80-180
				finishing					110-250
Cast iron		0.7	9	roughing	160-300				
				finishing					
Hardened materials		0.7	9	roughing	100-180				
				finishing					

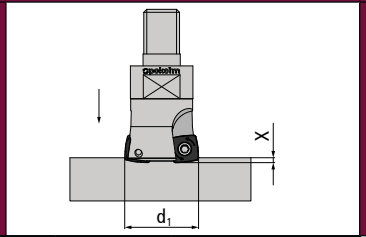
feed per tooth (f_z)) | d.o.c. (a_p)

Material	Insert	Insert radius	l	feed per tooth (f_z) d.o.c. (a_p)	K10 PVTi	P40 PVTi	P40 PVGO	P25 PVTi	M40 PVST
Steel		0.7	9	f_z(mm)		0.5-2.0	0.5-2.0	0.5-2.0	
				a_p(mm)		0.3-1.0	0.3-1.0	0.3-1.0	
High-temperature alloys		0.7	9	f_z(mm)					0.3-0.9
				a_p(mm)					0.2-0.7
Stainless steel		0.7	9	f_z(mm)					0.3-1.2
				a_p(mm)					0.2-0.9
Cast iron		0.7	9	f_z(mm)	0.5-2.2				
				a_p(mm)	0.2-1.2				
Hardened materials		0.7	9	f_z(mm)	0.2-1.0				
				a_p(mm)	0.2-0.5				

EXTENDED OPERATION DATA

QUADWORX® Size "M"

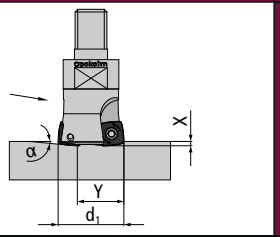
Plunging



Cutter diam. d_1 mm	diam. d_p mm	x max. mm
22	7.1	1.5
25	9.8	1.5
30	14.7	1.5
32	16.7	1.5
35	19.7	1.5
42	26.5	1.5
52	36.5	1.5

f_z see operation data table, but reduce value to 30%

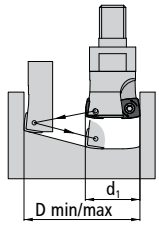
Ramping



α°	y mm
< 13.7	6
< 9.2	9
< 5.8	14
< 4.9	16
< 4.3	19
< 3.1	26
< 2.1	36

a_p | f_z see operation data table

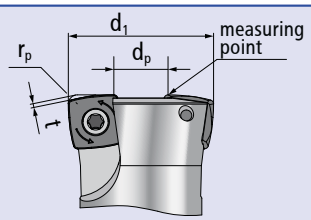
Helix



D_{min} mm	D_{max} mm
28.5	44
34.5	50
44.5	60
48.5	64
54.5	70
68.5	84
88.5	104

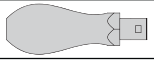
a_p | f_z see operation data table

Technical information



For the **CAD/CAM set-up** please program **1.5 mm** corner radius (r_p).
The **remainder of the material** is theoretically **0.65 mm** (t).
Please use „d_p" for **tool length measurement**.

QUADWORX® Size "M" – Accessories

Accessories	Catalogue No.	Description	Dimensions			
	30 500	Torxscrew M 1.8	M 3	L 7.0	T 10	
	10 500	Torx Screwdriver T 10	T 10			
	TV 1-5	Torque Screwdriver Vario® S with scale	from 1.0 Nm	up to 5.0 Nm	with scale	
	T10 500	Torx interchangable bit for Torque Vario®	T 10	L 175	max. 3.8 Nm	
	T10 502	Torx MagicSpring compatible bit for Torque Vario®	T 10	L 175	max. 3.8 Nm	

Starting torque for Torxscrews: M_d 2.25 Nm

Definitions and dimensions

a_p depth of cut in (mm)
f_z feed per tooth in (mm)
D_{max} = maximum bore diameter depending on cutter diameter in [mm]
x maximum plunge depth
D_{min} = minimum bore diameter depending on cutter diameter in [mm]
y minimum travel in [mm]
α angle of inclination in [°]

FROM PRACTICE TO PRACTICE

JOB TITLE:

VEMO Vereinigte Modellbau GmbH from the town of Kindsbach has been formed in 1971 as a company merger of 2 model making companies. Their more than 30 years experience as supplier of automotive industry and machine tool makers are the basis of their success today. With latest CNC-machining centres in combination with different CNC-programming systems, VEMO offers optimum qualification for a prosperous co-operation with their customers. A base plate, equipped with 4 mould inserts, should be prepared up to the pre-finished condition in the shortest possible time. The goal was finding the optimum between cost for tooling, process reliability and machining time. The roughing operation of those 4 mould inserts has been settled in less than 72 minutes by the largest diameter cutter body from our **QUADWORX®** "M"-range (6 52 348). The following operation of removing remaining material should be realized with a **QUADWORX®** "M"- cutter body 3 25 248 in a preferably manless operation without any machine downtime.

MACHINE	MATERIAL	PROGRAMMING SYSTEM
ZPS 2080	1.2312	DEPO-CAM / Euklid

These mould inserts for the foundry pattern have been machined in a z-constant cycle from inside to outside, with the focus for a maximum possible manless machining time. A base plate, fixed on the machine table with power clamps, cares for correct clamping on a ZPS 2080 machine with Selca control. With a combination of a Pokolm reduction sleeve (SK 50 to MTS 3) and a Morse Taper Adapter with M10 internal thread, together with the cutter body 3 25 248 from our **QUADWORX®** "M"-range, this operation could be finished, slim and rigid. The complete machining time for those 4 inserts from roughing to pre-finishing was 128 minutes, all this with minimum tool costs and maximum cutting parameters.

EXAMPLE FROM PRACTICE:

component:	mould insert
material:	1.2312
arbor:	50 3 710 (morse taper 3, SK 50)
extension:	30 610
cutter body:	3 25 248 (25 mm diam. / r_p = 1.5)
insert:	03 48 842, P40
coating:	PVTi
overhang:	113 mm
v_c (speed.):	196 m/min
v_f (feed rate):	8,000 mm/min
S (revolutions):	2,500 1/min
f_z (feed per tooth):	1.07 mm
a_p (depth of cut):	0.7 mm
a_e (width of cut):	15 mm
chip volume:	84 cm^3/min = 5.13 cu. in./min
machining time:	56 min

RESULT:

Machining time for roughing and removing remaining material was less than 130 minutes without any insert changes. This has contributed to an optimum use of the inserts and essential operation time. The increased chip volume as well as an almost manless roughing operation have contributed to a considerable cost reduction and remarkable time gaining for all following operations.

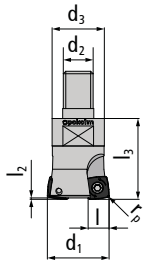
QUADWORX®

Size "L"

- 4 cutting edges per insert for extremely economic applications
- very high chip removal rates and very easy cutting actions
- all tools are provided with internal coolant supply and integrated pocket seats
- extremely high feed rates up to 2.5 mm mm feed per tooth (f_z)

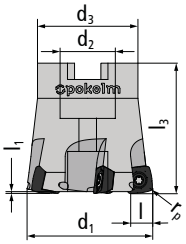
Milling cutter bodies

Screw-on type



Catalogue no.	d_1	l	r_p*	l_3	l_2	l_1	d_2	d_3	z	Accessories	Features
3 35 249	35	10	2.3*	42	2.5	-	M 16	29	3	A, B, C, D, E	
4 42 249	42	10	2.3*	42	2.5	-	M 16	29	4	A, B, C, D, E	
40 505 K A > Page 18	15 500 B > Page 18			TV 2-8 C > Page 18			T15 500 D > Page 18			T15 502 E > Page 18	

Shell type

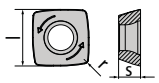


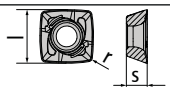
Catalogue no.	d_1	l	r_p*	l_3	l_2	l_1	d_2	d_3	z	Accessories	Features
4 42 349	42	10	2.3*	42	2.5	-	16	35	4	A, C, D, E, F	
5 52 349	52	10	2.3*	52	2.5	-	22	40	5	B, C, D, E, F	
7 66 349	66	10	2.3*	52	2.5	-	27	48	7	B, C, D, E, F	
8 80 349	80	10	2.3*	52	2.5	-	27	60	8	B, C, D, E, F	
40 505 K A > Page 18	40 505 B > Page 18			15 500 C > Page 18			TV 2-8 D > Page 18			T15 500 E > Page 18	T15 502 F > Page 18

*corner radius to be programmed

QUADWORX®-Inserts Size "L", ISO Standard: SDMX / SDHX / SDMT 100510

Indexable insert





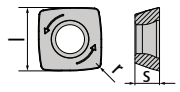
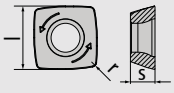
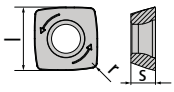
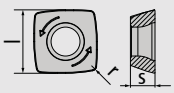
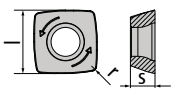
Catalogue no.	ISO Standard	Carbide Grade	Coating	l	s	r	M
04 49 842	SDMX100510	P40	PVTi	10	5	1	M 4
04 49 846	SDMX100510	P40	PVGO	10	5	1	M 4
04 49 852	SDMX100510	P25	PVTi	10	5	1	M 4
04 49 860	SDHX100510	K10	PVTi	10	5	1	M 4
04 49 896	SDMT 100510	M40	PVST	10	5	1	M 4

internal coolant supply
DuoPlug®
incorporated inserts
clamping flat
NEW latest items!
available as long as stock lasts
? on request
stock item, subject to confirmation

Cutting speeds V_c in m/min

Material	Application	Insert radius	l	Machining rates	K10 PVTi	P40 PVTi	P40 PVGO	P25 PVTi	M40 PVST
Steel		1	10	roughing		100-200		150-250	
				finishing					
Steel		1	10	roughing			100-200		
				finishing			160-250		
High-temperature alloys		1	10	roughing					40-80
				finishing					60-120
Stainless steel		1	10	roughing					80-180
				finishing					110-250
Cast iron		1	10	roughing	140-250				
				finishing					
Hardened materials		1	10	roughing	80-160				
				finishing					

feed per tooth (f_z)) | d.o.c. (a_p)

Material	Insert	Insert radius	l	feed per tooth (f_z) d.o.c. (a_p)	K10 PVTi	P40 PVTi	P40 PVGO	P25 PVTi	M40 PVST
Steel		1	10	f_z(mm)		0.3-2.5	0.3-2.5	0.3-2.5	
				a_p(mm)		0.3-1.5	0.3-1.5	0.3-1.5	
High-temperature alloys		1	10	f_z(mm)					0.35-1.0
				a_p(mm)					0.25-0.9
Stainless steel		1	10	f_z(mm)					0.35-1.5
				a_p(mm)					0.25-1.5
Cast iron		1	10	f_z(mm)	0.3-2.5				
				a_p(mm)	0.3-1.7				
Hardened materials		1	10	f_z(mm)	0.3-1.5				
				a_p(mm)	0.3-0.8				

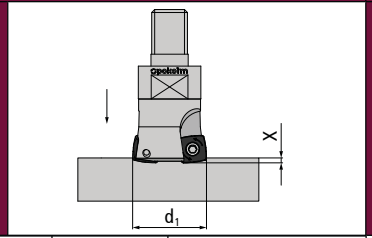
Major application roughing pre-finishing finishing

Minor application roughing pre-finishing finishing

EXTENDED OPERATION DATA

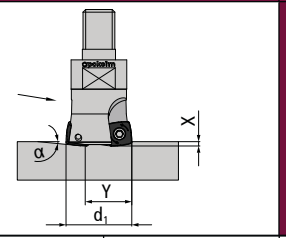
QUADWORX® Size "L"

Plunging



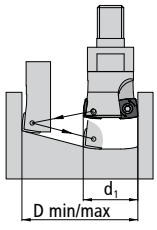
Cutter diam. d_1 mm	diam. d_p mm	x max. mm
35	17.7	2.5
42	24.7	2.5
52	34.7	2.5
66	48.7	2.5
80	62.7	2.5

Ramping



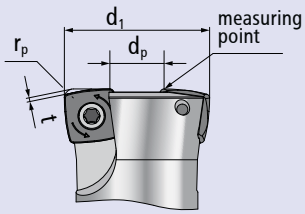
α°	y mm
< 8.3	17
< 5.9	24
< 4.2	34
< 2.9	48
< 2.3	62

Helix



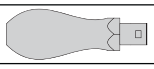
D_{min} mm	D_{max} mm
52	70
66	84
86	104
114	132
142	160

Technical information



For the **CAD/CAM set-up** please program **2.3 mm** corner radius (r_p).
The **remainder of the material** is theoretically **0.83 mm** (t).
Please use „d_p" for **tool length measurement**.

QUADWORX® Size "L" – Accessories

Accessories	Catalogue No.	Description	Dimensions			
	40 505	Torxscrew M 4	M 4	L 10.58	T 15	
	40 505 K	Torxscrew M 4	M 4	L 9.35	T 15 Plus	
	15 500	Torx Screwdriver T 15	T 15			
	TV 2-8	Torque Screwdriver Vario® S with scale	from 2.0 Nm	up to 8.0 Nm	with scale	
	T15 500	Torx interchangable bit for Torque Vario®	T 15	L 175	max. 5.5 Nm	
	T15 502	Torx MagicSpring compatible bit for Torque Vario®	T 15	L 175	max. 5.5 Nm	

Starting torque for Torxscrews: M_d 4 Nm

Definitions and dimensions

a_p depth of cut in (mm)
f_z feed per tooth in (mm)
D_{max} = maximum bore diameter depending on cutter diameter in [mm]
x maximum plunge depth
D_{min} = minimum bore diameter depending on cutter diameter in [mm]
y minimum travel in [mm]
α angle of inclination in [°]

FROM PRACTICE TO PRACTICE

JOB TITLE:

The company WWS Metallformen GmbH from the town of Hatzenbühl manufactures prototype and duplicate products together with the required metal forming moulds since more than 20 years. Specially, their service from design of those prototype components, conversion into CAD/CAM systems up to production of the metal forming moulds and the first tryouts, is very much appreciated by their customers. WWS supplies into all fields of sheet fabricating industry, from consumer goods industry, medical technology, automotive engineering and last but not least, complex deep-drawing parts for aircraft- and spaceware. Up to now, WWS machines their metal forming moulds with cutter bodies for round inserts from Pokolm. The milling cutter 52 310/7 (52 mm diam., r=6) offers most universal application possibilities and has been very much appreciated by our customers. But the power consumption related to the chip volume causes some problems for our customers in certain machining operations, specially, when female moulds with small draft angles have to be produced. Due to the geometric characteristics of the round inserts and those radial forces which occur during milling, vibrations arise suddenly, again and again. Feed rates and cutting depths have to be reduced in order to secure process reliability.

MACHINE	MATERIAL	PROGRAMMING SYSTEM
ZPS 1060	St 52-3	Cimatron

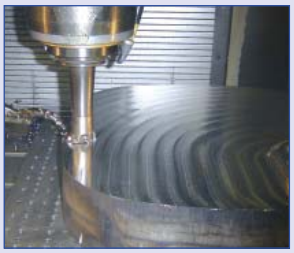
The male and female die of a deep-drawing mould for a truck-muffler has been machined in a z-constant circular-pocket cycle from inside to outside. Main focus was the maximum achievable chip volume with smallest possible spindle load. The component, clamped solid, was machined on a ZPS milling machine type 1060 with Selca control. There was no difficulty in maching material ST 52-3 itself, but the problem is a process reliable machining of those burn-out contours with a hardness of > 50 HRC. Those requirements habe been fulfilled and exceeded by our **QUADWORX®** "L" tooling.

EXAMPLE FROM PRACTICE:

component:	female drawing die
material:	St 52-3
arbor:	100 22 710 (22 mm diam., SK 50)
cutter body:	5 52 349 (52 mm diam., r_p 2.3)
insert:	04 49 852, P25
coating:	PVTi
overhang:	153 mm
v_c (.speed.):	212 m/min
v_f (feed rate):	8,000 mm/min
S (revolutions):	1,300 1/min
f_z (feed per tooth):	1.23 mm
a_p (depth of cut):	1.5 mm
a_e (width of cut):	31 mm
chip volume:	372 cm^3/min = 22.7 cu.in./min
machining time:	45 min

RESULT:

Machining time for roughing this female drawing die has been reduced by 50 %. And this with an only 5 % increase of spindle load, better smoothness of running and less vibrations. Increased chip volume together with the small increase in spindle load have reduced the costs for roughing operations by more than 50 % and the customer achieved a considerable time gaining for his following operations.



QUADWORX®

FL-172 EN 0212

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