



MIRROWORX®

TOOLING SYSTEMS PROCESS OPTIMIZATION CONSULTING IN MILLING STRATEGIES

 **pokolm**
PREMIUMTOOLS. WE KNOW HOW.

MILLING RATHER THAN GRINDING

MIRROWORX® is a Face Milling Cutter, specially developed for production of absolutely flat and smooth surface finish, simultaneously with highest economic efficiency. We enter into Grinding domains.

In using these Cutters, several operations can be combined. Usual grinding operations are eliminated completely.

This new line is designed with only two Indexable Inserts and has a simple but effective adjustment opportunity in μ -range by using two set-screws, eliminating axial run-out. This system allows processing optimum surface finish.

Furthermore this new tooling is impressive through its particular smooth running. Our new Milling Cutter is specially suitable for unstable components. Our concept, using only two Indexable Inserts, is an explicit proven design for milling components difficult to machine and which have a tendency to create vibrations.

Those **MIRROWORX®**-Milling Cutters achieve Feedrates up to 10.000 mm/min and produce up to 90.000 cm² (13.950 sq. n.) surface, causing bottom-line costs. This is possible through our successively advanced development of cutting materials and carbide grades.



2 42 384



2 52 384



2 66 384



2 80 384



2 100 384

YOU BENEFIT FROM FOLLOWING ADVANTAGES:

- ⊕ Surface Finish $R_z = < 2.5 \mu\text{m}$: your usual grinding operation is eliminated
- ⊕ Particular smooth running
- ⊕ Our setting-system adjusts your axial run-out
- ⊕ Suitable for unstable components
- ⊕ Very economic by using all 3 cutting edges from our Inserts



Due to successively advanced development of our own manufacturing performance and due to special carbide grades and latest coating technologies, tuned for every

possible machining process, Pokolm assists Tool- and Mould-makers in making difficult jobs more easy.



FACE MILLING CUTTER

MIRROWORX®

- „Milling instead of grinding“ is our slogan for **MIRROWORX®** face milling cutters.
- Developed for producing smooth and levelled surfaces with enormous feed rates.
- These tools enter into grinding domains.







Milling cutter bodies	Catalogue no.	d_1	d_2	d_3	l_2	l_3	z	Accessories
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Shell type								
	2 42 384	42	16	35	1	43	2	A, B, C, D, E, F, G
	2 52 384	52	22	48	1	43	2	A, B, C, D, E, F
	2 66 384	66	27	60	1	53	2	A, B, C, D, E, F
	2 80 384	80	27	60	1	53	2	A, B, C, D, E, F
	2 100 384*	100	32	70	1	53	2	A, B, C, D, E, F

* without Internal Coolant Supply






Indexable insert	Catalogue no.	ISO Standard	Carbide Grade	Coating	l	s	r	M
			04 84 835	TEHX 16T3 ZF	HSC 05	PVTi	ap- prox. 16.5	4

Cutting speed V_c in m/min | Feed per tooth (f_z) | d.o.c. (a_p)

Material	Application	Insert radius	l (mm)	Machining rates	Cutting speed (V_c)	Feed per tooth (f_z) d.o.c. (a_p)	HSC 05 PVTi
Steel		-	14.32	finishing	150 - 250*	f_z (mm)	0.5 - 2.0
						a_p (mm)	0.05 - 0.2
High-temperature Alloys		-	14.32	finishing	40 - 100	f_z (mm)	0.2 - 1.0
						a_p (mm)	0.05 - 0.1
Stainless Steel		-	14.32	finishing	100 - 200	f_z (mm)	0.5 - 1.0
						a_p (mm)	0.05 - 0.1
Cast Iron		-	14.32	finishing	150 - 250*	f_z (mm)	0.5 - 2.0
						a_p (mm)	0.05 - 0.2
Non-ferrous Materials		-	14.32	finishing	100 - 800	f_z (mm)	0.5 - 2.0
						a_p (mm)	0.05 - 0.25
Hardened Steel		-	14.32	finishing	35 - 200*	f_z (mm)	0.2 - 1.0
						a_p (mm)	0.05 - 0.1

* related to kind of machining and microstructure of material to be machined

MIRROWORX® – Accessories

Accessories	Catalogue no.	Description	Dimensions			
	45 500 L* ¹	Torx-Screw	M 4.5	L 14.5	T 20	
	35 500* ¹	Torx-Screw	M 3.5	L 7.5	T 15	
	15 500	Torx-Screwdriver	T 15			
	20 500	Torx-Screwdriver	T 20			
	TV 2-8	Screwdriver Torque Vario® S with scale	von 2.0 Nm	bis 8.0 Nm	with scale	
	T15 502	Torx MagicSpring compatible bit for Torque Vario®	T 15	L 175	max. 5.5 Nm	
	GWSTPS8ISK* ²	Hexagon socket set screw	M8 x 1.25	M8 x 0.75	Allen size 4	

*¹ Starting torque for Torxscrews: M 3.5 - 3.45 Nm, M 4.5 - 7.60 Nm

*² only usable in Cutter body 2 42 384 and is supplied with that body.

SAFETY INSTRUCTIONS:

Every Milling Cutter Body has setscrews for elimination of run-out. These screws have to be fixed with prestress prior to usage. This is absolutely necessary!!! Otherwise, there is danger of automatic unscrewing during operation. This leads to damage for operators, tools and components. If you don't need those set-screws, we recommend to remove it from the Body prior to usage.

APPLICATION EXAMPLES FROM OUR PRACTICE

JOB TITLE:

Every supporting surface of upper punch and bottom ram have to be machined to absolute level in order to leave no visible trace amounts on all lateral faces of a formed component. And the surface finish of a compression-moulding-die is always in customers view. For these applications, our new designed Milling Cutter **MIRROWORX®** is exactly the right tool.

Through already described characteristics of this new tool – and knowing about our customers requirements- we have put these tools through several endurance tests. Result: every test proved successful!

MACHINE	MATERIAL	CAD/CAM-SYSTEM
Deckel Maho DMC 64 V SK 40	1.2343 hardened to 55 HRC	Mastercam

For milling the surface flat of a bottom ram, a real spiral for milling from inside to outside has been programmed. The contour of the mould has been used for axial plunging. The component has been set-up very rigid on the machine table of a Deckel-Maho machining centre DMC 64 V with vertical spindle and machine connection of SK 40/DIN 69871A. Before trying

our new Cutter, our customer has used a normal Face-Milling Cutter with round inserts for this process.

This cutter had fulfilled all requirements, except adequate surface finish. With our new tool, we have reached a mirrorfinished surface!

FIRST EXAMPLE:

Component:	drawing mould
Material:	1.2343 55 HRC
Arbor:	25 22 750 (diam. 22; SK 40)
Milling Cutter Body:	2 52 384 (diam. 52)
Indexable Inserts:	04 84 835, HSC 05
Coating:	PVTi
Overhang:	approx 68 mm
V_c (speed):	204 m/min
V_f (feed/min):	1,120 mm/min
S (Revolutions):	1,250 1/min
f_z (feed per tooth):	0.448 mm
a_p (Depth of cut):	0.05 mm
a_e (Width of cut):	5 mm

RESULT

We have milled 10 steps in z-axis with a feed-motion of 0.05 mm each. After that, there was no wear-land on our cutting edges. The milled surface had a mirror finish and a waviness (90 % in feed direction) of < 0.06 mm.

This was more than sufficient regarding to customer's requirements.



A further example originates from our Pokolm-Demo-Centre. It shows how precise and effective our new Milling Cutters **MIRROWORX®** operates.

On a Deckel-Maho machine type DMC 103 with SK 40 machine connection we have made tool-life tests. But also here, particularly process capability and surface finish have been in our view.

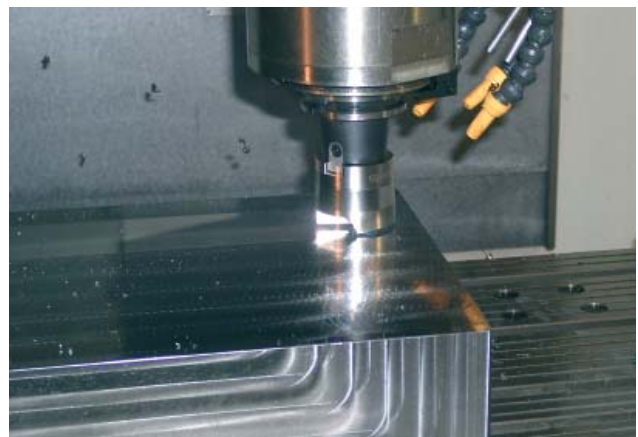
For these tests, we have machined a square piece of 1.2312 tool-steel size: 400 × 250 × 250 mm, with very rigid set-up

on machine table. We had to machine a surface of 0.1 m² (1.08 sq.ft.). We were able to create a continuous and final valuation very fast.

We have reached a machined surface of 25.000 mm² (3875 sq.in.) with below mentioned operation data and surface finish.

SECOND EXAMPLE:

Kind of machining:	finishing
Material:	1.2312
Arbor:	25 22 750
Milling Cutter Body:	2 52 384
Indexable Inserts:	04 84 835, HSC 05
Coating:	PVTi
Overhang:	approx 68 mm
V _c (speed):	204 m/min
V _f (feed/min):	5,000 mm/min
S (Revolutions):	1,250 1/min
f _z (feed per tooth):	2 mm
a _p (Depth of cut):	0.1 mm
a _e (Width of cut):	40 mm
Obtained Surface Quality:	R _z 2.56 μm



ONE FURTHER CUSTOMER REACTION:

„For us, this new **MIRROWORX®**-Milling Cutter is a real troubleshooter. It machines a mirror-finish surface withoutstanding surface roughness values.“

(Reiner Meier/ foreman of mechanic department at Benteler Machine Tools GmbH & Co. KG in Bielefeld)



Pokolm
Frästechnik GmbH & Co. KG

Adam-Opel-Straße 5
33428 Harsewinkel
Germany

fon: +49 5247 9361-0
fax: +49 5247 9361-99

info@pokolm.com
www.pokolm.com



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