

Product presentation

T | E | N | D | O[®] Slim 4ax 

Superior Clamping and Gripping

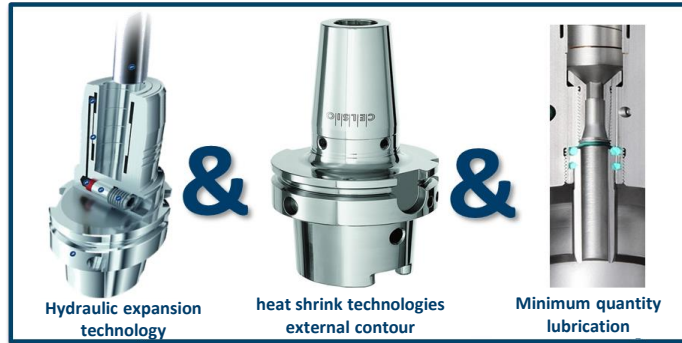


Basic idea of TENDO Slim 4ax

- Hydro-stretching technology in
- according to standardized DIN "69882-8" outer contour of heat shrink technologies with
- MMS- compatible inner contours (e.g. Gühring 1-K.-KMR / Gühring 1-K.-LVS / Bielomatik 2-K.-KMR / Bielomatik 2-K.-LVS)

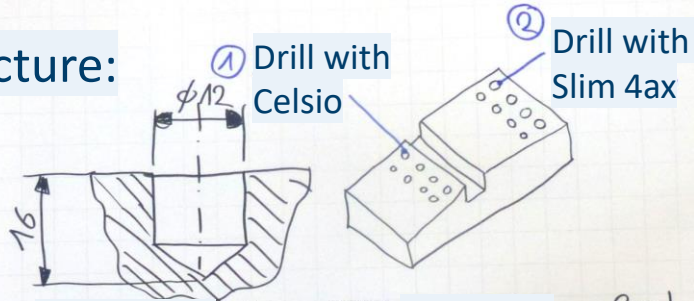
➔ Problem solver for production processes with heat shrinking technology
Interchangeability without reprogramming/new programming

„Plug & Work!“



Experiment 1: Drilling in steel

Structure:



Drill: Walter VHM (without IK) ca. 3xd
Workpiece: 16 MnCr 5

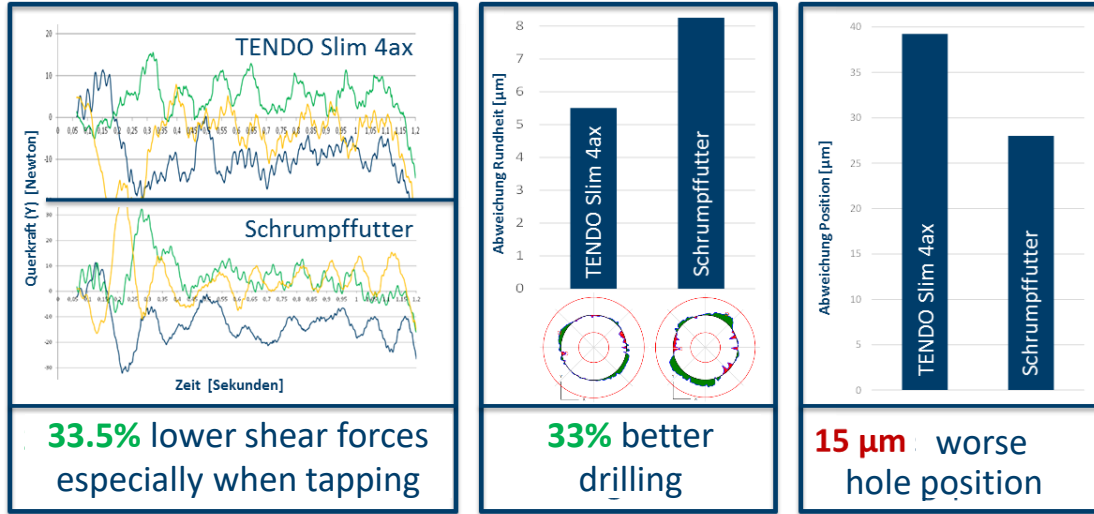
Technology: constant Z-feed

$$v_c = 100 \frac{\text{m}}{\text{min}} \rightarrow n = 2652 \frac{1}{\text{min}}$$

$$f_z = 0,14 \frac{\text{mm}}{\text{Schn.}} \rightarrow v_f = 743 \frac{\text{mm}}{\text{min}}$$



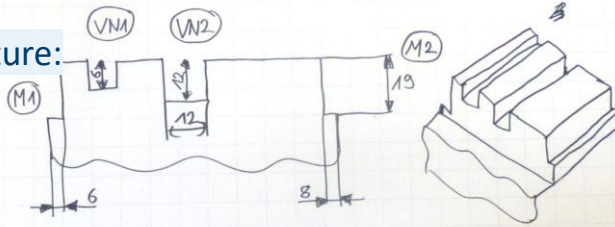
Experiment 1: Drilling in steel



- 🔩 up to 33.5% lower shear forces during tapping reduce wear of the tool cutting edges
- 🔩 therefore up to 15% longer tool life depending on the application
- 🔩 up to 33% better roundness of the bore due to "soft clamping"
- 🔩 deviation of bore from nominal position up to 15 μm due to "soft clamping"

Experiment 2: Milling in aluminum

Structure:



① Lateral + full slot with Celso

② Lateral + full slot with Slim 4ax

Tool: Fraisa 2-Schn. $\varnothing 12$ VHM

Technology: Lateral: $v_c = 452 \frac{m}{min}$ $\rightarrow n = 12000 \frac{1}{min}$

$f_z = 0,198 \frac{mm}{Schn.}$ $\rightarrow v_f = 4752 \frac{mm}{min}$

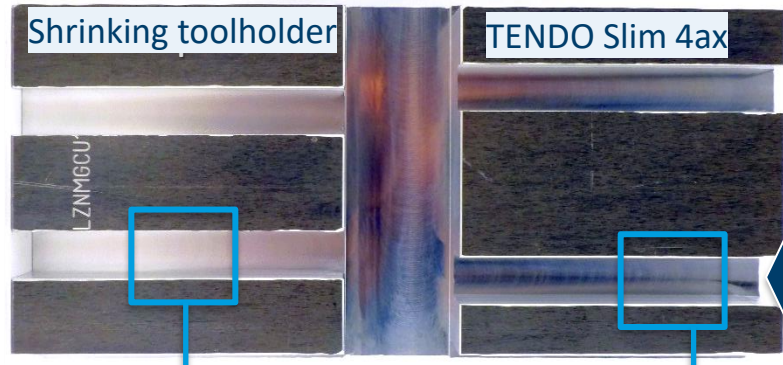
full slot: $v_c = 405 \frac{m}{min}$ $\rightarrow n = 10743 \frac{1}{min}$


$f_z = 0,140 \frac{mm}{Schn.}$ $\rightarrow v_f = 2997 \frac{mm}{min}$



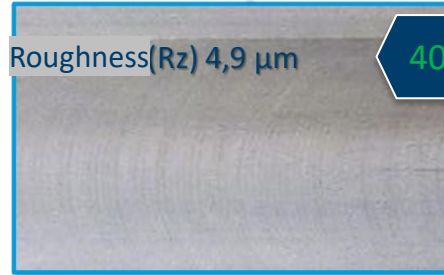
Experiment 2: Milling in aluminum

Comparison
Groove base
of the full groove



 40% better surface quality in the groove base due to vibration damping

visibly better surfaces

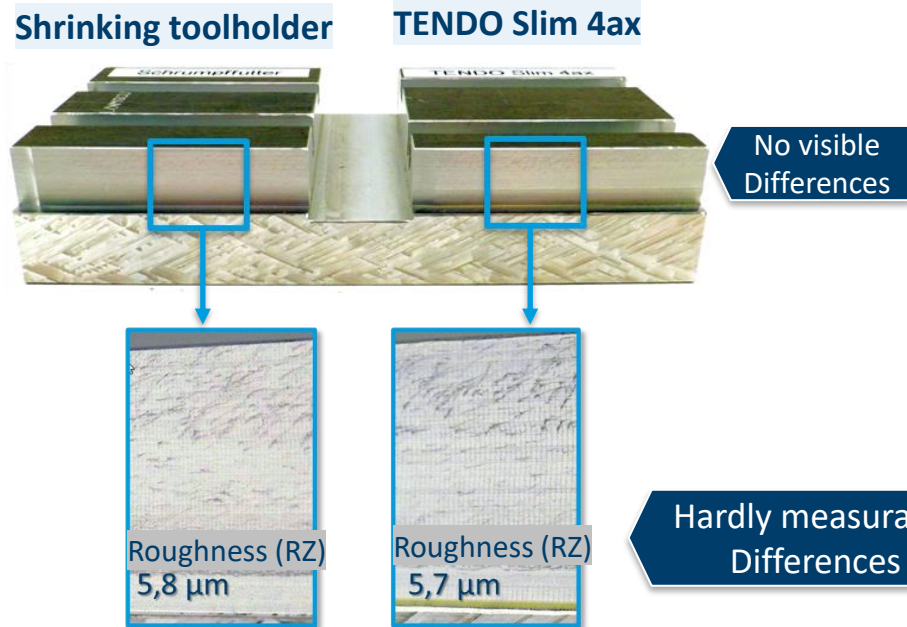


40% better

Experiment 2: Milling in aluminum

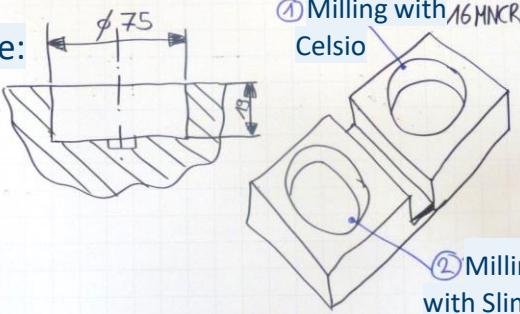
40% better surface quality in the groove base due to vibration damping

Comparison lateral milling Surface



Experiment 3: Milling in steel

Structure:



① Milling with 16 MNCR5 Celsio

② Milling with Slim 4ax

③ Milling with WTE (new tool)

Workpiece: Walter 4-Schn. $\varnothing 12$ VHM

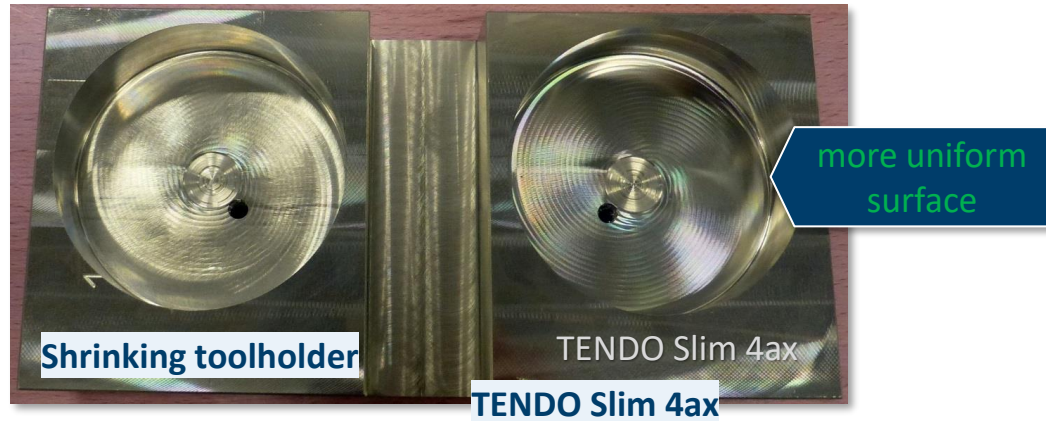
Technology:

$$v_c = 130 \frac{\text{m}}{\text{min}} \rightarrow n = 5040 \frac{1}{\text{min}}$$
$$f_z = 0,08 \frac{\text{mm}}{\text{Schn.}} \rightarrow v_f = 1612 \frac{\text{mm}}{\text{min}}$$

• Milling with $a_p = 13 \text{ mm}$
 $a_e = 1,5 \text{ mm}$



Experiment 3: Milling in steel



Conclusion:

- TENDO Slim 4ax is suitable for moderate milling operations
- Surface qualities with moderate milling operations are **at least** comparable with those of heat shrink technology



Demonstration set up

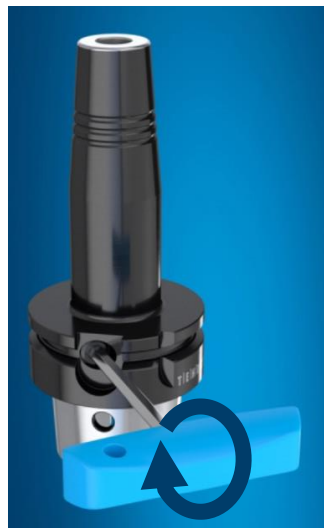
TENDO Slim 4ax  available as Excel-Tool!




KOSTENRECHNER
Lebensdauer

KOSTENRECHNER
Rüstprozess

	TENDO Slim 4ax	Schrumpfutter	
Rüstzeit pro Spannung	10	90	Sekunden
Stundensatz	40,00		Euro pro Stunde
benötigte Leistung	0	10	Kilowatt
Strompreis	0,16		Euro pro Kilowattstunde
Anzahl Spannungen	10000		
Rüstkosten	1111	10000	Euro
Energiekosten	0	400	Euro
Gesamtkosten	1111	10400	Euro
Kostenersparnis	9289		Euro
	89		%

-  Tool change within seconds!
-  No additional peripheral devices!



-  Work safety, no risk of burns!
-  Precise and user-friendly length presetting, 0.01 mm accurate, possible on tool measuring machines!
-  No settling behavior due to cooling!

Technical data



TENDO Slim 4ax Clamping-Ø 12 mm L1 = 90 mm	Features	Shrinking toolholder Clamping-Ø 12 mm L1 = 90 mm
3 (measured at 2,5xD)	Run-out accuracy [µm]	3 (Bore hole)
-28% 130 (Catalog specification 90 Nm)	Continuous torque [Nm]	180 (Catalog specification 150 Nm)
-18% 9,1	Radial rigidity [N/µm]	11,1
+38% 1,26	Damping [%]	0,91
+100% 2000	Life time [clamping cycles]	1000
G2,5 at 25.000 1/min	balancing grade	G2,5 at 25.000 1/min



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