

Comparison of end mill holders and hydro-expansion technology for roughing milling in steel

1) Experimental setup

Toolholder:		TENDO E compact	Tool holder	WELDON end mill holders	
		Hydro-expansion technology	Clamping principle	Lateral screw	
		Ø 20 mm	Clamping diameter	Ø 20 mm	
		80 mm	Cantilever length L1	80 mm	
		0206406	ID-number	0263537	
		ca. 180,- €	Acquisition cost	ca. 103,- €	
Tool:	Cutting material:	VHM with TiAlN (titanium aluminium nitrite) coating			
	Design:	4-cutting, unequal division			
Workpiece:	Material:	42CrMo4 (1.7225), tensile strength ca. 800 N/mm ²			
	Pre-machining:	bar section 98x77x345mm, scale removed Equipped with two VERO-S clamping bolts			

2) Test execution

Bearbeitung:	Processing	Depth-adjustment ap	Lateral delivery ae	Vc	n	fz	vf
		[mm]	[mm]	[m/min]	[U/min]	[mm/Schn.]	[mm/min]
	Jacket milling- Roughing	18	5	180	2865	0.08	916
Approx. 20.7 m are milled per workpiece. After machining, all cutting edges of the milling cutter used are examined with a microscope and then the next workpiece is machined.							

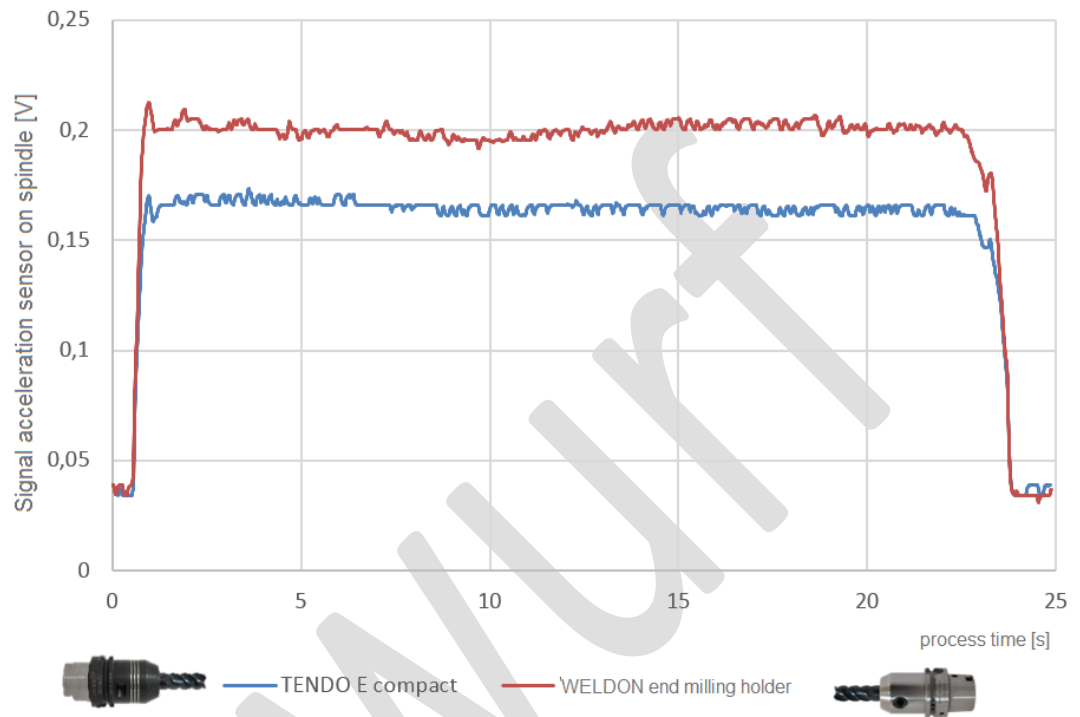
3) Test results

Setup process:	Comparison of set-up times for drilling tests:		
	Working step	TENDO E compact [sec]	WELDON end mill holders [sec]
	Clamping process	10	25
Time saving:	Set-up time reduction of approx. 60 % through the use of hydraulic expansion technology. After approx. 444 set-up processes, the lifetime costs with the TENDO E compact are lower than with the WELDON end mill holders.		
Break-Even:	Saving of set-up costs by 465 €, considering the service life, with a calculated cost rate of 40 €/h achieved.		

Observation during the milling process

21 % higher vibration of the milling spindle when using the WELDON end mill holders after 82.2 m.

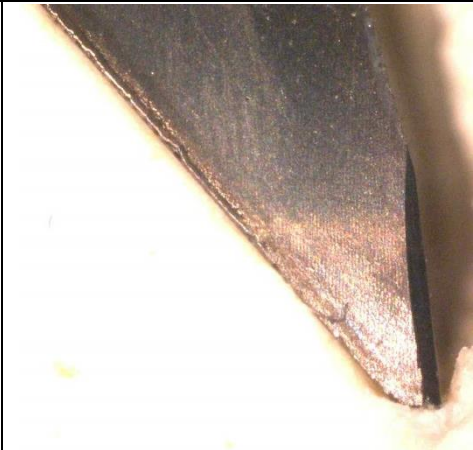
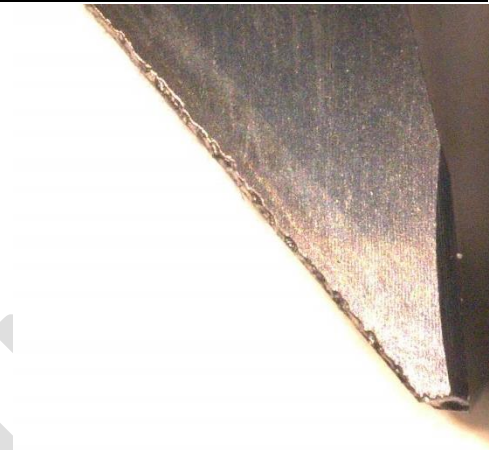
Workpiece 4 --- vibrations on the machine spindle



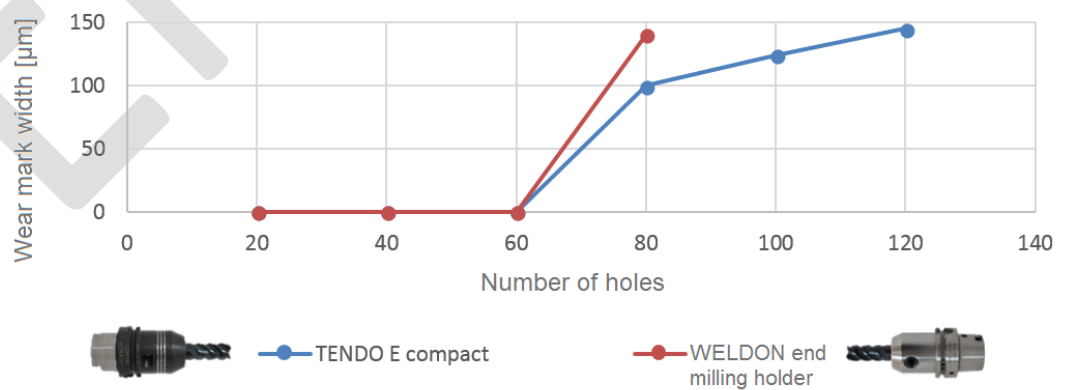
Späne:	Fräsweg [m]	TENDO E compact	WELDON end mill holders
	20.7		
	82.2		
	124.2		
Conclusion milling:		After 20.7 m no difference is found when looking at the chips produced. After 82.2 m, the chips of the WELDON end mill holders are torn out in the area of the tool exit, which indicates a blunting of the cutting edge.	

Wear of the milling cutter

Development of the wear mark width at the free surface:

Milling path [m]	Free area of tool in TENDO E compact [50x]	Free area of tool in WELDON end mill holders [50x]
82.2		
124.2		

Development of the wear mark width

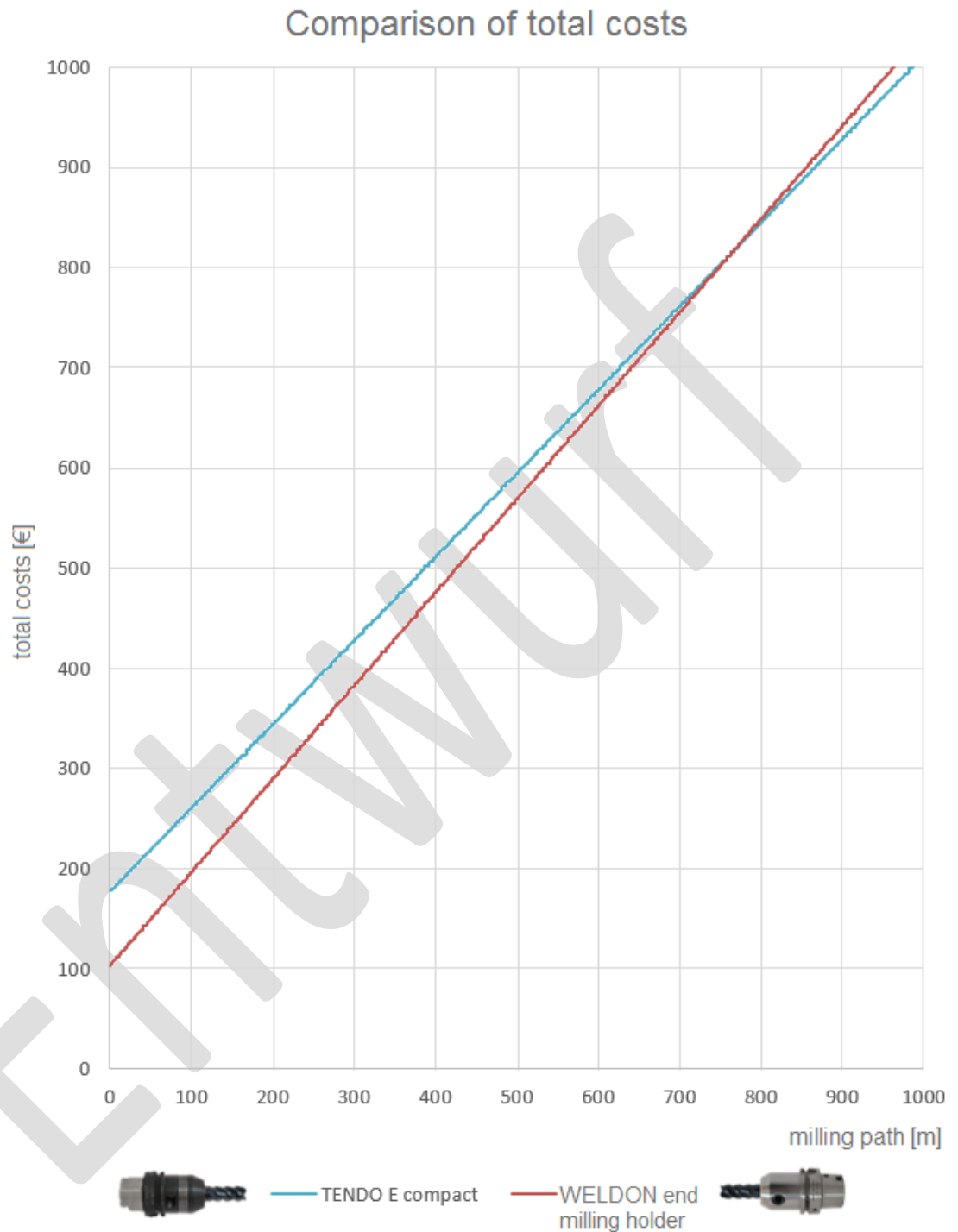


Conclusion:

Tool life increased by approx. 50 % with the use of hydraulic expansion technology.

4) Cost consideration

Total costs:



Break-Even:

From a milling path of approx. 765 m milling path, the total costs of the hydraulic expansion toolholder TENDO E compact are lower than when using the WELDON end mill holders. This corresponds to 7 to 15 tools.