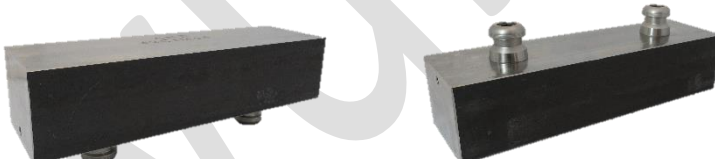


Comparison of collet chuck and hydro-expansion technology for roughing milling in steel

1) Experimental setup

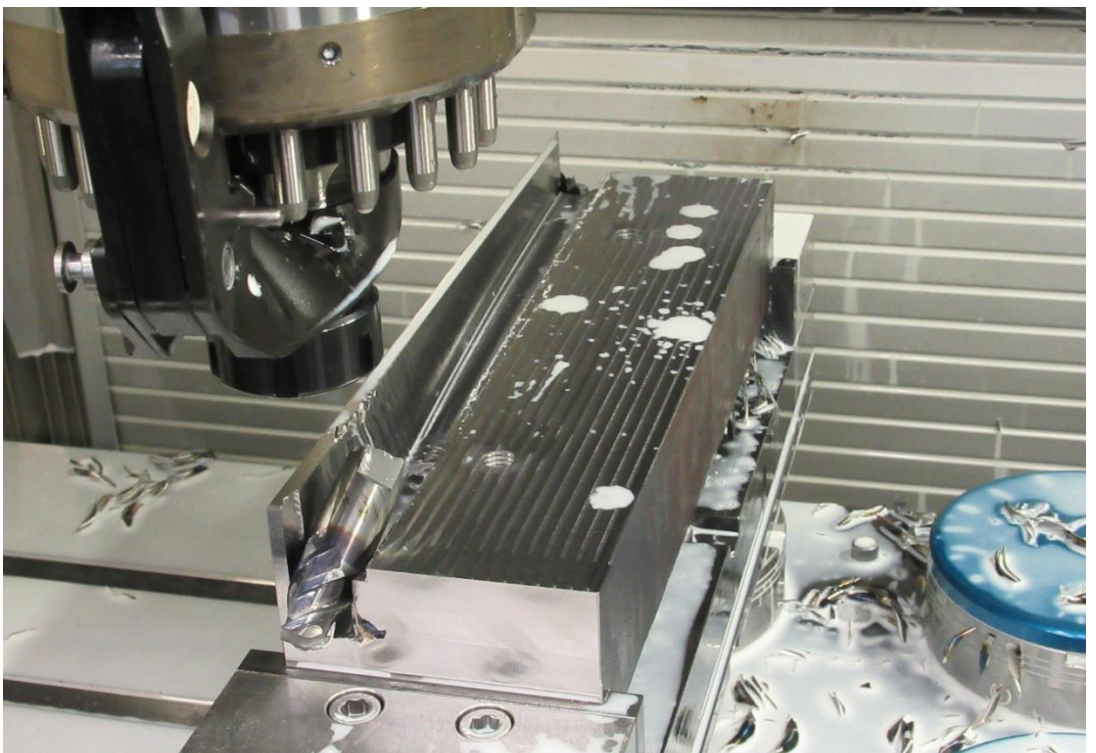
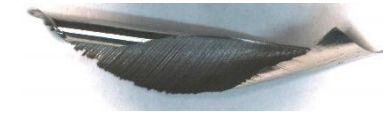
Toolholder:		TENDO E compact	Tool holder	ER 32 collet chuck	
		Hydro-expansion technology	Clamping principle	Collet chuck technology	
		Ø 20 mm	Clamping diameter D1	Ø 20 mm	
		80 mm	Cantilever length L1	75 mm	
		0206406	ID-number	0263365	
		ca. 180,- €	Acquisition cost	ca. 155,- €	
Tool:	Cutting material:	VHM with TiAlTi (titanium aluminium nitride) coating			
	Design:	4-cutter, unequal pitch			
Workpiece:	Material:	42CrMo4 (1.7225), Tensile strength ca. 800 N/mm²			
	Pre-machining:	bar section 98x77x345mm, scale removed Equipped with two VERO-S clamping bolts			
					

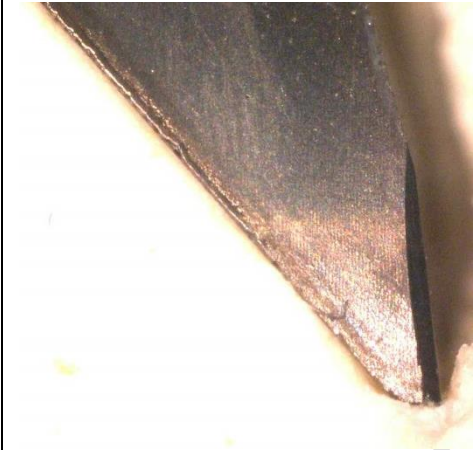
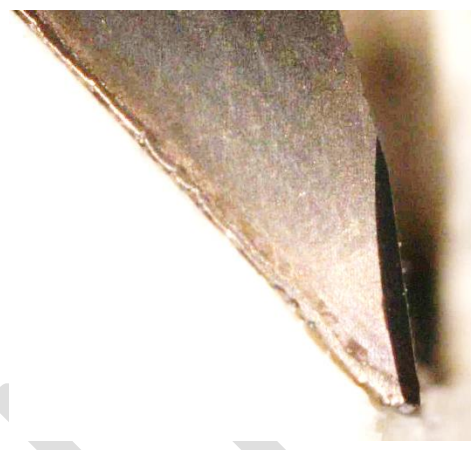
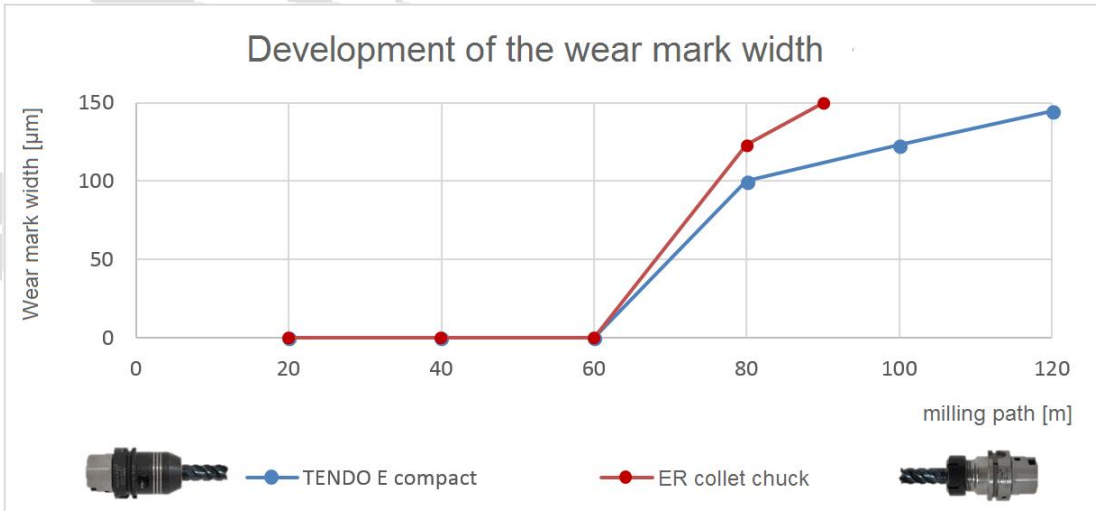
2) Test execution

Processing:	Processing	Depth-adjustment ap	Lateral delivery ae	Vc	n	fz	vf
		[mm]	[mm]	[m/min]	[U/min]	[mm/Schn.]	[mm/min]
	Jackt milling- Roughing	18	5	180	2865	0.08	916
Approx. 20.7m 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

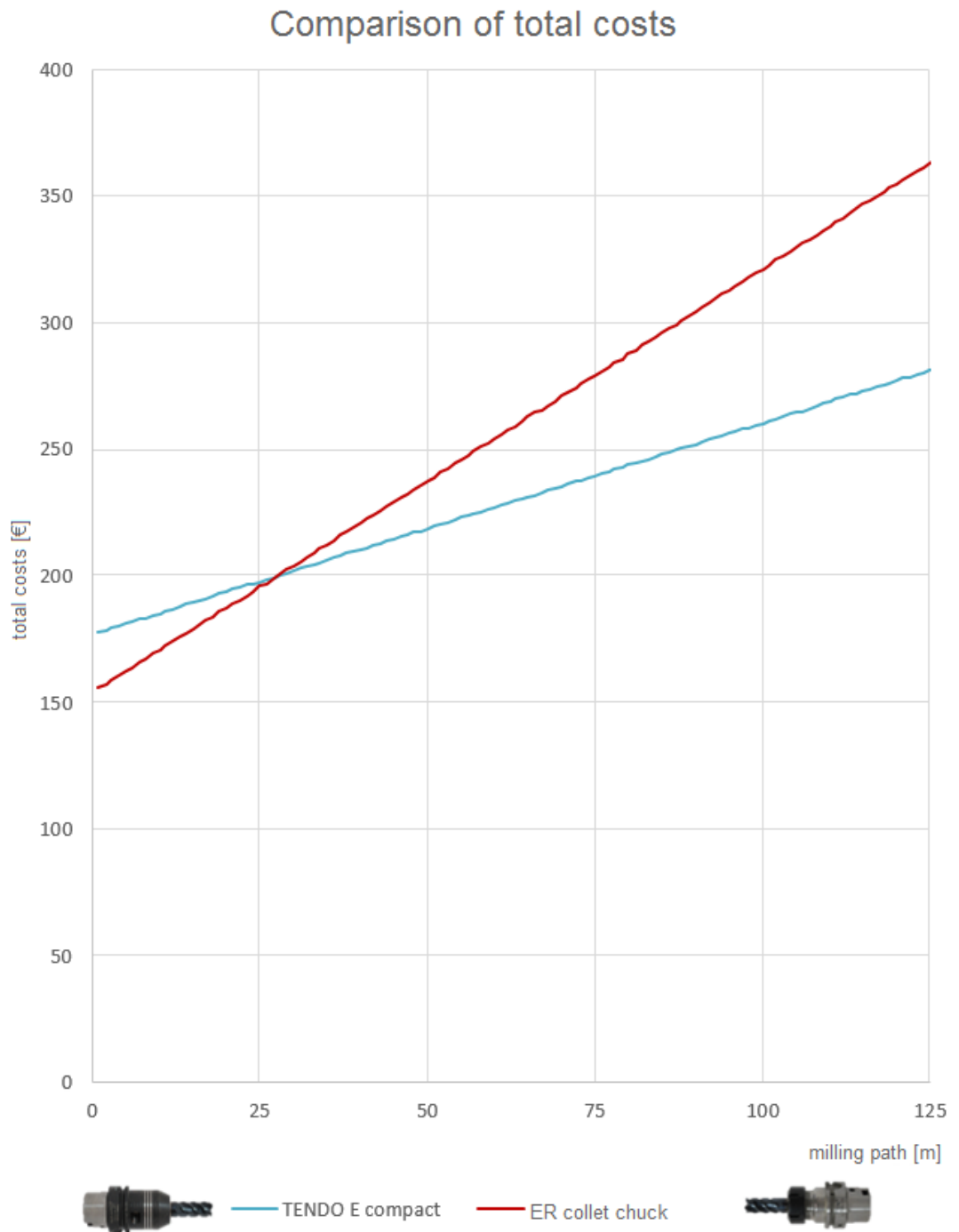
Setup process:	Comparison of set-up times for drilling tests:		
	Working step	TENDO E compact [sec]	ER 32 collet chuck [sec]
	Clamping process	10	25
Time saving:	Set-up time reduction of approx. 60 % through the use of hydraulic expansion technology. After approx. 138 set-up processes, the lifetime costs with the TENDO E compact are lower than with the ER 32 collet chuck.		
Break-Even:	Set-up cost saving of 610 € , considering the service life, achieved with a calculated cost rate of 40 €/h.		

Observation during the milling process	When milling with the ER 32 collet chuck, the tool is pulled out of the tool holder with a milling path of approx. 82.8 m. The ER 32 collet chuck is used for milling with a milling path of approx. 82.8 m. The ER 32 collet chuck is used for milling with the ER 32 collet chuck. After a milling path of approx. 88.3 m, the cutter has moved approx. 25 mm out of the tool holder and breaks off.		
Shavings:			
	Milling path [m]	TENDO E compact 	ER 32 collet chuck 
	20.7		
	82.2		
	124.2		
Conclusion milling:	While the ER 32 collet chuck breaks the tool after approx. 82m, the TENDO E compact hydraulic expansion toolholder achieves a milling path of approx. 124m. After 82.2 m, the chips of the ER 32 collet chuck are torn out in the area of the tool exit, which indicates a blunting of the notes.		

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 ER 32 collet chuck [50x]																								
																											
82.2																											
124.2																											
Development of the wear mark width  <table><thead><tr><th>Milling path [m]</th><th>TENDO E compact wear mark width [µm]</th><th>ER collet chuck wear mark width [µm]</th></tr></thead><tbody><tr><td>20</td><td>0</td><td>0</td></tr><tr><td>40</td><td>0</td><td>0</td></tr><tr><td>60</td><td>0</td><td>0</td></tr><tr><td>80</td><td>100</td><td>125</td></tr><tr><td>90</td><td>115</td><td>150</td></tr><tr><td>100</td><td>125</td><td>-</td></tr><tr><td>120</td><td>145</td><td>-</td></tr></tbody></table>  TENDO E compact ER collet chuck				Milling path [m]	TENDO E compact wear mark width [µm]	ER collet chuck wear mark width [µm]	20	0	0	40	0	0	60	0	0	80	100	125	90	115	150	100	125	-	120	145	-
Milling path [m]	TENDO E compact wear mark width [µm]	ER collet chuck wear mark width [µm]																									
20	0	0																									
40	0	0																									
60	0	0																									
80	100	125																									
90	115	150																									
100	125	-																									
120	145	-																									
Conclusion:	Tool life increased by approx. 33 % with the use of hydraulic expansion technology.																										

4) Cost consideration

Total costs:



Break-Even:

The total costs of the TENDO E compact hydraulic expansion toolholder are lower from a milling distance of approx. 27 m than with the ER 32 collet chuck. Already after the first tool exchange, the total costs of the ER collet chuck are higher than those of the TENDO E compact.