

10. Thread undercuts and fillets

Material fatigue appears also in the screw thread undercuts at many threaded components. Fillet radii are design elements with distinctive notch effect. Therefore, these critical areas must be deep rolled to improve fatigue under high dynamic loads. The process is applied for example, at oil field equipment, in general mechanical engineering (presses and mold injection machines), vehicles, (see also chapter 7), gear-box components and aviation parts.

Fig. 10-1 shows the treatment of a screw thread undercut exemplary at a piston for a good mover cylinder. These pistons failed partially through take the cracks in the screw thread undercuts. Deep rolling solved the problem and led to fatigue resistant pistons.

In same manner, fillet radiuses R=4 (Fig. 10-2) are deep rolled. A similar treatment leads to the success also with tie bars for presses and mold injection machines. Preferably, the hydrostatic tool ballpoint HG is applied. At alteration of contact angle



Fig. 10-1: deep rolling of a screw thread undercut

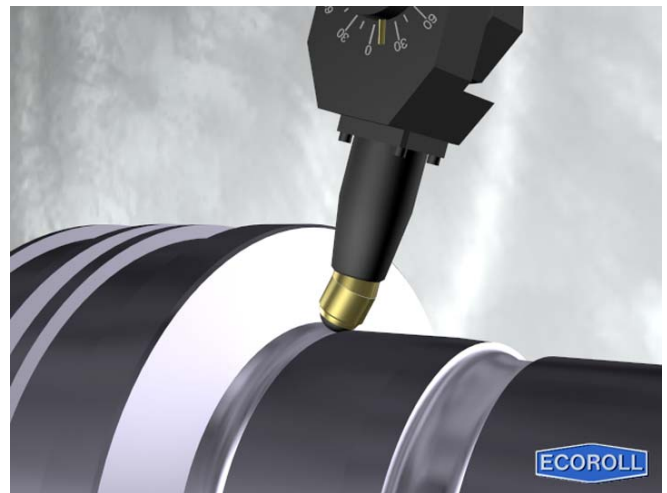


Fig. 10-2: deep rolling of a fillet radius

about more than $\pm 30^\circ$, the tool HGXX-9E270°, with adjustable angular positions is used. Following parameters are recommended for parts of high-strength steels:.

Circumferential speed	m/min	> 0 < 200	Low revenues required only for machines with slow control reaction
Feed rate for HG2	mm	< 0,2	Larger feed rates = <ul style="list-style-type: none"> • Short process time • deeper penetration of residual compressive stresses
HG3		< 0,25	
HG4		< 0,3	
HG6		< 0,35	
HG13		< 0,6	
Rolling forces for:HG2	kN / lbf	<0,1 / 22.5	Selects the largest possible tool which does not interfere with the workpiece contour..
HG3		<0,25 / 56	
HG4		<0,45 / 100	
HG6		<1,0 / 225	
HG13		<4 / 900	



Fig. 10-3: deep rolling tool EF45

Screw thread undercuts with $R \leq 4$ mm can be deep rolled with the mechanical tool EF45 (Fig. 10- 3), in the plunge-in mode is deep rolled. The advantage of this solution is the extremely short process time as only 10 to 15 workpiece revolutions are required. The floating roller suggest its position automatically for an equal load distribution in the radius and and compensates for positioning growers of the machine.

Alternatively, the hydrostatische tools can HG2 near R, 2,5 as well as HG 3 with R, 3 mm is put in. 2 tools each are required.

With larger radiuses, the modular hydrostatic tools ballpoint HG. are applied. The radiuses are apportioned in treatment zones and are processed with two or three tools with different angular position.



Fig. 10-4: molecular hydrostatic tools

Tool	Fillet radius
HG2	$R \geq 2,5$ mm
HG3	$R \geq 3$ mm
HG4	$R \geq 4$ mm
HG6	$R \geq 5$ mm
HG13	$R \geq 10$ mm