

5. Turbines

Numerous components of gas turbines, (stationery or in aircraft), steam and water turbines are subject to high mechanical, thermal and chemical loads which lead to life shortage by fatigue. The most exposed components are blades, blade disks and shafts. Housings and flange connections, also run under critical conditions.

5.1 Turbine shafts

Shafts for power plant turbines with diameters up to approximately 1200 mm and lengths up to approximately 16 m are provided with numerous grooves with radial depth until 400 mm and widths from 90 mm up. These grooves cause a considerable notch effect under the operational conditions (torsion and bending vibrations). The fillet radii are made as large as possible by 20 to 80 mm, in order to minimize the notch effect. However, these measures were not enough to achieve the desired operational safety. For this reason, deep rolling was imposed to increase durability.

Past experience existed with heavy deep rolling tools having roller diameters of 120 and 90 mm. Therefore, use of this roller size was mandatory. The task was to execute the deep rolling process in one setting with the prior cutting process.

The tools should be easy to install and simply to operate. A pressure supply for hydraulic cylinders should be avoided. The deep rolling operation should include the basic groove diameter, the flanks and the transition radiuses.

A mechanical system with low friction leaf springs was designed. The machine infeed is used to preload the springs and to generate the rolling force. ECOROLL offers these tools to FAK 90 and FAK 120.

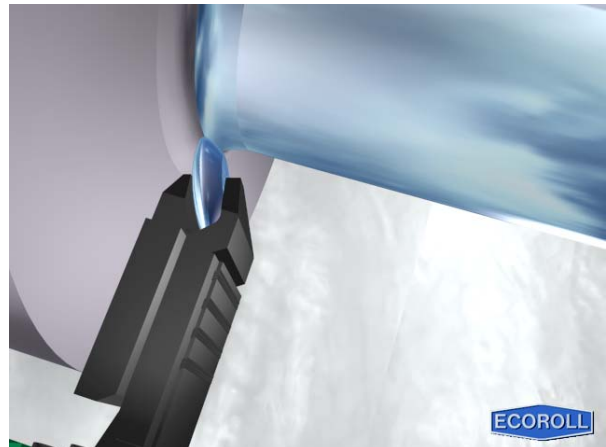


Fig. 5-1: FAK 120; deep rolling turbine shaft

The rolling force can be measured by two different means:

- inductive stroke sensor with analogous or digital display and line recorders for real-time documentation
- mechanical dial gages

The rolling force is determined with help of a standardized load - deflection characteristic curve.

Fig.5-1 shows the deep rolling tool FAK 120 in use. Typical parameters are:

Circumferential speed	50 - 150 m/min	
Feed rate	0,5 - 1 mm/rev.	
Rolling force	10 - 30 kN (2250 to 6750 lbf)	maximum capacity: 35 kN (8000 lbf)