

13. Tension bolts and bend shafts

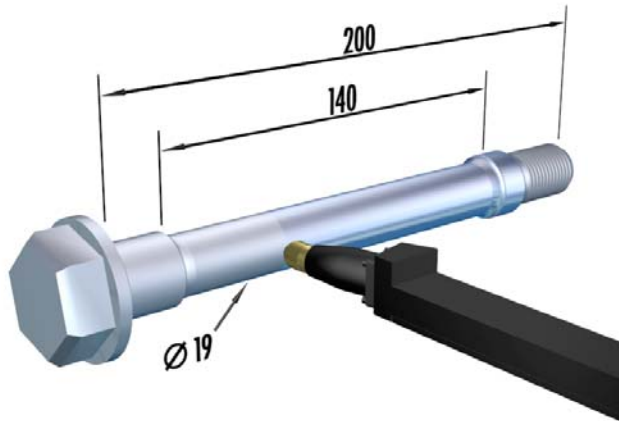


Fig. 13-1: deep rolling of tension bolts

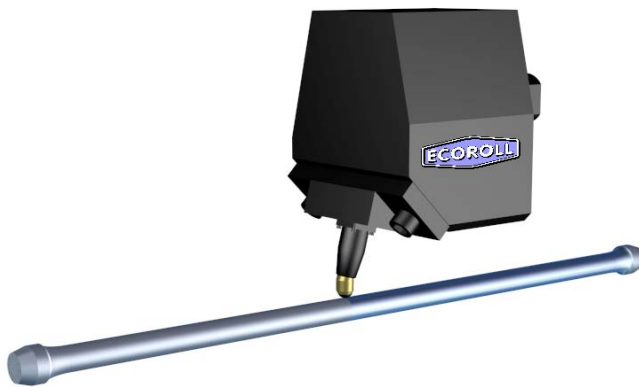


Fig.13-2: deep rolling of bend shafts with HG6

The neck areas tension bolts for fixing of airplane engines as well as the tension bolts for the assembly of high-pressure gas compressors are deep rolled by means of hydrostatic tool HG6 (Fig. 13-1). The extremely short time of few weeks for approval of the deep or components in the case of the airplane screws was remarkable. It indicates that the improvement achieved by deep rolling must have been significant.

Bend shafts for pumps as well as drilling more doors for oil and gas well drilling according to the Moineau-principal replace complicated and wear susceptible universal joint shafts. Under operation conditions, they are bent in the S-shaped, rotate transmit the driving torque to the output shaft. They are alternately designed to avoid the notch effect. Nevertheless they are subject to material fatigue caused by changing torsion and alternating bending. These and shafts are produced in diameters of approximately 6 to 60 mm and lengths until approximately 800 mm. Typical

materials are quenched and tempered high-strength steel and Titanium alloys.

In spite of the above-mentioned optimal design, deep rolling with HG6 or HG13 (Fig. 13-2), increases fatigue strength in a range of 30 - 50 percent. So, deep rolling leads to the best solution together with optimized geometrical form and metallurgy. This shows that the selection of an optimal material and optimized geometry doesn't exclude deep rolling but the combination of all measures provides full exploitation of material qualities resulting in light weight construction and cost-saving.