Basics-Calculation

Radial force

Radial forces cause a change in pressure at the contact surface. In the force direction, the pressure increases on one side and is reduced accordingly on the other side. This depends on the amount of radial forceand the rigidity of the parts. The following equation can be used to approximate the pressure change:

$$\Delta p_W = 0{,}75 \frac{F_{AX}}{d_W \, l_K}$$

The modified pressures $p_{Wmin,\,max}$ results from the following equation:

$$p_{W_{min,\,max}} = p_W \pm \Delta p_W$$

The minimum pressure $p_{W_{min}}$ should be at least 30 N/mm² to avoid gap corrosion. In addition, the material must be selected for a maximum pressure $p_{W_{max}}$.

Bending moment

Here the situation is similar to the radial forces. The pressure is greatest at the ends of the connection in this case. Again, the amount and stiffness are important. This leads to the following approximation:

$$\Delta p_{W,N} = 4{,}5 \frac{M_B}{d_W \, l_K^2}$$

As before, the modified pressures results from:

$$p_{W,N_{min,\,max}} = p_{W,N} \pm \Delta p_{W,N}$$

The conditions for minimum and maximum pressure are the same as before. It should be noted that there could be a change in pressure due to radial force!

Shaft and hub calculation

The catalogue contains information about the generated surface pressure of each locking assembly. Due to the generated radial pressure the hub is deformed, whereupon resilience of the shaft and surface smoothing still has to be added. For solid shafts resilience is negligible but has to be considered for hollow shafts. They are showing greater deformation and therefore greater stresses. This should be considered in addition to the other loads.

The equivalent stresses in the hub can be determined according to various hypotheses such as GEH. On the following pages you will find tables showing required hub sizes, taking pressure, shape and yield strength of hub material into consideration. The shown values for hub sizes are only valid for a solid hub cross-section! The calculation is simplified, includes no additional safety and covers the range of static loads only. Various calculation methods for different cases can be found in mechanical-engineering literature. Specialized software allows the same. For complex geometry reliable results can be determined only by verified FEA.

The minimum yield strength of solid shafts should be at least 2 * P_W, the yield point of hub material at least 1 * P_N. These values are for orientation only, represent minimum requirements and cannot replace calculations for each application! They also do not release from doing so!

Notch effect

Generally there is a notch effect on the components, caused by the radial pressure of the locking device. This depends mainly on the applied pressure. On the shaft the notch effect is usually much higher than at the hub, as the pressure is higher here. The factors are in the range of 1.2 to 1.8 at the shaft. This can, for example, be mitigated by appropriate design details, such as relief notches.

Bore in the shaft (Hollow shaft)

A large bore d_B in the shaft or use of a hollow shaft, reduces the stiffness of this component against radial pressure. Basically, a bore should not be greater than 0,3 d_W.