



ABSTRACT

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Load-bearing and deformation behaviour of expansion anchor-like connections in steel structures under shear loads

The proof of suitability for expansion anchor-like connections with hollow sections and other constructions hardly accessible on the back side has to be provided by an approval "Allgemeine bauaufsichtliche Zulassung". With the mentioned connecting elements, fixing takes place by the expansion of a sleeve by a cone at the non-accessible part of the connection. Large deformations during erection, whose influence on the load-bearing capacity remained unclear, are the starting point for this research. The results can be summarized as follows:

- To avoid the failure mode pull over with shear loads for systems which due to the design rules fail by shear off, the hole diameter normalised to the sleeve diameter $d_{Hü} = d_2$ has to be limited to

$$d_L \leq 1,15 \cdot d_2$$

- The clearance of the hole has predominantly an effect on the displacement and only to a lesser extent on the rotation. While the displacement under service load with the maximum allowed clearance ($d_L = 1,15 d_{Hü}$) amount to 2,5-times the displacement of the connection with the minimum clearance, the rotations consistently amount to 3° to 6°. Below the service load level, different values of rotation may arise, depending on load-bearing behaviour dominated by shear off or bearing.
- The bearing resistance corresponds to the bearing resistance of bolted connections. The regulations in the approval should be replaced by the regulations in DIN 18800-1:1990-11, retaining the upper limits $\alpha_1 \leq 2,0$ for external parts and $\alpha_1 \leq 3,0$ for internal parts.
- If the regulations of DIN EN 1993-1-8:2007-05 are applied for calculating the bearing resistance, similar to DIN 18800-1:1990-11, Element (807)

$$\frac{V_l}{V_{l,R,d}} \leq \frac{1}{1,2}$$

should be required.

- The design of the sleeves has no influence on the load-bearing resistance or the deformation behaviour of the connection. There is no evidence that a rubber ring affects the load-bearing resistance or the deformation behaviour in a negative way.
- Expansion anchor-like connections give larger displacements in the connection compared to bolted connections. This is predominantly a result of the comparatively large rotations. There is no negative influence on the load-carrying resistance.