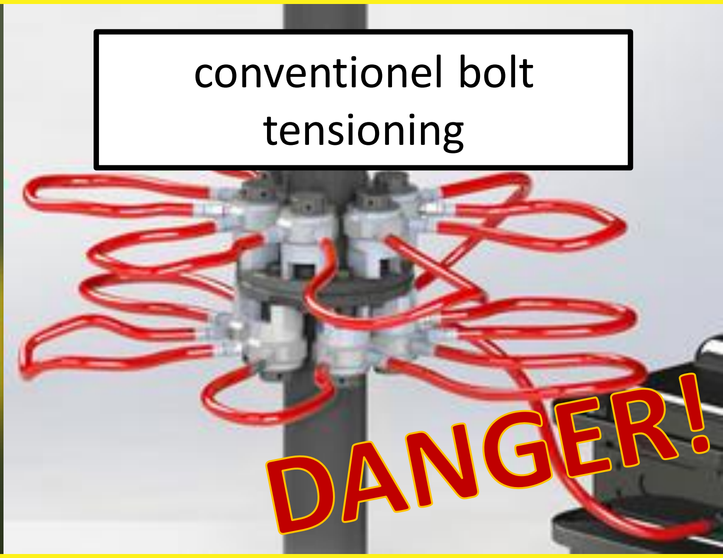
SAFE hydraulic tensioning!



System Energy

1300 J

8500 J

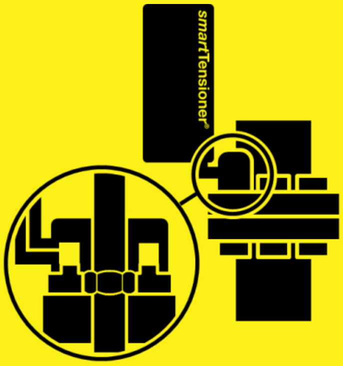
+654 %

Pressurized Oil Volume

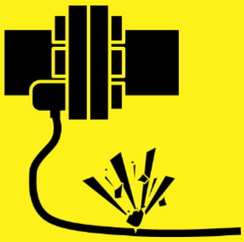
20 ml

245 ml

+1225 %



safe encapsulation of the hydraulic circuit in steel



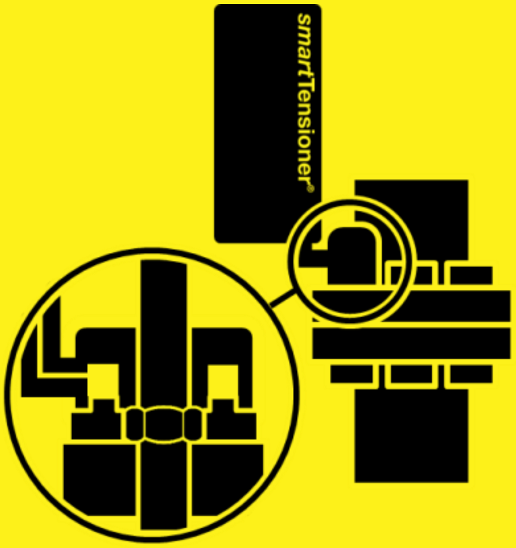
hose cracking

demolition at the connector

smartTensioner®
Hamburg, Germany

With BoltTensioners from smartTensioner, cracks in the material cannot occur because the hydraulic circuit runs completely in steel. In case of stress peaks beyond the yield strength, the steel initially deforms plastically and reduces it. Due to the absence of hydraulic hoses, the energy stored in the system is also a fraction compared to conventional bolt tensioners with the simultaneous use of far less hydraulic oil. This relationship between system energy and pressurized oil is one of smartTensioner's key safety features compared to traditional systems.

Hydraulic circuit in steel

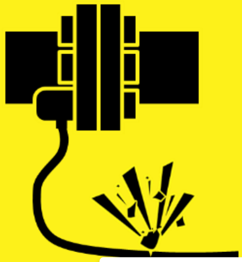


small energy

conventionel bolt tensioning

In the conventional bolt tensioners currently on the market, hydraulic hoses constitute a safety-relevant weak point. The hoses are under high pressure and thus store a lot of energy. Adding up with the energy needed for the tensioning process it results in the total energy of the system. In the event of a crack in the hose or demolition at the connector to the bolt tensioner this energy is released suddenly, so that on the one hand large amounts of hydraulic oil will discharge and on the other hand lead to uncontrolled flying around of the connector. This can become a life threatening danger.

hose cracking



High Energy

Uncontrolled flying connector

Energy M48 bolt tensioning

$$F_{V,M48} = 1170035\ N$$
$$\Delta l_{M48} = 1{,}135\ mm$$
$$E_{Bolt} = F_{V,M48} \cdot \Delta l_{M48} = \mathbf{1327,99\ J}$$

Deformation of the hoses

Pressure: $p_i = 1500\ bar$
Internal diameter: $d_{i0} = 5\ mm, r_{i0} = 2{,}5\ mm$
Wall thickness: $t = 1\ mm$, outer diameter: $d_{a0} = d_{i0} +\cdot\ t = 7\ mm, r_{a0} = 3{,}5\ mm$
Length: $l_0 = 10\ m$

Diameter

$$\Delta r_{i0} = \frac{p_i \cdot r_{i0} \cdot r_{i0}^2}{E \cdot \left(r_{a0}^2 - r_{i0}^2\right)} \cdot \left[\frac{r_{a0}^2}{r_{i0}^2} \cdot (1 + \nu) + 1 - \nu\right]$$
$$d_i = d_{i0} + 2 \cdot \Delta r_i = 5{,}27\ mm$$
$$\Delta r_{a0} = \frac{p_i \cdot r_{a0} \cdot r_{i0}^2}{E \cdot \left(r_{a0}^2 - r_i^2\right)} \cdot \left[\frac{r_{a0}^2}{r_{a0}^2} \cdot (1 + \nu) + 1 - \nu\right]$$
$$d_a = d_{a0} + 2 \cdot \Delta r_{a0} = 7{,}22\ mm$$

Length

$$\Delta l = \frac{F \cdot l_0}{E \cdot A} = 0{,}074\ m$$
$$l = l_0 + \Delta l = 10{,}074\ m$$

Volume

$$V_0 = \pi \cdot \frac{d_{i0}^2}{4} \cdot l_0 = 196{,}35\ ml$$
$$V_{deform} = \pi \cdot \frac{d_i^2}{4} \cdot l = 221{,}38\ ml$$
$$V_{comp} = \frac{0{,}7}{100} \cdot p_i \cdot V_{deform} = 23{,}25\ ml$$
$$\Delta V = (V_{deform} + V_{comp}) - V_0 = \mathbf{244,63\ ml}$$

Energy

$$E_{hose} = p_i \cdot \Delta V = 7241{,}63\ J$$
$$E = E_{hose} + E_{bolt} = \mathbf{8569,32\ J}$$