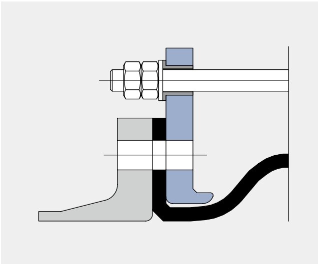
Expansion joint technology > Tie rod design

Rubber expansion joints cause force on the adjacent sliding or fixed points when under pressure (active bellows cross-section surface area x operating pressure). The force created by this pressure is designated as pressure thrust. Where the pipe supports are not designed to absorb this force, tie-rods must be incorporated across the joint from flange to flange so that the expansion joint is restrained in axial direction and can move lateral only. It can be eliminated also by using angular expansion joints with hinges and pin, such that the pipe anchors and guides are unburdened accordingly.

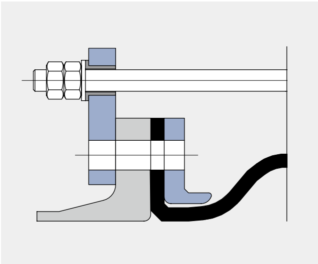
Based on the Pressure Equipment Directive PED 2014/68/EU the number and size of tie-rods must be calculated to take the full pressure thrust plus extra safety margins at the required hydraulic pressure test. Most commonly tie-rods are directly integrated into the backing flanges which influences their construction thickness depending from the design pressure and dimensions. The use of gusset plates placed behind the mating flange is an alternative but introduces pointwise forces into the flange. This technology works for steel pipes but their use is not allowed for glass reinforced epoxy (GRP) flanges which could break under these extra unconsidered forces.

Tie rods:	Several threaded rods mounted around the circumference assimilate pressure from the active bellows cross-section. Pipe flanges need to be parallel aligned for lateral expansion joints
Pressure:	The tie rods assimilate the axial stresses of the expansion joint
Stiffness rate:	Movements give rise to forces that rise under pressure and need to be taken into account in dimensioning the pipeline. Lateral stiffness rates to move the expansion joint under pressure can be found in the technical appendix; you may also enquire directly with us
Design:	Dimensioning according to design pressure (test pressure) based on the Pressure Equipment Directive
Pipeline:	For laterally stayed expansion joints the flange diameter of the pipeline must not be bigger than as defined in the norm, as otherwise the tie rod touches against the side of the flange and the lateral movement is restricted
Materials:	Tie rod materials can be according to DIN or ASTM standard which defines slightly different tensile and yield strength which is considered in our calculation
Coating:	Spherical bearings and ball disks PTFE-coated Tie rods galvanised, hot-dip galvanised or PTFE-coated

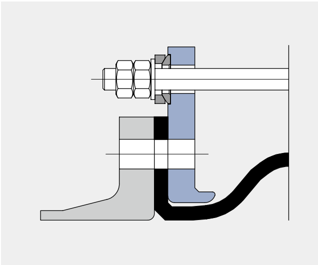
The following tie rod designs are used depending on the requirements:



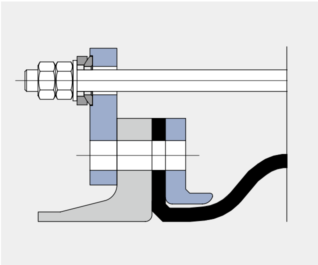
Design: B
Tie rods mounted outside in rubber bushing to accommodate pressure thrust forces



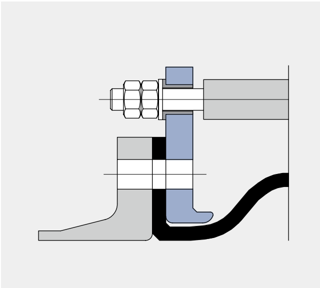
Design: R
Gusset plates: Tie rods mounted outside in rubber bushing to accommodate pressure thrust forces



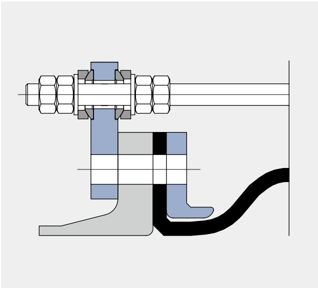
Design: E
Tie rods mounted outside in spherical washers and ball disks to accommodate pressure thrust forces



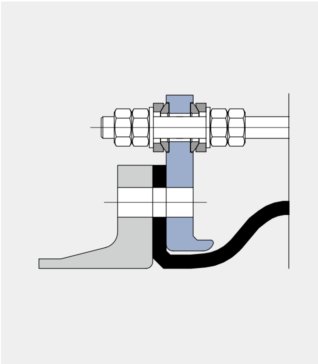
Design: K
Gusset plates: Tie rods mounted outside in spherical washers and ball disks to accommodate pressure thrust forces



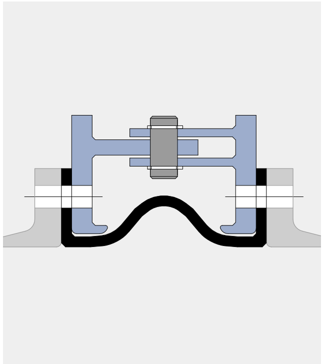
Design: C
Tie rods mounted outside in rubber bushing and inside with compression sleeve to accommodate pressure/vacuum thrust forces



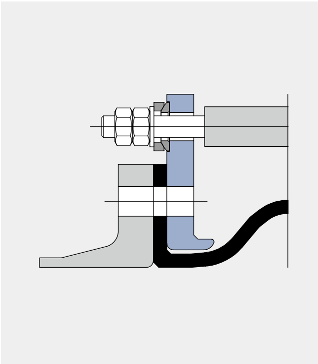
Design: L
Gusset plates: Tie rods mounted outside and inside in spherical washers and ball disks to accommodate pressure/ vacuum thrust forces



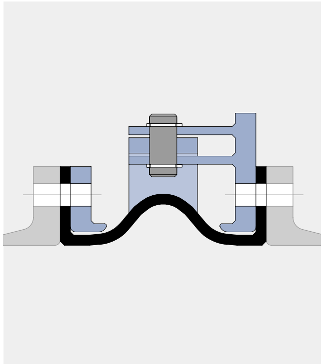
Design: M
Tie rods mounted outside and inside in spherical washers and ball disks to accommodate pressure/ vacuum thrust forces



Design: F
Hinge for angular movements on one plane with plates and pins to absorb the reaction forces from pressure and vacuum. Rotation axis in the center of the installation gap



Design: S
Tie rods mounted outside in spherical washers and ball disks with compression sleeve to accommodate pressure/ vacuum thrust forces



Design: G
Cardan joint for angular movements on two planes with plates and pins to absorb the reaction forces from pressure axis and vacuum. Rotation in the center of the installation gap

Note: Additional forces (e. g. weight forces) to be transmited by the expansion joints must be specified.