



Linear expansion joints are used worldwide in pipelines, that are subject to subsidence, in earthquake areas or subject to increased thermal influences, in order to minimize occurring tensions and create a length compensation.

Photo: Franz Schuck GmbH

New pipeline linear expansion joints for the highest requirements for integration in a system of cathodic corrosion protection (CCP)

■ Jürgen Heim

Linear compensators must be able to compensate for the displacements within a pipeline and are at the same time subject to high requirements for integration into the cathodic corrosion protection of a pipeline. For example, the metallic conductivity of the pipeline must not be interrupted by the expansion joints and the external insulation of the components must be provided in all operating states. In order to do justice to this, Franz Schuck GmbH continues to develop its expansion joints and has applied for a patent for the corresponding product innovations. With this new generation of linear expansion joints Schuck is equipping the high-pressure pipeline from Pogórska Wola to Tworzeń in Poland, thereby strengthening its special construction sector. By February 2021, 42 of the new expansion joints for underground use will be delivered with the nominal diameter DN1000 and a nominal pressure of PN84.

Linear compensators are used both underground and above ground in pipelines with which gaseous and liquid media are transported. For example, installation below bridges can be mentioned as an above-ground application. There, in particular, thermal changes in length occur due to solar radiation. Special measuring units for compensators make it possible to measure the axial displacement within the component in order to monitor the unit – especially with regard to its maximum adjustability. In addition to the requirements from the CCP, the components must meet high mechanical requirements. The bending moments induced by the pipeline in operation are absorbed by the linear expansion joints in addition to the load from the internal pressure. The components must often be able to withstand the loads over large temperature ranges.

It is important to design the compensators so that they are able to withstand the forces of the pipeline even at the end of their adjustment range, until they are replaced accordingly.

Requirements for linear expansion joints

The special requirements that generally apply to the components are summarized below:

- The electrical conductivity between the weld ends (inside the compensator) must be fully present.
- Permanent external insulation of 10 kV per mm
- Ongoing protection of parts at risk of corrosion
- Easy axial adjustability of up to 800 mm (depending on the pre-setting; for example +/- 400 mm)
- Temperature range: -30 / + 60 °C
- The usual bending forces occurring in the pipeline must be safely compensated by the component (problem-free movement under bending). / Maximum permissible bending angle of up to 0.5°
- Hydrostatic strength test / usual maximum test pressure = nominal pressure x 1.5
- Suitability for bi-directional pigging
- No ingress of water and dirt is acceptable

Additional product advantages of Schuck expansion joints

The Steinheim based valve and actuator manufacturer Schuck has been successfully producing its previously patented pipeline linear expansion joints for the gas, oil and water industry for over 40 years, with nominal sizes of up to DN1000 and nominal pressures of up to PN100. The following technical features in particular deliver very good experiences.

- Completely maintenance-free design with lifetime lubrication / no readjustment necessary
- Reusability after removal (at the end of the adjustment range)
- Use of two equivalent main seals that work separately
- Test opening for separate leak test and as an emergency sealing option with special grease
- Device for the defined setting of the main seal axial preload
- Schuck produces its own displacement measurement unit

Tests on linear expansion joints at Schuck

It is common for each expansion joint to be subjected to a hydrostatic strength test. In order to be able to avoid the compensator becoming elongated during this test, when the full axial force corresponding to the internal pressure, a special locking device is necessary. This can be seen in the figure below and consists, among other things, of bolts arranged on the circumference of the component, which block the axial movement and later they are removed before the pipeline is put into operation.



Fig. 1: Expansion joint DN1000 / PN84 during mounting and preparation for the hydrostatic strength test in the factory

During the strength test with static internal pressure, the locking unit with the screw bolts and their peripheral components are generally subjected to high loads. The specially optimized component design from Schuck, with tight-fitting screw bolts, ensures that the stress is kept as low as possible. If you look at the new expansion joint generation, there are further optimizations that ultimately allow higher component utilization with simultaneous cost optimization.

In addition to the actual pressure test on the components, Franz Schuck GmbH tests its linear expansion joints very extensively in specially designed test facilities and test stands. This includes, among other things, friction force measurements (see Fig. 2) and the determination of the bending angle, that occurs under the load with the bending moments from the pipeline.



Fig. 2: Frictional force measurement on a DN200 / PN70 linear compensator

Combined load cases are also simulated in the tests. For example, frictional forces can be determined while the compensator is being applied by the pipeline bending force.

Author:

M. Eng. Jürgen Heim
Product development
Franz Schuck GmbH, Steinheim am Albuch