

RELY ON EXCELLENCE

## Reliable storage of crude oil

Solution – Metal expansion joints for tank farm



A crude oil storage tank has a lifetime of approximately 15 to 20 years during which it is constantly filled to different levels or emptied. A completely filled tank can hold up to 630,000 barrels of crude oil. This enormous mass of crude oil causes the inner tank walls to bulge slightly and the entire tank unit to sink a little into the ground. The higher the filling level, the higher the bulging of the side walls and the more the tank settles into the ground. "This is normal, and therefore the pipe connections must be designed flexible enough to accommodate these movements" according to Jesper R. Dam, Technical Manager at EagleBurgmann.



**Special expansion joints from EagleBurgmann compensate for these position changes and work reliably even under unfavorable conditions such as low temperatures, proximity to the sea and explosive environments.**

A leading provider for crude oil logistics operates a terminal storage plant at the coast of the Baltic Sea. In recent years, one of its tank farms was extended by two newly constructed storage tanks with a capacity of 100,000 m<sup>3</sup> each.

### Specific working conditions

In the process of filling up storage tanks with crude oil, the added weight results in the double-walled tanks sinking into the ground, while the increase in volume leads to a bulging of the inner tank wall. Depending on the amount of oil, the pressure in a tank is between 6 and 16 barg. These effects are common with large volume tanks and are known as tank settling. Due to the difference between the initial and the settled state, a direct, rigid connection between pipeline and tank is not suitable. Expansion joints on the leakage and pressure lines are needed to compensate for the effects of tank movements resulting from different filling levels in terms of axial, lateral and angular movements, especially of the inner shell, and to ensure a sealed connection to prevent leakage.

In this case, components must also be able to withstand the location's harsh climate conditions with the temperature dropping as low as -30 °C. Withstanding this temperature is a prerequisite for the material in this application. Common carbon steels are only suitable for temperatures of -20 °C or higher and are therefore inadequate for this application. Furthermore, due to the proximity to the sea, the materials must also be able to cope with high humidity and a high salt content in the air.

### Advantages of expansion joints made from P355NL1 carbon steel:

- Compensate for large axial, lateral and angular movements
- Withstand high pressures
- Material properties which don't diminish at low temperatures



Crude oil storage tank at the coast of the Baltic Sea

### Expansion joints for various types of movement

In this project, EagleBurgmann was awarded the manufacturing of 22 double bellows metal expansion joints to serve as connections between the pipelines as well as between the tanks and pipelines. Their sizes range from DN250 up to DN1200 depending on the pipeline and whether they are incorporated in the outer or inner wall.

The customized expansion joints are used on leakage as well as pressure lines. They consist of two multi-convolution and multi-layer bellows that are connected by a central pipe. This design allows for a large lateral offset to be absorbed. By tolerating the required motions, the expansion joints compensate changes in the tank's position.

### Reliable components for harsh environments

With regard to withstanding very low temperatures, P355NL1 carbon steel emerged as the ideal solution. The pressure vessel steel is characterized by high impact toughness even in very cold conditions. Additional impact tests provided evidence that the material meets the requirements at -30 °C.

The expansion joints were designed in accordance with the norm EN 14917 and the pressure equipment directive (PED) of the European Union. The expansion joints between the inner and the outer tank wall comply with PED category III due to the increased explosion risk in this area.



Metal expansion joint for leakage and pressure lines



“The customized metal expansion joints made by EagleBurgmann effectively and reliably compensate for the tank settlement and are tailored to work flawlessly under the given conditions”, says Mahantesh Biradar, Area Sales Manager at EagleBurgmann and familiar with the project.

### Successful installation requiring no maintenance

EagleBurgmann is a proven, reliable supplier of this customer with a successful track record in previous projects for which they supplied expansion joints, mechanical seals as well as packings and gaskets.

While the overall construction of the storage tanks took 2 to 3 years, the fabrication of the metal expansion joints by EagleBurgmann was finished within a short time. This included product engineering and design, manufacturing as well as testing and documentation. As required by the norm, hydrostatic pressure tests, dye penetrant tests and visual tests were conducted. Additionally, hydrostatic pressure tests were carried out on-site after the expansion joints were installed.

The material used keeps its ability to contain the high internal pressure even at low outside temperatures. No maintenance is required, eliminating the need for shutdowns due to expansion joint inspections. The expansion joints are designed to be operational as long as the storage tanks are in service.



#### Operating conditions

- Media: crude oil
- Temperature: -30 °C ... 50 °C
- Movements: axial, lateral, angular

## EagleBurgmann – at the leading edge of industrial sealing technology

Our products are used wherever safety and reliability count: in the industries of oil & gas, refineries, petrochemicals, chemicals, pharmaceuticals, food, power, water and many more. About 6,000 employees contribute their ideas, solutions and dedication every day to ensure that customers around the globe can rely on our seals. With our modular TotalSealCare Service, we emphasize our strong customer orientation and offer custom-tailored services for every need. [Rely on excellence.](#)

