BUILT to Resist

Bunker silos to store the corn produced on the gigantic farms used to be the traditional landmarks dotting the wide North Dakota plains. Since the end of the 1950s, however, more and more oil rigs have popped up in the seemingly endless expanses of the Great Plains state in the northern United States. In 1951, prospecting teams dispatched by the Hess Corporation, now the largest gas producer and third largest oil producer in North Dakota, discovered the Bakken shale play, which holds large reserves of oil and gas. Initially, the gas was mostly flared. Nowadays, it is captured and used extensively. It is not far from the place where the first fossil treasures were discovered that the provincial town of Tioga is located. Here in western North Dakota, Hess operates a gas processing plant that is currently undergoing expansion. As part of this expansion, the plant operator opted to install the new Type 3291 Valves by SAMSON as they are particularly easy to service and operate reliably even at very low temperatures.

Shale gas and its impurities

Like crude oil, natural gas is a mixture of numerous substances, with methane accounting for the largest share (75 to 99 %). Depending on the reservoir's location, the recovered natural gas can contain further compounds similar to methane, such as ethane, butane or propane. It is these hydrocarbon gases that are used for energy generation or further chemical processing. But before they can be put to use, varying contents of unwanted impurities, such as steam, hydrogen sulfide, nitrogen or oil residue, need to be removed.

In ideal gas reservoirs, as encountered in Russia for example, the natural gas occurs in subterranean bubbles with a very high degree of purity. In the Bakken field, however, the gas is found as shale gas trapped in the oil-containing layers of rock. The gas needs to be dissolved from the rock, also the reason why it contains a lot of sulfur and carbon dioxide. At Tioga, such substances are removed and the remaining gas is transformed into NGLs (Natural Gas Liquids). The plant produces the major share of propane consumed in the region directly at the extraction site. Currently, Hess is implementing an expansion of the Tioga gas plant to increase the daily inlet gas capacity from 120 to 250 MMscfd, i.e. from 3 to 7 million m^3.

Bunker silos to store the enormous amounts of corn produced on the gigantic farms are traditional landmarks dotting the North Dakota landscape

Competence in cryogenics

While high temperatures are needed to refine crude oil, some steps in the gas fractionation process occur at extremely low temperatures. In this field, cryogenic procedures at temperatures below –150 °C have proven to be most efficient. The different gases are cooled to temperatures below their boiling point, at which they liquefy and can be separated from each other.

At –161.7 °C, methane has the lowest boiling point of the hydrogen gases involved. This is why the equipment installed in the Tioga plant needs to function reliably and without any problems even at extremely low temperatures.

Such temperatures really put the materials to the test as the cold even makes many metals go brittle. For valves, whose moving trim parts are exposed to the cryogenic medium, this means that only special alloys of the highest quality and special technical solutions can be employed. "Hess had experienced problems in exactly this area with valves from a different manufacturer," states Mr. Abraham John, head of SAMSON Project Engineering Inc. The company operates out of Houston, Texas, and assists its customers in oil and gas projects across the world. According to Mr. John, there was no other valve manufacturer with as much experience and expertise in cryogenic applications

as SAMSON: "We have been cooperating closely with the producers of technical gases for decades. This is why we know exactly what the requirements in this field are and can provide the right technical solutions." He adds that SAMSON's know-how and experience also were the decisive factors in winning over the engineers in charge of the Tioga expansion.

Decisive design advantage

For the plant expansion, Hess decided in favor of the new Type 3291 Valves, which control the pressure, temperature and flow rate of gases in the new liquefaction process to Hess's full satisfaction. The valves were specifically developed for application in the oil and gas industry. Their construction is based on the proven SAMSON valve design, with one significant difference: while the seats in SAMSON valves are normally screwed in place, the new valve type has a clamped-in seat to hold the plug.

The main benefit of this design is that valve maintenance is much easier, which is particularly important in oil and gas applications. Mr. John explains why: "Chemical plants are completely shut down at regular intervals for maintenance routines. The plants working directly at the oil and gas extraction sites, however, are not. They operate non-stop in most cases. And if a valve fails, its repair must be quick and easy."

The Type 3291 Valve was tailored to the specific requirements of the oil and gas industry

The first rigs of the Bakken shale play popped up in the wide North Dakota plains during the 1950s. The field holds shale gas trapped in the oil-containing layers of rock

Type 3291 Valve

The valve was specifically developed for application in the oil and gas industry. Its construction is based on the proven SAMSON valve design, but instead of being screwed in place, the valve's seat is clamped in. Contrary to the widespread cage valves, the SAMSON valve generates very little friction during operation and is resistant to dirt deposits and leakage.

- Clamped-in seat
- No special tools required for maintenance
- Proven design
- Minimized wear at the seat and plug
- High resistance to dirt deposits and leakage
- For temperatures from –198 to 450 °C
- Particularly suitable for applications where crevice corrosion is expected to occur between the seat and body

Quick and easy maintenance

Valve seats are subject to natural wear, particularly under the severe conditions that exist in gas processing. As a result, ease of maintenance is a competitive edge. The seat of the Type 3291 can be installed and removed fast. The only tool required is the standard seat tool always available in such plants. Compared to the valves with cages that are still widely used in the industry, the SAMSON valve has another decisive advantage that Mr. John describes as follows: "When the valve is depressurized, a cage is highly susceptible to dirt penetration. In addition, the piston-shaped plug is stroked inside the cage over a considerable distance. Both factors favor the generation of score marks, cracks and leakage." The design of the Type 3291 largely excludes such negative effects. Moreover, the new SAMSON valve generates considerably less friction during operation than a cage valve, which reduces the natural wear, significantly prolongs the valve's service life and extends the service interval.