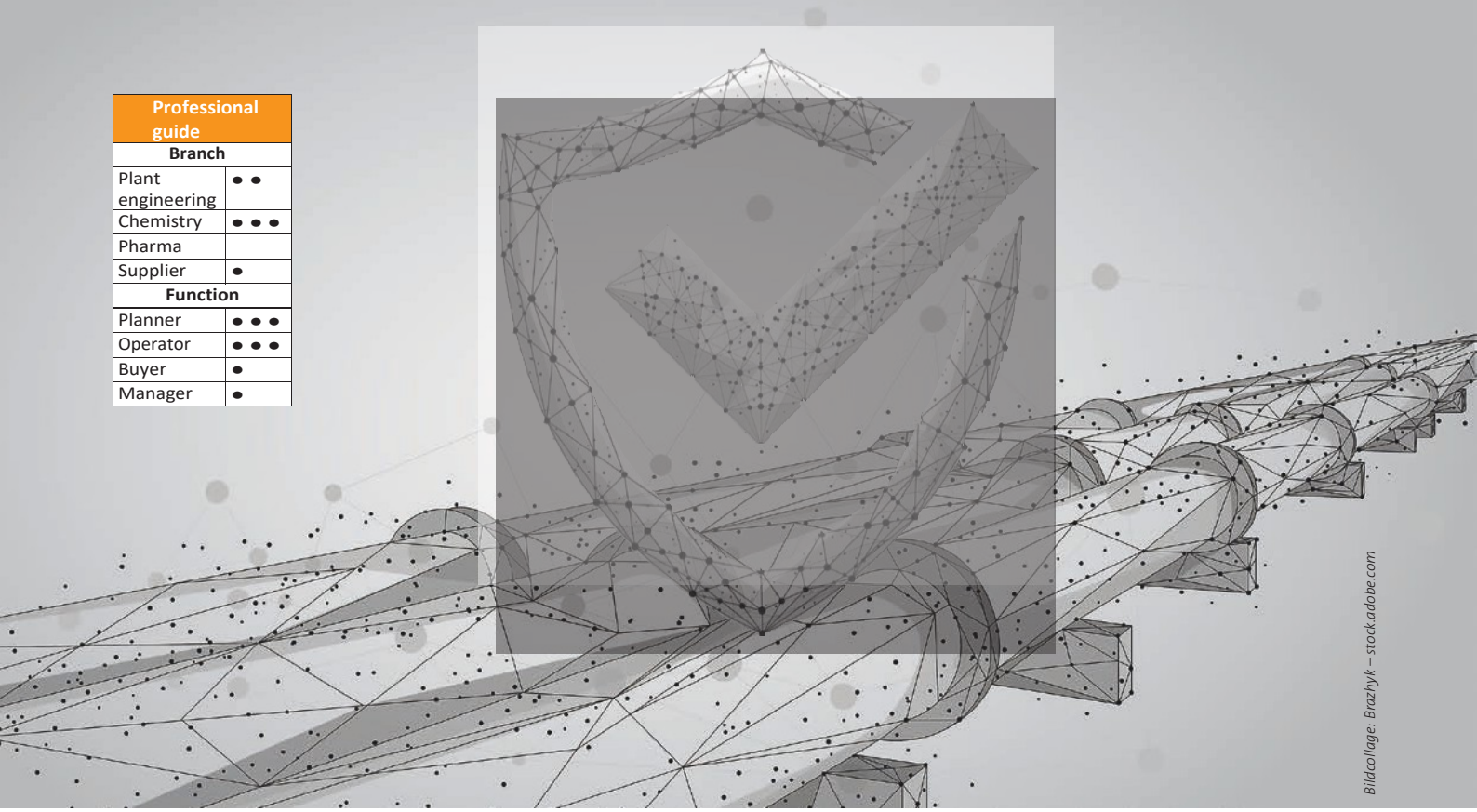
Professional guide	
Branch	
Plant engineering	● ●
Chemistry	● ● ●
Pharma	
Supplier	●
Function	
Planner	● ● ●
Operator	● ● ●
Buyer	●
Manager	●



Bildcollage: Brazhyk – stock.adobe.com

Pilot operated safety valves for various applications

Play it safe with oil and gas

There are many ways to protect vessels or systems against overpressure. In various applications in the oil and gas industry, pilot operated safety valves show their strengths, as three examples show.

All containers or systems must be protected against overpressure in order to protect the plant in the event of an incident and to prevent worse.

prevent. Various safety devices can be used for overpressure protection. In addition to spring-loaded safety valves, there are pilot-operated safety valves, controlled safety valves, bursting discs and safety valves and bursting discs in combination. The ISO 4126 series of standards provides an overview of all types of overpressure protection. Spring-loaded safety valves are by far the most common safety device for overpressure protection. Nevertheless, there are certain applications in which the other types of overpressure protection have advantages - such as pilot-operated safety valves.

How work pilot operated safety valves?

Pop-action pilot operated safety valves such as the Type 811 from Leser open and close abruptly. The valve opens at an overpressure of 1 %. Closing occurs at a pressure of 97% of the response pressure and can be further adjusted to 85%.

According to API, 521unacceptable overpressure can have different 17triggers, resulting in different mass flows to be discharged. The largest mass flow to be discharged determines the size of the valve. For all other triggers, partial loads are present. Due to the opening pressure difference of % 1and the closing pressure difference of %3, the blow-off cycle is significantly shorter than with a spring-loaded safety valve. As a result, less medium is blown off. In addition, the closing force of pilot-operated safety valves increases proportionally to the system pressure. This leads to improved tightness, especially close to the set pressure. With spring-loaded safety valves, the closing force decreases as the system pressure increases. At the set pressure, the spring force corresponds to the force generated by the system pressure.

Secure natural gas pipelines

Natural gas is often produced in regions where it is not consumed. A proven and economical transport therefore takes place through pipelines. After processing, the gas is fed into the long-distance pipelines at a high pressure of around bar100. However, due to the pressure loss caused by pipe friction, the pressure decreases as the length of the pipeline increases.

Author

Holger Gesche,
Marketing,
LESER

Left: Pop-action pilot-operated safety valves open and close abruptly.

Center: A dual-outlet pilot-operated safety valve has two outlets facing each other.

Right: Cryogenic applications pose a special challenge for safety valves.

Images: LESER

Therefore, the natural gas is recompressed in compressor stations and pressure losses are compensated.

To protect the stations, safety valves are used that provide large capacities at these high pressures. These are, for example, valves with a nominal size of 8T10 / DN 200 x DN 250. As a rule, conventional pilot-operated safety valves with one outlet are used. Under these conditions, the reaction forces can reach up to 340 kN, as calculated in accordance with API 520. These forces must be absorbed and supported by steel structures in compliance with the standards.

An alternative to this is the so-called dual outlet pilot-operated safety valve. It has two outlets that are located opposite each other. In the event of a response, the medium flows out evenly in exactly the opposite direction. Thus, the reaction forces that occur almost cancel each other out. This means that the plant operator can save on metal construction costs in the compressor station by installing a dual-outlet pilot-controlled safety valve.

Functioning in the cryogenic environment

A special challenge for safety valves is the protection of liquefied natural gas (LNG) with necessary cryogenic media temperatures of -161 to
-164 °C. The challenge arises from high pressures and low temperatures. Soft seals in particular must be considered separately. This also applies above all to the safety valves. As the final safeguard in the event of overpressure, they must also function reliably at the cryogenic process and ambient temperatures. Nevertheless, the liquefaction process must be designed efficiently so that the LNG can be offered economically.

The use of pilot-operated safety valves can improve plant efficiency in the relevant areas. In contrast to spring-loaded safety valves, they are tight until they respond and thus meet the requirement of a higher operating pressure in relation to the set pressure of the system.

In addition, a pilot-controlled safety valve can be adapted to the respective requirement. For example, an evaporator can be used or the pilot can be thermally decoupled from the main valve to ensure a gaseous media condition in the pilot. A temperature-resistant PTFE compound for piston sealing in the main valve allows the use of the spring-loaded grooved ring seal at operating temperatures down to -162 °C. A seat bushing is used at these temperatures. In this way, the coldest area with the highest pressures is sealed without a soft seal.

High pressures in offshore applications

Offshore oil production is increasingly shifting to deep-water locations. In these regions, where production depths can reach 6,000 m or more, floating production storage and offloading units (FPSOs) are increasingly being used. The associated gases produced alongside the raw material are recirculated and injected into the ground. The development of ever deeper deposits is increasing the pressures at which the gases have to be injected. Compressors and pumps with pressures of over bar600 are already in use today. In order for the plant to have an operating pressure of 600 bar, it has to be designed higher. This is because a plant is usually operated 15% below the set pressure of the safety valves. In this case, this would be 690 bar design pressure. The reason for this is the function of the spring-loaded safety valves. According to the applicable rules and regulations, the safety valves must operate at 10 % below the set pressure.
The Most manufacturers and codes recommend a difference of 3 to 5 % between the closing pressure and the operating pressure to ensure clean closing of the valve and to restore good seat tightness. For applications and operating pressures above %90 of set pressure, spring-loaded safety valves sometimes close incompletely. The result would be a constant, high loss of media. This means that the entire system must be designed for a higher load, which leads to correspondingly higher expenses. This leads to higher costs and is also reflected in the weight of the system, which is particularly significant on ships.

Design pressures can be reduced by using pilot-operated safety valves with lower closing pressure differentials. This saves material because lower pressure stages can be used. Alternatively, the delivery depths of an existing could be interesting. •

Decision Maker Facts

- *By far the most common safety device for overpressure protection are spring-loaded safety valves.*
- *Nevertheless, there are certain applications where the other types of overpressure protection, such as pilot-operated safety valves, show their strengths.*
- *This is shown by examples from the areas of natural gas, LNG and offshore oil production.*