THE ROLE OF *flow control*

Anthony Vangasse, Rotork, UK, considers the role of flow control in midstream storage applications.

Flow control is the management of liquids and gases. Actuators are key pieces of equipment that allow for automation, controlling the valves at the heart of the process. They can be electrically, pneumatically, hydraulically, or electro-hydraulically powered, depending on power supply and customer requirements. Electric actuators have varied roles within a large variety of applications in the oil and gas industry. They can control the flow of water, gas, crude oil and condensate in upstream applications, while in midstream applications isolating actuators are used for routine flow control around the plant, fail-safe actuators are used for critical safety duties, and modulating actuators are used for process applications. Electric actuators, especially intelligent electric actuators due to their ability to capture data, are increasingly the preferred choice for oil and gas operators. Powered by electricity, they are reliable, efficient, precise and simple to use. A watertight enclosure, such as one that is double-sealed, protects internal elements from the ambient environment, making actuators durable and robust. Actuators on oil and gas sites should have explosion-proof certification, as part of the high degree of safety required within production and processing. They often provide shutdown and emergency shutdown (ESD) capabilities. Flow control safety provisions on tank farms are largely a combination of explosion-proof certification and environmental protection (such as double-sealing). Electric actuators are also not subject to the negative impacts some flow control systems can have on the environment. Pneumatic actuators powered by gas have traditionally been used. Spring-return and diaphragm pneumatic actuators vent this gas (often methane) into the atmosphere. Electric actuators negate this, aiding in compliance with emission

Figure 1. Rotork IQ3 intelligent electric valve actuators with Pakscan digital control network at Horizon Tangiers Terminals S.A.

mandates that are increasingly imposed upon operators to aid in efforts tackling the climate crisis.

Tank farms

Tanks farms and storage terminals are a fundamental part of midstream oil and gas operations. They are used for natural gas, crude and refined oil, and finished oil products, and are therefore often attached to or found near to refineries. These products are stored in tanks before they are moved, often via pipelines, and enter the downstream stage of oil and gas activities. They can be stored for some time, depending on the product, while international supply and demand will affect what happens to it, and when. This level of control is part of the global market for oil and gas. Tanks and storage facilities can be above and/or below ground. Flow control plays a key role in most midstream applications. This occurs within the wide range of individual applications within terminals, such as receipt, storage and loading, pump stations, metering skids and blending systems, transfer safety/shutdown options, and liquefaction for LNG. On tank storage systems, actuators can be found in tank overfill protection, condition monitoring and tank gauging/measuring. For example, 100 intelligent electric IQ3 actuators were installed at a Moroccan terminal in 2019. The site has a capacity of 532 900 m^3 for petroleum products and blending components and is a critical operation for oil provisions in north-western Africa. The actuators operate gate and butterfly valves on tank inlets and outlets.

Safety

Flow control solutions play a key role within safety provision on midstream operations. Appropriate care and control is not only necessary to ensure smooth operation, but to prevent a safety incident like the Buncefield fire in 2005. Here, a storage tank overflowed and the vapour cloud ignited to cause a devastating fire. Safety systems to prevent this sort of incident are essential. Tank failures and safety incidents can lead to huge hazards and costs. Any site that contains flammable materials must always consider safety as the paramount operating consideration. Flow control systems contribute to this. Tank overfill protection is an important point to consider; this stops material overflowing from the tank, resulting in a loss of product, and the subsequent safety concerns. Actuators operate isolating valves (inlets and outlets) and also, in some cases, control valves. All of these elements of tank overfill systems require certified safety systems for filling, emptying, tank blanketing and level monitoring. Equipment should be explosion-proof, SIL 2/3 capable and suitable for use in SIS systems, operating to the minimum standard operators must work to; API/ANSI Standard 2350.

Other safety considerations include ESD/shutdown capabilities provided by actuators. They can stop the flow of oil and gas when required. This can be on loss of ESD signal, loss of power supply, or both, depending on customer specification. Ensuring that flow finishes in a safe operating state avoids both safety and monetary concerns. For example, Rotork Skilmatic electro-hydraulic actuators control Remote Operated Shut-off Valves (ROSOV) at multiple tank farms in India. They provide a spring-return fail-safe control action, ensuring high degrees of safe operation. The choice of electro-hydraulic actuators provides operators with the speed and flexibility of hydraulic operation and the reliability of spring action with the convenience and control benefits of electric actuators. They are therefore a popular choice for providing safety functions. Another example of the use of Skilmatic actuators is at a terminal in Rotterdam, the Netherlands. The Botlek Tank Terminal has 34 storage tanks, providing a combined storage capacity of 200 000 m^3, and benefits from ESD functionality from over 50 Skilmatics on site. They position inlet and outlet ports of the storage tanks (and on the marine and truck loading bays) to a pre-determined safe position.

Asset management

Downtime can be costly and disruptive. Within oil and gas production, tank farms and terminals require frequent operation of key flow control assets to continue to be productive and profitable. Sites that require flow control need actuators to consistently provide reliable, safe, and efficient operation. Interruption of flow control at a tank farm, for example, results in an inability to achieve the optimal mass balance and accuracy of blending needed. Any unplanned downtime will detract from key operational goals. The maintenance and upkeep of these important assets must therefore be at the forefront of operator's minds. Innovations within flow control technology can now contribute to the continued availability of assets, increasing essential uptime. Key in this is the use of data to improve operational effectiveness.

Asset management systems such as Intelligent Asset Management from Rotork exist to ensure actuators continuously operate at optimum performance levels, allowing sites to work reliably, efficiently and safely.

Figure 2. Rotork IQ intelligent actuators on a tank farm.

They contribute to the essential uptime needed in midstream oil and gas operations. Unplanned downtime caused by a lack of asset availability can cause economic loss and reputational damage, irrespective of how long a site is offline for. Part of the Industrial Internet of Things (IIoT), a system like Intelligent Asset management allows operators to access the data within intelligent actuators and act on it to improve performance and uptime to prevent the kind of damage mentioned above. Intelligent electric actuators contain data loggers that can provide a large amount of data, such as the number of valve operations, alarms, and valve torque profiles. Torque average, deviation, peak levels, and opening/closing torque are especially valuable and aid in understanding an actuator's health. Sudden changes can indicate a potential problem.

A holistic asset management system that analyses this data assists operators in running assets/a site at an optimum level, maximising productivity and reducing operational risk. A system that removes the need to manually review data lifts an access barrier and instead presents the information in a clear and straightforward manner.

Ensuring asset availability at tank farms can also be managed by battery technology. Such is the importance for process uptime on these sites, battery actuation can provide a solution for power supply concerns. If power is interrupted or tends to be intermittent, flow control can continue with a battery that helps to maintain operational and production activities. Such solutions can continue to operate while power is unavailable or bring the process to a safe stop; this safety provision is an additional benefit. Rotork's intelligent electric IQT part-turn Shutdown Battery, for example, can fail-safe, fail-close, fail-open or stayput on battery power. Processes will finish in a safe operating state, preventing safety and monetary consequences. Innovative battery functionality of this kind assists tank farm operators in achieving a high level of uptime, as well as safety benefits.

Conclusion

Tank farms and storage terminals are critical within the oil and gas industry. Flow control plays an important role in multiple applications on tank farms and storage terminals, such as overfill protection, condition monitoring and tank gauging/measuring. Actuators also provide essential safety functions within an environment where safety considerations are of paramount importance. T&T