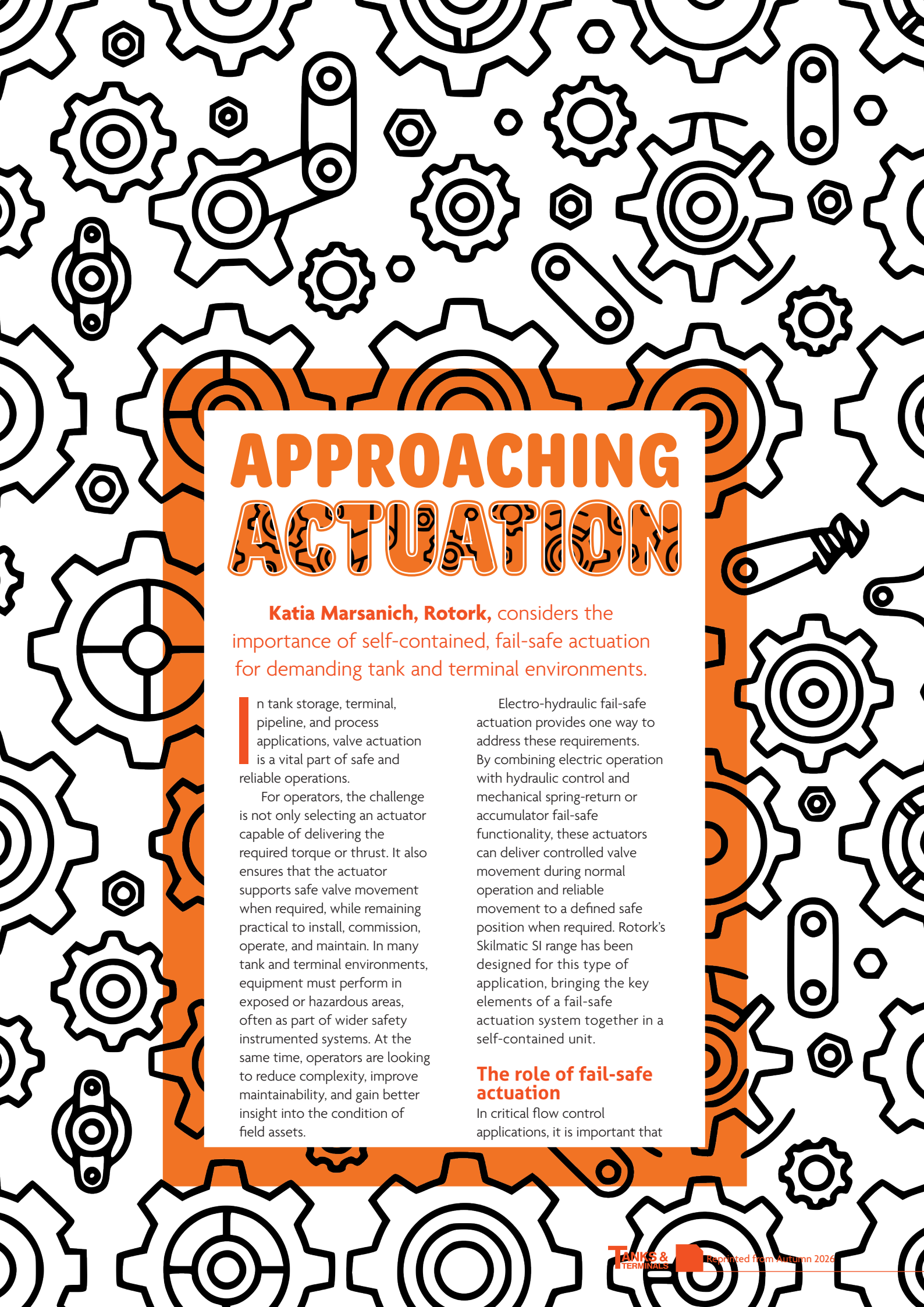




APPROACHING ACTUATION

Katia Marsanich, Rotork, considers the importance of self-contained, fail-safe actuation for demanding tank and terminal environments.

In tank storage, terminal, pipeline, and process applications, valve actuation is a vital part of safe and reliable operations.

For operators, the challenge is not only selecting an actuator capable of delivering the required torque or thrust. It also ensures that the actuator supports safe valve movement when required, while remaining practical to install, commission, operate, and maintain. In many tank and terminal environments, equipment must perform in exposed or hazardous areas, often as part of wider safety instrumented systems. At the same time, operators are looking to reduce complexity, improve maintainability, and gain better insight into the condition of field assets.

Electro-hydraulic fail-safe actuation provides one way to address these requirements. By combining electric operation with hydraulic control and mechanical spring-return or accumulator fail-safe functionality, these actuators can deliver controlled valve movement during normal operation and reliable movement to a defined safe position when required. Rotork's Skilmatic SI range has been designed for this type of application, bringing the key elements of a fail-safe actuation system together in a self-contained unit.

The role of fail-safe actuation

In critical flow control applications, it is important that

valves move to a known position in response to an emergency demand, loss of signal, or loss of power, depending on how the actuator is configured. In tank farms and terminals, this may include isolation duties, shutdown applications, loading and unloading operations, product transfer systems, or safety-related valve functions.

A fail-safe actuator is designed to move the valve to a predefined position, such as open or closed, when a specified condition occurs. This supports plant safety by helping to isolate flow, prevent escalation, or protect equipment and personnel. For many applications, the requirement is not simply that the actuator operates under normal conditions, but that it performs reliably under abnormal conditions.

The Skilmatic SI range is designed primarily for fail-safe applications where functional safety is paramount. The actuators can be supplied as fail-close or fail-open on loss of emergency shutdown (ESD) signal and, when selected, on loss of power supply. They can also be supplied with a stayput option on loss of power supply, where the application requires the valve to remain in position.

This flexibility is important because fail-safe requirements vary by process, valve duty, and site philosophy. Some applications require immediate closure to isolate flow, while others require a valve to open or remain in position to maintain a safe operating condition.

A self-contained electro-hydraulic approach

Traditional electro-hydraulic systems can require external hydraulic infrastructure, including hydraulic power units, pipework, and associated components. While these systems are effective, they can add installation complexity, introduce additional maintenance requirements, and increase the physical footprint of the installation.

Self-contained electro-hydraulic actuators take a different approach. They can combine the simplicity of electrical operation with the precision of hydraulic control and the reliability of mechanical spring-return or

accumulator fail-safe action. The actuator requires only an electrical power supply for operation, with one phase, three phase, or 24 VDC options available.

By integrating the electro-hydraulic control module and fail-safe mechanism into the actuator assembly, the need for complex external hydraulic systems is reduced. This can simplify installation and support a packaged solution for sites where space, access, and maintenance efficiency are important considerations.

The SI range, for example, consists of a self-contained electro-hydraulic control module with a spring-return scotch yoke drive. This design eliminates the high installation and maintenance costs associated with conventional electro-hydraulic systems that use central hydraulic power units.

For tank and terminal operators, the benefits of this approach are particularly relevant. Sites often contain a large number of automated and manually operated valves, spread across bunds, loading racks, jetty areas, transfer lines, and storage systems. Reducing the supporting infrastructure required for fail-safe actuation can help to simplify site layouts and make future service activity more straightforward.

Supporting safety instrumented systems

Functional safety is a key consideration in many terminal and process operations. Actuators used in safety-related applications must be capable of supporting the required safety function and suitable for integration into the wider safety instrumented system.

The Skilmatic SI range is suitable for use in safety instrumented systems (SIS), with SI3 and SI4 actuators certified with Systematic Capability SC-3 and suitable for use in SIL 2 and SIL 3 systems. The actuators also accept various input signals as standard, including ESD and partial stroke testing (PST), thereby supporting safety-critical duties.

PST is particularly useful in applications where valves remain in one position for extended periods but must operate on demand. PST allows operators to test part of the valve stroke without fully interrupting the process, helping demonstrate that the valve and actuator remain capable of movement. PST can be based on time and position, with pressure or torque logged during the test. PST can be initiated via the Rotork Bluetooth® Setting Tool Pro, hardwired or through digital network commands, with results displayed on the actuator screen and the last 25 tests recorded in the data logger.

Within terminal and storage facilities, ESD valves are often integrated into SIS to provide rapid isolation of process equipment during abnormal operating conditions. Fail-safe electro-hydraulic actuators can be configured to move valves to either the open or closed safe position on loss of power or ESD signal, while features such as redundant ESD solenoids, independent hardware shutdown circuits, and PST help support high levels of functional safety and operational integrity.



Figure 1. An engineer commissions the actuator using its integrated display and menu system.



Figure 2. Self-contained electro-hydraulic actuators for safety-critical and fail-safe applications.

Designed for demanding environments

Tank farms and terminals can present challenging operating conditions. Equipment may be installed outdoors, in coastal or exposed locations, in hazardous areas, or in environments with significant temperature variation. Actuators in these settings need to be robust enough to withstand these conditions while remaining accessible for operators and technicians.

Actuators are available with hazardous area certification and ingress protection ratings up to IP66/68 (control modules) and IP66/67 (complete assembly). These designs can be specified for operating temperatures from -50 to +70 °C, supporting use in a wide range of environmental conditions.

Part-turn actuators with torque outputs from 75 to 200 000 Nm (55 to 147 500 lbf/ft) and linear actuators capable of delivering thrusts up to 400 000 N (90 000 lbf), enabling deployment across a wide range of valve duties. Compact spring-return configurations are typically used for quarter-turn valves where fail-safe operation is required.

Commissioning and operation

Ease of commissioning is an important factor in both project delivery and ongoing lifecycle support. In safety-related applications, clear configuration processes and controlled access to settings are also important factors.

To fulfil these requirements, non-intrusive configuration methods allow actuators to be set and adjusted without removing covers. This approach can be especially useful in hazardous or exposed environments, where minimising enclosure access supports safer and more efficient field operations.

Commissioning is typically supported by handheld, intrinsically safe setting tools that provide guided interaction using structured menus. These tools can also facilitate the transfer of configuration data and operational records to control systems, supporting diagnostics and asset management activities.

From an operational perspective, local displays are often used to present valve position, actuator status, and process data, providing visibility at the point of use and supporting maintenance and analysis tasks.

Using data to support maintenance

Reliability is not only achieved through equipment design. It also depends on how assets are monitored, maintained, and managed throughout their life. For operators with large installed bases, understanding asset condition can help prioritise maintenance activity and reduce unplanned downtime.

An onboard data logger captures and stores valve, actuator, control signal operation, and status data, and can store up to 3000 events. This data can be used to support diagnostics, trend analysis, and asset management, helping operators review test history and valve performance over time.

An asset management system plays an increasingly important role in maintaining the performance and reliability of flow control infrastructure. Unplanned equipment failure can affect output, quality, and operational risk, making visibility of asset condition a priority.

By bringing together real-time data and analytics, systems such as Rotork's Intelligent Asset Management platform provide a clearer view of valve and actuator health across a site, helping to identify emerging issues and trends early. This improved visibility supports more informed decision-making, enabling maintenance to be prioritised based on actual condition rather than fixed schedules, while contributing to reduced downtime and more consistent overall performance.

Reducing complexity without compromising safety

For tank and terminal operators, every element of a valve automation system must support safe, efficient, and reliable operation. Fail-safe actuators are a critical part of this picture, particularly where valves form part of ESD, isolation, or safety-related functions.

By combining electric operation, hydraulic control and mechanical spring-return or accumulator fail-safe action in a self-contained package, these systems help reduce the complexity associated with conventional electro-hydraulic systems. At the same time, features such as SIL suitability, ESD, PST, hazardous area certification, non-intrusive commissioning, data logging, and digital communication support the needs of modern terminal operations.

As tank farms and terminals continue to focus on safety, reliability, and operational efficiency, self-contained fail-safe actuation provides a practical way to simplify installation while maintaining the performance and diagnostic capability required for critical valve duties.

The result is an actuator solution that supports both immediate operational needs and long-term asset management: reliable fail-safe movement, simplified field installation, flexible control options, and the data needed to make more informed maintenance decisions. 