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INDUSTRY LEADING VALVE ACTUATION NEWS FROM THE WORLD OF ROTORK



Rotork is 'one-stop actuation shop' for storage tank expansion project

Full story on page 4

WHITE PAPER

CVA Eliminating the problems of compressed air as a power medium

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Rotork delivers all-electric isolating and control valve actuation for gas plants

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Rotork IQ Pro valve actuator installations at Vopak Phase 8. Full story on Page 4.

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Nuclear power contract for *Rotork intelligent valve actuators*

Rotork has been awarded a major contract for the supply of electric valve actuators for the Hong Yan River and Ningde Nuclear Power Station project in China.

More than 1,200 Rotork IQ Pro intelligent electric valve actuators have been ordered for Phase 1 of the new Hong Yan River and Ningde Power Station complex. The power station will deliver a designed generating capacity of 16,000MW when all phases are completed.

The Rotork actuators will operate butterfly, gate and check valves on ancillary plant including high pressure systems serving the station's pressurised water reactors. Traditionally these applications have used basic valve actuation technology with limited functionality, requiring separate motor control centres.

The use of IQ Pro actuators introduces economies and efficiencies associated with integral starters

and controls as well as intelligent Rotork features that are in widespread use in conventional power stations and other contemporary industrial environments. These features include a non-intrusive set-up and commissioning technology, data-logging of valve activity with diagnostic capabilities and the facility for bus system integration.

The contract has been awarded to Rotork's subsidiary company in China and continues Rotork's long association with the fossil fuelled and nuclear power industry programmes in China.

The project is owned by the China Nuclear Power Engineering Company.



Rotork IQ Pro actuator.

Rotork actuators are fulfilling the all-electric specification for valve control on new gas dehydration units constructed at seven sites in the Transylvanian region of Romania.

The new plants have been built for Romgaz, the largest natural gas producer in Romania, responsible for the production of around 40% of the country's consumption. Dehydration plants use triethylene glycol to remove the water from natural gas in order to prevent downstream processing problems such as freezing, corrosion and the formation of hydrates.

The specification for the new plants ruled out the use of air instruments and compressors, dictating the use of explosionproof electric actuators for isolating and control valve duties in the hazardous areas. This has been achieved with ATEX certified Rotork IQT isolating valve actuators and CVA control valve actuators. Both designs feature intrinsically safe, non-intrusive setting and configuration technologies, data logging for diagnostics and preventative maintenance planning, and double-sealed watertight environmental protection.

Rotork delivers all-electric isolating and control valve actuation for gas plants



The CVA offers a highly accurate and responsive method of automating control valves, without the complexity and cost of a pneumatic supply. With resolution figures better than 0.1% and the ability to eliminate position overshoot, the CVA helps to maximise product quality and plant capacity.

The electrical supply to the dehydration units is secured by means of a three-tier fail-safe system comprising mains power supported by a 30 kVA uninterruptable power supply and a 45 kVA natural gas powered generator.

Centralised control is provided by a Cytect SCADA system and ABB plc, housed in a control room adjacent to each plant. In addition, an Eex-e certified PC with mimic panel and identical graphical interface is located within each plant, enabling operators to work on the system in the field as well as the control room. The main contractor for the project is Armax Gaz in Romania; Italian companies Pietro Fiorentini and TNC Tecnoconsulting have been responsible respectively for the process and base engineering and the automation and electrical devices, whilst a total of 76 IQT and 41 CVA actuators have been supplied by Rotork Italy.

Extended scope contract *secures improved fire protection at the Royal Mint*

The Rotork Site Services contract to install an automated shutdown system on the gas main has secured improved safety and fire protection for the coin and medal manufacturer, Royal Mint, in South Wales, UK.

The gas main serves the annealing and pickling plant at the site, where, following a fire, an investigation by Safety, Health and Environmental Services

recommended improvements. These involved the installation of five new actuated butterfly valves on the gas main for emergency shutdown duty and the motorisation of one existing hand operated valve. The new system is designed to close down the gas main serving three buildings within two minutes.

Following an initial survey, Rotork's Site Service department proposed a turnkey solution encompassing the design, procurement,

installation and commissioning of all the elements required for the new system. This included the provision of IQT Pro intelligent electric actuators with integral partial valve stroking software, facilitating function testing of the system without any interruption to normal operations.

In addition to installing the new actuated butterfly valves and retrofitting the existing valve, Rotork has been responsible for many pipework modifications and

the design and installation of a distributed control system with an uninterruptable power supply, comprising shut down panels for each of the three buildings and a shutdown panel for the entire system in the site's central security centre.

Rotork's successful completion of the contract has been achieved with the assistance of the Royal Mint's local sub-contractors including JRP Electrical and the Systems Group.

COVER STORY

Rotork has demonstrated its ability to be a 'one-stop shop' for valve actuation products and services for an oil storage tank expansion project in Holland.

Rotork's activities have encompassed the supply of intelligent electric actuators for isolating, modulating and fail-safe valves, digital control systems, valve gearboxes, valve adaptation, workshop motorisation, on-site retrofitting and commissioning.

Project description

Royal Vopak is the world's largest independent provider of tank terminal capacity for the oil and chemical industries. An expansion project at the Vopak Oil Europoort Terminal has increased the total storage capacity by 160,000 cubic metres to approximately 3.5 million cubic metres, strengthening the company's position as an independent bunker station in the Port of Rotterdam.

Phase 8 of the expansion project involved the construction of four new 40,000 cubic metre capacity fuel oil tanks, a pump pit with manifolds, which connect the tanks to each other and to the rest of the terminal, and an Odour Control Unit (OCU) which is the fourth to be installed on the site for environmental improvement.

Rotork is the holder of a valve actuation framework agreement with Vopak and has supplied more than 1500 actuators, the majority with Pakscan two-wire digital control systems, on the existing Vopak site. In Phase 8 of the expansion project Rotork has delivered a comprehensive range of products and services that illustrate many aspects of its group capabilities.

Rotork is a 'one-stop actuation shop' for storage tank expansion project

Rotork's scope of supply

Rotork has been able to tailor its scope of supply to closely match the technical and logistical demands of the Phase 8 project. Technically, Rotork IQ *Pro* intelligent electric valve actuation with Pakscan two-wire digital control has been adopted for the majority of valve duties throughout the existing facility. Therefore, the bulk of the new valves in Phase 8, totalling 111 on-off installations, have also been motorised with IQ *Pro* actuators. These include gate valves in sizes up to 24 inches on the manifolds and butterfly valves on the OCU lines.

IQ *Pro* actuators are designed for maximum reliability with enhanced functionality, featuring non-intrusive, intrinsically safe commissioning, data logging and predictive maintenance capabilities. A large and comprehensive user display on the actuator's double-sealed IP68 watertight and explosionproof enclosure is the interface for actuator setting, commissioning and interrogation by means of a hand-held setting tool. The illuminated window displays point-and-shoot setting menus, prompts and confirmation of setting data, local and remote control status and additional data including valve torque/position profiles. The hand-held setting tool, featuring bidirectional infra red communication,

facilitates on-site actuator configuration with or without mains power connected.

Bidirectional communication enables data to be retrieved and retransmitted to other actuators, offering the ability to save time and cost when many valves require near-identical commissioning. In addition, actuator data logger files can be downloaded and transported from plant to office for storage and analysis on a PC running Rotork IQ-Insight software. The Pakscan digital network can also be used for this function, enabling data retrieval to be performed in the comfort of the control room. Effective asset management programmes can then be planned and implemented, maximising plant utilisation and minimising the risk of unexpected process interruptions.

Vopak Project Manager, Cees Brijs, comments: "We have been using Rotork actuators for a long time throughout the terminal and find them to be of good quality. In addition, if there is a problem, the response time from Rotork is very swift."

Swift response is assisted by the nearby presence of Rotork Holland's offices and recently enlarged workshops. These facilities have also assisted with the supply of motorised valves for the Phase 8 project by enabling some of the valves to be free-issued to Rotork, fitted with actuators and tested in the workshop before delivery to site as completed packages. In addition, experienced engineers from Rotork Site Services (RSS) have been available to fit actuators to valves on the site when this has been seen to be the best solution, providing additional flexibility to suit the logistics of the contract.

Pakscan

The 111 new IQ *Pro* actuators installed on Phase 8 are linked on two new Pakscan master station networks for communication with the Rockwell PLC that controls the operation of the plant. The new master stations dovetail into the twelve existing Pakscan master station networks that are in service throughout the existing plant. Once again, the local availability of specialised Rotork Site Services engineers has assisted the project through swift final commissioning of the new actuators and Pakscan networks.



A Rotork Skilmatic EH electro-hydraulic actuator on safety related fail-safe valve duty at Vopak Phase 8.



Above and below - Rotork IQ Pro valve actuator installations at Vopak Phase 8.

Pakscan is a digital control system designed specifically for valve actuators and has actuator focused features that are unavailable from other designs. For example, the capacity for up to 240 actuators on a fault tolerant field network, up to twenty kilometres long without repeaters, is an important reliability and economic consideration in the spacious environments storage tank farms. Repeaters require separate power supplies, can slow the data transmission speed and introduce a single point of failure. The failure of a repeater will result in loss of communication with all downstream field units.

Pakscan also provides dual host communication paths as standard and has the ability to isolate any field based fault without interrupting communication with other units on the loop. In fact Pakscan's configuration provides built-in redundancy in every area – from the valve to the control room – ensuring that vital information for the host controller on valve position, status and condition is as secure as possible.

Specialised actuator duties

In addition to the predominant area of supply involving IQ Pro actuators from Rotork Controls Division, some specialised areas of actuation duty have been fulfilled with equipment from other divisions within the Rotork organisation. For example, Rotork Gears has supplied IS range spur gearboxes with stem extensions to enable double block and bleed valves to be conveniently operated from a nearby mezzanine walkway.

Rotork Fluid Systems has supplied Skilmatic SI/EH range electro-hydraulic fail-safe actuators for safety-related duties. These compact and robust actuators deliver a highly reliable means of valve management and positioning a valve to a safe condition, selectable for fail-safe to open, fail-safe to close or lock in position on power failure or emergency shutdown (ESD) signal. Based on

Rotork IQ Pro intelligent actuation technology, the Skilmatic SI/EH control module facilitates the same simple, safe and swift non-intrusive commissioning by means of a hand-held setting tool. Settings including internal hydraulic pressure, valve position, position limits, control, alarm and indication functions can be accessed and adjusted using user-friendly point-and-shoot menus. Actuator status, control and alarm icons are provided on the illuminated LCD display, which also gives access to real-time information, help screens and diagnostics. Designed to SIL3 standards for use on safety critical applications, the actuators are also capable of partial stroke testing, something of particular importance on ESD applications.

Control valve retrofit

During the project a problem was identified with some installed control valves in the boiler house that provides heating for the storage tanks. The 6 inch valves were equipped with linear electric actuators that had proved to be incapable of fully closing them at full differential pressure. Furthermore, the actuators operated from a 0 -10V control signal that is non-standard for the industry and required an engineer from the manufacturer to be flown in to commission them as the valvemaker was unable to do this. Other issues included the mounting of limit switches on the exterior of the enclosure, where they were vulnerable to damage, a nitrogen gas filled enclosure design that made maintenance very difficult and junction boxes that were judged to be not robust enough.

The situation gave Rotork Process Controls the opportunity to offer its CVA product, leading to the first substantial order from Vopak for this innovative control valve actuator. The CVA electric actuator provides extremely precise control valve operation with repeatability and resolution performance at less than 0.1% of full scale.

In addition to the convenience of all electric control and operation, the CVA uses Rotork's non-intrusive communication technology for swift and user-friendly actuator set-up, auto calibration and adjustment. Further benefits include comprehensive performance data-logging, a double-sealed explosionproof and IP68 watertight enclosure for environmental protection and programmable fail-to-position options using integral super-capacitors. The CVA data logger stores operational data such as valve torque profiles, events and statistics that can be downloaded for detailed analysis using Rotork Enlight software. By anticipating potential problems, preventative maintenance can be planned without interruption to the operation of the plant.

Four CVL1500 linear actuators have been ordered for retrofitting to the installed control valves by engineers from Rotork Site Services. Rotork's responsibilities included the design and fabrication of new adaptation between the CVAs and valves, which has been performed by Rotork Valvekits, the specialist valve accessory company in the Rotork Group.

Summary – A project involving the participation of every part of the Rotork Group:

Rotork Controls – Rotork IQ Pro intelligent valve actuators, Rotork Pakscan two-wire digital control systems.

Rotork Fluid Systems – Rotork Skilmatic SI/EH Pro electro-hydraulic fail-safe valve actuators.

Rotork Process Controls – Rotork CVA electric control valve actuators.

Rotork Gears – Rotork IS Range spur gearboxes.

Rotork Valvekits – Valve/actuator adaptation.

Rotork Site Services – Workshop valve motorisation, on-site valve motorisation, retrofitting and commissioning.



Planning in detail *delivers* successful outage service for power station actuators

Rotork Site Services in Australia has completed the comprehensive workshop service of twenty-eight Rotork IQ valve actuators within the critical four week timescale dictated by a power station shutdown.

The actuators have been installed at the 487 MW Pelican Point combined-cycle gas turbine power station near Adelaide in South Australia for seven years. On-site facilities to carry out the work were limited, so a decision was made to remove the actuators and transport them to Rotork's own fully equipped workshops at Ballarat, 600 kilometres from the power station.

Rotork took complete control of the project, hiring a truck to transport the actuators rather than relying on a third-party when the precise timing of activities would not be known.

The project was divided into four, week-long portions, involving removal, workshop service, return and refit and re-commission.

Actuators required only relatively minor repairs, mainly caused by environmental exposure. In all cases, only genuine Rotork parts were used, enabling the actuators to be tested and returned in an as-new condition. All the work was completed within the strict timescale, ensuring that Rotork Site Services' performance would not delay the power station's plans for re-starting.



One of the main considerations concerning the valve actuators at the Bens WWTP (Waste Water Treatment Plant) in Coruña, Spain, was its close proximity to the Atlantic coast and the resulting saline atmosphere in the area.

It is well known that this environment is highly corrosive to exposed electrical equipment and can be a major cause of unreliability and breakdowns.

Rotork was able to reassure the main contractor, engineering company and the end user by referring them to the nearby Repsol Refinery, where all the installed actuators are Rotork's intelligent IQ design, together with the Rotork Pakscan two-wire digital control system.

Although the specification for the Bens plant called for two hundred Rotork AWT range actuators, which are designed for simplified control duties in comparison to the IQ, they share the same watertight and non-breathing enclosure design. The watertight and dust tight enclosure, a benchmark of Rotork electric actuator designs, is rated to IP68 – IEC60529 and suitable for submersion to a depth of 7 metres for 72 hours.

Rotork IQ actuators, this time with Profibus digital control, have also been installed at a water treatment plant in Munguia, providing further evidence of the Rotork enclosure's ability to resist long-term exposure to corrosive

Corrosion resistance essential for Spanish WWTP valve actuators



environments without sacrificing reliability. The Bens WWTP illustrates Rotork's ability to tailor the specification of the equipment it supplies to economically suit the technology, design and level of control required by the application. This ability has contributed to the company's success in becoming a leading supplier of valve

actuation equipment to the world's water and waste treatment industry. Equally important, Rotork can provide locally based, life of plant service and maintenance support for its products, ensuring optimum plant performance and therefore low long-term cost of ownership.

Rotork IQ Pro intelligent electric valve actuation technology will assist the operation of the largest and most advanced waste water treatment, water reuse and sludge treatment plant in the Middle East.

Described as a 'landmark' project, the Doha North Sewage Treatment Works in Qatar has a peak waste water treatment design capacity of 439,000 cubic metres per day, serving a projected population of 900,000 by 2020.

Advanced membrane and ultra-violet treatment technologies are being utilised to reclaim high quality water for non-potable purposes, thereby freeing-up precious drinking water supplies for the community.

The site's sludge treatment plant will also receive and treat sludge from waste water plants throughout Qatar, the treated sludge being used as an organic fertiliser or a source of green energy. Defined as a model project of sustainable development for communities worldwide, Doha North STW is being constructed by a partnership between Keppel Seghers, the environmental engineering arm of Keppel integrated Engineering, and the Public Works Authority of Qatar.

Rotork IQ Pro actuators feature an IP68 watertight enclosure with non-intrusive setting, commissioning and interrogation technologies. An illuminated window displays setting prompts and confirmation of setting data, local and remote control status and additional data including valve torque/position profiles.

The hand-held setting tool, featuring bidirectional non-intrusive infra red communication, facilitates on-site actuator

Rotork valve actuators in 'landmark' waste water treatment project



Rotork IQ Pro actuators fitted to gate valves in sizes up to DIN 1800, destined for the Doha North Sewage Treatment Works. (Photograph by kind permission from Glenfield Valves Ltd).

configuration with or without mains power connected.

Bidirectional communication enables data to be retrieved and retransmitted to other actuators, saving immense amounts of time when many valves require near-identical commissioning. In addition, actuator data logger files can be

downloaded and transported from plant to office for storage and analysis on a PC running Rotork IQ-Insight software. Effective asset management programmes can then be planned and implemented, maximising plant utilisation and minimising the risk of unexpected plant interruptions.

Croatian water treatment plant *chooses Rotork valve actuators*

Rotork RC200 series pneumatic actuators have been installed for valve control and operation in a new water treatment plant at the Sisak Power Plant, south of Zagreb in Croatia.

The Croatian national power company Hrvatska Elektroprivreda (HEP) has invested €4 million in the new plant, which filters and demineralises water from the nearby River Sava before it is used for steam generation and media for the district heating system serving the city of Sisak.

The water treatment capacity is approximately 130 cubic metres an hour and the process is accurately controlled by RC200 valve actuators equipped with E4L limit switch boxes. The actuated valve packages were carefully selected

for reasons including reliability, environmental considerations and overall cost effectiveness.

Rotork RC200 series actuators feature a modern scotch yoke mechanism that provides a high start and end torque output in a very compact package. Pistons are guided in two places by high performance bearings which ensure proper alignment and long seal life.

The RC200 design has the lowest weight and the smallest external dimensions of any pneumatic actuator with an equivalent torque output. This contributes to a compact, lightweight and robust actuated valve package.

In addition, the design has less stroke volume than comparable rack and pinion actuators, providing a considerable saving in the use of compressed air.



Compact automatic filter *enables final effluent recycling*

A compact Rotork actuated automatic backwashing filter is providing reliable, efficient and economical filtration of final effluent for drum thickener washing duty at a sewage treatment works on the south coast of England, UK.

Using filtered final effluent is saving the operator the considerable cost previously incurred by the use of mains water for this duty.

The Cross Phoenix Type R filter is installed at the Wessex Water Weymouth Sewage Treatment Works, a 'flagship' Wessex Water site utilising state-of-the-art activated sludge treatment in a fully enclosed environment. The Cross filter incorporates a Rotork IQTF electric rotary valve actuator to operate the integral backwashing valve, reversing the flow to each of the unit's six stainless steel

filter coils in sequence, without interrupting the continuous filtration performance.

Backwashing is triggered automatically by a pressure differential switch that senses the increased pressure drop across the filter caused by the build-up of debris on the filter coils. The filter is rated at 200 microns and operates at a maximum flow rate of 18 litres per second. The compact installation at Weymouth incorporates a pump on the inlet from the adjacent final effluent holding tank which supplies the filter. The pump increases the inlet water pressure to 6 bar, providing enough pressure to ensure both efficient washing of the drum thickeners and backwashing of the filter coils. Cross filter coils utilise a patented 'zero gravity' design, whereby the coils open evenly along their entire length during backwashing to ensure completely



efficient cleaning without any mechanical scrapers or other moving parts.

The Cross Phoenix Type R filter has been developed specifically for the water and waste treatment industry and claims to be the only filter of its type to use a Rotork actuator for this type of application. The IP68 watertight actuator provides a single electrical interface for power and control cabling and

offers the proven benefits of Rotork actuation technology as standard, including non-intrusive setting and commissioning, operational data-logging, diagnostics and compatibility with water industry-preferred digital control protocols including Profibus. Unlike other filter designs, installing the Phoenix Type R filter is claimed to be as simple as installing a single motorised valve.

Rotork's innovative CVA electric control valve actuator is providing a critical fail-safe function on packaged oil-water separator (dewatering) units supplied to a refinery in Antwerp, Belgium.

Manufactured by Facet, the dewatering units utilise a passive gravity-flow technique for separating oil and solids from waste water in storage tanks. Specially designed coalescing plates manipulate the flow of water, forcing the oil to the top and enabling the solids to sink to the bottom, whilst the cleaned water passes through. The filtered water is clean enough to be released into the environment.

The Rotork CVA actuators have been installed to guard against accidental oil spillages or contamination that could occur if the power or the control signal to the unit is interrupted. The explosionproof certified CVA actuators will immediately close valves on the water outlet and oil return lines if the power or signal is lost.

Rotork demonstrated that the compact CVA actuator design uses integral super-capacitors to enable fail-safe operation, eliminating the inconvenience, cost and additional space considerations associated with separate battery packs or alternative back-up power sources,

Fail-safe duty for Rotork CVA electric actuators *guards against accidental oil spillages*



Dewatering packages under construction, with CVA actuators installed.

particularly in the hazardous environment of a refinery. In addition, programming the fail-safe operation is a standard part of the CVA's non-intrusive commissioning routine, simplifying instrumentation requirements. Space was an important consideration in the overall design, since each dewatering unit is packaged in a compact weatherproof housing with an external manifold for on-site pipework connections. Rotork also promoted the adoption of a linear valve design for the application as an alternative to the rotary ball valve originally specified.

With a stroke of only 7mm, the linear valve fully closes in only 1.5 seconds, instead of the 15 second closing time for the ball valve, providing increased fail-safe response and security. In addition to the convenience and speed of non-intrusive commissioning, the CVA also features built-in data logging, providing diagnostics to reduce the risk of unplanned process interruption.

The actuators for this contract have been supplied by Rotork Holland for a total of 11 dewatering units.

A programme of valve motorisation is a central feature of an extensive automation project that will obtain, store and process data in real time from a network of liquid hydrocarbon product pipelines in Latin America.

The project is installing a SCADA control system for the integration, monitoring and control of valves at more than 100 refining product, storage and injection sites on over 2,500 kilometres of pipeline. Unlike oil pipelines that transport only crude oil, product pipelines such as these transport a range of liquid hydrocarbons.

The project includes the necessity to replace manual gearboxes with actuators on over 100 mostly remotely sited valves. The actuator specification demanded a self-contained design, suitable for remote, exposed locations with only limited electric power availability. Further constraints of the specification included:

- Self-locking drive mechanism to prevent valve positional drifting.
- Permanent lubrication.
- Adjustable speed control.
- Manual operation.
- Low gas consumption.
- Operation available from stored gas energy source.
- Compact overall dimensions.

After reviewing the available technologies, Rotork's engineering department has been able to select the best solution with a standard product from the company's fluid power actuation portfolio.

The Twin Power is a self-contained multi-turn actuator, operated either pneumatically or hydraulically. The mechanical design is based on either a bevel gearbox for linear valves or a worm gearbox for quarter-turn valves. The actuators on this project are designed to operate from stored nitrogen tanks, sized for three valve cycles. Three operating modes are available:

- Remote control via a solenoid valve and stored nitrogen gas.
- Local control via manual pushbuttons and stored nitrogen gas.
- Local manual operation via a hand crank.

The electrical supply requirement is 12 VDC or 24 VDC, facilitating solar/wind powered renewable energy battery operation in remote locations. The actuators are supplied with an environmentally protected stainless steel control cabinet containing Local/Remote/Manual selectors, Open/Close pushbuttons,

Valve automation delivers centralised monitoring and control to pipeline network



solenoid valves, manifold blocks, flow control valves, limit switches and electrical terminals.

The new Rotork actuators and those already installed on the pipeline network will provide a vital role in the operation of the new SCADA system, which will yield greater security in the operation of facilities and mitigate risks for personnel, local communities and the environment.

The system is designed to centralise the monitoring of all operational variables, including pressure, temperature and fluid composition, all of which are significant factors in the transport, storage and distribution of liquid hydrocarbons.

In addition to increasing the security of operations, the integration of product storage field equipment is expected to improve efficiency and reliability by optimising the management of operational data and information. The SCADA system will make it possible to obtain, store and process data from geographically dispersed areas, in real time, to ensure the timely delivery of crude oil required by refining centres and the refined products needed to meet the demands of distribution and marketing centres. This would not be possible without the ability of self-contained actuators to operate valves in remote locations and communicate their activity and status to the centralised control system.

The remote area of north eastern British Columbia in Canada, where ambient seasonal temperatures can fluctuate between +30 °C and -40 °C, is the destination for a major order for Rotork GO range gas-over-oil pipeline valve actuators.

The application is a new Class 300 sour gas (0.1% H₂S) gathering system and pipeline owned by the Murphy Oil Company Ltd. Known as the Tupper West Gathering System, the project follows Murphy Oil's acquisition of the Tupper Field leases in 2007. 20 Rotork GO actuators have been ordered, three for barrel isolation and 17 for pipeline Emergency Shutdown Duties (ESD). The Rotork actuator design was selected due to the remote geographic location and challenging environment of the application, demanding both long term reliability and

Remote Canadian destination for Rotork pipeline valve actuators

low maintenance. Rotork GO actuators are designed to use pipeline gas as the power source and are available with control configurations to suit virtually any operational requirement. Low or high pressure control logic options, speed control in both directions and hydraulic manual override are amongst the standard features. With torque outputs up to 600,000 Nm (5,000,000 lbf-in), Rotork GO actuators are certified to IP66M/67M, ATEX 94/9/EC and in accordance with PED 93/27/EC. For this project the actuator electrical components are CSA Class 1, Division 1 approved. A separate sweet fuel gas line provides the power source for the actuators.



An engineer at the C E Franklin workshop tests the hydraulic manual override on one of the Rotork gas-over-oil actuators (model number GO-085S-180H/D1) bound for the Tupper West Gathering System.

The order has been supplied by Rotork Fluid Systems' agent in Alberta, C E Franklin. Franklin has also fitted the actuators to 16 inch ASME Class 300 ball valves in its workshop facilities at Edmonton.

The Tupper West Gathering System project, which is being engineered by Equinox Engineering of Calgary, is a major installation for Rotork GO actuators in Canada. The project is also utilising Rotork pneumatic actuators at manned compressor station valve sites.

Rotork IQ valve actuation upgrades assist Thames Water's Beckton improvements

Thames Water Beckton is one of Europe's largest sewage treatment works, serving 3.5 million people in the area of east London.

A £190 million improvement project is underway at the site that will enable it to treat up to 60% more sewage and fully treat increased flows during heavy rainfall. The result will improve the quality of the River Thames and also allow for a 10% population increase until 2021.

A key area of the improvement is the motorisation of manually operated valves, upgrading of obsolete actuation equipment and the expansion of Profibus DP digital two-wire control and monitoring throughout the site. Rotork's specialist Retrofit department is closely involved with these activities, continuing Rotork's long associated with Thames Water and a series of previous valve upgrade programmes at Beckton.

One of these recently included the installation of Rotork IQ Pro intelligent electric actuators on the site's inlet penstocks, replacing manually operated electric hoists and chains. The actuators here are programmed internally to pause when opening the substantial 150 x 300 cm penstocks at 10% of the travel position, in order to prevent any build-up of sludge from potentially overwhelming the inlet screening plant.



Some of the Rotork IQ Pro intelligent electric actuators on the inlet penstocks at Beckton sewage treatment works.

The latest Rotork retrofit project has focussed on the upgrade of valve actuation on the site's primary settlement tanks and activated sludge plant. Seventy-five IQ Pro actuators have been installed on existing valves and penstocks in a scheme that includes the introduction of fully actuated operated of the blowers with Profibus monitoring and control. In addition to the sizing, supply and installation of the new actuators, Rotork's contract has included the design and manufacture of associated valve adaptation parts. The residual sludge produced at Beckton

is burnt in the site's SPG (Sludge Powered Generator), which produces 7.5MW of electricity for use on-site.

The Beckton improvement project is due for completion in 2014, by which time a 1.5MW wind turbine will also have been installed to provide a further 8% of the energy needed to run the site. In a separate project, all sixteen of Beckton's primary settlement tanks – an area the size of ten football pitches – are being fully covered in order to reduce odour emissions by 50%.

Rotork IQ Pro actuators specified for *state-of-the-art water treatment plant in China*

Over 500 of Rotork's market-leading IQ Pro intelligent electric actuators have been supplied for valve control and operation throughout two new state-of-the-art water treatment plants serving the city of Wuxi in Jiangsu Province, 200 kilometres north of Shanghai.

The new plants, which are owned by the Wuxi Water Supplies Company, a subsidiary of the Wuxi Municipal Government, have a designed treatment capacity of 900 million litres a day.

The contract involved 480 IQ rotary and 60 IQT quarter-turn valve actuators. For the plants' automation they are controlled by Allen Bradley PLCs connected to Intouch SCADA distributed control networks. Processes controlled encompass intake, settlement

tanks, reverse gravity filter beds, contact tank dosing and distribution to the mains supply.

Rotork IQ Pro actuators feature a large and comprehensive user display, with a customer configurable multilingual text capability, which is the interface for non-intrusive actuator setting, commissioning and interrogation by means of a hand-held setting tool. The illuminated window displays setting prompts and confirmation of setting data,



Rotork IQ Pro actuators installed on filter bed valves at Wuxi.

local and remote control status and additional data including valve torque/position profiles. The hand-held setting tool, featuring bidirectional non-intrusive infra red communication, facilitates on-site actuator configuration with or without mains power connected.

Bidirectional communication enables data to be retrieved and retransmitted to other actuators, saving immense amounts of time when many valves require near-identical commissioning.

In addition, actuator data logger files can be downloaded and transported from plant to office for storage and analysis on a PC running Rotork IQ-Insight software.

Effective asset management programmes can then be planned and implemented, maximising plant utilisation and minimising the risk of unexpected plant interruptions.

Rotork CVA delivers *accurate valve control for Asian glass manufacturer*

An Asian fibreglass manufacturer uses electric valve actuators at several of its plants. Previously, a locally made control valve and actuator was used, which suffered from poor performance and inaccurate valve control.

Raw fibreglass material in pellet form is transported from a hopper into a furnace and melted. Globe control valves must accurately control the ratio of natural gas and oxygen supplied to the furnace to melt the raw glass. The correct mixture ensures good combustion and provides a lean burn, saving both gas and oxygen. The precision of the CVA now delivers this accurate control. In the photograph, the natural gas pipes are yellow and the oxygen pipes are grey.

The melted material is then extruded into fine threads of fibreglass which is sprayed with water to cool. The cooled threads are reeled into coils and sold as the finished product. These threads are extremely strong and are used in the manufacture of pipes, tanks, car parts and boats, amongst others.

The CVA offers a highly accurate and responsive method of automating control valves, without the complexity and cost of a pneumatic supply. As this fibreglass application illustrates, an increased focus on production costs and efficiency means that accurate control is vital. With resolution figures better than 0.1% and the ability to eliminate position overshoot, the Rotork CVA helps to maximise product quality and plant capacity.

In keeping with Rotork's 'sealed-for-life' philosophy, CVA set-up and calibration is carried out non-intrusively with a Bluetooth™ enabled PDA using the freely downloadable Rotork Enlight software, so that no

access is required to the main electronics compartment during commissioning. In addition, the terminal compartment is separately sealed, eliminating the risk of moisture ingress during installation.



Acquisition of K-Tork extends *Rotork's valve actuation product portfolio*

The acquisition of K-Tork International Inc. has provided significant additional scope of supply to Rotork's product portfolio.

K-Tork vane-type pneumatic actuators and Type K damper drive systems are well established in many industries and utilities. The simple one-moving-part design provides very accurate modulating control and long term service life in high cycle applications. K-Tork valve actuators are suitable for ball, butterfly and plug valves and can be easily retrofitted to existing valve installations. The range includes double-acting and spring-return options, manual overrides, open/close and modulating controls.

Type K damper drives are designed to control the combustion air and flue gas on power generation boilers, steam boilers, furnaces and process heaters. They are designed as 'drop in place' replacements for many older generation damper drives and will interface with conventional or bus network control systems. K-Tork products complement existing product ranges in the Rotork Fluid Systems Division and further strengthen Rotork's market presence in the water, industrial and power sectors.

K-Tork at work:

Retrofit at effluent treatment plant assists environmental recycling

K-Tork has successfully completed a \$1.9M retrofit contract for the supply and installation of valve actuators at the Las Vegas Water & Pollution Control facility.

In a desert area that barely sees 4 inches of rainfall per year, the use of reclaimed water for irrigation and other non-potable uses is on the increase. Treating and delivering recycled water saves the cost of pumping water from Lake Mead. While recycled water for irrigation does not expand the Las Vegas Valley's available water supply, it reduces energy costs and environmental impact. As a part of the reclaimed water treatment process, the tertiary filtration facility has 30 gravity filters that assist in removing the fine particles and phosphorous before the final disinfection treatment.

Prior to the upgrade, the valves on these filters were operated with AWWA cylinder actuators that did not provide reliable open / close or modulating service and were difficult to troubleshoot. The consulting engineer recommended the use of K-Tork vane actuators due to their simplicity (one-moving part) and long-lasting seal design. As a result, 205 K-Tork vane actuators were selected for retrofitting on



the AWWA butterfly valves, ranging in size from 12 to 60 inches, in the filter gallery and intake piping. The retrofit process was complicated and required a detailed field survey to measure the valve mounting dimensions, check for clearances and to provide easy operator access to the manual override and calibration points. Prior to fabrication, 3-D CAD drawings were provided for the engineer and end user, for review and approval.

All 205 actuators were installed without any linkage kit modifications or any obstruction issues and the commissioning was completed on-time. The success of this complex project was achieved with some excellent assistance from Southwest Valve & Equipment, the Rotork and K-Tork representative in the area.

Type K Damper Drives – five years arduous service, no maintenance and no breakdowns

K-Tork has supplied Ash Hopper (AH Series) damper drives to the Entergy Corporation's White Bluff Generating Station in Redfield, Arkansas to replace cylinder actuators that were proving to be unreliable. The units were installed in 2006 and after five years of operation a recent inspection has confirmed that the Type K products have solved a major maintenance problem at the plant.

The White Bluff Generating Station historically purchased 40-50 pneumatic cylinder actuators per year to operate their ash hopper rotary gates under routine maintenance budgets to replace failing cylinders. In 2006, the coal-fired power plant installed 136 Type K 'AH Series' damper drives to replace the poorly performing cylinder actuators. The units were fitted with a high-cycle 'no-play' linkage kit that eliminates hysteresis to adapt the TK-2 rotary drives to

the existing ash hopper equipment. After five years in service, there have been no failures. Not a single work order has been issued, no spare parts have been required, no seal kits installed and no units have been removed for servicing for any reason. By EPA mandate, ash particulate must be contained and cannot simply accumulate in piles on the ground in the way that coal piles are kept.

The pneumatic conveyors that operate under the precipitators collect the ash and push it with compressed air into collection bins, where it is sold as an ingredient for dry wall production or used in concrete mixes for civil construction. When a conveyor bank is in operation, the Type K damper drives cycle every 90-120 seconds 24/7.

The Type K Area Sales Manager, Dean Stedman, has surveyed the remaining 26 drives required for Unit 2 and an additional 120 drives required for Unit 1. Together with the Type K Representative, Boiler Valve and Equipment Company, K-TORK hopes to complete the Ash Hopper retrofit in 2012.



The ash hopper rotary gates at the White Bluff Generating Station before and after the retrofitting of a Type K damper drive.

Entergy Corporation is an integrated energy company engaged primarily in electric power production and retail distribution operations. Entergy owns and operates power plants with approximately 30,000 megawatts of electric generating capacity, and it is the second-largest nuclear generator in the United States. Entergy delivers electricity to 2.7 million utility customers in Arkansas, Louisiana, Mississippi and Texas.



Grant Wood, Managing Director, Rotork Controls Ltd.

New Managing Director for *Rotork Controls*

Grant Wood has been appointed Managing Director of Rotork Controls, the international electric valve actuation division of the Rotork Group of Companies.

Grant, 44, joined Rotork in 2006 as Director of Site Services, where he has been responsible for growing Rotork's worldwide after sales and engineering projects business.

In his new position he will lead the further acceleration of Rotork's activities with electric valve actuators and control systems through the further development of existing Rotork products and subsidiaries,

green field initiatives to extend market and product coverage, and acquisitions. He will also continue to improve Rotork's internal operations to further enhance the value delivered to customers and shareholders.

Before joining Rotork, Grant's career has included management consultancy and he has considerable experience of utility, financial and energy sectors.

His qualifications include an engineering degree from Imperial College London and a Masters in Business and Administration at the European School of Management in Paris, gained with a scholarship from the Royal Academy of Engineering and Sainsbury Management Fellows.

Rotork is pleased to announce the acquisition of Valco Valves and Automation AS, the group's long-standing sales and service agent in Norway.

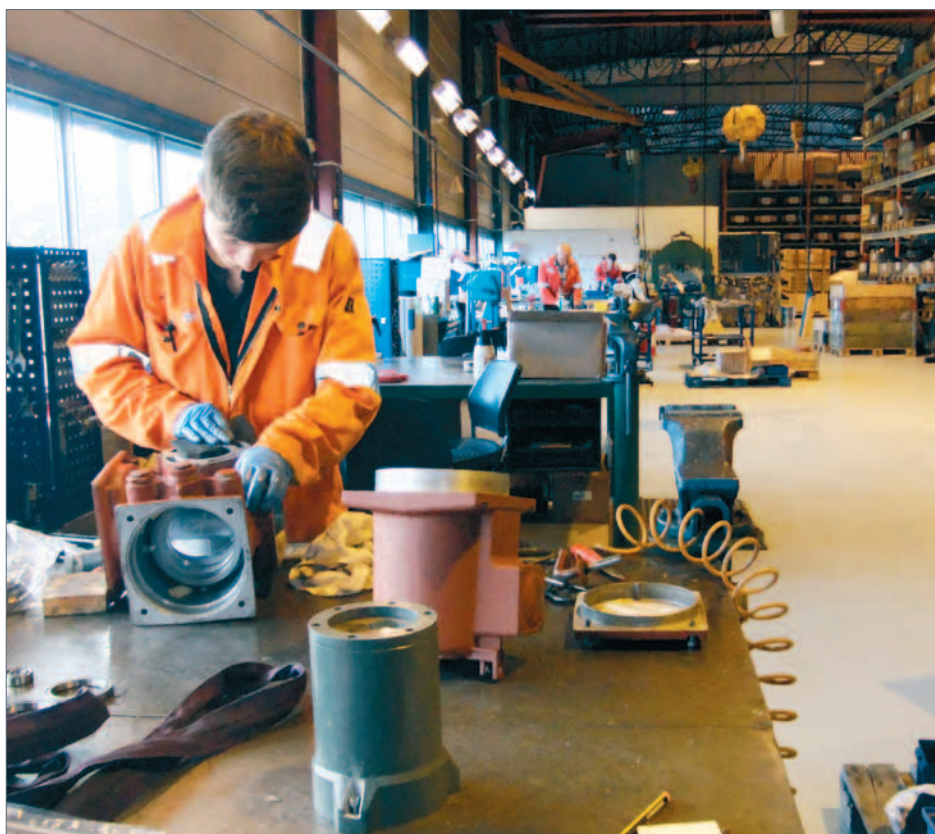
Valco Valves and Automation, which will now be known as Rotork Norge, has over 30 years experience of the valve actuation and control industries, encompassing sales, servicing, maintenance, repairs and total valve

Acquisition of long-standing agent creates *Rotork Norge*

management. The business is based at a 900 square metre workshop facility in Agotnes near Bergen, Norway, which offers full service and overhaul support for all Rotork products, including large fluid power actuators.

The company is particularly active in the offshore topside and subsea oil and gas industry, with 6 offshore trained staff enabling service work to be performed anywhere in the country – including the offshore sector – even at short notice. The acquisition enables Rotork to further develop its involvement in Norway through increased sales and service offerings for electric and fluid power actuation products, control systems and valve accessories.

Rotork Group Chief Executive, Peter France, explained: "The acquisition of Valco Valves and Automation strengthens our presence in the important Norwegian market. Our strategy is to provide our customers with local support and this acquisition continues our international expansion plan. Please join me in welcoming General Manager, Vidar Rossgård, and his team to the Rotork family."



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The workshop at Agotnes, busy motorising valves with Rotork IQ actuators for the Oseberg offshore platform project.



Tim Bessex, Sales Director, Rotork Controls Ltd.

Tim Bessex joins as Sales Director for Rotork Controls

Rotork is pleased to announce the appointment of a new Sales Director, Tim Bessex. Tim will be based at Rotork's head office in Bath and will be responsible for global sales for Rotork Controls, the electric valve actuation division.

He will be building on the success of Rotork's current sales position by creating a sales strategy for his team to adopt as well as working closely with the other divisions within Rotork. Tim takes over from Carlos Elvira who has moved to his new position as Group Sales Director.

With over 17 years of sales experience with a motion and fluid control technology company, Tim brings a wealth of knowledge to the business. He gained an Engineering Apprenticeship and Engineering Degree with honours that led him to his first role in sales. He was promoted internally during his 17 years at the company including working for their semi conductor and advanced technology group. His last role was Global Sales Manager working for the nuclear part of the business.

Tim commented: "I'm really excited about joining Rotork and working with the sales teams around the world to strengthen our global presence."

The Rotork Device Type Manager (DTM), providing enhanced commissioning and asset management benefits for Profibus-enabled Rotork valve actuators, has received Certification from the FDT Group.

The Rotork Profibus DTM works with Field Device Tool (FDT) technology to provide customers with a standard interface, independent of the communication protocol and the software environment of either the device or host system. End users have a single point to access and manage data from multiple networks using different protocols and containing equipment from multiple vendors. It can be used with the majority of Rotork actuator ranges, including IQ Pro, CVA, Skilmatic SI/EH and ROMPak.

In addition to accessing configuration, parameterisation and graphing for all supported actuator types from the comfort of the control room or a laptop computer, the DTM detects when it is connected to the latest generation of IQ Pro Profibus actuators. It then automatically displays the extended actuator configuration data and allows for the downloading of extensive logged data and complete actuator configuration.

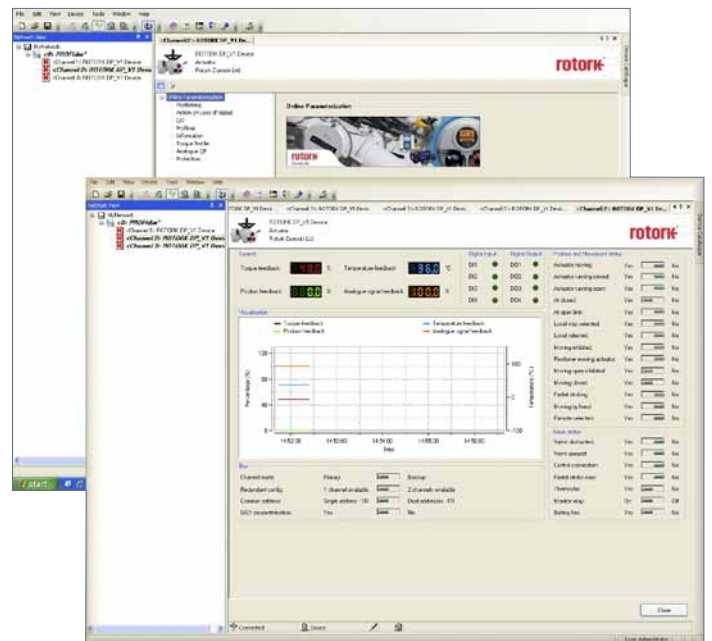
Benefits of the DTM include the elimination of trips into the field to review, record or change actuator configuration

Rotork Profibus Device Type Manager receives FDT Group Certification

information, particularly if the actuators are situated in remote, harsh or potentially dangerous environments. The same applies to the collection of data logger information that can be used for asset management and to diagnose problems. Maintenance can then be scheduled for the appropriate time, avoiding costly and inconvenient interruptions to plant operations. In addition, the DTM's easy to use common interface reduces the demand for training, further contributing to the overall lowering of costs and speeding up of plant processes facilitated by Rotork's DTM software.

Whilst FDT Group Certification signifies that the Rotork Profibus DTM can work with systems from all DCS manufacturers, Rotork has also invested in interoperability testing with a selection of vendors including ABB, Endress+Hauser, Honeywell, Ifak, M&M Software, the Phoenix Contact Group and Yokogawa to confirm optimum performance in a wide variety of applications.

Rotork is a member of the FDT Group and is committed to continually improving and



The Rotork DTM Device Observation Screen, superimposed on the Parameterization Screen.

developing the capabilities of this technology to provide customers with the latest capabilities. Future plans include development of Foundation Fieldbus and HART device DTMs to compliment the existing Profibus DTM which is now available.

The Rotork DTM software, a new Rotork DTM brochure and the FDT Certificate are all available to download free from the Rotork website, in the Profibus literature section:

<http://www.rotork.com/en/product/index/profibusliterature>

Rotork's comprehensive valve actuation training activities have expanded with the opening of purpose-built facilities at Rotork Singapore in response to the continuous growth of Rotork product markets in the Far East.

Rotork Training expands with purpose-built facilities in Singapore

Rotork's long-established training centre at the company's UK headquarters was originally born out of on-site service activity. As a result, to this day, the full-time training staff – now based in the UK, USA and Singapore – are all experienced site service engineers with practical 'hands-on' knowledge of Rotork's wide range of actuation products. Drawing on years of practical experience, training programmes are tailored to suit individual customers' asset ownership and their specific requirements, offering a more valuable solution than fixed training courses.

Training is available for all aspects of actuator ownership and is fully supported by actuated valve hardware for wiring, commissioning, dismantling and trouble-shooting exercises. Training, which can also be provided at customers' premises anywhere in the world, is



Training in progress in Singapore...

complemented with dedicated training literature, technical manuals and certification.

Training support is also available from a series of E-learning modules on the Rotork website, aimed at anyone with a requirement to commission and use Rotork actuators in the field. The modules consist of interactive learning programmes designed to be equally useful as a refresher course for those who deal with the equipment infrequently.

Training activities are widely used by Rotork customers in the oil, gas, power and water industries as well as Rotork agents and distributors.

The availability of E-learning and the opening of the new facility in Singapore are both evidence of Rotork's on-going commitment to provide these services on an increasingly accessible and localised basis.



...and Rochester USA...



... and Bath UK.

Asset management *for actuated valves in the 21st Century*

The key benefit of effective asset management for the actuated valve end user is an economic one. The implementation of preventative maintenance as the main activity in the asset management programme quickly translates into cost savings for the plant operator. This and many other benefits are facilitated and enhanced by the increased functionality inherent in Rotork's intelligent electric valve actuation technologies.

Figures obtained by Rotork from customers' own information show an average 20% reduction in valve and actuator related problems and a 30% reduction in maintenance costs in the first year for plant operators adopting the asset management service.

Rotork has been providing asset management since 1991. End users could see the virtue of allowing original equipment manufacturers to look after their own products, as long as they had an organisation capable of doing it. The manufacturer has unequalled knowledge of the product and a complete record of its specification, production, component parts, test documentation, the supply chain and other details of the original contract. Allowing the original equipment manufacturer to maintain their installed assets also enables the end users to focus more closely on their core occupations. Preventative maintenance has developed into a significant part of the activities now provided by Rotork Site Services, a specialist division that delivers life-of-plant support for all Rotork products. Rotork Site Services currently looks after over 70,000 electric actuators on asset management programmes throughout the world.

The intelligent connection

This 20 year timescale coincides closely with period that intelligent electric valve actuation has been available, pioneered by the introduction of the first Rotork IQ actuator in 1993. Rotork intelligent valve actuators incorporate functionality that greatly assists the provision of asset management for both actuator and valve. The focus of attention is the actuator's precise data recording capability which,

in combination with diagnostic software, can identify potentially costly problems and enable them to be eliminated before they have a negative impact on the end user. Rotork has developed its IQ-Insight and InVision software packages specifically for this purpose.

This data can be collected at each actuator, using a non-intrusive wireless link and a hand held setting tool, or, in an increasing number of cases, through digital bus control systems.

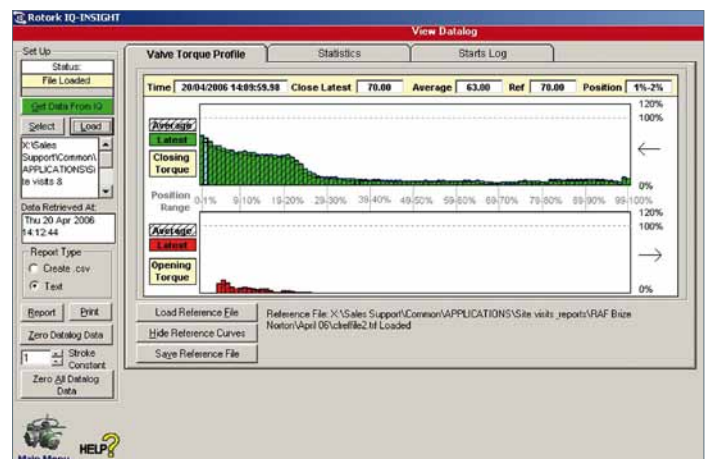
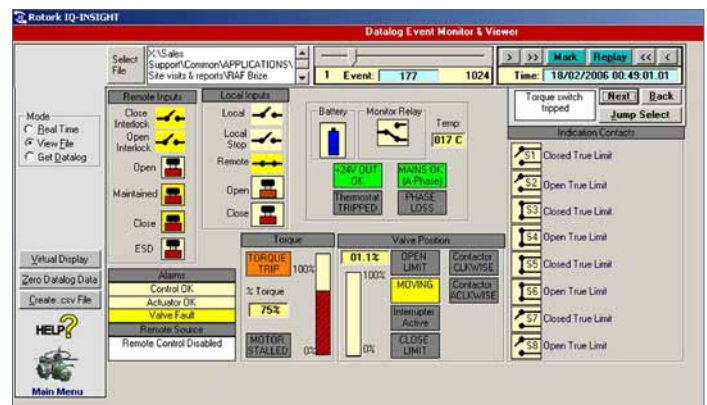
InVision is designed to operate with the Rotork Pakscan two-wire control system for this purpose. Using the control system enables the exercise to be performed in the comfort of the control room, saving the time and expense of visiting many individual valve installations on large sites, or actuated valves in remote or hazardous locations.

In fact, the IQ intelligent valve actuator is capable of providing a proliferation of data, recording all the activity with an immense amount of detail, including the number of valve operations, alarms, failure to respond events, valve torque profiles, unauthorised operation attempts and many other events. The ability to objectively analyse this information and identify the key areas that are important for each individual site's specific requirements is an essential requirement for effective asset management.

In Rotork's experience, the early part of the programme involves an audit of the installed equipment followed by a detailed analysis of this information, presented in a report to the customer together with recommendations for future action.



Rotork looks after over 70,000 actuators on asset management programmes.



IQ-Insight screen images of downloaded actuator data showing (top) data logger event monitoring and (below) valve operating torque profile.

The plan of action

The asset management programme should be focussed on establishing an equilibrium of maintenance scheduling to ensure that the life cycle of the equipment is extended as far as it is economically feasible without creating excessive interruptions to production to maintain and repair it. It is important to remember that the plant operator is equally interested in the actuator and the valve, so the maintenance programme must take into account both elements. Fortunately, much of the data provided by the actuator relates to the performance of the valve, such as alterations in the torque profiles during operation that can identify wear, lack of valve stem lubrication or an obstruction in the line. Visual inspection is also vitally important since a valve fault that is damaging an actuator, such as steam escaping through a stem seal, needs to be repaired at the same time as the actuator if the fault is not to return.

In order to achieve an efficient and economical schedule for inspection, the frequency of valve operation and the environment surrounding the installation must also be taken into consideration. Environmental conditions such as extremes of temperature, corrosive atmospheres and severe vibration will all have an effect on the physical condition of the actuated valve, and possibly associated cabling.

The frequency of operation can vary dramatically, depending on the duty, and this will affect the anticipated actuator lifespan. For example, if the average design life for an electric actuator is 10,000 operations during a 30 year lifespan, this equates to approximately one valve operation a day. However, some actuators will operate perhaps only once a week or once a month, whilst others will be operating every 15 minutes for much of the time, dictating a much shorter anticipated lifespan. As the intelligent actuator will provide a record of all of this operating data, it is necessary to monitor the actuator closely by downloading this information during the first six months or so of the asset management programme in order to build up an accurate picture of future maintenance and replacement part requirements.

Customised solutions

When all the above is taken into account it can be seen that there is no 'one size fits all' solution to asset management. Careful analysis of relevant site-specific data enables Rotork to design programmes that accurately suit the economic and operational expectations of end users in differing industrial cultures. In practical terms this can also include training courses to eliminate identified problems caused by operator errors and safety checks as a part of risk assessment exercises requiring third-party accreditation. Experience has also shown that maintenance inspections can identify a lot of problems that are not associated with the actuator at all.

The hydrocarbons industry has been quick to embrace the asset management philosophy using the original equipment manufacturer. In some cases this has developed to include the permanent stationing of Rotork engineers on large plant sites, working alongside the customer's own staff to constantly monitor critical valves for the prevention of expensive interruptions to production. Rotork asset management programmes now also cover other major industries including power generation and water treatment, as well as less obvious environments such as dockyards and river management schemes.

For most sites, engineers visit on an as-planned basis to carry out preventative maintenance and any follow-up repair work as required. To ensure the maximum operational time for the plant, the planned work is often scheduled to coincide with plant outages. For example, in Saudi Arabia Rotork is currently overhauling 108 actuators during a 45 day shut down at a major petrochemical complex. By the end of the year Rotork expects to be on the site for a total of 90 days and will also conduct a one-week training session for all the plant maintenance engineers. In the same country, at another site, the contract includes a 12 hour emergency response service, which has been used twice this year. In both cases the engineers attended the site in less than six hours and discovered that both issues were not actuator related.



The following 2 case studies provide illustrations of further aspects of asset management activity.

Hydrocarbon vapour recovery units

Vapour recovery unit (VRU) skids are installed in refineries' truck fuel loading facilities to recover the hydrocarbon vapours displaced when the truck is filled. The VRUs liquefy and return the hydrocarbons to the operational tanks. Governments typically return 5 cents (Euro) per litre of the stored capacity of the plant to compensate for the double taxation on liquefied vapour and for keeping the environment cleaner – but only if the VRUs have a greater availability time of a minimum of 96%.

Each VRU contains between 6 and 16 actuated valves and typically operates between 64 and 80 times a day. As an actuator's design life is usually in the region of 10,000 valve operations, VRU actuators would last in theory between 125 and 156 days of operation. However, an asset management programme can ensure that the actuators can survive a much longer life if wear and tear of the mechanical components, including the valves and gearboxes, is kept under control.

At one refinery where Rotork has the asset management contract the VRU actuators have been working for five years to date, representing approximately 117,000 operations. So far, asset management has effectively extended the life of the actuators by a factor of 11, prompting the customer to comment: "An asset management

programme is a must for vapour recovery units – it pays for itself."

Environmental irrigation

In Australia, Murrumbidgee Irrigation (MI) owns approximately 300 Rotork electric actuators installed at 50 remote sites throughout its extensive irrigation channel network. Prior to 2002 the company performed basic maintenance but called on Rotork to assist when major problems were detected. Since 2002 Rotork Australia has been contracted to perform more comprehensive maintenance and inspections on around 75 actuators a year, enabling each site to be inspected once every four years. Flexibility in the programme allows MI to identify sites where there is a higher duty cycle or other circumstances that dictate more frequent servicing.

Rotork provides an actuator service report that outlines the work performed on each actuator and identifies anything that needs to be addressed. For example, one report identified that MI had not installed seals in the cover tubes on one site and as a result the actuator centre columns were beginning to corrode. This was a simple repair but the problem was not visible and would have gone unnoticed until actuator failure if it had not been identified on the Rotork report. According to the customer, there have been numerous other instances where the maintenance service has potentially saved downtime on sites and the early detection of problems has saved the expense of sending actuators back to the factory for major repairs.

Electro-Hydraulic actuators for Remote Operated Shut-off Valve (ROSoV) duties

It is now over five years since the disastrous fire at the Buncefield fuel depot in Hertfordshire, UK, where a storage tank was overflowing for more than 40 minutes before it exploded, causing a 32-hour inferno. The overflow had caused a huge vapour cloud to build up, which was ignited by a spark.

Since then, a lot has been done to ensure that such a catastrophic accident should not happen again. Led by COMAH (Competent Authority/Industry Standards Task Group), safeguards are being put in place by the petroleum industry to give additional safety and environmental protection to tank storage installations. Endorsing the recommendations of the Buncefield Standards Task Group, a key feature of these safeguards is the installation of Remote Operated Shut-off Valves (ROSoV) with fail-safe actuation. The fail-safe design philosophy has been implemented by leading names in the industry, including Chevron UK, Total UK, BP, Ineos and Petroplus, who have all chosen the electrically operated actuator solution for this vital duty.

The case for the Electro-Hydraulic solution

The majority of ROSoV-relevant valves are situated on the inlet and outlet ports of the fuel storage tanks and are designed to isolate individual tanks in the event of a potential emergency. The tank farm layout is a very spacious environment, into which it would be very expensive to install a pneumatic ring main, whilst an electrical source for control and indication would also be required. It therefore makes economic and practical sense to use electricity to power the actuators as well. In some cases, existing cabling to nearby plant or to actuators being replaced by the ROSoV units can be utilised.

A specialised electric actuator design is necessary to achieve the swift fail-safe operation demanded by the ROSoV duty. Experience has shown that this can be successfully delivered through the electro-hydraulic route. Electro-hydraulic actuators use a simple and

therefore very reliable mechanical spring to provide fail-safe valve movement, whilst precise and swift valve movement in the opposite direction is achieved hydraulically by means of an integral electrically powered pump. With this design, reliable fail-safe performance can be combined with the benefits of the latest electric actuation technologies, facilitating a high level of asset management encompassing accurate control, monitoring and alarm signalling, operational data logging and diagnostics.

In Rotork's case, the Skilmatic range of self-contained electro-hydraulic actuators are well established as a solution for electric modulating and fail-safe control for quarter-turn or linear valves and dampers. Designed in double-acting or spring return configurations, these actuators comprise of an integrated control module and a power unit consisting of an electric motor, hydraulic pump and reservoir.

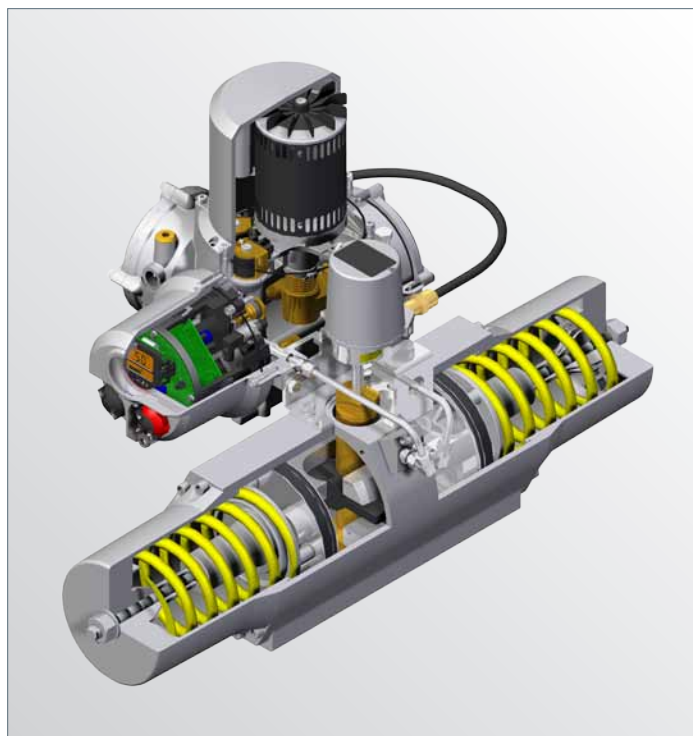
How it works

When the actuator is commanded to open from the closed limit, the bleed solenoid valves are energised. The motorised vane pump is started under no-load condition as a result of the delay in energising the by-pass solenoid valve. With the by-pass solenoid energised, the system pressure acts against a spring opposed piston to drive the actuator in the open direction.

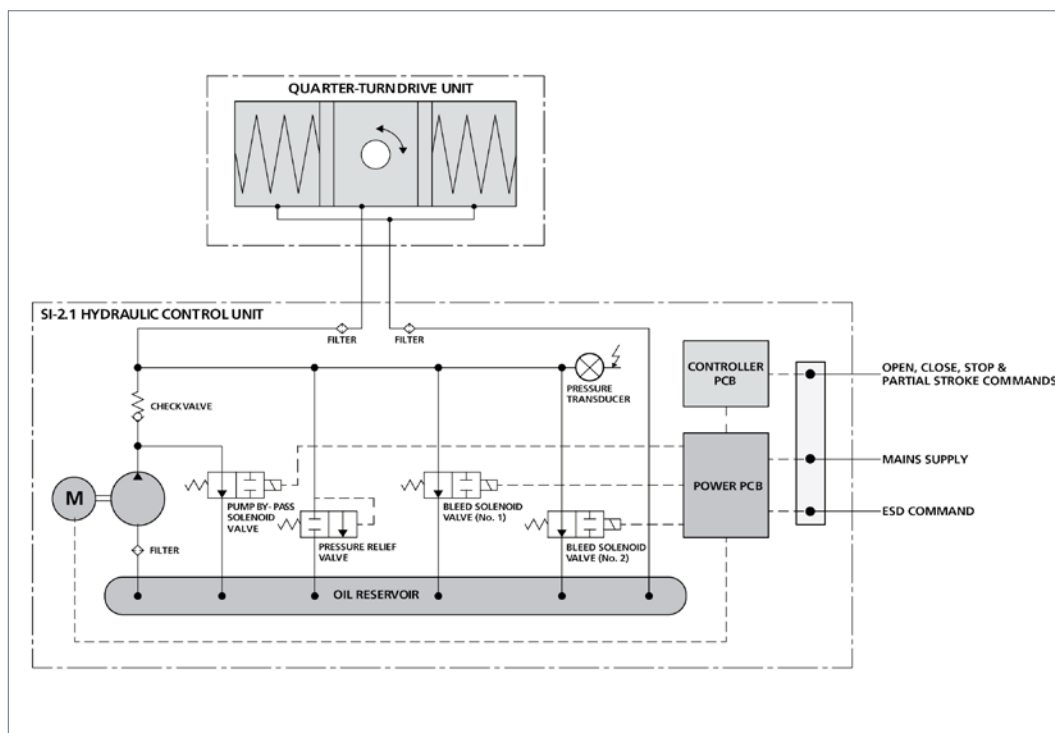
When the actuator is commanded to stop or reaches the open limit, the by-pass solenoid valve is de-energised, followed by the motorised vane pump after 5 seconds, unless a new command to open is given. The bleed solenoid valves remain energised and the system pressure is maintained to hold the actuator position.



At this refinery in Scotland gate valves have been replaced by triple-offset butterfly valves with Skilmatic EH fail-safe electro-hydraulic actuators for ROSoV duty.



Skilmatic EH actuators operate on a pump and bleed principle utilising a motorised vane pump to provide hydraulic pressure in one direction and spring-return in the opposite (bleed) direction.



Schematic diagram of solenoid valves in the Skilmatic actuator.

When the actuator is commanded to close or receives the ESD signal, the by-pass solenoid valve, bleed solenoid valves and motorised vane pump are de-energised. Pressure is released; the hydraulic fluid returns to the reservoir and the springs return the drive shaft to the closed or safe position.

Advanced intelligent control

Assisted by operating experience from a comprehensive installed user base in some of the world's harshest environments – from the Canadian Arctic circle to the deserts of the Middle East - Rotork invests comprehensively in the enhancement of its electro-hydraulic actuator portfolio.

The latest development sees the introduction of the intelligent SI/ EH Pro control and monitoring system, based on the well proven Rotork IQ Pro electric actuator. SI/ EH Pro actuators provide a new level of control and functionality for ROSoV applications by combining existing features with new text displays, performance monitoring and data logging that includes the valve signature profiles. Non-intrusive setting, commissioning and data communication – all benchmark features of Rotork's IQ Pro actuation technology – in combination with an intrinsically safe Bluetooth™ setting tool,

enables actuator configuration and data logger files to be transferred from the field to the office for download, analysis and storage.

The setting tool enables safe and rapid non-intrusive commissioning by means of easy to follow 'point and shoot' menus. Settings such as internal hydraulic pressure, position, limits, control options, alarm and indication functions can be accessed and adjusted. Actuator status, control and alarm icons are viewable on the illuminated LCD display which also provides access to real-time information including pressure, diagnostics and help screens.

The control module enables demanding operator requirements to be met, including compatibility with digital network control systems encompassing Pakscan, DeviceNet, Modbus, Profibus and Foundation Fieldbus. Designed to SIL3 standards for use on safety critical applications, the actuators are also capable of partial stroke testing, enabling isolating valves to be tested without interrupting the process, something of particular importance on emergency shutdown (ESD) applications. All key components within the actuator including the hydraulic pressure and movement are tested to confirm availability for shutdown on demand. The test can be initiated either remotely or

locally with the setting tool. The partial stroke position against stroke time is measured and compared to the original position to stroke time recorded at the commissioning stage. A pass or fail is displayed and, if enabled, a failure alarm will be activated. The alarm is one of three that can be configured to customer specific alarm and status requirements or for general group alarms. A monitor relay is also provided to monitor the power supply and any hardware errors.

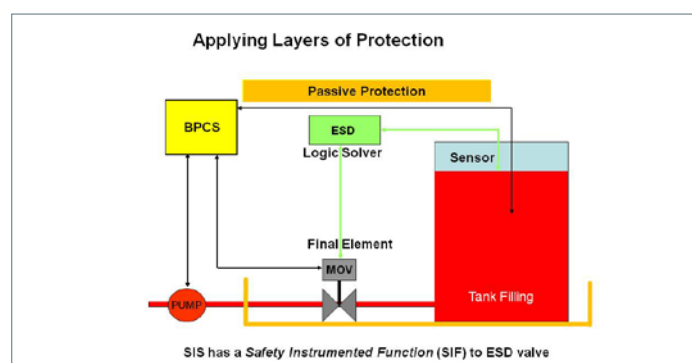
Emergency Shutdown (ESD) ROSoV applications

Skilmatic actuators are specifically designed for Emergency Shutdown (ESD) applications with a discrete input signal. The ESD signal can be configured to control the shutdown through a hardware circuit by-passing the internal processor. This processor circuit monitors the

position and internal hydraulic pressure and provides alarm monitoring but the ESD circuit is independent and thereby providing priority to an ESD command. Closing speeds can be adjusted to meet the specific requirements of the application.

For safety critical applications the actuator is designed to meet SIL3 standards with hardwired ESD. Alarms are indicated through both the local LCD display and alarm relay outputs. Mean Time Between Failures (MTBF) and Probability of Failure on Demand (PFD) calculations are provided. In the ROSoV scenario, in an emergency shutdown the actuator will immediately return to the predetermined safe position and will be ready to operate on the next command when the ESD signal is reinstated. As an added safeguard, an optional ESD manual reset can be enabled to restrict the actuator from operating until locally reset at the actuator or with an externally mounted switch. In the example below, a Safety Instrumented System (SIS) is applied to prevent over filling of a tank. The tank and pump are controlled by the BPCS (Basic Process Control System) and the installation is physically contained within a bund. The signal from the level sensor is feeding back to the PLC in the BPCS which controls the pump and the MOV. A fault with the level sensor leaves the tank vulnerable to overfilling, as was the case at Buncefield.

To account for this, the SIS is added, consisting of a separate level sensor and an ESD logic solver to control the MOV, which is the final element under the control of the SIS. The ESD signal is independent of other control signals and secures the valve in the safe position, providing a Safety Instrumented Function (SIF) for the ROSoV duty.



Layers of protection applied to ROSoV duty.

The benefits of *Wireless Valve Actuator Control Communication explained*

Every so often, a technological advancement happens that, when integrated into the processing plant environment, can save a substantial amount of money as well as improve plant productivity and efficiency. Such is the case with wireless motor operated valve (MOV) control.

At first glance, wireless network control and its application to valve actuation might not impress many process plant engineers as being an earthshaking technological development. Yet, because of the tremendous cost savings that can result, the ramifications and benefits associated with its adoption in the process plant environment can be dramatic - an evolutionary achievement that is likely to change the typical process plant landscape for decades to come.

Virtually any type of facility that has a need for communication between the plant's control system and MOVs located inside or outside plant walls can benefit greatly from wireless communication. Oil and gas refineries and terminals, electric utilities, water and wastewater treatment plants, pulp and paper manufacturers and chemical processing plants are just a few examples. Most

important, dependable, field-tested, wireless valve actuator network communication is available now, so the time is right for forward-thinking plant operators to consider adopting it when planning retrofits and new installations.

How it works

Introduced in 2009, the Rotork Pakscan P3 wireless network control system was one of the first wireless valve actuator control communication systems to be launched. It is a further development of the Pakscan two-wire digital control system used in thousands of plants throughout the world today. Simply stated, the system establishes a secure wireless mesh network that is used to control actuators and other field devices throughout the plant and to gather important operating data for asset management and preventative maintenance from the connected MOVs.

The wireless system consists of three main hardware components:

A Pakscan master station fitted with a wireless interface module, which is typically connected to the plant's control system using industry-standard Modbus protocol over either a serial or Ethernet connection.

A Pakscan P3 wireless coordinator module, which can be mounted, either indoors or outdoors, up to 200 metres away from the P3 master station and which functions as the base station for the system's robust mesh network.

A wireless actuator module installed in each actuator on the wireless network.

The wireless system operates on the license-free, globally recognised 2.4 GHz ISM (Industrial Scientific and Medical) frequency band and has a line-of-site operating range of approximately 30 metres indoors and 100 metres outdoors. Up to 60 actuators can mesh with a wireless

coordinator. In a Pakscan wireless mesh network, each actuator on the network can act as an independent router to help signals get to their intended destination. A correctly designed network will be configured to provide two or more paths between each actuator and the wireless coordinator. Therefore, if the normal traffic route is blocked or if a hardware or communication failure should occur, it can be overcome as the network dynamically determines an alternate route for the data to travel.

In such a network, privacy and security are high priorities. To prevent unauthorised commands being sent to devices over the wireless network, all control data is encrypted using the Advanced Encryption Standard (AES). Additional encryption is incorporated into the system to prevent unauthorised devices joining the network and to prevent a message replay attack.

Another important feature is that the Pakscan P3 master station offers users the choice of fully wireless, fully wired, or a combination of both wired and wireless capabilities. This means an existing Pakscan P3 user can add a wireless segment to his existing wired installation using the existing master station.

A recent installation

A large wastewater treatment plant in the USA recently faced a significant problem. It needed to retrofit actuators that controlled scum skimmers on several aeration tanks. Originally, the actuators were hardwired to the control room through a conduit that was embedded in concrete.

To hardwire the actuators for network control, the plant was presented with two very expensive options. The first was to demolish the existing concrete structure to install new conduit and then refinish. The second was to run external conduits on the surface of the structure. However, in order to avoid trip hazards and other health and safety issues, all external conduits needed to be clear from



A Rotork IQ valve actuator with wireless capability. Rotork IQ actuators are used throughout the world and serve some of the most rugged and challenging environments. They are double-sealed to prevent the ingress of water and dirt associated with many process applications.

walkways. Therefore, any new conduit would need to be located along the edge of the aeration basins. If that option was selected, the basins would have to be decommissioned during installation.

In both cases the plant faced considerable costs. With an average distance of over 100 metres from actuator to control room plus the associated cost of decommissioning the tanks during construction, the estimated cost to run the new wiring was in excess of \$1.5 million.

The plant therefore decided to install the newly available wireless solution, which was achieved at a small fraction of the estimated cost of the hardwiring options. In addition to eliminating the need for control wiring, another major benefit gained is that the wireless-equipped actuators can now communicate vital actuator datalogger information to the host control system.

All in all, plant personnel report a high level of satisfaction with the wireless system's performance and are especially pleased with the low cost of installation.

When is Wireless Control feasible?

The first step, before deciding to introduce wireless actuator control, is to contact the actuator manufacturer to schedule a wireless site survey. Rotork works with the customer to establish the locations of the new actuators

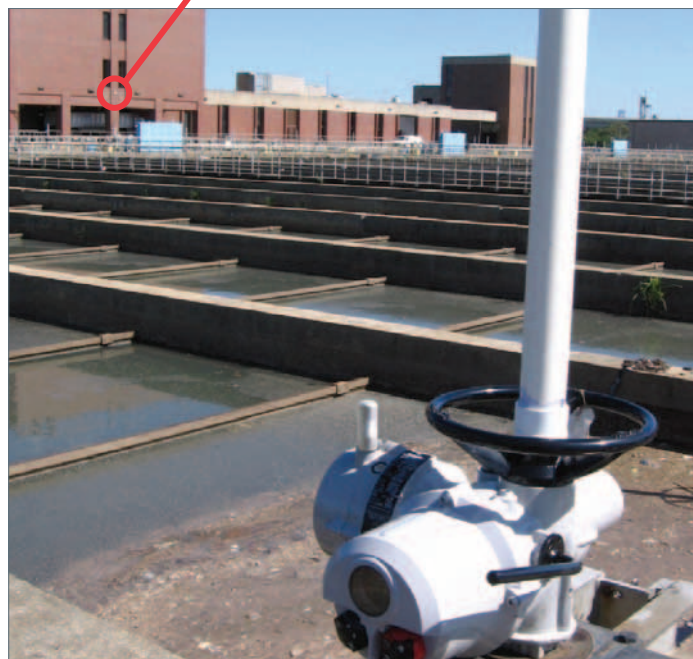
and physically test signal strength between all nodes. The overall topography of the site is important in order to maintain a reliable mesh network (a network that allows multiple communication paths to and from each actuator). In some instances wireless repeaters will be recommended to overcome wireless blackspot areas. Also, it is important to check other active wireless signals in the area to ensure that the system will co-exist with other equipment.

Wireless: The future is now

New and existing plants across a wide spectrum of various process applications can benefit from the many advantages that MOV wireless network control offers.

Most important, there is no reason to wait to implement such a system. Reliable, robust, and secure wireless systems are available today that can save a plant a significant amount of money in installation costs as well as provide a stream of vital MOV data to the control room that can help to improve asset management and predictive maintenance capabilities for increased plant productivity and efficiency.

Full details of the Rotork Wireless Pakscan System are published in Rotork document PUB059-001-00, which can be viewed and downloaded from the Rotork website: www.rotork.com



This composite photo shows a close-up (top) of the Pakscan wireless coordinator mounted on the outside wall of a wastewater treatment plant. The best position for the wireless coordinator was determined by a Rotork site survey. The photograph below is one of the Rotork IQ actuators fitted with wireless Pakscan module.



The Pakscan P3 master station with wireless capability is the bridge between the facility's host control system and the Pakscan wireless coordinator. Communication between the host and Pakscan P3 master station uses industry-standard Modbus protocol.

A new major technological advance is available that can help control valve users avoid many of the problems and inefficiencies associated with using compressed air as a power medium.

The new solution uses electric power and eliminates dependence on compressed air. This totally electric solution is appropriate and cost-effective for a wide variety of control valve applications, including those found in sectors such as power generation, chemical, petrochemical, and most other process industries.

While the new generation of electric control valve actuators may not be suitable for all process applications, it is ideal for many situations, especially where users have experienced problems with frozen air hoses, lack of process precision, stick slip, and so on. Therefore, it is prudent for today's process control engineers to take a serious look at how the design features of the new generation of totally electric control valve actuators can benefit them. In many situations, this technologically advanced equipment can substantially increase the output and efficiency of their process as well as help reduce maintenance and operating costs.

How electric control valve actuators can eliminate the problems of compressed air as a power medium

Control valve actuation

Before discussing this major technological solution, it's beneficial to understand how control valve actuation has evolved.

Decades ago, the main medium for controlling process control valves was by varying the pressure of the air supply to the valve's actuator. Typically, this air pressure varied between 3 and 15 PSI. A closed valve position would relate to 3 PSI and the open valve position to 15 PSI. This was an international standard for positioning linear control valves (and later rotary valves also) by balancing this air pressure against an opposing spring. The higher the pressure, the more compression was exerted on the spring, and the greater the movement of the control valve. As the pressure backed off down to 3 PSI, the spring pushed the valve stem back to the original position.

This simple means of position control was used in a wide variety of process control plants.



Rotork CVA all-electric control valve actuators are available for rotary and linear valves.



It was the mainstream solution offered by control valve actuator manufacturers as well as control system suppliers. In the simplest form, compressed air was both the power medium and the control medium. Desired positions were achieved by varying this applied pressure and entire plants were controlled by compressed air channelled through small-bore copper tubing. The backs of control panels were a mass of tubes skillfully arranged by control systems craftsmen into symmetrical layers of carefully laid pipe. However, with the advent of computers and programmable logic controllers (PLCs), the days of the 3-15 PSI control signals were numbered.

Soon, they were replaced by electronic signals carried on much lighter-duty copper wire with control at the speed of the electrons rather than pressure waves. This was a revolution in control technology, bringing with it tremendous cost savings in installations as well as vastly improved control capabilities.

Traditional pneumatic diaphragm actuators suffer from many operational problems in harsh and hostile environments.



Frozen air hoses are just one of the many problems that are solved by using electric control valve actuators.

The other great benefit of this change in technology was the elimination of the labour-intensive maintenance of the pneumatic control system. Filters, regulators, lubricators, and a multitude of small pilot control valves were eliminated and replaced with PLCs and their final element controllers. In place of the 3-15 PSI pressure signal, a 4-20 milliamp current control signal was adopted as a global standard.

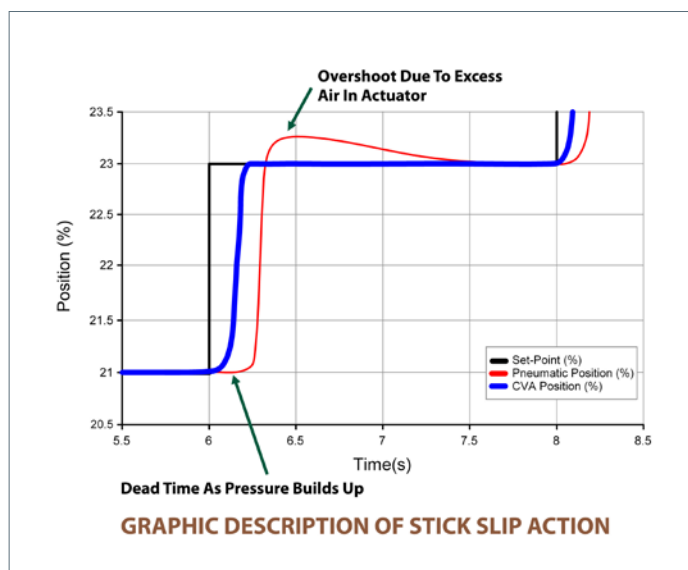
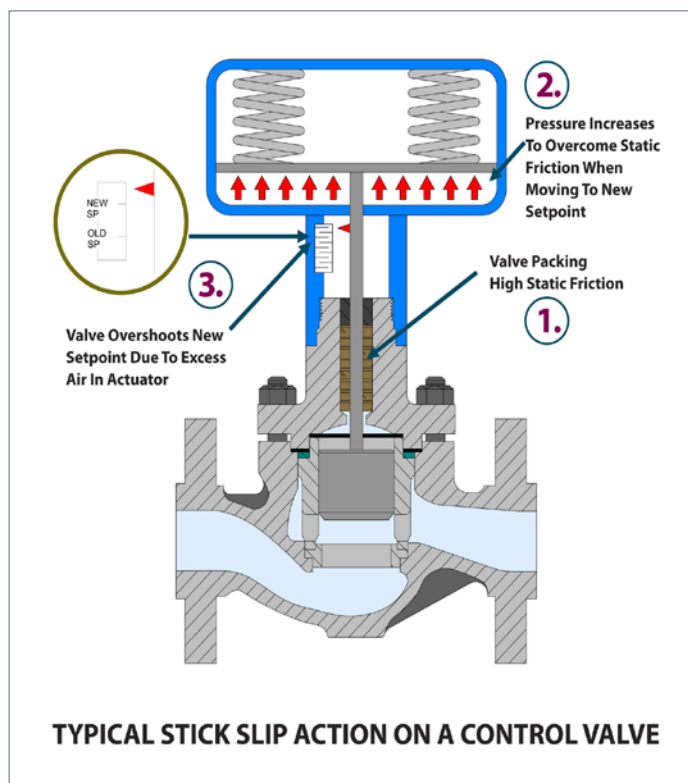
Although the control air signal has been superseded by a control current signal in most process plants, the power to move many of these process control valves remains to be compressed air.

Having used instrument air as the control medium in the past, it was perceived by many that there were some benefits in retaining instrument air as a power medium. The air can be used to transport energy from one place to another to operate remotely positioned control valves, dampers, and other equipment. In the evolution of pneumatic process control, the instrument air was upgraded from the 3-15 PSI supply to a nominal 80 PSI. This allows greater forces to be generated by smaller pistons or diaphragms. The result is that pneumatic spring diaphragm and piston type actuators have been the default standard for positioning control valves for many years.

The method used to translate or relay the applied control signal from 4-20 milliamps to a high pressure acting on the diaphragm is the valve "Positioner."

The simple pneumatic Positioner has evolved from the basic functionality of controlling applied high pressure air using a low pressure signal to the smart Positioner of today. Smart Positioners not only direct high pressure air to the valve actuator, but are also able to gather information at the various pressure positions within the actuator assembly to provide diagnostic information, which can be transmitted back over the 4-20 milliamp signal using a communications protocol such as HART.

This method is currently the de-facto standard for the majority of linear and rotary process control



valves in almost every industry, from oil and gas production through power generation to the chemical, petrochemical and many other process industries.

Why electric powered actuation may be better

However, this de-facto standard of coupling instrument air with a smart Positioner may not be the best solution for every application. Just as electronics have taken over control signal technology, electrically powered actuators now offer a viable alternative to those using the pneumatic spring diaphragm and piston design.

Specifically, there are many drawbacks to using compressed air as a power medium. For years, process engineers have had to engage in complex workarounds to overcome them. The drawbacks vary in degrees depending on particular applications.

Generally speaking, taking electrical energy, converting it to compressed air then transporting it via a filter regulator, lengths of tubing with fittings, and then directing it into a chamber for expansion is an incredibly inefficient method of moving power from one point to another.

The inefficiencies of compression and the friction losses in transmission can easily account for a net loss of 50% of the applied energy. This can be directly compared to the much more energy efficient method of transmitting the power via electricity and translating that electrical energy to kinetic energy in a motor located directly at the process control valve. In effect, the electric motor drive has been transferred from the compressor to the actuator, eliminating all the intermediate conversions and transmissions together with their attendant losses.

When considering the large number of process control valves in a plant and compounding this with the constant movement of process control valves, the elimination of compressed air in a plant can be significant and can result in a much more productive and cost-effective operation.

In addition, plant reliability and the associated availability is a significant factor in our consideration. Air supplies require proactive maintenance to ensure that moisture, dirt, and other contaminants do not accumulate in the air lines and cause the small orifices in smart controllers to plug up. This proactive maintenance has a significant cost, which should be included in every objective analysis.

Although many processes are enclosed in buildings that protect the valves and instruments controlling the process, this is not always the case.

There are several examples where valves are located in open areas and are vulnerable to temperature swings that can drop below the freezing point of water. This affects not just European and North American plants, but also Asian plants such as the many new process plants being built in China, Japan, Korea, and other areas.

A drop in the temperature below freezing point can cause air lines to freeze and incapacitate the pneumatic control valve actuator or controller.

Examples of why electric control valve actuators are often the best solution

In Halifax, Nova Scotia, a refinery technician recounted that every year he needed to replace frozen air lines because they had ruptured. After the hoses ruptured, certain modulating control valves could only be operated by hand. This, of course, defeats the basic reason for investing in automatic process control.

Another example is from a power plant in New Hampshire which recently replaced all of its spring diaphragm control valve actuators on fuel control due to the effects of reduced temperatures. Low temperatures not only had an adverse effect on the actuators, but also on the viscosity of the medium being controlled and the friction effect on the valve seats. That is, the valve became very difficult to control due to the stick slip effect, causing 'over shoot' of the desired set point of the valve.

In high altitude mining applications, such as those found in Chile and Peru, reduced temperatures and high altitude combined to make power air supplies extremely costly. Maintenance and running costs were problematically high. In such an environment,



Pictured above is a before and after photo showing how a Rotork all-electric CVA actuator (bottom right) was retrofitted to replace a traditional control valve actuator (top left) in a feed water heater level-control application at a large Arizona power plant.

freezing air lines were also an ongoing problem which caused valve actuator failures with attendant loss of production capability.

There are some instances where an air supply is not required for anything other than controlling a single process control valve actuator. In these circumstances a small air compressor complete with air set needs to be provided, taking up space, weight and cost. For example, there are many small package boilers that require a steam control valve. Quite often this requirement also includes the need for a fail-to-position capability. The traditional method of doing this would be to use a spring diaphragm actuator where loss of air or a shut down signal would vent the air to allow the spring to close or open the valve depending on the requirements of the process.

With the advent of new technology, electric actuators are capable of storing electric energy such that a loss of electric power can trigger a fail to position, which has been pre-programmed into the actuator. Furthermore, because of the greater degree of control available with an electric actuator, a preset position – either fully open or fully closed or anywhere in between - can be programmed easily into the actuator should power or control signal be lost. A different failure position could be programmed dependent for either loss of power or loss of control signal.

Finally, compressed air is by definition a resilient medium. In fact some cars even use it as a method of suspension. Because compressed air acts like a spring, pneumatic control valve actuators do not often have the stiffness required for precise process control. For example, consider a globe valve with a high degree of friction in its stem packing or a ball valve with a high degree of friction on its seat. In either case, the static friction is quite high, requiring an excessive amount of air pressure in order to initiate movement in the valve. Once the valve moves, static friction is replaced by dynamic friction, which is invariably lower. This causes the resistance to the excessive air pressure to drop. The result is the valve runs away with itself and often over shoots the desired set point causing a correction to be made resulting in oscillation around the set point.

This problem is eliminated with an electric control valve actuator due to the higher stiffness and controllability of today's electric drive trains and the advent of sophisticated dual sensor technology in the actuator.

Electric control valve actuators: a summary of features and benefits

Electric control valve actuators can provide superior control performance, are easy to set up and they eliminate the need for troublesome power air supplies and all their problems.

They are available in linear and quarter-turn actions and are suitable for a wide range of control valve duties throughout process industry applications including power generation, pipeline and gas installations, petrochemical and refinery facilities, mining and many other process applications.

The new actuators eliminate the need for costly air supplies and are easily integrated into most process control environments, including those that use Hart and Foundation Fieldbus protocols.

Rotork's CVA actuators, for example, provide extremely precise control valve operation with repeatability and resolution performance at <0.1% of full scale. In addition, they include, as a standard feature, wireless Bluetooth communication technology that can be used for quick and easy actuator set-up and adjustment.

Rotork CVA actuators incorporate a data logger, which provides an extensive record of such operational and maintenance-related data as valve torque profiles, dwell times, and relevant statistical information. They also utilise a built-in super-capacitor that provides an advanced, programmable method for fail-to-position protection, and Rotork CVA actuators can be specified for single-phase AC or DC electrical supplies.



Pictured above is a Rotork quarter-turn control valve actuator (model CVQ 1200) in a NEMA 6 enclosure at New Hampshire power plant, USA.

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