

Asset management for actuated valves in the 21st Century



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

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 modern intelligent electric valve actuation technologies.

Figures 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 the company's products.

The intelligent connection

This twenty year timescale coincides closely with period that intelligent electric valve actuation has been available, pioneered by the introduction of the first IQ actuator in 1993. These 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 negatively 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 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 modern 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. The early part of the programme usually 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.

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 account of 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.

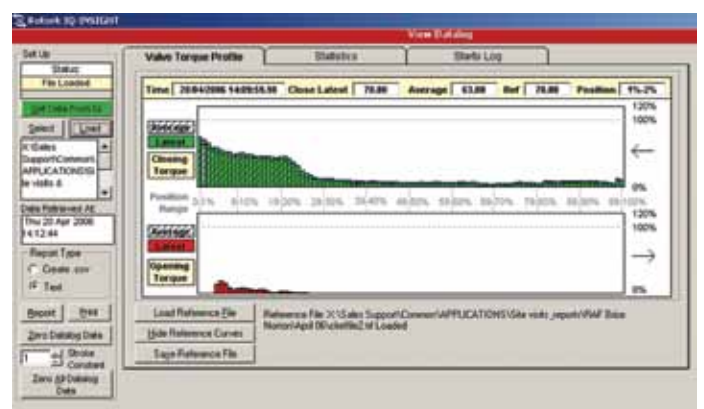
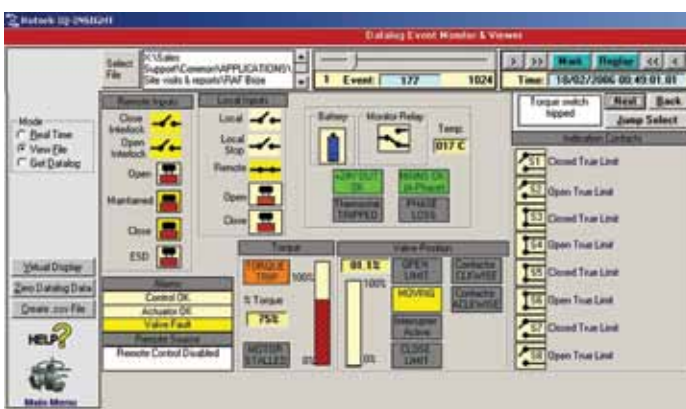
In order to achieve an efficient and economical schedule for inspection, the frequency of valve operation and the environment surrounding the installation must also be taken into consideration. Environmental conditions such as extremes of temperature, corrosive atmospheres and severe vibration will all 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 the provider 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



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



Rotork IQPro intelligent electric valve actuators on a vapour recovery unit at a refinery.

monitor critical valves for the prevention of expensive interruptions to production. The company's 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 the company 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 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, the Australian office 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.

An actuator service report is provided 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 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.



Engineers carry out routine inspection and maintenance at one of the remotely sited river gate installations on the Murrumbidgee Irrigation Scheme.