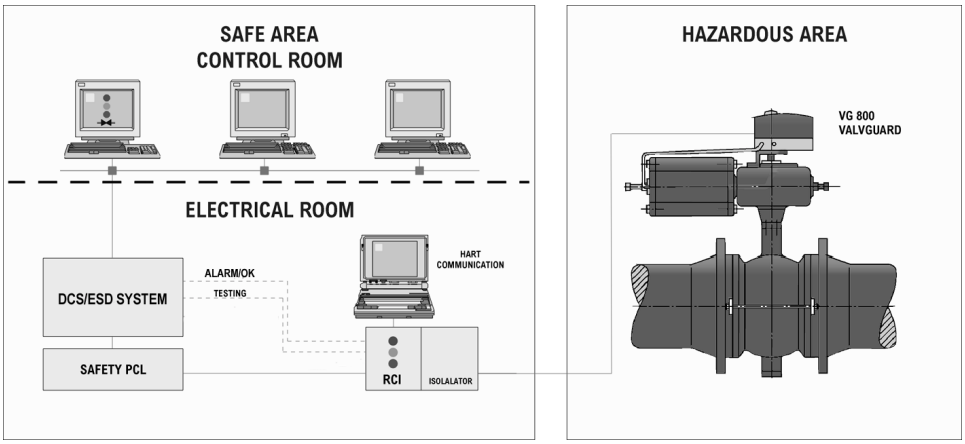
ARC White Paper

BY ARC ADVISORY GROUP

September 2001

Neles ValvGuard Allows BP to Increase Safety While Reducing Costs

Metso Automation's Neles ValvGuard System in the Field



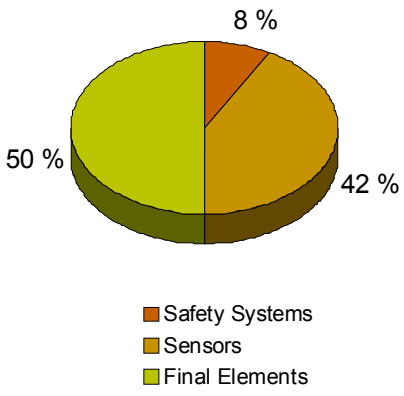
Neles ValvGuard for SIL 3 level applications

New IEC Standards Force BP to Reassess its Valve Testing Procedures

Safety engineers throughout the world are struggling with the problem of how to best comply with new and more stringent safety requirements. New IEC requirements state that manufacturers must determine and document precise levels of safety and furnish quantifiable proof of compliance. In light of these requirements, BP feels it is necessary to reassess its traditional safety loop testing procedures. In particular, BP feels it is important to improve its safety valve testing procedures in order to drive costs down and improve plant safety.

Valve Availability is Critical to Safety Loop Performance

In recent years it has become increasingly apparent that the total reliability of any safety loop is heavily dependent on the availability and reliability of its final elements. When overall loop performance, from system to final element, is quantified, it is easy to see that the weak link of most safety loops is the potential non-operability of safety valves, since they alone account for roughly one half of the probability of a dangerous failure. Emergency shutdown (ESD) valves are the final line of defense and are critical to minimizing the chance of fire or explosion during process upsets. As shutdown valves are rarely cycled, however, there is always concern over whether they will operate if actually needed. In fact, if these valves are not periodically stroked, it can almost be guaranteed that they won't work when called upon.



Safety loop failure sources

Although their importance to safety loops has often been overlooked in the past, IEC standards are forcing instrumentation technicians to significantly increase the frequency of their safety valve testing procedures. In order to meet and maintain desired SIL requirements up to SIL3, it has become necessary for manufacturers to test many of their safety valves several times a year. Faced with these increased valve testing requirements, BP realizes it must improve upon its conventional safety valve testing methods to avoid significant recurring labor costs.

Conventional Valve Testing Methods Prove Too Costly

Conventional safety valve testing procedures employed at BP involve sending a technician out in the field to attach either a mechanical stroke limiting device or pneumatic switch to each safety valve. With these devices attached, the movement of the safety valve is limited, which allows them to be partially stroked without interfering with the process. Once the safety valves' movement is restricted, technicians send a signal from the control room to determine if the valve would respond if called upon.

Manual testing	2 pers. x 2 h x 60 USD	= 240 USD
Reporting	1 pers. x 1 h x 60 USD	= 60 USD
Management	1 pers. x 1 h x 80 USD	= 80 USD
Data handling	1 pers. x 1 h x 60 USD	= 60 USD
Testing equipment & safety permits etc.		= 60 USD
TOTAL to carry out testing for one valve		= 500 USD
		========

To meet and maintain SIL 3 level it may be necessary to test valves several times a year.

Cost of Conventional Safety Valve Testing

BP finds this testing method to suffer from a number of drawbacks, most importantly, its highly labor-intensive nature and high operational costs. Using these conventional methods, BP personnel have to manually perform safety valve testing as well as maintain adequate records documenting the tests performed and their results. Consequently, if BP were to continue using conventional valve testing procedures, the company would face enormous recurring labor costs to comply with IEC standards.

Not only is the manual work associated with conventional testing methods expensive, but also unreliable. There are a number of deficiencies in conventional testing methods, which raise the uncertainty over whether safety valves will actually be available in case of an emergency. Concern over the reliability of conventional safety valve testing procedures is due to a number of reasons including the lack of real-time data and the absence of trending data. Another significant drawback to conventional testing methods is that they render the valve unavailable during testing if a real safety issue is encountered. Conventional valve testing procedures also put the burden on BP technicians to manually return safety valves to their proper operating mode after completing the tests. If an emergency were to occur during the testing procedure, or if a safety valve were to be left with its range of motion restricted, the valve would be unavailable to prevent a fire or explosion during a process upset. As a result of these risks, and its highly labor-intensive nature, BP feels it must improve its safety valve testing procedures.

BP Turns to Metso Automation for Help

The need for BP to improve its safety valve testing methods is prompted by a number of business pressures. Process audits are pointing to valve problems as the weak

link in safety loops, and new IEC standards demand that manufacturers increase the frequency of their safety valve testing. To meet the escalating business and safety requirements, BP is working with Metso Automation to develop a viable methodology of testing its safety valves automatically on a regular basis to confirm and document that they are functioning properly. To achieve this, BP is incorporating Metso Automation's Neles ValvGuard solution.

BP Sees No Competition for Neles ValvGuard on the Market

The Neles ValvGuard project was funded through a corporate initiative called "Manufacturing Vision". As part of BP's Manufacturing Vision initiative, a budget is set aside for certain sites to help them justify the purchase of new technologies. BP decided to use part of this budget to purchase Metso Automation's Neles ValvGuard, a safety valve monitoring and testing solution specifically designed to help manufacturers like BP solve historic safety valve operability problems and comply with the latest IEC standards. The decision to turn to Metso Automation was an easy one for BP as the company feels there are no other suppliers offering a similar product to the market.

Neles ValvGuard consists of three essential components: VG800, Remote Communication Interface, and management software. The VG800 intelligent field device performs the valve testing independently and sends/receives messages between itself and the Remote Communication Interface (RCI) via a simple pair of twisted wires operating at 24 VDC. The Remote Communication Interface provides continuous real time bi-directional communication between the VG800 and control system. The RCI receives messages (OK, testing, or an alarm) from the VG800 and sends the information to the control system. Communication between the RCI and control system is achieved via the HART protocol, which allows diagnostics data downloading and configuration changes to be sent from the RCI to the control system. Management software residing at the control system facilitates configuration and diagnostic analysis of the safety valve from the warm confines of the control room.

The initial phase of the Neles ValvGuard project includes BP's purchase of more than 60 units from Metso Automation for installation in two new chemical processes BP is bringing online in the UK this year. There are currently 40 units installed on the new monomer process and an additional 22 units installed on the new Ethyl Acetate (ETAC) process BP is commissioning in Hull, UK this year. The ETAC process has been running since the beginning of June, while the monomer process has yet to be commissioned.

Neles ValvGuard Saves BP Money While Increasing Plant Safety

Through Neles ValvGuard, BP is establishing an intense surveillance of its safety valves by monitoring and testing them online, as often as desired. Neles ValvGuard automatically checks the condition of the entire safety valve package by performing partial stroke tests while the process is running. In addition, Neles ValvGuard performs separate pneumatic tests that verify all of the system's components are in working order and that the system can handle a change of air pressure in the actuator. If a problem is discovered, Neles ValvGuard transmits an alarm in real time to the plant's control system, thereby eliminating unreported failure risks. With the purchase of Neles ValvGuard, BP significantly increases plant safety while relieving itself of unnecessary operations costs.

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BP Finds Neles ValvGuard Far Superior to Conventional Testing Methods

BP finds the Neles ValvGuard approach to be far superior to conventional valve testing because it eliminates many of the downfalls inherent to conventional methods. Specific benefits BP realizes through the use of Neles ValvGuard include an increase in the frequency of valve testing, real time monitoring, trending for predictive maintenance, remote operation, and reduced labor costs. In addition, the automation of valve testing significantly reduces the risk of human error by eliminating the need to manually disable the valve during testing and return the valve to its correct operating mode once the tests are completed.

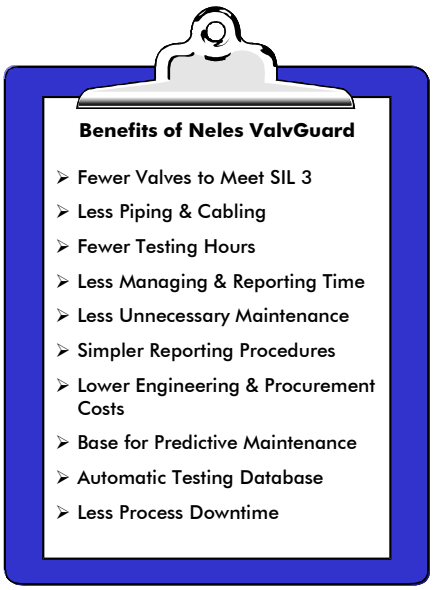
Neles ValvGuard also significantly increases the amount of information obtained from valve testing. With the increase in equipment status gathered by Neles ValvGuard, BP is now able to compare the performance and condition of each safety valve against the performance of the valve when it was new or newly maintained. This significantly increases the diagnostic coverage of safety valve testing while, at same time, giving BP a tool for predicting the maintenance needs of particular valves.

Neles ValvGuard also automatically downloads proof of the periodical valve tests and stores it in a common database in the form of test graphs, thus providing evidence of system integrity. Using Metso Automation's Neles Fieldbrowser technology, Neles ValvGuard can also post the valve performance data at regular intervals to a database accessible to authorized individuals over the Internet or intranet. This web-based approach dramatically reduces the number of man-hours

required for device monitoring and data collection, allowing BP to reallocate its resources to improving system performance and reducing associated costs.

Neles ValvGuard Lowers BP's Total Cost of Ownership for Safety Valves

BP expects to achieve a cost savings of £96,000 in operations costs per safety valve over the life of the plant through the use of Neles ValvGuard. In addition to lowering operational costs, Neles ValvGuard also allows BP to lower its capital costs as well. Without Neles ValvGuard, BP would have to install two valves in series for many applications to create redundancy and assure its safety loops meet integrity standards. Through the use of Neles ValvGuard, however, BP is able to achieve integrity standards with only one valve in most cases, thereby cutting its safety valve capital expenditures nearly in half.



Despite the higher initial cost of the Neles ValvGuard solution, BP enjoys a tremendous advantage in long-term cost of ownership. On the surface, the higher initial cost of Neles ValvGuard, roughly £1,250 per unit plus additional I/O, may seem outrageous compared to a traditional safety valve installation that typically costs about £100. With an expected savings of £96,000 per valve, per year, however, BP acknowledges that Neles ValvGuard is well worth the higher initial price as it considerably lowers the company's Total Cost of Ownership (TCO) of each safety valve. The estimated payback of less than one month has convinced BP to increase its adoption of Neles ValvGuard and expects to see the initial price of Neles ValvGuard decline as sales volume increases.

BP also hopes to achieve a significant reduction in maintenance costs and process downtime through the use of Neles ValvGuard. By using the trending data offered by Neles ValvGuard, BP hopes to establish a predictive maintenance environment, which will significantly lower maintenance costs. ARC estimates the cost of performing predictive maintenance to be up to five times less expensive than preventative maintenance and ten times less expensive than corrective maintenance. In addition, by reducing the risk of spurious plant trips, BP expects to achieve significant savings by reducing costs associated with unnecessary process downtime.

Neles ValvGuard Significantly Improves BP's Hazard Rate

Despite the importance of lowering the TCO of its safety valves, BP feels the biggest benefit offered through the use of Neles ValvGuard is the potential benefits of increased plant safety as defined by the IEC standards. To independently quantify the increase in safety of performing continuous valve monitoring with Neles ValvGuard,

BP conducted a liability analysis to calculate the anticipated improvement in the company's hazard rate. BP defines its hazard rate as the time between either a safety valve problem the company failed to detect or, worse, a case where a safety valve failed to shutdown the process in an emergency situation. BP estimates that, as a direct result of Neles ValvGuard, the company has reduced its hazard rate from one failure every 1,500 years to a rate of one failure every 13,000 years.

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BP is convinced that, without the aid of Neles ValvGuard, it would not have been able to achieve its safety goals. The company feels strongly that Neles ValvGuard provides BP with a truly best in class hazard rate. In addition, by significantly increasing plant safety and reducing the risk of a process fire or explosion, Neles ValvGuard helps BP retain its reputation as a world-class company with a strong safety record.

BP is Fully Committed to Using Neles ValvGuard and Other Metso Automation Products in the Future

BP believes Neles ValvGuard is the future of safety valve testing and is fully committed to the project. The company feels that utilizing Neles ValvGuard is essential to achieving its safety goals and complying with the new IEC standards. BP believes Metso Automation's future vision and capabilities are second to none and plan to continue strengthening its relationship with Metso Automation. Metso Automation's responsiveness to BP's feedback and criticism is further incentive for the company to continue increasing its use of Neles ValvGuard and other Metso Automation valve products.

BP and Metso Automation Enjoy a Collaborative Relationship

Metso Automation and BP have established a collaborative relationship, whereby BP meets with Metso Automation once a year to discuss Metso Automation's new R&D projects. BP feels this relationship is beneficial to both Metso Automation and itself as it gives Metso Automation a chance to air out its new ideas and provides BP a chance to establish a dialogue with Metso Automation and work out any issues the company faces with new products being introduced. BP and Metso Automation established this collaborative relationship about 5 years ago and BP expects their agreement to continue well into the future.

One of the leading benefits of the collaborative relationship between the two companies is that it gives BP the chance to work with Metso Automation on new product developments on an ongoing basis. As part of this collaboration, BP and Metso Automation are working together to fine-tune the functionality and capabilities of Neles ValvGuard. An example of this collaboration is BP's recent concern over the robustness of the 2-wire connection between Neles ValvGuard's RCI and the control system. BP is concerned with spurious plant shutdown if either of these two wires is disconnected for any reason. Despite meeting IEC requirements and the low probability that safe system wiring enclosed in a rigid conduit could accidentally be disconnected, Metso Automation will continue to enhance the unit to reduce the risks and increase safety by adding increasing redundancy to the Neles ValvGuard solution.

Another benefit of the relationship is the ongoing addition of new features to Metso Automation's products. One such new feature the two companies are working together on the final testing phase of the addition of acoustic sensors to BP's Neles ValvGuard units. BP hopes that, through the introduction of acoustic sensors to Neles ValvGuard, they can close yet another security gap that previously existed for emergency venting (ESV) valves. The concept behind the addition of acoustic sensors is that valve leakage creates an acoustic emission, which travels through nearby solid materials as a sound wave. To detect such leakages, Metso Automation has installed remote sensors situated on a containing structure, which can detect this acoustic wave's energy. After gathering acoustic information at the valve, Neles ValvGuard can interpolate the data using its management software, ValveManager, to reveal and track leakage levels as minute as a few bubbles.

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BP Plans to Expand its Use of Metso Automation's Valve Products

In addition to its incorporation of Neles ValvGuard, BP is also currently conducting a field trial for Metso Automation's Nelflow control valve. Nelflow is a product available through Metso Automation, which combines the control and measurement of process flow in a single unit by incorporating flow sensors on either end of a control valve. BP is very happy with the results of the Nelflow field trial so far. To date, the company is only utilizing Nelflow in non-critical applications but its uses could expand if the test results remain positive.

BP also plans to expand its use of Metso Automation's rotary control valve products in the future as the company shifts its focus toward rotary valves. BP feels that rotary valves hold a number of significant advantages over linear valves including reduced weight, smaller flange-to-flange dimensions, and ease of maintenance. Ac-

cording to BP, rotary valves are much easier to maintain then linear valves due to their modular design, which allows quick removal of the trim set by simply removing the seat ring. In the case of linear valves, BP has to take the entire top works off the valve, including the actuator, to replace the ring and plug.

In addition to its incorporation of Neles ValvGuard, BP is also currently conducting a field trial for Metso Automation's Nelflow control valve.

BP also hopes to reduce emissions as a result of its increasing use of rotary control valves. Due to their rotary motion and lack of a linear stem, rotary valves are inherently less likely to allow a leak past the packing as the valve ages. BP also feels rotary control valves are less likely to experience stiction problems because their rotary motion is much smoother through the full range of motion than linear valves, which prevents dirt and other debris from getting trapped and jamming the valve. BP feels that Metso Automation's rotary control valves have come a long way and that, with the addition of a standard soft seat, they not only make for excellent control valves, but also offer the tight shutoff required from ESD valves.

BP Puts its Trust in Metso Automation's Future Vision and Capabilities

As a result of Metso Automation's responsiveness, future vision, and strong rotary valve capabilities, BP plans to increase its use of Metso Automation valve products in the future. Although BP acknowledges that the company still faces some minor development issues with regard to Metso Automation's new suite of intelligent valve products, BP feels that Metso Automation is dedicated to helping it solve these development issues and is extremely responsive to BP's feedback and criticism. Consequently, BP has put its trust in Metso Automation and plans to continue strengthening the relationship between the two companies.

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Acronym Reference: For a complete list of industry acronyms, refer to our web page at www.arcweb.com/arcweb/Community/terms/indterms.htm

AI	Artificial Intelligence
ANSI	American National Standards Institute
API	Application Program Interface
APS	Advanced Planning & Scheduling
B2B	Business-to-Business
B2C	Business-to-Consumer
BP	British Petroleum
BPR	Business Process Reengineering
CAGR	Compound Annual Growth Rate
CAN	Controller Area Network
CMMS	Computerized Maintenance Management System
CNC	Computer Numeric Control
CPG	Consumer Packaged Goods
CRM	Customer Relationship Management
EAI	Enterprise Application Integration
EAM	Enterprise Asset Management
EC	Electronic Commerce
eFS	E-Fulfillment Solutions
eIS	E-Integration Solutions
ESD	Emergency ShutDown Valves
ESV	Emergency Vent Valves
ETAC	Ethyl Acetate
HMI	Human Machine Interface
IEC	International Electro-technical Commission
IT	Information Technology
LAN	Local Area Network
MIS	Management Information System
MRP	Materials Resource Planning
PAS	Process Automation System
PID	Proportional Integral Derivative
PIMS	Process Information Management System
R&D	Research & Development
RCI	Remote Communication Interface
ROI	Return on Investment
SCE	Supply Chain Execution
SIL	Safety Integrity Level
TCO	Total Cost of Ownership

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