

Fisher® Control Valves, the Nuclear Industry Standard

Proven in operating plants all over the world



The control valve supplier of choice for the

**VALVES INSTALLED IN OVER 90% OF OPERATING PLANTS,
35% OF INSTALLED BASE**

Whether running an existing nuclear power plant or building a new one, you will need a control valve supplier who has participated in the market for long enough that they understand your needs, and have the right products, skills and experience. Who better than Emerson Process Management?



Emerson's services help you achieve your business goals

International standards

Fisher® control valves were the first ever to receive N-Stamp certification in 1971. Many of Emerson's nuclear application experts participate in the development of international standards for the nuclear industry, working closely with the end user to keep the nuclear power industry safe as well as ensuring their knowledge remains current.

Fisher control valves are approved and certified to all the major regional and international nuclear standards, including:



- N-Stamp certification
- ASME Section III
- RCC-M
- JSME
- CSA
- EN

Fisher nuclear control valves have been available to the nuclear power industry for over 35 years, are installed in 90 percent of operating plants and account for over 35 percent of all control valves in the world's nuclear power plants, **more than three times the amount of their nearest competitor.**

As the largest control valve and regulator manufacturer in the world, and with over 250 employees dedicated to the nuclear power industry, Emerson is the control valve supplier of choice, recognized for delivering highly reliable, cost effective valves that are designed for the application, as well as providing support with a range of expert services.

Engineering services

Emerson engineers provide services that will help you achieve your business goals. Whether that is a focus on improved efficiency for existing plants or ensuring a low cost of generation for new, Emerson's services will help you reduce maintenance and operating costs, while increasing plant safety and efficiency.

Services include:

- Application and process reviews
- Design modification evaluations
- Seismic and weak link analysis
- Maintenance practice review
- Maintenance manual preparation and upgrades
- Spare parts support and inventory optimization

nuclear power industry



Emerson has a global network of field specialists

Global and local support

Wherever your nuclear plant is located, Fisher control valves are fully supported. Emerson has the most extensive global network of field specialists of any supplier. Manufacturing and assembly plants are located across the globe and technology centers are located in North America, Europe and Asia.

Emerson's control valve technology centers are used to validate control valve performance and are unmatched in the industry. Current product testing capabilities include:

- **Control valve dynamic performance**
- **Flow, acoustics and vibration**
- **Simulation and analysis**
- **Experimental stress analysis**
- **Seismic testing**
- **Instrumentation development and software**

Improved safety

Control valves used in safety-related applications in nuclear power plants are classified as critical equipment. In order to be 100% certain that safety-related valves will operate when required, extensive qualification testing of new designs is carried out.

Unit uprates

Generators often have to replace critical valves when attempting to uprate units. This can be costly. One plant struggling to get the required capacity from their condensate recirculation valves retrofitted a new custom trim. This provided the increased flow and prevented them from having to purchase new valves, saving them nearly \$150,000.

Plant downtime reduced

A plant was experiencing problems with heater drain systems leading to a mean time between failure (MTBF) of 49 days.

The installation of high performance Fisher valves and the implementation of other recommendations from Emerson engineers, including improved loop tuning, increased the MTBF by a factor of five.

Delivering innovative technologies to customers

IMPROVING PLANT RELIABILITY AND SAFETY

What is it that makes Emerson the supplier of choice for control valves in nuclear power plants? The difference is one of technology and the expertise to apply it in such a way that plants operate more reliably and more safely, valve life is extended and the cost of generation is minimized.

Plant safety should be a given, and with Emerson's nuclear application experts participating in the development of equipment and qualification standards, safety and reliability is built into Fisher control valves from start to finish. Control valve performance is also a key contributor to the safety and overall economics of running a nuclear power plant. Poorly performing valves can result in a poorly performing plant, possibly causing oscillations, that can lead to failures or plant trips.

Emerson understands control valve performance and every valve is designed with high performance in mind. In addition, Emerson's predictive technologies can be used to diagnose problems with control valves, and with the process too.



Installed valve performance

Control valve performance is about much more than merely quoting figures for the as-built hysteresis and deadband. It is also about how the valve will perform when installed; how it responds to small step changes under load. Our dynamic performance loops enable us to test valves under these conditions and to feed the test data back into the design specifications for our valves and instruments.



Dynamic performance loop

worldwide



Maintaining valve performance

Once a valve is installed, the performance needs to be maintained so that overall unit performance is not compromised. Emerson was the first to introduce control valve diagnostic technologies more than fifteen years ago with the release of the FlowScanner™ valve diagnostic system. The FlowScanner and other control valve diagnostic technologies are made available as a service offering for existing control valves and also reside in the Fisher FIELDVUE™ digital valve controller, a valve mounted instrument that takes the place of the valve positioner. The FIELDVUE instrument can be provided with new valves or retrofitted on existing.

Next generation technology

Fisher nuclear products meet next generation seismic and EQ requirements. When you pair Fisher control valves with FIELDVUE digital valve controllers, your plant's overall throughput and availability can increase dramatically.

Nuclear grade instruments

A wide selection of Fisher digital, pneumatic and electronic instruments regulate valve position and variables such as level, pressure and temperature. They incorporate the use of EPDM (or EPT) elastomers, including O-rings, gaskets, and EPDM/Nomex® diaphragms.



Nuclear grade I/P converter

Fisher valves, for second and third generation

FROM ZONE ONE/NUCLEAR ISLAND TO BALANCE OF PLANT

Emerson has a complete portfolio of control valve products for second and third generation nuclear power plants. These include a range of sliding-stem control valves and rotary control valves. Each valve carries the necessary certification for wherever the plant is located.

Every valve is tested and optimized to offer the best possible performance, whether fitted with electric actuators or pneumatic. High performance valves can improve plant reliability and performance as well as improve availability and reduce the cost of generation. When pneumatically actuated valves are paired with FIELDVUE digital valve controllers, they provide the additional benefit of predictive diagnostics.



Condensate recirculation valves

Condensate recirculation valves recirculate a minimum amount of flow through the condensate pumps and back to the condenser hot well. This prevents the pump from overheating. The service is arduous and there is potential for cavitation damage.



While going through a unit uprate, a plant was experiencing difficulties getting the required capacity through its three condensate recirculation valves.

Fisher DST trim protects against cavitation damage.

The operators planned to replace the valves with larger ones. Instead, engineers from Emerson's severe service valve team proposed a trim retrofit that would pass the required capacity while still protecting against cavitation and flashing damage.

The condensate recirculation valves are normally closed and require tight shutoff to eliminate excessive pumping requirements. The special Dirty Service Trim (DST) designed by the Emerson team for this application has a protected seating feature to promote long lasting, tight shutoff.

By retrofitting the trim rather than replacing the valves, the Emerson team saved this plant an estimated \$150,000, not to mention the costs of the significant amounts of labor and paperwork that would have been needed to remove and replace the old valves.

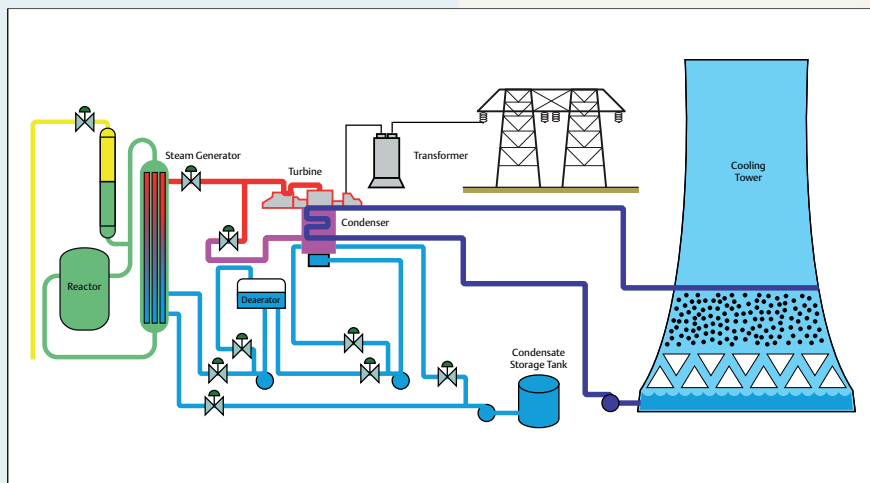
power plants

Zone one/nuclear island valves

Emerson is one of the leading suppliers of control valves for severe and critical duties. Coupled with their extensive experience of the nuclear power industry and their knowledge of nuclear standards, it is easy to see why they are the supplier of choice for zone one/nuclear island control valves as well as for the balance of plant.

Emerson has invested heavily in facilities and resources to support the nuclear power industry and also has significant expertise, enabling them to work closely with end users on new designs of safety-related control valves. To design a new valve for a safety-related application can be a technically challenging and demanding process involving qualification testing, the procurement of materials with complex specifications and testing requirements, rigorous NDT testing procedures and certified machining, assembly and testing routines.

The rigorous qualification testing reflects the job the valve does in the power plant. Control valves are used in safety-critical areas and it is imperative that the valve works when called upon. Even though control valves may only be a very small part of the overall budget, if that one safety-related valve is not delivered on time or doesn't work properly it may prevent the plant from coming online or could cause it to go offline.

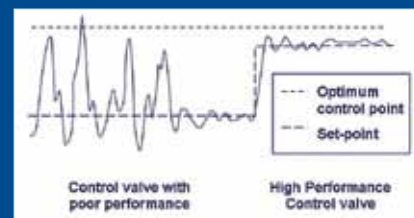


Schematic of typical power station

Control Valve Performance

Nearly all control loops depend on the movement of a control valve to control the parameter being measured. Great care is taken when selecting the transmitter and the controller and much thought is given to loop set-up and tuning.

What is often overlooked is the performance of the control valve, the moving element. With control valve performance loops located in laboratories in North America, Europe and Asia Pacific, Emerson understands the effect that control valve performance has on the overall loop performance and is able to ensure the dynamic performance matches the requirements of the application.



High performance control valves enable control closer to the optimum setpoint

Fisher valves, for second and third generation

FOR ALL YOUR CONTROL VALVE NEEDS

Feedwater valves

Unplanned shutdowns in a nuclear power plant can be costly. Engineers and technicians are always looking at ways to manage potential problems until the next planned shutdown is due, to avoid bringing the plant down early.

This was the situation a North American station found itself in when they noticed graphite dust on the packing flange of one of their feedwater valves. The dust indicated a potential issue with the gland packing. The problem was identified slightly more than a year before the next scheduled shutdown.

As well as preventing leakage, packing friction helps to stabilize the valve, preventing oscillations and premature failure of the loop.

The plant had previously installed Fisher FIELDVUE DVC6000 digital valve controllers on these valves and decided to use the diagnostics capabilities to monitor the packing friction.

Diagnostics tests were run while the valves were operational to determine the packing friction. When the friction had reduced to a level that could cause instability problems, the valves were injected with a sealant to extend the packing life. Diagnostics tests were run to ensure that not too much sealant was injected as this could seize the valve stem in the bonnet, causing a plant shutdown.

The valves remained operational until the planned shutdown one year later, avoiding an unplanned shutdown that could have cost more than \$1M/day.



Diagnostic tests enable the valve to run for longer

power plants

Valves for 2nd and 3rd generation plants

Emerson is continually working on new control valve designs for nuclear power plants. These designs incorporate Emerson's leading edge technologies that have been proven to extend service life, thereby reducing the time engineers must spend working in radioactive areas.

Technologies incorporated into these new designs include live loaded packing to reduce the possibility of packing leaks, improved sealing technology to provide better shutoff and predictive diagnostics to identify control valve issues prior to failure. New valve designs meet enhanced seismic requirements and all the other stringent requirements of nuclear certification agencies.

All Fisher nuclear control valve designs undergo extensive computational fluid dynamic analysis as well as full flow testing and functional and performance testing in one of their industry leading flow laboratories.



Computer generated image of new nuclear valve design

FIELDVUE Digital Valve Controllers

Digital valve controllers have become the dominant replacement technology for conventional and electro-pneumatic positioners since the mid-1990s.



The FIELDVUE DVC6000 digital valve controller

Fisher FIELDVUE digital valve controllers integrate functionality far beyond the traditional analog or pneumatic positioner and offer a far better dynamic performance along with a faster response, this improves control performance and reduces the number of additional accessories, such as boosters.

The benefits of using a FIELDVUE digital valve controller include: availability of equipment alerts to notify the user of pending issues, automated configuration, calibration and tuning, and access to advanced levels of valve assembly diagnostics.

This provides consistent and predictable knowledge of valve assembly performance and condition.

The FIELDVUE design is one of only two digital valve controllers to have passed the stringent requirements defined by EPRI to permit the use of digital instruments on safety-related applications, and is the only one that is actually being used in this extremely critical service.

Serving the Nuclear Industry

FOR THE LIFE OF YOUR PLANT

When selecting a control valve supplier for an existing or new nuclear power plant, it is important to choose a financially stable manufacturer who will work with you over the long term. Fisher control valves have been controlling nuclear power plants for over 35 years and are installed in over 90 percent of operating plants. Manufactured by Emerson Process Management, Fisher valves are the nuclear industry standard.

Established in 1890, Emerson is a \$24.8 billion (fiscal 2008) diversified global manufacturing company that brings technology and engineering together to provide innovative solutions to customers through its network power, process management, industrial automation, climate technologies, and appliance and tools businesses.

Emerson is well-respected for their technology expertise and business platforms. But the company's real advantage comes from bringing together the people and processes to understand and explore customer's needs from many angles. By collaborating across borders, divisions, industries and platforms, Emerson engineers new-to-the-business and new to-the-world solutions. Solutions that not only lead customers and industries through change, but actually transform them in unique and unexpected ways.

Emerson's ability to apply wireless technology in a process operating environment is a great example of a new-to-the-world solution. Emerson Process Management engineers understood that being wireless is not just about replacing wires – it is something much bigger.

Emerson Process Management is an Emerson business and is a leader in helping businesses automate their production, processing and distribution. The company combines superior products and technology with industry specific engineering, consulting, project management and maintenance services. Its brands include PlantWeb™, Fisher®, Micro Motion®, Rosemount®, Daniel®, DeltaV™, Ovation®, and AMS™ Suite.

Smart Wireless solutions offer the exceptional benefits of seeing, knowing and controlling things plant managers could never know or afford to know before, such as detecting leaks along miles of pipeline, gathering data from movable equipment in flexible manufacturing environments and tracking assets and people throughout the plant. Increasing this field intelligence and predictive power makes plants safer, more efficient and more competitive.



Emerson products are well established within the nuclear power industry

Providing the training you need, when and where you need it.



Emerson Educational Services are committed to providing quality training to customers, when and where they need it. Each year nearly 20,000 individuals attend courses at a regional training center, or participate in classes tailored to their particular needs and conducted locally or at their plant. Courses are available on control valve sizing and selection, control valve maintenance and control valve diagnostics.



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