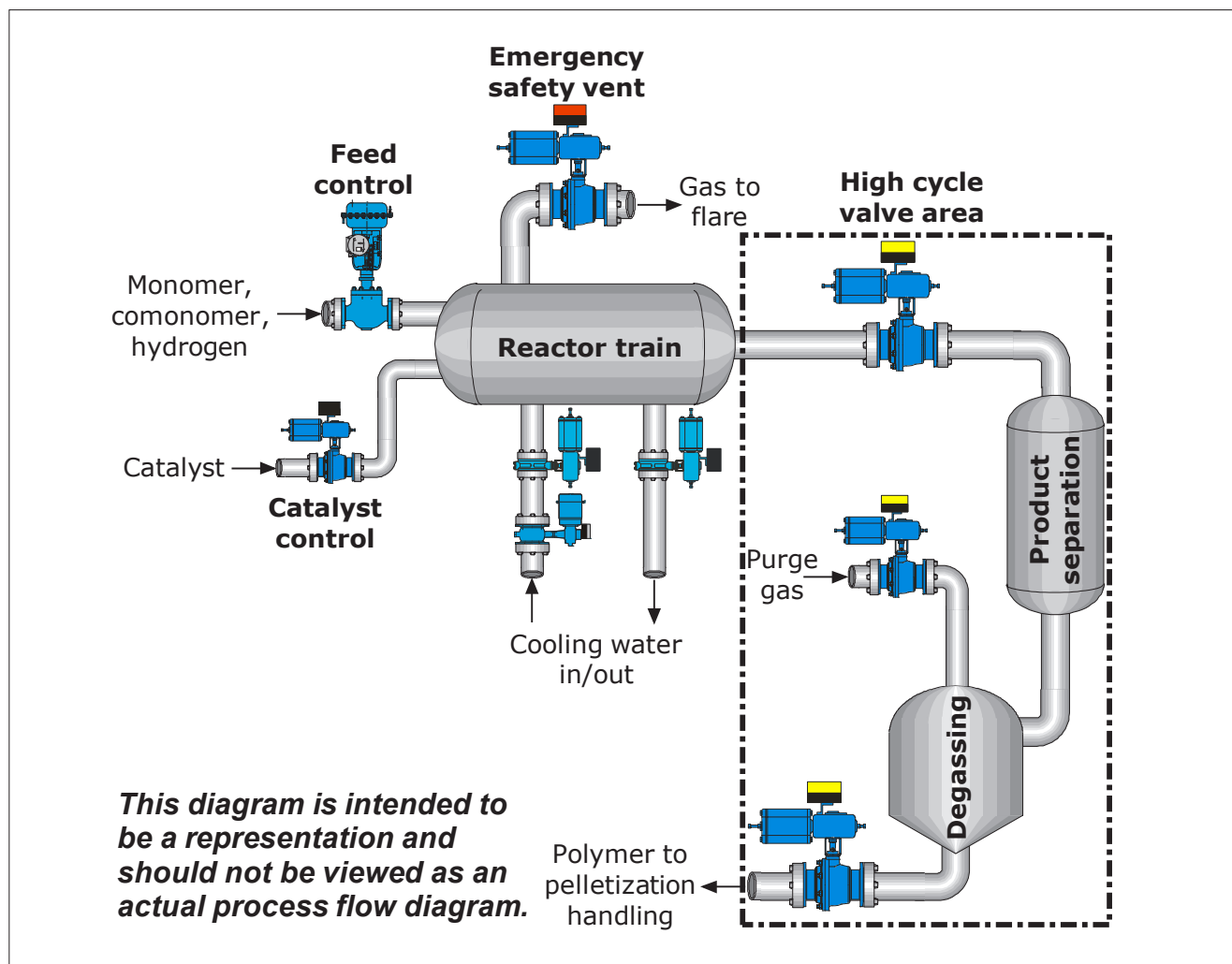


Polymerization – High cycle valves



Process overview

Polymerization is used to produce polymers from monomers, such as ethylene and propylene. Catalysed by proprietary catalysts, the monomers react to produce polymers. Comonomers are commonly used to alter the properties of the produced polymer and the length of polymer chains is controlled by the amount of hydrogen admitted to the process.

Following the reactor train, the product enters the separation and degassing section. Here unreacted monomer and left-over catalyst are recovered. In many cases, polymerization processes utilize valves which are operated very frequently in this section.

The function of high cycle valves varies depending on the exact process configuration used. In cases where the product separation and discharge section consists of multiple legs, these valves may be used for applications such as product conveyance, isolation, gas venting and pressure equalization.

After unreacted monomer and left-over catalyst has been recovered, the product is admitted to the pelletization and additive section where final adjustments to polymer properties are made before the product is sent to storage.

High cycle valve applications

A variety of high cycle valve applications exist in polymerization processes. The majority of these are located in the immediate surroundings of the reactor in the product separation section. Some examples are given below.

Product separation block valves

The block valves isolate the product separation line(s) from the reactor whenever the product separator(s) is/are not receiving resin from the reactor.

Main separation line valves

The main separation line inlet valve isolates the product chamber from the flow of polymer resin and purge gas. If more than one product chamber is installed, additional valves isolate the chambers from each other. Finally, the outlet valve isolates the product chamber from the product purge bin.

Pressure equalization valves

These valves are located between two separators or discharge vessels and are opened to equalize the pressure between them.

Purge gas valves

The purge gas valves isolate the purge gas inlet from the degassing chambers. Similar valves may also be installed in locations where gas venting is needed.

Process challenges

- The medium may contain hydrocarbon vapour, nitrogen, and abrasive catalyst residue with possible chunks and sheets of polymer resin
- Extremely high cycling demands – from around 100 000 up to 1 500 000 cycles per year with a stroke time of less than three seconds
- High pressure differences over the valve, plus heavy piping forces and vibration
- Growth of polymer in cavities and grooves on the seat and bearings due to continuous polymerization of the medium
- Newer catalyst types have led to improvements in the end-product quality, producing harder and thus more abrasive polymers

Neles™ solutions

Neles trunnion-mounted metal-seated ball valves equipped with a high-cycle cylinder actuator and, as an option, an intelligent on/off valve controller SwitchGuard designed for high cycle applications.

Valves

Neles metal-seated ball valves incorporate robust stem to ball connection, assuring solid long lasting performance in high cycle isolation applications.

- **Neles polymer proof metal seat**, preventing polymer from penetrating behind the seat and seizing the valve
- **Anti-abrasive feature**, making it the perfect choice for harder polymer produced with newer more abrasive catalyst types
- **Heavy duty valve design**, capable of withstanding the pressure differences and piping forces in the process
- **Polymer build-up prevention** by having continuous contact between the seat and the ball effectively wiping the seat surfaces with every cycle
- **Tested and field proven** – we have decades of experience in supplying high cycle ball valves for the polymer and petrochemical industry



Neles metal-seated ball valve

As an alternative for valves which handle purge gas and have little contact with polymer resin, **Jamesbury™ soft-seated ball valves** with Xtreme seats, a proprietary polymer formulation, offer a patented flexible-lip seat design that provides positive bi-directional shut-off.

- **Xtreme™ seat sealing technology**, providing longer life and expanded performance boundaries with performance and ratings that exceed the competition
- **Flexible lip design**, offering reliable bi-directional shut-off, cavity relief and extended cycle life with minimum maintenance
- **Superior control characteristics** coupled with tight shut-off capabilities make these valves ideal for on-off applications
- **Tight shut-off even after a million cycles**, proven by extensive use of the valve in industrial gas switching applications
- **Low fugitive emission approvals** by third party authorities

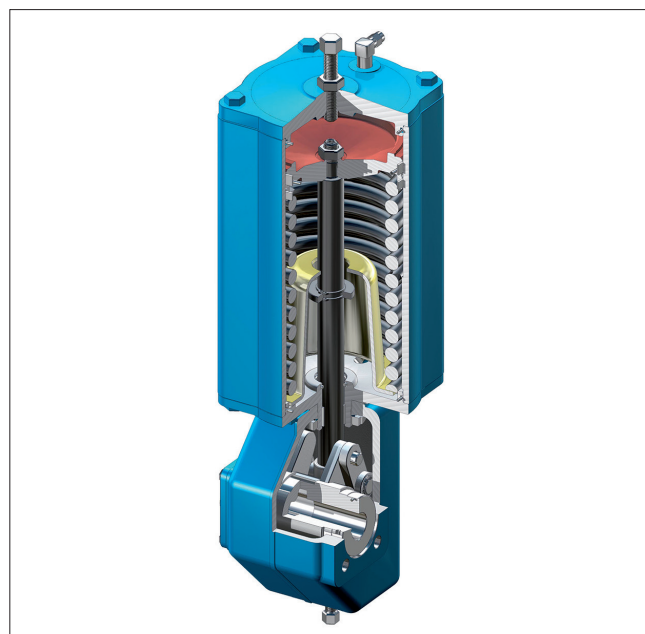


Jamesbury soft-seated ball valve

Actuators

Leading industrial gas suppliers have standardised **Neles pneumatic piston type high cycle cylinder actuator** due to its robust design, which allows longer plant operating time with less maintenance

- **A high cycle design**, which delivers over two million cycles due to a wear-resistant piston rod seal and special wear-resistant material in the lever arm bearings
- **Robust design** – standard anodized/chromed cylinder pipe, hard chromed piston rod, corrosion resistant construction and high quality springs improve robustness further
- **Provides high torque** when closing the valve allowing the use of a smaller actuator and achieving tight shut-off for the valve
- **Modular design**, simplifying maintenance and spare parts management
- **Arctic service compatible** – in case of extreme temperature conditions, the actuator can be equipped with a high performance piston seal and steel materials making it applicable in temperatures as low as -55 °C (-67 °F)

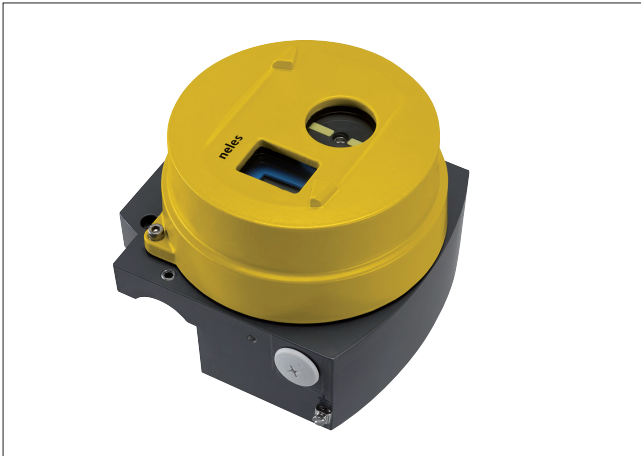


Neles pneumatic cylinder actuator

Valve controllers

Neles intelligent valve controller SwitchGuard™ offers topmost reliability in severe environmental conditions and provides extensive diagnostics for high cycle on/off applications, enabling users to guarantee the availability of high cycle valves.

- **Configure to meet process demands** – SwitchGuard gives the possibility to set the on-off valve stroking times and profiles according to the process needs
- **Operate millions of cycles without maintenance**, due to the advanced design of the controller's pneumatics
- **Reach fast stroking times without accessories**, such as volume boosters or quick exhaust valves, due high pneumatics capacity of SwitchGuard
- **Practise predictive maintenance** with the help of the extensive diagnostics that it provides on the high cycle valve performance
- **Simplify the installation** by installing different mechanical or inductive proximity switches inside the SwitchGuard housing
- **Comprehensive hazardous area certifications** for intrinsically safe and flameproof applications are available for all valve control instruments



SwitchGuard intelligent valve controller

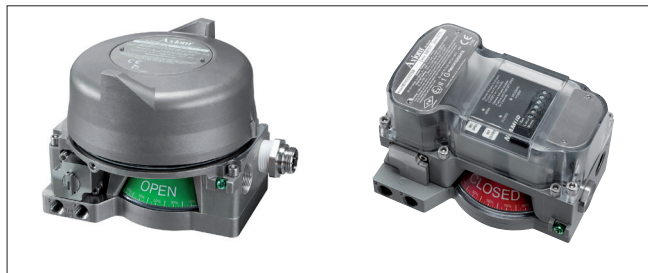
As an option to SwitchGuard, we can also provide a traditional control solution based on a separate solenoid valve, limit switches and other accessories.

Valve monitoring solutions offer a compact and organised way of handling traditional control solutions. They also offer easy to see visual indicators displaying valve status and make wiring quicker and more convenient.

Axiom™ is a valve valve monitor with an integrated 5-way, 2-position solenoid valve compatible with both single- and double-acting actuators. In addition, it also offers a diagnostic system reducing plant downtime and cutting maintenance costs. Available in explosionproof modular (AX) and nonincendive solid state (AMI) versions.

Quartz™ offers a quick access maintenance cover, with an option of 2, 4 or 6 mechanical or proximity switches. It also offers the possibility of installing position transmitters. Available in both explosionproof and nonincendive versions.

Eclipse™ has dual solid state sensors integrated into a sealed module, assuring long life and trouble-free operation. Available in nonincendive version.



Axiom AX (left) and AMI (right) valve controllers

Benefits

- Safety, long lasting tightness and cycle life
- Reliable operation with wiping seat design
- Emission proofing with rotary technology and standard live loaded packing
- Field proven performance
- Avoid polymer build-up in cavities
- Possibility to produce enhanced quality polymers that require new types of catalysts and metal seated valves
- Possibilities to equip valves with instrumentation according to site specific requirements
- Diagnostic capabilities from basic to extensive according to application and maintenance planning requirements

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