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servovalve
Actuators and Controls

Since 1976 **SERVOVALVE S.p.A.**

has designed and produced heavy duty pneumatic and hydraulic actuators for the most critical and complex industrial applications, becoming through the years a well known reliable and innovative independent supplier for the main worldwide valve manufacturers and Engineering Company.



Following the large experience on valve actuating systems and the deep knowledge of the most stringent international quality standards, production has been designed for the most arduous working conditions, providing actuators suitable to be installed in hostile and corrosive environmental and to withstand presence of high vibrations and severe service, saline atmosphere, high or low ambient temperatures and cryogenic service.

Servovalve fluid power actuators have been provided for various critical services for conventional, geothermal and nuclear power plants, offshore platforms and onshore oil&gas fields, refineries and desalination plants, LNG plants and FPSO applications all over the world.

Working closely with End Users and valve manufacturers, has brought **Servovalve** to be considered a customer's partner more than just a subsupplier. **Servovalve** policy of customer satisfaction for the most critical and out of standard requirements, has arisen as a consequence one of the most wide product range.



Servovalve reputation for excellence in valve actuation engineering and production is coming directly from a worldwide field experience of more than thirty years.

Many of the actual **Servo**valve actuators have been developed following customer's request, and their execution constantly improved according to End Users feedbacks and from new market requirements, keeping production updated to the latest needs of the most advanced and innovative valve actuation technology.



Highly trained and experienced sales and technicians provide customer with the best technical and cost effective solution for any actuation requirement, with a high quality and reliable construction and if necessary a full custom made proposal.

Due to his know-how and experience in the most critical valve control applications, **Servo**valve scope of supply is not limited to fluid power actuators, but include complete actuation systems for on-off or control service.

Quarter turn actuator

Servovalve quarter turn actuators are designed to operate ball, butterfly, plug or any other valve with 90° rotation, for on-off or modulating service. Rack&Pinion actuators are mainly adopted for small size valves or for very critical and accurate modulating service, while scotch yoke executions are preferred for medium and big size valves, due to their capacity of exalting output torques at 0° and 90° valve position.

To perform the best possible output torque diagram relevant to the valve requested torque, scotch yoke is available in symmetric or canted execution.





Quarter turn actuator

Well proofed heavy duty design concept provides a economical and reliable solution with the key following features:

Rack & Pinion or Scotch Yoke (Symmetric or Canted execution) mechanism

Pneumatic or Hydraulic execution in Single or Double acting configuration

Totally enclosed waterproof housing that provides complete protection for all moving parts

Fabricated carbon steel or ductile cast iron housing construction

Pneumatic/hydraulic cylinder is realised in internally chromium plated carbon steel in order to minimize piston movement friction and prevent corrosion phenomenon

Internal shaft in chromium plated alloy steel and bushings PTFE charged to reduce frictions

Spring cartridge designed to allow the replacement of the spring in field without any danger

Specially designed safety stay-bolts allow to open the cartridge and remove the springs only after having completely released the loaded spring, avoiding all risk of injury to operating personnel, thus maintaining the possibility of internal inspection or maintenance.

The same safety stay-bolts preload again the springs, closing the cartridge without any special tools

Standard operating temperature range min -20°C max $+80^{\circ}\text{C}$. Available on request execution for low temperature (up to -60°C) or high temperature (up to 200°C)

Emergency manual hand wheel or hydraulic override available on request

Special execution for critical modulating service with reduced friction and hysteresis

Output torques up to 500.000 Nm

Linear Actuator



Servovalve linear actuators are designed to operate gate or globe valves, for on-off or modulating applications.

These high performance actuators are compact and provide a simple but reliable design with particularly accurate execution for actuation of process control valves, allowing excellent response with low hysteresis and dead band.

Actuators can be supplied as double acting or spring return and are manufactured to operate in the most severe working conditions.



Key design features:

Pneumatic or Hydraulic execution in Single or Double acting configuration

Totally enclosed waterproof housing that provides complete protection for all moving parts

Pneumatic/hydraulic cylinder is realized in internally chromium plated carbon steel in order to minimize piston movement friction and prevent corrosion phenomenon

Shaft in chromium plated alloy steel and bushings PTFE charged to reduce frictions

Spring cartridge designed to allow the replacement of the spring in field without any danger

Specially designed safety stay-bolts allow to open the cartridge and remove the springs only after having completely released the loaded spring, avoiding all risk of injury to operating personnel, thus maintaining the possibility of internal inspection or maintenance. The same safety stay-bolts preload again the springs, closing the cartridge without any special tools

Standard operating temperature range min -20°C max $+80^{\circ}\text{C}$. Available on request execution for low temperature (up to -60°C) or high temperature (up to 200°C)

Adapting parts for valve assembly according to customer request

Emergency manual hand wheel or hydraulic override available on request

Special execution for critical modulating service with reduced friction and hysteresis, including optional hydraulic dampers

Output thrust up to 500 kN

Electrohydraulic actuator



The ultimate approach in engineering of Power plants and Oil&Gas production and treatment fields, has increased the demand for remote operation of valves with fully autonomous systems. Best solution to reduce plant installation cost where compressed air is not available or is not a practical solution and to allow operation in remote or unmanned locations, are self-contained hydraulic actuator systems.



Main advantages of an electrohydraulic actuator are the following:

Reduction of cost for installation and maintenance providing a simple and reliable system

Increased safety with automatic fail safe position in case of electric power failure

High level of reliability due to continuous monitoring of working status

Compact execution with reduction of dimensions and weight due to the availability of high pressure hydraulic medium for actuator operation, with possibility of providing a totally sealed system with corrosion protection of internal components for installation in harsh environmental or application of fireproof protections

Hydraulic energy stored in high pressure compact accumulators, available at any time under all circumstances

LCD display for easy calibration, position, pressure and fault diagnostic

Design of electrohydraulic system is extremely flexible and can be adapted to suit many different application or plant requirement, providing a highly customized product in various configuration:

Centralized power pack designed with built-in accumulator rack and control cabinet for control of one or more valves

Self-contained hydraulic units with compact power pack integrated with the actuator

Fully independent hydraulic system for on/off or modulating service with 4-20 mA control signal and Hart protocol

Hydraulic unit for HIPPS application on safety and critical valves

Direct gas operated actuators

Increasing worldwide demand for natural gas has pushed continuous developing on construction of new gas pipeline and gas treatment and compression stations. Gas spilled from pipeline is often adopted as medium supply for valve actuators, being the most direct and convenient power source.

In order to follow this tendency **Servovalve** has developed a full actuator range suitable to work using pipeline gas, already qualified and approved by few of main pipeline gas Company. Basis of this range are the highly reliable and well proven high pressure **Servovalve** actuators, available in both quarter turn or linear execution.



The particular pressure supply medium has brought few improvements and modifications to the standard high pressure cylinder actuators :

Compact inlet gas manifold complete of gas filter dehydrator with unique design in order to eliminate the presence of water and impurities in feed gas, protecting the components of the pneumatic control circuit and the actuator itself, assuring a long life and low maintenance to the equipment

Gas manifold with modular design in order to provide different control typicals for customized control logics

Main control circuit components enclosed in weather proof cabinets to ensure optimum corrosion protection for installation in harsh environmental with presence of aggressive gas or application in fireproof execution

Availability of PED or Asme approved gas storage tanks for emergency strokes in case of power loss - different tank certifications available on request

Manual emergency override composed of separated hydraulic cylinder with handpump. Emergency cylinder is consequently totally separated from high pressure gas cylinder avoiding mixture of the two fluids and allowing the possibility of maintenance or repair activity on pneumatic cylinder without losing operability of the valve controlled by the emergency override

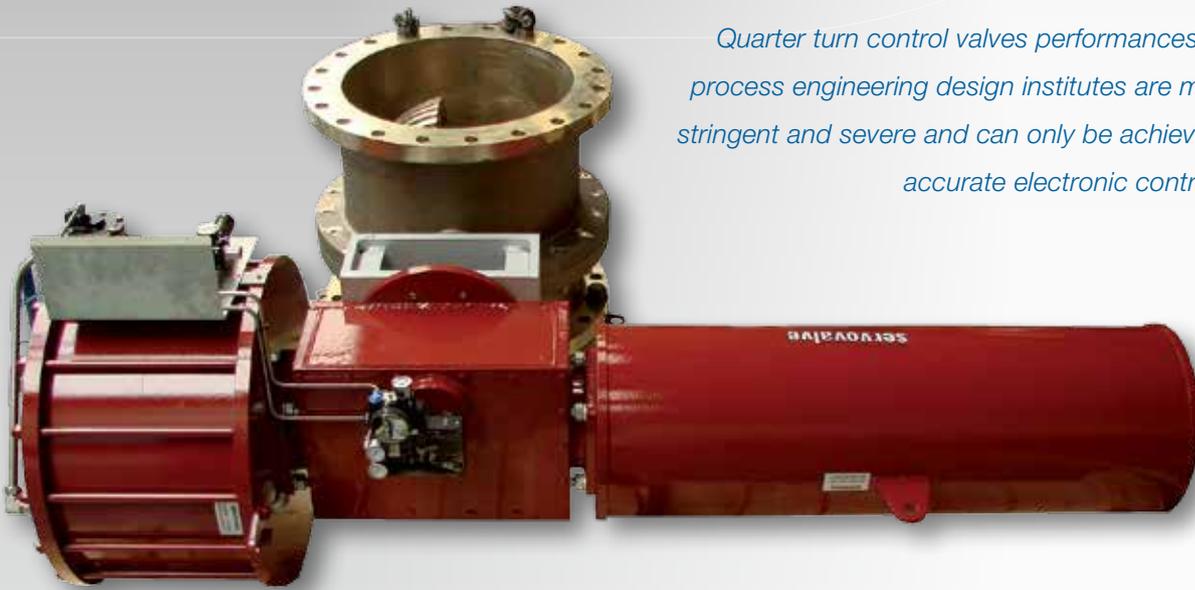
Local control by means of lever operated solenoid valve, allowing possibility of local testing and control

Standard working pressure up to 105 Barg (1500 psig) execution for higher pressure available on request

Standard temperature range - 20°C / + 80°C available execution for low temperature up to - 60°C

Quarter Turn Actuators for Control Valves

Quarter turn control valves performances requested by process engineering design institutes are more and more stringent and severe and can only be achieved with use of accurate electronic control positioners.

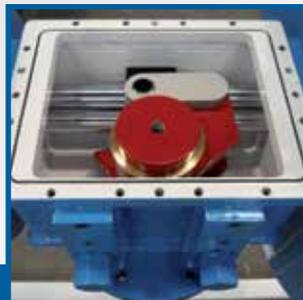


Digital signal outputs of electronic controllers must be converted in a valve position by means of the mechanical movement forced by the actuator.

The accuracy and precision of actuator movement become consequently of primary importance to achieve the theoretical valve control performance.

In particular is extremely important to obtain a constant mechanical action during the time avoiding any possibility of wearing or loosening in continuous modulating service.

For this kind of important process valves **Servovalve** has developed a new actuator range with a mechanical kinematics with crank handle system instead of usual scotch yoke actuators.



This mechanism added to the usual high quality features of Servovalve quarter turn actuators ensure the best possible performances for actuation of control valves :

Scotch yoke actuators used for critical modulating service might present during time loosening or wearing due to the high frictions on the linkage parts in movement, in particular in case of valves frequently modulating on a restricted and defined rotating angle range. Crank handle system ensure the best mechanical connection with total absence of wearing on linkage components and very low friction

Absence of wearing ensure an extremely precise response for an optimum valve positioning controls and guarantee constant performances and reliable and long life execution

Output torque diagram provided by crank handle system is the optimum solution for actuation of control valves with high dynamic torque during modulation, ensuring a correspondent increase of actuator torque, while scotch yoke actuators has a low running output torque

Pneumatic cylinders are internally chromium plated in order to minimize piston gaskets friction and prevent corrosion phenomena

Chromium plated internal shafts and bearings in PTFE charged sinterized bronze ensure minimum friction

Spring cartridge designed with safety bolts to allow on field maintenance without any danger for operating personnel

Available in execution with manual emergency override

Standard temperature range - 20°C / + 80°C
available execution for low temperature up to - 60°C

Compact Actuators

Technical feedback received from Customers and End Users has clearly shown that one of main critical features for Offshore & FPSO applications is the limited space availability.

Servovalve response to the rapidly increasing demand for compact actuators is the UCR series available in both hydraulic or pneumatic supply execution.



UCR series has been designed to provide same performances of scotch yoke actuators but, due to his innovative design, with a completely different result in overall dimensions, as showed in the below comparative figure.

Design is extremely flexible with the possibility to customize the ratio between external diameter and height adapting actuator construction to space availability on site and optimizing dimensions and weight to End User requirement.

Extreme compact design is particularly suitable to allow an optimum corrosion resistance and protection of internal parts, becoming the best solution for the extreme and severe working conditions of offshore, subsea and FPSO applications.





Compact Actuator

Main features and benefits of UCR construction :

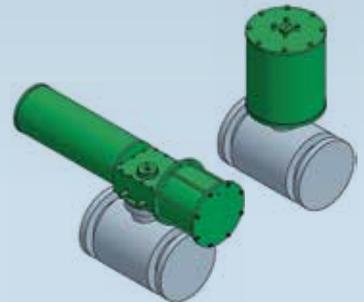
Extremely reduced dimensions

Perfect weights balance due to the symmetry respect valve spin axis, that means greater facility of assembly/disassembly with valve at site without special equipments to balance the eccentric load

Simple construction with reduction of parts and consequent reduction in weight

High efficiency and low friction ensuring a long free maintenance life of the actuator

Totally enclosed design for corrosion protection of internals and optimum resistance to dust and water



Reduction of hydraulic/pneumatic supply consumption. UCR actuator also allow to reduce the fluid displacement improving operating time, and reducing hydraulic power units components size

Flexible customized design according to installation site limitations

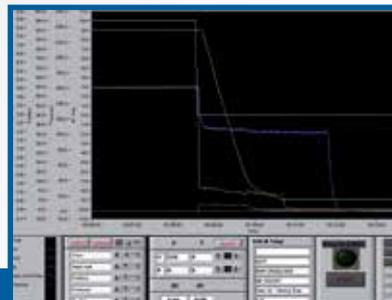
Fast acting actuator

Since the beginning of his activity Servovalve has designed, working closely with technical department of main steam turbine manufacturer, Emergency Fast Acting actuators for turbines by-pass valves.

Fast acting actuators are available in execution for on/off or modulating service in linear or quarter turn execution.

To maximize the already high reliability, due to their function of protection for the turbine or strategic and critical equipment, special executions have been developed using Belleville spring cartridges. Executions with rack and pinion mechanism also for

big size quarter turn valves has been provided for extremely accurate modulating service or in case of important dynamic torques requirement.



To certify with extreme accuracy performance and stroke test, dedicated equipment and software has been developed in order to guarantee

the respect of technical specification and simulate the effective working conditions in modulating and emergency actions. Fast acting emergency shutdown actuators are installed worldwide in a wide number of power plants of all the most important international turbine manufacturers.

Their execution has been developed and improved taking into account the particular severe service, defining actuators with the main following features:

High output torques for operation of big size valves working with high pressure and temperature steam

Execution with custom made manifolds and exhaust valves avoiding the use of piping and fittings due to the presence of high vibrations

Custom made quick discharge manifolds to reach emergency closing stroke time $< 0,15-0,2$ sec

Custom made dampers to avoid excessive dynamic stresses to valve seats in last part of closure stroke



Actuators for Nuclear Power Units

In the '80 during engineering and construction of nuclear power plants in Italy, Servovalve was one of the first company to design actuators suitable to comply with the requirements of Nuclear industry.



After severe test and qualification sessions, many actuators were supplied to the principal plants as:

*Montalto di Castro NPP - Italy
Research Center of Brasimone - Italy
Caorso NPP - Italy
SuperPheonix Plant - France*

Activity stopped after Italian plant construction interruption caused by Chernobyl disaster, but a certain activity had been maintained for assistance and small supplies for ending projects. Thanks to past experience and know-how, New Nuclear Renaissance, due to worldwide demand for environmentally friendly major source of energy for the future, has rapidly become a new opportunity of development for **Servovalve** production.

A skilled and experienced technical branch has been dedicated to new products and highly customised execution developed in co-operation with main European and Asian Company involved in Nuclear Plant construction.

As a result of the awarded approvals and qualifications, **Servovalve** has provided actuators to new Nuclear power plants including the following projects:

- **Cernavoda Nuclear Power Plant - Romania**
- **Flamanville 3 EPR Nuclear Power Plant - France**
- **Olkiluoto 3 EPR Nuclear power plant - Finland**
- **Qinshan 3-4 Nuclear Power Plant - China**
- **Hongyanhe Nuclear Power Plant - China**

Qualifications are still on-going also for supply of materials for life extension for many European Nuclear Power units.



Working under the most stringent Quality Assurance requirements , design of actuators for Nuclear application rely on the latest mechanical project software allowing the performing of:

Detailed 3-D models

Modal analysis calculation for natural frequencies and mode of vibrations calculation

Finite elements analysis for stress and strain and seismic calculations

Relying not only on theoretical results, actuators performances has been verified with functional test under third parties approval, including life cycle test and seismic resistance verification on vibrating tables at qualified Test Center

Self Contained Hydraulic actuators



Oil&Gas exploration, production, treatment and distribution plants are more and more often located in remote sites, consequently the request for providing reliable ESD valve shutdown systems able to work in condition where external power source is not available is highly increasing.

Following market demand **Servovalve** has developed a flexible module including a Self Contained Hydraulic unit suitable for service under the most severe environmental conditions, to be coupled either with quarter turn or linear spring return hydraulic actuators for pipeline valves to provide a fail safe emergency shutdown device.

Control unit is designed to provide a manual charging of the system and capability of maintaining normal valve opened condition for extremely long periods with a specially designed zero leakage hydraulic manifold.

Emergency action is both manual and automatic, controlled by process pipeline Pressure Sensing valves that detect emergency high or low pressure fluid pipeline conditions, activating the emergency closure.

System include automatic safety action in case of fire with selected fusible plug valves and oil temperature compensation and pressure relief allowing the unit suitable for any environmental including sites with wide temperature range such as desert or arctic climate.

Fail safe design

Pressure Sensing valve available for sweet gas or sour gas with construction in AISI 316



Main benefits and significant features of Servovalve Self Contained Hydraulic actuators are:

Flexible remote and/or local emergency shutdown system with possibility of customized execution

Elimination of any requirement of air, fuel gas, electricity or expensive nitrogen backup accumulator system

Ideal for remote unmanned and unpowered service

Absence of any hazardous gas emission to atmosphere, particularly important for plants treating sour gas with presence of H₂S

Elimination of any corrosion associated with the use of fuel/sour gas as medium supply, ensuring reduced maintenance and long life to actuator and control equipment

Fireproof actuator

Critical valves are often installed in hazardous and dangerous area of refinery, offshore and onshore plants, gas treatment units, where the event of explosion or fire is always possible.

To keep the control of the valve and relevant process even in case of fire,

Servo valve actuators can be provided with a suitable fireproof protection that will guarantee normal working conditions for several

minutes protecting all mechanical parts and control circuit equipment.



All insulation systems are provided with complete Third Party certification. According to the chosen solution, protection is provided for temperatures up to 1300°C and for periods up to 120 minutes.

Servo valve technicians are at disposal for training and demonstration on how to fit on our actuators the protective enclosures.



According to the various requirement and depending on actuator execution or dimension and design of the local control circuit, different insulation systems can be proposed:

Intumescent coating

Flexible passive protection certified for hydrocarbon pool fire or jet fire test

Rigid passive protection enclosure certified for jet fire test



Research & Development

Special care and resources have been dedicated since the beginning to satisfy customer requests in special and out of standard actuators, developing a skilled engineering team able to propose custom made solutions to any kind of application coming from End Users or Engineering Company.

Servovalve technical Dpt. can rely on the latest 3D software for actuator design.

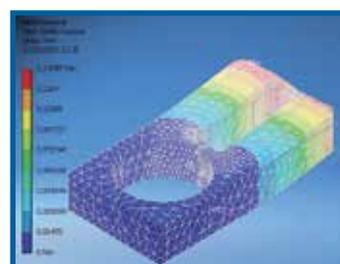
Finite elements mechanical stress analysis and motion simulations are currently adopted from our Engineers.

This top level ability added to the thirty years know-how and existing data base, allow accurate project realization and supports our Sales offices in providing fast replies to Customer request with detailed technical solutions.

Due to their innovative and unique design, many of the technical solutions proposed are actually under **Servovalve** patent.

Design of actuators is realized according to the most stringent international standards so to produce full control systems easy to be installed, used and maintained whilst remaining safe and environmentally friendly as the most cost effective and reliable solution to any flow control request.

All new projects are carefully tested during engineering phase with accurate simulations of working conditions and cycle load test, realized on our test bench complete of appropriate and sophisticate measurement instruments.



Actuator Testing

Every **Servo**valve actuator is the final result of an accurate design process started to satisfy Customer requests and expectation for the best technical solution on valve actuation.

To assure the highest quality level and reliable product, testing on actuators and to any new technical improvement is fundamental.

For this reason since beginning of activities **Servo**valve has invested many resources in developing a complete and fully equipped testing area in order to measure actuators performances and simulate as much as possible real working conditions and efforts on mechanical parts.

Servovalve test devices are suitable to provide a wide range of test and measurements so to guarantee Customers on a high quality product in conformity to his requirements.



Testing area can rely on the following devices:

Different torque range measurement test bench controlled by dedicated software to allow possibility of:

- Static torque measurement
- Dynamic torque measurement
- Simulation of valve resistant torque diagram
- Cycling endurance actuator test under load condition

Linear thrust measurement with thrust load cells

Dedicated software for measurement and record of stroke time and pressure diagrams, in particular for fast acting and ESD actuators

Hydraulic power units for hydraulic actuator pressure testing

Hydraulic power units for flushing test, complete of oil cleanliness level measurement electronic devices according to NAS or ISO standard

Dimensional measurement instruments for check on mechanical machined components

Softwares for hysteresis and dead band measurement on actuators for control valves

Painting dry film measurement



Special Executions

Custom made valve actuating systems have often brought Servovalve to develop new innovative products to satisfy the request of many different market niche for various industrial application.

Several of these executions have joined Servovalve product portfolio.

Gas Over Oil Actuators

Servovalve Gas-Over-Oil actuators have been specifically designed for actuation of pipeline valve in any kind of environmental and are available in different configurations so to comply to wide range of technical requirement. Available for different type of control due to highly flexible gas manifold design, can be equipped also with pneumatic or electronic line-break for emergency closure in case of pipeline pressure drop. Actuator and accumulators available according to PED or ASME, gas manifold protected inside stainless steel cabinet and emergency manual override with hydraulic local handpump. Standard execution for 1500 psig gas pressure, available construction for higher pressure or according to Nace requirement in case of sour gas.



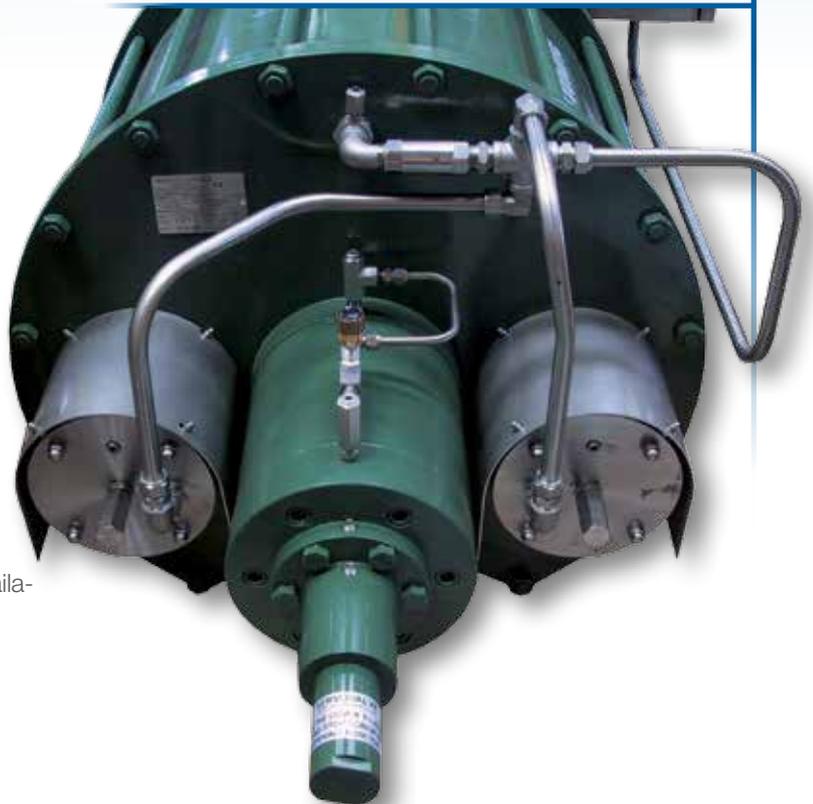
Pneumatic Fast Acting Actuators

Based on field experience on hydraulic fast acting actuators, **Servovalve** has developed and designed particular pneumatic quick exhaust valves for big size pneumatic spring return actuators. This design reduce at minimum dead time after pilot signal cut-off allowing to reach extremely fast emergency stroke times even when is required a high flow capacity typical of big pneumatic cylinders.

Quick exhaust valve can be provided complete of hydraulic damper so to smooth last degrees of closing stroke, protecting valve seat and reducing shock and vibrations on valve and pipeline.

Stroke time test diagram and measurement records are available on request.

This execution allow to reach fast stroke time up to 0.3 sec. (depending on cylinder volume and working pressure).



Quality Assurance and Certification



*Design, manufacturing and test procedures are complying according to the highest quality and efficiency standards, under the award of internationally recognized Third Party notified body, in particular **Servovalve** awarded certifications are the following:*

EN ISO 9001: 2008 Quality System awarded by Det Norske Veritas (DNV)

EN ISO 14001-2004 Environmental Management System awarded by Det Norske Veritas (DNV)

BS OHSAS 18001: 2007 Occupational Health and Safety Assessment Series awarded by Det Norske Veritas (DNV)

European Pressure Equipment Directive 97/23/CE (PED) awarded by Det Norske Veritas (DNV)

ATEX Directive 95/9/CE awarded by Det Norske Veritas (DNV)

Functional Safety Management System according to IEC 61508:2000 (SIL) awarded by TUV NORD for application up to SIL 3 Level

Gost-R Certificate

Rostekhnadzor Certificate





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