

PRODUCTS FOR USE IN HAZARDOUS ENVIRONMENTS

Explosion proof, flameproof and intrinsically-safe



When companies need to operate machinery in potentially explosive environments, maximum safety and reliability are critical. As an expert in providing motion control solutions for some of the world's most demanding environments, Moog provides a range of products for hazardous environments. From flameproof enclosures to increased safety and intrinsically-safe designs to obtaining certified accessories, Moog's expertise is designing and building products for high performance and long service life.

Moog designs and manufactures servo valves, proportional valves, radial piston pumps, manifold systems, brushless servo motors and actuators that have the rugged construction and increased-safety characteristics needed in potentially hazardous environments. To provide our customers with the highest level of confidence in the safety of our products, we obtain international approvals such as ATEX, IECEx, FM, UL, ETL, TIIS, and CSA.

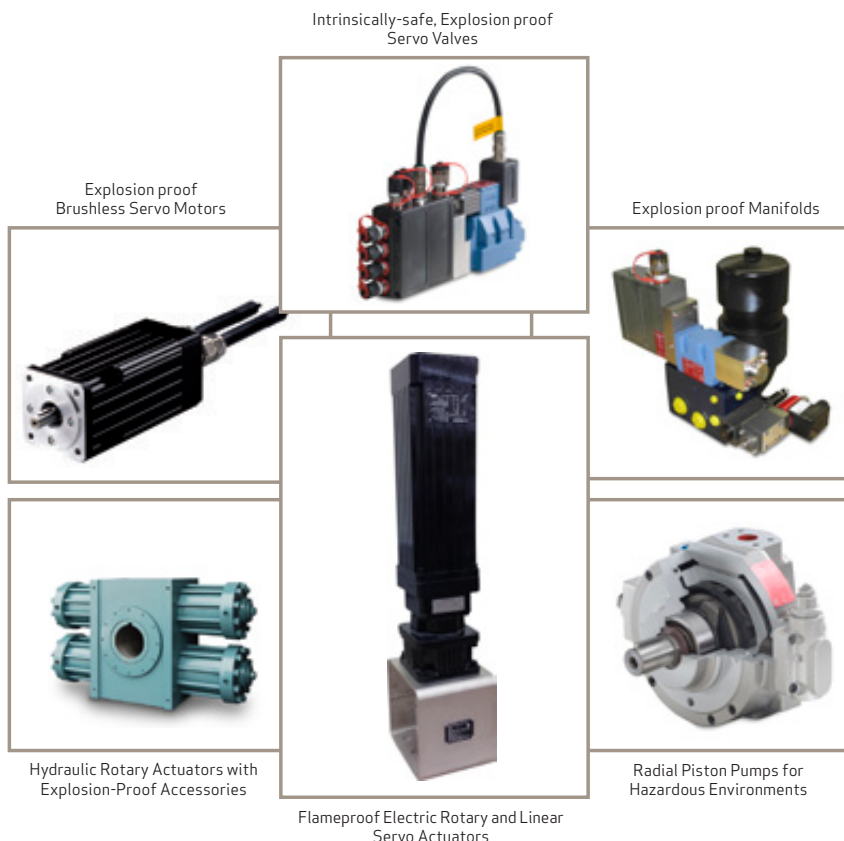
Let us help you obtain the highest motion control performance as well as ensure compliance to health, safety and environmental regulations around the world.

ADVANTAGES

- Wide range of certified products in both hydraulic and electric technologies offers flexibility for new machine designs
- Rugged construction and special designs for high temperature ensure long service life
- Technical support available from experts knowledgeable about applications in potentially hazardous environments
- All products designed and manufactured in Moog facilities so they can be tailored to meet unique customer requirements

APPLICATIONS

- Oil and Gas Exploration and Production
- Gas and Steam Turbines
- Power Generation
- Presses
- Mining



MOOG ENGINEERS CAN HELP YOU SELECT THE RIGHT PRODUCTS

Moog's experienced engineers work closely with customers to help them select the right products from a wide range of Moog's offerings. It can be confusing and time-consuming to manage purchasing products with the right certifications for the countries where you do business. We have trained engineers who can help you.

Our engineers typically will ask you a few key questions in order to identify the best product for your hazardous environment needs.

- What country or countries are you shipping to?
- What is the application?
 - Is it surface or mining?
- What is the rating of the location?
 - What is the ambient temperature?
 - What is the gas grouping?
 - What type of motion do you need (e.g. linear or rotary)?

To find a Moog expert near you who can help you find the best product for your needs, visit moog.com.

Certifications Overview

There are a range of certifications required for products used where fire or explosion hazards exist due to the presence of flammable gases or vapors, flammable liquids, combustible dust or easily ignitable fibers. An application can require different safety levels defined by the safety regulations. From the highest levels (e.g. ATEX II 2G Ex de IIC TX Gb, temperature classes T3 up to T6) to more occasional or short term levels, Moog engineers will work with you to adapt specific products and technologies to suit your needs.

Valve Overview

When an application needs high performance and reliable servo valves and proportional valves, Moog's products are the preferred choice of machine builders. With over 60 years of experience designing and manufacturing valves and global expertise in applying products with certifications for use in hazardous environments, Moog offers the ability to modify designs to meet your exact requirements.

- Superior dynamic performance
- Highest stability and repeatability
- Robust design, no service required

Servo Valves with an Intrinsically-Safe Design



- Products certifications to ATEX, FM, CSA, and TIIS
- Pilot-operated flow control valve with mechanical feedback (no integrated electronics)
- Products suitable for continuous and short period explosive environments as defined in safety regulations and approved

for a range of safety levels including ATEX: II 1 G Ex ia IIC T6 or T5

- Models with maximum flows up to 231 lpm (60 gpm) and maximum operating pressures up to 315 bar (4500 psi)
- Electrical interfaces with ex-proof cable glands with pigtail

ATEX Approved Servo and Proportional Valves

Analog and Digital Direct Drive Valves with integrated electronics



- Products suitable for occasional, frequent, and short-period explosive atmospheres as defined in safety regulations including gas zones to Ex II 2G Ex de IIB + H2 T3/T4 and dust zones to Ex II 3D Ex: tD A22 T155°C
- Available with flow control, pressure control, flow and pressure control and axis control functions with maximum

flow up to 180 lpm (47.6 gpm) and maximum operating of 350 bar (5000 psi)

- Electrical interfaces through explosion-proof cable glands with pigtail for analog version and explosion-proof connectors for the digital version

Analog and Digital Pilot Operated Valves with integrated electronics



- Products suitable for use in occasional, frequent, and short-period explosive atmospheres as defined in safety regulations including Ex II 2 G Ex d IIB + H2 T5 and II 2G Ex de IIC T6/T5/T4/T3 Gb
- Available in flow control and flow and pressure control functions with maximum flows to 3,600 lpm (951 gpm); Sizes 05, 07, 08, and 10 are available

- Analog and digital technology versions are available
- Electrical interfaces through explosion-proof cable glands with pigtail for analog version and explosion-proof connectors for the digital version

Integrated Manifold Systems

- Versions tailored for hazardous environment include application specific circuits, higher safety levels, and mounting for Digital or Analog ATEX Valves



- Integrated hydraulic manifold systems are self contained systems comprised of hydraulic manifolds, cartridge valves, servo cartridge valves and servo valves.

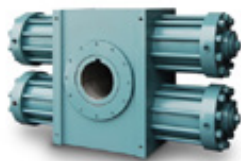
Radial Piston Pumps for Hazardous Environments



- Designed for demanding industrial applications and ATEX approved to EX II --/2 GD 135°C (T4) -15°C T_a $+60^\circ\text{C}$ for gas and dust
- Available in 7 pump sizes between 19 and 140 cc per revolution (19, 32, 45, 63, 80, 100 and 140) and has a maximum speed range of 1,800 to 2,900 rpm
- The standard design permits continuous pressure to 280 bar (4,000 psi) with 350 bar (5,000 psi) peak limit and the high-pressure version is capable of continuous pressures up to 350 bar (5,000 psi) with 420 bar (6,000 psi) peak limit
- Large selection of controls, including standard pressure compensator, remote pressure compensator, pressure and flow control
- Well-suited for mineral oil and a wide variety of special fluids including HFA, HFC, HFD, transmission oil, cutting emulsion, isocyanides and polyol

Visit www.moog.com for more technical details.

Hydraulic Rotary Actuators



- Available with ATEX approved accessories
- Sealed actuator with no external sliding components
- Available in 4 size ranges with torque output up to 67,791 Nm (600,000 lb-in) and 210 bar (3000 psi) maximum operating pressure
- Bearings and gear meshed permanently lubricated
- External configuration design for easy removal of dust deposits to prevent ignition source
- All internal sliding or moving joints designed utilizing bearing surfaces to eliminate friction and potential heat build up

For more information, visit <http://www.flotork.com> or call +1-330-682-0010

MOOG GLOBAL SUPPORT™

Moog Global Support™ is our promise to offer world-class Repair and Maintenance Services delivered expertly by our trained technicians. With the reliability only available from a leading manufacturer with facilities around the world, Moog offers you service and expertise you can count on to keep your equipment operating as it should.



Explosion proof Brushless Servo Motors



- Certified ATEX 94/9/CE directive "d" type protection and IECEx for II C gases with dust protection against III C and marked as Ex d IIC T4-T6 Gb Ex tb IIIC T 135°C to T 85°C Db IP65/67
- Compact, lightweight, highly dynamic servo motor, with low-cogging, rugged, minimum maintenance design with protection class IP67
- Commonly available in sizes 3 (70 mm [2.76 in] flange) and 5 (140 mm [5.51 in] flange) with other sizes and special versions available upon request
- Models available with nominal speed up to 7800 rpm, and rated power up to 5.3 kW (7.0 hp)
- Maximum torque up to 61.2 Nm (541.7 lbf in) and inertia up to 18.4 kg cm² (162.9 lbf in s²)
- Built-in PTC thermal sensor to protect motor from overheating under excessive loads
- Bearings greased for life and do not require maintenance
- Moog provides Servo Drives that are paired to these products in order to optimize performance

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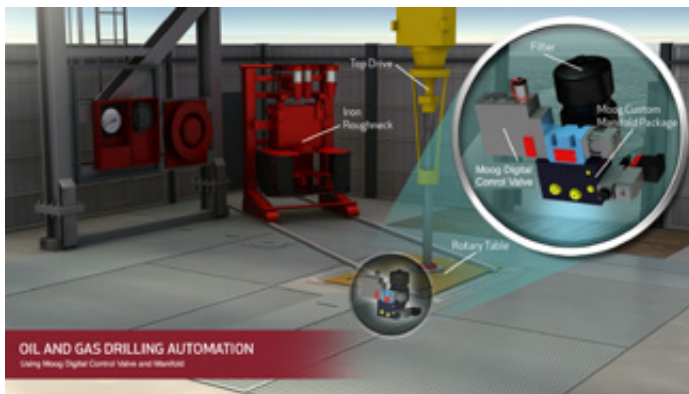
Flameproof Linear and Rotary Electric Actuators



- Based on the ATEX certified servo motor, the electric actuator designs are certified to ATEX:II 2G ex d 11B T4 or T6, CSA, UL, and ETL
- Specialized Actuators are optimized for Power Generation and Oil and Gas applications and are certified ATEX:II G, EEX d IIC T4
- Moog designs and manufactures linear and rotary actuators with flexible interfaces, bearing systems, gear boxes and ball screw sizes that are optimized for specific applications
- Based on the explosion-proof servo motor product line, actuators can be built in multiple frame sizes with lead lengths that are variable and dependant on ballscrew sizes
- Maximum speeds for linear actuators are up to 1600 mm/sec (63.0 in/sec)
- Maximum rotary actuator torque output up to 3,971 Nm (35,100 lbf in) with 100:1 gearbox



OPTIMIZING OIL AND GAS WELL DRILLING EFFICIENCY WITH ATEX APPROVED PRODUCTS



Introduction:

A major energy systems company was looking to improve the control of a large hydraulic motor in drilling subsystems. The drilling environment is demanding as it is characterized by heavy use, constant vibration and the potential to release underground gas pockets. The use of Servo Valves certified according to ATEX regulations (II 2G Ex d e IIC T4 Gb) was required.

The Request:

Initially the requests from the customer were for advanced flow control to dynamically control the hydraulic motor speed with minimal pressure drop in a consolidated package. While working with the customer's engineers, Moog proposed that future systems could benefit from pressure limited flow control that would allow repeatable output torque at slow speed.

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www.moog.com/industrial

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Overview of Products for Use in Hazardous Environments
TJW/PDF/Rev. 2, December 2013, Id. CDL32480-en

The Solution:

To meet the customer's requirements, Moog's engineers designed, developed and delivered a solution consisting of the single stage ATEX Digital Control Valve with a unique 4-way spool configuration and custom manifold package, consolidated piping connections with mounting for the servo valve, a solenoid valve, backpressure valve and a drainable pressure filter. All components meet hazardous operating environment ATEX requirements.

One of the unique aspects of the solution was the ATEX Valve had sensors coupled to onboard electronics to provide closed-loop control for both flow and pressure which correlate to highly accurate control of speed, torque, position and force. In the past, only pressure or flow control was possible. Having both pressure and flow control on one valve offered this customer new opportunities in motion control.

The Result:

The application evolved over time as more functionality of the digital valve was used. Initial models provided proportional flow control with 4-20 mA analog interface. Later configurations used more advanced valve features with combined flow and pressure control (pQ) control and the Profibus-DF® fieldbus interface. The pQ configured valve is capable of closed-loop speed control through the hydraulic motor's encoder and closed-loop pressure control through a pressure sensor with the valve for active control of the motors output torque. Most importantly the solution has delivered safe, reliable performance in spite of extreme variations in temperature, high vibration and variations in pressure.

This technical data is based on current available information and is subject to change at any time by Moog. Specifications for specific systems or applications may vary.

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