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MOOG

HIGH SECURITY VEHICLE BARRIERS TAKE ON NEW THREATS WITH HELP FROM MOOG ELECTRIC ACTUATION

Moog electric motion control technology helps high security vehicle barriers protect and perform in today's most hostile environments.

By Don Bockhahn, Electric Actuation Application Manager
Moog North America

High security vehicle barriers are an application Moog has worked on for several years that presents some motion control challenges commonly faced by many industrial companies:

- Speed, reliability and safety requirements are the highest priority
- The technology is moving from hydraulic to electric
- A demanding environment requires reliable hardware and electronics
- A complete turnkey solution must be easy to implement for technicians who are knowledgeable in hydraulic technology but limited in electric servo experience

Security Barrier Application

Security is a topic frequently in the news today as countries seek to protect institutions from embassies to military installations to power facilities from potential attack. High security vehicle barriers are a last line of defense for these institutions and the technology being used for actuation is a critical factor. These barriers must be designed to stop a 7.5 tonne (15,000 lb) vehicle traveling at 80 kph (50 mph) with no penetration and need to be deployed in 1-1.5 seconds.

Until recently the technology being deployed was exclusively "open-loop" hydraulic actuation but Moog has been instrumental in helping the industry adopt a new solution with many benefits. As Moog has significant expertise in both hydraulic and servo technology we were able to evaluate all options. Some factors encouraging barrier Original Equipment Manufacturers (OEMs) to adopt electric technology included the need to accommodate demanding environmental considerations (e.g. extreme temperatures, sand, dust, rain, ice, flooding, etc), meet power requirements, ensure maximum reliability and lower maintenance costs. Ultimately Moog has helped the industry to successfully transition from open loop hydraulic to closed-loop electric realizing many desirable performance and operational benefits. This article describes this demanding application, the reasons Moog recommended electric actuation to meet the customers goals and how companies have successfully implemented this technology to achieve impressive results.

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Background

Because of terrorist threats and tactics, security barriers have become essential for an effective security program. These were initially a concept of the US Department of State (US DoS) after the Beirut truck bombing of a US military barracks in 1983 but barriers are now used worldwide. There are 3 typical types of high security barriers available today that are shown in figure 1. We have all seen these in our everyday activities but may not know the technology involved. The type selected depends on the needs of the situation.

The wedge/plate barrier type uses large plates which can weigh over several thousand kilograms (several thousand pounds), requiring significant power to be raised during an Emergency Fast Operate (EFO) situation. The weight and speed requirements present many challenges to designing a motion control system.

Wedge/Plate barrier

Large steel plates which pop up out of the ground very quickly are typically deployed as final denial.

Drop Arm/Crash Beam barrier

These barriers may look fairly benign, but many have a large chain or cable inside the tubing that acts like a cheese cutter. Typically used for traffic control.

Bollards

This type of barrier is more aesthetically appealing than the large plates and also allow pedestrian traffic.

To see the videos on the above barrier crash tests along with other video clips for the articles in this newsletter, go to:
www.ideasinmotioncontrol.com/2011/11/high-security-vehicle-barriers-take-on-new-threats-with-help-from-moog-electric-actuation.html

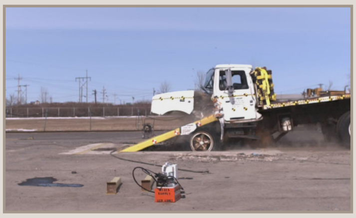

Figure 1: Types of Security Barriers
Source: Courtesy of American PSG

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To help you understand the application better it is important to explore what is required to stop a vehicle at various weights and speeds. Threat levels can be defined based on vehicle speed and weight. The vehicle bed penetration further defines the barriers stopping capability.

A vehicle moving toward a barrier has a certain kinetic energy which is the measure of how much "hitting power" it possesses. This is measured by its weight and speed. The kinetic energy changes as the square of its velocity. On impact, some of the energy is converted to heat, sound and deformation of the vehicle, the barrier must absorb the remainder. This information has been converted into standards by the Department of State, ASTM and other governmental organization shown in Table 1 below.

Standard	Rating	Vehicle Weight (lbs)	Vehicle Speed (mph)	Rating	Allowable Truck Bed Penetration (ft)
DoS K Ratings	K-Rating			L-Rating	
	K4	15,000	30	L1	20-50
	K8	15,000	40	L2	3-20
	K12	**15,000**	**50**	**L3**	**<3**
ASTM F 2656 07 Standard	M-Designation			P-Rating	
	M30	15,000	30	P4	>98
	M40	15,000	40	P3	23.1-98.4
	M50	**15,000**	**50**	P2	3.31-23
				P1	**<3.3**

Table 1 shows the requirements from the DoS and ASTM standards

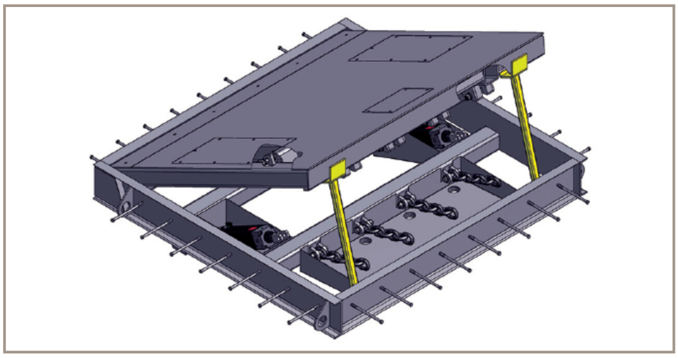

Figure 2: Wedge/Plate Barrier Construction
Source: Courtesy of American PSG

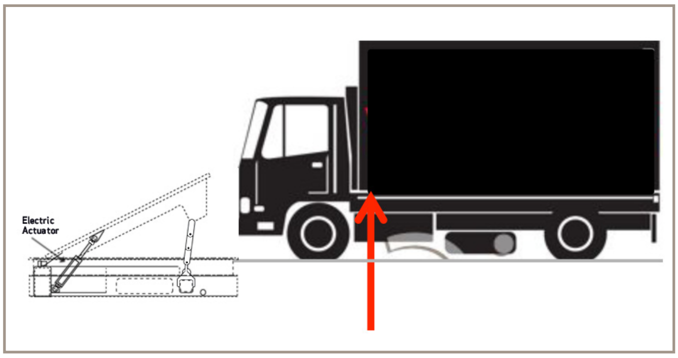

Figure 3: Penetration Measuring Location (P-Rating)

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The Customer Request

Traditionally hydraulic was the technology for plate barriers as it provided adequate power to lift the heavy plates at a speed required for fast deployment. These hydraulically actuated barrier systems did not utilize servo or proportional valves or position sensing for the motion control. Valves are just opened up, the hydraulic fluid flows and the cylinder stops when it hits the end stops, or the crash arresting system also known as operating in a bang-bang mode, see figure 5. During the all-important EFO (Emergency Fast Operate) situation there is considerable stress put on the barrier. Typically an accumulator is provided to supply additional hydraulic fluid for EFO and power failure. Consequently the constant stress from hitting the end stops was causing premature damage to barrier components and foundation. A new solution that addresses these issues could greatly improve reliability and lower maintenance costs for OEMs.

Moog needed to meet the most stringent requirements for the wedge security barrier that entail an actuation system that could lift a heavy plate barrier designed to stop a 7.5 tonne (15,000 lb) vehicle going 80 kph (50 mph) with an allowable penetration of the truck bed of less than 1 m (3 ft), all in 1 second . Customers also wanted to obtain higher reliability in demanding environments, lower maintenance costs and improve performance.

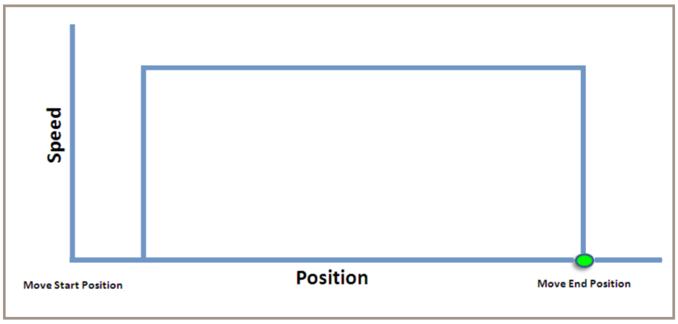

Figure 4: Hydraulic Velocity Profiling

The Moog Solution

As an expert in both hydraulic and electric technologies, Moog engineers evaluated the requirements for this application and recommended applying high performance electric actuation technology that could meet the speed and force requirements but offer some other key benefits such as lower maintenance costs, less environmental concerns and high reliability. Through velocity profiling, the constant stress from hitting end stops could be prevented thereby increasing the life of the barrier, while also providing smoother operation, lower component count and the ability to handle hostile environments, all important factors for longevity of the system.

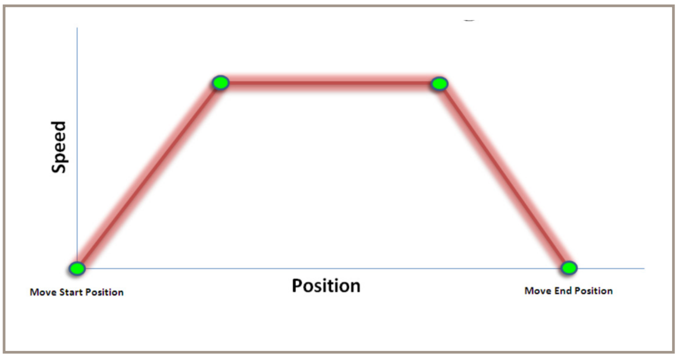

Figure 5: Electric Velocity Profiling

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Actuation Solution

To meet the needs of the customer Moog provided the following actuation system:

- Moog Electric Servo Actuator with a unique mechanical holding brake in case power is lost
- High performance AC Servo Drive
- Application-specific software for optimizing commissioning and sizing
- Spring-assist actuator to reduce power requirement (optional)
- Barrier Control Panel with all required components for operation including noise suppression to reduce the risk of electromagnetic interference (EMI) (optional)
- Battery backup (optional)
- Actuator heating for severe weather locations

The heart of the solution is Moog's integrated Servo Actuator and Servo Drive System with programmable control for acceleration/deceleration, speed, position and force which achieves extremely smooth, quiet operation. Since the Servo Drive controls the current into the motor, the force output of the actuator can be programmable for the specific barrier and installation, enabling optimized performance.

The other major advantage is the ability to operate reliably in hostile environments such as extreme low temperatures which are accommodated by using the motor as a heater to keep the encoder compartment at a programmable temperature level. Conditions such as rain and flooding are taken care of with the actuator environmental rating of IP67. Having no oil eliminates other environmental concerns and provides smooth consistent operation regardless of temperature swings.

Moog Servo Actuators utilize high performance servo motor and ball screw technology integrated into a small high power density package with many advantages over induction motors and existing barrier hydraulic technology:

- Servo motor can be stalled at continuous torque indefinitely without damage
- Peak torque to 3X the motor's continuous torque is available for high speed EFO
- Servo technology provides a smaller physical envelope with power densities similar to hydraulics
- Absolute encoder feedback eliminates homing requirements
- Automatic actuator heating for extreme environmental conditions

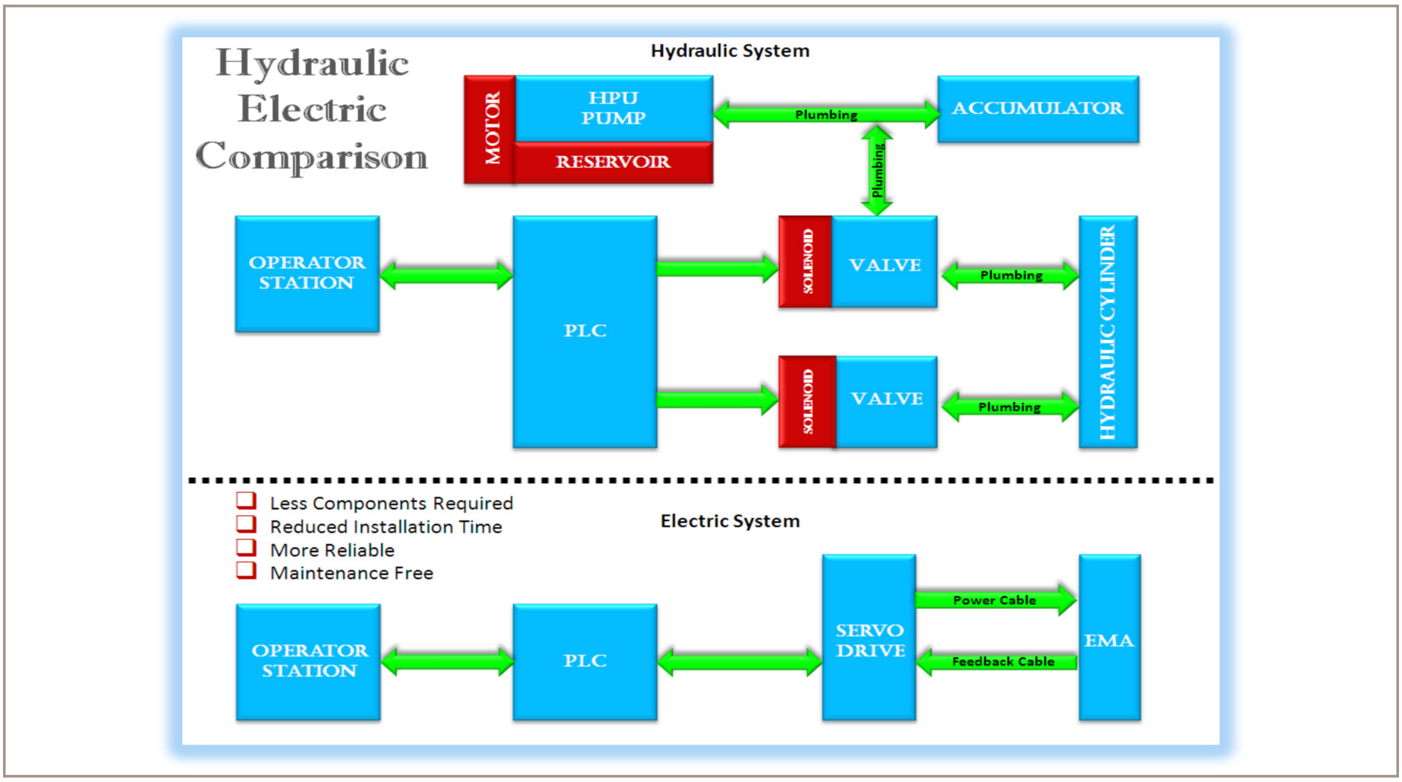

Figure 6: Comparison of Hydraulic and Electric Systems

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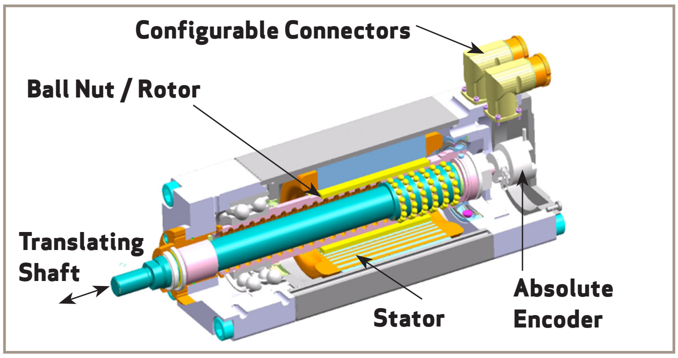

Figure 7: Cutaway of Moog Electric Actuator

A major benefit of the electric system is the lower component count (see figure 6), eliminating the need for the hydraulic infrastructure and reducing maintenance costs. Other features not available with the hydraulic system are also provided such as barrier obstruction detection. Should the barrier be deployed under a vehicle a decision can be made to continue or stop. Also provided on the actuator is a holding brake which is properly sequenced via the servo drive. When the barrier is in the deployed position, the mechanical brake is applied to hold position even if power is lost. This way if the terrorist tries to defeat the barrier by removing the power source, the barrier will remain in the deployed position.

Application-specific Software

One of the challenges of this application is that barrier manufacturers are more familiar with hydraulic than electric operation and needed assistance with sizing an electric actuator for security barriers. Moog Engineers developed proprietary specific sizing software for security barriers in order to assist customers with design and optimization for operation with electric servo technology. All pertinent data is entered into the appropriate fields and a comprehensive report is generated. Important information such as power requirements and actuator life are reported allowing the barrier manufacturer to optimize the design by changing mounting locations, weight or even adding external spring assist. See figure 8.

Commissioning and site set-up are another critical factor on location. Moog commissioning software is designed to make this quick and easy. Specific fields are provided for normal up/down motion as well as EFO. All moves are programmable for position, speed and acceleration/ deceleration. Actuator parameters are stored in the absolute encoder therefore accidental damage to the servo actuator is eliminated.

Value-added Offerings for Security Barrier Applications

Since site power can be quite limited, Moog's Engineering Team developed a spring assist actuator to reduce power requirements when raising a heavy plate barrier rapidly. The stored energy in the spring when the barrier is in the down position is released when the raise command is given, assisting the electric actuator and reducing power requirements. This design provides longer actuator life and reduced site power requirement for fast EFO on heavy wedge/plate barriers. Power reduction can be as much as 5X or more.

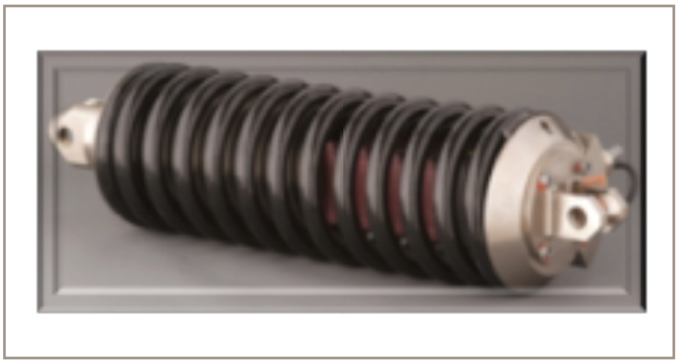

Figure 8: Spring assisted actuator

Moog engineers have also developed control sub-panel assemblies complete with all required components for barrier operation including noise suppression to reduce the risk of EMI interference with other equipment. Battery backup operation is also available making the sub-panel completely self-contained. A malfunction will affect only the one barrier not a group of them leaving sites more secure.

The Result

Until the last few years, hydraulic operation was the only technology with the power required to raise these large wedge/plate barriers quickly. As a technology neutral company with expertise in both hydraulic and electric technologies, Moog collaborated with barrier OEMs to evaluate all options and see what was best for this application. The result is a new solution able to deliver similar power densities as hydraulic technologies but able to provide many advantages that electric uniquely offers for this application.

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OEMs of high security vehicle barriers using the Moog electric servo actuation system are experiencing many advantages over existing hydraulic technology including:

- Virtually maintenance free, the electric actuator system lowers maintenance costs compared with hydraulic systems
- Velocity profiling prevents premature barrier component failure
- Emergency deployment <1.0 second (programmable)
- Wide operating temperature range with programmable actuator heating for extreme environments
- Tamper proof mechanical brake cannot be defeated assuring barrier will stay deployed
- Programmable barrier obstruction detection
- Increased power density and reliability in a self-contained ball screw design
- Ideal for new and retrofit applications

Author

Donald Bockhahn, EMA Product Application Manager is responsible for electric actuation activity in the US market. Don has worked in electrical engineering for 30+ years, with 11 of those years designing high performance servo drives. For the last 5 years at Moog he works in a sales support role promoting and applying electric actuation technology.

THE NEXT WAVE IN SUBSEA MOTION CONTROL FOR OIL AND GAS EXPLORATION

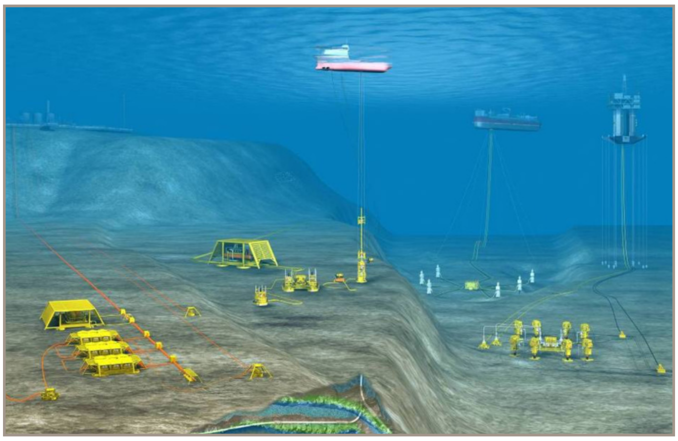
How a Moog Electric Actuation system delivers performance and control more than 2,500 meters below the ocean's surface

By Martin Jones, Market Manager, Niche and Emerging Markets - Europe

Subsea Processing - The Background:

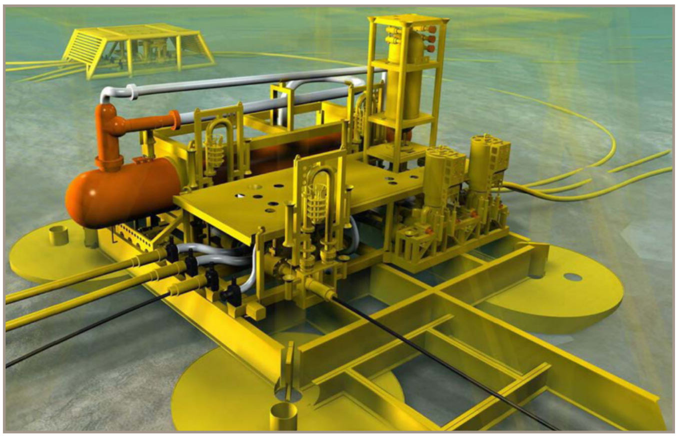
In recent years there has been a strong trend towards undertaking the initial stages of processing of oil and gas products on the sea-bed, rather than after transfer to the surface. Driving this revolution is a complex mix of environmental and commercial considerations.

Traditionally subsea oil and gas reserves were brought to the surface for processing, either on land, on a fixed platform or Floating Production, Storage and Off-loading unit (FPSO). This is an inherently inefficient process as the useful oil and gas components are a comparatively small proportion of the volume of material transported. Disposing of the unwanted elements brought to the surface - primarily sand and water - can also present a challenge, particularly as the waste water can contain small traces of potentially harmful hydrocarbons.



Concept for subsea processing system

With the advent of subsea processing in the last decade or so the oil, gas, sand and water emerging from the well are separated at the sea-bed with only the useful oil and gas elements being transported to the surface. The bulk of the waste components can be 're-injected' into the reservoir, boosting the reservoir pressure, giving a faster production rate. The re-injection process can also dramatically increase the percentage of oil and gas that can be recovered from a given reserve.



Subsea separation installation

Subsea Actuation Technology: Hydraulic or Electric?

Subsea processing requires the remote actuation of a number of process control valves controlling fluid switching and control of flow-rate and pressure. Traditionally these valves have been remotely actuated by means of a high pressure hydraulic system. This approach utilizes either hydraulic cylinders or rotary actuators to move the linear or rotary control elements in the process valve to achieve the desired fluid flow or pressure.

A major drawback with hydraulic actuation is the complexity, inefficiency and cost of the hydraulic power supply system. Usually located at the surface, the hydraulic supply can be situated up to 100+ km (62+ miles) remote from the subsea installation. Inherent in this approach is the use of two custom designed hydraulic hoses for both high pressure supply and low pressure return. These hoses represent a major infrastructure investment causing power losses and are potentially vulnerable to damage.

Electric actuation technology is still in its infancy, but promises to dominate the market in the future because of some key advantages, namely:

- The reduced cost of an electrical rather than hydraulic umbilical. This is particularly relevant to installations with large 'step-outs' (horizontal pipeline distances between the well and the surface). If the electrical power is transmitted at high voltages and low currents then relatively compact cables can be used.

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- The efficiency of power transmission is much higher than with hydraulics.
- The environmental impact is reduced, particularly when compared with a single hose, total-loss hydraulic system.

The FMC Anti-Surge Valve

FMC Technologies is the pre-eminent company in many aspects of subsea engineering, technology and project execution. In addition to subsea production systems comprising subsea trees, controls, manifolds and connection systems, FMC is also heavily involved in Improved Oil Recovery (IOR) technologies such as subsea processing, boosting and gas compression. This involvement also includes the qualification of new technologies such as Anti-Surge Valves for gas compression systems.

The project under consideration is the supply of an "Anti-Surge Valve" for a Subsea Gas compressor used to convey gas, and a limited amount of oil, to the surface.

The Anti-Surge Valve continually modulates the differential pressure across the compressor during start-up and normal running. It does this in response to position control inputs generated by a complex algorithm using inputs from multiple pressure, flow and temperature transducers.

However the Anti-Surge Valve also has a safety function to protect the compressor from damage from pressure surges, by opening a bypass path between the input and output of the compressor. See below.

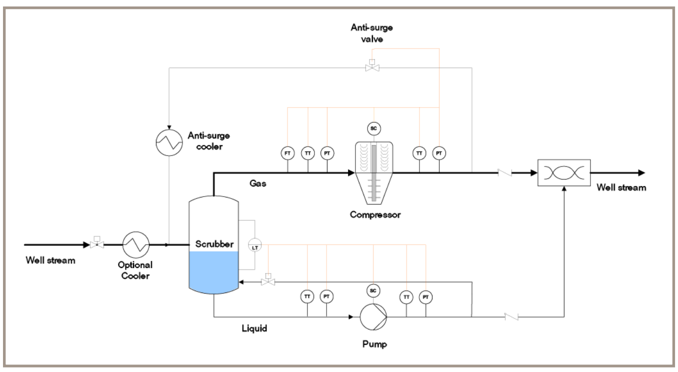

Diagram of gas compression system showing the anti-surge valve

The Moog Electric Actuator

Moog was chosen to supply the complete electric actuation system, including control electronics, for this highly dynamic subsea process valve. For Moog the key challenge was to engineer a very high performance actuation that could function with ultra-high reliability up to 2,500 m (8,200 ft) below the surface of the ocean.

Moog has been providing custom actuation products for the 'down-hole' drilling industry for over 20 years and utilized many aspects of this experience in this project.

Moog Electric Actuator mounted on Anti-Surge Valve

The prime mover of the actuator is a Moog duplex-redundant brushless motor. In order to achieve the ultimate in reliability this utilizes twin rotors, twin position sensors and two independent sets of control electronics (The electronics are each mounted in a separate housing maintained at a pressure of 1 atmosphere). To allow operation immersed in oil at the very high ambient pressures on the sea-bed, Moog employed special motor winding techniques, bearings, insulation materials as well as custom rotor design.

To convert the rotary motion of the motor to the high-force [30 KN (6,760 lbf)] linear motion required the use of a precision "ball-screw actuator". This long-life unit was specially developed for the application by Moog who have their own design and production center for ball-screws and roller-screws located near Milan, Italy.

A further design challenge for Moog was the dual functionality of the Anti-Surge Valve. Firstly the actuator was required to modulate at high speed while maintaining high positional accuracy. The second requirement was to

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fully open the valve extremely quickly (circa 2.0 seconds) to prevent compressor damage, in the event of a malfunction elsewhere in the control system.

To address this problem Moog turned to their unique, patented, 'fail-safe' system which is well established for turbine control in the power generation industry.
See below.

Moog turbine actuator

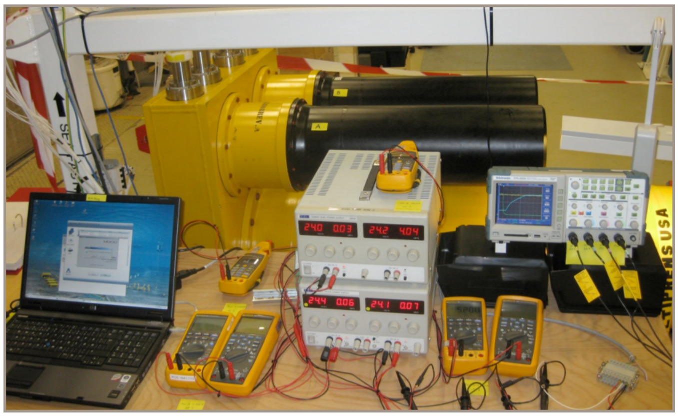
This arrangement uses a conventional fail-safe spring override to power the Anti-Surge Valve to the 'fully open' system in the event of a system problem. However, the novel part of the design is a 'toggle' mechanism which holds the spring in its fully compressed position during normal operation. This toggle is held in position by a mechanical toggle, latched by a low-power electrical solenoid. In the event of a system failure the solenoid is de-energized, releasing the latch and the spring extends fully opening the anti-surge valve.

Because the spring is not continually compressed and released during normal operation, the actuator can be designed with 50% of the power output normally required. Since it only has to overcome the operating forces of the valve not the combined force of the valve and the fail-safe spring.

Outcome and conclusions for the future

One of the key requirements for successful subsea equipment use is extreme reliability, as maintenance is very difficult and prohibitively expensive. To conduct a comprehensive test program, two prototype anti-surge valves were produced: one for life-testing at Moog and a second for hyperbaric testing at FMC. To summarize the successfully completed test program:

- Functional Testing of all operational scenarios (Factory Acceptance Testing)
- Environmental Stress Screening
- Performance and Power Load Testing
- Assembly Environmental Testing in accordance with ISO 13628-6 Level Q2 (shock, vibration and temperature cycling)
- Component Environmental Testing in accordance with ISO 13628-6 Level Q1 (shock, vibration and temperature cycling)
- Electro Magnetic Compatibility (EMC) Testing.
- Endurance Testing: 1 million operational cycles plus 5,000 failsafe operations
- Hyperbaric Testing at 220 Bar (3,200 psi) (150% of design pressure)



The Anti-Surge Valve under test at FMC

This test program which far exceeded the normal operational duty cycle for an anti-surge valve, proved the high performance and extreme durability of the design. The completion of this successful development by FMC and Moog demonstrates that even the most critical processes on the seabed can be remotely controlled via electric actuation. Over the next decade a dramatic increase in subsea processing activity is predicted. Playing a major part in this will be this new electric actuation technology with its inherent advantages for this challenging new frontier.

Author

Martin S. Jones is responsible for the Motorsport business around the world and is also the Market Manager for Niche and Emerging Markets in Europe. He has worked for Moog for 30 years in sales and applications engineering for a range of industries including mobile equipment, marine and offshore, blow molding and rolling mills. He studied Physics and Economics at the University of East Anglia.

SAFER LANDINGS START WITH SMARTER SERVO VALVES

Innovation, collaboration and a unique digital interface valve keep Airbus A350 tests flying high.

By Thorsten Köhler, Applications Engineer, Moog Germany

Figure 1: Landing flap test system
Source: Courtesy of Airbus Bremen

The Application

In 2009 the engineers from Airbus' High Lift Test Centre in Bremen, Germany needed a system to test the landing flap systems for the new Airbus A350 airplane. The new Airbus A350 has two landing flaps at each wing that are stressed by high aerodynamic forces. These forces need to be simulated during the test.

The motion control system for testing the landing flaps of the plane was to be mounted in a metal framework. The load frames are connected to 6 hydraulically-operated servo cylinders and follow the flap motion. Pneumatically-operated plunger cylinders mounted on metal frames would simulate the load. The 6 hydraulic cylinders are located so that the range of motion and load the forces are spread as equally as possible and each has closed-loop position control.

A standard industrial PC with a sampling rate of 1000 Hz, employs an EtherCAT field bus to controlling these 12 axes (6 for each flap) as well as the other actuators. Since both the absolute value and the direction of the aerodynamic forces are changing during the test, the metal framework with the pneumatic cylinders must follow predefined spatial motion. The force and motion profiles are described by coordinates of the plane. From these coordinates the PLC calculates in real time the required cylinder strokes during the motion.

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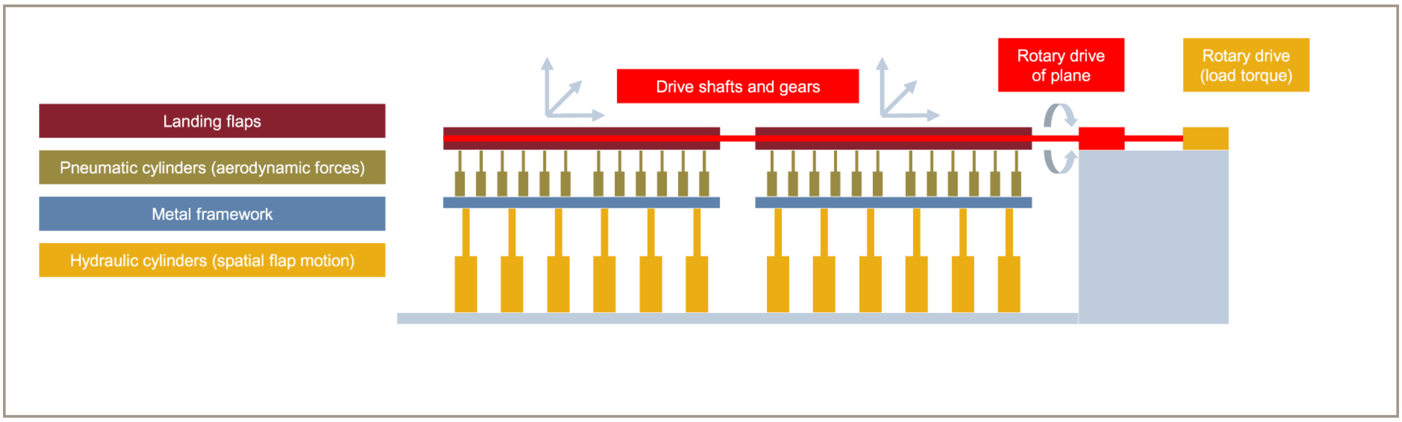

Figure 2: Principal sketch of landing flap system

Yellow actuators driven by Moog Servo Valves – 12 linear axes/valves for spatial motion of the metal frame,1 rotary drive/valve to load drive shafts and gears

In addition to spatial motion of the metal frame there is another force applied to the system to simulate the load torque to a drive shaft system. The motion for this subsystem required a highly specialized closed loop proportional valve. The testing of the motion of landing flaps is controlled by a combination of rotary drive, drive shafts and gears. The test system has an additional rotary drive to apply load torque to the rotary drive of the plane.

The Request

The Project team members for creation of the test system were Airbus Bremen, Hycom Hydraulic Systems from The Netherlands, the German engineering office IgH and Moog in Germany. Hycom Hydraulic Systems were responsible for designing and building the hydraulic system and IgH for implementing the motion control for the system.

As a market leader in high performance servo control and with product engineers with extensive experience in the aerospace test industry, Moog was selected to design and build highly specialized servo valves to fulfil the customer's unique requirements. From the beginning it was clear that the application called for Moog's Digital Valve Technology and special interfaces would be needed.

In addition to the high performance hydraulic functionality, the required valves needed specific features and characteristics:

- EtherCAT field bus interface
- Analog inputs for pressure transducers
- An interface for an incremental position encoder
- A new analog input for force control by a strain gauge
- Special wiring for the 11-pole + PE connector

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The Solution

The Moog Digital Servo Valve Series D671 with integrated I/O interfaces was determined to be the right solution to provide the closed-loop axis control in the flap test system. This valve, equipped with an EtherCat fieldbus interface, controls the axis positions via the central PLC.

Each valve actually controls two key functions: on one hand it acts as a bus coupler to allow simultaneous reading of cylinder pressures and on the other hand it switches the external safety valves (via the EtherCAT bus) to control clamping/braking of the cylinders or to by-pass the rotary drive.

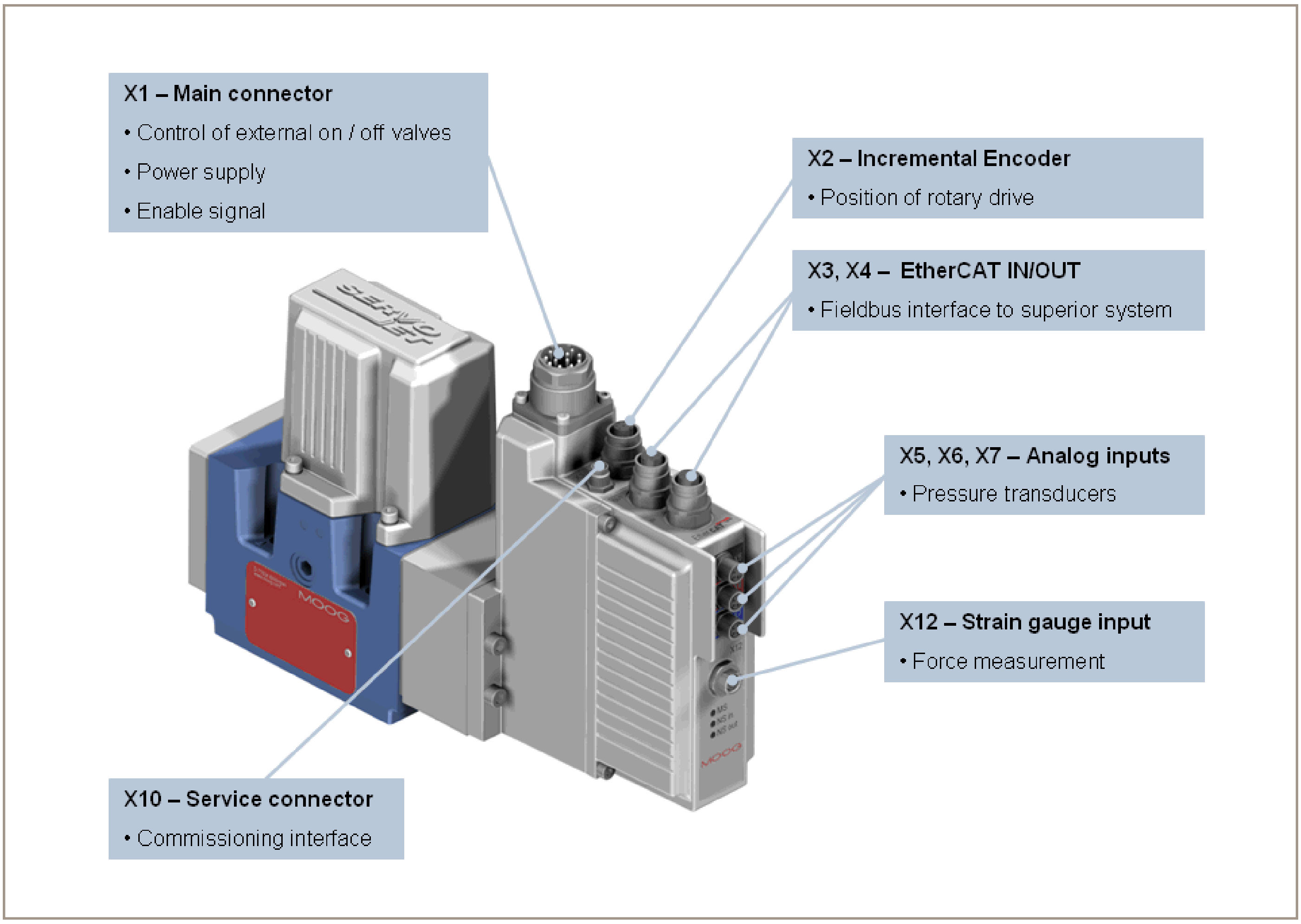

Figure 3: Moog valve as multi I/O device

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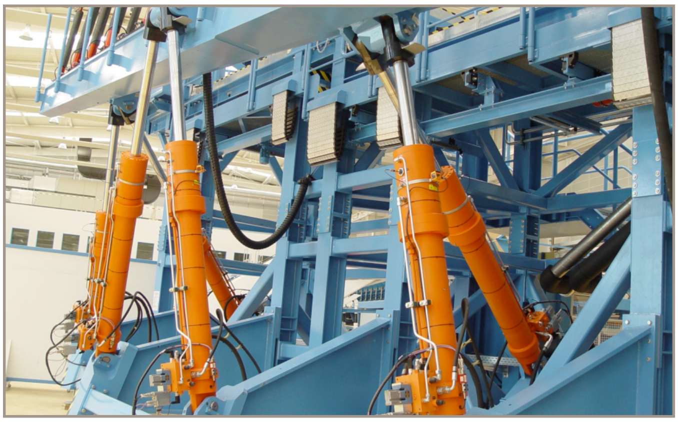

Figure 4: Metal framework with hydraulic cylinders
Source: Courtesy of Airbus Bremen

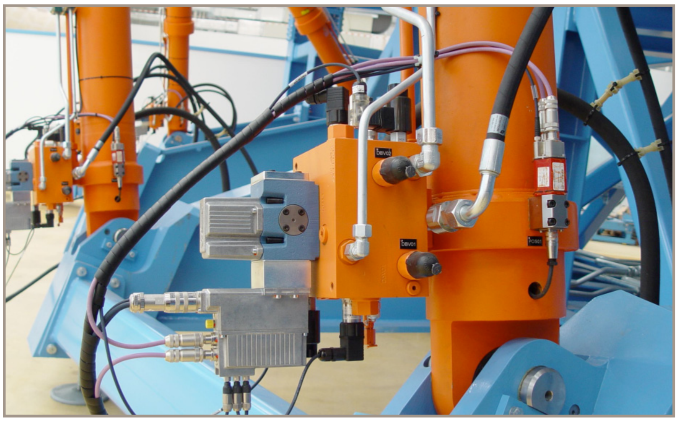

Figure 5: Cylinder with Moog D671 series valve
Source: Courtesy of Airbus Bremen

Analog Input X12 for Sensors with Resistive Bridges

In order to avoid additional wiring, the Airbus team requested that Moog develop an input on the Moog valve to allow interfacing of a force sensor. This was challenging as an interface for sensors of this kind had never been developed. The solution developed by the Moog team was to implement the connector on the OBE, more specifically a 4-pin female M8x1 connector located at the front of the electronics housing below the analog inputs X5, X6, X7. This solution greatly increased the flexibility of Moog's digital valves as the number of possible variants that could effectively use this new analog input was high. Think about X12 valves with sensors with resistive bridges in this case but there are many other possibilities such as:

- Force measuring gauge
- Pressure sensors without electronics
- Strain measuring gauge

Figure 6: New analog input for sensors with resistive bridges

Differential input resistor	40 kOhm
Input resistance to internal Reference (2 V)	20 kOhm each input
Supply resistor (low end)	200 Ohm
Sensor supply	12 V
Maximum input voltage for 100% A to D converter input	+/- 20 mV
Resolution A to D converter	+/- 12 Bit
Typical noise with shielded wiring	< 0.1 %
Cable break detection	Current consumption measured low side

Table 1: Technical Data of Analog Input X12

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Pin	Pin assignment	Special function	Bridges
1	Bridge to 7	-	
2	Ground (Bridge to 5 and 10)	-	
3	Enable input	-	
4	Analog command input (not used)	-	
5	Ground (Bridge to 2 and 10)	-	
6	Actual valve output (not used)	-	
7	Bridge to 1	-	
8	Digital output 1 (valve status); 24 V and 1,5 A	If enable and supply ok, valve ready; switching of external valve	
9	24 V DC power supply	-	
10	Ground (Bridge to 2 and 5)	-	
11	Digital output 2; 24 V and 1,5 A	Controlled by event handler; switching of external valve	
PE	Protective earth connection	-	

Table 2: Special wiring 11+PE-connector X1

Special Wiring on Main Connector X1

In this application, safety functions in the hydraulic system are critical and required external on / off valves. To reduce wiring expense and the need for junction boxes for each valve, Airbus asked Moog to offer a solution. Moog recommended using the two digital outputs to switch the external valves and for cabling reduction a special wiring with internal bridges was created.

For the first external valve the Digital output 1, which is the "valve ready" signal, is used. This output can be energized with the enable signal at Pin 3. The digital output 2 is controlled via the EtherCAT fieldbus. The logic behind this second output is programmed in the valve internal event handler.

These two digital outputs supply the external on / off-valves with 24 V and 1.5 A. In the test system this unique functionality is used for braking or clamping the cylinders. For the rotary drive only one output is used to switch an external by-pass valve.

The Result

The combination of a fast fieldbus system, a servo valve with integrated I/O's and a hydraulic servo cylinder results in a high performance automation solution and offers many benefits;

• Components are easy to change because the "intelligence of the system" is not programmed in the firmware of the components, but in the industrial PLC system

• The coincidental use of a hydraulic servo valve as I/O component for typical actuating elements and sensors on hydraulic cylinders without using these signals not only for itself, is highly beneficial for open automation solutions.

• Minimal cabling which reduces expense, complexity and space requirements

• Local parameterization offers users greater flexibility especially when compared with previous local axis controller solutions

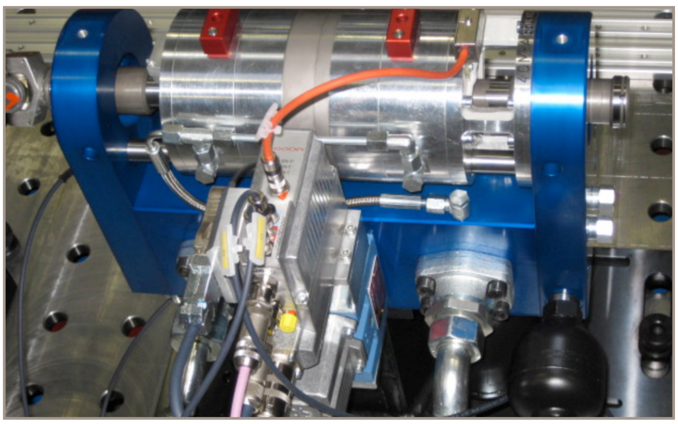

Figure 7: Moog Servo Valve with rotary drive during the test phase

Author

Thorsten Köhler started at Moog GmbH in 2007 as Product Engineer for hydraulic valves, with responsibility for pilot operated valves. At the end of 2008 he changed his role to become an Applications Engineer within the Control Solutions organization, Europe, where he helps to create customized solutions for a wide range of customers with applications in the injection molding machines, presses, test systems and other special machinery markets. He studied Mechanical Engineering at the University of Furtwangen, Germany.

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