HIGH PERFORMANCE MOTION CONTROL FOR MARINE APPLICATIONS

The Marine Industry
The marine industry faces many challenges in operating environments that are both harsh and unpredictable, and in which shipping of all types must be able to operate around the clock. In such a diverse and demanding marine market, shipbuilders are under increasing pressure to provide technology capable of delivering excellent performance and lower operational costs, as well as energy savings, noise emission reduction and shorter machinery downtimes. The industrial marine sector is also undergoing significant and broad technological changes, which include increasing digitalization as well as a need for lower emission levels and higher safety standards among many others. Marine systems and equipment engineers face all of these challenges, and are required to provide innovative solutions that add value to onboard technology.

Moog’s products and solutions can meet the demands of the marine sector’s extreme operating environments, and deliver reliable, long-life performance for a range of shipping applications. Our experience in tailoring high-performance motion control technology to specific machinery requirements, provides our customers in the industrial marine sector with a unique competitive advantage. Moog products can be used successfully across many types of industrial shipping vessel that perform a wide variety of tasks. As a trusted motion control partner for the marine sector Moog offers flexible, comprehensive and timely global support that ensures onboard applications function reliably around the clock.
MARINE APPLICATIONS THAT BENEFIT FROM OUR RANGE OF ELECTRIC AND HYDRAULIC SOLUTIONS:

**ABOVE DECK**
- Winches
- Offshore cranes

**BELOW DECK**
- Main engines
- Stabilizer fins
- Steering systems
- Water jet
EXPERTISE AND INNOVATION FOR A RANGE OF MARINE INDUSTRY CHALLENGES

Through close collaboration with its marine customers, Moog can help move the ideas of shipbuilding design engineers forward. Our portfolio of electromechanical, electrohydraulic and hybrid technology ranges from servo valves, brushless motors, the Electrohydrostatic Pump Unit, High Torque Motors, slip rings and ball and roller screws. Moog’s experts can help customers adapt these to meet their specific application requirements, irrespective of the technology.

We can therefore, help our customers in the shipbuilding industry resolve a number of the challenges facing them in today’s demanding and highly competitive marine market.

IMPROVING ENERGY EFFICIENCY

Ever increasing demand for energy efficiency and reduced fuel emissions on both hybrid and full electric powered vessels, means that ship owners and operators look for cleaner, more cost effective marine technology solutions. Moog’s range of technology neutral products, ranging from High Torque Motors to the Electrohydrostatic Pump Unit, lower energy consumption by providing power where and when it is needed, lessening the risk of oil spillages and lowering the onboard application footprint. Our innovative technology also reduces the effects of noise and vibration on key applications like stabilization systems, meaning that shipping crews and passengers will enjoy greater onboard comfort.

REDUCING OPERATIONAL DOWNTIME

Shipping operations are reliant on onboard applications that perform efficiently and reliably around the clock, even in the most extreme weather conditions. Moog designs long life, rugged motion control technology that delivers reliable high performance even in the world’s most challenging maritime environments. Our products have a small number of components making maintenance simpler and more cost effective, while also requiring less onboard space for spare parts storage. Moog’s experts support marine application engineers to ensure that our solutions like servo valves and radial piston pumps, meet specified marine application requirements and industry standards to deliver dependable round the clock service.

DEVELOPING INDUSTRY 4.0 SOLUTIONS

Ship owners and operators increasingly rely on predictive maintenance to get the most out of onboard applications such as engines, steering systems and stabilization fins. Moog’s motion control solutions feature sophisticated diagnostics and condition monitoring technology designed to prevent costly disruption or machine failure. We help you monitor the ageing process of the product and anticipate any serious failure in advance, either directly onboard your vessel or ultimately from anywhere in the world. Moog’s technology is supported by a team of engineering experts, who will assist customers in gaining maximum advantages from their shipping machinery investment.

PROVIDING LONG LIFE PERFORMANCE

Moog can enhance the performance, operational cost effectiveness and provide longer service life for key shipping applications such as steering systems, stabilizers and engines. Our components reduce overall requirements for cabling, piping and wiring and thereby free up vital space onboard, improving reliability and helping extend application lifetimes. Moog has the capability to work with marine customers across the world to provide technology neutral expertise across a range of shipping applications. Our expertise helps ship machinery engineers integrate Moog’s reliable, long life technology whether it be hydraulic, electric or hybrid, and you can count on our experts to support you in making the right choice for your machine through careful evaluation and benchmarking.

DELEVERING ENERGY SAVINGS, REDUCING EMISSIONS

The request
The leading designer of two stroke diesel engines, with sizes ranging from 1,560 kW to 82,440 kW, is using a motion control solution for engines fitted with an electronically controlled camshaft. Moog had the opportunity to provide servo valves capable of performing the fuel injection profiles demanded by the engine control system, with the aim of reducing both engine energy use and exhaust emissions.

The solution
Moog decided to provide the company with its fully digitally controlled D636 Direct Operated Servo Valves for analog signals, which are directly driven by a linear force motor and do not require a pilot flow. The valves are reliable and highly robust, thus making them suitable for demanding applications such as marine engines. Moog’s ability to offer the valve as an off the shelf customized solution with freely programmable code segments, meant that the company’s design engineers could customize its functionality according to their specific requirements.

The result
Moog’s D636 valves met the engine manufacturer’s requirements, helping to reduce both fuel consumption and emissions significantly. Our ability to deliver this easily customizable solution quickly with global service support met a vital requirement of all marine application manufacturers. The company now use the D636 widely on many of its diesel engines, and they have been able to lower both machine downtime and maintenance costs.
WORLD-CLASS PRODUCT PERFORMANCE

Moog provide a wide array of high quality hydraulic, electric and hybrid products designed to meet the marine industry’s most challenging machine applications. These building blocks lie at the heart of all our motion control solutions, and Moog’s solutions focused approach demonstrates that we have both the technology and expertise to design and install customized components that specifically meet marine customer requirements. In other words, we can work directly with you to create unique solutions that are precisely tailored to your machinery needs.

QUICK OVERVIEW OF SOME KEY PRODUCTS FOR MARINE DESIGN ENGINEERS AND MACHINERY BUILDERS

SERVO AND PROPORTIONAL VALVES

Moog Servo and Proportional Valves provide excellent, high-performance motion control for a range of industrial shipping applications. Their rugged design allows for their operational use even in the most demanding and hazardous environments such as engines or steering systems. Moog’s digital explosion proof valves successfully control and optimize main engine operation on liquefied natural gas (LNG) carriers, reducing emissions and fuel usage. Industrial shipping customers benefit from our ability to customize valves from standard building blocks that match specific onboard application requirements, and spare parts are readily available. Explosion proof certification includes: EX, IECEx, FM, ATEX.

Applications:
- Main engines
- Water jet
- Steering systems
- Stabilizer fins
- Offshore cranes

ELECTROHYDROSTATIC PUMP UNIT - EPU

Moog’s Electrohydrostatic Pump Unit (EPU) forms the core of electrohydrostatic actuation, and enables the use of hybrid decentralized drive systems. The EPU provides power where and when it is needed, which reduces energy loss and helps improve the operational range of full electric vessels while cutting emissions from conventional engines. It has no requirement for a hydraulic power unit or complex piping, thus making installation straightforward and saving vital space onboard. The pump’s innovative design generates lower noise emissions, enabling ships to cruise more silently with improved passenger comfort. Featuring a drive that is IoT ready, the EPU is fitted with a condition monitoring module for easier, time saving predictive maintenance, which is rendered simpler by the pump’s comparatively small number of components.

Applications:
- Water jet
- Steering systems
- Stabilizer fins
- Offshore cranes

RADIAL PISTON PUMP – RKP

Moog’s Radial Piston Pump (RKP Series) operates reliably in all weather conditions, featuring a robust design that prevents micro cavitation and contamination. The RKP’s extensive service life and long maintenance intervals make it particularly suitable for marine applications, while its low noise emissions significantly improve comfort levels on passenger vessels. The pump is available with digital onboard electronics, meaning that onboard personnel can operate, maintain and monitor it directly from the control room or on deck. It is readily available and can be easily shipped to anywhere in the world. The RKP carries the following certifications: DNV GL, BV, LR, ABS, CCS.

Applications:
- Main engines
- Water jet
- Steering systems
- Stabilizer fins
- Offshore cranes

SERVO MOTORS

Moog manufactures Servo Motors that provide the precise torque, speed and power modern marine applications require, delivering the highest reliability combined with smooth, low speed performance. The High Torque Motor’s (HTM) robust design allows critical shipping applications such as steering systems to operate in all weather conditions. It removes the need for complex piping or a hydraulic pump unit, which reduces noise emissions, saves space onboard and helps avoid the risk of oil spillages. Fitted with condition monitoring sensors, the Motor’s drive system and IoT features permit remote operation, allowing ship crews to anticipate downtime and limit the need for regular maintenance and inspection, saving vital time while at sea. As an electromechanical solution the motor provides power when and where it is needed, generating energy savings and lowering fuel emissions, an especially important consideration for long range vessels with hybrid engines maneuvering harbors where low emissions are required.

Applications:
- Water jet
- Steering gear
- Stabilizer fins
ABOUT MOOG

HYDRAULIC SOLUTIONS

Since Bill Moog invented the first commercially viable servo valve in 1951, Moog has set the standard for world-class hydraulic technology. Today, Moog products are used in a variety of applications - providing high power, enhanced productivity and ever better performance for some of the worlds most demanding applications.

ELECTRIC SOLUTIONS

Clean operation, low noise generation, less maintenance and reduced power consumption make Moog electric solutions ideal for applications worldwide. Moog is the ideal partner for applications where transitioning technologies requires special expertise.

HYBRID SOLUTIONS

By incorporating the advantages of existing hydraulic and electric technologies - including modular flexibility, increased efficiency and cleanliness - into innovative hybrid solutions, Moog offers new performance potential in specialized applications.

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.

This promise offers many benefits to our customers including:

• Reduce your downtime by keeping critical machines running in peak performance
• Protect your investment by ensuring reliability, versatility and long-life of products
• Better plan your maintenance activities and make systematic upgrades
• Leverage our flexible programs to meet the unique service requirements of your facility

Look to Moog for global support including:

• Repair services using OEM parts are performed by trained technicians to the latest specifications
• Stock management of spare parts and products to prevent unplanned downtime
• Flexible programs, tailored to your needs such as upgrades, preventative maintenance and annual/multiyear contracts
• On-site services bring the expertise to you, providing quicker commissioning, set-up and diagnostics
• Access to reliable services that are guaranteed to offer consistent quality anywhere in the world

For more information on Moog Global Support visit www.moog.com
OTHER MOOG PRODUCTS FOR THE MARINE INDUSTRY

TRITECH (A MOOG COMPANY)

Tritech International Limited [Tritech], a Moog Inc. Company, is a high-technology business designing and manufacturing sonars and underwater cameras for use in multiple markets across the world. These include the Oil and Gas, Aquaculture, Diving, Search and Recovery, and Defense sectors. Tritech’s bespoke products and customer focused engineering positions them as an industry leader in imaging and ancillary equipment.

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MOOG REKOFÄ

Moog Rekofa has been developing and manufacturing innovative slip ring assemblies since 1960 with the highest precision and reliability. In particular, the permanently rotating hybrid slip rings, a combination of power, data and media transmission in one protected housing, have proven highly successful. Customer specific slip rings are used on more than 70 different applications, including POD-drives, harbor and subsea cranes and cable drums.

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MOOG FOCAL

Focal Technologies (Moog Focal) specializes in providing custom electrical slip ring, fiber optic, fluid swivel and optical multiplexer solutions. Innovation and performance are incorporated in all that we do. From our ability and willingness to customize products to our ISO 9001 certification, to our unmatched global capacity we are defining and delivering custom integrated and proven products for the harshest marine environments in the world.

Product features include hybrid packages that combine fiber, electrical and fluid swivels, packaging for harsh environments, certification for hazardous locations and adaptation to your project’s size and mounting constraints.

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FOCAL™
MORE PRODUCTS. MORE SUPPORT.

Moog designs a range of motion control products to complement those featured in this document. Moog also provides service and support for all of our products. For more information, contact the Moog facility closest to you.

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High Performance Motion Control for Marine Applications
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