FAILSAFE ELECTRO-MECHANICAL ACTUATOR

High performance electric technology for failsafe operation in gas and steam turbines

Hydraulic systems dominate various control applications in the power generation industry due to their capability to reliably shut down in failure situations. When a shutdown is required, hydraulic systems provide the ability to close valves against gas pressure. However, these same hydraulic systems pose cost, complexity and physical space challenges due to the implied need for hydraulic infrastructure.

Moog has introduced an electric solution that eliminates the hydraulic infrastructure and provides safer, more compact and more cost-effective performance—plus the necessary failsafe protection in the event of an emergency shut-down. Moog’s integrated solution includes a Failsafe Electro-mechanical Actuator, Moog Motion Controller and Servo Drive as well as application software.

Working in close collaboration with our customers, Moog engineers developed a patented, state-of-the-art solution: the first electro-mechanical failsafe mechanism to meet performance and safety requirements. In fact, Moog’s electric solutions are approved to FM, CSA, and ATEX standards for use in hazardous areas. The solution reduces installation and maintenance effort bringing the advantages of electric control to the power generation market.

ADVANTAGES

- Ensures highest safety level via decoupled control and fast closing spring mechanism.
- Eliminates potential fire hazards from high-pressure oil leaks.
- Moog Motion Controller frees the processing power for other functions and increases flexibility.
- Delivers clean energy and low maintenance costs of electric technology.
- Eliminates hydraulic and pneumatic auxiliary systems.
- Helps to reduce the life cycle costs of the equipment: Lower cost of purchase, installation and commissioning, operation and maintenance.
- Enables preventative maintenance and monitoring for reduced operational costs.

APPLICATIONS

- Gas turbine applications
- Steam turbine applications
- Installation in harsh environments
- Retrofit and replacement of hydraulic actuators

WHAT MOVES YOUR WORLD
FAILSAFE ELECTRO-MECHANICAL ACTUATOR

Comparison of Moog Failsafe Electro-mechanical Actuator to conventional hydraulic systems

### FEATURES

- Extremely reliable failsafe function
- Innovative toggle lever
- No spring friction during ordinary turbine control
- Simplified, modular structure
- Same mechanical interfaces as hydraulic system
- Decoupled linear actuation and failsafe mechanism
- Simple, low-maintenance failsafe mechanism
- Condition monitoring of wear parts

### ADVANTAGES

- Linear actuation and failsafe mechanism are decoupled
- Reduced locking forces
- Compact dimensions of the system
- High level of customer flexibility
- Simple retrofit that doesn’t require tubing and a hydraulic power unit
- Protection of valuable gas turbine equipment
- Excellent preventative maintenance potential

### KEY DATA

#### ENVIRONMENTAL DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection degree</td>
<td>IP54</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-20 to +60 °C (-4 to +140 °F)</td>
</tr>
<tr>
<td>Hazardous location standards</td>
<td>ATEX II 3G -&gt; Zone 2</td>
</tr>
</tbody>
</table>

#### PERFORMANCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failsafe valve close time</td>
<td>200 to 300 ms from trigger for 100 % stroke</td>
</tr>
<tr>
<td>Time lag until failsafe motion starts</td>
<td>&lt; 50 ms</td>
</tr>
<tr>
<td>Rearming the failsafe functionality</td>
<td>3 s (uninterrupted logic supply)</td>
</tr>
<tr>
<td>Position accuracy (turbine control)</td>
<td>&lt; ±0.25 mm (0.01 in)</td>
</tr>
<tr>
<td>Repeat accuracy</td>
<td>&lt; ±0.1 mm (0.04 in)</td>
</tr>
<tr>
<td>Maximum motion time for full stroke</td>
<td>700 ms</td>
</tr>
</tbody>
</table>

#### ACTUATOR SIZES

<table>
<thead>
<tr>
<th>Size</th>
<th>Stroke</th>
<th>Spring force (minimum)</th>
<th>Force controlled (cont.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>50 mm (1.97 in)</td>
<td>15 kN</td>
<td>5, 10, 15 kN</td>
</tr>
<tr>
<td>M</td>
<td>100 mm (3.94 in)</td>
<td>30 kN</td>
<td>10, 20, 30 kN</td>
</tr>
</tbody>
</table>

Note: The Moog Failsafe Electro-mechanical Actuator can be tailored to meet your specific needs in terms of environmental and performance requirements (e.g. higher temperatures and forces, strokes, etc.)
MOOG SYSTEM FOR GAS AND STEAM TURBINES

The Moog failsafe solution for power generation systems includes several Moog-designed and -built building block products, including the failsafe electro-mechanical actuator, a decentralized motion control system (using Moog Motion Controllers and Servo Drives) and application software for homing, diagnostics and safety functions.

FAILSAFE ELECTRO-MECHANICAL ACTUATOR

Our patented Failsafe Electro-mechanical Actuator, suitable for hazardous areas, controls the flow characteristics of the process valve defined by the position commands of the turbine controller. Moog engineers use a spring-controlled system to close/open the valve to a safe position in the event of an emergency condition. The actuator employs flexible interfaces for command and feedback between the turbine controller and the Motion Controller, including CANopen, Profibus-DP and 4 to 20 mA.

MOTION CONTROLLERS

The Moog Ruggedized Motion Controller is easy to program and designed for harsh environments. Suitable for both electric and hydraulic systems, this product offers high-speed control even in the most demanding environments.

The PLC and Motion Controller utilize TÜV-certified application software. This software controls motion sequence, homing, plausibility tests, interpolated position, drive safety monitoring and application limits.

MODULAR MULTI-AXIS PROGRAMMABLE MOTION CONTROL SERVO DRIVE (MSD)

The MSD provides the highest levels of dynamic response, smooth performance and application versatility. It includes modular servo drives powered by a shared power supply and a motion controller to coordinate motion across multiple axes and single-axis modules with an integrated power supply. The MSD offers built-in closed-loop positioning capability, feedback sensors and an optional fieldbus interface. In addition, Moog certifies its use with cable lengths up to 500 m (1,640 ft), allowing placement of the servo drive and motion controller well outside the hazardous area of operation.
THE SYSTEM FEATURES A LOCKABLE, SPRING-CONTROLLED ASSEMBLY WITH THE HIGHEST SAFETY LEVEL DUE TO DECOUPLED CONTROL AND FAST-CLOSING SPRING MECHANISM.

IN ADDITION TO THE CONVENTIONAL WORKING PRINCIPLE (SPRING ASSEMBLY PERFORMING A PUSH), MOOG OFFERS THE OPTION OF HAVING A REVERSE MECHANISM, WHERE THE SPRING ASSEMBLY IS PULLED BACK IN CASE OF SHUTDOWN.

WHEREVER YOU ARE IN THE WORLD, YOU CAN REST ASSURED THAT MOOG’S TEAM OF EXPERIENCED, TRAINED TECHNICIANS ARE THERE FOR YOU WITH THE SERVICE, TRAINING AND PARTS YOU NEED TO KEEP YOUR EQUIPMENT PERFORMING AT PEAK CONDITION. MOOG GLOBAL SUPPORT® IS YOUR DIRECT LINK TO OPTIMAL GAS TURBINE RELIABILITY AND PERFORMANCE.

MOOG HAS OFFICES AROUND THE WORLD. FOR MORE INFORMATION OR THE OFFICE NEAREST YOU, CONTACT US ONLINE.

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FAILSAFE ELECTRO-MECHANICAL ACTUATOR
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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.