



Limitorque™ LHS

Limitorque Hydraulic Scotch Yoke Heavy-Duty Actuator



Experience In Motion

Limitorque Fluid Power Systems

The Limitorque Fluid Power family of heavy-duty actuators recently enlarged to include the Limitorque Hydraulic Scotch Yoke Actuator (LHS).

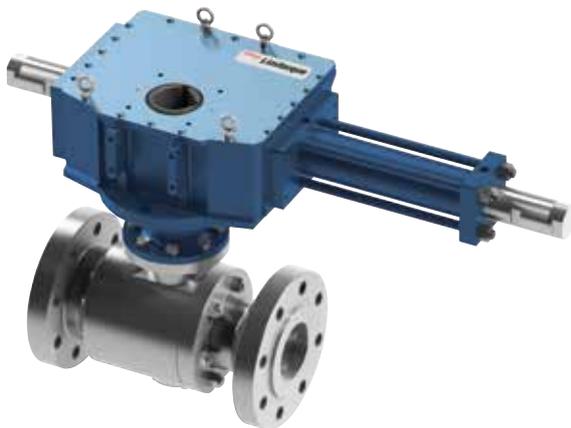
Today's industry requirements are more rigorous than ever before. Nowhere is this more evident than in the oil and gas industry, where new requirements are incorporated into project specifications almost every day and emphases on personnel safety and equipment uptime is the norm.

To more aggressively meet these demands, Flowserve Limitorque is offering the LHS Hydraulic Scotch Yoke Heavy-Duty Actuator—specifically designed to meet or exceed the latest and most rigorous of these requirements. This makes LHS the most technically advanced and market-compliant actuators available anywhere in the world.

The LHS range of Limitorque hydraulic actuators is a robust, modular scotch yoke design, available in both spring return and double-acting configurations. It is suitable for actuating ball, butterfly and plug valves or any other quarter-turn application.

LHS hydraulic actuators deliver up to 250 kNm* (184 000 ft-lb) of precisely controlled torque. The LHS is available in a selection of standard as well as in different and special material executions, upon request.

The same design philosophy, introduced on heavy-duty LPS actuators, has been adopted for the LHS range, delivering enhanced performance and high reliability.



The LHS actuator features a 25-year design life, depending on service conditions, proper installation, operation and maintenance. In order to achieve this industry-leading design life, in-field maintenance is prescribed to be performed every six years of operation. For high-cycle applications, such as control valve operation, more frequent maintenance of replaceable wear surfaces, as outlined in EN 15714, may be required.

To complete the actuation package, LHS actuators are available with accessories, such as lockout modules, manual overrides and control panels, like hydraulic power units, accumulator racks, self-contained units and other electro-hydraulic solutions.

Limitorque also provides engineering design services for mounting hardware, ensuring that your actuation solution is ready to handle the toughest challenges.

* For higher torque ranges, consult factory.

LHS Limitorque Hydraulic Heavy-Duty Scotch Yoke Actuators

With a design life of 25 years* and a maintenance interval up to six years*, the LHS is a hydraulic heavy-duty actuator, with an output torque up to 250 kNm (184 000 ft-lb). Enhanced performance is achieved by using a superior scotch yoke support design that significantly reduces transverse loads. LHS actuators feature modular construction to minimize repair time and initial cost while maximizing process availability.

Features

- Spring Return Single Acting (Fail Close CW and Fail Open CCW) and Double Acting (Fail Last / Fail As Is) executions
- True modular design for flexible and easy field conversion from Fail Close CW to Fail Open CCW configuration or vice versa
- Symmetrical and canted scotch yoke types to perfectly fit valve torque requirement
- Fabricated carbon steel scotch yoke housing, hydraulic cylinder and spring can, providing the most rugged actuator available; different materials of construction for polar or offshore applications upon request
- ENP Lined Cylinders with Chrome Plated Piston Rod; Stainless Steel Cylinders, Tie Rods and Spool Pieces available upon request
- Available for use in safety integrated systems up to and including SIL Level 3 in accordance with IEC 61508
- Suitable for use in on/off, modulating and control valve application in general service, protective service and safety applications such as ESD or HIPPS
- Full range of accessories and control systems: switchboxes, positioners; ESD and PST functionalities; hydraulic power units, accumulator racks, self-contained units, integrated electro-hydraulic solutions; fire protection; manual and hydraulic overrides

Specifications

- Available in standard single-acting spring return and double-acting configurations, in torque ranges up to 250 kNm (184 000 ft-lb); contact factory for larger sizes
- 207 barg (3000 PSIG) maximum allowable working pressure (MAWP); 345 barg (5000 PSIG) version upon request
- -29°C to 100°C (-20°F to 212°F) standard operating temperature range; Low temperature -60°C (-76°F) and High temperature 160°C (320°F) ranges available upon request (polar, cold, arid and tropical temperature requirements in accordance with IEC 60721)
- End mounted adjustable travel stops $\pm 5^\circ$, available also in an enclosed protected version upon request

Key Certifications and Standards Compliance

- Certified according to ATEX 94/9/EC Ex II 2GD c IIC T6
- NEMA 4 and NEMA 4X configurations, per NEMA 250
- IP66/IP66M and IP67/IP67M configurations
- Standard output valve interface in compliance with ISO 5211
- Actuator spring design in compliance with EN 13906
- Corrosion protection in compliance with ISO 12944-2 and EN 15714-4; optionally available up to and including C5-M
- Available in compliance with NACE specification MR0175 for sour gas applications
- Available in compliance with PED 97/23/EC, ASME BPVC Sec. VIII Div. 1, EN 13445-3 Part 2 for Unfired Pressure Vessels
- Manufactured and tested in compliance with ISO 9001 and EN 15714-4

*Depending on service conditions, proper installation, operation and maintenance.

LHS Available Configurations



LHS Double Acting



LHS Single Acting – Fail Close (CW)



LHS Single Acting – Fail Open (CCW)

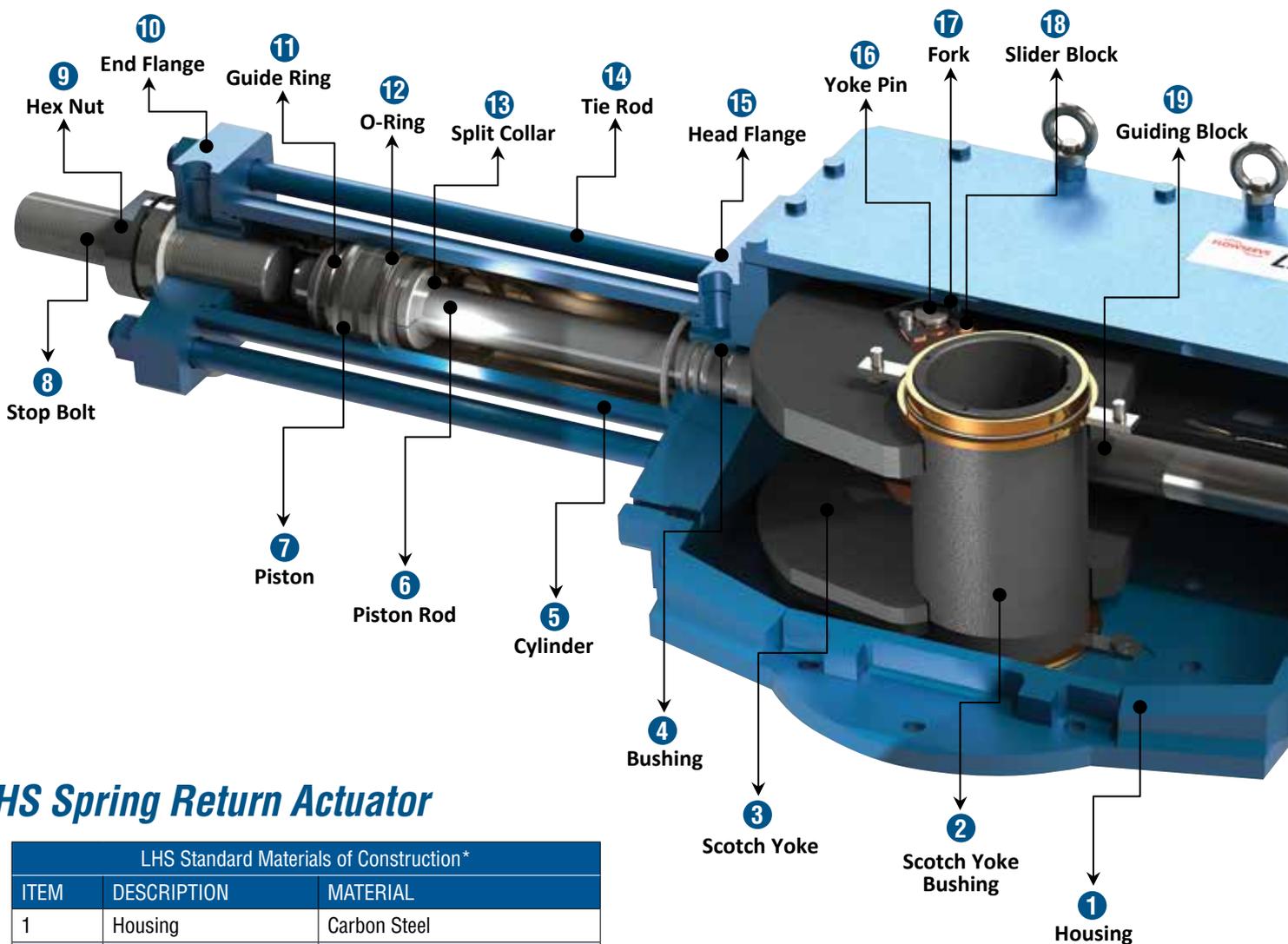
LHS Manual Overrides

- Hydraulic Hand-Pump as standard
- Hand-wheel upon request



Anatomy of Limatorque LHS Actuator

The LHS range of Limatorque Hydraulic actuators is a robust, modular scotch yoke design, available in both spring return and double acting configurations. The LHS Limatorque Hydraulic actuator is enlarging the recent Limatorque Fluid Power Systems family of heavy-duty scotch yoke actuators. The same design philosophy, introduced on the heavy-duty LPS actuators, has been adopted for the LHS range, delivering enhanced performance and high reliability. The LHS is available in a selection of standard as well as in different and special material executions, upon request.



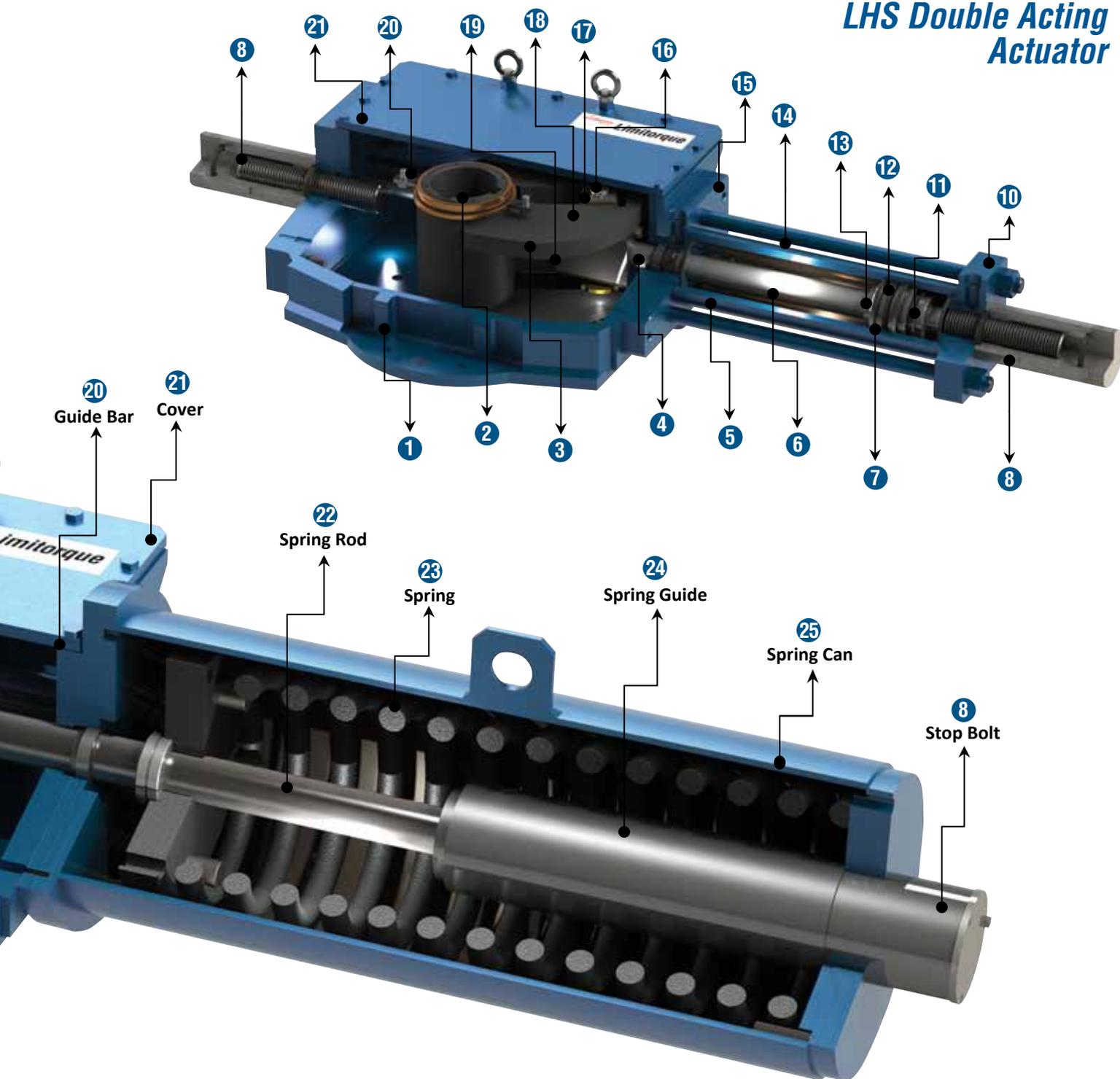
LHS Spring Return Actuator

LHS Standard Materials of Construction*		
ITEM	DESCRIPTION	MATERIAL
1	Housing	Carbon Steel
2	Scotch Yoke Bushing	Carbon Steel
3	Scotch Yoke	Carbon Steel
4	Bushing	PTFE + Steel
5	Cylinder	Carbon Steel (with treatment)
6	Piston Rod	Alloy Steel (chrome plated)
7	Piston	Carbon Steel (with treatment)
8	Stop Bolt	Carbon Steel (with treatment)

* Special or different materials available upon request

ITEM	DESCRIPTION	MATERIAL
9	Hex Nut	Carbon Steel
10	End Flange	Carbon Steel
11	Guide Ring	PTFE + Graphite
12	O-Ring	NBR
13	Split Collar	Alloy Steel

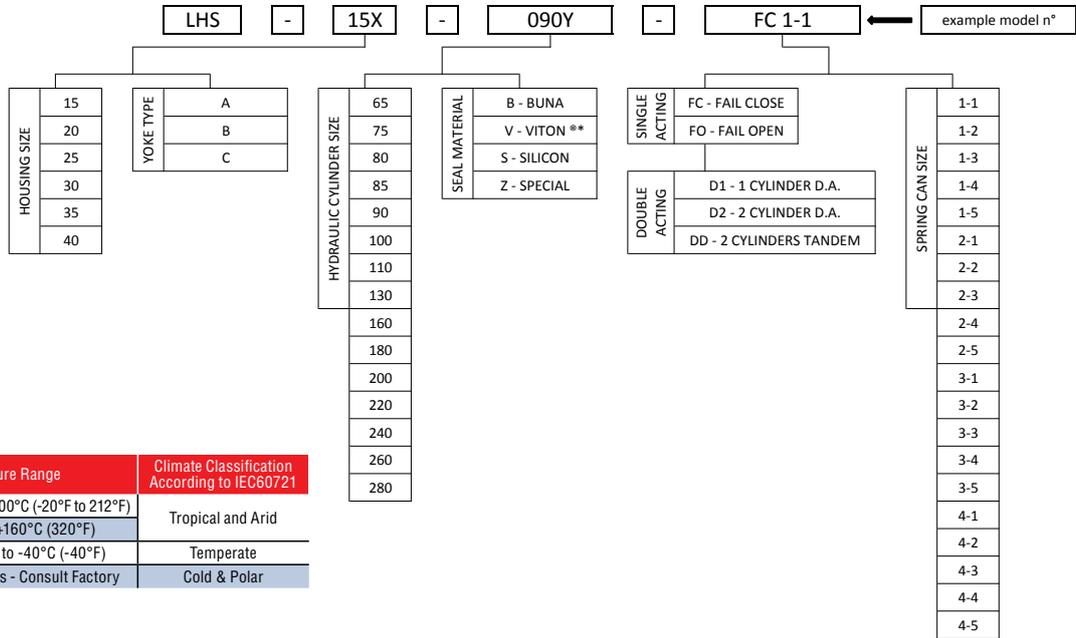
LHS Double Acting Actuator



ITEM	DESCRIPTION	MATERIAL
14	Tie Rod	Alloy Steel (with treatment)
15	Head Flange	Carbon Steel
16	Yoke Pin	Alloy Steel
17	Fork	Carbon Steel
18	Slider Block	Bronze
19	Guiding Block	Carbon Steel
20	Guide Bar	Alloy Steel (chrome plated)

ITEM	DESCRIPTION	MATERIAL
21	Cover	Carbon Steel
22	Spring Rod	Alloy Steel
23	Spring	Spring Steel
24	Spring Guide	Carbon Steel
25	Spring Can	Carbon Steel

LHS Actuator Selection Table



Seals Material

Code	Material	Temperature Range	Climate Classification According to IEC60721
B	Buna	Std Temp: -29°C to +100°C (-20°F to 212°F)	Tropical and Arid
V	Viton®	Hi Temp: up to +160°C (320°F)	
S	Silicon	Low Temp: down to -40°C (-40°F)	Temperate
Z	Other	Special Applications - Consult Factory	Cold & Polar

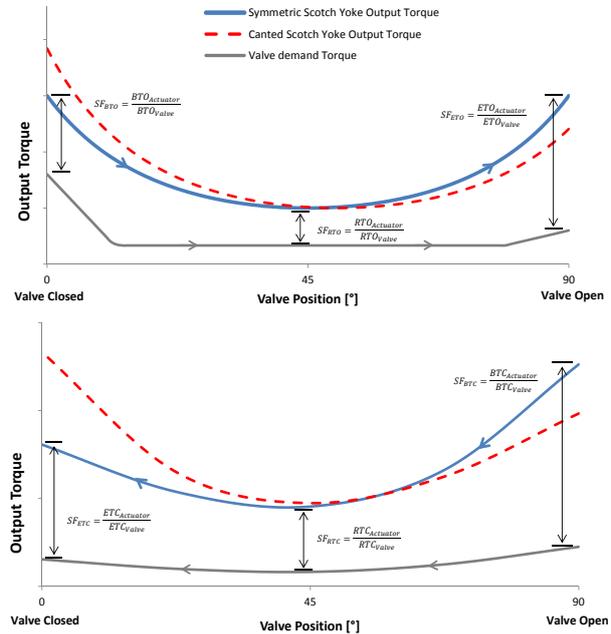
LHS Sizing and Selection

Due to the scotch yoke mechanism, LHS actuators have a particular U-shaped output torque curve, whether powered by a fixed supply pressure or the spring.

For a proper actuator model selection, the safety factors between actuator output torque and valve torque requirement shall be calculated at least in six points along the valve stroke. In addition, a final check is necessary to guarantee that actuator Maximum Output Torque does not exceed valve Maximum Allowable Stem Torque (MAST).

The minimum set of parameters and features necessary for an optimal actuator selection:

- Valve torques, including MAST
- Type of actuator:
 - Single Acting/Spring Return: Fail Safe Close (CW) or Fail Safe Open (CCW)
 - Double Acting configuration for Fail Last or Fail As Is
- Minimum, Normal and Maximum Hydraulic Supply Pressure to the actuator
- Safety Factors requested by the project or by a specific application
- Working Temperature range
- Open/Close stroking times
- Additional options (manual override, control panel, limit switch box, positioner, ...)



Detailed output torque graphs covering the full valve stroke are available for both spring return and double acting actuators.

Definitions

BTO	Break to open torque	BTC	Break to close torque
RTO	Running to open torque	RTC	Running to close torque
ETO	End to open torque	ETC	End to close torque
MAST	Maximum allowable stem torque	SF	Safety factor

*Viton is a registered trademarks of E. I. du Pont de Nemours

LHS Torque and Pressure Table

Model	MOT Maximum Operating Torque Nm (ft-lb)	MOP Maximum Operating Pressure barg (PSIG)	MAWP Maximum Allowable Working Pressure barg (PSIG)
LHS-15	5500 (4057)	Variable for every cylinder size. Please refer to Technical Bulletin LFENTB0003.	207 (3000)*
LHS-20	11 000 (8113)		
LHS-25	19 000 (14 014)		
LHS-30	38 000 (28 027)		
LHS-35	70 000 (51 629)		
LHS-40	140 000 (103 259)		
LHS-45	Consult Factory	Consult Factory	
LHS-50			
LHS-55			
LHS-60			

* MAWP 345 barg (5000 psig) available upon request

Control System Options

Limatorque offers a selection of standard and custom controls packages for most applications, including:

- Hydraulic Control Panels
- Hydraulic Power Units (HPU)
- Hydraulic Accumulators Racks
- Self-Contained Units (SCU)
- Electro-Hydraulic Integrated Solutions, upon request



Hydraulic Control System

Flowserve Solutions

In addition to providing actuators and controls, Flowserve and Limatorque lead the industry with all the solutions that our customers need to maintain efficiency and productivity.

- Aftermarket Parts and Services
- Business Assessments
- Actuator Inspection, Maintenance and Repair
- Engineering and Technical Services
 - Engineering Support and Technical Assessments
 - Equipment Performance Analysis and Upgrades
- Education and Training
 - On-site and Online Trainings
- Asset Data Management and Optimization Solutions

Limatorque Additional Product Range Offering

Electric Actuators and Controls

- MX — Non-intrusive, electronic multi-turn actuators
- QX — Non-intrusive, electronic quarter-turn actuators
- Master Station, Controller for redundant networked actuators
- Network Controls, Modbus, Profibus DP/PA, Foundation Fieldbus, DeviceNet, HART
- L120 — Electro-mechanical, Multi-turn electric actuators with integral & network controls
- SMB — Electro-mechanical, Multi-turn electric actuators for nuclear and severe duty service

Fluid Power Actuators

- Scotch Yoke Pneumatic actuators — LPS
- Compact Scotch Yoke Pneumatic actuators — LPC
- Scotch Yoke Hydraulic actuators — LHS
- Compact Scotch Yoke Hydraulic actuators — LHC*
- Linear Pneumatic actuators — LPL
- Linear Hydraulic actuators — LHL
- Direct Gas actuators — LDG*
- Gas Over Oil actuators — LGO*
- Electro-Hydraulic actuators — LEH*
- Standard and Customized Controls
- Application Engineering Support

Gearboxes

- V — Bevel gearboxes for manual or motorized operation
- WG — Worm gearboxes for manual or motorized operation
- SR — Spur gearboxes for manual or motorized operation

One Flowserve Solution

Flowserve brands for most common control accessories:

- | | |
|-----------------------|-----------------------|
| • Digital Positioners | • Valve Controllers |
| – Logix™ | – Automax™ |
| – PMV™ | – Worcester Controls™ |
| • Analog Positioners | • Limit Switch Boxes |
| – PMV | – Worcester Controls |
| – Accord™ | – PMV |
| • Diagnostic Software | – Automax |
| – ValveSight™ | – Accord |

* Contact Flowserve for product availability and additional information.



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Flowserve Limatorque Fluid Power Systems Product Sales

Via Rio Vallone 17
20883 Mezzago (MB), Italy
Phone: +39 039 62060 1
Fax: +39 039 62060 213
Email: lfpsinfo@flowserve.com

Flowserve Limatorque Fluid Power Systems Manufacturing and Operations

Via Rio Vallone 17
20883 Mezzago (MB), Italy
Phone: +39 039 62060 1
Fax: +39 039 62060 213
Email: lfpsinfo@flowserve.com

Flowserve Limatorque Fluid Power Systems Research & Development

Viale dell'Artigianato 24
29122 Piacenza (PC), Italy
Email: lfpsinfo@flowserve.com



To find your local Flowserve representative, visit www.flowserve.com or call USA 1 800 225 6989 or International +1 972 910 0774

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