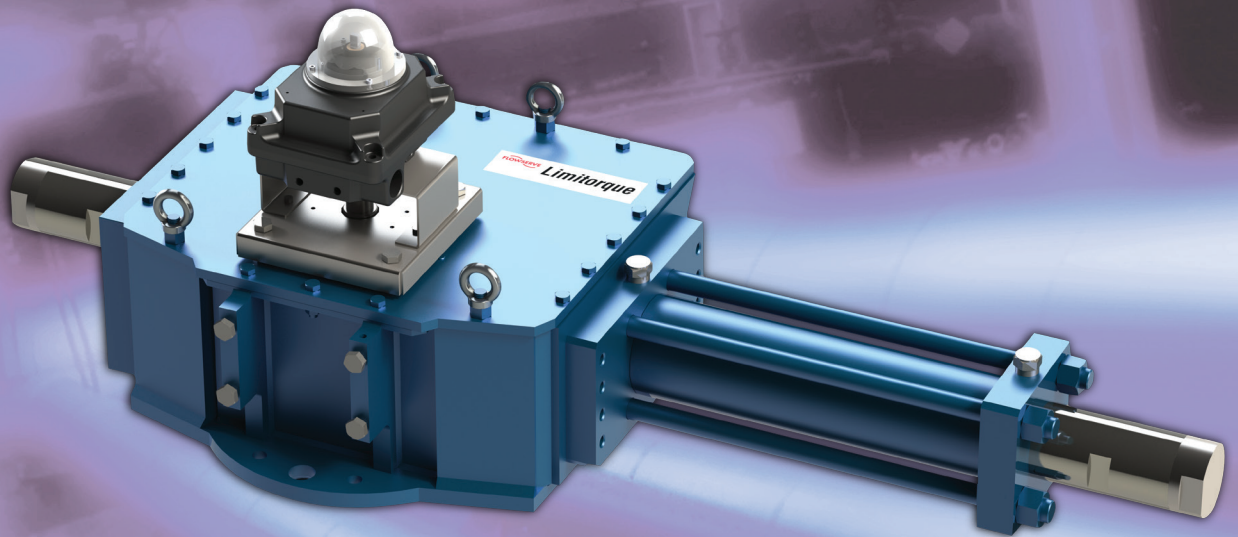




Limitorque™ LHS and LHH

Limitorque Hydraulic Scotch Yoke Heavy-Duty Actuator



Experience In Motion

Limitorque Fluid Power Systems

The Limitorque Fluid Power family of heavy-duty actuators presents the Limitorque Hydraulic Scotch Yoke Actuators Series LHS and LHH.

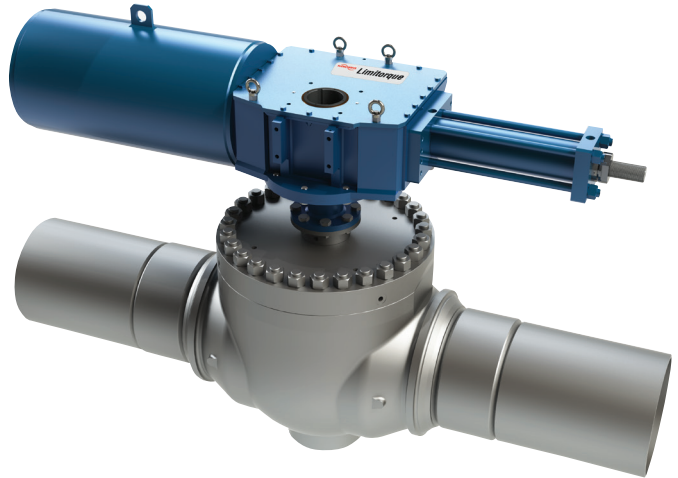
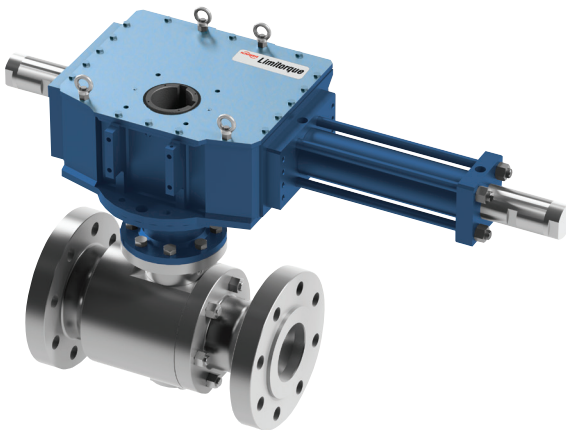
Today's industry requirements are more rigorous than ever before. Nowhere is this more evident than in the oil and gas industry, where new requirements are incorporated into project specifications almost every day and emphases on personnel safety and equipment uptime is the norm.

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

The LHS and LHH ranges of Limitorque hydraulic actuators are robust, modular Scotch yoke design, available in both springreturn and double-acting configurations. They are suitable for actuating ball, butterfly and plug valves or any other quarter-turn application.

LHS and LHH hydraulic actuators deliver up to 300 kNm (221 000 ft-lb) of precisely controlled torque. The LHS and LHH are 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 and LHH ranges, delivering enhanced performance and high reliability.



The 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 and LHH 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 and LHH: Limitorque Hydraulic Heavy-Duty Scotch Yoke Actuators

With a design life of 25 years* and a maintenance interval up to six years*, the LHS and LHH are hydraulic heavy-duty actuators, with an output torque up to 300 kNm (221 000 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

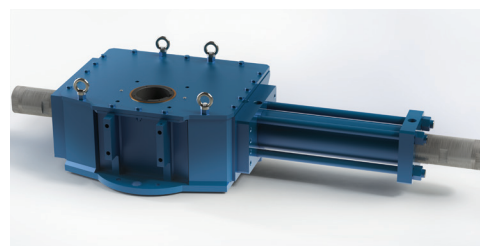
- Available in standard single-acting spring return and double-acting configurations, in torque ranges up to 250 kNm (184 000 ft-lb); contact factory for larger sizes
- 207 barg (3000 PSIG) maximum allowable working pressure (MAWP); 345 barg (5000 PSIG) version upon request
- -29°C to 100°C (-20°F to 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

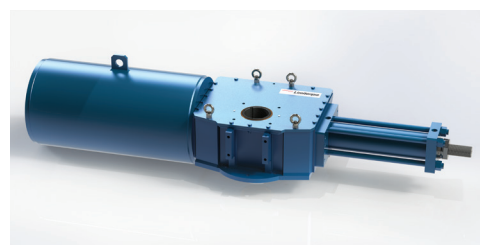
- Certified according to ATEX 94/9/EC Ex II 2GD c IIC T6
- NEMA 4 and NEMA 4X configurations, per NEMA 250
- IP66/IP66M and IP67/IP67M configurations
- Standard output valve interface in compliance with ISO 5211
- Actuator spring design in compliance with EN 13906
- Corrosion protection in compliance 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.

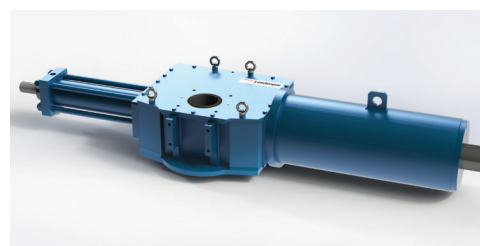
LHS and LHH Available Configurations



LHS/LHH Double Acting



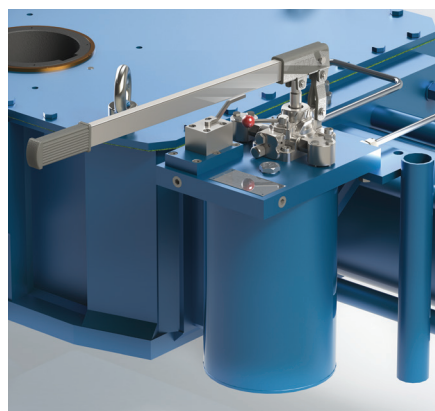
LHS/LHH Single Acting – Fail Close (CW)



LHS/LHH Single Acting – Fail Open (CCW)

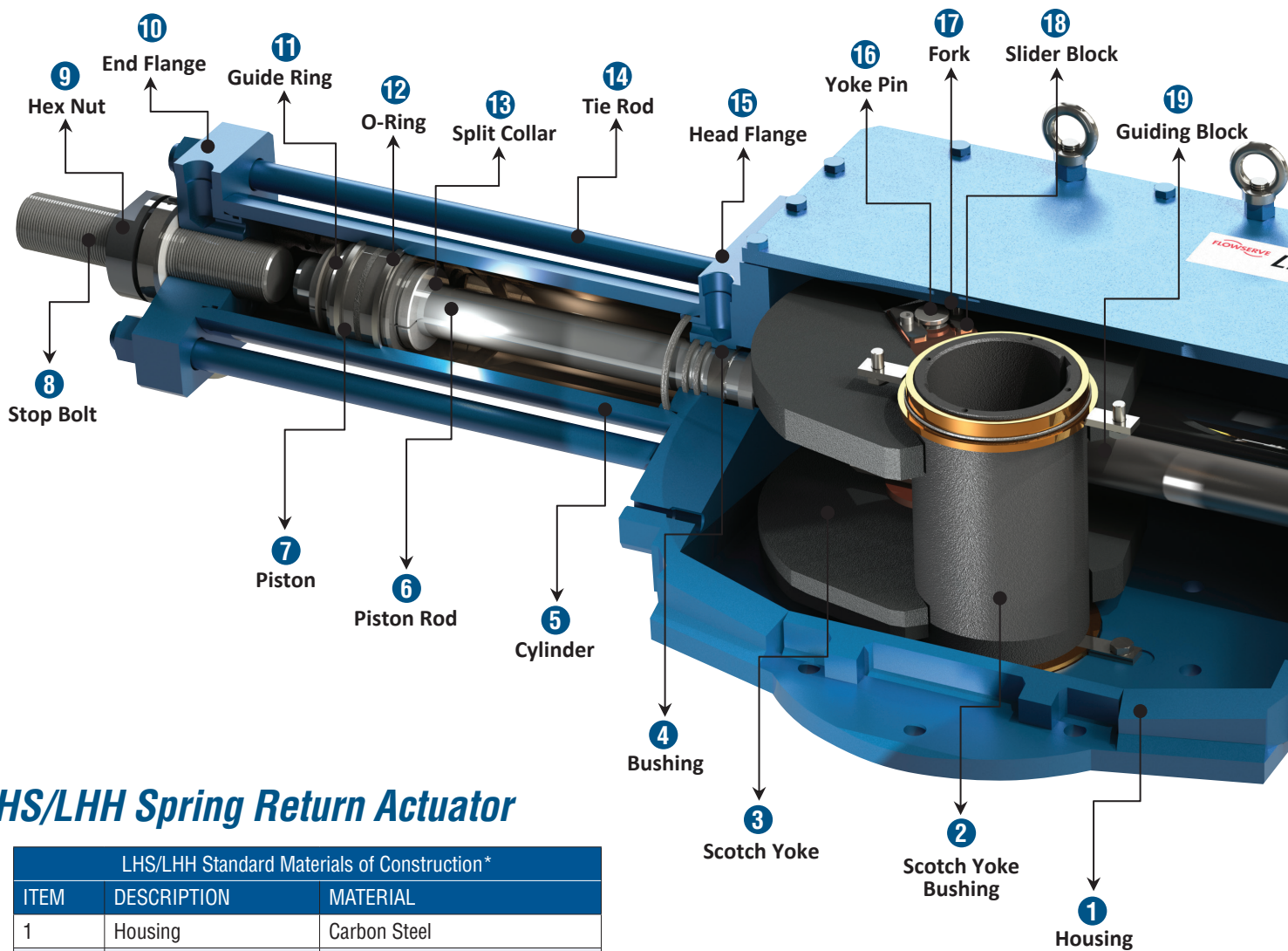
Manual Overrides

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



Anatomy of Limatorque LHS/LHH Actuator

The LHS/LHH ranges of Limatorque hydraulic actuators are a robust, modular Scotch yoke design, available in both spring return and double acting configurations. The design philosophy introduced on the heavy-duty LPS actuator has been adopted for the LHS/LHH ranges, delivering enhanced performance and high reliability. The LHS/LHH are available in a selection of standard as well as in different and special material executions, upon request.



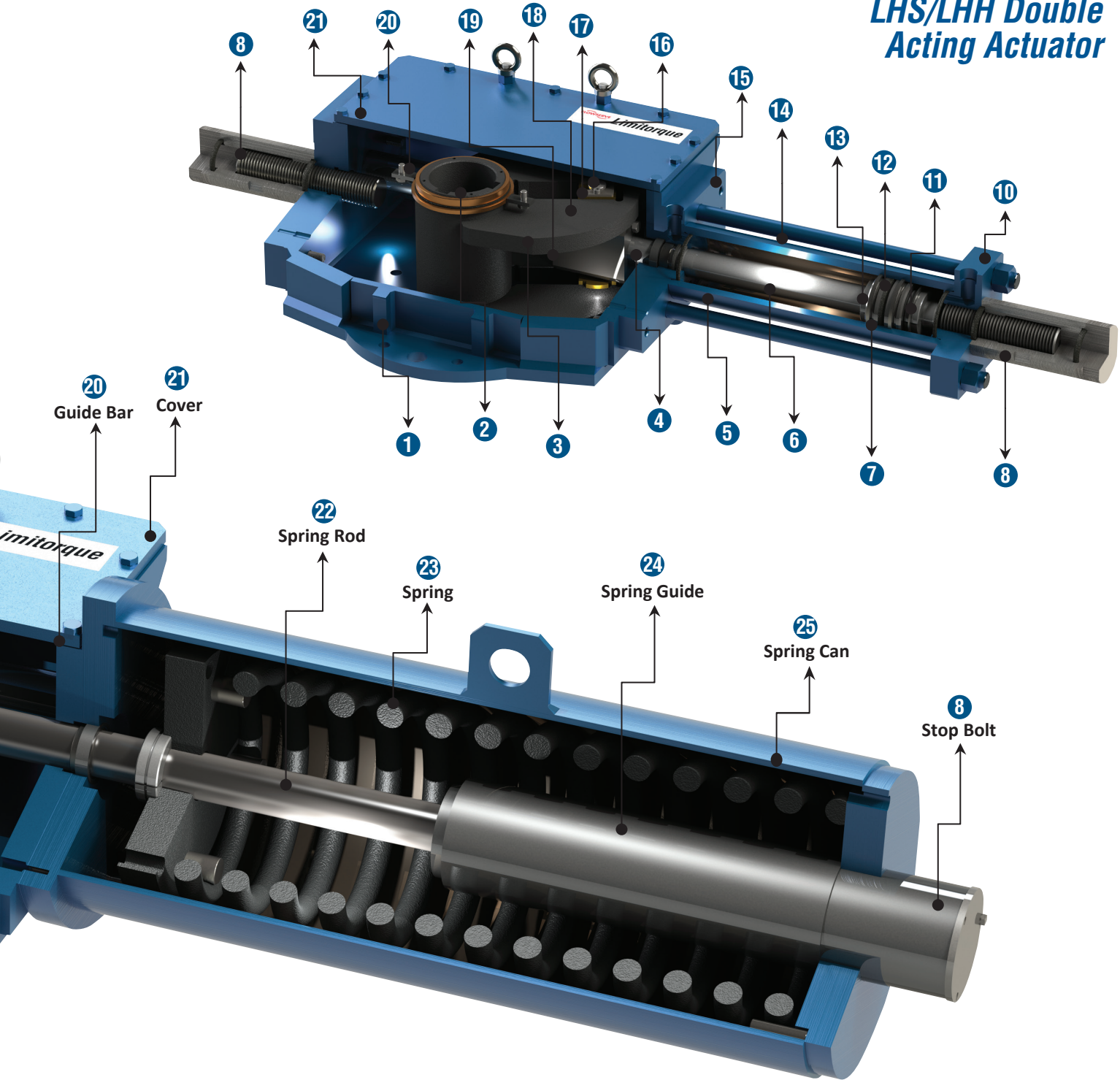
LHS/LHH Spring Return Actuator

LHS/LHH 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

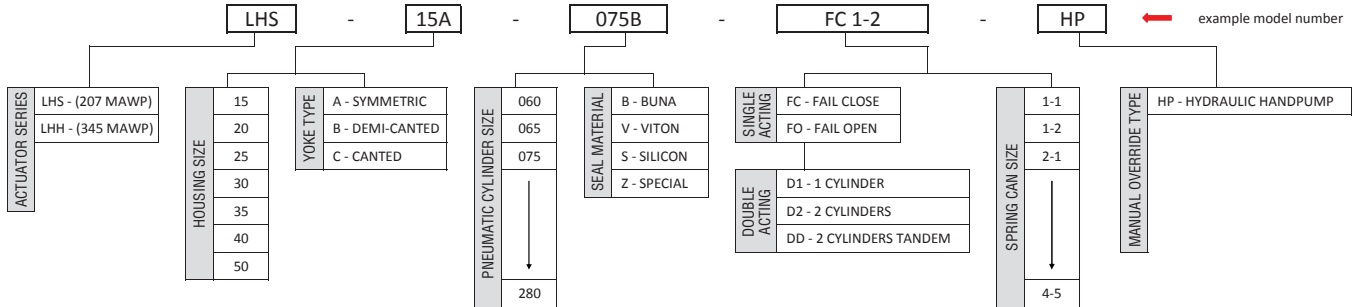
LHS/LHH Double Acting Actuator



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 and LHH 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

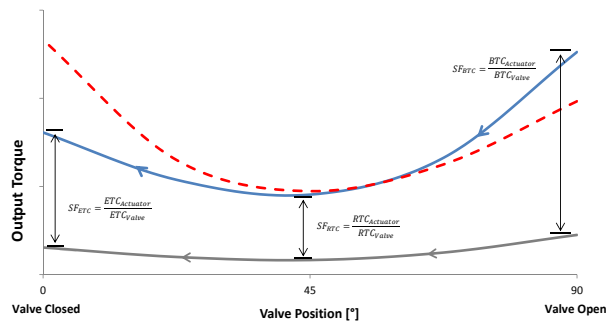
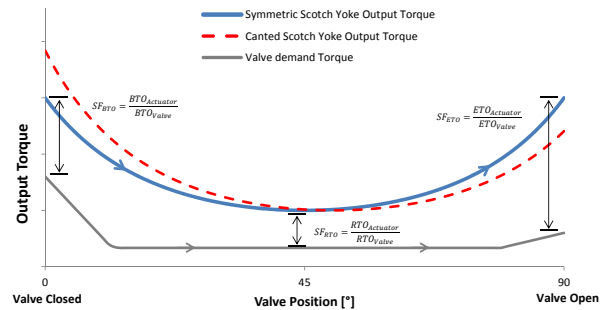
LHS and LHH Sizing and Selection

Due to the Scotch yoke mechanism, LHS/LHH 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 trademark of E. I. du Pont de Nemours.

LHS/LHH 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/LHH-15	6000 (4425)	Variable for every cylinder size.	LHS: 207 barg (3000 psig) LHH: 345 barg (5000 psig)
LHS/LHH-20	12 000 (8851)		
LHS/LHH-25	21 000 (15 489)		
LHS/LHH-30	40 500 (29 871)		
LHS/LHH-35	75 000 (55 317)		
LHS/LHH-40	150 000 (110 634)		
LHS/LHH-50	300 000 (221 268)		
LHS/LHH-60	Consult Factory	Consult Factory	

* MAWP 410 barg (6000 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/LHH
- 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.



To find your local Flowserve representative

or for more information about Flowserve Corporation,
visit www.flowserve.com or call USA 1 800 225 6989 or
International +1 972 910 0774

FCD LFENBR0003-02-AQ Printed in USA. October 2016 © 2016 Flowserve Corporation.

Flowserve Corporation has established industry leadership in the design and manufacture of its products. When properly selected, this Flowserve product is designed to perform its intended function safely during its useful life. However, the purchaser or user of Flowserve products should be aware that Flowserve products might be used in numerous applications under a wide variety of industrial service conditions. Although Flowserve can (and often does) provide general guidelines, it cannot provide specific data and warnings for all possible applications. The purchaser/user must therefore assume the ultimate responsibility for the proper sizing and selection, installation, operation, and maintenance of Flowserve products. The purchaser/user should read and understand the Installation Operation Maintenance (IOM) instructions included with the product, and train its employees and contractors in the safe use of Flowserve products in connection with the specific application.

While the information and specifications contained in this literature are believed to be accurate, they are supplied for informative purposes only and should not be considered certified or as a guarantee of satisfactory results by reliance thereon. Nothing contained herein is to be construed as a warranty or guarantee, express or implied, regarding any matter with respect to this product. Because Flowserve is continually improving and upgrading its product design, the specifications, dimensions and information contained herein are subject to change without notice. Should any question arise concerning these provisions, the purchaser/user should contact Flowserve Corporation at any one of its worldwide operations or offices.

© 2016 Flowserve Corporation, Irving, Texas, USA. Flowserve is a registered trademark of Flowserve Corporation.

**Flowserve Limitorque
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 Limitorque
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 Limitorque
Fluid Power Systems
Research and Development**

Via Belizzi 40/42
29122 Piacenza (PC), Italy
Email: lfpsinfo@flowserve.com