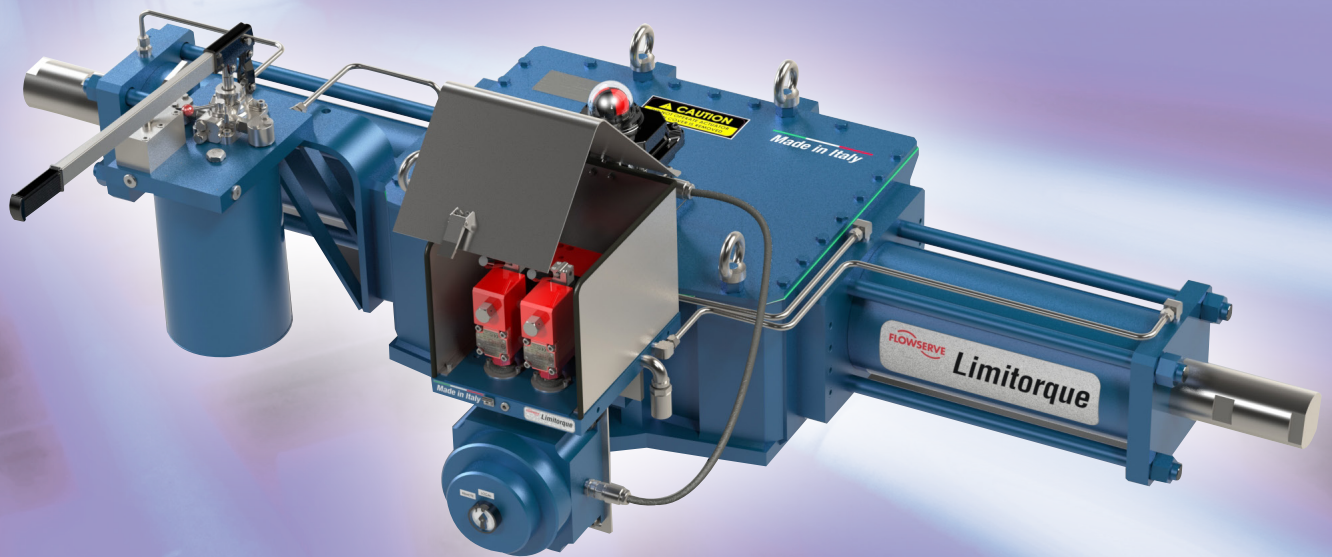




Limitorque™ LDG

Limitorque Direct Gas Powered Scotch Yoke Heavy-Duty Actuator



Experience In Motion

Limitorque Fluid Power Systems

Introduction

The Limitorque Fluid Power family of heavy-duty actuators presents the Limitorque Direct Gas Scotch Yoke Actuators LDG.

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.

The Limitorque Direct Gas (LDG) actuator has been specifically designed to operate on high pressure pneumatic supply, including pipeline gases, nitrogen and any other equivalent high pressure source. This makes it a robust and efficient way of providing reliable pipeline valve automation, even when no external motive power supplies are present. Based on Limitorque's high efficiency scotch-yoke modules, the self-contained system includes both the gas powered actuation unit and the high pressure gas control circuit.

The LDG range of Limitorque direct gas powered actuators are available in both spring-return and double-acting configurations. They are suitable for actuating ball, butterfly and plug valves or any other quarter-turn application.

LDG gas powered actuators deliver up to 300 kNm (221 000 ft-lb)* of precisely controlled torque. The LDG

is available in a selection of standard as well as special material executions, upon request.

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, more frequent maintenance of replaceable wear surfaces, as outlined in EN 15714, may be required.

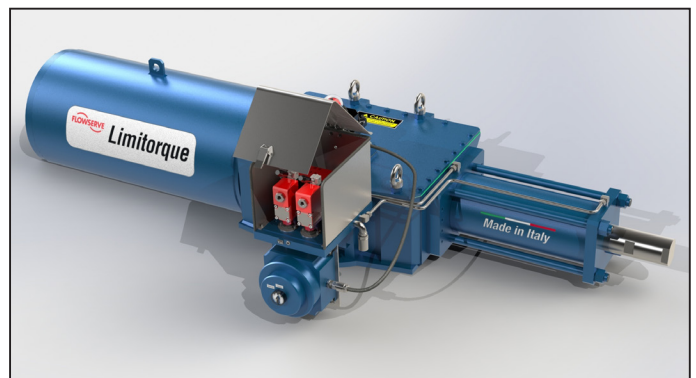
To complete the actuation package, LDG actuators are supplied with the on board Medium-High Pressure Control group (MHPC) including both local and remote operation configurations and multiple optional functionalities are available to meet all pipeline application requirements.

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.

Key Benefits

- Reduced equipment footprint due to compact dimensions and design.
- Improved Lifespan with 25 years design life and maintenance interval up to 6 years or as prescribed in EN 15714 for high-cycle applications.
- Robust ,cost effective modular construction for minimizing repair expenses and maximizing process availability.
- Simplified on-site maintenance for standard activities such as replacement of scotch yoke sliding block without removing the actuator from the valve.
- Reduced environmental impact through Limitorque's high pressure rated MHPC control group that minimizes gas consumption and exhaust.



LDG: Limitorque Direct Gas Heavy-Duty Scotch Yoke Actuators

With a design life of 25 years* and a maintenance interval up to six years*, the LDG range is a high pressure pneumatic heavy-duty actuator, 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. LDG 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, high pressure pneumatic 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 and modulating valve application, in general service, isolation service and safety applications such as ESD or HIPPS
- On board Medium-High Pressure Control group (MHPC) including both local and remote operation configurations and multiple optional functionalities are available to meet all pipeline application requirements
- MHPC components are all rated for full system pressure. High pressure rating of controls and actuator power cylinder eliminates need for pressure reducer, reducing system complexity, eliminating risks of gas condensation and freezing, allowing higher torque output with smaller overall dimensions and reducing gas use and exhaust.
- Dedicated MHPC control component enclosure in stainless steel with integral terminal box in anodized aluminium
- MHPC anodized aluminium piping manifold simplifies piping and wiring assembly and minimizes leak paths in gas control circuit.
- A full range of accessories including switchboxes, ESD & PST functionalities, custom control functions, fire protection systems and hydraulic manual overrides are available for the LDG

Specifications

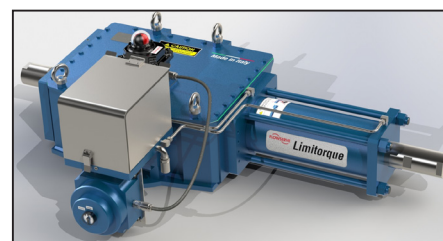
- Available in standard single-acting spring return and double-acting configurations, in torque ranges up to 300 kNm (221 000 ft-lb); contact factory for larger sizes
- 105 barg (1500 PSIG) maximum allowable working pressure (MAWP) for both LDG actuator and MHPC control group
- -29°C to 100°C (-20°F 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

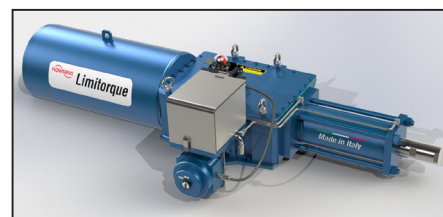
- Certified according to ATEX 94/9/EC Ex II 2GD c IIC T6
- IP66/IP66M and IP67/IP67M configurations (MHPC is IP67)
- Standard output valve interface in compliance with ISO 5211
- Actuator spring design in compliance with EN 13906
- Corrosion protection in compliance with ISO 12944-2 and EN 15714-4; optionally 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.

LDG Available Configurations



LDG Double Acting



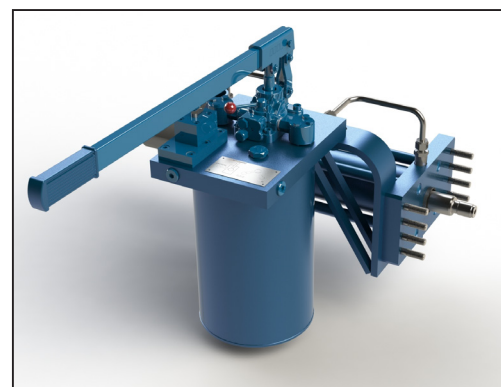
LDG Single Acting – Fail Close (CW)



LDG Single Acting – Fail Open (CCW)

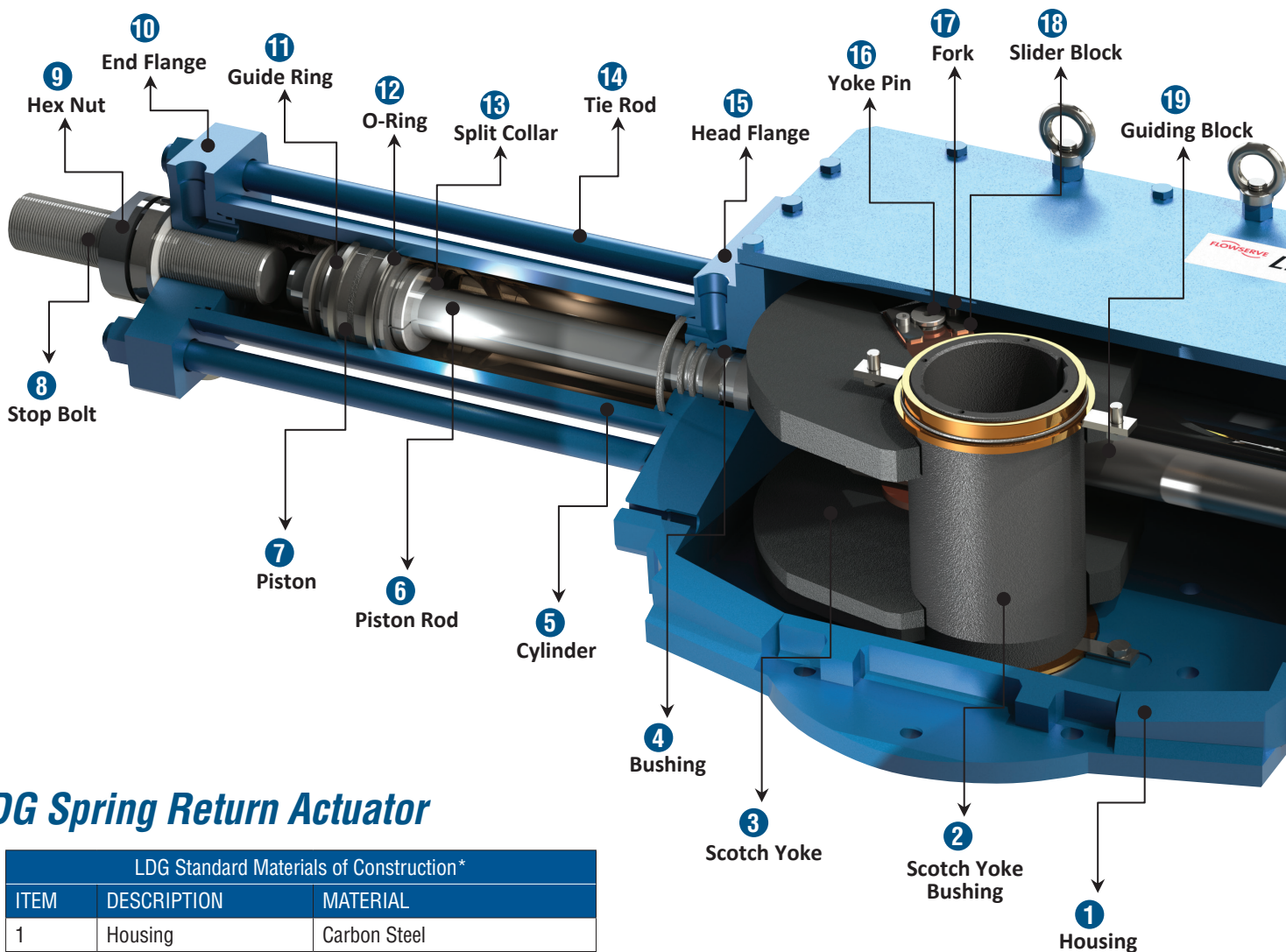
Manual Overrides

- Hydraulic Hand-Pump



Anatomy of Limitorque LDG Actuator

The LDG range of Limitorque Gas Powered actuators is 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 LDG ranges, delivering enhanced performance and high reliability. The LDG is available in a selection of standard as well as in different and special material executions, upon request.



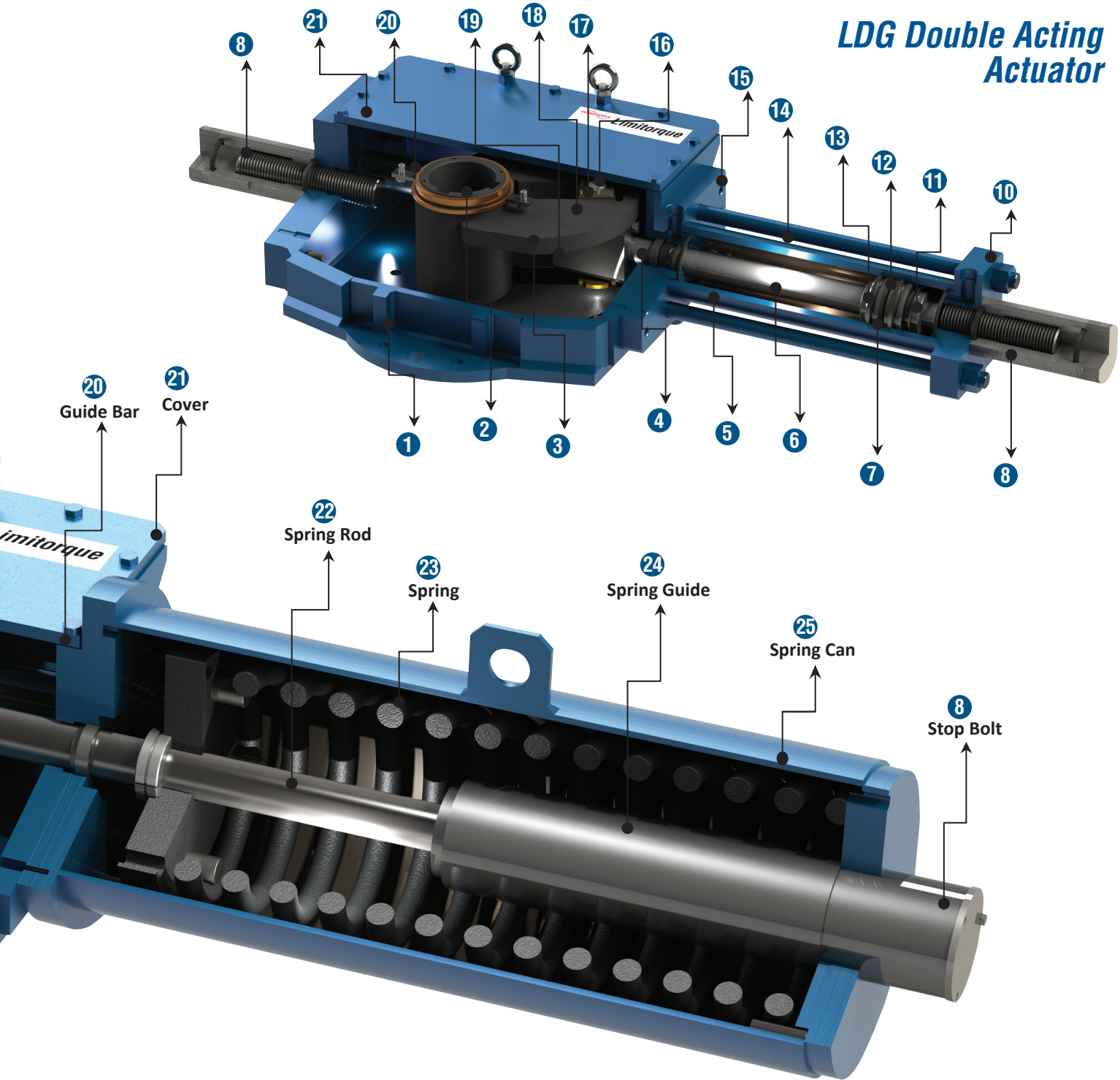
LDG Spring Return Actuator

LDG 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

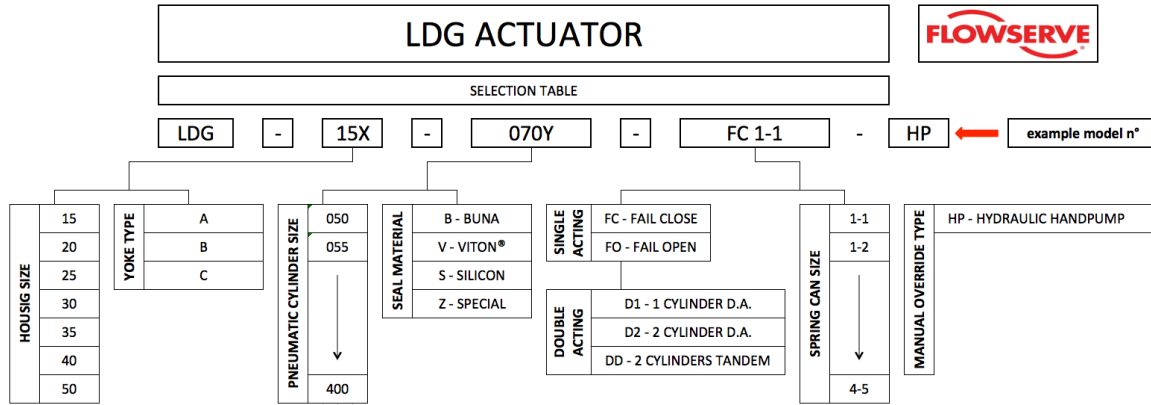
LDG Double Acting Actuator



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

LDG 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

LDG Sizing and Selection

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

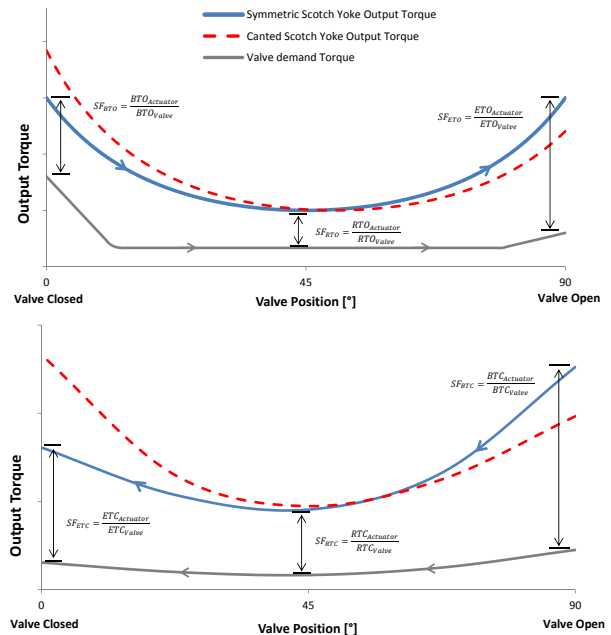
In sizing of actuators powered directly by pipeline gas, care must be taken to evaluate the valve torque requirements against the actuator output torques at the varying pressures in the actual pipeline.

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, and as minimum, at the minimum and maximum pipeline normal operating pressures.

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 at minimum and maximum pipeline pressure, 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 and Maximum gas supply pressure to the actuator
- Gas composition (H₂S content) in case of sour gas applications
- Safety Factors requested by the project or by a specific application
- Working Temperature range
- Open/Close stroking times
- Additional options (manual override, limit switches, specific functional requirements such as line-break, low or high pressure trip, etc, others as applicable)



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

LDG Torque and Pressure Table

Model	MOT Maximum Operating Torque Nm (ft-lbf)	MOP Maximum Operating Pressure Barg (PSig)	MAWP Maximum Allowable Working Pressure Barg (PSig)
LDG-15	6000 (4425)	Variable for every cylinder size	Variable for every cylinder size
LDG-20	12000 (8851)		
LDG-25	21000 (15489)		
LDG-30	40500 (29871)		
LDG-35	75000 (55317)		
LDG-40	150000 (110634)		
LDG-50	300000 (221268)		
LDG-60	Consult Factory		

Control System Options

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

- Torque limiting devices
- Pneumatic and electronic line-break systems
- High / Low pressure pilots
- ESD function

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
- Direct Gas actuators — LDG
- Compact Scotch Yoke Hydraulic actuators — LHC*
- Linear Pneumatic actuators — LPL
- Linear Hydraulic actuators — LHL
- 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™ | – Autamax™ |
| – PMV™ | – Worcester Controls™ |
| • Analog Positioners | • Limit Switch Boxes |
| – PMV | – Worcester Controls |
| – Accord™ | – PMV |
| • Diagnostic Software | – Autamax |
| – ValveSight™ | – Accord |

* Contact Flowserve for product availability and additional information.



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