

Double Acting and Spring Return Direct Gas Quarter-turn Actuators Output Torques to 6,500,000 lb.in.

Features and Benefits

- Separate gas and hydraulic cylinders prevent commingling of gas and oil, eliminating any possibility of oil release to the atmosphere during the opening or closing cycle.
- Scotch yoke mechanism generates high break torque for the actuation of quarter-turn pipeline valves.
- Totally enclosed, weatherproof carbon steel housing protects the critical internal components against corrosive elements.
- Heavily chrome plated guide bar provides support for the transverse forces generated during rotation of the scotch yoke, ensuring proper support of the piston rod and valve stem.
- All load-bearing components supplied with bronze or PTFE-graphite-bronze bearings, eliminating the need for lubrication maintenance and ensuring durable, smooth operation.
- Electroless nickel plated cylinder wall provides a smooth, long lasting sealing surface for the piston seal, assuring maximum sealing integrity and long service life.
- ISO 9001 certified design and manufacturing process provides assurance of a quality finished product.
- Integral manual hand pump provides a means of cycling the valve when sufficient line pressure is not available.
- Power gas consumption is significantly reduced as there are no gas/hydraulic tanks incorporated in the design.
- Independently adjustable 'open' and 'close' travel stops are located on center with the piston rod thus eliminating sideloading to the output shaft.



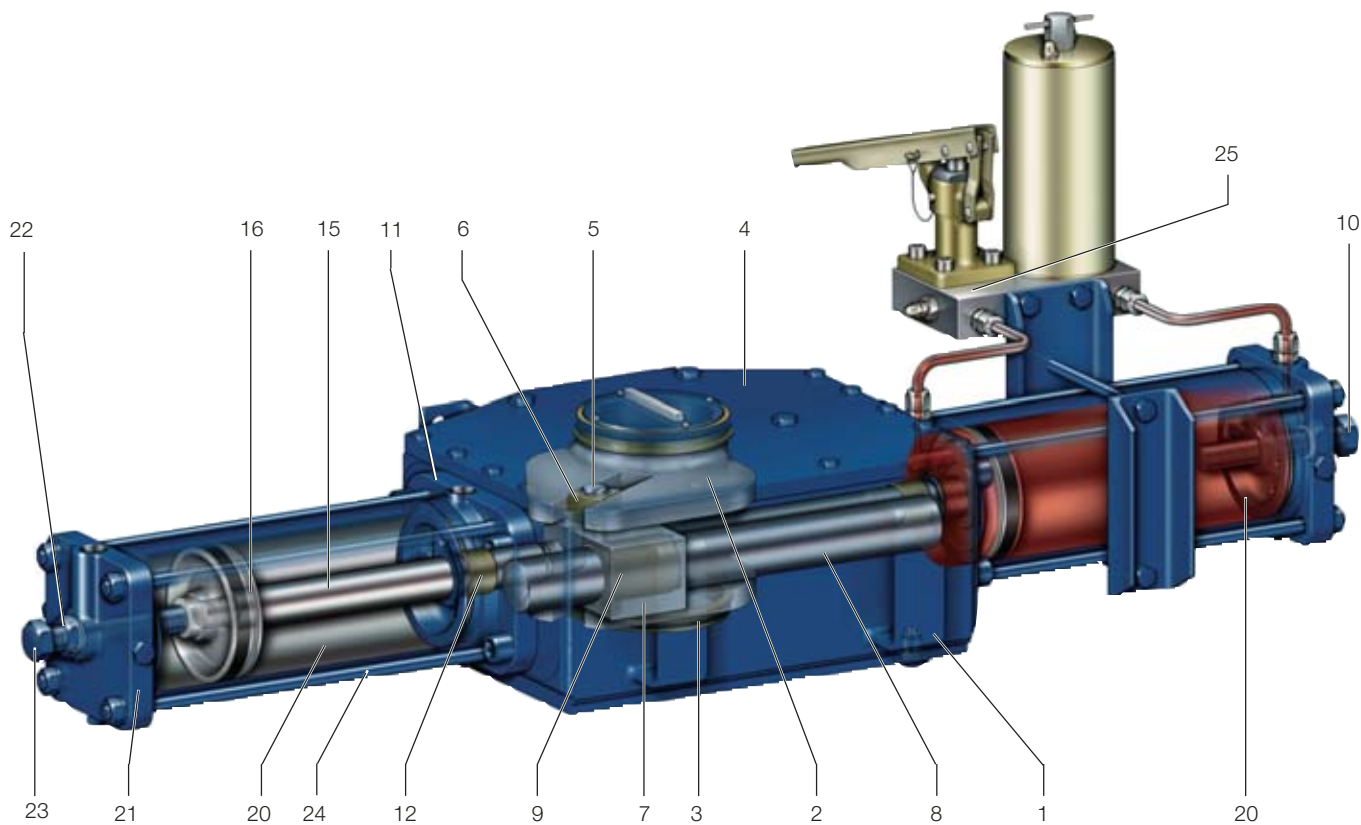
- Internationally recognized ISO 5211 mounting patterns facilitate in-field interchangeability of adaption hardware.

General Application

Typically used for the local or remote operation of quarter-turn ball, plug or butterfly valves when using high-pressure gas as a supply media.

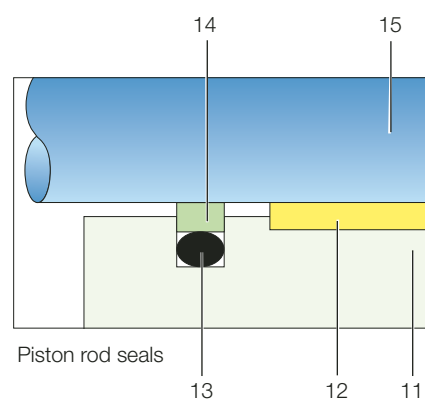
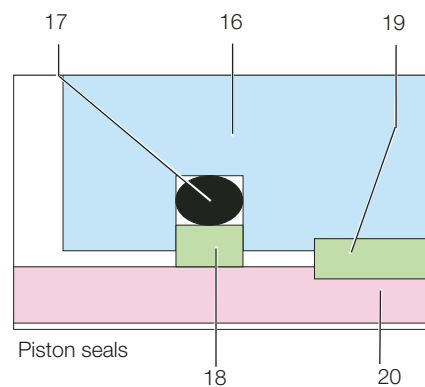
Technical Data

Supply pressure	: 150 to 1,500 psig (10.3 to 103 bar)
Option	: 1850 psig
Supply medium	: High pressure gas
Temperature rating	:
Standard range	: -20° to 210°F (-30° to 100°C)
Optional range	: -65° to 300°F (-54° to 150°C)
Angular rotation	: 90 degrees ± 4 degrees at each end of travel



Materials specification

Item	Name	Material	Material standards
1	Housing	Carbon steel	ASTM A537 cl.1 +ASTM A283 gr D
2	Yoke	Carbon steel	API 5LX gr X52 (C<0.2%) +ASTM A537 cl.1
3	Yoke bushing	Bronze	ASTM B427 Alloy UNS No. C90800
4	Cover	Carbon steel	ASTM A283 gr D
5	Guide block pin	Alloy steel	AISI SAE 9840
6	Sliding block	Bronze	ASTM B427 Alloy UNS No C90800
7	Guide block	Carbon steel	ASTM A537 cl.1
8	Guide bar	Alloy steel (Chromium plated)	AISI SAE 9840
9	Guide block bushing	Steel +Bronze +Teflon	
10	Travel stop screw	Carbon steel	AISI SAE 1040
11	Cylinder head flange	Carbon steel	ASTM A283 gr D
12	Piston rod bushing	Steel +Bronze +Teflon	
13	Piston rod O-ring	Nitrile rubber	
14	Piston rod seal ring	Teflon	
15	Piston rod	Alloy steel (Chromium plated)	AISI SAE 9840
16	Piston	Carbon steel	ASTM A283 gr D
17	Piston O-ring	Nitrile rubber	
18	Piston seal ring	Teflon	
19	Piston guide sliding ring	Teflon +Graphite	
20	Cylinder tube	Carbon steel (Nickel plated)	API 5LX gr X52
21	End flange	Carbon steel	ASTM A283 gr D
22	Sealing washer	PVC	
23	Travel stop screw	Carbon steel	AISI SAE 1040
24	Tie rod	Alloy steel	AISI SAE 9840
25	Manual hydraulic hand pump/speed control module	Carbon steel	ASTM A537 cl1 + A283 gr.D



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Principles of Construction

Biffi direct gas actuator incorporates the field proven scotch yoke design. The scotch yoke mechanism, yoke bearings, guide bar, guide block, guide block bearing, guide block pin and sliding block are contained in the totally enclosed, weatherproof carbon steel housing. Bearings are provided for each moving part. The guide bar prevents the scotch yoke, piston rods and valve stem from operating under excessive loads. Biffi's direct gas actuator is designed and manufactured to ISO 9001 standards.

Separate Gas and Hydraulic Cylinders

Gas and hydraulic fluid cannot commingle in the Biffi direct gas actuator. The gas and hydraulic fluid are contained in totally separate cylinders mounted on opposite ends of the actuator housing. The actuator is cycled by introducing gas directly from the pipeline to the gas cylinder of the actuator. Movement of the gas cylinder piston/piston rod is transmitted to the scotch yoke which, in turn, moves the piston/piston rod of the hydraulic cylinder. Check valves and adjustable orifices in the hydraulic circuit regulate the cycle speed of the actuator.

Reduced Gas Consumption

Introducing the power gas directly to the gas cylinder of the actuator requires significantly less power gas than systems using external gas/hydraulic tanks. The Biffi GIG actuator is also more compact and lighter than actuators incorporating gas/hydraulic tanks as the GIG actuator design does not require external gas/hydraulic tanks. This feature also makes the GIG actuator a more cost effective solution.

Integral Manual Hand Pump

Each Biffi GIG direct gas actuator is equipped with an integral manual hand pump and hydraulic oil reservoir. When pipeline pressure is not available, the manual hand pump can be used to safely and reliably open or close the valve at its maximum torque requirement.

Speed Control

Independently adjustable opening and closing speed controls are built into the manual hand pump module and are easily adjusted in the field without the need for special tools. The speed at which the actuator cycles the valve is controlled by adjusting the oil flow rate in the hydraulic circuit. Using the hydraulic circuit to control the cycling speed provides smooth operation and eliminates the possibility of power gas hydrating.

Linear Travel Stops

The externally adjustable travel stops are on center with the piston rod, eliminating side loading to the scotch yoke. Located at either end of the actuator, these travel stops provide precise adjustment of the rotary output. Both the 'open' and 'close' travel stops are independently adjustable.

Electroless Nickel Plated Cylinders

Both the gas and hydraulic cylinder walls are electroless nickel plated and precision honed to ensure long lasting, trouble free service. This plating process provides an extremely smooth and corrosion resistant surface for the piston seals.

Guide Bar

All Biffi GIG direct gas actuators have a heavily chrome-plated guide bar that supports the transverse forces generated by the scotch yoke while maintaining precise alignment of the piston rod and preventing sideloading to the output shaft. This feature greatly increases the cycle life of the actuator. This guide bar technology was origin-ated by Biffi and has proven to be the most effective way of controlling the forces generated by a scotch yoke. The heavily chrome-plated guide bar also provides an excellent bearing surface upon which the guide block travels.

Seals

The piston and piston rod seals are made by teflon rings precharged by an o-ring made of the most suitable compound for the most severe working conditions.

Yoke Design

Valve torque requirements are the most critical elements to consider when sizing an actuator. The torque requirements of a typical pipeline quarter-turn ball valve can vary greatly as the valve is moving from the closed to open or open to closed position. The Biffi GIG direct gas actuator is available with either a canted or symmetric scotch yoke mechanism. The actuator size is optimized by using the scotch yoke mechanism that will produce the proper amount of torque at any point during the valve stroke from 0 degrees to 90 degrees travel. The torque output characteristics of each of these mechanisms are documented in this brochure.

Mounting

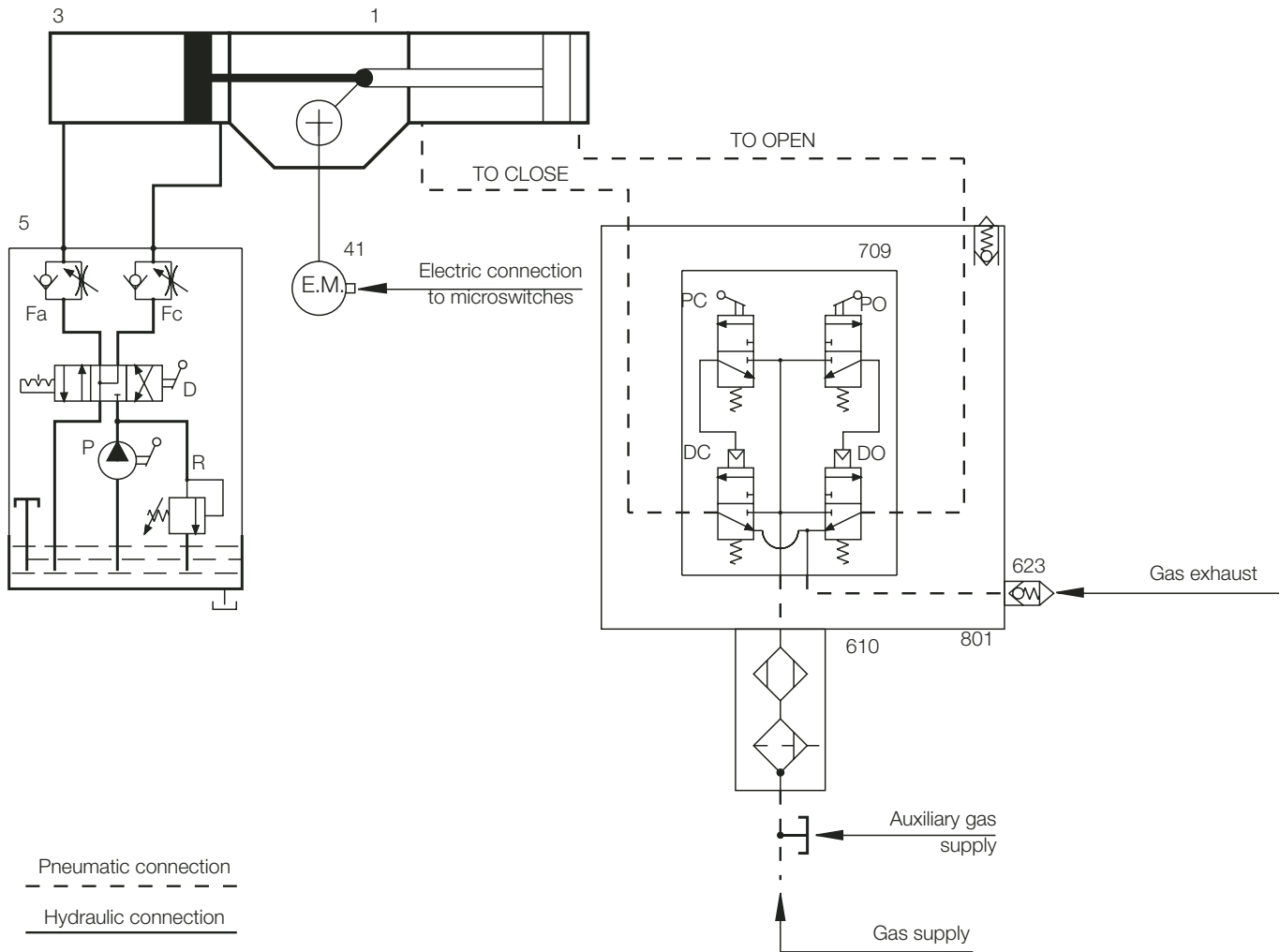
ISO 5211 mounting pads utilize internationally recognized mounting patterns. The Biffi GIG direct gas actuator can be provided as part of a new ball, plug or butterfly valve and actuator package or can easily be installed on existing valves in the field.

Spring Return

For critical emergency shutdown applications, the Biffi GIG is also available as a spring return unit. With the spring contained in a welded cartridge, this design eliminates the need for special spring compression tools during assembly and disassembly, greatly increasing worker safety.

Actuator Control Components

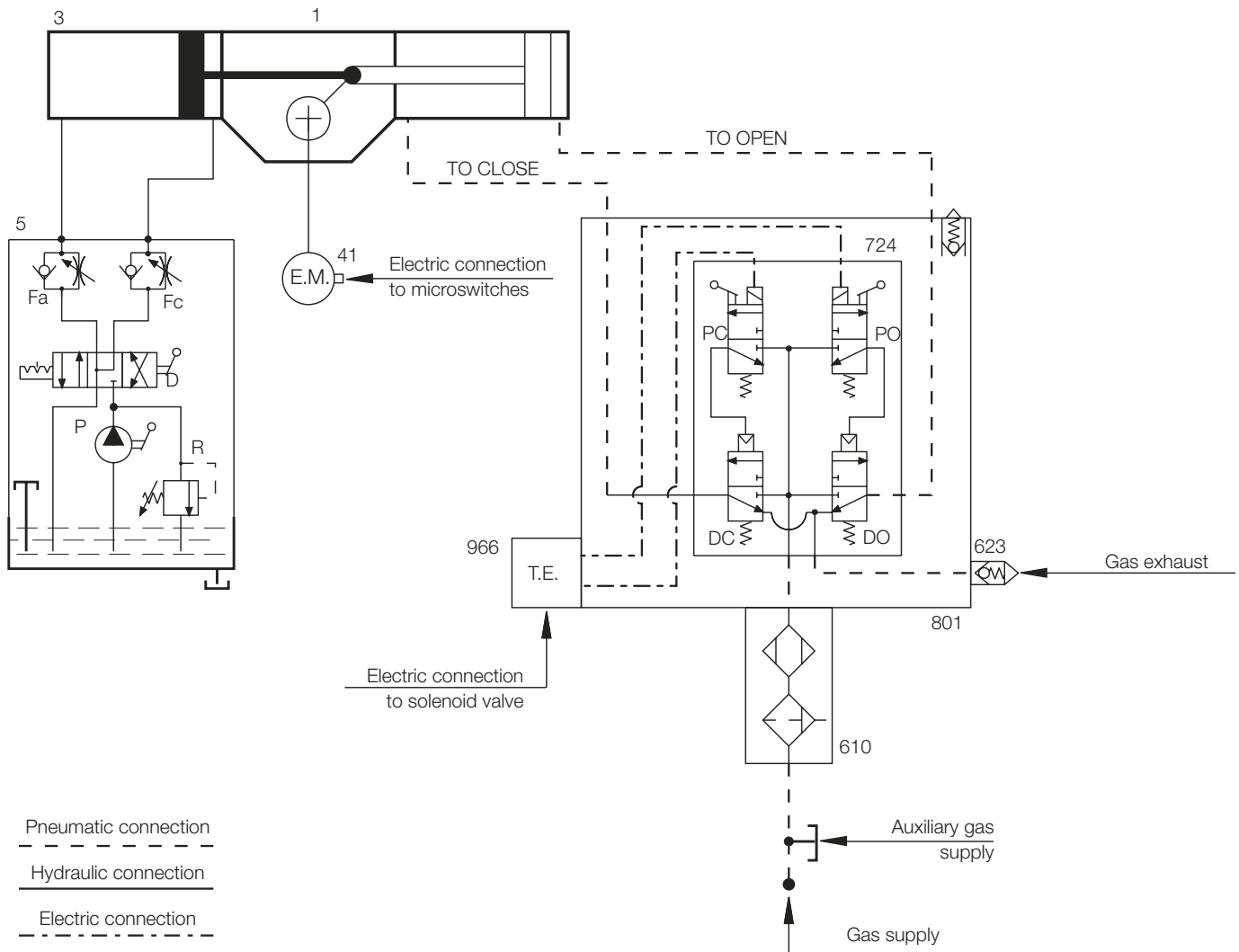
Since 1955, Biffi has been supplying the petroleum industry with the highest quality actuators and control components and can accommodate requirements from a basic local/manual control to a sophisticated line-break system.



Item	Description
1	Double acting pneumatic actuator
3	Hydraulic cylinder
5	Manual override
	R – Relief valve
	P – Hand pump
	D – Hand operated directional control valve
	Fa – Unidirectional flow regulator (Opening operation)
	Fc – Unidirectional flow regulator (Closing operation)
41	Electric microswitches (if specified)
610	Gas dehydrating filter/condensate separator
623	Dust excluder with check valve
709	Double 3/2 N.C. pneumatic pilot & hand operated/spring valve
	PC - 3/2 N.C. Hand operated / Spring pilot valve (to Close)
	PO - 3/2 N.C. Hand operated / Spring pilot valve (to Open)
	DC - 3/2 N.C. Pneumatic pilot / Spring return valve (to Close)
	DO - 3/2 N.C. Pneumatic pilot / Spring return valve (to Open)
801	Control valves enclosures with vent valve

Notes

- Local control to open and to close
Press lever on valve 709-PO to open or 709-PC to close with gas supply.
- Manual operation
Select by the valve 5-D the opening or closing operation and actuate the hand pump 5-P
The valve 5-D must be in "Remote control" position to allow the operation with gas supply
- The operating diagram is drawn with control valves not actuated



Notes

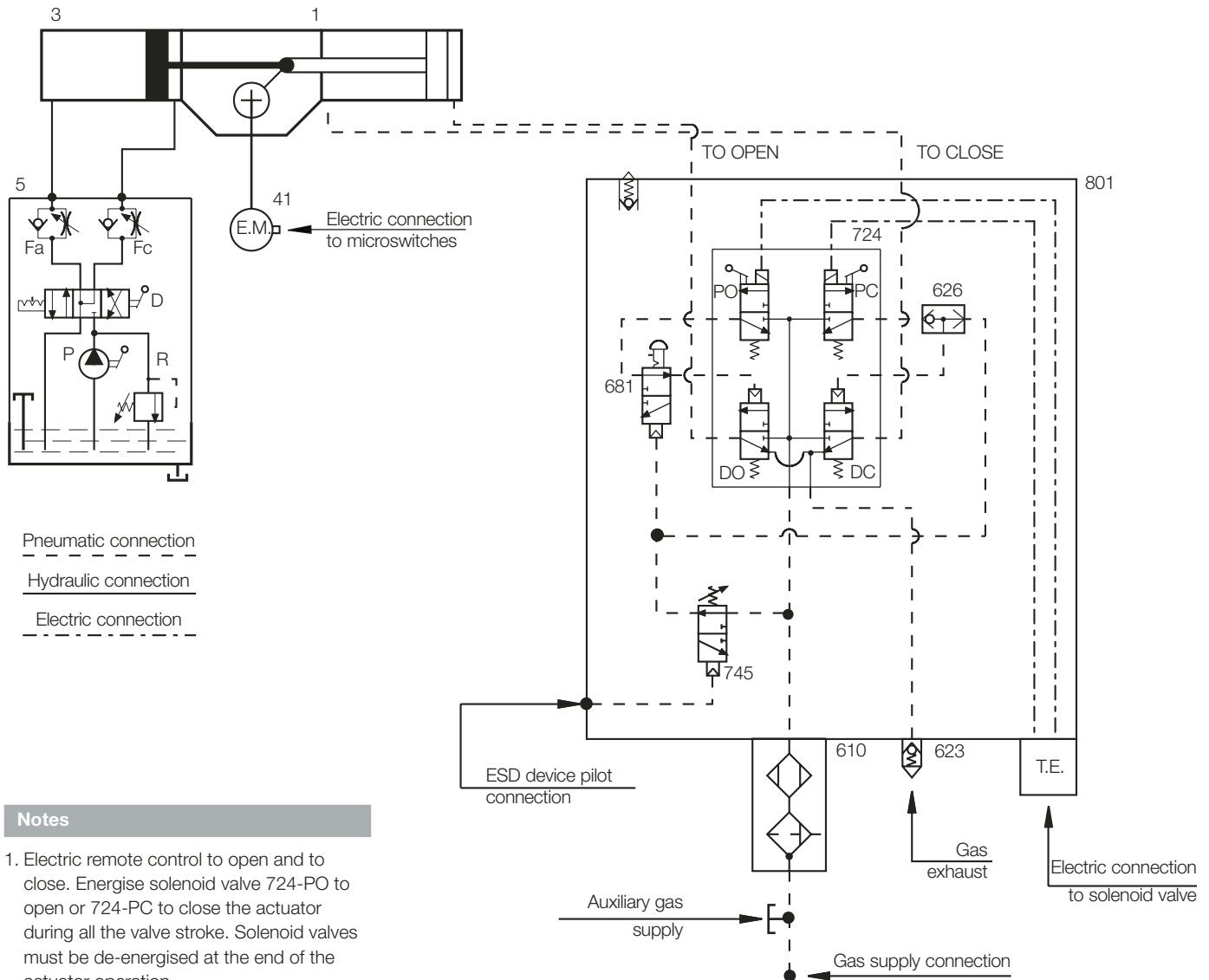
1. Electric remote control to open and to close. Energise solenoid valve 724-PO to open or 724-PC to close the actuator during all the valve stroke.
2. Local control to open and to close Press lever on valve 724-PO to open or 724-PC to close with gas supply.
3. Manual operation
Select by the valve 5-D the opening or closing operation and actuate the hand pump 5-P
The valve 5-D must be in "Remote control" position to allow the operation with gas supply
4. The operating diagram is drawn with control valves not actuated.

Item Description

Item	Description
1	Double acting pneumatic actuator
3	Hydraulic cylinder
6	Manual override R – Relief valve P – Hand pump D – Hand operated directional control valve Fa – Unidirectional flow regulator (Opening operation) Fc – Unidirectional flow regulator (Closing operation)
41	Electric microswitches (if specified)
610	Gas dehydrating filter/condensate separator
623	Dust excluder with check valve
724	Double 3/2 N.C. solenoid valve with manual override PC - 3/2 N.C. Piloted solenoid valve, Manual override (to Close) PO - 3/2 N.C. Piloted solenoid valve, Manual override (to Open) DC - 3/2 N.C. Pneumatic pilot / Spring return valve (to Close) DO - 3/2 N.C. Pneumatic pilot / Spring return valve (to Open)
801	Control valves enclosures with vent valve
966	Terminals enclosure

GIG Local and Remote Control - Low Pressure ESD to Close

operating diagram

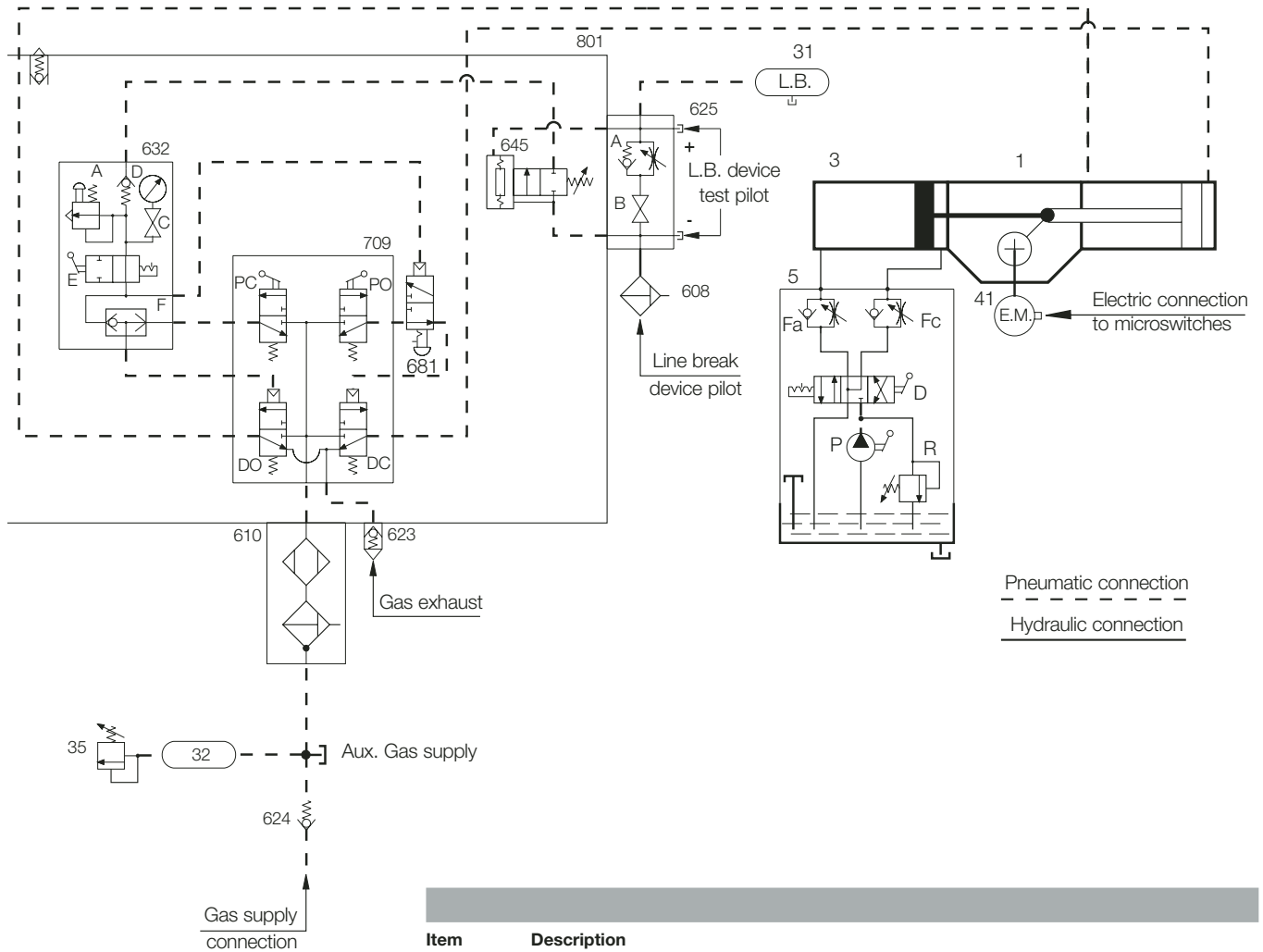


Notes

1. Electric remote control to open and to close. Energise solenoid valve 724-PO to open or 724-PC to close the actuator during all the valve stroke. Solenoid valves must be de-energised at the end of the actuator operation.
2. Local control to open and to close
Press lever on valve 724-PO to open or 724-PC to close with gas supply.
3. Emergency closing operation for Low pressure
The pressure to be controlled is connected to the pressure switch 7745 pilot. When the pressure decreases below the set point of pressure switch 7745, a pressure signal pilots the valve 681 to inhibit opening operation and the valve 724-DC controls the closing operation. The pilot pressure has to increase to normal value and the valve 681 must be manually reset before the opening operation can be controlled.
3. Manual operation
Select by the valve 5-D the opening or closing operation and actuate the hand pump 5-P
Note: the valve 5-D must be in "Remote control" position to allow the operation with gas supply
4. The operating diagram is drawn with control valves not actuated, low pressure in the "ESD" device pilot line, no pressure in the gas supply line

Item Description

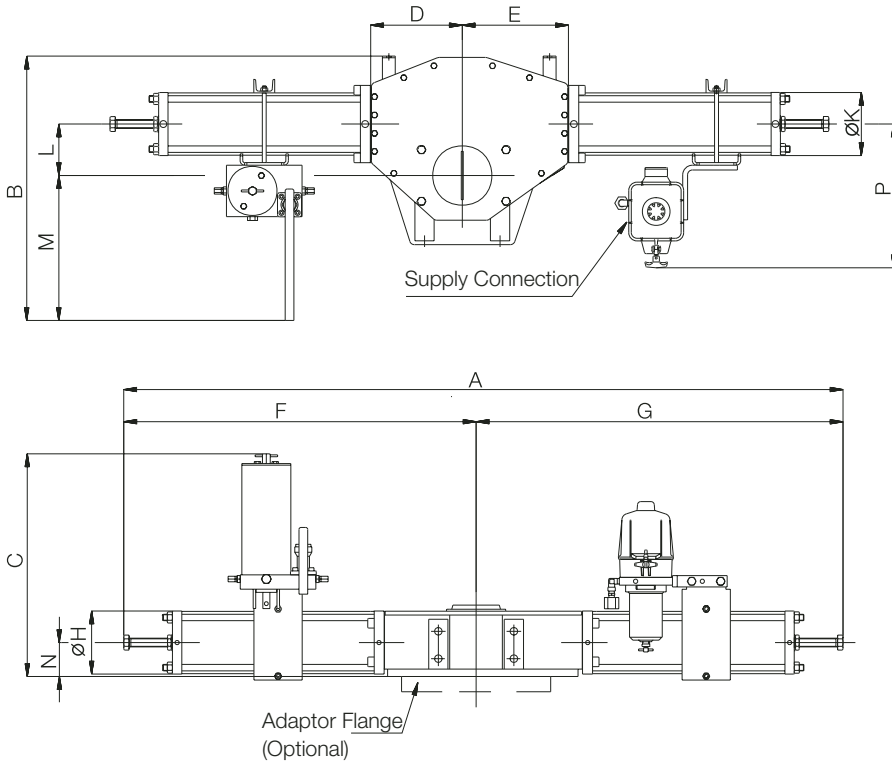
Item	Description
1	Double acting pneumatic actuator
3	Hydraulic cylinder
7	Manual override R - Relief valve P - Hand pump D - Hand operated directional control valve Fa - Unidirectional flow regulator (Opening operation) Fc - Unidirectional flow regulator (Closing operation)
41	Electric microswitches (if specified)
608	Gas filter/condensate separator
623	Dust excluder with check valve
626	High pressure shuttle valve
724	Double 3/2 N.C. solenoid valve with manual override PC - 3/2 N.C. Piloted solenoid valve, Manual override to Close PO - 3/2 N.C. Piloted solenoid valve, Manual override to Open DC - 3/2 N.C. Pneumatic pilot / Spring return valve (to Close) DO - 3/2 N.C. Pneumatic pilot / Spring return valve (to Open)
745	N.O. pneumatic pressure switch (adjust. setting)
801	Control valves enclosures with vent valve
966	Terminals enclosure



Item	Description
1	Double acting pneumatic actuator
3	Hydraulic cylinder
5	Manual override
	R – Relief valve
	P – Hand pump
	D – Hand operated directional control valve
	Fa – Unidirectional flow regulator (Opening operation)
	Fc – Unidirectional flow regulator (Closing operation)
31	Reference tank for line break device
32	Gas storage tank
35	Relief valve
41	Electric microswitches (if specified)
608	Gas filter/condensate separator
623	Dust excluder with check valve
624	Check valve
625	Check valve with orifice for line break device
	A – Check valve
	B – Low pressure vent valve
632	Shuttle valve device
	A – Check valve
	B – Low pressure vent valve
	D – Pressure gauge
	E – 2/2 hand operated valve
	F – Higher pressure shuttle valve
645	2/2 N.C. Diaphragm pilot valve (adjustable)
681	3/2 N.O. Pneumatic pilot/hand return valve
709	Double 3/2 N.C. pneum. pilot & Hand operated/spring valve
	PC - 3/2 N.C. hand oper./spring pilot valve (to Close)
	PO - 3/2 N.C. hand oper./spring pilot valve (to Open)
	DC - 3/2 N.C. Pneumatic pilot/Spring return valve (to Close)
	DO - 3/2 N.C. Pneumatic pilot/Spring return valve (to Open)
801	Control valves enclosures with vent valve

Notes

- Local control: press lever on valve 709-PO to open or 709-PC to close with gas supply
- Line break device operation: a rate of pressure drop in the gas pipeline causes a differential pressure across the diaphragm of valve 645 trips and pilots the valve 681 to inhibit open operation and the valve 709-DC causes the actuator to close. Be manually reset before the actuator can be reopened. The line break pilot has to be connected to the pipeline (Downstream the valve) and the pressure intake has to be separate from the gas supply pressure intake
- Manual operation select by the valve 5-D the opening or closing operation and active the hand pump 5-P
- The valves 5-D must be in "remote control" position to allow the operation with gas supply
- The operating diagram is drawn with control valves not actuated.



Notes

1. For dimensional data on yoke housing accessory mounting refer to publication K503 or K504.
2. The actuator is represented with standard local control box.

Dimensions (inches)

Actuator Model	A	B	C	D	E	F	G	∅H	∅K	L	M	N	Pneumatic Connections	Weight**
													NPT	(lbs)
0.3* - 75MHP 75	41.3	23.0	19.2	5.4	5.9	20.4	20.9	4.6	4.6	2.76	15.1	2.8	3/8"	146
0.3* - 100MHP100	43.0	23.0	18.5	5.4	5.9	21.2	21.8	4.9	4.9	2.76	15.1	2.8	3/8"	163
0.9* - 100MHP100	45.4	24.3	19.1	6.3	7.5	22.1	23.3	4.9	4.9	3.15	14.7	3.3	3/8"	192
0.9* - 135MHP135	50.8	25.0	19.1	6.3	7.5	24.8	26.0	6.3	6.3	3.15	15.4	3.3	3/8"	276
1.5* - 135MHP135	53.6	25.8	19.7	7.4	8.9	26.0	27.6	6.3	6.3	3.94	14.6	3.9	3/8"	366
1.5* - 175MHP175	58.5	26.9	21.4	7.4	8.9	28.5	30.0	7.7	7.7	3.94	15.8	3.9	3/8"	451
3.0* - 135MHP135	79.5	26.9	20.0	11.2	13.0	38.9	40.6	6.3	6.3	6.30	12.3	4.2	3/8"	550
3.0* - 175MHP175	84.8	28.0	21.7	11.2	13.0	41.5	43.3	7.7	7.7	6.30	13.4	4.2	3/8"	677
6.0* - 175MHP175	88.9	35.4	28.6	12.9	14.9	43.5	45.4	7.7	7.7	7.28	16.5	5.5	3/8"	1019
6.0* - 200MHP200	94.3	36.0	29.1	12.9	14.9	46.1	48.2	9.1	9.1	7.28	17.1	5.5	3/8"	1190
14* - 200MHP200	96.3	37.8	31.2	14.8	17.1	47.0	49.3	9.1	9.1	7.87	16.5	7.6	3/8"	1653
14* - 235MHP235	102.2	38.5	31.9	14.8	17.1	50.0	52.2	∅13.4	∅13.4	7.87	17.1	7.6	3/8"	1720
14* - 280MHP280	105.1	39.4	32.9	14.8	17.1	51.4	53.7	13.8	13.8	7.87	18.0	7.6	3/8"	1808
18* - 235MHP235	109.5	37.6	30.8	16.7	19.4	53.4	56.1	∅13.4	∅13.4	9.06	15.9	6.5	3/8"	1940
18* - 280MHP280	107.9	38.5	31.8	16.7	19.4	52.6	55.3	13.8	13.8	9.06	16.8	6.5	3/8"	2006
32* - 235MHP235	124.4	40.4	33.5	19.9	23.0	60.6	63.8	∅13.4	∅13.4	10.63	14.4	9.1	3/8"	3395
32* - 280MHP280	124.4	41.2	34.5	19.9	23.0	60.6	63.8	13.8	13.8	10.63	15.2	9.1	3/8"	3570
50* - 235MHP235	135.1	40.9	33.5	21.6	24.9	65.7	69.4	∅13.4	∅13.4	11.81	13.2	9.2	3/8"	3750
50* - 280MHP280	135.1	41.8	34.5	21.6	24.9	65.7	69.4	13.8	13.8	11.81	14.1	9.2	3/8"	3925
50* - 300MHP300	138.4	42.3	35.0	21.6	24.9	67.5	70.9	15.4	15.4	11.81	14.6	9.2	3/8"	4166
80* - 280MHP280	160.8	46.0	38.0	25.0	29.0	78.4	82.3	13.8	13.8	13.78	15.0	10.0	3/8"	5077
80* - 300MHP300	160.8	46.0	38.0	25.0	29.0	78.4	82.3	15.4	15.4	13.78	15.0	10.0	3/8"	5800
80* - 350MHP350	160.8	46.0	38.0	25.0	29.0	78.4	82.3	18.0	18.0	13.78	15.0	10.0	3/8"	6500

Notes

- 1.* Dimensional data for canted yoke mechanism (C) or symmetric yoke mechanism (S) are identical.
- 2.** Weight values are for complete actuator assembly as shown.

Symmetric Yoke - Output Torque (Maximum Allowable Pressure 1500 psig)*

Actuator Model	Max. Operating (**) Torque (lb.in.)	Output Torque at 0° (lb.in./psig)		Output Torque at 45° (lb.in./psig)	Output Torque at 90° (lb.in./psig)	
		Closed	To Open		To Close	Open
0.3S - 100MHP100	26100	44.5	43.8	25.2	41.3	50.0
0.9S - 100MHP100	69600	51.5	50.6	29.1	47.8	57.9
0.9S - 135MHP135	69600	94.4	92.5	53.5	87.6	106.0
1.5S - 135MHP135	130500	130.0	127.0	67.4	101.0	122.0
1.5S - 175MHP175	130500	220.0	214.0	115.0	172.0	207.0
3.0S - 135MHP135	261000	212.0	207.0	112.0	170.0	206.0
3.0S - 175MHP175	261000	359.0	350.0	190.0	289.0	347.0
6.0S - 175MHP175	522000	419.0	408.0	222.0	339.0	407.0
6.0S - 200MHP200	522000	544.0	535.0	288.0	440.0	533.0
14S - 200MHP200	1044000	604.0	593.0	315.0	473.0	572.0
14S - 235MHP235	1044000	860.0	822.0	448.0	673.0	793.0
14S - 280MHP280	1044000	1230.0	1170.0	638.0	960.0	1130.0
18S - 235MHP235	1566000	989.0	945.0	515.0	775.0	912.0
18S - 280MHP280	1566000	1410.0	1340.0	733.0	1100.0	1300.0
32S - 235MHP235	2610000	1146.0	1100.0	605.0	923.0	1090.0
32S - 280MHP280	2610000	1630.0	1550.0	862.0	1310.0	1540.0
50S - 235MHP235	3480000	1270.0	1220.0	673.0	1030.0	1210.0
50S - 280MHP280	3480000	1810.0	1730.0	958.0	1460.0	1720.0
50S - 300MHP300	3480000	2100.0	1980.0	1110.0	1691.0	1968.0
80S - 280MHP280	6525000	2139.0	2036.0	1131.0	1722.0	2021.0
80S - 300MHP300	6525000	2476.0	2337.0	1310.0	1994.0	2320.0
80S - 350MHP350	6525000	3422.0	3181.0	1811.0	2756.0	3158.0

Canted Yoke - Output Torque (Maximum Allowable Pressure 1500 psig)*

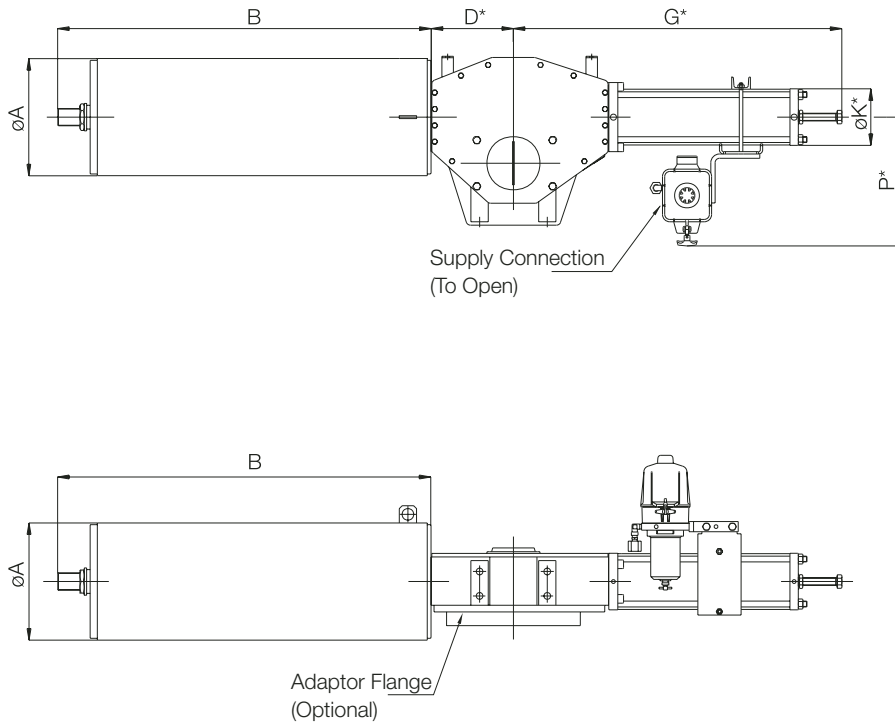
Actuator Model	Max. Operating (**) Torque (lb.in.)	Output Torque at 0° (lb.in./psig)		Output Torque at 45° (lb.in./psig)	Output Torque at 90° (lb.in./psig)	
		Closed	To Open		To Close	Open
0.3C - 100MHP100	26100	70.2	69.7	24.8	34.3	39.3
0.9C - 100MHP100	69600	81.2	80.6	28.6	39.7	45.4
0.9C - 135MHP135	69600	149.0	147.0	52.7	72.7	83.1
1.5C - 135MHP135	130500	188.0	187.0	66.4	92.0	105.0
1.5C - 175MHP175	130500	320.0	314.0	113.0	156.0	177.0
3.0C - 135MHP135	261000	312.0	309.0	110.0	152.0	174.0
3.0C - 175MHP175	261000	529.0	520.0	187.0	258.0	293.0
6.0C - 175MHP175	522000	619.0	608.0	218.0	302.0	343.0
6.0C - 200MHP200	522000	804.0	797.0	283.0	392.0	449.0
14C - 200MHP200	1044000	878.0	871.0	310.0	429.0	491.0
14C - 235MHP235	1044000	1250.0	1210.0	441.0	611.0	680.0
14C - 280MHP280	1044000	1780.0	1710.0	628.0	870.0	966.0
18C - 235MHP235	1566000	1440.0	1390.0	507.0	702.0	782.0
18C - 280MHP280	1566000	2050.0	1970.0	722.0	1000.0	1110.0
32C - 235MHP235	2610000	1690.0	1630.0	595.0	825.0	918.0
32C - 280MHP280	2610000	2400.0	2310.0	848.0	1170.0	1300.0
50C - 235MHP235	3480000	1880.0	1810.0	661.0	916.0	1020.0
50C - 280MHP280	3480000	2670.0	2570.0	942.0	1300.0	1450.0
50C - 300MHP300	3480000	3090.0	2950.0	1090.0	1510.0	1660.0
80C - 280MHP280	6525000	3151.0	3030.0	1132.0	1539.0	1707.0
80C - 300MHP300	6525000	3649.0	3478.0	1310.0	1781.0	1960.0
80C - 350MHP350	6525000	5043.0	4734.0	1811.0	2462.0	2668.0

Notes

- 0° is fully closed position (clockwise) 90° is fully open position (counter-clockwise)
- Output torques listed are minimum values and are for general reference only. Consult local distributor or Biffi for verification of output torques under specific operating conditions.
- * Maximum allowable pressure is the maximum static pressure that may be applied to a fully stroked actuator against the actuator travel stops.
- For models requiring greater torques than shown, contact your local representative.

IMPORTANT: The maximum supply pressure allowed by the actuator along the full stroke cannot generate torques exceeding more than 10% the values of column (**).

For higher pressure values, please contact your local representative.



Notes

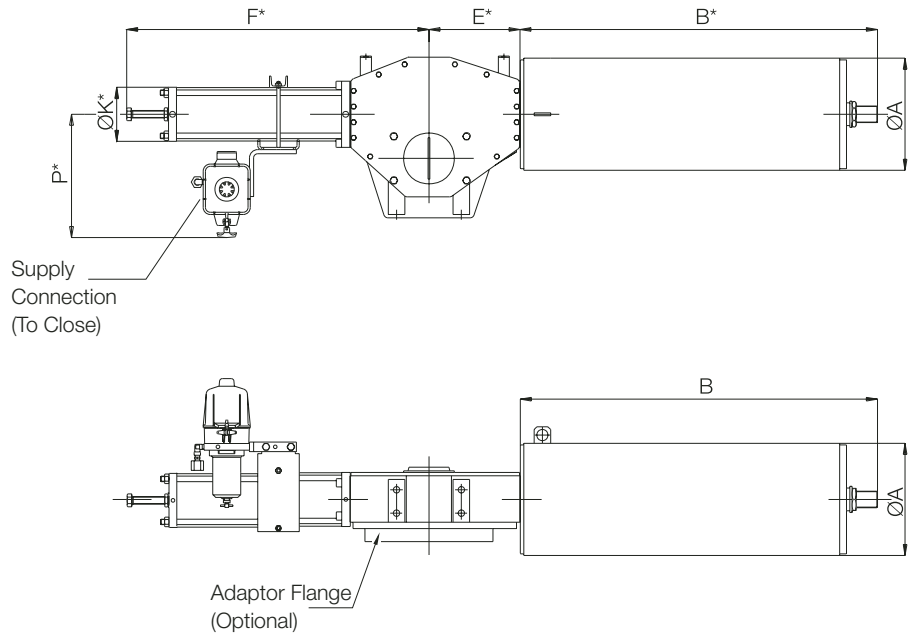
1. SST = Spring Start Torque
SRT = Spring Run Torque
SET = Spring End Torque
2. Spring torques listed are minimum values and are for general reference only. Consult local distributor or Biffi for verification of output torques under specific conditions.
3. Dimensions 'A' and 'B' and 'Weights' are identical for canted yoke or symmetric yoke models.
4. * Refer to page 4 for 'D,' 'G' and additional dimensional data.
To select the correct data, compare first numbers and last numbers of the actuator model on this page with the identical model numbers on page 4.
Example: 0.9C-0200-100 CL (pg 6)
0.9C-100MPH100 (pg 4)
5. ** Weight values are for complete actuator assembly as shown.

Spring Torque and Dimensions - Spring to Close

Actuator Model	Spring Torque (lb.in.)			Actuator Model	Spring Torque (lb.in.)			Dimensions (inches)		Weight ** (lbs)
	SST	SRT	SET		Symmetric Yoke	SST	SRT	SET	øA	
0.3C-0150- 75 CL	6980	3810	6470	0.3S-0150- 75 CL	4956	3805	8142	7.0	24.6	176
0.3C-0150-100 CL	6810	3750	6390	0.3S-0150-100 CL	4779	3717	8054	7.0	24.6	185
0.9C-0200-100 CL	8950	4980	8540	0.9S-0200-100 CL	6284	4956	10798	9.6	26.0	324
0.9C-0200-135 CL	8640	4870	8390	0.9S-0200-135 CL	6107	4868	10621	9.6	26.0	366
0.9C-0350-100 CL	17500	9550	16240	0.9S-0350-100 CL	12302	9559	20445	11.8	28.1	399
0.9C-0350-135 CL	17190	9440	16090	0.9S-0350-135 CL	12125	9382	20268	11.8	28.1	441
0.9C-0400-100 CL	23470	11710	19160	0.9S-0400-100 CL	16197	11771	24074	11.8	25.5	388
0.9C-0400-135 CL	23160	11600	19000	0.9S-0400-135 CL	15931	11683	18321	11.8	25.5	430
0.9C-0700-100 CL	31180	16250	27090	0.9S-0700-100 CL	21684	16258	34076	11.8	26.6	437
0.9C-0700-135 CL	30860	16140	26930	0.9S-0700-135 CL	21507	16108	33899	11.8	26.6	479
1.5C-1100-135 CL	45750	28060	49960	1.5S-1100-135 CL	32925	27084	55495	16.0	29.8	769
1.5C-1100-175 CL	45290	27890	49730	1.5S-1100-175 CL	32571	26907	55230	16.0	29.8	811
1.5C-1200-135 CL	62490	34060	57870	1.5S-1200-135 CL	44609	33368	64346	12.8	33.8	710
1.5C-1200-175 CL	62030	33890	57650	1.5S-1200-175 CL	44255	33191	64081	12.8	33.8	752
3.0C-2000-135 CL	99630	51370	85220	3.0S-2000-135 CL	70630	50716	96375	16.0	48.6	1360
3.0C-2000-175 CL	98870	51100	84840	3.0S-2000-175 CL	70099	50450	96475	16.0	48.6	1424
6.0C-2500-175 CL	148200	74130	121400	6.0S-2500-175 CL	104441	73551	138075	14.0	62.1	1832
6.0C-2500-200 CL	148000	74040	121200	6.0S-2500-200 CL	104441	73463	138075	14.0	62.1	1949
6.0C-3800-175 CL	221600	103300	164100	6.0S-3800-175 CL	155777	103566	187641	20.0	69.3	2963
6.0C-3800-200 CL	221300	103200	164000	6.0S-3800-200 CL	155777	103566	186756	20.0	69.3	3080
14C-5400-200 CL	320200	157100	255100	14S-5400-200 CL	227470	155777	284117	20.0	63.6	4410
14C-5400-235 CL	319900	157000	254900	14S-5400-235 CL	227470	155777	284117	20.0	63.6	4542
14C-5400-280 CL	318270	156400	254200	14S-5400-280 CL	225700	154892	283232	20.0	63.6	4652
14C-8300-200 CL	418100	203000	328100	14S-8300-200 CL	296508	201802	365546	20.0	65.9	4519
14C-8300-235 CL	417700	202900	327900	14S-8300-235 CL	296508	200917	365546	20.0	65.9	4652
14C-8300-280 CL	416100	202300	327100	14S-8300-280 CL	295623	200917	364661	20.0	65.9	4762
18C-9600-235 CL	562100	310600	530600	18S-9600-235 CL	403605	305359	592131	22.0	89.0	5754
18C-9600-280 CL	560300	309900	529700	18S-9600-280 CL	402720	304474	591246	22.0	89.0	5842
18C-9800-235 CL	695300	390700	672200	18S-9800-235 CL	498311	381478	747909	22.0	89.0	6526
18C-9800-280 CL	693500	390100	671300	18S-9800-280 CL	496541	380593	747024	22.0	89.0	6614

Notes

1. SST = Spring Start Torque
SRT = Spring Run Torque
SET = Spring End Torque
2. Spring torques listed are minimum values and are for general reference only. Consult local distributor or Biffi for verification of output torques under specific conditions.
3. Dimensions 'A' and 'B' and 'Weights' are identical for canted yoke or symmetric yoke models.
4. Refer to page 4 for 'E,' 'F' and additional dimensional data.
To select the correct data, compare first numbers and last numbers of the actuator model on this page with the identical model numbers on page 4.
Example: 0.9C-0200-100 OP (pg 7)
0.9C-100MPH100 (pg 4)
5. ** Weight values are for complete actuator assembly as shown.



Spring Torque and Dimensions - Spring to Open

Actuator Model	Spring Torque (lb.in.)			Actuator Model	Spring Torque (lb.in.)			Dimensions (inches)		Weight ** (lbs)
	SST	SRT	SET		Symmetric Yoke	SST	SRT	SET	øA	
0.3C-0150- 75 OP	12000	3180	3580	0.3S-0150- 75 OP	7346	3451	4425	7.0	24.6	176
0.3C-0150-100 OP	11850	3120	3500	0.3S-0150-100 OP	7257	3451	4336	7.0	24.6	185
0.9C-0200-100 OP	15260	3890	4260	0.9S-0200-100 OP	9293	4336	5222	9.6	26.0	324
0.9C-0200-135 OP	14980	3770	4110	0.9S-0200-135 OP	9116	4159	5045	9.6	26.0	366
0.9C-0350-100 OP	29050	7540	8370	0.9S-0350-100 OP	17702	8319	10267	11.8	28.1	399
0.9C-0350-135 OP	28770	7420	8210	0.9S-0350-135 OP	17524	8142	10090	11.8	28.1	441
0.9C-0400-100 OP	34430	9713	11400	0.9S-0400-100 OP	21153	10523	14250	11.8	25.5	388
0.9C-0400-135 OP	34150	9600	11240	0.9S-0400-135 OP	20976	10444	14073	11.8	25.5	430
0.9C-0700-100 OP	48560	13160	15030	0.9S-0700-100 OP	29739	14338	18675	11.8	26.6	437
0.9C-0700-135 OP	48280	13050	14870	0.9S-0700-135 OP	29562	14250	18410	11.8	26.6	479
1.5C-1100-135 OP	88220	20350	20990	1.5S-1100-135 OP	60540	23278	25756	16.0	29.8	769
1.5C-1100-175 OP	87800	20170	20760	1.5S-1100-175 OP	60275	23101	25490	16.0	29.8	811
1.5C-1200-135 OP	102900	26640	29520	1.5S-1200-135 OP	70719	29650	35846	12.8	33.8	710
1.5C-1200-175 OP	102500	26460	29280	1.5S-1200-175 OP	70453	29473	35581	12.8	33.8	752
3.0C-2000-135 OP	151500	41300	47350	3.0S-2000-135 OP	102671	45582	57708	16.0	48.6	1360
3.0C-2000-175 OP	150800	41020	46960	3.0S-2000-175 OP	101786	45228	57177	16.0	48.6	1424
6.0C-2500-175 OP	215500	60380	70530	6.0S-2500-175 OP	145156	66205	85854	14.0	62.1	1832
6.0C-2500-200 OP	215300	60280	70400	6.0S-2500-200 OP	145156	66116	85677	14.0	62.1	1949
6.0C-3800-175 OP	293200	87750	107100	6.0S-3800-175 OP	198262	95590	130109	20.0	69.3	2963
6.0C-3800-200 OP	293000	87660	107000	6.0S-3800-200 OP	198262	94705	130109	20.0	69.3	3080
14C-5400-200 OP	454200	129600	153300	14S-5400-200 OP	313325	141616	184985	20.0	63.6	4410
14C-5400-235 OP	453900	129500	153100	14S-5400-235 OP	312440	141616	184985	20.0	63.6	4542
14C-5400-280 OP	452500	128900	152300	14S-5400-280 OP	311555	141616	184100	20.0	63.6	4652
14C-8300-200 OP	583200	167900	199800	14S-8300-200 OP	401835	183215	240747	20.0	65.9	4519
14C-8300-235 OP	582900	167800	199600	14S-8300-235 OP	401835	183215	240747	20.0	65.9	4652
14C-8300-280 OP	581400	167200	198800	14S-8300-280 OP	400950	183215	239862	20.0	65.9	4762
18C-9600-235 OP	926500	234300	255800	18S-9600-235 OP	624616	261104	308899	22.0	89.0	5754
18C-9600-280 OP	924900	233600	254800	18S-9600-280 OP	633731	260219	308014	22.0	89.0	5842
18C-9800-235 OP	1173900	292200	315600	18S-9800-235 OP	805441	328372	384133	22.0	89.0	6526
18C-9800-280 OP	1172200	291500	314600	18S-9800-280 OP	804555	327487	383248	22.0	89.0	6614


Mechanical Data

Actuator Model	Gas Consumption (cu-in)	Hand Pump Strokes
0.3* - 75MHP 75	49	40
0.3* - 100MHP100	85	70
0.9* - 100MHP100	98	80
0.9* - 135MHP135	171	150
1.5* - 135MHP135	213	180
1.5* - 175MHP175	342	300
3.0* - 135MHP135	342	290
3.0* - 175MHP175	580	490
6.0* - 175MHP175	671	400
6.0* - 200MHP200	854	520
14* - 200MHP200	915	580
14* - 235MHP235	1281	800
14* - 280MHP280	1831	1140
18* - 235MHP235	1525	900
18* - 280MHP280	2136	1300
32* - 235MHP235	1770	1080
32* - 280MHP280	2502	1500
50* - 235MHP235	1953	1200
50* - 280MHP280	2746	1700
50* - 300MHP300	3173	1930
80* - 280MHP280	3203	1983
80* - 300MHP300	3701	2251
80* - 350MHP350	5037	3063

Notes

1. All values are based on one direction of travel, i.e. open to close or close to open.
2. * Mechanical data for canted yoke mechanism (C) or symmetric yoke mechanism (S) are identical.

Stem Acceptance Dimensions for Insert Bushings (inches)

Housing Size	Max. Stem Diameter With Square Key (Key Dimension)	Max. Stem Diameter With Rectangular Key (•)	Square Stem 	Maximum Stem Protrusion**	
0.3	2.05 (0.55)	2.16	1.81	2.52	4.72
0.9	2.60 (0.63)	2.75	2.16	3.03	5.51
1.5	3.34 (0.71)	3.54	2.87	4.06	7.08
3.0	4.72 (1.26)	5.12	4.09	5.78	7.48
6.0	5.90 (1.41)	6.69	5.23	7.40	9.48

Notes

1. The listed maximum acceptance values are applicable for stems with keyway parallel or perpendicular to the flow line and for square stems with diagonal parallel with the flow line.
2. • Key according to UNI6604 or DIN 6885 sh.1 or BS4325 part 1 or ISO 773 or equivalent.
3. † S max: maximum external diameter in case of rounded edge.
4. ** Without adaptor flange.
5. Insert bushing not utilized in actuator sizes larger than 6.0.
6. For mounting details refer to publication K503 or K504.
7. Bore and key machining available on request.