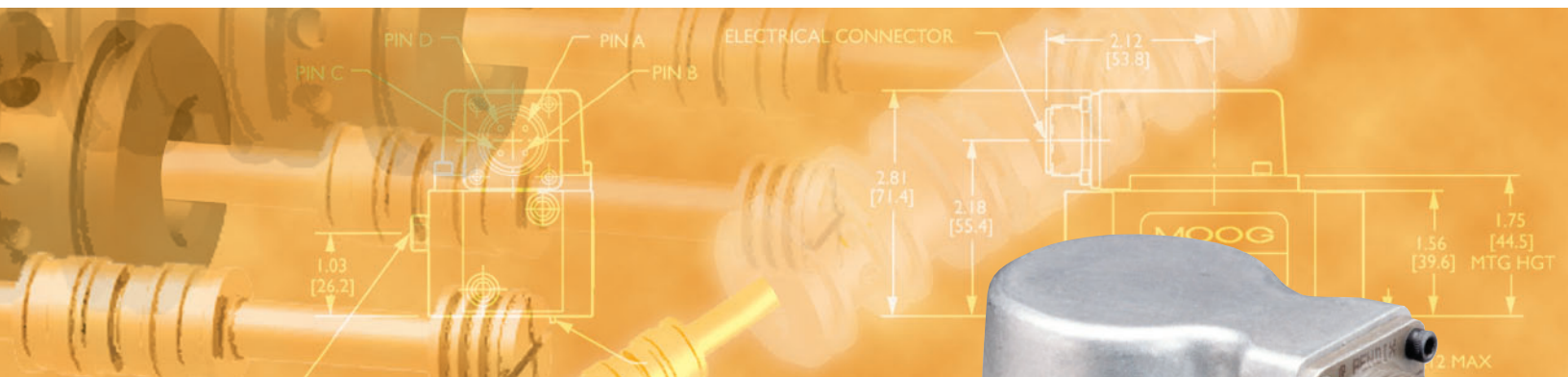


G77X Series Servovalves



G77X SERIES TWO STAGE SERVOVALVES

G77X SERIES SERVOVALVES

The G77X Series flow control servovalves are throttle valves for 3- and preferably 4-way applications. They are a high performance, two-stage design that covers the range of rated flows from 1 to 15 gpm at 1000 psi valve drop. The output stage is a closed center, four-way sliding spool. The pilot stage is a symmetrical double-nozzle and flapper, driven by a double air gap, dry torque motor. Mechanical feedback of the spool position is provided by a

cantilever spring. The valve design is simple and rugged for dependable, long life operation.

These valves are suitable for electrohydraulic position, speed, pressure or force control systems with high dynamic response requirements.

Principle of operation

An electrical command signal (flow rate set point) is applied to the torque motor coils, and creates a magnetic force which acts on the ends of the pilot stage armature. This causes a

deflection of the armature/flapper assembly within the flexure tube. Deflection of the flapper restricts fluid flow through one nozzle, which is carried through to one spool end, displacing the spool.

Movement of the spool opens the supply pressure port (P) to one control port, while simultaneously opening the tank port (T) to the other control port. The spool motion also applies a force to the cantilever spring, creating a restoring torque on the armature/flapper

assembly. Once the restoring torque becomes equal to the torque from the magnetic forces, the armature/flapper assembly moves back to the neutral position and the spool is held open in a state of equilibrium until the command signal changes to a new level.

In summary, the spool position is proportional to the input current. With constant pressure drop across the valve, flow to the load is proportional to the spool position.

VALVE FEATURES

- > 2-stage design with dry torque motor
- > Low friction double nozzle pilot stage
- > High spool control forces
- > High dynamics
- > Rugged, long-life design
- > High resolution, low hysteresis
- > Completely set-up at the factory
- > Small body size

The actual flow is dependent upon electrical command signal and valve pressure drop. The flow for a given valve pressure drop can be calculated using the square root function for sharp edge orifices:

$$Q = Q_N \sqrt{\frac{\Delta p}{\Delta p_N}}$$

Q gpm[l/min] = calculated flow

Q_N gpm[l/min] = rated flow

Δp psi[bar] = actual valve pressure drop

Δp_N psi[bar] = rated valve pressure drop



This catalog is for users with technical knowledge. To ensure that all necessary characteristics for function and safety of the

system are given, the user has to check the suitability of the products described here. In case of doubt, please contact Moog Inc.

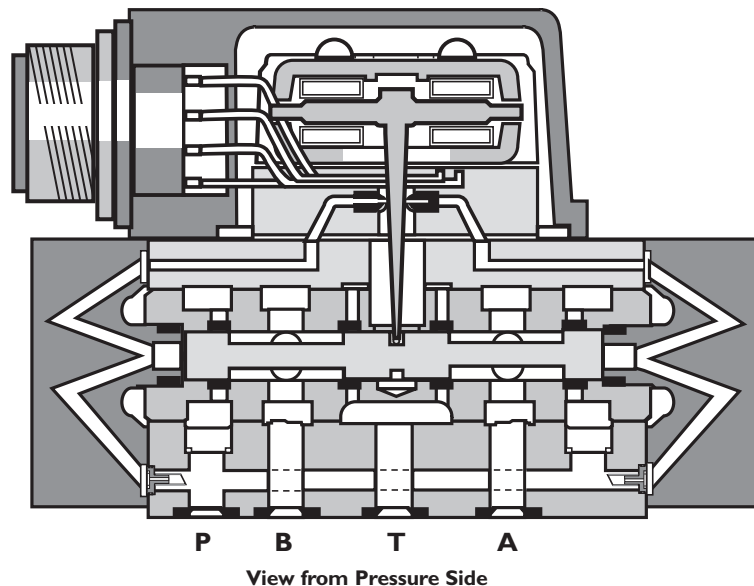
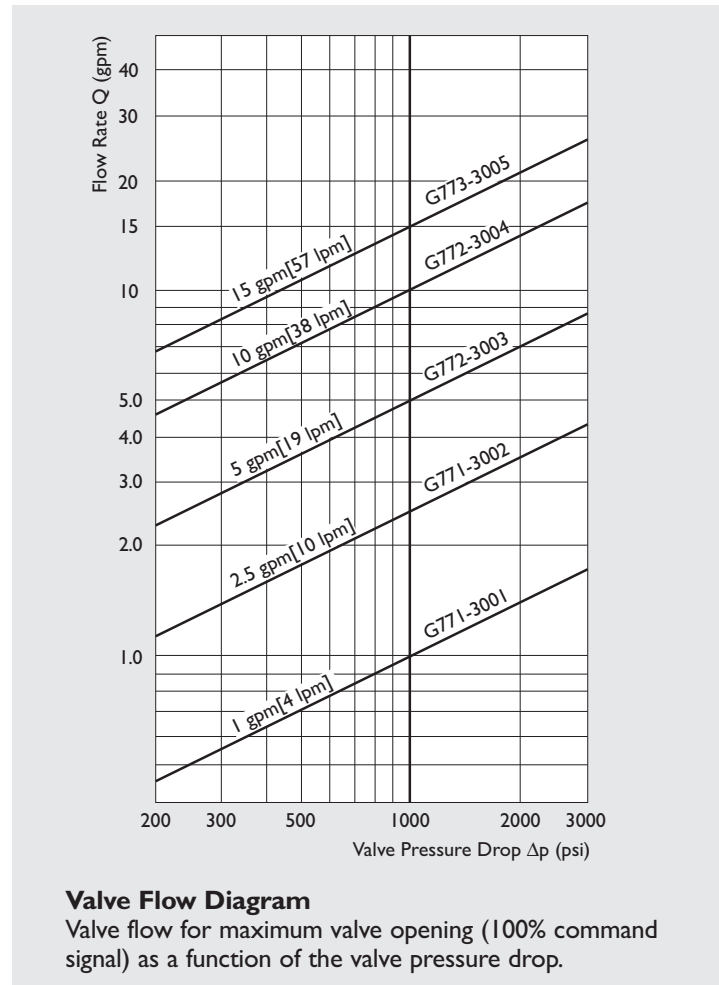


Intrinsically safe valve versions are available for use in hazardous locations. Specific models are certified to FM, ATEX, CSA, and TIIS standards. Contact the factory for details.

G77X SERIES
GENERAL TECHNICAL DATA

Operating Pressure	up to 3,000 psi [210 bar]
ports P,T,A and B	
Temperature Range	
Fluid	-20° to 275°F [-29° to 135°C]
Ambient	-20° to 275°F [-29° to 135°C]
Seal Material*	Fluorocarbon (Viton)
Operating Fluid	Compatible with common hydraulic fluids, other fluids on request.
Recommended viscosity	60-450 SUS @ 100°F
System Filtration:	High pressure filter (without bypass, but with dirt alarm) mounted in the main flow and if possible, directly upstream of the valve. Refer to Moog filtration catalog for recommended filtration scheme.
Class of Cleanliness:	The cleanliness of the hydraulic fluid greatly effects the performance (spool positioning, high resolution) and wear (metering edges, pressure gain, leakage) of the servovalve.
Recommended Cleanliness Class	
For normal operation	ISO 4406 < 14/11
For longer life	ISO 4406 < 13/10
Filter Rating recommended	
For normal operation	$\beta_{10} \geq 75$ (10 μm absolute)
For longer life	$\beta_5 \geq 75$ (5 μm absolute)
Installation Operations	Any position, fixed or moveable.
Vibration	30 g, 3 axes
Weight	1.9 lb [.86 kg]
Degree of Protection	EN50529P: class IP65, with mating connector mounted.
Shipping Plate	Delivered with an oil sealed shipping plate.

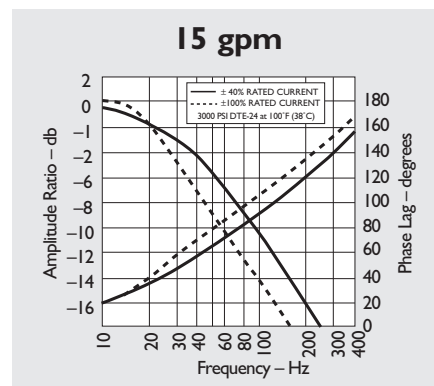
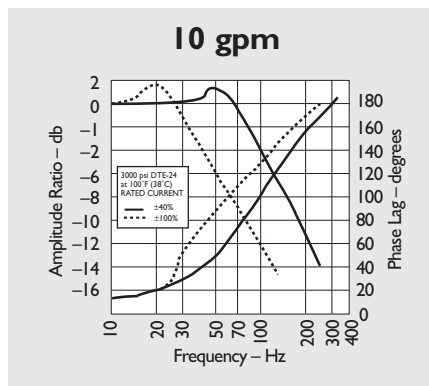
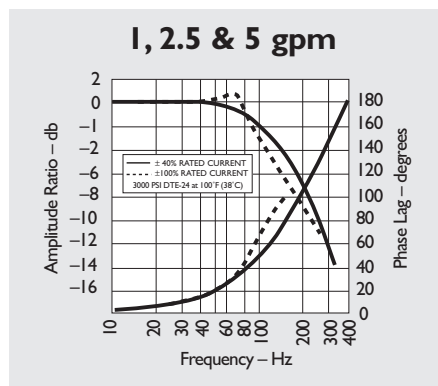
* Other seal materials on request



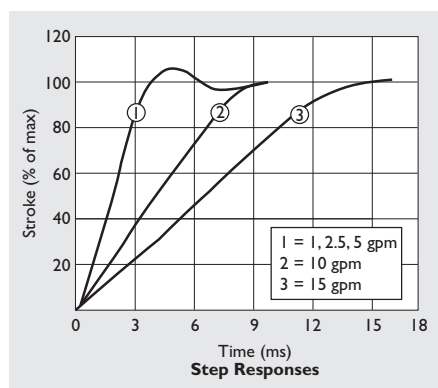
**G77X SERIES
TECHNICAL DATA**

Model... Type	G771		G772	G773
Mounting Pattern	see installation drawings			
Valve Body Version	4-way			
Pilot Stage	2-stage with spool-bushing assembly			
Pilot Connection	Nozzle/Flapper			
Fluid Supply	Internal			
Supply Pressure	G77X series servovalves are intended to operate with constant supply pressure			
Supply Pressure	minimum	200 psi [14 bar]		
Supply Pressure	maximum	3,000 psi [210 bar]		
Rated Flow Tolerance	@ 1,000 psi ΔP_N	[%]	± 10	
Symmetry		[%]	< 10	
Threshold		[%]	< 0.5	
Hysteresis		[%]	< 3.0	
Null Shift	with Temp., 100°F [55°K] variation	[%]	< 2.0	
Null Shift	with acceleration to 10 g		< 2.0	
Null Shift	for every 1,000 psi [70 bar] supply pressure change		< 2.0	
Null Shift	with return pressure 0 to 500 psi [0 to 35 bar]		< 2.0	

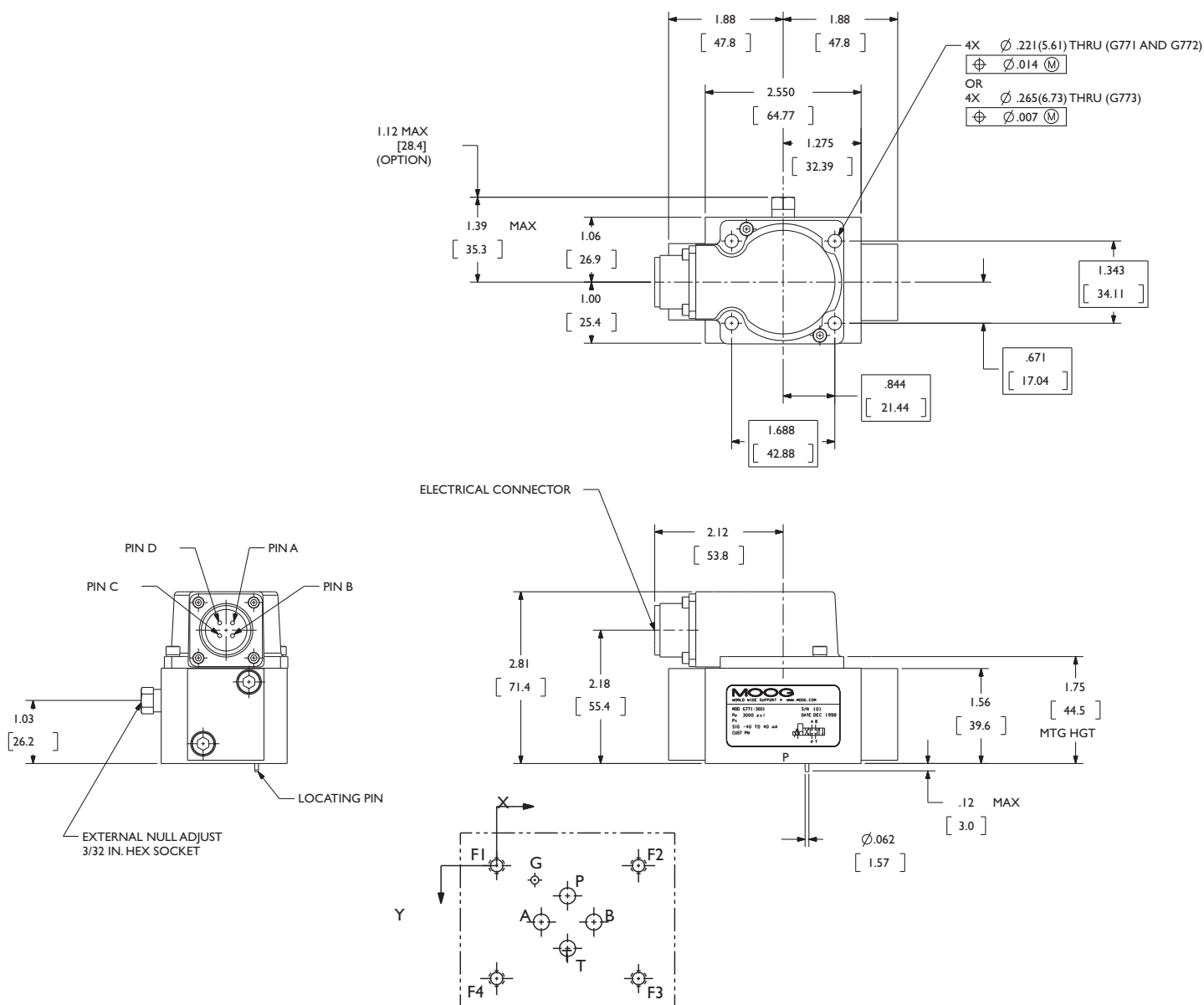
Typical characteristic curves with $\pm 40\%$ and $\pm 100\%$ input signal, measured at 3,000 psi operating pressure.



Step Response



**G77X SERIES
INSTALLATION DRAWINGS**



Standard electrical connector mates with MS3106F14S-2S or equivalent.

The mounting manifold for G772 conforms to ISO 10372-03-03-0-92.

Surface to which valve is mounted requires a $\sqrt{\Delta\Delta}$ finish, flat within 0.002[0.05] TIR.

For external null adjust:
Flow out of Port B will increase with clockwise rotation of null adjust screw ($\frac{3}{32}$ hex key). Flow bias is continually varied for a given port as the null adjust is rotated.

G771 U.S.

	P	A	B	T	G	F1	F2	F3	F4
	\varnothing .191	\varnothing .191	\varnothing .191	\varnothing .191	\varnothing .14	.190-32	.190-32	.190-32	.190-32
X	0.84	0.53	1.16	0.84	0.45	0	1.69	1.69	0
Y	0.36	0.67	0.67	0.98	0.17	0	0	1.34	1.34

METRIC

	P	A	B	T	G	F1	F2	F3	F4
	5.0	5.0	5.0	5.0	2.39	M5	M5	M5	M5
X	21.3	13.5	29.4	21.3	11.5	0	42.9	42.9	0
Y	9.1	17.1	17.1	25.0	4.4	0	0	34.1	34.1

G772 U.S.

	P	A	B	T	G	F1	F2	F3	F4
	\varnothing .260	\varnothing .260	\varnothing .260	\varnothing .260	\varnothing .14	.190-32	.190-32	.190-32	.190-32
X	0.84	0.45	1.23	0.84	0.45	0	1.69	1.69	0
Y	0.28	0.67	0.67	1.06	0.17	0	0	1.34	1.34

METRIC

	P	A	B	T	G	F1	F2	F3	F4
	6.6	6.6	6.6	6.6	3.5	M5	M5	M5	M5
X	21.4	11.5	31.3	21.4	11.5	0	42.9	42.9	0
Y	7.2	17.1	17.1	27	4.4	0	0	34.1	34.1

G773 U.S.

	P	A	B	T	G	F1	F2	F3	F4
	\varnothing .312	\varnothing .312	\varnothing .312	\varnothing .312	\varnothing .14	.250-20	.250-20	.250-20	.250-20
X	0.84	0.38	1.31	0.84	0.45	0	1.69	1.69	0
Y	0.20	0.67	0.67	1.14	0.17	0	0	1.34	1.34

METRIC

	P	A	B	T	G	F1	F2	F3	F4
	8.0	8.0	8.0	8.0	2.39	M6	M6	M6	M6
X	21.3	9.5	33.3	21.4	11.5	0	42.9	42.9	0
Y	5.1	17.1	17.1	29.0	4.4	0	0	34.1	34.1

**G77X SERIES
ELECTRICAL CONNECTIONS**

Rated current and coil resistance

A variety of coils are available for G771/2/3 Series Servovalves.

Coil connections

A four-pin electrical connector (that mates with an MS3106F14S-2S) is standard. All four torque motor leads are available at the connector so external connections can be made for series, parallel or single operation.

Servoamplifier

The servovalve responds to input current, so a servoamplifier that has high internal impedance (as obtained with current feedback) should be used. This will reduce the effects of coil inductance and will minimize changes due to coil resistance variations.

ELECTRICAL CONNECTIONS

(Examples with typical G771/2/3 series coils)

		Parallel	Series	Single
Coil Resistance	[Ω]	40	160	80
Rated Current	[mA]	±40	±20	±40
Coil Inductance @ 50 Hz	[H]	.18	.66	.22
Electrical Power	[W]	.064	.064	.128
Polarity for Valve Opening		A and C (+) B and D (-)	A (+), D (-) B and C connected	A (+), B (-) or C (+), D (-)

Note: Before applying electrical signals the pilot stage has to be pressurized.

G77X SERIES ORDERING INFORMATION SPARE PARTS AND ACCESSORIES

STANDARD MODELS

Model	Type Designation	Rated Flow ($\Delta 1,000$ psi)		Internal Leakage (at 3,000 psi)		Rated Current (Single Coil) mA	Nominal Coil Resistance Ohms
		gpm	lpm	gpm	lpm		
G771-3001	H04FOFM4VBL	1.0	4	< 0.31	< 1.2	40	80
G771-3002	H10FOFM4VBL	2.5	10	< 0.38	< 1.5	40	80
G772-3003	H19FOFM4VBL	5.0	19	< 0.49	< 1.9	40	80
G772-3004	S38FOFM4VBL	10.0	38	< 0.49	< 1.9	40	80
G773-3005	S57FOFM4VBL	15.0	57	< 0.49	< 1.9	40	80

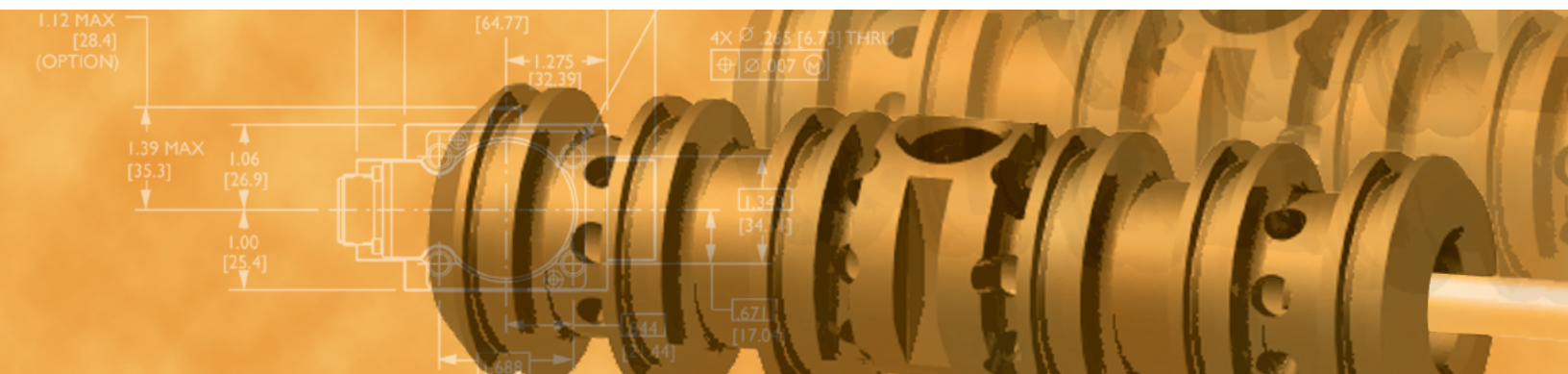
Model Number		Type Designation	
G77 F . F M 4 V . .	
Base Number 1 .625 Port circle 2 .780 Port circle 3 .937 Port circle		Signals for 100% Spool Stroke H ± 7.5 mA (series) L ± 20 mA (series)	
Optional Feature Series specification		Valve Connector A Connector over A-side B Connector over B-side	
Model Designation Assigned at the factory		Seal Material V Fluorocarbon	
Factory Identification (Revision Level)		Pilot Connections 4 Internal only	
Valve Version H High response .260 spool (04, 10, 19 lpm) S Standard response .312 spool (38, 57 lpm)		Spool Position without Electrical Signal M Mid-position	
Rated Flow Q_v gpm [lpm] at $\Delta p_v = 500$ psi [35 bar] per land 04 1 [4] G771 series only 10 2.5 [10] G771 series only 19 5.0 [19] G772 series only 38 10.0 [38] G772 series only 57 15.0 [57] G773 series only		Pilot Stage F Standard dynamics	
Maximum Operating Pressure (P) and Body Material F 3,000 psi [210 bar] aluminum		Main Spool Type O 4-way / axis cut / linear D 4-way / +/-10% overlap / linear	

SPARE PARTS AND ACCESSORIES

Moog Part	Size	Moog Part Number
O-Rings (included in delivery), for P,T,A and B G771 G772 G773	FPM 85 Shore ID 0.239 x 0.070 ID 0.364 x 0.070 ID 0.426 x 0.070	 -42082-007 -42082-013 -42082-022
Mating Connector, waterproof IP 65 (not included in delivery)		-49054F014S002S (MS3106F14S-2S)
Flushing Block Kit (not included in delivery) G771 and G772 G773		A01704-1K1 A01704-2K1
Mounting Bolts (included in delivery) G771 and G772 G773	.190-32 NF x 2.00 long (4 pcs.) [M5 x 0.8 x 50 mm] .250-20 NC x 2.25 long (4 pcs.) [M6 x 1.0 x 60 mm]	B64929-6D50 B64929-7D60
Field Replaceable Filter Kit (includes service manual)		B52555RK54K1



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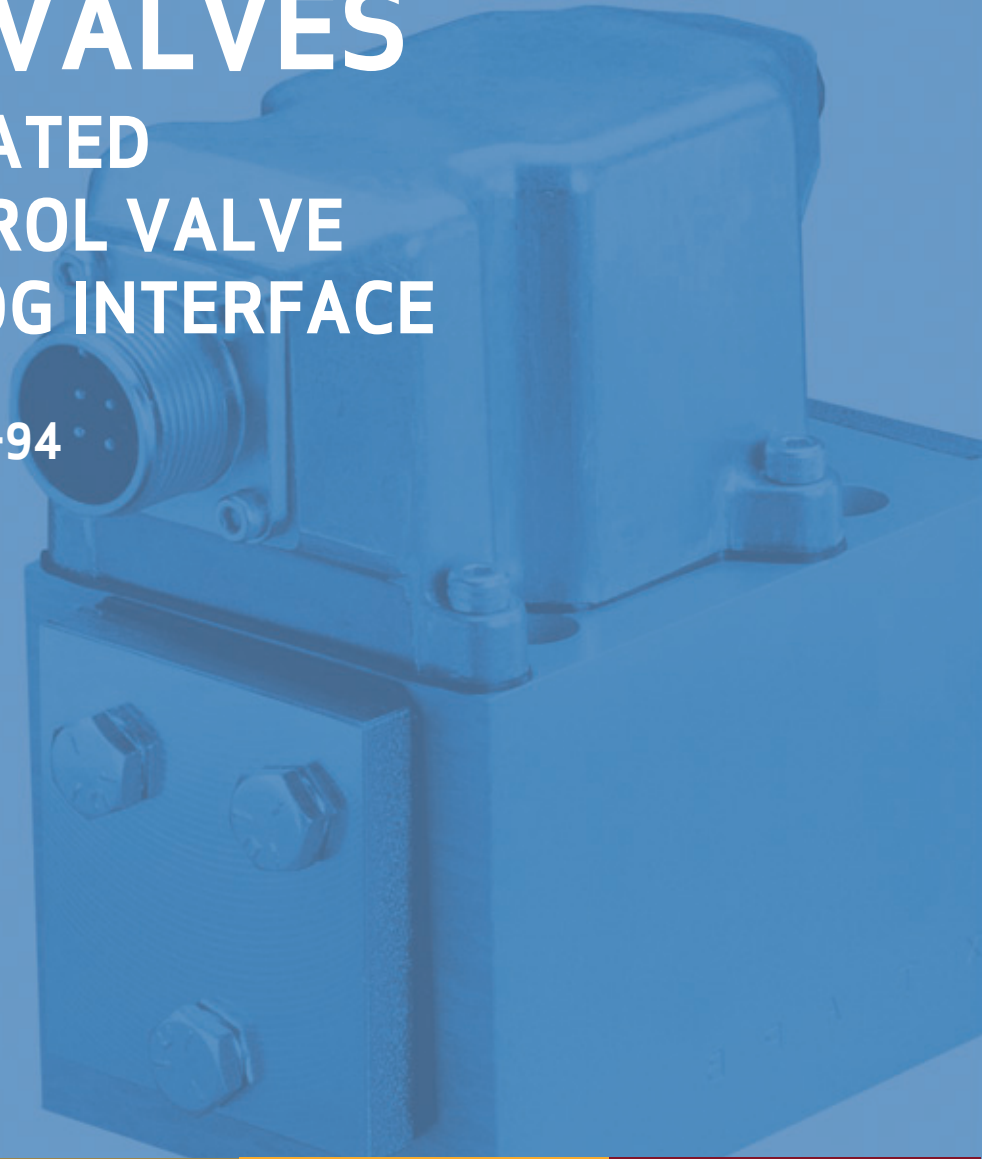
تهران، کیلومتر ۲۱ بزرگراه لشگری (جاده مخصوص کرج)

روبروی پالایشگاه نفت پارس، پلاک ۱۲

SERVO VALVES

PILOT OPERATED
FLOW CONTROL VALVE
WITH ANALOG INTERFACE

G631/631 SERIES
ISO 4401-05-05-0-94




Rev. N, June 2018

HIGH PERFORMANCE, TWO-STAGE DESIGN
PROVIDING FLOW CONTROL IN A SIMPLE,
RUGGED, DEPENDABLE, LONG LIFE DESIGN

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تهران، کیلومتر ۲۱ بزرگراه لشگری (جاده مخصوص کرج)

روبروی پالایشگاه نفت پارس، پلاک ۱۲

Whenever the highest levels of motion control performance and design flexibility are required, you'll find Moog expertise at work. Through collaboration, creativity and world-class technological solutions, we help you overcome your toughest engineering obstacles. Enhance your machine's performance. And help take your thinking further than you ever thought possible.

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This catalog is for users with technical knowledge. To ensure all necessary characteristics for function and safety of the system, the user has to check the suitability of the products described herein. The products described herein are subject to change without notice. In case of doubt, please contact Moog.

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For the most current information, visit www.moog.com/industrial or contact your local Moog office.

PRODUCT OVERVIEW

The G631/631 Series flow control servo valves are throttle valves for 3 and preferably 4-way applications. They are a high performance, 2-stage design that covers the range of rated flows from 5 to 75 l/min (1.3 to 20 gpm) at 35 bar (500 psi) valve drop per spool land.

The output stage is a closed center, four-way sliding spool. The pilot stage is a symmetrical double-nozzle and flapper, driven by a double air gap, dry torque motor. Mechanical feedback of spool position is provided by a cantilever spring. The valve design is simple and rugged for dependable, long life operation.

These valves are suitable for electrohydraulic position, speed, pressure or force control systems with high dynamic response requirements.

Valve design	2-stage, with spool and bushing and dry torque motor					
Mounting pattern	ISO 4401-05-05-0-94					
Maximum operating pressure to ports P, T, A, B	315 bar (4,500 psi)					
Pilot stage	Nozzle Flapper					
Rated flow at Δp_N 35 bar/spool land (500 psi/spool land)	5 l/min (1.3 gpm)	10 l/min (2.5 gpm)	20 l/min (5 gpm)	40 l/min (10 gpm)	60 l/min (15 gpm)	75 l/min (20 gpm)
Step response time for 0 to 100% stroke with spool and bushing design	18 ms	18 ms	18 ms	18 ms	18 ms	18 ms



Intrinsically safe valve versions are available for use in potentially hazardous environments. Specific models are certified to FM, ATEX and CSA standards. Contact Moog for details.

FEATURES AND BENEFITS

The G631/631 Series is proven technology that performs reliably in machines where high performance, stability and accuracy are required. Moog's Mechanical Feedback Valves are designed to provide high reliability and long service life.

Features	Benefits
100% factory tested to ensure critical specification performance	Ensures smooth and easy startup, reduces downtime and insures long life in critical industrial applications
2-stage design	Enables high machine performance, faster cycle times and greater accuracy - all resulting in higher productivity
Dual Coil torque motor	Redundancy for high reliability
Dual Precision Nozzles in Torque Motor	Precision flow control and predictability
Dry torque motor design	Eliminates potential contamination issues in the air gaps of the torque motor that could cause machine downtime
Hardened 440C Bushing and Spool	Provides for high life, wear resistance when used in the harsh environments; provides for low sliding friction during use
Emergency failsafe positioning	Most valves are set up to return to a failsafe position when the command signal is interrupted or eliminated
Field replaceable pilot stage filter	Enables preventive maintenance in the field, saving precious machine downtime and service costs
External null bias adjustment	Enables technicians to manually adjust the null bias of the valve to adapt to the conditions of the machine (see section on null flow adjustment – Page 11). This feature provides a simple adjustment to machine performance without the need to adjust a controller.

DESCRIPTION OF OPERATION

The G631/631 Series Flow Control Servo Valve consists of a polarized electrical torque motor and two stages of hydraulic power amplification. The motor armature extends into the air gaps of the magnetic flux circuit and is supported in this position by a flexure tube member. The flexure tube acts as a seal between the electromagnetic and hydraulic sections of the valve. The 2 motor coils surround the armature, one on each side of the flexure tube.

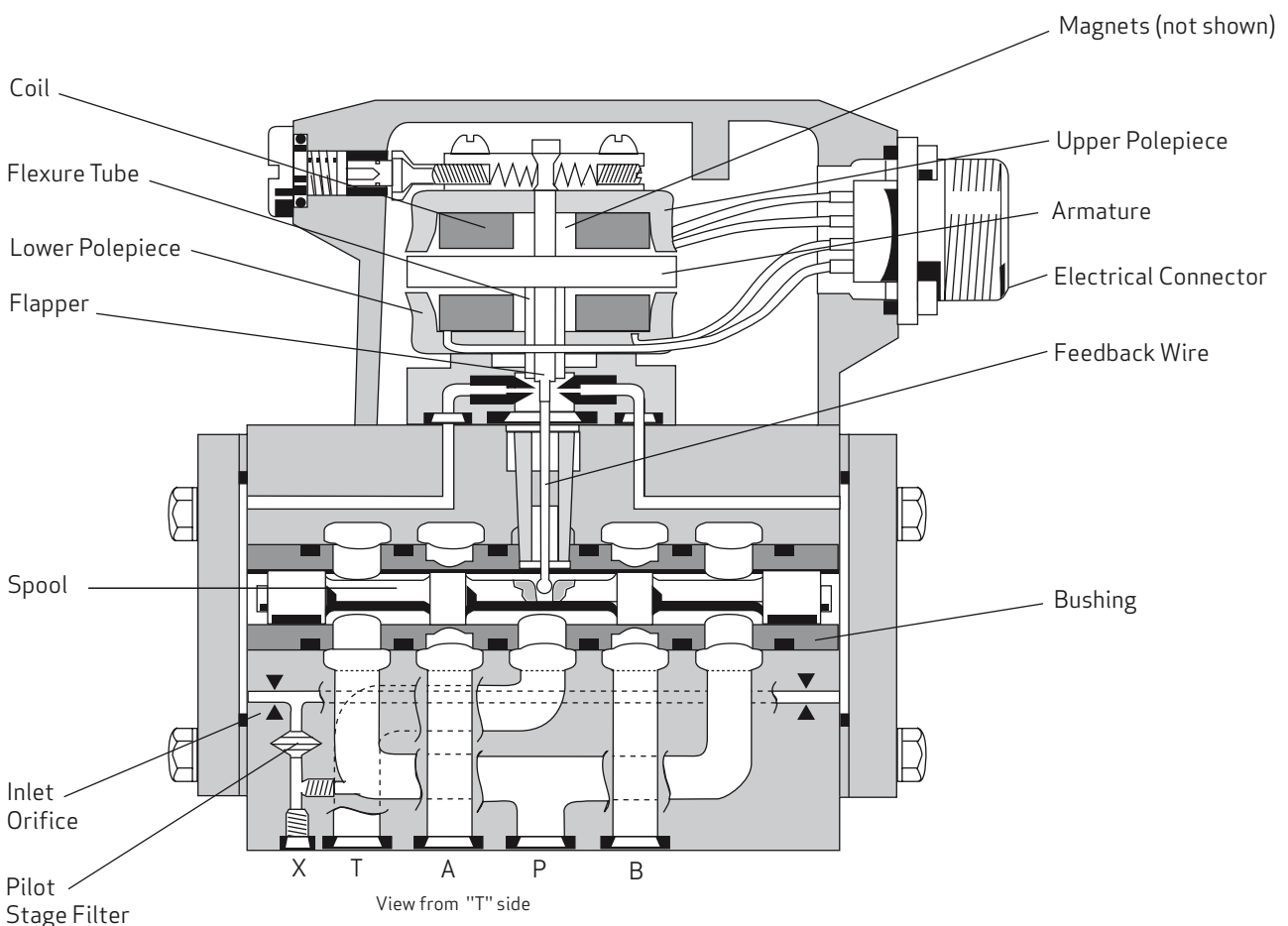
The flapper of the first stage hydraulic amplifier is rigidly attached to the armature. The flapper extends through the flexure tube and passes between 2 nozzles, creating two variable orifices between the nozzle tips and the flapper. The pressure controlled by the flapper and nozzle variable orifice is fed to the end areas of the second stage spool.

The second stage is a conventional four-way spool design in which output flow from the valve, at a fixed valve pressure drop, is proportional to spool displacement from the null position. A cantilevered feedback spring is fixed to the flapper and engages a slot at the center of the spool. Displacement of the spool deflects the feedback spring which creates a force on the armature/flapper assembly.

Input signals induce a magnetic charge in the armature and causes a deflection of the armature and flapper. This assembly pivots about the flexure tube and increases the size of one nozzle orifice and decreases the size of the other.

The differential pressure created by this action causes spool motion. The resulting spool displacement induces a linear force in the feedback wire which opposes the original input signal torque. Spool movement continues until the feedback wire force equals the input signal force.

Electro-hydraulic Servo Valve Cut-away



G631/631 SERIES - SERVO VALVES

General Technical Data

Valve design	2-stage, with spool and busing and dry torque motor
Pilot stage	Nozzle Flapper
Mounting pattern	ISO 4401-05-05-0-94
Installation position	Any orientation, fixed or movable
Weight	2.2 kg (4.9 lb)
Storage temperature range	-40 to +60 °C (-40 to +140 °F)
Ambient temperature range	-40 to +135 °C (-40 to +275 °F)
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz
Shock resistance	30 g, 3 axis
Seal material	Fluorocarbon (FKM) 85 Shore A Others upon request

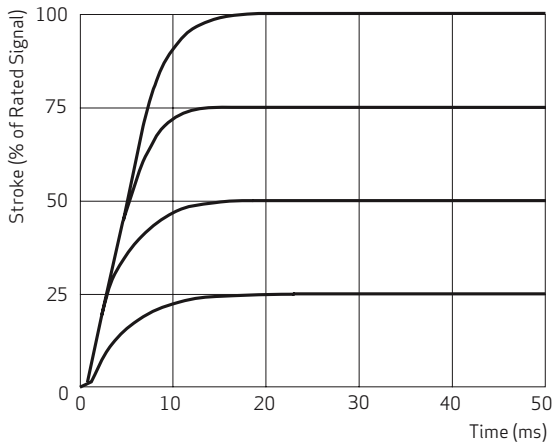
Hydraulic Data

Maximum operating pressure to ports P, A, B, X	315 bar (4,500 psi)
Maximum operating pressure to port T	20% of pilot pressure, max 100 bar (1,450 psi)
Rated flow at p_N 35 bar/spool land (500 psi/spool land)	5, 10, 20, 40, 60, 75
Null adjust authority	Greater than 10% of rated flow
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158 Other fluids on request.
Temperature range	-40 to +135 °C (-40 to +275 °F)
Recommended viscosity range	10 to 85 mm ² /s (cSt)
Maximum permissible viscosity range	5 to 1,250 mm ² /s (cSt)
Recommended cleanliness class as per ISO 4406	
For functional safety	19/16/13
For longer life	17/14/11
Recommended filter rating	
For functional safety	$\beta_{10} \leq 75$ (10 μ m absolute)
For longer life	$\beta_5 \leq 75$ (5 μ m absolute)

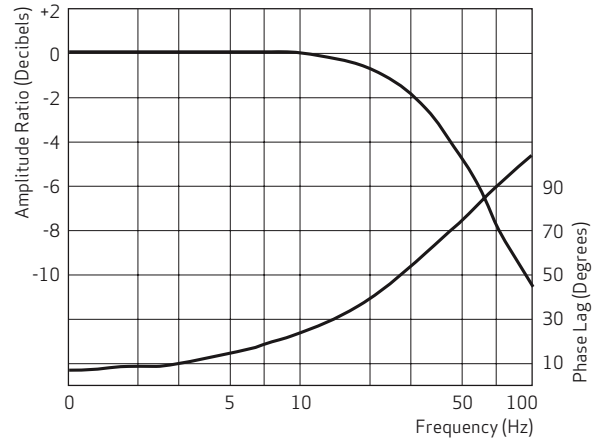
Static and Dynamic Data

Deviation of rated flow	$\pm 10\%$ of rated flow
Step response time for 0 to 100% stroke	18 ms
Threshold	1.0% of rated signal
Hysteresis	< 3% of rated signal
Null shift at $\Delta T = 38$ °C (100 °F)	< 4% of rated signal

G631/631 SERIES SERVO VALVES



Step Response



Standard Frequency Response
 3,000PSI DTE -24 at 38° C (100° F)
 ±25% Input Amplitude

ELECTRICAL DATA

Rated current and coil resistance

A variety of coils are available for G631/631 Series Servo Valves, which offer a wide choice of rated currents.

Coil impedance

The resistance and inductance of standard coils are given below. The 2 coils in each Servo Valve are wound with equal turns giving a normal production tolerance on coil resistance of $\pm 12\%$. Copper magnet wire is used, so the coil resistance will vary significantly with temperature. The effects of coil resistance changes can be essentially eliminated through use of a current feedback servoamplifier having high output impedance.

Inductance is determined under pressurized operating conditions and is greatly influenced by back electromagnetic forces of the torque motor. These effects vary with most operating conditions, and vary greatly with signal frequencies above 100 Hz. The apparent coil inductance values given are determined at 50 Hz.

Ordering code	Coil inductance [H] Command signal			Coil resistance [Ohms/coil at 25°C (77°F)]	Power consumption [W]		
	Single coil	Series coil	Parallel coil		Single coil	Series coil	Parallel coil
Q	± 30	± 15	± 30	300	0.27	0.14	0.14
R	± 100	± 50	± 100	28	0.28	0.14	0.14

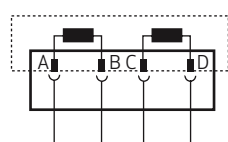
Ordering code	Coil inductance [H] Measured at 50 Hz		
	Single coil	Series coil	Parallel coil
Q	2.0	7.0	2.0
R	0.2	0.8	0.2

Coil connections

A 4-pin electrical connector that mates with an MS3106F14S-2S is standard. All 4 torque motor leads are available at the connector so that external connections can be made for series, parallel, or differential operation. G631/631 Series Servo Valves can be supplied on special order with other connectors or pigtail.

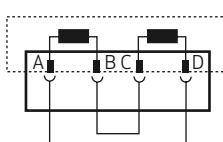
Configuration for valve opening P → B, A → T

Single



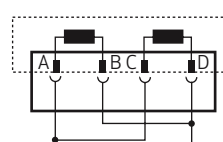
A (+), B (-) or C (+), D (-)

Series



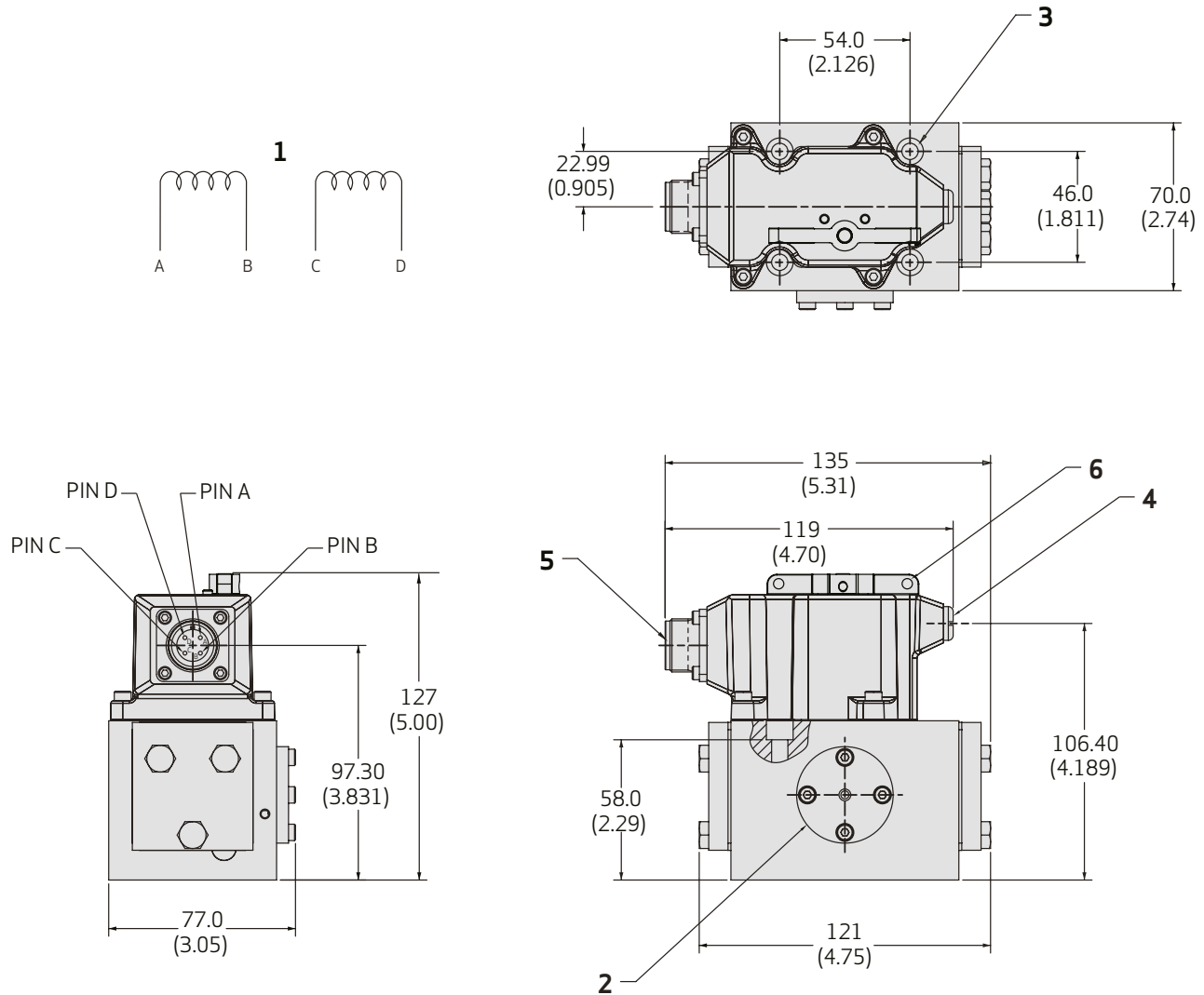
A (+), D (-), B and C connected

Parallel



A and C (+), B and D (-)

INSTALLATION DRAWINGS AND NULL ADJUST INSTRUCTIONS



- 1 Typical wiring schematic
- 2 Filter location
- 3 4X $\varnothing 6.76$ (0.266) thru $\varnothing 11.10$ (0.437) to depth shown Mounting Holes
- 4 Null adjust cover. Remove for screw access (requires 1/8" hex key)
- 5 Connector mates with MS3106F14S-2S (Moog P/N: -49054F014S002S)
- 6 Optional Manual Override

Fluid:

Industrial hydraulic fluid per DIN 51524 parts 1 to 3 and ISO 11158, maintained to ISO 4406 Code 19/16/13 recommended. Viscosity 10 to 85 mm²/s (cSt) at 38 °C (60 to 300 SUS at 100 °F)

Operating Temperature Range:

Fluid: -40 to +60 °C (-40 to +140 °F)
Ambient: -40 to +135 °C (-40 to +275 °F)

Valve Phasing:

Flow out port B results when:

Series coils: B & C connected, A+, D-

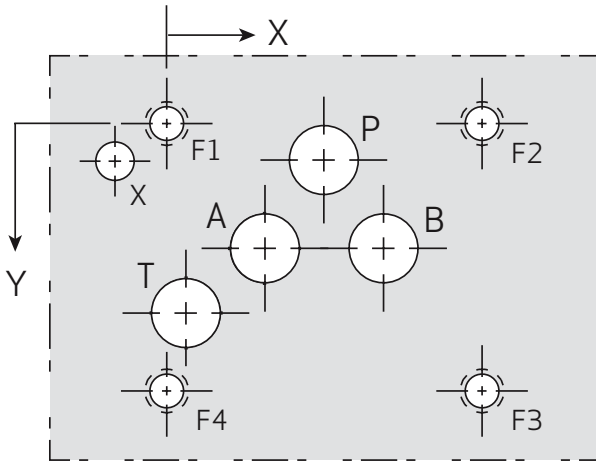
Parallel coils: A & C connected, B & D connected, A+/B- or C+/D-

Single coils: A & C+, B & D-

Null Adjust:

Flow out port A results with the clockwise rotation of the null adjust screw.

G631/631 SERIES HOLE PATTERN FOR MOUNTING SURFACE



Designation		P	A	B	T	X	F1	F2	F3	F4
Size Ø	mm	11.13	11.13	11.13	11.13	3.18	M6	M6	M6	M6
	in	0.438	0.438	0.438	0.438	0.125	1/4-20	1/4-20	1/4-20	1/4-20
Position X	mm	27.0	16.69	37.31	3.20	-9.00	0	54.0	54.0	0
	in	1.063	0.657	1.469	0.126	-0.354	0	2.126	2.126	0
Position Y	mm	6.32	21.41	21.41	32.51	6.32	0	0	46.02	46.02
	in	0.249	0.843	0.843	1.280	0.249	0	0	1.812	1.812

Notes

- Surface to which the valve is mounted requires flatness of 0.03 mm (0.001 in) over 100 mm (3.94 in) and an average finish R_a better than 0.8 μm (0.000032 in).
- Ports:
 P and T: 10 mm (0.390 in) diameter, counter-bored 15.75 mm (0.620 in) by 1.5 mm (0.061 in) deep
 A and B: 9 mm (0.344 in) diameter, counter-bored 15.75 mm (0.620 in) by 1.5 mm (0.061 in) deep
 X: 7.5 mm (0.295 in) diameter, counter-bored 11.75 mm (0.463 in) by 1.5 mm (0.061 in) deep
- Recommended Seals:
 90 durometer that is compatible with the hydraulic fluid.
 P, A, B and T: 12 mm inside diameter by 2 mm cross-section
 X: 8 mm inside diameter by 2 mm cross-section
- Location of X port in valve body does not correspond to ISO standards.

Conversion Instruction

For operation with internal or external pilot connection.

Pilot flow supply Screw and seal washer location (M4 X 6 DIN EN ISO 4762)

	X	P
Internal P	closed	open
External X	open	closed

NULL FLOW ADJUSTMENT

It is often desirable to adjust the null flow of a servo valve independently of other system parameters. The mechanical null adjustment permits convenient control function set-ups. Valves with mechanical null adjustment allow for at least $\pm 10\%$ adjustment of null flow. Mechanical feedback elements position the spool relative to the valve body for a given input signal.

Mechanical Adjustment Procedure

The mechanical null adjuster is a hex socket adaptor located behind the pan head screw in the motor cap (see illustration below) which, when adjusted, provides control of the spool position to obtain the desired flow null.

Normal adjustment should require less than \pm one turn. Limit null screw adjustment to less than \pm two turns.

Adjustment Procedure

- a. Using a blade screwdriver, remove the null access screw to permit adjustment of the hex socket setscrew.
- b. Using a 1/8 inch Allen Wrench, adjust the setscrew to obtain the desired flow null.

Note: Clockwise rotation of the null adjuster produces flow out port A.

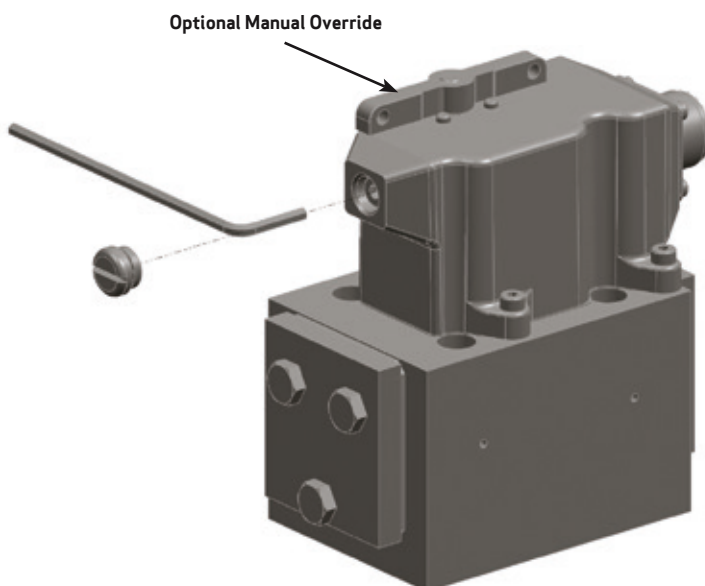
- c. After the desired flow null has been obtained, replace the null access screw.

Tools and Equipment

- a. Blade screwdriver
- b. Allen wrench set (1/8 inch)

Optional Manual Override Operation

At times it may be convenient to activate the servo valve manually rather than with an electrical control signal. This can be done on the G631/631 series with the optional manual override. With supply pressure applied, rotating the manual override handle on the motor cap fully counterclockwise will result in the right port pressure increasing. Rotating the manual override handle on the motor cap fully clockwise will result in the left port pressure increasing.



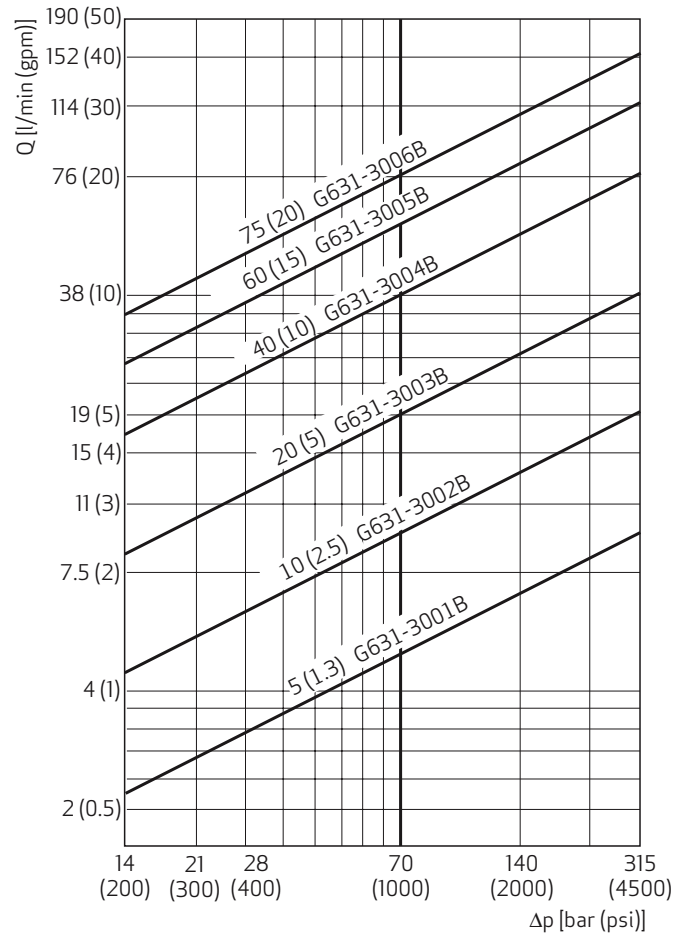
FLOW CALCULATION

The actual flow is dependent upon electrical command signal and valve pressure drop. The flow for a given valve pressure drop can be calculated using the square root function for sharp edge orifices.

$$Q = Q_N \sqrt{\frac{\Delta p}{\Delta p_N}}$$

Q actual flow
Q_N rated flow
Δp actual pressure drop per spool land
Δp_N rated pressure drop per spool land

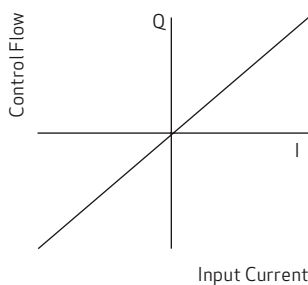
Flow Diagram



NULL CUT OPTIONS

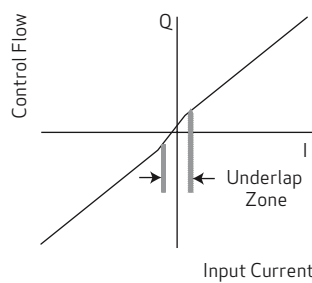
See Ordering Code for reference

Standard Axis Cut



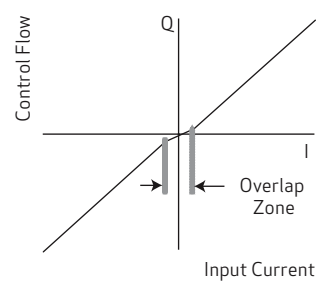
Default, without request for optional cuts

Open Center Spool Valves



Normally used in hydraulic motor applications

Closed Center Spool Valves

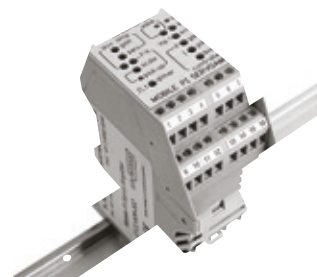


Normally used in failsafe applications

RELATED PRODUCTS

Din Rail Modules - Analog Control Cards

Moog's DIN rail mounted module analog control cards are ideal for use in enclosures where space is limited. Modules include servoamplifiers, transducer conditioning electronics, command and auxiliary function modules, valve drive amplifiers, and power supplies. All of these modules are CE marked and require a 24V DC supply. The modules mount to standard 35mm DIN rail mount for easy installation and removal.



Din Rail Module

Portable Valve Testers - Evaluates Valves in the Field

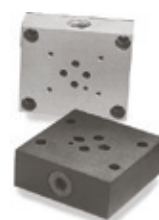
Valve testers are a cost effective method for evaluating valves in the field. They provide a quick and easy means of differentiating between hydraulic and electronic problems. There are five models to choose from, each with different levels of capability and flexibility to meet your specific requirements. All valve testers have a compact, easily portable design.



Valve Tester

Mounting Manifolds - Easier Installation and Maintenance

Various mounting manifolds are available for standard industrial valves, including base and adapter types for mounting and flushing requirements. Other hardware such as bolts and connectors are also available.



Mounting Manifolds

The specific accessories you may need for a particular model are listed in the relevant product catalogs and can be ordered through your local office.

Filtration - Oil Filtration Requirements for Industrial Servo Systems

The most effective way to reduce life cycle costs of an oil hydraulic system, regardless of the types of valve used, is through close attention to contamination control. For industrial servo systems the ideal system filter arrangement is summarized as follows:

- Use a 10 micron (Beta 10 >= 75) high pressure filter without by-pass just before the valve or critical parts of the valve (e.g. pilot)
- Use a 3 micron (Beta 3 >= 75) low pressure filter in the return or bypass line.
- Use a filter in the tank breather that is at least the same filtration level as the finest filter in the system.

This recommendation is based on the fact that most servo and proportional valves can accept the odd particle up to 25 microns so the pressure filter will protect the valve from catastrophic failure. The real work is done by the low pressure filter reducing the small particle contamination which is the prime contributor to component wear and silting.



Hydraulic Filters

Assuming that the filters are properly dimensioned and care is taken during initial installation and maintenance, the aim should be to limit oil contamination to 16/13 (under ISO 4406:1987) or 19/16/13 (under ISO 4406: 1999).

For long life, the maximum levels per ISO 4406: 1987 and 1999 are 14/11 and 17/14/11, respectively. It is important to note that these are maximum contamination levels and with proper care and regular filter change, significantly lower levels can and should be achieved. Attention must also be paid to a number of other factors that contribute to oil condition problems such as elevated temperatures, high tank humidity, "dirty" new oil, etc.

ROUTINE MAINTENANCE GUIDELINES

Every six months or 4,000 operating hours, check for proper operation of the control valve assembly by performing the preventative maintenance steps outlined below. These checks do not require removal of the valve from the process line. If a problem is suspected, repair the valve assembly prior to returning the unit to service.

- Replace the hydraulic filter element
- Stroke the valve and check for smooth, full-stroke operation; unsteady motion could indicate a servo valve, actuator or process valve problem

GENERAL INFORMATION

Effects when Storing Valves

The following effects may occur when storing valves for a long time:

- Sealing materials become brittle, possibly resulting in leaks
- Hydraulic fluid becomes gummy, possibly resulting in friction

Storage Time

The storage time starts at stock receipt and ends at mounting of the valve.

Preservatives

If preservation is carried out, use only preservatives which are compatible with the sealing materials and do not affect the valve, spare parts and accessories.

BEFORE STORAGE

Note: If the valves are exposed to aggressive environmental influences during storage, vacuum packaging may be necessary. We recommend the following preparatory measures for storage:

Mount the shipping plate on the valve.

This is the only way of adequately protecting the valves against the ingress of dirt and moisture and protecting the seals against the effects of ozone and UV.

Put the valve, spare parts and accessories into the original packaging.

Package each valve separately.

Enclose anti-tarnish paper or package the valve, spare parts and accessories with corrosion inhibiting film.

(Only for storage time > 1 year.)

Multipacks of single valves in their individual packages are allowed.

Seal the original packaging properly.

This is the only way of adequately protecting the valves, spare parts and accessories against damage.

STORAGE CONDITIONS

We recommend the following ambient conditions for storage:

- Dust-free, moderately ventilated
- As vibration-free and shock-free as possible

Shock resistance (as per EN 60068-2-27):
50 g, 6 directions, half-sine 3 ms

Vibration resistance (as per EN 60068-2-6):
30 g, 3 axes, frequency 10 to 2,000 Hz

Temperature

Recommended: +15 to +25 °C (+59 to +77 °F)

Permissible: -40 to +60 °C (-40 to +140 °F)

Temperature fluctuations >10 °C (50 °F) must be avoided.

Distance to shielded radiators: > 1 m (3 ft)

No direct exposure to sunlight

No sources of light with a high UV content

UV rays generate ozone, which damage sealing materials.

Relative air humidity: < 65 %, non condensing

AFTER STORAGE

We recommend to check the original packaging, valve, spare parts and accessories for possible damage or alterations due to storage, that is, before use.

Damaged or not functional valves, spare parts and accessories must not be started up.

Sealing materials with the following characteristics must not be used:

- Contamination
- Cracking
- Hardening/softening
- Stickiness
- Discoloration

Storage Time > 5 Years

We recommend that the valve be checked by us or one of our authorized service centers after a storage time of more than 5 years.

Storage Time > 10 Years

After a storage time of more than 10 years the valves have to be checked by us or one of our authorized service centers.

ABOUT MOOG

Moog Inc. is a worldwide designer, manufacturer and integrator of precision control components and systems. Moog's Industrial Group designs and manufactures high performance motion control solutions combining electric, hydraulic, and hybrid technologies with expert consultative support in a range of applications including energy production and generation machinery, industrial production machinery and simulation and test equipment. We help performance-driven companies design and develop their next-generation machines.

Moog maintains facilities in 26 countries around the globe. This vast scope ensures that our engineers remain close to the needs of machine builders and provide flexible design solutions and technical expertise tailored to our customers' toughest challenges.

Moog experts work in close collaboration with machine builders and application engineers to design motion control systems for greater productivity, higher reliability, superior connectivity, less costly maintenance and more effective operations. Our regional presence, industry knowledge and design flexibility ensures Moog motion control solutions are tailored to their environment—from meeting operating regulations and performance standards, to taking machine performance to a higher level.

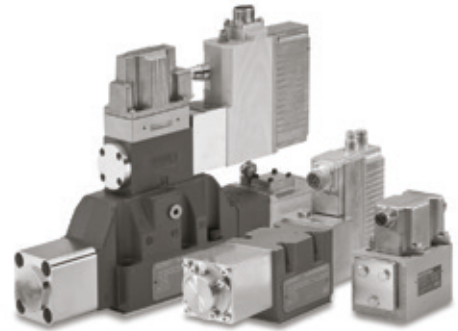
Products

At the heart of every Moog solution is an array of products engineered for precision, high performance and reliability. For more than six decades, Moog products have been specified for critical machine applications.

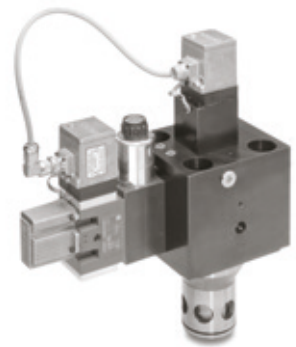
Some are developed specifically for unique operating environments. Others are standard equipment on machines across many industries. All are continuously improved to take advantage of the latest technology breakthroughs and advancements.

Moog products include:

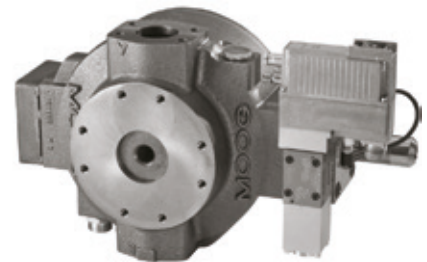
- Servo Valves and Proportional Valves
- Servo Motors and Servo Drives
- Servo Controllers and Software
- Radial Piston Pumps
- Actuators
- Integrated Hydraulic Manifold Systems and Cartridge Valves
- Slip Rings
- Motion Bases



Servo Valves



Active Cartridge Valves



Radial Piston Pumps



Servo Drives

ABOUT MOOG

Hydraulic solutions

Since Bill Moog invented the first commercially viable servo valve in 1951, Moog has set the standard for world-class hydraulic technology. Today, Moog products are used in a variety of applications - providing high power, enhanced productivity and ever better performance for some of the world's most demanding applications.

Electric solutions

Clean operation, low noise generation, less maintenance and reduced power consumption make Moog electric solutions ideal for applications worldwide. Moog is the ideal partner for applications where transitioning technologies requires special expertise.

Hybrid solutions

By incorporating the advantages of existing hydraulic and electric technologies - including modular flexibility, increased efficiency and cleanliness - into innovative hybrid solutions, Moog offers new performance potential in specialized applications.



Flight Simulation



Formula One Simulation Table

Moog Global Support

Moog Global Support is our promise to offer world-class Repair and Maintenance Services delivered expertly by our trained technicians. With the reliability only available from a leading manufacturer with facilities around the world, Moog offers you service and expertise you can count on to keep your equipment operating as it should.

This promise offers many benefits to our customers including:

- Reduce your downtime by keeping critical machines running in peak performance
- Protect your investment by ensuring reliability, versatility and long-life of products
- Better plan your maintenance activities and make systematic upgrades
- Leverage our flexible programs to meet the unique service requirements of your facility

Look to Moog for global support including:

- Repair services using OEM parts are performed by trained technicians to the latest specifications
- Stock management of spare parts and products to prevent unplanned downtime

- Flexible programs, tailored to your needs such as upgrades, preventative maintenance and annual/multi-year contracts
- On-site services bring the expertise to you, providing quicker commissioning, set-up and diagnostics
- Access to reliable services that are guaranteed to offer consistent quality anywhere in the world

For more information on Moog Global Support visit www.moog.com/industrial/service.



ACCESSORIES AND SPARE PARTS

Series Dependent Accessories and Spare Parts

Accessories G631/631 Series

Part designation	Description	Part number
Attachment screws Metric	4 required M8x45 ISO 4762-10.9 (5/16-18NC by 1.75 long) tightening Torque 13 Nm (11.5 lbf-in)	B64929-007B070
Attachment screws Inch	4 required 5/16-18NC by 1.75 long tightening torque 13 Nm (11.5 lbf-in)	C66391-144B
Mating connector	4 pin electrical connector	B46744-004 (-49054F014S002S) [MS3106F14S-2S]
Mounting manifold	Base mounting manifold	B52576AM001
Flushing plate	Manifold employed in place of valve when initially cleaning hydraulic fluids	B67728-002
AMO manifold	Adjustable metering orifice manifold used to bleed fluid between A and B ports for better pressure control	B64820AM003
Safety manifold	Sandwich manifold used to lock, extend and retract cylinder upon loss of electrical signal or hydraulic pressure	B64291AMNNXXXX

Spare Parts G631/631 Series

Part designation	Description	Material	Part number
Base O-ring for P, T, A and B ports	5 required for P, T, A, and B ports 12 mm (0.472 in) inside diameter x 2.0 mm (0.079 in) cross section.	Fluorocarbon FKM 85 shore	A25163-012-020 (G2141-012-020)
X port O-ring	1 required 8.0 mm (0.315 in) x 2.0 mm (0.079 in) cross section.		A25163-008-020 (G2141-008-020)
Replaceable filter,	100 µm nominal		A67999-100
Filter replacement kit	Contains the following: 2 pieces O-ring 13 mm (0.512 in) inside diameter x 1.5 mm (0.059 in) cross section 1 piece filter disc 100 µm	Fluorocarbon FKM 85 shore	B52555RK200K001

Documents (not included in scope of delivery)

Part designation	Description	Remark	Part number
Catalog	G631/631 series general information	Note: Visit www.moog.com/industrial/literature to download document	CDL 6641
Service manual	G631/631 standard series	Note: Visit www.moog.com/industrial/literature to download document	CDS 6672
Service manual	G631/631 intrinsically safe (K) series	Note: Visit www.moog.com/industrial/literature to download document	CDS 6750

NOTES

ORDERING CODE

Model number (assigned at the factory)

Type designation

G631/631	-													
Optional feature														
Series specification														
Model designation														
Assigned at the factory														
Factory Identification (Revision Level)														
1 Valve version														
H High response														
2 Rated flow in l/min (gpm)														
For $\Delta p_N = 35$ bar (500 psi) per spool land														
05	5.0	(1.3)												
10	10	(2.5)												
20	20	(5.0)												
40	40	(10)												
60	60	(15)												
75	75	(20)												
3 Maximum operating pressure in bar (psi) and body material														
J	315	(4,500) aluminum												
4 Bushing/spool design														
O	4-way/axis cut/linear													
D	4-way/ ± 10 % overlap/linear													

10 Signals for 100 % spool stroke												
Q ± 15 mA series												
R ± 50 mA series												
9 Valve connector												
B Connector over B-side												
8 Seal material												
V Fluorocarbon (FKM) 85 Shore A												
7 Pilot connections												
4 Internal												
5 External												
6 Spool position without electrical signal												
M Mid position												
5 Pilot stage design												
F Low flow, nozzle-flapper												

Preferred Models

Model Number	Type Designation	Rated Flow ($\Delta 1,000$ psi)		Internal Leakage (at 3,000 psi)		Rated Current (single coil)* mA
		lpm	gpm	lpm	gpm	
G361-3001B	H05JOFM4VBR	5	1.3	< 0.52	< 2.0	100
G631-3002B	H10JOFM4VBR	10	2.5	< 0.60	< 2.3	100
G631-3003B	H20JOFM4VBR	19	5.0	< 0.70	< 2.6	100
G631-3004B	H40JOFM4VBR	40	10.0	< 0.78	< 3.0	100
G631-3005B	H60JOFM4VBR	60	15.0	< 0.86	< 3.2	100
G631-3006B	H75JOFM4VBR	75	20.0	< 0.96	< 3.6	100

*Overdrive more than 10% current is NOT recommended.

TAKE A CLOSER LOOK.

Moog designs a range of motion control products that complement the performance of those featured in this catalog. Visit our website for more information and contact the moog facility nearest you.

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G631/631 Series Flow Control Servo Valves
TJW/PDF, Rev.N, June 2018, Id. CDL6641-en

WHAT MOVES YOUR WORLD


MOOG

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تهران، کیلومتر ۲۱ بزرگراه لشگری (جاده مخصوص کرج)

روبروی پالایشگاه نفت پارس، پلاک ۱۲