MOOG

G631 Series Servovalves

ISO 4401 Size 05

G631 SERIES SERVOVALVES

The G631 Series flow control servovalves are throttle valves for 3- and preferably 4-way applications. They are a medium performance, two-stage design that covers the range of rated flows from 1.0 to 20 gpm at 1,000 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 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 driving forces
- ISO 4401 port pattern for 4-ports (external pilot supply is not per ISO 4401 location)
- Rugged, long-life design
- High resolution, low hysteresis
- Completely set-up at the factory
- Field configurable fifth port for separate pilot supply
- Field replaceable first stage disc filter

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

ISO 9001 CERTIFIED

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.

GENERAL TECHNICAL DATA

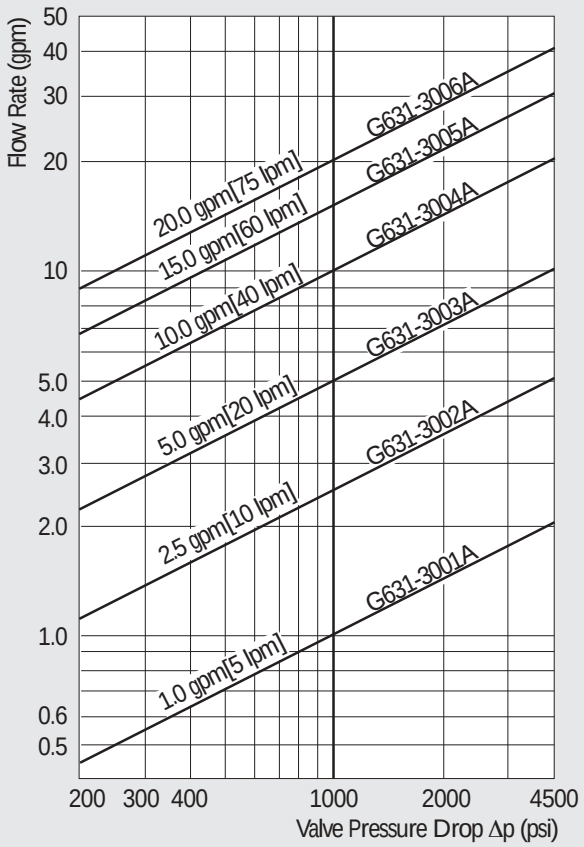
Operating Pressure	
Main stage: ports P, X, A and B	4,500 psi [315 bar]
port T	2,000 psi [140 bar]
Temperature Range	
Fluid	-20˚ to 275˚F [-29˚ to 135˚C]
Ambient	-20˚ to 275˚F [-29˚ to 135˚C]
Seal Material*	Fluorocarbon (Viton)
Operating Fluid	Compatible with common hydraulic fluids, other fluids on 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.

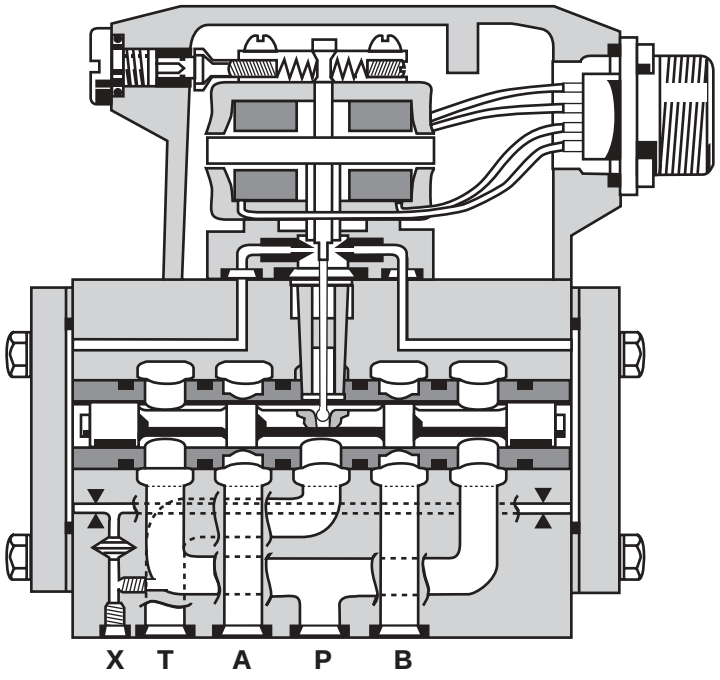
Class of Cleanliness: The cleanliness of the hydraulic fluid greatly effects the performance (spool positioning, high resolution) and wear (metering edges, pressure gain, leakage) of the servovalve.

Recommended Cleanliness Class	
For normal operation	ISO 4406 < 16/13
For longer life	ISO 4406 < 15/12
Recommended Filter Rating	
For normal operation	$ß_{15} \geq 75$ (15 µm absolute)
For longer life	$ß_{10} \geq 75$ (10 µm absolute)
Installation Operations	Any position, fixed or movable.
Vibration	15 g, 3 axes
Weight	4.7 lbs [2.1 kg]
Degree of Protection	EN60529P: class IP65, with mating connector mounted.
Shipping Plate	Delivered with an oil sealed shipping plate.

* Other seal materials available upon request



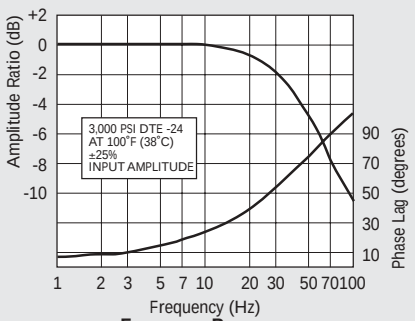
Valve Flow Diagram
Valve flow for maximum valve opening (100% command signal) as a function of the valve pressure drop.



Model…Type			**G631-……**
Mounting Pattern			ISO 4401-05-05-0-94 (for 4 ports)
Valve Body Version			4-way 2-stage with spool–bushing assembly
Pilot Stage			Nozzle/Flapper
Pilot Connection			Optional, Internal or External
Fluid Supply			G631 series servovalves are intended to operate with constant supply pressure
Supply Pressure	minimum		200 psi [14 bar]
	maximum standard		4,500 psi [315 bar]
Rated Flow Tolerance	@ 1,000 psi ΔP_N	[%]	±10
Symmetry		[%]	< 10
Threshold		[%]	< 1.0
Hysteresis		[%]	< 3.0
Null Shift	at ΔT = 100˚F [55°K]	[%]	< 4.0
	for every 1,000 psi [70 bar] supply pressure change		< 4.0
Spool Stroke		in [cm]	.05 [.127]
Spool Drive Area		in^2 [cm^2]	0.12 [.75]

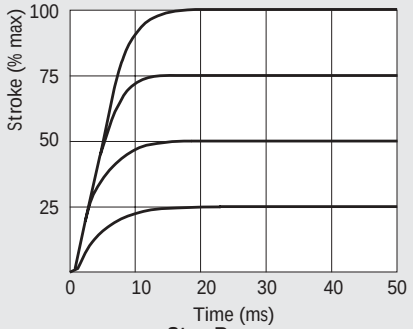
Typical Response Characteristic Curves measured at 3,000 pilot pressure, fluid viscosity of 100 SUS and fluid temperature of 100˚F.

Frequency Response



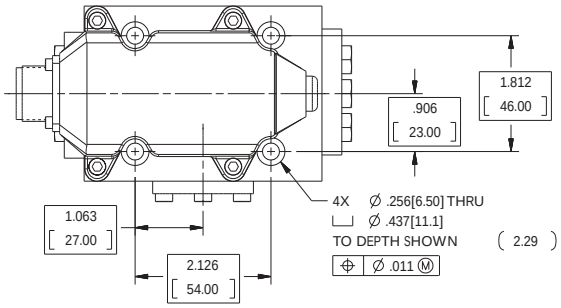
Frequency Response

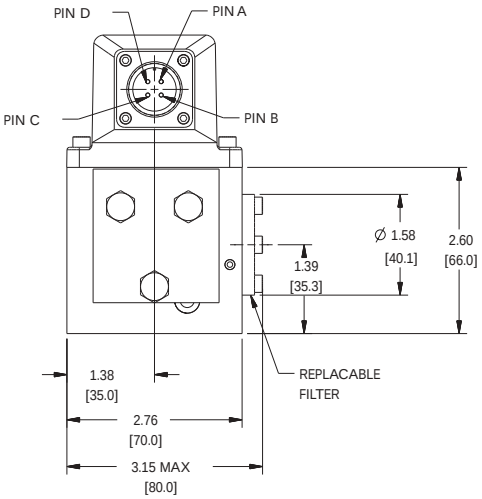
Step Response

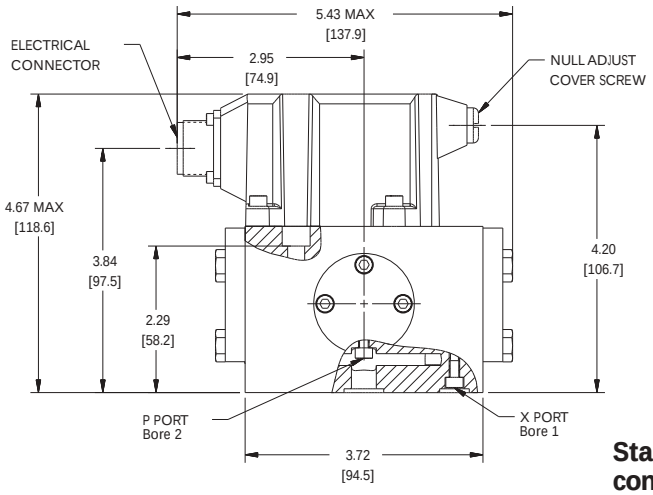


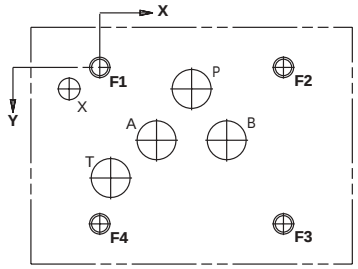
Step Response

INSTALLATION DRAWINGS









U.S.	P	A	B	T	X	F1	F2	F3	F4
	Ø.44	Ø.44	Ø.44	Ø.44	Ø.25	1/4 20	1/4 20	1/4 20	1/4 20
X	1.06	0.66	1.47	0.13	-0.35	0	2.13	2.13	0
Y	0.25	0.84	0.84	1.28	-0.25	0	0	1.81	1.81

METRIC	P	A	B	T	X	F1	F2	F3	F4
	Ø11,2	Ø11,2	Ø11,2	Ø11,2	Ø6,3	M6	M6	M6	M6
X	27	16,7	37,3	3,2	-9	0	54	54	0
Y	6,3	21,4	21,4	32,5	-6,4	0	0	46	46

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

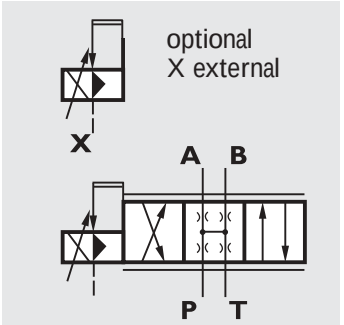
The mounting manifold must conform to ISO 4401-05-05-0-94*

***Note:** Location of X port in valve body does **not** correspond to ISO standards.

Mounting surface needs to be flat within 0.001[0.03] TIR and a 32 [ΔΔ] finish.

For external null adjust:

Flow out of port "A" will increase with clockwise rotation of null adjust screw (1/8 hex key).



CONVERSION INSTRUCTION

For operation with internal or external pilot connection.

Pilot flow supply	Screw & Seal Washer Location (M4 X 6 DIN EN ISO 4762)	
	Bore 1	Bore 2
Internal P	closed	open
External X	open	closed

ELECTRICAL CONNECTIONS

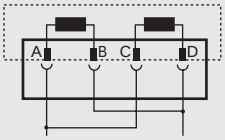
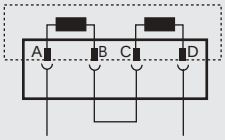
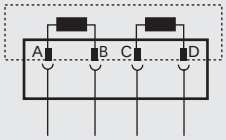
Rated current and coil resistance
A variety of coils are available for G631 Series Servovalves.

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 G631 series coils)

		Parallel	Series	Single
				
Coil Resistance	[Ω]	14	56	28
Rated Current	[mA]	±100	±50	±100
Coil Inductance @ 50 Hz	[H]	0.2	0.8	0.2
Electrical Power	[W]	.14	.14	.28
Polarity for Valve Opening P ◗ B, A ◗ T		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 must be pressurized.

G631 SERIES
ORDERING INFORMATION
SPARE PARTS AND ACCESSORIES

STANDARD MODELS

Model	Type Designation	Rated Flow (Δ 1,000 psi)		Internal Leakage (at 3,000 psi)		Rated Current (Single Coil)*	Nominal Coil Resistance
		gpm	lpm	gpm	lpm	mA	Ohms
G631-3001A	H05JOFM4VBR	1.0	5.0	< 0.52	< 2.0	100	28
G631-3002A	H10JOFM4VBR	2.5	10	< 0.60	< 2.3	100	28
G631-3003A	H20JOFM4VBR	5.0	20	< 0.70	< 2.6	100	28
G631-3004A	H40JOFM4VBR	10.0	40	< 0.78	< 3.0	100	28
G631-3005A	H60JOFM4VBR	15.0	60	< 0.86	< 3.2	100	28
G631-3006A	H75JOFM4VBR	20.0	75	< 0.96	< 3.6	100	28

*Overdrive more than 10% of rated current is NOT recommended.

Model Number

G631 • • • • • A

Optional Feature

	Series specification

Model Designation

	Assigned at the factory

Factory Identification (Revision Level)

Type Designation

H • • • • F M • V B • –

Valve Version

H	

Rated Flow Q_N gpm [lpm]

	At ΔP_N = 75 psi [5 bar] per land	At ΔP_N = 500 psi [35 bar] per land
05	0.4 [1.5]	1 [5]
10	1 [3.7]	2.5 [10]
20	2 [7.5]	5 [20]
40	4 [15]	10 [40]
60	6 [22]	15 [60]
75	8 [30]	20 [75]

Maximum Operating Pressure (P) and Body Material

J	4,500 psi [315 bar] Aluminum

Bushing/Spool Type

O	4-way / axis cut / linear
D	4-way / ±10% overlap / linear

Pilot Stage

F	Standard Flow, Nozzle-Flapper

Spool Position without Electrical Signal

M	Mid-position

Pilot Connections and Pressure

4	Internal
5	External

Seal Material

V	FPM (Viton)

Valve Connector

B	Connector over B-side

Signals for 100% Spool Stroke

Q	±15 mA (series)
R	±50 mA (series)

Special Equipment

–	None

SPARE PARTS AND ACCESSORIES

Moog Part	Size	Moog Part Number
O-Rings (included in delivery),	FPM 85 Shore	
for P,T,A and B	ID 0.472 x 0.079	G2141-012-020
for X	ID 0.315 x 0.079	G2141-008-020
Mating Connector (not included in delivery)		P/N 49054F014S002S(MS3106F14S-2S)
Flushing Block		P/N B67728-002
Mounting Bolts (not included in delivery)		
	1/4 - 20 NC x 2-3/4 long (4 pieces)	P/N A31324-144B
	[M6 x 1.0 x 70 mm]	[B64929-7B70]
Replaceable Filter		P/N A67999-100
Filter Replacement Kit (includes service manual)		P/N B52555RK200K001

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