SERVO VALVES PILOT OPERATED

FLOW CONTROL VALVE WITH ANALOG INTERFACE

72 SERIES
ISO 10372-06-05-0-92

Rev. AC, May 2024

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

WHAT MOVES YOUR WORLD

MOOG

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.

PRODUCT OVERVIEW

The 72 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 95 to 225 l/min (25 to 60 gpm) at 35 bar (500 psi) valve pressure 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.

The 72 Series is ideally suited for applications in the 95 to 225 l/min (25 to 60 gpm) when superior dynamics are a must.

Intrinsically safe valve versions are available for use in applications with potentially hazardous environments. Specific models are certified to FM, ATEX, CSA, TIIS and IECEx standards.

Valve design	2-stage, with spool and bushing and dry torque motor
Mounting pattern	ISO 10372-06-05-0-92
Maximum operating pressure - ports P, A, B and X	• Aluminium body: 210 bar (3,000 psi) • Steel body: 350 bar (5,000 psi) • Filterless body: 490 bar (7,000 psi)
Maximum operating pressure - port T	210 bar (3,000 psi)
Pilot valve	Nozzle flapper
Rated flow at Δp_N 35 bar/spool land (500 psi/spool land)	95 to 225 l/min (25 to 60 gpm)
Step response time for 0 to 100 % stroke	95 l/min: 11 ms 150 l/min: 18 ms 225 l/min: 33 ms

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

Documents

Part name	Description	Remark	Moog part number
Catalog	72 series general information	To download document click here or scan below:	CDL6266
Manual	-072		CDS6211
	-072K intrinsically safe Series		CDS6754
Installation drawing	-072 Series		CA79668
	-072K intrinsically safe Series		CA33638
	-072 filterless Series		CA35144

FEATURES AND BENEFITS

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
Carbide, ball-in-hole feedback mechanism	Extends lifetime of servo valve when compared to slotted spool and sapphire ball designs
Emergency fail-safe positioning	Most valves are set up to return to a fail-safe 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. This feature provides a simple adjustment to machine performance without the need to adjust a controller.
Standard field configurable 5th port for separate pilot supply	Provides for the precise control of low pressure applications and allows adaptability in service.
Many customizable options available	High adaptability to many applications.
Compliant to SAE-ARP-490 Valve Design Standard	Electrohydraulic Servo Valves according to this ARP standard are applicable to fluid power systems in all types of flight vehicles, and it is applicable to Military, Civil and Space design/certification standards
Port pattern per ISO Standard	Readily available mounting manifolds

DESCRIPTION OF OPERATION

The 72 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. 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.

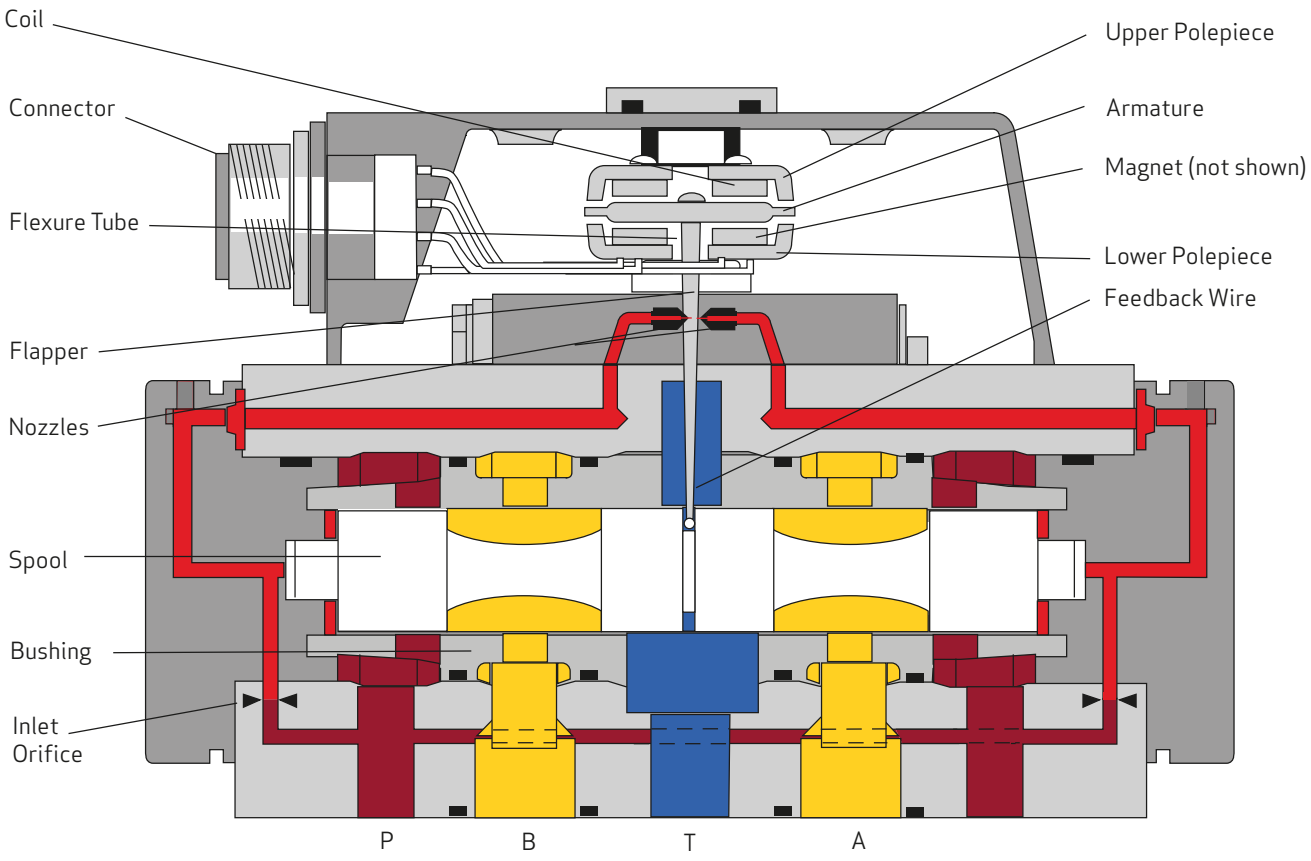
The flapper of the first stage hydraulic amplifier is rigidly attached to the midpoint of the armature. The flapper extends through the flexure tube and passes between 2 nozzles, creating two variable orifices between the nozzle tips and the flapper. The pressure controlled by the flapper and nozzle 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 defects the feedback sprint which creates a force on the armature/flapper assembly.

Input signals induce a magnetic charge in the armature and cause 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



72 SERIES SERVO VALVES

General Technical Data

Valve design	2-stage with spool and bushing and dry torque motor
Pilot valve	Nozzle flapper standard dynamics
Mounting pattern	ISO 10372-06-05-0-92
Installation position	Any position, fixed or movable
Weight with steel body	7.26 kg (16.0 lb)
Weight with aluminium body	3.52 kg (7.8 lb)
Storage temperature range	-40 to +60 °C (-40 to +140 °F)
Ambient temperature range	-29 to +135 °C (-20 to +275 °F) [1]
Vibration resistance	30 g, 3 axis, 10 Hz to 2 kHz
Shock resistance	30 g, 3 axis

1) Option available for higher temperature ranges up to 400 °F.

Hydraulic Data [1]

Maximum operating pressure port P, X, A, B	• Aluminium body: 210 bar (3,000 psi) • Steel body: 350 bar (5,000 psi) • Filterless body: 490 bar (7,000 psi)		
Maximum operating pressure port T	Static: same as P port. Normal operating: 70 bar (1,000 psi)		
Minimum operating pressure	14 bar (200 psi)		
Rated flow at Δp_N 35 bar (500 psi)/spool land	95 l/min (25 gpm)	150 l/min (40 gpm)	225 l/min (60 gpm)
Maximum flow Q_{max}	355 l/min (93.8 gpm)		
Typical leakage	3.50 l/min (0.92 gpm)	4.60 l/min (1.22 gpm)	5.20 l/min (1.39 gpm)
Maximum total leakage (axis cut)	5.82 l/min (1.54 gpm)	7.62 l/min (2.01 gpm)	9.00 l/min (2.38 gpm)
Pilot flow	0.80 l/min (0.21 gpm)		
Null adjust authority [2]	Greater than 10% of rated flow		
Hydraulic fluid	Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158		
Seal material	FKM (fluorocarbon) 90 Shore, EPR (ethylene-propylene copolymer) 90 Shore, others upon request		
Hydraulic fluid temperature range	-29 to +135 °C (-20 to +275 °F)		
Recommended viscosity range at 38 °C (100 °F)	10 to 85 mm^2/s (cSt)		
Recommended cleanliness class as per ISO 4406 for functional safety	17/14/11		
Recommended cleanliness class as per ISO 4406 for longer service life	15/13/10		
Recommended filter rating for functional safety	ß10 ≤ 75 (10 µm absolute)		
Recommended filter rating for longer service life	ß5 ≤ 75 (5 µm absolute)		

1) Measured at 210 bar (3,000 psi) pilot or operational pressure, oil viscosity 32 mm2/s and oil temperature +40 °C (+104 °F)

72 SERIES SERVO VALVES

Typical Static and Dynamic Data [1)]

Step response time for 0 to 100 % stroke	95 l/min (20 gpm) = 11 ms 150 l/min (40 gpm) = 18 ms 225 l/min (60 gpm) = 33 ms
Threshold, typical	≤ 1.5 %
Hysteresis, typical	≤ 4.0 %
Null shift per ΔT = 38 °C (100 °F)	≤ 2.0 %
Rated flow tolerance	±10 %

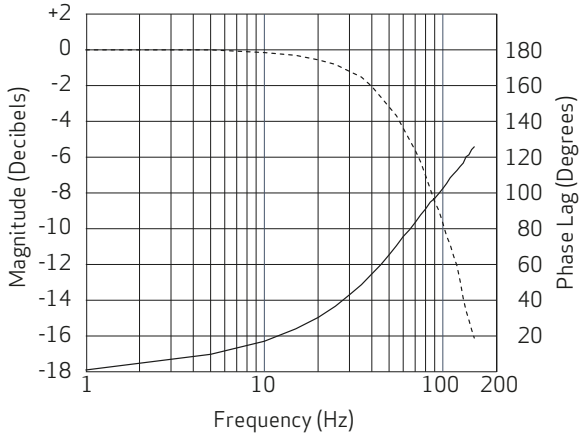
STANDARD RESPONSE

The low flow pilot stage (F) ensures a uniform pressure output. A high flow pilot stage (G) is available for improved dynamics.

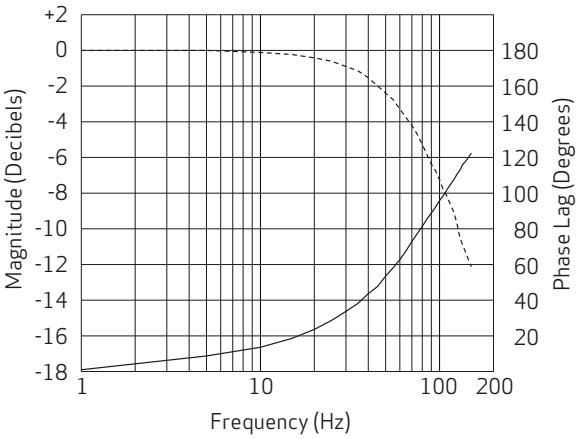
Type	Type 2 description	-3 dB point	90 deg phase lag	Step response
S09..FOF	S09 low response	48 Hz	80 Hz	11 ms
S09..FOG	S09 high response	56 Hz	92 Hz	8.8 ms
S15..FOF	S15 low response	41 Hz	84 Hz	18 ms
S15..FOG	S15 high response	80 Hz	95 Hz	13.5 ms

Typical Characteristic Curves

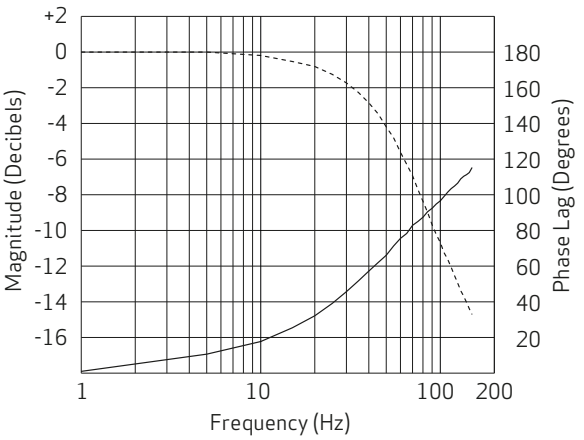
S09FOF



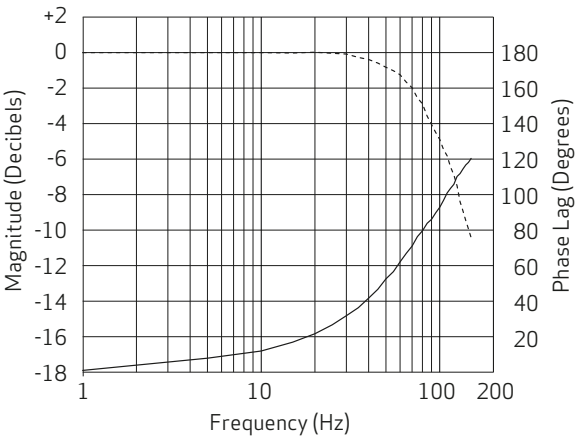
S09FOG



S15FOF



S15FOG



Measured with 40 % signal amplitude, at 3,000 psi (210 bar) pilot or operating pressure, fluid viscosity of 24 cSt, and fluid temperature of 104 °F (40 °C)

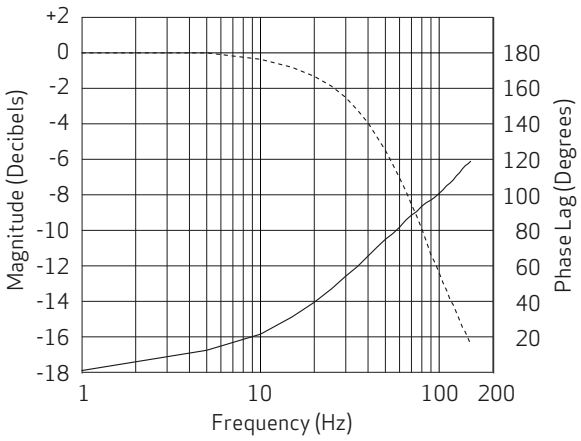
STANDARD RESPONSE

The low flow pilot stage (F) ensures a uniform pressure output. A high flow pilot stage (G) is available for improved dynamics.

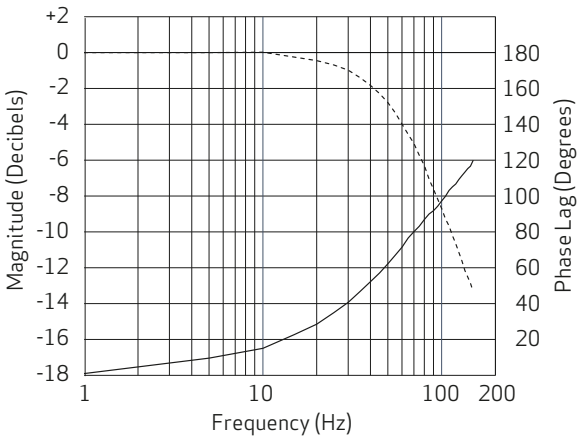
Type	Type 2 description	-3 dB point	90 deg phase lag	Step response
S22..FOF	S22 low response	32 Hz	75 Hz	33 ms
S22..FOG	S22 high response	52 Hz	88 Hz	25 ms

Typical Characteristic Curves

S22FOF



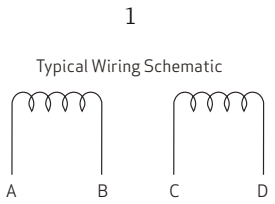
S22FOG

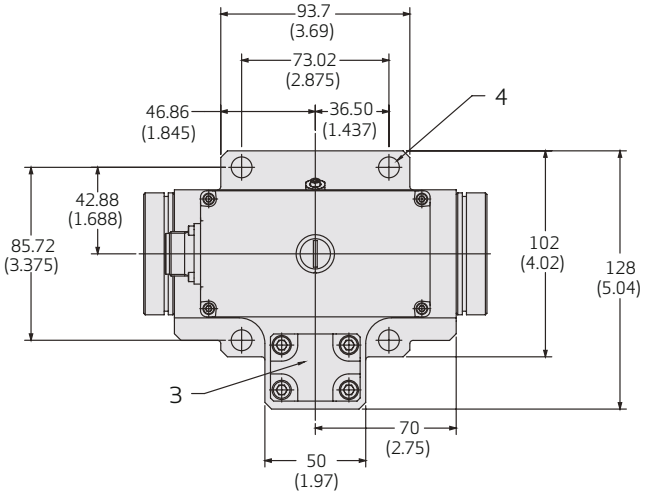


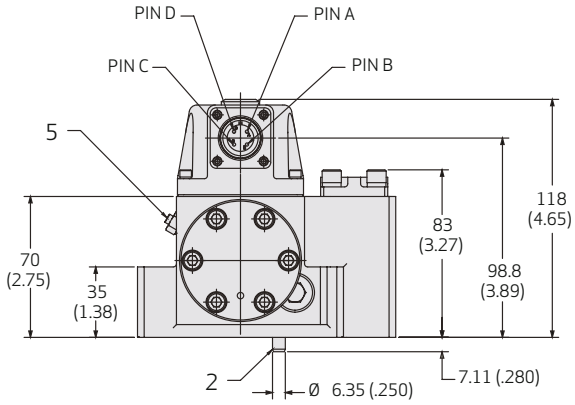
Measured with 40 % signal amplitude, at 3,000 psi (210 bar) pilot or operating pressure, fluid viscosity of 24 cSt, and fluid temperature of 104 °F (40 °C)

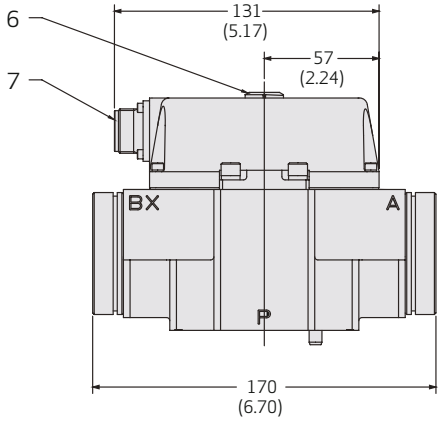
INSTALLATION DRAWING

Filtered Model





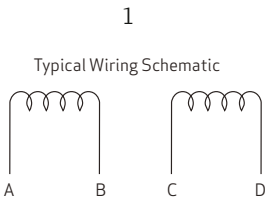


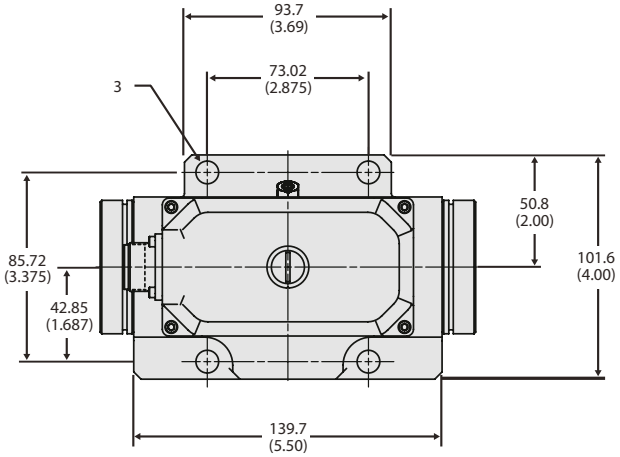


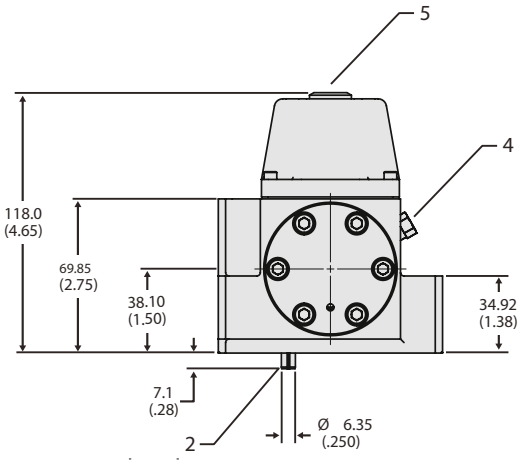
1. Typical wiring schematic
2. Location pin (refer to section Hole Pattern for position)
3. Filter
4. 4X Ø 10.31 mm (0.406 in) thru
5. Mechanical Null Adjust screw (requires 3/8" wrench and 3/32" hex key)
6. Optional Magnetic Null Adjust
7. 4-Pin connector mates with MS3106-14S-2S
   6-Pin connector mates with MS3106-14S-6S

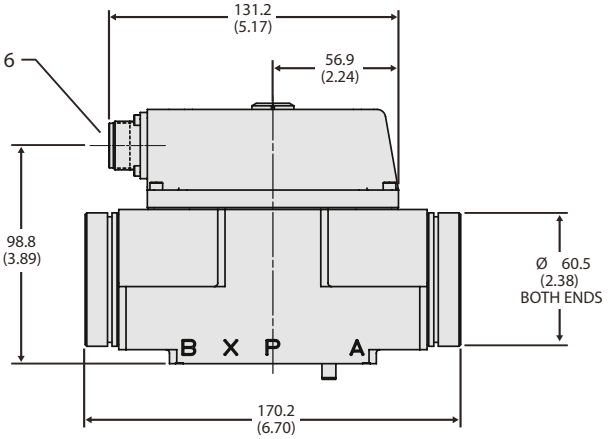
INSTALLATION DRAWING

Filterless Model









1. Typical wiring schematic
2. Location pin (refer to section Hole Pattern for position)
3. 4X Ø 10.31 mm (0.406 in) thru
4. Bushing pin is locked and cannot be adjusted
5. Optional Magnetic Null Adjust
6. 4-Pin connector mates with MS3106-14S-2S
   6-Pin connector mates with MS3106-14S-6S

MOUNTING REQUIREMENTS REF. ISO 10372-06-05-0-92 (PORT CIRCLE DIAMETER 2.0)

Surface

Surface to which valve is mounted requires:

- Flatness of 0.05 mm (0.002 in) over 100 mm (3.94 in)
- Average finish R_a better than 0.8 µm (0.000032 in)

Ports

For maximum flow ports must be designed as follows:

- P, T, A, B with diameters of 18 mm (0.709 in), 15.88 mm (0.625 in) Ø counter-bored 18.94 mm (0.746 in) inside Ø by 23.81 mm (0.937 in) outside Ø

Recommended Mounting Seals

- Material dependant on application
- 1.78 mm (0.070 in) cross section x 20.35 mm (0.801 in) inside diameter, 90 durometer. Equivalent AS83248/2 size -019 for P, A, B, and T ports
- 1.78 mm (0.070 in) cross section x 9.25 mm (0.364 in) inside diameter, 90 durometer. Equivalent AS83248/2 size -012 for X port

Recommended Mounting Screws

- Material dependant on application
- SHCS 3/8 x 2.0 long. Grade 8 minimum
- SHCS M10 x 50 long. Grade 10.9 minimum

ELECTRICAL CONNECTION

Rated Current and Coil Resistance

A variety of coils are available for 72 Series Servo Valves, which offer a wide choice of rated currents.

Standard ordering code [1]	Command signal (mA)			Coil resistance [Ohms/coil at 25 °C (77 °F)] [2]	Power consumption [W]			Coil inductance [H] measured at 50 Hz [3]		
	Single coil	Series coil	Parallel coil		Single coil	Series coil	Parallel coil	Single coil	Series coil	Parallel coil
4	±8	±4	±8	1,000	0.064	0.032		3.2	9.7	2.6
H	±15	±7.5	±15	206	0.045	0.023		0.72	2.2	0.59
L	±40	±20	±40	80	0.128	0.064		0.22	0.66	0.18

1) Others optional

2) 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 ±10 %. 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 servo amplifier having high output impedance.

3) 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.

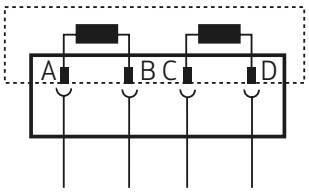
Coil Connections

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 single operation.

72 Series Servo Valves can be supplied on special order with other connectors or pigtail.

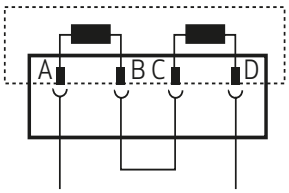
Standard Configuration for Valve Opening P → B, A → T

Single



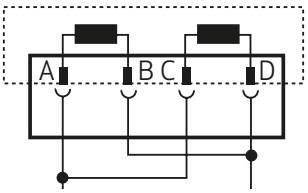
A (+), B (-) or C (+), D (-)

Series



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

Parallel



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

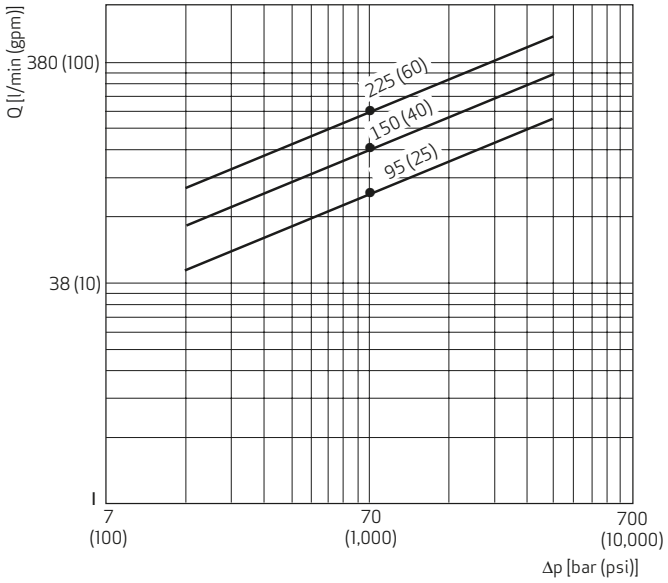
FLOW CALCULATION

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.

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

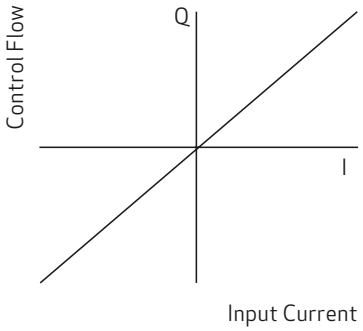
Q [l/min (gpm)]	Actual flow
Q_N [l/min (gpm)]	Rated flow
Δp [bar (psi)]	Actual pressure drop per spool land
Δp_N [bar (psi)]	Rated pressure drop

Flow Diagram for 4-way Operation



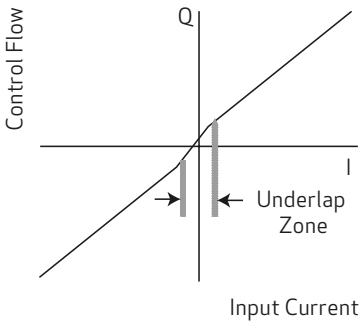
Null-cut Options

Standard Axis Cut



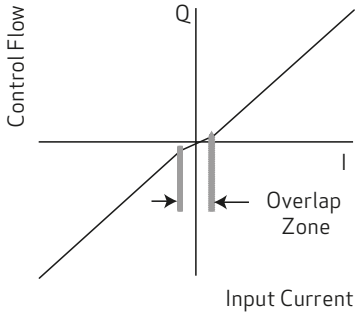
Minimal change in gain through null region. Best overall performance for most closed loop systems.

Underlap Spool



Null region flow gain is higher than normal. Always allows some small amount of flow past the spool.

Overlap Spool



Null region flow gain is lower than normal. Spool types can range from minimal overlap to completely blocked flow.

ACCESSORIES AND SPARE PARTS

Part name	Description	Material	Moog part number
Maintenance kit	Base o-rings	FKM per AMS7259 Note that o-ring material is dependant on application	B52555RK099K001
	Additional o-rings required for filter access		
	Filter tube		
	Field replaceable filter		

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 servo amplifiers, transducer conditioning electronics, command and auxiliary function modules, valve drive amplifiers and power supplies. All of these modules are CE marked and require a 24 V_{DC} supply. The modules mount to standard 35 mm DIN rail mount for easy installation and removal.

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.

Mounting Manifolds - Easier Installation and Maintenance

Various mountings 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.

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 is through close attention to contamination control.

For industrial servo systems with 72 Series Servo Valves 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 5 micron (beta 5 → 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.

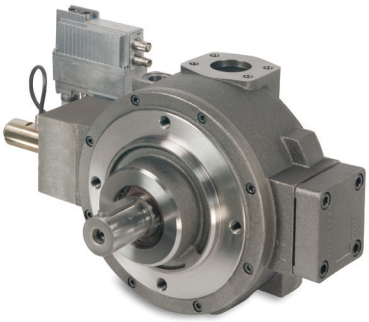
This recommendation is based on the fact that most servo and proportional valves can accept the odd particle up to 25 microns so the pressure filter will protect the valve from catastrophic failure. The real work is done by the low pressure filter reducing small particle contamination which is the prime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

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 ISO 4406 17/14/11.

For long life, the maximum levels are 15/13/10, 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.

ABOUT MOOG

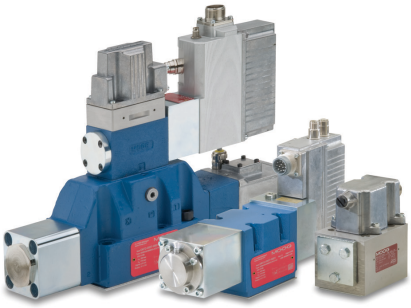
Moog Inc. is a worldwide designer, manufacturer and integrator of precision control components and systems. Moog's Industrial Systems Group designs and manufactures high performance motion control solutions combining electric, hydraulic, and hybrid technologies with expert consultative support in a range 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 Industrial Systems Group, with fiscal year 2020 sales of USD 909 million and over 40 locations worldwide, is part of Moog Inc. (NYSE: MOG.A and MOG.B) which has sales of USD 2.885 billion.



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.

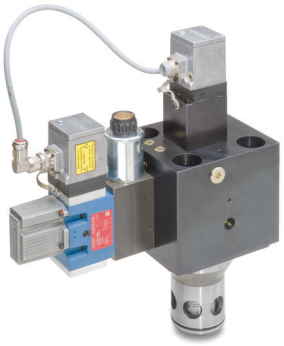
Moog experts work in close collaboration with machine builders and application engineers to design motion control systems for greater productivity, higher reliability, superior connectivity, less costly maintenance and more effective operations. Our regional presence, industry knowledge and design flexibility ensure 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
- Motion Controllers and Software
- Radial Piston Pumps
- Actuators
- Integrated Hydraulic Manifold Systems and Cartridge Valves
- Slip Rings
- Motion Bases

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 require 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/ multiyear 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.

MOOG GLOBAL SUPPORT®

ORDERING CODE

Model number (assigned at the factory) Type designation

-072	☐	☐☐☐☐	-	☐	-	S	☐☐	☐	☐	☐	☐	☐	☐	☐	☐
						1	2	3	4	5	6	7	8	9	10	11

Optional feature	
-	Series specification
K	Intrinsically safe

Model designation (assigned at factory)

Factory identification (revised level)

1	Valve version
S	Standard response

2	Rated flow in l/min (gpm)	
	For Δp_N = 35 bar (500 psi) per spool land	
09	95	(25)
15	150	(40)
22	225	(60)

3	Maximum operating pressure in bar (psi)		
F	210	(3,000)	aluminum
K	350	(5,000)	steel
0	490	(7,000) [1]	steel

4	Bushing/spool design (see Null Cut Options page 14 for designation)
0	4-way/axis cut/linear
D	4-way/±10 % overlap/linear
X	Special
A	4-way/< = 3% overlap/linear
B	3-way only, port A active, Port B vented to return
M	4-way/axis cut P_C > 80% of P_P/linear (servo drive)
N	4-way/< 3% underlap/linear

5	Pilot stage design
F	Standard dynamics
G	High dynamics

6	Spool position without electrical signal
M	Center position
A	Port A open to return
B	Port B open to return

7	Pilot connections and pressure		
	Pressure in bar (psi)	Supply	Return
4	17 to 210 (250 to 3,000)	Internal	Internal
5	17 to 210 (250 to 3,000)	External	Internal
6	17 to 490 (250 to 7,000)	External	External

8	Seal material
V	FKM 90 Shore
N	NBR 90 Shore (BUNA)
F	FKM High pressure seals
E	EPR (ethylene-propylene copolymer)

9	Valve connector
A	Connector over C1 (A) - side (RH)
B	Connector over C2 (B) - side (LH)

10	Signals for 100 % spool stroke
4	± 4 mA series (± 8 mA parallel)
G	± 5 mA series (± 10 mA parallel)
H	± 7.5 mA series (± 15 mA parallel)
J	± 10 mA series (± 20 mA parallel)
L	± 20 mA series (± 40 mA parallel)
M	± 25 mA series (± 50 mA parallel)
N	± 30 mA series (± 60 mA parallel)
Z	± 100 mA series (± 200 mA parallel)

11	Optional Mechanical Null Adjust
N	Magnetic Null Adjustment
R	Reverse Polarity

All combinations may not be available.

1) Values with (490 bar/7,000 psi) maximum operating pressure uses a filterless body. Refer to installation specifics in this catalog.

Preferred Models

Model Number	Type Designation	Rated Flow l/min	Rated Flow gpm	Rated Current (single coil) mA
-072-1201	S09FOFM4VBLN	95	25	±40
-072-1202	S15FOFM4VBLN	150	40	±40
-072-1203	S22FOFM4VBLN	225	60	±40
-072-1201-6	S09KOFM4VBLN	95	25	±40
-072-1202-6	S15KOFM4VBLN	150	40	±40
-072-1203-6	S22KOFM4VBLN	225	60	±40

MORE PRODUCTS. MORE SUPPORT.

Moog designs a range of motion control products to complement those featured in this document. Moog also provides service and support for all of our products. For more information, contact the Moog facility closest to you.

Australia
+61 3 9561 6044
Service + 61 3 8545 2140
info.australia@moog.com
service.australia@moog.com

Brazil
+55 11 3572 0400
info.brazil@moog.com
service.brazil@moog.com

Canada
+1 716 652 2000
info.canada@moog.com

China
+86 21 2893 1600
Service +86 21 2893 1626
info.china@moog.com
service.china@moog.com

France
+33 1 4560 7000
Service +33 1 4560 7015
info.france@moog.com
service.france@moog.com

Germany
+49 7031 622 0
Service +49 7031 622 197
info.germany@moog.com
service.germany@moog.com

Hong Kong
+852 2 635 3200
info.hongkong@moog.com

India
+91 80 4057 6666
Service +91 80 4057 6604
info.india@moog.com
service.india@moog.com

Ireland
+353 21 451 9000
info.ireland@moog.com

Italy
+39 0332 421 111
Service 800 815 692
info.italy@moog.com
service.italy@moog.com

Japan
+81 46 355 3767
info.japan@moog.com
service.japan@moog.com

Korea
+82 31 764 6711
info.korea@moog.com
service.korea@moog.com

Luxembourg
+352 40 46 401
info.luxembourg@moog.com

The Netherlands
+31 252 462 000
info.thenetherlands@moog.com
service.netherlands@moog.com

Singapore
+65 677 36238
Service +65 651 37889
info.singapore@moog.com
service.singapore@moog.com

South Africa
+27 12 653 6768
info.southafrica@moog.com

Spain
+34 902 133 240
info.spain@moog.com

Sweden
+46 31 680 060
info.sweden@moog.com

Turkey
+90 216 663 6020
info.turkey@moog.com

United Kingdom
+44 (0) 1684 858000
Service +44 (0) 1684 278369
info.uk@moog.com
service.uk@moog.com

USA
+1 716 652 2000
info.usa@moog.com
service.usa@moog.com

For product information, visit **www.moog.com/industrial**

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