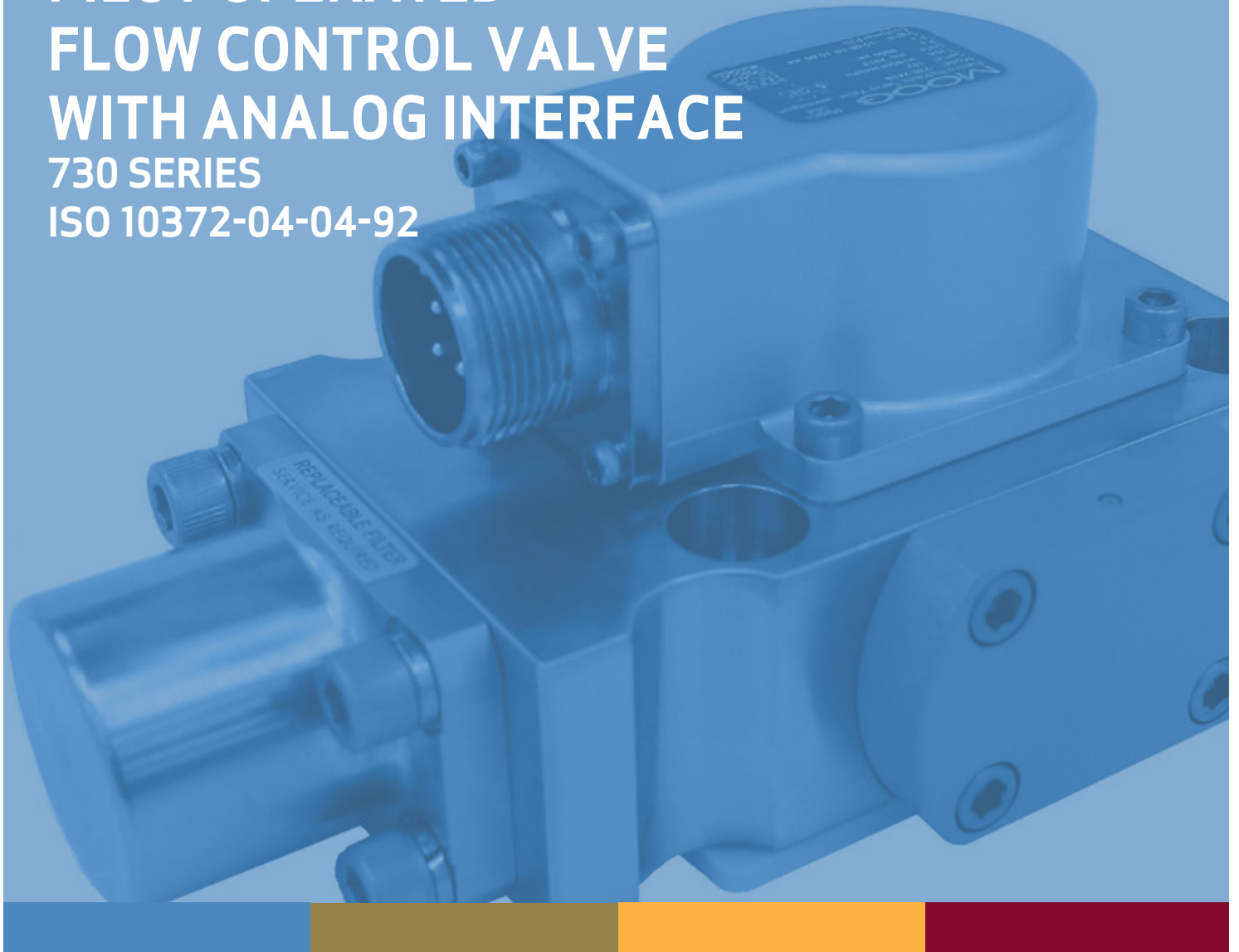


# SERVO VALVES

## PILOT OPERATED FLOW CONTROL VALVE WITH ANALOG INTERFACE

730 SERIES  
ISO 10372-04-04-92



Rev. F, June 2014

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

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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### TECHNICAL DATA

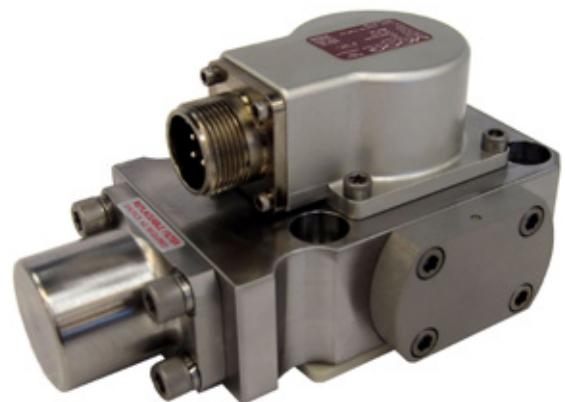
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This catalog is for users with technical knowledge. To ensure all necessary characteristics for function and safety of the system, the user has to check the suitability of the products described herein. The products described herein are subject to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

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For the most current information, visit [www.moog.com/industrial](http://www.moog.com/industrial) or contact your local Moog office.

## PRODUCT OVERVIEW

The 730 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 4 to 57 l/min (1 to 15 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 730 is ideally suited for applications in the 4 to 57 l/min (1 to 15 gpm) requirements when superior dynamics are a must.

|   |  |                        |                       |                        |                        |
|---|--|------------------------|-----------------------|------------------------|------------------------|
| Valve design  | 2-stage, with spool and bushing and dry torque motor |                        |                       |                        |                        |
| Mounting surface  | ISO 10372-04-04-92                                   |                        |                       |                        |                        |
| Maximum operating pressure  | 210 bar (3,000 psi) standard versions                |                        |                       |                        |                        |
| Maximum Flow  | 95 l/min (25 gpm)                                    |                        |                       |                        |                        |
| Pilot stage   | Nozzle-flapper                                       |                        |                       |                        |                        |
| Rated flow at $\Delta p_n$ 35 bar / spool land ( 500 psi /spool land) | 4 l/min<br>(1 gpm)                                   | 10 l/min<br>( 2.5 gpm) | 19 l/min<br>(5.0 gpm) | 38 l/min<br>(10.0 gpm) | 57 l/min<br>(15.0 gpm) |
| Standard step response time for 0 to 100 % stroke                     | 8 ms   | 8 ms                   | 8 ms                  | 9 ms                   | 16 ms                  |
| High step response time for 0 to 100 % stroke                         | 7 ms   | 7 ms                   | 7 ms                  | 7.5 ms                 | N/A                    |



Intrinsically safe 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.

## FEATURES AND BENEFITS

The 730 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.

| <b>Features</b>  | <b>Benefits</b>  |
|--|--|
| 2-stage design with dry torque motor                               | Servo valves are compatible with many different fluids                                   |
| Low friction, double nozzle pilot stage                            | Symmetrical build provides maximum stability over a variety of conditions                |
| High spool control force   | Stable consistent flows can be achieved, thus increasing accuracies                      |
| High dynamics  | Increased production cycles  |
| Rugged, long-life design   | Reduced maintenance and down time  |
| High resolution, low hysteresis                                    | Improved accuracies for close tolerance applications                                     |
| Set up at the factory  | Allows easy installation and setup   |
| Intrinsically safe or explosive proof valve versions are available | Servo valves are able to be employed in most hazardous environments                      |
| Field adjustable null bias   | Servo valves can be adjusted for perfect alignment when interchanging equipment          |
| Loss of electrical signal results in a zero position failsafe      | This feature allows for predictable, safe operation                                      |
| Large capacity field replaceable filter                            | Convenient replacement and longer duration between filter changes                        |
| Carbide, ball-in-hole feedback mechanism                           | Extends lifetime of servo valve when compared to slotted spool and sapphire ball designs |

## DESCRIPTION OF OPERATION

The 730 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 motor coils surround the armature, one on each side of the flexure tube.

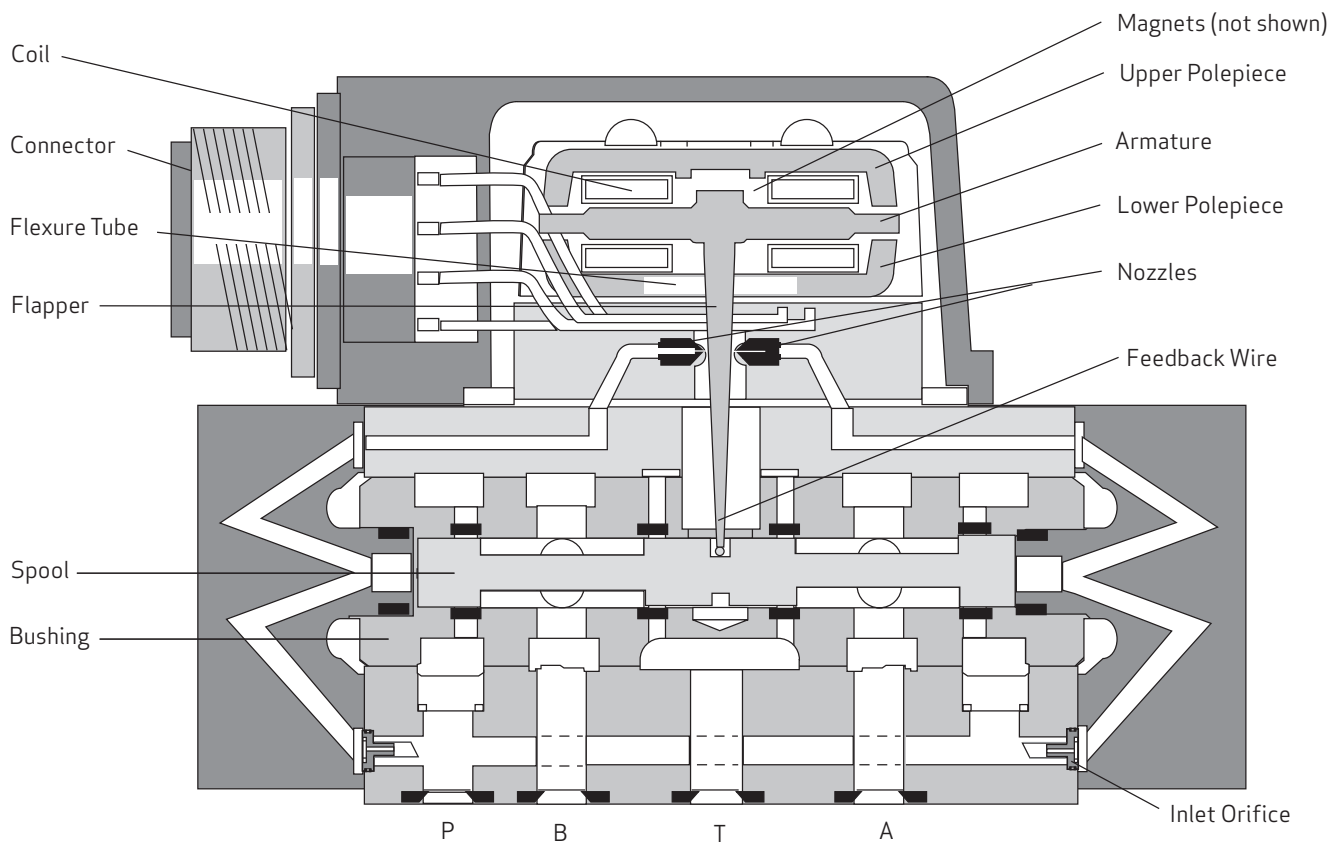
The flapper of the first stage hydraulic amplifier is rigidly attached to the midpoint of the armature. The flapper extends through the flexure tube and passes between the nozzles, creating two variable orifices between the nozzle tips and the flapper. The pressures controlled by the flapper and nozzle variable orifices are 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 signal induces 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.

This action creates differential pressure at the spool ends, and the resulting spool displacement causes a 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



## 730 SERIES - STANDARD RESPONSE SERVO VALVES

### General Technical Data

|                                  |  |
|----------------------------------|--|
| <b>Valve design</b>              | 2-stage, with spool and bushing and dry torque motor |
| <b>Pilot stage</b>               | Nozzle Flapper Standard Dynamics                     |
| <b>Mounting pattern</b>          | ISO 10372-04-04-92                                   |
| <b>Installation position</b>     | Any orientation, fixed or movable                    |
| <b>Weight</b>                    | 1.0 kg (2.25 lb)                                     |
| <b>Storage temperature range</b> | -40 to +60 °C (-40 to +140 °F)                       |
| <b>Ambient temperature range</b> | -40 to +135 °C (-40 to +275 °F)                      |
| <b>Vibration resistance</b>      | 30 g, 3 axis, 10 Hz to 2 kHz                         |
| <b>Shock resistance</b>          | 30 g, 3 axis   |
| <b>Seal material</b>             | Fluorocarbon (FKM) 85 Shore A<br>Others upon request |

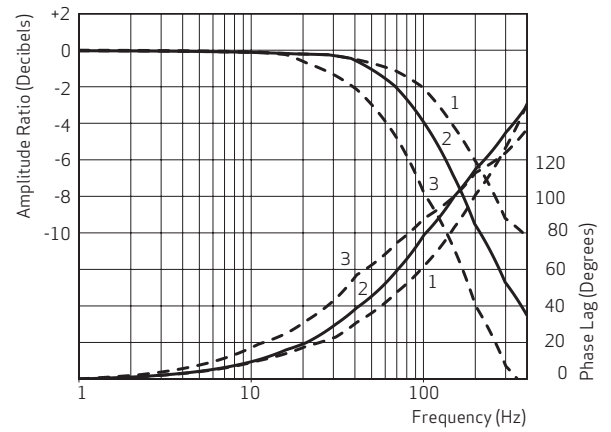
### Hydraulic Data

|  |  |                       |                     |                      |                      |
|--|--|-----------------------|---------------------|----------------------|----------------------|
| <b>Maximum operating pressure to ports P, A, B</b>                           | 210 bar (3,000 psi) standard versions  |                       |                     |                      |                      |
| <b>Maximum operating pressure to port T</b>                                  | 210 bar (3,000 psi)  |                       |                     |                      |                      |
| <b>Rated flow at <math>p_N</math> 35 bar/spool land (500 psi/spool land)</b> | 4 l/min<br>(1 gpm)   | 10 l/min<br>(2.5 gpm) | 19 l/min<br>(5 gpm) | 38 l/min<br>(10 gpm) | 58 l/min<br>(15 gpm) |
| <b>Maximum flow</b>  | 95 l/min (25 gpm)  |                       |                     |                      |                      |
| <b>Null adjust authority</b>   | Greater than 10% of rated flow   |                       |                     |                      |                      |
| <b>Hydraulic fluid</b>   | Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158.<br>Other fluids on request. |                       |                     |                      |                      |
| Temperature range  | -40 to +60 °C (-40 to +140 °F)   |                       |                     |                      |                      |
| Recommended viscosity range  | 10 to 85 mm <sup>2</sup> /s (cSt)  |                       |                     |                      |                      |
| Maximum permissible viscosity range  | 5 to 1,250 mm <sup>2</sup> /s (cSt)  |                       |                     |                      |                      |
| <b>Recommended cleanliness class as per ISO 4406</b>                         |  |                       |                     |                      |                      |
| For functional safety  | 17/14/11   |                       |                     |                      |                      |
| For longer service life  | 15/13/10   |                       |                     |                      |                      |
| <b>Recommended filter rating</b>   |  |                       |                     |                      |                      |
| For functional safety  | $\beta_{10} \leq 75$ (10 $\mu$ m absolute)   |                       |                     |                      |                      |
| For longer life  | $\beta_5 \leq 75$ (5 $\mu$ m absolute)   |                       |                     |                      |                      |

### Static and Dynamic Data (at 3,000 psi)

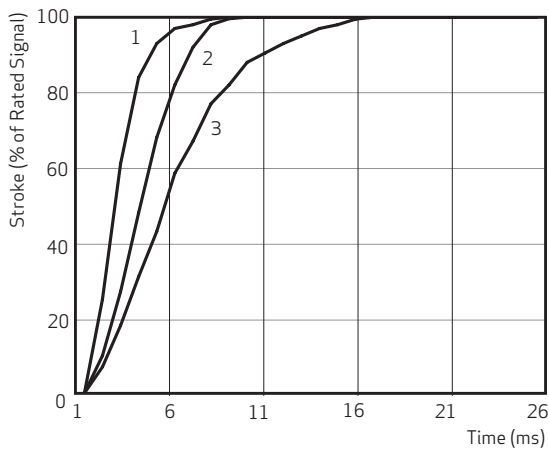
|  |                       |                       |                     |                      |                      |
|--|-----------------------|-----------------------|---------------------|----------------------|----------------------|
| <b>Sample deviation of rated flow</b>                        | 4 l/min<br>(1 gpm)    | 10 l/min<br>(2.5 gpm) | 19 l/min<br>(5 gpm) | 38 l/min<br>(10 gpm) | 57 l/min<br>(15 gpm) |
| <b>Rated flow tolerance</b>                                  | ± 10%                 |                       |                     |                      |                      |
| <b>Step response time for 0 to 100% stroke</b>               | 8 ms                  | 8 ms                  | 8 ms                | 9 ms                 | 16 ms                |
| <b>Threshold</b>   | ≤0.5% of rated signal |                       |                     |                      |                      |
| <b>Hysteresis</b>  | ≤3.0% of rated signal |                       |                     |                      |                      |
| <b>Null shift for <math>\Delta T = 38</math> °C (100 °F)</b> | ≤2.0% of rated signal |                       |                     |                      |                      |

# 730 SERIES SERVO VALVES - STANDARD RESPONSE SERVO VALVES



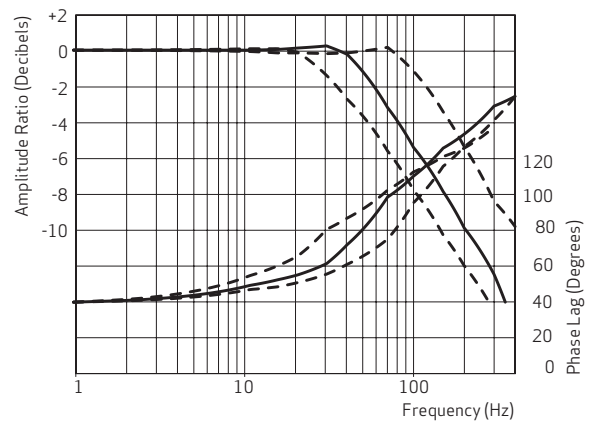
### Reduced Amplitude Standard Frequency Response

Plot 1 = 730-100B, 730-101B, 730-102B  
 Plot 2 = 730-103B  
 Plot 3 = 730-104B



### Full Amplitude Step Response

100% Step  
 Plot 1 = 730-100B, 730-101B, 730-102B  
 Plot 2 = 730-103B  
 Plot 3 = 730-104B



### Full Amplitude Standard Frequency Response

Plot 1 = 730-100B, 730-101B, 730-102B  
 Plot 2 = 730-103B  
 Plot 3 = 730-104B

## 730 SERIES - HIGH RESPONSE SERVO VALVES

### General Technical Data

|                                  |  |
|----------------------------------|--|
| <b>Valve design</b>              | 2-stage, with spool and bushing and dry torque motor |
| <b>Pilot stage</b>               | Nozzle Flapper Standard Dynamics                     |
| <b>Mounting pattern</b>          | ISO 10372-04-04-92                                   |
| <b>Installation position</b>     | Any orientation, fixed or movable                    |
| <b>Weight</b>                    | 1.0 kg (2.25 lb)                                     |
| <b>Storage temperature range</b> | -40 to +60 °C (-40 to +140 °F)                       |
| <b>Ambient temperature range</b> | -40 to +135 °C (-40 to +275 °F)                      |
| <b>Vibration resistance</b>      | 30 g, 3 axis, 10 Hz to 2 kHz                         |
| <b>Shock resistance</b>          | 30 g, 3 axis   |
| <b>Seal material</b>             | Fluorocarbon (FKM) 85 Shore A<br>Others upon request |

### Hydraulic Data

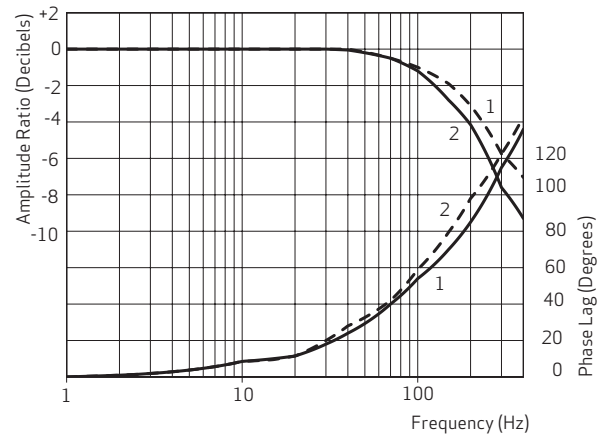
|  |  |                       |                     |                      |
|--|--|-----------------------|---------------------|----------------------|
| <b>Maximum operating pressure to ports P, T, A, B</b>                        | 210 bar (3,000 psi) standard versions  |                       |                     |                      |
| <b>Rated flow at <math>p_N</math> 35 bar/spool land (500 psi/spool land)</b> | 4 l/min<br>(1 gpm)   | 10 l/min<br>(2.5 gpm) | 19 l/min<br>(5 gpm) | 38 l/min<br>(10 gpm) |
| <b>Maximum flow</b>  | 95 l/min (25 gpm)  |                       |                     |                      |
| <b>Null adjust authority</b>   | Greater than 10% of rated flow   |                       |                     |                      |
| <b>Hydraulic fluid</b>   | Hydraulic oil as per DIN 51524 parts 1 to 3 and ISO 11158.<br>Other fluids on request. |                       |                     |                      |
| Temperature range  | -40 to +60 °C (-40 to +140 °F)   |                       |                     |                      |
| Recommended viscosity range  | 10 to 85 mm <sup>2</sup> /s (cSt)  |                       |                     |                      |
| Maximum permissible viscosity range  | 5 to 1,250 mm <sup>2</sup> /s (cSt)  |                       |                     |                      |
| <b>Recommended cleanliness class as per ISO 4406</b>                         |  |                       |                     |                      |
| For functional safety  | 17/14/11   |                       |                     |                      |
| For longer service life  | 15/13/10   |                       |                     |                      |
| <b>Recommended filter rating</b>   |  |                       |                     |                      |
| For functional safety  | $\beta_{10} \leq 75$ (10 $\mu$ m absolute)   |                       |                     |                      |
| For longer life  | $\beta_5 \leq 75$ (5 $\mu$ m absolute)   |                       |                     |                      |

### Static and Dynamic Data (at 3,000 psi)

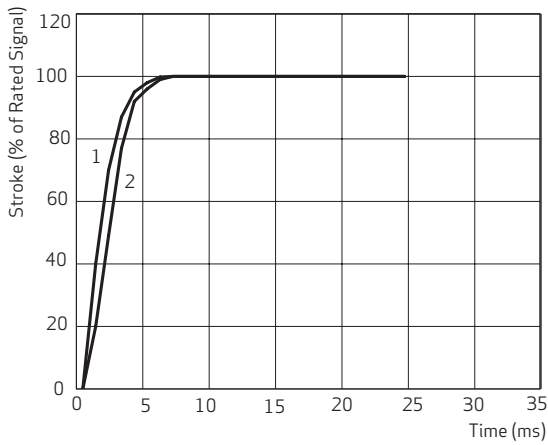
|  |                              |                       |                     |                      |
|--|------------------------------|-----------------------|---------------------|----------------------|
| <b>Sample deviation of rated flow</b>                        | 4 l/min<br>(1 gpm)           | 10 l/min<br>(2.5 gpm) | 19 l/min<br>(5 gpm) | 38 l/min<br>(10 gpm) |
| <b>Rated flow tolerance</b>                                  | $\pm 10\%$                   |                       |                     |                      |
| <b>Step response time for 0 to 100% stroke</b>               | 7 ms                         | 7 ms                  | 7 ms                | 7.5 ms               |
| <b>Threshold</b>   | $\leq 0.5\%$ of rated signal |                       |                     |                      |
| <b>Hysteresis</b>  | $\leq 3.0\%$ of rated signal |                       |                     |                      |
| <b>Null shift for <math>\Delta T = 38</math> °C (100 °F)</b> | $\leq 2.0\%$ of rated signal |                       |                     |                      |



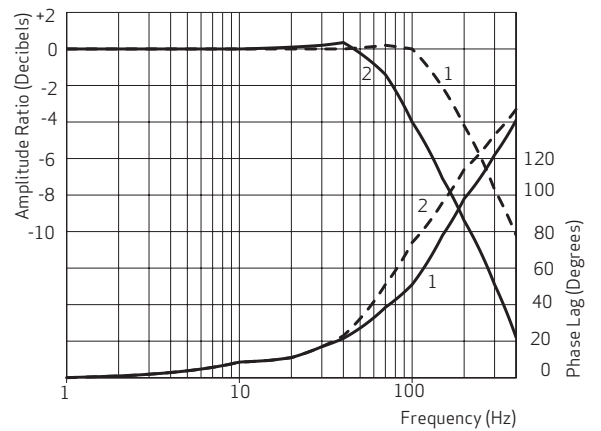
# 730 SERIES SERVO VALVES - HIGH RESPONSE SERVO VALVES



**Reduced Amplitude High Frequency Response**  
 Plot 1 = 730-230B, 730-231B, 730-232B  
 Plot 2 = 730-233B



**Full Amplitude Step Response**  
 100% Step  
 Plot 1 = 730-230B, 730-231B, 730-232B  
 Plot 2 = 730-233B



**Full Amplitude High Frequency Response**  
 Plot 1 = 730-230B, 730-231B, 730-232B  
 Plot 2 = 730-233B

# ELECTRICAL DATA

## Rated current and coil resistance

A variety of coils are available for 730 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  $\pm 10\%$ . 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 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 | Recommended rated current [mA]<br>Command signal |             |               | Coil resistance<br>[ohms/coil at<br>25 °C (77 °F)] | Power consumption [W] |             |               |
|---------------|--|-------------|---------------|--|-----------------------|-------------|---------------|
|               | Single coil                                      | Series coil | Parallel coil |  | Single coil           | Series coil | Parallel coil |
| H             | $\pm 15$   | $\pm 7.5$   | $\pm 15$      | 206  | 0.046                 | 0.023       | 0.023         |
| L             | $\pm 40$   | $\pm 20$    | $\pm 40$      | 80   | 0.128                 | 0.064       | 0.064         |

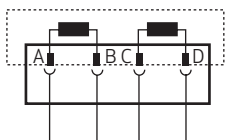
| Ordering code | Approximate Coil Inductance [H]<br>Measured at 50 Hz |             |               |
|---------------|--|-------------|---------------|
|               | Single coil  | Series coil | Parallel coil |
| H             | 0.72   | 2.2         | 0.59          |
| L             | 0.22   | 0.66        | 0.18          |

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

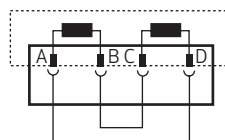
### Configuration for valve opening P $\rightarrow$ B, A $\rightarrow$ T

#### Single



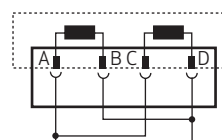
A (+), B (-) or C (+), D (-)

#### Series



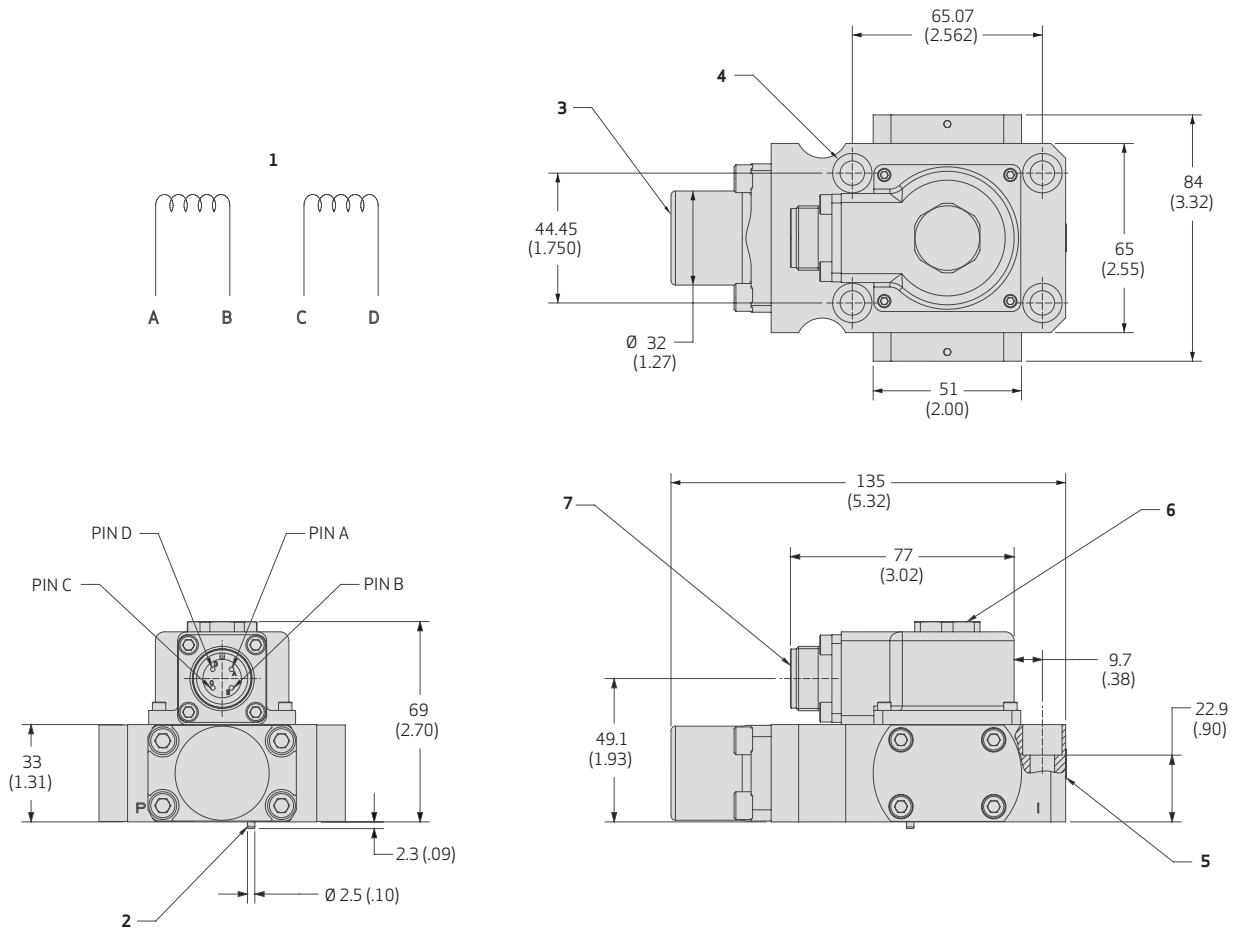
A (+), D (-), B and C connected

#### Parallel



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

# INSTALLATION DRAWINGS AND NULL ADJUST INSTRUCTIONS



- 1 Typical wiring schematic
- 2 Location pin (refer to section Hole Pattern for position)
- 3 Filter location
- 4 4X Ø 8.36 mm (0.329 in) thru  $\perp$  Ø 13.49 mm (0.531 in) to depth shown Mounting Holes
- 5 Mechanical Null Adjust screw (requires 3/8" wrench and 3/32" hex key)
- 6 Optional Magnetic Null Adjust (requires 7/8" wrench)
- 7 Connector mates with MS3106F14S-2S (Moog P/N: -49054F014S002S)

**Fluid:**

Industrial hydraulic fluid per DIN 51524 parts 1 to 3 and ISO 11158, maintained to ISO 4406 Code 17/14/11 recommended.  
 Viscosity 10 to 85 mm<sup>2</sup>/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).

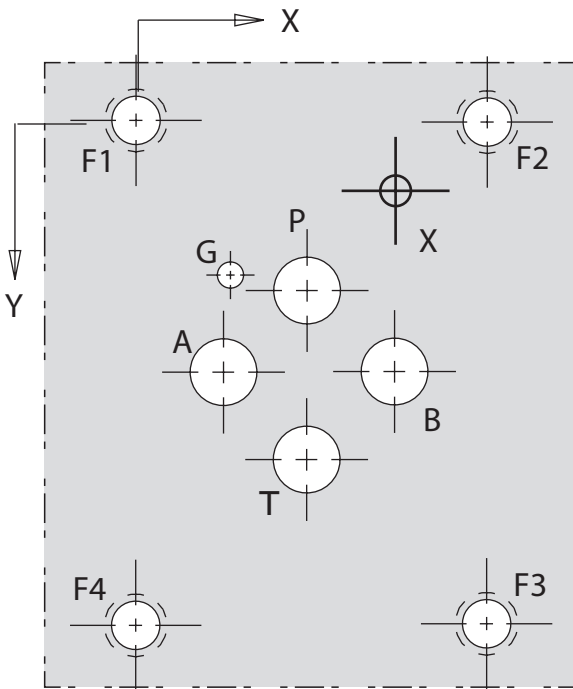
**Valve Phasing:**

Flow out port B results when:  
 Series coils: B & C connected, A+, D-  
 Parallel coils: A & C connected, B & D connected,  
 A and C+, B and D-  
 Single coils: A+/B- or C+/D-.

**Null Adjust:**

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

### 730 SERIES HOLE PATTERN FOR MOUNTING SURFACE



| Designation |    | P     | A     | B     | T     | X     | G     | F1      | F2      | F3      | F4      |
|-------------|----|-------|-------|-------|-------|-------|-------|---------|---------|---------|---------|
| Size Ø      | mm | 8.15  | 8.15  | 8.15  | 8.15  | 5.00  | 3.45  | M8      | M8      | M8      | M8      |
|             | in | 0.321 | 0.321 | 0.321 | 0.321 | 0.197 | 0.136 | 5/16-18 | 5/16-18 | 5/16-18 | 5/16-18 |
| Position X  | mm | 22.23 | 11.11 | 33.34 | 22.23 | 33.32 | 12.32 | 0       | 44.45   | 44.45   | 0       |
|             | in | 0.875 | 0.438 | 1.312 | 0.875 | 1.312 | 0.485 | 0       | 1.750   | 1.750   | 0       |
| Position Y  | mm | 21.42 | 32.54 | 32.54 | 43.64 | 8.74  | 19.84 | 0       | 0       | 65.07   | 65.07   |
|             | in | 0.844 | 1.281 | 1.281 | 1.718 | 0.344 | 0.781 | 0       | 0       | 2.562   | 2.562   |

**Notes**

- Surface:  
Surface to which the valve is mounted requires flatness of 0.01 mm (0.004 in) over 100 mm (3.94 in) and an average finish Ra better than 0.8 µm (0.000032 in).
- Ports:  
For maximum flow the ports P, T, A, and B must be designed with diameters of 8.15 mm above (0.321 in above), and port X 5.00 mm above (0.197 in) above.
- Recommended Seals:  
85 on previous pages durometer that is compatible with the hydraulic fluid.  
P, T, A, and B: 10.82 mm (0.426 in) inside diameter by 1.78 mm (0.70 in) cross section  
X: 9.25 mm (0.364 in) inside diameter by 1.78 mm (0.70 in) cross section

## NULL FLOW ADJUSTMENT

It is often desirable to adjust the null flow of a servo valve independently of other system parameters. Valves with mechanical null adjustment allow for at least  $\pm 10\%$  adjustment of null flow. The mechanical null adjustment is an eccentric bushing retainer pin, located above the tank port designation on the valve body, which if rotated provides control of the bushing location. Mechanical feedback elements position the spool relative to the valve body for a given input signal. Therefore, a movement of the bushing relative to the body changes the null flow.

### Mechanical Adjustment Procedure

With zero current (electrical connector disconnected). Using a  $3/8$  inch offset wrench, loosen the self-locking fitting until the null adjustor pin can be rotated. (This should usually be less than  $1/2$  turn). DO NOT remove the self-locking fitting. Insert a  $3/32$  inch Allen wrench in the null adjustor pin. Use the  $3/32$  Allen wrench to rotate the mechanical adjustor pin to obtain the desired null flow. Re-torque the self-locking fitting to 57 in lbs.



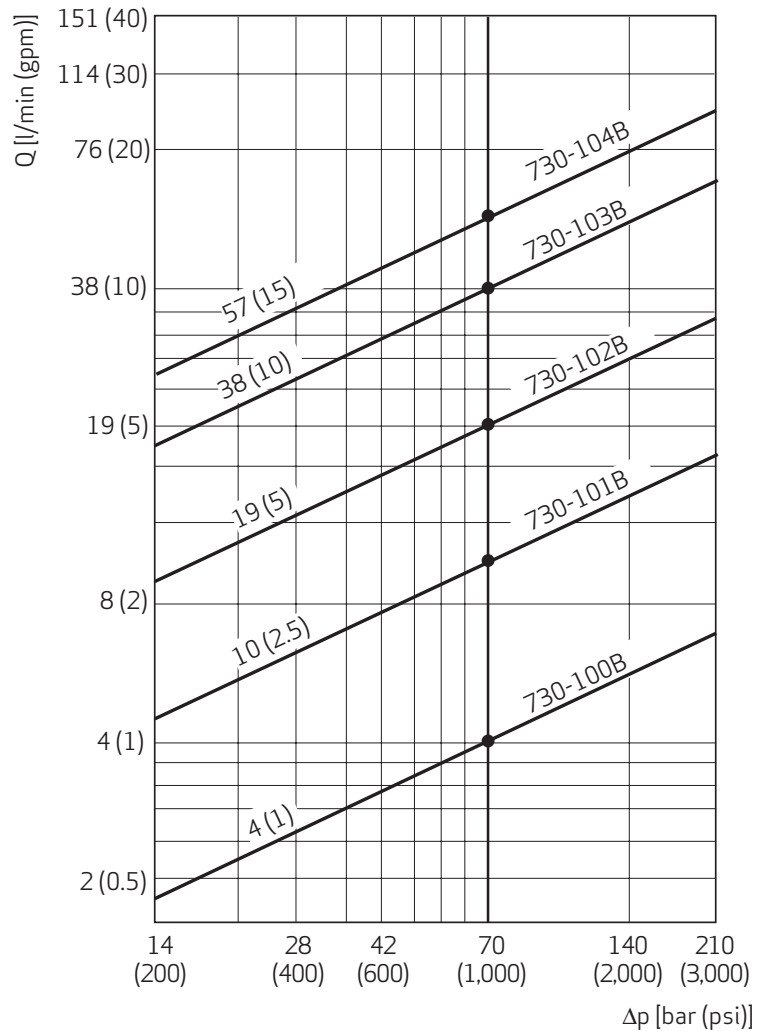
## FLOW CALCULATION

The actual flow is dependent upon the 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.

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

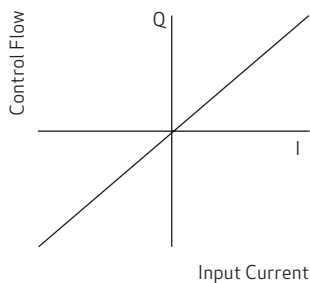
**Q** actual flow  
**Q<sub>N</sub>** rated flow  
**Δp** actual pressure drop per spool land  
**Δp<sub>N</sub>** rated pressure drop per spool land

**Flow Diagram**



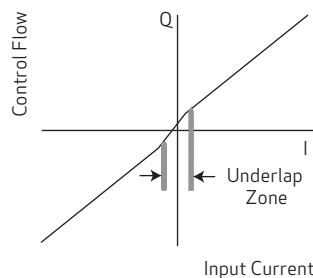
## NULL CUT OPTIONS

**Standard Axis Cut**



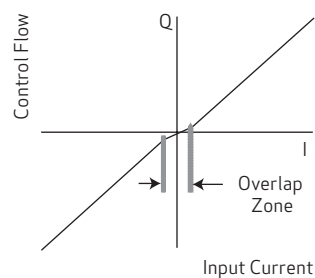
Default, without request for optional cuts

**Open Center Spool Valves**



Normally used in hydraulic motor applications

**Closed Center Spool Valves**

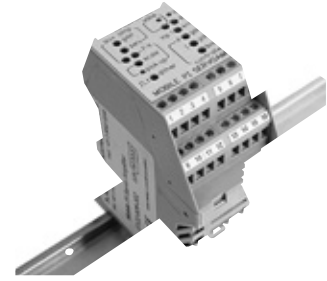


Normally used in failsafe applications

## 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 35 mm 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  $\geq$  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  $\geq$  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 14/11 (under ISO 4406:1987) or 17/14/11 (under ISO 4406: 1999).

For long life, the maximum levels per ISO 4406: 1987 and 1999 are 13/10 and 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, 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
- Electrolytic capacitors of the valve electronics may fatigue, possibly resulting in adverse effects on the valve electronics

#### Storage Time

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

#### Preservatives

If conservation is carried out, use only conservatives 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 +80 °C (-40 to +176 °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](http://www.moog.com/industrial/service).



## ACCESSORIES AND SPARE PARTS

### Series Dependent Accessories and Spare Parts

#### Accessories 730 Series

| Part designation            | Description   | Part number                     |
|-----------------------------|---|---------------------------------|
| Attachment screws<br>Metric | 4 required M8x40 long ISO 4762-10.9 tightening<br>Torque 11 Nm  | B64929-008B040                  |
| Attachment screws<br>Inch   | 5/16 - 18 UNC by 1.50 long tightening torque 8 lbf-in   | C66391-224B                     |
| Mating connector            | 4 pin electrical connector  | -49054F0145002S (MS3106F14S-2S) |
| Mounting manifold           | Base mounting manifold, four port   | -43586AM007                     |
| Flushing plate              | Manifold employed in place of valve when initially cleaning hydraulic fluids  | -23718-001K002                  |
| AMO manifold                | Adjustable metering orifice manifold used to bleed fluid between A and B<br>ports for better pressure control       | -65568AM002                     |
| CRV manifold                | Cross port relief manifold used to limit pressure levels in ports A and B   | -65711AM003-XXXX                |
| Safety manifold             | Sandwich manifold used to lock, extend and retract cylinder upon loss<br>of electrical signal or hydraulic pressure | B64377AMNNXXXX                  |

#### Spare Parts 730 Series

| Part designation                        | Description  | Material                  | Part number     |
|---|--|---------------------------|-----------------|
| Base O-ring for P, T, A<br>and B ports  | 4 required for P, T, A, and B ports 10.82 mm<br>(0.426 in) inside diameter x 1.8 mm (0.070 in)<br>cross section. Equivalent MIL-R-83248<br>size -018   | Fluorocarbon FKM 85 shore | -42082-022      |
| X port O-ring                           | 1 required for the X port 9.25 (0.364 in) x<br>1.8 mm (0.070 in) cross section. Equivalent<br>MIL-R-83248 size -012  |                           | -42082-013      |
| Replaceable filter<br>Field replaceable | 20 µm nominal  |                           | -22050K002      |
| Filter replacement kit                  | Contains the following:<br>2 pieces O-ring 5.3 mm (0.208 in) inside<br>diameter x 1.8 mm (0.070 in) cross section<br>Equivalent MIL-R-83248 size -009<br>2 pieces O-ring 4.1mm (0.161 in) inside<br>diameter x 1.8 mm (0.070 in) cross section<br>2 pieces O-ring 3.3mm (0.130 in) inside<br>diameter x 1.8 mm (0.070 in) cross section<br>2 pieces O-ring 1.8mm (0.070 in) inside<br>diameter x 1mm (0.040 in) cross section<br>1 pieces O-ring 9.2 mm (0.364 in) inside<br>diameter x 1.8 mm (0.070 in) cross section<br>Equivalent MIL-R-83248 size -012<br>1 pieces O-ring 23.5 mm (0.926 in) inside<br>diameter x 1.8 mm (0.070 in) cross section<br>Equivalent MIL-R-83248 size -021<br>1 piece filter tube, 60 mu absolute<br>1 piece filter cartridge, 20 mu nominal | Fluorocarbon FKM 85 shore | B52555RK012K001 |

#### Documents (not included in scope of delivery)

| Part designation | Description                    | Remark  | Part number |
|------------------|--------------------------------|---|-------------|
| Catalog          | 730 series general information | Note: Visit<br><a href="http://www.moog.com/industrial/literature">www.moog.com/industrial/literature</a><br>to download document | CDL6273     |
| Service manual   | 730 standard series            | Note: Visit<br><a href="http://www.moog.com/industrial/literature">www.moog.com/industrial/literature</a><br>to download document | CDS6106     |

# ORDERING CODE

Model number (assigned at the factory)

Type designation

|   |     |         |                              |  |  |  |  |  |  |  |  |  |  |  |
|---|-----|---------|------------------------------|--|--|--|--|--|--|--|--|--|--|--|
| 730   | -   |         |                              |  |  |  |  |  |  |  |  |  |  |  |
| Optional feature  |     |         |                              |  |  |  |  |  |  |  |  |  | 10 Signals for 100 % spool stroke          |  |
| Series specification  |     |         |                              |  |  |  |  |  |  |  |  |  | H ± 7.5 mA series                          |  |
| Model designation   |     |         |                              |  |  |  |  |  |  |  |  |  | L ± 20 mA series                           |  |
| Assigned at the factory                                     |     |         |                              |  |  |  |  |  |  |  |  |  |  |  |
| Factory Identification (Revision Level)                     |     |         |                              |  |  |  |  |  |  |  |  |  |  |  |
| 1 Valve version   |     |         |                              |  |  |  |  |  |  |  |  |  | 9 Valve connector                          |  |
| S Standard response   |     |         |                              |  |  |  |  |  |  |  |  |  | P Connector over P-side                    |  |
| H High response   |     |         |                              |  |  |  |  |  |  |  |  |  |  |  |
| 2 Rated flow in l/min (gpm)                                 |     |         |                              |  |  |  |  |  |  |  |  |  | 8 Seal material                            |  |
| For $\Delta p_N = 35$ bar (500 psi) per spool land          |     |         |                              |  |  |  |  |  |  |  |  |  | V Fluorocarbon (FKM) 85 Shore A            |  |
| 04  | 4.0 | (1.0)   |                              |  |  |  |  |  |  |  |  |  | 7 Pilot connections                        |  |
| 10  | 10  | (2.5)   |                              |  |  |  |  |  |  |  |  |  | 4 Internal                                 |  |
| 19  | 19  | (5.0)   |                              |  |  |  |  |  |  |  |  |  | 5 External                                 |  |
| 38  | 38  | (10.0)  |                              |  |  |  |  |  |  |  |  |  |  |  |
| 57  | 57  | (15.0)  |                              |  |  |  |  |  |  |  |  |  |  |  |
| 3 Maximum operating pressure in bar (psi) and body material |     |         |                              |  |  |  |  |  |  |  |  |  | 6 Spool position without electrical signal |  |
| F   | 210 | (3,000) | aluminum                     |  |  |  |  |  |  |  |  |  | M Mid position                             |  |
| K   | 350 | (5,000) | steel                        |  |  |  |  |  |  |  |  |  |  |  |
| Q   | 550 | (8,000) | steel, with dropping orifice |  |  |  |  |  |  |  |  |  |  |  |
| 4 Bushing/spool design                                      |     |         |                              |  |  |  |  |  |  |  |  |  | 5 Pilot stage design                       |  |
| O 4-way/axis cut/linear                                     |     |         |                              |  |  |  |  |  |  |  |  |  | F Low flow, nozzle-flapper,                |  |
| D 4-way/±10 % overlap/linear                                |     |         |                              |  |  |  |  |  |  |  |  |  | G High flow, nozzle-flapper,               |  |

## Preferred Models

| Model Number | Type Designation | Rated Signal (single coil) | Rated Flow         | Coil Resistance | Maximum Operating Pressure |
|--------------|------------------|----------------------------|--------------------|-----------------|----------------------------|
| -730-100B    | H04FOFM4VPH      | +/- 15 mA                  | 4 l/min (1 gpm)    | 200 ohms        | 210 bar (3000 psi)         |
| -730-230B    | H04FOGM4VPL      | +/- 40 mA                  | 4 l/min (1 gpm)    | 80 ohms         | 210 bar (3000 psi)         |
| -730-101B    | H10FOFM4VPH      | +/- 15 mA                  | 10 l/min (2.5 gpm) | 200 ohms        | 210 bar (3000 psi)         |
| -730-231B    | H10FOGM4NPL      | +/- 40 mA                  | 10 l/min (2.5 gpm) | 80 ohms         | 210 bar (3000 psi)         |
| -730-102B    | H19FOFM4VPHN     | +/- 15 mA                  | 19 l/min (5 gpm)   | 200 ohms        | 210 bar (3000 psi)         |
| -730-232B    | H19FOGM4VPL      | +/- 40 mA                  | 19 l/min (5 gpm)   | 80 ohms         | 210 bar (3000 psi)         |
| -730-103B    | H38FOFM4VPH      | +/- 15 mA                  | 38 l/min (10 gpm)  | 200 ohms        | 210 bar (3000 psi)         |
| -730-233B    | H38FOGM4VPL      | +/- 40 mA                  | 38 l/min (10 gpm)  | 80 ohms         | 210 bar (3000 psi)         |
| -730-104B    | S57FOFM4NPL      | +/- 40 mA                  | 57 l/min (15 gpm)  | 80 ohms         | 210 bar (3000 psi)         |

# 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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730 Series Flow Control Servo Valves  
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