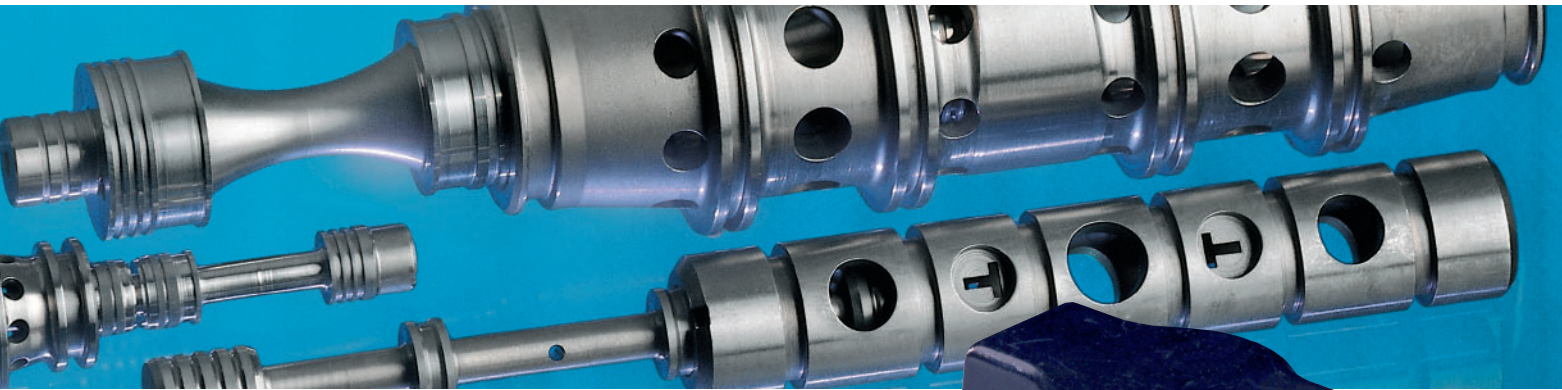


# MOOG

**760 Series  
Servovalves  
ISO 10372 Size 04**



## 760 SERIES TWO STAGE SERVOVALVES

### 760 SERIES SERVOVALVES

The 760 Series flow control servovalves are throttle valves for 3-, and preferably 4-way applications. They are a high performance, two-stage design that covers the range of rated flows from 1 to 15 gpm at 1000 psi valve drop. The output stage is a closed center, four-way, sliding spool. The pilot stage is a symmetrical double-nozzle and flapper, driven by a double air gap, dry torque motor. Mechanical feedback of 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 and, with constant pressure drop across the valve, flow to the load is proportional to the spool position.

### VALVE FEATURES

- > 2-stage design with dry torque motor
- > Low friction double nozzle pilot stage
- > High spool control forces
- > High dynamics
- > Rugged, long-life design
- > High resolution, low hysteresis
- > Completely set-up at the factory
- > Optional fifth port for separate pilot supply
- > Intrinsically safe or flameproof valve versions are available

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] = calculated flow
- Q<sub>N</sub> [gpm] = rated flow
- Δp [psi] = actual valve pressure drop
- Δp<sub>N</sub> [psi] = rated valve pressure drop



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



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



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

**760 SERIES  
GENERAL TECHNICAL DATA**

**Operating Pressure\***

ports P, X, A and B up to 3,000 psi  
port T up to 3,000 psi

**Temperature Range**

Fluid -20°F to 275°F  
Ambient -20°F to 275°F

**Seal Material**

Viton\*\*

**Operating Fluid**

Compatible with common hydraulic fluids, other fluids on request.

Recommended viscosity 60 – 450 SUS @ 100°F

**System Filtration:** High pressure filter (without bypass, but with dirt alarm) mounted in the main flow and, if possible, directly upstream of the valve. Refer to Moog filtration catalog for recommended filtration scheme.

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

**Recommended Cleanliness Class**

For normal operation ISO 4406 < 14/11  
For longer life ISO 4406 < 13/10

**Filter Rating** recommended

For normal operation  $\beta_{10} \geq 75$  (10  $\mu$ m absolute)  
For longer life  $\beta_5 \geq 75$  (5  $\mu$ m absolute)

**Installation Operations**

Any position, fixed or movable.  
30 g, 3 axes

**Vibration**

1.13 lb (1.91 lb for steel body)

**Weight**

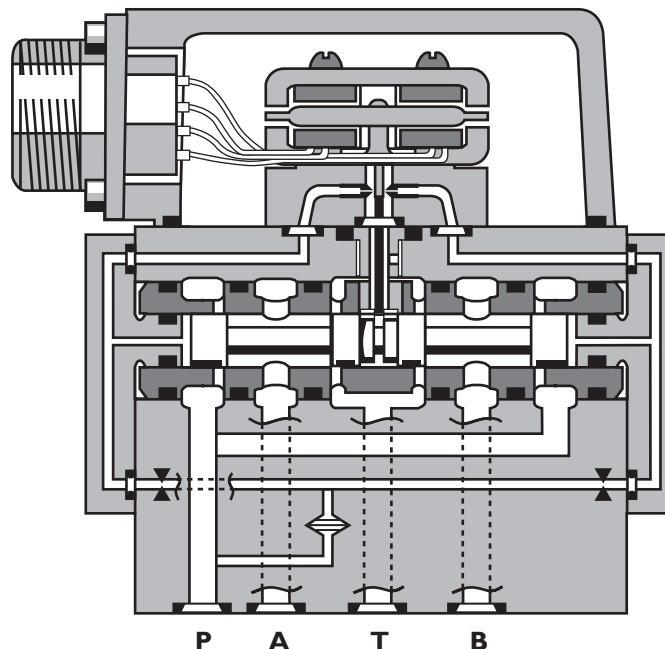
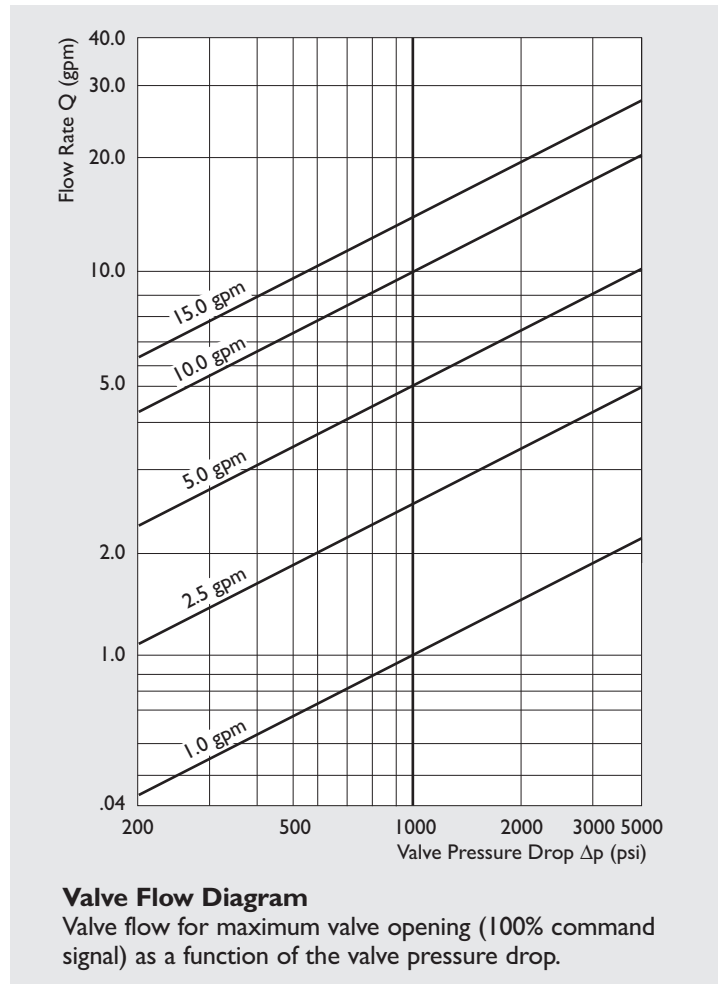
**Degree of Protection**

EN60529P: class IP65, with mating connector mounted.  
Delivered with an oil sealed shipping plate.

**Shipping Plate**

\* Maximum special order is 8,000 psi

\*\* Other seal material upon request



**760 SERIES  
TECHNICAL DATA**

**Model...Type**  
**Mounting Pattern**  
**Valve Body Version**

**760-.....**

ISO 10372 - 04 - 04 - 0 - 92

4-way

2-stage with spool-bushing assembly  
Nozzle/Flapper, Highflow

**Pilot Stage**  
**Pilot Connection** Optional, Internal or External  
**Rated Flow** ( $\pm 10\%$ ) at  $\Delta p_N = 1,000$  psi

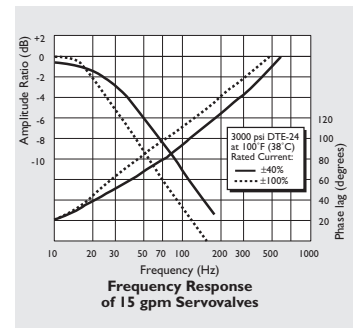
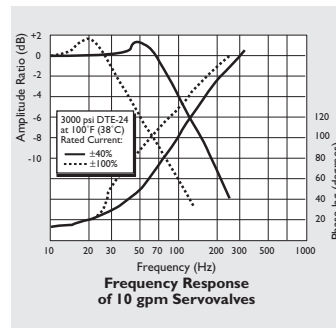
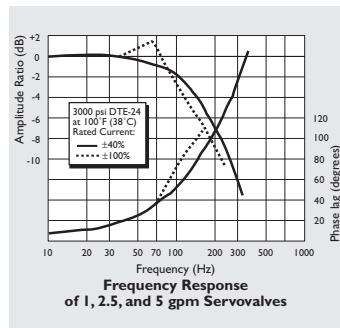
X

|                     |                             |                    |     |     |              |      |
|---------------------|-----------------------------|--------------------|-----|-----|--------------|------|
| Standard            | [gpm]                       | 1.0                | 2.5 | 5.0 | 10.0         | 15.0 |
| High Response       | [gpm]                       | 1.0                | 2.5 | 5.0 | 10.0         | 15.0 |
| Standard            | [ms]                        | 6                  | 6   | 6   | 10           | 16   |
| High Response       | [ms]                        | 4                  | 4   | 4   | 7            | 13   |
| Threshold*          | [%]                         |                    |     |     | 0.5          |      |
| Hysteresis*         | [%]                         |                    |     |     | 3.0          |      |
| Null Shift          | at $\Delta T = 100^\circ F$ | [%]                |     |     | < 2.0        |      |
| Null Leakage Flow*  | max.                        | [gpm]              |     |     | 0.40 to 0.61 |      |
| Pilot Leakage Flow* | max.                        | [gpm]              |     |     | 0.26         |      |
| Spool Drive Area    | Standard                    | [in <sup>2</sup> ] |     |     | .076         |      |
|                     | High Response               | [in <sup>2</sup> ] |     |     | .053         |      |
|                     | Super High Response         | [in <sup>2</sup> ] |     |     | .025         |      |

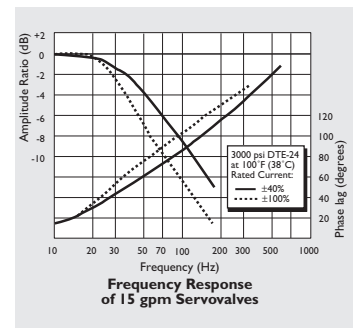
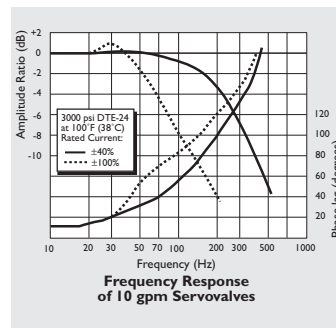
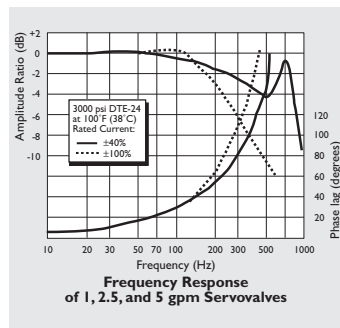
\* Measured at 3,000 psi pilot or operating pressure

**Typical Characteristic Curves** with  $\pm 40\%$  and  $\pm 100\%$  input signal, measured at 3,000 psi pilot or operating pressure.

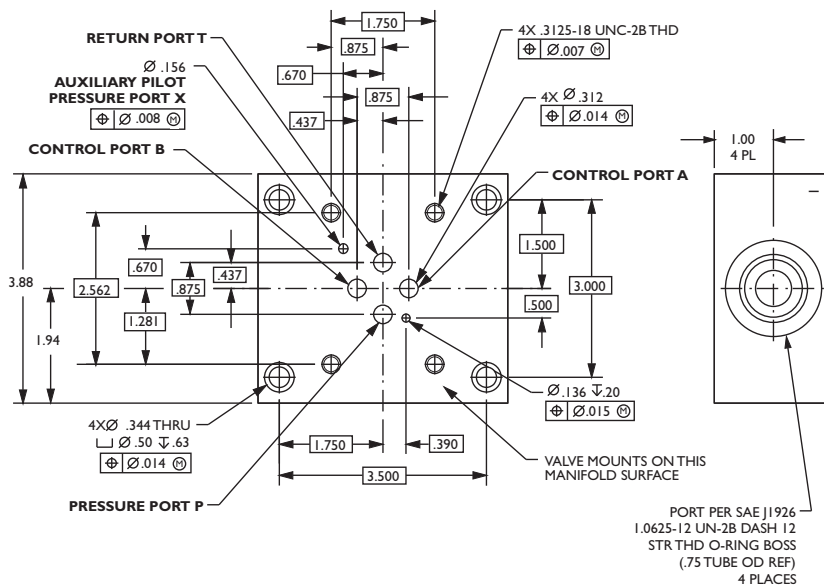
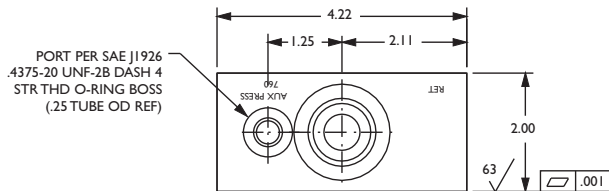
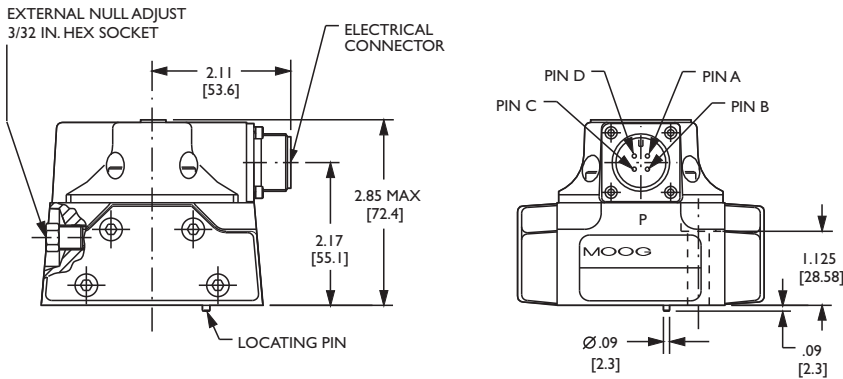
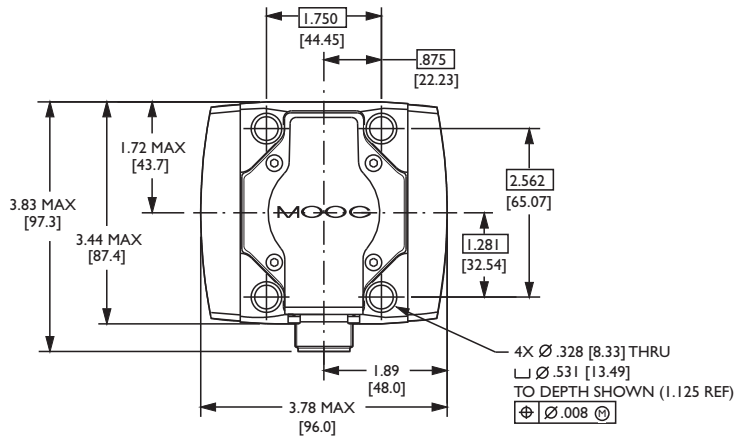
**Standard Valves**



**High and Super High Response Valves**



# 760 SERIES INSTALLATION DRAWINGS



The mounting manifold must conform to ISO 10372-04-04-0-92. Surface to which valve is mounted requires a  $\sqrt{32}$  [ΔΔ] finish, flat within 0.001 [0.03] TIR.

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

For external null adjust: Flow out of Port B will increase with clockwise rotation of null adjust (3/32 hex key)

Flow bias is continually varied for a given port as the null adjust is rotated.

# 760 SERIES ELECTRICAL CONNECTIONS

## Rated current and coil resistance

A variety of coils are available for 760 Series Servovalves, which offer a wide choice of rated current. See Table I.

## Coil connections

A four-pin electrical connector (that mates with an MS3106/14S/2S) is standard. All four torque motor leads are available at the connector so external connections can be made for series, parallel, or differential operation.

760 Series Servovalves can be supplied on special order with other connectors or a pigtail.

## Servoamplifier

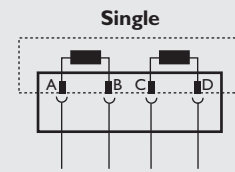
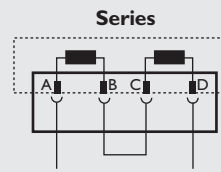
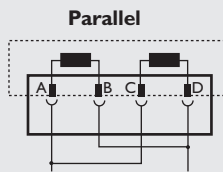
The servovalve responds to input current, so a servoamplifier that has high internal impedance (as obtained with current feedback) should be used. This will reduce the effects of coil inductance and will minimize changes due to coil resistance variations.

## ELECTRICAL CONNECTIONS

(Examples with typical 760 series coils)

Connector: MIL-C-5015/14S-2S

|                              |              |  |
|------------------------------|--------------|--|
| Coil Resistance              | [ $\Omega$ ] | 100  |
| Rated Current                | [mA]         | $\pm 15$   |
| Inductance                   | [H]          | 0.59   |
| Electrical Power             | [W]          | .023   |
| Connectors for Valve Opening |              | A and C (+)<br>P $\blacktriangleright$ B, A $\blacktriangleright$ T<br>B and D (-) |



|                              |                                   |                                 |
|------------------------------|-----------------------------------|---------------------------------|
| Coil Resistance              | 400                               | 200                             |
| Rated Current                | $\pm 7.5$                         | $\pm 15$                        |
| Inductance                   | 2.20                              | .72                             |
| Electrical Power             | .023                              | .045                            |
| Connectors for Valve Opening | A (+), D (-)<br>B and C connected | A (+), B (-)<br>or C (+), D (-) |

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

TABLE I

| Nominal Resistance Per Coil at 77°F (25°C) $\Omega$ | Recommended Rated Current—mA                    |              | Approximate Coil Inductance*—Henrys |              |                |
|---|---|--------------|-------------------------------------|--------------|----------------|
|   | Parallel, Differential or Single Coil Operation | Series Coils | Single Coils                        | Series Coils | Parallel Coils |
| 80  | $\pm 40$  | $\pm 20$     | 0.22                                | 0.66         | 0.18           |
| 200   | $\pm 15$  | $\pm 7.5$    | 0.72                                | 2.20         | 0.59           |
| 1000  | $\pm 8$   | $\pm 4$      | 3.20                                | 9.70         | 2.60           |

\* Measured at 50 Hz

# 760 SERIES ORDERING INFORMATION SPARE PARTS AND ACCESSORIES

## Model Number

760 . . . . .

## Type Designation

. . . . .

| Optional Feature |                      |
|------------------|----------------------|
|                  | Series specification |
| <b>K</b>         | Intrinsically safe   |
| <b>N</b>         | Flameproof           |

| Model Designation |                         |
|-------------------|-------------------------|
|                   | Assigned at the factory |

| Factory Identification (Revision Level) |  |
|---|--|
|   |  |

| Valve Version |                     |
|---------------|---------------------|
| <b>S</b>      | Standard response   |
| <b>H</b>      | High response       |
| <b>V</b>      | Super high response |

| Rated Flow |   |               |
|------------|---|---------------|
|            | Q <sub>v</sub> [gpm] at Δp <sub>v</sub> = 1,000 psi |               |
|            | Standard  | High Response |
| <b>04</b>  | 1   | 1             |
| <b>10</b>  | 2.5   | 2.5           |
| <b>19</b>  | 5.0   | 5.0           |
| <b>38</b>  | 10.0  | 10.0          |
| <b>57</b>  | 15.0  | 15.0          |

| Maximum Operating Pressure p <sub>p</sub> and Body Material |                    |
|---|--------------------|
| <b>F</b>  | 3,000 psi aluminum |
| <b>K</b>  | 5,000 psi steel    |
| <b>Q</b>  | 8,000 psi steel    |

| Main Spool Type |  |
|-----------------|--|
| <b>O</b>        | 4-way / axis cut / linear  |
| <b>A</b>        | 4-way / < +/-3% overlap - critical lap / linear                  |
| <b>D</b>        | 4-way / +/-10% overlap / linear                                  |
| <b>M</b>        | 4-way / axis cut p <sub>c</sub> > 80% of p <sub>p</sub> / linear |

| Signals for 100% Spool Stroke |                                  |
|-------------------------------|----------------------------------|
| <b>4</b>                      | ±4 mA series                     |
| <b>H</b>                      | ±7.5 mA series                   |
| <b>L</b>                      | ±20 mA series                    |
| <b>N</b>                      | ±30 mA series                    |
| <b>Z</b>                      | ±100 mA series                   |
| <b>Y</b>                      | Special signal (see spec. sheet) |

| Valve Connector |  |
|-----------------|--|
| <b>A</b>        | 4-G (CA 02 COM) connector C1 (A) – side (RH) |
| <b>B</b>        | 4-G (CA 02 COM) connector C2 (B) – side (LH) |
| <b>P</b>        | 4-G (CA 02 COM) connector P – side           |
| <b>T</b>        | 4-G (CA 02 COM) connector R (T) – side       |

| Seal Material |                   |
|---------------|-------------------|
| <b>V</b>      | Fluorocarbon      |
| <b>N</b>      | NBR               |
|               | Others on request |

| Pilot Connections and Pressure |                |          |
|--------------------------------|----------------|----------|
|                                | Pressure [psi] | Supply   |
| <b>A</b>                       | 250 to 3,000   | internal |
| <b>C</b>                       | 250 to 3,000   | external |
| <b>J</b>                       | 250 to 5,000   | internal |
| <b>L</b>                       | 250 to 5,000   | external |

| Spool Position without Electrical Signal |              |
|--|--------------|
| <b>M</b>                                 | Mid position |

| Pilot Stage |                   |
|-------------|-------------------|
| <b>F</b>    | Standard dynamics |
| <b>G</b>    | Improved dynamics |

Preferred configurations highlighted.  
All combinations may not be available.  
Options may increase price and delivery.  
Technical changes are reserved.

## SPARE PARTS AND ACCESSORIES

|   |                                  |           |
|---|----------------------------------|-----------|
| O-Rings (included in delivery),<br>for P,T,A and B            | FPM 85 Shore<br>ID 0.426 x 0.070 | 42082-022 |
| for X   | ID 0.364 x 0.070                 | 42082-013 |
| Mating Connector, waterproof IP 65 (not included in delivery) | P/N 49054F14S2S (MS3106F14S2S)   |           |
| Flushing Block  | P/N 55124                        |           |

|   |                 |
|---|-----------------|
| Mounting Bolts (not included in delivery)<br>5/16 - 18 NC x 1-3/4 long (4 pieces) | P/N A31324-228B |
| Replaceable Filter  | P/N A01713-1    |
| Field Replaceable Filter Kit  | B52555RK4K1     |



|           |            |
|-----------|------------|
| Australia | Mulgrave   |
| Brazil    | São Paulo  |
| China     | Hong Kong  |
|           | Shanghai   |
| Denmark   | Copenhagen |
| England   | Tewkesbury |
| Finland   | Espoo      |
| France    | Rungis     |



|             |                 |
|-------------|-----------------|
| Germany     | Böblingen       |
| India       | Bangalore       |
| Ireland     | Ringaskiddy     |
| Italy       | Brescia         |
|             | Malnate         |
| Japan       | Hiratsuka       |
| Korea       | Seoul           |
| Luxembourg  | Luxembourg City |
| Philippines | Baguio          |
| Singapore   | Singapore       |
| Spain       | Orio            |
| Sweden      | Askim           |
| USA         | East Aurora     |

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