FP06P, FP10P and FP12P SERIES SOLENOID VALVES

1.0 General
The FP06P, FP10P and FP12P direct acting solenoid valves are available as three way, two-position, balanced, normally universal, and with 1/4” NPT ports. The body and solenoid housing are 316L stainless steel. Standard valves are fitted with Viton seals, uni-directional surge suppression diode, and with an M20 x 1.5p cable entry thread. Options include: seals to suit particular applications, compliance with NACE, manual override, manual reset, fast response diodes, 3/8” and 1/2” NPT ports, BSP ports, 1/2” NPT cable entry thread, and mounting bracket kits.

2.0 Installation

2.1 Valve Identification Markings
The solenoid valve housing lid has a label fitted that shows the model code number, unique serial number, certification details, voltage and power consumption, and the maximum working pressure. The valve body also has the same unique serial number marking. Exchanging lids or solenoid housings from one solenoid valve assembly to another should be avoided since this may affect the performance of the assembly and will invalidate the certification.

2.2 Operating Media, Cleanliness, and Environmental Limitations
Different seal types are fitted within the valves to suit specific applications, temperatures, and the operating medium. The certification label fitted on the solenoid lid has a model code which will define the seal types fitted. Consideration must be taken by the installer/operator regarding filtration of the operating media. For air or gas applications, filtration to 40 microns is required. Before installation, the media piping system must be depressurised and cleaned of contamination. Humidity level up to 100% is acceptable down to 5°C ambient. Zero moisture is required to avoid freezing of internal components below 5°C. The valve should not be pressurised above 20 bar since excessive pressure may affect the safety function of the valve.
2.3 Connecting the Valve
Selection, installation, operation, and maintenance must only be carried out by qualified, trained, authorised, and competent personnel in accordance with the relevant codes, rules, and regulations. Good engineering practice must be carried out during installation, operation, and maintenance.

The flow direction and pipe connection are shown on the valve body. The valve ports are thread milled and should offer leak tight joints. If additional sealing methods are used, care must be taken to ensure there is no ingress of these sealing materials into the valve. Bifold Fluidpower strongly recommends that tube fittings are sealed into the ports using thread sealant. Loctite 577 or equivalent, and that PTFE tape is not used. To avoid damage to the equipment, do not over tighten pipe connections.

The solenoid assembly may be mounted in any position. The valve body is supplied with four M6 thread mounting holes. These threads may be used in conjunction with spacers, studding and nuts to position the valve onto a back plate or to the equipment. The valve may be attached onto the equipment via the valve body to allow the solenoid housing to be positioned to suit the cable routing. The solenoid housing can be rotated by loosening four screws (see figure) and rotating the solenoid housing to the required position. Ensure that the four screws are re-tightened before operating the valve.

If solenoid housing type is the EExd or explosion proof, sufficient clearance must be allowed for between the solenoid lid “Flame Path” and other solenoid lids, back plates or other equipment. See clause 4.0, Hazardous (Classified) Locations. Leave sufficient clearance below the valve to allow for servicing.

2.4 Electrical
The electrical supply must be de-energised and isolated as appropriate whilst the solenoid valves are installed and maintained.

The solenoid housing is provided with a two way terminal block. The terminals are not polarised for standard direct current voltages below 48Vdc. The positive and negative wires may be connected to either terminal on solenoids rated up to 48Vdc. The terminals of solenoids above 48Vdc are polarised and the positive wire must be connected to the red terminal block, and the negative wire must be connected to the black terminal block. The terminal block conductor acceptance range is 0.5 mm2 to 2.5 mm2 with a solid conductor, and 0.5mm2 to 1.5mm2 with a stranded conductor. The cable conductors must be fitted into the terminal block taking into consideration the conductor stripping lengths and terminal tightening torques. Do not leave any debris such as cable strippings, inside the solenoid housing. When wiring the solenoid, run the cable/conductors around the internal bore of the solenoid housing to avoid contact with override and reset operating components.
Under no circumstances should the cover or gland plug be removed for any length of time prior to wiring. Foreign objects such as debris or water may damage the solenoid internally.
The solenoid housing is provided with integral internal and external earth/ground terminals.
Select the appropriate cable entry gland, scaling fitting etc. to suit to the cable construction, applicable certification requirement, installation rules and regulations. Ingress Protection (IP) to EN/IEC 60529, IP66 and/or NEMA 4, 4X should be maintained as appropriate and/or as applicable.
The design of the solenoid ensures low temperature rise and negates the requirement for special high temperature cables to be fitted. The solenoid does not have a requirement that a waiting period is necessary before opening of the solenoid lid after it has been de-energised. The restrictions regarding opening of the solenoid enclosure lid apply as required by the relevant codes of practice, e.g. hot work permit, gas free permit, isolate elsewhere before opening etc…
Switching off a solenoid inductive coil may generate a voltage spike of hundreds of volts. These voltage spikes may damage solid state devices or generate electromagnetic interference into adjacent circuits. Most system specifications require the suppression of voltage spikes that result from inductive discharge.
The standard solenoid valves are fitted as standard with a bi-directional voltage dependant resistor to eliminate voltage spikes in solenoids up to 120Vdc only. The LE option solenoid is fitted with a uni-directional surge suppression diode, and is polarity conscious. Solenoids suitable for AC currents do not use surge suppression devices fitted to the terminal block. For particular applications, a fast acting diode can be supplied to improve system response time. Alternatively a bi-directional transient suppression diode can be fitted to eliminate the requirement for polarising the supply. If solenoid type is the EExem option, See clause 4, special conditions of safe use, ‘X’.

2.5 Line Monitoring
The installation of a line monitoring circuit will reduce the net force available for spring return of a solenoid valve and thus reduce the safety factor for a safe shutdown. Special valve options are available with increased voltage line monitoring on request from Bifold Fluidpower.
2.6 Testing After Installation or Maintenance
Before pressurising the valve, first check the correct operation of the valve. Energise the solenoid a few times testing for the “click” as the valve switches. The valve should energise at 15% below nominal voltage. The valve should de-energise at greater than 12.5% or nominal. A complete function test of the emergency shutdown solenoid valve is essential after all maintenance work is completed.

2.7 Flow performance
The flow performance will depend on the operation pressure, operating media, differential pressure, temperature, and solenoid type. Any reduction in pipe of fitting sizes e.g. 1/2" to 3/8" NPT, will affect the valve flow performance.

2.8 Manual Override Options
The Manual Override and Manual Reset operators are designed to push downwards onto the solenoid armature to manually operate the valve. Manual Override and Manuel Reset assemblies push the armature downwards onto coil holder to move the valve into the energised position. The Manual Override and Manual Resets versions are not detented and will automatically spring return when released. The coil winding on the Manual Reset version has a 2 watt power consumption. The valve will not move to the energised condition when the solenoid coil is energised until the Manual Reset assembly moves the armature into the magnetic field of the coil.
Manual Override operators are fitted with a black plastic button cover marked “OVERRIDE”. Manual Reset versions are fitted with a red plastic button cover marked “RESET”.

3.0 Maintenance
A solenoid valve used in an emergency shutdown system is a safety critical item. Maintenance not carried out by Bifold Fluidpower personnel may compromise the function and Safety Integrity Level on the valve and invalidate the warranty and certification.
The operating media must be de-pressurised and secured against re-activation before carrying out any maintenance.
The restrictions regarding opening of the solenoid enclosure lid apply as required by the relevant codes of practice, e.g. hot work permit, gas free permit, isolate elsewhere before opening etc.

3.1 Inspection and Cleaning
Periodic cleaning is recommended for the valves. The extent and duration of this maintenance will depend upon the application, environment, operating media, and cleanliness of the operating media. If, after inspection of valve components, wear or damage is shown, Bifold Fluidpower offers valve component spares and sealing kits for these applications. Please contact Bifold Fluidpower for assistance.
3.2 Servicing the Valve elements
For maintenance purposes, the valve can be serviced without removal from the pipe work or equipment by removing the end cap. The valve internal components can then be withdrawn for servicing.
1) Disconnect and Isolate the electrical supply to the solenoid and drain all media operating pressure.
2) Remove the two screws (Item 1) and pull out the end cap (Item 2).
3) Remove the stem assembly, (Item 3).
4) Remove the spring and two O ring seals from the end cap (Items 2).
5) Remove the two exposed O ring seals from the stem assembly (Item 3).
6) Unscrew the stem assembly and remove the two captive O ring seals.
7) Clean all metal components.
8) Lubricate all seals with a high quality silicone grease (Magnalube G)
9) Fit two new captive O ring seals into the Poppet seat and refit the two poppet stem components.
10) Fit two new O ring seals to the stem assembly.
11) Fit new O ring seals to the end cap (Item 2).
12) Fit a (new) spring (if necessary) into the end cap (Item 2).
13) Refit the stem assembly into the valve body.
   Note that the stem assembly will only fit one way.
14) Refit the End Cap (Item 2) and refit the two screws (Item 1).

3.3 Adjustment of the Manual Override
The plunger stroke can be adjusted by releasing the lock nut and adjusting the screw.
3.4 Armature Setting
A solenoid valve used in an emergency shutdown system is a safety critical item. Maintenance not carried out by Bifold Fluidpower personnel may compromise the safety function on the valve and invalidate the warranty and safety certification. Due to the fine adjustments required in the set-up of the solenoid, we do not recommend that any service work is carried out on the adjustment of the operator stroke by untrained personnel. We strongly recommend that valves are returned to Bifold Fluidpower as required. Please contact Bifold Fluidpower for assistance if adjustment of the solenoid armature stroke is required. The stroke is adjusted via the lock nut (Item 4) and adjuster screw (Item 5).

- Release the lock nut (Item 4) and unscrew the adjuster screw (Item 5) by two to three turns.
- Energise the solenoid and push the armature downwards until it contacts the coil holder.
- The armature should be locked onto the coil holder with the magnetic force.
- Apply a media supply of up to 10 Bar g. on to port number 1 and place a blanking plug into port number 2.
- Slowly adjust the screw downwards until the media bleeds out of port 3 and continue adjusting until the media stops bleeding from port 3.
- Tighten the lock nut ensuring the adjusting screw does not move.

Test the valve function by operating the valve with up to 10 Bar g. on port 1 and an electrical supply 15% below the nominal voltage shown on the solenoid valve label. Further adjustments may be required if the valve fails to “pull in” at the minimum voltage.

4.0 Hazardous (Classified) Locations
Products must be selected, installed, operated and maintained in accordance with the relevant Standards, Codes, Rules, Regulations and Recommended Practices as applicable.

For further information on the design, selection and installation of equipment for use in hazardous areas (classified locations) see:-
- IEC 60079-14 - Electrical installations in hazardous areas (other than mines)
- If the solenoid type is the EEExd or explosionproof option, IEC 60079-14 and the NEC code state a minimum distance requirement around the solenoid enclosure and lid flame path joint as follows:
  - Gas Group IIA, 10mm, Gas Group IIB, 30mm, Gas Group IIC, 40mm.
- If the solenoid type is an EEExemb option, the supply circuit must be protected by a 1500 Amp capable fuse.
- IEC 61892-7 - Mobile and fixed offshore units - Electrical installation, Part 7:
  - Hazardous areas
    - IEC 612141-1-2 - Electrical apparatus in the presence of combustible dust. Part 1-2: Electrical apparatus protected by enclosures and surface temperature
    - EN 60079-14 - Electrical installations in hazardous areas (other than mines)
- EN 50281-1-2 - Electrical apparatus for use in the presence of combustible dust – Part 1 - 2. Electrical apparatus protected by enclosures - selection, installation and maintenance
- ATEX 137 Directive 99/92/EC. The Directive covers the use of equipment in potentially explosive atmospheres and its aim is to establish minimum requirements for improving the safety and health of workers.
- NEC, NFPA 70, National Electric Code
- ANSI/API RP 14F – Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class 1, Division 1, and Division 2 Locations.
- ANSI/API RP 14FZ – Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class 1, Zone 0, Zone 1, and Zone 2 Locations.
- The applicable requirements of the Classification Society such as ABS, DNV, Lloyds, and/or Authorities Having Jurisdiction (AHJ), such as OSHA, USCG etc need also to be taken into consideration.
- For information regarding the installation and maintenance of equipment for use in hazardous areas see:- IEC 60079-17 - Inspection and maintenance of electrical installations in hazardous areas (other than mines) IEC 61241-17 - Electrical apparatus for use in the presence of combustible dust atmosphere - Part 17: Inspection and maintenance.

Other Directives that may be applicable include:
- Electromagnetic Compatibility, EMC 89/336/EC, as amended.
- Pressure Equipment Directive, PED, 97/23/EC, as amended

5.0 Bifold Fluidpower certification for the FP06P, FP10P and FP12P Solenoid Valve series includes:
ATEX Ex II 2 GD, EExd IIIC, T6 (T5, T4), 85 Deg C
ATEX Ex II 2 GD, EExemb, II T3
CSA, (C,US), Class 1, Division 1, Group B, C, and D
CSA, (C,US), Class 1, Zone 1, AExd IIIC T6
Inmetro/CEPEL, BR-Exd IIIC T6 (T5, T4)
SAA Exd IIIC T6 (T5, T4)
GOST 1 Exd IIIC T6 (T5, T4)
The certification label fitted on the solenoid housing will state the certification for the assembly. The relevant certificate will state any limitations or conditions of use ‘X’.

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Initial</th>
<th>Detail of Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>03/05</td>
<td>MTD</td>
<td>Released for customer use</td>
</tr>
<tr>
<td>1</td>
<td>10/09</td>
<td>RB</td>
<td>ADDITION OF STORAGE NOTE PAGE 3 AND DC VOLTAGE POLARITY CLARIFICATION</td>
</tr>
</tbody>
</table>