



F50 Flow Switch

Instruction Manual and Parts List

Description

F50 Flow Switches are utilized, in horizontal lines, to sense the start or stop of liquid flow in oil, chemical, gas, and water lines.

Principle of operation

The rate of flow through the valve body raises or lowers the disc. This in turn raises or lowers the magnetic sleeve, within its sealed non-magnetic enclosing tube. On an increasing flow rate, the magnetic sleeve rises into the field of the permanent magnet, located outside the enclosing tube, actuating the attached switch mechanism. When the flow rate drops, below the rate for which the flow disc is calibrated, a reversal of this action occurs.

Operating cycle

On an increasing flow rate, the flow disc moves the attraction sleeve up within the field of a switch magnet, drawing it in tightly to the enclosing tube. This causes the switch to make or break an electrical circuit. When the flow rate drops, below the rate for which the flow disc is calibrated, the attraction sleeve is pulled downward until, at a predetermined low flow rate, the switch magnet releases and swings outward, away from the enclosing tube, causing a reversal of the switching action.

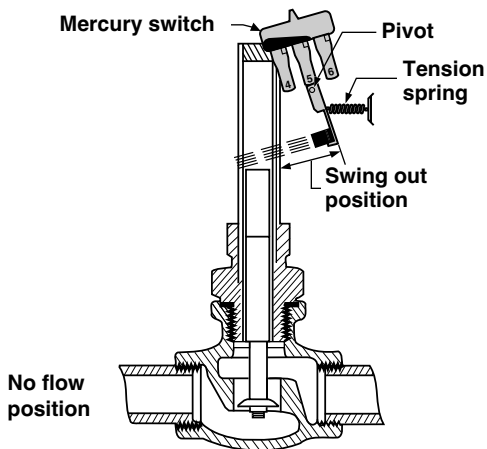


Figure 1

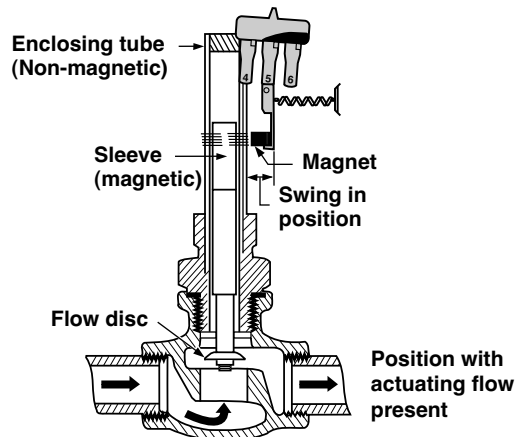


Figure 2

GENERAL INFORMATION

Unpacking

Unpack the instrument carefully, inspecting all components for damage. Report any concealed damage to the carrier within 24 hours. Check the contents of the carton/crate against those listed on the packing slip, and report any discrepancy to the factory. Check the part number on the nameplate to be certain it agrees with the part number shown on the packing slip and purchase order. Record the serial number for future reference when ordering parts.

Agency approvals

Agency	Approval	Models
FM	Non-Hazardous NEMA 4X	All models with an electric switch mechanism and a housing listed as NEMA 4X.
	Class I, Div. 1, Groups C & D Class II, Div. 1, Groups E, F & G	All models with an electric switch mechanism and a housing listed as NEMA 4X/7/9.
	Class I, Div. 1, Groups A, B, C & D Class II, Div. 1, Groups E, F & G	All models with an electric switch mechanism and a housing listed as NEMA 4X/7/9 Class I, Div. 1, Group B.
CSA	Non-Hazardous CSA TYPE 4X	All models with a Series B, C or D electric switch mechanism and a housing listed as CSA TYPE 4X.
	Class I, Div. 2 Groups A, B, C & D	All models with a Series A, E, 2 or 3 electric switch mechanism and a housing listed as CSA TYPE 4X.
	Class I, Div. 1, Groups C & D Class II, Div. 1, Groups E, F & G	All models with an electric switch mechanism and a housing listed as NEMA 4X/7/9.
	Class I, Div. 1, Groups B, C & D Class II, Div. 1, Groups E, F & G	All models with an electric switch mechanism and a housing listed as NEMA 4X/7/9 Class I, Div. 1, Group B.
Cenelec	EEx d IIC T6	All models with an electric switch mechanism and a Cenelec housing.
Baseefa	Ex d IIC T6	All models with an electric switch mechanism and a Baseefa housing.
SAA	Ex d IIC T6 1P65	All models with Series A, B, C, D or E electric switch mechanism and a housing listed as NEMA 4X/7/9 Class I, Div. 1, Group B.

Specific gravity correction

To determine the actuating flow rates for liquids, other than water (approximate viscosity of 20 centistokes or less), a specific gravity correction factor must be applied to the water flow rates given in the table.

Example: A 2" NPT size Model F50, with size C flow disc, actuates with water flow rates of 5.1 GPM increasing flow and 4.3 GPM decreasing flow. Then, used with a hydrocarbon liquid of 0.60 specific gravity (1.33 multiplication factor), the actuating flow rates are 6.8 GPM increasing and 5.7 GPM decreasing flow.

Model identification

F50 Flow Switches are identified by an alphanumeric part numbering system. The first six digits identify the basic model, materials of construction, and pipe line size; the next digit identifies the actuating flow rate; and the final three digits describe switch mechanism and the switch enclosure.

Model number construction

F50-□□2□-□□□

Basic part number, materials of construction, and pipe line size

Actuating flow rate

Switch mechanism and enclosure

Part number code

Pipe Size	Part Number Codes	
	Bronze ①	Stainless Steel ②⑦
¾" NPT	F50-1A2	F50-4A2
1" NPT	F50-1B2	F50-4B2
1½" NPT	F50-1C2	F50-4C2
2" NPT	F50-1D2	F50-4D2

① Bronze body with Type 300 series stainless steel trim; 400 series stainless steel magnetic sleeve.

② Type 316 stainless steel body and all internal trim.

Actuating flow rate

Pipe Size (NPT)	Actuating Flow Rate, GPM Water Flow Increasing and Decreasing Rate					
	A	B	C	D	E	F
¾"	Not Available	1.1 inc. 0.8 dec.	1.6 inc. 1.2 dec.	2.3 inc. 1.8 dec.	3.4 inc. 2.6 dec.	4.9 inc. 3.7 dec.
1"	1.0 inc. 0.8 dec.	1.7 inc. 1.4 dec.	2.5 inc. 2.1 dec.	3.7 inc. 3.0 dec.	5.5 inc. 4.5 dec.	7.1 inc. 5.8 dec.
1½"	1.3 inc. 1.1 dec.	2.7 inc. 2.3 dec.	4.7 inc. 4.0 dec.	7.6 inc. 6.5 dec.	12.3 inc. 10.5 dec.	21.1 inc. 17.9 dec.
2"	1.9 inc. 1.6 dec.	3.1 inc. 2.7 dec.	5.1 inc. 4.3 dec.	8.4 inc. 7.1 dec.	14.3 inc. 12.1 dec.	24.8 inc. 21.0 dec.

Specific gravity correction chart

Specific Gravity	Multiplication Factor	Specific Gravity	Multiplication Factor
.40	1.65	.95	1.03
.45	1.55	1.00	1.00
.50	1.46	1.05	.97
.55	1.39	1.10	.95
.60	1.33	1.15	.92
.65	1.27	1.20	.90
.70	1.22	1.25	.88
.75	1.17	1.30	.86
.80	1.13	1.35	.84
.85	1.10	1.40	.82
.90	1.06	1.45	.80

Electronic switch mechanism & enclosure

Switch Description	Max. ^③ ^④ Process Temp. °F (°C)	One Set Point Per Enclosure	Body Material of Construction	Pipe Size (NPT)	Flow Rate	NEMA 4X/7/9	
						Aluminum, Polymer Coated	Aluminum, CI I Div. 1 Group B
Series A Mercury Switches	550 (228)	SPDT	Bronze	¾" or 1"	A thru F	AKP	AKT
				1½" or 2"	A thru D		
			S.S.	¾" thru 2"	E and F	AKQ	AKS
		DPDT	Bronze	¾" or 1"	A thru F	ANP	ANT
				1½" or 2"	A thru D		
			S.S.	¾" thru 2"	E and F	ANQ	ANS
Series B Snap Switches	250 (121)	SPDT	Bronze	¾" or 1"	A thru F	BKP	BKT
				1½" or 2"	A thru D		
			S.S.	¾" thru 2"	E and F	BKQ	BKS
		DPDT	Bronze	¾" or 1"	A thru F	BNP	BNT
				1½" or 2"	A thru D		
			S.S.	¾" thru 2"	E and F	BNQ	BNS
Series C Snap Switches	450 (232)	SPDT	Bronze	¾" or 1"	A thru F	CKP	CKT
				1½" or 2"	A thru D		
			S.S.	¾" thru 2"	E and F	CKQ	CKS
		DPDT	Bronze	¾" or 1"	A thru F	CNP	CNT
				1½" or 2"	A thru D		
			S.S.	¾" thru 2"	E and F	CNQ	CNS
Series D Snap Switch for High DC Current	250 (121)	SPDT	S.S.	¾" thru 2"	A thru F	DKQ	DKS
		DPDT			DNQ	DNS	
Series E Vibration Resistant Mercury Switches	550 (228)	SPDT	Bronze	¾" or 1"	A thru F	EKP	EKT
				1½" or 2"	A thru D		
			S.S.	¾" thru 2"	E and F	EKQ	EKS
		DPDT	Bronze	¾" or 1"	A thru F	ENP	ENT
				1½" or 2"	A thru D		
			S.S.	¾" thru 2"	E and F	ENQ	ENS
Series HS 5 Amp ^⑦ Hermetically Sealed w/Wiring Leads	550 ^⑤ (228)	SPDT	Bronze ^⑥	¾" thru 2"	A thru F	HMC	—
		DPDT	S.S.		—	—	
Series HS 5 Amp ^⑦ Hermetically Sealed w/Terminal Block	550 ^⑤ (228)	SPDT	Bronze ^⑥	¾" thru 2"	A thru F	HM3	—
		DPDT	S.S.		—	—	

- ③ Process temperature based on +100° F (+38° C) ambient.
- ④ Bronze models are rated to a maximum process temperature of +500° F (+260° C). Stainless steel models are limited to the maximum temperature of the selected switch mechanism.
- ⑤ On condensing applications, temperature down-rated to +400° F (+204° C) process at +100° F (+38° C) ambient.
- ⑥ On models with bronze bodies with ¾" or 1" NPT pipe sizes, consult factory for HS switches.
- ⑦ HS switches are not available on models with stainless steel bodies.

Pneumatic switch mechanism and enclosure

Switch Description	Max. Process Temperature	Max. Supply Pressure	Material of Construction	Pipe Size (NPT)	Flow Rate	Bleed Orifice Diameter	Code (NEMA 1 Encl.)
Series J Bleed Type	400° F (204° C)	100 PSIG (7 Bar)	Bronze	¾" or 1"	A thru F	0.63" (1.6 mm)	JDG
				1½" or 2"	A thru D		
			S.S.	¾" thru 2"	E and F		JDE
		60 PSIG (4 Bar)	Bronze	¾" or 1"	A thru F	0.94" (2.4 mm)	JEG
				1½" or 2"	A thru D		
			S.S.	¾" thru 2"	E and F	JEE	
Series K Non-Bleed Type	400° F (204° C)	100 PSIG (7 Bar)	Bronze	1½" or 2"	E and F	—	KOE
			S.S.	¾" thru 2"	A thru F		
		40 PSIG (3 Bar)	Bronze	¾" or 1"	A thru F		KOG
				1½" or 2"	A thru D		

INSTALLATION

Piping

The Model F50 flow switch should be located in a horizontal pipe run, with the arrow on the valve body pointing in the direction of flow. The switch housing must always be above the valve body.

1. When installing, use wrenches on valve body only. Do not attempt to tighten or draw-up valve body on the pipe by pulling or pushing on switch housing cover.
2. Adjust pipe alignment, as required, to bring switch housing to a vertical position above pipeline. F50 flow switches must be mounted within three degrees (3°) of vertical. Three degree slant is noticeable to the eye, but installation should be checked with a spirit level on the side of the switch housing cover at two places, 90° apart.

NOTE: On flow switches using pneumatic switch assemblies, consult bulletin on mechanism furnished for air (or gas) piping instructions.

NOTE: For proper performance, a straight pipe run (12 pipe diameters upstream, and three pipe diameters downstream of the switch), is recommended.

Wiring

CAUTION: Model F50 flow controls are shipped from the factory with the enclosing tube tightened and the middle set screw, on the housing base, locked to the enclosing tube. Failure to loosen the set screw prior to repositioning the conduit connection may cause the enclosing tube to loosen, resulting in the possible leakage of the process liquid or vapor.

1. On high temperature applications (above 250°F [121°C] in pipeline), high temperature insulated wire should be used between the F50 and the first junction box, located in a cooler area.
2. To gain access to the switch mechanism, remove switch housing cover.
3. Pull in supply wires (conductors), wrap around enclosing tube underneath the baffle plate, and connect to proper terminals. Be certain that excess wire does not interfere with tilt of switch, and that adequate clearance exists for replacement of switch housing cover.

NOTE: See switch mechanism bulletin, which is furnished with your control, for proper connections. Refer to the chart on page 7 for the proper bulletin number.

4. Connect power supply to the F50, and test switch actuation by varying flow rate within pipeline.

NOTE: If the switch mechanism fails to function properly, check vertical alignment of control housing, and refer to installation bulletin on mechanism furnished, as listed on page 7.

5. Replace switch housing cover, and place flow switch into service.

TROUBLESHOOTING

Usually the first indication of improper operation is failure of the controlled equipment to function, i.e., pump will not start (or stop), signal lights fail to light, etc. When these symptoms occur, whether at time of installation or during routine service thereafter, check the following potential external causes first.

- Fuses may be blown.
- Reset button(s) may need resetting.
- Power switch may be open.
- Controlled equipment may be faulty.

If a thorough inspection of these possible conditions fails to locate the trouble, proceed to a check of the control's switch mechanism.

1. Pull disconnect switch, or otherwise assure that electrical circuit(s) of control are deactivated.
2. Remove switch housing cover.
3. Swing magnet assembly in and out by hand, checking carefully for any sign of binding. Assembly should require minimal force to move it through its full swing.

4. If binding exists, magnet may be rubbing enclosing tube, or pivot sockets may be overly tight. Readjust pivot sockets as required, until a slight amount of side play is evident. If magnet is rubbing, loosen magnet clamp screw, and shift magnet position.
5. If switch magnet assembly swings freely, and mechanism still fails to actuate, check installation of control to be certain it is within the specified three degrees (3°) of vertical. Use a spirit level on side of enclosing tube in two places, 90° apart.
6. If mechanism is equipped with a mercury switch, examine glass mercury tube closely. If switch is damaged, replace it immediately.

NOTE: As a matter of good practice, spare switches should be kept on hand at all times.

TROUBLESHOOTING cont.

If switch mechanism is operating satisfactorily, a test of the complete control's performance is the next likely step.

1. Reconnect power supply, and carefully actuate switch mechanism manually, using a non-conductive tool, to determine whether controlled equipment will operate.

CAUTION: With electrical power on, care should be taken to avoid contact with switch leads and connections at terminal block.

2. If controlled equipment responds to manual actuation test, trouble may be located in the flow sensing portion of the control.

NOTE: Check first to be certain liquid is flowing through pipeline. A valve may be closed, or pipeline may be plugged.

3. If magnet fails to pull in on increasing flow:
 - a. Disk may have too small a diameter.
 - b. Check for hang up or deposits in disk seat.
 - c. Check for malfunctioning by manually moving magnet carriage.
4. If magnet fails to pull out on decreasing flow:
 - a. Disk may have too large a diameter.
 - b. Check for hang up or deposits in disk seat.
 - c. Check for malfunctioning by manually moving magnet carriage.

If all components in the unit are in operating condition, the trouble must be (and should be) located external to the unit. Repeat inspection of external conditions previously described.

PREVENTIVE MAINTENANCE

Periodic inspections are a necessary means to keep your level control in good working order. This control is a safety device to protect the valuable equipment it serves. A systematic program of preventive maintenance must be implemented when the control is placed into service. If the following is observed, your control will provide reliable protection of your capital equipment for many years.

What to do

1. Keep control clean

Be sure the switch housing cover is always in place on the control. This cover is designed to keep dust and dirt from interfering with the switch mechanism operation. In addition, it protects against damaging moisture and acts as a safety feature by keeping bare wires and terminals from being exposed. Should the housing cover, or any seals become damaged or misplaced, obtain a replacement immediately.

2. Inspect switch mechanisms, terminals, and connections monthly

- a. Mercury switches may be visually inspected for short circuit damage. Check for small cracks in the glass tube containing the mercury. Such cracks can allow entrance of air into the tube causing the mercury to "oxidize". This is noticeable as the mercury will appear dirty or dull, and will not break into clean, round pools. If these conditions exist, replace the mercury switch immediately.
- b. Dry contact switches should be inspected for excessive wear on actuating lever or misalignment of adjustment screw at point of contact between screw and lever. Such wear can cause false switch actuating levels. Adjust switch mechanism to compensate (if possible) or replace switch.
- c. **DO NOT** operate your control with defective or maladjusted switch mechanism (refer to bulletin on switch mechanisms furnished for service instructions).
- d. Controls may sometimes be exposed to excessive heat or moisture. Under such conditions, insulation on electrical wiring may become brittle, eventually breaking or peeling away. The resulting bare wires can cause short circuits.

Check wiring carefully, and replace it at the first sign of brittle insulation.

What to do cont.

2. Inspect switch mechanisms, terminals, and connections monthly cont.

- e. Vibration may sometimes cause terminal screws to work loose. Check all terminal connections to be certain that screws are tight.
- f. On units with pneumatic switches, air (or gas) operating medium lines, subjected to vibration, may eventually crack or become loose at connections causing leakage. Check lines and connections carefully and repair or replace, if necessary.

NOTE: As a matter of good practice, spare switches should be kept on hand at all times.

3. Inspect entire unit periodically

Isolate control from vessel. Raise and lower liquid level to check for switch contact and reset.

What to avoid

1. **NEVER** leave switch housing cover off the control longer than necessary to make routine inspection.
2. **NEVER** place a jumper wire across terminals to cut-out the control. If a jumper is necessary for test purposes, be certain it is removed before placing control into service.
3. **NEVER** attempt to make adjustments or replace switches without reading instructions carefully. Certain adjustments provided for in F50 controls should not be attempted in the field. When in doubt, consult the factory or your local representative.
4. **NEVER** use lubricants on pivots of switch mechanisms. A sufficient amount of lubricant has been applied at the factory to ensure a lifetime of service. Further lubrication is unnecessary, and will only tend to attract dust and dirt which can interfere with mechanism operation.

SPECIFICATIONS

Dimensional specifications inches (mm)

NOTE:

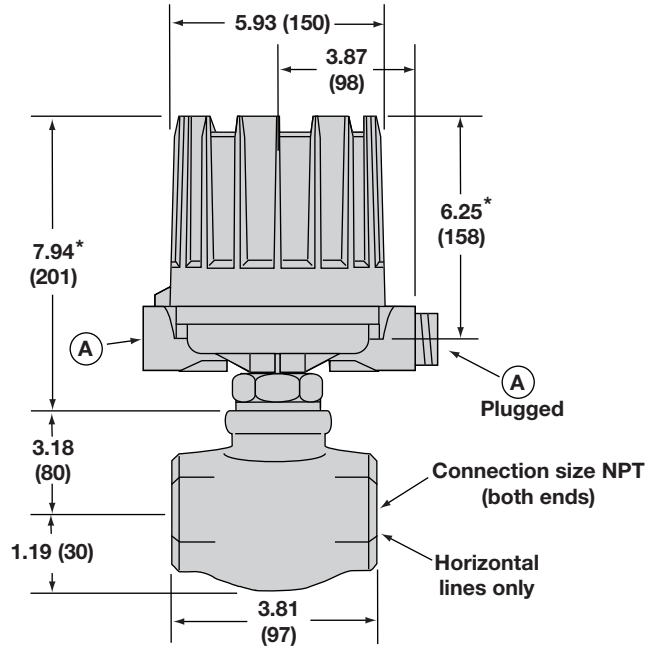
1. For NEMA 4X allow 8.00 (203) overhead clearance for cover removal.
2. For NEMA 4X/7/9 allow 10.00 (254) overhead clearance for cover removal.

Conduit Connections E	
Electrical Switches	
NEMA 4X:	1" NPT
NEMA 4X/7/9:	1" NPT
Group B:	1" NPT
Pneumatic Switches	
NEMA 1:	1/4" NPT

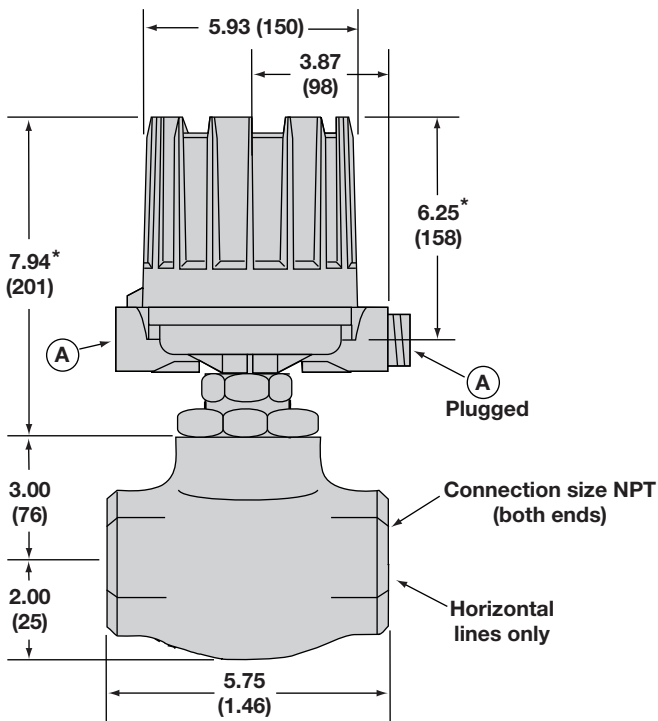
F50 Flow Switch with 3/4" or 1" NPT Internal Pipe, Bronze or Stainless Steel Body

Outline Dimensions				
Housing	A	B	C*	D
NEMA 4X	5.93	4.29	9.75	3.60
NEMA 4X/7/9	(151)	(108)		
NEMA 4X/7/9	5.93	4.29	(247)	(91)
Group B	(151)	(108)		
NEMA 1	4.70	5.00	8.44	3.44
Pneumatic	(119)	(127)	(214)	(87)

* This dimension increases by 2.19" (55) when the unit is supplied with an HS hermetically sealed switch with terminal block



F50 Flow Switch with 1 1/2" or 2" NPT Internal Pipe, Bronze or Stainless Steel Body



Outline Dimensions				
Housing	A	B	C*	D
NEMA 4X	5.93	4.29	10.75	4.60
NEMA 4X/7/9	(151)	(108)		
NEMA 4X/7/9	5.93	4.29	(273)	(116)
Group B	(151)	(108)		
NEMA 1	4.70	5.00	9.44	4.44
Pneumatic	(119)	(127)	(240)	(113)

* This dimension increases by 2.19" (55) when the unit is supplied with an HS hermetically sealed switch with terminal block

REPLACEMENT PARTS

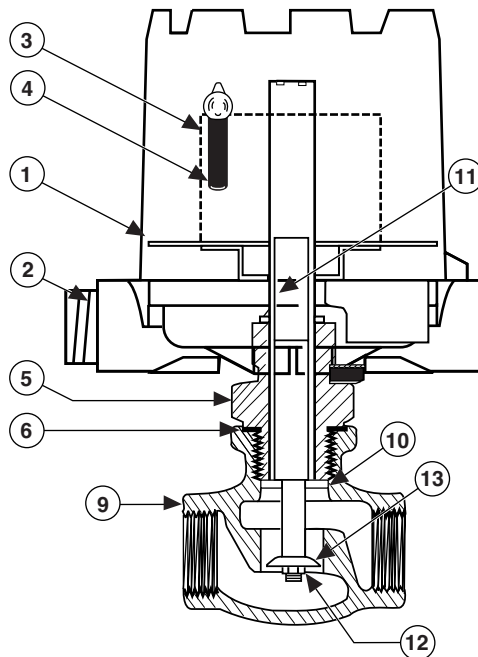
Item No.	Description	Bronze Body				Stainless Steel Body			
		3/4"	1"	1 1/2"	2"	3/4"	1"	1 1/2"	2"
1	Housing Cover	Refer to chart below for appropriate bulletin number on switch mechanism and housing replacement assemblies.							
2	Housing Base								
3	Switch Mechanism								
4	Switch								
5	Enclosing Tube	32-6325-002				32-6325-002			
6	E-Tube Gasket	12-1204-001				12-1204-001			
7	O Ring (not shown)	Not required		12-1204-036		Not Required		12-1204-036	
8	Body Adaptor (not shown)	Not Required		04-0481-001		Not Required		04-0481-001	
9	Threaded Body	02-5703-003	02-5703-004	02-5705-003	02-5705-004	02-5703-001	02-5703-002	02-5705-001	02-5705-002
10	Flow Piston Stop	05-5420-121		Not Required		05-5420-121		Not Required	
11	Flow Piston Assy. ①	32-7127-001	32-7127-003	32-7127-002		32-7108-001	32-7109-001	32-7109-002	
12	Lock Nut ②	10-2107-002	10-2107-003			10-2107-002	10-2107-003		
13	Flow Disc ③	Specify complete model number.							

① Highly corrosive applications use piston assembly with sheathed attraction sleeve. Consult local representative for ordering assistance.

② Use insoluble adhesive on nut when attaching new flow disc.

③ When actuated flow rate is critical, the entire control **must** be returned to the factory for replacement and recalibration of flow disc.

Switch Mechanism	Series Reference	Bulletin
Mercury Switch	A, 3	42-683
Dry Contact Switches	B, C, D	
Vibration Resistant Mercury Switch	E, 2	
Hermetically Sealed Snap Switch	HS	42-694
Bleed Type Pneumatic Valve	J	42-685
Non-Bleed Type Pneumatic Valve	K	42-686



IMPORTANT:

When ordering, please specify:

- A. Model and serial number of control.
- B. Name and number of replacement part.

IMPORTANT

PRODUCT WARRANTY

All Magnetrol mechanical level and flow controls are warranted free of defects in materials or workmanship for five full years from the date of original factory shipment. Repair parts are warranted free of defects in materials and workmanship for one year from the date of shipment. Materials, specifications, and contents are subject to change without prior written notice.

If returned within the warranty period; and, upon factory inspection of the control, the cause of the claim is determined to be covered under the warranty; then, Magnetrol will repair or replace the control at no cost to the purchaser (or owner) other than transportation.

Magnetrol shall not be liable for misapplication, labor claims, direct or consequential damage or expense arising from the installation or use of equipment. There are no other warranties expressed or implied, except special written warranties covering some Magnetrol products.

QUALITY ASSURANCE

The quality assurance system in place at Magnetrol guarantees the highest level of quality throughout the company. Magnetrol is committed to providing full customer satisfaction both in quality products and quality service.



Magnetrol's quality assurance system is registered to ISO 9001 affirming its commitment to known international quality standards providing the strongest assurance of product/service quality available.

ASSURED QUALITY & SERVICE COST LESS

SERVICE POLICY

Owners of Magnetrol may request the return of a control or any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Controls returned under our service policy must be returned by Prepaid transportation. Magnetrol will repair or replace the control at no cost to the purchaser (or owner) other than transportation if:

1. Returned within the warranty period; and
2. The factory inspection finds the cause of the claim to be covered under the warranty.

If the trouble is the result of conditions beyond our control; or, is NOT covered by the warranty, there will be charges for labor and the parts required to rebuild or replace the equipment.

In some cases it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned will be determined on the basis of the applicability of our warranty.

No claims for misapplication, labor, direct or consequential damage will be allowed.

LOW VOLTAGE DIRECTIVE

For use in Category II installations. If equipment is used in a manner not specified by manufacturer, protection provided by equipment may be impaired.

RETURN MATERIAL PROCEDURE

So that we may efficiently process any materials that are returned, it is essential that a "Return Material Authorization" (RMA) number be obtained from the factory, prior to the material's return. This is available through Magnetrol local representative or by contacting the factory. Please supply the following information:

1. Company Name
2. Description of Material
3. Serial Number
4. Reason for Return
5. Application

Any unit that was used in a process must be properly cleaned in accordance with OSHA standards, before it is returned to the factory.

A Material Safety Data Sheet (MSDS) must accompany material that was used in any media.

All shipments returned to the factory must be by prepaid transportation.

All replacements will be shipped F.O.B. factory.



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