



MAGNETROL
REGISTERED TO
ISO 9001
Your Assurance of
Quality and Service

C74 External Cage Liquid Level Switches

Instruction Manual and Parts List

Description

C74 external cage liquid level switches are displacer actuated units, utilizing a single switch mechanism for level alarm or control functions. These units are designed to provide high pressure/temperature capability with low specific gravity.

Operating principle

The design of displacer operated level switches is based upon the principle that a magnetic field will see through non-magnetic materials such as 316 stainless steel. In this case, the displacer moves a magnetic attraction sleeve within a non-magnetic enclosing tube and actuates a switch mechanism. The enclosing tube provides a pressure seal to the chamber and therefore to the process.

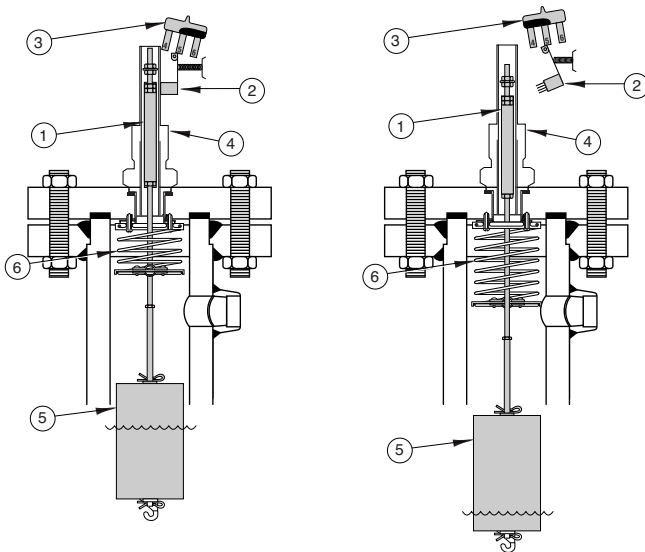


Figure 1

Figure 2

Operating cycle

As the liquid level rises in the chamber, refer to Figure 1, the displacer (5) moves the magnetic attraction sleeve (1) up within the enclosing tube (4), and into the field of the switch mechanism magnet (2). As a result, the magnet is drawn in tightly to the enclosing tube causing the switch (3) to trip, making or breaking an electrical circuit. As the liquid level falls, the displacer drops and moves the attraction sleeve out of the magnetic field, releasing the switch at a predetermined low level. Refer to Figure 2.

Unpacking

Unpack the instrument carefully. Inspect all units for damage. Report any concealed damage to carrier within 24 hours. Check the contents of the packing slip and purchase order. Check and record the serial number for future reference when ordering parts.

GENERAL INFORMATION

Model identification

C74 level controls are identified by a ten digit alphanumeric part numbering system. The part number provides exact specifications of unit configuration, materials of construction and other options vital to the performance of the instrument.

Part number construction

C74-□ □ □ □ - □ □ □

Model number code and materials of construction

Tank connection type and size

Switch mechanism and enclosure

MODEL number code & materials of construction

Model Number Code	Displacer Cage	Attraction Sleeve	Trim
C74-1	Carbon Steel	400 SST	Inconel and 316 SST
C74-2	Carbon Steel	316 SST	316 SST

Tank connection type & size

Connection Type	Connection Size					
	1"		1½"		2"	
	300 lb.	600 lb.	300 lb.	600 lb.	300 lb.	600 lb.
Threaded	B70	B90	C70	C90	D70	D90
Socket Weld	B80	B01	C80	C01	D80	D01
Flanged Upper Side/Bottom	N40	N50	P40	P50	Q40	Q50
Flanged Side/Side	S40	S50	T40	T50	V40	V50

Note: Flanges are ANSI raised face.

Pneumatic switch mechanism & enclosure

Switch Description	Max. Supply Pressure	Max. Process Temp.	Bleed Orifice Diameter	NEMA 1		
				C74-1	C74-2	
					300 lb.	600 lb.
Series J Bleed Type	100 PSIG (7 Bar)	400° F (204° C)	.063 (1.6 mm)	JDE	JDE	JKE
	60 PSIG (4 Bar)			JEE	JEE	JLE
Series K Non-Bleed	100 PSIG (7 Bar)		—	KOE	KPE	

Electric switch mechanism and enclosure ①

Switch ② Description	Max. ③ Process Temp. ° F (° C)	One Set Point	NEMA 4X/7/9	
			Alum., Polymer Coated	Alum., CI I Div. 1 Group B
Series A Mercury Switch	500 (260)	SPDT	AKQ	AKS
		DPDT	ANQ	ANS
Series B Snap Switch	250 (121)	SPDT	BKQ	BKS
		DPDT	BNQ	BNS
Series C Snap Switch	450 (232)	SPDT	CKQ	CKS
		DPDT	CNQ	CNS
Series D Snap Switch for DC Current Application	250 (121)	SPDT	DKQ	DKS
		DPDT	DNQ	DNS
Series E Vibration Resistant Mercury Switch	500 (260)	SPDT	EKQ	EKS
		DPDT	ENQ	ENS
Series F Hermetically Sealed Snap Switch	500 (260)	SPDT	FKQ	FKS
		DPDT	FNQ	FNS
Series HS Hermetically Sealed Snap Switch w/Wiring Leads	500 ④ (260)	SPDT	HMC	HEK
		DPDT	HMF	HET
Series HS Hermetically Sealed Snap Switch w/ Terminal Block	500 ④ (260)	SPDT	HM3	HM4
		DPDT	HM7	HM8

① Consult factory for NEMA 4X/7/9 cast iron housings.

② Uncontrolled housing heater; drain available in NEMA 4X/7/9 enclosures. Consult factory for switch codes.

③ Process temperature based on +100° F (+38° C) ambient.

④ On condensing applications, temperature down-rated to +400° F (+204° C) process at +100° F (+38° C) ambient.

INSTALLATION

Critical alarm function

It is recommended that for critical alarm functions, an additional level switch be installed as a high-high or low-low level alarm for maximum protection.

Piping

Figure 3 shows a typical piping installation of a C74 control to a pressure vessel. An instruction tag secured to the control gives dimensional data on switch actuating levels referenced from center line of upper side tank connection. Position control so that actuating levels correspond with the desired liquid level trip points in process vessel.

Use pipe of sufficient strength to support the control. If necessary, provide a stand or hanger to help support its weight. All piping should be straight and free of "low spots" or "pockets" so that lower liquid line will drain towards the vessel and upper vapor line will drain toward the control. Shut-off valves are recommended for installation between the vessel and the control. If control is to be used with a low temperature liquid (one which will "boil" in the float chamber if outside heat is absorbed), the chamber and piping should be insulated. Such boiling in the chamber will cause false level indications.

DO NOT INSULATE SWITCH MECHANISM HOUSING.

On controls equipped with pneumatic switch assemblies, consult bulletin on mechanism furnished for air (or gas) piping instructions. Refer to chart on Page 4 for bulletin numbers for pneumatic switches.

Mounting

Adjust piping as required to bring control to a vertical position. Magnetrol controls must be mounted within three degrees (3°) of vertical. A three degree slant is noticeable by eye, but installation should be checked with a spirit level on top and/or sides of float chamber.

Controls should be mounted as close to the vessel as possible. This will result in a more responsive and accurate level change in the control. Liquid in a long line may be cooler and more dense than liquid in the vessel causing lower level indication in the control than actual level in the vessel.

Wiring

CAUTION: All Series C74 units are shipped from the factory with the enclosing tube tightened and the switch housing set screw locked to the enclosing tube. Failure to loosen the set screw prior to repositioning the supply and output connections may cause the enclosing to loosen, resulting in possible leakage if the process liquid or vapor.

C74 controls are shipped with the conduit entry of the switch housing placed 180° opposite to the tank configurations to simplify installation in most cases. If this configuration is appropriate to the installation, proceed to Step 4 to begin wiring the unit. If another configuration is desired, the switch housing can be easily rotated by first following Steps 1, 2, and 3.

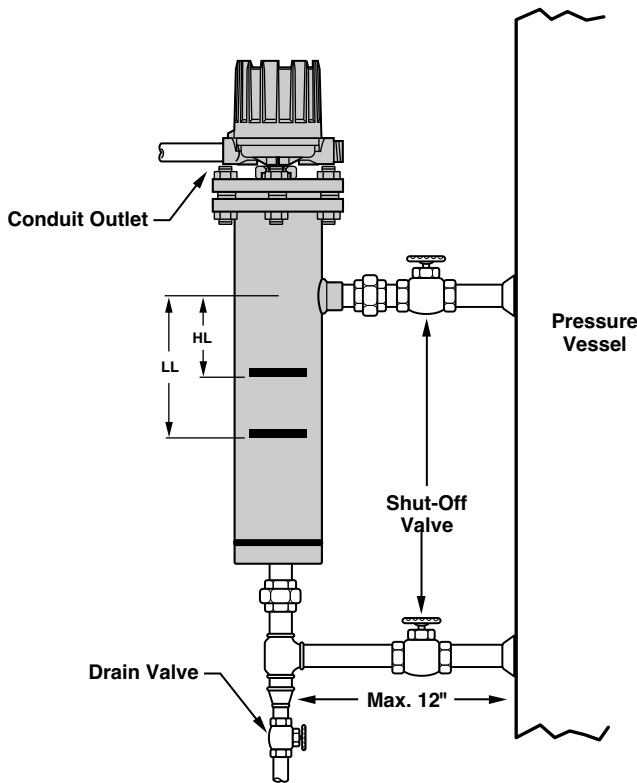


Figure 3
Typical Piping Arrangement

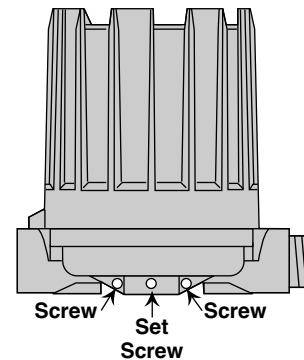


Figure 4

1. Loosen set screw(s) at base of switch housing. Refer to Figure 4.
2. Switch housing may be rotated 360° to allow correct positioning of conduit outlet.
3. Tighten set screw(s) at base of switch housing.
4. Unscrew and remove switch housing cover. The threads have been lubricated to facilitate removal.

NOTE: On high temperature applications (above 250° F [121° C] in float chamber), high temperature wire should be used between control and first junction box located in a cooler area.

5. The switch terminals are located next to the conduit outlet to facilitate wiring. Bring supply wires through conduit outlet. Route extra wire around enclosing tube under the baffle plate, and connect them to the proper terminals. Refer to the wiring diagram in your switch bulletin for this information.

INSTALLATION cont.

Wiring cont.

Switch Series Letter	Description	Bulletin No.
A	Standard Mercury Switch	42-683
B, C, D	Dry Contact Switch	
E	Vibration Resistant Mercury Switch	
F	High Temperature Hermetically Sealed Snap Switch	42-694
HS	Hermetically Sealed Snap Switch	
J	Bleed Type Pneumatic Switch	42-685
K	Non-Bleed Type Pneumatic Switch	42-686

NOTE: For models with a Series HS switch with high temperature lead wire, the leads are routed out through the conduit opening by the factory. A suitable conduit box should be provided for the connection of the leads to the control wiring.

- Dress wiring to ensure no interference or contact with tilt of switch, or replacement of switch housing cover.

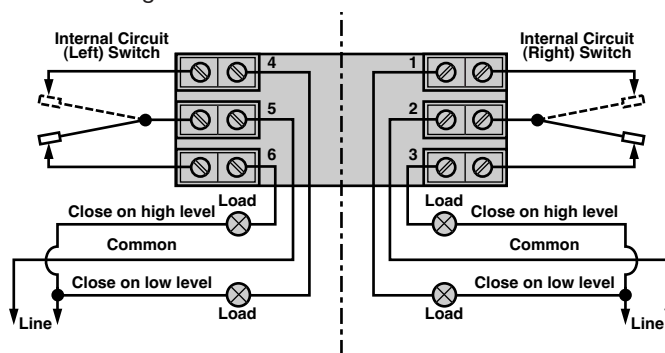
OBSERVE ALL APPLICABLE ELECTRICAL CODES AND PROPER WIRING PROCEDURES.

Prevent moisture seepage into the enclosure by installing approved seal-drain fittings in the conduit run leading into the unit.

CAUTION: In hazardous areas, do not power the unit until the conduit is sealed and the enclosure cover is screwed down securely.

Wiring cont.

- Replace housing cover.
 - If control has been furnished with an explosion proof or moisture proof (gasketed) switch housing, it must be sealed at the conduit outlet with a suitable compound or non-hardening sealant to prevent entrance of air.
 - Test switch action by varying liquid level in float chamber.
- NOTE:** If switch mechanism fails to function properly, check vertical alignment of control housing and consult installation bulletin on switch mechanism furnished.
- Check cover to base fit to be certain gasketed joint is tight. A positive seal is necessary to prevent infiltration of moisture laden air or corrosive gasses into switch housing.



**Terminal Connections
DPDT Switch Mechanism
Series A, B, C, D, E, and F**

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. Therefore, a systematic program of "preventive maintenance" must be implemented when the control is placed into service. If the following sections on "what to do" and "what to avoid" are observed, your control will provide reliable protection of your capital equipment for many years.

What to do

- 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 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.

- INSPECT SWITCH MECHANISMS, TERMINALS AND CONNECTIONS MONTHLY.

- 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.

What to do cont.

- 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.
- DO NOT** operate your control with defective or maladjusted switch mechanisms (refer to bulletin on switch mechanisms furnished for service instructions.)
- Level 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 at the first sign of brittle insulation.

- Vibration may sometimes cause terminal screws to work loose. Check all terminal connections to be certain that screws are tight.

INSTALLATION cont.

What to do cont.

2. INSPECT SWITCH MECHANISMS, TERMINALS AND CONNECTIONS MONTHLY. CONT.

- 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 inspections.
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 level 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 oiling is unnecessary and will only tend to attract dust and dirt which can interfere with mechanism operation.

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 lamps 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.
- Wiring leading to control may be defective.

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

Check switch mechanism

1. Pull disconnect switch or otherwise disconnect power to the control.
2. Remove switch housing cover.

CAUTION: Unit must be normalized to atmospheric pressure before removing switch housing assembly.

3. Disconnect power wiring from switch assembly.
4. Swing magnet assembly in and out by hand to check carefully for any sign of binding. Assembly should require minimal force to move it through its full swing.
5. If binding exists, magnet may be rubbing enclosing tube. If magnet is rubbing, loosen magnet clamp screw and shift magnet position. Retighten magnet clamp screw.
6. 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 (3°) degrees of vertical. (Use spirit level on side of enclosing tube in two places, 90° apart. Refer to Figure 3.
7. If mechanism is equipped with a mercury switch, examine glass mercury tube closely as previously described in “Preventive Maintenance” section. If switch is damaged, replace it immediately. If microswitch, check continuity with ohmmeter.

8. If switch mechanism is operating satisfactorily, proceed to check sensing unit.

Check sensing unit

1. Check to be certain liquid is entering float chamber. A valve may be closed or piping plugged.
2. With liquid in chamber, proceed to check level sensing action by removing switch housing assembly and enclosing tube.
3. Inspect attraction sleeve and inside of enclosing tube for excessive corrosion or solids build-up which could restrict movement, preventing sleeve from reaching field of magnet.
4. **Never** change the settings of the jam nuts which position the magnet attractor.
5. Remove parting flange. Check spring and displacer assembly for freedom of movement. Check for collapsed or liquid filled displacer. If displacer is determined to be filled or collapsed, contact the factory.

Check complete unit

Reassemble unit. Reconnect power supply and carefully actuate switch mechanism manually (using a non-conductive tool) to determine whether controlled equipment will operate.

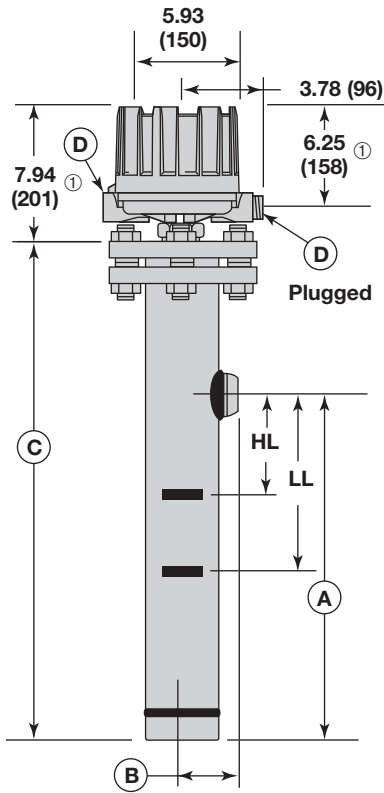
CAUTION: With electrical power “on”, care should be taken to avoid contact with switch leads and connections at terminal block.

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

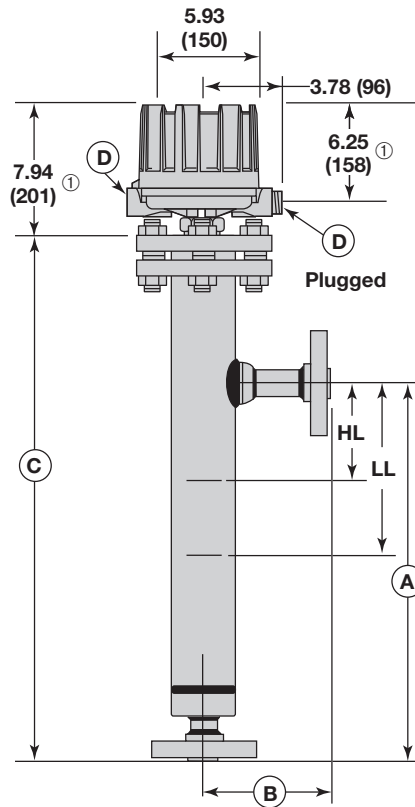
NOTE: If difficulties are encountered which cannot be identified, consult the factory or your local representative for assistance. A complete description of the trouble should be provided along with information concerning your piping and mounting arrangement, plus a description of your operating sequence. Sketches or photographs showing the installation are also beneficial.

When communicating about your control, be certain always to specify the complete Model and Serial numbers.

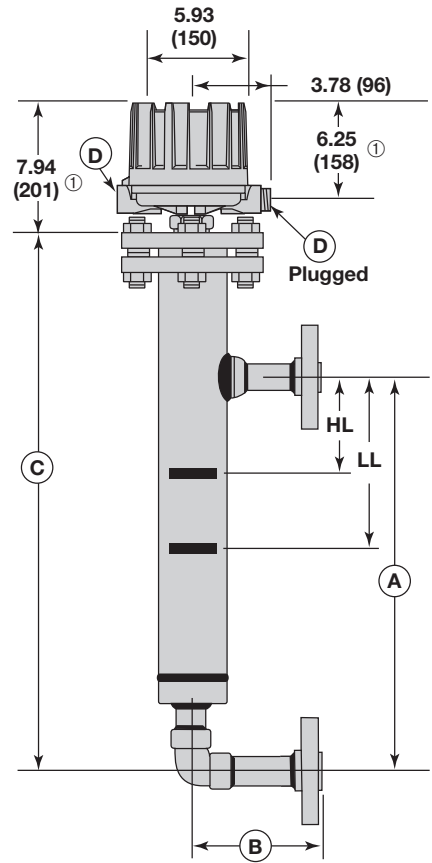
SPECIFICATIONS



**Threaded and Socket Weld
Upper Side/Bottom**



**Vertical Flanges
Upper Side/Bottom**



**Horizontal Flanges
Side/Side**

Conn. Size	Flange Rating	NPT Threaded & Socket Weld			Upper Side/Bottom Flanges			Side/Side Flanges		
		A	B	C	A	B	C	A	B	C
1"	300 lb.	15.65	2.77	22.69 (601)	18.33	5.45	25.38 (644)	18.97	5.45	26.0 (270)
	600 lb.	(397)	(70)	23.06 (585)		(138)	25.75 (653)		(138)	26.38 (670)
1½"	300 lb.	15.77	3.19	22.81 (579)	(465)	6.19	25.38 (644)	(481)	6.19	26.0 (270)
	600 lb.	(400)	(81)	23.19 (589)		(157)	25.75 (653)		(157)	26.38 (670)
2"	300 lb.	15.90	3.31	22.94 (582)		6.25	25.38 (644)		6.25	26.0 (270)
	600 lb.	(403)	(84)	23.31 (592)		(158)	25.75 (653)		(158)	26.38 (670)

① These dimensions increase by 2.19 when used with series HS Switch w/ Terminal Block.

Conduit Connections D	
Electric Switches:	
NEMA 4X/7/9:	1" NPT
Group B:	1" NPT
Pneumatic Switches:	
NEMA 1:	¼" NPT

SPECIFICATIONS cont.

Actuating Levels In Inches

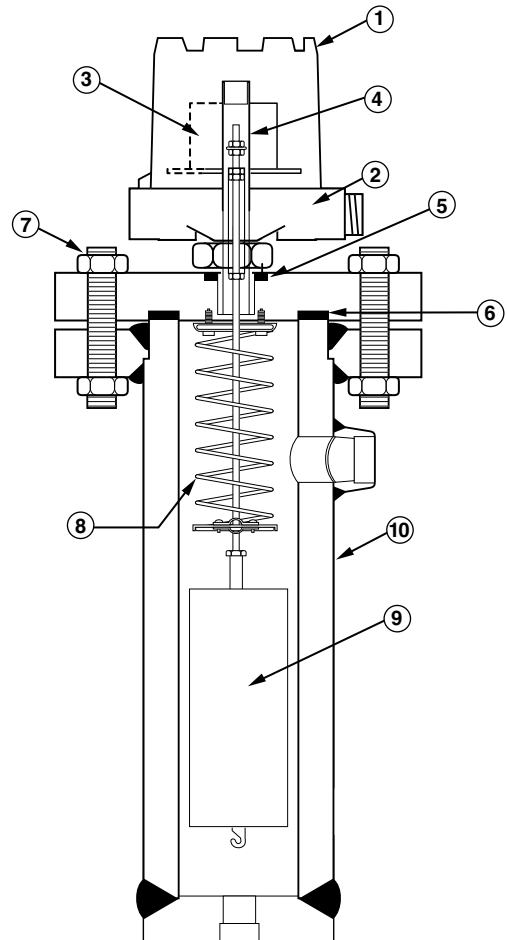
Process Temperature °F (°C)	Liquid Specific Gravity													
	0.40		0.50		0.60		0.70		0.80		0.90		1.00	
	HL	LL	HL	LL	HL	LL	HL	LL	HL	LL	HL	LL	HL	LL
100 (38)	4.38	8.24	5.56	8.74	6.35	9.07	6.92	9.31	7.34	9.49	7.67	9.63	7.94	9.74
200 (93)	4.01	7.83	5.27	8.41	6.11	8.80	6.71	9.08	7.16	9.28	7.51	9.44	7.79	9.57
300 (149)	3.59	7.36	4.94	8.04	5.83	8.49	6.47	8.81	6.95	9.05	7.32	9.24	7.62	9.39
400 (205)	3.13	6.84	4.56	7.62	5.52	8.14	6.20	8.51	6.72	8.79	7.12	9.00	7.44	9.18
500 (260)	2.61	6.26	4.15	7.15	5.18	7.75	5.91	8.18	6.46	8.50	6.89	8.75	7.23	8.94

Actuating Levels In Millimeters

Process Temperature °F (°C)	Liquid Specific Gravity													
	0.40		0.50		0.60		0.70		0.80		0.90		1.00	
	HL	LL	HL	LL	HL	LL	HL	LL	HL	LL	HL	LL	HL	LL
100 (38)	111	009	141	222	161	230	176	236	186	241	195	245	202	247
200 (93)	102	199	134	214	155	224	170	231	182	236	191	240	198	243
300 (149)	91	187	125	204	148	216	164	224	177	230	186	235	194	239
400 (205)	80	174	116	194	140	207	157	216	171	223	181	229	189	233
500 (260)	66	159	105	182	132	197	150	208	164	216	175	222	184	227

REPLACEMENT PARTS

Item	Description	Replacement Part Number
1	Housing Cover	Housing Kit Refer to bulletin on switch mechanism and housing furnished (listed on page 4).
2	Housing Base	
3	Switch Mechanism	
4	Enclosing Tube	300 lb. 032-6325-002 600 lb. 032-6325-003
5	E-Tube Gasket	012-1204-001
6	Head Flange Gasket	012-1204-019
7	Bolts and Nuts	300 lb. 089-3101-001 600 lb. 089-3102-001
8	Spring and Stem Assy.	C74-1 (300 lb.) 089-5321-001
		C74-1 (600 lb.) 089-5322-001
		C74-2 (300 lb.) 089-5323-001
		C74-2 (600 lb.) 089-5324-001
9	Displacer Assy.	300 lb. 089-6137-001
		600 lb. 089-6138-001
10	Chamber and Flange Assy	Chamber and head flange assemblies are available by contacting the factory. When ordering specify model and serial number of control.



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 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 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.



5300 Belmont Road • Downers Grove, Illinois 60515-4499 • 630-969-4000 • Fax 630-969-9489 • www.magnetrol.com
145 Jardin Drive, Units 1 & 2 • Concord, Ontario Canada L4K 1X7 • 905-738-9600 • Fax 905-738-1306
Heikensstraat 6 • B 9240 Zele, Belgium • 052 45.11.11 • Fax 052 45.09.93
Regent Business Ctr., Jubilee Rd. • Burgess Hill, Sussex RH15 9TL U.K. • 01444-871313 • Fax 01444-871317

Copyright © 2009 Magnetrol International, Incorporated. All rights reserved. Printed in the USA.

BULLETIN: 46-609.3
EFFECTIVE: January 2000
SUPERSEDES: June 1996