

# Flanged External Cage

Installation and Operating Manual



*Float*

*Actuated*

*Liquid*

*Level*

*Switches*

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## Read this Manual Before Installing

This manual provides information on the Flanged External Cage Liquid Level Switches. It is important that all instructions are read carefully and followed in sequence. Detailed instructions are included in the Installation section of this manual.

## Conventions Used in this Manual

Certain conventions are used in this manual to convey specific types of information. General technical material, support data, and safety information are presented in narrative form. The following styles are used for notes, cautions, and warnings.

### NOTES

Notes contain information that augments or clarifies an operating step. Notes do not normally contain actions. They follow the procedural steps to which they refer.

### Cautions

Cautions alert the technician to special conditions that could injure personnel, damage equipment, or reduce a component's mechanical integrity. Cautions are also used to alert the technician to unsafe practices or the need for special protective equipment or specific materials. In this manual, a caution indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

### WARNINGS

Warnings identify potentially dangerous situations or serious hazards. In this manual, a warning indicates an imminently hazardous situation which, if not avoided, could result in serious injury or death.

**WARNING!** Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

### Low Voltage Directive

For use in Installation Category II, Pollution Degree 2. If equipment is used in a manner not specified by manufacturer, protection provided by equipment may be impaired.

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Performance specifications are effective with date of issue and are subject to change without notice. Magnetrol reserves the right to make changes to the products described in this manual at any time without notice. Magnetrol makes no warranty with respect to the accuracy of the information in this manual.

## 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.

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.

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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.





# Flanged External Cage Float Actuated Liquid Level Switches

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## 1.0 Installation

**Caution:** If equipment is used in a manner not specified by manufacturer, protection provided by equipment may be impaired.

### 1.1 Unpacking

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

Serial # \_\_\_\_\_

**Caution:** Do not discard the shipping container until all parts are accounted for.

### 1.2 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.

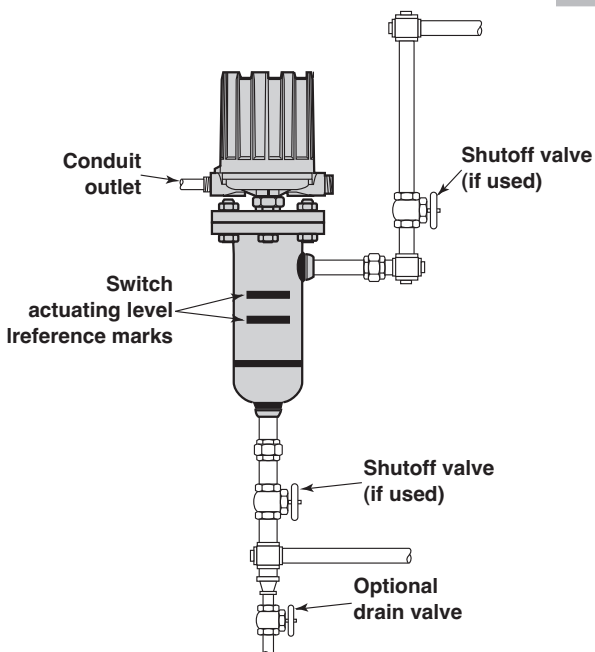
### 1.3 Piping

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.

**Caution:** DO NOT INSULATE SWITCH MECHANISM HOUSING.

For controls equipped with pneumatic switch assemblies, consult bulletin on mechanism furnished for air (or gas) piping instructions.



Typical Piping Arrangement

## 1.4 Mounting

**Caution:** This instrument is intended for use in Installation Category II, Pollution Degree 2 locations.

Adjust piping as required to bring control to a vertical position. Magnetrol controls must be mounted within 3° of vertical in all directions. 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.

**Caution:** Never insulate the switch housing of the level control.

Installation and maintenance of tandem float models are accomplished in much the same manner as described for standard models. Additional consideration must be given to the piping arrangement to allow for alignment of the two switch actuating level marks on the float chamber with the desired levels in the vessel.

**Caution:** Operation of all buoyancy type level devices should be done in such a way as to minimize the action of dynamic forces on the float or displacer sensing element. Good practice for reducing the likelihood of damage to the control is to equalize pressure across the device slowly.

## 1.5 Wiring

**Caution:** All Flanged Float Cage 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 tube to loosen, resulting in possible leakage of the process liquid or vapor.

Flanged float cage controls are shipped with the conduit entry of the switch housing placed 180° opposite the tank connections to simplify most installations. 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.

**NOTE:** A switch or circuit breaker shall be installed in close proximity to equipment and within easy reach of operator. It shall be marked as the disconnecting device for equipment.

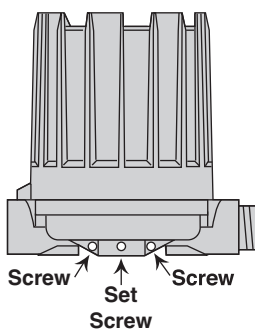


Figure 1

1. Loosen set screw(s) at base of switch housing. Refer to **Figure 1**.
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: For supply connections, use wire with a minimum rating of +167° F (+75° C) as required by process conditions. Use a minimum of 14 AWG wire for power and ground field wires.

NOTE: Housing must be grounded via protective ground screw in the base of the housing.

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. On non-hazardous applications, flexible conduit may be used between the control and the first junction box.

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 **Figure 2** or your switch bulletin for this information. See *Switch and Housing Reference, Section 6.2.2*.

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

NOTE: It is the responsibility of the customer to comply with applicable installation codes and practices. Class I, Division 1 locations may contain explosive gas mixtures. Appropriate precautions must be taken. Installation should be performed by qualified personnel.

7. Replace housing cover.

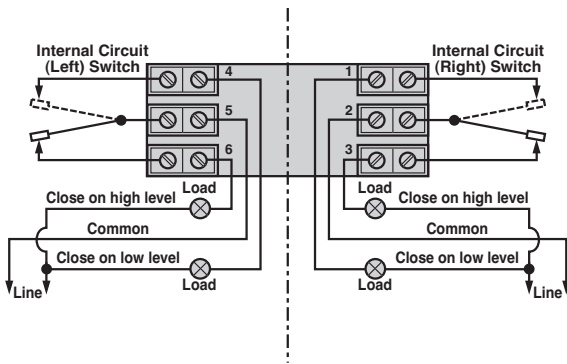
8. If control has been furnished with an explosion proof or moisture proof switch housing, it must be sealed at the conduit outlet with a suitable compound or non-hardening sealant to prevent entrance of air.

9. 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 for additional wiring information on switch mechanism furnished. See *Switch and Housing Reference, Section 6.2.2*.

10. 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 housings.

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



**Figure 2**  
**Terminal Connections**  
**DPDT Switch Mechanism**  
**Series A, B, C, D, and E**

## 2.0 Reference Information

### 2.1 Description

Flanged External Cage liquid level switches are completely self-contained units designed for side mounting to a vessel or tank with threaded or flanged pipe connections.

### 2.2 Theory of Operation

The design of float-operated level switches is based upon the principle that a magnetic field will not be affected by non-magnetic materials such as 316 stainless steel. The float moves a magnetic attraction sleeve within a non-magnetic enclosing tube and actuates a magnetic switch mechanism. The enclosing tube provides a pressure seal to the chamber and therefore to the process.

### 2.3 Operating Cycle

As the liquid level rises in the chamber, the float moves the magnetic attraction sleeve up within the enclosing tube and into the field of the switch mechanism magnet. As a result, the magnet is drawn in tightly to the enclosing tube, causing the switch to trip making or breaking an electrical circuit. Refer to **Figure 3**.

As the liquid level falls, the float drops and moves the attraction sleeve out of the magnetic field, releasing the switch mechanism magnet. The tension spring ensures the return of the switch in a snap action. Refer to **Figure 4**.

Tandem float units incorporate two floats which operate independently. They are arranged so that the lower float actuates the upper switch mechanism while the upper float actuates the lower switch mechanism. The upper float is attached to the lower attraction sleeve by means of a hollow stem. The lower float attaches to the upper attraction sleeve with a solid stem which extends upward through the upper float and stem assembly.

### 2.4 Switch Differential Adjustment

The standard differential of Flanged Cage float models with one switch may be field adjusted. Adjustment may be necessary if a wider differential needs to be set to overcome switch chatter caused by the process.

NOTE: This procedure may be applied to single switch models only.

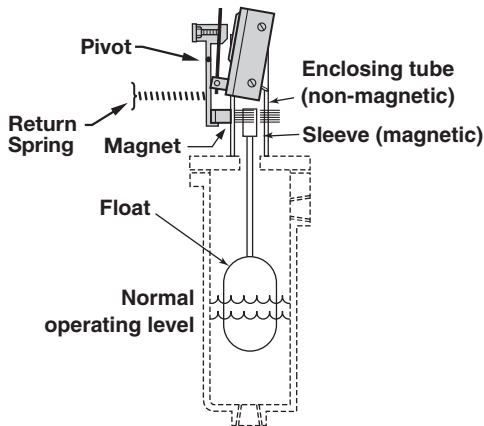


Figure 3

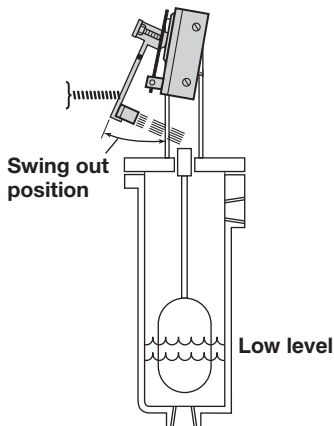
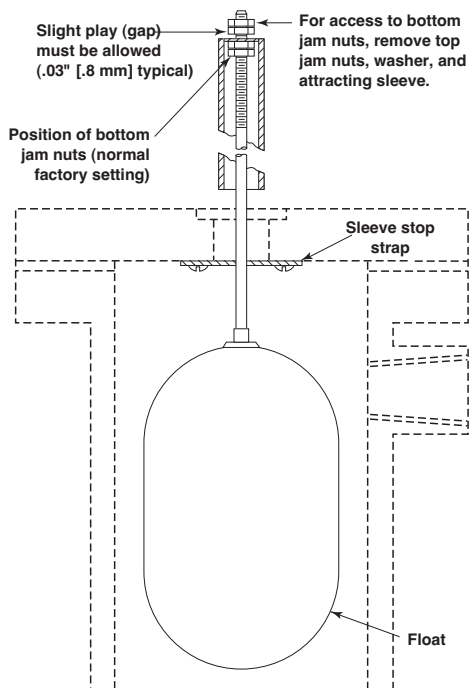
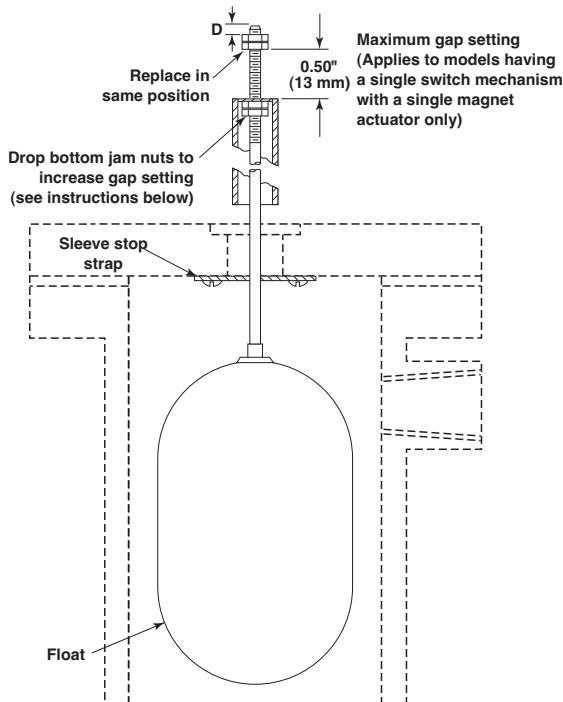


Figure 4



**Figure 5**  
**Normal Factory Setting**  
**(minimum differential)**



**Figure 6**  
**Differential adjustment**

The differential, or the amount of level travel between switch-on and switch-off, may be adjusted by repositioning the lower jam nuts on the float stem. This adjustment is different for high level and low level controls. Refer to the appropriate section below for adjustment instructions.

NOTE: Maximum differential adjustment is 1 inch.

**Caution:** Differential adjustments should NOT be made in the field on tandem float models. Switch actuation levels have been set at the factory to meet customer specifications. Variations in actual conditions from design conditions, usually require special control modifications. Consult the factory or your local representative for assistance.

### 2.4.1 Low level controls

On low level controls the switch trips on the lower actuation point and resets on the higher actuation point. Widening the differential will allow the switch to trip on the original actuation point and reset at a later or higher point.

The differential on low level controls may be adjusted by repositioning the lower jam nuts on the float stem. The standard factory setting is for a minimum amount of play (gap) between the top jam nuts and the attraction sleeve. Refer to **Figure 6**.

1. Determine what change in differential is necessary.

NOTE: To widen the differential by one inch, the lower jam nuts must be set proportionately lower on the stem (i.e., in this example by 1 inch).

2. Make sure power source is turned off.
3. Unscrew and remove switch housing cover.
4. Disconnect power supply wires from switch mechanism. Pull wires out of conduit connection opening in housing base. Refer to **Figure 7**.
  - 5a. Perform system shut-down procedures as required to relieve pressure from float chamber of control. Allow unit to cool.
  - 5b. Close shut-off valves (if so equipped) to isolate control from tank. Drain off liquid in float chamber.
  - 5c. On installations without shut-off valves, relieve pressure from the tank. Drain liquid in tank to a level below the connections of the float chamber.

NOTE: Level control, connections and pipe lines need not be removed from the tank.

6. Loosen enclosing tube nut with a  $\frac{1}{16}$ " wrench. Unscrew enclosing tube counterclockwise (switch and housing base will rotate also), until it is free. Refer to **Figure 7**.

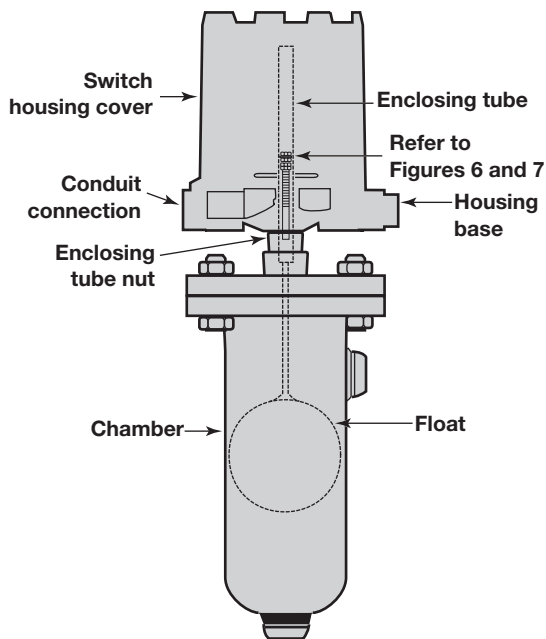


Figure 7

7. Lift enclosing tube, switch, and base off float chamber. Jam nuts and attraction sleeve are now accessible.
8. Measure the distance “D” from the top edge of the upper jam nuts to the top of the float stem. Refer to **Figure 6**. Record this measurement.
9. Loosen and remove upper jam nuts, guide washer and attraction sleeve.
10. Loosen and adjust lower jam nuts to the desired position. Tighten lower jam nuts securely. Refer to **Figure 6**.
11. Replace attraction sleeve on stem.
12. Replace upper jam nuts and guide washer on the stem in the position previously noted. Tighten upper jam nuts securely. Refer to **Figure 6**.

NOTE: Use a new enclosing tube gasket when reassembling enclosing tube to the chamber. Make certain that all gasket surfaces are thoroughly cleaned to allow proper gasket seating. Coat enclosing tube threads with anti-seizing compound.

13. Replace enclosing tube, switch, and base on chamber. Screw tube clockwise until tightened to 200–225 foot-pounds of torque.
14. Loosen the set screws at the base of the switch housing. Rotate switch housing to correct position and tighten set screws. Refer to **Figure 1** on page 5.

**Caution:** After increasing gap setting, be certain to check for proper operation of switch mechanism by raising and lowering float assembly. Magnet must snap cleanly. Additional float movement will be available after magnet snaps.

15. Bring supply wires through conduit outlet. Follow steps 5 through 10 in *Wiring, Section 1.5*.
16. 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. If the unit still fails to function properly, consult the factory.

## 2.4.2 High level controls

On high level controls the switch trips on the higher actuation point and resets on the lower actuation point.

**Caution:** In high level controls, widening the differential requires raising the trip point a proportional amount. The reset point will remain the same.

To widen the differential by raising the trip point, follow steps 1 through 16 in *Low level controls, Section 2.4.1*.

## 2.5 Replacement of Standard Float and Stem Assembly

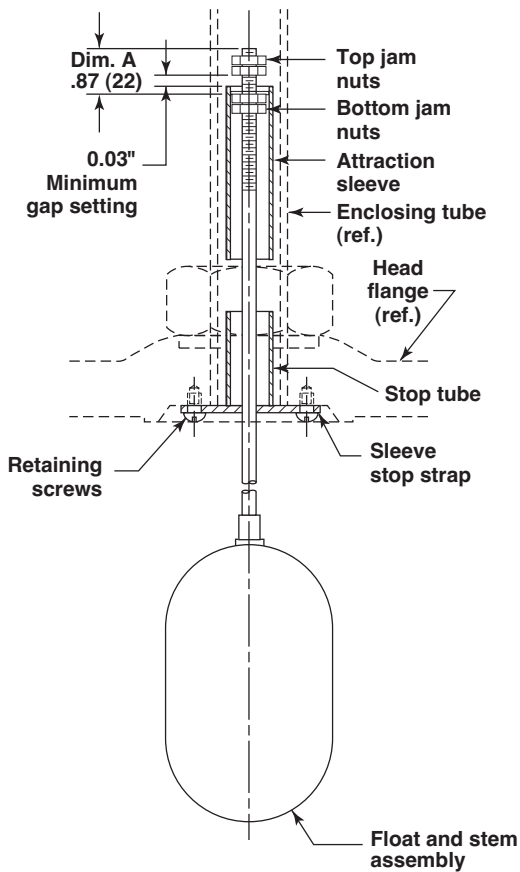


Figure 8

1. Disconnect wiring or medium lines from control and perform system shutdown. See *Troubleshooting, Section 3.0*.
2. Remove switch housing assembly from float chamber at head flange.
3. Remove sleeve stop strap from the underside of the head flange and slide the float stem assembly out of the enclosing tube.

NOTE: New float and stem kits are supplied unassembled. Refer to **Figure 8** for standard jam nut settings (Dimension A).

4. Check new float and stem assembly to be certain it is the correct replacement unit:
  - a. Float should be of same physical size and shape.
  - b. Stem length should match closely.
  - c. Set attraction sleeve per Dimension A as shown in **Figure 8**.

NOTE: If differential adjustment has been altered in the field, disregard Dimension A and readjust new assembly to the previously determined level differential settings. See *Switch Differential Adjustment, Section 2.4*.

5. Replace new float and stem assembly into head flange and install new stop strap with screws included.
6. Remount head flange on float chamber using new gasket provided. Tighten flange nuts evenly, using an alternating pattern typical of standard industry practice.

NOTE: Care must be taken during installation to be certain float stem does not bend.

7. With control assembly in place, test switch actuation by varying liquid level in float chamber.

NOTE: When reassembling the enclosing tube or the upper flange assembly to the control, tighten according to the following torque values.

Model	Flange Bolting	Enclosing Tube
C29, D30	55–60 ft–lbs	200–225 ft–lbs
C60, J30, L30	100–125 ft–lbs	75–100 ft–lbs
B60	250–300 ft–lbs	200–225 ft–lbs

## 3.0 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 switch mechanism.

### 3.1 Check Switch Mechanism

1. Pull switch or otherwise disconnect power to the control.
2. Remove switch housing cover.
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  $3^\circ$  of vertical.
7. Check microswitch continuity with ohmmeter. If switch is damaged, replace immediately.
8. If switch mechanism is operating satisfactorily, proceed to check sensing unit.

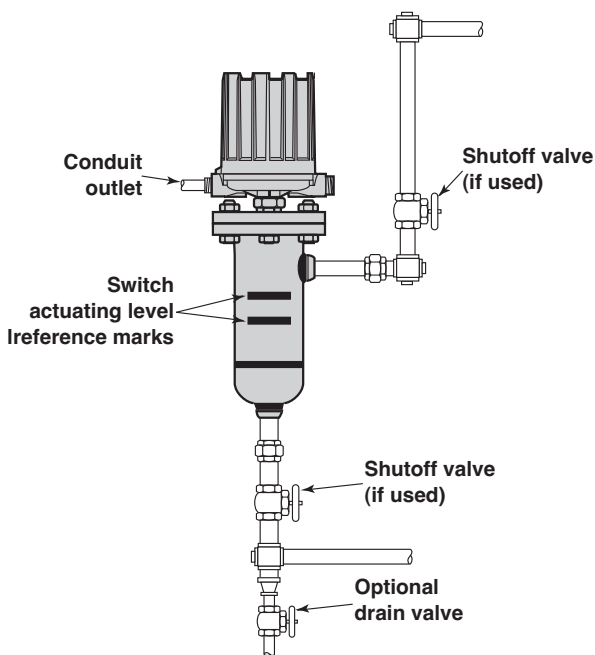


Figure 9

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

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## 3.2 Check Sensing Unit

1. Reconnect power supply. Carefully actuate the switch mechanism manually (use a non-conductive tool on electrical switch mechanisms) 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 level sensing portion of the control, float(s), stem(s), and magnetic attraction sleeve(s).
3. Check to be certain liquid is entering float chamber. A valve may be closed or piping may be plugged.

**Caution:** Be certain to pull disconnect switch or otherwise ensure that electrical circuit(s) through control is deactivated. Close operating medium supply valve on controls equipped with pneumatic switch mechanisms.

4. Disconnect wiring from supply side of switch mechanism(s) and remove electrical conduit or operating medium line connections to switch housing.
5. Perform system shutdown to relieve pressure from float chamber of control. Allow unit to cool.
6. Close shutoff valves (if equipped) to isolate control from vessel. Drain off liquid in chamber if necessary.
7. On installations without shutoff valves, relieve pressure from vessel and drain off liquid head above control mounting level.

**NOTE:** Control chamber, connections, and pipe lines need not be removed from vessel or boiler.

8. Remove switch housing assembly by loosening hex nut, which is located immediately below housing base.
9. With switch housing assembly removed, inspect attraction sleeve(s) and inside of enclosing tube for excessive corrosion or solids buildup. Such buildup could restrict movement, preventing sleeve(s) from reaching field of switch magnet(s).
10. If differential has been changed in the field by repositioning the lower jam nuts on the float stem, check tightness and position of the jam nuts.

**NOTE:** Differential adjustment affects a change in the amount of level travel between switch-on and switch-off actuations. **Do not attempt** adjustment without first consulting factory for assistance in computing level differential change for your control.

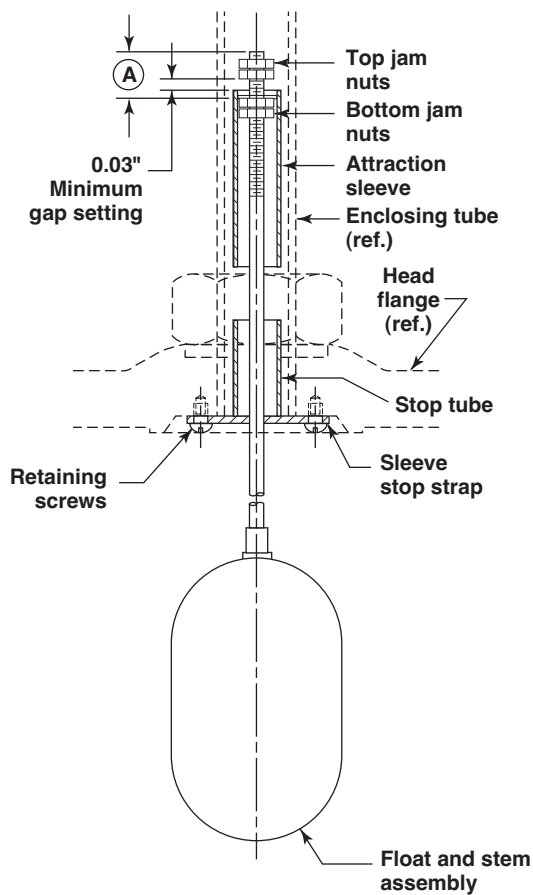


Figure 10

11. Check float to be certain it is buoyant in the liquid (float chamber or vessel must have adequate liquid level). If float is determined to be filled with liquid, or it is collapsed, it must be replaced immediately.

**Caution:** Do not attempt to repair a float. See *Replacement of Standard Float and Stem Assembly, Section 2.5*.

If all components in the control are in operating condition, the trouble is likely located external to the control. Repeat inspection of external conditions as 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 inquiring about your control, be certain to always specify the complete Model and Serial numbers.

## 4.0 Preventive Maintenance

Periodic inspections are necessary 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 sections on “what to do” and “what to avoid” are observed, your control will provide reliable protection of your equipment for many years.

### 4.1 What To Do

#### 4.1.1 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 switch mechanism operation. It also 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.

#### 4.1.2 Inspect switch mechanisms, terminals, and connections monthly

1. 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.

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Such wear can cause false switch actuating levels. See switch mechanism bulletin supplied with control should switch adjustment or replacement become necessary.

2. DO NOT operate your control with defective or maladjusted switch mechanisms. Refer to bulletin on switch mechanisms furnished for service instructions. See *Switch and Housing Reference, Section 6.2.2*.
3. 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.

NOTE: Check wiring carefully and replace at the first sign of brittle insulation.

4. Vibration may cause terminal screws to loosen. Check all terminal connections to be certain that screws are tight.
5. On units with pneumatic switches, air (or gas) 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.

#### **4.1.3 Inspect entire unit periodically**





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

## **4.2 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.

## 5.0 Specifications

### 5.1 Agency Approvals

AGENCY	APPROVED MODEL	AREA CLASSIFICATION
<b>FM</b> 	All with an electric switch mechanism and a housing listed as TYPE 4X	Non-Hazardous TYPE 4X
	All with an electric switch mechanism and a housing listed as TYPE 4X/7/9	Class I, Div 1, Groups C & D Class II, Div 1, Groups E, F & G
	All with an electric switch mechanism and a housing listed as TYPE 4X/7/9 Class I, Div 1, Group B	Class I, Div 1, Groups B, C & D Class II, Div 1, Groups E, F & G
<b>CSA</b> 	All with an electric switch mechanism and a housing listed as CSA TYPE 4X	Non-Hazardous CSA TYPE 4X
	All with a Series HS, H1, F, 8 or 9 electric switch mechanism and a housing listed as CSA TYPE 4X	Class I, Div 2, Groups B, C & D
	All with an electric switch mechanism and a housing listed as TYPE 4X/7/9	Class I, Div 1, Groups C & D Class II, Div 1, Groups E, F & G
	All with an electric switch mechanism and a housing listed as TYPE 4X/7/9 Class I, Div 1, Group B	Class I, Div 1, Groups B, C & D Class II, Div 1, Groups E, F & G
<b>ATEX / IEC Ex ②</b> 	All with an electric switch mechanism and an ATEX housing ①	ATEX II 2 G EEx d IIC T6 94/9/EC IEC Ex Ex d IIC T6
<b>CE</b> 	Low Voltage Directive 2006/95/EC Per Harmonized Standard: EN 61010-1/1993 & Amendment No. 1	Installation Category II Pollution Degree 2

① Dual stage units with “HS” or “H1” switches are not ATEX approved.

② IEC Installation Instructions:

The cable entry and closing devices shall be Ex d certified suitable for the conditions of use and correctly installed.

For ambient temperatures above +55° C or for process temperatures above +150° C, suitable heat resistant cables shall be used.

Heat extensions (between process connection and housing) shall never be insulated.

**Special conditions for safe use:**

When the equipment is installed in process temperatures higher than +85° C the temperature classification must be reduced according to the following table as per IEC60079-0.

Maximum Process Temperature	Temperature Classification
< 85° C	T6
< 100° C	T5
< 135° C	T4
< 200° C	T3
< 300° C	T2
< 450° C	T1

These units are in conformity with IECEx KEM 05.0020X

Classification Ex d IIC T6

T<sub>ambient</sub> -40° C to +70° C

## 5.2 Physical

### CHAMBERS WITH 1-INCH CONNECTIONS INCHES

### MILLIMETERS

	Min. Sp. Gr.	1" NPT Threaded & Socket Weld			1" Flanged Upper Side/Bottom			1" Flanged Side/Side			Actuating Levels		1" NPT Threaded & Socket Weld			1" Flanged Upper Side/Bottom			1" Flanged Side/Side			Actuating Levels	
		A	B	C	A	B	C	A	B	C	HL	LL	A	B	C	A	B	C	A	B	C	HL	LL
C29	.76	9.94	3.02	13.50	12.81	5.87	16.44	13.46	5.87	17.06	2.95	3.85	252	76	342	325	149	417	341	149	433	74	97
D30	.65	9.19	3.27	12.75	12.06	6.12	15.63	12.71	6.12	16.25	2.50	3.33	233	83	323	306	155	155	322	155	412	63	84
J30	.48	10.19	4.33	14.63	13.06	7.18	17.50	13.71	7.18	18.19	2.61	3.34	258	109	371	331	182	182	348	182	462	66	84
L30	.40										3.24	3.98										82	101
B60	.68	9.81	3.80	14.25	12.68	6.68	17.12	13.33	6.68	17.75	2.77	3.44	249	96	361	322	169	434	338	169	450	70	87
C60	.55										2.87	3.60										72	91

### CHAMBERS WITH 1½-INCH CONNECTIONS INCHES

### MILLIMETERS

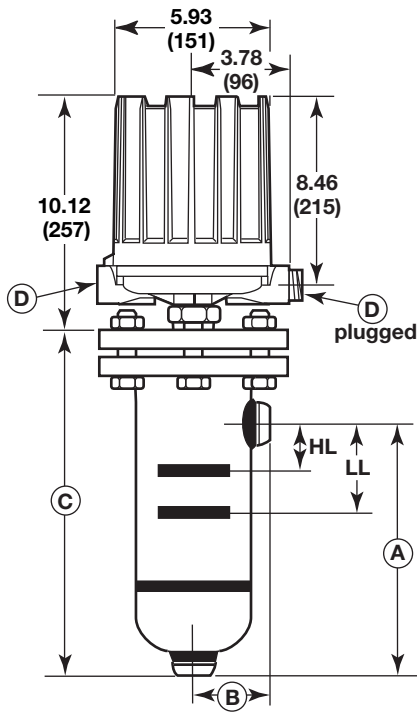
	Min. Sp. Gr.	1½" NPT Threaded & Socket Weld			1½" Flanged Upper Side/Bottom			1½" Flanged Side/Side			Actuating Levels		1½" NPT Threaded & Socket Weld			1½" Flanged Upper Side/Bottom			1½" Flanged Side/Side			Actuating Levels	
		A	B	C	A	B	C	A	B	C	HL	LL	A	B	C	A	B	C	A	B	C	HL	LL
C29	.76	9.75	3.44	14.38	13.81	6.87	18.38	14.46	6.87	19.06	2.02	2.92	247	87	365	350	174	466	367	174	484	51	74
D30	.65	9.00	3.69	13.12	13.06	7.12	17.19	13.71	7.12	17.88	1.87	2.70	228	93	333	331	180	436	348	180	454	47	68
J30	.48	10.00	4.75	15.06	14.06	8.18	19.12	14.71	8.18	19.75	1.97	2.70	254	120	382	357	207	485	374	207	501	50	68
L30	.40										2.60	3.34										66	84
B60	.68	9.62	4.22	14.69	13.68	7.68	18.75	14.33	7.68	19.38	1.46	2.13	244	107	373	347	195	476	383	195	492	37	54
C60	.55										1.93	2.66										49	67

### CHAMBERS WITH 2-INCH CONNECTIONS INCHES

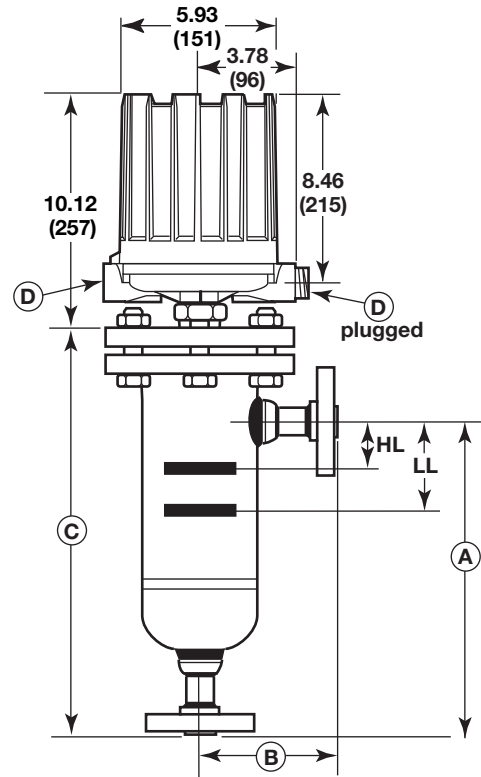
### MILLIMETERS

	Min. Sp. Gr.	2" NPT Threaded & Socket Weld			2" Flanged Upper Side/Bottom			2" Flanged Side/Side			Actuating Levels		2" NPT Threaded & Socket Weld			2" Flanged Upper Side/Bottom			2" Flanged Side/Side			Actuating Levels	
		A	B	C	A	B	C	A	B	C	HL	LL	A	B	C	A	B	C	A	B	C	HL	LL
C29	.76	10.00	3.56	14.44	13.81	6.87	18.25	14.46	6.87	18.94	2.07	2.97	254	90	366	350	174	463	367	174	481	52	75
D30	.65	8.75	3.81	13.25	13.06	7.12	17.56	13.71	7.12	18.25	1.50	2.33	222	96	336	331	180	446	348	180	463	38	59
J30	.48	9.74	4.87	15.19	14.06	8.18	19.50	14.71	8.18	20.12	1.60	2.33	247	123	385	357	207	495	374	207	511	40	59
L30	.40										2.23	2.97										56	75
B60	.68	9.38	4.34	14.81	13.68	7.68	19.12	14.33	7.68	19.75	1.52	2.19	238	110	376	347	195	485	363	195	501	38	55
C60	.55										1.99	2.72										50	69

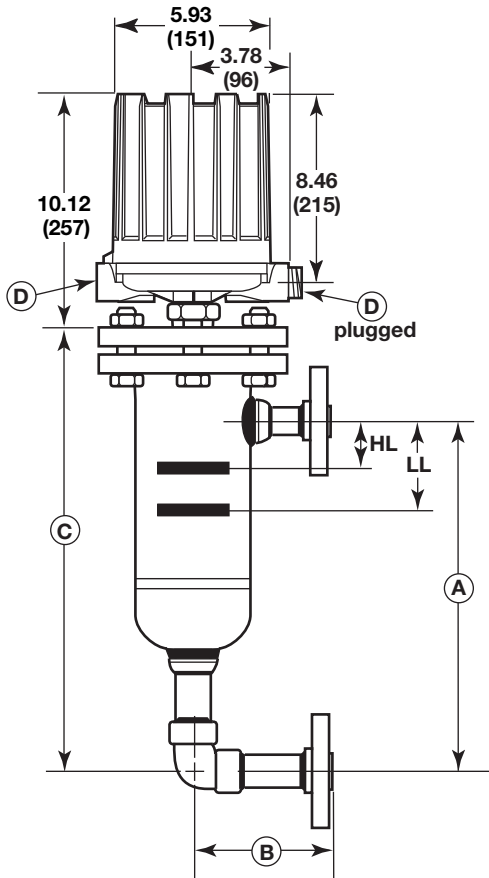
Inches (mm)



Threaded and Socket Weld



Side/Bottom Flanged



Side/Side Flanged

**Conduit Connections D**

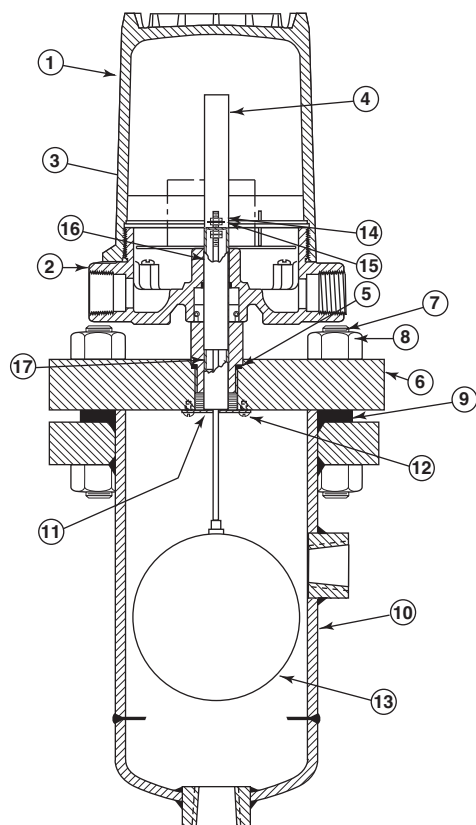
Electrical Switches	
TYPE 4X/7/9:	1" NPT
Group B:	1" NPT
Pneumatic Switches	
TYPE 1:	¼" NPT

**NOTES:**

1. Switch actuating levels (HL & LL) are given for minimum specific gravity conditions. Levels will be lower in the float chamber for higher specific gravities.
2. Standard process connections are a combination of 1" NPT and 1" socket weld coupling.
3. Allow overhead clearance of 10" (254 mm) for NEMA 4X/7/9 housing.

## 6.0 Replacement Parts

### 6.1 Standard Flanged External Cage Models



#### 6.1.1 Parts identification

1	Housing cover
2	Housing base
3	Switch mechanism
4	Enclosing tube
5	Enclosing tube gasket
6	Head flange
7	Studs
8	Hex nuts
9	Flange gasket
10	Float chamber
11	Stop strap
12	Screws
13	Float and stem assembly
14	Jam nuts
15	Guide washer
16	Attraction sleeve
17	Stop tube (not required for Models C29 and D30)

#### IMPORTANT:

When ordering, please specify:

- A. Model and serial number of control.
- B. Replacement assembly (kit) part number.

#### 6.1.2 Switch and housing reference

	Series Type	Bulletin #
Dry contact	B, C, D	42-683
Hermetically sealed	F	42-683
Hermetically sealed	HS, H1	42-694
Bleed type pneumatic	J	42-685
Non-bleed type pneumatic	K	42-686
High temperature	8, 9, R	42-799

#### 6.1.3 Model C29

Housing cover	Refer to Section 6.1.2
Housing base	Refer to Section 6.1.2
Switch mechanism	Refer to Section 6.1.2
Enclosing tube kit: includes items 4 and 5 ①	089-5933-004
Enclosing tube gasket	012-1204-001
Head flange kit: includes items 5, 6, 7, 8, and 9	089-4203-001
Flange gasket	012-1301-025
Float chamber kit: includes items 7, 8, 9, and 10	089-4603-001
Float and stem assembly: includes items 9, 11, 12, 13, 14, 15, 16, and 17 ①	089-3257-001
Complete control less float chamber (10), bolts (7), and nuts (8)	089-6567-003

### 6.1.4 Models D30, J30 and L30

	D30	J30	L30
Housing cover		Refer to Section 6.1.2	
Housing base		Refer to Section 6.1.2	
Switch mechanism		Refer to Section 6.1.2	
Enclosing tube kit ① ② includes items 4 and 5	089-5915-001	089-5933-011	
Enclosing tube gasket	012-1204-001	012-1301-002	
Head flange kit includes items 5, 6, 7, 8, and 9	089-4204-001	089-4205-001	
Flange gasket	012-1301-023	012-1301-026	
Float chamber kit ③ includes items 7, 8, 9, and 10	089-4604-001	089-4605-001	
Float and stem assembly ① includes items 9, 11, 12, 13, 14, 15, 16, and 17	089-3204-001	089-3205-001	089-3206-001
Complete control ① ④ less float chamber (10), bolts (7), and nuts (8)	089-6569-002	not available	

### 6.1.5 Models B60 and C60

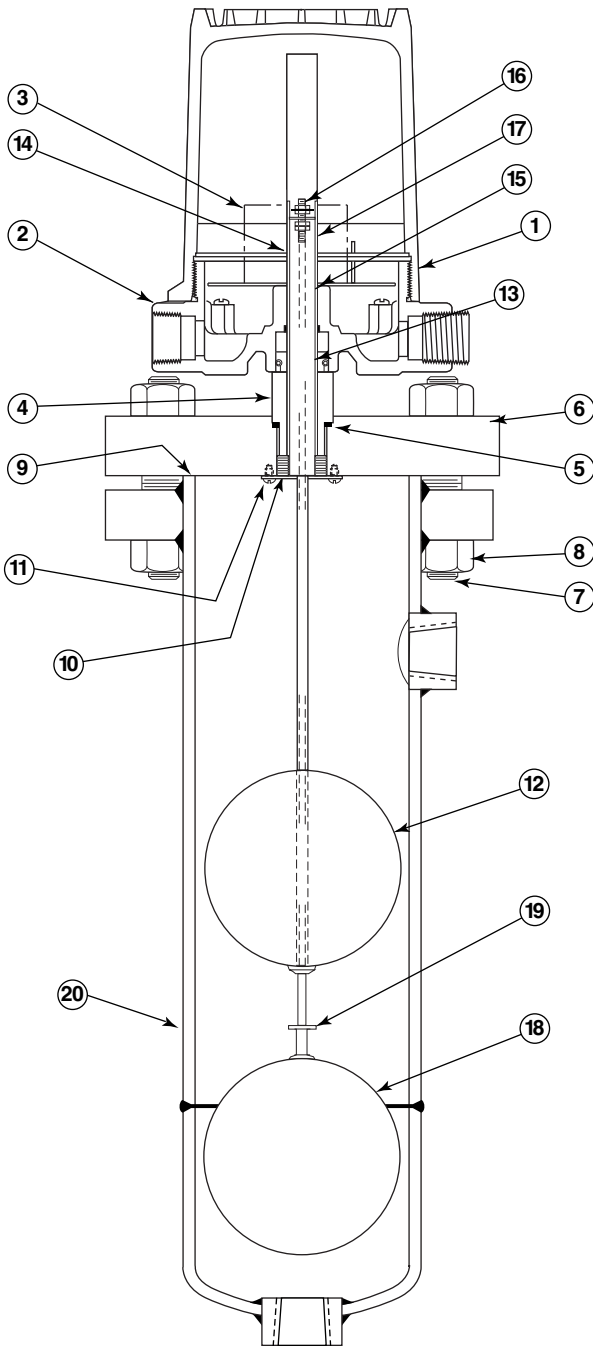
	B60	C60
Housing cover	Refer to Section 6.1.2	
Housing base	Refer to Section 6.1.2	
Switch mechanism	Refer to Section 6.1.2	
Enclosing tube kit: includes items 4 and 5 ①	089-5933-004	089-5933-011
Enclosing tube gasket	012-1204-001	012-1301-002
Head flange kit: includes items 5, 6, 7, 8, and 9	089-4206-001	089-4206-002
Flange gasket	012-1204-015	012-1301-024
Float chamber kit: ③ includes items 7, 8, 9, and 10	089-4606-001	089-4606-002
Float and stem assembly: includes items 9, 11, 12, 13, 14, 15, 16, and 17 ①	089-3208-001	089-3209-001
Complete control less float chamber (10), bolts (7), and nuts (8) ① ④	089-6568-004	089-6568-003

NOTE: All replacement assemblies listed are furnished in kit form for standard base models. Consult local representative for ordering assistance on all special model replacement parts or accessories not included in above listing.

- ① For models with -2 material codes, consult factory for spare parts.
- ② Model D30 unit is specially designed for Dowtherm "A" service only, with Hastelloy C enclosing tube.
- ③ Kits are units with 1" NPT or SW side/bottom connections. For other configurations, consult factory.
- ④ Furnished with one Series 3, SPDT Mercury Switch and standard switch housing.

## 6.2 Tandem Flanged External Cage Models

### 6.2.1 Parts identification



1	Housing cover
2	Housing base
3	Switch mechanism
4	Enclosing tube
5	Enclosing tube gasket
6	Head flange
7	Studs and bolts
8	Hex nuts
9	Flange gasket
10	Stop strap
11	Screws
12	Upper float and stem assembly
13	Lower attraction sleeve
14	Spacer washer
15	Retaining ring
16	Jam nuts
17	Upper attraction sleeve
18	Lower float and stem assembly
19	Safety stop washer
20	Float chamber
21	Chamber liner (not shown)

**IMPORTANT:**

When ordering, please specify:

- A. Model and serial number of control.
- B. Replacement assembly (kit) part number.

### 6.2.2 Switch and housing reference

	Series Type	Bulletin #
Dry contact	B, C, D	42-683
Hermetically sealed	F	42-683
Hermetically sealed	HS, H1	42-694
Bleed type pneumatic	J	42-685
Non-bleed type pneumatic	K	42-686
High temperature	8, 9, R	42-799

### 6.2.3 Model C29 TDM

Housing kit: includes items 1 and 2	Refer to Section 6.2.2
Switch mechanism	Refer to Section 6.2.2
Enclosing tube kit: includes items 4 and 5	89-5909-002
Enclosing tube gasket	12-1204-001
Head flange kit: includes items 5, 6, 7, 8, and 9	89-4203-001
Flange gasket	12-1301-025
Upper float and stem kit: includes items 9, 10, 11, 12, 13, 14 and 15	89-3217-001
Lower float and stem kit: includes items 9, 16, 17, 18 and 19	Special order ①
Float chamber kit: includes items 7, 8, 9, and 20	Special order ①

### 6.2.4 Models D30 TDM, J30 TDM and L30 TDM

	D30 TDM ②	J30 TDM	L30 TDM
Housing kit: includes items 1 and 2		Refer to Section 6.2.2	
Switch mechanism		Refer to Section 6.2.2	
Enclosing tube kit		089-5909-002	
includes items 4 and 5			
Enclosing tube gasket		012-1204-001	
Head flange kit	089-4204-001		089-4205-001
includes items 5, 6, 7, 8, and 9			
Flange gasket	012-1301-023		012-1301-026
Upper float and stem kit	089-3218-001	089-3219-001	089-3220-001
includes items 9,10,11,12,13,14, and 15			
Lower float and stem kit		Special order ①	
includes items 9, 16, 17, 18, and 19			
Float chamber kit		Special order ①	
includes items 7,8 9, and 20			

### 6.2.5 Models B60 TDM and C60 TDM

	B60 TDM	C60 TDM
Housing kit: includes items 1 and 2	Refer to Section 6.2.2	
Switch mechanism	Refer to Section 6.2.2	
Enclosing tube kit: includes items 4 and 5	089-5933-004	089-5933-011
Enclosing tube gasket	012-1204-001	012-1204-001
Head flange kit: includes items 5, 6, 7, 8, and 9	089-4206-001	089-4206-002
Flange gasket	012-1204-015	012-1301-024
Upper float and stem kit: includes items 9, 10, 11, 12, 13, 14, and 15	089-3222-001	089-3223-001
Lower float and stem kit: includes items 9, 16, 17, 18, and 19		Special order ①
Float chamber kit: includes items 7, 8, 9, and 20		Special order ①

NOTE: All replacement assemblies listed are furnished in kit form for standard base models. Consult local representative for ordering assistance on all special model replacement parts or accessories not included in above listing.

① Specify model and serial number when ordering special order items.

② Model D30 unit is specially designed for Dowtherm "A" service only, with Hastelloy® C enclosing tube.

## 7.0 Model Numbers

### MODEL NUMBER CODE

① Model No.	Minimum Specific Gravity ② for Models with Material of Construction Code		Pressure Rating							
			psig @ ° F				bar @ ° C			
	1	2	100	750	900	1000	38	399	482	538
C29	0.76	0.81	500	403	388	383	34	28	27	26
D30 ③	0.65	0.69	250	201	194	191	17	14	13	13
J30	0.48	0.51	400 ④	322 ④	310	167	28 ④	22 ④	21	12
L30	0.40	0.42	300 ④	242 ④	233	167	21 ④	17 ④	16	12
B60	0.68	0.71	900	725	496	182	62	50	34	13
C60	0.55	0.59	500	403	388	182	34	28	27	13

### MATERIALS OF CONSTRUCTION

1	Carbon Steel Chamber, 316 SS Float, 400 Stainless Steel Sleeve
2	Carbon Steel Chamber, 316 SS Float, 316 Stainless Steel Sleeve

### TANK CONNECTION TYPE AND SIZE

Connection Type	Connection Size								
	1"			1½"			2"		
Threaded	B20			C20			D20		
Socket Weld	B30			C30			D30		
	Cage Mounting Flange Rating (lbs.)								
	150	300	600	150	300	600	150	300	600
Flanged Upper Side/Bottom	N30	N40	N50	P30	P40	P50	Q30	Q40	Q50
Flanged Side/Side	S30	S40	S50	T30	T40	T50	V30	V40	V50

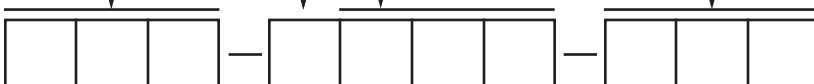
Connection flanges are ASME B16.5 raised face.

### PNEUMATIC SWITCH MECHANISM AND ENCLOSURE

Switch Description	Maximum Supply Pressure		Maximum Process Temperature		Bleed Orifice Diameter		Models with Material of Construction Code	
	psig	bar	° F	° C	inches	mm	NEMA 1	NEMA 1
Series J Bleed Type	100	7	+400	+204	.063	1.6	JDG	JDE
	60	4	+400	+204	.094	2.3	JEG	JEE
Series K Non-Bleed	100	7	+400	+204	—	—	KOE	KOE
	40	3	+400	+204	—	—	KOG	—

Electric switch mechanism and enclosure codes on next page

- ① Models are limited to maximum temperature rating of selected switch mechanisms.
- ② For single stage models only. Consult factory for multiple stages.
- ③ Model D30 recommended for Dowtherm applications.
- ④ Float cage rated 600 psig @ +100° F (41 bar @ +38° C) and 340 psig @ +750° F (23 bar @ +399° C).
- ⑤ Process temperature based on +100° F (+38° C) ambient.
- ⑥ Consult factory for NEMA 4X/9 cast iron housing codes.
- ⑦ On condensing applications, temperature down-rated to +400° F (+209° C) process at +100° F (+38° C) ambient.



## ELECTRIC SWITCH MECHANISM AND ENCLOSURE

Switch Description	Process <sup>®</sup> Temperature Range °F (°C)	Contacts	Set Points	All models with Material of Construction Code 1			All models with Material of Construction Code 2		
				TYPE 4X/7/9 Aluminum Enclosure <sup>®</sup>					
				Class I, Div 1 Groups C&D	Class I, Div 1 Group B	ATEX Ex II 2 G EEx d IIC T6	Class I, Div 1 Groups C&D	Class I, Div 1 Group B	ATEX Ex II 2 G EEx d IIC T6
Series B Snap Switch	-40 to +250 (-40 to +121)	SPDT	1	BAK	BKJ	BCC	BKB	BKK	BC9
			2	BLA	BLJ	BDC	BLB	BLK	BD9
			3	BMA	BMJ	BEC	BMB	BMK	BE9
		DPDT	1	BNA	BNJ	BFC	BNB	BNK	BF9
2	BOA		BOJ	BGC	BOB	BOK	BG9		
Series C Snap Switch	-40 to +450 (-40 to +232)	SPDT	1	CKA	CKJ	CCC	CKB	CKK	CC9
			2	CLA	CLJ	CDC	CLB	CLK	CD9
			3	CMA	CMJ	CEC	CMB	CMK	CE9
		DPDT	1	CNA	CNJ	CFC	CNB	CNK	CF9
2	COA		COJ	CGC	COB	COK	CG9		
Series D DC Current Snap Switch	-40 to +250 (-40 to +121)	SPDT	1	DKB	DKK	DC9	DKB	DKK	DC9
			2	DLB	DLK	DD9	DLB	DLK	DD9
			3	N/A			DMB	DMK	DE9
		DPDT	1	DNB	DNK	DF9	DNB	DNK	DF9
2	DOB		DOK	DG9	DOB	DOK	DG9		
Series F Hermetically Sealed Snap Switch	-50 to +750 (-46 to +399)	SPDT	1	FKA	FKJ	FCC	FKB	FKK	FC9
			2	FLA	FLJ	FDC	FLB	FLK	FD9
		DPDT	1	FNA	FNJ	FFC	FNB	FNK	FF9
			2	FOA	FOJ	FGC	FOB	FOK	FG9
Series HS <sup>⑦</sup> Hermetically Sealed 5-amp Snap Switch with Wiring Leads	-50 to +550 (-46 to +288)	SPDT	1	HMJ	HMK	N/A	HMJ	HMK	N/A
			2	HMN	HMP		HMN	HMP	
		DPDT	1	HMS	HMT		HMS	HMT	
			2	HMY	HMZ		HMY	HMZ	
Series HS <sup>⑦</sup> Hermetically Sealed 5-amp Snap Switch with Terminal Block	-50 to +550 (-46 to +288)	SPDT	1	HM3	HM4	HA9	HM3	HM4	HA9
		DPDT	1	HM7	HM8	HB9	HM7	HM8	HB9
Series H1 Hermetically Sealed 1-amp Snap Switch with Wiring Leads	-50 to +750 (-46 to +399)	SPDT	1	HKJ	HKK	N/A	HKJ	HKK	N/A
			2	HKN	HKP		HKN	HKP	
Series R High Temperature Snap Switch	-40 to +750 (-40 to +399)	SPDT	1	RKB	RKK	RC9	RKB	RKK	RC9
			2	RLB	RLK	RD9	RLB	RLK	RD9
		DPDT	1	RNB	RNK	RF9	RNB	RNK	RF9
			2	ROB	ROK	RG9	ROB	ROK	RG9
Series 8 Hermetically Sealed Snap Switch	-50 to +750 (-46 to +399)	SPDT	1	8KA	8KJ	8CC	8KB	8KK	8C9
			2	8LA	8LJ	8DC	8LB	8LK	8D9
			3	8MA	8MJ	8EC	8MB	8MK	8E9
		DPDT	1	8NA	8NJ	8FC	8NB	8NK	8F9
			2	8OA	8OJ	8GC	8OB	8OK	8G9
Series 9 High Temperature Hermetically Sealed Snap Switch	-50 to +750 (-46 to +399)	SPDT	1	9KA	9KJ	9CC	9KB	9KK	9C9
			2	9LA	9LJ	9DC	9LB	9LK	9D9
			3	9MA	9MJ	9EC	9MB	9MK	9E9
		DPDT	1	9NA	9NJ	9FC	9NB	9NK	9F9
			2	9OA	9OJ	9GC	9OB	9OK	9G9
				CS/Aluminum	Cast Iron		CS/Aluminum	Cast Iron	
				NEMA 4X	Class I, Div 1 Groups C&D	Class I, Div 1 Group B	NEMA 4X	Class I, Div 1 Groups C&D	Class I, Div 1 Group B
Series R High Temperature Snap Switch	-40 to +1000 (-46 to +538)	SPDT	1	R1M	RKM	RKW	R1M	RKM	RKW
			2	R3M	RLM	RLW	R3M	RLM	RLW
		DPDT	1	RDM	RNM	RNW	RDM	RNM	RNW
			2	REM	ROM	ROW	REM	ROM	ROW
Series 9 High Temperature Hermetically Sealed Snap Switch	-50 to +1000 (-46 to +538)	SPDT	1	9AD	9KD	9KV	9AM	9KM	9KW
			2	9BD	9LD	9LV	9BM	9LM	9LW
			3	9CD	9MD	9MV	9CM	9MM	9MW
		DPDT	1	9DD	9ND	9NV	9DM	9NM	9NW
			2	9ED	9OD	9OV	9EM	9OM	9OW



### 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.

### 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's 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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