FLANGED EXTERNAL CAGE

Liquid float level switches

Magnetrol®

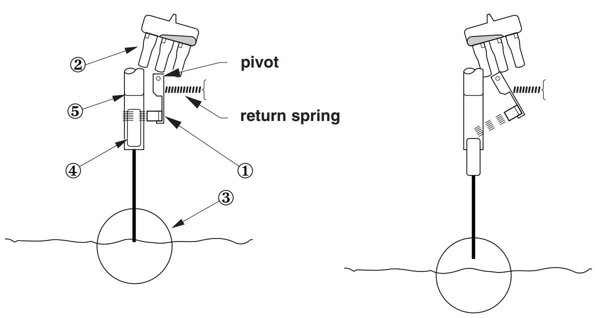
INSTRUCTION MANUAL AND REPLACEMENT PARTS

DESCRIPTION

External cage type level switches are completely self-contained units designed for side mounting to a tank or vessel with threaded or flanged pipe connections. These switches have thoroughly demonstrated their worth for years in hundreds of industrial applications – particularly in the fields of petroleum refining, petro-chemical production and power generation.

OPERATING PRINCIPLE

A permanent magnet ① is attached to a pivoted switch actuator ②. As the float/ displacer ③ rises following the liquid level, it raises the attraction sleeve ④ into the field of the magnet, which then snaps against the non-magnetic enclosing tube ⑤, actuating the switch. The enclosing tube provides a static pressure boundary between the switch mechanism and the process. On a falling level, an inconel spring retracts the magnet, deactivating the switch.



Rising level **Falling level**

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.

AGENCY APPROVALS

Agency	*Approval*
ATEX	II 2G EEx d II C T6, explosion proof II 1G EEx ia II C T6, intrinsically safe
CENELEC	EEx d II C T6, explosion proof
FM	Class I, Div. 1, Groups C & D Class II, Div. 1, Groups E, F & G, Type NEMA 7/9
FM/CSA ①	Non-Hazardous area
	Explosion proof area – Groups B, C, D, E, F & G Type NEMA 4X/7/9
SAA ①	Explosion proof area
LRS	Lloyds Register of Shipment (marine applications)
GOST	Russian Authorisation Standards
Other approvals are available, consult factory for more details	

① Consult factory for proper model numbers.

MODEL IDENTIFICATION

A complete flanged external cage float level switch, consists of 1 order code:

1. Order code for liquid float level switches in an external cage
   BASIC MODEL NUMBER

O 3 0	down to S.G. 0,84	up to 27,6 bar (400 psi)	min S.G. varies per material of construction max pressure varies per material of construction and temperature - select as per table on left page -
B 4 1	down to S.G. 0,67	up to 19,6 bar (285 psi)	
B 4 3	down to S.G. 0,72	up to 27,6 bar (400 psi)	
B 6 0	down to S.G. 0,69	up to 62 bar (900 psi)	
A 4 0	down to S.G. 0,65	up to 51 bar (740 psi)	
G 3 3	down to S.G. 0,54	up to 51 bar (740 psi)	
J 3 1	down to S.G. 0,50	up to 19,6 bar (285 psi)	
J 3 3	down to S.G. 0,50	up to 27,6 bar (400 psi)	

MATERIALS OF CONSTRUCTION

Code	*Cage & process connection material*	*Float and trim*	*Magnetic sleeve*
A	Carbon steel	316 SST (1.4401)	400 series SST
B	Carbon steel	316 SST (1.4401)	316 SST (1.4401)
D	316/316L (1.4401/1.4404)	316 SST (1.4401)	316 SST (1.4401)

PROCESS CONNECTION **– O75, B73 and O30 units are only available with 1"/DN 25 size connections**

	Threaded NPT connection	**Socket weld connection**
	upper side / bottom	upper side / bottom
1"	B20	B30
1 1/2"	C20	C30
2"	D20	D30

	ANSI Flanges					
	upper side / bottom			side / side		
	150 lbs RF	300 lbs RF	600 lbs RF	150 lbs RF	300 lbs RF	600 lbs RF
1"	N30	N40	N50	S30	S40	S50
1 1/2"	P30	P40	P50	T30	T40	T50
2"	Q30	Q40	Q50	V30	V40	V50

	DIN Flanges - Form to DIN 2526					
	upper side / bottom			side / side		
	PN 16 (DIN 2633) Form C	PN 25/40 (DIN 2635) Form C	PN 64 (DIN 2636) Form E	PN 16 (DIN 2633) Form C	PN 25/40 (DIN 2635) Form C	PN 64 (DIN 2636) Form E
DN 25	1FA	1HA	1JA	1FB	1HB	1JB
DN 40	2FA	2HA	2JA	2FB	2HB	2JB
DN 50	3FA	3HA	3JA	3FB	3HB	3JB

SWITCH MECHANISM & ENCLOSURE
- for all units except B73 and B41
- for B73 and B41 units
- for pneumatic switch mechanisms

☐☐☐ – ☐☐☐☐ – ☐☐☐ **complete order code for *caged* models**

Select electric switch mechanism & enclosure for **all models except B41** (see page 4 for switch ratings)

qty and switch type		All models with material codes A									All models with material codes B and D								
		Weather proof (IP 66)		ATEX (IP 66)				CENELEC (IP 66)		FM (IP 66)	Weather proof (IP 66)		ATEX (IP 66)				CENELEC (IP 66)		FM (IP 66)
				II 2G EEx d II C T6		II 1G EEx ia II C T6		EEx d II C T6		NEMA 7/9			II 2G EEx d II C T6		II 1G EEx ia II C T6		EEx d II C T6		NEMA 7/9
		cast Aluminium		cast Aluminium		cast Aluminium		cast Iron		cast Alu.	cast Aluminium		cast Aluminium		cast Aluminium		cast Iron		cast Alu.
		M20 x 1,5	1" NPT	M20 x 1,5	1" NPT	M20 x 1,5	1" NPT	M20 x 1,5	3/4" NPT	1" NPT	M20 x 1,5	1" NPT	M20 x 1,5	1" NPT	M20 x 1,5	1" NPT	M20 x 1,5	3/4" NPT	1" NPT
A	1 x SPDT	A2A	AAA	AKC	ACC	-	-	AK7	AU7	AKA	A2B	AAB	AK9	AC9	-	-	AK5	AU5	AKB
	2 x SPDT	A4A	ABA	ALC	ADC	-	-	AL7	AV7	ALA	A4B	ABB	AL9	AD9	-	-	AL5	AV5	ALB
	3 x SPDT	36E	3CA	38E	3EE	-	-	367	377	3ME	A6B	ACB	AM9	AE9	-	-	A65	A75	AMB
	1 x DPDT	A8A	ADA	ANC	AFC	-	-	AD7	AW7	ANA	A8B	ADB	AN9	AF9	-	-	AD5	AW5	ANB
	2 x DPDT	A1A	AEA	APC	AGC	-	-	AO7	AY7	AOA	A1B	AEB	AP9	AG9	-	-	AO5	AY5	AOB
3	1 x SPDT	32A	3AA	3KC	3CC	-	-	3K7	3U7	3KA	32B	3AB	3K9	3C9	-	-	3K5	3U5	3KB
	2 x SPDT	34E	3BA	39E	3DE	-	-	3L7	3V7	3LE	34B	3BB	3L9	3D9	-	-	3L5	3V5	3LB
	3 x SPDT	36E	3CA	38E	3EE	-	-	367	377	3ME	36B	3CB	3M9	3E9	-	-	365	375	3MB
	1 x DPDT	38A	3DA	3NC	3FC	-	-	3D7	3W7	3NA	38B	3DB	3N9	3F9	-	-	3D5	3W5	3NB
	2 x DPDT	31A	3EA	3PC	3GC	-	-	3O7	3Y7	3OA	31B	3EB	3P9	3G9	-	-	3O5	3Y5	3OB
B	1 x SPDT	B2A	BAA	BKC	BCC	-	-	BK7	BU7	BKA	B2B	BAB	BK9	BC9	-	-	BK5	BU5	BKB
	2 x SPDT	B4A	BBA	BLC	BDC	-	-	BL7	BV7	BLA	B4B	BBB	BL9	BD9	-	-	BL5	BV5	BLB
	3 x SPDT	B6A	BCA	BMC	BEC	-	-	B67	B77	BMA	B6B	BCB	BM9	BE9	-	-	B65	B75	BMB
	1 x DPDT	B8A	BDA	BNC	BFC	-	-	BD7	BW7	BNA	B8B	BDB	BN9	BF9	-	-	BD5	BW5	BNB
	2 x DPDT	B1A	BEA	BPC	BGC	-	-	BO7	BY7	BOA	B1B	BEB	BP9	BG9	-	-	BO5	BY5	BOB
C	1 x SPDT	C2A	CAA	CKC	CCC	C2X	CAX	CK7	CU7	CKA	C2B	CAB	CK9	CC9	C2T	CAT	CK5	CU5	CKB
	2 x SPDT	C4A	CBA	CLC	CDC	C4X	CBX	CL7	CV7	CLA	C4B	CBB	CL9	CD9	C4T	CBT	CL5	CV5	CLB
	3 x SPDT	C6A	CCA	CMC	CEC	-	-	C67	C77	CMA	C6B	CCB	CM9	CE9	-	-	C65	C75	CMB
	1 x DPDT	C8A	CDA	CNC	CFC	C8X	CDX	CD7	CW7	CNA	C8B	CDB	CN9	CF9	C8T	CDT	CD5	CW5	CNB
	2 x DPDT	C1A	CEA	CPC	CGC	C1X	CEX	CO7	CY7	COA	C1B	CEB	CP9	CG9	C1T	CET	CO5	CY5	COB
D	1 x SPDT	D2B	DAB	DK9	DC9	-	-	DK5	DU5	DKB	D2B	DAB	DK9	DC9	-	-	DK5	DU5	DKB
	2 x SPDT	D4B	DBB	DL9	DD9	-	-	DL5	DV5	DLB	D4B	DBB	DL9	DD9	-	-	DL5	DV5	DLB
	3 x SPDT	-	-	-	-	-	-	-	-	-	D6B	DCB	DM9	DE9	-	-	D65	D75	DMB
	1 x DPDT	D8B	DDB	DN9	DF9	-	-	DD5	DW5	DNB	D8B	DDB	DN9	DF9	-	-	DD5	DW5	DNB
	2 x DPDT	D1B	DEB	DP9	DG9	-	-	DO5	DY5	DOB	D1B	DEB	DP9	DG9	-	-	DO5	DY5	DOB
F	1 x SPDT	FCA	FAA	FKC	FCC	-	-	FK7	FU7	FKA	FCB	FAB	FK9	FC9	-	-	FK5	FU5	FKB
	2 x SPDT	FFA	FBA	FLC	FDC	-	-	FL7	FV7	FLA	FFB	FBB	FL9	FD9	-	-	FL5	FV5	FLB
	1 x DPDT	FGA	FDA	FNC	FFC	-	-	FD7	FW7	FNA	FGB	FDB	FN9	FF9	-	-	FD5	FW5	FNB
	2 x DPDT	FHA	FEA	FPC	FGC	-	-	FO7	FY7	FOA	FHB	FEB	FP9	FG9	-	-	FO5	FY5	FOB
HS	1 x SPDT	H7A	HM2	HFC	HA9	-	-	HB3	HB4	HM3	H7A	HM2	HFC	HA9	-	-	HB3	HB4	HM3
	1 x DPDT	H7C	HM6	HGC	HB9	-	-	HB7	HB8	HM7	H7C	HM6	HGC	HB9	-	-	HB7	HB8	HM7
U	1 x SPDT	U2A	UAA	UKC	UCC	U2X	UAX	UK7	UU7	UKA	U2B	UAB	UK9	UC9	U2T	UAT	UK5	UU5	UKB
	2 x SPDT	U4A	UBA	ULC	UDC	U4X	UBX	UL7	UV7	ULA	U4B	UBB	UL9	UD9	U4T	UBT	UL5	UV5	ULB
	3 x SPDT	U6A	UCA	UMC	UEC	-	-	U67	U77	UMA	U6B	UCB	UM9	UE9	-	-	U65	U75	UMB
	1 x DPDT	U8A	UDA	UNC	UFC	U8X	UDX	UD7	UW7	UNA	U8B	UDB	UN9	UF9	U8T	UDT	UD5	UW5	UNB
	2 x DPDT	U1A	UEA	UPC	UGC	U1X	UEX	UO7	UY7	UOA	U1B	UEB	UP9	UG9	U1T	UET	UO5	UY5	UOB
V	-	-	-	-	-	VJS	VLS	-	-	-	-	-	-	-	VCS	VES	-	-	-
W	1 x SPDT	W2A	WAA	WKC	WCC	W2X	WAX	WK7	WU7	WKA	W2B	WAB	WK9	WC9	W2T	WAT	WK5	WU5	WKB
	2 x SPDT	W4A	WBA	WLC	WDC	W4X	WBX	WL7	WV7	WLA	W4B	WBB	WL9	WD9	W4T	WBT	WL5	WV5	WLB
	3 x SPDT	W6A	WCA	WMC	WEC	-	-	W67	W77	WMA	W6B	WCB	WM9	WE9	-	-	W65	W75	WMB
	1 x DPDT	W8A	WDB	WN9	WF9	W8T	WDT	WD5	WW5	WNB	W8B	WDB	WN9	WF9	W8T	WDT	WD5	WW5	WNB
	2 x DPDT	W1B	WEB	WP9	WG9	W1T	WET	WO5	WY5	WOB	W1B	WEB	WP9	WG9	W1T	WET	WO5	WY5	WOB
X	1 x SPDT	X2A	XAA	XKC	XCC	X2X	XAX	XK7	XU7	XKA	X2B	XAB	XK9	XC9	X2T	XAT	XK5	XU5	XKB
	2 x SPDT	X4A	XBA	XLC	XDC	X4X	XBX	XL7	XV7	XLA	X4B	XBB	XL9	XD9	X4T	XBT	XL5	XV5	XLB
	3 x SPDT	X6A	XCA	XMC	XEC	-	-	X67	X77	XMA	X6B	XCB	XM9	XE9	-	-	X65	X75	XMB
	1 x DPDT	X8B	XDB	XN9	XF9	X8T	XDT	XD5	XW5	XNB	X8B	XDB	XN9	XF9	X8T	XDT	XD5	XW5	XNB
	2 x DPDT	X1B	XEB	XP9	XG9	X1T	XET	XO5	XY5	XOB	X1B	XEB	XP9	XG9	X1T	XET	XO5	XY5	XOB

Select electric switch mechanism & enclosure for **B41 models** (see page 4 for switch ratings)

qty and switch type		All models with material codes A									All models with material codes B and D								
		Weather proof (IP 66)		ATEX (IP 66)				CENELEC (IP 66)		FM (IP 66)	Weather proof (IP 66)		ATEX (IP 66)				CENELEC (IP 66)		FM (IP 66)
				EEx d IIC T6		II 1G EEx ia II C T6		EEx d IIC T6		NEMA 7/9			EEx d IIC T6		II 1G EEx ia II C T6		EEx d IIC T6		NEMA 7/9
		cast Aluminium		cast Aluminium		cast Aluminium		cast Iron		cast Alu.	cast Aluminium		cast Aluminium		cast Aluminium		cast Iron		cast Alu.
		M20 x 1,5	1" NPT	M20 x 1,5	1" NPT	M20 x 1,5	1" NPT	M20 x 1,5	3/4" NPT	1" NPT	M20 x 1,5	1" NPT	M20 x 1,5	1" NPT	M20 x 1,5	1" NPT	M20 x 1,5	3/4" NPT	1" NPT
A	1 x SPDT	A2P	AAP	AHC	AAC	-	-	AK7	AU7	AKP	A2Q	AAQ	AH9	AA9	-	-	AK5	AU5	AKQ
	1 x DPDT	A8P	ADP	AJC	ABC	-	-	AD7	AW7	ANP	A8Q	ADQ	AJ9	AB9	-	-	AD5	AW5	ANQ
3	1 x SPDT	32P	3AP	3HC	3AC	-	-	3K7	3U7	3KP	32Q	3AQ	3H9	3A9	-	-	3K5	3U5	3KQ
	1 x DPDT	38P	3DP	3JC	3BC	-	-	3D7	3W7	3NP	38Q	3DQ	3J9	3B9	-	-	3D5	3W5	3NQ
B	1 x SPDT	B2P	BAP	BHC	BAC	-	-	BK7	BU7	BKP	B2Q	BAQ	BH9	BA9	-	-	BK5	BU5	BKQ
	1 x DPDT	B8P	BDP	BJC	BBC	-	-	BD7	BW7	BNP	B8Q	BDQ	BJ9	BB9	-	-	BD5	BW5	BNQ
C	1 x SPDT	C2P	CAP	CHC	CAC	C2L	CAL	CK7	CU7	CKP	C2Q	CAQ	CH9	CA9	C2S	CAS	CK5	CU5	CKQ
	1 x DPDT	C8P	CDP	CJC	CBC	C8L	CDL	CD7	CW7	CNP	C8Q	CDQ	CJ9	CB9	C8S	CDS	CD5	CW5	CNQ
D	1 x SPDT	-	-	-	-	-	-	-	-	-	D2Q	DAQ	DH9	DA9	-	-	DK5	DU5	DKQ
	1 x DPDT	-	-	-	-	-	-	-	-	-	D8Q	DDQ	DJ9	DB9	-	-	DD5	DW5	DNQ
F	1 x SPDT	F2P	FAP	FHC	FAC	-	-	FK7	FU7	FKP	F2Q	FAQ	FH9	FA9	-	-	FK5	FU5	FKQ
	1 x DPDT	F8P	FDP	FJC	FBC	-	-	FD7	FW7	FNP	F8Q	FDQ	FJ9	FB9	-	-	FD5	FW5	FNQ
HS	1 x SPDT	-	-	-	-	-	-	-	-	-	H7A	HM2	HFC	HA9	-	-	HB3	HB4	HM3
	1 x DPDT	-	-	-	-	-	-	-	-	-	H7C	HM6	HGC	HB9	-	-	HB7	HB8	HM7
U	1 x SPDT	U2P	UAP	UHC	UAC	U2L	UAL	UK7	UU7	UKP	U2Q	UAQ	UH9	UA9	U2S	UAS	UK5	UU5	UKQ
	1 x DPDT	U8P	UDP	UJC	UBC	U8L	UDL	UD7	UW7	UNP	U8Q	UDQ	UJ9	UB9	U8S	UDS	UD5	UW5	UNQ
V	-	-	-	-	-	VFS	VHS	-	-	-	-	-	-	-	V5S	VBS	-	-	-
W	1 x SPDT	W2P	WAP	WHC	WAC	W2L	WAL	WK7	WU7	WKP	W2Q	WAQ	WH9	WA9	W2S	WAS	WK5	WU5	WKQ
	1 x DPDT	-	-	-	-	-	-	-	-	-	W8Q	WDQ	WJ9	WB9	W8S	WDS	WD5	WW5	WNQ
X	1 x SPDT	X2P	XAP	XHC	XAC	X2L	XAL	XK7	XU7	XKP	X2Q	XAQ	XH9	XA9	X2S	XAS	XK5	XU5	XKQ
	1 x DPDT	-	-	-	-	-	-	-	-	-	X8Q	XDQ	XJ9	XB9	X8S	XDS	XD5	XW5	XNQ

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 Magnetrol float cage control to a vessel or boiler. Level decals on control identify the actuation levels for a unit with three switches at minimum specific gravity. Refer to the Actuation Level charts for the actuation levels for a unit with one switch at different minimum specific gravities.

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 below for bulletin numbers for pneumatic switches.

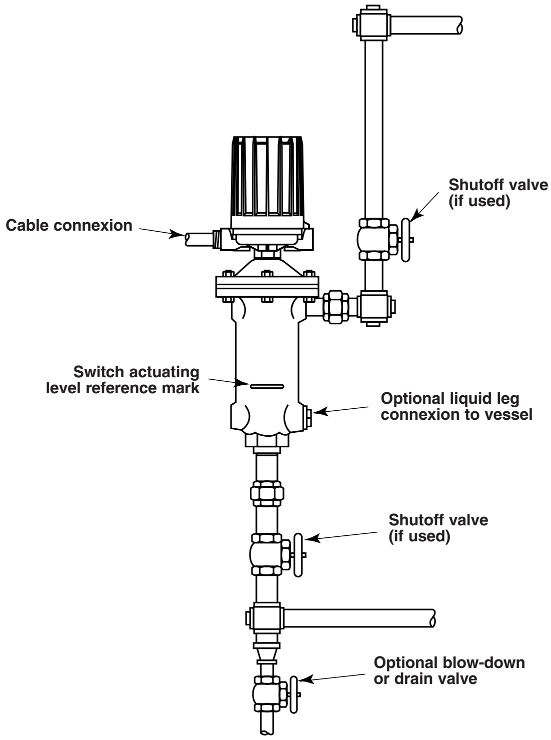


Figure 3

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.

AVAILABLE SWITCH MECHANISMS

Type of switch module ①	Max. Process Temp. ②	Switch ratings – A res. ③			Code
		24 V DC	240 V AC	120 V AC	
Micro switch	max 120 °C (250 °F)	6	15	15	B
Micro switch	max 230 °C (450 °F)	10	15	15	C
Micro switch - DC current	max 120 °C (250 °F)	10	–	10	D
Micro switch with gold alloy contacts	max 120 °C (250 °F)	1	–	1	U
Hermetically sealed micro switch	max 290 °C (500 °F)	5	5	5	HS ④
Hermetically sealed micro switch with silver plated contacts	max 230 °C (450 °F)	3	1	1	W
Hermetically sealed micro switch with gold plated contacts	max 230 °C (450 °F)	0,5	0,5	0,5	X
Hermetically sealed micro switch	max 400 °C (750 °F)	4	–	2,5	F
Proximity switch - type SJ 3.5 SN	max 100 °C (210 °F)	NA	NA	NA	V
Mercury switch	max 290 °C (500 °F)	10	6,5	13	A
Mercury switch	max 400 °C (750 °F)	10	6,5	13	3
Pneumatic bleed type (open air)	max 200 °C (400 °F)	NA	NA	NA	J
Pneumatic non bleed type (closed circuit)	max 200 °C (400 °F)	NA	NA	NA	K

① For applications with heavy vibration, consult factory for suited switch modules.
② Max process temperature is specified at 40 °C (100 °F) ambient temperature and for non condensing applications.
③ For more details - see bulletin BE 42-120.
④ For condensing applications, max process temperature is down-rated to 200 °C (400 °F) @ 40 °C (100 °F) ambient.

WIRING

Most mechanical control switch housings are designed to allow 360° positioning of the cable entries by loosening the set screw(s). See **figure 4**. On high temperature applications (above 120° C [250° F]), high temperature wire should be used between control and first junction box located in a cooler area.

1. To gain access to switch mechanism(s) remove switch housing cover.
2. Pull in supply wires (conductors), wrap them around enclosing tube under 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 bulletin on switch mechanism furnished with your control (as listed below) for proper connections.

3. Connect power supply to control and test switch action by varying liquid level in tank or vessel.

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

NOTE: If switch mechanism fails to function properly, check vertical alignment of control housing and consult installation instructions in switch mechanism bulletin.

4. Replace switch housing cover and place control into service.

NOTE: If control has been furnished with an explosion proof (cast) or moisture proof (gasketed) switch housing, check the following:

– After wiring connections have been completed, housings must be sealed via the propre cable gland to prevent entrance of air.
– 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 gases into switch housing.

Switch mechanism	*Bulletin*	*Reference series*
Mercury switches	42-783	A
Dry contact switches	42-683	B, C, D, U, W, X
Anti-vibration mercury switches		E
Anti-vibration dry contact switches	42-684	G, H, I
Bleed type pneumatic valve	42-685	J
Non-bleed type pneumatic valve	42-686	K

OBSERVE ALL APPLICABLE ELECTRICAL CODES AND PROPER WIRING PROCEDURES

Weatherproof
ATEX
FM

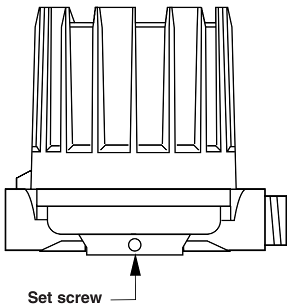


Figure 4a

CENELEC

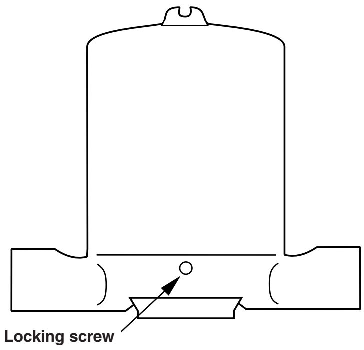


Figure 4c

NEMA 7/9
CAST IRON

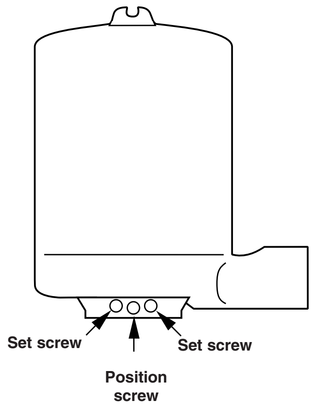


Figure 4b

CAUTION:
- *DO NOT attempt to reposition NEMA 4 / NEMA 7/9 housings without loosening the set screws; CENELEC housings MAY NOT BE REPOSITIONNED. ALWAYS retighten set screw(s) after repositionning.*
- *DO NOT attempt to unscrew cover of CENELEC housings before loosening locking screw in base of housing. ALWAYS retighten locking screw after replacing cover.*

PREVENTIVE MAINTENANCE

Periodic inspections are a necessary means to keep your Magnetrol level control in good working order. This control is, in reality, a safety device to protect the valuable equipment it serves. Therefore, a systematic program of "preventive maintenance" should be implemented when 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

1. Keep control clean

NEVER leave switch housing cover off 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 become damaged or misplaced, order a replacement immediately.

2. 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 and have a tendency to "string out" like water, instead of breaking into round pools. If these conditions exist, replace the mercury switch immediately.

– Dry contact switches should be inspected for excessive wear on actuating lever or misalignment of adjusting 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 mechanism furnished for service instructions).

– Magnetrol controls may sometimes be exposed to excessive heat or moisture. Under such conditions, insulation on electrical wires may become brittle, eventually breaking or peeling away. The resulting "bare" wires can cause short circuits.

Check wiring carefully and replace at 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. 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.

– On units with pneumatic switches, air (or gas) operating medium lines subjected to vibration, may eventually crack or become loose at 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** use lubricants on pivots of switch mechanisms. A sufficient amount of lubricant has been applied at the factory to insure a lifetime of service. Further oiling is unnecessary and will only tend to attract dust and dirt which can interfere with mechanism operation.

3. **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.

4. **NEVER** attempt to make adjustments or replace switches without reading instructions carefully. Certain adjustments provided for in Magnetrol controls should not be attempted in the field. When in doubt, consult the factory or your local Magnetrol representative.

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)
— 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.
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 place, 90° apart. Refer to **Figure 3** on page 4).
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.
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. Proceed to check level sensing action by removing switch housing assembly, as described in Steps 4 through 7 of the "Switch Differential Adjustment" section on **Page 8**.

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

3. Inspect attraction sleeve(s) and inside of enclosing tube for excessive corrosion or solids build-up which could restrict movement, preventing sleeve(s) from reaching field of magnet(s).
4. If the differential has been changed in the field, check tightness and position of the jam nuts.

NOTE: Differential adjustment causes a change in the amount of level travel between "switch-on" and "switch-off" actuations. Refer to **Page 8**.

5. Fill chamber with liquid at room pressure. Check float(s) to be certain it is buoyant in the liquid (float chamber must have adequate liquid level). If float is determined to be filled with liquid or collapsed, entire float chamber assembly (sensing unit) should be replaced.

CHECK COMPLETE UNIT

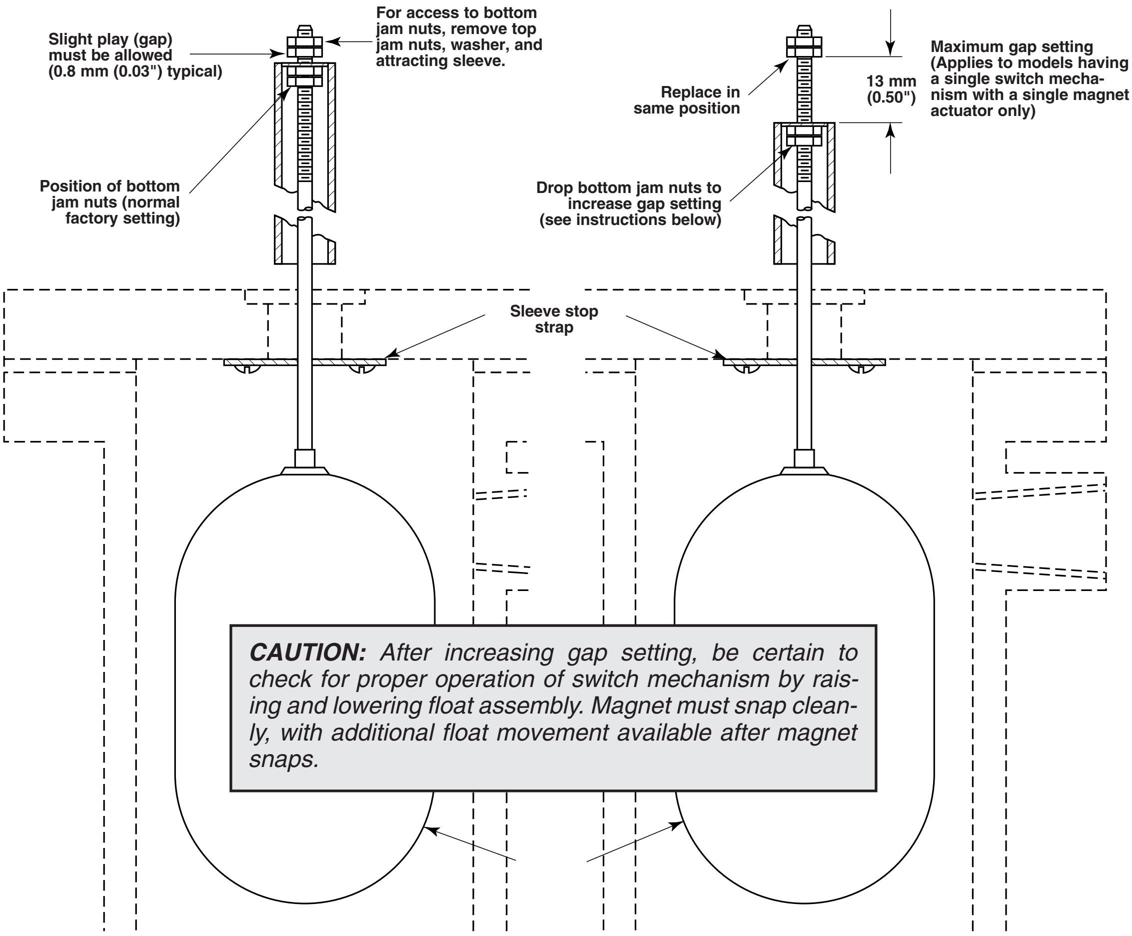
Reassemble unit. Reconnect power supply and carefully actuate switch mechanism manually (using a non-conductive tool) to determine whether controlled equipment will operate.

> *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 can not be identified, consult with 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 operation 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.

SWITCH DIFFERENTIAL ADJUSTMENT



> ***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, with additional float movement available after magnet snaps.*

Figure 5
Normal Factory Setting (minimum differential)

Figure 6
Differential adjustment

The amount of level travel between switch-on and switch-off actuations (differential) may be field 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, as shown in **Figure 5**. This setting may be increased to a maximum of 0.50" (13 mm), as shown in **Figure 6**.

NOTE: For assistance in computing level differential change for a specific control, consult the factory giving the model and serial numbers of the control.

With level change specifications determined, proceed as follows:

> ***CAUTION:*** *Before attempting any work on the control, pull disconnect switch, or otherwise assure that electrical circuit(s) through the control is deactivated. Close operating medium supply valve on controls equipped with pneumatic switch mechanisms.*

1. Disconnect wiring from supply side of switch mechanism(s) and electrical conduit or operating medium line connections to switch housing.
2. Perform system shutdown as required to relieve pressure from float chamber of control and allow unit to cool.

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

3. Remove switch housing assembly by loosening hex nut, which is located immediately below housing base (refer to **Figure 8**).
4. With switch housing removed, jam nuts and attraction sleeve are accessible. Measure position of upper jam nuts from stem end; then loosen and remove upper jam nuts, guide washer, and attraction sleeve.
5. Loosen and adjust lower jam nuts to desired position. Make certain jam nuts are retightened securely.

NOTE: Use new gasket in assembly of switch housing to chamber.

6. Test switch actuation by varying liquid level in float chamber.

REPLACEMENT OF STANDARD FLOAT AND STEM ASSEMBLY

1. Disconnect wiring or medium lines from control and perform system shutdown as previously described in Troubleshooting and Differential Adjustment Sections.
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 standard lower jam nut settings chart (below) and to **Figure 7** for 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 the chart below.

NOTE: If differential adjustment has been altered in the field, disregard dimension A and readjust new assembly to the previously determined level differential settings per instructions on page 8.

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 become bent.

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

STANDARD LOWER JAM NUT SETTINGS

Model	Dimension A	
	mm	inches
B24, C24, A40, B41, B43, J31, J33, G33, B60, O30	51	2

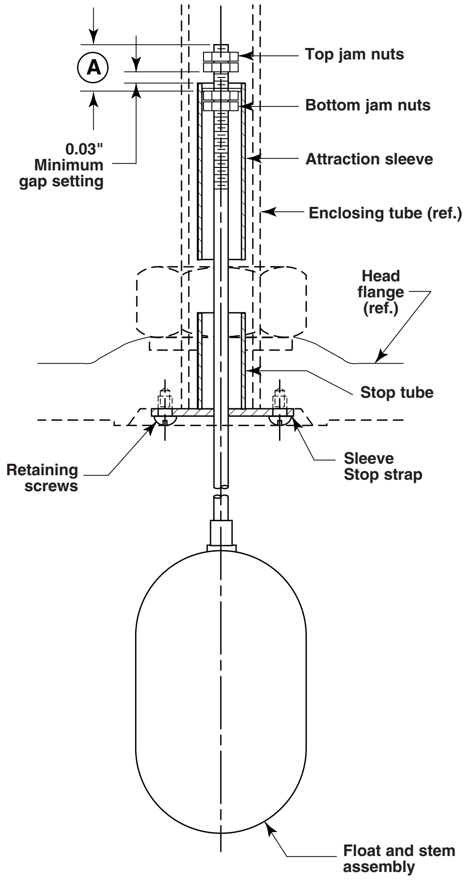


Figure 7

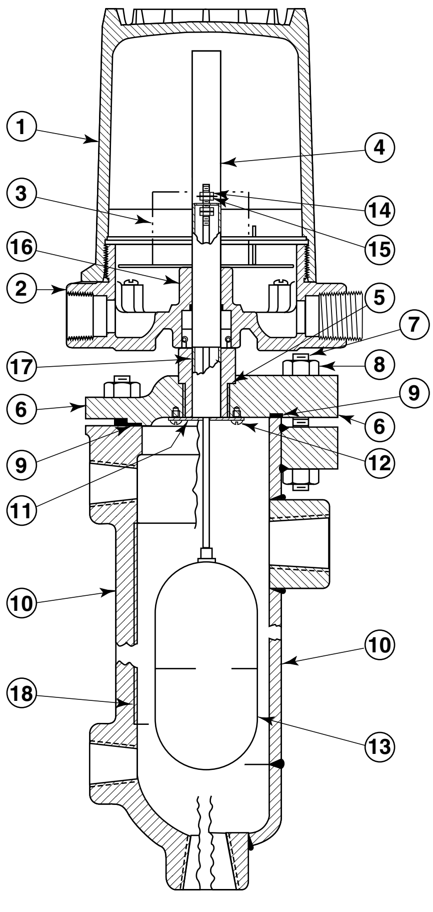


Figure 8

REPLACEMENT PARTS

No.	Description		Standard Replacement Assembly Kits								
			B24 C24 ①	A40 ①	B41	B43	J31	J33	G33	B60	O30
1	Housing cover	Housing Kits	Refer to Bulletin 42-683 for Switch Housing Cover and Base Assemblies								
2	Housing base										
3	Switch mechanism	—	Refer to bulletin on Switch Mechanism Furnished (listed on page 3)								
4	Enclosing tube	—	See table below								
5	E-Tube gasket	—	12-1204-001	12-1301-002						12-1204-001	12-1301-002
6	Head flange	Head Flange Kits	89-4201-001	Consult Factory							
7	Studs/Bolts										
8	Hex nuts										
9	Flange gasket										
7	Studs/Bolts	Float Chamber Kits	89-4601-001	Consult Factory							
8	Hex nuts										
9	Flange gasket										
10	Float Chamber										
9	Flange gasket	Float and Stem Kits	89-3201-001 ①	Consult Factory							
11	Stop Strap										
12	Screws										
13	Float and stem assembly										
14	Jam nuts										
15	Guide washer										
16	Attraction sleeve										
17	Stop tube (if used)										
18	Chamber liner ①	—	**B24** 05-5524-001	Consult Factory							
9	Flange gasket	—	12-1301-003	12-1301-015	12-1301-014	12-1301-015	12-1301-009	12-1301-006		12-1204-015	12-1301-018
Complete Control Less Float Chamber, Bolts, and Nuts			89-6564-003 ②	Consult Factory							

			Models with mat'l code A & B	Models with mat'l code D
4	Enclosing Tube	Cast aluminium housing	032-6302-033 032-6302-031 (B/C 24 & B 41)	032-6302-037 032-6302-036 (B 41)
		Cast iron housing	032-6344-002	032-6344-001
		Pneumatic switch housing	032-6302-031	032-6302-036

Notes:

① Cast float cage models used on boiler service require brass chamber liner. Refer to bulletin 46-625 for replacement instructions.

② Furnished with one Series A, SPDT Mercury Switch and standard switch housing.

IMPORTANT:

When ordering, please specify:

A. Model and serial number of control.

B. Replacement assembly (kit) part number.

TANDEM FLOAT MODELS

DESCRIPTION

Models with tandem style floats are used on applications where widely spaced high and low switching functions can be accomplished with a single control. The units incorporate two floats which operate independently, and are arranged so that the lower float actuates the upper switch mechanism, and 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 that extends upward, through the upper float and stem assembly.

INSTALLATION, PREVENTATIVE MAINTENANCE, AND TROUBLESHOOTING

Installation and maintenance of tandem float models is accomplished in much the same manner as for standard models previously described. Some 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 or boiler. When troubleshooting the level sensing portion of the control, additional checks may be made of the following:

1. Inspect for binding of solid (lower) float stem within hollow (upper) float stem due to corrosion or possible damage incurred during shipment or previous maintenance.
2. Make certain that retaining (snap) rings, used to locate lower attraction sleeve, are locked in place. An extreme shock or hammer, such as during blow-down on a water column boiler control, may have damaged a ring causing it to snap out of its retaining groove in the hollow (upper) float stem.

DIFFERENTIAL ADJUSTMENT

> ***CAUTION:*** *No differential adjustment should be made on tandem float models in the field. Switch actuation levels have been set at the factory to meet specific customer specifications. Variations in actual conditions, from design conditions, usually require special control modifications. Consult factory or local representative for assistance.*

REPLACEMENT OF FLOAT AND STEM ASSEMBLIES

Should replacement of either upper or lower float and stem assembly be required, instructions previously given for standard units (page 9) may be followed with additional consideration as follows:

1. New float and stem assemblies are available in separate replacement kits, with attraction sleeve parts furnished loose, to allow for field assembly with existing serviceable components. Consult factory.
2. Dimension A, referred to in standard instructions, must be arrived at by direct measurement from old assembly.

NOTE: Disregard dimension A figures shown in chart on page 9. If in doubt, or unable to get an accurate measurement from old assembly, consult factory or local representative for assistance.

3. Lower attraction sleeve locks in place on hollow (upper) float stem with external type snap rings. Care must be taken to be certain rings are properly installed. If available, use the correct type external snap ring pliers.

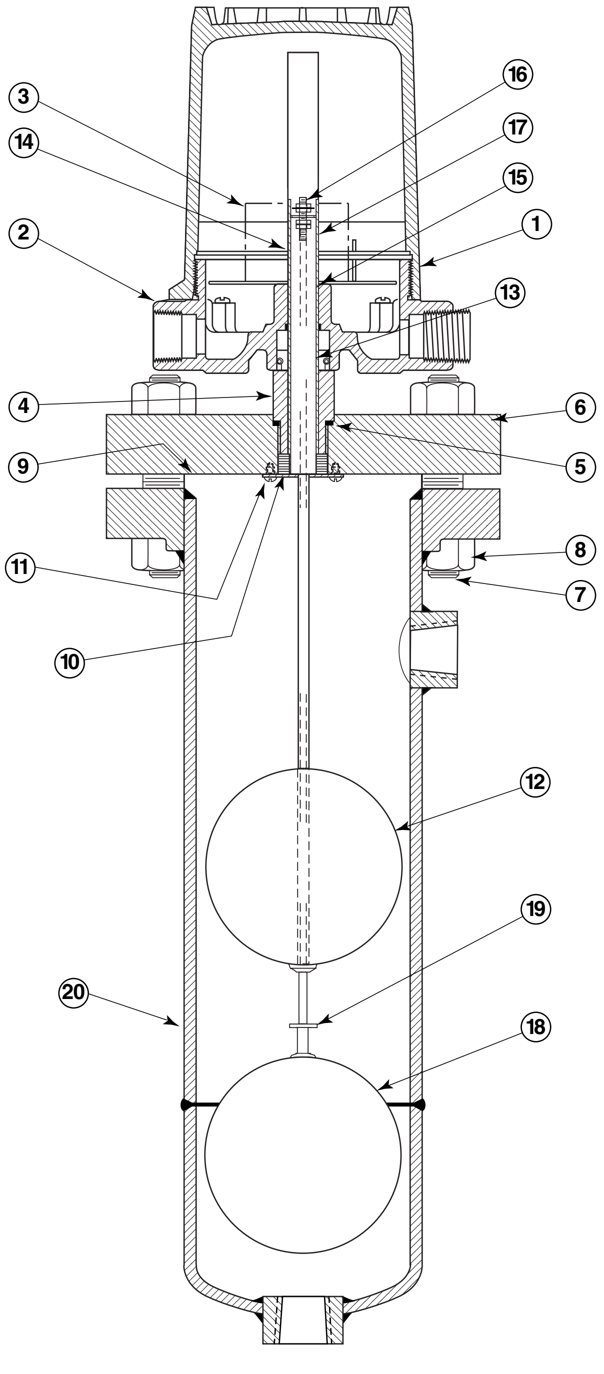
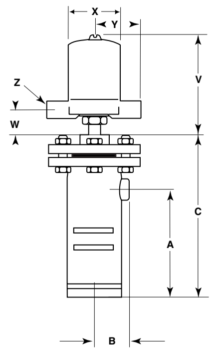


Figure 9
Typical tandem float model

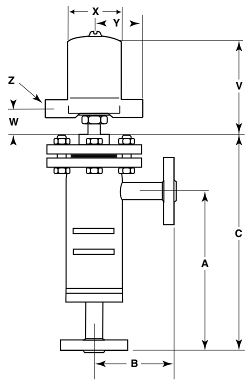
NOTE: Model shown has fabricated steel float cage; models W25 and W24 have cast iron float cage.

FLANGED CAGE MODEL DIMENSIONAL SPECIFICATIONS in mm (inches)

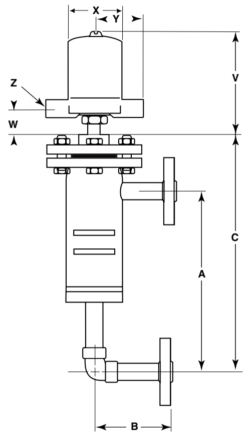
– Only A40 Model –



Threaded & socket weld upper side/bottom cast iron housing

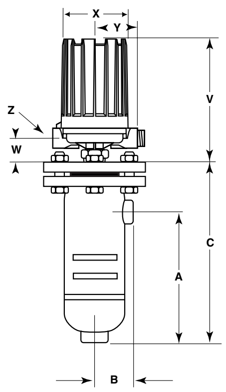


Flanged upper side/bottom cast iron housing

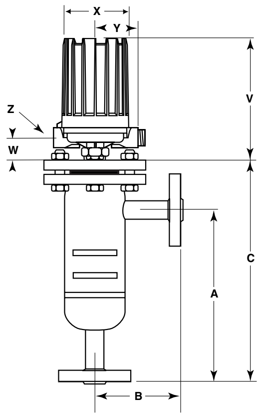


Flanged side/side cast iron housing

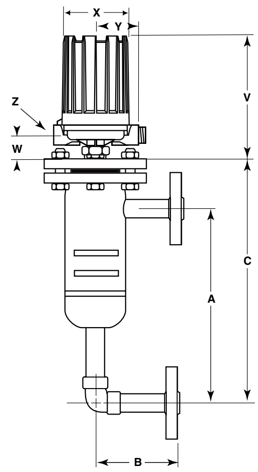
– All models except A40 –



Threaded & socket weld upper side/bottom aluminium housing



Flanged upper side/bottom aluminium housing



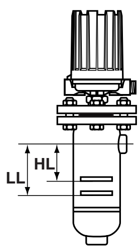
Flanged side/side aluminium housing

Housing type	Models	V		W		ø X		Y		Z
		mm	inches	mm	inches	mm	inches	mm	inches	
Weatherproof- FM (NEMA 7/9) - ATEX (Cast Alu)	B73/B41 with HS-switch All other models	257	10.12	42	1.66	151	5.93	109	4.29	M20 x 1,5 (*) or 1" NPT (2 entries - 1 plugged) (*) not for FM (NEMA 7/9)
	B73/B41 excl. HS-switch	202	7.94							
CENELEC (Cast Iron)	All	249	9.80	45	1.77	143	5.63	110	4.33	M20 x 1,5 or 3/4" NPT (single entry - 2 entries at request)
Pneumatics Switch Module J	All	165	6.50	39	1.54	118	4.65	110	4.33	1/4" NPT
Pneumatics Switch Module K								130	5.12	

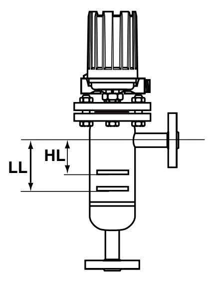
Allow 200 mm (7.87") overhead clearance / All housings are 360 ° rotatable

ACTUATING LEVELS

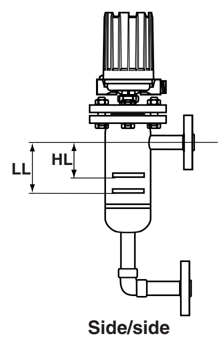
Actuating levels shown are for single switch units at minimum specific gravity only. Levels will change for multistage units. Consult factory for these units.



NPT & Socket weld



Upper side/bottom



Side/side

FLANGED CAGE MODEL DIMENSIONAL SPECIFICATIONS in mm (inches)

Process connection size	Mounting configuration	Model	Dimensions						Model	Dimensions					
			A		B		C			A		B		C	
			mm	inches	mm	inches	mm	inches		mm	inches	mm	inches	mm	inches
1" - DN 25	threaded / socket welded		222	8.74	82	3.23	391	15.39		250	9.84	96	3.78	408	16.06
	flanged upper side / bottom		356	14	185	7.28	525	20.67		356	14	200	7.87	514	20.24
	flanged side/side		356	14	185	7.28	525	20.67		356	14	200	7.87	514	20.24
1 1/2" - DN 40	threaded / socket welded		222	8.74	94	3.70	391	15.39		260	10.24	107	4.21	418	16.46
	flanged upper side / bottom	**A40 (*)**	356	14	200	7.87	525	20.67	**B60 (*)**	356	14	215	8.46	514	20.24
	flanged side/side		356	14	200	7.87	525	20.67		356	14	215	8.46	514	20.24
2" - DN 50	threaded / socket welded		222	8.74	97	3.82	391	15.39		262	10.31	110	4.33	420	16.54
	flanged upper side / bottom		356	14	200	7.87	525	20.67		356	14	220	8.66	514	20.24
	flanged side/side		356	14	200	7.87	525	20.67		356	14	220	8.66	514	20.24
1" - DN 25	threaded / socket welded		250	9.84	82	3.23	411	16.18		250	9.84	82	3.23	419	16.50
	flanged upper side / bottom		356	14	185	7.28	517	20.35		356	14	185	7.28	525	20.67
	flanged side/side		356	14	185	7.28	517	20.35		356	14	185	7.28	525	20.67
1 1/2" - DN 40	threaded / socket welded		260	10.24	94	3.70	421	16.57		260	10.24	94	3.70	429	16.89
	flanged upper side / bottom	**B41**	381	15	200	7.87	542	21.34	**B43 (*)**	381	15	200	7.87	550	21.65
	flanged side/side		356	14	200	7.87	517	20.35		356	14	200	7.87	525	20.67
2" - DN 50	threaded / socket welded		261	10.28	97	3.82	422	16.61		261	10.28	97	3.82	430	16.93
	flanged upper side / bottom		381	15	200	7.87	542	21.34		381	15	200	7.87	550	21.65
	flanged side/side		381	15	200	7.87	542	21.34		381	15	200	7.87	550	21.65
1" - DN 25	threaded / socket welded		250	9.84	109	4.29	429	16.89		250	9.84	109	4.29	418	16.46
	flanged upper side / bottom		356	14	215	8.46	535	21.06		356	14	215	8.46	524	20.63
	flanged side/side		356	14	215	8.46	535	21.06		356	14	215	8.46	524	20.63
1 1/2" - DN 40	threaded / socket welded		261	10.28	121	4.76	440	17.32		261	10.28	121	4.76	429	16.89
	flanged upper side / bottom	**G33 J33**	381	15	230	9.06	560	22.05	**J31 (*)**	381	15	230	9.06	549	21.61
	flanged side/side		356	14	230	9.06	535	21.06		356	14	230	9.06	524	20.63
2" - DN 50	threaded / socket welded		262	10.31	124	4.88	441	17.36		262	10.31	124	4.88	430	16.93
	flanged upper side / bottom		381	15	235	9.25	560	22.05		381	15	235	9.25	549	21.61
	flanged side/side		381	15	235	9.25	560	22.05		381	15	235	9.25	549	21.61
1" - DN 25	threaded / socket welded		222	8.74	70	2.76	353	13.90							
	flanged upper side / bottom	**O30 (*)**	356	14.02	165	6.50	487	19.17							
	flanged side/side		356	14.02	165	6.50	487	19.17							

(*) Add 33 mm (1.30") to **C-dimension** for cast iron EEx d II C T6 housings.

Actuation levels in mm (inches) for minimum specific gravity and as per selected material of construction (see selection data)

Model	1" / DN 25				1 1/2" / DN 40				2" / DN 50			
	Material code A		Material code B & D		Material code A		Material code B & D		Material code A		Material code B & D	
	High Level (HL)	Low Level (LL)	High Level (HL)	Low Level (LL)	High Level (HL)	Low Level (LL)	High Level (HL)	Low Level (LL)	High Level (HL)	Low Level (LL)	High Level (HL)	Low Level (LL)
A40	34 (1.34)	56 (2.20)	32 (1.26)	59 (2.32)	34 (1.34)	56 (2.20)	32 (1.26)	59 (2.32)	34 (1.34)	56 (2.20)	32 (1.26)	59 (2.32)
B41	23 (0.91)	45 (1.77)	25 (0.98)	51 (2.01)	23 (0.91)	45 (1.77)	25 (0.98)	51 (2.01)	23 (0.91)	45 (1.77)	25 (0.98)	51 (2.01)
B43	53 (2.09)	77 (3.03)	60 (2.36)	90 (3.54)	46 (1.81)	70 (2.76)	53 (2.09)	83 (3.27)	38 (1.50)	62 (2.44)	45 (1.77)	75 (2.95)
B60	76 (2.99)	94 (3.70)	81 (3.19)	102 (4.02)	57 (2.24)	75 (2.95)	62 (2.44)	83 (3.27)	49 (1.93)	67 (2.64)	54 (2.13)	75 (2.95)
G33	65 (2.56)	83 (3.27)	66 (2.60)	87 (3.43)	58 (2.28)	76 (2.99)	59 (2.32)	80 (3.15)	50 (1.97)	68 (2.68)	51 (2.01)	72 (2.83)
J31/J33	74 (2.91)	93 (3.66)	80 (3.15)	103 (4.06)	55 (2.17)	74 (2.91)	61 (2.40)	84 (3.31)	47 (1.85)	66 (2.60)	53 (2.09)	76 (2.99)
O30	-	-	57 (2.24)	85 (3.35)	-	-	-	-	-	-	-	-

IMPORTANT

SERVICE POLICY

Owners of Magnetrol products 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. Magnetrol International will repair or replace the control, at no cost to the purchaser, (or owner) ***other than transportation cost*** if:

a. Returned within the warranty period; and,
b. The factory inspection finds the cause of the malfunction to be defective material or workmanship.

If the trouble is the result of conditions beyond our control; or, is **NOT** covered by the warranty, there will be charges for labour 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, labour, direct or consequential damage will be allowed.

RETURNED MATERIAL PROCEDURE

So that we may efficiently process any materials that are returned, it is essential that a “Return Material Authorisation” (RMA) form will be obtained from the factory. It is mandatory that this form will be attached to each material returned. This form is available through Magnetrol’s local representative or by contacting the factory. Please supply the following information:

1. Purchaser Name
2. Description of Material
3. Serial Number
4. Desired Action
5. Reason for Return
6. Process details

All shipments returned to the factory must be by prepaid transportation. Magnetrol **will *not* accept** collect shipments.

All replacements will be shipped FOB factory.

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UNDER RESERVE OF MODIFICATIONS

Magnetrol®

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