BULLETIN IN-409
Supersedes Bulletin 409A

MERCOID SERIES 401
MAGNETIC LIQUID LEVEL CONTROLS

TOP MOUNTING—FOR PRESSURIZED OR NON-PRESSURIZED TANKS OR SUMPS

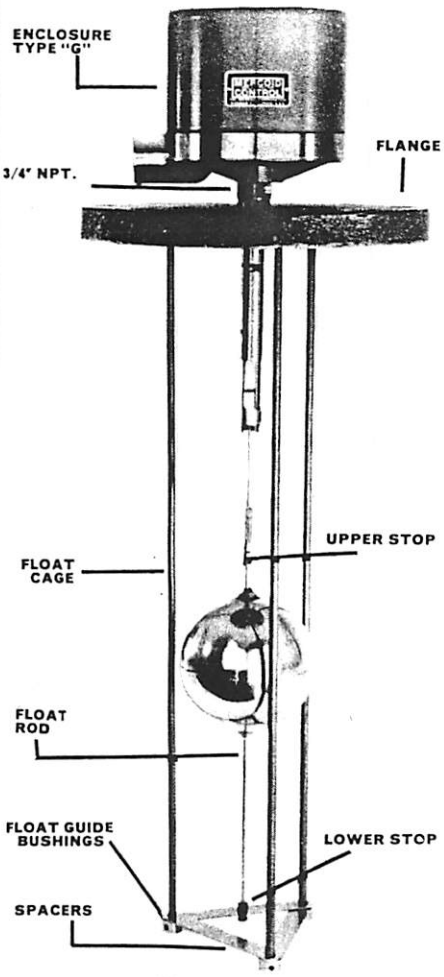

Illustration No. 1

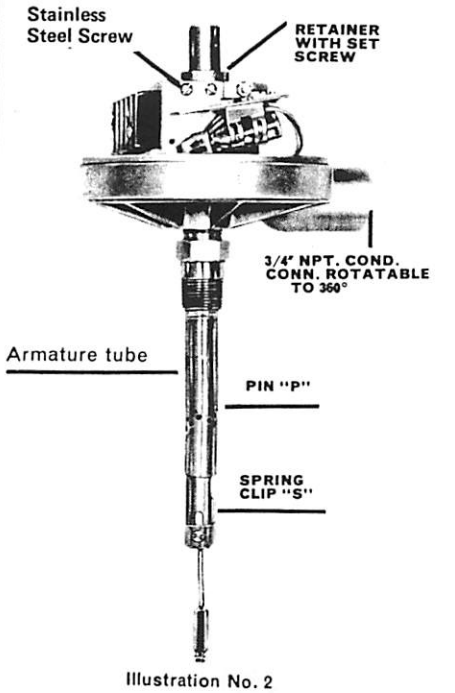

Illustration No. 2

INSTALLATION INSTRUCTIONS

APPLICATION

SERIES 401-1 Single Stage Operation—Adjustable high and low operating levels.
SERIES 401-2 Two Stage Operation—Adjustable operating levels plus high level alarm or trip.
SERIES 401-3 Two Stage Operation—Adjustable operating levels plus low level alarm or trip.
SERIES 401-4 Two Stage Operation—High and low alarm or trip with adjustable spread between stages.

OPERATION

Mercoid Series 401 Controls incorporate magnetically actuated switch mechanisms which are operated by a magnetic armature placed by float action into or out of the magnetic field of the switch magnet. The armature operates within a nonmagnetic tube within the switch enclosure. The switch mechanism is mounted on the armature tube. Poles of the switch magnets face the armature tube and when float action moves the armature into position to attract the magnet, switch action takes place. As the armature is moved out of position, the magnetic attraction is broken and the switches return to the original position. The armature tube and switch structures are designed so that two switch mechanisms may be stacked on the tube, each responsive to different float levels for individual two stage operation.

ENCLOSURES

GENERAL PURPOSE: NEMA 1 Type 401G.	WEATHER-RESISTANT (Raintight): NEMA 3R Type 401W.
SPLASH-PROOF: NEMA 2 Type 401S.	EXPLOSION-PROOF: NEMA 7, 9 Type 401E.
WATERTIGHT-DUSTIGHT: NEMA 3S, 4, 4X & 6. Type 401 WT	VAPOR PROOF-EXPLOSION-PROOF: NEMA 7, 9 Type 401EV.

FLOATS—(PRESSURE AND TEMPERATURE RATINGS)		
4-1/2" Copper	150 PSI @ 300°F. MAX.	(NO. 45-43-1)
4-1/2" 304 S.S.	300 PSI @ 500°F. MAX. 600 PSI @ 500°F. MAX.	(NO. 45-30)
3-1/2 x 6" S.S.	300 PSI @ 500°F. MAX. 450 PSI @ 100°F. MAX.	NO. 45-57SS
7" Copper	150 PSI @ 300°F. MAX.	(NO. 45-49)
7" 304 S.S.	450 PSI @ 100°F. MAX. 425 PSI @ 200°F. MAX. 300 PSI @ 500°F. MAX.	(NO. 45-50)

FLANGES (ANSI) SPECIFICATIONS		
4-1/2" Float	STEAM	COLD NON-SHOCK
6" Cast Iron	125#	175#
6" Cast Iron (Heavy Duty)	250#	400#
6" Forged Steel	300#	600#
5" Flange for 3-1/2" x 6" FLOAT same ratings as above.		
8" Flange for 7" FLOAT same ratings as above.		

MOUNTING

Select location recommended by equipment manufacturer. Be sure opening in vessel is large enough so that the float and float cage (if used) are properly contained. Before installing, check nameplate for Type Number and Circuit Specification Number and follow instructions under each specific type as shown on the following pages.

The guide rods for the float cage are 7/16" in diameter and threaded on one end for screwing into tappings of the flange. The float guide rod spacers are held in place by a bushing at the bottom of the rod. Float guide rods may be shortened to the desired length by using a hacksaw. NOTE—if float is to operate in a suitable standpipe, guide rods are not necessary.

CAUTIONS

Be sure switch mechanism is mounted in a vertical position. Keep cover on control head at all times. Never oil switch mechanism. Do not overload—see electrical rating on nameplate.

Weather-Resistant Types (W) are provided with drain (vent) hole in bottom of enclosure base which must be kept open. (Water-Proof Type WT has no drain hole.) Explosion-Proof (E), Observe Cover Instructions.

IMPORTANT—On two-stage units the upper and lower mercury switch assemblies are not interchangeable with the exception of circuit specification No. 4815 (SP-DT.) Interchanging two-stage units will reverse switch action from that obtained in its original position —see circuit response table for respective upper and lower units under each specific type number.

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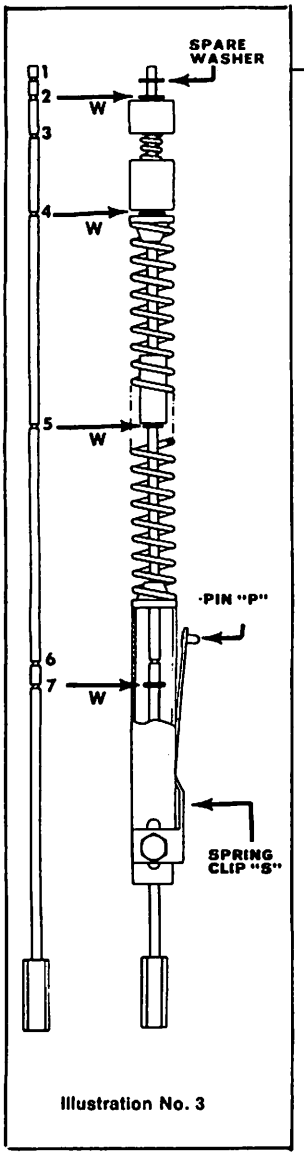


Illustration No. 3

MERCOID TYPE 401-1 SINGLE STAGE OPERATION
Adjustable High and Low Operating Levels

MERCOID TYPE 401-2 TWO STAGE OPERATION
Adjustable Operating Levels Plus High Level Alarm or Trip

Before installing, check armature rod assembly (illustration Nos. 2 and 3). Press down on the adjusting SPRING CLIP "S" which releases PIN "P" and pull out entire armature rod assembly. Check to see that SNAP WASHERS "W" are properly located in slots as indicated by illustration No. 2. A SNAP WASHER "W" must be in slots 2, 4, 5 and 7. Note that an extra washer is located in slot No. 1 which serves no purpose except as a spare washer. The other components must also be positioned as shown.

After determining that the assembly is correct, note the four holes on the armature tube marked 2, 5, 8, 10 above designation "401-1 or 2". Insert PIN "P" in proper hole in accordance with table shown on right.

FLOAT ROD LENGTH	HOLE NUMBER
Up to 3 ft.	2
Over 3 ft. to 6 ft.	5
Over 6 ft. to 9 ft.	8
Over 9 ft.	10

Assemble switch mechanism (illustration No. 2) to mounting flange or other mounting method. Do not twist the control case by hand, use a wrench on the hex section of the ¾" NPT connection. Connect float rod to armature rod and lock with coupling nut. Place float on rod with upper and lower float stops. Secure float stops in place for low and high level operation. Note float diagram and level change table for high and low level limitations.

For the initial settings of float stops for operating levels, it may be assumed that level line on float is at center of float. Stop may be positioned to locate center of float at the desired level distances from top of mounting flange. Float level line will vary somewhat in operation and with respect to differences in floats and specific gravities. Note that for Type 401-2 the top and bottom float stops determine the operating levels "A" and "B" for the lower switch unit. The top switch unit operates upon a fixed level rise above "A". (See float diagram, dimension "C".)

Assemble guide rods to flange and secure their bottom ends together with the spacers and clamps provided (illustration No. 1). Insert float structure into vessel and bolt flange into place.

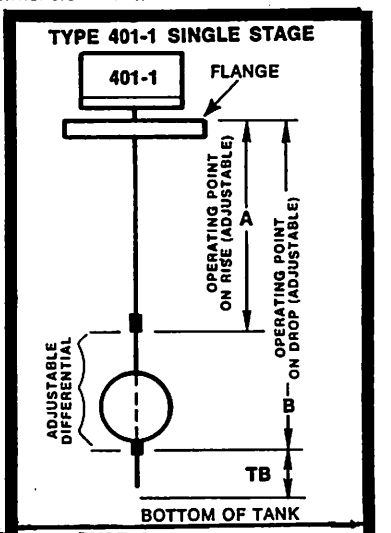
TO REMOVE SWITCH ASSEMBLY

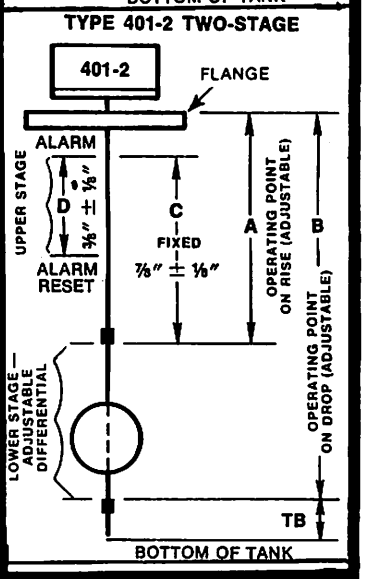
The switch mechanism is easily removed. First loosening set screw in retainer ring (illustration No. 2) after which, loosen the stainless steel screw and lift up entire assembly. When reassembling be sure switch mechanism is positioned at the bottom of the armature tube within the control case. Note: Where two switch assemblies are used (Type 401-2) the first switch assembly must be positioned at the bottom of the armature tube and follow this by positioning second switch assembly on top of the first one – second assembly must also be as far down on the armature tube as possible. This is jmportant as incorrect positioning can result in operating failures. The switch magnets must assume their proper relationship to the armature tube as it is raised and lowered by float action.

Align wiring block to face conduit opening and tighten S.S. screw to secure switch mechanism into place. Replace retainer ring and tighten with set screw.

WIRING

Wire in accordance with local electrical codes. Make sure that each switch unit is properly positioned as explsined in preceding paragraph.





CAUTIONS See page 1.

Electrical Circuits and Ratings

Switch	SWITCH ACTION	ELECTRICAL RATINGS IN AMPS AC 120V.	AC 240V.	AC 440†	DC 125V	DC 250V	401-1 Single Stage	401-2 401-3 401-4 Two-Stage Lower	Two-Stage Upper
Mercury Contacts	SP-ST Open on level FALL	10	5	3†	10	5	-4820	-4820	-21
	SP-ST Open on level RISE	10	5	3†	10	5	-4821	-4821	-20
	SP-DT One Switch	4	2	1†	4	2	-4810	-4810	-10
	DP-DT Two switches E.I.*	10	5	3†	10	5	-4815	-4815	-15
	DP-ST Two switches E.I.* Open on level FALL	10	5	3†	10	5	-4814	-4814	-13
	DP-ST Two switches E.I.* Open on level RISE	10	5	3†	10	5	-4813	-4813	-14
	DP-DT Two SP-DT switches	4	2	1†	4	2	-4806	-4806	-06
Snap Action Contacts	SP-DT One switch	12	5	3†	0.5**	0.25**	-7810	-7810	-10
	DP-DT Two SP-DT switches	12	5	3†	0.5**	0.25**	-7806	-7806	-06
	DP-DT Two SP-DT switches	10	3		10‡	3‡	-9806	-9806	-06
	SP-DT One Switch	10	3		10‡	3‡	-9810	-9810	-10

*Electrically Independent
‡10 Amp Inductive (Polarized) at 125V DC
†Available on special order.
**Resistive

MAXIMUM & MINIMUM OPERATING DEPTHS IN INCHES BELOW TOP OF FLANGE FOR STANDARD GUIDE ROD LENGTHS AT VARIOUS SPECIFIC GRAVITIES

TYPE NO.	FLOATS C=Copper SS=Stainless Steel	MINIMUM "A" Sp. Gr. 1.0 Slightly less for .72, .62, 0.5	MINIMUM "B" Sp. Gr. 1.0 Slightly less for .72, .62, 0.5	MAXIMUM FOR "B"—DISTANCE BELOW TOP OF FLANGE FOR OPERATION Sp. Gr. 1.0 GUIDE RODS 4'	8'	12'	Sp. Gr. .72 GUIDE RODS 4'	8'	12'	Sp. Gr. .62 GUIDE RODS 4'	8'	12'	Sp. Gr. .5 GUIDE RODS 4'	8'	12'
401-1 401-2	3-1/2"x6" SS	13	15	45	93	141	*44-1/2	*92-1/2	*126-1/2	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	4-1/2" C	12-1/2	14	46	94	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	4-1/2" SS	13	14	46-1/2	94-1/2	142-1/2	46	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	7" C	14-1/2	15-1/2	45-1/2	93-1/2	142	45	93	141	44	92	140	N.A.	N.A.	N.A.
	7" SS	15	16	46	94	142	46	94	142	45-1/2	93-1/2	141-1/2	44-1/2	92-1/2	140-1/2

MERCOID TYPE 401-3 TWO STAGE OPERATION
Adjustable Operating Levels Plus Low Level Alarm or Trip

Before installing check armature rod assembly (illustration No. 4). Press down on the adjusting SPRING CLIP "S" which releases PIN "P" and pull out entire armature rod assembly. Check to see that SNAP WASHERS "W" are properly located in slots as indicated by illustration No. 4. A SNAP WASHER "W" must be in slots 1, 4, 5 and 6. The other components must also be positioned as shown.

After determining that the assembly is correct, note the four holes on armature tube, marked 3, 6, 9, 12 above designation "401-3". Insert PIN "P" into proper hole in accordance with table shown on right.

FLOAT ROD LENGTH	HOLE NUMBER
Up to 4 ft.	3
Over 4 ft. to 7 ft.	6
Over 7 ft. to 10 ft.	9
Over 10 ft.	12

Assemble switch mechanism (see illustration No. 2 page 1) to mounting flange or other mounting. Do not twist the control case by hand, use a wrench on the hex section of the ¾" NPT connection. Connect float rod to armature rod and lock with coupling nut. Place float on rod with upper and lower float stops.

Fasten stops in place for low and high level operation. Note float diagram and level change chart for high and low level limitations. For the initial settings of float stops for operating levels, it may be assumed that level line on float is at center of float. Stop may be positioned to locate center of float at the desired level distance from top of flange mounting. Float level line will vary somewhat in operation and with respect to differences in floats and specific gravities. For the Type 401-3 the top and bottom float stops determine the operating levels of "A" and "B" for the upper switch mechanism. The lower switch mechanism operates upon a fixed level drop below level "B" (see float diagram dimension "C").

Assemble guide rods to flange and secure their bottom ends together with the spacers and clamps provided (see illustration No. 1, page 1). Insert float structure into vessel and bolt flange into place.

TO REMOVE SWITCH ASSEMBLIES

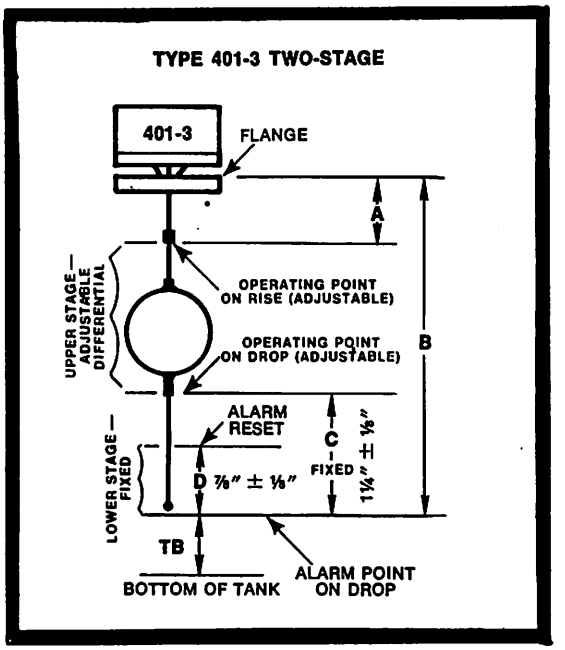
Switch mechanism consists of two switch assemblies. First loosen set screw in retainer ring (see illustration No. 2, page 1). Note – illustration only shows one switch assembly. Remove retainer ring. Loosen stainless steel screw on each of the switch assemblies, after which lift up assemblies to remove.

When reassembling, be sure that the first switch assembly is positioned at the bottom of the armature tube within the control case. Follow this by positioning the second switch assembly on top of the first one making sure it also is as far down on the armature tube as possible. The correct placement of the two switch assemblies is important for an incorrect position can result in operating failure. The switch magnets must assume their proper relationship to the armature within the armature tube as it is raised and lowered by float action.

Align wiring block to face conduit opening and tighten screw in each switch assembly to secure it in place. Replace retainer ring and tighten set screw.

WIRING

Wire in accordance with local electrical codes. Make sure that both switch assemblies are in correct position as noted in preceding paragraph.



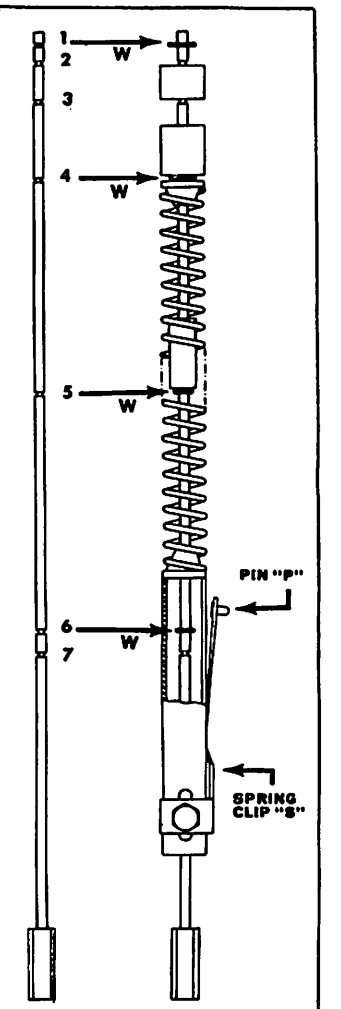


Illustration No. 4

FOR ELECTRICAL CIRCUITS AND RATINGS — See Page 2 —

CAUTIONS See page 1.

MAXIMUM & MINIMUM OPERATING DEPTHS IN INCHES BELOW TOP OF FLANGE FOR STANDARD GUIDE ROD LENGTHS AT VARIOUS SPECIFIC GRAVITIES

TYPE NO.	FLOATS C=Copper SS=Stainless Steel	MINIMUM "A" Sp. Gr. 1.0 Slightly less for 0.72, 0.62, 0.5	MINIMUM "B" Sp. Gr. 1.0 Slightly less for 0.72, 0.62, 0.5	MAXIMUM FOR "B" — DISTANCE BELOW TOP OF FLANGE FOR OPERATION											
				Sp. Gr. 1.0 GUIDE RODS			Sp. Gr. 0.72 GUIDE RODS			Sp. Gr. 0.62 GUIDE RODS			Sp. Gr. 0.5 GUIDE RODS		
				4'	8'	12'	4'	8'	12'	4'	8'	12'	4'	8'	12'
401-3	3½" x 6" SS	12	16	45	93	141	44½	92½	126½	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	4½" C	11½	14	44½	92½	140½	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	4½" SS	11½	14½	46½	93	141	44½	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	7" C	13½	15½	45½	92	140	44	91½	139½	43	91	139	N.A.	N.A.	N.A.
	7" SS	14	16	46	92½	142½	44½	92½	140½	44	92	140	44	92	140

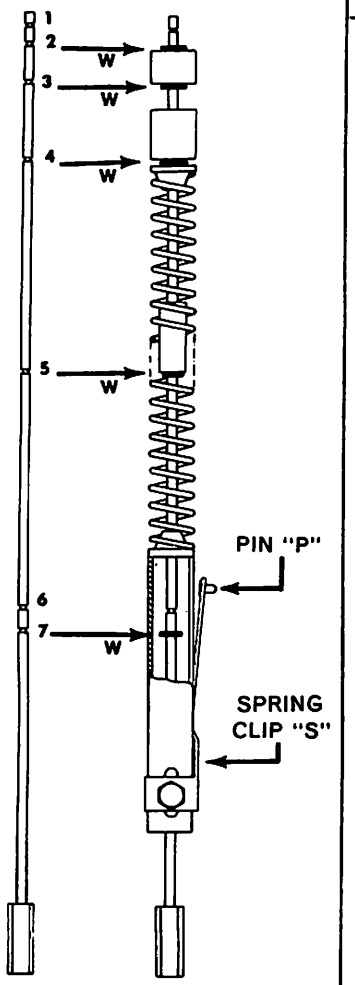


Illustration No. 5

MERCOID TYPE 401-4 TWO STAGE OPERATION
High and Low Alarm or Trip With Adjustable Spread Between Stages

Before installing, check armature rod assembly (illustration No. 5). Press down on the adjusting SPRING CLIP "S" which releases PIN "P", and pull out entire armature rod assembly. Check to see that SNAP WASHERS "W" are properly located in slots as indicated by illustration No. 5. A SNAP WASHER "W" must be in slots 2, 3, 4, 5 and 7. The other components must also be positioned as shown.

After determining that the assembly is correct note the four holes on armature tube marked 3, 6, 9, 12 above designation "401-4". Insert PIN "P" into proper hole in accordance with the following table:

FLOAT ROD LENGTH	HOLE NUMBER
Up to 4 ft.	3
Over 4 ft. to 7 ft.	6
Over 7 ft. to 10 ft.	9
Over 10 ft.	12

Assemble switch mechanism (unit) to mounting flange or other mounting. Do not twist the control case by hand, use a wrench on the hex section of the ¾" N.P.T. connection. Connect float rod to armature rod and lock with coupling nut. Place float on rod with upper and lower float stops. Clamp float stops in place for low and high level operation. Note float diagram and level change chart for high and low level limitations. For the purpose of estimating level position of float for setting float stops, assume liquid level at center of float.

Float level line will vary somewhat in operation and with respect to differences in floats and specific gravity. For type 401-4 the Top and Bottom float stops determine the operating levels "A" (upper switch Assembly) and "B" (lower switch assembly). Each switch assembly has a fixed operation differential "C" and "D" (see float diagram dimension

Assemble guide rods to flange and secure their bottom ends together with the spacers and clamps provided (see illustration No. 1, page 1). Insert float structure into vessel and bolt flange into place.

TO REMOVE SWITCH ASSEMBLIES

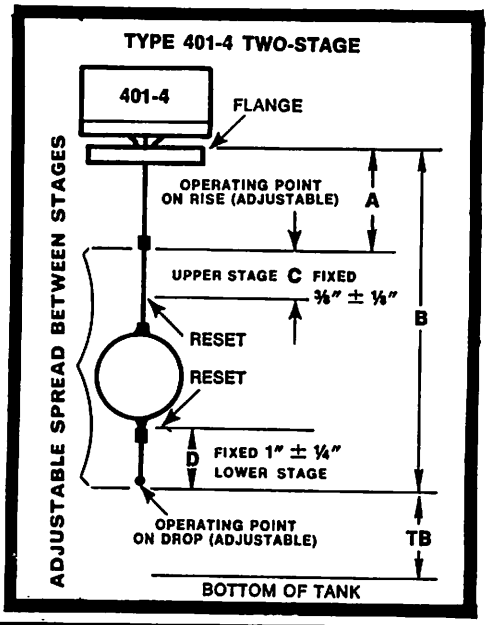
Switch mechanism consists of two switch assemblies. First loosen set screw in retainer ring (see illustration No. 2, page 1). Note that illustration only shows one switch assembly. Remove retainer ring. Loosen stainless steel screw on each of the switch assemblies, after which, lift up assemblies to remove. When reassembling, be sure that the first switch assembly is positioned at the bottom of the armature tube within the control case. Follow this by positioning the second switch assembly on top of the first one and be sure it is as far down on the armature tube as possible.

Align wiring blocks to face conduit opening and tighten screw in each switch assembly to secure it in place. Replace retainer ring on top of assembly and tighten set screw. The correct placement of the two switch assemblies is important for an incorrect position can result in operating failures. The switch magnets must assume their proper relationship to the armature within the armature tube as it is raised and lowered by float action.

WIRING

Wire in accordance with local electrical codes. Make sure that both switch assemblies are in correct position as noted in preceding paragraph.

CAUTIONS See Page 1.



FOR ELECTRICAL CIRCUITS AND RATINGS
– See Page 2 –

MAXIMUM & MINIMUM OPERATING DEPTHS IN INCHES BELOW TOP OF FLANGE FOR STANDARD GUIDE ROD LENGTHS AT VARIOUS SPECIFIC GRAVITIES

TYPE NO.	FLOATS C=Copper SS=Stainless Steel	MINIMUM "A"	MINIMUM "B"	MAXIMUM FOR "B" — DISTANCE BELOW TOP OF FLANGE FOR OPERATION											
		Sp. Gr. 1.0 Slightly less for 0.72, 0.62, 0.5		Sp. Gr. 1.0 GUIDE RODS			Sp. Gr. 0.72 GUIDE RODS			Sp. Gr. 0.62 GUIDE RODS			Sp. Gr. 0.5 GUIDE RODS		
				4'	8'	12'	4'	8'	12'	4'	8'	12'	4'	8'	12'
401-4	3½" x 6" SS	12	15½	45	93	141	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	4½" C	11½	14½	46½	94½	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	4½" SS	12	14½	47	95	143	47	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	7" C	13½	15½	45½	93½	141½	45	93	141	44½	92½	140½	N.A.	N.A.	N.A.
	7" SS	14½	16½	46	94	142	46	94	142	45½	93½	141½	45	93	141

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