NORRISEAL CONTROLS

MANUFACTURED IN CANADA BY ALBERTA OIL TOOL

LEVEL CONTROLLERS

SERIES 1001A and 1001XL

CONTENTS

INTRODUCTION – MODEL DESIGNATION

2 | SM | 60 | - | S | R | D | L | - | A | G

END CONNECTIONS	
SIZE	CODE
2.00"	2
2.50"	5
3.00"	3
4.00"	4
6.00"	6

END CONNECTIONS	
TYPE	CODE
Beveled Slip On	SC
Raised Face	RF
Flanged Ring Type Joint	RJ
Screwed Ma le NPT	SM

PRESSURE RATING		
ANSI	RATING*	CODE
150	285	02
300	740	07
400	960	09
	1000	10
600	1480	14
	1500	15
	2000	20
900	2220	21
	2500	25
	3000	30
1500	3705	36
	4000	40
	5000	50
	6000	60
2500	6170	60

*Body Pressure Rating subject to selection of displacer. See Displacer Chart

MATERIAL – BODY/SHAFT/BLOCK			
BODY	SHAFT/BEARING	BEARING BLOCK	CODE
A696 CS or WCC	303	303	---
A696 CS (NACE)	316	316	N
316 (NACE)	316	316	R
316	316	316	S

PILOT MODE	
MODE TYPE	CODE
Electric DPDT (X-Proof)	D
Electric SPDT (X-Proof)	E
Pneumatic Relief (w/60 PSIG Gauge)	G
Electric SPDT (Hermetic Sealed)	K
Electric DPDT (Hermetic Sealed)	L
Pneumatic Snap (On/Off)	S
Pneumatic Throttle (Modulating)	T

ENCLOSURE	
CODE	TYPE
B	Sealed Case/Cover Only
C	Sealed Case/Cover and Piped Exhaust
D	Sealed Case/Cover, Piped Exhaust and Special Marine Internals
E	Sealed Case/Cover and Special Marine Internals
G	Sealed Case/Cover Only (Lever Latch) 1001A & 1001XL
H	Sealed Case/Cover and Piped Exhaust (Lever Latch) 1001A & 1001XL
J	Sealed Case Cover and Piped Exhaust, and Special Marine Service (Lever Latch) 1001A & 1001XL
K	Sealed Case/Cover and Special Marine Service (Lever Latch) 1001A & 1001XL

SERVICE CONDITION	
CODE	SERVICE
A	Standard/Standard Gauges
B	Vibration/Standard Gauges
C	Vibration/Vibration Gauges
D	Vibration/Liquid Filled Gauges

DESCRIPTION	UNIT TYPE	CODE
Pressure Gauges Bronze 0 to 30 psi	1001A & 1001XL	-
Pressure Gauges Bronze 0 to 60 psi	1001A & 1001XL	H
Pressure Gauges 316 SST 0 to 30 psi	1001A & 1001XL	J
Pressure Gauges 316 SST 0 to 60 psi	1001A & 1001XL	K

SEAL/BEARING - MATERIAL			
CODE	O-RING	BEARING	TEMP.**
E	EPR	303 SST	275
F	VITON	316 SST	400
L	BUNA	303 SST	180
S	AFLAS	316 SST	400
V	VITON	DELRIN	180

** Seal temperature rating subject to selection of displacer. See Displacer Chart

PILOT ACTION	
CODE	ACTION TYPE
D	Direct Acting
R	Reverse Acting

MOUNTING CASE	
CODE	MOUNTING TYPE
B	Back
L	Left Hand
R	Right Hand

DISPLACER TEMPERATURE/PRESSURE RATINGS DISPLACER CHART					
MATERIAL	PVC	ACRYLIC	ALUMINUM	SST-0	SST-2
MAX. TEMP (°F)	140	200	400	400	400
MAX. PRESSURE (PSIG)	6,170	6,170	6,170	720	2,000

INTRODUCTION – SPECIFICATIONS

PERFORMANCE CHARACTERISTICS [1]

Pilot – Pneumatic

Output:

Proportional – Throttle	3-15 PSIG, 6-30 PSIG
Differential Gap – Snap	0-20 PSIG, 0-30 PSIG
Block & Bleed – Relief	0-30 PSIG, 0-50 PSIG
	0-100 PSIG

Supply Pressure Requirement:

3-15 PSIG, 0-20 PSIG	20-30 PSIG (min)
6-30 PSIG, 0-30 PSIG	35-40 PSIG (min)
0-50 PSIG	60 PSIG (max)
0-100 PSIG	100 PSIG (max)

Action: Field Reversible

between Direct Acting	Increasing Level Increases Output
and Reverse Acting	Increasing Level Decreases Output

Pilot Capacity:

Throttle C_v	0.394	Snap C_v	0.282
Relief C_v	0.403		

Air Consumption:

The Throttle or Snap Pilot is a metal seated "No Bleed" Force-Balance device, where steady state consumption is virtually zero; hence, air consumption is dependent on frequency of switching operation resulting from liquid level changes.

The Relief Pilot has an elastomeric o-ring seat; thus achieving an absolute steady state "Bubble Tight" seal. Air consumption is entirely dependent on frequency of switching operation.

Supply & Output Connection: ¼ inch NPT Female

Proportional Band Adjustment:

(Recommended adjustment for a full output pressure change over a percent of sensing element)

Throttle	20% - 150%	Snap	7% - 55%
Relief	@ 30 PSI Supply = 7% - 55%		
	@ 50 PSI Supply = 20% - 100%		
	@ 100 PSI Supply = 50% - 200%		

Pilot – Electric – Snap Switch

Output:

Circuitry & Rating	See Section 2

Action: Field Reversible

between Direct Acting	Increasing Level Increases Output
and Reverse Acting	Increasing Level Decreases Output

Enclosure: See Section 2

Proportional Band Adjustment:

(Electric – Micro Switch)

SPDT	7% - 55%
DPDT	20% - 150%

(Electric – Hermetically Sealed)

SPDT	10% - 75%
DPDT	10% - 75%

Repeatability: 1.0% of output span

Dead Band: 5.0% of input span

Linearity: 1.75% of output span

Ambient Temperature Effect on Set point:

1.0% @ -40 °F

Mechanical Disturbance Effects on Set point:

1.0%

Specific Gravity:

Interface Detection	0.035
Top Level Range	0.35 to 2.00

Process Pressure Rating: See section on Configuration

Temperature Limits:

Body Process Temperature (dependent on mat'l selection):

See section on Materials of Construction

-70 °F to +600 °F

Instrument Case

Pneumatic Pilot Ambient Temperature	-40 °F to +180 °F
	-40 °F to +275 °F (High Temp)
Electric Pilot Ambient Temperature	-40 oF to +160 oF

A Case Extension is used for extreme process temperatures or when body insulation is to be used.

[1] The performance characteristics published are based on tests using a series 1001 Model 2SM60LLC with 1.88" Dia. X 12.00" long displacer and 12.5" arm length for horizontal element position or 15.00" arm length for vertical element position, operating in a specific gravity liquid at 80 oF temperature, and 100 PSIG pressure. Performance characteristics may vary depending on application.

INTRODUCTION – SPECIFICATIONS

MATERIALS OF CONSTRUCTION

Body: LLC

1001A	ASTM A696/A105 (-20 °F to +600 °F)
	ASTM A276/A182 (-70 °F to +600 °F)
1001XL	ASTM A216 WCC/A105 (-20 °F to +600 °F)
	ASTM A351 CF8M/A182 (-70 °F +600 °F)
Displacers:	PVC (-20 °F to +140 °F)
	Acrylic (-20 °F to +200 °F)
NACE Service	316 SST (-20 °F to +400 °F)

Displacer Arm: 316 SST (Std.)

Vertical Hanger (swivel for vertical displacer position):
316 SST (Std.)

Chain (for vertical extension and/or split displacer)
304 SST

Shaft: 316 SST (-70 °F to +600 °F)

Bearing Blocks: 316 SST (Std.) (-70 °F to +600 °F)

Bearings: TFE Sealed 440 C SST
(-70 °F to +600 °F)

Shaft Seals: Nitrile (-50 °F to +180 °F)
Nitrile Lo-Temp (-70 °F to +180 °F)
Fluorocarbon (-20 °F to +400 °F)
Aflas (-20 °F to +600 °F)
EPR (-70 °F to +250 °F)

Case & Cover: Die Cast Anodized Aluminum, with Enamel Paint

Pilot:

Body	
Throttle	Aluminum w/ Aluminum Seat
Relief	Aluminum w/ Elastomer Seat
Snap	Aluminum Seat
Snap-Vibration Service	Aluminum w/ Plastic Seat
Gasket Diaphragm	Nitrile (Std.), Fluorocarbon (Opt.)
Filter Element	40 micron Phenolic Resin Impregnate Felt
Screws & Nuts	SST

Supply & Output Gauges: Brass (Std.), 316 SST (Opt.)
Brass Liquid Filled (Opt.)
316 SST Liquid Filled (Opt.)

Torque Bar: Aluminum (Std.)

Flapper Bar: 303 SST

Spring Adjusting Knot: Aluminum (Std.)

Fulcrum: Nylon w/ Zinc Screw (Std.)

Balancing Spring: Light – SST w/ Green Marking
Medium – SST w/ No Marking
Heavy – SST w/ Yellow Marking
Extra Heavy – SST w/ Red Marking

CONFIGURATION

Body End Connections:

Sizes (Pipe)	1.5" to 8.0"
Beveled – Butt Weld	To 6000 PSIG
Threaded (NPT)	To 6000 PSIG
Flanged (RF & RT)	150 thru 2500 ANSI Class

Case Mounting – 1001A:

Right Hand	Where the body process connection is to the right of the case.
Left Hand	Where the body process connection is to the left of the case.

Displacer Positions: Horizontal, Vertical, Split, Link,
HV (Horizontal/Vertical),
TV (Hinged – Tilt Under)

Displacer Size (Diameter x Length in inches):
Selection is dependent on sizing for media application

Diameter Range	1.00" thru 4.00"
Length Range	3.00" thru 32.00"

Diameter x Length combinations are limited within controller construction.

Displacer Arms Length (inches): 7.75" thru 30.00"

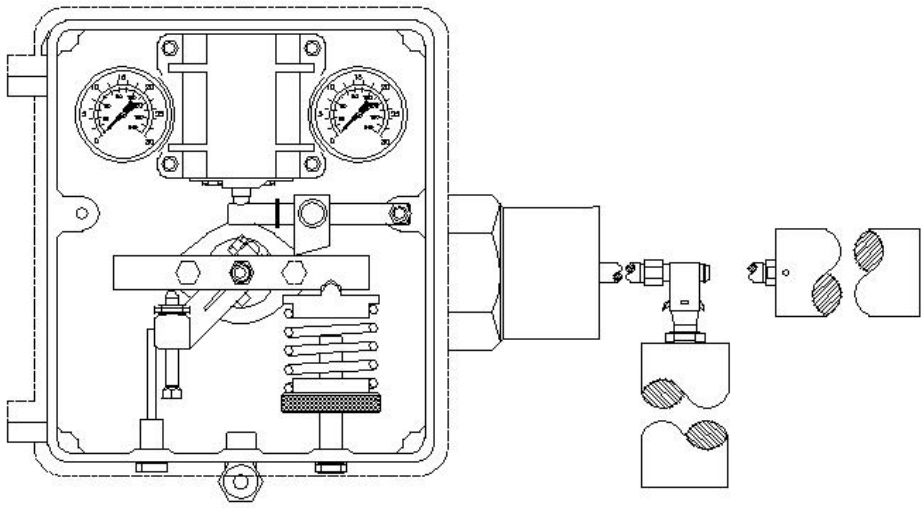
Balancing Spring
Four Ranges. Color coded dependent on arm length and displacer size.

Light Duty (Green)	Medium Duty (None)
Heavy Duty (Yellow)	Extra Heavy Duty (Red)

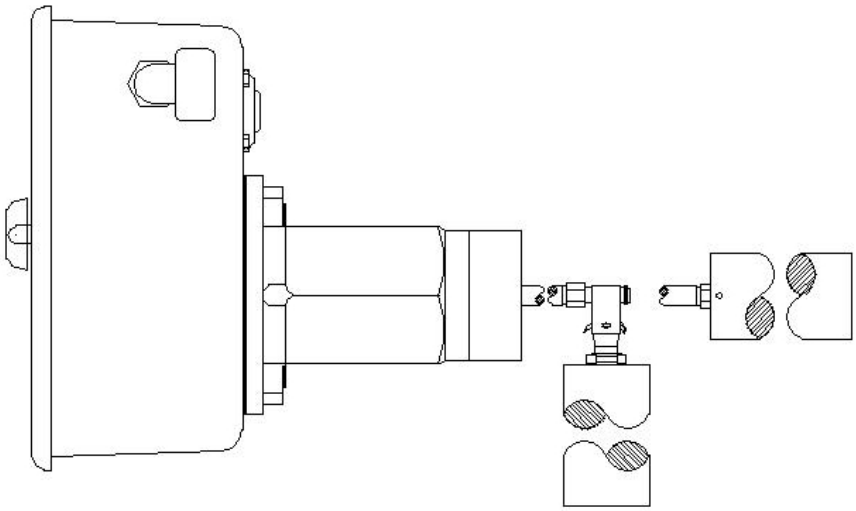
INSTALLATION AND STARTUP – CONFIGURATION

The following drawings illustrate some of the standard configurations of Norriseal's level controllers. Utilize these drawings to verify that your level controller is properly configured.

Series 1001A

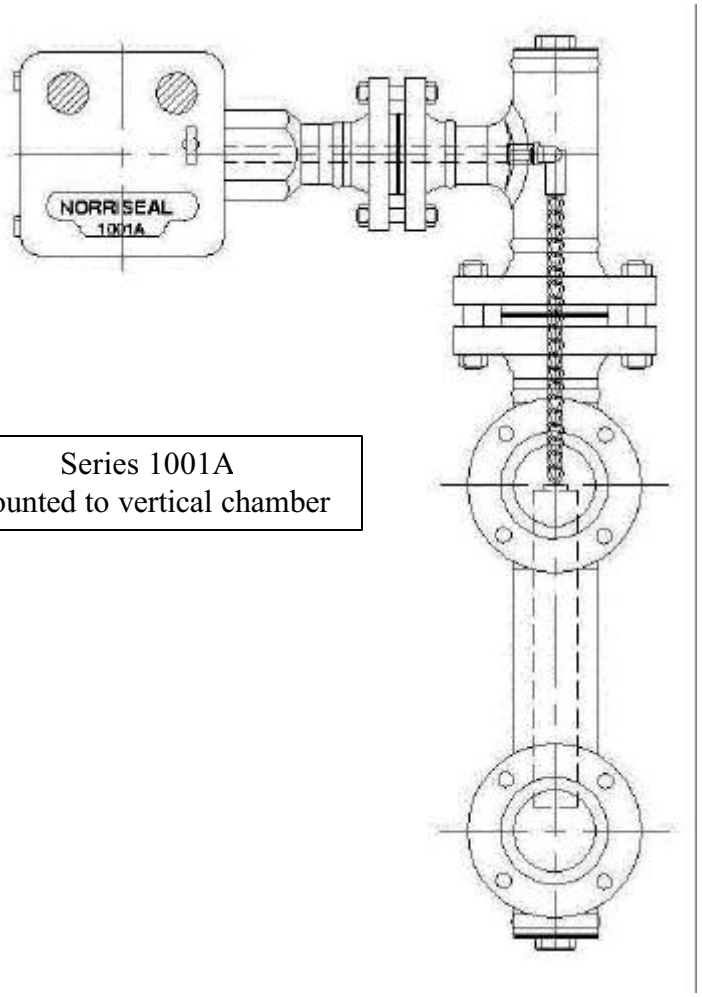


Series 1001XL



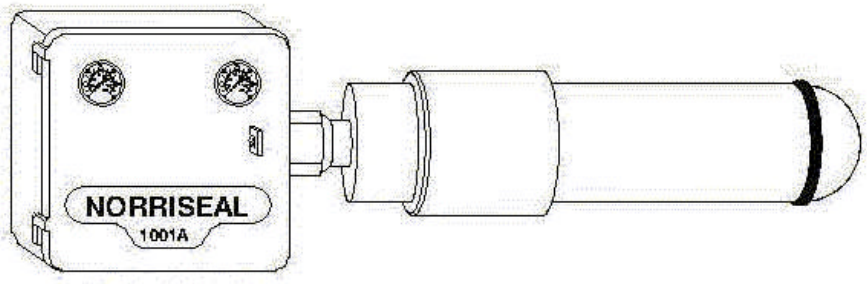
INSTALLATION AND STARTUP – CONFIGURATION (continued)

The following drawings illustrate some of the standard configurations of Norriseal's level controllers. Utilize these drawings to verify that your level controller is properly configured.



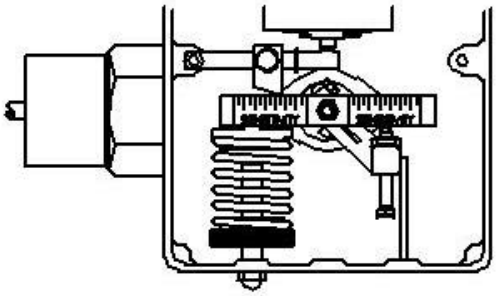
Series 1001A
Mounted to vertical chamber

Series 1001A
With horizontal chamber

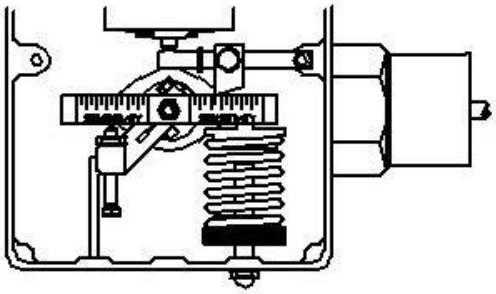


INSTALLATION AND STARTUP – CONFIGURATION (continued)

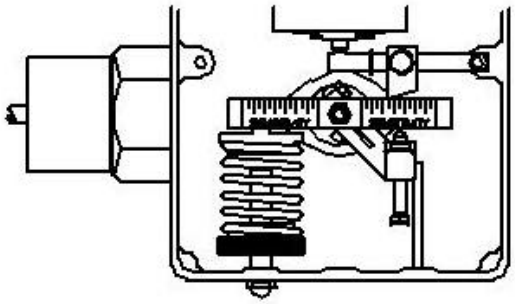
The following drawings illustrate some of the standard configurations of Norriseal's level controllers. Utilize these drawings to verify that your level controller is properly configured.



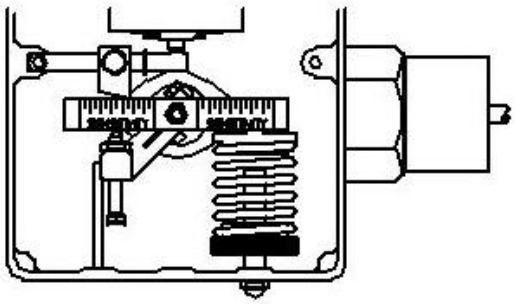
LEFT HAND MOUNT
DIRECT ACTING
Rising level Increases
Pilot Output



RIGHT HAND MOUNT
DIRECT ACTING
Rising Level Increases
Pilot Output

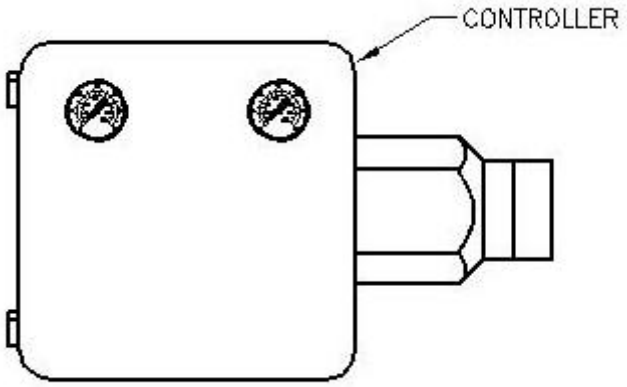


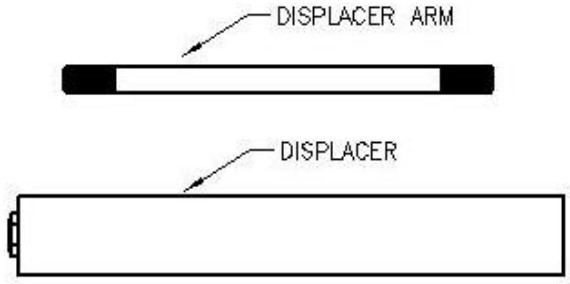
LEFT HAND MOUNT
REVERSE ACTING
Rising Level Decreases
Pilot Output



RIGHT HAND MOUNT
REVERSE ACTING
Rising Level Decreases
Pilot Output

INSTALLATION AND STARTUP – STARTUP





Norriseal level controllers are normally shipped in three pieces. Therefore, some assembly is required. The following sections will lead you through assembly and recommended start-up procedure.

Assembly Steps:

1. Screw displacer arm into controller body.
2. Screw displacer onto displacer arm.

Arm Adjustment:

Rock Torque Bar by hand to verify Arm is NOT resting against vessel nozzle. (Arm must be reasonably centered in connection opening). Turn Adjusting Knob under Balance Spring to position Arm.

To Lower Level:

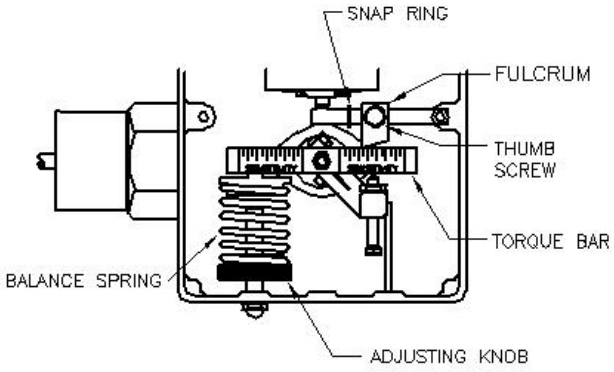
Turn Adjusting Knob CLOCKWISE to increase compression on Balance Spring.

To Raise Level:

Turn Adjusting Knob COUNTERCLOCKWISE to decrease compression on Balance Spring.

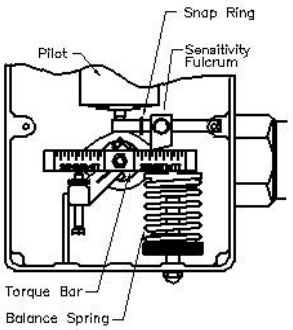
To Adjust Proportional Band (Span):

Loosen Screw in Sensitivity Fulcrum and slide Fulcrum along Flapper Bar. To DECREASE Proportional Band (INCREASES SENSITIVITY) slide Fulcrum toward Snap Ring. To INCREASE Proportional Band (DECREASES SENSITIVITY) slide Fulcrum away from Snap Ring.



OPERATION – PRINCIPLE OF OPERATION

Principle of Operation



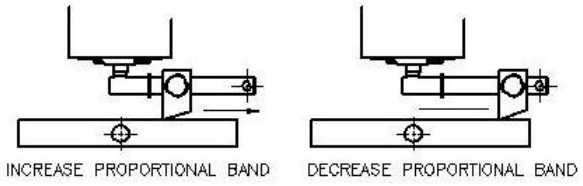
A spring balances the weight of a displacement type sensing element. As liquid rises around the displacer, the amount of force made available to the pilot is proportional to the volume of liquid displaced by the displacer. The higher the liquid level, the greater the force available to the pilot thrust pin. This direct-acting force is easily reversed in the field.

The force available is transmitted to the pilot thrust pin through a lever and fulcrum. The control is **direct acting** (rising level increases pilot output) when the pivot point of the lever is on the spring side of the control case.

The control is **reverse acting** when the pivot point is on the opposite side of the control case from the spring (rising level decreases pilot output).

Adjusting Proportional Band:

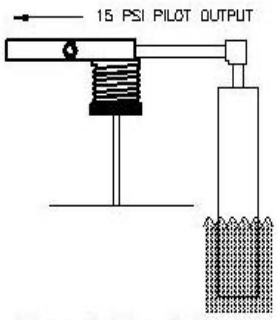
Moving the fulcrum closer to the pivot point increases the proportional band*; moving the fulcrum toward the snap ring decreases the proportional band. A 3-15 psi or 6-30 psi output signal may be obtained over any portion of the displacer by adjusting the fulcrum as described.



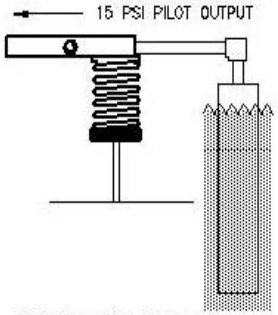
- Proportional band is the ratio of used displacer length to total length of displacer. Example: If six inches of level change will develop a 3-15 psi output signal with a 12" long vertical displacer, the level controller is said to have a 50% proportional band.

Top Level Control:

With spring force held constant, the higher the liquid level on the displacer, the greater becomes the force available to the pilot. When spring force is reduced (by decompressing the spring), a higher level on the displacer is required to produce the same force as before.



Compressing the spring lowers the level on the displacer



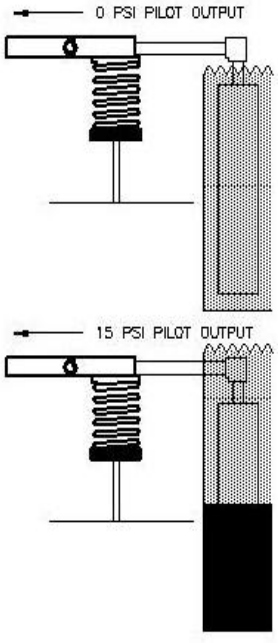
Reducing spring force raises level to provide a predetermined pilot output.

Liquid Interface Control:

Spring compression can be reduced to a further position where a hydrocarbon liquid level will rise above the displacer.

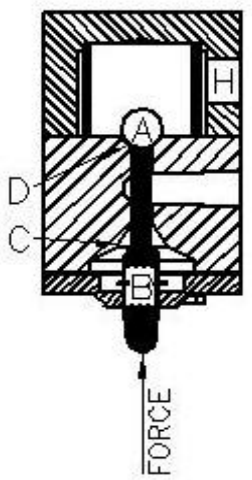
This wide spring range makes the control of a liquid interface possible with the standard displacer. The adjustment is usually made as the lighter liquid rises on the displacer.

After the spring is adjusted so the lighter liquid will not operate the control, there is adequate spring force in reserve to enable displacement of the heavier liquid to actuate the pilot.



OPERATION – PRINCIPLE OF OPERATION, SNAP PILOT, RELIEF PILOT AND THROTTLE PILOT

Snap Pilot



The snap pilot is comprised of two metal seated valves - one at "D" to admit pilot supply pressure, and one at "C" to exhaust pressure.

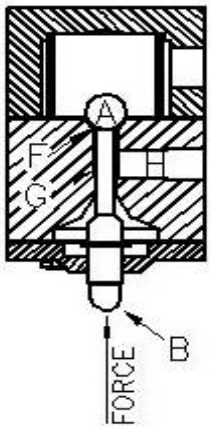
Ball "A" controls the flow of instrument air into the pilot at seat "D" and is held closed with force exerted by supply pressure on the seating area of the ball.

When the upward mechanical force transmitted to thrust pin "B" is sufficient to overcome the force holding ball "A" seated, "A" snaps upward allowing instrument air to flow past "A" and to the output port "H" of the pilot.

The spherical end of thrust pin "B" closes the exhaust port at "C" the instant ball "A" snaps upward. The exhaust port seating area is smaller than the seating area of the supply port; therefore, the push rod must remain seated against supply pressure until force on the thrust pin "B" diminishes.

As the force acting on thrust pin "B" is reduced the supply pressure acting downward on ball "A" overcomes the upward force at thrust pin "B" and reversing action occurs. ball "A" closes the supply pressure at valve "D" and simultaneously opens the exhaust port at valve "C"; thus venting gas from port "H". The Snap Action results from the differences in seating areas of the two internal pilot valves.

Relief Pilot

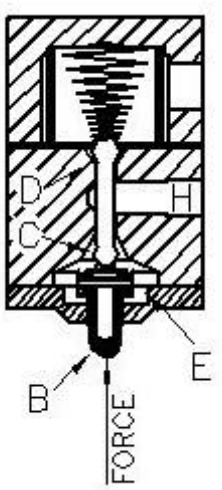


The relief pilot used in Block & Bleed systems operates identically to the snap pilot, except with two differences. Seat "D" has an added resilient seat "F" and flow passage at "G" is enlarged. The seat seal "F" is an elastromeric o-ring which gives air absolute "zero leakage" seal of the supply pressure at ball "A". Just as in the snap pilot, when mechanical force transmitted through thrust pin "B" exceeds the downward force of the supply pressure at seat "D", ball "A" snaps upward allowing instrument air to flow past ball "A" and to port "H".

The flow passage at "G" has a 43% larger flow capacity than the snap pilot; thus permitting instrument supply air to vent at a faster rate. The pilot valves will reset when mechanical force is reduced.

The relief pilot cannot be converted into snap or throttle application.

Throttling Pilot



The throttle pilot, used for modulating control, also utilizes two internal valves ("D" and "C") to admit and exhaust air pressure. A diaphragm "E" used in conjunction with the valve at "C" creates a chamber for sensing pressure/force feedback.

When a mechanical force pushes upward on thrust rod at "B", the valve at "C" is closed and simultaneously opens valve "D" allowing instrument air to flow into the chamber above diaphragm "E" and to output "H". The air continues flowing until the increasing pressure builds a feedback force on diaphragm "E" that pushes downward equalizing the upward force applied to thrust rod "B". These balanced forces are the reason to the term "Force Balance."

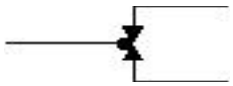
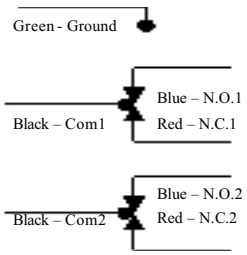
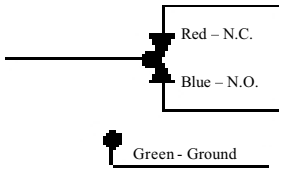
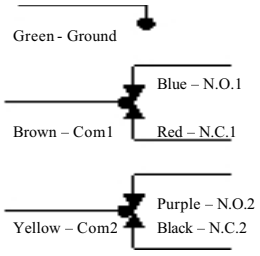
The throttle pilot works in the same manner as the snap pilot except the output pressure is proportional the mechanical force applied at push rod "B". As the push rod force changes, the pilot seeks to maintain equilibrium by either decreasing (exhausting) output loading pressure at valve "C" or increasing output loading pressure at valve "D".

Instrument air does not flow when the loading pressures of the pilot are balanced.

OPERATION – ELECTRIC PILOT SWITCHES
EXPLOSION-PROOF AND SPLASH PROOF ENCLOSURES

Electric Pilot Switches

Two standard switches are available, single pole double throw (SPDT) or double pole double throw (DPDT).

CODE	CIRCUITRY		ELECTRICAL RATING
"E" EX-Q or "O" OP-Q	 Single – Pole Double – Throw	A	UL and CSA Listed: 15 amps, 125, 250 or 480 VAC 1/8 hp, 125 VAC; 1/4 hp, 250 VAC; 1/2 amp, 125 VDC; 1/4 amp, 250 VDC
"D" EXD-Q or "F" OPD-Q	 Double – Pole Double – Throw	B	UL and CSA Listed: 10 amps, 125 or 250 VAC .3 amp, 125 VDC; .125 amp, 250 VDC
HERMETICALLY SEALED PILOT			
"K" Hermetic 030	 Single – Pole Double - Throw		
"L" Hermetic 057	 Double – Pole Double - Throw		11 amps, 1/4 hp @ 125/250 VAC; 5 amps Res @ 28 VDC; 0.5 amps @ 125 VDC

"EX" Explosion-Proof Enclosure

Flame paths within the housings of these switches cool exploding gases below the kindling temperature before they reach explosive gases surrounding the housing.

The enclosed replaceable basic switch is accessible when the cover plate is removed. "EX" explosion-proof switches are not sealed and therefore are not recommended for use in areas where they will be subjected to liquid splash.

Micro Switch "EX" switches are listed by Underwriter's Laboratories and CSA for use in hazardous locations Class 1, Groups C and D, and Class 2, Groups E, F and G. This includes vapors of ethyl ether, gasoline, petroleum, alcohol, acetone, lacquer solvent, natural gas and atmosphere charged with grain dust, metal dust, carbon black, and coal or coke dust. Switch listed for Class 1, Group B (hydrogen atmosphere) is available. EX switches also meet NEMA 1 enclosure requirements. CSA requires the following statement for Class 1, Group B:

CAUTION:
To prevent the emission of hot particles, joint surfaces must be thoroughly cleaned before closing cover.

ATTENTION:
Pout empecher la projection de particles chaudes, les joints du couvercle doivent etre nettoyes a fond avant de fermer le couvercle.

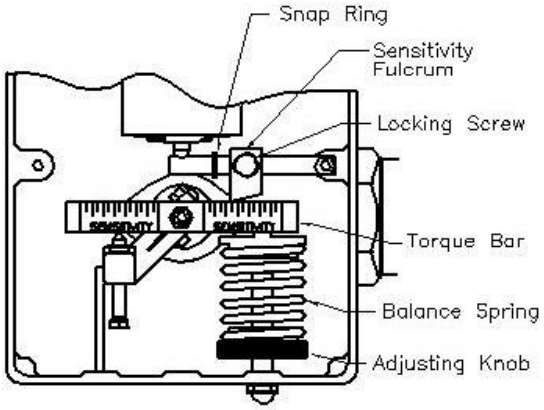
Hermetically Sealed Enclosure for Hazardous Locations

These switch leads are terminated in a junction box UL listed Class 1, Groups C and D, Class 2, Groups E, F and G. The switches are hermetically sealed for hazardous locations listed UL and CSA Class 1, Groups A, B, C and D; Class 2, Groups E, F and G.

OPERATION – CONTROL ADJUSTMENTS, CASE MOUNTING AND ACTION CONVERSIONS

CONTROL ADJUSTMENTS – LEVEL, SENSITIVITY & LIQUID INTERFACE

Level



1. Compress balance spring with adjusting knob to balance weight of displacer.
2. Make sure displacer arm is not resting against vessel nozzle by rocking torque bar.

- To Lower Level - Increase spring compression.
- To Raise Level - Decrease spring compression.

Sensitivity

1. Loosen locking screw on the sensitivity fulcrum.
2. **To Increase Sensitivity** - Slide fulcrum nearer Snap Ring.
3. **To Decrease Sensitivity** - Slide fulcrum away from Snap Ring.
4. Tighten locking screw. Finger tight only required.

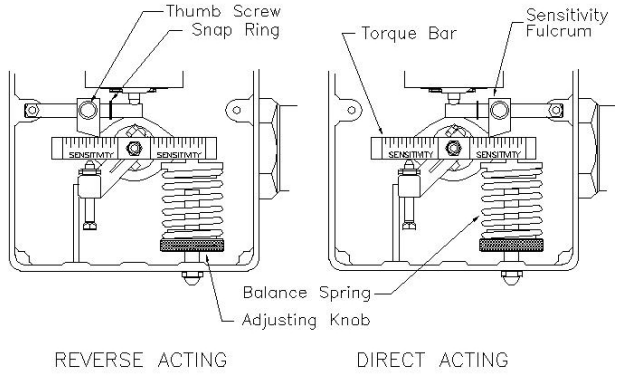
Liquid Interface

1. Set sensitivity fulcrum 1/4" from snap ring, reduce spring tension slowly and let the upper fluid rise to submerge the displacer. For fine tuning after displacer is submerged in upper fluid, increase spring tension slowly until an output signal is obtained; back-off spring tension again (slowly) until output signal pressure returns to zero. The instrument is now ready to control the lower fluid.
2. Let lower fluid rise on displacer until desired level is reached. This can be accomplished by reducing spring tension slowly as fluid rises.
3. If a longer dump span is desired, move fulcrum farther away from snap ring and repeat the above procedure.

Note: All controls are preset at factory for average level and sensitivity. Normally no further adjustment is required. The square head screw under the torque bar is used only for fine adjustment on metering applications to set an exact increment of dump.

Case Mounting and Action Conversion

The following are instructions for the disassembly, conversion and re-assembly of all parts involved in case mounting and/or controller action of liquid level controls.



Pilot Action (Direct to Reverse, or Reverse to Direct) Disassembly

(Note location and position of parts before proceeding)

1. Relax all tension on balance spring (item 16).
2. Remove 10/32 lock nut (item 46 or 47) from pivot pin.
3. Slide flapper bar (item 2) from pivot pin.
4. Remove thumb screw (item 45 or 46) from sensitivity fulcrum (item 15).
5. Replace thumb screw (item 45 or 46) in opposite hole of fulcrum from which it was originally removed.
6. Reverse position of flapper bar (item 2).
7. Slide flapper bar on opposite pivot pin from which it was originally removed. Thumb screw (item 45 or 46) should be facing outward and fulcrum (item 15) should be facing so that the longest side (with contact point) is closest to the retaining ring (item 14) on the flapper bar (item 2).
8. Install 10/32 lock nut (item 46 or 47) to retain flapper bar (item 2). (Flapper bar must remain free to pivot).
9. Adjust tension on balance spring (item 16).

OPERATION – CONTROL ADJUSTMENTS, CASE MOUNTING AND ACTION CONVERSIONS (continued)

Procedure for Case Mounting Conversion

Disassembly

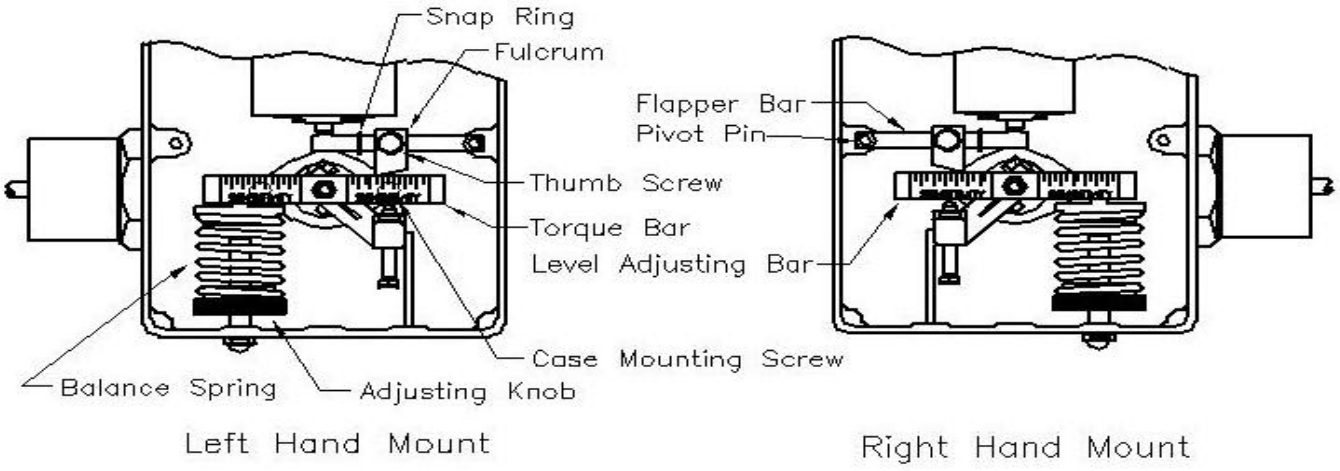
(Note location and position of parts before proceeding)

1. Relax all tension on balance spring (item 16).
2. Remove balance spring (item 16) and upper spring retainer (item 24) from pilot case (item 1).
3. Remove 3/8-24 x 1.75" cap screw (item 51 or 52) and lower spring retainer (item 33) from case (item 1).
4. Remove 2, 10/32 lock nuts (item 46 or 47). (Use 7/16 wrench.)
   a. One nut on end of shaft (item 32).
   b. One nut on pivot pin retaining flapper bar (item 2).
5. Slide flapper bar (item 2) from pivot pin.
6. Slide torque bar (item 36) from shaft (item 32).
7. Loosen 2, 1/4" hex head cap screws (items 42 or 44) in level adjusting bar (item 17). (Use 1/2 box-end wrench).
   a. Holding level adjusting bar (item 17), loosen both screws until level adjusting bar (item 17) is free on shaft (item 32).
   b. Slide level adjusting bar (item 17) from shaft (item 32).
   c. Slide spacer (item 26) from shaft (item 32).
8. Remove 2, 1/4-28 x 3/8" hex head cap screws (item 41 or 45) so that pilot case (item 1) is loose. (Use 1/2 socket wrench.)
9. Remove case (item 1) from level control body (item 54 or 55).

Conversion and Re-Assembly

(See drawings for desired mounting location.)

1. Install 2, 1/4-28 x 3/8" hex head cap screws (item 41 or 45) into case mounting holes.
   a. Mount case (item l) to body (item 54 or 55) with 2 screws.
   b. Tighten screws. (Torque to 6 ft. lbs.)
2. Slide spacer (item 26) on the shaft (item 32).
3. Level Adjusting Bar (item 17).
   a. Position level adjusting screw (item 35) so that there is equal amount of thread showing above and below bar.
   b. Slide level adjusting bar (item 17) on shaft (item 32) against spacer (item 26).
   c. Snug up 2, 1/4-28 x 3/8" hex head cap screws (item 41 or 45) in bar. (Do not tighten.)
   d. Slide torque bar (item 36) on shaft (item 32) temporarily for positioning of level adjusting bar (item 17).
   e. Position level adjusting bar (item 17) so that torque bar is parallel with displacer arm (item 23) when the round tip of level adjusting screw (item 52) is touching the torque bar (item 36).
   f. With level adjusting bar (item 17) positioned - slide torque bar (item 36) from shaft and tighten 2, 1/4-28 x 3/8" hex head cap screws (items 41 or 45). Tighten screw nearest the slotted end of the level adjusting bar first. (Torque to 6 ft.lbs.)
4. Slide torque bar (item 36) onto shaft (item 32) with countersunk hole for spring retainer (item 24) facing down.



OPERATION – CONTROL ADJUSTMENTS, CASE MOUNTING AND ACTION CONVERSIONS (continued)

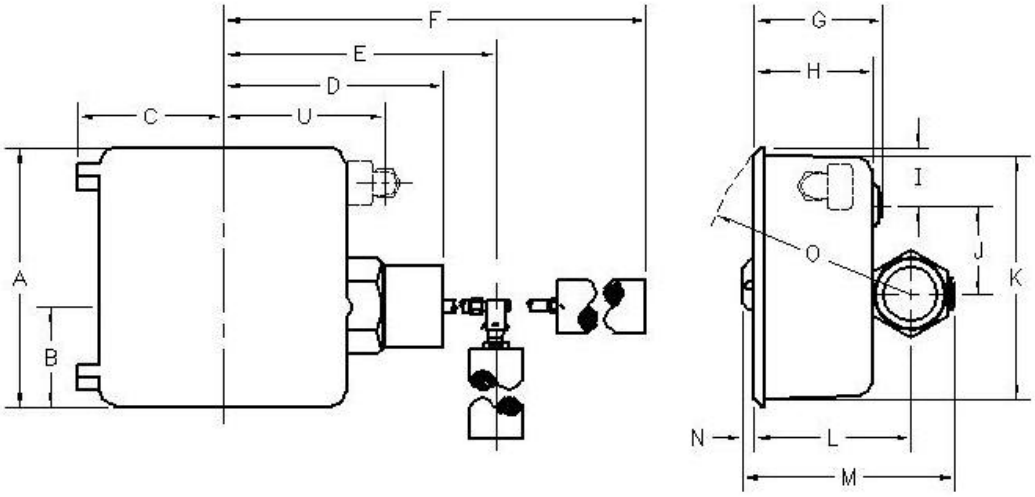
5. Install 10/32 lock nut (item 46 or 47) on end of shaft (item 32). (Allow 1/16 inch clearance between back of lock nut (item 46 or 47) and torque bar (item 36).)
6. Slide flapper bar (item 2) onto pivot pin.
   a. Left Hand Mount - Direct acting - use left pivot pin.
   b. Left Hand Mount - Reverse acting - use right pivot pin.
   c. Right Hand Mount - Direct acting - use right pivot pin.
   d. Right Hand Mount - Reverse acting - use left pivot pin.
7. Install 10/32 lock nut (item 46 or 47) to retain flapper bar (item 2). (Flapper bar must remain free to pivot.
8. Install 3/8-24 x 1.75" cap screw (item 51 or 52) and lower spring retainer into lower pilot case (item 1).
   a. Left Hand Mount – Bolt (cap screw) stud is at left side.
   b. Right Hand Mount - Bolt (cap screw) stud is at right side.
9. Install spring (item 16) and upper spring retainer (item 24) engaging retainer with hole in torque bar (item 36).

DIMENSIONS

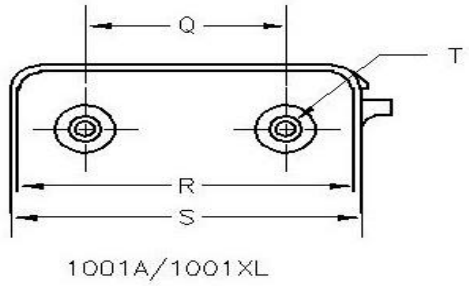
*Using standard 1.875" dia. x 12" displacer and 12.5" displacer arm.

Length is dependant upon displacer arm and displacer.

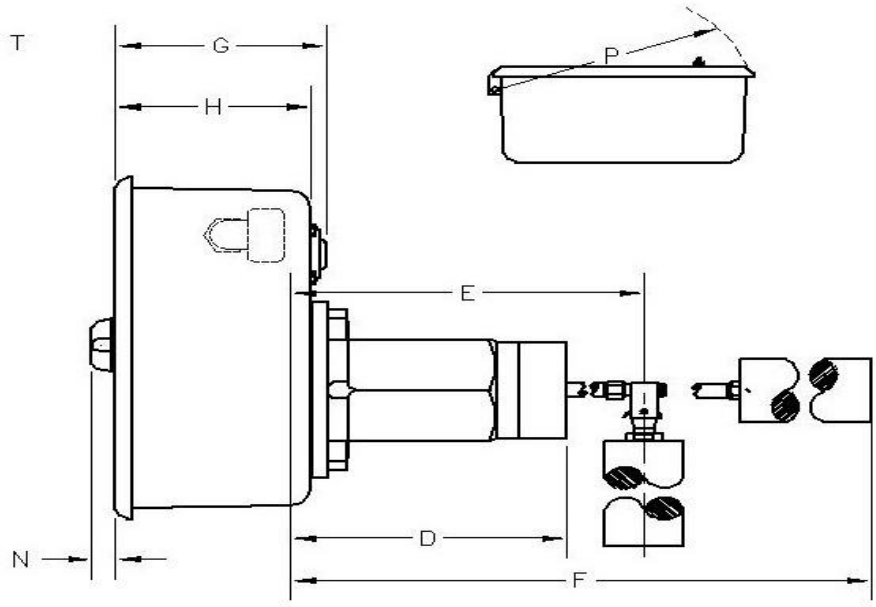
	MODEL	
	1001A	1001XL
A	8.74	8.74
B	3.85	3
C	4.13	4.13
D	6	6
E	13.12*	13.12*
F	24.43*	24.44*
G	4.36	4.36
H	3.95	3.95
I	1.9	1.9
J	2.98	2.98
K	7.98	7.98
L	5.19	---
M	7.47	---
N	0.69	0.69
O	7.13	---
P	7.85	7.85
Q	4	4
R	7.06	7.06
S	8.01	8.01
T	1/4 NPT	1/4 NPT
U	4.87	5.16



OPERATION – CONTROL ADJUSTMENTS, CASE MOUNTING AND ACTION CONVERSIONS (continued)



1001A/1001XL



Side View of 1001XL

OPERATION – MAINTENANCE

Preventive Maintenance

1. In normal service o-ring and bearings on main shaft should last for many years. If leak does occur, replace o-rings.
2. If controller is used in high paraffin service or interface control with horizontal displacer, remove and inspect body of controller after three (3) months from installation and check for debris build up. Inspection time after initial inspection can be gaged by how much build up of debris occurred in three (3) months.
3. For high temperature service, consult your Norriseal Catalog. If in doubt of compatibility of fluid with Norriseal Controller, consult your Norriseal Representative.

Basic Electric Switch

The following are instructions for replacing the electric switch:

1. **IMPORTANT** - Disconnect the power supply circuit before opening switch.
2. Remove the cover of the housing, disconnect the lead-in wires, loosen the screws holding the basic switch, and then remove the basic switch.
3. Place the replacement switch in the insulator, insert the screws and place basic switch in the housing. Switches with "MN" basics have no separate insulator.
4. Tighten the screws and connect the lead-in wires.
5. Be sure the small compression spring is returned to its position between the top of the basic switch and the internal lever (or above the internal lever in the case of the CCW actuated switches).

CAUTION

To prevent the emission of hot particles, joint surfaces must be thoroughly cleaned before closing cover.

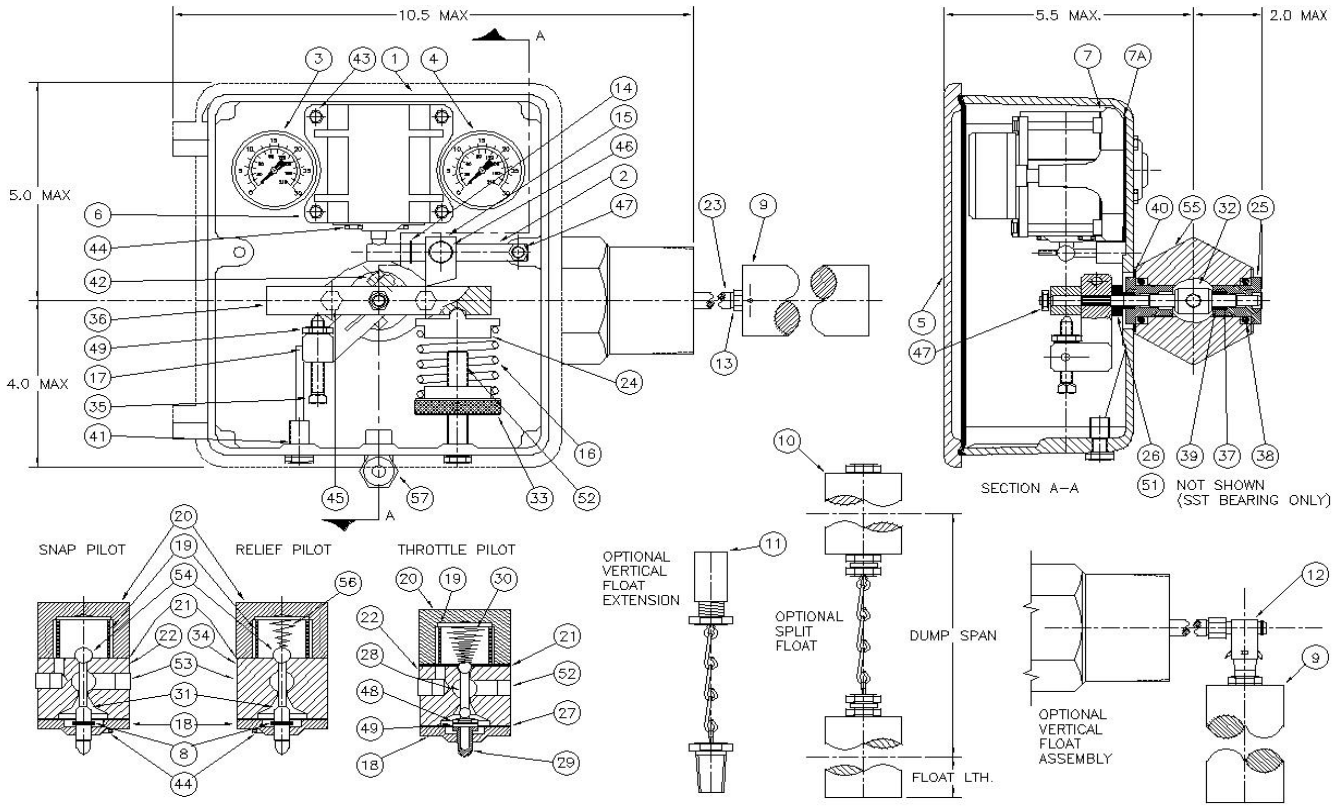
ATTENTION

Pout empecher la projection de particles chaudes, les joints du couvercle doivent etre nettoyes a fond avant de fermer le couvercle.

WARNING SIGNAL	IMMEDIATE CAUSE	CORRECTIVE ACTION
Pilot output pressure gage indicated output pressure signal when fluid level is below displacer on a direct acting* controller.	Spring is too compressed and puts too much pressure on torque bar. Displacer is set too high or displacer is hitting something inside vessel.	1. Back off spring retainer until output pressure signal goes off. Recheck when fluid rises. 2. Check displacer arm by moving leveling bar up and down. If leveling bar will move in only one direction, this indicates displacer arm is riding at either the top or bottom of vessel connection. By turning thumb screw displacer arm can be re-centered in vessel connection.
Fluid level above displacer and pressure gage indicates no output signal for a direct acting* control.	Spring is not compressed enough. Displacer arm is set too low.	1. Turn spring retainer which will compress spring. Turn until an output signal is indicated by showing pressure on the output pressure gage. Output pressure should go off when fluid level drops down to the displacer's controllable range. 2. Same as in (2) above.
Controller does not repeat at same fluid level after each dump and sometimes fails to either dump or shut off.	Paraffin or debris build up inside level control body.	Remove controller from service and clean out pilot body with a solvent. You can usually tell there is a build up of paraffin or debris by depressing the torque bar and the releasing it quickly. If bar does not bounce fast and appears to hardly move, this is a good indication of a build up of foreign matter in controller body in which displacer arm cannot move freely.
Pneumatic pilot bleeds air continuously.	1. Foreign matter under ball on snap control pilot or under peanut on throttle pilot. 2. TRU arc ring on snap pilot thrust pin could have slipped down due to some unusual happening.	Remove supply and output tubing connections from pipe adapters in pilot. Remove the two (2) cap screws from the top of housing case that support pilot in place. Remove pilot from case and then remove the two (2) cap screws from bottom of pilot. Clean pilot thoroughly and reassembly for throttle pilot. For snap pilot, check the Tru Arc dimension from the bottom of in to bottom of Tru Arc. Dimension should be 3/4". If not correct dimension, tap to correct measurement.
Interface control; occasionally loses liquid or vessel overflows. Usually happens with temperature change. Displacer arm is free and displacer is not hitting inside of vessel.	Displacer is not big enough to handle interface differential. Close specific gravity of two fluids and a temperature change can cause this problem.	Exact specific gravities or API gravity of both fluids should be given to Norriseal Engineering Department for exact sizing of required displacer size on close gravity fluids

***For indirect Acting Controllers follow the same corrective procedures for direct acting controller. WARNING SIGNAL: Except pressure gage output signal will be reversed.**

SERIES 1001A LIQUID LEVEL CONTROL



440004–1001–115 THROTTLE PILOT CONVERSION KIT
(To change pilot from Snap to Throttle)
440005–1001–116 SNAP PILOT CONVERSION KIT
(To change pilot from Throttle to Snap)

440003–1001–71 THROTTLE PILOT COMPLETE
440002–1001–70 SNAP PILOT COMPLETE
440007–1004–6 RELIEF PILOT COMPLETE

EFFECTIVE 11.JUN.2003
SIDE A REVISION: G

ITEM NO.	COMM. CODE	MATERIAL	PARTS DESCRIPTION	QTY
1	490101A320	ALUMINUM	CASE Ass,y with manifold	1
2	490101A106	303 SST	BAR Flapper	1
3	490101A213 490101A215	BRONZE 316 SST	GAGE Pressure Supply 0–30 PSI GAGE Pressure 0–30 PSI OPT.	1 1
4	490101A215 490101A240	316 SST BRONZE	GAGE Pressure 0–30 PSI OPT. GAGE Pressure Output 0–30 PSI	1 1
5	490101A319	ALUMINUM	COVER LLC Pneumatic	1
6	490101A232	ALUMINUM	CLAMP Pilot	1
*7	490101A241	BUNA–N	GASKET Manifold/Pilot	1
*7A	490101A234	BUNA–N	GASKET Manifold/Case	1
8	490101A157	18–8 SST	RING Retainer Truarc	1
9	490101A122 490101A186 490101A175	PVC ACRYLIC 316 SST	FLOAT 1.88 X 12.00 FLOAT 1.88 X 12.00 FLOAT 1.66 X 12.00	1
10	490101A208	PVC	FLOAT Split 1.88 X 6.00 X 2	1
11	490101A218	316 SST	EXTENSION Float	1
12	490101A140	A351 SST	ASS'Y Float Swivel	1
13	490101A198	316 SST	Hex Bushing 1/4 X 1/8	1
14	490101A116	18–8 SST	RING Retainer Truarc	1
15	490101A117	NYLON	FULCRUM Sensitivity	1
16	490101A127 490101A125 490101A126 490101A159	302 SST 302 SST 302 SST 302 SST	SPRING Light Duty (Green) SPRING Medium Duty (GREY) SPRING Heavy Duty (Yellow) SPRING Ex. Heavy Duty (Red)	1
17	490101A101	ALUM/ALLOY	BAR Adjusting Level	1
18	490101A107	ALUMINUM	CAP Pilot Bottom	1
*19	490101A110	FELT MEDIA	FILTER Pilot	1
20	490101A111	ALUMINUM	CAP Pilot Top	1
*21	490101A112	ACRYLONITILE	GASKET Pilot Upper	1
22	490101A113	ALUMINUM	BODY Pilot Throttle or Snap	1
23	490101A190 490101A120 490101A121 490101A176	316 SST 316 SST 316 SST 316 SST	ARM Float 7.75 ARM Float 12.50 ARM Float 15.00 ARM Float 18.00	1
24	490101A124	ALUMINUM	RETAINER Spring Upper	1

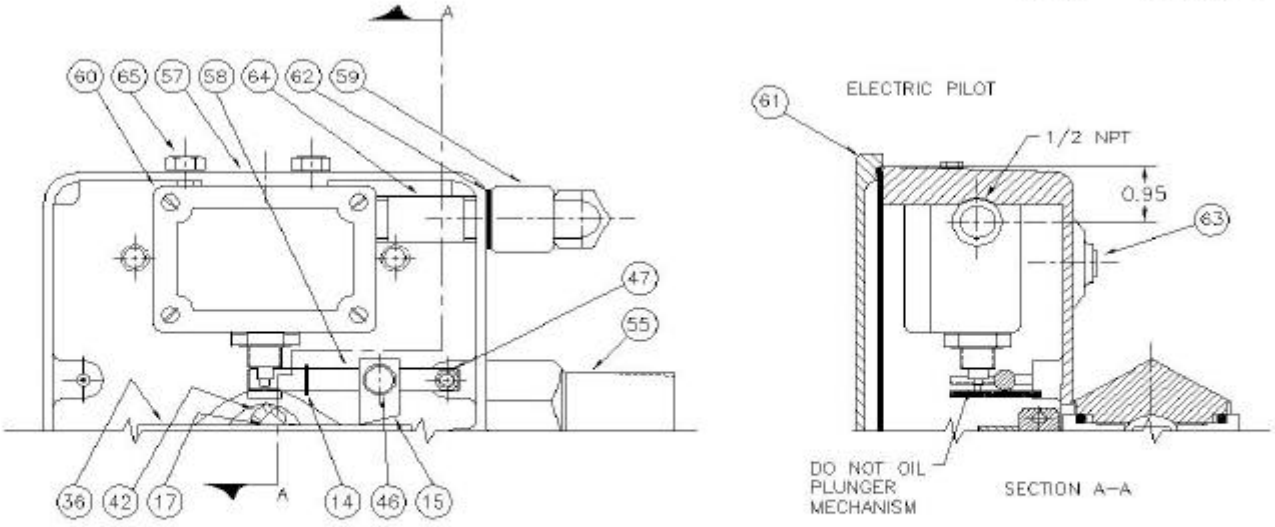
ITEM NO.	COMM. CODE	MATERIAL	PARTS DESCRIPTION	QTY
25	490101A194	316 SST	BLOCK Bearing	2
26	490101A138	303 SST	SPACER	1
*27	490101A154	BUNA–N	DIAPHRAGM Pilot	1
28	490101A150	303 SST	PEANUT	1
29	490101A147	303 SST	SEAT Pilot Moving	1
30	490101A151	316 SST	SPRING Peanut	1
31	490101A156	303 SST	PIN Thrust	1
32	490101A134 490101A193	303 SST 316 SST	SHAFT	1
33	490101A128	ALUMINUM	RETAINER Spring Lower	1
34	490101A205	ALUMINUM	BODY Pilot Relief W/O–ring	1
35	490101A100	304 SST	SCREW Adjusting Level	1
36	490101A104	ALUMINUM	BAR Torque	1
37	490101A135	TEFLON	RING Back–up	2
*38	490101A153 490101A192	VITON TEFLON	O–RING Block Bearing O–RING Opt. Block Bearing	2
*39	490101A152 490101A191	VITON TEFLON	O–RING Shaft O–RING Opt. Shaft	2
*40	490101A247	VITON	O–RING	1
41	490101A246	18–8 SST	SCREW Cap Hex 3/8–24 x 0.50	2
42	490101A105	18–8 SST	SCREW Cap Hex 1/4–28 x 0.75	2
43	490101A244	18–8 SST	SCREW Cap Hex 1/4–20 X 2.00	4
44	490101A115	18–8 SST	SCREW CAP Hex 10–32 x 2.00	2
45	490101A103	18–8 SST	SCREW CAP Hex 1/4–28 X 0.50	2
46	490101A118	18–8 SST	SCREW Thumb 10–32 x 0.50	1
47	490101A119	18–8 SST	NUT Hex Lock 10–32	2
49	490101A149	18–8 SST	NUT Hex Reg 1/4–28	1
50	490101A148	NYLON	WASHER Flat 0.25	1
51	490101A233	18–8 SST	WASHER Flat 0.25	1
52	490101A137	18–8 SST	CAP SCREW HEX 3/8–24 X 1.75	1
53	490101A248	ALUMINUM	PLUG Pipe 1/8	2
54	490101A155	302 SST	BALL 0.50	1
55			BODY (See Chart on Reverse Side)	
56			SPRING Pilot Relief	
57	490101A170	18–8 SST	1/4 PIPE Adapter (Optional)	1
58	490101A318		Screen Vent Mesh	1

* Recommended Spare Parts All Dims In Inches

EDMONTON, ALBERTA
9530 – 60 Ave. T6E 0C1
Phone (780) 434–8566
Fax (780) 434–4267

SERIES 1001A LIQUID LEVEL CONTROL

EFFECTIVE OCT 03,2001
SIDE B REVISION: E



PART NUMBERS FOR ITEMS 1-56 ARE ON REVERSE SIDE

ITEM NO.	COMM. CODE	MATERIAL	PARTS DESCIPTION	QTY
57	490101A284	ALUMINUM	CASE LLC Electric	1
58	490101A143	303 SST	BAR Flapper Micro Switch	1
59	490101A202	MALL IRON	ELBOW Conduit 0.50 x 90°	1
60	490101A144	EXD-Q EX-Q	SWITCH Electric DPDT Explosion SWITCH Electric SPDT Explosion	1
61	490101A216	ALUMINUM	COVER LLC Electric	1
62	490101A153	VITON	O-RING	1
63		CSTL	PLUG Pipe 1/4	2
64	490101A203	CSTL	NIPPLE Pipe Sch 40 .50 x 2.00	1
65	490101A211	18-8 SST	SCREW Cap Hex 10-32 x 0.38	2

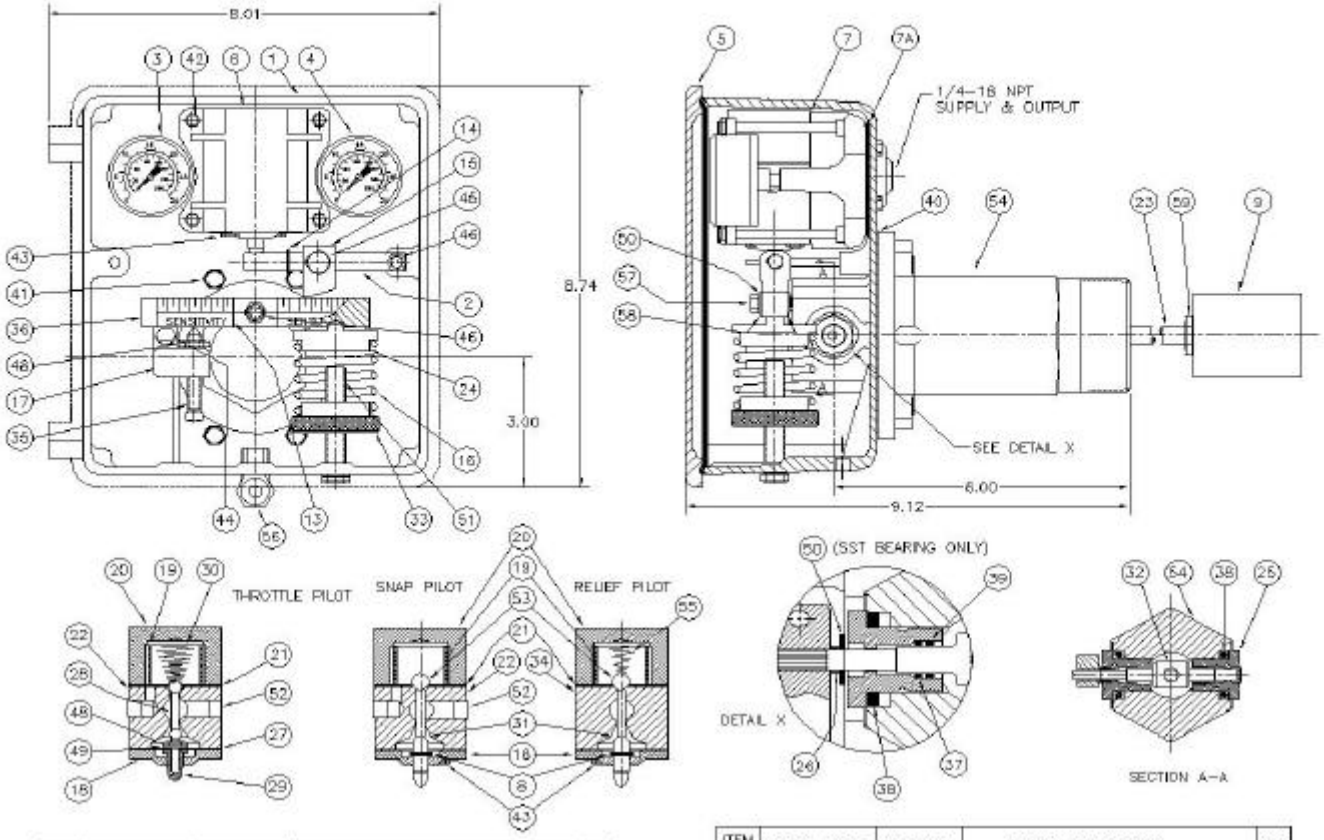
BODY STYLE	SIZE, COMM. CODE and STOCK NO.					
	2.00		3.00		4.00	
	COMM. CODE	MATERIAL	COMM. CODE	MATERIAL	COMM. CODE	MATERIAL
BEVEL Slip On SCREW Male NPT	490101A174 490101A139	A696	N/A N/A	N/A N/A	N/A N/A	N/A N/A
150 RF 300 RF	490101A225 490101A224	A696/A105	490101A223 490101A251	A696/A105	490101A220 490101A146	A696/A105
600 RF RFJ	490101A166		490101A249		490101A221	
900 RF RFJ	490101A256 490101A252					

EDMONTON, ALBERTA
8530 - 60 Ave. T6E 0C1
Phone (780) 434-8566
Fax (780) 434-4267

SERIES 1001XL LIQUID LEVEL CONTROL

EFFECTIVE 11Jun.2003
SIDE A REVISION: H

PARTS LIST STANDARD SERVICE – PNEUMATIC PILOT



ITEM NO.	COMM. CODE	MATERIAL	PARTS DESCRIPTION	QTY
1	490101B100	ALUMINUM	CASE Ass'y With Manifold & Studs	1
2	490101A106	303 SST	BAR Flapper	1
3	490101A213	BRONZE	GAGE Pressure Supply 0-30 PSI	1
	490101A215	316 SST	GAGE Pressure 0-30 PSI OPT.	1
4	490101A215	316 SST	GAGE Pressure 0-30 PSI OPT.	1
	490101A240	BRONZE	GAGE Pressure Output 0-30 PSI	1
5	490101A216	ALUMINUM	COVER LLC Pneumatic	1
6	490101A232	ALUMINUM	CLAMP Pilot	1
*7	490101A241	BUNA-N	GASKET Manifold/Pilot	1
*7A	490101A234	BUNA-N	GASKET Manifold/Case	1
8	490101A157	18-8 SST	RING Retainer Truarc	1
9	490101A122	PVC	FLOAT 1.88 X 12.00	1
	490101A186	ACRYLIC	FLOAT 1.88 X 12.00	
	490101A175	316 SST	FLOAT 1.66 X 12.00	
10	490101A208	PVC	FLOAT Split 1.88 x 6.00 x 2	1
11	490101A218	316 SST	EXTENSION Float	1
12	490101A140	A351 SST	ASS'Y Float Swivel	1
13	490101B108	VINYL	SCALE Indicator Fulcrum Sticker	1
14	490101A116	18-8 SST	RING Retainer Truarc	1
15	490101A117	NYLON	FULCRUM Sensitivity	1
16	490101A127	302 SST	SPRING Light Duty (Green)	1
	490101A125	302 SST	SPRING Medium Duty (Grey)	
	490101A126	302 SST	SPRING Heavy Duty (Yellow)	
	490101A159	302 SST	SPRING Ex. Heavy Duty (Red)	
17	490101B102	ALUM/ALLOY	BAR Adjusting Level	1
18	490101A107	ALUMINUM	CAP Pilot Bottom	1
*19	490101A110	FELT MEDIA	FILTER Pilot	1
20	490101A111	ALUMINUM	CAP Pilot Top	1
*21	490101A112	ACRYLONITILE	GASKET Pilot Upper	1
22	490101A113	ALUMINUM	BODY Pilot Throttle or Snap	1
23	490101A190	316 SST	ARM Float 7.75	1
	490101A120	316 SST	ARM Float 12.50	
	490101A121	316 SST	ARM Float 15.00	
	490101A176	316 SST	ARM Float 18.00	
24	490101A124	ALUMINUM	RETAINER Spring Upper	1

ITEM NO.	COMM. CODE	MATERIAL	PARTS DESCRIPTION	QTY
25	490101A194	316 SST	BLOCK Bearing	2
26	490101A138	303 SST	SPACER	1
*27	490101A154	BUNA-N	DIAPHRAGM Pilot (Throttle)	1
28	490101A150	303 SST	PEANUT (Throttle)	1
29	490101A147	303 SST	SEAT Pilot Moving (Throttle)	1
30	490101A151	316 SST	SPRING Peanut (Throttle)	1
31	490101A156	303 SST	PIN Thrust	1
32	490101B103	316 SST	SHAFT	1
33	490101A128	ALUMINUM	RETAINER Spring Lower	1
34	490101A205	ALUMINUM	BODY Pilot Relief W/O-ring	1
35	490101A100	304 SST	SCREW Adjusting Level	1
36	490101B104	ALUMINUM	BAR Torque	1
37	490101A135	TEFLON	RING Back-up	2
*38	490101A153	VITON	O-RING Block Bearing	2
	490101A192	TEFLON	O-RING Opt. Block Bearing	
*39	490101A152	VITON	O-RING Shaft	2
	490101A191	TEFLON	O-RING Opt. Shaft	
*40	490101B109	NEOPRENE	GASKET Body/Case	1
41	490101A103	18-8 SST	SCREW Cap Hex 1/4-28 X 0.50	4
*42	490101B132	18-8 SST	1/4-20NC X 2 3/4 HEX. HEAD CAP SCREW	4
43	490101A115	18-8 SST	SCREW CAP Hex 10-32 X 2.00	2
44	490101A105	18-8 SST	SCREW CAP Hex 1/4-28 X 3.75	2
45	490101A118	18-8 SST	SCREW Thumb 10-32 x 0.50	1
46	490101A119	18-8 SST	NUT Hex Lock 10-32	2
48	490101A149	18-8 SST	NUT Hex Reg 1/4-28	2
49	490101A148	NYLON	WASHER Flat 0.25	1
50	490101A233	18-8 SST	WASHER Flat 0.25	2
51	490101A137	18-8 SST	CAP SCREW HEX 3/8-24 X 1.75	1
52	490101A248	GR. 5	PLUG Pipe 1/8	2
53	490101A156	302 SST	BALL 0.50 302	1
54			BODY (See Chart on Reverse Side)	
55			SPRING Pilot Relief	
56	490101A170	302 SST	1/4 TUBE Fitting (Optional)	1
57	490101B126	316 SST	POST Pivot F/ XL	1
58	190101A052	TEFLON	1/4 FLAT Solid Washer	2
59	490101A198	316 SST	1/4 X 1/8 BUSHING	2
60	490101A318		Screen Vent Mesh	1

* Recommended Spare Parts All Dims In Inches

EDMONTON, ALBERTA
9530 – 60 Ave. T6E 0C1
Phone (780) 434-8566
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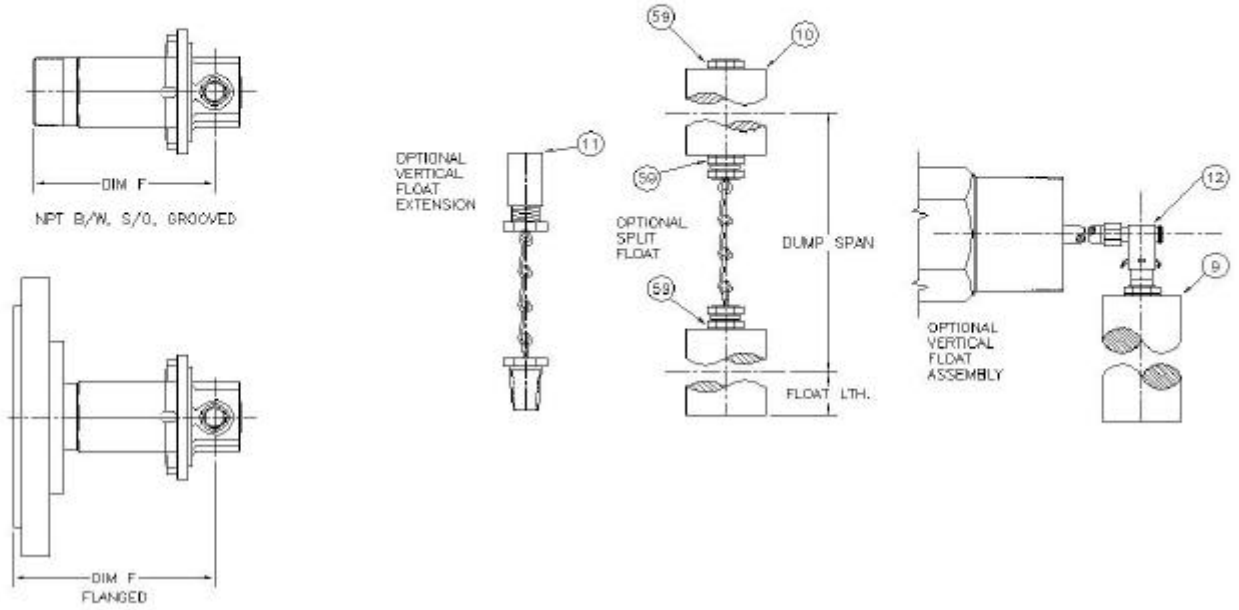
SERIES 1001XL LIQUID LEVEL CONTROL

EFFECTIVE OCT. 03,2001
SIDE B REVISION: E

PARTS LIST STANDARD SERVICE – PNEUMATIC PILOT



BODY CHART 28 BODY STYLES *	BODY MATERIAL	2.00 COMM. CODE	2.00 MATERIAL	DIM F	3.00 COMM. CODE	3.00 MATERIAL	DIM F	4.00 COMM. CODE	4.00 MATERIAL	DIM F	6.00 COMM. CODE	6.00 MATERIAL	DIM F
BEVELED SLIP-ON	1018 CSTL	490101B116	A696	6.00	N/A	N/A	---	N/A	N/A	---	N/A	N/A	---
SCREWED MALE NPT	1018 CSTL	490101B110	A696	6.00	N/A	N/A	---	N/A	N/A	---	N/A	N/A	---
FLANGED 150 RF	1018/A105 CSTL			6.50			6.56	490101B113	A105	6.56			6.50
150 RTJ	1018/A105 CSTL			6.69			6.88			6.88			6.69
300 RF	1018/A105 CSTL			6.81			6.75			6.88			6.94
300 RTJ	1018/A105 CSTL			7.06			7.00			7.25			7.19
600 RF	1018/A105 CSTL			7.19	490101B114	A105	7.12	490101B115	A105	7.50			7.62
600 RTJ	1018/A105 CSTL			7.25			7.31			7.58			7.69
900 RF	1018/A105 CSTL			8.00			7.50			7.75			---
900 RTJ	1018/A105 CSTL			8.06			7.56			7.75			---
1500 RF	1018/A105 CSTL			8.00			7.88			8.12			---
1500 RTJ	1018/A105 CSTL			8.06			7.94			8.19			---
2500 RTJ	1018/A105 CSTL			8.56			8.75			9.19			---

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