F. Double to reverse — acting

1. Holding control module, as shown in Figure 9c (so that bellows is in upper left corner), remove small valve cap (32).
2. Turn module so that valve spring (39) and valve poppet (42) drop out.
3. Drop new exhaust plug (60) into module through small threaded hole. Press firmly into place with small 1/8"(3.18 mm), blunt tool like a nail.
4. Insert new small valve cap (32) with "O" Ring (52), seating on "O" Ring.

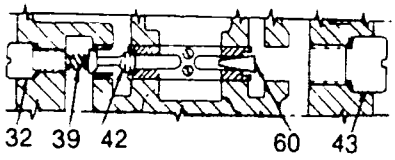


Figure 9A

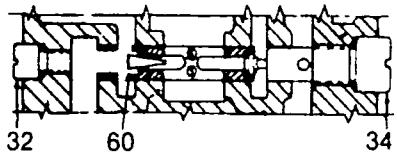


Figure 9B

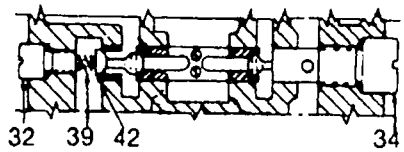


Figure 9C

Instrument Pressure Range

Instrument signal pressure range can be changed in the field by changing the range spring (40) as shown in Figure 10 from back side of control module. These springs are listed in Table 2 under "Spanstroke calibration".

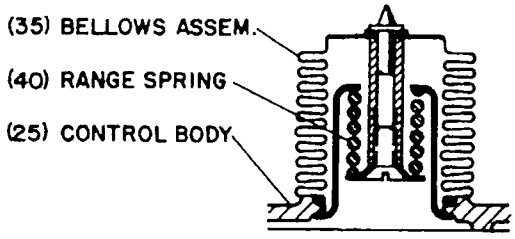


Figure 10. Range spring assembly

Type of Manifold

The manifold can be converted in the field by changing the disc valve (73) and disc valve spring (74) as shown in Figure 11. These parts are available as kits as listed below:

Conversion to	Kit no.	Max. pressure
No bypass	6113344	150 psig
Bypass	6113351	60 psig

Split Range

Double split range operation is necessary when the instrument pressure signal is divided between two positioner-controlled valves. Such operation requires simple adjustments to the positioner but no change of parts if the desired span is within the capability of the selected range spring. See Tables 2 and 3 for the split-ranging capabilities of the several standard range springs.

Bypass

An optional bypass valve feature is available to maintain reasonable control of a process valve when the positioner control module is deactivated or removed for service.

This feature provides such control by sending instrument signal pressure directly to the actuator. Control with the bypass valve is possible only if:

1. The actuator is single-acting.
2. The positioner is inherently direct-acting (GP50 type).
3. Maximum instrument pressure equals normal positioner supply pressure.
4. Supply connection is made at the bottom of the positioner.

A positioner with a bypass valve feature cannot be used above 60 PSIG(414 kPa) supply pressure. (See Figure 18).

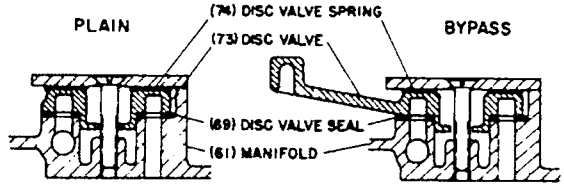


Figure 11. Disc valve assemblies

Cam Selection

General

Three cams are provided with each positioner for the purpose of achieving different flow versus signal characteristics with a given valve. Such variations are sometimes required to correct instability of oversize valves or to make the characteristic of the valve conform to that of the process or controller.

Effects on Actuator Motion

Cam "A" produces linear actuator motion; that is, the same amount of motion for a given change in signal at any point in the range.

Cam "B" produces faster motion than Cam "A" at the low end of the signal range and slower motion at the high end of the signal range.

Cam "C" is the opposite of Cam "B", producing the same nonlinear motion, but in opposite relationship to the signal range.

Figure 6 illustrates the motion versus signal characteristics produced by these cams.

Feedback Cams

Effects on Flow Characteristics

Figure 13 illustrates the effects which these actuator motions have on the flow versus signal characteristics with a linear valve plug.

Figure 14 illustrates the effects which these actuator motions have on the flow characteristics when the valve has an equal-percentage plug.

Installation

General

Unless otherwise specified by order, the positioner will be shipped with Cam "A" in place; Cams "B" and "C" will be shipped loose.

Direction

Direction of the cam is very important. For this reason, the cams are reversible and have an arrow which must be directed as follows:

The arrow on the cam must point in the direction that the actuator will move due to an increasing signal pressure.

The cam mounting screw is accessible through the side of the control module with the cover removed. This screw must be tight to prevent instability due to back-lash in feedback motion.

Adjustments

Span adjustment is unaffected by changing cams if the feedback arm (14) is exactly horizontal at midstroke of the actuator.

Zero-settings must be reset if cams are changed.

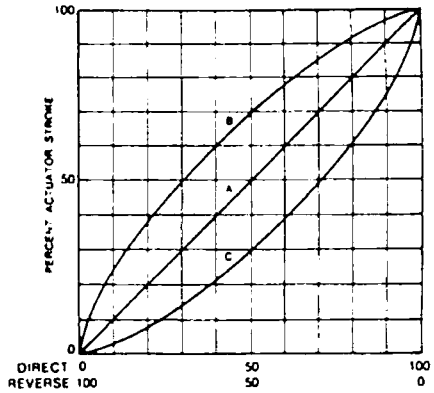


Figure 12

Actuator Motion

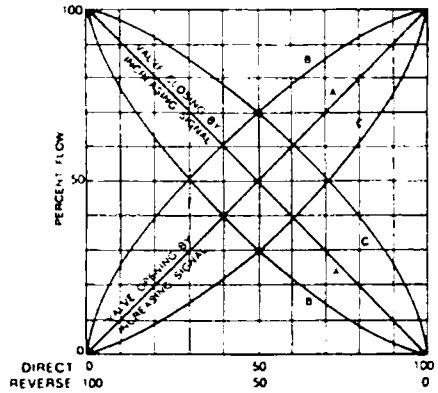


Figure 13

Flow Characteristics with Linear Valve Plug
(constant pressure drop)

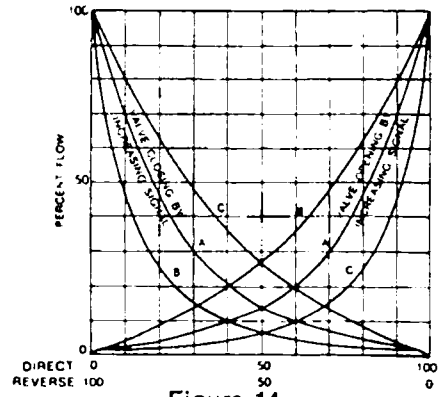


Figure 14

Flow Characteristics with Equal — Percentage Valve Plug
(constant pressure drop)

Trouble Shooting

Observation	Corrections
General	
Resilient seals may deform or deteriorate in storage or after extensive use, causing leaks and problems which are difficult to identify.	Bubble test for leakage at piping connections, disc valve, manifold gasket, bellows base, diaphragm stack, valve caps, nozzle socket.
Most other problems result from poor feedback motion; they are relatively easy to identify.	Check cam direction, binding or looseness of feedback parts, positioner location on actuator.
Installation Problem — No Response	
1. Check signal indication at INSTRUMENT gauge	Clear piping if necessary.
2. Does SUPPLY gauge show pressure?	
NO—Is disc valve turned to "BYPASS"?	
YES	Switch valve if control module is operative.
NO	Clear supply piping.
YES—See item 3 ...	
3. Does OUTPUT gauge show pressure?	
if PORT 1 is output—**NO** ...	
if PORT 2 is output—**YES** ...	
Does actuator respond by pushing flapper?	
NO—Does diaphragm move at this time?	
NO	Push restrictor clearer and assure its return.
YES	Screw adjustable valve out if PORT 2 is output. Check for play in valve lever connections.
YES—Does flapper contact balance beam?	
YES	Raise nozzle and/or extend contact screw.
NO—Does bellows move 3/16"(4.76 mm) range?	
NO	Check for leakage at bellows base — replace seal. Disassemble bellows — check range spring color.
YES—Is cam roll at low point?	
YES	Check feedback mechanism, positioner location.
NO	Call representative.
if PORT 1 is output—**YES** ...	
if PORT 2 is output—**NO** ...	
Does actuator respond by pulling flapper?	
NO—Does diaphragm move at this time?	
NO	Disassemble diaphragm and clear holes.
YES	Screw adjustable valve in if PORT 2 is output. Check for play in valve lever connections.
YES—Is flapper bent by nozzle contact?	
NO	Lower nozzle and/or retract contact screw.
YES—Is bellows motion excessive?	
YES	Disassembly bellows — check range spring color. Disassembly bellows — check spring retainer.
NO—Is cam roll at high point?	
YES	Check feedback mechanism, positioner location.
NO	Call representative.

Other Possible Problems

Oscillation — only with cover on	Clear exhaust port or related piping if any.
Oscillation — with cover off	Check feedback mechanism for excess looseness. Check all rivets for tightness.
Hunting	Check balance beam location on pivot points.
Excessive overshoot	Check for disconnected balance beam spring.
Sluggish stopping	Check for friction in feedback mechanism.
Slow response (normal in large actuators)	Push restrictor clearer and assure its return. Check nozzle, diaphragm stack holes, piping for obstruction. Check leakage at all points described above.
Drift	Check leakage, balance pressure setting.

Disassembly Procedures	Maintenance Checkpoints
Control Module (Figure 15)	
Control Cover (19) 1. Retract four screws (23) from control module. 2. Lift Cover (19) and "O"-ring (24) off module.	a. Condition of "O"-ring.
Removing Control from Manifold 1. Switch disc valve (73) to "bypass" if provided. Otherwise shut off supply and instrument pressure. 2. Remove four screws (9) at back of manifold. (Figure 16). 3. Remove fifth screw (85) from center front of control body. (Figure 17). 4. Lift control module over feedback cam.	a. Condition of manifold gasket (62). b. Cleanliness of ports in manifold. c. Cleanliness of cavities in control body.
Balance Beam Assembly (28) 1. Unhook springs (38 and 84) from balance beam (28). 2. Lift beam off two pivot points. 3. Slide beam from under flapper contact (45).	a. Rivets must be tight — no motion. b. Freedom of cam roller (28).
Bellows Assembly (35, 36, 37, 40, 55, 56) 1. Remove screw (55) at back of control body. 2. Remove range spring (40) and screw out housing (36). 3. Lift bellows (35) out of control body.	a. Check spring for correct range (by color code). b. Condition and lubrication of "O"-ring (56). c. General condition of bellows for cracks.
Valve Lever Assembly (26) 1. Remove two screws (53) and lockwashers (54) holding exhaust sleeve (31) flexure to lever (26b). 2. Remove nut (78) and lockwasher (83) from diaphragm stud (33a). 3. Remove four screws (50) from control body and gently lift away from rubber diaphragm and control body.	a. No distorted or broken flexures. b. No distorted level stampings. c. All riveted joints must be tight — no motion. d. All rivets must be tight.
Diaphragm Subassembly (33) Lift diaphragm subassembly (33) off control body by prying under projection provided. Be careful not to damage small tube.	a. Condition of tube, clear passage. b. Condition of diaphragms. c. Clear passage through 2 small holes in control body.

Flapper Assembly (27)
1. Remove screw (58).
2. Unscrew nozzle (29) from control body.

a. Flatness and tightness of flexure rivets.
b. Condition of point on contact screw (45).
c. Cleanliness of hole in nozzle.
d. Condition and lubrication of nozzle "O"-ring.

Direct Valve (32)
Remove small valve cap (32), also spring (39) and poppet (42) if direct-acting model.

a. Condition of parts and hole in control body.
b. Possible plugged bleed hole in poppet.

Reverse Valve (34 or 43)
Remove adjustable valve (34), or large valve cap (43) if direct-acting model.

Same as for DIRECT VALVE (32).

Exhaust Sleeve (31)
1. Valve lever subassembly (26) must be removed first.
2. Reverse valve (34) or (43) must also be removed.
3. From the back of the control body gently push the exhaust sleeve out the reverse valve hole.

a. Thin web flexure must be straight and not bowed or cracked.
b. Exhaust seats must not be worn or damaged.
c. "O"-rings should be round, no compression set or wear, and lubricated.

Restrictor Clearer (30)
1. Remove screw (49), then clearer (30) and spring (39).

a. Condition of parts and hole in control body.
b. Condition and lubrication of "O"-ring.

Assembly Procedures

Control Module (1) (Figure 15)

A. Restrictor clearer (30)
1. Slide "O"-ring (48) onto clearer (30) and lubricate.
2. Slide spring (39) onto small end of clearer.
3. Push into control body (25) with head of clearer projecting 1/8"(3.18 mm) from face of hole.
4. Insert screw (49) tightly to avoid leakage.

B. Exhaust sleeve (31)
1. Slide "O"-rings (52) onto sleeve (31) and lubricate.
2. Press plug (60) into one end, if single acting.
3. Push sleeve to approximate center of opening in control body casting . . .
   a. Plugged end first if reverse acting.
   b. Plugged end last if direct acting.

C. Direct valve — active (32, 39, 42)
1. Slide "O"-ring (52) onto small valve cap (32).
2. Press valve spring (39) onto end of cap.
3. Press poppet (42) into free end of spring.
4. Screw group into control body, seating on "O"-ring.

D. Direct valve — inactive (32)
1. Screw valve cap (32) with "O"-ring (52) into control body omitting poppet (42) and spring (39).

E. Reverse valve — active (34)
1. Screw adjustable valve subassembly (34) with "O"-rings into control body until head projects about ⅛".

F. Reverse valve — inactive (43)
1. Screw large valve cap (43) with "O"-ring (59) into control body until it bottoms.

G. Diaphragm subassembly (33)
1. Assure projection of tube through lower diaphragm.
2. Tube I.D. must be unrestricted and clear.
3. Set (33) onto control body with short tube in mating hole.

H. Valve lever assembly (26)
1. Place on diaphragm subassembly.
2. Insert screws (50) with lockwashers (16) through cover plate (26a) and diaphragm subassembly into control body. Tighten evenly to avoid leakage by distortion.
3. Tighten nut (78) on diaphragm stud (33a).
4. Turn module over, tighten two screws (53), with lockwashers (54), to secure exhaust sleeve (31) to valve lever (26b).

Note: If additional adjustments are required in steps 1-5, it will be necessary to re-inspect the flexure for straightness. This is of great importance to the responsiveness of the unit.

I. Flapper (27, 45, 78)
1. Slide flapper support (27a) under valve lever extension (26e) and rest on two support pads.
2. Drop span adjuster (41), with clip ring (51), into third hole so that teeth mesh.
3. Screw nozzle (29) with "O"-ring (47) through hole in flapper support and into control body.
4. Insert screw (58), with washer (44), through slot in flapper support and into control body.

J. Bellows (35, 36, 37, 40, 55, 56)
1. Slide "O"-ring (56) onto bellows (35) and lubricate.
2. Drop bellows into large hole in control body.
3. Screw spring housing (36) up through same hole and tighten securely to compress "O"-ring gasket.
4. Place desired range spring (40) in housing.
5. Insert screw (55) through spring retainer (37) and range spring, and into bellows stem.

K. Balance beam (28, 84)

1. Hook springs (38) (84) into holes in control body.
2. Rest one pivot socket (28D) on bellows pivot (35A).
3. Swing beam under flapper contact screw (45) and rest other pivot socket (28D) on valve lever pivot (26f).
4. Hook upper ends of springs (38) (84) into respective holes provided in balance beam (28).

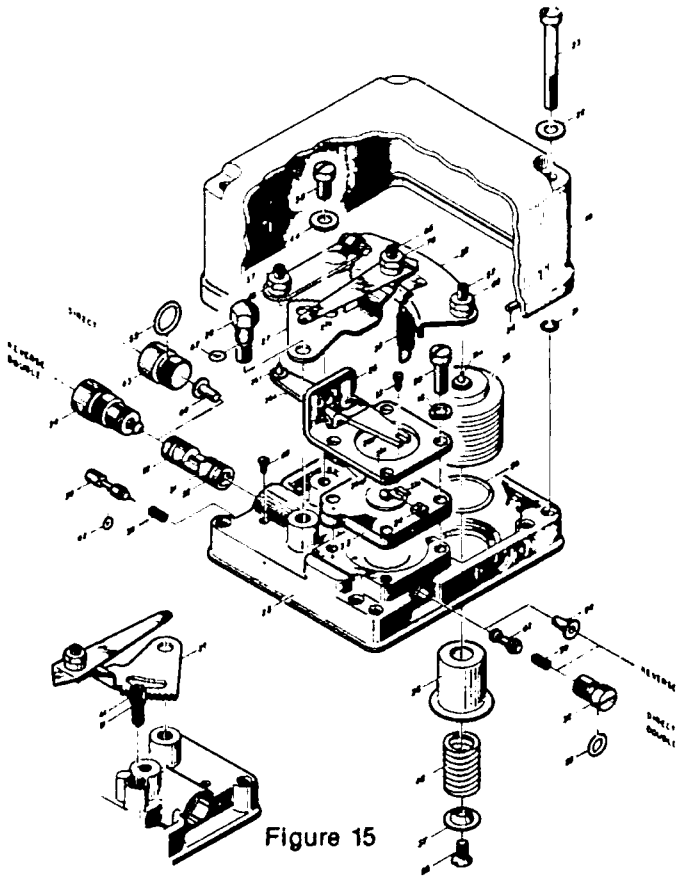


Figure 15

Manifold (Figure 16)

Disc Valve (73)

1. Remove screw (70) and cover (68) from manifold.
2. Remove valve (73) and springs (74).

Feedback Arm (66)

1. Remove feedback stud (14) from arm (66).
2. Remove screw (71) from feedback shaft (63).
3. Slide shaft out of bushings (61a).
   a. Check cleanliness of ports in manifold.
   b. Check condition and lubrication of valve seal rubber.
   a. Shaft not too loose in bushings.
   b. Check lubricity of bushings.

Disc valve (73)

1. Bond valve seal (69) in manifold (61) with tab in opening. Lubricate top side of seal only.
2. Place disc valve (73) in hole with tab or arm projecting through opening.
3. Put the valve spring (74) on top of disc valve.
4. Set valve cover (68) on top of spring.
5. Insert screw (70) through cover and into manifold.

Feedback arm (66)

1. Insert feedback shaft (63) through bushings (61a) with flatted end toward edge of manifold.
2. Fit feedback arm (66) into slot in shaft with offset toward edge of manifold.
3. Insert screw (76) and lockwasher (75) through arm and into shaft.
4. Check freedom of shaft rotation.

Feedback cam (17, 18, or 64)

1. Set desired cam (17, 18, or 64) on flatted end of shaft with arrow pointing in required stroke direction.
2. Insert screw (71) with washer (72), through cam and into shaft. Tighten well to avoid backlash.
3. Hook feedback spring (65) into hole in manifold.
4. Hook free end of spring into nearest hole in cam.

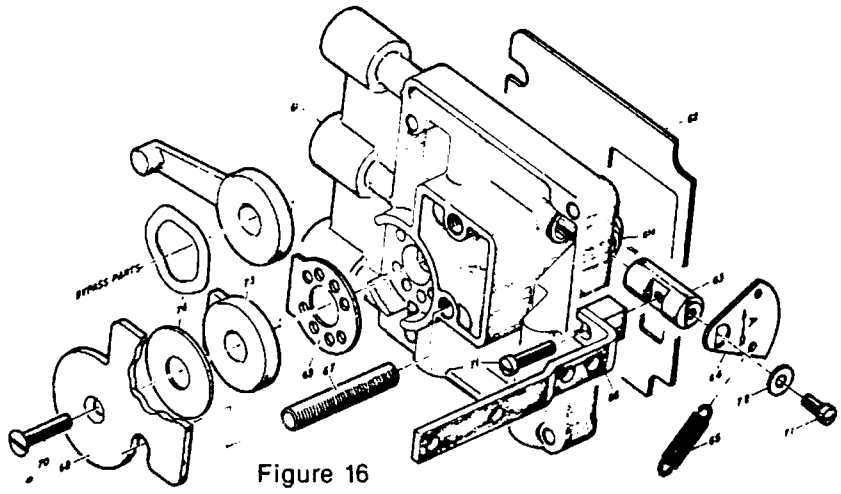


Figure 16

Complete Positioner (Figure 17)

Control module (1) and manifold (2)

Insert screws (9) (85) with lockwashers (16) (75) through manifold and control module respectively. First tighten screw (85) to maximum. Then follow with even and alternate tightening of screws (9) until metal contact is obtained on four corner pads at screw (9) locations.

Positioner cover (19)

1. Slide "O"-ring (24) down to flange on control body.
2. Insert screws (23) through cover (19).
3. Slide cover screw retainers (21) over screw threads.
4. Tighten screws (23) into control body sufficiently to seal.

Feedback stud (14)

Insert feedback stud (14) with nut (15) and lockwasher (16) into a numbered hole of feedback arm (66) best suited to stroke and span requirements. (See Figure 3 and Table 3).

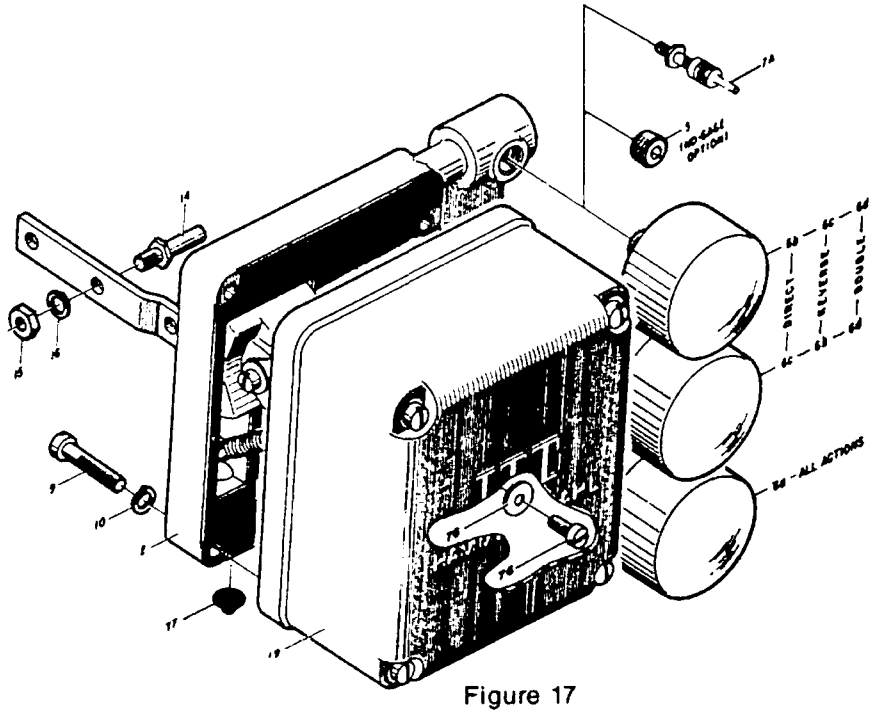


Figure 17

Parts List

Item	Description	Part no.	Material	Qty.
1	Control module/double-acting /3-15 PSI(21-103 kPa)	6112338	assembly (fig. 12)	1
	Control module/double-acting/6-30 PSI(41-207 kPa)	6112346	assembly (fig. 12)	1
	Control module/direct-acting/3-15 PSI(21-103 kPa)	6112353	assembly (fig. 12)	1
	Control module/direct-acting/6-30 PSI(41-207 kPa)	6112361	assembly (fig. 12)	1
	Control module/reverse-acting/3-15 PSI(21-103 kPa)	6112379	assembly (fig. 12)	1
	Control module/reverse-acting/6-30 PSI(41-207 kPa)	6112387	assembly (fig. 12)	1
2	Manifold/plain	6112486	assem. w/o feedback arm (fig. 13)	1
	Manifold/bypass	6112494	assem. w/o feedback arm (fig. 13)	1
3[1]	Actuator arm	6179857	stainless	1
4[1]	Feedback clip	6179840	stainless	1
5	Pipe plug	6165948	aluminum	3
6a	Gage/"INSTRUMENT"/0-30 PSI(0-207 kPa)	6188536	standard gage materials	1
6b	Gage/" OUTPUT"/0-60 PSI(414 kPa)	6124135	standard gage materials	1
6c	Gage/"SUPPLY"/0-60 PSI(414 kPa)	6124101	standard gage materials	1
6d	Gage/" OUTPUT"/0-160 PSI(1103 kPa)	6124143	standard gage materials	2
7	Test gage assembly (order separately)	6113401	commercial (not illus.)	1
7a	Test Gauge Valve	6180202	commercial (fig. 17)	3
8	Thread protector (for shipping only)	6188510	polyethylene	4
8a	Pipe plug	6165930	aluminum	1
9	Screw (Manifold)	6125280	stainless	4
10[1]	Washer	6139034	stainless	2
11[1]	Lockwasher (1 shipped in bag)	6130900	stainless	2
12[1]	Nut	6126643	stainless	2
13[1]	Lockwasher	6130992	stainless	1
14[1]	Feedback stud	6180012	stainless	1
15[1]	Nut	6127328	stainless	1
16[1]	Lockwasher	6130736	stainless	5
17[1]	Feedback cam "B"	6179964	stainless	1
18[1]	Feedback cam "C"	6179972	stainless	1
19	Cover	6179543	aluminum	1
20	Nameplate (inside cover)	6180046	aluminum	1
21	Cover screw retainer	6164917	Buna N	4
23	Screw (Cover)	6125256	stainless	4
24	"O"ring	6164982	Buna N	1
25	Control body subassembly	6112510	aluminum	1
26	Valve lever subassembly	6112411	stainless, plated steel	1
27	Flapper subassembly	6112429	stainless, plated steel	1
28	Balance beam subassembly	6112437	aluminum, plated steel	1
29	Control nozzle	6179394	stainless	1
30	Clearer subassembly (restrictor)	6112478	stainless	1
31	Exhaust sleeve	6179410	stainless	1
32	Valve cap — small	6179428	stainless	1
33[2]	Diaphragm subassembly	6112445	aluminum, Buna N	1
34	Adjustable valve subassembly	6112460	stainless	1
35	Bellows subassembly	6112452	phos. bronze, stainless	1

NOTES: 1. Mounting Parts and Cams can be purchased individually or as parts (unassembled), under number 6114367.
2. Recommended spare parts can be purchased individually or as a Spare Parts Kit, under number 6385434
Spare Parts Kit — P50 Series
Consists of items 33, 47, 48, 52, 56 and 59.

Parts List

Item	Description	Part no.	Material	Qty.
36	Range spring housing	6179519	brass	1
37	Range spring cap	6179527	plated steel	1
38	Balance beam spring	6179535	stainless	1
39	Valve spring	6179550	stainless	1 or 2
40	Range spring (plain) 15 PSIG(103 kPa) max. signal	6179568	stainless	1
	Range spring (red) 30 PSIG(207 kPa) max. signal	6179576	stainless	1
	Range spring (green) 11 PSIG(76 kPa) max. signal	6079594	stainless	1
41	Span adjustor	6179402	plated steel	1
42	Valve poppet	6179584	stainless	1 or 2
43	Valve cap — large	6179592	stainless	1
44	Disc spring	6180186	stainless	1
45	Flapper contact screw	6079479	stainless	1
47[2]	"O"-ring	6076574	Buna N	1
48[2]	"O"-ring	6164909	Buna N	1
49	Screw	6125025	stainless	1
50	Screw	6125249	stainless	4
51	Clip ring	6179733	stainless	4
52[2]	"O"-ring	6076608	Buna N	4
53	Screw	6179808	stainless	2
54	Split lockwasher	6130827	stainless	2
55	Screw	6125165	stainless	1
56[2]	"O"-ring	6164966	Buna N	1
58	Screw	6125264	stainless	1
59[2]	"O-ring	6076640	Buna N	1
60	Exhaust plug	6081509	polyethylene	1
61	Manifold subassembly	6112734	aluminum	1
62	Manifold gasket	6180038	Buna N	1
63	Feedback camshaft	6179980	stainless	1
64	Feedback cam "A"	6179956	stainless	1
65	Feedback spring	6180020	stainless	1
66[1]	Feedback arm subassembly	6112312	plated steel	1
67[1]	Manifold stud	6180152	stainless	2
68	Disc valve cover	6179923	plated steel	1
69	Disc valve seal	6179915	Buna N	1
70	Screw	6125009	stainless	1
71	Cam screw	6131940	stainless	1
73	Disc valve — plain	6179618	aluminum	1
	Disc valve — bypass	6179907	aluminum	1
74	Disc valve spring	6180160	steel	1
75[1]	Lockwasher (1 shipped in bag)	6225346	stainless	2
76[1]	Screw (1 shipped in bag)	6125871	stainless	2
77	Exhaust strainer	6095699	stainless	1
78	Nut	6127336	stainless	1
83	Lockwasher	6130926	stainless	1
84	Kickback spring	6079578	stainless	1
85	Screw	6125272	stainless	1

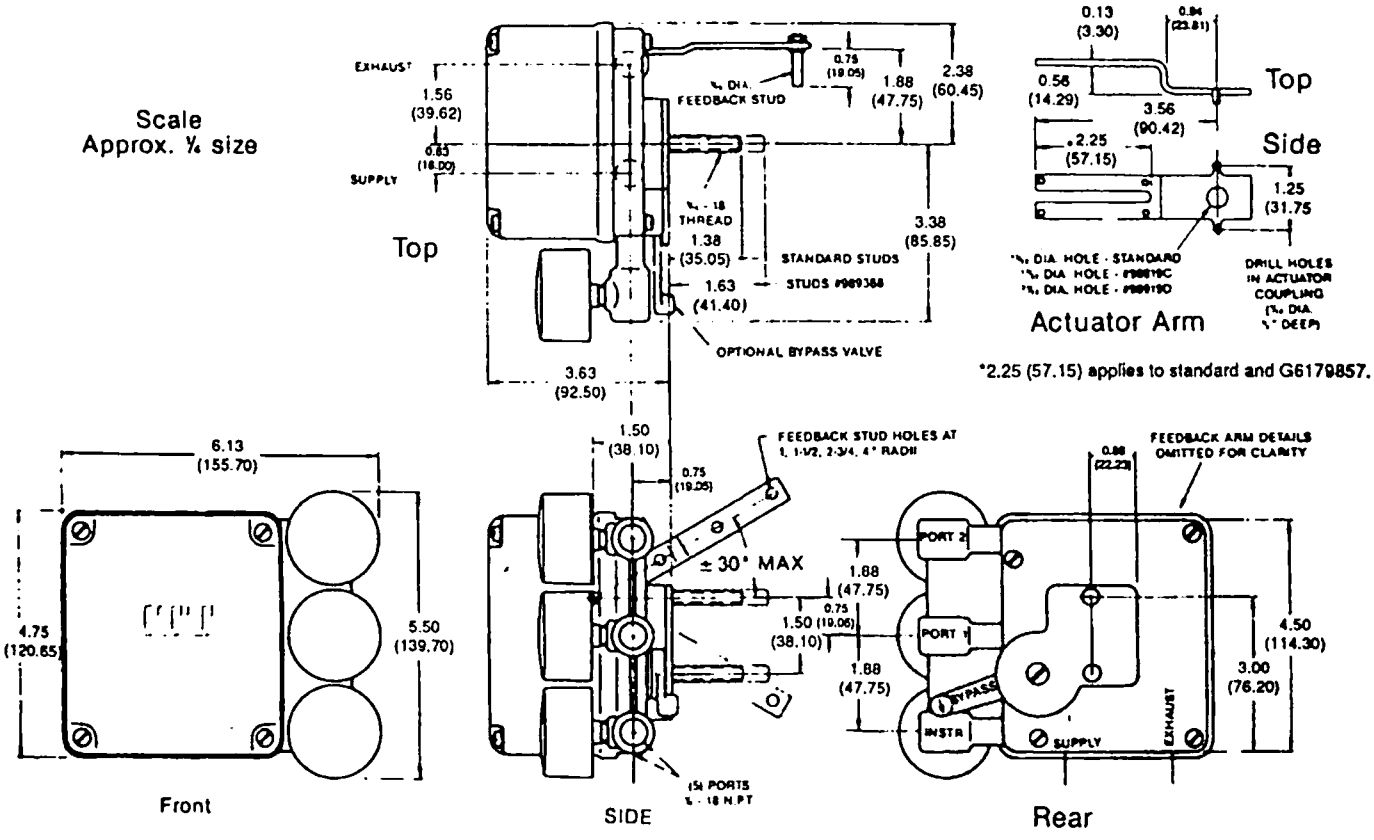
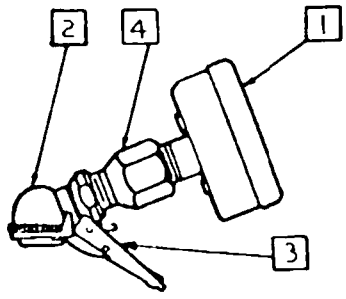


Figure 18, Positioner dimensions
For Certified Dimensional Drawing,
Refer To A21-12.



Clip on test gauge assembly
6113401

1 Gauge
2 Air chuck
3 Clip
4 Bushing

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Telephone: (803) 563-9281
FAX (803) 563-2131

WARNING: **MANUFACTURED WITH (1, 1, 1-TRICHLOROETHANE), A SUBSTANCE WHICH HARMS PUBLIC HEALTH AND ENVIRONMENT BY DESTROYING OZONE IN THE UPPER ATMOSPHERE.**