

# Conoflow



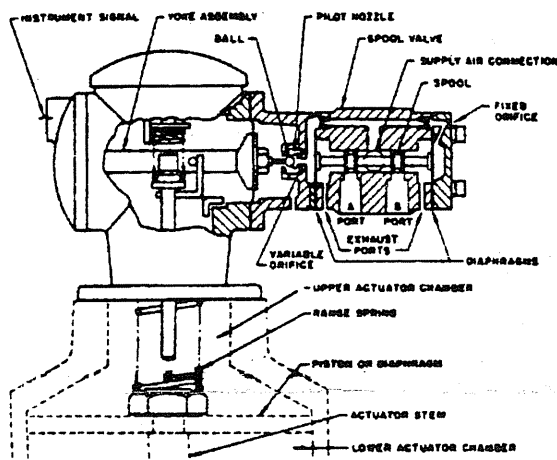
## ITT Industries

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### INSTRUCTION AND MAINTENANCE MANUAL GJ21 / J22 FULL REVERSAL POSITIONERS

**WARNING**  
Conoflow's products are designed and manufactured using materials and workmanship required to meet all applicable industry standards. The use of these products should be confined to services specified and/or recommended in the Conoflow catalogs, instructions or by Conoflow application engineers (i.e. exceeding pressure temperature rating or using device for services other than those specified). To avoid personal injury or equipment damage due to misuse or misapplication of a product, it is necessary to select the proper materials of construction and pressure temperature ratings which are consistent with performance requirements.

FIGURE 1



#### PRINCIPLE OF OPERATION

The spool valve section of the positioner permits full reversal of the supply air pressure to either actuator chamber allowing use of maximum air pressure against the effective area of actuator piston or diaphragm. The spool in spool valve is pressure balanced between two diaphragms when instrument air signal remains steady, because air flow through pilot nozzle is equal to air flow through fixed orifice. With diaphragms in balance, spool position is such that air pressures and stem load are maintained dynamically balanced. As soon as a change in the instrument air signal or stem load occurs, the variable orifice in pilot nozzle is opened or closed thereby causing diaphragms to move to left or right. This action changes position of the spool, opening or closing Port A or B, supplying or exhausting air pressure to upper and lower actuator chamber until balanced condition is again reached.

In the *direct-acting Model GJ21*, increasing instrument air signal moves the yoke assembly to the right, seating ball in pilot nozzle, causing the spool to move to the right, opening Port B. Supply air flows through Port B to upper actuator chamber extending stem. This movement increases tension on range spring thereby restoring yoke to initial balanced position. Air displaced from bottom actuator chamber flows to atmosphere through Port A and adjacent spool valve exhaust ports.

In the *reverse-acting Model GJ22*, increasing instrument air signal moves the yoke to the left, unseating ball in pilot nozzle, causing spool to move to the right, opening Port A. Supply air flows through Port A to the lower actuator chamber retracting stem. This movement reduces tension on range spring thereby restoring yoke to initial balanced position. Air displaced from upper actuator chamber flows to atmosphere through Port B and adjacent spool valve exhaust ports.

Positioner	Action
GJ2103	Direct
GJ2215	Reverse Acting 15-3 PSi(103-2) kPa(7)
GJ2230	Reverse Acting 30-3 PSi(207-2) kPa(15)

Labels in drawings: REMOVABLE COVER, GEAR ADJUSTMENT, SUPPLY SIGNAL, RANGE SPRING, PISTON OR DIAPHRAGM, ACTUATOR STEM, LOWER ACTUATOR CHAMBER.

Dimensions: 1.00 (25.40), 0.375 (9.52), 0.84 (21.34), 1.25 (31.75), 5.00 (127.00), 0.50 (12.70), 0.375 (9.52), 0.50 (12.70), 0.375 (9.52), 0.50 (12.70), 0.375 (9.52), 0.50 (12.70), 0.375 (9.52), 0.50 (12.70).

Notes: THE SPRING IS DETERMINED BY SIZE OF CONOFLUX CYLINDER OR MUST BE SPECIFIED BY CUSTOMER. DIMENSIONS IN MILLIMETERS. NOTE: ALL CONNECTIONS ARE 1/4" NPT.

Diagrams: (a) BASIC, (b) LOCK IN LAST POSITION, (c) AIRLOCK STEM EXTENDS ON AIR FAILURE, (d) AIRLOCK STEM RETRACTS ON AIR FAILURE.

FOR CERTIFIED DIMENSIONAL DRAWING, REFER TO A50-16.

## SUPPLY PRESSURE (20 to 100 PSI(138 to 690 kPa))

A filtered air supply should be used. A Conoflow Model GFX04 Filter is supplied.

Zero adjustment can be made by turning the zero adjust coupling (1) clockwise or counterclockwise. Connect supply and instrument air to the positioner. Set the instrument signal to the 0% value (e.g. 3PSI for 3-15 PSI(21 kPa for 21-143 kPa) range). Turn the zero adjust coupling to bring the actuator slightly off of the fully retracted position for the GJ21 or fully extended position for the GJ22. The starting point may then be checked by reducing the instrument signal below the 0% value and then slowly increasing it. As the 0% input signal is reached, movement of the actuator stem plus an audible increase in the air flow through the positioner should be observed.

Next, increase the instrument signal to the 100% value (e.g. 15 PSI(103 kPa) for 3-15 PSI(21-103 kPa) range). Verify that the actuator stem moves to the fully extended position for the GJ21 or fully retracted position for the GJ22.

Set the instrument signal to the 50% value. Using a suitable measuring device such as a scale, and verify that the actuator stem has extended to 50% of full stroke.

## SPAN

Positioner span determines the control range. A positioner with a 3-15 PSI(21-103 kPa) range has a 12 PSI(83 kPa) span and is set with a 3 PSI(21 kPa) start-point (retracted position). Positioner span has been factory calibrated as specified. Instrument signals of 3-9, 3-15 and 6-30 PSI(21-62, 21-103 and 41-207 kPa) are available. For field changes, refer to page 6.

## REMOVING POSITIONER FROM ACTUATOR

Piston or diaphragm should be in the fully retracted position. **Disconnect tubing and bleed all air out of the actuator.** Remove cap (9) from positioner and spirolox ring (10), so that headplate (1A) can be lifted out. Loosen setscrew (11) using 1/8"(3.30 mm) Allen Wrench and remove spring rod nut (13)\*. Remove six capscrews (5) and lift positioner from actuator.

## INSTALLING POSITIONER ON ACTUATOR

The range spring (8C) is adjusted and set at the factory for the proper range and spring rod (8A) extension as shown on page 1. With the actuator stem in the fully retracted position and the spring rod nut (13) removed

from the spring rod (8A), thread the spring nut assembly (8d) onto the actuator stem. Hold the range spring assembly in a vertical position without applying any tension to the range spring (8C). Measure the distance between the positioner mounting surface on the actuator (without gasket) and the top of the spring rod (8A). This distance must be a  $2 \frac{5}{16}'' \pm 1/64''$  (58.8 mm  $\pm$  .40 mm) for proper operation of the positioner. If adjustment is necessary, grasp the lower spring clip (8B) and range spring (8C) firmly in one hand. Loosen the upper spring clip (8B) making sure that the lower spring clip is not allowed to turn on the range spring (8C). If the lower clip (8B) is allowed to turn, the number of inactive coils on the range spring (8C) will have to be reset to obtain the proper range. After loosening the upper spring clip (8B), rotate the spring rod (8A) in the direction required to obtain the  $2 \frac{5}{16}''$  (58.8 mm) dimension. Continue holding the lower clip (8B) and range spring (8C) while retightening the upper clip securely. Measure the  $2 \frac{5}{16}''$  (58.8 mm) dimension again to make sure it is correct. Be sure that the actuator stem is fully retracted when making this measurement.

Remove the cap (9) from the positioner and, using a small screwdriver, remove the spirolox ring (10). Pull out the positioner headplate assembly (1) and set it aside. The zero spring (12) should be attached to the headplate assembly (1). If not, remove it also. Place the gasket (7) and the positioner on the actuator guiding the spring rod (8A) through the hole in the bellcrank (4L). Install the six 1/4"-20 screws (5) that secure the positioner to the actuator.

Turn the set screw (11) in the spring rod nut (13) such that the head of the screw is flush with the top of the nut as shown. Install this assembly onto the spring rod (8A) finger tight. Hold the spring rod nut (13) with a wrench or suitable tool to prevent it from turning and tighten the set screw (11) securely. It is important to make sure that the spring rod nut (13) does not turn while tightening the set screw (11) to maintain calibration of the range spring assembly (8).

Insert the zero spring (12) onto the headplate and install the headplate assembly (1). Make sure the zero spring (12) is properly centered on the spring rod nut (13) when inserting this assembly. Replace the spirolox ring (10) and the cap (9). Install the necessary piping per the schematic on page 7. Proceed with the zero adjustment procedure outlined previously.

\* For positioner removal kit, order 6385266.

## OPERATING CHECKS & FIELD SERVICING

With positioner installed and adjusted in accordance with the preceding instructions, the actuator stem should react to variations in input instrument air signal. By removing cap (9) and depressing zero adjust coupling (1) while input instrument air signal is applied, step excursions of stem should take place and the stem should return accurately to its previous position. If the actuator does not appear to function properly, it is advisable to check the following points:

### SUPPLY AIR

A regulated - filtered air supply should be used.

### INSTRUMENT AIR SIGNAL

Actuator control range must agree with instrument control range.

**CAUTION:** Before the positioner is disassembled for inspection, bleed all air from the actuator.

### YOKE AND BELLCRANK RELATIONSHIP

Remove cap (9) and headplate (1) and inspect for proper arrangement and connection of parts. Note carefully that capsule plates (4F) are not bent or twisted.

The positioner consists of three main sections. These are the **Body Assembly, Range Spring Assembly, and Pilot Valve Assembly.**

### BODY ASSEMBLY

Body (4J), including input cap (4A), pilot nozzle housing (4N), and yoke-capsule plate assembly, is **factory adjusted and should not be disassembled in the field.** Operation can be checked by removing headplate (1) and noting freedom of yoke (4K) motion toward stops in both directions. Bellcrank and flexures can be inspected for freedom of movement.

### RANGE SPRING ASSEMBLY

Includes spring rod (8A), spring clips (8B), range spring (8C), and stem nut assembly (8D). Can be inspected for proper arrangement and connection of parts while

headplate (1) is removed. Spring rod nut (13) should be locked to spring rod (8A) and, with actuator stem in retracted position, slight range spring (8C) tension holds bellcrank against yoke pin.

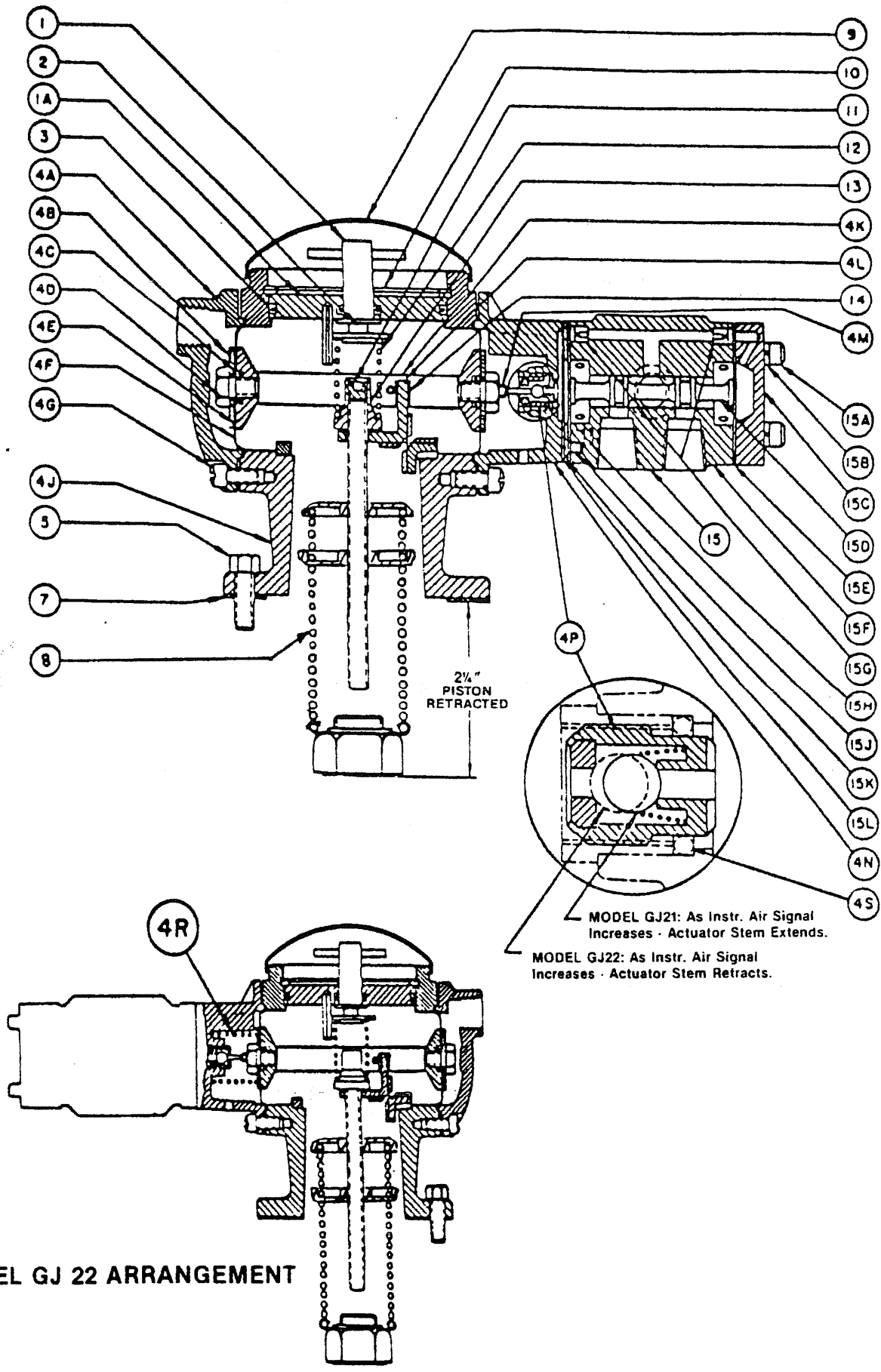
### SPOOL VALVE ASSEMBLY

The full reversal spool valve assembly requires no adjustment and should be serviced only when contaminated air has entered the internal section. Model GFX04 Filter is supplied.

The spool valve assembly is removed from the positioner body by disconnecting air tubing and removing four socket head capscrews (15H) which attach it to the nozzle housing assembly (4N). While pilot valve assembly is removed, mating section of pilot nozzle housing and pilot nozzle assembly (4P) should be inspected for dirt and any other foreign matter. **Do not disturb nozzle position in housing.**

It is important to keep all parts free from dirt and other foreign matter. Remove diaphragms (15E) by removing the four socket head capscrews (15A) which hold cap (15C) to the spool valve body (15F) and the two flathead machine screws (15J) attaching holding ring (15K) to pilot valve body (4N). No further **disassembly** is necessary. Check openings in the orifice inserts (15G). Remove spool (15D) from main body bore and wipe clean. Also clean bore by blowing air stream through passage or by wiping with cloth. Make certain that all passages are clean and unobstructed. Replace spool (15D) in main body bore and check to see if spool slides freely in bore.

Reassemble spool valve assembly using new diaphragms (15E) if necessary. The air passage in these diaphragms (15E) must be aligned with the passage containing orifice inserts (15G). Attach spool valve assembly to nozzle housing assembly with four socket head capscrews (15H). Take care to connect air tubing to proper locations.



MODEL GJ 22 ARRANGEMENT

ITEM NO.	DESCRIPTION	QTY. REQ'D	GJ21 - GJ22	ITEM NO.	DESCRIPTION	QTY. REQ'D.	GJ21-GJ22
1(3)	Headplate Assembly	1	6027130	8B	Spring Clips		
1A	Headplate	1	----		Upper	1	6026587
2	Upper Spring Plate	1	----		Lower	1	6026595
3(1)	O-Ring	1	6077143	8C	Range Spring		
4(3)	Body Assembly				Red (4)	1	6026603
	GJ2103	1	6026264		Yellow	1	6026611
	GJ2215	1	6026272		White	1	6026629
	GJ2230	1	6026280		Blue	1	6026637
4A	Input Cap	1	6025928		Green	1	6026645
4B	Capsule Plate Washer	2	6025282	8D	Stem Nut Assembly		
4C	O-Ring	2	6076608		New Style B50	1	6025688
4D	Capsule Screw	2	6025779		Old Style B50	1	6025621
4E	Capsule Plate Gasket	2	6025290		B51	1	6025639
4F	Capsule Plate	2	6025266		B52	1	6025647
4G	Fillister Hd. Screw				B53	1	6025738
	#10-32 x 1/2" Lg.	12	6900059		B54	1	6025746
4J	Body	1	6025472		Blank Nut	1	6025654
4K	Yoke	1	6026348	9	Cap	1	6025969
4L	Flexare Ring Assembly			10	Spool Ring	1	6004691
	(Bellcrank)	1	6025753	11	Socket Setscrew		
4M	Pilot Nozzle Pin	1	6025985		1/4"-28 x 1/4" Lg.	1	6900113
4N	Pilot Nozzle Housing			12	Zero & Suppression		
	Assembly	1	6026173		Spring	1	6025811
4P	Pilot Nozzle Assembly	1	6026157	13	Spring Rod Nut	1	6025803
4R	Spring			14	Bellcrank Cover	1	6025761
	GJ2215	1	6026017	15(3)	Spool Valve Assembly	1	6026355
	GJ2230	1	6026041	15A	Socket Head Capscrew	---	----
4S	Pilot Nozzle O-Ring	1	6076616	15B	Lockwasher	---	----
5	Hex Hd. Capscrew			15C	Cap	---	----
	1/4"-20 x 5/8" Lg.	6	6900095	15D	Spool	---	----
7(1)	Gasket	1	6001762	15E(1)	Diaphragm	1	6025852
8(3)	Range Spring Assembly			15F	Body	---	----
	(To be ordered as			15G	Orifice Insert	---	----
	complete assembly -			15H	Socket Head Capscrew	---	----
	Refer to Page 5).	1	GJ800	15J	Flathead Screw	---	----
8A(4)	Spring Rod			15K	Holding Ring	---	----
		1	6025399	15L(1)	Gasket	1	6026215
		1	6025415				

- NOTES: 1. Recommended Spare Parts can be purchased individually or as a Spare Parts Kit, under number 6385365 Spare Parts Kit — GJ21/22 (Consists of items 3, 7, 15E and 15L).
2. When ordering spare parts, specify complete catalog no., item no. and part no. This will permit positive identification and rapid handling of order.
3. Assembly Components  
Item 1 — Headplate Assembly consists of items 1A and 3.  
Item 4 — Body Assembly consists of items 4A thru 4S.  
Item 8 — Range Spring Assembly consists of items 8A thru 8D.  
Item 15 — Spool Valve Assembly consists of items 15A thru 15L.
4. When a red range spring is used, the 6025415 spring rod is required.

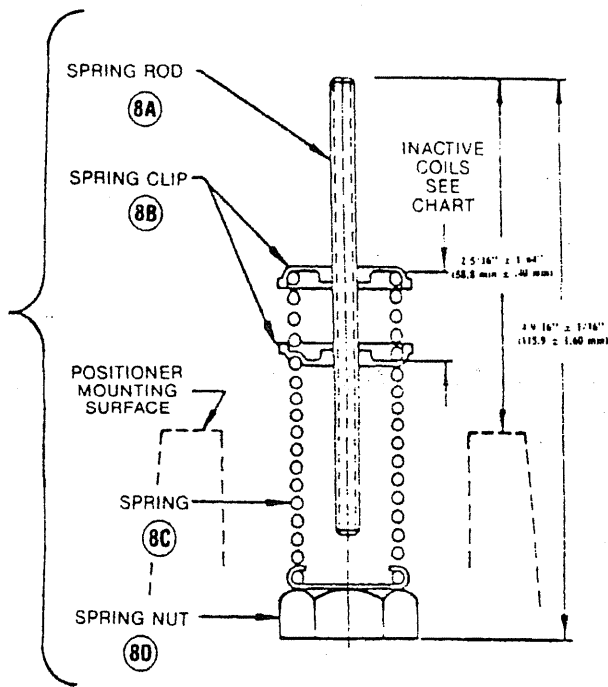


TABLE #1 STEM NUT IDENTIFICATION

STEM NUT ASSY NO.	THREAD	ACTUATOR	CYLINDER BORE O.D.
1	1/4"-24	GB50 1/2" STEM DIA.	3"
2	3/8"-20	GB50 3/4" STEM DIA.	2 1/4"
3	1/2"-20	GB51	4"
4	3/4"-18	GB52	6"
5	5/8"-18	GB53	8"
6	3/4"-14	GB54 GB55	10"
7	NOT THREADED	—	—

**ORDERING INSTRUCTIONS AND RANGE SPRING ASSEMBLY IDENTIFICATION**

**EXAMPLE:** Basic No. Stem Nut Ass'y. No. Stroke Length in 1/16" (1.60 mm) Specify Spring Color

RANGE SPRING ASSEMBLY: GJ800 5 Y

This is a basic GJ800 Assembly with #5 Stem Nut Assembly (5/8"-18 thread); 6" (152 mm) Stroke: 12 PSI (83 kPa) Instrument Span. A Yellow Range Spring is selected (See Chart below) and lower clip is turned to provide 9.5 inactive coils. Spring Rod Dimension from Positioner Mounting Flange is 2-5/16 ± 1/16" (58.8 mm ± 1.60 mm).

Refer to manual C-8053 for ordering information.

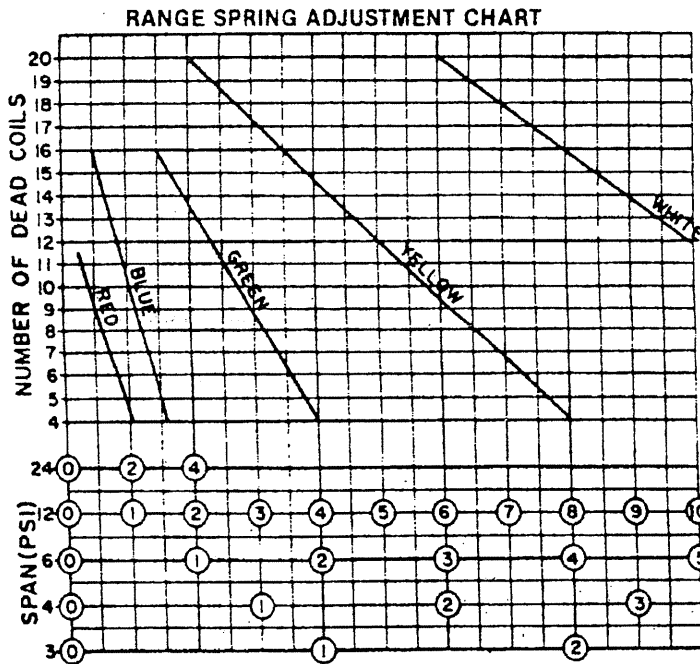
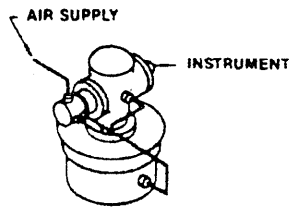
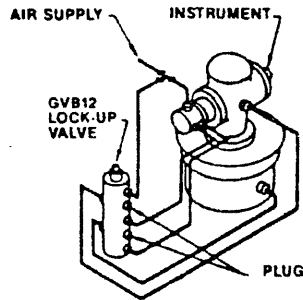


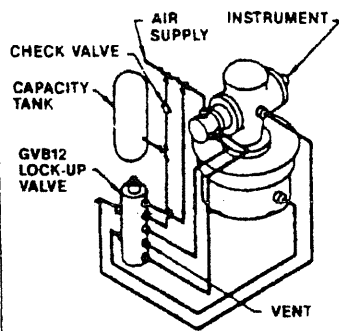
FIG. 4  
Note: For travels greater than 10" (254 mm), consult the factory.



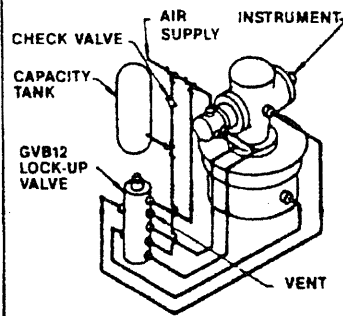
① BASIC



② LOCK IN LAST POSITION



③ AIRLOCK-STEM EXTENDS ON AIR FAILURE



④ AIRLOCK-STEM RETRACTS ON AIR FAILURE

MODEL		GJ21	GJ22
As Instrument Signal Increases	Positioner Output	Increases Pressure in Top Chamber	Decreases Pressure in Top Chamber
		Decreases Pressure in Bottom Chamber	Increases Pressure in Bottom Chamber
	Actuator Stem Moves	Out	In

NOTE: ALL PIPING CONNECTIONS 1/4" N.P.T.

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