

## FALK CLUTCH CONTROL SYSTEM

The pneumatic control schematic diagram (Figure 1) shows the relationship between control valves and other components, which makes up the Falk speed and direction control system. The control system is available in either one of two standard configurations: slip and lock-up.

## LOCK-UP CONTROL SYSTEM

Movement of the control handle to the first detent, on either side of neutral, will shift the 4-way valve, selecting either the ahead or astern clutch for inflation. At the same time, a 30 psig speed signal is sent to the control panel. Clutch air passes through the H-5 inflation valve during all phases of clutch inflation. Initially, clutch air flows through an orifice, providing soft engagement. When the clutch pressure reaches 45 psig, the governor signal begins increasing in proportion to the clutch pressure. At 70 psig clutch pressure, the boost valve opens, allowing supply air to by-pass the orifice and flow directly into the clutch, minimizing the time to full clutch pressure. Once the clutches are fully inflated, control handle movement past the first detent regulates engine between idle and full speed.

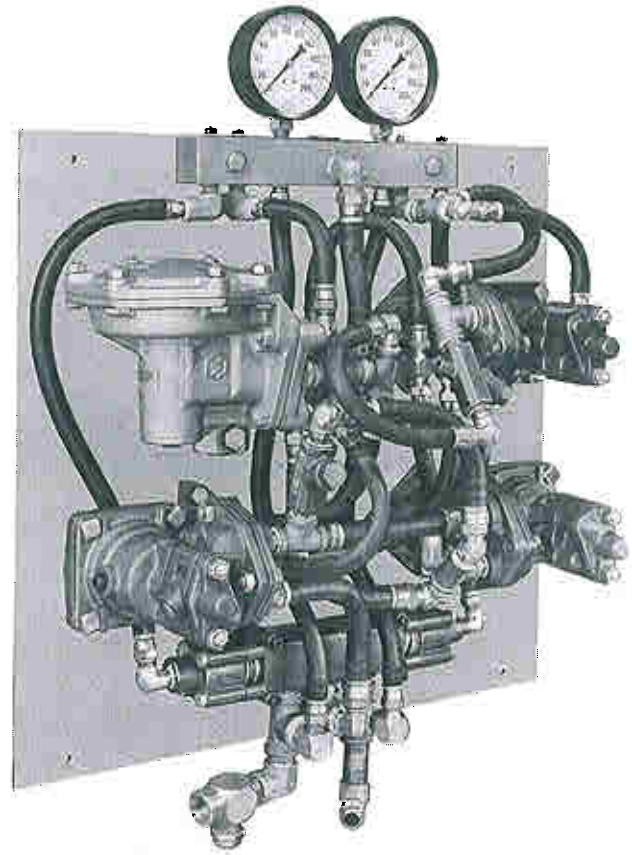
If supply air pressure drops for any reason, the maximum engine speed will be reduced in proportion to the clutch capacity, preventing inadvertent clutch slippage. If the pressure drops to 75 psig or less, the controls will shift into neutral with the governor signal line vented. At any intermediate pressure, full control is available below the limiting speed allowed by the governor limit valve.

The design of the control system prevents the engagement of both clutches at the same time during normal operation.

## SLIP CONTROL SYSTEM

Movement of the control handle to the first detent, on either side of neutral, shifts the 4-way valve, selecting either the ahead or astern clutch. Simultaneously, a 15 psig speed signal is sent to the C-2 valve, which acts as a flow booster. Between the first and second detents, the speed signal sets the clutch pressure, allowing the clutch to slip. By this method, the propeller speed may be varied between 0 rpm and idle speed. When the control handle is moved into the second detent, the inflation valve will shift, providing full clutch lock-up pressure. Additional movement of the handle will control engine speed. Once the control handle reaches the second detent, the operation of the slip panel becomes identical to the operation of the lock-up control panel.

Neither the slip nor the lock-up panel have any provisions for hand adjustment. The only alteration possible, is to change the orifice size, which requires removal and redrilling of the valve portion of the orifice assembly. The orifice drill size is matched to the clutch size during shop assembly and will be correct for most installations without necessity for revision in the field. Consult Falk before making any modifications to the control system.



PNEUMATIC CONTROL DIAGRAM

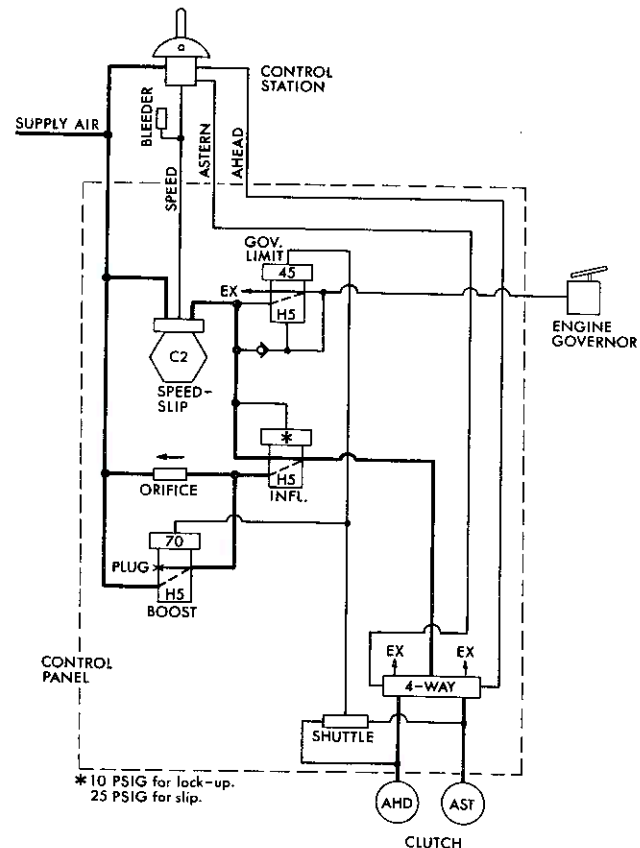


Figure 1.

## USE OF CONTROLS

Control of an engine/gear combination equipped with the Falk clutch control system is direct and simple. A single hand lever, Figure 2, is provided for each propeller. Forward movement of the lever will provide forward rotation of the propeller at a speed which increases with handle travel away from neutral. Backward movement of the handle provides astern rotation of the propeller with speed increasing as the handle is moved farther from neutral. The center position provides a neutral setting in which the engine is disconnected from the propeller and no power is transmitted.

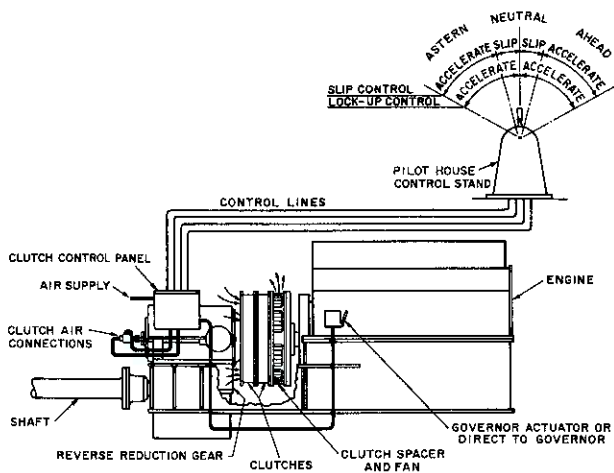


Figure 2.

The control lever determines only the final operating speed and direction with all intermediate steps handled within the clutch control panel.

All parts of the control, clutches and reduction gear are proportioned to withstand high power maneuvering; however, to avoid unnecessary wear and strain on connected parts it is recommended that shaft reversals be made at reduced speed and power whenever possible.

## CONTROLLED SLIP OPERATION

Some reduction gears will be equipped with the optional controlled slip feature which provides for operation of the propeller at speeds below engine idle. This will give direct speed control for unloaded travel at low speed or delicate maneuvering in restricted waters.

As with any clutch, continuous slip operation will shorten the life of liners and drums so this feature should only be used when conditions dictate.

Depending on lineshaft alignment and bearing conditions, higher torque than normal may be required on some vessels to start the shaft turning. In this case, it may be necessary to move the control lever beyond the slip area to break the shaft loose, backing off to maintain propeller speed once it has started.

Changes in speed through the water when operating in slip speeds may require occasional adjustment of the control to hold a particular speed.

## STANDARD OPERATING CONDITIONS

### Clutch Air Supply

140 ± 5 psig or as specified. It is recommended that pressure of the supply air to the clutches be monitored with an alarm system to be set for 125 psig falling pressure.

Falk recommends that the clutch air supply system include a pressure tank with at least 2.5 cubic foot capacity for each clutch assembly plus a pressure regulator, filter, safety valve and check valve upstream of the air tank and a valve downstream from the air tank. The filter and air tank should be suitably valved for draining.

The air tank provides emergency inflation of the clutch upon loss of ships supply air and the valving provides for limited service during operation without declutching (blow down of tank for example). A positive means to prevent accidental closing of a hand operated valve should be provided. All connections should be made on top of the tank except the drain line, Figure 3 below.

### CAUTION

*Use of air from the clutch supply system for other components such as horns, may cause pressure drops which could result in clutch failure, especially if the recommended air tank is not supplied.*

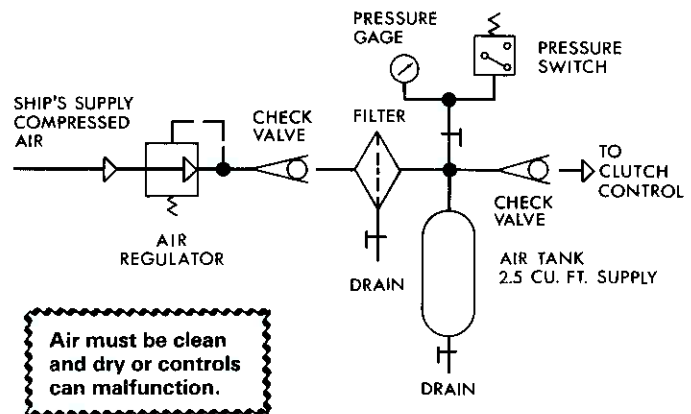


Figure 3.

## CONTROL SETUP - NON-SLIP SYSTEM

1. Set tank pressure at recommended value. Blow out moisture. Clear filter.
2. Move each controller to minimum ahead setting to verify that ahead pilot is installed correctly. Ahead clutch should inflate to full tank pressure. Check by watching clutch as well as "ahead" pressure gage.
3. Move each controller astern to check astern pilot. Astern clutch should inflate to full tank pressure. Check by watching clutch as well as "astern" pressure gage.
4. Disconnect both clutch air lines from the rotary seal and cap or plug them to assure complete clutch disconnect. Connect 0-100 psig test gauge in speed line of first control stand to be setup.

5. Start engine, set idle speed using mechanical governor stop and check to see that engine accelerates off idle at pressure marked on the governor. Record pressure.
6. Increase rpm to rated speed. Record speed line pressure for this condition. Shut down engine.
7. Set handle to minimum speed, 10° detent or Z slot. Adjust regulator to minimum speed pressure (Step 5). Move pressure full ahead (Step 6) and set stop. Move to pressure full astern (Step 6) and set stop.
8. Repeat Step 7 for all stands.
9. Unplug and reconnect hoses.

#### CONTROL SETUP - SLIP CLUTCH SYSTEM - Fig. 5

Follow Steps 1 to 6 above; then proceed as follows:

7. Set handle to 40° detent ahead (HD-2-FM valve) or equivalent of alternate controllers. Adjust regulator to engine idle speed pressure (Step 5). Move handle to astern 40° detent and check pressure. Adjust valve linkage to get same pressure reading at both positions. Move to full ahead pressure (Step 6) plus 3 psig and set stop. Repeat astern. Reconnect clutch lines.
8. Move handle to minimum position 10° detent and check for speedline pressure of 15 psig  $\pm$  5. Adjust cam if necessary.
9. **After making certain mooring lines are secure and propeller is clear, start engine and move handle slowly to 30°  $\pm$  ahead, noting travel and pressure at which lock-up occurs. (If substantially less than 30° and 20-22 psig, regulator may be readjusted to reduce speedline pressure at 40° by 2 psig maximum. Record this setting in lieu of Step 5 pressure.**
10. Move handle from 10° to 40° slowly checking that clutch inflation goes to full tank pressure at 35°  $\pm$  and engine does not accelerate prior to 40° detent.
11. Set handle at minimum position, 10° detent ahead, and adjust cam for minimum speed, maximum slip (approximately 50% of idle speed). Record pressure. Repeat for astern setting.

12. Shut down engine and install test gauge successively in speedlines of any alternate control stands. At each, adjust regulator to duplicate the recorded speedline pressure of master controller at 40° ahead and astern, adjust the cam for the settings at 10° ahead/astern, and the stops for setting full speed ahead/astern.

#### EMERGENCY SHAFT LOCKING PROCEDURE - Fig. 4

1. Transfer the engine-gear control to the engine room and shut down the engine with the control in neutral.
  2. Shut off the manual main engine starting supply valve near the starting air motors.
  3. Remove the astern air hose from the control panel assembly. Remove the cap nut from the tee in the ahead clutch air line.
  4. Reconnect them exchanging their locations.
  5. With the engine shut down, place the engine room control handle in the full ahead position and air pressure will inflate both clutches for a shaft lock.
- NOTE:** Engine must be shut down during this procedure. Do not attempt to start it again until the control panel is reassembled for normal use.
6. Return the engine room propulsion control handle to the neutral position to vent the clutches before disconnecting this emergency shaft brake arrangement.

#### NOTES

1. For R. R. King pivoted cam, set speedline pressure at 40° detent in Step 7, 2 psig below idle pressure (Step 5).
2. For non-adjustable slip cam, Steps 8, 9 and 11 may be omitted. In Step 10, with engine running, note minimum shaft rpm that can be maintained (may slip). Speedline pressure in Step 7 may be set slightly lower, 28-30 psig, if specified setting results in excessively high minimum propeller speed at the 10° first detent.

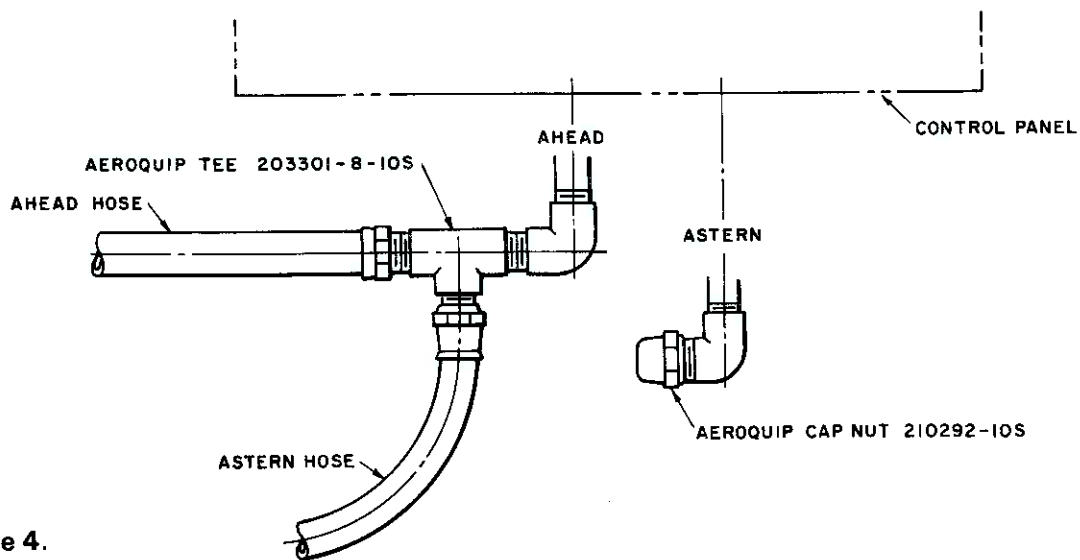
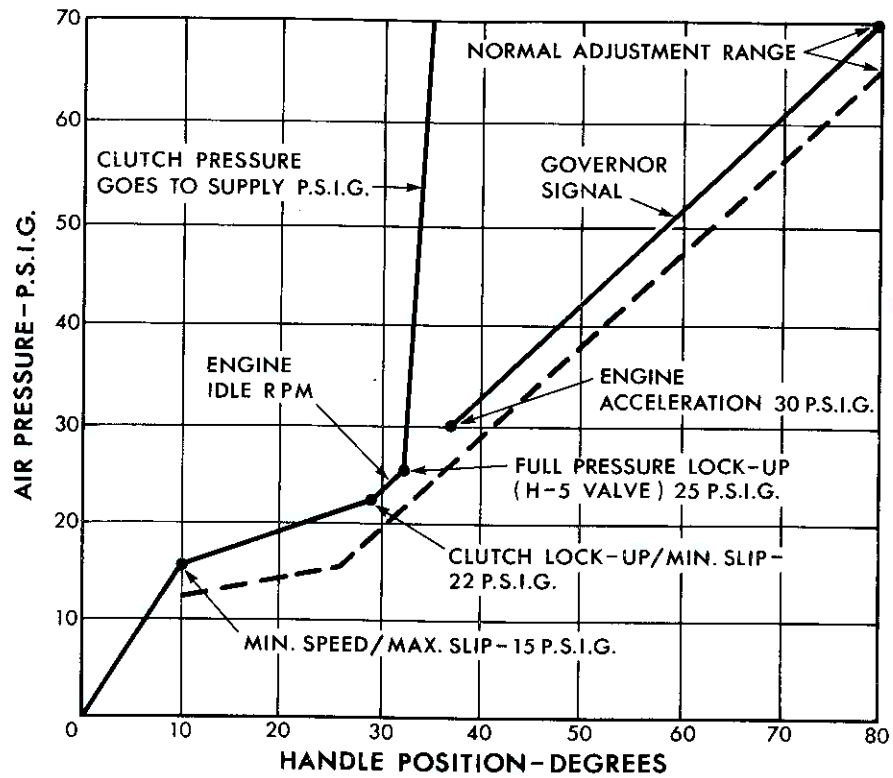
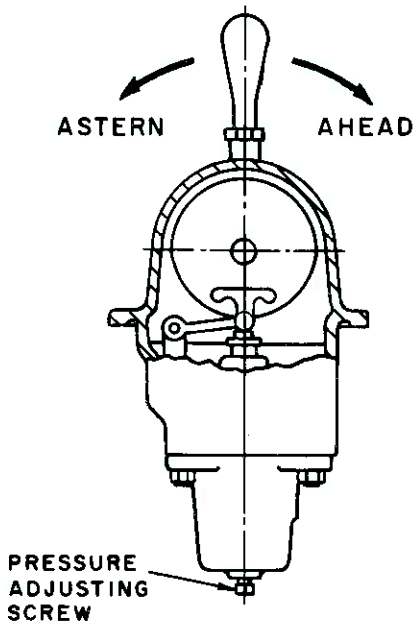


Figure 4.

### SLIP CLUTCH AIR PRESSURE



### CONTROL VALVE ADJUSTMENT



### SLIP CAM ADJUSTMENT

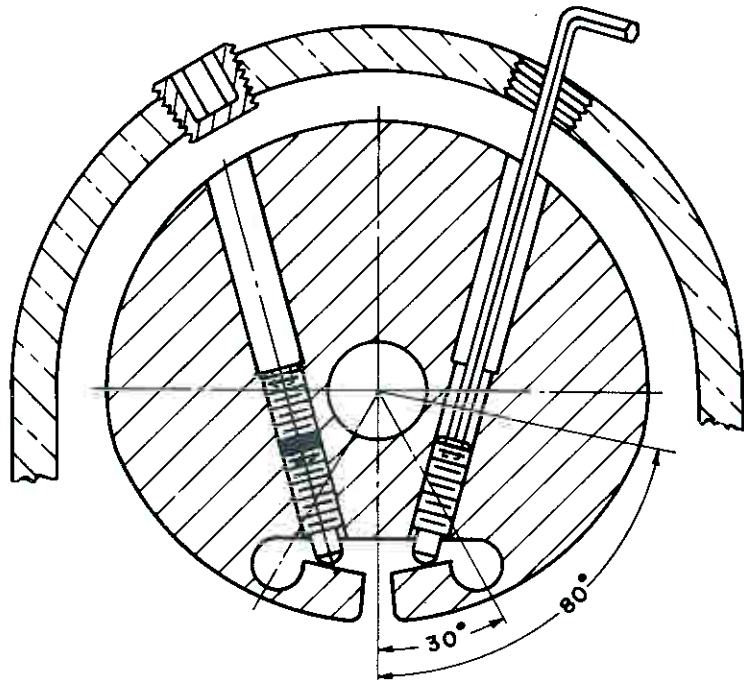


Figure 5.

**SUGGESTED MAINTENANCE**

Periodically check the air pressure to the clutch, maintaining 140 psig.

Once a month, operate all control systems to clear lines not frequently used.

Once a year, inspect air control panel valve bodies. Clean and lubricate all operating rubber parts and replace any damaged parts. Reassemble and operate all cycles while checking for leaks.

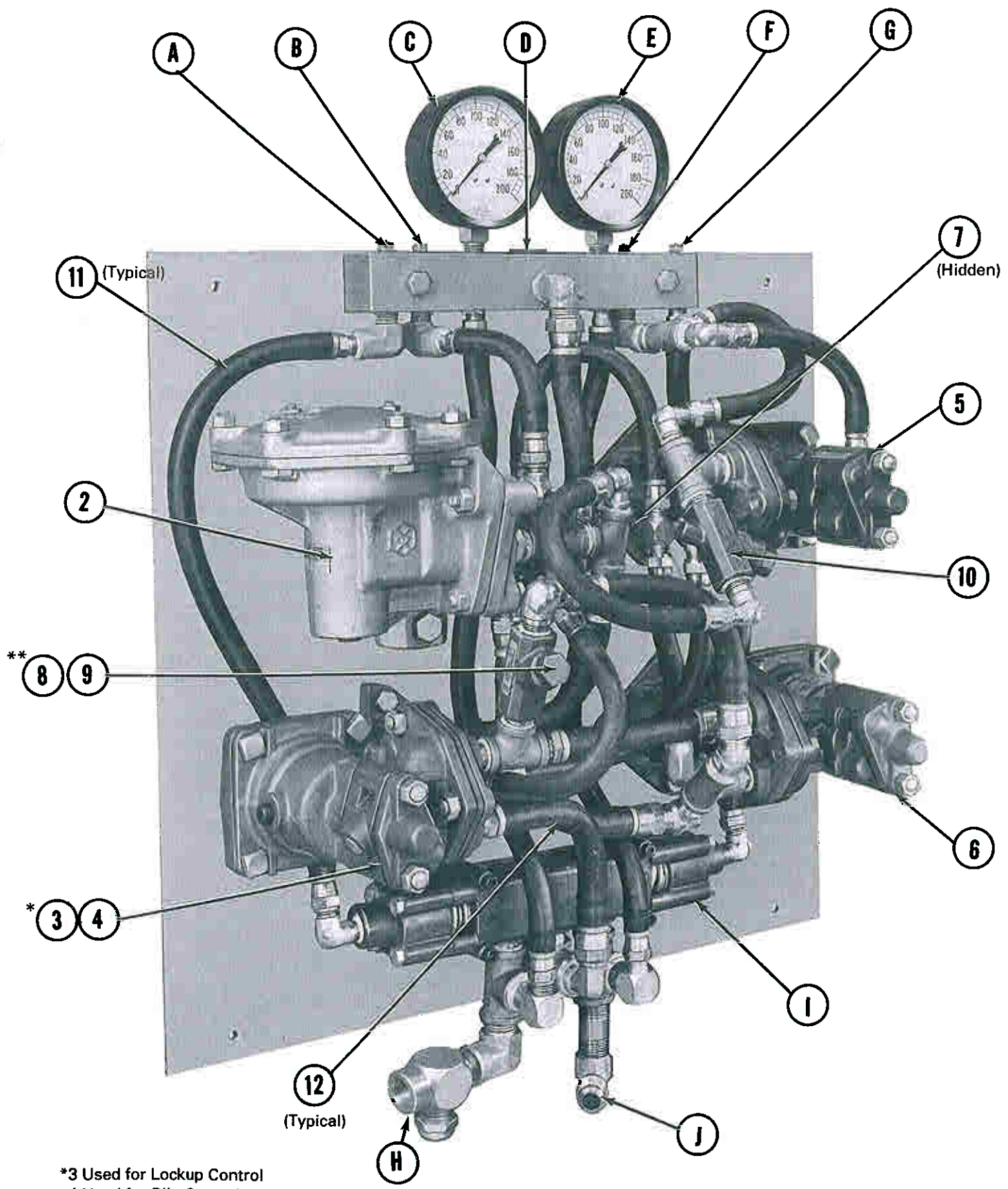
Problems with the control system will normally become apparent as sloppiness in one or more functions,

rather than as an abrupt loss of control. This may be due to accumulations of foreign materials in the valve bodies or leaks developing. Locate the valve associated with the poorly performing function by referring to the operation description found on Page 2 and rebuild.

The operating portion of each air control valve, with the exception of the 4-way valve, is accessible without disconnecting any of the interconnecting hoses. For maintenance instructions on the individual valves and assembly and disassembly instructions, see the exploded views and discussion for each type.

REF. NO.	MAJOR ASSEMBLIES	OEM NO.	FALK PART NO.	PAGE
1	Pilotair Valve	P62572	916355	11
2	C-2 Relay Valve	538975	916358	12
3	H-5 Relayair Valve	P59155-0010	916336	8 & 9
4	H-5 Relayair Valve	P59155-0025	916307	8 & 9
5	H-5 Relayair Valve	P59155-0045	916308	8 & 9
6	H-5 Relayair Valve	P59155-0070	916314	8 & 9
7	Shuttle Valve - 1/4	P54350-2	916371	10
8	Check & Choke Valve - 3/8"	P55025-56	916312	10
9	Check & Choke Valve - 3/8"	P55025-52	916311	10
10	Check Valve - 3/8"	P55025	916339	10
11	Hose	2556-6	913943	...
12	Hose	2556-8	913949	...
	Spare Parts Kit	P64392	916337	...
	Control Panel Complete	...	424743	...

Ref.	Connections
A	Astern 1/4" - 18 N.P.T.
B	Speed Line from Pilothouse 1/4" - 18 N.P.T.
C	Ahead Press Gauge Line 1/4" - 18 N.P.T.
D	Supply 1/2" - 14 N.P.T.
E	Astern Press Gauge Line 1/4" - 18 N.P.T.
F	Engine Governor 1/4" - 18 N.P.T.
G	Ahead 1/4" - 18 N.P.T.
H	Ahead Clutch
J	Astern Clutch



\*3 Used for Lockup Control  
 4 Used for Slip Control  
 \*\*8 Used for 26", 30" & 35" Clutches  
 9 Used for 40" & 48" Clutches

## RELAYAIR® VALVE H-5

Pilot Pressure (psi)	Valve Model	Valve Pc. No.		Valve Less Pipe Bracket	Diaphragm Follower Unit (Ref. 29 - 36)	Diaphragm Spring			
		Superseding	Obs.			Outer (Ref. 31)		Inner (Ref. 32)	
						Pc. No.	Color	Pc. No.	Color
10	H-5	P59155-0010	532324	P58926	P58653	P58817	Brown	—	—
20	H-5	P59155-0020	529017	P58928	P58944	P58971	Yellow	—	—
25	H-5	P59155-0025	527561	P58929	P58945	P58956	Plain	—	—
30	H-5	P59155-0030	551738	P58930	P58946	P58674	Red	—	—
45	H-5	P59155-0045	A & D	P58932	P58948	P58825	Blue	P58632	Plain
70	H-5	P59155-0070	A & D	P58935	P58951	P58830	Br. & Wh.	P58824	Brown

## MAINTENANCE

No adjustments are required on the RELAYAIR VALVE.

By removing only the nuts (1) the valve portion can be removed from the pipe bracket for servicing without disconnecting piping.

Periodically disassemble the valve for cleaning, inspection, and lubrication. Remove the nuts (6) and slide all parts off the studs in the valve body. The exhaust valve (14) will still be attached to the diaphragm follower (29). Move the exhaust valve to one side and unhook. **This must be done** before the diaphragm cover (17) is removed.

After disassembly, clean all metal parts with a non-flammable solvent, and wash all rubber parts with soap and water. Rinse thoroughly and blow dry with a low-pressure air jet. Replace those parts which are damaged or worn, giving particular attention to the diaphragm (27) and "O" ring (30). The supply and exhaust valves (9, 14) are metal seated valves and, if not worn excessively, can be relapped by using a fine grade valve grinding compound.

Since each valve is factory-set for its proper control pressure, the **diaphragm follower unit should not be removed** unless spring replacement is required. **Caution** should be taken during this disassembly as the caged diaphragm spring (31, 32) is under compression. After, removing the "O" ring (30), place the assembly in a vise or press and compress the spring further to remove the split spring retainer (36). Slowly release the spring pressure. When reassembling, be sure the split spring retainer is assembled in the groove closest to the diaphragm follower piston. The lower groove is for the "O" ring (30).

Reassemble the valve, using the exploded view as reference. As the assembly proceeds, lubricate all rubber parts with Dow Corning 55 M Grease and all metal-to-metal surfaces with Number 107 Lubriplate.

Before the strainers (5) are reassembled, insert them through the port gaskets (4) until the flange of the strainer is centered in the gasket. As a unit, insert the strainer and gasket into the valve body or pipe bracket. When assembled properly, the bottom of the strainer will rest against the valve body, and the port gasket will seat in the pipe bracket.

## Parts List

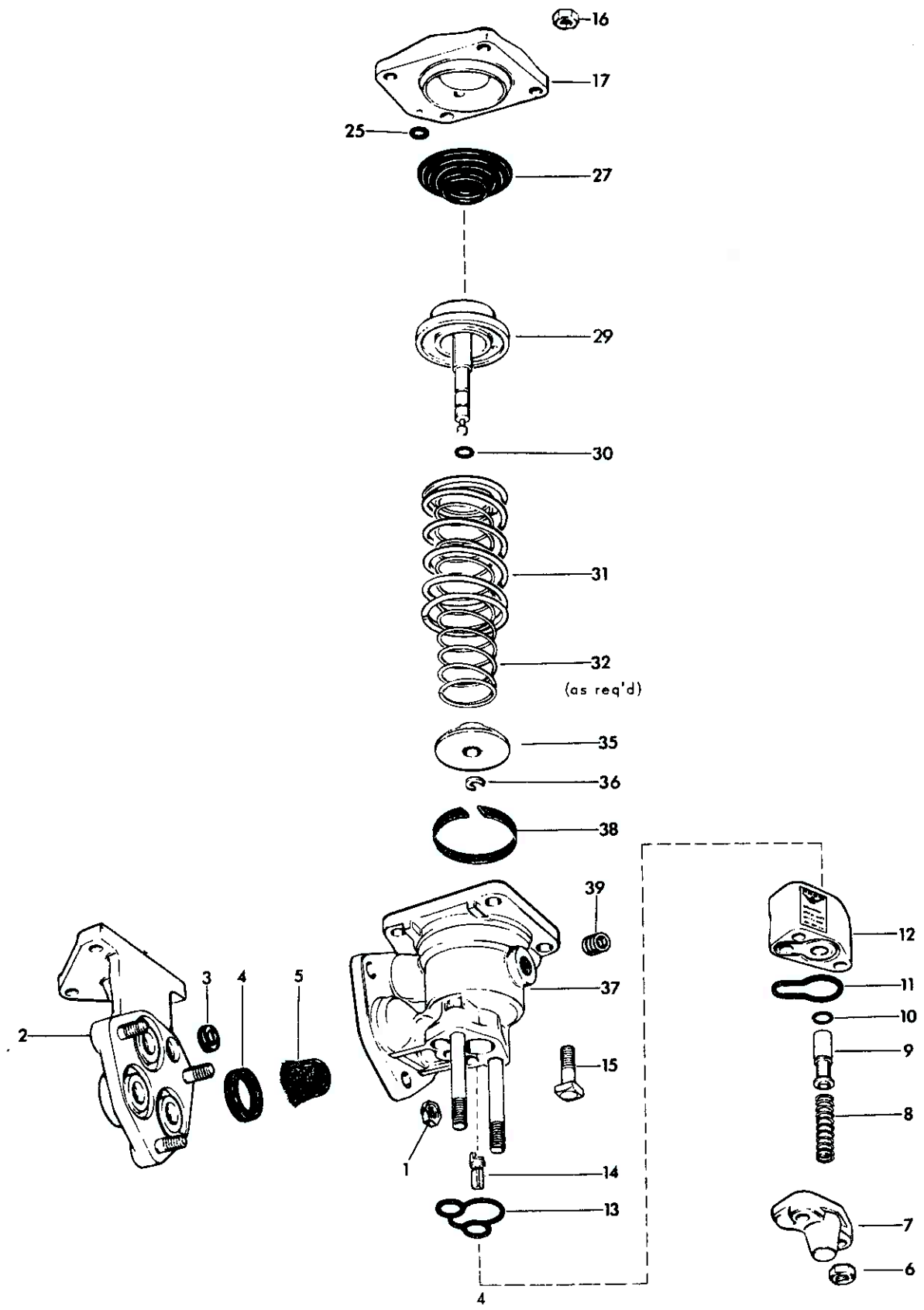
Ref. No.	Part Description	Piece No.
1	Nut, 3/8" Hex.	P49876-0001
2	Bracket, Pipe - W/Studs	P54359-0001
3*	Gasket, Port	550992
4*	Gasket	93840
5	Strainer	P58974
6	Nut, 3/8" Hex.	P49876-0001
7	Cover, Check Valve Body	P58634
8*	Spring, Supply Valve - 200 psig	P58633
9*	Valve, Supply	P58642
10*	Ring, 1/2" OD "O"	P49708-0012
11*	Gasket, Check Valve Body Cover	527582
12	Body, Check Valve	P58643
13*	Gasket, Check Valve Body	527581
14*	Valve, Exhaust	P58640
15	Bolt, 3/8" x 1 1/8"	P50275
16	Nut, 3/8" Hex.	P49876-0001
17	Cover, Diaphragm	P58648-0001
25*	Gasket, Port	523619
27*	Diaphragm	522980
29	Follower, Diaphragm	P58637
30	Ring, 3/8" OD "O"	P49708-0010
31	Spring, Outer Diaphragm	(see schedule)
32	Spring, Inner Diaphragm	(see schedule)
35	Seat, Spring	P58636
36	Retainer, Spring Seat	P58672
37	Body - W/Studs - Includes Ref. Nos. 27 & 28	P58963
38	Strip, Bushing	P58967
39	Plug, Breather	P49594

\*Recommended spare parts to be retained in stock at all times.



# EXPLODED VIEW

H-5 Models



## CHECK AND CHOKE VALVE

**MAINTENANCE:** No adjustments are necessary.

The scheduled inspection periods will be determined by frequency of use and the working environment of the valve. The pipe connections need not be disturbed. Access to all internal parts is through the body after removing the cap nut 1.

Remove all of the parts as shown by the exploded view. Wash the metal parts with a non-flammable solvent and all rubber parts with soap and water. Examine each part carefully and replace them if it is apparent that they will not provide trouble free service until the next scheduled maintenance period.

Lubricate the metal to metal surfaces with No. 107 Lubriplate and the packing rings with No. 55 Pneumatic Grease (Dow Corning) or their equivalents.

### Identity Schedule

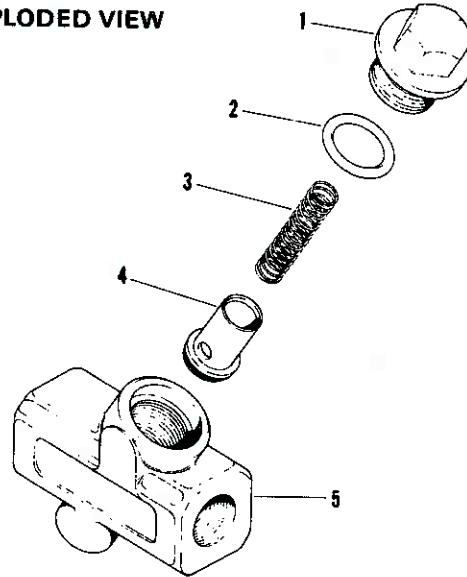
Port Size Dryseal-NPTF	Model Pc. No.	Choke Size	Valve (Ref. 4)
3/8-18	P55025-56	.047"	P55377-56
	P55025-52	.064"	P55377-52
	P55025	—	P5154-1

### Parts List

Ref. No.	Part Description	Piece Number 3/8
1	Nut, Cap	P53024
2*	Ring, "O"	P49708-114
3*	Spring	P53022
4*	Valve	(See IDENTITY Schedule)
5	Body	P55002

\*Recommended spare parts to be retained in stock at all times.

### EXPLODED VIEW



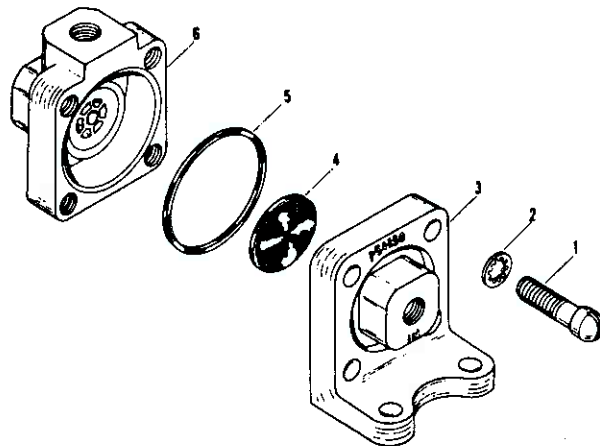
## SHUTTLE VALVE

### MAINTENANCE

The Shuttle Valve does not require adjustment.

By removing only the screws (1) and washers (2), the cover can be removed for easy replacement of the diaphragm (4) without disturbing piping connections.

When complete disassembly is required, clean all metal parts with a nonflammable solvent and wash all rubber parts with soap and water. Rinse thoroughly and blow dry with a low-pressure air jet. Replace the diaphragm (4) and gasket (5) if damaged or worn. Reassemble the valve, using the exploded view as reference. No lubrication is necessary, and no special tools are required.



### EXPLODED VIEW

### Parts List (In Order of Disassembly)

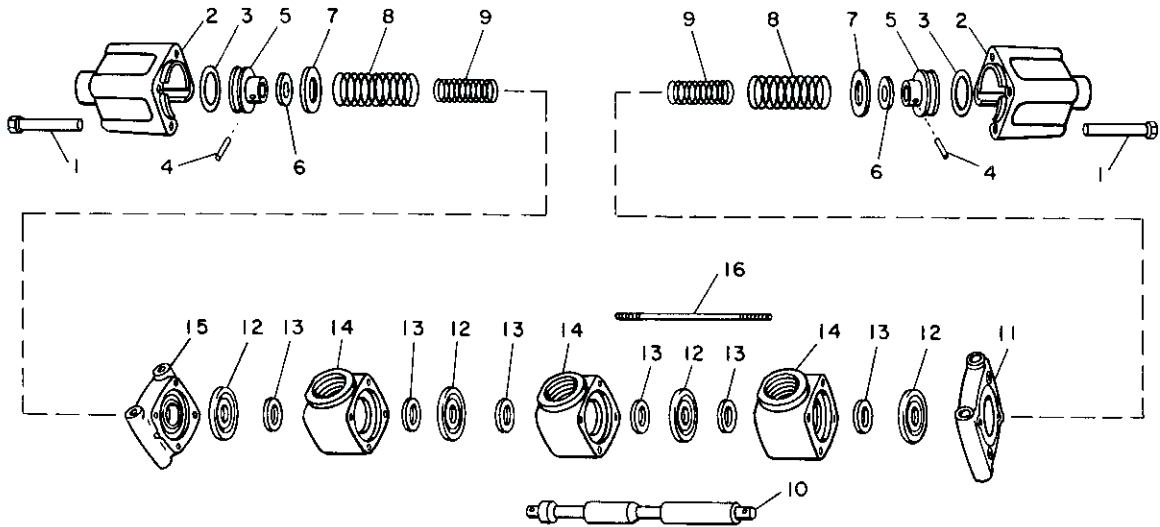
Piece Number	Port Size	Screw (1)	Washer (2)	Cover (3)	Diaphragm* (4)	Gasket* (5)	Body (6)
P54350-2	1/4"	P49835-19	P49898-9	P54326-1	P5112-1	P5111-7	P54325-1

\*Recommended spare parts to be retained in stock at all times.

## TYPE "D" PILOTAIR VALVE (Piece No. P62572)

### Parts List

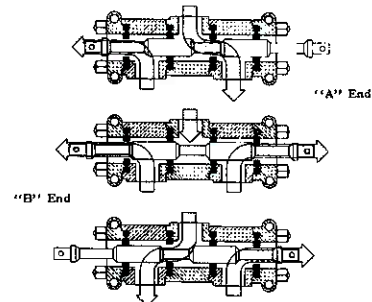
Ref. No.	Part Description	Qty.	Piece Number	Ref. No.	Part Description	Qty.	Piece Number
1	Nut Mounting Adapter	8	P50570-0001	9	Spring, Inner	2	P62575
2	Cylinder, Pilot	2	P50633-0003	10	Stem, Valve	1	P51838
3	Ring, Packing	2	P49708-0215	11	Cover, B End	1	P62574
4	Roll Pin	2	P49618-0005	12	Ring, Packing	4	P5014
5	Piston	2	P50629	13	Retainer	6	P51677
6	Stop	2	P49804-0002	14	Segment, Body	3	P51643
7	Retainer	2	P49804	15	Cover, A End	1	P62753
8	Spring, Outer	2	P62576	16	Rod, Tie	4	P49985-0003



### MAINTENANCE

The "D" PILOTAIR Valve requires no adjustment. Periodically dismantle the "D" PILOTAIR Valve for inspection and cleaning. Wash all metal parts with kerosene or a solvent with like characteristics. Wash all seals with soap and water and examine them for cracks or signs of wear. Dry all parts with a low pressure air jet. Replace worn or defective parts. During reassembly, lubricate all friction surfaces and seals with No. 1 grade graphite grease. When reassembling the valve, place the stenciled end of the stem at the end of the valve with the name plate.

### OPERATION (Diagrammatic Views)



4-Way Valve, Open Exhaust  
Exhaust Center Position

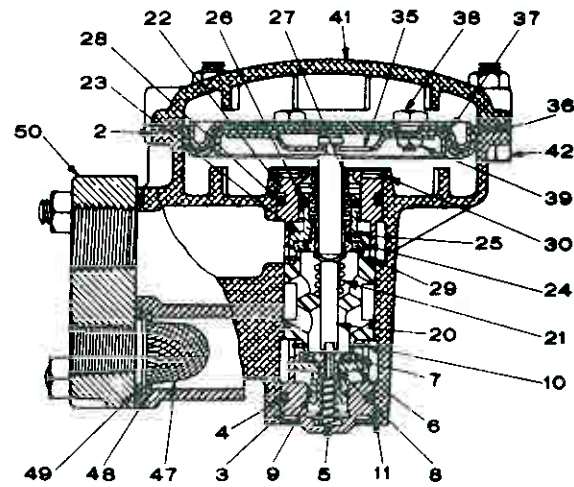
## C-2 RELAY VALVE (Piece No. 538975)

### MAINTENANCE

The C-2 Relay Valve requires no adjustment.

The C-2 Relay Valve should be dismantled at periodic intervals for inspection, cleaning and lubrication. The filter units may be removed after the valve is removed from the pipe bracket. Wash all metal parts with a suitable solvent such as Stoddard Solvent, kerosene or one of like characteristics, wash all rubber parts with soap and water and dry with a low pressure air jet. Replace worn or defective parts with new ones.

The diaphragm and rubber packing rings should be carefully inspected and replaced if cracked or worn. During re-assembly, all friction surfaces of moving parts and rubber packing rings should be lubricated with wide temperature range grease.



ASSEMBLY VIEW

### Parts List

Ref. No.	Part Description	Piece No.	Ref. No.	Part Description	Piece No.
	C-2 Relay Valve, complete	538975	24*	Seal, Exhaust Valve	850027
	Relay Valve Portion, complete (Includes Ref. Nos. 2 to 46, inclusive)	850012	25	Retainer, Exhaust Valve Seal	850028
2	Body, Relay Valve	P50756-1	26*	Ring, 15/16" O.D. Ex. V. Seal Housing Packing	524614
	Valve, Supply, complete (Includes 3, 5, 9, 10 and Pc. 850051)	850050	27*	Spring, Exhaust Valve	P50303
3	Cage, Supply Valve	850015	28*	Ring, 1 1/8" O.D. Cage Packing	532282
4*	Ring, 1-7/16" O.D. Supply Valve Cage Packing	536239	29	Ring, Exhaust Valve Retaining	850029
5*	Spring, Supply Valve	850020	30	Ring, Exhaust Valve Cage	540570
	Seal, Supply Valve, complete (Includes 6, 7 and 8)	850051		Diaphragm complete (Includes 35, 36, 37, three of 38 and 39)	850030
6	Housing, Supply Valve Seal	850046	35	Follower, Diaphragm	850031
7*	Seal, Supply Valve	850047	36*	Diaphragm	536300
8	Retainer, Supply Valve Seal	850019	37	Plate, Diaphragm Clamping	850034
9*	Ring, 5/8" O.D. Supply V. Seal	523842	38	Screw, Diaphragm Clamping (3 req'd)	P51181
10	Ring, Supply Valve Retaining	850021	39	Nut, Diaphragm Clamping (3 req'd)	17152
11	Ring, Supply Valve Cage Retaining	540569	40*	Gasket, 9/16" Port (Not Shown)	527717
20	Stem, Diaphragm	850022	41	Cover, Diaphragm	P50394-1
21*	Spring, Diaphragm Stem	521391	42	Bolt and Nut, 5/16" x 1-1/4" Diaphragm Cover (6 req'd)	540571
	Valve, Exhaust, complete (Includes 22, 26; 27, 29, and Pc. 850025)	850023	47	Strainer (2 req'd)	527583
22	Cage, Exhaust Valve	850024	48	Ring, Strainer Retaining (2 req'd)	529161
	Seal, Exhaust Valve, complete (Includes 23, 24 and 25)	850025	49*	Gasket, Pipe Bracket	850037
23	Housing, Exhaust Valve Seal	850026	50	Bracket, Pipe	P50395
			51	Bolt and Nut, 3/8" x 1-3/4" Pipe Bracket (3 req'd)	540731
			52	Bolt and Nut, 3/8" x 2-1/4" Pipe Bracket	540572

\*Recommended spare parts to be retained in stock at all times.