

HD-2 CONTROLAIR® VALVE

Service Information

Description of Models

The **HD-2 Type Controlair Valves** are handle operated 4-way, exhausted center, pressure control valves.

The typical unit contains two directional control 3-way side valves and a pressure graduating portion that is arranged to increase, decrease or maintain air pressure to a separate delivery line. In neutral position, both 3-way side valves exhaust both delivery lines. A movement of 10 degrees either side of center position opens the appropriate side valve and directs pressure to the indicated outlet port. Continued movement past 10 degrees up to full travel, or 46 degrees either side of neutral continues to actuate the pressure graduating portion to deliver a graduated pressure according to the valve of the control spring.



Models

There are six models with similar valve functions, but different handle operating characteristics.

HD-2-X Controlair Valve - Handle is spring returned to neutral position from all positions in the handle travel. Some special models exist. See notes on Identity schedule on page 7.

HD-2-LX Controlair Valve - Handle is spring returned to neutral position from all positions except at the maximum pressure setting on both sides of center. The handle is held in both extreme positions by a mechanical detent.

HD-2-FX Controlair Valve - Handle is equipped with a friction brake that will hold the handle in any position selected in the handle travel.

HD-2-XS Controlair Valve - Handle detents in both maximum pressure positions. The handle is spring returned to neutral position from all other positions in the handle travel. Graduated pressure to port (8) is only delivered in one direction of the handle movement.

HD-2-FXR Controlair Valve - Handle function is similar to the HD-2-FX Valve. The difference is the two directional valves are *supplied* instead of being *exhausted* when the handle is in the neutral position,

HD-2-LS Controlair Valve - Handle holds in full travel, neutral and detent positions.

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Installation and General Maintenance Recommendations

WARNING: INSTALLATION AND MOUNTING

The user of these devices must conform to all applicable electrical, mechanical, piping and other codes in the installation, operation or repair of these devices.

INSTALLATION! Do not attempt to install, operate or repair these devices without proper training in the technique of working on pneumatic or hydraulic systems and devices, unless under trained supervision.

Compressed air and hydraulic systems contain high levels of stored energy. Do not attempt to connect, disconnect or repair these products when a system is under pressure. Always exhaust or drain the pressure from a system before performing any service work. Failure to do so can result in serious personal injury.

MOUNTING! Devices should be mounted and positioned in such a manner that they cannot be accidentally operated.

Installation and General Maintenance Recommendations

Before installing the Controlair® Valve, all air lines in the system should be cleaned to remove all dirt, moisture or contamination.

A strainer is furnished on the inlet port to protect the valve from large particles or foreign matter in the supply line. To insure long, trouble-free service, a 10 micron or better filter should be installed in the supply line to the valve.

The HD-2 Controlair Valve is designed for panel mounting. The valve less the pipe bracket can be installed from the top of the panel. Refer to the installation view for panel opening dimension. Allow suitable clearance for installing or removing of the (3) pipe bracket screws which are 2 1/8" (54 mm) long.

GENERAL MAINTENANCE AND REPAIR RECOMMENDATIONS

Maintenance periods should be scheduled in accordance with frequency of use and working environment of the Controlair Valve.

All valves must be visually inspected for wear and given an "In System" operating performance and leakage test at least once a year. If these visual observations indicate valve repair is required, the valve must be removed immediately and repaired.

A major overhaul is recommended at one million cycles. However, where frequency of use is such that it would require more than two years to obtain the one million cycles, the valve must be overhauled at the two year period.

When it is determined that the Controlair Valve requires a major repair as a result of the one million cycles, one year routine inspection or the two year service period has elapsed, the device must be disassembled, cleaned, inspected, parts replaced as required. The valve then must be tested for leakage and proper operation prior to installation, refer to the Major Repair and Maintenance Instructions and test procedures.

Notice that the operating portion of the valve can be removed without disturbing the pipe connections by just removing the (3) screws that hold the pipe bracket to the valve.

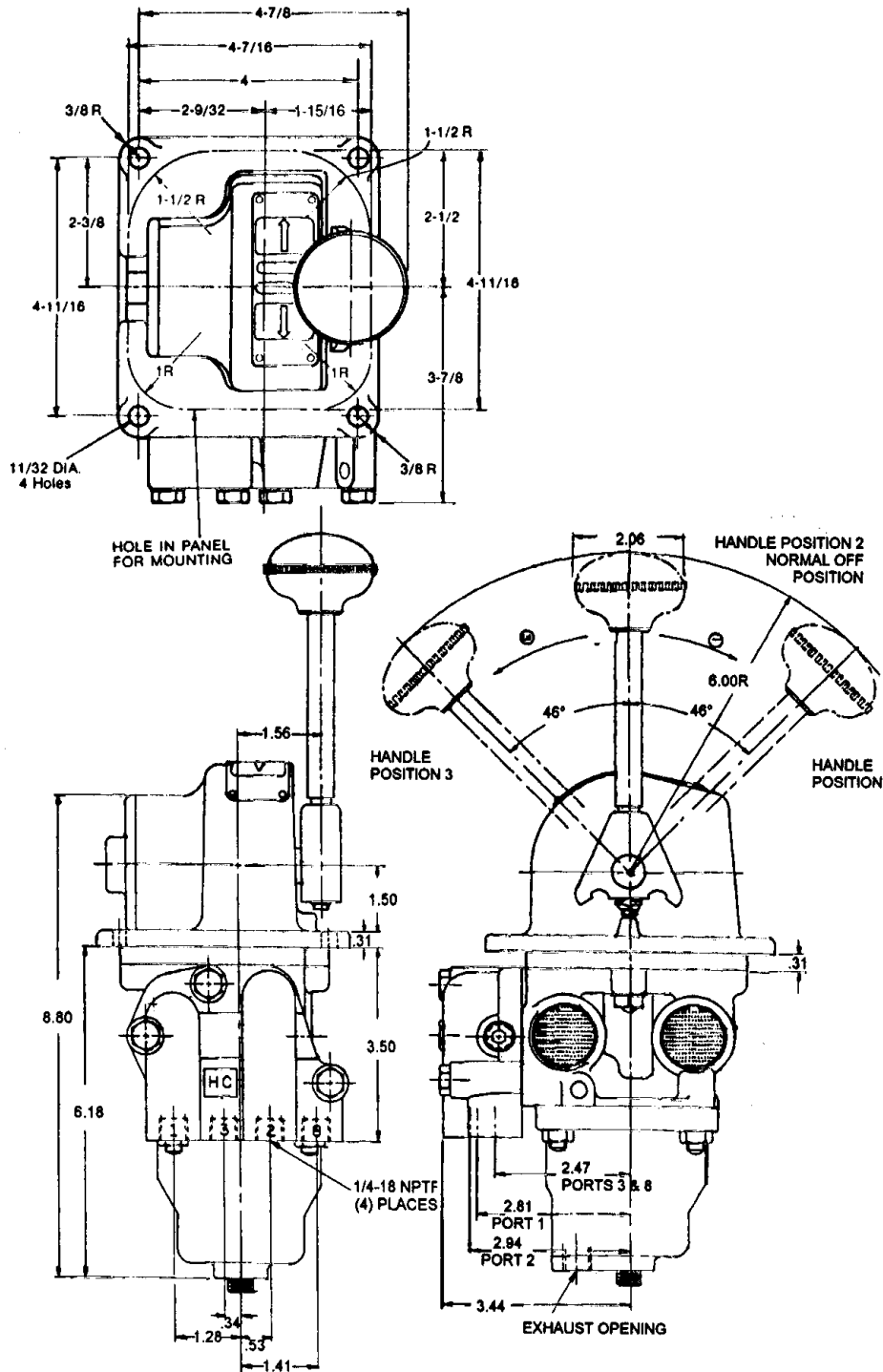
No special tools are required to maintain the Controlair valves, with the exception of internal snap-ring pliers.

One complete Controlair valve should be kept in stock for every (4) valves in service. During the maintenance period, replacing the complete valve with the stand-by unit reduces production down time and affords inspection and replacement of parts at a more appropriate time and favorable location.

Technical Data:	
Max. Operating Pressure	200 PSI (13.8 Bar)
Admissible Mediums	Clean & Dry Compressed Air
Operating Temperature	-40° to 160° F (- 40° to 71° C)
Hysteresis	1 1/2 Psi
Control Pressure Range	Ref. Identity Chart
Pressure Change	1/2 Psi. Increments
Mounting	Flanged Plate
Port Size	1/4-18 NPTF
Materials	
Controlair Valve	
Housing & Body	Die Cast Aluminum
Internal Parts	Brass, Rubber, Aluminum, Steel, Plastic and Hytrel™
Weight	9 Lb. (4.1 Kgs.)

Outline View

HD-2 TYPE CONTROLAIR® VALVE



Description of Operation For HD-2 Controlair® Valve

Note in the diagrammatic view that supply pressure is connected to port (2) and this supply pressure is directed to the pressure-graduating portion and the side control valves. The delivery graduating portion is directed to port (8). The delivery from the side valves is directed to outlet ports (1) or (3).

With the handle in neutral position both outlet (1) & (3) ports are open to atmosphere through their respective side valve and port 8 is at minimum pressure.

Movement of the handle through the first 10 degrees of travel from neutral operates one of the 3 way side valves to connect the supply pressure from port 2 to the appropriate outlet port (1) or (3), and the graduating portion to port (8). Movement of the handle to 10 degrees either side of center position causes the dual cam to push down on the pressure control plunger closing the exhaust valve and opening the upper supply valve, which allows air to flow to port (8) and the upper diaphragm chamber. As the pressure builds up in the delivery line Port (8) and through the sensing port orifice it deflects the control diaphragm downward, compressing the control spring. When sufficient diaphragm deflection is obtained to allow the upper supply valve in the pressure control portion to close, the pressure in the delivery line is held to that value.

The value of the pressure delivered to the outlet port is proportional to the pressure graduating portion plunger movement. This movement in turn is controlled by the cam contour and is proportional to the handle travel.

The HD-2 Controlair Valve will automatically compensate for air pressures changes. These air pressure changes can be caused by line leakage, temperature change or load feedback. If air pressure at port (8) increases over that called for by the handle position, the diaphragm in the control portion will deflect downward opening the lower exhaust valve and exhausting air until the original setting is obtained. If the pressure drops below that called for by the handle position the decreased force on the diaphragm will allow the control spring to force the diaphragm upward, opening the upper supply valve to restore the set pressure.

The range of pressure is controlled by the strength of the diaphragm spring. Various values are available as shown on the Identity Schedule on page 7.

Repair and Maintenance Instructions

Repair and Maintenance Instructions

When it has been determined that the Controlair® Valve requires repairs, the following general instructions are recommended.

Disassembly, Cleaning and Lubrication

Completely disassemble the Controlair valve. Wash all metal parts in a non-flammable solvent. Rinse each part thoroughly and blow dry with low pressure air.

Inspect and clean the inlet filter Item #2 and gasket Item #3 (older models had multiple gaskets that are still supplied in the repair kits). Be sure all passages in the body and pipe bracket and sensing port orifice in top of the diaphragm chamber are clean and unrestricted.

To remove cam set screw Item #55 use of an impact wrench (set soft) will break it loose to remove the cam and shaft from cam housing.

Examine all parts carefully. Replace all rubber parts and all worn or damaged parts. *The use of repair kits is recommended.*

Reassemble

Refer to exploded Parts and Assembly Views.

Valves should always be reassembled using new rubber parts.

Lubricate all metal to metal wear surfaces with Lubriplate 107 Grease. Lubricate all the rubber parts, **except the diaphragm** with Dow Corning No. 55 Pneumatic Grease.

The exhaust valve and seat if not replaced should be polished for minimum leakage using a 600 grit lapping compound. Be sure to clean these parts prior to installing in the valve.

Installing the cam set screw Item #55. The cam set screw must be fully seated into the drill point location on the cam shaft, Items #62 or 63. When installing set screw Item #55 use a thread locker like Loctite TL242.

Installing the handle Item #53, seat the handle into the yoke, Item #52 before installing the nut, Item #51.

Do not over torque the cap nut, Item #60.

Adjustments

Screw, Item #40 varies the graduated output pressure setting. Screws Item #23 adjust the opening of the side valves and screw, Item #19 aligns the follower Item #18 with the cam Item #61. The nut Item #50 adjusts the brake tension on the HD-2-FX versions.

Side Valve Lever Adjustments

With air supplied to the valve, turn adjusting screw Item #40 in or until the control spring Item #29 is slightly compressed. Remove the snap rings and screens Item #3. Move the Controlair Valve handle Item #53 back and forth, both sides of the neutral position, observing the action of the levers Items #20 & 22. The side valves should be fully open after the handle moves the first 10 degrees of travel.

Move the control handle to a maximum pressure position. With 3/32" Allen Wrench, back out adjusting screws Items #23 of the operated lever Items #20 or 22 just far enough to crack the exhaust valve so that gage in the output line starts to show a drop in pressure. From this point, turn the adjusting screw in a full three (3) turns. This will open the inlet valve of the side valve to its maximum capacity.

Move the handle to the other extreme position and repeat these adjustments on the other side valve lever.

Graduated Output Pressure Adjustments

Adjusting screw Item #40 varies the maximum pressure setting. Turning the adjusting screw in raises the *maximum* pressure. Turning the screw out decreases the *maximum* pressure. The maximum control pressure adjustment should not exceed the maximum control pressure shown in the Identity Schedule for that part number. (Control Springs are color coded).

The maximum output pressure rating can be changed by changing the control spring Item #30.

With air supplied to the valve, move handle from neutral to full travel position and hold. Adjust graduating valve screw Item #40 to obtain the maximum control pressure per Identity schedule. Move handle back to neutral position and *note* delivery line is exhausted to zero. Move handle to full travel position in the opposite direction and the delivery pressure should be the same as the other side. If the delivery pressure is higher or lower by 2 to 3 psi it can be corrected by adjusting the cam dog Item #18 with adjusting screw Item #19. Move the handle back to neutral position and *note* delivery line is exhausted to zero.

Cam Dog Adjustment

The eccentric cam dog screw Item #19 aligns the cam follower Item #18 with the rise in the cam item #61. If the pressure setting is not within 2 to 3 psi from one full handle travel position to the other, the difference can be compensated for by turning the eccentric screw Item #19 either clockwise or counter-clockwise. This adjustment is accessible from the outside of the valve through the notch under the panel flange using a long flat bladed screw driver.

The following procedure is recommended: move the valve handle to Full Travel in one direction (on detented models handle should be placed in detent position). Observe the output gage and note the pressure. Move the handle to the opposite position, turn the eccentric cam follower screw Item #19 to half way between the pressure difference. Continue adjustment until delivery gages (1 and 3) match within 2 to 3 psi of each other for related handle position.

Special Preload Setting

This settings calls for a predetermined delivery pressure when the handle is moved 10° from neutral in either direction.

Place handle 10° from neutral in either direction. Turn adjusting screw Item #40 in until the gage reads the desired preload pressure. Move the handle to the maximum pressure position. The delivery gage should read, preload pressure plus the range value of the control spring within ± 3 psi. Check handle setting in the opposite direction.

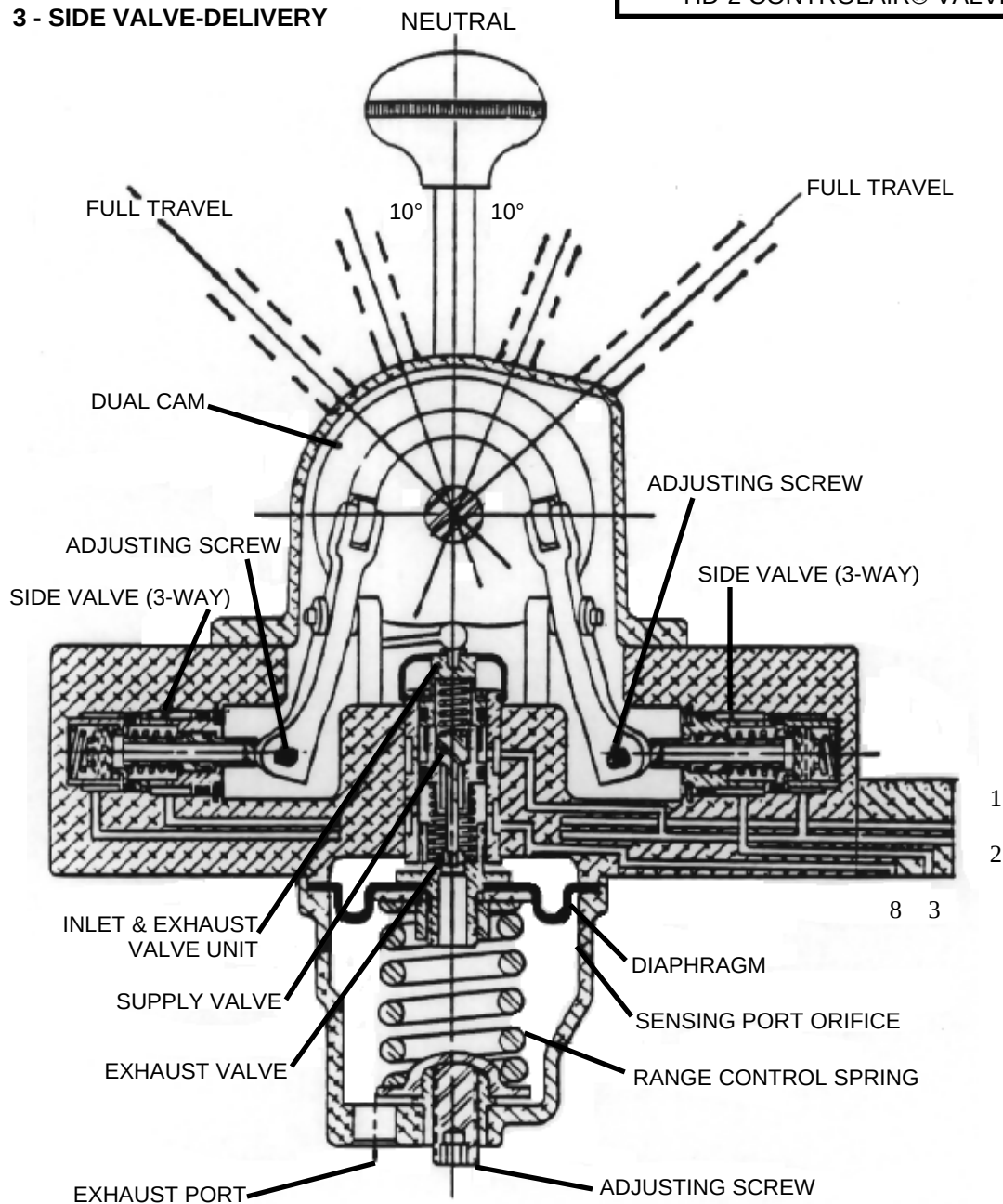
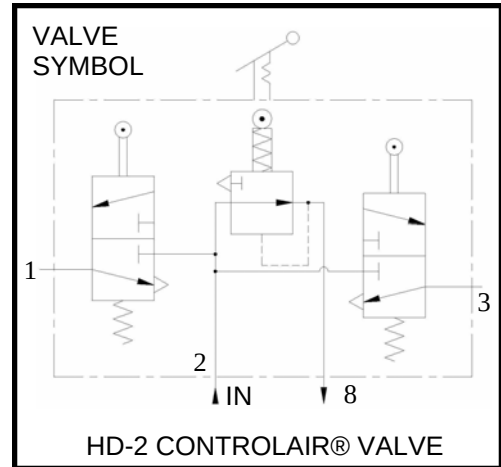
Force Brake Adjustment

The handle force of the HD-2-FX Controlair Valve can be varied by adjusting nut Item #50 on the brake shoe holder Item #47. This adjustment increases or decreases the force required to move the handle in any position of the handle travel.

This adjustment is normally made on the cam housing portion before assembling to the control portion. Factory setting is 8 lbs.

DIAGRAMMATIC VIEW

LEGEND - PIPE BRACKET
 2 - SUPPLY-IN
 8 - GRADUATED-DELIVERY
 1 - SIDE VALVE-DELIVERY
 3 - SIDE VALVE-DELIVERY



HD-2 IDENTITY SCHEDULE

Model	Control Pressure Range (PSI)	New Complete Part Number	New Control Spring & Color Code Ref.#29)	New Cam Portion *Complete	New Valve Portion **Complete	Old Complete Part Number	Old Control Spring & Color Code (Ref. # 29)	Old Cam Portion *Complete	Old Valve Portion **Complete	Remarks
HD-2-X	0 - 65	R431002831	R431003732	R431000138	R431003829	P -050973-00001	P -055442-00000 Brown	-850258-00000	P -055583-00001	
	0 - 100	R431002832	R431000043	R431000138	R431003830	P -050973-00002	-526749-00000 Yellow	-850258-00000	P -055583-00002	
	0 - 125	R431002833	R431000099	R431000138	R431003831	P -050973-00003	-540577-00000 Light Blue	-850258-00000	P -055583-00003	
	0 - 150	R431002834	R431003731	R431000138	R431003832	P -050973-00004	P -055441-00000 Red	-850258-00000	P -055583-00004	
	0 - 15		R431005473	R431000138		P -050973-00005	P -060293-00000 White	-850258-00000	P -055583-00005	
HD-2-FX	0 - 65	R431002823	R431005475	R431000147	R431003781	P -050970-00001	P -060295-00000 Brown	-850426-00000	P -055510-00008	
	0 - 100	R431002824	R431003722		R431003776	P -050970-00002	P -055442-00000 Yellow	-850427-00000	P -055510-00001	
	0 - 125	R431002825	R431000099		R431200377	P -050970-00003	-540577-00000 Light Blue	P -065990-00000	P -055510-00003	
	0 - 150	R431002826	R431000099	R431000147		P -050970-00004	-540577-00000 Red	-850426-00000	P -063408-00003	
	0 - 65		R431003732	R431000149	R431003776	P -063512-00001	P -055442-00000 Brown	-850426-00000	P -055510-00001	Note 2
	0 - 100		R431000043	R431000149	R431003777	P -063512-00002	-526749-00000 Light Blue	-850428-00000	P -055510-00002	Note 3
	15 - 70	R431001749	R431000099	R431000149	R431003778	P -064924-00017	-540577-00000 Orange	-850428-00000	P -055510-00003	Note 4
	0 - 65	R431001204	R431003731	R431000149	R431003779	P -066514-00001	P -055441-00000 Brown	-850428-00000	P -055510-00004	Note 1
	0 - 65		R431000056	R431000149	R431003782	P -068503-00001	-531418-00000 Silver	-850428-00000	P -055510-00010	Note 5
HD-2-LX	0 - 65	R431002827	R431003732		R431003776	P -050972-00001	P -055442-00000 Brown	-850429-00000	P -055510-00001	
	0 - 100	R431002828	R431000056		R431003782	P -050972-00002	-531418-00000 Yellow	-85429-00000	P -055510-00010	
	0 - 125	R431002829	R431000099		R431003778	P -050972-00003	-540577-00000 Light Blue	P -066326-00000	P -055510-00003	
	0 - 150	R431002830	R431000099	R431006800	R431003778	P -050972-00004	-540577-00000 Red	P -066326-00003	P -055510-00003	
HD-2-LS	0 - 65	R431003736	R431003732	R431002810	R431003792	P -055449-00001	P -055442-00000 Brown	P -050926-00000	P -055513-00001	
	0 - 125		R431000043	R431002810	R431003793	P -055449-00003	-526749-00000 Light Blue	P -050926-00000	P -055513-00002	
	0 - 150	R431001988	R431000099	R431002810	R431003794	P -055449-00004	-540577-00000 Red	P -050926-00000	P -055513-00003	
HD-2-FXR	0 - 65		R431003732	R431002949	R431003792	P -051868-00001	P -055442-00000 Brown	P -051847-00000	P -055813-00001	
HD-2-XS	0 - 65	R431009025	R431000043	R431002949	R431003793	P -067556-00001	-526749-00000 Brown	P -051847-00000	P -055813-00002	Note 6

Cam Portion - less valve portion, pipe bracket, screws and nameplate

** Valve Portion - less pipe bracket, screws and cam portion.

Note 1 - Same as R431002823 (P -050970-00001) except items 38, 52 & 53 are chrome plated (refer to page 8).

Note 2 - Same as R431002823 (P -050970-00001) except external surfaces are painted with black epoxy paint.

Note 3 - Same as R431002825 (P -050970-00003) except external surfaces are painted with black epoxy paint.

Note 4 - Same as P -050970-XXXXX - type except range setting.

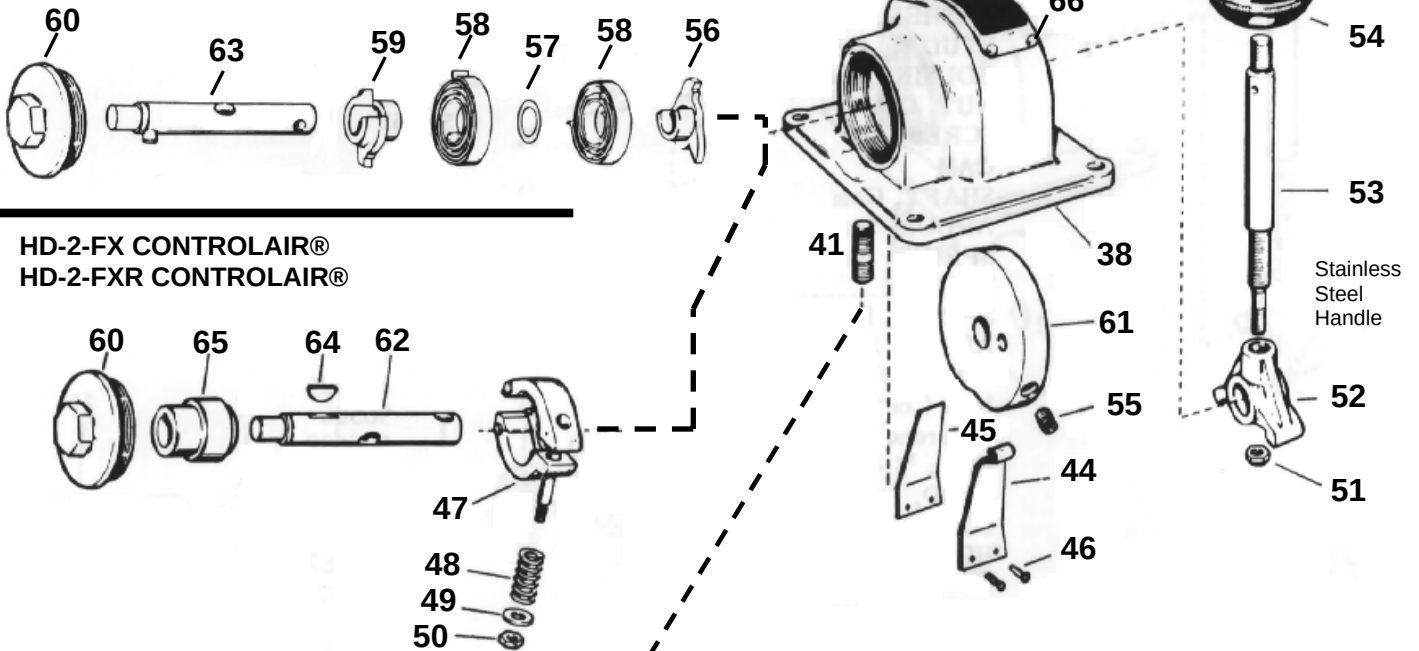
Note 5 - Same as P -050970-XXXXX - type except pressure setting and cam, Item 61, Part No. R431007304 (P -068502-00000).

Special setting 0 psi at clutch and heavy detent at 13 degrees

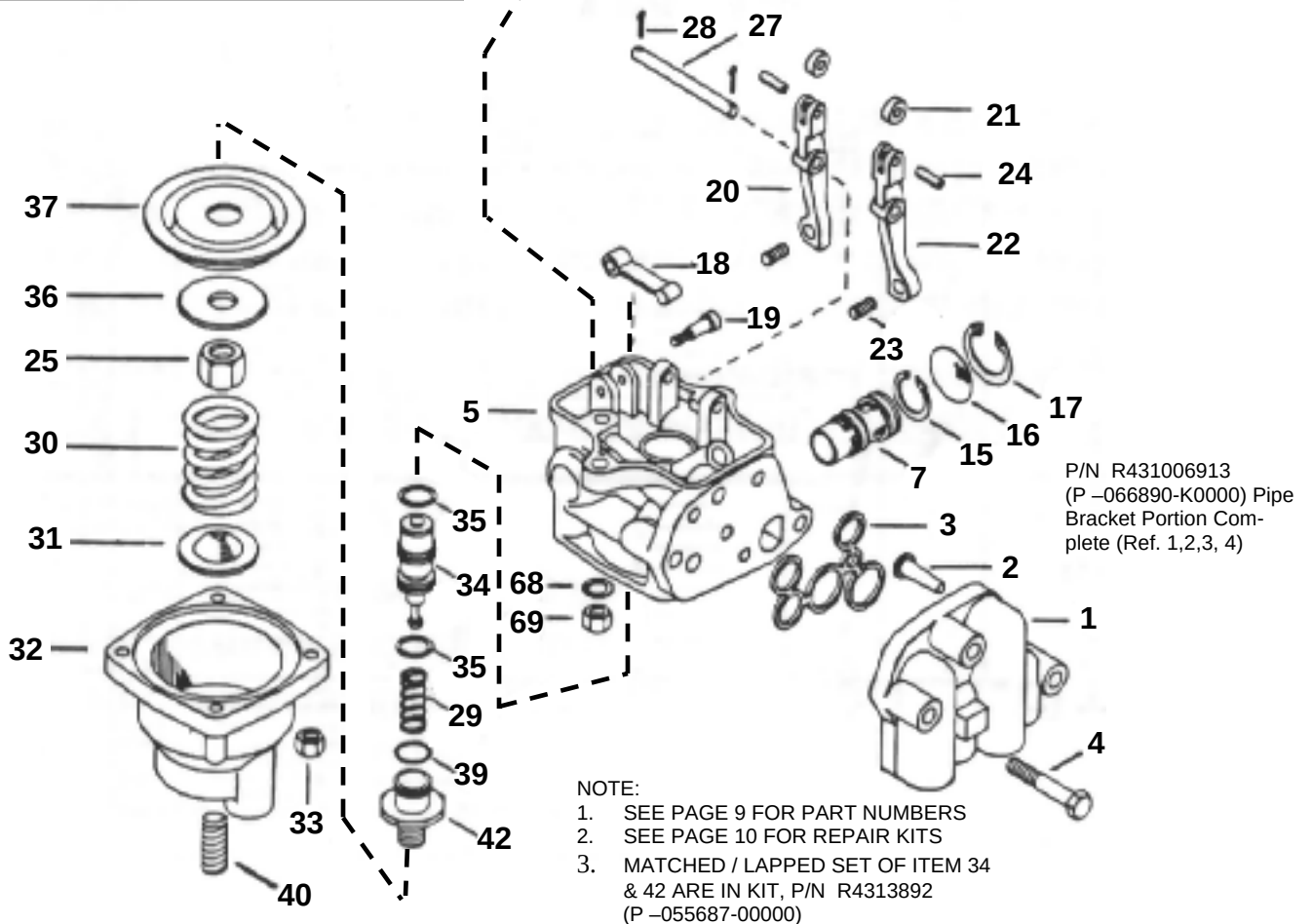
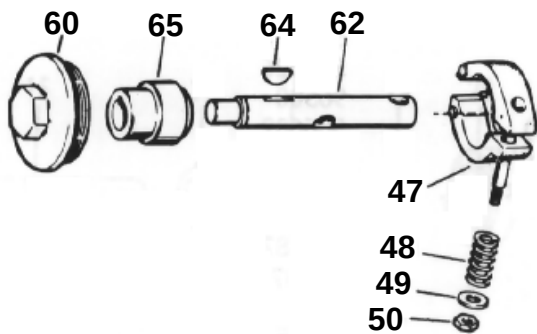
Note 6 - Same as HD-2-X, Part No. R431002831 (P -050973-00001), except cam and escutcheon plate, Item 61 & 67 Part No.'s R431007217 (P -067554-00001) & R431001602 (P -048348-00000) respectively. (no graduated pressure at delivery line (8) when handle is moved in direction towards pipe bracket.)

EXPLODED VIEW

HD-2-X CONTROLAIR®
HD-2-LX CONTROLAIR®
HD-2-LS CONTROLAIR®
HD-2-XS CONTROLAIR®



HD-2-FX CONTROLAIR®
HD-2-FXR CONTROLAIR®



HD-2 Controlair® Valve Parts List

Ref.	Qty.	Description	HD-2-X New P/N	HD-2-X Old P/N	HD-2-LX New P/N	HD-2-LX Old P/N	HD-2-LS New P/N	HD-2-LS Old P/N	HD-2-XS New P/N	HD-2-XS Old P/N	HD-2-FX New P/N	HD-2-FX Old P/N	HD-2-FXR New P/N	HD-2-FXR Old P/N
		Complete Device												
1	1	Pipe Bracket	R431006883	P-50972-000X	R431006883	P-50972-000X	R431006883	P-55446-000X	R431006883	P67556-000X	R431006883	P50970-000X	R431006883	P-51888-000X
2	*1	Filter	R431006895	P-066812-00006	R431006895	P-066812-00006	R431006895	P-066812-00006	R431006895	P-066812-00006	R431006895	P-066812-00006	R431006895	P-066812-00006
3	*1	Gasket	R431006889	P-066849-00000	R431006889	P-066849-00000	R431006889	P-066849-00000	R431006889	P-066849-00000	R431006889	P-066849-00000	R431006889	P-066849-00000
4	3	Screws	R431002440	P-049902-00048	R431002440	P-049902-00048	R431002440	P-049902-00048	R431002440	P-049902-00048	R431002440	P-049902-00048	R431002440	P-049902-00048
5	1	Complete Bottom Portion includes items 1 thru 33	P55583-000X	P55583-000X	P55583-000X	P55583-000X	P55583-000X	P55583-000X	P55583-000X	P55583-000X	P55583-000X	P55583-000X	P55583-000X	P55583-000X
Must specify spring range, same as last digit on valve														
6	1	Complete Body Bushed with 7 "O" rings	R431002868	P-051112-00001	R431002868	P-051112-00001	R431002868	P-051112-00001	R431002868	P-051112-00001	R431002868	P-051112-00001	R431002868	P-051112-00001
7	1	Cartridge Valve	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
8	2	Side Cartridge Valve w/2 "O" rings	R431003741	P-055474-00002	R431003741	P-055474-00002	R431003741	P-055474-00002	R431003741	P-055474-00002	R431003741	P-055474-00002	R431003741	P-055474-00002
8A	2	Side Cartridge Valve w/2 "O" rings including	R431003985	P-057094-00001	R431003985	P-057094-00001	R431003985	P-057094-00001	R431003985	P-057094-00001	R431003985	P-057094-00001	R431003985	P-057094-00001
	4	*Snap rings	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
	2	*Screens	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
15	2	Snap Ring	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
16	2	Screen	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
17	2	Snap Ring	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
18	*1	Cam Dog	R431003014	P-052835-00000	R431003014	P-052835-00000	R431003014	P-052835-00000	R431003014	P-052835-00000	R431003014	P-052835-00000	R431003014	P-052835-00000
19	1	Cam Dog Pin	R431002950	P-051856-00000	R431002950	P-051856-00000	R431002950	P-051856-00000	R431002950	P-051856-00000	R431002950	P-051856-00000	R431002950	P-051856-00000
20	1	Left Lever includes items 21, 23 & 24	R431004868	P-058978-00001	R431004868	P-058978-00001	R431004868	P-058978-00001	R431004868	P-058978-00001	R431004868	P-058978-00001	R431004868	P-058978-00001
21	1	Roller included with lever												
22	1	Rt. Lever, includes items 21, 23 & 24	R431004871	P-058979-00001	R431004871	P-058979-00001	R431004871	P-058979-00001	R431004871	P-058979-00001	R431004871	P-058979-00001	R431004871	P-058979-00001
23	1	Adjusting screw included with lever												
24	1	Pin included with lever												
25	*1	Nut	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
27	1	Lever Pin	R431002722	P-050686-00007	R431002722	P-050686-00007	R431002722	P-050686-00007	R431002722	P-050686-00007	R431002722	P-050686-00007	R431002722	P-050686-00007
28	2	Cotter Pins	R431002541	P-049913-00001	R431002541	P-049913-00001	R431002541	P-049913-00001	R431002541	P-049913-00001	R431002541	P-049913-00001	R431002541	P-049913-00001
29	*3	Exhaust Valve Spring	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
30	1	Control Springs	See page 6	See page 6	See page 6	See page 6	See page 6	See page 6	See page 6	See page 6	See page 6	See page 6	See page 6	See page 6
31	1	Spring Seat	R431000036	-526347-00000	R431000036	-526347-00000	R431000036	-526347-00000	R431000036	-526347-00000	R431000036	-526347-00000	R431000036	-526347-00000
32	1	Spring Housing	R431006822	P-066488-00002	R431006822	P-066488-00002	R431006822	P-066488-00002	R431006822	P-066488-00002	R431006822	P-066488-00002	R431006822	P-066488-00002
33	4	Mounting Nuts	R431002419	P-049901-00020	R431002419	P-049901-00020	R431002419	P-049901-00020	R431002419	P-049901-00020	R431002419	P-049901-00020	R431002419	P-049901-00020
34	*1	Graduating Valve includes items 21 & 22	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
35	*2	3/4" "O" Rings	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
36	*1	Washer	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
	1	Complete Top Portion	R431000138	-850258-00000	R431000138	-850258-00000	R431003854	P-055592-00000	R431007218	P-067555-00000	R431000141	-850260-00000	R431003829	P-055593-00001
37	*1	Diaphragm	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
	1	Complete Cam Housing includes items 38, 39, 40, 41, 42, 63 & 64	R431002902	P-051284-00000	R431002888	P-051205-00000	R431002888	P-051205-00000	R431002903	P-051284-00001	R431002888	P-051205-00000	R431002888	P-051205-00000
38	*1	Cam Housing with bushing	R431002766	P-050851-00002	R431002766	P-050851-00002	R431002766	P-050851-00002	R431002766	P-050851-00002	R431002766	P-050851-00002	R431002766	P-050851-00002
39	*1	"O" Ring	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits
40	1	Adjusting screw	R431006770	P-066209-00000	R431006770	P-066209-00000	R431006770	P-066209-00000	R431006770	P-066209-00000	R431006770	P-066209-00000	R431006770	P-066209-00000
41	2	Studs	R431002505	P-049906-00014	R431002505	P-049906-00014	R431002505	P-049906-00014	R431002505	P-049906-00014	R431002505	P-049906-00014	R431002505	P-049906-00014
42	*1	Exhaust Valve Seat	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits	See Repair Kits

HD-2 Controlair® Valve Parts List (continued)

Ref.	Qty.	Description	HD-2-X New P/N	HD-2-X Old P/N	HD-2-LX New P/N	HD-2-LX Old P/N	HD-2-LS New P/N	HD-2-LS Old P/N	HD-2-XS New P/N	HD-2-XS Old P/N	HD-2-FX New P/N	HD-2-FX Old P/N	HD-2-FXR New P/N	HD-2-FXR Old P/N
43	1	Brake Assembly includes items 47, 48, 49, 50 & 65										850187		850187
44	1	Latch												
45	1	Latch Spring												
46	2	Rivets												
47	1	Brake Shoe & Holder												
48	1	Brake Spring												
49	1	Washer												
50	1	Nut												
51	1	Nut												
52	1	Yoke												
53	1	Handle Shaft												
54	1	Ball												
55	1	Stop Pin included with cam #61												
56	1	Arbor												
57	1	Spacer Washer												
58	2	Return Springs												
59	1	Arbor												
60	1	End Cap Nut												
61	1	Cam w/Stop Pin												
62	1	Cam Shaft												
63	1	Cam Shaft												
64	1	Woodruff Key												
65	1	Brake Drum												
66	4	Screws												
67	1	Escutcheon Plate												
68	2	Tooth Washers												
69	2	Mounting Nuts												

* These items are in the a minor repair kit for graduating section

** These items are in the major repair kit for graduating section.

See Page 10
For Repair Kits

Repair Kits for HD-2 Controlair® Valves

New Part No.	Old Part No.	Quantity Per Valve	Description
R431003892	P -055687-00000 Note 1	1	Minor Graduating Valve Portion-Repair Kit includes items 25, 29, 34, 35, 36, 37, 39 & 42
R431004005	P -057136-00000 Note 1	1	Major Graduating Valve Portion-Repair Kit includes items 2,3 & 18 and kit R431003892
R431003741	P -055474-00002	2	Minor Side Valve Portion-Repair Kit includes item 7 cartridge with "O" Rings
R431003985	P -057094-00001	2	Major Side Valve Portion-Repair Kit includes snap ring, screen and kit R431003741
R431006521	P -064894-00002 Notes 1,2,3 & 4	1	Complete Repair Kit for Control Portion - includes (1) kit R431003892, (2) kits R431003985, items 2, 3, 16 & 17
R431006416	P -064421-00001 Note 5	1	Spring Latch Kit for LX, LS, FX and FXR Models includes items 44, 45 & 46
R431000132	-850187-00000 Note 5	1	Friction Brake Kit for FX & FXR Models includes items 47, 48, 49, 50 & 65
R431006418	P -064421-00004 Note 5	1	Cam Shaft Kit for FX & FXR Models includes items 51, 52, 53, 54 & 62
R431006419	P -064421-00005 Note 5	1	Cam Shaft Kit for X, LX, LS & XS Models includes items 51, 52, 53, 54 & 63
R431006423	P -064421-00009 Note 5	1	Return Spring and Arbor Kit for X, LX, LS & XS Models includes items 57, 58 & 59
R431006913	P -066890-K0000	1	Pipe Bracket Portion Kit for all Models includes items 1, 2, 3 & 4

NOTES:

1. The inlet and exhaust valve unit Item 34 and exhaust valve seat Item 42 are lapped together to form a matched set. Kits that contain these items from the factory include matched sets.
2. Select replacement range control spring from identity schedule on page 7.
3. All kits above include small tubes of the recommended lubricants.
4. Valve portion kits listed above contain the seals and other parts that are needed to repair the valve portion.
5. Replace all worn or damaged components, especially in the mechanical portions of the valve. The mechanical parts are listed on pages 7, 8 and 9.

Chrome plated HD-2 Controlair® Valves with chrome plated parts for item numbers listed (See Note 1 -- Page 6)

Model	New Complete Part Number	Old Complete Part Number	New Item 23 Cam Housing Part Number	Old Item 23 Cam Housing Part Number	New Item 42 Yoke Part Number	Old Item 42 Yoke Part Number	New Item 43 Handle Shaft Part Number	Item 43 Handle Shaft Part Number
HD-2-FX	R431001204	P -066514-00001	R431002889	P -051205-00001	R431006897	P -066852-00001	R431002846	P -050979-00001
HD-2-FX	R431001749	P -064924-00017	R431002888	P -051205-00000	R431006896	P -066852-00000	R431000155	850460-00000

Testing and Test Set-Up

Testing

After any repair or adjustments, The HD-2 Controlair Valve should be tested using the following procedures and test arrangements described in this section.

Pressure control valves need to be tested for the following

- | | |
|-----------------------|-----------------------|
| 1. Function | 4. Leakage |
| 2. Pressure Range | 5. Mechanical Detents |
| 3. Directional Output | |

The adjustments affecting these points were described in the previous sections.

General instructions for accomplishing this test are listed below using a 3 way 3 position valves with closed center. To test the valve for function, pressure range and directional output if using a Rexroth "D" Pilotair Valve place handle in position 1. To test for leakage place handle in position 2. To remove the valve after these tests are performed move handle to position 3.

1. Function: The HD-2 Controlair Valve has 2 directional airlines and one pressure regulated airline. The selection between the directional airlines depends on the movement of the handle to either side of neutral or center position. The pressure or regulated line output is proportional to the handle position on either side of the neutral position.

2. Pressure Range: The minimum and maximum pressure range is generated in delivery line #8 and is specified by the control spring in use. See the graduated output pressure setting adjustment section. After the valve is adjusted confirm the minimum and maximum pressure is generated in delivery line #8 by moving the handle from neutral to 10° then to full travel position both sides of center.

3. Directional Output: The two directional outputs are arranged to supply inlet pressure to these ports. After adjusting the lever arms to the setting in the adjustment section. Confirm that lines 1 & 3 in the neutral position have zero output. Then move the handle 10 degrees to either side of center and the output should go to the inlet pressure in either line 1 or 3 not both. Then move the handle to full travel and the pressure should stay the same as the inlet pressure. Then bring the handle back to center and the pressure should go to zero. Move the handle to the other side and perform the same operation.

4. Leakage: To test the leakage on HD-2 requires the following,

1. A zero leak test: Make sure that supply port #2 is at system pressure and moved that handle to the directional valve is in position #2. This will isolate the supply in the supply line.
2. At least a 12 cubic Inch volume (P/N

R434002910) in the supply line prior to the HD control air supply connection.

3. A vented ball valve to bleed off the supply after testing.
4. 4" gage in the supply line between the non-vented valve, volume and supply port on the HD-2.

Set the supply pressure to 20 psi (1.4 Bar) above the spring range of the valve. Using a soap and water solution, coat the valve at the pipe bracket #1 and the spring housing # 32 parting line. No leakage is permitted in any handle position.

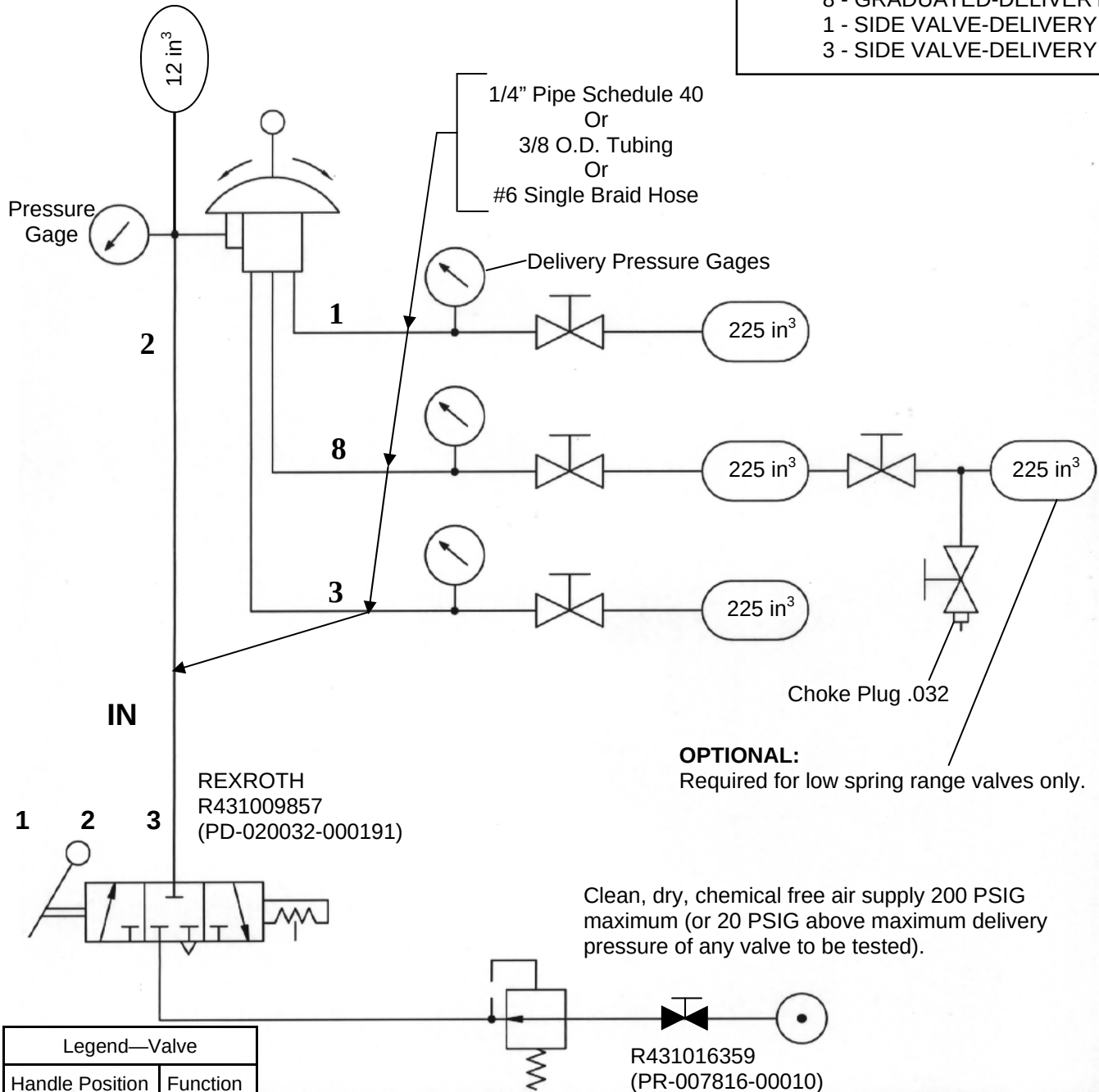
- A. **Pilot valves 1 & 3** operation is dependent upon the handle quadrant through in the neutral position. Moving the handle to either side 10 degrees, the pressure gage at 1 or 3 should go to system pressure . Shut off the supply air at the gage and 1 or 3 should maintain system pressure for at least 30 secs. Then return the handle to neutral and gages 1 or 3 should go to zero, Repeat the test for the other side.
 - B. **Port 8: For** valves with a spring range of less than 90 psi, set the supply line pressure to at least 100 psi. Move the handle in either direction to the full travel position and hold . Then close the supply line to port #2 or delivery line to isolate the graduating valve. Observe the gage in the delivery line. A pressure drop of no more than 2 psi in 30 seconds is permitted.
 - C. **For** valves with a spring range of more than 100 psi, set the supply line pressure to at least 15 psi above the spring range. Move the handle in either direction to the full travel position and hold . Then close the supply line to port #2 (or move the handle of PD-020031-~~00191~~ valve) to the center position to isolate the graduating valve. Observe the gage in the delivery line. A drop of no more than 2 psi in 30 seconds is permitted pressure.
 - D. Shut –off the supply line after testing to vent downstream lines. Move the handle of the directional valve to position 3, this will insure supply line 2 is exhausted. Shut –off the ball valve before the regulator to insure that **that** line is also vented
- 5. Mechanical Detent:** (HD-2-LX or SX Models only): Move the handle to the extreme detented position. Connect a spring scale just under the knob item #54. The force required to pull the handle out of the detented position should be at least 12 lbs. Check the detent hold in both extreme **handle** positions.

Test Arrangement Diagram

Notes:

1. Rexroth Taskmaster® Timing Volumes (4), part number R431002899 (TM-058887-000225) and R431002910 (TM-061890-00012) can be used for the volumes indicated.
2. The supply air line to the valve and the delivery lines must be full size as shown. Line must not exceed 3 Ft. between the supply valve and port (2), or between ports (1) & (3).
3. It is recommended that as large a gage as practical be used on the delivery lines. A 6" gage is recommended.

LEGEND - PIPE BRACKET
 2 - SUPPLY-IN
 8 - GRADUATED-DELIVERY
 1 - SIDE VALVE-DELIVERY
 3 - SIDE VALVE-DELIVERY



NOTICE TO PRODUCT USERS

1. WARNING: FLUID MEDIA

Bosch Rexroth pneumatic devices are designed and tested for use with filtered, clean, dry, chemical free air at pressures and temperatures within the specified limits of the device. For use with media other than air or for human life support systems, Bosch Rexroth must be consulted. Hydraulic cylinders are designed for operation with filtered, clean, petroleum based hydraulic fluid; operation using fire-resistant or other special types of fluids may require special packing and seals. Consult the factory.

2. WARNING: MATERIAL COMPATIBILITY

Damage to product seals or other parts caused by the use of noncompatible lubricants, oil additives or synthetic lubricants in the air system compressor or line lubrication devices voids Bosch Rexroth's warranty and can result in product failure or other malfunction. See lubrication recommendations below.

AIR LINE LUBRICANTS! In service higher than 18 cycles per minute or with continuous flow of air through the device, an air line lubricator is recommended.* (Do not use line lubrication with vacuum products.) However, the lubricator must be maintained since the oil will wash out the grease, and lack of lubrication will greatly shorten the life expectancy. The oils used in the lubricator must be compatible with the elastomers in the device. The elastomers are normally BUNA-N, NEOPRENE, VITON, SILICONE and HYTREL. Bosch Rexroth recommends the use of only petroleum based oils without synthetic additives, and with an aniline point between 180° F and 210° F.

COMPRESSOR LUBRICANTS! All compressors (with the exception of special "oil free" units) pass oil mist or vapor from the internal crankcase lubricating system through to the compressed air. Since even small amounts of non-compatible lubricants can cause severe seal deterioration (which could result in component and system failure) special care should be taken in selecting compatible compressor lubricants. It is recommended that users review the National Fluid Power Association "Recommended Guide Lines For Use Of Synthetic Lubricants In Pneumatic Fluid Power Systems" (NFPA T1.9.2-1978).

3. WARNING: INSTALLATION AND MOUNTING

The user of these devices must conform to all applicable electrical, mechanical, piping and other codes in the installation, operation or repair of these devices.

INSTALLATION ! Do not attempt to install, operate or repair these devices without proper training in the technique of working on pneumatic or hydraulic systems and devices, unless under trained supervision. Compressed air and hydraulic systems contain high levels of stored energy. Do not attempt to connect, disconnect or repair these products when a system is under pressure. Always exhaust or drain the pressure from a system before performing any service work. Failure to do so can result in serious personal injury.

MOUNTING! Devices should be mounted and positioned in such a manner that they cannot be accidentally operated.

4. WARNING: APPLICATION AND USE OF PRODUCTS

The possibility does exist for any device or accessory to fail to operate properly through misuse, wear or malfunction. The user must consider these possibilities and should provide appropriate safe guards in the application or system design to prevent personal injury or property damage in the event of a malfunction.

5. WARNING: CONVERSION, MAINTENANCE AND REPAIR

When a device is disassembled for conversion to a different configuration, maintenance or repair, the device must be tested for leakage and proper operation after being reassembled and prior to installation.

MAINTENANCE AND REPAIR! Maintenance periods should be scheduled in accordance with frequency of use and working conditions. All Bosch Rexroth products should provide a minimum of 1,000,000 cycles of maintenance free service when used and lubricated as recommended. However, these products should be visually inspected for defects and given an "in system" operating performance and leakage test once a year. Where devices require a major repair as a result of the one million cycles, one year, or routine inspection, the device must be disassembled, cleaned, inspected, parts replaced as required, rebuilt and tested for leakage and proper operation prior to installation. See individual catalogs for specific cycle life estimates.

6. PRODUCT CHANGES

Product changes including specifications, features, designs and availability are subject to change at any time without notice. For critical dimensions or specifications, contact factory.

*Many Bosch Rexroth pneumatic valves and cylinders can operate with or without air line lubrication; see individual sales catalogs for details.

LIMITATIONS OF WARRANTIES & REMEDIES

Bosch Rexroth warrants its products sold by it to be free from defects in material and workmanship to the following:

For twelve months after shipment Bosch Rexroth will repair or replace (F.O.B. our works), at its option, any equipment which under normal conditions of use and service proves to be defective in material or workmanship at no charge to the purchaser. No charge will be made for labor with respect to defects covered by this Warranty, provided that the work is done by Bosch Rexroth or any of its authorized service facilities. However, this Warranty does not cover expenses incurred in the removal and reinstallation of any product, nor any downtime incurred, whether or not proved defective.

All repairs and replacement parts provided under this Warranty policy will assume the identity, for warranty purposes, of the part replaced, and the warranty on such replacement parts will expire when the warranty on the original part would have expired. Claims must be submitted within thirty days of the failure or be subject to rejection.

This Warranty is not transferable beyond the first using purchaser. Specifically, excluded from this Warranty are failures caused by misuse, neglect, abuse, improper operation or filtration, extreme temperatures, or unauthorized service or parts. This Warranty also excludes the use of lubricants, fluids or air line additives that are not compatible with seals or diaphragms used in the products. This Warranty sets out the purchaser's exclusive remedies with respect to products covered by it, whether for negligence or otherwise. Neither, Bosch Rexroth nor any of its affiliates will be liable for consequential or incidental damages or other losses or expenses incurred by reason of the use or sale of such products. Our liability (except as to title) arising out of the sale, use or operation of any product or parts, whether on warranty, contract or negligence (including claims for consequential or incidental damage) shall not in any event exceed the cost of replacing the defective products and, upon expiration of the warranted period as herein provided, all such liability is terminated. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHETHER FOR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE. No attempt to alter, amend or extend this Warranty shall be effective unless authorized in writing by an officer of Bosch Rexroth Corporation.

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