INTRODUCTION

This manual covers the assembly, installation and operation of the whole range of HVA Gate valves. These valves can be grouped into three families: 5/8" to 6", 8" to 12" and 14" to 21" based on their internal mechanism design. This manual has been arranged with parts lists and assembly instructions based on these families. However, even within each family minor differences can occur which may not be reflected on the illustrations but are covered by special "Discrepancy notes" in the text. Please read each section completely through before proceeding in order to become familiar with these differences.

VALVE BASICS

While the details of the internal mechanisms may differ from one valve size to another, all HVA Gate valves operate on the same principles.

The vacuum seal is made by an O-ring on the Gate pressing against the inside of the valve Body. The Gate is attached through some nks to a rigid mechanical structure called the Strongback. The Gate and Strongback together are called the Carriage. The Body consists of the case, which is the narrow rectangular structure in which the Carriage is raised and lowered, and the flanges which allow the valve to be installed in your system. There is sufficient room in the upper part of the Body for the Carriage to be completely retracted thus leaving the flow path completely unobscured.

The top of the Body is sealed with a lid called the Bonnet. On top of the Bonnet is the Actuator which can be either a hand operated crank mechanism or a pneumatic cylinder (there is also a motorized option, but that is not covered in this manual). The Actuator operates through a stainless steel Bellows which seals the Bonnet and allows the Body and all internal pieces to be vacuum tight (i.e. the vacuum can be applied to either side of the Gate). To leave room for the Bellows, the Actuator is spaced up from the Bonnet by a simple flanged pipe called the Standpipe. Finally, the Actuator is attached to the Strongback by a two bar linkage which both amplifies the Actuator's motion (to increase its stroke enough to raise and lower the Carriage) and provides and over-center action to lock the valve closed.

The valve action works as follows: The Actuator, working through the linkage, starts lowering the Carriage. The Carriage is guided by four wheels on the corners of the Strongback riding down the

narrow side of the case. These wheels are called the Guide Wheels. Protruding from the bottom of the Gate are a pair of pivoting stops called Carriage Bars[1]. As the Carriage nears the end of its travel, the Carriage Bars contact first preventing any further vertical travel by the Gate. As the Actuator continues to force the Strongback lower, its vertical motion is converted into horizontal Gate motion by the Links connecting them. When the Gate begins to seal, reaction forces are taken up by another set of wheels on the Strongback, oriented 90° to the Guide Wheels, which roll on the wide side of the case. These wheels are called Side Wheels.

When properly adjusted, the Gate will seal just as the Actuator Linkage goes over center. When this happens, the travel-limiting screw on the linkage will stop against the side of the case giving the characteristic "click" of the valve closing.

Special Note for the 5/8" valve - The 5/8" valve is the smallest gate valve made by HVA. Due to its tiny size, certain of the design elements mentioned above have been consolidated. Most noticeable is the Actuator and its attachment to the Carriage. The Actuator, Bellows and Bonnet are a single assembly rather than an assemblage of separate items as in the larger valves. Also, the 5/8" is the only HVA gate valve without the two bar linkage between the Actuator and Strongback. With so little travel required, there is enough stroke in the Actuator to operate the Carriage directly. Finally, there are no Carriage Bars at the bottom of the Gate. Another pair of Side Wheels attached to the Gate protrude far enough below the bottom of the Gate to provide the pivot function.

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1. On most valves, the Carriage Bars are simple solid bars with a rounded pivot edge. There are some models, however, that use a more elaborate setup of pivoting plates, wheels and axles called the Front Wheel Carriage (FWC). For both clarity and brevity in this manual the FWC will be referred to as simply the "Carriage Plate."

GENERAL INSTALLATION NOTES

All flange screws must be coated with anti-galling compound such as Dow Corning Molykote 44 or equivalent prior to assembly.

All flanges and other sealing surfaces should be cleaned with trichlorcethane or other suitable solvent before assembly. O-ring grooves should be blown out with dry nitrogen and the O-rings cleaned with solvent immediately before assembling.

CAUTION!
SOME VALVES CONTAIN ELECTRO-PNEUMATIC OPERATED ASSEMBLIES

DISCONNECT ELECTRICAL POWER AND AIR SUPPLY BEFORE SERVICING VALVE

DO NOT INSERT FINGERS, HANDS OR TOOLS
INSIDE THE ASSEMBLY IF AIR SUPPLY IS ATTACHED

GENERAL ASSEMBLY NOTES

All screws must be coated with anti-galling compound such as Dow Corning Molykote 44 or equivalent prior to assembly.

All flanges and other sealing surfaces should be cleaned with trichloroethane or other suitable solvent before assembly. O-ring grooves should be blown out with dry nitrogen and the O-rings cleaned with solvent immediately before assembling.

CAUTION! THIS IS A PNEUMATICALLY OPERATED ASSEMBLY

DO NOT INSERT FINGERS, HANDS OR TOOLS
INSIDE THE ASSEMBLY AT ANY TIME.

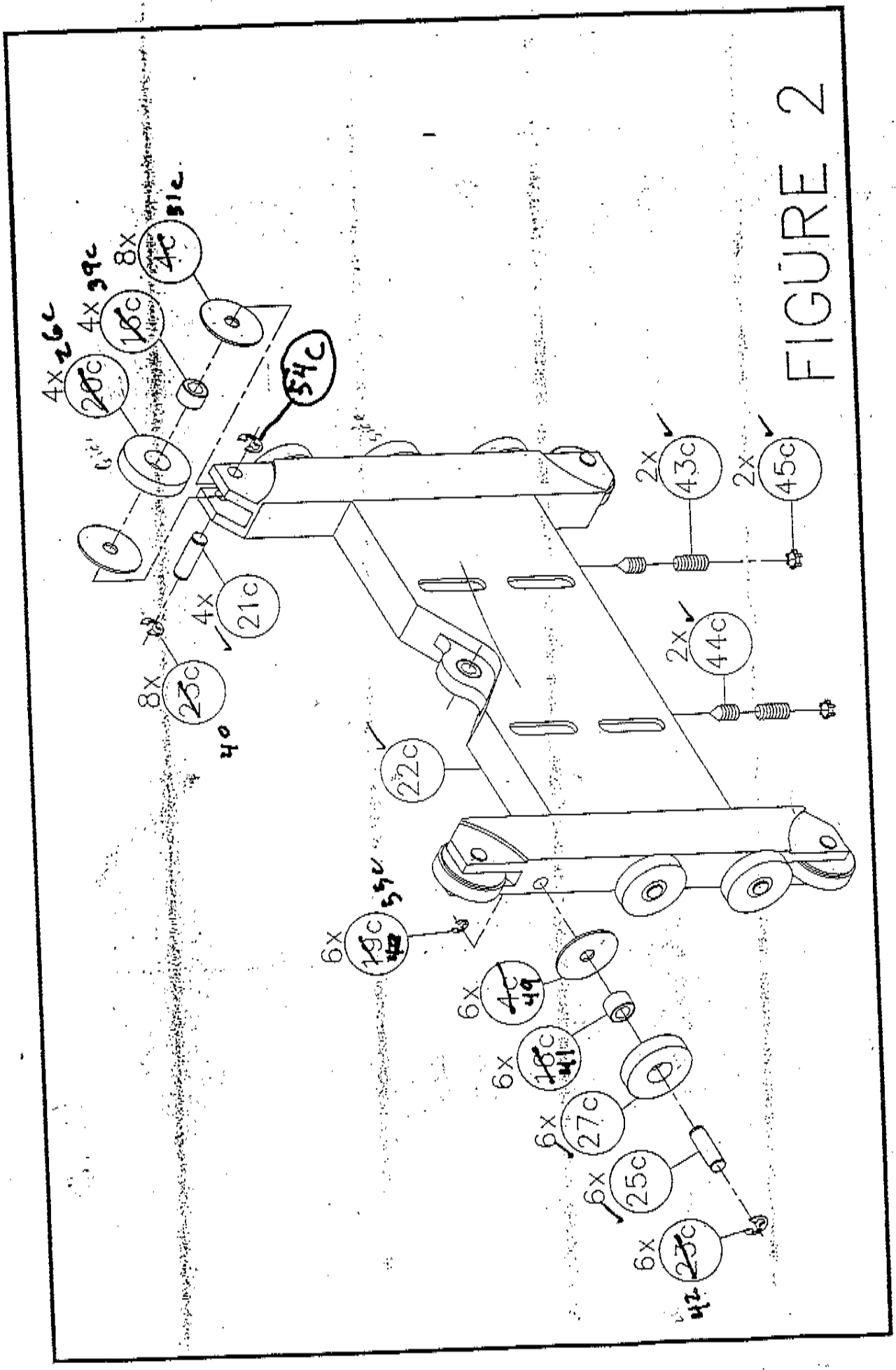
8X 41c
4X 39c
4X 26c
54c
2X 43c
2X 45c
4X 21c
8X 23c
2X 44c
22c
6X 49c
6X 47c
6X 48c
6X 27c
6X 25c
6X 42c

FIGURE 2

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1. Strongback to Lower Linkage assembly.

Assembly shown in Figure 1.

Discrepancy notes - The 5/8" valve has no Actuator Linkage, the Actuator operates directly on the Strongback. For 1 1/2" through 3" valves, the Lower Linkage UL and the T-Bolt are a combined piece using only one jam nut and washer.

Other washer and bearing counts may vary slightly within the families. Check with HVA customer service if in doubt.

PARTS REQUIRED:

ITEM	DESCRIPTION	NUMBER REQUIRED BY FAMILY 5/8 TO 6	8 TO 12	14 TO 22
5c	Lower Linkage UL	1	1	1
6c	Cotter Key	2	–	2
7c	Lock Washer	2	2	2
8c	Jam Nut Right Hand	1	1	1
9c	Jam Nut Left Hand	1	1	1
10c	T-Bolt	1	1	1
10c	Lower Linkage SB	1	1	1
11c	Pivot Pin, SB	1	1	1
19c	Bearing, LLUL	1	1	–
22c	Strongback Assembly	1	1	1
23c	Bearing, LLSB	2	3	2
24c	Flat Washer LLSB	–	2	2
38c	Retainer, LLSB	–	2	–

1.1. Press bearing(s) (23c) into the center hole(s) of the Strongback (22c) and end of the Lower Linkage SB (10c), if applicable. Also press bearing (19c) into Lower Linkage UL (5c), if applicable. Refer to section 13 for manufacturers recommended bearing installation procedure.

Note: THE FOLLOWING FOUR STEPS FOR 8 TO 12 INCH ONLY

1.2. Assemble pin (11c) and one retaining ring (38c).

1.3. Position Lower Linkage SB (10c) over center web in Strongback. Insert two thrust washers (24c), one on each side of the Strongback web, between the Strongback and Lower Linkage forks. Note: the models that do not use thrust washers will not have room for them.

1.4. Line up parts by inserting the alignment tool through the center.

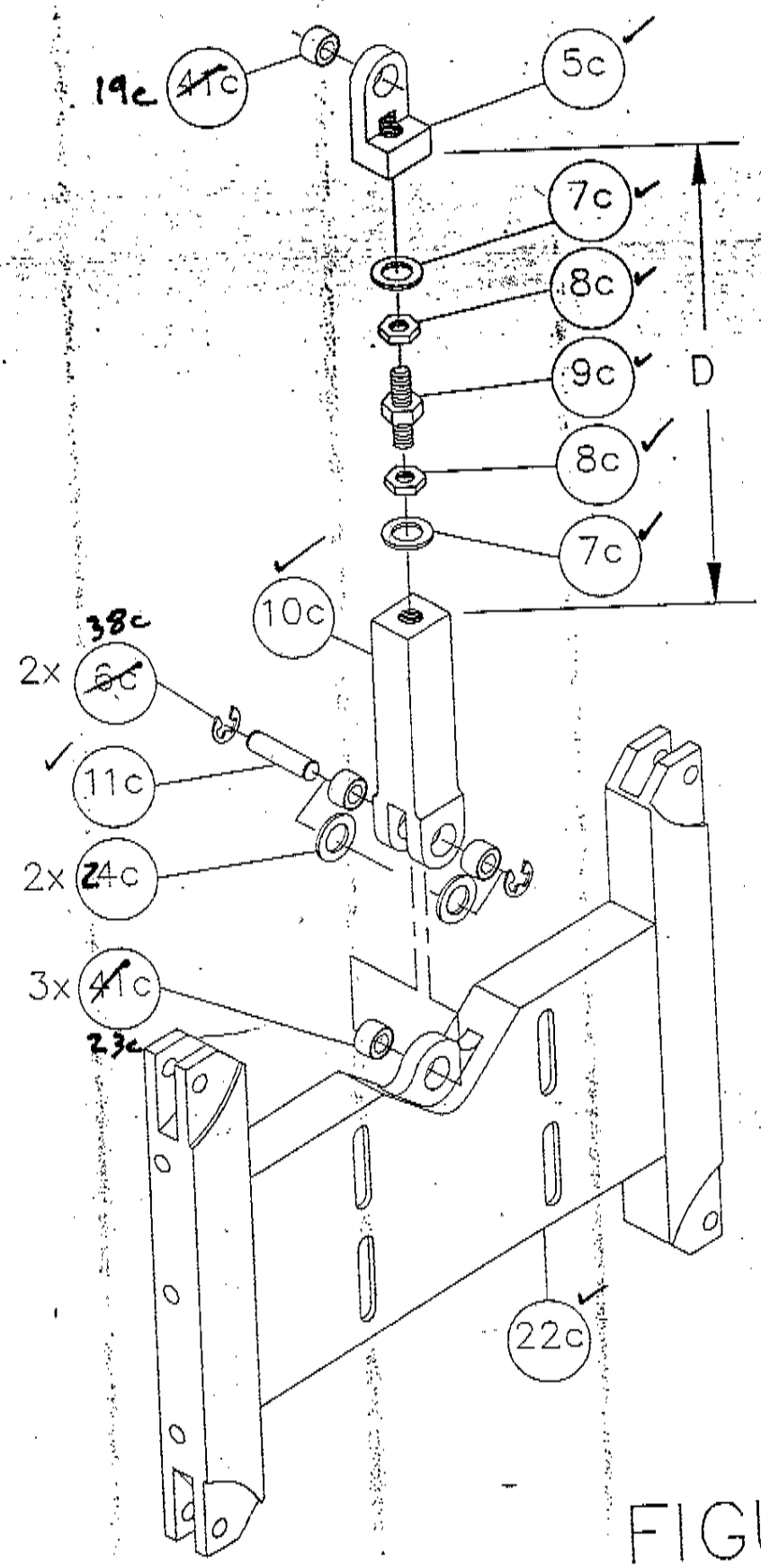

FIGURE 1

1.5. Insert pin assembly (11c) through all parts and secure with another retaining ring (38c).

Note: THE FOLLOWING THREE STEPS FOR 5/8 to 6 and 14 TO 22 INCH ONLY

1.6. Position the tongue of the Lower Linkage SB (10c) into the slot in the Strongback. Insert two thrust washers (24c), one on each side of the LLSB tongue and within the Strongback slot.

1.7. Line up parts by inserting the alignment tool through the center.

1.8. Insert pin (11c) through all parts and secure with Cotter Key (6c).

1.9. 3" and larger valves only: Assemble T-Bolt (9c) and jam nuts (8c) right hand to right hand and left hand to left hand.

1.9.1. Put one lock washer (7c) on right hand threaded end of T-Bolt and screw into end of Lower Linkage SB.

1.9.2. Put one lock washer (7c) on left hand threaded end of T-Bolt and screw on the Lower Linkage UL.

1.9.3. Begin adjustment of the linkage by setting the T-Bolt length (dimension "D" on Figure 1) to the dimension listed in Chart 1 according to the valve size. Further adjustment may be required after assembling the valve.

CHART 1

VALVE SIZE	BEGINNING T-Bolt DIMENSION 2 threads into LL
1.5	.775
2.0	.690
2.5	.708
3.0	.700
4.0	.690
6.0	.730
8.0	2.100
10.0	1.080
12.0	1.130
14.0	1.430
16.0	1.970
21.0	

2. Wheels to Strongback assembly.

Assembly shown in Figure 2.

Discrepancy notes – The Strongback wheels (both Guide Wheels and Side Wheels) in the smaller valves are optimized to the size of valve and therefore have the greatest variation in both size and number within a family. The following is a summary of these variations:

5/8" – no Guide Wheels, 2 Side Wheels, 2 more Side Wheels attached to Gate acting as Carriage Bars.

1 1/2" – 4 Guide Wheels, 4 Side Wheels (same P/N as Guide Wheels) for the upper and lower pairs, and 2 larger Side Wheels for the center pair.

2" – no Guide Wheels, 2 special "conical" wheels on the Strongback perform both side and guide duties. 2 more identical wheels are on the Carriage Plate.

2 1/2" & 3" – 4 special "mushroom" wheels (1 piece wheel/axle) used as the Guide Wheels. The bearing is in the SB and only 1 retaining ring/washer needed. 2 Side Wheels and 2 more identical wheels on Carriage Plate.

3" – 4 Guide Wheels. Center pair of Side Wheels have hubs machined into one side to space them out for clearance. Otherwise identical to the other 4 Side Wheels.

Washer and bearing counts may vary slightly within the families. Check with HVA customer service if in doubt.

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PARTS REQUIRED:

ITEM	DESCRIPTION	NUMBER REQUIRED BY FAMILY 5/8 TO 6	8 TO 12	14 TO 22
21c	Guide Wheel Axle	*	4	4
22c	Strongback Assembly	1	1	1
25c	Side Wheel Axle	*	6	4
26c	Guide Wheel	*	4	4
27c	Side Wheel	*	6	4
39c	Guide Wheel Bearing	*	4	4
40c	Retainer, GW Gate side	*	4	4
41c	Side Wheel Bearing	*	6	4
42c	Retainer, SW outer	*	6	4
43c	Cup Point Set Screw	1	2	-
44c	Cone Point Set Screw	1	2	-
45c	Retainer, Set Screw	1	2	-
49c	Side Wheel Washer	*	8	4
51c	Guide Wheel Washer	*	0	-
55c	Retainer, SW inner	*	6	4
56c	Retainer, GW SB side	*	4	4

* see "discrepancy notes" above

2.1. Press bearings (39c) into wheels (26c) and bearings (41c) into wheels (27c).

2.2. Assemble retaining rings (40c) to one end of each Guide Wheel Axle (21c) and retaining rings (42c) to the outer end of each Side Wheel Axle (25c).

Note: Some wheel axles have different size grooves at each end. Be sure the retainer is in the right groove.

2.3. Assemble Guide Wheels to Strongback (22c).

2.3.1. Position one Guide Wheel/bearing assembly at one corner of the Strongback, with washer(s) (51c).

Note: The 8" to 12" valves use two washers, one on each side of wheel. The 14" to 22" valves do not use washers.

2.3.2. Line up parts by inserting the alignment tool through center.

2.3.3. Insert an Axle assembly (21c) through all parts and secure with retaining ring (58c).

2.3.4. Repeat previous three steps at the other three corners of the Strongback.

2.4. Assemble Side Wheel to Strongback.

2.4.1. Assemble onto each Side Wheel Axle (25c) one wheel bearing assembly and one thrust washer (49c).

2.4.2. Insert Side Wheel/Axle/washer assemblies through the top holes on either side of the Strongback. Secure with retaining rings (58c).

Note: for 8" to 12" valves retain remaining Side Wheel Axle assemblies for later installation. All other valves, install remaining assemblies.

3. Gate and Link assembly.

Assembly is shown in Figure 3.

Discrepancy notes – The 5/8" valve does not use Carriage Bars or Plates but rather has wheels (same P/N as the Side Wheels) on either end of the Gate. The 2" through 6" valves use a single Carriage Plate with wheels at each end. The 8" and larger valves use solid Carriage Bars although some earlier models use two Carriage Plates with two wheels each.

Washer and bearing counts may vary slightly within the families. Check with HVA customer service if in doubt.

PARTS REQUIRED:

ITEM	DESCRIPTION	NUMBER REQUIRED BY FAMILY 5/8 TO 6	8 TO 12	14 TO 22
27c	Carriage Plate Wheel	2	4	4
28c	Gate Spring	1	2	2
29c	Gate Link Pin, Short	–	2	2
30c	SB Link Pin Short	–	2	2
31c	Link	2	4	8
32c	Gate Link Pin, Long	2	2	2
34c	Carriage Bar/Plate	1	2	2
35c	SB Link Pin Long	2	2	2
36c	Gate	1	1	1
37c	Gate O-Ring	1	1	1
40c	Gate Link Pin Long, Inner Retainer	–	–	2
41c	Carriage Wheel Brng	2	2	2
42c	Carriage Wheel Ret (out)	2	2	2
46c	Gate Spring Pin	1	2	–
47c	Strongback Spring Pin	–	2	–
48c	Link Bearing	4	8	16
49c	Carrg Plt Wheel Wshr	2	–	–
52c	Link Pin Retainer	6	8	14
53c	Carriage Plate Axle	2	–	–
55c	Carriage Wheel Ret (in)	2	–	2
56c	Carriage Plate Stop Scr	1	–	–
57c	Carriage Plate Jam Nut	1	–	–

3.1. Assemble Links and pins to back of Gate according to the Figure. Keep in mind that all Strongback pins and retainers are not installed until the next step.

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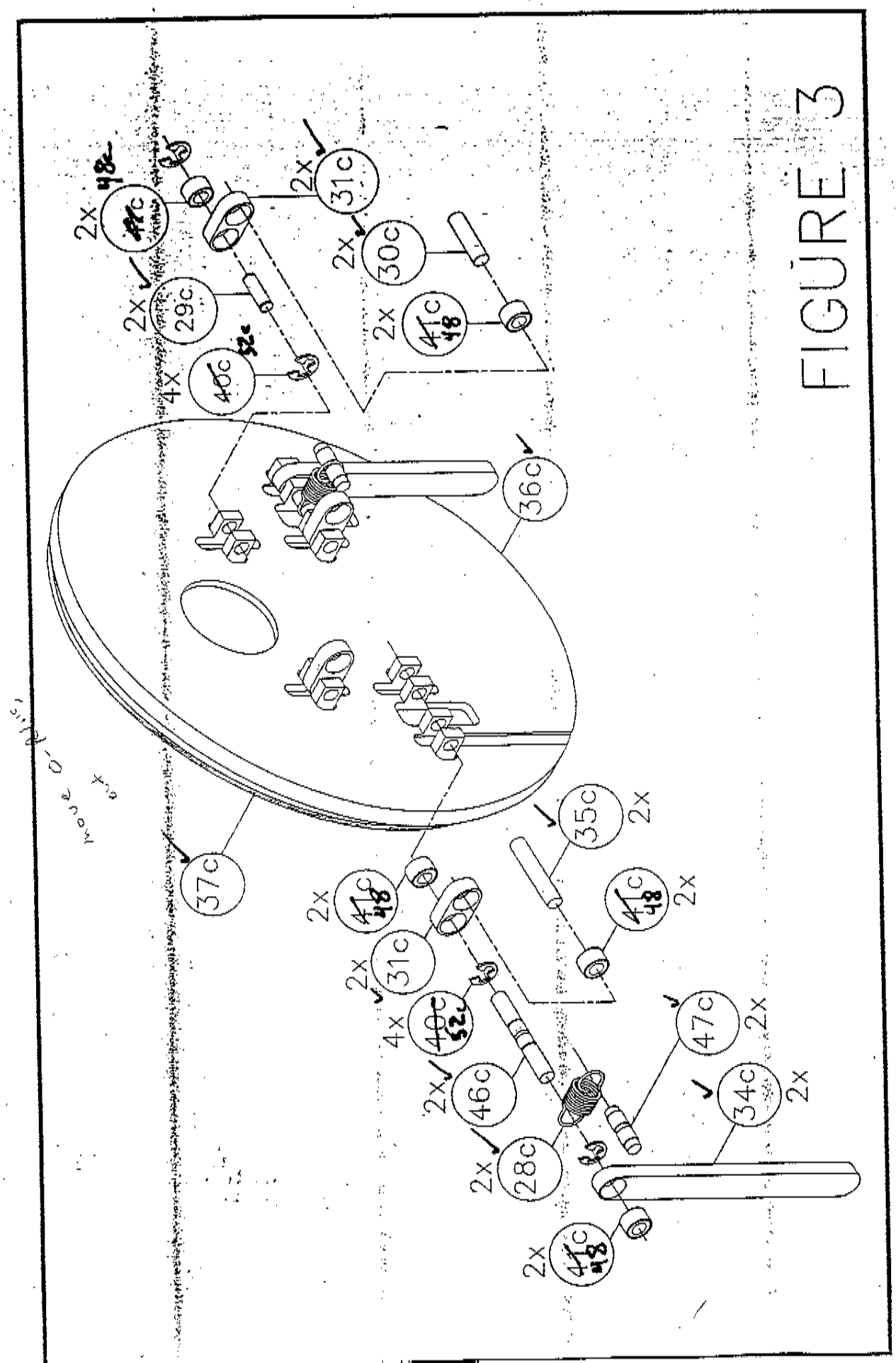
Note: On Models using compression spring(s), the spring is not installed until the next step.


2x 48c
2x 31c
2x 29c
2x 30c
4x 40c
2x 47c 48
36c
37c
2x 35c
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2x 31c
4x 40c
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2x 28c
2x 47c 48
2x 47c
2x 34c

FIGURE 3

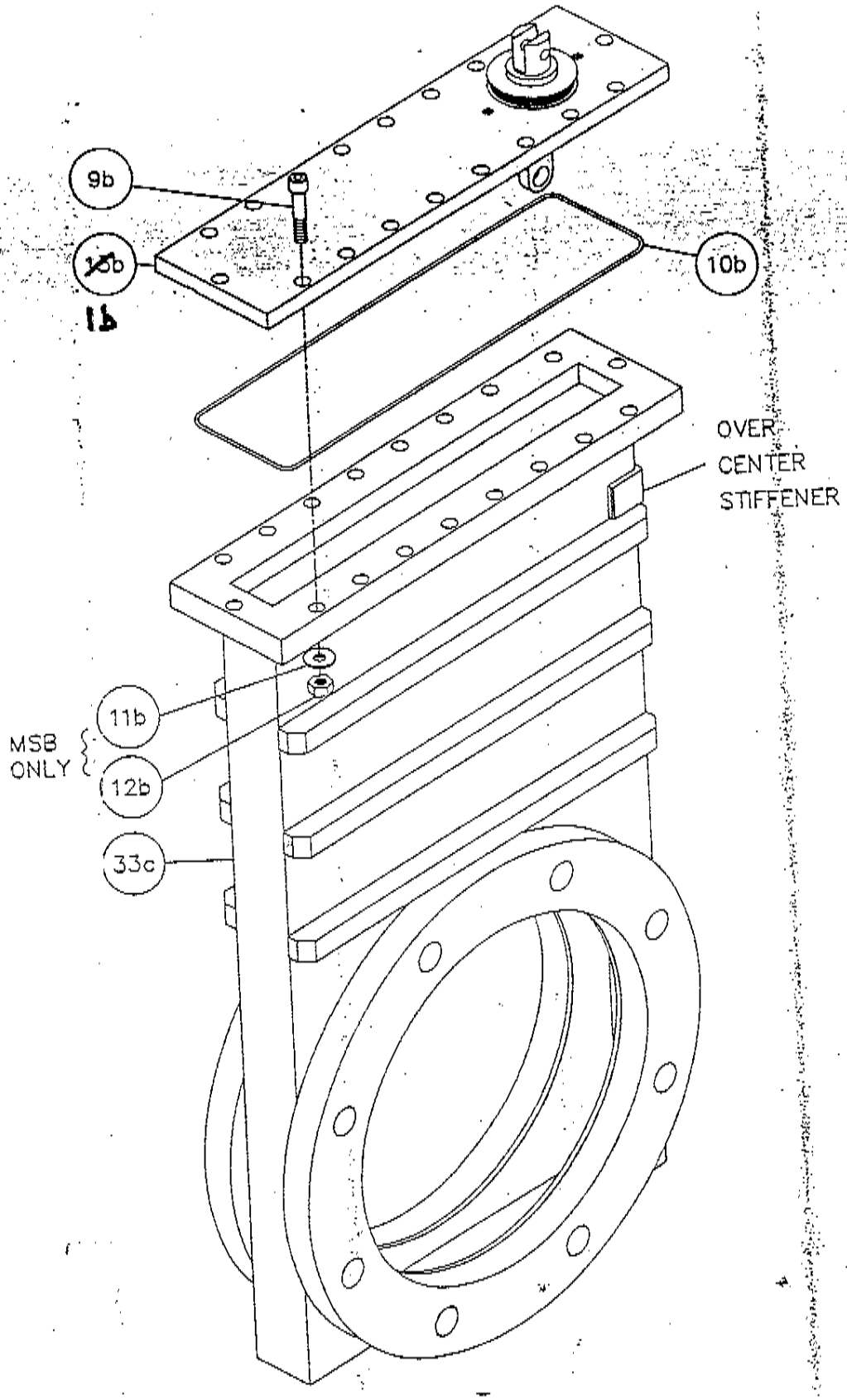

FIGURE 8

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4. Assembly of Strongback and Gate.

All parts listed in previous step.

4.1. Place Strongback on table, machined pocket side up.

4.2. For compression spring models only: Place spring(s) onto Strongback spring pads.

4.3. Lower Gate assembly onto Strongback. Line up Strongback Link Pins with respective Strongback pockets. On compression spring models, line up spring(s) on Gate spring pads.

4.4. Holding Gate and Strongback together, flip assembly over.

Note: When turning the assembly over, bear in mind the Strongback Link Pins can move in the Links unless captured in the Strongback pockets.

The following four steps for 8" to 12" valves only:

4.5. Secure Strongback Link Pins to Strongback center bar with set screws (44c, Figure 2).

4.6. Follow with second set screw (43c, Figure 2) as back-up screw and install retaining ring (45c, Figure 2) in each counter bore against the screw.

4.7. Through slots in Strongback, capture loop of springs and hold in place. Extend springs and insert spring pins (47c, Figure 3).

4.8. Insert the remaining Side Wheel assemblies (27c) and washers (43c). Secure with retaining rings (55c)

The following step for 5/8" to 6" and 14" to 22" valves only:

4.9. Secure Gate to Strongback using Strongback Link Pins and retainers, as appropriate.

4.10. Install O-ring (37c) into Gate groove (36c).

4.10.1. Clean O-ring and groove with trichloroethane or alcohol. Blow out with dry nitrogen.

4.10.2. Position O-ring in groove.

4.10.3. Using a blunt tool or gloved finger, gently press the O-ring into the groove at the four pump out holes.

Note: Be sure both the mold seams on the O-ring are down in the groove and facing the groove walls, otherwise the valve may not seal properly.

4.10.4. Equalize the amount of slack between the four pump out holes.

4.10.5. Carefully press the O-ring into the rest of the groove evenly. Do not stretch to fit.

4.10.6. For Standard Valves apply a thin film of Apiezon L grease to the Gate O-ring.

Note: For Metal Sealed Bonnet (MSB) Valves there is no grease applied to the Gate O-Ring.

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5. Actuator-Bonnet Assembly

Assembly is shown in Figures 4 and 7.

Discrepancy notes - The Bellows and Actuator are integral to the Bonnet on the 5/8" valve. On the 1 1/2" and 2" valves the Actuator is held to the Bellows stem by a single internal retaining ring rather than a pin and two external rings. The 3" and smaller valves do not have a Standpipe-to-Bonnet screw (6b).

Washer and bearing counts may vary slightly within the families. Check with HVA customer service if in doubt.

PARTS REQUIRED:

ITEM	DESCRIPTION	NUMBER REQUIRED BY FAMILY 5/8 TO 6	8 TO 12	14 TO 22
3c	Bellows Stem Bearing	?	1	1
16c	Upper Linkage Bearing	?	1	?
1b	Bonnet Bellows Assy	1	1	1
3	PI Collar	-	-	1
4b	Stem Pin Retainer	2	2	2
5b	PI Collar Set Screw	-	-	1
6b	Standpipe-Bonnet Screw	-	2	2
7b	S'Pipe-Actuator Screw	4	4	4
	Note: Valves with PI boxes use only 2 screws 7b			
8b	Bellows Stem Pin	1	1	1
3i	Standpipe	1	1	1
23p	Pneumatic Actuator Assy	1	1	1
10m	Manual Actuator Assy	1	1	1

5.1. Press one bearing (16c, Figure 5) into the Bonnet pivot and one bearing (3c, Figure 5) into the bottom of the Bellows stem. Be careful to not damage the Bellows by over extending or collapsing them.

5.2. Attach Actuator to Bonnet Bellows assembly (1b).

5.2.1. 14" to 21" valves only: Attach PI Bar collar (3b) using set screw (5b)

5.2.2. Place Standpipe (3i) over Bellows and install two screws (6b), aligning the other two holes on the Standpipe with respective mounting holes in the Bonnet.

Note: the following three steps for 2 1/2" and larger valves only

5.2.3. Assemble pin (8b) to one retaining ring (4b).

5.2.4. Lift the Bellows using the PI bar extending the top of the Bellows stem until hole aligns with access hole in Standpipe. Partially insert pin (8b) into the Bellows stem. Do not over stretch the Bellows.

5.2.5. Insert the drive shaft from either the Manual Actuator (10m) or the Pneumatic Actuator (23p) as appropriate into the Bellows stem. Push the pin through and secure with another retaining ring (4b).

5.2.6. 1 1/2" and 2" valves only: Secure Actuator to Bellows stem with internal retaining ring (4b).

5.3. Attach Actuator to Standpipe.

Note: The following two steps are for Pneumatic Actuators only.

5.3.1. Attach air lines to Pneumatic Actuator. Note: be sure there is 0 psi on the lines.

5.3.2. Open air line to bottom port of Actuator, gradually increasing pressure until Actuator mounting flange is near Standpipe. This should require no more than 10 psi.
CAUTION! DO NOT USE HIGHER PRESSURE AT THIS STAGE.

5.3.3. Manual Actuators only: Turn the knob until Actuator mounting flange is near Standpipe.

5.3.4. Align the holes and secure the Actuator with screws (7b) in the holes along the long axis of the Bonnet. The other two holes are left open for

the later installation of the PI box. If no PI box is to be installed, then insert all four screws (7b).

5.3.5. Pneumatic Actuators only: Test by cycling the air a few times at low pressure to be sure it moves smoothly. Disconnect air lines.

5.3.6. Manual Actuators only: Test by running the Actuator up and down a few times to be sure all components move smoothly.

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6. Upper Linkage to Bonnet Bellows assembly.

Assembly shown in Figure 5.

Discrepancy notes - On 1 1/2" and 2" valves, the Stop Screw does not use a washer. Other washer and bearing counts may vary slightly within the families. Check with HVA customer service if in doubt.

PARTS REQUIRED:

ITEM	DESCRIPTION	NUMBER REQUIRED BY FAMILY 5/8 TO 6	8 TO 12	14 TO 22
1c	Pivot Pin, UL	1	1	1
2c	Upper Linkage Assy	1	1	1
3c	Bellows Stem Bearing	1	2	1
13c	Stop Screw	1	1	1
14c	Stop Screw Jam Nut	1	1	1
15c	Stop Screw Lock Washr	1	1	1
16c →	Upper Linkage Bearing	4	4	4
17c	Bellows Stem Pin	1	1	1
18c	Upper Link Retainer*	2	2	2
20c	Bellows Stem Retainer	2	2	2
50c	Thrust Washer/Bearing	-	4	4

6.1. Place Bonnet Bellows assembly on work surface, Actuator down. Place the other end of the Bonnet Bellows assembly on a support so that the Bonnet is level.

6.2. Press all bearings (3c) and (16c) into Upper Linkage (2c) as shown in Figures 3 and 6.

6.3. Assemble stop screw (13c) with nut (14c) and washer (15c) to Upper Linkage.

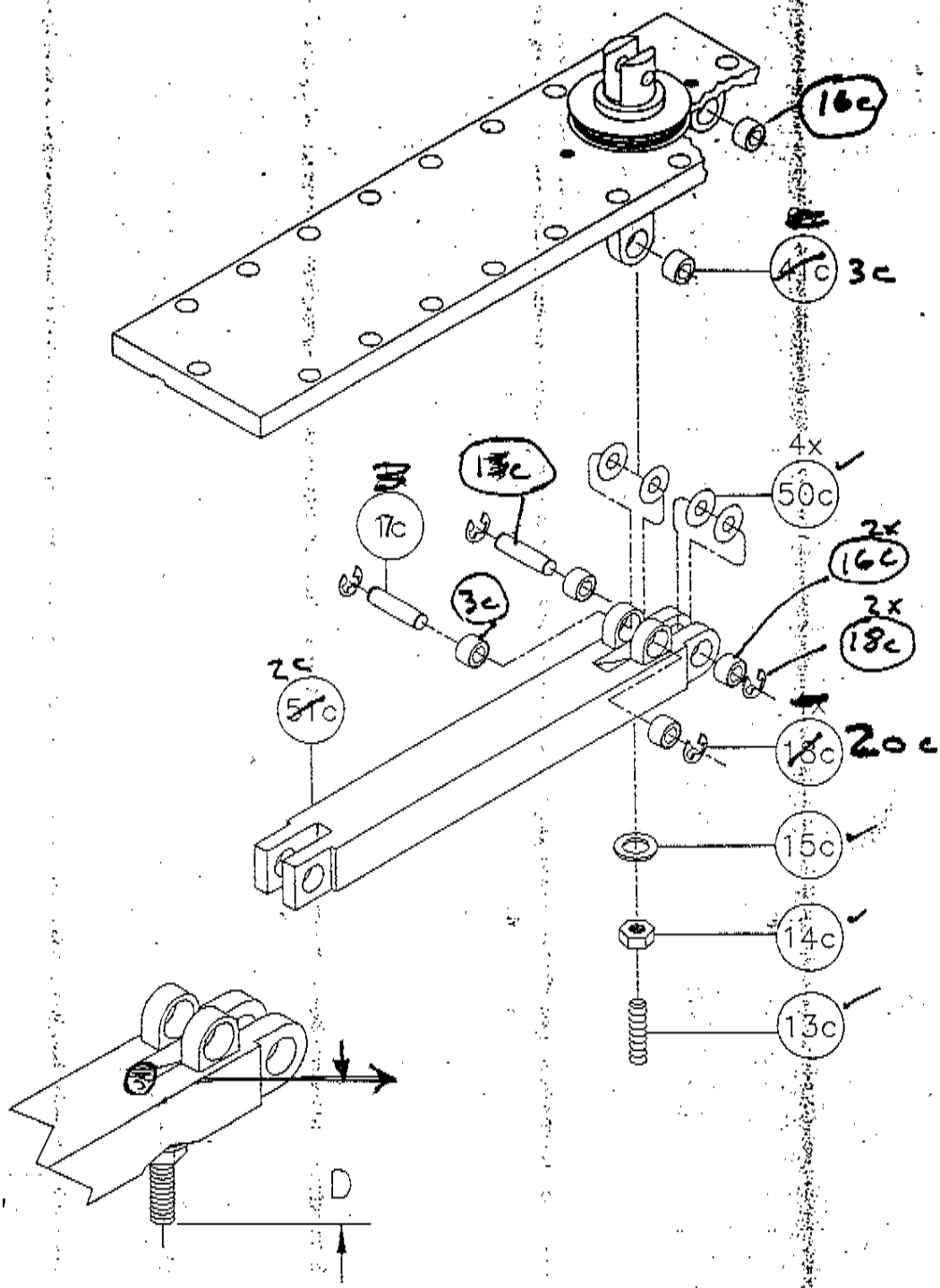

FIGURE 5

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6.3.1. Begin adjustment of the over center stop by setting the dimension "D" in Figure 5 to the distance listed in chart 2 according to the valve size. Further adjustment may be required after the valve is assembled.

CHART 2

VALVE SIZE	BEGINNING STOP SCREW DIMENSION
1.5	.690
2.0	.685
2.5	.980
3.0	1.007
4.0	1.312
6.0	1.300
8.0	1.490
10.0	1.900
12.0	1.820
14.0	1.750
16.0	1.610
21.0	2.180

6.4. Pneumatic Actuators only: With a low pressure air supply (10 psi), move Actuator enough to extend the Bellows stem above the Bonnet Bellows flange.

6.5. Manual Actuators only: Move Actuator enough to extend the Bellows stem above the Bonnet Bellows flange.

CAUTION! DO NOT OVER EXTEND THE BELLOWS.

6.6. Mate the stem pulls of the Upper Linkage and the Bellows stem.

6.6.1. For 6" and larger valves only: Insert two thrust bearing/washers (50c), on on either side of the Bellows stem.

6.6.2. Line up parts by inserting the alignment tool through the center.

6.6.3. Insert pin (17c) through all parts and secure with retaining rings (20c).

6.7. Attach the Upper Link to the Bonnet pivot.

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6.7.1. Using either the low pressure air supply or manual Actuator as appropriate, continue moving the Bellows enough to align the Upper Linkage end with the pivot on the Bonnet Bellows flange.

CAUTION! DO NOT OVER EXTEND THE BELLOWS.

6.7.2. Assemble the thrust washers/bearings (50c), pin (1c) and retaining rings as in previous section. Note:The 3" and smaller valves do not use washers.

6.8. Test by cycling the Actuator a few times to be sure the assembly moves freely.

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7. Carriage assembly to Bonnet Bellows assembly.

Assembly shown in Figure 6.

Discrepancy notes - Washer counts may vary slightly within the families. Check with HVA customer service if in doubt.

PARTS REQUIRED:

ITEM	DESCRIPTION	NUMBER REQUIRED BY FAMILY 5/8 TO 6	8 TO 12	14 TO 22
4c	Flat Washer LLUL	-	2	2
6c	Cotter Key	1	-	1
12c	Elbow Pivot Pin	1	1	1
18c	Upper Link Retainer	-	2	-

7.1. 8" to 12" valves only: Assemble pin (12c) and one retaining ring (18c).

7.2. Lay both assemblies on their sides. Position free end of Upper Linkage (2c) over end of Lower Linkage UL (5c) on the Carriage assembly.

7.3. Insert washers (4c) on both sides of Lower Linkage UL, between Lower Linkage UL and Upper Linkage forks. Note: The 3" and smaller valves do not use washers.

7.4. Align parts with an alignment tool. Insert pin (12c).

7.5. 8" to 12" valves only: Fasten with another retaining ring (18c).

7.6. All other valves: Fasten with cotter key (6c)

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8. Carriage-Bonnet assembly to Body assembly.

Assembly shown in Figures 7 and 8.

Discrepancy notes - The 1 1/2" through 3" MSB valves have threaded Body flanges eliminating the need for the nut (12b). Washers (11b) are still used. The nut and screw counts in the table are the range within the families. Check your individual valve or with HVA customer service if in doubt.

PARTS REQUIRED:

ITEM	DESCRIPTION	NUMBER REQUIRED BY FAMILY 5/8 TO 6	8 TO 12	14 TO 22
2b	5" Pipe-Bonnet Screw	2	2	2
9b	Bonnet Screw	8-12	16-20	20-36
11b	MSB Washer	8-12	16-20	20-36
12b	MSB Nut	8-12	16-20	20-36
=	Body Assembly	1	1	1

8.1. Clean all components and blow off with dry nitrogen occasionally while assembling.

8.2. Insert Carriage-Bonnet Assembly into Body (33c) with the stop screw on the Upper Linkage on the same side of the Body as the over center stiffener.

8.3. Insert bolts (9b) through Bonnet flange and into the Body flange, one at each end.

8.3.1. Standard Valves: screw bolt directly into Body flange. Fasten finger tight.

8.3.2. MSB Valves: secure finger tight with washer (11b) and nut (12b).

8.4. Insert bolts (2b) through Standpipe, Bonnet and Body flanges. Secure finger tight (with nut (12b) and washer (11b) on MSB valves).

8.5. Align the edges of the Bonnet and Body flanges by carefully tapping a with nylon or rubber mallet.

8.6. Tighten the bolts to 10 lb-ft.

8

8.7. Close the valve using 30 to 40 psi line pressure or the manual Actuator, as appropriate. The Gate should remain sealed when the air is turned off or the handle is released. If it does not remain sealed, the stop screw on the Upper Linkage may be set too long, the T-Bolt may be set too long or both.

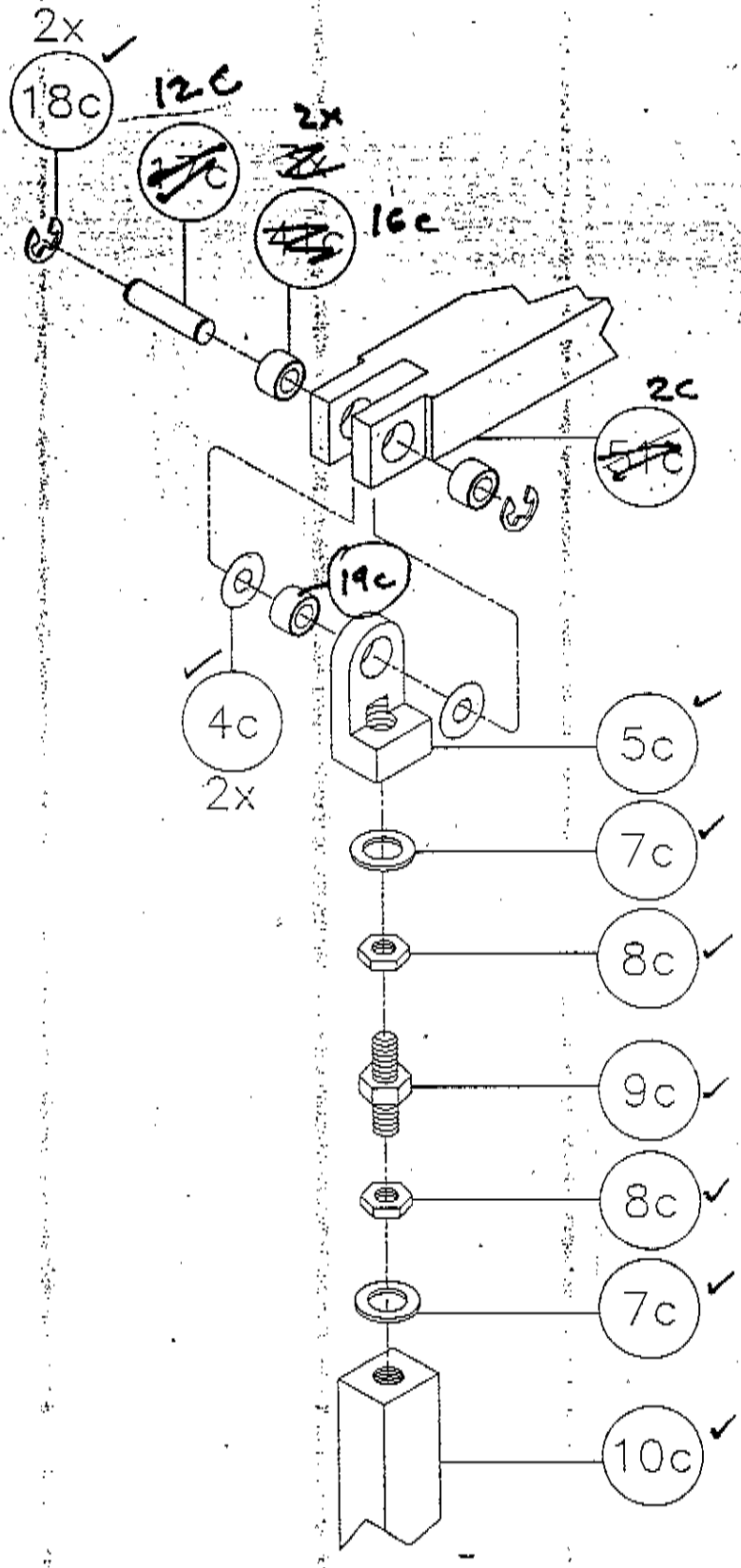

FIGURE 6

10

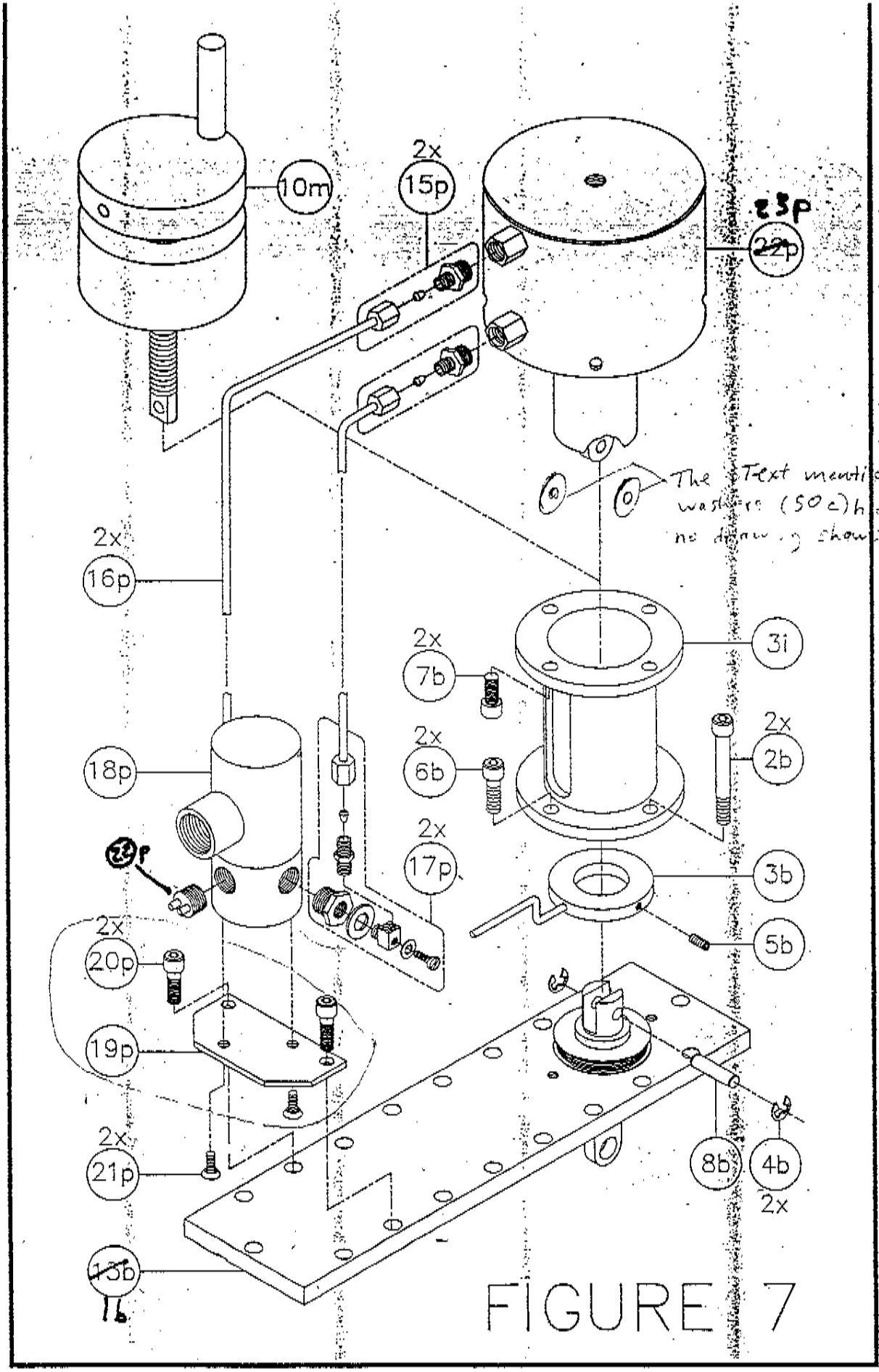
10m
2x
15p
23p
22p
The Text mentions 2 washers (50c) here, but no drawing shows them
2x
16p
2x
7b
3i
2x
6b
2x
2b
18p
2x
17p
3b
22f
2x
20p
5b
19p
2x
21p
8b
4b
2x
15b
16

FIGURE 7

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9. Linkage Adjustment

When the Gate locks closed there is a distinct click, if properly adjusted.

If the linkage does not lock, there may be too much compression. Either the T-Bolt (9c, Figure 6) needs to be shortened or the Upper Linkage stop screw (13c, Figure 5) is too long.

If there is a gap between the Gate and the Body wall after closing, the T-Bolt may need to be lengthened, but also check the stop screw on the Upper Linkage. If the stop screw allows the linkage to go beyond the lock point, the Gate will start to reopen. For correct adjustment you must determine whether the Gate closed and went over center or just never closed.

If there is a loud bang against the side of the Body at the over center stiffener, the stop screw is too short. The stop screw should meet the Body wall after the linkage has locked, yet before the Gate drops away from the Body wall.

After making these observations it is a matter of trial and error to determine the amount of adjustment required to set the T-Bolt and stop screw correctly. Work carefully and you will develop the knack for it.

9.1. Adjusting The T-Bolt

To adjust the T-Bolt, hold the bolt with a wrench and loosen both jam nuts (8c, Figure 6). Turn the bolt clockwise to shorten the linkage (which decreases compression). Turn the bolt counter-clockwise to lengthen the linkage (which increases compression).

9.2. Adjusting the Stop Screw

To adjust the Stop Screw, loosen the jam nut (14c, Figure 5) and turn the screw clockwise to shorten or counter-clockwise to lengthen.

Note: The only sound the valve should make while closing is the hiss of the pneumatic actuator (on pneumatic valves) and the "click" of the linkage closing. If you hear other noises such as rubbing, dragging or squeaking, try to determine the cause and fix as necessary. If the cause can not be determined, return the valve to High Vacuum Apparatus for repair.

9.3. Adjusting the Pneumatic Actuator

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On valves 8" and larger, the Pneumatic Actuator must be adjusted to set the maximum "up" travel of the Gate when opening. To minimize the noise and shock of the valve opening and closing, this should be done with the valve sitting in the position it will be in during use. The Actuator adjustment will then position the Carriage assembly in the Body correctly.

9.3.1. Set the valve in the position of use. The valve should be partially open when the stop screw is adjusted.

9.3.2. Remove the set screw in the top of the air cylinder.

Note: If the Actuator stop screw is already adjusted to the full "open" position, then the microswitches will require repositioning.

9.3.3. Adjust the Actuator stop screw with a flat blade screwdriver.

9.3.4. Open the valve all the way after adjusting the screw to , check the Gate position. Repeat the adjustment until the bottom of the Gate is approximately 1/16 inch inside (above) the port opening when fully open.

9.4. Before taking the valve apart for final assembly, put masking tape on the edge of both the Bonnet Bellows and Body flanges.

9.4.1. Mark both flanges with lines. These will be used as register marks when putting the Carriage back in the Body.

9.4.2. Remove all Bonnet screws and withdraw the Carriage Assembly.

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10. Final Assembly after adjustments have been made.

Discrepancy notes - The 1 1/2" through 3" MSB valves have threaded Body flanges eliminating the need for the nut (12b). Washers (11b) are still used. The nut and screw counts in the table are the range within the families. Check your individual valve or with HVA customer service if in doubt.

Note: If you are only changing the O-ring, put masking tape on the edge of both the Bonnet Bellows and Body flanges. Mark both flanges with lines. These will be used as register marks when putting the Carriage back in the Body.

PARTS REQUIRED:

ITEM	DESCRIPTION	NUMBER REQUIRED BY FAMILY 5/8 TO 6	8 TO 12	14 TO 22
9b	Bonnet Screw	8-12	16-20	20-36
10b	Bonnet O-Ring/Gasket	1	1	1
11b	MSB Washer	8-12	16-20	20-36
12b	MSB Nut	8-12	16-20	20-36

Note: The following items are for pneumatically operated valves with the optional solenoid

16p	Air Line	A/R	A/R	A/R
17p	Fitting Kit	2	2	2
18p	Solenoid	1	1	1
19p	Solenoid Mounting Plate	1	1	1
20p	Solenoid-Bonnet Screw	2	2	2
21p	Solenoid Mounting Screw	2	2	2
22p	"Speed Control" Plug	1	1	1

10.1. Standard Valves: clean the O-ring (10b) with alcohol.

10.2. MSB Valves: clean the gasket (10b) with Skotchbrite or equivalent and trichloroethane or alcohol.

10.3. Position the Bonnet Bellows-Carriage assembly on the table upside down (i.e. resting on the Actuator). Rest free end of Bonnet Plate on support so that the Bonnet is horizontal.

10.4. Position the gasket (MSB) or O-ring (STD) on the Bonnet Bellows-Carriage assembly.

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Note: Be sure all parts are clean. Check Bonnet Bellows and Body flanges for any nicks or scratches. These could prevent proper sealing.

10.5. Check the position of the gasket. It should be in the groove in the Bonnet Bellows flange.

10.6. Slide the Body over the Carriage. Be sure that the over center stiffener is on the same side as the Stop Screw.

10.7. Lay the valve on its side.

10.8. Insert two bolts (9b) into the center holes of the flange. For MSB valves also use washers (11b) and nuts (12b). Tighten finger tight.

Note: The following three steps for Pneumatic Actuators with the optional solenoid valve only.

10.9. Attach the solenoid mounting plate (19p) to the solenoid valve (18p) using 2 screws (21p).

10.10. Attach solenoid/mounting plate assembly to Bonnet using 2 screws (20p).

10.11. Connect solenoid valve port 1 to top Pneumatic Actuator port using air line (16p) and fitting kits (15p) (included with cylinder) and (17p) at the solenoid. Connect valve port 2 to bottom Actuator port using similar fitting kits.

10.12. Insert two bolts (2b) through the Standpipe flange into the Bonnet. For remaining flange holes insert bolts (9b).

10.13. MSB valves only: secure all the bolts with washers (11b) and nuts (12b).

10.14. Tighten all flange bolts finger tight.

10.15. Tap the flanges with a nylon or rubber mallet to align to previously marked lines.

10.16. Tighten the bolts gradually (refer to Figure 9 for tightening sequence).

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10.16.1. Tighten bolts sequentially a fraction of a turn at a time according to the tightening sequence.

10.16.2. As the bolts tighten make the percentage of turn equally smaller on all the bolts.

10.16.3. Repeat the sequence until all the bolts are tightened to 21 lb-ft of torque.

10.17. Cycle test and leak check the valve prior to installation.

FIGURE 9
Bonnet Tightening Sequence

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11. Install the position indicator.

Assembly shown in Figure 10.

Discrepancy notes - None.

PARTS REQUIRED:

ITEM	DESCRIPTION	NUMBER REQUIRED BY FAMILY 5/8 TO 6	8 TO 12	14 TO 22
1i	PI Box Assembly	1	1	1
2i	Micro-Switch Kit	1	1	1
4i	PI Box Mounting Screws	2	2	2
5i	PI Box Cover	1	1	1
6i	Strain Relief	1	1	1
7i	Wire Harness	1	1	1

11.1. Assemble microswitches (2i) on opposite ends of bracket in the PI box (1i) as shown using screws provided.

11.2. Thread wire harness (7i) through PI box and secure with strain relief (6i).

11.3. Assemble the PI Box to the Standpipe using 2 screws (4i).

11.4. To adjust the microswitches, operate the valve to the open and closed positions and slide each respective microswitch into the PI bar until the switch clicks and tighten the screws.

11.5. Install the PI Box cover (5i).

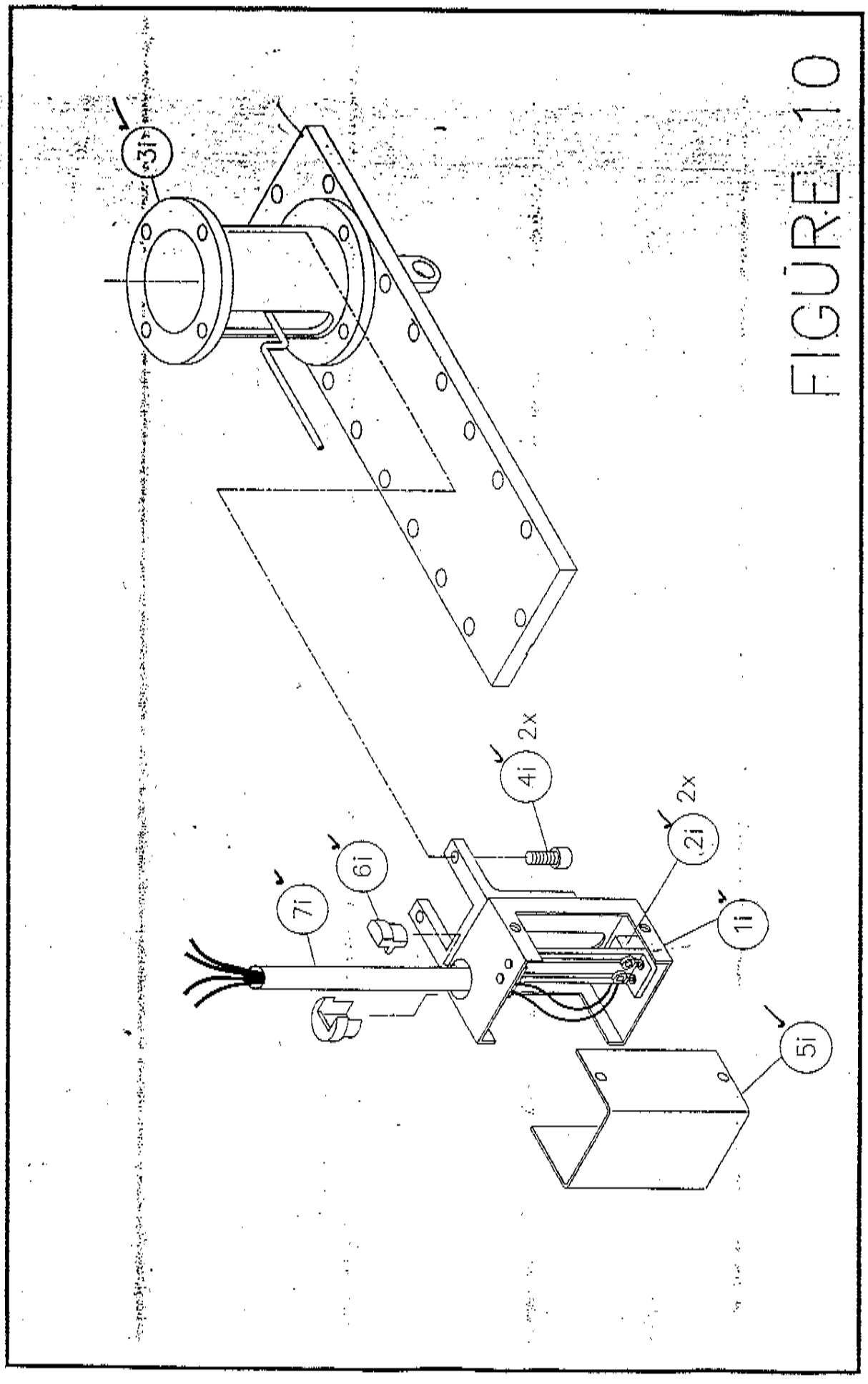

FIGURE 10

12. Installation of valve in the system.

12.1. Determine that the valve and adjacent plumbing in the vacuum system will be adequately supported when installed.

12.2. Make sure that the mating flanges are in line, parallel and the correct distance apart to minimize straining of valve Body.

12.3. Remove the flange cover and wipe the flange and the gaskets with a lint free wipe. In the case of O-ring seal flanges, apply light film of vacuum grease to the O-ring and install in flange groove.

Caution: During placement in the system, make sure that no foreign particles enter the valve.

12.4. Bolt up valve-to-system flanges.

Caution: It is essential that the proper length bolts be used. BOLTS LONGER THAN THE COMBINED THICKNESS OF BOTH MATING FLANGES WILL DAMAGE THE BODY PANELS AND DESTROY THE SEAL SURFACE AREA FOR THE GATE O-RING.

For best results, always use bolts that are 1/4 of an inch shorter than the combined thickness of both mating flanges.

12.4.1. Lightly grease the flange bolts with high temperature non-galling type grease when installing.

12.4.2. Carefully tighten around the flange in a 180 degree alternating pattern until flanges are metal to metal and bolts are snug.

12.4.3. Do final tightening according to Chart 3

CHART 3 SYSTEM FLANGE TORQUES

FLANGE TYPE	TORQUE
All O-Ring sealed flanges	5-10 lb-ft
Metal sealed up to 2.75" O.D.	16 lb-ft
Metal sealed up to 10" O.D.	26 lb-ft

Note: Valves will work equally well with Actuator center line located in any position around the flange. In addition, vacuum may be applied to either side of the Gate and still maintain a vacuum tight seal. However, in air lock applications and other situations where the valve stays under vacuum, it is preferable to install the valve with the vacuum on the underside of the valve Gate so that the valve Body remains under vacuum at all times and the pumpdown of the valve Body is eliminated.

12.5. Operation Check, Manually operated valves.

12.5.1. Check to see that the valve actuation works freely.

12.6. Operation Check, Pneumatically operated valves.

12.6.1. Connect the compressed air supply either to the solenoid (if so equipped) or directly to the cylinder. Use teflon tape on the threads to insure leak proof joints.

12.6.2. For continued trouble free operation, it is recommended that an air filter/lubricator be used in the air line system.

12.6.3. Refer to the solenoid nameplate for the correct voltage and current type when connecting to the control system.

12.6.4. Check the operation of the valve carefully carefully starting with 5 to 10 psi air pressure. Increase the pressure slowly until the valve is heard to mechanically lock over center. At this point, note the pressure and increase by an additional 5 psi. The valve is now set and ready for operation.

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13. Operation Notes

13.1. To ensure trouble free use, keep the valve clean and free of contaminates.

13.2. DO NOT operate pneumatic valves above 100 PSI. Higher pressures may damage the piston Actuator and may cause serious injury to personnel.

13.3. DO NOT excessively tighten or adjust the hand operated valve, especially to prevent leakage. The Gate mechanism is designed to go "over-center" in order to achieve a seal. Any further tightening of the Actuator will only push the linkage further over center and will increase the leak rate. It will also damage internal linkage of the valve.

13.4. Check for O-ring damage and cleanliness if leakage should occur at the Gate.

14. Drawn cup bearing installation procedures.

Installation tool illustrated in Figure 11.

14.1. A drawn cup bearing must be pressed into its housing.

14.1.1. An installation tool must be used in conjunction with a standard press.

14.1.2. It is advisable to use a positive stop on the press tool to locate the bearing properly in the housing.

14.1.3. The assembly tool should have a leader or pilot, as shown, to aid in starting the bearing true in the housing.

14.1.4. The installation tool must be coaxial with the housing bore.

14.1.5. The ball detent shown on the drawing is used to assist in aligning of the rollers of a full complement bearing during installation and to hold the bearing on the installation tool.

14.2. Assemble the bearing with the stamped end (the end with identification markings) against the angled shoulder of the pressing tool.

Warning: Never press the bearing tightly against a shoulder in the housing. If it is necessary to use a shouldered housing, the depth of the housing bore must be sufficient to ensure that the housing shoulder fillet, as well as the shoulder face, clears the bearing.

14.3. To remove a Drawn Cup bearing from a through-bored housing, use a tool similar to the installation tool illustrated, but without the stop.

Figure 11
Bearing Installation Tool

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15. Pneumatic Actuator Maintenance

Actuator Assembly is shown in Figure 12.

Discrepancy notes - Actuators for the 6" and smaller valves do not have a Stop adjustment screw or its related O-Ring and set screw. They also do not have the internal tension spring nor the related thrust washer. The Piston/Drive Shaft for these smaller valves comes as a two part assembly whereas in the 8" and larger valves it is machined as one piece. For the 5/8" valve, the Actuator is integral with the Bellows and Standpipe. For the 1 1/2" and 2" valves, the Actuator is held to the Bellows Stem by a single internal retaining ring rather than a pin and two external rings.

PARTS REQUIRED:

ITEM	DESCRIPTION	NUMBER REQUIRED BY FAMILY 5/8 TO 6	8 TO 12	14 TO 22
1p	Cylinder Nipple	2	2	2
2p	Set Screw	–	1	1
3p	Air Cylinder Assy	1	1	1
4p	Stop Screw	–	1	1
5p	Socket Head Screw	4	4	4
6p	Stop Screw O-Ring	–	1	1
7p	Air Cylinder Spring	–	1	1
8p	Bearing Kit	–	1	1
9p	Drive Shaft (1-piece)	–	1	1
9-1p	Piston only	1	–	–
9-2p	Drive Shaft only	1	–	–
9-3p	Piston-Shaft screw	1	–	–
10p	Piston O-Ring	1	1	1
11p	Inter Plt O-Ring Int	1	1	1
12p	Inter Plt O-Ring Ext	1	1	1
13p	Intermediate Plate	1	1	1
14p	Bushing "DU"	1	1	1

CAUTION: The air cylinder assembly sold under this agreement is potentially dangerous. DO NOT DISMANTLE EXCEPT IN STRICT CONFORMITY WITH THE FOLLOWING DIRECTIONS. ANY UNAUTHORIZED DISASSEMBLY WILL VOID THE WARRANTY.

Note: If your valve is currently under warranty, any disassembly will void the warranty. Please contact HVA to check warranty status.

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15.1. Disassembly Notes: The spring loaded Pneumatic Actuators (8" and larger valves) contain a medium high strength die spring. This spring is designed for reduction of noise and vibration during cycling of the valve and is not intended for sealing the Gate or holding differential pressure.

Caution is necessary whenever dismantling because the spring maintains load at all times.

15.2. Removing the spring loaded Pneumatic Actuator.

Please follow the instructions outlined below closely to insure the safety of the person disassembling the Actuator. For Actuators without internal springs, air may be used to move the carriage into position for removal, but is not required to hold it in position.

15.2.1. Attach air lines with zero psi to the Pneumatic Actuator.

15.2.2. Slowly increase air pressure until Gate starts to move towards the open position.

15.2.3. Allow Gate to open until Bellows stem/drive shaft pin is aligned with the access hole in the Standpipe.

15.2.4. Hold air pressure constant so that Gate remains static.

NOTE: This will oppose the force of the Actuator's internal spring thus allowing easier removal of Actuator.

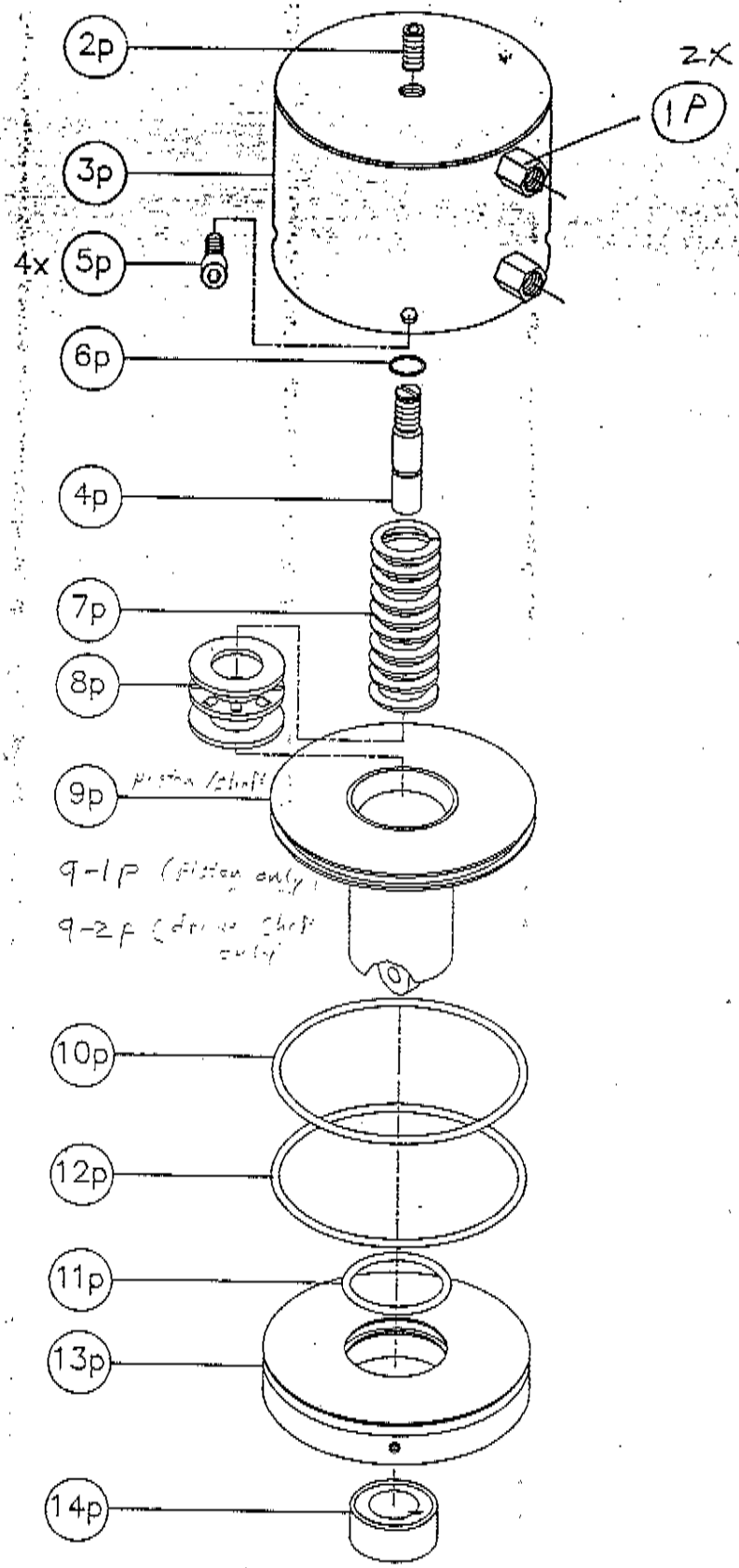
2p
2X
1P
3p
4x
5p
6p
4p
7p
8p
9p
piston/shaft
9-1p (piston only)
9-2p (drive shaft only)
10p
12p
11p
13p
14p

FIGURE 12

15.2.5. Detach Pneumatic Actuator from Standpipe by removing the four screws.

15.2.6. Slowly decrease air pressure and remove all air lines.

15.2.7. Remove the Actuator from the Bellows stem (see "Discrepancy notes" above regarding 5/8" through 2" valve actuators).

15.2.7.1. Pull on the Actuator until the Bellows stem pin is in line with the access holes on the sides of the Standpipe.

15.2.7.2. Remove retainer rings on both sides of Bellows stem and save for reassembly.

15.2.7.3. Push out the Bellows stem pin through the access hole in the Standpipe.

NOTE: The tool used for pushing must be smaller or equal in diameter to Bellows stem pin.

15.3. Actuator disassembly.

Note: For reassembly of Actuator follow the steps in reverse.

15.3.1. Place Pneumatic Actuator under a hydraulic or arbor press, with the air cylinder top facing downward on a non-skidding surface.

Note: press not required for 6" and smaller valve actuators since there is no internal spring.

15.3.2. Push down about 1/4" on Actuator shaft, just enough to remove spring load from side screws.

15.3.3. Lock the press in this position and remove screws (3p).

15.3.4. Unlock the press unit and carefully release the compressed spring.

15.3.5. The intermediate plate (13p) should normally slide out of the cylinder when compressed spring is released. If it does not, keep the Actuator under the press and gently pry intermediate plate to loosen it.

NOTE: EXCESSIVE FORCE MAY DAMAGE O-RING SURFACES.

15.4. Actuator reassembly notes.

The O-ring should be well lubricated before installing using Dow Corning high vacuum silicon grease or equivalent on the O-ring, and on the inside surface of the Air Cylinder (3p).

Piston and intermediate plate should be pushed into cylinder as straight as possible to prevent damage to O-ring.

Use Dow Corning Molykote 44 grease on the spring, washers, bearings, and screws to prevent galling.

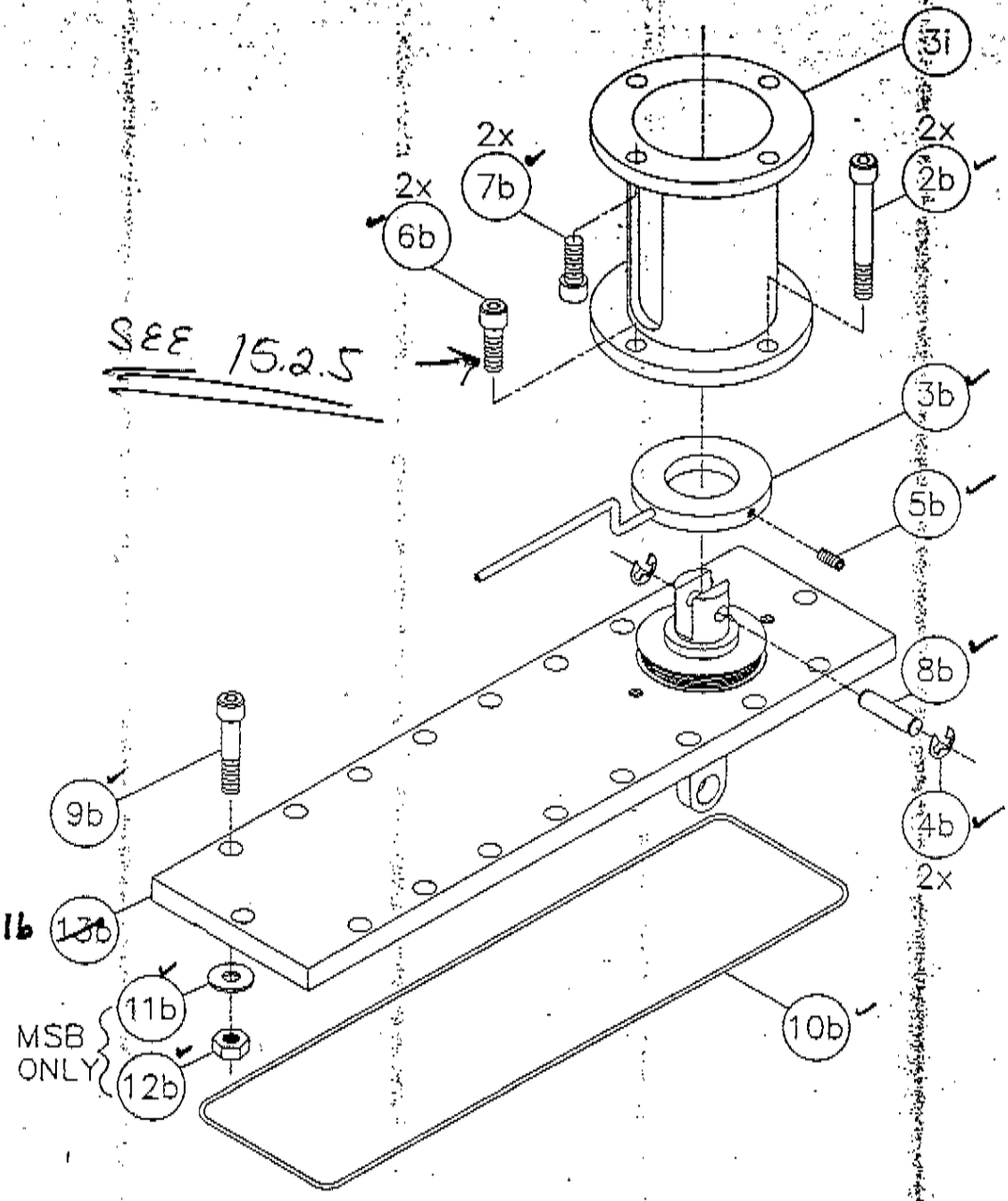
3i
2x
7b
2x
6b
2x
2b
SEE 15.2.5
3b
5b
8b
9b
4b
2x
1b
12b
11b
MSB
ONLY
12b
10b

FIGURE 4

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WARRANTY

Each product sold by High Vacuum Apparatus (HVA) is warranted to be free from manufacturing defects that adversely affect the normal functioning thereof during the one-year period immediately following delivery thereof by HVA (or in the case of products or components of any product purchased by HVA from another for any lesser period of time that such manufacturer warrants said product or components to HVA.)

Due to the potential danger from a misuse of the goods sold under this agreement, SELLER'S WARRANTIES OF FITNESS AND MERCHANTABILITY, AS WELL AS ANY OTHER EXPRESS WARRANTIES MADE IN CONNECTION WITH THIS SALE, SHALL NOT BE EFFECTIVE OR ACTIONABLE UNLESS the product is operated under conditions of normal use and that regular, periodic maintenance and service is performed or replacements made, in accordance with the instructions provided by HVA.

The foregoing warranty shall not apply to any product or component that has been repaired or altered by anyone other than an authorized HVA representative or that has been subject to improper installation or abuse, misuse, negligence or accident. HVA shall not be liable for any damage, loss or expense, whether consequential, special, incidental, direct or otherwise, caused by, or arising out of or connected with manufacture, delivery (including any delay in or failure to deliver), packaging, storage or use of any product so sold or delivered by HVA, whether or not resulting from negligence or from breach of contract except that in the event that any product sold or delivered by HVA shall fail to conform to the foregoing warranty or to the description thereof contained herein, the purchaser thereof, as its exclusive remedy, shall upon prompt notice to HVA of any such defect or failure and upon the return of the product, part or component in question to HVA at its factory, with transportation charges prepaid, and upon HVA's inspection confirming the existence of any defect inconsistent with said warranty or any such failure, be entitled to have such defect or failure cured at HVA's factory and at no charge therefore, by replacement or repair of said product as HVA may elect.

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