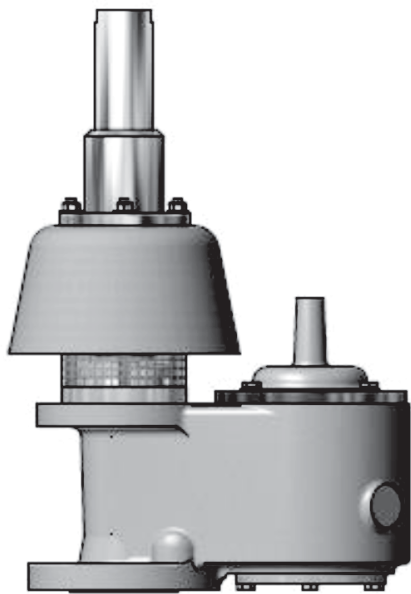




ANDERSON GREENWOOD 4020HP PRESSURE AND VACUUM RELIEF VALVE

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

Before installation, these instructions must be read carefully and understood.



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1.0 SAFETY PRECAUTIONS

Read and understand this instruction manual before installing, operating, or performing maintenance on the Anderson Greenwood 4020HP Pressure and Vacuum Relief Valve (PVRV) following all precautions and warnings noted herein.

NOTE

This manual is issued for guidance only and does not affect our standard terms and conditions and our Product Limited Warranty, all of which are available on request.

WARNING

The relief valve must be isolated from tank pressure before servicing. All gas/vapour must be blocked and pressure safely vented. Wear appropriate protective clothing and breathing apparatus if hazardous gas/vapours are present. Use appropriate lifting equipment where required.

2.0 GENERAL DESCRIPTION

The Anderson Greenwood 4020HP PVRV is employed in gas/vapour service applications for low pressure storage tanks, vessels or applications requiring combined low pressure and vacuum protection with high capacity flow requirements. This product helps to prevent damage to the tank and also prevents the tank's contents from escaping, ensuring the safety of personnel and the surrounding environment.

Pressure/Vacuum valves are designed to limit the maximum pressure or vacuum that can exist in a tank due to inflow or outflow of the tank contents or due to changes in temperature as a result of environmental conditions.

The Anderson Greenwood 4020HP PVRV consists of a common inlet connection with two separate seats, pressure and vacuum. The vacuum seat draws atmospheric pressure into the tank being protected and the pressure seat discharges directly to atmosphere.

- For ease of maintenance, both pressure and vacuum seats are removable.
- Polytetrafluoroethylene (PTFE) coated internals are supplied as an all-weather option.

3.0 OPERATION

The Anderson Greenwood 4020HP PVRV is a direct acting vent valve with a spring-loaded pallet on the pressure side and a weighted loaded pallet on the vacuum side to keep the valve closed. When tank pressure or vacuum acting on the seat sealing area equals the opposing force acting on the pallet, the valve is on the threshold of opening. Any further increase in pressure will cause the pressure pallet to lift allowing the contents of the tank to vent through the valve (out-breathing). Any further increase in vacuum will cause the vacuum pallet to begin to lift thus breaking the vacuum by allowing atmospheric air to be drawn into the tank (in-breathing).

In order for the valve to open and achieve its design lift, an overpressure will be required. The 4020HP PVRV has been designed to achieve this design lift and rated capacity within 10% overpressure. Set pressures are adjusted by altering the compression on the pressure setting spring and set vacuums are adjusted by varying the weight on the pallet.

ANDERSON GREENWOOD 4020HP PRESSURE AND VACUUM RELIEF VALVE

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4.0 SET PRESSURE/VACUUM VERIFICATION

Before installation, verify the pressure and vacuum settings by using a test rig with a suitable accumulator having the following general features:

- Ensure that the connection to the accumulator tank has a negligible pressure drop between the accumulator and the test valve.
- Observed pressure should be measured in the accumulator tank.
- The flange on which the valve is mounted should be level.
- The valve should be tested using clean air or nitrogen.

Remove valve from shipping container and remove all packaging. Check that the set pressure/vacuum, the rated capacities and other details on the nameplate are correct.

4.1 Set Pressure Verification

For set pressure verification, the test apparatus needs to limit the maximum flow rate into the accumulator such that a pressure drop measured in the accumulator can be observed when the valve set pressure is reached.

1. Ensure that the test rig is clean then fasten the valve securely to the test flange.
2. Check nameplate for required set pressure.
3. Establish a steady flow into the test vessel to increase the inlet pressure slowly. The adjusted set pressure is the pressure at which no further rise is observed. Repeat further two times to ensure repeatability.

4.2 Set Pressure Adjustment (See Figure 1)

The valve has been factory set to the required setting; however, if it is necessary to make a set pressure adjustment, this can be done as follows:

1. Remove cap [P19] and release locknut [P18].
2. The set pressure can be increased or reduced using adjusting screw [P16]. Turning clockwise will increase set pressure and anticlockwise will decrease set pressure. After adjustment, secure adjusting screw [P16] using locknut [P18] and refit cap [P19].
3. Repeat set pressure verification as per 4.1 and repeat set pressure adjustment if required.

4.3 Vacuum Setting Verification

For verification of the vacuum setting, the flow rate out of the accumulator should be limited such that when the vacuum setting is reached, the point at which atmospheric pressure is admitted to the accumulator can be observed.

1. Ensure that the test rig is clean then fasten the valve securely to the test flange.
2. Check nameplate for required vacuum setting.
3. Increase the inlet vacuum slowly until the pallet assembly can be seen to be gently lifting and reseating on the seat. The inlet vacuum at this point is the adjusted setting and should coincide with the point at which no further increase in inlet vacuum is observed. Repeat further two times to ensure repeatability.

4.4 Vacuum Setting Adjustment (See figure 1)

The valve has been factory set to the required setting however, if it is necessary to make vacuum setting adjustment, this can be done as follows:

1. Remove cover hex set screws [V10], washers [V9] then remove cover [V2] with O-ring [V8].
2. The vacuum setting can be increased or reduced by adding or removing lead weights which can be supplied in various settings.
3. Refit cover [V2] ensuring O-ring [V8] is correctly installed and secure using hex set screws [V10] and washers [V9].

CAUTION

Whenever the cover is removed and refitted, ensure correct engagement of the pallet stem in the cover guide.

4. Repeat set vacuum verification as per 4.3 and repeat adjustment, if required.

If it is not possible to verify the set vacuum on a test rig, the required setting can be verified by measuring the combined weight of the pallet and installed weights. Refer to Table 7 for combined weight and equivalent set vacuums.

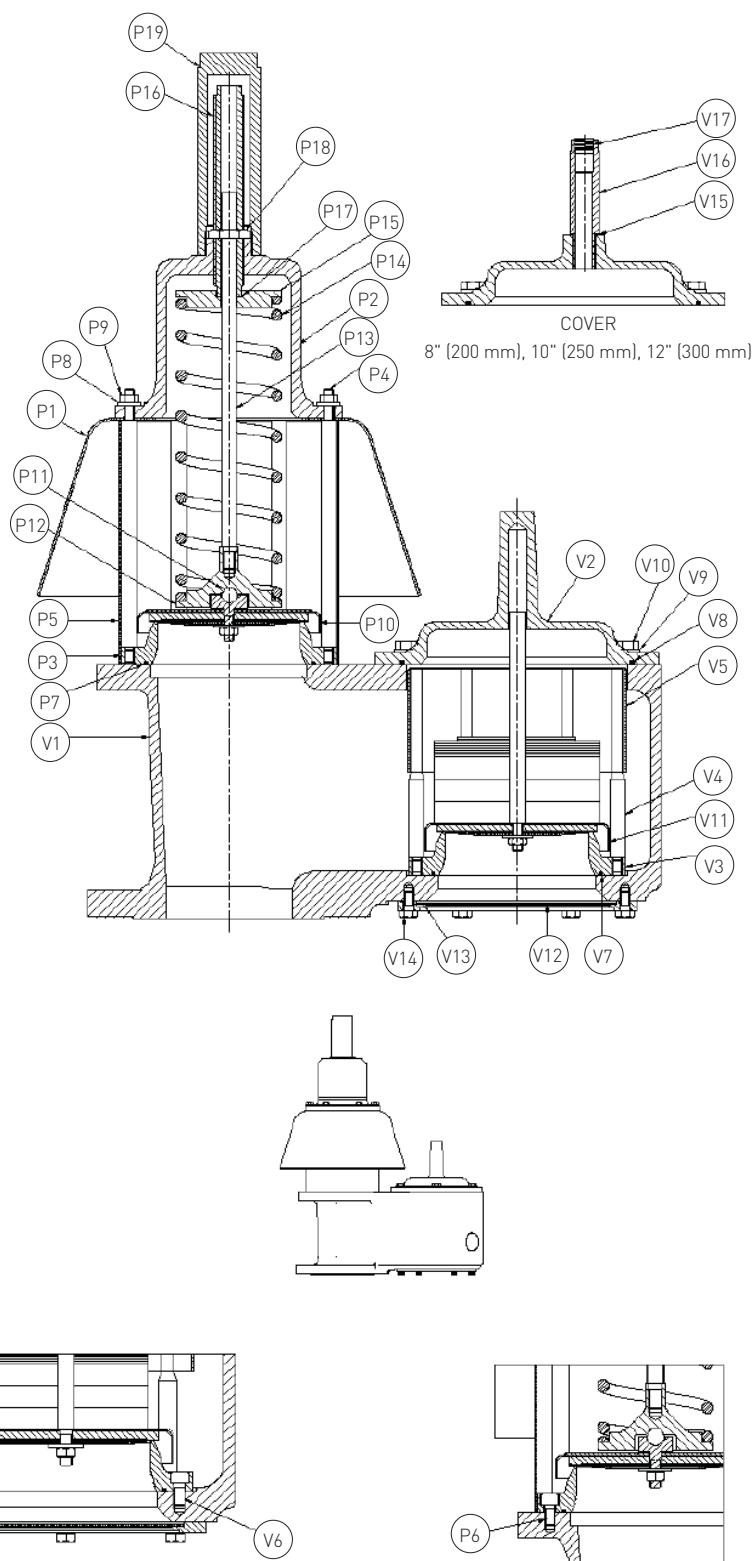
ANDERSON GREENWOOD 4020HP PRESSURE AND VACUUM RELIEF VALVE

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

PARTS LIST

Item No.	Description
P1	Weather Hood
P2	Pressure Spring Casing
P3	Pressure Seat
P4	Guide Post
P5	Bird Screen
P6	Cap Screw
P7	Seat O-ring
P8	Casing Washer
P9	Casing Nut
P10	Pressure Pallet Assembly
P11	Ball
P12	Lower Spring Plate
P13	Stem
P14	Pressure Compression Spring
P15	Upper Spring Plate
P16	Pressure Adjusting Screw
P17	Skid Ring, 6" (150 mm) and larger
P18	Locknut
P19	Pressure Cap
V1	Vacuum Seat Body
V2	Cover
V3	Vacuum Seat
V4	Vacuum Post
V5	Shroud
V6	Cap Screw
V7	Seat O-ring
V8	Cover O-ring
V9	Cover Washer
V10	Cover Hex Set Screw
V11	Vacuum Pallet Assembly
V12	Vacuum Mesh
V13	Mesh Plate
V14	Mesh Plate Hex Set Screw
V15	Guide Tube Gasket
V16	Guide Tube
V17	Taper Plug

FIGURE 1
Valve General Assembly



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5.0 INSTALLATION

1. Ensure that the mating connection to the tank is flat machined horizontal flange.
2. Thoroughly clean the mating connection to remove all foreign matter which could lead to valve leakage if trapped between the valve seat and the pallet.
3. Ensure that the bore diameter of the tank connection nozzle is at least equal to the inlet bore of the valve connection.
4. For correct valve operation, there should be no external loads applied to the valve body.
5. Fit an inlet gasket to the mating flange ensuring it does not obstruct the flow path.
6. Install the valve. Ensure that the main axis of the valve is perpendicular.
7. Tighten the flange bolting uniformly to ensure a good seal.

NOTE

The valve connection flange will have a combination of plain through holes, tapped through holes and blind tapped holes. The thread form of the tapped holes can be found from Table 1.

For valves of aluminium construction, appropriate flat face flanges should be used and a full-face gasket fitted.

NOTE

Storage tank inlet piping configurations should conform to recognized standards. Different configurations will develop different inlet pressure losses when the valve is flowing. This should be taken into consideration when sizing the valve for the application.

It is recommended that the external surfaces of carbon steel valves are painted immediately after installation.

6.0 MAINTENANCE

Regular inspection should be carried out to ensure that the pressure and vacuum ports are free from debris and that nothing preventing the correct operation of the valve is present. Maintenance should be performed at regular intervals and should be carried out by suitably qualified personnel in an appropriately equipped workshop. Alternatively, the valve should be returned to the manufacturer or suitably authorized agent for service/repair. During transport to the workshop the valve should be kept vertical to prevent damage to the internals.

WARNING

The relief valve must be isolated from tank pressure before servicing or removing. All gas/vapour must be blocked and pressure safely vented. Wear appropriate protective clothing and breathing apparatus if hazardous gas/vapours are present.

7.0 VALVE DISASSEMBLY (SEE FIGURE 1)

Before the valve is disassembled it should be thoroughly cleaned to remove potential hazards from process contamination.

IMPORTANT

During disassembly, it is important to identify the pressure and vacuum pallets so that on reassembly they are returned to the correct seat.

7.1 Pressure Side

1. Remove cap [P19] and release locknut [P18].
2. Remove all load from spring by removing adjusting screw [P16] complete with locknut.
3. Remove nuts [P9], washers [P8] and casing [P2].
4. Remove upper spring plate [P15]. For valves 6" (150 mm) and above, recover skid ring [P17] which is lifted between the adjusting screw and upper spring plate.
5. Remove spring [P14] and stem [P13] complete with lower spring plate [P12].
6. Remove weather hood [P1], bird screen [P5] and remove ball [P11]. Lift out pressure pallet assembly [P10].
7. Remove seat [P3] complete with guide posts [P4] by removing cap screws [P6].
8. Remove O-ring [P7]. Identify pallet assembly and seat pressure side parts.

TABLE 1 - INLET FLANGE THREAD FORMS

Size, In (mm)	Imperial ANSI 125, 150	Metric PN102	Metric PN162
3 (75)	5/8 - 11 UNC	M16 x 2	M16 x 2
4 (100)	5/8 - 11 UNC	M16 x 2	M16 x 2
6 (150)	3/4 - 10 UNC	M20 x 2.5	M20 x 2.5
8 (200)	3/4 - 10 UNC	M20 x 2.5	M20 x 2.5
10 (250)	7/8 - 9 UNC	M20 x 2.5	M24 x 3
12 (300)	7/8 - 9 UNC	M20 x 2.5	M24 x 3

ANDERSON GREENWOOD 4020HP PRESSURE AND VACUUM RELIEF VALVE

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

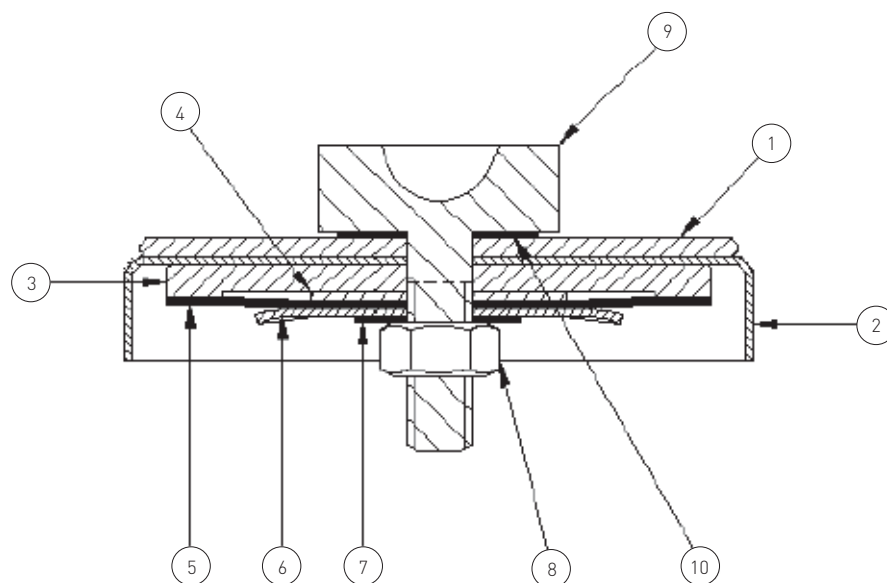
7.2 Vacuum Side

1. Remove hex set screws [V10], washers [V9], cover [V2] and O-ring [V8].
2. Remove shroud [V5] and lift out vacuum pallet assembly [V11] complete with vacuum setting weights (for higher set valves, remove some of the lead before lifting out the pallet assembly).
For 8" (200 mm), 10" (250 mm) and 12" (300 mm) sizes, cover [V2] has separate guide. If required, remove guide tube [V16] and guide tube gasket [V15].
3. Remove seat [V3] complete with vacuum posts [V4] by removing cap screws [V6].
4. Remove O-ring [V7]. Identify pallet assembly, weights and seat as vacuum side parts. If required, unscrew hex set screws [V14], remove mesh plate [V13] and recover vacuum mesh [V12].

7.3 Pressure Pallet (See Figure 2)

1. Remove nut [8] and washer, where used [7] to release pivot point [9] from assembly.
2. Separate pallet disk [6], diaphragm [5], diaphragm plate [4], disk [3], pallet [2] and support plate [1].
3. Remove pivot point gasket [10].

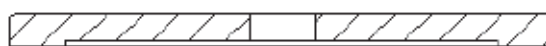
FIGURE 2
Pallet Assembly



SUPPORT PLATE (1)



PALLET (2)



DISK (3)



DIAPHRAGM PLATE (4)



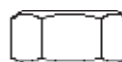
DIAPHRAGM (5)



PALLET DISK (6)



WASHER (7)



NUT (8)

NOTE

Washer Item (7) not fitted to 2" (50 mm) and 3" (75 mm) sizes.

ANDERSON GREENWOOD 4020HP PRESSURE AND VACUUM RELIEF VALVE

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

7.4 Pressure Pallet (See Figures 3, 4 and 5)

NOTE

The vacuum pallet construction will depend on size and vacuum setting. The VLP and LP have a similar construction whereas the HP has a significant disc for strength. Refer to Table 2 for vacuum pallet ranges.

VLP/VP Vacuum Pallet 2" (50 mm), 3" (75 mm), and 4" (100 mm)

Remove nut [5], washer where used [4], to release stem [6] from assembly. Separate pallet disk [3], diaphragm [2], pallet [1] and any weights taking care to identify weights removed to help reassembly.

VLP/VP VACUUM PALLET 6" (150 mm), 8" (200 mm), 10" (250 mm) and 12" (300 mm)

Remove nut [7], washer where used [6], to release stem [8] from assembly. Separate pallet disk [5], diaphragm [4], backing disk [3], spacer disk [2], pallet [1] and any weights taking care to identify weights removed to help reassembly.

NOTE

Figure 3
Washer item [4] not fitted to 2" (50 mm) and 3" (75 mm) sizes.

FIGURE 3 (See Note)
VLP/VP Vacuum Pallet 2" (50 mm), 3" (75 mm) and 4" (100 mm)

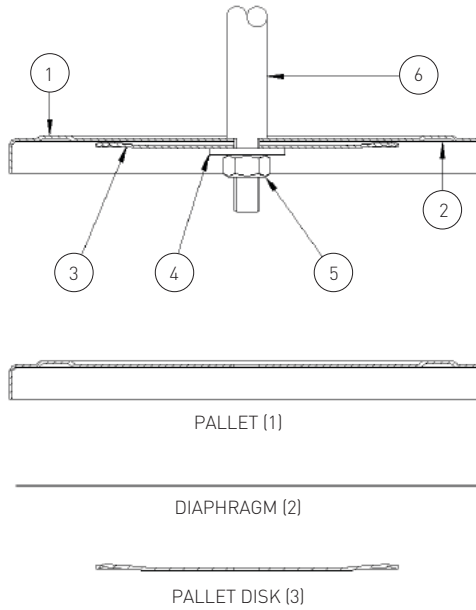
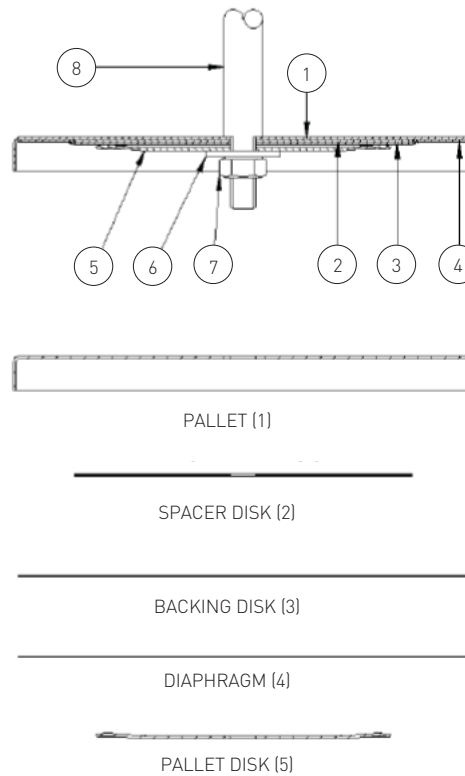


FIGURE 4
VLP/VP Vacuum Pallet 6" (150 mm), 8" (200 mm), 10" (250 mm) and 12" (300 mm)



ANDERSON GREENWOOD 4020HP PRESSURE AND VACUUM RELIEF VALVE

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HP Vacuum Pallet

Remove nut [8], washer where used [7], to release stem [9] from assembly. Separate pallet disk [6], diaphragm [5], backing disk [4], spacer disk [3], disk [2], pallet [1], support plate where fitted [10] and any weights taking care to identify weights removed to help reassembly.

NOTES

Figure 5

Washer item [7] not fitted to 2" (50 mm) and 3" (75 mm) sizes and; Support plate [10] used on 8" (200 mm), 10" (250 mm) and 12" (300 mm) only

Figure 5

For HP vacuum pallets subject to 2.91 psig (200 mbar) or more in service positive pressure, use diaphragm plate and diaphragm construction as per spring loaded pallet shown in Figure 2.

FIGURE 5 (See Notes)

HP Vacuum Pallet

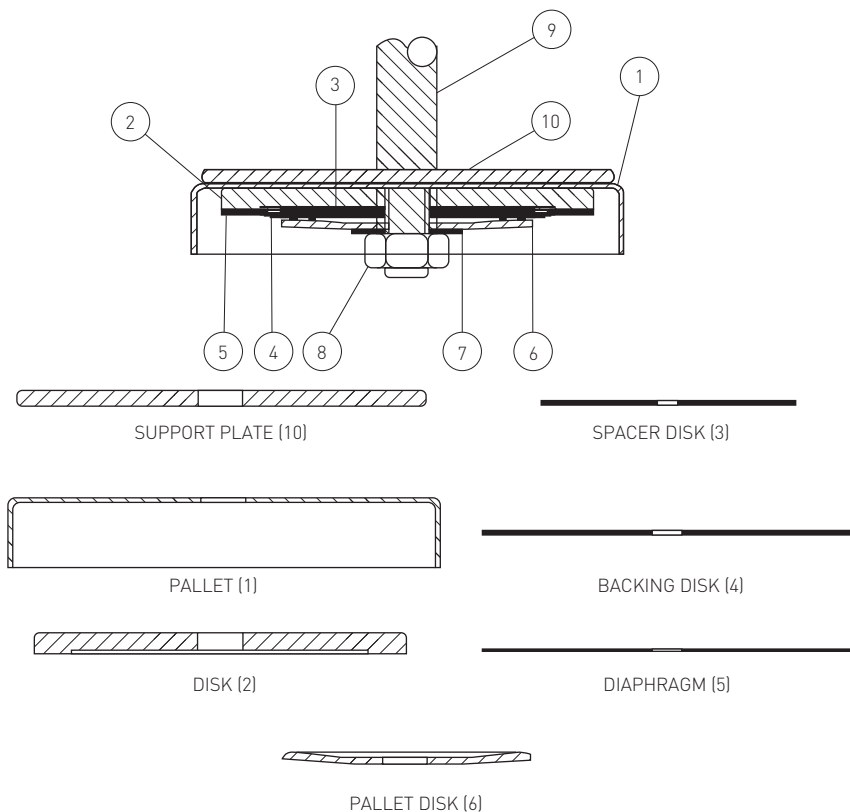


TABLE 2 - VACUUM PALLET RANGES, inch

Nominal Size	Trim Material	VLP Pallet		LP Pallet		HP Pallet	
		From	To (inc)	Above	To (inc)	Above	To
2	Aluminium	1.2	2.4	2.4	7.0	7.0	100
	316 SST	2.5	5.8	5.8	14.0	14.0	100
3	Aluminium	1.1	1.7	1.7	7.0	7.0	100
	316 SST	2.5	3.9	3.9	14.0	14.0	100
4	Aluminium	1.1	1.6	1.6	7.0	7.0	100
	316 SST	2.5	3.5	3.5	14.0	14.0	100
6	Aluminium	1.1	2.0	2.0	7.0	7.0	100
	316 SST	2.5	4.4	4.4	14.0	14.0	100
8	Aluminium	1.1	2.3	2.3	12	12	100
	316 SST	2.5	4.8	4.8	20	20	100
10	Aluminium	1.1	2.6	2.6	13	13	100
	316 SST	2.5	4.6	4.6	22	22	100
12	Aluminium	1.1	2.1	2.1	14	14	100
	316 SST	2.5	4.4	4.4	24	24	100

TABLE 3 - VACUUM PALLET RANGES, mm

Nominal Size	Trim Material	VLP Pallet		LP Pallet		HP Pallet	
		From	To (inc)	Above	To (inc)	Above	To
50	Aluminium	30	61	61	178	178	2540
	316 SST	64	147	147	356	356	2540
75	Aluminium	28	43	43	178	178	2540
	316 SST	64	99	99	356	356	2540
100	Aluminium	28	41	41	178	178	2540
	316 SST	64	89	89	356	356	2540
150	Aluminium	28	51	51	178	178	2540
	316 SST	64	112	112	356	356	2540
200	Aluminium	28	58	58	305	305	2540
	316 SST	64	122	122	508	508	2540
250	Aluminium	28	66	66	330	330	2540
	316 SST	64	117	117	559	559	2540
300	Aluminium	28	53	53	356	356	2540
	316 SST	64	112	112	610	610	2540

ANDERSON GREENWOOD 4020HP PRESSURE AND VACUUM RELIEF VALVE

INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS

8.0 VALVE REFURBISHMENT

With valve in component parts, thoroughly clean all surfaces with a suitable solvent and check for wear, corrosion or other forms of damage. Particular attention should be given to the sealing face of the valve seat.



Slight damage can be removed by lapping the seat face (removing guide or vacuum posts); however, care should be taken not to increase the width of the seat face beyond those given in Table 4. If successive refurbishments or severe damage requires the seat to be re machined, consult the factory for approved dimensions.

Discard and replace any damaged parts plus all soft goods including:

- O-rings
- Diaphragms
- Backing Disks
- Spacer Disks
- Gaskets
- Skid Ring (if fitted)

9.0 VALVE REASSEMBLY (SEE FIGURE 1)

Check identification to ensure pressure and vacuum components are returned to respective seats.

Pallets should be identified during disassembly however, they can also be identified by thickness and length. See Tables 4 and 5.

Also discard and replace the pallet disk.

9.1 Vacuum Pallet

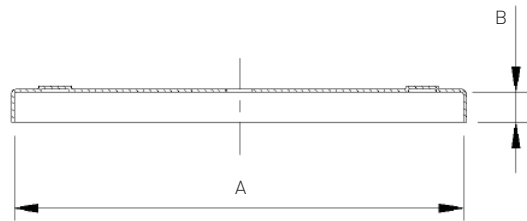
VLP/LP Vacuum Pallet 2" (50 mm), 3" (75 mm) and 4" (100 mm) (See Figure 3)

Assemble pallet [1], diaphragm [2], and pallet disk [3], to stem [6] and secure using washer if fitted [4] and nut [5].

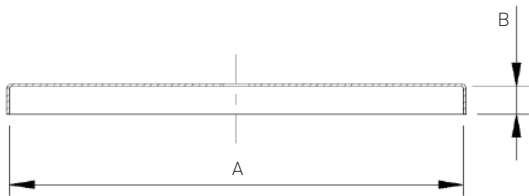
VLP/LP Vacuum Pallet 6" (150 mm), 8" (200 mm), 10" (250 mm) and 12" (300 mm) (See Figure 4)

Assemble pallet [1], spacer disk [2], backing disk [3], diaphragm [4], and pallet disk [5], to stem [8] and secure using washer if fitted [6] and nut [7].

VLP/LP Pressure Pallet 2" (50 mm), 3" (75 mm) and 4" (100 mm)



VLP/LP Pressure Pallet 6" (150 mm), 8" (200 mm), 10" (250 mm) and 12" (300 mm)



HP Pressure Pallet

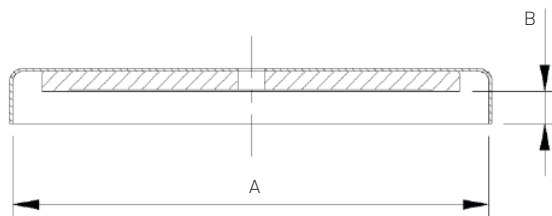


TABLE 4 - SEAT LAP BAND WIDTHS

Nominal Size, In. (mm)	Nominal Width, In. (mm)	Maximum Width, In. (mm)
2 (50)	0.03 (0.76)	0.05 (1.27)
3 (75)	0.03 (0.76)	0.05 (1.27)
4 (100)	0.04 (1.02)	0.07 (1.78)
6 (150)	0.05 (1.27)	0.07 (1.78)
8 (200)	0.05 (1.27)	0.08 (2.03)
10 (250)	0.07 (1.78)	0.11 (2.79)
12 (300)	0.07 (1.78)	0.11 (2.79)

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HP Vacuum Pallet (See Figure 5)

Assemble support plate, where used [10], pallet [1], disk [2], spacer disk [3], backing disk [4], diaphragm [5], and pallet disk [6], to stem [9] and secure using washer if fitted [7] and nut [8].

9.2 Pressure Pallet (See Figure 2)

Assemble pivot point gasket [10], support plate [1], pallet [2], disk [3], diaphragm plate [4], diaphragm [5], and pallet disk [6], to pivot point [9] and secure using washer if fitted [7] and nut [8].

If required, PTFE tape can be applied to stem threads and locking compound used to secure the nut.

9.3 Vacuum Side (See Figure 2)

1. If previously removed, assemble vacuum mesh [V12], mesh plate [V13] and secure using hex set screws [V14].
2. Reassemble vacuum posts [V4] (if removed), and O-ring [V7] to seat [V3]. Secure seat to body [V1] using cap screws [V6] ensuring that O-ring is not dislodged during assembly.
3. Reinstall vacuum pallet as identified during valve disassembly ensuring the pallet slides easily between the vacuum posts.

4. Return vacuum setting weights again as identified during disassembly. Assemble shroud [V5] which should be installed over the vacuum posts [V4]. For 8" (200 mm), 10" (250 mm) and 12" (300 mm) sizes, cover [V2] has separate guide. If previously removed, fit new guide tube gasket [V15] and assemble guide tube [V16].
5. Assemble O-ring [V8] to cover [V2] and assemble cover to body [V1] ensuring that O-ring is not dislodged during assembly. Secure using washers [V9], and hex set screws [V10].

CAUTION

Whenever cover is removed and refitted, ensure correct engagement of the pallet stem.

9.4 Pressure Side (See Figure 1)

1. Reassemble guide posts [P4] (if removed), and O-ring [P7] to seat [P3]. Secure seat to body [V1] using cap screws [P6] ensuring that O-ring is not dislodged during assembly.
2. Reinstall pressure pallet as identified during valve disassembly ensuring the pallet slides easily between the guide posts. Place ball [P11] in socket of pivot point [8]. Refit bird screen [P5] and weather hood [P1].

3. Assemble stem [P13] complete with lower spring plate [P12] to locate on ball [P11]. Assemble spring [P14], and upper spring plate [P15]. For valves 6" (150 mm) and larger, fit skid ring [P17] in recess of upper spring plate.
4. Assemble casing [P2] over stem [P13] and guide posts [P4] securing with washers [P8] and nuts [P9]. Assemble adjusting screw [P16] over stem [P13] and screw into casing [P2]. Apply nominal load to spring and secure using locknut [P18]. Assemble Cap [P19].

10.0 TESTING SET PRESSURE AND VACUUM

The pressure and vacuum settings should be checked and if necessary adjusted as described in Section 4.

CAUTION

This product is a safety related component and improper application, installation or maintenance of the valve or the use of parts or components not supplied by Emerson Automation Solutions Final Control UK Ltd. may result in failure of the valve.

TABLE 5 - PALLET THICKNESS

	Pallet Material Thickness, In. (mm)						
	2 (50)	3 (75)	4 (100)	6 (150)	8 (200)	10 (250)	12 (300)
HP	0.03 (0.76)	0.03 (0.76)	0.03 (0.76)	0.05 (1.27)	0.05 (1.27)	0.05 (1.27)	0.05 (1.27)
LP	0.03 (0.76)	0.03 (0.76)	0.03 (0.76)	0.05 (1.27)	0.05 (1.27)	0.05 (1.27)	0.05 (1.27)
VLP	0.03 (0.76)	0.02 (0.51)	0.02 (0.51)	0.02 (0.51)	0.02 (0.51)	0.02 (0.51)	0.02 (0.51)

TABLE 6 - PALLET LENGTHS

Nominal Size, In. (mm)	Dimensions			
	Pressure Pallet		Vacuum Pallet	
	A, In. (mm)	B, In. (mm)	A, In. (mm)	B, In. (mm)
2 (50)	3.03 (77)	0.19 (5)	3.03 (77)	0.31 (8)
3 (75)	4.40 (112)	0.3 (8)	4.40 (112)	0.5 (13)
4 (100)	5.78 (147)	0.4 (10)	5.78 (147)	0.6 (15)
6 (150)	8.70 (221)	0.6 (15)	8.70 (221)	0.9 (23)
8 (200)	11.6 (295)	0.8 (20)	11.6 (295)	1.25 (32)
10 (250)	14.5 (368)	1.0 (25)	14.5 (368)	1.57 (40)
12 (300)	17.4 (442)	1.18 (30)	17.4 (442)	1.8 (46)

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TABLE 7 - EQUIVALENT WEIGHTS FOR VACUUM SETTINGS

Inlet Size	2 [50]			3 [75]			4 [100]			6 [150]			8 [200]			10 [250]			12 [300]		
Mean Sealing Area, in ² (cm ²)	4.53 [29]			9.971 [64]			17.603 [114]			39.662 [256]			69.829 [451]			109.563 [707]			156.894 [1012]		
Setting, in. w.c. (mbar)	lbs.	oz.	kg	lbs.	oz.	kg	lbs.	oz.	kg	lbs.	oz.	kg	lbs.	oz.	kg	lbs.	oz.	kg	lbs.	oz.	kg
0.04 [1]	0	1.1	0	0	2.3	0	0	4.1	0	0	9.2	0.0	1	0.2	0.5	1	9.4	0.5	2	4.4	0.9
0.08 [2]	0	2.1	0	0	4.6	0	0	8.2	0	1	2.4	0.5	2	0.4	0.9	3	2.9	1.4	4	8.9	1.8
1.2 [3]	0	3.2	0	0	6.9	0	0	12.3	0	1	11.6	0.5	3	0.6	1.4	4	12.3	1.8	6	13.3	2.7
1.6 [4]	0	4.2	0	0	9.3	0	1	0.4	0.5	2	4.8	0.9	4	0.9	1.8	6	5.8	2.7	9	1.7	4.1
2.0 [5]	0	5.3	0	0	11.6	0	1	4.4	0.5	2	14.0	0.9	5	1.1	2.3	7	15.2	3.2	11	6.2	5.0
2.4 [6]	0	6.3	0	0	13.9	0	1	8.5	0.5	3	7.3	1.4	6	1.3	2.7	9	8.7	4.1	13	10.6	5.9
2.8 [7]	0	7.4	0	1	0.2	0.5	1	12.6	0.5	4	0.5	1.8	7	1.5	3.2	11	2.1	5.0	15	15.0	6.8
3.2 [8]	0	8.4	0	1	2.5	0.5	2	0.7	0.9	4	9.7	1.8	8	1.7	3.6	12	11.5	5.4	18	3.5	8.2
3.6 [9]	0	9.5	0	1	4.8	0.5	2	4.8	0.9	5	2.9	2.3	9	1.9	4.1	14	5.0	6.4	20	7.9	9.1
4.0 [10]	0	10.5	0	1	7.2	0.5	2	8.9	0.9	5	12.1	2.3	10	2.2	4.5	15	14.4	6.8	22	12.3	10
4.8 [12]	0	12.6	0	1	11.8	0.5	3	1.1	1.4	6	14.5	2.7	12	2.6	5.4	19	1.3	8.6	27	5.2	12
5.6 [14]	0	14.7	0	2	0.4	0.9	3	9.2	1.4	8	0.9	3.6	14	3.0	6.4	22	4.2	10	31	14.1	14
6.4 [16]	1	0.8	0.5	2	5.0	0.9	4	1.4	1.8	9	3.4	4.1	16	3.5	7.3	25	7.1	11	36	6.9	16
7.2 [18]	1	2.9	0.5	2	9.7	0.9	4	9.6	1.8	10	5.8	4.5	18	3.9	8.2	28	10.0	13	40	15.8	18
8.0 [20]	1	5.0	0.5	2	14.3	0.9	5	1.8	2.3	11	8.2	5.0	20	4.3	9.1	31	12.9	14	45	8.7	20
8.8 [22]	1	7.1	0.5	3	2.9	1.4	5	9.9	2.3	12	10.6	5.4	22	4.8	10	34	15.7	15	50	1.5	23
9.6 [24]	1	9.2	0.5	3	7.6	1.4	6	2.1	2.7	13	13.1	5.9	24	5.2	11	38	2.6	17	54	10.4	24
10 [26]	1	11.3	0.5	3	12.2	1.4	6	10.3	2.7	14	15.5	6.4	26	5.6	12	41	5.5	19	59	3.3	27
11 [28]	1	13.5	0.5	4	0.8	1.8	7	2.5	3.2	16	1.9	7.3	28	6.0	13	44	8.4	20	63	12.2	29
12 [30]	1	15.6	0.5	4	5.5	1.8	7	10.6	3.2	17	4.3	7.7	30	6.5	14	47	11.3	21	68	5.0	31
13 [32]	2	1.7	0.9	4	10.1	1.8	8	2.8	3.6	18	6.7	8.2	32	6.9	15	50	14.2	23	72	13.9	33
14 [34]	2	3.8	0.9	4	14.7	1.8	8	11.0	3.6	19	9.2	8.6	34	7.3	15	54	1.1	24	77	6.8	35
14 [36]	2	5.9	0.9	5	3.4	2.3	9	3.2	4.1	20	11.6	9.1	36	7.8	16	57	3.9	26	81	15.6	37
15 [38]	2	8.0	0.9	5	8.0	2.3	9	11.3	4.1	21	14.0	9.5	38	8.2	17	60	6.8	27	86	8.5	39
16 [40]	2	10.1	0.9	5	12.6	2.3	10	3.5	4.5	23	0.4	10	40	8.6	18	63	9.7	29	91	1.4	41
17 [42]	2	12.2	0.9	6	1.2	2.7	10	11.7	4.5	24	2.8	11	42	9.1	19	66	12.6	30	95	10.2	43
18 [44]	2	14.3	0.9	6	5.9	2.7	11	3.9	5.0	25	5.2	11	44	9.5	20	69	15.5	31	100	3.1	45
18 [46]	3	0.4	1.4	6	10.5	2.7	11	12.0	5.0	26	7.7	12	46	9.9	21	73	2.4	33	104	12.0	47
19 [48]	3	2.5	1.4	6	15.1	2.7	12	4.2	5.4	27	10.1	12	48	10.4	22	76	5.3	34	109	4.8	49
20 [50]	3	4.6	1.4	7	3.8	3.2	12	12.4	5.4	28	12.5	13	50	10.8	23	79	8.1	36	113	13.7	51

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TABLE 7 - EQUIVALENT WEIGHTS FOR VACUUM SETTINGS (continued)

Inlet Size	2 [50]			3 [75]			4 [100]			6 [150]			8 [200]			10 [250]			12 [300]		
Mean Sealing Area, in ² (cm ²)	4.53 [29]			9.971 [64]			17.603 [114]			39.662 [256]			69.829 [451]			109.563 [707]			156.894 [1012]		
Setting, in. w.c. (mbar)	lbs.	oz.	kg	lbs.	oz.	kg	lbs.	oz.	kg	lbs.	oz.	kg	lbs.	oz.	kg	lbs.	oz.	kg	lbs.	oz.	kg
0.08 [52]	3	6.7	1.4	7	8.4	3.2	13	4.6	5.9	29	14.9	13	52	11.2	24	82	11.0	37	118	6.6	54
1.2 [54]	3	8.8	1.4	7	13.0	3.2	13	12.7	5.9	31	1.4	14	54	11.6	24	85	13.9	39	122	15.4	55
1.6 [56]	3	10.9	1.4	8	1.7	3.6	14	4.9	6.4	32	3.8	15	56	12.1	25	89	0.8	40	127	8.3	58
2.0 [58]	3	13.0	1.4	8	6.3	3.6	14	13.1	6.4	33	6.2	15	58	12.5	26	92	3.7	42	132	1.2	60
2.4 [60]	3	15.1	1.4	8	10.9	3.6	15	5.3	6.8	34	8.6	15	60	12.9	27	95	6.6	43	136	10.0	62
2.8 [62]	4	1.2	1.8	8	15.6	3.6	15	13.4	6.8	35	11.0	16	62	13.4	28	98	9.5	44	141	2.9	64
3.2 [64]	4	3.3	1.8	9	4.2	4.1	16	5.6	7.3	36	13.5	16	64	13.8	29	101	12.3	46	145	11.8	66
3.6 [66]	4	5.4	1.8	9	8.8	4.1	16	13.8	7.3	37	15.9	17	66	14.2	30	104	15.2	47	150	4.6	68
4.0 [68]	4	7.5	1.8	9	13.5	4.1	17	6.0	7.7	39	2.3	18	68	14.7	31	108	2.1	49	154	13.5	70
4.8 [70]	4	9.6	1.8	10	2.1	4.5	17	14.1	7.7	40	4.7	18	70	15.1	32	111	5.0	50	159	6.4	72
5.6 [72]	4	11.7	1.8	10	6.7	4.5	18	6.3	8.2	41	7.1	19	72	15.5	33	114	7.9	52	163	15.2	74
6.4 [74]	4	13.8	1.8	10	11.3	4.5	18	14.5	8.2	42	9.6	19	74	16.0	34	117	10.8	53	168	8.1	76
7.2 [76]	4	15.9	1.8	10	16.0	4.5	19	6.7	8.6	43	12.0	20	77	0.4	35	120	13.7	54	173	1.0	78
8.0 [78]	5	2.1	2.3	11	4.6	5.0	19	14.8	8.6	44	14.4	20	79	0.8	36	124	0.5	56	177	9.9	80
8.8 [80]	5	4.2	2.3	11	9.2	5.0	20	7.0	9.1	46	0.8	21	81	1.3	37	127	3.4	58	182	2.7	83
9.6 [82]	5	6.3	2.3	11	13.9	5.0	20	15.2	9.1	47	3.2	21	83	1.7	38	130	6.3	59	186	11.6	84
10 [84]	5	8.4	2.3	12	2.5	5.4	21	7.4	9.5	48	5.7	22	85	2.1	39	133	9.2	60	191	4.5	87
11 [86]	5	10.5	2.3	12	7.1	5.4	21	15.5	9.5	49	8.1	22	87	2.6	39	136	12.1	62	195	13.3	88
12 [88]	5	12.6	2.3	12	11.8	5.4	22	7.7	10	50	10.5	23	89	3.0	40	139	15.0	63	200	6.2	91
13 [90]	5	14.7	2.3	13	0.4	5.9	22	15.9	10	51	12.9	23	91	3.4	41	143	1.9	65	204	15.1	93
14 [92]	6	0.8	2.7	13	5.0	5.9	23	8.1	10	52	15.4	24	93	3.8	42	146	4.7	66	209	7.9	95
14 [94]	6	2.9	2.7	13	9.7	5.9	24	0.3	11	54	1.8	24	95	4.3	43	149	7.6	68	214	0.8	97
15 [96]	6	5.0	2.7	13	14.3	5.9	24	8.4	11	55	4.2	25	97	4.7	44	152	10.5	69	218	9.7	99
16 [98]	6	7.1	2.7	14	2.9	6.4	25	0.6	11	56	6.6	25	99	5.1	45	155	13.4	70	223	2.5	101
17 [100]	6	9.2	2.7	14	7.5	6.4	25	8.8	11	57	9.0	26	101	5.6	46	159	0.3	72	227	11.4	103

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TABLE 8 - REPLACEMENT PARTS

Description	Reference	Usage	Material	Nominal Size						
				2 (50)	3 (75)	4 (100)	6 (150)	8 (200)	10 (250)	12 (300)
Pallet Disk	Figures 3 and 4	Very Low Pressure	Stainless steel	11183378	11183398	11183420	11183439	11183457	11183475	11183493
		Low Pressure		11182941	11182943	11182945	11182946	11183009	11183092	11183133
	Figure 5	High Pressure		11182941	11182943	11182945	11182946	11183009	11183092	11183133
	Figure 2	Spring Loaded								
Diaphragm	Figures 3 and 4	Very Low Pressure	PFA	11183880	11183882	11183884	11183266	-----	-----	-----
			PTFE	11183257	11183260	11183263	11183267	11183271	11183275	11183279
	Figure 5	Low Pressure	PFA	11183881	11183883	11183885	11411605	-----	-----	-----
			PTFE	11183258	11183261	11183264	11411606	11411607	11411612	11411614
	Figure 2	High Pressure	PTFE	11183259	11183262	11183265	11183269	11183273	11183277	11183281
			Spring Loaded <200mbar	PTFE	11281485	11280622	11281490	11281493	11281496	11281498
		Spring Loaded >200mbar	PTFE	11281489	11280624	11281492	11281495	11281497	11280837	11281502
Backing Disk	Figures 4 and 5	Very Low Pressure	General	-----	-----	-----	11183856	11183886	11183887	11183888
		Low Pressure	Service	-----	-----	-----	11411623	11411631	11411634	11411636
		High Pressure	Gasket	11183282	11183284	11183285	11183286	11183287	11183288	11183289
Spacer Disk	Figures 4 and 5	Very Low Pressure	General	-----	-----	-----	11183857	11183889	11183890	11183891
		Low Pressure	Service	-----	-----	-----				
		High Pressure	Gasket	11183290	11183292	11183293	11183294	11183295	11183296	11183297
Gasket	Figure 1	Guide Tube	General	-----	-----	-----	-----	11183311	11183311	11183311
	Figure 2	Pivot Point	Service Gasket	11272778	11272778	11272778	11405355	11272733	11272733	11272733
O-ring	Figure 1	Seat	Viton	11183351	11183354	11183320	11180110	11183326	11182024	11180089
			Nitrile	11183350	11183353	11183319	11180109	11183325	11182023	11180088
			PTFE	11183349	11183352	11183318	11180108	11183324	11182022	11180087
		Cover	Viton	11183314	11183317	11183323	11183326	11183334	11183337	11183340
			Nitrile	11183313	11183316	11183322	11183325	11183333	11183336	11183339
		PTFE	11183312	11183315	11183321	11183324	11183332	11183335	11183338	
Skid Ring	Figure 1	-----	PTFE	-----	-----	-----	11405352	11272734	11275612	11275612

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