Double Disc™ Pumps

Installation, Operating and Maintenance Manual

Model 3DDSX12 MK2



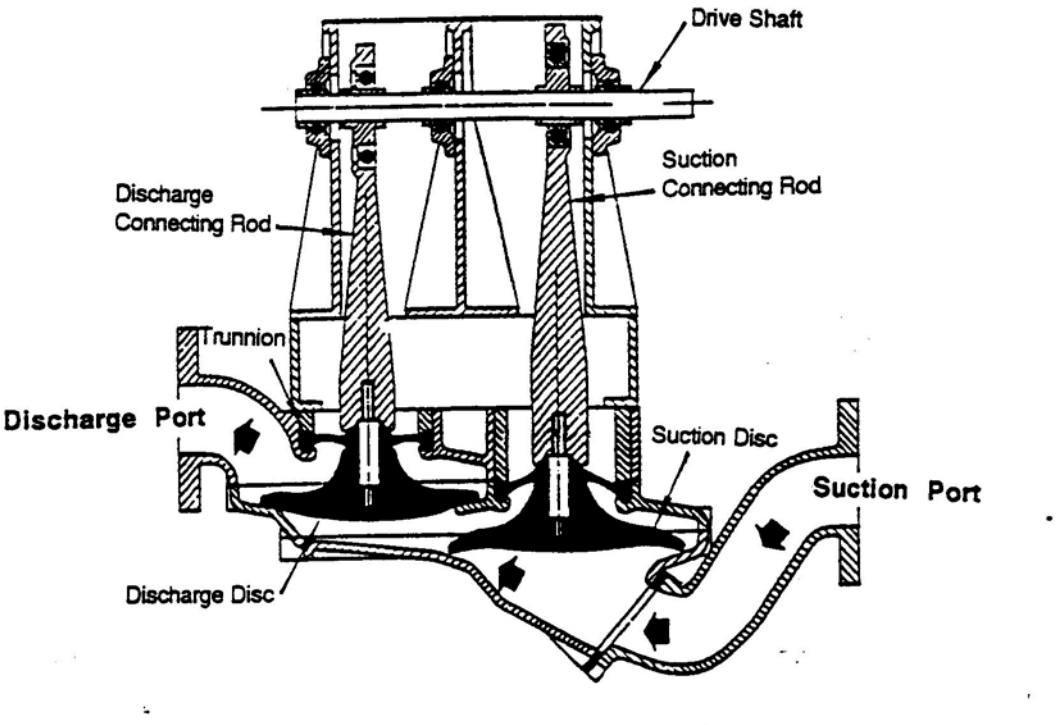
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Principle of Operation

The Penn Valley, Double Disc™ Pump utilizes a unique principle of operation whereby the discs perform the duties of both diaphragm and valve, providing a double acting, non-clogging, pumping action. Through an arrangement of connecting rods and a cam shaft, a reciprocating action of the discs is created, forming a large cavity between discs. This cavity is filled and exhausted in a continuous flow. The large, valve-like discs (11" diameter on the 4" pump), means that large solids and rags can be handled without loss of pumping action. The valve-like discs have large seating areas that provide for low internal velocities, extending the pump wear life on abrasive sludges and lime slurry. The trunnions provide a seal for the fluid chamber eliminating the need for mechanical seals and packing.



Benefits and Features

- The Double Disc™ Pumps use a flexing membrane, which achieves the sealing of the fluid chamber with no rotating shafts requiring packing or mechanical seals.
- Suction Lift: Penn Valley Pumps will dry prime under 10" Hg (11 feet) and will operate at 25" Hg (28 feet) when fully primed.
- All Penn Valley Pumps can operate dry without fluid chamber damage.
- There are no close-clearance, rotating parts in the fluid chamber to wear on abrasive applications.
- There are no check valves in suction or discharge that would plug. Double Disc™ pumps will pass hand towel sized rags.
- There are no reciprocating pistons requiring packing or that will wear on abrasive slurries.
- Penn Valley Pumps can operate in either direction of shaft rotation without affecting the pump efficiency.

GENERAL

PUMP DESCRIPTION
This manual is offered to assist you in understanding the construction and the correct methods of installing, opening and maintaining your new Model 3" Penn Valley Double Disc™ Pump.

The Penn Valley, Double Disc™ Pump utilizes a unique principle of operation whereby the discs perform the duties of both diaphragm and valve, providing a double acting, non-clogging, pumping action. The Double Disc™ Pump has no close tolerances in the fluid chamber to wear on abrasive applications. The fluid chamber sealing is achieved by flexible trunnions with no rotating shafts requiring packing or mechanical seals.

PUMP IDENTIFICATION
Penn Valley pumps are permanently recorded by serial number at the factory. When ordering repair parts, please supply the serial number of the pump, pump model number, if known, part identification number and part designation.

SHIPPING AND PREPARATION
Penn Valley thoroughly inspects each pump during the manufacturing process and assembly. Each pump is subjected to an operational test prior to shipment to assure trouble free operation in the field.

RECEIVING THE PUMP
Check the pump for damage or shortages immediately upon receiving the pump. *Make all claims with the transportation company promptly.* This will prevent a controversy when the claim is made and will expedite prompt and satisfactory settlement.

Care should be taken when unloading and receiving the pump to prevent dropping the unit or rough handling. The same care should be taken as you would with other pieces of precision-engineered equipment.

PUMP STORAGE

If the pump is not to be placed into service immediately, ft should be stored in a clean, dry well ventilated place, free from vibration, moisture, dirt, rapid or wide variation in temperature and potential damage. Care should be taken to protect the Penn Valley Pumps from foreign objects, excessive heat or direct sun light because of the elastomers contained within the pump.

***CAUTION:* SYNTHETIC RUBBER COVERED EQUIPMENT**

This special notice is to advise you of certain precautions to be exercised in handling and storing synthetic rubber covered equipment. All items are carefully inspected and packaged before shipment and should be in excellent condition when received. Improper handling of this equipment will often cause serious damage. Synthetic rubber covered equipment is subject to damage by various causes which may be avoided by following these instructions.

Do Not allow synthetic rubber lined items to contact liquids that are incompatible.
Do Not store in temperatures over 100 degrees Fahrenheit.
Do Not store where temperature changes faster than 10 degrees Fahrenheit per hour.
Do Not allow synthetic rubber to contact other items when temperature is below 40 degrees Fahrenheit.
Do Not store in direct sunlight.
Do Not store near electrical equipment.
Do Not attach slings or any lifting device on synthetic rubber surfaces.
Do Not use anything sharp that may pierce the synthetic rubber covering.
Do Not weld in area of lining as it may destroy the lining or the diaphragm.

INSTALLATION

CAUTION: It is imperative that the coupling hubs or sheaves be a slip fit on the drive shaft. Shock loads from a mallet can have a destructive effect on the bearings, resulting in immediate failure. The use of taper lock bushings are recommended.

PUMP LOCATION

The Penn Valley Pump should be located as close to the source as possible, with the suction piping as short and as direct as practical. It is imperative that the suction pipe hydraulics be carefully considered when locating the pump. Contributing factors are percent solids, losses through elbows, valves, flow in gallons per minute, length of piping run, etc.

FOUNDATION & BASE

It is essential to provide a solid foundation for the proper operation of the pump. The foundation must be rigid enough to prevent vibration and misalignment during operation. The pump sub-base must be anchored to the floor with appropriate anchor bolts and leveled by shimming at the anchor bolt locations.

PIPING

CAUTION: When connecting piping to the pump, the connection should be made with the pipe in a free supported state and without the need to apply vertical or side pressure to obtain alignment of the piping with the pump flanges.

All piping should be independently supported near the pump so that pipe strain will not be transmitted to the pump. Sufficient, rigid, piping support and bracing must be supplied to prevent the suction and discharge piping from moving during the pump operation.

If flexible connections are used on the suction and discharge ports of the pump, care must be taken to support the piping on the up-stream and down-stream sides of the flexible connection as close to the connection as practical. It is recommended that tie rods be installed around the flexible connection to provide rigidity.

The suction and discharge piping should be equal to the pump suction and discharge port size. On high suction lifts or on applications handling high percent solids, the suction piping should be one or two sizes larger to reduce friction losses and allow the pump to fill.

SUCTION PIPING

***CAUTION:* Do not operate Penn Valley pumps against a closed suction line. Excessive vacuum build-up will cause disc and/or trunnion failure.**

The majority of pump problems are created by improper suction line hydraulics. It is imperative that the proper sized suction piping system be used in accordance with the suction conditions.

Suction pipe size is determined by the liquid viscosity, length of run, flow in gallons per minute, taking into consideration the number of elbows and other obstructions in the suction piping. A rule of thumb is that the suction pipe size should never be smaller than the suction port on the pump being installed.

On a horizontal run, the suction piping should have a gradual rise, up to the suction port of the pump. This is to prevent air entrapment, causing improper pump operation.

It is recommended that a vacuum limit switch be installed as close to the pump suction port as possible. This switch is set to turn the pumping system off when excessive vacuum is experienced. A vacuum gauge is supplied with the limit switch, permitting the operator to determine any unstable pump operation by observing this gauge. Any change in the system operating characteristics will be indicated in the gauge readings. Install isolation valves in suction and discharge piping as close to the pump as practical. The valves will allow for the removal of the pump or permit maintenance on the pump without draining the system.

DISCHARGE PIPING

CAUTION: **Do not operate Penn Valley pumps against a closed discharge line. Excessive pressure build-up will cause disc and/or trunnion failure.**

Penn Valley Double Disc™ pumps must not be operated against a closed valve in the discharge piping or damage can occur. This type of operation can delaminate or break the discharge disc. To avoid this, it is recommended that a pressure limit switch installed as close to the discharge port as practical. This switch is set to turn the pumping system off when excessive discharge pressure is experienced. A pressure gauge is supplied with the limit switch, permitting the operator to determine any unstable pump operation by observing this gauge. Any change in the system operating characteristics will be indicated in the gauge readings.

DRIVES

Penn Valley Pumps will accommodate almost any drive to meet the customer's requirement. These pumps are relatively slow speed pumps and require a speed reduction from the standard 1150, 1750 rpm motor speeds. The reduction is commonly obtained through a guard enclosed, belt and sheave arrangement to arrive at the desired pump speed. A gear reducer between the motor and pump can also be used. The reducer is then directly coupled to the pump shaft through a flexible coupling.

DRIVE ALIGNMENT

Pumps and drives that are mounted at the factory are mounted on a common base and are accurately aligned before shipment. This alignment must be re-checked after the pump unit has been installed. Periodic checking is advisable during the pump service life.

The 4-inch pump may be either V-belt driven or direct connected. The 6-inch duplex pump must be driven through V-belts and sheaves to accommodate the duplex design.

V-BELT DRIVES

The V-belts must be aligned and properly tensioned to obtain the most efficient operation. All V-belt drives are furnished with an OSHA approved guard. This type of drive is the most commonly used on Penn Valley Pumps, providing for ease of speed change in the field.

DIRECT CONNECTED DRIVES

Certain flexible coupling designs are more tolerant of misalignment between pump and drive. Misalignment above the maximum coupling manufactures recommendations will result in premature bearing failure and will cause other problems such as excessive power consumption, etc. For this reason the angular and parallel misalignment must be maintained as close as possible and within the recommended limits of the coupling manufacturer.

The following couplings are recommended based on their greater tolerance for misalignment. Spider type couplings generally have less tolerance for misalignment.

Sure-Flex coupling (Standard on Penn Valley pumps)
Parallel:* .015 - .025 Angular: 1 degree

Grid type coupling
Parallel:* .005 - .012 Angular: 1 degree

Paraflex coupling
Parallel:* .005 - .015 Angular: 1 degree

* Depending on size of the coupling.

PUMP OPERATION

NOTE: All Penn Valley Pumps can operate dry without fluid chamber damage.

DIRECTION OF ROTATION

Penn Valley Pumps can be operated in either direction of rotation without affecting the pump efficiency.

NOISY OPERATION

Noisy operation and/or excessive vibration is generally caused by pump starvation. This is commonly referred to as cavitation. The most common causes of cavitation are as follows:

1. Suction line size is too small to handle the percent solids at the existing flow rate.
2. Suction valve is partially closed.
3. Suction line is obstructed and will not permit sufficient flow to pump.
4. Suction line is too long, creating excessive resistance, which restricts the flow to the pump.

WATER HAMMER & PIPE VIBRATION

Water Hammer and/or pipe vibration may occur in the discharge or suction piping of the Penn Valley Double Disc™ pump during each pump revolution. The discs, acting as valves, opening and closing create this condition. When the movement of the liquid column ceases, the weight of the column of liquid causes a slight reversal of flow, thus causing noise and/or vibration.

The kinetic energy of this reversal of flow causes a series of rapid reversals or waves causing vibration and noise in the pipe until the energy is expended in friction.

After making certain that the discharge piping is securely supported and the pump is securely bolted to a rigid foundation, the following solution for reducing this phenomenon is recommended.

AIR CHAMBERS

The use of air chambers in the suction and/or discharge lines in the piping system is the most effective solution. Air chambers must be sealed from atmospheric pressure, as even a minute leak will soon deplete the air in the top of the chamber. The liquid being pumped may gradually absorb the air in the chamber, causing the chamber to become ineffective until the chamber is purged of liquid and the air is replenished. This is easily accomplished by introducing compressed air on top of the air chamber through the valve provided. This forces the liquid back into the piping system, thereby re-establishing the air cushion in the chamber.

RECOMMENDED SPARE PARTS

The proper selection of spare parts is an excellent way to insure a minimum of down time for repairs. The variation in materials being pumped, pumping rates, etc. are too numerous to enable us to specify the exact quantity of spare parts required. For normal operation in wastewater treatment plants it is suggested that one set of the following spare parts be in stock for each pump in service.

One (1) Suction Disc
One (1) Discharge Disc
Two (2) Trunnions
One (1) Clack valve
One (1) Suction gasket
One (1) Discharge gasket

For more detail information please contact our factory or your local representative to match the spare parts to your particular application.

START-UP PROCEDURE FOR A NEW INSTALLATION

1. Back flush the piping system to be certain the system is free of foreign material left from construction. Isolate the pump prior to back flushing.

2. Pressurize the system with a non-hazardous liquid to check that all piping connections are tight and free from leakage. CAUTION: Do not pressurize over 40 psi.

3. Check that all valves in the discharge piping system are open and the discharge piping is un-obstructed.

4. Check that all valves in the suction piping system are open and the suction line if open to the source.

5. Check that all guards are in place and secure.

6. Pump rotation can be in either direction without affecting the pump efficiency.

7. Start pump drive. Where possible, start at a low speed or jog the drive.

8. If the system is equipped with a suction limit switch and/or a discharge pressure switch, check to be certain that the switch is set at the proper pressure. The cut off pressure of the limit switches are preset at the Penn Valley factory at 30 psi.

Troubleshooting a Penn Valley Pump Installation

It is common to assume on a pumping installation that the pump is the problem, being the only mechanical device in the system. More often than not the problem is created by pipeline hydraulics. This is particularly true on new installations. The following checkpoints are offered to identify some of the problems that may arise.

Symptom	Cause	Solution
A. Will not prime or slow to prime.	1. Air leak in the suction line.	1. Tighten connections.
	2. Clack valve not seating properly.	2. Replace clack valve.
	3. Discs worn or damaged.	3. Replace discs.
	4. Suction strainer clogged.	4. Clean strainer.
	5. Suction lift to high.	5. Reduce suction lift.
	6. Liquid temp. to high for lift.	6. Reduce temp. or lift.
	7. Discs not seating property due to solids accumulation.	7. Clean or replace discs.
B. Low Pump capacity or discharge pressure lower than planned	1. Discharge head too high.	1. Reduce pump capacity.
	2. Excessive suction lift.	2. Reduce suction lift.
	3. Pump obstructed.	3. Remove obstruction.
	4. Pump worn.	4. Disassemble and replace worn parts.
	5. Pump speed too low.	5. Increase pump speed.
C. Pump requires excessive horse-power.	1. Liquid viscosity or specific gravity greater than planned.	1. Review liquid and system specifications.
	2. Total head higher than planned.	2. Review liquid and system specifications.
	3. Closed or partially closed discharge valve.	3. Check discharge piping system for closed valve.
	4. Piping obstructed by solids build-up.	4. Clean piping system.
D. Excessive vibration.	1. Discharge head too high.	1. Reduce pump capacity.
	2. Liquid viscosity too high.	2. Reduce pump speed.
	3. Cavitation caused by obstructed suction piping system.	3. Remove suction line obstruction.
	4. Pump damaged.	4. Disassemble and repair pump.
	5. Pipe line obstructed.	5. Remove obstruction.
E. Poor disc wear life.	1. Discharge head too high.	1. Reduce pump capacity.
	2. Liquid attacking disc elastomer.	2. Replace discs with compatible elastomer.
	3. Liquid temperature too high for disc elastomer.	3. Replace disc's with compatible elastomer.
F. Poor drive life	1. Misalignment between pump and drive.	
Obvious but often overlooked		
E. No flow.	1. Suction pipe not immersed in liquid.	1. Lengthen suction pipe.
	2. Drive not operating.	2. Check circuit breaker.
	3. Flow being diverted in discharge piping system.	3. Check valves in discharge piping system.
	4. Obstruction in suction piping system.	4. Open valve or clear obstruction.

PREVENTATIVE MAINTENANCE

1. Be sure that all nuts and cap screws are fully tightened. Gaskets have a tendency to compress over a period of time therefore the cap screws should be checked for tightness.

2. Check coupling wear and alignment periodically. Replace coupling element before excessive backlash develops on direct connected units. The belt tension should be checked and re-adjusted to normal standards if a V-belt drive is used.

3. Be sure the drive cover is always in place to protect personnel from injury and to keep foreign material from entering the area above the sealing trunnions.

4. After extensive usage the upper surface of the trunnions should be visually inspected for any signs of cracking or flex failure. Replace trunnions immediately if any deterioration is noticed.

5. Check suction and discharge pressure gauges occasionally. Higher pressure may indicate a piping obstruction and lower pressure may indicate fluid chamber wear or damage.

LUBRICATION SCHEDULE

Long-term experience has shown that the best bearing life is achieved when the pump shaft bearings are never re-lubed. These bearings are grease packed for life with a specially formulated lubricant that should not be replenished.

Traditional equipment maintenance normally includes a re-greasing schedule. In many cases we have found that over greasing significantly reduces the life of the pump shaft bearings.

PUMP DISASSEMBLY INSTRUCTIONS

1. Drain pump by removing pipe plug (33) from sump.

2. Remove four (4) screws (47) and lift off drive cover.

3. Disconnect suction and discharge flanges.

4. Remove six (6) screws (37) and four (4) through bolts (36) which secures the suction housing and drop suction housing.

5. Clean and securely grasp suction disc (21) and unscrew from drive rod. Two people may be required. Drape a newspaper over the disc to aid grip and wear gloves to protect hands from the cuts or abrasions as the disc releases.

6. Remove four (4) through bolts (36), two (2) short screws (37) and four (4) long screws (35). Lift off complete discharge housing (3) and drive assembly. The suction trunnion (1 4) and clamp (1 5) may now be lifted clear.

7. Clean and remove discharge disc as in step 5.

8. Remove four (4) short bolts (43) to release drive assembly. Lift off drive assembly, which releases the discharge trunnion (1 4) and clamp (1 6).

PUMP ASSEMBLY INSTRUCTIONS

1. Fit discharge trunnion (14) and position clamp ring (16) into discharge casting (3). Conical face of trunnion must point upwards as shown.

2. Position complete drive assembly over the discharge casing and lower on to the top face while passing the discharge drive rod (1 3) through the trunnion center. Secure using four (4) short hex head screws (46) through the discharge pedestal (6) and discharge side of the center support (7).

3. Apply a liberal amount of grease to the discharge drive rod (1 3) and *inside and on top of the conical form of the discharge* disc (22). Screw the disc on to the drive rod. Tighten by hand until it bottoms against the shoulder. The disc cannot be properly seated and tightened without greasing the rubber cone. This allows the disc to slide against the trunnion under side.

4. Fit the suction trunnion into its housing and position the suction clamp (1 5) above the trunnion. Fit a new gasket on to the cleaned upper face of the intermediate housing.

5. Place the discharge housing and drive assembly onto the intermediate housing, ensuring that the suction drive rod slips through the trunnion. Secure with four (4) long cap screws (35) through the drive pedestals and discharge housing into the intermediate housing, two (2) short screws (37) and four (4) thru bolts (36). Firmly tighten all screws.

6. Fit suction Disc (21) as in step 3. *Don't forget the grease.*

7. Inspect the flapper valve for cracks or wear. Replace if necessary. Don't forget the four (4) spacers.

8. Position the suction gasket on the suction casing and replace the casing, securing with four (4) through bolts and six (6) hex screws.

9. Double check all screws for tightness.

10. The pump is now ready to placed back in service.

DOUBLE DISC™ PUMP BEARING REPLACEMENT

1. Using 1/4" punch, drive the four spirol pins (29) out of the cam lobes (9) to free the cams from the drive shaft (8). Apply heat to the inner ring locking screws (46) on the four pedestal bearings (31) to soften the "loctite" and remove the screws (total of eight 8).

2. Utilizing a copper or hide mallet and a soft punch, drive the shaft (8) out of the supports and con rods.

3. Carefully inspect all bearings for roughness of rotation, wear or loose fit between the outer race and housing on the pedestal bearings (31).

4. Replace any bearings found to be worn. The pedestal bearings simply unbolt. All four (4) bearings *must* be loosened if any bearings are to be replaced. To replace the con rod bearings (31), remove the two retaining screws from the cam lobe and press the cam out of the bearing. Remove the single retaining screw (if fitted) from the con rod (10 & 11). Heat the casting around the bearing to soften the "Loctite" and press the bearing out. The new bearing should be de-greased on the outside diameter and the con rod (1 0 & 11) cleaned to remove any residual "Loctite" and de-greased. Then apply fresh "Loctite or Permatex" to the bearing bore and press the bearing into position. Check with a 0.005" feeler gauge to ensure that the bearing is fully pressed into the housing. A gap will remain between the rubber seal and the back face, even when the outer race is tight against the housing. Press the cam lobe (9) into the bearing, using a light lubricant, not "Loctite". Replace the cam lobe and bearing retaining screws.

5. With the four pedestal bearings (31) loosely sub-assembled onto the pedestals and the two con rods correctly positioned, lubricate the shaft (8) with "Never-Seize" or equal. Insert the assembly and lightly

tap, using a soft mallet, through the bearings. Most pumps are assembled with the keyed end of the shaft adjacent to the suction con rod (10). A reverse drive is assembled with the keyed end of the shaft toward the discharge. Caution: Ensure that your pump is re-assembled to the correct configuration.

6. When the shaft is in position, replace the four spirol drive pins (29). Any broken or damaged pins should be replaced, ensure that they are spirol drive pins and not roll pins, if not purchased from The Penn Valley Pump Company. Check that the cams (9) are positioned one up and one down, 180 deg. out of sequence.

7. It the drive pedestals (6) have been removed from the pump, they should now be positioned and fully tightened back onto the discharge housing (3). The complete shaft (9) and con rod assembly should remain free to slide back and forth through the pedestal bearings (3).

8. Lightly nip the four bolts (46) securing each of the four bearings (31) to the pump pedestals. Ensure that the inner rings still rotate around the shaft (8) without binding. Then tighten the bearing retaining bolts (46), once again, checking to be sure that the inner rings rotate freely, which ensures the correct alignment.

9. Align the bearing inner rings; nip one of the screws in each. Turn the shaft 90 deg, back out the other screws. Using the largest drill, which will fit into the tapped hole (I 7/64) drill the shaft just deep enough to provide a full drill diameter (0.080"). Apply "Loctite or Permabond" thread lock to the hole and retaining screws, re-fit and tighten. Remove the other lock screws and repeat the procedure (Drill, Loctite, re-fit and tighten). Allow time for the "Loctite" to cure prior to putting the pump back into service.

Assembling the drive in this manner ensures that all the bearings will be aligned and free from any undue side loads without resorting to using precise dial indicators or other such devices.

The numbers after the parts are item numbers on the exploded view on page 14.

SPECIAL TOOLS

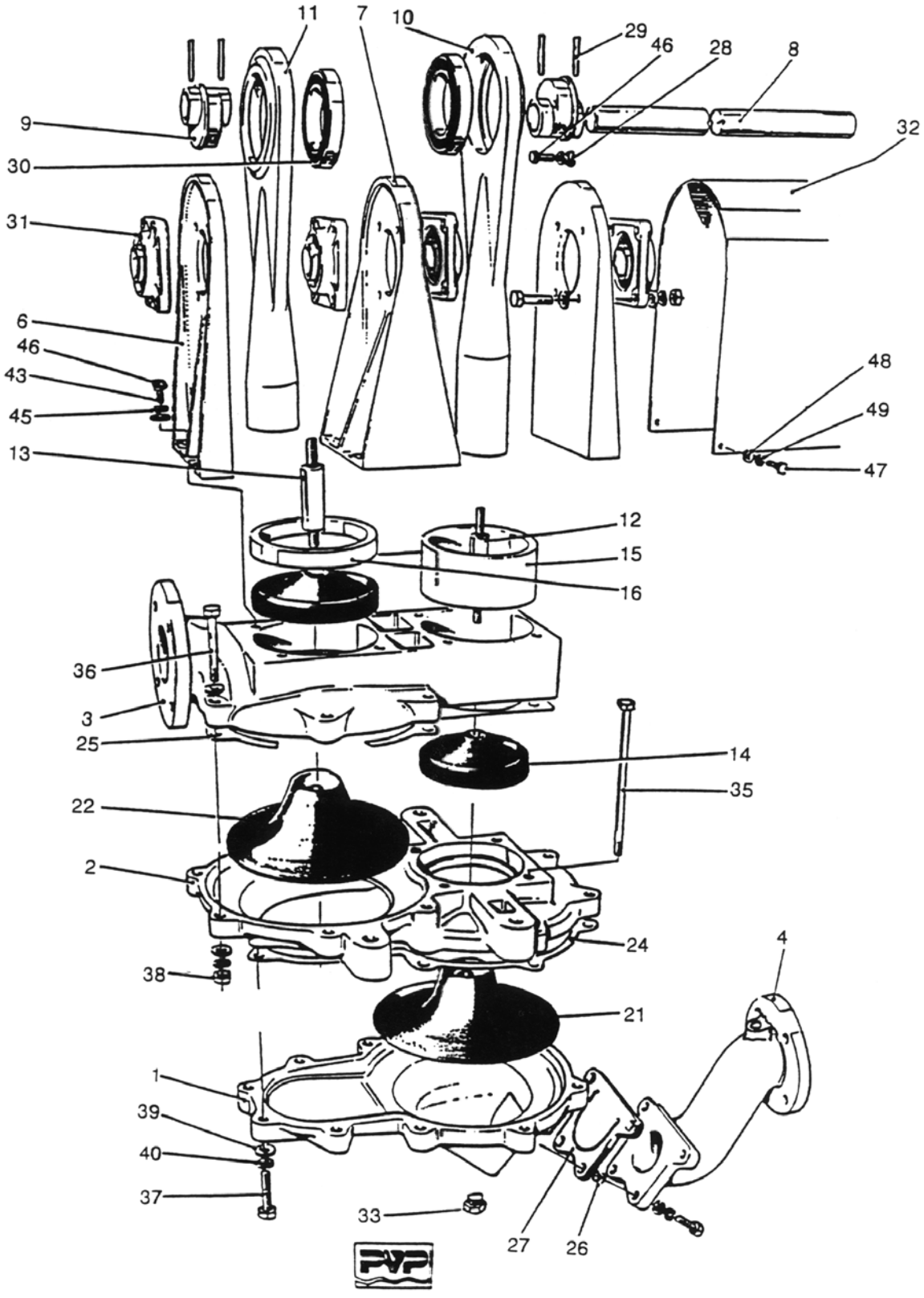
Maintenance and repair of Double Disc™ pumps requires no special tools, standard repair shop tools will be sufficient. Normal tools will include.

- 7/16", 1/2", 9/16", 3/4", AF Wrenches
- Gasket scraper
- 1/4" Punch
- Soft mallet
- Press ring bearing puller (if replacing bearing)
- 17/64" twist drill

Other materials needed.

- Shop rags
- Loctite, Permatex or equal
- Never Seize or equal

Model 3" Inch Double Disc™ Pump Exploded View



Model 3-Inch Double Disc™ Parts List

Item Number	Quantity per Unit	Description	Part Number
1	1	Suction Housing	PVC685C
2	1	Intermediate Housing	PVC102
3	1	Discharge Housing	PVC1033
4	1	Swan Neck, Cast Iron	PVC686C
6	1	Pedestal	PVB1063
7	1	Center Support	PVB1073
8	1	Drive Shaft	PVB1083
9	1	Cam Lobe	PVA1093
10	1	Con Rod, Suction	PVC1103A
11	1	Con Rod, Discharge	PVC1103B
12	1	Drive Rod, Suction	PVA111
13	1	Drive Rod, Discharge	PVA112
14*	2	Trunnion	PVB113N
15	1	Trunnion Clamp Ring, Suction	PVB114A
16	1	Trunnion Clamp Ring, Discharge	PVB114B
21*	1	Integral Disc, Suction	PVC188N
22*	1	Integral Disc, Discharge	PVC160N
24*	1	Gasket, Suction	PVB119
25*	1	Gasket, Discharge	PVB120
26	1	Clack Valve Gasket	PVB695
27	1	Clack Valve	PVC681N
28*	4	Special Washer	PVA138
29	4	Drive Pin	PVA182
30	2	Bearing Con Rod	PVA2433
31	4	Bearing Pedestal	PVA2453
32	1	Drive Cover	PVB123
33	3	Priming/Drain Plug	PVA180
35	4	1/2" -13 UNC x 5" Bolt	PVA390
36	8	1/2" -13 UNC x 3-1/4" Bolt	PVA389
37	16	1/2" -13 UNC x 2-1/4" Bolt	PVA388
38	20	1/2" -13 UNC Nut	PVA386
39	58	1/2" Flat Washer	PVA385
40	38	1/2" Lock Washer	PVA384
46	12	1/2" -13 UNC x 2" Bolt	PVA387
47	4	5/16" -18 x 3/4" Bolt	PVA383
48	4	5/16" Flat Washer	PVA382
49	4	5/16" Lock Washer	PVA381

* Recommended spare parts

When ordering trunnions, suction discs, discharge discs or clack valves, specify the elastomer required.

[1] Note: The Model 4 Inch Duplex Double Disc™ Pump consists of two (2) Model 3 inch Double Disc™ Pumps manifolded into a six inch (4") suction and discharge port arrangement. The quantities are per unit, therefore should be doubled for the Model 4 inch Double Disc™ Pump.

Model 3" Simplex Materials of Construction

Common Parts

Item Number	Quantity per Unit	Description	Construction
6	1	Pedestal	Cast Iron
7	1	Center Support	Cast Iron
8	1	Drive Shaft	High Tensile Stainless Steel
9	1	Cam Lobe	High Tensile Stainless Steel
10	1	Con Rod Suction	Aluminum Alloy
11	1	Con Rod, Discharge	Aluminum Alloy
12	1	Drive Rod, Suction	High Tensile Stainless Steel
13	1	Drive Rod, Discharge	High Tensile Stainless Steel
15	1	Trunnion Clamp Ring, Suction	Aluminum Alloy
16	1	Trunnion Clamp Ring, Discharge	Aluminum Alloy
24	1	Gasket, Suction	CF
25	1	Gasket, Discharge	CF
27	4	Clack Valve Spacer	Stainless Steel
30	2	Bearing	Standard Commercial
31	4	Bearing	Standard Commercial
32	1	Drive Cover	Steel Plated
33	3	Priming / Drain Plug	Steel Plated
35-49		Fastener construction available on application	

Cast Iron Construction with Neoprene Elastomers

1	1	Suction Housing	Cast Iron
2	1	Intermediate Housing	Cast Iron
3	1	Discharge Housing	Cast Iron
4	1	Swan Neck	Cast Iron
14	2	Trunnion	Neoprene
21	1	Integral Disc Suction	Neoprene
22	1	Integral Disc Discharge	Neoprene
26	1	Clack Valve	Neoprene

Cast Iron Construction with Hypalon Elastomers

1	1	Suction Housing	Cast Iron
2	1	Intermediate Housing	Cast Iron
3	1	Discharge Housing	Cast Iron
4	1	Swan Neck	Cast Iron
14	2	Trunnion	Hypalon
21	1	Integral Disc Suction	Hypalon
22	1	Integral Disc Discharge	Hypalon
26	1	Clack Valve	Hypalon

Neoprene Lined, Cast Iron Construction with Neoprene Elastomers

1	1	Suction Housing	Cast Iron, Neoprene Lined
2	1	Intermediate Housing	Cast Iron, Neoprene Lined
3	1	Discharge Housing	Cast Iron, Neoprene Lined
4	1	Swan Neck	Cast Iron, Neoprene Lined
14	2	Trunnion	Neoprene
21	1	Integral Disc Suction	Neoprene
22	1	Integral Disc Discharge	Neoprene
26	1	Clack Valve	Neoprene

Model 3" Simplex Materials of Construction

Item Number	Quantity per Unit	Description	Construction
Hypalon Lined, Cast Iron Construction with Hypalon Elastomers			
1	1	Suction Housing	Cast Iron, Hypalon Lined
2	1	Intermediate Housing	Cast Iron, Hypalon Lined
3	1	Discharge Housing	Cast Iron, Hypalon Lined
4	1	Swan Neck	Cast Iron, Hypalon Lined
14	2	Trunnion	Hypalon
21	1	Integral Disc Suction	Hypalon
22	1	Integral Disc Discharge	Hypalon
26	1	Clack Valve	Hypalon
Soft Rubber Lined, Cast Iron Construction with Neoprene Discs, trunnions & Clack valves			
1	1	Suction Housing	Cast Iron, Soft Rubber Lined
2	1	Intermediate Housing	Cast Iron, Soft Rubber Lined
3	1	Discharge Housing	Cast Iron, Soft Rubber Lined
4	1	Swan Neck	Cast Iron, Soft Rubber Lined
14	2	Trunnion	Neoprene
21	1	Integral Disc Suction	Neoprene
22	1	Integral Disc Discharge	Neoprene
26	1	Clack Valve	Neoprene
Ebonite Lined, Cast Iron Construction with Neoprene Discs, trunnions & Clack valves			
1	1	Suction Housing	Cast Iron, Ebonite Lined
2	1	Intermediate Housing	Cast Iron, Ebonite Lined
3	1	Discharge Housing	Cast Iron, Ebonite Lined
4	1	Swan Neck	Ebonite Lined
14	2	Trunnion	Neoprene
21	1	Integral Disc Suction	Neoprene
22	1	Integral Disc Discharge	Neoprene
26	1	Clack Valve	Neoprene

Other standard elastomer parts are:
Viton suction & discharge disc's, Viton trunnions and Viton clack valves.
EPDM suction & discharge disc's, EPDM trunnions and EPDM clack valves.

Other materials of construction are available on request.

TYPICAL CAPACITY PER REVOLUTION

The following data is based on a test liquid of water (32 SSU) at 70 degrees Fahrenheit (70º F).

Model	Pump Speed		Head in feet of water					
			0	20	40	60	80	100
2 inch	150 rpm	GPM	10	9	7	6		
		Per Rev	0.07	0.06	0.05	0.04		
	300 rpm	GPM	21	18	15	12		
		Per Rev	0.07	0.06	0.05	0.04		
	500 rpm	GPM	35	30	25	20		
		Per Rev	0.07	0.06	0.05	0.04		
	750 rpm	GPM	52	45	37			
		Per Rev	0.07	0.06	0.05			
3 inch	150 rpm	GPM	35	29	23	18	14	11
		Per Rev	0.23	0.19	0.15	0.12	0.09	0.07
	300 rpm	GPM	69	57	45	36	27	21
		Per Rev	0.23	0.19	0.15	0.12	0.09	0.07
	500 rpm	GPM	115	95	75	60	45	
		Per Rev	0.23	0.19	0.15	0.12	0.09	
	750 rpm	GPM	173	143	113	90		
		Per Rev	0.23	0.19	0.15	0.12		
4 inch	150 rpm	GPM	48	41	36	32	27	24
		Per Rev	0.32	0.27	0.24	0.21	0.18	0.16
	300 rpm	GPM	96	81	72	63	54	48
		Per Rev	0.32	0.27	0.24	0.21	0.18	0.16
	500 rpm	GPM	160	135	120	105	90	
		Per Rev	0.32	0.27	0.24	0.21	0.18	
	750 rpm	GPM	240	203	180	158		
		Per Rev	0.32	0.27	0.24	0.21		
4 inch Dplx	150 rpm	GPM	70	58	46	36	28	22
		Per Rev	0.46	0.38	0.30	0.24	0.18	0.14
	300 rpm	GPM	118	104	90	72	54	42
		Per Rev	0.46	0.38	0.30	0.24	0.18	.0.14
	500 rpm	GPM	230	190	150	120	90	
		Per Rev	0.46	0.38	0.30	0.24	0.18	
6 inch Dplx	150 rpm	GPM	98	83	72	63	56	50
		Per Rev	0.65	0.55	0.48	0.42	0.37	0.33
	300 rpm	GPM	195	165	144	126	111	99
		Per Rev	0.65	0.55	0.48	0.42	0.37	0.33
	500 rpm	GPM	325	275	240	210	186	
		Per Rev	0.65	0.55	0.48	0.42	0.37	
	750 rpm	GPM	488	413	360	315		
		Per Rev	0.65	0.55	0.48	0.42		

The following are correction factors to be used on applications involving a suction lift.

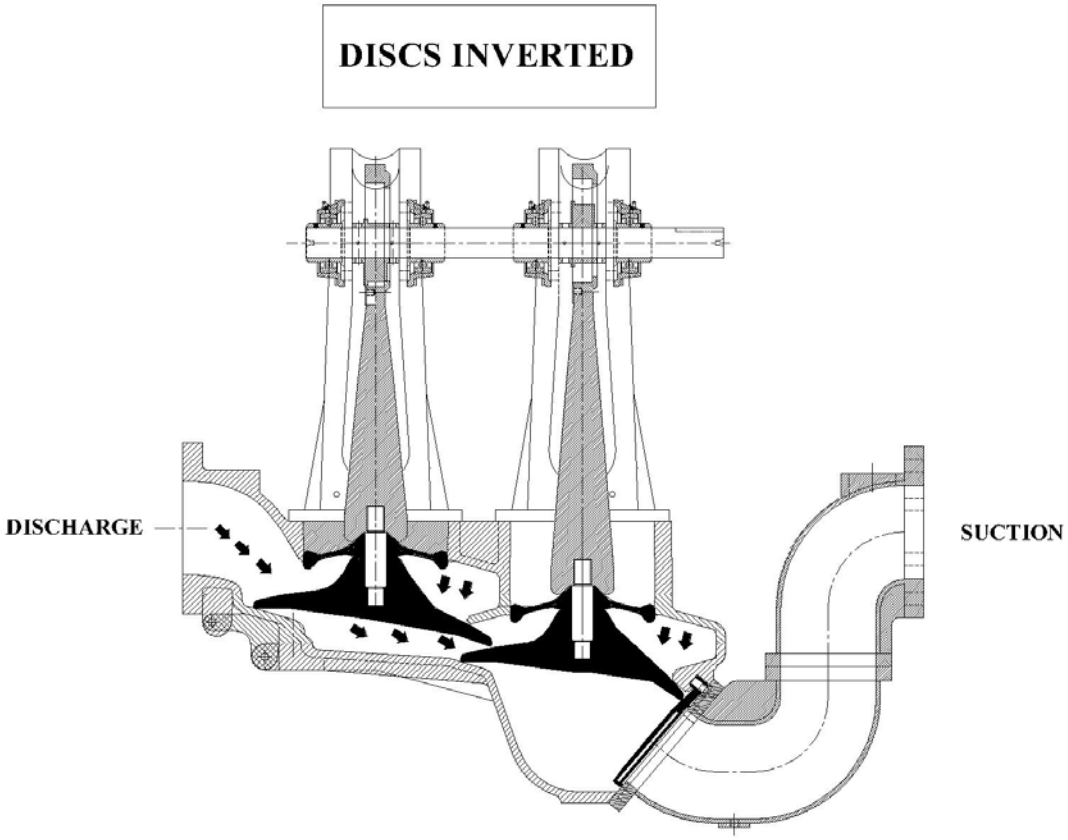
10 foot suction lift - Factor at .82
20 foot suction lift - Factor at .55

Example: The application is to pump non-potable water, 32 SSU at 70 degree F, Specific Gravity of 1.0 at the rate of 100 gallons per minute against 40 foot head, with a 10 foot suction lift, out of a sump.

Solution: Divide 100 gallon per minute by .82 which equals 122 gallons per minute. Follow the 40 foot head column down to 120 GPM. The Model Number 4 inch Double Disc™ Pump will deliver 120 GPM at 500 RPM. The capacity per revolution is 0.24 gallons.

PENN VALLEY DOUBLE DISC™ PUMPS

Failure caused by excessive discharge pressure.



Cause:

Double Disc Pump operated against a closed discharge valve or a plugged discharge line.

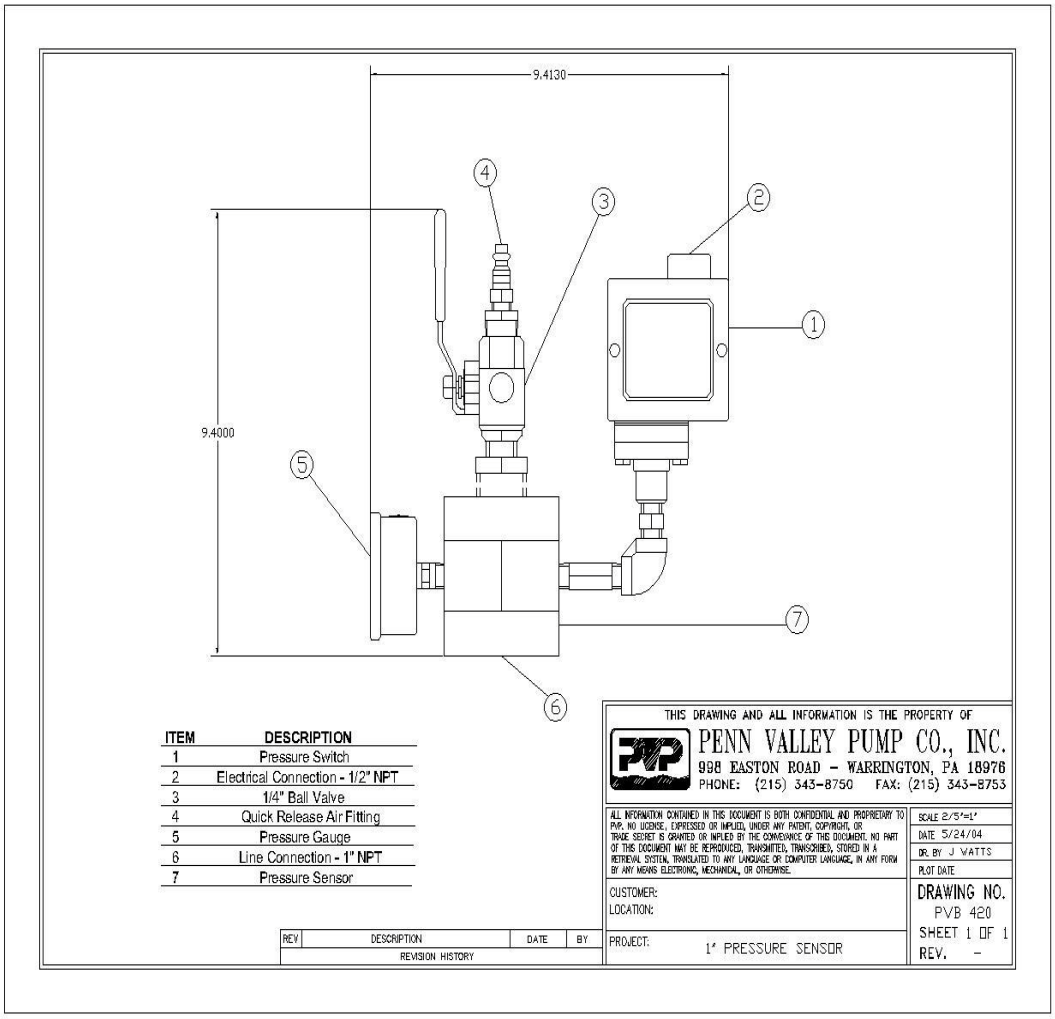
Effect:

1. Discharge disc is forced below it's seat.
2. Suction disc is forced downward off of it's seat.

Solution:

Install a pressure switch in the discharge line set to turn pump off at a predetermined pressure. Typically this pressure would be the maximum recommended operating pressure.

Pressure Switch Assembly



PURPOSE

The Penn Valley, Double Disc™ Pump is a positive displacement pump and when operated against a closed discharge line, will build pressure until failure occurs. This failure is described on page 17 of this manual. This is normally caused by a closed discharge valve, however, can also be caused by plugged or restricted discharge line. The pressure switch assembly is recommended to limit the discharge pressure to the maximum recommended operating pressure of the Double Disc™ Pump. The following are the maximum recommended pressures:

2" Pump	70 ft. head (30 psi)
3" Pump	100 ft. head (43 psi)
4" Pump	100 ft. head (43 psi)
6" Simplex Pump	100 ft. head (43 psi)

The above head / pressure conversions are based on a specific gravity of one (1). If other than one (1) divide head in feet by the specific gravity and the multiply by 2.31.

Installation

The pressure switch assembly should be installed as close to the pump discharge port as possible. A 1" line is installed in the discharge piping and connected to the 1 " N PT inlet port of the pressure sensor, located on the bottom of the sensor housing. A 1 " isolating valve is installed on the outlet port with a connection for a water hose. This is used for back flushing (cleaned in - place) of the sensing chamber of the pressure sensor. Over a period of time a solids build-up can occur in the sensing chamber. In most cases the build-up can be cleared by openingtheisolationvalveandutilizingthesystempressuretoclearthebuild-up. If the system pressure is not sufficient to remove the build-up, then the potable or non-potable water system can be used to back flush the sensing chamber. This cleaned in place feature eliminates the need to remove the pressure sensor for cleaning such as is the case with diaphragm seals.

The system consists of a pressure sensor, a l/4" needle valve, a 0-60 psi pressure gauge and a pressure switch. The pressure sensor reads the line pressure in the pump discharge line. The needle valve is used to modulate pressure fluctuations and provide a steady signal. The pressure switch is activated when the set pressure is exceeded and that in turn shuts the pumping system down.

The pressure sensor is supplied with a Buna-N sensing tube for applications on slurry applications such as sludge, raw sewage, scum, grit and lime slurry in Wastewater Treatment Plants. The sensing system is filled with a 50% ethylene glycol and water solution and is completely protected from the process slurry by the Buna-N sensing tube. The sensing tube is one-piece construction with integral flanges locked into the pressure sensor with bolted end covers.

The needle valve is constructed in brass and is equipped with 1/4 inch pipe threaded in and out connections. A standard 0 - 60 psi pressure gauge is supplied.

The pressure switch is supplied in a watertight, epoxy coated, alloy enclosure for corrosion resistance. Meets NEMA3, 4, 4X and 13 requirements. For severe corrosive atmospheres type 3l6 stainless steel and Monel are available. The actuator seal is constructed of Buna-N with process temperature limits of 0 to 150 deg. F. The pressure switch has a plus or minus 1 percent of the range set point repeatability and a minimum of 400 percent of range proof pressures. This unit performs well on applications where shock and vibration could be problem on services such as slurries or abrasive process fluids.

Calibration Procedure

The Pressure Switch Assemblies ordered from the factory are preset at 30 psi (69 feet). If recalibration is required in the field, the following procedure would be required.

1. Remove the pressure switch cover (environment permitting).

2. Open all system valves and turn the pump on.

3. Check the pressure gauge, the gauge indicator should swing slightly (not more than plus or minus 3 psi) to show line pressure. Adjust the needle valve to achieve the desired gauge indicator fluctuation-open (turn counterclockwise) to increase - close (turn clockwise) to decrease.

4. *Carefullv* throttle the pump using the discharge valve until the desired pressure is achieved. **Caution: Do not exceed 45 psi.** The pressure switch is factory set at 30 psi so the pump will shut down when that pressure is exceeded.

5. Adjust the 7/8" hex nut in the pressure switch to cut out at the desired pressure. If a lower pressure is being set, the pump will continue to operate until the adjusting nut is turned down (counterclockwise) to the new trip point. It a higher pressure is being set, it will be necessary to adjust the switch (clockwise), then open the discharge valve. Re-start the pumping unit. Then throttle the pump again up to the desired pressure **Caution: Do not exceed 45 psi.** If the pressure switch does not trip, adjust the switch again, repeating the throttling procedure until the correct cut out pressure is achieved.

6. Always re-check the cut out pressure two or three times to be certain that the pressure sensing switch is operating properly. The motor should be wired such that it stays off after the pressure is relieved and requires a manual re-set to be placed back into operation.

7. Re-install the pressure switch cover. The system is ready to be placed in operation.

SAFETY

Safety instructions for Double Disc™ Pumps

1. Pumping equipment must only be operated by personnel who are fully trained in all safety procedures.
2. To prevent personnel injury, equipment must not be operated unless all guards and covers are in place and secured.
3. No maintenance or adjustments are to be performed until the equipment is stopped and electrical power has been locked out.
4. Suitable safety equipment must be worn by any personnel performing maintenance on this equipment; including safety glasses, safety shoes and hard hats.
5. Keep hands, clothing etc. away from moving parts.
6. Never permit people who have been drinking alcohol or using drugs to maintain or repair this equipment.
7. Locate "WARNING" signs in areas where moving parts are present. Limit access to authorized personnel only.
8. Inspect and maintain equipment as per equipment operating instructions.
9. Always use factory replacement parts for equipment maintenance, always follow equipment maintenance manual for assembly and disassembly instructions.

SHUT DOWN INSTRUCTIONS

Shut Down Instructions for Double Disc™ Pump

1. Shut pump off.
2. Disconnect power to pump motor.
3. Close both Suction and Discharge Valves.