CHICAGO INDUSTRIAL PUMP COMPANY
PITBULL PUMPS

Installation and Operations Manual

For All Pitbull Pumps With a DP220 Or DP220H Control Panel

PUMP MODEL NUMBER______________________________

SERIAL NUMBER ___________________________________

OPTIONS ____

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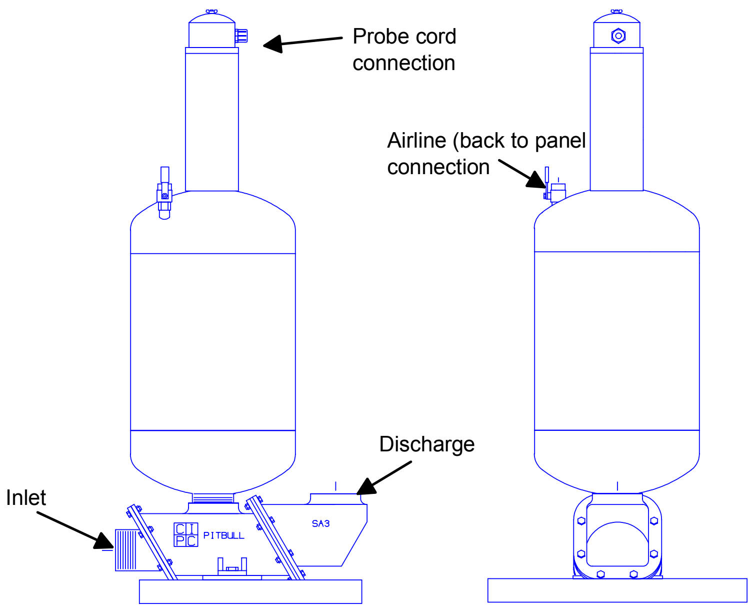
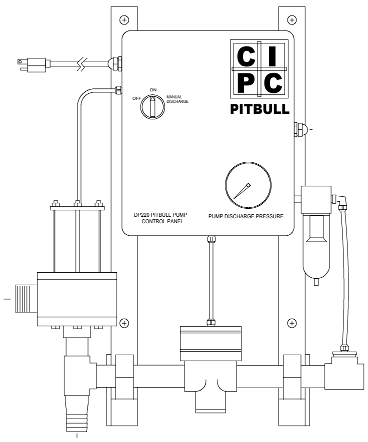
SYSTEM OVERVIEW

Each PITBULL pumping system is comprised of a pump with two check valves, a control panel, and the connecting airline with probe cord.

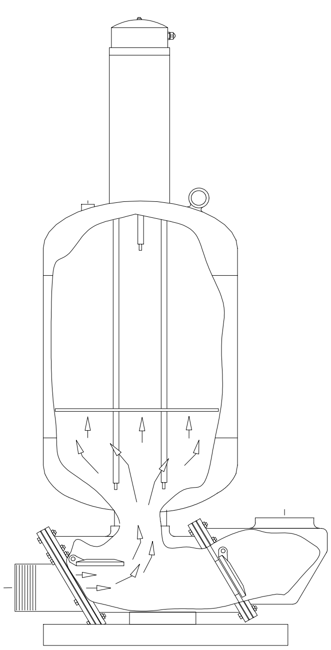




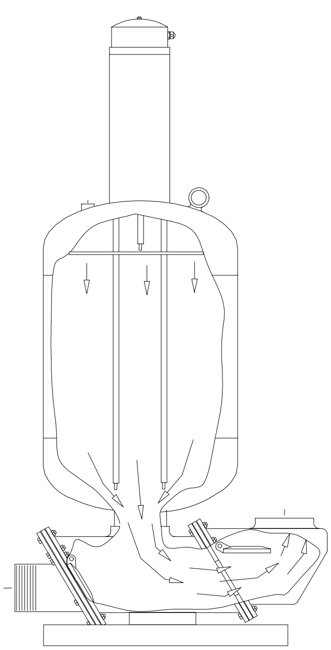
THE PITBULL PUMPING PRINCIPLE

The PITBULL pumps liquid by allowing liquid to fill the pump through the inlet check valve, and then when full, it pressurizes with compressed air and forces the liquid out through the discharge check valve. The check valves act to direct the liquid in the correct direction.

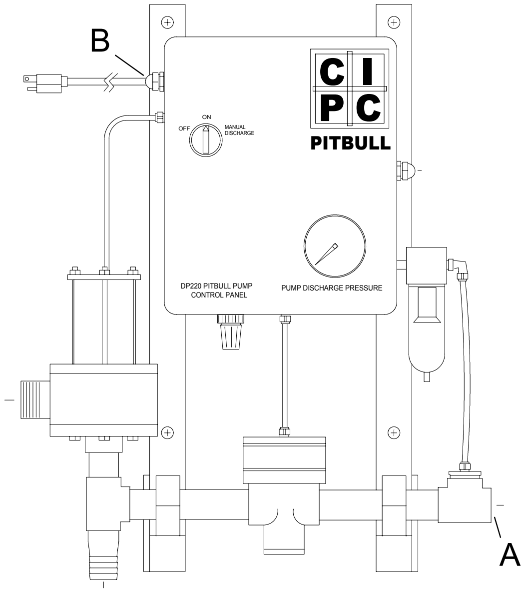
In its standard configuration the PITBULL uses gravity to fill the pump, requiring the pump to be below the liquid level in order to fill. In the PITBULL's self-priming configuration the pump will pull liquid into it, and can be located above the liquid level



Pump filling through inlet check valve.



Pump pressurized, forcing liquid out discharge.



The DP220 control panels are shipped loose for remote mounting. Fifteen feet of airline and probe cord are included as standard. *To finish installing the control panel, please follow the steps outlined below.*

1- <u>Mount the panel above the liquid level</u> on the inlet side whenever possible.

2- Bring your compressed air supply to the inlet (A) on the side of the panel (see figure).

- Please follow the table for the recommended air piping size for your pump model to insure full and correct functioning of your system. Be aware that the PITBULL uses compressed air in spurts, and needs a larger diameter airline than the average air consumption would require.

<u>Pump# - Inlet</u>	<u>Air Supply</u>
F2C/S 2"	3/4" pipe (DP220 panel)
F3C/S 3"	1" pipe (DP220 panel)
F4C/S 4"	1" pipe (DP220 panel)
Custom 6" and larger	1-1/2" pipe (DP220H panel)

(C) Filtration required. Use 40 to 80 micron filter with bowl. <u>Do Not Lubricate!</u>

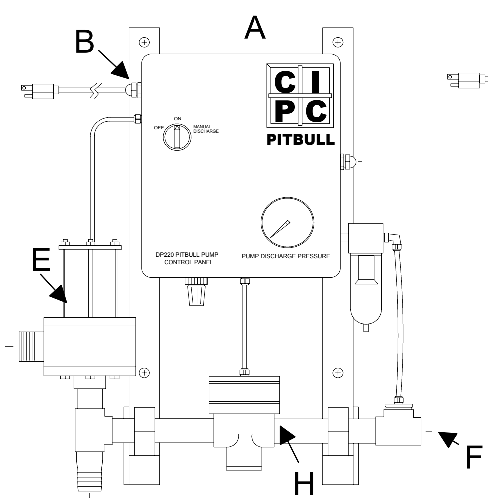
2- Provide the panel with a 110VAC power source. The hole for the power cord strain relief will fit 1/2" conduit if the standard cord is not acceptable (B).

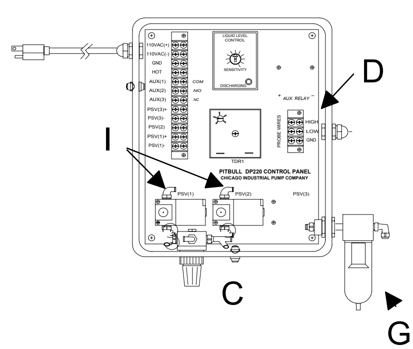
3- (optional) On dry piped applications it is often desirable to run an exhaust line from the open exhaust port back up to the top of the feed tank, or to a suitable drain. This will prevent spillage in the event of compressed air or power failure (see "Recommended Installation" sketches) and will reduce exhaust noise. Note that this line will require a drain valve/port because of condensation.

- **Mufflers:** you may choose to install a muffler, especially in high-pressure applications. <u>However, avoid porous media mufflers that will plug up and throttle/stop the pump</u>. CIPC also sells straight through (no restriction) mufflers, part #ST-6B, as an option for vacuum generators.

<u>IMPORTANT</u>

<u>DO NOT install a solenoid valve on the air supply</u> as the on/off control for the PITBULL.
<u>DO NOT</u> use the air supply as the on/off control for the PITBULL.
<u>DO NOT</u> use the power supply as the on/off control for the PITBULL.
<u>DO use the supply of liquid (the PITBULL will not cycle without liquid)</u> or the exhaust path as your on/off control (the pump can't fill/cycle with the vent path closed).





CONTROL PANEL COMPONENTS

A- enclosure
B- 110-vac power cord
C- discharge pressure regulator
D- high/low/ground probe connections
E- exhaust valve
F- required 40-80 um air filter
G- mini filter for control valves
H- pilot operated regulator
I- piloting solenoid valves

*SEE SECTION FOLLOWING 'TROUBLESHOOTING' IN THIS MANUAL FOR DP220 CONTROL PANEL COMPONENTS

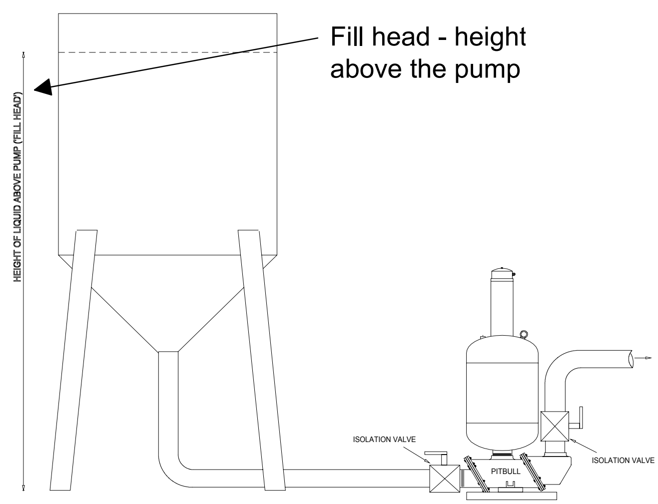
Please refer to the "Recommended Installation" sketch (bottom left), which illustrates the following piping advice.

1- Try to match your supply and discharge piping to that of your PITBULL. Using the matching diameter on the inlet will help insure full flow capacity, while matching the discharge piping will reduce head, erosive velocity and the risk of plugging the line with a solid that passed through the pump.

2- Install an isolation valve upstream of the PITBULL's inlet check valve and another isolation valve downstream of the discharge check. Configure these so that the check valves could be completely removed for servicing without disturbing the isolation valves.

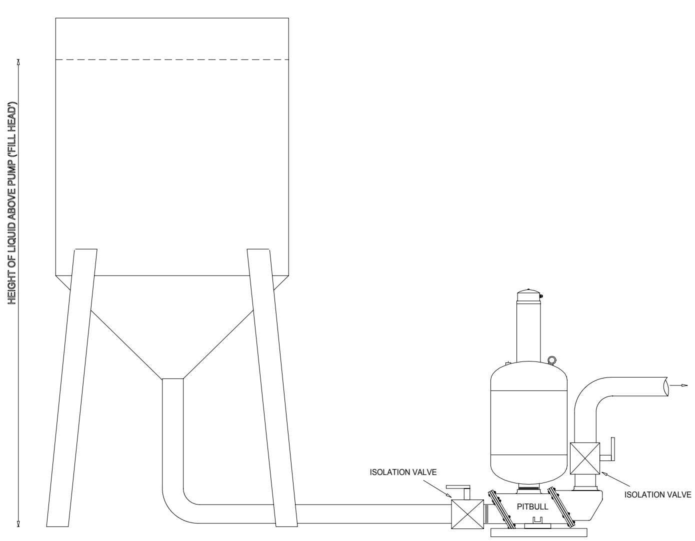
<u>**3-** PLAN ON USING THE VALVE AHEAD OF THE INLET CHECK AS THE PRIMARY ON/OFF CONTROL OF THE PUMP.</u> You may wish to use some type of operated valve in automated processes as a remote controlled shut-off for the pump.

There are important considerations when installing a PITBULL under a positive head, dry piped condition. Please read the following section carefully to insure the best installation and performance from you PITBULL pump.



Please refer to the sketch on the right to familiarize yourself with the term 'fill head', which is the distance between the top of the pump housing and the maximum elevation of the liquid feeding the pump. *<u>PITBULL pumps are designed for slow cycling rates at full flow</u>*, under low fill head conditions. *If you connect the pump to a high fill head source (example- a 20' high clarifier) the incoming flow rate may exceed the design flow rate and liquid will often spray from the exhaust, causing a housekeeping mess and fouling of the exhaust valve.*

In the case of high fill head, the inflow rate must be slowed down, requiring throttling by using the isolation valve (see recommended installations sketch) or by using the ball valve on the pump's exhaust to throttle the air leaving the pump. <u>**You must slow the incoming flow rate so that the 'fill' part of the cycle is > 6 sec.</u>



<u>**RECOMMENDED INSTALLATION**</u>

The sketch on the left shows proper installation of a dry piped pump, with isolation valves before and after the pump to allow easy servicing. TIP: if an exhaust line is run from the panel's exhaust valve to the top or headspace of the supply tank, the loop will be completely closed and no fluid can leak out in the event of pump failure or loss of supply pressure. This configuration requires a valve to drain the exhaust line, as condensation will collect in it.

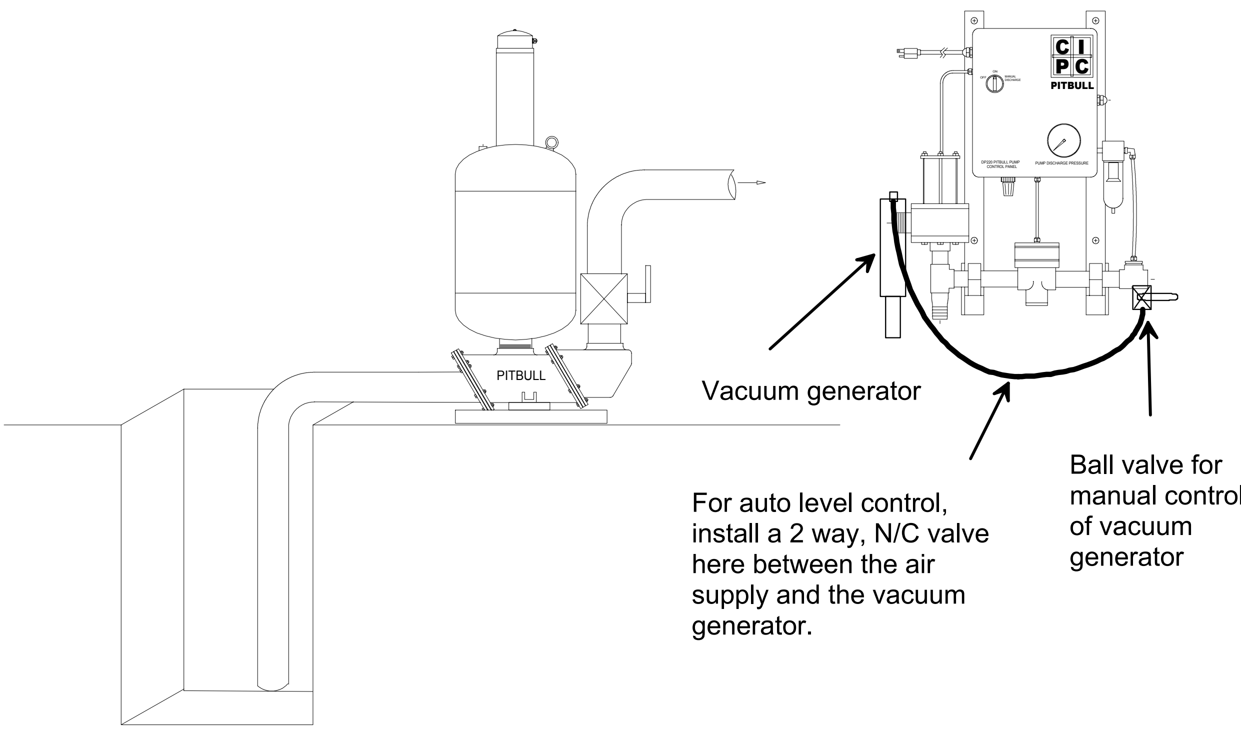
NOTE THE ISOLATION VALVES; VERY IMPORTANT!

SELF PRIMING INSTALLATIONS (PERMANENT)

CIPC modifies a standard transfer pump to create a self-priming pump. This is done by adding an air-powered vacuum generator on the panel's open exhaust port. The vacuum generator uses compressed air and the venturi principle to create vacuum airflow. The operation is 'manual', in which the pump pulls suction at all times, cycling whenever the pump chamber gets full. To put the pump in the self-priming mode, a ball valve is opened, supplying compressed air to the vacuum generator. It will run indefinitely in this mode until the ball valve is manually closed, at which time the pump will only cycle if fed by gravity.

USER INSTALLED LEVEL CONTROLS

To prevent the pump from trying to prime when no liquid is present, level controls can be installed to control the air supply to the vacuum generator. A two-way, normally closed valve is used to control the air supply to the vacuum generator (3/8 - 1/2" valve size with Cv> 2 is suitable). The level controls should energize the valve at high level and de-energize at low level.



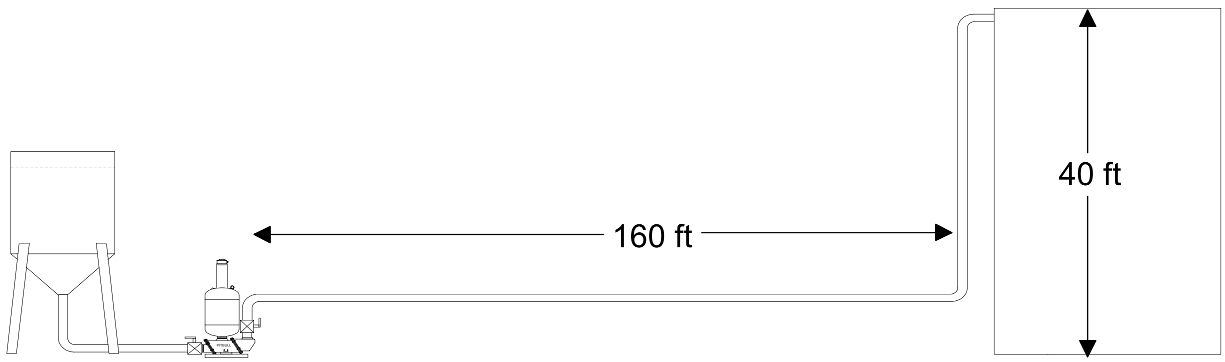
NOTE: The self-priming PITBULL pump is capable of pulling up a maximum of 15' of water. At this level, the flow rate will go to '0'. Near this level the flow rate will be very low and if there are any air leaks in the suction piping or the discharge check valve, the vacuum will not build high enough to prime. At this suction level be careful about the piping/seal integrity and consider using two discharge checks in a row, or an isolation valve (shown above) if you intend start the pump with the discharge piping dry (which requires an absolutely tight seal on the discharge check - not required when the discharge piping is flooded).

Mufflers: because the vacuum exhaust can be fairly noisy, customers often choose to muffle it. Be aware that any muffler with a screen or porous material for the air to pass through will probably clog and defeat the vacuum. CIPC offers a muffler, part number PBXM375 that has a straight through flow path and is suitable for this application. Otherwise, a section of hose or piping (1” ID or greater) will also work well to dampen and carry sound away.

START-UP PROCEDURE

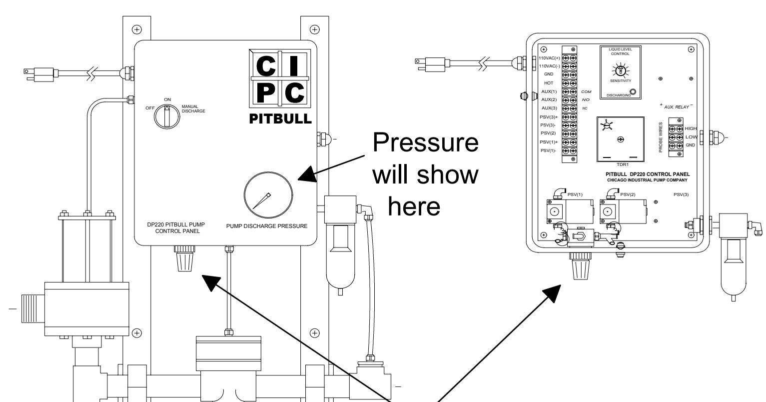
The PITBULL uses two distinct strokes to perform its pumping action; the fill stroke and the discharge stroke. Filling the pump is largely controlled by nature (gravity), and proceeds at a rate dependent upon the inlet hydraulic conditions (the pump fills faster with high inlet pressure). However, the user controls the discharge conditions. Following are directions to correctly set up the pump's discharge stroke.

Set the discharge pressure. Try to determine the total dynamic head required for the application. In simple terms, take the vertical height the pump must push the liquid to and convert it to psi (there are 2.31 ft per 1 psi), and then add in..... your calculated or 'guesstimated' friction loss (guess high if the liquid is thick/viscous) in psi, and finally add 15 psi for a



safety margin. This total should be enough to push the liquid out of the pump at a good flow rate. Note: too little pressure and nothing discharges (the pump is essentially deadheaded), too much pressure and you waste compressed air and put extra wear on your check valves.

Example: The pump is at grade and must pump to an elevated tank 40' above grade, through 200' of 2" pipe at an average flow rate of 20 gpm.
The elevation difference is 40’ so, 40/2.31= 17.3 psi. Now, the flow rate was said to be 20 gpm, but from the PITBULL has separate fill and discharge cycles and therefore *to put out a 20 gpm flow rate the pump must take in 40 gpm while nothing is discharging, and then discharge at 40 gpm while nothing is filling in order to average the 20 gpm.* So, use 40 gpm to calculate friction loss.



TIP: If your discharge piping is the same as the PITBULL's, the velocity will be so low that friction loss is negligible on shorter runs with watery fluids.

Finally, from a friction loss chart you find that the loss for 40 gpm of water flowing through 200' of 2" pipe is 3.6 ft/100', or a total of 7.2' (3.1psi). So set the discharge regulator for 17.3 + 3.1 + 15 = 35.4 psi (Note that the friction loss was relatively negligible).

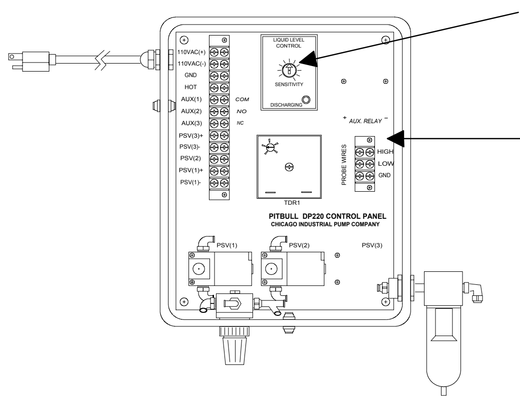
__For Filter Press Applications:__ you do not need to worry about the pump stalling. It will continue to pump until the discharge pressure is equal to the press backpressure, at which time it will remain pressurized but unable to force liquid out. It can remain in this state indefinitely and will begin pumping as soon as the discharge head is lowered or the discharge pressure is raised.

Initial start-up: With compressed air and power supplied to the panel first, slowly open the inlet isolation valve. Try to run the pump with the valve only 1/4-1/3 open for the first stroke or two while confirming that everything is functioning correctly.

To change/re-set the sensitivity of the probes: __This procedure is rarely required when pumping conductive sludges and slurries.__ Usually the combination of wastewater and solids produces so many ions that the liquid is very conductive. If your application falls into this category just leave the "Sensitivity Adjustment" knob near the "Low" setting, almost all the way counterclockwise (this is the standard factory setting upon shipment).

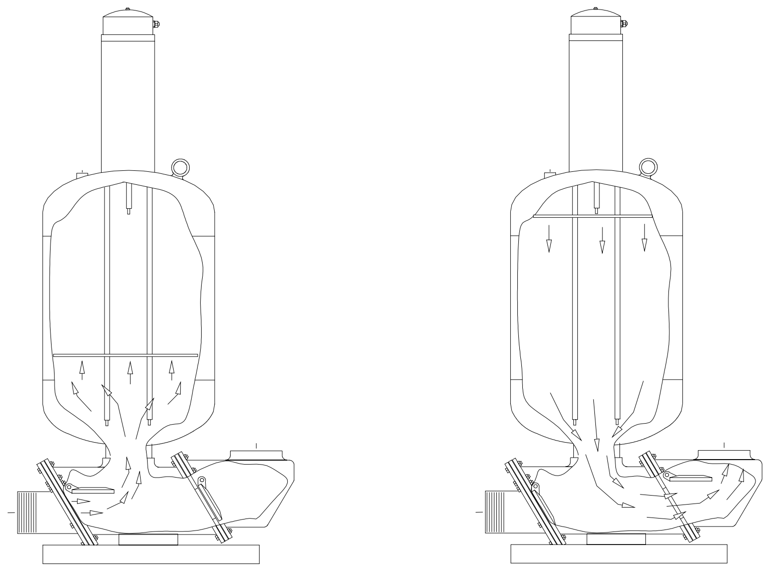
However, if your liquid is only mildly conductive, you may need to set the sensitivity higher to be able to detect it. Please follow this simple procedure to reset the sensitivity (see figure below).

1- Remove the 'high' and 'ground' probe wires from the probe terminals (marked below).
2- Add a length of temporary wire to each terminal that is long enough to reach a container of the liquid being pump.
3- Place both jumpers into the liquid so that they are not physically touching each other or the container side wall.
4- Increase the sensitivity adjustment until the discharge light comes on.
5- Pull the high level wire out of the liquid. Observe that the discharge light goes on and off consistently with the insertion and removal of the high level wire from the liquid. Make any further sensitivity adjustments until this is the case. Use the least sensitive setting that will allow this consistent detection of the liquid.



The PITBULL pumps with DP220 series control panels are designed to discharge one pump chamber full of contents on every stroke. The stroke is therefore volume-dependent and not time dependent. This means that once the pump is in the discharge mode, it will stay in that pressurized mode until the pump is empty. If the pump is deadheaded, then it will stay pressurized indefinitely.

The sketch below shows that the pump cycles between high and low liquid levels inside. The discharge stroke is not initiated until the high probe detects liquid, and once it does, the pump will pressurize until the low probe and ground probe are uncovered (out of the liquid).



Cycling problems can occur if there is a non-conductive build-up on the probes. These insulators desensitize the probes until they can no longer detect liquid. The practical solution to this problem is two part.
First- increase the sensitivity as high as possible without getting false level readings (if the pump is in the discharge mode when empty, the probes are set too sensitive or shorted).
Second- plan on preventative maintenance to clean the probes before they foul. This will prevent you from having to clean slurry from the air valving that was flooded when the fouled probes did not detect the high level in the pump.
The PM approach is much, much easier.

IF: the pump constantly discharges, blowing air down the discharge piping long after the pump is empty.
THEN: first check the discharge light. If it is lit, then the controls are sensing liquid that isn't there. If the light is off then the problem is either the discharge air valve (stuck open), or the pilot valve (stuck open or burnt out). See the section on servicing the discharge air valve, and/or replace the pilot valve.

Given that the discharge light is lit, there must be a conductive path between the high **or** low probe and the ground probe. The path is from tip to tip, and can follow any wet surface up one insulated probe, across the pump's top, and down the other insulated probe. This can occur more easily in highly conductive sludges that build up layers on the probes. Also note - wet or nicked probe wires will create the same short path. Check that the wiring is in good condition, and then remove the probe wires from the top of each probe, unscrew the probes from the pump (turn the whole 1/2" npt fitting by its hex base, not the smaller compression nut) pull and clean all three probes, wiping all build-up off and cleaning the metal tip to the bare metal.

IF: the pump does not cycle and is in the 'fill' mode (discharge light not lit).
THEN: it is most likely that the pump has not filled to the level of the high probe inside, or the high level has been reached but not detected.

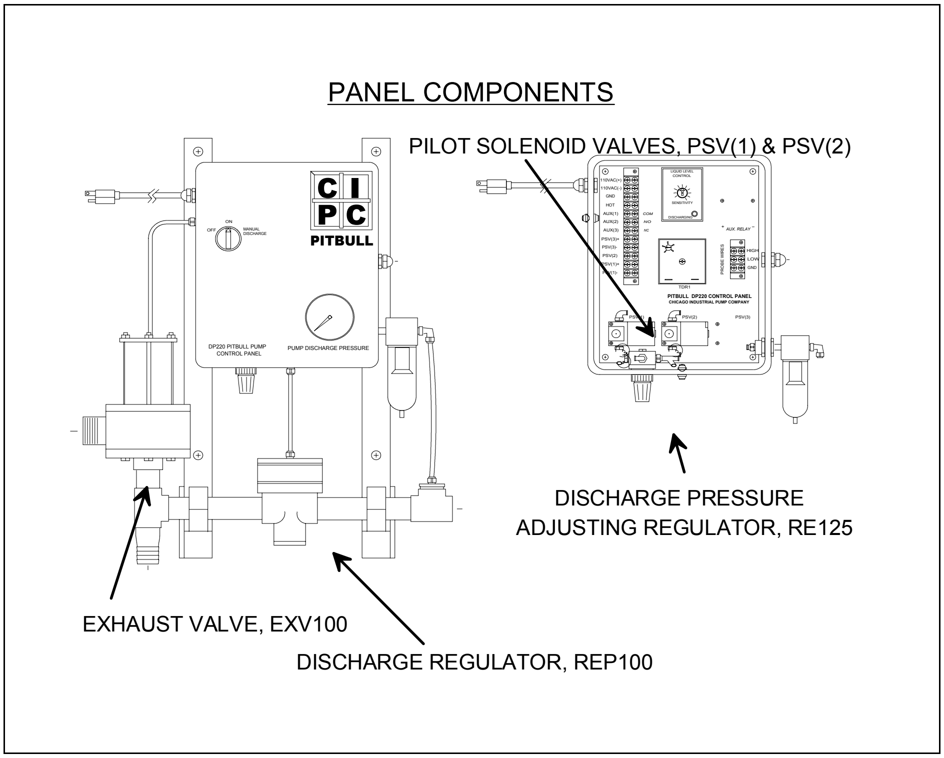
You will know right away if a flooded pump has not detected the high level because liquid will come right up the exhaust path, flooding the exhaust valve. If this is the case, then the probes are insulated from build-up, or the sensitivity is set too low. Use the same cleaning procedure from above to clean the probes. Once clean, if there is any doubt about the sensitivity setting, double check it using the procedure outlined under the START UP section. Also, broken or corroded probe wiring will cause this condition.

The reasons for the pump not filling are either that the liquid path is blocked (in the piping or at the check valve), preventing flow, or that the exhaust path is blocked (if no air is vented out the top of the pump, no liquid can enter and displace it). To fix these conditions simply requires opening the blockage, noting that the exhaust path must be free and clear from the pump opening to wherever the exhaust is finally released.

IF: the pump cycles normally but output (flow or pressure) is low.
THEN: the likely problem is check valve failure. If the inlet is failed open (full or partially) then the pump will blow liquid back through the inlet on each cycle, causing low discharge pressure and reduced flow. If the discharge check has failed open, output pressure may be maintained, but the flow drops off because some of the liquid runs back into the pump each cycle to be 'pumped' again.

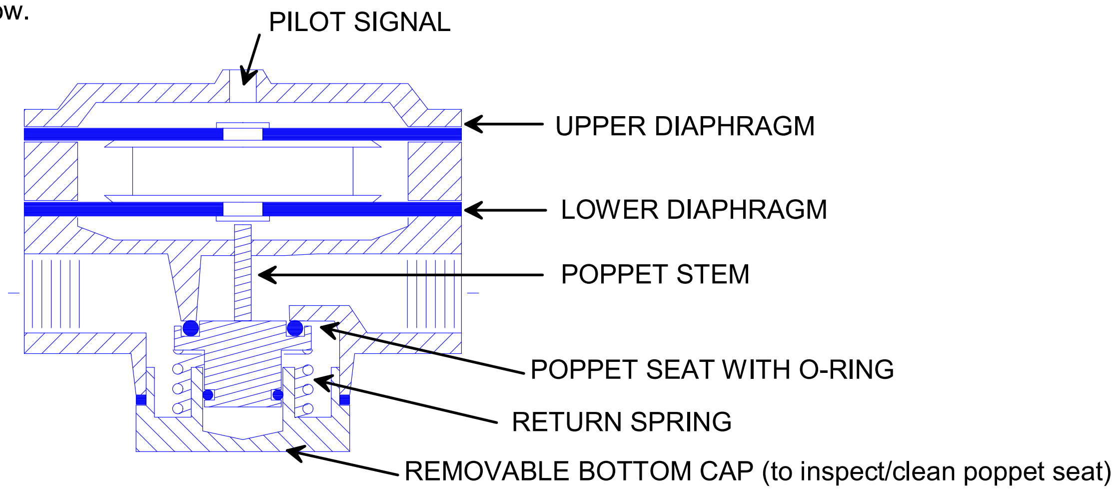
In either case, inspect and repair or replace the checks as needed. Take these opportunities to inspect seats and replace elastomers to prevent damage to the check valve body.

IF: the fill cycle is excessively long.
THEN: most likely, the pump is being throttled by a restriction in the exhaust path. Long vent lines with dips to collect water, mufflers that are plugged up and small diameter vent lines are some of the most common causes. If it is confirmed the vent path is free and wide open, then suspect the inlet piping after it is confirmed that the fill head is adequate in the first place.



<u>FAILURE CONDITIONS OF CONTROL PANEL COMPONENTS</u>

Discharge regulator: When debris is stuck under the poppet, the regulator will allow excess air pressure by, which it will try to vent out of its bonnet, causing a significant leak (hissing) at the bonnet. When the diaphragms are torn, the similar symptoms will occur: if the top diaphragm is torn, the pilot air signal will blow through making an audible leak and most likely the regulator will not open and pass air downstream. If the lower diaphragm is torn, there will also be an air leak and a chance the regulator won't open. Clean or repair using the appropriate repair kit from the parts list. See cutaway view below.



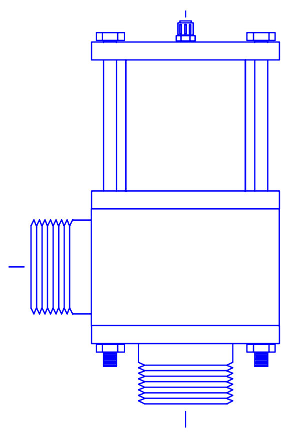
<u>EXV100 Exhaust Valve:</u> (EXV200 is identical but has larger 2” ports)

Problem - FAILED OPEN - will cause a lack of pressure in the pump during discharge, because the discharge air is coming right back up through the exhaust valve. The discharge pressure gage will drop further than normal, and liquid may spray from the exhaust. Also, the fill cycle may be short, as in a deadheaded condition.

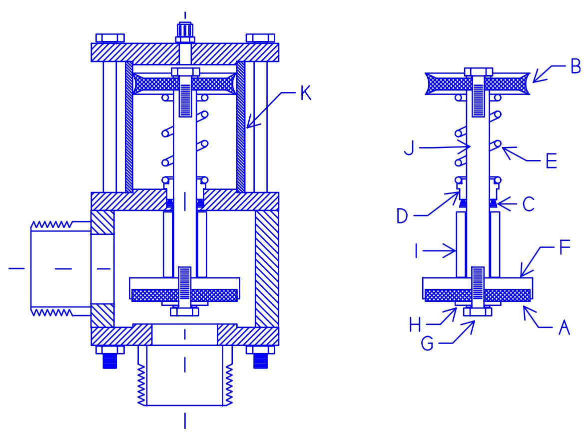
Response - Remove assembly bolts and pull the cylinder and valve body apart to expose both the poppet seat and the piston seal. Look for 1) debris inside valve holding poppet off the seat, 2) worn/missing poppet seat, 3) worn piston seal or other possible leak point of the pilot signal, 4) significant damage/wear to the shaft or its guide bushings/seal, 5) or if all is OK, check the pilot signal coming from the solenoid pilot valve (see below).

Problem - FAILED CLOSED - will cause the pump to cycle slowly or stop altogether.

- Do the same disassembly and inspection as above.

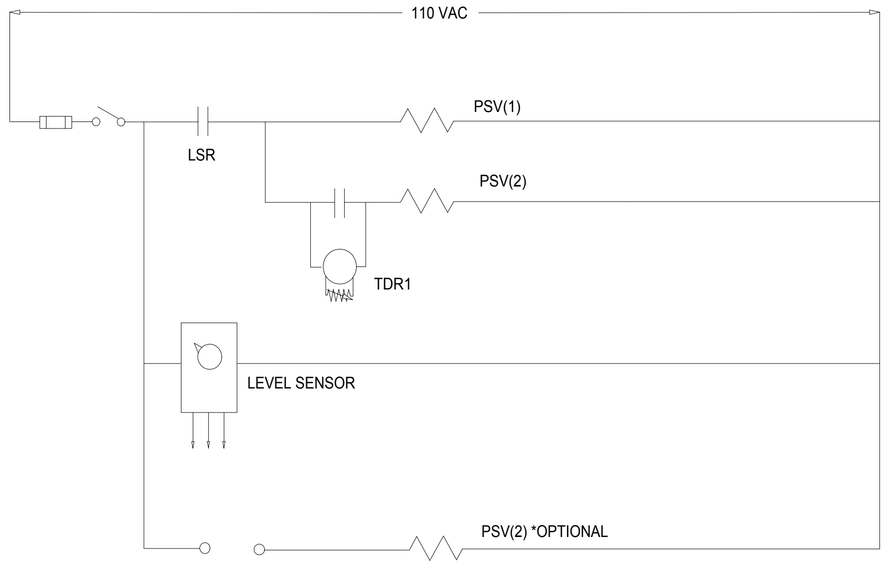


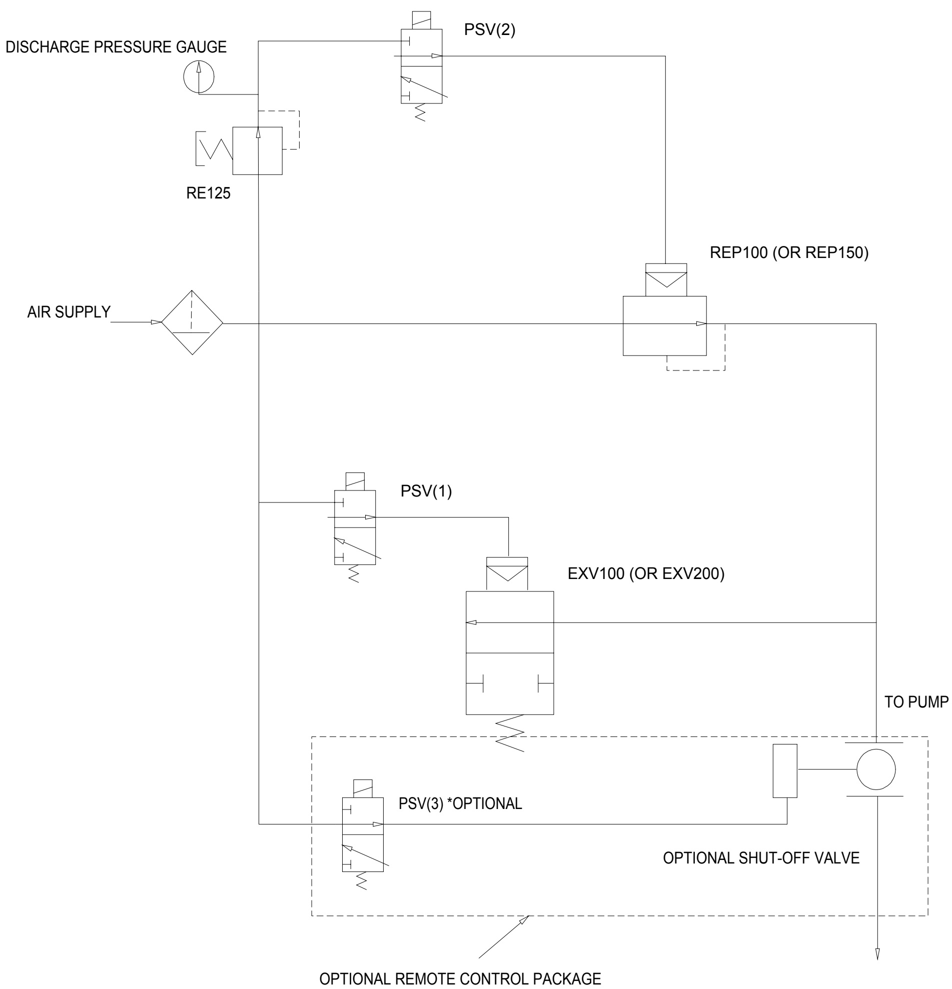
A-poppet seat
B-piston seal
C-shaft seal
D-shaft bushing
E-return spring
F-poppet back
G-retaining bolts (2)
H-poppet keeper washer
I-spacer
J-shaft
K-cylinder



PILOT SOLENOID VALVES
PSV(1) & PSV(2)

These two solenoid valves are identical, with PSV(2) responsible for piloting the discharge regulator, and PSV(1) pilots the exhaust valve EXV100. The exhaust valve pilot operates on full line pressure, and puts out a full pressure/flow signal when energized. The discharge regulator pilot valve operates on regulated pressure supplied by the small, adjustable regulator inside the panel, and puts out a controlled pressure signal. Note that PSV(2) has a short (<1 sec) delay before energizing. TDR1 controls this delay, which is used to reduce inlet valve ‘slamming’.


110 VAC
PSV(1)
LSR
PSV(2)
TDR1
LEVEL SENSOR
PSV(2) *OPTIONAL


PSV(2)
DISCHARGE PRESSURE GAUGE
RE125
REP100 (OR REP150)
AIR SUPPLY
PSV(1)
EXV100 (OR EXV200)
TO PUMP
PSV(3) *OPTIONAL
OPTIONAL SHUT-OFF VALVE
OPTIONAL REMOTE CONTROL PACKAGE

DP220 CONTROL PANEL SPARE PARTS AND COMPONENTS

Part #	Description
DP220	Complete 1" control panel less probes
EXV100	1” exhaust valve.
EXV100/200K*	Operator, shaft and poppet seals for 1" & 2” exhaust valve
REP100	1" piloted discharge regulator
REP100K*	1" discharge regulator repair kit.
F125	Pilot valve air filter
LCM120	Level control module for probes
PBDE125*	20 micron filter element for F125 filter
PSV125*	PSV(1, 2 & 3) solenoid pilot valve
	Items specific to 6" and larger pumps (high flow) are in italics
DP220H	*Complete high flow, 2" control panel less probes*
EXV200	*2” exhaust valve*
*EXV100/200K**	*Operator, shaft and poppet seals for 1” & 2" exhaust valve*
REP150	*1.5" piloted discharge regulator*
*REP150K**	*1.5" discharge regulator repair kit*
PRH	Jacketed high level probe for all filter press pumps
PRL2	Jacketed low level and/or ground probe for #F2_ pumps
PRL3	Jacketed low level and/or ground probe for #F3_ pumps
PRL4	Jacketed low level and/or ground probe for #F4_ & F6_ pumps

* - Indicates a recommended spare (for the respective panel only).

CIPC CHECK VALVES

CIPC recommends that customers stock inlet and discharge check valve internals, and in cases of expected high wear such as abrasive slurries we recommend entire spare check valves. Following is a list of CIPC check valve part numbers and descriptions.

Part #	Size	Description
2CVP/1(_)	**2"**	**CIPC steel swing check, plate style, full port, for F2C pumps**
2CVP/2(_)	**2"**	**CIPC 316SS swing check, plate style, full port, for F2S pumps**
2CVFK(_)	**2"**	**Flapper (316SS)**

Seat adders for check valve, both styles

(blank)	Nitrile seat for 2" check
(V)	Viton seat for 2" check
(T)	Teflon seat for 2" check
(U)	Urethane seat for 2" check
(E)	EPDM seat for 2" check

CIPC CHECK VALVES CONTINUED

Part #	Size	Description
2CVSK(_)	**2"**	**Seat kit (2 seats), for 2" checks**
(blank)		Nitrile seat for 2" check
(V)		Viton seat for 2" check
(T)		Teflon seat for 2" check
(U)		Urethane seat for 2" check
(U)/HD ????????		Heavy duty urethane seat for 2” check
(E)		EPDM seat for 2" check
2CVGK	**2"**	**Flange gasket kit (3 gaskets) for 2" check valve bolt pattern**

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Part #	Size	Description
3CVP/1(_)	**3"**	**CIPC steel swing check, plate style, full port, for F3C pumps**
3CVP/2(_)	**3"**	**CIPC 316SS swing check, plate style, full port, for F3S pumps**
3CVFK(_)	**3"**	**Flapper (316SS)**

Seat adders for check valve, both styles

(blank)	Nitrile seat for 3" check
(V)	Viton seat for 3" check
(T)	Teflon seat for 3" check
(U)	Urethane seat for 3" check
(E)	EPDM seat for 3" check

Part #	Size	Description
3CVSK(_)	**3"**	**Seat kit (2 seats), for 3" checks**
(blank)		Nitrile seat for 3" check
(V)		Viton seat for 3" check
(T)		Teflon seat for 3" check
(U)		Urethane seat for 3" check
(U)/HD ???????		Heavy duty urethane seat for 3” check
(E)		EPDM seat for 3" check
3CVGK	**3"**	**Flange gasket kit (3 gaskets) for 3" check valve bolt pattern**

CIPC CHECK VALVES CONTINUED

Part #	Size	Description
4CVP/1(_)	**4"**	**CIPC steel swing check, plate style, full port, for F4C pumps**
4CVP/2(_)	**4"**	**CIPC 316SS swing check, plate style, full port, for F4S pumps**
4CVFK(_)	**4"**	**Flapper (316SS)**

Seat adders for check valve, both styles

(blank)	Nitrile seat for 4" check
(V)	Viton seat for 4" check
(T)	Teflon seat for 4" check
(U)	Urethane seat for 4" check
(E)	EPDM seat for 4" check

4CVSK(_)	**4"**	**Seat kit (2 seats), for 4" checks**

(blank)	Nitrile seat for 4" check
(V)	Viton seat for 4" check
(T)	Teflon seat for 4" check
(U)	Urethane seat for 4" check
(U)/HD ????????	Heavy duty urethane seat for 4" check
(E)	EPDM seat for 4" check

4CVGK	**4"**	**Flange gasket kit (3 gaskets) for 4" check valve bolt pattern**

6" & 8" CHECK VALVES ARE SUPPLIED PER REQUEST. PLEASE HAVE PUMP SERIAL NUMBER AND MODEL NUMBER AVAILABLE WHEN ORDERING OR PRICING.