Series PMPNT & PMPNTS Pressure Motive Pump

Installation

Operation &

Maintenance

Manual

PMPNT

PMPNTS

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Safety Considerations

Follow installation guidelines to ensure the product functions properly and as intended.
Improper installation and use may result in such hazards as damage to the product or malfunctions that may lead to injuries or damage. Failure of the product to function may result in problems occurring in the system, such as equipment flooding with condensate or improper drainage.

See page 9 & 10 for System Troubleshooting.

When disassembling or removing the product, wait until the internal pressure is relieved and the product has cooled to room temperature.
Disassembling or removing the product when it is hot or under pressure may lead to injuries or damage.

Do not excessively over tighten or torque when connecting piping to the product.
Over-tightening may cause cracks and damage to the product which may lead to fluid discharge, which may cause injuries.

PMPNT Specifications

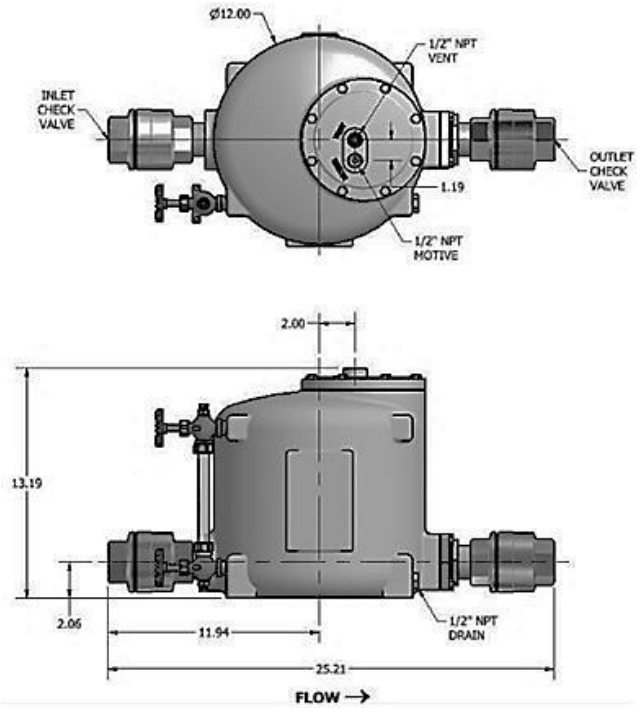

Figure 1: PMPNT Pump

PMPNTS Specifications

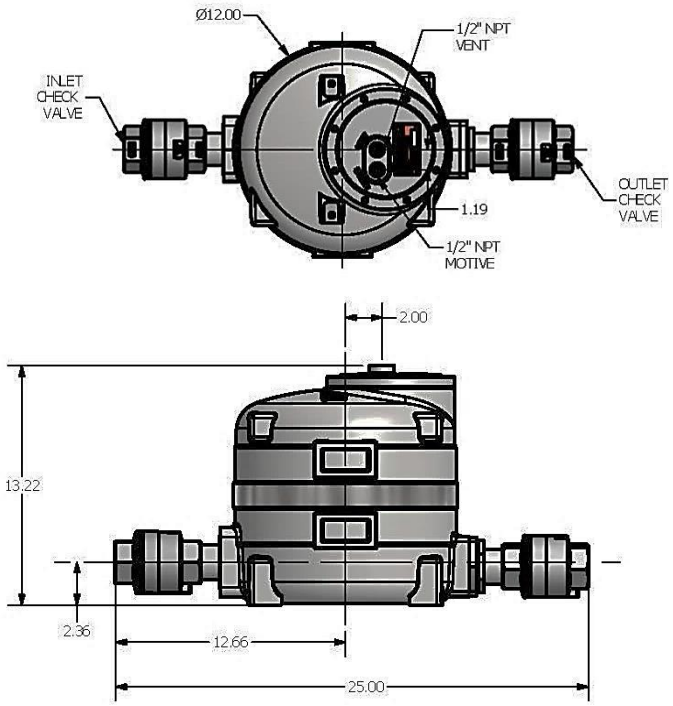

Figure 2: PMPNTS Pump

Note: Pump overall length dimensions shown with 1½" check valves. For 1" check valve overall length, subtract 2.86".

Operating Specifications	
Average instantaneous discharge rate	16.1 gpm
Average pump discharge per cycle	1.9 gal
Average steam consumption	3 lbs. per 1000 lbs. liquid pumped
Average Air consumption	100 SCF per 1000 lbs. liquid pumped

PMPNT/S Pressure-Temperature Ratings	
PMO Max. Operating Pressure	125 psig
TMO Max Operating Temperature	353°F
PMA Max Allowable Pressure	150 psig
TMA Max Allowable Temperature	450°F

Weight	
1"	85 lb
1 ½"	95 lb
1 ½" SS	98 lb

Pump **Serial Number** and **Date Code** can be located on the tag mounted to the top of the pump cover.

Figure 3: PMPNT Cutaway View

Principle of Operation

The Pressure Motive Pump allows discharge of high-temperature condensate for return to the boiler. They can also be used to discharge water and other liquids for transfer to other locations. The PMPNT is for applications requiring compact design due to spatial constraints and is used when liquids must be moved to higher elevation, higher pressure, or extended distances. The PMPNT is intended to work in an open loop (vented) system.

A Pressure Motive Pump consists of a pump tank, float with internal operating mechanism, and a set of inlet and outlet check valves to control direction of flow. The positions of the vent and motive valves control the filling and discharge of the pump. The vent valve must be open during the filling cycle to allow air or steam in the pump to be displaced as water enters the pump. Once the pump becomes filled, pressurized gas enters the tank through the motive line to push condensate out of the pump and into the downstream return line. Since water flows into the pump by gravity, the pump tank pressure must be neutralized for the pump tank to fill.

1. When the pump is in the normal start up position, the float mechanism will be at its lowest point with the vent valve open and the motive pressure valve closed.

2. As condensate fills the pump, the float mechanism begins to rise.

3. The float mechanism will continue to rise until it reaches the upper trip point. When the spring loaded mechanism reaches the trip point, it snaps over the center and the motive pressure valve opens and the vent valve closes.

4. When the motive valve opens, the pump becomes pressurized under the motive pressure, opening the outlet check valves and discharging condensate out of the tank. A check valve placed at the condensate inlet will stop the condensate from being pumped back into the receiver. As the condensate flows out of the pump under the motive pressure, the float begins to drop.

5. When the float reaches the low trip point, the mechanism snaps over the center and the motive pressure valve closes and the vent valve opens. The pressure in the pump is released and the condensate is able to once again flow from the receiver down into the pump.

Installation – Open Loop (Vented) System

1. The pump must be installed standing in the vertical position and located below an atmospheric (vented) receiver. It is important that the preferred operating filling head be established from the top of the pump body to the underside of the receiver. A minimum of 6" filling head is recommended. **Note:** Less fill head is possible, but capacity will be reduced from published values.

2. **Vented Receiver:** A vented receiver should be installed before and above the pressure motive pump. If you will be using and existing tank or fabricated one, be sure to verify that the vessel is properly sized and vented for the application. Please consult our sizing guide on Page 10 of this instruction.

3. Connect the inlet and outlet check valves to the pump. **Caution:** Make sure that the flow arrows on the check valves are oriented in the proper direction. For optimum performance, horizontal pipe runs immediately before and after the check valves should be kept as short as possible. Pipe up the pump inlet check valve to the receiver and outlet check to the discharge line. It is recommended that full port isolation valves be used for the pump, matching the line size.

4. Connect the operating steam supply pressure to the motive inlet connection (1/2" FNPT) at the top of the pump head. Motive pressure line should always be equipped with an isolation valve, strainer and a steam trap. The motive steam drip trap condensate discharge may be piped to the top of the receiver or pump discharging line. A PRV may also be considered in the motive piping to adjust the pressure to optimum level.

5. **Pump Vent/Exhaust Line:** Install a pipe line from the pump vent connection (1/2" FNPT) to the top of the receiver. This piping is extremely important to ensure proper operation of the pump and system.

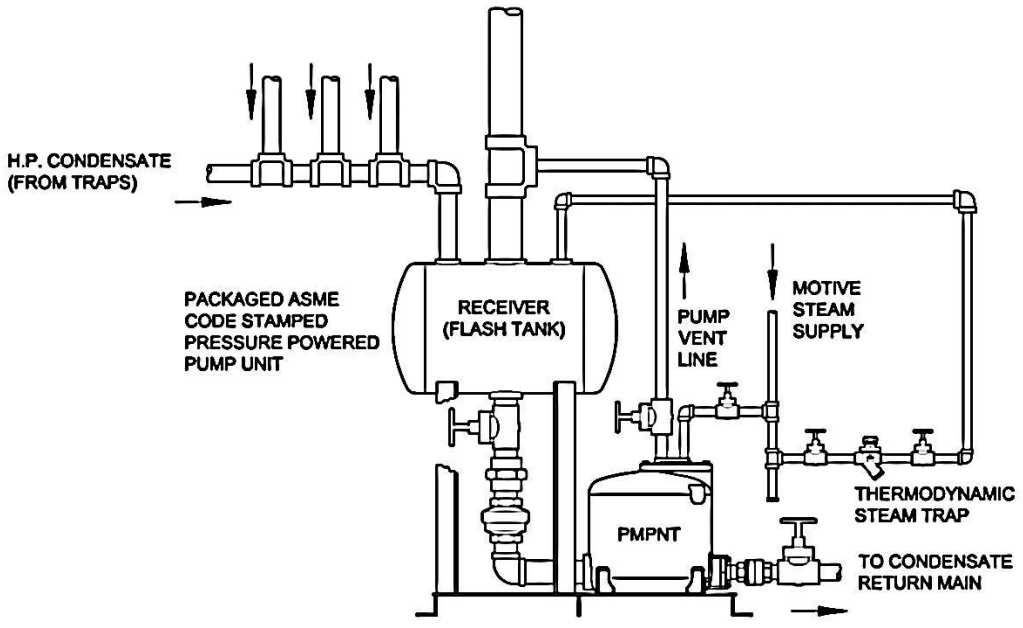

Figure 4: Open Loop Pump System

Start up

1. Gradually open steam supply to provide pressure at the pump motive inlet. Make sure the motive trap is operational.

2. Completely open the full port isolation valves in the pump condensate inlet and outlet lines as well as any isolation valves in the pump vent/exhaust line.

3. Open the isolation valve(s) ahead of the pump receiver allowing condensate to enter the vessel and begin to fill the pump body below it. Pump will discharge when full.

4. Carefully observe the PMP unit. The pump(s) should cycle periodically with an audible sound at the end of each pumping cycle. If any irregularities are observed, recheck installation and start-up instructions for proper procedure, or call the applications engineering department for assistance.

5. If overflow piping has been provided (see below), check that a water seal has been established to prevent any steam from being vented in normal operation. Prime piping if necessary.

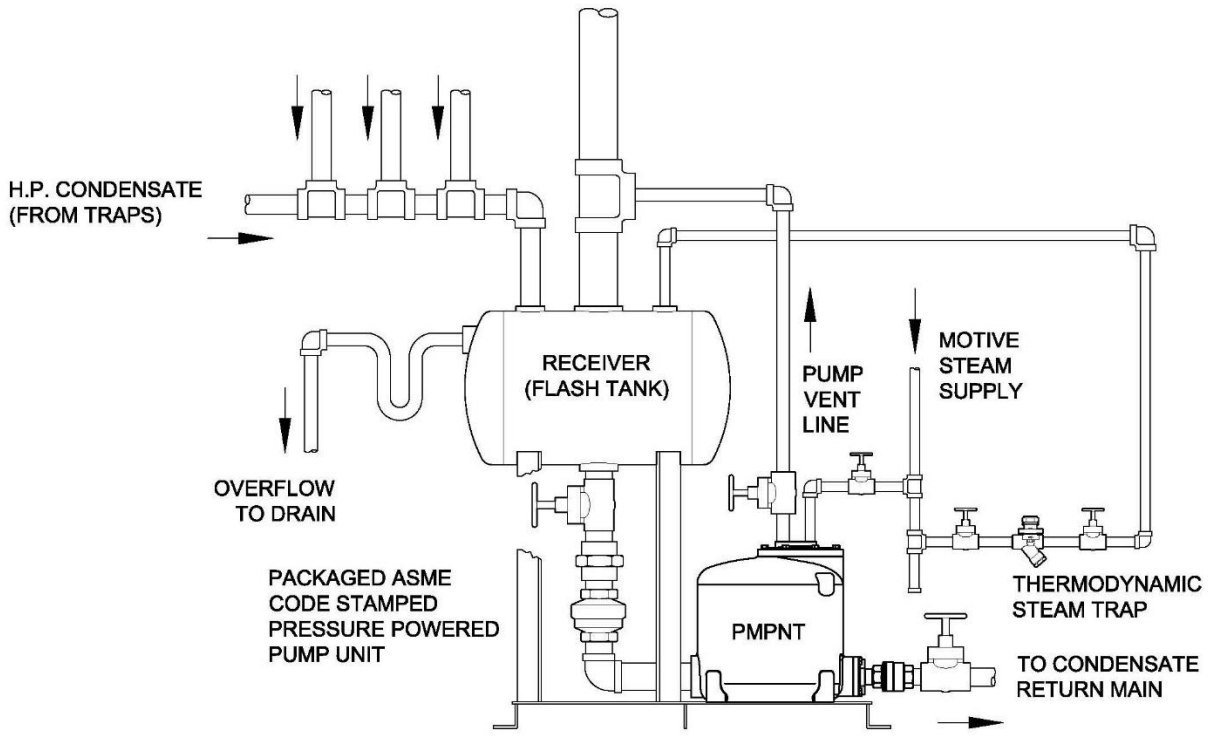

Figure 5: Open Loop Pump System with Overflow

Maintenance

Close all pump isolation valves. Make certain no pressure is trapped in the system. Allow unit and piping to cool to room temperature.

1. Remove the motive pressure and vent piping connections. Remove bolts from top cover and lift complete mechanism out of pump body.

2. Inspect mechanism for wear, dirt, and scale. Make sure the mechanism moves as intended. Remove check valves and inspect for any dirt or debris that could be obstructing the valve. Clean seating surfaces then reinstall or replace if necessary.

3. Check the (2) springs and pins. If either is defective, remove and replace with new springs and pins. **Note**: Disassemble and replace one spring at a time

4. Inspect motive pressure inlet and vent valves. Clean the valve and seats, and replace if necessary. If pump is not cycling, check motive pressure and adjust to 10 psi min. above the backpressure. If the motive pressure valve is leaking, the inlet valve may be obstructed or damaged. With the pump isolated, remove the cover and inspect. Replace the inlet valve and seat assembly, if necessary.

5. Make sure the pump mechanism is in the proper orientation when reassembling. Reconnect the motive and vent lines to the pump, refer to the installation instructions. After the pump is reinstalled, follow the start-up procedures to bring the pump into operation.

Maintenance cont.

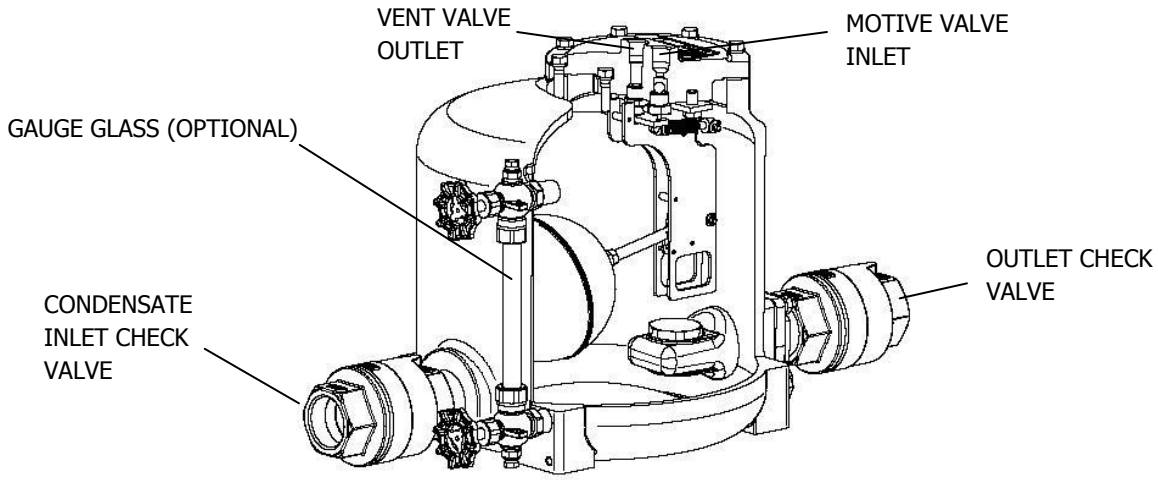

Figure 6: PMPNT(S) Cutaway View

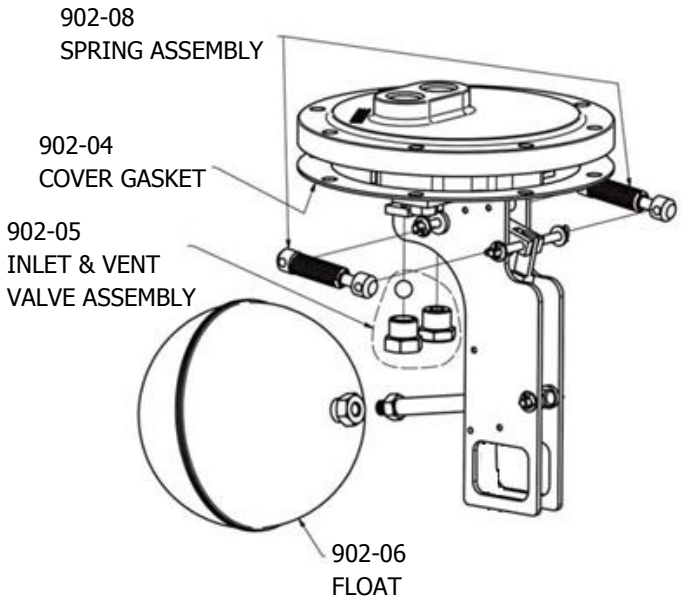

Figure 7: PMPNT(S) Cutaway View

Ordering Spare Parts

Model	Kit Order #	Description
PMPNT & PMPNTS	**W-KIT-902-04**	Cover Gasket
	W-KIT-902-05	Inlet & Vent Valve Assembly
	W-KIT-902-06	Float & Cover Gasket
	W-KIT-902-08	Spring Assembly
	W-KIT-914-03	Complete Pump Mechanism Assembly & Gasket PMPNT
	W-KIT-914-03-SS	Complete Pump Mechanism Assembly & Gasket PMPNTS

System Troubleshooting

PROBLEM	POSSIBLE	CAUSE CORRECTION
1. Pump fails to operate on startup.	a) Motive pressure line closed	a) Open valves to supply motive pressure to pump
	b) Motive pressure insufficient to overcome backpressure	b) Check motive pressure and backpressure. Adjust motive pressure to 10 psi (min.) higher than the backpressure
	c) Liquid inlet line closed	c) Open all valves to supply liquid to the pump
	d) Liquid discharge line closed	d) Open all valves on the discharge side of the pump
	e) Pump vapor-locked	e) Break vent connection at pump cover. Stand clear of vent connection. If pump begins to cycle, vapor locking has occurred. Re-check that the exhaust tie-back line is unobstructed and completely self-draining to a lower pressure area with sufficient vapor space
	f) Insufficient fill head to allow pump to trip	f) Check that fill head is large enough for condensate to drain freely by gravity into the pump properly. Raise condensate source or lower pump to achieve required filling head
2. Liquid backup and equipment flooded, but pump appears to cycle normally	a) Motive pressure is too low to achieve required capacity	a) Check motive pressure setting and maximum backpressure during operation. Check against sizing table. Increase motive pressure as required
	b) Insufficient filling head to achieve required capacity	b) Verify required filling head is large enough for condensate to drain freely by gravity into the pump properly. Raise condensate source or lower pump to achieve required filling head
	c) Restriction in liquid inlet line	c) Check that only full ported fittings are used. Clean the strainer. Verify that all valves are fully open
	d) Inlet check valve stuck open	d) Isolate inlet check valve and relieve pressure. Remove cap and visually inspect for debris. Clean seating surfaces and reinstall or replace, if necessary
	e) Pump undersized	e) Verify rated capacity in the sizing capacity table. Increase check valve size or install additional pump as required
3. Liquid backup and equipment flooded, and pump has stopped cycling	a) Motive pressure low	a) If motive pressure is below backpressure, increase motive pressure setting to 10 psi (min.) above backpressure. Do not exceed rated pressure limits of equipment
	b) Discharge line closed via valve blocked with debris	b) Compare motive pressure and backpressure. If backpressure is higher or equal, a closed or blocked discharge line is possible. Check valves downstream of pump

PROBLEM	POSSIBLE	CAUSE CORRECTION
3. (continued) Liquid backup and equipment flooded, and pump has stopped cycling **SAFETY NOTE TO PREVENT INJURY: For steps (d) through (g), it is necessary to disconnect the vent line at the pump head. It is possible that hot condensate may run out of the vent connection when broken.**	c) Outlet check valve stuck closed	c) After checking per step 3(b), isolate discharge check valve and relieve line pressure. Remove cap and visually inspect. Clean seating surfaces and reinstall or replace, if necessary
	d) Inlet check valve stuck closed	d) If mechanism is not heard to trip and fluid is not running from the vent connection, it is suspected that the fault lies in the condensate inlet piping. Be sure that all valves leading to the pump have been opened. If so, this is a possible indication that the inlet check valve is stuck closed. Isolate the pump and check valve and relieve line pressure. Remove the check valve and visually inspect. Clean seating surfaces and reinstall or replace, if necessary. Reinstall exhaust/tie-back connection and open line
	e) Motive inlet valve leaking and/or worn	e) Gradually open motive supply line, leaving the condensate inlet and discharge lines closed. Observe the vent connection for steam or air leakage. If observed, inlet valve is obstructed or damaged. With pump isolated, remove cover and visually inspect. Replace inlet valve and seat assembly
	f) Mechanism failure 1. Ruptured float 2. Mechanism binding	f) Keeping motive line open, slowly open condensate inlet line to the pump, allowing pump to fill and observe vent connection. If condensate runs out of vent connection, a mechanism problem is apparent. Isolate pump by shutting off motive supply and condensate inlet, remove cover and visually inspect. Examine float for defects. Stroke mechanism and check for any binding or increased friction. Repair or replace as needed
	g) Exhaust/tie-back causing vapor lock	g) Recheck the vent/tie-back piping layout for compliance with the installation instructions. Check that the exhaust tie-back line is unobstructed and completely self-draining to a lower pressure area with sufficient vapor space
4. Valve will not close	a) When a pump discharges a significant volume of liquid into a long horizontal return line with rises and drops, the sudden changes in velocity can develop a vacuum	a) Install a vacuum breaker at high point in return line. For pressurized return systems, an air eliminator may be required down-stream of the vacuum breaker
	b) Pump is blowing by	b) Compare inlet and outlet pump pressure. If the inlet pressure equals or exceeds the backpressure, a "blow through" problem is possible

PMPNT(S) Check Valve Capacities

Operating Check Valve - Capacities

CAPACITIES - Condensate (lbs/hr) Using steam as motive pressure, (SCFM) Using air as motive pressure

Motive Pressure (PSIG)	Total Back Pressure (PSIG)	1-1/2" x 1-1/2" Check Valve Size							
		0" Fill Head		6" Fill Head		12" Fill Head		18" Fill Head	
		Cap•Air	Cap•Stm	Cap•Air	Cap•Stm	Cap•Air	Cap•Stm	Cap•Air	Cap•Stm
5	2	1721	1375	2592	2071	3059	2445	3417	2731
10	5	1678	1369	2495	2036	2932	2393	3266	2665
10	2	1794	1528	2758	2349	3278	2792	3677	3132
25	15	1628	1354	2385	1983	2788	2318	3095	2574
25	10	1721	1489	2592	2242	3059	2647	3417	2956
25	5	1794	1601	2758	2461	3278	2925	3677	3281
50	40	1495	1196	2095	1676	2409	1927	2647	2118
50	25	1678	1455	2495	2164	2932	2543	3266	2833
50	10	1794	1638	2758	2518	3278	2992	3677	3357
75	60	1495	1203	2095	1685	2409	1938	2647	2129
75	40	1662	1443	2460	2136	2886	2506	3212	2788
75	15	1794	1653	2758	2541	3278	3020	3677	3388
100	80	1495	1207	2095	1690	2409	1944	2647	2136
100	60	1628	1397	2385	2047	2788	2392	3095	2656
100	40	1721	1542	2592	2322	3059	2741	3417	3062
100	15	181 1	1690	2795	2608	3327	3104	3736	3486
125	115	1359	1046	1803	1388	2032	1564	2204	1697
125	100	1495	1209	2095	1693	2409	1947	2647	2140
125	80	1606	1367	2336	1989	2724	2319	3019	2570
125	60	1687	1492	2515	2225	2959	2618	3298	2917
125	40	1752	1597	2662	2426	3151	2872	3526	3214
125	15	1820	1713	2817	2650	3356	3157	3770	3547

Note: For 1” x 1” Check Valve, multiply capacity by 0.58

Vented Receiver Sizing

Vented Receiver Sizing			
Flash Steam up to --	**Receiver**		**Vent Line Dia.**
	Dia.	**Length**	
75 pph	4″	36″	1″
150 pph	6″	36″	2″
300 pph	8″	36″	3″
600 pph	10″	36″	4″
900 pph	12″	36″	6″
1200 pph	16″	36″	6″
Below figures are approximate for 4″ X 4″ Packages			
2000 pph	20″	60″	8″
3000 pph	24″	60″	8″
4000 pph	26″	60″	10″
5000 pph	28″	60″	10″
6000 pph	30″	72″	12″
7000 pph	32″	72″	12″
8000 pph	36″	72″	14″

When sizing a Pressure Motive Pump for an atmospheric return system, the amount of flash steam to be vented through the receiver must be calculated. Vent sizing is critical to maintain zero psig in the receiver tank to allow free drainage of low pressure systems. Undersized vents will cause gradual pressure increase in the receiver. This impedes drainage from the condensate source, and can cause water logging of the system.

To Size Receiver & Vent:

Usually the condensate load to be pumped comes from multiple sources. For each source determine the pressure and load. Then go into the "Percent Flash" table with the condensate pressure and move right until under the appropriate tank pressure to read the percentage of condensate that will flash into steam. Now take that source load and multiply it by the decimal value of the percentage to calculate the amount (lbs/hr) of flash steam. Repeat this for all condensate sources and total the flash steam. Enter the "Vented Receiver Sizing" table with the total flash steam load to determine the correct sizes for receiver and vent.

Percent Flash Steam											
Condensate Pressure (PSIG)	**Flash Tank Pressure (PSIG)**										
	0	2	5	10	15	20	30	40	60	80	100
5	1.6	0.9	0								
10	2.9	2.2	1.3	0							
15	3.9	3.3	2.4	1.1	0						
20	4.9	4.2	3.3	2.1	1	0					
30	6.5	5.8	5	3.7	2.6	1.7	0				
40	7.8	7.2	6.3	5.1	4	3	1.4	0			
60	10	9.4	8.5	7.3	6.2	5.3	3.7	2.3	0		
80	12	11	10	9.1	8.1	7.1	5.5	4.2	1.9	0	
100	13	13	12	11	9.6	8.7	7.1	5.8	3.5	1.6	0
125	15	14	14	12	11	10	8.8	7.5	5.3	3.4	1.8
150	16	16	15	14	13	12	10	9	6.8	4.9	3.3
200	19	18	17	16	15	14	13	12	9.4	7.6	6
250	21	20	19	18	17	16	15	14	12	9.8	8.2
300	23	22	21	20	19	18	17	16	13	12	10
350	24	24	23	22	21	20	18	17	15	13	12
400	26	25	24	23	22	21	20	19	17	15	14