

Sizing and Selecting a PMP

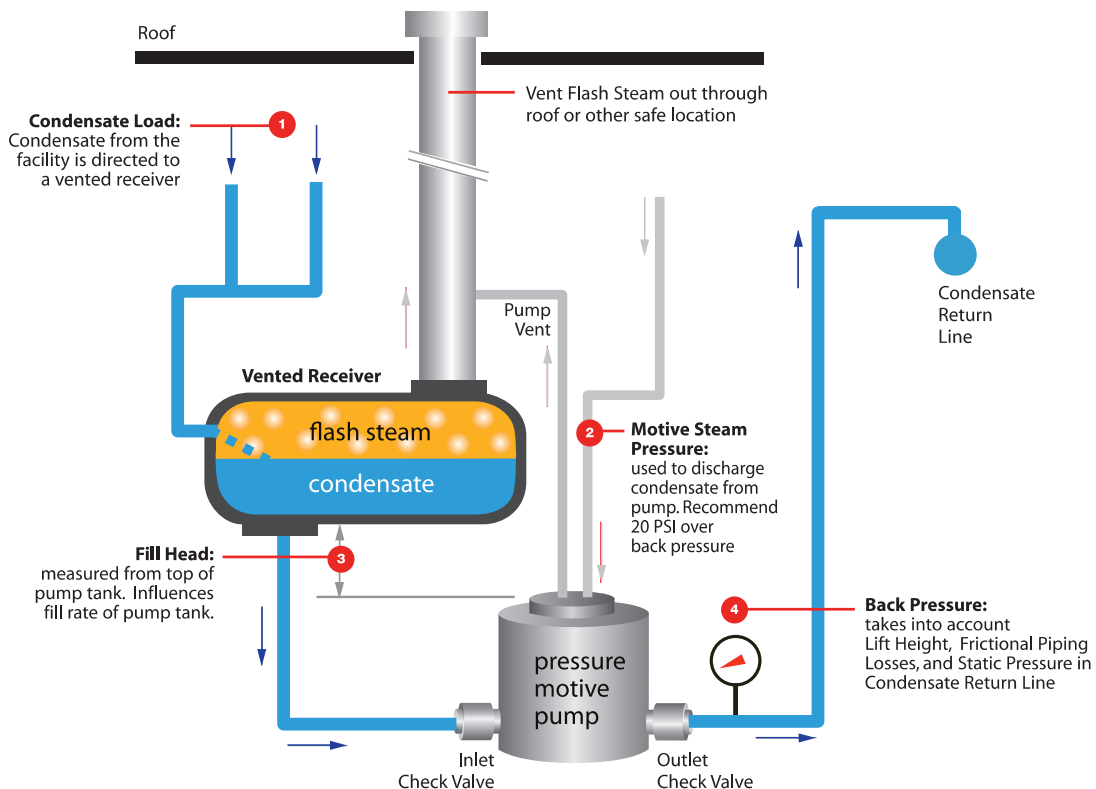
The Capacity Charts cover both Stand Alone Pumps (PMPC, PMPF, PMPLS, etc.) as well as Pumps with Receiver Tanks (Simplex, Duplex, Triplex). If a stand alone pump is chosen, consideration should be given to the size of the vented receiver that collects the condensate before the PMP (see flash tank vent sizing). If the pump is replacing an existing installation, a vented receiver that is acceptable in size and configuration may already be installed. If required to meet capacity, pre-packaged systems with more than one pump, such as the Duplex or Triplex are available. These units come pre-mounted with the pump(s), a receiver tank as well as other options to optimize the system. A multiple pump unit may also be chosen for reserve capacity or pump redundancy in critical applications.

To select the proper size pressure motive pump requires you to know a few key pieces of information:

- 1 **Condensate load you need to pump:** Condensate Load is normally expressed in lbs/hr. To convert to GPM flow rate, note that 500 lbs/hr is equivalent to 1 GPM.
- 2 **Motive Pressure:** The motive pressure of the steam (or other gas) impacts pump capacity. The sizing chart indicates different flow rates based upon motive steam inlet pressure. It is recommended to regulate the steam inlet pressure to 20 psi above the total back pressure.
- 3 **Fill head:** Is the height (in inches) of the condensate receiver tank (or flash tank) above the pump tank. This head pressure determines how quickly the pump tank will refill with condensate after its discharge cycle. Therefore, reducing the fill time will increase the overall capacity of the pump. The capacity chart is based on 12" of fill head (PMPLS based on 6" fill head). Increasing fill head height can increase capacity by as much as 20 - 50%. (See Capacity Correction Chart.)
- 4 **Back Pressure:** Back Pressure is the sum total of condensate return line pressure and the physical height that the condensate needs to be elevated. (See sizing section for guidance on how to calculate back pressure.)

Inlet x Outlet Size:

In addition to body material, pumps are designated by inlet and outlet size. For example, PMPC 3 x 2 has 3" inlet and 2" outlet check valves with a ductile iron tank. Since the pump fills by gravity from the receiver tank located above it, the size of the inlet check valve significantly impacts pump capacity. The larger the check valve, the quicker the condensate will fill the pump tank, allowing it to cycle again. For example, a 3" check valve may have twice the inlet flow rate of a 2" check valve. The size of the outlet (or discharge) check valve also affects capacity but to a lesser extent.



Capacity Charts

Condensate Pumps

Stand Alone Pumps & Systems

Capacity based on 12" Fill Head except as noted

CAPACITIES – Condensate (lbs/hr) Using steam as a motive pressure												
Motive Pressure (PSIG)	Total Back Pressure (PSIG)	PMPLS 6" Fill Head 1" X 1"	PMPC, PMPF, PMPSS* (12" Fill Head)						PMPBP 4" x 4" 24" Head			
			1 1/2" X 1"	1 1/2" X 1 1/2"	2" X 1"	2" X 1 1/2"	2" X 2"	3" X 2"				
5	2	1,760	1,860	1,920	2,860	3,180	3,540	5,000	10,000	15,000	20,000	16,600
10	5	1,870	2,200	2,450	4,350	4,840	5,380	7,210	14,420	21,630	28,840	19,000
10	2	2,200	3,030	3,370	6,880	7,650	8,500	11,110	22,220	33,330	44,440	22,600
25	15	1,650	3,130	3,480	4,990	5,550	6,170	8,230	16,460	24,690	32,920	33,200
25	10	1,980	3,600	3,990	6,560	7,290	8,100	10,780	21,560	32,340	43,120	40,300
25	5	2,300	4,700	5,200	7,970	8,860	9,850	13,350	26,700	40,050	53,400	46,200
50	40	1,650	2,280	2,530	3,370	3,750	4,170	5,670	11,340	17,010	22,680	33,300
50	25	1,980	4,050	4,500	6,800	7,560	8,440	11,550	23,100	34,650	46,200	40,100
50	10	2,300	4,700	5,240	7,970	8,860	9,850	13,440	26,880	40,320	53,760	47,000
75	60	1,540	2,400	2,660	3,600	4,000	4,440	6,340	12,680	19,020	25,360	32,900
75	40	1,980	3,780	4,190	5,920	6,580	7,320	9,870	19,740	29,610	39,480	39,400
75	15	2,420	5,130	5,700	8,580	9,540	10,600	14,330	28,660	42,990	57,320	47,200
100	80	1,650	2,750	3,060	4,160	4,630	5,150	6,860	13,720	20,580	27,440	27,200
100	60	1,870	3,600	4,000	5,560	6,180	6,870	9,100	18,200	27,300	36,400	35,100
100	40	2,090	4,700	5,210	6,880	7,650	8,500	11,270	22,540	33,810	45,080	42,100
100	15	2,420	5,400	6,010	8,740	9,720	10,800	14,330	28,660	42,990	57,320	48,000
125	115	1,430	2,380	2,640	3,270	3,640	4,050	4,960	9,920	14,880	19,840	19,500
125	100	1,540	2,980	3,330	4,140	4,600	5,130	6,390	12,780	19,170	25,560	25,300
125	80	1,760	3,430	4,100	5,400	6,000	6,670	8,540	17,080	25,620	34,160	32,200
125	60	1,980	4,170	4,850	6,600	7,340	8,160	10,530	21,060	31,590	42,120	38,500
125	40	2,200	5,100	5,950	7,760	8,630	9,590	12,500	25,000	37,500	50,000	44,000
125	15	2,420	5,850	6,660	9,240	10,270	11,420	15,100	30,200	45,300	60,400	49,200
150	120	1,590	2,650	2,940	3,400	3,780	4,200	5,690	11,380	17,070	22,760	21,600
150	100	1,640	3,150	3,490	4,320	4,800	5,350	7,000	14,000	21,000	28,000	29,000
150	80	1,860	3,800	4,230	5,490	6,100	6,770	9,100	18,200	27,300	36,400	34,500
150	60	2,080	4,500	5,000	6,660	7,400	8,240	11,120	22,240	33,360	44,480	40,300
150	40	2,300	5,290	5,870	7,920	8,800	9,780	13,220	26,440	39,660	52,880	44,700
150	15	2,520	6,100	6,820	9,450	10,500	11,680	15,500	31,000	46,500	62,000	49,500
175	140	-	2,600	2,900	3,800	4,200	4,650	6,200	12,400	18,600	24,800	-
175	120	-	3,100	3,400	4,400	4,850	5,400	7,200	14,400	21,600	28,800	-
175	100	-	3,600	4,000	5,100	5,700	6,300	8,400	16,800	25,200	33,600	-
175	60	-	4,850	5,400	6,900	7,700	8,550	11,400	22,800	34,200	45,600	-
175	40	-	6,200	6,900	8,900	9,850	10,950	14,600	29,200	43,800	58,400	-
175	15	-	7,500	8,350	10,600	11,900	13,200	17,600	35,200	52,800	70,400	-
200	160	-	2,400	2,700	3,500	3,800	4,300	5,700	11,400	17,100	22,800	-
200	140	-	3,100	3,400	4,400	4,900	5,400	7,200	14,400	21,600	28,800	-
200	100	-	4,200	4,650	5,950	6,600	7,350	9,800	19,600	29,400	39,200	-
200	80	-	4,700	5,250	6,750	7,500	8,300	11,100	22,200	33,300	44,400	-
200	40	-	6,800	7,550	9,700	10,800	11,950	15,950	31,900	47,850	63,800	-
200	15	-	8,400	9,350	12,000	13,300	14,800	19,700	39,400	59,100	78,800	-

* PMPSS is rated to only 150 PSIG.

Note: For PMPNT capacity, refer to PMPNT specification page.

Capacity Correction Factors for Alternate Filling Heads							
Pump Inlet Size	Filling Head						
	6"	12"	18"	24"	36"	48"	60"
1"	1.00	1.10	1.20	1.30	1.50		
1 1/2"	0.70	1.00	1.10	1.20	1.35		
2"	0.70	1.00	1.10	1.20	1.35		
3"	0.84	1.00	1.04	1.08	1.20		
4"			0.80	1.00	1.10	1.15	1.20

NOTE: When the filling head differs from the standard filling height, the capacity of the pressure power pumps are either increased or decreased. For example, a pump with a 3" inlet that has a filling head of 36" as opposed to a standard filling head of 12", will have a capacity increase of 20%. Multiply the value found in the Capacity Table above by 1.2.

Capacity Correction Factors for Gas as Motive Pressure									
Pump Inlet Size	% Back Pressure relative to Motive Pressure								
	10%	20%	30%	40%	50%	60%	70%	80%	90%
1"	1.00	1.13	1.16	1.20	1.25	1.30	1.35	1.40	1.45
1 1/2"	1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28
2"	1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28
3"	1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28
4"	No Capacity Change								

Note: For low specific gravity applications, consult factory.

Pump Size

The models of a Pressure Motive Pump are designated by the size of the inlet and outlet check valves (for example, a 3" x 2" PMPC or PMPF has a 3" Inlet check valve and a 2" outlet check valve). The larger the check valves, the larger the pump capacity.

STAND-ALONE PUMPS include pump tank, internal pumping mechanism, and check valves.

PUMP(S) WITH RECEIVER TANKS includes stand-alone pump(s), and vented receiver tank mounted together on a frame. These are available in Simplex, Duplex, Triplex and Quadraplex systems.

When sizing and selecting a Pressure Motive Pump, Four system conditions are required:

(See Diagram on following page)

- 1 Condensate Load:** If condensate from several sources of equipment is required to be pumped, sum up the maximum flow rate of condensate each could produce separately.
- 2 Motive Pressure:** Normally steam is used; however, other gases can be used to pump the condensate, including Air or Nitrogen.
- 3 Filling Head:** The Filling Head is measured between the bottom of the receiver tank and the top of the pump tank. It has a significant effect on pump capacity.
- 4 System Back Pressure:** Pressure in condensate return line that pump will be operating against, as determined by condensate return line pressure and vertical height condensate must be lifted.

Sample System Conditions:

1	Condensate Load	8,000 lbs/hr
2	Motive Steam Pressure	100 PSIG
3	Filling Head	12"
4	System Back Pressure:	40 PSIG

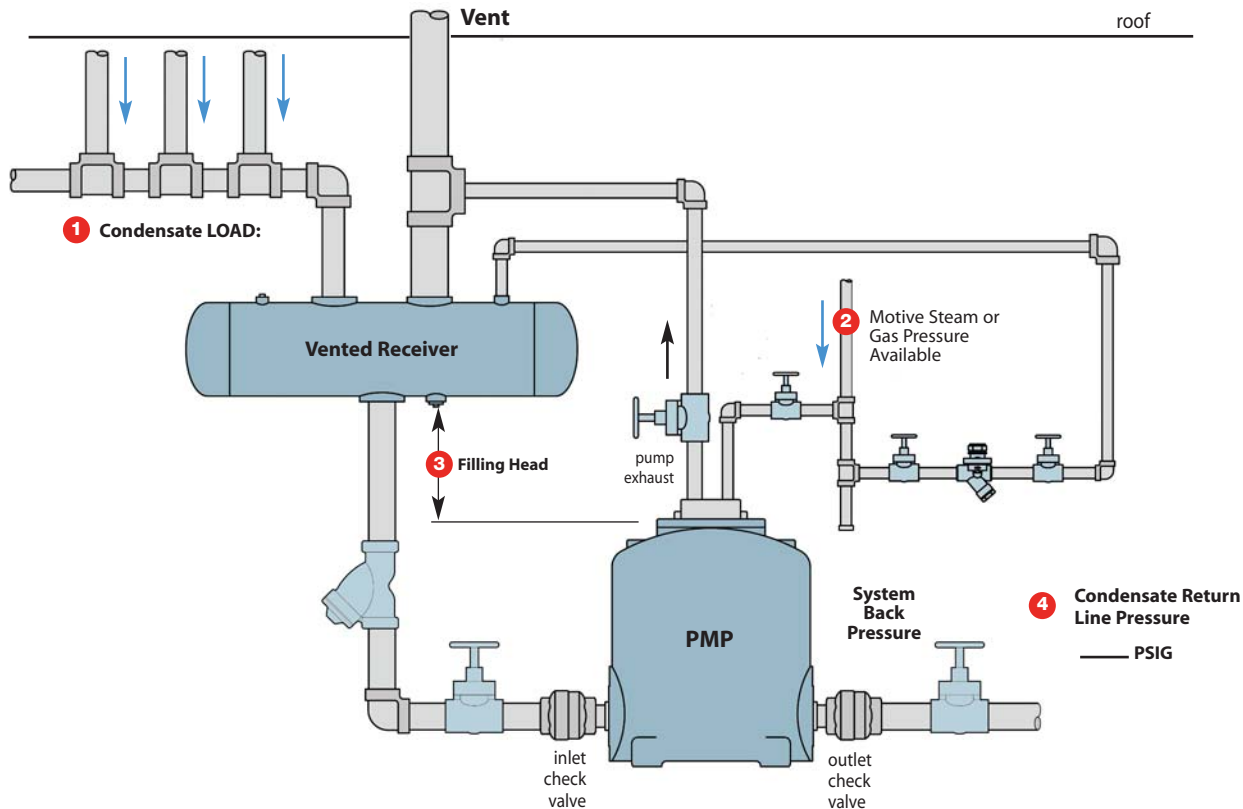
(To find the pressure required to lift condensate in PSIG, multiply Vertical lift in feet by 0.433)

For PMP Selection: Consult PMP Sizing Capacity Chart using 100 PSIG inlet pressure and 40 PSIG back pressure. A 2" x 2" pump has a capacity of 8,500 lbs/hr and is an appropriate selection. Pump choices are models PMPC, PMPF and PMPSS.

How to specify when ordering:	Example:
1) Model	PMPC
2) Size of Pump(s)	2" x 2"
3) Stand-alone Pump or Pump with Receiver Tank <i>(Note: Size of Receiver Tank must be specified when ordering Pump with Receiver Tank)</i>	Simplex or Duplex
4) Options	Gauge glass
5) When ordering a Customized Skid System, please confirm and specify Receiver size.	

Sizing & Selection

Vented Receiver (Open-Loop System)



Condensate Pumps

Receiver & Vent Sizing

The purpose of the vented receiver is to neutralize the pressure inside the condensate return line so condensate will properly drain from the processes and into the pump tank. An undersized vent will increase the velocity of flash steam in the vent pipe, potentially pulling condensate from the receiver tank out the vent. It may also increase pressure in the receiver and condensate return line upstream of the receiver, possibly causing issues with condensate drainage from the steam traps. The table below lists vent and corresponding receiver sizes based on the amount of flash steam. The amount of flash steam generated is determined by the condensate flow rate and condensate pressure entering the vented receiver.

Determine the amount of condensate in lbs/hr flowing into the vented receiver. The percentage of condensate that will flash into steam is based on the initial condensate pressure and the pressure inside the vented receiver. Since we are trying to achieve 0 psig, reference the 0 psig flash tank pressure to determine % flash steam. Multiply the % flash by the total condensate load.

Example: 10,000 lbs/hr of condensate is generated at an estimated steam pressure of 20 psig. The percent (%) flash steam is **4.9%**. **Quantity of flash steam = .049 x 10,000 = 490 lbs/hr.**

From the table, select a Vent and Receiver size which can handle **600 lbs/hr** of flash steam. (**4"** vent with a **10"** receiver diameter and **36"** length.)

PERCENT (%) FLASH STEAM										
Produced when condensate is discharged to atmosphere or into a flash tank controlled at various pressures										
Condensate Pressure (PSIG)	Flash Tank Pressure (PSIG)									
	0	5	10	20	30	40	60	80	100	
5	1.6	0.0								
10	2.9	1.3	0.0							
15	3.9	2.4	1.1							
20	4.9	3.3	2.1	0.0						
30	6.5	5.0	3.7	1.7	0.0					
40	7.8	6.3	5.1	3.0	1.4	0.0				
60	10.0	8.5	7.3	5.3	3.7	2.3	0.0			
80	11.8	10.3	9.1	7.1	5.5	4.2	1.9	0.0		
100	13.3	11.8	10.6	8.7	7.1	5.8	3.5	1.6	0.0	
125	14.9	13.5	12.3	10.4	8.8	7.5	5.3	3.4	1.8	
150	16.3	14.9	13.7	11.8	10.3	9.0	6.8	4.9	3.3	

VENTED RECEIVER SIZING (inches)			
Quantity of Flash Steam (lbs/hr)	Vent Line Diameter	Receiver	
		Diameter	Length
75	1"	4"	36"
150	2"	6"	36"
300	3"	8"	36"
600	4"	10"	36"
900	6"	12"	36"
1200	6"	16"	36"
2000	8"	20"	60"
3000	8"	24"	60"
4000	10"	26"	60"
5000	10"	28"	60"
6000	12"	30"	72"
7000	12"	32"	72"
8000	14"	36"	72"