

NON-ELECTRIC CONDENSATE PUMPS

Sizing & Selection

Pressure Motive Pumps - Capacities

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PUMPS

CAPACITIES – Condensate (lbs/hr) Using steam as a motive pressure

Motive Pressure (PSIG)	Total Back Pressure (PSIG)	PMPLS 1" X 1" 6" Head	PMPC, PMPF, PMPSS*,									PMPBP 4" x 4" 24" Head
			1 1/2" X 1" 12" Head	1 1/2" X 1 1/2" 12" Head	2 X 1" 12" Head	2" X 1 1/2" 12" Head	2" X 2" 12" Head	3" x 2" 12" Head	3" x 2" Duplex	3" x 2" Triplex	3" x 2" Quadraplex	
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 only rated to 150 PSIG.

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 an increase capacity 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	% of Back Pressure vs 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								

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Closed Loop System (Pressurized Reservoir)

RESERVOIR SIZING

When sizing Pressure Motive Pumps for closed loop return systems a condensate reservoir should be installed on the inlet side of the pump and below the equipment to be drained. This will enable the condensate to collect while the pump is in the discharge cycle, thus preventing liquid backup into the equipment. The Reservoir Sizing Table gives the minimum pipe size & length to produce the required reservoir volume to accommodate the condensate load.

How to select: Determine the total condensate load to be pumped. Find that load value or greater in the table and move right to read the pipe lengths in feet with the diameters indicated above.

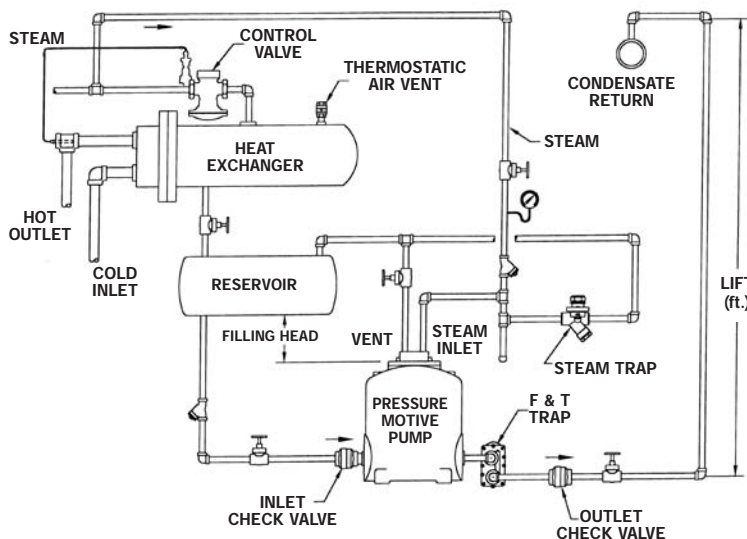
Customized reservoirs can be designed to accommodate specific space and dimensional requirements. It is critical for these designs to have adequate vapor space for condensate to collect. When the volume required is known, from the previous selection table, optional pipe diameters and lengths can be selected to provide the same or greater volume. This table will allow you to convert required volumes to customized sizes needed. Watson McDaniel can furnish customized Pressure Motive Pump Packages to fit your needs.

RESERVOIR PIPE LENGTH in feet (ft)

Condensate Load (lbs/hr)	Reservoir Pipe Size (NPS)				
	3"	4"	6"	8"	10"
0-500	2'				
1,000	2'				
1,500	3'	2'			
2,000	3.5'	2'	1'		
3,000		3'	2'		
4,000		4'	2'	1'	
5,000		6'	3'	2'	
6,000			3'	2'	
7,000			3'	2'	
8,000			4'	2'	
9,000			4.5'	3'	2'
10,000			5'	3'	2'
20,000				5.5'	4'

Note: When back pressure against the pump outlet is less than 50% of the motive pressure, the above pipe lengths can be reduced by half.

DATA REQUIRED FOR SIZING PMP IN A CLOSED LOOP SYSTEM (pressurized reservoir)



Condensate Load produced by Heat Exchanger: _____ lbs/hr

Motive Steam Pressure (PSIG): _____

Total Back Pressure (PSIG): _____

Is there enough clearance under the Heat Exchanger to allow for the Reservoir and preferred Filling Head of 12 inches as illustrated?

Maximum Clearance (inches): _____

To size the PMP, see catalog Pump Capacity chart.

To size the Reservoir, see Reservoir Pipe Length Chart

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Pressure Motive Pumps

PUMPS

Open Loop System (Vented Receiver)

RECEIVER AND VENT SIZING

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 waterlogging of the system.

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 flash tank pressure to read the percentage of condensate that will flash into steam. Take the 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. Enter the **Vented Receiver Sizing** table with the total flash steam load to determine the correct sizes for receiver and vent.

VENTED RECEIVER SIZING – (inches)

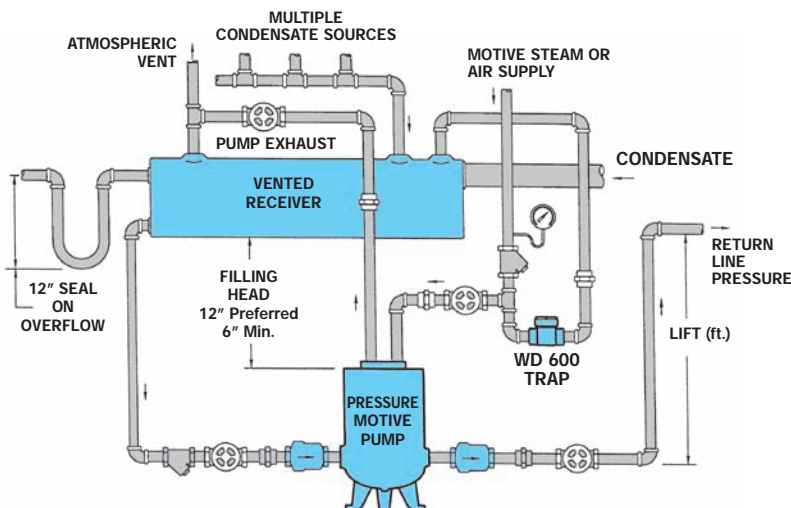
Quantity of Flash Steam (pph)	Receiver Diameter	Receiver Length	Vent Line Diameter
75	4"	36"	1"
150	6"	36"	2"
300	8"	36"	3"
600	10"	36"	4"
900	12"	36"	6"
1200	16"	36"	6"
2000	20"	60"	8"
3000	24"	60"	8"
4000	26"	60"	10"
5000	28"	60"	10"
6000	30"	72"	12"
7000	32"	72"	12"
8000	36"	72"	14"

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
200	18.7	17.3	16.2	14.3	12.8	11.5	9.4	7.6	6.0
250	20.8	19.4	18.2	16.4	14.9	13.7	11.5	9.8	8.2
300	22.5	21.2	20.0	18.2	16.8	15.5	13.4	11.7	10.2
350	24.1	22.8	21.7	19.9	18.4	17.2	15.1	13.4	11.9
400	25.6	24.2	23.1	21.4	19.9	18.7	16.7	15.0	13.5

DATA REQUIRED FOR SIZING PMP IN A OPEN LOOP SYSTEM (vented receiver)



Condensate Load(s):

Source 1: _____ lbs/hr @ _____ psig;

Source 2: _____ lbs/hr @ _____ psig;

Motive Pressure (PSIG): _____

Steam, Air, Other _____ ;

Total Back Pressure (PSIG): _____

Is there enough clearance under the equipment and/or piping to allow for the installation of the Receiver and PMP with the Preferred Filling Head of 12" as illustrated above?

To size the PMP, see Pump Capacity chart.

To size the Vented Receiver, see Vented Receiver Sizing chart.