

# Pressure Operated Condensate Return Pumps

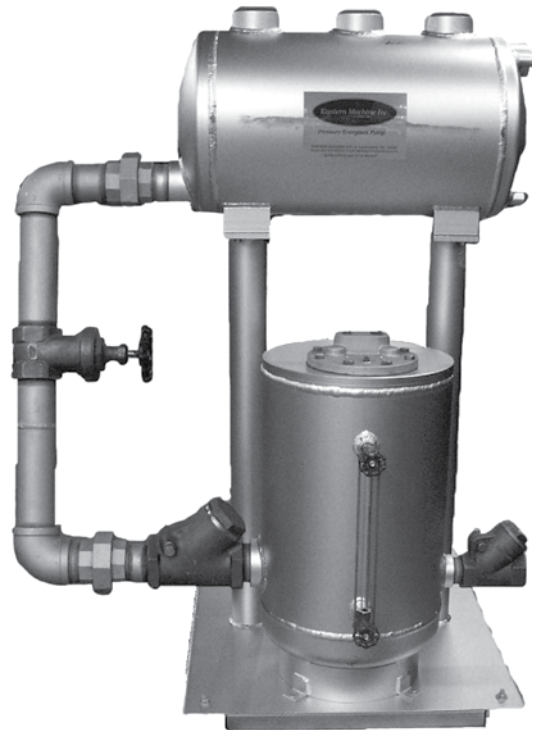
Model  
POPS

## PRESSURE OPERATED PUMPS

Making the most out of the BTU's in your system is key to efficient operation. Yet you may be pouring up to 20% of your heat energy down the drain with the condensate that is being discharged from your steam traps. It's not enough to simply remove condensate from your system . . . the true benefits come from adopting a simple condensate recovery system.

- **Condensate recovery** – a condensate recovery program will enable you to reclaim the condensate that is routinely discharged from your steam traps by recirculating it to your boiler for use in producing additional steam. By doing this, you'll find savings in a number of areas
- **Recapture lost heat energy** – instead of losing the useable BTU's in the condensate, recalculate them in the return main and boiler feed water system for use in producing additional steam
- **Lower make-up costs** – returning hot condensate to the return main not only conserves on energy, it also lowers your costs for preheating boiler make-up water
- **Reduced operating costs** – instead of sending treated water down the drain, a condensate recovery system will return water to the boiler where it will be reused without requiring additional treatment chemicals

The design of the "Single Compression Spring" pressure operated pump received the *Plant Engineering Magazine* 1992 Gold Award for the best Fluid Handling Product. It is used constantly in many fluid mediums throughout the world (a permanent solution to excessive maintenance costs on return condensate systems). The design is simple to ensure maximum operating reliability under the most challenging conditions and to provide plant operations with the best performing, non-electric, "maintenance free" pressure operating pump available.



A Division of  
Richards Industries  
3170 Wasson Road  
Cincinnati, OH 45209

toll free. 800.543.7311  
local. 513.533.5600  
fax. 513.871.0105

steam@richardsind.com  
www.bestobellsteamtraps.com

## PRESSURE OPERATED PUMPS

### FEATURES & BENEFITS

---

All stainless steel internal mechanism / no internal adjustment required . . . ever! High quality machined parts made in the USA

**Long life and dependable service.** Simple float/compression spring operation and rugged construction allow for long, trouble-free operation. No electrical wiring or solenoid valves required.

**Largest selection of pumps and pumping rates in the industry – from 1" to 4".** Pumping system packages include multiple pumps with high volume capacity.

**Skid mounted for minimal engineering and installation costs.** Custom designed to meet customer needs in limited area. Standard units in stock for fast delivery. Duplex package units available from 1" through 4"; customized to meet your needs.

**Ideal for remote locations without electric power.** Use steam, air or gas pressure for motive force, up to 150 psig / higher pressure options available. Steam or air can move your liquids.

All stainless steel mechanisms can be retrofitted to most competitor pumps except the 1" Sarco and Armstrong 200 Series.

All units except mechanisms are shipped with sight glass and bronze swing check valves. Skid mounted units are provided with piping between the receiver and pumps.

**Safe for the environment.** No seals or packing glands to leak recovery fluids to environment.

**Typical applications include:** Condensate collection, heat exchanger condensed steam, remote installations, steam tracing pipe lines, tank farms, etc.

**Target industries include:** Pharmaceutical, utilities, petrochemical, pulp & paper, food processing, hospitals and universities, prisons and municipal facilities

## CONDENSATE RECOVERY CAN LEAD TO SIGNIFICANT SAVINGS

Using a pressure-operated pump will pay for itself many times over in just a short period of time. Conservative figures have been used in this example. To calculate your actual savings, substitute your own figures.

### EXAMPLE

#### Application Data & Unit Costs:

Condensate load:	7500 lbs/hr	Cost of fuel oil:	\$0.75 gallon
Annual usage (80%)	7008 hours	Cost of steam:	\$6.00 1000 lbs
Cost of water	\$0.005 gallon (includes water/sewage/treatment)		
Discharge condensate temperature:	180°F		
Cold make-up water temperature:	55°F		
Temperature difference (rise)	125°F		

#### Water & Treatment Savings (calculated at 85% to allow for 15% flash steam loss in an open type system)

Annual savings = (85% x condensate load x yearly hours use x cost of gallon of water) / weight of gallon of water

$$\text{Annual Water Savings} = \frac{0.85 \times 7500 \times 7008 \times 0.005}{8.34 \text{ lbs}} = \$26,784.17$$

#### Fuel Oil Savings from Reduction in Pre-Heating Make-up (@ 85% to allow for flash steam in an open type system)

Annual savings = (85% x condensate load x yearly hours use x temperature rise x cost of oil) / heat from gallon of water

$$\text{Oil Savings} = \frac{0.85 \times 7500 \times 7008 \times 125^\circ\text{F} \times 0.75}{127,500} = \$26,784.17$$

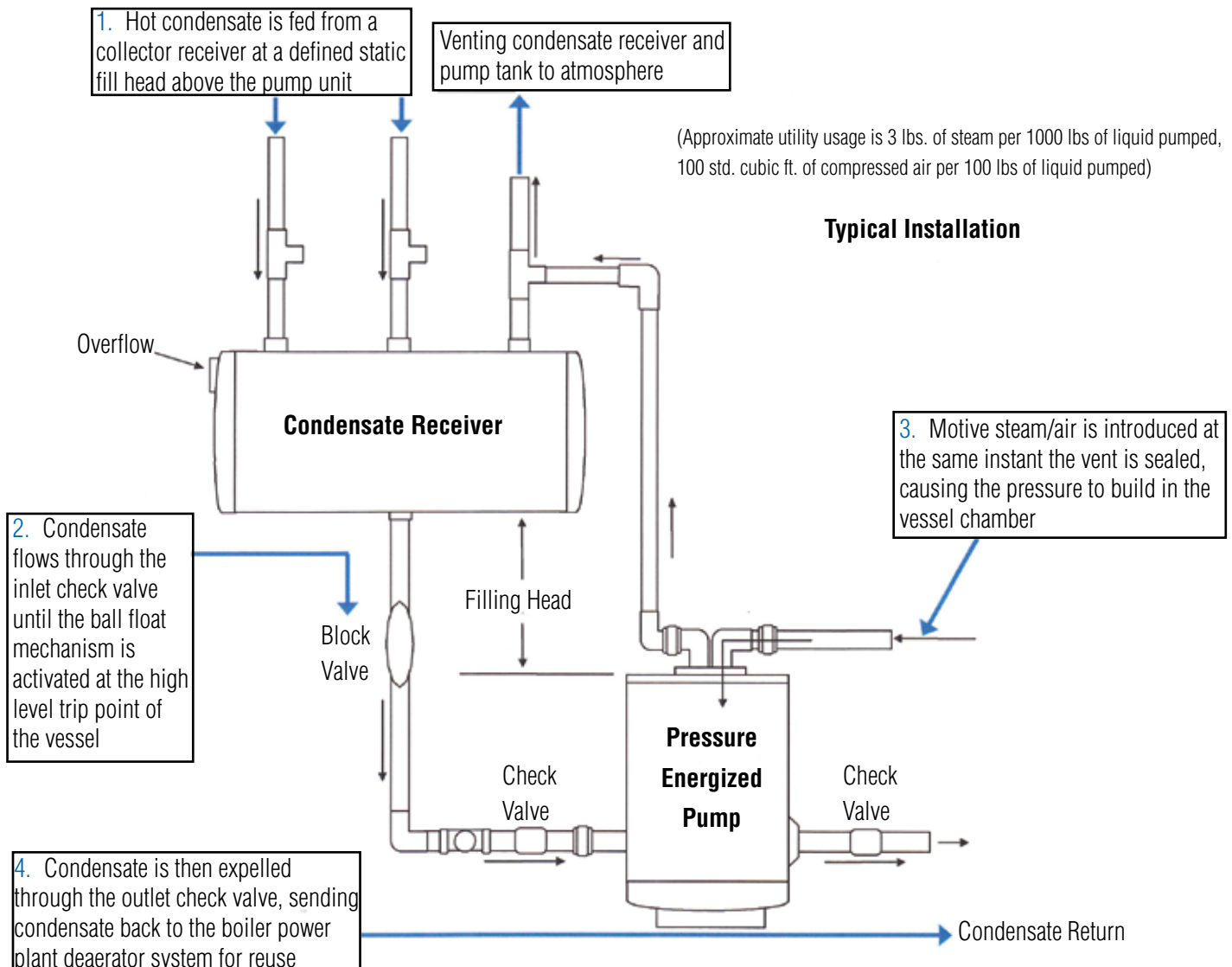
$$\begin{aligned} \text{Total Yearly Savings} &= \text{Water Savings} + \text{Oil Savings} = \\ & \$26,784.17 + \$42,850.00 = \$59,634.17 \text{ Total Annual Savings} \end{aligned}$$

**RETURN CONDENSATE WITHOUT THE USE OF ELECTRICITY**

Bestobell Steam's **Pressure Operated Pump System (POPS)** are designed to move condensate or other liquids (i.e. Dowtherm, hydrocarbons, liquid food products, etc.) without the use of electricity, and return condensate at temperatures above the 200°F limit typical of conventional electric pumps. Since they are pressure operated, they require no electrical panels, starters or accessories. They operate with minimal maintenance with no rotating seals to leak or motors to burn out.

**How the Pressure Operated Pump System works:**

In its normal position prior to start-up, the float is at its lowest position with the motive pressure inlet valve closed and the exhaust outlet valve (vent) open. As the liquid to be pumped flows by gravity through the inlet check valve enters the pump tank, the float becomes buoyant and begins to rise. With the increasing liquid level the pump mechanism float continues to rise until the liquid level reaches its "high level", the compression spring simultaneously forces the vent valve to close and the motive steam/air (pressure) valve to open. The motive pressure forces the liquid through the exit check valve. During the pumping period, the ball float drops as the liquid level recedes to "low level" trip. The action of the compression spring then simultaneously forces the vent valve open and the motive steam/air valve closes. Pressure in the pump tank is released through the vent, and liquid to be pumped enters through the inlet check valve beginning a repeating cycle.



### POPS SIZING

#### EXAMPLE

- |  |           |
|--|-----------|
| 1. Condensate load to be pumped –                  | 6000 PPH  |
| 2. Steam pressure available as pump motive force – | 100 psig  |
| 3. Vertical lift from pump to return piping –      | 11.5 feet |
| 4. Pressure in return piping –                     | 35 psig   |

Calculate the total back pressure against which the condensate must be pumped (i.e. lift pressure =  $11.5 \times 0.443 = 5.0$  psi, discharge piping pressure = 35 psig, total back pressure = 40 psig).

The table below indicates pound per hour for liquids with specific gravity = 0.9 to 1.0 with a filling head of 12 inches above the pump top, and using steam as the motivation force. For other specific gravity fluids, filling heads and motivating force mediums, check with your local representatives.

#### Refer to the table to review sizing

A 2" pump with a minimum filling head of 12", standard bronze check valves and piping will pump 6,600 pounds per hour providing an overall capacity of 110% of required flow.

\* Consult with your representative to achieve rate capacity; the pump must be installed with check valves supplied with the pump unit. Use of any other check valves may alter pump performance.

Capacities (lbs/hr)

Motive Pressure (psig)		Pump Size				
Inlet	Total Lift	1"	1-1/2"	2"	3" x 2"	4"
150	15	2,550	4,650	7,300	12,300	43,120
	40	2,400	4,450	6,800	11,200	38,090
	60	2,250	3,850	6,500	11,000	34,050
125	15	2,550	4,650	7,300	12,300	43,000
	40	2,350	4,450	6,800	11,200	38,000
	60	2,250	3,850	6,500	11,000	34,000
100	15	2,550	4,550	7,200	12,100	41,500
	40	2,350	4,150	6,600	11,300	36,600
	60	2,250	3,550	6,300	12,700	32,000
75	15	2,450	4,150	7,290	12,100	41,200
	40	2,350	3,750	6,300	10,600	33,500
	60	1,950	3,350	5,400	9,200	26,000
50	10	2,450	3,900	6,900	11,700	41,200
	25	2,350	3,600	6,300	10,600	33,000
	40	1,950	3,150	5,200	8,900	24,500
25	5	2,250	4,100	6,600	11,300	*
	10	2,050	3,800	6,100	10,400	
	15	1,950	3,200	5,500	9,400	

**SIMPLEX & DUPLEX CONDENSATE RECOVERY SYSTEM**

Prepackaged condensate recovery systems are available that include the pressure operated pump in a simplex arrangement, or two pumps in duplex systems, along with all inter-connecting piping, isolating valves, base, and receiver tank completely installed and ready for operation.

**Sizing for multiple pumps:**

Use the previous example but change the total condensate load to 11,500 PPH. The single pump previously chosen would offer 6,600 PPH which is too small if you look at the 3" x 2" unit, it can only handle 11,300, which is also not enough. The 4" would be able to handle the load but would not be cost effective. Based on the amount of back-pressure in the system, your only option would be to offer a duplex 2" system that would provide 13,200 PPH under the prescribed conditions and offer a capacity of 106% of the required flow.

The unit chosen would be a 2" duplex system with 24 gallon receiver skid mounted complete with bronze check valves, sight glass and all necessary piping to connect the receiver and pumps. Note that if motive pressure is greater than 150 psig it needs to be reduced for flow control purposes; a regulator must be purchased separately, it can be provided by your representative.

**ORDERING SCHEMATIC**

PUMP	TYPE	SIZE		RECEIVER
PSP	4	7	7	1

1 PUMP	
POP	Pump
PSP	Pump Station

3 SIZE			
1"		4	4
1-1/2"		6	6
2"		7	7
3"		8	0
4"		B	B

2 TYPE	
01	Tank with Mechanism
02	Simplex Skid
03	Low profile Duplex Skid
04	Duplex Skid
05	4" Complete Pump

4 RECEIVER	
0	Without Receiver
1	24 Gallon Receiver
2	54 Gallon Receiver

**Replacement Parts:**

- POP-REP-1 Mechanical insert replacement for competitor's pumps (except Sarco 1" and Armstrong 4" 200 Series)
- POP-REP-2 Standard Bestobell rebuild
- POP-REP-3 4" mechanical insert of 4" Sarco retrofit

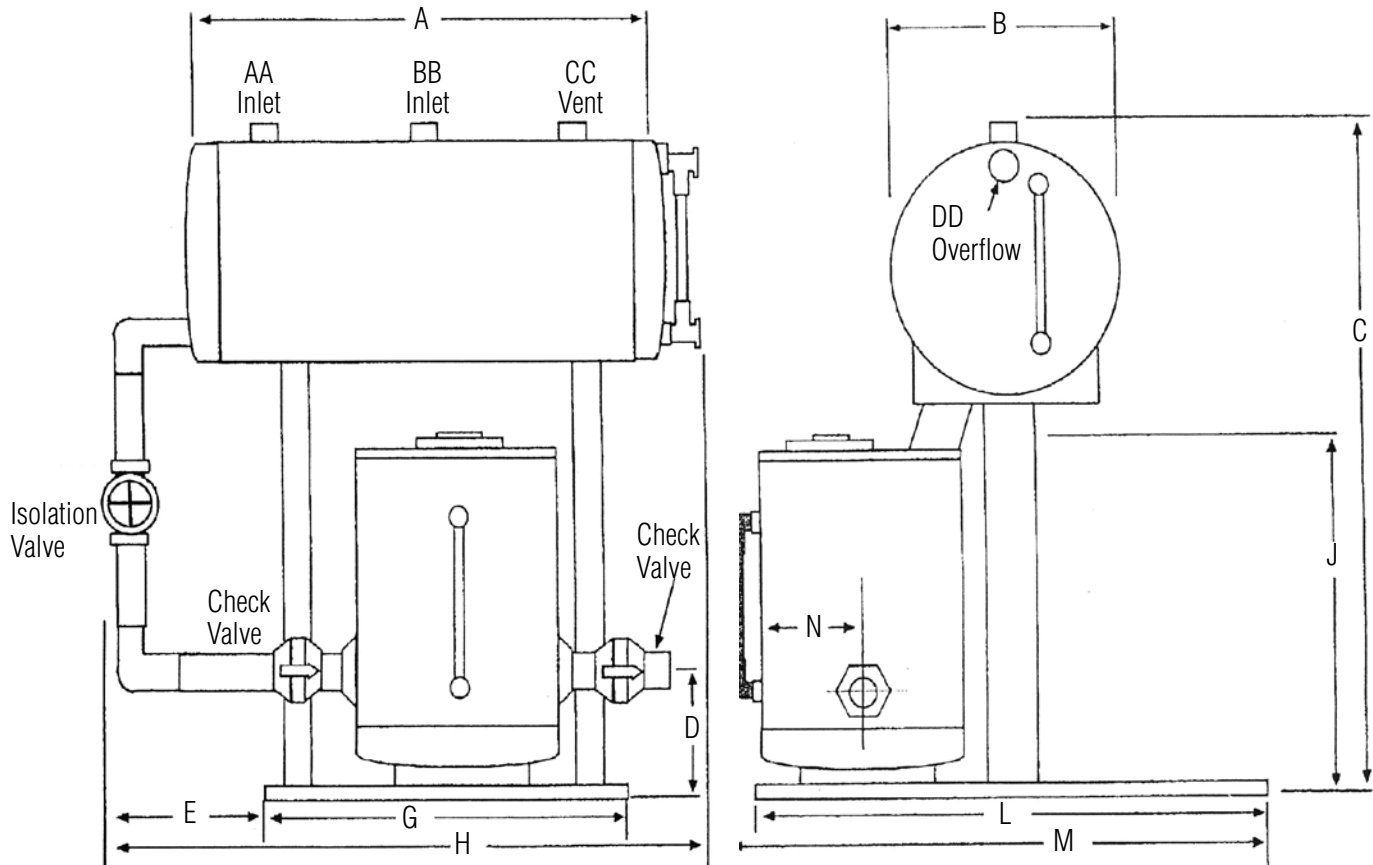
### POPS SIZING

#### EXAMPLE

1. Condensate load to be pumped – 6000 PPH
2. Steam pressure available as pump motive force – 100 psig
3. Vertical lift from pump to return piping – 11.5 feet
4. Pressure in return piping – 35 psig

Calculate the total back pressure against which the condensate must be pumped (i.e. lift pressure =  $11.5 \times 0.443 = 5.0$  psi, discharge piping pressure = 35 psig, total back pressure = 40 psig).

The table below indicates pound per hour for liquids with specific gravity = 0.9 to 1.0 with a filling head of 12 inches above the pump top, and using steam as the motivation force. For other specific gravity fluids, filling heads and motivating force mediums, check with your local representatives.



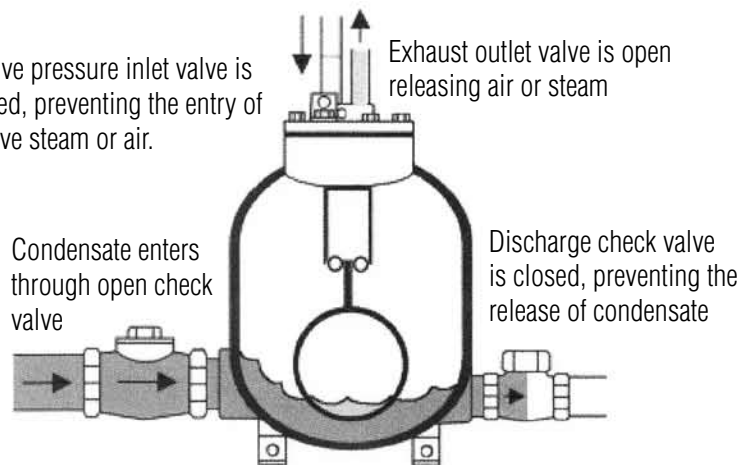
Size	A	B	Gal	C	D	E	G	H	J	L	M	AA	BB	CC	DD	Lbs
1-1/2"x1-1/2"	34	16	24	52	6.75	8	30	44	22.5	36	39	2	2	2	2	450
2x2	34	16	24	58.5	11.75	17.5	30	52	33	36	39	2	2	2	2	625
3x2	34	16	24	58.5	11.75	17.5	30	52	33	36	39	3	3	3	2	650

**PRESSURE OPERATED PUMPS**

**Operation on Start-Up**

Motive pressure inlet valve is closed, preventing the entry of motive steam or air.

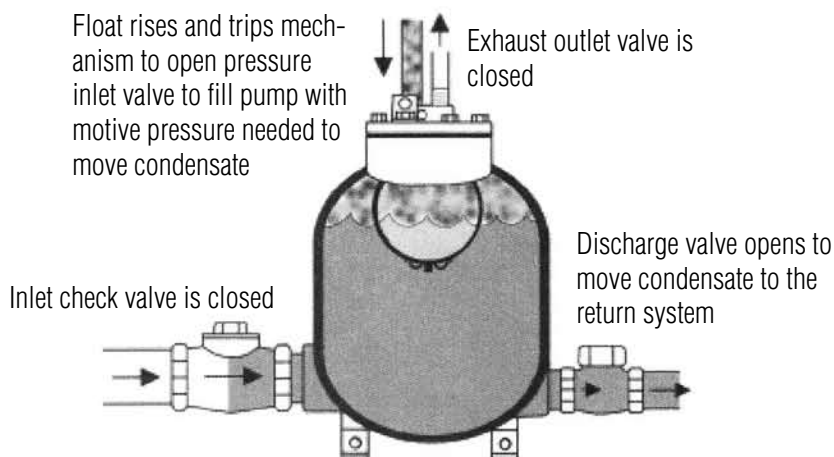
Exhaust outlet valve is open releasing air or steam



**Operation During Pumping**

Float rises and trips mechanism to open pressure inlet valve to fill pump with motive pressure needed to move condensate

Exhaust outlet valve is closed



**Operation After Pumping**

As condensate is discharged, the float drops, and trips the mechanism to close the motive pressure inlet valve

Exhaust outlet valve is open, releasing air or steam

Inlet check valve begins to open to allow additional condensate to fill the pump body

Discharge valve closes to allow the condensate level to build up again

