Armstrong PT-104

Mini Pump Trap

The Armstrong PT-104 mini pump trap is the smallest non-electric solution that can move condensate or other liquids from lower to higher points and from lower to higher pressures. Condensate can be returned at temperatures well above the 210°F limit of conventional electric centrifugal pumps without the headaches of leaking seals or cavitation problems. The PT-104 Mini Pump Trap is the small solution for a big problem.

Features:

- Non-electric - Operates using inexpensive steam, air or inert gas.
- Low maintenance - No leaking seals, impeller or motor problems reducing maintenance and downtime.
- Small and compact - Low profile body fits in tight space requirements while allowing minimal fill head.
- Reduced installation cost - Single trade required for installation and maintenance.
- Explosion proof - Standard unit intrinsically safe.
- All stainless steel internals - Provide corrosion resistance and long service life.
- Long lasting Inconel X-750 spring.

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Table 1-1 PT-104 Mini Pump Trap - Connection Sizes

Connection	Type	in	mm
Inlet	npt	1	25
Outlet		1	25
Vent		1/2	15
Motive Pressure		1/2	15
Optional Guage Glass		1	25
Optional Cycle Counter		1	25

Table 1-2 PT-104 Mini Pump Trap - List of Materials

Name of Part	Material
Body and Cap	Cast Iron ASTM A48 cl.30
Vent/Inlet Valves	Stainless Steel
Mechanism Assembly	Stainless Steel
Spring	Inconel X-750
Gasket	Compressed non-asbestos
Bolts	SA 449
Nuts	ASTM A194 Gr.2H
Plug	Cast Iron

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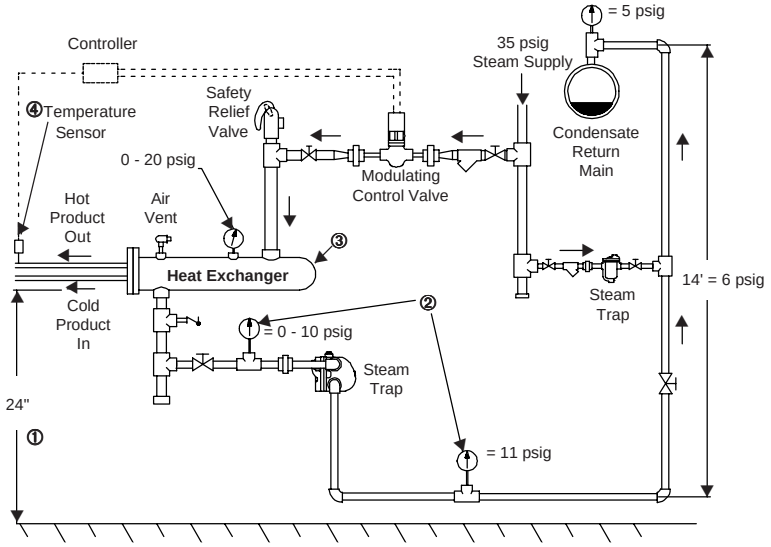
A small solution for a big problem



Big Problem

① Space constraints - heat exchanger equipment being low to the floor.

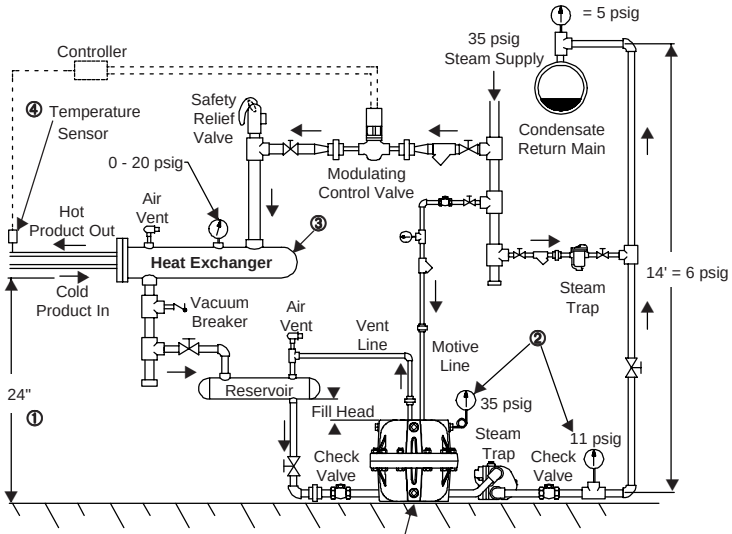
② No condensate drainage - back pressure exceeds system pressure.

③ Heat exchanger equipment floods causing equipment damage from:

- Water hammer - steam and condensate occupying the same space
- Corrosion - non-condensible gases are reabsorbed into the condensate forming carbonic acid.

④ Production Loss - due to inaccurate temperature control

Maintenance Headache!



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Small Solution

① Small and compact - PT-104 Mini Pump Trap fits in tight spaces

② Condensate drainage - Motive pressure to PT-104 Mini Pump Trap provides enough pressure to lift condensate to return lines.

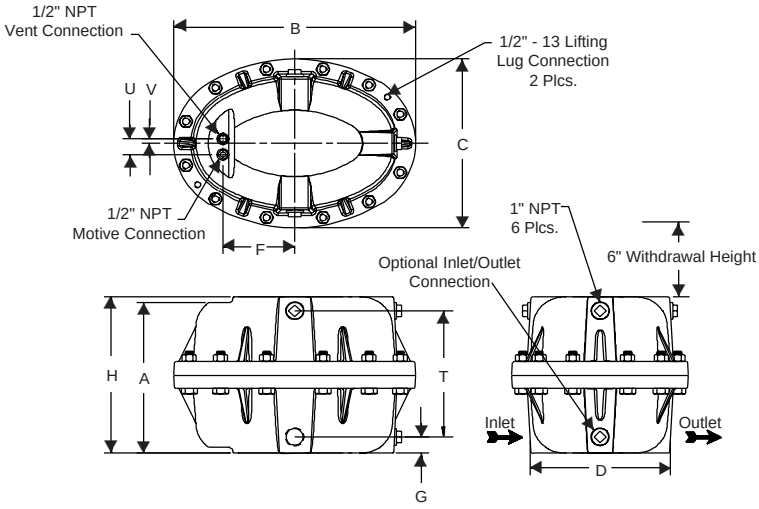
③ Heat exchanger is free and clear of condensate due to proper drainage, provided by the PT-104 Mini Pump Trap.

④ Accurate temperature control providing less product loss.

Long trouble free service life for heat exchanger equipment due to condensate and non-condensable gas evacuation.

Table 2-1 PT-104 Mini Pump Trap - Physical Data

	in	mm
A	12	305
B	18-1/2	470
C	13-1/2	343
D	10-3/4	272
F	5-1/2	140
G	1-5/16	33
H	12-1/2	317
U	1-1/4	32
V	3/8	9
T	10-1/16	256
Weight lb (kg)	169	(77)
Bronze Check Valves lb (kg)	4	(2)
Stainless Steel Check Valve lb (kg)	4	(2)
Maximum Operating Pressure	100 psig (7 bar)	
Maximum Allowable Pressure (vessel design)	150 psig (10 bar) @ 450°F (232°C)	



All dimensions and weights are approximate. Use certified print for exact dimensions.

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Table 3-1 PT-104 Mini Pump Trap - Capacities For Steam and Air

Motive Pressure		Total Lift or Back Pressure		Filling Head 6" Liquid Specific Gravity .09 - 1.0			
				Steam		Air	
psig	bar	psig	bar	lb/hr	kg/hr	lb/hr	kg/hr
15	1.0	5	0.34	1125	510	2100	952
25	1.7			1300	590	2200	998
50	3.5			1550	703	2275	1032
75	5.0			1650	748	2300	1043
100	7.0			1400	635	2350	1066
25	1.7	15	1.0	650	295	1900	862
50	3.5			700	363	2050	930
75	5.0			750	317	2100	952
100	7.0			800	340	2150	975
35	2.5	25	1.5	400	181	1800	816
50	3.5			450	204	1935	878
75	5.0			500	227	2050	930
100	7.0			550	249	2075	941
50	3.5	40	3.0	250	113	1620	735
75	5.0			300	136	1850	823
100	7.0			350	159	1950	884

Notes: Published capacities are based on the use of external check valves supplied by Armstrong. Fill head measured from drain point to top of pump case. See Figures 5-1 and 5-2.

Pump Trap Sizing and Selection

Sizing Example: The mini pump trap is sized based on the actual condensate load (lb/hr or kg/hr) being pumped. The following steps are used to size this pump trap.

1. Determine the total condensate load to be pumped in lb/hr or kg/hr.
2. Determine:
   - Total back pressure the pump will operate against.
   - Vertical lift expressed in psig, See Figure 5-1 or Figure 5-2.
   - Frictional loss from pipe, valves and fittings.
3. Determine what type of motive gas will be used (steam, air, or other inert gas) and the pressure.

Example:

1. Condensate load = 700 lb/hr (317 kg/hr)
2. Back pressure = 15 psig (1.0 bar)
   23 foot (3.6m) vertical lift = 10 psig (.68 bar) and 5 psig (.34 bar) in the return line
3. Motive pressure is steam at 50 psig (3.5 bar)

Find the 15 psig (1.0 bar) total lift or back pressure in column two of Table 3-1. Then find 50 psig (3.5 bar) motive pressure in column one. Move horizontally across the capacity table until you reach the correct capacity under steam motive pressure. See shaded area in Table 3-1.

Reservoir and Vented Receiver Sizing

Either a closed reservoir pipe or a vented receiver is required for proper condensate storage during the pump-down cycle of the pumping trap.

For closed resevoir piping:

1. Determine condensate load (using the example above) = 700 lb/hr

Reference Table 4-1. Find 700 lb/hr in column. Move horizontally across the columns to find proper pipe sizing (see shaded area in Table 4-1).

For vented receiver sizing:

1. Determine the pressure from where the condensate is being discharged.
2. Determine condensate load.

Reference Chart 4-1 to find the pressure that corresponds with the discharge condensate pressure. For this example, use 15 psig.

Follow 15 psig to where it intersects the "0" psig curve. Move to the left from the intersecting lines for the percentage of flash that will be created (see shaded area). For this example it will be 3%.

Multiply 3% by the condensate load. For this example it is 700 lb/hr. 700 lb/hr x .03 = 21 lb/hr flash steam.

Using Table 4-2, find the amount of flash steam in column one. Follow the table across to determine the size of the vented receiver (see shaded area).

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Table 4-1 Inlet Reservior Pipe Sizing for "Closed Systems"

Condensate Load		Reservior Pipe Diameter							
		in	mm	in	mm	in	mm	in	mm
		2	50	3	76	4	102	6	152
lb/hr	kg/hr	Length of Pipe							
up to		ft	m	ft	m	ft	m	ft	m
500	227	4	1.2	2-1/2	0.7	1-1/2	0.4		
1000	453	6	1.8	3	0.9	2	0.6	1	0.3
1500	680	8-1/2	2.6	4	1.2	2-1/2	0.7	1-1/2	0.4
2000	907	11	3.3	5	1.5	3	0.9	1-3/4	0.4
2500	1134	14	4.3	6-1/2	1.9	4	1.2	2	0.6

Important Note: Inlet reservoir pipe sizing. When draining condensate from a single piece of equipment in a **"closed system"** to achieve maximum energy efficiency (See Figure 5-2) a reservoir should be installed horizontally above and ahead of the pump trap. Sufficient reservoir volume is required above the filling head level to hold condensate during the pump trap discharge cycle. The chart above shows the minimum reservoir sizing, based on the condensate load to prevent equipment flooding during the pump trap discharge cycle.

Table 4-2 Vented Receiver Sizing for an "Open System"

Flash Steam		Receiver Diameter		Receiver Length		Vent Line Diameter	
lb/hr	kg/hr	in	mm	in	mm	in	mm
up to							
75	34	4"	102			1-1/2	40
150	68	6"	152	36"	914	2	50
300	136	8"	203			2-1/2	64
600	272	10"	254			3	76

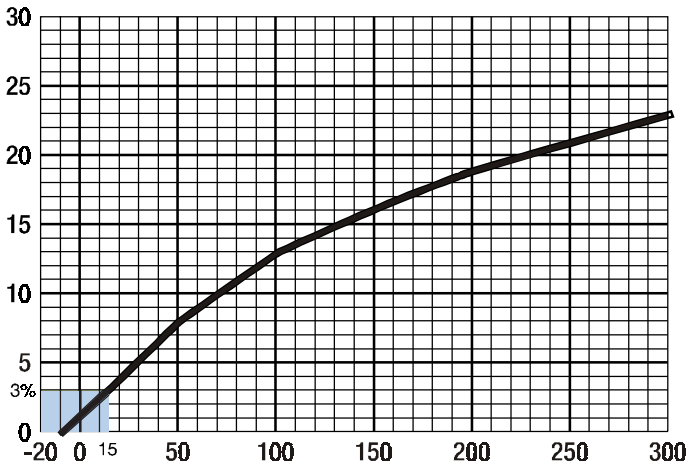
Important Note: Vented Receiver Sizing. When draining from single or multiple pieces of equipment in an **"open system"**, a vented receiver should be installed horizontally above and ahead of the pump trap (See Figure 5-1). In addition to sufficient holding volume of the condensate above the fill head of the pump trap during the pump trap discharge cycle, the receiver **must** also be sized to allow enough area for flash steam and condensate separation. An overflow could also be added when required. The minimum recommended water seal is 12". The chart above shows proper receiver tank sizing based on flash steam present. See Chart 4-1 to calculate the % of flash steam at a atmospheric (0 psig) pressure.

Table 4-3 PT-104 Mini Pump Trap - Capacity Conversion Factors For Other Fill Heads

Filling Head				
in	0	6	12	*24 or greater
mm	0	152	305	*610 or greater
PT-104 Mini Pump Trap	0.7	1.0	1.2	*Consult factory

*** Note:** Fill head measured from drain to top of cap. See Figure 5-1 and Figure 5-2.

Chart 4-1 Percentage of flash steam formed when discharging condensate to atmospheric pressure.



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General Applications

"OPEN SYSTEMS" - For the majority of applications, a steam trap is recommended on each piece of heat exchange equipment. The steam trap, or traps, discharge to a vented receiver where flash steam will be vented to the atmosphere. The pump trap is located down stream and below the vented receiver allowing for proper fill head height. See Table 4-2 for vented receiver and vent sizing for an "open system".

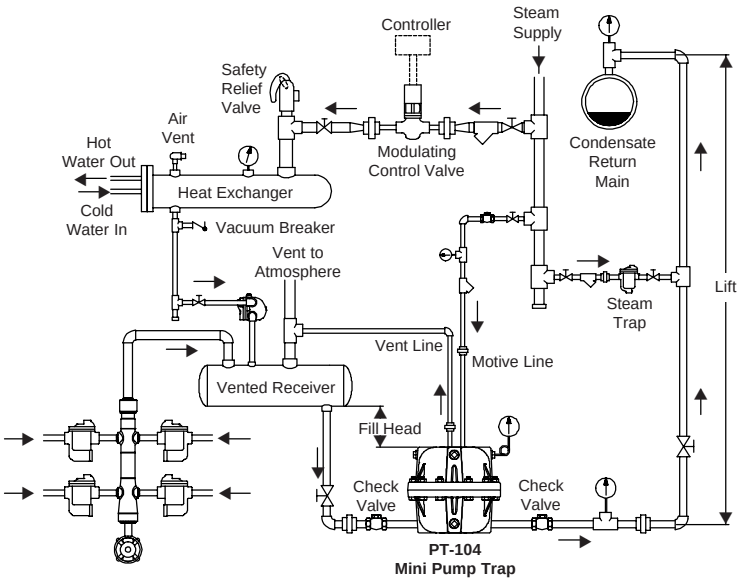

Fig. 5-1 Multiple or single traps discharging to a vented receiver.

"CLOSED SYSTEMS" - Applications exist where it is desirable to tie the vent line back into the heat exchange space equalizing the pressure in the heat exchanger, reservoir/piping and the pump trap. This allows water to flow by gravity down to the pump where it can be returned. **Valuable btu's remain within the system due to no flash steam loss to the atmosphere through the vent.** Closed system applications can also be used to drain liquid from equipment under a vacuum. See Installation and Operation Manual IB-100. For reservoir pipe sizing reference Table 4-1.

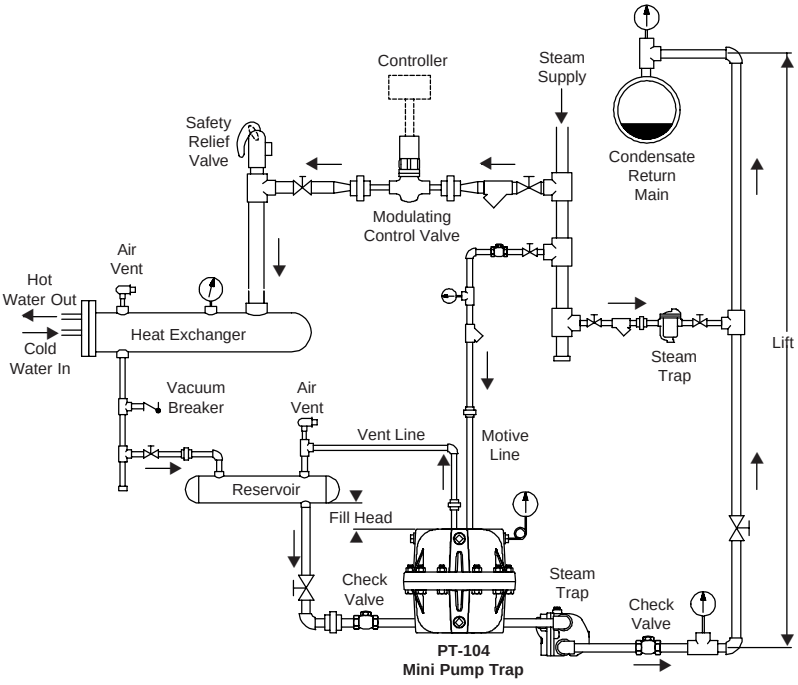

Fig. 5-2 Drainage from heat exchange equipment in a closed-loop system where the discharge pressure may be higher or lower than the back pressure. If the heat exchange equipment pressure exceeds the back pressure, the pump trap will be idle and the steam trap will prevent the steam from "blowing through" into the return line. If the system steam pressure is always lower than the back pressure, a steam trap is not required. The pump and check valve combination will act as both the pump and the trap.

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Options

Use of external check valves required for operation of pumping trap.

- **Inlet Swing Check Valve**
  - — NPT Bronze ASTM B 62
  - — Teflon® Disc
  - — Class 150 (Minimum)
- **Outlet Lift Check Valve**
  - — NPT Bronze ASTM B 62
  - — Teflon® Disc
  - — Class 150 (Minimum)
- **In-line Check Valves**
  - — Stainless Steel Non-Slam Check Valves
- **Bronze Gauge Glass Assembly***
- **Armored Steel Guage Glass Assembly**
- **Removable Insulation Jacket**
- **Digital Cycle Counter****

* See Bulletin AFH-236
** See Bulletin AFH-237

Suggested Specification

The mechanical condensate pump trap shall utilize steam, air or inert gas as the motive force to remove condensate from the receiving vessel. Electricity, seals, or packings shall not be used. The non-electric condensate pumps shall be sized to meet the actual maximum capacity of the system being drained.

Pump internals shall consist of an all stainless steel, float operated mechanical mechanism with actuating springs constructed of Inconel material for maximum spring life. Pump will operate up to a maximum 100 psig using steam, air or inert gas as the motive force and be capable of handling water at 350°F when pumping from a closed loop, equalized system.

Vessel body shall be constructed of corrosion resistant cast iron providing long service life. The vessel body shall be a horizontal design with a maximum overall height of 12.5" and have optional inlet and outlet connections for small confined space requirements.

When required, pump shall be supplied with gauge glass to observe operation, custom-designed insulation jackets for optimum energy savings, or cycle counters to measure amount of returned condensate.

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