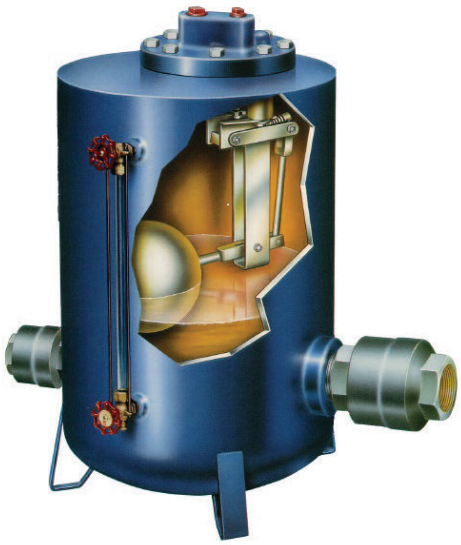
YARWAY CONDENSAVER™ SERIES STEAM CONDENSATE RETURN PUMPS

DATASHEET

Efficiently conserves energy and reduces CO_2/NOx emissions by collecting and returning hot condensate for reuse as boiler feedwater. Recycles treated condensate, reducing cold make-up water and chemicals and decreasing energy loss from boiler blowdown.



FEATURES

- Electricity-free design uses pressurized steam to propel the condensate.
- Cavitation-free
- Reduced maintenance and operating cost compared to centrifugal condensate pumps with dynamic seals susceptible to leaking and bearings and impellers prone to damage.
- Can handle condensate above the 210°F (99°C) limit of conventional electrical pumps. This results in less flash steam loss and additional sensible heat savings reducing energy costs up to 20%.
- Utilizes a single Inconel® compression spring.

GENERAL APPLICATION

Yarway CondenSaver™ Series condensate return pumps are designed to return condensate efficiently and economically to the boiler feedwater tank without the use of electrical energy.

TECHNICAL DATA

Technology:	Mechanical Condensate Return pump
Maximum Temperature Rating:	400°F (204°C)
Capacity:	Up to 17,600 lb/hr (8000 kg/hr)
Materials:	Steel construction with Stainless steel mechanism and check valves
Port Sizes:	NPS ½ (DN 15) NPT Steam Inlet NPS 1 (DN 25) NPT Exhaust Outlet

AVAILABLE OPTIONS

The Yarway CondenSaver Series comes standard with inlet and outlet check valves.

- Glass Level Gauge
- Digital Cycle Counter
- Steam Regulator
- Insulating Jacket - Removable fiberglass jacket

TABLE 1. CONDENSAVER SERIES TECHNICAL DATA

TYPE	CHECK VALVE SIZE	MAXIMUM OPERATING PRESSURE	
		psig	bar
SCP21	NPS 1 and 1½ (DN 25 and 40)	150	10.3
SCP25	NPS 1, 1½, 2 and 3x2 (DN 25, 40, 50 and 80x50)	250	17.2
SCP33	NPS 1, 1½, 2 and 3x2 (DN 25, 40, 50 and 80x50)	200	13.8

Inconel® is a mark owned by Special Metals Corporation.

PRINCIPLE OF OPERATION

The CondenSaver™ Series pumps utilize steam, compressed air or other suitable pressurized gas as the pumping force (see Figure 1).

1. Pump body is empty. Condensate flows by gravity from reservoir through the inlet check valve. The internal float begins to rise as the pump body fills.
2. Condensate has filled the pump body. With a "Snap Action", the float and internal linkage are engaged to simultaneously close the outlet exhaust port and open the inlet steam port.
3. Steam flows into the pump body. The inlet check valve is closed and the outlet check valve is open as condensate is forced out of the pump body into the condensate return system. The float falls as the liquid level in the pump body drops. At the lowest tripping position, the linkage simultaneously closes the steam inlet port and opens the exhaust port to repeat the filling cycle.

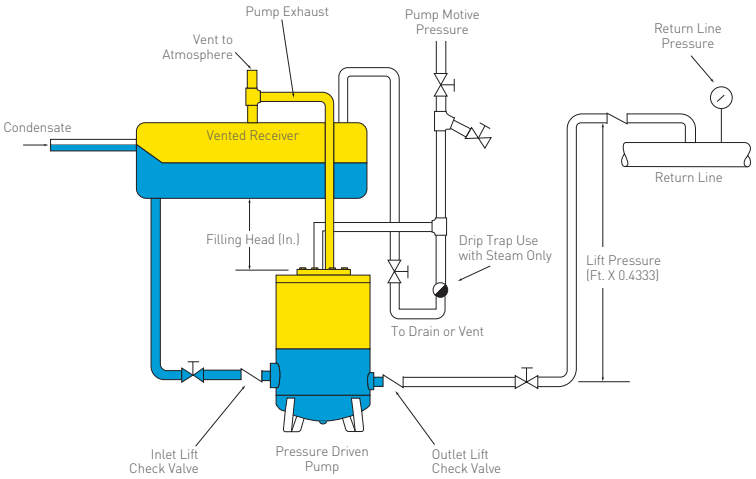
INSTALLATION

See Figures 2 and 3 for the recommended piping layout.

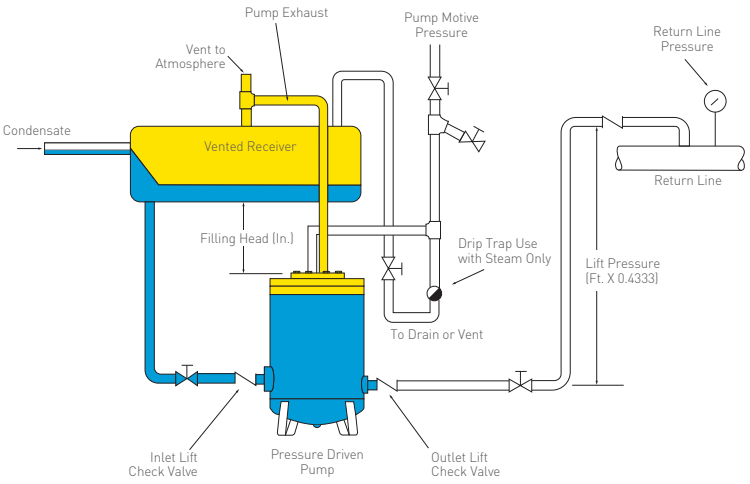
To maximize service life of the mechanism, the motive pressure should be reduced to the minimum pressure that meets the pump capacity requirement. A pressure reducing valve installed in the supply line should be given sufficient piping volume between it and the pump to maximize diaphragm service life.

FIGURE 1
CondenSaver Series Operation

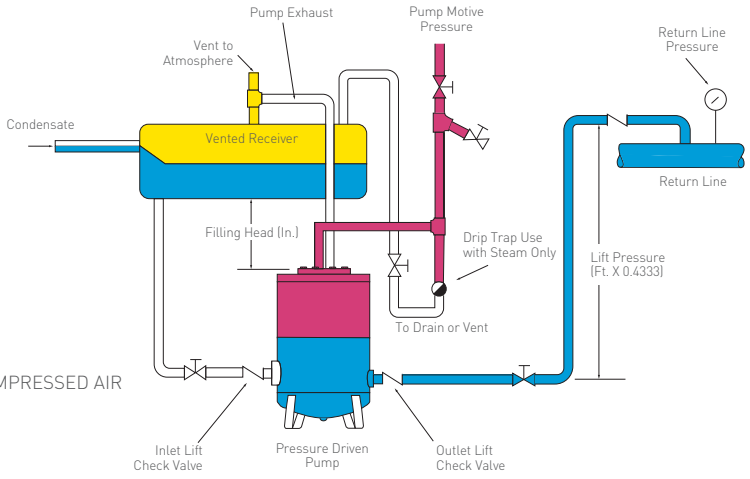
Filling Phase



Transition to Pumping Phase



Pumping Phase



CONDENSATE
STEAM OR COMPRESSED AIR
FLASH STEAM

APPLICATION

Vented Receiver (Figure 2)
The condensate is being pumped from a vented receiver to an elevated and/or pressurized condensate return system. Note the points of reference for both the filling head and lifting head. If steam is to be used as a motive pressure source, both the pump exhaust and steam trap discharge should be returned to the vented receiver for safety reasons.

Pressurized Receiver (Figure 3)
The condensate or other liquid has to be moved from a pressurized system to a return system which is also pressurized and which may be elevated as well. In this case the total back pressure may actually be higher than the system pressure or the available differential pressure may be too low to allow proper drainage. Note the point of reference for both the filling head and the lifting head. In this application it is absolutely necessary to connect the pump exhaust to the pressurized system to avoid discharge into the atmosphere during the filling cycle.

Also note the in-line process steam trap installed on the discharge side of the pump which must be sized to handle the pump load at the specified operating conditions. This steam trap is required to prevent blow-through of steam if there is no condensate arriving at the pump.

FIGURE 2
Vented Receiver

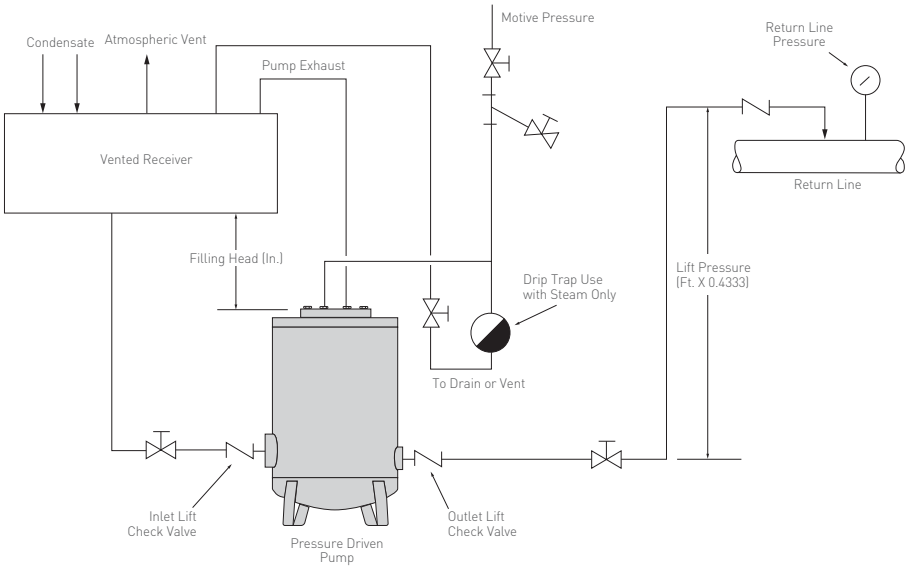
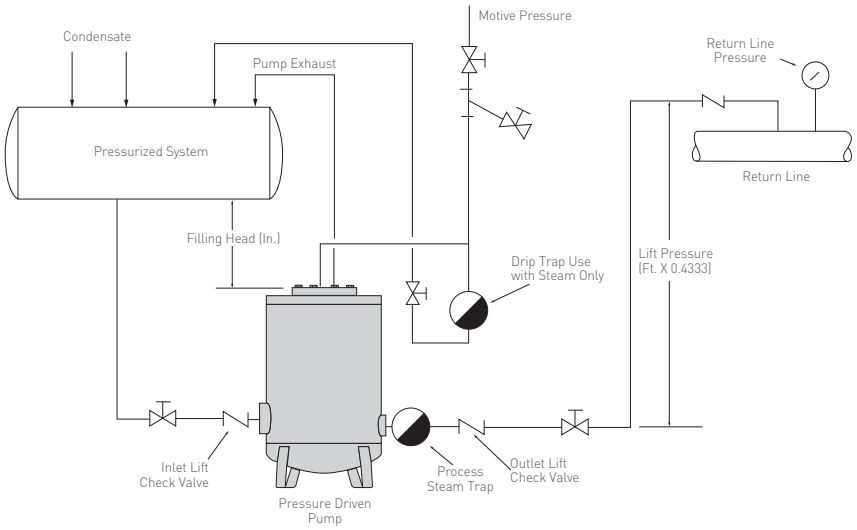


FIGURE 3
Pressurized Receiver



OPERATING INFORMATION

Every 1 psig (0.07 bar) inlet pressure can lift condensate to a height of approximately 2 ft. (0.61 m). The minimum operating pressure required for a particular application is dependent upon both the height to which the liquid must be pumped and the pressure in the system into which the liquid is being transferred.

When pumping with steam (vented to atmosphere) the pump uses approximately 3 lbs (1.4 kg) for every 1000 lbs (454 kg) of liquid pumped.

When pumping with compressed air, the consumption is 100 std ft^3 (2.8 std m^3) for each 1000 lbs (454 kg) of liquid pumped.

NOTE

The air should be exhausted to atmosphere, not returned to the system.

PUMP SIZING

1. Calculate Backpressure

   Backpressure (psig) = Lift height (ft) x 0.433 + Pressure in Return Line (psig)

   Backpressure (barg) = Lift height (m) x 0.098 + Pressure in Return Line (barg)

2. Use Tables 5 and 6 to determine which pump(s) will meet the required condensate load for the application. The capacity tables assume steam as the pumping force and 12 in. (305 mm) filling head. See Tables 3 and 4 correction factors for alternate setups.
   a. Because the capacity table assumes steam as the pumping force, it accounts for the additional condensate generated by the steam. If using a motive gas supply other than steam, the CondenSaver™ Series capacity is 4% - 28% higher depending on the ratio of the backpressure to motive pressure. Use Table 3 to determine the appropriate correction factor.
   b. If the condensate receiver is mounted with less filling head, then the pump capacity will be limited. Conversely, increased distance between the bottom of the condensate receiver and the top of the pump increases the CondenSaver Series capacity. Use Table 4 below.
3. Select the best pump for your application. The best practice to maximize the life of the pump mechanism is to minimize the number of cycles. See Table 2 for the maximum flow rate and volumer per discharge cycle.

TABLE 2. MAXIMUM FLOW RATE AND VOLUME PER DISCHARGE CYCLE

OPERATING INFORMATION	TYPE SCP21	TYPE SCP25	TYPE SCP33
Maximum Discharge Rate	60 GPM (227 LPM)	90 GPM (341 LPM)	90 GPM (341 LPM)
Volume per Discharge Cycle (approximate)	4.7 gal (17.8 L)	9.9 gal (37.5 L)	8.2 gal (31.0 L)

TABLE 3. CAPACITY CORRECTION FACTORS FOR ALTERNATIVE MOTIVE MEDIA

% BACK PRESSURE VS. MOTIVE PRESSURE (BP/MP)	10%	20%	30%	40%	50%	60%	70%	80%	90%
CAPACITY MULTIPLYING FACTORS	1.04	1.06	1.08	1.10	1.12	1.15	1.18	1.23	1.28

TABLE 4. CAPACITY CORRECTION FACTOR FOR FILLING HEAD VARATION

FILLING HEAD, in. (mm)	CHECK VALVE AND PIPING SIZE			
	NPS 1 (DN 25)	NPS 1½ (DN 40)	NPS 2 (DN 50)	NPS 3 x 2 (DN 80 x 50)
6 (152)	0.70	0.70	0.70	0.84
12 (305)	1.00	1.00	1.00	1.00
24 (610)	1.20	1.20	1.20	1.08

TABLE 5. CONDENSAVER™ SERIES PUMP CAPACITY IN LBS/HR, 12 IN. FILL HEAD

MOTIVE PRESSURE, psig	BACK PRESSURE, psig	TYPE SCP21		TYPES SCP25 AND SCP33			
		NPS 1 x 1	NPS 1.5 x 1.5	NPS 1 x 1	NPS 1.5 x 1.5	NPS 2 x 2	NPS 3 x 2
250	40	- - - -	- - - -	2703	6392	10,196	11,537
	60	- - - -	- - - -	3670	7203	7787	8551
	80	- - - -	- - - -	3457	6071	6531	7105
	100	- - - -	- - - -	3891	5278	5753	6202
	120	- - - -	- - - -	3700	4730	5213	5587
	150	- - - -	- - - -	3196	4074	4552	4842
	175	- - - -	- - - -	2845	3624	4092	4331
	200	- - - -	- - - -	2456	3152	3650	3847
	225	- - - -	- - - -	1963	2732	3221	3380
200	40	- - - -	- - - -	2503	5919	9441	10,682
	60	- - - -	- - - -	3398	6669	7210	7918
	80	- - - -	- - - -	4021	5579	6110	6619
	100	- - - -	- - - -	3741	4855	5403	5804
	120	- - - -	- - - -	3286	4242	4768	5088
	150	- - - -	- - - -	2741	3533	4058	4297
	175	- - - -	- - - -	2151	2926	3476	3661
150	25	2590	8195	2314	5722	10,376	12,105
	40	4367	6940	3386	7077	8465	9450
	60	4465	6046	4464	6338	6995	7630
	80	3741	4958	3763	4974	5607	6040
	100	3229	4223	3168	4150	4743	5064
	120	2763	3613	2669	3522	4156	4408
125	25	3527	8061	2942	6740	10,712	12,337
	40	4591	6596	3983	7197	7965	8836
	60	3981	5381	4066	5513	6220	6758
	80	3367	4451	3326	4416	5064	5432
	100	2742	3620	2656	3544	4216	4482
	115	2129	3072	1952	2976	3589	3788
100	15	2907	8869	2762	6393	11,889	14,241
	25	4472	7620	3763	7658	9818	11,170
	40	4401	6173	4569	6603	7403	8164
	60	3619	4864	3612	4893	5641	6092
	80	2797	3741	2716	3681	4428	4721
75	15	4248	8599	3867	7978	11,977	14,038
	25	4770	7054	4649	7823	8914	10,026
	40	4023	5556	4078	5723	6654	7273
	60	2860	3901	2786	3863	4721	5057
50	10	5285	8958	4692	9227	12,492	14,737
	25	4250	6069	4343	6387	7603	8421
	40	2932	4128	2863	4120	5172	5578
25	5	5529	9461	5825	10,486	13,760	16,560
	10	4734	7230	4845	7774	9812	11,193
	15	3928	5735	3950	6043	7657	8513
10	2	5561	9490	5610	10,348	14,520	17,621
	5	4205	6569	4150	6954	9708	11,085
5	2	4257	7304	4130	7602	11,747	13,781

TABLE 6. CONDENSAVER™ SERIES PUMP CAPACITY IN KG/HR, 305 mm FILL HEAD

MOTIVE PRESSURE, bar	BACK PRESSURE, bar	TYPE SCP21		TYPES SCP25 AND SCP33			
		DN 25 x 25	DN 40 x 40	DN 25 x 25	DN 40 x 40	DN 50 x 50	DN 80 x 50
17.24	2.76	- - - -	- - - -	1226	2899	4625	5233
	4.14	- - - -	- - - -	1665	3267	3532	3879
	5.52	- - - -	- - - -	1568	2754	2962	3223
	6.90	- - - -	- - - -	1765	2394	2610	2813
	8.28	- - - -	- - - -	1678	2146	2365	2534
	10.34	- - - -	- - - -	1450	1848	2065	2196
	12.07	- - - -	- - - -	1290	1644	1856	1965
	13.79	- - - -	- - - -	1114	1430	1656	1745
	15.52	- - - -	- - - -	890	1239	1461	1533
13.79	2.76	- - - -	- - - -	1135	2685	4282	4845
	4.14	- - - -	- - - -	1541	3025	3270	3592
	5.52	- - - -	- - - -	1824	2531	2771	3002
	6.90	- - - -	- - - -	1697	2202	2451	2633
	8.28	- - - -	- - - -	1491	1924	2163	2308
	10.34	- - - -	- - - -	1243	1603	1841	1949
	12.07	- - - -	- - - -	976	1327	1577	1661
10.34	1.72	1175	3717	1050	2595	4707	5491
	2.76	1981	3147	1536	3210	3840	4287
	4.14	2025	2743	2025	2875	3173	3461
	5.52	1696	2249	1707	2256	2543	2740
	6.90	1465	1915	1437	1882	2151	2297
	8.28	1254	1639	1211	1598	1885	1999
8.62	1.72	1599	3657	1334	3057	4859	5596
	2.76	2082	2992	1807	3265	3613	4008
	4.14	1806	2440	1844	2501	2821	3065
	5.52	1528	2019	1509	2003	2297	2464
	6.90	1244	1642	1205	1608	1912	2033
	7.93	965	1394	885	1350	1628	1718
6.90	1.03	1319	4023	1253	2900	5393	6460
	1.72	2029	3456	1707	3474	4453	5067
	2.76	1996	2800	2072	2995	3358	3703
	4.14	1641	2206	1638	2219	2559	2763
	5.52	1269	1696	1232	1670	2009	2141
5.17	1.03	1926	3901	1754	3619	5433	6368
	1.72	2163	3200	2109	3549	4043	4548
	2.76	1825	2520	1850	2596	3018	3299
	4.14	1298	1769	1264	1752	2141	2294
3.45	0.69	2398	4063	2128	4185	5666	6685
	1.72	1928	2753	1970	2897	3449	3820
	2.76	1329	1872	1299	1869	2346	2530
1.72	0.34	2508	4291	2642	4756	6242	7512
	0.69	2148	3280	2198	3526	4451	5077
	1.03	1782	2602	1792	2741	3473	3861
0.69	0.14	2522	4305	2545	4694	6586	7993
	0.34	1908	2980	1882	3154	4404	5028
0.34	0.14	1931	3313	1873	3448	5328	6251

CONDENSATE RECEIVER SIZING

Vented Receiver

1. The condensate receiver must be sized to allow for flash steam separation from the condensate. Using Table 7, determine what percent of the pressurized condensate passing through the steam traps will flash into steam.
2. Multiply The result of step 1 by the max condensate load and use Table 8 to determine the necessary receiver diameter and vent line size assuming a 36 in. (914 mm) long receiver.

Pressurized Receiver

The condensate receiver in a pressurized system should be sized correctly to allow for condensate backup during the CondenSaver's discharge stroke. Size using Table 9

ORDERING GUIDE

Available Configurations (Select One)

- ☐ Type SCP21
- ☐ Type SCP25
- ☐ Type SCP33

Check Valve (Select One)

- ☐ NPS 1 (DN 25) inlet and outlet
- ☐ NPS 1½ (DN 40) inlet and outlet
- ☐ NPS 2 (DN 50) inlet and outlet
- ☐ NPS 3 inlet x NPS 2 outlet (DN 80 x 50)

Options

- ☐ Level Gauge
- ☐ Digital Cycle Counter
- ☐ Steam Regulator
- ☐ Insulating Jacket

TABLE 7. PERCENT OF FLASH STEAM FORMED, VENTED RECEIVER at 0 psig

INCOMING CONDENSATE PRESSURE		SATURATED TEMPERATURE		FLASH STEAM FORMED
psig	bar	°F	°C	%
10	0.69	239	115	3.0
25	1.72	267	131	5.7
50	3.45	298	148	9.0
75	5.17	320	160	11.3
100	6.90	338	170	13.3
125	8.62	353	178	14.8

TABLE 8. VENTED RECEIVER SIZING TABLE

FLASH VAPOR		PIPE DIAMETER		RECEIVER LENGTH		VENT LINE SIZE	
lbs/hr	kg/hr	In.	mm	In.	mm	In.	mm
75	34	4	102	36	914	1½	38
150	68	6	152	36	914	2	51
300	136	8	203	36	914	3	76
600	272	10	254	36	914	4	102
900	408	12	305	36	914	6	152
1200	544	16	406	36	914	6	152
2000	907	20	508	60	1524	8	203

TABLE 9. PRESSURIZED RECEIVER PIPE LENGTH

LIQUID		RECEIVER PIPING									
		NPS 3 (DN 80)		NPS 4 (DN 100)		NPS 6 (DN 150)		NPS 8 (DN 200)		NPS 10 (DN 250)	
lbs/hr	kg/hr	ft.	mm	ft.	mm	ft.	mm	ft.	mm	ft.	mm
> 500	> 227	2	610	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
1000	454	2	610	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
1500	680	3	914	2	610	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
2000	907	3.5	1067	2	610	1	305	- - - -	- - - -	- - - -	- - - -
3000	1361	- - - -	- - - -	3	914	2	610	- - - -	- - - -	- - - -	- - - -
4000	1814	- - - -	- - - -	4	1219	2	610	1	305	- - - -	- - - -
5000	2268	- - - -	- - - -	6	1829	3	914	2	610	- - - -	- - - -
6000	2722	- - - -	- - - -	- - - -	- - - -	3	914	2	610	- - - -	- - - -
7000	3175	- - - -	- - - -	- - - -	- - - -	3	914	2	610	- - - -	- - - -
8000	3629	- - - -	- - - -	- - - -	- - - -	4	1219	2	610	- - - -	- - - -
9000	4082	- - - -	- - - -	- - - -	- - - -	4.5	1372	3	914	2	610
10,000	4536	- - - -	- - - -	- - - -	- - - -	5	1524	3	914	2	610
11,000	4990	- - - -	- - - -	- - - -	- - - -	5	1524	3	914	2	610

FIGURE 4
Type SCP21 Pump Dimension

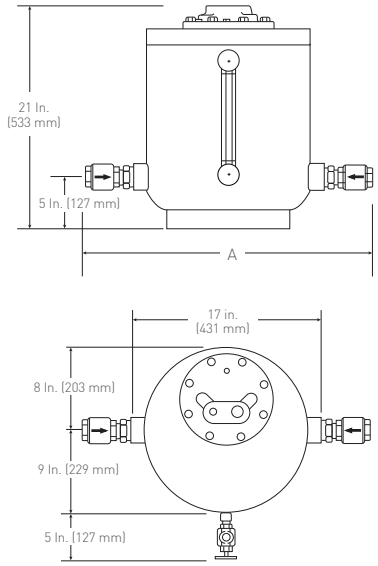


FIGURE 5
Type SCP25 Pump Dimension

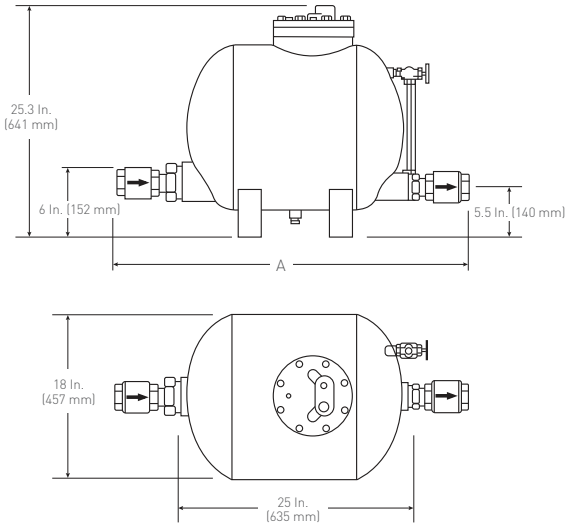


FIGURE 6
Type SCP33 Pump Dimension

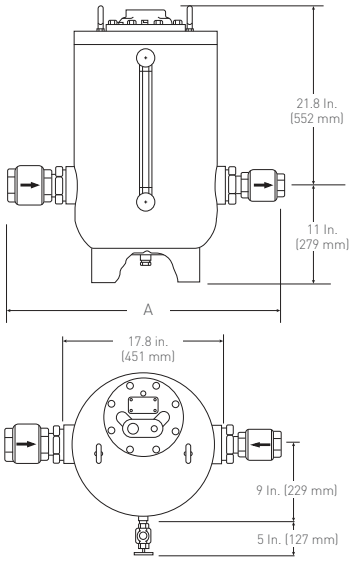


TABLE 10. CONDENSAVER™ SERIES DIMENSIONS AND WEIGHTS

TYPE	SIZE		A		WEIGHT	
	NPS	DN	In.	mm	lbs	kg
SCP21	1 x 1	25 x 25	26	660	151	68
	1½ x 1½	40 x 40	29	737	155	71
SCP25	1 x 1	25 x 25	34 ¼	879	174	79
	1½ x 1½	40 x 40	36 ¾	933	178	81
	2 x 2	50 x 50	37 ⅛	943	183	83
	3 x 2	80 x 50	38 ¼	971	190	86
SCP33	1 x 1	25 x 25	26 ¾	680	168	76
	1½ x 1½	40 x 40	29 ½	750	170	77
	2 x 2	50 x 50	30	762	173	79
	3 x 2	80 x 50	31 ½	800	185	84