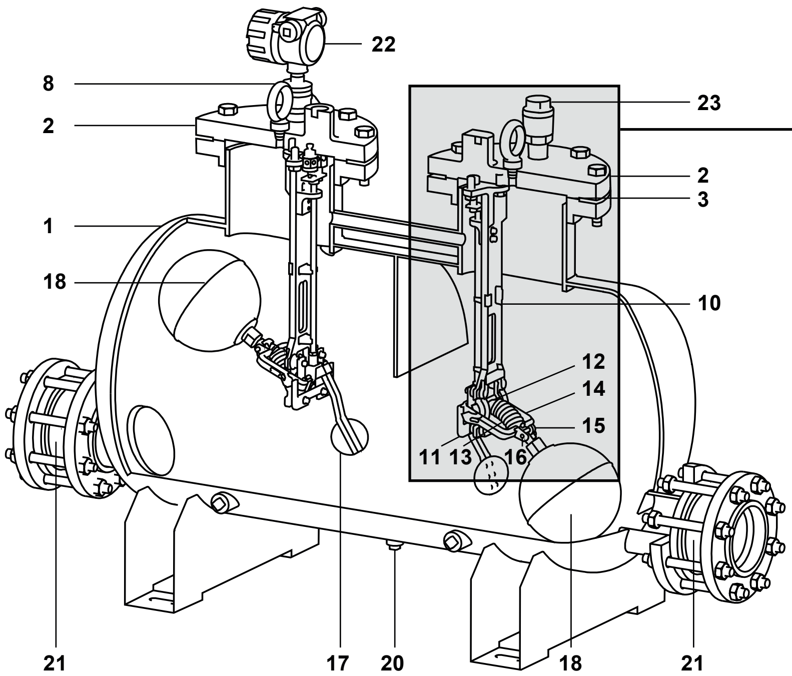
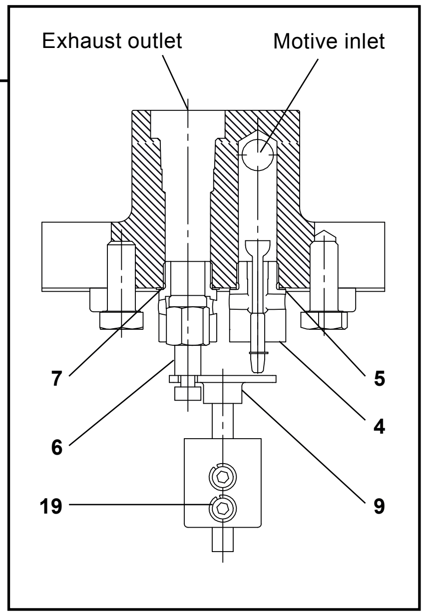
TI-P135-13
ST Issue 2

PTF4
Pivotrol® Pump (patented) CE version Dual Mechanism - Pressure Powered Pump



Cross sectional view



Description

The Spirax Sarco Pivotrol® Pump (patented) is a non electric pump which transfers high temperature condensate, or other liquids from a low point, low pressure or vacuum space to an area of higher pressure or elevation. This self-contained unit including PowerPivot® technology (patented) uses steam, compressed air or any other suitable pressurised gas as the pumping force.
The standard Pivotrol® PTF4 Pump will handle liquids from 0.88 to 1.0 specific gravity.

Compliance

This product fully complies with the requirements of the European Pressure Equipment Directive 97/23/EC and is certified for use to Category III within Group 2 Gases and to SEP for Group 2 liquids. The product carries the CE mark when so required.
This product is designed and built to the pressure vessel code ASME Section VIII, Division 1.

Accessories: Reflex type gauge glass - Insulation cover.

Operating characteristics

Pump discharge per cycle	102.1 litres (26.9 US gal)
Maximum instantaneous discharge rate	28 litres/s (450 US gpm)
Steam consumption	See page 8
Average air consumption	See page 8

For increased service life - Operate the pump with a motive pressure of 1.03 to 1.37 bar g (15 to 20 psi g) above the pump backpressure.

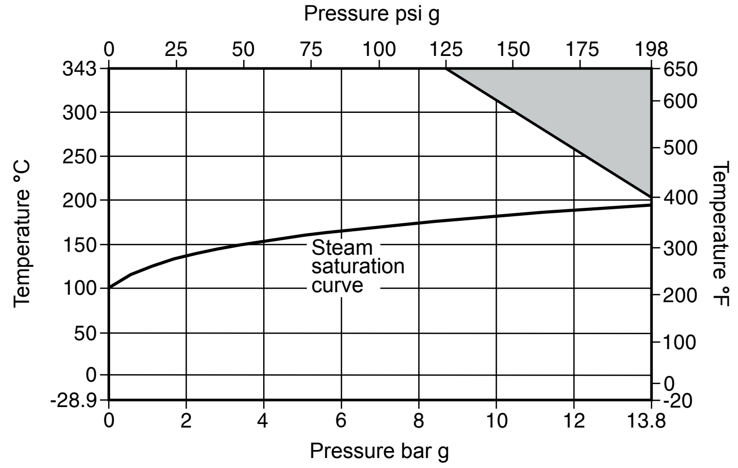
Sizes and pipe connections

Inlet and Outlet:	DN100 x DN100 Flanged ASME Class 150, 4" x 4" Screwed NPT and Socket weld
Motive and Exhaust:	4" x 4" Screwed NPT and Socket weld

Materials

No.	Part	Material
1	Body	Fabricated steel 200 psi g ASME code stamped
2	Cover	Cast steel ASTM A216 WCB
3	Cover gasket	Spiral wound AISI 304/Graphite
4	Steam inlet valve assembly	Stainless steel
5	Steam inlet valve gasket	Stainless steel
6	Exhaust valve assembly	Stainless steel
7	Exhaust valve gasket	Stainless steel
8	Eye bolt	Stainless steel
9	Pushrod assembly	Stainless steel
10	Mechanism support	Stainless steel
11	Bushing mounting plate	Stainless steel
	Bushings	Carbide
12	Spring anchor	Carbide
13	Spring	Inconel
14	Float arm assembly	Stainless steel
	Pivots	Carbide
15	Float pivot	Stainless steel
16	Pin	Stainless steel
17	Paddle	Stainless steel
18	Float	Stainless steel
19	Screws (typical)	Stainless steel
20	Plugs (typical)	Forged stainless steel
21	Check valves (SDCV44)	Stainless steel
22	Cycle counter	Various
23	Vent assist valve	Stainless steel

Pressure / temperature limits



The product **must not** be used in this region.

Body design condition			ASME Section VIII, Division 1
PMA	Maximum allowable pressure	13.8 bar g @ 204°C	(200 psi g @ 400°F)
TMA	Maximum allowable temperature	343°C @ 8.6 bar g	(650°F @ 125 psi g)
Minimum allowable temperature		-28.9°C	(-20°F)
PMO	Maximum operating pressure	13.8 bar g	(200 psi g)
TMO	Maximum operating temperature for saturated steam service	198°C	(388°F)
Minimum operating temperature **Note:** For lower operating temperatures consult Spirax Sarco		-28.9°C	(-20°F)
Minimum motive differential required:		0.5 bar g	(7 psi g)
Maximum backpressure:			75% of motive pressure
Designed for a maximum cold hydraulic test pressure of:		20.7 bar g	(300 psi g)
Note: With internals fitted, test pressure must not exceed:		20.7 bar g	(300 psi g)

Specific gravity of pumped liquid 0.88 to 1.0

Cycle counter: For further technical information about the cycle counter contact Spirax Sarco or your local Spirax Sarco representative.

Filling head requirements

Filling head	Filling head above pump cover	Filling height from base of pump
Standard recommended	305 mm (12")	1125 mm (44.3")
Maximum filling head	1524 mm (60")	2337 mm (92.0")
Minimum filling head	-76 mm (-3")	744 mm (29.3")

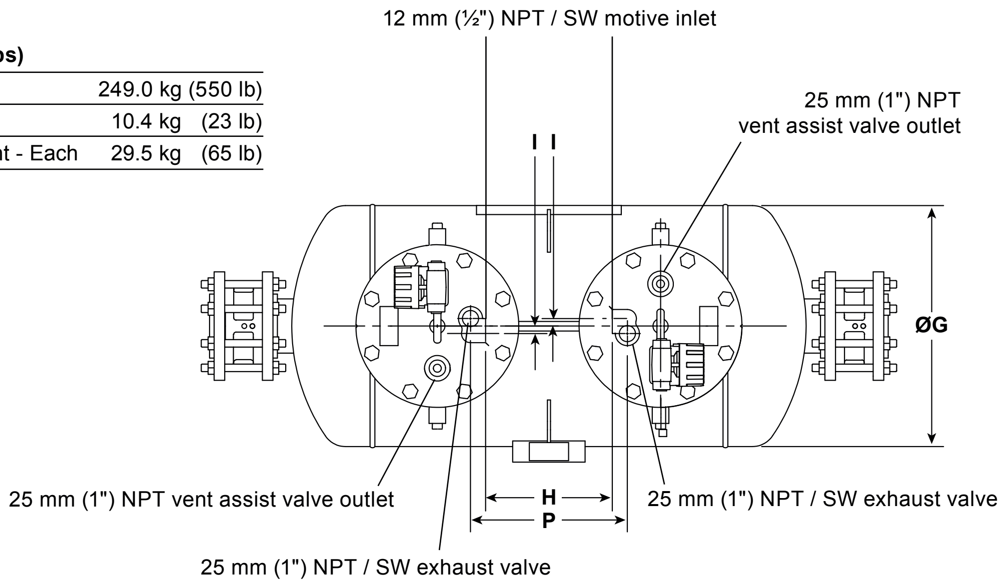
Maximum number of cycles per minute = 6

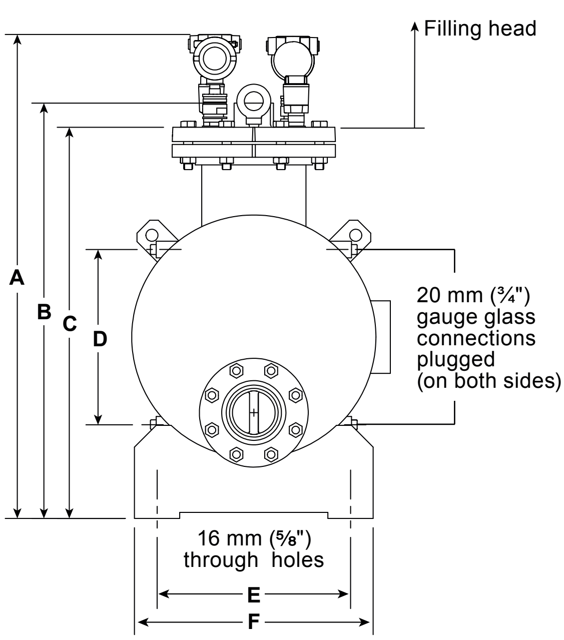
Dimensions (approximate) in millimetres and (inches)

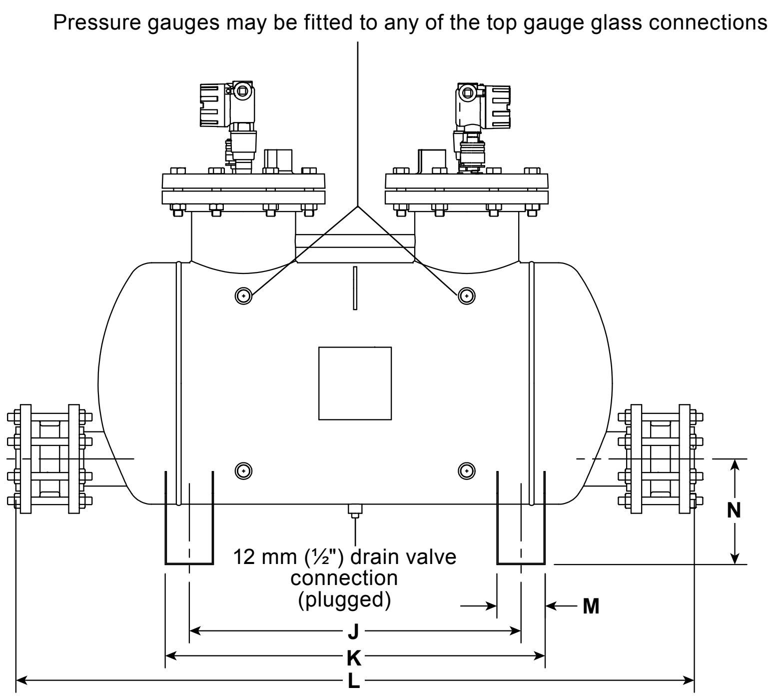
Dimension	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P
millimetres	1002	851	813	368	406	503	508	267	15	699	800	1427	102	224	330
inches	(39.5)	(33.5)	(32.0)	(14.5)	(16.0)	(19.8)	(20.0)	(10.5)	(0.6)	(27.5)	(31.5)	(56.2)	(4.0)	(8.8)	(13.0)

Weights (approximate) in kgs (lbs)

PTF4 complete unit weight	249.0 kg (550 lb)
Reflex gauge glass weight - Each	10.4 kg (23 lb)
Cover and mechanism assembly weight - Each	29.5 kg (65 lb)



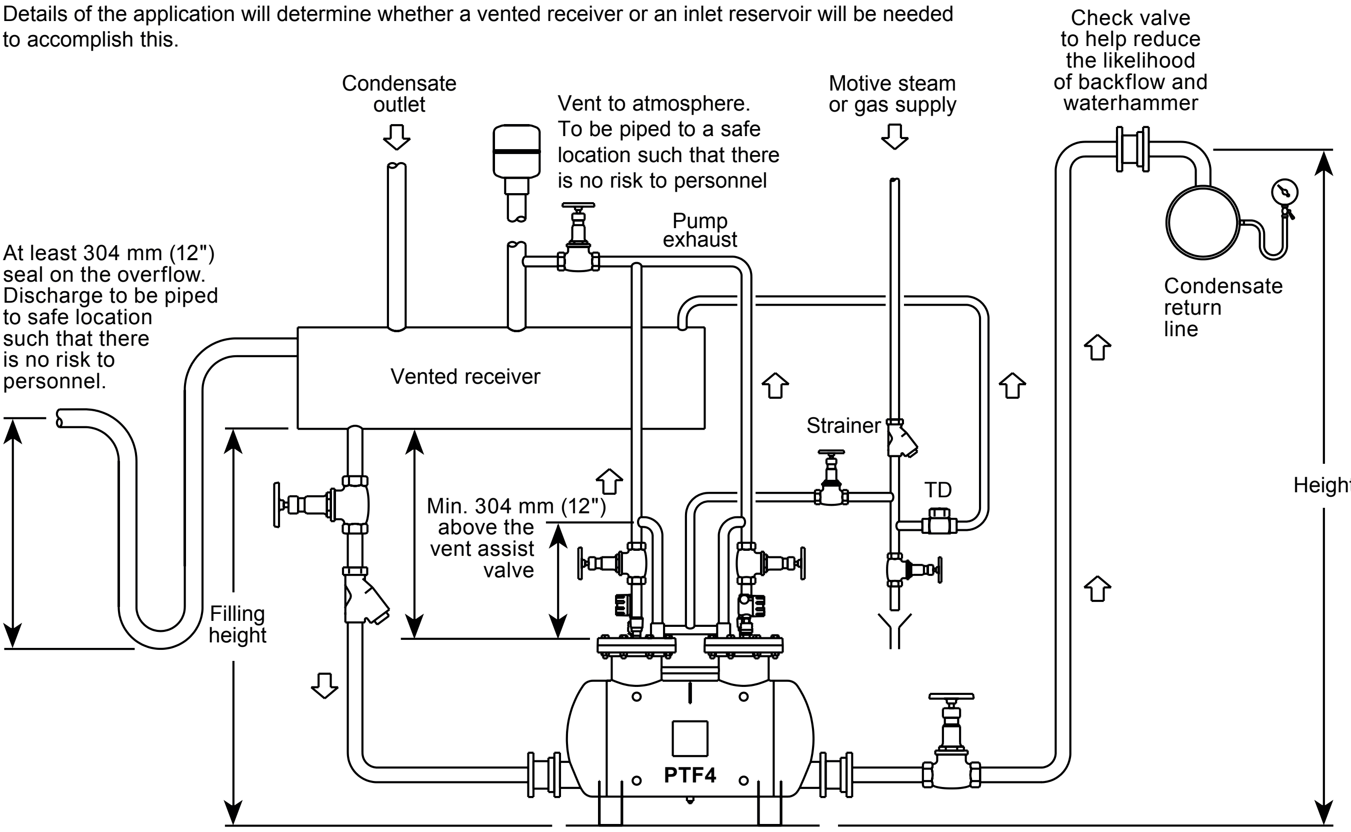




Polígono Industrial O Rebullón s/n. 36416 - Mos - España - rodavigo@rodavigo.com

Recommended installation

The pump is fitted with a vented receiver or an inlet reservoir.
Details of the application will determine whether a vented receiver or an inlet reservoir will be needed to accomplish this.



Sizing and selection

How to size and select

From the inlet pressure, backpressure and filling head conditions given below, select the pump size and check valve package which meets the capacity requirement of the application.

Specify pump body - Type PTF4. Select optional extras as required.

For kg/h, multiply the capacities below by 0.454 (For gpm, multiply the capacities below by 0.002).

Backpressure in bar g = lift height (H) in metres divided by 10 plus the pressure in the return line (Backpressure in psi g = lift height (H) in feet x 0.433 plus the pressure in the return line). Added to this is the downstream piping friction pressure drop in bar g (psi g) calculated and based on the maximum instantaneous discharge rate of the respective pump selected - See TI sheets.

Note: To achieve rated capacity, the pump must be installed with check valves supplied by Spirax Sarco. Use of a substitute check valve may affect the performance of the pump.

Capacity lb/h when installed with the recommended filling head above the top of the pump.

Condensate load	9 545 kg/h	(21 000 lb/h)
Steam pressure available for operating pump	5.5 bar g	(80 psi g)
Vertical lift from pump to the return piping	9.1 m	(30 feet)
Pressure in the return piping (piping friction negligible)	1.7 bar g	(25 psi g)
Filling head on the pump available	610 mm	(24")

Solution:

1. Calculate '**H**', the total lift or backpressure, against which the condensate must be pumped:
'**H**' Metric = (9.1 m / 10) + 1.7 bar g = 2.6 bar g
'**H**' Imperial = (30 feet x 0.433) + 25 psi g = 38 psi g)

2. From the capacity table, given an inlet pressure of 5.5 bar g (80 psi g) and a backpressure of 2.8 bar g (40 psi g), choose a PTF4 pump with stainless steel check valves, which has a capacity of 12 264 kg/h (26 980 lb/h).

Note from capacity multiplying factor charts:

A. If filling head were 457 mm (18") PTF4 pump capacity would be: = 0.98 x 12 264 kg/h (26 980 lb/h) = 12 018 kg/h (26 441 lb/h)

B. Pump capacity using compressed air would be (% backpressure is 5.5 to 2.6 bar g (38 to 80 psi g) = 47% e.g. use 50%):
= 1.85 x 12 264 kg/h (26 980 lb/h) = 22 688 kg/h (49 914 lb/h).

Intended use

This product fully complies with the requirements of the European Pressure Equipment Directive 97/23/EC and is certified for use to Category III within Group 2 Gases and to SEP for Group 2 liquids. The product carries the CE mark when so required. This product is designed and built to the pressure vessel code ASME section VIII Division 1.

Vented receiver (open system)

To drain condensate from a single or multiple source an 'open system', a vented receiver should be installed in a horizontal plane above and ahead of the pump. Sufficient receiver volume is needed above the filling head level to accept the condensate reaching the receiver during the pump discharge stroke. More important, the receiver must be sized to allow sufficient area for complete flash steam separation from the condensate. The Table below displays the proper vented receiver sizing (per criteria set forth in the A.S.H.R.A.E. Handbook) based on the amount of flash steam present. If the receiver is sized as shown below, there will be sufficient volume for condensate storage and sufficient area for flash steam separation. The receiver can be a length of large diameter pipe or a tank.

Pump size

Flash steam up to:	Pipe size Diameter	Length	Vent line Diameter
454 kg/h (1 000 lb/h)	400 mm (16")	1 524 mm (60")	150 mm (6")
907 kg/h (2 000 lb/h)	500 mm (20")	1 524 mm (60")	200 mm (8")
1 361 kg/h (3 000 lb/h)	600 mm (24")	1 524 mm (60")	200 mm (8")
1 814 kg/h (4 000 lb/h)	650 mm (26'')	1 524 mm (60")	250 mm (10")
2 268 kg/h (5 000 lb/h)	700 mm (28")	1 524 mm (60")	250 mm (10")
2 722 kg/h (6 000 lb/h)	750 mm (30")	1 829 mm (72")	300 mm (12")
3 175 kg/h (7 000 lb/h)	800 mm (32")	1 829 mm (72")	300 mm (12")
3 629 kg/h (8 000 lb/h)	900 mm (36")	1 829 mm (72")	350 mm (14")

Inlet reservoir piping (closed system)

To drain condensate from a single piece of equipment in a 'closed system', a reservoir should be installed in a horizontal plane above and ahead of the pump. Sufficient reservoir volume is needed above the filling head level to accept the condensate reaching the reservoir during the pump discharge stroke. The Table below displays the minimum reservoir sizing, based on a condensate load, needed to prevent equipment flooding during the pump dischare stroke. The reservoir can be a length of large diameter pipe or a tank.

Pump size

Liquid load	Reservoir pipe size*			
kg/h (lb/h)	**300 mm (12")**	**400 mm (16")**	**500 mm (20")**	**600 mm (24")**
4 535 kg/h (10 000 lb/h)	1 524 mm (5 ft)	914 mm (3 ft)	610 mm (2 ft)	
9 070 kg/h (20 000 lb/h)	3 048 mm (10 ft)	2 133 mm (7 ft)	1 219 mm (4 ft)	
13 605 kg/h (30 000 lb/h)		2 743 mm (9 ft)	1 828 mm (6 ft)	1 219 mm (4 ft)
18 141 kg/h (40 000 lb/h)		3 658 mm (12 ft)	2 286 mm (7.5 ft)	1 828 mm (6 ft)
22 676 kg/h (50 000 lb/h)			2 743 mm (9 ft)	1 828 mm (6 ft)
27 211 kg/h (60 000 lb/h)			2 743 mm (9 ft)	1 828 mm (6 ft)

*** When the backpressure or motive pressure is less than 50%, these reservoir lengths can be reduced by half.**

Multiplying factors for non-standard conditions

Filling head mm	inches	Capacity multiplying factors for non-standard filling heads
-76	**(-3")**	0.23
-25	**(-1")**	0.41
0	**(0)**	0.70
152	**(6")**	0.89
305	**(12")**	0.95
457	**(18")**	0.98
610	**(24")**	1.00
914	**(36")**	1.00
1 219	**(48")**	1.08
1 524	**(60")**	1.20

Capacity multiplying factors for motive gas supply (other than steam)									
% Back pressure v. Motive pressure (bp/MP)	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
Capacity multiplying factors	1.19	1.43	1.43	1.53	1.85	2.04	2.14	2.20	2.44

To size the PTF4 in a closed system:

Please note that the vent assist valve that is noted in the formula below can be identified by item 23 on page 1.
Establish the available motive pressure.
Establish the static backpressure on the pump-trap combination.
Place the established pressures into the formula below:

- Pump motive pressure – Minimum valve assist valve delta P **>** Backpressure
- Capacity charts to be read as normal, i.e. at pump motive and backpressure.
- If, Pump motive pressure – Minimum valve assist valve delta P **<** Backpressure, then isolate or remove the valve assist valve and multiply the capacity by 0.77 to find the reduced capacity without the valve assist valve.

Sizing example: 1
A closed system has the following conditions:

Motive steam available = 10.3 bar g (150 psi g). Static backpressure = 3.1 bar g (45 psi g).

Open system
PTF4 capacity charts show capacity at 10.3 bar g (150 psi g) motive with 3.1 bar g (45 psi g) backpressure.

Closed system
The vent assist valve on the PTF4 requires at least 5.2 bar g (75 psi g) differential pressure to operate in a closed system.

To size the PTF4 pump:
Pump motive pressure – Minimum valve assist valve delta P **>** Backpressure

10.3 bar g (150 psi g) – 5.2 bar g (75 psi g) **>** 3.1 bar g (45 psi g)

As the motive pressure is 10.3 bar g (150 psi g) and the valve assist valve requires a minimum 8.3 bar g (120 psi g) to operate:

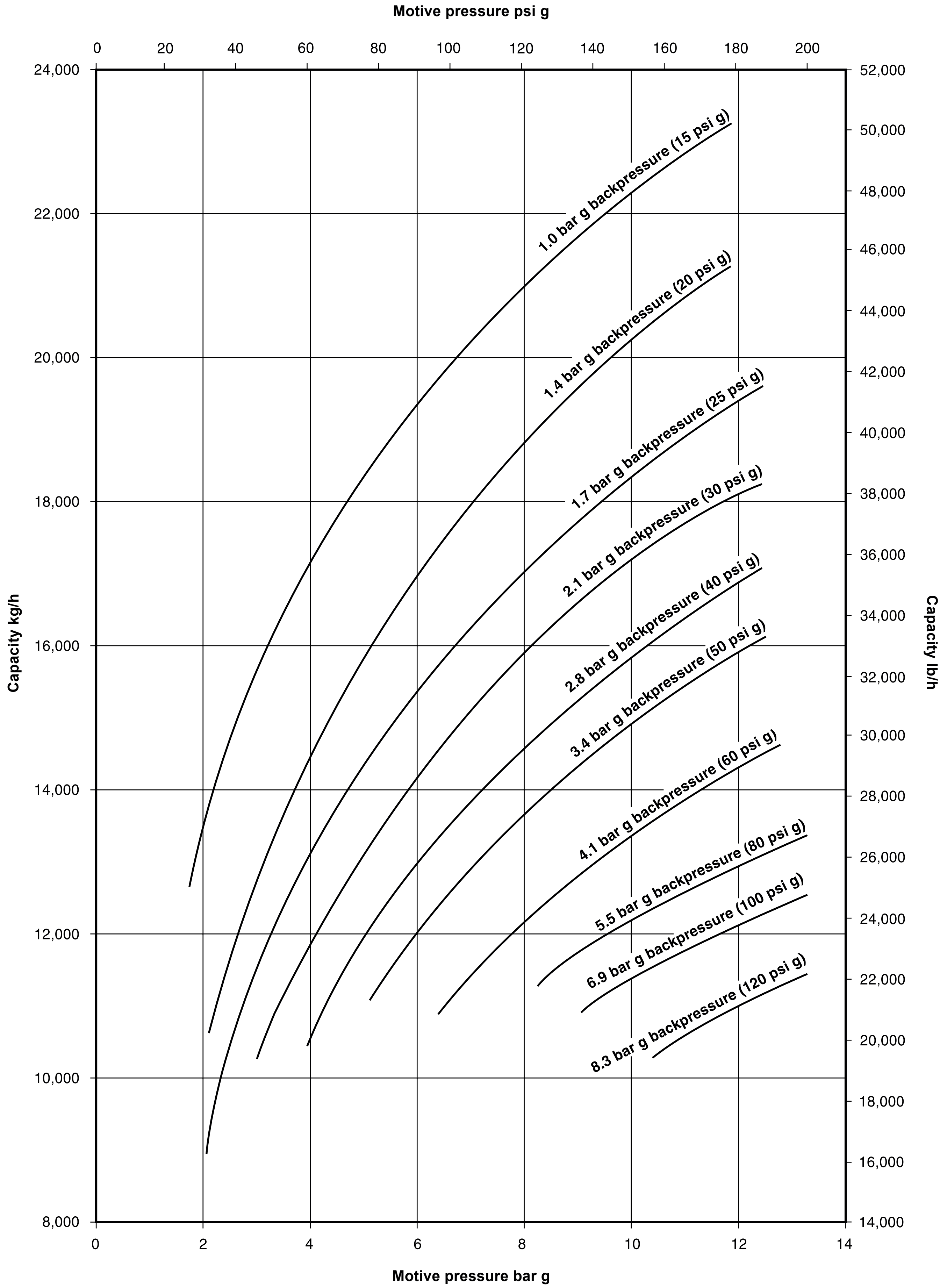
5.2 + 3.1 = 8.3 bar g (75 + 45 = 120 psi g), this combination is sized correctly.

Motive pressure		Backpressure		Condensate capacity	
bar g	psi g	bar g	psi g	kg/h	lb/h
13.8	200	10.3	150	10055	22120
13.8	200	9.7	140	10441	22970
13.8	200	8.3	120	11305	24870
13.8	200	6.9	100	12323	27110
13.8	200	5.5	80	13573	29860
13.8	200	4.1	60	15182	33400
13.8	200	3.4	50	16200	35640
13.8	200	2.8	40	17450	38390
13.8	200	2.1	30	19059	41930
13.8	200	1.4	20	21327	46920
13.8	200	1.0	15	22936	50460
12.4	180	8.3	120	10773	23700
12.4	180	6.9	100	11827	26020
12.4	180	5.5	80	13114	28850
12.4	180	4.1	60	14773	32500
12.4	180	3.4	50	15823	34810
12.4	180	2.8	40	17109	37640
12.4	180	2.1	30	18773	41300
12.4	180	1.4	20	21109	46440
12.4	180	1.0	15	22768	50090
11.0	160	8.3	120	10241	22530
11.0	160	6.9	100	11327	24920
11.0	160	5.5	80	12650	27830
11.0	160	4.1	60	14359	31590
11.0	160	3.4	50	15445	33980
11.0	160	2.8	40	16768	36890
11.0	160	2.1	30	18482	40660
11.0	160	1.4	20	20891	45960
11.0	160	1.0	15	22600	49720
9.7	140	6.9	100	10641	23410
9.7	140	5.5	80	11918	26220
9.7	140	4.1	60	13568	29850
9.7	140	3.4	50	14614	32150
9.7	140	2.8	40	15891	34960
9.7	140	2.1	30	17541	38590
9.7	140	1.4	20	19868	43710
9.7	140	1.0	15	21518	47340
8.3	120	5.5	80	11186	24610
8.3	120	4.1	60	12777	28110

Motive pressure		Backpressure		Condensate capacity	
bar g	psi g	bar g	psi g	kg/h	lb/h
8.3	120	3.4	50	13782	30320
8.3	120	2.8	40	15014	33030
8.3	120	2.1	30	16605	36530
8.3	120	1.4	20	18845	41460
8.3	120	1.0	15	20432	44950
6.9	100	4.1	60	11241	24730
6.9	100	3.4	50	12318	27100
6.9	100	2.8	40	13641	30010
6.9	100	2.1	30	15341	33750
6.9	100	1.4	20	17741	39030
6.9	100	1.0	15	19445	42780
5.5	80	4.1	60	9705	21350
5.5	80	3.4	50	10855	23880
5.5	80	2.8	40	12264	26980
5.5	80	2.1	30	14077	30970
5.5	80	1.4	20	16641	36610
5.5	80	1.0	15	18455	40600
4.8	70	3.4	50	9932	21850
4.8	70	2.8	40	11286	24830
4.8	70	2.1	30	13036	28680
4.8	70	1.7	25	14145	31120
4.8	70	1.4	20	15505	34110
4.8	70	1.0	15	17255	37960
4.1	60	2.8	40	10427	22940
4.1	60	2.1	30	12200	26840
4.1	60	1.7	25	13323	29310
4.1	60	1.4	20	14695	32330
4.1	60	1.0	15	16468	36230
3.4	50	2.1	30	11505	25310
3.4	50	1.7	25	12714	27970
3.4	50	1.4	20	14050	30910
3.4	50	1.0	15	15527	34160
2.8	40	2.1	30	8855	19480
2.8	40	1.7	25	10105	22230
2.8	40	1.4	20	11636	25600
2.8	40	1.0	15	13609	29940
2.1	30	1.4	20	9291	20440
2.1	30	1.0	15	11659	25650

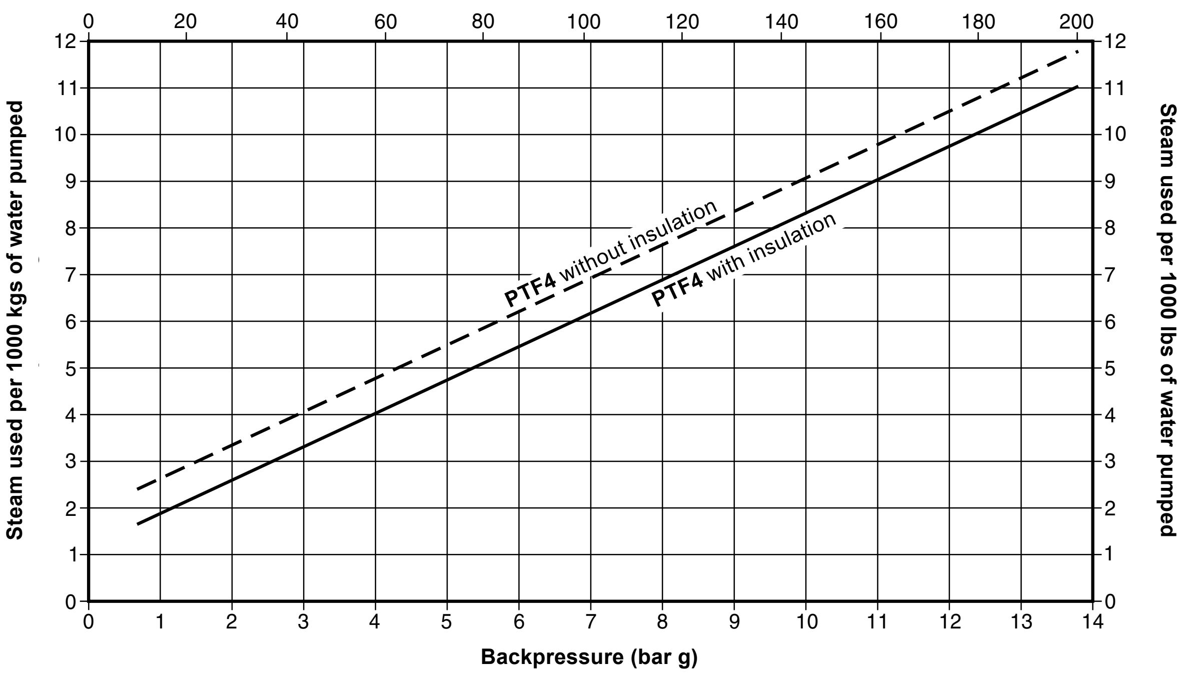
Assumes a Fill Head - 1.42m (36"), Fill Height - 2.86m (70")

Capacity charts

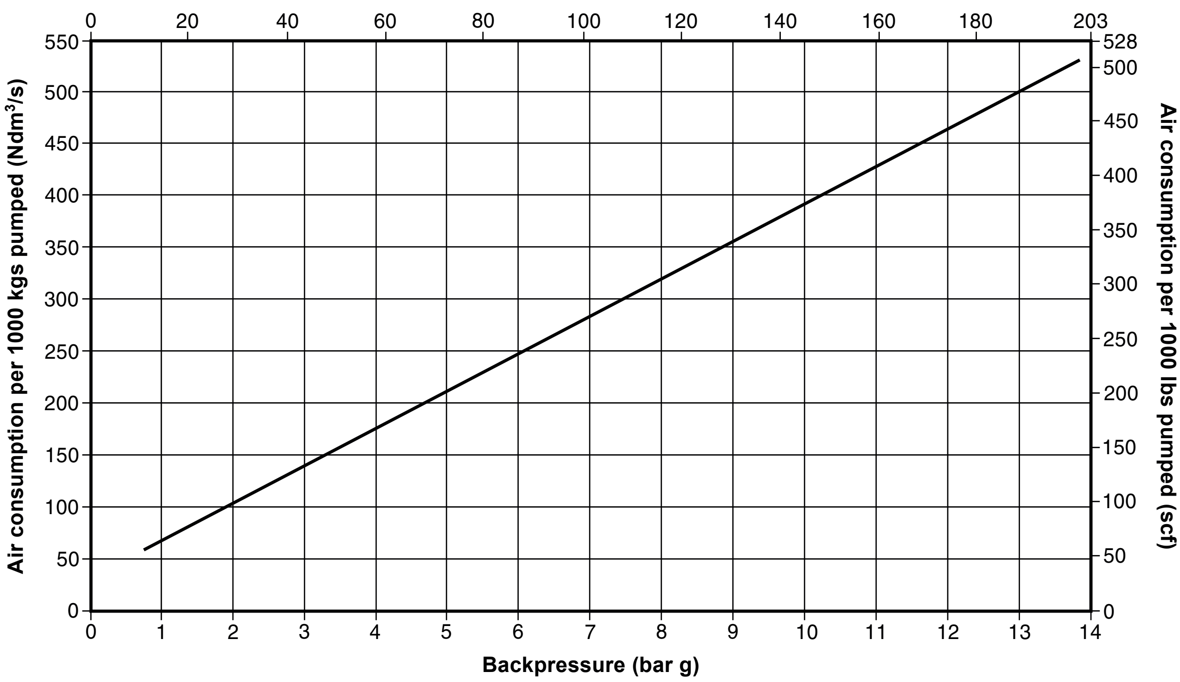


Polígono Industrial O Rebullón s/n. 36416 - Mos - España - rodavigo@rodavigo.com

PTF4 Pivotrol® steam consumption chart



PTF4 Pivotrol® air consumption chart



How to order

Sample specification

The pump shall be Spirax Sarco Pivotrol® Pump (patented) Dual Mechanism PTF4, operated by steam, compressed air or other pressurised gas to 13.8 bar g (200 psi g), which does not require any electrical energy, and is capable of pumping liquids down to 0.88 specific gravity. The pump shall have stainless steel, split disc check valves on the inlet and outlet connections. The pump shall contain Spirax Sarco PowerPivot® (patented) technology to ensure longevity and reliability of the pump. The Pivotrol® Pump shall include an Inconel spring with a lifetime warranty and be supplied with an integral cycle counter to monitor a 3 million cycle x 3 year warranty. When required the pump shall be supplied with a reflex gauge glass.

Safety information, installation and maintenance

For full details see the Installation and Maintenance Instructions (IM-P135-14) supplied with the product.