MFP14 Automatic pumps

for condensate and other industrial fluids

spirax sarco

Effective condensate management ... an essential part of any steam plant

If energy requirements are to be kept to a minimum, then efficient handling of condensate is essential to optimise plant efficiency and product quality.
Spirax Sarco offers the solutions to achieve this efficiency in all areas of condensate pumping.

Condensate Management covers two separate key areas:

Condensate recovery

When condensate leaves the steam trap it has approximately 20 % of the original heat energy contained within the steam.

Recovering and returning this valuable energy source saves:

- Heat energy - saving fuel.
- Expensive water treatment chemicals.
- High feedwater make-up costs.

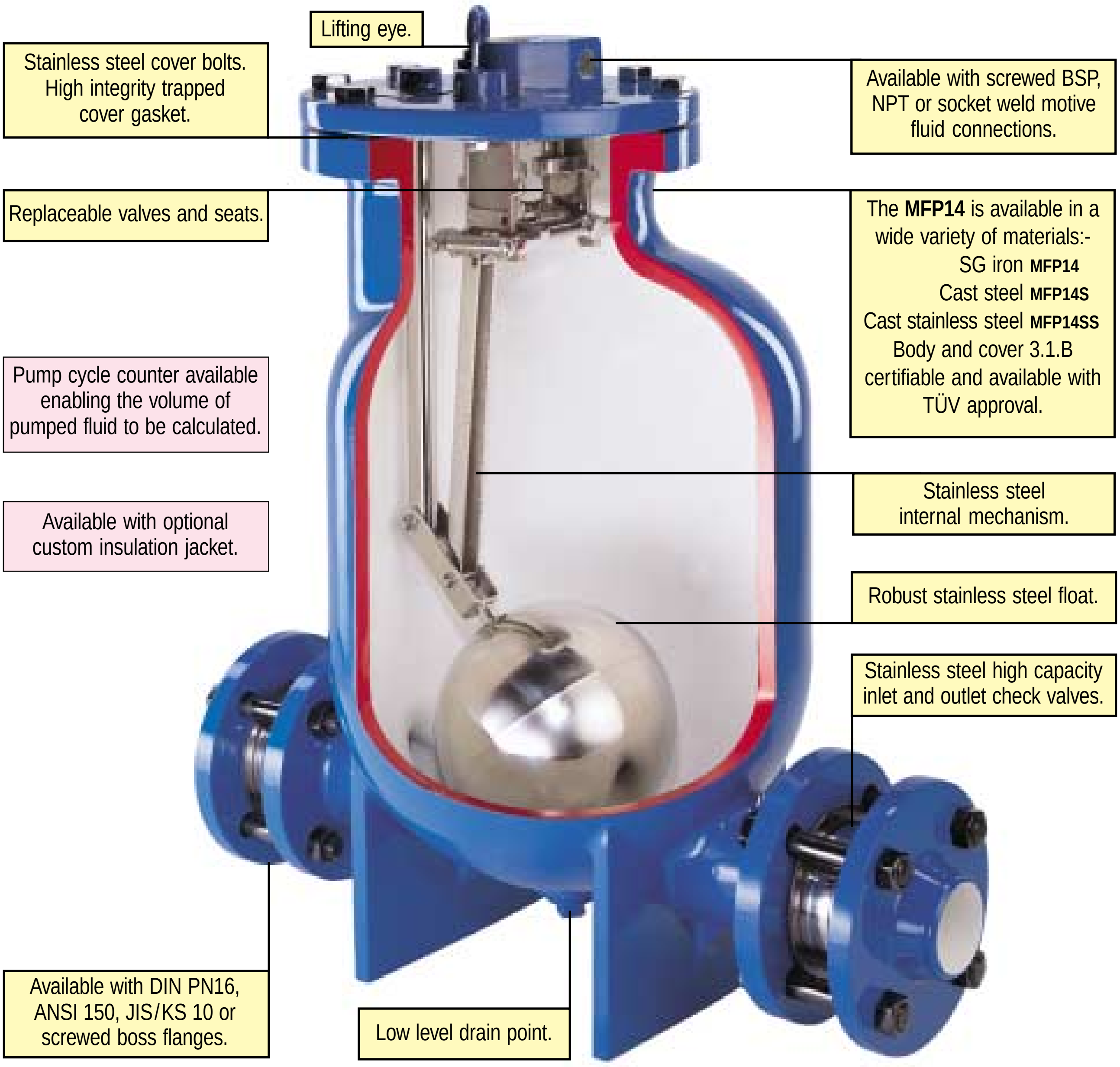
All too often these problems have been neglected because no fully engineered system was readily available.

Condensate removal

Condensate removal from all heat exchange and process equipment is necessary to provide stable operating conditions, giving improved efficiency and prolonging equipment life.

Efficient condensate removal prevents:

- Unstable temperature control.
- Product quality problems.
- Excessive corrosion of heating surfaces.
- Waterhammer.
- Noisy operation.
- Equipment damage.



The total solution

Spirax Sarco's range of MFP14 automatic pumps are specifically designed to remove and recover condensate under all operating conditions and provide the unique opportunity to solve all condensate handling problems.

The pumps are self-contained units using steam or other pressurised gas as their motive power. There are no electric motors or level switches, simplifying installation and making it ideal for hazardous areas.

One pump design covers all applications from vacuum systems to general condensate return. MFP14 automatic pumps are able to pump high temperature fluids without cavitation, reducing plant maintenance problems. They are also well suited to pump other industrial fluids including contaminated water, oils, and some hydrocarbon condensates.

User benefits

- Removes condensate under all load conditions, even vacuum, ensuring maximum process efficiency.
- Requires no electrical power - suitable for hazardous environments.
- Cavitation problems eliminated reducing maintenance.
- No mechanical seals or packing glands to leak.
- Effective design provides high capacity in a rugged, compact package.
- Available in a range of materials, sizes and end connections to suit a wide variety of applications.
- Can be supplied with TÜV approval.
- Spirax Sarco's guarantee of worldwide technical support, knowledge and service.

Range and options

Material			SG iron	Steel	Stainless steel
Pump type			**MFP14**	**MFP14S**	**MFP14SS**
Body material			SG iron DIN GGG 40.3	Steel DIN GSC 25N / ASTM A216 WCB	Stainless steel DIN 1.4409 / ASTM A351 CF3M
Body design rating			PN16	PN16	PN16
Size	DN25	1"	●		
Size	DN40	1½"	●		
Size	DN50	2"	●	●	
Size	DN80 inlet DN50 outlet	3" inlet 2" outlet	●	●	●
Inlet / Outlet Connections	Flanged	PN16	●	●	●
Inlet / Outlet Connections	Flanged	ANSI 150	●	●	●
Inlet / Outlet Connections	Flanged	JIS / KS 10	●	●	●
Inlet / Outlet Connections	Screwed	BSP	●	●	●
Motive fluid Connections	Screwed	BSP	●	●	●
Motive fluid Connections	Screwed	NPT	●	●	●
Motive fluid Connections	Socket weld			●	●
Stainless steel internal mechanism			●	●	●
Maximum operating pressure			13.8 bar g		
Maximum operating temperature			200°C		

Nominal capacity with 8 bar g operating pressure and 1 bar g back pressure

DN25 1"	DN40 1½"	DN50 2"	DN80 inlet x DN50 outlet 3" inlet x 2" outlet
1 100 kg/h	1 800 kg/h	3 800 kg/h	5 500 kg/h

How the MFP14 works

The MFP14 automatic pump operates on a positive displacement principle.

1 Fluid enters the pump body through the inlet check valve causing the float to rise.

2 Residual non-condensibles in the body escape through the open exhaust valve, Fig 1. As the chamber fills, the valve change over linkage is engaged opening the motive inlet valve and closing the exhaust valve, Fig 2. This snap action linkage ensures a rapid change from filling to pumping stroke.

3 As pressure inside the pump increases above the total back pressure, fluid is forced out through the outlet check valve into the return system.

4 As the fluid level falls within the pump, the float re-engages the valve change over linkage causing the motive inlet valve to close and the exhaust valve to open.

5 As the pressure inside the pump body falls, fluid re-enters through the inlet check valve and the cycle is repeated.

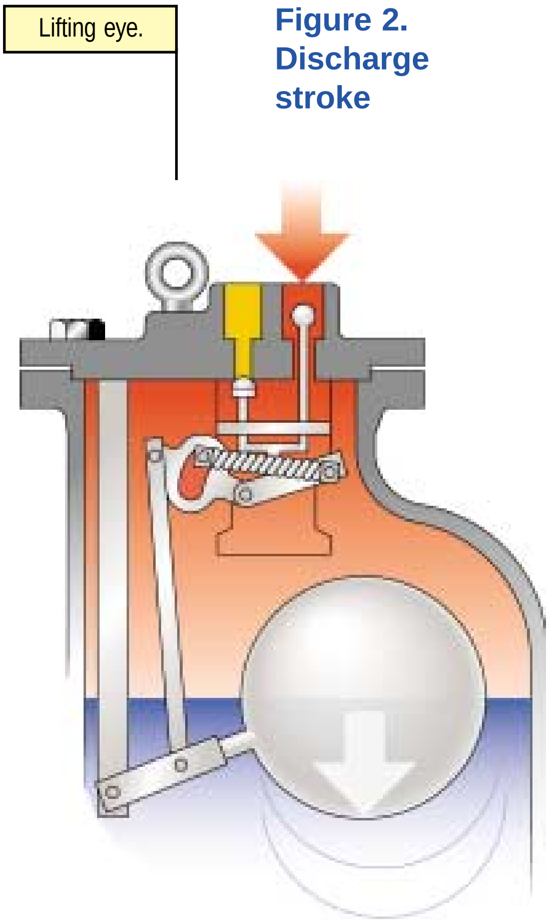


Figure 2. Discharge stroke

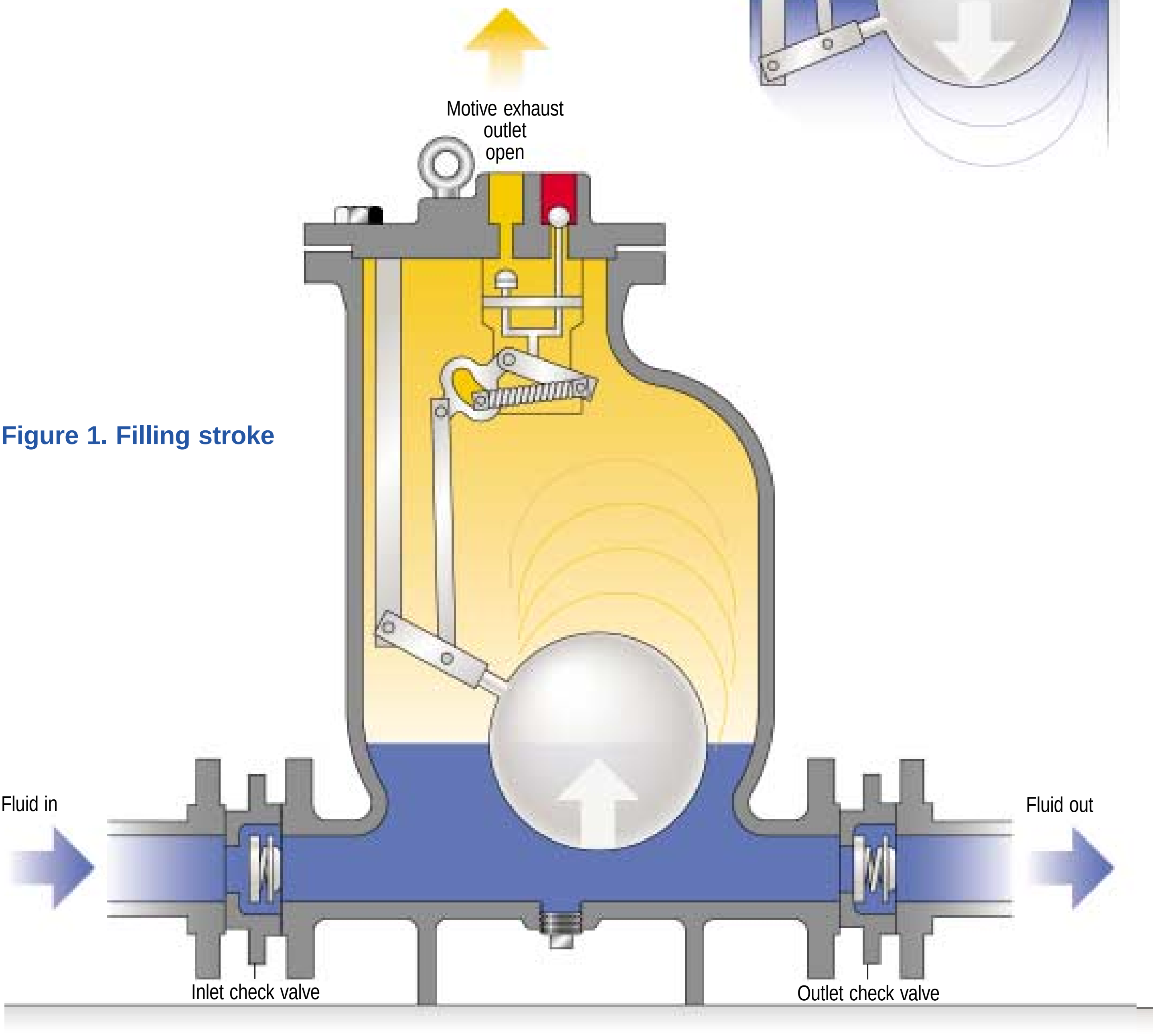
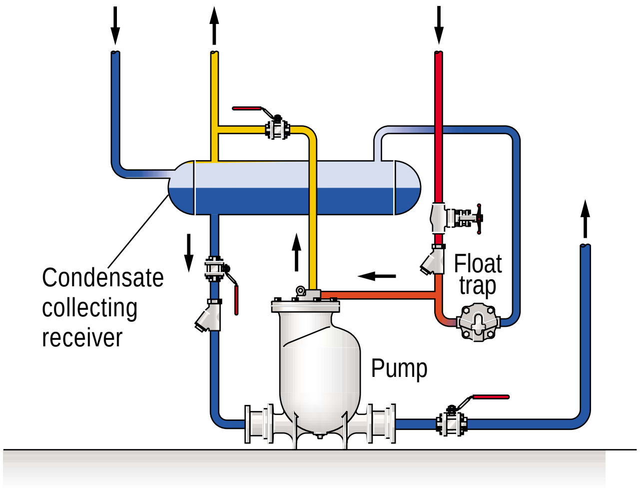


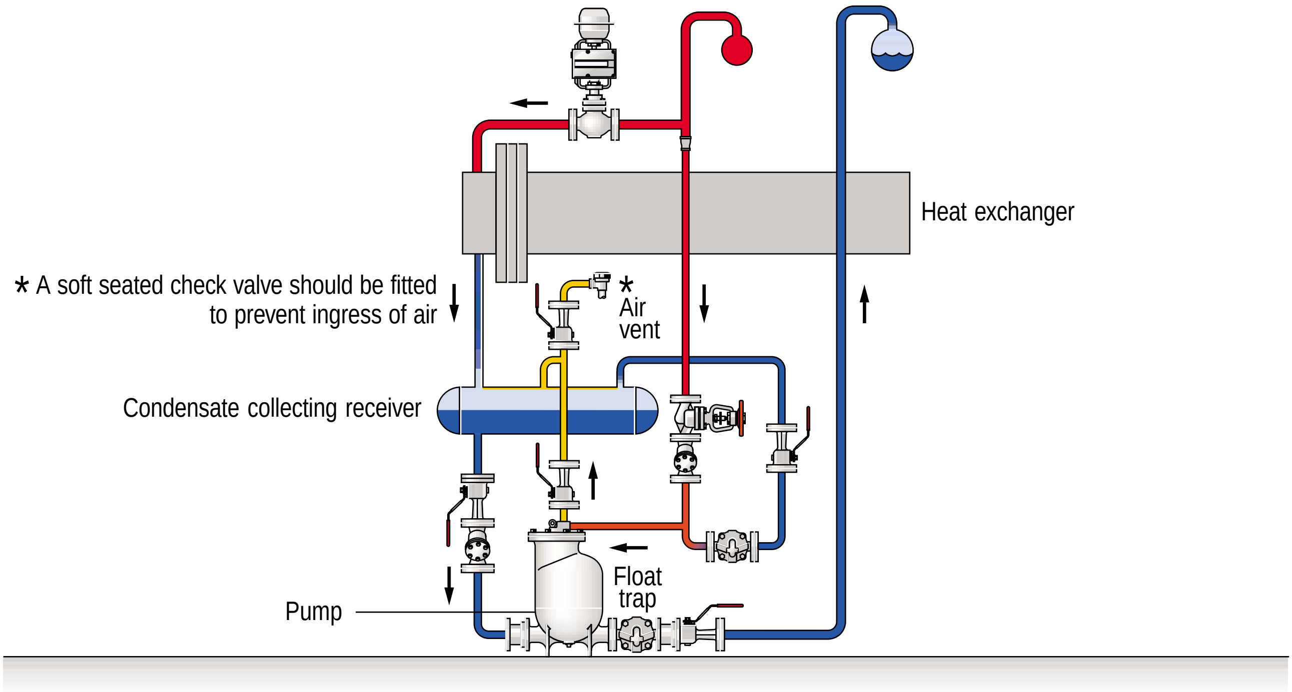
Figure 1. Filling stroke

Typical applications

Condensate recovery (open system)

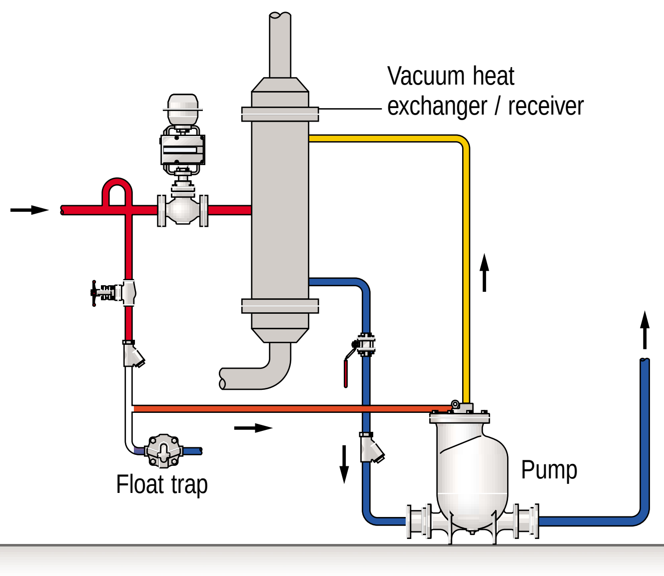
Pumping high temperature condensate without cavitation or mechanical seal problems. Provides maximum heat energy recovery.





Condensate removal from process vessels and heat exchangers (pump/trap combination, closed system)

Removal of condensate under all pressure conditions ensures stable temperatures.
It also prevents bottom end tube corrosion and potential waterhammer and freezing.

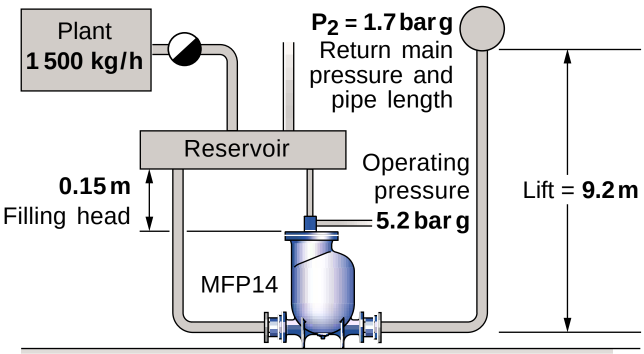


Condensate removal from vacuum equipment

Simple and efficient solution to a difficult problem without the need for expensive electrical pumps and sensors.

How to size and select the MFP14

Considering the inlet pressure, back pressure and filling head conditions, select the pump size which meets the capacity requirements of the application.



The known data

Condensate load	**1 500 kg/h**
Steam pressure available for operating pump	**5.2 bar g**
Vertical lift from pump to the return piping	**9.2 m**
Pressure in the return piping (piping friction negligible)	**1.7 bar g**
Filling head on the pump available	**0.15 m**

Selection example

Firstly calculate the total effective lift against which condensate must be pumped.

Total effective lift is calculated by adding **vertical lift from the pump to return piping (9.2 m)** to the **pressure in the return piping (1.7 bar g).** To convert pressure in the return pipe into pressure head, divide it by the conversion factor of 0.0981:-

P_2 = 1.7 bar g ÷ 0.0981 = 17.3 m Pressure head (lift)

The total effective lift then becomes calculable :-

9.2 m + 17.3 m

The total effective lift is 26.5 m.

Now that the total effective lift has been calculated, a pump can be selected by plotting the known data onto the graphs opposite.

1. Plot a horizontal line from 5.2 bar g (Motive pressure).
2. Plot a line indicating 26.5 m lift.
3. From the point where the motive pressure line crosses the m lift line, drop a vertical line to the X axis.
4. Read the corresponding capacity (2 500 kg/h).

Note: As the filling head is different to 0.3 m, then the capacity calculated above must be corrected by the appropriate factor selected from the table below.

Capacity multiplying factors for other filling heads

Filling head metres (m)	Capacity multiplying factors			
	DN25	DN40	DN50	DN80 x DN50
0.15	0.90	0.75	**0.75**	0.80
0.30	1.00	1.00	1.00	1.00
0.60	1.15	1.10	1.20	1.05
0.90	1.35	1.25	1.30	1.15

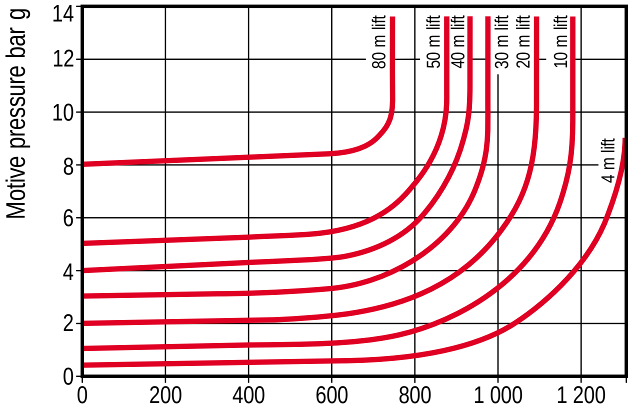
For motive fluids other than steam, see the relevant technical information sheet

Final pump selection

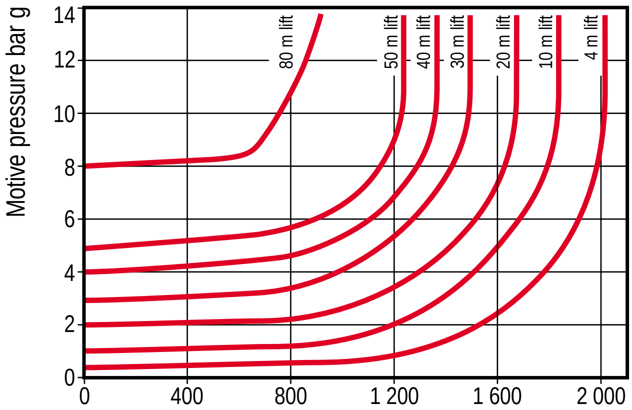
The size of pump selected in this case would be **DN50.**
This has the capability to pump:-
0.75 x 2 500 kg/h = 1 875 kg/h
easily coping with a condensate load of 1 500 kg/h.

Capacity charts

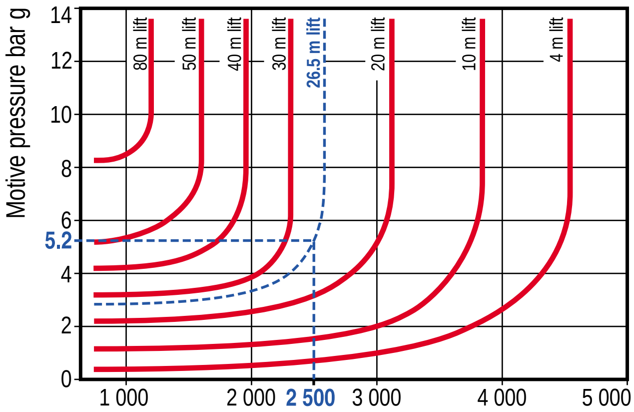
The capacity charts are based on a filling head of 0.3 meters.
The lift lines represent the net effective lift
(i.e. lift plus frictional resistance)



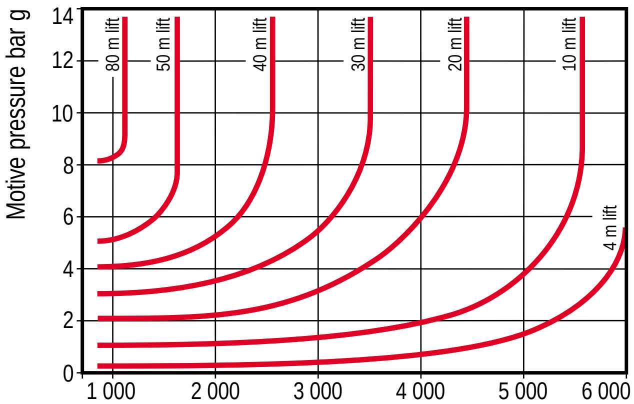
DN25 (1") Flowrate kg/h



DN40 (1½") Flowrate kg/h



DN50 (2") Flowrate kg/h



DN80 x DN50 (3"x 2") Flowrate kg/h

Condensate removal from temperature controlled equipment

The operation of temperature controls on plant equipment such as heat exchangers can create a 'Stall' condition whereby the condensate cannot flow through the steam trap because of insufficient differential pressure.

Under stall conditions partial or complete waterlogging may occur leading to :-

- Temperature fluctuation.
- Corrosion of heating surfaces.
- Waterhammer, noise and damage.

By constructing a simple stall chart (as example opposite), it is possible to predict the point at which stall will occur and hence determine the conditions at which waterlogging will begin.

T_1 represents the minimum incoming secondary fluid temperature when the plant is under 100 % load.
T_2 represents the controlled outgoing secondary fluid temperature.

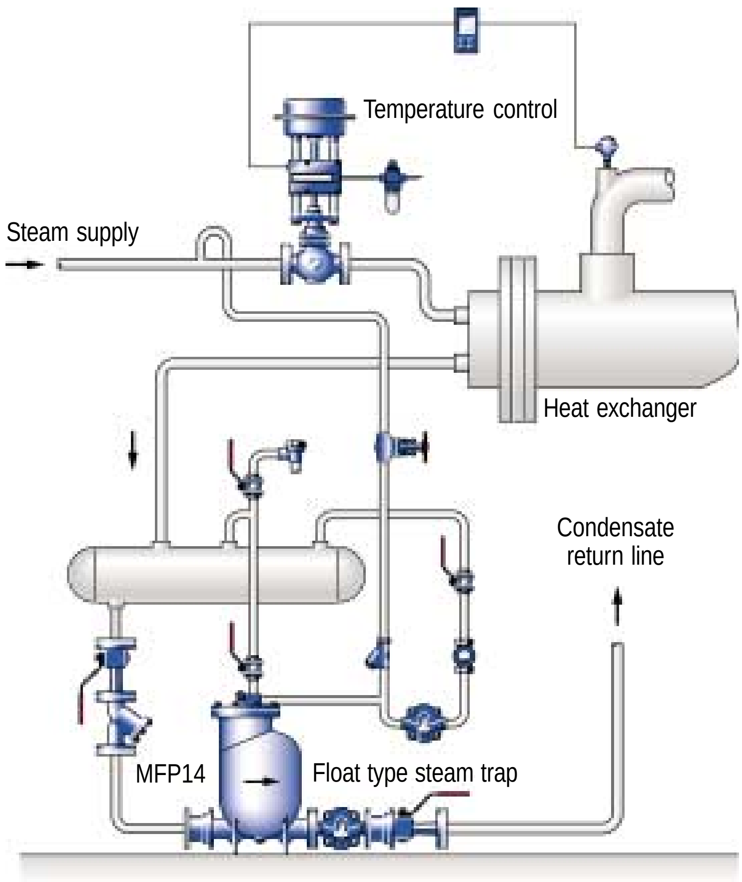
P_1 represents the controlled pressure of the steam when the plant is under 100 % load (corresponding temperature on the left hand axis).

P_2 represents the back pressure acting on the trap.

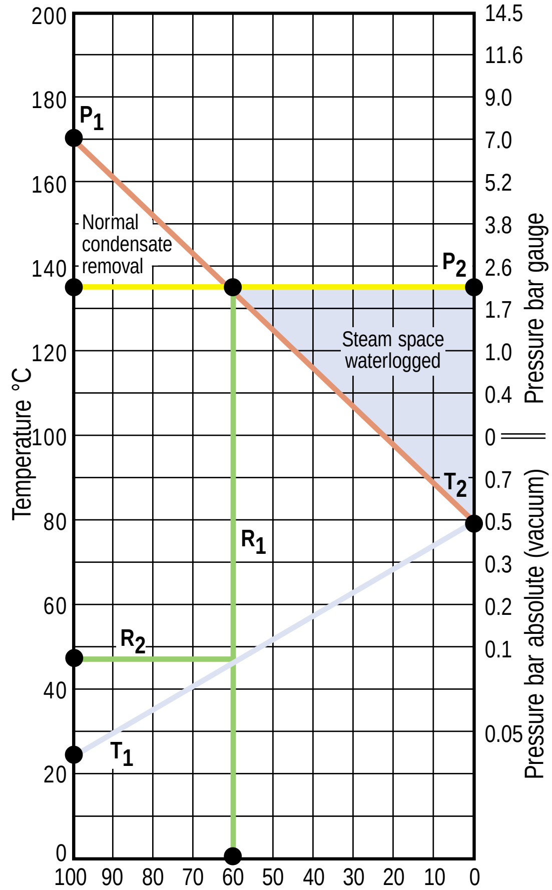
R_1 is a vertical line drawn from the point at which **P_1-T_2** intersects **P_2**.

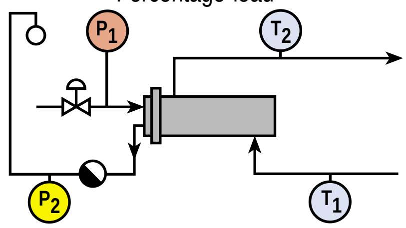
The percentage load at which the system is predicted to stall can be determined where **R_1** touches the X-axis.

The incoming secondary fluid temperature at which the system is predicted to stall can be determined where **R_1** intersects **T_1-T_2**, the horizontal line **R_2 will give this value.**



Stall chart





The solution

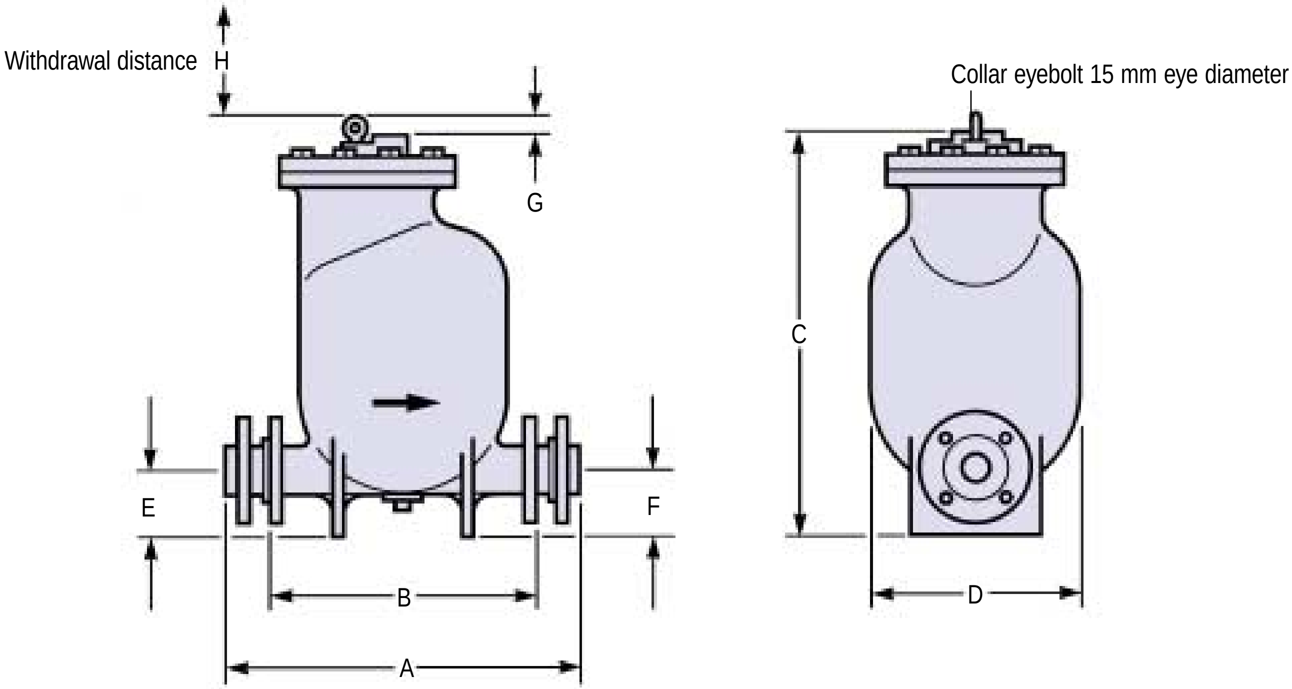
Spirax Sarco's range of MFP14 automatic pump/trap combinations provide the total solution to stall conditions. By mounting the steam trap immediately downstream of the pump (between the pump outlet and the downstream check valve) condensate can be removed under all pressure conditions.

When the steam space pressure is sufficient to overcome the total back pressure (including static lift) the trap will operate normally.

When the steam space pressure falls below the total back pressure, the pump automatically trips into operation and forces all the condensate out through the trap before waterlogging can occur.

This pump/trap combination enables optimum performance to be achieved from all types of temperature controlled process equipment. See your local Spirax Sarco sales engineer for further details on how a Spirax Sarco pump/trap combination could improve the performance of your process equipment.

Dimensions (approximate in millimetres)



	Size	A	B	C	D	E	F	G	H	Weight (kg)*
MFP14 SG iron	DN25 1"	410	310	510	280	72	72	22	480	58
	DN40 1½"	440	310	530	280	85	85	22	480	63
	DN50 2"	557	420	627	321	104	104	22	580	82
	DN80 x DN50 3" x 2"	573	420	627	321	119	104	22	580	86

	Size	A	B	C	D	E	F	G	H	Weight (kg)*
MFP14S Steel	DN50 2"	557	420	627	321	104	104	22	580	100
	DN80 x DN50 3" x 2"	573	420	627	321	119	104	22	580	105

	Size	A	B	C	D	E	F	G	H	Weight (kg)*
MFP14SS Stainless steel	DN80 x DN50 3" x 2"	573	420	627	321	119	104	22	580	105

*Weights inclusive of check valves and flanges

Typical specification

The pump shall be a Spirax Sarco automatic pump type MFP14 operated by steam, compressed air or other pressurised gas to 13.8 bar g. No electrical energy shall be required.

Body construction of SG iron (DIN 1693, GGG 40.3) with disc type check valves for pumping liquids of specific gravity of 0.8 and above. The pump shall contain a float operated stainless steel snap-action mechanism with no external seals or packing. When required, it should be fitted with a custom insulation jacket for maximum energy saving and a cycle counter to enable the volume of pumped liquid to be calculated.

Some of the products may not be available in certain markets.

MFP

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