

SAMSON LIQUID RING VACUUM PUMPS

LIQUID SEPARATOR

INSTRUCTION MANUAL FOR LIQUID SEPARATOR



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1 INTRODUCTION

1.1 Declaration of incorporation



Declaration of incorporation

Annex IIB

Samson Pumps A / S

Petersmindevej 21
DK-8800 Viborg

Hereby declares that the following products:

Liquid separator 5, -10, -20, -30, -40, -50, -60, -70, -90, -100

Conforms to the following directives:

Machinery Directive 2006/42/EC

I hereby declare, that the products is in conformity with the following harmonized standards:

DS/EN ISO 12100:2011	Safety of machinery - General principles for design - Risk assessment and risk reduction
DS/EN 1012-2 + A1:2009	Compressors and Pumps - Safety requirements - Part 2: Vacuum pumps

The standards are used to the extent it is relevant to the product.

The product must not be used before the complete system, which it must be incorporated in, has been conformity assessed and found to comply with all relevant health and safety requirements of 2006/42/EC and other relevant directives. The product must be included in the overall risk assessment.

The equipment must not be exposed to an operating pressure of more than 0.5 bar gauge.
Liquid separator may only be used on a Samson Pumps liquid ring pump or unit.

Viborg, 09.03.2017

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DOC4013B

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1.2 Explanation of warning symbols

Important technical and safety instructions is showed by symbols. If instructions are not performed correctly, it may lead to personnel injury or incorrect function of the liquid separator.



To be used with all safety instructions that must be followed. A failure to follow the instructions may result in injury and/or incorrect machine operation.

1.3 General description of liquid separator

The purpose of a liquid separator is to recycle the service liquid from a liquid ring pump.

When a liquid ring pump is in operation, it needs a certain flow of service liquid to function. The service liquid is fed into the pump through the inlet (suction side) and blown out on the discharge (pressure) side. In order to reduce the consumption of the service liquid, a liquid separator must be mounted on the discharge side of the pump.

The liquid separator will separate the service liquid and air, and the service liquid will afterwards be let back to the pump for recirculation. Liquid separators ability to separate the service liquid from the air, depends on the pump operating point. Separation ability can be up to 98%.

Due to recycling of the service liquid, a part of the pump`s energy will be accumulated in the operating liquid as heat, and it may therefore be necessary to establish a cooling system. Different options for cooling are described later in this manual.

1.4 Available series & capacities

Liquid separator series	Liquid ring pump series	Capacity [m ³ /h]
5	ME	0 - 200
10 - 40	KE, KL	200 - 530
50 - 60	KS	530 - 1100
70	KS	1100 - 1300
90 - 100	KM	1300 - 3000

1.5 Storage conditions

When delivered from factory, the liquid separator is drained for water and is frost safe.

If the liquid separator is out of operation for a period of time, it should be emptied for operating liquid.

1.6 General requirements for installation

If the liquid separator outlet is connected to an existing piping system, this interconnection must be relieved in order not to create load on the liquid separator. The liquid separator is not designed to withstand external loads.

Installation of the liquid separator must be vibration proof. External vibrations can lead to fatigue stress in the construction of the liquid separator.

Allowable pressure in Samson Pumps Liquid separator is 0,5 barg. Do NOT exceed this pressure.

1.7 Requirements for service liquid

The temperature of the service liquid, supplied from the external water supply, must not exceed 50 ° C. Particles in the service liquid must not exceed 2mm in size.

The maximum pressure in the external liquid/water supply must not exceed 10 barg.

It is recommended not to use aggressive liquid, as this may damage the liquid separator and the pump.

It is recommended to use an operating liquid with as low a temperature as possible. The lower the temperature is, the better the possibility to exploit the capacity of the pump.

Service liquid may, depending on operating conditions, contain dangerous substances. This must be taken into account at the disposal and replacement of the service liquid.

1.8 Non return valve

In the installations, where multiple liquid ring pumps are connected in series, it is necessary to install a non-returnvalve on the pump outlet (pressure side).

If the liquid ring pump is equipped with a liquid separator, the valve must be mounted on the liquid separator outlet.

1.9 Disposal

Samson liquid separator has been designed in the way, that the most of it can be recycled.

Samson Pumps therefore offers the user of the S liquid separators to return the worn liquid separators for renovation or scrapping. For those who do not make use of the Samson Pumps offer, liquid separator must be sorted into components.

The liquid separators can be disassembled into the following components:

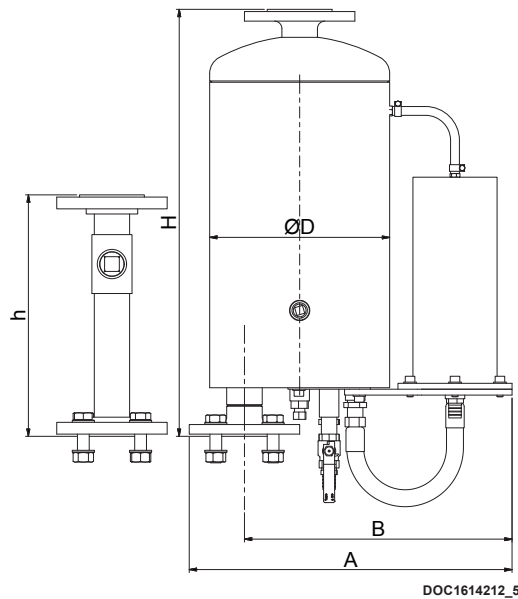
- Operating fluid
- Gaskets
- Hoses
- Plastic parts
- Plastic parts
- Steel

These components must be disposed according to national rules.

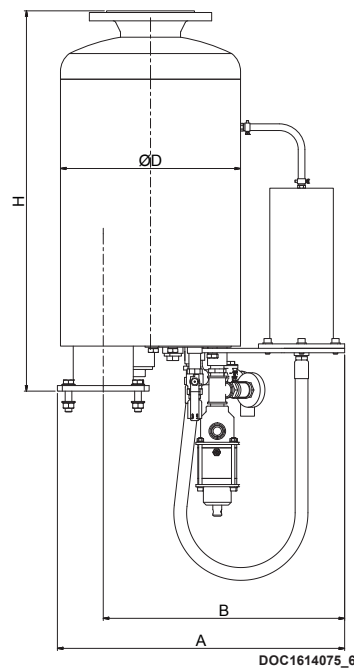
Remaining parts, consisting of the metal components, can be sent to the remelting.

2 TECHNICAL DATA

2.1 Dimensions



Dimensions [mm]						
Liquid separator type	A	B	h	H	ØD	Weight [kg]
5	440	365	330	580	245	42



Dimensions [mm]					
Liquid separator type	A	B	H	ØD	Weight [kg]
10 - 40	500	435	655	325	45
50 - 60	520	435	685	325	65
70	685	590	1110	500	90
90 - 100	935	840	1155	750	107

3 METHOD OF OPERATION

Some of the service liquid will be released with the exhausted air. It is therefore necessary to add service liquid during operation. Use of a liquid separator is recommended for any Samson pump, in order to achieve the best operation of the pump and minimizing operating costs.

Beside the collection and recycling of the service liquid, a liquid separator will ensure correct pump intake pressure.

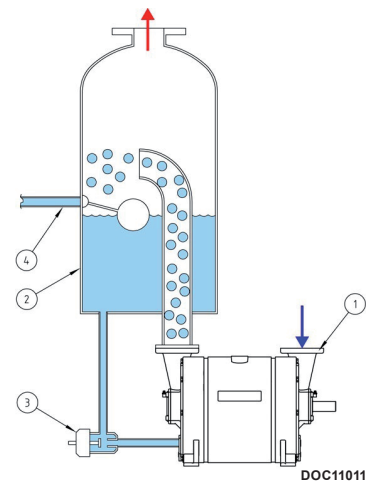
3.1 Configuration without cooling

A liquid separator is fitted with a float valve to ensure correct level of service liquid inside the separator.

When the float valve is connected to the water supply, it will automatically refill the system with the amount of service liquid equal to the evaporated liquid. As the liquid level in the liquid separator is above the level of the pump, it is necessary to close the supply of liquid into the pump, when the pump is not in operation.

For this purpose Samson Pumps have developed a service liquid valve. The service liquid valve is managed by pilot pressure, created by the liquid ring in the pump, and therefore there is no requirement for external control of the valve. This service valve is listed in our product range under valves.

Pos.	Description
1	Liquid ring pump
2	Liquid separator
3	Service liquid valve
4	Service liquid supply

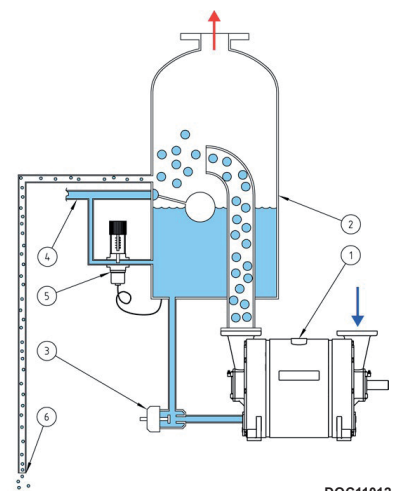


3.2 Configuration with partial recovery

The service liquid heats up during operation, and therefore cooling of the service liquid may often be required. Cooling by partial recirculation is achieved by replacing part of the service liquid.

A temperature regulating valve ensures that the required amount of water is fed to the liquid separator. The excess hot water flows out of an overflow pipe. The amount of water consumed depends on the selected water temperature and water supply temperature. Typically, the amount of water added is between 10 and 20 % of the total water flow.

Pos.	Description
1	Liquid ring pump
2	Liquid separator
3	Service liquid valve
4	Service liquid supply
5	Temperature regulating valve
6	Overflow pipe

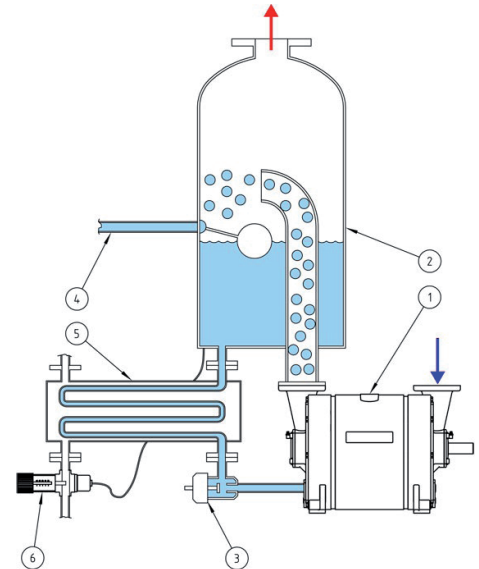


3.3 Configuration with full recovery

In instances where access to external cooling water is available, water consumption can be reduced to a few litres per hour.

The operating liquid for the pump is fed through a heat exchanger where it is cooled before being fed back into the pump. A temperature regulating valve ensures the correct flow of cooling water for the required temperature.

Pos.	Description
1	Liquid ring pump
2	Liquid separator
3	Service liquid valve
4	Service liquid supply
5	Heat exchanger
6	Temperature regulating valve



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3.4 Configuration with air cooling

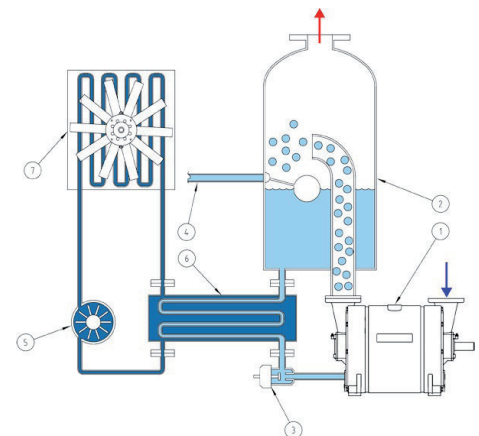
Cooling of service liquid with the aid of an air cooler also minimises water consumption.

The operating temperature is generally slightly higher than that solutions 3.1, 3.2 and 3.3 (typically around 20 ° C above the ambient temperature).

As the air cooler is sensitive to impurities, the unit includes two cooling circuits.

The hot service liquid is fed through a heat exchanger, where it is cooled by the cold water from the air cooler. This means that any impurities drawn through the liquid ring vacuum pump will not be fed through the air cooler.

Pos.	Description
1	Liquid ring pump
2	Liquid separator
3	Service liquid valve
4	Service liquid supply
5	Cirkulation pump
6	Heat exchanger

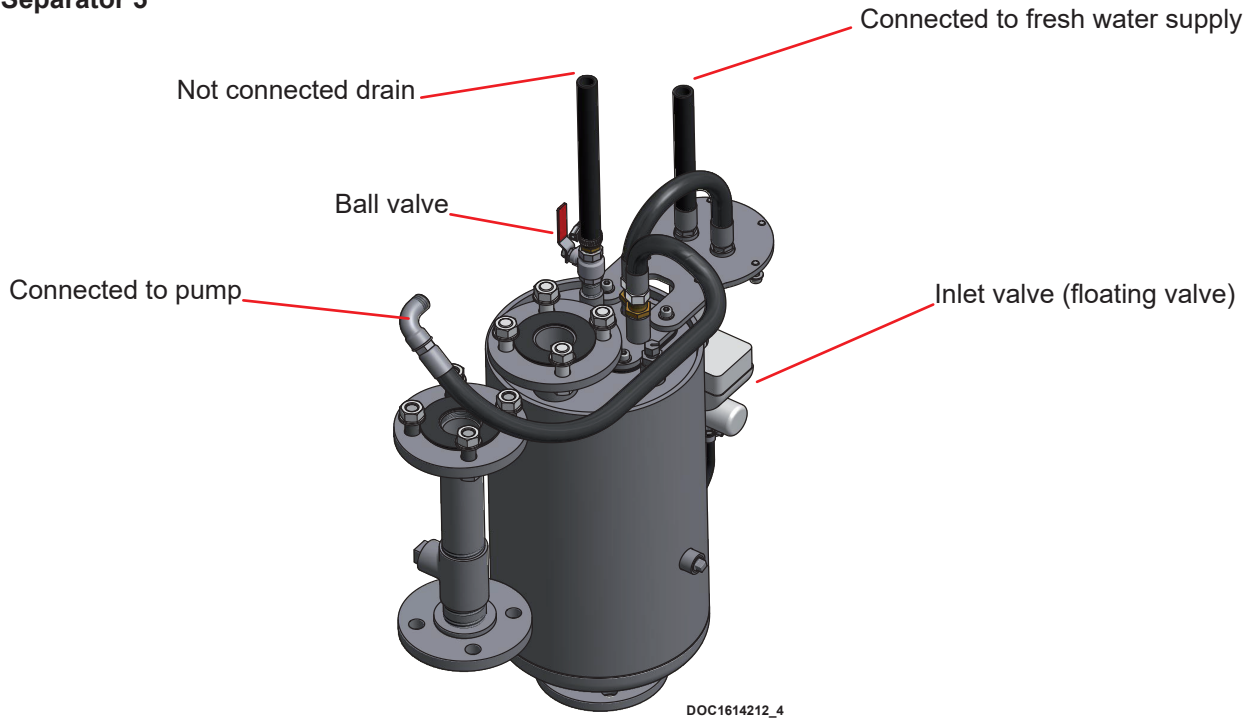


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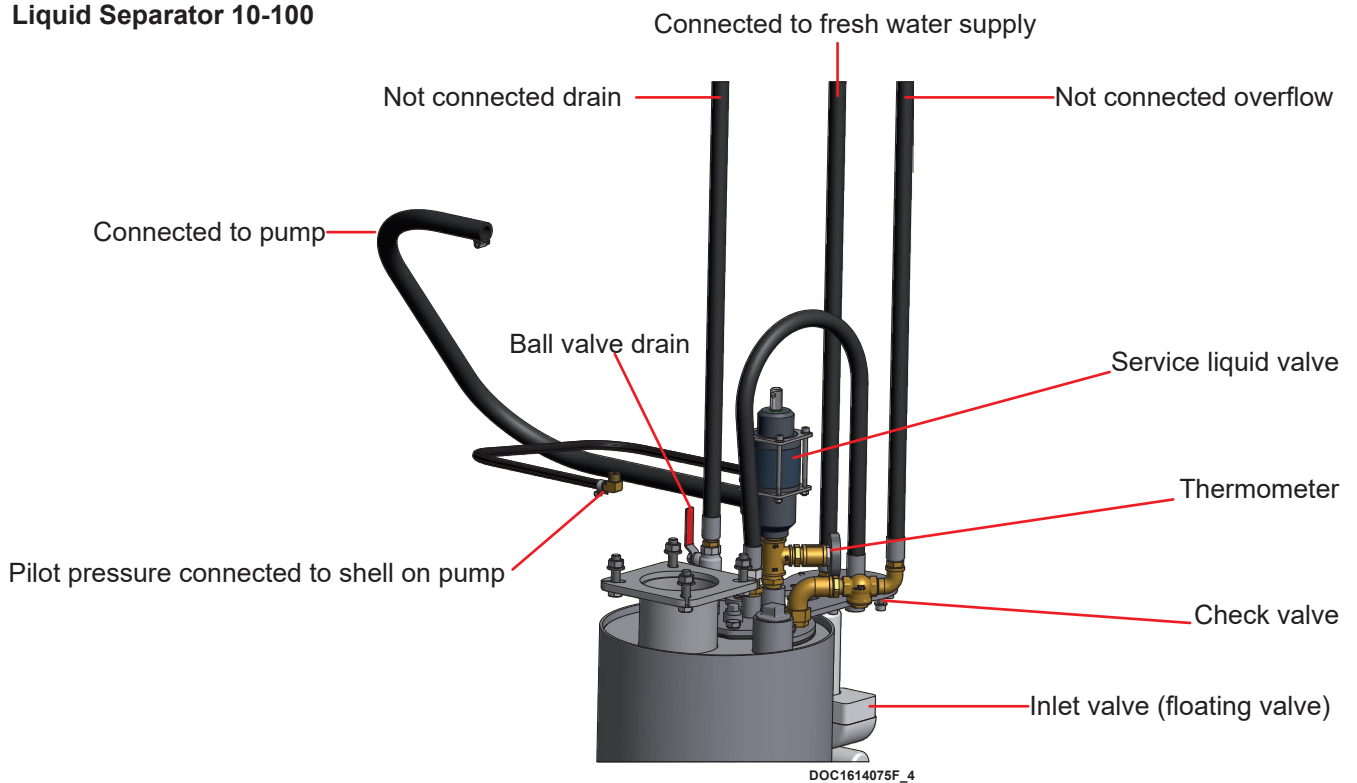
4 CONNECTIONS

4.1 Connecting the configuration without cooling

Liquid Separator 5

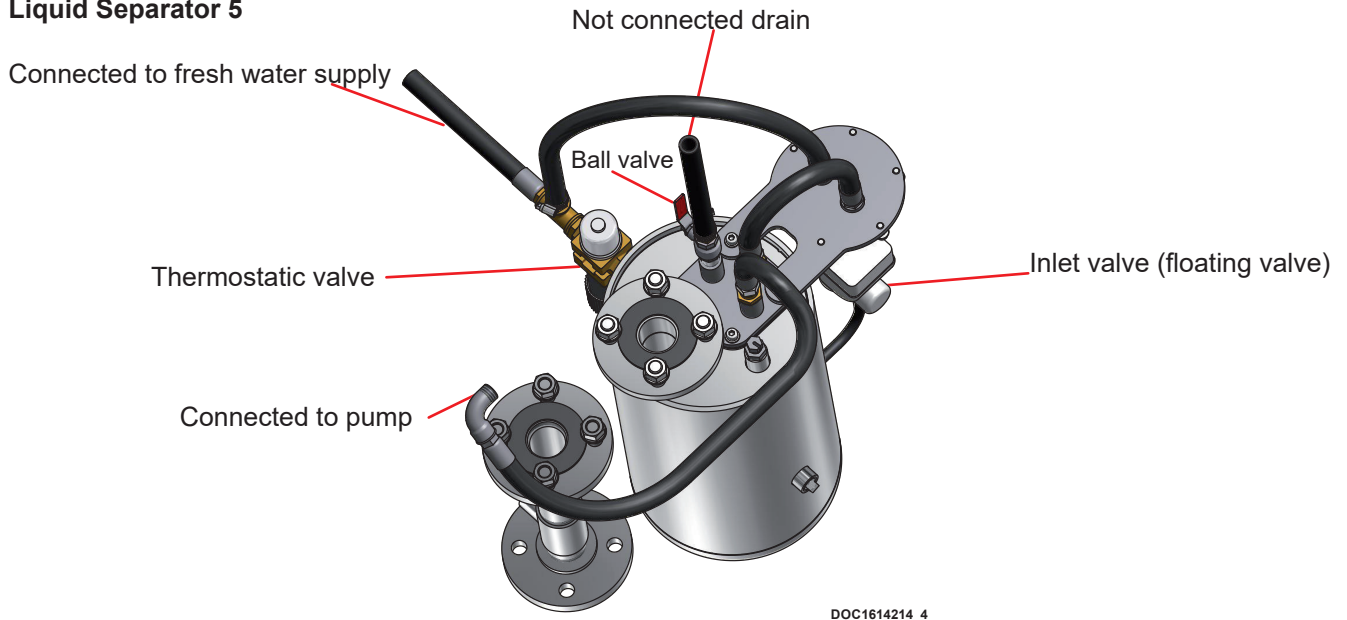


Liquid Separator 10-100

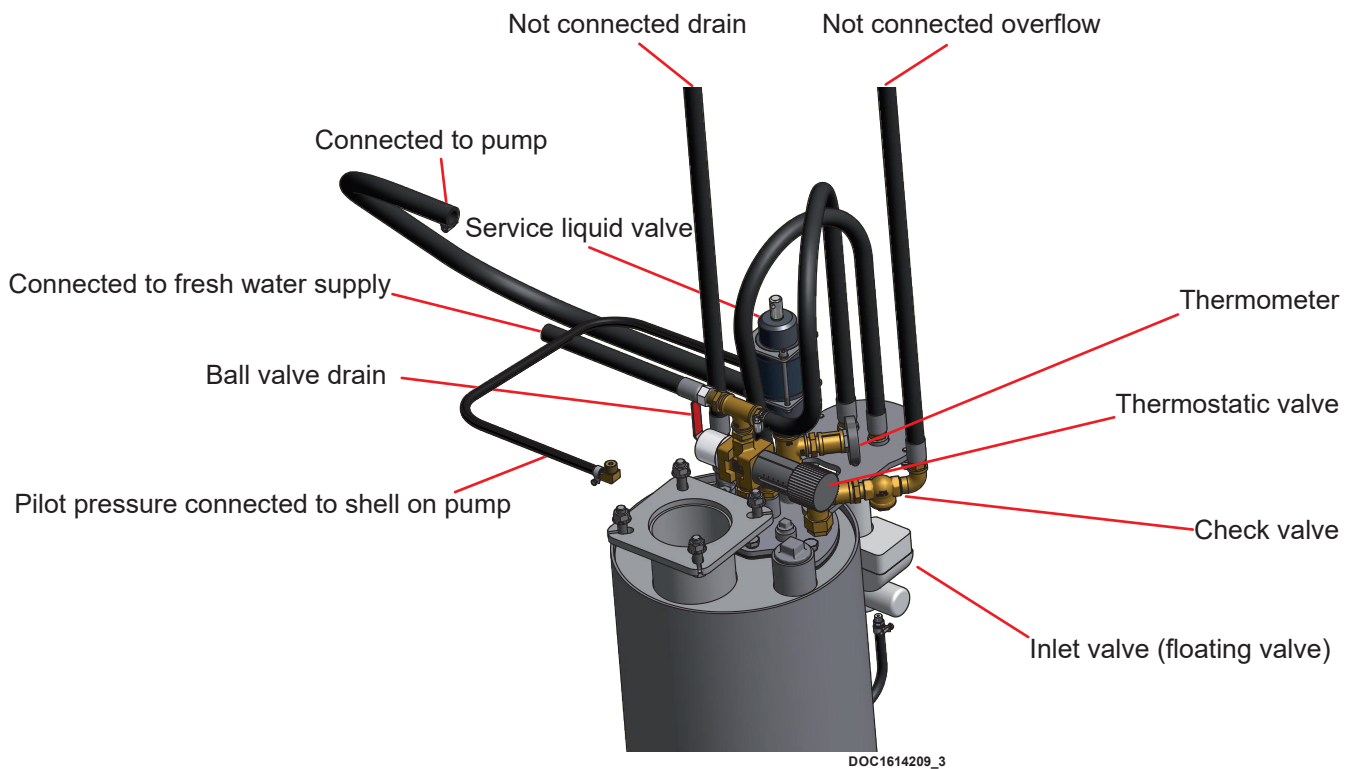


4.2 Connecting the configuration with partial recovery

Liquid Separator 5

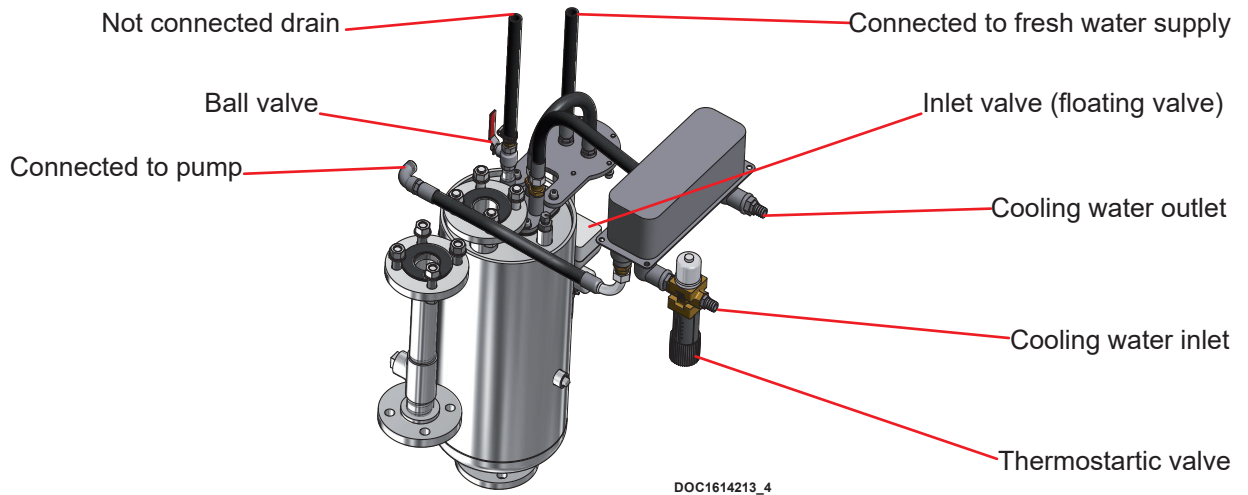


Liquid Separator 10-100

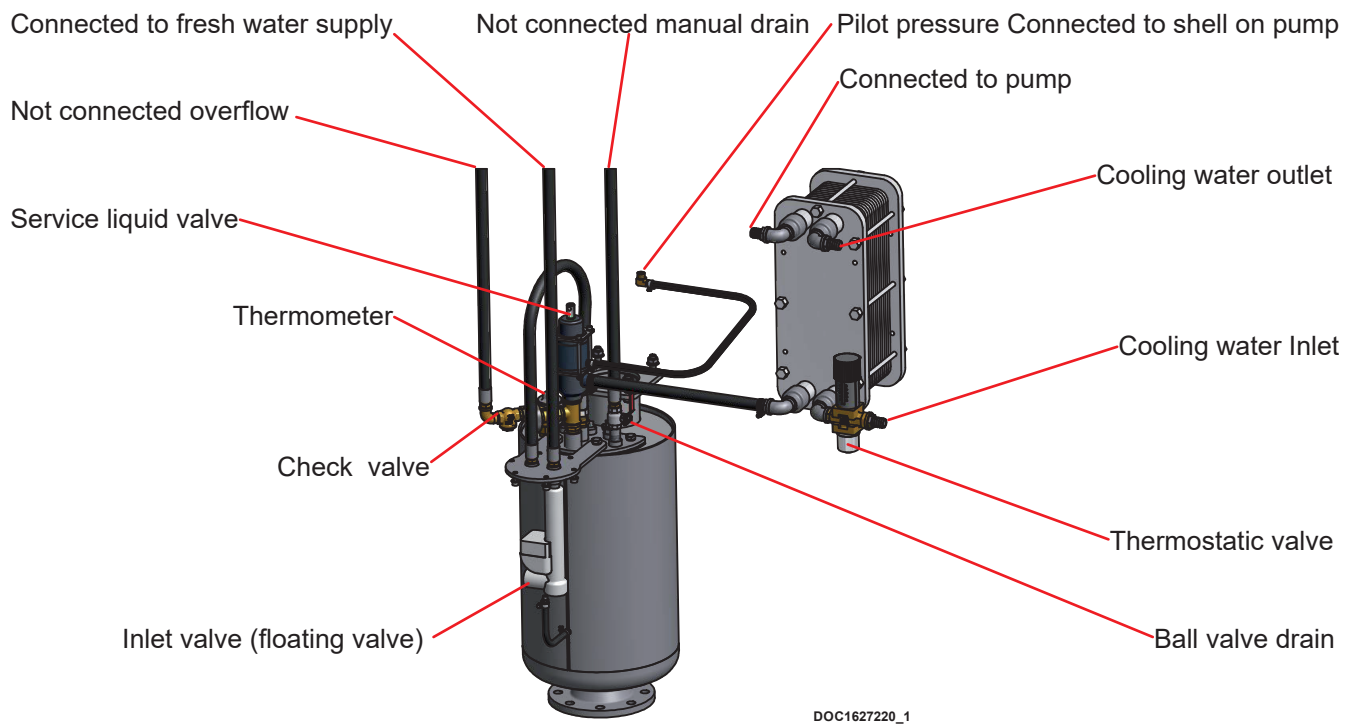


4.3 Connecting the configuration with full recovery and/or air cooling

Liquid Separator 5



Liquid Separator 10-100



Liquid separator type	Outlet flange	Inlet flange	Fresh water connection (hose tail) Config. A and B
5	DN40	DN40	Ø5/8" (Ø16 mm)
10 - 20	DN50	DN40	Ø5/8" (Ø16 mm)
30 - 40	DN50	DN50	Ø5/8" (Ø16 mm)
50 - 60	DN100	DN80	Ø5/8" (Ø16 mm)
70	DN100	DN80	Ø5/8" (Ø16 mm)
90 - 100	DN125	DN125	Ø5/8" (Ø16 mm)

5 OPERATION

5.1 Startup

1. Check that the liquid separator is connected correctly according to the previous instructions in this manual.
2. If liquid separator is equipped with a thermostatic control valve, set it to the number 1, as a benchmark for future fine-tuning.
3. Check that there is pressure on the external water supply.
4. Open the external water supply.
5. Filling the liquid separator is now started. To check this, open the ball valve drain. If the filling of the liquid separator is done correct, the water will run out of the open ball valve drain.
6. Close ball valve drain (completely).
7. Liquid separator will be filled up to the level, where the float valve automatically will cut off the water supply. In quiet surroundings, it will be possible to hear when the float valve closes. Otherwise, wait for 10 min.
8. The liquid separator is now filled, and the pump can be started.
9. As soon as the pump is running, check that the service liquid valve opens for the liquid flow to the pump. This can be seen by the green indicator that will be ejected at the end service liquid valve (Please read the manual for service liquid valve).
10. The system will from now on operate automatically.

5.2 Temperature of service liquid

The influence of temperature of the service liquid on the pump performance:

- Pump performance decreases with increasing temperature of the service liquid, and therefore it is important to provide as low temperature of the service liquid as possible. At a service liquid temperature of, for example, 40°C, performance will be decreased by about 10%, and at 50°C with approx. 25%.
- The temperature of the intake air / gas must not exit 100°C and the temperature of service liquid must not be higher than 60°C.
- All our Samson Pumps performance curves are based on temperature of service liquid of 15°C.

5.3 Thermostatic valve

Thermostatic control valve function area is between 10 - 80°C.

The valve has a visual setting scale, which ranges from 1 to 5. There is no correlation between the scale numbers and a specific operating temperature. The valve must be set individually for each installation. The purpose of adjustment of the thermostatic control valve, is to find the balance between pump performance and water consumption.

Method of setting the thermostatic control valve:

1. Set the valve on figure 1. This is the most sensitive setting, which will cause the valve is always completely open and add fresh water. Water consumption is now maximum. When the thermostatic control valve is open, the excess water will run out through the overflow tube.
2. Observe the temperature of the liquid separator, and control if the pump performance is satisfying in relation to the function.
3. Set the valve at the figure 2 and wait 20 minutes. Thermostatic control valve will now raise the temperature of service liquid in the liquid separator, and the consumption from the external water supply will be reduced. The result of this adjustment may be the decrease of performance of the pump.
4. Observe again the temperature of the service liquid in the liquid separator, and check if the pump performance is still satisfying in relation to the process.
5. Continue the adjustment of the system until the optimal balance is achieved.

5.4 Cavitation



Increased temperature of the service liquid, increases also the risk of cavitation. It is not recommended to work under the under cavitation threshold.

Cavitation is a state, when the pressure in the system drops to below the vapor pressure of the service liquid. Hereby the service liquid will start to boil and air bubbles will occur in the operating fluid. There will be heard cracking sound (implosion of air bubbles) from the pump, and the suction capability of the pump, at the current temperature of the inlet air and service liquid, exceeded. Continued operation under this condition will result in major mechanical damage of the pump.

By operating modes where cavitation may occur, the pump should be protected against cavitation, by using a cavitation protection valve, called "vacuum limiter" (Read the manual for vacuum limiter valve).

5.5 Maintenance

It is recommended that the liquid separator is manually emptied once a day, by opening the drain valve.

If your installation is not in operation for more than 30 days, it is recommended to close the external water supply and empty the liquid separator.

6 TROUBLESHOOTING

Problem ID	Reason	Effect	Action
Service liquid is too hot	<ol style="list-style-type: none"> 1. Thermostatic control valve is set incorrectly. 2. Thermostatic control valve is defective. 3. The drain valve is not completely closed. 4. The supply of external cooling water is blocked. 5. The temperature of the external cooling water is too high in relation to the pump power, and therefore cannot cool enough. 6. An occluded liquid separator can prevent the water to circulate. 	<p>Reduced capacity of the pump.</p> <p>Risk for cavitation.</p>	<ol style="list-style-type: none"> 1. Set the thermostatic control valve according to the manual. 2. Replace the thermostatic control valve. 3. Close the drain valve completely 4. Reestablish supply of cooling water. 5. Establish cooling according to the manual's explanation for configuration B, C or D. 6. Disassemble the system and clean.
The water continue to run out of the overflow when the unit is not in operation	<ol style="list-style-type: none"> 1. Float valve is deffect. 2. Float valve is set incorrectly. 3. Float valve is defect. 	<p>Unnecessary loss of service liquid</p>	<ol style="list-style-type: none"> 1. Exchange the float valve. 2. Set the float valve according to the manual.

7 SPARE PARTS

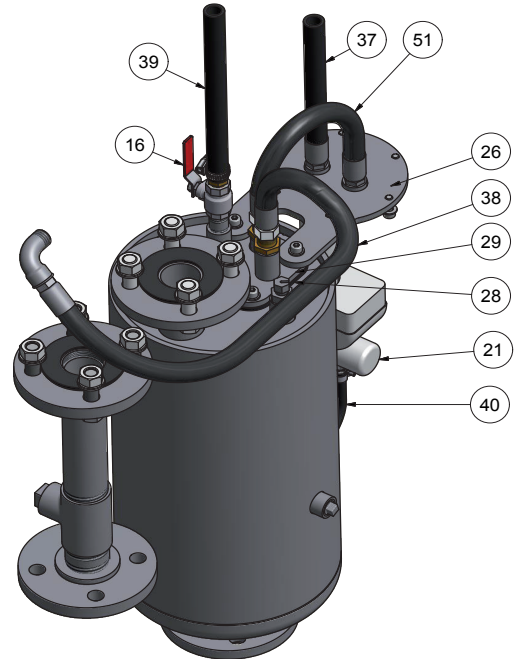
To order spare parts, the following information must be disclosed:

- Pump model
- Liquid separator configuration: A, B, C or D
- Liquid separator series: 5; 10-40; 50-70; 80 or 90-100
- Desired Pos. No

7.1 Configuration without cooling

Liquid Separator 5

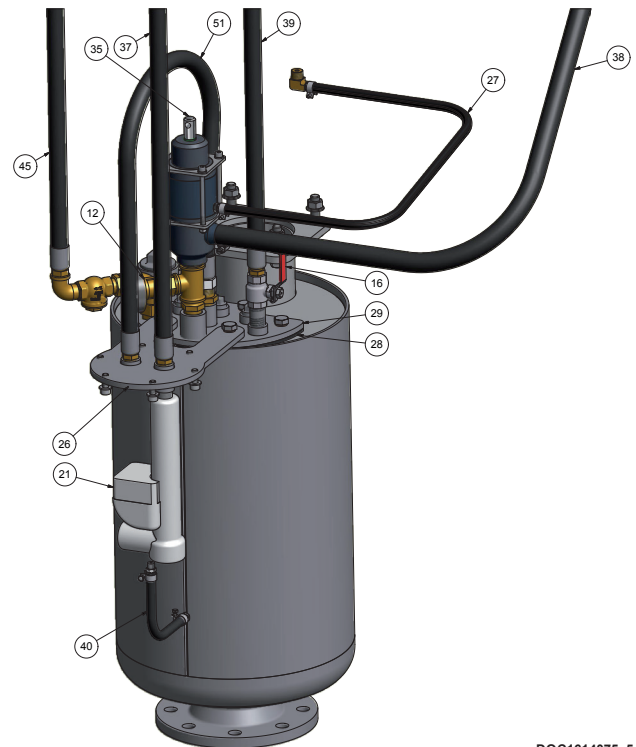
Pos.	Description
16	Drain valve
21	Float valve
26	Manifold for float valve housing
28	Gasket for manifold
29	Manifold
37	Hose 1 for float valve housing
38	Supply hose for liquid ring pump
39	Hose for drain
40	Hose for float valve housing top
51	Hose 2 for float valve housing



DOC1614212_3

Liquid Separator 10-100

Pos.	Description
12	Thermometer
16	Drain valve
21	Float valve
26	Manifold for float valve housing
27	Hose for pilot pressure
28	Gasket for manifold
29	Manifold
35	Service liquid valve
37	Hose 1 for float valve housing
38	Supply hose for liquid ring pump
39	Hose for drain
40	Hose for float valve housing top
45	Hose for overflow
46	Thermostatic control valve
50	Hose for overflow
51	Hose 2 for float valve housing
52	Hose for external water supply

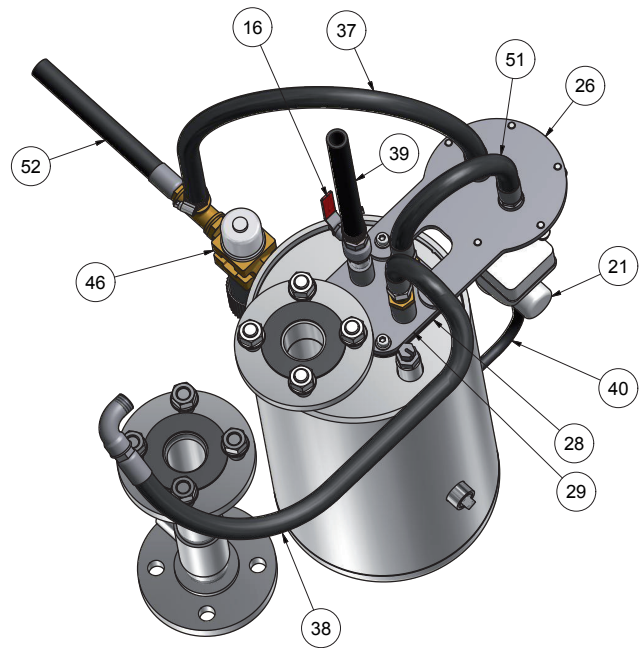


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7.2 Configuration with partial recovery

Liquid Separator 5

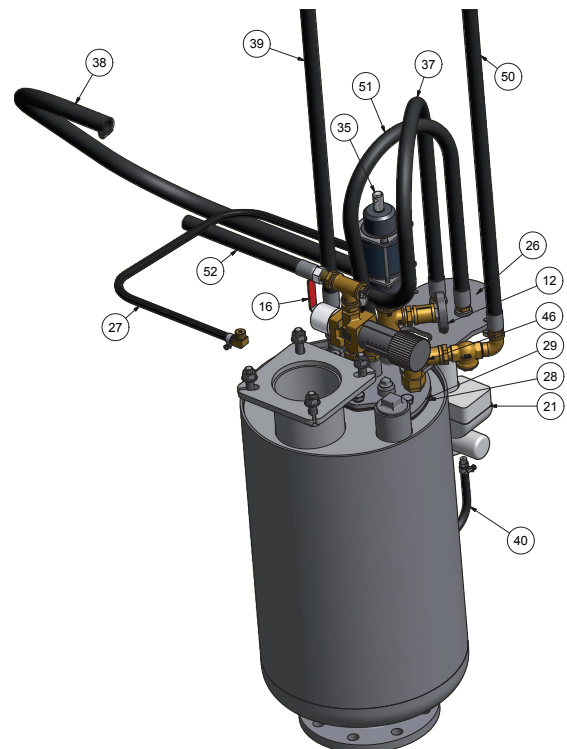
Pos.	Description
16	Drain valve
21	Float valve
26	Manifold for float valve housing
28	Gasket for manifold
29	Manifold
37	Hose 1 for float valve housing
38	Supply hose for liquid ring pump
39	Hose for drain
40	Hose for float valve housing top
46	Thermostatic control valve
51	Hose 2 for float valve housing
52	Hose for external water supply



DOC1614214_3

Liquid Separator 10-100

Pos.	Description
12	Thermometer
16	Drain valve
21	Float valve
26	Manifold for float valve housing
27	Hose for pilot pressure
28	Gasket for manifold
29	Manifold
35	Service liquid valve
37	Hose 1 for float valve housing
38	Supply hose for liquid ring pump
39	Hose for drain
40	Hose for float valve housing top
45	Hose for overflow
46	Thermostatic control valve
50	Hose for overflow
51	Hose 2 for float valve housing
52	Hose for external water supply

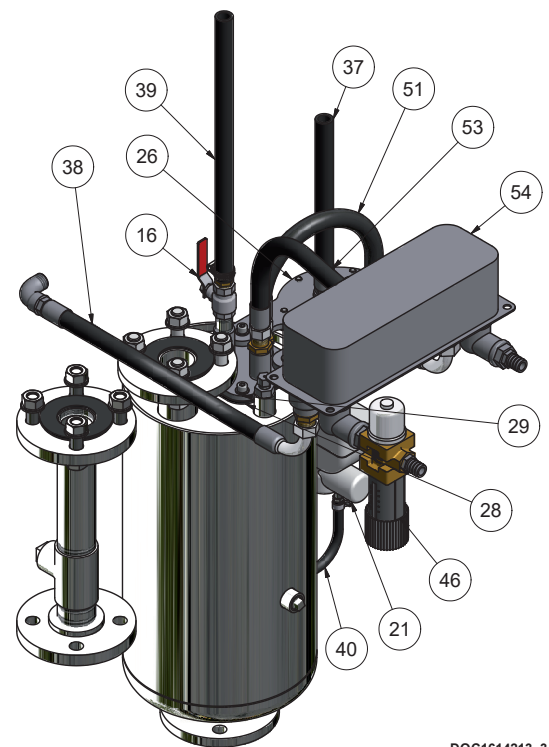


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7.3 Configuration with full recovery and/or air cooling

Liquid Separator 5

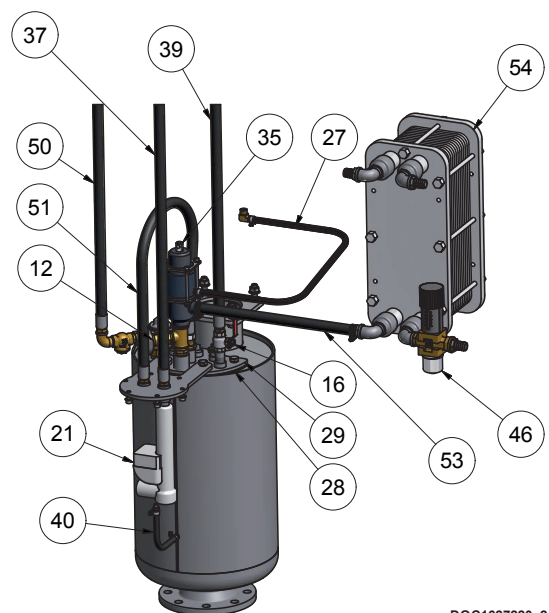
Pos.	Description
16	Drain valve
21	Float valve
26	Manifold for float valve housing
28	Gasket for manifold
29	Manifold
37	Hose 1 for float valve housing
38	Supply hose for liquid ring pump
39	Hose for drain
40	Hose for float valve housing top
46	Thermostatic control valve
51	Hose 2 for float valve housing
53	Hose for external water supply
54	Heat exchanger



DOC1614213_3

Liquid Separator 10-100

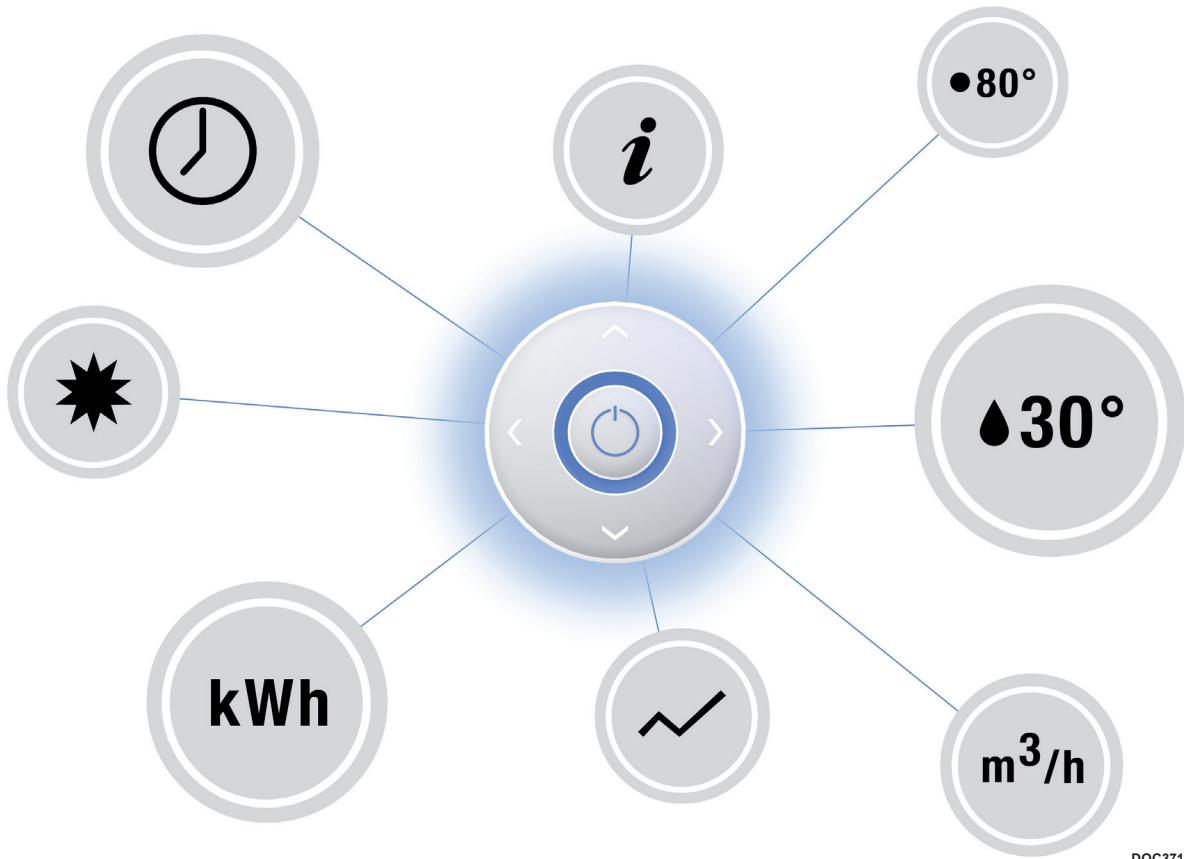
Pos.	Description
12	Thermometer
16	Drain valve
21	Float valve
26	Manifold for float valve housing
28	Gasket for manifold
29	Manifold
37	Hose 1 for float valve housing
39	Hose for drain
40	Hose for float valve housing top
46	Thermostatic control valve
51	Hose 2 for float valve housing
52	Hose for external water supply
54	Heat exchanger



DOC1627220_2

8 SCS & MEMENTO

For supplies, where the unit and the liquid separator is controlled by Samson MEMENTO system, please study the following chapter.



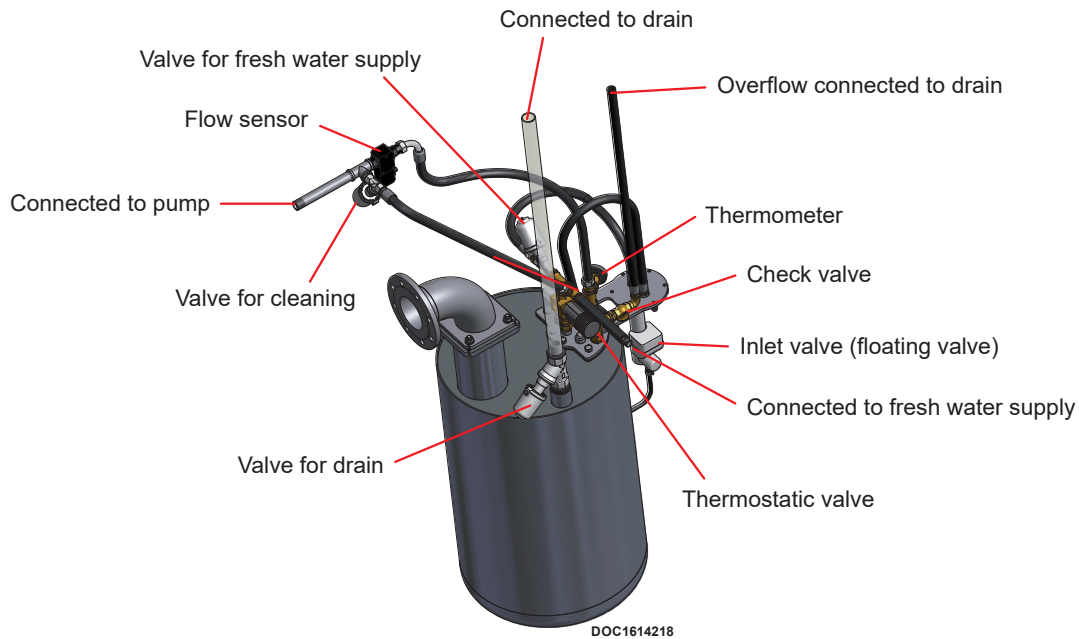
8.1 Purpose of use

SCS (Self Cleaning System) is an automatic cleaning program, that allows automatic supply of additional operating liquid to the pump. Small amounts of particles in the suction gas is normally harmless for the vacuum pump. The dirt will end up in the liquid separator, where it will settle.

If the water flow to the pump is affected of the dirt, it will be detected of the flow sensor, and a cleaning process will start. The SCS valve and the drain valve will open and connect the pump to the permanent water supply. This will flush the pump and the liquid separator.

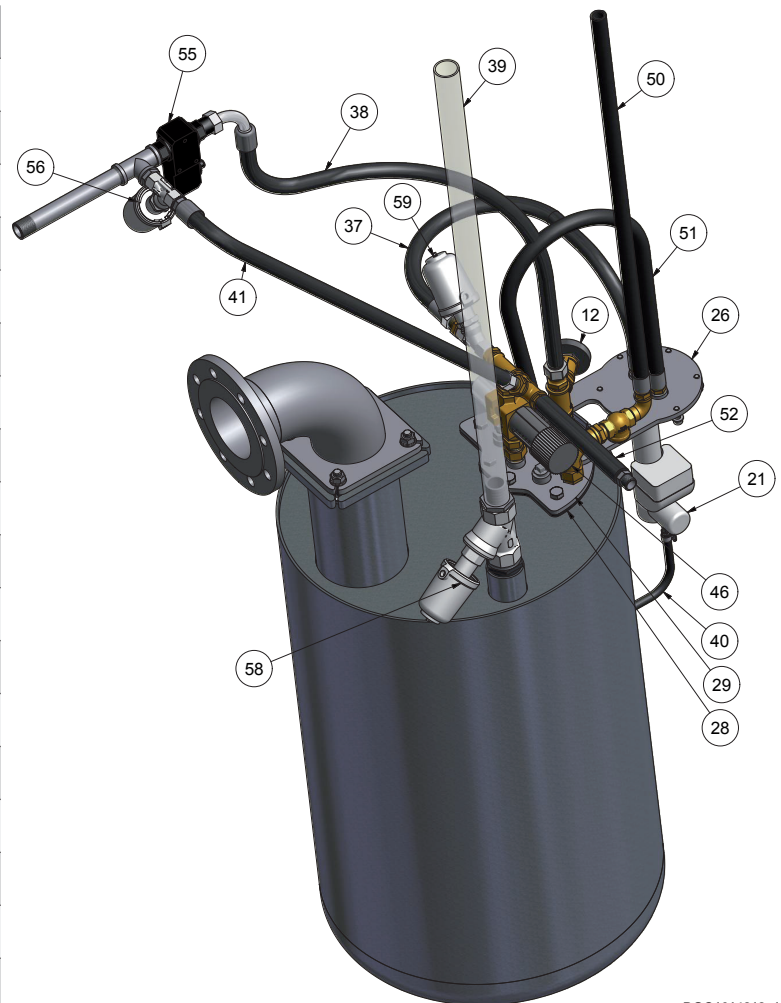
For more information about the SCS System, please study the MEMENTO system operator's manual.

8.2 Connections



8.3 Spare parts

Pos. nr	Description
12	Thermometer
21	Float valve
26	Manifold for float valve housing
28	Gasket for manifold
29	Manifold
37	Hose 1 for float valve housing
38	Supply hose for liquid ring pump
39	Hose for drain
40	Hose for float valve housing top
41	Hose for cleaning
46	Thermostatic control valve
50	Hose for overflow
51	Hose 2 for float valve housing
52	Hose for external water supply
55	Flow sensor
56	Valve for cleaning
58	Valve for drain
59	Valve for fresh water supply



Notes:

Notes:

SAMSON PUMPS

Samson Pumps is the only company in the world to specialise exclusively in liquid ring vacuum pumps. Samson pumps are made in Denmark and used around the globe. We offer worldwide delivery, and we export to more than 80 countries around the world.

For over 40 years, our name has been synonymous with the strongest pumps for vacuum trucks and tankers. We constantly adapt our products to meet the changing needs of our customers. Today, it is not enough to simply produce a pump. Products must be refined so the customer can concentrate on what they do best. We therefore offer a wide range of standardised components that allow our customers to build vacuum systems without the need for specialist in-house expertise.

Strength and durability are our hallmarks! We have often heard from customers that our pumps are working in many years, and in most cases without the need for maintenance or repair. This emboldens us to say that we have the strongest program of pumps on the market.