

FILTER SPARES SERVICE

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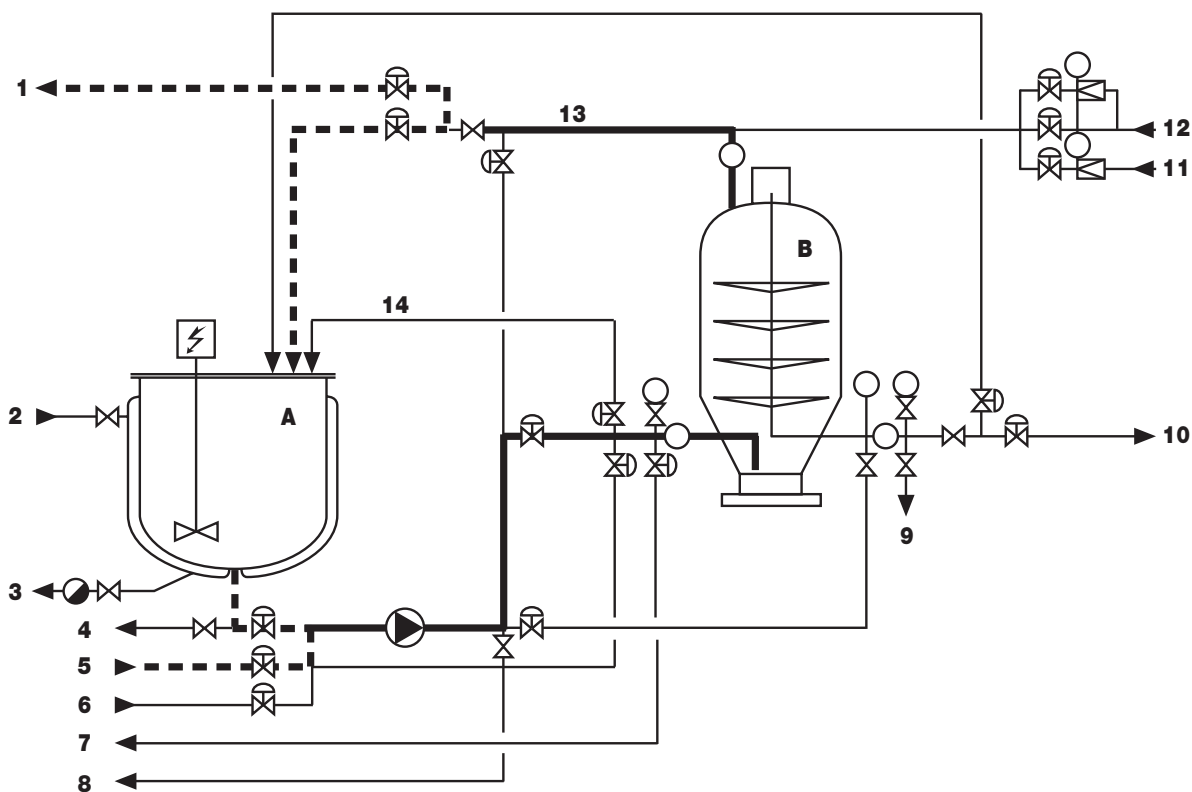
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Test unit diagram R 0.2 m²



Legend

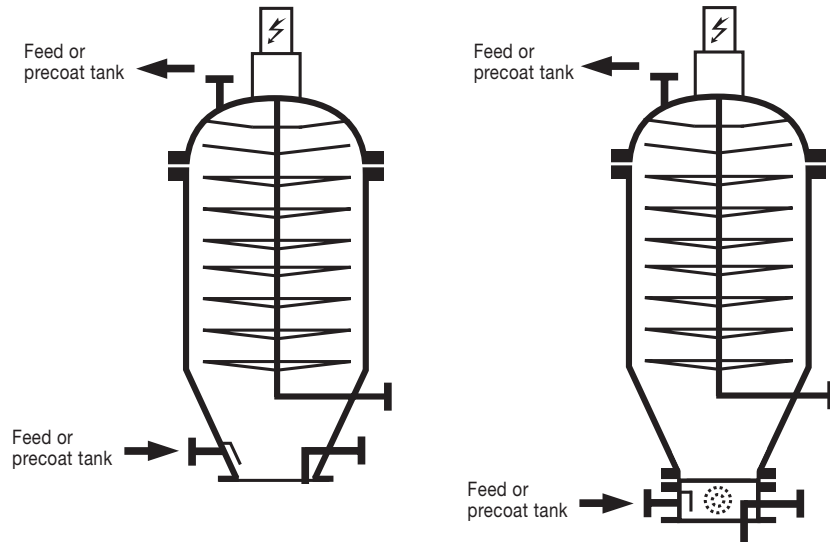
— Flow	6 Washliquid
--- Option	7 Heel drain
A Precoat tank	8 Drain
B Filter	9 Samples
1 Overflow	10 Filtrate
2 Steam	11 Steam
3 Condensate	12 Compressed air
4 Drain	13 Venting
5 Feed	14 Heel drain



1 Filling of the filter without residues on the filter plates

Description

Diagram
(left without / right with slurry cylinder)



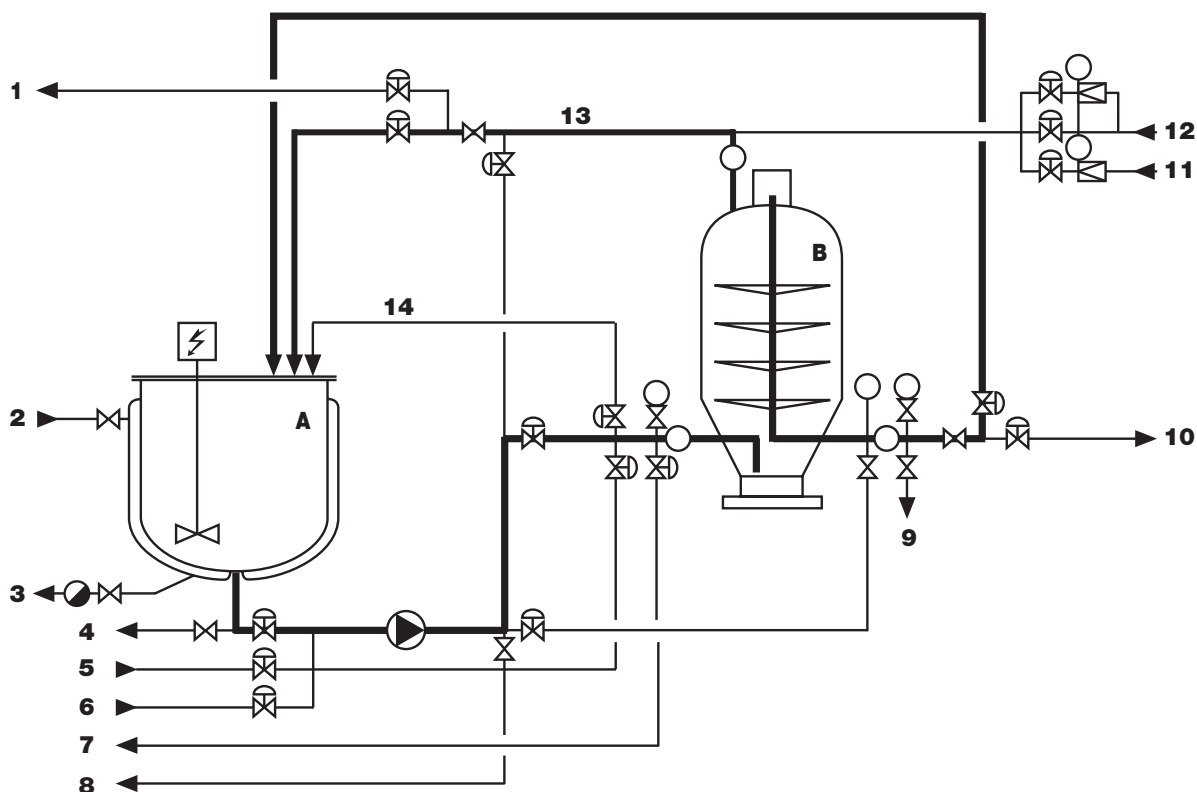
Description The filter is filled by use of a pump and the gas phase located in the filter is led back to the receiving feed tank through the collector pipe and the ventilation pipe. When the filter is full, the product flows back through the ventilation pipe to the receiving feed tank. A circulation feed tank – filter – feed tank is introduced. This circulation is required to ensure homogenous dispersion of the solid to be filtered in the whole liquid.

This homogenization takes between 5 ... 15 minutes, depending on the situation.

- Notes**
- When operating in an open system throttling the centrifugal pump is required. In case of failure to do so the pump produces a multiple of the rated volume. This results in an overload of the pump motor and a break down of the motor overload protector/cut out.
 - Open the supply prior to starting the pump so that the pump can operate with full volume from the moment it is started.
 - Orientate the overflow from the filter to the receiving feed tank towards the wall in order to prevent the liquid from being enriched with air/gas eventually causing cavitations in the pump.



Test unit diagram R 0.2 m²



Legend

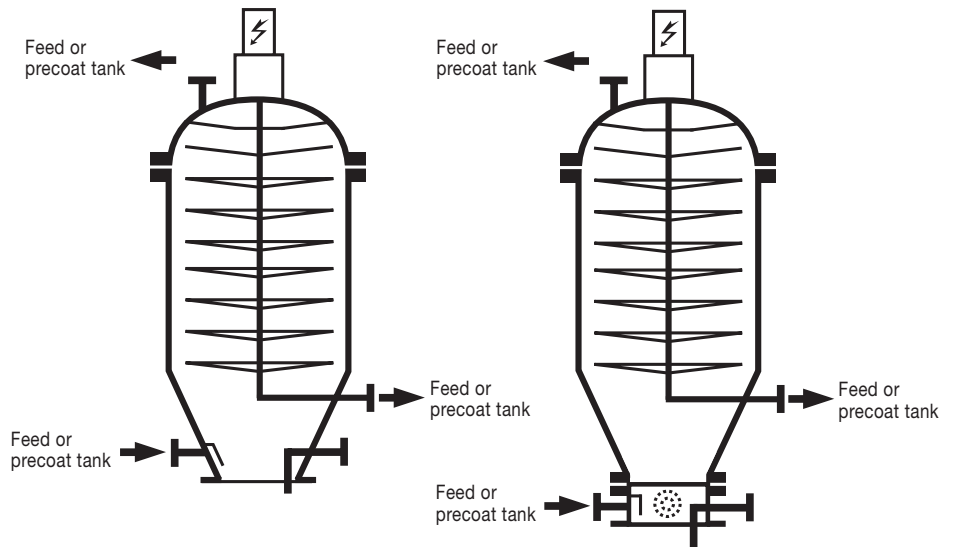
— Flow	6 Washliquid
--- Option	7 Heel drain
A Precoat tank	8 Drain
B Filter	9 Samples
1 Overflow	10 Filtrate
2 Steam	11 Steam
3 Condensate	12 Compressed air
4 Drain	13 Venting
5 Feed	14 Heel drain



2 Precoating

Description

Diagram
(left without / right with slurry cylinder)



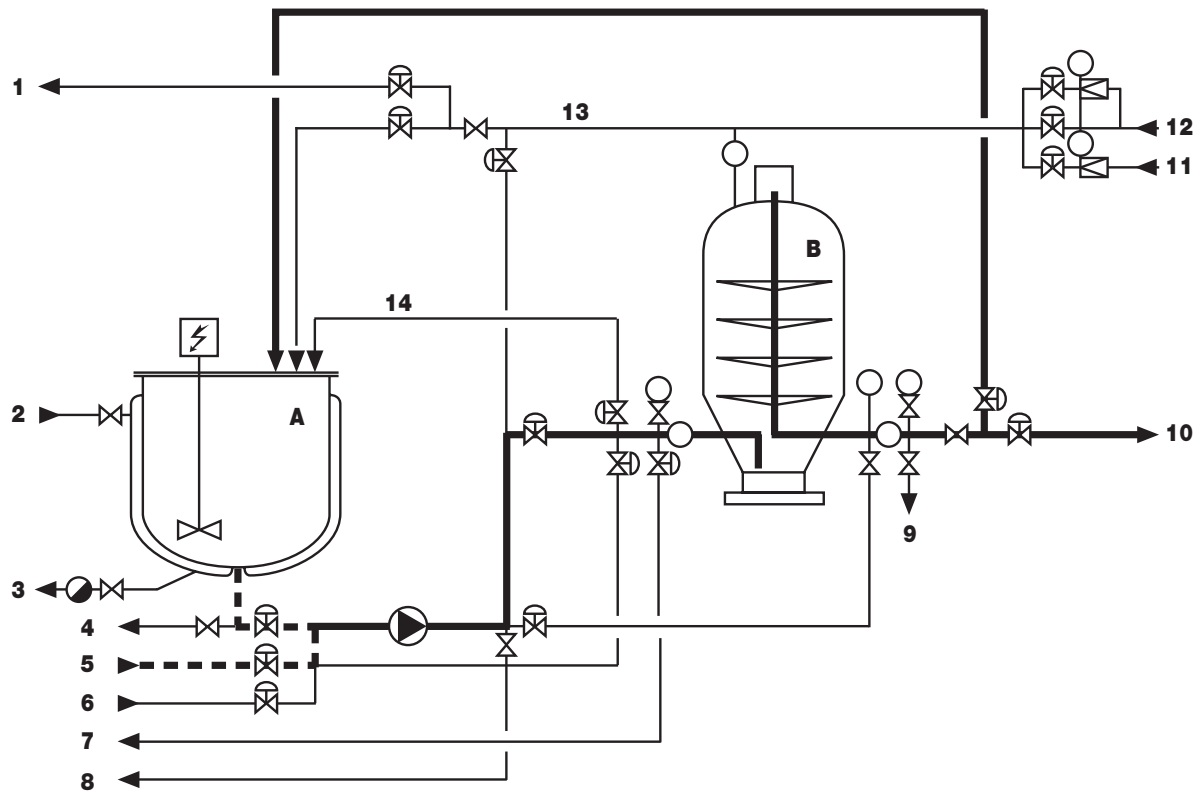
Description In many filtrations a precoat layer is build up on the support fabric to ensure the required filtration purity and to protect the fabrics.

The precoat suspension is delivered to the filter by a pump. A continuous overflow from the collector nozzle on the filter cover back to the feed/precoat tank avoids sedimentation of the solids. The filtrate flows through the filter plate to the hollow shaft, the bottom support/seal from where it is led back to the precoat tank through the filtrate pipe. The precoating time varies according to the application however, normally is approx. 20 minutes.

- Notes**
- To ensure equal dispersion of the solids in the filter always open the overflow to an extent that, considering the sedimentation speed of the solid, a buoyancy of approx. 20 ... 30 cm/min between the tank wall and the top filter plate is always guaranteed.
 - The feed between the pump and the filter should be opened entirely. All eventual flow controls are to be fitted in the filtrate pipe.
 - The filtrate pipe should be equipped with a restriction (manual valve/orifice plate) ensuring that the static height of the filter multiplied by the specific weight of the liquid plus approx. two meter in the filtrate pipe is exceeded. For example 0.5 bar. In case of a continuous flow control this restriction may be higher.
 - If a dosing is made in the filter system this should be started during the prefiltration process.



Test unit diagram R 0.2 m²



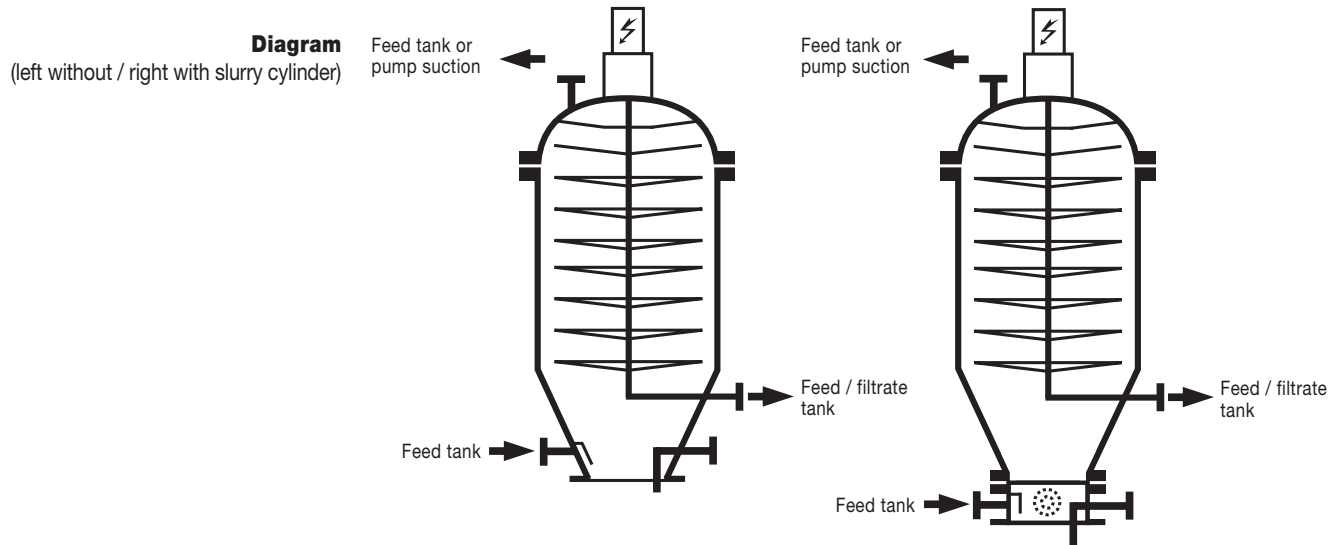
Legend

—	Flow	6	Washliquid
---	Option	7	Heel drain
A	Precoat tank	8	Drain
B	Filter	9	Samples
1	Overflow	10	Filtrate
2	Steam	11	Steam
3	Condensate	12	Compressed air
4	Drain	13	Venting
5	Feed	14	Heel drain



3 Prefiltration and filtration

Description



Description In this stage the solid is separated from the liquid, either by direct filtration through a fabric or through a precoat layer. For media that are difficult to filter an additional filter aid is used for dosing (bodyfeed).

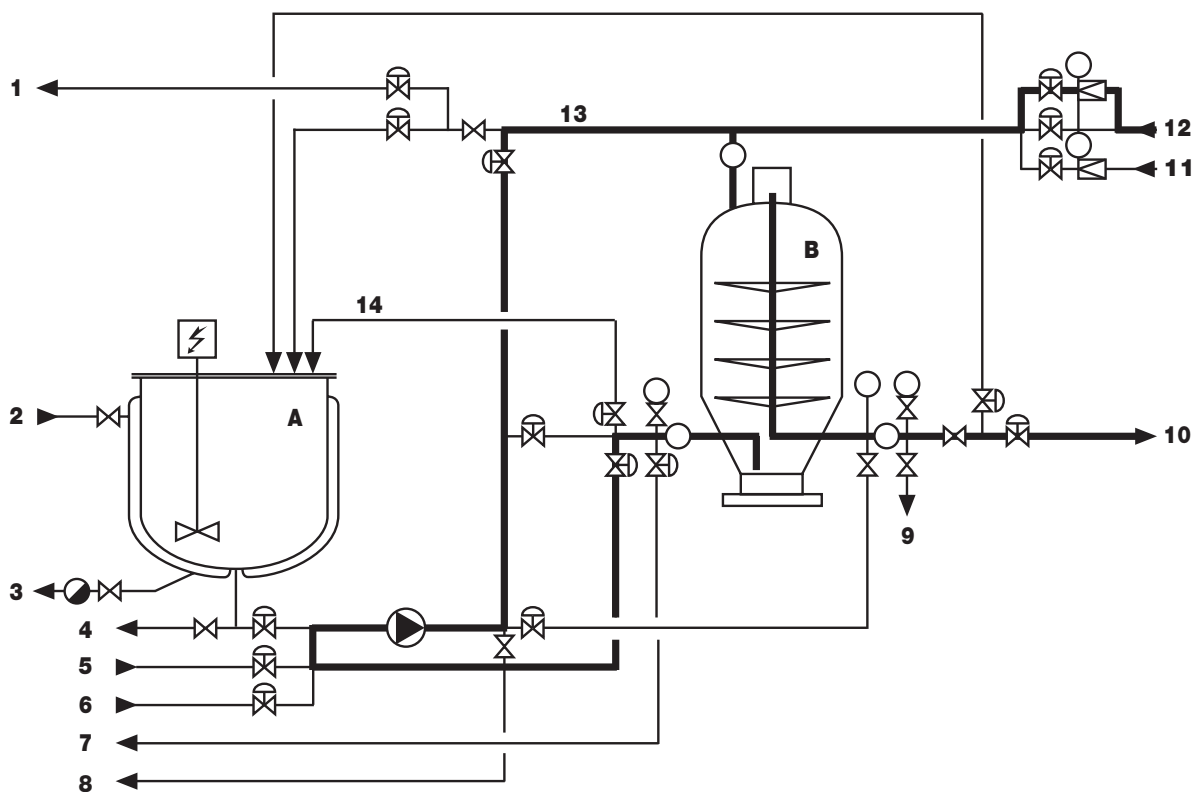
- Notes**
- Just like for the precoating an overflow back to the feed tank with the unfiltered liquid must be provided during the prefiltration and filtration, respectively. The overflow must be adjusted in a way that, considering the sedimentation speed of the solid, a buoyancy of approx. 20 ... 30 cm/min between the filter wall and the top filter plate is always guaranteed. This ensures equal dispersion of the solids in the filter.
 - In order to ensure an equal flow (filtration performance) at the bottom and top filter plate it is important to throttle the filtrate pipe at least to an extent that the static filter height multiplied by the specific weight of the liquid plus two meter is obtained. Approx. 0.5 bar or more. This adjustment ensures a proper cake dispersion which is important for the extraction and drying of the filter cake.
 - For filter systems with continuous flow regulations this must be made in the filtrate pipe.
 - In the event that the filter overflow can not be returned to the tank with the unfiltered liquid under no circumstances, the overflow may also be led to the suction side of the filtration pump.



4 Filtration of residual volume (Heel volume filtration)

Diagram

Test unit diagram R 0.2 m²



Legend

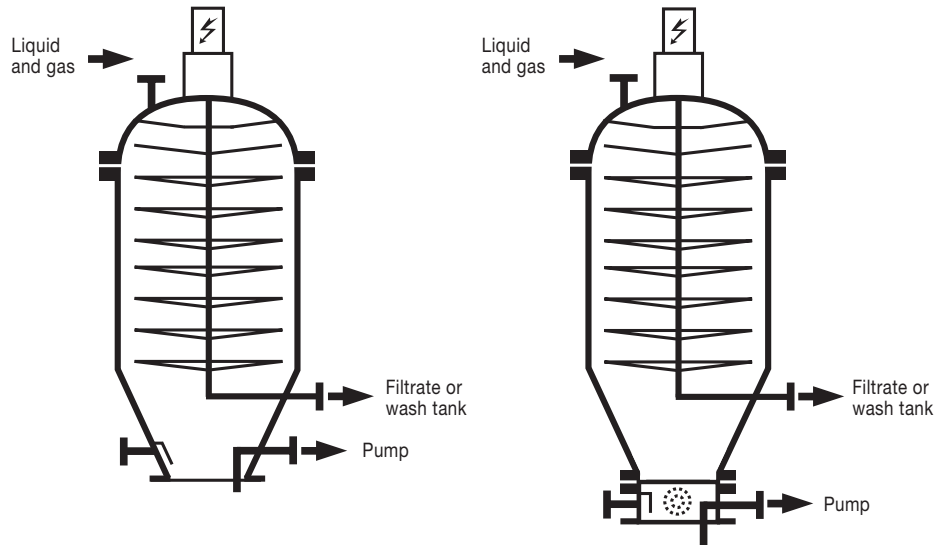
— Flow	6 Washliquid
--- Option	7 Heel drain
A Precoat tank	8 Drain
B Filter	9 Samples
1 Overflow	10 Filtrate
2 Steam	11 Steam
3 Condensate	12 Compressed air
4 Drain	13 Venting
5 Feed	14 Heel drain



4 Filtration of residual volume (Heel volume filtration)

Description

Diagram
(left without / right with slurry cylinder)



Description Especially for batch filtrations or when changing between different products the liquid remaining in the filter after filtration (or washing) must be filtered out in order to avoid losses or cross contaminations. For this purpose the CD filter uses the entire filter package. This allows an equal dispersion of the residual substance on all filter plates. The filter is pressurized with gas. The pressure depends on the cake resistance and must be employed individually, according to the product. The required amount of gas is:

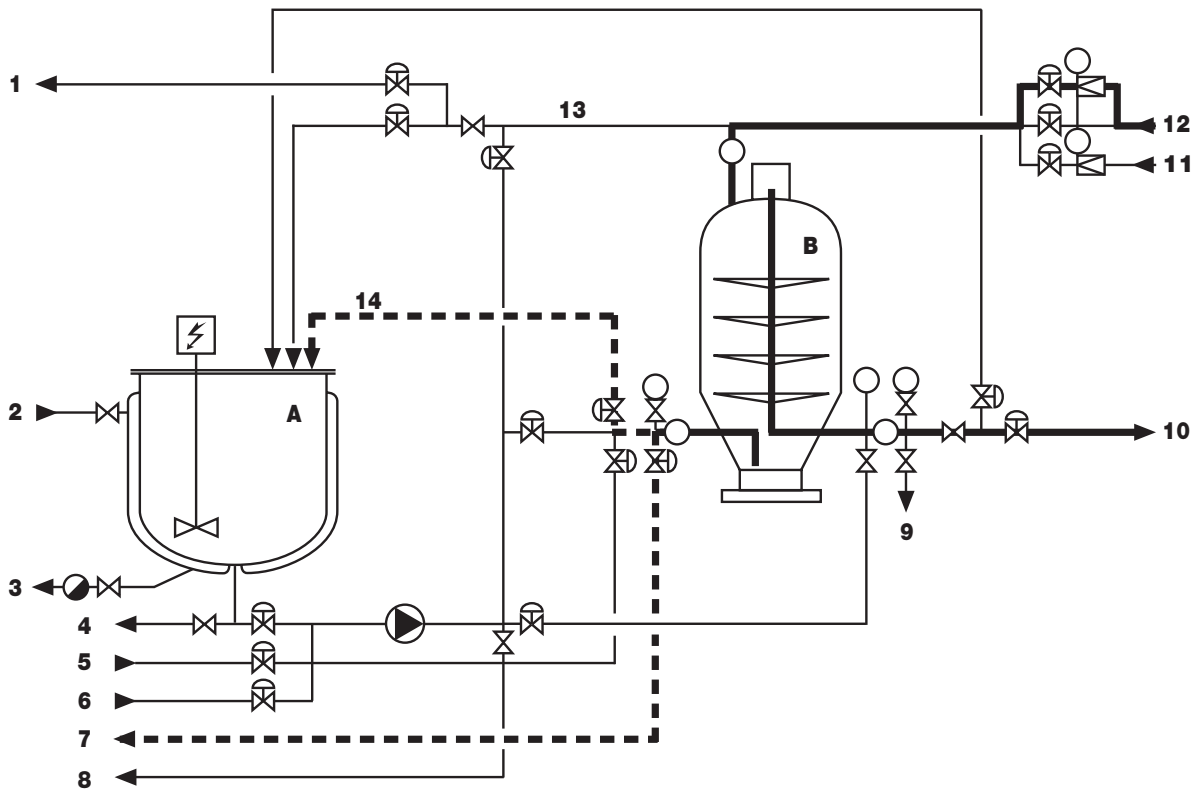
The displaced volume of liquid multiplied by the pressure.

Now, the liquid is recirculated by a pump to the collector pipe on the cover through the residual volume drain pipe located at the filter. The gas pressure in the filter causes part of the liquid to be pressed through the cake and leaves the filter as clarified filtrate. This extraction of liquid causes a decrease of the liquid level in the filter resulting in an increasing number of filter plates emerging from the liquid. The recirculation and the distributor plate in the filter ensure that the emerged filter plates are supplied with sufficient liquid at any time to prevent a gas leak. In such way the complete residual volume of the filter can be obtained as clarified filtrate.

- Notes**
- The filtrate pipe must be fitted with a separate pipe and valve equipped with an orifice plate, according to local requirements. This helps to prevent a gas leak. A gas leak would cause formation of cracks in the filter cake preventing subsequent clean extraction, washing, and drying of the cake.
 - See separate sheet for capacity.



Test unit diagram R 0.2 m²



Legend

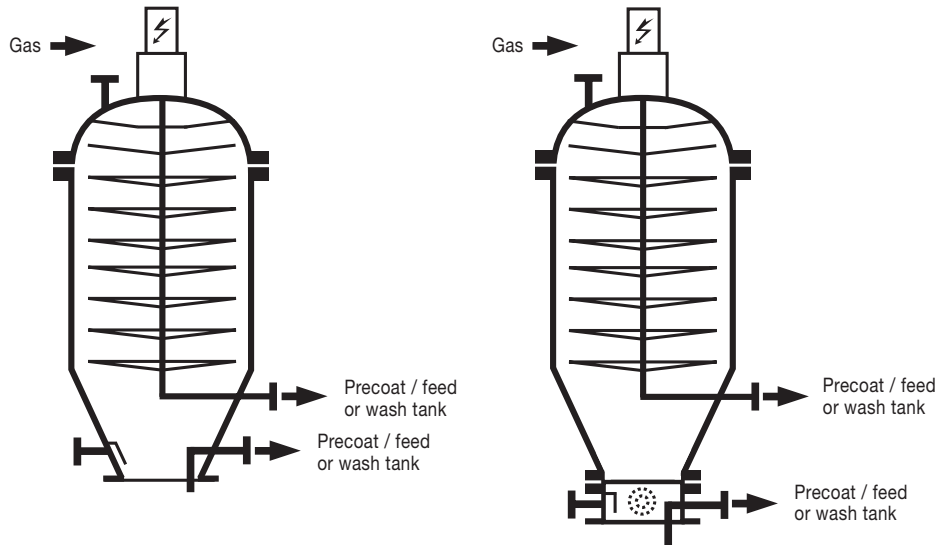
—	Flow	6	Washliquid
---	Option	7	Heel drain
A	Precoat tank	8	Drain
B	Filter	9	Samples
1	Overflow	10	Filtrate
2	Steam	11	Steam
3	Condensate	12	Compressed air
4	Drain	13	Venting
5	Feed	14	Heel drain



5 Drainage

Description

Diagram
(left without / right with slurry cylinder)



Description In certain cases the residual filter volume must be returned to the corresponding receiving feed tank at the end of a programme step. This can be realized either by:

- a) Gravity drainage or
- b) Gas pressure drainage.

In both cases it must be ensured that the filter cake is not washed away. Ensure that the liquid level decreases equally in the hollow shaft and the tank. For this purpose the clarification pipe must be equipped with a bypass with an orifice plate. The filter drainage requires only a minor gas volume and a pressure depending on the cake resistance.

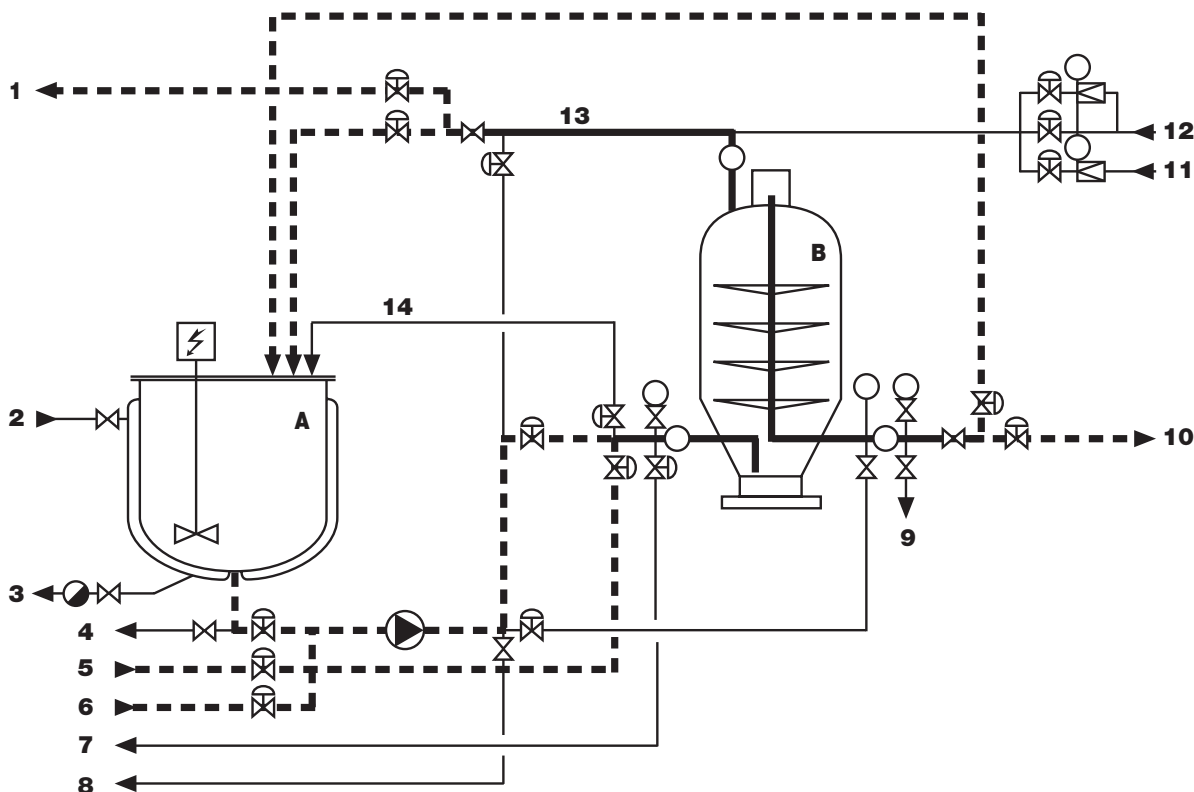
- Notes**
- Provide orifice plates in the clarification pipe bypass and in the drainage pipe.
 - Empty filter slowly, guide values: 3 ... 10 minutes.



6 Filling the filter with residues on the filter plates

Diagram

Test unit diagram R 0.2 m²



Legend

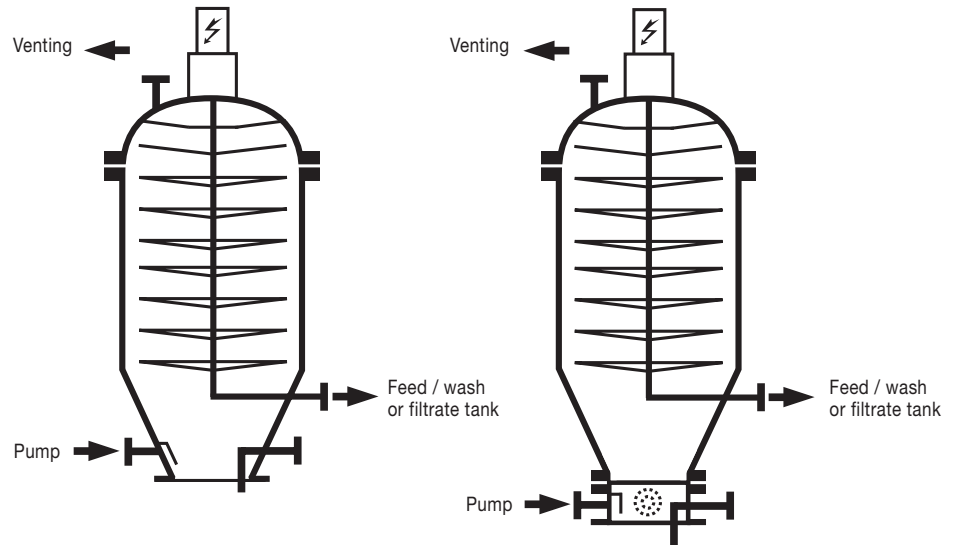
— Flow	6 Washliquid
--- Option	7 Heel drain
A Precoat tank	8 Drain
B Filter	9 Samples
1 Overflow	10 Filtrate
2 Steam	11 Steam
3 Condensate	12 Compressed air
4 Drain	13 Venting
5 Feed	14 Heel drain



6 Filling the filter with residues on the filter plates

Description

Diagram
(left without / right with slurry cylinder)

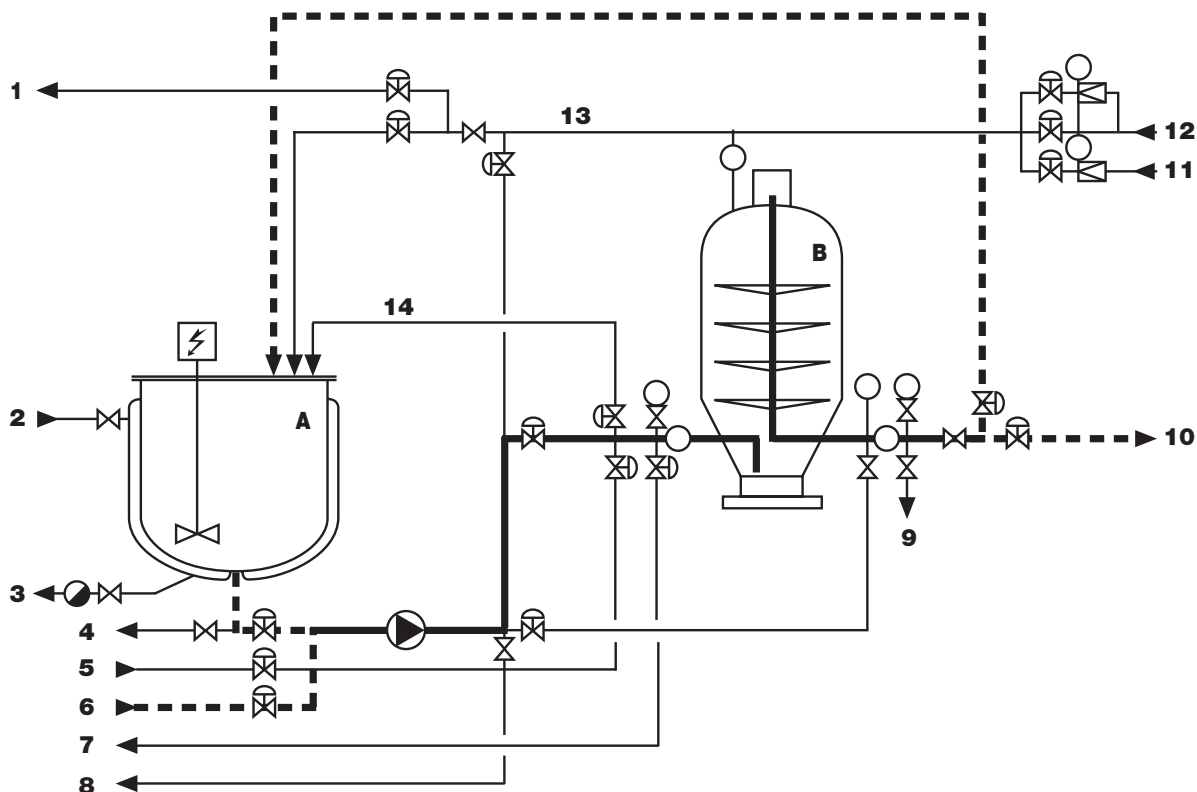


Description In this case the liquid must be drained prior to the next process step.

- Notes**
- Fill the filter with reduced capacity in order to avoid major turbulent flow which could wash away the filter cake at the edge of the plate.
 - The ventilation required is only small. A minor pressure in the filter is favourable as it ensures a small flow in the direction of the clarification pipe and prevents the cake from being washed away. Ventilation of the filter is required in order to avoid an eventual gas leak by the filter cake which would affect the subsequent washing and drying of the filter cake.
 - The clarification pipe must be opened when refilling the filter in order to prevent the cake from being washed away. If, for example, the filtrate pipe leads to the top for 12 meters the filter ventilation must be throttled in a way that this static height is compensated and a flow in the direction of the clarification pipe is still ensured. Hence, a pressure of 1.5 bar times the specific weight of the liquid is required. An additional throttled valve (orifice plate) may be required in addition.
 - For filtrate pipes that run straight up a return valve must be fitted as close to the filter as possible. This has the effect to prevent a return when the valve is opened.



Test unit diagram R 0.2 m²



Legend

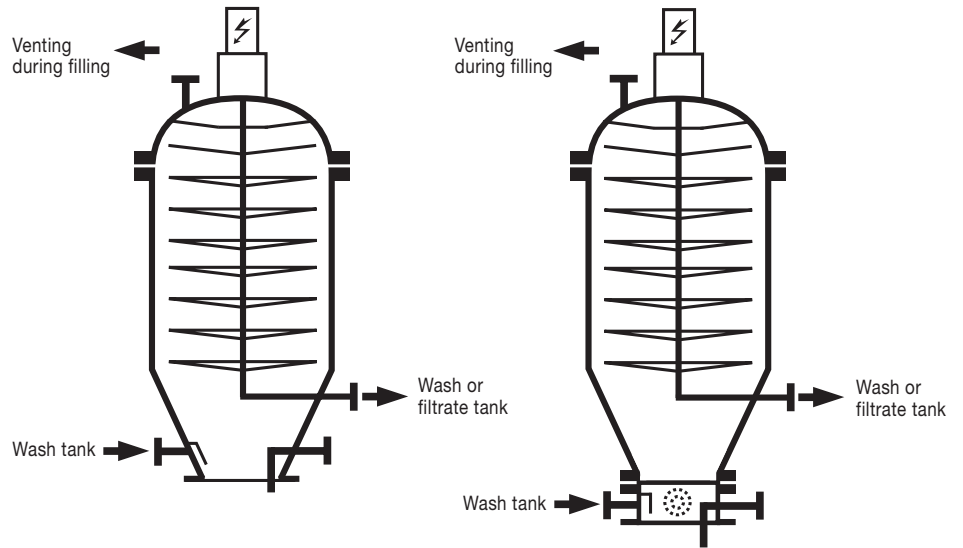
— Flow	6 Washliquid
--- Option	7 Heel drain
A Precoat tank	8 Drain
B Filter	9 Samples
1 Overflow	10 Filtrate
2 Steam	11 Steam
3 Condensate	12 Compressed air
4 Drain	13 Venting
5 Feed	14 Heel drain



7 Washing the cake

Description

Diagram
(left without / right with slurry cylinder)

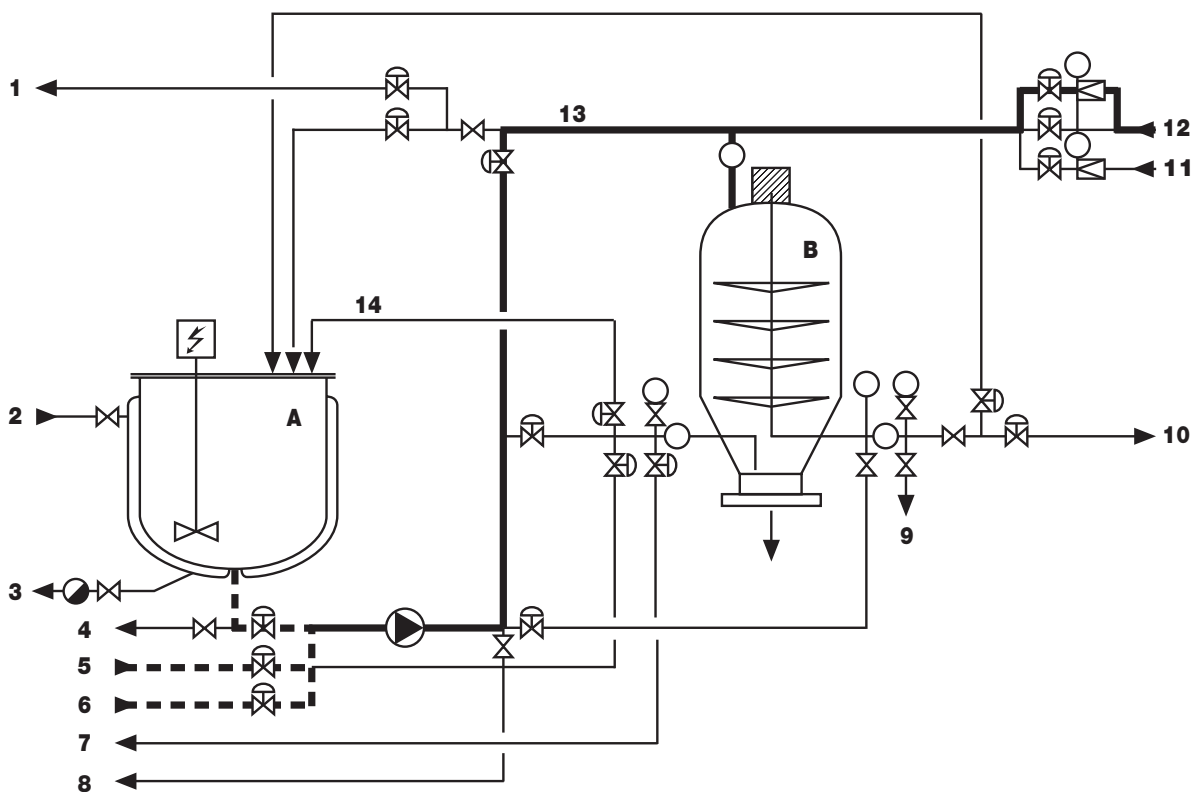


Description After filling the filter the cake is washed on the filtration way. This is the easiest and best procedure for washing the cake and should normally be employed.

- Note**
- Optimal washing of the cake is subject to an equal flow through the filter cake of all filter plates. Hence, the filtrate pipe must be throttled in a way that a back pressure is obtained reaching at least the static height of the filter multiplied by the specific weight of the liquid plus 2 m WS, approx. 0.5 bar or more.



Test unit diagram R 0.2 m²



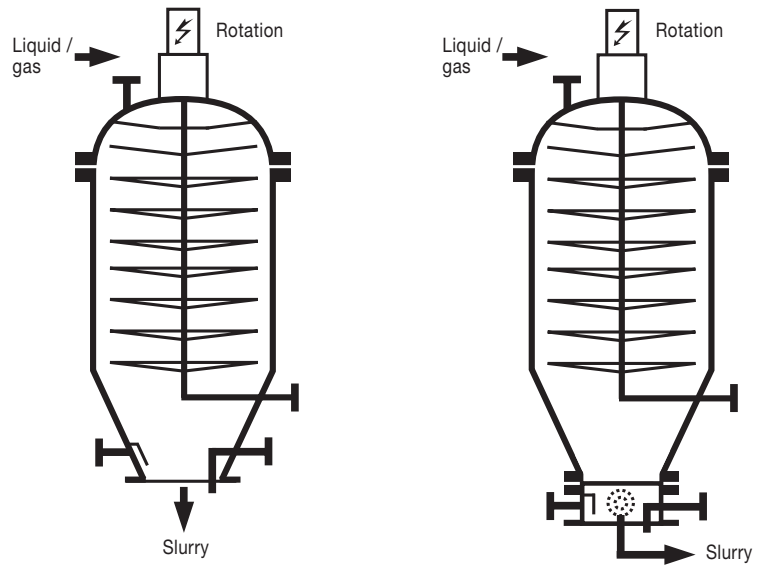
Legend

—	Flow	6	Washliquid
---	Option	7	Heel drain
A	Precoat tank	8	Drain
B	Filter	9	Samples
1	Overflow	10	Filtrate
2	Steam	11	Steam
3	Condensate	12	Compressed air
4	Drain	13	Venting
5	Feed	14	Heel drain

8 Discharging slurry

Description

Diagram
(left without / right with slurry cylinder)



Description At the end of the filtration cycle the filter cake shall be discharged as slurry. The liquid is added through the collector nozzle on the filter cover. Just like for the residual volume filtration the liquid flows cascade-like over the filter plates, due to their cone shape, maintaining a liquid level on the cake. As soon as liquid leaves the filter on the bottom the rotation of the filter package can be started. The cake is now centrifuged to the filter wall and rinsed by the liquid to the bottom of the filter. The subsequently flowing liquid washes the solid from the filter walls. The primed gas pressure causes the resulting slurry to be pressed out of the filter through the discharge pipe.

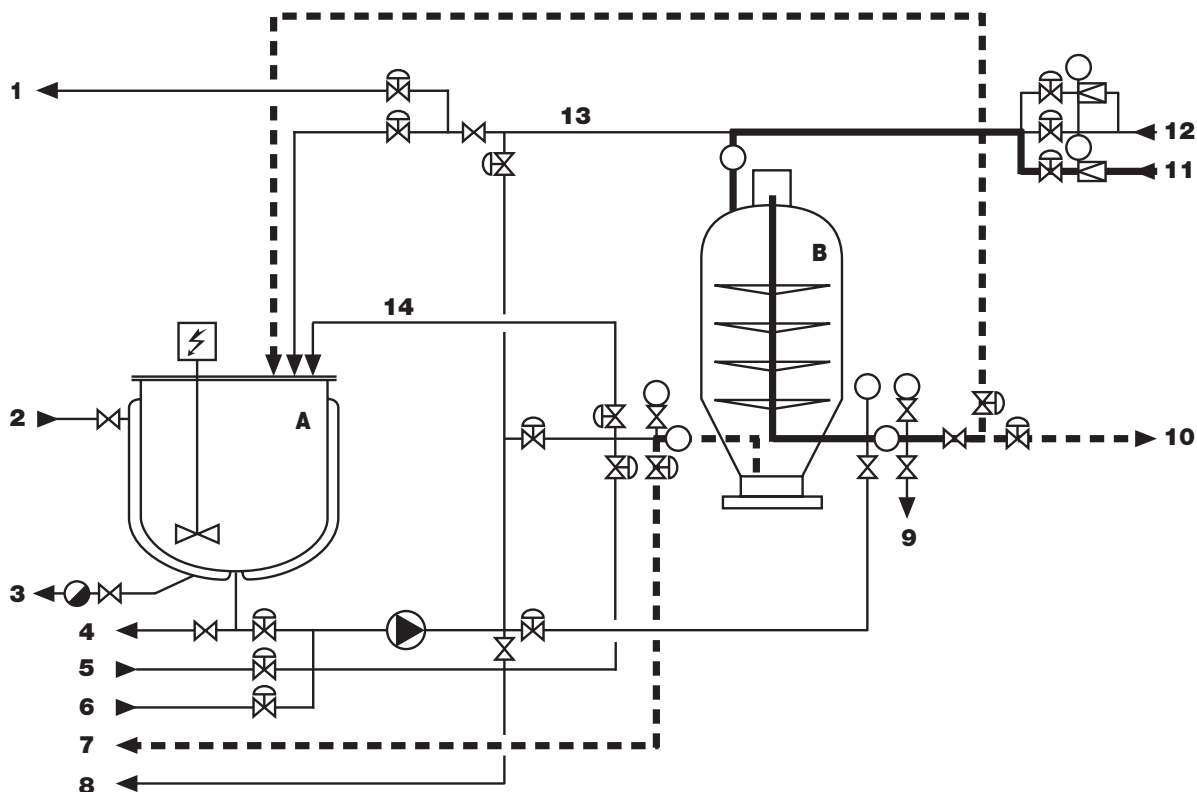
- Notes**
- Rotation up to maximum speed or for a maximum of 30 seconds.
 - The procedure can be repeated several times.
 - The filter must not be operated at high speed for more than 20 seconds.



9 Cake drying or extraction over collector nozzle with saturated steam

Diagram

Test unit diagram R 0.2 m²



Legend

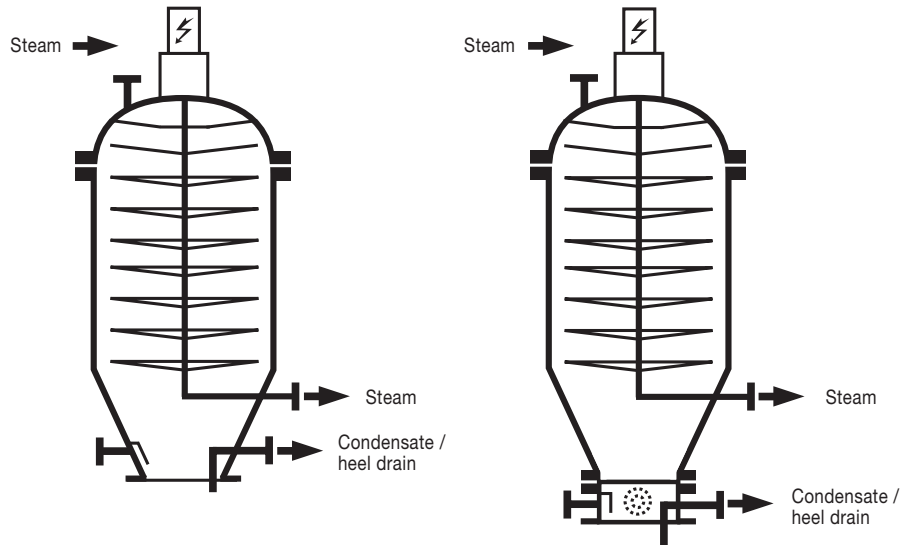
—	Flow	6	Washliquid
---	Option	7	Heel drain
A	Precoat tank	8	Drain
B	Filter	9	Samples
1	Overflow	10	Filtrate
2	Steam	11	Steam
3	Condensate	12	Compressed air
4	Drain	13	Venting
5	Feed	14	Heel drain



9 Cake drying or extraction over collector nozzle with saturated steam

Description

Diagram
(left without / right with slurry cylinder)



Description At the end of the filtration steam/gas or a combination of both can be used to dry the filter cake. At the same time a cake extraction may occur by the saturated steam. When drying the cake a distinction is made between two stages:

- a) Displacement of the residual liquid in the cake. The required gas volume is low but the pressure is high (filtration end pressure)
- b) The actual drying for evaporation of the liquid attached to the solid particulates.

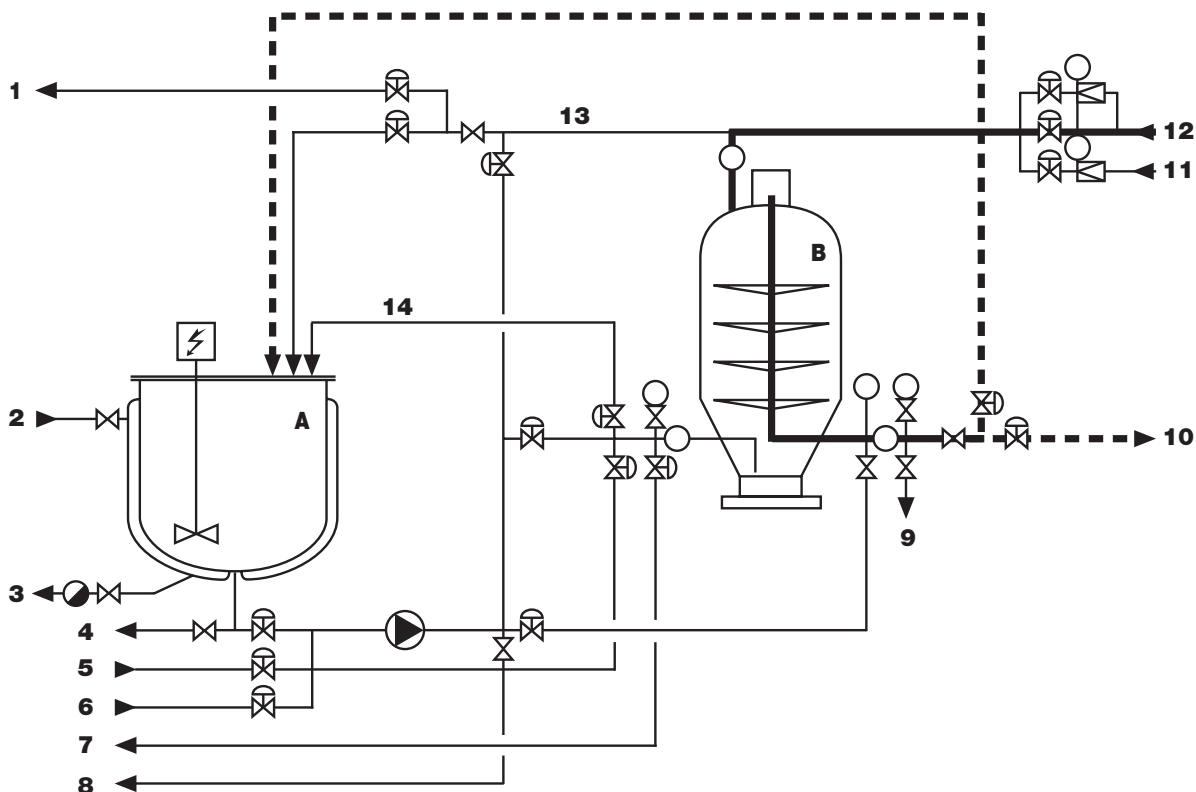
- Notes**
- To ensure that the cake is warmed up equally, warm up the filter tank first, i.e. open the residual volume exit pipe in the initial stage to allow the condensate to drain off.
 - Before completion of the drying procedure the condensate must be drained in order to prevent that several litres of liquid leave the filter when discharging the solids.



10 Cake drying with gas over collector nozzle

Diagram

Test unit diagram R 0.2 m²



Legend

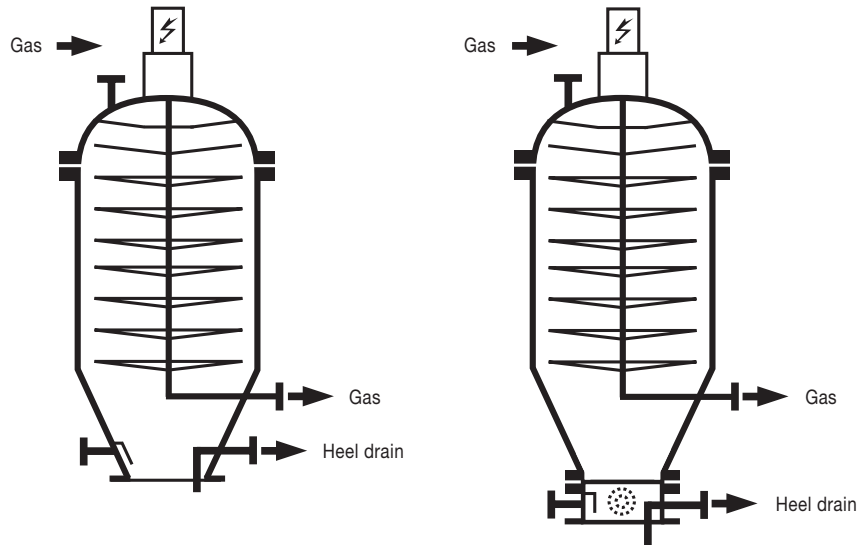
—	Flow	6	Washliquid
---	Option	7	Heel drain
A	Precoat tank	8	Drain
B	Filter	9	Samples
1	Overflow	10	Filtrate
2	Steam	11	Steam
3	Condensate	12	Compressed air
4	Drain	13	Venting
5	Feed	14	Heel drain



10 Cake drying with gas over collector nozzle

Description

Diagram
(left without / right with slurry cylinder)



Description After the filtration gas can be used to dry the filter cake. When drying the cake a distinction is made between two stages:

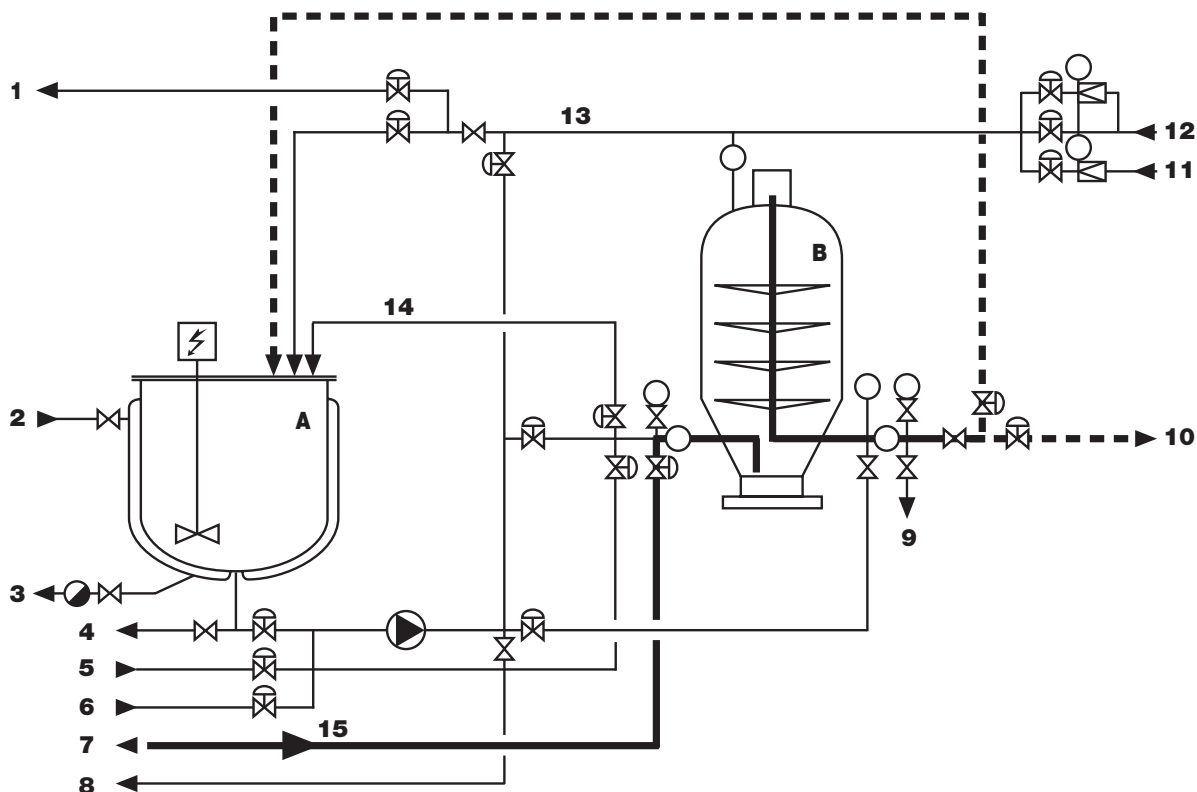
- a) Displacement of the residual liquid in the cake. The required gas volume is low but the pressure is high (filtration end pressure).
- b) The actual drying for evaporation of the liquid attached to the solid particulates.

- Notes**
- To ensure optimal drying of the cake it is important that the gas expands in the filter cake and not outside of it.
 - This means that build-up of any back pressure at the filter exit due to too small pipes or valves must be avoided.
 - Before completion of the drying procedure the residual liquid (condensate) must be drained on the bottom of the filter via the residual volume drain pipes in order to prevent that several litres of liquid leave the filter when discharging the solids.



11 Cake drying with saturated steam or with gas and extraction with saturated steam over the heel nozzle

Test unit diagram R 0.2 m²

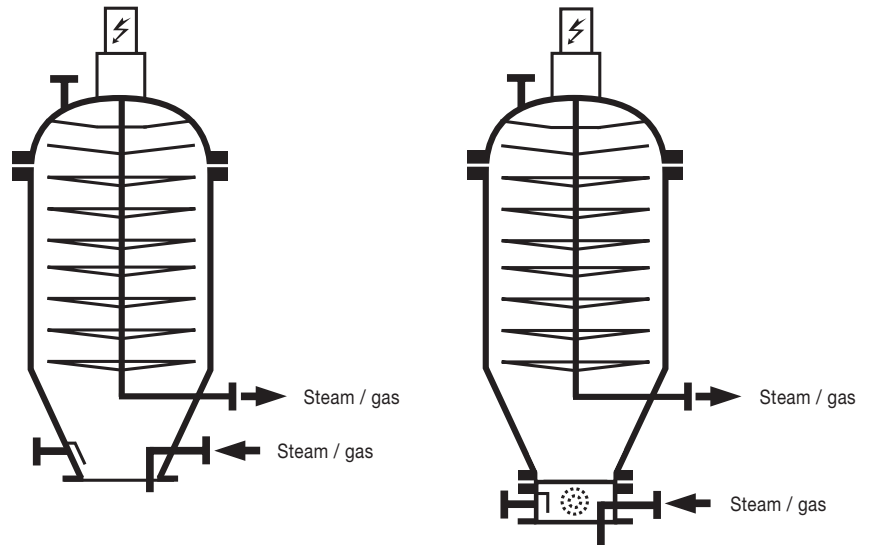


Legend

—	Flow	6	Washliquid
---	Option	7	Heel drain
A	Precoat tank	8	Drain
B	Filter	9	Samples
1	Overflow	10	Filtrate
2	Steam	11	Steam
3	Condensate	12	Compressed air
4	Drain	13	Venting
5	Feed	14	Heel drain
		15	Steam or gas

11 Cake drying with saturated steam or with gas and extraction with saturated steam over the heel nozzle

Diagram
(left without / right with slurry cylinder)



Description At the end of the filtration steam/gas or a combination of both can be used to dry the filter cake.

In case of toxic agents that must not enter the drain the filter feed is used from the bottom. In this case the residual liquid is entrained with the steam or the drying air (gas). This system is also used to avoid the loss of expensive residues such as catalyst.

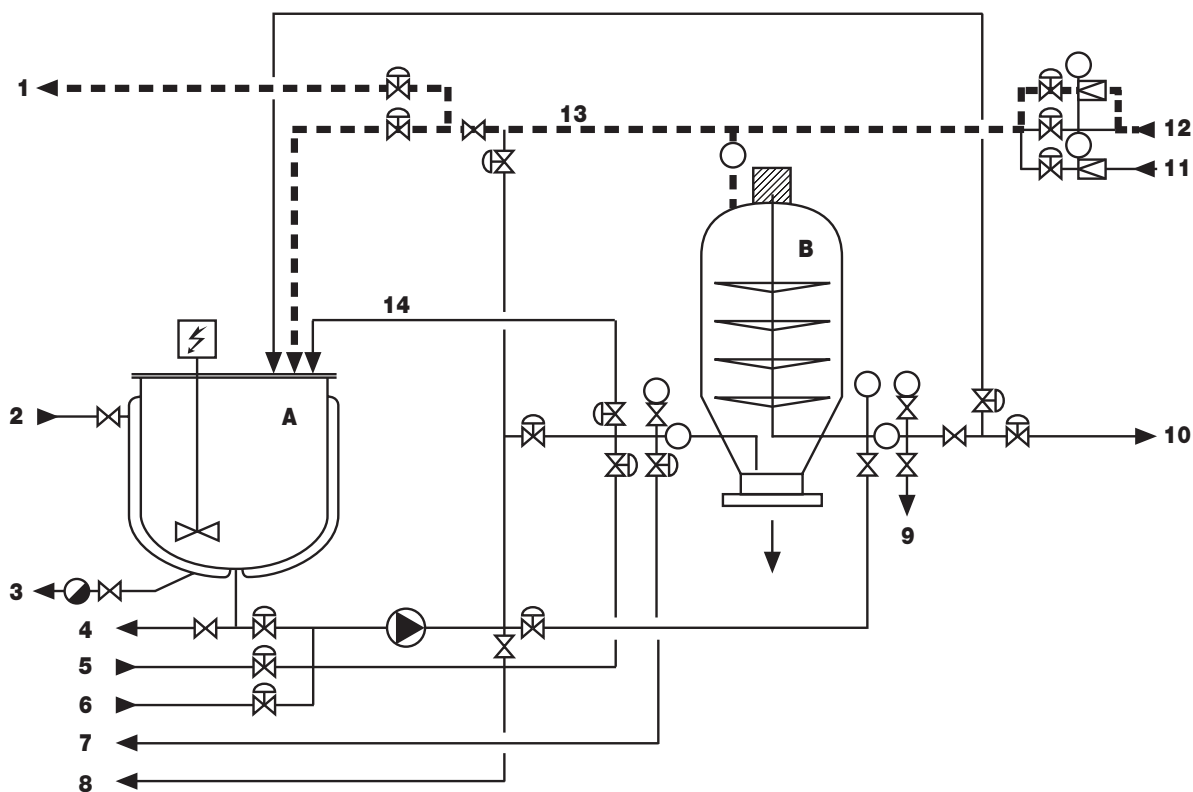
- Notes**
- To ensure optimal drying of the cake it is important that the gas expands in the filter cake and not outside of it.
 - This means that build-up of any back pressure at the filter exit due to too small pipes or valves must be avoided.



12 Discharging the dry cake

Diagram

Test unit diagram R 0.2 m²



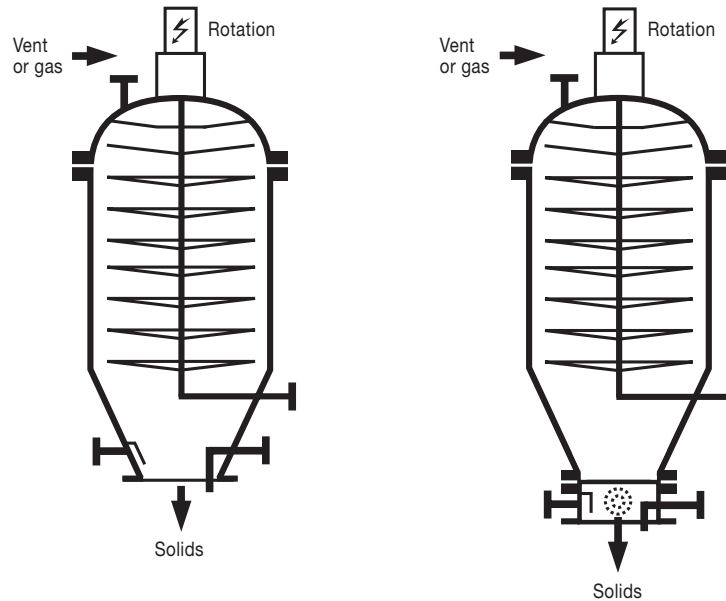
Legend

—	Flow	6	Washliquid
---	Option	7	Heel drain
A	Precoat tank	8	Drain
B	Filter	9	Samples
1	Overflow	10	Filtrate
2	Steam	11	Steam
3	Condensate	12	Compressed air
4	Drain	13	Venting
5	Feed	14	Heel drain

12 Discharging the dry cake

Description

Diagram
(left without / right with slurry cylinder)



Description At the end of the filter cycle the cake is to be discharged as dry substance. The rotation of the filter package generates a centrifugal force. This causes the cake to be centrifuged to the outside. The gravitation causes the solid substance to fall down between the plate edge and the filter tank wall. The cone in the bottom part of the filter allows the solid substance to exit the filter tank in free fall and to fall in the receptacle provided.

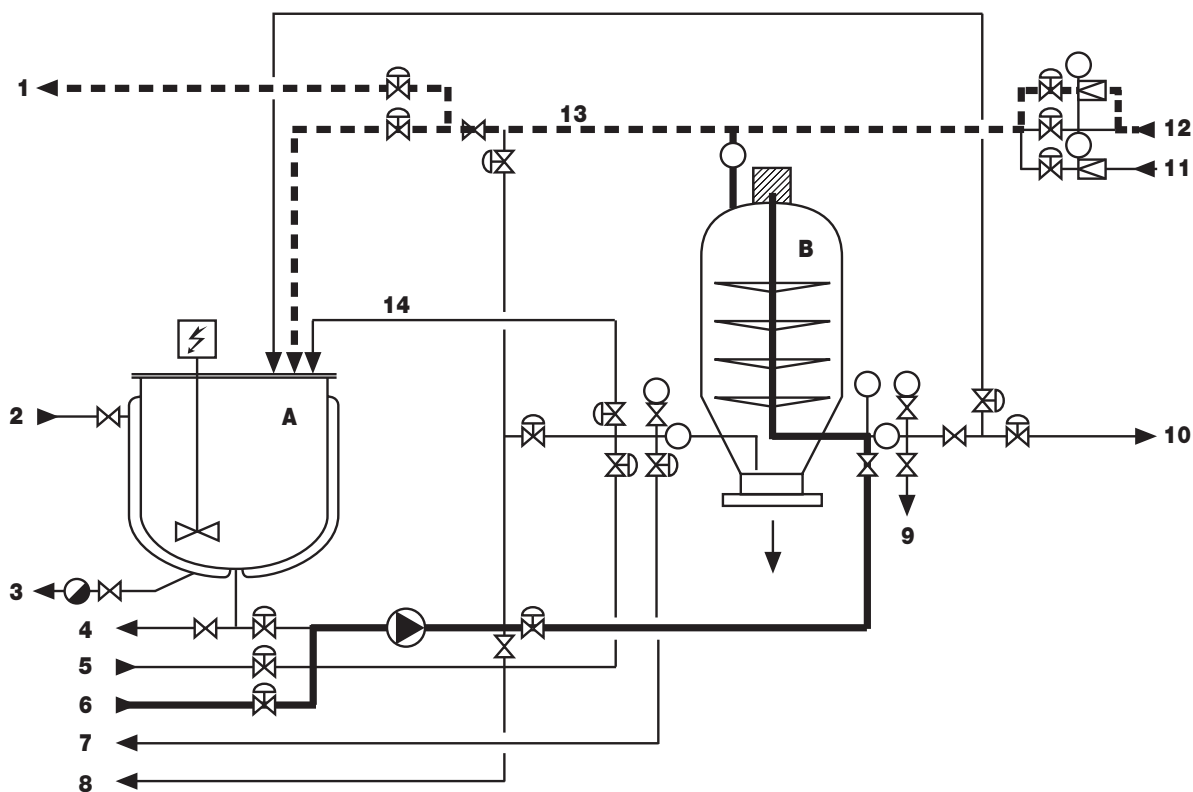
- Notes**
- The filter **must** be vented through the residual volume pipe in the filter cone before the residual valve is opened. (Condensate discharge drainage).
 - The residual valve must be opened completely **before** start of the rotation. It is recommended to protect the filter motor by an end contact at the residual gate (damper).
 - The ventilation in the filter lid must be opened completely during discharge of the cake or gas must be supplied to prevent a momentary vacuum in the filter (piston effect).
 - Rotating the filter package up to full speed is enough.
 - The filter must not be operated at high speed for more than 20 seconds.



13 Cleaning the fabric by backwashing

Diagram

Test unit diagram R 0.2 m²



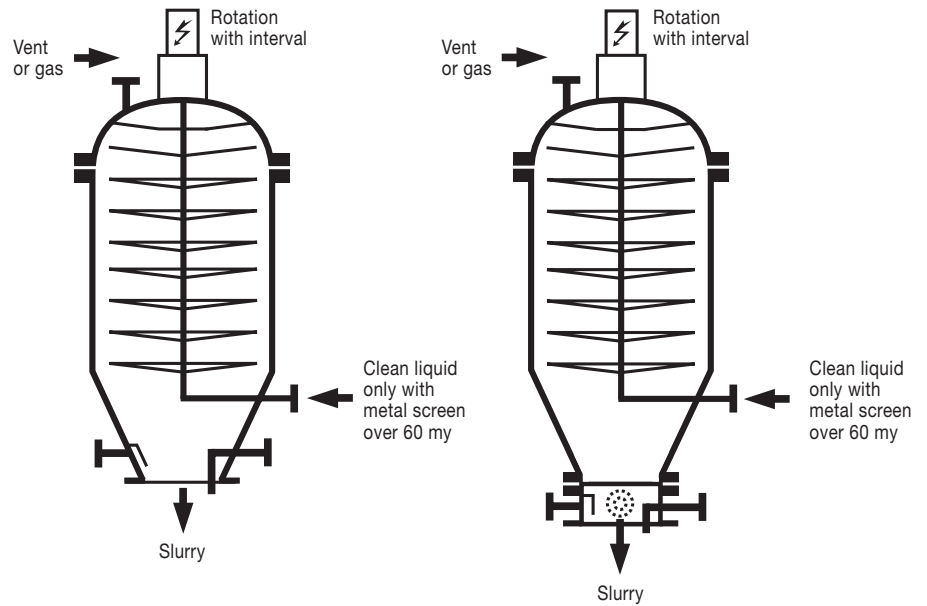
Legend

—	Flow	6	Washliquid
---	Option	7	Heel drain
A	Precoat tank	8	Drain
B	Filter	9	Samples
1	Overflow	10	Filtrate
2	Steam	11	Steam
3	Condensate	12	Compressed air
4	Drain	13	Venting
5	Feed	14	Heel drain

13 Cleaning the fabric by backwashing

Description

Diagram
(left without / right with slurry cylinder)



Description In case of eventual blockage of the fabrics they can be cleaned by backwashing with clean liquid in most cases. Departing from the filtrate pipe, clean liquid is washed through the filter system after the residual valve has been opened. Wait until the backwash liquid has left the residual valve for approx. 10 seconds and then turn filter package. The liquid is pressed through the fabric by the centrifugal force leaching out and washing away the particulates ingressed into the fabric from the top.

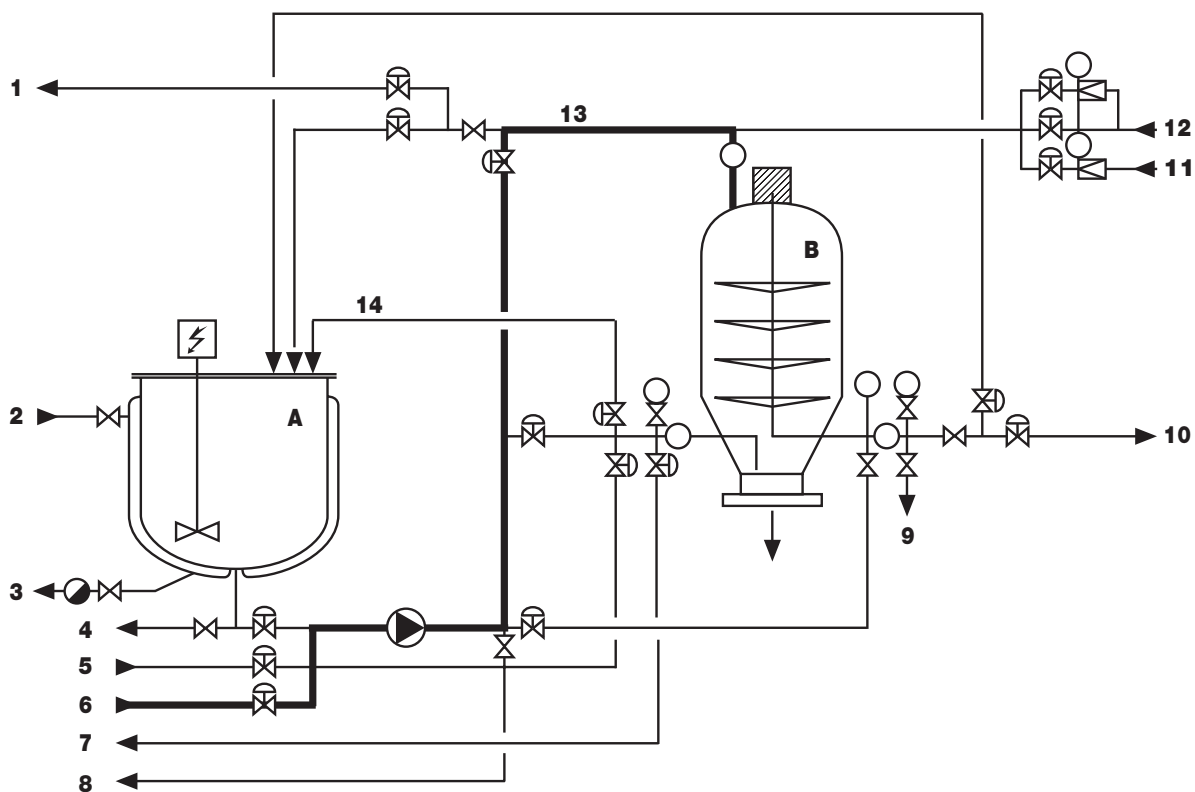
- Notes**
- Only use entirely clean liquid.
 - Backwashing is only allowed for metal fabrics with a mesh width of 60 my and above.
 - Maximum pressure at the filter pipe 0.3 to 0.8 bar, according to filter size.
 - Liquid volume approx. 30 liter/m² minute.
 - For best backwashing results a gravity tank is used. If a pump is used for backwashing a stand pipe should be provided to avoid overpressure.
 - The filter ventilation must be opened.



14 Washing the filter

Diagram

Test unit diagram R 0.2 m²



Legend

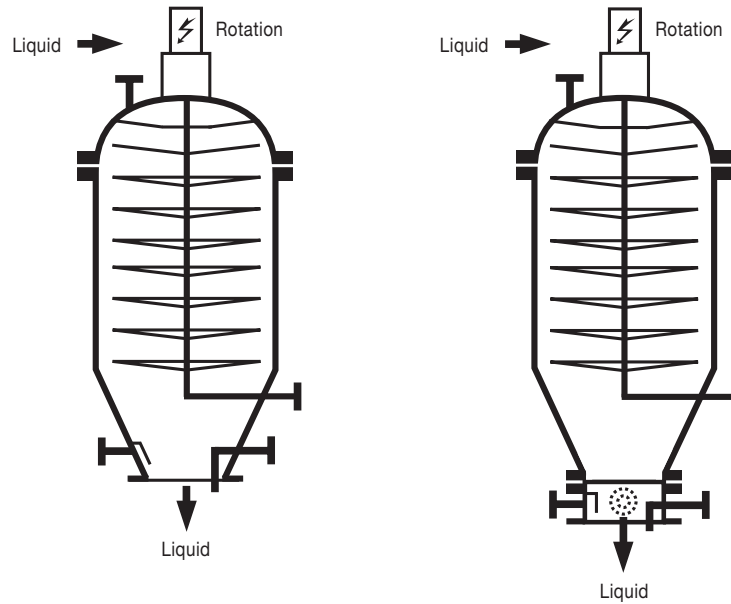
— Flow	6 Washliquid
--- Option	7 Heel drain
A Precoat tank	8 Drain
B Filter	9 Samples
1 Overflow	10 Filtrate
2 Steam	11 Steam
3 Condensate	12 Compressed air
4 Drain	13 Venting
5 Feed	14 Heel drain



14 Washing the filter

Description

Diagram
(left without / right with slurry cylinder)



Description In many cases one filter is used for filtering various products. In order to avoid contamination between individual products the filter can be washed as follows. Open the residual valve and add washing liquid through the collector pipe. The liquid will now flow from plate to plate (cascade) and wet them all. Ten seconds after the washing liquid started entering the residual valve the filter package is put into rotation. The liquid accumulated on the plates will now spray in all corners, just like a washing machine, washing the filter clean. The procedure can be repeated as many times as required.

- Notes**
- The filter package should not be rotated for more than 20 seconds.
 - The filter ventilation must be opened.



**Operating manual
CD-Filter**

BA • en • v2.0 • 03.2008

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