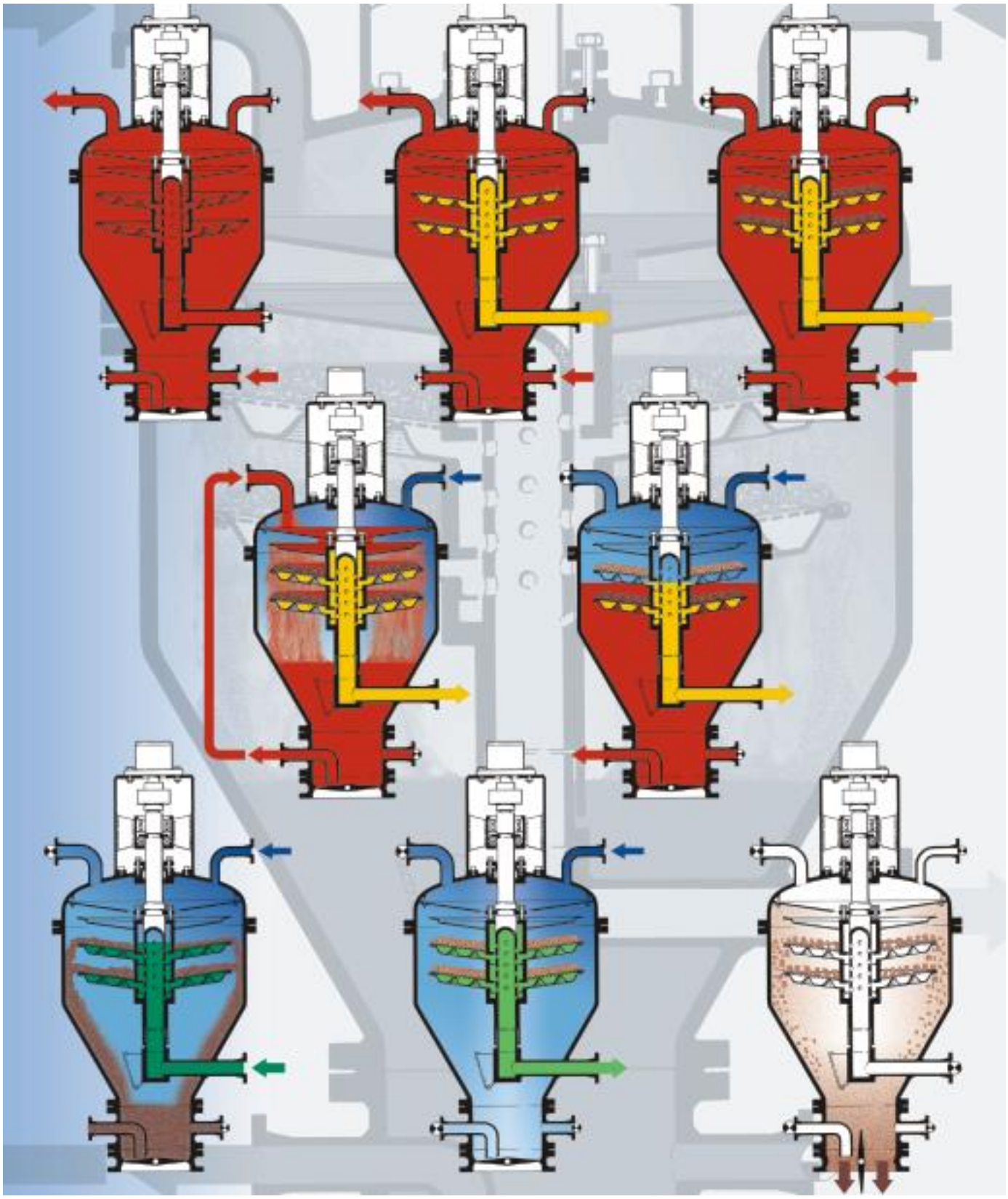
Process Discription Chemap®-Filter



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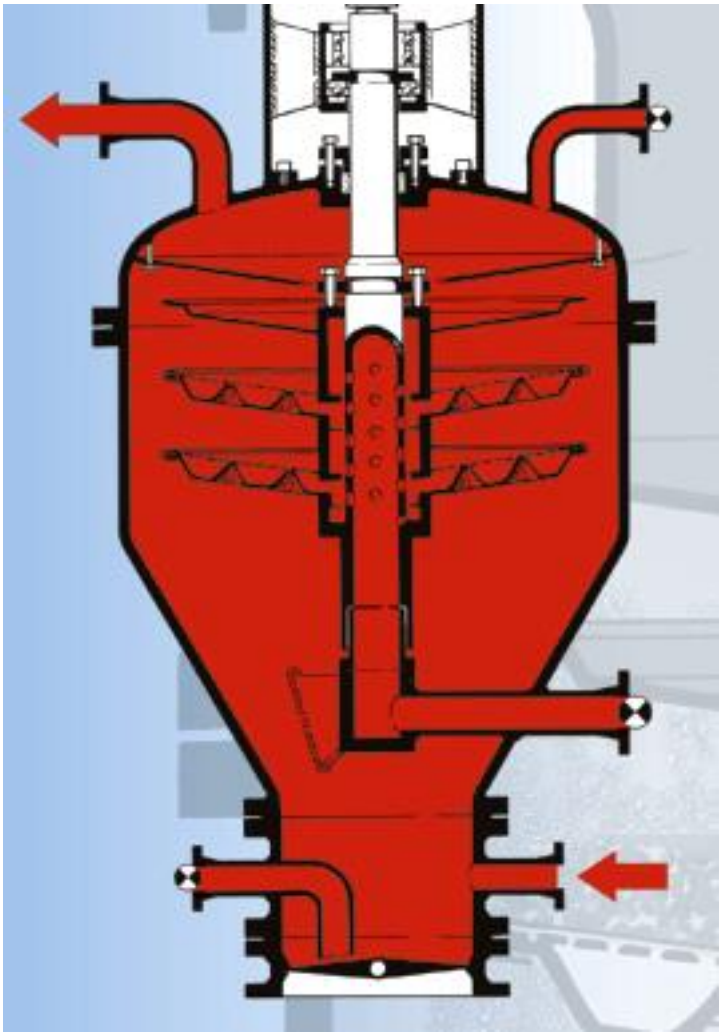
Design and manufacturing of Chemap®-Filters and complete filtration units – Spare parts for Chemap®-Filters – Enlarging of filtration area and modifications on existing Chemap®-Filters – Test filtrations and renting of Chemap® -Filter test units – Engineering and consulting.

Table of contents

Filling of the filter without solids on the filter plates



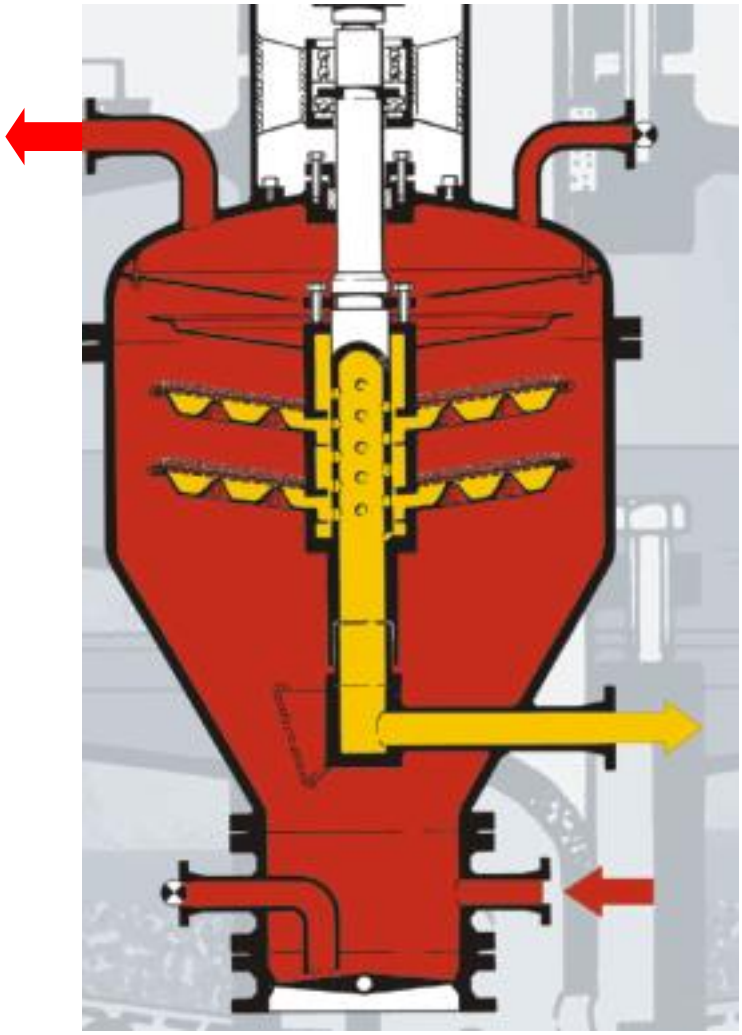
Description

The filter is filled by way of a pump and the gas phase is pushed back to the feed tank by way of the collector nozzle on the filter head. Once the filter is full, the product flows back to the feed tank by way of the collector nozzle. A circulation is established: feed vessel - pump - filter - feed vessel. This circulation is necessary to arrive at a homogeneous distribution of the solids in the feed solution. Timespan of this homogenization is 5 - 15 minutes, depending on the local situation.

Remarks

- A centrifugal pump has to be throttled if it is employed against an open system. The pump will otherwise run away. This overloads its motor and it will burn out its fuses.
- Before activating the pump motor, make sure that on its suction side, the valves are open so that it gets full flow.
- The overflow from the filter entering the feed vessel has to be turned against the wall, to avoid entrainment of gas into the liquid from splashing which leads to pump cavitation.

Precoating



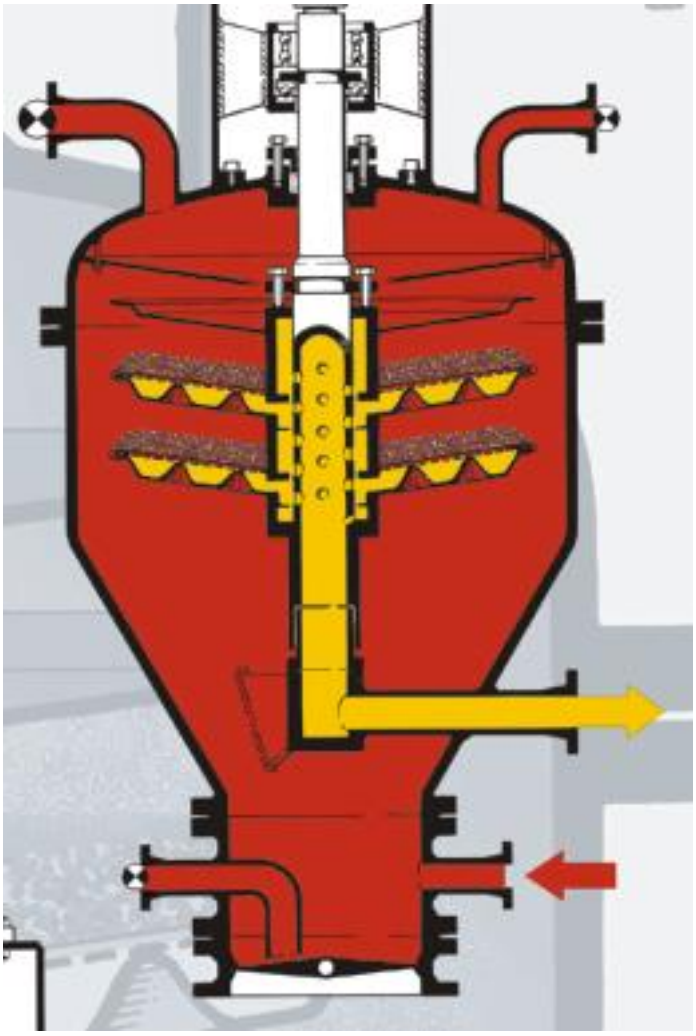
Description

In many filtrations, a precoat is used on a supporting screen to achieve the desired filtrate clarity and to protect the filter screen from contamination. From the precoat tank, the precoat solution is fed with a pump to the filter. A constant overflow from the collector nozzle in the filter cover to the precoat tank counteracts any sedimentation within the filter. The filtrate flows through the filter plates into the hollow shaft and from there through the lower bearing and seal arrangement back to the precoat tank. The precoating varies from application to application, but normally is approximately 20 minutes.

Remarks

- To assure an even solids distribution in the filter, the overflow has to be always proportionally open so as to counteract any sedimentation within the filter. An upward flow between the vessel wall and the topmost filter plate of 20-30 cm per minute is required.
- The flow between the feed vessel and the pump should have no obstruction. Any flow regulation has to be done in the filtrate line.
- The filtrate line has to have a restriction (hand valve or orifice plate) to assure a pressure equal to the filters height multiplied by the liquids specific weight, plus 2 meters. For instance, 0.5 bar. This restriction can, however, as in the case of a constant flow regulation, produce a higher pressure.
- If a bodyfeed is foreseen during filtration, this should be started during prefiltration.

Prefiltration and Filtration



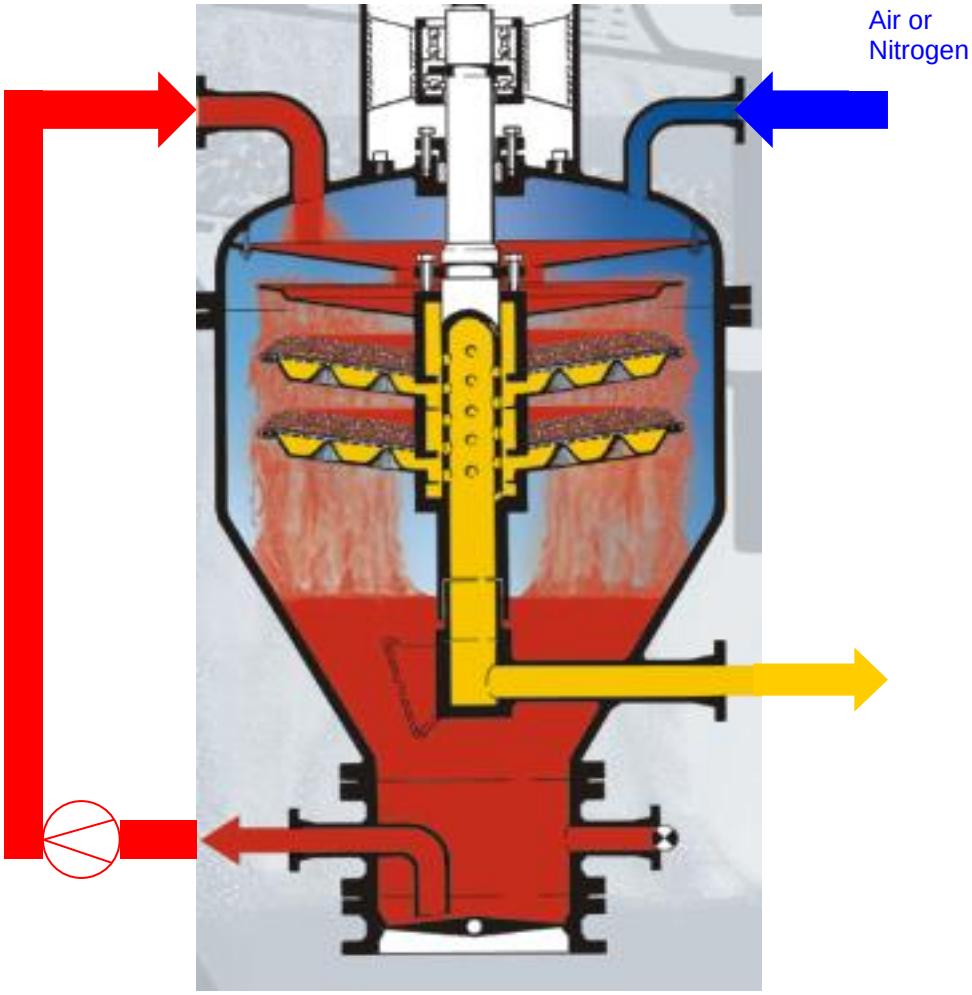
Description

In this step, the solids are separated from the liquid either by direct filtration over a suitable filterscreen (cloth), or over a precoat layer. For difficult – to - filter products, a bodyfeed is used.

Remarks

- As during precoating, also during prefiltration and filtration, an overflow is required back to the feed tank. The overflow has to be adjusted under consideration of the solids sedimentation that an upward flow of between 20 to 30 cm/min. at the uppermost filter plate is achieved. This assures an even distribution of solids within the whole filter.
- To assure an equal flowrate between the topmost and the bottom plate, it is important to throttle the filtrate flow at least so much to achieve a pressure in the filtrate line equal to the static filter height multiplied by the liquids specific weight plus 2 meter, approximately, 0.5 bar or more. This regulation assures an equal solids deposition on all plates which is very important for the subsequent cake washing and cake drying.
- Filtrations using constant flow regulations have to be regulated in the filtrate line.
- In case the filter overflow cannot be put back into the feed tank, it has to be connected to the suction side of the filtration pump.

Heel Volume Filtration



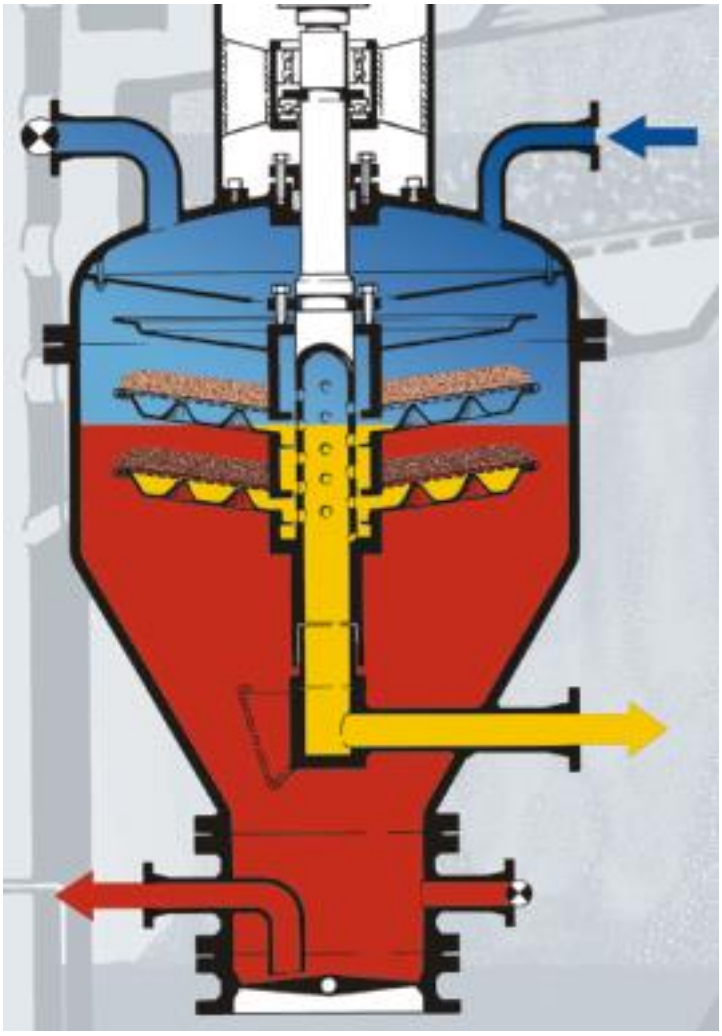
Description

Especially for batch filtrations or while changing from one product to another one, the heel volume remaining in the filter after filtration (or washing) has to be totally filtered, to avoid losses or cross-contaminations. For this purpose, the whole filternest is used in the Chemap®-Filter. This system allows the distribution of the remaining solids on all filter plates.
The filter is put under gas pressure. The pressure has to be set in relation to the cake resistance and has to be individually determined according to the product filtered. The necessary gas volume is: The displaced liquid volume multiplied by the pressure. Now the liquid is circulated by way of the heel volume outlet nozzle, the pump and the collector nozzle in the filter head. The gas pressure in the filter assures that part of the liquid is pushed through the cake and exits the filter as filtrate. The liquid level in the filter drops exposing more and more filter plates. Through the circulation of the liquid and the distribution plates in the filter head, a constant wetting of the exposed filter plates is insured, to avoid a gas breakthrough through the cake. Operating in this manner, the full liquid volume can be obtained as filtrate.

Remarks

The filtrate has to be diverted by a separate valve and pipeline with an orifice which accounts for the local piping layout. This eliminates the possibility of a gas breakthrough. A gas breakthrough results in cracks within a given cake portion. Such cracks would eliminate a good cake extraction and drying.

Emptying of the filter



Description

In many cases, the filter heel volume has to be transferred back to the respective feed vessel. This can he achieved by either:

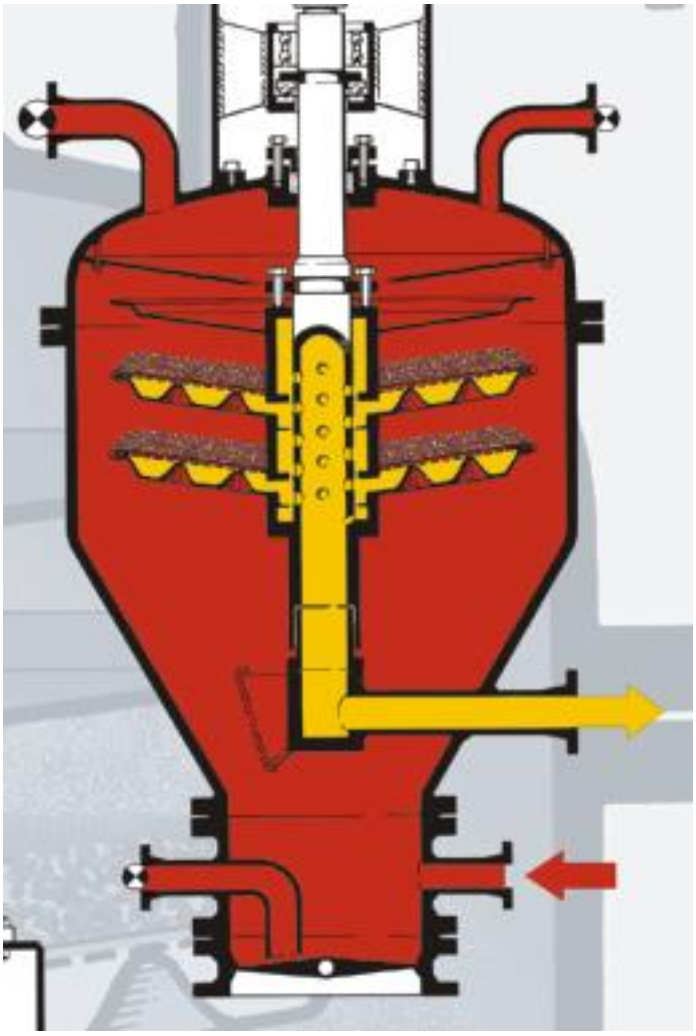
- Draining with gravity
- Emptying with gas pressure

In both cases, a disturbance of the existing cake has to-be avoided. It has to be assured, that the liquid level in the vessel, as well as in the hollow shaft, are dropping at the same rate. For this reason the filtrate line needs a bypass which is provided with an orifice plate. For the heel draining, we need only a small amount of gas and a pressure according to the cake‘s resistance and the pipelines configuration.

Remarks

- Provide orifice plates in both heel drain and filtrate pipe.
- Drain filter slowly, depending on size and product, 3 - 10 minutes.

Filling the filter with solids on the plates



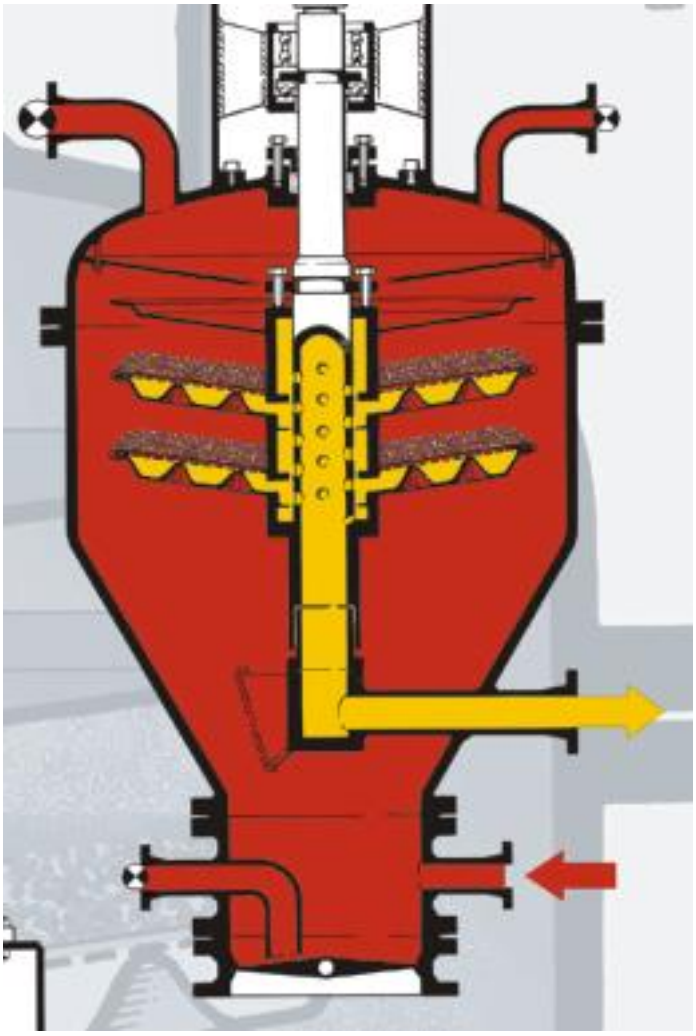
Description

In this case the liquid had to be drained in the previous process step.

Remarks

- The filter has to be filled with a reduced flowrate to avoid currents and disturbances which could damage the existing cake.
- The venting of the gas phase can be kept at a minimum. A small pressure build - up can be allowed without any problem. This assures that we have a small flow towards the filtrate side giving a positive pressure on the cake. The venting of the filter is necessary to avoid gas break - through through the cake, which would impair the subsequent washing and drying of the filter cake.
- It is important, that the filtrate side is open during the filling of the filter to avoid a disturbance of the filter cake. Should, for instance, the filtrate line, after the filter, climb for 12 meters, the filter vent would have to be reduced to create a backpressure within the filter to overcome this static height and still produce a flow towards the filtrate side. A pressure build-up of 1.5 bar times the liquides specific weight has, therefore, to be applied. Possibly a separate valve with orifice plate is needed.
- Filtrate lines which ascend after the filter, require a check valve right at the filter to avoid any backflow when the filtrate valve is opened.

Cake washing



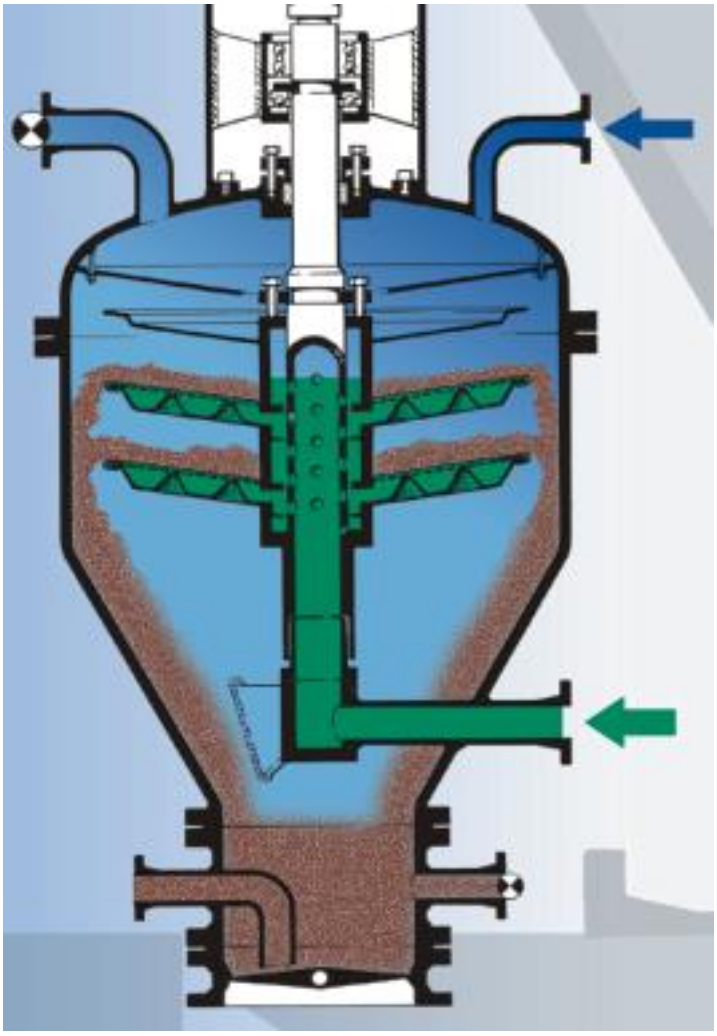
Description

After filling the filter with wash solution, the cake is washed by way of filtration. This is the easiest, simplest and best method and should normally be employed.

Remarks

A good cake washing requires an even flow of liquid through the cakes of all filter plates. To achieve this, the flow through the filtrate pipe has to be throttled to create a backpressure equal to the static filter height multiplied by the liquids specific weight, plus 2 meters, approximately 0.5 bar or more.

Cake discharge in slurry form



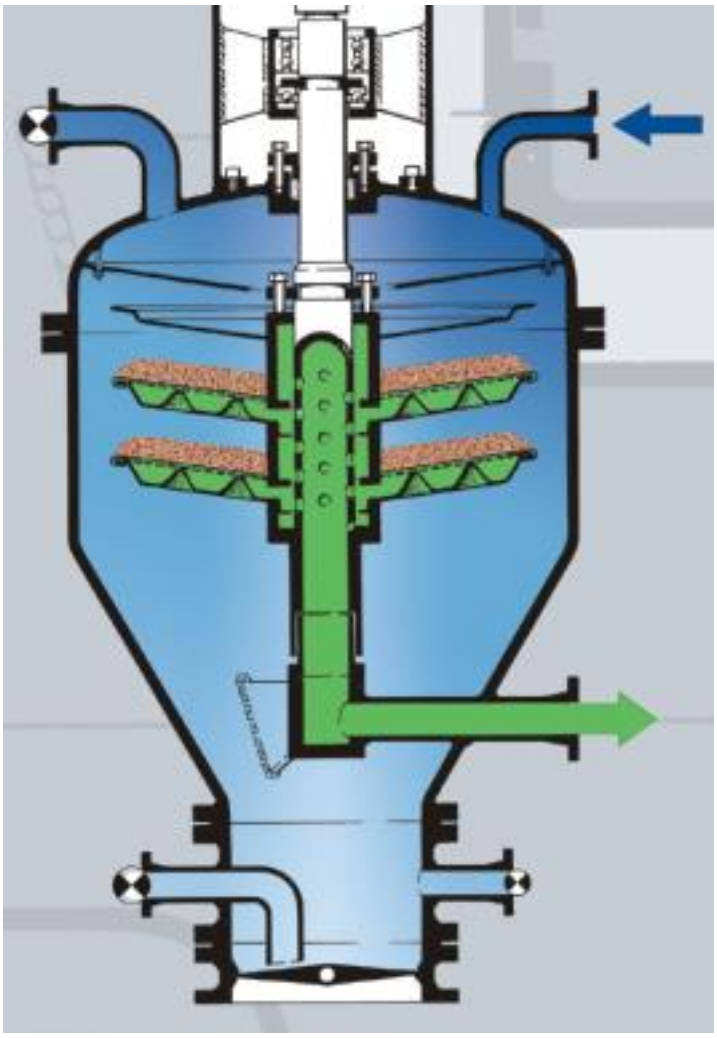
Description

At the end of the filter cycle, it is desired to discharge the accumulated solids as a slurry. First, the slurry discharge valve at the filter bottom is opened. The discharge liquid is added through the collector nozzle in the filter head. As in the heel volume filtration, the liquid is flowing in the manner of a cascade from plate to plate. The conical shape of the filter plate and therefore the cake, leads to a lake formation on each cake. Then seconds after the first liquid exits from the bottom valve, the filternest can be rotated. The filtercake is now thrown out to the wall and flushed down to the conical filter section by the liquid. New liquid flowing into the filter washes the filter walls free of any solids, through the preset gas pressure the resulting slurry is pushed out of the heel outlet nozzle.

Remarks

- Rotation should be only up to full speed or 30 seconds as a maximum.
- The procedure can be repeated.
- It is prohibited to run the filternest longer than 20 seconds on full speed.

Cake drying or extraction with steam



Description

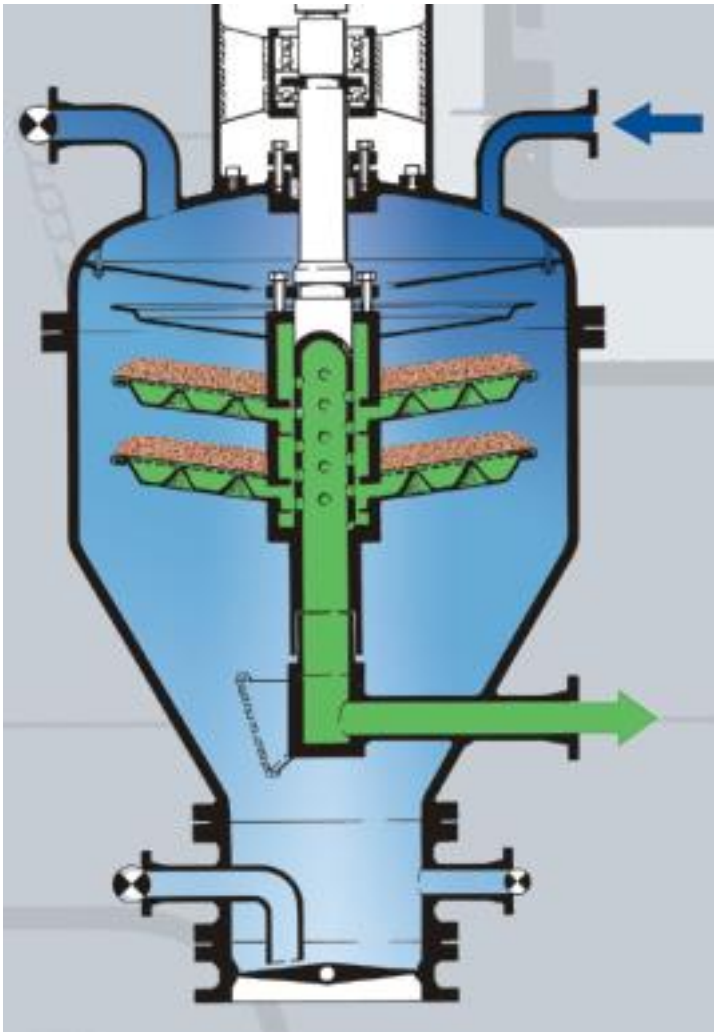
At the end of filtration, the filter cake can be dried with steam, gas or a combination of the two. At the same time an extraction of the cake with saturated steam can be made. In the drying of the filter cake we differentiate between two phases:

a) Displacement of the liquid in the capillaries of the cake. For this we need a low gas volume but high pressure (equal to the filtration end pressure).
b) The actual drying to evaporate the liquid on the surface of the individual cake particles.

Remarks

- It is important that the filter and the filter cake are heated uniformly and that the resulting condensate is drained from the filter.
- At the end of cake drying, the condensate in the bottom of the conical filter section has to be drained to avoid that, upon opening of the cake discharge valve, liquid spills out first and impairs the dry cake discharge.

Cake drying with gas



Description

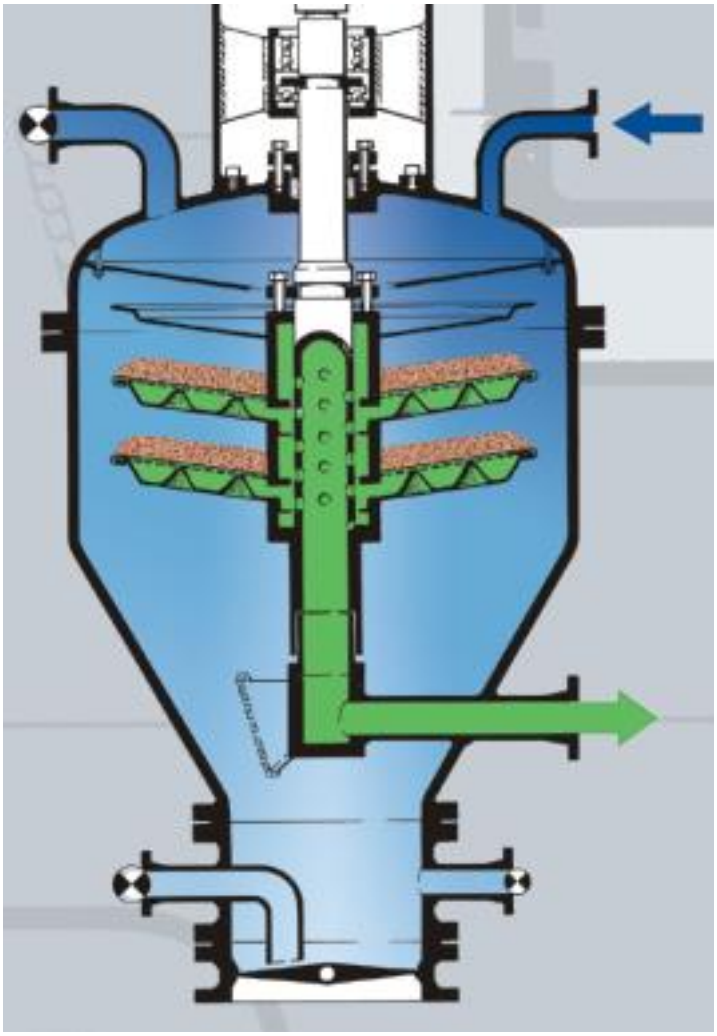
At the end of filtration, the filter cake can be dried with gas. In the drying of filter cake we differentiate between two phases:

- Displacement of the liquid in the capillaries of the cake. For this we need a low gas volume but high pressure (equal to the filtration end pressure).
- The actual drying to evaporate the liquid on the surface of the individual cake particles.

Remarks

- For an optimal cake drying it is important, that the gas is expanding within the filtercake and not outside the filter.
- Therefore no pressure build up is allowed at the filtrate outlet, because of to small piping or a valves.
- At the end of cake drying, the condensate in the bottom of the conical filter section has to be drained to avoid that, upon opening of the cake dump valve, liquid spills out-first and impairs the dry cake discharge.

Cake drying with saturated steam and/or gas



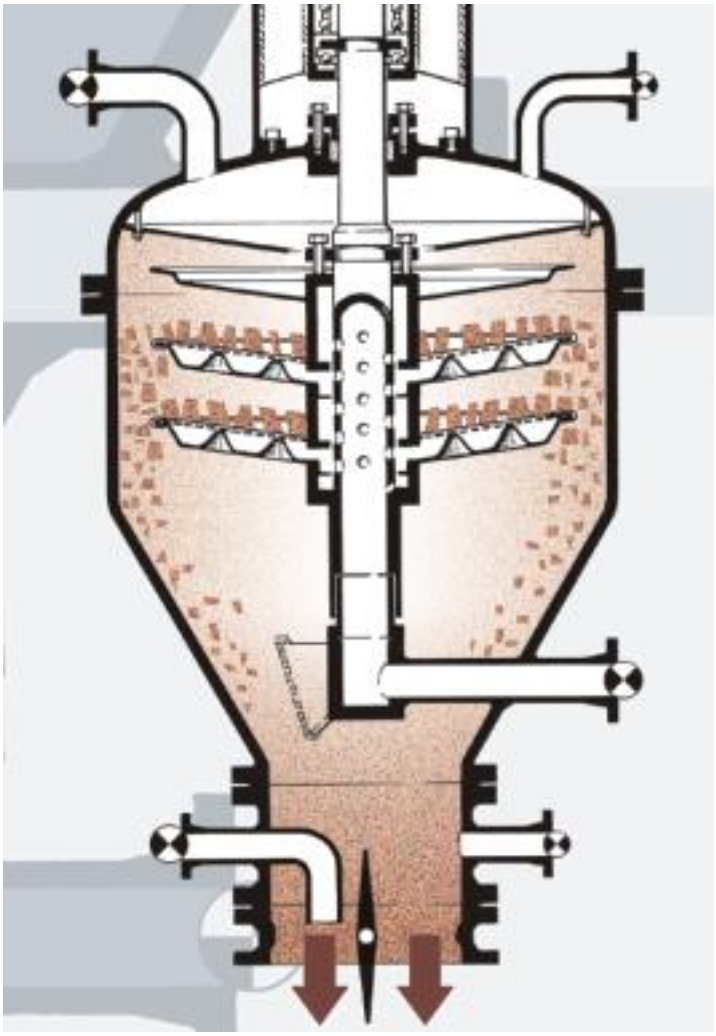
Description

At the end of filtration, the filter cake can be dried with steam, gas or a combination of the two. The inlet into the bottom of the filter is used if volatile or poisonous material is handled which has to be contained one hundred percent. The condensing rest moisture is then picked up by the steam or gas flow and pushed through the cake. This system is also used to avoid loss with expensive solids, like catalysts etc.

Remarks

- For an optimal cake drying it is important, that the gas is expanding within the filtercake and not outside the filter.
- Therefore no pressure build up is allowed at the filtrate outlet, because of to small piping or valves.

Dry cake discharge



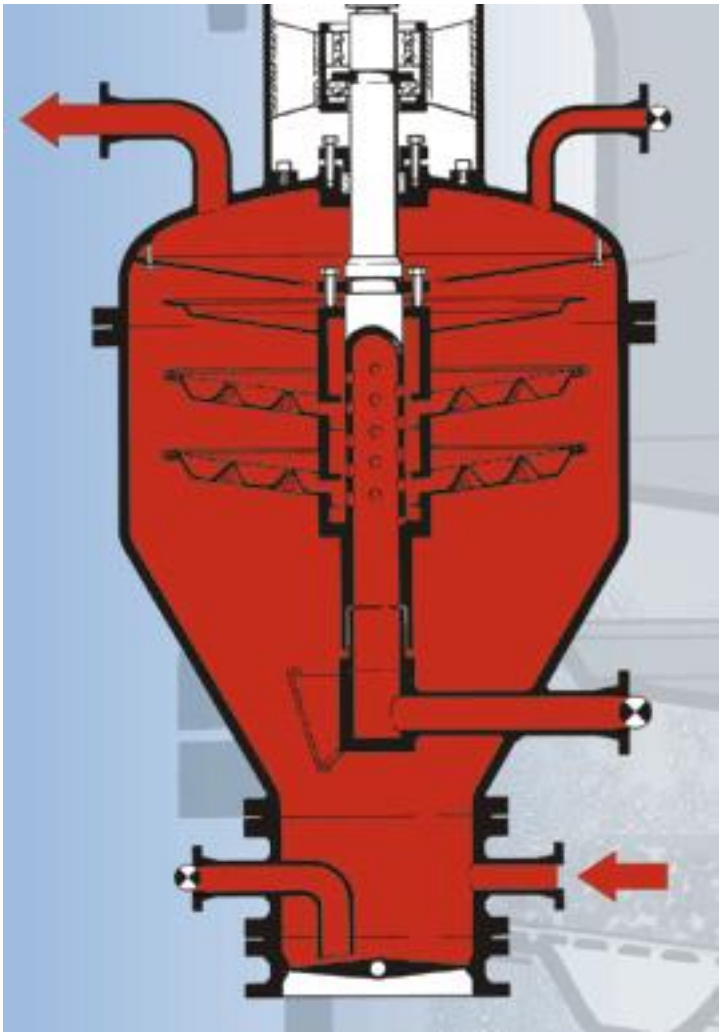
Description

At the end of the filtration cycle, the cake has to be discharged as a dry substance. By rotation of the filternest, a centrifugal force is created which acts on the cake and throws it off the plates out to the vessel wall. By gravitation, the solids now fall down in the space between the edge of the filter plates and the vessel wall. The conical bottom section assures a free fall out of the filter into an appropriate vessel.

Remarks

- The filter has to be depressurized before the cake dump valve is opened. This depressurization is by way of the heel volume outlet nozzle to assure, at the same time, the blow down of any accumulated condensate.
- The cake dump valve has to be completely open before rotation of the filternest starts. It is recommended to block the activation of the filter motor by an open position limit switch on the cake dump valve.
- During the cake discharge, the filter vent valve has to be fully open or alternately gas has to be added in sufficient amounts to avoid a vacuum in the filter (piston effect).
- Rotation up to the filternest‘s full speed is sufficient
- It is prohibited to rotate the filternest for longer than 20 seconds on its full speed.

Cleaning of the filter



Description

In many cases the filter is used to filter several different products. To avoid contamination between the products, the filter can be washed as follows: The cake dump valve is opened and then the wash liquid is added by way of the collector nozzle. The liquid flows now from plate to plate (cascade) and wets all of them. Ten seconds after the first wash liquid exits at the cake dump valve, the filternest is rotated. The liquid accumulated on the individual filterplates is thrown outwards and splashes into all corners, like in a washing machine, cleaning the filter from top to bottom. This procedure can be repeated as often as desired.

Remarks

- The maximum rotation time of the filternest shall not exceed 20 seconds.
- The filter vent has to be open.