Locating of broken membrane filter plates in the filter plate package by radio data transmission

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In the field of solid-liquid separation, membrane filter plates have become established in filter presses. Using membrane filter plates, a higher solid content of sludges can be achieved in less time compared to chamber filter plates. Membrane filter plates are subject to wear and have to be replaced in case of damage. Broken membrane filter plates lead to a loss of squeezing medium, thus, the product in the filter (filter cake or filtrate) can be contaminated. Locating of broken membrane filter plates in the filter press is complex and extremely time-consuming, resulting in high labor costs and a downtime or capacity loss of the filter system respectively. As a solution, the JZ Engineering GmbH offers a newly developed indicator unit, which allows for a fast and reliable identification of broken membrane plates (fig. 1 and 2).

Indicator unit specifications

Regarding single squeeze connection the assembly prevalently takes place at the membrane plate at the connecting point of the tubes, coming from the manifold for the squeezing medium. The assembly rarely takes place at the junction of the connecting tubes at the collecting pipe itself. Regarding central squeeze connection, the indicator is assembled at the membrane plate near the internal squeezing medium drilling. The assembly positions are shown in figures 3 and 4.

The principle to find broken membrane plates is based on the determination of flow in the squeeze connections into each membrane plate. When the filter cake in the chambers is squeezed with the specified pressure, hardly any filtrate leaves the cake or the chamber respectively. In case of an intact plate, no additional squeezing medium can reach the membrane filter plates and the flow in the squeeze connection comes to a standstill.

The displays of the new indicator units do not have direct contact with the squeezing medium and can therefore not be contaminated. The indicator units are furthermore insensitive to particles up to a diameter of 1,5 mm in the squeeze system. In order to hold back bigger suspended particles, the units are equipped with appropriate filters in the inlets of the indicators.

The display is also completely protected against external contamination. If the indicator unit and the surrounding area is contaminated by dust or splashing water, a simple cleaning will be possible.

An operation of the indicator unit is guaranteed for several squeezing mediums such as water, edible oil and air. If different squeezing mediums are required, individual tests can be carried out in order to find customized solutions.

The standard version of the indicator unit is designed for a squeeze pressure of 16 bar at a squeezing medium temperature of 80°C. For special applications, solutions for higher pressures or temperatures can be provided.

Fig. 1: Flow indicator unit with LED – attachment for single squeeze connection

Fig. 2: Flow indicator unit with LED – attachment for central squeeze connection

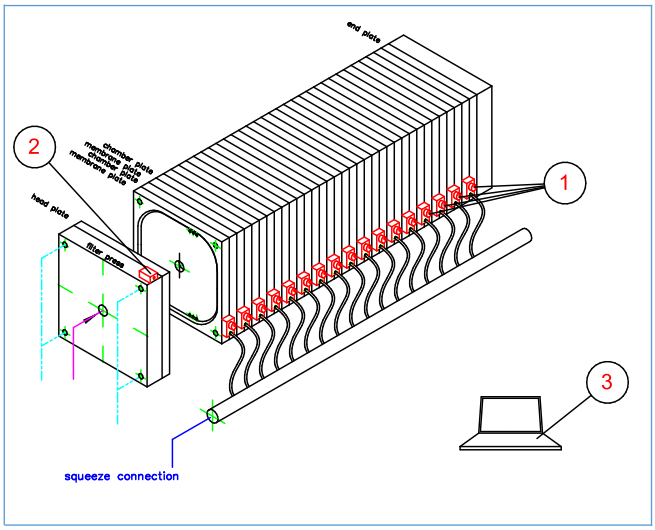

Fig. 3: Filter press with single squeeze connection;
(1) indicator unit, (2) amplifier, (3) PC

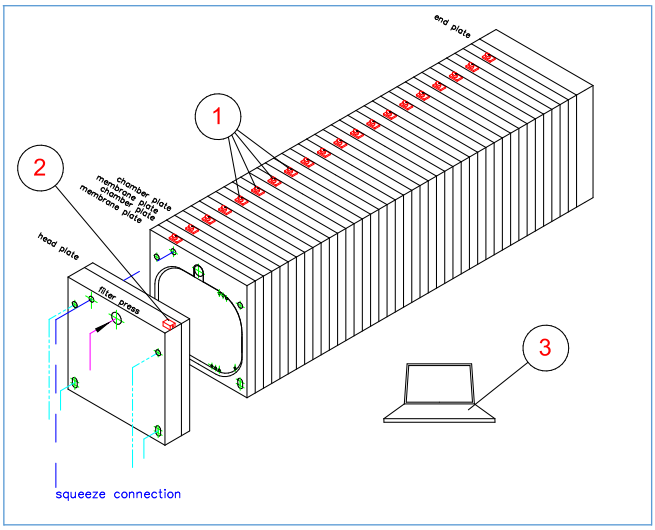

Fig. 4: Filter press with central squeeze connection;
(1) indicator unit, (2) amplifier, (3) PC

Locating of broken membrane plates by means of LED displays

The indicator units with rotating needle are equipped with a signal receiver, recording the impulse of the needle and transforming them into electric and optical signals. In practice, this means that an electronics attachment is mounted on the flow rate indicator unit, tripping the flashlight of a LED signal lamp. The corresponding power supply is located in the unit and designed for an operating time of 2 to 5 years. The big range in the service life results from the diverse applications for membrane filter plates and depends on the number of filtration cycles.

The most frequent flashlight signals will probably occur during the filtration of concentrated juice in the field of sugar filtration, the fewest during sewage sludge filtration.

The flashlight signals can be related to a specific volume. Thus, the frequency of the signals can be related to a specific flow of medium at the squeeze connection. If a flashlight signal can be monitored at a filter press after reaching the squeeze pressure at the membrane filter plate, squeezing medium is still flowing into the plate, meaning that this filter plate will have to be exchanged. The signal indicating the exchange of a plate is visible from a distance, which is especially helpful if the filter presses work in dust areas or are difficult to access.

Data collection and transmission via radio signal

Primarily, the flow indicator unit was developed in order to record flows of the squeezing medium simultaneously at all membrane filter plates in one filter press and to display the signals for the operator as simple as possible. Regarding the wireless modules, the information of the squeezing medium is transmitted from the rotating needle to the wireless module. In this module, the data is processed by a special program and then transmitted to a computer located in a control room for example. In this case, a change from simple data displaying to data measuring is made. Compared to the flow indicator unit specified up to now the volume of squeezing medium can be determined by measuring the flow.

In case of a noticeable pressure drop in the squeeze system, the squeezing medium demand of every single membrane filter plate can be queried during the squeezing cycle. When opening the filter press, it is already apparent which membrane plate shows a defect and thus has to be changed.

The quantity of volume of squeezing medium entering into every membrane filter plate is being recorded in relation to time. This measurement can easily be performed at several filter presses simultaneously, whereas the mapping of the volume data of each plate or press, respectively, is guaranteed. The data is saved on a computer and the analysis program has access to the respective data to be queried.

The following advantages result from the wireless data transmission:

Regarding central squeeze connection, a monitoring of the membranes during operation has been difficult so far, as the flow of squeezing medium outside the filter plate package could not be recorded and analyzed during the squeeze period. Even for a filtration of medium harmful to health, this is now possible.

As concerns long filter presses or several filter presses within one factory building, the locating of leaky membrane plates is more complex. Now, the query for required squeezing medium can be carried out during the squeeze cycle. At the end of the cycle, the membrane filter plate to be exchanged has already been determined. This fact is especially helpful for large filter plates, as in this case, the squeeze connections at the machines can only be reached with difficulty.

The demand of squeezing medium subject to time is recorded for each membrane plate itself. According to this data, conclusions on e.g. the condition of the filter cloth can be drawn or irregular cake thicknesses can be detected. Cake thickness influences, among other things, the washing result of cake washing. Based on this data, the filtration process and the subsequent process steps can be optimized.

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