Automatic Filter Press cloth failure detection: IntelliPlate™

An industry white paper

Contents

Executive summary

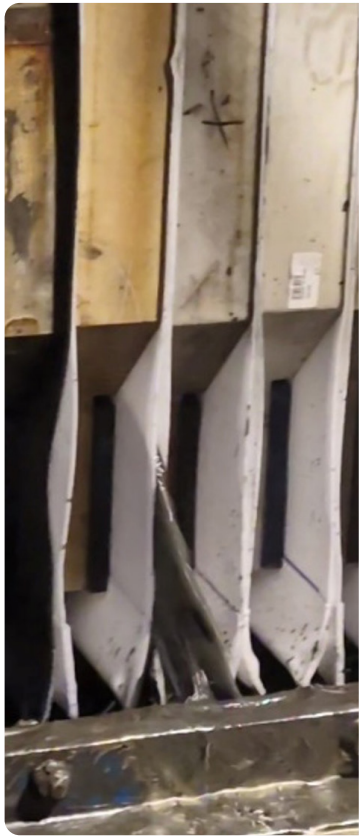
In filter press applications, the filter cloth is subject to wear and eventual failure. If undetected, this quickly leads to excessive wear on the filter plate and its potential failure - a much more costly outcome. Early detection of cloth failure is thus an integral part of condition monitoring to maintain optimal filter production.

Predicting how many cycles a filter cloth can endure before failure is a serious challenge. But it must be solved if supply chain management is to have a replacement on hand when a filter cloth fails and if the maintenance team is to be ready for change-out, without disrupting production.

To effectively support the operator, a solution must both detect cloth failure and identify which cloth within the plate stack has failed. Without these capabilities, operators lack the critical insight needed to make the fast, consistent decisions that maintain optimal filter press performance.

The IntelliPlate turbidity-detecting plate alarm system solves this challenge. It directly measures turbidity in the filtrate on individual filter plates, pinpointing cloth failure while eliminating external variables that often complicate filtration diagnostics. This targeted approach streamlines troubleshooting and enhances the reliability and efficiency of the entire filtration process.

Introduction to filter cloth failures



Failure mechanisms

Mechanical abrasion - An incomplete cloth wash leaves filter cake on the seal edge of the filter plate, sometimes called 'heel', to be re-compressed during the next cycle. Continuous cycles eventually abrade holes in the cloth along the seal edge, stay-bosses, and feed shoes.

Installation misalignment - Creases in the cloth during installation cause uneven wear that will eventually lead to a hole in the cloth.

Plate shifting - As the plates are positioned for filling, elements may cause adjacent plates to misalign. During filling, the slurry then exits between the plates, abrading a hole in the cloth and plate.

Chemical and thermal impacts - Chemical incompatibility and/or high temperatures reduce material strength, leading to increased deformation and wear.

Figure 1 - Plate seal edge wear

The critical impact of failure

If the failed cloth is not detected quickly enough, the plate's sealing edges will wear (Figure 1), leading to costly plate failures and lost production.

Filter plate arrangements

The ability to detect and locate a cloth failure depends partly on how a filter press discharges its filtrate. Different arrangements offer different levels of visibility - and thus different challenges for detecting a failure.

Closed discharge

Closed-discharge arrangements are the most common filter press configuration. Filtrate is discharged from both #1 and #3 button plates through a closed piping system. As a result, the filtrate is not visible as it leaves the system. When turbidity is detected, the operator must inspect all plates and cloth to determine which chamber is affected.

Open discharge

In open-discharge arrangements, #3 button plates discharge filtrate from the bottom into drip trays. Because the filtrate drains openly, operators can quickly spot dirty filtrate and identify the failed plate or cloth. This gives operators direct visibility of half the plate stack.

However, because #1 button plates discharge through a closed piping system (as in closed-discharge arrangements), manual inspection of these plates and cloth is still required to determine the location of any failure.

Current cloth failure detection methods

Manual inspection

Manual inspection of a torn filter cloth typically involves visually examining the cloth and its surroundings for tears, holes, or other signs of damage. This includes checking for any visible inconsistencies on the cloth's surface and along its edges.

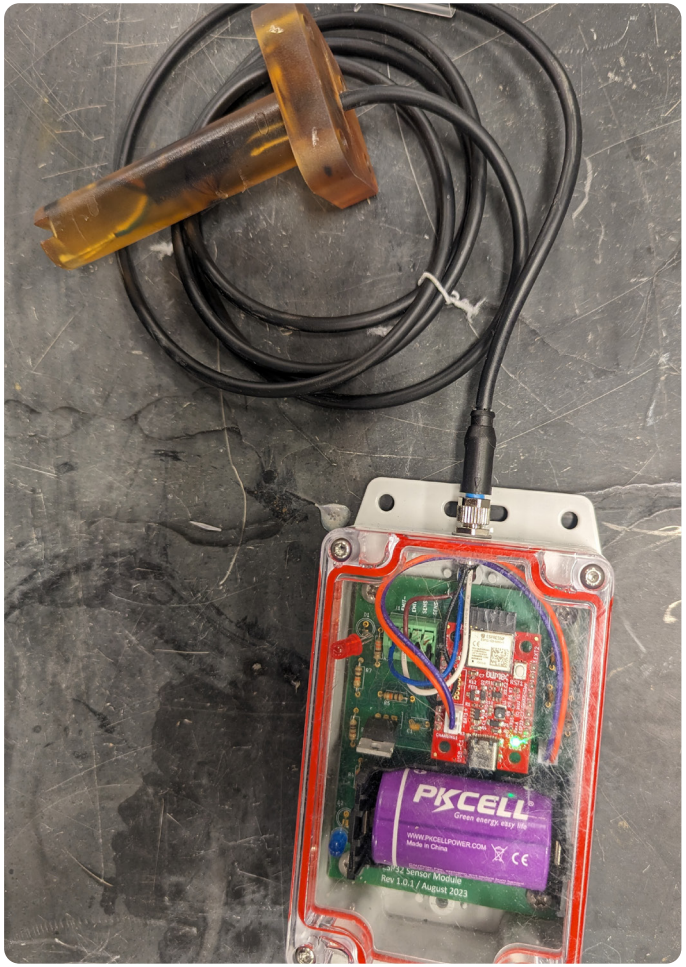
A visual check should be performed as part of a regular maintenance routine. A torn filter cloth is often indicated by a distinct whistling or blowing sound during the air-blow step. This audible anomaly enables the operator to identify the location of the damaged cloth.

However, manual inspection is time-consuming and reactive: it cannot predict future failures, and by the time a scheduled inspection occurs, a cloth failure may have already damaged the plate.

Bulk turbidity sensor

A torn cloth can be detected by observing bulk turbidity in the filtrate using a bulk turbidity sensor. These are usually installed at one end of the filter. Cloudiness, or increased turbidity, in the filtrate indicates that particles are passing through the cloth due to tears or other damage. This is because a torn cloth allows unfiltered solids to enter the filtrate stream, increasing its turbidity.

However, bulk turbidity sensors are costly and only indicate that a cloth has failed, not which cloth has failed. The operator must still inspect all the plates and cloth to identify the affected plate.



Proposing a solution: plate alarm system

Solution requirements

Any system designed to detect torn filter cloth must account for variable turbidity levels. The system should not detect excessive fines and should be adjustable for different process conditions.

Secondly, a sensor must only detect turbidity from the installed plate. False positives from adjacent plates cause unnecessary confusion and delays in evaluating the failure. The operator must be able to quickly and accurately identify the plate or plates with damaged cloth.

Finally, the system must be capable of disconnecting and reconnecting each transmitter during maintenance intervals. The transmitter must also connect to the correct receiver when multiple filters are in proximity.

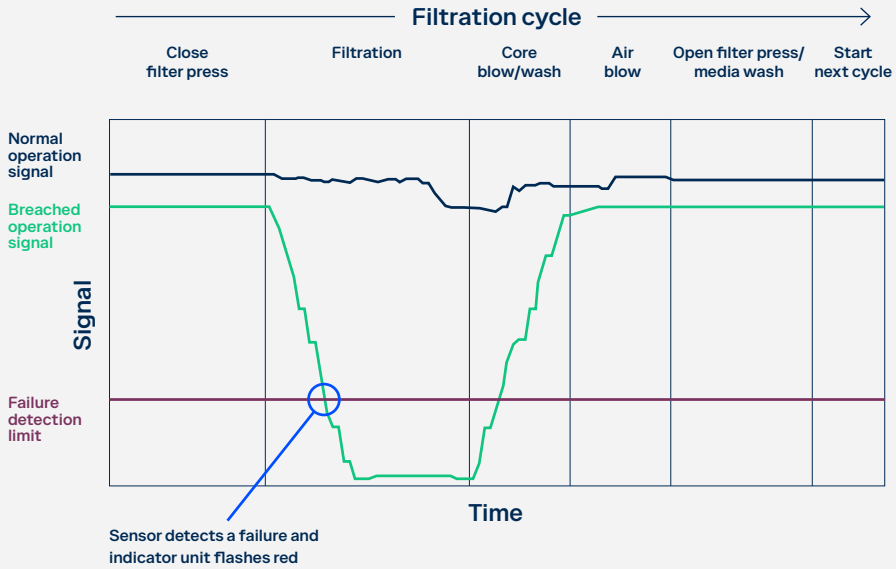
Introducing the IntelliPlate turbidity-detecting plate alarm system

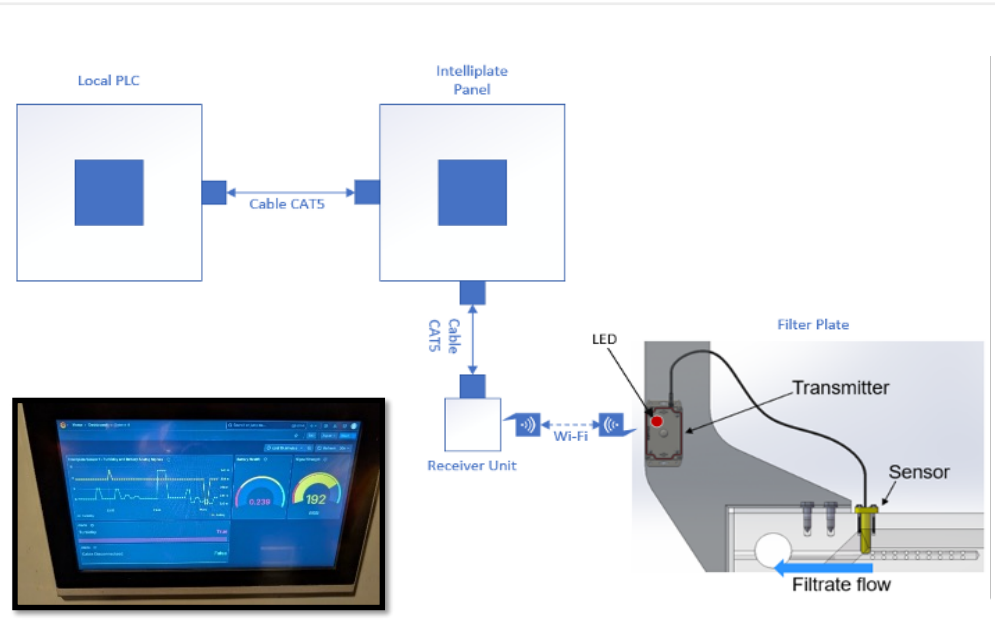
The IntelliPlate alarm system meets these requirements by quickly and accurately identifying cloth or plate failure. At set intervals, the sensor transmits status information to a receiver, which collects the data from all connected sensors and sends it to a processing centre.

Detection - Each filter plate is equipped with a turbidity sensor installed at the filtrate port. A corresponding transmitter, mounted in a visible location on the same plate, is integrated with an LED indicator. When turbidity is detected, the LED illuminates, signalling a potential tear in the cloth. Upon receiving a turbidity alarm, the operator can inspect the filter press and visually identify the plate with the active LED to locate the torn filter cloth.

Processing - A human-machine interface (HMI) panel is supplied to aggregate data from the receiver and display the real-time status of each connected turbidity sensor. When any sensor detects turbidity, the system triggers an alarm to notify the operator.
The HMI also provides detailed operational data about the IntelliPlate system, enabling enhanced monitoring and diagnostics.

Sensor and indicator of the IntelliPlate system





Proof of concept

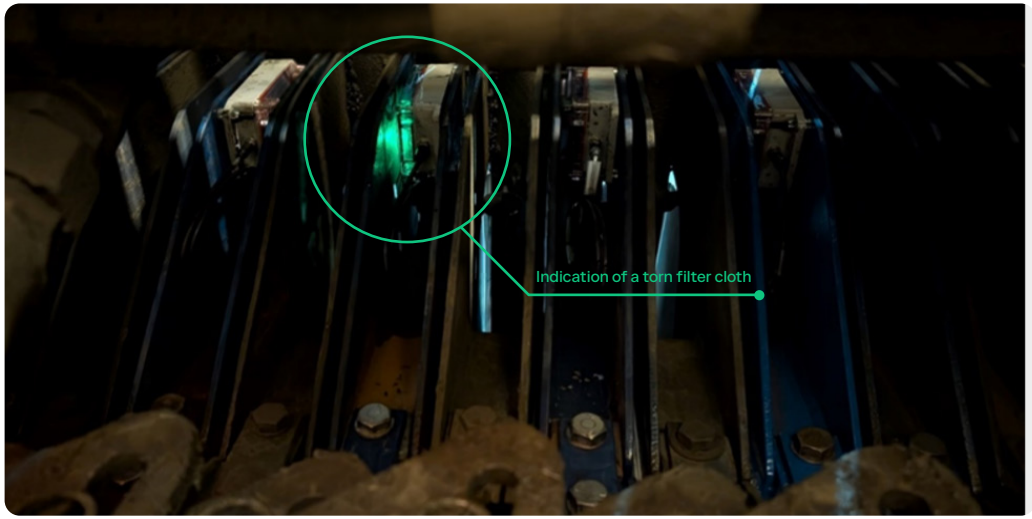
Testing

A series of tests was conducted at a mine site to validate the performance of the IntelliPlate solution against the previously defined evaluation criteria. After installing four sensors in four filter plates, baseline testing confirmed that the sensors did not produce false positives, demonstrating reliable performance under normal filter press operation.

After baseline testing, a 50-mm incision was made in one of the filter cloths, and a filter cycle was initiated. A few moments into the filtration step, the sensor on the plate with the cut cloth detected turbidity and activated the transmitter LED. At the same time, the HMI also reported turbidity.

After the filtration step was completed, the LED turned off because it did not detect turbidity. The HMI also confirmed no turbidity.

After the filter cycle and subsequent opening of the filter, the plate and cloth were inspected. The plate behind the cut cloth exhibited slurry residue across the entire pip surface of the filter plate, indicating that slurry had passed through the cut in the cloth.



Observations

In this test, the sensors and HMI functioned properly and provided accurate results, capturing turbidity measurements during the filtration phase, when turbidity levels are typically at their peak. Additionally, no other adjacent sensors triggered a turbidity event.

Field testing also confirmed that the system is mechanically robust: no leaks were observed at sensor installation points, and the sensors withstood the abrasive slurry without degradation. The transmitter enclosures are watertight and positioned to minimise the risk of physical damage. For open-discharge filters, installing two sensors per #1 button plate is recommended, as filtrate from a torn cloth will flow to the nearest outlet and may bypass a single sensor.

While the current sensor placement is not ideal for visibility, the LED becomes clearly visible once the filter is opened, and the positioning offers the best available line of sight to the indicator when turbidity is detected.

The receiver functioned as intended, maintaining strong signal strength throughout the filter building. However, due to the high signal range, care must be taken when pairing sensors with receivers in facilities with multiple filters in proximity to avoid cross-communication.

Conclusion

Filter cloth failure is an unavoidable operational reality in filter press applications. The consequences - undetected failures, unplanned downtime, and the progression from cloth damage to costly plate replacement - depend almost entirely on how quickly and precisely a failure can be located. Current methods, whether scheduled manual inspection or bulk turbidity monitoring, cannot provide that precision.

By eliminating the need to open and inspect the full plate stack, the IntelliPlate alarm system reduced the time required to locate a failure and the risk of undetected cloth failures. The system's plate-level turbidity detection closes the gap left by existing methods.
To find out how IntelliPlate can be integrated into your filter press operation, contact your FLS representative.

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