Case Study

Machinery Asset Monitoring Breakthrough: How a Five-Site Rollout Sparked Enterprise-Wide Reliability Gains and ROI

AMS™

EMERSON™

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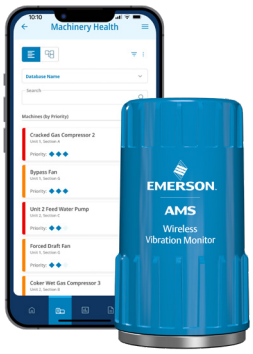


Global Building Products Manufacturer Deploys AMS Solutions Across Multiple Manufacturing Sites, Realizes Savings Approaching $700K in First 12 Months

RESULTS

- 7 quantified machine saves spanning multiple sites and multiple asset types using a mix of online and offline technologies.
- 100% reduction in catastrophic spindle failures in first year.
- Twice as many machines able to be precision balanced, dramatically extending mean time between failure.
- Proof-of-concept so successful that now deployed enterprise-wide.

> The **results** to date have been **significant.** At one site, we've increased plant reliability by 3.5% – a gain **worth $1.44M annually** — while also **improving throughput by 23% and reducing maintenance costs on key components by 66%.** Other sites have leveraged the solution to avoid costly downtime events, with cost **avoidance savings ranging from $30K to $116K per incident.**
>
> — Corporate Reliability & Maintenance Manager

APPLICATION

Proactive monitoring of mechanical and lubrication health enabled across a diverse mix of rotating machinery assets including pumps, motors, fans, conveyors, gearboxes, spindles, and more.

CUSTOMER

Global specialty building products manufacturer with multiple sites across North America.

CHALLENGE

High maintenance costs and catastrophic failures of critical production machinery were hampering operations at multiple production sites. An incumbent supplier's solutions consisting of portable data collection systems and wireless sensors were not delivering the results expected by the customer.

SOLUTION

Although in use for several years, the incumbent solution had unfortunately fallen well short of success targets through lack of critical features, poor reliability, and underwhelming vendor support. The issues had grown so acute that the customer made the difficult decision to abandon their investment and find another provider. A detailed technical and commercial evaluation across five potential suppliers was conducted, and Emerson was selected as a result.

Initial deployment consisted of our AMS 2140 Machinery Analyzer and AMS Wireless Vibration Monitors at a single site. It delivered sufficiently compelling results during a 6-month trial to warrant not just full replacement of the incumbent products at the trial site, but replacement at-scale across all five candidate sites spanning more than 2,500 wireless sensors, multiple portable machinery analyzers, and companion software. The customer now has a total of nine vibration analysts using these products as part of a corporate-wide emphasis on reliability and uptime.

At present, all five sites have implemented Emerson's offline products and three sites have implemented online products – with the remaining two sites slated to follow with installation of AMS Wireless Vibration Monitors in the next 24 months.

As a result, the customer has realized impressive savings in the first 12 months alone, some of which delivered 200% ROI in a single incident:

Site	Scenario	Savings
A	1 – Motor bearing issues	$32,300
	2 – Dryer gearbox issues	$73,400
B	3 – Spindle reliability issues	$213,300
	4 – Fan bearing issues	$116,300
	5 – Hydraulic pump vane passing issues	$9,700
	6 – ID fan lubrication/bearing issues	$99,700
C	7 – Vacuum pump calcification issues	$116,800
	Total	**$661,500**

> We have already seen **measurable improvements** at the sites where (this solution) has been implemented. It has allowed us to **identify and resolve defects** that would have previously gone undetected. With the added capabilities of PeakVue technology, we have also been able to **re-evaluate our lubrication strategy**, adjusting application rates and quantities for better asset performance. In addition to its analytical strengths, the system's stability and *Wireless*HART mesh network have provided **reliable connectivity** to software and updates, ensuring **consistent performance and confidence** in the data we receive.
>
> — Corporate Reliability & Maintenance Manager

Global Building Products Manufacturer Averts $30K in Unplanned Downtime Repercussions as Part of First-Year Savings Totaling more than $100K

RESULTS

- AMS products detected serious bearing degradation that an incumbent's online wireless sensors had missed.
- Timely motor replacement averted expensive unplanned downtime affecting multiple production lines.
- First-year savings at the site totaled more than $100K; across the 5-site enterprise, first-year savings totaled nearly $700K.

> The sensors from our incumbent supplier **did not detect any problems.** Thankfully, we relied on the data from our AMS products which **clearly revealed the problem** and allowed us to intervene in a timely manner.
>
> — Plant Reliability Team

APPLICATION

A large-scale process for manufacturing ceiling tiles from mineral fiber necessitates dust collection where ID fans create the required suction. Multiple manufacturing lines are typically serviced by a single dust collector, meaning a failure will impact multiple production lines and will thus be 2-3 times as expensive as a failure impacting only a single line.

This manufacturer has multiple manufacturing sites across North America where dust collection and associated ID fans are used. They are a common source of issues as underscored by both this **example** and this **example** at one of the customer's sister sites.

The fans are currently monitored with Emerson's AMS 2140 portable machinery analyzer in conjunction with Machine Works software. However, given their critical role in the process, plans are in place later in the year to fit these machines – along with many others at site – with AMS Wireless Vibration Monitors to provide quasi-continuous monitoring instead of manually collected data every few weeks.

The plant is one of five in a **corporate-wide program** that fully instruments the machinery at each manufacturing site with AMS solutions as part of a reliability improvement initiative.

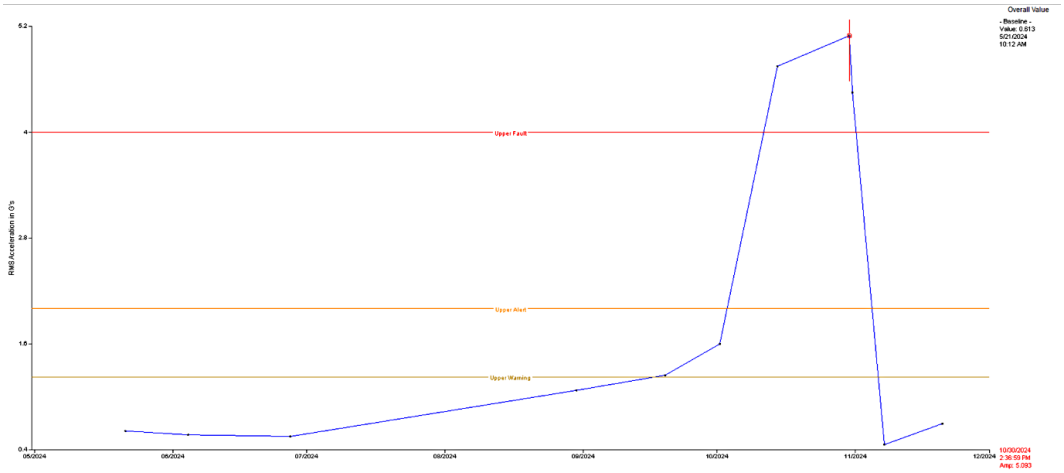
CUSTOMER

This customer is a global leader in the building products sector. Five of its North American sites are large enough to justify comprehensive, in-house condition monitoring of the machinery.

CHALLENGE

This fan is actually fitted with wireless vibration sensors from a different supplier, but they are due for replacement because they were failing to deliver satisfactory results. In fact, the deficiencies were so significant that the customer made a corporate-wide decision to replace the incumbent with Emerson's AMS products after a detailed technical and commercial evaluation. This decision entailed thousands of sensors across five different sites. Most sites have installed the sensors already, but this site is not slated for the change out until later in 2025.

Underscoring the necessity for a better solution, the incumbent's installed wireless sensors indicated no issues on the fan, even though it was clearly in distress. The plant had meanwhile stopped relying on those sensors and was instead using their AMS 2140 portable machinery analyzer to take periodic readings. The 2140 recorded that vibration amplitudes on the fan had more than tripled in ten weeks, and then tripled again barely two weeks later.



Between June and September 2024, the customer's AMS 2140 measurements showed that vibration amplitude had tripled, triggering a first-level warning alarm. By early October, the levels had more than tripled again, meaning a 9-fold increase over original levels. This triggered the highest level of alarm. During all this time, the incumbent wireless sensors did not flag any problems.

SOLUTION

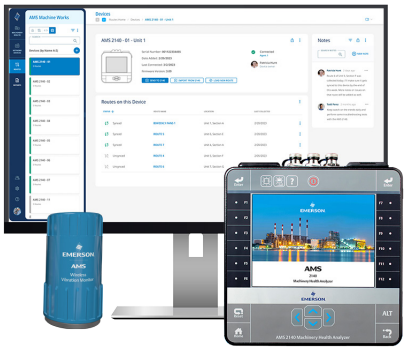
Armed with increasing trends and waveform data that clearly indicated bearing problems, a decision was made to replace the motor. However, routine complementary predictive maintenance tests prior to installing the spare showed that it had bad windings. It had to be sent for repairs while another motor was sourced under expedited conditions with a 24-hour turnaround. When it arrived, the replacement at last commenced. The vibration was measured after installation and indicated that levels had subsided to normal as can be seen in the trend plot above.

The motor on an induced draft fan – similar to the one picture here – is normally spared and is not a particularly high-value asset. In this case, the spare was defective and another had to be secured in about 24 hours. Several production lines rely on a single fan, equating to downtime repercussions of about $20,000 per day, not including labor or parts. Thus, even a single day of downtime eclipses the cost of the motor. As is often the case, the justification for monitoring is more about the cost of unplanned downtime than the cost of the asset.

Had the fan run to failure, which would have occurred if relying on the incumbent sensors, several production lines would have been down. Only then would the plant have discovered that the spare was bad too, incurring at least a 24-hour delay for another motor to arrive. This combination of downtime and parts would have meant a minimum of $32,000. Instead, based on the actionable data provided by the plant's AMS 2140, the motor was replaced without the duress, delays, and corresponding costs of an unplanned outage and unusable spare parts.

As was noted earlier, although the plant presently relies solely on its AMS 2140 as part of a route-based, manual data collection program, this is merely an interim solution. Several hundred AMS Wireless Vibration Monitors are slated for installation in late 2025 to ensure that all of the plant's vital equipment is continuously monitored. At this plant, even without online monitoring yet implemented, their AMS products have delivered more than $100K in savings in less than one year.

> **As is often the case, the justification for monitoring is more about the cost of unplanned downtime than the cost of the asset.**



Global Building Products Manufacturer Improves Gearbox Reliability, Realizes $70K in Savings in Just One Incident

RESULTS

- $73,400 in quantified savings in just one incident.
- Costly dryer fire avoided through early intervention.
- Two days of unplanned downtime avoided.
- Ability to monitor all types of machines – even those with extremely low rpms.

> By addressing these issues proactively, we have **improved the reliability** of the dryers and **minimized the risk of unplanned failures.**
>
> — Plant Reliability Manager

APPLICATION

As sheets of acoustic tiles are manufactured, they go through a dryer section more than 100 meters in length that moves the sheets at very low speeds through hot air. Speed-reduction gearboxes with an output of approximately 4 rpm essentially drive a long conveyor by means of a chain and sprockets. Multiple drying decks are used, each with its own gearbox. If a gearbox failure occurs, production from the entire production line must cease and the gearbox must be repaired. Additionally, a gearbox that causes the line to stop moving represents not only production downtime, but also the potential for a fire as the material will remain in one place under constant heat and may consequently burst into flame.

As part of efforts to improve gearbox reliability, the customer employed motion amplification technology. It revealed underlying issues that justified a mechanical redesign to alter the motor-to-gear connection from a c-face design to a conventional coupling. At the same time, the gears were added to the AMS vibration monitoring infrastructure in the plant, currently relying on an AMS 2140 Portable Machinery Analyzer in conjunction with Machine Works software.

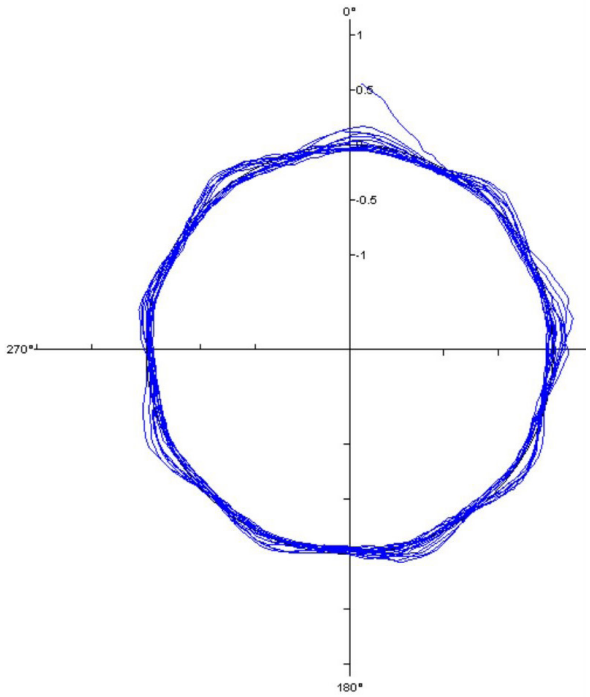
CUSTOMER

This customer, a global leader in the building products sector, uses our AMS 2140 machinery analyzer and Machine Works software to address numerous assets in the facility, including the dryer gearboxes. Within the next 12 months, the plant will be installing AMS Wireless Vibration Monitors, allowing the 2140 to assume a more supporting role rather than the primary means of data acquisition. This is part of a **corporate-wide initiative** to fully instrument the machinery across five manufacturing sites with AMS solutions as part of a corporate reliability improvement initiative.

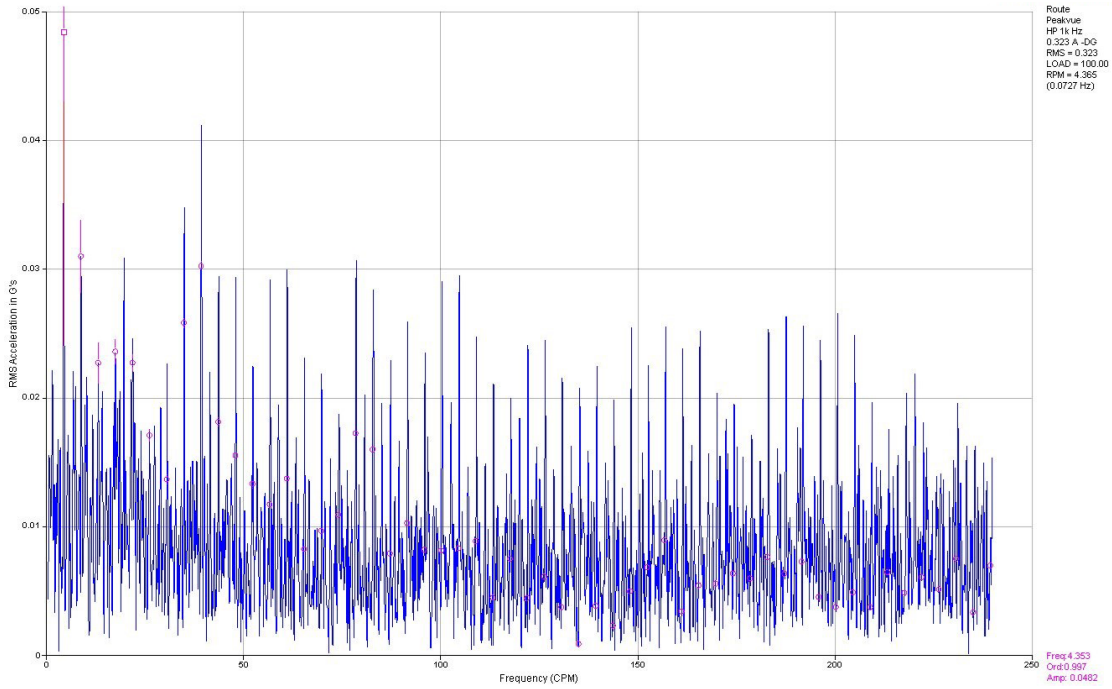
CHALLENGE

Although the mechanical redesign was anticipated to improve reliability, the ability to monitor actual condition was still important and the customer uses their AMS 2140 to collect data periodically. As mentioned above, plans exist later in the year to rely more heavily on online monitoring through installation of our AMS Wireless Vibration Monitors and 220 units are thus slated for eventual deployment at the site's board mill. In 2027, this will further expand beyond the board mill to fabrication areas of the plant.

Review of vibration data from one of the gearboxes revealed unusual activity in the circle plot at 9X running speed, suggesting the teeth on the output sprocket might be misaligned. At the same time, a large number of high-amplitude, 1X harmonics in the spectrum suggested possible mechanical looseness.



The circle plot revealed unusual activity at 9X running speed – corresponding to the nine teeth on the output sprocket.



A large number of high-amplitude, 1X harmonics were observed, suggesting possible mechanical looseness.

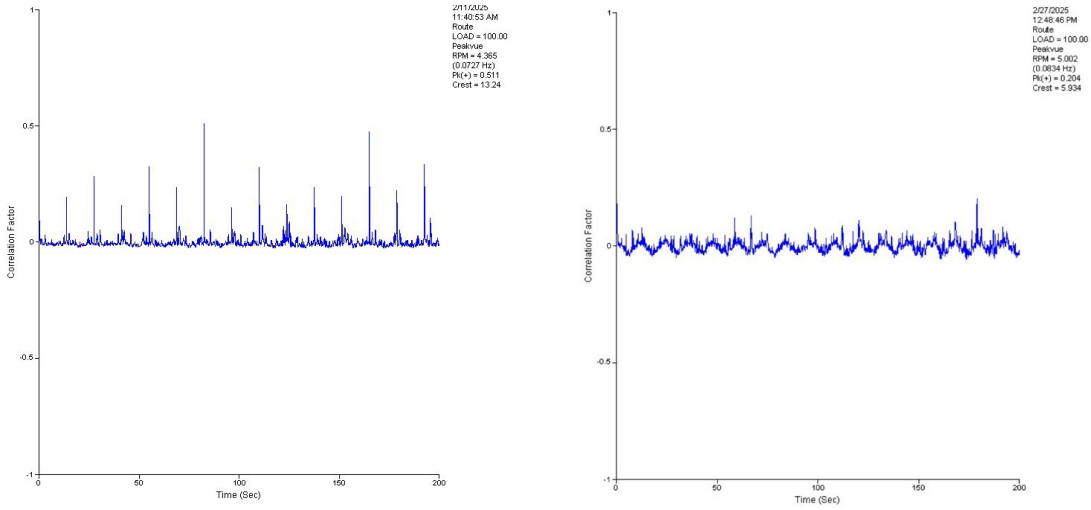
SOLUTION

Armed with this information, an inspection of the gearbox's output sprocket was undertaken, and a loose bolt was found. The bolt was tightened and the issues resolved.

The plant thereby avoided the potential for a fire and more than $70,000 in unnecessary cost as detailed below.

$22,000	Production labor cleaning the dryer (3 Days)
$8,400	Scrap (Full dryer using average weight cost by mix)
$5,000	Maintenance labor (2 days)
$6,000	Maintenance parts (sprockets/rails/chain sections)
$18,000	Contractors
$14,000	Avoided downtime
$73,400	**Total estimated cost of full dryer fire**

In the short time (less than 12 months) that the plant has been using their AMS infrastructure, more than $100,000 in savings has already been realized.



Time-series waveform showing high 1X harmonics prior to repair (left) versus after repair (right).

> This analysis demonstrates the capability of the Emerson system to detect mechanical defects even at **low RPMs**, allowing for **early intervention** and **preventive maintenance.**
>
> — Plant Reliability Manager

Global Building Products Manufacturer Dramatically Improves Spindle Reliability, Realizes Nearly Half Million in Cost Avoidance

RESULTS

- Nearly $450,000 in first-year savings, sitewide, inclusive of spindles and other assets.
- Twice as many spindles able to achieve precision balance states.
- Spindle maintenance costs per ton of product decreased by a factor of three.

> By reducing the number of spindle failures to zero in just one year, we realized $216,000 in cost avoidance — a 2x ROI for the entire project.
>
> — Plant Reliability Manager

APPLICATION

This customer manufactures mineral fiber "wool" that is used in its other plants to produce ceiling tiles. The fiber is produced by pouring molten material between closely spaced wheels attached to high-speed (6400 rpm) spindles, resulting in fibers that can be baled and shipped as raw material to the individual ceiling tile plants.

Due to the abrasive composition of the molten material feedstock, the wheels wear, creating an imbalance condition that is directly seen and felt on the spindles. Obtaining optimal life from the spindles as well as proper quality and consistency of fiber requires both balancing the spindles in a test stand before placing them into service and then continuously monitoring them using wireless vibration sensors – with a particular eye to imbalance. A portable machinery analyzer is used for the balancing task, incorporating semi-automated balancing tools to streamline the activities and prevent calculation errors.

CUSTOMER

This customer, a global leader in the building products sector, uses our AMS Wireless Vibration Monitors, our AMS 2140 machinery analyzer, and Machine Works software to address numerous assets in the facility, including the spindles. This is part of a **corporate-wide effort** to fully instrument the machinery across five manufacturing sites with AMS solutions as part of a corporate reliability improvement initiative.

CHALLENGE

Many of the assets at this site – most notably the spindles – had been instrumented with another supplier's solution. Unfortunately, that solution was not delivering the expected improvements in reliability, was very maintenance intensive, and could be mounted only on the motor and not the actual spindles. The hand-held part of the solution did not allow the level of precision balancing or detailed diagnostics that the customer needed. The as-found situation was as follows:

- An unacceptable level of catastrophic spindle failures were still occurring: eight in 2022 and another eight in 2023.
- Only 40% of spindles were able to be balanced within precision tolerances, due to shortcoming in the instrument used.
- The incumbent's wireless sensors exhibited poor battery life and entailed 30 minutes of labor just to change a battery. Across the enterprise, $21,000 was being spent each year merely on the replacement of batteries.
- System sampling rates and intervals had to be reduced in order to mitigate poor battery life and achieve even quasi-acceptable replacement frequencies and costs.

As previously explained, the spindles at this site produce feedstock for other sites across the enterprise, and are thus extremely critical assets in the customer's overall North American operations.

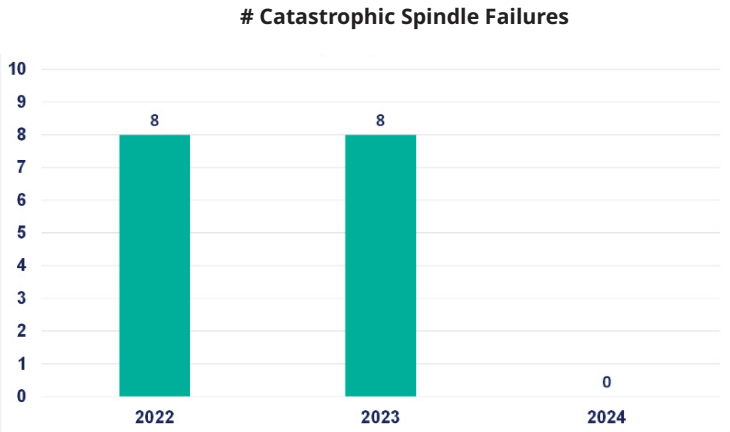
The customer set out to replace the incumbent supplier and after an extensive technical and commercial evaluation among five competitors, Emerson was selected. For the spindles, a modest goal of reducing catastrophic failures by merely one incident per year was set – as this alone could justify the replacement costs of the incumbent products. Benchmarks were established, such as the spindle maintenance costs per ton of product produced, number of catastrophic failures, percentage of spindles that could be precision balanced, and battery replacement costs. These benchmarks would allow the before/after results to be assessed.

SOLUTION

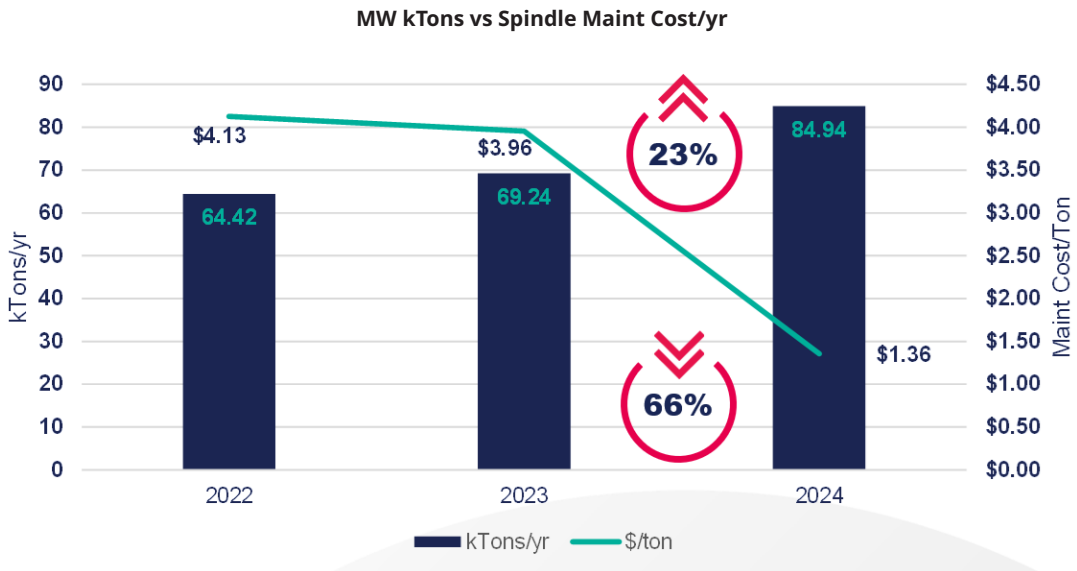
AMS Wireless Vibration Monitors were placed on all of the plant's spindles and an AMS 2140 was purchased to allow precision balancing as well as to augment any wireless vibration readings when necessary or conduct in-situ analysis on a spindle.

Within the first year, nearly $450,000 in savings were realized and the cost avoidance on the spindles alone accounted for $216,000 of this. In addition:

- Catastrophic spindle failures were reduced to zero, far exceeding the modest expectations of reducing from eight to seven such failures.
- Battery maintenance costs were reduced dramatically, and sampling rates could be much faster. Whereas the old system was capable of less than 100 readings within the span of a battery's life, the AMS Wireless Vibration Monitor was achieving more than 20,000 readings — a 200-fold increase.

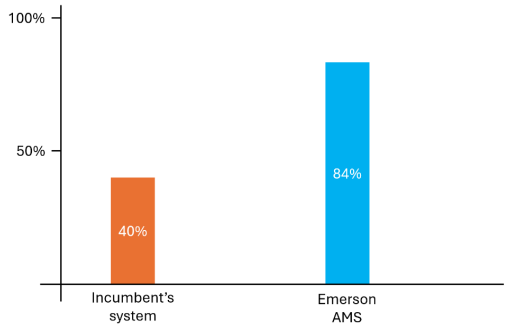


Eight catastrophic spindle failures occurred under the previous provider's technology in both 2022 and 2023. These systems were replaced with Emerson AMS products in 2024 and resulted in zero failures, far exceeding the project's charter which was merely to reduce the number of catastrophic failures by one per year.



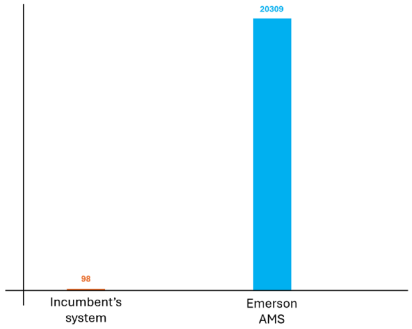
Emerson's AMS solutions resulted in a 23% increase in the combined annual output of the spindles while reducing their annual maintenance costs per ton by 66%.

Percentage of Spindles for which Precision Balance State could be Achived



Emerson's AMS solutions allowed more than twice as many spindles to be balanced to precision tolerances, helping to dramatically improve both performance and maintenance costs.

Readings between Battery Replacements



Emerson's AMS Wireless Vibration Monitor did not require battery life to be sacrificed for data quality as was the case for the incumbent system.

> **Early indication** of high vibration on these spindles allowed us to swap them **before they could impact production**, reducing downtime and **lowering rebuild costs**.
>
> — Plant Reliability Team

Global Building Products Manufacturer Avoids More Than $116K in Catastrophic ID Fan Failure Implications

RESULTS

- Fan swap could not ultimately be avoided, but was performed under planned conditions at greatly reduced cost.
- Deficiencies in machine construction were uncovered and corrected; new, proactive inspection processes were implemented to address root cause.
- Site realized more than $450K in savings during first year by monitoring all critical assets, assuring timely intervention before failures occurred.

> Had we not been able to spot looseness using the vibration data, the fan probably would have **run to failure** at **significant attendant cost** because prior to the modifications we made, it was **impossible** to inspect the affected bolts in-situ.
>
> — Plant Reliability Team

APPLICATION

A large-scale process for manufacturing the fibers used in ceiling tiles necessitates a dust collection baghouse, utilizing Induced Draft (ID) fans to draw the dust into the filtration system. A baghouse is essentially like a giant array of vacuum cleaner filters, and the ID fans are essentially used to create the necessary suction. The ID fans are extremely large and critical to the process: if dust collection ceases, or is curtailed, the manufacturing line must likewise stop or be curtailed. Emerson's AMS Wireless Vibration Monitors, AMS 2140 Portable Machinery Analyzer, and Machine Works software are used to monitor many of the assets at site, including the ID fans.

The plant is one of five in a **corporate-wide program** that fully instruments the machinery at each manufacturing site with AMS solutions as part of a reliability improvement initiative.

CUSTOMER

This customer is a global leader in the building products sector with multiple global sites. Five of its North American sites are large enough to justify comprehensive, in-house condition monitoring of the machinery.

CHALLENGE

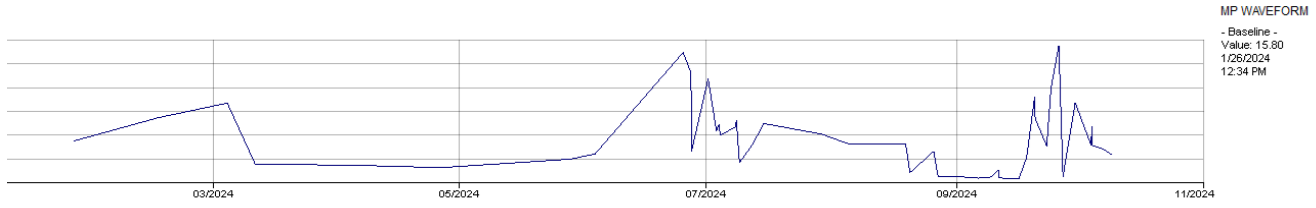
A routine vibration check revealed slightly elevated PeakVue amplitudes on both inboard and outboard bearings of the ID fan. One month later, the levels had risen by 74% and did not subside with reduction of fan speed, suggesting the issue was not related to balance condition as it did not track with speed (rotating imbalance forces are related to the square of the speed).

Vibration was monitored more frequently thereafter, but within 2 weeks had further deteriorated and was now 91% above the original levels. A decision was made to perform maintenance on the fan earlier than originally scheduled, consisting of bearing inspection / cleaning, bearing clearance checks, an alignment check, and greasing. The coupling was also inspected and serviced.

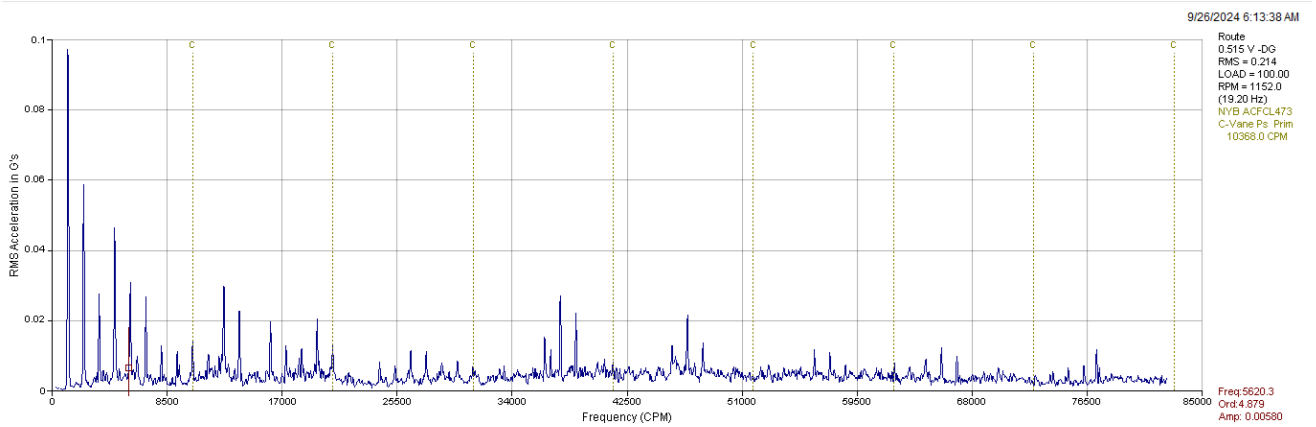
Although the vibration initially reduced substantially as a result of these efforts, the fan continued to be closely monitored because root cause had not yet been identified. After 10 weeks, the vibration returned with a vengeance to levels even higher than before, and a series of multiple iterations involving greasing and other actions were ultimately unsuccessful when issues again returned and levels again spiked – this time even higher than before.

During each of the interventions, it was known that the vibration data strongly indicated looseness somewhere in the machine train, but because the fan was in a sealed housing, it was not possible to conduct an in-situ inspection of the bolts that held the fan to its hub without completely disassembling the fan. This would mean bringing it down for an extended period of time and so the team attempted to rule out all other causes first. Looseness was indeed investigated in all accessible locations like couplings and bearing housings, but nothing was found.

Reasoning that attempting to further diagnose and repair the existing fan in-situ would entail considerable downtime, and that if other problems beyond looseness were found, a restart could be delayed even further, it was decided to swap the problematic fan with a rebuilt unit rather than trying to nurse the existing unit back to health. This approach would allow the changeover to occur with minimal downtime as well as allow more time for forensic analysis of the outgoing unit without the repercussions of lost production.



Trend of the ID fan's inboard bearing PeakVue vibration amplitude showing ongoing issues until the unit was finally replaced 9 months later. Vibration would typically subside following application of fresh grease and other adjustments, only to return shortly thereafter.



Spectral analysis revealed strong harmonics of 1X, indicative of looseness. This was eventually confirmed when the fan was removed from the machine and inspected – revealing that every bolt securing the fan to the hub was loose.

SOLUTION

Upon inspection, every single one of the fan's 16 bolts was found to be loose. As a result, the customer worked with their fan OEM to install access doors on the fans, allowing the bolts to be checked and torqued in the future without removal of the fan assembly – a highly invasive activity that incurred far too much downtime. Armed with the new access, Preventive Maintenance (PM) processes were modified to add routine checks of the fan bolts for proper torque. Lastly, the OEM that rebuilds the fans is now required to confirm proper bolt torquing so that fans arrive on site properly torqued and witness marked.

The plant's ability to replace the fan proactively during a planned outage rather than waiting for a catastrophic failure and being caught without a spare resulted in cost avoidance of more than $116,000. The vibration monitoring capabilities also helped the customer address root cause to prevent reoccurrence, as described previously. Finally, more broadly across this site, cost avoidance of more than $450,000 through multiple different machine saves beyond the ID fan chronicled here was realized in their very first year using our AMS solutions.

> **Upon removal, every single one of the fan's 16 bolts was found to be loose.**
>
> **...Preventive Maintenance (PM) processes were augmented to routinely check the fan bolts for proper torque.**

Global Building Products Manufacturer Saves Nearly $450K in a Single Plant, Averts Unnecessary Downtime on Baler Line

RESULTS

- $440K in savings at one site alone in first year.
- Hydraulic pump issue isolated; replacement scheduled for planned outage, incurring minimal operational disruption.
- Plantwide visibility to all monitored assets ensured lingering issues did not go unaddressed.

> Overall, the Emerson Wireless Vibration Monitors are already **proving their value**, delivering both **operational reliability** and **financial impact** across our facilities.
>
> — Corporate Maintenance & Reliability Manager

APPLICATION

Mineral fibers are used in the manufacturing of acoustic ceiling tiles and are thus a raw material for the ceiling tile plants in this customer's enterprise. The fibers are manufactured at one of the customer's sites and then shipped to the other sites in the form of bales. As a result, if the baling machine goes down, a compound effect occurs, impacting multiple sites.

Hydraulic pumps are used as part of the baling process, allowing the baling machines to exert the pressures needed to compactly strap and package the fibers. Failure of a hydraulic pump is thus highly disruptive to the customer's integrated operations.

The customer uses AMS Wireless Vibration Monitors, an AMS 2140 machinery analyzer, and Machine Works software to address numerous assets across the facility, including the pumps in the baling section. A dashboard allows the customer to see the status of all assets, providing early indication of developing problems and allowing timely intervention.

The plant is one of five in a **corporate-wide initiative** to fully instrument the machinery at each manufacturing site with AMS solutions as part of a reliability improvement initiative.

CUSTOMER

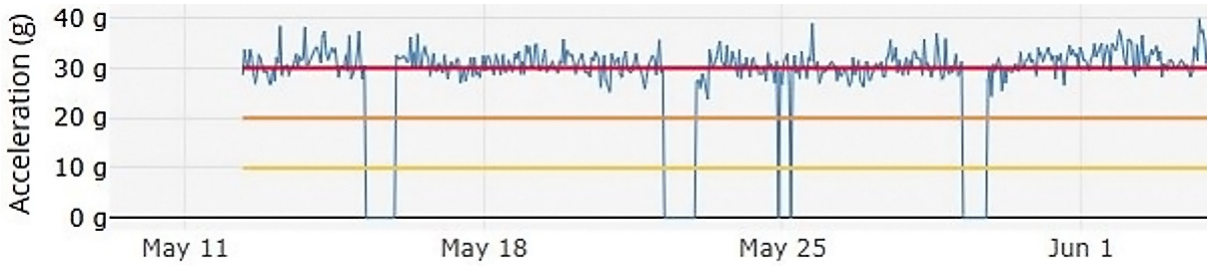
This customer is a global leader in the building products sector with multiple sites. Five of its North American sites are large enough to justify comprehensive, in-house condition monitoring of the machinery.

CHALLENGE

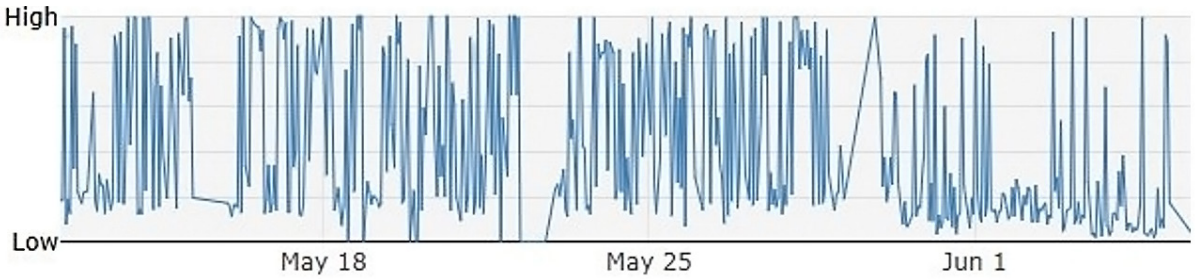
Repeated critical warnings were occurring on the Machine Works dashboard where all equipment is monitored, specifically showing that the south hydraulic pump in the baling area was in distress. This data originates from the multiple AMS Wireless Vibration Monitors affixed to the machine.

PeakVue Parameter	Critical	6/4/2025, 9:29:46 AM	Warning
PeakVue Parameter	Warning	6/4/2025, 9:29:47 AM	Critical
PeakVue Parameter	Critical	6/4/2025, 3:29:48 AM	Warning
PeakVue Parameter	Warning	6/4/2025, 1:29:49 AM	Critical
PeakVue Parameter	Critical	6/3/2025, 3:29:51 AM	Warning

P4H\PeakVue Parameter



P4H\Bearing Severity PeakVue PeakVue Plus

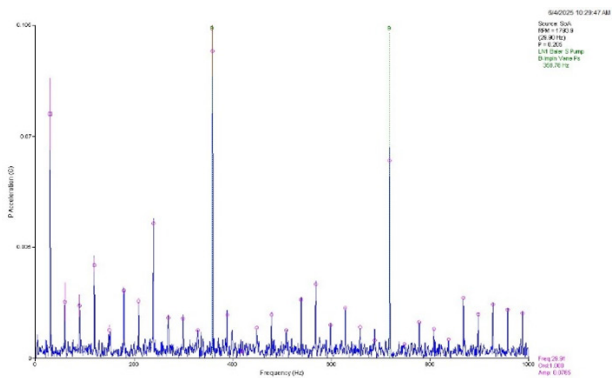


The south hydraulic baling pump was continually operating above its Warning alarm threshold and frequently triggering its Critical alarm threshold as well. This patten had been ongoing for more than 3 weeks.

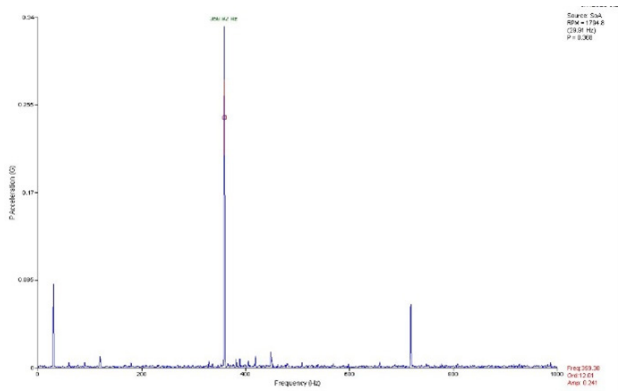
SOLUTION

Vibration analysts at site were tasked with reviewing the data in more detail and collecting supplemental data as required. It was found that high levels of vibration were occurring around the vane-pass frequency of the pump, resulting in overall amplitudes approach 30 g's peak. However, because the cost of this pump is less than $2000, a replacement was ultimately less costly than attempting more detailed in-situ investigation or repair.

OVERALL BEFORE: 29.58 g (pk)



OVERALL AFTER: 8.8 g (pk)



The spectrum from the original pump (left) showed substantial amplitude at the vane-pass frequency (12X), surrounded by rich sideband activity. The new pump (right) showed greatly reduced vibration (70% reduction in overall amplitude), quiet sidebands, and no evidence of issues. The vane-pass frequency is the most prominent peak in both spectrums, which is normal for these hydraulic pumps. The prominent lower peak in both spectrums corresponds to the running speed (1794 rpm).

The pump was replaced by performing the work during a day when the baler line was scheduled to be down anyway, minimizing impact and reducing costs to only that of normal labor rates and parts rather than additional downtime and overtime rates. The total savings to the business were approximately $10,000, but this represented merely the smallest of four incidents at the same site that cumulatively accounted for nearly $450,000 in savings during the first year alone.

This scenario underscores that the justification for monitoring is not necessarily tied to the replacement value of the asset. Instead, the real cost is in the downtime that it will incur and that when a failure occurs, it often means the activities associated with replacement are done under non-ideal conditions where parts must be expedited at additional costs and shipping charges, labor occurs at overtime rates, and the downtime itself is more valuable because it may fall within periods of peak demand. Swapping out an asset may thus be the most rational decision, and spares may even be stocked in such instances. The key is that the work can be planned in advanced, performed at a time when least impactful to operations, and total costs can be minimized. The asset removed from service can then be studied more carefully and with less urgency to reveal the root causes, and proactive defect-elimination actions can be undertaken to prevent similar issues in the future with not only the affected asset, but others like it across the enterprise.

> **...this represented merely the smallest of four incidents at the same site that cumulatively accounted for nearly $450,000 in savings during the first year alone.**

Global Building Products Manufacturer Isolates Incorrectly Installed Bearing, Chalks Up Fourth Win in First Year

RESULTS

- Intervention on an ID Fan allowed avoidance of up to $100,000 in financial impact.
- Bearing – and by extension the fan – was saved entirely by identifying an installation error that blocked lubrication flow.
- Site realized more than $450K in savings during first year by monitoring all critical assets, not just the ID fan, assuring timely intervention before failures occurred.

> The **replacement cost** for this asset is approximately $60K. Had we not spotted this installation issue as the root cause, a **catastrophic failure** could easily have occurred. That means not just the **replacement cost** of the asset, but the **downtime** on our fiber line – bringing the total impact of a failure up to $100K.
>
> — Plant Reliability Team

APPLICATION

A large-scale process for manufacturing ceiling tiles from mineral fibers necessitates the use of ID fans as part of the fiber manufacturing line. These fans are critical to production and represent a replacement value approaching $100K, including the cost of unscheduled downtime which is approximately $40K per day.

The machinery at site – including the subject ID Fans – is monitored via AMS Wireless Vibration Monitors, augmented by an AMS 2140 portable machinery analyzer, and brought into AMS Machine Works software.

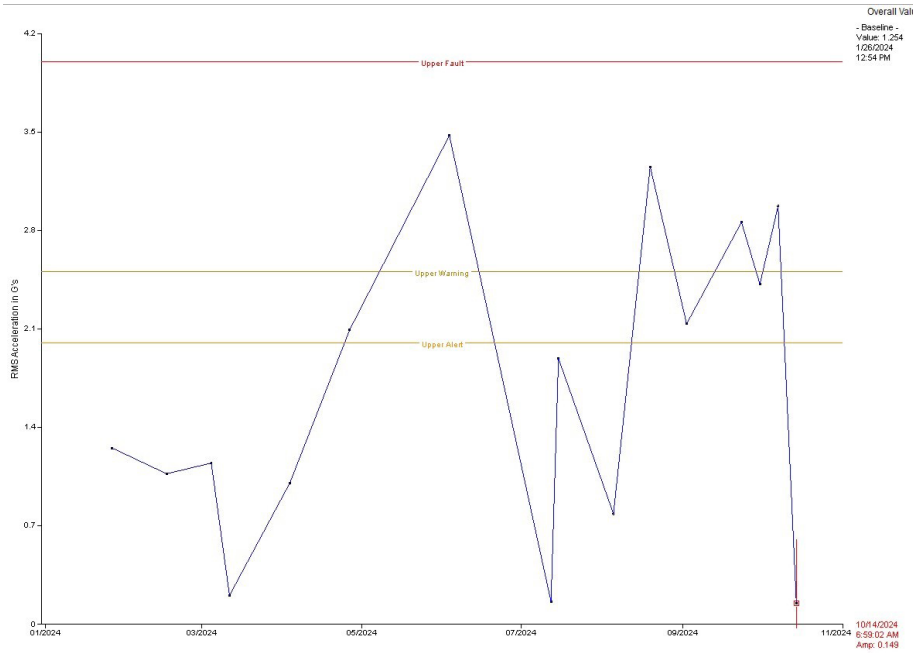
The plant is one of five in a **corporate-wide program** that fully instruments the machinery at each manufacturing site with AMS solutions as part of a reliability improvement initiative.

CUSTOMER

This customer is a global leader in the building products sector with multiple sites. Five of its North American sites are large enough to justify comprehensive, in-house condition monitoring of the machinery.

CHALLENGE

One of the pillow block bearings on the overhung ID fan began showing elevated vibration that persisted over a 9-month period. Although grease was applied several times, the vibration would quickly return to levels that exceeded warning thresholds. Root cause was surmised to be either a faulty bearing, issues with the grease, or incorrect bearing installation.



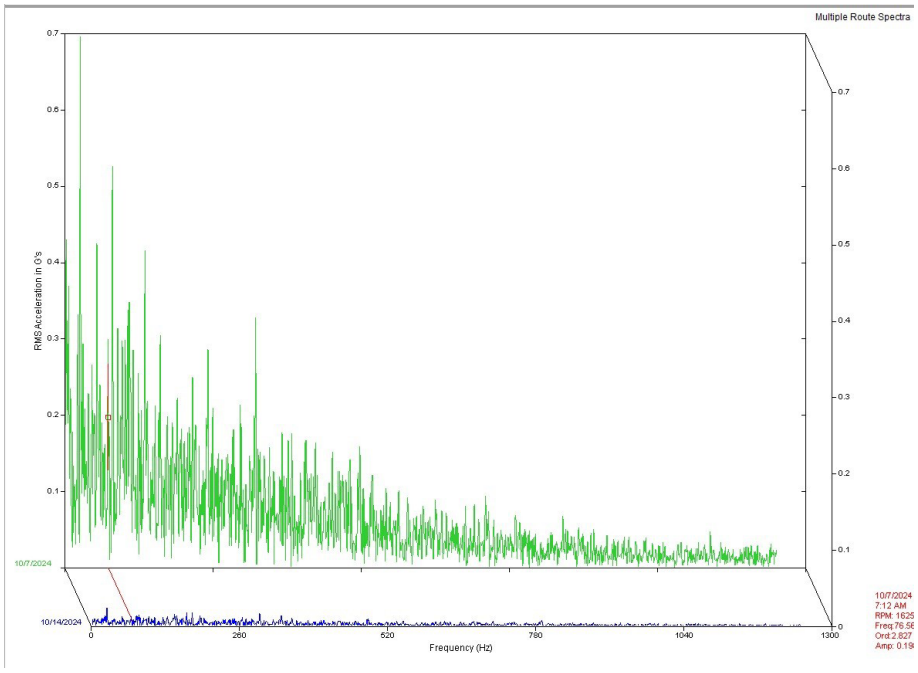
A trend of bearing vibration over a 9-month period showed amplitude subsiding immediately after administration of fresh grease, only to return again to unacceptable levels. Note that this machine was not continuously monitored at the time by AMS Wireless Vibration Monitors and data was thus being manually collected approximately every 2 weeks – explaining the large gaps between trend data points.

SOLUTION

When routine administration of grease in the bearing failed to resolve the issue, more focus was placed on either a faulty bearing or some type of installation error that was keeping the grease from reaching the bearing.

A subsequent careful inspection revealed that when grease was being administered, it was not being taken into the bearing properly and was instead oozing out of the clearance between the housing and the outer race. A disassembly was then undertaken and it was discovered that a slot in the outer race was not correctly aligned with the grease fitting, essentially starving the bearing internals of necessary lubrication and simply shunting the grease around the outer race and out the gap between housing and race.

This issue was corrected and bearing vibration levels reduced by 95%, allowing the machine to continue to run until the bearing reaches the end of its useful life.



A spectral comparison showing the as-found condition(green) versus the as-left (blue), both using the same vertical axis scales. Notice that the levels one week after correction are suitably low to preclude the need for a bearing replacement. Confidence in the decision that the bearing did not require replacement was bolstered by the embedded intelligent PeakVue analytics (inset image) in the AMS 2140, clearly indicating that both the bearing and its lubrication were not areas of concern.

As part of a best-practice discipline that quantifies the value of every save registered under the plant's condition monitoring program, personnel are tasked with recording the downtime averted and other savings versus the amount actually spent to correct the defect. In this case, the save was estimated at nearly $60,000 in parts and $40,000 in unscheduled downtime. More broadly across this site, four saves were recorded in the first 12 months of using AMS solutions, totaling more than $450K. Even better results are now expected as the site has implemented continuous monitoring via AMS Wireless Vibration Monitors, giving visibility to asset conditions in real time rather than only intermittently every 2-4 weeks.

> **The AMS infrastructure doesn't just tell us when to replace a bearing – it helps us find root cause so that we might not have to replace a bearing at all. The PeakVue Plus analytics are particularly valuable as they help us quickly and confidently distinguish bearing problems from lubrication problems.**
>
> **— Plant Reliability Team**

Rapid diagnoses of calcium deposition on pump using AMS Wireless Vibration Monitors saves more than $100K

RESULTS

- 16 hours / $50,000 of downtime averted.
- Nearly $60,000 in cost avoided for unnecessary pump replacement.
- $6000 in labor cost eliminated.

> (The AMS solution) is absolutely **fantastic** ... the power in the box alone is **far beyond** anything we've had. It is **worth its weight in gold** for us and it's been a very, very **worthwhile investment.**
>
> — Corporate Maintenance & Reliability Manager

APPLICATION

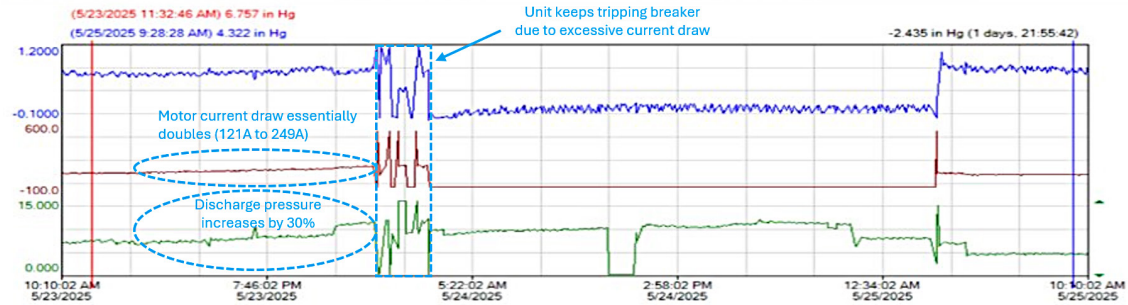
The couch roll is the last roll in the forming section for making acoustic ceiling tiles – a process somewhat similar to making paper from wet pulp, but much thicker in composition. This roll is a large, rotating drum with a screened surface that uses a vacuum pump to extract moisture from the wet, pulpy sheet of raw tile material before it moves to other stages of the manufacturing process. The vacuum pump is thus critical to the process as without this pump, the production line must stop – an expensive proposition totaling more than $80,000 per day.

CUSTOMER

This customer, a global leader in the building products sector, uses our AMS 2140 machinery analyzer, AMS Wireless Vibration Monitors, and AMS Machine Works software to address numerous assets in the facility, including the couch roll vacuum pump.

CHALLENGE

When a breaker tripped on one of these pumps due to excessive current draw from the motor, inspection of a trend confirmed elevated current draw (200% of normal) as well as an approximately 30% increase in discharge pressure. The cause was initially unknown and the plant made plans to replace the pump. However, the reliability engineer on-site requested that the vibration data from the installed AMS products be consulted more closely before the plant committed to a pump replacement and the corresponding costs. It was believed that the vibration data might reveal the real cause and help avert the need for a new pump along with the associated downtime to install it.



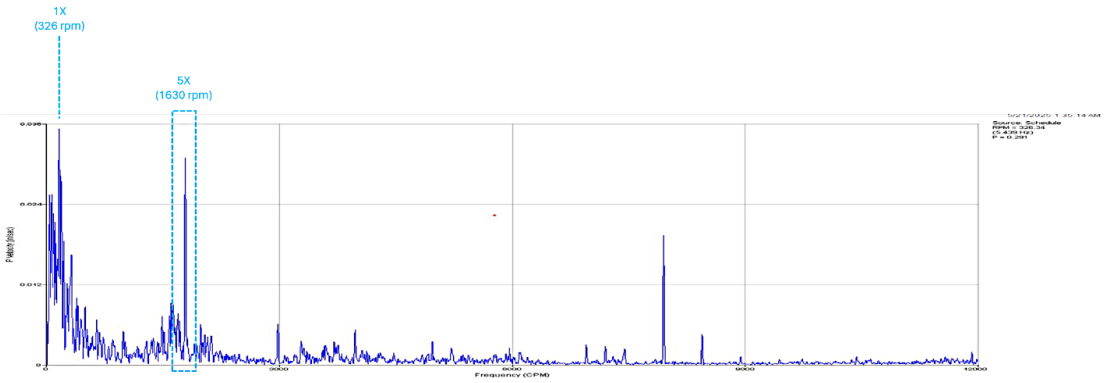
Examination of trend plots for motor current (red), pump suction pressure (blue), and pump discharge pressure (green) revealed that the motor current essentially doubled while the discharge pressure (green) rose by 30%. Eventually, the excessive current resulted in multiple trips of the unit.

SOLUTION

Calcium buildup is a known issue that can affect this pump. The water drawn out of the pulp by the pump has substantial mineral content – not unlike hard tap water, but considerably worse. The buildup affects pump performance because under the burden of pump internals covered with calcium deposition, the machine must work much harder to try and maintain sufficient suction – drawing more motor current. As a result, the plant performs an acid flush once per week and has even found a way to perform this task without taking the pumps offline.

Examination of the vibration data revealed that that a large spike was occurring in the spectrum corresponding to the vane pass frequency of this 5-vane pump. The reliability engineer quickly understood that this was consistent with calcium build-up: the build-up on the pump casing can indeed be enough to cause rubs as each impeller vane passes by.

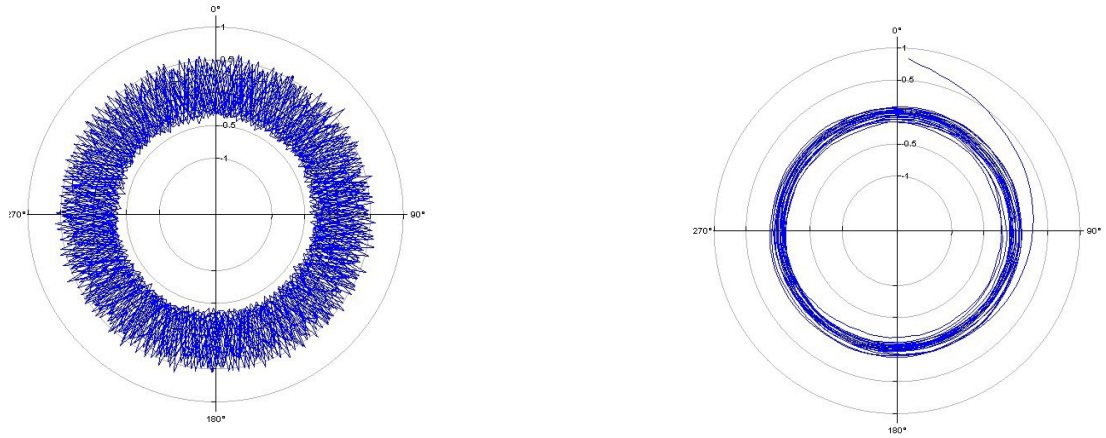
All of the available evidence thus pointed to excessive calcium deposition: excessive current draw in the motor, high discharge pressure in the pump, and apparent rubbing at vane-passing frequency in the pump vibration signature. The high discharge pressure can be compared to constricted arteries in the human body which causes blood pressure to go up. In like fashion, the calcium deposition shrinks the size of the pump's discharge port, elevating discharge pressure.



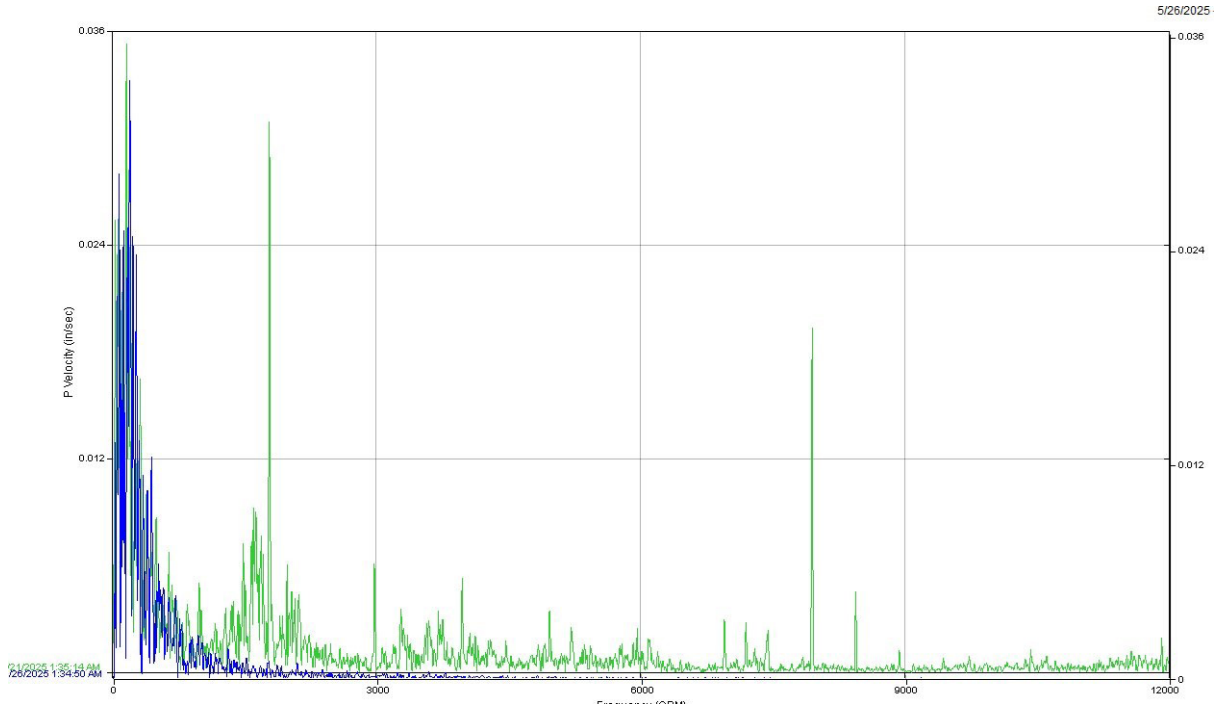
Examination of the vibration spectra revealed large, abnormal amplitudes clustered about the vane-passing frequency for the 5-vane vacuum pump.

Calcium deposition is a recurring issue with these pumps, requiring weekly acid flushes to keep pump internals clean.

Tentatively confident that removal of calcium buildup would remedy the situation, and knowing that a minimally intrusive acid flush could be conducted without taking the pump apart and removing it entirely from service, it was agreed that a flush would be conducted and then vibration data along with motor current and discharge pressure trends consulted. The flush was subsequently performed and the pump immediately resumed expected behavior; motor current returned to normal, pump discharge pressure returned to normal, and the vibration spectrum no longer showed elevated activity in the vane-pass frequency region. The plant thereby avoided nearly $60,000 for a new pump, 16 hours of downtime totaling more than $50,000, and $6000 of labor. Averted costs thus came to more than $116,000.



Circle plots showing distribution of vibration over the full impeller rotation. On the left are the amplitudes prior to the acid wash; on the right are the greatly reduced amplitudes after the acid wash. Note also the absence of high frequencies on the right plot where the dominant vibration is now once-per-revolution (1X) instead of vane-passing frequency (5X). Careful examination of the pre-flush circle plot under further zoom by the vibration analyst actually showed where the vanes were hitting the calcium deposits on the pump casing, causing each vane to impact the deposit as it passed, and manifesting as elevated vane-pass frequencies.



Spectrum overlay showing pre-flush data (green) and post-flush data (blue). Notice the dramatic reduction in the vane-pass frequency cluster as well as harmonics.

> PeakVue and PeakVue Plus is a **huge, huge unlock** for us. As we get our readings, whether it's on the 2140 or the (wireless) sensors... we've been able to get with our lubricators and **adjust our lubrication frequencies** based on what we're seeing. And that's typically not something we've been historically able to do.
>
> — Corporate Maintenance & Reliability Manager

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