

Up in the air

The integration of hardware, software and communication networks will provide the big wins at underground mines when it comes to mine ventilation, Dan Gleeson discovers

The ability to align air supply with production requirements is one of the main – if not ‘the’ – challenge for operators in the mining space, according to Australia-based MINETEK.

Yet, the task of matching the two is becoming even more difficult.

The entrance of battery-electric vehicles, a proliferation of autonomous and teleremote operated vehicles, the move to increasing depths underground and incoming regulations related to emissions and air flow means the optimal ventilation solution is harder to come by.

However, what is becoming increasingly apparent is today’s ventilation challenges will not be solved by hardware alone. It will be a combination of ‘connected’ hardware, communication infrastructure and software that ensures underground mines are adequately and efficiently ventilated now and in the future.

Maestro driving out complexity

Maestro Digital Mine is used to ‘upsetting the apple cart’ in the underground mine ventilation space, with a company tag line of “real-time data means more time at the face” exemplifying how it is upending the status quo.

By providing smart IIoT devices that can be integrated with any third-party platform, it has made the difficult task of optimally ventilating underground mines that much easier.

Air quality stations, digital communication network solutions, automated air regulators and the like have made the Sudbury-based company a household name in mining circles in recent years, yet its solutions have been making an impact underground for more than a decade.

Prior to the introduction of the company’s MaestroFlex™ automated regulators that have been used since 2007, the industry was constrained by a lack of “infrastructure”, according to Michael Gribbons, President, CEO & Co-founder of Maestro.

“This means several things, starting with a solid network for communication,” he told *IM*. “The majority of the ventilation control hardware is at the far extremities of the mine – past all the headings and at the return air raise. That is a location that is serviced last and difficult to get either the network installed or repaired due to the proximity of the working faces.”

Without an effective communication network, ventilation technicians would need to travel underground to evaluate and make manual changes.

MaestroFlex automated regulators replace drop board manual regulators that cannot be adjusted from surface, while allowing surface-based control room operators the ability to control ventilation through manual, event-based, time-based or full ventilation on demand (VoD) functions, according to Maestro. They, like all of Maestro’s products, have been designed to withstand the realities of underground mining.

The opposing blade design of these regulators provide optimal flow control over large ranges, allowing its use in real-time VoD applications, Maestro says.

When equipped with ModuDrive™ digital IIoT actuators, the regulators can also provide real-time diagnostics that allow troubleshooting from surface through Maestro’s networked-based software platform, MaestroLink™ Server.

The introduction of this regulator design

Howden’s Hugo Dello Sbarba says Howden’s Ventsim CONTROL integration with several Maestro products is about “two best-in-class products coming together for a best-in-class ventilation solution”

drives out significant capital expenditure underground by eliminating expensive PLCs, transformers, engineering services and panel fabricators, according to the company. The IIoT actuators require less current and, as a result, eliminate the requirement of a transformer. The ModuDrive connects to any network switch allowing complete control, monitoring and real-time diagnostics over Modbus TCP/IP or EtherNet/IP™ communication protocols. These elements lead to capital expenditure savings of some 40-70% over the incumbent technology, according to Gribbons.

The combination of the regulators and actuators also have a role to play in the mining sector’s evolving ESG needs.

“If you take a look at institutional investor demands when it comes to ESG, greenhouse gas (GHG) emissions are front and centre,” Gribbons said. “Investors and consumers are demanding that mining must be sustainable. Controlling ventilation optimally means GHG reductions and a smaller carbon footprint. The main concern from the mining industry revolves around carbon reduction.”

He added: “Blockchain methods, a type of distributed ledger, can provide safe tracking of carbon content throughout the entire value chain, thereby tracking total GHG emissions. At some point, carbon will be assigned a value and a miner that has reduced their GHG emissions will have a competitive commercial advantage. For example, dirty nickel with a high carbon content will sell for less than clean nickel with a lower carbon content. Clean is green, and green will translate to higher commodity prices and profits.”

This increased investor scrutiny has led many mining companies to test, buy or factor in the use of battery-electric equipment underground. This is especially the case in Canada, which is recognised as a leader in the application of this technology.

Yet, the use of this technology will not completely eradicate mine ventilation needs. Higher strata temperatures that come with operating at increased depths will mean cooled air needs to circulate in areas of high activity. Blast gases will continue to require removal with effective ventilation fans before personnel can re-enter production areas.

Gribbons said miners would do well to evaluate their actual ventilation requirements underground and then gain control of the ventilation process to effectively reduce their GHG emissions as part of a sustainability drive.

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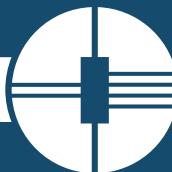
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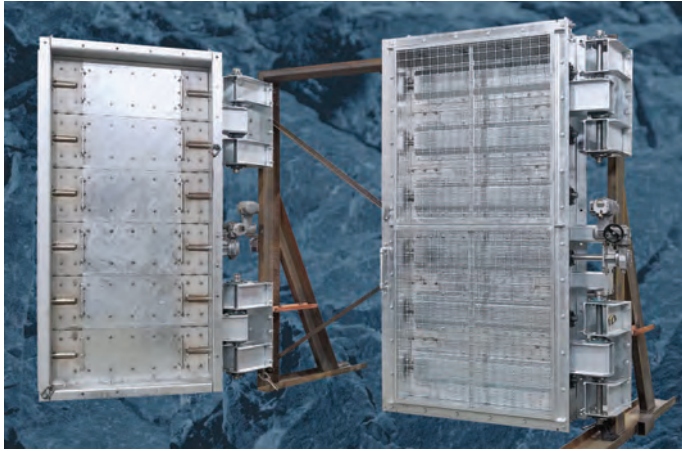
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MaestroFlex automated regulators replace drop board manual regulators that cannot be adjusted from surface, while allowing surface-based control room operators the ability to control ventilation through manual, event-based, time-based or full ventilation on demand (VoD) functions, according to Maestro

“If you take a look at trying to reduce carbon content in your operations, reducing your energy footprint is going to be the most important factor for these mines,” he said.

The energy profile of a typical deep mine means up to 70% of the energy expended is directly related to ventilation, according to Gibbons.

This percentage may be widely accepted by suppliers, but not all mine managers and operating personnel factor this into their decision making.

“Mine managers think about tonnes per day/month, or, if they are in gold mining, ounces per day/month,” Gibbons said. “A better metric that makes sense to them in terms of ventilation is tonnes per tonne. That is the amount of air circulating in a mine versus how much ore is being skipped/hailed to surface.”

In some of these deep mines Maestro studied, there were ratios of 18-22:1 in favour of air.

“The weight of air being pushed through the mine was 18 to 22 times the amount of ore that came up to surface,” Gibbons explained. That air could be cooled or heated too, adding another layer of expense.

These are ratios that operating personnel will need to understand and appreciate if they are to achieve their ESG goals.

“If you are seriously considering trying to reduce carbon content, you should consider this metric,” Gibbons said. “Ventilation is becoming a constraining factor for miners being able to produce at deep mines. That constraint is both economic and environmental.”

After an evaluation of actual ventilation requirements, these miners should then ensure the ventilation is getting to the right spot, according to David Ballantyne, Vice President of Product Development and Co-founder of Maestro.

This is where the company’s Vigilante AQS™ and Zephyr AQS™ Air Quality Stations come into play, providing measurement of the environmental conditions, control and feedback to the MaestroFlex regulators in order to optimally ventilate the mine level.

Gibbons said: “Our whole goal is to make the ventilation process

a lot less complicated and reduce the requirement for specialists. This is what we did with the Vigilante AQS and Zephyr AQS, and we are doing it again with the regulators and actuators using both IIoT and Edge-based controls.”

Pairing all these elements with MaestroLink Server provides improved maintenance processes and a reduced need for specialist intervention, according to the company. This software features a multi-instance web-based interface to monitor and record the health of all of Maestro’s IIoT devices and the Plexus PowerNet™ ‘last mile’ underground communication network.

Gibbons explained the origins of the software: “When thousands of our Vigilante AQS and Zephyr AQS were operating, we realised the constraint was keeping the sensors in compliance by calibration. We had all these advanced diagnostic functions on board the devices, but the client was not able to access them.”

The software takes all the embedded data in Maestro devices and pulls it into an easy-to-use platform for viewing and reporting, according to the company.

“MaestroLink Server will poll the IIoT devices and pull the diagnostic bits into the software,” Gibbons said. “The software will then provide a detailed action plan to calibrate or repair the device.

“It gives you the ability to maintain these devices from surface, instead of using time-based maintenance functions that deploy personnel underground unnecessarily.”

The company is focusing on utilising MaestroLink Server as an on-premise software platform to eliminate cybersecurity risks. Future implementations could easily leverage cloud-based infrastructure when mining companies deem this method safe.

Maestro’s aim of driving out complexity in the ventilation space – epitomised by providing all data via open communication protocols – has recently been aided by a collaboration with

Howden and its Ventsim CONTROL ventilation design program for control and optimisation.

Gibbons said the two companies share a “simplistic” operational aim, with Ventsim CONTROL and Maestro’s IIoT devices reducing the complexity and integration time required for any underground ventilation project.

“We integrate with everyone’s solution, but what is very different with Howden’s integrated approach today is they are making it even easier for their clients,” he said. “Simple pull-down menus allow you to select any Maestro device in the software, and it gets populated automatically. That is a huge saving on complexity and engineering costs, allowing the client to manage much more of the system integration themselves.”

He added: “The other software VoD platforms require significant configuration and engineering services, which incurs huge engineering costs and time delays. With this integration, the client can eradicate that complexity and expense.”

Howden boosts CONTROL functionality

Howden is continuing to take on user feedback to improve its flagship Ventsim CONTROL software, with the latest update set to bring an ‘on demand’ element to mine ventilation cooling.

Ventsim CONTROL was born out of such feedback – in fact almost 10 years of customer input. This helped the original owners of the software, Simsmart and Chasm, develop a no programming ‘plug and play’ approach that could see instrumentation, automation, fans, dampers and fan motor starters integrated quickly and easily into any Ventsim CONTROL system.

An upgrade from Ventsim DESIGN, Ventsim CONTROL uses intelligent software connected to Howden or third-party hardware devices to remotely monitor, control and automate airflow heating and cooling to deliver safer, more productive, and lower cost ventilation for mines, the company says.

Hugo Dello Sbarba, Director of Ventsim and Sales Mining, says the addition of a ‘cooling on demand’ module to Ventsim CONTROL coincides with an industry move to install more cooling plants to achieve higher standards of health and safety for workers. Howden has seen this trend up close and personal, having recently successfully delivered the first phase of an 8 MW surface bulk air cooling plant for Roxgold’s Yaramoko gold mine in Burkina Faso.

“We chose now to introduce cooling on demand to Ventsim CONTROL partially because more mines are getting deeper, require cooled air and are adopting higher standards in advance of incoming regulations,” he told *IM*. “This reflects a wider industry move towards more sustainable operations.”

There was also a push from existing Ventsim

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Howden recently delivered the first phase of a 8 MW surface bulk air cooling plant for Roxgold's Yaramoko gold mine in Burkina Faso

CONTROL customers for such cooling functionality, according to Dello Sbarba, with these clients realising the benefits that could come with controlling the process from the underground readings, assessing where cooling was most needed.

"While the actual capital cost associated with the cooling plant installation is unlikely to change – given these plants should be sized by engineers on a worse-case scenario basis – you should definitely see significant improvements in terms of the operating and energy cost of the plants," he said.

This economic benefit is complemented by the health and safety advantages already mentioned.

"At the moment, miners tend to put a chilling plant on surface and just cool the air regardless of where it is destined to go," Dello Sbarba said. "This process doesn't consider the fact that the only reason you are cooling air on surface is for the deeper levels of the mine that experience particularly high temperatures.

"You currently don't have intelligent control of this cooled air across the underground mine."

With Howden's cooling on demand module within Ventsim CONTROL, users can monitor if they are obtaining the required temperatures at these deeper levels, making sure the cooled air is pushed to where it needs to go.

Aside from a subscription to Ventsim CONTROL with at least Level 3 and 5 functionality – providing required set points for airflow, gas levels, and/or temperature – and the right-sized ventilation fans, users only require temperature and humidity sensors underground to carry out such control.

"Even though you need many of these monitors, they are relatively cheap with many hardware solutions available on the market," Dello Sbarba said.

Equipped with these elements, users can assign certain temperature/humidity setpoints in areas of high activity, plug these setpoints into Ventsim CONTROL and allow the software to

'communicate' with the cooling plant and fans to automatically cool these areas to the required temperature. An advanced Level 5 installation of Ventsim CONTROL allows the users to automatically optimise underground fan and regulator settings and adjusting main fan settings to maintain required cooling levels

while maximising energy savings.

He concluded on the subject: "The reason it is advantageous to perform cooling on demand with Ventsim CONTROL over other solutions is the 3D modelling capabilities within the software. The model helps you predict and better control your air flows based on what you are seeing in the simulation.

"It has an edge over any other custom-made ventilation engineering solution on the market."

When Dello Sbarba spoke to *IM* in early June, the new cooling on demand functionality was in the final throes of testing in a factory setting. A mine site trial was being lined up for later in the year too.

He also flagged the potential for a 'heating on demand' solution where mines are not limited to stay above freezing point at the shaft collar. Such control would result in significant energy savings and reduced greenhouse gas emissions which comes in line with the low NOx-emissions heaters provided by Howden that many northern mines currently rely on.

One of the other new major features of Ventsim CONTROL is the ability to offer advanced connectivity with third-party software. This ensures data can be exchanged and Ventsim CONTROL can mirror the control abilities of any SCADA system.

Dello Sbarba explained: "In the market, we were seeing a lot of mines wanting to keep on using their existing software and standardise on a given SCADA. This provides them the ability to do so."

This year, Howden has been very busy signing agreements with other third parties to ensure it remains a 'total ventilation solutions provider' in the mining space.

A recent pact with VortexOHS could see the company gain further market share in South Africa and neighbouring countries in the near term, while setting the company up to provide the sophisticated occupational health and safety platform global mining leaders will soon require, according to Dello Sbarba.

The company's software improves safety by assisting ventilation and occupational hygiene professionals to collect, manage and report data

and information from their occupational health and safety sampling programs. It streamlines the process, reducing the administration burden and cutting costs, Dello Sbarba explained.

"VortexOHS is a software widely used across South Africa, meeting the regulation needs of the South African government in terms of air sampling and reporting," he said. "South Africa is by far the most advanced in terms of mine ventilation reporting – it is the only one that has such high standards – but I strongly believe the rest of the world will strive to meet those same standards over time."

And, as previously mentioned in this article, Howden has teamed up with Maestro to integrate several Maestro products into Ventsim CONTROL.

"Maestro's products are purpose built for underground mining, having been tested over a really large installed base," Dello Sbarba said. "At the same time, Ventsim CONTROL is a high quality, purpose-built offering for the industry. This is where we see a good fit in terms of integrating their hardware with our software.

"It is about two best-in-class products coming together for a best-in-class ventilation solution."

That optimal ventilation solution is, according to Dello Sbarba, making the industry transition towards battery-electric vehicle use that much easier, ensuring that the combination of the machine and ventilation system is right sized from the off and the economics stack up.

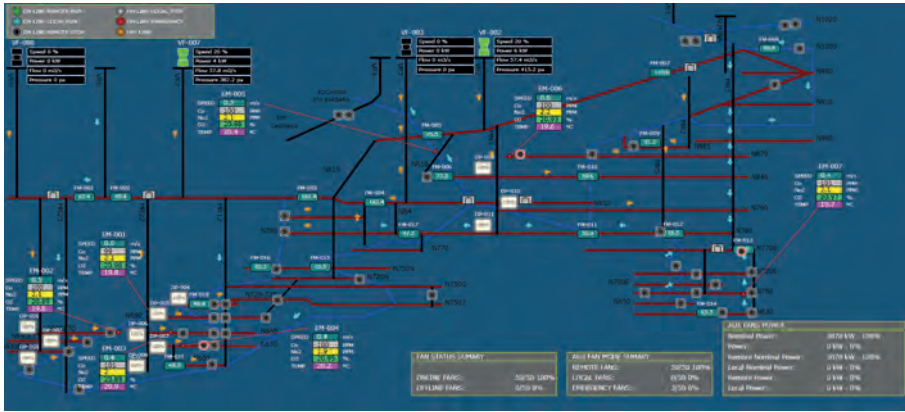
"Howden's goal here is to support mining operations in making their project more feasible whether it is from a capital or operating expenditure basis," he said. "Miners looking at battery-electric vehicles can come to us for a full evaluation of their ventilation needs that ensures the system they employ is safe, affordable, consumes as little energy as possible and – increasingly important nowadays – comes with the lowest greenhouse gas footprint."

Measure to optimise

Zitrón has also designed an intelligent ventilation management system for mining that, it says, can optimise underground air flow for a significant improvement in working conditions and an up to 40% reduction in energy consumption.

"The rationale is to direct air where it is needed and in the volume that is required, to have safer working conditions, to increase productivity and to reduce energy consumption," the company explained. "All this translates into a faster return on investment due to energy savings, reduced carbon emissions and greater guarantees in both safety and system reliability."

Zitrón says it wants to streamline the ventilation process, eradicating the need to consult several complex 3D representations of ventilation circuits offering up difficult to



The Zitrón monitoring system: The control panel showing the ventilation system, above, and a representation of the control system of the main equipment, dampers as a function of the ventilation requirements at each production level, below. Both taken from a mine in southern Europe



manage information, by producing an agile, simple and useful system.

Correctly sizing the ventilation requirement is

the place to start with such a system.

“In most mines around the world, ventilation is not correctly sized,” Zitrón said. “It is

necessary to analyse the actual airflow needs to know if the ventilation system is optimised, otherwise the mine could miss out on many opportunities for improvement.”

The result of such an analysis is one of the most important aspects for planning, Zitrón explained.

“It is not only about providing the necessary flow, but also about getting it to the place where it is needed at any given moment,” the company said. “This will depend on the tasks being performed and the location in the mine where they are being carried out.

“It is essential to measure in order to optimise.”

Zitrón’s team of mining experts devised this system, taking their knowledge of mine ventilation systems and different mining methods to come up with a management and monitoring system that can be adapted to the needs of each mine in an efficient and effective way, the company said.

To create such a system, an exhaustive analysis of the primary and secondary ventilation platforms is carried out, obtaining the main ventilation key performance indicators (KPIs). These KPIs become the necessary indicators to optimise the system and, subsequently, design an automation plan adapted to each mine, Zitrón said.

The information is inputted into a control and monitoring software that displays the ventilation

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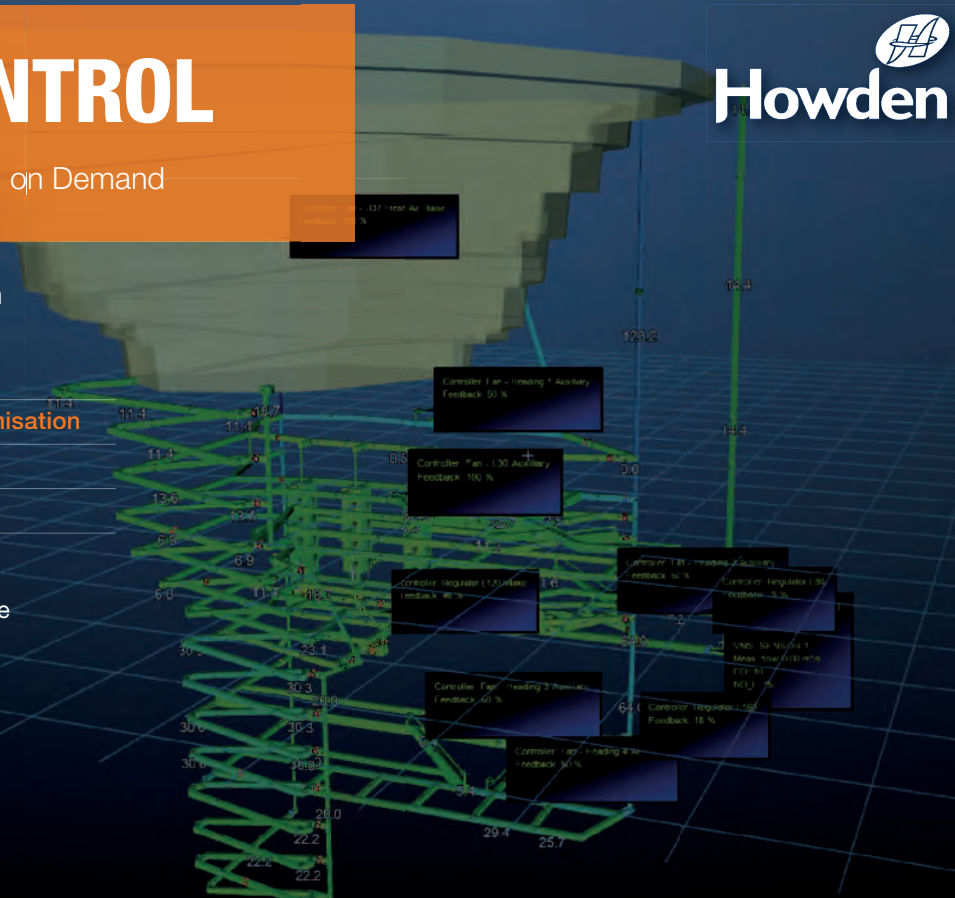
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needs in real time and can implement saving strategies according to the type of mining, according to the company.

Zitrón's engineers can offer a "total integration solution" that introduces a new communication system, or they can integrate it with existing communications infrastructure.

"It is flexible, simple and practical, and its implementation can be done in phases, collecting, in real time, all the parameters of the equipment that make up the system (main fans, dampers, auxiliary fans, etc)," Zitrón added.

Another advantage of this system is the possibility of adding predictive maintenance functions, which, in turn, reduce operating and capital expenses associated with critical equipment, minimising failures and outages.

Zitrón concluded: "The elements that make up the real-time monitoring system, and that are integrated in the fans, dampers, gas stations, etc, have been designed and manufactured by Zitrón's research and development department and comply with the highest quality standards."

Mission-critical savings

A diamond mine operation in northern Canada has been reaping the rewards of directing air where it is needed over the last decade.

Using SHYFTinc's NRG1-ECO mine ventilation control system, the operation has been able to keep up with aggressive production targets in key mining zones while keeping energy costs to a minimum.

"The operation adopted NRG1-ECO as its platform for controlling the entire mine ventilation almost 10 years ago and they have not looked back," SHYFT Inc, a Bestech Engineering company, said. "They needed a robust solution for their harsh environment to make sure mine air was being directed where and when it was needed."

NRG1-ECO has worked "flawlessly" for control of primary, auxiliary and booster fans on surface and underground over this period, while the remote support element of system has played a critical role in ensuring users are properly trained, SHYFT Inc said. This includes the provision of live demonstrations and support for the first few changes to the system.

"We all know that production and tonnes are what keep the mines open," the mine's Ventilation Engineer, said. "NRG1-ECO has allowed us to control a mission-critical system, mine ventilation, in a way that maximised air to production areas and uses only the energy required to get the job done.

"We used to rely on expensive programming changes and updates that would take weeks but, with NRG1-ECO, I can make the additions and updates within a matter of minutes. So, we just keep on using it."

An additional benefit of the system is the reduced energy consumption it offers by turning down the speed of fans and shutting down others when not in use. This has led to significant energy savings for the mine in question over the last 10 years – around 22% in savings, in fact.

Such benefits are meaningful for a site operating on grid power, but even more critical for remote operations generating their own power with diesel generators.

Using SHYFTinc's NRG1-ECO mine ventilation control system, the diamond operation in northern Canada has been able to keep up with aggressive production targets in key mining zones while keeping energy costs to a minimum



Performance on Demand (PoD)

The same mines that are looking for optimal mine ventilation solutions would do well to consider the concept **MINETEK** is pushing.

MINETEK explained: “The contemporary approach to delivering on-demand air supply in recent times has been to regulate airflow through complex and expensive infrastructure. The solution has been the application of variable speed drives (VSDs), variable frequency drives (VFDs), or variable voltage variable frequency drives (VVVFDs) – which control power to the ventilation system, enabling air flow to be ramped up or down based on demand.”

VSDs, VFDs and VVVFDs are, by their very nature, costly solutions, according to MINETEK. They come with infrastructure and supporting control software that can cost anything from tens to hundreds of thousands of dollars to install and run.

“As expensive as they are, they are equally fragile, requiring dedicated air-conditioned rooms and custom cabling for operation,” it said. “While the benefits of VoD via the use of VSDs seem apparent, their use now almost seems illogical in the harshest of underground environments.”

MINETEK says it has devised an alternative way to optimise air circuits underground without the use of VSDs with its Performance on Demand (PoD) solution.

Able to be manually or autonomously

controlled, the mechanically driven solution delivers the required flexibility for operators by tuning the dynamics of the air flow over the system’s impellers.

“By mechanically controlling the flow of air over the impellers – not the supply of power to the fan – power consumption is optimised and can be maintained at a significantly lower level,” MINETEK claims.

This has seen the company, in some instances, halve power consumption costs compared with traditional VSD-backed VoD systems, all while enabling operators to maintain flexibility in line with production and scheduling requirements.

Evan Redman, Strategic Marketing Manager for MINETEK, told **IM**: “The Minetek fan system provides a 50% reduction in power consumption due to the flexibility of power/performance/pressure on demand, particularly in the ability to provide low air flow at high pressure, which is something the VSD control option cannot deliver.”

By driving down operational costs and energy consumption, miners can yield better environmental outcomes too.

Redman says MINETEK is the only company in the secondary fan market offering VoD via a mechanically driven solution involving the system’s impellers. The PoD system works using RFID tags, among other technologies, to target air delivery based on people and vehicle movements.

The company added: “By removing the need for VSDs, mines can use all available power without risk of fans stalling or creating harmonic imbalance. This flexibility in control and application offers true agility by lowering power consumption and costs, and allows faster re-entries following blasting activity.”

MINETEK can point towards PoD references from Aeris Resources, Gold Fields, OZ Minerals, Barmenco and Glencore. These companies are also familiar with its compact and robust single-speed fans that, again, have been proven to reduce power consumption costs by as much as 50%, MINETEK claims.

“By virtue of their smaller size, MINETEK fans can be easily installed in a range of orientations and tight underground locations,” it said. “This agility and responsiveness enables operators to adapt to changing conditions, while reducing the potential for manual handling safety impacts.”

Maintenance that makes sense

Reliable air flow is critical in deep mining operations for the removal of hazardous gases, the cooling of equipment and distribution of clean air, **NYB** says.

Thanks to recent innovations in remote monitoring, the equipment involved in the ventilation space – primary and secondary fans – is lasting longer, giving mining operations the productivity and reliability boost they require to

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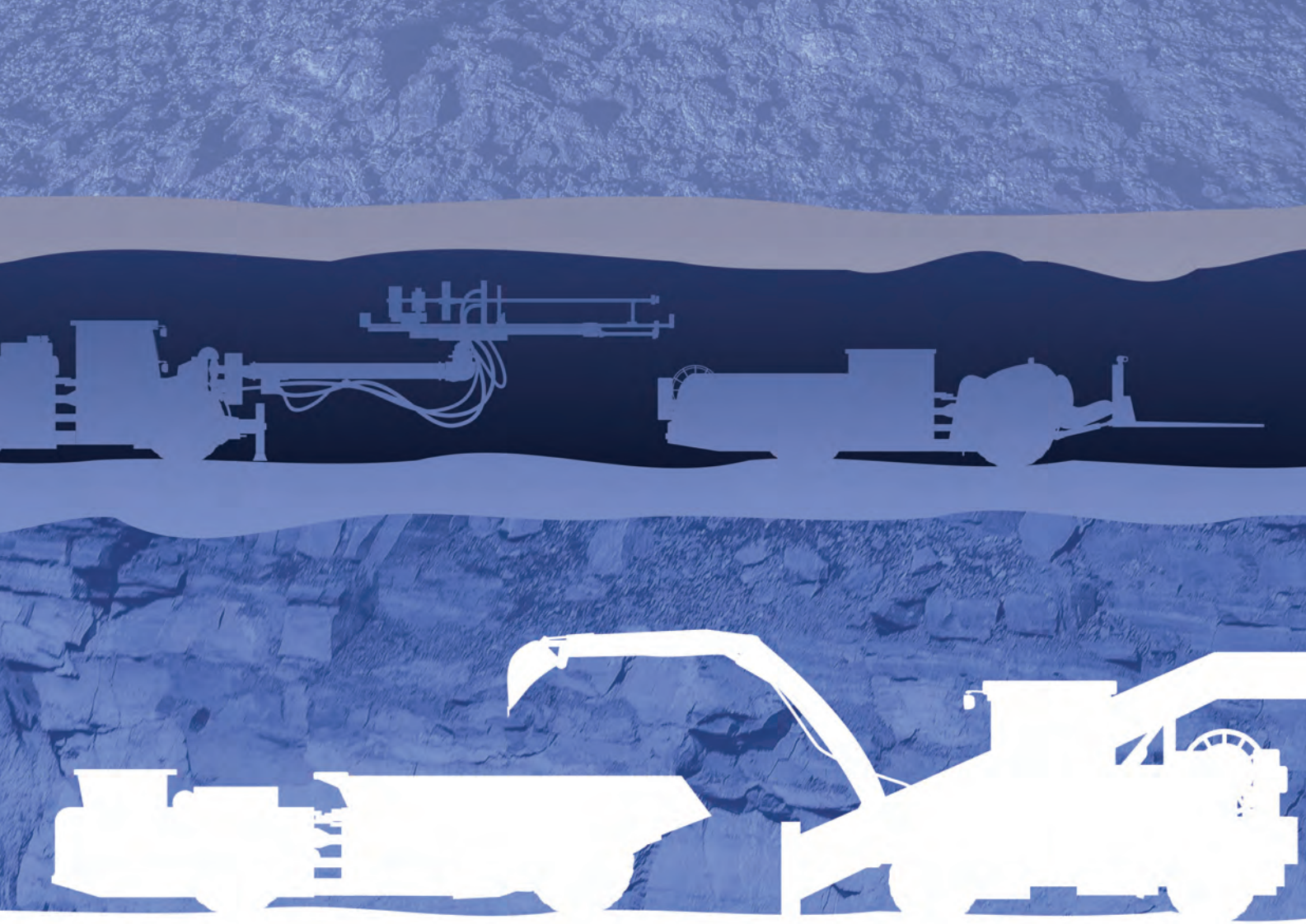
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NYB offers several mechanical sensors to gauge vibration, temperature, and speed of motor, bearings and drives

operate at increased depths.

“Given the stress on fans over time, wear is inevitable and can be properly managed using monitoring devices to avoid unplanned downtime and maximise productivity and output,” NYB says.

Material build-up from heavy dust loads, corrosion caused by excess moisture, and other harsh conditions can all result in decreased fan efficiency. Overcoming deficiencies causes the motor in these fans to work harder, leading to excessive energy consumption and increased energy costs – and potential safety hazards when motors operate outside their safe range. Repetitive or unexpected maintenance also increases costs and results in lost production time.

Fan sensors, however, give users greater visibility into the performance of their equipment to help predict and prevent mechanical failures while optimising operational efficiency, according to NYB.

“The difference in being proactive to potential maintenance problems can result in significant long-term cost savings,” the company says.

NYB offers several mechanical sensors to gauge vibration, temperature, and speed of motor, bearings and drives. When the devices detect changes above a certain threshold, they send automatic alerts or can make preemptive changes if programmed to do so. The amount of dirt and dust in the airstream and moisture content can also be monitored and air flow can be adjusted automatically.

By continuously monitoring power input, meanwhile, artificial intelligence-powered software can adjust for optimal power usage.

The initial cost of purchasing and installing these fan sensors is quickly recovered with the multitude of benefits they provide, NYB argues.

“By presenting immediate insight into equipment performance, remote monitoring

enables users to measure and improve overall equipment effectiveness,” it said. “Some benefits include trend tracking over time to improve and increase reliability, reduced maintenance costs for replacement parts and personnel, and optimised power consumption.”

This all plays into the growing trend of VoD to maximise energy efficiency, increase safety for mine workers, and reduce operating costs, NYB says.

Collaborating on safety

DSI Underground, now owned by Sandvik Mining and Rock Solutions, signed a joint venture agreement with **ABC Canada** in 2020 to create **DSI Underground Ventilation Systems**.

The product portfolio of the new joint venture includes Flexline™ and semi-rigid Hardline™ flexible vents for positive and negative airflow, high-efficiency Toughvent fans and other ventilation accessories – curtains and coverings, emergency shelters, inflatable airstop and repair kits.

DSI Underground Ventilation Systems has a team of engineers specialising in the design of

ventilation systems capable of providing advice and the necessary technical support to clients, increasing the level of safety and profitability of projects by optimising energy use, the companies said. It started operations in Santiago, Chile, with a production plant of more than 2,000 sq.m and will be present in Latin America directly through entities in the region and an exclusive distributor in Colombia.

“We are confident that this new company will allow us to deliver more efficient and comprehensive solutions to our customers and will enable us to continue to reinforce progress in underground mining and tunnelling,” the companies said.

CFH takes on 100% of Korfmann

Germany-based **CFH GmbH**, a supplier of ventilation, cooling/heating, methane drainage and dedusting solutions to the mining industry, recently took over Korfmann Lufttechnik GmbH.

The 100% owner of Compact Filter Technic (CFT) technology, its systems are used in all types of mining, with de-dusting, ventilation, air heating and cooling, and methane drainage all key CFT competences.

Since 2001, all Korfmann fans and silencers have been manufactured exclusively by CFT, with nearly 6,000 Korfmann fans successfully designed and delivered for mining and tunnelling applications worldwide.

In recent years, CFT and Korfmann have successfully implemented ventilation projects for main mine fans with impeller diameters up to 3.35 m. The CFT portfolio also includes numerous successfully completed projects for air heating and cooling systems in mining. These range from single heating or cooling units with a capacity of up to 3 MW each, or complete systems with capacities exceeding 30 MW. **IM**

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**The future of mining
Measure to optimise**

Intelligent Ventilation Management Systems for the Mining Industry

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A partner with the expertise to tackle tomorrow's challenges



Increasing dewatering throughput while preserving product quality, drying with the lowest possible energy consumption, minimising operating costs, increasing water reuse, or minimising tailing ponds: efficient separation is a crucial competitive advantage in the mining and minerals business. Having mastered these challenges for more than a century, we at ANDRITZ know how to tailor our complete range of state-of-the-art technologies to meet your needs. And, by exploring innovative new ways to safely handle tailings or automate and monitor remote facilities, we ensure that you are ready for the future as well.

Advanced control – one step further in digitalisation

From higher plant efficiency to preventive maintenance and increased profitability, digital

ANDRITZ belt press CPF-Q for flexible, efficient, and high-throughput dewatering (© ANDRITZ)

innovation is bringing a variety of benefits to industrial operations. ANDRITZ has combined the power of smart sensors, big data analytics and virtual and augmented reality to create Metris, a portfolio of digital industrial solutions. Within this portfolio, Metris addIQ control systems offer cutting-edge machine and process control for solid/liquid separation equipment and systems. To ensure safe, trouble-free operations, our automation solutions range from upgrades to individual systems, including electrics, control equipment and instrumentation, to full automation of entire plants. For greenfield plants, we design and test using dynamic simulations in order to ensure error-free start-up. For upgrades and

optimisation projects, we can customise a complete range of engineering, simulation, control and training solutions, depending on your local requirements.

The right separation solution for your requirements

ANDRITZ's current portfolio covers the full process from sedimentation and dewatering to drying, and ensures excellent throughput of high-quality products; all with low operating costs and high reliability.

From flocculant plants for potash to pusher centrifuges for dewatering lithium carbonate, from heavy-duty belt presses or hyperbaric disc filters for coal to closed cycle contact dryers for base metals – we've got you covered. For the efficient and responsible treatment of tailings, you can choose between screen bowl decanters, thickeners and filter presses, the latter a flagship for the use of IIoT: The intelligent filter press. It keeps you at the forefront of Industry 4.0 and ready for the future! To further optimise efficiency and maximise profit, you can take advantage of clever automation solutions like Metris Digital Twins (powered by IDEAS). Or the Metris Performance Center, a digital service and support platform for the optimisation of production processes, operator troubleshooting and decision support.

Efficient tailings treatment with a smaller footprint

Tailings treatment continues to be one of the fastest growing challenges in the mining sector. At the same time, environmental risks, space constraints, and water scarcity all need to be managed cost-effectively. Our complete range of individual technologies and turnkey solutions can be tailored to help you achieve your goals at the optimal OPEX or CAPEX for your specific operations. Higher dryness with lower energy consumption? Or, high specific throughput with the smallest equipment footprint? When it comes to finding the right tailings treatment solution, everything starts with your requirements. Based on the conditions at your site, we can recommend and fine-tune a solution that gives you the highest possible process efficiency.

What's your separation challenge? Ask your separation specialist!

Mario Gerards
Industry Director, Mining & Minerals
+49 22035752219
mario.gerards@andritz.com
www.andritz.com/separation-en



ANDRITZ overhead filter presses A4 F 2500 with a future-proof control and automation system for tailings treatment (© IMAGINE IMAGENS INCRÍVEIS)