

Durable and continuous



Today's mining operations want maximum efficiency and durability for their conveyor systems, despite these installations becoming larger and more complex. But the technology and service providers are up to the challenge, reports Paul Moore

One major trend that has the potential to boost the market for large conveyor installations is the large open pit mining operations going underground as pit dimensions reach their limits and orebodies continue at depth. Tenova **TAKRAF** commented to **IM**: "The next years will tell us if existing open pit mines will decide to make the move to an underground operation. This depends on the remaining life of a mine and demand for the mineral. Some of the mining houses/mines have gone in this direction, like PT Freeport Indonesia or Chuquicamata, whereas other mines discussed and evaluated the matter but never took the final step – of course capex is significantly high.

The overall design concepts for surface and underground conveyors are not significantly different. However, underground conveyors require a specific consideration with regards logistics and constructability, together with other considerations such as access and maintainability. Considering the limited space underground and naturally dusty environment, even with a high performance dust collection and ventilation system, special attention has to be paid to maintainability of the components, even to change out a complete conveyor belt after 10+ years of operation. Another aspect for the conceptual layout of an underground to surface conveyor system is the aim of limiting underground transfer points. This leads to single flight conveyors with maximum feasible

lengths and lifts, and thanks to the recent developments in increased belt strength and gearless drive design underground transfer caverns can be minimised and rock excavation costs significantly reduced.

The ultimate underground the surface installation started up only recently. After successful pre-commissioning, crushed copper ore was in October 2019 conveyed along the complete 13 km belt conveyor system designed and delivered by Tenova **TAKRAF** for Codelco's Chuquicamata Underground copper mining project in northern Chile. The system has been dubbed "the world's most powerful belt conveyor system." Capacity of the entire system was steadily increased so that on October 7, the system's design capacity of 11,000 t/h could be reached. Commissioning has now been completed.

Tenova **TAKRAF** states: "Our world-leading belt conveyor system transports crushed copper from underground storage bins to the surface along a 7 km underground tunnel that overcomes a non-insignificant 1 km of vertical elevation change. Once on the surface, ore is then fed onto an overland conveyor that transports it the final 6

Fenner Dunlop belts in action at Port Hedland, Australia

km to the distribution silo."

The underground system (comprising two conveyors of about equal length) as well as the overland conveyor boast advanced gearless drive technology provided by drive technology partner, **ABB**. Gearless drives eliminate the need for a gearbox, hereby significantly reducing the number of main wear parts, which results in increased efficiency and reliability, as well as less maintenance being required. Further advantages include a considerable reduction in the drive system's footprint and the amount of



First ore on the new conveyor at Codelco Chuquicamata Underground in 2019

instrumentation required. Total installed drive power for the entire system, including various feeder conveyors, totals an incredible 58 MW, of which we have 11 x 5 MW gearless synchronous motors.

Marc Hollinger, TAKRAF Project Manager, had this to say from site: “This mega project achieves a number of world firsts, from the system’s installed drive power to the first global application of the ST 10,000 conveyor belt. With this project, we firmly entrench Tenova TAKRAF as one of the world’s only providers capable of delivering a mega project of this nature incorporating advanced technologies that really push the boundaries of what has been done before. This is a project that will certainly go down in the record books as a defining moment for our client and we are very proud to be a part of this.”

Gearless driven conveyor updates

ABB is also working on a new project with GCD for medium power based on PM motor technology. Ulf Richter, Global Product Manager – Conveyor Systems told IM: “We have an order to replace the shaft mounted geared drives of existing conveyors in a European coal mine by GCD. The conveyors are connecting the coal mine with the power station. The gearless drive will be designed so that it can replace the geared drive unit without considerable modification of the existing drive pulley and main structure. It will be 100% exchangeable back and forward compatible. The main motivation to go for gearless was frequent failing motor bearing due to vibration issues and noise limits because of new EU regulations.”

Siemens’ Christian Dirscherl, Vice President Mining Excavation and Transport told IM of its installations: “At the moment the gearless conveyors for Antapaccay, Las Bambas, Escondida OGP1 and Cuajone are in operation. Prosper Haniel was in operation until December 21 2018 due to the mine then closing. The gearless drives for the other projects at Oyu Tolgoi, Quellaveco and Qulong Copper in China are already delivered but not commissioned yet.

To take an example, looking at the technical scope of the Cuajone mine conveyor. thyssenkrupp supplied the semi-mobile crusher to the existing stockpile feed conveyor adjacent to the concentrator. There are four conveyors including the crusher discharge conveyor and three transfer towers. These include a 2,800 mm wide, 80 m long discharge conveyor and transfer tower; an 1,830 mm wide and 410 m long sacrificial conveyor and transfer tower powered by a 1,200 kW motor and fluid coupling; an 1,830 mm wide 6,515 m long ST6800 overland conveyor #1 powered by dual 6,000 kW Siemens



gearless motors; and an 1,830 mm wide, 1,043 m long overland conveyor #2 powered by head and tail end 550 kW VFD driven motors. Siemens supplied the complete electrical solution to thyssenkrupp. The EP project was awarded in 2014 and began operations in late 2017. Elsewhere on the current projects, for Oyu Tolgoi Siemens is supplying the gearless drives for the underground conveyor that feed a mine hoist (Phase 1) and the three incline conveyors for Phase 2.

Digital twinning and modelling

Together thyssenkrupp and **Overland Conveyor Company** have been using digitalisation and the IoT to greatly improve their conveyor products by developing a dynamic conveyor digital twinning product. Like many of the products thyssenkrupp offers, conveyors are a complex system of many parts that must work well together to accomplish their goal. The company states: “Our engineers take their considerable experience and knowledge of machine design and standards to ensure that these complex conveyors can accomplish their design purposes. However, we must recognise that our design practices are driven by using experience and design standards to address a purely theoretical operating condition. The more well known the operating conditions, the less conservative we can be within our design, and the smaller the “safety-factors” we use to size the equipment. We choose design optimisations and innovations to tailor our design to meet the needs of our clients all based upon a theoretical operating condition. It is not until the machine is first turned on and commissioned that we truly see whether the provided design is fit-for-purpose; whether the innovations implemented accomplish their promised effects; whether old design practices still get the job done.”

Conveyor system supplied by thyssenkrupp to the Shougang Hierro iron ore in Peru

Yet, even if the design provided to the client is determined to be fit-for-purpose, feedback regarding how the machine actually operates is limited to information received during the small (relative to the operating life of the machine) commissioning window. “Rarely do the original conveyor designers get significant feedback about how each of their design decisions ultimately effected the conveyor performance. We often hear back when there are design defects, but rarely do we hear when things are over-designed. Because of this, the speed of product innovation is limited to the slow pace of the project pipeline and the discipline of following up on the operation of the machine.”

This is where a digital twin of conveyors can help. The conveyor digital twin is a calibrated digital representation of the physical installed conveyor system that takes live operating data from the machine, processes it through its physics based engine, and provides immediate feedback on how the conveyor is running and how each major component is operating. When properly calibrated, the digital twin tool can be used to answer many important questions about machine operation: Is the conveyor operating within design expectations? Which, if any, component is operating under unexpected loads, and how will it affect (conveyor?) life? Are any components over-designed for the operation? How efficient is the conveyor operating? What is the utilisation of the conveyor?

“We can then take this continually provided information as feedback for our own future design purposes to drive innovation at a much faster pace...and we can use this information to provide feedback to the client on how they can adjust the design or operations to improve

defined key performance indicators. The digital twin can simulate proposed operations changes or design adjustments to provide guidance in ways to improve machine performance or operations efficiency. In effect the digital twin tool allows us to treat the design of a conveyor as a dynamic entity that can constantly change to meet the requirements of the operation or provide the client feedback on how they can adjust operations to better utilise the capabilities of the conveyor.”

thyssenkrupp says the conveyor digital twin is a vehicle to provide its conveyor engineers the accelerated feedback they need to push forward innovation. “It allows us to know how well our conveyors are performing, so that we can push our machines to be more efficient and better meet our client’s needs. It provides the opportunity for improvement.”

Tenova TAKRAF states: DEM is a powerful tool for material flow simulations, in combination with wear protection. DEM calculations are very helpful for evaluation of the behaviour of the material to be conveyed at non-standard transfer points. Therefore, DEM is today an almost mandatory tool to optimise the 3-D design models, where material transfers are the key points. Furthermore, clients today increase their requests on the 3D models, to include intelligent information to have a digital twin, that can be used for design optimisation and later in operation and maintenance. However, clients need to consider that there is an increased effort necessary during the engineering phase, time and costs, and the equipment itself. A detailed trade-off study is necessary to analyse the higher capex versus benefits in opex later on.”

With its modern sensor technology in the form of REMA MCube and the associated software REMA CCube, **REMA TIP TOP** additionally offers a unique system for predictive monitoring and maintenance of conveyor systems: the digital twin. The customer’s conveyor system is digitally reconstructed with all its details, allowing each individual station of the conveyor process to be remotely monitored and optimised. Thanks to digital and cloud-based monitoring, plant operators can detect and correct critical loads at an early stage to prevent expensive damage or, in the event of premature failure, even entire plant components. One of the conditions for successful controlling is a detailed sensor technology on the system. Therefore, REMA TIP TOP exclusively offers radar-based measurements of volume, speed and misalignment on the conveyor belt.

ABB’s Ulf Richter referred to the fact that ABB’s digital services for material handling performance and optimisation are now available. Due to decreasing ore contents and deeper mines, continuous belt conveyors are becoming

more and more important. Even in global supply chains of raw materials, storage locations with belt conveyors and conveying equipment have a great influence on the efficiency of the entire transport process. To date, however, only a fraction of the operating data is used for optimisation. ABB has therefore worked with experienced operators to develop a specific KPI system that identifies optimisation potential. This system is provided as a customised toolbox based on the ABB Ability™ framework with data collection, pre-processing, calculation engine and dashboards. The KPIs are determined with the help of KI methods such as machine and deep learning algorithms to allow new services such as performance analysis such as OEE, energy and load performance; energy efficiency analysis; automated alarm and event analysis including prediction of critical asset conditions; and lifetime Estimation and Predictive Maintenance

Belt durability is key

Andy Parry, a Director at **Bridgestone** says mines are increasingly in need of higher performing belt to maximise life. “Durability is a prime driver of design improvements to belts. Mine operators are mainly asking for increased belt life and automated monitoring technologies. Automated monitoring technologies are important future improvements to conveyors and belts need to work in conjunction with these technologies. On drive systems, the important belt design factor for the drive system is the maximum tension imparted to the belt. The newer drive systems such as gearless drives are intended to provide higher reliability. We work with both the design engineering firms and the mining companies to find the optimal solution for belt performance.”

The company continues to invest in mining specific service provision in key markets. Last year, Bridgestone announced that Australian subsidiary Bridgestone Mining Solutions Australia Pty Ltd (BMSA), which sells and provides services pertaining to tyres for mining vehicles and conveyor belts, established the

Hunter Valley Mining Solution Centre (HMSC) as a new mining solution centre on April 10, 2019. HMSC is the second Bridgestone mining solution centre in Australia following the Pilbara Mining Solution Centre, which was established in Western Australia in November 2017.

Tenova TAKRAF – the OEM perspective

Conveyor projects are complex installations often involving the OEM, the mine, an EPC/EPCM, consultant engineering, steel fabricator plus supplier of idlers, belting etc. Tenova TAKRAF told IM on how its role can vary: “It basically all depends on the project phase of when we get involved. We have performed a significant number of pre-feasibility and feasibility studies and with this early involvement, we were able to provide our experience in trade-off analysis (where not always conveyors have an advantage versus trucks) and system optimisations. During this phase of a project, TAKRAF works either directly with the client or with engineering firms, depending on the complexity of the scope of work. Suppliers and other service providers are engaged, under the lead of TAKRAF, if special equipment is required, such as direct conveyor drives and other “out of standard” products, or special logistic requirements to transport large pre-assembled and tested units to remote areas. Those are some of the advantages certain OEMs can provide to a customer, having the experience from study works to final commissioning – the full end-to-end solution.”

On why mines opt for major conveyor installations the company adds: “Conveyor systems, considering that most of the equipment is electrically driven, boast a significant advantage in their overall environmental footprint as compared to trucking. Employing large mining trucks within a mining operation will gradually reduce as we go forward. This as a result of optimised IPCC systems, where conveyors have to automatically follow the mining equipment and transport material out of the pit as directly as possible. In parallel, the



Thanks to recent developments in condition and online monitoring of equipment and processes, availability will be increased as a result of ‘on demand’ planning for maintenance and service activities. Tenova TAKRAF has installed such systems on key equipment, in coordination with some of its end users

Paul Moore spoke to David Landgren, Fenner Dunlop Executive Director about the mining conveyor market and its role as a leading supplier of belting solutions

Q Are you seeing the mining industry investing in larger and higher capacity conveyors as well as those incorporating steel uphill/downhill section as well as curves?

A Yes. While the conveyor versus truck choice depends on mine specific conditions, we are seeing a trend with existing miners to expand near field developments and utilise existing infrastructure via long connecting overland conveyors. Iron ore expansion is a good example of this – we are the OEM for BHP’s South Flank overland conveyor. Longer conveyors mean logically more geographical challenges, so conveyors with inclines and declines are part of that challenge. The drive for increased production will always drive conveyors to have larger capacity. This is a trend seen over many decades.

Q As a leading global conveyor belt supplier to the mining industry what does that mean in terms of the design of belts and aspects such as durability?

A Longer conveyors mean increased energy requirements to drive larger loads over longer distances. Low rolling resistance rubber on the pulley side of the conveyor belt to reduce friction and therefore energy has been around for a long time in conveyors, as it has been in the tire industry. Fenner Dunlop with the support of Michelin has made great breakthroughs in this area in recent years and is one of the reasons we have been so successful in supplying so many energy efficient overland conveyors.

Q With many big open pits going underground, is there also increasing demand for conveyors that incorporate both surface and underground sections?

A Traditionally materials handling in above ground coal mining has been the domain of trucks and underground the domain of conveyors. When open cut mines go underground it is almost exclusively with conveyors. We are currently designing and



supplying the whole conveyor system at Anglo American’s Aquila mine as they develop underground.

Q Has the advent of gearless driven conveyors meant any changes to how belts are designed or maintained?

A In a similar line to the requirement of reducing power consumption for high capacity conveyors on the belting side the equipment providing the input power is also critical in the design. Gearless conveyors provide an improvement in efficiency, maintenance requirements and reliability with the removal of the gearbox. A combination of an engineered conveyor solution utilising technologies such as gearless driven conveyors, low rolling resistance belt, dynamic electrical control systems and condition monitoring will continually develop the improvement in belt selection, design and maintenance.

Q Many companies are now looking at on-conveyor analysis and bulk sorting solutions; has this also meant any changes in the conveyor belt approach/strategy?

A As with the rest of the mining industry, the concepts of a smart conveyor is the clear future direction for the materials handling industry. We have invested in technologies focused on asset health and predicting life performance, such as our Online Thickness Tester which we see as key technology to assist mines in better planning conveyor shutdowns. The more

Fenner Dunlop designs, construct and supplies whole conveyors including electrical systems. It has been doing this since 2012 when it acquired Australian Conveyor Engineering and remains the only conveyor belting OEM in Australia that does this

information, the better the decisions to increase productivity and lower cost.

Q What are mining operators asking you for today as a conveyor belt solutions supplier?

A The key message remains to increase the life of conveyor. Generally this means better abrasion and impact resistance on the carry cover and lower energy requirements, driven by specialised rubbers and belt constructions. None of this is new - the difference is now mining operators have better information to substantiate the value proposition. The recent trends we’ve seen is a move away from Steel Cord reinforced to High tension Fabric belts, such as our USFlex product, to improve impact resistance and tear resistance, seeing and a shift away from low cost country supply to consistent quality given increased performance information - this is consistent with our business model.

Q How closely do you work with the company that builds the conveyor installation itself? Or is the norm just to work mainly with the mining company/operator? Are you normally involved from the design phase?

A Very closely! We design, construct and supply

efficiency and availability of equipment increases all the time with corresponding benefits in terms of operating costs and energy consumption. Thanks to recent developments in condition and online monitoring of equipment and processes, availability will be increased as a result of ‘on demand’ planning for maintenance and service

activities. Tenova TAKRAF has installed such systems on key equipment, in coordination with some of our end users.

These aspects are becoming more and more important for existing and especially new mining operations, to get the necessary permits and especially social acceptance. Look at the recent

commitments of large mining operations to increase their use of renewable energies.”

Comprehensive options and solutions

In the mining industry, operators require systems capable of transporting bulk materials efficiently from the mine to their destination often through

whole conveyors including electrical systems. We have been doing this since 2012 when we acquired Australian Conveyor Engineering and we are the only Conveyor Belting OEM in Australia that do this. We have 3 pillars to our business – engineering, services and belt supply. Currently we have a 20/40/40 split on sales and our goal is to have them as equal contributors in the near term. Our engineering business is our fastest growing business. When we design, manufacture, supply, service and condition monitor all the conveyor components, we have total accountability for the conveyor performance and that's where our Engineered Conveyor Solutions outshine our competitors.

Q There has been a lot of industry consolidation to the point where there are now only a few major premium players like Contitech/Phoenix and Fenner Dunlop/Michelin. Has this meant that there is now more competition from lower tier players eg Indian and Chinese suppliers offering slightly lower quality but also a lower price?

A Lower prices from emerging economy suppliers have affected price over the last decade. The difference is now increases in product performance information mean customers can prove performance. We have just been through a tender process with a major miners where we were successful because the customer could prove we had the best product. The value proposition for the customer will always be performance over price because the economic cost of not having tonnes on a ship or train is so high. We are not seeing any real improvements in the quality of emerging economy belts because performance and cost is driven by the quality of inputs used and these countries generally use the cheapest. Customers are also under pressure to keep working capital and particularly inventory to a minimum and Fenner Dunlop's strategy of having the most state of the art manufacturing as close to the end user as possible is a significant advantage for achieving those goals. It not only reduces lead times for our customers but guarantees customers have consistent quality engineered products every time, from a reliable local source that treats their business as a local priority.

rough terrain and populated areas. **BEUMER Group** supplies customised systems such as open troughed belt conveyors and closed pipe conveyors. The systems operate quietly and only minimal amounts of dust or exhaust gases are emitted. Compared to trucks they are often more energy-efficient and can be adjusted to the



structure of the premises. They are also able to safely handle steep sloping routes, rivers or road crossings. The system provider determines the optimum conveying route, then takes over project planning and installation. BEUMER Group also ensures that the owner remains sustainably competitive - with cost efficiency and comprehensive customer support.

"With our belt conveying systems, we design comprehensive system solutions for the mining and cement industries world-wide", says Dr Andreas Echelmeyer, Head of the Conveying & Loading Systems sector at BEUMER Group, located in Beckum, Germany: The cement plant of the manufacturer Sichuan Yadong Cement Co Ltd in the Chinese province of Sichuan, near Pengzhou, uses a 12.7 km long BEUMER Group overland conveyor installed in 2009, to transport limestone from the mine to the intermediate bin. The troughed belt conveyor runs through hilly terrain and over rivers and unstable ground. In 2016, in a second project, the system provider installed two more overland conveyors, this time with an overall length of 13.7 km. These overland conveyors transport the limestone to the cement plant. "Unlike with the first order, our task now was to build the conveyor through a populated area," explains the division manager. "No material should be lost during the process and in addition, no dust was allowed to escape; the prescribed level for noise emissions was not to be exceeded." The requirements could not have been more different, even for one and the same customer. However, BEUMER optimally adapted closed pipe conveyors and the open troughed belt conveyors to the respective situation. In order to reduce the noise emissions, as required at Sichuan Yadong Cement, BEUMER installed special idlers and low-noise bearings, and selected the correct conveying speed for the application. An essential feature of the technology is that it enables horizontal and

A section of one of BEUMER's conveyor flights transporting limestone for Sichuan Yadong Cement

vertical curves. Angles of inclination of up to 15 degrees are possible, depending on the characteristics of the material to be transported and the topography. Due to the ability to navigate curves, considerably fewer and in some cases no transfer towers are required. This results in substantial cost savings for the customer and the system continuously transports the material even over challenging ascending and descending sections. The open troughed belt conveyors are particularly suitable for high throughputs. Conveying capacities of up to 10,000 t/hour are usual. Using BEUMER calculation programs, a team of experts precisely calculates the static and dynamic tractive forces of the belt during the development phase of the system. This is the prerequisite for the safe dimensioning of the curves. BEUMER engineers select the type of drive technology and conveyor belts needed on the basis of these calculations. This ensures longevity of the entire system.

"To ensure that our customers remain competitive over a very long period of time, we always dimension our plants and systems as well as the associated production processes with regard to their long-term benefits", says Echelmeyer. It is important that the user considers not only the overall costs when making investment decisions. Therefore BEUMER Group says it is committed to evaluating its products comprehensively on the levels of economy, ecology and social responsibility. Usually, the total cost of ownership (TCO) is the primary focus of business activities, therefore defining sustainability solely from an economical perspective. "However, we also incorporate ecological and social aspects", the division manager points out. "Therefore, we follow a total value of ownership (TVO) approach. This means,

we consider the conveying system in its entirety, not only from its cost side. For example we continuously look to reduce energy and resource consumption in the production cycle and in operating the machine, as well as reducing emissions to a minimum.”

Conveyor installation and maintenance

Ongoing maintenance is the key to conveyor productivity and there are a number of global specialists in this area. A new conveyor belt cleaner has been designed with an innovative method of holding the urethane blade in place without the need to mill any slots for holding pins. Combining the benefits of previous designs into one product, the QC1+TM Belt Cleaner from **Martin Engineering** can be cut to length to fit virtually any application, reducing the need for customers to stock multiple blade sizes to accommodate different belt widths. Operators simply trim the blade to the desired size from the stock 2.74 m length to match the material path, slide in the blade holders and lock them in position. The new blade can be retrofitted to virtually any Martin main frame and most competing designs.

“In most belt cleaner designs, the blade is pinned in place, but this new approach uses a hole right in the aluminium extrusion to keep the blade firmly in position,” explained Conveyor Products Manager Dave Mueller. “The biggest benefit to customers is the ability to buy long length blades and cut them to size without doing any machining. Most customers have a number of different belt widths, so in the past they’ve had to stock different blade sizes. But this design can accommodate a wide range of belts with a single product.”

In some applications, existing cleaner designs are limited by the placement of the pin holes. In the case of a 91.4 cm wide belt that has a material path of just 51 cm, for example, there might be pin holes at 5 cm, 15 cm and 20.3 cm, with no holes for a 51 cm blade. The result would be the dreaded ‘smiley face’ wear pattern, and the uneven blade wear shortened its service life.

“With this design, the blade holders slide and lock on a blade guide rail and are adjustable to whatever width is needed to match the material path,” Mueller said. “That contributes to better cleaning efficiency and longer blade life.”

The mainframes on the QC1+ are 3-piece assemblies, with a square centre section and a torque tube sliding into each end. The tubes are formed from high-strength steel and engage in the corners of the square main frame. They transmit the torque from the tensioner through the tubes and into the main frame to maintain blade tension.

The torque tube lock collars are designed to

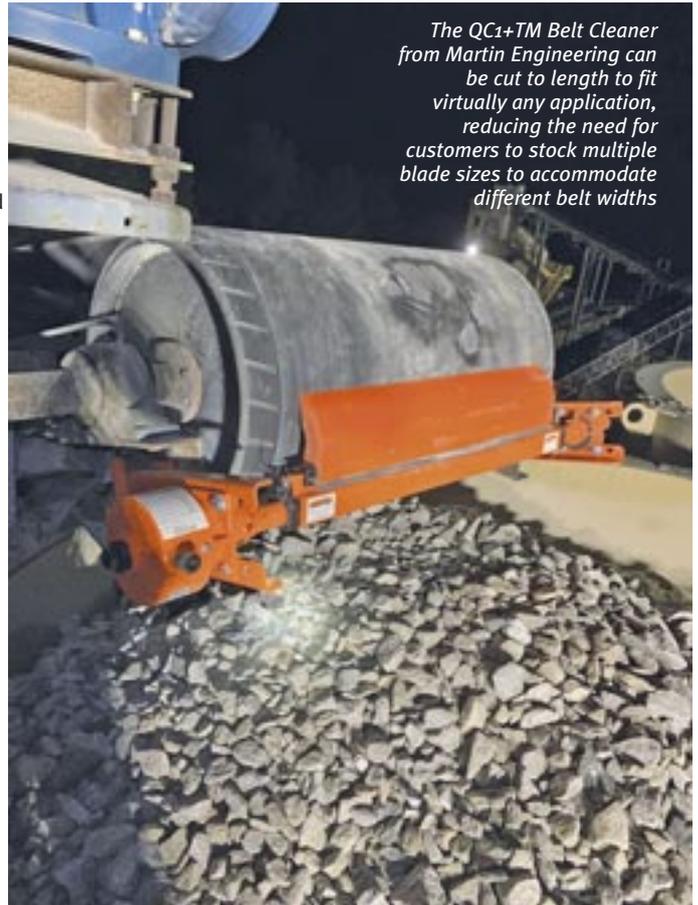
be an interference fit with the square mainframe. To assemble, the tube is installed first, then the collars are added and set in position. The length of the mainframe is adjusted next, and finally the set screws on the collars are tightened down. In most applications, the simple sequence can be performed by a single worker in just a few minutes. The new design is compatible with any of the Martin tensioning systems.

Urethane belt cleaner blades from Martin Engineering are designed with the company’s patented Constant-Area Radial Pressure (CARP) technology to deliver consistent cleaning throughout all stages of blade life. Martin designed and developed the concept, patented in 1990, which has been adopted worldwide. The innovative cleaners maintain the same contact area, blade angle and pressure to effectively remove virtually any type of material carryback, even as the blade wears down over time.

Five different urethane formulations are currently available for the QC1+ including standard orange for most applications (approved by MSHA for mining applications). The product is initially being launched in the USA, followed by other regions over the coming year. This design introduces a new generation of belt cleaning technology,” Mueller added. “It’s a truly revolutionary product that delivers the cleanest belt and the longest blade life -- at the lowest cost.”

For operators in the mining industry, abrasive material leaves traces of wear in many places in the production process including conveyor transfer points and chutes. And the wear protection used, often does not bring the desired effect and must be replaced after a few months. To improve this, REMA TIP TOP says it has developed a modular wear protection system that offers long service life even in demanding applications: RMS-MP-70.

The clever part of the modular system: in the event of punctual damage, the modules can be replaced individually thanks to their uniform size, which considerably reduces operating costs compared with the large-scale replacement of a



The QC1+TM Belt Cleaner from Martin Engineering can be cut to length to fit virtually any application, reducing the need for customers to stock multiple blade sizes to accommodate different belt widths

lining. The installation is simple: the trapezoidal elements are interconnected like a puzzle. Their overlap ensures a stable construction that prevents fine material from entering between the parts.

The RMS-MP-70 rubber design is a combination of highly wear-resistant rubber material and an underlying orange signal layer (wear indicator): “REMA PERFORMANCE line 70 is a material used in areas of high wear and impact because of its excellent abrasion resistance”, explains Johannes Klöpfer, Product Manager at REMA TIP TOP. “REMA LINE 40 orange as a softer substructure is characterised by its high elasticity.” The orange signal layer acts as an indicator of wear and tear in order to plan maintenance measures in good time. A 5 mm thick steel support plate on which the rubber material is vulcanised ensures secure attachment and also protects against material migration. So far, REMA TIP TOP offered the modules in a total thickness of 80 mm for heavy wear applications. The modular wear protection system RMS-MP-70 is manufactured in the German REMA TIP TOP plant in Fürstentzell near Passau and is available worldwide. The modules have a size of 300/600 by 600 mm.

REMA TIP TOP Australia was recently selected by Monadelphous to install more than 50 km of conveyor belting for the BHP-owned South Flank iron ore project, in the Pilbara of Western

Australia. A key component of the project to build the \$3.6 billion mine, the conveyor belting will be delivered with splice kits and the installation and splicing of steel cord and fabric belt on five conveyors systems, three of which are overland conveyors, with 77 rolls of belt to be installed and 77 splices to be completed in total. REMA TIP TOP Australia will assist Monadelphous in this work.

The conveyor solutions specialist has worked with Monadelphous on a range of major projects in the past and it is this proven track record that was critical in securing the project for the business, it said.

Steve Hipwell, REMA TIP TOP Australia Projects Manager, said: "This project represents a significant win for the business and is a testament to the commitment we have shown to delivering quality projects. Monadelphous have a substantial pipeline of works in the resources, energy and infrastructure sectors so it's great to continue to build on our successes with this leading engineering company."

Hipwell said mobilisation was set to begin in the June 2020 quarter. Earlier in 2019, Fenner Dunlop (see box) secured the contract to manufacture and deliver the overland conveyor belt package to South Flank. BHP is targeting first ore extraction at the operation in 2021 and expects to ramp up to 80 Mt/y of output. This will replace production from the existing Yandi mine, which is reaching the end of its economic life.

Flexco has recently come out with the EZP1T, an advanced version of its proven EZP1 precleaner. The models in this new series incorporate a torsion spring instead of a tension spring, which means they take up less space than the standard version. Conveyor system operators benefit from faster and easier installation. The EZP1T is available with four different polyurethane blades, depending on the application. These include a version for the extremely high temperatures encountered in mining.

Carryback is a considerable cost factor for conveyor system operators because it is lost. These residues can be moist, sticky, dry, acidic or abrasive, depending on the ambient temperature. Precleaners mounted on the pulley can remove most of this material. However, installing them is often a challenge. Experts are required for this work, and the components don't always have the right dimensions for the system's supporting structure. Flexco has therefore enhanced its proven EZP1 precleaner and launched the EZP1T series. The new design features a torsion spring (represented by "T" in the name) in place of the tension spring in the standard version. This significantly reduces the necessary installation space.

Like the standard version with a tension spring, the EZP1T is also suitable for cleaning belts with mechanical connectors. When a connector passes the blade, the blade quickly turns away from the belt and is immediately returned by the torsion spring to its position. There is no damage to the belt and the cleaning process is interrupted only briefly. For better cleaning of reversible belts the precleaner can be mounted at each of the two pulleys. The EZP1T is available for belt widths of 300 to 1,800 mm.

Flexco offers polyurethane precleaner blades in four different versions – identified by different colors – depending on the application. Purple, for example, is the colour for standard applications with a maximum belt speed of 3.5 m per second and a temperature range of -35 to +82°C. Mining operations often involve extreme temperatures, both hot and cold. For such applications Flexco offers high-temperature precleaner blades, identified by their bright yellow colour. They are able to withstand temperatures up to 135°C in continuous operation and peak temperatures up to 163°C. All of these precleaner blades are characterised by extreme durability in their respective applications. They require less frequent replacement than comparable competing products – a significant advantage when it comes to downtimes and material costs.

ASGCO's Tru-Trainer (dual return) conveyor belt tracking idlers recently improved production uptime on a critical primary crusher belt conveyor at one of the world's largest copper mines in Chile. The production department had complained to the maintenance superintendents about the unavailability of the conveyor belt when running in drier conditions without a counterweight. This particular conveyor belt tended to mistrack when the belt was running but not loaded. As a result, the mistrack sensors would constantly stop a conveyor belt that outputs roughly 10,800 t of copper ore per hour. After many head and tail pulley calibrations the problems continued and ASGCO was called in to specify an effective tracking system.

ASGCO's representatives performed a complete conveyor survey and had mine personnel describe the issues. After thorough analysis, ASGCO recommended installing two 96" Dual Return Tru-Trainers. With a solution in mind, the main issue the site faced was stopping operations for a prolonged period of time. With only 4 to 5 hours available for installation, ASGCO adapted to the situation and installed both Dual Return Tru-Trainers while maintenance supervisors were on leave without contracting any additional resources. Following ASGCO's improvements, the conveyor belt now remains centred when running without a load and does not trigger mistracking sensors which would cause unplanned down time, use of electrical

personnel and unplanned production stoppage. As a result, on-site staff can now use the conveyor belt at all times and production in the copper mine has increased. 