

# WORLD CEMENT®

December 2020

Efficient, low-emission drying of  
alternative CO<sub>2</sub>-neutral fuels in  
the cement industry

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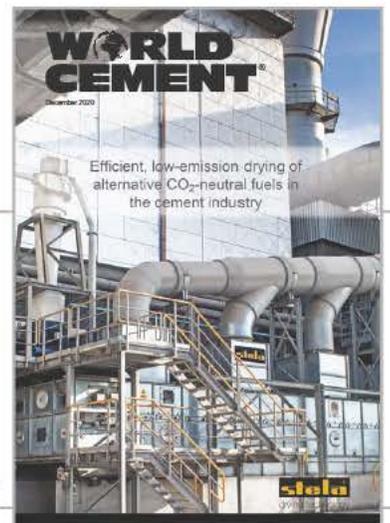
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## ON THE COVER

Saving CO<sub>2</sub> is one of the central issues that has been plaguing energy-intensive industries in recent years. Especially in the cement industry, the use of alternative fuels is playing an increasingly important role. By drying RDF (Refuse Derived Fuel) the controllability and quality assurance in the clinker production is supported. Since dryers are able to use the waste heat from upstream production processes, the economic operation of drying plants is guaranteed in the long term. Low-temperature belt dryers are causing a sensation within the industry.



# A CLEAN SWEEP

Chris Schmelzer and Alan Highton, Martin Engineering, and R. Todd Swinderman, RToddS Engineering, explain why factory-direct managed servicing is the best solution for effective conveyor belt cleaning.

**T**he need for conveyor belt cleaning is well established. Belt cleaners help reduce accumulations of carryback under the conveyor and minimise the release of dust from buildup on rollers as the carryback dries. A belt cleaning system performing poorly will contribute to buildup on pulleys and idlers on the return run. This material buildup is one of the primary reasons a belt will mistrack, causing damage to its edges, and also potentially attacking the covers of the belt through abrasion. The belt is typically the most expensive piece of equipment on a conveyor, so by not

removing carryback at the discharge, it will contribute to premature belt failure.

Excessive fugitive material can reduce component and belt life by as much as 30%, while a multiple belt cleaner system contributes less than 5% to overall belt wear, delivering a significant benefit.<sup>1</sup> Further, the effect of a properly adjusted cleaner on the belt is far less than one that is under- or over-tensioned and allows material buildup to contribute to increased wear. For operators who have 'tried them all' and are unable to find cleaner that works, it could be that the problem is not the equipment, but the maintenance.

A managed service relationship from a factory direct, manufacturer-trained technician may be the solution.

It is no secret that belt cleaners require frequent inspection and adjustment to perform at a level that meets or exceeds expectations. The optimum solution must include the right belt cleaners, mounted in the correct positions and proactively serviced to deliver a positive cost benefit month after month. Correctly installed and maintained belt cleaners reduce direct costs by reducing cleanup labour, and indirect costs through improving safety, minimising dust emissions and increasing component life.



Figure 1. Proper matching of the blade formulation to the application is essential for optimal performance and service life.



Figure 2. Automatic tensioner.

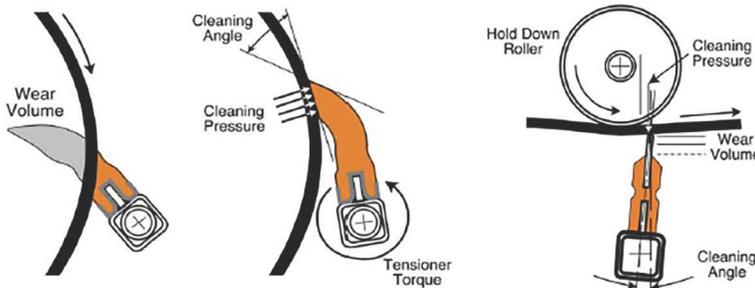


Figure 3. Right – Primary cleaner with constant angle and cleaning pressure. Left – Secondary (or tertiary) cleaner with belt support.

Basic questions that should be asked where all conveyor systems are concerned include whether maintenance personnel are trained in selecting the proper belt cleaning system, installing it correctly, know what to look for on inspection and know how to set the proper cleaning pressures. It may sound elementary, but there is a great deal of knowledge and skill required to tune a belt cleaning system to work under varying material, environmental and belt cover conditions, while still operating effectively and economically.

Belt cleaner manufacturers know that if their equipment is not maintained, the blame typically falls on their components and not on the lack of proper service by in-house maintenance crews. As a result, the money spent on belt cleaning equipment is often wasted. When performance falls to a level that can no longer be tolerated, the equipment is scrapped and another supplier's cleaners are installed, only to have the cycle repeat itself. In contrast, some manufacturers provide factory-trained direct service personnel and replacement parts – delivering expert maintenance for optimum performance and component life. A few will even supply free remote monitoring and reporting equipment that is accessible by wi-fi or cell phone. These managed service technicians, supported by a financially stable, well-established manufacturer and armed with the specific knowledge and equipment to do the job, are often the answer to common belt cleaning problems. For these technicians, who spend every day assessing and servicing belt conveyors, maintenance and repairs become more of a precise science than a judgement by rule of thumb.

### The proper equipment

The number and style of belt cleaners depends upon balancing many factors.<sup>2</sup>

First, the level of cleaning required for the application must be established. Aggregate mining can often tolerate more carryback accumulation, because an acceptable level of cleanup can be done with mobile equipment and minimal manual follow-up to keep the conveyors operating.

Other applications, like coal mining or power generation, cannot tolerate much carryback because of the potential for accumulation to be the fuel in a fire triangle or explosion pentagon.

Once the level of cleaning is established, the next task is determining the type and number of cleaners required to do the job. Open pit aggregate mining may achieve acceptable performance with a single cleaner, while coal handling may require three or more cleaners to reach a satisfactory cleaning level. The trend in belt cleaning, regardless of application, is to plan for two or more cleaners per discharge. In addition to better cleaning from multiple cleaners, there is a redundancy factor that can provide a longer service interval window.

With the level of cleaning and the number of cleaners established, the appropriate materials of construction for the frame and tensioner are evaluated (e.g. stainless steel or powder coated mild steel) and the best blade for the application selected.

### Effective location

In the 7<sup>th</sup> edition of its design guide, *Belt Cleaners for Bulk Materials*, the Conveyor Equipment Manufacturers Association (CEMA) specifies the cleaning locations as Primary, Secondary and Tertiary. The most desirable location for belt cleaners is on or very close to the head pulley in the primary position, so the material can fall with the main flow of material and reduce build-up on dribble chutes. If cleaning must be done away from the head pulley, cleaners are preferably mounted in the secondary position. If the secondary position is not accessible, cleaners may be mounted in the tertiary position, but this may require a second dribble chute or collection pit.

Many conveyors are designed without much consideration for belt cleaner location, despite the critical role they play in meeting production goals. Poor conveyor head designs often have the structure obscuring the optimum mounting location or simply not enough room at the head to install or access them so they can be serviced. When faced with these restrictions, facilities need a supplier partner that can make the best decision on equipment and location for their specific situation.

### The importance of service

The US Bureau of Mines and several researchers since have established that there are sweet zones for cleaning pressures for different styles of belt cleaners.<sup>3</sup> Outside of these ranges the cleaning performance is lower, while the blade wear, belt wear and power consumption are higher. Reputable manufacturers design their cleaners and

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tensioners to achieve optimum cleaning performance versus blade wear. It may seem counter-intuitive, but if the cleaner is not doing a good job, more cleaning pressure can actually make the problem worse. Maintenance personnel must understand these phenomena and know how and when to adjust each style of cleaner. Some sophisticated users optimise their cleaning performance versus blade replacement costs by testing different blade materials at different cleaning pressures and changing blade materials and cleaning pressures for different seasons or ROM (run of mine) conditions.

### Inspection and monitoring

Some manufacturers offer conveyor inspections and cleaner maintenance as part of a managed service relationship. Their monitoring systems can track component wear and update the service technician and/or operations personnel via wifi or mobile phone on upcoming service needs. There are some new systems that can even adjust belt cleaner tension automatically. The technology will also send an alert through a mobile app in the event of upset conditions.

Factory-trained service technicians provide an added set of eyes on the conveyors,



Figure 4. Position indicator with remote monitoring.

Cost of Capital	10%	Year-by-Year Savings & Costs				
Initial Investment	\$7,500	Year 1	Year 2	Year 3	Year 4	Year 5
Cleaning Labor Savings		\$30,000	\$30,000	\$30,000	\$30,000	\$30,000
Reduction in Injuries Savings						
Increased Availability Savings						
Increased Component Life Savings						
Reduced Citations Savings						
Managed Service & Parts Cost		\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
Net Cash Flow (Savings – Costs)		\$25,000	\$25,000	\$25,000	\$25,000	\$25,000
Net Present Value of Cash Flows	\$94,770					
Net Present Value of Cash Flows Minus Initial Investment		\$87,270 free cash flow Over 5 years of managed service				

Figure 5. Sample data for a decision based on Return On Investment calculation.

travelling to and from the equipment to be serviced and logging details in their service reports. Because they see so many different applications, they can often bring attention to problems that maintenance personnel do not see or have become accustomed to ignoring. With factory-direct managed service, the responsibility for maintenance falls on the manufacturer, allowing the staff to focus on other priorities.

### Safety

A trained belt cleaner service technician is aware of hazards involved with maintaining belt cleaners. The indirect costs of an injury or accident can be significant. In-house maintenance and cleaning are two job classifications that are exposed to significant potential for muscular or skeletal injuries and are typically involved in more than half of reportable lost time accidents.

In many operations, a supplier's ability to work in the facility is directly related to its safety record. Having a trained provider that focuses on safety but at the same time is more productive than in-house maintenance can be a significant benefit. Keeping the shutdown to a minimum is important in meeting process availability goals. There are specialised systems for servicing belt cleaners where the belt runs 24/7 and cannot be shut down, but virtually all other cleaner maintenance must be performed following lockout, tagout, blockout and testout (LO/TO/BO/TO) procedures.

### The return on investment

At first glance it may seem that a plant has the in-house capacity to maintain belt cleaners, and hiring a managed service provider just does not make sense. The reality is that a conveyor will run with a belt, a head and tail pulley and a drive –

maintaining everything else can be put off (and often is) for production at any cost. A 'run till broke' philosophy means more than broken machinery – it can also exacerbate financial issues and affect worker morale. Then, in the rush to patch things together, maintenance workers are tempted to take shortcuts and work around established

procedures, exposing them to greater potential for injury.<sup>4</sup>

A common injury for cleaning labourers is a muscle or back strain. The Occupational Safety & Health Administration (OSHA) Safety Pays Calculator puts the direct cost of a muscle strain at US\$33 000 and the indirect costs at US\$36 000 – making the total cost of a single incident US\$69 000.

Every minute of downtime for cleaner maintenance counts. A managed belt cleaner service programme can cut the downtime to a minimum because they have the knowledge, the right tools and parts, and are aware of the safety issues involved.

When calculating the return on investment for professionally installing and maintaining belt cleaners, the analysis should be done over the life of the belt cleaner assembly using a net present value calculation. Many spreadsheet apps have a net present value function in formulas. For example: if the cost of capital is 10%, the initial investment is US\$5000, cleaning labour savings are US\$6000 per year and service and parts are US\$2000 per year, the NPV of the cash flow (discounted by the cost of capital) is US\$15 163. Subtracting the initial investment and the managed service cost, this example generated over US\$10 000 in free

cash flow over the life of the equipment without considering all the other potential savings. The spreadsheet makes it easy to change the inputs and compare different equipment and savings scenarios.

The example in Figure 5 is based on simply reducing cleanup labour by 2000 hours per year at US\$15 per hour. Other benefits should also be factored in, despite not being estimated in the example in Figure 5, such as the savings from avoiding injury, increased equipment availability, improved equipment life or reductions in citations and fines. Facility managers often find that the cash flow values are surprisingly large over the life of the equipment and service relationship.

A typical belt cleaner assembly should last five years with minimal frame or tensioner repairs. Inspections should be done regularly and any problems addressed immediately. Some manufacturers with factory-direct service offer free replacement and upgrades of frames and tensioners as part of their managed service offerings.

Blade wear will vary based on the blade material and abrasiveness of the bulk materials, along with several other factors such as correct cleaning pressure. Belt wear from the cleaner is typically in the neighbourhood of just

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2% per cleaner, so concerns over blade type and cover wear are usually unfounded. The cost of safety is minimised by reducing the frequency and hours of manual cleaning and therefore the exposure to injuries.

NPV analysis will often show such a large free cash flow that worrying over the cost of service or replacement blades is a misplaced concern. Similarly, NPV analysis done when designing a new conveyor will often show there is no reason to skimp on the details or costs that improve belt cleaner performance and access for service.

## Conclusion

Allowing the blade to wear past its limits, having the wrong tension or installing a cleaner system that is hard to access creates hazards for workers and can lead to excessive downtime. Automated tensioning and monitoring equipment mitigates some of the issues with blade wear and provides data and alerts when blades need servicing. This can help lower labour costs and

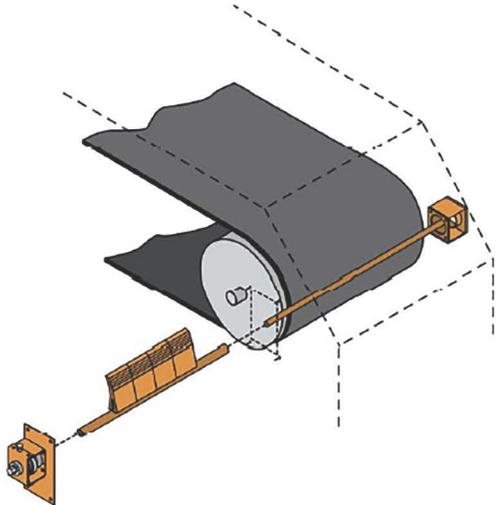


Figure 6. A slide-out mandrel assembly makes the removal and replacement operation faster and safer.



Figure 7. A managed service provider can deliver complete on-site belt cleaner maintenance.

improve safety due to fewer inspections and proactive maintenance.

Belt cleaner maintenance can be time-consuming and pull labour from other essential tasks, so it is important to choose a supplier with trained and experienced service technicians who know the equipment and safety procedures and can respond quickly to customer needs. Considering a managed service programme makes sense in terms of safety and productivity and could improve profitability with additional positive cash flow. ■

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## About the author

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