

MOTORING ON

MIKE GAWINSKI, RULMECA CORP.,
US, EXPLAINS HOW MOTORISED
PULLEYS CAN IMPROVE PRODUCTION,
MAINTENANCE AND SAFETY IN
UNDERGROUND COAL MINES,
PREPARATION PLANTS AND
TRANSFER TERMINALS.



Internally-powered conveyor belt drives have improved system reliability and personnel safety, while lowering maintenance expenses, at a variety of surface and underground coal handling facilities in Europe and the US. The key to this is hermetically sealing the motorised pulley's AC motor and gearbox within the oil-filled shell (Figure 1). The oil splash lubricates all mechanical components, while transferring heat from the motor through the pulley shell and into the conveyor belt. The conveyor belt is used as an infinite heat sink.

Conveyor drive problems and solutions

Bulk materials such as coal, ore and salt are often problematic to handle on belt conveyors that are driven by exposed drive systems. This is because it is difficult to protect electromechanical components such as motors, gearboxes, sheaves, chains, sprockets and couplings from abrasive and corrosive materials and harsh operating conditions.

Cast iron enclosures are usually built to protect the components from the environment and expanded metal grating and access doors are

Figure 1. The AC motor and gearbox are hermetically sealed within the oil-filled motorised pulley shell.



Figure 2. Exposed drive system for a salt barge loading conveyor consists of motor, gearbox, chain and sprocket, all protected by cast iron and steel enclosures. The steel enclosure protects personnel from rotating motor/gearbox coupling.

installed to protect personnel from the moving components (Figure 2). The bigger the protective enclosure, the more space it requires. By eliminating the protective enclosures and hiding motors and gearboxes out of harm's way within an oil-filled pulley shell, motorised pulleys have proven to be an optimal conveyor drive solution in numerous operating conditions.

This drive design yields three primary advantages:

- Gears and bearings are continuously and automatically

splash lubricated, lowering maintenance requirements.

- Electromechanical components are sealed within the pulley shell, increasing drive reliability, minimising drive size and improving personnel safety.
- Redundant enclosures (e.g. cast iron motor frame) are eliminated, decreasing drive weight.

Applications

Shipping ports

Developed in Europe in 1953, motorised pulley technology was slow to gain acceptance in North America until the latter part of the 20th century. The compactness and reliability of the concept has now been proven on large materials handling machines at various rail-to-ship terminals during the last three decades.¹

Installed in several bucket wheel reclaimers along the US Great Lakes since 1985, Rulmeca motorised pulleys have moved hundreds of millions of tonnes of iron ore. Space above the gantry (center of mass) of the bucket wheel machines is limited. Compact conveyor drives were therefore essential to limit overhung

loads and permit personnel access where needed on boom and discharge conveyors.

More recently, a major Alaskan coal export facility used a 75 hp. motorised pulley to upgrade the ship loading rate from 800 – 2000 tph (Figure 3). The narrow footprint of the 24.80 in. dia., 47.24 in. long conveyor drive facilitated the loading rate upgrade within the tight enclosure at the tip of the shuttle conveyor, supported beneath the ship loader apron.

Coal preparation plants

After eliminating a problem of 30 days and 300,000 tpa of lost production at its Kellingley coal mine in 2003, UK Coal Ltd quickly expanded its use of motorised pulleys.² The initial trial was conducted during a one year period on the mine's tailings conveyor. A 100 hp. motorised pulley was installed at the discharge end of the conveyor, replacing a problematic bottom-side belt conveyor drive located near the conveyor tail.

Within three years, UK Coal's installed base of motorised pulleys totalled 24 (Table 1). The primary motivation for the change in conveyor drive technology was the demonstrated annual savings of tens



Figure 3. Seward coal terminal shiploader uses model 630H 75 HP motorised pulley to transfer Alaskan coal into export ships at 2000 tph.

Table 1. Comparison of Rulmeca motorised pulleys installed at UK Coal preparation plants in 2006 and 2011

Site	Diameter (mm)	Face width (mm)	Power (kW)	Belt speed (m/s)	Quantity
Kellingley	400 – 800	700 – 1150	7.5 – 75	1.0 – 2.5	14
Welbeck	630 – 800	750 – 1200	7.5 – 75	0.8 – 2.0	3
Maltby	500 – 630	1050 – 1650	22 – 55	1.6 – 3.15	6
Ellington	165	450	0.75	0.5	1
			2006 total		24
			2011 total		63

of thousands of dollars in reduced maintenance expense and electrical power consumption, initially on the Kellingley main coarse discard conveyor, then subsequently on numerous other conveyors at four other UK Coal preparation plants.

Steve Pringle, group coal processing engineer for UK Coal, said: “The company’s plant managers and engineers were skeptical about the motorised pulley concept in 2003, mainly due to previous experience with drives of a similar design that had been unsuccessful in the UK in the 1960s and 1970s. However, the technology has now been proven within UK Coal and its confidence with the use of the equipment and the service that it receives from Rulmeca continues to pay dividends to UK Coal’s business. The benefits from the safety aspect of improved access around drive heads and the vastly

reduced requirements of guarding are invaluable in what is still a tough and challenging industry.”

Pringle continued: “As of March 2011, UK Coal has replaced exposed drive systems or newly installed 63 Rulmeca motorised pulleys in its coal preparation plants. The company’s engineering policy is to continue to change out old and exposed drives as its budget permits. The development of motorised pulleys to be used in underground applications of potentially explosive atmospheres could eventually replace many large and major conveyor drives systems that UK Coal operates.”

Underground mines

Cline Resources, a North American coal producer with mines in the Illinois basin and Appalachian beds, recently increased its inventory of motorised pulleys to drive panel belts

in its underground mines. The company thoroughly tested a drive system at its mines in West Virginia and Illinois, insisting that Rulmeca provide a spare motorised pulley (to reduce the risk of a stoppage) during the trial period.

The trial at its Maryan mine consisted of moving 1200 tph of ROM coal at 600 fpm on a 48 in. wide conveyor belt with two model 630H motorised pulleys, nested into an EZMP frame manufactured by Kerco Inc.

The trial was conducted on conveyors that extend from 800 – 1200 ft long to accommodate the movement of continuous miners. The dual drive system incorporates two model 630H, 75 hp. motorised pulleys and has a narrow footprint, as each motorised pulley has a 24.80 in. dia. and 55.12 in. face width (Figure 4). All mechanical components are hermetically sealed within the pulley’s oil-filled shell.

Todd Leverton, Maryan mine superintendent, said: “The mine has incorporated these drives because their compactness, reliability and low maintenance requirements will help us maintain our aggressive production rate of 9 t/man-hour of 11,000 Btu coal with only two continuous miners.”

The drive’s compactness and light weight are advantageous when moving conveyors in restricted spaces, such as coal mines, hundreds of feet below the earth’s surface. Each 75 hp. drive weighs 2200 lb, much less than an equivalent exposed drive system.

Exposed drive systems require each motor and gearbox to be protected within a separate cast iron enclosure, but motorised pulleys enclose their motor and gearbox within the pulley shell, thus eliminating redundant parts.



Figure 4. Two 75 hp. motorised pulleys in nested dual arrangement move 1200 tph of ROM coal at 600 fpm on 48 in. wide 1200 ft long underground conveyor belt. Note the absence of external motor, gearbox and pillow blocks.

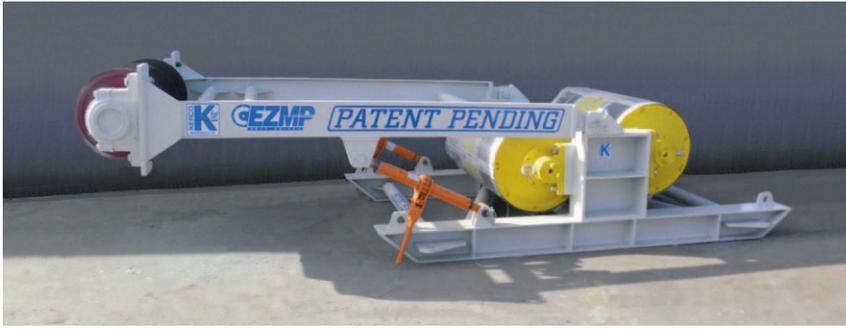


Figure 5. Kerco's 150 HP EZMP drive may be mounted to mine floor or ceiling. An optional boom converts the system from booster to discharge end drive.

Dual drive system

In general, underground coal mines use numerous dual drive systems as booster drives to spread effective belt tension along the length of the conveyor instead of concentrating all effective tension at the discharge end of the conveyor. Minimising the amount of tension that a conveyor belt must withstand reduces its weight, which is essential to assembling and relocating conveyors underground efficiently.

Ideally, each booster drive should be as small and light as possible due to space restrictions underground. The EZMP dual drive (patent pending) is built for underground coal mines and incorporates Rulmecca motorised pulleys in a nested dual configuration (Figure 5). Each drive may be mounted to the mine floor or hung from the ceiling. Currently configured to provide 150 hp. with two 24.80 in. dia. 75 hp. motorised pulleys, the system

is available up to 660 hp. with two 40.16 in. dia. 330 hp. motorised pulleys.

Conclusion

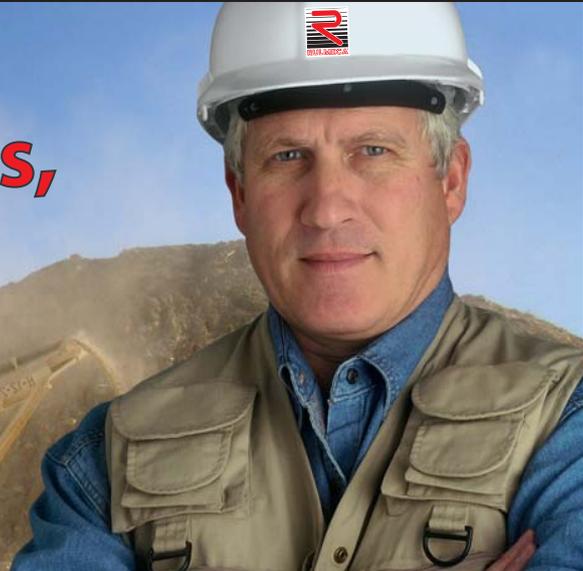
The successful use of motorised pulley technology has been well demonstrated within the coal industry in Europe and North America. The rapidly growing list of applications indicates that knowledge of the internally-powered conveyor drive technology is spreading among plant operators and engineers at surface plants and in deep coal mines. 

References

1. GAWINSKI, M. J.; GRESCH, W., "Motorised pulleys solve harsh environmental problems at North American ship loading terminals", Proceedings of Bulk Europe 2006 Conference, Barcelona, Spain, October 2006.
2. PRINGLE, S., BARRY, M., and GAWINSKI, M., "Motorised pulley solves dirt conveyor problem at UK Coal colliery", 23rd Annual International Coal Preparation and Aggregate Processing Exhibition and Conference, Lexington, US, May 2006.



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