DUAL DRIVE SYSTEM FOR BELT CONVEYORS

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EXPLAINS THE MOTORISED PULLEY UPGRADE AT BUZZI UNICEM USA.

Introduction

Cement plants, shipping terminals, mines, and a variety of other bulk materials handling facilities have incorporated Rulmeca Motorised Pulleys into plant upgrades for more than 60 years. This article describes how the Buzzi Unicem USA Pryor, Oklahoma cement plant modified a 'dual drive' Motorised Pulley system on their reclaim tunnel conveyor to optimise the continuous online analysis of material chemistry in the raw mix proportioning area.

Original installation

Buzzi Unicem USA upgraded its 550 ft long tunnel reclaim conveyor in 2009 to solve operational problems. These problems included production delays (due to inadequate power to start the conveyor under full load), severe belt bounce during 'empty belt' start-up, and occasional tunnel flooding due to a high water table and heavy rains.

The reclaim tunnel conveyor moves high calcium limestone from the covered bulk storage area to the ball mills while additional ingredients were also added to the mills.

Buzzi Unicem USA selected Rulmeca Motorised Pulleys in a dual drive

Figure 1. Reclaim conveyor transfers high calcium hard rock from bulk storage shed to ball mills, while being fed with ingredients such as bauxite, and iron ore from six storage hoppers by transverse conveyor. Close proximity of settling ponds indicate presence of high water table.

Figure 2. Both Model 630H 50 HP Motorised Pulleys were installed in one shift because total weight is only 1850 lbs and all mechanical components are pre-aligned.

configuration for the tunnel reclaim conveyor upgrade primarily because they had good experience with smaller Rulmeca Motorised Pulleys elsewhere at the plant. The product's hermetic seal was particularly important to plant personnel because they were concerned about high calcium limestone abrasiveness and occasional tunnel flooding.

Buzzi Unicem USA's original reclaim tunnel drive consisted of a 75 HP motor coupled to a pedestal-mounted gear reducer which was coupled to a live-shaft lagged drive pulley with external pillow block bearings. Starting the empty conveyor from the head pulley caused severe belt bounce (up to 4 ft) in the conveyor concave curve area at the tunnel exit due to high tension in the belt's carrying strand.

Two 50 HP model 630H Motorised Pulleys were installed in the head and tail positions. Only one shift was needed to install the two Motorised Pulleys thanks to the pulleys' light weight and ease of alignment. Time-consuming drive component alignment was unnecessary because all drive components were internal and pre-aligned.

With a start-up torque of 200%, the twin 50 HP drive system eliminated the problem of inadequate power at start up. Since the two drives provided a total of 360° of belt wrap instead of 180°, the slack side tension requirement was reduced. Therefore, energising the head and tail drives simultaneously eliminated belt bounce when starting an empty belt. Additionally, the dual drive system dramatically extended belt life.

Originally concerned that the tail pulley drive would be inundated during occasional tunnel flooding conditions, plant personnel reported that the Motorised Pulley has performed well for more than seven years in spite of repeated tunnel flooding. This proves that the hermetic seal has stood the test of time.

A flux vector VFD drives each Motorised Pulley. They were originally programmed to drive the conveyor at 60 Hz. At that time, the reclaim conveyor, fed by six belt feeders, moved 'high calcium' hard rock and a mixture of other ingredients at 500 tph at a nominal belt speed of 384 fpm during 10% of the available production time.

Plant process improvement

Three years after the installation of the new reclaim tunnel conveyor drives, Buzzi Unicem USA revised the process to include the installation of an online cross belt x-ray analyser and a raw material handling system that included six bins and associated weigh feeders, enabling the plant to improve product quality.

Materials including low calcium rock, bottom ash, bauxite, and iron ore were transferred from six hoppers and combined with high calcium limestone from the bulk storage shed on the reclaim tunnel conveyor and analysed by an online cross belt x-ray analyser. The analyser sends a signal to a PLC to adjust feed rates for all materials as needed to achieve the desired chemistry.

The two objectives necessary for this revision were:

1. To increase the period of time during which material was transferred from the raw storage area to ball mills.
2. Increase the material bed depth to improve the performance of the X-ray analyser.

Since a control algorithm adjusts the feed rate to the hoppers every five minutes, Buzzi Unicem USA decided to decrease the reclaim tunnel conveyor flow rate and increase the time during which the conveyor was working. Flow rate decreased from 500 – 600 tph to 75 – 200 tph and operating time was increased from 10% to 80% of available production time. Average flow rate is currently 80 tph. In other words, rather than moving 500 t in less than one hour while the X-ray analyser made nine chemistry adjustments, the plant now moves 500 t in approximately 6 hours, enabling the X-ray to make more than 75 adjustments. By decreasing belt speed from 384 fpm to 244 fpm, material bed depth is increased 38% at 150 tph and 29% at 80 tph.

In addition to the general decrease in reclaim tunnel throughput, the raw material PLC was programmed to adjust throughput from 75 tph to 200 tph, as needed. The reclaim tunnel belt speed as well as the speed of each of the six hopper feeder belts are controlled by the PLC as guided by the 'decisions' of the online cross belt x-ray analyser.

Since the reclaim tunnel conveyor is fed by six belt feeders and the conveyor is driven by two VFDs, the changes in flow rate and belt speed were simple. The feed rate from the six feeders was reduced while the power supply frequency to the two Motorised Pulleys was reduced from 60 Hz to 38.1 Hz (reducing the reclaim tunnel belt speed from 384 fpm to 244 fpm).

During a February 2016 visit, the two 50 HP Motorised Pulleys moved raw material mix at 244 fpm. The Motorised Pulleys motors were drawing 28.5 amps at the head and 36.3 amps at the tail, respectively, while moving 149 tph. Since full load amps of each motor is 57 amps, the drive system has more than enough installed power.

Conclusion

The Buzzi Unicem USA experience is typical. Many international major bulk materials handling facilities have taken advantage of the versatility of Rulmeca Motorised Pulleys, revising how they are employed, as necessary, to adapt to changing plant operating conditions. The growing use of VFDs has made ac squirrel cage induction motors more flexible while offering higher levels of control and protection.

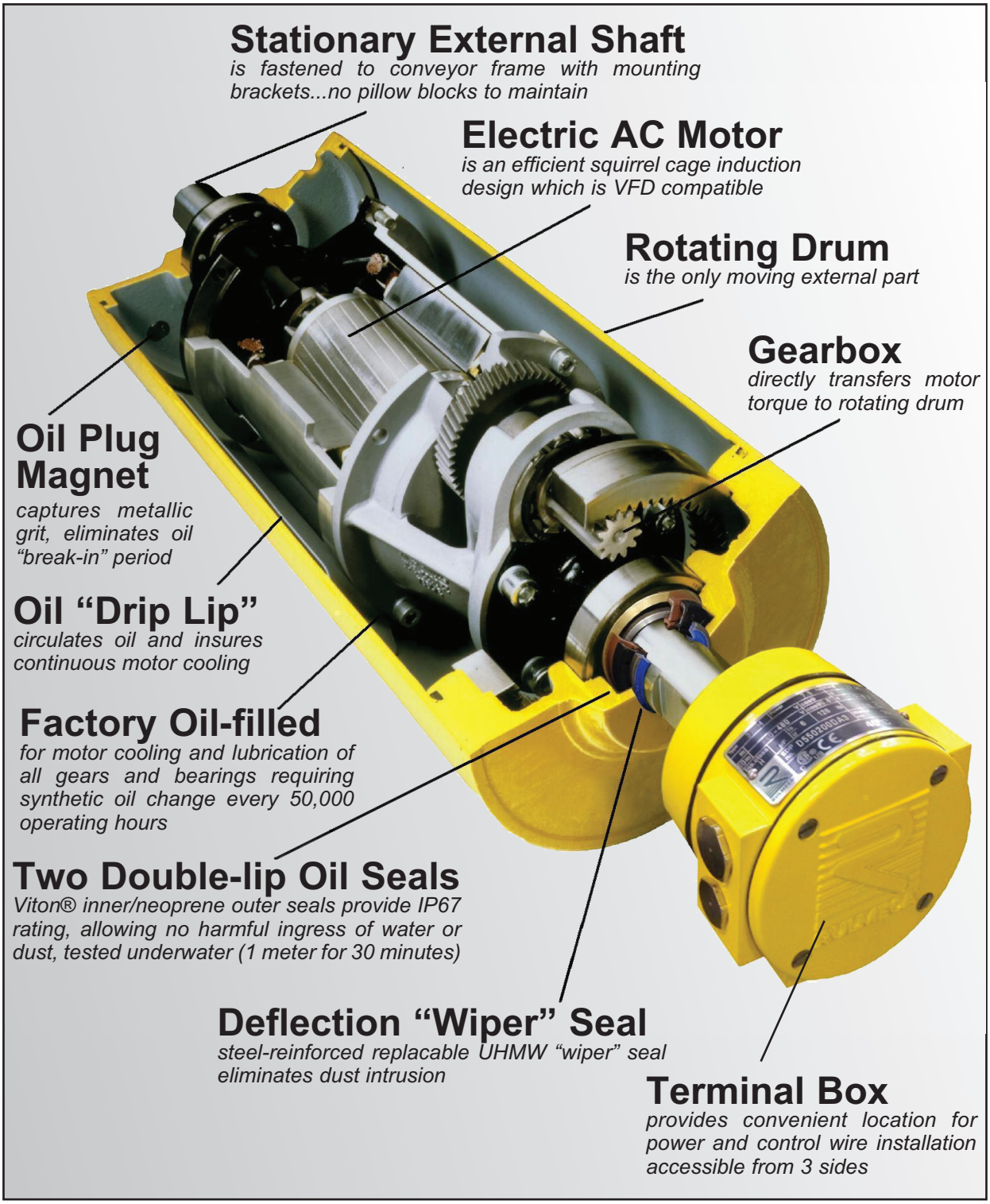
References

1. GAWINSKI, M. J., 'Protective Pulleys', *Bulk Materials Handling Review: A Supplement to World Cement* (2011), pp. 49 – 53.
2. GAWINSKI, M.J., 'Dual Personality', *World Coal* (January, 2013), pp. 65 – 70.

Figure 3. Online cross belt X-ray analyser measures the amount of each ingredient on the belt, checking them by using mix optimisation software to achieve consistent composition, minimise raw mix variability, and improve kiln efficiency.

Figure 4. Rulmeca 50 HP Motorised Pulley has performed well for more than six years in spite of being inundated during periodic tunnel flooding.

Rulmeca Motorized Pulley Cut-away View
Summary of Key Benefits



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AR119: 06/16