

The Sweet Life

Improving Sugar Mill Efficiency with Fenner Industrial Motion's MAV Keyless Locking Device in Collaboration with Rossi Gearboxes

Matthew Jaster, Senior Editor

Sugarcane roller mills are essential components in the sugar industry, responsible for extracting sucrose-rich juice from sugarcane by squeezing it between two/three rolls. The efficiency and effectiveness of these mills are crucial for the overall performance of sugar production. As the industry evolves, it faces increasing pressure to improve environmental conditions, safety, operational flexibility, and reduce costs associated with maintenance and energy consumption.

The transition from traditional mechanical drives to electric mill drives has revolutionized sugar mills by offering better regulation and control, enhanced safety and significant operational cost reductions. However, to maintain such improvements, the power transmission components in these systems must also evolve to meet growing demands for performance and reliability.

"Rossi—and gearboxes in general—have different types of couplings within the operating machine. Everything depends on how the machine shaft that connects to the gearbox is designed. The best solution depends on the requirements of the machine. Every coupling has advantages and disadvantages," said Davide Balestrieri, technical department, MAV.

A Keyless Locking Solution

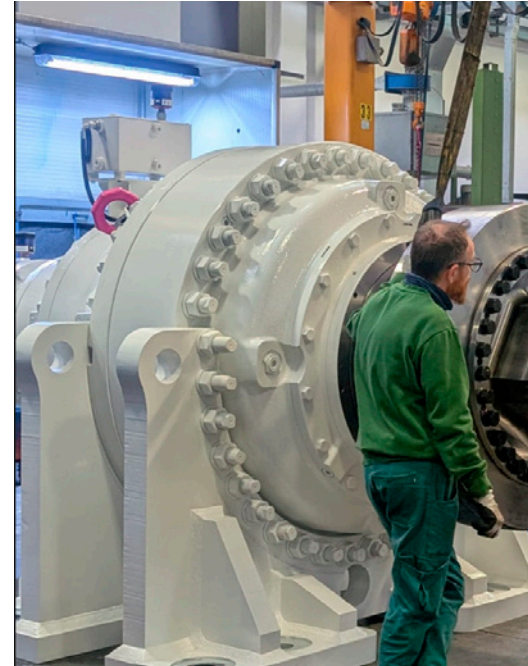
Fenner Industrial Motion, through its MAV product line, worked with Rossi, a leader in industrial gearboxes, to provide a keyless locking device for the sugar mill's power transmission system. Rossi's gearboxes are used globally in every stage of sugar production, from cane

preparation to crystallization. The solution was the MAV Shrink Disc 3009 560 mm x 940 mm Special, which created a rigid, frictional connection between the gearbox's hollow shaft and the crusher rollers' solid shaft, eliminating the need for traditional keys/couplings or mechanical fasteners.

The shrink disc is a mechanical assembly composed of conical rings and a set of screws. They provide a rigid, backlash-free, frictional keyless connection between an outer hollow shaft (hub) and an inner shaft. This is installed directly onto the hub which is then mounted onto the shaft. They allow the transmission of torque, bending, thrust loads, etc., either alone or in combination. They are suitable for shock and reversing loads. These components provide high contact pressure between the hub and shaft, offering high load capacity in combination with ease of installation and removal.

"Rossi wants to increase the maximum torque data of several gearboxes including the EP 1500 (from 2150 kNm to 2500 kNm) to be published in their product catalogs to align with the competitors. So, they need a better performing shrink disc. The same request came for the EP1060 (from 1500 kNm to 1800 kNm), EP2120 (from 3.000 kNm to 3.800 kNm), EP3000 (from 4250 kNm to 5400 kNm), the largest models they produce. We did this easily by modifying the geometry of the shrink disc (taper, number of screws, outer diameter, etc.) In this sense, we have improved performance," Balestrieri said.

The shrink disc has provided 40+ years of proven technology for light,



According to Fenner/MAV, the shrink disc pictured is the largest ever produced by MAV and is one of four shrink discs supplied to sugar mills.

normal and heavy-duty applications. Fenner/MAV engineers utilize 3D CAD and calculation software, including *FEM Analysis* to provide its customer base with the necessary tools to select the proper components. MAV specializes in designing and manufacturing special items according to customer application and design requirements. The company manufactures keyless locking devices, external shrink discs, and rigid couplings for shafts ranging from 5 mm to more than 1 meter. This includes more than 40 series available in both metric and imperial bores.

The solution had to handle a significant torque of 2,500 kNm, while keeping the overall system compact and minimizing stress on the components. The MAV-designed shrink disc met these strict requirements, improving both performance and cost-efficiency in the power transmission system.

Editor's note:

If your components or system helped solve a mechanical power transmission challenge we'd love to hear from you. Send your case studies and application articles to Matt Jaster, senior editor at jaster@agma.org.



Cost efficiency was gained by not changing the geometry (diameters and lengths) of the output shaft, the material and the production technology of the shaft, according to Balestrieri.

"The application of a higher performance shrink disc would have caused the shaft to suffer from excessive stress," he added.

Rossi supplies cost effective, reliable and high-performance solutions for the sugar industry, with expertise in various sugar processes and applications. These gear reducers and gearmotors offer productivity, energy efficiency and great customization capacity. Thanks to the company's engineering knowhow, they know what is required during every stage of sugar processing.

Unique Production Challenges

According to sugar.org, sugar cane stalks are harvested from fields in U.S. locations such as Florida, Louisiana and Texas and global countries such

as India, Brazil, Australia, Thailand, Mexico and China. At the sugar mill, the sugar cane stalks are washed and cut into shreds. Huge rollers press sugar cane juice out of these shredded stalks.

Once the cane arrives at the mill it is weighed and then shredded. The shredding breaks the fibrous stalks apart, bursting the cells that contain the sweet juice. Following this, the cane is crushed through a series of rollers, separating the juice from the leftover fibrous material. The leftover material is used to fuel the mill's furnaces. Having extracted the juice, impurities need to be removed. This is done by adding lime and heating. The clear juice is then concentrated by boiling under a vacuum into a syrup.

The juice is then clarified, concentrated and crystalized. The crystals are spun in a centrifuge to remove the liquid and produce golden raw sugar (this is 96–98 percent sucrose). Raw sugar is transported to a cane sugar refinery, where it will be further purified.

The amount of molasses left on the crystals or added back to the sugar crystals determines which type of sugar is produced. Beyond the traditional white granulated sugar and light and dark brown sugars, there are lightly colored sugars, golden or tan, produced for specialty uses. As for the materials leftover from sugar processing, many of them are recycled and reused. For example, sugar cane refining results in leftover cane fiber is called bagasse. This bagasse is used to generate electricity for sugar mills and even their surrounding communities.

Global Impact

The global production of sugarcane in 2019–2020 was reduced due to limited production in India, Brazil

and the United States. Unfortunately, the industry suffers the same fate as many food and beverage markets where high production costs, seasonal weather, government policies and outdated machinery and production prevent the global expansion at a greater pace. Shortages of skilled labor for harvesting and transporting sugarcane has also caused production limitations.

Customization and Modularity

Modularity can be considered the foundation of Rossi. Modular products and "modular" processes allow Rossi to engineer a solution for almost every industrial application requiring a gearmotor or gear reducer. Modularity means flexibility for the engineers behind the scenes and the ability to provide customers with a wider range of options, faster delivery and most important of all, competitiveness. The limitless configurations available allow Rossi to deliver standard or custom solutions in a cost-effective manner.

MAV and Rossi have been collaborating for over a decade, providing both standard and custom solutions across a range of industries. By combining Rossi's high-performance gearboxes with MAV's keyless locking device, the partnership has delivered a flexible and reliable solution for sugar mills, improving the efficiency and durability of power transmission systems.

"The MAV solution was to design a longer shrink disc to reduce the contact pressure on the shaft and reduce the intensity of mechanical stress, respecting the space constraints imposed by Rossi," Balestrieri said.

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