

The Optimization of 70 Tons of Scrap

Electric pre-shredder provides energy efficient option with MAV shrink discs

Matthew Jaster, Senior Editor

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The engineering community is fascinated with big, shiny, yellow machines. Walk into any manufacturing facility around the globe and you'll find guests huddled around the biggest, loudest, and most intimidating equipment on the shop floor. These large machines must play by the same rules as everybody else—they need to reduce energy consumption, lower plant costs, and increase productivity. Many power transmission component suppliers are tasked with optimizing this equipment.

Big Yellow Machines

Wendt Corporation, Buffalo, N.Y., is an independently owned and operated family business serving the scrap metal recycling industry for 40+ years. The company is the North American distributor for MTB, a provider of metal recycling pre-shredding, shredding and sorting equipment based in France.

"The pre-shredder offers our customers a simple way to grow their business by maximizing the use of existing assets," says Ethan Willard, Wendt's business development manager. "I believe pre-shredders will revolutionize existing grinding operations with their ability to increase production and reduce operating costs and downtime."

Wendt sold the MTB EZR Electric—a pre-shredding machine with an electric drive—to Rochester Iron and Metal, a recycling operation located in Rochester, Ind. The EZR Electric is the first U.S. electric pre-shredder, providing 92% drive efficiency thanks to its synchronous high-torque electric motors. MTB machine designers turned to electric power over hydraulics, reducing energy consumption while developing a more circular economy.

Combining this with a mechanical design that allows the adjustment of output density and throughput of the machine after installation, MTB can tailor the EZR's operation to meet specific customer needs at a lower energy cost.

These upgrades allow nongrindable material to be stopped or disposed of without risk of damage to the EZR pre-shredder. Slow shaft speeds, for example, significantly reduce the risk of explosions or mill damage that could cause critical machine downtime. Shrink discs made by MAV S.p.A., a product line of Fenner Drives, are right at the heart of the 70-ton-per-hour pre-shredder, the EZR Electric.

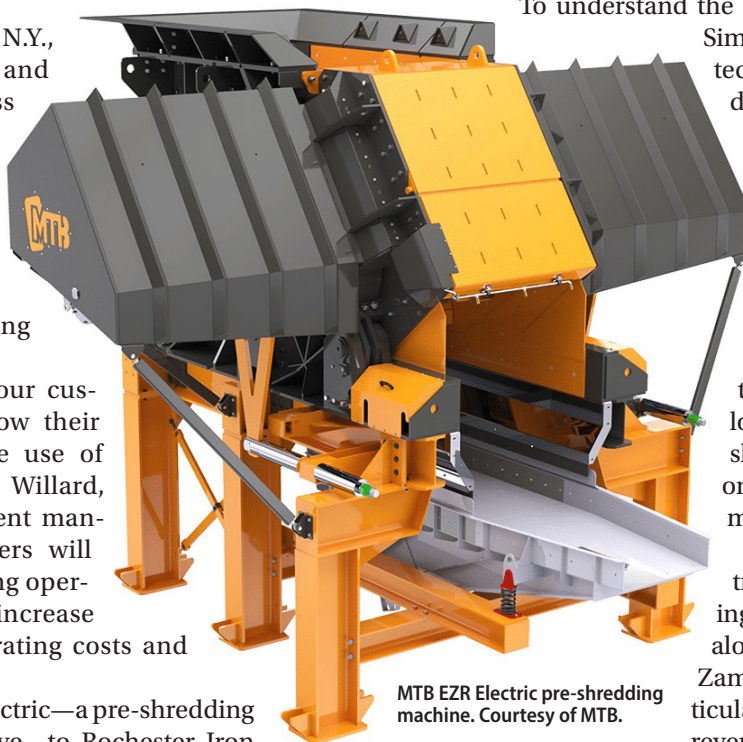
Shrink Disc Analysis

To understand the importance of shrink discs, Simone Zambanini, engineer, technical department at MAV, discussed the components history and application advantages.

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.

"Shrink discs allow the transmission of torque, bending, thrust loads, etc., either alone or in combination," Zambanini said. "They are particularly 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."

The MAV 3208 shrink discs—used for this application—are mounted on the extraction and feeding rotors. They are extremely important in achieving the electrification of the unit. The shrink discs connect to the gearbox's hub to the rotor's shaft, allowing MTB to use gearboxes with hollow, low-speed shafts and a compact design, saving weight and space in the EZR Electric pre-shredder.



MTB EZR Electric pre-shredding machine. Courtesy of MTB.

Zambanini said that the two-part design of the MAV 3208 is less conditioned by installation accuracy than the three-parts design shrink disc, since the single outer ring is guided during tightening operations by the long shallow taper of the inner ring, leading to extremely low runout error.

“Wear and fretting corrosion in the parts or in other locking elements (typ. keyed and splined connections) are eliminated, due to high contact pressure and absence of play (backlash-free).

Clearance fit mounting makes installation and removal much easier than in case of interference-fit or keyed connections,” Zambanini added.

In addition, the high contact pressure between the parts creates a stronger connection and a longer useful lifetime, especially in applications, like shredders, with shock or reversing loads.

Previous generations of pre-shredders relied on hydraulics because of the large amount of power required. In addition, the electric units will have a smaller footprint and be less complex than a hydraulics model.

A History of Application Requirements

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

“Project files are stored in a PLM software,” Zambanini said. “This grants safe and quick traceability of all pertaining documents.”

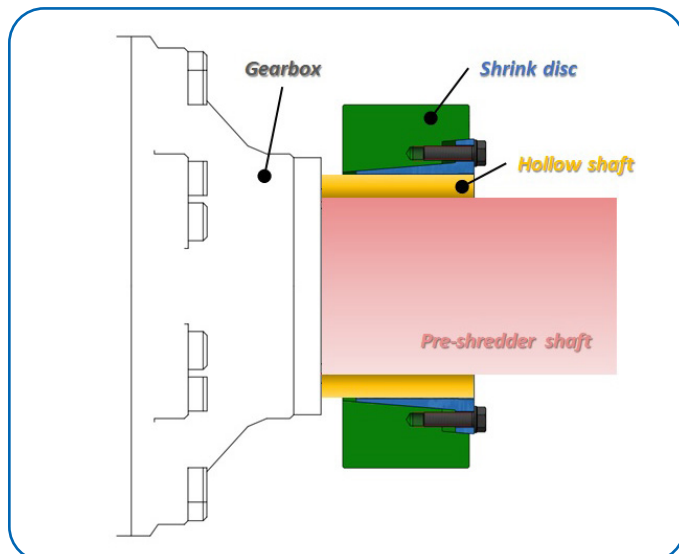
MAV specializes in designing and manufacturing special items according to customer application and design requirements. The company manufactures keyless locking devices, external shrink discs, and rigid couplings for shafts ranging from 5 mm to more than 1 meter. This includes more than 40 series available in both metric and imperial bores.

MAV locking assemblies use tapers that generate high radial forces when pushed together, creating high contact pressure and a zero-backlash connection. The locking assemblies mount gears, pulleys, cams, levers, rotors, and similar devices onto shafts, while the rigid couplings connect two shafts. These products are adjustable both radially and axially, allowing machine designers and users to achieve perfect timing, making installation and removal easier.

“Shrink discs are very versatile. You can position the connecting elements as you want—as they are required—so you’re not constrained by keyways or splines, etc. You can reach any position with these components,” said Sebastien Collignon, international sales manager, Fenner Drives.

Collignon added that the next step in the shrink discs versatility is a brake-integrated shrink disc.

“Attaching a brake directly to the shrink disc is advantageous if the gearbox needs a braking system for service or for a parking brake. This is a unique and special application where it locks the gearbox to the machine shaft. We are using this technology in areas such as mining, oil and gas and other heavy industrial applications,” he said.



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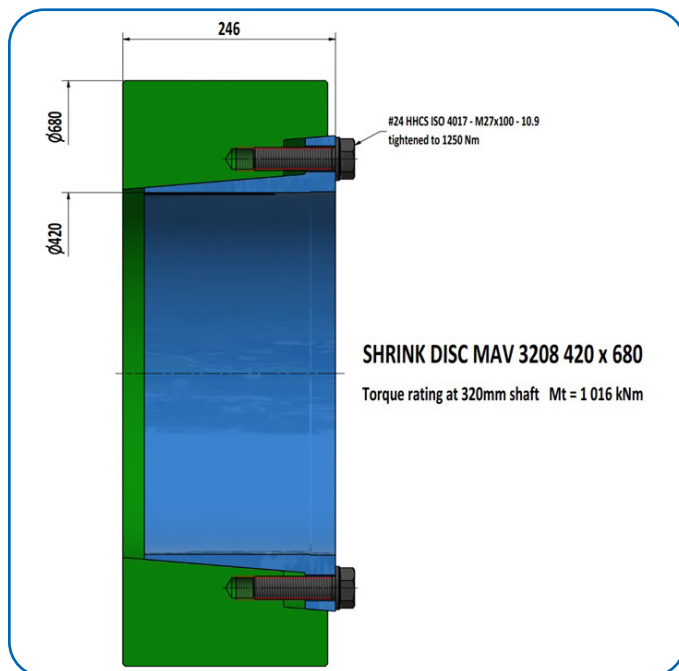


Diagram of the MAV 3208 series shrink disc.

Increased Throughput and Efficiency

The addition of the MTB EZR Electric pre-shredder will make the Rochester facility a safer, more efficient operation. In effect, the pre-shredder prepares the waste stream for the company’s large Wendt M6090 shredding machine. The pre-shredder uses low-speed, high-torque technology to allow Rochester to increase the throughput and cut the wear on its primary shredder. It also removes unshreddable material, greatly reducing the chance of catastrophic failure at the mill.

“We are basically going to become an 80-inch mill without the installation costs,” said Dan Zeiger, controller for Rochester Iron and Metal. “From a financial perspective, the payback estimations are in months, not years.” **PTE**