

Improved Solutions for Open-Pit Mine Dewatering



The Pump People®

Technological advances in open-pit mining have enabled a more streamlined approach with the operation of pumps for dewatering. Increased pump head pressure, more flexible portability and reduced energy usage have provided significant advantages for increased throughput, system uptime, reduced cost of operation and maximized ROI.

According to a 2023 Ernst & Young (E&Y) report, "Top Mining and Metals Sector Challenges in 2023", "Mining companies must juggle competing priorities within a fast-changing global environment. Key issues influencing the mining industry include managing productivity, legacy technology, power costs and supply chain disruption."

To this assessment can be added the key factor of water management, particularly specific to open-pit mining. Effective water management is critical to open-pit mining operations. Generally, more water is encountered as the mine becomes deeper, which can make the mine vulnerable to becoming a lake due to the under-site water table and precipitation. Water in the mine leads to slope depreciation and safety hazards, and creates adverse effects on production while increasing mining costs. Consequently, open-pit mine dewatering is essential as it creates dry conditions so the mine can be operated safely, efficiently and cost-effectively.



Gorman-Rupp widebase submersible products (right) are ideal for moving large volumes of water quickly. Slimline models are designed to fit where space is a concern.

Dewatering from Open-Pit Mines

Dewatering in open-pit mines is achieved by pumping continuously from dewatering wells on the mine floor to remove surface water. As these mines become increasingly deeper, dewatering becomes more challenging and costly, requiring additional bench pit ponds to be located on the side walls of the mine with booster pumps to maintain the head pressure needed



Developed for harsh mine site dewatering, priming-assisted pumps thrive in applications where liquid levels fluctuate.

to bring groundwater to the surface – a process that considerably increases dewatering costs.

The type of pumps used depends on various factors such as water properties, the presence of abrasive solids, the concentration of solids, the location of the installation and the mine depth. Pit-installed pumps on pontoons or barges commonly use submersible, vertical turbine or end-suction self-priming pump technologies. Submersible pumps connected in series, single-stage end-suction pumps or multistage pumps can be used for booster stations and bench pit ponds.

Vertical turbine pumps, with their high head pressures, can reduce the need for added bench pit ponds and booster pumps, but turbines provide only a partial solution as they are challenging to maintain and have limited use in shallow water depths. The

pond being pumped from needs to be deep enough to support a vertical turbine. Because turbines require a permanent supporting infrastructure, they are a poor choice for portability, an important factor in dewatering pump selection.

When water needs to be pumped over a long distance or up to a high elevation, horizontal multistage centrifugal dewatering pumps are also utilized in open-pit mines. These diesel-driven pumps are more economical, feasible and cost-effective than turbine pumps. They can be installed within a shorter time frame and can be more easily moved as necessary to meet the job requirements.

The majority of dewatering pumps used in open-pit mines are submersible pumps. In addition to their adaptability to different water conditions, submersible pumps come in a wide range of sizes and capabilities.

Open-pit mining operations require equipment that is designed to fit their specific production requirements, capable of handling high-volume capacities, while reliably operating 24/7/365. The machinery must fulfill the most demanding specifications for the processes required.

Latest-Generation Pump Technology for Dewatering

Technological advances in open-pit mining have enabled a more streamlined approach with the operation of dewatering pumps. Increased pump head pressure, improved portability and reduced energy usage have provided significant advantages for throughput, system uptime, cost of operation, and ROI.

Case in point, when latest-generation high-capacity diesel horizontal centrifugal dewatering pumps – capable of delivering over 500 feet of head pressure – are utilized, the number of pumps and bench pit ponds currently in use can be significantly reduced, as well as reliance on vertical turbine pumps without loss in head pressure. Not only does this minimize the number of pumps needed, it enhances location flexibility and reduces energy consumption.

The importance of reducing energy consumption has

become a more critical issue as energy costs escalate and open-pit operations are pressured to lower operating costs without loss of productivity. This is driving the evolution of more energy-efficient open-pit mining operations, along with the controls to optimize their operation. When better energy-efficient pump solutions are implemented into open-pit dewatering, the energy and cost savings potential can be considerable.

One company that has provided significant improvements to open-pit mining dewatering pump technology is Gorman-Rupp Pumps. The company has manufactured pumps for municipal, sewage, industrial, mining, construction, petroleum, OEM, government and agriculture markets for more than 90 years.

Following are examples of the company's latest-generation pump solutions for dewatering that can deliver significantly improved performance for open-pit mining applications:

Priming-Assisted Horizontal Dewatering Pumps

With a variety of sizes and operating ranges, Gorman-Rupp's extensive line of Prime Aire® (PA Series®) priming-assisted (dry prime) pumps can handle the toughest applications including pumping large solids.

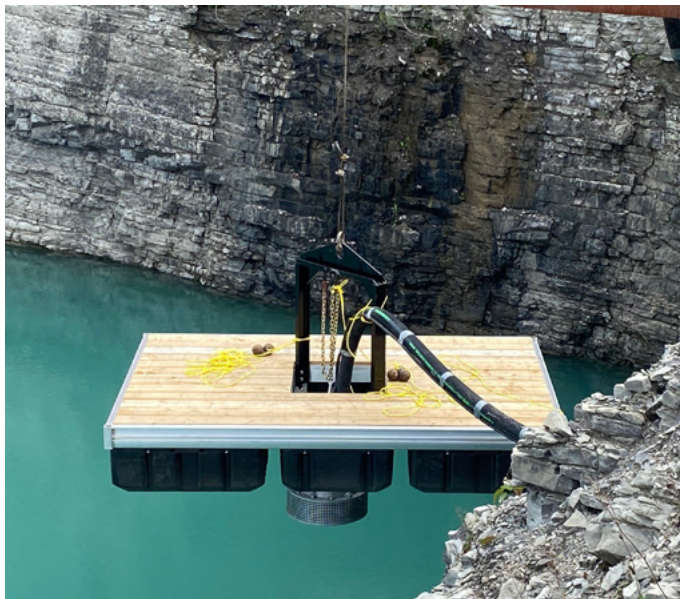
The Prime Aire system uses a venturi compressor priming chamber and priming valve which eliminates leaks associated with traditional vacuum-assisted pumps. Compressed air is forced through the venturi by the air compressor to create a vacuum. The air in the pump casing and suction line are then evacuated to the atmosphere. The pump begins to prime as atmospheric pressure causes water to replace the evacuated air. This unique system enables the pump to operate under flooded suction conditions without leaking. The positive priming capabilities make it ideal when using long suction lines or for intermittent flow and slurping type applications. The pumps are configured with EPA Tier compliant engines.



PAH Series® pumps can be mounted to a trailer or skid base for added portability around mines and job sites.

- **Dry Run Capability** – Dry run capability is designed into the Prime Aire system. An oversized, oil-lubricated mechanical seal allows the pump to run dry continuously without damage.
- **Compressor-Over-Pump** – Some PA Series models are available in a compressor-over-pump arrangement. This configuration offers a compact, flexible design while allowing ease of operation and servicing when needed.
- **Abrasive-Handling Seal** – The pump is equipped with oversized, mechanical, oil-lubricated, double-floating, self-aligning seals, with silicon carbide rotating and stationary faces designed to take the wear and tear of pumping solids and other abrasives.
- **Standard Auto-Start Controls** – An Auto-Start control starts and stops the pump in response to liquid levels. The pump only starts when there is water to pump and turns itself off when the water reaches the desired level.

- **Optional Diaphragm Priming System** – As an alternative to the venturi/compressor priming system, some PA Series pump models offer an integrally mounted diaphragm vacuum pump for the priming assembly.
- **Impeller Selection** – PA Series pumps utilize a variety of impeller types based on the specific application. Models feature rugged, two-vane, ductile iron, semi-open solids handling impellers that handle up to 4" diameter solids, or higher-efficiency enclosed impellers for clean water applications.
- **Self-Cleaning Wear Plate** – Several PA Series models are available with Gorman-Rupp's Eradicator® solids management technology. These pumps are equipped with an aggressive self-cleaning wear plate utilizing grooves, notches and a lacerating tooth to break up materials and pass them through the pump without impacting performance or interrupting service. Many PA Series models include a side port which allows easy access to the pump interior for inspection and clean-out, should a clog occur.



Widebase submersible pumps are commonly suspended from floating platforms in open pit mines. This helps the pump avoid silt and other debris on the water's bottom while the platform serves as a dock for service personnel should the pump need to be pulled.

Heavy-Duty Priming-Assisted Dewatering Pumps

Designed and engineered for the most rugged and demanding mining applications, the Prime Aire Plus® (PAH Series®) priming-assisted pumps from Gorman-Rupp, utilize the same venturi compressor priming system as the PA Series pumps.

With increased head, flow and enhanced maintenance features, PAH Series pumps feature sizes up to 16" discharge, with 275 HP engines capable of delivering 400 – 500 feet of head pressure, and are suitable for corrosive and abrasive liquids containing large solids.

These pumps can be configured with EPA Tier compliant engines or premium efficiency motors, and are available in multiple drive variations including trailer-mounted engine-driven and skid-mounted electric-driven.

Widebase Submersible Dewatering Pumps

Where large solids passage is not required, the widebase S Series submersible dewatering pump line from Gorman-Rupp provides high-head, high-volume discharge up to 12", while fully or partially submerged under the worst conditions.

These submersible pumps are built to operate quietly, effectively and safely. The wide, solid base helps prevent pumps from turning into the ground or pumping into a hole.

- **Minimized Maintenance & Repair** – The S Series submersible pumps have few moving parts and wearing surfaces to minimize maintenance and repairs.
- **Abrasive-Handling Impeller** – Abrasion-resistant ductile iron and manganese bronze impellers stand up to sand, gravel and other abrasive materials. The fully shrouded impeller back reduces seal pressure and helps prevent foreign material from entering the seal cavity, extending operational life of the pump. Optional impellers of CD4MCu (stainless steel) are available for corrosive/abrasive applications.

- **Dual Seals** – The primary seal keeps dirty water in the pump end and prevents contamination of the oil cavity. A second fail safe seal provides extra protection against the possibility of damage to the motor. Positive oil lubrication enables the pump to run dry without seal damage.
- **Corrosion-Resistant Stainless Hardware** – The rotor shaft and all internal nuts and bolts coming in contact with the liquid are made of stainless steel to resist corrosion and pitting and extend the operational life of the pump. For severely corrosive/abrasive applications, stainless steel fitted pump models of CD4MCu (stainless steel) are available.

Optional Gorman-Rupp Hard Iron and hardened stainless steel wet-end components are available when extremely abrasive or corrosive conditions are present.
- **Portability** – Portable control panels with on-off switches and overload protection are standard on these submersible dewatering pump models.
- **Staged Operation** – The discharge of one pump can be connected to the suction of another for tandem operation to effectively double the head at a given flow.

Slimline Submersible Dewatering Pumps

For narrow and hard-to-reach dewatering applications, slimline S Series submersible pumps, from Gorman-Rupp, are lighter and easier to handle than the larger widebase models while retaining the same features. Available in 2”

through 6” discharge, the pumps may be operated fully or partially submerged.

This line also offers motors that are specifically designed for vertical submersible pumps, and meet all Mine Safety and Health Administration (MSHA) requirements.

New Paradigm for Dewatering in Open-Pit Mining

Open-pit mining operations must continuously assess production capacity against the capability and performance of their mining machinery for the extraction of raw materials. Capacity decisions affect production lead time, operating costs and essentially, the mining company’s ability to profitably compete.

Using Gorman-Rupp’s efficient pumping systems in open pit mine applications helps operators achieve optimal production levels.

About Gorman-Rupp Pumps

For more than 90 years Gorman-Rupp Pumps has manufactured pumps for municipal, sewage, industrial, mining, construction, petroleum, OEM, government and agriculture markets.

The company’s extensive line of pump products include self-priming centrifugal pumps, standard centrifugal pumps, end-suction centrifugal pumps, submersible pumps, rotary gear pumps, engine-driven pumps and priming-assisted pumps. In addition, Gorman-Rupp manufactures a complete line of state-of-the-art packaged lift stations and booster stations that include pumps, motors, controls, piping, accessories and enclosures.



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