



# Reliability and Condition Monitoring Solutions for the Mining Industry



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## The Business Problem

Mining is an indispensable part of the global economy and makes modern life possible. Everything from the titanium and aluminum that allows an airplane to be both lightweight and incredibly strong, to the fuels for nuclear and fossil-fired power plants, to the copper in the wires that make up our communications infrastructure—all of these and many more find their origins in mining. It is even responsible for an increasingly important share of our petroleum needs thanks to tar sands mining and extraction technologies.

Today, the demand and corresponding prices for the raw materials we remove from the ground are at all time highs, meaning mining operators can sell everything they can produce at premium



prices. Capacity has become more essential than ever before. Consequently, a mining operation's reliance upon its machinery has never been more important. Downtime is more expensive. Uptime is more valuable. Operators need to know if they can push machinery to its design capacity and beyond while remaining safe and maximizing the balance between useful life and capacity. And, as always, operators need to remain safe—for their families, for their communities, and for the environment.

## Reliability is the Key

Unreliable assets have enormous consequences. What if your assets could consistently operate at or above their rated capacities, for a greater percentage of total hours each year, all while spending less money on maintenance? That's exactly what today's best companies have discovered how to do. Industry studies show that the average facility spends approximately 5% of its Replacement Asset Value (RAV) on maintenance each year. In comparison, best performers spend 60% less—just 2% of RAV—while enjoying better uptime, efficiency, and profitability. It's not about simply spending less on maintenance, it's about working differently—working smarter—to achieve more reliable mining operations.

## GE Can Help

Closing the gap between your reliability "entitlement" and what you are actually obtaining from your efforts typically involves the following three categories:

- **Processes:** Our comprehensive reliability services help customers assess their goals, identify the reliability gaps in their current operations, and then implement the appropriate corrective actions.
- **Tools:** Our Bently Nevada\* product line is world-renowned for unsurpassed quality in machinery condition monitoring. Everything needed to address the assets in mining facilities is available, from sensors to continuous monitoring systems to portable data collectors and analyzers. And, it's all brought together in a unified platform for asset condition monitoring and diagnostics—GE's System 1\* software. We also assist customers in integrating and using their already installed tools, such as computerized maintenance management systems (CMMS) and reliability software.
- **People:** Reliability is about more than just technologies and processes. Armed with even the most sophisticated tools and effective strategies, companies can fail to reach their reliability goals unless they are able to successfully change the way they work. Reliability is a company-wide effort that touches operations, maintenance, planning and scheduling, purchasing, management, and engineering. GE is able to help customers change the way they work by addressing the organizational culture issues that keep companies mired in ineffective processes, helping them transform their businesses and balance sheets.

Because GE is able to fully address each one of these, we are able to solve the whole problem—not just bits and pieces.

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## Condition Monitoring

While condition monitoring may not be the only element in a successful reliability program, it is nonetheless an essential element. For years, we've been taught that the older an asset is, the more likely it will fail. As such, many plants have evolved elaborate and finely tuned maintenance schedules based on calendar intervals or running hours.

There's just one problem with that approach: time- or usage-based maintenance strategies alone are only valid for 10 to 15% of the assets in a typical industrial facility.

In other words, if you have applied a time or usage based only maintenance strategy to the majority of your equipment, most are getting "maintained" when they don't need to be. That's wasteful, and it's one of the major reasons that many companies are overspending on maintenance. In other cases, the asset may fail before it reaches its scheduled maintenance interval. Frustrated, companies are left to scratch their heads and wonder "what went wrong?"

Today we understand that the probability of an asset failure is often highest just after it has been placed in service (or undergone maintenance). Following this "infant mortality" period, its probability of failure becomes constant and does not rise linearly over time. This means that running hours and calendars are poor "predictors" of failure. How do you know when such assets will fail if the time-based intervals can't be trusted? By measuring the mechanical condition of the asset – vibration, temperature, efficiency, oil chemistry/particulates, and other physical parameters. In other words, condition monitoring.

This approach results in maintenance only when the condition indicates the asset is failing. Further, failure progression can often be trended quite accurately, allowing maintenance intervention at exactly the right time—not too soon, not too late. And, condition data can be remarkably precise, indicating not just that the asset is failing, but exactly what is wrong, even identifying root cause and mitigating failure completely.

## Different Assets, Different Approaches

Not all assets are created equal. Some, such as mills and ventilation fans, are critical to operations. Other assets are merely essential. And still others have little impact on safety, environment or production, with only maintenance costs as the primary consideration. As such, a variety of condition monitoring products and approaches are required.



Criticality	Attributes	Recommended Monitoring
High	<ul style="list-style-type: none"> <li>• Large impact on process</li> <li>• Large safety and/or economic impact of failure</li> </ul>	Continuous, online monitoring
Medium	<ul style="list-style-type: none"> <li>• Some impact on process</li> <li>• Physically inaccessible or impractical for manual data collection</li> </ul>	Scanning, online monitoring
Low	<ul style="list-style-type: none"> <li>• Minimal environmental, safety or economic consequences of failure</li> <li>• Little or no impact on process</li> <li>• Physically accessible for manual data collection</li> </ul>	Offline, route-based manual data collection using a portable instrument

## Services

**Reliability Improvement:** Whether your facility has all the tools it needs or is just getting started, GE can add value through far more than just a collection of condition monitoring products. In fact, our Reliability Consulting Services offering is designed to function independently of the condition monitoring products you may have chosen—whether our own or someone else’s. It provides a holistic approach to your reliability efforts by reviewing your entire program and benchmarking you against world-class performance. Where gaps exist, we show you what to do about them and the financial benefit you can expect via a clear ROI.

We also go beyond just making recommendations and actually help you implement the improvements you’ve chosen. For example, perhaps a gap has been identified that you aren’t using your CMMS to its full potential. We’ll help you get there with

training and system integration support. Or, perhaps you are using interval-based maintenance on assets where run-to-failure is actually a better strategy. Or, you may find that most of your time is spent “reacting”, leaving insufficient time to be proactive in your maintenance—and you don’t quite know how to get out of this vicious cycle. Or, your spare parts inventory may be problematic and you need help developing a rational strategy for what parts to stock and what quantities. Every one of these can be addressed through our comprehensive portfolio of reliability services.

Finally, we help you change the way you work. Many organizations invest in technology and have excellent strategies, but neglect the most important factor: the human factor. When people understand the role of reliability and can feel the difference it makes in not just their jobs, but the balance sheet, they are better able to embrace new ways of doing things. We understand how to tackle these often difficult, but vital, organizational culture issues in ways that get everyone playing on the same team and working towards common goals.

**Installation:** Our extensive project capabilities combine our services with our hardware and software to deliver fully installed, fully engineered solutions in your plant—solutions that are tailored to your specific requirements, tested, configured, commissioned, and completely ready to use. And, they’re available for every product we offer.

- Scope based on your needs, from 100% turnkey to coordination with and use of internal plant resources for selected functions—design-only services also available upon request
- Compliance with plant IT standards, hazardous area requirements, and country-specific certification agencies
- Outstanding record for safety, timeliness, and adherence to budget





**Machinery Diagnostics:** Since 1972, we have been helping customers interpret their condition monitoring data, helping them isolate not just machinery problems, but root causes. These services are available globally through a team of more than 70 specially trained engineers, and can be delivered either locally or via remote access using System 1 software.

**Training:** We believe in helping customers help themselves. Each year, we train thousands of customers worldwide on topics ranging from operation and maintenance of our instrumentation systems, to machinery balancing and alignment, to reliability awareness and improvement, to machinery diagnostics.

- Worldwide network of professional training centers—on-site training also available
- Hands-on laboratories using real-world case histories—ensures underlying theory and practice are mastered
- Students consistently rate their GE training as “outstanding” and “exceptionally practical”

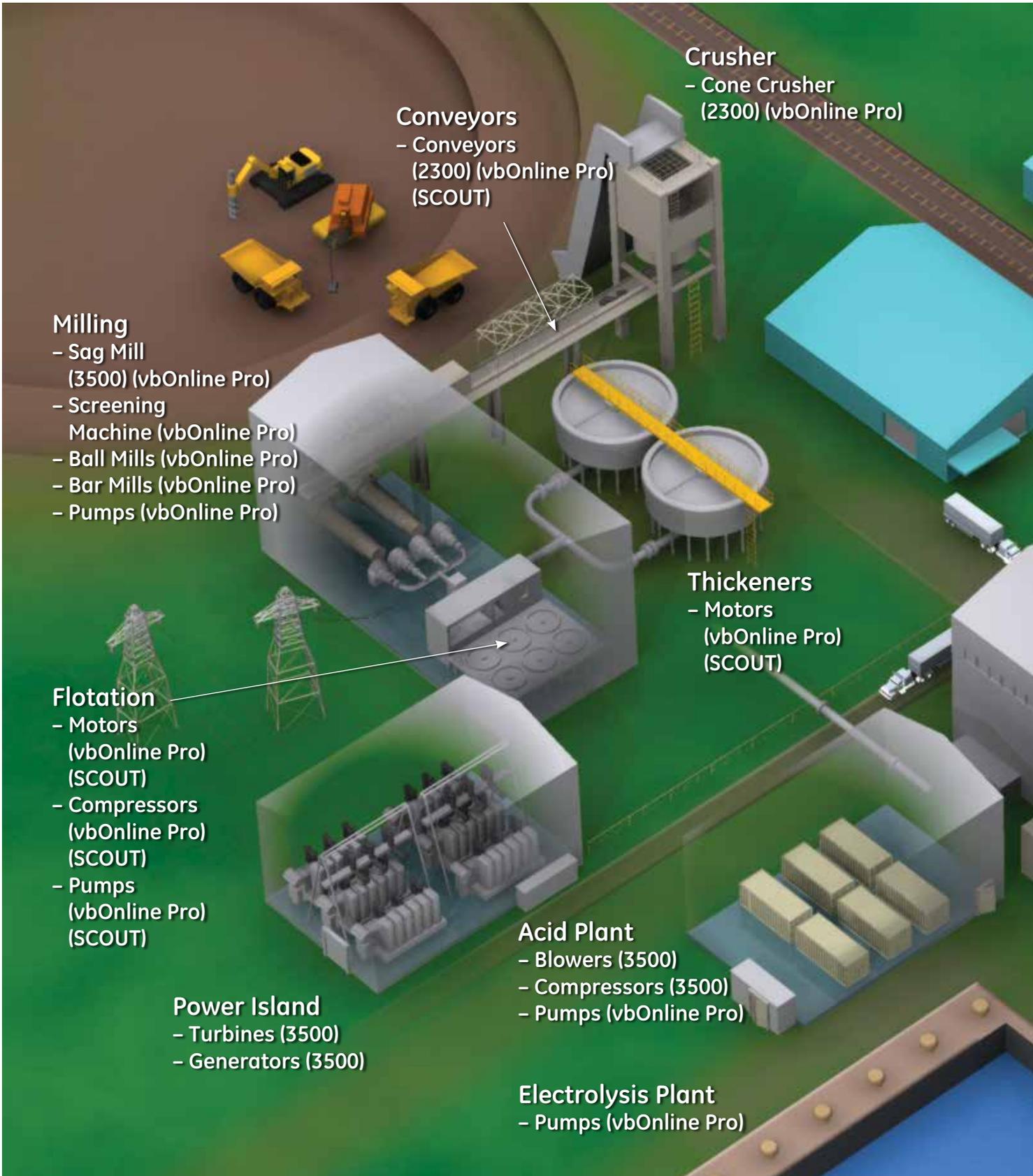
## You can rely on us

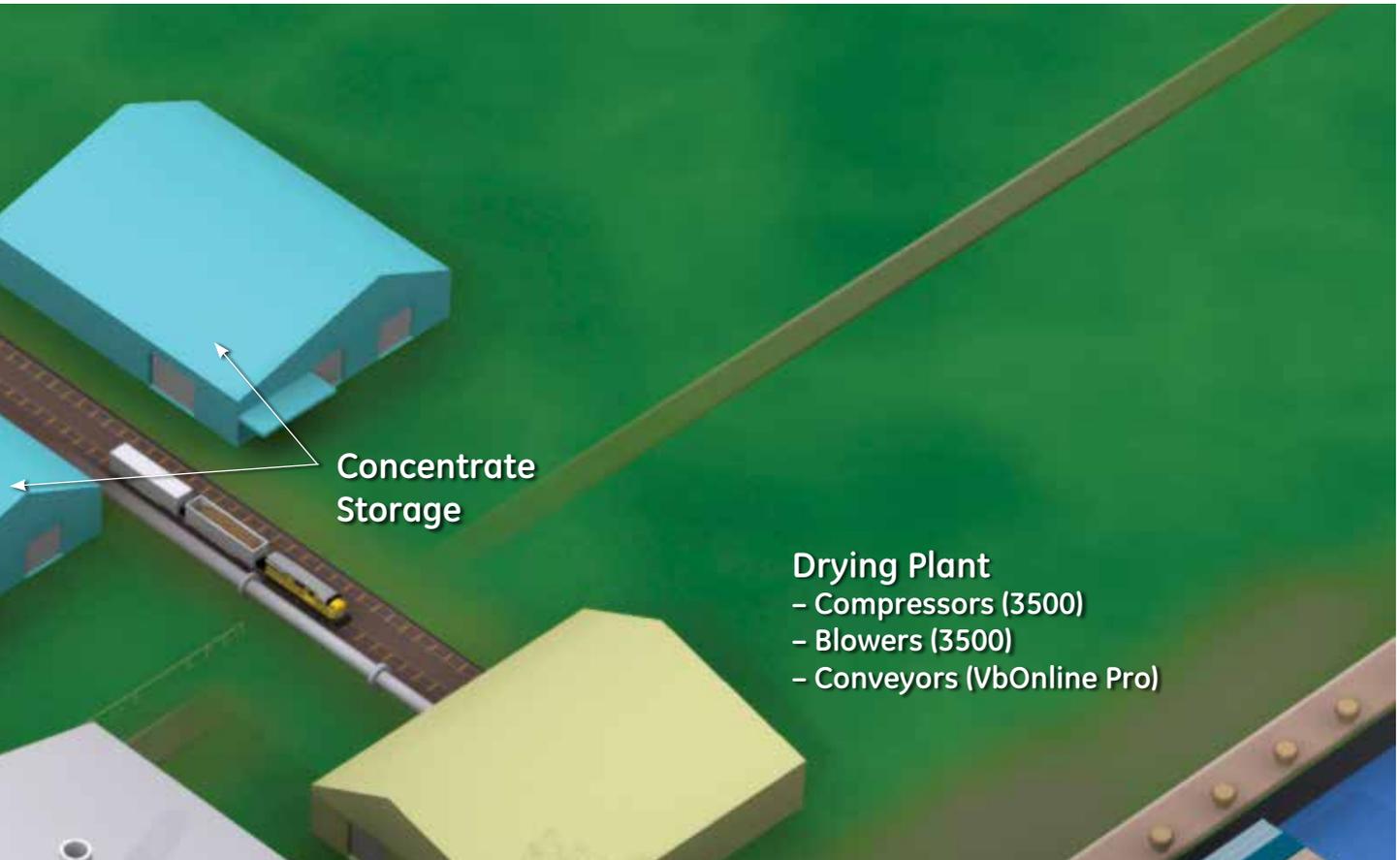
For more than 50 years, we’ve been supplying condition monitoring solutions to machinery-intensive industries. We also bring two decades of experience conducting reliability improvement projects. Customers turn to us for a simple reason: lasting value. Our solutions demonstrate their worth, day in and day out. We combine the highest quality products and responsive customer support with a service team that takes the time to understand the uniqueness of your plant, your personnel, and your goals.

Our products can be found in many of the mining sites or mines, often supplied as standard by the OEM on critical equipment such as blowers and compressors. Today, many of those same plants are turning to GE for a more comprehensive solution to their needs, moving beyond just machinery protection instrumentation on a few assets to plant-wide strategies and systems for improved environmental compliance, safety, asset production, quality and reduced operation and maintenance costs.



# Condition Monitoring Applications in Mining

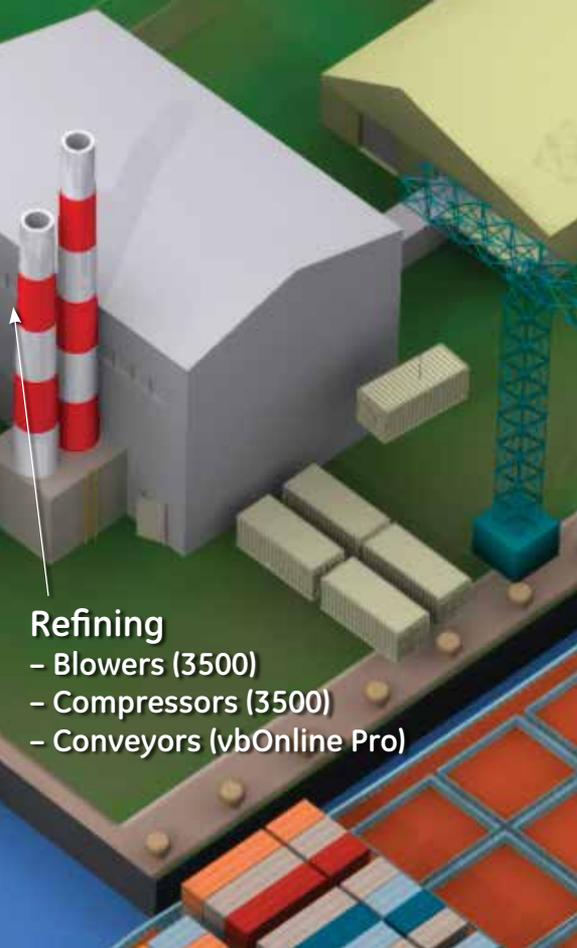




Concentrate Storage

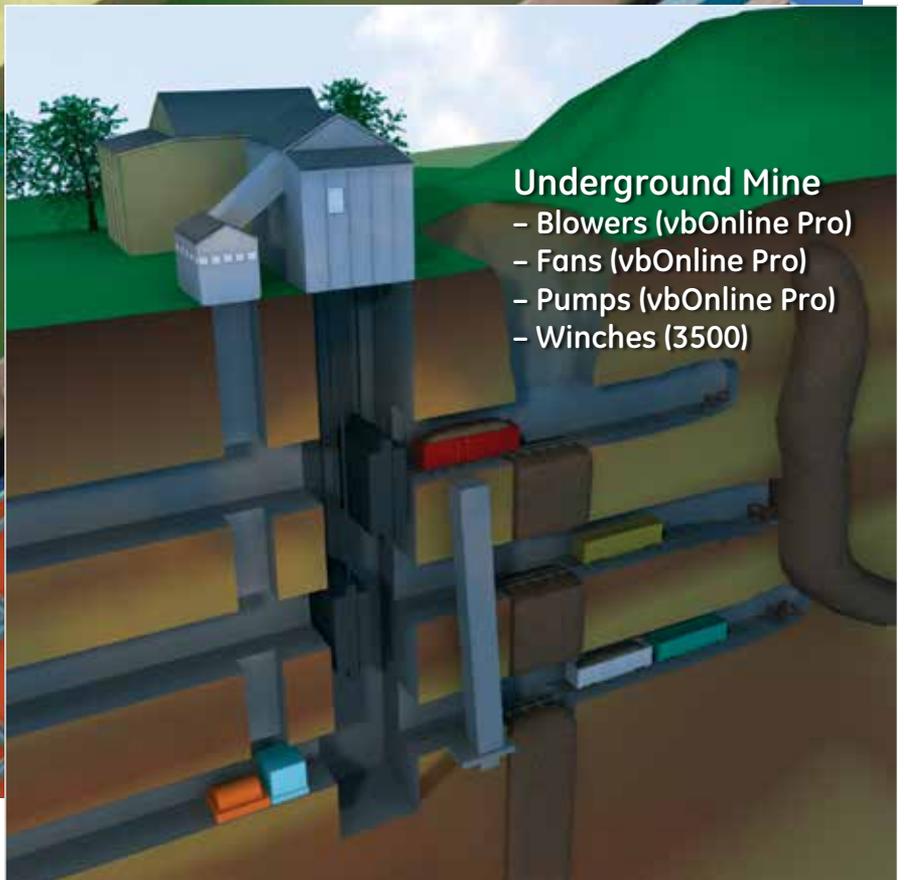
### Drying Plant

- Compressors (3500)
- Blowers (3500)
- Conveyors (VbOnline Pro)



### Refining

- Blowers (3500)
- Compressors (3500)
- Conveyors (vbOnline Pro)



### Underground Mine

- Blowers (vbOnline Pro)
- Fans (vbOnline Pro)
- Pumps (vbOnline Pro)
- Winches (3500)

For more information about our mining products and services, please contact us at +1-775-215-1773, [bnsales@ge.com](mailto:bnsales@ge.com) or visit [www.gemeasurement.com](http://www.gemeasurement.com)

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