

ARMOUR™ Mill liner solutions

Augmenting grinding excellence
and sustainability



FLS

A complete solution for your operation

Mining businesses need to be able to rely on productive milling operations, built on today's most advanced equipment and expert process know-how. FLS serves the global mining industry as a leading original equipment manufacturer (OEM) supplier of engineering, equipment and service solutions. Today's mill-liner customers depend on FLS for safe, efficient milling equipment solutions. Our range of proven mill liners is ideal for the full scope of mill brands currently available in the market.

Benefits

■ Increased productivity

Encompassing solutions derived from expert process-know-how, advanced equipment, and complete service.

■ Improved throughput

Optimized and highly durable mill liners can increase grinding capacity enabling the mill to process more material.

■ Safer maintenance

Lighter mill liners with fewer parts allow for a less complex, less time-consuming and much safer maintenance process.

■ Reduced energy costs

Reducing energy consumption by reducing overall mill weight when using lightweight mill liners

■ Additional uptime

Highly durable mill liners allow for extended periods between scheduled maintenance times.



Superior wear protection

Designed to break raw materials down into usable product, few pieces of mining equipment are exposed to as consistently intense wear as mills. Mill liners help protect those mills, by providing a shield against the internal stresses that have been known to tear equipment apart from the inside. But liners only take so much punishment, and when they wear out, maintenance, replacement costs and downtime are the natural result.

FLS has the answer. As a complete supplier of mill liner products and services, we offer optimised ARMOUR™ mill liner solutions to fit any applications. Including customised and ready-made solutions, our range of durable, high-quality liners give your equipment the wear protection it needs to continue operating at peak efficiency.

Cutting-edge technologies

To optimise your equipment life and improve throughput, we employ the latest in material sciences and engineering. Incorporating a range of materials — including rubber, cast

steel and composite options — ARMOUR mill liners offer industry leading wear protection for your grinding mills. By incorporating unique geometric designs, these liners empower you to improve your equipment performance, processing more raw materials and allowing for finer grinding than traditional options.

Customised solutions

In mining, there is no one-size-fits-all solution. Your business is unique, and so is the equipment it relies on. Our mill liners are designed with this reality in mind.

Every ARMOUR mill liner solution is optimised to your unique equipment needs. Using state of the art simulation technology and industry leading expertise, rest assured ARMOUR mill liners are going to protect your mill and perform as they are engineered to. ARMOUR maximizes your investments to get more out of them. With solutions designed specifically for you, we ensure that you get more out of your mills, so you get more out of your investment.

Options to fit any need

Mill liners fill a basic role: to protect your mills from the intense wear and tear that comes from grinding down hard, raw materials. But even if they all do the same job, not all mill liners are created equal. From the abrasion resistance of rubber to the impact resistance of steel, different material parts offer different advantages. We supply the full range of mill liners options, including composite, steel and rubber liner solutions.

Composite

For top performance across a range of applications, ARMOUR™ composite mill liners are a best-of-both-worlds approach. These liners offer a longer use life than other options on the market, incorporating a unique matrix of rubber, steel and ceramic. By significantly reducing downtime and allowing for increased throughput, ARMOUR composite mill liners offer a return on investment unmatched by single material liners, and are an effective wear solution in all SAG and ball mills.

Advantages of ARMOUR composite mill liners

- Up to 50% reduction in weight
- Up to 50% reduction in parts
- Engineered for maximizing grinding efficiency

Steel

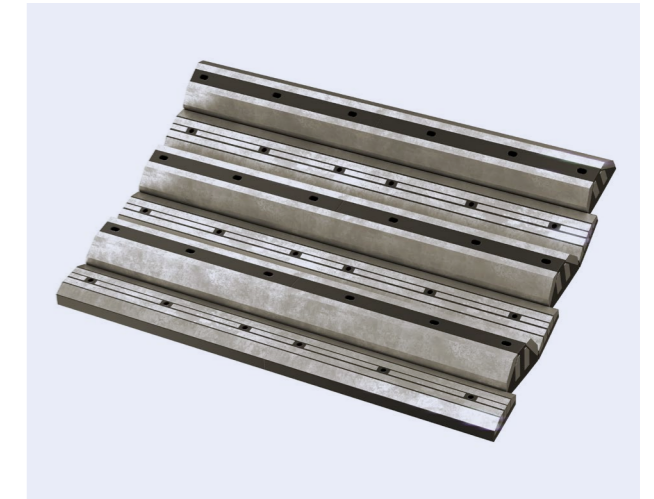
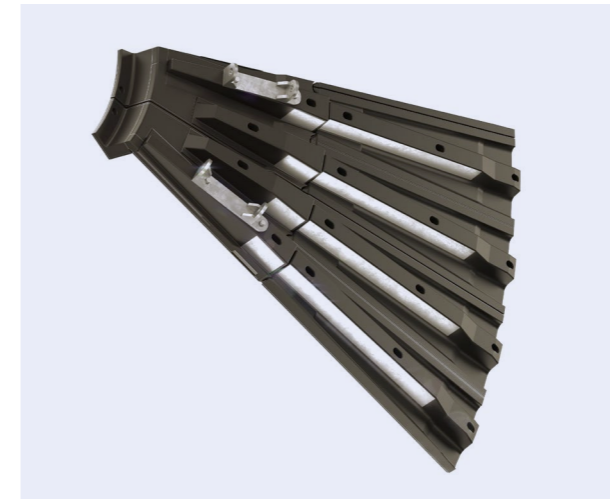
Surpassed only by composite mill liners, steel mill liners offer high-quality impact wear protection. By incorporating different alloys into the steel mill liners, we tailor the mill liner solution to fit the specific customer application. And, with casting services available regionally around the globe, we optimise your supply chain to improve your logistics, cut down on lead times and reduce costs.

Rubber

Rubber liners are ideal for combating wear from abrasion grinding. Rubber liners are most commonly used in smaller operations, typically found in grinding mills smaller than 22 feet (6.5 metres) in diameter. Rubber mill liners are a reliable, standard solution that can be designed to fit most applications.

Expert recommendations

Each material comes with its own advantages, and each milling operation faces its own unique challenges. We help you choose the best mill liner materials to fit your needs. Whether your goals are to cut costs, increase energy efficiency, improve throughput, reduce downtime or all of the above, we have the mill liners — and the expertise — to help make it happen.

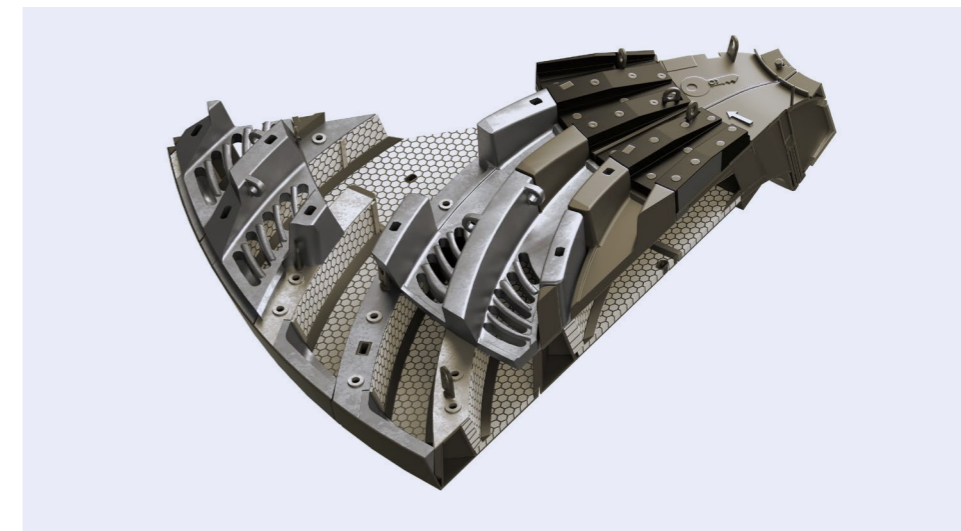


Feedheads

Available in rubber-and-hot-rolled-steel composite and cast steel; optimised around improving equipment life.

Shells

Available in rubber-and-hot-rolled-steel composite and cast steel; optimised around improving performance and equipment life.

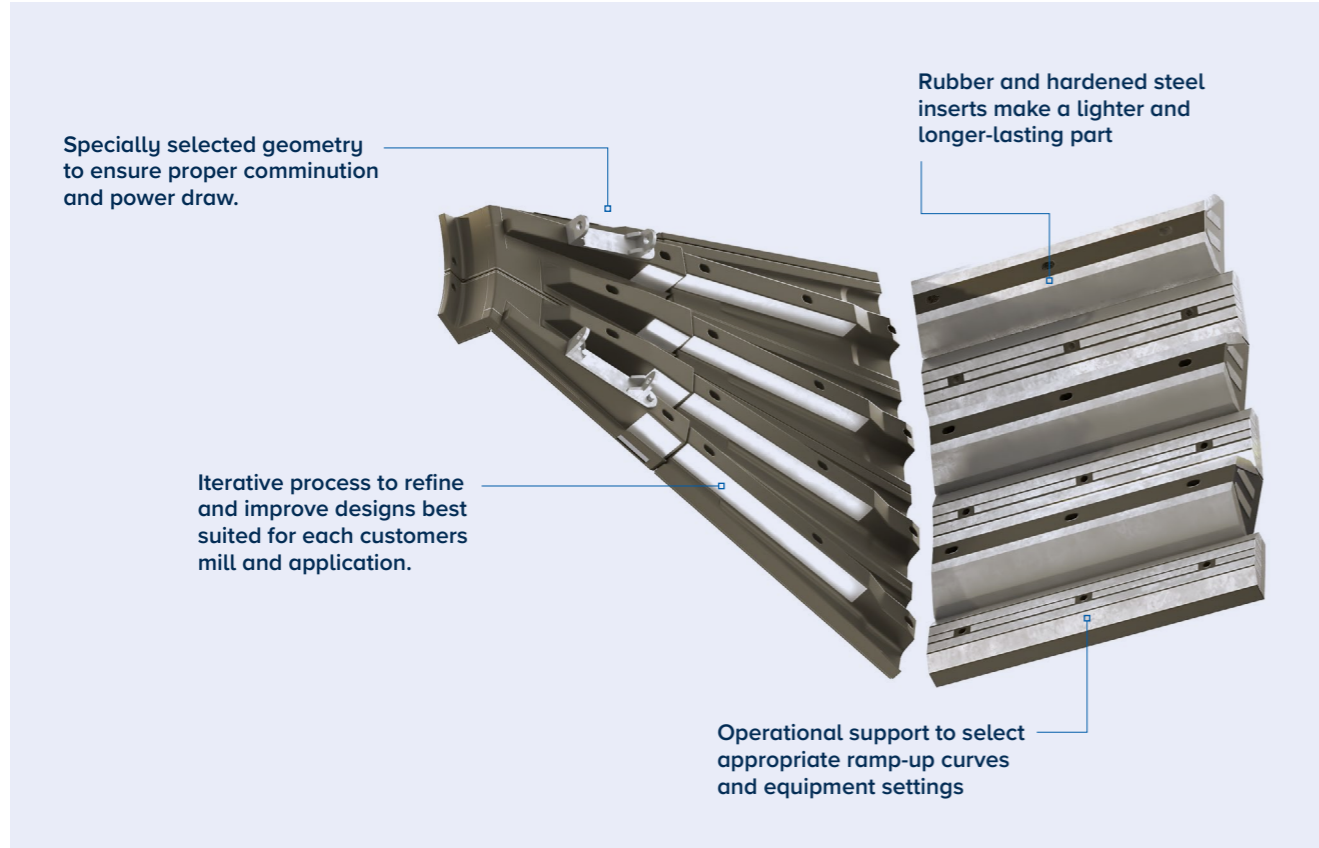


Discharge

Available in rubber-steel-ceramic composite and cast steel; optimised around improving throughput efficiency.

We understand the processes that drive your business

As an OEM manufacturer of milling equipment, we have an in-depth understanding of the milling process. Our experience and know-how help you optimise your entire milling circuit.



Everything working together

To get the most out of your operation, you need every part. We help make that happen. Working closely with you and your machinery, on-site, our experts will help you improve your processes and identify potential issues before they become problems. We'll also help you optimise your comminution circuits for best possible energy efficiency. The end result? Everything comes together to improve your productivity, reduce downtime and cut energy costs.

The profits are in the details

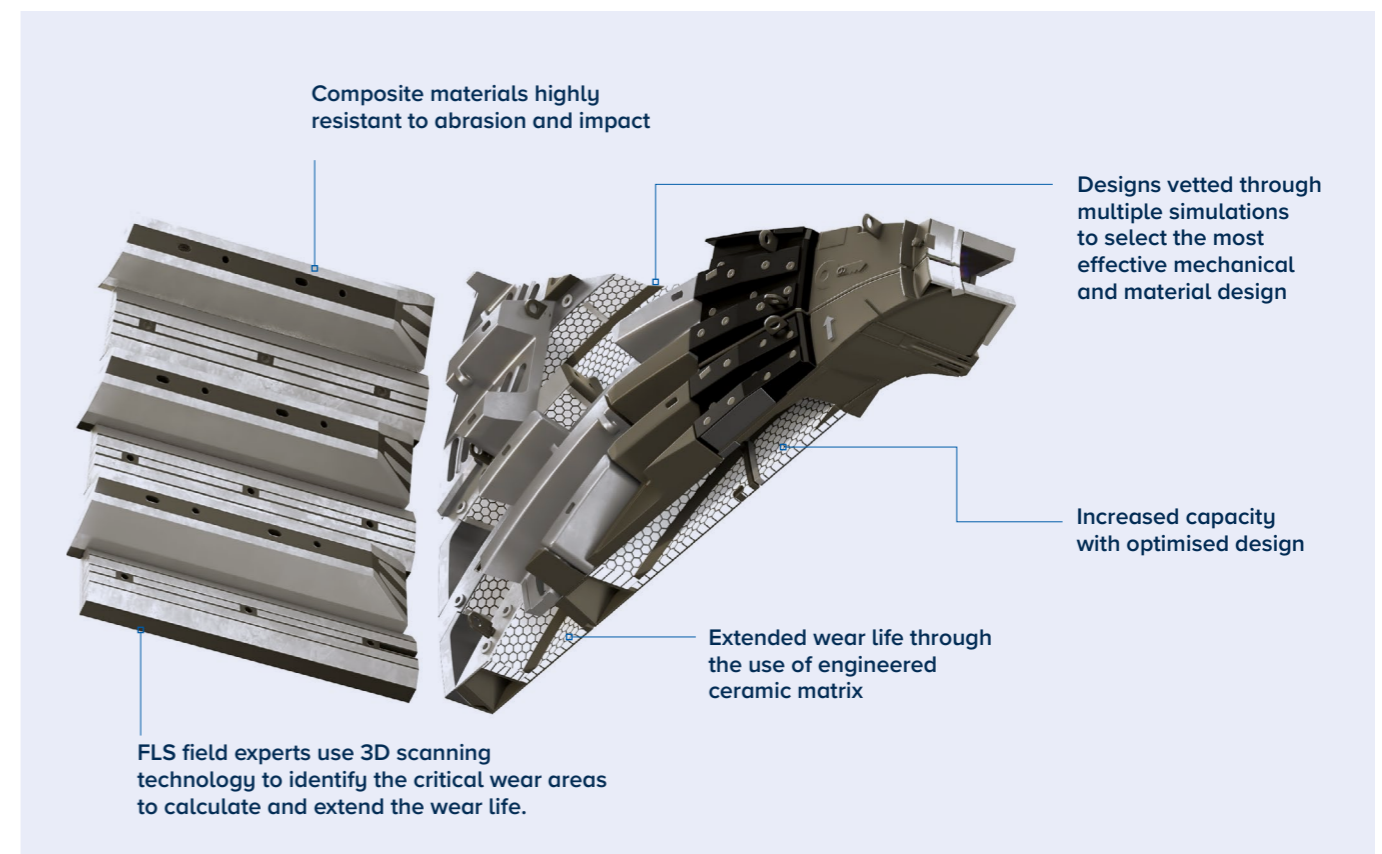
Improving processes is your key to achieving the best possible return on investment (ROI). And, when it comes to optimising your milling processes, our on-site experts leave no stone unturned. Perfect your operation with an FLS on-site visit, where we evaluate and offer knowledgeable recommendations related to:

- Product feed size
- Tonnage
- Equipment settings
- Slurry density
- Mill speed
- Operational setpoints

Every piece of the big picture

As a complete OEM supplier of mills and mill parts, we employ experts who understand mill equipment and processes inside and out. That means that rather than focus on only one part of the equation, our experts take a holistic view of the entire mill and how it's working with the rest of the comminution circuit. You get actual, complete solutions, rather than short-term fixes.

When you invest in ARMOUR™ mill liners, you get more than just a premier product; you get process know-how and expertise earned from working with mining sites around the globe.



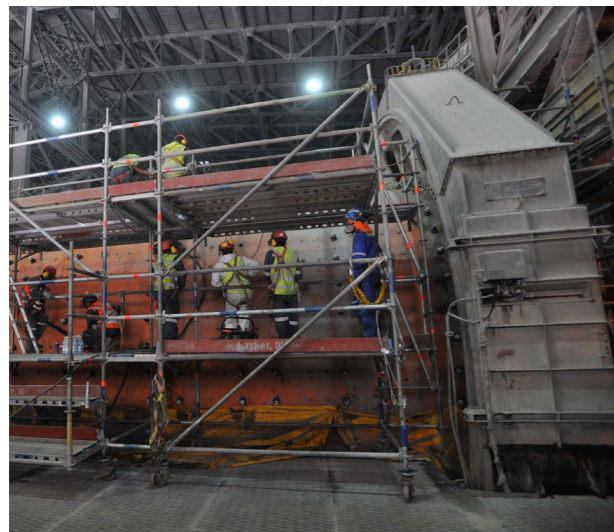
Liners are only the beginning

There are many suppliers of mill liners on the market, but only FLS offers a complete range of value-added services to back up our products. This is one of the core differentiators that sets us apart as a leader in the market.

Relining services

When it comes time to replace your mill liners, every second of downtime can mean significant loss in profits. Our reline services help ensure that your equipment is back up and running as quickly as possible. We offer regionally based, full-reline services and maintenance support. These services include assistance and recommendations for:

- Planning
- Inventory control
- Installation
- Maintenance
- Follow up



Key service benefits

- Increased productivity
- Improved safety
- Optimised equipment and processes

On-site services

Our on-site services allow us to put boots on the ground, with regional product specialists ready to visit your site and work with you to review your current operation. These services include:

- 3D scanning
- Wear measurements and maintenance forecasts
- Inventory control
- Detailed site and technical reports

Avoid unforeseen downtime and prevent failures before they occur. Our on-site services give regional experts a chance to get into your mill and see exactly what's happening and why. We then distill our findings down into comprehensive reports designed to give you the kind of insight that only comes from having experts on-site.

Laboratory services

Get quality data to build the cornerstone of proper flowsheet design and optimisation projects. As a partner in your productivity, FLS Minerals Testing and Research Center and local FLS testing center services extend to:

- Complete in-plant consultations
- Plant surveys
- Grade and recovery optimisation
- Ore characterisation
- Comminution evaluation

3D scanning

To understand how your mills are wearing — and how to best protect them — you need to go deeper. Our 3D scanning services make it all possible.

In this process, a 3D scanner is inserted into the mill chamber. The scanner creates a complete, 360°, three-dimensional map of the existing liners and the entire interior of your mill. This map of the worn liners is compared to scans of new liners. Differences between the two scans are used to identify where and how the mill is experiencing wear. The analysis includes up to 50 million data points. This information is incredibly detailed and reliable, and can be used to gauge wearing trends, inform operating practices and accurately project wear life.

With this data, we generate a comprehensive report for you, detailing equipment life estimations, shutdown planning and opportunities for improvements in your operating procedures.

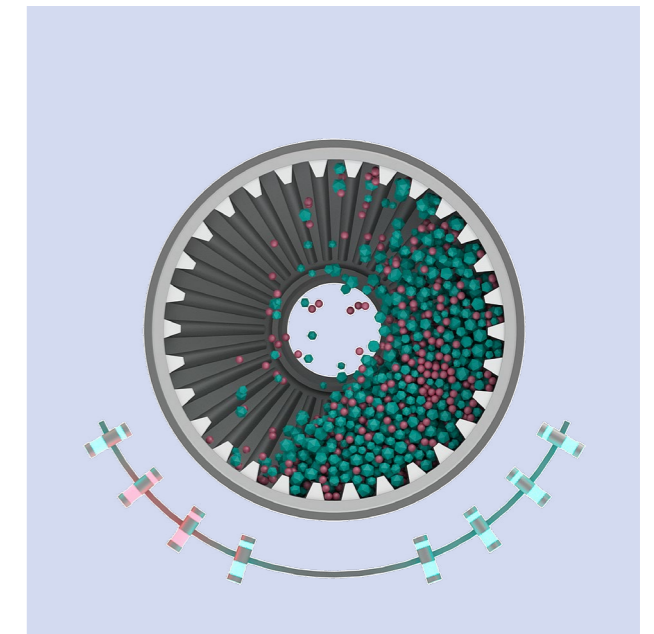


SAGwise™ total process control

SAG mills walk a tightrope of loading efficiency. On the one side, overloaded mills mean inefficient ore reduction, naturally leading to increased energy consumption. On the other side, an underloaded SAG mill leads to an increase in critical impacts, causing damage to critical media and mill liners, and resulting in costly repairs and downtime. With our SAGwise™ total process control system, you can keep your mills operating optimally, always.

The SAGwise system sensors relay detailed operational data to intelligent software, which analyzes the information and automatically adjusts feed, speed and pulp density to compensate. With SAGwise, your mill will maximize both throughput and energy efficiency, while significantly reducing wear and downtime.

SAGwise total process control optimises your mill efficiency. SAGwise can reduce your mill power usage by as much as 6%, and cut the number of critical impacts nearly in half.



SAGwise™ audio sensors listen for and identify critical impacts, and relay that information to software designed to automatically adjust equipment settings to compensate.



Optimise mill loading with our LoadIQ mill scanning technology

When you're working with raw materials, inconsistency is to be expected. Optimal mill loading ensures you're making the most of all that grinding energy to achieve the best possible results for the lowest possible cost.

What you need is state-of-the-art sensing technology that detects all these changing conditions in real time and enables you to adjust your operating parameters accordingly.

Enter LoadIQ, the smart load optimization tool for SAG and AG that enables you to increase throughput by 3 – 6%.

Our LoadIQ, is the smart load optimization tool for SAG and AG that enables you to increase throughput by 3 – 6%

Learn more about [LoadIQ](#)

Your partner in productivity

As your partner in productivity, we are fully committed to helping your operation grow. That means providing you with reliable products, valuable services and innovative support options.

Good enough is never good enough

We operate under the belief that no matter how effective a product or solution is, there's always room for improvement. That is why we're always looking for better ways to solve your problems. This constant innovation allows us to provide the best possible service, every time.

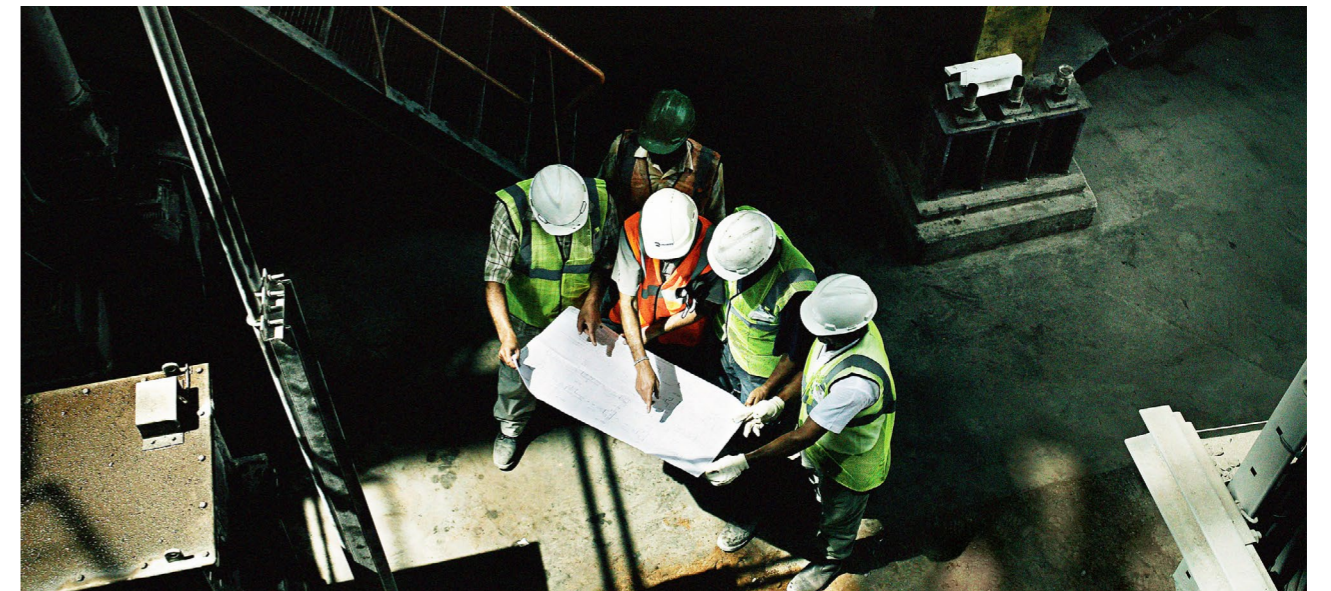
Your success is our success

We are a full equipment and service supplier, but we're also much more. We're your partner, and we are invested in your success. That means we stand ready to provide the equipment, software and advisory services to help your plant achieve its full potential. With ARMOUR™ mill liners, not only do you receive all of the benefits that come from working with the original equipment manufacturer (OEM), you also have the backing of a global market-leading company that is committed to your goals.

The right foundation

Our solutions are based on process and operational know-how gained from designing and supplying minerals plants around the globe. We look forward to working with you to optimise your milling operations, and providing you with the expert personnel and service offerings for a complete solution, customised to your business.

With your needs as our starting point, together we bring the best possible solutions to light.



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