Minerals

VULCO®
Mill Lining Systems
Our innovative Vulco® Mill Lining Systems are designed and manufactured to suit our customers specific milling needs.

Experience and Expertise
At Weir Minerals we engineer innovative designs, tailored specifically for every customer. Our designs are manufactured to the highest industry standard for Autogenous Grinding (AG), Semi-Autogenous Grinding (SAG), Primary / Secondary and re-grind rod or ball mills.

Every Vulco® mill lining system designed by our highly trained, in-field dedicated team throughout the world has taken your entire comminution circuit into consideration. Supporting our front line Mill Engineers, is a large team of extremely specialised design engineers, material chemists, manufacturing and logistics experts responsible for delivering exceptional service.

Optimal mill designs engineered by our team take into consideration service life; grind & power efficiency and ore characteristics, along with customer circuit constraints both up and down stream of the mill lining.

Design and Development
Onsite, our Weir Minerals engineers will undertake extensive mill surveys; contour monitoring of the shell plates/lifter bars and pulp segments.

Small wear patterns identified on the leading edge of lifter bars throughout the service life are captured and modelled in our advanced numerical modelling programs.

These numerical modelling tools include CFX (fluid dynamics), Rocky DEM (Discrete Element Modelling) charge analysis, Mill Trajectory and other internal software tools. Combined with 3D visualisation, they benefit our customers by providing the most appropriate design, optimal grinding performance and lowest ownership costs for future mill lining systems.

Technology Applied for Continuous Improvement
Our global capability at Weir Minerals and experience in all aspects of comminution circuits throughout the world, has promoted us as a leading developer of slurry and abrasive resistance materials for all applications.

New material technology developed for our pump lining applications has been successfully applied to our Vulco® mill lining under the “R” series of rubber formulations. In larger AG/SAG mill applications, composite design components of Vulco® mill liners are also available to increase service life. These composite designs are leveraged to ensure you get the best design for your mill circuit.
Our customers benefit from reduced processing costs, installation, reline periods and optimal lifting points designed with safety in mind.

Processing Costs
The emphasis on liner design to ensure efficient milling operations is based on maintaining the original design profiles for longer periods throughout their service life.

At Weir Minerals we have developed a series of lifter bar and shell plates formulated from best in class rubber “R” series compounds, to composite designs developed for high wear impact zones where extended service life is needed.

By employing unique designs to your specific application, mill volumes can be increased and variable speed mills can potentially maintain a longer period of effective grind recovery and optimisation. Through balancing the high and low wear zones within the mill, similar service life can be achieved for all zones.

Installation and Reline Periods
Versatile, economical, and efficient Vulco® wear resistant rubber and composite mill liners provide:

- Lower installed cost – This is achieved through correct dimensional components, on time and fully labelled packaging, certified lifting points along with trained personnel from Weir Minerals to assist with risk, hazard management strategies.
- Operating efficiency – “R” series rubber compounds are specially formulated for maximum tear/wear resistance, for different conditions on site. Examples are mill temperature, abrasion/impact or other site specific problems.
- Relining – At Weir Minerals we take extreme care during our quality assured dimensional checks that are undertaken at every facility thus ensuring optimal reline times are achieved.

Safety Design
Improved safety with the manual handling of rubber mill lining components over cast steel with sharp cast edges is a major advantage in this industry. Vulco® mill linings are available with an innovative, certified and tested lifting device. This device is ideal if you do not have a mechanical liner handling machine, restricted entry access or staff limitations. The lifting knuckle slides quickly over the pin head integrated to the composite shell plate or lifter bar, and is subsequently attached to a lifting device.

Improving safety by removing pinch points and manual handling does not have any impact on the high performance Vulco® lining systems.
Continuous interaction with customers improves the lining design, material and circuit optimisation for each unique site’s process circuits.

**Lining Design**

Our global Weir Minerals network has the capacity to manufacture extremely large cross-sectional rubber components. Designs are based on Rocky DEM, Mill Trajectory programs and in house software developed to select the correct design for your milling application.

The inherent characteristics of elasticity, high tensile strength, and corrosion resistance found in the rubber compounds used in Vulco® linings makes rubber the preferred mill lining material over steel. Rubber elasticity permits restoration of its original profile after impact along with its high tensile strength, preventing premature tearing or cracking.

**Rubber vs Composite**

Vulco® linings are custom designed for each grinding application with consideration given to available mill power, trunnion bearing loads, mill weight restrictions, grinding media charge volume and finally service life.

At Weir Minerals we have a wide range of flexible manufacturing techniques that enable combinations of rubber shell plates and lifter bars to be produced to different specifications. After identifying high wear zones, Weir Minerals engineers provide upgrades of the “R” series compounds or insert composite material to maximise service life.

Lifter bars and shell plates can be manufactured together in single large pieces reducing quantity of components required in the mill systems.

**Circuit Optimisation**

Weir Minerals mill lining design engineers consider the mill the heart of your comminution circuit and will design a lining system that interacts optimally with the cyclones, screens, and secondary or scat crusher.

The key to circuit optimisation is the value that Weir Minerals’ ongoing mill inspection reports deliver. Allowing for trend analysis of lining system wear patterns, visual inspections can identify changes occurring in the mill lining patterns which can subsequently be linked to site performance. Our Weir Minerals engineers utilise their experience to support your site to maximise your circuit returns whilst optimising the lining systems service life.
**Composite Rubber Shell Plates:**

At Weir Minerals we see no limitation in converting any mills throughout the world to composite rubber shell plates. These plates combine the best characteristics of metal alloys and rubber to obtain a superior design for use in AG/SAG or general grinding ball mills.

**Rubber Composite Lifter Bars:**

In aggressive SAG/AG applications where higher impact wear protection is required above that offered by the “R” series rubber formulation, composite lifter bars are available for this application.

Weir Minerals has designed a series of composite inserts for square/face angle leading edge lifter bars ranging from 100 mm up to 500 mm wide and high. All composite designs are pressure moulded to provide outstanding surface impact resistance with considerable weight savings over traditional steel lining systems.

Vulco® composite lifter bars utilise a variety of materials from chromium-molybdenum and white iron castings and high abrasive steel plate, all vulcanised within an elastometric matrix.

**Discharge Grates:**

Vulco™ rubber and composite grates have many advantages over traditional cast steel. Our Vulco™ range of grates includes non-pegging grate designs, with relief angles on apertures, positive sealing and fitment between adjoining components, safety and ease of installation.

Vulco™ discharge grates have flexibility in sizing, shape and location of apertures. Options range from small multiple apertures per grate to large SAG/AG mill applications with integrated reinforcement for structural integrity with open pebble ports for maximum open area.

**Vulco® mill linings are available for small regrind mills to our extremely specialised “one off” designs for SAG and AG applications.**
Vulco® mill lining components incorporate features that have been engineered for severe ore and milling characteristics.

**Pulp Discharge Designs**

Discharge pulp segments designed by our engineers at Weir Minerals maintain a high throat discharge area to reduce slurry carry-over and backflow circulation.

These designs incorporate outer or upper, intermediate discharge segments with a centre cone or discharge pant leg segment design, allowing for steel, composite or rubber grates to be installed with or without apertures.

By preventing recirculation between segments, the overall service life is extended, and reline times reduced. At Weir Minerals we design and manufacture complementary products to the mill lining systems; including trommel design, screening, moulded trunnion liners and high impact chute components.

**Fastening System**

Weir Minerals fastening systems are designed and tested through numerical FMEA modelling and are destruction load tested to suit any application. They are unique and employ a track system using either aluminium, rolled steel or in specific conditions stainless steel.

Vulco® moulded lifter bars incorporate the robust security of mechanical and chemical rubber bonding to the “T” track and are designed to provide safe and secure attachment for the reline personnel.

This system design produces a low profile fastening system giving maximum utilisation of wear material.

**Optimal Lifter Bar Geometry**

Weir Minerals employs numerical analysis using Rocky DEM to guarantee the correct lifter bar face angle design.

Delivering you exceptional support and performance, regular onsite mill inspections and monitoring by our mill lining engineers will link in-field results to Rocky DEM or mill charge trajectory analysis.

Vulco® mill lining system combinations of height to width shell/lifter bars with an optimal leading edge face angle will ensure the available power is converted to particle size reduction in the most efficient manner.
Global Manufacturing Facilities

Weir Minerals’ global network of offices, service facilities and manufacturing teams provide a truly worldwide Total Care Package for Vulco® products, including:

- Design analysis
- Condition monitoring services
- Responsive manufacturing
- Installation supervision
- Inventory management
- Research and development
- Technical reporting
- Safety and risk monitoring
- Innovative solutions
- Access to a worldwide network
- In-house engineering

Quality Assurance Tested

Vulco® mill lining products are quality checked from the original design, engineering, manufacturing and curing stage to installation to provide high quality, correct fitment and low installation time.

Our Weir Minerals global production facilities are registered to quality assurance standards to guarantee that Vulco® mill lining products are manufactured to the highest quality standard.

In addition, Weir Minerals’ internal quality control procedures, which include comprehensive raw material checks and visual, electronic, chemical and physical testing procedures, ensure that Vulco® products meet strict design and quality expectations.

Customer Care/Product Monitoring

Vulco™ mill lining services are designed around customer support, performance and commitment to technical solutions for every site across the globe. Condition monitoring of mill linings from installation, together with periodical inspections until the mill liners are due for replacement, form part of the service.

The Weir Minerals team utilises special tooling and software packages to monitor service life performance, predict replacement schedules and reduce your unplanned downtime.

3D laser scanning technology coupled with numerical analysis, is also available for continuous improvements in your mill lining system design.