

Excellent
Minerals
Solutions



THE WEIR MINERALS MILL CIRCUIT SOLUTION

OPTIMISE OPERATIONS AND MINIMISE DOWNTIME

KHD®
High Pressure Grinding Rolls



WARMAN®
Centrifugal Slurry Pumps



VULCO®
Wear Resistant Linings



CAVEX®
Hydrocyclones



ISOGATE®
Slurry Valves

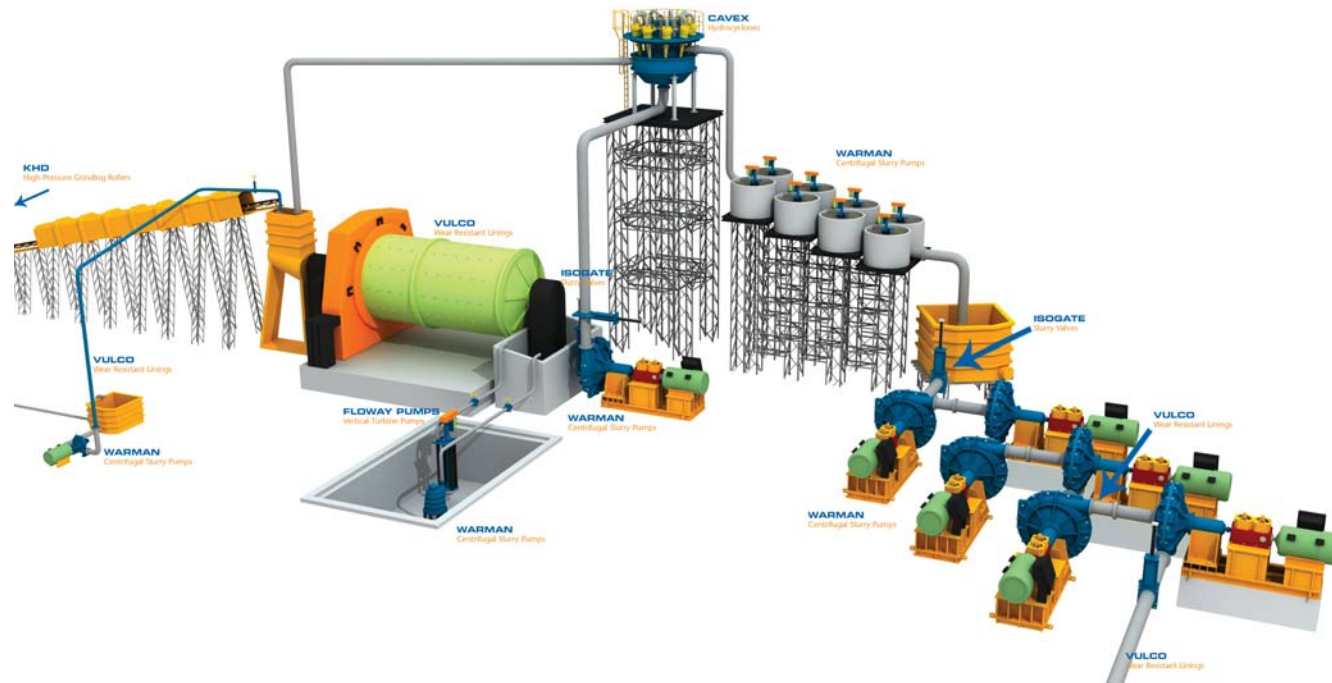


Decreasing throughput. Interrupted flow. Unrealised potential. When your job is to micromanage movement, your equipment must function seamlessly. You depend on each piece of your circuit to work as one. You demand reliable starts and continuous processing—anything less than swift and steady is unacceptable.

Why the Weir Minerals Mill Circuit Solution?

Because you're only as strong as your weakest link.

For more than 75 years Weir Minerals has perfected the delivery and support of mill process and slurry equipment solutions including grinding technology, pumps, hydrocyclones, valves and wear resistant linings. We understand the implications and processes of extraction, milling and slurry handling, and we are experts in designing and manufacturing the equipment you need to do it efficiently, eliminating bottlenecks, flow interruptions and unplanned downtime.



The Weir Minerals Mill Circuit Solution is a combination of five performance-leading brands, each with an exceptional success record. KHD® high pressure grinding rolls, Warman® pumps, Vulco® wear resistant linings, Cavex® hydrocyclones and Isogate® valves create the solution you can count on to deliver more durability, improved throughput and less downtime. You can also count on technically led and quality assured complete management service throughout the life of your operation.

We know that vital factors, including water levels, play a critical role in throughput and output. Weir Minerals offers Floway® vertical turbine pumps, which work seamlessly in the circuit for many types of applications. They are recognised worldwide for superior quality, top hydraulic performance and long service life.

Weir Minerals addresses the issues that plant managers and engineers face. All slurries are not created equal and all wear is not universal. So, we don't just sell a pump, we provide a solution. We help our customers address the critical issues of uptime, performance, durability, consistency, longevity, capacity, efficiency of operation and maintenance.

Weir Minerals enables customers to achieve significant improvements in their process and productivity efficiencies, at a lower total cost of ownership by providing a range of products that function in synergy with each other. The Weir Minerals Mill Circuit Solution reduces the risk of disruption, maximises the performance of the entire slurry handling system, and delivers longer wear life.

Weir Minerals can deliver solutions for any size operation. Our customers range from the world's largest minerals and mining multinationals to single site coal producers. By using KHD high pressure grinding rolls, Warman and Floway pumps, Vulco wear resistant linings, Cavex hydrocyclones and Isogate valves together in the mill circuit, you can reduce maintenance and the frequency of interruptions, and improve wear life and throughput.

"We view our products in the same way as our customers, seeing them not in isolation, but as part of a chain. In doing this, we recognise that a chain—the customer's process—is only as strong as its weakest link. This philosophy ensures that we address the areas that cost the customer time and money. Our specialist approach to these critical applications means that all our development time and effort ensures that we deliver maximum performance where it counts most."

- Geoff Moore, Divisional Marketing Director

| Total Cost of Ownership (TCO) | Cyclone Feed Costs | Cyclone Feed Percentages |
|-------------------------------|--------------------|--------------------------|
| Capital | US \$26,800 | 13% |
| Energy | US \$129,946 | 61% |
| Water | US \$392 | 0% |
| Maintenance | US \$50,617 | 24% |
| Inventory | US \$1,669 | 1% |
| Availability | US \$0 | 0% |
| Overhead | US \$3,944 | 2% |
| TCO (US\$/Y) | US \$213,400 | |
| TCO (US\$/T) | US \$0.13 | |

KHD® High Pressure Grinding Rolls



Roller press grinding significantly enhances overall throughput.

Using comminution, or high-pressure grinding, involves material being crushed between two counter rotating rollers under increased pressure. What results from this high pressure grinding roll (HPGR) technology is an outstanding higher size reduction. Weir Minerals and KHD roller presses deliver high material throughput rates at a comparably low total cost of ownership. They require low maintenance, use less space and operate with low vibration and noise.

Material processed by roller presses is generally discharged in the form of fragile flakes of compacted material. Weir Minerals and KHD's HPGR technology delivers an improved ground product which results in an increased throughput rate as well as reduced labor, maintenance and wear around fewer operating ball mills.

Interparticle
comminution
delivers maximum
size reduction.

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- **Micro-cracks and disintegration:** Compaction and pressure generate micro-cracks within the particles, resulting in the disintegration of most particles and promoting the liberation of asset for easier recovery.
- **Low energy consumption:** Compared to conventional milling, the selection and breakage characteristics of the process are substantially better and the energy consumed is considerably less than in other grinding processes.
- **Downstream advantages:** The improved grade of crushed material provides enhanced downstream grindability and recovery and also facilitates the processing of relatively wet ores.
- **Wear protection through patented Stud-Plus® linings:** In this state-of-the-art technology, the rolls provide a longer wear life due to a more wear resistant surface and the embedding of an autogenic wear layer.



KHD is a core component of the Weir Minerals Mill Circuit Solution. Together with Warman, Vulco, Cavex and Isogate your plant can experience reduced downtime, less maintenance and consistent throughput at a lower total cost of ownership.

WARMAN® Centrifugal Slurry Pumps



Warman pumps have become renowned as the heart of the mill circuit.

Their high efficiency, long service life and low maintenance costs, combined with the adaptability for unique and specialised requirements, has made Weir Minerals' Warman pumps the world leaders in critical pump applications. Warman centrifugal slurry pumps are the world's most comprehensive range of slurry pumps for use in mining, chemical and industrial applications. We research and test materials, and scrutinise our product design, engineering and manufacturing processes to ensure minimised downtime and reduced risk of disruption to our customers' operations.

- **Protection against slurry implications:** Warman slurry pumps are perfected to protect against abrasion, erosion and all types of corrosion and solids concentration.
- **Quality engineering:** We offer an optimum mix of wear resistant materials for maximum wear life and common components between sizes to reduce your spare inventory and make maintenance easy.

- **Simplicity in part replacement:** When rapid change outs are required to meet plant maintenance requirements, remove and replace the entire wet end of the pump in one single piece in the space of a few short hours.

Get longer wear life even with large particles passing and coarse slurries.

Warman is a core component of the Weir Minerals Mill Circuit Solution. Together with KHD, Vulco, Cavex and Isogate your plant can experience reduced downtime, less maintenance and consistent throughput at a lower total cost of ownership.

The Warman MC range of mill circuit pumps is the culmination of decades of experience with pump models, operating in thousands of mill circuit applications throughout the world. This reputation has been earned through many proving-trial installations where Warman MC pumps have consistently out-performed other brands.

The Warman MC line includes the following models:

Type MCR features elastomer liners inside ductile iron outer casing with metal impeller and metal or elastomer throatbrush and frame plate liner insert.

Type MCU features all metal unlined hard white iron casing with metal impeller, throatbrush and frame plate liner insert.

Type MCM features hard white iron metal liners inside ductile iron outer casing with metal impeller, throatbrush and frame plate liner insert.

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VULCO® Wear Resistant Linings

Vulco is a pioneer in product advancements and a clear leader in liner design.

The extent to which a liner effectively protects the mill, imparts energy and controls the mill charge, impacts on the total cost of ownership for plant owners and operators. In general, the harder the material fed to a grinding mill, the greater economy achieved using rubber liners. Because they can tackle rigorous and hazardous applications, Vulco rubber products have continued to replace steel as the material of choice by providing superior performance benefits. Weir Minerals' Vulco wear resistant linings are custom designed, maximising mill productivity and reducing power consumption, maintenance, downtime and ore processing costs.

- **Operating efficiency:** Liner profiles are custom engineered to fit specific geometry and operating conditions. Reducing the mass of lining systems commits greater charge weight to be utilised, increasing throughput, as well as increased power efficiency and reduced energy costs.

- **Reduced maintenance:** The low profile T-Track system eliminates the need for frequent inspections, repair and bolt tightening. Rubber conforms to the mill's internal surface creating a seal that prevents leakage and slurry erosion of the mill shell.

- **Low operating cost:** Mill liners are the highest recurring expense for a mineral grinding operation. Compared to traditional metal liners, the benefits of rubber liners effectively reduce this expense.

- **Quality through testing:** Vulco wear resistant products are quality checked at the design and engineering stage to ensure correct fit and lowest installation time. In addition, Weir Minerals' internal quality control procedures include comprehensive raw material checks and visual, electronic, chemical, and physical testing procedures.



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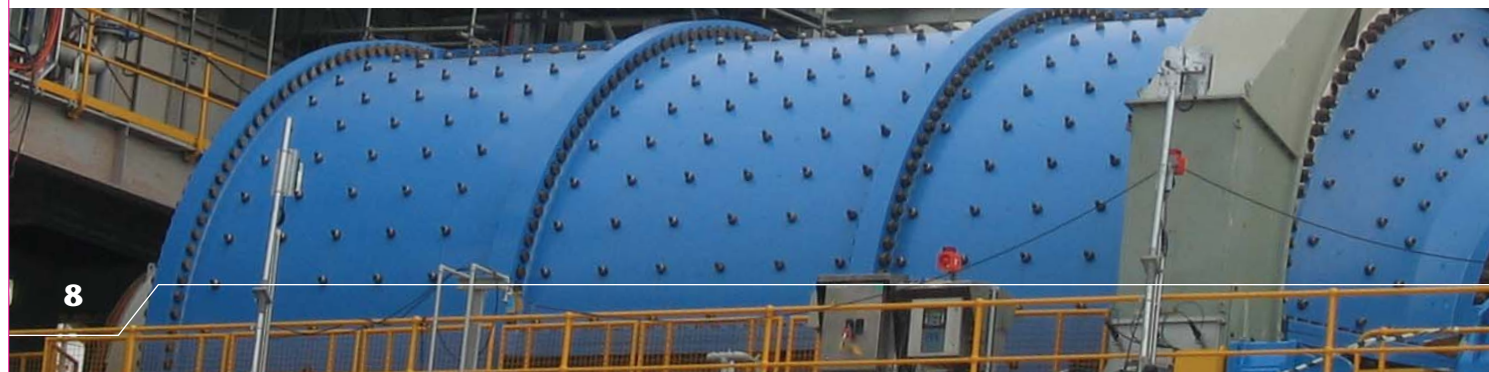
Rubber mill liner systems are low cost, long wearing and at the forefront of innovative design. The superior rubber compound is specifically formulated to provide outstanding resistance to impinging abrasion and the initiation and prorogation of cuts and tears.

AG & SAG mill pulp discharge assembly improves flow and reduces recirculation for increased mill efficiency. Easy installation and replacement improves operating efficiency. Autoclave vulcanising and moulded parts deliver greater efficiency in high wear areas. Pulp lifter and cone discharge assemblies are pre-assembled to improve fit and avoid extended mill downtime.

Expansion joints are available in a variety of materials and fit a variety of pipe systems. They absorb multi-directional movements and expansions in systems of rigid pipes, compensate for misalignments, and deliver greater flexibility and improved wear life

Vulco tubes handle a range of abrasive materials and are available in a variety of straight, preformed and angle variations. Flexible and durable, they absorb vibrations, noise and compensate for misalignments. Vulco **carbon steel spools** are available with or without inner rubber or polyurethane coatings.

Reduce the wear and tear from gold and platinum.



Vulco is a core component of the Weir Minerals Mill Circuit Solution. Together with KHD, Warman, Cavex and Isogate your plant can experience reduced downtime, less maintenance and consistent throughput at a lower total cost of ownership.

CAVEX® Hydrocyclones



Cavex hydrocyclones provide maximum efficiency, maximum capacity and lower operating costs than conventional hydrocyclones.

The unique design of Cavex hydrocyclones features laminar spiral inlet geometry designed to deliver maximum efficiency, maximum capacity and longer wear life than conventional involute or tangential feed hydrocyclone designs. Handling severe mining and mineral processing applications, Cavex design improvements result in lower operating costs and fewer hydrocyclones required for a given duty.

- **Efficiency in shape:** Cavex hydrocyclones provide maximum efficiency by reducing turbulence. Laminar spiral inlet geometry provides a natural flow path into Cavex hydrocyclones. In conventional hydrocyclones, slurry bursts into the cylinder with no flow control and the resulting turbulence is responsible for gouging liner walls. Revolutionary designed Cavex hydrocyclones reduce turbulence resulting in an increase in wear life.

- **Maximum capacity:** Improved flow means you can do more with less—less power consumption and fewer hydrocyclones. Cavex hydrocyclones process substantially higher slurry volumes than conventional hydrocyclones with equivalent fittings, reducing the quantity of hydrocyclones required and/or reducing the energy required to perform a given duty.

Cavex is a core component of the Weir Minerals Mill Circuit Solution. Together with KHD, Warman, Vulco and Isogate your plant can experience reduced downtime, less maintenance and consistent throughput at a lower total cost of ownership.

Cavex hydrocyclones don't just feature a cone modification. They utilise an entirely new feed geometry that substantially increases hydraulic capacity while minimising localised wear on the feed chamber and vortex finder.

Cavex hydrocyclones increase circuit capacity for grinding circuit applications by minimising the quantity of fines bypassing to the underflow stream. Cavex hydrocyclones achieve these results by maximising the air core diameter created within the rotating mass of fluid in the cyclone. Cavex offers eight different models with laminar spiral inlet geometry and other performance-enhancing features designed to reduce turbulence and increase wear life.

Experience flow control and end the turbulence that can gouge liner walls.

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ISOGATE® Slurry Valves

Isogate valves are the proven choice for today's highly abrasive slurry applications.

Conventional valves, designed only for liquid service, have sometimes been applied in abrasive/corrosive slurries, though seldom with satisfactory results. Typical problems include rapid wear of the valve seat, sticking valves and leakage to the atmosphere when the valve is operated. Isogate valves are designed to eliminate these problems and improvements are constantly being made in material, product design, engineering and manufacturing to ensure minimised downtime and reduced risk of disruption during operation.

Reliable and versatile. Isogate valves operate under positive or negative pressures and are fully bi-directional as a standard, allowing you to handle the harshest and most heavy duty wet slurries.

Superior sleeve materials. Sleeves are available in a variety of materials to handle abrasive and chemical applications: Natural rubber, EPDM, Nitrile, Neoprene.

Full port design. Flow reduces pressure drop and turbulence, minimising wear.

Simplified maintenance. Flush control option allows for periodic cleaning of the lower discharge vent and allows flushing as needed.

Eliminate rapid wear, sticking and leakage.



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Isogate heavy-duty knife gate valves are specifically designed for highly abrasive and corrosive applications. The **WB series** features a robust design and rugged construction for coarse slurries. The **WS series** is designed as a wafer style slurry knife gate valve to save pipeline space.

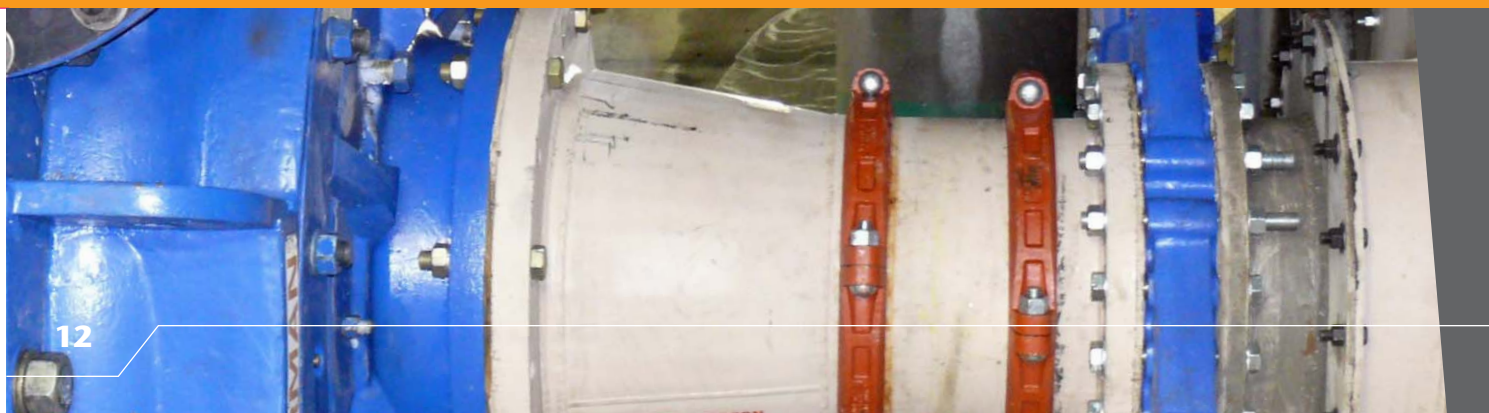
Body options include:

The open bottom style allows for the purging of large solids and solids in higher concentration. The purging of solids stops when the gate is in the full open or closed position.

The flush control option protects against fluids discharging from valve during opening and closing cycles and serves as a collection point that can be periodically cleaned or flushed or can be continuously drained.

The Isogate® Autoball™ AB3 valve provides a simple automatic changeover system without the costly process control systems otherwise needed. The low-density ball inside the valve is automatically transferred to clock the inactive inlet once a pump has started.

Isogate is a core component of the Weir Minerals Mill Circuit Solution. Together with KHD, Warman, Vulco and Cavex your plant can experience reduced downtime, less maintenance and consistent throughput at a lower total cost of ownership.



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Today, tomorrow and the big picture of small particle output.

Requirements in the international mining industry are not always parallel with standards in the marketplace. Where differences exist, we will continue to use our knowledge and experience to bring efficacies to procedure and bridge gaps in policy. In an ever-changing world, our mission will remain to concentrate on a customer's critical applications and dedicate the proper resources to ensure that we develop complete solutions and product innovations to benefit that customer. Our customers' needs are always put first. Fulfilling our customers' needs is what we do best.

The Weir Minerals Mill Circuit Solution



- A suite of 5 performance-leading brands
- Superior technical expertise
- Improved operating efficiency
- Consistent plant throughput
- Reduced unplanned downtime
- Lower total cost of ownership
- Integrated service partnership
- 24-hour support

From crushing, to linings in a grinding mill, to pumping highly abrasive slurries, to isolating slurry pipelines with heavy duty slurry valves or using our cyclones to carry out a critical classification operation, Weir Minerals products lead the world in mill circuit processing and slurry handling.

Our overriding philosophy of ensuring that our products always provide the lowest possible cost of ownership has seen our world famous brands become industry standards worldwide.

Weir Minerals has in-house production facilities and holds a number of patents on abrasion and corrosion resistant materials. Because we look at what's being processed and how it's being processed, as well as the conditions and elements surrounding your mill, we can devise innovative solutions to enhance your productivity. Weir Minerals' quality control is unmatched in the industry.

Weir Minerals customers include:

- Alcoa
- Anglo-American
- Barrick
- BHP-Billiton
- Codelco
- Vale
- De Beers
- Grupo Mexico
- Newmont
- Freeport-McMoRan
- Rio Tinto
- Xstrata

Weir Minerals responds to the challenge of large scale, complex operations around the world by offering tailored solutions that incorporate a combination of select products. In 1997 the first integrated package was offered to Minera Collahuasi (Anglo-American, Falconbridge), which involved slurry pumps, rubber linings, hydrocyclones and related products. The circuit solution has been duplicated and repeated in mining operations throughout the world, including the Antamina mine in Peru and the Escondida 4 project in Chile.

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About Weir Minerals: Weir Minerals is committed to delivering market-leading products and services. Our whole project, whole process solutions are designed to meet both the technical and commercial challenges of customers operating within the global mining and minerals processing industry.

Weir Minerals is a specialist in delivering and supporting a wide range of slurry equipment solutions, including pumps, valves, hydrocyclones, wear resistant linings and dewatering products for applications in mining, transportation, milling, processing and waste management activities.

Our comprehensive portfolio of high performance pumps and superior minerals processing equipment is designed and manufactured to meet the highest specifications—for robust and reliable use in the world's most demanding environments.

This is all backed up by an outstanding service and support program—including installation and commissioning, equipment monitoring, emergency repairs, on-site or in-shop servicing, engineering consultancy, customer training and asset management expertise. With the Weir Minerals Mill Circuit Solution, you can be assured of engineering excellence at all times.

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KHD is the registered trademark of KHD.