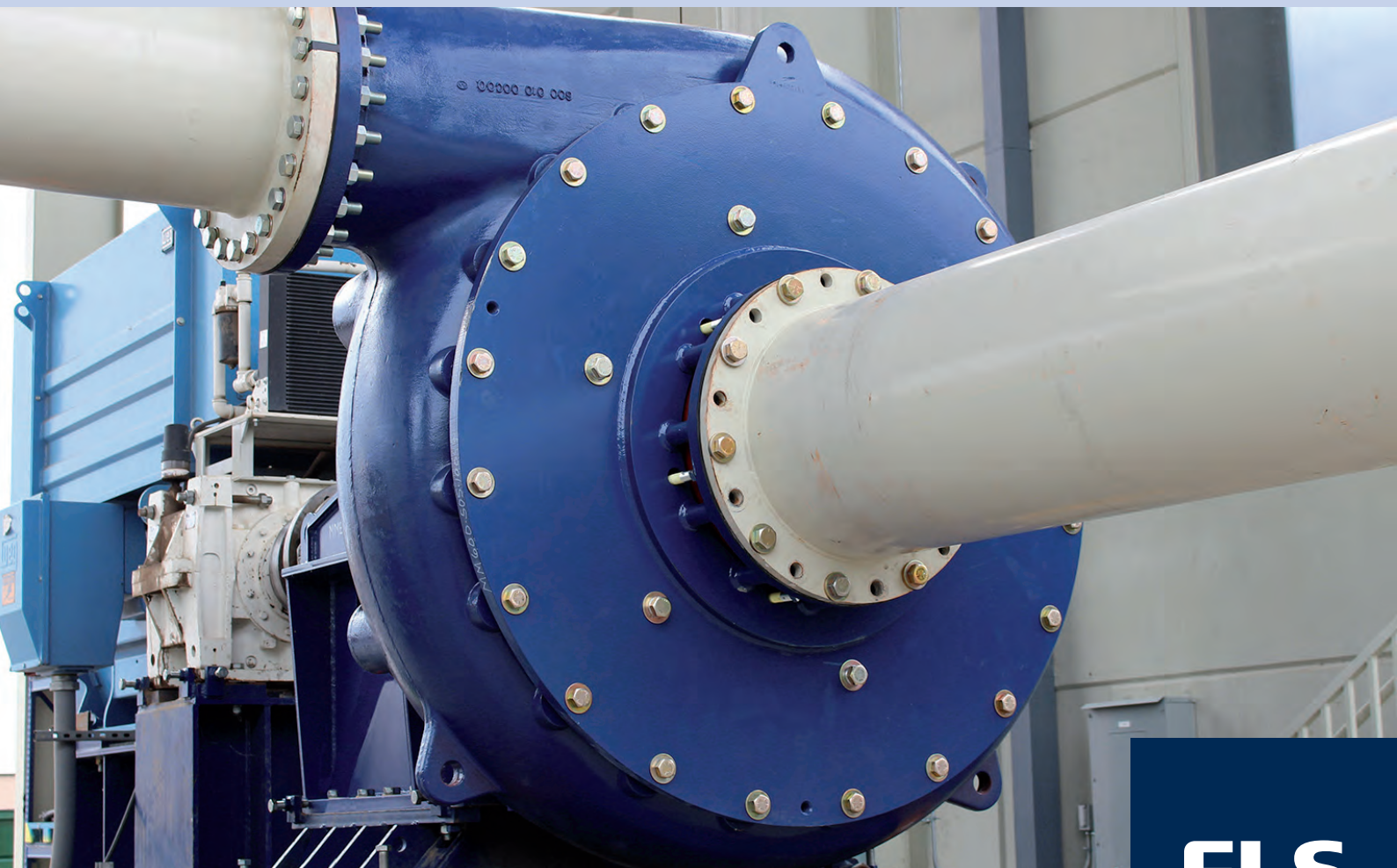


# KREBS® millMAX™ pump

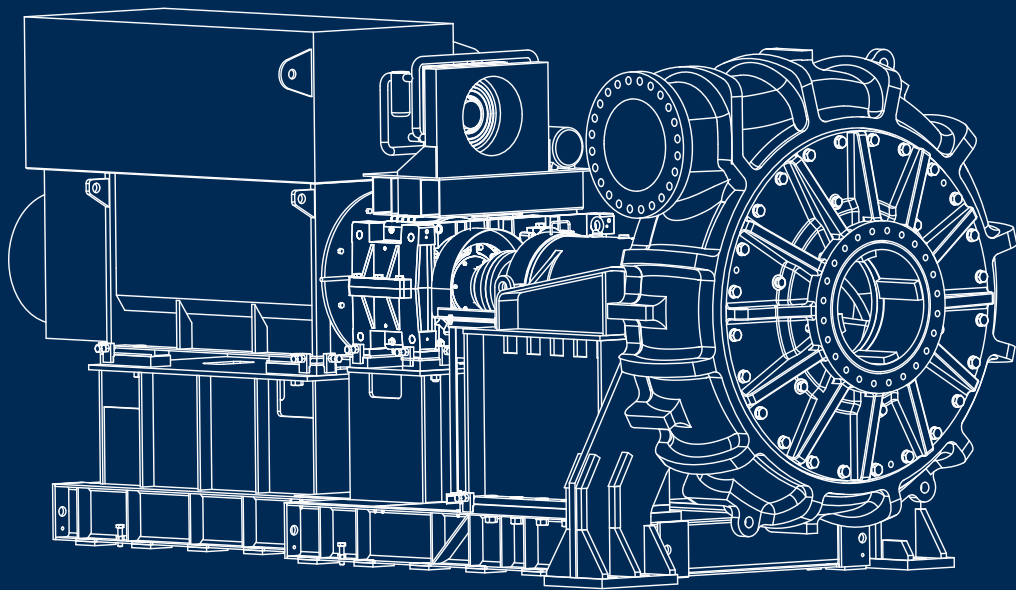
## The original suction side sealing slurry pump



**FLS**

# Proprietary design the wear ring advantage

Our millMAX™ pump has a unique proprietary design developed specifically for severe duty applications such as mill discharge and other severe abrasive slurries.



## Benefits

- Even and predictable wear life for wet end parts
- Significant energy savings
- Constant hydraulic performance
- Long-lasting bearings that cannot be over-greased
- Increased tonnage throughput

## Problems faced by conventional slurry pumps

Prior to the millMAX, slurry pumps experienced two major problems: mechanical grinding of solids between the suction liner and impeller, and flow recirculating back to the impeller eye on the suction side. Both of these problems decrease pump life and increase power consumption. Conventional slurry pumps can only solve one of these issues through impeller and liner adjustment—but not both.

Problems are magnified as the pump wears and the gap between the impeller and the suction liner opens. Slurry recirculates rather than exiting the pump through the discharge, causing the flow and head generated by the pump to drop.

To keep up with production, the speed of the pump is increased. Increasing the speed of the pump causes the rate of wear of all pump components to increase exponentially. To compensate for the loss in production from wear, the speed is further increased, which inevitably leads to the destruction of the pump.

## The millMAX difference

The millMAX product family features our proprietary wear ring suction-side sealing system that eliminates both major problems faced by conventional pumps. The wear ring closes the suction side gap while the pump is running, restoring performance WITHOUT speeding up the pump. This feature makes the millMAX the ONLY pump line that can effectively eliminate both the inefficient recirculation and the grinding of slurry.

## KREBS® millMAX™ pump product range

millMAX™	millMAX™ HP	millMAX™ HH
3×2	---	3×2
4×3	---	4×3*
6×4	---	6×4
8×6	---	8×6
10×8	---	10×8
12×10	---	12×10
14×12	14×12	---
16×14	---	---
18×16	---	---
20×18	20×18	---
24×20	24×20**	---
28×26	---	---

\* Extra high head available    \*\* Extra high pressure available



## Full Service Lab Testing

Our full-service lab provides performance testing and customer specific testing. The knowledge gained from the test work and slurry analysis help lay the foundation for successful projects. We also utilize this facility for product development test work to ensure we are always providing our customers with the highest quality and cutting-edge technology.

## Pump Selection

Selection of the appropriate pump for a specific application is the work of an expert, as is the proper operation and maintenance of the pump when installed and in service. FLS offers this industry-leading pump expertise, assisting in selecting the most suitable pumps for our customer's specific application needs.

# The millMAX™ advantage

The key advantages of our slurry pump design are lower power requirements (up to 25% less); long, even wear life; and less pump downtime—all of which result in lower cost-per-ton pumped, along with better cyclone separation.

## Grind in the mill, not in your pump

To stop recirculation on a pump without a wear ring, the suction-side clearance is closed with either a full-face suction liner adjustment or by adjusting the impeller to the suction liner. This can be effective when pumping fluids with no solids; with slurries, however, the solids become caught between the rotating impeller and static suction liner are crushed.

## Lower your operating costs

Grinding solids consumes power and wears out the impeller and liner. Additionally, in industries such as the diamond and potash mining, grinding solids is not acceptable because it degrades the value of the product. The millMAX wear ring stops stop recirculation and allows for a large gap between the impeller and suction liner—eliminating solids grinding. This advantage has been proven worldwide to reduce power costs, maintenance costs, and eliminate particle degradation when compared to conventional pumps.



millMAX inventor, John Frater

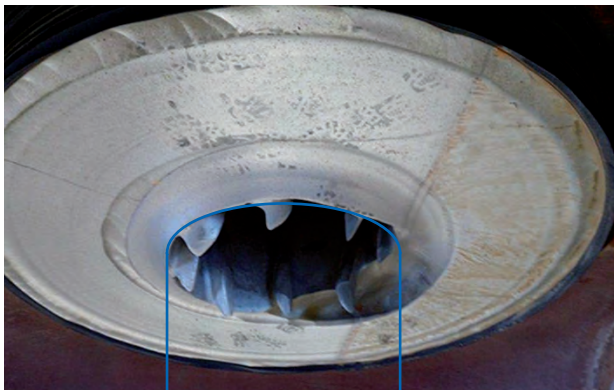


millMAX pump installed at a phosphate plant in Saudi Arabia

# The millMAX™ advantage

## The millMAX™ payoff

Because millMAX pumps maintain a constant operating speed and do not grind particles, they naturally last longer and consume less power. This means less plant downtime and lost production, with less money spent on pump maintenance and power. millMAX pumps represent the latest and most advanced slurry pumping technology on the market today.



Competitor's pump impeller eye is enlarged and deformed, indicating suction-side recirculation

## See the difference for yourself

If you'd like to experience the difference first-hand, millMAX pump wet ends can easily adapt to competitor power frames for a head-to-head comparison. We do recommend complete pump replacements, when possible, as the millMAX bearing assembly design has the potential to eliminate common bearing failure caused by over-greasing.



millMAX pump impeller eye is protected from recirculation wear by the wear ring

# millMAX™ features

Our unique millMAX™ pumps treat the causes of pump wear and efficiency loss, whereas competitive pumps only treat the symptoms through materials or costly upgrades.

## The millMAX™ pump design includes the following:

### Casing

Designed for minimum slurry turbulence and even wear—includes integral wear ring, wear ring carrier and adjustment screws for online adjustment and elimination of suction-side recirculation.

### Wear ring

Adjustable assembly to permit closing of suction-side impeller clearance during operation

### Impeller

Designed for high slurry efficiency and hydraulic performance—machined surface at the eye for wear ring adjustment and high expelling vanes.

### Suction liner

Includes integral wear ring—matches full impeller diameter and profile for close operating clearance

### Power frame

Heavy-duty cast iron pedestal with external bearing assembly adjustment mechanism

### Flanges

Multiple flange options drilled to suit various pipe requirements

### Reverse-taper roller bearings

- Increase the effective load span to improve life
- Pumping action of taper rollers discharges grease to the outside, preventing ingress of slurry and eliminating possibility of failure due to over-greasing

## Narrow clearance between impeller and backliner

- Reduces pressure at gland to assist centrifugal dry-gland seal

## Optimised expelling vane design

- Clears large solids
- Prevents crushing of solids
- Reduces casing slurry pressure at impeller eye

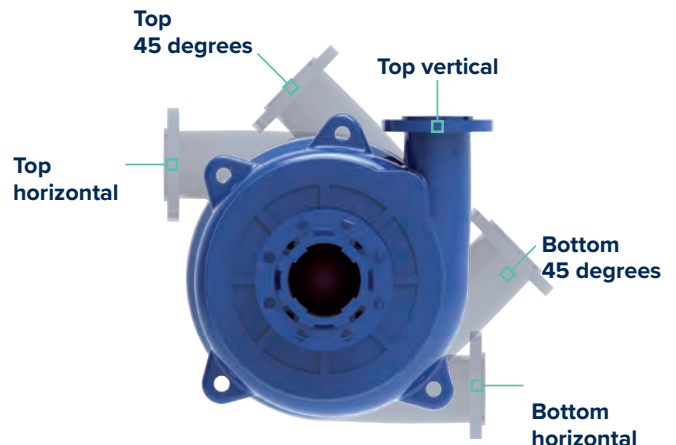
## External wear ring adjustment bolts

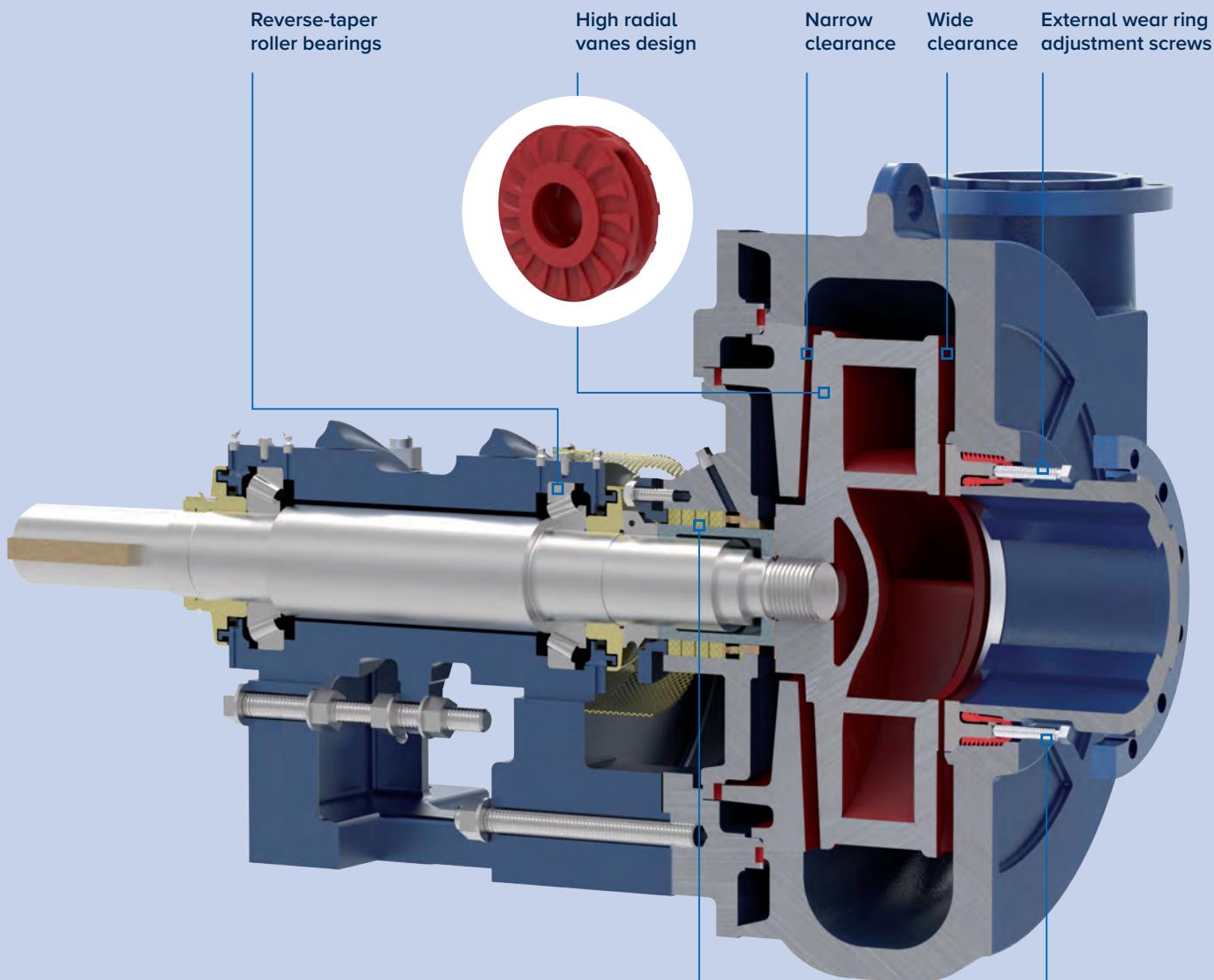
- Allow simple and safe wear ring adjustment while pump is operating

## Wide clearance between impeller and suction liner

- Dramatically reduces crushing of solids
- Increases wear life
- Reduces power consumption

## Standard millMAX discharge positions





Maximum expected flow rate into a water flush seal at 10 psig (68.9 kPa) above pump discharge pressure

Power frame	Full flow (gpm)	Full flow (m <sup>3</sup> /h)	Low flow (gpm)	Low flow (m <sup>3</sup> /h)
MMAA	8.0	1.8	1.0	0.2
MMA	15.0	3.4	2.0	0.5
MMB	20.0	4.5	3.0	0.7
MMC	25.0	5.7	4.0	0.9
MMD	30.0	6.8	5.0	1.1
MME	55.0	12.5	N/A	N/A
MMF	85.0	19.3	N/A	N/A
MMG	150.0	34.1	N/A	N/A



Water flush full flow gland seal

External wear ring adjustment screws

# millMAX™

## pump model options

We offer a wide range of pump designs, pump selections and application knowledge. We can provide you with the highest quality and lowest total cost-of-ownership solution for any slurry pump application.

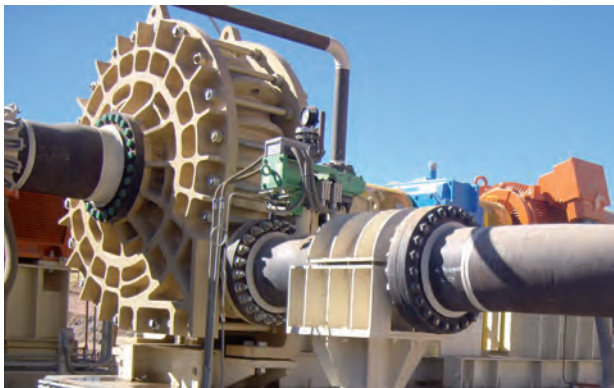
### millMAX high-pressure pump

Our millMAX high-pressure (millMAX HP) product line includes a tie-bolt design for high-pressure, multi-stage applications. millMAX tie-bolt-design pumps have the same superior internal hydraulic design as our standard-pressure millMAX pumps, yet can handle operating pressures of greater than 500 psi (35 bar).

High-pressure applications produce extreme forces on the pump suction liners, making full-face adjustment of traditional designs nearly impossible, as well as unsafe. The millMAX wear ring has proven to be easily adjustable in the highest pressure applications due to its small cross-sectional area.

The result? Our millMAX HP will easily maintain suction-side sealing throughout the life of the pump, leading to higher pumping efficiency and constant operating speeds for a given discharge head. These factors increase the wear life of the wet-end components over our competition.

The tie-bolt design of the millMAX HP also allows for ultrasonic casing thickness measurements. By measuring casing thicknesses all around the pump, operators can predict and schedule maintenance shutdowns before any failures occur—an action that is not possible with split-casing pumps.



millMAX HP

### millMAX high-head pump

Our millMAX high-head (millMAX HH) pump is designed for applications that have high total dynamic head requirements. The pump's primary feature is the concentric casing that creates a uniform clearance between the casing and impeller. Along with the concentric casing design, the casing has a higher-pressure rating to handle high-speed and multi-stage applications.

Standard volute slurry pumps experience radial thrust on the impellers due to differential pressure zones within the pump casing when they operate far away from their best efficiency point (BEP). This radial thrust causes shaft deflection and premature bearing and gland-sealing failures. The millMAX HH concentric casing design creates an even velocity and pressure around the casing, regardless of where the pump is in relation to its BEP.

One application that the millMAX high-head design is ideally suited for is filter press feed. The pump operates at duties that range from low head and high flow, to high head and low flow.

In addition to filter press feed, the millMAX HH is suited for any application where high heads are required in one or two-stage pumping systems.



millMAX HH in series

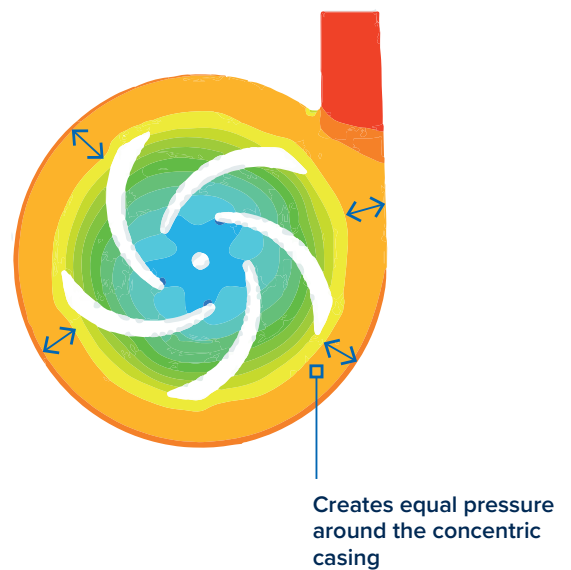
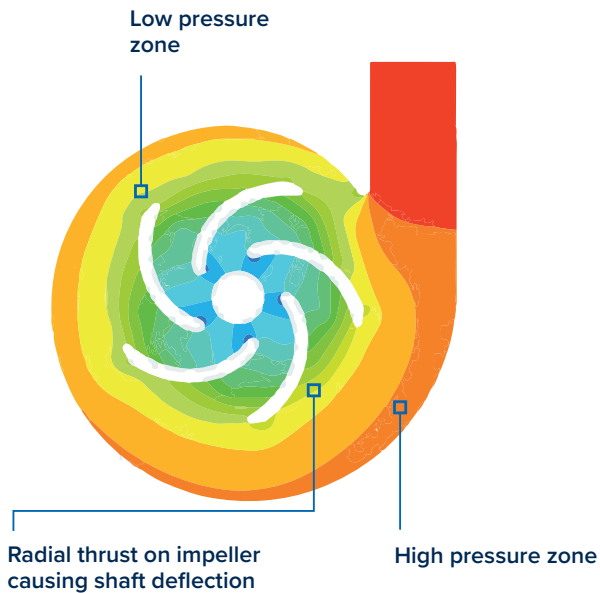


# Casing pressure distribution operating far left of BEP

millMAX standard volute design



millMAX HH concentric volute design



Pressure (Pa)



# FLS provides full life-cycle service for all our slurry pumps

## Site Support

Once the pump is installed, our team of site support engineers closely monitors the pump's operation on-site, ensuring that it is consistently operating within the designated parameters.

This is particularly important as mines and mineral processing plants are not static operations: they develop and change over time, which can result in pumps operating outside of their BEP zone, with negative impacts on performance, energy consumption, and wear rates.

A site support engineer will note any changes to the operating conditions and be able to recommend upgrades or changes to practice that will ensure the pump continues to deliver the best-possible performance. They can also offer training to mine personnel on the correct operation and maintenance, including how to properly adjust the wear ring.



## Service Centers and Rebuilds

To guarantee top-notch products for our customer at every service center worldwide, all pump assemblies are uniformly constructed with the same precision and quality. These service centers are strategically located around the world, allowing us to provide fast and efficient offsite rebuilds.

## Condition Monitoring

FLS offers a variety of digital services including our SiteConnect mobile application and condition monitoring reports. Customer signal/sensor data is connected to FLS Cloud through our Field Agent box or through customer OSI-PI system. Advanced KPI's are then provided through our SiteConnect mobile application. Weekly insight reports look at performance and identify potential failure modes.

## Aftermarket

By working closely with our customers, we ensure that our products are readily available whenever they are needed. From casting to finished painted parts, FLS has the equipment and expertise to deliver the best material options to our customers. Not only that, but our engineers are continually innovating to give our customer the best solutions.

FLS has a wide range of elastomers that can handle various chemicals, pH/concentrations, and temperatures ranges. Additionally, we offer proprietary high chrome irons specially designed to provide outstanding abrasion and/or corrosion resistance. Beyond that, in the most abrasive applications we offer tungsten carbide laser cladding to significantly extend the wear life. New to our material offering is our range of urethane liners capable of operating at higher tip speeds and able to withstand fine particle wear.

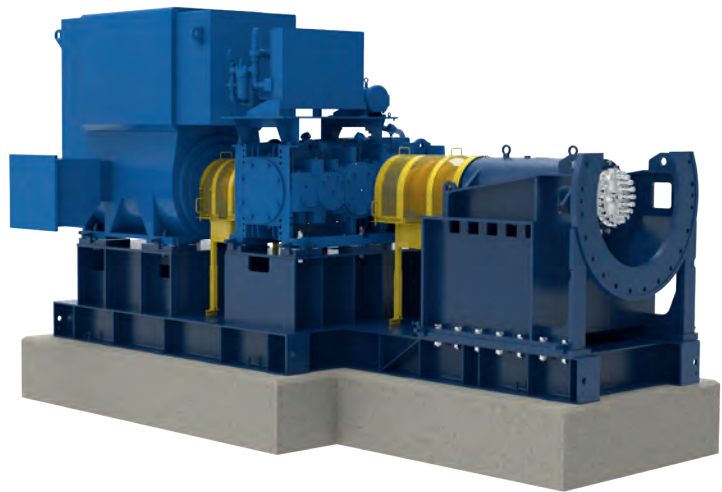
# KREBS® quick release Feature for quick and safe rebuids

In mining operations, reducing the time spent on pump maintenance is critical because it directly impacts the bottom line. The concept of reducing downtime is similar to a professional auto race where the seconds spent changing tires during a pit stop are some of the most pivotal moments of the race.

Similar to swapping out worn tires, our quick release design allows you to quickly change out the worn wet end for a new module that's been fully assembled off site.

## Our quick release feature provides:

- 50% reduction in pump rebuild time
- Modularization for safe and easy rebuilds
- Option for off-site maintenance with our wet end module exchange program



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