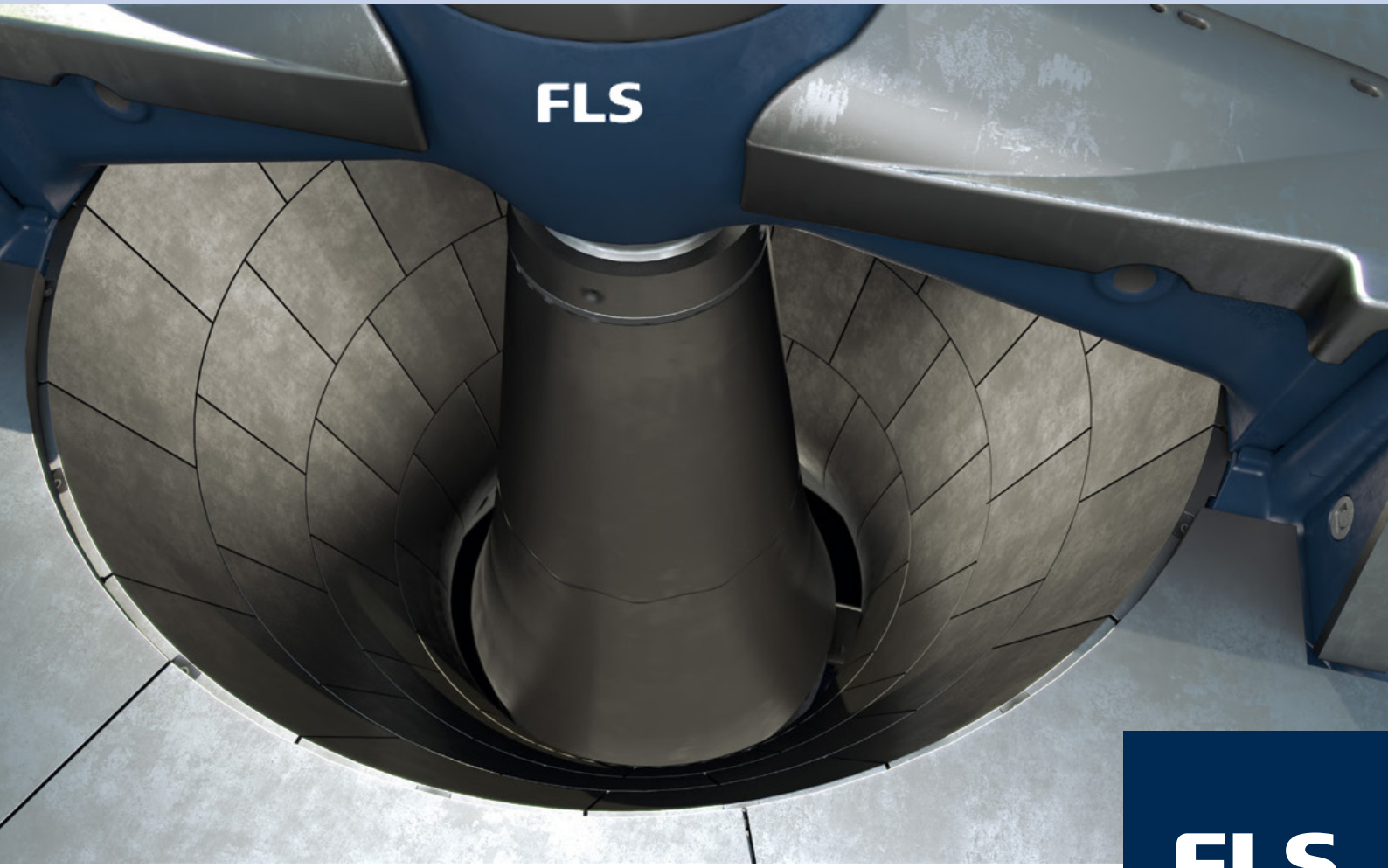
Top Service
TSUV Gyratory Crusher

Safer, smarter and more powerful crushing

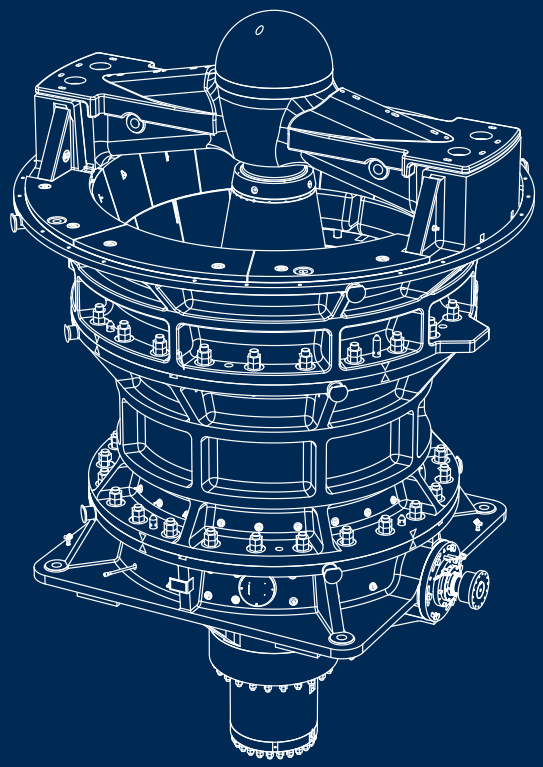


FLS

Mission Zero Towards zero emissions by 2030

The lowest cost per tonne of product processed

Crushing just got harder. With low grade ore deposits requiring higher power and higher throughputs than ever before, you need a crusher that can take the impact – without compromising on efficiency. With more power and greater capacity, the digitally-enabled TSUV is the world's most OPEX and CAPEX-efficient gyratory crusher.



Key benefits

- Ultra-heavy duty design
- Lowest cost per tonne in operation
- Lowest total cost of ownership (TCO) Safer, simpler maintenance
- Digitally enabled for optimal productivity

It’s a hard rock life

With mining companies increasingly turning to low-grade deposits to meet market demand, the pressure on crushing operations is greater than ever.

Are you doing more work for the same yield?

Your energy bill is higher. Your maintenance costs are higher. Your health and safety risks are higher. That’s the reality of crushing low-grade ore.

At the same time there is pressure to reduce the environmental impact of your operation. Bring down energy consumption. Increase efficiency. And of course, always, protect your personnel from harm.

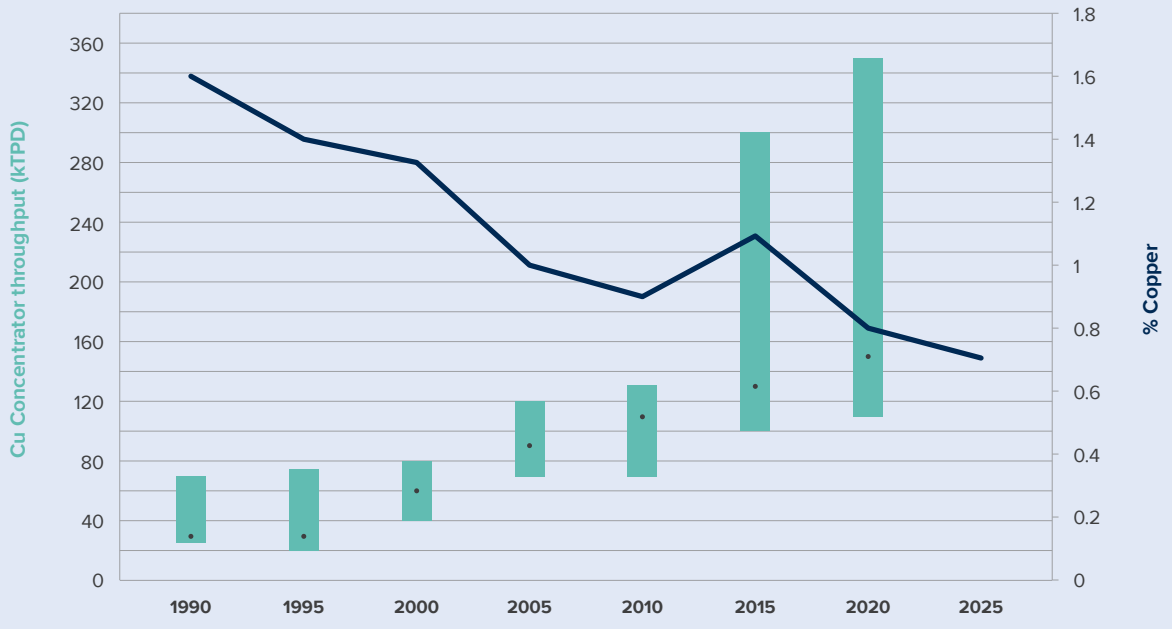
It’s time for next-generation crushing

We can’t change the nature of your deposit. But we can change the way you crush it. Our Mark V Top Service Gyratory Crusher – the TSUV – brings you:

- More power without a significant increase in crusher footprint
- Greater capacity without compromising on performance
- Optimised speed to balance throughput and wear rates
- Enlarged feed opening for greater flexibility
- Service through the top, significantly reducing safety risks
- Integrated, smart controls, including wear compensation and automatic mantle adjustment to maximise crushing efficiency
- Potential to connect to your mobile device for real time status and alerts, wherever you are
- Liner optimisation for the lowest wear cost per tonne

It’s the most efficient gyratory crusher on the market, designed to help your mining operation reach its full potential.

World copper demand increases as copper deposit grades fall



A chip off the old rock

Mining has a long history – and so do we. Our commitment to optimising the comminution process with quality crushers dates back to the Traylor and Fuller-Traylor gyratory crushers of the early 1900s. Since then, our crushers have continuously withstood the harshest demands of the world's mines and rock quarries. Through constant improvements in engineering, we have earned our place as a proven and preferred crusher supplier throughout the industry.

Safety, reliability and performance

The TSUV is our latest generation gyratory crusher, following the successful rollout of our Top Service (TS) and Top Service Ultra Duty (TSU) models. The unique design emphasises safety, easy maintenance and efficient crushing performance.

Unlike other gyratory crushers, which require workers to get in underneath the crusher to perform maintenance tasks – a high-risk operation – the TS range allows service and maintenance to be carried out from above. The eccentric assembly, bushings and hydraulic piston are easily accessible and removed through the top of the crusher, hence the name 'Top Service'. Not only is this much safer than the bottom service crusher design, it also increases the speed and simplicity of maintenance work, reducing costs and boosting availability.

In addition to safety and the reduced maintenance burden, the TS gyratory crushers are built for strength, durability and the ability to adapt to the various requirements of mine operators.

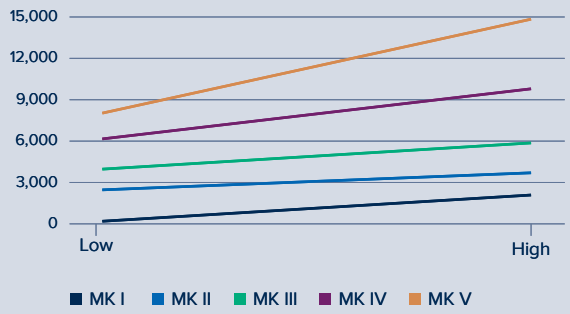
Harder, better, faster, stronger

The Mark V design builds on these strengths and adds even more power, capacity and flexibility. We have re-engineered the entire crusher to deliver advanced crushing efficiency with only a nominal increase in footprint.

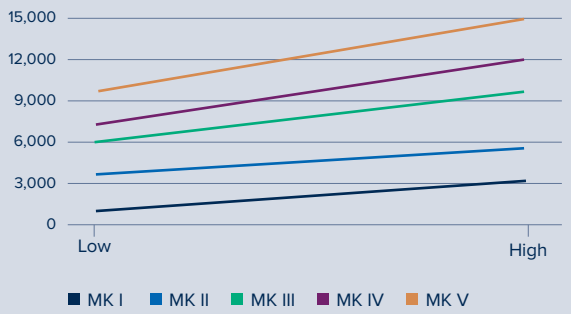
It's also safer than ever before. The all-new self-aligning main-shaft negates the need for service personnel to be working underneath a heavy suspended load. Previously the 100+ tonne fully-dressed main-shaft had to be guided into the eccentric assembly by hand. With this new development the shaft aligns automatically, dramatically reducing risk.

To offer even greater potential to optimise performance, the TSUV is digitally enabled – giving you more control over operations and availability. This is a game-changer. The ability to make fine adjustments to wear compensation, track equipment trends and instantly detect crusher obstructions will enable increased uptime, optimum equipment life and a significantly reduced risk of unplanned downtime. Additionally, our integrated control system incorporates all the required safety and interlock features to keep your operators safe.

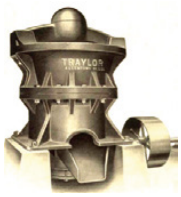
Capacity increase (mtph)



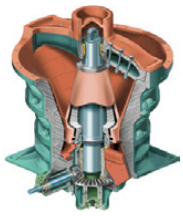
Power increase (kW)



The evolution of a master crusher

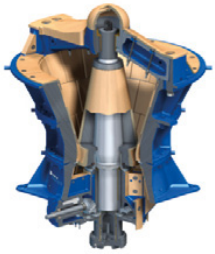


1905
Bulldog MK I



1950
TV MK II

1990
NT MK III



2006
TS MK IV

2020
TSUV MK V

Crusher model	First built	Designation	Feed opening (in)	Capacity (mtph)	Power (kW)	Power to weight ratio	Reduction ratio	Strip down time (hrs)	Notes
Bulldog	1905	MK I	18	200	150	1 : 1	2.5 : 1	48	Side discharge - belt driven (flat, later V-type)
	1910	MK I	48	1.200	225	1 : 1	2.5 : 1	48	Maintenance intense (multi-daily)
	1919	MK I	60	2.000	330	1 : 1	2.5 : 1	48	Grew over 50 years. Became basis for all other designs
	1950				Superseded				Eventually, over 2,400 sold
TC	1950	MK II	60	3.000	375	1 : 15	3.5 : 1	30	Circular discharge - belt driven (flat, later V-type)
	1969	MK II	72	3.400	525	1 : 15	3.5 : 1	30	Hydraulic adjustment introduced in early 60's
	1990				Superseded				
NT	1990	MK III	60 x 113	4.500	750	1 : 1.7	4.0 : 1	17	Circular discharge - shaft driven
	2005	MK III	60 x 113	6.000	1.000	1 : 2.3	4.0 : 1	17	Incorporation of FEA and modern controls
	2013				Still current				Modularised and simplified components
TSU	2006	MK IV	63 x 114	8.000	750	1 : 1.7	4.5 : 1	5	Circular discharge - shaft driven
	2009	MK IV	63 x 118	10.000	1.200	1 : 2.3	4.5 : 1	5	Incorporation of FEA and modern controls
	2013				Still current				Eccentric serviced from top
TSUV	2020	MK V	72 x 130	15.000	1.500	1 : 2.7	4.5 : 1	4	As TSU but more enhancements. Rotable shells, self-aligning main-shaft
				Our next generation model					1,500 kW and capacities up to 15,000 mtph

With great power comes greater throughput

As ore grade decreases and the industry seeks to crush ever harder material, crushers have to rise to the challenge. You need more power to handle greater capacities. You need the kind of hard-wearing, durable system that can manage ore with a BCWi into the 50s. But more power typically means more wear and you can't afford more outages – you need less.

We understand that to cope with new challenges, you need new technology. It's why we re-engineered the entire TSUV, rather than adding features to the previous model. Every part of the Mark V has been strengthened and improved to give you greater crushing efficiency and a low total cost of ownership (TCO). We've instilled all our knowhow and process experience into the design to bring you:

Higher power – Improved power handling capabilities allow you to process more material as ore yields decline, enabling you to remain competitive. The crusher footprint has only nominally increased but maximum power handling is now up to 1500 kW.

Higher capacity – Improved capacity throughputs make use of the additional power available without compromising on setting or product size. You get the same product – but more of it.

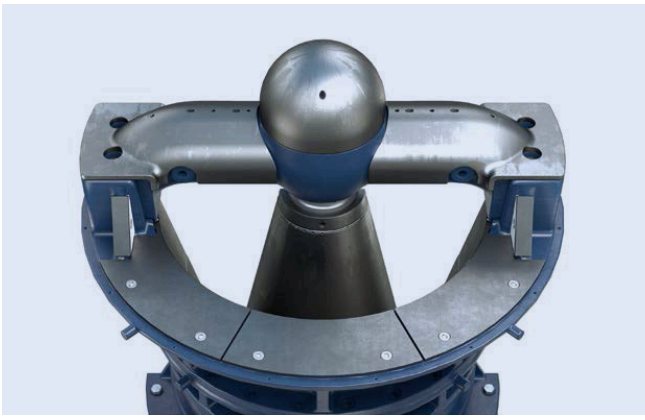
Optimised speed – We've optimised eccentric speeds to ensure maximum throughput without incurring excessive wear rates. This is a finely balanced equation, based on extensive R&D work, which together with the new service and operational features, gives you the lowest possible cost per tonne of material processed.

Enlarged feed opening – For those customers with 'slabby' or 'blocky' materials, we have introduced extended topshells to give you larger feed openings. These are optional for all machines in the TSUV range.

Liner optimisation service – This service ensures wear maintains the desired nip angle, which keeps power at a constant range and thus optimises throughput.

Easier maintenance – Up to 74% reduction in planned maintenance time means more time in production, increasing productivity and boosting your bottom line.

Integrated controls – Our advanced control system includes KPI dashboards, built-in trending, power and PSD wear compensation, automatic lowering of the mantle and camera/laser detection of oversize boulders and bridging. These are significant developments that will enable you to increase reliability and reduce the risk of an unscheduled stop.



Raising the bar

Are you crushing large lump ore or "blocky" material? Our optional High-Flow Spider features a raised design that increases the feed height under the spider arms by as much as 200 mm, allowing plenty of room for larger material to enter the crushing chamber.

While bridging can never be fully eliminated, this option, together with our oversize feed particle size detection system, ensures it is minimised and your crusher maintains maximum availability.

+7%
Greater speed

+10%
Increased capacity

72” x 130”
Feed opening

15,000 mtph
Throughput

1,500 kW
Power

1:2.7
Power to weight ratio

4.5:1
Reduction ratio

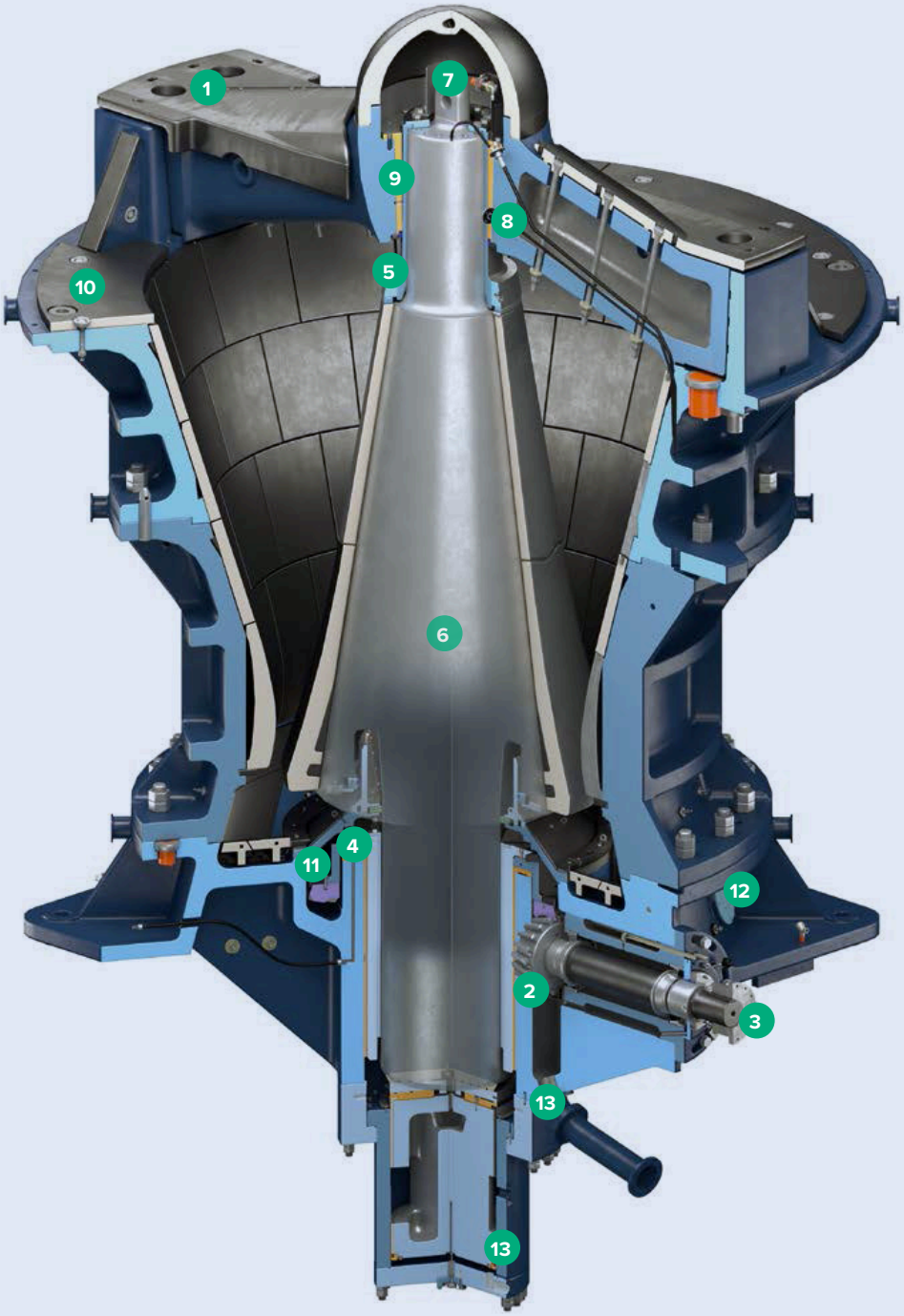
TSUV – the Mark V gyratory crusher

In this latest generation, speed is increased by a further 7%. This, in conjunction with the larger mantle diameter, equates to approximately a 10% capacity increase – and not at the expense of setting.

- Higher power handling – maximum power now up to 1500 kW
- Rotable top and middle shells as standard
- Self-aligning main-shaft as standard on all TSUV models (a significant advantage to health, safety and availability)
- Digitally enabled controls and condition monitoring
- Designed to crush even the hardest ore

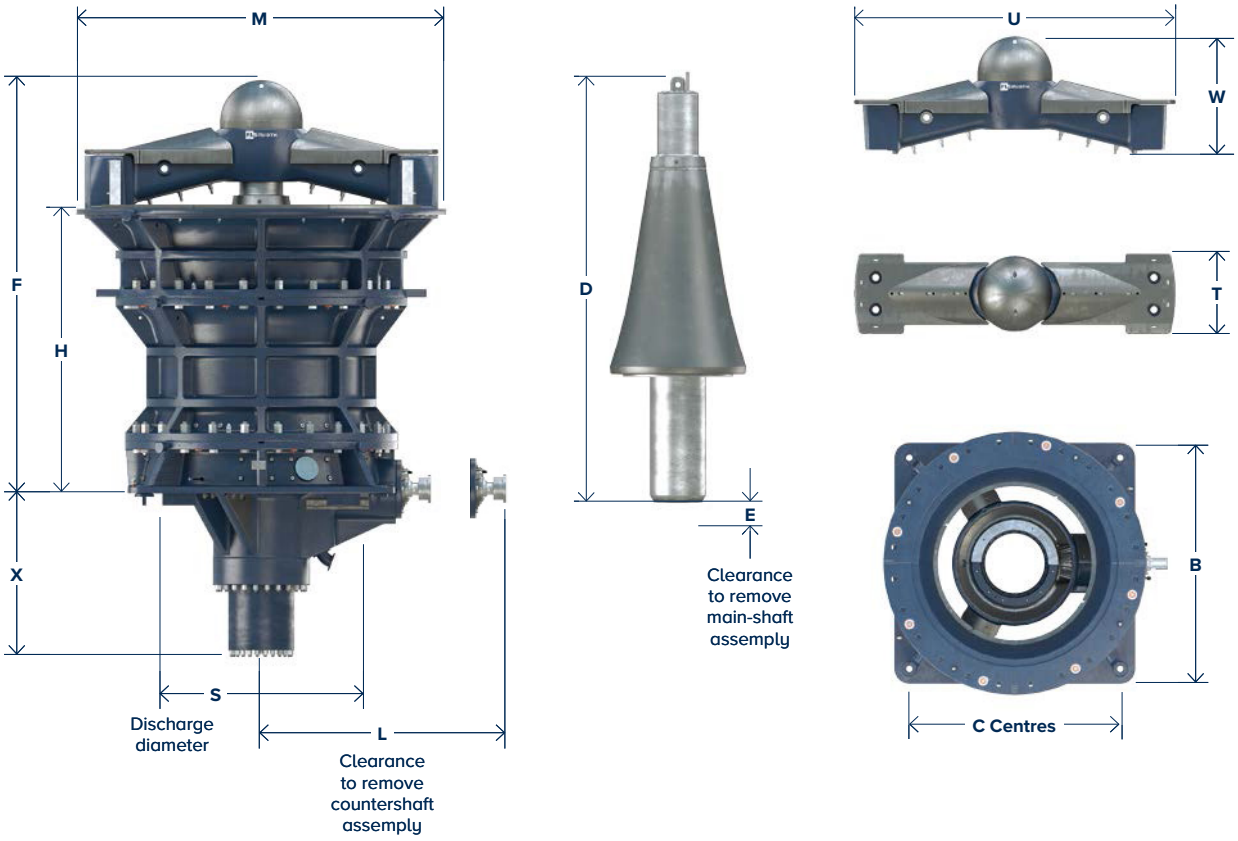
Features

1. **The bar-type spider's** four-bolt design reduces the amount of time required for removal. Further, its rectangular design reduces the overall amount of space necessary during maintenance.
2. **Spiral bevel gearing** allows for larger installed power on the crushers.
3. **The countershaft assembly** is designed to allow for fine adjustment of gear mesh during installation. It includes self-adjusting bearings that require no maintenance or pre-load.
4. **Eccentric and hydraulic** piston now accessed from the top, are serviced faster, more efficiently, and safer than a traditional bottom service gyratory crusher.
5. **Threadless main-shaft** design improves strength by minimising peak stresses during demanding crushing operations.
6. **One-piece integral main-shaft** standard on all sizes eliminates core shrink fit and reduces any loose core downtime.
7. **Integral main-shaft lifting eye** ensures that it is stronger and never misplaced.
8. **Grease spider lubrication** is simpler than oil lubrication and easier to maintain.
9. **Bronze spider bushing** provides improved life and better impact resistance than a cast iron spider bushing.
10. **Top shell wear plates** are designed to be easily replaceable, better fitting and leading to faster dump pocket clean-out.
11. **Pressurised dust seal** minimises particle ingress and ensures that oil stays clean of contaminants.
12. **Bottom shell view ports** allow maintenance personnel to view crusher shell liners and check for wear.
13. We utilise **identical oil in both the hydraulic and lubrication systems**, ensuring that if cross-contamination occurs there is no need to flush out the system.



1. Bar-type spider
2. Spiral bevel gearing
3. Countershaft assembly
4. Top serviceable eccentric and hydraulic piston
5. Threadless main-shaft design
6. One-piece integral main-shaft
7. Integral main-shaft lifting eye
8. Grease spider lubrication
9. Bronze spider bushing
10. Top shell wear plates
11. Dust seal pressurised chamber
12. Bottom shell view ports
13. Identical lube and hydraulic oil

Range and major dimensions



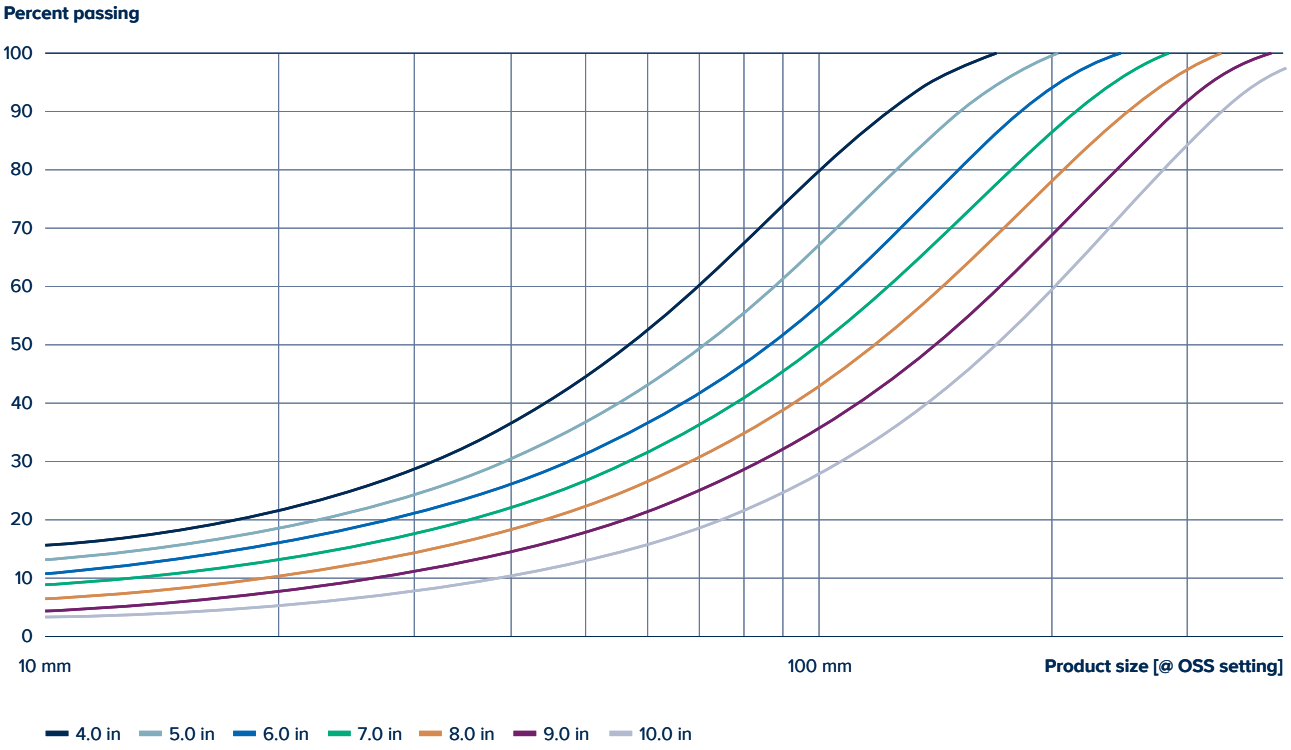
Model	Motor (kW) (Low – Standard)	Weight (mt)	B	C	D	E	F	H	L	M	S	T	U	W	X
900 x 1500	375 - 450	90	2,507	2,186	4,245	150	3,923	2,687	2,770	3,451	2,300	805	3,259	820	1,334
1100 x 1500	375 - 450	108	2,507	2,186	4,453	150	4,136	2,898	2,770	3,650	2,300	805	3,457	705	1,334
1100 x 1900	450 - 600	147	3,343	2,843	5,717	150	5,136	3,376	3,645	4,470	3,080	1,139	3,966	1,228	2,068
1300 x 1900	450 - 600	175	3,343	2,843	5,998	150	5,414	3,641	3,645	4,728	3,080	1,139	4,207	1,056	2,068
1400 x 2200	600 - 750	250	3,900	3,400	6,716	150	6,102	4,177	3,850	5,568	3,599	1,250	4,836	1,275	1,973
1600 x 2200	600 - 750	298	3,900	3,400	7,046	150	6,433	4,505	3,850	5,889	3,599	1,250	5,130	1,096	1,973
1600 x 2600	750 - 1,000	391	4,850	4,250	8,029	150	7,139	4,877	4,975	6,770	4,171	1,500	6,325	2,635	2,981
1800 x 2600	750 - 1,000	474	4,850	4,250	8,423	150	7,526	5,260	4,975	7,160	4,171	1,500	6,710	2,266	2,981
1600 x 3000	1,000 - 1,200	522	5,450	4,850	8,770	150	7,929	5,408	5,215	6,574	4,775	1,670	6,320	2,468	2,780
1800 x 3000	1,000 - 1,200	608	5,450	4,850	9,200	150	8,318	5,833	5,215	6,953	4,775	1,670	6,705	2,122	2,780
1600 x 3300	1,200 - 1,500	554	5,450	4,850	8,631	150	7,539	5,001	5,350	6,900	4,780	1,670	6,416	2,538	3,060
1800 x 3300	1,200 - 1,500	654	5,450	4,850	9,055	150	7,948	5,394	5,350	7,297	4,780	1,670	6,807	2,183	3,060

Capacities and gradations

Capacity (mtph)

Model \ OSS	4 in 102 mm	5 in 127 mm	6 in 152 mm	7 in 178 mm	8 in 203 mm	9 in 229 mm	10 in 254 mm	11 in 279 mm
900 x 1500	680 - 1,058	1,199 - 1,823	1,536 - 2,259	1,915 - 2,749	–	–	–	–
1100 x 1500								
1100 x 1900	–	1,474 - 2,272	2,254 - 3,383	2,800 - 4,058	3,396 - 4,766	–	–	–
1300 x 1900								
1400 x 2200	–	–	2,351 - 3,791	2,886 - 4,519	3,472 - 5,300	–	–	–
1600 x 2200								
1600 x 2600	–	–	2,926 - 4,842	4,142 - 6,733	4,913 - 7,821	5,436 - 8,494	–	–
1800 x 2600								
1600 x 3000	–	–	–	4,800 - 6,050	5,550 - 7,450	6,700 - 8,750	7,500 - 9,650	8,250 - 10,750
1800 x 3000								
1600 x 3300	–	–	–	5,000 - 6,100	7,250 - 8,750	8,600 - 10,100	10,500 - 12,550	12,400 - 14,400
1800 x 3300								

Product gradation



Digitalizing the crushing circuit

To increase productivity in your mine, we provide a strong portfolio of digital solutions and services that connect, monitor and optimise performance of your assets. This is the smart way to increase your output, reduce operational costs and reduce energy usage.

Central control room

Monitor and control your single crusher or entire plant from one central control room – onsite or remotely.

Remote operations and services

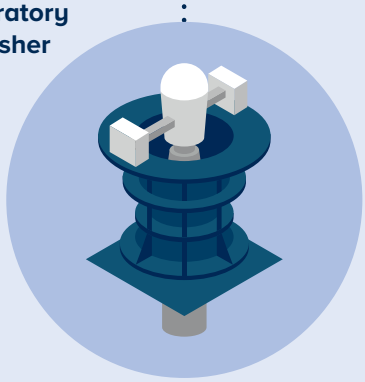
Protect your assets by monitoring or controlling your entire plant or single crusher. The FLS 24/7 Global Remote Service Center makes our expertise and know-how available to maximise your performance.

Internet and cloud solutions

Connect your single crusher or entire plant to our secure cloud infrastructure. It seamlessly integrates data and signals, enabling greater visibility to identify operational improvements or potential bottlenecks that may impact productivity. Access your data anytime and anywhere – even on your mobile device.

Cyber security

Gyratory crusher



Equipment monitoring

Get easy and direct access to information on your crusher health and performance with our intuitive HMIs or on your mobile device.

Connectivity

Monitor, control and optimise remotely

Connecting your crusher to the internet via our secure infrastructure is the prerequisite for harvesting the benefits of digitalisation.

ECS/Product Control
Integrated product control enables faster commissioning, fewer programming errors and better overall performance. We have embedded our extensive knowledge of how best to operate and control the crusher into our state-of-the-art control system. The integrated controls also provide you with the "ecosystem" for plug and play future upgrades and services.

SiteConnect™
Real-time data on your mobile device. Instant notifications in case of unexpected events and live access to performance data.

24/7 Global Remote Service Center
Reduce unplanned downtime through insightful analytics and 24/7 monitoring by crushing experts.

Cyber Security
Keep your connected IT updated, safe and unbreachable. Cyber security is an integrated and fundamental capability of our digital portfolio.

Crusher health

Maximise the availability of your crusher

Online condition monitoring of equipment and wear parts protects your crusher and mitigates risks to ensure optimal crusher reliability.

Crusher Sensors
Multiple sensors to monitor oil, lubrication, vibration and more.

Life Tracker
Enables you to analyse oil, mantle and concave conditions, plotting trends and helping you make the best decisions for greater productivity.

Augmented Field Engineer
Allows our engineers to remotely assist with your operational issues. A hands-free remote collaboration tool enables you to share vision of your equipment with our field service technicians. Results in faster resolution of incidents, reduced cost of service delivery and increased availability.

Online Condition Monitoring Services
We use secure and advanced cloud analytics, coupled with our local and global experts, to provide you with actionable insights to avoid losses associated with unexpected downtime and breakdowns.

ECS/UptimeGo
Get insights to identify causes of equipment failure and eliminate downtime root causes.

Performance optimisation

Boost your productivity

Our digital solutions uses data intelligence to optimise your crusher performance, boost your productivity and reduce your energy usage.

Wear Compensation
Maintain product consistency and quality even as your liners wear. Your operators never again have to guess when to adjust your OSS setting. The wear compensation option enables the crusher to automatically adjust the OSS as the liners wear.

Auto Lower
Protect your crusher and your throughput with our quick-reacting auto lower feature. When you run into harder ore or changing ore bodies your crusher will adjust automatically based on your configured power and pressure settings.

Particle Size Direct Measurement
Use direct measurement of your crusher output to further optimise your crusher performance.

Oversize Feed
Analyse the crusher feed to detect oversize material. Reduce the chance of damaging your crusher and potential loss of production do to oversize material being jammed in the crusher.

Bridging
Increase efficiency of your crusher operations by automatically identifying bridging in the crusher feed, alerting the operator to hold further feed until the bridging event has worked through the crusher.

ECS/Plant Data Management
Transform process and quality data into real-time operations and get the most out of your plant and equipment.

Key benefits of a connected crusher

- On demand information in the control room or on your mobile
- Expedite remote support
- Enable faster decisions and actions
- Real-time insights available to top management
- Increase uptime and availability by decreasing unplanned breakdowns
- Maximise productivity and reliability
- Reduce environmental impact
- Cut operating costs
- Control and optimise operations

Taking asset health to the next level with online condition monitoring services

Our online condition monitoring services combine digital technologies with process expertise. It's like having a team of specialists onsite whose sole focus is optimising your crusher's performance. Condition monitoring sensors automatically send data to our experts who then analyse it and propose action plans – this could be anything from reacting to an alarm within the system, to identifying energy saving opportunities.

Service packages can be tailored to your needs in line with your process goals, such as reducing downtime or improving efficiency.

Remote troubleshooting

With experts on hand via video, telephone, email and even our Augmented Field Engineer (a hands-free tablet class wearable computer for service personnel) remote troubleshooting can be carried out as a one-off service or as a package covering one or multiple assets.

Downtime analysis software

When stoppages happen, it's vital to know what went wrong. Finding out what caused your plant and equipment to fail is the first step to preventing the same thing happening again in the future. Our downtime analysis software, ECS/UptimeGo, gives you the insight you need to identify what causes the equipment to fail and improve your processes for the future.

3D liner scanning and optimisation

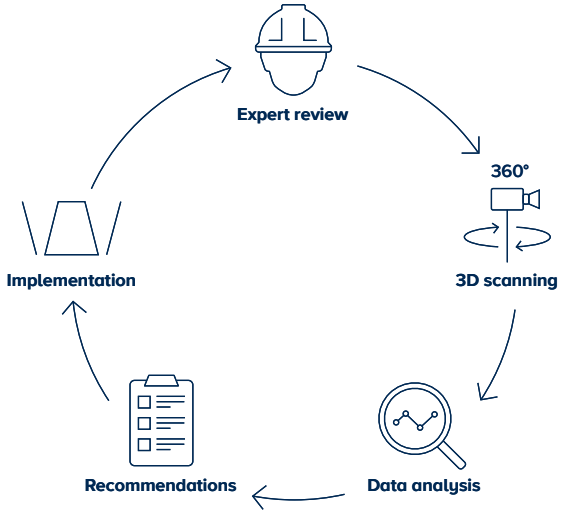
Maximise your crusher liner performance with our 3D liner scanning and optimisation service. Our chamber scanner uses laser technology that is capable of recording up to 50 million data points of the liner profile at accuracy levels physical measurements cannot achieve. It can easily be performed within planned maintenance and inspection schedules.

Our experts compile, analyse and interpret the raw scanned data, then discuss wear life estimations, shutdown planning, and opportunities for improved operating procedures with you.

ECS/UptimeGo includes the capability to:

- Document what occurred in the lead up to stoppages
- Perform Pareto analysis
- Track maintenance KPIs
- Provide automatic downtime reports
- Quantify the cost of the stoppage on a plant and department level

This enhanced visibility of downtime metrics enables you to eliminate root causes of downtime and increase equipment availability.



“Unplanned downtime costs the mining industry billions of dollars each year”

Predictive maintenance can result in up to 75% reduction in breakdowns.

You don’t need more data – you need insights

Our condition monitoring service combines data, technology and expertise to deliver you reduced downtime, greater reliability, better margins and more sustainable operations. We offer you two levels of online condition monitoring services:

Level I package
Existing signals

Key benefits

- Plug and play – no need for additional sensors
- Proactive notifications on critical failures
- Severity assessment and monitoring
- Reduced probability of unplanned breakdowns
- Priority in quotation for add-on services

Level II package
Added sensors

Key benefits

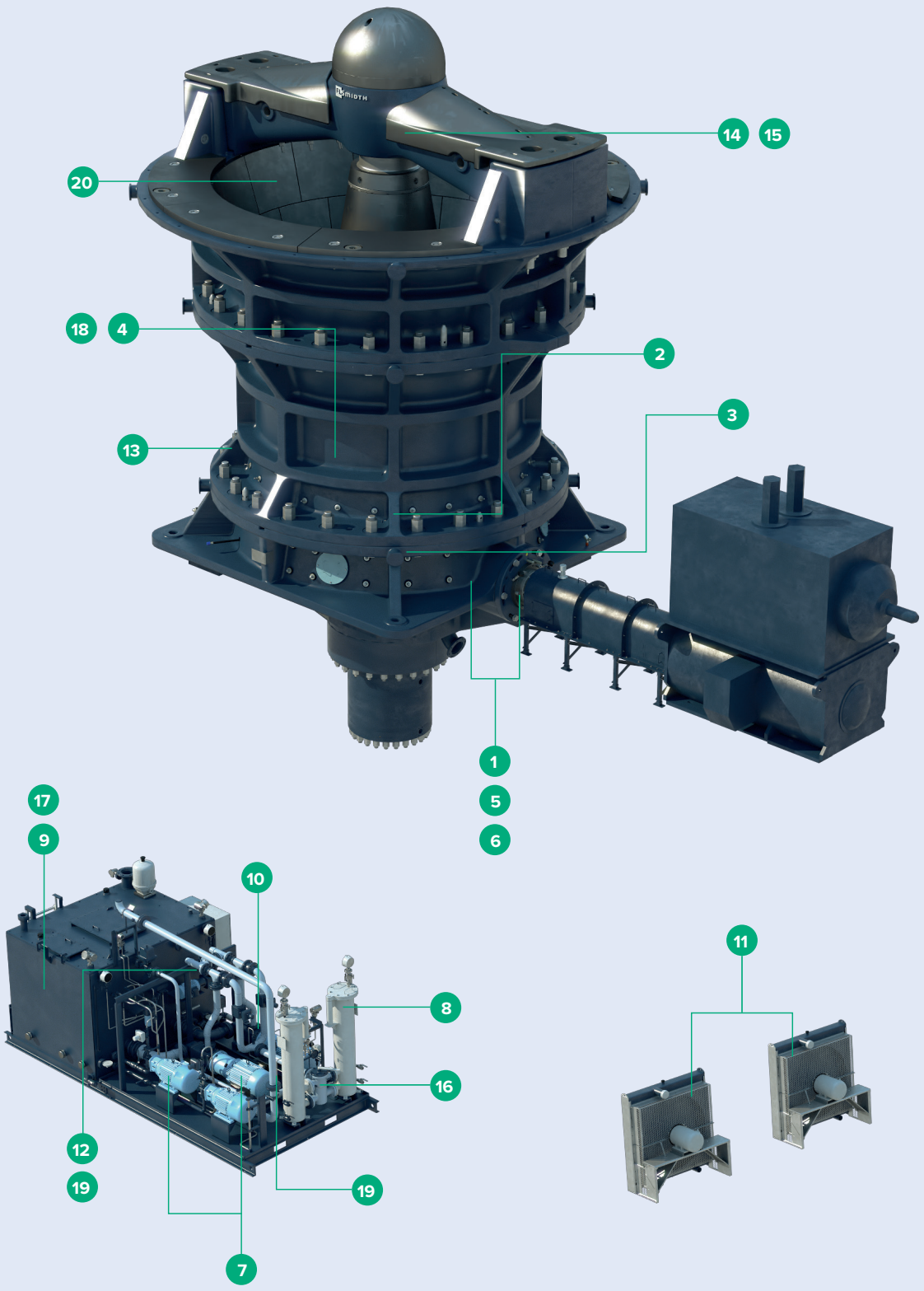
- ‘Level I package’ +
- Significant, additional coverage to predict failures on critical components such as bearings, gears and more.

Results in further reduced risk of downtime

The TSUV gyratory crusher condition monitoring system

Condition monitoring moves you from reactive to proactive maintenance.

General catergory		Monitoring Point	Benefit	Service package level	
				Level I	Level II
Overload monitoring		General overload warning	All these features are monitored by the smart control system. The aim is to avoid long-term cumulative overload damage to bearings, frame, eccentric main-shaft, gears and drive	Yes	Yes
		High specific power		Yes	Yes
		Linear wear		Yes	Yes
		Excessive tramp		Yes	Yes
		Excessive reduction		No	Yes
		Excessive fines		No	Yes
		High ore work index		No	Yes
Crusher bearings		Overall bearing condition	Ensures component replacement at next planned shutdown before unexpected catastrophic failure	Yes	Yes
	1	Countershaft bearings		Yes	Yes
	2	Outer eccentric bushing		Yes	Yes
	3	Inner eccentric bushing		No	Yes
	4	Main-shaft wear rings		No	Yes
Vibration	5	Countershaft bearings	Proactive component replacement at next planned shutdown before unexpected catastrophic failure	No	Yes
	6	Wavespring		No	Yes
		Gear condition		No	Yes
		Tramp monitoring		No	Yes
Oil lube system	7	Pump wear	Proactive lube system adjustments to avoid nuisance crusher auto shut down	Yes	Yes
	8	Filter condition		Yes	Yes
	9	Reservoir level monitoring		Yes	Yes
	10	Flow split monitoring		Yes	Yes
	11	Cooling system optimisation		Yes	Yes
	12	Oil contamination monitoring	Increase lube system component and bearing life as a result of improved oil cleanliness quality and dust seal system monitoring	No	Yes
	13	Dust seal system		No	Yes
Grease lube system	14	Grease level monitoring	Avoids nuisance trips from low grease level. Ensures adequte grease flow to spider bushing	Yes	Yes
	15	Grease flow rate monitoring		Yes	Yes
Hydraulic system	7	Pump wear	Proactive lube system maintenance to avoid interrupted OSS crusher adjustment	Yes	Yes
	16	Filter condiiton		Yes	Yes
	17	Reservoir level monitoring		Yes	Yes
		Leakage monitoring	Prevent main-shaft drift and oversize product	Yes	Yes
	18	Piston seal damage	Allows proactive oil replacement thereby extending hydraulic system component life	Yes	Yes
	19	Oil contamination monitoring		No	Yes
Liners	20	Wear monitoring	Optimises liner procurement & changeout planning	Yes	Yes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Digitalisation enables performance optimisation

From wear compensation to particle size distribution, digital technologies are driving performance improvements.

Built in tools extend liner life

Innovative new tools enable you to get the maximum return on your liners:

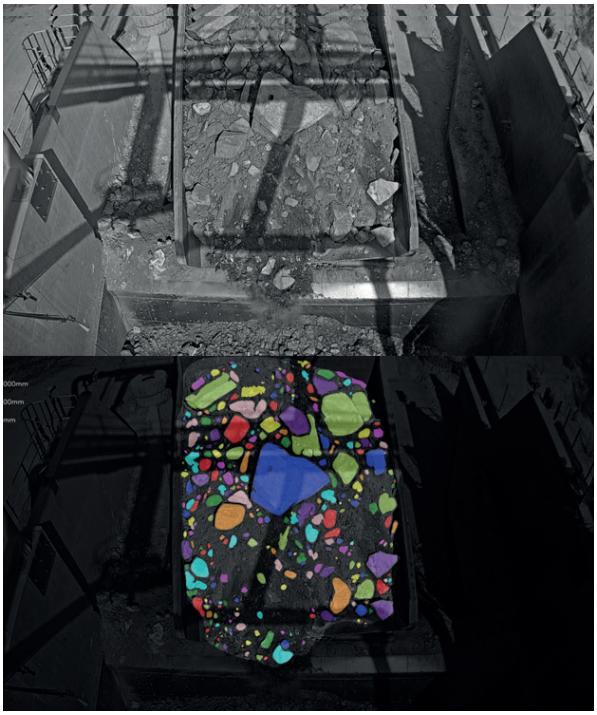
- Power Wear Compensation: Fine adjustments for wear compensation calculated with power targets and tonnage.
- PSD Wear Compensation: Fine adjustments for wear compensation calculated with PSD targets with feedback from camera/laser scanner.
- Feed Camera/Laser Option: Detection of oversize boulders and bridging will alert you to take early/fast decisions.

Plus, intelligent controls automatically adjust the mantle position setpoint, raising it to compensate for liner wear and lowering it in response to over-pressure or over-power events.

Monitoring input and output

It's not only the machinery that needs monitoring – the rocks are important too. The TSUV can also include three systems to analyse crusher input and output, which help to avoid blockages, bridging and reduced throughput.

- The Gyratory Crusher Oversize Feed Particle Size system uses cameras to analyse the particle size of each truck load prior to it entering the crusher. The system interlocks with the tipping signal light to prevent tipping of oversize rock into the crusher.
- The Gyratory Crusher Bridging Particle Size System monitors the crusher feed opening using camera equipment and a particle size analyser to detect bridging/blocking. If a blockage is detected, an alert is sent to the operator and the tipping signal is triggered to prevent further feed entering the crusher.
- The Gyratory Crusher Particle Size – Product Belt Camera System analyses the output of the crusher to check the reduction ratio is as expected. If output is oversized, the crusher gap is automatically adjusted.



Plant performance review

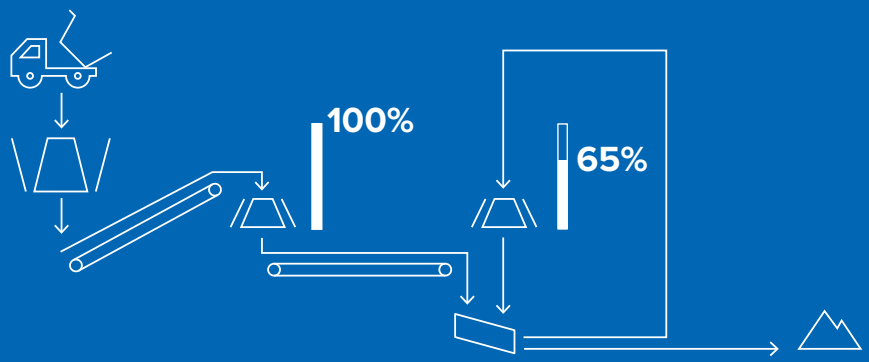
Beyond providing high quality equipment and parts, we partner with you in all aspects of your plant process, including equipment loading, screening efficiency, product size needs and material handling. Our process experts assist in designing, installing, commissioning, and auditing your plant to ensure it keeps operating at peak performance.

Our team will evaluate the following typical concerns and help deliver the best solution:

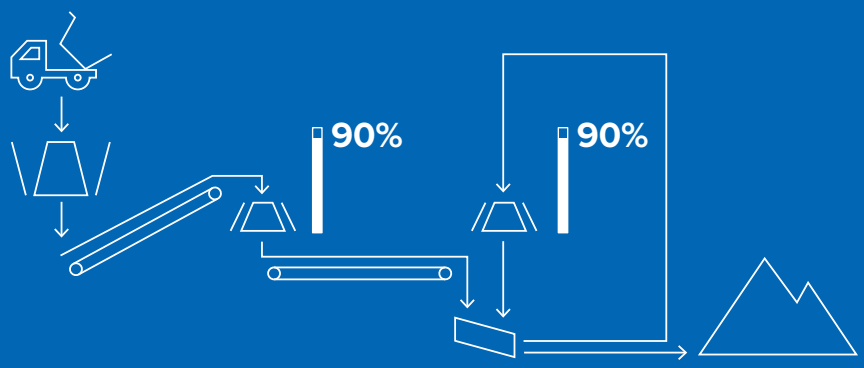
- Liner profile wear
- Crusher load sharing
- Oversize and waste material
- Recirculating load
- Wear rates
- Power draw

The end result? A productivity and profitability boost thanks to improvements in product quality, wear part utilisation and equipment availability.

Imbalanced crusher loading resulting in poor production



Properly balanced crusher loading resulting in maximum production



Dedicated design capabilities

Our materials handling engineering team now brings seamless capability to design stations dedicated to the 'Top Service' TSUV crushers.

From fixed stations to traditional truck-fed semi-mobile stations to low profile semi-mobile stations, we have the solution you need.

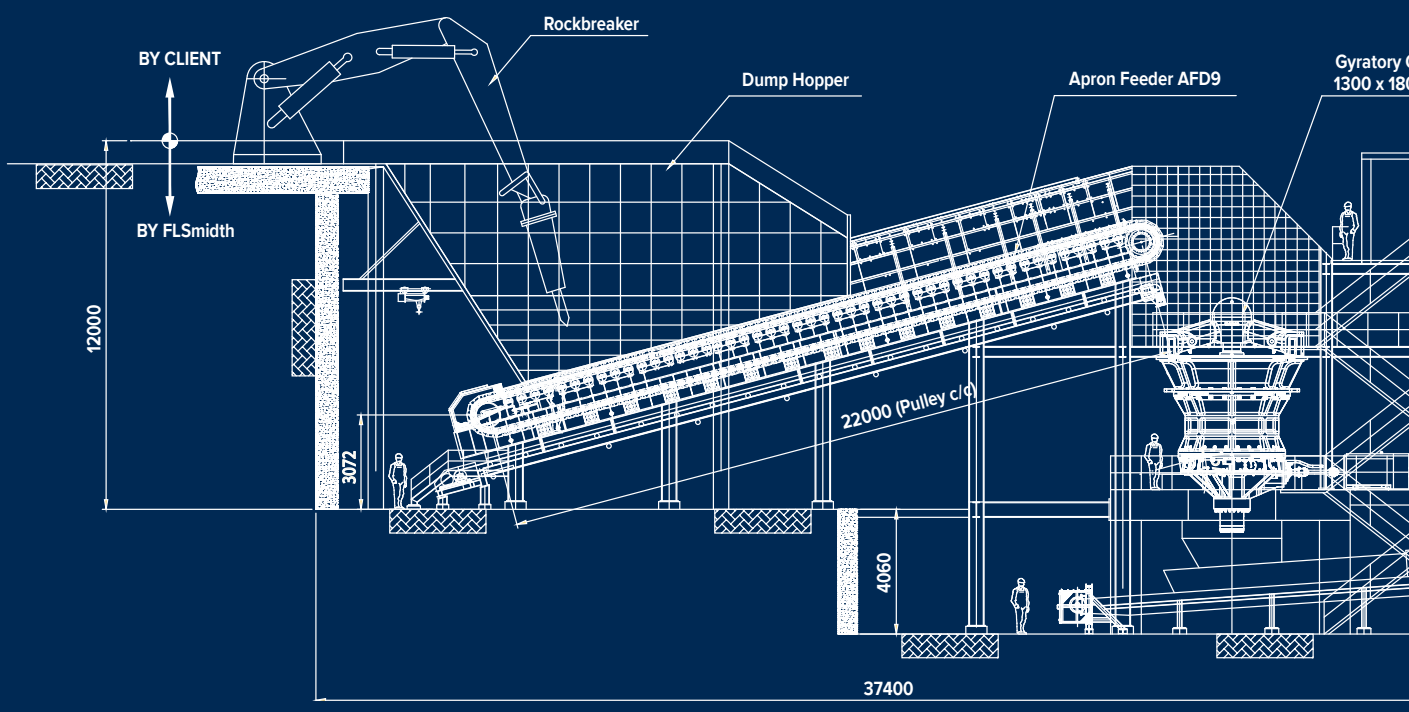
The TSUV crushers offer benefits that no other crushers can offer when you consider the following:

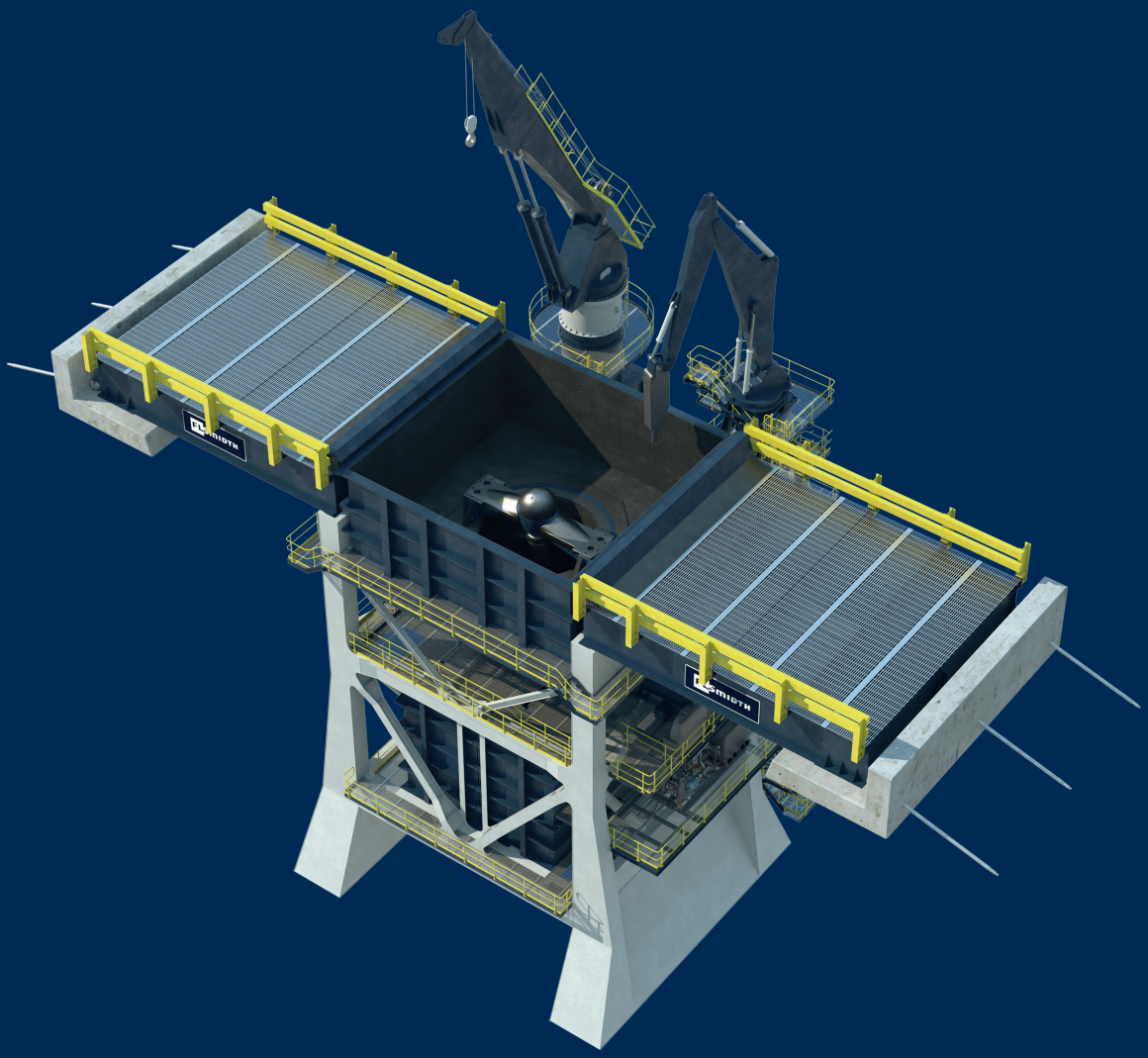
Despite their higher power handling capabilities, TSUV crushers offer the lowest dynamic loadings in their class. This leads to less steelwork, less civils and therefore no need to compromise on the crusher you really need for the job at hand.

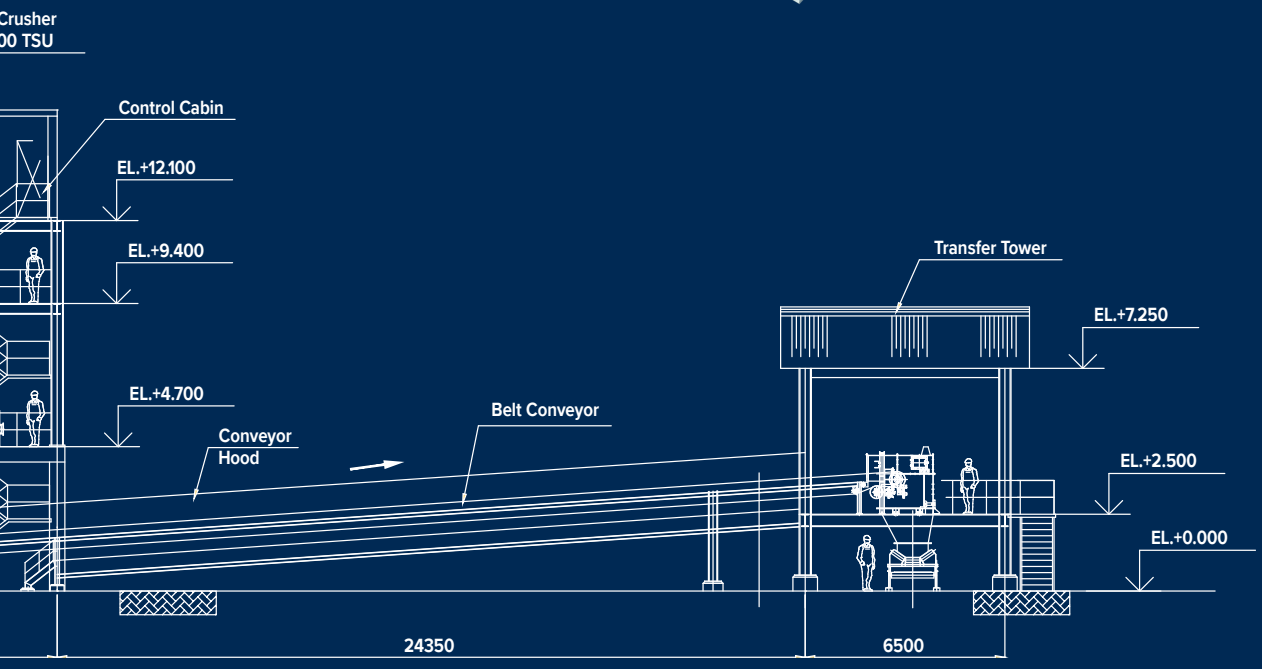
The TSUV range greatly decreases the maintenance cycle and negates the need and additional height required for a costly eccentric maintenance cart.

Our complete range of TSUV Gyratory Crushers can be mounted on fixed and semi-mobile steel plants, giving you the freedom and flexibility to design your plant the way you want.

Not enough height to go direct dump? Opt for the "Low-Profile" configuration, which can accommodate your civil constraints.



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TLC for primary crushers

Charlie Madsen, Manager of Life Cycle Services for FLS spoke to Engineering & Mining Journal about our approach to preventive maintenance.

The team at FLS has been working with a number of our customers to eliminate unexpected crusher shutdowns and to optimise equipment reliability. Manager of Life Cycle Services Charlie Madsen was happy to share this knowledge. “Planned major maintenance predominantly means liner changeouts,” he said. “But generally, the crusher will be shut down for two mantle changes and one concave change per year. Mantle changes can be done in approximately 24 hours and a concave with a mantle change in four to seven days depending on factors such as mine location and site specifics.

“Hydroset replacements are planned/recommended anywhere between one and five years, again depending on site-related variations. General maintenance is hard to time, but an educated estimate would be something along the lines of three to four days every half year. Maintenance schedules are planned through information, data, and trending of wear and components.” Rate of wear and wear characteristics are typically determined by the orebody type, work index, abrasiveness and fracture rate, as well as throughput.

“These are characteristics that can change over the lifespan of a pit or orebody, requiring constant attention to liner material choice and profiles. This ensures wear patterns and wear loss are kept at the optimum level and secures lowest cost per metric ton in operation,” Madsen said. “We mitigate wear rates by using different types of manganese in its liners, upgrading to chromemoly where necessary. White iron can also be advantageous.”

Combining this with the optimisation of liner profiles, throat/chamber design and operations on-site for feed characteristics tends to give the most successful result, and changes in the above can extend liner profiles and throughput over a lifetime by up to 500,000 mt in some cases. This is obviously welcomed by the customer as downtime is cut and maintenance costs reduced. Madsen explained: “There are an abundance of checks that should be carried out fully and thoroughly in preventative maintenance inspections and with a computerised maintenance management system (CMMS). These, in combination with customer training, can reduce maintenance times and cut unplanned failures. It also enables more consistent scheduling of work activities, planned shutdowns and parts supply.”

Maintaining the open side setting (OSS) is typically done by operators with a control system that shows the main shaft position at all times. Our automation team has designed new software that can carry out optimisation of the main shaft position based upon a number of instruments that maximise throughput, power/wear and final product. “Calibration of the main shaft is an infield exercise, as manual verification and measurements have to be conducted in order to calibrate and scale the electronic equipment,” said Madsen. “By optimising the main shaft position, we create a more effective and constant wear profile, which allows the end user to get full wear out of liners.”

We have developed a comprehensive maintenance management system for our Excel-Raptor cone and gyratory crusher lines. “We also we have a self-aligning main shaft, which improves on installation times, and more importantly, safety and suspended loads,” Madsen added. “We are also the only OEM with a fully top service gyratory, which improves on maintenance downtime and saves on building and construction designs and sizes.”

The team has designed rotable shell segments to reduce concave liner changeout times, and the spider removal jacks are threaded into the shell rather than being free standing to reduce manual handling requirements and improve ergonomic positioning for staff.

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