Longwall Shearers

Longwall Shearers Features

> Powerful Control System

State-of-the-art Ethernet communication down to I/O-level for advanced automation and monitoring.

> Unique One-piece Mainframe Design

Delivers maximum protection for all modular units and designed for ease of maintenance.

> Innovative Two-piece Trapping Shoe

Allows quick, easy wear part replacement for maximum uptime.

> VibraGuard Continuous Online Vibration Monitoring Option

Protects equipment by warning of damage risk and predicting component wear.

> Upgradeable Design

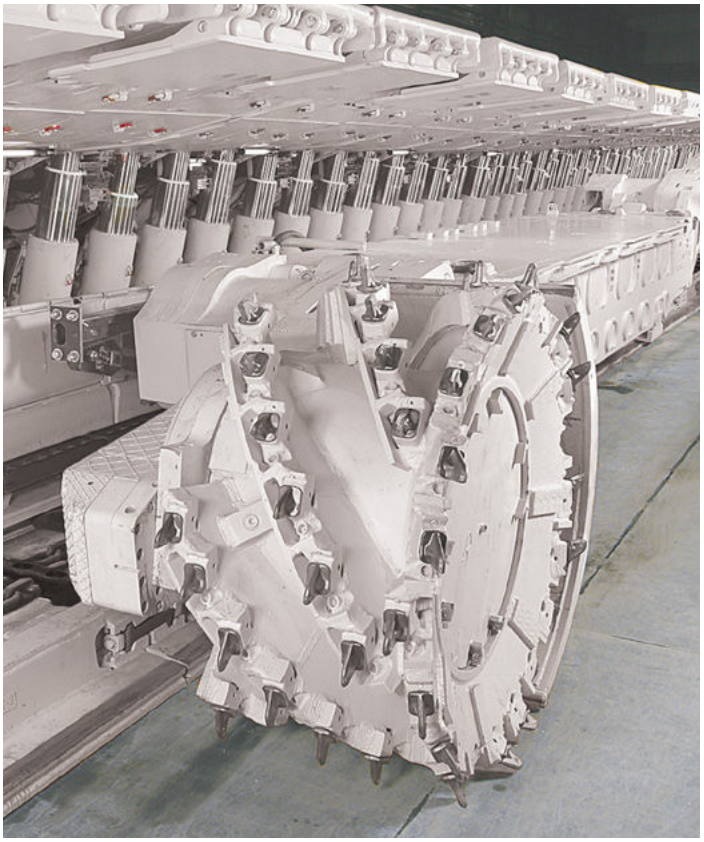
Easy upgrades during rebuilds for long, reliable service life and installation of additional performance enhancing features.

Contents

TAKING THE SHEARER TO THE NEXT LEVEL
DESIGNED FOR HIGH-PERFORMANCE MINING

Survival of the Fittest

To do this, we invested heavily in refining our successful range of shearers. We started by reviewing and analyzing all more recent shearer installations and setting goals to improve productivity, availability and reliability. This was not a re-design, but an evolution – keeping the best tried-and-tested features of the existing design while using the latest findings from science and technology to improve features and add new ones.



Your shearer is the most critical part of your longwall production process. That's why high-performance longwall operations demand shearers that deliver the highest productivity, availability and reliability. HBT shearers were always designed to meet these demands. But HBT has taken them to the next level.

SHEAR PERFORMANCE

With high-powered ranging arms and haulage units, HBT shearers cut and load up to 5000 tonnes (5,500 tons) per hour and more, depending on mining conditions. The unique, one-piece mainframe design offers maximum structural integrity and service life. The mainframe is available as a split unit in the event of transportation limitations. Featuring the superior Jumbotrack shearer haulage system, the shearer also offers advanced integrated automation and communication options.

KEY IMPROVEMENTS

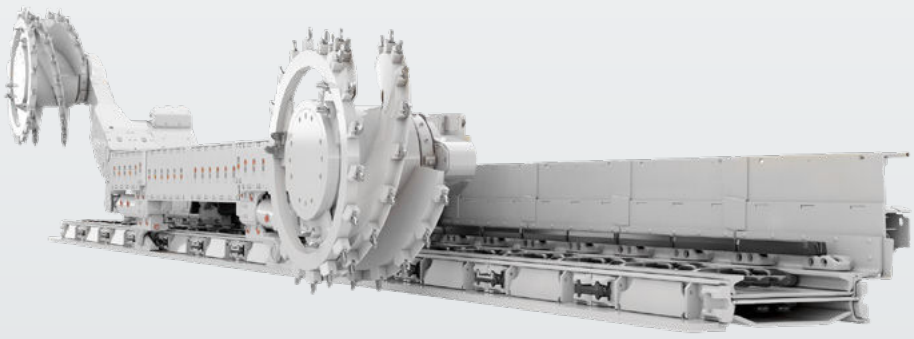
HBT shearers incorporate numerous new features and benefits. These are presented in the following pages by category. The key improvements include:

- Extremely powerful PMC™ Evo-S control system with state-of-the-art Ethernet communication
- Improved innovative downdrive design
- Ranging arm with longer service life
- Further development of the modular haulage and electrical control box
- Enhanced power pack with easy access
- Online vibration monitoring with VibraGuard™
- Clear wiring and use of plug and play for easy maintenance
- Trapping Shoe Ix (Insert Exchange) for longer service life, safe and easy to replace
- Future-proof design allowing upgrades – such as stronger ranging arms and haulage units or addition of coal sizer – during rebuild
- Mainframe designed to handle 1200 kW (1,930 hp) ranging arms and 200 kW (320 hp) haulage units – EL3000 only

MACHINE MAINFRAME

MADE FOR MUSCLE

The unique mainframe of the HBT shearer is one of its key features. The fabricated structure of the mainframe with cast ranging-arm hinge points results in an extremely robust design not only to meet the toughest mining conditions and ensure reliability and long service life, but also to handle even higher cutting and haulage forces in the future. The mainframe of the EL3000 is designed to allow retrofit of 1200 kW (1,930 hp) ranging arms and 200 kW (320 hp) haulage units. A split mainframe is available in case of transportation limitations.



1) Trapping Shoe Ix offers longer service life, greater flexibility, faster replacement, and greater safety and ease of handling during replacement.

2) The robust mainframe protects the electrical boxes from cutting and haulage forces; door handling system for easy access to the electrical compartments.

BENEFITS:

- High structural integrity and absorption of all cutting and haulage forces, providing maximum protection for all major units
- Maximum protection of electrical boxes, providing the highest level of flameproof integrity
- Improved access for maintenance and ease of overhaul and repair
- Versatility of application due to fully modular construction
- Flexible and cost-effective equipment management
- Independent unit exchange and selective overhaul
- Long service life
- Low operational costs
- High reliability

INNOVATIVE TRAPPING SHOE

Trapping shoes attach the shearer to the haulage rack system, part of the armored face conveyor, allowing the shearer to be hauled up and down the face. A new type of trapping shoe developed by HBT – the Trapping Shoe Ix – offers numerous advantages over the conventional design:

- Greater safety and ease of handling during replacement
- Faster replacement
- Greater flexibility
- Longer service life
- Lower operating costs

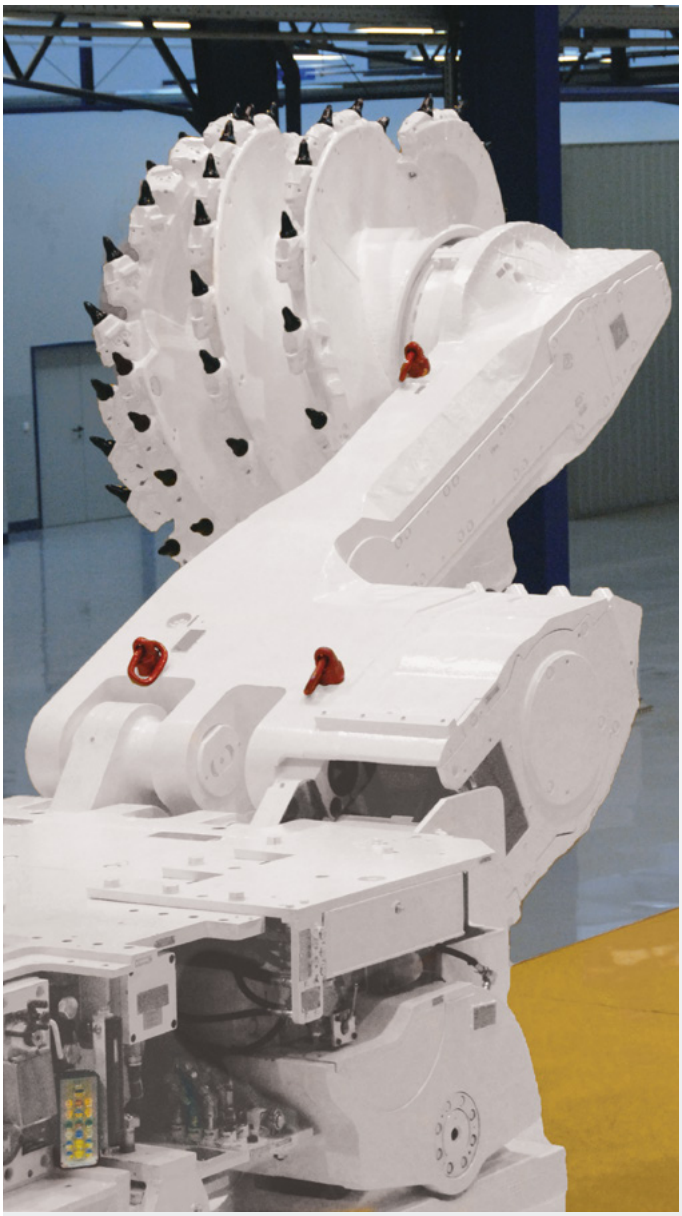
The patent-pending Trapping Shoe Ix continues the HBT principle of designing products with separate structural and wear parts to allow quick and easy replacement of surfaces subject to wear. The new design cuts the weight that has to be handled during replacement from more than 500 kg to less than 50 kg per insert, and cuts the time required for exchange to a fraction of the previous time. Because the weight handled is so much lower, changeout can take place anywhere along the face – previously this work had to be done at the gate ends, where heavy lifting equipment was available.

EXTENDED SERVICE LIFE

The inserts have the same wear area as conventional shoes and are articulated. This – combined with the fact that the shoe does not have to exert as much pressure, resulting in a lower point load – means less wear. Field tests of the Trapping Shoe Ix showed its service life to be 50 percent longer than conventional trapping shoes.

RANGING ARMS

POWER FOR THE TOUGHEST CONDITIONS



Our shearers cover a wide range of cutting heights and mining conditions. They have installed cutting power to provide world-class production in the toughest mining conditions: The EL3000 with a cutting power of up to 860 kW (1,380 hp) and the EL2000 with up to 750 kW (1,200 hp). A new 1200 kW (1,930 hp) ranging arm is under development and can be retrofitted to existing EL3000 shearers during rebuild.

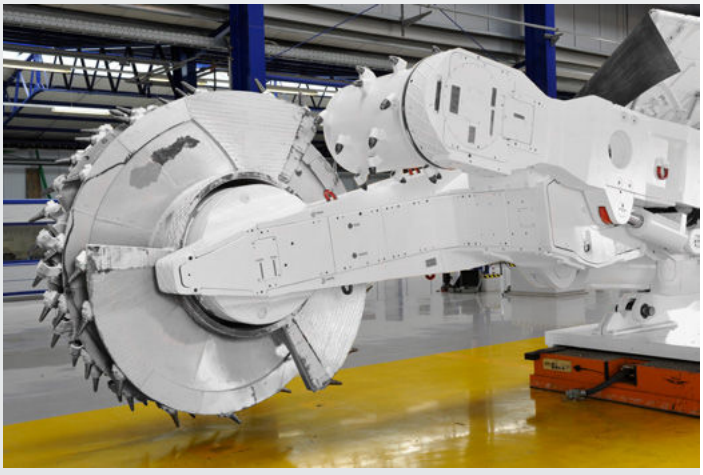
- High levels of installed power available in each class
- Cutting depth of 0.85 m (2.79 ft) and 1.0 m (3.28 ft)
- A range of cutter motors available to suit all mining conditions
- Compact design for optimum coal-loading performance
- Fast and accurate positioning of the ranging arm through two-speed technology and a more powerful lifting cylinder
- Modularity allows fast in-situ maintenance and repair
- Improved lubrication results in lower operating temperatures
- New, more robust cowl drives

STRONG ARM

The safety factor for the ranging arm has been further increased. Gear rating, bearing life and redundancy have also been increased, leading to longer overhaul intervals based on typical usage.

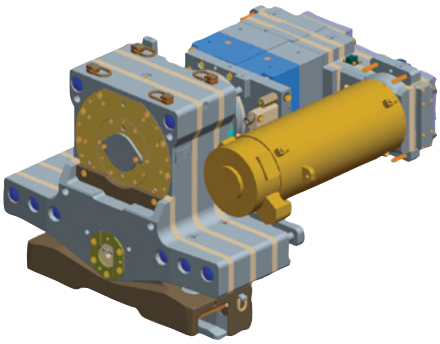
COAL SIZER

HBT shearers can be supplied with an optional rugged coal sizer, currently with up to 200 kW (320 hp) of installed power for maximum productivity in high seams or difficult mining conditions. The coal sizer can be ordered separately for installation during rebuild or overhaul.



HAULAGE SYSTEM

SIMPLE DESIGN FOR IMPROVED RELIABILITY



MODULAR HAULAGE SYSTEM

HBT has further developed its modular haulage concept with increased power rating, gear rating, bearing life and redundancy, leading to longer overhaul intervals based on typical usage. The haulage system is a simple design capable of achieving cutting speeds of up to 32 m/min (105 ft/min), with improved reliability and longer service life. The fully modular haulage gearbox is located in the shearer mainframe and does not form part of the shearer structure. The haulage system offers:

- Simple construction, improved reliability and longer service life
- Fully proven load-sharing system
- Reduced cost

POWER PACK

The power pack has been re-engineered to provide increased functionality, optimized performance and better access to filtration units via simplified layout. Both of the following units are modular, with drawer units providing easy access and upgrade.

TRANSFORMER BOX

- Features closed-loop control with measurement of speed, not power
- Transforms to 600V for haulage units' frequency converter motors
- Connectorized cables for reduced wiring and quick, clear installation
- Temperature monitoring and water cooling

CONTROL BOX

- Plug and play
- Easy to maintain
- Quick and easy troubleshooting

DOWNDRIVE SYSTEM

INNOVATIVE AND FULLY MODULAR

DOWNDRIVE

An innovative downdrive design results in longer bearing life, increased gear rating and greater modularity for simplified maintenance. Height adjustment of the shearer is relatively easy and is achieved with replacement of the downdrive to allow adaptation to changing seam conditions. Every mainframe is designed to take the full range of downdrive arrangements to fit a wide range of seam heights.

- Fully modular design
- Easy maintenance access
- Fully articulating shoe
- High pull and maximum life

TESTED FOR RELIABILITY

STRINGENT TESTING ASSURES HIGHEST QUALITY

Downtime is extremely expensive for operators – costs continue to add up while nothing is produced. This is why HBT ensures that our superbly engineered shearers are up to the job. That's why each shearer design – which is optimized for maximum availability – is subjected to rigorous in-house testing to ensure that there are no unpleasant surprises when units are in service. Shearer production quality assurance falls into three main categories: lubrication verification, endurance block load testing and production load testing.

1) Shearer in the last manufacturing stage getting tested before delivery to customer site

Lubrication Verification

Ranging arms and haulage units are subjected to an intense test regime to establish the optimum oil-level requirements to suit all mining conditions. The units are mounted on purpose-designed test rigs that are positioned to simulate the gradient of the underground seam. A suite of tests is performed with a range of different gradients and arm positions to represent even the most severe mining conditions. The units are operated until stable temperatures are achieved at all gradients. This establishes the minimum, maximum and optimum oil quantities for all conditions.

Endurance Block Load Testing

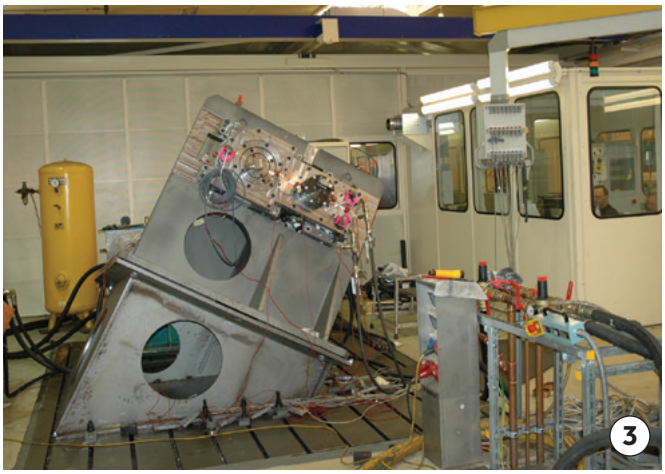
This test applies loads far in excess of those encountered during normal mining operations, ensuring that the shearer can operate reliably at the installed power ratings. Ranging arms or haulage units are mounted on purpose-designed test rigs in a back-to-back configuration driven by a suitable test motor. The endurance block load test imposes loads from 100% to 175% to ensure that the ranging arm design meets the requirements of the most demanding applications. Input torque, losses and output torque are monitored during the test, as are bearing, gear and shaft temperatures. Vibration is monitored by dedicated sensors. Oil samples are collected at intervals for analysis, as the presence of metal in the oil can indicate excessive component wear. On completion of the endurance test, units are dismantled for a full internal and external inspection to verify that the design is fit for purpose.

Production Load Testing

After successful endurance block load testing, the same test rigs are used to carry out production load testing of all ranging arms and haulage units. The test gradually increases the load up to full load. All temperatures and vibration points are monitored during the test, and oil samples are again collected for analysis.

Proven Productivity

This extensive range of tests ensures the highest possible availability of shearers in service and maximum return on investment for your longwall installation. Nothing is left to chance in ensuring that our shearers are unsurpassed in reliability.



2) Lubrication test under the most extreme conditions
3) Haulage unit in testing to ensure highest reliability

1) Integrated end station display

SHEARER AUTOMATION

UNPARALLELED CONTROL

Industry-leading Automation from the Pioneer of State-based Automation

HBT has developed a state-of-the-art distributed automation system for the control, monitoring and protection of the shearer. Its modular design allows it to be configured to meet individual control needs, from basic monitoring and protection to advanced automation and data transmission. The PMC™ Evo-S control system with state-of-the-art Ethernet communication and backup functionality allows the shearer to be operated even if the overall control system is not functioning. In 2002, State-Based Automation was invented and launched. Using this technology, HBT now offers a comprehensive range of automation products.

Power and Flexibility

With extensive computer power installed and simple upgrade to new features, HBT shearer automation is fit for the future. Components connect into the network rather than directly to a central computer, simplifying installation, wiring, maintenance and troubleshooting. The shearer is equipped with a state-of-the-art industry PC in a flame-proof housing with plenty of computing power, allowing flexibility to upgrade to future features such as condition monitoring.

A Programmable Logic Controller (PLC) takes care of basic machine control tasks, ensuring that coal is mined. Unlike competitor systems, the modularity of the longwall system and control allow the longwall to operate in “fault-tolerant” mode, even when there is a problem with the overall automation system. In other words, integrated automation does not prevent control via individual PLCs in order to keep production up and running.

The Net is the Control

The shearer control system uses a state-of-the-art Ethernet bus, resulting in a drastic reduction in wiring and a huge increase in flexibility. There are no interfacing problems, as equipment connected to the network only needs to be able to communicate via Internet Protocol. Commissioning, maintenance, upgrades and troubleshooting are much easier and faster, and equipment is self-configuring. The few cables that are used are standard Ethernet cables rather than application-specific cables – cutting costs and simplifying spare parts inventories.

Flameproof housings are no longer required, simplifying installation and speeding up maintenance. New modules are based on standardized CIOS™ modules (configurable input output system), resulting in a plug and play approach to upgrades. No reprogramming is necessary.

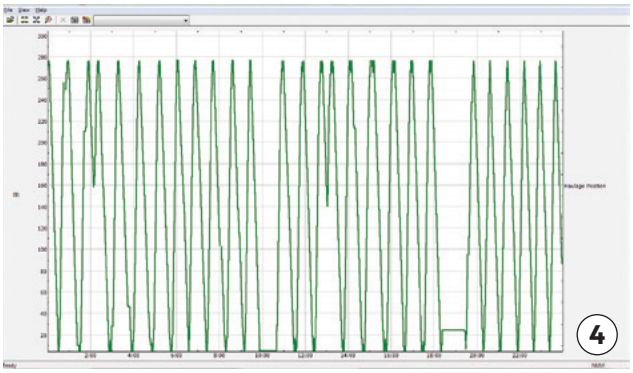
Remote control and diagnosis are also possible for all components. And because of the Ethernet-based approach, the failure of one component does not impact the whole system.

Intrinsic Safety

More components designed to be intrinsically safe means simpler installation and speedier maintenance. New modules are based on standardized CIOS™ modules, resulting in a plug and play approach to upgrades. Changes to the system only require commissioning changes – such as mounting and connection of sensors. No replacement of control software is required. Remote control and diagnosis are also possible for all components. And because of the Ethernet-based approach, the failure of one component does not impact the whole system. This not only supports the unique “fault- tolerant” mode, which allows the longwall to continue to operate when there is a problem with the overall automation system, but also, through systematic isolation, allows faulty units to be identified while production continues.

PMC™ EVO-S OFFERS RELIABILITY FROM DAY ONE

- Robust cables and plugs
- Minimized cabling due to network approach
- Vibration-tested components
- Designed for the working environment



2) Color display
3) Intrinsically safe CIOS™ block with state-of-the-art Ethernet communication
4) Consistent performance using advanced automation

CONDITION MONITORING

MAXIMUM PROTECTION FOR MACHINE COMPONENTS

Visualization

Visualization not only provides a graphical representation of current operating conditions, but can also display historical conditions and a graphic display of trends. An automated longwall is a highly complex system with many interacting components generating time-variant data. Visualization gives operators a better understanding of the overall system, allowing them to further optimize operations. VLongwall provides a system overview and access to the dedicated visualization modules VShield, VDrive, VPlow and VShearer. It also gives access to VTrend for trend analysis and VGraph3D for waterfall plots of the entire longwall.

VibraGuard™

VibraGuard™ allows trained personnel to predict machine component wear, avoid unplanned downtime and set alarms to warn the operator if monitored machine components run the risk of damage. This comprehensive protection backs long life and high availability of your valuable mining equipment.

- Permanent online monitoring and protection of equipment instead of sporadic offline measurements
- Assists in the prediction of machine component wear
- Alarms warn the operator if monitored components are at risk of damage
- When utilized by trained personnel, VibraGuard™ makes repairs predictable and helps avoid unplanned downtime
- Repair work can be done largely without stress
- Allows timely procurement of spare parts
- Transfers data to a surface control center PC for detailed analysis and evaluation

MODULAR CONTROL

OFFERING FLEXIBILITY AND POWER

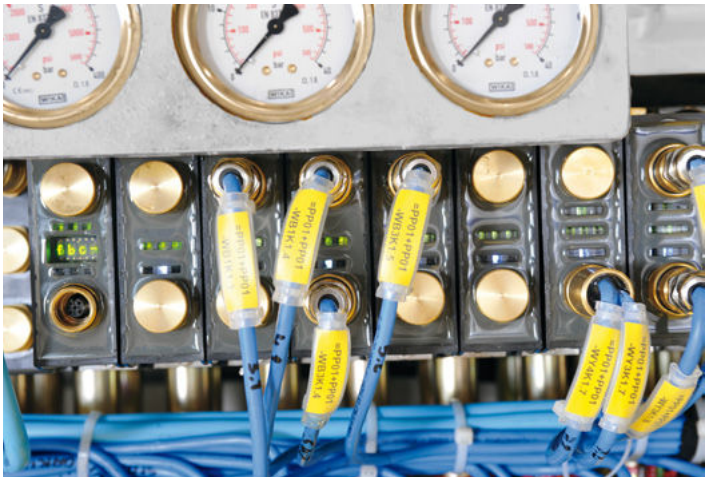
PMC™ Evo-S brings state-of-the art processor performance underground. Designed by the market leader in shearer automation, the advanced HBT automation package allows improved utilization of manpower in a safe environment; with increased yield from any given seam section, faster haulage speeds, improved face management and increased life of all longwall equipment, including AFC and shields.

Automation systems match your needs – from basic to highly sophisticated – while remaining easy to install, operate and maintain. The modular control concept is:

- Easily expandable based on modular design
- Ready for integration of highly sophisticated technologies and devices
- Equipped for XML-based interfaces to third- or fourth-party systems

MAKING IT EASY

- HBT self-configuring controls and standard interfaces such as Ethernet allow quick and easy system configuration changes with no programming effort
- Ready for future technologies such as high-quality condition monitoring, including vibration monitoring
- Easy and flexible adaptation to existing data environments
- Greater use of Ethernet, standard connectorization and PMC™ control family mean greater simplicity, reduced spares inventories and shorter downtimes
- Standardization and modularization allow quick and easy customization of components and systems



Intrinsically safe CIOS™ block with remote access down to I/O level

FAST TROUBLESHOOTING

- Widespread use of intrinsically safe components allows large-scale fault diagnosis under power
- Remote access to most components down to I/O level
- Diagnosis from surface or by HBT Mine Control Center
- Managed switches and field bus coupler (FBC) allows selective routing:
  - Permits sequential disable and enable of components and/or communication routes
  - Isolation of faulty units until next repair shift allowing production to continue

LESS MAINTENANCE EFFORT

- Widespread use of intrinsically safe components in PMC™ Evo-S reduces time-consuming opening of flame-proof housings in the event of faults.
- Quick and easy exchange of modules.

MODULARITY IS STRENGTH

Modularity is a key feature of the HBT shearer. It results in independent major units, each driven by its own dedicated electric motor and housed within or attached to a robust mainframe unique to the HBT range. Control systems are also modular.

This modular design offers maximum availability – through “fault-tolerant” mode operation – and the flexibility to meet even the most demanding customer requirements by upgrading components such as the ranging arm.

EL1000

For low seam shearer applications the most compact HBT solution yet will be there to deliver the results you expect: the HBT EL1000. This latest addition to the successful range of HBT longwall shearers will cover seam heights from 1.6 to 3.2 m (63 to 126 in). A compact powerhouse for high productivity the EL1000 shearer makes maximum impact in low and medium seams:

- Cutting power: 2 × 500 kW (1,600 hp)
- Haulage power: 2 × 100 kW (2 × 134 hp)
- Covering seam heights from 1.6-3.2 m (63-126 in)

EL2000

The EL2000 incorporates all the features and benefits that have been established with the HBT shearer range in a compact, rugged machine designed to meet the demands of high productivity in low- to medium-seam applications from 1.80 to 4.50 m (70 to 177 in). High installed power is a feature of the EL2000 shearer, with up to 750 kW (1,200 hp) in a compact design. The haulage system is tailored to the needs of high-productivity medium-seam applications with up to 125 kW (200 hp) AC drives.

BENEFITS:

- High level of structural integrity provided by the unique HBT shearer mainframe design
- Maximized coal cutting and coal clearance ability
- Advanced automation for optimized performance and improved face management

THE HBT SHEARER PRODUCT LINE
COVERING VARIOUS SEAM HEIGHTS

EL3000

The EL3000 shearer has been developed for medium to high seams to meet the requirements of the most demanding longwall installations in the world. World-class performance has demonstrated the practical capabilities of this machine. The EL3000 shearer mines seams of up to 5.50 m (216 in).

It offers 2 × 860 kW (1,150 hp) of cutting power combined with haulage motors of up to 2 × 150 kW (201 hp), with a 75 kW (100 hp) pump motor to provide a total installed power in excess of 2000 kW (2,681 hp) and a production capacity of over 5000 tonnes per hour (5,511 tons per hour). Some of the highest-producing longwall installations in the USA and Australia utilize HBT shearers.

BENEFITS:

- High level of installed power provides high level of performance in the most arduous mining conditions
- AC haulage system capable in excess of 100 tonnes (110 tons) haulage force
- Heavy-duty, high mass for maximum stability and reliability in the most demanding applications

TECHNICAL DATA

Model Series	EL1000		EL2000		EL3000	
Height Range	1.6-3.2 m	63-126 in	1.80 m-4.50 m	71-177 in	2.50 m-5.50 m	98-217 in
Typical Machine Length	13 635 mm	44.7 ft	13.75 m	45.1 ft	15.20 m	49.9 ft
Installed Power	Up to 1230 kW	Up to 1,916 hp	1900 kW	3,040 hp	2295 kW	3,680 hp
Available Cutting Power	2 × 500 kW		2 × 500 kW 2 × 620 kW 2 × 750 kW		2 × 650 kW 2 × 750 kW 2 × 860 kW	
Cutting Drum Diameter	1524 to 2000 mm	60 to 78 in	1.40 m-2.30 m	55-91 in	Up to 2.70 m	Up to 106 in
Haulage System	AC		AC		AC	
Available Haulage Motors	2 × 100 kW	2 × 134 hp	2 × 125 kW	2 × 200 hp	2 × 150 kW	2 × 240 hp
Haulage Speed	Up to 29.5 m/min	Up to 97 ft/min	Up to 32 m/min	Up to 105 ft/min	Up to 32 m/min	Up to 105 ft/min
Haulage Pull	Up to 732 kN	Up to 82 tons	Up to 920 kN	Up to 100 tons	Up to 1075 kN	Up to 120 tons
Coal Sizer	100 kW	160 hp	100 kW	160 hp	200 kW	320 hp
Pump Motor	30 kW	48 hp	50 kW	80 hp	75 kW	120 hp
Machine Weight – Approximate	60 tonnes	66 tons	70 tonnes	77 tons	105 tonnes	116 tons
Body Height	530 mm	21 in	520 mm	20.5 in	685 mm	27.0 in
Operating Voltages	3300V, 4160V		2300V, 3300V, 4160V		3300V, 4160V	
Applicable Minimum Pan Width	832 mm	32.7 in	1032 mm	40.6 in	1132 mm	44.6 in

OPTIONAL ACCESSORIES

Model Series	EL1000	EL2000	EL3000
Multi-piece Mainframe	○	○	○
Cowl	○	○	○
Spall Guards	○	○	○
Coal Sizer			
100 kW (134 hp)	○	○	○
200 kW (268 hp)	○	–	○
Trapping Shoe Ix	●	●	●
Insert Exchange	○	○	○
Shearer Clearer	○	○	○
Spray Bars	○	○	○
Central Lubrication System	●	●	●
PMC™ Evo-S	●	●	●
Gate End Data Connection			
Powerline	●	●	●
Fibre Optics	○	–	○
WLAN	●	●	●
IPC	○	○	○
Zone-based Automation “Navigator 1”	○	○	○
State-based Shearer Automation “Navigator 2”	○	○	○
Integrated Longwall Automation with “Navigator 2 + 3”	○*	○*	○*
“Longwall Navigator” for Improved Face Alignment and Horizon Control Incorp. LASC Tech.	○*	○*	○*
VibraGuard™	○	○	○
Cameras	○	○	○
Condition Monitoring	○	○	○

● Standard equipment ○ Available equipment ○* Only with HBT longwall equipment

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