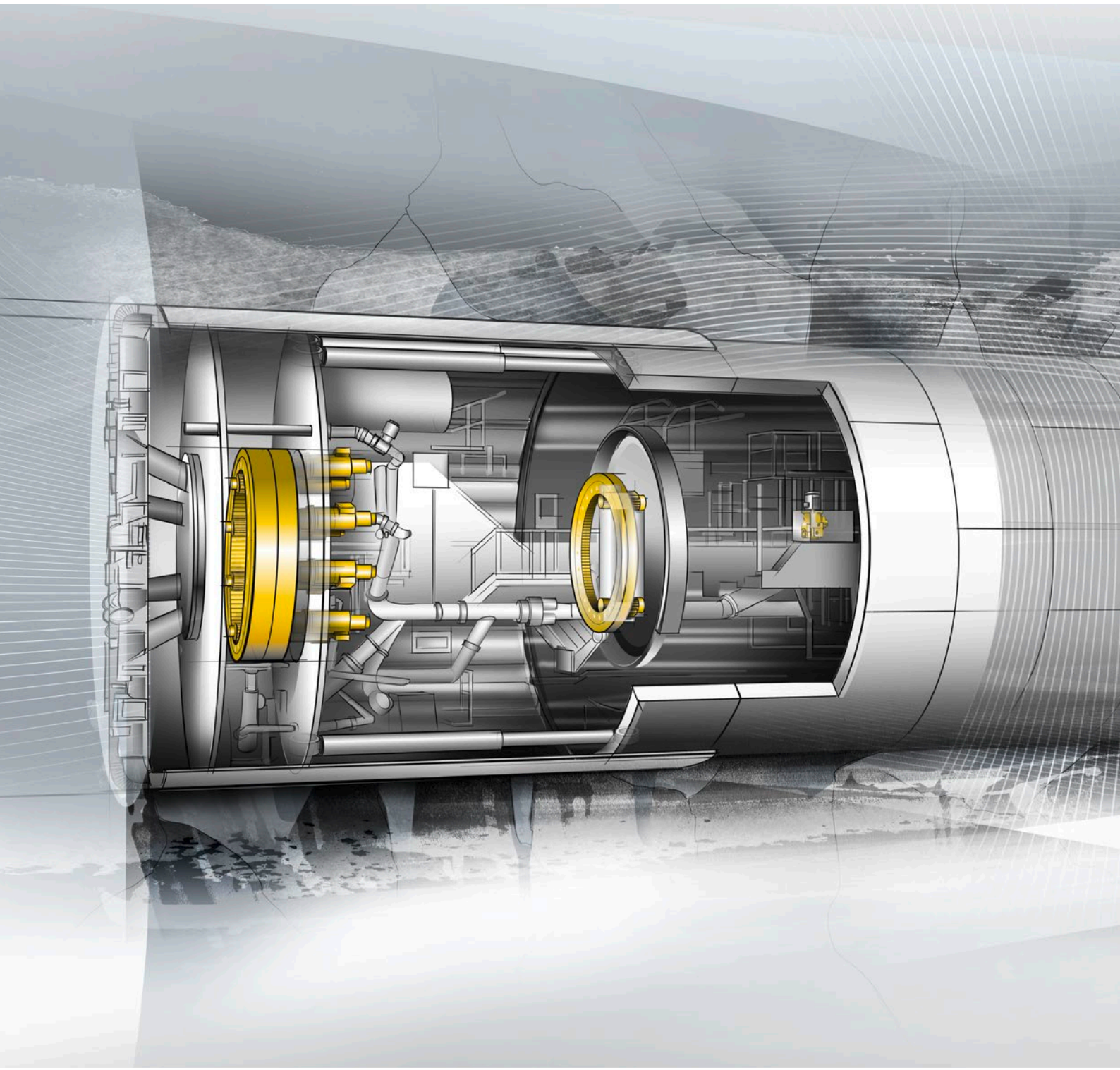
Advanced Tunnel Technology

Components for Tunnelling Machines



LIEBHERR

A strong Partner for Tunnelling Applications

Components for Tunnelling Machines

Liebherr is one of the world‘s leading manufacturers of components for construction machinery, maritime applications and other sophisticated fields. Components by Liebherr have been used in tunnelling projects around the world for several years now. Thereby we have more than 60 years of experience in the development, design and manufacture of these products. Since then, the factories in Biberach an der Riss, Germany, in Bulle, Switzerland and in Dalian, China, have been producing for worldwide use in the most diverse applications both within and outside the Liebherr Group.

Slewing bearings
Main and Erector Bearings for tunnelling machines

Gearboxes
New LPS Gearbox series for tunnelling applications

Electric motors
Compact KFE series squirrel cage motors drive the gearboxes

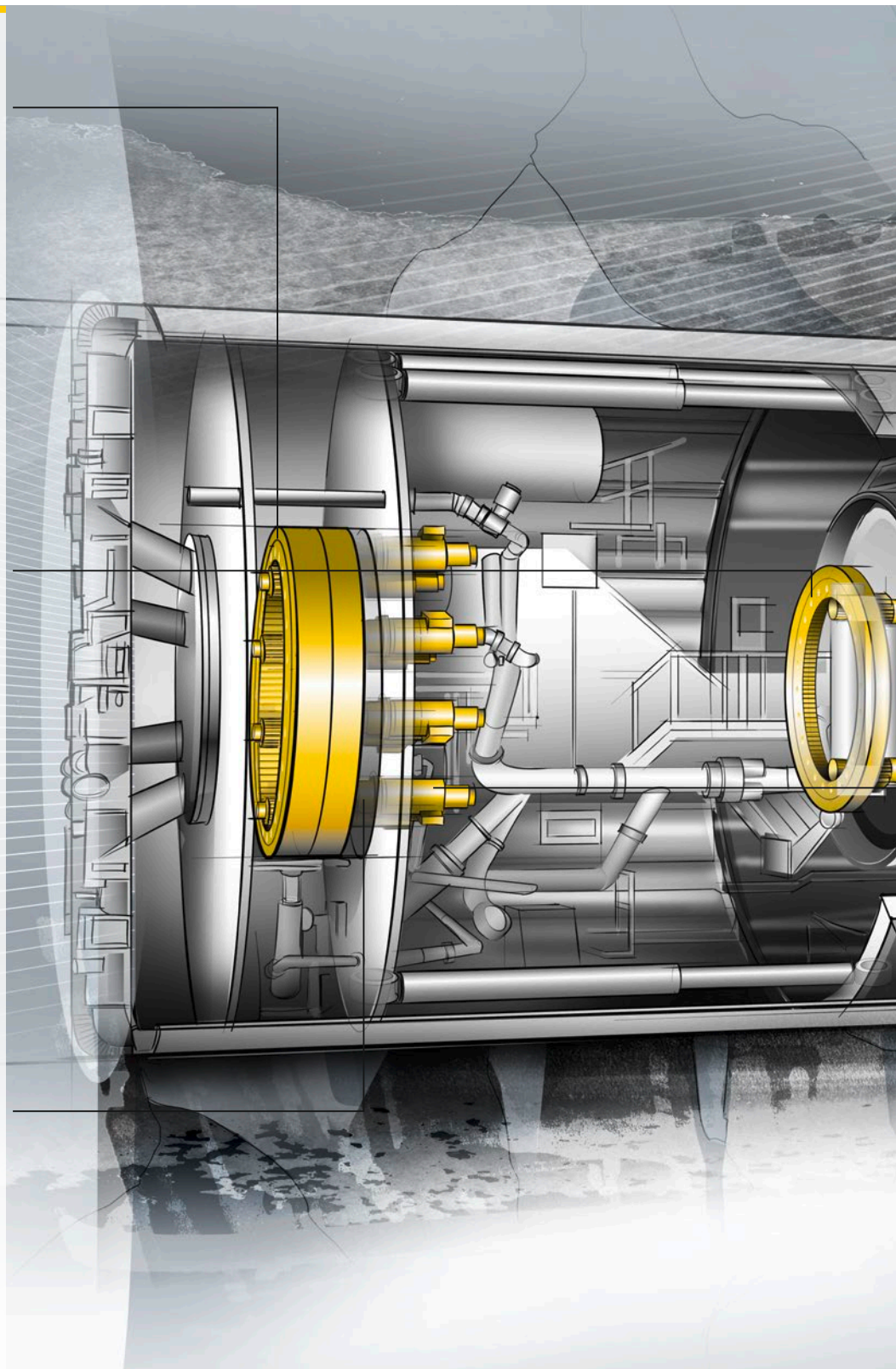
Axial piston pumps
Liebherr axial piston pumps with proven and robust design

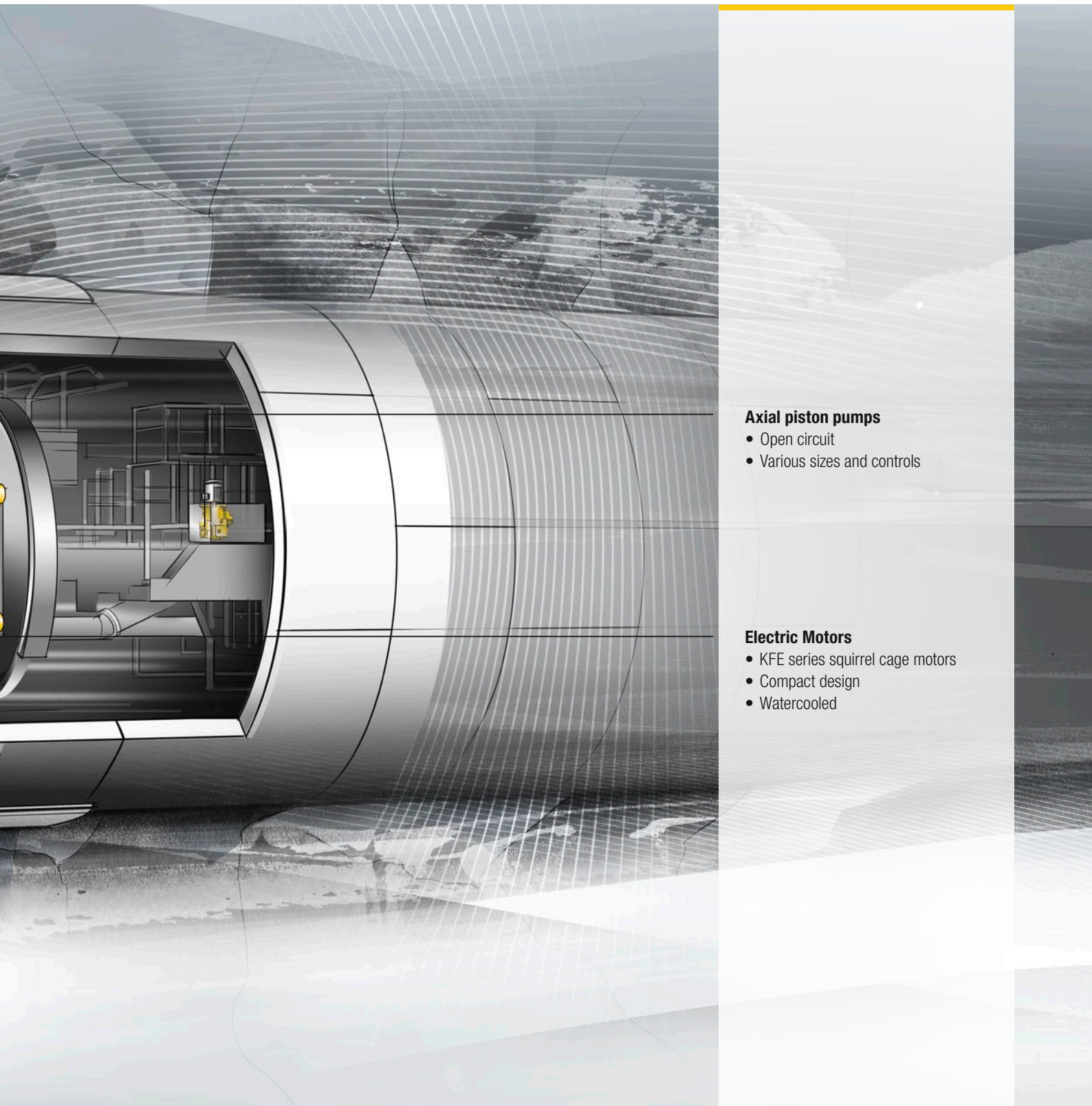
Liebherr Components for Tunnelling

Main Bearings
- Three-row cylindrical roller bearings
- Double-row tapered roller bearings

Erector Bearings
- Single-row four-point bearings
- Cross-roller bearings

Gearboxes
- Modular construction
- Different sizes
- Integrated water cooling

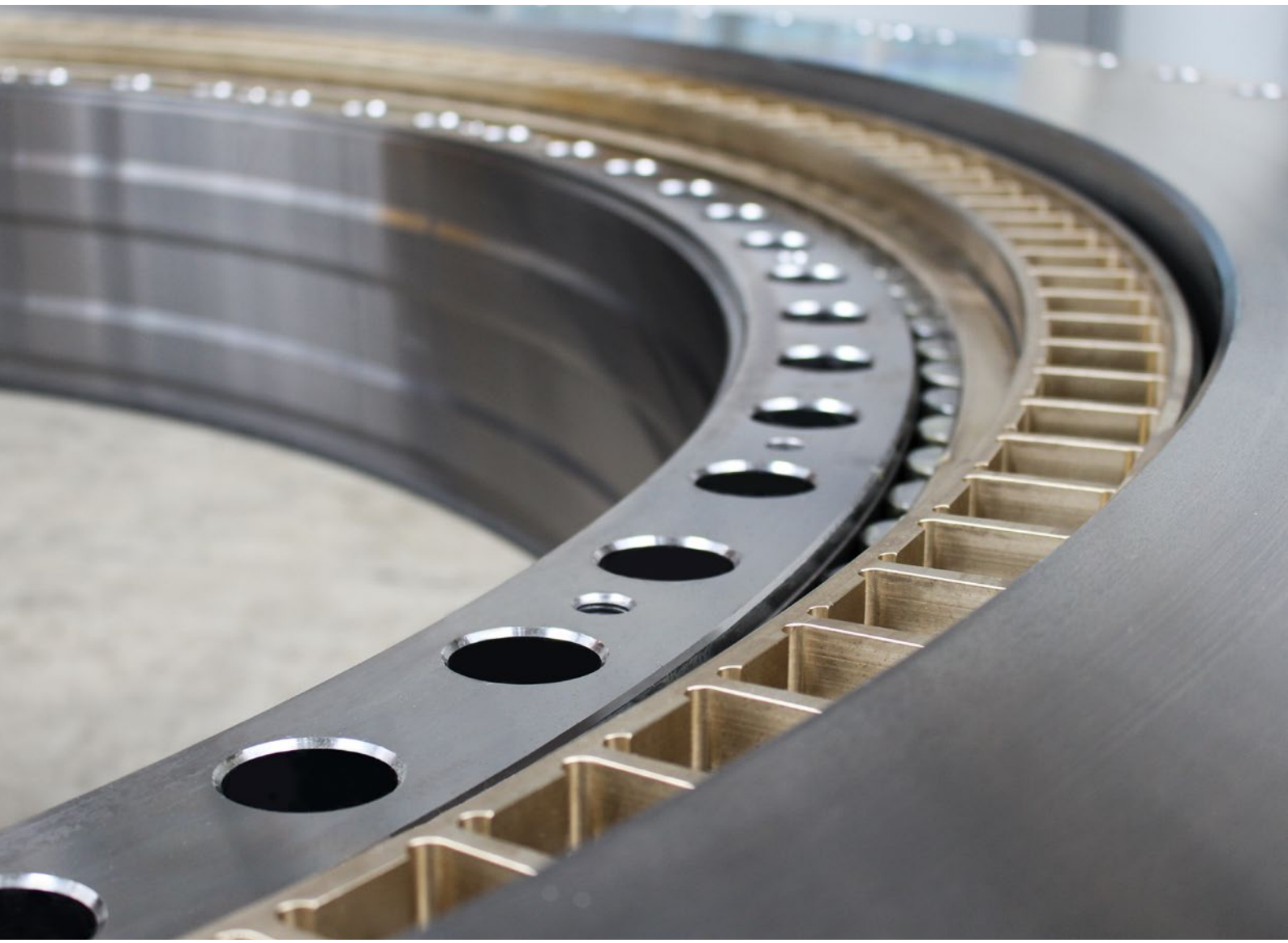




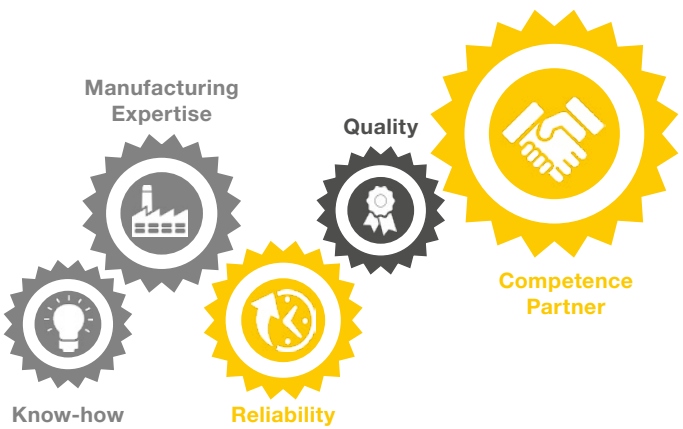
Axial piston pumps
- Open circuit
- Various sizes and controls

Electric Motors
- KFE series squirrel cage motors
- Compact design
- Watercooled

Main and Erector Bearings for Tunnelling Machines



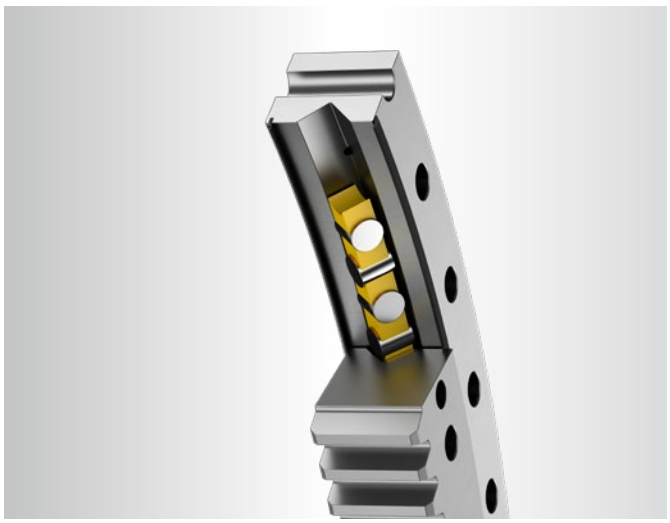
Liebherr - Your Bearing Competence Partner
Relying on our outstanding bearing know-how and advanced engineering methods our customers are used to receive detailed engineering support to identify the best solution according to specific project requirements.
Our success factors are high engineering competence, reliable products as well as high production and service standards. All parameters combined are vital for a successful and long lasting partnership.



The main parts of a tunnel boring machine are a rotating cutting shield, followed by a main bearing, a thrust system and trailing support mechanism. The slewing bearings by Liebherr will be specifically developed for EPB-, Hard rock- and other types of shields. Possible gearing types are external, internal or without gear. The bearings are available in a diameter range of up to 9,000 mm and have been proved in subway projects – for example in Mumbai (India), London (UK) and Qingdao (China).

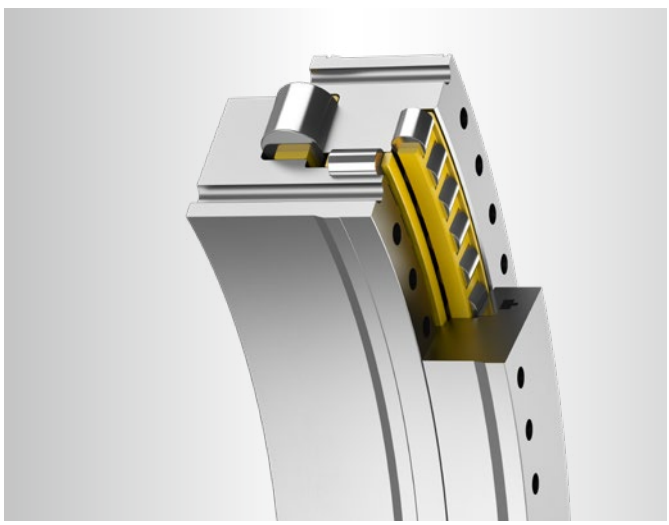
Erector Bearings

Single-row four-point bearings and cross-roller bearings are used for the erector system, to realize the positioning of the lining segments.

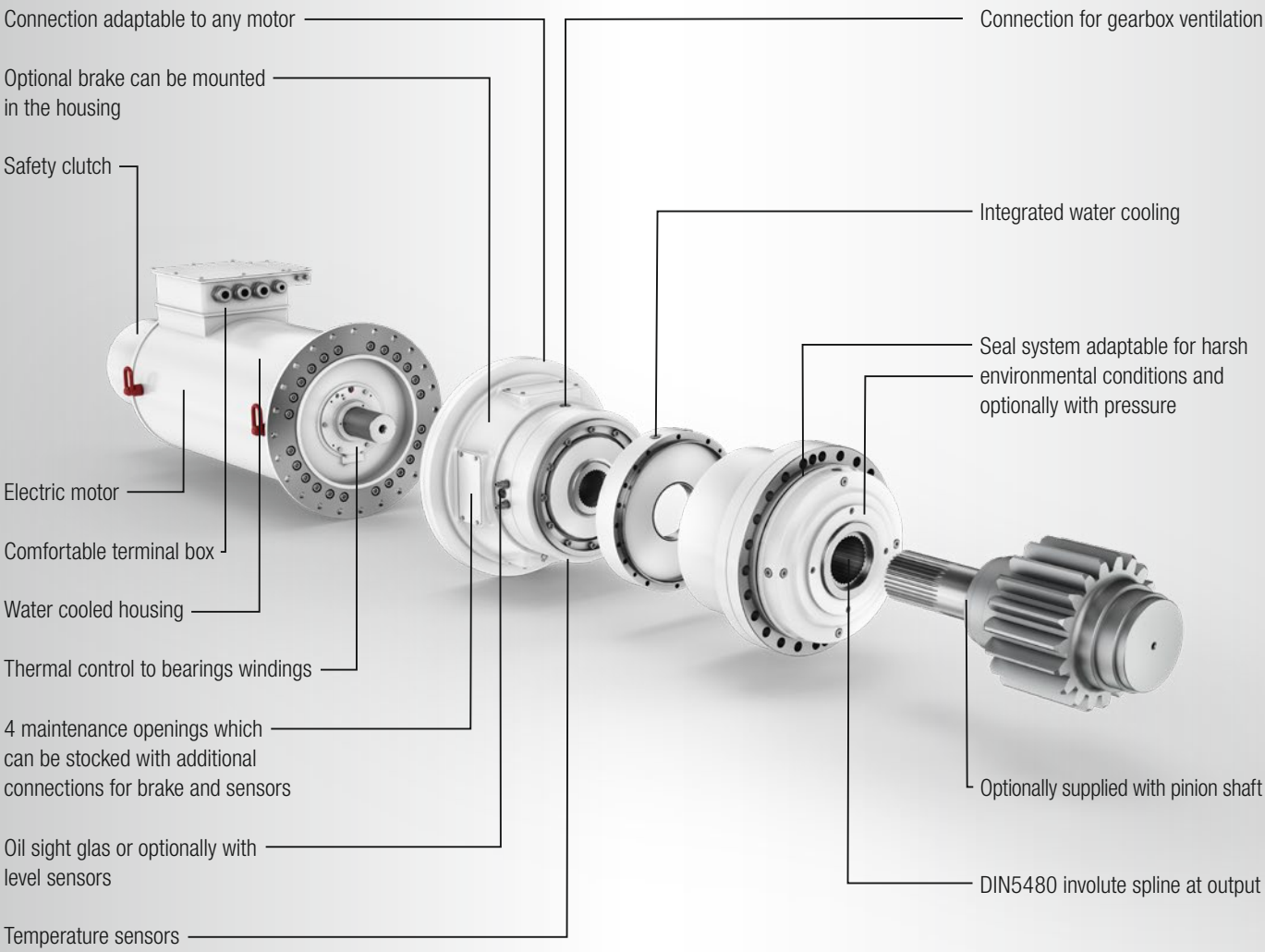


Main Bearings

Main bearings connect the cutter head with the thrust system and carry all the cutter head loads for a secure and continuous operation. Therefore, three-row cylindrical roller bearings are perfectly suited as main bearings. As an alternative, double-row tapered roller bearings can also be offered.



Drive Technology for Tunnelling Machines



Liebherr - Your Partner for Drive Technology
Liebherr's portfolio of components for tunnel construction now also includes the newly developed LPS gearbox series and KFE series squirrel cage motors.

All individual Liebherr components are perfectly matched to each other according to customer requirements and can therefore be used as an integrated drive system, for example for the cutter head in tunnel boring machines.

Gear unit series for Cutterhead Drive

The gearboxes have a modular design and are suitable for dynamic output torques of up to 610,000 Nm. They are equipped with a specially developed cooling system that keeps the temperatures of individual components low. This, in turn, increases the life expectancy of the components and considerably extends the time between oil changes and maintenance intervals.

Liebherr has also developed a sealing system with pressure-resistant seals as an option. This increases operational safety in harsh environmental and operating conditions. The gearboxes can be equipped optionally with oil particle sensors, oil level sensors and temperature monitoring sensors to provide an ultra-rapid and safe overview of the operating conditions.

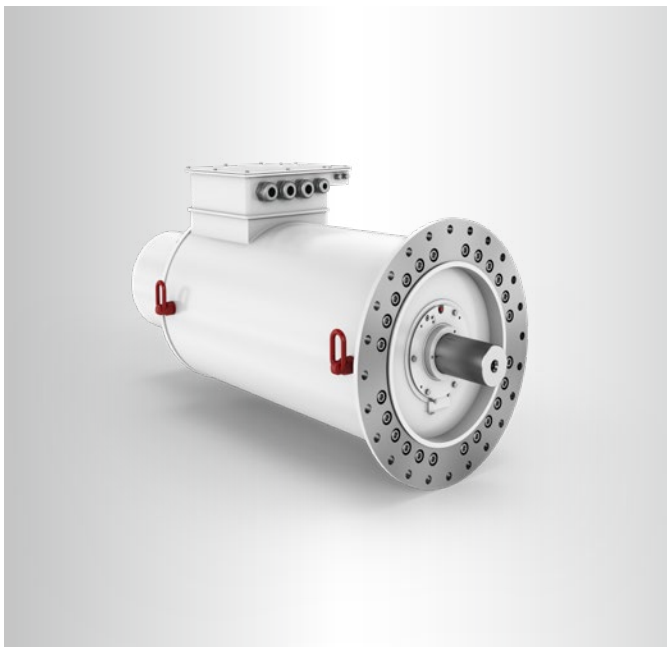
Gearboxes available up to 610,000 Nm output torque

Features and Benefits

- Robust design - designed for harsh operating conditions
- Flexible customer ports / interfaces
- Optional with condition monitoring
- Engineering and service support

Electric Motors for Cutterhead Drive

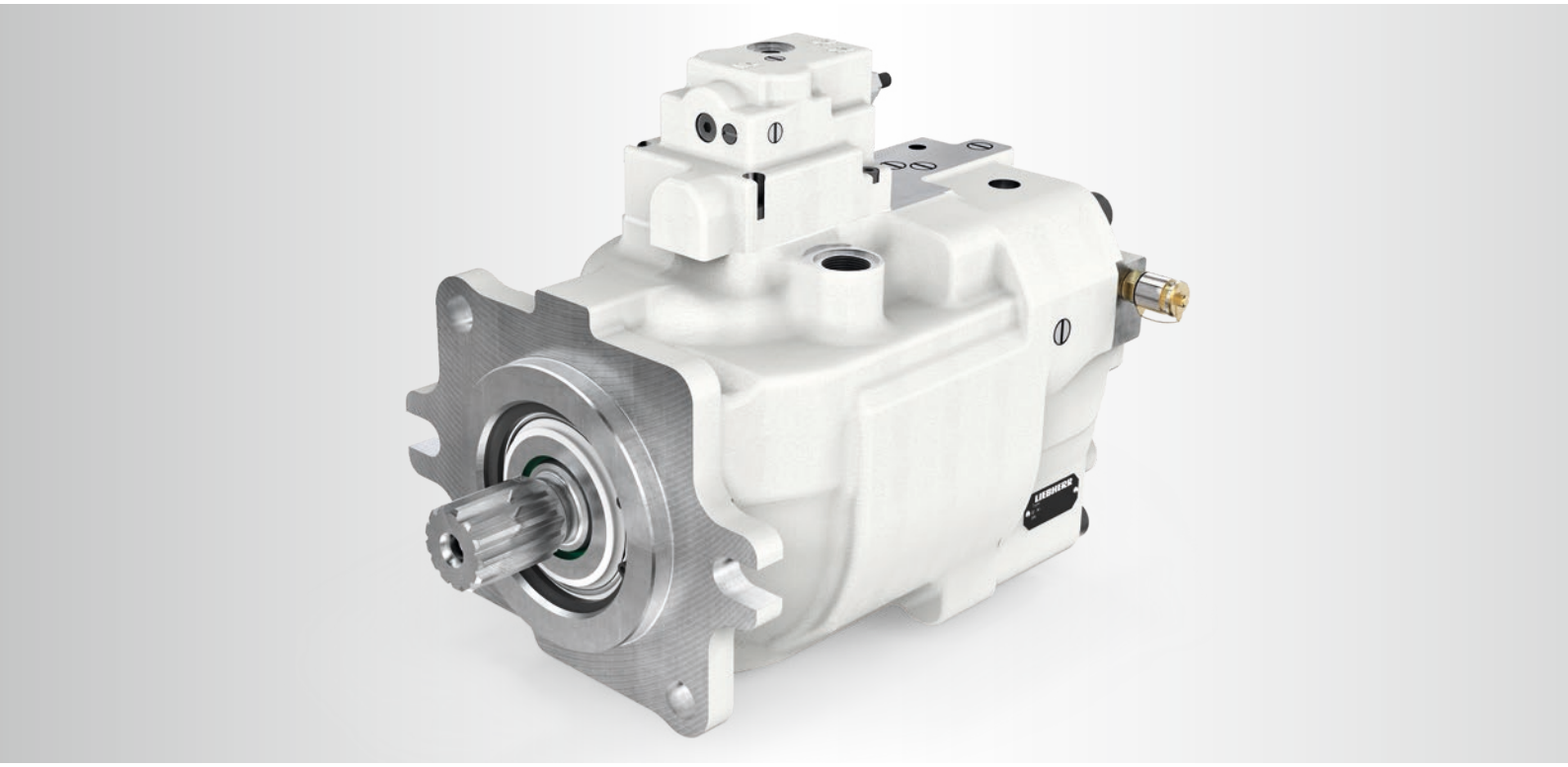
Liebherr will also be expanding the component portfolio for tunnel boring machines with high-performance and compact KFE series squirrel cage motors. The series has been developed according to a modular system and meets all customer requirements. With optimised water cooling, the motors are highly efficient and have high performance, even in the smallest sizes. The power range of the machines is between 50 kW and 400 kW and is available in different voltage categories. Due to the experience in applications with high shock and vibration loads, Liebherr's electric machines are ideally prepared for use in tunnel boring applications.



Features and Benefits

- Power range 50-400 kW
- Voltage range 400-690 V
- Highly efficient
- Water cooled squirrel cage motor
- Compact design
- Shock and vibration resistant

Hydraulic Pumps for Tunnelling Machines



Following its successful implementation in a variety of mining applications, the Liebherr axial piston pump DPVO series has also proven itself for tunneling machines. Given their robust and long-lasting built, the Liebherr pumps can withstand the harshest environments and work their way through kilometers of soft and hard rock with ease. Thanks to these features combined with the pumps high reliability and availability, Liebherr was able to win a contract with one of the worldwide market leaders in tunnelling technology.

Suited for tunnel boring machines with a diameter of up to 6 meters, these variable displacement pumps are available in nominal sizes ranging from 108 to 215. The nominal pressure of the unit is 400 bar and the peak pressure is 450 bar. The open circuit pumps with inverted piston designs were specifically developed for high-pressure applications.

With an unique 22° swivel angle, a high nominal pressure and a 100 percent through-drive capability, these pumps are extremely efficient and reliable. The DPVO series is available with a variety of hydraulic and electric controls. In nominal size 215, the variable displacement pump is also available with impeller, allowing higher self-suction speed and higher displacement.

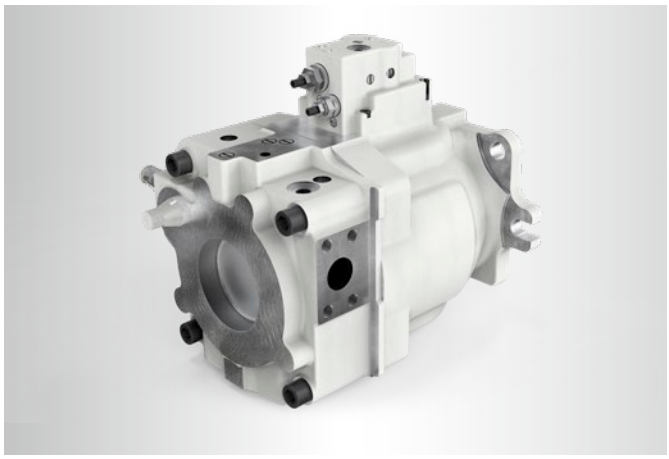
Valid for:
DPVO 108
DPVO 140
DPVO 165
DPVO 215

Features:
Variable displacement
Open circuit
Robust design

Controls:
Various controls can be selected

Pressure range:
Nominal pressure pHD_N = 400 bar
Maximum pressure pHD_{max} = 450 bar

Features



Size 108*

Max. speed	2,100 rpm at $V_{g\,max}$
Drive power	151 kW at Δp = 400 bar
Max. through-drive torque	1,265 Nm

Size 140*

Max. speed	2,100 rpm at $V_{g\,max}$
Drive power	196 kW at Δp = 400 bar
Max. through-drive torque	1,830 Nm

Size 165

Max. speed	2,100 rpm at $V_{g\,max}$
Drive power	235 kW at Δp = 400 bar
Max. through-drive torque	1,950 Nm

Size 215 impeller boosted

Max. speed	2,600 rpm at $V_{g\,max}$
Drive power	375 kW at Δp = 400 bar
Max. through-drive torque	2,200 Nm

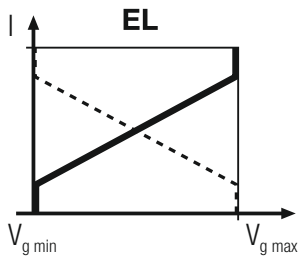
Size 215

Max. speed	2,000 rpm at $V_{g\,max}$
Drive power	289 kW at Δp = 400 bar
Max. through-drive torque	1,810 Nm

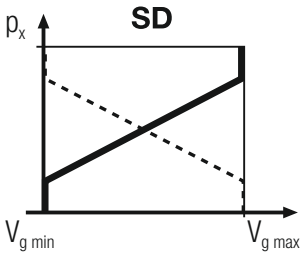
*For nominal sizes 108 and 140, a high speed version, max. speed at $V_{g\,max}$ = 2,300 rpm, is available. Values upon request.

Note:
Different mounting flanges are possible SAE or ISO, shafts in SAE or DIN available. Integrated gear pump for control pressure is optional. Through-drive for pumps up to the same size as the installed pump is possible.

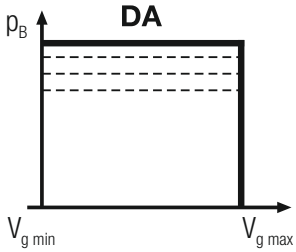
Controls
Other functions and combinations upon request



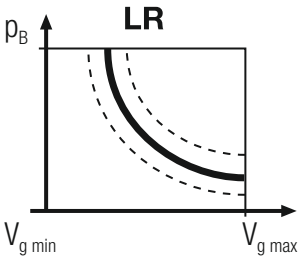
Electric proportional adjustment with positive or negative characteristic



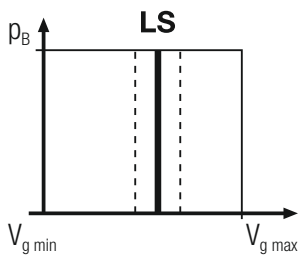
Hydraulic adjustment proportional to control pressure with positive or negative characteristic



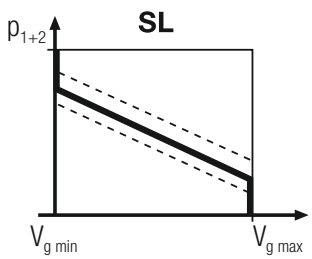
Pressure control



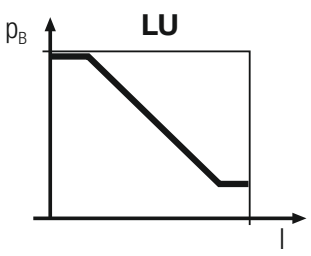
Hyperbolic power control



Load Sensing

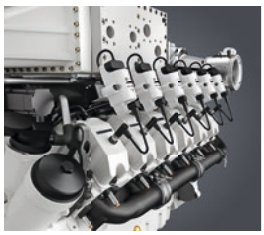


Summation power control

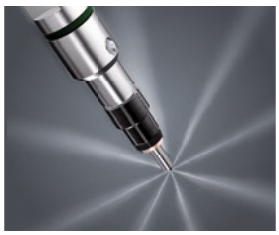


Electric proportional pressure control/fan drive

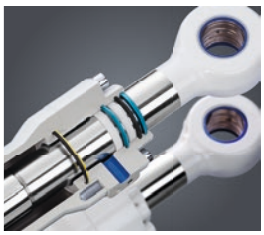
Liebherr Components


Gas engines


Diesel engines

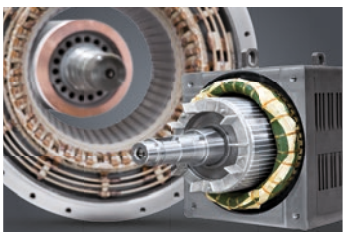

Fuel injection systems

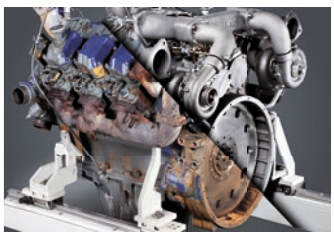

Axial piston hydraulics


Hydraulic cylinders

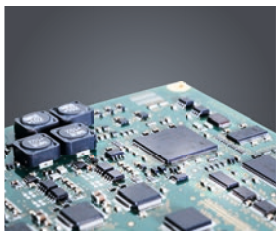

Slewing bearings


Gearboxes and winches


Electric machines


Remanufacturing


Human-machine interfaces and gateways


Control electronics and sensor technology


Power electronics


Control cabinets


Software

From A to Z – the components division of the Liebherr Group offers a broad range of solutions in the area of mechanical, hydraulic, electric and electronic drive system and control technology. The efficient components and systems are produced at a total of ten production sites around the world to the highest standards of quality. Central contact persons for all product lines are available to our customers at Liebherr-Components AG and the regional sales and distribution branches.

Liebherr is your partner for joint success: from the product idea to development, manufacture and commissioning right through to customer service solutions like remanufacturing.

components.liebherr.com

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