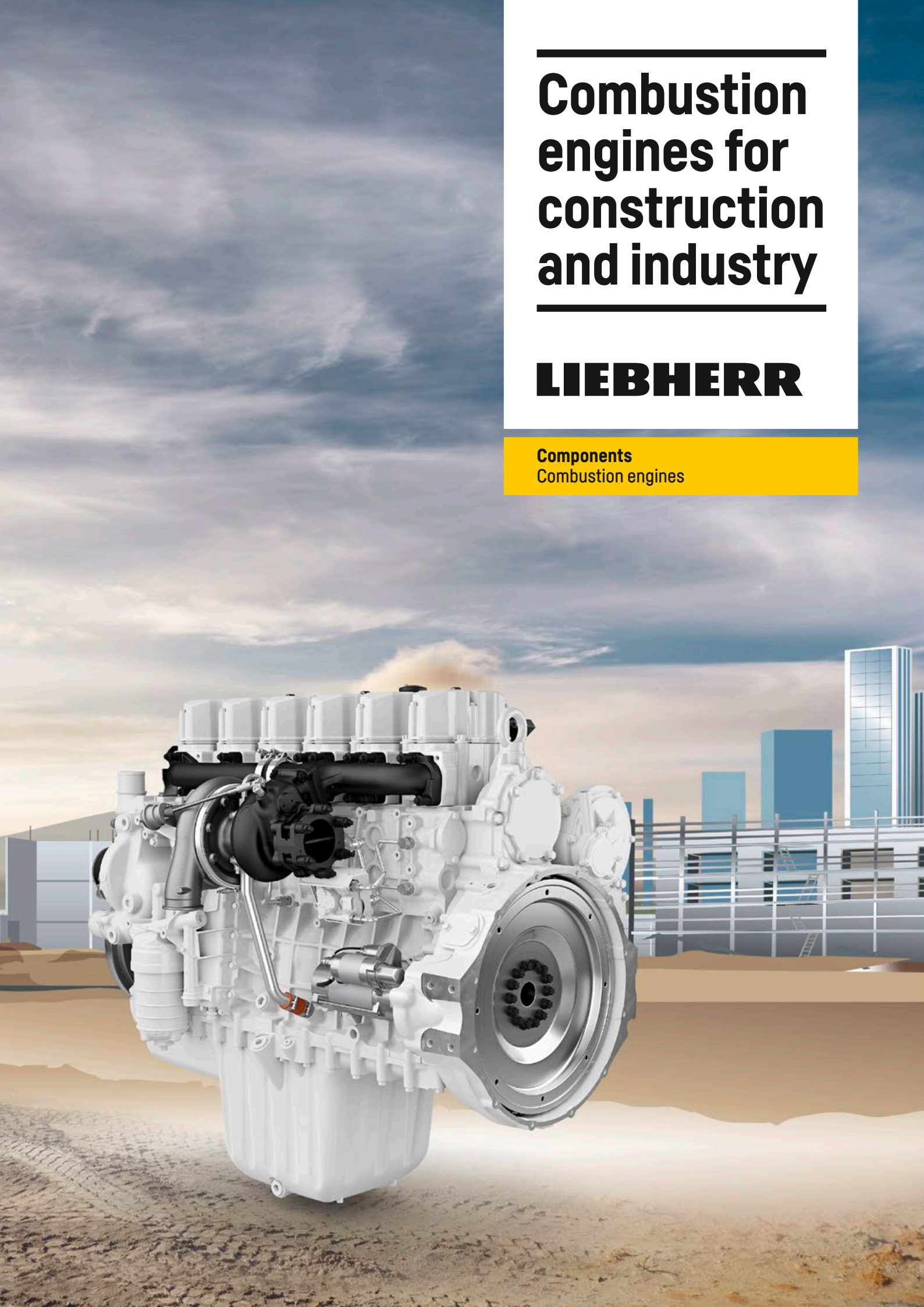
Combustion engines for construction and industry

LIEBHERR

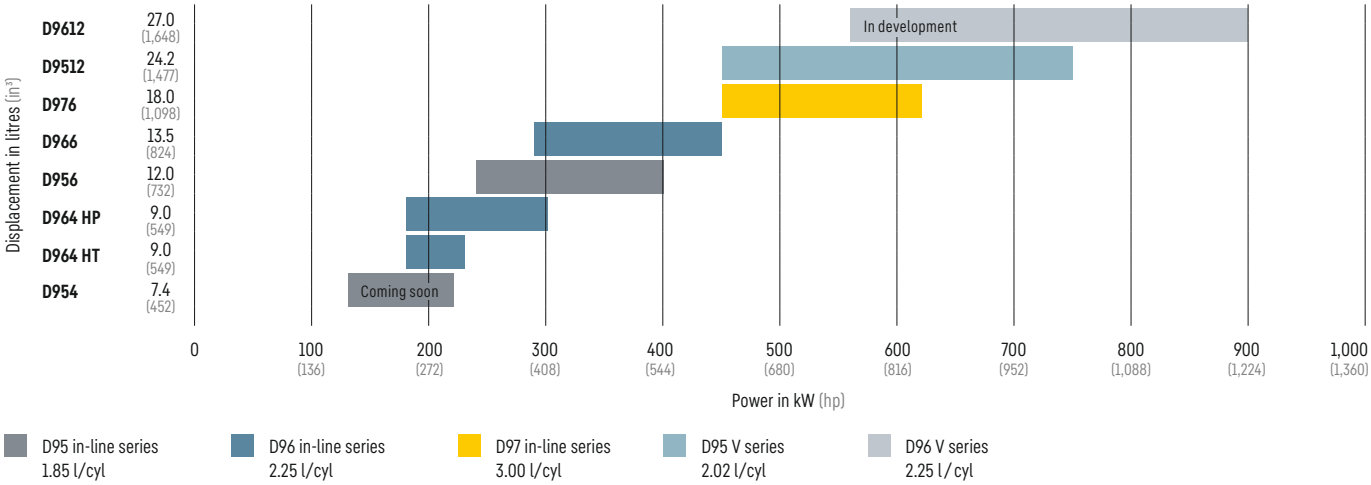
Components
Combustion engines



Combustion engines for construction and industry

Liebherr is your perfect partner for heavy duty engines for construction and industrial equipment. Building tough engines for these applications is part of our identity. Our dedicated engines have a robust and sturdy design resulting in long engine life. This makes them the most reliable engines for C&I. Our customers require tough, reliable and economic engines. Our modular system allows our engines to be tailored to our customers' requirements, while complying with emission regulations.

Power range



Application know-how

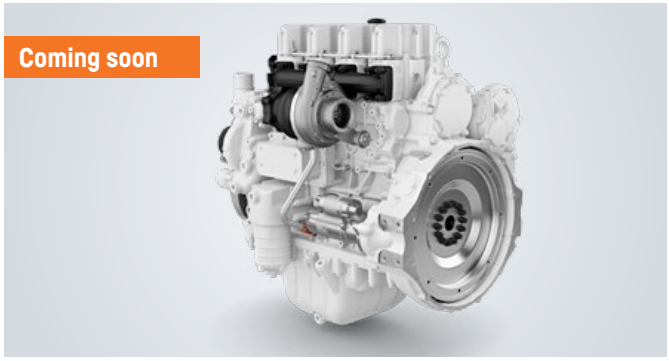
Our combustion engines have been specially developed for use in off-road applications. They are perfectly suited to the toughest environmental conditions and are thus ideal for a large variety of industries and applications. Since 1984, our units have proven their efficiency in Liebherr construction machinery such as crawler and wheeled excavators, wheel loaders, crawler tractors and dozers, mobile and crawler cranes as well as maritime cranes. Liebherr as an engine manufacturer has developed a very deep knowledge and know-how of integrating its engine in the construction and industry segments. A growing number of customers have decided to trust us to be the engine of their success. They value our power units because of their performance capability, reliability, and low total cost of ownership (TCO).

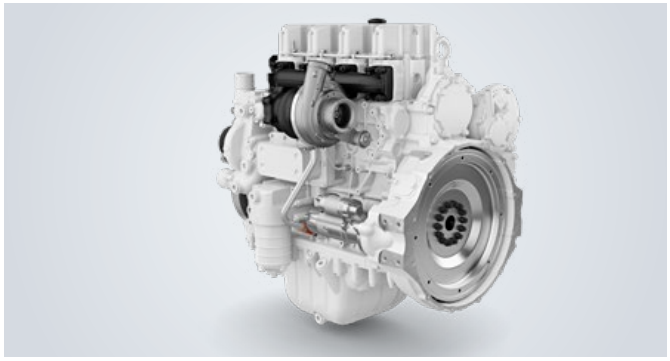
Mastering components

In addition, our engines have outstanding low oil and fuel consumption. This is achieved by selecting high-performance key components that have been developed in-house such as Liebherr engine control unit and common rail fuel system.

From 130 – 450 kW

Coming soon





D954

Bore	mm (in)	130	5.1
Stroke	mm (in)	140	5.5
Displacement	l (in^3)	7.4	451.6
Power rating	kW (hp)	130 - 220	174 - 295
Rated speed	rpm (rpm)	1,900	1,900
Peak torque	Nm (lb-ft)	1,423 at 1,300 rpm	1,050 at 1,300 rpm
Dry weight	kg (lbs)	902	1,989
Dimensions (L x W x H)	mm (in)	1,044 x 813 x 1,123	41.1 x 32 x 44.2

D964 High Power (HP) or High Torque (HT) version

Bore	mm (in)	135	5.3
Stroke	mm (in)	157	6.2
Displacement	l (in^3)	9.0	549.2
Power rating (HP) Power rating (HT)	kW (hp) kW (hp)	180 - 300 180 - 230	241 - 402 241 - 308
Rated speed	rpm (rpm)	1,700 - 2,100	1,700 - 2,100
Peak torque (HP) Peak torque (HT)	Nm (lb-ft) Nm (lb-ft)	1,731 at 1,400 rpm 1,965 at 1,100 rpm	1,277 at 1,400 rpm 1,449 at 1,100 rpm
Dry weight	kg (lbs)	975	2,150
Dimensions (L x W x H)	mm (in)	1,048 x 827 x 1,123	41.3 x 32.6 x 44.2

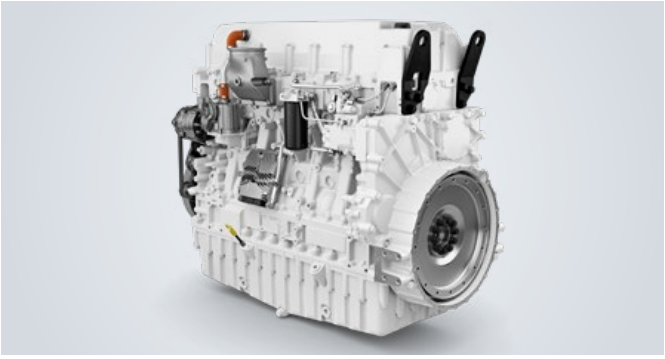
D956

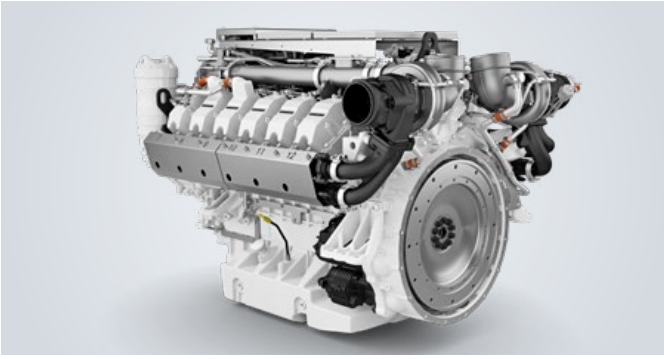
Bore	mm (in)	130	5.1
Stroke	mm (in)	150	5.9
Displacement	l (in^3)	12.0	732.3
Power rating	kW (hp)	240 - 400	322 - 536
Rated speed	rpm (rpm)	1,700 - 2,100	1,700 - 2,100
Peak torque	Nm (lb-ft)	2,516 at 1,400 rpm	1,856 at 1,400 rpm
Dry weight	kg (lbs)	1,176	2,593
Dimensions (L x W x H)	mm (in)	1,369 x 852 x 1,159	53.9 x 33.5 x 45.6

D966

Bore	mm (in)	135	5.3
Stroke	mm (in)	157	6.2
Displacement	l (in^3)	13.5	823.8
Power rating	kW (hp)	290 - 450	389 - 603
Rated speed	rpm (rpm)	1,700 - 2,100	1,700 - 2,100
Peak torque	Nm (lb-ft)	2,767 at 1,400 rpm	2,041 at 1,400 rpm
Dry weight	kg (lbs)	1,169	2,577
Dimensions (L x W x H)	mm (in)	1,369 x 852 x 1,169	53.9 x 33.5 x 46

From 450 – 900 kW



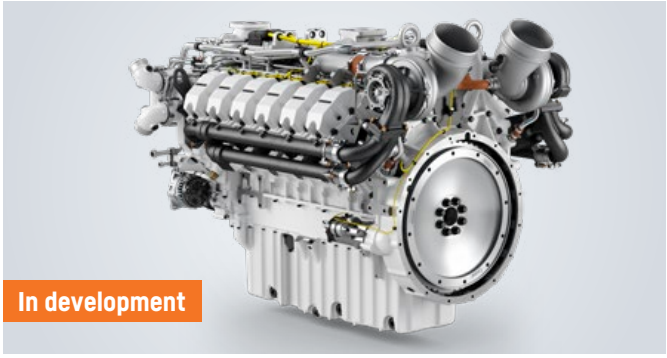


D976

Bore	mm (in)	148	5.8
Stroke	mm (in)	174	6.9
Displacement	l (in^3)	18.0	1,098.4
Power rating	kW (hp)	450 – 620	603 – 831
Rated speed	rpm (rpm)	1,700 – 1,900	1,700 – 1,900
Peak torque	Nm (lb-ft)	4,000 at 1,300 rpm	2,950 at 1,300 rpm
Dry weight	kg (lbs)	1,830	4,034
Dimensions (L x W x H)	mm (in)	1,546 x 1,057 x 1,284	60.9 x 41.6 x 50.6

D9512

Bore	mm (in)	128	5.0
Stroke	mm (in)	157	6.2
Displacement	l (in^3)	24.2	1,476.8
Power rating	kW (hp)	450 – 750	603 – 1,006
Rated speed	rpm (rpm)	1,700 – 2,000	1,700 – 2,000
Peak torque	Nm (lb-ft)	4,774 at 1,500 rpm	3,521 at 1,500 rpm
Dry weight	kg (lbs)	2,150	4,740
Dimensions (L x W x H)	mm (in)	1,869 x 1,226 x 1,183	73.6 x 48.3 x 46.6



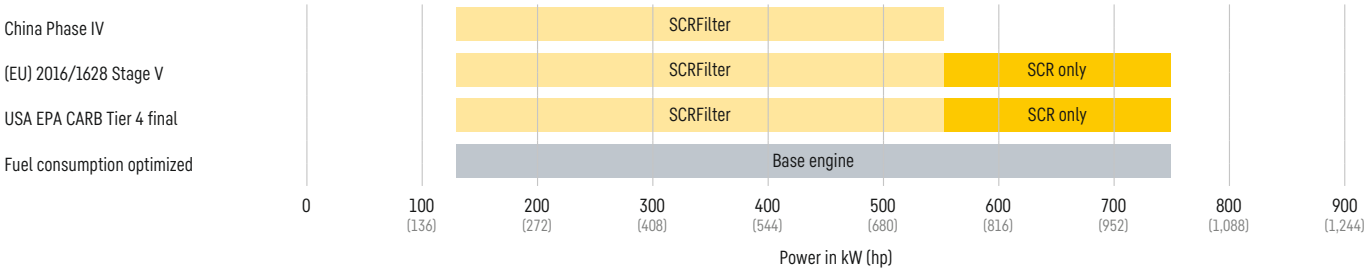
D9612

Bore	mm (in)	135	5.3
Stroke	mm (in)	157	6.2
Displacement	l (in^3)	27.0	1,647.6
Power rating	kW (hp)	560 – 900	751 – 1,207
Rated speed	rpm (rpm)	1,800	1,800
Peak torque	Nm (lb-ft)	5,374 at 1,500 rpm	3,900 at 1,500 rpm
Dry weight	kg (lbs)	2,350	5,181
Dimensions (L x W x H)	mm (in)	2,117 x 1,361 x 1,355	83.3 x 53.6 x 53.3

Emission Standards

With reduced fuel consumption and low emissions, Liebherr's combustion engines are suited to contain environmental impacts and optimize costs. Our exhaust gas aftertreatment systems are adapted to the application and legislative requirements applicable in each region.

Aftertreatment technologies



Model	D954	D964	D956	D966	D976	D9512	D9612
China Phase IV[1]	■	■	■	■			
(EU) 2016/1628 Stage V	■	■	■	■	■	■	■
USA EPA CARB Tier 4 final[2]	■	■	■	■	■	■	■
Fuel consumption optimized	■	■	■	■	■	■	■*

China Phase IV[1]: D956, D964 HP, D966 from Dec. 2022 / D954, D964 HT from Dec. 2023
USA EPA CARB Tier 4 final[2]: D976 from Dec. 2022
* for genset only

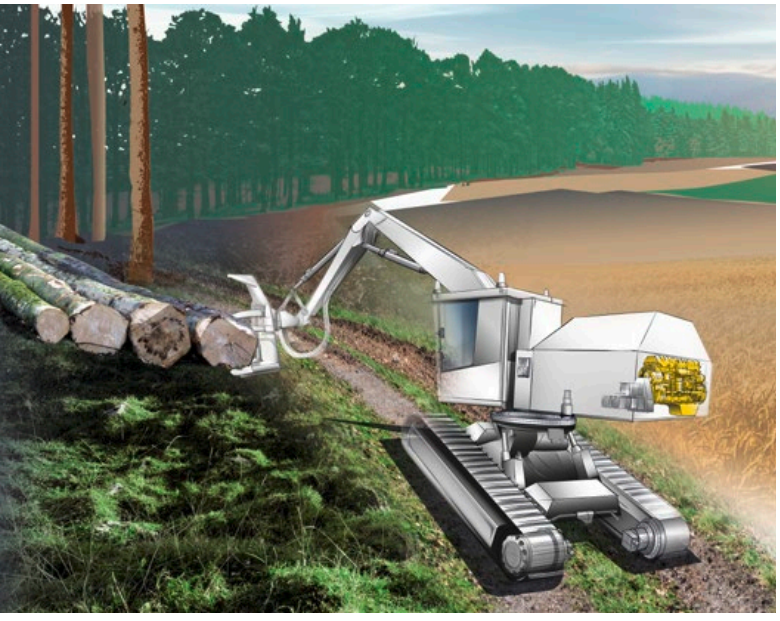
Modular system
Modularity is at the core of Liebherr's combustion engines development: our base engines can be equipped with different exhaust gas aftertreatment systems to meet the required emission standards, including the most stringent global requirements. For Tier 4 final, Liebherr relies fully on an innovative SCR only system, and for Stage V on the SCRFilter system, both inhouse developments. Keywords being: compactness and a low TCO for the end customer. This means that OEMs only require one machine design to comply with all relevant industry Standards and Norms.

Liebherr Vision – 2030

The reduction of global greenhouse gases is one of the biggest challenges of our generation. Striving to reach zero emissions in the future, Liebherr works on alternative and zero-emission power train concepts. Thereby, the Liebherr team pursues an open-technology approach. In the field of combustion, the focus of the research and development activities lies on multiple solutions, depending on the needs different fields of application will show in the future.

Liebherr is convinced that internal combustion engines will remain an important solution for heavy-duty and off-highway vehicles and machines, while responding to the goal of carbon neutrality by 2050. We consider the combustion engine is the most capable power train for the generation of sustainable, high mechanical power under extreme operating conditions in the off-highway industry. Despite impressive developments, other powertrain solutions, such as fuel cells or battery electrics, are not able to operate efficiently and reliably under the harsh conditions which many heavy-duty vehicles are exposed to. Internal combustion engines have met these challenges and requirements for decades, and will remain the primary power train in this sector. Regulations limiting CO_2 emissions from on and off-highway vehicles and machines are getting tighter worldwide. Which is why hydrogen combustion is a straightforward way to decarbonize these engines, with a relatively minor requirement for further technical innovation.

In terms of exhaust emissions, the concern is not the combustion engine, but the fuel that is burned. The challenge then is to find the right fuel and to adapt the engine in a way to produce zero to near zero emissions.



Hydrogen is one of the options, since it is a promising, carbon-free energy and can be burned in the internal combustion engine without producing CO_2 emissions. Hydrogen is colorless, odorless, can be produced from water using renewable electricity. It holds a great potential in reaching the zero emissions destination.

Liebherr has made a significant investment into the development of the hydrogen combustion engine and test facilities recently. Prototype engines are being tested since 2020 and are providing promising results in terms of performance and emissions. Injection technologies, such as port fuel injection (PFI) and direct injection (DI), are being further developed and tested. We have had prototype machines equipped and running with these hydrogen injection solutions since 2021.

On the road to zero emission, Liebherr is continuously investigating and looking for the best combustion technologies. Some additional solutions and research activities are already ongoing and should enable an even more stable combustion, resulting in very high power density.

Liebherr thinks globally when it comes to reducing emissions and examines different technologies and fuels. Hydrotreated Vegetable Oils (HVO) is particularly interesting because it is an already available, interim technology. Liebherr's entire line of combustion engines are validated and approved for use with HVO fuels providing a simple and efficient alternative to diesel.

In older construction, machines with diesel engines, which are often in use even longer in many regions of the world emissions, can also be reduced significantly with HVO as a diesel admixture – a further contribution to reducing climate change.

The advantages that present HVO are numerous:

- The use of HVO requires no modification and is compliant with fuel system components.
- The HVO has a very good low temperature resistance.
- HVO enables the reduction of Ad blue use.
- HVO decreases nitrogen oxides and soot particle emissions.
- HVO can be mixed with diesel for use in conventional internal combustion engines.

HVO fuels that comply with standard EN15940 with a base of hydrogenated vegetable oils can make a valuable contribution to reducing global emissions of greenhouse gases. Of course, different technologies will exist or coexist in the future to achieve a long-term climate target. Liebherr will develop and propose multiple powertrain solutions in the future and select applications to support the customer's needs.

Digitalisation

Digitalisation has touched all aspects of our daily lives. Based on decades of experience in the development and production of drive components, Liebherr works on producing intelligent solutions in the field of engine condition monitoring and diagnostic. Monitoring the performance of engines is a critical part of every industry. By constantly monitoring and improving the components' current state, machine downtime can be reduced to a minimum. Using diagnostics tools allows customers to properly care for the engine system while maximising uptime and equipment availability.

To further support their customers with the engine performance and maintenance, Liebherr has developed a suite of data-driven digital products and services as part of its combustion engines product portfolio.

Liebherr's engine condition monitoring provides meaningful insights in form of various Key Performance Indicators (KPI) on the engine's current health, performance and maintenance; the KPIs can be delivered to a mobile device as an application or to the customer's backend through a web service (API).

LiDIA is an intuitive and user-friendly engine diagnostics tool, which requires no configuration and reduces the complexity of diagnostic procedures to the essentials. LiDIA offers a rapid overview of all information on the engine system status, error codes, active limitations and error reactions.

Service

Providing our customers with high quality product support and tailored assistance is what we strive for. Whether it is connecting you with a local service partner or assigning an urgent problem to a dedicated team of Liebherr experts, we are ready to assist you.

Our combustion engines are designed to support the highest level of serviceability.

Customer service & training center
Professional maintenance and repair make a significant contribution towards maximum exploitation of Liebherr components' lasting character. Comprehensive training courses prepare our customers' technicians to provide efficient customer support. Liebherr consequently offers hands-on basic and advanced training. In our training center the experienced trainers can also simulate extreme repair operations.

Maintenance and spare parts
Practically orientated maintenance and repair kits, such as packs of seals, facilitate combined ordering of parts that need to be replaced together and ensure a high level of repair quality.

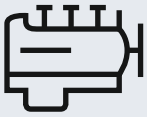
Remanufacturing/repowering
As your engine needs to be replaced several times during the overall lifetime of your machine, we are helping you to reduce your costs by offering you an alternative to a new engine. With our Reman program, we will transform your used engine by equipping it with new parts in accordance with industry standards. The program offers a financial benefit by helping businesses to cut costs whilst reducing environmental impacts through the various product's life cycle stages. Our second alternative is the repowering of your machine regardless of its brand and make. To improve reliability and fuel consumption, we can offer a complete repowering service and kit. Overall, we are focusing on saving your time, increasing your equipment availability and optimising your total operating costs so that your total costs of ownership meets or exceeds your expectations and forecasts.

Components

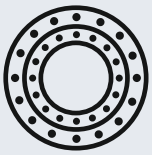
As a provider of a vast variety of products, the components product segment offers solutions in the area of mechanical, hydraulic, electric and electronic drive system and control technology. Our state-of-the-art components and systems of the highest quality are designed and manufactured at ten production sites worldwide. Representatives from each of our product segments are available to our customers at Liebherr-Components AG and the regional sales and distribution branches.

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

components.liebherr.com

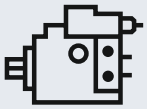

Engines


Fuel injection systems

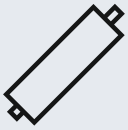

Slewing bearings


Gearboxes

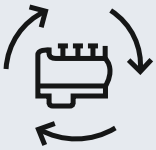

Winches

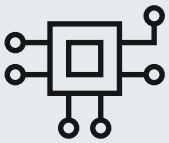

Hydraulic pumps and motors


Hydraulic cylinders


Piston accumulators


Electric machines


Remanufacturing


Industrial electronics


Electrical drive and control technology


Drive systems


Aerospace electronics


Fibre composite

LIEBHERR

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