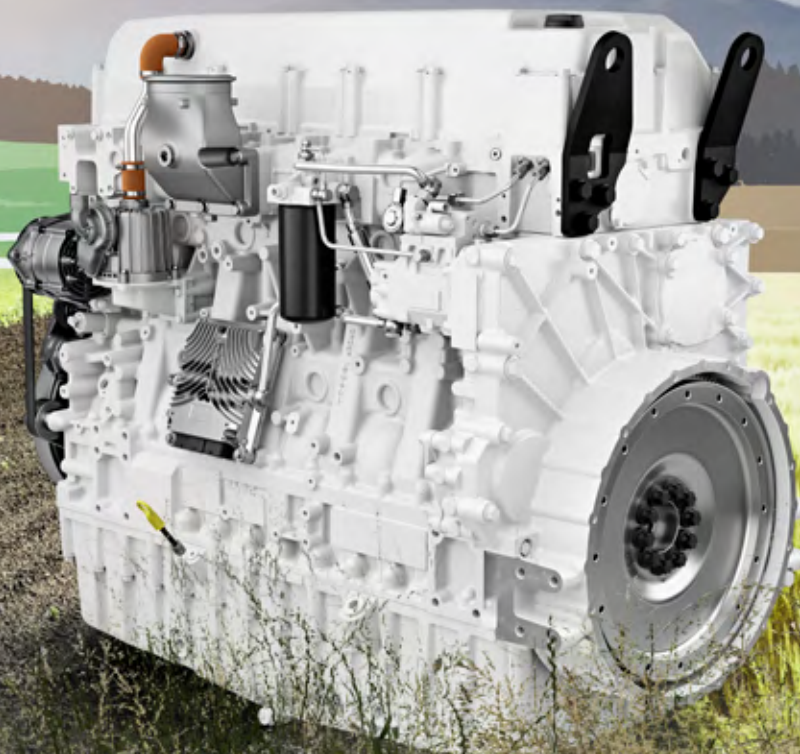

Combustion engines for the agriculture and forestry industry

LIEBHERR

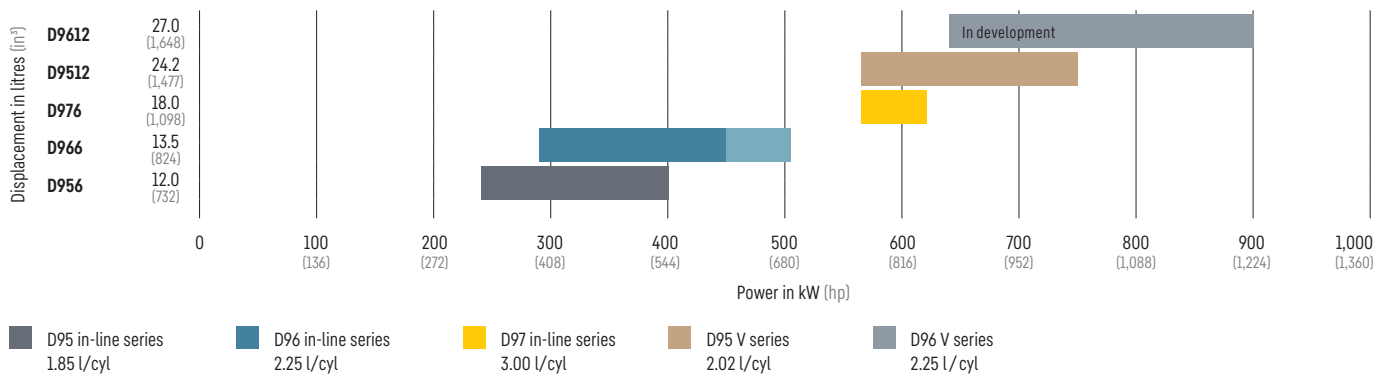
Components
Combustion engines



Combustion engines for the agriculture and forestry industry

Agriculture and construction share many similarities in their requirements for tough, efficient and torque producing power solutions. Our engines comply with worldwide emission standards and are able to cover the entire industry cycle from seeding to harvesting. Liebherr engines are particularly appreciated for their increased efficiency, long engine lifetime, and low total cost of ownership.

Power range



Low total cost of ownership (TCO)

Long maintenance intervals and short service operations ensure the high availability of Liebherr engines. Furthermore, thanks to low fuel consumption and longer oil change intervals, our engines contribute substantially to an increased efficiency of our customers' machinery. The option of a general overhaul or remanufacturing of the engines to an as new condition enables the service life of the engines to be significantly extended, thus reducing the total cost of ownership.

Your engineering partner

Our engineers are continuously working on further engine developments and improvements to achieve greater performance. Thanks to our engineering expertise, many OEMs became our partner to get an engine that suits their needs.

From 240 – 750 kW



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 (LxWxH)	mm (in)	1,369x852x1,159	53.9x33.5x45.6



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 – 505	389 – 677
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 (LxWxH)	mm (in)	1,369x852x1,169	53.9x33.5x46



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)	565 – 620	758 – 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 (LxWxH)	mm (in)	1,546x1,057x1,284	60.9x41.6x50.6



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)	565 – 750	758 – 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 (LxWxH)	mm (in)	1,869x1,226x1,183	73.6x48.3x46.6

From 640 – 900 kW



D9612

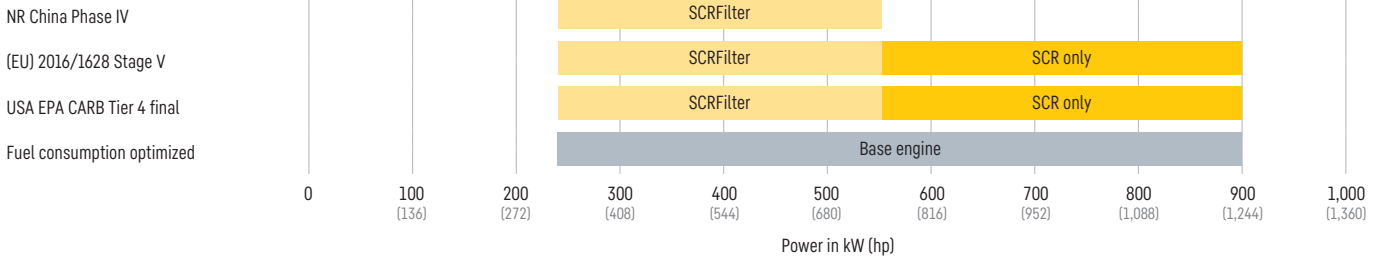
Bore	mm (in)	135	5.3
Stroke	mm (in)	157	6.2
Displacement	l (in ³)	27.0	1,647.6
Power rating	kW (hp)	640 – 900	858 – 1,207
Rated speed	rpm (rpm)	1,800	1,800
Peak torque	Nm (lb-ft)	5,100 at 1,400 rpm	3,700 at 1,400 rpm
Dry weight	kg (lbs)	2,350	5,181
Dimensions (LxWxH)	mm (in)	2,117x1,361x1,355	83.3x53.6x53.3



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	D956	D966	D976	D9512	D9612
China Phase IV ¹	■	■			
(EU) 2016/1628 Stage V ²	■	■	■	■	■
USA EPA CARB Tier 4 final ³	■	■	■	■	■
Fuel consumption optimised	■	■	■	■	■*

China Phase IV¹: D956, D964 HP, D966 from Dec. 2023
 (EU) 2016/1628 Stage V²: D9612 from Dec. 2023
 USA EPA CARB Tier 4 final³: D956, D9612 from Dec. 2023
 * 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. 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.

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 one of the most promising powertrains for high mechanical power under extreme operating conditions in the off-highway industry. In particular, harsh conditions, to which many heavy-duty vehicles are exposed to, challenge the development of climate-friendly, reliable and efficient powertrain solution. Internal combustion engines have met these challenges and requirements for decades, and will remain the primary powertrain in this sector – offering a sustainable solution to the market's demands.

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 CO₂ 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 stability.
- 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 diagnostic 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 diagnostic 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.



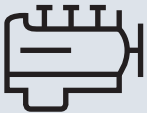
Components

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.

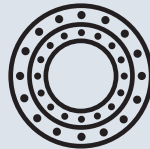
components.liebherr.com



Engines



Fuel injection systems



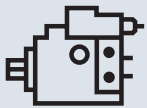
Slewing bearings



Gearboxes



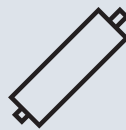
Winches



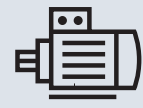
Hydraulic pumps and motors



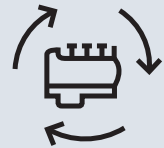
Hydraulic cylinders



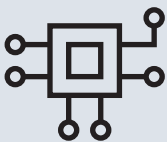
Piston accumulators



Electric machines



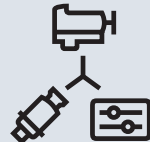
Remanufacturing



Industrial electronics



Electrical drive and control technology



Drive systems



Aerospace electronics



Fibre composite

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