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MTU Engines for Locomotives and Trainsets

Economic and Clean Railway Drive Systems

- **Technology Leadership: from the “Flying Hamburger“ to the fastest Diesel Loco in the World**
- **Yet more Reductions in Consumption and Emissions: the powerful Series 4000 Diesel Engines with Power Outputs of up to 3,000 kW**
- **Complete Drive System: PowerPacks for Railcars up to 390 kW**
- **Perfect Control: Automation System “Powerline“**
- **Partner for a long Engine Life: Single-Source Service & Maintenance**

MTU South Africa (PTY) Ltd. For many decades, MTU engines have been providing reliable railway drive systems. As early as 1924, serial engines developed and manufactured by *Maybach Motorenbau GmbH* - MTU Friedrichshafen GmbH's, Germany, predecessor - have been put into service on a regular basis. In 1933, Maybach diesel engines powered the legendary “Flying Hamburger“ with a top speed of 160 km/h on the Berlin/Hamburg service. At the time, this was the world record for a regular train service.

With more than 4,000 diesel engines delivered, MTU has been a major partner of Deutsche Bahn AG for their new procurement and repowering programs since the early 50s.

Around the globe, MTU has supplied more than 17,000 diesel drive systems for rail vehicles and is one of the world's leading system partners for locomotive and railcar manufacturers.

Thus, modern high speed trains, such as the popular British "High Speed Trains", are equipped with reliable and consistently powerful MTU Series 16V 4000 R41 diesel engines. On 12 July 2002, a Talgo XXI high speed train, in service with Spanish national train operator Renfe, and furnished with an MTU diesel power car, achieved the current world speed record of 256 km/h for diesel-hydraulic rail vehicles.

Full load or low load operation - MTU drive systems for regular service and multi-purpose locomotives are designed to meet the requirements of a wide variety of operating conditions. They prove their worth in heavy duty freight train operations, in industrial locomotives, or in shunting operations, as well as high speed passenger transport.

Reliability, economic viability and environmental friendliness: these are the factors that contribute to MTU drive systems reaching peak performances in local and regional rail traffic. This typical continuous operation is very demanding: rain or shine, sometimes covering 24-hours service, regional trains must provide steady, punctual and reliable service connecting towns, cities and regions. Stop & Go operation, typical for regional traffic, with its continuous alternating between acceleration and braking gives rise to a permanent fluctuation in load, with high thermal and mechanic loads for the engine and all other components.

Compact diesel engines from MTU are also being utilized in a variety of special rail vehicles. With their low emission rates, they ideally meet the requirements for the utilization of tunnel assistance locomotives or in locomotives for construction and maintenance work in underground rail systems. Thanks to the variable coupling options with electric or hydraulic systems, these engines can also be

utilized in special vehicles with extremely low operational speeds, such as railcar loaders.

Reduced consumption, reduced emissions: the powerful Series 4000 diesel engines with power outputs of up to 3,000 kW

MTU rail engines are put into service in a huge variety of vehicles. However, they all have one thing in common: powerful performance requirements coupled with low emissions and low fuel consumption. The finger on the pulse for environmental issues, so to say.

The maintenance-friendly, economic and low-emission MTU Series 4000 engines with eight, twelve, 16 or 20 cylinders cover a power output range from 1,000 kW to 3,000 kW (from 1300 HP to 4080 HP). For more than a decade, they have been the preferred drive systems for modern locomotives of all kinds.

For this reason, the Series RH 2016 EuroRunner Siemens freight and universal locomotives - known in Austria as "Hercules" - are also equipped with a Series 4000 MTU engine, just like the powerful "work horses" of the Deutsche Bundesbahn, Series DB 218.

The Series 4000 engines are predominantly characterized by their high performance density, their low-noise operation, low exhaust gas emission readings, and low maintenance effort. This is facilitated by state-of-the-art technologies such as Common-Rail injection, powerful turbo-charging, as well as the perfectly matched control and monitoring electronics, such as "Powerline" with its integrated engine management system ADEC (Advanced Diesel Engine Control).

The Series 4000 engines comply with the increasingly stringent limits imposed by EU tier IIIA emission regulations, predominantly stipulating, from 2009, a significant reduction of NOx emissions from current levels of 9.5 g/kWh to a projected maximum of 6 g/kWh. MTU-rail drive systems fall below this NOx limit due to the engine internal design and workings, i.e. without exhaust gas after-treatment.

With the so-called 'Miller process', the inlet valves are closed earlier than usual during the combustion process, which leads to lower combustion temperatures and, consequently, to lower engine NOx emissions. Likewise, soot particle emissions significantly decrease thanks to the new harmonized combustion processes of the Series 4000 rail engines.

The engines are also furnished with a two-phase charge-air cooling system, which increases the amount of oxygen introduced into the combustion process, and thereby not only increasing performance, but simultaneously reducing fuel consumption and noxious substance emissions.

Complete Drive system: PowerPacks for railcar bis 390 kW

Worldwide, the "MTU PowerPack" is the benchmark for drive systems, powering trainsets and railcars in modern local and regional rail traffic. The PowerPack is an innovative drive system integrating all individual components on one compact mounting frame. Overall, this results in a significantly reduced total weight.

With a length of 3.5 m, a width of 2.1 m, yet a mere 87 centimeters in height, a PowerPack can be installed in the underfloor space of all common railcar models. As a result of this particularly flat design, passengers have more space and, subsequently, an enhanced travel experience. Since the compact system has only a few interfaces, quick disassembly and re-assembly is possible for maintenance purposes. For testing, the complete drive system can be operated outside the vehicle.

MTU PowerPacks are furnished with type 6H 1800 engines - providing compact power with an output of 315 to 390 kW (430 to 530 HP).

The "Power Pack" is put together following the principles of a modular system. The power unit is assembled in combination with the necessary auxiliary units, including fuel, oil and air filters, as well as the exhaust gas silencer and the entire cooling plant. Apart from the vehicle drive unit, the system also includes other units such as a compressor for the braking system, another one for the Air Conditioning cooling circuit, as well as a generator for the train's power supply.

No matter if it is a large on-board generator, a mechanical or hydraulic gearbox or a diesel-electric drive: the individual components are integrated on a variety of mounting frames to assemble a single compact system, as required by the integration specifications of the vehicle.

As an option, the soot particle filters can be integrated into the exhaust silencer. Worldwide, the PowerPack ranks as the lowest emission drive for diesel railcars and complies with the EU emission requirements to apply from 2009.

Not only are these compact PowerPacks used in new vehicles, but they can also be integrated into older trainsets for repowering purposes.

Usually, one of these units can be operated for up to 18,000 operating hours, or three to four years, without interruption, up to their basic overhaul. Assuming an average speed of 40 km/h, this corresponds with a performance of approx. 720,000 kilometers.

From day one, MTU has been playing an important role in the development of the PowerPack for railcars. Since 1997, MTU has been supplying "Power Packs", specifically for underfloor drives of modern railcars. During the first year alone, about 800 units left the MTU plants. In the meantime, more than 3000 units with Series 183 engines, as well as almost 500 Series 1800 PowerPacks have been put into operation, mostly in the railcar types Lint by Alstom, Desiro by Siemens and Talent by Bombardier. The units are in service with railway operators around the globe, in the United Kingdom, Eastern Europe or the USA.

Perfectly controlled: "Powerline" Automation System

As a Complete System Provider, MTU supplies the Electronics to suit their PowerPacks. The electronic Management System "Powerline", developed and manufactured by MTU, monitors and controls all drive plant functions.

The modular system can be adjusted to suit the specific drive plant and the various operational conditions occurring in railway operations. During conversion work, this facilitates easy integration into new or existing vehicle control systems.

The PAU (Power Automation Unit) safety system integrated into the “Powerline“ unit, automatically controls the engine output when changes in operating conditions occur, reduces the power output, or even shuts down the engine, if so required in emergency situations. The diagnostic function transmits all operationally relevant data to the trainset operator and displays defects or warnings both optically and acoustically.

The Power Output Module (POM) controls the starter, the generator and regulates the energy supply within the plant. This interaction is fully automated and enables the operator to fully focus on his work.

Partner for a long engine life: Single-Source Service & Maintenance

MTU is not only a developer & manufacturer of drive systems, but rather a Full System & Service Provider. MTU looks after rail projects from the initial concept through to the integration of the engines. This includes the option of basic engine and PowerPack overhauls, and system maintenance for the duration of their entire useful life. With a worldwide customer service network of 1,100 service points, MTU is able to provide fast and reliable support and guarantee the supply of spares and tools. Individual service & maintenance contracts increasingly ensure the reliability and economic efficiency of these rail drive systems.

Many years of experience and expertise in the railways engines sector have been successfully applied to sell over 2000 of the 4000 Series engines for rail applications and 15,000 units throughout all applications: Rail, Energy, Marine, Mining and Industrial. With its powers of innovation, reliability and system engineering skills, MTU offers a unique level of traction system expertise and outstanding product quality.

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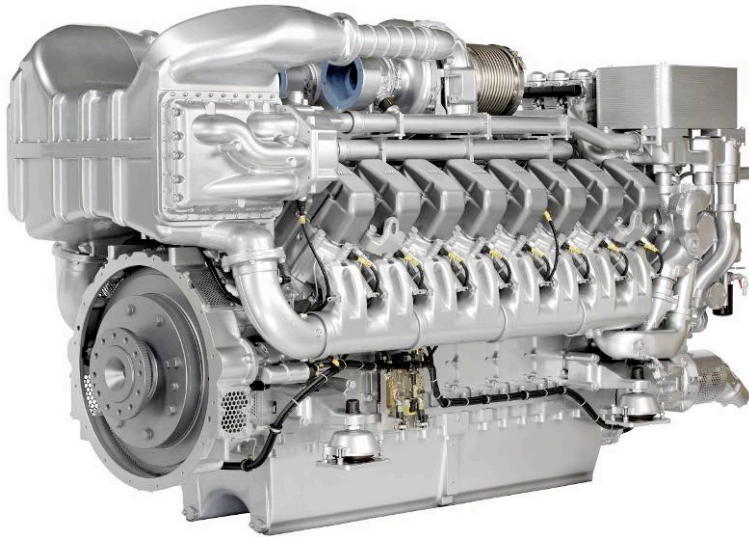
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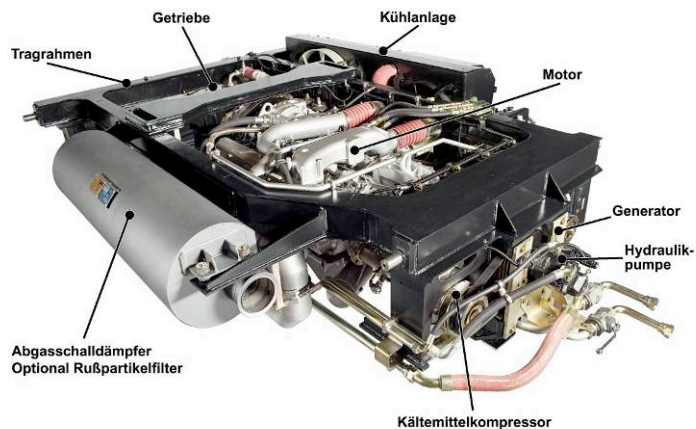
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Pictures and graphics



The new MTU Series 4000 Rail diesel engines are available as 8-, 12-, 16- and 20-cylinder variants and provide power outputs between 1.000 and 3.000 kW (pictured: a rail engine, type 16V 4000 R43).



MTU Rail PowerPacks are compact underfloor drive systems with engine, cooling system, gearbox, generator and other components. Diesel particulate filters can be integrated into the exhaust silencer.