

Series 4000 Diesel Engines
for Railway Vehicles



The engine of your success.

The development, production and servicing of diesel traction systems for railway rolling stock are among our core capabilities.

MTU rail engines are in service across the globe in an enormous variety of trains and conditions – from the rigors of everyday operation to extremes of climate, from mainline locomotives to shunters, and as traction units or driving electricity generators for the trains' electrical systems.

With its powers of innovation, reliability and system engineering skills, MTU offers a unique level of traction system expertise and outstanding product quality. And combined with the comprehensive product and customer support provided, that means you can be certain of maximum availability, wherever your trains are operating.

A global network of subsidiaries, distributors and service centers staffed by customer service technicians trained by MTU ensures that MTU engines benefit from a level of support that meets the highest standards.

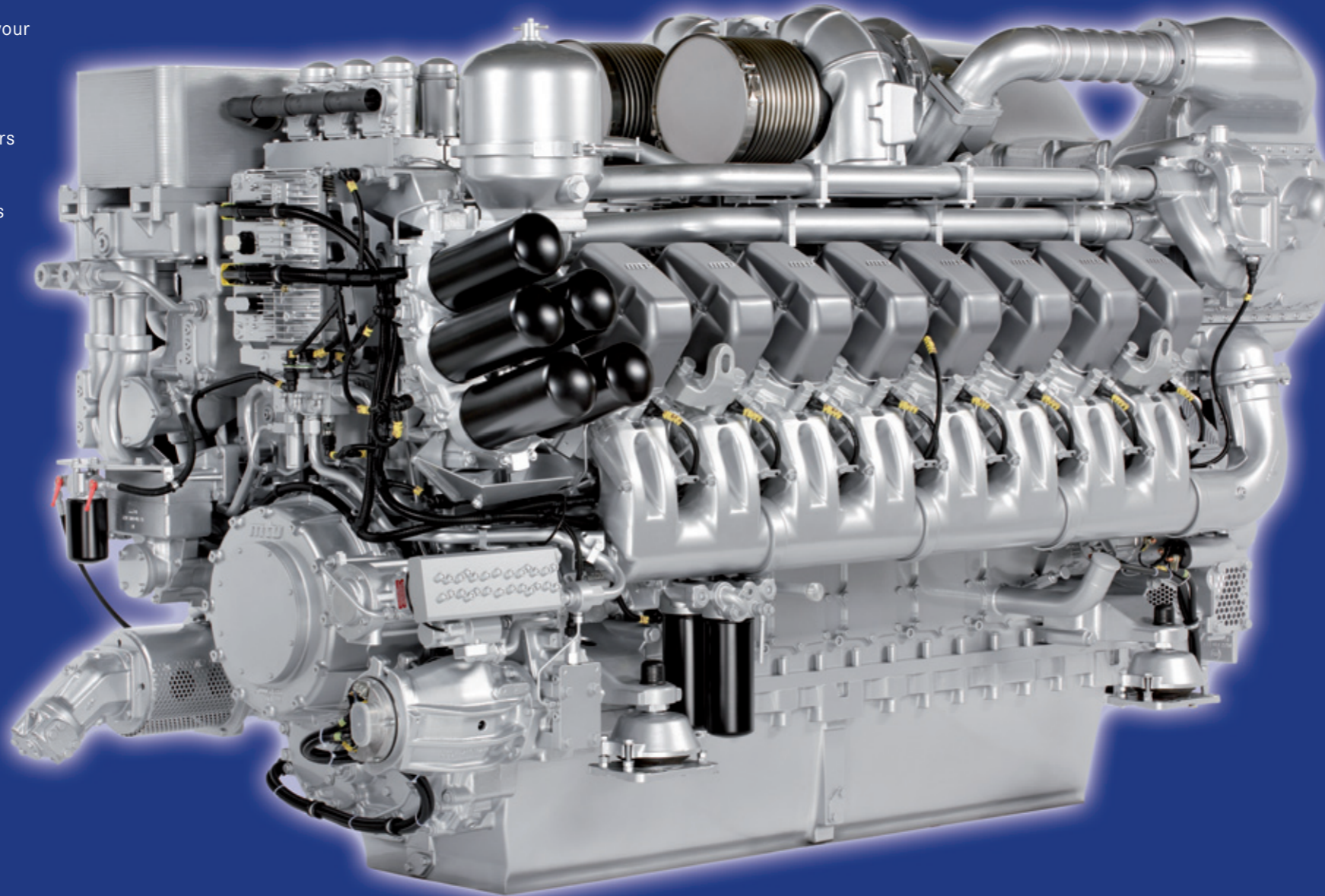
MTU Series 4000: the economizers.

The MTU Series 4000 engines were the first in their class to be fitted with the common-rail system.

The most important advantages of this advanced fuel-injection system are the optimized consumption figures and exhaust emissions.

The Series 4000 engines also benefit from the latest combustion chamber technology and easily meet the legal requirements that come into force of 01/01/2009.

So with all those advantages in its favor, it's no surprise that the Series 4000 has become the standard power unit for European railways.



Your benefits:

Life-cycle costs

- > Competitive advantages due to low running costs
- > Low fuel consumption across entire power curve
- > Low oil consumption due to special piston ring design
- > Ease of maintenance due to
 - Easy accessibility of all components
 - Maintenance-free, wheel-driven power take-off
 - Large inspection cover

Engine characteristics

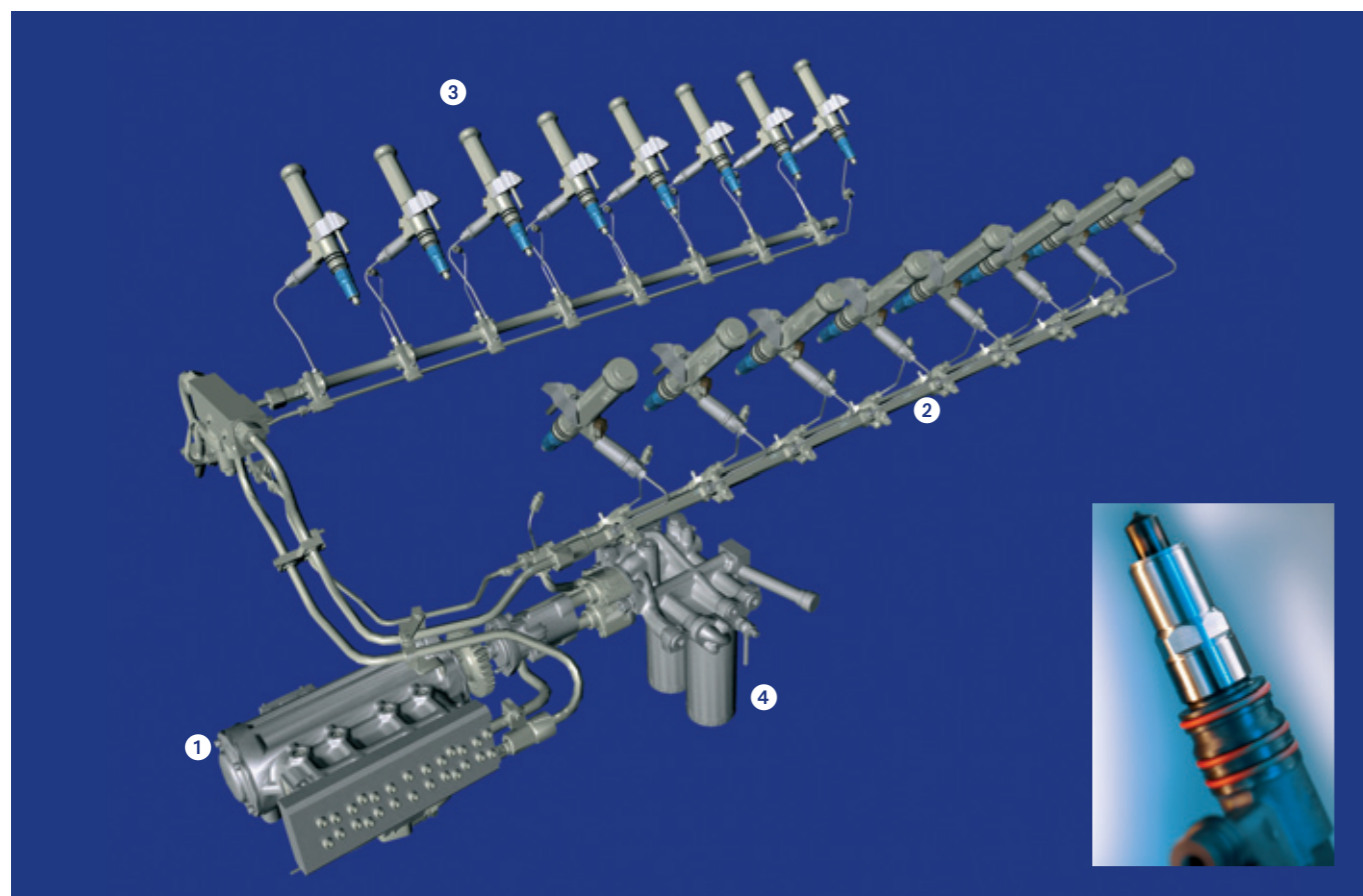
- > Constant power output at up to 40 °C intake air temperature and 400 m above sea level or 1500 m altitude and 25 °C intake air temperature
- > Unrestricted low/medium-load operation

Environmental credentials

- > Compliance with UIC II and UIC III/EU Directive and EU Directive 97/68 EC, Stage III A and potential compliance with future regulations Stage III B
- > Low particulate emission levels
- > Low noise and vibration levels
- > Minimal use of resources for consumables and in production

Our services:

- > 24-hour support
- > Sales and service network with 1,500 centers worldwide



- ❶ High-pressure pump
- ❷ Common rail
- ❸ Injector with high-pressure accumulator
- ❹ Fuel filter

Common-rail fuel injection

Electronically controlled common-rail fuel injection system with high-pressure pump, pressure accumulator (fuel rail) and unit injectors.

Advantages:

- > Optimum control of
 - injection timing
 - injection volume
 - injection pressure
- > Substantial reduction of particulate emissions
- > Low fuel consumption across entire operating range
- > No mechanical adjustments required
- > Outstanding acceleration and shock load response characteristics
- > Excellent reliability

Cylinder heads

Unit cylinder heads made of special cast iron. Two inlet and two exhaust valves. Centrally positioned fuel injector. Designed for high compression.

Advantages:

- > Excellent reliability
- > Low fuel consumption
- > Low exhaust emissions
- > Long service life
- > Low maintenance costs

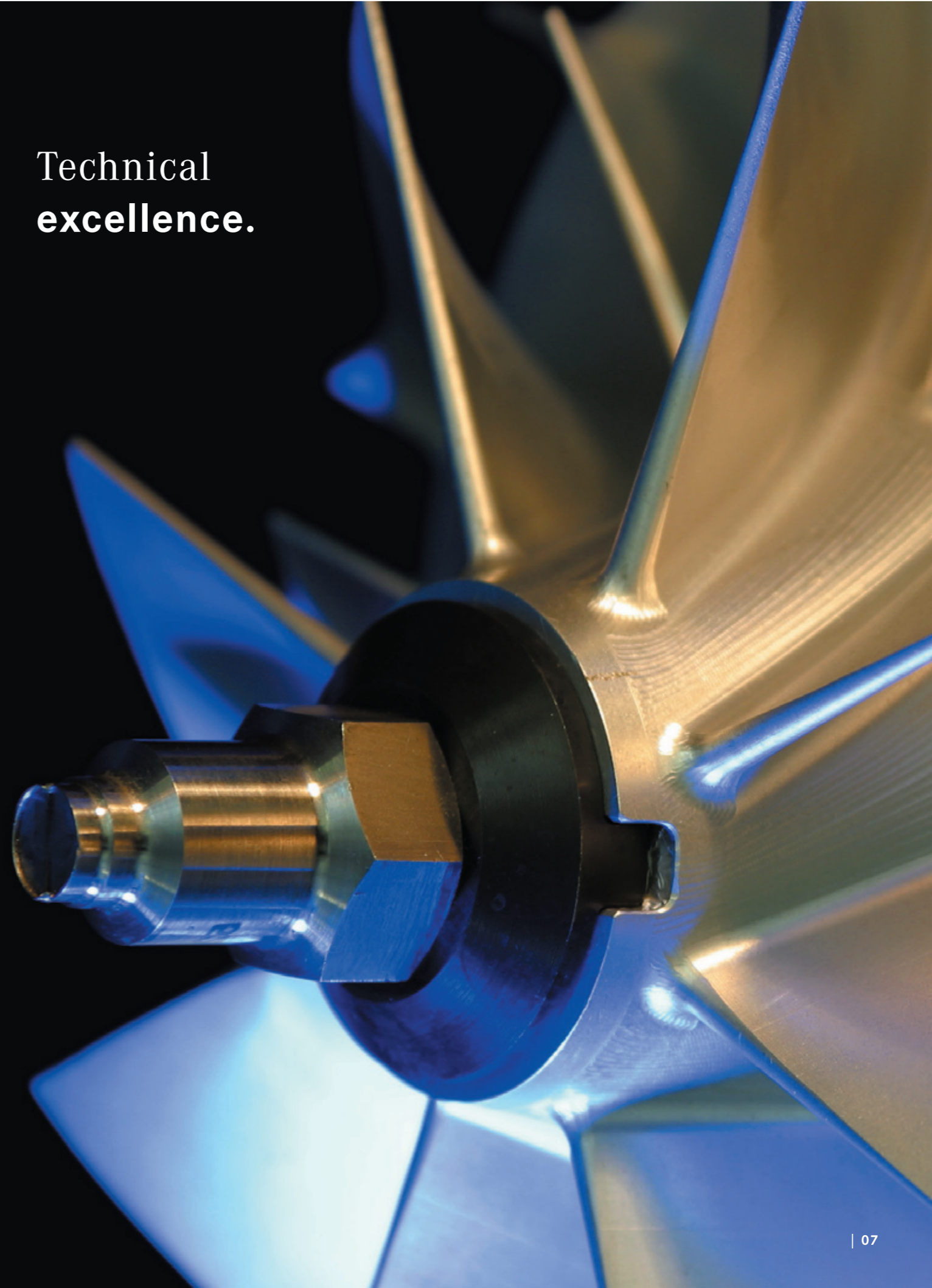
Resilient mountings

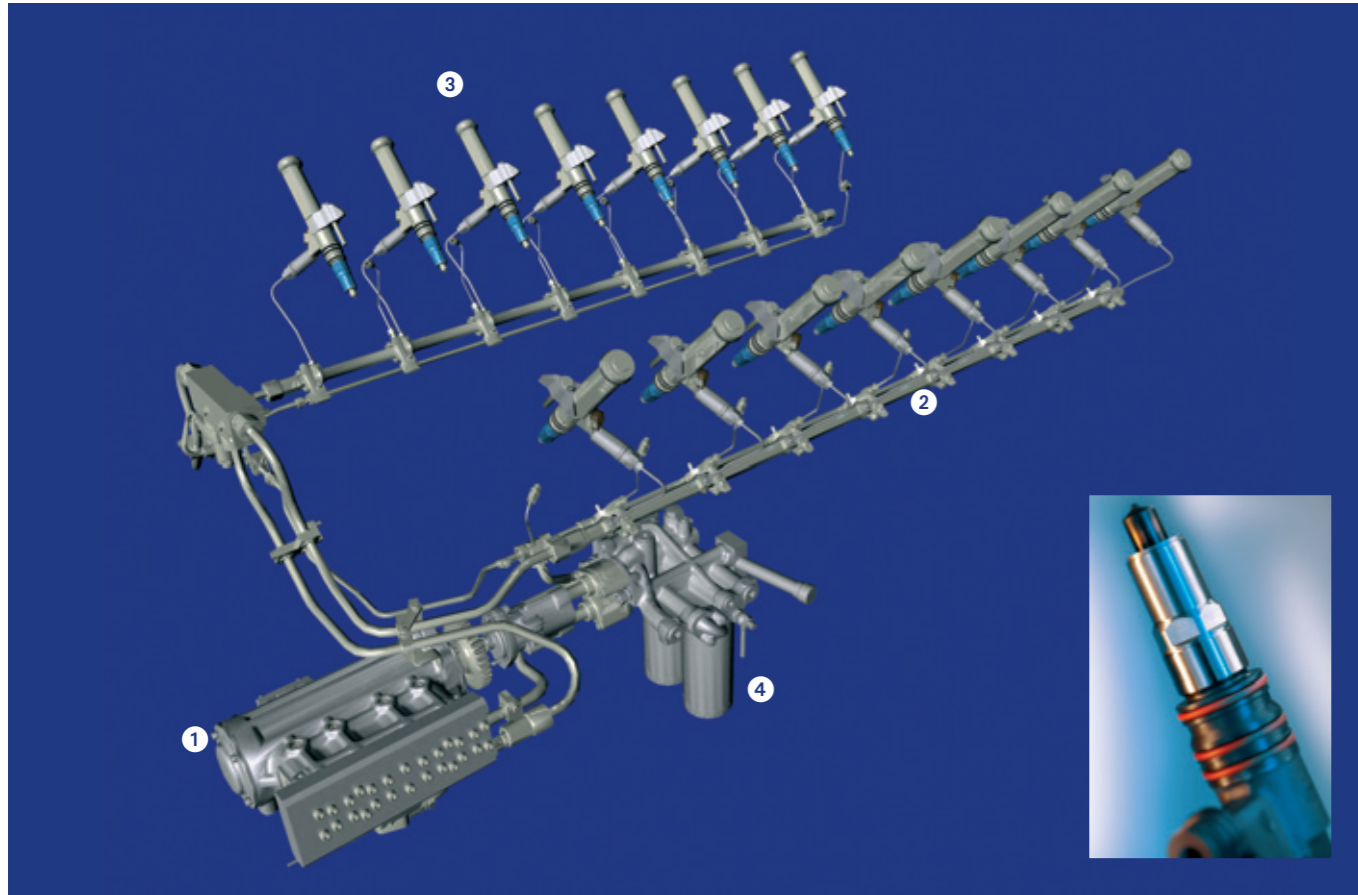
Advantages:

- > Adjustable height
- > Excellent sound and vibration insulation



Technical
excellence.





- 1 High-pressure pump
- 2 Common rail
- 3 Injector with high-pressure accumulator
- 4 Fuel filter

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Cooling system

High-temperature system (engine coolant and oil circuits). Low-temperature system (turbocharger intercooler).

Advantages:

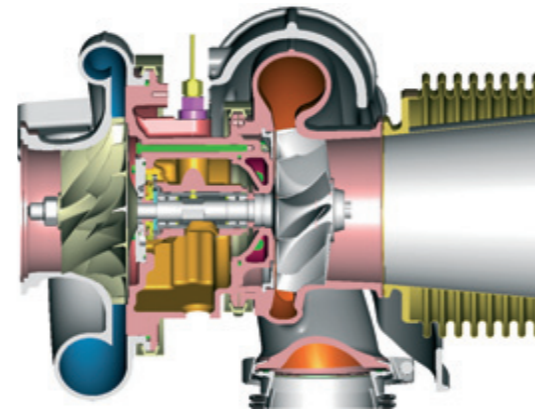
- > Optimized power output
- > Ideal operating temperatures for coolant, oil and intake air across entire power range even at extreme ambient temperatures

Exhaust system

Uncooled exhaust pipes. Routed between the two cylinder banks in engine "vee", thermally insulated/cooled exhaust pipes (R33)

Advantages:

- > Greater safety for operative and maintenance staff
- > Low/optimized heat transfer to cooling system
- > Small cooler size



Turbocharger

Pistons

Aluminum skirt with screw-on steel crown. Three grooves for two compression rings and one oil control ring. First compression ring has highly wear-resistant surface coating. Optimized for minimum wear and ultra-low friction.

Advantages:

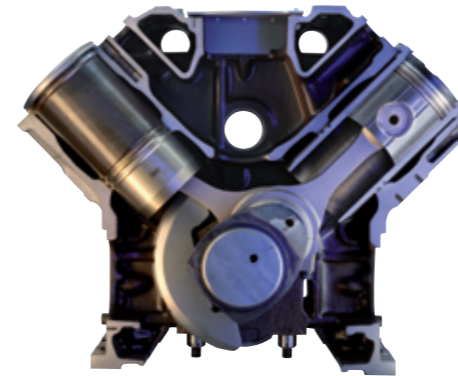
- > Long service life
- > Low oil consumption

Cylinder liners

Replaceable, cooled cylinder liners manufactured by spin casting. Plateau-honed in two stages. Optimized for minimum wear and ultra-low friction.

Advantages:

- > Long service life
- > Low oil consumption
- > Long oil-change intervals



Aspiration

Two or four turbochargers.

Advantages:

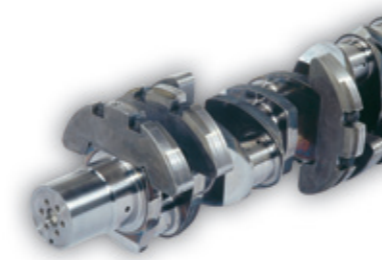
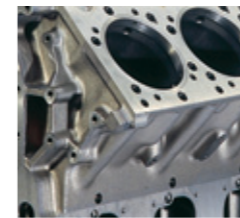
- > Optimum load-response characteristics
- > Optimized across entire speed range

Crankcase and crankshaft

One-piece cast crankcase made of special cast iron with integrated main oil channel and coolant channels. Crankshaft machined on all sides with bolt-on counterweights. New-design wear-resistant plain bearings. Large inspection cover.

Advantages:

- > High performance
- > Low sound and vibration levels
- > Maximum service life
- > Straightforward maintenance
- > Low wear
- > Multiple complete overhauls possible



Technical data

Series 4000 diesel engines		
Model	4000-01	4000-03
Cylinder configuration	8V, 12V, 16V	8V, 12V, 16V, 20V
Bore/Stroke	mm (in)	165/190 (6.5/7.3)
Cylinder capacity	l (cu in)	4.06 (248)
Fuel specification	EN 590	EN 590

Power output			
Engine model	Rated power kW	Speed rpm	Emission*
8V 4000 R41	850 - 1100	1500 - 1860	UIC II
12V 4000 R41	1380 - 1650	1500 - 1860	UIC II
16V 4000 R41	1700 - 2200	1500 - 1860	UIC II
8V 4000 R43	1000 - 1200	1800	EU III A / UIC III
12V 4000 R43	1500 - 1800	1800	EU III A / UIC III
12V 4000 R33*	1680	1800	EPA 2
16V 4000 R43	2000 - 2400	1800	EU III A / UIC III
20V 4000 R43L	2700 - 3000	1800	EU III A / UIC III

* available for american market only

Emissions: UIC: International Railway Association (UIC Code 624V)
 EPA: US Rail Regulation 40 CFR 92
 EU: EU Nonroad Directive 97/68/EC

4000 R43 available from Jan. 2009

powerline – The management for your rail drive.

powerline - An integral automation system for rail drives with MTU engines

Along with the generational change related to MTU Series 4000 engines for rail applications comes **powerline**, the new MTU automation system for rail drives – another step into the future of rail vehicle technology. The basic of the **powerline** drive automation system components ADEC, POM and PAU allow easy integration of the engine in the locomotive. POM as well as ADEC represent engine-mounted electronic modules. The scope of supply of MTU comprises control, regulation and monitoring equipment. Optimized interface technology allows easy and quick engine installation.

ADEC (Advanced Diesel Engine Control): Engine management system

ADEC is a management system developed and produced by MTU for state-of-the-art high performance diesel engines – designed not only for unlimited control of the Common Rail technology of the new engine Series 4000, but most of all for the command over frequently occurring extreme load conditions and rapid load changes which ADEC manages reliably and smoothly.

The main ADEC features are:

- > Engine-mounted and wired assembly
- > Engine management with integrated control and monitoring system
- > Integrated safety system and self-test system
- > CAN bus interface

POM (Power Output Module): Module for starter and battery-charging generator control

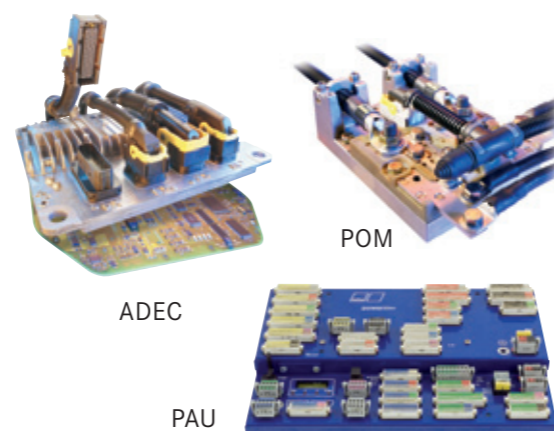
The main POM features are:

- > Engine-mounted component, connected to starter and battery-charging generator
- > Customers do no longer need to connect their power cabling to the engine
- > Starter is generally connected to POM, no starter relay required
- > Starting process optimization
- > Starter monitoring with engagement verification
- > Monitoring of battery-charging generator operation
- > Line break and short circuit monitoring
- > Battery voltage monitoring with interference in start process and output of status and fault information
- > Connection between ADEC and POM via CAN bus
- > Fully automatic start control by ADEC

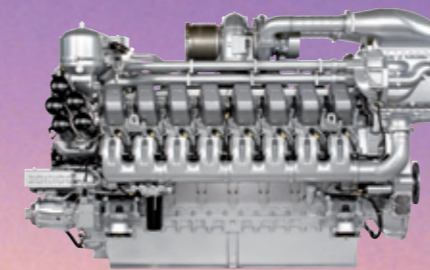
PAU (Power Automation Unit): Module for monitoring, control and plant-specific system integration of peripheral components

The main PAU features are:

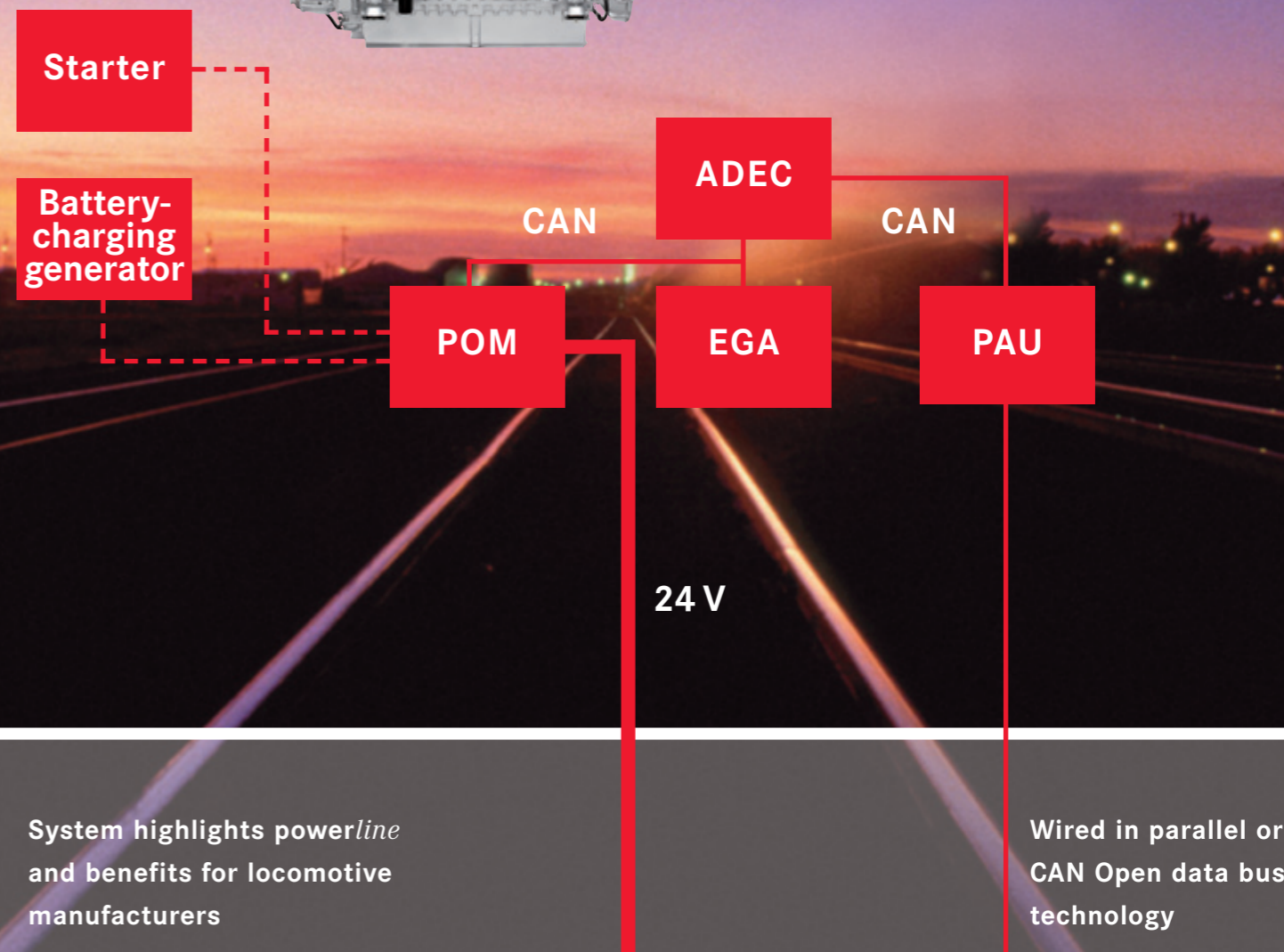
- > Component supplied as loose part, with (redundant) CAN Open interface to locomotive control
- > Transmission of all engine-related operating values incl. diagnostic data to the locomotive control system
- > Supplementary monitoring and control of engine-related peripheral equipment/functions, e.g.
 - Coolant preheating
 - Coolant level monitoring
 - Charge-air preheating
 - Fuel pumps
 - Air filter
 - Integrated safety features (e.g. automatic shutdown, power reduction etc.)
 - Data output for fuel consumption display
 - Ethernet diagnostic interface (e.g. service laptop) on browser level)
 - Data storage function



powerline
for Series 4000 R43

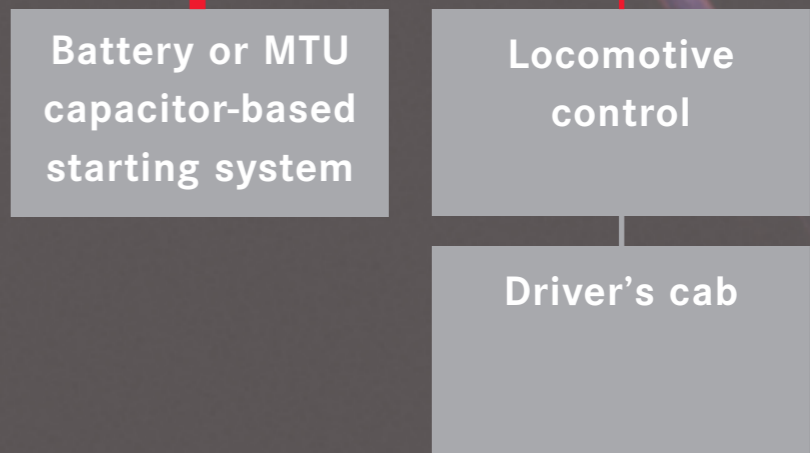


EGA = Exhaust Gas Aftertreatment
ADEC = Advanced Diesel Engine Control
POM = Power Output Module
PAU = Power Automation Unit



System highlights powerline and benefits for locomotive manufacturers

- > Complete system from one single source
- > Modular design
- > Reduced wiring and size
- > Optimized diagnostic function
- > Intelligent CAN bus technology
- > Easy Interface
- > Fast project implementation
- > Easy integration
- > Certified system design



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