MAN 51/60DF

Dual-fuel flexibility and reliability

Engineering the Future – since 1758.

MAN Diesel & Turbo

MAN Diesel & Turbo

Powering the world – responsibly

MAN Diesel & Turbo is the world's leading provider of large-bore diesel engines and turbomachinery. Our product portfolio includes two-stroke and four-stroke engines for marine and stationary applications, turbochargers and propellers, as well as gas and steam turbines, compressors and chemical reactors.

MAN solutions can be found in ship propulsion, engine-based power plants and turbomachinery trains for the oil & gas and process industries. We support our global customers with a comprehensive range of after-sales services under the MAN PrimeServ brand.

MAN Diesel & Turbo has always been committed to increasing fuel efficiency and reducing emissions. Today, this commitment ensures that our customers are able to meet increasingly strict emissions regulations and plays a vital role in reducing the environmental impact of global trade and industry.

Modern and Innovative Technology

Short description of major engine parts

The MAN 51/60DF engine from MAN Diesel & Turbo is a dual-fuel engine that converts liquid fuel (diesel operation) or natural gas into electrical power efficiently and with low emissions. Being able to switch smoothly and seamlessly from gas to diesel operation (and vice versa) enables multiple applications with a variety of fuels. The engine delivers maximum output combined with maximum flexibility and reliability.

Key features and components at a glance

All our engine parts are designed and built with the aim of achieving reliable operation, straightforward maintenance and the longest TBO*. The MAN 51/60DF features the following:

Engine frame

The engine is housed in a rigid single-cast monobloc frame, further strengthened by tie bolts running from the suspended main bearing through to the top edge of the engine frame, and from the cylinder head through to the intermediate bottom.

Cylinder liner

The thick-walled design of MAN Diesel & Turbo cylinder liners offers high resistance to deformation, enabling optimum running conditions for the piston.

Cylinder head

Improved combustion chamber geometry optimises the combustion of gas and diesel/HFO. And atomisation of the injection spray – with no negative effects on either operating modes – enables a good air-fuel ratio for highly effective combustion.

Rocker arm casing

The weight-reduced design of the rocker arm casing facilitates fast removal for the overhaul and service of injection nozzles in gas and diesel/HFO operation.

Stepped piston

Forged, dimensionally stable steel crown (with shaker cooling by using oil), made from high-grade materials with skirt in nodular graphite iron. Chromium ceramic coating of the first piston ring with highly resistant ceramic particles in the ring surface, resulting in low wear of ring and liner.

Connecting rod and bearing

Optimised “marine head” design to allow piston overhaul without removal of the connecting rod bearing cap. Specially designed bearing shells in the connecting rod for increased reliability.

Valves

Exhaust gas valves with propellers on the shaft for self-turning effect in the exhaust gas stream and seating in armoured, water-cooled valve seats, resulting in low valve temperatures. The inlet valves are equipped with Rotocap mechanical rotators.

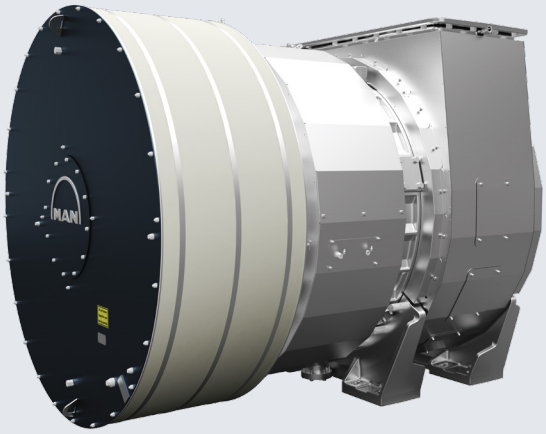
Injection

In operation with liquid fuels high-pressure injection with improved atomisation ensures good combustion of fuel with the lowest, but still acceptable, qualities of HFO. In gas operation pilot fuel is injected through a common rail injection system.

* TBO = time between overhaul

MAN Diesel & Turbo turbocharging system

The constant pressure turbocharging system leverages state-of-the-art MAN Diesel & Turbo TCA series turbochargers with long bearing TBOs. They ensure thorough combustion with very low residues and low thermal stress on combustion-chamber components. In addition, high efficiency at full and partial loads results in substantial air surplus. Plus, very high efficiency of the turbocharger at low-pressure ratios enables good operation at part load. Both vee- and inline MAN 51/60DF engines are charged by a single TCA turbocharger with the advantage that only one common exhaust gas pipe is required for all cylinders.



Service-friendly design

Hydraulic tools used for tightening and loosening cylinder head nuts make for easy servicing of the MAN 51/60DF. The engine also features clamps with quick release fasteners and/or clamp and plug connectors. And the access covers are generously sized for simple access. In addition, MAN 51/60DF has hydraulic tools for crank-shaft bearings and big-end bearings and the sleeve spring vibration damper is practically maintenance free.

SaCoS

The MAN 51/60DF engine is equipped with the SaCoS-DF safety and control system. SaCoS-DF guarantees reliable engine operation in diesel and gas mode with an optimum operation range between knocking and misfiring in gas operation. All cylinders are regulated individually. In diesel mode, control is based on well proven engine management of the MAN Diesel & Turbo medium-speed diesel engines. This system is tested at the factory together with the engine, making fine tuning and functional testing easier and smoother when the power plant is commissioned.

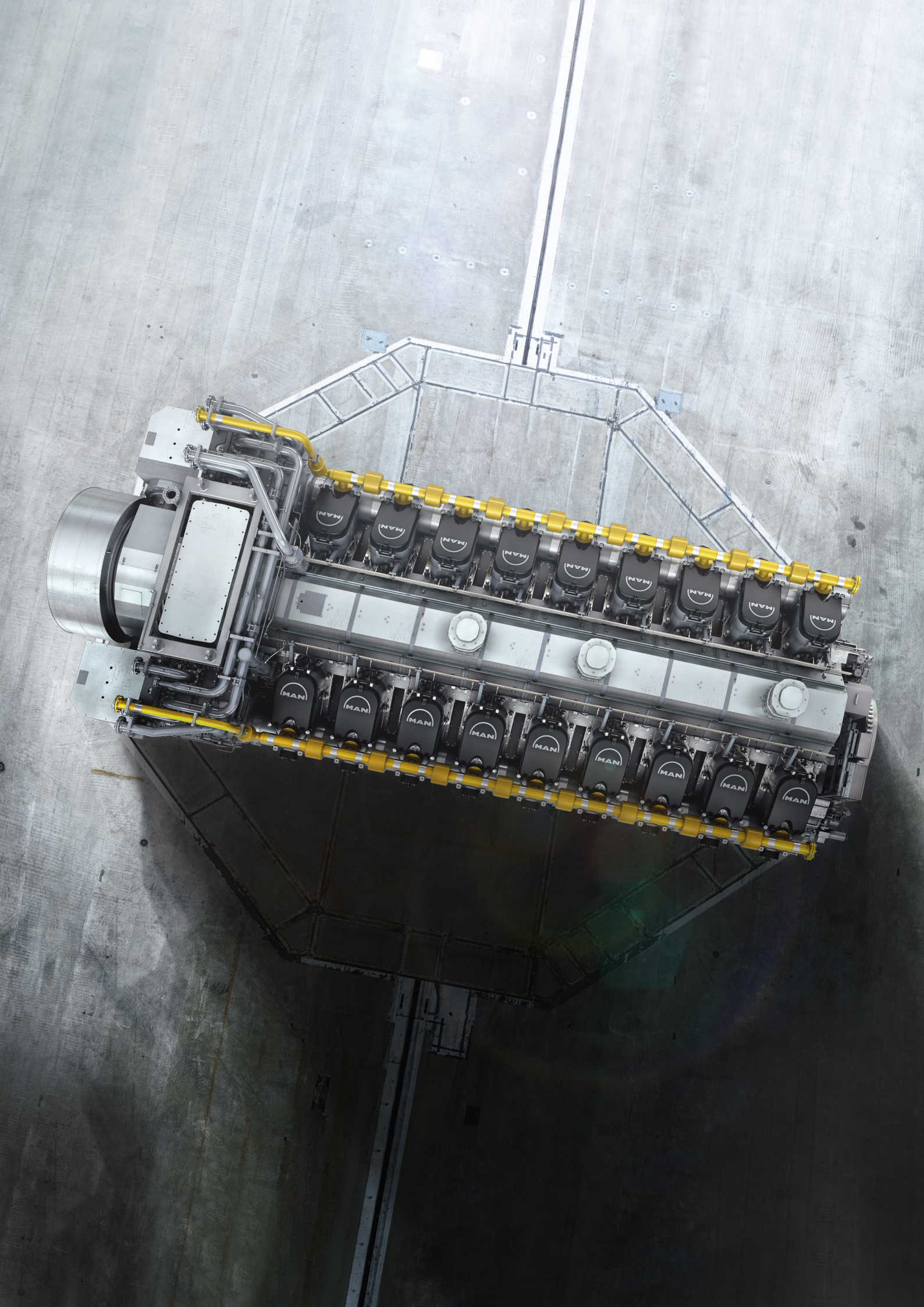
NO_x

As with all MAN Diesel & Turbo engines, the NO_x emissions of the MAN 51/60DF meet the requirements set by the World Bank 2007/2008. In gas mode, the engine's emissions are significantly below the permissible World Bank limits. To comply with stringent NO_x limits, we also offer selective catalytic reduction technology (SCR) for this engine type.

Fuels

The MAN 51/60DF is designed for operation with liquid and gaseous fuels. In liquid fuel operation, the engine can be operated with HFO with a viscosity of up to 700 mm^2/s (cSt) at 50°C. It is designed for fuel qualities specified in CIMAC 2003 H/K700/DIN ISO 8217. With liquid fuels, continuous HFO operation is possible between 20% and 100% load.

For gas operation, the gaseous fuel must comply with the latest valid MAN Diesel & Turbo quality requirements. MAN Diesel & Turbo can also deliver solutions for lower methane numbers. Key features and components at a glance.


MAN

Technical Data
Definitions

Engine data for MAN 51/60DF

Engine cycle: four-stroke
Turbocharging system: constant pressure
Number of cylinders, V-engines: 18, 14, 12
Number of cylinders, L-engines: 9
Bore: 510 mm
Stroke: 600 mm
Swept volume per cylinder: 122.6 dm^3

Cylinder output (MCR)

at 514 rpm, 60 Hz: 1,000 kW_m
at 500 rpm, 50 Hz: 1,000 kW_m

Power unit output
Between 8,847 and 17,766 kW_e

Cooling

Cylinder cooling (single-stage): fresh water
Charge air cooler (two-stage): fresh water
Fuel injector cooling: fresh water

Starting method

Compressed air

Emissions

The engines comply with the World Bank guidelines for thermal power plants.

Note

The electrical power quoted depends on the make of alternator. Power and consumption values may vary according to specific configuration.

Reference conditions according ISO 3046-1: 2002

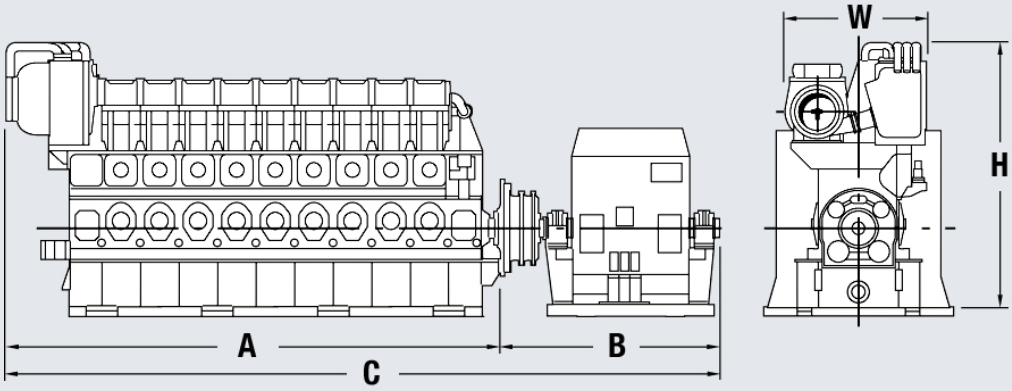
The stated consumption figures refer to:

- Ambient air pressure: 1,000 mbar
  Relative humidity: 30%
- Ambient air temperature: +25°C (77°F)
- Charge air temperature:
  According to engine type, corresponding to 25°C cooling water temperature before charge air cooler

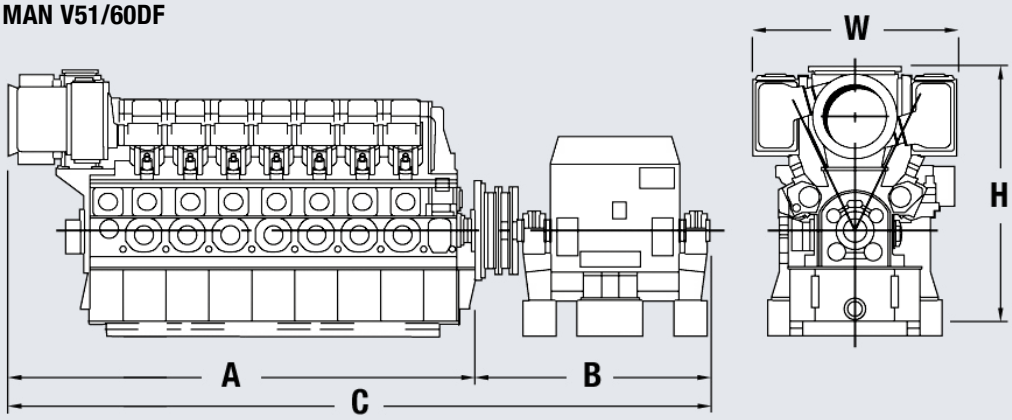
Technical Data

Output, dimensions and weight

MAN L51/60DF



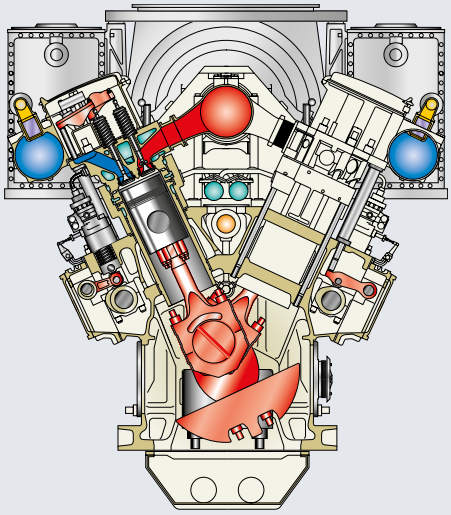
MAN V51/60DF



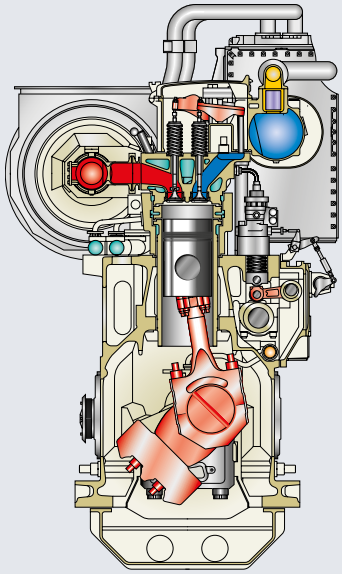
Engine MAN 51/60DF

Engine type	No. of cyl.	A (mm)	B (mm)	C (mm)	W (mm)	H (mm)	Dry mass (t)
MAN 9L51/60DF	9	10,545	4,805	15,350	2,970	6,030	225
MAN 12V51/60DF	12	9,835	4,950	14,785	4,700	6,530	276
MAN 14V51/60DF	14	10,835	5,150	15,985	4,700	6,530	318
MAN 18V51/60DF	18	13,148	5,410	18,558	4,700	6,530	381

Weights and dimensions are subject to final application



MAN V51/60DF



MAN L51/60DF

MAN 51/60DF

Bore 510 mm, stroke 600 mm		**9L**	**12V**	**14V**	**18V**
Engine speed	rpm	500/514	500/514	500/514	500/514
Frequency	Hz	50/60	50/60	50/60	50/60
Electrical Genset power	kW_e	8,847	11,796	13,790	17,766
Electr. Genset heat rate at 100% load		**9L**	**12V**	**14V**	**18V**
Liquid fuel (WB 2007/2008)	kJ/kWh_e	7,689	7,689	7,673	7,658
Gas fuel (WB 2007/2008)	kJ/kWh_e	7,456	7,456	7,442	7,427
Gas fuel (TA-Luft)	kJ/kWh_e	7,508	7,508	7,493	7,477
Lube oil consumption	kg/h	3.6	4.8	5.6	7.2

Gas fuel: incl. pilot fuel.
There is a special variant of the MAN 51/60 engine optimized for liquid fuel operation, offering easy modification to DF or G.

World-Class Service

Marine propulsion, gensets, and stationary plants

The PrimeServ offering

The MAN Diesel & Turbo Group offers worldwide, round-the-clock service, 365 days a year. In addition to MAN Diesel & Turbo's service headquarters in Augsburg, Copenhagen, Frederikshavn, Saint-Nazaire, Hamburg and Stockport, service centers on all continents provide comprehensive and continuous support.

MAN Diesel & Turbo engines are renowned for their quality and durability. We are a global organization with a strong local presence, delivering exceptional field service management, tailor-made solutions, and first-class technical support.

PrimeServ provides advice and assistance to customers throughout the product life cycle, from delivery to resale. With our far-reaching network of service centers, we respond rapidly to customer needs. Furthermore, we offer outstanding service and unrivalled technical expertise. Plus, we only use genuine spare parts – safeguarding the longevity of your engine.

PrimeServ's aim is to provide:

- Prompt delivery of high-demand OEM spare parts within 24 hours
- Fast, reliable and competent customer support
- Individually tailored O&M contracts
- Ongoing training and qualification of operators and maintenance staff
- Global service, 24 hours a day, 365 days a year
- Diagnosis and troubleshooting with our high-performance Online Service


PrimeServ Academy

D2366337EN-N9 Printed in Germany GGKMS-AUG-05161

MAN Diesel & Turbo
86224 Augsburg, Germany
Phone +49 821 322-3897
Fax +49 821 322-1460
powerplant@mandieselturbo.com
powerplants.man.eu

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