18V48/60TS
Two-stage turbocharged diesel engine
MAN Diesel & Turbo is the world’s leading designer and manufacturer of low and medium speed engines. Our involvement with electrical power generators goes back to 1904 when we supplied the first ever diesel generator sets to the Kiev Tram System.

Since those early days, MAN Diesel & Turbo has never lost its technological pre-eminence in the large engine field. Likewise, our engines have never relinquished their status as the most efficient combustion engines available.

More than ever before, MAN Diesel & Turbo’s development focus is on the environmental performance of our engines. Using our unrivalled grasp of large engine technology, we aim to make our engines progressively cleaner, more powerful and more efficient.

With our firm commitment to reducing emissions while increasing fuel efficiency and power density, and with our active partnership with environmental institutions and development banks, we intend to be part of the global emissions solution.
The Best in its Class
18V48/60TS

Turbochargers from MAN Diesel & Turbo
Turbochargers are the core of this innovative new concept – and MAN Diesel & Turbo is the only engine manufacturer that also designs and builds turbochargers. This unique expertise translates into exceptional efficiency and reliability.

Two-stage turbocharging
The idea is simple: just place two of MAN’s most efficient turbochargers upstream from the engine, one after the other. The result: the engine gets twice the charge air pressure, while turbocharger efficiency is increased significantly.

A single turbocharger, such as MAN Diesel & Turbo’s well known TCA88, is highly efficient; however, it has a limited pressure ratio. A specially designed compressor, as in the TCA88/PCE23, can increase the pressure ratio – but also has the effect of decreasing efficiency. The only solution to this dilemma is two-stage turbocharging.

The 18V48/60TS deploys MAN Diesel & Turbo’s tried and tested TCA88 and TCA77 standard turbochargers in sequence. The TCA88 is located upstream and provides the low pressure turbocharger, while the TCA77 forms the high pressure turbocharger, next to the engine. In this configuration, both turbochargers can achieve pressure ratios over 6 bars and efficiencies of more than 76 per cent.

Two turbochargers in sequence provide a new dimension in engine performance and operational flexibility. A wide load range from 1,050 to 1,200 kW per cylinder, a specific fuel oil consumption of 171 g/kWh at 1,050 kW/cyl. and reduced NOx emissions set a new benchmark for four stroke diesel engines.

The diesel engine 18V48/60TS
The 48/60 type diesel engine is a perfect example of proven technology and robust design. Over 800 units have been sold since the product was launched in 1988. They are now operating in a range of applications in power generation and marine propulsion.

Thanks to its high efficiency, the 18 cylinder engine is the 48/60 engine family’s best-selling configuration.

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For the two-stage turbocharged 18V48/60TS, only a few modifications were made to the standard engine:

- Adapted fuel injection nozzles
- Three-ring piston with higher compression ratio
- Modified camshaft for enhanced Miller timing
- Additional charge air bypass valve for low smoke emissions during engine start up

Comparison two-stage (48/60TS) – one-stage turbo charging (48/60B)
Standard Components, Proven Design

The overall design of the two-stage turbocharged 18V48/60TS has been kept as simple as possible. Apart from the modifications described above, the engine is standard, with the high pressure turbocharger directly mounted to it.

The low pressure turbocharger is located upstream from the engine, on its own steel frame. The combustion air and exhaust gas piping between both turbochargers is fitted with compensators, ensuring complete insulation from vibrations.

An air blower is situated below the steel frame of the low pressure turbocharger. Active during engine start-up and low part-load operation (up to 25 per cent load), it cares for low smoke emissions even during these operation phases.

Lowest fuel oil consumption or NOx emissions

The excess combustion air from the turbochargers provides greater operational flexibility. The high charge air pressure can be used for enhanced Miller Cycling, delivering significant fuel savings and further reducing NOx emissions.

As a result, the 18V48/60TS diesel engine’s extremely low specific fuel oil consumption of 171.5 g/kWh makes it the most cost-effective in its class.

Alternatively, the excess combustion air can be leveraged to significantly increase the engine’s power output, up to 1200 kW/cylinder. Although this does not save as much fuel, it does allow for a greater reduction of NOx emissions within a wide operation range. NOx emissions of 1480 mg/Nm³ make the 18V48/60TS the cleanest diesel engine in its power range.

Two-stage turbocharging is a modular system: its design enables most MAN Diesel & Turbo power plants to be retrofitted with this solution.

Flexibility in fuels, flexibility in operations

Like the 48/60 series standard engines the two-stage turbocharged 18V48/60TS can be operated with a wide range of different fuels:

- Heavy fuel oils with a viscosity up to 700 cst
- Marine diesel oil
- Gas oil

Due to the unique features of two-stage turbocharging, the 18V48/60TS can be operated continuously at shaft power outputs from 18,900 up to 21,600 kW. For example, this allows power producers to operate the engines at a normal load of 18,900 kW – taking advantage of the extremely low fuel oil consumption and giving them the possibility of a spinning reserve up to 21,600 kW.

Effects of Two-Stage Turbocharging

<table>
<thead>
<tr>
<th>Fuel consumption g/kW/h</th>
<th>177</th>
<th>175</th>
<th>172.5</th>
<th>171</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output (kW)</td>
<td>1200</td>
<td>1150</td>
<td>1100</td>
<td>1050</td>
</tr>
<tr>
<td>NOx (mg/Nm³)</td>
<td>1480</td>
<td>1480</td>
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</table>
18V48/60TS Technical Data

Overview

<table>
<thead>
<tr>
<th>Performance data</th>
<th>Unit</th>
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<th>3</th>
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<tr>
<td>Power per cylinder</td>
<td>kW</td>
<td>1050</td>
<td>1100</td>
<td>1150</td>
<td>1200</td>
</tr>
<tr>
<td>Tot. engine power</td>
<td>kW</td>
<td>18,900</td>
<td>19,800</td>
<td>20,700</td>
<td>21,600</td>
</tr>
<tr>
<td>Tot. el. genset power</td>
<td>kW</td>
<td>18,428</td>
<td>19,305</td>
<td>20,183</td>
<td>21,060</td>
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<tr>
<td>Spec. fuel oil consumption*</td>
<td>g/kWh</td>
<td>171.5</td>
<td>172.5</td>
<td>174.5</td>
<td>177.5</td>
</tr>
<tr>
<td>Heat Rate*</td>
<td>kJ/kWh</td>
<td>7,325</td>
<td>7,365</td>
<td>7,450</td>
<td>7,580</td>
</tr>
<tr>
<td>NOx emissions (dry at 15% O₂)</td>
<td>mg/Nm³</td>
<td>1650</td>
<td>1740</td>
<td>1850</td>
<td>1980</td>
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<tr>
<td>Mean effective pressure</td>
<td>bar</td>
<td>23.2/22.8</td>
<td>24.3/23.7</td>
<td>25.4/24.4</td>
<td>26.5/25.5</td>
</tr>
<tr>
<td>Spec. lube oil consumption</td>
<td>g/kWh</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
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</table>

Engine type specific reference charge air temperature before cylinder 43 °C. Lower calorific value (LHV) of the fuel 42.700 kJ/kg. Without attached pumps. Tolerance +5%.

Dimensions (mm)

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<tr>
<th>A</th>
<th>13148</th>
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<tbody>
<tr>
<td>B</td>
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</tr>
<tr>
<td>C</td>
<td>2410</td>
</tr>
<tr>
<td>H</td>
<td>9023</td>
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<tr>
<td>W</td>
<td>4700</td>
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Dry mass (t)

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<th>1</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>407</td>
<td>407</td>
<td>407</td>
<td>407</td>
</tr>
<tr>
<td>B</td>
<td>407</td>
<td>407</td>
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</tr>
</tbody>
</table>

Engine cycle: four-stroke
Turbocharging system: 2-stage, constant pressure
Low pressure TC type: MAN TCA88
High pressure TC type: MAN TCA77
Number of cylinders: 18
Bore: 480 mm
Stroke: 600 mm
Swept volume per cyl.: 108.6 dm³
Engine speed 50/60Hz: 500/514 rpm
Mean piston speed: 10.0/10.3 m/s
Nom. generator efficiency: 97.5%

Cooling:
- Cylinder cooling: HT cooling water
- LP-TC charge air cooler: 2-stage HT and LT cooling water
- HP-TC charge air cooler: 2-stage HT and LT cooling water
Starting method: compressed air with blower for low part load operation up to 25% load

Reference conditions according ISO 3046-1: 2002

- 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

Abbreviations:
- TC: Turbocharger
- HP: High pressure
- LP: Low pressure
- HT: High temperature
- LT: Low temperature
World Class Service
Expert advice and assistance

PrimeServ – peace of mind for life
With more than 150 PrimeServ service stations and service partners worldwide and our growing network of PrimeServ Academies, MAN Diesel & Turbo is committed to maintaining the most efficient, accessible after-sales organisation in the business.

PrimeServ’s aim is to provide:
- Prompt, OEM-standard service for the complete life cycle of an installation
- Training and qualification of service personnel at our PrimeServ Academies to maximise the plant’s availability and viability
- Rapid, global availability of genuine, quality-assured MAN Diesel & Turbo spare parts via local outlets or our 24 hour hotline.

PowerManagement by MAN Diesel & Turbo
Complementing the PrimeServ after-sales offering is the MAN PowerManagement concept.

MAN PowerManagement packages provide integrated support solutions for all aspects of running a power or co-generation plant. Individually negotiated agreements can cover assistance with – or delegation of – the management of all mechanical, electrical and thermal equipment. This gives the power plant operator comprehensive access to the technology, experience, best practices and professional resources of MAN Diesel & Turbo.

In short: PowerManagement by MAN Diesel & Turbo allows you to benefit from our specialist expertise in running a power plant while you concentrate on your core business.