

# 18V48/60TS

Two-stage turbocharged diesel engine

Engineering the Future – since 1758.

**MAN Diesel & Turbo**





## MAN Diesel & Turbo

The responsible way in leading technology

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

# A New Dimension



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 NO<sub>x</sub> emissions set a new benchmark for four stroke diesel engines.

### 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/RCF23, 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.

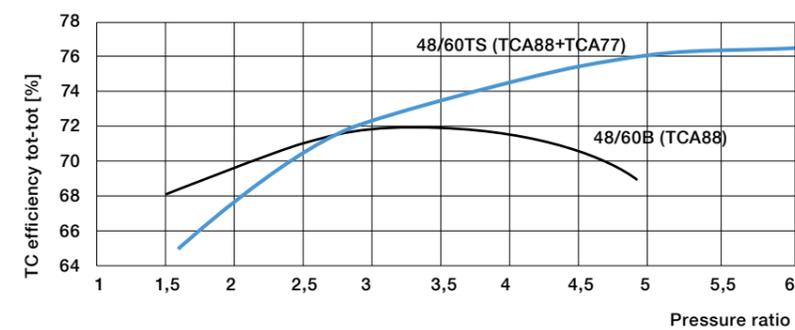
### The diesel engine 18V48/60TS

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.

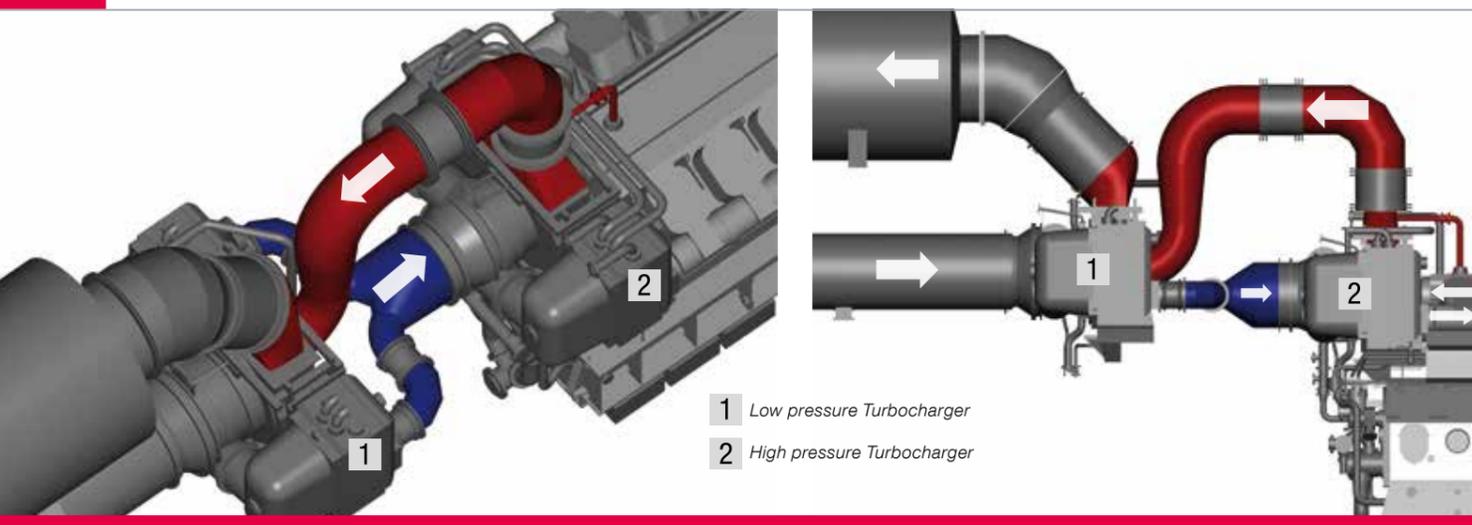
For the two-stage turbocharged 18V48/60TS, only a few modifications were made to the standard engine:

- 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



## 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 NO<sub>x</sub> 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 NO<sub>x</sub> 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 NO<sub>x</sub> emissions within a wide operation range. NO<sub>x</sub> emissions of 1480 mg/Nm<sup>3</sup> 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.

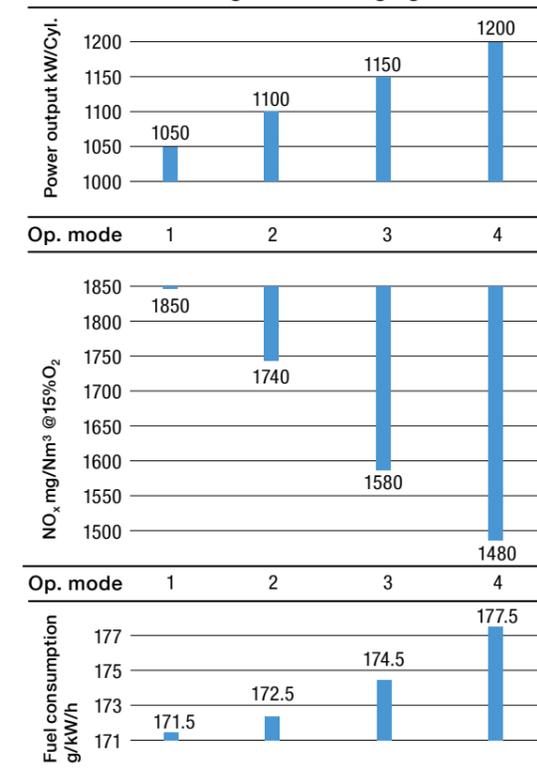
## Flexibility in fuels, flexibility in operations

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

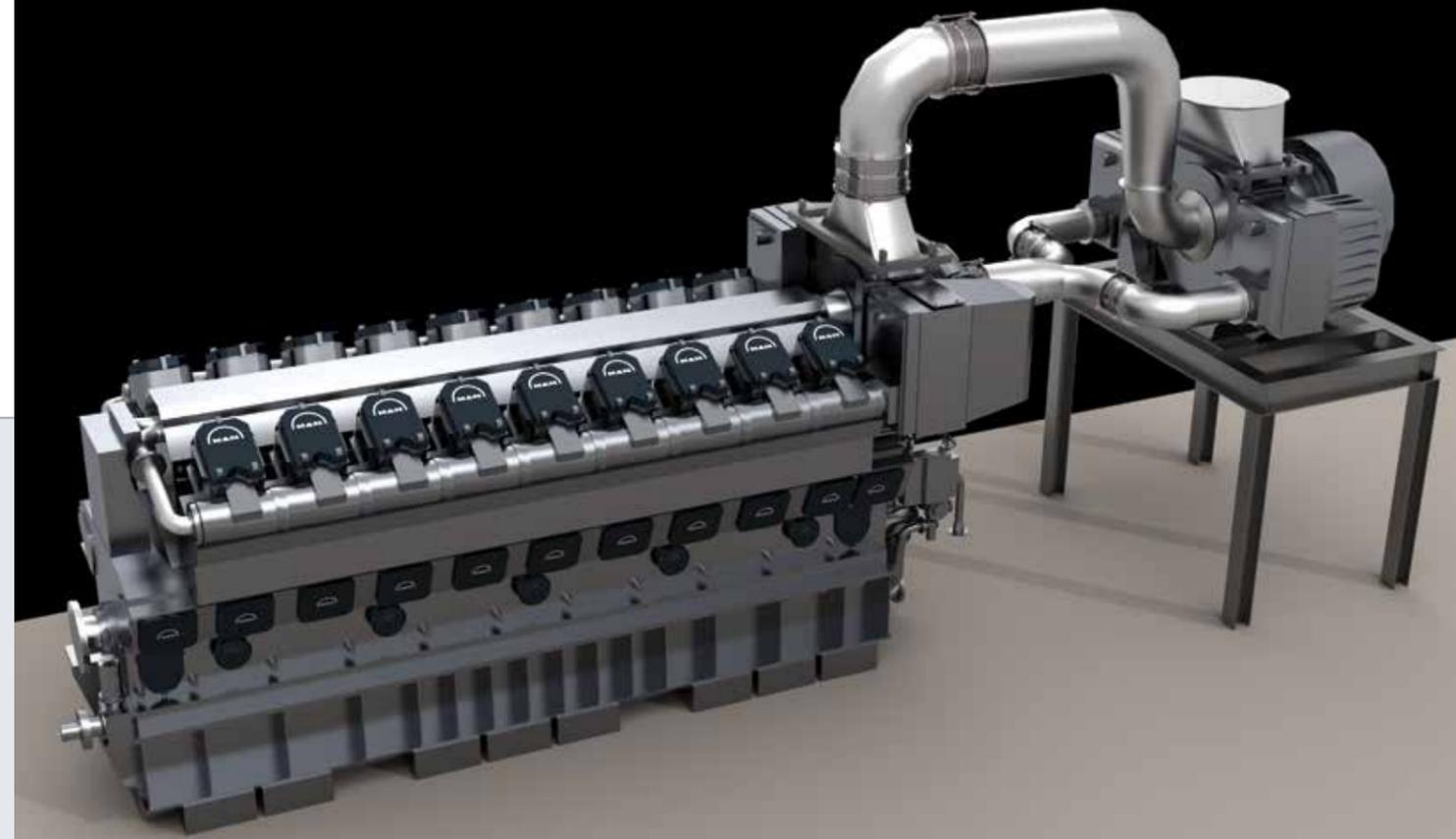
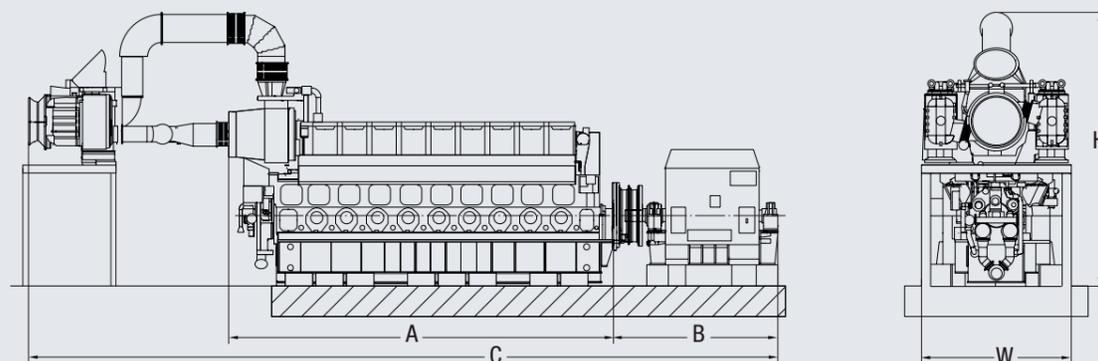
Due to the unique features of two-stage turbocharging, the 18V48/60TS can be operated continuously at shaft power outputs from 18,900 up to 21,600 kW. For example, this allows power producers to operate the engines at a normal load of 18,900 kW – taking advantage of the extremely low fuel oil consumption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

Effects of Two-Stage Turbocharging



# 18V48/60TS Technical Data

## Overview



### 18V48/60TS engine

Performance data	Unit	Operation mode				
		1	2	3	4	
Power per cylinder	kW	1050	1100	1150	1200	
Tot. engine power	kW	18,900	19,800	20,700	21,600	
Tot. el. genset power	kW	18,428	19,305	20,183	21,060	
Spec. fuel oil consumption*	g/kWh	171.5	172.5	174.5	177.5	
Heat Rate*	kJ/kWh	7,325	7,365	7,450	7,580	
NO <sub>x</sub> emissions (dry at 15% O <sub>2</sub> )	mg/Nm <sup>3</sup>	1850	1740	1580	1480	
Mean effective pressure	bar	23.2/22.6	24.3/23.7	25.4/24.7	26.5/25.8	
Spec. lube oil consumption	g/kWh	0,50	0,50	0,50	0,50	
+20% tolerance						
		A	B	C	H	W
Dimensions (mm)		13148	5410	24510	9023	4700
Dry mass (t)		407	407	407	407	407

\*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%

### Engine type:

**18V48/60TS**

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 dm<sup>3</sup>  
 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

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

### 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.

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