Marine engine programme

MAN Energy Solutions

2nd edition 2023

All data provided in this document is non-binding. This data serves informational purposes only and is especially not guaranteed in any way.

Depending on the subsequent specific individual projects, the relevant data may be subject to changes and will be assessed and determined individually for each project. This will depend on the particular characteristics of each individual project, especially specific site and operational conditions.

If this document is delivered in another language than English and doubts arise concerning the translation, the English text shall prevail.

Contents

MAN B&W two-stroke propulsion engines


LNG

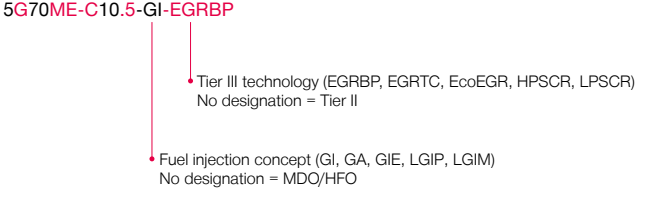
MAN Energy Solutions Tier II and Tier III engine programme

The two-stroke engines in this programme are either:
- Tier II engines complying with IMO Tier II
- Tier III engines complying with Tier II when operated in Tier II mode, and with Tier III when operated in Tier III mode

The latest updates on engine development and options are available at:
www.man-es.com → marine → planning-tools-and-downloads → market-update-notes

The latest updated engine programme is available at:
www.man-es.com → marine → planning-tools-and-downloads → marine-engine-programme

Engine type designation
To ensure that the engine designation describes the engine with regard to the fuel injection concept and the Tier III technology applied, the engine type designation also includes these concepts as described below (full designation, see page 19):



Fuel injection concepts are explained in detail on page 10 (ME-GI, ME-LGI and ME-GA dual fuel engines) and Tier III technologies on page 12.

ME-C engines
The electronic control of the ME-C engines includes flexible control of the cylinder processes, i.e. fuel injection timing and actuation of exhaust valves, starting valves, and cylinder lubrication.

ME-B engines
ME-B engines use electronically controlled pressure boosters for the fuel injection whereas actuation of the exhaust valves is camshaft operated, but with electronically controlled variable closing timing.

CEAS and TCS

CEAS (computerized engine application system) and TCS (turbocharger selection) applications cover all engine variants including available dual fuel and Tier III technology options. These applications provide essential data for the design and dimensioning of a ship's engine room (CEAS) and applicable turbochargers (TCS).

CEAS/TCS are available online at:
www.man-es.com → marine → planning-tools-and-downloads → ceas-engine-calculations/turbocharger-selection

In CEAS and TCS, all engines in this programme can be selected from the category 'Catalogue: Official'.

Earlier versions of this engine programme mention additional engine types. Some of these are still available in CEAS and TCS under the category 'Catalogue: Replaced'. New development will only be implemented in these designs to the extent it is considered necessary based on service experience. New efficiency enhancing features will not be available on older engine types.

Engine power

The engine brake power is stated in kW. The power values stated in the tables are available up to tropical conditions at sea level, i.e.:
- turbocharger inlet air temperature 45°C
- turbocharger inlet air pressure 1,000 mbar
- cooling water (sea/fresh) temperature 32/36°C

Specific fuel oil consumption (SFOC)

The figures in the two-stroke chapter represent the values obtained when the engine and turbocharger are matched to the lowest possible SFOC values while fulfilling the IMO NO_x Tier II or Tier III emission limits.

The SFOC figures are given in g/kWh and are based on the use of a fuel oil with a lower calorific value (LCV) equal to 42,700 kJ/kg at ISO conditions:
- turbocharger inlet air temperature 25°C
- turbocharger inlet air pressure 1,000 mbar
- cooling water temperature 25°C

Tolerances

The energy efficiency design index (EEDI) has led to increased focus on part-load SFOC. Therefore, MAN Energy Solutions offers the option to select the SFOC guarantee at a load point in the range from 50% to 100%. It is recommended that the SFOC guarantee point should be limited to the range 50% to 85% for part-load or low-load tuning methods.

When choosing an SFOC guarantee at or below 100%, the tolerances, adjustment, and calibration at 100% will affect an engine running at the lower SFOC guarantee load point. This includes tolerances on measuring equipment, engine process control, and turbocharger performance.

Consequently, SFOC guarantee tolerances are as follows:
- 5% tolerance for 100-85% engine load
- 6% tolerance for <85-65% engine load
- 7% tolerance for <65-50% engine load

Please note that the SFOC guarantee can only be given in one load point for Tier II engines. For Tier III engines see page 12.

Turbocharging system

Two-stroke engines can be delivered with MAN, Accelleron, or MHI turbochargers as standard.

The SFOC figures given in the two-stroke chapter are based on turbocharging with the best possible turbocharging efficiency generally available, which means 67% for all engines with 45-cm bore and larger, and 64% for engine bores smaller than 45 cm. Both efficiency figures refer to 100% SMCR.

There are exceptions to this rule, S40ME-C9.5 and S35ME-C9.7 are also available as standard high-efficiency applications offering all Tier II standard tunings and all Tier III options requiring a high-efficiency turbocharger.

Only engine specifications for which an applicable high-efficiency turbocharger is available are subject to firm order.

Fuel consumption and optimisation possibilities for Tier II engines

Various optimisation possibilities for improved part-load and low-load SFOC are available for MAN B&W type engines. High-load optimisation is for best possible SFOC at 100% engine load.

Optimisation of SFOC in the part-load range (50-85%) or low-load range (25-70%) requires selection of the EGB (exhaust gas bypass) tuning method available for most ME-C and ME-B engines. For G80ME-C10.6, S60ME-C10.6, G50ME-C10.7 and S50ME-C10.6, the EGB tuning method is available in the low-load version.

EPT (engine process tuning) is available for G95ME-C10.5, G80ME-C10.5 and G60ME-C10.5. EPT uses engine control process parameters to improve part or low-load SFOC.

SEQ (sequential tuning) is standard for G95ME-C10.6. This includes sequential fuel injection and turbocharging application similar to the EGRTC Tier III technology. This will be available in the low-load version.

The tuning methods mentioned are available for all SMCR points, but cannot be combined.

In cases where a higher steam production is needed, the EEC (economiser energy control) solution offers additional automatic control of an EGB. Forcing an EGB open at loads where the EGB is normally closed results in a higher exhaust gas temperature, but with an SFOC penalty. However, the total fuel consumption (engine and oil-fired boiler) will be improved.

By adding an EGB, a higher steam production can also be obtained for EPT and SEQ-tuned engines. The EGB must be closed above 90% engine load, but can be opened below 90% to obtain higher exhaust temperatures resulting in increased steam production.

Calculations with EEC are made on request.

ME-GI, ME-LGI and ME-GA dual fuel engines

This engine programme includes a number of engines designed for gas fuel (ME-GI and ME-GA engines) and liquid gas fuel (ME-LGI engines) operation.

ME-GA

The ME-GA engine is the latest addition to our dual fuel portfolio. Methane is admitted during the compression stroke in the Otto cycle process, which allows for a lower supply pressure compared to ME-GI engines. This is especially interesting for LNG carrier designs where boil-off gas handling and engine fuel gas supply is integrated.

The ME-GA engine includes EGR. This enables Tier III compliance both in dual fuel mode and in fuel oil mode.

Figures for the G70ME-C10.5-GA-EGRBP engine are included in this engine programme (see page 47).

Fuel types

Fuel	Fuel designation	LCV [kJ/kg]
Methane (LNG)	GI/GA	50,000
Methanol	LGIM	19,900
LPG*	LGIP	46,000
Ethane (LEG)	GIE	47,500

*LPG is a mixture of liquid propane and butane.

In this engine programme, engines available for the different fuel types are listed in separate sections: GI (page 41), LGIM (page 55), LGIP (page 63), and GIE (page 69).

Pilot oil energy fraction

In dual fuel mode, the pilot oil energy fraction amounts to 1.5%-5.0% for GI, depending on engine type, 5.0% for GIE, LGIP and for LGIM in L_1 rating. For actual pilot oil energy fractions, refer to individual engine pages and CEAS.

Fuel designation	Available pilot oil fraction in %	Compatible pilot fuel oil types
GI	1.5-5.0	MDO & HFO (<0.5% S)
GA	0.5	MDO & HFO (<0.5% S)
LGIM	5.0	MDO & HFO (<0.5% S)
LGIP	5.0	MDO & HFO (<0.5% S)
GIE	5.0	MDO & HFO (<0.5% S)

G95/90/80/70ME-C10.5-GI engines have a gas tuning, called “dual fuel gas optimised”, with improved gas consumption in dual fuel mode. All other ME-GI engines have a “dual fuel standard” gas tuning. Both gas tunings apply to both Tier II and all Tier III technologies.

The following fuel consumption figures are shown in the tables for dual fuel engines:
- dual fuel mode with distribution of specific gas consumption (SGC) and specific pilot oil consumption (SPOC)
- fuel oil mode

Guarantee figures for dual fuel engines are given for heat rate, which has the same tolerances as SFOC guarantees, see page 8.

Heat rate is defined as follows (example for methane as dual fuel): Heat rate (kJ/kWh) = SGC (g/kWh) × 50 kJ/g + SPOC (g/kWh) × 42.7 kJ/g.

The CEAS report will specify the distribution between SGC and SPOC as well as the heat rate over the load range.

In the past, cylinder lubrication oils have been mixed to optimise the cleaning performance of an oil to the level required by a specific engine, or specific operating conditions. For example, by mixing a Cat. II BN 100 oil with a less efficient BN 40–70 oil. With the introduction of Cat. II BN 40 oils, alternating between high- and low-BN cylinder oils is no longer necessary.

Greenhouse gas emissions

In existing IMO regulations, the energy efficiency design index (EEDI) and other measures operate with CO_2 as the only contributor to greenhouse gas (GHG) emissions. However, IMO is considering to regulate other GHGs than CO_2 (methane and laughing gas). The expected timeframe for adoption of IMO regulation of methane slip is 3-5 years. Further, upcoming EU regulations (FuelEU Maritime and EU Emission trading system (ETS)) are expected to cover methane slip and laughing gas from 2025 and 2026 respectively.

In its effort to facilitate decarbonisation in the shipping industry, MAN Energy Solutions will, for the complete two-stroke engine programme, be able to guarantee a methane slip of 0.2 g/kWh with a tolerance of +/-0.2 g/kWh for ME-GI engines. Additionally, MAN Energy Solutions provides methane slip figures for part-load engine operation, please refer to CEAS.

Tier III technologies

To ensure compliance with IMO Tier III regulations, a Tier III NO_x reduction technology must be selected. The preferred technology depends on market demands, engine type, other requirements, and operational pattern.

The Emission Project Guide provides more detailed descriptions of these technologies at:
www.man-es.com → marine → planning-tools-and-downloads → project-guides → two-stroke

All Tier III engines have at least two operating modes:
- Tier III mode fulfilling the IMO Tier III regulations
- Tier II mode fulfilling the IMO Tier II regulations

Tier III technologies are designed for either low-sulphur fuels (<0.1%) or high-sulphur fuels (>0.5% and <3.5%) in Tier III operation. In Tier II operation, the engine is in all cases capable of using fuels with a high sulphur content. The fuel sulphur content must be selected when the engine is ordered, as it impacts the engine design. Fuel consumption guarantees can be given for engines for both Tier II and Tier III modes.

EGR
Two EGR-matching concepts are available depending on engine bore:
- **EGRTC:** T/C cut-out matching for ME-C engines with bores ≥ 80 cm
- **EGRBP:** Bypass matching for ME-C engines with bores ≤ 70 cm

EGR operation is also possible for GI and LGIM engines.

EcoEGR
EcoEGR is an SFOC-optimised version of the EGRBP system available on most ME-C engines. Compared to the standard EGRBP system, EcoEGR engines operate with 10–15% recirculation in Tier II mode and with slightly increased recirculation in Tier III mode. EcoEGR engines are available for compliant fuels (<0.5 %S) where considerable overall savings are obtained and available on request for high-sulphur fuels.

EcoEGR operation is also possible for GI and some LGIM engines, except engines with gas-optimised tuning.

SCR

Two SCR concepts are available:

- **HPSCR:** High-pressure SCR with a reactor installed upstream the turbocharger(s)
- **LPSCR:** Low-pressure SCR with a reactor installed downstream the turbocharger(s)

SCR operation applies to most ME-C and ME-B engines, including some dual fuel engine types. The SCR system must be supplied by an approved supplier.

ME-GA

As mentioned on page 10, the ME-GA engine is Tier III compliant in dual fuel mode, and as it is equipped with EGR as standard, it is also Tier III compliant in fuel oil mode.

Application of high-sulphur fuels and SO_X scrubbers

All two-stroke engines in the MAN Energy Solutions marine engine programme are compatible with SO_X scrubbers, with the exception of ME-GA engines.

A SO_X scrubber installation will increase the backpressure, thereby affecting engine performance. Accordingly, it is required that a SO_X scrubber installation does not increase the backpressure by more than 30 mbar at SMCR.

Fuels

Since 1 January 2020, the global sulphur content for marine fuels must not exceed 0.5%. To ensure compliant operation, one of the following methods must be selected:

- Use a compliant fuel:
  - Global: max. 0.5% sulphur
  - ECA: max. 0.1% sulphur
- Use methane, ethane, methanol, or LPG together with a compliant pilot fuel.
- Use a high-sulphur fuel in combination with a SO_X scrubber to obtain an exhaust gas SO_X level equivalent to operation on a compliant fuel.

Some dual fuel engines are available on request with high-sulphur fuels in Tier II fuel oil mode with a scrubber installed.

The fuel specification must be selected at engine order as it impacts the engine design.

Fuels with a viscosity below 700 cSt at 50°C can be used.

Waste heat recovery systems

Waste heat recovery systems (WHRS) are available for certain engine configurations on request for both Tier II and Tier III engines with high-efficiency turbochargers. Contact MAN Energy Solutions for further information.

Power take off systems

Power take off (PTO) systems are available on request for both Tier II and Tier III engines with high-efficiency turbochargers. PTO systems operate in the margin between the light propeller curve and the load limits of the engine. The magnitude of PTO power permitted is as such influenced by the propeller light running margin applied for the specific project. The specific load of the engine permitted for design, including power for propulsion and PTO power, as a function of speed, is governed by the PTO layout limit.

For further information on the PTO layout limit as well as the availability and integration of PTOs, please contact MAN Energy Solutions. Information about the different PTO solutions can be found in the paper “Shaft generators for low speed main engines” – available at: www.man-es.com → marine → planning-tools-and-downloads → technical-papers

Lubricating oil consumption

The system oil consumption varies according to engine sizes and, operational and maintenance patterns.

Specific cylinder oil consumption

Alpha ACC (Adaptive Cylinder oil Control) is the lubricating mode for MAN B&W two-stroke engines that involves lube oil dosing proportional to the engine load and to the sulphur content in the fuel being burned.

Dosage:
- 0-0.5% sulphur fuels including methane (LNG), methanol, LPG and ethane (LEG):
  Minimum feed rate: 0.6 g/kWh
- >0.5% sulphur fuels (HSFO) (scrubber applications):
  Feed rate (g/kWh) = ACC × S%,
  - where typically ACC = 0.3 g/(kWh × S%)

Recommended cylinder oils:
- Cat. II BN 40 cylinder oil is recommended for engines using low-sulphur fuels:
  0-0.5% sulphur fuels including methane, methanol, LPG and ethane
- Cat. II BN 100-140+ cylinder oil is recommended for engines using high-sulphur fuels:
  >0.5% sulphur fuels

For specific lubrication guidelines, reference is made to the latest lubrication guidelines available for your specific engine type, for example service letters. Service letters are available at: www.man-es.com → marine → planning-tools-and-downloads → Service Letters

Extent of delivery

The final and binding extent of delivery of MAN B&W two-stroke engines is to be supplied by our licensee, the engine maker, who should be contacted to determine the execution for the actual project.

Special certification processes will need to be specified before order is placed as they require a different scope of delivery, for example: engines certified for US EPA, engines with SCR certified by Scheme B, etc.

MAN Asset+

MAN Asset+ engine functionality options enable installation and management of optional updates and features for MAN B&W engines. It is a flexible solution that can match the individual needs of the end users. The first five MAN Asset+ options available are described in the following. Their application depends on the engine and ship type, and they can be ordered directly from our licensees.

PMI ACCo

Adaptive Cylinder Control (ACCo) is a fully automatic system that ensures constant optimal engine tuning regardless of engine load, load changes, and varying fuel calorific values. Using performance values from the engine's official shop test as reference, the algorithm adjusts the fuel index and exhaust valve operation of each cylinder. PMI ACCo ensures the lowest possible fuel consumption.

ACCo is available on request for ME-C engines and is delivered as the standard configuration for ME-C10.6 and dual fuel engines.

Synchrophasing

Synchrophasing is an effective, maintenance-free tool introduced for ship types with twin propulsion to reduce vibrations on both vessel and engine structures. Vibrations are reduced by synchronising the port and starboard shaft speeds, thereby out-balancing forces/moments from the starboard engine/propeller with the same forces/moments from the portside engine/propeller.

Vibrations can be reduced by up to 50-70% depending on sea wave state and vessel roll/pitch. Synchrophasing is available on request for all ME-C engines.

PTO interface option C

PTO interface option C is an enhanced interface between the engine control system (ECS) and the vessel's power management system (PMS) for plants with a large power take off (PTO) or shaft generator capacity relative to the SMCR-power.

The enhanced interface improves governor stability and performance, and increases PTO power availability in the design. In addition, PTO interface option C provides signals to the PMS that enable automatic load sharing

between the main engine, the PTO, and the gensets. This ensures a higher utilisation rate of the PTO, thus reducing the genset's running hours. If power is supplied solely by the PTO, it will also reduce the risk of blackout without overloading of the engine.

PTO interface option C is available on request for all ME-C engines equipped with a large PTO, and it is delivered as the standard configuration for ME-GA engines with PTO.

Adaptive Cooling

Adaptive Cooling is an improved design of the piping and valve arrangement for automatic control of the cooling water flow to the scavenge air cooler and the exhaust gas recirculation cooler for EGR engines, depending on the engine operating mode.

It reduces the power consumption for coolant circulation significantly when running in Tier II mode (EGRBP and EcoEGR engines) or TC cut-out mode (EGRTC engines), see page 12, and, as a result, reduces fuel consumption and improves the carbon intensity indicator (CII) rating.

Adaptive Cooling is available on request for all EGR engines.

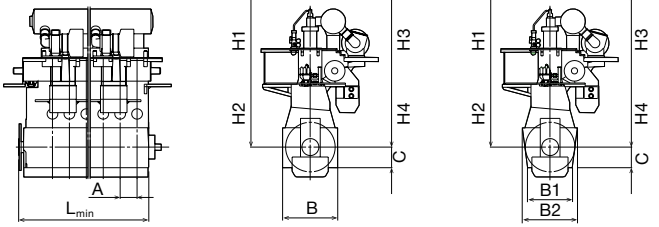
Two-stage Cooler

The Two-stage Cooler is a new scavenge air cooler design that uniquely enables utilisation of the energy from the scavenge air cooling process for other energy-consuming processes on board, such as increasing the boiler feed water temperature, gas vaporisation, fresh water production, air condition heating, organic Rankine cycle system, or the ballast water treatment system. This leads to lower fuel consumption and improved CII rating.

The Two-stage Cooler is available on request for all MAN B&W two-stroke engines, based on a case-specific pre-study conducted by MAN Energy Solutions.

Engine dimensions

The minimum length Lmin is stated from the aft end of the crankshaft to the fore end of the engine.



L_{min}	Minimum length of engine
A	Cylinder distance
B	Bedplate width
B1	Bedplate width at foot flange
B2	Bedplate width at top flange
C	Crankshaft to underside of foot flange
H1	Normal height lifting procedure
H2	Reduced height lifting procedure
H3	Reduced height lifting procedure with MAN B&W double-jib crane
H4	Normal height lifting procedure with MAN B&W double-jib crane

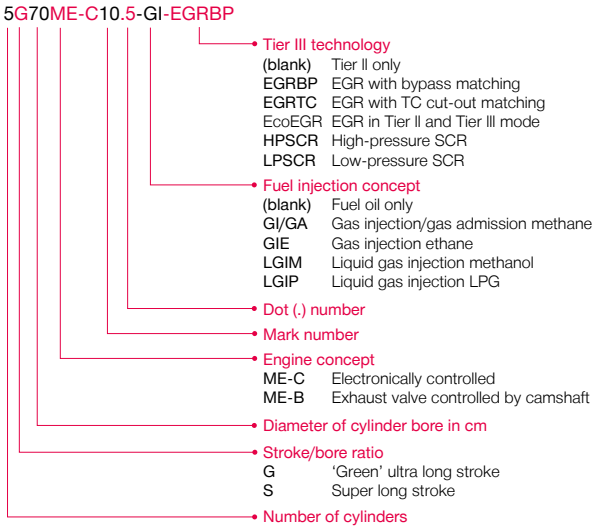
Dry masses

Dry masses are stated in metric tonnes for engines with MAN turbocharger(s) and a standard turning wheel. Figures will vary depending on the design and options chosen, for example, moment compensators, turning wheel, etc.

Dry masses for Tier III engines cover components directly integrated on the engine.

Indicated values are for guidance only and are not binding.

Engine type designation



Engine fuel variants

Engine type	Fuel oil	GI	GA	LGIM	LGIP	GIE
G95ME-C10.6	●					
G95ME-C10.5	●	●		●		
G90ME-C10.5	●	●				
G80ME-C10.6	●					
G80ME-C10.5	●	●		●		
G70ME-C10.5	●	●	●			
S70ME-C10.5	●	●				
G60ME-C10.5	●	●		●	●	
G60ME-C9.5						●
S60ME-C10.6	●					
S60ME-C10.5	●	●		●	●	
G50ME-C10.7	●					
G50ME-C9.6		●		●	●	
G50ME-C9.5						●
S50ME-C10.6	●					
S50ME-C9.7	●	●				
S50ME-C9.6				●		
S46ME-C8.6	●					
G45ME-C9.7	●			●		
G45ME-C9.5		●				
S40ME-C9.5	●					
S35ME-C9.7	●	●			●	
S30ME-B9.5	●					

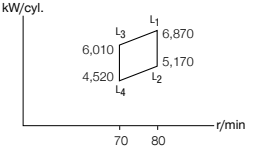
Fuel oil

MAN B&W G95ME-C10.6

Tier II Tier III

Cyl.	L_1 kW
6	41,220
7	48,090
8	54,960
9	61,830
10	68,700
11	75,570
12	82,440

Stroke: 3,460 mm/**L_1 MEP: 21.0 bar**



MAN B&W G95ME-C10.6

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
Low-load SEQ	151.5	155.0	163.5

MAN B&W G95ME-C10.6-EGRTC

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	151.5	155.0	163.5
Tier III mode	158.5	158.0	161.0

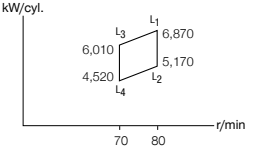
MAN B&W G95ME-C10.6-LPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	151.5	155.0	163.5
Tier III mode	155.5	158.0	161.0

MAN B&W G95ME-C10.5

Cyl.	L_1 kW
6	41,220
7	48,090
8	54,960
9	61,830
10	68,700
11	75,570
12	82,440

Stroke: 3,460 mm/**L_1 MEP:** 21.0 bar



MAN B&W G95ME-C10.5

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	158.5	157.0	161.0
Part-load EPT	156.5	155.5	163.5
Low-load EPT	154.5	156.5	163.5

MAN B&W G95ME-C10.5-EGRTC

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	154.5	156.5	163.0
Tier III mode	160.5	160.0	165.0

MAN B&W G95ME-C10.5-LPSCR

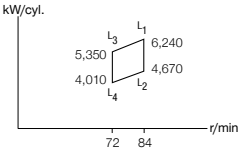
L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	154.5	156.5	163.5
Tier III mode	155.5	157.5	164.5

MAN B&W G90ME-C10.5

Tier II | Tier III

Cyl.	L_1 kW
6	37,440
7	43,680
8	49,920
9	56,160
10	62,400
11	68,640
12	74,880

Stroke: 3,260 mm/**L_1 MEP:** 21.5 bar



MAN B&W G90ME-C10.5

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	162.5	161.0	165.0
Part-load EGB	160.5	159.5	167.5
Low-load EGB	158.5	160.5	167.5

MAN B&W G90ME-C10.5-EGRTC

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	158.5	160.5	167.0
Tier III mode	164.5	164.0	169.0

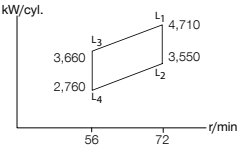
MAN B&W G90ME-C10.5-LPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	158.5	160.5	167.5
Tier III mode	159.5	161.5	168.5

MAN B&W G80ME-C10.6

Cyl.	L_1 kW
6	28,260
7	32,970
8	37,680
9*	42,390

Stroke: 3,720 mm/**L_1 MEP:** 21.0 bar



MAN B&W G80ME-C10.6

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	158.5	157.0	161.0
Low-load EGB	154.5	155.0	165.0

MAN B&W G80ME-C10.6-EGRTC

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	154.5	155.0	165.0
Tier III mode	156.5	156.0	162.0

MAN B&W G80ME-C10.6-HPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	154.5	155.0	165.0
Tier III mode	154.5	155.0	165.5

MAN B&W G80ME-C10.6-LPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	154.5	155.0	165.0
Tier III mode	157.0	156.5	165.5

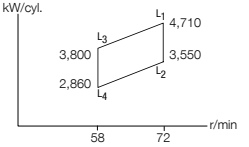
* Available on request for HPSCR

MAN B&W G80ME-C10.5

Tier II Tier III

Cyl.	L_1 kW
6	28,260
7	32,970
8	37,680
9*	42,390

Stroke: 3,720 mm/L_1 **MEP:** 21.0 bar



MAN B&W G80ME-C10.5

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	160.5	159.0	163.0
Part-load EPT	158.5	157.5	165.5
Low-load EPT	156.5	158.5	165.5

MAN B&W G80ME-C10.5-EGRTC

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	156.5	158.5	165.0
Tier III mode	162.5	162.0	167.0

MAN B&W G80ME-C10.5-HPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	156.5	158.5	165.5
Tier III mode	158.0	159.5	166.0

MAN B&W G80ME-C10.5-LPSCR

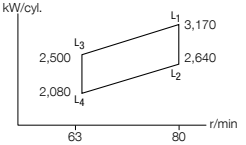
L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	156.5	158.5	165.5
Tier III mode	157.5	159.5	166.5

* Available on request for HPSCR

MAN B&W G70ME-C10.5

Cyl.	L_1 kW
5	15,850
6	19,020

Stroke: 3,256 mm/**L_1 MEP:** 19.0 bar



MAN B&W G70ME-C10.5

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	160.5	158.5	163.0
Part-load EGB	158.5	157.0	165.5
Low-load EGB	156.5	158.0	165.5

MAN B&W G70ME-C10.5-EGRBP

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	156.5	158.0	166.0
Tier III mode	163.5	162.5	168.0

MAN B&W G70ME-C10.5-HPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	156.5	158.0	165.5
Tier III mode	158.0	159.0	166.0

MAN B&W G70ME-C10.5-LPSCR

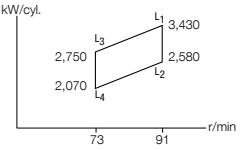
L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	156.5	158.0	165.5
Tier III mode	157.5	159.0	166.5

MAN B&W S70ME-C10.5

Tier II | Tier III

Cyl.	L_1 kW
5	17,150
6	20,580
7	24,010
8	27,440

Stroke: 2,800 mm/**L_1 MEP:** 21.0 bar



MAN B&W S70ME-C10.5

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	164.5	163.0	167.0
Part-load EGB	162.5	161.5	169.5
Low-load EGB	160.5	162.5	169.5

MAN B&W S70ME-C10.5-EGRBP

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	160.5	162.5	170.0
Tier III mode	167.5	167.0	172.0

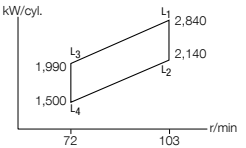
MAN B&W S70ME-C10.5-HPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	160.5	162.5	169.5
Tier III mode	162.0	163.5	170.0

MAN B&W G60ME-C10.5

Cyl.	L_1 kW
5	14,200
6	17,040
7	19,880
8	22,720

Stroke: 2,790 mm/**L_1 MEP:** 21.0 bar



MAN B&W G60ME-C10.5

L_1 SFOC [g/kWh]			
Opt. load range	50%	75%	100%
High-load	161.5	160.0	164.0
Part-load EPT	159.5	158.5	166.5
Low-load EPT	157.5	159.5	166.5

MAN B&W G60ME-C10.5-EGRBP

L_1 SFOC [g/kWh]			
	50%	75%	100%
Tier II mode	157.5	159.5	167.0
Tier III mode	164.5	164.0	169.0

MAN B&W G60ME-C10.5-HPSCR

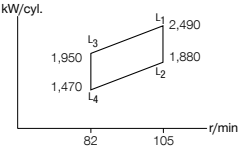
L_1 SFOC [g/kWh]			
	50%	75%	100%
Tier II mode	157.5	159.5	166.5
Tier III mode	159.0	160.5	167.0

MAN B&W S60ME-C10.6

Tier II Tier III

Cyl.	L_1 kW
5	12,450
6	14,940
7	17,430
8	19,920

Stroke: 2,400 mm/**L_1 MEP:** 21.0 bar



MAN B&W S60ME-C10.6

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	157.5	156.0	160.0
Low-load EGB	153.5	154.0	164.0

MAN B&W S60ME-C10.6-EGRBP

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	153.5	154.0	165.0
Tier III mode	156.5	156.0	165.0

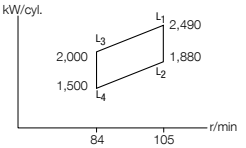
MAN B&W S60ME-C10.6-HPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	153.5	154.0	164.0
Tier III mode	153.5	154.0	164.5

MAN B&W S60ME-C10.5

Cyl.	L_1 kW
5	12,450
6	14,940
7	17,430
8	19,920

Stroke: 2,400 mm/**L_1 MEP:** 21.0 bar



MAN B&W S60ME-C10.5

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	164.5	162.0	166.0
Part-load EGB	161.5	160.5	167.5
Low-load EGB	159.5	161.5	167.5

MAN B&W S60ME-C10.5-EGRBP

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	159.5	161.5	168.0
Tier III mode	167.5	166.0	171.0

MAN B&W S60ME-C10.5-HPSCR

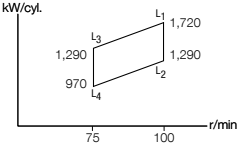
L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	159.5	161.5	167.5
Tier III mode	161.0	162.5	168.0

MAN B&W G50ME-C10.7

Tier II Tier III

Cyl.	L_1 kW
5	8,600
6	10,320
7	12,040
8	13,760

Stroke: 2,500 mm/L_1 **MEP:** 21.0 bar



MAN B&W G50ME-C10.7

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	161.5	160.0	164.0
Low-load EGB	157.5	159.5	166.5

MAN B&W G50ME-C10.7-EGRBP

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	157.5	159.5	167.0
Tier III mode	164.5	164.0	169.0

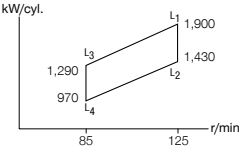
MAN B&W G50ME-C10.7-HPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	157.5	159.5	166.5
Tier III mode	159.0	160.5	167.0

MAN B&W S50ME-C10.6

Cyl.	L_1 kW
5	9,500
6	11,400
7	13,300
8	15,200
9	17,100

Stroke: 2,214 mm/**L_1 MEP:** 21.0 bar



MAN B&W S50ME-C10.6

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	158.5	157.0	161.0
Low-load EGB	154.5	155.0	165.0

MAN B&W S50ME-C10.6-EGRBP

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	154.5	155.0	166.0
Tier III mode	157.5	157.0	166.0

MAN B&W S50ME-C10.6-HPSCR

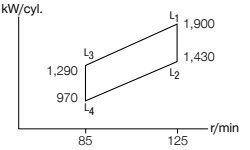
L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	154.5	155.0	165.0
Tier III mode	154.5	155.0	165.5

MAN B&W S50ME-C9.7

Tier II | Tier III

Cyl.	L_1 kW
5	9,500
6	11,400
7	13,300
8	15,200
9	17,100

Stroke: 2,214 mm/**L_1 MEP:** 21.0 bar



MAN B&W S50ME-C9.7

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	161.5	160.5	165.0
Part-load EGB	159.5	159.0	167.5
Low-load EGB	157.5	160.0	167.5

MAN B&W S50ME-C9.7-EGRBP

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	157.5	160.0	168.0
Tier III mode	164.5	164.5	170.0

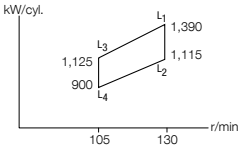
MAN B&W S50ME-C9.7-HPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	157.5	160.0	167.5
Tier III mode	159.0	161.0	168.0

MAN B&W S46ME-C8.6

Cyl.	L_1 kW
5	6,950
6	8,340
7	9,730
8	11,120

Stroke: 1,932 mm/L_1 **MEP:** 20.0 bar



MAN B&W S46ME-C8.6

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	165.5	163.0	167.0
Part-load EGB	163.5	161.5	169.5
Low-load EGB	161.5	162.5	169.5

MAN B&W S46ME-C8.6-EGRBP

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	161.5	162.5	170.0
Tier III mode	168.5	167.0	172.0

MAN B&W S46ME-C8.6-HPSCR

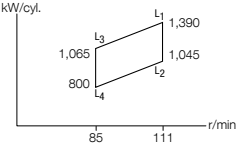
L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	161.5	162.5	169.5
Tier III mode	163.0	163.5	170.0

MAN B&W G45ME-C9.7

Tier II Tier III

Cyl.	L_1 kW
5	6,950
6	8,340
7	9,730
8	11,120

Stroke: 2,250 mm/**L_1 MEP:** 21.0 bar



MAN B&W G45ME-C9.7

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	162.5	161.0	165.0
Part-load EGB	160.5	159.5	167.5
Low-load EGB	158.5	160.5	167.5

MAN B&W G45ME-C9.7-EGRBP

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	158.5	160.5	168.0
Tier III mode	165.5	165.0	170.0

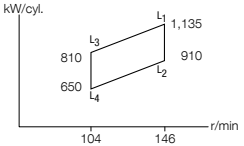
MAN B&W G45ME-C9.7-HPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	158.5	160.5	167.5
Tier III mode	160.0	161.5	168.0

MAN B&W S40ME-C9.5

Cyl.	L_1 kW
5	5,675
6	6,810
7	7,945
8	9,080
9*	10,215

Stroke: 1,770 mm/**L_1 MEP:** 21.0 bar



MAN B&W S40ME-C9.5

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	172.5	170.0	174.0
Part-load EGB	169.5	168.5	175.5
Low-load EGB	167.5	169.5	175.5

MAN B&W S40ME-C9.5-HPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	167.5	169.5	175.5
Tier III mode	169.0	170.5	176.0

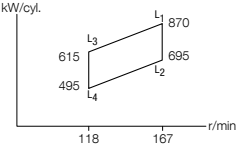
Note: All fuel consumption figures are based on engine driven HPS
* Not available with HPSCR

MAN B&W S35ME-C9.7

Tier II Tier III

Cyl.	L_1 kW
5	4,350
6	5,220
7	6,090
8	6,960

Stroke: 1,550 mm/**L_1 MEP:** 21.0 bar



MAN B&W S35ME-C9.7

L_1 SFOC [g/kWh]			
Opt. load range	**50%**	**75%**	**100%**
High-load	169.5	167.0	171.0
Part-load EGB	166.5	165.5	172.5
Low-load EGB	164.5	166.5	172.5

MAN B&W S35ME-C9.7-HPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	164.5	166.5	172.5
Tier III mode	166.0	167.5	173.0

MAN B&W S35ME-C9.7-LPSCR

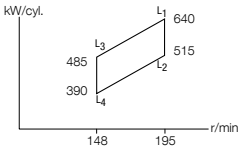
L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	164.5	166.5	172.5
Tier III mode	165.5	167.5	173.5

Note: All fuel consumption figures are based on engine driven HPS

MAN B&W S30ME-B9.5

Cyl.	L_1 kW
5	3,200
6	3,840
7	4,480
8	5,120

Stroke: 1,328 mm/**L_1 MEP:** 21.0 bar



MAN B&W S30ME-B9.5

L_1 SFOC [g/kWh]			
Opt. load range	50%	75%	100%
High-load	175.5	173.0	176.0

MAN B&W S30ME-B9.5-HPSCR

L_1 SFOC [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	175.5	173.0	176.0
Tier III mode	177.0	174.0	176.5

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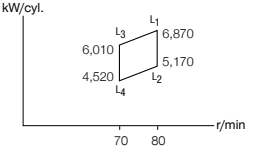
Methane/LNG (GI/GA)

MAN B&W G95ME-C10.5-GI

Tier II Tier III

Cyl.	L_1 kW
6	41,220
7	48,090
8	54,960
9	61,830
10	68,700
11	75,570
12	82,440

Stroke: 3,460 mm/**L_1 MEP:** 21.0 bar



MAN B&W G95ME-C10.5-GI (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Gas optimised	126.9+3.8/157.5	126.3+2.9/160.0	132.9+2.4/164.0

MAN B&W G95ME-C10.5-GI-EGRTC (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	125.2+3.8/157.5	126.3+2.9/160.0	132.9+2.4/164.0
Tier III mode	131.1+3.8/157.5	131.5+2.9/157.5	134.6+2.4/161.0

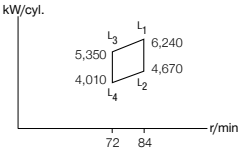
MAN B&W G95ME-C10.5-GI-LPSCR (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	126.9+3.8/157.5	127.8+2.9/160.0	133.7+2.4/165.0
Tier III mode	128.6+3.8/155.5	131.5+2.9/158.0	134.6+2.4/161.0

MAN B&W G90ME-C10.5-GI

Cyl.	L_1 kW
6	37,440
7	43,680
8	49,920
9	56,160
10	62,400
11	68,640
12	74,880

Stroke: 3,260 mm/L_1 **MEP:** 21.5 bar



MAN B&W G90ME-C10.5-GI (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Gas optimised	130.2+3.9/161.5	129.7+3.0/164.0	136.2+2.5/168.0

MAN B&W G90ME-C10.5-GI-EGRTC (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	128.5+3.9/161.5	129.7+3.0/164.0	136.2+2.5/168.0
Tier III mode	134.5+3.9/162.5	134.8+3.0/162.0	137.9+2.5/165.0

MAN B&W G90ME-C10.5-GI-LPSCR (gas optimised)

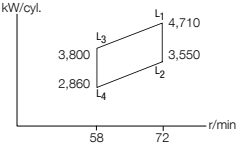
L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	130.2+3.9/161.5	131.1+3.0/164.0	137.1+2.5/169.0
Tier III mode	131.9+3.9/159.5	134.8+3.0/162.0	137.9+2.5/165.0

MAN B&W G80ME-C10.5-GI

Tier II Tier III

Cyl.	L_1 kW
6	28,260
7	32,970
8	37,680
9*	42,390

Stroke: 3,720 mm/**L_1 MEP:** 21.0 bar



MAN B&W G80ME-C10.5-GI (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Gas optimised	128.5+3.9/159.5	128.0+3.0/162.0	134.6+2.5/166.0

MAN B&W G80ME-C10.5-GI-EGRTC (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	126.8+3.9/159.5	128.0+3.0/162.0	134.6+2.5/166.0
Tier III mode	132.8+3.9/160.5	133.1+3.0/160.0	136.3+2.5/163.0

MAN B&W G80ME-C10.5-GI-HPSCR (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	128.5+3.9/159.5	128.0+3.0/162.0	135.4+2.5/167.0
Tier III mode	130.3+3.9/157.5	131.4+3.0/158.0	135.4+2.5/162.0

MAN B&W G80ME-C10.5-GI-LPSCR (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	128.5+3.9/159.5	129.5+3.0/162.0	135.4+2.5/167.0
Tier III mode	130.3+3.9/157.5	133.1+3.0/160.0	136.3+2.5/163.0

* Available on request for HPSCR

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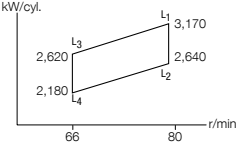
MAN B&W G70ME-C10.5-GI

Tier II Tier III

Cyl.	L_1 kW
5	15,850
6	19,020

Stroke: 3,256 mm/**L_1 MEP:** 19.0 bar



MAN B&W G70ME-C10.5-GI (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Gas optimised	128.6+3.9/159.5	127.8+3.0/161.5	134.6+2.5/166.0

MAN B&W G70ME-C10.5-GI-EGRBP (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	128.6+3.9/159.5	127.8+3.0/161.5	136.3+2.5/168.0
Tier III mode	134.6+3.9/162.5	134.6+3.0/161.5	138.0+2.5/165.0

MAN B&W G70ME-C10.5-GI-HPSCR (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	128.6+3.9/159.5	127.8+3.0/161.5	135.4+2.5/167.0
Tier III mode	130.3+3.9/157.5	131.2+3.0/157.5	135.4+2.5/162.0

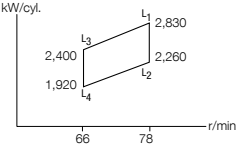
MAN B&W G70ME-C10.5-GI-LPSCR (gas optimised)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	128.6+3.9/159.5	129.3+3.0/162.0	135.4+2.5/167.0
Tier III mode	130.3+3.9/157.5	132.9+3.0/159.5	136.3+2.5/163.0

MAN B&W G70ME-C10.5-GA

Cyl.	L_1 kW
5	14,150
6	16,980

Stroke: 3,256 mm/**L_1 MEP:** 17.4 bar



MAN B&W G70ME-C10.5-GA-EGRBP

L_1 dual fuel mode equivalent SFOC (heat-rate)/fuel oil mode SFOC [g/kWh]

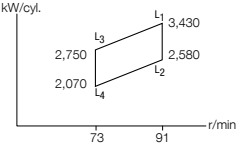
	50%	75%	100%
Tier III mode	162.0 (6,918)/171.9	161.0 (6,876)/171.0	166.0 (7,088)/179.0
Tier II mode	162.0 (6,918)/170.1	161.0 (6,876)/169.2	166.0 (7,088)/177.1

MAN B&W S70ME-C10.5-GI

Tier II Tier III

Cyl.	L_1 kW
5	17,150
6	20,580
7	24,010
8	27,440

Stroke: 2,800 mm/L_1 **MEP:** 21.0 bar



MAN B&W S70ME-C10.5-GI (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Standard tuned	133.6+4.0/164.5	133.1+3.0/163.0	139.6+2.5/167.0

MAN B&W S70ME-C10.5-GI-EGRBP (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	133.6+4.0/160.5	136.1+3.0/162.5	143.0+2.5/170.0
Tier III mode	139.6+4.0/167.5	139.9+3.0/167.0	144.7+2.5/172.0

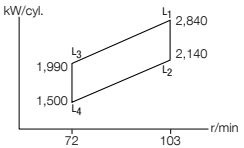
MAN B&W S70ME-C10.5-GI-HPSCR (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	133.6+4.0/160.5	136.1+3.0/162.5	142.6+2.5/169.5
Tier III mode	134.9+4.0/162.0	136.9+3.0/163.5	143.0+2.5/170.0

MAN B&W G60ME-C10.5-GI

Cyl.	L_1 kW
5	14,200
6	17,040
7	19,880
8	22,720

Stroke: 2,790 mm/**L_1 MEP:** 21.0 bar



MAN B&W G60ME-C10.5-GI (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Standard tuned	131.1+3.9/161.5	130.6+3.0/160.0	137.1+2.5/164.0

MAN B&W G60ME-C10.5-GI-EGRBP (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	131.1+3.9/157.5	133.5+3.0/159.5	140.5+2.5/167.0
Tier III mode	137.1+3.9/164.5	137.4+3.0/164.0	142.2+2.5/169.0

MAN B&W G60ME-C10.5-GI-HPSCR (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	131.1+3.9/157.5	133.5+3.0/159.5	140.1+2.5/166.5
Tier III mode	132.4+3.9/159.0	134.4+3.0/160.5	140.5+2.5/167.0

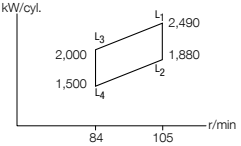
Note: Also available with 5.0% pilot oil fraction

MAN B&W S60ME-C10.5-GI

Tier II Tier III

Cyl.	L_1 kW
5	12,450
6	14,940
7	17,430
8	19,920

Stroke: 2,400 mm/**L_1 MEP:** 21.0 bar



MAN B&W S60ME-C10.5-GI (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Standard tuned	133.7+4.0/164.5	132.4+3.0/162.0	138.8+2.5/166.0

MAN B&W S60ME-C10.5-GI-EGRBP (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	132.8+4.0/159.5	135.4+3.0/161.5	141.3+2.5/168.0
Tier III mode	139.7+4.0/167.5	139.3+3.0/166.0	143.9+2.5/171.0

MAN B&W S60ME-C10.5-GI-HPSCR (standard gas tuning)

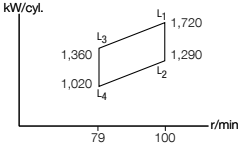
L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	132.8+4.0/159.5	135.4+3.0/161.5	140.9+2.5/167.5
Tier III mode	134.1+4.0/161.0	136.3+3.0/162.5	141.3+2.5/168.0

Note: Also available with 5.0% pilot oil fraction

MAN B&W G50ME-C9.6-GI

Cyl.	L_1 kW
5	8,600
6	10,320
7	12,040
8	13,760
9	15,480

Stroke: 2,500 mm/**L_1 MEP:** 21.0 bar



MAN B&W G50ME-C9.6-GI (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Standard tuned	134.4+4.0/165.5	133.9+3.1/164.0	140.5+2.5/168.0

MAN B&W G50ME-C9.6-GI-EGRBP (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	134.4+4.0/161.5	136.9+3.1/163.5	143.9+2.5/171.0
Tier III mode	140.4+4.0/168.5	140.7+3.1/168.0	145.6+2.5/173.0

MAN B&W G50ME-C9.6-GI-HPSCR (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	134.4+4.0/161.5	136.9+3.1/163.5	143.5+2.5/170.5
Tier III mode	135.7+4.0/163.0	137.7+3.1/164.5	143.9+2.5/171.0

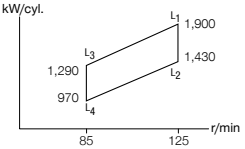
Note: Also available with 5.0% pilot oil fraction

MAN B&W S50ME-C9.7-GI

Tier II Tier III

Cyl.	L_1 kW
5	9,500
6	11,400
7	13,300
8	15,200
9	17,100

Stroke: 2,214 mm/L_1 **MEP:** 21.0 bar



MAN B&W S50ME-C9.7-GI (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Standard tuned	131.1+3.9/161.5	131.2+3.0/160.5	137.9+2.5/165.0

MAN B&W S50ME-C9.7-GI-EGRBP (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	131.1+3.9/157.5	134.2+3.0/160.0	141.4+2.5/168.0
Tier III mode	137.1+3.9/164.5	138.0+3.0/164.5	143.1+2.5/170.0

MAN B&W S50ME-C9.7-GI-HPSCR (standard gas tuning)

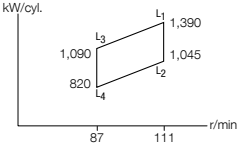
L_1 dual fuel mode (SGC+SPOC (1.5%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	131.1+3.9/157.5	134.2+3.0/160.0	140.9+2.5/167.5
Tier III mode	132.4+3.9/159.0	135.0+3.0/161.0	141.4+2.5/168.0

Note: Also available with 5.0% pilot oil fraction

MAN B&W G45ME-C9.5-GI

Cyl.	L_1 kW
5	6,950
6	8,340
7	9,730
8	11,120

Stroke: 2,250 mm/**L_1 MEP:** 21.0 bar



MAN B&W G45ME-C9.5-GI (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Standard tuned	129.0+13.5/168.5	129.7+10.3/166.0	137.1+8.5/170.0

MAN B&W G45ME-C9.5-GI-EGRBP (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	128.1+13.5/163.5	132.6+10.3/165.5	139.6+8.5/172.0
Tier III mode	134.9+13.5/171.5	136.5+10.3/170.0	142.2+8.5/175.0

MAN B&W G45ME-C9.5-GI-HPSCR (standard gas tuning)

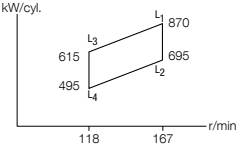
L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	128.1+13.5/163.5	132.6+10.3/165.5	139.2+8.5/171.5
Tier III mode	129.4+13.5/165.0	133.5+10.3/166.5	139.6+8.5/172.0

MAN B&W S35ME-C9.7-GI

Tier II Tier III

Cyl.	L_1 kW
5	4,350
6	5,220
7	6,090
8	6,960

Stroke: 1,550 mm/**L_1 MEP:** 21.0 bar



MAN B&W S35ME-C9.7-GI (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Standard tuned	129.8+13.6/169.5	130.5+10.4/167.0	137.9+8.6/171.0

MAN B&W S35ME-C9.7-GI-HPSCR (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	128.9+13.6/164.5	133.5+10.4/166.5	140.0+8.6/172.5
Tier III mode	130.2+13.6/166.0	134.3+10.4/167.5	140.4+8.6/173.0

Note: All fuel consumption figures are based on engine driven HPS

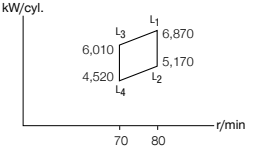
Methanol (LGIM)

MAN B&W G95ME-C10.5-LGIM

Tier II Tier III

Cyl.	L_1 kW
6	41,220
7	48,090
8	54,960
9	61,830
10	68,700
11	75,570
12	82,440

Stroke: 3,460 mm/**L_1 MEP:** 21.0 bar



MAN B&W G95ME-C10.5-LGIM (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]

	50%	75%	100%
Standard tuned	303.9+12.8/154.5	314.6+9.8/156.5	333.6+8.1/163.5

MAN B&W G95ME-C10.5-LGIM-EGRTC (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]

	50%	75%	100%
Tier II mode	303.9+12.8/154.5	314.6+9.8/156.5	332.5+8.1/163.0
Tier III mode	316.8+12.8/160.5	322.1+9.8/160.0	336.8+8.1/165.0

MAN B&W G95ME-C10.5-LGIM-LPSCR (standard methanol tuning)

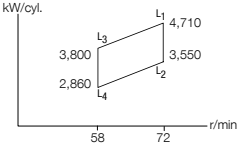
L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]

	50%	75%	100%
Tier II mode	303.9+12.8/154.5	314.6+9.8/156.5	333.6+8.1/163.5
Tier III mode	306.0+12.8/155.5	316.7+9.8/157.5	335.7+8.1/164.5

MAN B&W G80ME-C10.5-LGIM

Cyl.	L_1 kW
6*	28,260
7	32,970
8	37,680
9	42,390

Stroke: 3,720 mm/**L_1 MEP:** 21.0 bar



MAN B&W G80ME-C10.5-LGIM (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Standard tuned	307.9+12.9/156.5	318.6+9.9/158.5	337.6+8.2/165.5

MAN B&W G80ME-C10.5-LGIM-EGRTC (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	307.9+12.9/156.5	318.6+9.9/158.5	336.6+8.2/165.0
Tier III mode	320.7+12.9/162.5	326.1+9.9/162.0	340.8+8.2/167.0

MAN B&W G80ME-C10.5-LGIM-HPSCR (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	307.9+12.9/156.5	318.6+9.9/158.5	337.6+8.2/165.5
Tier III mode	311.1+12.9/158.0	320.7+9.9/159.5	338.7+8.2/166.0

MAN B&W G80ME-C10.5-LGIM-LPSCR (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	307.9+12.9/156.5	318.6+9.9/158.5	337.6+8.2/165.5
Tier III mode	310.0+12.9/157.5	320.7+9.9/159.5	339.8+8.2/166.5

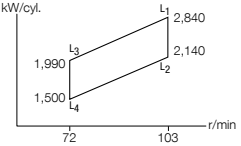
* 6-cylinder engines can be ordered with reduced or external moment compensation depending on rating and ship dynamics. Evaluation is made on request.

MAN B&W G60ME-C10.5-LGIM

Tier II Tier III

Cyl.	L_1 kW
5	14,200
6	17,040
7	19,880
8	22,720

Stroke: 2,790 mm/L_1 **MEP:** 21.0 bar



MAN B&W G60ME-C10.5-LGIM (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Standard tuned	324.3+13.3/164.5	327.7+10.1/163.0	340.4+8.4/167.0

MAN B&W G60ME-C10.5-LGIM-EGRBP (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	315.7+13.3/160.5	326.7+10.1/162.5	346.9+8.4/170.0
Tier III mode	330.7+13.3/167.5	336.3+10.1/167.0	351.1+8.4/172.0

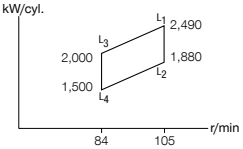
MAN B&W G60ME-C10.5-LGIM-HPSCR (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	315.7+13.3/160.5	326.7+10.1/162.5	345.8+8.4/169.5
Tier III mode	318.9+13.3/162.0	328.8+10.1/163.5	346.9+8.4/170.0

MAN B&W S60ME-C10.5-LGIM

Cyl.	L_1 kW
5	12,450
6	14,940
7	17,430
8	19,920

Stroke: 2,400 mm/**L_1 MEP:** 21.0 bar



MAN B&W S60ME-C10.5-LGIM (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Standard tuned	326.3+13.3/165.5	329.7+10.2/164.0	342.5+8.4/168.0

MAN B&W S60ME-C10.5-LGIM-EGRBP (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	315.6+13.3/160.5	328.7+10.2/163.5	346.7+8.4/170.0
Tier III mode	332.7+13.3/168.5	338.3+10.2/168.0	353.2+8.4/173.0

MAN B&W S60ME-C10.5-LGIM-HPSCR (standard methanol tuning)

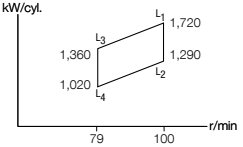
L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	319.9+13.3/162.5	331.7+10.2/165.0	345.7+8.4/169.5
Tier III mode	323.1+13.3/164.0	333.8+10.2/166.0	346.7+8.4/170.0

MAN B&W G50ME-C9.6-LGIM

Tier II Tier III

Cyl.	L_1 kW
5	8,600
6	10,320
7	12,040
8	13,760
9	15,480

Stroke: 2,500 mm/**L_1 MEP:** 21.0 bar



MAN B&W G50ME-C9.6-LGIM (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Standard tuned	326.3+13.3/165.5	329.7+10.2/164.0	342.5+8.4/168.0

MAN B&W G50ME-C9.6-LGIM-EGRBP (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	317.7+13.3/161.5	328.7+10.2/163.5	348.9+8.4/171.0
Tier III mode	332.7+13.3/168.5	338.3+10.2/168.0	353.2+8.4/173.0

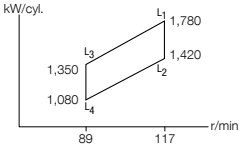
MAN B&W G50ME-C9.6-LGIM-HPSCR (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	317.7+13.3/161.5	328.7+10.2/163.5	347.8+8.4/170.5
Tier III mode	320.9+13.3/163.0	330.8+10.2/164.5	348.9+8.4/171.0

MAN B&W S50ME-C9.6-LGIM

Cyl.	L_1 kW
5	8,900
6	10,680
7	12,460
8	14,240
9	16,020

Stroke: 2,214 mm/**L_1 MEP:** 21.0 bar



MAN B&W S50ME-C9.6-LGIM (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Standard tuned	322.4+13.3/163.5	327.2+10.1/162.5	340.4+8.4/167.0

MAN B&W S50ME-C9.6-LGIM-EGRBP (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	313.8+13.3/159.5	326.2+10.1/162.0	346.9+8.4/170.0
Tier III mode	328.8+13.3/166.5	335.8+10.1/166.5	351.1+8.4/172.0

MAN B&W S50ME-C9.6-LGIM-HPSCR (standard methanol tuning)

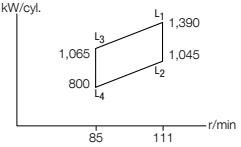
L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	313.8+13.3/159.5	326.2+10.1/162.0	345.8+8.4/169.5
Tier III mode	317.0+13.3/161.0	328.3+10.1/163.0	346.9+8.4/170.0

MAN B&W G45ME-C9.7-LGIM

Tier II Tier III

Cyl.	L_1 kW
5	6,950
6	8,340
7	9,730
8	11,120

Stroke: 2,250 mm/**L_1 MEP:** 21.0 bar



MAN B&W G45ME-C9.7-LGIM (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Standard tuned	328.3+13.4/166.5	331.8+10.2/165.0	344.5+8.5/169.0

MAN B&W G45ME-C9.7-LGIM-EGRBP (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	319.7+13.4/162.5	330.7+10.2/164.5	350.9+8.5/172.0
Tier III mode	334.7+13.4/169.5	340.3+10.2/169.0	355.2+8.5/174.0

MAN B&W G45ME-C9.7-LGIM-HPSCR (standard methanol tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	319.7+13.4/162.5	330.7+10.2/164.5	349.9+8.5/171.5
Tier III mode	322.9+13.4/164.0	332.8+10.2/165.5	350.9+8.5/172.0

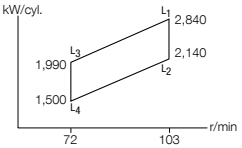
LPG (LGIP)

MAN B&W G60ME-C10.5-LGIP

Tier II Tier III

Cyl.	L_1 kW
5	14,200
6	17,040
7	19,880
8	22,720

Stroke: 2,790 mm/**L_1 MEP:** 21.0 bar



MAN B&W G60ME-C10.5-LGIP (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Standard tuned	137.7+13.0/161.5	139.2+9.9/160.0	144.6+8.2/164.0

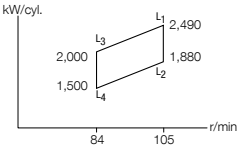
MAN B&W G60ME-C10.5-LGIP-HPSCR (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	134.0+13.0/157.5	138.7+9.9/159.5	146.9+8.2/166.5
Tier III mode	135.4+13.0/159.0	139.6+9.9/160.5	147.4+8.2/167.0

MAN B&W S60ME-C10.5-LGIP

Cyl.	L_1 kW
5	12,450
6	14,940
7	17,430
8	19,920

Stroke: 2,400 mm/**L_1 MEP:** 21.0 bar



MAN B&W S60ME-C10.5-LGIP (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Standard tuned	140.5+13.2/164.5	141.2+10.1/162.0	146.4+8.3/166.0

MAN B&W S60ME-C10.5-LGIP-HPSCR (standard gas tuning)

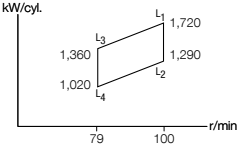
L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	135.8+13.2/159.5	140.7+10.1/161.5	147.8+8.3/167.5
Tier III mode	137.2+13.2/161.0	141.6+10.1/162.5	148.2+8.3/168.0

MAN B&W G50ME-C9.6-LGIP

Tier II Tier III

Cyl.	L_1 kW
5	8,600
6	10,320
7	12,040
8	13,760
9	15,480

Stroke: 2,500 mm/**L_1 MEP:** 21.0 bar



MAN B&W G50ME-C9.6-LGIP (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Standard tuned	141.2+13.3/165.5	142.6+10.2/164.0	148.2+8.4/168.0

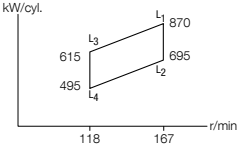
MAN B&W G50ME-C9.6-LGIP-HPSCR (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	137.4+13.3/161.5	142.2+10.2/163.5	150.5+8.4/170.5
Tier III mode	138.8+13.3/163.0	143.1+10.2/164.5	150.9+8.4/171.0

MAN B&W S35ME-C9.7-LGIP

Cyl.	L_1 kW
5	4,350
6	5,220
7	6,090
8	6,960

Stroke: 1,550 mm/**L_1 MEP:** 21.0 bar



MAN B&W S35ME-C9.7-LGIP (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Standard tuned	144.7+13.6/169.5	145.5+10.4/167.0	150.8+8.6/171.0

MAN B&W S35ME-C9.7-LGIP-HPSCR (standard gas tuning)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	140.1+13.6/164.5	145.1+10.4/166.5	152.2+8.6/172.5
Tier III mode	141.5+13.6/166.0	146.0+10.4/167.5	152.7+8.6/173.0

Note: All fuel consumption figures are based on engine driven HPS

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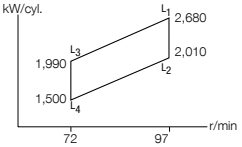
Ethane/LEG (GIE)

MAN B&W G60ME-C9.5-GIE

Tier II Tier III

Cyl.	L_1 kW
5	13,400
6	16,080
7	18,760
8	21,440

Stroke: 2,790 mm/**L_1 MEP:** 21.0 bar



MAN B&W G60ME-C9.5-GIE (gas optimised)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Gas optimised	139.3+13.6/168.5	141.2+10.4/167.5	146.0+8.6/171.0

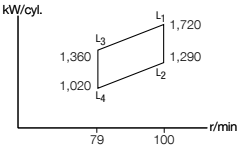
MAN B&W G60ME-C9.5-GIE-HPSCR (gas optimised)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	75%	100%
Tier II mode	134.8+13.6/163.5	140.8+10.4/167.0	147.4+8.6/172.5
Tier III mode	136.1+13.6/165.0	141.7+10.4/168.0	147.8+8.6/173.0

MAN B&W G50ME-C9.5-GIE

Cyl.	L_1 kW
5	8,600
6	10,320
7	12,040
8	13,760
9	15,480

Stroke: 2,790 mm/**L_1 MEP:** 21.0 bar



MAN B&W G50ME-C9.5-GIE (gas optimised)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Gas optimised	140.1+13.7/169.5	142.1+10.4/168.5	146.9+8.6/172.0

MAN B&W G50ME-C9.5-GIE-HPSCR (gas optimised)

L_1 dual fuel mode (SGC+SPOC (5.0%))/fuel oil mode (SFOC) [g/kWh]			
	50%	**75%**	**100%**
Tier II mode	135.6+13.7/164.5	141.6+10.4/168.0	148.2+8.6/173.5
Tier III mode	136.9+13.7/166.0	142.5+10.4/169.0	148.7+8.6/174.0

Scalable energy transition

MAN Energy Solutions
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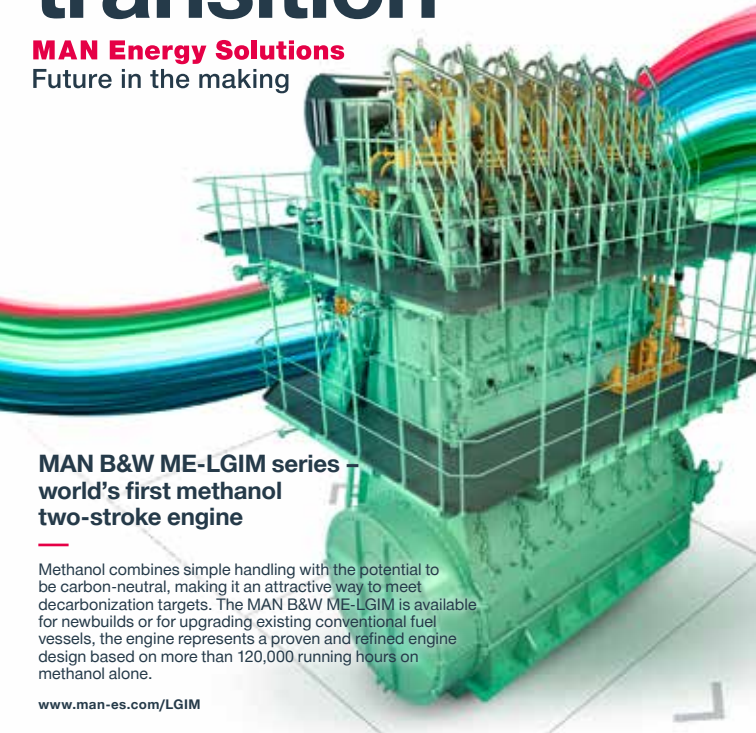


MAN B&W ME-LGIM series – world's first methanol two-stroke engine

Methanol combines simple handling with the potential to be carbon-neutral, making it an attractive way to meet decarbonization targets. The MAN B&W ME-LGIM is available for newbuilds or for upgrading existing conventional fuel vessels, the engine represents a proven and refined engine design based on more than 120,000 running hours on methanol alone.

www.man-es.com/LGIM

Specifications
(dimensions and dry masses)

MAN B&W G95ME-C10.6

Tier II | Tier III

Specifications

Dimensions:	A	B	C	H1
Fuel oil mm	1,574	5,380	2,060	16,100

Cyl. distance	6-9 cyl.	10 cyl.	11 cyl.	12 cyl.
mm	1,574	1-6: 1,574	1-6: 1,574	1-6: 1,574
mm	-	7-10: 1,670	7-11: 1,670	7-12: 1,670

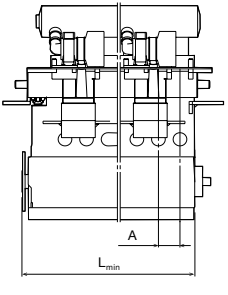
Cylinders:	6	7	8	9	10	11	12
L_{min} mm	13,042	14,616	16,190	17,804	19,779	21,489	23,159

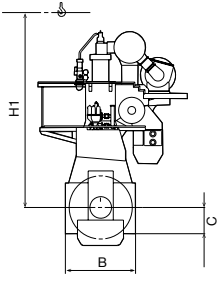
Dry mass

Tier II t	1,220	1,360	1,615	1,780	1,950	2,130	2,320

Tier III (added)

EGRTC t	16	17	18	19	20	21	31
LPSCR t	0	0	0	0	0	0	0





MAN B&W G95ME-C10.5

Specifications

Dimensions:		A	B	C	H1
Fuel oil	mm	1,574	5,380	2,060	16,100
GI	mm	1,574	5,380	2,060	16,100
LGIM	mm	1,574	5,380	2,060	16,100

Cyl. distance	6-9 cyl.	10 cyl.	11 cyl.	12 cyl.
mm	1,574	1-6: 1,574	1-6: 1,574	1-6: 1,574
mm		7-10: 1,670	7-11: 1,670	7-12: 1,670

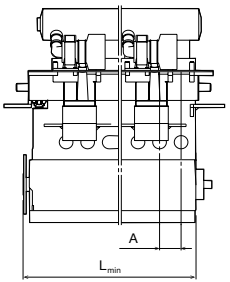
Cylinders:		6	7	8	9	10	11	12
L_{min}	mm	13,042	14,616	16,190	17,804	19,779	21,489	23,159

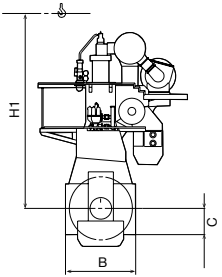
Dry mass

Tier II	t	1,220	1,360	1,615	1,780	1,950	2,130	2,320

Tier III (added)								
EGRTC	t	16	17	18	19	20	21	31
LPSCR	t	0	0	0	0	0	0	0

Dual fuel (added)								
GI	t	8	9	10	11	12	13	14
LGIM	t	9	10	11	12	13	14	15





MAN B&W G90ME-C10.5

Tier II Tier III

Specifications

Dimensions:		A	B1	B2	C	H1
Fuel oil	mm	1,490	5,110	5,034	1,885	14,425
GI	mm	1,490	5,110	5,034	1,885	14,425

Cylinders:		6	7	8	9	10	11	12
L_{min}	mm	12,040	12,855	14,345*	15,835*	18,040	19,530	21,020

Dry mass

Tier II	t	1,050	1,170	1,330	1,470	1,610	1,750	1,890

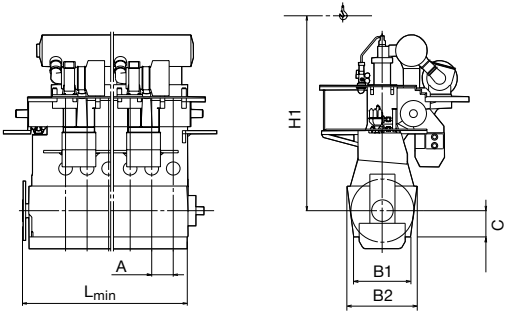
Tier III (added)

EGRTC	t	17	17	18	18	20	20	20
LPSCR	t	0	0	0	0	0	0	0

Dual fuel (added)

GI	t	7	8	9	10	11	12	13

* 8 and 9-cylinder engines can be ordered with either divided or undivided crankshaft. Data is given for undivided crankshaft.



MAN B&W G80ME-C10.6

Specifications

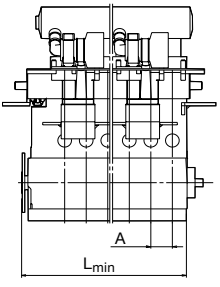
Dimensions:		A	B1	B2	C	H1
Fuel oil	mm	1,400	5,018	5,254	1,960	15,750

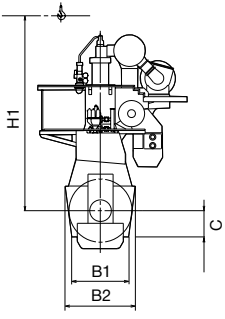
Cylinders:		6	7	8	9
L_{min}	mm	11,509	12,135	13,535	14,935

Dry mass

Tier II	t	900	1,000	1,110	1,240

Tier III (added)					
EGRTC	t	14	14	14	15
HPSCR	t	4	5	5	-
LPSCR	t	0	0	0	0





MAN B&W G80ME-C10.5

Tier II Tier III

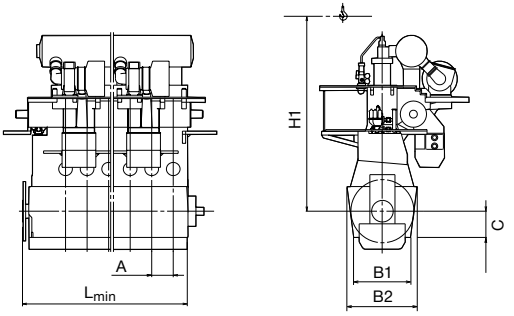
Specifications

Dimensions:		A	B1	B2	C	H1
Fuel oil	mm	1,400	5,018	5,254	1,960	15,750
GI	mm	1,400	5,018	5,254	1,960	15,750

Cylinders:		6	7	8	9
L_{min}	mm	11,509	12,135	13,535	14,935

Dry mass

Tier II	t	900	1,000	1,110	1,240
Tier III (added)					
EGRTC	t	14	14	14	15
HPSCR	t	4	5	5	-
LPSCR	t	0	0	0	0
Dual fuel (added)					
GI	t	6	7	8	9
LGIM	t	7	8	9	10



MAN B&W G70ME-C10.5

Specifications

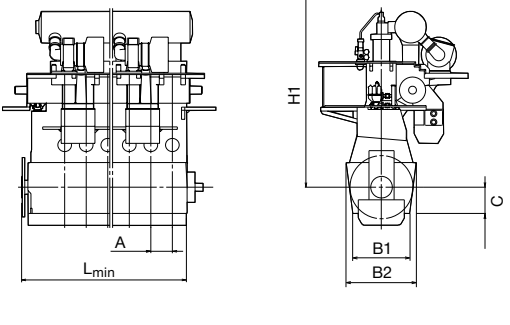
Dimensions:		A	B1	B2	C	H1
Fuel oil	mm	1,044	4,470	4,628	1,750	13,625
GI	mm	1,044	4,470	4,628	1,750	13,625
GA	mm	1,044	4,470	4,628	1,750	13,800

Cylinders:		5	6
L_{min}	mm	7,399	8,443

Dry mass			
Tier II	t	525	590

Tier III (added)			
EGRBP	t	11	11
HPSCR	t	3	3
LPSCR	t	0	0

Dual fuel (added)			
GI	t	5	6
GA	t	5	5



MAN B&W S70ME-C10.5

Tier II Tier III

Specifications

Dimensions:		A	B1	B2	C	H1
Fuel oil	mm	1,098	4,012	4,150	1,520	12,675
GI	mm	1,098	4,012	4,150	1,520	12,725

Cylinders:		5	6	7	8
L_{min}	mm	7,581	8,679	9,777	10,875

Dry mass

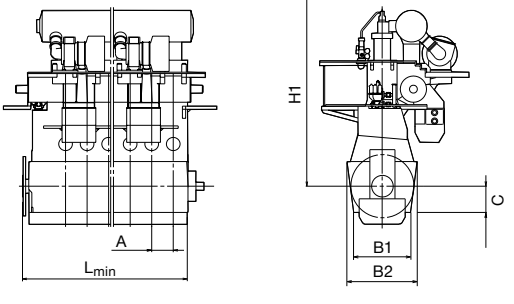
Tier II	t	460	510	545	615

Tier III (added)

EGRBP	t	11	11	12	12
HPSCR	t	4	5	6	7

Dual fuel (added)

GI	t	5	6	7	8



MAN B&W G60ME-C10.5

Specifications

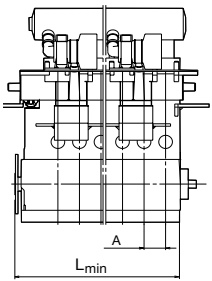
Dimensions:		A	B1	B2	C	H1	H4
Fuel oil	mm	1,080	4,090	4,220	1,500	12,175	11,975
GI	mm	1,080	4,090	4,220	1,500	12,175	11,975
LGIM	mm	1,080	4,090	4,220	1,500	12,175	11,975
LGIP	mm	1,080	4,090	4,220	1,500	12,175	11,975

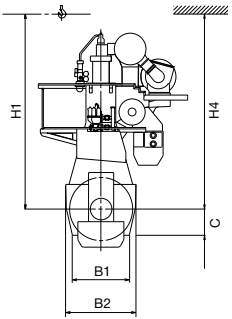
Cylinders:		5	6	7	8
L_{min}	mm	7,390	8,470	9,550	10,630

Dry mass					
Tier II	t	395	440	490	555

Tier III (added)					
EGRBP	t	10	10	11	11
HPSCR	t	3	4	5	5

Dual fuel (added)					
GI	t	5	5	6	7
LGIM	t	5	5	6	7
LGIP	t	5	5	6	7





MAN B&W G60ME-C9.5

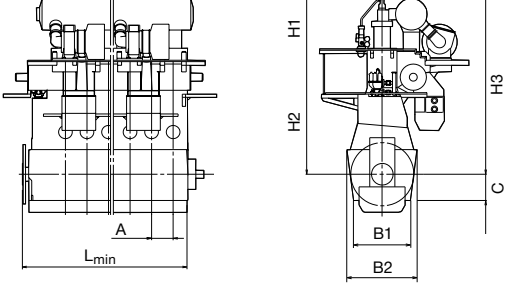
Tier II Tier III

Specifications

Dimensions:		A	B1	B2	C	H1	H2	H3
GIE	mm	1,080	4,090	4,220	1,500	12,175	11,700	11,550

Cylinders:		5	6	7	8
L_{min}	mm	7,390	8,470	9,550	10,630

Dry mass					
Tier II	t	395	440	490	555
Tier III (added)					
HPSCR	t	3	4	5	5
Dual fuel (added)					
GIE	t	5	6	7	7



MAN B&W S60ME-C10.6

Specifications

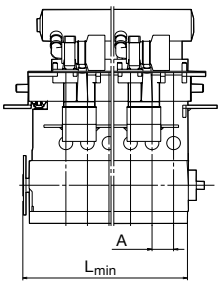
Dimensions:	A	B1	B2	C	H1	H2	H3
Fuel oil	940	3,420	3,550	1,300	10,500	10,000	10,350

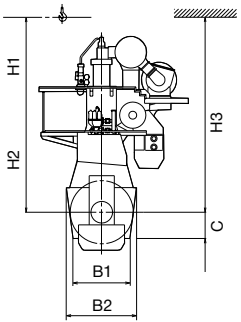
Cylinders:		5	6	7	8
L_{min}	mm	6,502	7,442	8,382	9,322

Dry mass

Tier II	t	320	345	370	410

Tier III (added)					
EGRBP	t	10	10	11	11
HPSCR	t	6	6	6	6





MAN B&W S60ME-C10.5

Tier II Tier III

Specifications

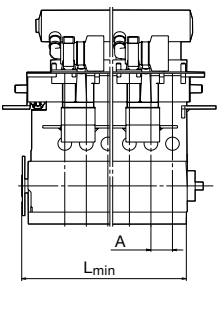
Dimensions:		A	B1	B2	C	H1	H2	H3
Fuel oil	mm	940	3,420	3,550	1,300	10,500	9,775	10,125
GI	mm	940	3,420	3,550	1,300	10,500	10,025	10,375
LGIM	mm	940	3,420	3,550	1,300	10,500	10,175	10,525
LGIP	mm	940	3,420	3,550	1,300	10,500	10,175	10,525

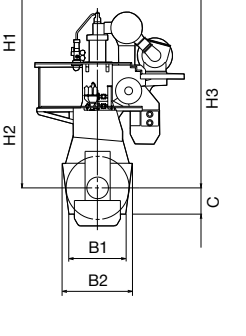
Cylinders:		5	6	7	8
L_{min}	mm	6,502	7,442	8,382	9,322

Dry mass					
Tier II	t	305	330	355	395

Tier III (added)					
EGRBP	t	10	10	11	11
HPSCR	t	6	6	6	6

Dual fuel (added)					
GI	t	5	5	6	7
LGIM	t	5	5	6	7
LGIP	t	5	5	6	7





Specifications

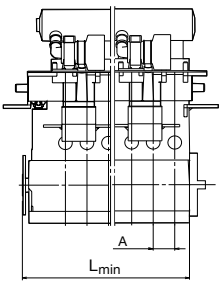
Dimensions:		A	B1	B2	C	H1	H2	H3
Fuel oil	mm	872	-	3,652	1,205	10,775	10,075	9,825

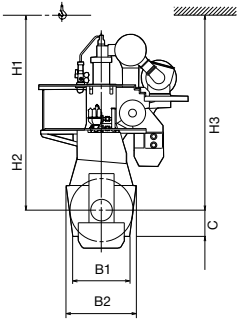
Cylinders:		5	6	7	8
L_{min}	mm	5,748	6,620	7,492	8,364

Dry mass

Tier II	t	214	249	280	315

Tier III (added)					
EGRBP	t	12	12	13	13
HPSCR	t	6	6	7	7





MAN B&W G50ME-C9.6

Tier II | Tier III

Specifications

Dimensions:		A	B1	B2	C	H1	H2	H3
Fuel oil	mm	872	3,776	3,652	1,205	10,775	10,075	9,825
GI	mm	872	3,776	3,652	1,205	10,775	10,075	9,825
LGIM	mm	872	3,776	3,652	1,205	10,775	10,075	9,825
LGIP	mm	872	3,776	3,652	1,205	10,775	10,075	9,825

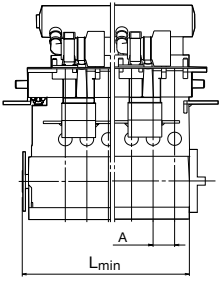
Cylinders:		5	6	7	8	9
L_{min}	mm	5,748	6,620	7,492	8,364	9,236

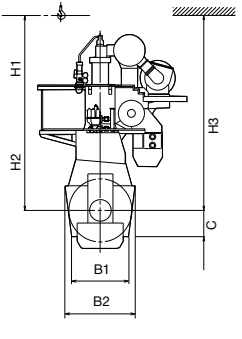
Dry mass						
Tier II	t	211	246	276	311	346

Tier III (added)						
EGRBP	t	12	12	13	13	13
HPSCR	t	6	6	7	7	7

Dual fuel (added)						
GI	t	4	4	5	5	6
LGIM	t	7	7	8	9	10
LGIP	t	6	6	7	8	9

* Tier III compliance





MAN B&W G50ME-C9.5

Specifications

Dimensions:		A	B1	B2	C	H1	H2	H3
GIE	mm	872	3,776	3,652	1,205	10,775	10,075	9,825

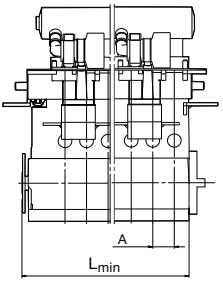
Cylinders:		5	6	7	8	9
L_{min}	mm	5,748	6,620	7,492	8,364	9,236

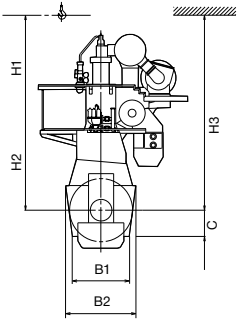
Dry mass

Tier II	t	211	246	276	311	346

Tier III (added)						
HPSCR	t	6	6	7	7	7

Dual fuel (added)						
GIE	t	4	4	5	5	6





MAN B&W S50ME-C10.6

Tier II | Tier III

Specifications

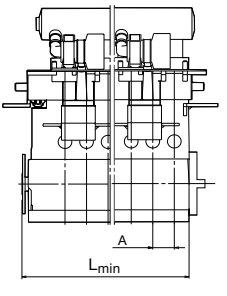
Dimensions:	A	B1	B2	C	H1	H2	H3
Fuel oil mm	875	3,350	3,290	1,190	9,875	9,225	9,000

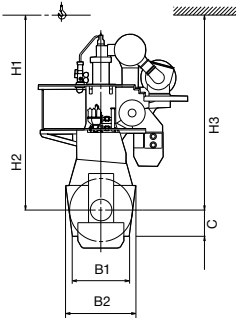
Cylinders:	5	6	7	8	9
L_{min} mm	5,747	6,622	7,497	8,372	9,247

Dry mass

Tier II t	195	226	262	293	324

Tier III (added)					
EGRBP t	12	12	13	13	13
HPSCR t	6	6	6	6	6





MAN B&W S50ME-C9.7

Specifications

Dimensions:		A	B1	B2	C	H1	H2	H3
Fuel oil	mm	875	3,350	3,290	1,190	9,875	9,200	8,850
GI	mm	875	3,350	3,290	1,190	-	-	-

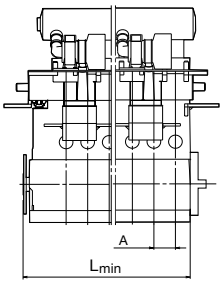
Cylinders:		5	6	7	8	9
L_{min}	mm	5,747	6,622	7,497	8,372	9,247

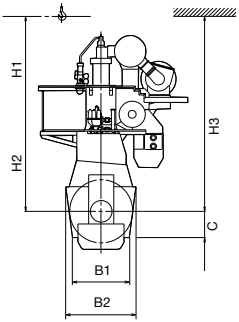
Dry mass

Tier II	t	193	223	259	289	320

Tier III (added)						
EGRBP	t	12	12	13	13	13
HPSCR	t	4	4	5	6	7

Dual fuel (added)						
GI	t	4	4	5	5	6





MAN B&W S50ME-C9.6

Tier II | Tier III

Specifications

Dimensions:		A	B1	B2	C	H1	H2	H3
LGIM	mm	875	3,350	3,290	1,190	9,875	9,200	8,850

Cylinders:		5	6	7	8	9
L_{min}	mm	6,073	6,948	7,823	8,698	9,573

Dry mass

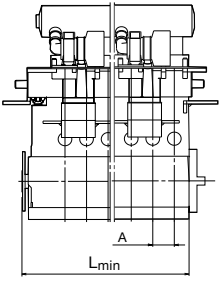
Tier II	t	190	220	255	285	315

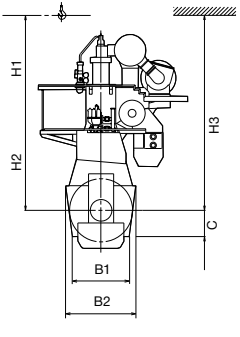
Tier III (added)

EGRBP	t	12	12	13	13	13
HPSCR	t	4	4	5	6	7

Dual fuel (added)

LGIM	t	7	7	8	9	10





MAN B&W S46ME-C8.6

Specifications

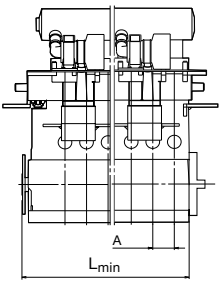
Dimensions:		A	B	C	H1	H2	H3
Fuel oil	mm	782	2,924	986	8,725	8,175	7,925

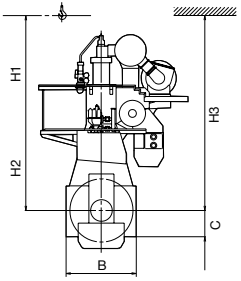
Cylinders:		5	6	7	8
L_{min}	mm	5,100	5,882	6,664	7,446

Dry mass

Tier II	t	150	168	191	211

Tier III (added)					
EGRBP	t	12	12	12	12
HPSCR	t	3	3	4	4





MAN B&W G45ME-C9.7

Tier II Tier III

Specifications

Dimensions:	A	B1	B2	C	H1	H2	H3
Fuel oil mm	784	3,350	3,260	1,169	9,775	9,575	9,275
LGIM mm	784	3,350	3,260	1,169	9,775	9,575	9,275

Cylinders:	5	6	7	8
L_{min} mm	5,200	5,984	6,768	7,552

Dry mass

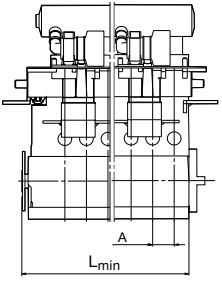
Tier II t	165	186	209	238

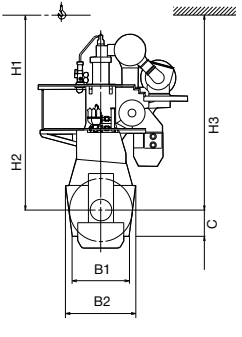
Tier III (added)

EGRBP t	12	12	12	12
HPSCR t	3	3	4	4

Dual fuel (added)

LGIM t	7	7	8	9





MAN B&W G45ME-C9.5

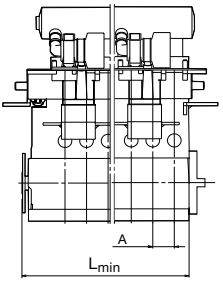
Specifications

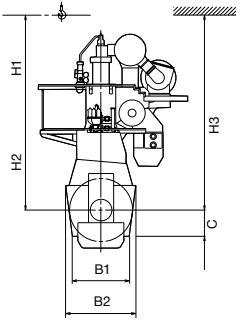
Dimensions:		A	B1	B2	C	H1	H2	H3
GI	mm	784	3,350	3,260	1,169	9,775	9,575	9,275

Cylinders:		5	6	7	8
L_{min}	mm	5,200	5,984	6,768	7,552

Dry mass

Tier II	**t**	163	183	206	234
Tier III (added)					
EGRBP	**t**	12	12	12	12
HPSCR	**t**	3	3	4	4
Dual fuel (added)					
GI	**t**	4	4	5	5





MAN B&W S40ME-C9.5

Tier II | Tier III

Specifications

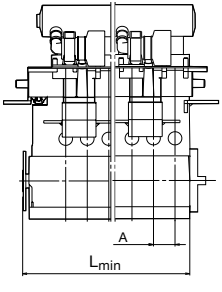
Dimensions:		A	B1	B2	C	H1	H2	H3
Fuel oil	mm	700	2,650	2,610	950	7,975	7,475	7,200

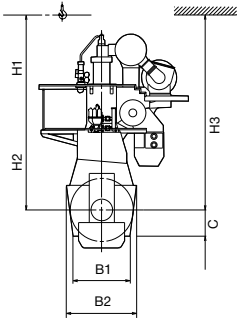
Cylinders:		5	6	7	8	9
L_{min}	mm	4,642	5,342	6,042	6,742	7,442

Dry mass

Tier II	t	107	126	142	157	189

Tier III (added)						
EGRBP	t	10	10	10	10	10
HPSCR	t	3	3	4	4	-
LPSCR	t	0	0	0	0	0



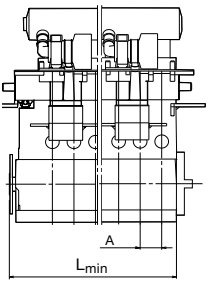


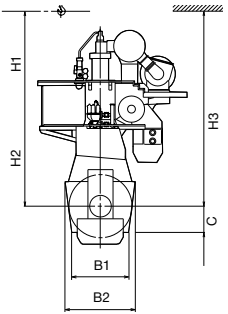
Specifications

Dimensions:		A	B1	B2	C	H1	H2	H3
Fuel oil	mm	612	2,300	2,288	830	7,025	6,675	6,275
GI	mm	612	2,300	2,288	830	7,025	6,675	6,275
LGIP	mm	612	2,300	2,288	830	7,025	6,675	6,275

Cylinders:		5	6	7	8
L_{min}	mm	4,080	4,692	5,304	5,916

Dry mass					
Tier II	t	77	87	98	108
Tier III (added)					
EGRBP	t	8	8	8	8
HPSCR	t	3	3	4	4
LPSCR	t	0	0	0	0
Dual fuel (added)					
GI	t	3	3	4	4
LGIP	t	5	5	6	6





MAN B&W S30ME-B9.5

Tier II Tier III

Specifications

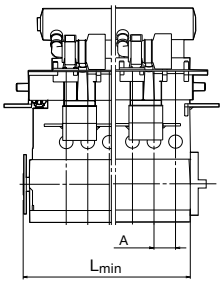
Dimensions:		A	B1	B2	C	H1	H2	H3
Fuel oil	mm	538	1,980	2,020	712	6,025	5,950	5,625

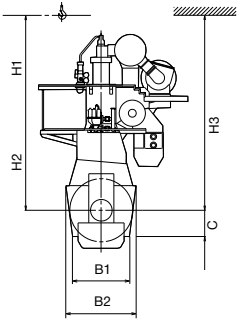
Cylinders:		5	6	7	8
L_{min}	mm	3,700	4,238	4,776	5,314

Dry mass

Tier II	t	61	69	77	86

Tier III (added)					
HPSCR	t	3	3	4	4





The perfect fit for your LNG carrier

MAN Energy Solutions
Future in the making

MAN B&W ME-GA with superior EGR design

The MAN B&W ME-GA is the perfect two-stroke dual-fuel engine for contemporary LNG carrier designs. Its cost-efficient exhaust gas recirculation optimizes performance while significantly lowering emissions and methane slip. The proven design also ensures low installation, operation, and maintenance costs.

www.man-es.com/mega

MAN B&W two-stroke propulsion systems

MAN Alpha

Propeller Programme – FPP and CPP

The MAN Alpha FPP portfolio covers:

- power range of 4-40 MW per shaft
- blade configurations for 3, 4, 5 and 6-bladed propellers
- propellers with integrated shaft line and stern tube solutions
- wide range of stern tube lube and sealing systems
  – oil, water, biodegradable oils.

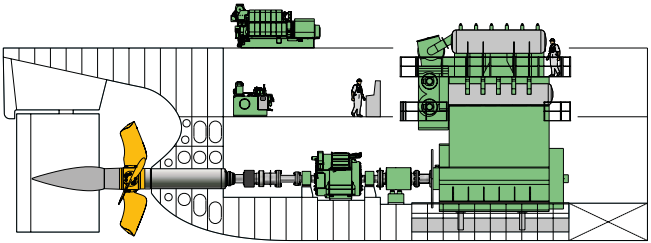
The MAN Alpha FPPs are characterised by the following benefits:

- High-efficient, hydrodynamically optimised blade profiles
  – Kappel designs available
- High reliability: robust approach with ample mechanical design margins
- High-efficient aft-ship integration with rudder, rudder bulb, ducts, etc.
- Layouts for complete two-stroke propulsion systems, e.g. with PTO solutions
- Plant calculations with upfront consideration to torsional vibration calculation (TVC), alignment and control systems.

MAN Alpha controllable pitch propeller

- Standard Mk 5 versions are 4-bladed – 3 and 5-bladed propellers are available upon request
- The figures stated after the VBS indicate the propeller hub diameter
- Standard blade/hub materials are Ni-Al-bronze; stainless steel is optional
- Propellers are available up to the highest ice classes; however the standard programme is based on ‘no ice’.

Two-stroke propulsion system installation



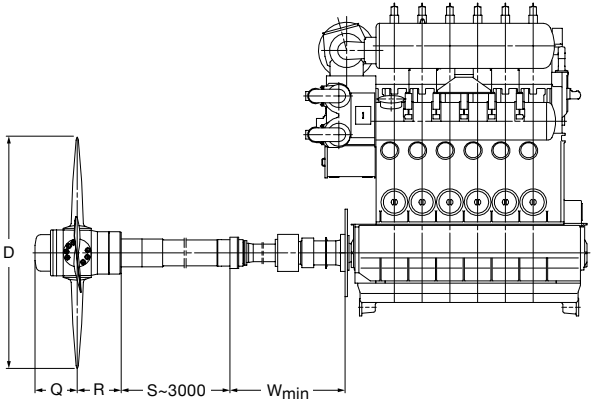
Complete powertrain with propeller and aft ship equipment.

MAN B&W standard package examples

Cyl.	kW	Prop. speed r/min	D [1] mm	Hub VBS mm	Q mm	R mm	Wmin mm	Prop. mass t [2]
G70ME-C10.5/-GI								
5	15,850	80	8,100	1,890	1,622	1,441	4,300	84.1
6	19,020	80	8,450	1,970	1,690	1,504	4,300	92.5
G50ME-C9.6-GI/-LGIM/-LGIP								
5	8,600	100	6,150	1,450	1,102	1,174	3,100	42.7
6	10,320	100	6,450	1,550	1,178	1,231	3,100	45.1
7	12,040	100	6,650	1,550	1,178	1,231	3,100	48.1
8	13,760	100	6,850	1,640	1,246	1,287	2,900	50.9
9	15,480	100	7,050	1,730	1,315	1,339	3,100	58.1

[1] For optimal Kappel blades, the propeller diameter is reduced by an average of 3-10% compared to the listed standard diameters

[2] The masses are stated for 4,000 mm stern tube and 8,000 mm propeller shaft



MAN B&W standard package examples

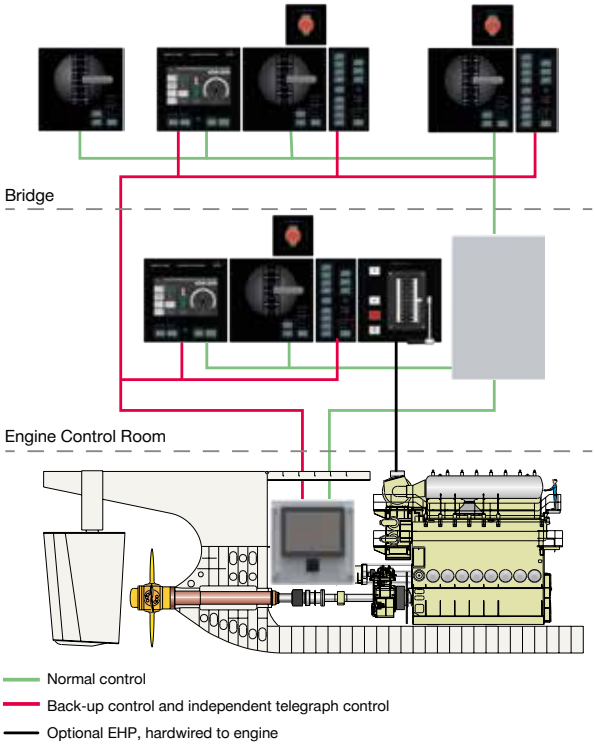
Cyl.	kW	Prop. speed r/min	D [1] mm	Hub VBS mm	Q mm	R mm	Wmin mm	Prop. mass t [2]
S50ME-C9.7/-GI								
5	9,500	125	5,650	1,450	1,114	1,163	2,700	35.3
6	11,400	125	5,850	1,550	1,187	1,163	2,700	39.6
7	13,300	125	6,050	1,640	1,295	1,281	2,700	43.8
8	15,200	125	6,200	1,730	1,424	1,327	2,700	48.7
9	17,100	125	6,350	1,810	1,553	1,377	2,950	56.3
G45ME-C9.7								
5	6,950	111	5,650	1,350	1,026	1,109	2,700	28.8
6	8,340	111	5,900	1,350	1,026	1,109	2,700	30.6
7	9,730	111	6,100	1,450	1,102	1,197	2,700	35.1
8	11,120	111	6,250	1,550	1,178	1,236	2,700	37.6
S40ME-C9.5								
5	5,675	146	4,650	1,100	885	972	2,500	22.1
6	6,810	146	4,800	1,180	957	1,025	2,500	24.6
7	7,945	146	4,950	1,180	957	1,025	2,500	26.0
8	9,080	146	5,050	1,260	975	1,081	2,500	29.8
9	10,215	146	5,550	1,350	1,026	1,140	2,700	34.4
S35ME-C9.7/-GI/-LGIP								
5	4,350	167	4,050	940	821	920	2,500	16.3
6	5,220	167	4,200	1,020	821	920	2,500	16.9
7	6,090	167	4,350	1,100	885	946	2,500	19.4
8	6,960	167	4,450	1,100	885	946	2,500	20.4
S30ME-B9.5								
5	3,200	195	3,500	860	653	750	2,350	10.5
6	3,840	195	3,600	860	653	750	2,350	11.0
7	4,480	195	3,700	940	714	886	2,350	12.3
8	5,120	195	3,800	940	714	886	2,350	13.0

[1] For optimal Kappel blades, the propeller diameter is reduced by an average of 3-10% compared to the listed standard diameters

[2] The masses are stated for 3,000 mm stern tube and 8,000 mm propeller shaft

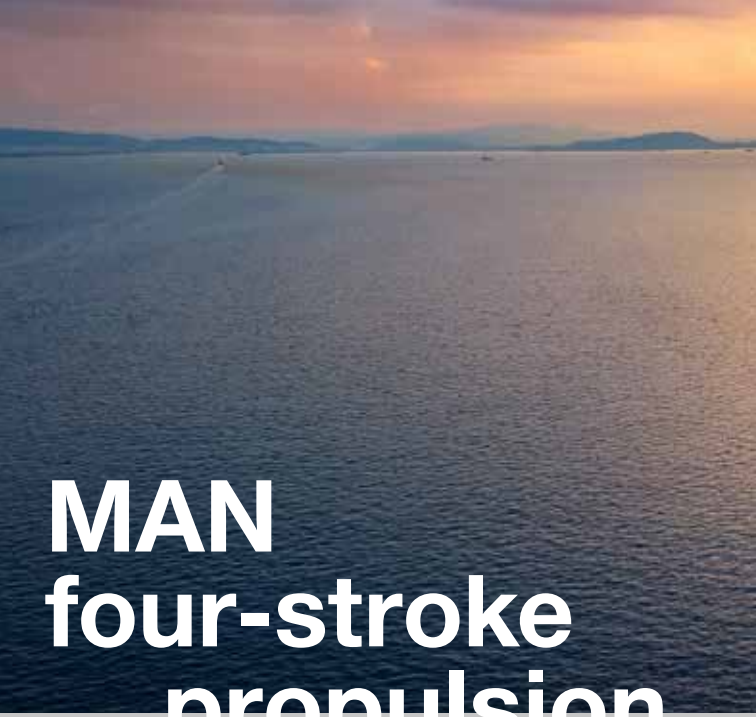
Alphatronic 3000 Propulsion control system

A high number of various FPP and CPP propulsion package applications are controlled by the Alphatronic 3000 system – customised for combinations of MAN low and medium speed engines in a wide range of diesel-mechanical, hybrid or diesel-electric propulsion setups.



Simple system architecture for a straightforward two-stroke CPP propulsion plant

Alphatronic propulsion control system



MAN four-stroke propulsion engines

MAN four-stroke propulsion engines – all emission requirements

Besides focus on power density and fuel economy, MAN Energy Solutions is committed to a steady reduction of the environmental impact of our engines.

IMO Tier II

Applying well-proven methods to achieve a cleaner and more efficient combustion process, MAN Energy Solutions has significantly decreased NO_x emissions. Our four-stroke propulsion engines are IMO Tier II compliant with internal engine measures alone.

IMO Tier III

For operation in emission control areas (ECA), MAN Energy Solutions has developed a comprehensive range of selective catalytic reduction (SCR) systems that tremendously reduce NO_x levels surpassing IMO Tier III requirements.

MAN Energy Solutions is the first manufacturer to successfully produce and offer IMO Tier III compliant four-stroke marine engines based on a fully modular SCR kit covering our entire four-stroke engine portfolio. In 2014 MAN Energy Solutions was awarded the first IMO Tier III EIAPP certificate together with the classification society DNV-GL.

MAN Energy Solutions' standard SCR system is available in fourteen different sizes covering our entire portfolio of four-stroke engines. Customised SCR systems are offered on demand.

MAN has developed a complete range of SCR systems that work perfectly with our engines for maximum system efficiency. The intelligent exhaust gas temperature control allows significant savings in fuel consumptions as compared to third-party supplier systems. MAN SCR systems work with MGO, MDO and HFO with up to 3.5% sulphur.

Our modular system comes in 14 different sizes to match all power demands. Some notable benefits of standardisation are significant cost reduction and simplification of installation.

MAN SCR system

The modular SCR component kit

Urea consumption

The urea consumption depends on engine type, selected performance characteristics (engine map), in case of an engine with ECOMAP capability, operating profile, fuel type, ambient conditions, type of reduction agent, etc.

For more detailed information on the expected level of urea consumption, please contact MAN Energy Solutions with your project specific request.

Conventional injection engines

Our well-established engine types are used in a vast array of applications all over the world. Based on long-term experience of historical proportions, our engines are in continuous development to increase power, reduce emissions, increase reliability, reduce fuel oil consumption, and increase longevity. Our engines are the prime movers of choice in the maritime sector.

Common rail (CR) engines

The flexibility of our CR technology enables a substantial improvement of the combustion process that improves the fuel economy and reduces emission levels. It is particularly advantageous in the low-load and mid-load ranges where our unique ECOMAP system (optional) applies different engine maps to reduce fuel consumption while observing IMO emission limits. Another feature is our patented Boost Injection. Our engine control system senses a load increase at a very early stage and tremendously improves the load response with the activation of boost injection by the common rail control. In addition, exhaust gas opacity is markedly reduced, far below the visibility limit. Our CR engines run efficiently on liquid fuels complying with ISO 8217 DMA, DMZ, and DMB, and on residual fuels (HFO) up to 700 cSt (in compliance with ISO-F-RMK 700).

Diesel oil (D) engines

The V28/33D STC features very favourable ratios of power-to-weight and power-to-installation space. The combination of low fuel consumption, low emissions and reduced life cycle costs makes this engine the ideal solution

for propulsion in high speed ferries, naval and offshore patrol vessels. The V28/33D STC engine operates on distillates according to ISO 8217 DMA or equivalent fuel types.

With the MAN 175D, MAN Energy Solutions is presenting a new power pack setting future standards in the high-speed diesel engine market. The MAN 175D, developed especially for use in the shipping industry, is part of a product initiative aimed at providing MAN customers with a product portfolio that covers every power requirement, from high-speed diesel engines to low-speed diesel engines.

Sequential turbocharging (STC)

The MAN Energy Solutions sequential turbocharging system operates with two high-efficiency turbochargers. Depending on the amount of charge air required, the second turbocharger is switched on or off. In this way, the engine is operated at its optimum operating point over the whole applicable load range.

The result is an extended operating envelope at low engine speeds, which gives a power reserve for ship acceleration, ship turning, sprints or towing. Furthermore, the STC system is characterised by a low thermal signature, decreased smoke emission, low vibrations and continuous low-load operation with reduced fuel consumption, which makes it the ideal solution for propulsion in naval applications and offshore patrol vessels.

Dual fuel (DF) engines

Dual fuel engines from MAN Energy Solutions run efficiently on liquid fuels or natural gas with very low emissions that are compliant with IMO limits. On gaseous fuel, the engines comply with IMO Tier III without the need for additional exhaust gas aftertreatment, and on liquid fuel they either fulfill IMO Tier II, or IMO Tier III together with an SCR system. The possibility to switch over seamlessly from gas to diesel operation and vice versa provides full flexibility in multiple applications.

All dual fuel engines can run on natural gas with a methane number higher than 80 without adjustments. For lower methane numbers, MAN Energy Solutions can deliver well-adapted solutions. The optimised combustion chamber ensures very low fuel consumption in both operational modes.

Methane emissions

CH_4 has a notably higher impact on the climate than CO_2, and the emission of unburnt CH_4 fuel not only reduces the overall operation efficiency, but also affects the environmental footprint of ship operation.

Modern low-pressure dual fuel four-stroke engines provide extensive means of controlling the combustion process. Due to the operating principle, CH_4 emissions cannot be avoided completely. However, based on extensive expertise and experience, the latest MAN four-stroke dual fuel engines are designed to achieve the best possible results, for example:

- Halving of the CH_4 slip since the introduction of dual fuel engines
- The newest developments have halved the values once more
- Further development is successfully ongoing to reach yet another 50% reduction
- Using smart vessel operation optimisation, effective emissions can be additionally reduced already today.

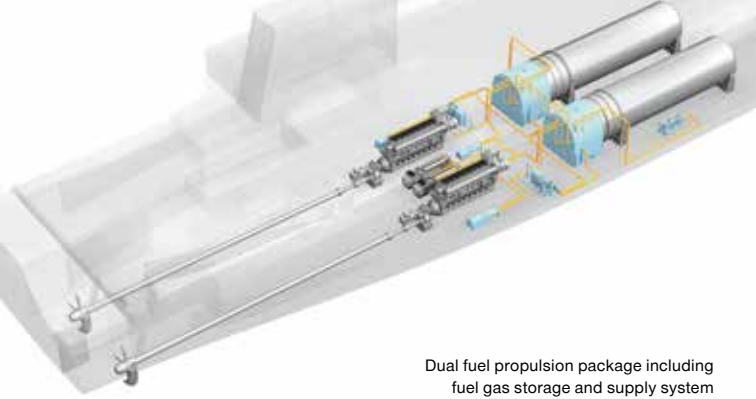
Biofuel

MAN engines are capable of operating on various kinds and shares of biofuel. Contact MAN Energy Solutions if this option is required.

MAN Cryo

MAN Cryo are world leaders in engineering solutions for safe storage of energy on board ships, and reliably providing gas to both engines and fuel cells.

After 20 years of pioneering the market for LNG-fuelled ships with more than 60 reference projects, MAN Cryo has entered groundbreaking territory, developing unique solutions for storage and regasification of liquid hydrogen. With this milestone, MAN Cryo consolidates its position as your reliable engineering partner for marine applications, as well as breaking new ground with its green “power-to-x” solutions for onshore applications.



Dual fuel propulsion package including
fuel gas storage and supply system

Engine power

Engine brake power is stated in kW.

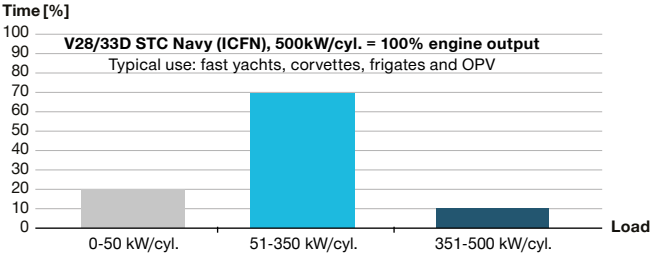
Ratings are given according to ISO 3046-1.

According to ISO 15550, the power figures in the tables are valid within a range of ±3% up to tropical conditions at sea level, i.e.:
- compressor inlet temperature 45°C
- compressor inlet pressure 1,000 mbar
- sea water temperature 32°C

For all commercial medium speed propulsion engines the power is defined according ICN[1] definition (ISO 3046-1:2002: ISO standard power).

For all navy medium speed propulsion applications the engine rated power is stated as ICFN (ISO standard Continuous Fuel stop Net power), derived from standard ISO 3046-1:2002. It means the engine is capable to deliver power continuously during a period of time corresponding to the application. The engine is operated at stated speed and reference ambient conditions as stated above, while the fuel amount is limited and the fuel stop power cannot be exceeded. The engine rated power is delivered between the maintenance intervals as defined. The ICFN[1] engine power rating description corresponds to 100% engine power output and cannot be exceeded.

Exemplary load profile type:



[1] **I** = Power ISO 3046. **C** = continuous power output. **F** = fuel stop power. **N** = net

Specific fuel oil consumption (SFOC) and heat rate

The stated consumption figures refer to the following reference conditions according to ISO 3046-1:

- ambient air pressure: 1,000 mbar
- ambient air temperature: 25°C (77 °F)
- charge air temperature: according to engine type, corresponding to 25°C cooling water temperature before CAC

The figures are given with a tolerance of +5% and without engine driven pumps. Additional fuel oil consumption must be considered for attached pumps and for engines directly driving dredge pumps.

In accordance with the NO_x Technical Code 2008 of the International Maritime Organization, DM-grade fuel oil is used as reference fuel oil for engine tests and, thus, also forms the basis for the SFOC figures stated for engines in liquid fuel operation.

Unless otherwise specifically stated, SFOC figures are based on a lower calorific value of the fuel oil of 42,700 kJ/kg and, in addition for engines with common rail injection (CR-engines), on DMA-grade fuel oil (ISO 8217). For engines with conventional fuel injection, SFOC figures are based on DMB-grade fuel oil (ISO 8217). For further details, please refer to our engine specific project guides available from MAN Energy Solutions.

Specific lube oil consumption (SLOC)

The specific lube oil consumption is specified at MCR (maximum continuous rating) with a tolerance of 20%.

Blocking of output

Blocking of output is made for engines driving a propeller at 100% of the rated output. For engines powering an alternator, blocking of output is made at 110%. However, operation above 100% load is only recommended for a short period of time for recovery and prevention of a frequency drop.

Weights and dimensions

For marine main engines, the weights stated refer to engines without a flywheel.

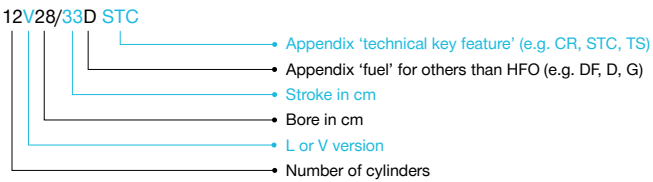
All weights given are without lube oil and cooling water.

For auxiliary engines (GenSets), weights refer to the unit (including alternator). The weight of the GenSet may vary depending on the alternator make.

The length of the GenSet unit depends on the alternator make. For a twin engine installation, the centreline distance is stated for each engine type.

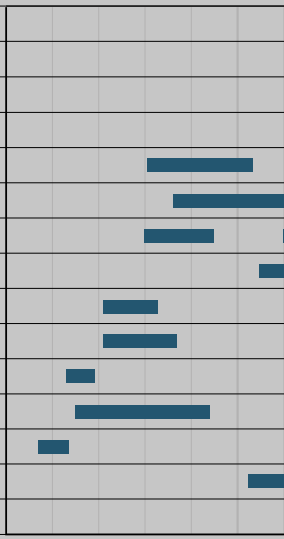
The centreline distance for twin engine installation is given as a minimum value. Specific requirements to the passageway (e.g. of classification societies or flag state authority), seating type or a gallery can lead to higher values.

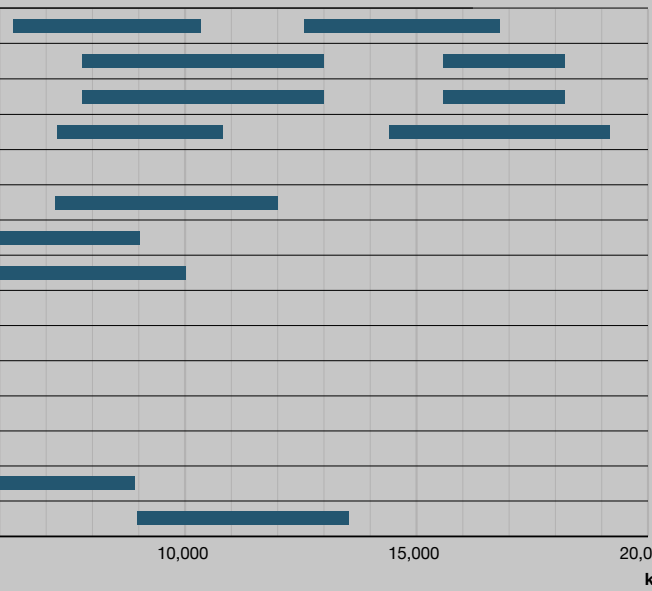
Engine type designation



MAN four-stroke propulsion engines programme

r/min	Engine type
500-514	L51/60DF V51/60DF
600	L49/60DF V49/60DF
600	L49/60 V49/60
500-514	L48/60CR V48/60CR
720-750	L35/44DF
720-750	L32/44CR V32/44CR
720-750	L32/40 V32/40
1,000-1,032	V28/33D STC
750-800	L27/38 L27/38 (MDO/MGO)
750-900	L27/38 Mk2
1,000	L21/31
1,600-2,000	175D
1,300	S.E.M.T. Pielstick PA4 SM & SMDS
1,050-1,084	S.E.M.T. Pielstick PA6B STC
600	S.E.M.T. Pielstick PC2.6B




10,000
15,000
20,000
kW

MAN V51/60DF

Tier II Tier III

High efficiency variant

Tier III in gas mode

Bore: 510 mm, **Stroke:** 600 mm

Speed	**r/min**	514	500
mep	**bar**	20.0	20.6
		kW	**kW**
12V51/60DF		12,600	12,600
14V51/60DF		14,700	14,700
16V51/60DF		16,800	16,800

LHV of fuel gas ≥ 28,000 kJ/Nm^3
(Nm^3 corresponds to one cubic meter of gas at 0°C and 1.013 bar)

Specific fuel oil consumption (SFOC) and Heat rate at ISO conditions

MCR	**100%**	**85%**
Specific fuel oil consumption[1)]	177.0 g/kWh (43°C)[4)]	174.5 g/kWh (43°C)[4)]
Heat rate[2)]	7,150 kJ/kWh (43°C)[4)]	7,150 kJ/kWh (45°C)[4)]

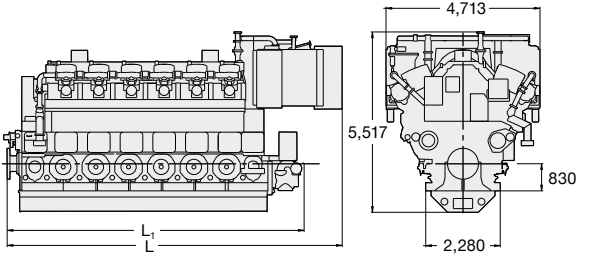
Specific lube oil consumption[3)]: 0.38 g/kWh for nominal output 1,050 kW/cyl.

[1)] Liquid fuel operation
[2)] Gas operation (including pilot fuel, cetane no. 55 - 60), gas fuel: methane no. 80
[3)] Related to 100% actual engine load
[4)] Engine type specific reference charge air temperature before cylinder

Dimensions

Cyl. No.		**12**	**14**	**16**
L	**mm**	10,254	11,254	12,254
L_1	**mm**	9,088	10,088	11,088
Dry mass	**t**	199	228	250

Minimum centreline distance for twin engine installation: 4,800 mm



MAN L51/60DF

High efficiency variant

Bore: 510 mm, **Stroke:** 600 mm

Speed	**r/min**	514	500
mep	**bar**	20.0	20.6
		kW	**kW**
6L51/60DF		6,300	6,300
7L51/60DF		7,350	7,350
8L51/60DF		8,400	8,400
9L51/60DF		9,450	9,450

LHV of fuel gas ≥ 28,000 kJ/Nm^3
(Nm^3 corresponds to one cubic meter of gas at 0°C and 1.013 bar)

Specific fuel oil consumption (SFOC) and Heat rate at ISO conditions

MCR	**100%**	**85%**
Specific fuel oil consumption[1)]	178.5 g/kWh (43°C)[4)]	176.0 g/kWh (43°C)[4)]
Heat rate[2)]	7,150 kJ/kWh (43°C)[4)]	7,150 kJ/kWh (45°C)[4)]

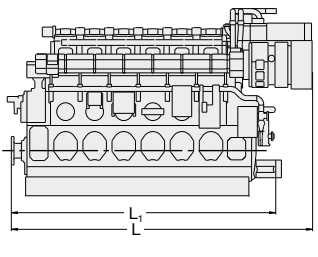
Specific lube oil consumption[3)]: 0.38 g/kWh for nominal output 1,050 kW/cyl.

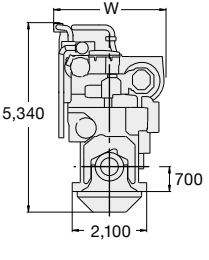
[1)] Liquid fuel operation
[2)] Gas operation (including pilot fuel, cetane no. 55 - 60), gas fuel: methane no. 80
[3)] Related to 100% actual engine load
[4)] Engine type specific reference charge air temperature before cylinder

Dimensions

Cyl. No.		**6**	**7**	**8**	**9**
L	**mm**	8,494	9,314	10,134	11,160
L_1	**mm**	7,455	8,275	9,095	9,915
W	**mm**	3,165	3,165	3,165	3,283
Dry mass	**t**	110	124	137	155

Minimum centreline distance for twin engine installation: 3,200 mm





MAN V51/60DF

Tier II Tier III

High power variant

Tier III in gas mode

Bore: 510 mm, **Stroke:** 600 mm

Speed	**r/min**	514	500
mep	**bar**	21.9	22.5
		kW	**kW**
12V51/60DF		13,800	13,800
14V51/60DF		16,100	16,100

LHV of fuel gas ≥ 28,000 kJ/Nm^3
(Nm^3 corresponds to one cubic meter of gas at 0°C and 1.013 bar)

Specific fuel oil consumption (SFOC) and Heat rate at ISO conditions

MCR	**100%**	**85%**
Specific fuel oil consumption[1]	185.0 g/kWh (43°C)[4]	181.0 g/kWh (43°C)[4]
Heat rate[2] **(12V51/60DF)**	7,350 kJ/kWh (50°C)[4]	7,250 kJ/kWh (50°C)[4]
Heat rate[2] **(14V51/60DF)**	7,350 kJ/kWh (50°C)[4]	7,300 kJ/kWh (50°C)[4]

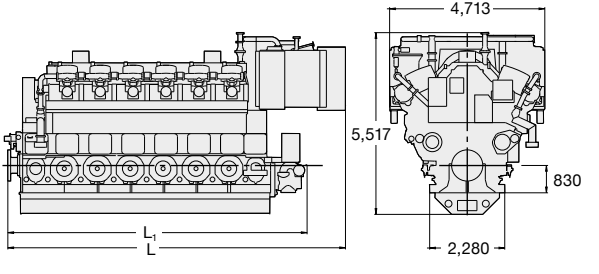
Specific lube oil consumption[3]: 0.35 g/kWh for nominal output 1,150 kW/cyl.

[1] Liquid fuel operation
[2] Gas operation (including pilot fuel, cetane no. 55 - 60), gas fuel: methane no. 80
[3] Related to 100% actual engine load
[4] Engine type specific reference charge air temperature before cylinder

Dimensions

Cyl. No.		**12**	**14**	**16**
L	**mm**	10,254	11,254	12,254
L_1	**mm**	9,088	10,088	11,088
Dry mass	**t**	199	228	250

Minimum centreline distance for twin engine installation: 4,800 mm



MAN L51/60DF

High power variant

Bore: 510 mm, **Stroke:** 600 mm

Speed	**r/min**	514	500
mep	**bar**	21.9	22.5
		kW	**kW**
6L51/60DF		6,900	6,900
7L51/60DF		8,050	8,050
8L51/60DF		9,200	9,200
9L51/60DF		10,350	10,350

LHV of fuel gas ≥ 28,000 kJ/Nm^3
(Nm^3 corresponds to one cubic meter of gas at 0°C and 1.013 bar)

Specific fuel oil consumption (SFOC) and Heat rate at ISO conditions

MCR	**100%**	**85%**
Specific fuel oil consumption[1]	186.5 g/kWh (43°C)[4]	182.5 g/kWh (43°C)[4]
Heat rate[2]	7,420 kJ/kWh (50°C)[4]	7,350 kJ/kWh (50°C)[4]

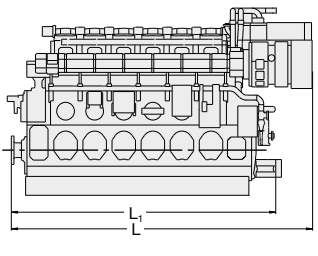
Specific lube oil consumption[3]: 0.35 g/kWh for nominal output 1,150 kW/cyl.

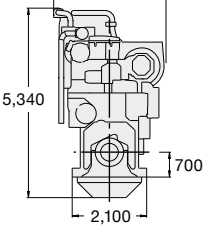
[1] Liquid fuel operation
[2] Gas operation (including pilot fuel, cetane no. 55 - 60), gas fuel: methane no. 80
[3] Related to 100% actual engine load
[4] Engine type specific reference charge air temperature before cylinder

Dimensions

Cyl. No.		**6**	**7**	**8**	**9**
L	**mm**	8,494	9,314	10,134	11,160
L_1	**mm**	7,455	8,275	9,095	9,915
W	**mm**	3,165	3,165	3,165	3,283
Dry mass	**t**	110	124	137	155

Minimum centreline distance for twin engine installation: 3,200 mm





MAN V49/60DF

Tier II Tier III

Tier III in gas mode

Bore: 490 mm, **Stroke:** 600 mm

Speed	**r/min**	600
mep	**bar**	23
		kW
12V49/60DF		15,600
14V49/60DF		18,200

LHV of fuel gas ≥ 28,000 kJ/Nm^3
(Nm^3 corresponds to one cubic meter of gas at 0°C and 1.013 bar)

Specific fuel oil consumption (SFOC) and Heat rate at ISO conditions

MCR	**100%**	**85%**
Specific fuel oil consumption[1)]	174.4 g/kWh	171.0 g/kWh
Heat rate[2)]	6,985 kJ/kWh	6,990 kJ/kWh

Specific lube oil consumption[3)]: 0.5 g/kWh for nominal output 1,300 kW/cyl.

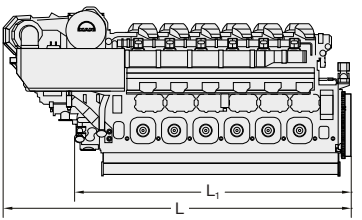
Engine type specific reference charge air temperature before cylinder 50°C

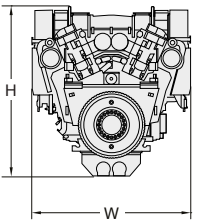
[1)] Liquid fuel operation.
[2)] Gas operation (including pilot fuel, cetane no. 55-60), gas fuel: methane no. 80
[3)] Related to 100% actual engine load

Dimensions

Cyl. No.		**12**	**14**
L	**mm**	10,898	11,878
L$_1$	**mm**	9,350	10,330
W	**mm**	5,019	5,019
H	**mm**	5,681	5,681
Dry mass	**t**	217	245

Minimum centreline distance for twin engine installation: 5,050 mm





MAN L49/60DF

Tier III in gas mode

Bore: 490 mm, **Stroke:** 600 mm

Speed	**r/min**	600
mep	**bar**	23
		kW
6L49/60DF		7,800
7L49/60DF		9,100
8L49/60DF		10,400
9L49/60DF		11,700
10L49/60DF		13,000

LHV of fuel gas ≥ 28,000 kJ/Nm^3
(Nm^3 corresponds to one cubic meter of gas at 0°C and 1.013 bar)

Specific fuel oil consumption (SFOC) and Heat rate at ISO conditions

MCR	**100%**	**85%**
Specific fuel oil consumption[1), 4)]	174.4 g/kWh	171.0 g/kWh
Heat rate[2), 4)]	6,985 kJ/kWh	6,990 kJ/kWh

Specific lube oil consumption[3)]: 0.5 g/kWh for nominal output 1,300 kW/cyl.

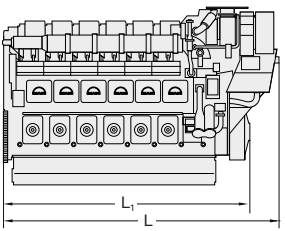
Engine type specific reference charge air temperature before cylinder 50°C

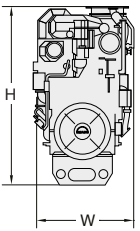
1) Liquid fuel operation.
2) Gas operation (including pilot fuel, cetane no. 55-60), gas fuel: methane no. 80
3) Related to 100% actual engine load
4) Higher values for 8L
* Please contact MAN Energy Solutions for further details

Dimensions

Cyl. No.		**6**	**7**	**8**	**9**	**10**
L	**mm**	8,518	9,338	10,399	11,219	12,039
L_1	**mm**	7,238	8,058	8,878	9,698	10,518
W	**mm**	3,134	3,134	3,134	3,154	3,154
H	**mm**	5,426	5,426	5,426	5,582	5,582
Dry mass	**t**	130	145	165	180	195

Minimum centreline distance for twin engine installation: 3,700 mm





MAN V49/60

Tier II Tier III

Tier III with SCR

Bore: 490 mm, **Stroke:** 600 mm

Speed	**r/min**	600
mep	**bar**	23
		kW
12V49/60		15,600
14V49/60		18,200

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	**100%**	**85%**
Specific fuel oil consumption	174.4 g/kWh	171.0 g/kWh

Specific lube oil consumption[1]: 0.5 g/kWh for nominal output 1,300 kW/cyl.

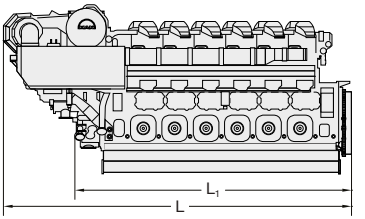
Engine type specific reference charge air temperature before cylinder 50°C

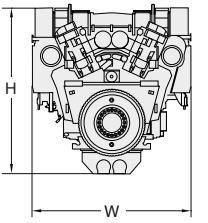
[1] Related to 100% actual engine load

Dimensions

Cyl. No.		**12**	**14**
L	**mm**	10,898	11,878
L_1	**mm**	9,350	10,330
W	**mm**	5,019	5,019
H	**mm**	5,681	5,681
Dry mass	**t**	217	245

Minimum centreline distance for twin engine installation: 5,050 mm





Tier III with SCR

Bore: 490 mm, **Stroke:** 600 mm

Speed	**r/min**	600
mep	**bar**	23
		kW
6L49/60		7,800
7L49/60		9,100
8L49/60		10,400
9L49/60		11,700
10L49/60		13,000

Specific fuel oil consumption (SFOC) at ISO conditions

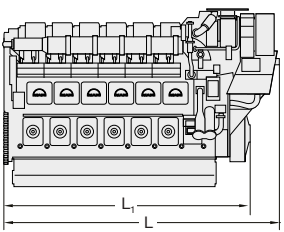
MCR	**100%**	**85%**
Specific fuel oil consumption[1)]	174.4 g/kWh	171.0 g/kWh
Specific lube oil consumption[2)]: 0.5 g/kWh for nominal output 1,300 kW/cyl.		
Engine type specific reference charge air temperature before cylinder 50°C		

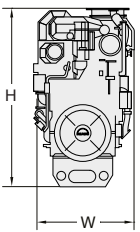
[1)] Higher values for 8L
[2)] Related to 100% actual engine load
* Please contact MAN Energy Solutions for further details

Dimensions

Cyl. No.		**6**	**7**	**8**	**9**	**10**
L	**mm**	8,518	9,338	10,399	11,219	12,039
L_1	**mm**	7,238	8,058	8,878	9,698	10,518
W	**mm**	3,134	3,134	3,134	3,154	3,154
H	**mm**	5,426	5,426	5,426	5,582	5,582
Dry mass	**t**	130	145	165	180	195

Minimum centreline distance for twin engine installation: 3,700 mm





MAN V48/60CR

Tier II | Tier III

Tier III with SCR

Bore: 480 mm, **Stroke:** 600 mm

Speed	**r/min**	514	500
mep	**bar**	25.8	26.5
		kW	**kW**
12V48/60CR		14,400	14,400
14V48/60CR		16,800	16,800
16V48/60CR		19,200	19,200

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	**100%**	**85%**
V48/60CR	182.0 g/kWh	173.5 g/kWh

Specific lube oil consumption[1]: 0.5 g/kWh for nominal output 1,200 kW/cyl.

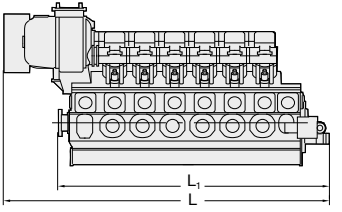
Engine type specific reference charge air temperature before cylinder 37°C

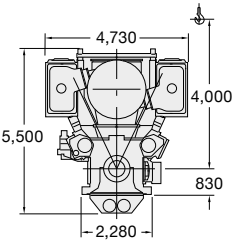
[1] Related to 100% actual engine load

Dimensions

Cyl. No.		**12**	**14**	**16**
L	**mm**	10,790	11,790	13,140
L_1	**mm**	9,088	10,088	11,088
Dry mass	**t**	189	213	240

Minimum centreline distance for twin engine installation: 4,800 mm





MAN L48/60CR

Bore: 480 mm, **Stroke:** 600 mm

Speed	**r/min**	514	500
mep	**bar**	25.8	26.5
		kW	**kW**
6L48/60CR		7,200	7,200
7L48/60CR		8,400	8,400
8L48/60CR		9,600	9,600
9L48/60CR		10,800	10,800

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	**100%**	**85%**
L48/60CR	184.0 g/kWh	175.5 g/kWh

Specific lube oil consumption[1]: 0.5 g/kWh for nominal output 1,200 kW/cyl.

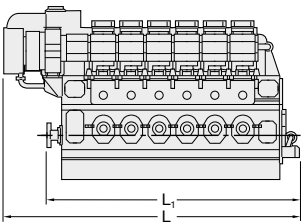
Engine type specific reference charge air temperature before cylinder 37°C

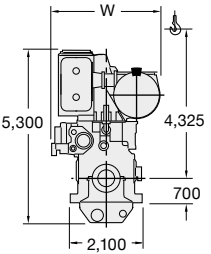
[1] Related to 100% actual engine load

Dimensions

Cyl. No.		**6**	**7**	**8**	**9**
L	**mm**	8,760	9,580	10,540	11,360
L_1	**mm**	7,455	8,275	9,095	9,915
W	**mm**	3,165	3,165	3,280	3,280
Dry mass	**t**	106	119	135	148

Minimum centreline distance for twin engine installation: 3,200 mm





MAN Energy Solutions
Future in the making

Moving big things to zero

with green engines running on climate-friendly fuels

We're powering carbon-neutral shipping

Global shipping is advancing towards a sustainable future. And we're developing new engines to run on climate-neutral fuels. We already offer fuel-flexible engines that can operate on green methanol, green hydrogen, and synthetic natural gas. Our world-first methanol dual-fuel engine will be followed in 2024 by the first green ammonia engine. Working together with the marine industry, we can move big ships with zero carbon emissions.

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Tier III in gas mode

Bore: 350 mm, **Stroke:** 440 mm

Speed	**r/min**	750	720
mep	**bar**	20.0	20.1
		kW	**kW**
6L35/44DF		3,180	3,060
7L35/44DF		3,710	3,570
8L35/44DF		4,240	4,080
9L35/44DF		4,770	4,590
10L35/44DF		5,300	5,100

LHV of fuel gas ≥ 28,000 kJ/Nm^3
(Nm^3 corresponds to one cubic meter of gas at 0°C and 1.013 bar)

Specific fuel oil consumption (SFOC) and Heat rate at ISO conditions

MCR		**100%**	**85%**
Specific fuel oil consumption[1]	6L	179.5 g/kWh	175.5 g/kWh
	7L-10L	178.5 g/kWh	175.5 g/kWh
Heat rate[2]		7,410 kJ/kWh	7,440 kJ/kWh

Specific lube oil consumption[3]: 0.5 g/kWh for nominal output 530 kW/cyl. or 0.52 g/kWh for nominal output 510 kW/cyl.

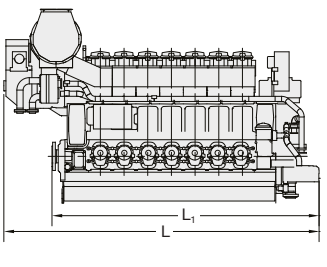
Engine type specific reference charge air temperature before cylinder 40°C

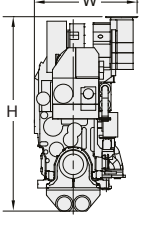
[1] Liquid fuel operation
[2] Gas operation (including pilot fuel, cetane no. 55 - 60), gas fuel: methane no. 80
[3] Related to 100% actual engine load

Dimensions

Cyl. No.		**6**	**7**	**8**	**9**	**10**
L	**mm**	6,485	7,015	7,545	8,075	8,605
L$_1$	**mm**	5,265	5,877	6,407	6,937	7,556
W	**mm**	2,539	2,678	2,678	2,678	2,678
H	**mm**	4,163	4,369	4,369	4,369	4,369
Dry mass[4]	**t**	43.1	48.2	53.3	57.6	62.3

Minimum centreline distance for twin engine installation: 2,500 mm
[4] Including built-on lube oil automatic filter, fuel oil filter and electronic equipment
Speed 720 r/min for generator drive only





MAN V32/44CR

Methanol ready* | Tier II | Tier III

Tier III with SCR

Bore: 320 mm, **Stroke:** 440 mm

Speed	**r/min**	750	720
mep	**bar**	27.1	28.3
		kW	**kW**
12V32/44CR		7,200	7,200
14V32/44CR[1)]		8,120	8,120
16V32/44CR		9,600	9,600
18V32/44CR[2)]		10,800	10,800
20V32/44CR		12,000	12,000

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	**100%**	**85%**
V32/44CR	175.5 g/kWh	171.0 g/kWh
14V32/44CR	176.0 g/kWh	171.5 g/kWh
V32/44CR FPP	176.5 g/kWh	172.5 g/kWh
14V32/44CR FPP	177.5 g/kWh	174.0 g/kWh

Specific lube oil consumption[3)]: 0.5 g/kWh for nominal output 600 kW/cyl., 0.52 g/kWh for nominal output 580 kW/cyl., 0.55 g/kWh for nominal output 550 kW/cyl.

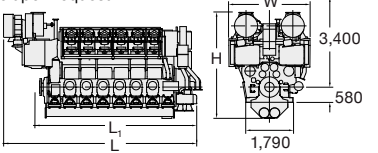
Engine type specific reference charge air temperature before cylinder 40°C

* Please contact MAN Energy Solutions for further details

Dimensions

Cyl. No.		**12**	**14**	**16**	**18**	**20**
L	**mm**	7,195	7,970	8,600	9,230	9,860
L_1	**mm**	5,795	6,425	7,055	7,685	8,315
W	**mm**	3,100	3,100	3,100	3,100	3,100
H	**mm**	4,039	4,262	4,262	4,262	4,262
Dry mass[4)]	**t**	70	79	87	96	104

Minimum centreline distance for twin engine installation: 4,000 mm
Speed 720 r/min for generator drive/constant speed operation only
[1)] 580 kW/cyl.
[2)] 18V32/44CR available rigidly mounted only
[3)] Related to 100% actual engine load
[4)] Including built-on lube oil automatic filter, fuel oil filter and electronic equipment
Fixed pitch propeller: 550 kW/cyl., 750 r/min
Wet oil sump available upon request



MAN L32/44CR

Tier III with SCR

Bore: 320 mm, **Stroke:** 440 mm

Speed	**r/min**	750	720
mep	**bar**	27.1	28.3
		kW	**kW**
6L32/44CR		3,600	3,600
7L32/44CR[1)]		4,060	4,060
8L32/44CR		4,800	4,800
9L32/44CR		5,400	5,400
10L32/44CR		6,000	6,000

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	**100%**	**85%**
L32/44CR	176.0 g/kWh	172.0 g/kWh
7L32/44CR	176.5 g/kWh	172.5 g/kWh
L32/44CR FPP	176.5 g/kWh	172.5 g/kWh
7L32/44CR FPP	177.5 g/kWh	174.0 g/kWh

Specific lube oil consumption[2)]: 0.5 g/kWh for nominal output 600 kW/cyl., 0.52 g/kWh for nominal output 580 kW/cyl., 0.55 g/kWh for nominal output 550 kW/cyl.

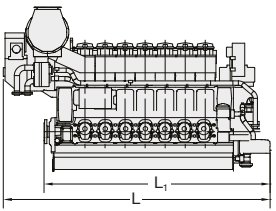
Engine type specific reference charge air temperature before cylinder 40°C

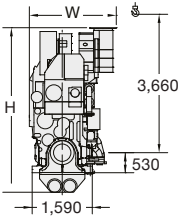
* Please contact MAN Energy Solutions for further details

Dimensions

Cyl. No.		**6**	**7**	**8**	**9**	**10**
L	**mm**	6,312	6,924	7,454	7,984	8,603
L_1	**mm**	5,265	5,877	6,407	6,937	7,556
W	**mm**	2,174	2,359	2,359	2,359	2,359
H	**mm**	4,163	4,369	4,369	4,369	4,369
Dry mass[3)]	**t**	39.5	44.5	49.5	53.5	58.0

Minimum centreline distance for twin engine installation: 2,500 mm
Speed 720 r/min for generator drive/constant speed operation only
[1)] 580 kW/cyl.
[2)] Related to 100% actual engine load
[3)] Including built-on lube oil automatic filter, fuel oil filter and electronic equipment
Fixed pitch propeller: 550 kW/cyl., 750 r/min
Wet oil sump available upon request





MAN V32/40

Tier II Tier III

Tier III with SCR

Bore: 320 mm, **Stroke:** 400 mm

Speed	**r/min**	750	720
mep	**bar**	24.9	25.9
		kW	**kW**
12V32/40		6,000	6,000
14V32/40		7,000	7,000
16V32/40		8,000	8,000
18V32/40		9,000	9,000

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	100%	85%
V32/40	184 g/kWh	182 g/kWh
V32/40 FPP	187 g/kWh	183 g/kWh

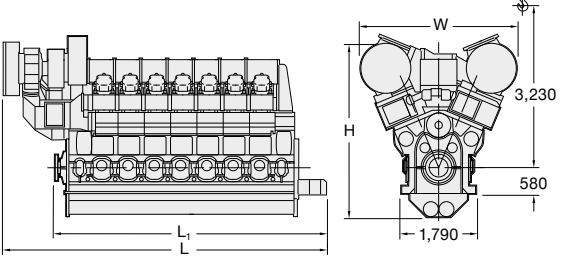
Specific lube oil consumption[1]: 0.5 g/kWh for nominal output 500 kW/cyl., 0.56 g/kWh for nominal output 450 kW/cyl.

Engine type specific reference charge air temperature before cylinder 43°C

Dimensions

Cyl. No.		12	14	16	18
L	**mm**	6,915	7,545	8,365	8,995
L_1	**mm**	5,890	6,520	7,150	7,780
W	**mm**	3,140	3,140	3,730	3,730
H	**mm**	4,100	4,100	4,420	4,420
Dry mass	**t**	61	68	77	85

Minimum centreline distance for twin engine installation: 4,000 mm
Speed 720 r/min for generator drive/constant speed operation only
Fixed pitch propeller: 450 kW/cyl., 750 r/min
V32/40 as marine main engine to be applied for multi-engine plants only
[1] Related to 100% actual engine load



Bore: 320 mm, **Stroke:** 400 mm

Speed	**r/min**	750	720
mep	**bar**	24.9	25.9
		kW	**kW**
6L32/40		3,000	3,000
7L32/40		3,500	3,500
8L32/40		4,000	4,000
9L32/40		4,500	4,500

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	100%	85%
L32/40	186 g/kWh	183 g/kWh
L32/40 FPP	189 g/kWh	184 g/kWh

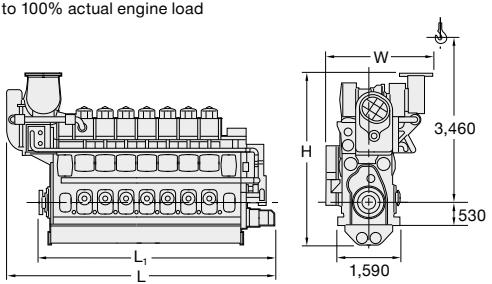
Specific lube oil consumption[1]: 0.5 g/kWh for nominal output 500 kW/cyl., 0.56 g/kWh for nominal output 450 kW/cyl.

Engine type specific reference charge air temperature before cylinder 43°C

Dimensions

Cyl. No.		6	7	8	9
L	**mm**	5,940	6,470	7,000	7,530
L_1	**mm**	5,140	5,670	6,195	6,725
W	**mm**	2,630	2,630	2,715	2,715
H	**mm**	4,010	4,010	4,490	4,490
Dry mass	**t**	38	42	47	51

Minimum centreline distance for twin engine installation: 2,500 mm. Please contact MAN Energy Solutions for the precise information about the centreline distance for two engines with the same cylinder number standing near each other.
Speed 720 r/min for generator drive/constant speed operation only.
Fixed pitch propeller: 450 kW/cyl., 750 r/min
[1] Related to 100% actual engine load



MAN V28/33D STC

Tier II Tier III

Tier III with SCR

Bore: 280 mm, **Stroke:** 330 mm

		Standard engine	Load profile 'Navy'
Speed	**r/min**	1,000	1,032
mep	**bar**	26.9	28.6
12V28/33D STC		5,460	6,000
16V28/33D STC		7,280	8,000
20V28/33D STC		9,100	10,000

Specific fuel oil consumption (SFOC) at ISO conditions

Output		100%	85%	100%	85%
12V28/33D STC	**g/kWh**	189.0	186.0	194.0	188.5
16V28/33D STC	**g/kWh**	188.0	183.5	192.0	186.5
20V28/33D STC	**g/kWh**	188.0	183.5	192.0	186.5

Specific lube oil consumption[1]: 0.4 g/kWh for nominal output 455 kW/cyl., 0.36 g/kWh for nominal output 500 kW/cyl.

Engine type specific reference charge air temperature before cylinder 40°C

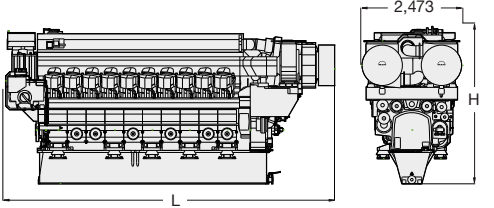
Figures on theoretical propeller curve for distillates according to ISO 8217 DMA, with all attached pumps

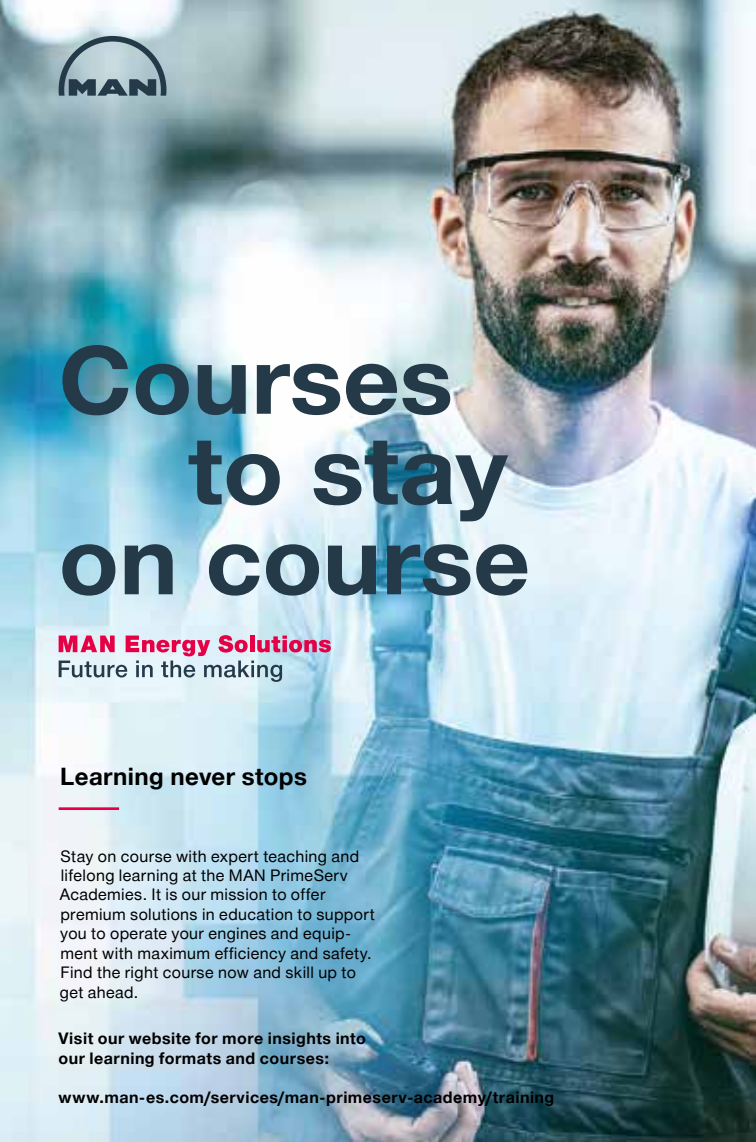
Dimensions

Cyl. No.		12	16	20
L	**mm**	6,207	7,127	8,047
H[2]	**mm**	3,417	3,417	3,417
H[3]	**mm**	3,682	3,682	3,682
Dry mass[4]	**t**	35.6	43.0	50.6

[1] Related to 100% actual engine load
[2] With low oilsump
[3] With deep oilsump
[4] Tolerance: 5%

Weight and performance parameters refer to engine with flywheel, TC silencer, attached pumps, oil filters and lube oil cooler.
V28/33D STC as marine main engine to be applied for multi-engine plants only in class-approved vessels.





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MAN L27/38

Tier II Tier III

Tier III with SCR

Bore: 270 mm, **Stroke:** 380 mm

Speed	**r/min**	750	800	800 (MDO[1]/MGO)
mep	**bar**	25.7	23.5	25.2
		kW	**kW**	**kW**
6L27/38		2,100	2,040	2,190
7L27/38		2,450	2,380	2,555
8L27/38		2,800	2,720	2,920
9L27/38		3,150	3,060	3,285

Specific fuel oil consumption (SFOC) at ISO conditions

MCR			**100%**			**85%**
	340 kW	350 kW	365 kW	340 kW	350 kW	365 kW
L27/38 CPP	188 g/kWh	189 g/kWh	191 g/kWh	185 g/kWh	186 g/kWh	186 g/kWh
L27/38 FPP	187 g/kWh	-	191 g/kWh	181 g/kWh	-	185 g/kWh

Specific lube oil consumption 0.8 g/kWh

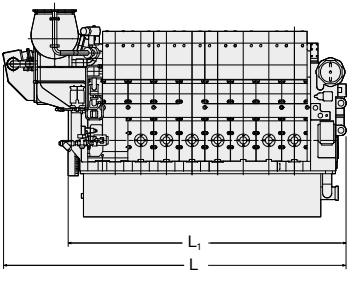
Engine type specific reference charge air temperature before cylinder 40°C

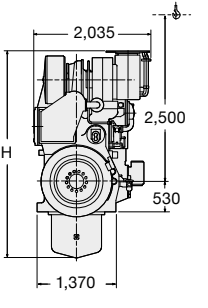
Dimensions

Cyl. No.		**6**	**7**	**8**	**9**
L	**mm**	5,070	5,515	5,960	6,405
L_1	**mm**	3,962	4,407	4,852	5,263
H	**mm**	3,555	3,687	3,687	3,687
Dry mass	**t**	29.0	32.5	36.0	39.5

Minimum centreline distance for twin engine installation: 2,500 mm

[1] MDO viscosity must not exceed 6 mm^2/s = cSt at 40°C.





MAN L27/38 Mk2

Tier III with SCR

Bore: 270 mm, **Stroke:** 380 mm

Speed	**r/min**	750	900
mep	**bar**	25.7	23.5
		kW	**kW**
6L27/38 Mk 2		2,100	2,460
7L27/38 Mk 2		2,450	2,870
8L27/38 Mk 2		2,800	3,280
9L27/38 Mk 2		3,150	3,690

Specific fuel oil consumption (SFOC) at ISO conditions

MCR		**100%**		**85%**	
	350 kW	410 kW	350 kW	410 kW
L27/38 CPP	189 g/kWh	191 g/kWh	186 g/kWh	186 g/kWh
L27/38 FPP	-	191 g/kWh	-	185 g/kWh

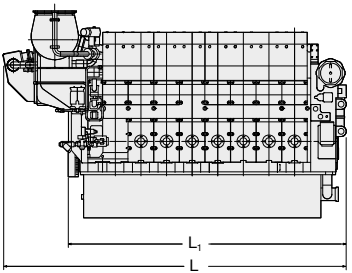
Specific lube oil consumption 0.8 g/kWh

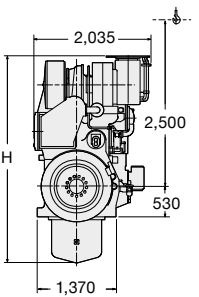
Engine type specific reference charge air temperature before cylinder 40°C

Dimensions

Cyl. No.		**6**	**7**	**8**	**9**
L	**mm**	5,070	5,515	5,960	6,405
L_1	**mm**	3,962	4,407	4,852	5,263
H	**mm**	3,555	3,687	3,687	3,687
Dry mass	**t**	29.0	32.5	36.0	39.5

Minimum centreline distance for twin engine installation: 2,500 mm





MAN L21/31

Tier II Tier III

Tier III with SCR

Bore: 210 mm, **Stroke:** 310 mm

Speed	**r/min**	1,000
mep	**bar**	24.0
		kW
6L21/31		1,290
7L21/31		1,505
8L21/31		1,720
9L21/31		1,935

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	**100%**	**85%**
L21/31 CPP	192 g/kWh	190 g/kWh
L21/31 FPP	192 g/kWh	190 g/kWh

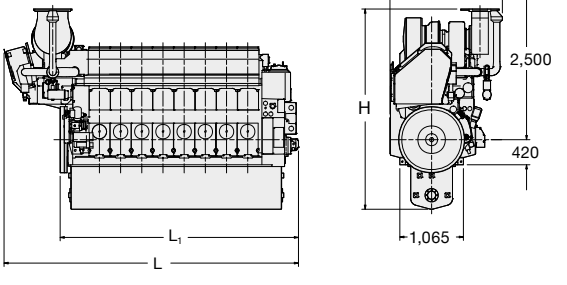
Specific lube oil consumption 0.4-0.8 g/kWh

Engine type specific reference charge air temperature before cylinder 40°C

Dimensions

Cyl. No.		**6**	**7**	**8**	**9**
L	**mm**	4,544	4,899	5,254	5,609
L_1	**mm**	3,424	3,779	4,134	4,489
H	**mm**	3,113	3,267	3,267	3,267
W	**mm**	1,695	1,695	1,820	1,820
Dry mass	**t**	16.0	17.5	19.0	20.5

Minimum centreline distance for twin engine installation: 2,400 mm



Bore: 175 mm, **Stroke:** 215 mm

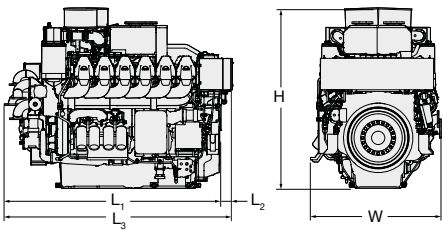
Engine model	Rating def.	kW	rpm	SFOC at 100% MCR Tier II/Tier III g/kWh	Avg. Load %
12V175D-MH	Heavy Duty	1,740	1,800	192.5/193.0	85
12V175D-MM	Medium Duty	1,860	1,800	191.0/192.0	80
12V175D-MM	Medium Duty	1,920	1,800	193.0/194.0	80
12V175D-MM	Medium Duty	2,040	1,800	191.0/191.5	70
12V175D-MM	Medium Duty*	2,220	1,800	191.5/193.0	40
12V175D-MM	Medium Duty	2,220	1,900	195.0/196.0	65
12V175D-MM	Medium Duty*	2,400	1,800	193.0/193.0	40
12V175D-ML	Light Duty	2,400	2,000	197.5/198.0	60
12V175D-ML	Light Duty	2,580	2,000	202.0/ -	60

For multi-engine arrangement only. Specific fuel oil consumption according to ISO 3046-1:2002 based on a lower calorific value of 42,700 kJ/kg with attached lube oil, HT and LT cooling water pumps fulfilling IMO Tier II/Tier III emission limits with 5% tolerance.
* for tug applications only

Dimensions

Cyl. No.		12
L_1	mm	2,734
L_2	mm	167
L_3	mm	2,901
H	mm	2,295
W	mm	1,661
Dry mass	t	8.70

Configuration shown: MAN 12V175D-MM without seawater cooler



MAN 175D

Tier II | Tier III

16V

Tier III with SCR

Bore: 175 mm, **Stroke:** 215 mm

Engine model	Rating def.	kW	rpm	SFOC at 100% MCR Tier II/Tier III g/kWh	Avg. Load %
16V175D-MM	Medium Duty	2,560	1,800	193.0/194.0	80
16V175D-MM	Medium Duty	2,720	1,800	191.0/192.5	70
16V175D-MM	Medium Duty*	2,960	1,800	192.5/194.0	40
16V175D-MM	Medium Duty	2,960	1,900	196.0/197.0	65
16V175D-ML	Light Duty	3,200	2,000	197.5/198.0	60

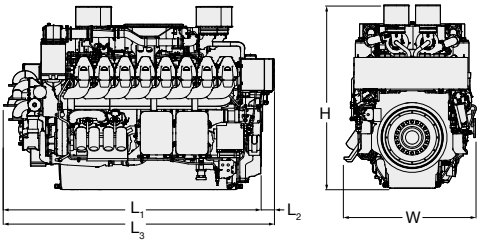
For multi-engine arrangement only. Specific fuel oil consumption according to ISO 3046-1:2002 based on a lower calorific value of 42,700 kJ/kg with attached lube oil, HT and LT cooling water pumps fulfilling IMO Tier II/Tier III emission limits with 5% tolerance.

* for tug application only

Dimensions

Cyl. No.		16
L_1	mm	3,254
L_2	mm	167
L_3	mm	3,421
H	mm	2,316
W	mm	1,661
Dry mass	t	10.80

Configuration shown: MAN 16V175D-MM without seawater cooler



Bore: 175 mm, **Stroke:** 215 mm

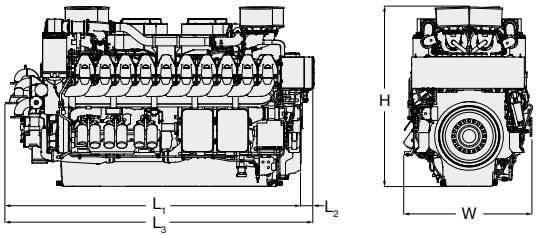
Engine model	Rating def.	kW	rpm	SFOC at 100% MCR Tier II/Tier III g/kWh	Avg. Load %
20V175D-MM	Medium Duty	3,400	1,800	191.0/191.5	70
20V175D-MM	Medium Duty*	3,700	1,800	191.5/193.0	40
20V175D-MM	Medium Duty	3,700	1,900	194.0/195.0	65
20V175D-ML	Light Duty	4,000	2,000	197.5/198.0	60
20V175D-ML	Light Duty	4,400	2,000	199.0/-	60

For multi-engine arrangement only. Specific fuel oil consumption according to ISO 3046-1:2002 based on a lower calorific value of 42,700 kJ/kg with attached lube oil, HT and LT cooling water pumps fulfilling IMO Tier II/Tier III emission limits with 5% tolerance.
* for tug application only

Dimensions (preliminary)

Cyl. No.		20
L_1	mm	3,774
L_2	mm	167
L_3	mm	3,941
H	mm	2,297
W	mm	1,647
Dry mass	t	13.00

Configuration shown: MAN 20V175D-MM without seawater cooler



MAN four-stroke marine mechanical pump drive

Picture courtesy Dragages-Ports

MAN V48/60CR

Tier II | Tier III

Tier III with SCR

Bore: 480 mm, **Stroke:** 600 mm

Speed	**r/min**	514	500
mep	**bar**	23.2	23.9
		kW	**kW**
12V48/60CR		12,960	12,960
14V48/60CR		15,120	15,120
16V48/60CR		17,280	17,280

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	**100%**	**85%**
V48/60CR	180.5 g/kWh	175.5 g/kWh

Specific lube oil consumption[1]: 0.6 g/kWh for nominal output 1,080 kW/cyl.

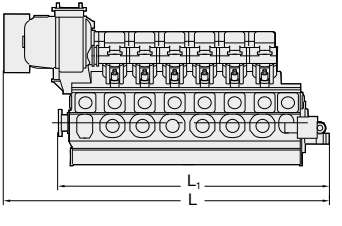
Engine type specific reference charge air temperature before cylinder 37°C

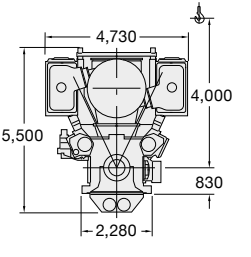
[1] Related to 100% actual engine load

Dimensions

Cyl. No.		**12**	**14**	**16**
L	**mm**	10,790	11,790	13,140
L_1	**mm**	9,088	10,088	11,088
Dry mass	**t**	189	213	240

Minimum centreline distance for twin engine installation: 4,800 mm





MAN L48/60CR

Bore: 480 mm, **Stroke:** 600 mm

Speed	**r/min**	514	500
mep	**bar**	23.2	23.9
		kW	**kW**
6L48/60CR		6,480	6,480
7L48/60CR		7,560	7,560
8L48/60CR		8,640	8,640
9L48/60CR		9,720	9,720

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	**100%**	**85%**
L48/60CR	181.5 g/kWh	177.5 g/kWh

Specific lube oil consumption[1]: 0.6 g/kWh for nominal output 1,080 kW/cyl.

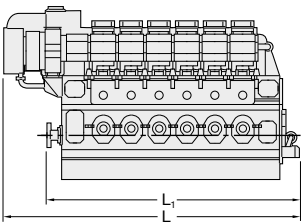
Engine type specific reference charge air temperature before cylinder 37°C

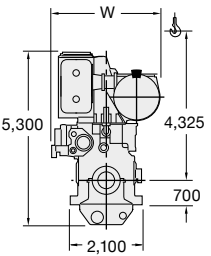
[1] Related to 100% actual engine load

Dimensions

Cyl. No.		**6**	**7**	**8**	**9**
L	**mm**	8,760	9,580	10,540	11,360
L_1	**mm**	7,455	8,275	9,095	9,915
W	**mm**	3,165	3,165	3,280	3,280
Dry mass	**t**	106	119	135	148

Minimum centreline distance for twin engine installation: 3,200 mm





MAN V32/44CR

Methanol ready* | Tier II | Tier III

Tier III with SCR

Bore: 320 mm, **Stroke:** 440 mm

Speed	**r/min**	750
mep	**bar**	24.9
		kW
12V32/44CR		6,600
14V32/44CR		7,700
16V32/44CR		8,800
18V32/44CR[1)]		9,900

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	**100%**	**85%**
V32/44CR	176.5 g/kWh	172.5 g/kWh
14V32/44CR	177.5 g/kWh	174.0 g/kWh

Specific lube oil consumption[2)]: 0.55 g/kWh for nominal output 550 kW/cyl.

Engine type specific reference charge air temperature before cylinder 40°C

* Please contact MAN Energy Solutions for further details

Dimensions

Cyl. No.		**12**	**14**	**16**	**18**
L	**mm**	7,195	7,970	8,600	9,230
L_1	**mm**	5,795	6,425	7,055	7,685
W	**mm**	3,100	3,100	3,100	3,100
H	**mm**	4,039	4,262	4,262	4,262
Dry mass[3)]	**t**	70	79	87	96

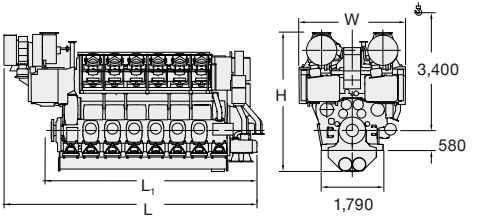
Minimum centreline distance for twin engine installation: 4,000 mm

[1)] 18V32/44CR available rigidly mounted only

[2)] Related to 100% actual engine load

[3)] Including built-on lube oil automatic filter, fuel oil filter and electronic equipment

Wet oil sump available upon request



MAN L32/44CR

Tier III with SCR

Bore: 320 mm, **Stroke:** 440 mm

Speed	**r/min**	750
mep	**bar**	24.9
		kW
6L32/44CR		3,300
7L32/44CR		3,850
8L32/44CR		4,400
9L32/44CR		4,950
10L32/44CR		5,500

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	**100%**	**85%**
L32/44CR	176.5 g/kWh	172.5 g/kWh
7L32/44CR	177.5 g/kWh	174.0 g/kWh

Specific lube oil consumption[1]: 0.55 g/kWh for nominal output 550 kW/cyl.

Engine type specific reference charge air temperature before cylinder 40°C

* Please contact MAN Energy Solutions for further details

Dimensions

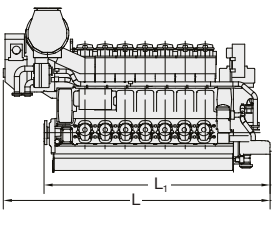
Cyl. No.		**6**	**7**	**8**	**9**	**10**
L	**mm**	6,312	6,924	7,454	7,984	8,603
L_1	**mm**	5,265	5,877	6,407	6,937	7,556
W	**mm**	2,174	2,359	2,359	2,359	2,359
H	**mm**	4,163	4,369	4,369	4,369	4,369
Dry mass[2]	**t**	39.5	44.5	49.5	53.5	58.0

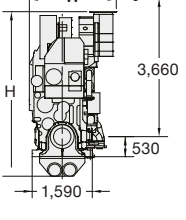
Minimum centreline distance for twin engine installation: 2,500 mm

[1] Related to 100% actual engine load

[2] Including built-on lube oil automatic filter, fuel oil filter and electronic equipment

Wet oil sump available upon request





MAN V32/40

Tier II Tier III

Tier III with SCR

Bore: 320 mm, **Stroke:** 400 mm

Speed	**r/min**	750
mep	**bar**	22.4
		kW
12V32/40		5,400
14V32/40		6,300
16V32/40		7,200
18V32/40		8,100

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	100%	85%
V32/40	189.0 g/kWh	189.0 g/kWh

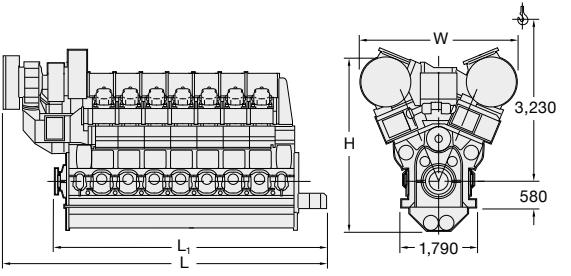
Specific lube oil consumption[1]: 0.56 g/kWh for nominal output 450 kW/cyl.

Engine type specific reference charge air temperature before cylinder 43°C

Dimensions

Cyl. No.		12	14	16	18
L	**mm**	6,915	7,545	8,365	8,995
L_1	**mm**	5,890	6,520	7,150	7,780
W	**mm**	3,140	3,140	3,730	3,730
H	**mm**	4,100	4,100	4,420	4,420
Dry mass	**t**	61	68	77	85

Minimum centreline distance for twin engine installation: 4,000 mm
V32/40 as marine main engine to be applied for multi-engine plants only
[1] Related to 100% actual engine load



Bore: 320 mm, **Stroke:** 400 mm

Speed	**r/min**	750
mep	**bar**	22.4
		kW
6L32/40		2,700
7L32/40		3,150
8L32/40		3,600
9L32/40		4,050

Specific fuel oil consumption (SFOC) at ISO conditions

MCR	100%	85%
L32/40	191 g/kWh	190.0 g/kWh

Specific lube oil consumption[1]: 0.56 g/kWh for nominal output 450 kW/cyl.

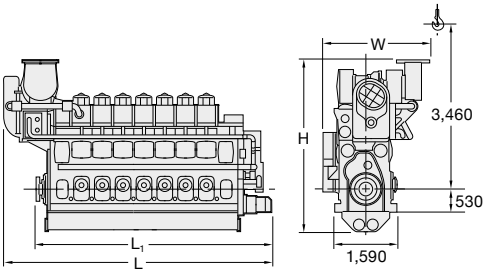
Engine type specific reference charge air temperature before cylinder 43°C

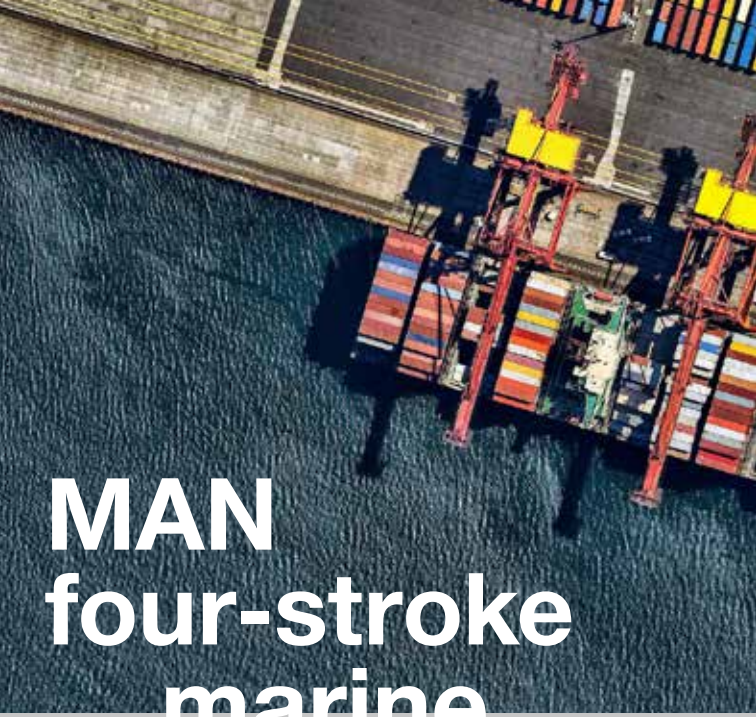
Dimensions

Cyl. No.		6	7	8	9
L	**mm**	5,940	6,470	7,000	7,530
L_1	**mm**	5,140	5,670	6,195	6,725
W	**mm**	2,630	2,630	2,715	2,715
H	**mm**	4,010	4,010	4,490	4,490
Dry mass	**t**	38	42	47	51

Minimum centreline distance for twin engine installation: 2,500 mm. Please contact MAN Energy Solutions for the precise information about the centreline distance for two engines with the same cylinder number standing near each other.

[1] Related to 100% actual engine load





MAN four-stroke marine GenSets

MAN four-stroke marine GenSets – all emission requirements

Besides focus on power density and fuel economy, MAN Energy Solutions is committed to a steady reduction of the environmental impact of our engines.

IMO Tier II

MAN Energy Solutions has decreased NO_x emissions significantly by applying well-proven methods that ensure a cleaner and more efficient combustion process. Our four-stroke propulsion engines are IMO Tier II compliant by internal engine measures alone.

IMO Tier III

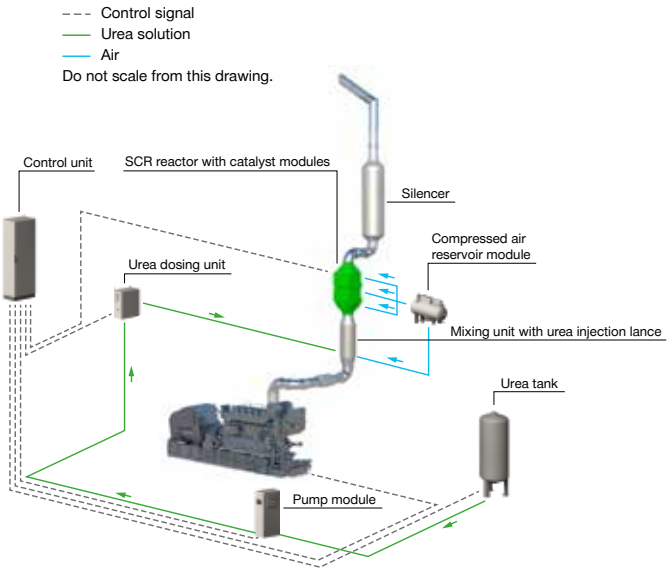
For operation in emission control areas (ECA), MAN Energy Solutions has developed a comprehensive range of selective catalytic reduction (SCR) systems that provides a tremendous reduction in NO_x levels surpassing IMO Tier III requirements.

MAN Energy Solutions is the first manufacturer to successfully produce and offer IMO Tier III compliant four-stroke marine engines based on a fully modular SCR kit covering our entire four-stroke engine portfolio.

In 2014 MAN Energy Solutions was awarded the first IMO Tier III EIAPP certificate together with the classification society DNV-GL.

MAN Energy Solutions' standard SCR system is available in fourteen different sizes covering our entire portfolio of four-stroke engines. Customised SCR systems are offered on demand.

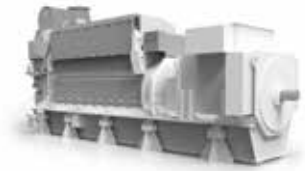
MAN has developed a complete range of SCR systems that work perfectly with our engines for maximum system efficiency. The intelligent exhaust gas temperature control enables significant savings in fuel consumption as compared to third party supplier systems. MAN SCR systems work with MGO, MDO and HFO with up to 3.5% sulphur.



MAN GenSet plant with complete SCR system

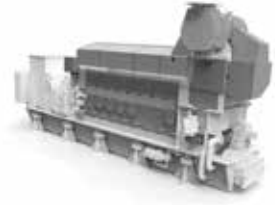
100% MCR PTO-solutions for L21/31 Mk 2 and L27/38 GenSets

Optimised for both new and existing ship designs.



PTO on alternator – external pump

Pump on alternator – common base frame



PTO on front end – external pump (new feature)

Pump on front end – common base frame (new feature)

Fuel oil saving for small bore GenSet (part load optimised)

GenSets can be delivered with improved fuel oil consumption at low load and part load. The penalty will be higher SFOC at high load. The part-load optimised engine complies with the IMO Tier II limit.

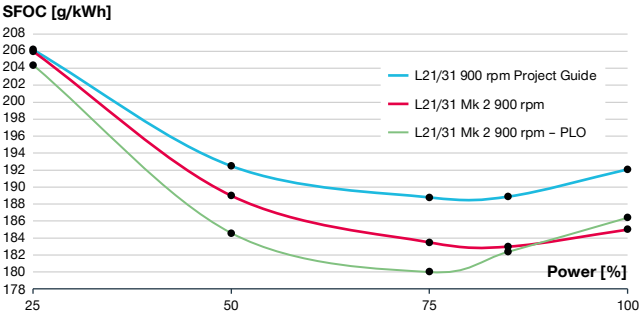
The new tuning method, referred to as part-load optimisation, optimises the engine performance at approx. 60-65% MCR, as this is often the load range in which the GenSet is operating, but it can also be customised to other specific operating conditions.

With the new development of L21/31 Mk 2 together with part-load optimisation techniques, fuel oil savings of up to nearly 12 g/kWh have been obtained, depending on the engine type/model and load point.

Traditionally, GenSets are optimised at 80-85% MCR due to limitations in turbocharger matching, but this is also the load point where power management will engage additional GenSets when more power is needed.

With part-load optimisation, there is a fuel oil penalty when the load exceeds approx. 80% MCR, but this has no practical consequence as the GenSet rarely exceeds 85% MCR.

This is illustrated in the figure below. For further information, please contact MAN Energy Solutions.



Based on Project Guide figures for IMO Tier II engines – 60Hz: ISO reference condition, HFO/MDO, Without pumps, tolerance +5% (not included) August 2020.

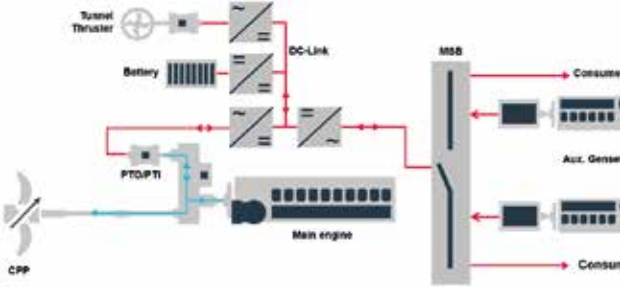
Electric and hybrid propulsion trains (HyProp ECO)

MAN Energy Solutions offers a full range of electric and hybrid power and propulsion plants. Our solutions are designed and optimised to meet the highest efficiencies of an integrated system covering the complete operational profile of the vessel. Our propulsion systems provide a well-balanced and tailor-made solution with emphasis on increased fuel efficiency, flexibility and performance.

Our comprehensive propulsion packages include the complete array of required components from GenSets to propulsors, including switchboards, variable speed drives, propulsion motors and controls. They ensure the optimal technical and economical solution while minimising the operational costs.

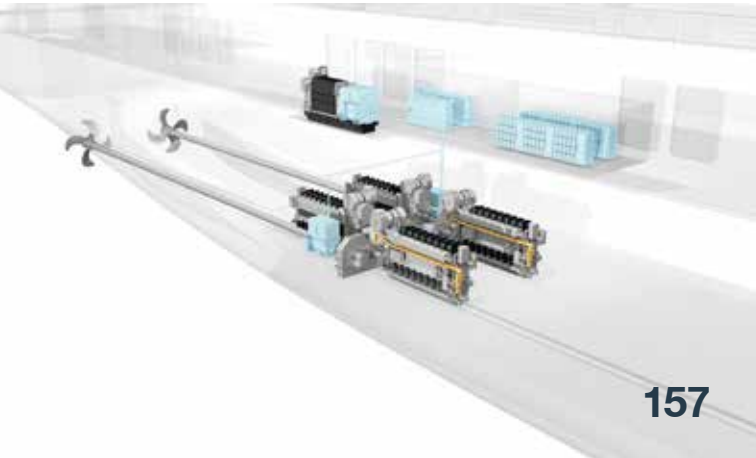
The HyProp ECO introduces a system to control the power delivered by or to the shaft machine. It overcomes the constraint on constant speed propulsion machinery by utilising variable speed drives at the shaft generator/motor.

Our innovative HyProp Battery system also integrates batteries which enable an optimised loading of our engines, and provide an electric spinning reserve, dynamic support of the propellers as well as peak shaving.



HyProp ECO Battery system with integrated energy storage system

HyProp ECO
Hybrid
propulsion
system

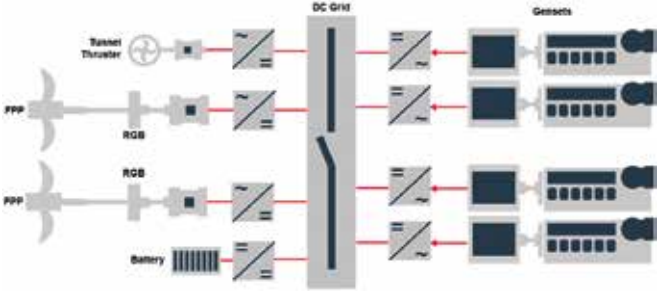


Energy saving electric propulsion (EPROX-DC)

Recent developments in electric propulsion have resulted in electric systems where engines can operate at variable speed. The “classic” constant speed operation of GenSets is no longer a constraint. Utilising an enlarged engine operation map with a speed range of 60% to 100% paves the way to a high potential in fuel oil savings. Each speed set point of the engines can be adjusted independently in order to achieve a minimum fuel oil consumption according to the system load. The electric system using DC distribution enables a decoupled operation of the engines, propulsion drives, and other consumers.

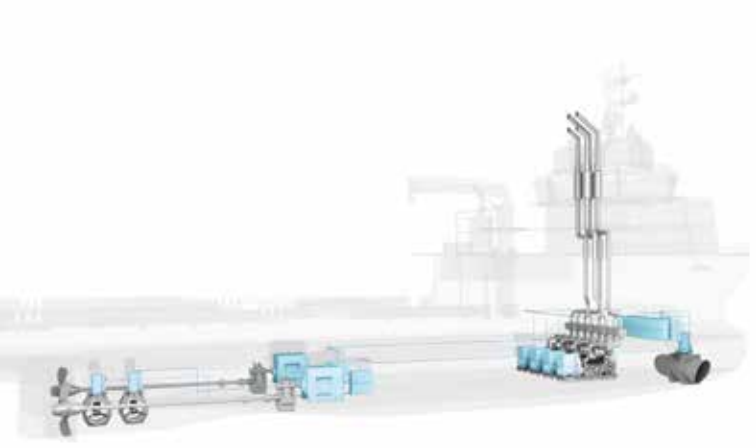
Another major advantage is the possible integration of energy storage systems, like batteries. They can reduce the transient loads on the engines and improve the dynamic response of the propulsion system. Fast load application is removed from the engines and load peaks are shaved. Also, emission free propulsion can be realized when running on the batteries. In addition, the energy storage system allows a constant and high loading of the engines, provides spinning reserve and will have a positive effect on engine maintenance.

MAN Energy Solutions offers this advanced package solution in close cooperation with our partner Aspin Kemp & Associates.



EPROX-DC energy-saving electric propulsion plant

EPROX-DC propulsion solution



EPROX-DC propulsion solution on anchor handling tug supply vessel

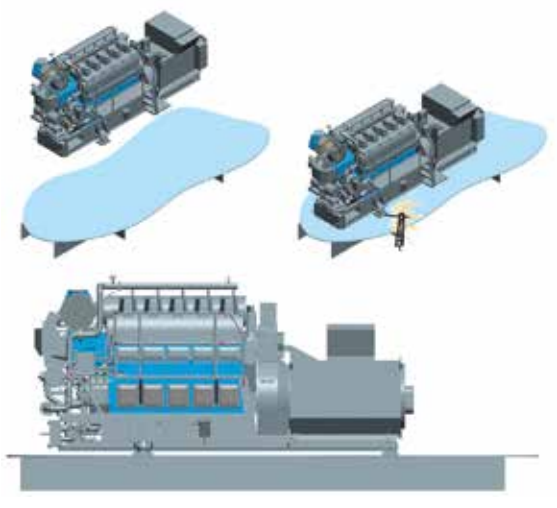
MAN L23/30H monocoque GenSet – continued development

The monocoque GenSet includes several updates of the tried and tested L23/30H engine, which are focused on weight reduction, vibration optimisation and simplified installation.

The most significant update is that the alternator is now a load-bearing component, with a 'top brace' connection to the engine. This enables up to 63% weight reduction of the base frame, which again results in weight reduction of up to 13% of the GenSet and a lower vibration level.

The three and four point 'deck-level' supports significantly simplify the GenSet installation process. This design is installed on a flat deck, which is a major reduction of the vessels foundation structure. Furthermore, applying only three conicals makes the GenSets self-leveling.

The monocoque GenSet application is available for all variants of the L23/30H engine.



Monocoque GenSet

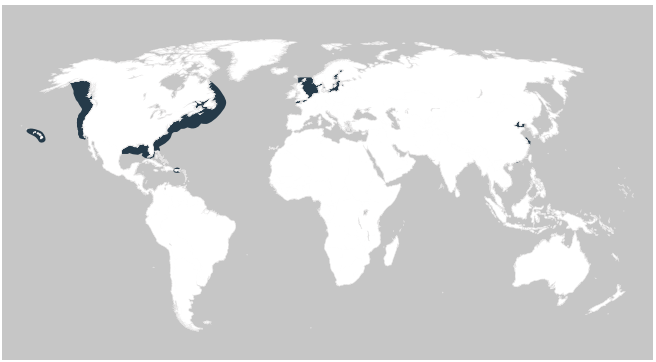
Marine fuels after 2020 (in accordance with ISO 8217)

From 1 January 2020, the global 0.5% limit for sulphur content in marine fuels enters into force. To ensure compliant operation, one of following methods must be used:

- HFO GenSet running on a compliant low-sulphur fuel oil (LSFO) in accordance with ISO 8217.
- Global: max 0.5% sulphur (VLSFO).
- ECA: max 0.1% sulphur (ULSFO).
- HFO GenSet running on a high-sulphur fuel oil (HSFO) in accordance with ISO 8217 and with a SO_X scrubber for exhaust gas cleaning.
- DF GenSet running on LNG with a compliant pilot distillate fuel.

MAN GenSets have for decades been running on low-sulphur and low-viscosity fuels on small power plants on Greenland. The many years of experience have been transferred to the standard marine GenSet. To be prepared for operation on compliant fuels after 2020, the HFO GenSets will be updated with optimised fuel pumps and inlet/exhaust valve materials for low-viscosity fuels.

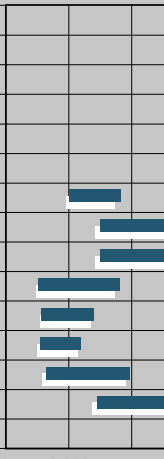
It is important to note that paraffinic and aromatic fuels are incompatible and should not be mixed in the same fuel tank. Notice the issued Service Letters, PrimeServ Customer Information and follow MAN guidelines.



ECAs – 0.10% S (effective 2015) Global sulfur cap – 0.50% S (effective 2020)

MAN four-stroke marine GenSets programme

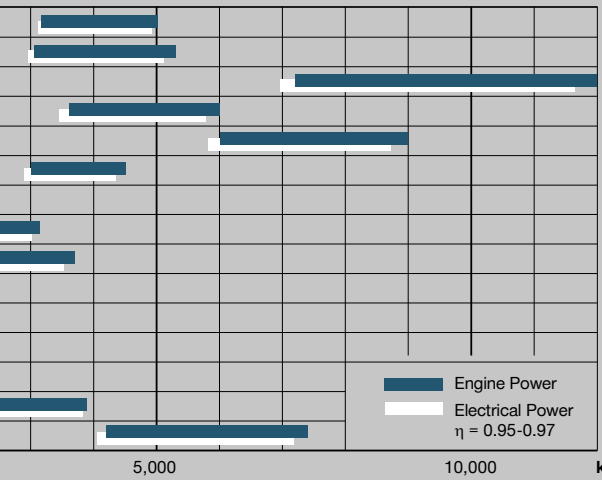
r/min	Engine type
720	L35/44DF CD
720-750	L35/44DF
720-750	V32/44CR
720-750	L32/44CR
720-750	V32/40
720-750	L32/40
720-750	L28/32DF
720-750	L27/38 L27/38 (MDO/MGO)
720-900	L27/38 Mk2
720-900	L23/30H Mk 3
720-900	L23/30H Mk 2
720-900	L23/30DF
900-1,000	L21/31 Mk 2
1,080-1,800	175D
900-1,000	S.E.M.T. Pielstick PA6B



GenSets

GenSets can be applied as auxiliary GenSets, GenSets for electric propulsion or for offshore applications.

Project specific demands can be clarified at an early project stage.



Tier III GenSets

Four-stroke GenSets are Tier III compatible when a downstream SCR is added to clean the exhaust gas on a Tier II engine. The additional SCR will only have an impact on SFOC if the backpressure is increased.

The full spectrum of power

MAN Energy Solutions
Future in the making

New MAN 35/44DF CD GenSet

Low carbon emissions, high power density, fuel flexibility, and future-proof engineering: the new MAN 35/44DF CD delivers a full spectrum of strengths. Its unique blend of proven and innovative technologies is designed to boost your economic and environmental performance, even reducing methane slip by up to 85 % compared with the standard.

www.man-es.com/3544DFCD

MAN L35/44DF CD

Tier III in gas mode

Bore: 350 mm, **Stroke:** 440 mm

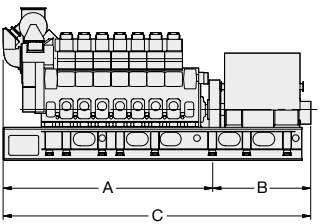
Speed	**r/min**	720	
Frequency	**Hz**	60	
		Eng. kW	**Gen. kW**[1]
6L35/44DF		3,360	3,242
7L35/44DF		3,920	3,783
8L35/44DF		4,480	4,323
9L35/44DF		5,040	4,864

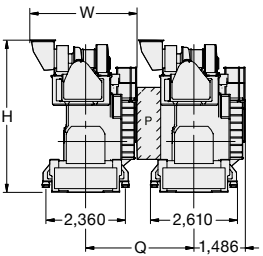
* Please contact MAN Energy Solutions for further details

Dimensions[2]

Cyl. no.		**6**	**7**	**8**	**9**
A	**mm**	6,270	6,900	7,480	8,110
B[3]	**mm**	3,900	4,100	4,400	4,600
C[3]	**mm**	10,170	11,000	11,880	12,710
W	**mm**	2,958	3,108	3,108	3,108
H	**mm**	4,631	4,867	4,867	4,867
Dry mass[3]	**t**	76	84	91	96

1) Based on nominal generator efficiencies of 96.5%
2) Dimensions are not finally fixed
3) Depending on alternator applied





P Free passage between the engines, width 600 mm and height 2,000 mm
Q Minimum distance between centre of engines: ~3,400 mm (with gallery)

MAN V32/44CR

Methanol ready* | Tier II | Tier III

Tier III with SCR

Bore: 320 mm, **Stroke:** 440 mm

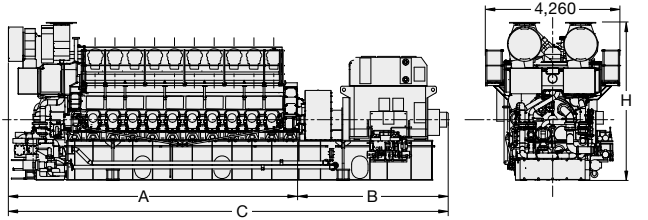
Speed	**r/min**	750		720	
Frequency	**Hz**	50		60	
		Eng. kW	**Gen. kW[1)]**	**Eng. kW**	**Gen. kW[1)]**
12V32/44CR		7,200	6,984	7,200	6,984
14V32/44CR[2)]		8,120	7,876	8,120	7,876
16V32/44CR		9,600	9,312	9,600	9,312
18V32/44CR[3)]		10,800	10,476	10,800	10,476
20V32/44CR		12,000	11,640	12,000	11,640

* Please contact MAN Energy Solutions for further details

Dimensions

Cyl. no.		**12**	**14**	**16**	**18**	**20**
A	**mm**	5,382	6,012	6,642	7,272	7,902
B	**mm**	4,201	4,201	4,201	4,201	4,201
C	**mm**	11,338	11,968	12,598	13,228	13,858
H	**mm**	5,014	5,014	5,014	5,014	5,014
Dry mass	**t**	117	131	144	159	172

[1)] Based on nominal generator efficiencies of 97%
[2)] 580 kW/cyl.
[3)] 18V32/44CR available rigidly mounted only
Frame Auxiliary Box (FAB) available upon request
Available for Electric Propulsion application and as Auxiliary GenSet



Tier III with SCR

Bore: 320 mm, Stroke: 440 mm

Speed r/min	750		720	
Frequency Hz	50		60	
	Eng. kW	Gen. kW[1)]	Eng. kW	Gen. kW[1)]
6L32/44CR	3,600	3,474	3,600	3,474
7L32/44CR[2)]	4,060	3,918	4,060	3.918
8L32/44CR	4,800	4,632	4,800	4,632
9L32/44CR	5,400	5,211	5,400	5,211
10L32/44CR	6,000	5,790	6,000	5,790

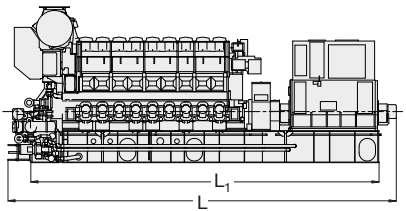
* Please contact MAN Energy Solutions for further details

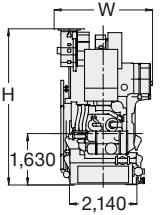
Dimensions

Cyl. no.		6	7	8	9	10
L	mm	10,738	11,268	11,798	12,328	12,858
L_1	mm	10,150	10,693	11,236	11,779	12,309
W	mm	2,490	2,490	2,573	2,573	2,573
H	mm	4,768	4,768	4,955	4,955	4,955
Dry mass	t	71	78	84	91	97

1) Based on nominal generator efficiencies of 96.5%
2) 580 kW/cyl.

Frame Auxiliary Box (FAB) available upon request
Available for Electric Propulsion application and as Auxiliary GenSet





Free passage between the engines, width 600 mm and height 2,000 mm
Minimum distance between centre of engines: ~2,835 mm (without gallery) ~3,220 mm (with gallery)

MAN V32/40

Tier II Tier III

Tier III with SCR

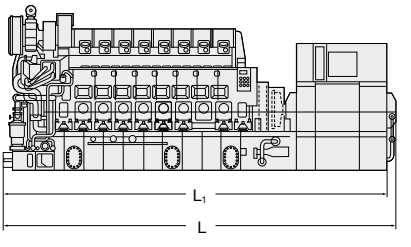
Bore: 320 mm, **Stroke:** 400 mm

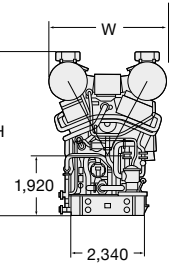
Speed	**r/min**	750		720	
Frequency	**Hz**	50		60	
		Eng. kW	**Gen. kW**[1)]	**Eng. kW**	**Gen. kW**[1)]
12V32/40		6,000	5,820	6,000	5,820
14V32/40		7,000	6,790	7,000	6,790
16V32/40		8,000	7,760	8,000	7,760
18V32/40		9,000	8,730	9,000	8,730

Dimensions

Cyl. no.		**12**	**14**	**16**	**18**
L	**mm**	11,045	11,710	12,555	13,185
L_1	**mm**	10,450	11,115	11,950	12,580
W	**mm**	3,365	3,365	3,730	3,730
H	**mm**	4,850	4,850	5,245	5,245
Dry mass	**t**	101	113	126	138

[1)] Based on nominal generator efficiencies of 97%
Available for Electric Propulsion application and as Auxiliary GenSet





Tier III with SCR

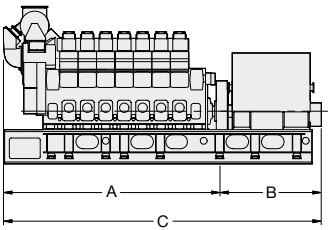
Bore: 320 mm, **Stroke:** 400 mm

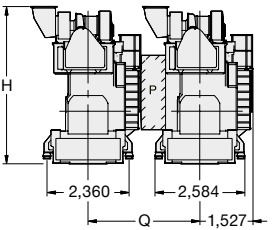
Speed	r/min	750		720	
Frequency	Hz	50		60	
		Eng. kW	Gen. kW[1)]	Eng. kW	Gen. kW[1)]
6L32/40		3,000	2,895	3,000	2,895
7L32/40		3,500	3,378	3,500	3,378
8L32/40		4,000	3,860	4,000	3,860
9L32/40		4,500	4,343	4,500	4,343

Dimensions

Cyl. no.		6	7	8	9
A	mm	6,340	6,870	7,400	7,930
B	mm	3,415	3,415	3,635	3,635
C	mm	9,755	10,285	11,035	11,565
H	mm	4,622	4,622	4,840	4,840
Dry mass	t	70.5	74.3	81.8	85.8

[1)] Based on nominal generator efficiencies of 96.5%
Available for Electric Propulsion application and as Auxiliary GenSet





P Free passage between the engines, width 600 mm and height 2,000 mm
Q Minimum distance between centre of engines: ~2,835 mm (without gallery) ~3,220 mm (with gallery)

MAN L28/32DF

Tier II Tier III

Tier III in gas mode

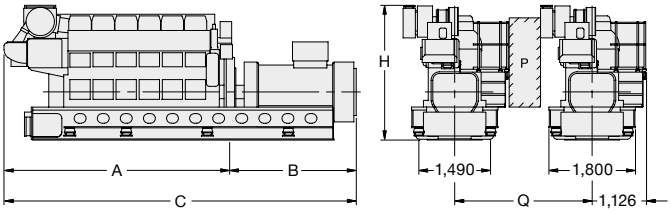
Bore: 280 mm, **Stroke:** 320 mm

Speed	**r/min**	750		720	
Frequency	**Hz**	50		60	
		Eng. kW	**Gen. kW**[1)]	**Eng. kW**	**Gen. kW**[1)]
5L28/32DF		1,050	1,000	1,050	1,000
6L28/32DF		1,260	1,200	1,260	1,200
7L28/32DF		1,470	1,400	1,470	1,400
8L28/32DF		1,680	1,600	1,680	1,600
9L28/32DF		1,890	1,800	1,890	1,800

Dimensions

Cyl. no.		**5**	**6**	**7**	**8**	**9**
A	**mm**	4,321	4,801	5,281	5,761	6,241
B	**mm**	2,400	2,510	2,680	2,770	2,690
C	**mm**	6,721	7,311	7,961	8,531	8,931
H	**mm**	2,835	3,009	3,009	3,009	3,009
Dry mass	**t**	32.6	36.3	39.4	40.7	47.1

[1)] Based on nominal generator efficiencies of 95%
Gas methane number ≥ 80



P Free passage between the engines, width 600 mm and height 2,000 mm
Q Minimum distance between centre of engines: ~2,655 mm (without gallery)
~2,850 mm (with gallery)

MAN Energy Solutions
Future in the making

Moving big things to zero

with future-proof retrofit solutions

We're enabling long-term sustainability

Balancing decarbonization, availability, and economics is a challenge for energy-intensive sectors like power generation, shipping, and process industries. Retrofits are one of the most effective ways to achieve net-zero targets. Our experts convert your conventional fuel engines into dual fuel systems that can also run on green e-fuels. By upgrading existing engines and turbomachinery, we balance ecology and economy, and give your business a long, clean future.

www.man-es.com

MAN L27/38

Tier II Tier III

Tier III with SCR

Bore: 270 mm, **Stroke:** 380 mm

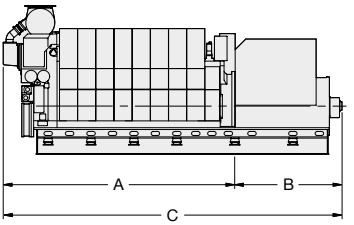
Speed	**r/min**	750/720		750/720 (MDO[1]/MGO)	
Frequency	**Hz**	50/60		50/60	
		Eng. kW	**Gen. kW[2]**	**Eng. kW**	**Gen. kW[2]**
5L27/38		1,600/1,500	1,535/ 1,440	-	-
6L27/38		1,980	1,900	2,100	2,015
7L27/38		2,310	2,220	2,450	2,355
8L27/38		2,640	2,535	2,800	2,690
9L27/38		2,970	2,850	3,150	3,025

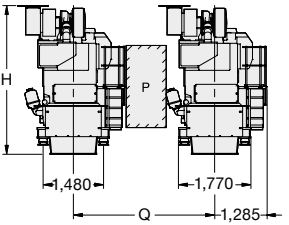
Dimensions

Cyl. no.		**5**	**6**	**7**	**8**	**9**
A	**mm**	4,346	4,791	5,236	5,681	6,126
B	**mm**	2,486	2,766	2,766	2,986	2,986
C	**mm**	6,832	7,557	8,002	8,667	9,112
H	**mm**	3,712	3,712	3,899	3,899	3,899
Dry mass	**t**	40.0	44.5	50.4	58.2	64.7

[1] MDO viscosity must not exceed 6 mm^2/s = cSt @ 40 °C

[2] Based on nominal generator efficiencies of 96%





P Free passage between the engines, width 600 mm and height 2,000 mm

Q Minimum distance between centre of engines: ~2,900 mm (without gallery) ~3,100 mm (with gallery).

MAN L27/38 Mk2

Tier III with SCR

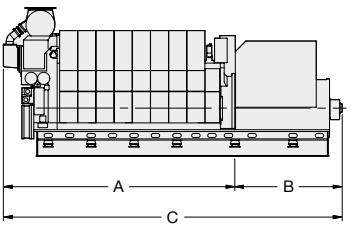
Bore: 270 mm, **Stroke:** 380 mm

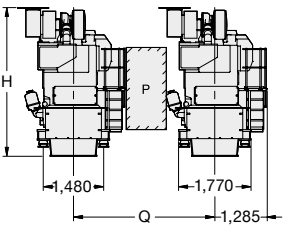
Speed	**r/min**	750/720		900	
Frequency	**Hz**	50/60		50/60	
		Eng. kW	**Gen. kW**[1)]	**Eng. kW**	**Gen. kW**[1)]
5L27/38 Mk2		1,600/1,500	1,536/1,440	-	-
6L27/38 Mk2		1,980	1,900	2,460	2,360
7L27/38 Mk2		2,310	2,220	2,870	2,755
8L27/38 Mk2		2,640	2,535	3,280	3,150
9L27/38 Mk2		2,970	2,850	3,690	3,540

Dimensions

Cyl. no.		**5**	**6**	**7**	**8**	**9**
A	**mm**	4,346	4,791	5,236	5,681	6,126
B	**mm**	2,486	2,766	2,766	2,986	2,986
C	**mm**	6,832	7,557	8,002	8,667	9,112
H	**mm**	3,712	3,712	3,899	3,899	3,899
Dry mass	**t**	40.0	44.5	50.4	58.2	64.7

[1)] Based on nominal generator efficiencies of 96%





P Free passage between the engines, width 600 mm and height 2,000 mm
Q Minimum distance between centre of engines: ~2,900 mm (without gallery) ~3,100 mm (with gallery).

MAN L23/30H Mk 3

Tier II Tier III

Tier III with SCR

Bore: 225 mm, **Stroke:** 300 mm

Speed	r/min	750		720		900	
Frequency	Hz	50		60		60	
		Eng. kW	Gen. kW[1)]	Eng. kW	Gen. kW[1)]	Eng. kW	Gen. kW[1)]
5L23/30H Mk 3 ECR		-	-	500-600	475-570	-	-
5L23/30H Mk 3		885	840	850	810	-	-
6L23/30H Mk 3		1,062	1,010	1,020	970	1,200	1,140
7L23/30H Mk 3		1,239	1,180	1,190	1,130	1,400	1,330
8L23/30H Mk 3		1,416	1,345	1,360	1,290	1,600	1,520
9L23/30H Mk 3		1,593	1,515	1,530	1,455	1,800	1,710

Dimensions (5-7 cylinder)

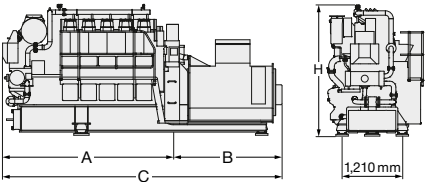
Cyl. no.		5	5	6	6	7	7
	r/min	720 ECR	720/750	720/750	900	720/750	900
A	mm	3,379	3,379	3,749	3,749	4,119	4,276
B	mm	2,202	2,202	2,252	2,252	2,302	2,302
C	mm	5,581	5,581	6,001	6,001	6,421	6,578
H	mm	2,621	2,621	2,621	2,621	2,621	2,621
Dry mass	t	16.8	16.8	18.4	18.6	20.7	20.7

Dimensions (8-9 cylinder)

Cyl. no.		8	8	9	9
	r/min	720/750	900	720/750	900
A	mm	4,489	4,896	4,859	5,266
B	mm	2,352	2,352	2,402	2,402
C	mm	6,841	7,248	7,261	7,668
H	mm	2,621	2,621	2,621	2,621
Dry mass	t	22.5	22.6	24.5	24.5

[1)] Based on nominal generator efficiencies of 95%

Note: Part load optimised – available



Free passage between the engines, width 600 mm and height 2,000 mm

Minimum distance between centre of engines: ~2,250 mm (without gallery) ~2,600 mm (with gallery)

MAN L23/30H Mk 2

Tier III with SCR

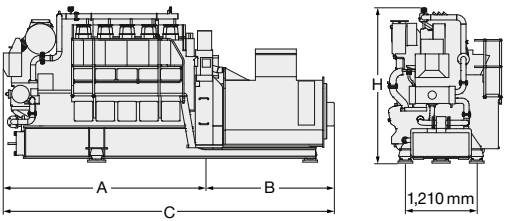
Bore: 225 mm, **Stroke:** 300 mm

Speed	**r/min**		750		720		900
Frequency	**Hz**		50		60		60
		Eng. kW	**Gen. kW**[1)]	**Eng. kW**	**Gen. kW**[1)]	**Eng. kW**	**Gen. kW**[1)]
5L23/30H Mk 2 ECR		580	550	580	550	-	-
5L23/30H Mk 2		675/740	640/705	650/710	620/675	-	-
6L23/30H Mk 2		888	845	852	810	1,050	1,000
7L23/30H Mk 2		1,036	985	994	945	1,225	1,165
8L23/30H Mk 2		1,184	1,125	1,136	1,080	1,400	1,330

Dimensions

Cyl. no.		5	6	6	7	7	8	8
	r/min	720/750	720/750	900	720/750	900	720/750	900
A	**mm**	3,379	3,749	3,749	4,119	4,276	4,489	4,896
B	**mm**	2,202	2,252	2,252	2,302	2,302	2,352	2,352
C	**mm**	5,581	6,001	6,001	6,421	6,578	6,841	7,248
H	**mm**	2,621	2,621	2,621	2,621	2,621	2,621	2,621
Dry mass	**t**	16.8	18.4	18.6	20.7	20.7	22.5	22.6

[1)] Based on nominal generator efficiencies of 95%
Note: Part load optimised – available



Free passage between the engines, width 600 mm and height 2,000 mm
Minimum distance between centre of engines: ~2,250 mm (without gallery) ~2,600 mm (with gallery)

MAN L23/30DF

Tier II Tier III

Tier III in gas mode

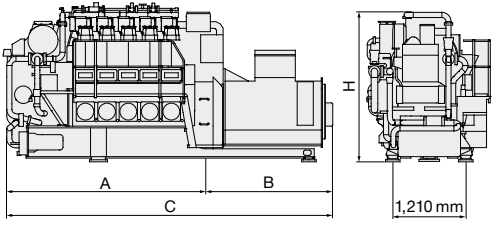
Bore: 225 mm, **Stroke:** 300 mm

Speed	**r/min**	750		720		900[2]	
Frequency	**Hz**	50		60		60	
		Eng. kW	**Gen. kW**[1]	**Eng. kW**	**Gen. kW**[1]	**Eng. kW**	**Gen. kW**[1]
5L23/30DF		625	590	625	590	-	-
6L23/30DF		750	710	750	710	990	940
7L23/30DF		875	830	875	830	1,155	1,095
8L23/30DF		1,000	950	1,000	950	1,320	1,255
9L23/30DF		-	-	-	-	-	-

Dimensions

Cyl. no.		**5**	**6**	**6**	**7**	**7**	**8**	**8**
	r/min	720/750	720/750	900	720/750	900	720/750	900
A	**mm**	3,469	3,839	3,839	4,209	4,276	4,579	4,896
B	**mm**	2,202	2,252	2,252	2,302	2,302	2,352	2,352
C	**mm**	5,671	6,091	6,091	6,511	6,578	6,931	7,241
H	**mm**	2,749	2,749	2,749	2,749	2,749	2,749	2,749
Dry mass	**t**	17.3	19.0	19.2	21.4	21.4	23.3	23.4

[1] Based on nominal generator efficiencies of 95%.
[2] The 900 rpm version is only approved for Aux GenSet application. For Diesel-Electric Propulsion please contact MAN Energy Solutions.
Gas methane number ≥ 80.



Free passage between the engines, width 600 mm and height 2,000 mm
Minimum distance between centre of engines: ~2,250 mm (without gallery) ~2,600 mm (with gallery)

MAN L21/31 Mk 2

Tier III with SCR

Bore: 210 mm, **Stroke:** 310 mm

Speed	**r/min**	1,000		900	
Frequency	**Hz**	50		60	
		Eng. kW	**Gen. kW**[1)]	**Eng. kW**	**Gen. kW**[1)]
5L21/31 Mk 2		1,000	950	1,000	950
6L21/31 Mk 2		1,320	1,255	1,320	1,255
7L21/31 Mk 2		1,540	1,465	1,540	1,465
8L21/31 Mk 2		1,760	1,675	1,760	1,675
9L21/31 Mk 2		1,980	1,880	1,980	1,880

* DNV Class notation: Fuel ready (LFL[MEc; AEc])

Dimensions (1 bearing)

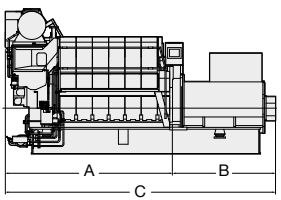
Cyl. no.		**5**	**5**	**6**	**6**	**7**	**7**
	r/min	900	1,000	900	1,000	900	1,000
A	**mm**	3,504	3,504	3,859	3,859	4,214	4,214
B	**mm**	1,995	1,995	2,047	2,047	2,027	2,027
C	**mm**	5,499	5,499	5,906	5,906	6,241	6,241
H	**mm**	3,074	3,074	3,161	3,161	3,161	3,161
Dry mass	**t**	22.2	22.2	25.7	25.7	29.2	29.2

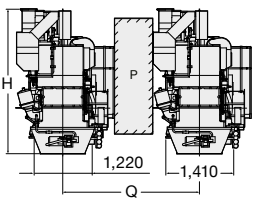
Dimensions (2 bearings)

Cyl. no.		**5**	**5**	**6**	**6**	**7**	**7**	**8**	**8**	**9**	**9**
	r/min	900	1,000	900	1,000	900	1,000	900	1,000	900	1,000
A	**mm**	3,504	3,504	3,859	3,859	4,214	4,214	4,569	4,624	4,979	4,979
B	**mm**	2,545	2,545	2,597	2,597	2,577	2,577	2,577	2,577	2,657	2,657
C	**mm**	6,049	6,049	6,456	6,456	6,791	6,791	7,146	7,201	7,636	7,636
H	**mm**	3,074	3,074	3,161	3,161	3,161	3,161	3,161	3,267	3,267	3,267
Dry mass	**t**	22.2	22.2	25.7	25.7	29.2	29.2	32.7	32.7	36.2	36.2

[1)] Based on nominal generator efficiencies of 95%

Note: Part load optimised – available





P Free passage between the engines, width 600 mm and height 2,000 mm

Q Minimum distance between centre of engines: ~2,500 mm (without gallery) ~2,700 mm (with gallery).

MAN 175D

12V

Tier II Tier III

Tier III with SCR

Bore: 175 mm, **Stroke:** 215 mm, **Cylinder:** 12

Engine model	Rating def.	kWm	kWe[1)]	rpm (frequency)	SFOC at 100% MCR Tier II/Tier III g/kWh
		Electric propulsion			
12V175D-MEM	Medium duty	1,440	1,382	1,500 (50 Hz)	184/185
		1,620	1,555	1,500 (50 Hz)	183/184
		1,800	1,728	1,800 (60 Hz)	190/191
		1,920	1,843	1,800 (60 Hz)	189/190
12V175D-MEL	Light duty	1,800	1,728	1,500 (50 Hz)	184/188
		1,980	1,901	1,500 (50 Hz)	186/188
		2,100	2,016	1,800 (60 Hz)	190/191
		2,280	2,189	1,800 (60 Hz)	192/193.5
12V175D-MEV	Variable Speed	1,860	1,786	1,080-1,800 (36-60 Hz)	191/192
		2,040	1,958	1,080-1,800 (36-60 Hz)	190/191
		2,280	2,189	1,080-1,800 (36-60 Hz)	192/193,5
		Auxiliary power			
12V175D-MA	Auxiliary power	1,620	1,555	1,500 (50 Hz)	183/184
		1,800	1,728	1,500 (50 Hz)	184/188
		1,980	1,901	1,500 (50 Hz)	186/188
		1,920	1,843	1,800 (60 Hz)	189/190
		2,100	2,016	1,800 (60 Hz)	190/191
		2,280	2,189	1,800 (60 Hz)	192/193.5

[1)] 3-phase, 0.8 p.f., assumes alternator efficiency of 96.0%.
Specific fuel oil consumption related to mechanical output acc. to ISO 3046-1:2002 based on a lower calorific value of fuel 42,700 kJ/kg with attached lube oil, HT and LT-cooling water pumps fulfilling IMO Tier II/Tier III emission limits with 5% tolerance.

Rating definitions:

Marine electric propulsion medium duty	Average load: up to 75%/50%
Marine electric propulsion light duty	Average load: up to 50%
Marine electric propulsion, variable speed	Average load: up to 75%/50%
Marine auxiliary	Average load: up to 50%

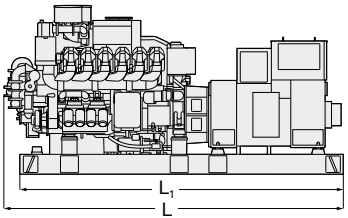
MAN 175D

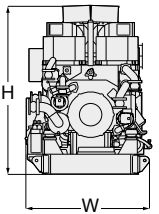
12V

Dimensions

L	**mm**	5,140
L_1	**mm**	4,900
H	**mm**	2,555
W	**mm**	1,880
Dry weight	**t**	18.9

Weight and dimensions are subject to confirmation and have to be adjusted acc. to the various configuration possibiliites. Please request installation drawings for planning purposes.





MAN 175D

16V

Tier II Tier III

Tier III with SCR

Bore: 175 mm, **Stroke:** 215 mm, **Cylinder:** 16

Engine model	Rating def.	kWm	kWe[1)]	rpm (frequency)	SFOC at 100% MCR Tier II/Tier III g/kWh
16V175D-MEM	Electric	2,160	2,074	1,500 (50 Hz)	183.0/185.0
	propulsion	2,400	2,304	1,800 (60 Hz)	190.0/192.0
	medium duty	2,560	2,458	1,800 (60 Hz)	189.0/191.5
16V175D-MEL	Electric	2,400	2,304	1,500 (50 Hz)	185.0/189.0*
	propulsion	2,640	2,534	1,500 (50 Hz)	187.0/189.0*
	light	2,800	2,688	1,800 (60 Hz)	190.0/191.0*
	duty	2,960	2,842	1,800 (60 Hz)	192.5/194.0*
16V175D-MEV	Electric	2,480	2,381	1,080-1,800 (36-60 Hz)	191.0/193.0
	propulsion	2,720	2,611	1,080-1,800 (36-60 Hz)	191.0/193.0
	variable speed	2,960	2,842	1,080-1,800 (36-60 Hz)	192.5/194.0*
16V175D-MA	Auxiliary power	2,400	2,304	1,800 (60 Hz)	190.0/192.0

[1)] 3-phase, 0.8 p.f., assumes alternator efficiency of 96.0%.
Specific fuel oil consumption related to mechanical output acc. to ISO 3046-1:2002 based on a lower calorific value of fuel 42,700 kJ/kg with attached lube oil, HT and LT-cooling water pumps fulfilling IMO Tier II/Tier III emission limits with 5% tolerance.
* Preliminary

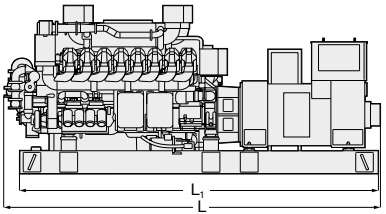
Rating definitions

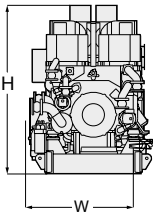
Marine electric propulsion medium duty	Average load: up to 75%/50%
Marine electric propulsion light duty	Average load: up to 50%
Marine electric propulsion, variable speed	Average load: up to 75%/50%
Marine auxiliary	Average load: up to 75%

Dimensions

L	**mm**	5,780
L_1	**mm**	5,500
H	**mm**	2,575
W	**mm**	1,880
Dry weight	**t**	22.6

Weight and dimensions are subject to confirmation and have to be adjusted acc. to the various configuration possibiliites. Please request installation drawings for planning purposes.





MAN 175D

Tier II Tier III

20V

Tier III with SCR

Bore: 175 mm, **Stroke:** 215 mm, **Cylinder:** 20

Engine model	Rating def.	kWm	kWe[1)]	rpm (frequency)	SFOC at 100% MCR Tier II/Tier III g/kWh
20V175D-MEM	Electric	2,700	2,592	1,500 (50 Hz)	183.0/184.5
	propulsion	3,000	2,880	1,800 (60 Hz)	190.0/191.0
	medium duty	3,200	3,072	1,800 (60 Hz)	189.0/190.0
20V175D-MEL	Electric	3,000	2,880	1,500 (50 Hz)	185.0/189.0
	propulsion	3,300	3,168	1,500 (50 Hz)	187.0/189.0
	light	3,500	3,360	1,800 (60 Hz)	190.0/191.0
	duty	3,800	3,648	1,800 (60 Hz)	192.0/193.5
20V175D-MEV	Electric	3,100	2,976	1,080-1,800 (36-60 Hz)	191.0/192.0
	propulsion	3,400	3,264	1,080-1,800 (36-60 Hz)	190.0/191.0
	variable speed	3,800	3,648	1,080-1,800 (36-60 Hz)	192.0/193.5

[1)] 3-phase, 0.8 p.f., assumes alternator efficiency of 96.0%.
Specific fuel oil consumption related to mechanical output acc. to ISO 3046-1:2002 based on a lower calorific value of fuel 42,700 kJ/kg with attached lube oil, HT and LT-cooling water pumps fulfilling IMO Tier II/Tier III emission limits with 5% tolerance.

Rating definitions

Marine electric propulsion medium duty	Average load: up to 75%/50%
Marine electric propulsion light duty	Average load: up to 50%
Marine electric propulsion, variable speed	Average load: up to 75%/50%

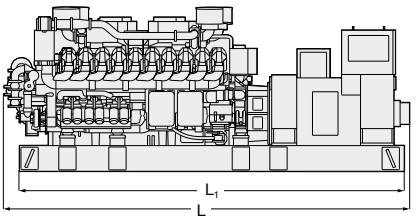
MAN 175D

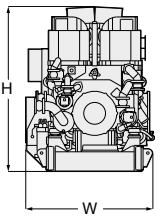
20V

Dimensions

L	**mm**	6,330
L_1	**mm**	6,000
H	**mm**	2,555
W	**mm**	1,980
Dry weight	**t**	26.7

Weight and dimensions are subject to confirmation and have to be adjusted acc. to the various configuration possibiliites. Please request installation drawings for planning purposes.





S.E.M.T. Pielstick four-stroke propulsion engines

S.E.M.T. Pielstick PA4 SM & SMDS

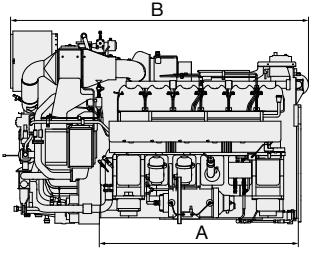
Bore: 200 mm, **Stroke:** 210 mm

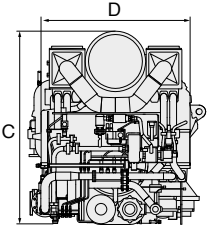
Speed	**r/min**	1,300
Rated power output		**kW**
8 PA4 V 200 SM		700
12 PA4 V 200 SMDS		1,330

Dimensions

Engine type		**8 PA4 V 200 SM**	**12 PA4 V 200 SMDS**
A	**mm**	1,515	2,140
B	**mm**	2,350	3,120
C	**mm**	1,785	2,085
D	**mm**	1,470	1,670
Dry mass	**t**	5.5	9.5

All dimensions and masses are approximate and subject to change without prior notice.
For detailed information, please contact MAN Energy Solutions.





Tier II Tier III

Tier III with SCR

S.E.M.T. Pielstick PA6 B STC

Bore: 280 mm, **Stroke:** 330 mm

		Standard engine	Load profile 'Navy'
Speed	**r/min**	1,050	1,084
mep	**bar**	22.8	24.3
Rated power output		**kW**[1]	**- ICFN kW**
12PA6 B STC		4,860	5,346
16PA6 B STC		6,480	7,128
20PA6 B STC		8,100	8,910

Specific fuel oil consumption (SFOC) to ISO conditions

Engine rating	ICFN stop power	MCR 100%	MCR 85%
Load profile 'Navy'	213 g/kWh	205 g/kWh	200 g/kWh

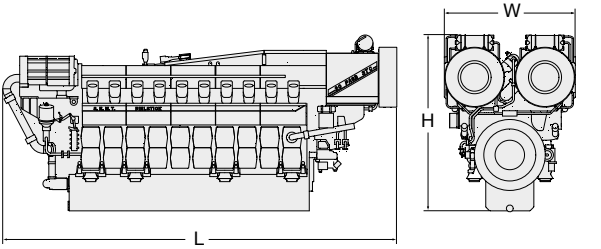
Specific lube oil consumption[1]: 0.7 g/kWh.
Figures on theoretical propeller curve for distillates according to ISO 8217 DMA, with all attached pumps.
ICFN, 1 hour every 6 operating hours

Dimensions

Cyl. No.		12	16	20
L	**mm**	6,035	6,948	8,167
W	**mm**	2,444	2,444	2,714
H	**mm**	3,170	3,170	3,620
Dry mass	**t**	31	37	43

Engine fuel: distillate according to ISO 8217 DMX to DMB. Capabilities with JP-5 and bio-fuel.
Shock qualified.

[1] Related to 100% actual engine load.



S.E.M.T. Pielstick PA6 B

Tier II Tier III

Tier III with SCR

GenSet for electric propulsion.

Bore 280 mm, **Stroke** 330 mm

Speed	**r/min**	**1,000**		**900**	
Frequency	**Hz**	50		60	
		Eng. kW	**Gen. kW**[1)]	**Eng. kW**	**Gen. kW**[1)]
12PA6 B		4,440	4,307	4,200	4,074
16PA6 B		5,920	5,742	5,600	5,432
18PA6 B		6,660	6,460	6,300	6,111
20PA6 B		7,400	7,178	7,000	6,790

Specific fuel oil consumption (SFOC) to ISO conditions

Engine rating	**MCR 110%**	**MCR 100%**	**MCR 85%**
Frequency 50 Hz	204 g/kWh	200 g/kWh	198 g/kWh
Frequency 60 Hz	204 g/kWh	199 g/kWh	197 g/kWh

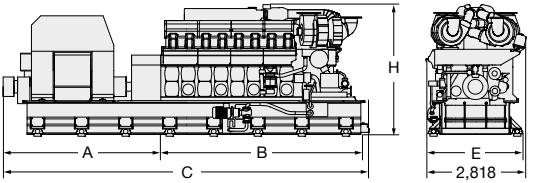
Figures at constant speed for theoretical propeller curve for distillates according to ISO 8217 DMA, with all attached pumps.

Dimensions[2)]

Cyl. No.		**12**	**16**	**18**	**20**
A	**mm**	4,370	4,727	4,732	4,770
B	**mm**	4,600	5,637	6,097	6,557
C	**mm**	9,287	10,583	11,048	11,547
H	**mm**	3,695	3,695	3,695	3,695
E	**mm**	2,670	2,670	2,670	2,670
Dry mass[3)]	**t**	60	72	80	85

1) Nominal generator efficiencies: 97%.
2) Dimensions are based on operation under inclination up to 25 degrees in any direction.
3) Incl. 5% tolerance, weight may vary due to different configurations.

Engine fuel: distillate according to ISO 8217 DMX to DMB. Capabilities with JP-5 and bio-fuel.
Engine rating: engine suitable for 110% overload during 1 hour every 12 operating hours. Shock qualified.



Tier II Tier III

Tier III with SCR

S.E.M.T. Pielstick PC2.6 B

Bore: 400 mm, **Stroke:** 500 mm

Speed	**r/min**	600
mep	**bar**	23.9
Rated power output		**kW**
12PC2.6 B		9,000
14PC2.6 B		10,500
16PC2.6 B		12,000
18PC2.6 B		13,500

Specific Fuel Oil Consumption (SFOC) to ISO conditions

Engine rating	**MCR 100%**	**MCR 85%**
PC2-6 B	185 g/kWh	179 g/kWh

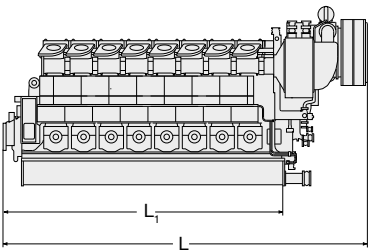
Specific lube oil consumption: 1.2 g/kWh
Figures at constant speed for distillates according to ISO 8217 DMA, with all attached pumps.

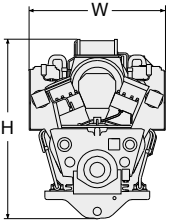
Dimensions

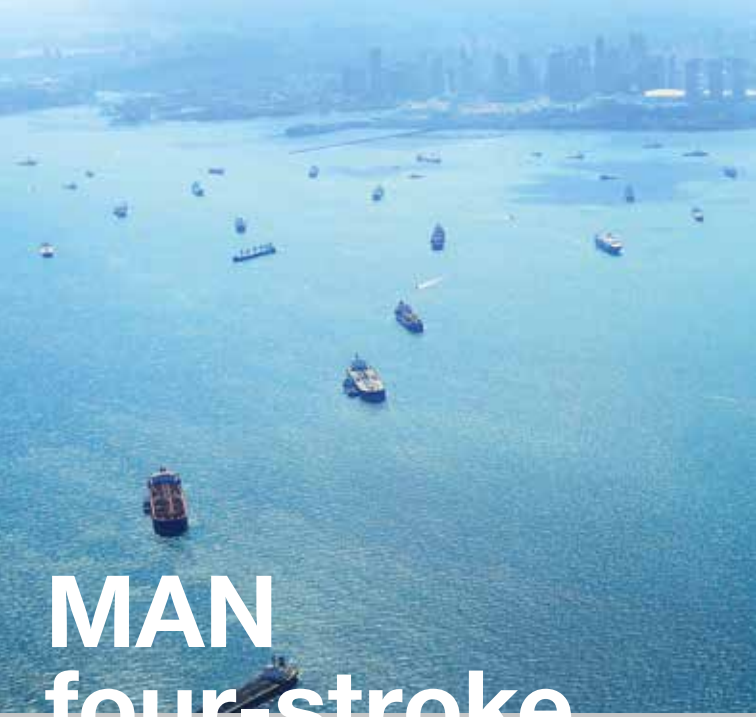
Cyl. No.		**12**	**14**	**16**	**18**
L	**mm**	8,247	8,987	9,727	10,467
L_1	**mm**	5,960	6,700	7,440	8,180
W	**mm**	3,674	3,674	3,674	3,674
H	**mm**	4,794	4,794	4,794	4,794
Dry mass	**t**	94	104	114	123

Engine rating: engine suitable for 110% overload during 1 hour every 6 operating hours.
Engine fuel: distillate according to ISO 8217 DMX to DMB. Capabilities with JP-5 and heavy fuel oil.
Shock qualified.

[1] Related to 100% actual engine load.







MAN four-stroke propulsion systems

MAN Alpha

Propeller programme – FPP and CPP

The MAN Alpha FPP portfolio covers:

- power range of 4-50 MW per shaft
- blade configurations for 3-, 4-, 5- and 6-bladed propellers
- propellers with integrated shaft line and stern tube solutions
- a wide range of stern tube lube and sealing systems
  - oil, water, biodegradable oils

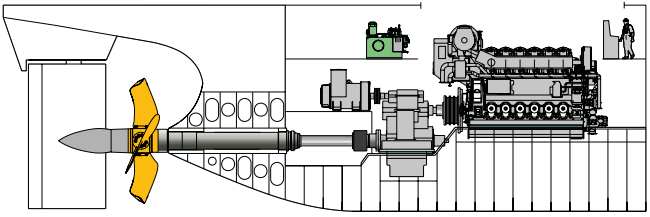
The MAN Alpha FPPs are characterised by the following benefits:

- High-efficient hydrodynamically optimised blade profiles
  - Kappel designs available
- High reliability: robust approach with ample mechanical design margins
- High-efficient aft ship integration with rudder, rudder bulb, ducts, etc.
- Layouts for complete propulsion systems
- Plant calculations with upfront consideration to torsional vibration calculation (TVC), alignment and control systems

MAN Alpha controllable pitch propeller

- As standard Mk 5 versions are 4-bladed – optionally 3- and 5-bladed propellers are available on request
- The figures stated after VBS indicate the propeller hub diameter
- Standard blade/hub materials are Ni-Al-bronze, stainless steel is optional
- The propellers are available up to the highest ice classes. However the standard programme, is based on 'no ice'

Four-stroke propulsion system installation



Complete powertrain with propeller and aft ship equipment.

MAN standard package examples

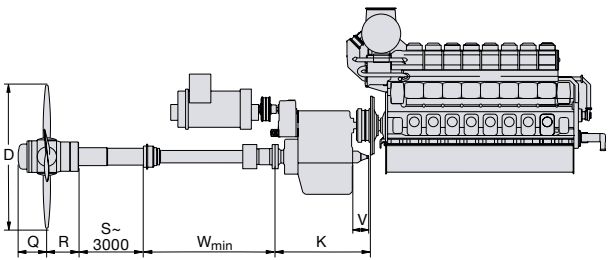
Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm	Q mm	R mm	Wmin mm	Prop. mass t[1)]
L51/60DF								
6	6,900	161	4,250	1,100	851	935	1,650	17.9
6	6,900	103	5,600	1,260	972	1,052	1,698	28.1
6	6,900	133	4,800	1,180	914	1,004	1,698	22.4
7	8,050	160	4,400	1,180	914	1,004	1,698	21.5
7	8,050	133	5,000	1,260	972	1,052	1,698	26.1
7	8,050	104	5,850	1,350	1,037	1,111	1,738	32.1
8	9,200	157	4,550	1,260	972	1,052	1,698	25.1
8	9,200	132	5,150	1,350	1,037	1,111	1,738	29.5
8	9,200	103	6,000	1,450	1,114	1,163	1,778	36.8
9	10,350	154	4,700	1,350	1,037	1,111	1,698	27.7
9	10,350	130	5,300	1,350	1,037	1,111	1,778	32.0
9	10,350	102	6,200	1,450	1,114	1,178	1,831	39.6
L49/60DF								
6	7,800	169	4,350	1,100	851	962	1,700	-
6	7,800	142	4,900	1,180	914	1,014	1,700	-
6	7,800	122	5,700	1,350	1,027	1,035	1,750	-
7	9,100	167	4,500	1,180	914	1,014	1,700	-
7	9,100	139	5,100	1,260	972	1,223	1,700	-
7	9,100	111	5,900	1,450	1,127	1,197	1,800	-
8	10,400	164	4,650	1,180	914	1,034	1,700	-
8	10,400	138	5,250	1,350	1,027	1,040	1,750	-
8	10,400	110	6,100	1,450	1,127	1,197	1,800	-
9	11,700	159	4,850	1,260	972	1,233	1,750	-
9	11,700	135	5,450	1,350	1,027	1,100	1,750	-
9	11,700	108	6,300	1,550	1,175	1,236	1,900	-
10	13,000	162	4,900	1,350	1,027	1,080	1,750	-
10	13,000	136	5,500	1,450	1,122	1,197	1,800	-
10	13,000	109	6,400	1,550	1,175	1,256	1,900	-

[1)] S_{min} and propeller mass are based on 6,000 mm propeller shaft and 3,000 mm stern tube

MAN standard package examples

Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm	Q mm	R mm	Wmin mm	Prop. mass t[1]
V49/60DF								
12	15,600	161	5,100	1,450	1,122	1,197	1,800	-
12	15,600	133	5,750	1,550	1,175	1,236	1,900	-
12	15,600	106	6,750	1,640	1,260	1,288	1,950	-
14	18,200	164	5,200	1,450	1,122	1,227	1,800	-
14	18,200	131	5,950	1,550	1,175	1,256	1,900	-
14	18,200	104	7,000	1,730	1,330	1,339	3,000	-
V48/60CR								
12	14,400	166	4,950	1,450	1,114	1,163	1,778	33.2
12	14,400	136	5,600	1,550	1,187	1,223	1,831	39.6
12	14,400	107	6,600	1,730	1,424	1,332	1,881	51.9
14	16,800	167	5,100	1,550	1,187	1,223	1,778	37.4
14	16,800	132	5,850	1,640	1,295	1,281	1,881	45.9
14	16,800	105	6,850	1,730	1,424	1,332	1,913	57.5
16	19,200	166	5,250	1,640	1,295	1,281	1,831	41.7
16	19,200	131	6,050	1,730	1,424	1,332	1,913	52.5
16	19,200	103	7,100	1,810	1,553	1,412	1,966	65.5

[1] S_{min} and propeller mass are based on 6,000 mm propeller shaft and 3,000 mm stern tube



MAN standard package examples

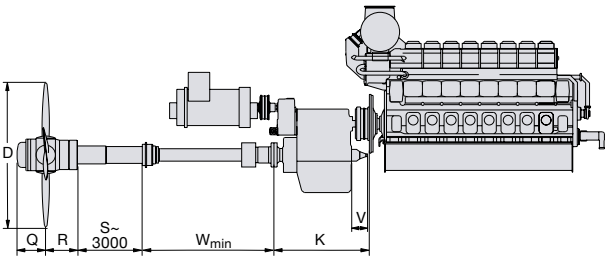
Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm	Q mm	R mm	Wmin mm	Prop. mass t[1)]
L48/60CR								
6	7,200	172	4,250	1,180	914	979	1,650	18.5
6	7,200	112	5,600	1,260	972	1,052	1,698	27.4
6	7,200	143	4,800	1,180	914	1,004	1,698	21.8
7	8,400	169	4,400	1,180	914	1,004	1,698	21.1
7	8,400	141	5,000	1,260	972	1,052	1,698	25.8
7	8,400	110	5,850	1,350	1,037	1,111	1,738	31.7
8	9,600	167	4,550	1,260	972	1,052	1,698	24.7
8	9,600	139	5,150	1,350	1,037	1,111	1,698	28.6
8	9,600	110	6,000	1,450	1,114	1,163	1,778	35.7
9	10,800	165	4,700	1,350	1,037	1,111	1,698	27.2
9	10,800	137	5,300	1,450	1,114	1,163	1,778	33.3
9	10,800	108	6,200	1,450	1,114	1,178	1,778	38.4
L35/44DF								
6	3,180	208	3,300	790	639	704	1,401	8.4
6	3,180	167	3,800	860	686	739	1,401	10.2
6	3,180	130	4,400	940	735	813	1,522	12.4
7	3,710	198	3,500	860	686	739	1,401	9.9
7	3,710	161	4,000	940	735	813	1,522	12.0
7	3,710	128	4,600	1,020	795	859	1,557	14.3
8	4,240	197	3,600	940	735	793	1,522	11.5
8	4,240	165	4,050	940	735	813	1,522	12.6
8	4,240	127	4,750	1,020	795	894	1,629	16.0
9	4,770	202	3,600	940	735	813	1,522	11.7
9	4,770	167	4,100	1,020	795	859	1,557	13.8
9	4,770	130	4,800	1,100	851	935	1,629	17.5
10	5,300	199	3,700	1,020	795	859	1,522	12.9
10	5,300	166	4,200	1,020	795	859	1,557	14.7
10	5,300	126	5,000	1,100	851	935	1,650	18.7

[1)] S_{min} and propeller mass are based on 6,000 mm propeller shaft and 3,000 mm stern tube

MAN standard package examples

Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm	Q mm	R mm	Wmin mm	Prop. mass t[1]
V32/44CR								
12	7,200	209	3,800	1,100	851	935	1,629	15.8
12	7,200	167	4,400	1,180	914	979	1,698	19.7
12	7,200	128	5,250	1,260	972	1,052	1,698	25.8
14	8,120	204	3,950	1,180	914	979	1,629	17.7
14	8,120	163	4,550	1,180	914	1,004	1,698	21.5
14	8,120	126	5,400	1,260	972	1,052	1,698	27.4
16	9,600	208	4,050	1,180	914	1,004	1,698	20.1
16	9,600	165	4,650	1,260	972	1,052	1,698	25.1
16	9,600	127	5,550	1,350	1,037	1,111	1,738	31.4
18	10,800	207	4,150	1,260	972	1,052	1,698	22.9
18	10,800	165	4,750	1,350	1,037	1,111	1,698	27.4
18	10,800	126	5,700	1,450	1,114	1,163	1,778	35.2
20	12,000	206	4,250	1,260	972	1,052	1,698	24.2
20	12,000	165	4,850	1,350	1,037	1,111	1,738	29.0
20	12,000	124	5,850	1,450	1,114	1,178	1,778	37.4

[1] S_{min} and propeller mass are based on 6,000 mm propeller shaft and 3,000 mm stern tube



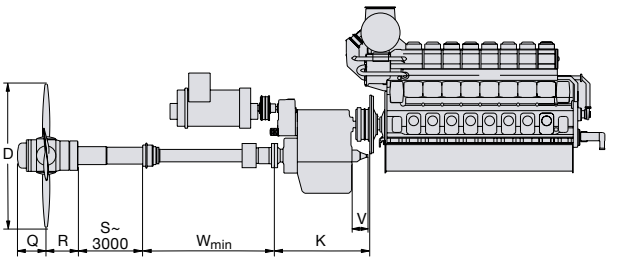
MAN standard package examples

Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm	Q mm	R mm	Wmin mm	Prop. mass t[1)]
L32/44CR								
6	3,600	210	3,350	860	686	739	1,401	9.5
6	3,600	173	3,800	940	735	793	1,522	11.5
6	3,600	133	4,450	940	735	813	1,522	13.0
7	4,200	203	3,500	860	686	739	1,401	10.1
7	4,200	170	3,950	940	735	813	1,522	12.1
7	4,200	133	4,600	1,020	795	859	1,557	15.0
8	4,800	203	3,600	940	735	813	1,522	11.7
8	4,800	170	4,050	1,020	795	859	1,522	13.5
8	4,800	132	4,750	1,100	851	935	1,629	17.2
9	5,400	204	3,650	1,020	795	859	1,522	12.8
9	5,400	169	4,150	1,020	795	859	1,557	14.6
9	5,400	131	4,900	1,100	851	935	1,650	18.5
10	6,000	205	3,700	1,020	795	859	1,557	13.4
10	6,000	168	4,250	1,100	851	935	1,629	16.6
10	6,000	131	5,000	1,180	914	1,004	1,698	21.6
V32/40								
12	6,000	186	3,950	1,020	795	859	1,557	20.4
12	6,000	159	4,400	1,100	851	935	1,629	17.2
12	6,000	128	5,050	1,180	914	1,004	1,698	21.8
14	7,000	183	4,100	1,100	851	935	1,629	16.8
14	7,000	158	4,550	1,180	914	1,004	1,698	20.8
14	7,000	127	5,250	1,260	972	1,052	1,698	25.7
16	8,000	183	4,200	1,180	914	979	1,698	19.4
16	8,000	155	4,700	1,180	914	1,004	1,698	22.0
16	8,000	126	5,400	1,260	972	1,052	1,698	27.1
18	9,000	183	4,300	1,260	972	1,052	1,698	22.8
18	9,000	153	4,850	1,260	972	1,052	1,698	25.5
18	9,000	123	5,600	1,350	1037	1,111	1,738	30.7

[1)] S_{min} and propeller mass are based on 6,000 mm propeller shaft and 3,000 mm stern tube

Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm	Q mm	R mm	Wmin mm	Prop. mass t[1]
L32/40								
6	3,000	205	3,300	790	639	704	1,401	8.3
6	3,000	171	3,700	860	686	739	1,401	9.8
6	3,000	137	4,200	940	735	813	1,522	11.8
7	3,500	199	3,450	860	686	739	1,401	9.3
7	3,500	168	3,850	940	735	793	1,522	11.6
7	3,500	134	4,400	940	735	813	1,522	12.7
8	4,000	198	3,550	860	686	739	1,401	10.2
8	4,000	165	4,000	940	735	813	1,522	12.2
8	4,000	133	4,550	1020	795	859	1,557	14.6
9	4,500	195	3,650	940	735	813	1,522	11.7
9	4,500	164	4,100	940	735	813	1,522	12.8
9	4,500	134	4,650	1020	795	859	1,629	15.9
V28/33D STC								
12	6,000	187	3,700	1,020	795	859	1,557	16.7
12	6,000	138	4,000	1,100	851	935	1,698	22.3
12	6,000	125	4,300	1,100	851	960	1,698	23.6
16	8,000	210	3,700	1,100	851	935	1,629	19.5
16	8,000	184	4,000	1,180	914	979	1,698	23.6
16	8,000	160	4,300	1,180	914	1,004	1,698	25.1
20	10,000	228	3,700	1,180	914	979	1,698	23.4
20	10,000	200	4,000	1,260	972	1,052	1,698	26.8
20	10,000	176	4,300	1,260	972	1,052	1,698	28.2

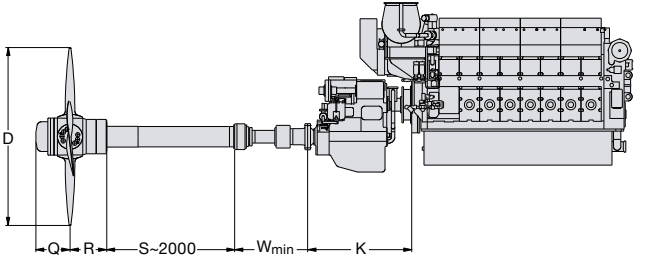
[1] S_{min} and propeller mass are based on 6,000 mm propeller shaft and 3,000 mm stern tube



MAN standard package examples

Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm	Q mm	R mm	Wmin mm	Prop. mass t[1)]
L27/38								
6	2,040	258	2,650	660	557	630	1,316	4.8
6	2,040	218	2,950	720	597	669	1,331	5.8
6	2,040	191	3,200	720	597	669	1,331	6.2
6	2,040	163	3,500	790	639	704	1,331	6.9
6	2,040	152	3,650	790	639	704	1,331	7.1
7	2,380	247	2,800	720	597	669	1,331	5.9
7	2,380	211	3,100	720	597	669	1,331	6.2
7	2,380	186	3,350	790	639	704	1,331	6.9
7	2,380	161	3,650	790	639	704	1,401	7.5
7	2,380	150	3,800	790	639	704	1,401	8.0
8	2,720	242	2,900	720	597	669	1,331	6.1
8	2,720	209	3,200	790	639	704	1,331	6.9
8	2,720	186	3,450	790	639	704	1,401	7.4
8	2,720	173	3,600	860	686	739	1,401	8.7
8	2,720	147	3,950	860	686	739	1,401	9.3
9	3,060	243	2,950	790	639	704	1,331	6.7
9	3,060	206	3,300	790	639	704	1,401	7.4
9	3,060	184	3,550	860	686	739	1,401	8.8
9	3,060	172	3,700	860	686	739	1,401	9.1
9	3,060	148	4,050	940	735	793	1,522	10.7

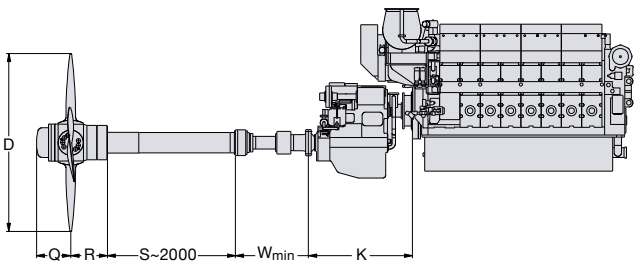
[1)] S_{min} and propeller mass are based on 4,000 mm propeller shaft and 2,000 mm stern tube for 21/31, 27/38 and 6,000 mm propeller shaft and 3,000 mm stem tube for the other types



MAN standard package examples

Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm	Q mm	R mm	Wmin mm	Prop. mass t[1)]
L21/31								
6	1,290	272	2,350	540	339	576	1,316	3.8
6	1,290	231	2,600	600	456	603	1,316	4.0
6	1,290	203	2,800	660	557	630	1,316	4.6
6	1,290	179	3,000	660	557	630	1,316	4.7
7	1,505	258	2,500	600	456	603	1,316	4.1
7	1,505	222	2,750	660	557	630	1,316	4.7
7	1,505	196	2,950	660	557	630	1,316	4.8
7	1,505	175	3,150	660	557	630	1,331	5.2
8	1,720	261	2,550	660	557	630	1,316	4.6
8	1,720	219	2,850	660	557	630	1,316	4.9
8	1,720	195	3,050	660	557	630	1,331	5.3
8	1,720	174	3,250	720	597	669	1,331	6.0
9	1,935	262	2,600	660	557	630	1,316	4.7
9	1,935	221	2,900	660	557	630	1,331	5.2
9	1,935	198	3,100	720	597	669	1,331	6.0
9	1,935	187	3,200	720	597	669	1,331	6.1

[1)] S_{min} and propeller mass are based on 4,000 mm propeller shaft and 2,000 mm stern tube for 21/31, 27/38 and 6,000 mm propeller shaft and 3,000 mm stem tube for the other types



MAN Alpha CPP solutions for MAN 175D

Engine	Output		Ship speeds [knots]							
Type	Power	RPM	30		25		20		15	
	[kW]	[r/min]	Recommended propeller diameters [mm]							
12V175D	1,499	1,600	1,450	1,550	1,650	1,800	1,900	2,050	2,200	2,300
12V175D	1,499	1,800	1,400	1,500	1,650	1,750	1,800	1,850	1,950	2,100
12V175D	1,740	1,800	1,400	1,500	1,600	1,700	1,800	1,950	2,050	2,200
12V175D	1,860	1,800	1,400	1,550	1,650	1,750	1,850	1,950	2,050	2,200
12V175D	2,040	1,800	1,450	1,550	1,700	1,800	1,850	1,975	2,100	2,225
12V175D	2,220	1,900	1,450	1,550	1,700	1,850	2,000	2,150	2,250	2,300
12V175D	2,220	1,800	1,450	1,600	1,750	1,850	1,900	2,000	2,150	2,250
12V175D	2,400	2,000	1,400	1,525	1,650	1,775	1,900	1,950	2,000	2,100
16V175D	2,000	1,600	1,525	1,700	1,775	1,850	2,000	2,150	2,275	2,400
16V175D	2,000	1,800	1,425	1,550	1,700	1,775	1,850	1,975	2,100	2,200
16V175D	2,320	1,800	1,500	1,600	1,750	1,875	1,925	2,025	2,150	2,275
16V175D	2,480	1,800	1,500	1,650	1,775	1,900	1,975	2,050	2,150	2,300
16V175D	2,720	1,800	1,525	1,675	1,800	1,950	2,050	2,100	2,200	2,350
16V175D	2,960	1,900	1,525	1,650	1,775	1,900	2,050	2,150	2,200	2,300
16V175D	2,960	1,800	1,550	1,700	1,850	1,975	2,100	2,175	2,200	2,350
16V175D	3,200	2,000	1,500	1,625	1,750	1,875	2,000	2,125	2,225	2,275
Reduction gear ratio			3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5

Propellers for the MAN 175D engines are optimised for a diesel-mechanical twin screw vessel operating at 85% engine rating. For engine versions and rating conditions, see the MAN four-stroke propulsion engines chapter. The standard propeller programme is dimensioned according to Lloyd's Register No Ice.

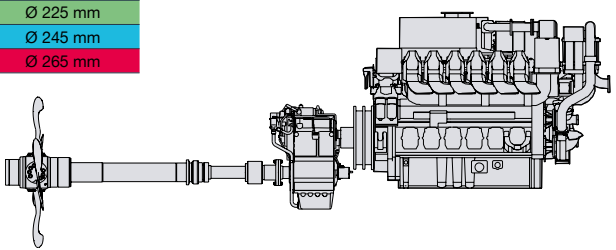
MAN Alpha and CPP solutions for MAN 175D

Engine	Output		Ship speeds [knots]							
Type	Power	RPM	30		25		20		15	
	[kW]	[r/min]	Recommended propeller diameters [mm]							
20V175D	2,500	1,600	1,600	1,750	1,900	1,975	2,075	2,200	2,350	2,500
20V175D	2,500	1,800	1,500	1,650	1,775	1,900	1,975	2,050	2,150	2,300
20V175D	2,900	1,800	1,550	1,700	1,850	1,950	2,100	2,150	2,200	2,350
20V175D	3,100	1,800	1,600	1,700	1,850	2,000	2,125	2,200	2,250	2,400
20V175D	3,400	1,800	1,625	1,750	1,900	2,025	2,150	2,275	2,325	2,400
20V175D	3,700	1,900	1,600	1,750	1,850	2,000	2,150	2,250	2,350	2,425
20V175D	3,700	1,800	1,650	1,775	1,925	2,050	2,200	2,325	2,400	2,450
20V175D	4,000	2,000	1,600	1,700	1,850	1,975	2,100	2,200	2,350	2,450
20V175D	4,400	2,000	1,650	1,800	1,900	2,000	2,200	2,250	2,400	2,500
2x12V175D	4,440	1,900	1,700	1,800	1,950	2,050	2,200	2,350	2,450	2,575
2X16V175D	4,960	1,800	1,800	1,900	2,050	2,200	2,300	2,500	2,600	
2X16V175D	5,440	1,800	1,850	1,950	2,100	2,250	2,375			
2X16V175D	5,920	1,900	1,850	1,950	2,075	2,200				
2X20V175D	6,800	1,800	1,950	2,100	2,200					
2X20V175D	7,400	1,900	1,950	2,075	2,200					
2X20V175D	8,000	2,000	1,900	2,075						
Reduction gear ratio			3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5

Propellers for the MAN 175D engines are optimised for a diesel-mechanical twin screw vessel operating at 85% engine rating. For engine versions and rating conditions, see the MAN four-stroke propulsion engines chapter. The standard propeller programme is dimensioned according to Lloyd's Register No Ice.

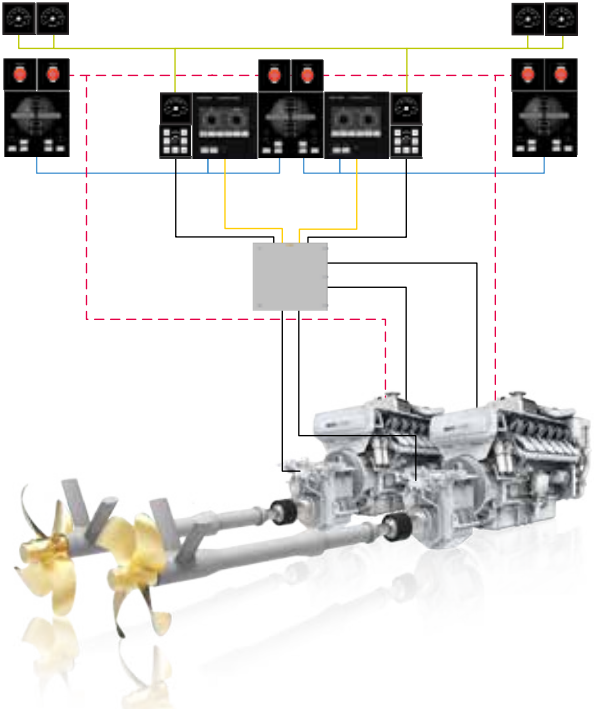
Standard shaft diameter:

- Ø 175 mm
- Ø 205 mm
- Ø 225 mm
- Ø 245 mm
- Ø 265 mm



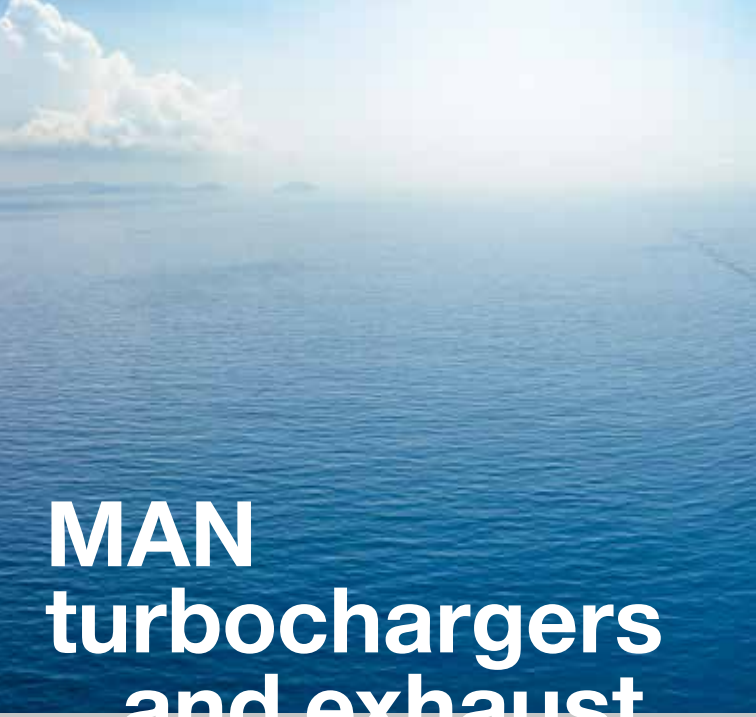
Alphatronic 3000 propulsion control system

A high number of various FPP and CPP propulsion package applications are controlled by the Alphatronic 3000 system – customised for combinations of MAN medium and high speed engines in a wide range of diesel-mechanical, hybrid or electric propulsion setups.



Simple system architecture for a straightforward twin MAN 175D FPP plant

Alphatronic 3000 at your finger tips: Safe and accurate propulsion control all the way – from the navigator's finger tips to the propeller tips. Any manoeuvring order given is translated into electrical speed setting-, pitch- or clutch signals, governing the hydraulic servo circuits of the gearbox and propeller system. Swift and reliable vessel manoeuvres are ensured due to quick and stable system response.



MAN turbochargers and exhaust gas systems

MAN turbochargers and exhaust gas systems

MAN Energy Solutions has a long and successful track record in the development of exhaust gas turbochargers for low, medium and high-speed diesel and gas engines. Drawing on its unrivalled expertise in the design and manufacture of this crucial engine component, MAN Energy Solutions can offer you world-leading technology that helps you maximise the efficiency of your operations.

MAN turbochargers are designed to deliver peak performance throughout their working lives – in some of the harshest conditions encountered anywhere in the world. This is achieved by combining three elements: simplicity, flexibility and reliability. For example, we develop and build our turbochargers to make installation, operation, servicing and maintenance as easy and efficient as possible. This reduces your initial capital investment and results in lower lifecycle costs.

Applications

- Marine propulsion
- Marine GenSets
- Power generation
- Construction
- Mining
- Off-road vehicles
- Locomotives
- Industrial
- Offshore
- Mechanical drives

TCP and TCF

The TCP and TCF turbochargers are from our latest generation of radial turbochargers. TCP turbochargers are suitable for high-speed and medium-speed engines, whereas the TCF type turbochargers are suitable for all speed ranges, including low speed. Both types are used in marine, power, locomotive and off-road applications designed for operation on both future and conventional fuels.

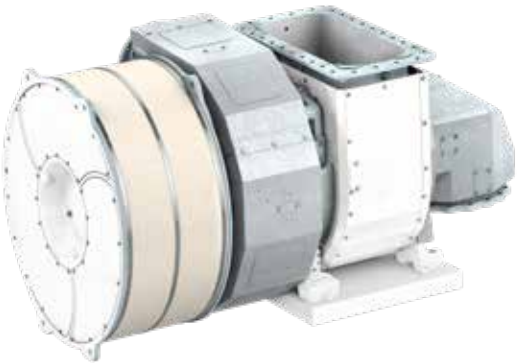
Technical data

Turbine type	Axial flow turbine
Max. permissible temperature	520°C
Pressure ratio	up to 4.7
Optimised for IMO Tier III	

Supercharged engine output

Type	kW	Mass kg
TCT30	7,500	1,820
TCT40	9,460	2,500
TCT50	12,000	4,375
TCT60	15,120	4,735
TCT70	19,040	6,480
TCT80	24,030	8,890

Specific air consumption (le) 7.5 kg/kWh



MAN TCP Series

Technical data

Turbine type	Radial
Max. permissible temperature	650/750°C
Pressure ratio	up to 6.7
Suitable for future fuels (hydrogen, ammonia and methanol) as well as conventional fuels (HFO, MDO and gas)	

Supercharged engine output

Type	kW	Mass kg
TCP12	**800**	**80**
TCP14	1,150	120
TCP16	1,600	190
TCP18	2,200	320
TCP19	3,000	520
TCP20	4,200	840
TCP22	5,800	1,300

Technical data

Turbine type	Radial
Max. permissible temperature	650/750°C
Pressure ratio	up to 5.4
Suitable for Future fuels (Hydrogen, Ammonia and Methanol) as well as conventional fuels (HFO, MDO and gas)	

Supercharged engine output

Type	kW	Mass kg
TCF12	**1,000**	**70**
TCF14	1,450	120
TCF16	2,000	190
TCF18	2,700	320
TCF19	3,800	520
TCF20	5,200	830
TCF22	7,200	1,400

MAN TCA Series

Technical data

Turbine type	Axial flow turbine
Max. permissible temperature	500°C two-stroke / 650°C four-stroke
Pressure ratio	up to 5.5
Suitable for HFO, MDO, gas	

Turbocharger programme

	Max. supercharged engine output kW		
	Two-stroke	**Four-stroke**	**Mass**
Type	**le* = 7.5 kg/kWh**	**le* = 6.5 kg/kWh**	**kg**
TCA33	-	5,400	2,078
TCA44	7,400	7,900	1,950
TCA55	10,200	10,400	3,200
TCA66	14,600	14,800	5,300
TCA77	20,700	21,000	8,330
TCA88	32,400	30,000	14,000

* Specific air consumption

Technical data

Turbine type	Radial flow turbine
Max. permissible temperature	650°C
Pressure ratio	up to 5.4
Suitable for HFO, MDO, gas	

Turbocharger programme

	Max. supercharged engine output	
	Four-stroke	Mass
Type	**le* = 6.5 kg/kWh**	**kg**
TCR10	600	50
TCR12	880	80
TCR14	1,300	110
TCR16	1,850	180
TCR18	2,750	300
TCR20	4,000	500
TCR22	6,850	1,050

* Specific air consumption

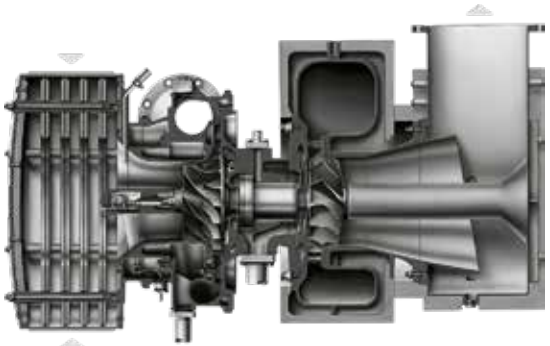
Technical data

Turbine type	Radial flow turbine
Max. permissible temperature	650°C (opt. 720°C)
Pressure ratio	up to 4.5
Suitable for HFO, MDO, gas	

Turbocharger programme

	Max. supercharged engine output	Mass
Type	**kW**	**kg**
NR20/S	1,870	350
NR24/S	2,690	505
NR29/S	3,820	780
NR34/S	5,400	1,450

Specific air consumption Ie = 7 kg/kWh



MAN ECOCHARGE
Market leader in two-stage turbocharging

MAN ECOCHARGE two-stage turbocharging is suitable for high and medium-speed engines of all fuel types and for application in all engine power ranges. Extremely high efficiencies and pressure ratios enable increased power density and improved key engine parameters. For example, it is possible to use a smaller engine for the same required power output or to achieve lower NO_X emissions and lower specific fuel oil consumptions (SFOC).

As a compact two-stage unit, the MAN ECOCHARGE delivers outstanding turbocharging efficiency. A variety of product types and sizes are available, ensuring the perfect turbocharger-to-engine-fit. MAN ECOCHARGE always consists of a clever combination of high and low-pressure turbochargers. While MAN TCX has been specifically designed for high-pressure applications, MAN TCA and MAN TCR as well as our new MAN TCT, TCF and TCP generation series round up the package as low-pressure turbochargers.

Technical data

Turbine type	Mixed flow turbine
Max. permissible temperature	650°C
Pressure ratio (two stages)	up to 10.5
Suitable for HFO, MDO, gas	

TCX turbocharger programme

	Max. engine output*	Mass
Type	**kW**	**kg**
TCX17	8,500	517
TCX19	11,900	870
TCX21	16,600	1,564
TCX23	23,300	2,394

* le=6kg/kWh; pHPCin=3,5 bar, THPCin=45°C

MAN ETB

MAN's EGR Blower series – Electrical Turbo Blower (ETB)

Specifically designed for EGR systems the MAN ETB plays an important role in enabling these systems to reach IMO Tier III emission limitation. The EGR blower is a core component of MAN Energy Solutions' high-pressure EGR system that raises the exhaust-gas pressure in order to overcome the pressure difference between exhaust gas and scavenging receiver. In addition the recirculated exhaust gas amount is controlled during the EGR operation by varying the blower speed.

The desired EGR operating conditions are achieved by using a high-speed electric motor, directly coupled to the compressor wheel and speed controlled by a frequency converter. The scope of supply consists of the ETB and one cabinet with frequency converter and sine wave filter.

The MAN ETB features a high-efficient blower wheel, optimized for the low-pressure ratios necessary for the high pressure EGR system of a two-stroke diesel engine with materials designed to withstand corrosive agents caused by Sulphur content fuels. As such MAN's ETB is suitable for high-pressure EGR engines of all fuel types and in all application ranges.

Type	Max. blower speed	Mass of blower
	rpm	kg
ETB40	9,170	1,860

The maximum engine power output with one ETB depends on the EGR volume flow and the pressure difference between exhaust gas and scavenging receiver. Therefore an EGR blower selection tool will be introduced and the output will be available in CEAS soon.

For more information and blower assignment, please contact turbochargers@man-es.com.

ETB – explicitly designed for EcoEGR

MAN's ETB is explicitly designed for EcoEGR applications where the blower will run continuously in both Tier III and Tier II Eco mode. This results in a compact and cost optimized design with highest availability.

In Tier II Eco mode the EGR volume flow is approx. 50% of the required volume flow in Tier III mode. To cover the operating points of both running modes MAN's ETB features an extremely wide compressor map.

The ETB achieves benchmark efficiencies and therefore the operational costs are minimized.

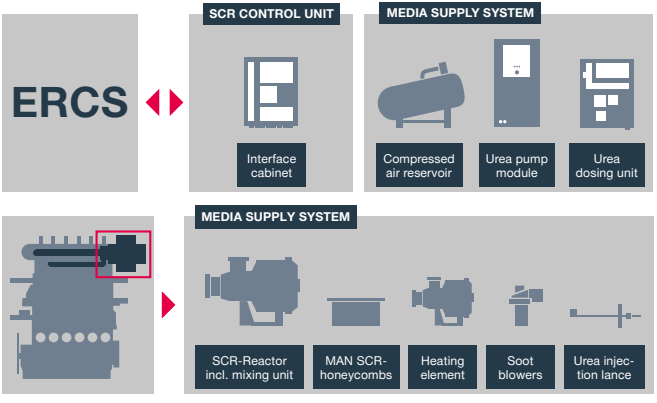
For more information about EcoEGR see the section EcoEGR in the MAN B&W two-stroke propulsion engines chapter.

MAN SCR-HP

Dimensions

Cluster	Reactor diameter	Reactor length < 0.1% sulphur	Reactor length < 3.5% sulphur
	mm	mm	mm
1	2,000	4,800	5,800
2	2,400	5,000	6,000
3	2,900	5,500	6,500
4	3,400	5,900	6,900
5	3,900	6,300	7,300
6	4,500	6,900	7,900

Illustration contains optional features



MAN SCR-HP

The MAN SCR-HP is a small and compact NO_X emission reduction system. The most compact design in the market allows for easy integration, and the few frame sizes will cover the entire two-stroke portfolio up to 25 MW per SCR reactor.

The integrated mixing unit reduces the overall length and volume. The specific honeycombs ensure a compact design.

The MAN SCR-HP can be mounted in all positions and is capable of running on all fuels.

Auxiliary components like the urea injection lance, urea dosing unit and urea pump module are from MAN's well-proven SCR-LP system.

SCR-HP system

MAN PrimeServ

Service for your piece of mind

- Increase uptime with high-quality OEM spare parts
- Manage maintenance costs with tailor-made service agreements
- High-quality maintenance, repair and reconditioning for all major brands
- Global service network for 24/7 reliable support, technical expertise and on-site recovery
- Digital service solutions for enhanced monitoring and analytics
- Hands-on training at our MAN PrimeServ Academies and flexibility with our digital training formats
- Optimise efficiency and sustainability with advanced retrofit and upgrade solutions

MAN Fluid Monitor

Step into a new dimension of operation & maintenance with condition monitoring

**It all starts with a tiny anomaly. Something is off by just a little bit in a machine – not noticeable, even to an experienced operator.
But it's not going to go away on its own. Sooner or later, it will have consequences: performance degradation, safety hazards or even failure and downtime.**

What if you could receive an alarm or a recommendation to stop your engine in real time? And then do something about it in time? To prevent serious damage?

How do you usually detect a bearing seizure? Cylinder scuffing? Slight wear of components? Water presence? Fuel pollution? Soot pollution?

How do you detect tiny anomalies between planned maintenances? Now you can. Now there's MAN Fluid Monitor for lube oil.

PrimeServ Omnicare

Your one-stop service solution

For over a century, MAN PrimeServ has provided the best service solutions and technical support for all MAN engines and equipment. With PrimeServ Omnicare we now offer the same level of care and complete support for all your major equipment in your engine room - regardless of manufacturer and all in just one stop. For you this means global and local expertise, whenever and wherever you need it, from the industry's most trusted specialist.

Cooperation with other equipment manufacturers is an essential pillar of PrimeServ Omnicare's global offering. PrimeServ is authorized by a number of OEMs to ensure strong technical support and genuine OEM spare parts for your equipment. Our Omnicare service scope currently covers MET turbochargers, CENTA flexible couplings and C.C. Jensen lube oil filtration systems, bringing simplicity and cost-efficiency to your fleet management, minimizing unplanned downtime, reducing costs, and extending the lifetime of your assets.

Dual-fuel conversion

A dual-fuel conversion is one of the most effective ways to drive greater efficiency and profitability from your fleet. In this process, we convert your existing diesel engine to a dual-fuel gas engine. This enables you to switch between diesel and gas as necessary, to both reduce operational costs and take advantage of optimal fuel prices as they arise.

Using alternative fuels, such as SNG, LNG, ethane, LPG, or methanol, greatly reduces SO_X, NO_X, CO_2, and particulate matter, enabling you to comply with global environmental regulations, secure worldwide port access, and meet your own sustainability targets.

Our dual-fuel retrofit solutions are not limited to the main engine, and customised projects can be provided as a turnkey solution, or including gas systems in partnership with MAN Cryo. To ensure the process is executed seamlessly from start to finish, MAN PrimeServ covers everything from research and site survey to engineering and project management, and finally to hardware commissioning.

MAN PrimeServ Academies

Professional certification

MAN PrimeServ Academies offer courses covering the entire portfolio of MAN Energy Solutions products, both two- and four-stroke, power generation, and turbochargers. In the academies, participants are guided through theoretical lectures, and hands-on exercises covering the operation, maintenance, and troubleshooting, of the MAN Energy Solutions product portfolio. We strive to create a “real life” atmosphere such that participants can relate learning objectives to their daily working environment. That includes working on original engines, fully functioning diesel GenSets, and simulators.

In addition to our on-site courses, we have adapted to the use of new digital training methods and solutions. From self-paced eLearning courses, to instructor led online courses, to blended learning courses, we offer you maximum flexibility in choosing a course format that perfectly fits your needs.

PrimeServ Assist

Secured availability – optimised efficiency

Be one step ahead by using MAN PrimeServ Assist. A proactive service solution from MAN Energy Solutions.

Get an instant, accurate snapshot of your machinery's status with all relevant data consolidated on one interface. PrimeServ Assist makes sure your operators are always on top of efficiency data. The result: accelerated decision-making as well as improved efficiency and cost-effectiveness. For an even better fleet oversight, PrimeServ Assist provides precise and far-reaching efficiency insights about how the individual units perform. All digital and absolutely accurate, PrimeServ Assist offers the ideal groundwork for informed decisions and the right adjustments.

Get advice on how to keep your machinery operating at peak efficiency for longer. Our experts are here for you 24/7, continuously monitoring and analysing live data from machinery in the field, diagnosing anomalies and notifying you with valuable operational and maintenance advice.

The earlier you know about an anomaly, the earlier you can take action to prevent potential problems. That's the philosophy behind PrimeServ Assist.

Contacts

Headquarters

Germany
Four-stroke propulsion engines and systems, GenSets, turbochargers and exhaust gas systems
MAN Energy Solutions SE
Stadtbachstrasse 1
86153 Augsburg
Tel.: +49 821 322 0
info-aug@man-es.com

Germany
Gas-, steam turbines, compressors
MAN Energy Solutions SE
Steinbrinkstraße 1
46145 Oberhausen
Tel.: +49 208 692 1
turbomachinery@man-es.com

Denmark
Two-stroke propulsion engines and systems, GenSets
MAN Energy Solutions SE
MAN B&W
Teglholmsgade 41
2450 Copenhagen SV
Tel.: +45 3385 1100
info-cph@man-es.com

Denmark
Propellers, aft ship and propulsion control systems
MAN Energy Solutions SE
MAN Alpha
Niels Juels Vej 15
9900 Frederikshavn
Tel.: +45 9620 4100
info-frh@man-es.com

Czech Republic
Turbochargers and exhaust gas systems
PBS Turbo s.r.o.
Velká Bíteš
Vlkovská 279
595 01 Velká Bíteš
Tel.: +420 566 822 201
pbst_sales@pbsvb.cz

France
Four-stroke propulsion engines, GenSets
MAN Energy Solutions France S.A.S.
S.E.M.T. Pielstick
Avenue de Chatonay Porte n° 7
BP 427
44615 Saint-Nazaire
Tel.: +33 2 40 90 65 00
info-fr@man-es.com

Headquarters

United Kingdom
Four-stroke propulsion engines
MAN Energy Solutions UK Ltd.
Original Brands of: Mirrlees Blackstone; Ruston and Paxman
1 Mirrless Drive
Hazel Grove
Stockport
Cheshire SK7 5BP
Tel.: +44 161 483 1000
primeserv-uk@man-es.com

Sweden
Cryogenic Engineering Solutions
MAN Energy Solutions Sverige AB
MAN Cryo
Oljevägen 105
41878 Gothenburg
Tel.: +46 31 176295
cryo@man-es.com

Switzerland
Axial-, centrifugal compressors, complete compressor packages
MAN Energy Solutions Schweiz AG
Hardstraße 319
8005 Zürich
Tel. +41 44 278 20 71
info-zur@man-es.com

International group companies

Argentina
MAN Energy Solutions Argentina S.A.
Armenia 3575
CP B1605BOH - Munro
Prov. Buenos Aires
Tel.: +54 11 5236 6006/07
guillermo.lemo@man-es.com

Australia
MAN Energy Solutions Australia Pty. Ltd.
Building 2,
202 Fairfield Road
Yennora NSW 2161
Sydney
Tel.: +61 2 8874 0700
jeffrey.moloney@man-es.com

Bangladesh
MAN Energy Solutions Bangladesh Ltd.
Crystal Palace, 9th Floor
SE (D) 22, Road 140
Gulshan South Avenue, Gulshan-1
Dhaka-1212
Tel.: +92 42 3533 0091 3148
tariq.anwar@man-es.com

Belgium
MAN Energy Solutions N.V.
Noorderlaan 181
2030 Antwerpen
Tel.: +32 3 543 8500
dirk.willems@man-es.com

Brazil
MAN Energy Solutions Brazil E&S Ltda.
Rua Carlos Gomes, 23 – bloco 1,
Barreto, Niterói – RJ
CEP 24.110-075
Tel.: +55 21 3506 2151
jens.hueren@man-es.com

Bulgaria
MAN Energy Solutions Bulgaria EOOD
7 Al. Dyakovich, Floor 5, Office 1
9000 Varna
Tel.: +359 52 33 59 60
valentin.yankov@man-es.com

Canada
MAN Energy Solutions Canada Ltd.
Unit 180 – 13111 Vanier Place
Richmond BC V6V 2J1
Tel.: +1 604 235 9378
thomas.juul@man-es.com

Chile
MAN Energy Solutions Chile Ltda.
Parcela 291
- sector Placilla de Peñuelas
Ruta 68 - Km. 98
Valparaíso
Tel.: +56 9 4004 9600
gabriel.guevara@man-es.com

International group companies

China
MAN Energy Solutions China Co., Ltd.
Floor 8, Xinxi Building 1
No. 3576 Zaho Lou Road
Pujiang Town, Minhang District
Shanghai 201112
Tel.: +86 21 3891 9600
pan.ke@man-es.com

Colombia
MAN Energy Solutions Colombia
Branch Office of Chile
Av. Cra. 7 No. 127-48, Oficina 1009
Centro Empresarial 128
Bogotá D.C.
Tel.: +57 312 432 5521
juan.salguero@man-es.com

Cyprus
MAN Energy Solutions Cyprus
Office 403, Taitou Court
2M Koutsofta Str.
3031 Limassol
Tel.: +357 25 342 379/746/082
hans.odgaard@man-es.com

Egypt
MAN Energy Solutions Egypt LLC
Office G19 Katameya Heights
Business Center
Katameya New Cairo
11771 Cairo
Tel.: +20 2 20200 462
amr.tahoun@man-es.com

Ecuador
MAN Energy Solutions Ecuador
Branch office of Chile
Edificio Ambar, Piso 10 Oficina 1002
Av. Portugal E10-77 y República del Salvador
Quito
Tel.: +593 233 31344
carlos.solano@man-es.com

Finland
MAN Energy Solutions Finland
Branch office of Sweden
Electrocity, office 511
Tykistökatu 4
20520 Turku
Tel. +358 040801 9820
joska.taipale@man-es.com

France
MAN Energy Solutions France S.A.S.
Av. de Chatonay - Porte 7
44615 Saint-Nazaire
Tel.: +33 24090 6599
yann.tanguy@man-es.com

Germany
MAN Energy Solutions SE
Representative Office
Rossweg 6
20457 Hamburg
Tel.: +49 40 7409 360
colin.peesel@man-es.com

International group companies

Greece
MAN Energy Solutions Hellas E.P.E.
Akti Miaouli 89
185 38 Piraeus
Tel.: +30 210 45 87 900
dionissis.christodoulopoulos@man-es.com

Hong Kong
MAN Energy Solutions Hong Kong Ltd.
Units 4607-15, Level 46, Tower 1
Metroplaza, 223 Hing Fong Road
Kwai Fong, New Territories
Hong Kong
Tel: +852 6624 8038
sarath.prasannan@man-es.com

India
MAN Energy Solutions India Pvt. Ltd.
E-73, MIDC Waluj 431 136
Aurangabad - 431136
Maharashtra
Tel.: +91 240 2566 700
santosh.kumar@man-es.com

India
MAN Energy Solutions India Pvt. Ltd.
Branch Office Mumbai
402, Bldg No 2, Star Hub
Sahar Road, Andheri (East)
Mumbai - 400 099
Tel.: +91 22 6687 5427
santosh.kumar@man-es.com

Indonesia
PT MAN Engergy Solutions Indonesia
Unit #17-01, 17th Floor Menara Palma
Jl. H.R. Rasuna Said,
Block X2 Kav. 6
12950 Jakarta
Tel.: +62 21 5795 7490
jesper.gram@man-es.com

Italy
MAN Energy Solutions S.r.l.
Via Ponte Caracciolo, 1
16126 Genova
Tel.: +39 010 209 1637
pierpaolo.da-fieno@man-es.com

Japan
MAN Energy Solutions Japan Ltd.
Yokohama Blue Avenue 13F
4-4-2 Minatomirai, Nishi-ku
Yokohma 220-0012
Tel.: +81 45 227 6250
shinichi.nagata@man-es.com

Malaysia
MAN Engergy Solutions Malaysia ES Sdn. Bhd
Suite 3.01, 3rd Floor Kenanga International
Jalan Sultan Ismail
50250 Kuala Lumpur, Malaysia
Tel.: + 603 2162 0410
jesus.montenegro@man-es.com

International group companies

Mexico
MAN Energy Solutions
Mexico S. de R.L. de C.V.
Sierra Candela 111-116, C.P. 11000
Col. Lomas de Chapultepec
Mexico, D.F.
Tel.: +52 55 4000 6104
marcos.vazquez@man-es.com

Netherlands
MAN Energy Solutions
Netherlands B.V.
Schiekade 36
3125 KJ Schiedam
(Port of Rotterdam)
Tel.: +31 10 272 4500
bart.speckens@man-es.com

New Zealand
MAN Energy Solutions
New Zealand Ltd.
Naval Dockyard PO Box 32-061
Queens Parade, Devonport
Auckland 0744
Tel.: +61 2 8874 0701
jeffrey.moloney@man-es.com

Norway
MAN Energy Solutions
Norway AS
Haakon VII's gate 1
0161 Oslo
Tel.: +47 2201 7190
erik.dahl@man-es.com

Pakistan
MAN Energy Solutions
Pakistan Pvt. Ltd.
16-Km Raiwind Road
Lahore-55150
Tel.: +92 42 3533 0091 3
naveed.rehman@man-es.com

Panama
MAN Energy Solutions
Panama Inc.
Av. Las Brujas, Edificio 3870,
Local 1
Veracruz, Arraiján
Tel.: +507 6572 6146
joerg.glaus@man-es.com

Peru
MAN Energy Solutions
Peru S.A.C.
Av. Argentina 2415
Lima 15081
Tel.: +51 1 6284756
xavier.vallejos@man-es.com

Philippines
MAN Energy Solutions
Philippines Inc.
Km. 17, West Service Road
Cervantes Compound Brgy.
Marcelo Green
South Superhighway
Paranaque City, 1700
Tel.: +63 2 776 3369/3347
sebastien.marchand@man-es.com

International group companies

Poland
MAN Energy Solutions Poland Sp. z o.o.
ul. Lubowidzka 43
80-174 Gdansk
Tel.: +48 58 325 33 90
Mob: +48 502 536 800
dariusz.dziedziul@man-es.com

Portugal
MAN Energy Solutions Portugal, Unipessoal, Lda.
Avenida do Rio Tejo, lote 3
Parque Industrial Sapec Bay
2910-440 Setúbal
Tel.: +351 265 799 500
pablo.montes@man-es.com

Qatar
MAN Energy Solutions Qatar Navigation L.L.C.
Ras Laffan Avenue
Zone T-45
Ras Laffan Industrial City (RLIC)
Doha
Tel.: +974 4031 09101
goetz.kassing@man-es.com

Russia
MAN Energy Solutions Russia Ltd.
Preobrazhenskaya square 8,
block A, 13 floor
107061 Moskow
Tel.: +7 905751 5284
kirill.olesevich@man.es.com

Russia
MAN Energy Solutions Russia Ltd.
Branch Office St. Petersburg
Vozdukhoplavatelnaya dom 19
196084 St. Petersburg
Tel.: +7 812 449 2655
alexander.danilenko@man-es.com

Saudi Arabia
MAN Energy Solutions Saudi Arabia LLC
Prince Mohammed Bin Abdulaziz
Street, Jameel Square Building,
2nd Floor No. 211
P.O. Box 55990
21544 Jeddah
Tel.: +966 2 639 4346
abdullah.kuzkaya@man-es.com

Senegal
MAN Energy Solutions Senegal SARL
Derrière cité Faycal
En face de la clinique du Golf
Cambérène
Dakar
Tel.: +221 33 867 79 77
abdou.fofana@man-es.com

Singapore
MAN Energy Solutions Singapore Pte. Ltd.
29 Tuas Avenue 2
Singapore 639460
Tel.: +65 6349 1600
olaf.gunia@man-es.com

International group companies

South Africa
MAN Energy Solutions South Africa (Pty) Ltd.
Cnr. Cartwright & Petter Street,
C.E. 6
Vanderbijlpark, 1911
Tel.: +27 11 842 0700
chris.meyer@man-es.com

South Africa
MAN Energy Solutions South Africa (Pty) Ltd.
Corners of Vanguard,
Ocean and Portside Roads
Port of Cape Town
8000 Paarden Eiland
Tel.: +27 21 514 3361
norman.hall@man-es.com

South Korea
MAN Energy Solutions Korea Ltd.
51, Beombang 2-ro, Gangseo-gu
Busan, South Korea 46727
Tel.: +82 51 635 6644
tommyr.rasmussen@man-es.com

Spain
MAN Energy Solutions España S.A.
Calle Pedro Teixeira, 8-10
Edificio Iberia Mart
28020 Madrid
Tel.: +34 914 111 413
pablo.montes@man-es.com

Spain
MAN Energy Solutions Canarias, S.L.
Muelle Reina Sofia s/n
Puerto de Las Palmas
Las Palmas de Gran Canaria
35008
Tel.: +34 928 935 959
pablo.montes@man-es.com

Sri Lanka
MAN Energy Solutions Lanka (Pvt) Ltd.
No. 57/8, Sir Ernest De Silva
Mawatha
Colombo 00700
Tel.: +94 11 2678930
ruwan.dassanayake@man-es.com

Sweden
MAN Energy Solutions Sverige AB
Oljevägen 105
41878 Gothenburg
Tel.: +46 705 172161
henrik.malm@man-es.com

Taiwan
MAN Energy Solutions Taiwan Ltd.
14F-1, No. 8, Min Chuan 2nd Road
Chienchen
80661 Kohsiung
Tel.: +886 7 537 2225
adam.green@man-es.com

International group companies

Turkey
MAN Energy Solutions Servis ve Ticaret Ltd. Sti.
Esentepe Kore Sehitleri Caddesi
No:16/1 K:4 D:41
34394 Zincirlikuyu – Sisli/Istanbul
Tel.: +90 2165 819 900
timur.iyi@man-es.eu

United Arab Emirates
MAN Energy Solutions Middle East LLC
Jumeira Beach Road
At Drydocks World Dubai
P.O. Box 57091
Dubai
Tel.: +971 4 345 40 45
khalid.alzayani@man-es.com

United Kingdom
MAN Energy Solutions UK Ltd.
Hythe Hill
Colchester
Essex, CO1 2HW
Tel.: +44 1206 795 151
robert.plant@man-es.com

USA
MAN Energy Solutions North America Inc.
1758 Twinwood Parkway
Brookshire, TX 77423
Tel.: +1 346 3793029
mahesh.joshi@man-es.com

USA
MAN Energy Solutions North America Inc.
Branch Office Ft. Lauderdale
1491 SW 5th Court Building 1501
Pompano Beach, FL 33069
Tel.: +1 604 235 9378
thomas.juul@man-es.com

Vietnam
MAN Energy Solutions Singapore Pte. Ltd.
Branch Office Hanoi
Unit 9, Second Floor,
International Central
17 Ngo Quyen, Hoan Kiem
Hanoi
Tel.: +84 4 3936 9728
hoanghai.tran@man-es.com

List of licensees

Symbols used:

T: MAN Energy Solutions two-stroke licence
F: MAN Energy Solutions four-stroke licence
P: MAN Energy Solutions four-stroke SEMT Pielstick licence
TC: MAN Energy Solutions turbocharger licence
FP: MAN Energy Solutions fixed pitch propeller license

China, The People's Republic of

China Shipbuilding Industry Corporation Diesel Engine Co., Ltd. (T)
Tel: +86 532 86708080 6908

CSSC Marine Power Zhenjiang Co Ltd. (T, F)
Tel.: +86 (511) 845 11 273
cssc-cmp@cssc-cmp.cn

CSSC-MES Diesel Co., Ltd. (T)
Tel.: +86 (21) 6118 6666
market@shcmd.com.cn

Dalian Marine Diesel Co. Ltd. (T)
Tel.: +86 (411) 8441 7273
dmd@online.in.cn

Dalian Marine Propeller Co., Ltd (FP)
Tel.: +86 (411) 8444 2866 8103
sale@dmpp.cn

Henan Diesel Engine Industry Co., Ltd. (F)
Tel.: +86 (379) 6407 6161
cys@hnd.com.cn

Hengli Engine (Dalian) Co., Ltd. (T)
Tel.: TBA
E-mail: TBA

Hudong Heavy Machinery Co., Ltd. (T, P)
Tel.: +86 (21) 51 31 00 00
+86 (21) 58 71 30 07
hhm@hhm.com.cn

List of licensees

Shaanxi Diesel Engine Heavy Industry Co., Ltd. (F, P)
Tel.: +86 (29) 3831 4367
+86 (29) 3831 4626
sxd408@sxdinfo.com.cn

Weichai Heavy Machinery Co., Ltd. (F)
Tel.: +86 186 7807 5963
zhaoke@weichai.com

Yichang Marine Diesel Engine Co., Ltd. (T)
Tel.: +86 (717) 646 86 89
market@ymd.com.cn

Yuchai Marine Power Co. Ltd. (T)
Tel: + 86 756 5888600
sales@ycmp.com.cn

Zhenjiang Tongzhou Propeller Co., Ltd (FP)
Tel.: +86 (511) 8198 2822
zhangjinlong@zjtpp.com

Czech Republic
PBS Turbo s.r.o. (TC)
Tel.: +420 (566) 822 201

Japan
Hitachi Zosen Corporation (T)
Tel: +81 (3) 6404 0141
de-info@hitachizosen.co.jp

JFE Engineering Corporation (P, F)
Tel: +81 (45) 505 7914
hoshino-minoru@jfe-eng.co.jp

Kawasaki Heavy Industries Ltd. (T, F, TC)
Tel: +81 (3) 3435 2313
hashimoto_h@khi.co.jp / takano_hi@khi.co.jp

List of licensees

Kawasaki Sub-licensee:
The Hanshin Diesel Works Ltd. (T)
Tel: +81 (78) 332 2081
overseas-section@hanshin-dw.co.jp

Mitsubishi Heavy Industries Engine & Turbocharger, Ltd. (F)
Tel: +81 (42) 763 1594
gmmp383621b10g04@mhiet.mhi.co.jp

Mitsui E&S Machinery Co., Ltd. (T, TC)
Tel: +81 (3) 3544 3475
meseba99@mu.mes.co.jp

Mitsui Sub-Licensee:
Makita Corporation (T)
Tel: +81 (87) 821 5501
webmaster@makita-corp.com

IHI Power Systems Co., Ltd. (P)
Tel: +81 3 4366 1200
webmaster1@niigata-power.com / naofumi_murakami@niigata-power.com

Saudi Arabia
Hyundai Sub-licensee:
Saudi Engine Manufacturing Company (Makeen) (T)
Tel.: +966 13 512 2002
info@makeen-ksa.com

South Korea
HSD Engine Co., Ltd. (T, F)
Tel.: +82 (55) 260 6154
sangsoo1.lee@hsdengine.com

Hyundai Heavy Industries Co., Ltd. (T, TC)
Engine & Machinery Division
Tel.: +82 (52) 202 7281
enginesales@hhi.co.kr

List of licensees

STX Engine Co., Ltd. (F, T)
Tel. +82 (55) 280 0566
C104CM2T11422@stxengine.co.kr
youngminkim@stxengine.co.kr

STX Heavy Industries Co., Ltd. (T,TC)
Tel.: +82 (55) 239 5673
stx-stxhi-enginesales@stxhi.com

Spain
Navantia S.A. (F)
Fábrica De Motores Cartagena
Tel.: +34 (968) 128 200
navantia@navantia.es

USA
Fairbanks Morse (F, P)
Tel.: +1 (608) 364 8073
mike.clark@fmdefense.com

Notes

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4510-0022-02web Aug 2023. MANPM-00-0884.