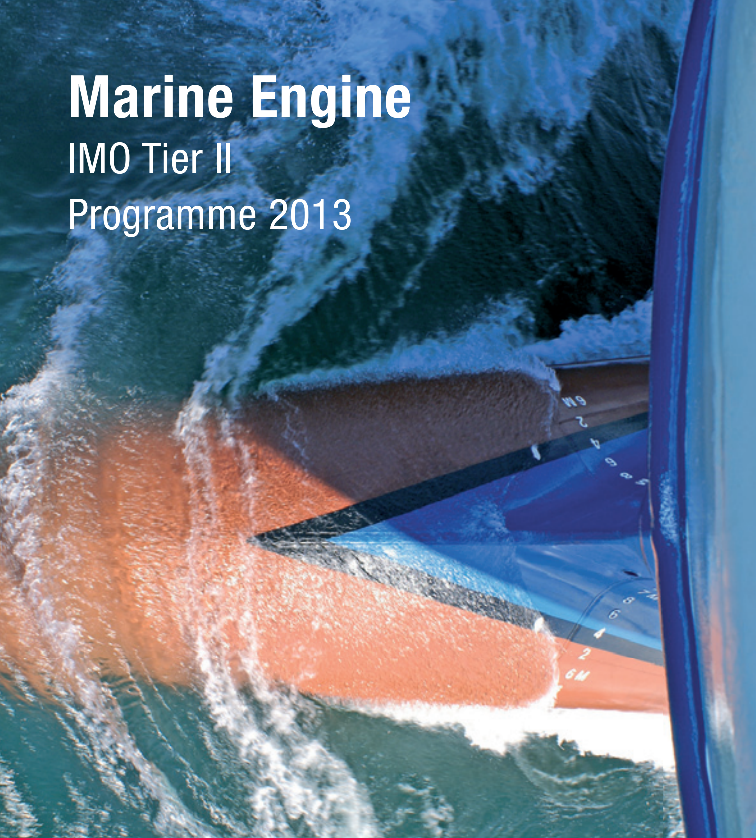
Marine Engine
IMO Tier II
Programme 2013



Engineering the Future – since 1758.

MAN Diesel & Turbo

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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.

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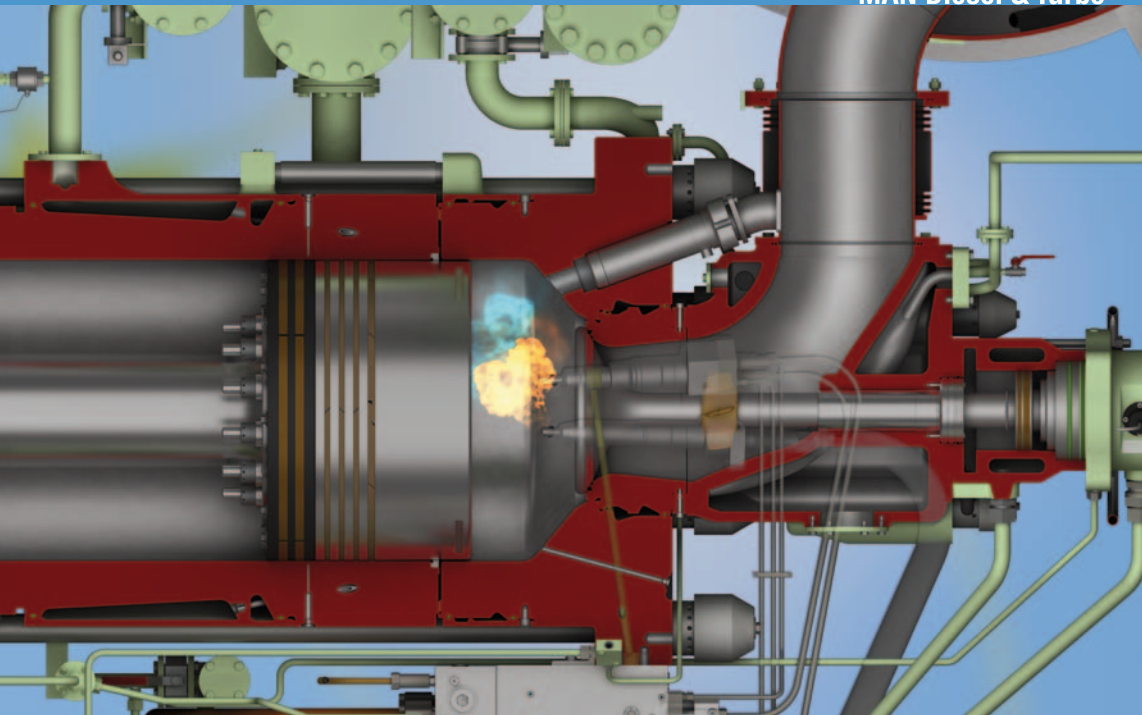
MAN B&W Low Speed

Propulsion engines

Engineering the Future – since 1758.

MAN Diesel & Turbo



MAN B&W Low Speed Propulsion Engines

MAN Diesel & Turbo Tier II Engine Programme
The engines in this programme all comply with IMO's Tier II emissions.

ME Programme
The electronic control of ME/ME-C/-GI engines includes the combustion process, i.e. fuel injection timing, actuation of exhaust valves and starting valves, and cylinder lubrication. On ME-B/-GI engines, the combustion process is electronically controlled while the actuation of exhaust valves and starting valves is hydraulically or mechanically controlled.

The advantages of ME engines are:

- fuel optimised over a wide power range
- improved cylinder lube oil consumption
- improved low-load running
- adaptation to different fuel oil qualities
- better part- and low-load effiency

As a standard integrated feature, ME engines are specified with MAN B&W Alpha Lubricators.

GI Dual Fuel Engines
In addition to the engines mentioned on page 55-66, the following are available for natural gas operation as dual fuel engines with high-pressure gas injection, designated '-GI' (Gas Injection):

- S65ME-C8.2
- L60ME-C8.2

Currently, these engines have the same fuel consumption as diesel engines, but will be available with lower fuel consumption on request.

ME-B engines (excl. S30ME-B9) are also available for natural gas operation. These engines have the same fuel consumption as similar diesel engines.

Improved SFOC for Mark 9 Engines
The test results from the first mark 9 engines have confirmed that the SFOC for large bore mark 9 engines has been improved compared to earlier versions. In addition, the S80ME-C9 has been upgraded mechanically to match the performance and SFOC of the S90ME-C9.

MAN B&W Low Speed Propulsion Engines

MC Programme
MAN B&W two-stroke MC/MC-C engines are characterised by having mechanically driven camshaft-controlled fuel pumps.

VIT (Variable Injection Timing) fuel pumps are MAN Diesel & Turbo's standard design on mechanically controlled MC/MC-C Tier II engines with 46 bore and above. The engine's maximum firing pressure can be controlled accordingly to ensure optimum combination of NO_x and SFOC can be obtained at all loads.

Old Replaced Engines
Earlier versions of this engine programme have additional engines mentioned. Those engine types are still available and are categorised 'Old replaced engines'. However, new development will only be implemented in these designs to the extent considered necessary based on service experience. New efficiency enhancing features and SFOC guarantee down to 50% load 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 compressor inlet temperature 45 °C
- turbocharger compressor inlet pressure 1,000 mbar
- sea water temperature 32 °C

MAN B&W Low Speed Propulsion Engines

Specific Fuel Oil Consumption (SFOC)
The figures given in this folder represent the values obtained when the engine and turbocharger are matched to the lowest possible SFOC values while also fulfilling the IMO NO_x Tier II emission limitations.

Stricter emission limits can be met on request, using proven technologies.

The SFOC figures are given in **g/kWh**, and are based on the use of fuel with a lower calorific value (LCV) equal to 42,700 kJ/kg (~10,200 kcal/kg) at ISO conditions:

- ambient air pressure 1,000 mbar
- ambient air temperature 25 °C
- cooling water temperature 25 °C

Most commercially available HFO with a viscosity below 700 cSt at 50 °C can be used.

The energy efficiency design index (EEDI) has increased the focus on part-load SFOC. We therefore offer the option of selecting the SFOC guarantee at a load point in the range between 50% and 100%.

All engine design criteria, e.g. heat load, bearing load and mechanical stresses on the construction are defined at 100% load independent of the guarantee point selected. This means that turbocharger matching, engine adjustment and engine load calibration must also be performed at 100% independent of guarantee point. At 100% load, the SFOC tolerance is 5%.

When choosing an SFOC guarantee below 100%, the tolerances, which were previously compensated for by the matching, adjustment and calibration at 100%, will affect engine running at the lower SFOC guarantee load point. This includes tolerances on measurement equipment, engine process control and turbocharger performance.

Consequently SFOC guarantee tolerances are as follows:

- 100% – 85%: 5% tolerance
- 84% – 65%: 6% tolerance
- 64% – 50%: 7% tolerance

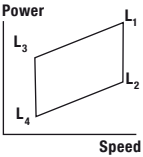
Please note that the SFOC guarantee can only be given in one (1) load point.

MAN B&W Low Speed Propulsion Engines

Layout Diagram

The layout diagram applicable for the engines is defined by the power and speed combinations L_1 - L_2 - L_3 and L_4, with L_1 indicating the nominal MCR.

Any combination of speed and power within the layout diagram may be used for selecting the specified MCR point.



G80ME-C9, G50ME-B9, G45ME-B9 and G40ME-B9 Engines Available at Increased Speed with Unchanged MEP

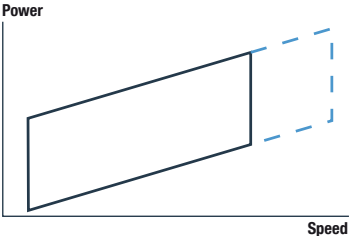
Four of the G-engines (G80ME-C9, G50ME-B9, G45ME-B9 and G40ME-B9) are specified with the L_1 speed and power indicated in the table below:

Engine	L_1 speed [rpm]	L_1 power/cyl. [kW]
G80ME-C9	68	4,450
G50ME-B9	100	1,720
G45ME-B9	111	1,390
G40ME-B9	125	1,100

Variants of these engines with increased speed and unchanged MEP are available on request:

Engine	L_1 speed [rpm]	L_1 power/cyl. [kW]
G80ME-C9	72	4,710
G50ME-B9	108	1,860
G45ME-B9	120	1,505
G40ME-B9	135	1,190

Schematic Layout Diagram with Extended Area for G80ME-C9, G50ME-B9, G45ME-B9 and G40ME-B9



MAN B&W Low Speed Propulsion Engines

Fuel Consumption and Optimisation Possibilities

The current economic scenario has placed more emphasis on operational flexibility in terms of demand for improved part-load and low-load SFOC. As described below, different optimisation possibilities for the MAN B&W type engines have been developed.

NO_x regulations place a limit on the SFOC on two-stroke engines. In general, NO_x emissions will increase if SFOC is decreased and vice versa. In the standard configuration, the engines are optimised close to the IMO NO_x limit and, therefore, NO_x emissions may not be further increased.

The IMO NO_x limit is given as a weighted average of the NO_x emission at 25, 50, 75 and 100% load. This relationship can be utilised to tilt the SFOC profile over the load range. This means that SFOC can be reduced at part load or low load at the expense of a higher SFOC in the high-load range without exceeding the IMO NO_x limit.

Optimisation of SFOC in the part-load (50-85%) or low-load (25-70%) range requires selection of a tuning method:

- ECT: Engine Control Tuning (only available on ME/ME-C/ME-B engines)
- VT: Variable Turbine area
- EGB: Exhaust Gas Bypass

The above tuning methods are available for all SMCR in the specific engine layout diagram. The specific SFOC reduction potential of each tuning method together with full rated (L_1/L_3) and maximum derated (L_2/L_4) can be seen for each individual engine page.

Only high-load optimisation is available for engines with conventional efficiency turbochargers (64% instead of 67%) including S46ME-B8, S46MC-C8 and G45ME-B9 and for engines with non-adjustable maximum firing pressure at part load (MC engines without VIT).

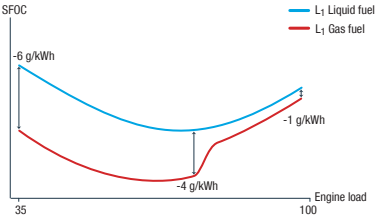
The methods and options mentioned will be explained in the following.

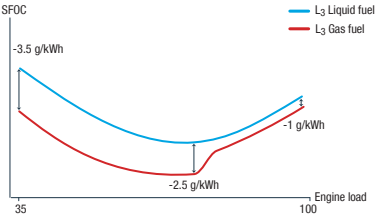
For K98 engines high-load optimising is not a relevant option any more. However, for such engines in part-load or low-load optimised execution, the full 100% load is still available when needed for operational reasons.

MAN B&W Low Speed Propulsion Engines

SFOC Curves for the GI Engines

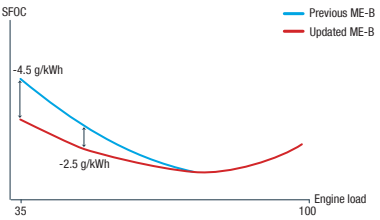
Examples of SFOC curves for GI engines with liquid fuel and gas fuel are shown on the following two graphs for L_1 and L_3 layout points respectively. Depending on engine type, these points differ.





SFOC Curves for the ME-B Engines

The SFOC curves for the new ME-B engines with adjustable exhaust valve closing compared to the previous.



MAN B&W Low Speed Propulsion Engines

Engine Control Tuning – Available for 50-98 Bore Electronic Controlled Engines
This method can be implemented without change of engine components (including matching of turbochargers), only engine control parameters are changed. The method solely utilises the possibility for variable exhaust valve timing and injection timing and profiling.

Two different optimisation possibilities are available. With part-load optimisation, SFOC is decreased at all loads below 85%. With low-load optimisation, SFOC is further decreased at loads below 70%, however, at the expense of a higher SFOC in the high-load range. Which option is optimal on a specific engine depends on the operating pattern.

Variable Turbine Area – VT Technology (or similar)
This method requires special turbocharger parts allowing the turbocharger(s) on the engine to vary the area of the nozzle ring. The nozzle ring area is minimum at the lower engine load range. When the engine load is increased above approx. 80%, the area gradually starts to increase and reaches its maximum at 90% engine load. With this technology, SFOC is decreased at low load at the expense of a higher SFOC at high load.

The VT technology is available for both the ME and MC type engines. The SFOC potential is better on the ME type engine, where VT is combined with variable exhaust valve timing.

For both the ME and MC type engines,two optimisation possibilities are available. With part-load optimisation, SFOC is decreased at all loads below 85%. With low-load optimisation, SFOC is further decreased at loads below 70%, at the expense of a higher SFOC in the high-load range. Which option is optimal on a specific engine depends on the operating pattern.

MAN B&W Low Speed Propulsion Engines

Exhaust Gas Bypass (EGB)
This method requires installation of EGB technology. The turbocharger(s) on the engine are matched at 100% load with fully open EGB. At approximately 85% load, the EGB starts to close and is fully closed below 70% load. With this technology SFOC is decreased at low load, at the expense of a higher SFOC at high load.

The EGB technology is available for both ME and MC type engines. The SFOC potential is better on the ME type engine, where EGB is combined with variable exhaust valve timing.

For both ME and MC type engines, two optimisation possibilities are available. With part-load optimisation, SFOC is decreased at all loads below 85%. With low-load optimisation, SFOC is further decreased at loads below 70%, at the expense of a higher SFOC in the high-load range. Which option is optimal depends on the operating pattern.

Turbocharger (TC) Cut-out
Besides the above-mentioned part-load and low-load methods (ECT, VT and EGB), cut-out of one turbocharger can be applied on MAN B&W engines with more than two turbochargers. The cut-out can be effected either by means of blind plates or pneumatically actuated valves. During cut-out, the allowed engine load is limited to 65% and 70% of SMCR for engines with 3 or 4 turbochargers, respectively. TC cut-out cannot be combined with other methods of low or part-load SFOC optimisations.

The cut-out will enhance the performance of the working turbochargers and, thereby, lead to higher scavenge, compression and maximum combustion pressures, ultimately resulting in lower SFOC and lower exhaust gas temperatures and amount. Data for changes in SFOC, exhaust gas temperature and amount can be supplied on request for the actual project. Depending on the specific engine layout, the heat load can increase significantly when running close to the reduced limit for allowable engine load.

MAN B&W Low Speed Propulsion Engines

Turbocharging System
Two-stroke low speed engines can be delivered with MAN, ABB or MHI turbochargers as standard.

The SFOC figures given in this folder for two-stroke engines are based on turbocharging with the best possible turbocharging efficiency generally available, i.e. 67% for all engines with 45 bore and above, and 64% for engine bores smaller than 45 cm. Both efficiency figures refer to 100% specified MCR. At lower loads the turbocharger efficiency will be even higher.

All engines with high efficiency (67%) turbochargers can be ordered with lower turbocharging efficiency. Utilising this possibility will result in increased exhaust gas temperatures, reduced exhaust gas amounts, and a slight change in SFOC. Converting to conventional efficiency (64%), turbocharger(s) results in a small SFOC increase, a 20 °C increase of the turbine outlet temperature, and a 6% decrease of the air/exhaust amount. **It is not possible to apply tuning methods (part or low load) when making such a conversion**.

For more information visit: www.mandieselturbo.com → Products → Marine Engines & Systems → Low Speed → Turbocharger Selection.

MAN B&W Low Speed Propulsion Engines

Waste Heat Recovery Systems

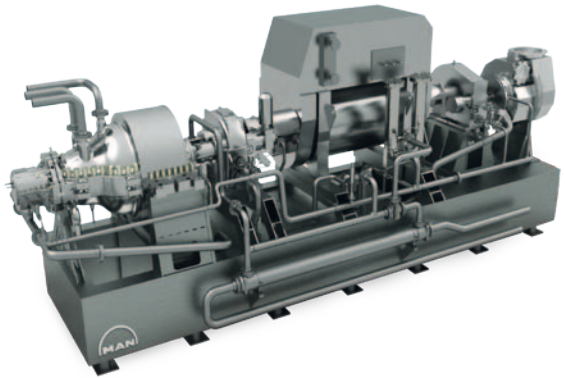
Waste heat can be economically recovered from all MAN B&W two-stroke engines from 50 bore and up, by installing equipment for waste heat recovery systems (WHRS) and matching the engine for WHRS.

A standard WHR-matched MAN B&W two-stroke engine will have a higher exhaust gas temperature compared with an engine without WHR, and can produce an extra electric power output corresponding to approx. 10% of the engine shaft power. Total system efficiency will therefore be better than that of the engine itself.

Through state-of-the-art components offered by MAN Diesel & Turbo, up to 10% of otherwise lost main-engine power can be recovered. The electrical output varies from approximately 1-6 MW or higher, based on requirments. The Modular Arrangement Concept provides configuration flexibility with or without a power turbine.

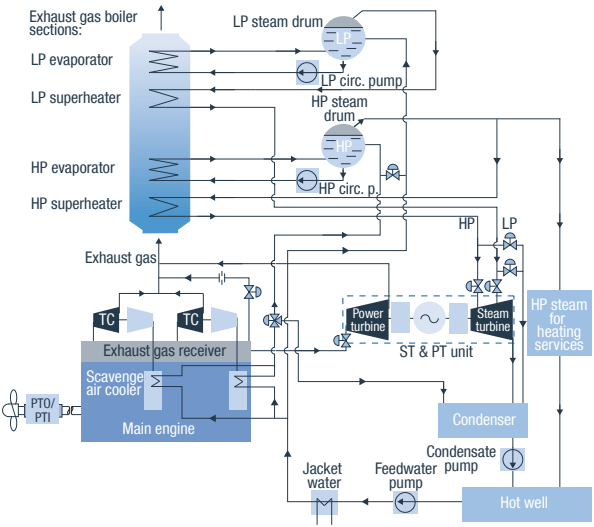
MAN Diesel & Turbo provides:

- complete WHRS
- WHRS integration/interfacing and performance guarantee
- WHRS comprising equipment from the most recognised and reliable suppliers available
- global service and after-sales network
- superior 'in-house' technology concerning the interaction of complete WHRS with the main engine(s)
- the most effective EEDI reduction methods with a figure of up to 10% achievable

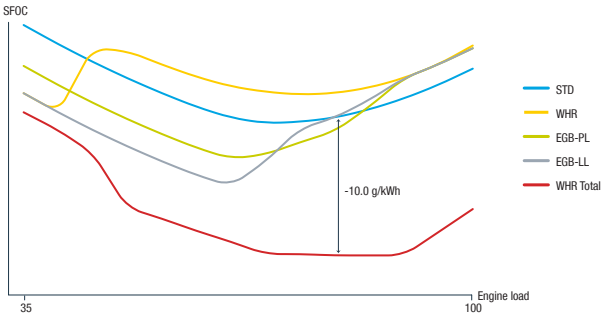


MAN B&W Low Speed Propulsion Engines

Dual Steam Pressure and Heat Water Diagram



SFOC with different layout strategies



MAN B&W Low Speed Propulsion Engines

Lubricating Oil Consumption

The system oil consumption varies for the different engine sizes and operational patterns. Typical consumptions are in the range from negligible to 0.1 g/kWh.

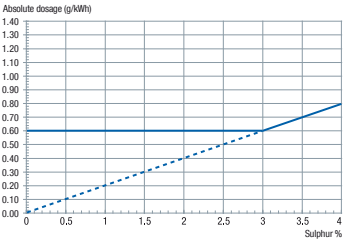
Specific Cylinder Oil Consumption

Alpha ACC (Adaptive Cylinder-oil Control) is the lubrication mode for MAN B&W two-stroke engines, i.e. lube oil dosing proportional to the engine load and proportional to the sulphur content in the fuel oil being burnt. The specific minimum dosage at lower-sulphur fuels is set at 0.6 g/kWh.

After a running-in period of 2,500 hours, the feed rate sulphur proportional factor is 0.20 g/kWh x S% for all engines with 60 bore and above and 0.26 g/kWh x S% for engines with 50 bore and below.

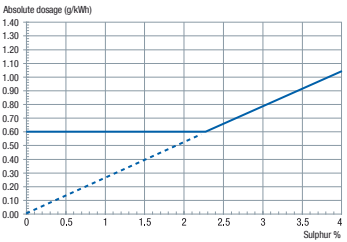
Engines with 60 Bore and above – ACC Dosage for BN70 Cylinder Oil

Based on calculations of the average worldwide sulphur content used on MAN B&W two-stroke engines, the average cylinder oil consumption will be less than 0.65 g/kWh.



Engines with 50 Bore and below – ACC Dosage for BN70 Cylinder Oil

Based on calculations of the average worldwide sulphur content used on MAN B&W two-stroke engines, the average cylinder oil consumption will be less than 0.7 g/kWh.



Further information on cylinder oil as a function of fuel oil sulphur content and alkalinity of lubricating oil is available from MAN Diesel & Turbo.

MAN B&W Low Speed Propulsion Engines

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 in order to determine the execution for the actual project.

In order to facilitate negotiations between the yard, the engine maker and the customer, a set of guiding 'Extent of Delivery' (EoD) forms is available in which MAN Diesel & Turbo's recommended basic and optional executions are specified.

Please note that licensees may select a different extent of delivery as their standard.

CEAS - Engine Room Dimensioning
The CEAS program calculates basic data essential for the design and dimensioning of a ship's engine room. CEAS is available at www.mandieselturbo.com → Products → Marine Engines & Systems → Low Speed → CEAS – Engine Room Dimensioning.

In CEAS, engine designations have the version numbers '.1', '.2', '.3' or '.4'. In this programme, K98ME7/ME-C7 refer to K98ME7.1 and K98ME-C7.1. The mechanically upgraded S80ME-C9 is named S80ME-C9.4.
All other designations refer to '.2', except ME-B engines, which refer to '.3' – e.g. G80ME-C9.2 and S50ME-B9.3.

For the G80ME-C9, the CEAS calculations can be made for the extended layout area (ref. page 10), whereas for the G50ME-B9, G45ME-B9 and G40ME-B9, CEAS calculations for the extended layout area are available on request.

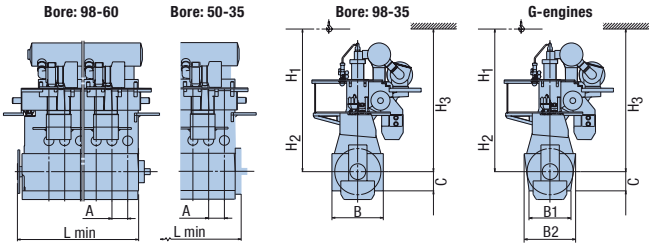
Old replaced engines from earlier versions of the engine marine programme can now be found on CEAS with the following disclaimer:

The following engines are all replaced by newer and more efficient engines. Data from the replaced engines should only be used for comparison and processing existing or repeat orders. For new projects the latest version of engine catalogue must be used.

MAN B&W Low Speed Propulsion Engines

Engine Dimensions

The minimum length L_{min} 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
H_1: Normal lifting procedure
H_2: Reduced height lifting procedure
H_3: With electric double-jib crane

Dry Masses

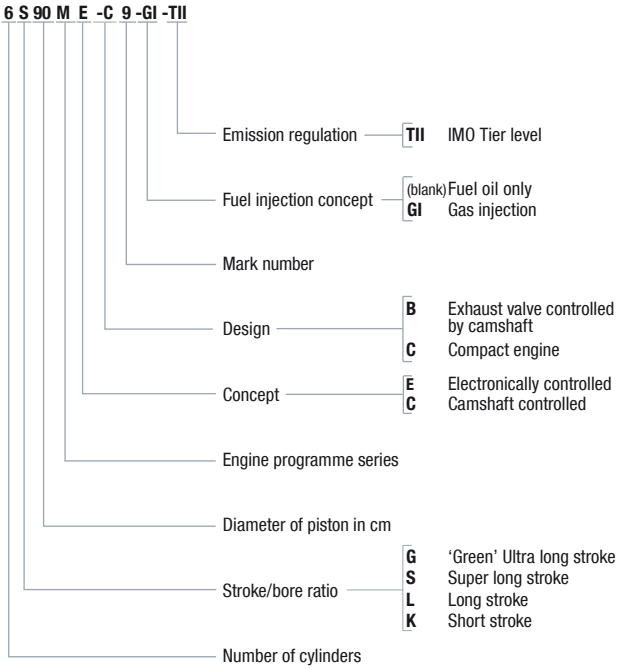
Dry masses are stated for engines with MAN turbocharger(s) and a standard turning wheel. The figures can vary up to 10% depending on the design and options chosen, e.g. moment compensators, tuning wheel, etc.

Alternative Cylinder Numbers

Engine types with 70 bore and smaller are available with 4 cylinders on request.

MAN B&W Low Speed Propulsion Engines

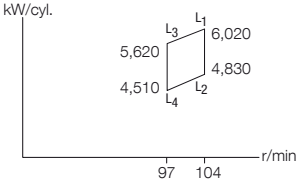
Engine Type Designation



MAN B&W K98ME-C7

Cyl.	L_1 kW
6	36,120
7	42,140
8	48,160
9	54,180
10	60,200
11	66,220
12	72,240
14	84,280

Stroke: 2,400 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 19.2 bar

SFOC optimised load range	Tuning	50%	75%	100%
Part load (50%-85%)	ECT	171.5	169.0	177.0
	EGB	169.5	168.5	175.5
Low load (25%-70%)	ECT	170.0	169.5	175.5
	EGB	167.5	169.5	175.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 15.4 bar

SFOC optimised load range	Tuning	50%	75%	100%
Part load (50%-85%)	ECT	167.5	163.0	171.0
	EGB	165.5	162.5	169.5
Low load (25%-70%)	ECT	166.0	163.5	169.5
	EGB	163.5	163.5	169.5

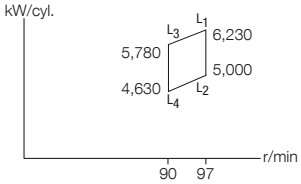
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,750	4,370	1,700	12,900	12,575	-

Cylinders:		6	7	8	9	10	11	12	14
L_{min}	mm	12,865	14,615	16,410	19,135	20,885	22,635	24,385	27,885
Dry mass	t	1,046	1,211	1,393	1,532	1,680	1,912	1,975	2,246

Cyl.	L_1 kW
6	37,380
7	43,610
8	49,840
9	56,070
10	62,300
11	68,530
12	74,760
14	87,220

Stroke: 2,660 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 19.2 bar

SFOC optimised load range	Tuning	50%	75%	100%
Part load (50%-85%)	ECT	171.5	169.0	177.0
	EGB	169.5	168.5	175.5
Low load (25%-70%)	ECT	170.0	169.5	175.5
	EGB	167.5	169.5	175.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 15.4 bar

SFOC optimis ed load range	Tuning	50%	75%	100%
Part load (50%-85%)	ECT	167.5	163.0	171.0
	EGB	165.5	162.5	169.5
Low load (25%-70%)	ECT	166.0	163.5	169.5
	EGB	163.5	163.5	169.5

Specifications

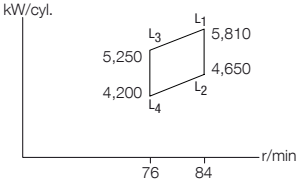
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,750	4,640	1,700	13,375	13,075	-

Cylinders:		6	7	8	9	10	11	12	14
L_{min}	mm	12,865	14,615	16,410	19,135	20,885	22,635	24,385	27,885
Dry mass	t	1,067	1,220	1,437	1,581	1,755	1,895	2,058	2,328

MAN B&W S90ME-C9

Cyl.	L_1 kW
5	29,050
6	34,860
7	40,670
8	46,480
9	52,290
10	58,100
11	63,910
12	69,720
14	81,340

Stroke: 3,260 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	164.5	162.0	166.0
Part load (50%-85%)	ECT	163.5	161.0	169.0
	VT	161.5	160.5	166.5
	EGB	161.5	160.5	167.5
Low load (25%-70%)	ECT	162.0	161.5	167.5
	VT	159.5	161.5	166.5
	EGB	159.5	161.5	167.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	160.5	156.0	160.0
Part load (50%-85%)	ECT	159.5	155.0	163.0
	VT	157.5	154.5	160.5
	EGB	157.5	154.5	161.5
Low load (25%-70%)	ECT	158.0	155.5	161.5
	VT	155.5	155.5	160.5
	EGB	155.5	155.5	161.5

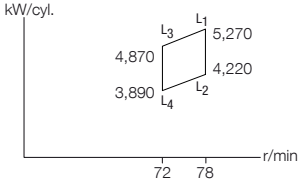
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,590	5,160	1,900	15,000	14,025	14,500

Cylinders:		5	6	7	8	9	10	11	12	14
L_{min}	mm	11,212	12,802	13,585	16,115	17,705	19,295	20,885	22,475	25,765
Dry mass	t	950	1,100	1,250	1,440	1,620	1,765	1,935	2,080	2,370

Cyl.	L_1 kW
6	31,620
7	36,890
8	42,160
9	47,430

Stroke: 3,188 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	166.5	164.0	168.0
Part load (50%-85%)	ECT	165.5	163.0	171.0
	VT	163.5	162.5	168.5
	EGB	163.5	162.5	169.5
Low load (25%-70%)	ECT	164.0	163.5	169.5
	VT	161.5	163.5	168.5
	EGB	161.5	163.5	169.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	162.5	158.0	162.0
Part load (50%-85%)	ECT	161.5	157.0	165.0
	VT	159.5	156.5	162.5
	EGB	159.5	156.5	163.5
Low load (25%-70%)	ECT	160.0	157.5	163.5
	VT	157.5	157.5	162.5
	EGB	157.5	157.5	163.5

Specifications

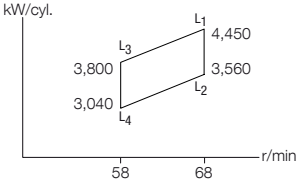
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,602	5,000	1,800	14,500	13,650	14,100

Cylinders:		6	7	8	9
L_{min}	mm	12,802	14,404	16,006	17,608
Dry mass	t	1,010	1,136	1,290	1,450

MAN B&W G80ME-C9

Cyl.	L_1 kW
6	26,700
7	31,150
8	35,600
9	40,050

Stroke: 3,720 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 21.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	164.5	162.0	166.0
Part load (50%-85%)	ECT	163.5	161.0	169.0
	VT	161.5	160.5	166.5
	EGB	161.5	160.5	167.5
Low load (25%-70%)	ECT	162.0	161.5	167.5
	VT	159.5	161.5	166.5
	EGB	159.5	161.5	167.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.8 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	160.5	156.0	160.0
Part load (50%-85%)	ECT	159.5	155.0	163.0
	VT	157.5	154.5	160.5
	EGB	157.5	154.5	161.5
Low load (25%-70%)	ECT	158.0	155.5	161.5
	VT	155.5	155.5	160.5
	EGB	155.5	155.5	161.5

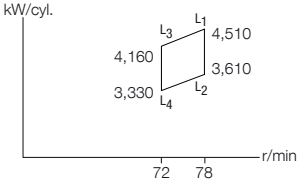
Specifications

Dimensions:		A	B1	B2	C	H_1	H_2	H_3
	mm	1,400	5,320	5,320	1,960	16,100	14,775	14,525

Cylinders:		6	7	8	9
L_{min}	mm	10,735	12,135	13,535	14,935
Dry mass	t	945	1,055	1,175	1,285

Cyl.	L_1 kW
6	27,060
7	31,570
8	36,080
9	40,590

Stroke: 3,450 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	164.5	162.0	166.0
Part load (50%-85%)	ECT	163.5	161.0	169.0
	VT	161.5	160.5	166.5
	EGB	161.5	160.5	167.5
Low load (25%-70%)	ECT	162.0	161.5	167.5
	VT	159.5	161.5	166.5
	EGB	159.5	161.5	167.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	160.5	156.0	160.0
Part load (50%-85%)	ECT	159.5	155.0	163.0
	VT	157.5	154.5	160.5
	EGB	157.5	154.5	161.5
Low load (25%-70%)	ECT	158.0	155.5	161.5
	VT	155.5	155.5	160.5
	EGB	155.5	155.5	161.5

Specifications

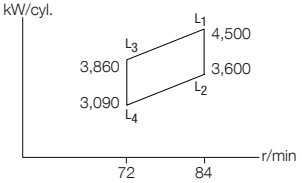
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,334	5,280	1,890	15,050	13,925	13,500

Cylinders:		6	7	8	9
L_{min}	mm	10,100	11,434	12,768	14,102
Dry mass	t	833	933	1,043	1,153

MAN B&W S80ME-C8

Cyl.	L_1 kW
6	27,000
7	31,500
8	36,000

Stroke: 3,200 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	166.5	164.0	168.0
Part load (50%-85%)	ECT	165.5	163.0	171.0
	VT	163.5	162.5	168.5
	EGB	163.5	162.5	169.5
Low load (25%-70%)	ECT	164.0	163.5	169.5
	VT	161.5	163.5	168.5
	EGB	161.5	163.5	169.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	162.5	158.0	162.0
Part load (50%-85%)	ECT	161.5	157.0	165.0
	VT	159.5	156.5	162.5
	EGB	159.5	156.5	163.5
Low load (25%-70%)	ECT	160.0	157.5	163.5
	VT	157.5	157.5	162.5
	EGB	157.5	157.5	163.5

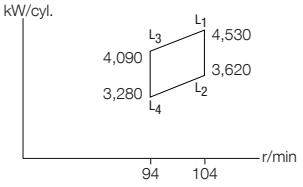
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,424	5,000	1,736	14,325	13,175	12,950

Cylinders:		6	7	8
L_{min}	mm	11,431	12,066	13,490
Dry mass	t	820	922	1,023

Cyl.	L_1 kW
6	27,180
7	31,710
8	36,240
9	40,770
10	45,300
11	49,830
12	54,360

Stroke: 2,600 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	170.5	168.0	172.0
Part load (50%-85%)	ECT	169.5	167.0	175.0
	VT	167.5	166.5	172.5
	EGB	167.5	166.5	173.5
Low load (25%-70%)	ECT	168.0	167.5	173.5
	VT	165.5	167.5	172.5
	EGB	165.5	167.5	173.5

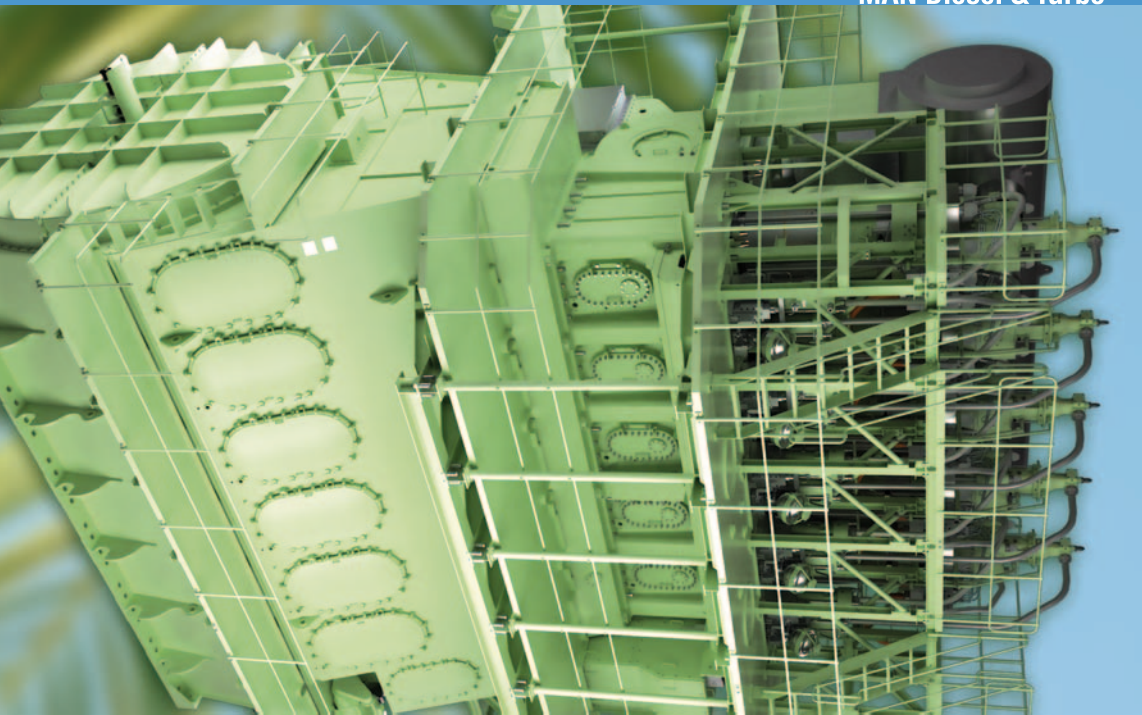
SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	166.5	162.0	166.0
Part load (50%-85%)	ECT	165.5	161.0	169.0
	VT	163.5	160.5	166.5
	EGB	163.5	160.5	167.5
Low load (25%-70%)	ECT	164.0	161.5	167.5
	VT	161.5	161.5	166.5
	EGB	161.5	161.5	167.5

Specifications

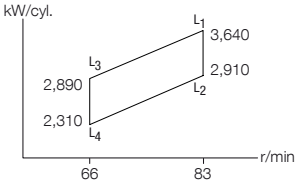
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,334	4,400	1,650	12,400	11,825	11,675

Cylinders:		6	7	8	9	10	11	12
L_{min}	mm	10,100	11,434	12,768	14,102	16,676	18,010	19,344
Dry mass	t	705	790	890	985	1,130	1,220	1,315



Cyl.	L_1 kW
5	18,200
6	21,840
7	25,480
8	29,120

Stroke: 3,256 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 21.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	165.5	163.0	167.0
Part load (50%-85%)	ECT	164.5	162.0	170.0
	VT	162.5	161.5	167.5
	EGB	162.5	161.5	168.5
Low load (25%-70%)	ECT	163.0	162.5	168.5
	VT	160.5	162.5	167.5
	EGB	160.5	162.5	168.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.8 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	161.5	157.0	161.0
Part load (50%-85%)	ECT	160.5	156.0	164.0
	VT	158.5	155.5	161.5
	EGB	158.5	155.5	162.5
Low load (25%-70%)	ECT	159.0	156.5	162.5
	VT	156.5	156.5	161.5
	EGB	156.5	156.5	162.5

Specifications

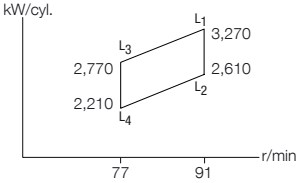
Dimensions:		A	B1	B2	C	H_1	H_2	H_3
	mm	1,260	4,760	4,900	1,750	14,225	13,250	12,800

Cylinders:		5	6	7	8
L_{min}	mm	8,290	9,350	10,610	11,870
Dry mass	t	550	642	728	822

MAN B&W S70ME-C8

Cyl.	L_1 kW
5	16,350
6	19,620
7	22,890
8	26,160

Stroke: 2,800 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	167.5	165.0	169.0
Part load (50%-85%)	ECT	166.5	164.0	172.0
	VT	164.5	163.5	169.5
	EGB	164.5	163.5	170.5
Low load (25%-70%)	ECT	165.0	164.5	170.5
	VT	162.5	164.5	169.5
	EGB	162.5	164.5	170.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	163.5	159.0	163.0
Part load (50%-85%)	ECT	162.5	158.0	166.0
	VT	160.5	157.5	163.5
	EGB	160.5	157.5	164.5
Low load (25%-70%)	ECT	161.0	158.5	164.5
	VT	158.5	158.5	163.5
	EGB	158.5	158.5	164.5

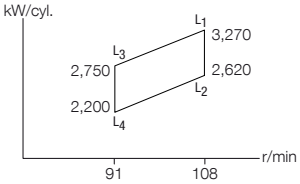
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,190	4,390	1,520	12,550	11,725	11,500

Cylinders:		5	6	7	8
L_{min}	mm	7,514	8,704	9,894	11,084
Dry mass	t	451	534	605	681

Cyl.	L_1 kW
5	16,350
6	19,620
7	22,890
8	26,160

Stroke: 2,360 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	168.5	166.0	170.0
Part load (50%-85%)	ECT	167.5	165.0	173.0
	VT	165.5	164.5	170.5
	EGB	165.5	164.5	171.5
Low load (25%-70%)	ECT	166.0	165.5	171.5
	VT	163.5	165.5	170.5
	EGB	163.5	165.5	171.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	164.5	160.0	164.0
Part load (50%-85%)	ECT	163.5	159.0	167.0
	VT	161.5	158.5	164.5
	EGB	161.5	158.5	165.5
Low load (25%-70%)	ECT	162.0	159.5	165.5
	VT	159.5	159.5	164.5
	EGB	159.5	159.5	165.5

Specifications

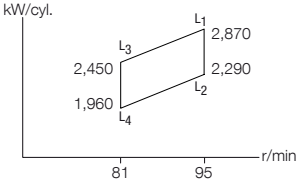
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,190	3,980	1,262	11,250	10,650	10,625

Cylinders:		5	6	7	8
L_{min}	mm	7,639	8,829	10,019	11,209
Dry mass	t	437	506	569	642

MAN B&W S65ME-C8

Cyl.	L_1 kW
5	14,350
6	17,220
7	20,090
8	22,960

Stroke: 2,730 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	167.5	165.0	169.0
Part load (50%-85%)	ECT	166.5	164.0	172.0
	VT	164.5	163.5	169.5
	EGB	164.5	163.5	170.5
Low load (25%-70%)	ECT	165.0	164.5	170.5
	VT	162.5	164.5	169.5
	EGB	162.5	164.5	170.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	163.5	159.0	163.0
Part load (50%-85%)	ECT	162.5	158.0	166.0
	VT	160.5	157.5	163.5
	EGB	160.5	157.5	164.5
Low load (25%-70%)	ECT	161.0	158.5	164.5
	VT	158.5	158.5	163.5
	EGB	158.5	158.5	164.5

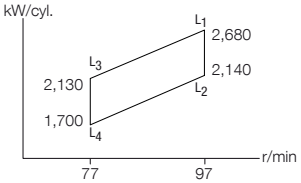
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,084	4,124	1,410	11,950	11,225	11,025

Cylinders:		5	6	7	8
L_{min}	mm	6,914	7,998	9,062	10,138
Dry mass	t	382	451	512	575

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

Stroke: 2,790 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 21.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	165.5	163.0	167.0
Part load (50%-85%)	ECT	164.5	162.0	170.0
	VT	162.5	161.5	167.5
	EGB	162.5	161.5	168.5
Low load (25%-70%)	ECT	163.0	162.5	168.5
	VT	160.5	162.5	167.5
	EGB	160.5	162.5	168.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.8 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	161.5	157.0	161.0
Part load (50%-85%)	ECT	160.5	156.0	164.0
	VT	158.5	155.5	161.5
	EGB	158.5	155.5	162.5
Low load (25%-70%)	ECT	159.0	156.5	162.5
	VT	156.5	156.5	161.5
	EGB	156.5	156.5	162.5

Specifications

Dimensions:		A	B1	B2	C	H_1	H_2	H_3
	mm	1,080	4,090	4,220	1,500	12,425	*	*

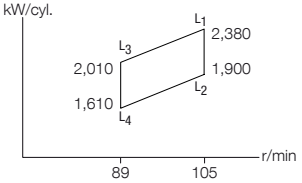
Cylinders:		5	6	7	8
L_{min}	mm	8,000	9,080	9,360	10,440
Dry mass	t	387	439	491	543

** Data is available on request*

MAN B&W S60ME-B8

Cyl.	L_1 kW
5	11,900
6	14,280
7	16,660
8	19,040

Stroke: 2,400 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	167.5	165.0	168.0
Part load (50%-85%)	ECT	166.5	164.0	171.0
	VT	164.5	163.5	168.5
	EGB	164.5	163.5	169.5
Low load (25%-70%)	ECT	165.0	164.5	169.5
	VT	162.5	164.5	168.5
	EGB	162.5	164.5	169.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	163.5	159.5	162.0
Part load (50%-85%)	ECT	162.5	158.5	165.0
	VT	160.5	158.0	162.5
	EGB	160.5	158.0	163.5
Low load (25%-70%)	ECT	161.0	159.0	163.5
	VT	158.5	159.0	162.5
	EGB	158.5	159.0	163.5

The SFOC excludes 1 g/kWh for the consumption of the electric HPS

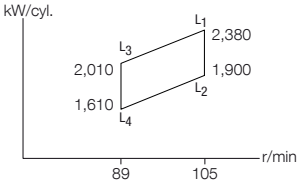
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,020	3,770	1,300	10,800	10,000	9,775

Cylinders:		5	6	7	8
L_{min}	mm	6,439	7,459	8,479	9,499
Dry mass	t	Not yet available			

Cyl.	L_1 kW
5	11,900
6	14,280
7	16,660
8	19,040

Stroke: 2,400 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	167.5	165.0	169.0
Part load (50%-85%)	ECT	166.5	164.0	172.0
	VT	164.5	163.5	169.5
	EGB	164.5	163.5	170.5
Low load (25%-70%)	ECT	165.0	164.5	170.5
	VT	162.5	164.5	169.5
	EGB	162.5	164.5	170.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	163.5	159.0	163.0
Part load (50%-85%)	ECT	162.5	158.0	166.0
	VT	160.5	157.5	163.5
	EGB	160.5	157.5	164.5
Low load (25%-70%)	ECT	161.0	158.5	164.5
	VT	158.5	158.5	163.5
	EGB	158.5	158.5	164.5

Specifications

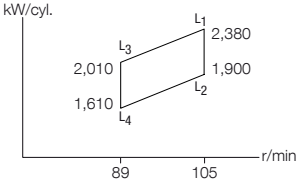
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,020	3,770	1,300	10,800	10,000	9,775

Cylinders:		5	6	7	8
L_{min}	mm	6,439	7,459	8,479	9,499
Dry mass	t	308	350	393	452

MAN B&W S60MC-C8

Cyl.	L_1 kW
5	11,900
6	14,280
7	16,660
8	19,040

Stroke: 2,400 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	174.0	169.0	172.0
Part load (50%-85%)	VT	172.0	167.5	174.0
	EGB	172.0	167.5	175.0
Low load (25%-70%)	VT	171.0	168.5	173.0
	EGB	171.0	168.5	174.0

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	170.0	163.5	166.0
Part load (50%-85%)	VT	168.0	162.0	168.0
	EGB	168.0	162.0	169.0
Low load (25%-70%)	VT	167.0	163.0	167.0
	EGB	167.0	163.0	168.0

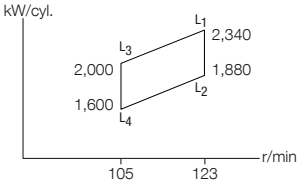
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,020	3,770	1,300	10,775	10,025	9,775

Cylinders:		5	6	7	8
L_{min}	mm	6,439	7,459	8,479	9,499
Dry mass	t	324	368	410	467

Cyl.	L_1 kW
5	11,700
6	14,040
7	16,380
8	18,720
9	21,060

Stroke: 2,022 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	168.5	166.0	170.0
Part load (50%-85%)	ECT	167.5	165.0	173.0
	VT	165.5	164.5	170.5
	EGB	165.5	164.5	171.5
Low load (25%-70%)	ECT	166.0	165.5	171.5
	VT	163.5	165.5	170.5
	EGB	163.5	165.5	171.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	164.5	160.0	164.0
Part load (50%-85%)	ECT	163.5	159.0	167.0
	VT	161.5	158.5	164.5
	EGB	161.5	158.5	165.5
Low load (25%-70%)	ECT	162.0	159.5	165.5
	VT	159.5	159.5	164.5
	EGB	159.5	159.5	165.5

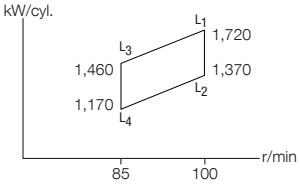
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,020	3,490	1,134	9,650	9,125	8,925

Cylinders:		5	6	7	8	9
L_{min}	mm	6,439	7,459	8,479	9,499	10,519
Dry mass	t	286	326	354	426	479

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

Stroke: 2,500 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 21.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	166.5	164.0	167.0
Part load (50%-85%)	ECT	165.5	163.0	170.0
	VT	163.5	162.5	167.5
	EGB	163.5	162.5	168.5
Low load (25%-70%)	ECT	164.0	163.5	168.5
	VT	161.5	163.5	167.5
	EGB	161.5	163.5	168.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.8 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	162.5	158.5	161.0
Part load (50%-85%)	ECT	161.5	157.5	164.0
	VT	159.5	157.0	161.5
	EGB	159.5	157.0	162.5
Low load (25%-70%)	ECT	160.0	158.0	162.5
	VT	157.5	158.0	161.5
	EGB	157.5	158.0	162.5

The SFOC excludes 1 g/kWh for the consumption of the electric HPS

Specifications

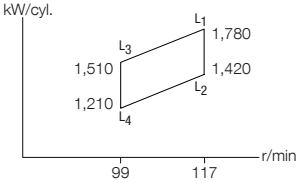
Dimensions:		A	B1	B2	C	H_1	H_2	H_3
	mm	894	3,896	3,672	1,205	10,525	10,400	10,150

Cylinders:		5	6	7	8	9
L_{min}	mm	6,325	7,200	8,075	8,950	9,825
Dry mass	t	225	260	295	330	365

MAN B&W S50ME-B9

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

Stroke: 2,214 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 21.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	167.5	165.0	168.0
Part load (50%-85%)	ECT	166.5	164.0	171.0
	VT	164.5	163.5	168.5
	EGB	164.5	163.5	169.5
Low load (25%-70%)	ECT	165.0	164.5	169.5
	VT	162.5	164.5	168.5
	EGB	162.5	164.5	169.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.8 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	163.5	159.5	162.0
Part load (50%-85%)	ECT	162.5	158.5	165.0
	VT	160.5	158.0	162.5
	EGB	160.5	158.0	163.5
Low load (25%-70%)	ECT	161.0	159.0	163.5
	VT	158.5	159.0	162.5
	EGB	158.5	159.0	163.5

The SFOC excludes 1 g/kWh for the consumption of the electric HPS

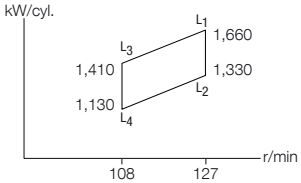
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	875	3,290	1,185	9,775	9,200	8,900

Cylinders:		5	6	7	8	9
L_{min}	mm	6,073	6,948	7,823	8,698	9,573
Dry mass	t	194	225	257	289	321

Cyl.	L_1 kW
5	8,300
6	9,960
7	11,620
8	13,280
9	14,940

Stroke: 2,000 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	168.5	166.0	169.0
Part load (50%-85%)	ECT	167.5	165.0	172.0
	VT	165.5	164.5	169.5
	EGB	165.5	164.5	170.5
Low load (25%-70%)	ECT	166.0	165.5	170.5
	VT	163.5	165.5	169.5
	EGB	163.5	165.5	170.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	164.5	160.5	163.0
Part load (50%-85%)	ECT	163.5	159.5	166.0
	VT	161.5	159.0	163.5
	EGB	161.5	159.0	164.5
Low load (25%-70%)	ECT	162.0	160.0	164.5
	VT	159.5	160.0	163.5
	EGB	159.5	160.0	164.5

The SFOC excludes 1 g/kWh for the consumption of the electric HPS

Specifications

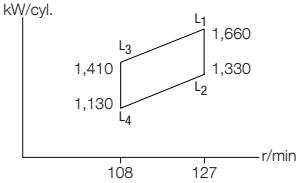
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	850	3,150	1,088	9,050	8,500	8,250

Cylinders:		5	6	7	8	9
L_{min}	mm	5,924	6,774	7,624	8,474	9,324
Dry mass	t	189	215	241	276	314

MAN B&W S50ME-C8

Cyl.	L_1 kW
5	8,300
6	9,960
7	11,620
8	13,280
9	14,940

Stroke: 2,000 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	168.5	166.0	170.0
Part load (50%-85%)	ECT	167.5	165.0	173.0
	VT	165.5	164.5	170.5
	EGB	165.5	164.5	171.5
Low load (25%-70%)	ECT	166.0	165.5	171.5
	VT	163.5	165.5	170.5
	EGB	163.5	165.5	171.5

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	164.5	160.0	164.0
Part load (50%-85%)	ECT	163.5	159.0	167.0
	VT	161.5	158.5	164.5
	EGB	161.5	158.5	165.5
Low load (25%-70%)	ECT	162.0	159.5	165.5
	VT	159.5	159.5	164.5
	EGB	159.5	159.5	165.5

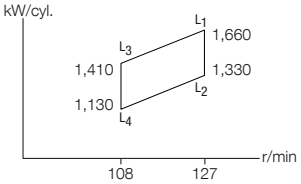
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	850	3,150	1,085	9,050	8,500	8,250

Cylinders:		5	6	7	8	9
L_{min}	mm	5,924	6,774	7,624	8,474	9,324
Dry mass	t	180	211	241	271	293

Cyl.	L_1 kW
5	8,300
6	9,960
7	11,620
8	13,280
9	14,940

Stroke: 2,000 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	175.0	170.0	173.0
Part load (50%-85%)	VT	173.0	168.5	175.0
	EGB	173.0	168.5	176.0
Low load (25%-70%)	VT	172.0	169.5	174.0
	EGB	172.0	169.5	175.0

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	171.0	164.5	167.0
Part load (50%-85%)	VT	169.0	163.0	169.0
	EGB	169.0	163.0	170.0
Low load (25%-70%)	VT	168.0	164.0	168.0
	EGB	168.0	164.0	169.0

Specifications

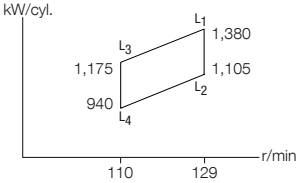
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	850	3,150	1,085	9,000	8,475	8,250

Cylinders:		5	6	7	8	9
L_{min}	mm	5,924	6,774	7,624	8,474	9,324
Dry mass	t	186	212	238	273	311

MAN B&W S46ME-B8

Cyl.	L_1 kW
5	6,900
6	8,280
7	9,660
8	11,040

Stroke: 1,932 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	169.5	167.0	170.0

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	165.5	163.0	166.0

The SFOC excludes 1 g/kWh for the consumption of the electric HPS

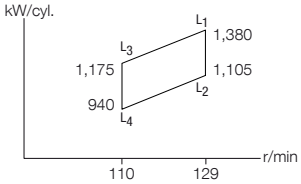
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	782	2,924	986	9,000	8,175	7,900

Cylinders:		5	6	7	8
L_{min}	mm	5,528	6,310	7,092	7,874
Dry mass	t	159	177	199	219

Cyl.	L_1 kW
5	6,900
6	8,280
7	9,660
8	11,040

Stroke: 1,932 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 20.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	177.0	172.0	174.0

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	173.0	168.0	170.0

Specifications

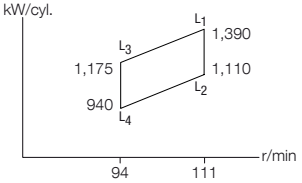
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	782	2,924	986	9,000	8,175	7,900

Cylinders:		5	6	7	8
L_{min}	mm	5,528	6,310	7,092	7,874
Dry mass	t	157	175	197	217

MAN B&W G45ME-B9

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

Stroke: 2,250 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 21.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	168.5	166.0	169.0

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.8 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	164.5	162.0	165.0

The SFOC excludes 1 g/kWh for the consumption of the electric HPS

Specifications

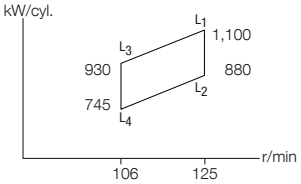
Dimensions:		A	B1	B2	C	H_1	H_2	H_3
	mm	826	3,506	3,306	1,085	9,900	*	*

Cylinders:		5	6	7	8	9
L_{min}	mm	5,680	6,506	7,332	8,158	8,984
Dry mass	t	164	190	216	242	268

** Data is available on request*

Cyl.	L_1 kW
5	5,500
6	6,600
7	7,700
8	8,800

Stroke: 2,000 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 21.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	173.5	171.0	174.0

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.8 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	169.5	167.0	170.0

The SFOC excludes 1 g/kWh for the consumption of the electric HPS

Specifications

Dimensions:		A	B1	B2	C	H_1	H_2	H_3
	mm	716	3,118	2,938	964	8,550	*	*

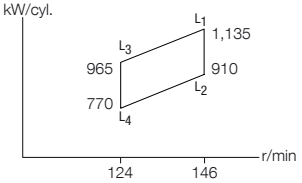
Cylinders:		5	6	7	8	9
L_{min}	mm	5,060	5,775	6,490	7,205	7,920
Dry mass	t	121	140	159	178	197

** Data is available on request*

MAN B&W S40ME-B9

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

Stroke: 1,770 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 21.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	173.5	171.0	174.0

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.8 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	169.5	167.0	170.0

The SFOC excludes 1 g/kWh for the consumption of the electric HPS

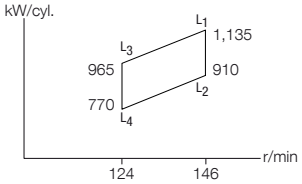
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	700	2,590	950	7,800	7,475	7,200

Cylinders:		5	6	7	8
L_{min}	mm	5,000	5,700	6,400	7,100
Dry mass	t	112	131	148	163

Cyl,	L_1 kW
5	5,675
6	6,810
7	7,945
8	9,080

Stroke: 1,770 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 21.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	180.0	175.0	177.0

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.8 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	176.0	171.0	173.0

Specifications

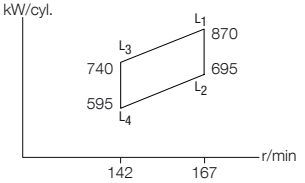
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	700	2,590	950	7,800	7,475	7,200

Cylinders:		5	6	7	8
L_{min}	mm	5,000	5,700	6,400	7,100
Dry mass	t	112	131	148	163

MAN B&W S35ME-B9

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

Stroke: 1,550 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 21.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	174.5	172.0	175.0

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.8 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	170.5	168.0	171.0

The SFOC excludes 1 g/kWh for the consumption of the electric HPS

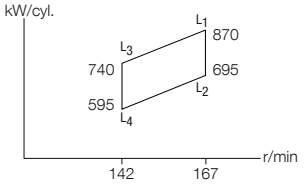
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	612	2,265	830	6,875	6,700	6,325

Cylinders:		5	6	7	8
L_{min}	mm	4,378	4,990	5,602	6,214
Dry mass	t	81	90	99	111

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

Stroke: 1,550 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 21.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	181.0	176.0	178.0

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.8 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	177.0	172.0	174.0

Specifications

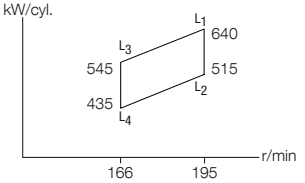
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	612	2,265	830	6,875	6,700	6,325

Cylinders:		5	6	7	8
L_{min}	mm	4,378	4,990	5,602	6,214
Dry mass	t	81	90	99	111

MAN B&W S30ME-B9

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

Stroke: 1,328 mm



SFOC for engines with layout on L_1 - L_3 line [g/kWh] **L_1/L_3 MEP:** 21.0 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	175.5	173.0	176.0

SFOC for engines with layout on L_2 - L_4 line [g/kWh] **L_2/L_4 MEP:** 16.8 bar

SFOC optimised load range	Tuning	50%	75%	100%
High load (85%-100%)	-	171.5	169.0	172.0

The SFOC excludes 1 g/kWh for the consumption of the electric HPS

Specifications

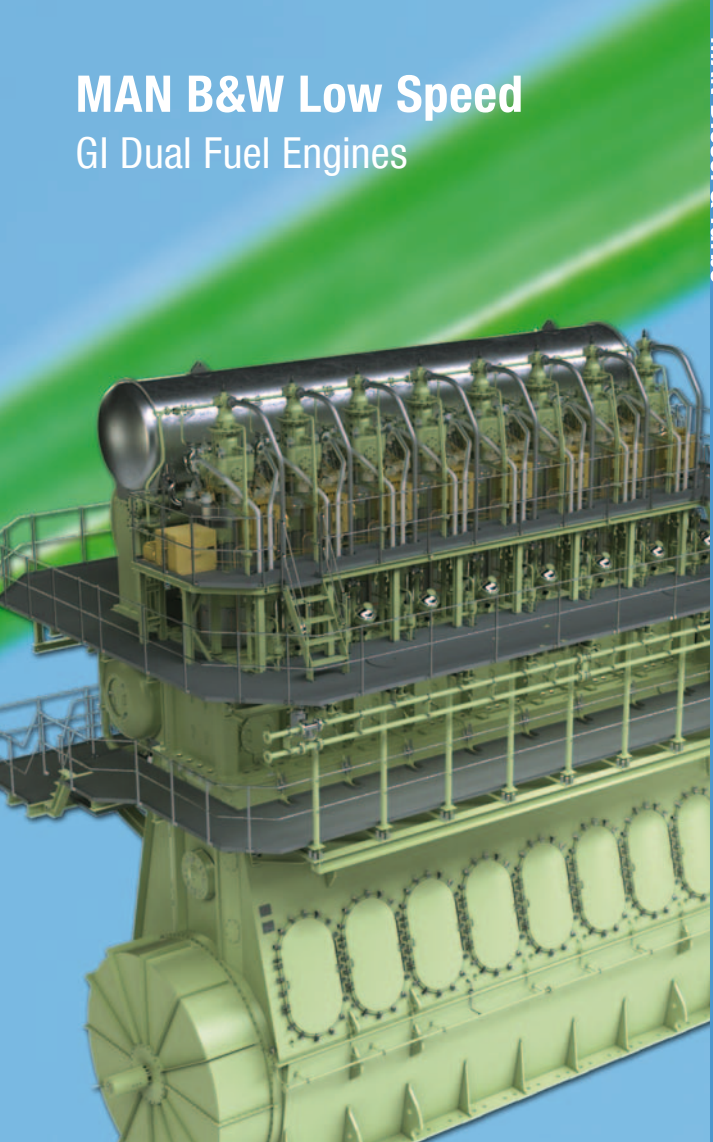
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	525	1,942	712	6,000	*	*

Cylinders:		5	6	7	8
L_{min}	mm	3,765	4,290	4,815	5,340
Dry mass	t	48	55	62	69

** Data is available on request*

MAN B&W Low Speed

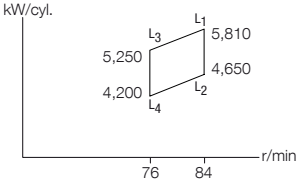
GI Dual Fuel Engines



MAN B&W S90ME-C9-GI

Cyl.	L_1 kW
5	29,050
6	34,860
7	40,670
8	46,480
9	52,290
10	58,100
11	63,910
12	69,720
14	81,340

Stroke: 3,260 mm



SFOC gas engines [g/kWh] **L_1/L_3 MEP:** 20.0 bar – **L_2/L_4 MEP:** 16.0 bar

		50%	75%	100%
Gas fuel	L_1	161.5	159.0	165.0
	L_2	157.5	153.0	159.0
	L_3	161.5	159.5	165.0
	L_4	157.5	153.5	159.0
Liquid fuel	L_1/ L_3	164.5	162.0	166.0
	L_2/ L_4	160.5	156.0	160.0

Specific gas consumption consists of 5% pilot liquid fuel and gas fuel.
Gas fuel LCV (50000 kJ/kg) is converted to diesel fuel LCV (42,700 kJ/kg) for comparison.

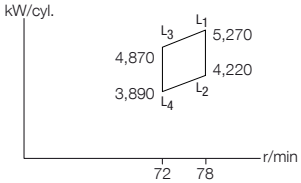
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,590	5,160	1,900	15,000	14,025	14,500

Cylinders:		5	6	7	8	9	10	11	12	14
L_{min}	mm	11,212	12,802	13,585	16,115	17,705	19,295	20,885	22,475	25,765
Dry mass	t	950	1,100	1,250	1,440	1,620	1,765	1,935	2,080	2,370

Cyl.	L_1 kW
6	31,620
7	36,890
8	42,160
9	47,430

Stroke: 3,188 mm



SFOC gas engines [g/kWh] **L_1/L_3 MEP:** 20.0 bar – **L_2/L_4 MEP:** 16.0 bar

		50%	75%	100%
Gas fuel	L_1	162.5	160.0	167.0
	L_2	158.5	154.0	161.0
	L_3	163.0	161.5	167.0
	L_4	159.0	155.5	161.0
Liquid fuel	L_1/L_3	166.5	164.0	168.0
	L_2/L_4	162.5	158.0	162.0

Specific gas consumption consists of 5% pilot liquid fuel and gas fuel.
Gas fuel LCV (50000 kJ/kg) is converted to diesel fuel LCV (42,700 kJ/kg) for comparison.

Specifications

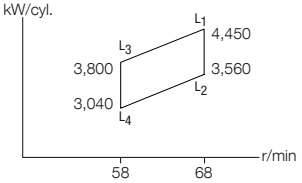
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,602	5,000	1,800	14,500	13,650	14,100

Cylinders:		6	7	8	9
L_{min}	mm	12,802	14,404	16,006	17,608
Dry mass	t	1,010	1,136	1,290	1,450

MAN B&W G80ME-C9-GI

Cyl.	L_1 kW
6	26,700
7	31,150
8	35,600
9	40,050

Stroke: 3,720 mm



SFOC gas engines [g/kWh] **L_1/L_3 MEP:** 21.0 bar – **L_2/L_4 MEP:** 16.8 bar

		50%	75%	100%
Gas fuel	L_1	160.5	158.0	165.0
	L_2	156.5	152.0	159.0
	L_3	161.0	159.5	165.0
	L_4	157.0	153.5	159.0
Liquid fuel	L_1/ L_3	164.5	162.0	166.0
	L_2/ L_4	160.5	156.0	160.0

Specific gas consumption consists of 5% pilot liquid fuel and gas fuel.
Gas fuel LCV (50000 kJ/kg) is converted to diesel fuel LCV (42,700 kJ/kg) for comparison.

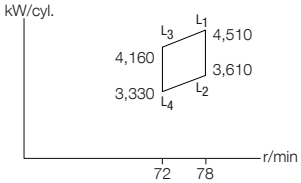
Specifications

Dimensions:		A	B1	B2	C	H_1	H_2	H_3
	mm	1,400	5,320	5,320	1,960	16,100	14,775	14,525

Cylinders:		6	7	8	9
L_{min}	mm	10,735	12,135	13,535	14,935
Dry mass	t	945	1,055	1,175	1,285

Cyl.	L_1 kW
6	27,060
7	31,570
8	36,080
9	40,590

Stroke: 3,450 mm



SFOC gas engines [g/kWh] **L_1/L_3 MEP:** 20.0 bar – **L_2/L_4 MEP:** 16.0 bar

		50%	75%	100%
Gas fuel	L_1	158.5	158.0	165.0
	L_2	154.5	152.0	159.0
	L_3	161.0	159.5	165.0
	L_4	157.0	153.5	159.0
Liquid fuel	L_1/ L_3	164.5	162.0	166.0
	L_2/ L_4	160.5	156.0	160.0

Specific gas consumption consist of 5% pilot liquid fuel and gas fuel
Gas fuel LCV (50,000 kJ/kg) is converted to diesel fuel LCV (42,700 kJ/kg) for comparison

Specifications

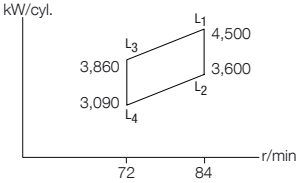
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,334	5,280	1,890	15,050	13,925	13,500

Cylinders:		6	7	8	9
L_{min}	mm	10,100	11,434	12,768	14,102
Dry mass	t	833	933	1,043	1,153

MAN B&W S80ME-C8-GI

Cyl.	L_1 kW
6	27,000
7	31,500
8	36,000

Stroke: 3,200 mm



SFOC gas engines [g/kWh] **L_1/L_3 MEP:** 20.0 bar – **L_2/L_4 MEP:** 16.0 bar

		50%	75%	100%
Gas fuel	L_1	160.5	160.0	167.0
	L_2	156.5	154.0	161.0
	L_3	163.0	161.5	167.0
	L_4	159.0	155.5	161.0
Liquid fuel	L_1/ L_3	166.5	164.0	168.0
	L_2/ L_4	162.5	158.0	162.0

Specific gas consumption consist of 5% pilot liquid fuel and gas fuel
Gas fuel LCV (50,000 kJ/kg) is converted to diesel fuel LCV (42,700 kJ/kg) for comparison

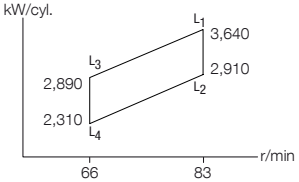
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,424	5,000	1,736	14,325	13,175	12,950

Cylinders:		6	7	8
L_{min}	mm	11,431	12,066	13,490
Dry mass	t	820	922	1,023

Cyl.	L_1 kW
5	18,200
6	21,840
7	25,480
8	29,120

Stroke: 3,256 mm



SFOC gas engines [g/kWh] **L_1/L_3 MEP:** 21.0 bar – **L_2/L_4 MEP:** 16.8 bar

		50%	75%	100%
Gas fuel	L_1	161.5	159.0	166.0
	L_2	157.5	153.0	160.0
	L_3	162.0	160.5	166.0
	L_4	158.0	154.5	160.0
Liquid fuel	L_1/L_3	165.5	163.0	167.0
	L_2/L_4	161.5	157.0	161.0

Specific gas consumption consist of 5% pilot liquid fuel and gas fuel
Gas fuel LCV (50,000 kJ/kg) is converted to diesel fuel LCV (42,700 kJ/kg) for comparison

Specifications

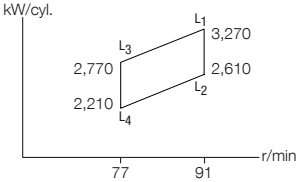
Dimensions:		A	B1	B2	C	H_1	H_2	H_3
	mm	1,260	4,760	4,900	1,750	14,225	13,250	12,800

Cylinders:		5	6	7	8
L_{min}	mm	8,290	9,350	10,610	11,870
Dry mass	t	550	642	728	822

MAN B&W S70ME-C8-GI

Cyl.	L_1 kW
5	16,350
6	19,620
7	22,890
8	26,160

Stroke: 2,800 mm



SFOC gas engines [g/kWh] **L_1/L_3 MEP:** 20.0 bar – **L_2/L_4 MEP:** 16.0 bar

		50%	75%	100%
Gas fuel	L_1	161.5	161.0	168.0
	L_2	157.5	155.0	162.0
	L_3	164.0	162.5	168.0
	L_4	160.0	156.5	162.0
Liquid fuel	L_1/ L_3	167.5	165.0	169.0
	L_2/ L_4	163.5	159.0	163.0

Specific gas consumption consist of 5% pilot liquid fuel and gas fuel
Gas fuel LCV (50,000 kJ/kg) is converted to diesel fuel LCV (42,700 kJ/kg) for comparison

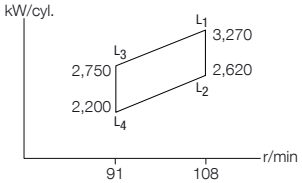
Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,190	4,390	1,520	12,550	11,725	11,500

Cylinders:		5	6	7	8
L_{min}	mm	7,514	8,704	9,894	11,084
Dry mass	t	451	534	605	681

Cyl.	L_1 kW
5	16,350
6	19,620
7	22,890
8	26,160

Stroke: 2,360 mm



SFOC gas engines [g/kWh] **L_1/L_3 MEP:** 20.0 bar – **L_2/L_4 MEP:** 16.0 bar

		50%	75%	100%
Gas fuel	L_1	162.5	162.0	169.0
	L_2	158.5	156.0	163.0
	L_3	165.0	163.5	169.0
	L_4	161.0	157.5	163.0
Liquid fuel	L_1/L_3	168.5	166.0	170.0
	L_2/L_4	164.5	160.0	164.0

Specific gas consumption consist of 5% pilot liquid fuel and gas fuel
Gas fuel LCV (50,000 kJ/kg) is converted to diesel fuel LCV (42,700 kJ/kg) for comparison

Specifications

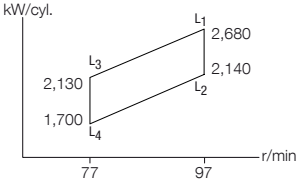
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,190	3,980	1,262	11,250	10,650	10,625

Cylinders:		5	6	7	8
L_{min}	mm	7,639	8,829	10,019	11,209
Dry mass	t	437	506	569	642

MAN B&W G60ME-C9-GI

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

Stroke: 2,790 mm



SFOC gas engines [g/kWh] **L_1/L_3 MEP:** 21.0 bar – **L_2/L_4 MEP:** 16.8 bar

		50%	75%	100%
Gas fuel	L_1	161.5	159.0	166.0
	L_2	157.5	153.0	160.0
	L_3	162.0	160.5	166.0
	L_4	158.0	154.5	160.0
Liquid fuel	L_1/ L_3	165.5	163.0	167.0
	L_2/ L_4	161.5	157.0	161.0

Specific gas consumption consist of 5% pilot liquid fuel and gas fuel
Gas fuel LCV (50,000 kJ/kg) is converted to diesel fuel LCV (42,700 kJ/kg) for comparison

Specifications

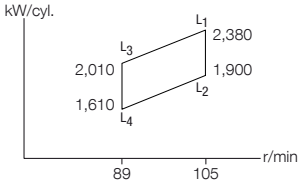
Dimensions:		A	B1	B2	C	H_1	H_2	H_3
	mm	1,080	4,090	4,220	1,500	12,425	*	*

Cylinders:		5	6	7	8
L_{min}	mm	8,000	9,080	9,360	10,440
Dry mass	t	387	439	491	543

** Data is available on request*

Cyl.	L_1 kW
5	11,900
6	14,280
7	16,660
8	19,040

Stroke: 2,400 mm



SFOC gas engines [g/kWh] **L_1/L_3 MEP:** 20.0 bar – **L_2/L_4 MEP:** 16.0 bar

		50%	75%	100%
Gas fuel	L_1	164.5	162.0	168.0
	L_2	160.5	156.0	162.0
	L_3	164.5	162.5	168.0
	L_4	160.5	156.5	162.0
Liquid fuel	L_1/L_3	167.5	165.0	169.0
	L_2/L_4	163.5	159.0	163.0

Specific gas consumption consist of 5% pilot liquid fuel and gas fuel
Gas fuel LCV (50,000 kJ/kg) is converted to diesel fuel LCV (42,700 kJ/kg) for comparison

Specifications

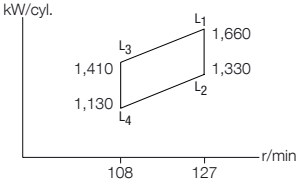
Dimensions:		A	B	C	H_1	H_2	H_3
	mm	1,020	3,770	1,300	10,800	10,000	9,775

Cylinders:		5	6	7	8
L_{min}	mm	6,439	7,459	8,479	9,499
Dry mass	t	308	350	393	452

MAN B&W S50ME-C8-GI

Cyl.	L_1 kW
5	8,300
6	9,960
7	11,620
8	13,280
9	14,940

Stroke: 2,000 mm



SFOC gas engines [g/kWh] **L_1/L_3 MEP:** 20.0 bar – **L_2/L_4 MEP:** 16.0 bar

		50%	75%	100%
Gas fuel	L_1	164,5	162,0	169,0
	L_2	160,5	156,0	163,0
	L_3	165,0	163,5	169,0
	L_4	161,0	157,5	163,0
Liquid fuel	L_1/ L_3	168,5	166,0	170,0
	L_2/ L_4	164,5	160,0	164,0

Specific gas consumption consist of 5% pilot liquid fuel and gas fuel
Gas fuel LCV (50,000 kJ/kg) is converted to diesel fuel LCV (42,700 kJ/kg) for comparison

Specifications

Dimensions:		A	B	C	H_1	H_2	H_3
	mm	850	3,150	1,085	9,050	8,500	8,250

Cylinders:		5	6	7	8	9
L_{min}	mm	5,924	6,774	7,624	8,474	9,324
Dry mass	t	180	211	241	271	293

MAN B&W Low Speed

Propulsion systems

Engineering the Future – since 1758.

MAN Diesel & Turbo

MAN Alpha

Fixed Pitch Propeller Programme

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
- a wide range of stern tube lube and sealing systems
  – oil, water, biodegradable oils

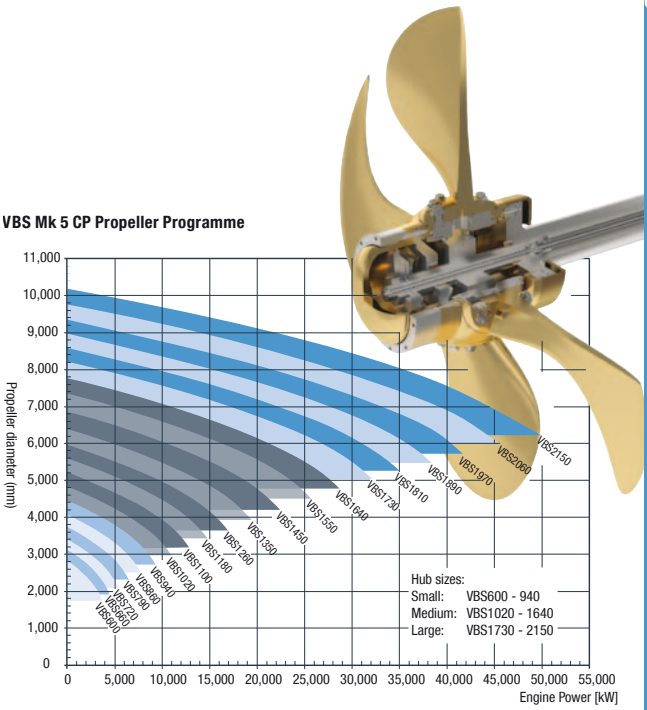
The MAN Alpha FPP's are characterised by the following benefits:

- 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 TVC, alignment and control systems

MAN B&W Low Speed Propulsion Systems

MAN Alpha Controllable Pitch Propeller

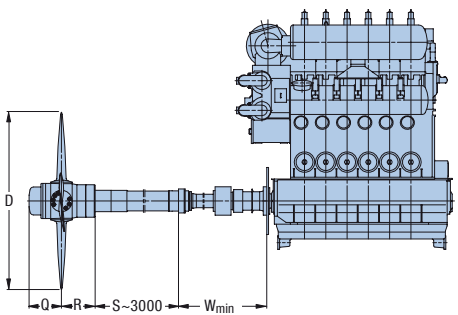
- as standard Mk 5 versions are 4-bladed – and 5-bladed versions are available upon request
- the figures stated after VBS indicate the propeller hub diameter
- standard blade/hub materials are Ni-Al-bronze, stainless steel is optional
- the propellers are available up to the highest ice classes. The below standard programmes, however, are based on 'no ice'.



MAN B&W Standard Package Examples

Cyl.	kW	Prop. speed r/min	D [1] mm	Hub VBS mm	Q mm	R mm	W_{min} mm	Prop. mass t [2]
G70ME-C9/-GI [3]								
5	18,200	83	8,100	1,890	1,436	1,496	3,700	90.0
6	21,840	83	8,450	2,060	1,565	1,593	3,700	93.5
7	25,480	83	8,750	2,150	1,634	1,645	3,700	102.0
8	29,120	83				[5]		
S70ME-C8/-GI [3]								
5	16,350	91	7,450	1,810	1,375	1,413	3,700	72.8
6	19,620	91	7,750	1,890	1,436	1,500	3,700	84.0
7	22,890	91	8,050	1,970	1,497	1,550	3,700	93.4
8	26,160	91	8,250	2,060	1,565	1,630	3,700	101.3
L70ME-C8/-GI [3]								
5	16,350	108	6,750	1,640	1,246	1,306	3,700	63.0
6	19,620	108	7,000	1,730	1,315	1,367	3,700	70.0
7	22,890	108	7,250	1,810	1,375	1,448	3,700	78.0
8	26,160	108	7,400	1,890	1,436	1,500	3,700	85.6
S65ME-C8/-GI [3]								
5	14,350	95	7,150	1,730	1,315	1,339	3,400	66,1
6	17,220	95	7,450	1,810	1,375	1,385	3,400	73,0
7	20,090	95	7,700	1,890	1,436	1,466	3,400	81,2
8	22,960	95	7,900	1,970	1,497	1,512	3,400	89,3

[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 6,000 mm propeller shaft
[3] The masses are stated for 4,000 mm stern tube and 8,000 mm propeller shaft
[5] Available on request



MAN B&W Standard Package Examples

Cyl.	kW	Prop. speed r/min	D [1] mm	Hub VBS mm	Q mm	R mm	W_{min} mm	Prop. mass t [2]
G60ME-C9/-GI [3]								
5	13,400	97	6,950	1,640	1,246	1,287	3,300	60.0
6	16,080	97	7,250	1,730	1,315	1,339	3,300	64.2
7	18,760	97	7,450	1,810	1,375	1,420	3,300	70.3
8	21,440	97	7,700	1,890	1,436	1,496	3,100	74.6
S60MC-C/ME-B8, S60ME-C8/-GI								
5	11,900	105	6,500	1,550	1,278	1,289	3,000	53.4
6	14,280	105	6,750	1,640	1,367	1,362	3,000	59.7
7	16,660	105	6,950	1,730	1,367	1,367	3,000	63.2
8	19,040	105	7,150	1,810	1,458	1,450	3,000	72.0
L60MC-C/ME-B8, L60ME-C8/-GI [4]								
5	11,700	123	5,900	1,450	1,175	1,248	2,925	43.8
6	14,040	123	6,100	1,550	1,278	1,284	2,925	49.4
7	16,380	123	6,300	1,640	1,278	1,284	2,925	52.7
8	18,720	123	6,450	1,640	1,367	1,367	2,925	60.3
G50ME-B9 [3]								
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
S50ME-B9								
5	8,900	117	5,650	1,460	1,100	1,141	2,700	35.7
6	10,680	117	5,850	1,560	1,175	1,202	2,700	41.3
7	12,460	117	6,050	1,560	1,175	1,202	2,700	44.5
8	14,240	117	6,200	1,680	1,278	1,279	2,700	50.5
9	16,020	117	6,350	1,800	1,367	1,332	2,900	58.0
S50MC-C/ME-B8, S50ME-C8/-GI [4]								
5	8,300	127	5,400	1,350	1,030	1,082	2,690	31.7
6	9,960	127	5,600	1,350	1,100	1,145	2,690	35.4
7	11,620	127	5,800	1,450	1,175	1,233	2,690	39.9
8	13,280	127	5,950	1,450	1,175	1,248	2,690	42.0

[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 6,000 mm propeller shaft

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

[4] Data for 9 cylinders is available on request

Cyl.	kW	Prop. speed r/min	D [1] mm	Hub VBS mm	Q mm	R mm	W_{min} mm	Prop. mass t [2]
S46MC-C/ME-B8								
5	6,900	129	5,200	1,260	957	1,035	2,650	27.4
6	8,280	129	5,400	1,350	1,030	1,082	2,650	29.9
7	9,660	129	5,550	1,350	1,100	1,145	2,650	34.0
8	11,040	129	5,700	1,450	1,175	1,233	2,650	38.9
G45ME-B9								
5	6,950	111	5,650	1,350				
6	8,340	111	5,900	1,350				
7	9,730	111	6,100	1,450				
8	11,120	111	6,250	1,550				
G40ME-B9 [3]								
5	5.500	125	5.000	1.180				24,1
6	6.600	125	5.250	1.260				28,0
7	7.700	125	5.400	1.260				29,7
8	8.800	125	5.550	1.350				32,9
S40MC-C/ME-B9								
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	1,030	1,081	2,500	29.8
S35MC-C/ME-B9								
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 [3]								
5	3.200	195	3.500	860				10,5
6	3.840	195	3.600	860				11,0
7	4.480	195	3.700	940				12,3
8	5.120	195	3.800	940				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 6,000 mm propeller shaft

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

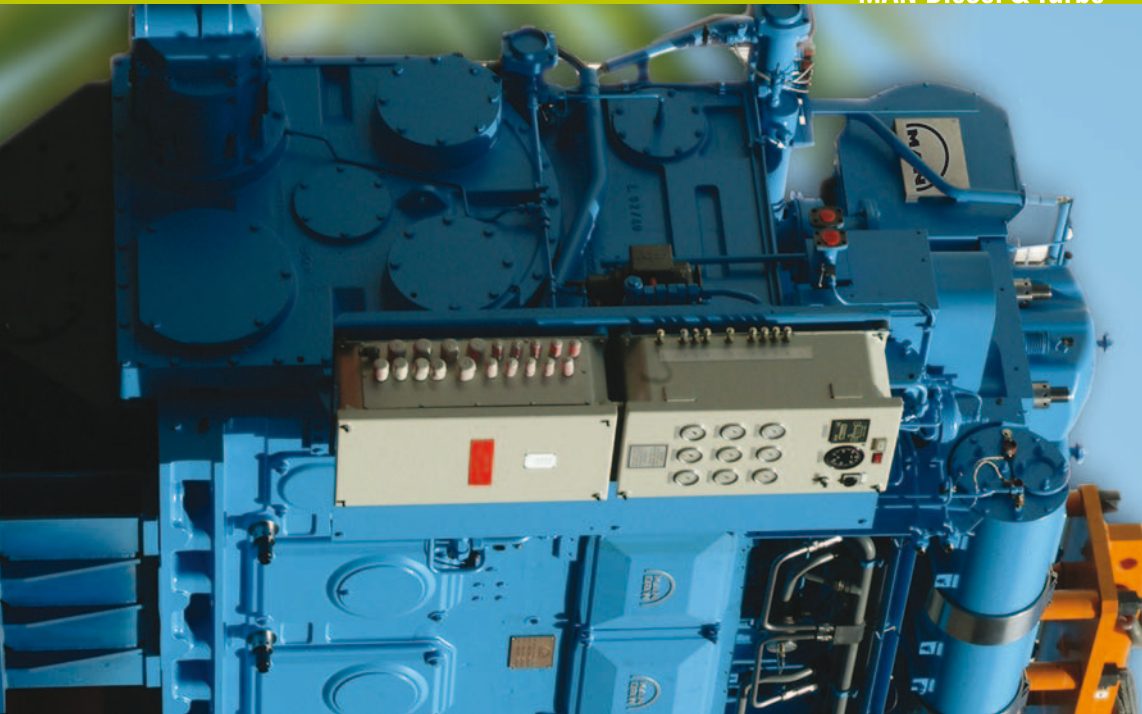
[4] Data for 9 cylinders is available on request

MAN Medium Speed

Propulsion engines

Engineering the Future – since 1758.

MAN Diesel & Turbo



MAN Medium Speed Propulsion Engines

IMO Tier II Compliant Engine Programme
Besides the focus on power density and fuel economy, MAN Diesel & Turbo has also committed itself to a steady reduction of the environmental impact of its engines.

By applying engine internal and well-proven measures to achieve a cleaner and more efficient combustion, MAN Diesel & Turbo is able to decrease NO_x emissions to IMO Tier II level without applying exhaust gas after-treatment.

MAN Medium Speed Propulsion Engines

MAN Diesel & Turbo SCR system

The MAN Diesel & Turbo SCR system uses urea to transform the pollutant NO_x into nitrogen and water vapour. This system has been specially adapted to our engines, and the control unit has been integrated into our engine control program $SaCoS_{one}$.

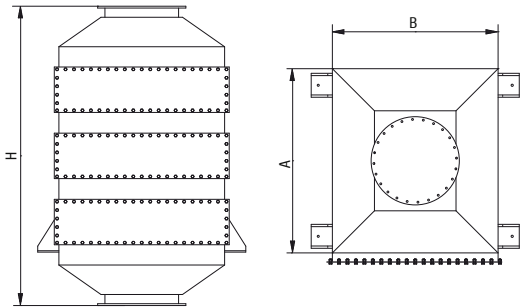
Under the right preconditions, SCR is capable of complying with IMO Tier III regulations.

The MAN Diesel & Turbo SCR system standard is available in fifteen different sizes to cover the complete engine portfolio. Furthermore, customised SCR systems can be offered on demand.

The two main components of an SCR system are the reactor, containing a number of catalyst cores, and the urea supply system, comprising a pump station dosing unit and a control unit.

As an option, a NO_x measuring system can be included to achieve a closed loop control of the urea injection.

MAN Medium Speed Propulsion Engines



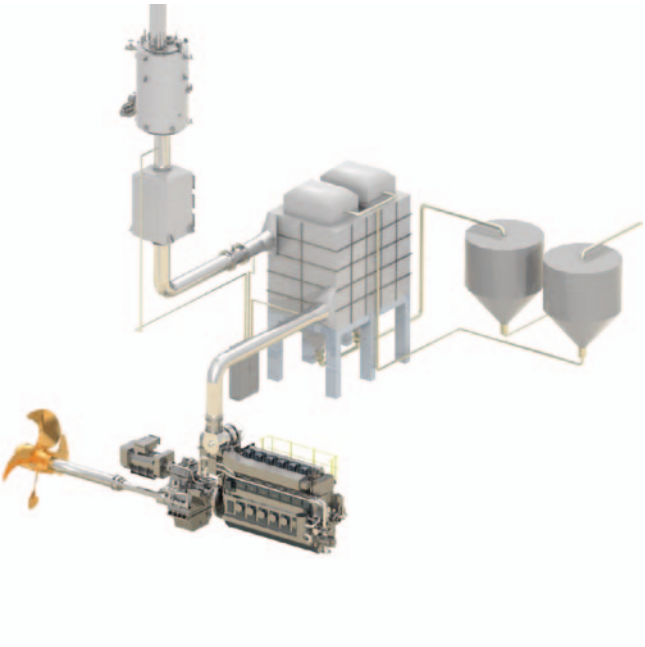
MAN Diesel & Turbo SCR System Dimension Table

Engine Group	Engine Power [kW]	Reactor Dimension Width A [mm]	Length B [mm]	Height H [mm]	Total Reactor Weight [kg]	Mixing Pipe Length [mm]
1	450 – 880	850	670	2,200	550	2,200
2	881 – 1,650	1,050	1,050	2,500	900	2,300
3	1,651 – 2,025	1,350	1,150	2,500	1,100	2,300
4	2,026 – 3,000	1,550	1,320	2,800	1,400	3,100
5	3,001 – 3,500	1,700	1,460	2,900	1,800	3,600
6	3,501 – 4,000	1,650	1,650	2,900	1,900	3,700
7	4,001 – 5,040	1,980	1,630	3,000	2,100	3,800
8	5,041 – 6,720	1,990	2,250	3,400	3,000	3,900
9	6,721 – 8,000	2,300	2,250	3,600	3,800	4,000
10	8,001 – 9,000	2,650	2,250	3,800	3,900	4,100
11	9,001 – 10,080	2,650	2,420	3,900	3,950	4,100
12	10,081 – 12,600	2,950	2,950	4,300	5,500	4,400
13	12,601 – 14,400	3,250	2,950	4,500	7,500	4,500
14	14,401 – 16,800	3,250	3,250	4,500	8,500	5,200
15	16,801 – 21,600	3,600	3,900	5,500	12,500	5,400

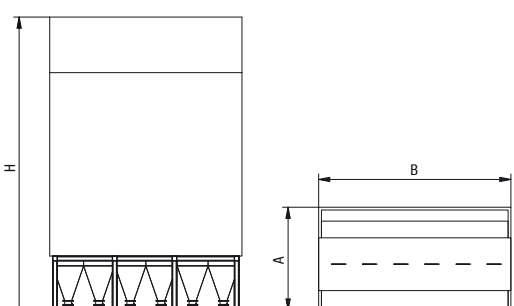
MAN Medium Speed Propulsion Engines

MAN Diesel & Turbo Dry Exhaust Gas Cleaning System (DryEGCS®)
The DryEGCS® system enables the vessel to comply with IMO's sulphur regulations inside emission control areas while still operating the engines on HFO with up to 4.5% sulphur content. This enables the operator to achieve significant cost savings compared with an otherwise needed fuel switch to expensive distillate fuels.

The DryEGCS® is based on absorption of SO_x in the reactor by using hydrated lime granulate. The main component of the system is the reactor, which contains the packed bed granulate. The exhaust gas passes through the granules and the SO_x reacts with the slacked lime to gypsum, thus removing it completely from the biosphere. The DryEGCS® standard is available in different sizes to cover the complete MAN engine portfolio. Customising the DryEGCS® system for special purposes is easy.



MAN Medium Speed Propulsion Engines



MAN Diesel & Turbo DryEGCS® Dimension Table

Category	Engine Power [kW]	Design	Width A [mm]	Length B [mm]	Height H [mm]	Total Absorber weight [t]
I	450 – 2,380	Transversal = Longitudinal	2,440	3,300	6,350 – 9,850	21 – 36
II	2,381 – 6,720	Transversal*	4,680	3,300	7,850 – 11,850	54 – 88
		Longitudinal	3,840	5,600	7,850 – 11,850	56 – 93
III	6,721 – 10,080	Transversal*	6,920	3,300	9,850 – 11,350	106 – 127
		Longitudinal	3,840	8,300	9,850 – 11,350	111 – 132
IV	10,081 – 12,000	Transversal*	6,920	3,700	11,850 – 13,350	133 – 153
		Longitudinal	4,240	8,900	11,850 – 13,350	143 – 165
V	12,001 – 21,600	Transversal*	10,280	3,700	11,350 – 14,350	187 – 246
		Longitudinal	5,360	8,900	11,350 – 14,350	195 – 256

** Default design*

MAN Medium Speed Propulsion Engines

Conventional Injection Engines
These well-established engine types are used in various applications all around the world. Based on long-term experience, the engines have been continously developed to improve their power, emissions, fuel oil consumption and reliability, making them the prime mover of choice in the maritime sector.

Common Rail (CR) Engines
The flexibility of the CR technology offers benefits in the combustion process and in the fuel economy, while still keeping the IMO Tier II emission levels. This gives unique advantages, especially in the low-load range where the exhaust gas opacity can be brought down far below the visible limit. CR engines from MAN Diesel & Turbo run efficiently on liquid fuels complying with ISO 8217-2010 DMA, DMZ, and DMB, and on residual fuels up to 700 cSt (in compliance with ISO-F-RMK 700).

Diesel Oil (D) Engines
The V28/33D features very favourable ratios of power-to-weight and power-to-installation space. Its 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 engine operates on distillates according to ISO 8217 DMA or equivalent fuel types.

MAN Medium Speed Propulsion Engines

Sequential Turbocharging (STC)
The MAN Diesel & Turbo 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 Diesel & Turbo run efficiently on liquid fuels or natural gas with emissions far below the IMO limit. The possibility to switch over seamlessly from gas to diesel operation and vice versa provides full flexibility in multiple applications.

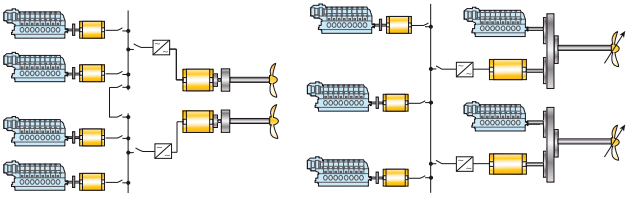
All dual fuel engines can run on natural gas with a methane number higher than 80 without adjustments. For lower methane numbers, MAN Diesel & Turbo can deliver well-adapted solutions. The optimised combustion chamber ensures very low fuel consumption in both operational modes.

MAN Medium Speed Propulsion Engines

Diesel-Electric and Hybrid Propulsion Trains

Apart from the well-established diesel-mechanic propulsion packages, based on the MAN Alpha propeller programme (see pages 128-136), MAN Diesel & Turbo offers a full range of diesel-electric and hybrid propulsion trains. The solutions offered are designed and optimised to meet the highest efficiencies of the complete propulsion plant system over the whole operational profile of the vessel. The systems provide well-balanced and tailor-made solutions regarding flexibility and performance.

The propulsion packages include all components from gensets to propulsors, including switchboards, variable speed drives, and propulsion motors. Full diesel-electric propulsion trains as well as hybrid systems for CoDLaD and CoDLoD applications ensure the optimal technical and economical solution for flexible power demands.



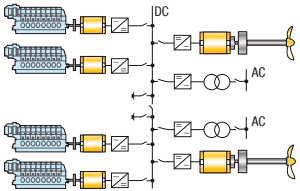
High-efficient and customised power trains for diesel-electric and hybrid propulsion applications

MAN Medium Speed Propulsion Engines

Energy-Saving Electric Propulsion

Recent developments in the electric component technology have paved the way for diesel-electric propulsion systems with a high potential in energy saving. Diesel engines now can operate at variable speeds, which means that the rpm of the engines can be adjusted for minimum fuel oil consumption according to the system load. Based on a common DC-distribution inside the system, power generation and consumption is decoupled. Diesel & Turbo offers this advanced package solutions in cooperation with leading E-suppliers.

Another major advantage is the integration of energy storage sources, like batteries. The energy storage sources reduce the transient loads on the diesel engines and give much better system dynamic response times. Also, emission-free propulsion can be realized when running on batteries. The footprint of such a propulsion plant is up to 30% less compared with a classic diesel-electric propulsion plant.



Energy-saving diesel-electric propulsion plant

MAN Medium Speed Propulsion Engines

Engine Power
Engine brake power is stated in kW.

Ratings are given according to ISO 3046-1:2002.

According to ISO 15550:2002, the power figures in the tables remain valid within a range of ±3% up to tropical conditions at sea level, i.e.:

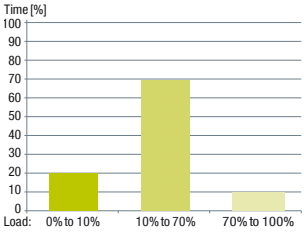
- compressor inlet temperature 45 °C
- compressor inlet pressure 1,000 mbar
- sea water temperature 32 °C

For all medium speed propulsion engines, except for V28/33D and V28/33D STC, the power is defined according to the ICN[1] definition (ISO 3046-1:2002 : ISO standard power).

The engine rated power for V28/33D and V28/33D STC refers to ICFN[1] power definition (ISO 3046:2002 : ISO standard fuel stop power).

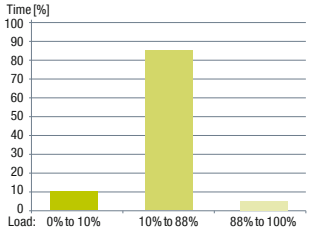
Furthermore, two different load profile types are considered for V28/33D and V28/33D STC depending on the engine application.

Load profile type: Navy



Typical use : Fast yachts
Corvettes
Frigates
OPV

Load profile type: Ferry



Typical use : Ferries
Catamarans
Commercial vessels

[1] *IC[F]N according ISO 3046-1:2002 :*
I = ISO power – C = continuous power output – [F = fuel stop power] – N = net

MAN Medium Speed Propulsion Engines

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. Attached pumps and engines running in suction dredger operation will require additional fuel.

The SFOC figures for engines in diesel operation are based on a lower calorific value of the fuel of 42,700 kJ/kg.

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.

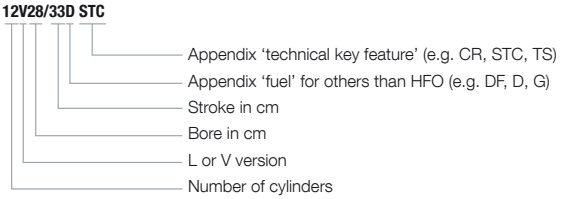
Weights and Dimensions
For marine main engines, the weights stated refer to engines without a flywheel.

For auxiliary engines (GenSets), the weights correspond to the unit (including alternator). The weight of the GenSets may vary depending on the alternator make. All weights given are without lube oil and cooling water.

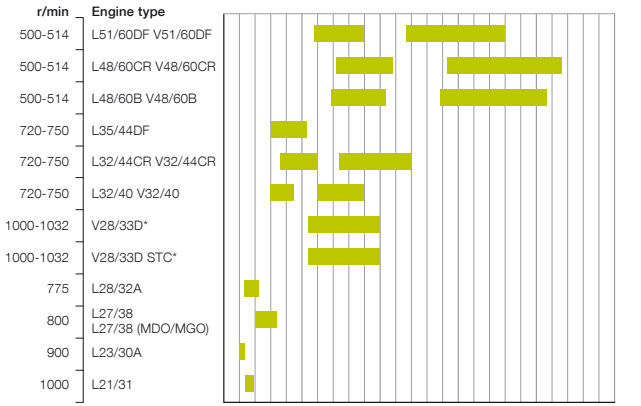
The length of the GenSet unit depends on the alternator make. For a twin engine installation, the centreline distance is stated for each engine type.

MAN Medium Speed Propulsion Engines

Engine Type Designation



MAN Medium Speed Propulsion Engines



** The engine complies with EPA Tier 2*

MAN V51/60DF

Bore: 510 mm, Stroke: 600 mm

Speed	r/min	514	500
mep	bar	19.1	19.1
		kW	kW
12V51/60DF		12,000	11,700
14V51/60DF		14,000	13,650
16V51/60DF		16,000	15,600
18V51/60DF		18,000	17,550

Specific Fuel Oil Consumption (SFOC) and Heat Rate to ISO conditions

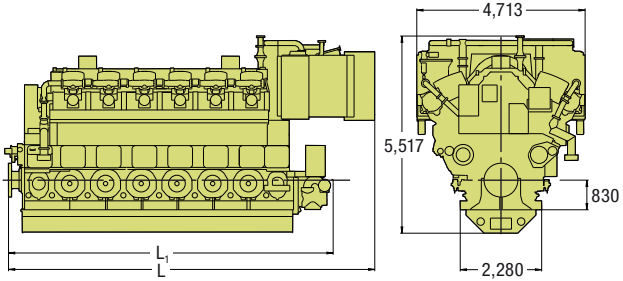
MCR	100%	85%
Specific fuel oil consumption (HFO)*	183.5 g/kWh	183 g/kWh
Heat Rate**	7,479 kJ/kWh [1)] 7,530 kJ/kWh [2)]	7,457 kJ/kWh [1)] 7,550 kJ/kWh [2)]
Specific lube oil consumption 0.4 g/kWh		
Engine type specific reference charge air temperature before cylinder 43 °C		

** Diesel or HFO fuel operation*
*** Gas operation (including pilot fuel)*
1) Application with constant speed
2) CPP-Application
LHV of fuel gas ≥ 28,000 kJ/Nm³ (Nm³ corresponds to one cubic meter of gas at 0°C and 1.013 bar)
Speed 500 r/min for generator drive only

Dimensions

Cyl. No.		12	14	16	18
L	mm	10,254	11,254	12,254	13,644
L_1	mm	9,088	10,088	11,088	12,088
Dry mass	t	187	213	240	265

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



Bore: 510 mm, Stroke: 600 mm

Speed	r/min	514	500
mep	bar	19.1	19.1
		kW	kW
6L51/60DF		6,000	5,850
7L51/60DF		7,000	6,825
8L51/60DF		8,000	7,800
9L51/60DF		9,000	8,775

Specific Fuel Oil Consumption (SFOC) and Heat Rate to ISO conditions

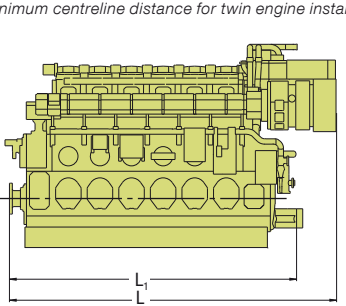
MCR	100%	85%
Specific fuel oil consumption (HFO)*	183.5 g/kWh	183 g/kWh
Heat Rate**	7,479 kJ/kWh [1)] 7,530 kJ/kWh [2)]	7,457 kJ/kWh [1)] 7,550 kJ/kWh [2)]
Specific lube oil consumption 0.4 g/kWh		
Engine type specific reference charge air temperature before cylinder 43 °C		

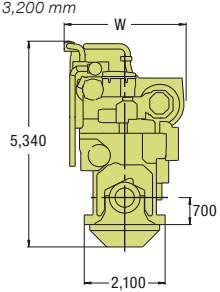
** Diesel or HFO fuel operation*
*** Gas operation (including pilot fuel)*
[1)] Application with constant speed
[2)] CPP-Application
LHV of fuel gas ≥ 28,000 kJ/Nm³ (Nm³ corresponds to one cubic meter of gas at 0°C and 1.013 bar)
Speed 500 r/min for generator drive only

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	106	119	135	148

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





MAN V48/60CR

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
18V48/60CR		21,600	21,600

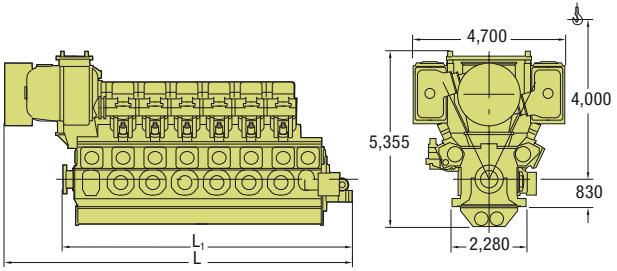
Specific Fuel Oil Consumption (SFOC) to ISO conditions

MCR	100%	85%
V48/60CR	181 g/kWh	173 g/kWh
Specific lube oil consumption 0.5 g/kWh		
Engine type specific reference charge air temperature before cylinder 34 °C		

Dimensions

Cyl. No.		12	14	16	18
L	mm	10,760	11,760	13,100	14,100
L_1	mm	9,088	10,088	11,088	12,088
Dry mass	t	189	213	240	265

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



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

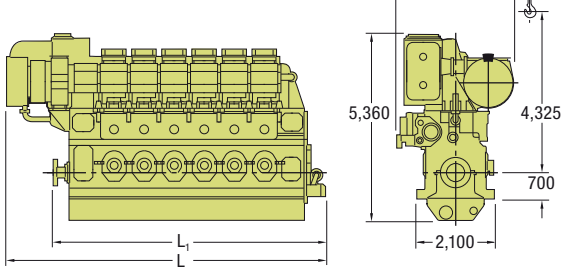
Specific Fuel Oil Consumption (SFOC) to ISO conditions

MCR	100%	85%
L48/60CR	183 g/kWh	175 g/kWh
Specific lube oil consumption 0.5 g/kWh		
Engine type specific reference charge air temperature before cylinder 34 °C		

Dimensions

Cyl. No.		6	7	8	9
L	mm	8,615	9,435	10,460	11,425
L_1	mm	7,455	8,275	9,095	9,915
W	mm	3,195	3,195	3,325	3,325
Dry mass	t	106	119	135	148

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



MAN V48/60B

Bore: 480 mm, Stroke: 600 mm

Speed	r/min	514	500
mep	bar	24.7	25.4
		kW	kW
12V48/60B		13,800	13,800
14V48/60B		16,100	16,100
16V48/60B		18,400	18,400
18V48/60B		20,700	20,700

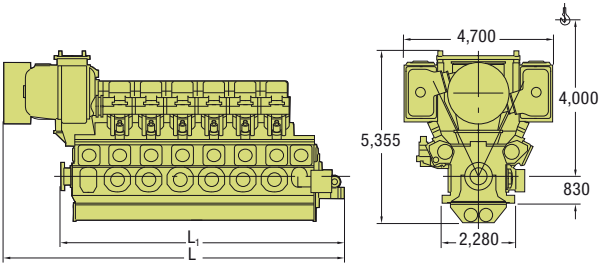
Specific Fuel Oil Consumption (SFOC) to ISO conditions

MCR	100%	85%
V48/60B	184 g/kWh	182 g/kWh
Specific lube oil consumption 0.6 g/kWh		
Engine type specific reference charge air temperature before cylinder 34 °C		

Dimensions

Cyl. No.		12	14	16	18
L	mm	10,760	11,760	13,100	14,100
L_1	mm	8,915	9,915	10,915	11,915
Dry mass	t	186	209	240	259

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



Bore: 480 mm, Stroke: 600 mm

Speed	r/min	514	500
mep	bar	24.7	25.4
		kW	kW
6L48/60B		6,900	6,900
7L48/60B		8,050	8,050
8L48/60B		9,200	9,200
9L48/60B		10,350	10,350

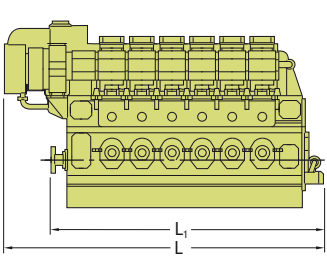
Specific Fuel Oil Consumption (SFOC) to ISO conditions

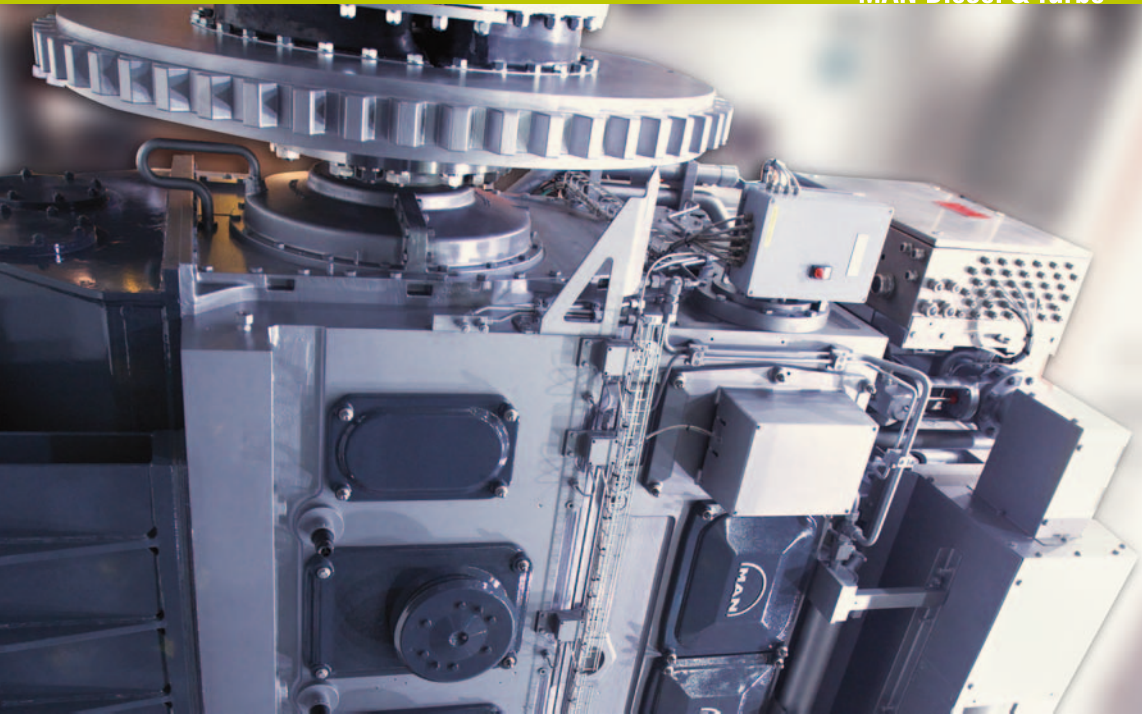
MCR	100%	85%
L48/60B	186 g/kWh	184 g/kWh
Specific lube oil consumption 0.6 g/kWh		
Engine type specific reference charge air temperature before cylinder 34 °C		

Dimensions

Cyl. No.		6	7	8	9
L	mm	8,615	9,435	10,460	11,425
L_1	mm	7,290	8,110	8,930	9,895
W	mm	3,195	3,195	3,325	3,325
Dry mass	t	104	118	134	146

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




MAN

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

Specific Fuel Oil Consumption (SFOC) and Heat Rate to ISO conditions

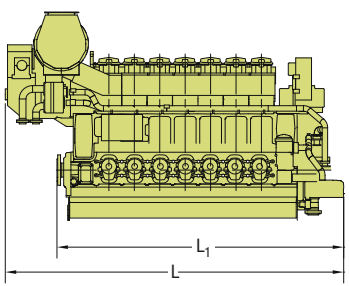
MCR	100%	85%
Specific fuel oil consumption (HFO)[1)]	183 g/kWh	181.5 g/kWh
Heat Rate [2)]	7,530 kJ/kWh	7,615 kJ/kWh
Specific lube oil consumption 0.5 g/kWh		
Engine type specific reference charge air temperature before cylinder 40 °C		

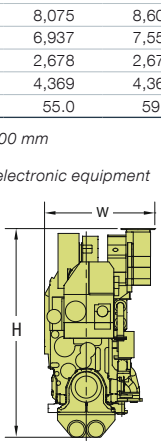
[1)] *Diesel or HFO fuel operation.*
[2)] *Gas operation (including pilot fuel)*
LHV of fuel gas ≥ 32,400 kJ/Nm³ (Nm³ corresponds to one cubic meter of gas at 0°C and 1.013 bar)

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[3)]	t	40.5	45.6	50.7	55.0	59.7

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





MAN V32/44CR

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*		8,400	8,400
16V32/44CR		9,600	9,600
18V32/44CR		10,800	10,800
20V32/44CR		12,000	12,000

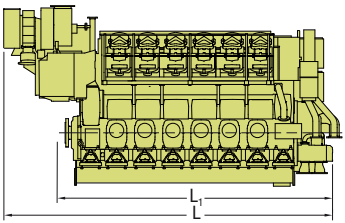
Specific Fuel Oil Consumption (SFOC) to ISO conditions

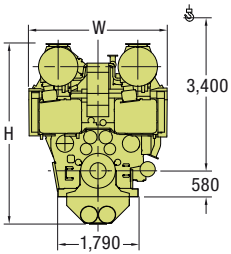
MCR	100%	85%
V32/44CR	177.5 g/kWh	174.5 g/kWh
14V32/44CR	178.5 g/kWh	176.0 g/kWh
Specific lube oil consumption 0.5 g/kWh		
Engine type specific reference charge air temperature before cylinder 40 °C		

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**	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
** TC under development*
*** Including built-on lube oil automatic filter, fuel oil filter and electronic equipment*





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*		4,200	4,200
8L32/44CR		4,800	4,800
9L32/44CR		5,400	5,400
10L32/44CR		6,000	6,000

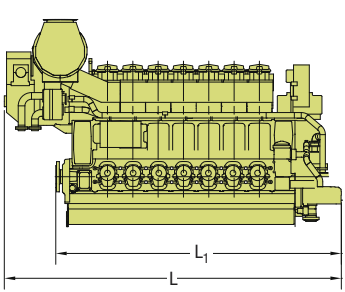
Specific Fuel Oil Consumption (SFOC) to ISO conditions

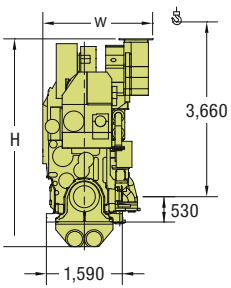
MCR	100%	85%
L32/44CR	177.5 g/kWh	174.5 g/kWh
7L32/44CR	178.5 g/kWh	176.0 g/kWh
Specific lube oil consumption 0.5 g/kWh		
Engine type specific reference charge air temperature before cylinder 40 °C		

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**	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
** TC under development*
*** Including built-on lube oil automatic filter, fuel oil filter and electronic equipment*





MAN V32/40

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

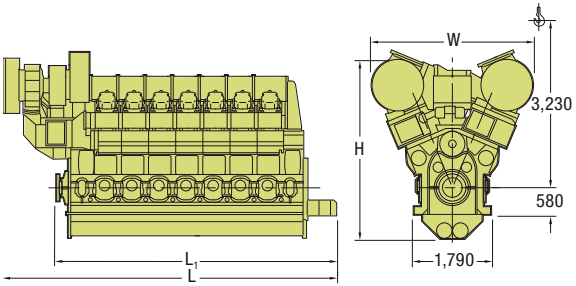
Specific Fuel Oil Consumption (SFOC) to ISO conditions

MCR	100%	85%
V32/40	183 g/kWh	181 g/kWh
V32/40 FPP	187 g/kWh	183 g/kWh
Specific lube oil consumption 0.5 g/kWh		
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



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) to ISO conditions

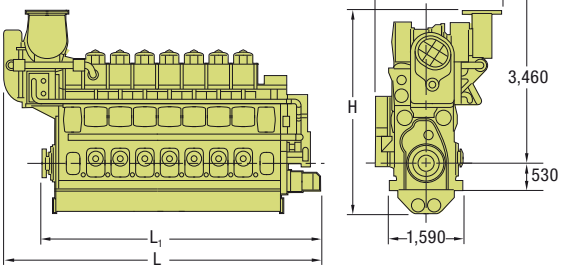
MCR	100%	85%
L32/40	185 g/kWh	182 g/kWh
L32/40 FPP	189 g/kWh	184 g/kWh
Specific lube oil consumption 0.5 g/kWh		
Engine type specific reference charge air temperature before cylinder 43 °C		

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 [1)]
Speed 720 r/min for generator drive/constant speed operation only
Fixed Pitch Propeller: 450 kW/cyl, 750 r/min

[1)] Please contact MAN Diesel & Turbo, for the precise information about the centreline distance for two engines with the same cylinder number standing near to each other



MAN V28/33D

Bore: 280 mm, Stroke: 330 mm

		Load profile 'Ferry'	Load profile 'Navy'
Speed	r/min	1000	1032
mep	bar	26.9	28.6
Rated power output - ICFN		kW	kW
12V28/33D		5,460	6,000
16V28/33D		7,280	8,000
20V28/33D		9,100	10,000

Specific Fuel Oil Consumption (SFOC) to ISO conditions

MCR 100%	189 g/kWh	193 g/kWh
MCR 85%	186 g/kWh	190 g/kWh
Specific lube oil consumption 0.4 g/kWh		
Engine type specific reference charge air temperature before cylinder 49 °C		

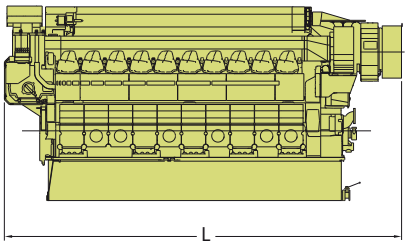
Figures for FPP operation

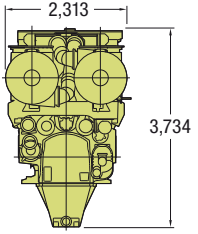
Dimensions

Cyl. No.		12	16	20
L	mm	5,703	6,623	7,543
Dry mass *	t	34.6	41.3	48.1

For multi engine arrangement only
Engine fuel: Distillate according to ISO 8217 DMA
Engine is EPA Tier 2 compliant

Weight and performance parameters refer to engine with flywheel, TC silencer, attached pumps, oil filters and lube oil cooler
** Tolerance: 5%*





Bore: 280 mm, Stroke: 330 mm

		Load profile 'Ferry'	Load profile 'Navy'
Speed	r/min	1000	1032
mep	bar	26.9	28.6
Rated power output - ICFN		kW	kW
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) to ISO conditions

MCR 100%	189 g/kWh	193 g/kWh
MCR 85%	186 g/kWh	190 g/kWh
Specific lube oil consumption 0.4 g/kWh		
Engine type specific reference charge air temperature before cylinder 49 °C		

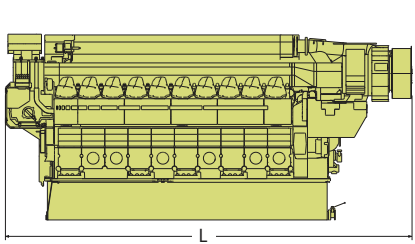
Figures for FPP operation

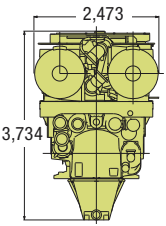
Dimensions

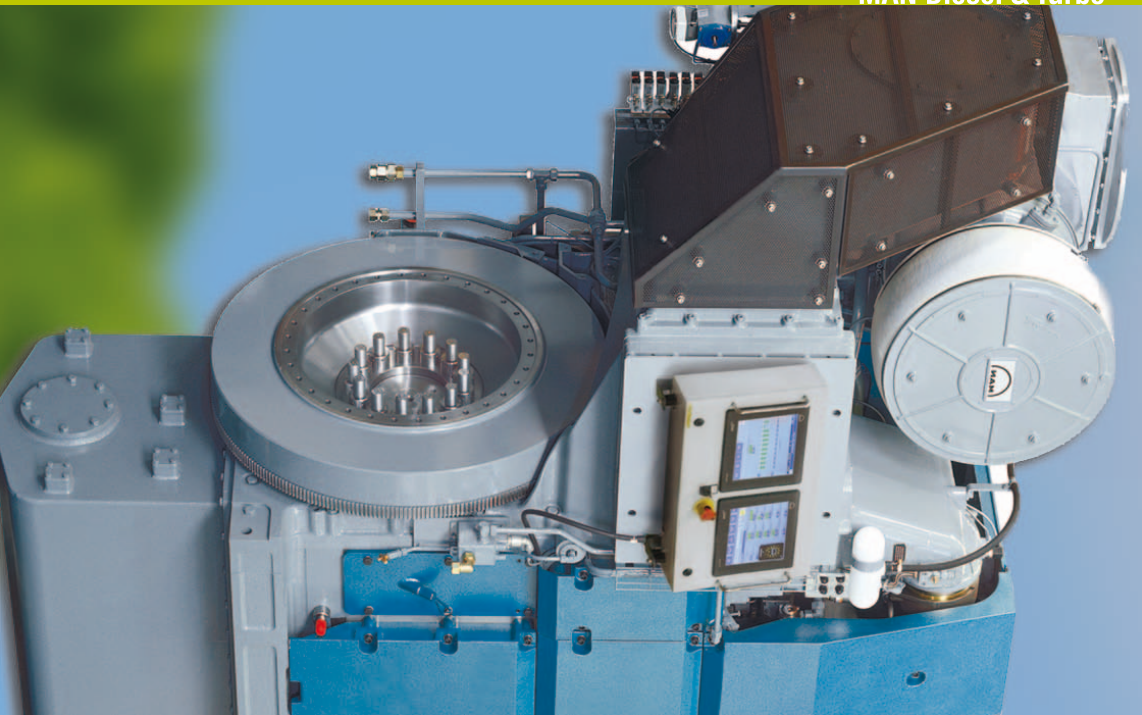
Cyl. No.		12	16	20
L	mm	6,207	7,127	8,047
Dry mass *	t	36.0	43.6	50.4

For multi engine arrangement only
Engine fuel: Distillate according to ISO 8217 DMA
Engine is EPA Tier 2 compliant

Weight and performance parameters refer to engine with flywheel, TC silencer, attached pumps, oil filters and lube oil cooler
** Tolerance: 5%*







Bore: 280 mm, Stroke: 320 mm

Speed	r/min	775
mep	bar	19.3
		kW
6 L28/32A		1,470
7 L28/32A		1,715
8 L28/32A		1,960
9 L28/32A		2,205

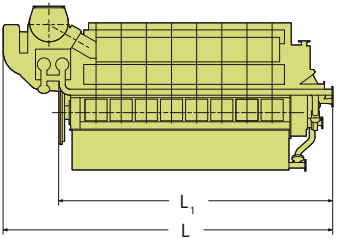
Specific Fuel Oil Consumption (SFOC) to ISO conditions

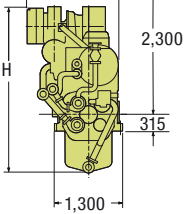
MCR	100%	85%
L28/32A	194 g/kWh	192 g/kWh
Specific lube oil consumption 1.0 g/kWh		
Engine type specific reference charge air temperature before cylinder 40 °C		

Dimensions

Cyl. No.		6	7	8	9
L	mm	5,330	5,810	6,290	6,770
L_1	mm	4,340	4,750	5,230	5,780
W	mm	1,732	1,732	1,732	1,844
H	mm	3,186	3,186	3,186	3,242
Dry mass	t	18.0	20.5	23.0	25.5

Minimum centreline distance for twin engine installation: 2,000 mm





MAN L27/38

Bore: 270 mm, Stroke: 380 mm

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

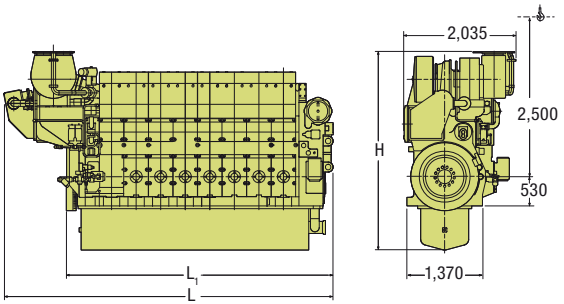
Specific Fuel Oil Consumption (SFOC) to ISO conditions

MCR	100%	85%
L27/38	188 g/kWh	185 g/kWh
L27/38 (MDO*/MGO)	191 g/kWh	186 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
** MDO viscosity must not exceed 6 mm²/s = cSt @ 40 °C.*



Bore: 225 mm, Stroke: 300 mm

Speed	r/min	900
mep	bar	17.1
		kW
6 L23/30A		960
8 L23/30A		1,280

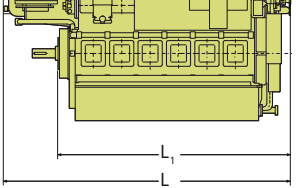
Specific Fuel Oil Consumption (SFOC) to ISO conditions

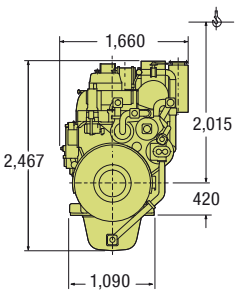
MCR	100%	85%
L23/30A	194 g/kWh	193 g/kWh
Specific lube oil consumption 1.0 g/kWh		
Engine type specific reference charge air temperature before cylinder 40 °C		

Dimensions

Cyl. No.		6	8
L	mm	3,737	4,477
L_1	mm	3,062	3,802
Dry mass	t	11.0	13.5

Minimum centreline distance for twin engine installation: 1,900 mm





MAN L21/31

Bore: 210 mm, Stroke: 310 mm

Speed	r/min	1000
mep	bar	24.0
		kW
6L21/31		1,290
7L21/31		1,505
8L21/31		1,720
9L21/31		1,935

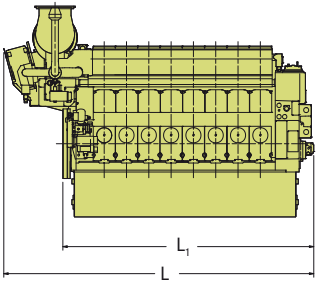
Specific Fuel Oil Consumption (SFOC) to ISO conditions

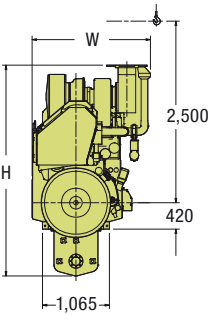
MCR	100%	85%
L21/31	195 g/kWh	192 g/kWh
Specific lube oil consumption 0.8 g/kWh		
Engine type specific reference charge air temperature before cylinder 40 °C		

Dimensions

Cyl. No.		6	7	8	9
L	mm	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





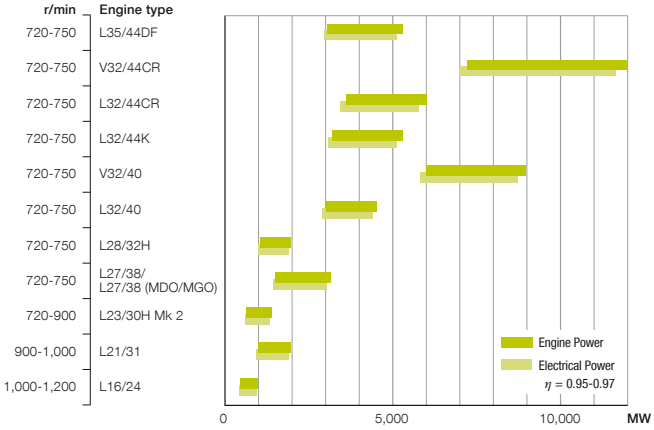
MAN Medium Speed

Marine GenSets

Engineering the Future – since 1758.

MAN Diesel & Turbo

MAN Medium Speed Marine GenSet



GenSets

Applications for GenSets vary from Auxiliary GenSets, GenSets for Diesel-Electric Propulsion up to Offshore Applications.

Project specific demands to be clarified at early project stage.

MAN Medium Speed Marine GenSet MAN L35/44DF

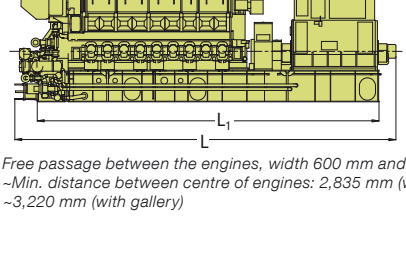
Bore: 350 mm, Stroke: 440 mm

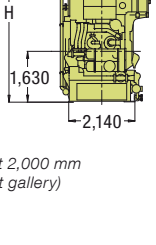
Speed	r/min	750		720	
Frequency	Hz	50		60	
		Eng. kW	Gen. kW*	Eng. kW	Gen. kW*
6L35/44DF		3,180	3,069	3,060	2,953
7L35/44DF		3,710	3,580	3,570	3,445
8L35/44DF		4,240	4,092	4,080	3,937
9L35/44DF		4,770	4,603	4,590	4,429
10L35/44DF		5,300	5,115	5,100	4,922

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

** Based on nominal generator efficiencies of 96.5%*
*** Dimensions are not finally fixed*





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

MAN V32/44CR

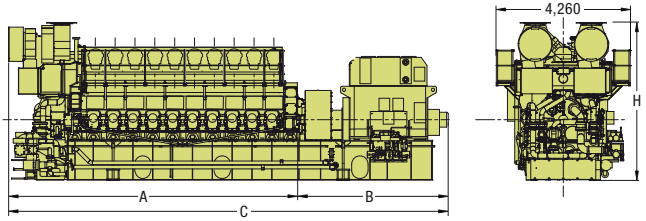
Bore: 320 mm, Stroke: 440 mm

Speed	r/min	750		720	
Frequency	Hz	50		60	
		Eng. kW	Gen. kW*	Eng. kW	Gen. kW*
12V32/44CR		7,200	6,984	7,200	6,984
14V32/44CR**		8,400	8,148	8,400	8,148
16V32/44CR		9,600	9,312	9,600	9,312
18V32/44CR		10,800	10,476	10,800	10,476
20V32/44CR		12,000	11,640	12,000	11,640

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

* *Based on nominal generator efficiencies of 97%*
** *TC under development*



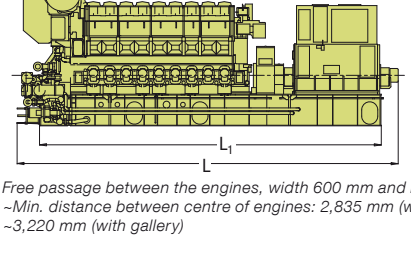
Bore: 320 mm, Stroke: 440 mm

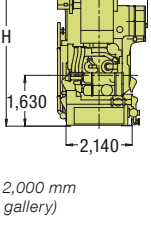
Speed	r/min	750		720	
Frequency	Hz	50		60	
		Eng. kW	Gen. kW*	Eng. kW	Gen. kW*
6L32/44CR		3,600	3,474	3,600	3,474
7L32/44CR**		4,200	4,053	4,200	4,053
8L32/44CR		4,800	4,632	4,800	4,632
9L32/44CR		5,400	5,211	5,400	5,211
10L32/44CR		6,000	5,790	6,000	5,790

Dimensions

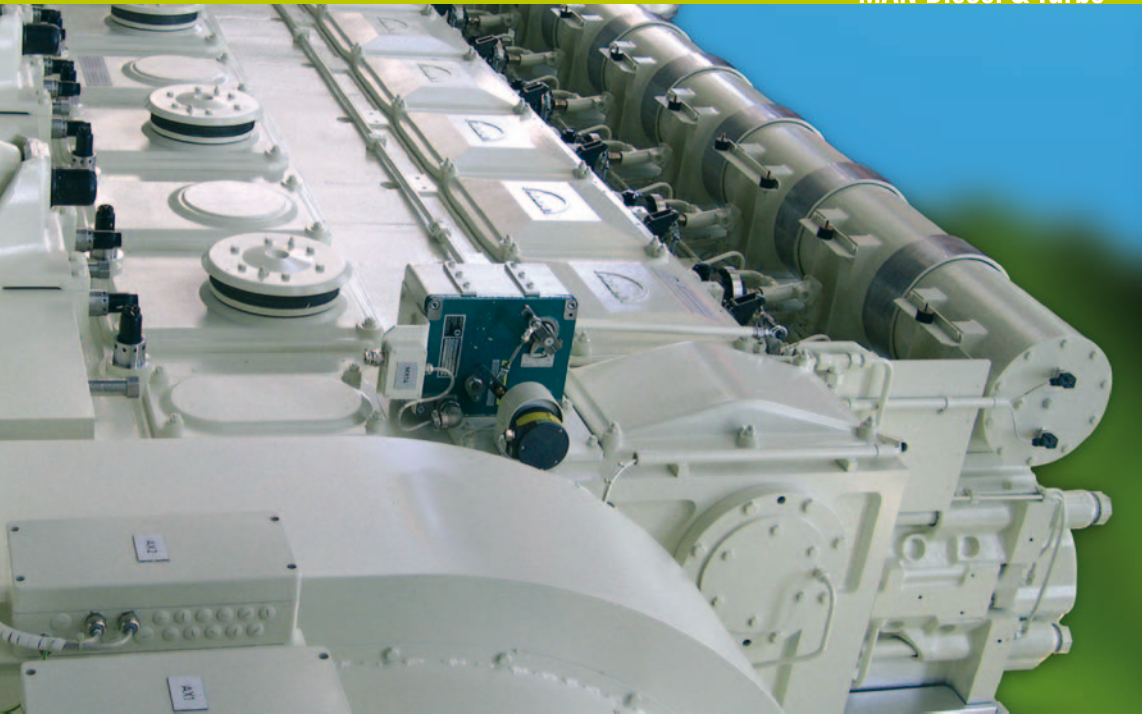
Cyl. No.		6	7	8	9	10
L	mm	10,738	11,268	11,798	12,328	12,858
L_1	mm	10,150	10,693	11,236	11,779	12,309
W	mm	2,490	2,490	2,573	2,573	2,573
H	mm	4,768	4,768	4,955	4,955	4,955
Dry mass	t	71	78	84	91	97

** Based on nominal generator efficiencies of 96.5%*
*** TC under development*





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



For auxiliary GenSet only. Engine with conventional injection and optimised SFOC for part load operation.

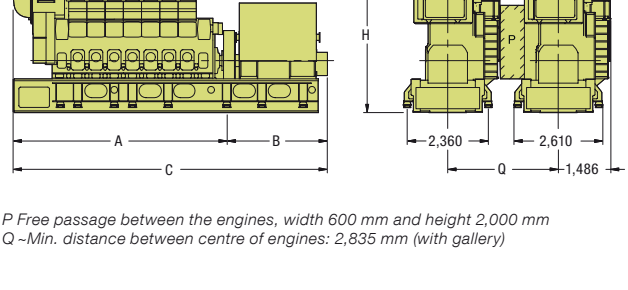
Bore: 320 mm, Stroke: 440 mm					
Speed	r/min	750		720	
Frequency	Hz	50		60	
		Eng. kW	Gen. kW*	Eng. kW	Gen. kW*
6L32/44K		3,180	3,069	3,180	3,069
7L32/44K		3,710	3,580	3,710	3,580
8L32/44K		4,240	4,092	4,240	4,092
9L32/44K		4,770	4,603	4,770	4,603
10L32/44K		5,300	5,115	5,300	5,115

Dimensions

Cyl. No.		6	7	8	9	10
A	mm	6,340	6,870	7,495	8,025	8,580
B**	mm	3,300	3,520	3,740	3,960	4,180
C**	mm	9,640	10,390	11,235	11,985	12,760
W	mm	2,903	2,903	3,109	3,109	3,109
H	mm	4,688	4,688	4,894	4,894	4,894
Dry mass**	t	71	78	84	91	97

** Based on nominal generator efficiencies of 96.5%*

*** Depending on generator applied*



P Free passage between the engines, width 600 mm and height 2,000 mm
Q ~Min. distance between centre of engines: 2,835 mm (with gallery)

MAN V32/40

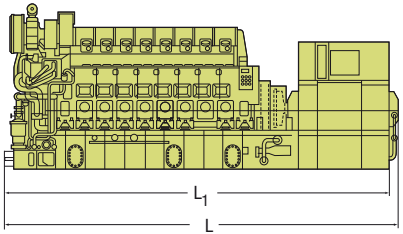
Bore: 320 mm, Stroke: 400 mm

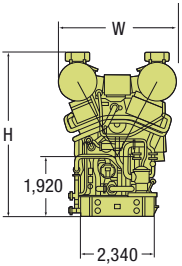
Speed	r/min	750		720	
Frequency	Hz	50		60	
		Eng. kW	Gen. kW*	Eng. kW	Gen. kW*
12V32/40		6,000	5,820	6,000	5,820
14V32/40		7,000	6,790	7,000	6,790
16V32/40		8,000	7,760	8,000	7,760
18V32/40		9,000	8,730	9,000	8,730

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

* *Based on nominal generator efficiencies of 97%*





Bore: 320 mm, Stroke: 400 mm

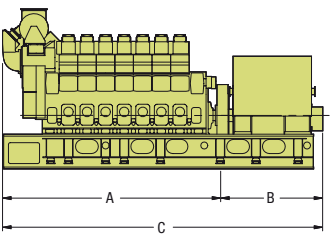
Speed	r/min	720		750	
Frequency	Hz	60		50	
		Eng. kW	Gen. kW*	Eng. kW	Gen. kW*
6L32/40		3,000	2,895	3,000	2,895
7L32/40		3,500	3,380	3,500	3,380
8L32/40		4,000	3,860	4,000	3,860
9L32/40		4,500	4,345	4,500	4,345

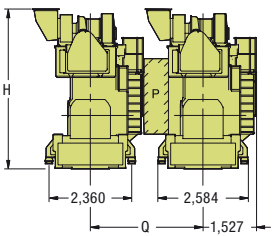
Dimensions

Cyl. No.		6	7	8	9
	r/min	720/750	720/750	720/750	720/750
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	75.0	79.0	87.0	91.0

** Based on nominal generator efficiencies of 96.5%*

GenSet also available with L32/40CR engine





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

MAN L28/32H

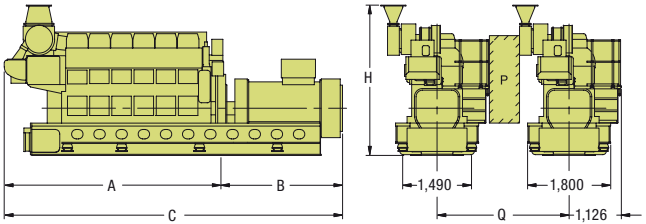
Bore: 280 mm, Stroke: 320 mm

Speed	r/min	720		750	
Frequency	Hz	60		50	
		Eng. kW	Gen. kW*	Eng. kW	Gen. kW*
5L28/32H		1,050	1,000	1,100	1,045
6L28/32H		1,260	1,200	1,320	1,255
7L28/32H		1,470	1,400	1,540	1,465
8L28/32H		1,680	1,600	1,760	1,670
9L28/32H		1,890	1,800	1,980	1,880

Dimensions

Cyl. No.		5	6	7	8	9
	r/min	720/750	720/750	720/750	720/750	720/750
A	mm	4,279	4,759	5,499	5,979	6,199
B	mm	2,400	2,510	2,680	2,770	2,690
C	mm	6,679	7,269	8,179	8,749	8,889
H	mm	3,184	3,184	3,374	3,374	3,534
Dry Mass	t	32.6	36.3	39.4	40.7	47.1

** Based on nominal generator efficiencies of 95%*



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

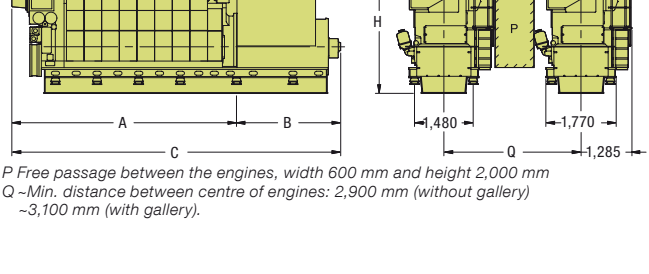
Bore: 270 mm, Stroke: 380 mm

Speed	r/min	720/750		720/750 (MDO**/MGO)	
Frequency	Hz	60/50		60/50	
		Eng. kW	Gen. kW*	Eng. kW	Gen. kW*
5L27/38		1,500/1,600	1,440/1,536	-	-
6L27/38		1,980	1,900	2,100	2,016
7L27/38		2,310	2,218	2,450	2,352
8L27/38		2,640	2,534	2,800	2,688
9L27/38		2,970	2,851	3,150	3,024

Dimensions

Cyl. No.		5	6	7	8	9
	r/min	720/750	720/750	720/750	720/750	720/750
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

* *Based on nominal generator efficiencies of 96%*
** *MDO viscosity must not exceed 6 mm²/s = cSt @ 40 °C*



P Free passage between the engines, width 600 mm and height 2,000 mm
Q ~Min. distance between centre of engines: 2,900 mm (without gallery) ~3,100 mm (with gallery).

MAN L23/30H Mk 2

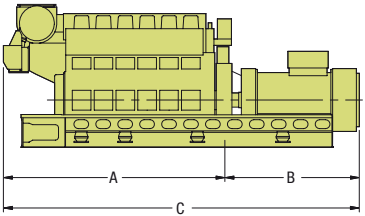
Bore: 225 mm, Stroke: 300 mm

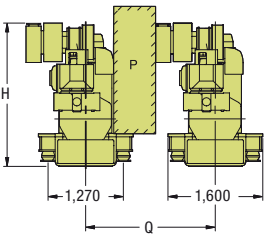
Speed	r/min	720		750		900	
Frequency	Hz	60		50		60	
		Eng. kW	Gen. kW*	Eng. kW	Gen. kW*	Eng. kW	Gen. kW*
5L23/30H		650/710	618/675	675/740	641/703	-	-
6L23/30H		852	809	888	844	1,050	998
7L23/30H		994	944	1,036	984	1,225	1,164
8L23/30H		1,136	1,079	1,184	1,125	1,400	1,330

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	3,369	3,738	3,738	4,109	4,109	4,475	4,475
B	mm	2,155	2,265	2,265	2,395	2,395	2,480	2,340
C	mm	5,524	6,004	6,004	6,504	6,504	6,959	6,815
H	mm	2,402	2,402	2,466	2,466	2,466	2,466	2,466
Dry Mass	t	17.0	18.5	19.8	20.0	21.4	21.9	22.9

** Based on nominal generator efficiencies of 95%*





P Free passage between the engines, width 600 mm and height 2,000 mm
Q ~Min. distance between centre of engines: 2,250 mm

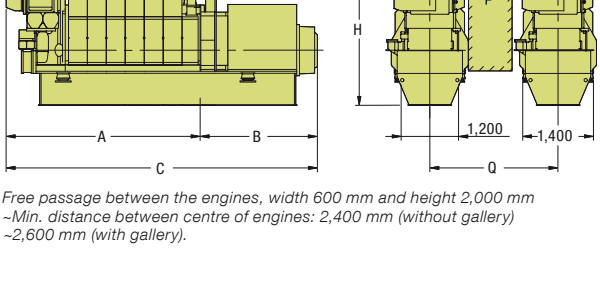
Bore: 210 mm, Stroke: 310 mm

Speed	r/min	900		1,000	
Frequency	Hz	60		50	
		Eng. kW	Gen. kW*	Eng. kW	Gen. kW*
5L21/31		1,000	950	1,000	950
6L21/31		1,320	1,254	1,320	1,254
7L21/31		1,540	1,463	1,540	1,463
8L21/31		1,760	1,672	1,760	1,672
9L21/31		1,980	1,881	1,980	1,881

Dimensions

Cyl. No.		5	6	7	8	9
	r/min	900/1000	900/1000	900/1000	900/1000	900/1000
A	mm	3,959	4,314	4,669	5,572	5,927
B	mm	1,870	2,000	1,970	2,110	2,135
C	mm	5,829	6,314	6,639	7,682	8,062
H	mm	3,183	3,183	3,289	3,289	3,289
Dry Mass	t	22.5	26.0	29.5	33.0	36.5

** Based on nominal generator efficiencies of 95%*



P Free passage between the engines, width 600 mm and height 2,000 mm
Q ~Min. distance between centre of engines: 2,400 mm (without gallery) ~2,600 mm (with gallery).

MAN L16/24

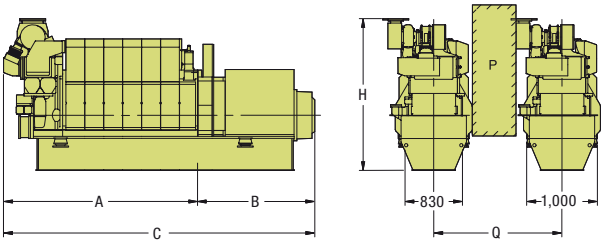
Bore: 160 mm, Stroke: 240 mm

Speed	r/min	1,200		1,000	
Frequency	Hz	60		50	
		Eng. kW	Gen. kW*	Eng. kW	Gen. kW*
5L16/24		500	475	450	428
6L16/24		660	627	570	542
7L16/24		770	732	665	632
8L16/24		880	836	760	722
9L16/24		990	941	855	812

Dimensions

Cyl. No.		5	6	7	8	9
	r/min	1200/1000	1200/1000	1200/1000	1200/1000	1200/1000
A	mm	2,807	3,082	3,557	3,832	4,107
B	mm	1,400	1,490	1,585	1,680	1,680
C	mm	4,207	4,572	5,142	5,512	5,787
H	mm	2,337	2,337	2,415/2,337	2,415	2,415
Dry Mass	t	9.5	10.5	11.4	12.4	13.1

** Based on nominal generator efficiencies of 95%*



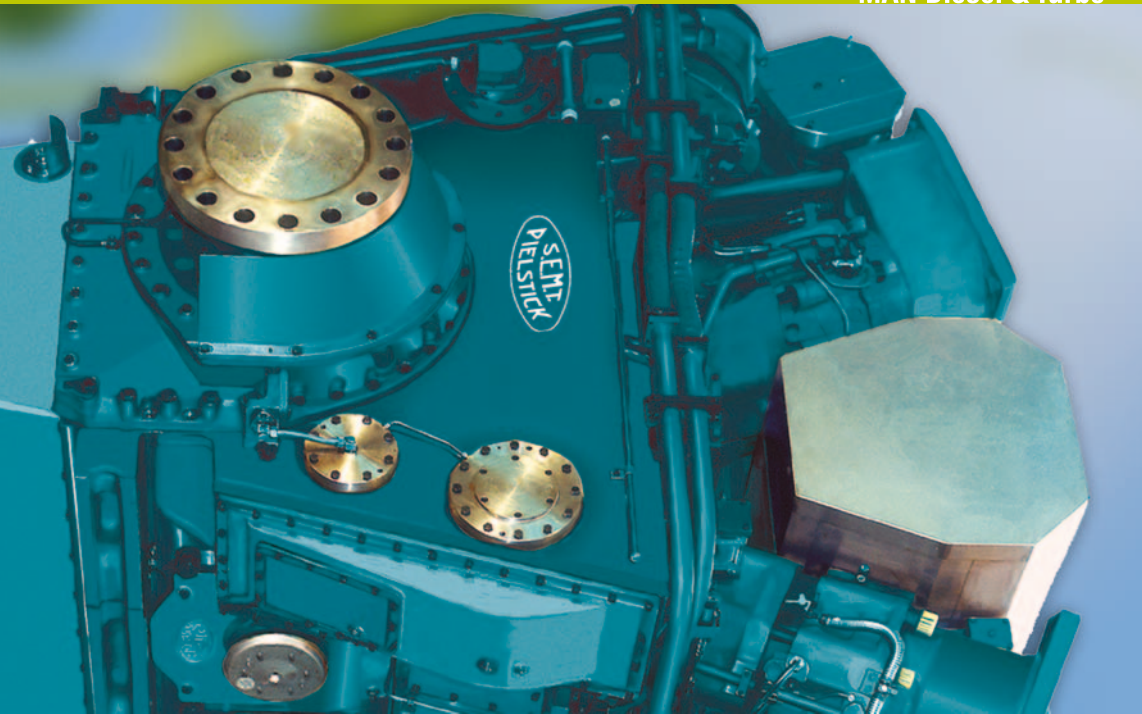
P Free passage between the engines, width 600 mm and height 2,000 mm
Q ~Min. distance between centre of engines: 1,800 mm.

S.E.M.T. Pielstick Medium Speed

Propulsion engines

Engineering the Future – since 1758.

MAN Diesel & Turbo


S.E.M.I.
PIELSTICK

S.E.M.T. Pielstick PC2.6 B

Bore: 400 mm, Stroke: 500 mm

Speed	r/min	600
mep	bar	23.9
		kW
12PC2.6 B		9,000
14PC2.6 B		10,500
16PC2.6 B		12,000

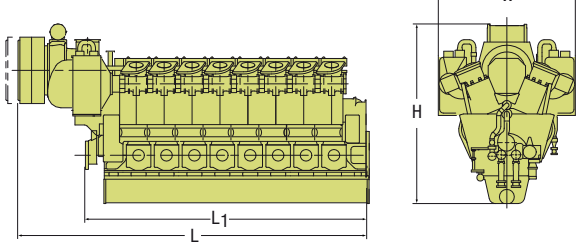
Specific Fuel Oil Consumption (SFOC) to ISO conditions

MCR	100%	85%
PC2.6 B	-[1)]	-[1)]

Dimensions

Cyl. No.		12	14	16
L	mm	9,100	9,840	10,580
L_1	mm	5,960	6,700	7,440
W	mm	3,780	3,780	3,780
H	mm	4,800	4,800	4,800
Dry mass	t	94	104	114

[1)] *SFOC values are project specific. Please contact MAN Diesel & Turbo for further information*



S.E.M.T. Pielstick PA6 B STC

Bore: 280 mm, Stroke: 330 mm

Speed	r/min	1050
mep	bar	22.8
		kW*
12PA6 B STC		4,860
16PA6 B STC		6,480
20PA6 B STC		8,100

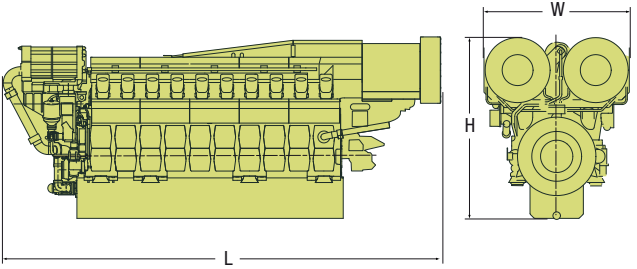
Specific Fuel Oil Consumption (SFOC) to ISO conditions

MCR	100%	85%
PA6 B STC	-[1)]	-[1)]

Dimensions

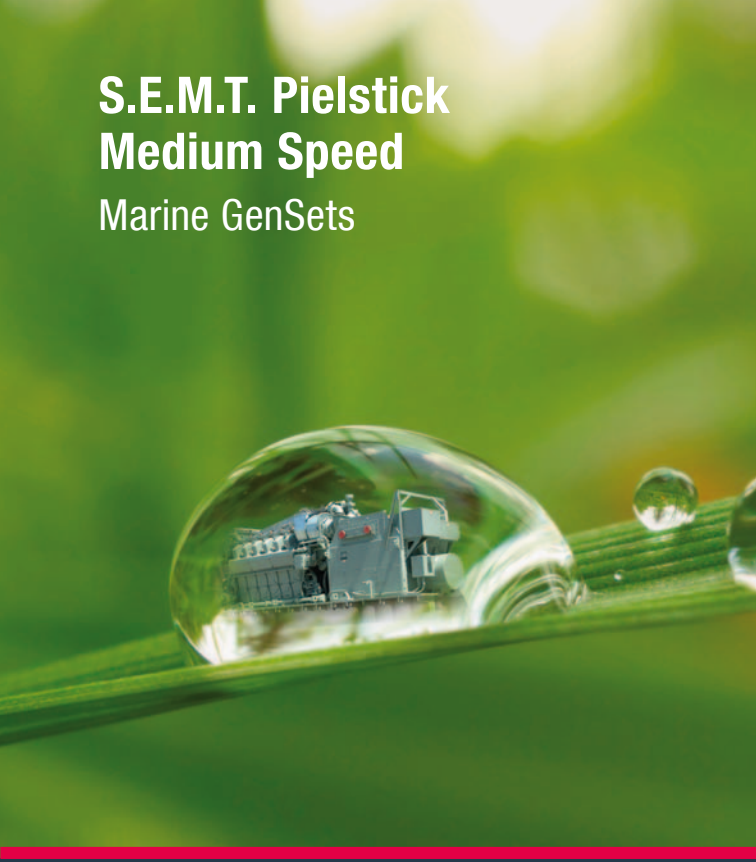
Cyl. No.		12	16	20
L	mm	5,830	6,780	7,960
W	mm	2,340	2,340	2,640
H	mm	3,124	3,124	3,166
Dry mass	t	31	37	43

Engine fuel: Distillate according to ISO 8217 DMA
Engine rating: engine rating according to ISO 3046 conditions
** 110% load for navy application for vessels with approval according to HSVR from DNV available 1 hour of 6 hours of engine operating time on special request*
1) SFOC values are project specific. Please contact MAN Diesel & Turbo for further information.



S.E.M.T. Pielstick Medium Speed

Marine GenSets



Engineering the Future – since 1758.

MAN Diesel & Turbo

S.E.M.T. Pielstick PA6 B

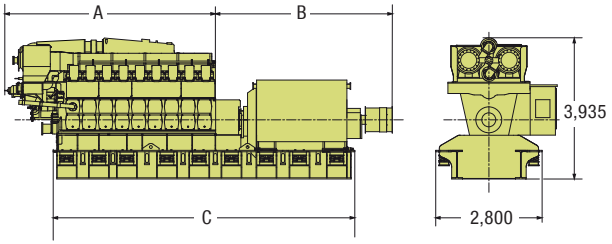
Bore 280 mm, Stroke 330 mm

Speed	r/min	1000		900	
Frequency	Hz	50		60	
		Eng. kW	Gen. kW*	Eng. kW	Gen. kW*
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

Dimensions

Cyl. No.		12	16	18	20
A	mm	4,510	5,430	5,890	6,350
B	mm	4,600	4,800	4,933	5,000
C	mm	6,840	7,760	8,220	8,680
Dry mass	t	65	78	86	95

** Nominal generator efficiencies: 97%*
Engine fuel: Distillate according to ISO 8217 DMA



MAN Medium Speed

Propulsion systems

Engineering the Future – since 1758.

MAN Diesel & Turbo

MAN Alpha

Fixed Pitch Propeller Programme

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
- a wide range of stern tube lube and sealing systems
  – oil, water, biodegradable oils

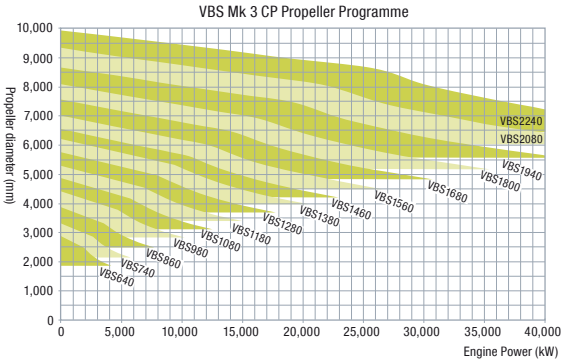
The MAN Alpha FPP's are characterised by the following benefits:

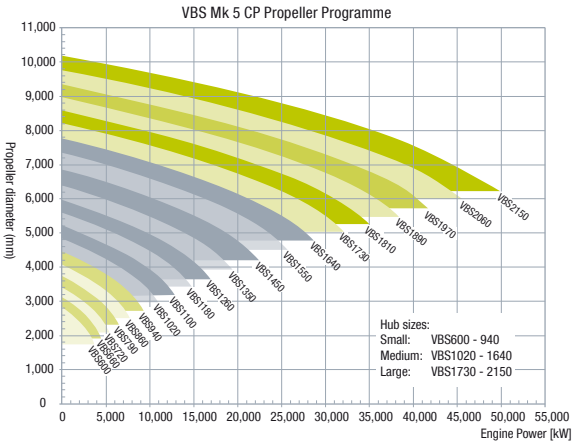
- high-efficient hydrodynamically optimised blade profiles
  – Kappel designs available
- high reliability: Robust approach with ample mechanical design margins
- high-efficient aft ship integration with rudder, rudder bulb, ducts, etc.
- layouts for complete propulsion systems
- plant calculations with upfront consideration to TVC, alignment and control systems

MAN Medium Speed Propulsion Systems

MAN Alpha controllable Pitch Propeller

- as standard Mk 5 versions are 4-bladed – and 5-bladed versions are available upon 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. The below standard programmes, however, are based on 'no ice'.





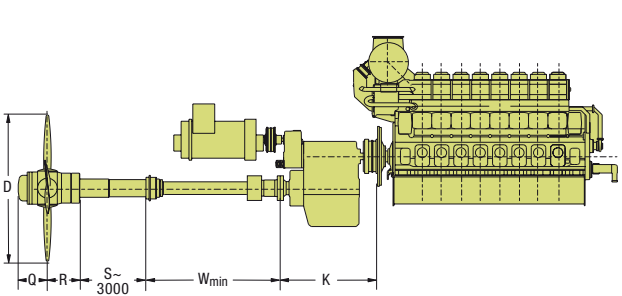
MAN Standard Package Examples

Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm	Q mm	R mm	W_{min} mm	K mm	Gear mass t	Prop. mass t*
L58/64										
6	8,400	170	4,500	1,280	975	1,115	2,200	2,250	12.2	23.9
6	8,400	130	5,100	1,280	975	1,115	2,350	2,350	15.1	28.2
6	8,400	90	6,100	1,560	1,190	1,305	2,550	2,700	26.2	40.3
7	9,800	170	4,650	1,280	975	1,115	2,200	2,385	14.5	27.1
7	9,800	130	5,300	1,380	1,050	1,175	2,350	2,585	20.1	32.2
7	9,800	90	6,300	1,560	1,190	1,305	2,570	2,835	31.0	45.4
8	11,200	170	4,800	1,380	1,050	1,175	2,270	2,420	15.0	30.8
8	11,200	130	5,500	1,460	1,110	1,220	2,350	2,620	20.8	35.9
8	11,200	90	6,500	1,680	1,280	1,380	2,570	3,120	36.5	52.2
9	12,600	170	4,950	1,380	1,050	1,175	2,350	2,520	16.8	31.9
9	12,600	130	5,650	1,560	1,190	1,305	2,550	2,740	23.7	41.2
9	12,600	90	6,700	1,680	1,280	1,380	2,570	3,140	43.0	55.4
V48/60CR										
12	14,400	180	4,950	1,460	1,100	1,170	2,676	2,620	19.9	34.4
12	14,400	140	5,600	1,560	1,175	1,242	2,676	2,770	27.0	40.2
12	14,400	100	6,600	1,680	1,278	1,333	2,919	3,140	42.9	49.3
14	16,800	180	5,100	1,560	1,175	1,242	2,651	2,775	23.5	38.6
14	16,800	140	5,850	1,680	1,278	1,333	2,676	2,905	31.9	50.1
14	16,800	100	6,850	1,800	1,370	1,227	2,920	3,355	48.2	62.7
16	19,200	180	5,260	1,680	1,278	1,333	2,676	2,805	26.8	46.5
16	19,200	140	6,050	1,800	1,370	1,227	2,920	3,155	37.1	58.8
16	19,200	100	7,100	1,940	1,480	1,307	3,000	3,455	57.8	74.0
18	21,600	180	5,400	1,680	1,278	1,333	2,676	2,905	30.9	50.1
18	21,600	140	6,200	1,800	1,370	1,227	2,900	3,155	37.4	61.4
18	21,600	100	7,300	1,940	1,480	1,307	3,000	3,655	68.3	77.2
L48/60CR										
6	7,200	180	4,250	1,180	885	996	2,170	2,415	10.5	19.9
6	7,200	140	4,800	1,280	957	1,075	2,500	2,485	12.8	24.9
6	7,200	100	5,600	1,380	1,050	1,175	2,270	2,905	23.2	30.2
7	8,400	180	4,400	1,280	957	1,075	2,170	2,485	12.2	24.3
7	8,400	140	5,000	1,380	1,030	1,131	2,580	2,585	15.2	29.3
7	8,400	100	5,850	1,460	1,100	1,170	2,657	2,935	26.3	34.7
8	9,600	180	4,550	1,280	975	1,115	2,200	2,250	12.6	25.5
8	9,600	140	5,150	1,380	1,030	1,131	2,500	2,450	17.0	30.6
8	9,600	100	6,000	1,560	1,175	1,257	2,600	2,800	29.7	38.3
9	10,800	180	4,700	1,380	1,030	1,131	2,500	2,385	14.7	24.8
9	10,800	140	5,300	1,460	1,100	1,170	2,651	2,485	17.4	34.6
9	10,800	100	6,200	1,560	1,190	1,350	2,550	2,835	30.7	42.4

MAN Standard Package Examples

Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm	Q mm	R mm	W_{min} mm	K mm	Gear mass t	Prop. mass t*
L35/44DF										
6	3,180	208	3,300	790						6.4
6	3,180	167	3,800	940						8.7
6	3,180	130	4,400	1,020						10.9
7	3,710	198	3,500	860						7.9
7	3,710	161	4,000	940						9.5
7	3,710	128	4,600	1,100						12.7
8	4,240	197	3,600	860						8.4
8	4,240	165	4,050	940						10.0
8	4,240	127	4,750	1,100						13.6
9	4,770	202	3,600	940						9.3
9	4,770	167	4,100	1,020						11.9
9	4,770	130	4,800	1,100						14.7
10	5,300	199	3,700	940						10.2
10	5,300	166	4,200	1,020						12.5
10	5,300	126	5,000	1,180						16.8

* *S_{min} and propeller mass are based on 6,000 mm propeller shaft and 3,000 mm stern tube*




Efficiency Improving Devices

MAN Standard Package Examples

Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm
V32/44CR				
12	6,720	200	3,800	1,180
12	6,720	160	4,400	1,180
12	6,720	120	5,250	1,380
14	7,840	200	3,950	1,280
14	7,840	160	4,550	1,380
14	7,840	120	5,400	1,380
16	8,960	200	4,050	1,380
16	8,960	160	4,650	1,380
16	8,960	120	5,550	1,460
18	10,080	200	4,150	1,380
18	10,080	160	4,750	1,460
18	10,080	120	5,700	1,560
20	11,200	200	4,250	1,380
20	11,200	160	4,850	1,460
20	11,200	120	5,850	1,560

L32/44CR				
6	3,360	200	3,350	860
6	3,360	160	3,800	980
6	3,360	120	4,450	1,080
7	3,920	200	3,500	980
7	3,920	160	3,950	1,080
7	3,920	120	4,600	1,180
8	4,480	200	3,600	1,080
8	4,480	160	4,050	1,080
8	4,480	120	4,750	1,180
9	5,040	200	3,650	1,080
9	5,040	160	4,150	1,080
9	5,040	120	4,900	1,280
10	5,600	200	3,700	1,180
10	5,600	160	4,250	1,180
10	5,600	120	5,000	1,280

** S_{min} and propeller mass are based on 6,000 mm propeller shaft and 3,000 mm stern tube*

MAN Standard Package Examples

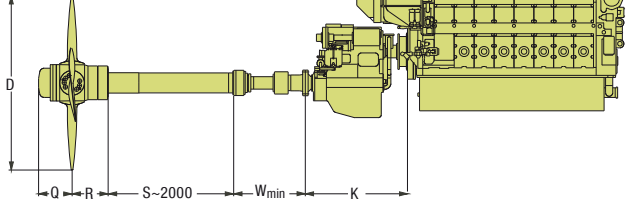
Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm	Q mm	R mm	W_{min} mm	K mm	Gear mass t	Prop. mass t*
V32/40										
12	6,000	200	3,950	1,080	821	880	1,560	2,090	8.5	16.2
12	6,000	160	4,400	1,180	821	945	1,630	2,220	10.6	16.8
12	6,000	120	5,050	1,280	957	1,075	1,700	2,590	19.5	23.6
14	7,000	200	4,100	1,180	821	945	1,630	2,165	8.9	16.7
14	7,000	160	4,550	1,180	885	996	1,650	2,365	12.5	19.2
14	7,000	120	5,250	1,380	957	1,075	1,700	2,785	22.0	26.7
16	8,000	200	4,200	1,180	885	996	1,630	2,295	10.5	20.8
16	8,000	160	4,700	1,280	885	996	1,700	2,465	14.5	22.6
16	8,000	120	5,400	1,380	1,030	1,131	1,740	2,815	25.1	29.6
18	9,000	200	4,300	1,280	885	1,021	1,650	2,295	10.7	20.7
18	9,000	160	4,850	1,280	957	1,075	1,700	2,465	14.8	23.4
18	9,000	120	5,600	1,460	1,100	1,170	1,780	2,915	29.4	33.1
L32/40										
6	3,000	200	3,300	860	655	735	1,400	1,740	4.5	8.8
6	3,000	160	3,700	980	655	735	1,520	1,830	5.6	9.9
6	3,000	120	4,200	1,080	820	805	1,520	2,130	9.8	12.4
7	3,500	200	3,450	980	655	735	1,400	1,740	4.6	9.7
7	3,500	160	3,850	980	746	785	1,520	1,880	6.5	11.8
7	3,500	120	4,400	1,080	820	875	1,560	2,130	10.1	14.5
8	4,000	200	3,550	980	655	735	1,520	1,920	5.7	10.4
8	4,000	160	4,000	1,080	820	805	1,520	2,030	7.4	12.6
8	4,000	120	4,550	1,180	885	880	1,630	2,290	11.9	16.4
9	4,500	200	3,650	980	746	785	1,520	1,920	5.8	12.2
9	4,500	160	4,100	1,080	820	805	1,560	2,090	9.0	13.2
9	4,500	120	4,650	1,180	885	880	1,630	2,390	13.9	17.2

* *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	K mm	Gear mass t	Prop. mass t*
L27/38										
6	2,040	256	2,650	740	569	655	1,300	2,279	8.5	4.7
6	2,040	208	2,950	740	569	655	1,300	2,279	8.5	5.3
6	2,040	177	3,200	860	653	743	1,400	2,279	8.5	5.7
6	2,040	145	3,500	860	653	743	1,400	2,279	8.5	7.0
6	2,040	133	3,650	860	653	743	1,400	3,071	14.0	7.3
7	2,380	256	2,800	740	569	655	1,300	2,279	8.5	5.3
7	2,380	208	3,100	860	653	743	1,400	2,279	8.5	6.4
7	2,380	177	3,350	860	653	743	1,400	2,279	8.5	6.6
7	2,380	145	3,650	860	653	743	1,450	2,279	8.5	7.7
7	2,380	133	3,800	980	746	806	1,500	3,071	14.0	9.4
8	2,720	256	2,900	860	653	743	1,400	2,279	8.5	6.4
8	2,720	208	3,200	860	653	743	1,400	2,279	8.5	6.8
8	2,720	177	3,450	860	653	743	1,450	2,279	8.5	7.6
8	2,720	161	3,600	860	653	743	1,450	2,279	8.5	7.8
8	2,720	133	3,950	980	746	806	1,500	3,071	14.0	9.6
9	3,060	256	2,950	860	653	743	1,400	2,279	8.5	6.7
9	3,060	208	3,300	860	653	743	1,400	2,279	8.5	7.1
9	3,060	177	3,550	860	653	743	1,400	2,279	8.5	8.1
9	3,060	161	3,700	980	746	806	1,500	2,279	8.5	9.4
9	3,060	133	4,050	980	746	806	1,550	3,071	14.0	10.0

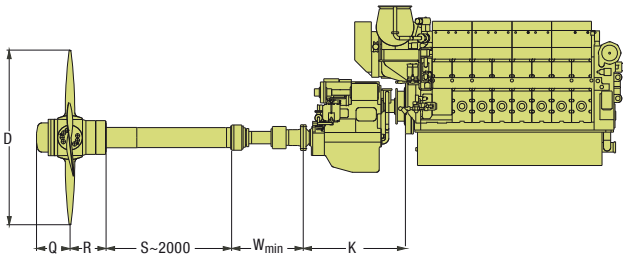
* *S_{min} and propeller mass are based on 4,000 mm propeller shaft and 2,000 mm stern tube for 21/31, 27/38 and 6,000 mm propeller shaft and 3,000 mm stem tube for the other types*



MAN Standard Package Examples

Cyl.	kW	Prop. speed r/min	D mm	Hub VBS mm	Q mm	R mm	W_{min} mm	K mm	Gear mass t	Prop. mass t*
L21/31										
6	1,290	270	2,350	640	550	596	1,200	2,241	4.9	3.2
6	1,290	218	2,600	640	550	596	1,200	2,241	4.9	3.6
6	1,290	190	2,800	740	569	655	1,300	2,241	6.4	4.5
6	1,290	167	3,000	740	569	655	1,300	2,241	6.4	5.7
7	1,505	270	2,500	640	550	596	1,200	2,241	4.9	3.6
7	1,505	218	2,750	740	569	655	1,300	2,241	4.9	4.4
7	1,505	190	2,950	740	569	655	1,300	2,241	6.4	4.9
7	1,505	167	3,150	860	653	743	1,400	2,241	6.4	6.2
8	1,720	278	2,550	640	550	596	1,200	2,241	6.1	3.7
8	1,720	218	2,850	740	569	655	1,300	2,241	6.1	4.6
8	1,720	190	3,050	740	569	655	1,300	2,241	6.4	6.1
8	1,720	167	3,250	860	653	743	1,400	2,241	6.4	6.5
9	1,935	278	2,600	740	569	655	1,300	2,241	6.1	4.5
9	1,935	218	2,900	740	569	655	1,300	2,241	6.1	5.0
9	1,935	194	3,100	860	653	743	1,400	2,241	8.5	6.4
9	1,935	182	3,200	860	653	743	1,400	2,241	8.5	7.0

** 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 Exhaust Gas Turbochargers

Engineering the Future – since 1758.

MAN Diesel & Turbo

MAN Exhaust Gas Turbochargers

TCR and NR types with radial flow turbine and TCA and NA types with axial flow turbine

- straightforward design, uncooled gas casings, inboard bearing arrangement, plain bearings
- lube oil supply from the engine
- high availability, reliability, durability
- high efficiency
- easy maintenance and servicing
- long lifetimes of components
- long intervals between overhauls

Applications for Marine and Stationary

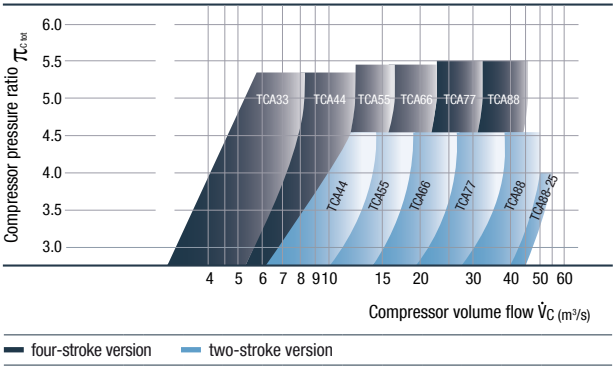
- propulsion units
- generating sets
- diesel and dual fuel engines
- gas engines
- HFO engines

Special

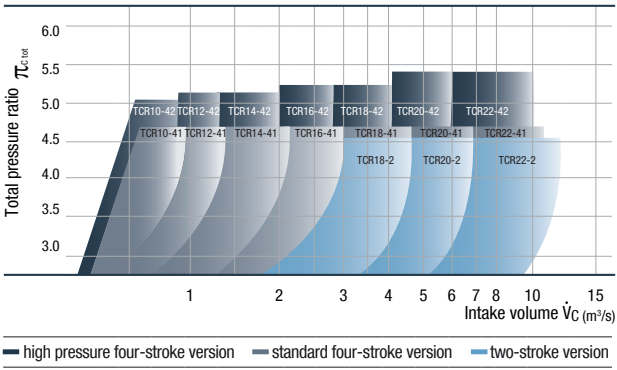
- tailormade solutions
- Power Turbines (PTG)
- Turbo Compound Systems (TCS - PTG) with Power Turbine Generator
- Variable Turbine Area (VTA)

MAN Exhaust Gas Turbochargers

MAN Turbocharger application ranges TCA



MAN Turbocharger application ranges TCR



MAN TCA Series

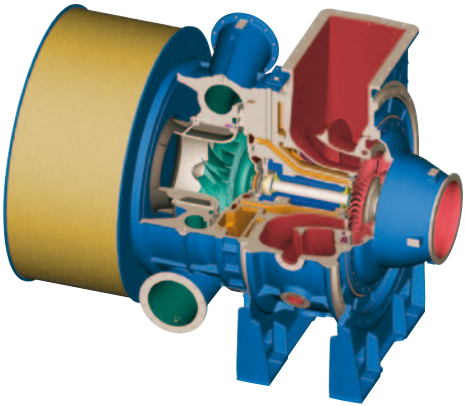
Main features

Turbine type	Axial flow turbine
Max. permiss. temp.	500 °C 2-stroke / 650 °C 4-stroke
Pressure ratio	up to 5.5
Suitable for HFO, MDO, Gas	

Turbocharger programme

Turbocharger	Max. supercharged engine output kW		Max. permissible	
type	2-stroke	4-stroke	Speed	Mass
	le* = 8.5 kg/kWh	le* = 6.5 kg/kWh	rpm	kg
TCA33	-	5,400	27,800	1,370
TCA44	6,500	7,900	22,700	1,950
TCA55	9,000	10,400	20,000	3,200
TCA66	13,200	14,800	16,900	5,300
TCA77	18,750	21,000	14,200	8,330
TCA88	28,500	30,000	12,000	14,000

** Specific air consumption*



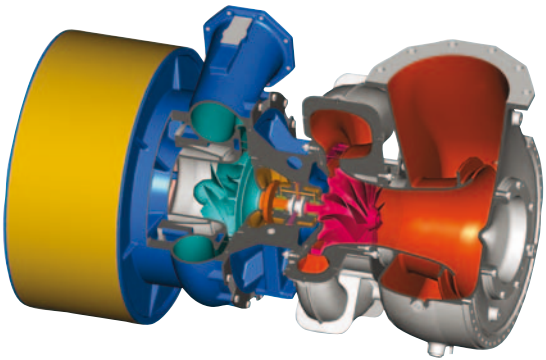
Main features

Turbine type	Radial flow turbine
Max. permiss. temp.	650 °C
Pressure ratio	up to 5.4
Suitable for HFO, MDO, Gas	

Turbocharger programme

Turbocharger	Max. supercharged engine output kW		Max. permissible	
type	2-stroke	4-stroke	Speed	Mass
	le* = 7.5 kg/kWh	le* = 6.5 kg/kWh	rpm	kg
TCR10	-	600	85,000	50
TCR12	-	880	70,900	80
TCR14	-	1,300	58,700	110
TCR16	-	1,850	48,800	180
TCR18	2,500	2,750	40,300	300
TCR20	3,700	4,000	33,400	500
TCR22	6,600	6,850	25,600	1,050

** Specific air consumption*



MAN NA/S/T9 Series

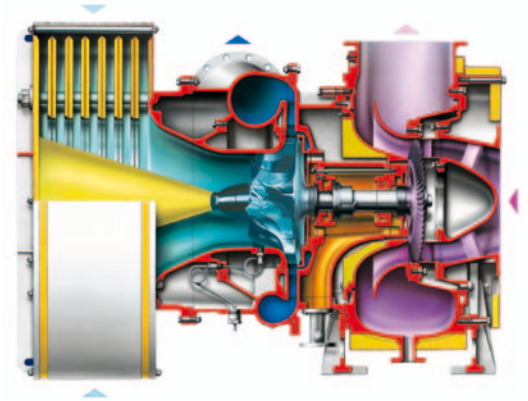
Main features

Turbine type	Axial flow turbine
Max. permiss. temp.	650 °C
Pressure ratio	up to 4.5
Suitable for HFO, MDO, Gas	

Turbocharger programme

Turbocharger type	Max. supercharged engine output kW	Max. permissible speed rpm	Mass kg
NA29/S	3,600	31,300	1,050
NA34/S	5,100	26,300	1,350
NA40/S	7,300	22,400	2,200
NA48/S	11,000	18,600	3,700
NA57/T9*	16,100	15,000	5,100
NA70/T9**	24,500	12,000	9,800

* *Pressure ratio up to 4.2*
** *Pressure ratio up to 4.0*
Specific air consumption Ie = 6.5 kg/kWh



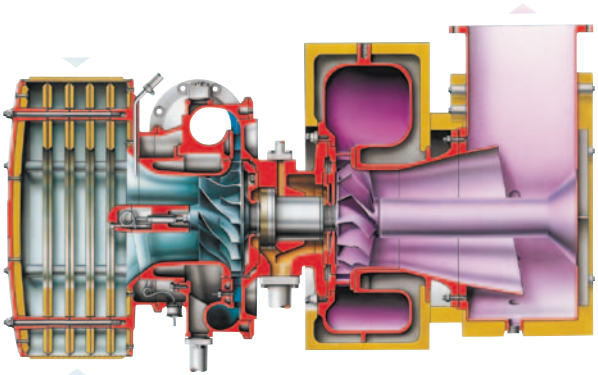
Main features

Turbine type	Radial flow turbine
Max. permiss. temp.	650 °C (opt. 720 °C)
Pressure ratio	up to 4.5
Suitable for HFO, MDO, Gas	

Turbocharger programme

Turbocharger type	Max. supercharged engine output kW	Max. permissible speed rpm	Mass kg
NR12/S	670	75,000	155
NR14/S	950	64,000	190
NR17/S	1,350	52,600	260
NR20/S	1,870	44,700	350
NR24/S	2,690	37,300	505
NR29/S	3,820	31,300	780
NR34/S	5,400	26,300	1,450

Specific air consumption Ie = 7 kg/kWh



MAN (TCS-) PTG Power Turbines

Exhaust Gas Turbine
- newly developed high efficiency turbine
- new turbine nozzle ring with extended life time
- bearing arrangement with long life time
- axial: Based on most modern TCA series
- radial: Based on most modern TCR series

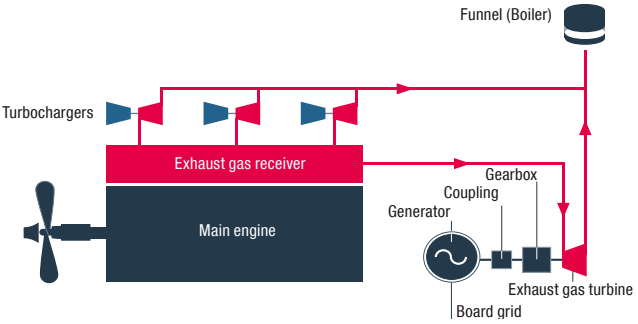
Gearbox
- high efficiency high speed gearbox reducing turbine speed to generator speed

Couplings
- gearbox to generator: High flexible coupling

Generator
- synchronous generator

Exhaust Gas System
- control valves for power turbine operating range
- fast acting emergency valves for emergency shutdown
- control and saftey equipment

Optional: Variable Turbine Area (VTA) for Exhaust Gas Turbine
- increasing efficiency and flexibility of operation



MAN (TCS-) PTG Power Turbines

Main Features Power Turbines

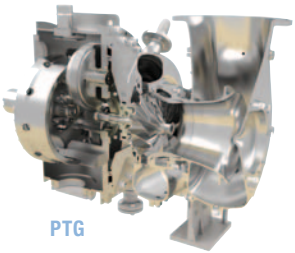
Turbine type	Radial or Axial
Max. permiss. temp.	550 ºC
Output shaft speed	1,800 rpm (1,500 rpm)
Suitable for HFO, MDO, Gas	

Radial flow turbine

	Max. output kW_{el}	Max. flow rate kg/s	Speed PT 1/min
	$\prod_T = 3.9$	Temperature before turbine 480 °C	
(TCS-) PTG18	1,070	6.7	34,000
(TCS-) PTG20	1,560	9.7	28,000
(TCS-) PTG22	2,700	16.5	21,000

Axial flow turbine

(TCS-) PTG55	4,020	24.6	16,000



PTG

TCS - PTG

MAN Variable Turbine Area (VTA)

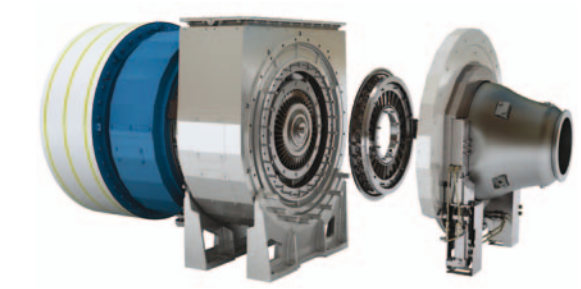
Variable Turbine Area (VTA)

The VTA system consists of a nozzle ring equipped with adjustable vanes which optionally replace the fixed-vane nozzle rings in MAN Diesel & Turbo's standard TCA and TCR turbochargers.

By altering the pitch of the adjustable vanes, the pressure of the exhaust gases on the turbine is regulated and thus the volume of charge air can be precisely matched to the quantity of injected fuel at all points in an engine's load and speed range. The result is reduced specific fuel consumption, reduced emissions HC and CO_2 and improved engine response.

Benefits of VTA

- up to 5 g/kWh lower fuel consumption
- lower soot and smoke emission
- lower CO_2 emissions
- lower particle emissions
- suitable for TCA and TCR turbochargers
- retrofit packages
- short payback time
- VTA cuts fuel consumption and reduces emissions



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Engineering the Future – since 1758.

MAN Diesel & Turbo

List of Licensees

Symbols used:
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F: MAN Diesel & Turbo Four-stroke licence
FS: MAN Diesel & Turbo Four-stroke SEMT Pielstick licence
P: MAN Diesel & Turbo Propeller licence
TC: MAN Diesel & Turbo Turbocharger licence

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