MAN B&W Stationary Engines and Small Bore GenSets Programme 2018
All data provided in this document is non-binding. This data serves informational purposes only and is especially not guaranteed in any way.

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

If this document is delivered in another language than English and doubts arise concerning the translation, the English text shall prevail.
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Let us take another green step together

In a world with constant focus on reducing CO₂ emissions, MAN Diesel & Turbo offers the well-proven engines from the market-leading marine engine programme, but adapted to stationary power production. The robust and innovative engine design is equally important irrespective of the application.

Whether fuel oil or dual fuel operation is needed, the high efficiency of two-stroke diesel engines is a key factor in lowering CO₂ emissions. With our G and S engine versions, a step into the fully electronically controlled world is taken.

The engines in this programme comply with the NOₓ emission limits set out in the World Bank 2008 guidelines. For lower emission limits, MAN Diesel & Turbo offers selective catalytic reduction (SCR) solutions or exhaust gas recirculation (EGR) solutions on request.

With electronic control, it is possible, within reasonable limits, to compensate for variations in fuel oil and fuel gas qualities, thereby securing power to the grid at the optimum efficiency.

For customers preparing for a digitised world with online monitoring possibilities, the electronic control can provide such solutions from the beginning of each project.

Our core design focus continues being:
- High efficiency
- High reliability
- Fuel flexibility
- Low maintenance costs

MAN B&W engines are sold and built by our licensees (engine builders) placed worldwide.
MAN B&W Two-Stroke Engines

Engineering the Future – since 1758.
MAN Diesel & Turbo
### MAN B&W Two-Stroke Engines

#### Speed r/min - Engine type

<table>
<thead>
<tr>
<th>Speed r/min</th>
<th>Engine type</th>
</tr>
</thead>
<tbody>
<tr>
<td>83.3-83.7</td>
<td>G90ME-S/G90ME-GI-S</td>
</tr>
<tr>
<td>76.9-78.3</td>
<td>S80ME-S/S80ME-GI-S</td>
</tr>
<tr>
<td>90.9-90.0</td>
<td>S70ME-S/S70ME-GI-S</td>
</tr>
<tr>
<td>103.4-102.9</td>
<td>S60ME-S/S60ME-GI-S</td>
</tr>
</tbody>
</table>

#### Technical data

For technical engine data for a specific project, please contact MAN Diesel & Turbo in Copenhagen, or the engine builder, listing the following input data:

- Name of site
- GPS coordinates
- Required total output, kWm or kWe
- Ambient temperature, min./max., °C
- Altitude above sea level, m
- Scavenge air coolant temperature min./max., °C
- Type of cooling water system, i.e. radiator cooling, central cooling or cooling tower
- Copy of fuel and fuel gas specifications
- Emission limits at site

#### Engine power MW

<table>
<thead>
<tr>
<th>Type</th>
<th>Power range</th>
<th>Speed 50 Hz</th>
<th>Speed 60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kWm</td>
<td>r/min</td>
<td>r/min</td>
</tr>
<tr>
<td>G90ME-S/G90ME-GI-S</td>
<td>34,300 – 67,680</td>
<td>83.3</td>
<td>83.7</td>
</tr>
<tr>
<td>S80ME-S/S80ME-GI-S</td>
<td>26,460 – 38,700</td>
<td>76.9</td>
<td>78.3</td>
</tr>
<tr>
<td>S70ME-S/S70ME-GI-S</td>
<td>19,250 – 26,160</td>
<td>90.9</td>
<td>90.0</td>
</tr>
<tr>
<td>S60ME-S/S60ME-GI-S</td>
<td>13,860 – 18,720</td>
<td>103.4</td>
<td>102.9</td>
</tr>
</tbody>
</table>
MAN B&W Two-Stroke Engines

Definitions
MAN B&W two-stroke low speed engines are designed to provide optimum fuel flexibility and are an ideal source of power, whether operating on gas, liquid fuel or liquid biofuel.

Liquid fuels: HFO and diesel according to ISO 8217, crude biofuel, and crude oil.
Gaseous fuels: Natural gas, LNG, and ethane.
Liquid gas fuels: Methanol, LPG, DME, and ethanol.

Engine and GenSet power
Engine and generator power figures are stated in kW. Ratings are given according to ISO 3046-1:2002. The electrical power has been calculated based on a standard generator with a nominal efficiency of 97.5% and according to IEC 60034 in the corresponding power range and at a power factor of 0.9. This is for guidance only as it is to be confirmed by the selected generator maker.

Nominal rating
The engine ratings quoted are valid up to tropical conditions:
- Blower inlet temperature 45ºC
- Blower inlet pressure 1,000 mbar
- Charge air coolant temperature 32ºC

If the engine will operate under more demanding ambient conditions, please contact MAN Diesel & Turbo, Copenhagen or the engine builder.

Engine application
The engine ratings and speeds shown are based on generator drive application. For other drives, such as mechanical drive of mills, pumps, compressors, etc., please contact MAN Diesel & Turbo, Copenhagen, or the engine builder. The diesel generating set ratings and heat rates shown depend on the actual generator maker and are for guidance only.

Site specified rating
L ≥ site specified rating ≥ L
The engine may be operated without restriction at any load up to site specified rating. Operating at overload rating, i.e. 110% of the site specified rating, is permissible for one hour every 12 consecutive hours.
MAN B&W Two-Stroke Engines

**Engine heat rate and fuel oil consumption guarantee**

The figures specified in the tables are subject to a tolerance of ±5% and are given at 100% MCR while meeting the World Bank 2008 emission limits and according to ISO 3046/1-2002 ambient conditions:

- Blower inlet temperature 25°C
- Blower inlet pressure 1,000 mbar
- Charge air coolant temperature 25°C

If the engine is operated under other ambient conditions or if the engine is equipped with emission control systems, TCS and/or BCST, please contact MAN Diesel & Turbo, Copenhagen, or the engine builder.

All engine design criteria, for example heat load, bearing load and mechanical stress on the construction, are defined at 100% load, independent of the selected guarantee point. This means that turbocharger matching, engine adjustment and engine load calibration must also be performed at 100% load, independent of the guarantee point.

When choosing a specific fuel oil consumption (SFOC) guarantee at or below 100%, the tolerances, 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:

- 5% tolerance for 100-85% engine load
- 6% tolerance for <85-65% engine load
- 7% tolerance for <65-50% engine load

Please note that the SFOC guarantee can only be given in one load point for stationary two-stroke engines.

Conversion between heat rate and SFOC can be found by applying the following formula:

\[
\text{SFOC [g/kWh]} = \frac{\text{Heat Rate [kJ/kWh]} \times 1000}{\text{LCV [kJ/kg]}}
\]

**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.
MAN B&W Two-Stroke Engines

Cylinder oil consumption
Alpha ACC (Adaptive Cylinder-oil Control) is the lubrication mode for MAN B&W two-stroke engines that involves lube oil dosing proportional to the engine load and to the sulphur content in the fuel oil being burned. The specific minimum dosage for low-sulphur fuels is set to 0.6 g/kWh. The typical ACC dosage for a BN 100 cylinder oil is 0.3 g/kWh × S%.


Turbocharger selection
Two-stroke low speed engines can be delivered with MAN Diesel & Turbo, ABB Turbo Systems Ltd. or Mitsubishi Heavy Industries, Ltd. turbochargers as standard.

Engine design
ME-S design
Two-stroke diesel engines designed with electronic control of the combustion process (i.e. fuel injection timing, exhaust valve actuation) and the starting air valves and cylinder lubrication. These engines operate on liquid fuels only.

ME-GI-S design
Dual fuel engines operating on high-flashpoint gaseous fuel oil and pilot oil. These engines operate on any high-calorific gas that can be compressed to 300 bar or 400 bar at 45°C and be injected into the combustion chamber in a single phase.

ME-LGI-S design
Dual fuel engines operate on low-flashpoint liquid gas fuels and pilot oil. For methanol the inlet pressure is 8 bar and for LPG the inlet pressure is 50 bar. Please contact MAN Diesel & Turbo or the engine builder for evaluations regarding ethane, LPG, methanol, biofuel or other fuels.

Guiding fuel specification
The engine data stated are valid using marine diesel oil or heavy fuel oil according to the guiding specification (maximum values at inlet to centrifuging plant):

Designation: ISO 8217 RMK700, with a sulphur content up to 3.5%

For operation on other fuel qualities, please contact MAN Diesel & Turbo, Copenhagen, or the engine builder.
**MAN B&W Two-Stroke Engines**

**Guiding biofuel specification (ref. 5755829-2)**

The values stated below are valid at the inlet to the centrifuge plant. Limit values may change if required by the engine conditions.

<table>
<thead>
<tr>
<th><strong>Designation</strong></th>
<th><strong>Density at 15°C</strong></th>
<th><strong>Max. 1,010</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kinematic viscosity at 50°C</strong></td>
<td>cSt</td>
<td><strong>Max. 55</strong></td>
</tr>
<tr>
<td><strong>Flash point</strong></td>
<td>°C</td>
<td><strong>Min. 65</strong></td>
</tr>
<tr>
<td><strong>Carbon residue</strong></td>
<td>% (m/m)</td>
<td><strong>Max. 20</strong></td>
</tr>
<tr>
<td><strong>Ash</strong></td>
<td>% (m/m)</td>
<td><strong>Max. 0.15</strong></td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td>% (m/m)</td>
<td><strong>Max. 1.0</strong></td>
</tr>
<tr>
<td><strong>Sulphur</strong></td>
<td>% (m/m)</td>
<td><strong>5.0</strong></td>
</tr>
<tr>
<td><strong>Phosphor</strong></td>
<td>ppm (m/m)</td>
<td><strong>Max. 15</strong></td>
</tr>
<tr>
<td><strong>Vanadium</strong></td>
<td>ppm (m/m)</td>
<td><strong>Max. 450</strong></td>
</tr>
<tr>
<td><strong>Aluminium/silicon</strong></td>
<td>mg/kg</td>
<td><strong>Max. 60</strong></td>
</tr>
<tr>
<td><strong>Sodium plus potassium</strong></td>
<td>ppm (m/m)</td>
<td><strong>Max. 200</strong></td>
</tr>
<tr>
<td><strong>Calcium</strong></td>
<td>ppm (m/m)</td>
<td><strong>Max. 200</strong></td>
</tr>
<tr>
<td><strong>Lead</strong></td>
<td>ppm (m/m)</td>
<td><strong>Max. 10</strong></td>
</tr>
<tr>
<td><strong>TAN (total acid number)</strong></td>
<td>mg KOH/g</td>
<td><strong>Max. 25</strong></td>
</tr>
<tr>
<td><strong>SAN (strong acid number)</strong></td>
<td>mg KOH/g</td>
<td><strong>Max. 0</strong></td>
</tr>
</tbody>
</table>

*Iodine, phosphorus and sulphur content according to agreement with the manufacturer of the emission control system.*

You can ask MAN Diesel & Turbo or the engine builder for a copy of the specification No 5755829-2 at any time.

For other biofuel qualities, please contact MAN Diesel & Turbo.
MAN B&W Two-Stroke Engines

Guiding gas specification (ref. 5739463-6)
The engine data stated are valid using gaseous gas according to the guiding specification.

**Designation**

<table>
<thead>
<tr>
<th>Designation</th>
<th>Unit</th>
<th>Min. or Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower calorific value (LCV)</td>
<td>MJ/kg</td>
<td>Min. 38</td>
</tr>
<tr>
<td>Gas methane number</td>
<td>No limit</td>
<td>-</td>
</tr>
<tr>
<td>Methane content</td>
<td>% (mol)</td>
<td>Max. 82</td>
</tr>
<tr>
<td>Ethane (C$_2$H$_6$)</td>
<td>% (mol)</td>
<td>Max. 15</td>
</tr>
<tr>
<td>Propane + butane (C$_3$H$_8$ + C$<em>4$H$</em>{10}$)</td>
<td>% (mol) (total)</td>
<td>Max. 5</td>
</tr>
<tr>
<td>Higher order hydrocarbons (C$<em>5$H$</em>{12}$ and higher)</td>
<td>% (mol) (total)</td>
<td>Max. 1</td>
</tr>
<tr>
<td>Hydrogen sulphide (H$_2$S) + carbonyl sulphide (COS)</td>
<td>mg/Nm$^3$</td>
<td>5 Max.</td>
</tr>
<tr>
<td>Water and hydrocarbon condensates</td>
<td>% volume</td>
<td>Max. 0</td>
</tr>
<tr>
<td>Gas inlet temperature</td>
<td>°C</td>
<td>45 ± 10</td>
</tr>
<tr>
<td>Gas pressure</td>
<td></td>
<td>According to MAN Diesel &amp; Turbo specification</td>
</tr>
</tbody>
</table>

*If operation on maximum gas fuel is to be obtained. Below 38 a higher pilot fuel oil amount might be required.*

You can ask MAN Diesel & Turbo or the engine builder for a copy of the specification No 5739463-6 at any time.

For other gas qualities, please contact MAN Diesel & Turbo, Copenhagen, or the engine builder.
MAN B&W Two-Stroke Engines

Guiding methanol specification (ref. 5741809-8)
The engine data stated are valid using liquid gas according to the guiding specification.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Unit</th>
<th>Min/Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower calorific value (LCV)</td>
<td>MJ/kg</td>
<td></td>
</tr>
<tr>
<td>Methanol (CH₃OH)</td>
<td>(% volume)</td>
<td>Min. 95</td>
</tr>
<tr>
<td>Water and hydrocarbon condensates</td>
<td>(% volume)</td>
<td>Max. 5</td>
</tr>
<tr>
<td>Acetone (CH₃COCH₃)</td>
<td>(mg/Nm³)</td>
<td>Max. 30</td>
</tr>
<tr>
<td>Chloride as Cl--</td>
<td>(mg/Nm³)</td>
<td>Max. 0.5</td>
</tr>
<tr>
<td>Sulphur (S)</td>
<td>(mg/Nm³)</td>
<td>Max. 0.5</td>
</tr>
<tr>
<td>Particles or solid size</td>
<td>(μm)</td>
<td>Max. 5</td>
</tr>
<tr>
<td>Gas pressure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

You can ask MAN Diesel & Turbo or the engine builder for a copy of the specification No 5741809-8 at any time.

For other qualities, please contact MAN Diesel & Turbo, Copenhagen, or the engine builder.
MAN B&W Two-Stroke Engines

Guiding LPG specification (ref. 5741441-7))
The engine data stated are valid using liquid gas according to the guiding specification.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Unit</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower calorific value (LCV)</td>
<td>MJ/kg</td>
<td>Min. 46</td>
</tr>
<tr>
<td>Methane</td>
<td>% (mol)</td>
<td>Max. 0.1</td>
</tr>
<tr>
<td>Ethane</td>
<td>% (mol)</td>
<td>Max. 12</td>
</tr>
<tr>
<td>Propane and butane</td>
<td>% (mol)</td>
<td>Max. 88</td>
</tr>
<tr>
<td>Higher-order hydrocarbons</td>
<td>% (mol)</td>
<td>Max. 3</td>
</tr>
<tr>
<td>1.3-Butadiene (C₄H₈)</td>
<td>% (mol)</td>
<td>Max. 0.1</td>
</tr>
<tr>
<td>Unsaturated hydrocarbons</td>
<td>% (mol)</td>
<td>Max. 11</td>
</tr>
<tr>
<td>Total evaporation residue</td>
<td>mg/kg</td>
<td>Max. 20</td>
</tr>
<tr>
<td>Free water at 15°C</td>
<td>–</td>
<td>Negative</td>
</tr>
<tr>
<td>Hydrogen sulphide (H₂S) + carbonyl sulphide (COS)</td>
<td>(mg/Nm³)</td>
<td>Max. 5</td>
</tr>
<tr>
<td>Gas pressure</td>
<td></td>
<td>According to MAN Diesel &amp; Turbo specification</td>
</tr>
</tbody>
</table>

You can ask MAN Diesel & Turbo or the engine builder for a copy of the specification No 5741441-7 at any time.

For other qualities, please contact MAN Diesel & Turbo, Copenhagen, or the engine builder.
MAN B&W Two-Stroke Engines

Guiding ethane specification (ref. 5770829-7)
The engine data stated are valid using gaseous gas according to the guiding specification.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Unit</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower calorific value (LCV)</td>
<td>MJ/kg</td>
<td>Min. 39</td>
</tr>
<tr>
<td>Methane (% mol)</td>
<td>Max. 15</td>
<td></td>
</tr>
<tr>
<td>Ethane (% mol)</td>
<td>Max. 85</td>
<td></td>
</tr>
<tr>
<td>Higher-order hydrocarbons (% mol)</td>
<td>Max. 15</td>
<td></td>
</tr>
<tr>
<td>Nitrogen (% mol)</td>
<td>Max. 15</td>
<td></td>
</tr>
<tr>
<td>Hydrogen sulphide (H₂S) + carbonyl sulphide (COS)</td>
<td>mg/Nm³</td>
<td>Max. 5</td>
</tr>
<tr>
<td>Gas pressure</td>
<td></td>
<td>According to MAN Diesel &amp; Turbo specification</td>
</tr>
</tbody>
</table>

You can ask MAN Diesel & Turbo or the engine builder for a copy of the specification No 5770829-7 at any time.

For other qualities, please contact MAN Diesel & Turbo, Copenhagen, or the engine builder.
MAN B&W Two-Stroke Engines

Two-stroke low speed engine of MAN B&W design in combined cycle
MAN B&W Two-Stroke Engines

Engine emissions
The data are valid for engines with emission control according to World Bank 2008. For guidance on how to meet lower emission levels, please contact MAN Diesel & Turbo, Copenhagen, or the engine builder.

Turbo compound system (TCS)
The turbo compound system, subject to the use of high-efficiency turbo-chargers, can be applied on both the G90 and S60 engine types. The use of a TCS system allows a reduction of up to 3% of the combined heat rate, depending on the site ambient conditions.

For detailed information, please contact MAN Diesel & Turbo, Copenhagen, or the engine builder.

Utilisation of the energy sources of the diesel engine
MAN B&W two-stroke low speed stationary diesel engines can be optimised to the following fields of energy production:
- District heating/cooling
- Freshwater

The diesel engine can provide energy for district heating/cooling or freshwater production utilising:
- Heat from scavenge air cooling
- Heat from jacket cooling
- Heat from lube oil cooling

For further technical information about this topic, please contact MAN Diesel & Turbo, Copenhagen, or the engine builder.

Extent of delivery
The final and binding extent of delivery of MAN B&W two-stroke diesel engines is to be supplied by our licensees, the engine builders, who are to be contacted in order to plan the execution of the actual project. In order to facilitate negotiations between the end-user, contractor and engine maker, a guiding Extent of Delivery’ (EoD), is available. This specifies the recommendations for MAN Diesel & Turbo’s basic and optional executions for the engine proper, and it is subject to modification without notice in the interest of the technical progress.

Please note that the licensees may select a different extent of delivery as their standard.
MAN B&W Two-Stroke Engines

Engine type designation

7 G 90 M E -GI -S

- Design
  - ME Electronically controlled
  - Stationary

- Fuel injection concept
  - GI Gas injection high flash point gas fuel
  - LGI Gas injection for low flash point gas fuel
  - GIE Ethane gas injection
  - LGIM Liquid gas injection methanol
  - LGIP Liquid gas injection LPG

- Engine concept
  - Diameter of piston in cm

- Stroke/bore ratio
  - 'Green' ultra long stroke
  - Super long stroke

- Number of cylinders
  - (blank) Fuel oil only
MAN B&W G90ME-S

Bore 900 mm, Stroke 3,260 mm

Site Rating

- $L_1$: Power optimised
- $L_2$: Fuel economy optimised

Fuel Oil

Power and Heat Rate

<table>
<thead>
<tr>
<th>Speed r/min</th>
<th>$L_1$</th>
<th>$L_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>83.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>83.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency Hz</td>
<td>50</td>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Layout points</th>
<th>7 G90ME-S</th>
<th>8 G90ME-S</th>
<th>9 G90ME-S</th>
<th>10 G90ME-S</th>
<th>11 G90ME-S</th>
<th>12 G90ME-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>$kW_m$</td>
<td>39,340</td>
<td>44,960</td>
<td>50,580</td>
<td>56,200</td>
<td>61,820</td>
<td>67,440</td>
</tr>
<tr>
<td>$kW_e$</td>
<td>38,357</td>
<td>43,836</td>
<td>49,316</td>
<td>54,795</td>
<td>60,275</td>
<td>65,754</td>
</tr>
<tr>
<td>$kW_m$</td>
<td>34,300</td>
<td>39,200</td>
<td>44,100</td>
<td>49,000</td>
<td>53,900</td>
<td>60,275</td>
</tr>
<tr>
<td>$kW_e$</td>
<td>33,443</td>
<td>38,220</td>
<td>42,998</td>
<td>47,775</td>
<td>52,553</td>
<td>58,800</td>
</tr>
<tr>
<td>$kW_m$</td>
<td>39,480</td>
<td>45,120</td>
<td>50,760</td>
<td>56,400</td>
<td>60,400</td>
<td>65,754</td>
</tr>
<tr>
<td>$kW_e$</td>
<td>38,493</td>
<td>43,992</td>
<td>49,491</td>
<td>54,990</td>
<td>54,990</td>
<td>60,504</td>
</tr>
</tbody>
</table>

Heat Rate at MCR

| $kJ/kWh_m$ | 7,100    | 7,280    |
| $kJ/kWh_e$ | 6,980    | 7,160    |

According to WB 2008 emission limits

With TCS

Up to 3% heat rate reduction is obtainable depending on actual site ambient conditions.
### Specifications

#### Dimensions:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B₁</th>
<th>B₂</th>
<th>C</th>
<th>H₁</th>
<th>H₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>1,490</td>
<td>5,110</td>
<td>5,034</td>
<td>1,885</td>
<td>14,425</td>
<td>13,975</td>
</tr>
</tbody>
</table>

#### Cylinders:

<table>
<thead>
<tr>
<th></th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lₘᵟᵣᵩ</td>
<td>mm</td>
<td>12,855</td>
<td>14,345*</td>
<td>15,835*</td>
<td>18,040</td>
<td>19,530</td>
</tr>
</tbody>
</table>

#### Dry mass

<table>
<thead>
<tr>
<th></th>
<th>G90ME-S</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1,162</td>
</tr>
</tbody>
</table>

* 8-9-cylinder engines can be ordered with either divided or undivided crankshaft. Data is given for undivided crankshaft.
**MAN B&W G90ME-GI-S**

**Bore 900 mm, Stroke 3,260 mm**

- **L₁**: Power optimised
- **L₂**: Fuel economy optimised

**Equivalent Gas + Pilot Fuel**  
**L₁ MEP:** 19.5 bar

### Power and Heat Rate

<table>
<thead>
<tr>
<th>Speed r/min</th>
<th>83.3</th>
<th>83.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Hz</td>
<td>50</td>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Layout points</th>
<th>L₁</th>
<th>L₂</th>
<th>L₁</th>
<th>L₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>kWₘₐₜ</td>
<td>kWₑ</td>
<td>kWₘₐₜ</td>
<td>kWₑ</td>
<td>kWₘₐₜ</td>
</tr>
<tr>
<td>7 G90ME-GI-S</td>
<td>39,340</td>
<td>38,357</td>
<td>34,300</td>
<td>33,443</td>
</tr>
<tr>
<td>8 G90ME-GI-S</td>
<td>44,960</td>
<td>43,836</td>
<td>39,200</td>
<td>38,220</td>
</tr>
<tr>
<td>9 G90ME-GI-S</td>
<td>50,580</td>
<td>49,316</td>
<td>44,100</td>
<td>42,998</td>
</tr>
<tr>
<td>10 G90ME-GI-S</td>
<td>56,200</td>
<td>54,795</td>
<td>49,000</td>
<td>47,775</td>
</tr>
<tr>
<td>11 G90ME-GI-S</td>
<td>61,820</td>
<td>60,275</td>
<td>53,900</td>
<td>52,553</td>
</tr>
<tr>
<td>12 G90ME-GI-S</td>
<td>67,440</td>
<td>65,754</td>
<td>58,800</td>
<td>57,330</td>
</tr>
</tbody>
</table>

### Heat Rate at MCR

<table>
<thead>
<tr>
<th>kWₑ</th>
<th>kJ/kWhₑ</th>
</tr>
</thead>
<tbody>
<tr>
<td>7,060</td>
<td>6,940</td>
</tr>
</tbody>
</table>

**According to WB 2008 emission limits**

**With TCS**

Up to 3% heat rate reduction is obtainable depending on actual site ambient conditions.
MAN B&W G90ME-GI-S

Engine Dimensions

**Specifications**

### Dimensions:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B₁</th>
<th>B₂</th>
<th>C</th>
<th>H₁</th>
<th>H₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>1,490</td>
<td>5,110</td>
<td>5,034</td>
<td>1,885</td>
<td>14,425</td>
<td>13,975</td>
</tr>
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</table>

### Cylinders:

<table>
<thead>
<tr>
<th>Lₘᵟᵢₙ</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>12,855</td>
<td>14,345*</td>
<td>15,835*</td>
<td>18,040</td>
<td>19,530</td>
<td>21,020</td>
</tr>
</tbody>
</table>

### Dry mass

<table>
<thead>
<tr>
<th></th>
<th>G90ME-GI-S</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,171</td>
<td>1,326</td>
</tr>
</tbody>
</table>

* 8-9-cylinder engines can be ordered with either divided or undivided crankshaft.
Data is given for undivided crankshaft.
**MAN B&W S80ME-S**

Bore 800 mm, Stroke 3,450 mm

**Site Rating**

- L₁: Power optimised
- L₂: Fuel economy optimised

**Fuel Oil**

- L₁ MEP: 19.0 bar

### Power and Heat Rate

<table>
<thead>
<tr>
<th>Speed r/min</th>
<th>L₁</th>
<th>L₂</th>
<th>L₁</th>
<th>L₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>76.9</td>
<td>kW&lt;sub&gt;m&lt;/sub&gt;</td>
<td>kW&lt;sub&gt;e&lt;/sub&gt;</td>
<td>kW&lt;sub&gt;m&lt;/sub&gt;</td>
<td>kW&lt;sub&gt;e&lt;/sub&gt;</td>
</tr>
<tr>
<td>78.3</td>
<td>kW&lt;sub&gt;m&lt;/sub&gt;</td>
<td>kW&lt;sub&gt;e&lt;/sub&gt;</td>
<td>kW&lt;sub&gt;m&lt;/sub&gt;</td>
<td>kW&lt;sub&gt;e&lt;/sub&gt;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Layout points</th>
<th>L₁</th>
<th>L₂</th>
<th>L₁</th>
<th>L₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 S80ME-S</td>
<td>29,540</td>
<td>28,802</td>
<td>26,460</td>
<td>25,799</td>
</tr>
<tr>
<td>8 S80ME-S</td>
<td>33,760</td>
<td>32,916</td>
<td>30,240</td>
<td>29,484</td>
</tr>
<tr>
<td>9 S80ME-S</td>
<td>37,980</td>
<td>37,031</td>
<td>34,020</td>
<td>33,170</td>
</tr>
</tbody>
</table>

### Heat Rate at MCR

- kW<sub>m</sub>
- kW<sub>e</sub>

| kW<sub>m</sub> | 7,200 | 7,100 | 7,200 | 7,100 |
| kW<sub>e</sub> | 7,380 | 7,280 | 7,380 | 7,280 |

According to WB 2008 emission limits

**With TCS**

Up to 3% heat rate reduction is obtainable depending on actual site ambient conditions.
Specifications

Dimensions:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B₁</th>
<th>B₂</th>
<th>C</th>
<th>H₁</th>
<th>H₂</th>
<th>H₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>1,334</td>
<td>5,180</td>
<td>5,374</td>
<td>1,890</td>
<td>15,175</td>
<td>13,925</td>
<td>13,800</td>
</tr>
</tbody>
</table>

Cylinders:

<table>
<thead>
<tr>
<th></th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lₘᵟᵳₐₓ mm</td>
<td>11,434</td>
<td>12,768</td>
<td>14,102</td>
</tr>
</tbody>
</table>

Dry mass

<table>
<thead>
<tr>
<th>S80ME-S</th>
<th>t</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>933</td>
<td>1,043</td>
<td>1,153</td>
</tr>
</tbody>
</table>
**MAN B&W S80ME-GI-S**

*Bore 800 mm, Stroke 3,450 mm*

**Site Rating**

- **L₁**: Power optimised
- **L₂**: Fuel economy optimised

**Equivalent Gas + Pilot Fuel**

**Power and Heat Rate**

| Speed r/min | 76.9 | 78.3 |
| Frequency Hz | 50   | 60   |

<table>
<thead>
<tr>
<th>Layout points</th>
<th>L₁</th>
<th>L₂</th>
<th>L₁</th>
<th>L₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>kWe</td>
<td>kWe</td>
<td>kWe</td>
<td>kWe</td>
<td>kWe</td>
</tr>
<tr>
<td>7 S80ME-GI-S</td>
<td>29,540</td>
<td>28,802</td>
<td>26,460</td>
<td>25,799</td>
</tr>
<tr>
<td>8 S80ME-GI-S</td>
<td>33,760</td>
<td>32,916</td>
<td>30,240</td>
<td>29,484</td>
</tr>
<tr>
<td>9 S80ME-GI-S</td>
<td>37,980</td>
<td>37,031</td>
<td>34,020</td>
<td>33,170</td>
</tr>
</tbody>
</table>

**Heat Rate at MCR**

| kJ/kWhₘ | 7,160 | 7,060 | 7,160 | 7,060 |
| kJ/kWhₑ | 7,340 | 7,240 | 7,340 | 7,240 |

According to WB 2008 emission limits

With TCS

Up to 3% heat rate reduction is obtainable depending on actual site ambient conditions.
Engine Dimensions

Specifications

Dimensions:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B₁</th>
<th>B₂</th>
<th>C</th>
<th>H₁</th>
<th>H₂</th>
<th>H₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>1,334</td>
<td>5,180</td>
<td>5,374</td>
<td>1,890</td>
<td>15,175</td>
<td>13,925</td>
<td>13,800</td>
</tr>
</tbody>
</table>

Cylinders:

<table>
<thead>
<tr>
<th></th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lₘᵟᵣ</td>
<td>11,434</td>
<td>12,768</td>
<td>14,102</td>
</tr>
</tbody>
</table>

Dry mass

<table>
<thead>
<tr>
<th></th>
<th>S80ME-GI-S</th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>941</td>
</tr>
</tbody>
</table>
### MAN B&W S70ME-S

Bore 700 mm, Stroke 2,800 mm

#### Site Rating

- **L₁**: Power optimised
- **L₂**: Fuel economy optimised

#### Fuel Oil

**L₁ MEP**: 20.0 bar

#### Power and Heat Rate

<table>
<thead>
<tr>
<th>Speed r/min</th>
<th>L₁</th>
<th>L₂</th>
<th>L₁</th>
<th>L₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>90.9</td>
<td>22,890</td>
<td>19,460</td>
<td>22,610</td>
<td>19,250</td>
</tr>
<tr>
<td>90.0</td>
<td>22,318</td>
<td>18,974</td>
<td>22,045</td>
<td>18,769</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency Hz</th>
<th>L₁</th>
<th>L₂</th>
<th>L₁</th>
<th>L₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>25,506</td>
<td>21,684</td>
<td>25,840</td>
<td>22,000</td>
</tr>
<tr>
<td>60</td>
<td>26,160</td>
<td>22,240</td>
<td>25,194</td>
<td>22,000</td>
</tr>
</tbody>
</table>

#### Heat Rate at MCR

| kJ/kWhₑ | 7,200 | 7,040 | 7,200 | 7,040 |
| kJ/kWhₑ | 7,380 | 7,220 | 7,380 | 7,220 |

According to WB 2008 emission limits

**With TCS**

Up to 3% heat rate reduction is obtainable depending on actual site ambient conditions.
### Engine Dimensions

#### Specifications

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>A</th>
<th>B₁</th>
<th>B₂</th>
<th>C</th>
<th>H₁</th>
<th>H₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>1,098</td>
<td>4,012</td>
<td>4,140</td>
<td>1,520</td>
<td>12,500</td>
<td>11,750</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cylinders</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lₘᵋᵣₑᵦ</td>
<td>9,641</td>
<td>10,739</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dry mass</th>
<th>S70ME-S</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>t</td>
<td>563</td>
<td>634</td>
</tr>
</tbody>
</table>
### MAN B&W S70ME-GI-S

**Bore 700 mm, Stroke 2,800 mm**

#### Site Rating

- **L₁**: Power optimised
- **L₂**: Fuel economy optimised

#### Equivalent Gas + Pilot Fuel

**Power and Heat Rate**

<table>
<thead>
<tr>
<th>Speed r/min</th>
<th>90.9</th>
<th>90.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Hz</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Layout points</td>
<td><strong>L₁</strong></td>
<td><strong>L₂</strong></td>
</tr>
<tr>
<td></td>
<td>kWₘ</td>
<td>kWₑ</td>
</tr>
<tr>
<td>7 S70ME-GI-S</td>
<td>22,890</td>
<td>22,318</td>
</tr>
<tr>
<td>8 S70ME-GI-S</td>
<td>26,160</td>
<td>25,506</td>
</tr>
</tbody>
</table>

**Heat Rate at MCR**

| kW/KWhₘ | 7,160 | 7,000 | 7,160 | 7,000 |
| kW/KWhₑ | 7,340 | 7,180 | 7,340 | 7,180 |

According to WB 2008 emission limits

**With TCS**

Up to 3% heat rate reduction is obtainable depending on actual site ambient conditions.
**Specifications**

**Dimensions:**

<table>
<thead>
<tr>
<th></th>
<th>A (mm)</th>
<th>B₁ (mm)</th>
<th>B₂ (mm)</th>
<th>C (mm)</th>
<th>H₁ (mm)</th>
<th>H₄ (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,098</td>
<td>4,012</td>
<td>4,140</td>
<td>1,520</td>
<td>12,500</td>
<td>11,750</td>
</tr>
</tbody>
</table>

**Cylinders:**

<table>
<thead>
<tr>
<th></th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lₘₐₙ (mm)</td>
<td>9,641</td>
<td>10,739</td>
</tr>
</tbody>
</table>

**Dry mass**

| S70ME-GI-S | t | 570 | 641 |
**MAN B&W S60ME-S**

**Bore 600 mm, Stroke 2,400 mm**

### Site Rating

- **L₁:** Power optimised
- **L₂:** Fuel economy optimised

### Fuel Oil

<table>
<thead>
<tr>
<th>Speed r/min</th>
<th>L₁</th>
<th>L₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>103.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>102.9</td>
<td></td>
<td></td>
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<table>
<thead>
<tr>
<th>Frequency Hz</th>
<th>L₁</th>
<th>L₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Power and Heat Rate

<table>
<thead>
<tr>
<th>Layout points</th>
<th>L₁ (kWₘ)</th>
<th>L₂ (kWₑ)</th>
<th>L₁ (kWₘ)</th>
<th>L₂ (kWₑ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 S60ME-S</td>
<td>16,380</td>
<td>15,971</td>
<td>13,930</td>
<td>13,582</td>
</tr>
<tr>
<td>8 S60ME-S</td>
<td>18,720</td>
<td>18,252</td>
<td>15,920</td>
<td>15,522</td>
</tr>
</tbody>
</table>

### Heat Rate at MCR

<table>
<thead>
<tr>
<th>Heat Rate at MCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>kJ/kWₘ</td>
</tr>
<tr>
<td>7,200</td>
</tr>
<tr>
<td>7,040</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Heat Rate at MCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>kJ/kWₑ</td>
</tr>
<tr>
<td>7,380</td>
</tr>
<tr>
<td>7,220</td>
</tr>
</tbody>
</table>

According to WB 2008 emission limits

### With TCS

Up to 3% heat rate reduction is obtainable depending on actual site ambient conditions.
### Engine Dimensions

#### Dimensions:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B₁</th>
<th>B₂</th>
<th>C</th>
<th>H₁</th>
<th>H₂</th>
<th>H₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>1,080</td>
<td>4,090</td>
<td>4,220</td>
<td>1,500</td>
<td>12,175</td>
<td>11,400</td>
<td>11,075</td>
</tr>
</tbody>
</table>

#### Cylinders:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Lₘᵟᵳₐ</td>
<td>mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9,550</td>
<td>10,630</td>
</tr>
</tbody>
</table>

#### Dry mass

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S60ME-S</td>
<td>t</td>
<td></td>
</tr>
<tr>
<td></td>
<td>491</td>
<td>543</td>
</tr>
</tbody>
</table>
MAN B&W S60ME-GI-S

Bore 600 mm, Stroke 2,400 mm

Site Rating

$L_1$: Power optimised

$L_2$: Fuel economy optimised

**Equivalent Gas + Pilot Fuel**  
$L_1$ MEP: 20.0 bar

<table>
<thead>
<tr>
<th>Speed r/min</th>
<th>103.4</th>
<th>102.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Hz</td>
<td>50</td>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Layout points</th>
<th>$L_1$</th>
<th>$L_2$</th>
<th>$L_1$</th>
<th>$L_2$</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>$kW_m$</td>
<td>$kW_e$</td>
<td>$kW_m$</td>
<td>$kW_e$</td>
</tr>
<tr>
<td>7 S60ME-GI-S</td>
<td>16,380</td>
<td>15,971</td>
<td>13,930</td>
<td>13,582</td>
</tr>
<tr>
<td>8 S60ME-GI-S</td>
<td>18,720</td>
<td>18,252</td>
<td>15,920</td>
<td>15,522</td>
</tr>
</tbody>
</table>

**Heat Rate at MCR**

<table>
<thead>
<tr>
<th>$kJ/kWh_m$</th>
<th>7,160</th>
<th>7,000</th>
<th>7,160</th>
<th>7,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>$kJ/kWh_e$</td>
<td>7,340</td>
<td>7,180</td>
<td>7,340</td>
<td>7,180</td>
</tr>
</tbody>
</table>

*According to WB 2008 emission limits*

**With TCS**

Up to 3% heat rate reduction is obtainable depending on actual site ambient conditions.
### Engine Dimensions

#### Specifications

<table>
<thead>
<tr>
<th>Dimensions:</th>
<th>A</th>
<th>B₁</th>
<th>B₂</th>
<th>C</th>
<th>H₁</th>
<th>H₂</th>
<th>H₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>1,080</td>
<td>4,090</td>
<td>4,220</td>
<td>1,500</td>
<td>12,175</td>
<td>11,400</td>
<td>11,075</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Cylinders:</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>L&lt;sub&gt;min&lt;/sub&gt; mm</td>
<td>9,550</td>
<td>10,630</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dry mass: MAN B&amp;W S60ME-GI-S</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>S60ME-GI-S</td>
<td>498</td>
</tr>
</tbody>
</table>
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ENGINE PROGRAMME

Engineered the Future – since 1758.
MAN Diesel & Turbo
MAN Four-Stroke Small Bore GenSets
**MAN Four-Stroke Small Bore GenSets**

<table>
<thead>
<tr>
<th>Speed rpm</th>
<th>Engine type</th>
<th>Electric power range (kW</th>
<th>Speed range (rpm)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>720-750</td>
<td>V28/32S</td>
<td>3,517 – 4,133</td>
<td>720 – 750</td>
<td>40</td>
</tr>
<tr>
<td>720-750</td>
<td>L28/32S</td>
<td>1,008 – 1,921</td>
<td>720 – 750</td>
<td>41</td>
</tr>
<tr>
<td>720-750</td>
<td>L28/32S-DF</td>
<td>950 – 1,710</td>
<td>720 – 750</td>
<td>42</td>
</tr>
<tr>
<td>720-750</td>
<td>L27/38S</td>
<td>1,455 – 2,881</td>
<td>720 – 750</td>
<td>43</td>
</tr>
<tr>
<td>720-750-900</td>
<td>L23/30S</td>
<td>682 – 1,344</td>
<td>720 – 750 – 900</td>
<td>44</td>
</tr>
<tr>
<td>720-750-900</td>
<td>L23/30S-DF</td>
<td>600 – 1,152</td>
<td>720 – 750 – 900</td>
<td>45</td>
</tr>
<tr>
<td>900-1,000</td>
<td>L21/31S</td>
<td>960 – 1,921</td>
<td>900 – 1,000</td>
<td>46</td>
</tr>
</tbody>
</table>

**Engine type designation**

9L28/32S-DF

- Dual fuel
- Type of application
- Stroke in cm
- Bore in cm
- L or V version
- Number of cylinders
MAN Four-Stroke Small Bore GenSets

Engine programme
These well-established engine types are used in various applications all around the world. Based on long-term experience, the engines are subject to continuous development to improve power, emissions, fuel consumption and reliability, making them the ‘work horse’ in your power house.

Full fuel flexibility
MAN four-stroke small bore diesel engines are designed to offer the optimum in fuel flexibility. The engines are the ideal source of power whether you want to build a ‘green power plant’ burning liquid bio fuels or you need power from crude oil. Please contact MAN Diesel & Turbo for further information.

Liquid fuels: diesel, HFO, liquid bio fuel and crude oil.

GenSet power
The GenSet power is stated in kW on alternator. Ratings are given according to ISO 3046-1:2002.

The electrical power quoted is based on a normal alternator efficiency in the corresponding power range and a power factor of 1.0. The maximum output varies according to the site conditions.

Emission control
All small bore engines in this booklet comply with the World Bank 1998 & 2007/2008 guidelines for power plants < 300 MW th thermal fuel input. All small bore four-stroke engines comply with the latest World Bank guidelines. Engines with even lower NOx values are available on request. MAN Diesel & Turbo is prepared to deliver NOx as well as SOx and particle reduction systems.
MAN Four-Stroke Small Bore GenSets

Heat rate
The figures are given for 100% load and without engine driven pumps. Attached pumps will result in an increased fuel consumption. The tolerance for guarantee is +5%. Please note that the increase in fuel consumption must be considered before the tolerance for guarantee is taken into account. Basis for reference conditions, see section: ‘Ambient conditions according to ISO 3046-1:2002’

Conversion between heat rate and specific fuel oil consumption (SFOC) is found by applying the following formula:

\[
SFOC \ [g/kWh] = \frac{\text{Heat Rate} \ [kJ/Kwh] \times 1000}{\text{LCV} \ [kJ/kg]}
\]

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

Ambient conditions according to ISO 3046-1:2002
The stated consumption figures refer to the following reference conditions according to ISO 3046-1:

- Ambient air pressure 100 kPa (1,000 mbar)
- Ambient air temperature 298 K (25°C)
- Charge air temperature According to engine type, corresponding to 25°C cooling water temperature before charge air cooler.

Masses and dimensions
The masses stated correspond to the complete unit (including alternator). The total weight varies depending on the alternator make. All masses given are without lube oil and cooling water. Dimensions and weights are given for guidance only and are subject to change without notice. The length of the GenSet unit depends on the alternator make.
MAN Four-Stroke Small Bore GenSets

Small power plant development – partner concept
MAN Diesel & Turbo has more than 20 years of experience in building small power plants with our worldwide partners. A small power plant usually means a plant with single or multiple units of approximately 1-4 MW/unit. The basic idea of the concept is to keep overall costs as low as possible by working with a high degree of standardisation and using as much local equipment and manpower as possible.

‘Low costs for us – low costs for you’

The partner concept is basically a concept where we work with local or international partners, who then build power plants based on our GenSets and our basic documentation and engineering. The remaining plant equipment and civil works are then delivered either by the partner or the customer, as the case may be.

MAN Diesel & Turbo has a great interest in maintaining the relevant standard and quality of all plants equipped with our GenSets.

For this reason, we provide partners and customers with our standard documentation, enabling the builder to complete the plant and the user to operate the plant successfully.

Ambatovy power plant with 9 x 7L27/38 is located on Madagascar.
# MAN V28/32S

**Bore 280 mm, Stroke 320 mm**

<table>
<thead>
<tr>
<th></th>
<th>WB 2007</th>
<th>WB 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine speed rpm</td>
<td>750</td>
<td>720</td>
</tr>
<tr>
<td>Frequency Hz</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Electr. GenSet power kW</td>
<td>3,674</td>
<td>3,517</td>
</tr>
</tbody>
</table>

### Electr. GenSet Heat Rate at 100% Load

<table>
<thead>
<tr>
<th></th>
<th>WB 2007</th>
<th>WB 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid fuel (WB2007/2008) kJ/kWh</td>
<td>8,142</td>
<td>8,134</td>
</tr>
<tr>
<td></td>
<td>8,142</td>
<td>8,134</td>
</tr>
</tbody>
</table>

### Lube Oil Consumption kg/h

- 16V: 1.5-3.0
- 18V: 1.6-3.4

**Nominal generator efficiency 97.7%**

### GenSet Dimensions

<table>
<thead>
<tr>
<th></th>
<th>WB 2007</th>
<th>WB 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>mm</td>
<td>6,116</td>
</tr>
<tr>
<td>B</td>
<td>mm</td>
<td>3,822</td>
</tr>
<tr>
<td>C</td>
<td>mm</td>
<td>9,938</td>
</tr>
<tr>
<td>W</td>
<td>mm</td>
<td>2,470</td>
</tr>
<tr>
<td>H</td>
<td>mm</td>
<td>3,574</td>
</tr>
<tr>
<td>Dry mass</td>
<td>t</td>
<td>62.2</td>
</tr>
</tbody>
</table>

Weights and dimensions are subject to final application.

---

![Diagram of MAN V28/32S Diesel Generator Set](image)
MAN L28/32S

**WB 2007** WB 2008

<table>
<thead>
<tr>
<th>Bore 280 mm, Stroke 320 mm</th>
<th>5L</th>
<th>6L</th>
<th>7L</th>
<th>8L</th>
<th>9L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine speed (rpm)</td>
<td>750</td>
<td>720</td>
<td>750</td>
<td>720</td>
<td>750</td>
</tr>
<tr>
<td>Frequency (Hz)</td>
<td>50</td>
<td>60</td>
<td>50</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Electr. GenSet power (kW)</td>
<td>1.056</td>
<td>1.008</td>
<td>1.267</td>
<td>1.210</td>
<td>1.478</td>
</tr>
</tbody>
</table>

**Electr. GenSet Heat Rate at 100% Load**

<table>
<thead>
<tr>
<th>Liquid fuel (WB2007/2008)</th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>kJ/kWh</td>
<td></td>
</tr>
<tr>
<td>8,460</td>
<td>8,429</td>
</tr>
<tr>
<td>8,460</td>
<td>8,429</td>
</tr>
<tr>
<td>8,460</td>
<td>8,429</td>
</tr>
<tr>
<td>8,460</td>
<td>8,429</td>
</tr>
<tr>
<td>8,460</td>
<td>8,429</td>
</tr>
<tr>
<td>8,342</td>
<td>8,373</td>
</tr>
<tr>
<td>8,342</td>
<td>8,373</td>
</tr>
</tbody>
</table>

**Lube Oil Consumption (kg/h)**

|                 | 0.7-1.1 | 0.8-1.3 | 0.9-1.5 | 1.0-1.8 | 1.2-2.0 |

*Nominal generator efficiency is 96% for 5L, 6L, 7L and 97% for 8L, 9L*

**GenSet Dimensions**

<table>
<thead>
<tr>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>W (mm)</th>
<th>H (mm)</th>
<th>Dry mass (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,279</td>
<td>2,400</td>
<td>6,679</td>
<td>2,370</td>
<td>2,684</td>
<td>32.6</td>
</tr>
<tr>
<td>4,759</td>
<td>2,510</td>
<td>7,269</td>
<td>2,370</td>
<td>2,684</td>
<td>36.3</td>
</tr>
<tr>
<td>5,499</td>
<td>2,680</td>
<td>8,179</td>
<td>2,390</td>
<td>2,874</td>
<td>39.4</td>
</tr>
<tr>
<td>5,979</td>
<td>2,770</td>
<td>8,749</td>
<td>2,419</td>
<td>2,874</td>
<td>40.7</td>
</tr>
<tr>
<td>6,199</td>
<td>2,690</td>
<td>8,889</td>
<td>2,489</td>
<td>3,034</td>
<td>47.1</td>
</tr>
</tbody>
</table>

*Weights and dimensions are subject to final application*
### MAN L28/32S-DF

**Bore 280 mm, Stroke 320 mm**

<table>
<thead>
<tr>
<th></th>
<th>5L</th>
<th>6L</th>
<th>7L</th>
<th>8L</th>
<th>9L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine speed</td>
<td>rpm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>750</td>
<td>720</td>
<td>750</td>
<td>720</td>
<td>750</td>
</tr>
<tr>
<td>Frequency</td>
<td>Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>60</td>
<td>50</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Electr. GenSet power</td>
<td>kW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>960</td>
<td>960</td>
<td>1,152</td>
<td>1,152</td>
<td>1,152</td>
</tr>
</tbody>
</table>

**Electr. GenSet Heat Rate at 100% Load**

<table>
<thead>
<tr>
<th></th>
<th>kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas fuel (WB1998)</td>
<td>9,168</td>
</tr>
</tbody>
</table>

**Tolerance +10%**. Please note that the additions to fuel consumption must be considered before the tolerance is taken into account.

**WB2007/2008 on request.**

<table>
<thead>
<tr>
<th>Lube Oil Consumption</th>
<th>kg/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>5L, 6L, 7L</td>
<td>0.6-1.0</td>
</tr>
<tr>
<td></td>
<td>0.7-1.2</td>
</tr>
<tr>
<td></td>
<td>0.8-1.4</td>
</tr>
<tr>
<td>8L, 9L</td>
<td>1.0-1.6</td>
</tr>
<tr>
<td></td>
<td>1.0-1.8</td>
</tr>
</tbody>
</table>

**Nominal generator efficiency is 96% for 5L, 6L, 7L and 97% for 8L, 9L**

**GenSet Dimensions**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>W</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>4,321</td>
<td>2,400</td>
<td>6,721</td>
<td>2,463</td>
<td>2,835</td>
</tr>
<tr>
<td></td>
<td>4,801</td>
<td>2,510</td>
<td>7,311</td>
<td>2,463</td>
<td>3,009</td>
</tr>
<tr>
<td></td>
<td>5,281</td>
<td>2,680</td>
<td>7,961</td>
<td>2,463</td>
<td>3,009</td>
</tr>
<tr>
<td></td>
<td>5,761</td>
<td>2,770</td>
<td>8,531</td>
<td>2,463</td>
<td>3,009</td>
</tr>
<tr>
<td></td>
<td>6,241</td>
<td>2,690</td>
<td>8,931</td>
<td>2,463</td>
<td>3,009</td>
</tr>
</tbody>
</table>

**Dry mass**

|   | 32.6 | 36.3 | 39.4 | 40.7 | 47.1 |

**Weights and dimensions are subject to final application.**
## MAN L27/38S

**Bore 270 mm, Stroke 380 mm**

<table>
<thead>
<tr>
<th>Engine speed</th>
<th>5L</th>
<th>6L</th>
<th>7L</th>
<th>8L</th>
<th>9L</th>
</tr>
</thead>
<tbody>
<tr>
<td>rpm</td>
<td>750</td>
<td>750</td>
<td>750</td>
<td>750</td>
<td>750</td>
</tr>
<tr>
<td>Frequency</td>
<td>720</td>
<td>720</td>
<td>720</td>
<td>720</td>
<td>720</td>
</tr>
<tr>
<td>Hz</td>
<td>50</td>
<td>60</td>
<td>50</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Electr. GenSet power</td>
<td>kW</td>
<td>1,552</td>
<td>1,455</td>
<td>1,921</td>
<td>1,921</td>
</tr>
</tbody>
</table>

**Electr. GenSet Heat Rate at 100% Load**

<table>
<thead>
<tr>
<th>Liquid fuel (WB2007/2008)</th>
<th>kW/kW</th>
<th>8,056</th>
<th>8,012</th>
<th>8,056</th>
<th>8,012</th>
<th>8,056</th>
<th>8,012</th>
<th>8,056</th>
<th>8,012</th>
<th>8,056</th>
<th>8,012</th>
</tr>
</thead>
</table>

**Lube Oil Consumption**

<table>
<thead>
<tr>
<th>kg/h</th>
<th>0.7-1.3</th>
<th>0.8-1.6</th>
<th>0.9-1.8</th>
<th>1.1-2.1</th>
<th>1.2-2.4</th>
</tr>
</thead>
</table>

**Nominal generator efficiency 97%**

<table>
<thead>
<tr>
<th>GenSet Dimensions</th>
<th>mm</th>
<th>4,346</th>
<th>4,791</th>
<th>5,236</th>
<th>5,681</th>
<th>6,126</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>mm</td>
<td>2,486</td>
<td>2,766</td>
<td>2,766</td>
<td>2,986</td>
<td>2,986</td>
</tr>
<tr>
<td>B</td>
<td>mm</td>
<td>6,832</td>
<td>7,557</td>
<td>8,002</td>
<td>8,667</td>
<td>9,112</td>
</tr>
<tr>
<td>C</td>
<td>mm</td>
<td>2,293</td>
<td>2,293</td>
<td>2,420</td>
<td>2,420</td>
<td>2,420</td>
</tr>
<tr>
<td>W</td>
<td>mm</td>
<td>3,712</td>
<td>3,712</td>
<td>3,899</td>
<td>3,899</td>
<td>3,899</td>
</tr>
<tr>
<td>H</td>
<td>mm</td>
<td>40,0</td>
<td>44,5</td>
<td>50,4</td>
<td>58,2</td>
<td>64,7</td>
</tr>
</tbody>
</table>

**Dry mass**

| t | 40,0 | 44,5 | 50,4 | 58,2 | 64,7 |

Weights and dimensions are subject to final application.
## MAN L23/30S

### Bore 225 mm, Stroke 300 mm

<table>
<thead>
<tr>
<th></th>
<th>5L</th>
<th>6L</th>
<th>7L</th>
<th>8L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine speed rpm</td>
<td>750</td>
<td>720</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>Frequency Hz</td>
<td>50</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Electr. GenSet power kW</td>
<td>710</td>
<td>682</td>
<td>852</td>
<td>818</td>
</tr>
</tbody>
</table>

### Electr. GenSet Heat Rate at 100% load

<table>
<thead>
<tr>
<th></th>
<th>WB 2007</th>
<th>WB 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid fuel (WB2007/2008) kJ/kWh</td>
<td>8,540 8,496 8,540 8,496 8,584</td>
<td>8,540 8,496 8,584</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>5L</th>
<th>6L</th>
<th>7L</th>
<th>8L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine speed rpm</td>
<td>-</td>
<td>900</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>Frequency Hz</td>
<td>-</td>
<td>60</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Electr. GenSet power kW</td>
<td>-</td>
<td>1,008</td>
<td>1,176</td>
<td>1,344</td>
</tr>
</tbody>
</table>

### Electr. GenSet Heat Rate at 100% load

<table>
<thead>
<tr>
<th></th>
<th>WB 2007</th>
<th>WB 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid fuel (WB2007/2008) kJ/kWh</td>
<td>8,584</td>
<td>8,584</td>
</tr>
</tbody>
</table>

### Lube Oil Consumption kg/h

|                     | 0.4-0.7 | 0.5-1.0 | 0.6-1.2 | 0.7-1.4 |

Nominal generator efficiency 96%

### GenSet Dimensions

<table>
<thead>
<tr>
<th>Cyl. No.</th>
<th>5</th>
<th>6</th>
<th>6</th>
<th>7</th>
<th>7</th>
<th>8</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>r/min</td>
<td>720/750</td>
<td>720/750</td>
<td>900</td>
<td>720/750</td>
<td>900</td>
<td>720/750</td>
<td>900</td>
</tr>
<tr>
<td>A</td>
<td>3,369</td>
<td>3,738</td>
<td>3,738</td>
<td>4,109</td>
<td>4,109</td>
<td>4,475</td>
<td>4,475</td>
</tr>
<tr>
<td>B</td>
<td>2,155</td>
<td>2,265</td>
<td>2,265</td>
<td>2,395</td>
<td>2,395</td>
<td>2,480</td>
<td>2,340</td>
</tr>
<tr>
<td>C</td>
<td>5,524</td>
<td>6,004</td>
<td>6,004</td>
<td>6,504</td>
<td>6,504</td>
<td>6,959</td>
<td>6,815</td>
</tr>
<tr>
<td>W</td>
<td>1,690</td>
<td>1,690</td>
<td>1,768</td>
<td>1,715</td>
<td>1,888</td>
<td>1,715</td>
<td>1,888</td>
</tr>
<tr>
<td>H</td>
<td>2,402</td>
<td>2,402</td>
<td>2,466</td>
<td>2,466</td>
<td>2,466</td>
<td>2,466</td>
<td>2,466</td>
</tr>
<tr>
<td>Dry mass</td>
<td>18.5</td>
<td>19.7</td>
<td>19.7</td>
<td>23.0</td>
<td>23.0</td>
<td>25.5</td>
<td>25.5</td>
</tr>
</tbody>
</table>

Weight and dimensions are subject to final application.
### MAN L23/30S-DF

**Bore 225 mm, Stroke 300 mm**

<table>
<thead>
<tr>
<th></th>
<th>5L</th>
<th>6L</th>
<th>7L</th>
<th>8L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine speed</td>
<td>rpm</td>
<td>750</td>
<td>720</td>
<td>900</td>
</tr>
<tr>
<td>Frequency</td>
<td>Hz</td>
<td>50</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>Electr. GenSet power kW</td>
<td>600</td>
<td>600</td>
<td>720</td>
<td>864</td>
</tr>
</tbody>
</table>

**Electr. GenSet Heat Rate at 100% load**

Gas fuel (WB1998) kJ/kWh

<table>
<thead>
<tr>
<th></th>
<th>5L</th>
<th>6L</th>
<th>7L</th>
<th>8L</th>
</tr>
</thead>
<tbody>
<tr>
<td>9,284</td>
<td>9,284</td>
<td>9,284</td>
<td>9,284</td>
<td>9,284</td>
</tr>
</tbody>
</table>

Tolerance +10%. Please note that the additions to fuel consumption must be considered before the tolerance is taken into account.

**Lube Oil Consumption kg/h**

<table>
<thead>
<tr>
<th></th>
<th>0.4-0.7</th>
<th>0.5-1.0</th>
<th>0.6-1.2</th>
<th>0.7-1.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal generator efficiency 96%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GenSet Dimensions**

<table>
<thead>
<tr>
<th>Cyl. No.</th>
<th>5</th>
<th>6</th>
<th>6</th>
<th>7</th>
<th>7</th>
<th>8</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyl No.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>720/750</td>
<td>720/750</td>
<td>900</td>
<td>720/750</td>
<td>900</td>
<td>720/750</td>
<td>900</td>
</tr>
<tr>
<td>B</td>
<td>2,088</td>
<td>2,088</td>
<td>2,088</td>
<td>2,088</td>
<td>2,088</td>
<td>2,088</td>
<td>2,088</td>
</tr>
<tr>
<td>C</td>
<td>2,749</td>
<td>2,749</td>
<td>2,749</td>
<td>2,749</td>
<td>2,749</td>
<td>2,749</td>
<td>2,749</td>
</tr>
<tr>
<td>H</td>
<td>17.3</td>
<td>19.0</td>
<td>19.2</td>
<td>21.4</td>
<td>21.4</td>
<td>23.3</td>
<td>23.4</td>
</tr>
</tbody>
</table>

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

Minimum distance between centre of engines: ~2,250 mm (without gallery) ~2,600 mm (with gallery)
## MAN L21/31S

**Bore 210 mm, Stroke 310 mm**

<table>
<thead>
<tr>
<th></th>
<th>5L</th>
<th>6L</th>
<th>7L</th>
<th>8L</th>
<th>9L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine speed rpm</td>
<td>1,000</td>
<td>900</td>
<td>1,000</td>
<td>900</td>
<td>1,000</td>
</tr>
<tr>
<td>Frequency Hz</td>
<td>50</td>
<td>60</td>
<td>50</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>Electr. GenSet power kW</td>
<td>960</td>
<td>960</td>
<td>1,267</td>
<td>1,267</td>
<td>1,478</td>
</tr>
</tbody>
</table>

### Electr. GenSet Heat Rate at 100% Load

<table>
<thead>
<tr>
<th></th>
<th>5L</th>
<th>6L</th>
<th>7L</th>
<th>8L</th>
<th>9L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid fuel (WB1998) kJ/kWh</td>
<td>8,140</td>
<td>8,140</td>
<td>8,140</td>
<td>8,140</td>
<td>8,056</td>
</tr>
<tr>
<td>Liquid fuel (WB2007/2008) kJ/kWh</td>
<td>8,362</td>
<td>8,362</td>
<td>8,362</td>
<td>8,362</td>
<td>8,276</td>
</tr>
</tbody>
</table>

### Lube Oil Consumption kg/h

<table>
<thead>
<tr>
<th></th>
<th>5L</th>
<th>6L</th>
<th>7L</th>
<th>8L</th>
<th>9L</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.4-0.9</td>
<td>0.5-1.1</td>
<td>0.6-1.2</td>
<td>0.7-1.4</td>
<td>0.8-1.6</td>
<td></td>
</tr>
</tbody>
</table>

**Nominal generator efficiency is 96% for 5L,6L,7L and 97% for 8L,9L**

### GenSet Dimensions

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>W</th>
<th>H</th>
<th>Dry mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm</td>
<td>3,959</td>
<td>4,314</td>
<td>4,669</td>
<td>5,572</td>
<td>5,927</td>
<td>22.5</td>
</tr>
<tr>
<td>mm</td>
<td>1,870</td>
<td>2,000</td>
<td>1,970</td>
<td>2,110</td>
<td>2,135</td>
<td>26.0</td>
</tr>
<tr>
<td>mm</td>
<td>5,829</td>
<td>6,314</td>
<td>6,639</td>
<td>7,682</td>
<td>8,062</td>
<td>29.5</td>
</tr>
<tr>
<td>mm</td>
<td>2,110</td>
<td>2,110</td>
<td>2,110</td>
<td>2,180</td>
<td>2,180</td>
<td>33.0</td>
</tr>
<tr>
<td>mm</td>
<td>3,183</td>
<td>3,183</td>
<td>3,289</td>
<td>3,289</td>
<td>3,289</td>
<td>36.5</td>
</tr>
</tbody>
</table>

**Weights and dimensions are subject to final application**
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List of Licensees

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

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