MAN Diesel is the world’s leading designer and manufacturer of low and medium speed engines – engines from MAN Diesel cover an estimated 50% of the power needed for all world trade. We develop two-stroke and four-stroke engines, auxiliary engines, turbochargers and propulsion packages that are manufactured both within the MAN Diesel Group and at our licensees.

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

Our absolute commitment to reducing emissions while increasing fuel efficiency and power density starts with our active partnership in the emissions law making process and ends with the delivery of engines that achieve an ideal synthesis of prime mover characteristics.
A notable reduction in NO\textsubscript{x}, CO\textsubscript{2} and soot emissions is a strategical factor for success of modern diesel engines. Therefore it is the entire aim of MAN Diesel to develop and use the best technologies and measures to fulfil the appropriate exhaust emission limits of the International Maritime Organisation – IMO Tier II –.

**Increased Compression Ratio**
The use of the highest point provides a higher compression ratio giving a faster reduction in temperature after the ignition of the fuel, thus reducing NO\textsubscript{x} formation. The increase in compression ratio also compensates the reduction in firing temperature due to retarded injection and hence the associated increase in SFOC.

**Miller Valve Timing**
To reduce the temperature peaks which promote the formation of NO\textsubscript{x}, early closure of the inlet valve causes the charge air to expand and cool before start of compression. The resulting reduction in combustion temperature reduces NO\textsubscript{x} emissions.

**High Pressure Ratio Turbocharger**
The use of MAN Diesel turbochargers equipped with the latest high efficiency compressor wheels can alleviate the NO\textsubscript{x}-SFOC trade off. The higher pressure ratio increases the efficiency of the engine and thus compensates the increase in SFOC normally associated with lower NO\textsubscript{x} emissions. The higher pressure ratio also increases the scope for Miller valve timing.

**VVT Variable Valve Timing**
Variable valve timing enables variations in the opening and closing of the inlet and exhaust valves. It can be used to compensate the increase in SFOC associated with lower NO\textsubscript{x} emissions. VVT is an enabling technology of variable Miller valve timing. A strong Miller effect under high load operation results in an improvement in the NO\textsubscript{x}-SFOC trade-off. At low load the Miller valve timings are reduced to attain higher combustion temperatures and thus lower soot emissions.

**Common Rail Injection**
The 32/44 common rail injection system uses the latest MAN Diesel common rail technology which allows flexible setting of injection timing, duration and pressure for each cylinder. This flexibility allows the fuel consumption and emissions of the 32/44CR to be optimised on its operating profile. Due to constant development of our safety concept the redundant high pressure pumps guarantee further operation of the engine even in the event of high pressure pump malfunction.
Committed to the future
Technologies which promise compliance with the IMO Tier III round of emissions limits due in 2016 combined with further optimised fuel consumption and new levels of power and flexibility are already under development at MAN Diesel. With this level of commitment MAN Diesel customers can plan with confidence.

Core technologies in-house
As well as its expertise in engine design, development and manufacture MAN Diesel is also a leading manufacturer of the key technologies which determine the economic and ecological performance of a diesel engine:

- high-efficiency exhaust gas turbochargers
- advanced electronic fuel injection equipment
- electronic hardware and software for engine control, monitoring and diagnosis

Our impressive array of computer-aided design tools and one of the engine industry’s largest, best-equipped foundries allow us decisively to shorten product development, and application engineering processes. Our mastery of these engine technologies – and, the best brains in the large engine industry – are the firm foundation for

- low emissions
- low operating costs
- low life cycle costs
- long service life

The range of technical measures employed comprises:

- Improved charge air cooling
- Enhanced turbocharging
- Miller valve timing
- Revised injection timing
- Higher compression ratios
- Low swirl inlet ports
- Variable valve timing (VVT)
Engine Specifications
High Specific Power Output Meets High Availability

The actual 32/44CR engine represents the newest technologies in the area of medium speed operated industrial sized diesel engines. By the use of electronic injection, high effiency turbochargers, electronic hardware and variable valve timing the 32/44CR is a synthesis of the most advanced large engine technologies available.

Injection
The patented common rail injection system from MAN Diesel is based on the following principle: High pressure pumps compress the fuel to the required pressure and deliver it to the inline accumulator units (common rail). At the accumulator units are connections for the injection valves and also the components for fuel distribution and injection control. The common rail system achieves its high level of flexibility by consistent separation of pressure generation and injection control.

Electronics
The 32/44CR is equipped with the newest generation of proven MAN Diesel engine management system. For the first time, SaCoSone breaks down all functions of modern engine management into one complete system. Through integration on the engine, it forms one unit with the drive assembly. SaCoSone offers:
- Integrated self-diagnosis functions
- Maximum reliability and availability
- Simple use and diagnosis
- Quick exchange of modules (plug in)
- Trouble-free and time-saving commissioning

Components
The 32/44CR is equipped with the newest generation of MAN Diesel turbochargers (TCR). Based on positive experiences from the 32/40, important power unit components, such as crankshaft, conrod and piston, were optimised for increased performance. It was ensured in this way that the 560 kW/cyl. engine has the tried and tested good wear properties for which MAN Diesel engines are well known throughout the world.

More output at lower fuel consumption
Development of the 32/44CR has benefitted from many years of experience of industrial sized diesel engine architecture and also knowledge from detailed research and developed plans. As a result, the output of the engine was substantial increased and at the same time the fuel consumption was significantly reduced.

High effiency turbochargers
MAN Diesel turbochargers with increased pressure ratios compensate the shorter inlet valve opening times of the Miller cycle. This ensures that the quantity of combustion air entering the cylinder and thus engine performance and efficiency remain unaffected. Paralleling the fuel injection flexibility of common rail systems is the air management flexibility of the MAN Diesel’s high efficiency turbocharger systems with variable output.

Fuels
The common rail injection system of the 32/44CR was designed for operation with heavy fuel oil (HFO) in accordance with specification DIN ISO 8217 (viscosities up to 700 cSt at 50 °C) and fuel temperatures up to 150 °C.
General performance definition for diesel engines as per ISO 30461/1-2002

ISO reference conditions:
Air temperature: 298 K (25 °C)
Air pressure: 1 bar
Fresh water temperature upstream of charge-air cooler: 298 K (25 °C)
Relative humidity: 30%

For maritime engines, no power reduction required below:
Air temperature: 318 K (45 °C)
Air pressure: 1 bar
Fresh water temperature upstream of charge-air cooler: 311 K (38 °C)

IMO requirements:
The engine detailed herein will comply with the emission limits referred to as IMO Tier II.

The fuel consumption is based on a lower calorific value (LHV) of the fuel of 42,700 kJ/kg without engine driven pumps. Tolerance 5%.
Lubricating oil consumption value is given with a tolerance of 20%.

*) For generator drive only

Engine data for 32/44CR

General
Engine cycle: Four-stroke
Turbocharging system: Constant pressure
No. of cylinders, In-line engine: 6, 7, 8, 9, 10
No. of cylinders, V-engine: 12, 14, 16, 18, 20
Bore: 320 mm
Stroke: 440 mm
Displacement per cyl.: 35.4 dm³

Power-to-weight ratio (MCR)
In-line engine: 10.4 – 11.8 kg/kW, 7.6 – 8.7 kg/bhp
V-engine: 9.3 – 10.4 kg/kW, 6.8 – 7.6 kg/bhp

Cylinder output (MCR)
at 750/720 *) rpm: 560 kW / 760 bhp

Cooling
Cylinder cooling: Cooling water
Charge-air cooling (two-stage): Fresh water
Fuel injector cooling: Cooling water

Starting method
In-Line and V-engine: air (turbine) starter
L+V32/44CR Technical Data

Outputs MCR (maximum continuous rating)

<table>
<thead>
<tr>
<th>Engine speed</th>
<th>100% load</th>
<th>85% load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine speed</td>
<td>750 rpm</td>
<td>720* rpm</td>
</tr>
<tr>
<td>Mean piston speed</td>
<td>11.0 m/s</td>
<td>10.6 m/s</td>
</tr>
<tr>
<td>Mean effective pressure</td>
<td>25.3 bar</td>
<td>26.4 bar</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6L32/44CR</th>
<th>750 rpm</th>
<th>720* rpm</th>
<th>kW / bhp</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 cyl.</td>
<td>3,360 / 4,568</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7L32/44CR</td>
<td>750 rpm</td>
<td>720* rpm</td>
<td>kW / bhp</td>
</tr>
<tr>
<td>7 cyl.</td>
<td>3,920 / 5,330</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8L32/44CR</td>
<td>750 rpm</td>
<td>720* rpm</td>
<td>kW / bhp</td>
</tr>
<tr>
<td>8 cyl.</td>
<td>4,480 / 6,092</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9L32/44CR</td>
<td>750 rpm</td>
<td>720* rpm</td>
<td>kW / bhp</td>
</tr>
<tr>
<td>9 cyl.</td>
<td>5,040 / 6,852</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10L32/44CR</td>
<td>750 rpm</td>
<td>720* rpm</td>
<td>kW / bhp</td>
</tr>
<tr>
<td>10 cyl.</td>
<td>5,600 / 7,614</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12V32/44CR</td>
<td>750 rpm</td>
<td>720* rpm</td>
<td>kW / bhp</td>
</tr>
<tr>
<td>12 cyl.</td>
<td>6,720 / 9,137</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14V32/44CR</td>
<td>750 rpm</td>
<td>720* rpm</td>
<td>kW / bhp</td>
</tr>
<tr>
<td>14 cyl.</td>
<td>7,840 / 10,659</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16V32/44CR</td>
<td>750 rpm</td>
<td>720* rpm</td>
<td>kW / bhp</td>
</tr>
<tr>
<td>16 cyl.</td>
<td>8,960 / 12,182</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18V32/44CR</td>
<td>750 rpm</td>
<td>720* rpm</td>
<td>kW / bhp</td>
</tr>
<tr>
<td>18 cyl.</td>
<td>10,080 / 13,705</td>
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<td></td>
</tr>
<tr>
<td>20V32/44CR</td>
<td>750 rpm</td>
<td>720* rpm</td>
<td>kW / bhp</td>
</tr>
<tr>
<td>20 cyl.</td>
<td>11,200 / 15,228</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*) For generator drive only
# Dimensions And Weights

## All Cylinder Numbers

### In-line engine L32/44CR

<table>
<thead>
<tr>
<th>Engine type</th>
<th>No. of cyl.</th>
<th>L (mm)</th>
<th>L1 (mm)</th>
<th>W (mm)</th>
<th>H (mm)</th>
<th>Weight (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6L32/44CR</td>
<td>6</td>
<td>6,312</td>
<td>5,265</td>
<td>2,174</td>
<td>4,163</td>
<td>39.5</td>
</tr>
<tr>
<td>7L32/44CR</td>
<td>7</td>
<td>6,924</td>
<td>5,877</td>
<td>2,359</td>
<td>4,369</td>
<td>44.5</td>
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<tr>
<td>8L32/44CR</td>
<td>8</td>
<td>7,454</td>
<td>6,407</td>
<td>2,359</td>
<td>4,369</td>
<td>49.5</td>
</tr>
<tr>
<td>9L32/44CR</td>
<td>9</td>
<td>7,984</td>
<td>6,937</td>
<td>2,359</td>
<td>4,369</td>
<td>53.5</td>
</tr>
<tr>
<td>10L32/44CR</td>
<td>10</td>
<td>8,603</td>
<td>7,556</td>
<td>2,359</td>
<td>4,369</td>
<td>58.0</td>
</tr>
</tbody>
</table>

### V-engine V32/44CR

<table>
<thead>
<tr>
<th>Engine type</th>
<th>No. of cyl.</th>
<th>L (mm)</th>
<th>L1 (mm)</th>
<th>W (mm)</th>
<th>H (mm)</th>
<th>Weight (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12V32/44CR</td>
<td>12</td>
<td>7,195</td>
<td>5,795</td>
<td>3,100</td>
<td>4,039</td>
<td>70</td>
</tr>
<tr>
<td>14V32/44CR</td>
<td>14</td>
<td>7,970</td>
<td>6,425</td>
<td>3,100</td>
<td>4,262</td>
<td>79</td>
</tr>
<tr>
<td>16V32/44CR</td>
<td>16</td>
<td>8,600</td>
<td>7,055</td>
<td>3,100</td>
<td>4,262</td>
<td>87</td>
</tr>
<tr>
<td>18V32/44CR</td>
<td>18</td>
<td>9,230</td>
<td>7,685</td>
<td>3,100</td>
<td>4,262</td>
<td>96</td>
</tr>
<tr>
<td>20V32/44CR</td>
<td>20</td>
<td>9,860</td>
<td>8,315</td>
<td>3,100</td>
<td>4,262</td>
<td>104</td>
</tr>
</tbody>
</table>

All weights and dimensions are for guidance only and apply to dry engines without flywheel. Masses include built-on lube oil automatic filter, fuel oil filter and electronic equipment. Minimum centreline distance for twin engine installation: 2,500 mm (L32/44), 4,000 mm (V32/44). More information available upon request.
PrimeServ – peace of mind for life

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

PrimeServ’s aim is to provide:

- Prompt delivery of high demand OEM spare parts within 24 hours
- Fast, reliable and competent customer support.
- Individually tailored O&M contracts
- Ongoing training and qualification of service personnel.
- Global service, open 24 hours-a-day, 365 days-a-year
- Diagnosis and troubleshooting with our high performance Online Service.

The PrimeServ Offering

Based on almost 110 years of service experience with marine Diesel engines, our sophisticated logistics system ensures that all frequently requested spare parts are available worldwide within 24 hours. In addition, MAN Diesel Online Service helps to optimise maintenance cycles by the use of remote engine monitoring, diagnostics and calibration. The resulting condition-based maintenance (CBM) promotes high availability, increases operational safety, shortens downtimes and enhances the performance of MAN Diesel marine engines.

The bottom line: leaner operating costs and better planning for you.

When service is required, the MAN Diesel PrimeServ network responds to organise assistance as fast as possible. This guarantees rapid completion of maintenance work and high availability of MAN Diesel engines, GenSets, turbochargers, gears, propellers and marine propulsion packages.

In short: MAN Diesel PrimeServ gives you the benefit of our specialist expertise in marine power so that you can concentrate on your own core business.