Long-Stroke Diesel Engines for Maximum Efficiency and High Reliability

M 25 C
M 25 C, part of the MaK long-stroke engine generation, is based on the proven design characteristics of the M 20 C, M 32 C and M 43 C engine series. In the development of this new engine generation, the objective was to achieve a high benefit level for the customer. In all design and development considerations, therefore, three criteria had maximum priority – reliability, economy and environmental compatibility.

Other important points of great significance in the engine’s design and development work were ease of maintenance, long maintenance intervals, long component life and ease of installation.
The M 25 C series can now be supplied with different cylinder powers: 300 kW or 333 kW per cylinder. So a power range of between 1,800 and 3,000 kW is available. Main features of the series are their high levels of reliability and economy in both MDO and HFO operation. The series is available in 6, 8 and 9-cylinder variants.

With its modern design and high performance, the M 25 C offers its operators a wide range of applications and the certainty that they have bought a reliable and economic engine. Another feature of the series is its low emission levels, which are well within IMO regulatory limits.

Marine Propulsion
- M 25 C: The right solution for marine propulsion application
  - for fishing vessels
  - for tugs and for all the conditions of off-shore use
  - for cargo vessels

On-Board Power
- M 25 C: The reliable generator drive for container reefer and on-board electricity generation
  - the dependable solution
  - on-board electricity for all types of ships
M 25 C – Design Improvement

- The new M 25 C was changed to meet the same design principles as M 20 C, M 32 C and M 43 C.
- All MaK engine series have the same nomenclature with the design status “C”.
- The power output of the M 25 C increased slightly.
- The engine development also considers a possible Caterpillar Common Rail introduction.
- The design changes of the new M 25 C cylinder block result in an improved way of founding with an increased dimensional accuracy.
- The new governor drive is of simple and robust design.
- The design of the lower valve drive was changed to modular pre-assembly.
- New camshaft cover design for improved handling.
- No change of connecting points.
Intelligent simplicity
This MaK design principle is most clearly reflected in the reduction in the number of components. About 40% of parts – in particular conduits – have been dispensed with and a high level of functional integration achieved among the remaining components. There are also about 40% fewer interfaces, – with their susceptibility to failure and associated maintenance requirements.
The remaining connections are plug-in connections, again reducing maintenance needs. All of this has resulted in a marked gain in operational reliability and a reduction in operating costs.

Crankshaft with thrust bearing
- Forged from one piece
- Generously sized trunnions
- Capable of bearing the single-part gearwheel for the control drive
- Linked to the flywheel via an oil-pressure connection
- Generously sized 100% mass counterweights

Camshaft
- Individual cylinder sections
- Integrated non-adjustable cams for injection and valve timing
- Low wear due to cam follower lever arm

Cylinder liner with calibration ring
- Robust
- Cooling only above the crankcase
- Cylinder liner protected from wear
- Longer oil change intervals thanks to reduced dirt intake

Multifunctional cooling water ring
- Centering action during assembly of cylinder liner and head
- Guides cooling water and charge air
- Concentrated cooling of cylinder liner and head
- Protects cylinder head bolts from corrosion
M 25 C – Design Features

**Piston**
- Piston with stable combustion chamber
- Hardened first ring groove
- First ring with chromium ceramic-plated running surface
- Piston rings have a long service life and high operational reliability

**High-efficiency turbocharger**
- Low temperature level of components surrounding the combustion chamber
- Two-stage design
- Corrosion-free turbocharger casing without water cooling

**Cylinder head**
- Intensive cooling by means of generously dimensioned radial openings
- Longitudinal holes for integrated media guidance
- Robust and form stable thanks to double-bottom construction in nodular cast iron

**Injection pumps**
- Secure mounting
- Monobloc design with constant-pressure valve
- Integrated low-pressure damping prevents high pressure pulses
- Integrated stop cylinder
Reliable energy supply
The complete diesel generating set is notable for its ease of installation, reliable operation, ease of maintenance and good component accessibility. The basis is formed by the rigid base frame as foundation of the engine and alternator with integrated oil sump, large oil volume and universal equipment for both HFO and MDO operation.

Generation of electricity
In addition to its use as a marine propulsion unit, the M 25 C has a wide range of application providing power for the continuous generation of electricity applications where a high level of reliability is always important. The power range of the M 25 C engine series as a generator unit is from 2,140 to 3,560 kVA.
Complete
In addition to many outstanding technical features, the long-stroke M 25 C engine is also easy to install and provides good maintenance access to all component parts.

Installation-friendly
Further installation advantages are compact engine construction and the optimal position of interfaces for fuel, lubricating oil and cooling water systems. These are located at the opposite end to the coupling, making connection easier. All engine operating elements and remote switching are integrated into the operating panel, easily accessible to the engine.

Resilient mounting system
The resilient mounting system for vibration and structure-borne noise damping can be assembled safely and simply.

The above mentioned data are not binding. They only serve as standard values. These standard values can be attained if the MaK operating and maintenance specifications are strictly observed and only MaK spare parts are used. Please consider as well the negative effect of bad fuel qualities.

HFO/MDO – Long TBO and lifetime
Long maintenance intervals and the life of components are the basis for low operating costs.
### M 25 C – Technical Data

#### PROPULSION

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<tr>
<th>Type</th>
<th>Output range kW</th>
<th>mhp</th>
<th>rpm</th>
<th>Mean eff. pressure bar</th>
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<th>Spec. fuel consumption (g/kWh)</th>
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Specific lubricating oil consumption 0.6 g/kWh, ± 0.3 g/kWh
LCV = 42,700 kJ/kg, without engine-driven pumps, tolerance 5%

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Specific lubricating oil consumption 0.6 g/kWh, ± 0.3 g/kWh
LCV = 42,700 kJ/kg, without engine-driven pumps, tolerance 5%
Generator efficiency: 0.96, cos φ: 0.8

*Dependent on generator make/type.
M 25 C – MaK Propulsion Package

Complete propulsion systems
The supply of complete propulsion systems is a market requirement which is becoming more and more important. We have wide experience gathered in the design and installation of many successful propulsion plants and from our close cooperation with competent partners.

We offer
- System responsibility and supply from a single source
- Accurately matched interfaces
- Coordinated delivery data control

A complete propulsion system usually consists of:
- MaK main propulsion engine with flexible coupling
- Reduction gearbox with or without installed clutch and gearbox PTO with shaft generator
- Propeller and shaft installation
- Matched remote control and monitoring equipment

*Power Take Off

Examples of complete propulsion systems

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Subject to be change
M 25 C – Clean Solution

The long-stroke concept for ecological operation

Environmental protection is also becoming increasingly important for seagoing shipping. Caterpillar Motoren recognized this trend in good time and, with the design and development of the modern long-stroke engine concept, created the conditions for engine operation at reduced emission levels. The NOx emissions of the M 20 C engine lies well below the International Maritime Organisation’s limiting curve.

The long-stroke concept for engine operation at reduced emission levels

The following features characterise the concept which ensures, in addition to smooth running, maximum operational reliability and also permits operation on heavy fuel oil up to 700 cSt/50°C.

- Long piston stroke
- Large stroke/bore ratio
- Intensive injection
- Shaped injection curve
- Optimised control times
- High ignition pressure

For MDO operation the engine is also available with less NOx emission: Det Norske Veritas DNV “Clean Design” and Federal Ministry of Environment “Blue Angel”.

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**Diagram:**

- NOx emissions over engine speed for different fuel types and engine designs.
- M 20 C engine is highlighted with its NOx emissions compared to other designs.
You specify Cat or MaK power solutions, because you believe in the power of Caterpillar engines to keep you and your vessel safely on course. Cat Financial has the same commitment to your success — whether you need construction, term or repower financing.

We know how to support customers in one country, construction in a second country and registration in a third. We understand the marine industry — we’ve been lending to marine customers for nearly 30 years. And, as it has been since 1986, our service commitment is powered by Caterpillar and Cat and MaK dealers everywhere.

**Global Coverage**

Whether you’re a German operator building at a Chinese shipyard or a U.S. citizen building a yacht in Italy, Cat Financial can help. Our customers do business around the world, and we support them wherever they go.

Our service commitment extends to all marine sectors. From production and custom yachts to workboats and ocean-going vessels — we have you covered.

**Local Presence**

Need a local expert? We know local markets and how to navigate the legal and regulatory environments.

Cat Financial has offices in the Americas, Europe and Asia, and financing representatives all over the world. Put our knowledge to work to power the deal.

Get your project moving anywhere in the world with Cat Financial — backed by the power of Caterpillar and our unmatched dealer network.

Visit us online at MARINE.CAT.COM/finance
Integrated Solutions – Product Support Portfolio

Providing integrated solutions for your power system means much more than just supplying your engines. Beyond complete auxiliary and propulsion power systems, we offer a broad portfolio of customer support solutions and financing options. Our global dealer network takes care of you wherever you are – worldwide. Localized dealers offer on-site technical expertise through marine specialists and an extensive inventory of all the spare parts you might need.

To find your nearest dealer, simply go to: 
MARINE.CAT.COM
Perfect Solutions for Main Propulsion and On-Board Power Supply

The Program: Quality is our Motto.
For more than 90 years we have developed, built, supplied and serviced diesel engines worldwide. Today Caterpillar Marine with its brands Cat and MaK offer high-speed and medium-speed engines with power ratings from 93 kW to 14,400 kW. Many different engine families are available to meet your specific application needs.

Cat and MaK diesel engines are distinguished by high reliability, extremely low operational costs, simple installation and maintenance and compliance with IMO environmental regulations.

The application of engines in main and auxiliary marine power systems varies greatly and extends from high-speed boats and yachts, through tugs, trawlers and offshore vessels to freighters, ferries and cruise liners.

Sales and Service Organization

Caterpillar has combined the sales and service activities and responsibility of their Cat and MaK brand marine engine business into Caterpillar Marine Power Systems with headquarters in Hamburg/Germany.

In setting up this worldwide structure, we have concentrated on integrating the Cat and MaK brand groups into a single, united marine team, which utilises the particular expertise of each group.

Commercial marine engine business is split into three geographic regions,
- Europe, Africa, Middle East
- Americas
- Asia-Pacific,
Production Facilities

which manage all sales and product support activities. They have direct responsibility for achieving the ambitious growth targets set for the Cat and MaK brands and for providing our customers and dealers with complete marine solutions. Caterpillar’s global dealer network provides a key competitive edge – customers deal with people they know and trust.

Cat dealers strive to form a strong working relationship with their customers, offering comprehensive and competent advice from project support to repair work.

Some of the most advanced manufacturing concepts are used at Caterpillar locations throughout the world to produce engines in which reliability, economy and performance are second-to-none.

From the production of core components, the assembly of engines to the delivery of complete propulsion packages, quality is always the top priority.

Comprehensive, recognized analysis systems, test procedures and measuring methods ensure that quality requirements are met throughout all the individual manufacturing phases. All of our production facilities are certified under 1:2000 ISO 9001 EN, the international benchmark that is helping to set new quality standards worldwide.

In addition to product quality, our customers expect comprehensive service which includes the supply of spare parts throughout the life of the engine.
The Power You Need.

The Cat® and MaK™ brands of Caterpillar Marine offer premier high- and medium-speed propulsion, auxiliary, and generator set solutions, as well as optional dual fuel, diesel-electric, and hybrid system configurations. With the launch of Caterpillar Propulsion our comprehensive and evolving product line gives customers one source for the most extensive engine power range available, complete propulsion systems, controllable pitch propellers, transverse and azimuth thrusters, and controls. Cat and MaK products and technologies are proven reliable and are built to last in all marine applications, demonstrating superior productivity and the lowest lifecycle cost.

The Cat Global Dealer Network, more than 2,200 global service locations strong, ensures that you’ll have local expertise, highly-trained technicians, rapid parts delivery, and the proper equipment and services to keep you working – anytime, anywhere.

Construction, term, or repower financing through Cat Financial helps you make Cat and MaK power a reality. With our knowledge of customer needs, local markets, and legal and regulatory requirements, we’ve been providing tailored financing solutions and exceeding expectations since our start in 1986.

For more information and to find your local dealer, please visit our website: MARINE.CAT.COM
Visit Cat Financial at: CatPowerFinance.com

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