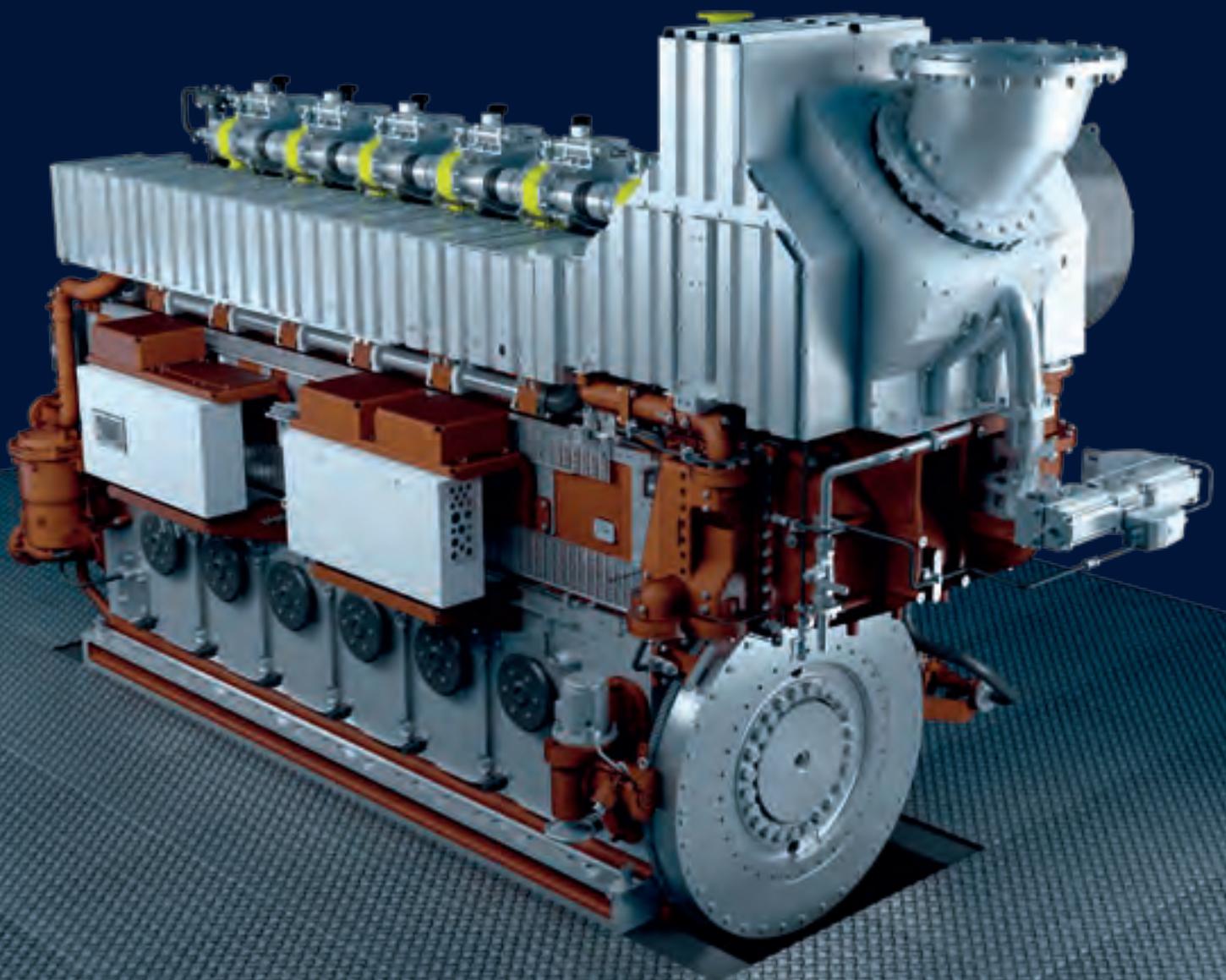
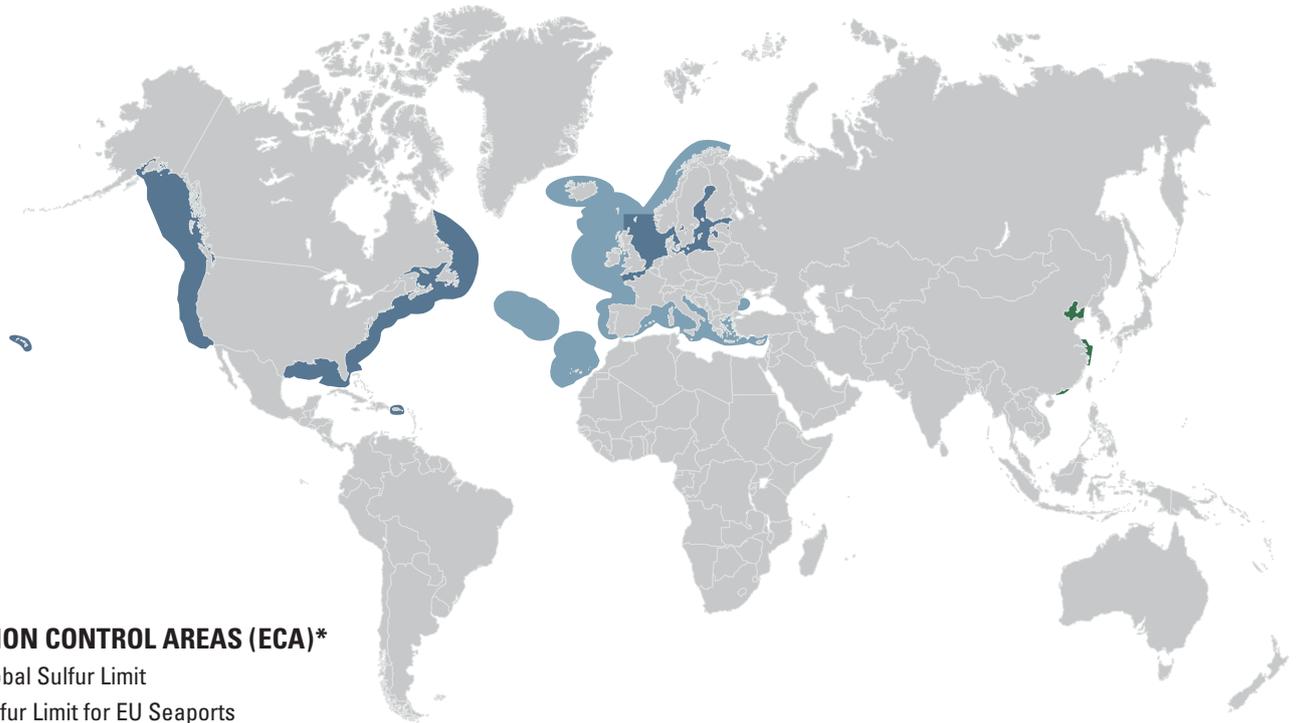


M 34 DF

Dual Fuel Engine
6 • 8 • 9 Cylinder



MAK



EMISSION CONTROL AREAS (ECA)*

- 0,5% Global Sulfur Limit
- 0,1% Sulfur Limit for EU Seaports
- 0,1% Emission Control Areas (ECA)
- 0,5% Local Sulfur Limit for Hongkong and China

* IMO, MARPOL Annex VI (more countries being discussed)



BIG CHALLENGES CALL FOR INNOVATIVE SOLUTIONS

Few industries face greater challenges than shipping – steadily tightening regulations, increasing cost pressures and a public more focused than ever on resource conservation and sustainability.

At Caterpillar, we're here to help you address these issues with innovative, efficient and environmentally friendly marine engines that help ensure your vessel's smooth operation, with no technical or legal restrictions, on all seas, coasts, canals and ports of call.

As a market leader in medium-speed marine engines, we continue to evolve our products to live up to your high expectations for quality, reliability and sustainability, and our new MaK M 34 DF engine is no exception.

Let us do the work, so you can concentrate on what matters most:
Keeping your business profitable.

Cargo



Cruise



Ferry



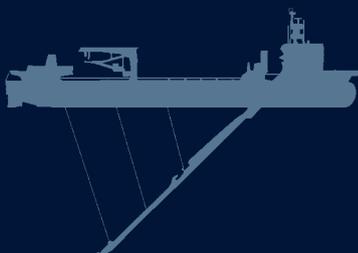
Fishing



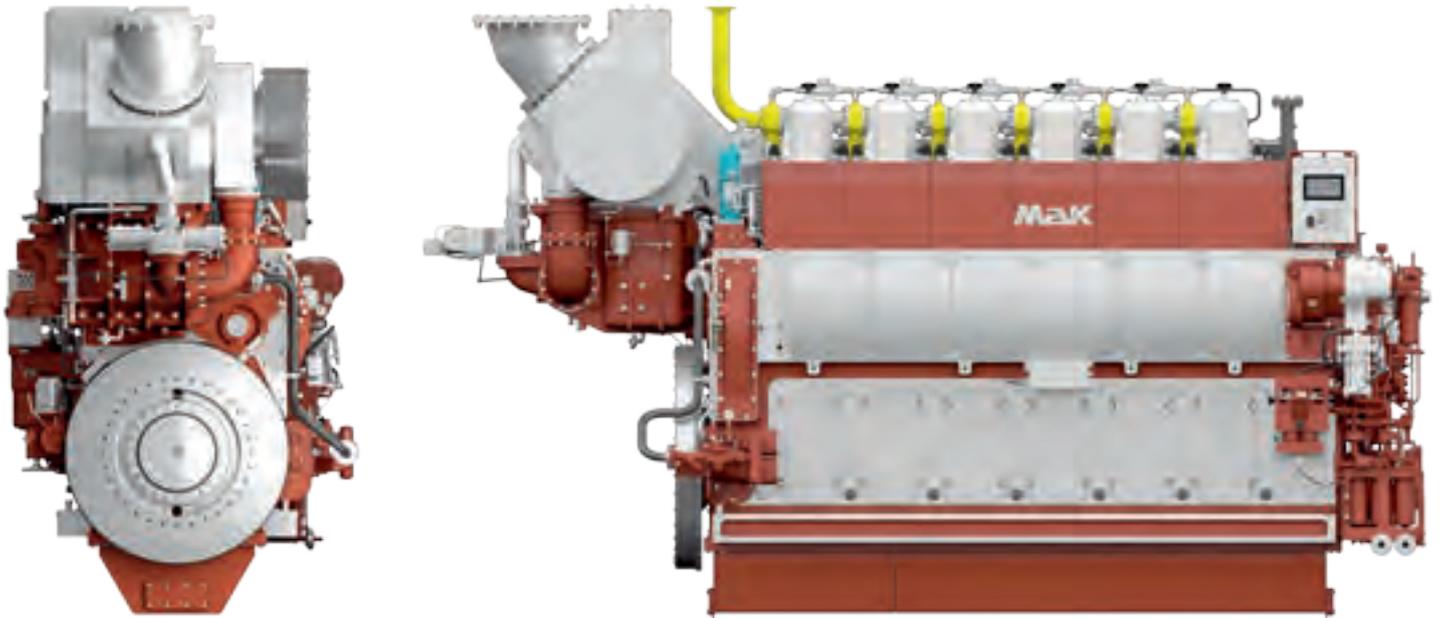
Offshore



Dredge



INTRODUCING THE M 34 DF: THE FUTURE-PROOF ENGINE CONCEPT



Caterpillar, Rostock, Germany





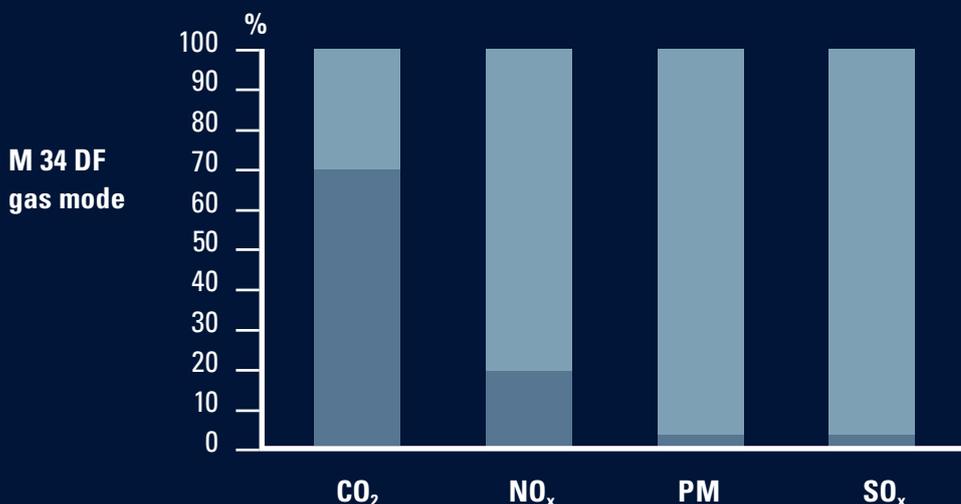
Low emissions, combined with the highest efficiency and reliability, position the M 34 DF as your ideal solution for operation both inside and outside Emission Controlled Areas (ECAs).

Featuring dual-fuel technology – which allows operation on marine diesel and LNG – the M 34 DF is a cost-effective, environmentally sound solution that serves as an economical alternative to scrubbers or MDO operations. When running on LNG, the M 34 DF:

- Produces no sulfur oxides or soot particles
- Reduces NO_x by 80% and CO₂ by nearly 30%
- Provides a benefit of 10% in CO₂ equivalence compared to typical heavy fuel oil (HFO) operation, even considering methane slip
- Operates with invisible soot even in low-load operation and maneuvering (if needed, short-term diesel apportionment can improve load acceptance)

Fuel consumption curves are flat and provide exceptional part load efficiency in gas and diesel modes. The M 34 DF also provides excellent values for Energy Efficiency Design Index (EEDI) calculations. Due to detailed turbocharger mating for all operation modes, the engine can be applied for genset and propulsion drives, with wide speed range to utilize best propulsion efficiency.

EMISSION REDUCTIONS



STRINGENT ENVIRONMENTAL REGULATIONS

In the past years, global and local regulations have focused on limiting NO_x, SO_x and PM emissions from large marine engines. With ever-more stringent rules, emissions of CO₂ are now coming under more scrutiny. The M 34 DF engine positively supports the reduction of global warming, because CO₂ emissions decrease by nearly 30%. Furthermore, CO₂ equivalents of Green House Gas (GHG) emissions decrease by more than 10% compared to the widespread use of heavy fuel oil.

SAFE AND RELIABLE OPERATION, EVEN IN THE ROUGHEST SEAS

To meet the International Maritime Organization's (IMO) strict requirements for both emissions and safety, the M 34 DF features double-walled pipe system to prevent gas leaks, as well as a sophisticated alarm and monitoring systems designed to detect gas, track in-cylinder pressures and manage gas flow, just to name a few.

In addition, because engine optimized response is critical for the operation of dual-fuel engines, the M 34 DF features a control and monitoring system developed by Caterpillar. It is based on long experience with gas engines and proven across various applications and engine sizes.

Together, these components help guarantee safe and reliable operation – even in the worst weather conditions at sea.





M 34 DF – KEY FEATURES AND BENEFITS

Reduced Carbon Footprint and Extreme Fuel Efficiency

- Low emissions combined with the highest efficiency and reliability
- Gas start capability to avoid diesel emissions completely
- Low amount of methane slip due to optimized combustion control
- First-class fuel efficiency and loading capacity

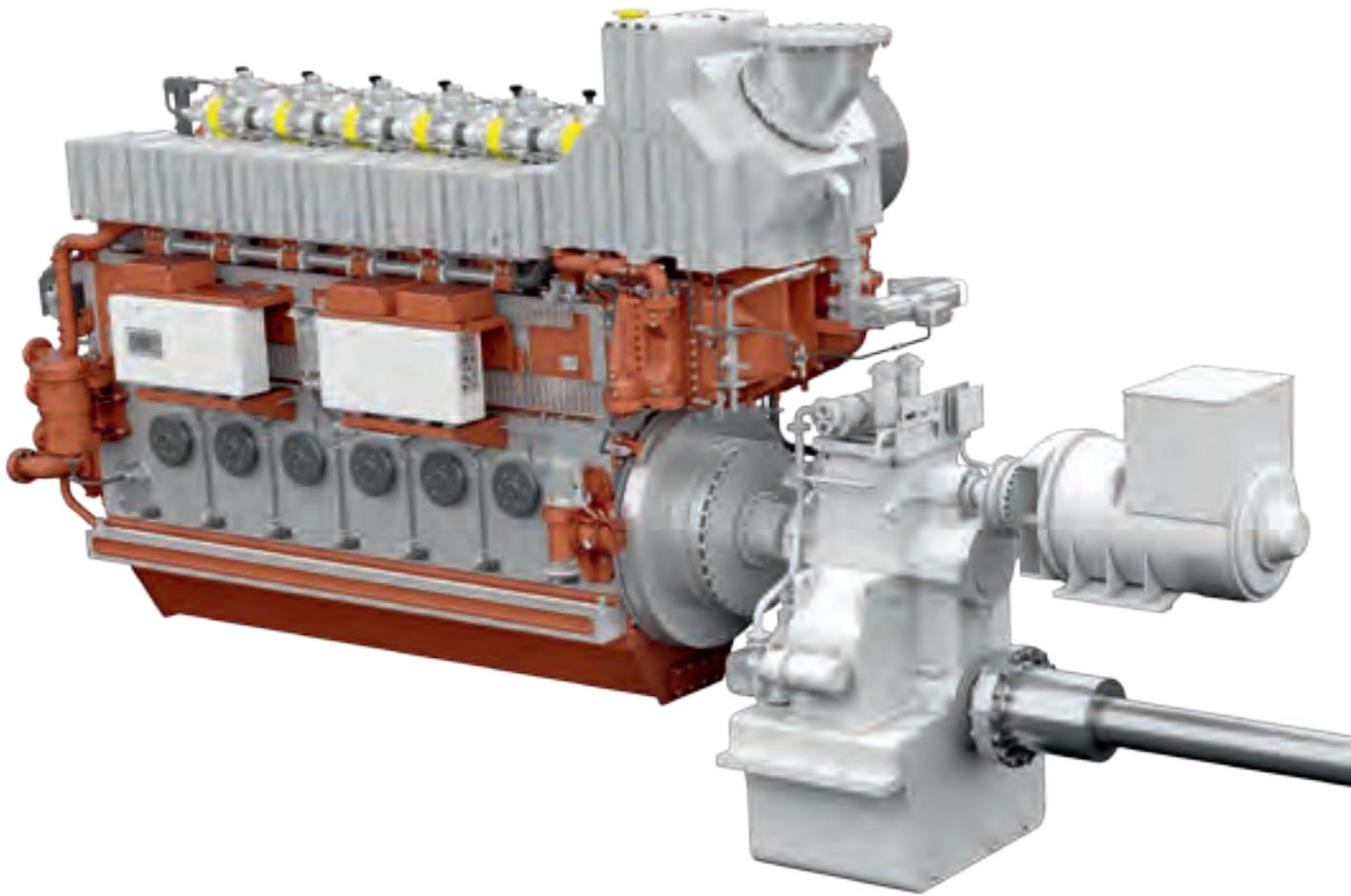
Operational Simplicity and Safety

- Advanced Modular Alarm and Control System (aMACs) for safe and easy operation
- Modular engine design for simplified service and maintenance
- Reliable and steady speed regulations even in heavy weather and breaking seas

Environment and Safety Focused

- Meets IMO Tier III in gas and diesel modes with optional Cat[®] SCR (Selective Catalytic Reduction technology)
- Complies with the International Code of Safety (IGF Code)
- Supports excellent EEDI values

A TOTAL PROPULSION SOLUTION TO MEET TIGHTENING REQUIREMENTS



Planning Today for Tomorrow's Success

The **Energy Efficiency Design Index (EEDI)*** requires that ship designs achieve certain levels of efficiency and emissions. Today, most new builds must meet EEDI requirements and receive a class-approved certificate. Acting now to achieve EEDI standards is critical, as they are scheduled to be further tightened.

The better you manage emissions today, the greater your competitive advantage tomorrow. Optimized MaK dual-fuel engines and selected propulsion systems are the perfect choice to boost your vessel's energy efficiency.

* Introduced by MARPOL Annex VI, Chapter 4, in 2008. Provides a specific figure for an individual ship design, expressed in grams of CO₂ per the ship's capacity-mile (the smaller the EEDI, the more energy efficient the ship design) and calculated by a formula based on the technical design parameters for a given ship.

Engine selection is critical in ensuring safe, sustainable, cost-effective ship operation. The right engine and propeller combination can improve your vessel's efficiency even further, helping you meet EEDI and other regulatory requirements. At Caterpillar, we have comprehensive experience in this area through many completed installations, working with trusted partners to provide engine-propeller packages that deliver environmentally friendly, economical propulsion solutions that fit your vessel design and application profile.

Combining the highly efficient M 34 DF engine with a propeller designed by these partners not only reduces emission and costs, but also can increase your vessel's efficiency even more by ensuring the propulsion solution is perfectly matched to your engine characteristics. The correct engine-propeller match reduces noise and vibration – and therefore cavitation – to low levels for the best possible propeller efficiency. That saves valuable raw materials, decreases costs and reduces CO₂ emissions while maintaining powerful propulsion.



ONE-STOP SHOPPING FOR ALL YOUR LNG NEEDS

At Caterpillar, we have a long history with gas engines, and our dual-fuel engines have earned a reputation for efficiency and reliability around the world. Every day, we help vessel owners and operators solve big challenges and achieve tough sustainability goals. Our solutions include complete LNG Fuel Gas Systems, thanks to our relationships with renowned cryogenics partners.

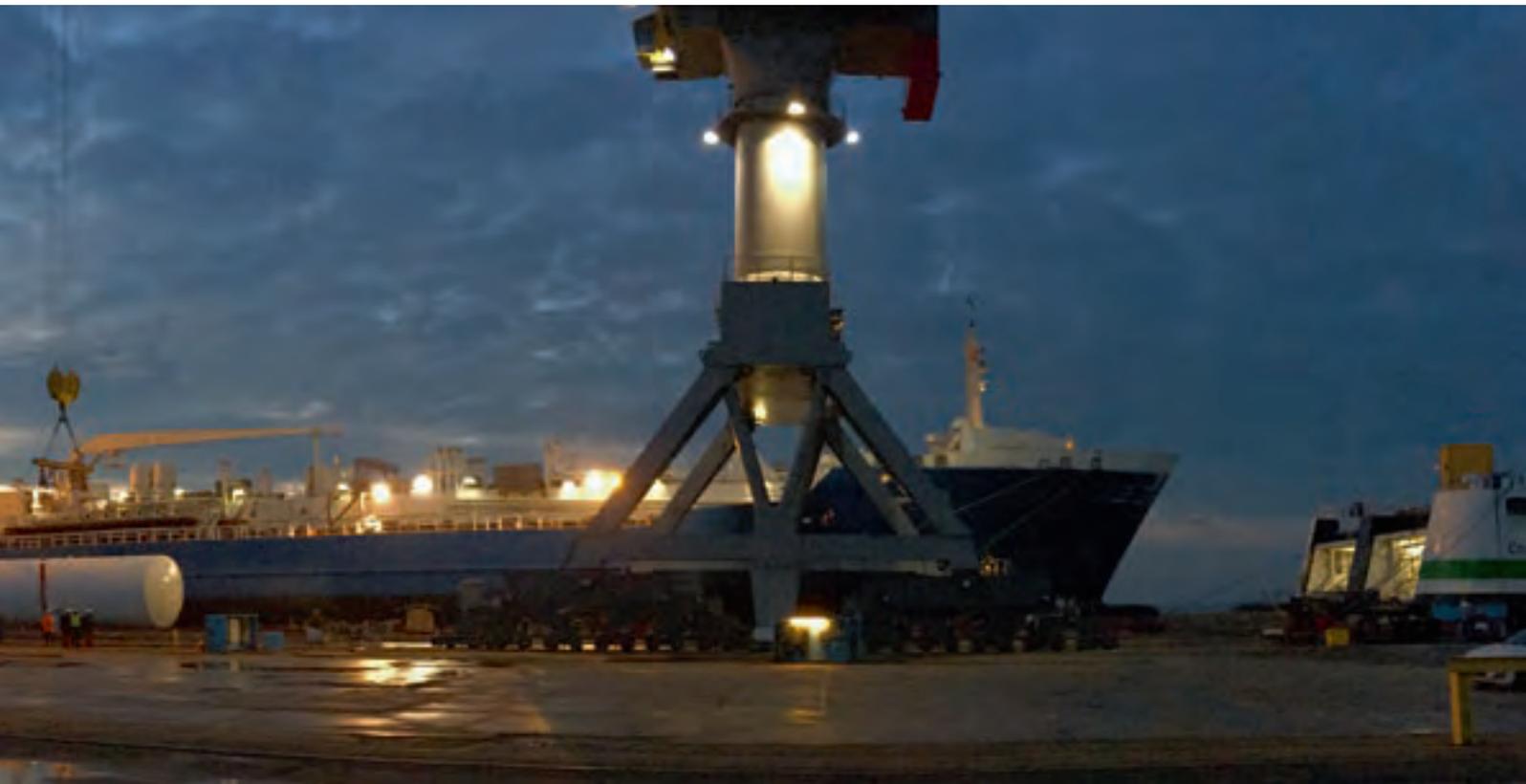
From project planning, to implementation and coordination, to ongoing operation and support, our experienced engineers and global Cat dealer specialists will work with you to develop a tailored solution from one trusted source.



SCR OPTION MAKES DIESEL OPERATION MORE SUSTAINABLE

Running on gas fuel, the M 34 DF meets IMO Tier III standards — and with the addition of Caterpillar's optional Selective Catalytic Reduction (SCR) technology, it can meet those same requirements in diesel mode as well.

SCR provides a sustainable solution for reducing NO_x emissions without sacrificing engine efficiency, longevity and reliability. It's a useful addition if operation in diesel mode is unavoidable, particularly if your vessel carries reserve diesel capacity because it is deployed in waters where infrastructure for LNG bunkers is not well developed.



CAT DIGITAL TECHNOLOGY

THAT MAKES IT EASY TO BE PROACTIVE

INFORM

Get a comprehensive view of engine health, identify potential issues and schedule service and repairs proactively. **Cat Remote Fleet Vision** works with your engine's Product Link™ hardware to monitor status, condition and performance from a remote location.

With Cat Remote Fleet Vision, it's fast and easy to determine if issues lie with the engine or with other equipment such as a generator, transmission or pump. The system works with any brand of equipment and is ideal for those with vessels spread over a wide geographic area.

ADVISE

Take advantage of advanced, automated predictive analytics with the option of expert advisory service across your vessel – or across your entire fleet. **Cat Asset Intelligence** helps you maximize efficiency, increase productivity and decrease operating costs by providing the right information to the right people at the right time.

When environmental regulations require you to submit ship-specific reports, for example, Cat Asset Intelligence makes compliance easy. As soon as your vessel enters an ECA zone, the system logs critical data points and automatically generates reports on fuel consumption and emissions.



THE SUPPORT YOU NEED, WHEN AND WHERE YOU NEED IT

MaK CUSTOM TRAINING

Our Engine Training Center in Kiel, Germany, offers tailor-made courses that can relate specifically to your engine application or cover all current engine types, new technologies and control and monitoring systems. Courses are held on request and in small groups of four to eight participants.

For more information, email training_center_kiel@cat.com



MaK REParts™

When your engine requires service, you need options that get your vessel back into operation quickly. Our extensive MaK REParts™ program provides you with sustainable, cost-effective and high-quality service solutions through the optimal reuse of parts during an engine overhaul. MaK REParts offers extensive repair and exchange options that provide same-as-new performance and reliability at a fraction-of-new price. These genuine spare parts also come with the same warranty as our new parts.

Email REParts_Center@cat.com for more information.



GLOBAL DEALER NETWORK

Quick response, expert advice and service options that reduce your downtime and costs – when you choose Caterpillar, you get all that and more. Our team and our extensive network of local dealers worldwide are available to help you optimize the economic efficiency and performance of your equipment, offering project planning and management, engine commissioning, total maintenance and repair solutions, upgrades and conversions, lifecycle services and much more.



M 34 DF – TECHNICAL DATA

PROPULSION ENGINE

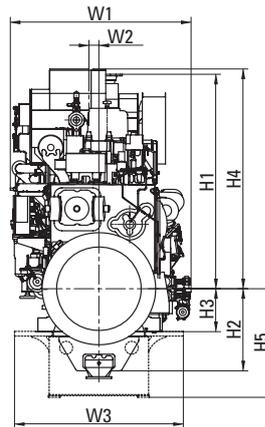
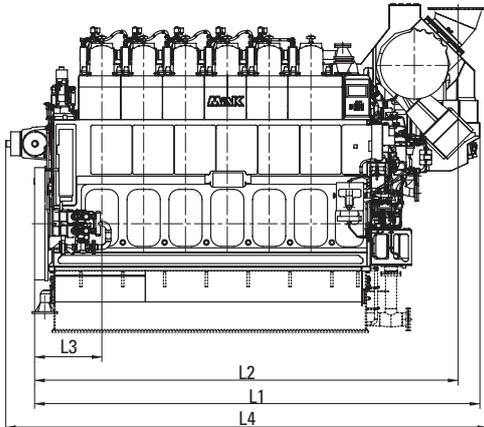
Dimensions (mm) and Weights (t)

Type	L1	L2	L3	L4	H1	H2	H3	H4	H5	W1	W2	W3	Weight
6 M 34 DF	6079	5366	852	6109	2767	1052	550	2817	1392	2303	126	2140	39.5
8 M 34 DF	7139	6533	852	7325	2970	1052	550	2995	1392	2303	191	2140	49.0
9 M 34 DF	7669	7063	852	7855	2970	1052	550	2995	1392	2303	191	2140	52.0

Type	Output range		Speed	Mean eff. pressure	Mean piston speed	Spec. fuel consumption (Diesel mode)		Total spec. energy consumption (Gas mode)	
	kW	mhp	rpm	bar	m/s	100%	85%	100%	85%
6 M 34 DF	3180	4324	720	21.2	11.0	183/183	7450/7620		
	3300	4487	750	21.1	11.5	186/186	7560/7730		
8 M 34 DF	4240	5765	720	21.2	11.0	183/183	7450/7620		
	4400	5983	750	21.1	11.5	186/186	7560/7730		
9 M 34 DF	4770	6486	720	21.2	11.0	183/183	7450/7620		
	4950	6730	750	21.1	11.5	186/186	7560/7730		

Stroke: 460 mm
Bore: 340 mm

Maximum continuous rating according to ISO 3046/1.



Engine centre distance: 2800 mm

Removal of cylinder liner:
in transverse direction: 3040 mm
in longitudinal direction: 3400 mm

Engine with turbocharger at free end available, ask for dimensions.

Please contact us for lead times.



GENERATOR SET

Dimensions (mm) and Weights (t)

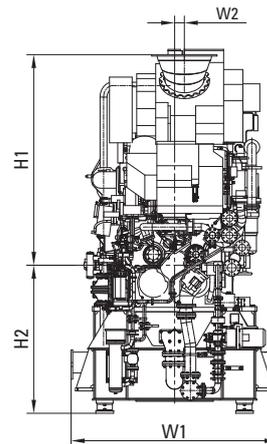
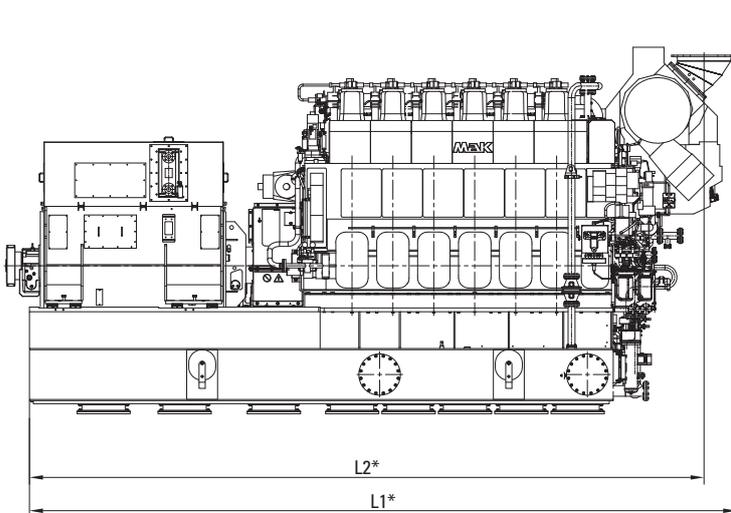
Type	L1*	L2*	H1	H2	W1	W2	Weight*
6 M 34 DF	9160	8737	2749	1930	2680	127	72.0
8 M 34 DF	10268	9845	2970	1930	2680	191	84.0
9 M 34 DF	10862	10389	2970	1930	2680	191	90.0

* Dependent on generator make/type

Type	Engine rating		Output range		Frequency	Speed	Mean eff. pressure	Mean piston speed	Spec. fuel consumption (Diesel mode)	Total spec. energy consumption (Gas mode)
	kW	kWe	kVA	Hz	rpm	bar	m/s	g/kWh	kJ/kWh	
6 M 34 DF	3180	3085	3856	60	720	21.2	11.0	183/183	7450/7620	
	3300	3201	4001	50	750	21.1	11.5	186/186	7560/7730	
8 M 34 DF	4240	4113	5141	60	720	21.2	11.0	183/183	7450/7620	
	4400	4268	5335	50	750	21.1	11.5	186/186	7560/7730	
9 M 34 DF	4770	4627	5784	60	720	21.2	11.0	183/183	7450/7620	
	4950	4802	6002	50	750	21.1	11.5	186/186	7560/7730	

Stroke: 460 mm
Bore: 340 mm

Specific lubricating oil consumption 0.6 g/kWh,
Generator efficiency: 0.97, cos φ: 0.8



Generator set centre distance:
min. 3000 mm

Removal of cylinder liner:
in transverse direction: 3040 mm
in longitudinal direction: 3400 mm

Engine with turbocharger at driving end available, ask for dimensions.

Please contact us for lead times.

M 34 DF THE PREFERRED CHOICE!

For more information contact you local dealer.

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