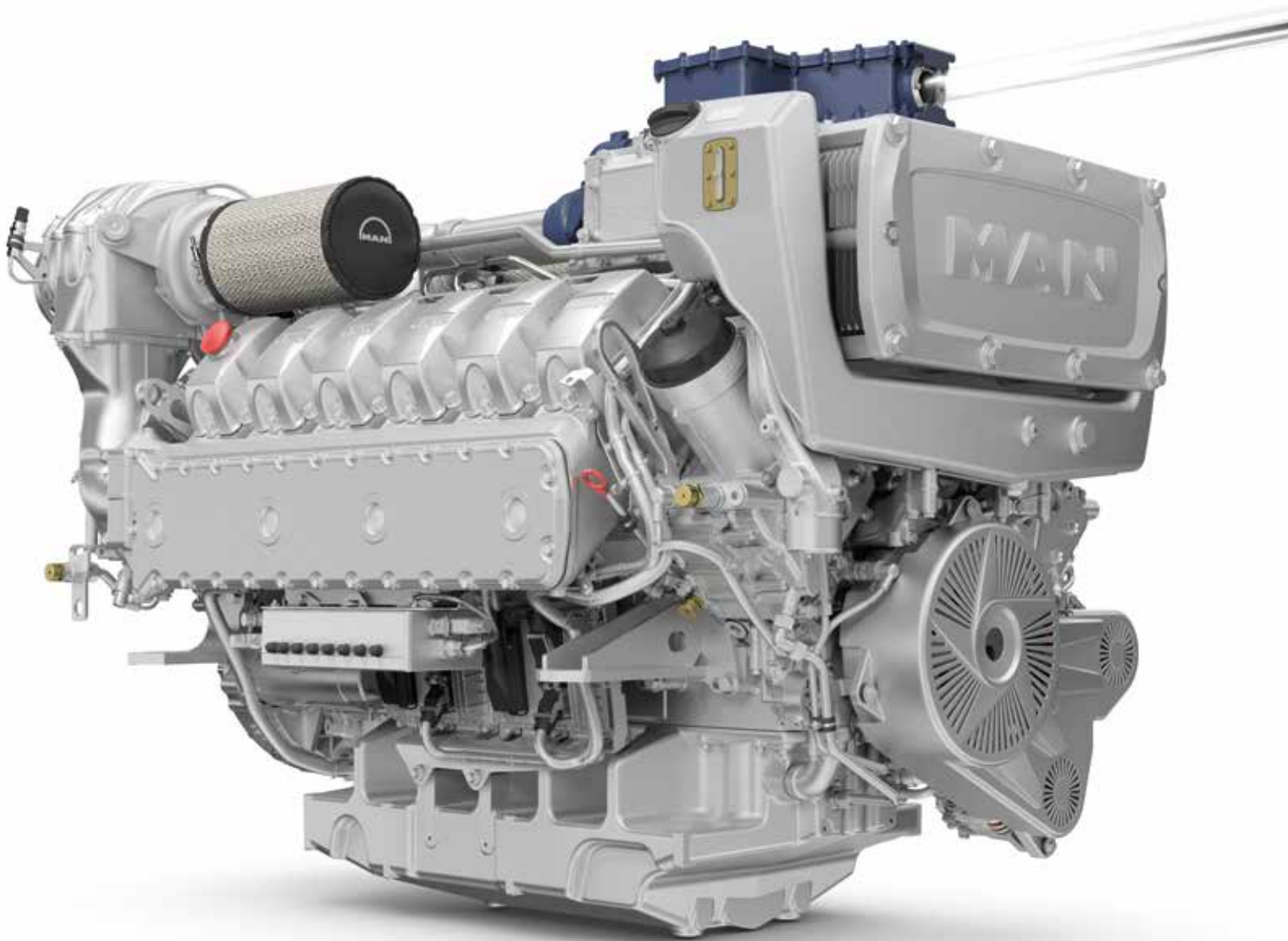


# MAN DUAL FUEL MARINE ENGINE.

Sustainable hydrogen-diesel solution.



MAN Engines



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# TWO OPERATING MODES FOR TWO FUELS.

## Diesel mode

The engine is started and initially operated with diesel fuel only. In diesel mode, the operating behaviour, fuel consumption and all other characteristics correspond exactly to the MAN D2862 LE428 with the same performance.

The modular MAN SCR system reduces the nitrogen oxides in the exhaust gas by means of effective exhaust gas aftertreatment, so that the limit values in accordance with IMO Tier III can be complied with.

## Dual fuel mode

In a type of pretreatment, a precisely measured quantity of hydrogen is added to the charge air. This mixture of hydrogen and air is then ignited in the combustion chamber of the cylinders using the injected diesel fuel. Depending on the operating point of the engine, only a very small amount of diesel fuel is required.

For this reason, significantly less CO<sub>2</sub> occurs in the exhaust gas in dual fuel mode. With a typical collective daily load of a working boat, exhaust CO<sub>2</sub> emissions can be expected to be up to 50% lower. Particulate and nitrogen oxide emissions can also be reduced. As a result, the operator also benefits from lower consumption of AdBlue®, the reducing agent for the SCR reaction in exhaust gas aftertreatment.

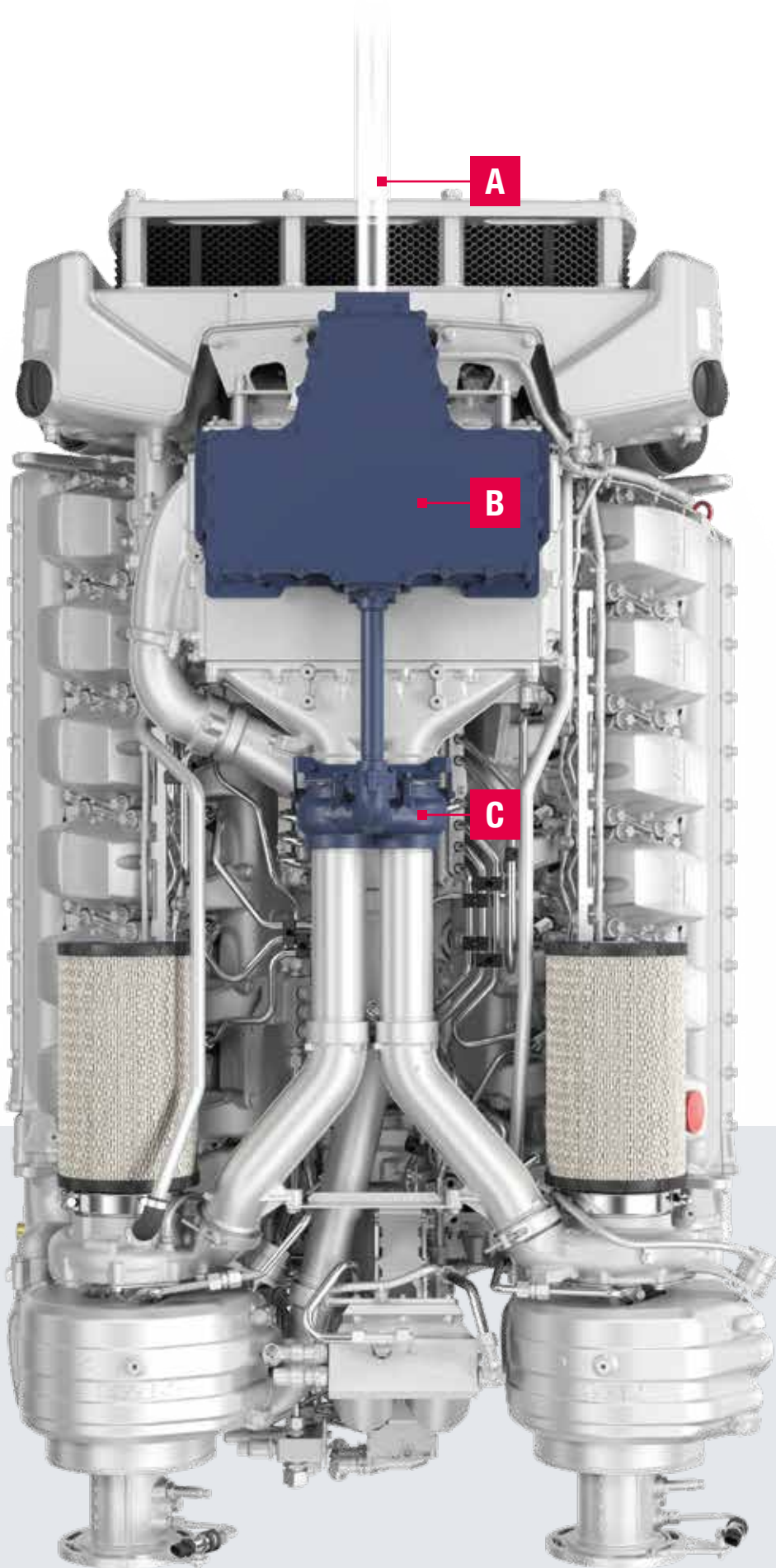
In the event of problems in the hydrogen circuit or an exhausted hydrogen supply, it is possible to switch back to diesel mode at any time. This ensures uninterrupted operation with the usual reliability and economy of a marine engine from MAN Engines.

Irrespective of the operating mode, the limit values according to IMO Tier III are complied with.



## Benefits

- Up to 66% less engine out CO<sub>2</sub> emissions compared with the diesel engine
- Just as powerful and reliable as the diesel engine
- Operation either as a pure diesel drive or as a dual fuel engine
- Uninterrupted operation even when the hydrogen tank is empty or the hydrogen circuit is faulty

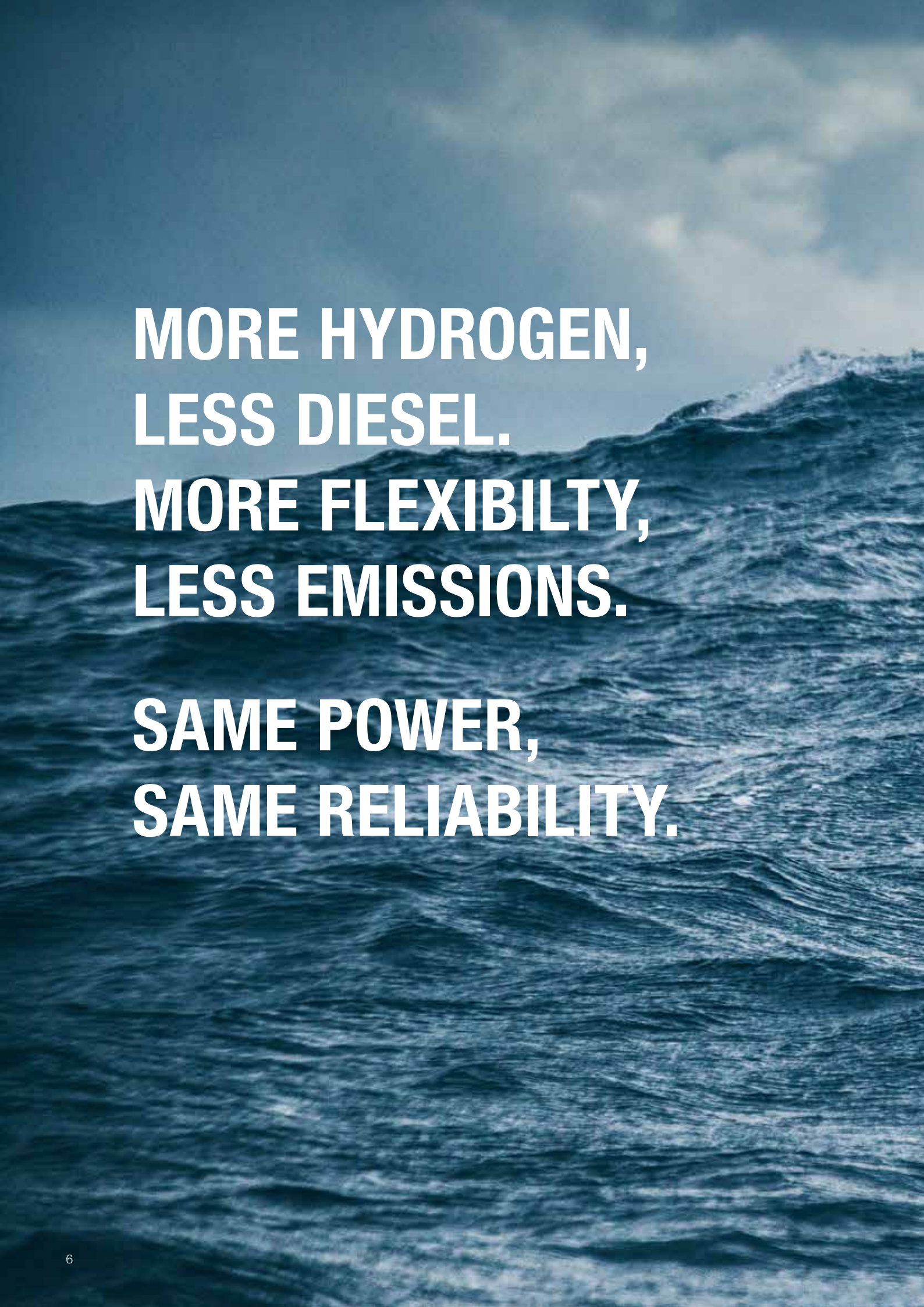


**A** Hydrogen supply

**B** CMB.TECH's  
hydrogen unit

**C** Hydrogen injection  
manifold

All hydrogen carrying components are double walled. With the hydrogen monitoring system, a hydrogen leakage will be detected immediately. The venting system will evacuate the leaked hydrogen safely and the hydrogen supply to the engine is cut immediately. The engine will return to safe diesel mode, supplying uninterrupted power.

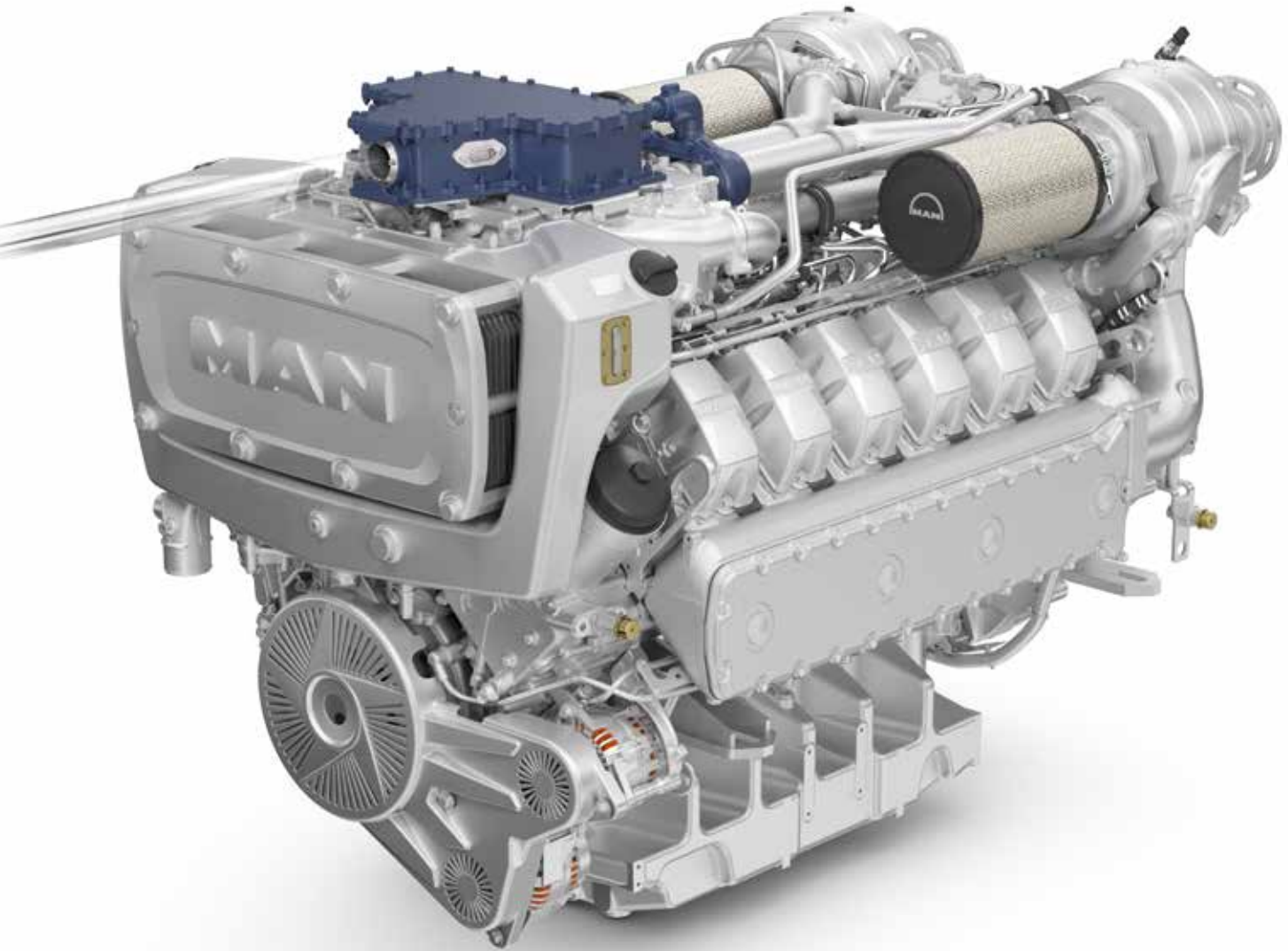


**MORE HYDROGEN,  
LESS DIESEL.  
MORE FLEXIBILITY,  
LESS EMISSIONS.**

**SAME POWER,  
SAME RELIABILITY.**



# D2862 DUAL FUEL



## Characteristics

- Application: Main propulsion dual fuel (hydrogen/diesel) engine for ships with fixed or variable pitch propeller
- Operation profile: Up to 4000 operating hours per year and an average load up to 60%
- Construction: Four-stroke dual fuel engine, direct diesel injection and hydrogen injection into charge air, exhaust after-treatment system
- Cylinders: 12 cylinders in V-arrangement, single cylinder heads, replaceable cylinder liners, SAE 1 flywheel housing
- Air system: Single-stage turbocharger with charge air intercooler and wastegate
- Cooling system: Seawater cooled by rubber impeller pump or two-circuit-cooling system for hull cooling
- Oil system: Force-feed lubrication by gear pump, lubricating oil cooler in cooling water circuit
- Fuel system: Common Rail injection system with EDC17 control, diesel fuel to according to DIN EN 590, Hydrogen N40
- Auxiliary PTO: PTO for hydraulic pump 16 cm<sup>3</sup> (180Nm), front-PTO by crank shaft extension
- Alternator: Three-phase generator with rectifier and transistorized governor, 28V, 120A
- Starting system: Solenoid-operated electric starter, 24 V, 7.0 kW
- Service: Oil change interval 500 operating hours



## Technical features

| Performance data        |         | D2862 LE448  | Consumption data <sup>1)</sup>  |             | Diesel   | Hydrogen |
|-------------------------|---------|--------------|---|-------------|----------|----------|
| Rated power             | kW (PS) | 749 (1 019)  | Specific fuel consumption <sup>2)</sup>   | 164.5 g/kWh | 16 g/kWh |          |
| Speed                   | rpm     | 2 100        | Absolute fuel consumption <sup>2)</sup>   | 148 l/h     | 12 kg/h  |          |
| Bore                    | mm      | 128          | Highest fuel saving <sup>3)</sup>   | 44 l/h      | -        |          |
| Stroke                  | mm      | 157          | Highest reduction <sup>3)</sup>   | 66%         | -        |          |
| Displacement            | l       | 24.24        | 1) In dual fuel mode: diesel fuel according to DIN EN 590 (tolerance +5% - ISO 3046), urea solution 32,5% according to ISO 22241 (tolerance +3%) and hydrogen N40 (tolerance +5%) |             |          |          |
| Rated torque            | Nm      | 3 406        | 2) At rated power   |             |          |          |
| Maximum torque          | Nm      | 3 750        | 3) On propeller curve   |             |          |          |
| at speed                | rpm     | 1 300-1 900  |   |             |          |          |
| Compression ratio       |         | 19:1         |   |             |          |          |
| Mean effective pressure | bar     | 17.7         |   |             |          |          |
| Classification          |         | on request   |   |             |          |          |
| Emission status         |         | IMO Tier III |   |             |          |          |



## Dimensions

| Type designation                        |    | D2862 dual fuel |
|---|----|-----------------|
| A-Overall length                        | mm | 1940            |
| B-Overall width                         | mm | 1 153           |
| C-Overall height with flat oil pan      | mm | 1 355           |
| D-Top of engine to middle of crankshaft | mm | 890             |
| E-Length to flywheel front              | mm | 1 630           |
| Dry weight                              | kg | 2 270           |

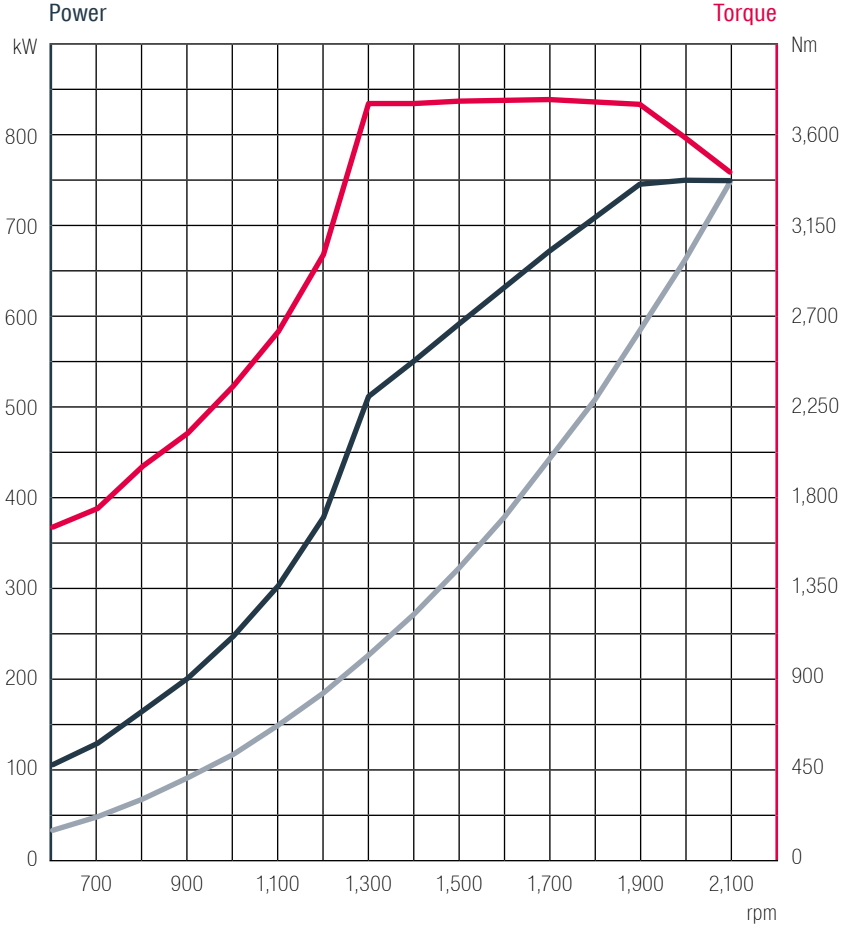
All data are reference values. Please request installation drawings for detailed specifications.

# D2862 DUAL FUEL

## Performance

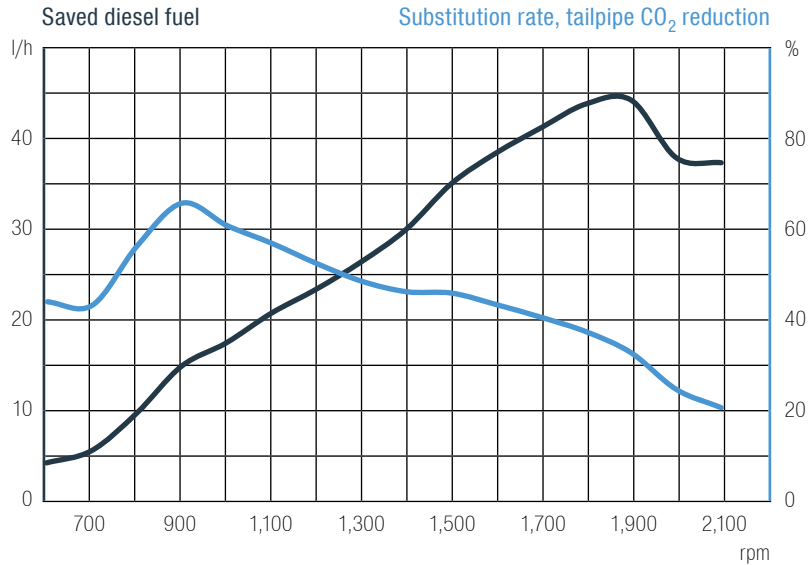
Applies in diesel mode as well as in dual fuel mode.

- Power under full load
- Power (propeller curve)
- Torque



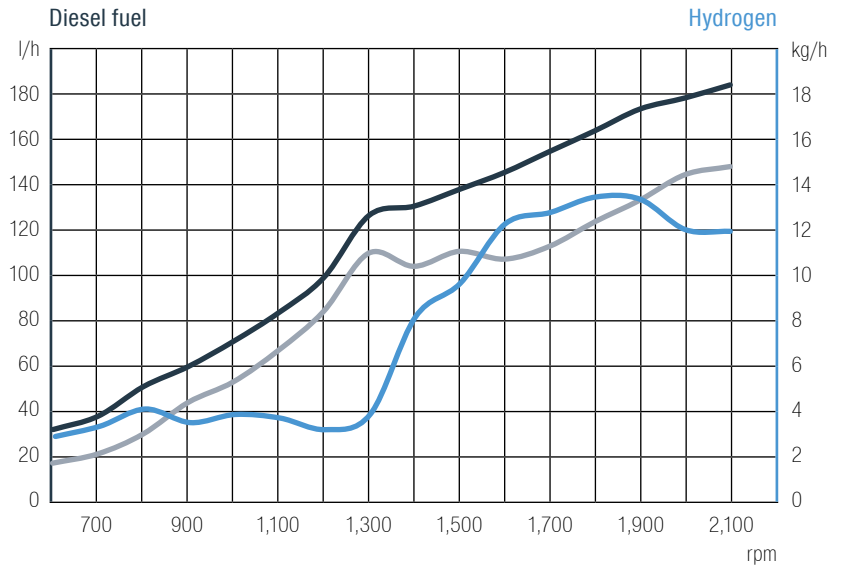
## Energy savings (propeller curves)

- Saved diesel fuel in dual fuel mode
- Substitution rate



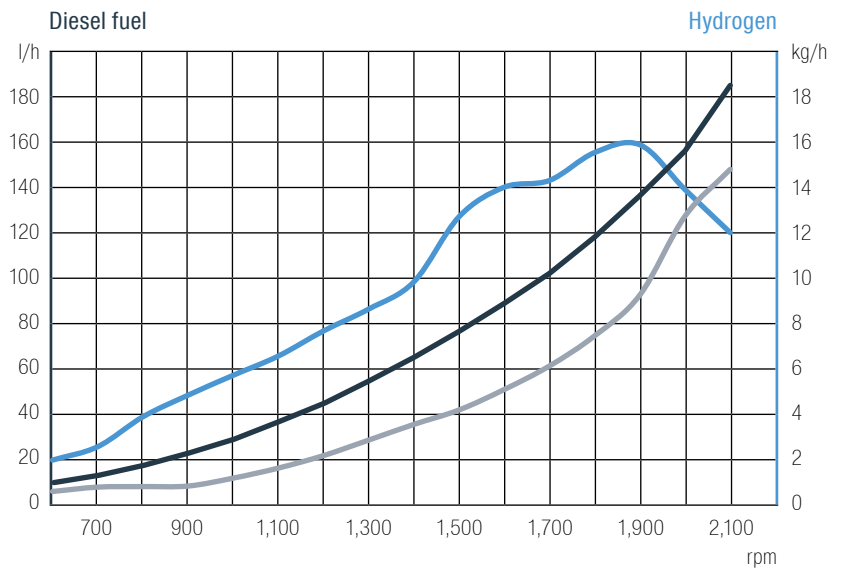
**Fuel consumption under full load**

- Diesel fuel consumption in diesel mode
- Diesel fuel consumption in dual fuel mode
- Hydrogen consumption in dual fuel mode



**Fuel consumption (propeller curves)**

- Diesel fuel consumption in diesel mode
- Diesel fuel consumption in dual fuel mode
- Hydrogen consumption in dual fuel mode



# THE HYDROCAT. DRIVEN BY MAN DUAL FUEL.



## The HydroCat project

For the HydroCat – the world's first hydrogen-driven crew transfer vessel – a 749 kW strong dual fuel engine was designed. This marine approved dual fuel drive solution is based on the reliable MAN D2862 LE428, a V12 diesel engine with a displacement of 24 litres. It was prepared by MAN Engines for dual fuel operation and retrofitted by CMB.TECH with a hydrogen injection system which injects hydrogen in front of the intercooler. The hydrogen manifold is double walled and was designed for the latest 3D additive manufacturing technology.

Further engine variants for propulsion with higher power and for gensets are going to be developed soon.






### **CMB: Compagnie Maritime Belge**

CMB.TECH is a cleantech company that builds, owns, operates and designs large marine and industrial applications that run on hydrogen and ammonia.

CMB.TECH also offers hydrogen and ammonia fuel to its customers, either through own production or by sourcing it from third party producers.

CMB.TECH has four divisions:

- Marine: Design, building and operation of a future proof fleet powered by hydrogen and ammonia
- Engineering: A fast growing highly skilled engineering team with more than 15 years of experience with hydrogen systems
- H2 infra: Technology and infrastructure to produce and distribute the clean fuels of the future
- Industry: Design and retrofit of industrial applications to run on the clean fuel of hydrogen



MAN Engines is the ideal partner when it comes to innovative drive solutions especially for working boats. With the MAN D2862 dual fuel engine – developed and produced with CMB – you can sustainably reduce the emissions while at the same time benefiting from maximum operating reliability you are used to from MAN diesel engines.

# THE SUSTAINABLE HYDROGEN POWER EXPERIENCE FOR COMMERCIAL VESSELS.



**MAN Truck & Bus SE**  
Vogelweiherstrasse 33  
90441 Nürnberg, Germany  
man-engines@man.eu  
www.man-engines.com

D 114.651 · wd 03/2023-3000 · Printed in Germany  
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