

**CMB**  
**.TECH**

# HYDROGEN TRACTOR



**POWERED BY HYDROGEN**

## H<sub>2</sub> DUAL FUEL TECHNOLOGY

Off-road machinery requires incremental innovation instead of disruptive innovation. CMB.TECH's H<sub>2</sub> dual fuel technology is the first step towards the zero emission goal. This novel technology has been proven to reduce carbon emissions by up to 60% on the existing diesel-only platforms. Furthermore, the Hydrogen Tractor is currently being used in the Netherlands and saves up to 103kg of CO<sub>2</sub> emissions per refuel.

In the H<sub>2</sub> dual fuel technology, hydrogen is aspirated into the combustion chamber. This substitution directly reduces the amount of diesel fuel required to power the engine. The clean H<sub>2</sub> fuel contains no carbon, drastically reducing the CO<sub>2</sub> emissions whilst maintaining same power output and still trusting to the proven ICE technology.

### H<sub>2</sub> REFUELLING

- Standard H<sub>2</sub> receptacle
- Optional high-flow Receptacle
- No cooling required
- 10 mins refuelling-time

### H<sub>2</sub> STORAGE

- 5x Type III, 35MPa H<sub>2</sub> cylinders
- Individual solenoid valve per cylinder
- Integrated on top of cabin
- Separate EC79-approved pressure regulator
- EC79 compliant (UN/ECE-R134 ready)
- Total of 11.5kg of H<sub>2</sub>





## KEY FEATURES

- The most cost-effective technology for lowering CO<sub>2</sub> emissions available today
- Savings of up to 60% of CO<sub>2</sub> with the technology available today, more possible in future
- The base tractor is not modified, so maintenance can still be undertaken by the same technicians
- Real-world CO<sub>2</sub> savings available now
- Facilitate the energy transition, while not being dependent on the availability of the H<sub>2</sub> refuelling infrastructure





## SPECIFICATION

Engine	-	4.5L FPT
Power	-	140 BHP
Torque	-	491 Nm
Wheelbase	-	2490 mm
H <sub>2</sub> Storage	-	11.5 kg
H <sub>2</sub> Pressure	-	35 MPa
RefuelTime	-	10 Minutes



## SAFETY

With one click, the system can be switched to diesel only, instantly shutting down and closing the H<sub>2</sub> system to safe mode. This also happens automatically when a sensor or fault is active. The diesel engine goes back to 100% diesel and operability of the machine is guaranteed. Because of this strategy, the dual fuel system has no influence on the reliability of the original machine. In addition, the hydrogen system is:

- Based on CMB.TECH's 3 layers of safety strategy
- Fully EC79 (2009) approved
- UN/ECE-R134 ready



## CMB.TECH'S 3 LAYERS OF SAFETY

The H<sub>2</sub> dual fuel system is designed supervisory, allowing the switch back to diesel if needed, ensuring operational reliability of the machine. On top of that, the hydrogen system itself has 3 different layers of safety to ensure redundant safety:

- 1 - The first layer is provided by using high integrity components as used on other CMB.TECH projects that exceed normal safety requirements as well as conforming to all the relevant class and safety requirements. All hydrogen components are carefully selected to be the industry's most reliable of its class and are EC79 (2009) approved and UN/ECE-R134 ready.
- 2 - The second layer is provided by leak detection software and control system that is developed from the ground up at CMB.TECH. The H<sub>2</sub> control strategy allows for safe and efficient operation of the system and comprises of two parts:
  - **Static Leak Detection** – In diesel only mode, engine key on/off and Dual Fuel Mode request, integrity of the storage cylinders and gas lines are checked. Any decay in pressure declares a leak, causing the cylinder valves to close, isolating the system and declaring a fault.
  - **Dynamic Leak Detection** – The H<sub>2</sub> control system will constantly perform a dynamic leak test when the engines are running in dual-fuel mode. During the test one stillage at a time is being isolated and pressures and temperatures are being compared over a calibrated period. If there is any pressure decay the dual fuel mode is being stopped automatically where the engines switch over to diesel only mode seamlessly. The dynamic leak detection process cycles over time for each separate stillage.





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