



GENERAL SPECIFICATIONS		
Truck	Length/Width/Height (mm)	2445/1165/2275
	Load capacity (kg)	2500
	Voltage (V)	36
Fuel cell unit	Type	PEFC
	Continuous rated power (kW)	9
	Supplier	General Hydrogen (Canada)
Fuel	Type	Compressed Hydrogen Gas
	Storage type	High pressure hydrogen tank

FUEL CELL VEHICLE



NISSAN FORKLIFT EUROPE B.V.

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NISSAN FORKLIFT FCV

Fuel Cell Vehicle – concept forklift



Green and Clean

ozon

The world's economy is strongly relying on the availability of energy. As we cannot imagine living without it, we are also becoming more and more aware that today's fossil energy source is not inexhaustible. As frontrunner in minimum emission engines, Nissan Forklift is intensively working on products to be powered by alternative fuel sources.

As part of the continuous search for efficient and clean products, Nissan Forklift is developing and testing forklift powered by hydrogen fuel cell technology. In this research, Nissan Forklift is closely cooperating with the Nissan Automotive branch which also actively uses this clean technology for cars.

Hydrogen

Hydrogen is in every living element in the world and it is part of every drop of water. Without hydrogen there would be no life on earth. It has no colour, no taste, has no smell and is not toxic. It's been on earth for more than thousands of years.

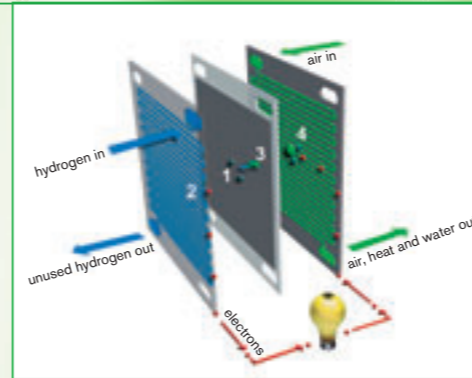
The way to get energy from pure hydrogen is to have a controlled electro-chemical reaction in a fuel cell. That way, hydrogen and oxygen combine to form water and release electrical energy. In this reaction no combustion takes place and therefore it produces less heat, and as a result, more energy is released. This process is very efficient and clean (no CO₂, CO, NO_x and HC emission).

Fuel cell principle

A fuel cell consists of one coated "membrane electrode assembly" (MEA) and two "flow field plates" with a total thickness of approximately 3 millimetres.

The MEA is the core of the fuel cell and incorporates the catalyst to allow the main reaction between hydrogen and water. This produces the needed electricity. Basically the process is:

- The coated membrane assists hydrogen atoms to be split into electrons and protons (hydrogen ions) (1).
- The hydrogen ions pass, via the plastic membrane, to the other side of the fuel cell (3). There it reacts with oxygen and finalises the reaction and creates water (4).
- On each side of the MEA the flow field plates lead hydrogen and air equally to opposite sides of the MEA. This provides fuel for the reaction. The plates direct the by-products; air, heat and water away from the cells. The electrons are guided from the cell (2) to the forklift motor and returned to the cell to finalise the circuit and the reaction.

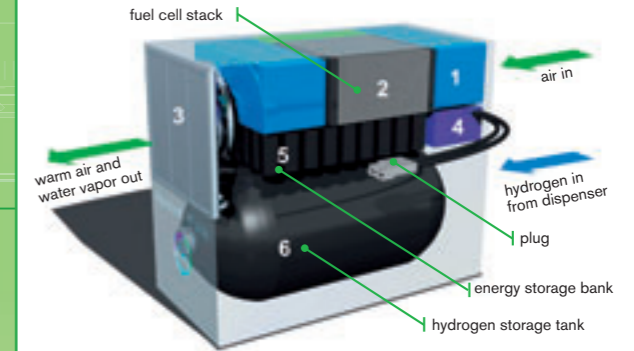


How fuel cell packs work

A single fuel cell provides less energy to power the forklift. In order to have sufficient energy, a large number of fuel cells is combined to make a "fuel cell stack".

A fuel cell pack is in fact a complete system that can replace current lead-acid batteries in forklift trucks. Basic operation is as follows:

- Hydrogen from the storage tank and outside air are humidified (1) before entering the fuel cell stack
- The humidified gasses pass through the fuel cell stack (2) where electricity, heat and gas are produced.
- The surplus of by-products, heat and water vapour, are led through a radiator into the atmosphere (3).
- The generated electricity is transformed to the required current and voltage (4) and led to the forklift motor.
- An energy storage bank (5) supplies extra energy for high demand operations like lifting.
- When the hydrogen storage tank (6) is empty, refilling is necessary.



Main advantages for Nissan Forklift

As already described, one of the main advantages is the fact that hydrogen is a clean energy source which does not exhausts harmful emissions as today's fossil energy products.

By using the fuel cell technology it is expected that runtimes of the forklift trucks can be multiplied when compared to current days' battery powered trucks. Furthermore downtime will be significantly reduced as only a few minutes are required to fuel hydrogen compared to hours of battery charging. Additionally there is no need for battery replace equipment and additional batteries.

