



Hydrogen

Product offer for hydrogen fuel applications

Hydrogen

Hydrogen is the lightest element, it's a gas at standard conditions having the formula H_2 .

Hydrogen is:



Colourless



Non-toxic



Odourless



Highly
combustible



Tasteless

Hydrogen is the most abundant chemical substance in the universe and exists on earth in molecular forms such as water and organic compounds.

It's mainly produced by chemical processes that extracts hydrogen from hydrocarbons such as natural gas, coal and biomass. The drive to eliminate

combustion of fossil fuels will accelerate the use of hydrogen and increase the production of clean hydrogen from renewable energy sources.

Hydrogen will be decisive in the energy transition and key to achieving decarbonising of heavy industry and revolutionizing clean mobility.



As a pioneer in hydrogen we have developed unique expertise in the industry over the last 50 years which has allowed us to master the entire value chain: production, transport, storage and distribution.

Air Liquide already serves customers in the world's main industrial basins. This proximity, combined with our expertise and technologies, allows us to develop synergies between the industrial and

mobility markets, to ensure the availability of hydrogen in large quantities.

The hydrogen fuel industry is growing faster than ever and changing the market landscape and hydrogen value chain. Applications such as electrolyzers, hydrogen combustion engines, appliances, and fuel cells require a specific purity of hydrogen.



Hydrogen helps to decarbonise:

- Car and transport sector, known as "Mobility"
- Residential or commercial combustion appliances
- Energy production and distribution network, known as "Power Generation"
- Industrial processes for "Heat and Power" generation



Hydrogen for fuel applications

Hydrogen fuel refers to hydrogen that is burned as a fuel with oxygen. It is carbon free, provided it is made in a process that does not involve carbon. Hydrogen purity or hydrogen quality describes the presence of impurities in hydrogen, impurities can interfere with the proper functioning of equipment or vehicles that combust hydrogen. The impact of impurities varies by application, specific impurity matter.

The European Commission published a delegated act to modify Annex 2 of the Alternative Fuel Infrastructure Directive. Under this delegated act, the hydrogen quality used by EU member states is defined by EN 17124 [E], which is mandatory for hydrogen fuelled applications.

Product Offer

- Hydrogen Fuel Grade
- Calibration standards
- Hydrogen Analysis Services

Air Liquide is responsible for ensuring H₂ fuel quality at the point of use based on quality assurance systems that cover the entire hydrogen supply chain.

Air Liquide internal laboratories have been in charge, for several decades, of the quality program of industrial plants in several markets using accredited ISO 17025 methods to analyse critical impurities. We have the capability to analyse all the contaminants in hydrogen according to the ISO 21087 guidelines listed in EN 17124 and ISO 14687 to support requirements to meet hydrogen fuel application.

Hydrogen Fuel Grade

One grade that meets hydrogen based fuel classifications

Our Hydrogen Fuel Grade has been designed to meet all ISO-14687 specifications required for mobility, combustion appliances, power generation and heat source applications:

Hydrogen Fuel Grade for use as:

- Research and development fuel and start-up operations
- Development of H₂ fuelled power & heat generation units
- Fuel for PEM (Proton Exchange Membrane) Fuel Cell, combustion engines and appliance



Available packaging:

- Cylinder
- Tube trailer
- Cylinder bundle
- On site production

Hydrogen H₂ 99,97%

Impurity		Amount (ppm v/v)
Water	H ₂ O	< 5
Total Hydrocarbons	THC	< 2
Oxygen	O ₂	< 5
Helium	He	< 300
Nitrogen + Argon	N ₂ + Ar	< 100
Carbon Dioxide	CO ₂	< 2
Carbon Monoxide	CO	< 0,2
Total Sulphur Compounds	TS	< 0,004
Formaldehyde	HCHO	< 0,01
Formic Acid	HCOOH	< 0,2
Ammonia	NH ₃	< 0,1
Total Halogenated Compounds	TH	< 0,05

Applicable for all ISO 14687 fuel grades: Grade A - for internal combustion engines, Grade B - industrial fuel for power generation and heat generation, Grade C - aircraft and space-vehicle ground support systems, Grade D a,b - PEM fuel cell applications, for mobile and stationary appliances and Grade E 1,2,& 3 - hydrogen based fuels.

Calibration Standards

- to support hydrogen analysis

Air Liquide specialty gas plants produce a complete range of calibration gases to support hydrogen gas analysis -13 compounds - according to ISO 14687 and EN 17124 for Quality Control, Online or Off-line process control and Research and Development applications. Available in convenient cylinders.



Hydrogen Analysis Services

Analysis according to ISO 14687 and EN 17124

Our CEMIAG Laboratory provides hydrogen analytical services for sampling and complete analysis (13 components) according to ISO 14687, EN 17124 or partial hydrogen analysis (H₂O and N₂), according to ISO 14687 for:

- Quality control analysis at nozzle of Hydrogen Refuelling Stations at start-up of the station and after station maintenance.
- Quality control of hydrogen gas network and at production.



Hydrogen, at the heart of Air Liquide's activities

The Group is responding to the urgency of climate change and is committed to achieving carbon neutrality by 2050. In this context, a major challenge for Air Liquide is to scale up the production of renewable and low-carbon hydrogen to decarbonize our activities and those of our customers committed to the energy transition.

Green and Blue Hydrogen

Our technologies and capacity for innovation enable us to offer renewable or low-carbon hydrogen, depending on market needs.

Hydrogen is produced by:

- Electrolysis from renewable energies (wind, solar, hydro) or low-carbon sources - **Green Hydrogen**.
- Methane (natural gas) or biomethane reforming with CO₂ capture and storage - **Blue Hydrogen**.





Contact us

We are happy to count you among our customers and to support all your gas activities.

If you have any questions, don't hesitate to contact our experts.

You can get in touch with our customer service from 8AM to 5PM:

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A world leader in gases, technologies and services for Industry and Health, Air Liquide is present in 75 countries with approximately 66,400 employees and serves more than 3.8 million customers and patients.