

The Atlas Copco logo is positioned in the top right corner of the page. It consists of the company name "Atlas Copco" in a white, serif font, centered between two horizontal white bars. The background of the entire page is a night-time photograph of an industrial facility, likely a refinery or gas processing plant, with numerous pipes, towers, and structures illuminated by bright lights against a dark sky. A large, semi-transparent blue triangle is overlaid on the bottom left side of the image, containing technical drawings and the main title.A large, semi-transparent blue triangle is overlaid on the bottom left side of the image. Inside this triangle, there is a technical drawing of a circular component, possibly a valve or a part of a compressor, with various dimensions and labels. The drawing is rendered in white lines on the blue background. The main title is written in white, bold, sans-serif font over the bottom part of this triangle.

# Driving a cleaner future – Hydrogen Solutions from Atlas Copco Gas and Process

Hydrogen is a critical part of our vision to reduce greenhouse gases and achieve net zero emissions by 2050. Leaning on our extensive experience in cryogenic process applications, Atlas Copco Gas and Process provides several solutions to power your energy transition.



At Atlas Copco Gas and Process, we see hydrogen as a key driver in powering the energy transition, with the goal of reaching net zero emissions by 2050. We have technology today to help you reduce environmental emissions and make a circular, sustainable economy a reality.

From blue / grey hydrogen produced by separating H<sub>2</sub> in traditional hydrocarbon processes, to providing equipment for green hydrogen liquefaction, we have the solutions now and for a greener future.

## Hydrocarbons and Hydrogen: Closer than you think, process-wise

When you think of hydrogen, applications like gas processing, LNG or petrochemical processes most likely do not come to mind. While gas properties vary, the machines needed to process them are remarkably similar. Our decades of LNG, natural gas processing, chemical / petrochemical, fuel gas boosters and air separation experience have Atlas Copco Gas and Process well positioned to apply these technologies to hydrogen processes. Creating a boil-off-gas compressor that can handle hydrogen is similar to the hundreds of BOG compressors we have produced for LNG storage and transportation. With a few key modifications to material choices and manufacturing techniques, we can apply our many years of expertise to these and emerging hydrogen markets.



## The challenges of hydrogen processing and handling



### Cold operating environment

- To liquefy H<sub>2</sub>, extremely cold temperatures are needed. At temperatures below -250°C, care must be taken in minimizing heat transfer into the process.
- Thermal insulation is a key design feature for liquefaction, and we are collaborating with cold box manufacturers an integrated expander cold box interface that minimizes heat transfer and maximizes process efficiency.
- At these cryogenic temperatures, standard internal components can become brittle and fail unexpectedly. We lean on our decades of cryogenic gas processing experience to ensure we design each unit with suitable materials to reduce the chance of embrittlement.



### Lightweight gas properties

- Hydrogen is the lightest molecule which poses some challenges for turbomachinery. Multiple stages are often required to achieve the desired results.
- We manufacture integrally-gear compressors that can feature up to eight stages, allowing for the necessary compression requirements while reducing the overall footprint of your process equipment.

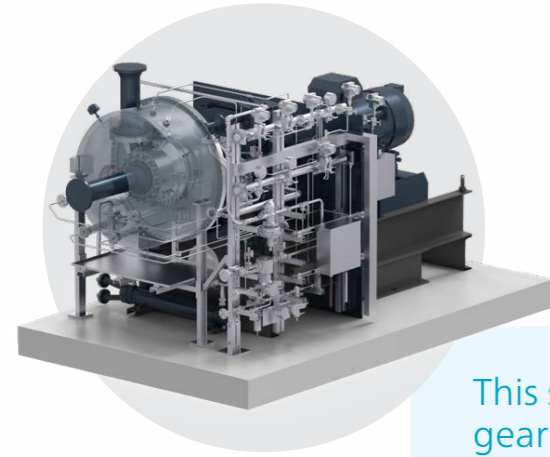


### Energy intensive transportation

- Gaseous hydrogen has a relatively small energy density, making it cost-prohibitive to transport. Liquefaction makes transportation feasible, but there are still gains to be realized here. We are continuously working with our customers to increase our machines' efficiencies in order to increase LH<sub>2</sub> production to support growing H<sub>2</sub> fuel station demands.



# Unique technologies

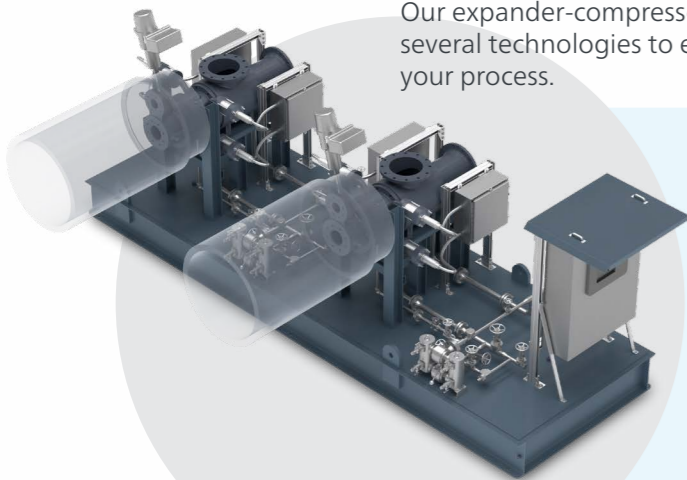


## Hydrogen Boil Off Gas (BOG) compressor for seafaring H<sub>2</sub> transportation

Using our extensive experience in cryogenic LNG processing, we were able to meet an extreme customer request - to safely and reliably compress H<sub>2</sub> BOG in the coldest environment currently recorded for hydrogen transportation.

This single stage, integrally-gear compressor can reliably operate in environments as cold as

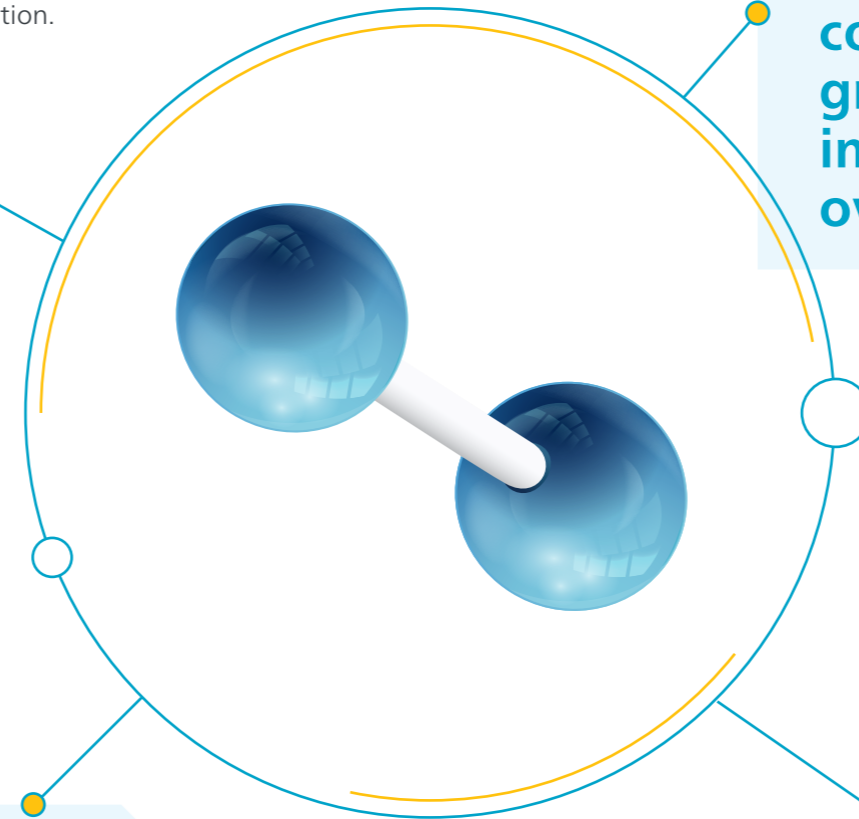
**-253°C**



## Hydrogen liquefaction expanders

Our expander-compressors for hydrogen liquefaction use several technologies to extract increased efficiency from your process.

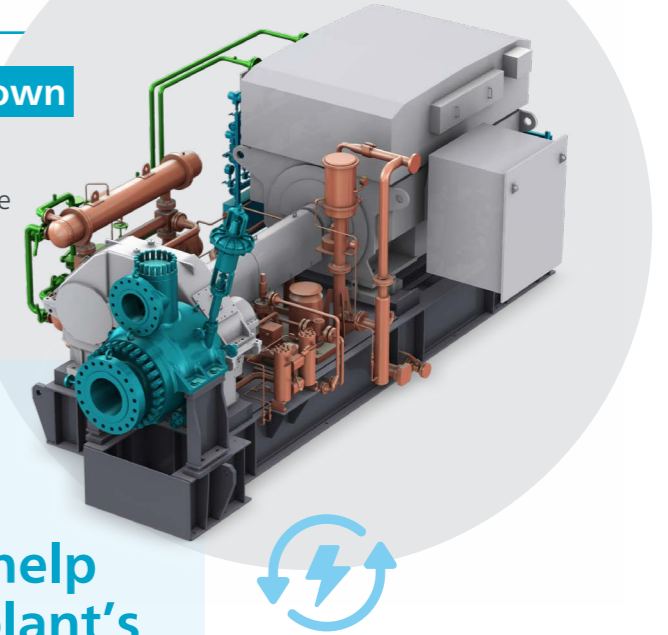
By utilizing oil-free magnetic bearings, our hermetically-sealed turboexpanders offer **efficient power recovery with no loss of seal gas.**



## Hydrogen pressure let down (energy recovery)

Utilizing readily available high pressure H<sub>2</sub>, our PLD expanders harness the energy expelled in the pressure letdown process via integrally-gear expander-generators.

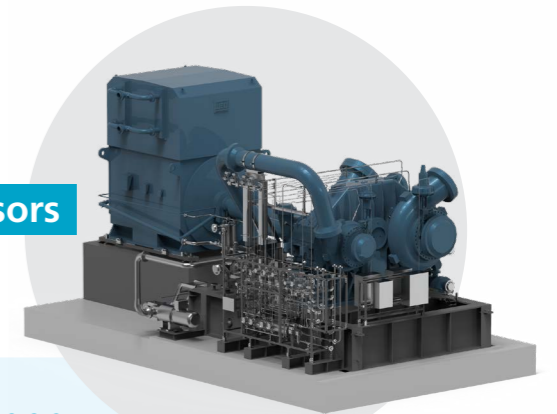
This form of power generation is **completely green and can help improve your plant's overall efficiency.**



## Refrigeration compressors

Not all equipment for H<sub>2</sub> liquefaction directly involves hydrogen gas (or liquid).

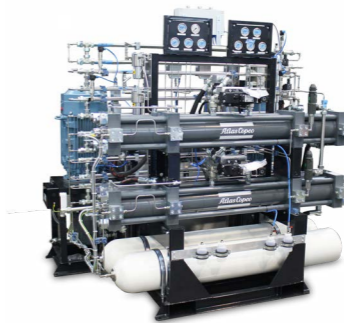
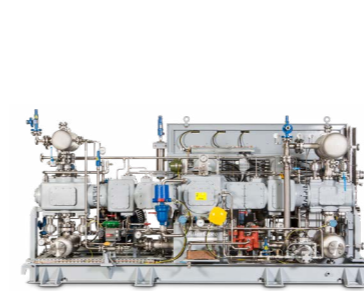
No matter your hydrogen refrigeration needs (whether nitrogen or mixed refrigerant), **Atlas Copco has the solution to optimize your LH<sub>2</sub> pre-cooling process.**





# Atlas Copco's range of hydrogen boosters for high-pressure compression

Atlas Copco also provides a range of reciprocating compressor-boosters beyond our Gas and Process offerings. Below are a few examples of our hydrogen booster products for air compression.



## Production

Hydrogen production can be realized in different ways. For example, by using technologies such as the Steam Methane Reformer (SMR), Autothermal Reforming (ATR), or electrolysis. From hydrocarbon-dominant grey hydrogen sources to increasingly sustainable "blue" and "green" hydrogen, Atlas Copco Gas and Process designs centrifugal compressors and expanders engineered to rise to the challenges of hydrogen production.



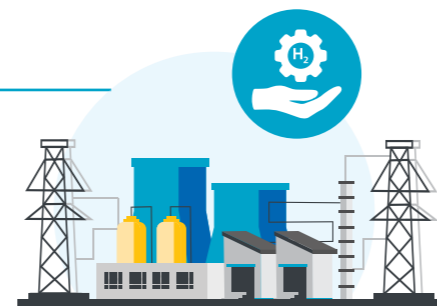
## Transportation

One economically viable method to enable hydrogen transportation is liquefaction. Turboexpanders and compressors are critical in efficient LH<sub>2</sub> plant designs. Our solutions enable plant operators to achieve lower specific energy consumptions. Our equipment can operate in the industry's most cryogenic working environments.

We also offer BOG compressors to capture and re-liquefy LH<sub>2</sub> for storage, as well as compress the gas further for use in hydrogen-burning propulsion systems.

## Usage

Pure hydrogen is essential as a feedstock and fuel in many applications of modern industries. This includes the mobility sector, power generation, chemical/petrochemical, fertilizer and refinery (i.e., ammonia production). Due to hydrogen's chemical makeup and extremely low process temperatures, special attention needs to be paid to the equipment that will be processing the gas / liquid.



### Hydrogen oil-free boosters

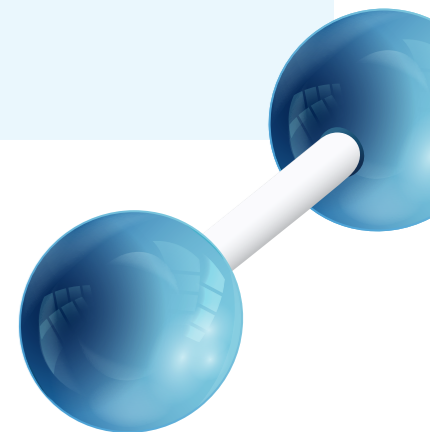
- H<sub>2</sub>D range
- Min inlet 0.01 bar, max discharge 100 bar
- Proven design for several decades in hydrogen application
- Standardized portfolio developed for Green Hydrogen applications

### Hydrogen hydraulic oil-free boosters

- H<sub>2</sub>Y range
- Mini inlet 5 bar, max discharge 1000 bar
- Global installations in mobility & grid injection applications
- Standard plug & play containerized design for trailer filling & hydrogen refueling stations

### Hydrogen piston boosters

- H<sub>2</sub>P range
- Min inlet 0.1 bar, max discharge 350 bar
- Several global installations for hydrogen & other gases
- Modular design for industrial applications





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