THE LINDE GROUP

Hydrogen technologies.
The ionic compressor 50.

Description

Linde's ground-breaking ionic compression technology leads the way to the next generation of safe, fast and efficient hydrogen fuelling. The ionic compressor 50 is a high-performance, easy-to-maintain solution with a listed design. It allows for quick, safe, highly efficient and economical fuelling of hydrogen vehicles at 25 MPa and 35 MPa. This is achieved by an innovative compression system, the ionic compressor, where, instead of a mechanical piston, a column of ionic fluid is in direct contact with the gaseous hydrogen. This allows for the continuous high-performance, fast fuelling of hydrogen vehicles. It is designed to fuel 25-MPa and 35-MPa vehicles with the highest filling levels while considerably reducing operating costs.

Design

The compression station is installed within a transportable standard-steel ISO container. The electrical system and compressor/storage compartments are separated by a gas-tight wall. All power distribution equipment and controls are located in the electronics compartment.

In the standard configuration, the container is equipped with an on-board dispenser installed at the end of the container. The dispenser controls can be connected to the local point-of-sale system for retail sales. In order to use stored pressure and compressor capacity in the most cost-efficient manner, the station utilises a cascade storage system. It consists of two storage banks (buffer tubes) in which the hydrogen for fast fuelling is held.

Fuelling process

The initial vehicle pressure is determined by a test pulse. Based on this test measurement and taking the ambient and hydrogen temperature into account, the final vehicle target pressure is calculated. The fuelling process starts with an equalisation of the low-pressure bank, followed by the equalisation of the medium-pressure bank. The selection of the bank system is based on the hydrogen flow rate to the dispenser. After fuelling, the station automatically switches to recharge mode and fills the 35-MPa storage banks. The specific energy required for 35-MPa fuelling is 2.2 to 2.9 kWh/kg (depending on the inlet pressure).

The ionic compressor 50 is capable of fuelling between 5 and 25 vehicles per hour, depending on vehicle service pressure, state of charge and the size of the vehicle tanks (based on a 1.6-kg vehicle tank volume). When the storage banks are fully charged, the station can dispense up to 25 kg in 30 minutes.

Control and automation system

Safe and fast refuelling is achieved by a PLC-based control system:

- → Optimised software reflecting the experience of numerous fuellings
- → A touch-panel-based operator system is used to visualise and monitor all processes
- → Online access to the entire control system and data acquisition is supported
- → Remote diagnostic and maintenance is part of the operating strategy

Safety concept

Designed and built to meet global technical standards, the Linde ionic compressor can be adapted to region-specific codes and standards (e. g. US, EU). The Linde hydrogen safety concept for vehicle fuelling includes:

- → Continuous monitoring of system leakage in stand-by mode
- → Initial pulse and hold, then continuous leak testing of the vehicle during fuelling
- → All hydrogen components are located in a gas-tight compartment with an overpressure relief vent
- → Hydrogen gas detection and thermal detection in confined areas; earthquake detection
- → Automatic emergency shutdown (ESD) de-energizes the station, hydrogen supply and any co-located fuel supplies

Technical data

	Unit	Ionic compressor 50
Max. delivery rate with two IC 50	kg/h	18
Max. feasible compression pressure	MPa	50.0
Target fuelling pressure at 15 °C	MPa	35.0
Pre-cooling temperature	°C	-
Losses	%	-
Weight	t	10
Ambient operating temperature	°C	-20 to +45
Electricity consumption, inlet 0.8 MPa	kWh/kg	2.9
Electricity consumption, inlet 2.5 MPa	kWh/kg	2.2
Electricity consumption, pre-cooling	kWh/kg	Not required
Power requirements, installed	kW	95
Design	-	Containerised solution
Footprint	m²	15
Codes and standards	-	CE
Maintenance interval	Operating h	2,000 (10,000)
Operating hours (accumulated), reference value	h	28,000

Competitive advantages

- → Highly efficient three-stage gas boosting which allows for an almost isothermal compression
- → Optimal delivery rates
- → Low energy consumption
- → Compact construction of the compression and dispensing system
- → Requires only electricity and a minor amount of gaseous nitrogen or compressed air for the operation of pneumatic valves as station utilities

- → No contamination of the hydrogen gas
- → Minimal moving parts and mechanical seals, which means less maintenance
- → Low noise level, below 65 db(A)
- → Conformity with “Release A”

Linde AG
Gases Division, Seitnerstrasse 70, 82049 Pullach, Germany
Phone +49.89.7446-0, Fax +49.89.7446-1230, www.linde-gas.com

43486088 0911 – 1.0,4 L&P Subject to change.