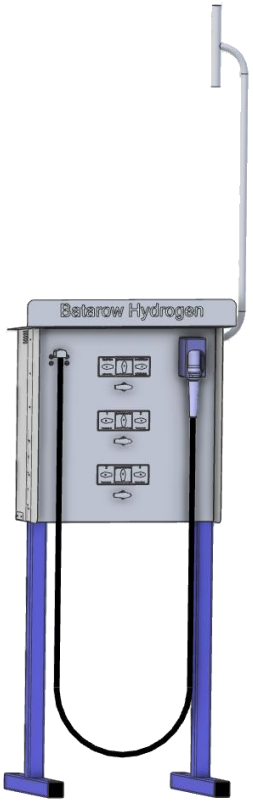
Operating Intructions

for filling stations T11, T12 and T14

version: b

Customer	Batarow Hydrogen GmbH Gewerbegebiet 4 18276 Karow
Updated	20.02.2026
Editor/ person responsible	Mathias Leinz

Asset number: (20XX-XX)



Preface

This operating manual contains all information required by § 3 of the German Equipment Safety Act “Requirements for launching on the market” (in connection with the Machinery Directive 2006/42/EC in its currently valid version).

The operating instructions is intended for persons who are employed on or with the system described here. Only with knowledge of these operating instructions can errors in the system be avoided and trouble-free operation be ensured. It is therefore necessary that the responsible persons are familiar with these operating instructions.

The operating instructions are part of the user information provided when the system is placed on the market and must be kept in such a way that they are accessible to the operator and user. If the system is relocated, the operating and/or user manuals (including those from suppliers) must be provided.

The instructions in the operating and/or user manuals (including those from suppliers) must be observed in all life cycle phases (see section 4). To this end, the relevant chapters in the operating instructions must be read carefully before starting work. No liability is accepted for damage and malfunctions resulting from failure to observe these operating instructions.

It must be clearly and unambiguously defined within the company who is responsible for the system (operator) and who is allowed to work on it (user).

The respective responsibilities of personnel assigned to transport, install, setup, configure, operate, maintain, and servicing must be clearly defined.

The difference between the various versions is that the T11 filling stations are connected to one cylinder bundle, the T12 to two cylinder bundles, and the T14 to four cylinder bundles. This difference is clearly visible in the number of cascade valves. The following descriptions explain the adjustments for all three versions in the relevant sections.

This special operating manual for the consultation process is marked in green in some places and labeled with the note “present in the original”; these passages are of course included in full in the final documentation.

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1 Declaration of Conformity

EC Declaration of conformity in accordance with EC Directive 2014/34/EU

The manufacturer hereby declares:

Batarow Hydrogen GmbH
Gewerbegebiet 4
D-18276 Lüssow OT Karow

that the equipment described below:

Type: T1x
Serial number: (20XX-XX)
Year of manufacture: 20XX

Available in the original

Furthermore, the design complies with the provisions of the following directives, which, however, do not permit CE marking:
2014/68/EU on pressure equipment

This EC Declaration of Conformity loses its validity if:

- the system is modified, altered, or used for purposes other than those intended without our written consent,
- the instructions in the operating manual are not followed.

Authorized representative for documentation: Mario Batarow

Karow, XX.XX.20XX

Mario Batarow
CEO

2 Safety Intructions

for system no.: (20XX-XX)

from

Batarow Hydrogen GmbH
Gewerbegebiet 4
18276 Lüssow OT Karow

As manufacturer

to

Batarow Hydrogen GmbH
Gewerbegebiet 4
18276 Lüssow OT Karow

As customer

By signing this document, the customer confirms that they have,

1. received the operating instructions for system no. (20XX-XX) completely and properly.
2. been informed that the operating instructions contain extremely important information (in particular safety instructions) and information about residual risks.
3. been instructed that the system may only be commissioned after the operating instructions have been studied in detail.
4. been informed that the system may only be operated by trained, instructed, and qualified personnel.
5. been informed that compliance with the operating instructions does not release the user from the obligation to comply with the applicable laws and regulations, in particular when using the system outside the EU. This also applies if additional requirements must be implemented due to corresponding changes in laws and regulations and due to leading decisions.

Place/Date:

Name in Block Letters:

Signature:

3 Technical Data

3.1 Measurements

- length: 870 mm
- width: 610 mm
- Height with ventilation device: 3000 mm
- Delivery height: 1840 mm
- Weight 70kg (without cylinder bundle)

3.2 Sound pressure level

- Less than 85 dB(A) during venting, otherwise no significant noise emissions

3.3 Ambient conditions

- Designed for outdoor use
- Temperatures from -15°C to 50°C

3.4 Operating material

- Hydrogen in accordance with ISO 14687 / EN 17124
- Refueling of fuel cell vehicles with a minimum purity of 99.97%
- Refueling of internal combustion engine vehicles with a minimum purity of 98.0%
- Max. inlet temperature: 50°C
- Gaseous hydrogen from 30 bar to 300 bar

Limit Values for Impurities in Hydrogen (Fuel Cell Grade, ≥ 99.97%)

Category	Impurity	Limit Value	Unit	Remark
Major / Inert Gases	Nitrogen (N_2)	≤ 300	ppm	Dilution
Major / Inert Gases	Oxygen (O_2)	≤ 5	ppm	Oxidation
Major / Inert Gases	Argon (Ar)	≤ 300	ppm	Inert
Major / Inert Gases	Helium (He)	≤ 300	ppm	Inert
Carbon Compounds	Carbon dioxide (CO_2)	≤ 2	ppm	Acid formation
Carbon Compounds	Carbon monoxide (CO)	≤ 0.2	ppm	Catalyst poison
Carbon Compounds	Methane (CH_4)	≤ 100	ppm	Inert
Carbon Compounds	Total hydrocarbons (C_1–C_4)	≤ 2	ppm	Catalyst surface coverage
Carbon Compounds	Formaldehyde (HCHO)	≤ 0.01	ppm	Polymer degradation
Carbon Compounds	Formic acid (HCOOH)	≤ 0.2	ppm	Membrane damage
Sulfur Compounds	Total sulfur	≤ 0.004	ppm (4 ppb)	Critical
Sulfur Compounds	Hydrogen sulfide (H_2S)	≤ 0.004	ppm (4 ppb)	Critical
Sulfur Compounds	Carbonyl sulfide (COS)	≤ 0.004	ppm (4 ppb)	Critical
Halogens	Total halogens (F, Cl, Br, I)	≤ 0.05	ppm	Corrosive
Halogens	Hydrogen chloride (HCl)	≤ 0.05	ppm	Membrane damage
Halogens	Chlorinated hydrocarbons	≤ 0.05	ppm	Catalyst poison
Nitrogen Compounds	Ammonia (NH_3)	≤ 0.1	ppm	Ionic contamination
Nitrogen Compounds	Nitrogen oxides (NO + NO_2)	≤ 0.2	ppm	Electrode degradation
Physical Impurities	Water (H_2O)	≤ 5	ppm	Ice formation
Physical Impurities	Particulates	≤ 1	mg/kg	Mechanical damage

Impurity Limits – Hydrogen 3.0 (≥ 99.9%)

Note: Hydrogen 3.0 refers to technical / industrial hydrogen. Limit values are industry typical and not uniformly defined by a single binding standard.

Impurity	Limit Value	Unit	Remark
Total impurities	≤ 1,000	ppm	Corresponds to 99.9% H_2
Nitrogen (N_2)	≤ 500	ppm	Common inert component
Oxygen (O_2)	≤ 50	ppm	Oxidizing
Argon (Ar)	≤ 300	ppm	Inert
Carbon dioxide (CO_2)	≤ 50	ppm	Chemically active
Carbon monoxide (CO)	≤ 10	ppm	Catalyst poison
Methane (CH_4)	≤ 100	ppm	Inert
Total hydrocarbons	≤ 100	ppm	Process-dependent
Water (H_2O)	≤ 50	ppm	Moisture-dependent
Sulfur compounds (total)	≤ 1	ppm	Application-dependent
Ammonia (NH_3)	≤ 10	ppm	Process-related
Halogens (total)	≤ 1	ppm	Rarely specified

3.5 Manufacturers address

Batarow Hydrogen GmbH
Gewerbegebiet 4
D- 18276 Lüssow OT Karow
Tel.: 03843/855550

3.6 Type of screw connection/connection

- Screw connection at inlet: W 30x2 LHa according to DIN 477-5
- Connection to vehicle tank: CHV08/C according to ISO 17268

SAE J2600 H35

4 Basic safety instructions

The safety and health of employees can only be guaranteed if the safety measures described above are observed at all stages of life (construction, transport, installation, etc.).

4.1 Explanation of symbols and information

Warning of a danger spot!

This symbol means an imminent or imminent danger to the life and health of persons. Failure to observe these warnings can result in property damage and minor injuries, but also serious adverse health effects and even life-threatening injuries.

Warning of explosion risk!

This symbol indicates danger during use due to explosive atmospheres.

Warning of explosive substances!

Note on reading the documentation and data sheets!

This symbol refers to the reading of the enclosed documents.

Reference to additional information!

This symbol indicates useful additional information.

Note on wearing personal protective equipment!

4.2 Dangers when dealing with the filling station

In general, the usual accident prevention regulations (UVV) apply in the current version, in particular the UVV on safety at installations. The operator is obliged to comply with the applicable laws and regulations, especially when used outside the EU. This applies if extended requirements must be implemented through corresponding changes to laws and regulations.

4.3 Intended use

The operational safety of the delivered system is only guaranteed when used as intended.

Intended use also includes observing the operating and/or user manuals (including those of suppliers) and complying with all maintenance and service work. The filling station may only be pressurized to a maximum of 350 bar and may only be filled with hydrogen (H2).

This filling station may only be used for:

- Filling hydrogen vehicles

No other gases (e.g., methane, oxygen, etc.) may be introduced into the filling station.

Also, no foreign objects may be introduced into the filling station. These objects can cause harm to people and damage to the refilling station. Batarow Hydrogen GmbH is not liable for any resulting damage. In the event of damage, responsibility remains with the operator and cannot be transferred to Batarow Hydrogen GmbH.

4.4 Foreseeable misuse

The following applications are foreseeable misuses:

- Violation of the temperature range (-15 °C/ 50°C)
- Exceeding the operating pressure (300 bar)
- Contamination of the filling coupling and the connection pieces of the inlet lines
- Dropping the filling coupling

4.5 Prohibited use

Warranty and liability claim for personal injury and property damage are excluded if they are due to one or more of the following causes:

1. Improper assembly, commissioning, operation and maintence of the system,
2. Operation of the system in a faulty condition
3. Improper use of fixtures, accessories, peripherals, etc.
4. Operation without safety devices
5. Operation with safety devices that are not in perfect condition, short-circuited or out of use
6. The use of operating materials that are not approved by the manufacturer
7. Inadequate monitoring of system components that are subject to wear and tear
8. Improperly carried out repairs
9. Catastrophes du to foreign bodies and force majeure
10. Unauthorized structual changes tot he facility
11. Unauthorized changes tot he performance data

4.6 Obligation to instruct

Before initial commissioning, the operator must instruct its employees about the potential hazards and residual risks associated with using the filling station and about the measures to be taken to avert them. This instruction must be given to every employee who operates the system or is in the immediate danger zone.

Proper operation of the system requires knowledge of how to operate and maintain it in accordance with the following maintenance, servicing, and cleaning regulations for the system. In order to be able to carry out the relevant work in accordance with the state of the art, the system operator must have the appropriate qualifications for such tasks. This includes the ability to assess residual risks.

The operator of the system is responsible for ensuring that these operating instructions are supplemented and adhered to by internal instructions

regarding work instructions, supervision and reporting obligations, work organisation, personnel qualifications, etc..

The individual competencies regarding the various tasks on and with the system and in the immediate vicinity of the system must be clearly defined, marked and adhered to by the operator. Hazard potentials and risks must be considered.

4.7 Safety Device

The safety of the system is ensured by the following safety devices:

1. Locking the filling hose to the vehicle

This safety device ensures that the connection between the filling station and the vehicle remains secure during the filling process. The lock uses the pressure in the station's filling hose. Once the vehicle tank is full, the clamp lock on the filling hose can be released by setting the valve to the “Ventilation” position.

2. Locking the screw connection to the cylinder bundle

This safety measure prevents the screw connection between the cylinder bundle and the filling station from being accidentally loosened. To change the cylinder bundles, the supply line must be depressurized. This is done by closing the valve on the cylinder racks and repeatedly switching the valve position of the filling station between “closed” and “vented.” This process is continued until no or hardly any gas escapes. The amount of gas escaping from the venting device indicates the progress of the pressure relief and enables a safe cylinder bundle change, see section 9.3.1.

3. Protection against uncontrolled escape of hydrogen during filling

This safety measure concerns the filling hose in conjunction with the filling coupling. If, due to misuse for a variety of reasons, the filling coupling and the filling hose are subjected to increasing tensile tension, the connection in the breakaway coupling installed in the hose is mechanically separated on both sides at a force of 222 N to 667 N.

Please make sure that the system is bolted to the floor!

These safety devices play a crucial role in preventing accidents and ensuring the proper and safe functioning of the filling station during use. For more information, see Chapter 8.

4.8 Structural modifications to the filling station

Structural modifications to the system and its accessories generally require the written consent of Batarow Hydrogen GmbH. Any violations will void all liability and warranties of the manufacturer!

Structural modifications to the system carried out by the operator or third parties, the dismantling of regulators and throttles, the use of non-original replacement and wear parts from Batarow Hydrogen GmbH, and similar actions are the responsibility of the operator, particularly with regard to system safety and overall functionality.

If these are the cause of damage, the manufacturer shall not be liable for this damage or for consequential damage, including to third parties.

All components of the system, in particular safety components, may only be replaced with original components or, with the written consent of Batarow Hydrogen GmbH, with other components.

4.9 Information on residual risks

Following residual risks may occur when working with the filling station:

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1	Delivery, unpacking, installation
2	Install
3	Commissioning
4	Operation
5	Maintenance
6	Restoration
7	Disposal

NO. IN ACCORDANCE WITH DIN EN 1050	DANGER	OCCURS AT	REMARK
1	**Mechanical hazards**		
1.1	Danger from crushing	1,2,7	Severe crushing hazards due to inertia of the system when moving, never under the load place and/or grab, never place and/or grab between the moving load and a fixed point
1.2	Danger from crushing	1,2,3,5,6,7	carry out every activity slowly, thoughtfully and prudently, instruct the necessary people, turn away spectators
1.3	Hazard from splashing out due to gases under pressure	3,5,6,7	Slowly loosen the thread to release residual pressure combined with personal protective equipment
1.4	Loss of stability	1 to 7	If necessary, protect the system against tipping over
2	**Hazards from materials and other substances**		
2.1	Dangers from fire and explosion	5,6,7	Explosive mixture when opening the pipe connections, vent freely or flush for at least 5 minutes
2.2	Dangers from fire and explosion	4	Explosive mixture on the emergency ventilation device, do not introduce an ignition source into this area (Ex)
3	**Hazards due to neglect of ergonomic principles**		
3.1	Negligent use of personal protective equipment	1,2,3,5,6,7	
	Protection equipment		

3.2	Human behavior or misbehaivior	1 to 7	Regular training of staff
3.3	Slipping, tripping, or Falling of persons (in Connection with the facility)	1 to 7	Routing hoses ergonomically to avoid tripping hazards

4.10 Dangers during repairs and maintenance work

All repairs and maintenance work may only be carried out when there is no connection to the cylinder bundle. Furthermore, it must be ensured that there is pressure equalization between the filling station system and the surrounding environment.

Even after pressure equalization, there is still hydrogen in the system!

The leading operator is obliged to instruct the operating personnel on the design, effect, and function of the safety devices, as well as on remaining hazards and on behavior that complies with occupational safety regulations.

Any working practices that compromise the safety of the system must be avoided. The operator must ensure that no unauthorized persons who have not been trained and instructed in accordance with the requirements of the operating instructions work on the system.

As a matter of principle, no safety equipment may be dismantled or put out of service!

In the case of work on the system that deviates from normal operation (e.g. repair, conversion, etc.), the operator must ensure that no parts can penetrate the system.

If it is unavoidable that safety equipment is dismantled for repair work, the greatest caution is required (see also chapter "10 Maintenance ").

Immediately after completion of the repair work, the safety devices must be reinstalled, and their effectiveness must be checked. It must be ensured that injured or removed seals of safety equipment are replaced.

Before switching it back on, check whether:

- Malfunction resolved
- All safety equipment in proper working order

5 Explosion protection

In the context of explosion protection, the areas in which the occurrence of explosive gas-air mixtures cannot be ruled out due to the material being handled are considered.

The present explosion protection analysis refers to the filling station as well as the immediate surroundings of the station.

In general, due to the substance being handled, an explosive atmosphere is to be expected. Therefore, the area with an explosive atmosphere (Ex area) must be discussed in relation to the pressure relief system of the present plant.

In the event of a malfunction leading to a leak in the system, two measures are taken to prevent the formation of a hazardous explosive atmosphere:

1. System Shutdown: The system is immediately shut down to stop the flow of gas, minimizing the possibility of further leakage and reducing the risk of an explosive atmosphere.

2. Dissipation via the air: Any leaked gas that enters the environment naturally dissipates and disperses in the air. This dilution process helps to reduce the concentration of the gas to values below the flammability limit and thus prevents the formation of an explosive atmosphere.

These safety measures reduce the risk of an explosive atmosphere and ensure the safety of the environment and personnel.

5.1 Assessment of the possibility of explosion

An assessment of the frequency and duration of the occurrence of a hazardous explosive atmosphere must be carried out for installations where this cannot be reliably prevented.
The conditions for the formation of a hazardous explosive atmosphere are, in relation to gases:

- Combustible gas
- Sufficient dispersion
- Exceeding the lower explosion limit (LEL)
- Falling below the upper explosion limit (UEL)
- Sufficient oxygen content
- Connected volume of explosive atmosphere greater than 10 L or, in small rooms, 1/100 of the room volume
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According to DIRECTIVE 1999/92/EC, the zoning of explosion protection in areas where a hazardous explosive atmosphere may exist can be determined.

The following applies:
Areas at risk of explosion are divided into zones according to the frequency and duration of the occurrence of explosive atmospheres.

Zone 0:

Area in which an explosive atmosphere consisting of a mixture of air and combustible gases, vapors, or mists is present continuously, for long periods, or frequently.

Zone 1:

Area in which an explosive atmosphere consisting of a mixture of air and combustible gases, vapors, or mists may occasionally occur during normal operation.

Zone 2:

Area in which an explosive atmosphere consisting of a mixture of air and combustible gases, vapors, or mists does not normally occur during normal operation, or if it does, only for a short period of time.

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5.2 Marking of devices and protection systems

The equipment marking for equipment and protective systems in potentially explosive atmospheres is defined for gases, vapours and mists as follows:

Zone	Marking (device group, category)
0	II 1 G
1	II 2 G
2	II 3 G

The labelling also specifies the explosion group (IIA, IIB or IIC) and the temperature class (T1 to T4) in the context of the labelling. The temperature class depends exclusively on the ignition temperature.

Explosion group IIC and temperature class T1 apply to hydrogen.

5.3 Protection concept

In the following sub-chapters, measures that apply to explosion protection are listed. It can be divided into primary and secondary explosion protection as well as organizational measures. The grounding concept is explicitly listed once again. These protective measures apply to the present system.

5.3.1 Primary explosion protection:

The following points serve primary explosion protection and apply to the present system:

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5.3.2 Secondary explosion protection:

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5.3.3 Organizational explosion protection

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Available in the original

5.4 Explosion protection document (according to BetrSichV §6)

Date:

Person in charge:

Signature:

5.4.1 General Information

COMPANY NAME	BATAROW HYDROGEN GMBH GEWERBEGEBIET 4 18276 LÜSSOW OT KAROW
WORKSPACE	Exterior of the venting device, Batarow Hydrogen
NAME OF THE SYSTEM	Refill station for T1x, built in 20XX
DESCRIPTION OF THE PROCEDURE	Overflow of hydrogen from storage tank, max. filling rate 10 g/s hydrogen, ambient temperature not higher than 50°C

5.4.2 Related documents

Risk assessment
Safety data sheets
Site plan
Exzone plan
Test certificates Operating instructions
Proof of instruction

5.4.3 Input materials and safety indicators

The properties of the substances are used to assess the risk of explosion:

Hydrogen

Ignition temperature:	560 °C
LEL:	4 vol.-%
OEG:	77 vol.-%
Gas density (0°C, 1,013 bar):	0,08989 g/l

5.4.4 Assessment of the risk of explosion

Normal:

A hazardous explosive atmosphere may occur in the area of the hydrogen vent opening.

Breakdown:

A dangerous explosive atmosphere can be expected in the event of technical malfunctions (e.g. leakage, rupture of pipes) due to sufficiently large technical ventilation by fans of the cooling unit and natural ventilation in the open air.

5.4.5 Measures

TECHNICAL MEASURES	**NATURAL ROOM VENTILATION**
ZONING	Available in the original
EQUIPMENT IN ZONE 1	Selection criterion: Device group: II Device category 2G Check and adjust lighting systems or similar accordingly Grounding of the system planned
EQUIPMENT IN ZONE 2	Selection criterion: Device group: II Device category 3G Check and adjust lighting systems or similar accordingly Grounding of the system planned

CONSTRUCTIVE EXPLOSION PROTECTION	No constructive explosion protection
ORGANIZATION	• Inspections of work equipment • Determination of cleaning intervals • EC declaration of conformity • Alarm plan • Operating instructions • Instruction • Procedure for the use of external companies • Approval procedures for maintenance and repair work
EARTHING	• System made of conductive material, so that equipotential bonding is given • Contact with the vehicle also with conductive material, so that equipotential bonding is given. Resistance measurement result: < 1 Ω  **Do not place on insulating surfaces!**
LABELING ACCORDING TO ISO 7010	According to ASR A1.3, the areas are to be marked with the following symbols 

Comment:

6 Storage, transport and handling

Information on transport, storage, and handling of the system:

1. Transport and storage: The system is transported to the operator and later stored on a standard euro-pallet. This ensures easy handling and compatibility with standard logistics procedures.

2. Ventilation device: The ventilation device is mounted upside down during transport and storage. This configuration is necessary to ensure proper functioning and safety during these phases.

3. Temperature range: The system must be transported and stored within a temperature range of -15°C to +50°C. This range must be carefully monitored and maintained to prevent possible damage or malfunction due to extreme temperatures.

4. Inspection and complaints: In the event of an inspection or complaint about the system, it must be returned to the same condition in which it was delivered by the manufacturer. This ensures that all problems can be properly assessed and rectified.

5. Load securing: The system must be properly secured during transport in order to comply with applicable load securing regulations and to prevent damage or accidents during transport.

By complying with the above specifications in points 1 to 5, the manufacturer can guarantee the operator the safety and proper functioning of the system. Compliance with the specified temperature range and load securing regulations helps to minimize potential risks and maintain the integrity of the system throughout its service life.

7 Installation and assembly

Installation and assembly must be carried out in accordance with the manufacturer's drawings and using only the original parts supplied. Assembly work may only be carried out by trained personnel, taking into account the risks mentioned in section 4.9.

8 Commissioning/Setup

8.1 Requirements for the installation site

The system is designed for operation in outdoor conditions. It is expressly not intended for use inside buildings.

The installation area must ensure that both the filling station and the cylinder bundles are stable. In addition, the filling station and the cylinder bundles should not be placed on insulating surfaces. Otherwise, grounding must be provided. Furthermore, the minimum distances specified in the appendix must be observed.

8.2 Safety regulations

Only commission the system under the following conditions:

- The technical condition of the system is flawless.
- The system is used as intended.
- The operating instructions are followed.
- All safety devices are present and active.
- This system is not suitable for the initial filling of tanks in hydrogen vehicles. The operator must ensure that the minimum tank pressure specified by the hydrogen vehicle manufacturer is not undercut.
- The permissible tank volume must not be less than 50 liters (2 kg according to SAE J2601). (If the tank volume is smaller, the throttle used can be adjusted; this is documented in two separate documents.)

The operator must check the system for errors at regular intervals and keep and evaluate error statistics. The operator must immediately notify the manufacturer of any identified defects so that the manufacturer can eliminate the defects as quickly as possible.

In the time between fault detection and complete fault elimination, it is the responsibility of the operator to ensure that the installation:

- is operated normally;
- is operated to a limited extent (with warnings and instructions by the operator specially adapted to the problem [cf. Work Equipment Use Ordinance]);
- is shut down.

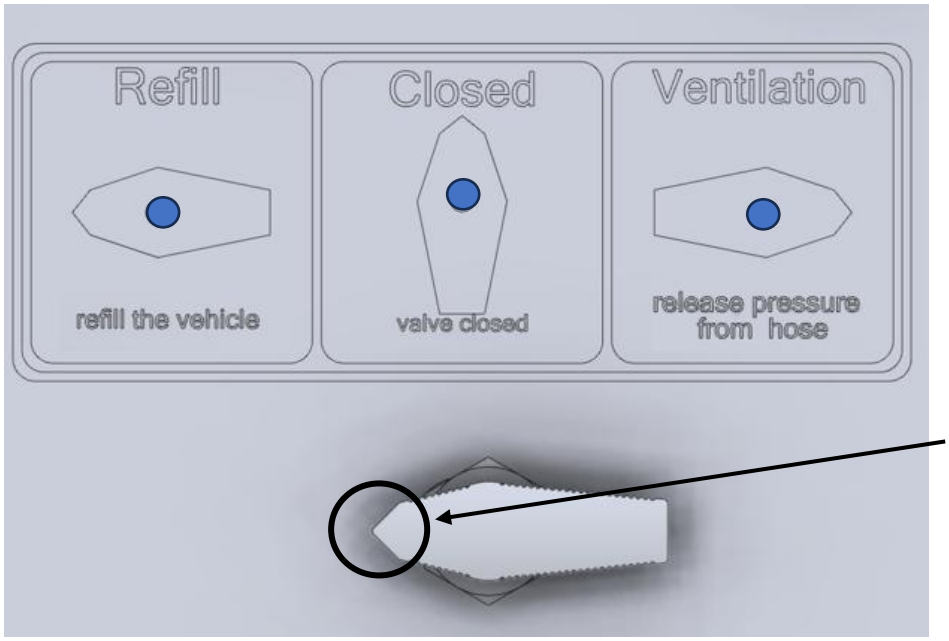
In case of doubt, the following always applies:

Decommission the system immediately!

8.3 Valvepositions

Before commissioning or refilling, check the position of the valves. If necessary, adjust the valve position responsible for the refilling process.

The position of the valve can be seen in the following illustration.



The BV filling valve can have 3 different positions:

Tip to the left: **Filling**

Tip tot he top: **Closed**

Tip to the right: **Releasing Pressure**

The K12 cascade valve can have 3 different positions:

Tip to the left: **Selection of cylinder bundle 1**

Tip to the top: **Closed**

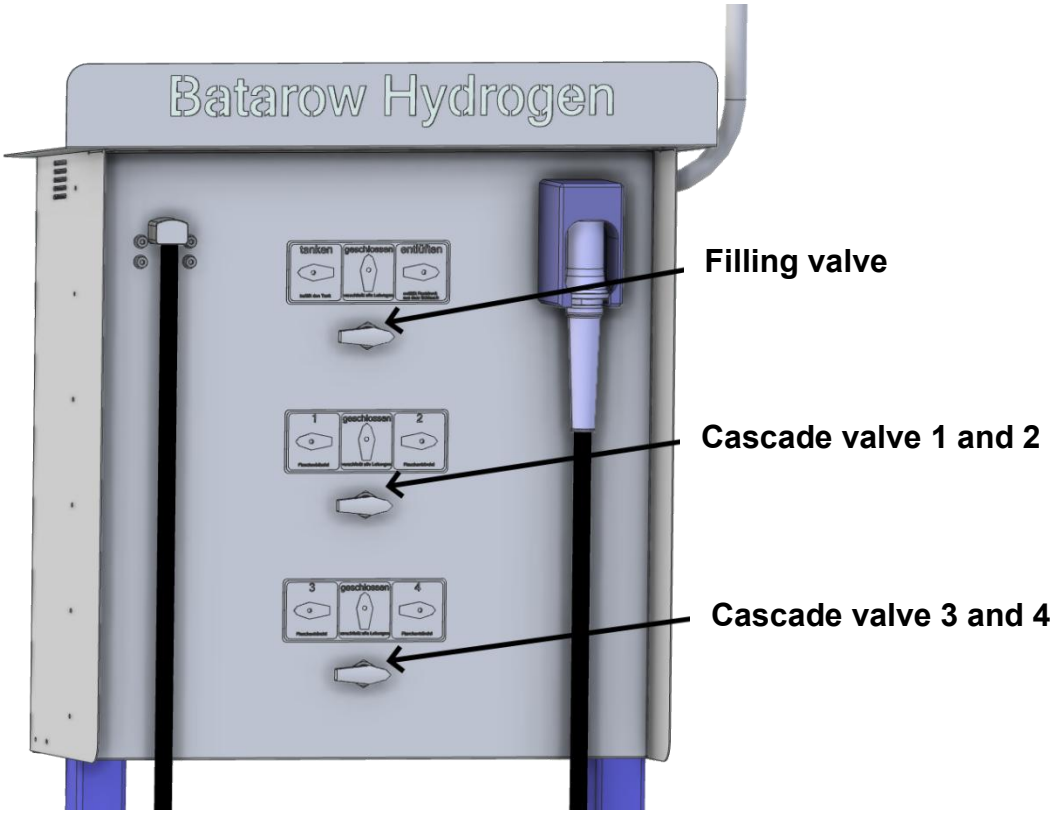
Tip to the right: **Selection of cylinder bundle 2**

The K34 cascade valve can have 3 different positions:

Tip to the left: **Selection of cylinder bundle 3**

Tip to the top: **Closed**

Tip to the right: **Selection of cylinder bundle 4**



The following valves are located at the filling station:

Filling valve: Control for start and end of filling Available in all three versions
Cascade valve K12: Switch between cylinder bundles 1 and 2 in T12 and T14 available
Cascade valve K34: Switch between cylinder bundles 3 and 4 in T14 available

8.4 Initial commissioning

Before initial commissioning, all valves must be set to “Closed.”

Commission the system for the first time as follows:

1. Ensure that the system and its associated peripherals are firmly in place!
2. Position the cylinder bundles so that no tension can occur in the supply lines.
3. Connect the grounding cable to the cylinder bundle.
4. Connect the supply lines and set the valve to “Closed.”
5. Now open the valve on the storage tanks.
6. Now set the valve at the filling station several times (at least 10 times) from “Closed” to “Ventilation” and back again. This is to remove the remaining air mixture from the system.
7. Now open the valve on storage tank 1, set the cascade valve to 1 and the filling valve to refuel.
8. Close the valve on the storage tank and check for any visible or audible leaks. If nothing can be detected, the supply line from storage tank 1 to the vehicle is leak-tight.
9. Now set the valve at the filling station several times (at least 10 times) from “Closed” to “Vkentilation” and back again. This will release the pressure.
10. The steps 5 to 9 must be carried out separately for all storage tanks.(T11 1x, T12 2x and T14 4x)
11. The filling station can only be used as intended if all supply lines to the storage tanks are tightly connected.

This procedure must be repeated with full cylinder bundles (300 bar) each time the system is moved. This procedure must also be carried out if the system has been temporarily disconnected from the supply units and is to be reconnected to them. In the event of leaks, take the system out of operation immediately and check chapter 11 to see what to do.

9 Functional explanation

9.1 Components

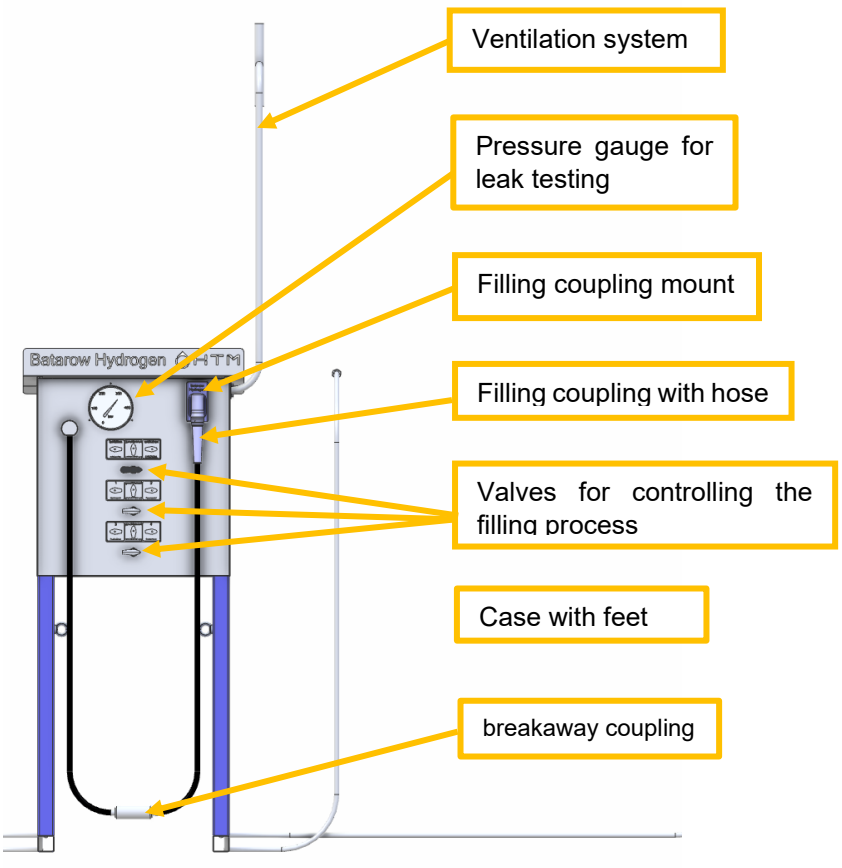
The following illustrations show the structure of the filling station with its functional elements. The complete system includes 1 to 4 storage tanks (bottle bundles). These storage tanks are **not** included in the scope of delivery!

The storage tanks are connected to the filling station via supply lines. Each supply line is secured to the filling station with a check valve. Therefore, the filling station can also be operated with fewer than 4 storage tanks.

The filling coupling is attached to the filling station with a hose.

The filling coupling enables hydrogen to be filled into the vehicle.

Three different functions can be performed using the ball valves on the filling station: selection of the storage tank, filling, and venting.



The supply lines are not shown in this image. They connect the filling station to the individual bottle bundles. The supply lines are mounted on the underside of the case.

9.2 Description of the system

The filling station consists of a technically sealed piping system with an operating pressure of 300 bar. This operating pressure is verified by a test report prior to delivery.

Each cylinder bundle has a pressure gauge, a shut-off valve, and a check valve. The system does not have a safety valve to protect against overpressure.

The ball valves of the three control valves only allow overflow to the vehicle tank from one of the cylinder bundles or no overflow at all. Overflow of hydrogen between storage tanks is not possible due to check valves.

A shut-off valve is installed in the filling station, which automatically closes the supply line to the filling coupling if the hose of the filling coupling is deflected too far. This component ensures that if a vehicle with a filling coupling attached starts to move, the line is no longer connected to the cylinder bundle, the hose is not thrown through the air if it breaks off, and no hydrogen can escape uncontrollably.

The venting is carried out via a separate valve position. This releases an estimated 1.75 g of hydrogen, which corresponds to approximately 21 l of hydrogen at an ambient pressure of 1.013 bar. This is an estimate based on the pipes used.

During venting, the hydrogen in the storage tank cannot escape into the environment.

The general plant description can also be found as a pictogram in the P&ID document in the appendix.

9.3 Functionality

The operation of the refill station is based on a pressure balance between two pressure vessels, specifically between the cylinder racks and the hydrogen tank of the vehicle. This pressure compensation process does not rely on any electrical or external equipment for conveyance. It only refers to the filling process between the cylinder bundles and the hydrogen vehicle via the filling station.

9.3.1 Replacement of reservoirs

The empty storage containers (bottle bundles) are replaced with filled storage containers. To do this, simply disconnect the supply line to the refill station of the respective empty bottle bundle and connect it to the filled storage containers.

The following steps must be taken to **disconnect** the connection:

1. Set all valves on the filling station to “Closed.”
2. Close all valves on the storage tanks (cylinder bundles).
3. Turn the cascade valve onto the storage container to be replaced.
4. Set the filling valve to “Closed” and then to“Ventilation” at least 10 times (repeat this process until no venting noise is audible).
5. Loosen the screw connection of the inlet line on the cylinder bundle by hand.
6. Disconnecting the grounding cable from the cylinder bundle

Attention: Do not use tools for unscrewing!
Attention: Left-hand thread, turn clockwise to loosen!
Attention: If not detachable by hand, residual pressure is left in the line!

The following steps must be taken to **establish** the connection:

1. Set all valves on the filling station to “Closed.”
2. Position the cylinder bundles so that there is no tension in the supply lines.
3. Connect the grounding cable to the cylinder bundle.
4. Connect the supply lines.
5. Now open the valve on the replaced cylinder bundle.
6. Now set the valve at the filling station several times (at least 10 times) from “Closed” to “Vent” and back again. This is to remove the remaining air mixture from the system.
7. Now open the valve on the replaced cylinder bundle, set the cascade valve to the replaced cylinder bundle and the filling valve to “refill.”
8. Tighten the screw connection of the supply line on the cylinder bundle by hand.
9. Close the valve on the storage tank and check for any visible or audible leaks. If nothing can be detected, the supply line from storage tank 1 to the vehicle is leak-tight.
10. Now set the valve at the filling station several times (at least 10 times) from “closed” to “ventilation” and back again. This will release the pressure.
11. Steps 5 to 9 must be performed separately for all replaced cylinder bundles. (T11 1x, T12 2x and T14 4x)
12. The filling station can only be used as intended if all supply lines to the storage tanks are connected tightly.

Attention: Do not loosen the screw connection with tools!
Attention: Turn the left-hand thread counterclockwise to tighten.
Attention: Check that the O-ring seal is present and seated correctly!

Caution! Avoid getting dirt etc. into the screw connection!

9.3.2 Refill process

The refill process proceeds as follows:

1. Park the vehicle at 1 to 1.5 meters from the refill station.
2. Secure the vehicle against rolling away by applying the handbrake.
3. Remove the ignition key (or remove keys from keyless systems)
4. Check that the valve positions at the station are set to “Closed” and that the filling coupling is inserted into the designated holder.
5. Open the valves on the cylinder bundles.
6. Test 1: initial pressure surge
    i. Set the filling valve to „Refuel“.
    ii. Open the cylinder bundle with the highest pressure, select it, and open and close the corresponding cascade valve for 3 seconds. Close cylinder bundle as well
    iii. Set the filling valve at the filling station several times (at least 10 times) from “Closed” to “Vent” and back again.
    iv. The test is successful when the system is depressurized again.
7. Insert the filler coupling into the vehicle's fuel filler neck. To do this, the filler coupling must be depressurized. This is the case when the front cover of the filler coupling can be moved.
8. test 2: initial pressure test
    i. Select the cylinder bundle with the lowest pressure by adjusting the cascade valve accordingly and opening the cylinder bundle.
    ii. Open the filling valve for 5 seconds and close it again, close the cylinder bundle as well, and wait for 1 minute.
    iii. Observe the system; if there is no pressure drop in the pipe system over a period of 60 seconds, the system is correctly connected and leak-proof.
    iv. Release pressure by setting the filling valve to “Ventilation.”
9. The filling process can be started once the system has passed Test 1 and Test 2. If not, the connection between the vehicle and the filling station must be checked. If no fault can be found in the connection, there is a fault in the system and it must be serviced.
10. The filling process is started by setting the filling valve (FV) to “Refill.”
11. The pressures are displayed on the pressure gauge of the cylinder bundle.
12. Select the cylinder bundle with the lowest pressure, open it, and set the cascade valve accordingly. The number of the supply line can be read on the hose section near the connection piece to the cylinder bundle.
13. The hydrogen flows over. A slight hissing sound is audible.
14. When the noise subsides, set the cascade valve to the “closed” position, close the cylinder bundle, and wait 60 seconds. There must be no pressure drop in the system.
15. Switch to the cylinder bundle with the second lowest pressure and repeat steps 11 and 12. (only for T12 and T14)

16. Switch to the cylinder bundle with the third lowest pressure and repeat steps 11 and 12. (only for T14)
17. Switch to the cylinder bundle with the highest pressure and repeat steps 11 and 12. (only for T14)
18. When the noise subsides, set all valves to “Closed.”
19. Now set the valve at the filling station several times (at least 10 times) from “Closed” to “Ventilation” and back again until no venting noise is audible.
20. Set the filling valve to “Closed.”
21. Remove the filling coupling and hang it back in the mount.
22. Close the valves on the cylinder bundles.
23. The filling process is now complete.

The following figure 1 is displayed at the filling station and explains the filling process described above using pictograms.

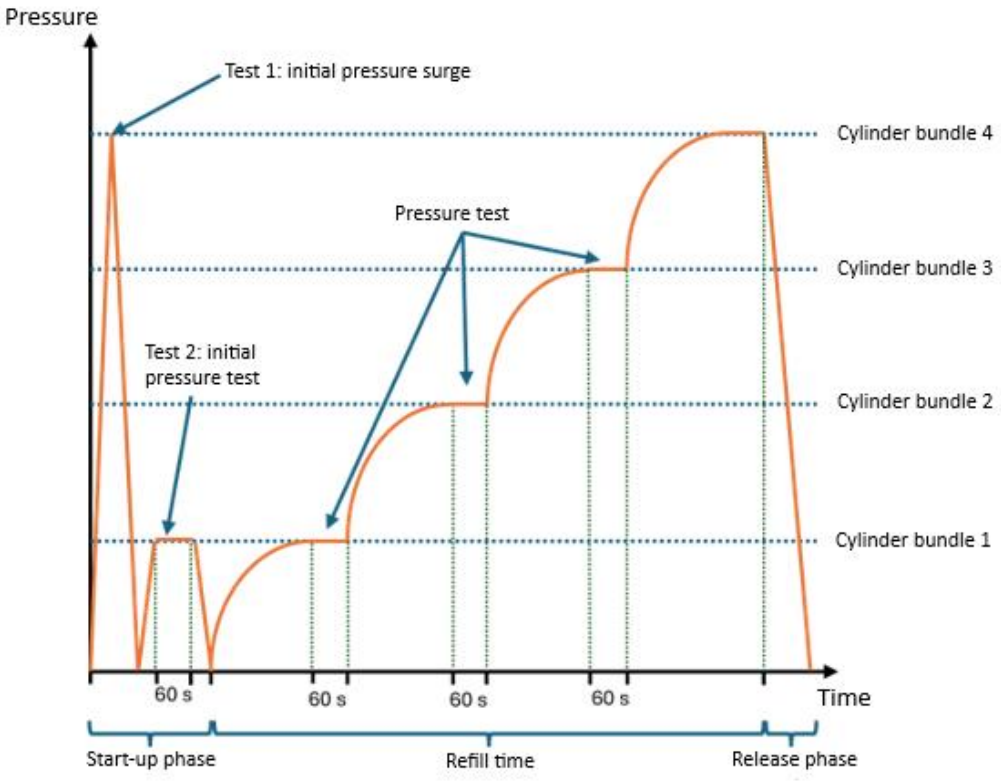


Figure 1: Exemplary schematic representation of the chronological sequence of a refueling process with 4 cylinder bundles

Depending on the pressure difference between the vehicle tank and the storage tank, the filling process may vary in duration. The fill level of the tank in the vehicle is determined by:

- Pressure difference between the vehicle and the storage tanks
- Pressure in the storage tanks before the filling process

To successfully complete the filling process (see step 15), the filling coupling must be unlocked. This is a lock that is activated by the pressure in the filling hose. By setting the valves to “Ventilation,” the residual pressure in the filling hose can be released to ambient pressure via the venting device. This can be recognized by a hissing sound from the venting device.

9.4 Gas supply

The gas supply requires no more than the “delivery capacity” provided by the cylinder bundle. This is based on the described functioning of the gas overflow. If the pressure difference between the storage containers and the vehicle tank is too low or negative, the filling process cannot be carried out.

10 Maintenance

With the handover of the filling station to the owner, the responsibility about the maintenance and control obligation, of the safety equipment, is transferred to the owner of the system!

10.1 Operating and maintenance personnel

Operating and maintaining the system requires varying degrees of understanding. All persons who work with, on, or around the system on a permanent basis require training.

The training is divided into the following categories:

10.1.1 First-level training:

Persons working **around** the plant must be instructed about risks and potential hazards by means of symbols, signs, or verbal instructions from authorized persons with a higher level of training.

10.1.2 Second-level training:

Persons who work **with** the system for its intended use require Level 2 training in the form of knowledge of the operating instructions. This can be provided in the form of verbal instruction by authorized persons with the same level of training or through extensive knowledge of the operating instructions.

10.1.3 Third-level training

Persons who are to carry out repairs or maintenance on the system require Level 3 training. This training can only be provided in consultation with the manufacturer, Batarow Hydrogen GmbH.

10.2 Safety instructions for maintenance and repairs

During maintenance or repair work, ensure that there is no pressure in the system.

There may also be pressure in the system when the cylinder racks are disconnected.

This can be achieved by performing a repeated rotation of the filling valve between the "closed" and "ventilation" positions. This process should be repeated at least 10 times or until no venting noise is heard, to completely remove any residual pressure.

In case of improper ventilation, the screw connection is difficult to loosen. It comes with a security risk!

After loosening connections, other than the supply lines on the cylinder racks, it is necessary to conduct a leak test using a certified device or leakage spray. The system should be carefully checked for any signs of leakage, and no leakage should be registered before proceeding with any further steps.

10.3 Maintenance

POSITION	CIRCUMFERENCE	INTERVAL
SYSTEM	Leak testing	Before every filling process
	Functional test after vacancy	Every 3 month
	Pressure retention test	At commissioning/ 1x annually
FILTER ELEMENT	Filter change	1 x annually

Attention! An escape of hydrogen should only occur when the valve is set to the "Ventilation" position or in very small quantities and for a very short period when changing the storage containers.

Dirt or any debris must be cleaned when changing cylinder racks in the connection piece, as well as during maintenance work on connections within the system.

Attention! Insertion of small parts into the pressure system can lead to clogging and thus the failure of the system

10.4 Spare parts order

All components of the plant, especially safety components, must be replaced only with original parts. In exceptional cases where alternative components are considered, prior written approval from Batarow Hydrogen GmbH is mandatory.

11 Disruptions to operations

11.1 Safety

Corrective actions for faults must only be performed by authorized and trained personnel who possess a thorough understanding of the plant's operation. Improper troubleshooting could result in personal injury and/or damage to property.

11.2 Behaviour in case of disturbance or danger

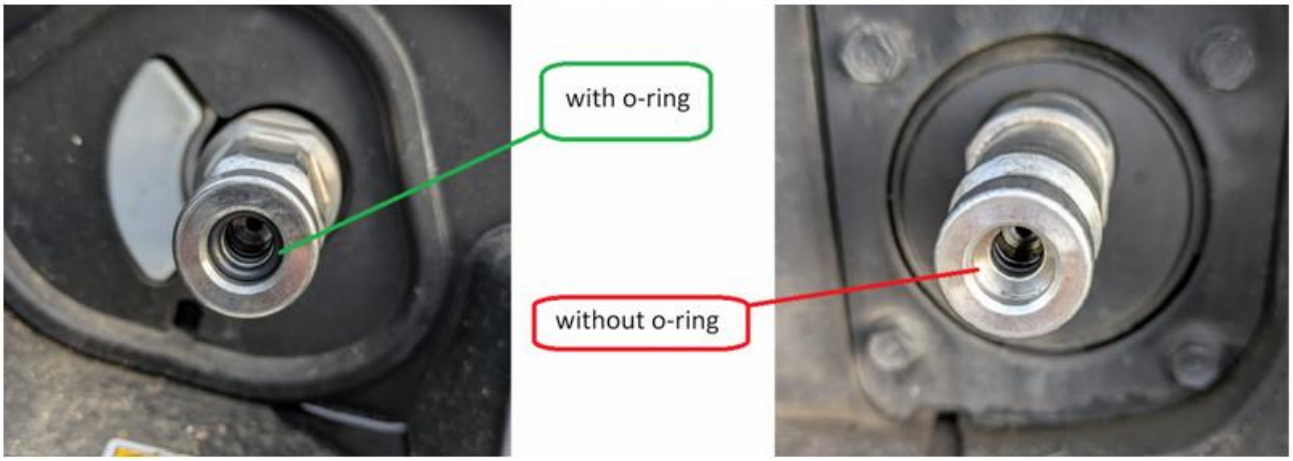
1. If the malfunction poses a risk of personal injury, property damage, or operational uncertainty, the plant must be stopped immediatly.
2. Disconnect the systems from the fluid supply and ensure that they are securely isolated to prevent accidental reconnection.
3. Inform the person responsible at the site about the fault without delay, providing all relevant details and observations.
4. Seek assistance from qualified personnel to assess the nature, extent, and cause of the fault. They should promptly undertake the necessary rectification measures to resolve the issue.

Before recommissioning, the causes of the defects must be determined, documented, and eliminated by suitable specialist personnel in accordance with the rules of technology.

11.3 Causes of disorders

DISTURBANCE	CAUSE	REMEDY
FILLING NOZZLE CANNOT BE COUPLED TO VEHICLE	Residual pressure on the filling hose	With filling valve on "Venting" release residual pressure
	Mechanical clamps of the filling coupling	Contact service, contact service for assistance and further instructions.
FILLING NOZZLE ON VEHICLE CANNOT BE DISCONNECTED	Residual pressure on the filling hose	With filling valve on "Venting" release residual pressure
NO HYDROGEN FLOWS TO THE VEHICLE	Valves on the cylinder racks closed	Open valves of the cylinder racks
	Valve position at the filling station incorrect	Check valve position
	Filter clogged in supply line	Perform maintenance
	Leakage in the piping system	Perform maintenance
	Hydrogen pressure in the reservoirs not high enough	Refill/replace storage containers
HISSING SOUND TO BE HEARD	Leakage in the piping system	Perform maintenance

One possible point of leakage is the H35 O-ring on the vehicle's fuel filler neck. In the following illustration, green indicates an O-ring in the fuel filler neck and red indicates no O-ring in the fuel filler neck.



f the seal is missing, gas will escape at this point.

12 Decommissioning

12.1 Safety regulations

Ensure compliance with the currently valid accident prevention regulations!

Decommissioning should only be carried out by authorized and competent personnel who are familiar with the operation of the plant.
After decommissioning, secure the system against unauthorized reconnection to prevent accidental or unauthorized use.

Install signs indicating that work is being carried out on the plant to alert others to the potential hazards and prevent accidental access.

12.2 Dismantling procedure

Decommissioning: Decommissioning the system without pressure and disconnecting supply lines

Cleaning: Leave hoses open for 1 hour

Set the filling valve at least 10 times alternating from "closed" to "vent" (repeat this process more often until no venting noise is heard)

Preservation: All inlets and outlets must be fixed and the connections shielded against contamination

12.3 Service

In case of malfunctions, questions or spare parts deliveries, please contact the following address:

Batarow Hydrogen GmbH
Gewerbegebiet 4
18276 Lüssow OT Karow

Phone: 03843/855555

13 Related documents