



Overland Park KS
Tywon@H₂HUBB.com
www.H₂HUBB.com

Date: 6/24/2025

H₂HUBB Official Test Report

Evaluation Introduction

This report provides a comprehensive analysis of the 4500PRO Hydrogen inhalation therapy device from HYDRO 4 HEALTH®, a company based in Europe. H₂HUBB classifies this device as a Professional-Grade, high-flow-rate hydrogen inhalation system. It is equipped with hydrogen electrolytic cells utilizing a PEM/SPE membrane, ensuring the production of pure hydrogen gas with only deionized or distilled water required for operation. The device supports continuous hydrogen gas production, allowing users to extend inhalation sessions up to 8 hours. We thoroughly evaluated the system's hydrogen gas output in mL/min to verify its performance. Additionally, we assessed its safety features and operations to confirm the presence of appropriate mechanisms for safe and reliable usage. Our investigation determines whether the 4500PRO device meets our H₂ product performance standards required for approval and recommendation by H₂HUBB. For more information about our performance standards for hydrogen inhalation systems, please visit [H₂HUBB](https://www.H2HUBB.com).

H₂ Products

- Company: HYDRO 4 HEALTH®
- Product Name: 4500PRO
- Type: Pure H₂ Inhalation Device (>99.9%/3N)
 - PEM/SPE
 - High Flow Rate
- Mfg rated H₂ Output: 3000 mL/min
- URL Link: <https://hydro4health.com>

Method and Procedure

- Distilled Water (used for testing): 6.0 pH
- Water Temperature: 65~70F/ 18~21C
- Reservoir Vol Size: 4 L/4000 mL (1.05 gals)
- H₂ Output: up to 3000 mL/min or 247.34 mg/min (@ SATP)
- Test Location: 277 meters (909 ft elevation)
- H₂ Flow Test: mL/min, normal timing for a breathing session (1 hr)
- Test methodology:
 - [Alicat H₂ Mass Flow Meter](#)
- All measurements converted to SATP where applicable

Test Results

To evaluate the hydrogen gas flow rate, the system was assembled according to protocol and filled with distilled water to the manufacturer's recommended level. The device was tested at each designated output mode—1500, 3000, and 4500 mL/min of H₂/O₂—and operated for a 1-hour session per setting. A 10-minute warm-up period preceded each measurement to allow for system stabilization. During operation, the produced hydrogen gas was routed through a drying column, followed by a humidity and temperature sensor, before entering an Alicat Mass Flow Meter for precise measurement of molecular hydrogen output. To ensure measurement accuracy, a 5–10 minute stabilization period was observed to eliminate ambient air interference. Minor flow corrections were made to compensate for resistance or moisture-induced losses in the system. Each output mode was tested a minimum of three times, and the flow rate values reported herein represent the average of these measurements.

H₂ Flow Rate Test Results at SATP:

Mode: 1500 mL/min Setting

- Device H₂ Flow Rate (mL/min) (mg/min) avg: $\cong$ 1513.00 mL/min H₂ ($\approx$ 124.74 mg/min)
- Device O₂ Flow Rate (mL/min) avg: $\cong$ 756.52 mL/min
- Total H₂/O₂ Flow Rate (mL/min) avg: $\cong$ 2269.50 mL/min

Mode: 3000 mL/min Setting

- Device H₂ Flow Rate (mL/min) (mg/min) avg: $\cong$ 2303.43 mL/min H₂ ($\approx$ 190 mg/min)
- Device O₂ Flow Rate (mL/min) avg: $\cong$ 1151.74 mL/min
- Total H₂/O₂ Flow Rate (mL/min) avg: $\cong$ 3455.15 mL/min

Mode: 4500 mL/min Setting

- Device H₂ Flow Rate (mL/min) (mg/min) avg: $\cong$ 3193.17 mL/min H₂ ($\approx$ 263.27mg/min)
- Device O₂ Flow Rate (mL/min) avg: $\cong$ 1596.62 mL/min
- Total H₂/O₂ Flow Rate (mL/min) avg: $\cong$ 4789.76 mL/min

Claimed Mfgr's H₂ mL/min (mg/min) confirmed: Yes

H₂HUBB Hydrogen Flow Rate Assessment

- H₂HUBB's hydrogen gas flow rate test results confirm and exceed the manufacturer's performance claims for the 4500PRO. At standard atmospheric pressure (SATP), the device produced an average of 3193.17 mL/min of hydrogen gas on the 4500 mL/min setting, aligning with and slightly surpassing the expected output. This demonstrates that the manufacturer's stated values are conservative, reinforcing the device's reliability and consistent performance under real-use conditions. Notably, when operated at the 4500 mL/min setting with a single-user nasal cannula, the device delivers an estimated inhaled hydrogen concentration of 17–20%, which exceeds safe levels used in most human clinical studies. These results exceed **H₂HUBB's minimum performance standards** and qualify the 4500PRO as a **Level 5 hydrogen inhalation device** within our performance ranking system.

INTERNAL BREAKDOWN AND PERFORMANCE:

Manufacturer's Rated Electrical Values:

Type of Device / Electrolytic Cell:

- Pure H₂: PEM/SPE Membrane

Power Supply Rating (per label):

- Voltage Output Rating: 40 V
- Current Output Rating: 13.4 A
- Rated Power: 536 Watts

Confirmed Electrical Values:

- Applied Voltage at Stack: 9.4 V DC
- Total Measured Current: 36 A DC
- Total Electrical Power: 338.4 Watts ($9.4 \text{ V} \times 36 \text{ A}$)

Cell Configuration:

- Number of Stacks: 3 (wired in parallel)
- Cells per Stack: 4 (wired in series)
- Total Number of Electrolytic Cells: 12 PEM cells

Electrolytic Cell Stack Characteristics:

- Voltage per Stack: 9.4 V
- Voltage per Cell: 2.35 V ($9.4 \div 4$)
- Current per Stack: 12 A ($36 \text{ A} \div 3$)
- Current per Cell: 12 A (same across all cells in series)
- Effective Electrochemical Current per Stack: 144 A ($12 \text{ A} \times 4 \text{ cells}$)
- Total Effective Electrochemical Current: 432 A ($144 \text{ A} \times 3 \text{ stacks}$)
- Power per Stack: 112.8 W ($9.4 \times 12 \text{ A}$)
- Total System Power: 338.4 W (112.8×3)

H₂ Production: (Based on measured amperage @SATP)

- Total Theoretical Max H₂ production (@ 100% cell efficiency)
 - Total: 3287.92 mL/min (271 mg/min)
- Measured H₂ production
 - 3193.17 mL/min (263.27 mg/min)
- Electrolytic cell efficiency
 - 97.12%

Product Assessment

Functionality:

- **Power input/Power cord:**
 - Located on the back of the system; supplies power to the device.
- **Digital Display and Control Panel**
 - Displays the session duration
 - Shows the combined hydrogen and oxygen gas production in mL/min
 - Allows the user to select hydrogen/oxygen gas production settings: 1500, 3000, 4500 mL/min
 - Allows the user to select and adjust session time in 1-hour increments, up to 8 hours
 - Allows the user to refill the device with distilled water using the "Add Water" function on the display control panel.
 - Allows the user to drain the internal distilled water using the "Drain Water" function on the display control panel.
- **Power Start/Stop Button:**
 - Initiates electrolysis for hydrogen inhalation
 - Pressing the button while the device is running will stop gas production
- **Water Collection/Humidifier**
 - Collect water moisture from the hydrogen and oxygen gas production
- **Reservoir (4.0 L or 1.05 gal):**
 - Requires 4.0 liter of distilled water
- **H₂ Port (1x):**
 - Outputs hydrogen gas for single-user inhalation
- **O₂ Vent (1x):**
 - Vents oxygen gas produced during electrolysis
- **Drain Port:**
 - Allows the user to empty the distilled water reservoir using a special drain port and tubing located on the back of the system.

Product Safety

Safety Components:

- The system has 7 fundamental safety mechanisms for ensuring the device's safety.
 - Low-water protection
 - Protects cells from excessive heat
 - Large distilled water reservoir
 - Protects cells from excessive heat
 - Internal Fans
 - Prevents hydrogen gas build-up in case of leaks and may also aid in preventing overheating
 - Reservoir water cooler
 - Prevents reservoir water from overheating and protects the H₂ cells from thermal damage
 - Internal gas separator
 - The apparatus helps to improve H₂ gas purity.
 - Internal deionization resin filters
 - Improves gas purity and reduces ions (mineral, metal, etc.)
 - Heat Vents
 - Prevents excessive heat in the system

The system theoretically should only be combustible at the tip of the nasal cannula as the system produces >99% pure hydrogen gas. As with all inhalation devices that produce pure hydrogen gas, care should be taken to avoid exposing the cannula tip to any source of ignition (such as an open flame or a spark) which could result in the combustion of the gas.

Overall Opinion

The 4500PRO Hydrogen Inhalation Device has been confirmed through H₂HUBB testing to be a well-engineered and high-performing system for hydrogen inhalation. The manufacturer specifies a hydrogen gas output of 3000 mL/min at >99.9% purity under standard operating conditions. Our independent testing verified these claims, demonstrating that the device consistently achieves and slightly exceeds the stated hydrogen output. Notably, the device exhibited overperformance ranging from 6.44% to 51.3% across multiple flow settings, indicating that the manufacturer has taken a conservative approach in its performance claims. This suggests an emphasis on reliability and consistency in the device's design and manufacturing, reinforcing its credibility as a therapeutic hydrogen inhalation system.

Hydrogen gas output flow rates are a critical performance parameter for inhalation devices. At H₂HUBB, the minimum standard for hydrogen generators or inhalation units (whether pure hydrogen, oxyhydrogen, or H₂ mixed with air) is 120 mL/min of H₂. This rate corresponds to approximately 0.7-1.3% H₂ at typical resting breathing rates (4-6 L/min) when using a nasal cannula for an average adult. Scientific studies on molecular hydrogen inhalation therapy generally utilize concentrations between 0.5% and 4% or more at resting breathing rates, a range that has been shown to provide therapeutic benefits. Given these findings, H₂HUBB establishes 120 mL/min of H₂ as the baseline requirement for hydrogen inhalation devices to ensure effectiveness. The 4500PRO H₂ inhalation device significantly exceeds this minimum standard, delivering performance well within the therapeutic range.

The 4500PRO is equipped with an advanced PEM/SPE electrolytic cell system, configured with three parallel stacks, each consisting of four cells in series, totaling 12 PEM cells. This engineering enables the device to consistently produce high-purity hydrogen gas (>99.9%). During H₂HUBB's performance testing, the system's electrical values were confirmed at 9.4 V DC and 36 A DC, yielding a total power draw of 338.4 watts. Each stack operated at 9.4 V and 12 A, delivering 112.8 watts per stack. Based on these confirmed values, the measured hydrogen gas output averaged 3193.17 mL/min (263.27 mg/min) at standard atmospheric pressure (SATP), closely aligning with the theoretical maximum of 3287.92 mL/min (271 mg/min)—assuming 100% cell efficiency. This indicates an excellent electrolytic cell efficiency of 97.12%, which is highly efficient for a PEM/SPE-based hydrogen inhalation system. The 4500PRO's hydrogen flow rate is more than sufficient to deliver therapeutic hydrogen concentrations of approximately 17–20% when used by a single adult with a nasal cannula at the highest setting—levels that exceed most clinically studied concentrations. **According to our flow-rate test results, the product will be featured on our website as a Level 5 hydrogen inhalation device.**

You can view the meaning of this ranking [here](#).

The 4500PRO Hydrogen Inhalation Device provides a substantial flow rate of hydrogen gas, making it essential to assess whether its output exceeds hydrogen's detonability concentrations in air when delivered through a nasal cannula. According to NASA [1] and other sources [2][3], the detonability concentration of hydrogen in ambient air ranges from 18% to 59% (vol/vol). Taking into account both the lower detonability threshold of 18% and the recommended safety range of 10–15%, we identify a hydrogen concentration caution zone between 11–18%, which warrants special attention.

To assess the real-world hydrogen concentration delivered by high-output systems like the 4500PRO, it is important to understand how nasal cannula delivery and human physiology influence administered dose. Based on hydrogen's physical properties—including its small molecular size [9], high diffusivity [10], and the dynamics of tidal breathing [11]—a significant portion of gas is lost to the atmosphere during use, specifically during exhalation. At H₂HUBB, we estimate an average hydrogen loss of 66-67% when delivered via nasal cannula.

At its maximum setting, the 4500PRO produces 3193.17 mL/min of pure hydrogen gas. After accounting for a 66% loss, the actual administered hydrogen flow rate becomes:

$$3193.17 \times 0.334 = 1064.58 \text{ mL/min}$$

Assuming an average minute ventilation of 6 L/min (6000 mL/min), the estimated inhaled hydrogen concentration is:

$$1064.58 \div 6000 = 0.1774 \rightarrow 17.74\%$$

•

The 4500PRO's 3000 and 1500 mL/min modes, however, are more appropriate for single-user applications:

- 3000 mode (2303.43 mL/min H₂ output):
 - Adjusted for loss → 767.81 mL/min, resulting in 12.80% inhaled H₂ concentration
- 1500 mode (1513.00 mL/min H₂ output):
 - Adjusted for loss → 504.33 mL/min, resulting in 8.41% inhaled H₂ concentration

Both settings remain below the recommended 15% threshold and are suitable for home or therapeutic use by a single user via nasal cannula.

Each flow mode on the 4500PRO—1500, 3000, and 4500 mL/min—delivers a unique therapeutic dose of hydrogen based on its corresponding inhaled concentration, and these doses are not interchangeable simply by extending the duration of inhalation. While it may seem intuitive to assume that breathing from a lower flow rate (e.g., 3000 mL/min) for a longer period could match the effects of a higher flow rate (e.g., 4500 mL/min), this is not supported by the physiological data or Henry's Law. The concentration of hydrogen that dissolves into the blood (expressed in $\mu\text{mol/L}$) is a function of inhaled partial pressure—not time alone. For example, a 4% H₂ inhalation will never reach the same tissue saturation or blood concentration as a 6% or 10% H₂ concentration, regardless of how long it is inhaled. As shown in validated models and studies, each concentration reaches a distinct equilibrium level in tissues and blood [12].

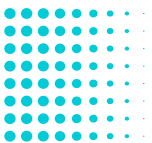
Therefore, the 4500 mL/min setting does provide the highest potential for systemic saturation and cellular delivery—

Ensuring the safety of high-flow hydrogen inhalation systems is critical. Several devices delivering comparable flow rates have been used in clinical research, demonstrating a strong safety record when operated under proper conditions.

In conclusion, the 4500PRO delivers a highly therapeutic and efficient hydrogen flow, but due to the elevated hydrogen concentrations possible at its highest setting, proper usage context is critical. Users should adhere to safe guidelines and utilize lower flow settings for single-user use to remain within recommended hydrogen concentration limits. The 4500PRO's performance confirms its status as a high-level hydrogen inhalation system, provided it is used with informed safety practices.

The manufacturer's claims regarding the molecular hydrogen output flow rate have been validated by our tests, and the device's performance aligns well with the product's marketing materials. No safety concerns were identified, as the system appears to incorporate adequate safety measures. Overall, we are satisfied with the device's performance. The 4500PRO device exceeded H₂HUBB's minimum performance standards, and in our assessment, it is both safe and effective for in-home hydrogen inhalation. Based on these findings, we are confident in recommending this product to the public.

H₂ Hubb LLC disclaimer: All tests conducted and test results produced by H₂ Hubb LLC have been done according to industry-accepted practices and standards. Nevertheless, these results may not necessarily reflect test results performed by manufacturers, suppliers or third-party labs. Our test results are independent of all other parties, and testing by other parties may produce different results. We understand that many variables are involved in testing, some of which are extremely difficult to control. These reports are not meant or intended for any other purpose but to uphold H₂ Hubb LLC's business practices and to validate the reasons for our recommendations.





Approved by:

Justin Hubbard

CEO, H₂HUBB LLC

