Overland Park KS
Tywon@H_2HUBB.com
www.H_2HUBB.com

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H_2HUBB Official Test Report

Evaluation Introduction

This report presents a detailed evaluation of the Inhale H_2 hydrogen inhalation therapy device, developed by Inhale H_2, a U.S.-based company. H_2HUBB classifies this unit as a Professional-Grade, H_2-mixed-with-air inhalation system. It features advanced hydrogen electrolytic cells incorporating a PEM/SPE membrane, enabling the production of high-purity hydrogen gas using only distilled or deionized water. The system supports continuous hydrogen output, with inhalation durations extending beyond 8 hours. Our assessment includes precise measurement of hydrogen gas output (mL/min) and the corresponding hydrogen concentrations to verify performance. In addition, we examined the unit's integrated safety features to confirm proper protections are in place for safe, reliable, and long-term operation. This analysis ultimately determines whether the Inhale H_2 device meets our H_2HUBB performance standards required for approval and public recommendation. For more information about our performance standards for hydrogen inhalation systems, please visit **H_2HUBB.**

H_2 Products

- Company: Inhale H_2
- Product Name: Inhale H_2
- Type: Pure Hydrogen (H_2) Mixed-with-Air Inhalation Device
- Technology: PEM/SPE Electrolytic Cell
- Manufacturer-Rated Output: 10 L/min total air flow with 1–4% H_2 concentration
- Website: https://inhaleh2.com/
- **Update: Latest models now operate at 12 L/min total mixed gas flow while maintaining 1–4% H_2 concentration. See footnote at the end of this report for confirmation data.**

Method and Procedure

- Distilled Water (used for testing): 6.0 pH
- Water Temperature: 65~70F/ 18~21C
- Reservoir Vol Size: 1 L/1000 mL (33.81 oz/0.26 gals)
- H_2 Output: 100-400 mL/min or 8.24-33 mg/min (@ SATP)
- Test Location: 277 meters (909 ft elevation)
- H_2 Flow Test: mL/min, normal timing for a breathing session (1 hr)
- Test methodology:
  - Alicat H_2 Mass Flow Meter
- All measurements converted to SATP where applicable

Test Results

To evaluate the hydrogen gas flow rate and corresponding H_2 concentration when mixed with air, the Inhale H_2 system was unpacked, assembled according to protocol, and filled with distilled water to the manufacturer's recommended level. The device was then partially disassembled to access both the hydrogen and air flow lines for measurement. Testing was conducted at each designated H_2 concentration output mode—1%, 2%, 3%, and 4%—with the system operated for a 1-hour session per setting. Each session began with a 10-minute warm-up period to allow for system stabilization. During operation, the hydrogen gas was routed through a drying column, then passed through a humidity and temperature sensor before entering an Alicat Mass Flow Meter for precise quantification of hydrogen gas output. A 5–10 minute stabilization window preceded each reading to minimize interference from ambient air and ensure measurement accuracy. Minor adjustments were made to account for pressure resistance or moisture-related flow deviations. The same procedure was applied for measuring air flow rates. Each H_2 concentration setting was tested a minimum of three times, and the reported flow rate values represent the average of these replicates.

H_2 Flow Rate and Concentration Results (SATP Conditions):

Device Setting: 1% H_2

- Device H_2 Flow Rate (mL/min) (mg/min) avg: ≅ 105 mL/min H_2 (≈ 8.65 mg/min)
- Device Air Flow Rate (mL/min) avg: ≅ 9336.00 mL/min
- Total Mixed Gas Flow Rate (H_2 + Air) avg: ≅ 9441.00 mL/min
- **Calculated H_2 Concentration (Post-Mixing): 1.10%**

Device Setting: 2% H_2

- Device H_2 Flow Rate (mL/min) (mg/min) avg: ≅ 197 mL/min H_2 (≈ 16.24 mg/min)
- Device Air Flow Rate (mL/min) avg: ≅ 9336.00 mL/min
- Total Mixed Gas Flow Rate (H_2 + Air) avg: ≅ 9533.00 mL/min
- **Calculated H_2 Concentration (Post-Mixing): 2.06%**

Device Setting: 3% H_2

- Device H_2 Flow Rate (mL/min) (mg/min) avg: ≅ 287 mL/min H_2 (≈ 23.66 mg/min)
- Device Air Flow Rate (mL/min) avg: ≅ 9336.00 mL/min
- Total Mixed Gas Flow Rate (H_2 + Air) avg: ≅ 9623.00 mL/min
- **Calculated H_2 Concentration (Post-Mixing): 3.0%**

Device Setting: 4% H_2

- Device H_2 Flow Rate (mL/min) (mg/min) avg: ≅ 395 mL/min H_2 (≈ 32.56 mg/min)
- Device Air Flow Rate (mL/min) avg: ≅ 9336.00 mL/min
- Total Mixed Gas Flow Rate (H_2 + Air) avg: ≅ 9731.00 mL/min
- **Calculated H_2 Concentration (Post-Mixing): 4.05%**

Claimed Mfgr's H_2 mL/min (mg/min) confirmed: Yes

H_2HUBB Hydrogen Flow Rate Assessment

- H_2HUBB's hydrogen gas flow rate and concentration testing confirms the manufacturer's performance claims for the Inhale H_2 device. Under standard atmospheric pressure (SATP), the device produced an average hydrogen gas flow rate ranging from 105 to 395 mL/min, mixed with approximately 9336 mL/min of air across its 1–4% H_2 output settings. These results align closely with the manufacturer's stated performance values, demonstrating the device's reliability and consistency under real-use conditions. The Inhale H_2 is a single-user system equipped with a specialized dual-valve rebreather mask, enabling the user to inhale therapeutic levels of hydrogen gas while maintaining concentrations well below the lower flammability limit (4.6%) and far below the detonation threshold (18%) in air. The 1–4% H_2 concentration range corresponds well with the levels used in most human clinical studies, further supporting its potential therapeutic relevance. Given these findings, the Inhale H_2 device not only delivers consistent and accurate performance but also stands out as one of the safest H_2 inhalation systems currently available on the market. These results exceed **H_2HUBB's minimum performance standards** and qualifies the device for H2HUBB recommendation. **Refer to the footnote at the end of this report for scaled performance data and validated hydrogen output results at 12 L/min total mixed gas flow on the current Inhale H_2 system configuration.**

INTERNAL BREAKDOWN AND PERFORMANCE:

Manufacturer's Rated Electrical Values:

Type of Device / Electrolytic Cell:

- Pure H_2: PEM/SPE Membrane

Power Supply Rating (per label):

- Voltage Output Rating: 5.0 V
- Current Output Rating: 15.0 A
- Rated Power: 225 Watts

Confirmed Electrical Values:

- Applied Voltage Range (System): 4.8-5.235 V DC
- Measured Current Range (System): 5.06-18 A DC
- Total Power Consumption: 24-94 Watts

Electrolytic Cell Configuration:

- Number of Stacks: 1
- Cells per Stack: 3 (wired in series)
- Total Number of Electrolytic Cells: 3 PEM cells

Electrolytic Cell Stack Characteristics:

- Voltage per Cell: 1.60 – 1.75 V
- Current per Cell: 5.06 – 18.00 A (same across all cells due to series configuration)
- Effective Electrochemical Current per Stack: 15.18 – 54.00 A
  - (calculated as: current × number of cells = 5.06–18.00 A × 3)

H_2 Production: (Based on measured amperage @SATP)

H_2 Setting	Voltage (V)	Current (A)	Electrical Power (W)	Effective Electrochemical Current (A)	Theoretical Max H_2 (mL/min)	Measured H_2 (mL/min)
1%	4.8 V	5.06 A	24.29 W	15.18 A	115.53 mL/min	105 mL/min
2%	5.00 V	9.06 A	45.30 W	27.18 A	206.00 mL/min	197 mL/min
3%	5.10 V	13.00 A	66.30 W	39.00 A	296.00 mL/min	287 mL/min
4%	5.235 V	18.00 A	94.23 W	54.00 A	411.00 mL/min	395 mL/min

These results demonstrate consistent hydrogen output across all settings, with electrolytic cell efficiency averaging around 95%, confirming the system's strong electrochemical performance.

Product Assessment

Functionality:

- **Power input/Power cord:**
  - Located on the back of the system; supplies power to the device.
- **Digital Display Knob and Control Interface**
  - Enables users to initiate hydrogen inhalation sessions and activate electrolysis
  - Displays current session duration in real-time
  - Shows the selected hydrogen concentration level during operation
  - Offers selectable H_2 concentration settings: 1%, 2%, 3%, and 4%
  - Allows session time to be set anywhere from 1 minute to 100 hours
  - Pressing the control knob during operation immediately stops gas production
- **H_2 Water Bubbler / Humidifier**
  - Adds moisture to the hydrogen–air gas mixture to improve comfort during inhalation.
- **Reservoir (1.0 L or 33.81 oz):**
  - Requires 1.0 liter of distilled water
- **Dual-Valve Rebreather H_2 Mask & Hose:**
  - An integrated, sealed H_2 mask features a built-in adapter with two one-way valves that direct airflow —allowing the user to inhale hydrogen only from the machine and exhale solely into the room. This prevents backflow and maintains consistent H_2 concentration in the hose and system.
- **H_2-Mixed-Air Breathing Bag:**
  - Collects the hydrogen–air mixture and inflates/deflates with each breath through the mask, ensuring a precise and consistent H_2 concentration is delivered during inhalation.
- **Drain Port:**
  - Allows the user to empty the distilled water reservoir and internal system via a drain located at the bottom of the unit.

Product Safety

Safety Components:

- The system has 10 fundamental safety mechanisms for ensuring the device's safety.
  - Final H_2 Concentration
    - Maintained well below flammability (4.6%) and detonation (18%) thresholds for safe inhalation.
  - 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
  - Internal gas separator
    - The apparatus helps to improve H_2 gas purity.
  - Internal deionization resin filters
    - Improves gas purity and reduces ions (mineral, metal, etc.)
  - Heat Vents
    - Prevents excessive heat in the system
  - HEPA Filter
    - Enhances air quality by removing particulates, ensuring clean and safe hydrogen inhalation.
  - 1% H_2 Leak Sensor
    - Automatically shuts down the unit if a hydrogen gas leak is detected within the housing or cabinet, activating at a 1% H_2 concentration to ensure user safety.
  - Bleeder Hole
    - Prevents excessive pressure buildup in the H_2–mixed-air breathing bag and line by allowing controlled gas release

Although the system produces >99% pure hydrogen gas, it is immediately mixed with 10–12 L/min of ambient air, resulting in a final H_2 concentration below the flammability threshold. Therefore, the system is theoretically non-combustible throughout normal operation. However, as with all hydrogen inhalation devices, proper caution should be exercised to avoid exposure to ignition sources (e.g., open flames or sparks), as a safety best practice in the unlikely event of system malfunction.

Overall Opinion

The Inhale H_2 Hydrogen Inhalation Device has been independently validated by H_2HUBB as a well-engineered, high-performing system for hydrogen mixed-with-air inhalation. According to the manufacturer, the device delivers hydrogen concentrations ranging from 1–4% H_2, mixed with 10 L/min of air under standard operating conditions. H_2HUBB's testing confirmed these specifications, demonstrating that the device consistently achieves the stated hydrogen output across all concentration settings.

Hydrogen gas output flow rates are a critical performance parameter for inhalation devices. At H_2HUBB, the minimum standard for hydrogen generators or inhalation units (whether pure hydrogen, oxyhydrogen, or H_2 mixed with air) is 120 mL/min of H_2. This rate corresponds to approximately 0.7-1.3% H_2 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, H_2HUBB establishes 120 mL/min of H_2 as the baseline requirement for hydrogen inhalation devices to ensure effectiveness. The Inhale H_2 inhalation device exceeds our minimum standard, delivering performance well within the therapeutic range.

The Inhale H_2 is equipped with a PEM/SPE electrolytic cell system consisting of a single stack with three PEM cells wired in series. This design enables the device to consistently generate high-purity hydrogen gas (>99.9%) using only distilled water. During H_2HUBB's performance testing, the system's electrical values were confirmed across various output modes, ranging from 4.8 to 5.235 V DC and 5.06 to 18 A DC, resulting in a total power draw between 24.3 and 94.2 watts. At the highest setting (4% H_2), the system drew 5.235 V and 18 A, with a measured hydrogen gas output averaging 395 mL/min—closely aligning with the theoretical maximum of 411 mL/min, indicating an excellent electrolytic cell efficiency of 96.11%. Across all four settings (1–4%), the device maintained an average efficiency of approximately 95.67%, confirming reliable and consistent hydrogen output performance. The Inhale H_2 mixes this hydrogen output with 10 L/min of air to deliver hydrogen–air concentrations ranging from 1% to 4%, well within the concentrations studied in clinical research and safely below flammability thresholds. This makes it an ideal system for single-user, long-duration hydrogen inhalation therapy while maintaining a strong safety profile.

While the Inhale H_2 Hydrogen Inhalation Device is not the first hydrogen–air mixing system on the market, it is the first to reliably deliver safe and precise hydrogen concentrations with no gas loss to the atmosphere. Unlike many other systems that allow hydrogen to dissipate between breaths, the Inhale H_2 device ensures that hydrogen is only delivered during inhalation, preserving both safety and efficiency. This performance is made possible by two key components: the specialized Dual-Valve Rebreather H_2 Mask & Hose and the 3-liter H_2-Mixed-Air Breathing Bag. Upon initiation, the breathing bag fills with the hydrogen–air mixture in approximately 30–35 seconds, acting as a dynamic reservoir that inflates and deflates with each breath. The sealed, dual-valve mask ensures that users inhale only from the breathing bag while exhaled air is vented directly into the room, preventing backflow and preserving the intended H_2 concentration. This dual-valve system enables each inhalation to consistently deliver a targeted therapeutic hydrogen concentration, a level of control and conservation not commonly found in other hydrogen inhalation devices. H_2HUBB testing confirms the effectiveness and performance of these components in real-use scenarios.

Safety is a critical factor for all hydrogen inhalation devices—whether delivering pure hydrogen gas, oxyhydrogen, or hydrogen mixed with air. It is essential to assess whether the hydrogen concentration delivered through a nasal cannula or H2 mask falls within accepted safety thresholds. According to NASA **[1]** and other sources **[2][3][4][5]**, the flammability range of hydrogen in ambient air is approximately 4.6% to 75% (vol/vol), with the detonation range between 18% to 59% (vol/vol). Furthermore, several peer-reviewed studies recommend keeping hydrogen inhalation concentrations below 10% **[6][7][8][9]** to ensure safe use in clinical and residential settings. Some sources note that concentrations around 15% may cause small, non-harmful combustion events (i.e., audible "pops") **[10]**. Based on this data, H_2HUBB identifies a hydrogen concentration caution zone between 4.6% and 10%, and a not-to-exceed upper limit between 10% and 15%. These thresholds warrant special attention, especially in uncontrolled environments such as private homes. In the absence of strict regulatory guidance, H_2HUBB adopts a conservative safety standard, recommending that inhaled hydrogen concentrations remain below 10–15%, particularly for home use. While this mitigates the risk of detonation, it is important to note that the gas remains flammable at the delivery tip of a nasal cannula or within the mask interface.

The Inhale H_2 device is uniquely designed to operate well within these safety limits. Although it is not the first hydrogen–air mixing system on the market, it is the first to integrate safety-focused components that deliver therapeutic concentrations of hydrogen (1–4%), maintain concentrations well below flammability and detonation thresholds, and ensure no hydrogen is wasted or vented directly into the atmosphere.

Additionally, H_2HUBB identified more than 9 built-in safety mechanisms, including a 1% H_2 leak detection sensor, HEPA filtration, a bleeder valve to prevent pressure buildup, etc. Several of these features—particularly in this specific combination and level of implementation—have not been observed in any other hydrogen inhalation device evaluated by H_2HUBB to date. While the Inhale H_2 may lack some multifunctional capabilities found in other devices—such as dual-user support, dual H_2 inhalation and water generation, or adjustable flow rates beyond 395 mL/min—it stands apart by prioritizing safety, precision, and usability. This makes it especially well-suited for medical clinics, research environments, elderly care facilities, and consumer home use

In conclusion, the Inhale H_2 Hydrogen Inhalation Device delivers therapeutic, efficient, and safe hydrogen gas inhalation. Its measured hydrogen output and concentration levels were validated through H_2HUBB's independent testing, confirming the accuracy of the manufacturer's performance claims. No safety concerns were identified during testing. The system appears to incorporate engineering safeguards and demonstrates consistent, reliable performance under standard atmospheric conditions. Aesthetically, the unit is appealing and well-constructed. The Inhale H_2 not only exceeds H_2HUBB's minimum performance standards but also sets a new benchmark for single-user safety in the hydrogen therapy space. Based on these findings, we are confident in recommending the Inhale H_2 device to the public for safe, in-home hydrogen inhalation.

Footnote:

Following the publication of this report, the engineers of the Inhale H_2 device updated the system to increase the total mixed gas flow rate to 12 L/min, while maintaining the same hydrogen concentration output range of 1–4% (FiH_2). This change results in a hydrogen gas production range of approximately 120–480 mL/min to preserve the target H_2 concentrations.

To confirm the updated specifications, we conducted a follow-up validation using our in-house system, which demonstrated that as airflow increases, hydrogen production scales proportionally to maintain the correct FiH_2 levels. Additionally, we scaled our original H_2 output data to match the new 12 L/min total flow rate. The recalculated hydrogen flow ranged from 133.35 to 487 mL/min, corresponding to concentrations of 1.11% to 4.06%, consistent with our original measured values.

These findings confirm that the Inhale H_2 system continues to deliver accurate and therapeutic hydrogen concentrations (1–4% FiH_2) at the new 12 L/min flow rate.

Approved by:

Tywon Hubbard

CEO, H_2HUBB LLC

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