Overland Park, KS
620-805-1216
tywon@h2hubb.com
www.h2hubb.com

H_2 HUBB Official Test Report

Product:

Name: HX900 Pure Hydrogen Inhaler with PULSE mode and BG
Company: Hydrogen For Health
Mfgr rated H_2 Output: 600 mL/min
Type: Pure H_2 Inhalation Device (99.9%/3N)

- PEM/SPE
- O_2 port supplied as well.

Tester: Tywon Hubbard (TH)
Testing start date: 9/8/23
Completion date: 10/23/23

PERFORMANCE:

H_2 mL/min Confirmation Test: HX900

- **METHODOLOGY:**
- Distilled Water (used for testing): 6.0 pH
- Water Temperature: 65~70F/ 18.3~21.1C
- Reservoir Vol Size: 1.0 L/1000 mL
- H_2 output: 600 mL/min or 49.46 mg/min (@ SATP)
- Test Location: 277 meters (909 ft elevation)
- H_2 Flow Test: mL/min, normal timing for a breathing session
    - Test methodology: Gas Displacement
    - All measurements converted to SATP

H_2 Flow Rate Test Results at SATP:

- **Device H_2 mL/min (mg/min) avg:** ≅ 704 mL/min (58.04 mg/min)
- **Device H_2 mL/sec alternating-breath Pulse mode:** ≅ 26.5 mL/sec
- **Device O_2 mL/min (mg/min) avg:** ≅ 351.96 mL/min
- **Device Total H_2/O_2 mL/min (mg/min) avg:** ≅ 1055.89 mL/min
- **Claimed Mfgr's H_2 mL/min (mg/min) confirmed:** Yes
    - In this report, we are exclusively presenting the test results for the 900 mL/min H_2/O_2 setting, which is essential to meet our H_2HUBB recommendation standards. If clients wish to examine the results for the lower gas output settings tested by H_2HUBB, please feel free to contact us.

INTERNAL BREAKDOWN AND PERFORMANCE:

Manufacturer's Rated Electrical Values: (as stated on the power supply)

- **Type of device/electrolytic cell**
    - Pure H_2: PEM/SPE membrane
- **Applied volts:**
    - 12 volts
- **Total Amps:**
    - 27 amps
- **Total watts:**

- 324 watts

Measured Electrical Values (@ 4 electrolytic cells in series configuration)

- **Cell Configuration**
  - Four cells in series
- **Electrolysis amps:**
  - 23.46 amps (DC) per cell
  - 93.84 effective amps (DC)
- **Electrolysis volts:**
  - 6.72 volts (DC)
  - 1.68 volts (DC) per cell
- **Electrolysis watts:**
  - 157.65 watts

H_2 Production: (Based on measured amperage @SATP)

- **Total Theoretical Max H_2 production (@ 100% cell efficiency)**
  - 714.21 mL/min (58.88 mg/min)
- **Measured H_2 production**
  - 704 mL/min (58.04 mg/min)
- **Electrolytic cell efficiency**
  - 98.56%

PRODUCT ASSESSMENT:

Functionality:

- **Power**
  - **Power input/Power cord:** Located on the back of the system and provides power to the device.
- **LED Digital Display and control panel**
  - Displays the session time-frame
  - Displays the combined hydrogen gas and oxygen gas production in mL/min
  - **Output Flow:**
  - Allows the user to change the hydrogen gas/oxygen gas production in mL/min (150, 300, 450, 600, 750, 900)
  - **Power/Start button**
  - Initiates electrolysis for hydrogen/oxygen gas inhalation.
  - Tapping the power button while the device is producing hydrogen gas will stop electrolysis/hydrogen gas production.
  - **Timer**
  - Increases the session time by 1-hr intervals up to 6 hrs.
  - **Regular Mode:**
  - Continuous hydrogen flow to the nasal cannula
  - **Pulse Mode:**
  - Introduces a small quantity of hydrogen gas into the hydrogen gas production each time an individual inhales.
  - **Sleep mode**
  - The sleep mode button will dim the display.
- **Reservoir (1.0L or 1000 mL)**
  - Requires 1.0L liters of distilled water.
- **H_2 ports**
  - Delivers the H_2 gas production for H_2 inhalation for single or dual users.
- **O_2 port**
  - Delivers the O_2 gas production for H_2/O_2 inhalation for single or dual users.
- **Drain port**
  - Allows you to drain the distilled water reservoir with a special fitting.

Reliability:

- **New: No**
  - Initial test results and evaluation are currently on the report. (see Overall Opinion)
- **3 months:** N/A
- **6 months:** N/A
- **1 year:** N/A
- **Reliability Summary**: N/A

PRODUCT SAFETY:

Safety Components:

- The system has 4 fundamental safety mechanisms for ensuring the device's safety.
    - Low-water protection
        - Protects cells from excessive heat (two cells)
    - Internal Fans (5X)
        - 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.
    - Large Heat Vents (2X)
        - 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.

Cost:

- **Hydrogen For Health (HX900™):** $2,280.00
- **H_2 Hubb discount:** TBA
- **H_2 Hubb recommendation cost:** TBA

Overall Opinion:

Hydrogen For Health HX900 Pure Hydrogen Inhaler with PULSE mode and BG is a well-engineered hydrogen inhalation device based on our testing. The unit is rated by the manufacturer to supply 600 mL/min of pure hydrogen gas (99.9%) at 100% production capacity. We were able to confirm the manufacturer's claims of the HX900. In addition, the system is claimed to provide 300 mL/min of pure O_2, which we also confirmed.

Hydrogen gas output flow rates are a critical performance parameter for inhalation devices. H_2HUBB's minimum standard for hydrogen generators or inhalation units (pure H_2, mixed with air, etc.) is 120 mL/min of H_2 (120 mL/min ≅ 2% H_2 at resting breathing rates (4-6 L/min)). This is based on preliminary observations and/or studies demonstrating that 1~1.3% (vol/vol) of H_2 may offer therapeutic potential. For these reasons, 120 mL/min of H_2 is our minimum standard for hydrogen generators and the HX900 device easily surpasses this standard.

The system utilizes a quad electrolytic cell in a series configuration. We measured the system electrical values at 6.72V/23.46 A at the device's 100% production capacity. That means each cell will draw 23.46 amps at 1.68V. Given these measured electrical values, our measurement of ≅ 704 mL/min (58.04 mg/min) not only confirms but surpasses the manufacturer's claims of 600 mL/min, correlating well with our findings. The total H_2 gas output for the device based on the theoretical maximum (100% cell efficiency) would be ≅ 1071.31 mL/min at SATP. Therefore, it appears that the H_2 inhalation system electrolytic cell is operating at a cell efficiency of 98.56%. This means, that the O2 production of the system was calculated to be ≅ 351.96 mL/min (@ SATP). Our findings confirmed the claims that the device can provide 900 mL/min of oxyhydrogen (H_2/O_2). The measured oxyhydrogen production of the system based on our analysis was ≅ 1055.89 mL/min. This represents nearly a 20% increase in hydrogen production compared to the advertised claim, which is truly exceptional. **Based on these results, the product will be featured on our website as a Level 4 Inhalation device.** You can view the meaning of this ranking **here**. We are satisfied with the device's performance characteristics as indicated by our gas output measurements.

The device features a function known as "Pulse Mode," which allows it to introduce a small quantity of additional hydrogen gas into the nasal cavity with each inhalation. To activate this function, the "Pulse Mode" button must be pressed. Once pressed, the system will attempt to match the person's inhalation and add approximately 11.7~23.5 mL of H_2 (704 mL/min ÷ 60 seconds) x (1-2 seconds inhalation) = 11.7-23.5 mL) with each breath depending on a person's breathing rate. It is claimed that the pulse function can double the amount of H_2 inhaled by a person breathing hydrogen.

Based on our measurement of approximately 704 mL/min (58.04 mg/min) at SATP, it suggests the system provides 11.7 mL/sec or 4.69% H_2 for an average male. Theoretically, if the device can momentarily double the 11.7~23.5 mL of H_2 with each inhalation, changing the rate to 23.5~47 mL/sec, the device effectively doubles the inhaled H_2 (from 4.69% to 9.39%) for that inhalation. This means that, for that inhaled breath, the inhaled H_2 would be equivalent to inhaling approximately 1408 mL/min of H_2 (or 23.4 mL/sec). The HX900 features a hydrogen reservoir that stores gas during pulse mode and releases it when the pressure within the reservoir reaches 5.68 psi (equivalent to 0.4 kg of pressure). Following our discussion with the device manufacturer, we discovered that in pulse mode, the device consistently delivers the standard flow rate, which we measured at 704 mL/min of H_2 at SATP (equivalent to 11.7 mL/sec) only when the person inhales and subsequently releases the stored hydrogen with the standard gas flow rate once the reservoir reaches 5.68 psi. Given that the stored or additional hydrogen gas is not released with each inhalation but only when the reservoir reaches a specific internal pressure, we needed to verify the timeframe for the release of this additional gas and the quantity of H_2 that is stored. To assess this, we conducted timing tests and determined that, on average, the system releases the additional gas approximately every 5-6 seconds. Based on our results from our time-frame test of 5-6 seconds we calculated that the system stores 58-70 mL of H_2 before releasing the gas. This is easily calculated by dividing the measured flow rate of 704 mL/min by 60 to get mL/sec and then multiplying the mL/sec by 5 or 6 (704/60 = 11.7 mL of H_2, and 11.7 x 5 = 58 mL of H_2). The calculated amount of stored H_2 aligns closely with our gas displacement measurement of released hydrogen gas, which amounted to ≥ 50 mL of hydrogen gas. The additional ≥ 50 mL added to the gas being delivered is a good target amount. This is because, considering inhalation dynamics, 50-70% of the additional H_2 could escape into the atmosphere, implying that when adding ≥ 50 mL of H_2, approximately 15-25 mL is actually inhaled by the body. Adding 15-25 mL to the inhaled gas would approximately double the inhaled H_2. Unfortunately, based on the information provided by

the manufacturer, the system will not double the inhaled hydrogen with every breath inhalation. This is due to the fact that the extra stored H_2 is released every 6 seconds, while the average time frame for an adult male's inhalation and exhalation combined is 3-4 seconds. Therefore, the system has the potential to double the inhaled hydrogen gas every other breath, not with every inhalation. Therefore, rather than doubling the inhaled H_2, the system has the potential to increase inhaled H_2 by 30%. However, this is all contingent on the sensing device's ability to accurately match a person's breathing rate. Based on our evaluation, the sensing device appears to align well with inhalation, but it doesn't precisely replicate an individual's breathing patterns. As a result, the figures we've established may not accurately represent real-world scenarios for this system. Taking into account this fact and other variables not yet considered in this report, we strongly recommend using the system in "regular mode," which consistently provides a flow of 704 mL/min of H_2. This ensures a therapeutic level of hydrogen gas is consistently delivered to the body.

The "pulse mode" function needs further refinement in our opinion. If the theory behind it proves accurate, this feature could be a game-changer for H_2 inhalation devices, differentiating this system from others in the US market. However, as it stands, H_2HUBB is not convinced of its efficacy.

Lastly, the HX900 has great build quality and a beautiful design. It's compact, easy to move, and easy to set up. The LED control panel has great lighting and displays the device's key features and functions well. Overall, the design is sleek and the is highly therapeutic based on our analysis and knowledge of human studies.

The validity of the manufacturer's claims regarding molecular hydrogen output flow rate is not in question and the device's performance agrees with the product's marketing materials. We have no safety concerns with the system as it seems to implement sufficient safety measures. We are generally pleased with the performance of the device. The HX900 device performed above our minimum performance standards and, in the opinion of H_2HUBB, the system appears to be safe and suitable for in-home H_2 inhalation. We desire to move forward with recommending the product to the public.

Approved by:

Tywon Hubbard CEO of H_2HUBB