AEM WATER ELECTROLYSIS

HXS-2

Stack integration guide

Design data for integrators building their own balance of plant around the bare stack: sizing basis, instrumentation and interlocks.

2 kW · 50 A	4 L/min	0 / 10 barg
Rated operation	Nominal flow	Hydrogen pressure

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SCOPE · DESIGN INPUTS

Scope and design inputs

HXS-2 is a stack. Power, electrolyte circulation, gas handling and interlocks are yours to build.
This document gives the figures and the structure that design needs.

1. Which document to use when

Datasheet	Specifications and measured performance. While you evaluate the purchase
This guide	BoP sizing basis, instrumentation and interlocks. While you design
User manual	Port connections, commissioning, maintenance, troubleshooting. After delivery. ver2.1, 48 pages
Assembly guide	Opening, disassembly and reassembly bolting. 8 pages
Warranty policy	Cover and exclusions, MEA replacement thresholds

2. Design inputs

NOMINAL · LIMIT

Current	50 A	Max 80 A
Stack voltage	approx. 40 V (BOL)	Max 50.6 V · 2.2 V/cell × 23 cells
Electrolyte	0.3 M KOH in DI water	KOH purity 95% or better · no fixed interval; judge by condition and trend
Temperature	60 °C	Room temperature to 80 °C
Circulation flow	4 L/min	1 to 10 L/min
Hydrogen pressure	0 barg	Max 10 barg
Feed water	ASTM D1193 Type II	1.0 µS/cm or lower · make-up 0.42 L/h at 50 A
Cells · active area	23 cells	Anode 100 cm^2 · cathode 79 cm^2

Performance curves are measured at 0.1 M KOH and 50 °C.
Where we have given you project-specific conditions, apply those for first commissioning.

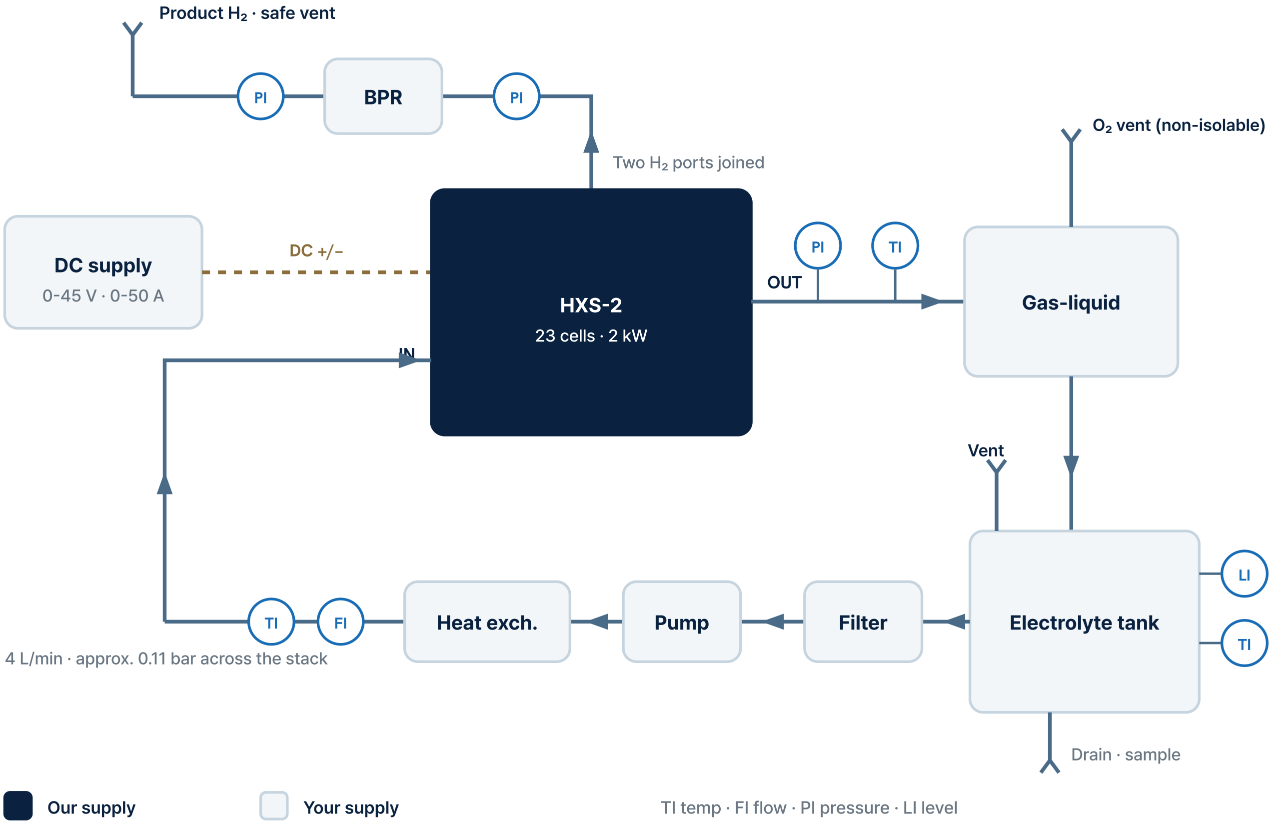
3. What follows

Page 3, schematic	Minimum electrolyte loop and hydrogen line, with instrument locations
Page 4, ports	Fluid ports and DC terminals, connection sizes and torque

PROCESS SCHEMATIC

Process schematic

The minimum arrangement of the electrolyte loop and the hydrogen line. A concept schematic, not a P&ID.

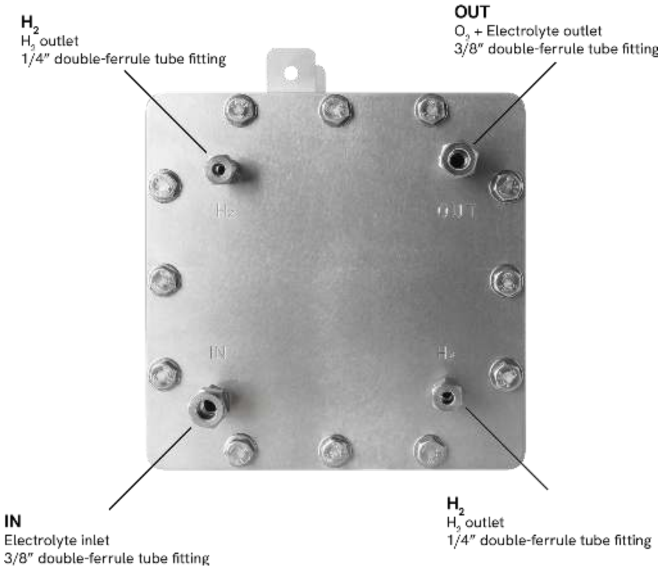


- Feed runs from the tank through filter, pump and heat exchanger into stack IN. Keep the pump below the tank liquid level.
- OUT is a wet outlet, so it passes through gas-liquid separation and returns to the tank. Anode pressure and outlet temperature are measured here.
- The two hydrogen ports are joined and routed to the BPR. Fit a pressure transmitter before it; one after it is recommended.
- No valve that could isolate them goes on the tank vent or the O_2 vent.

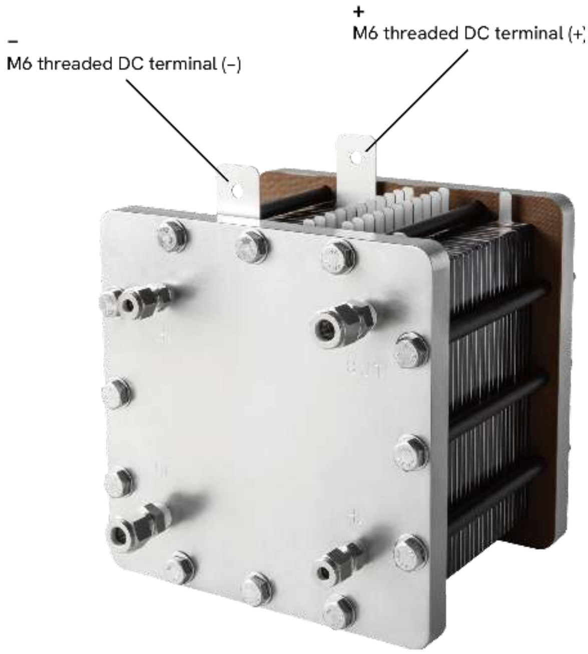
PORTS · CONNECTIONS

Ports and connections

Port markings follow the labels stamped on the stack. Layout can differ by revision, so check the unit itself first.



Fluid ports (end plate)



DC terminals

IN	Electrolyte inlet · 3/8″ double-ferrule
OUT	Wet outlet, oxygen with electrolyte · 3/8″ double-ferrule
H_2 (two)	Hydrogen outlets · 1/4″ double-ferrule each
DC terminals	M6 threaded tabs · torque 4 to 6 N·m
Output at rating	approx. 500 NL/h H_2 at 50 A. Oxygen is half of that
Make-up water	approx. 0.42 L/h at 50 A
Size · weight	190 × 210 × 215 mm · 19 kg

- Support the weight of piping and cables separately so it does not rest on the ports or terminals.
- Size DC cables for 50 A continuous and keep the terminal torque at 4 to 6 N·m. Over-torque damages the terminal.
- The stack weighs 19 kg. Use two people or a lift.
- Port connection and first-run procedures are in sections 5 and 6 of the user manual, with photographs.

ELECTROLYTE LOOP · THERMAL LOAD

Electrolyte loop and heat load

Three things must be settled in the loop: flow, pump head, and wetted-part materials.

Nominal flow	4 L/min (allowable 1 to 10 L/min)
Stack pressure drop	approx. 0.11 bar at 4 L/min. Measured, stack alone
Pump sizing basis	Variable-speed pump with approx. 0.3 bar or more available differential at 4 L/min
Speed command	A 24 VDC BLDC with 0 to 5 V or PWM is sufficient. Equivalent arrangements are fine

- 0.11 bar is the stack alone. Add filter, heat exchanger, flowmeter, valve and piping losses to set the final head.
- 0.3 bar is a sizing basis before the P&ID and the full loop pressure-loss calculation. It is not a guaranteed final head.
- Keep the pump below the reservoir liquid level, flooded suction. Do not use it to pressurise the anode loop.
- Wetted-part materials must be confirmed by the component supplier at your concentration, temperature and design margin.
- Electrolyte is distributed to the cells in parallel from a shared anode manifold, not in series.
- Fewer cells means proportionally less flow. 4 L/min for 23 cells is about 2 L/min for 12 cells. Current per cell is unchanged.

If you are considering flow above the standard

Higher flow raises the pressure drop across the stack and widens the anode to cathode pressure difference, which raises crossover. The bottleneck is the internal flow field, a multi-channel geometry that does not reduce to a single figure. A separate loop is the alternative. This is outside the validated range, so we promise no figures for it.

Requests to change the internal flow field

The bipolar plate is formed in a die, so a new flow field means new tooling. It is not a practical option. We can share drawings and go through it on a call.

Heat to remove

Heat load is input power minus the hydrogen energy. Calculated from Faraday and HHV, not measured.

Rated	50 A · 40 V	Input 2.0 kW · H_2 43 g/h · 1.7 kW as HHV
Rated heat load	approx. 0.3 kW	The difference of the two
Operating limit	80 A · 50.6 V	Input 4.1 kW · H_2 69 g/h · 2.7 kW as HHV
Limit heat load	approx. 1.3 kW	A 1.5 kW heat exchanger leaves margin

Voltage rises with degradation, so heat load rises with it. Size for the voltage limit.

GAS HANDLING · PRESSURE READINESS

Gas handling and pressure readiness

Low-current operation needs a heater

At low current, electrolysis heat alone does not reach the recommended temperature. For extended low-current runs, fit a KOH-compatible heater on the reservoir with temperature monitoring and over-temperature protection.

1. Gas handling and venting

- OUT is a wet outlet: oxygen leaves together with electrolyte. Fit gas-liquid separation and return the electrolyte to the reservoir.
- Do not fit any valve or device on a vent line that could isolate it. The reservoir vent must not be isolable either.
- Put the drain and sample points at the lowest point of the reservoir.
- Where a hydrogen volume can be closed or pressurised, provide a dry nitrogen purge connection and a safe vent. Purge flow and duration follow the piping volume and the P&ID. Never purge with compressed air or oxygen.

2. First commissioning

Pressure	Atmospheric or near atmospheric on both sides
Hydrogen outlet	Unrestricted, free vent
BPR	Fully open or bypassed

3. A pressurised arrangement must include

- Independent anode and cathode pressure transmitters, and a calculated differential
- Independent high-pressure and differential-pressure shutdown interlocks
- Automatic product isolation on high pressure
- A verified safe vent or depressurisation path
- A manual BPR may be used as an adjustment component only. We do not approve it as the sole pressure-control or safety device.

PRESSURE LIMITS · INSTRUMENTATION

Pressure limits and instrumentation

Do not read 10 barg as a differential

10 barg is the maximum operating pressure on the hydrogen side. It does not mean 10 bar of allowable differential pressure. The anode to cathode difference is a separate item; see the open item below.

1. Measured at full load under pressure

The control threshold is 2 vol% hydrogen in oxygen. Measured data from a separate 10 barg run below.

Recorded window	189.5 h	The window with gas analysis on record
H_2-in-O_2 mean	1.006 vol%	Maximum 1.435 vol% in the same window
Control threshold	2 vol%	We recommend shutdown above it

2. Crossover rises at part load

Multipliers from 49 measured points between ambient and 6 barg, consistent across pressures.

Full load	Baseline, 1×	Control threshold is 2 vol% H_2-in-O_2
60% load	1.25 to 1.43×	
40% load	1.67 to 1.94×	Below 40 to 50% load, 2 vol% is the practical design limit

Use at least one of: a minimum-load limit, reduced pressure at low load, or a 2 vol% interlock.

Not yet determined

For a standalone HXS-2 there is no customer-approved numerical differential-pressure limit covering steady and transient states. Pressurised full-stack validation is under way. Trip settings are fixed per project after a P&ID review of transmitter ranges, valve fail positions, relief arrangement and enclosed gas volume. Do not copy system (HXB-V1) alarm values onto a bare stack.

3. Minimum instrumentation by location

Reservoir	Level, temperature, non-isolable vent, lowest-point drain and sample
Stack inlet · outlet	Inlet temperature downstream of the heat exchanger and flow. Outlet temperature and KOH-compatible anode pressure
Hydrogen outlet	Cathode pressure after the stack, upstream of the regulator. A second transmitter downstream of the BPR is recommended
External controller	Flow, both pressures, stack current and voltage, reservoir, inlet and outlet PT100, level, leak, E-stop and valve feedback, pump and PSU commands, isolation and vent outputs, hardwired E-stop

HXS-2 has no onboard PLC or standard communications interface. An external controller provides these.

COMMISSIONING · MAINTENANCE

Commissioning and service boundary

1. Commissioning sequence

Detailed steps and first-run checks are in section 6 of the user manual.

1. **Confirm atmospheric on both sides**
   Hydrogen outlet open, BPR open or bypassed.
2. **Fill electrolyte and check for leaks**
   Fill the reservoir, circulate, and check every joint.
3. **Set flow and temperature**
   Set 4 L/min and confirm the recommended temperature. Use the heater for low-current operation.
4. **Connect DC and ramp from low current**
   Raise it in steps while watching voltage and temperature.
5. **First-run checks**
   Check voltage behaviour, leaks, temperature and gas discharge, following section 6-5 of the manual.

2. Service and disassembly boundary

- MEA replacement is a return-to-base service. Send the stack and we replace the MEA and ship it back. End plates, bipolar plates, cell frames and fasteners are reused.
- To open it yourself you need a 5-tonne hydraulic press. The bolting procedure is in the assembly guide.
- Once a stack has been opened we no longer warrant its performance or sealing. See the warranty and service policy.
- There is no fixed electrolyte replacement interval. What is consumed in operation is water; the KOH itself is not consumed. Stop and inspect, then replace, when H_2-in-O_2 exceeds the control limit or when electrolyte condition and performance trend change. Other routine checks are in section 7 of the manual.

3. Related documents

Datasheet	HXS-2 specifications and measured performance
User manual	ver2.1, 48 pages. Ports through troubleshooting
Assembly guide	8 pages. Opening and reassembly bolting
Warranty policy	Cover and exclusions, MEA replacement thresholds

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