
— HYDROXPAND · ELECTRODE GUIDE

HXP

AEM electrodes (anode and cathode)

Electrode Handling and Operation Guide



DOCUMENT CONTROL

Document control

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About this guide

This guide is the formal print edition of the HydroXpand web handbook. Its content is the same as the web handbook.

The web handbook is updated first. Where this print and the web differ, the web handbook is current. Each chapter shows its own update date at the top.

Read the safety chapter first. The meaning of the signal words (danger, warning, caution, notice) is in its first section.

Revision history

Rev.	Date	Description
1.0	2026-10-02	First version (built from the web handbook)
1.1	2026-10-04	HXP-ca orientation corrected (catalyst-layer face to the membrane; only HXP-an is the same on both faces)
1.2	2026-10-04	Measurement comparison wording corrected (half-cell vs cell voltage, current-limit check, temperature and concentration, Tafel slope)
1.3	2026-10-04	Safety messages reworked (how to handle KOH safely added)
1.4	2026-10-05	Korean wording revised
1.5	2026-10-05	Format size and thickness drawing (Figure 3-1) added; HXP-ca orientation marked in Figure 4-1

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01 Safety and handling

HXP-an · HXP-ca · updated 2026-09-30

Rules for inspecting and handling HXP-an and HXP-ca electrodes, and for making up the KOH electrolyte that goes into your cell. Consult the electrode operation note for assembly and operating conditions appropriate to your hardware.

HANDLING Wear gloves · handle by the edges **PRE-TREATMENT** No additional pre-treatment

MAKING UP ELECTROLYTE Goggles · alkali-resistant gloves · apron

HOW TO READ THIS CHAPTER

First time

Read the inspection criteria, then handling and pre-assembly checks. If you are making up electrolyte for the first time, read the KOH section first.

Done this before

Check for damage and debris on the assembly surfaces.

Check damage before assembly

Check for creases, tears, catalyst delamination, contamination and changes in edge thickness. If anything is wrong, send photographs before placing the electrode in a cell.

Protect the catalyst and sealing surfaces

- Wear gloves and handle the edges. Do not rub or scratch the catalyst-bearing surface.
- Keep the electrode flat. Do not roll or fold it.
- Do not press the surface with metal tools.
- Remove offcuts and dust from the assembly area. Debris trapped in a seal causes leaks.

Making up and handling the electrolyte (KOH)

WARNING

KOH solution is corrosive and can cause severe skin and eye burns.

- Add KOH to water, never the other way round, which spatters.
 - Handle it with safety glasses and alkali-resistant gloves. If it touches you, rinse at once with plenty of water.
- Handle it according to the SDS and your laboratory procedures.
 - Use only KOH-compatible containers, tubing and fittings.

- Label every container with its contents, concentration and date.
- If it spills, contain it, clean it up by your institution's procedure and dispose of the waste as regulations require.
- If it reaches skin or eyes, rinse with water at once and seek medical attention if needed.
- Keep an eyewash station and a safety shower close to where KOH is handled.

TASK	WEAR
Inspecting and handling electrodes	Gloves
Making up and handling electrolyte	Splash-proof goggles or a face shield, alkali-resistant gloves, and a chemical apron or lab coat

i NOTICE

Where your institution's PPE rules are stricter than this table, follow them.

- Operating conditions such as electrolyte concentration and temperature are in the electrode operation note. Venting the hydrogen and oxygen your cell produces, and emergency procedures for your test rig, are outside this handbook; follow your institution's procedures.

Use conditions for your own hardware

Do not apply stack press or tightening conditions directly to a test cell. Confirm assembly conditions for the gasket and cell construction.

Electrodes ship cleaned and dried. No additional pre-treatment or separate activation procedure is required.

02 Receiving and storage

HXP-an · HXP-ca · updated 2026-09-30

From delivery to the moment the electrode goes into a cell: the state it arrives in, what to check, and how to handle and store it.

Cell assembly and clamping, operating conditions, start-up, the measurement sequence, and what to check when your numbers differ from the datasheet are all in the electrode operation note. This chapter stops just before it.

AS SHIPPED **Cleaned and dried** PRE-TREATMENT **None needed** STORAGE **Dry, once opened**

HOW TO READ THIS CHAPTER

First time

Do the inspection section on the day it arrives, read the handling section, then move on to building your cell. Assembly and measurement live in the electrode operation note.

Done this before

When putting away unused electrodes, the storage section is all you need.

The state it arrives in

Cleaned and dried	Electrodes ship cleaned and dried. No additional pre-treatment is needed on your side.
Orientation	HXP-an (anode) is the same on both faces, so either side can face the membrane. HXP-ca (cathode) has an orientation: the catalyst-layer face goes towards the membrane and the carbon-paper (GDL) face towards the cell hardware.
Inspected before shipment	Dimensions and thickness are measured and every piece is visually inspected before it ships. Those are the two things to check on arrival.

PRACTICAL NOTES

Do not look for an activation step. There is not one.

- Put it into the cell as received and set the operating conditions. A separate conditioning procedure is not part of using this product.

Inspection

1

Look at the packaging first.

- Photograph any crushing or wetness. Electrodes are thin, so a crushed package usually means a crushed electrode.

2

Check the count and the format against your order.

3

Inspect the surfaces.

- Look for creases, tears, places where the catalyst layer has come away, and contamination.
- Check for edges crushed to a different thickness. That is where a cell will fail to seal.

4

If anything is wrong, tell us before you build a cell with it.

- Send us photographs and we will look at it. A defect in format or appearance is replaced at no charge.

i NOTICE

The warranty covers conformity to specification at receipt.

- That means dimensions, thickness and catalyst loading conforming to specification, with format and appearance defects replaced free of charge.
- MEA assembly and cell operation are your configuration, so performance and life after assembly are not covered. That is why the inspection on arrival matters.

Handling

- Keep it flat when you move it. Do not roll or fold it: a fold does not recover its thickness when flattened.
- Handle it by the edges. Do not rub or scratch the catalyst-bearing surface.
- Wear gloves. Skin oils on the catalyst layer change how that spot wets.
- Do not press the surface with a metal tool. It leaves a mark.
- Keep offcuts and dust away from the assembly area. Trapped in a seal, they leak.

PRACTICAL NOTES

The most common failure is not the electrode but the gasket.

- The electrode operation note covers what usually goes wrong in cell assembly and what to do about it. Read it before you assemble.

Storage

- After opening, store the electrodes dry.

- Return them flat to the original packaging, and do not stack anything on top.
- Keep them away from corrosive gases and solvent vapour.

 NOTICE

The performance of an electrode that has been run is outside the warranty.

- Use a fresh electrode when you compare against the datasheet curves.

03 Formats and ordering

HXP-an · HXP-ca · updated 2026-09-30

What you need to decide which format to order. There are two standard formats for different purposes, and anything else is made to order.

The exact dimensions, thickness and catalyst loading are in the full specification table on the product pages. This chapter is only about which row of that table you want.

MINIMUM ORDER **One sheet · no minimum value** LEAD TIME **Standard two weeks · custom up to two months**
CUSTOM RANGE **Within 300 mm long by 200 mm wide**

HOW TO READ THIS CHAPTER

First time
Decide the format in the first section, then check in the second whether your dimensions fall inside what we can make.

Done this before
The lead time and the minimum order are what you need.

Which format to choose

FORMAT	WHEN	WATCH FOR
Anode · laboratory format	For cutting to the active area you need. This is the large-area, thin one.	Being thin, it is less forgiving to handle. Keep it flat.
Anode · stack format	The format that goes into our own stacks. This is the thick one.	Its thickness has to suit your gasket stack-up, which changes the compression.
Cathode	One standard format, with a choice of Pt/C or PtRu/C catalyst.	Both cost the same; they differ in behaviour. Pt/C starts lower but lasts longer, and PtRu/C is the reverse.

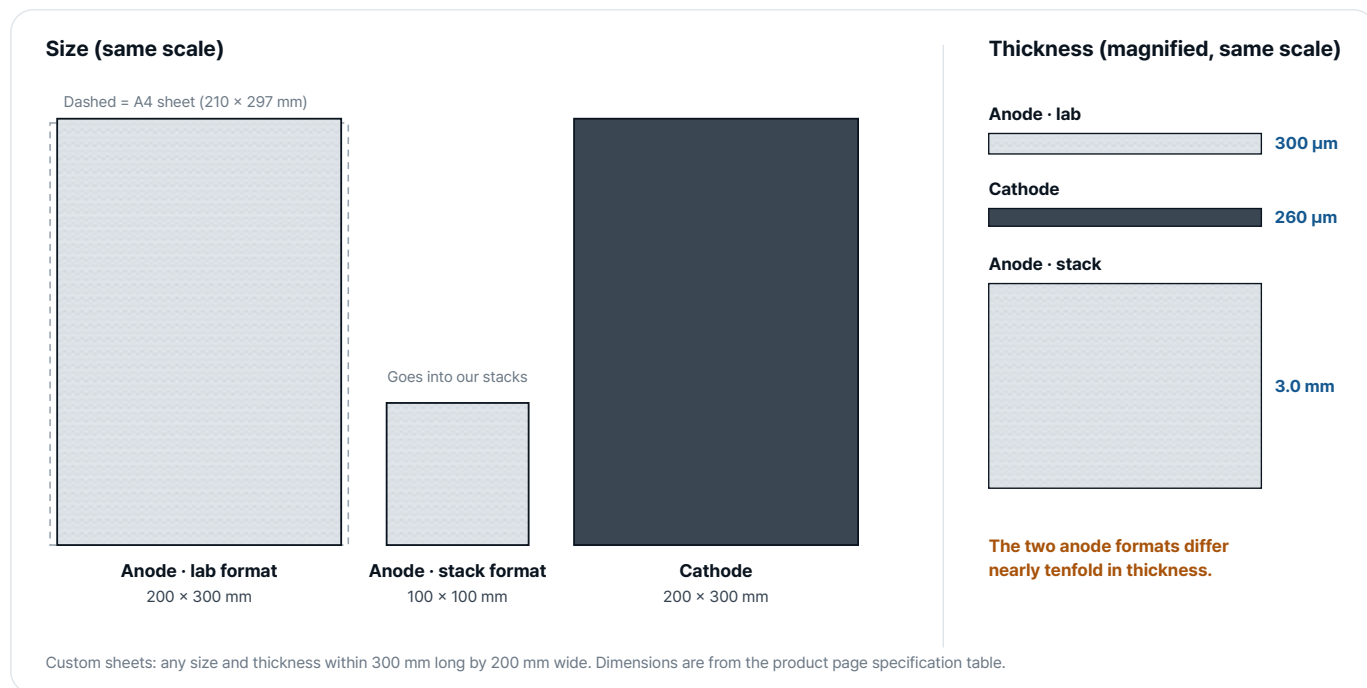


Figure 3-1 Standard formats, size and thickness. Dimensions are from the product page specification table; see it for tolerances.

PRACTICAL NOTES

The two anode formats differ in thickness by nearly ten times.

- Same material, different place in the cell. Choose by your gasket thickness and active area; the exact figures are in the specification table on the product page.
- If the thickness you need falls between the two, either order a custom format or take up the difference in the gasket. How to settle the gasket thickness is in the electrode operation note.
- If the thickness you need is close to a standard one, look at the standard first. The catalyst layer is the same, only the substrate thickness differs, and the standard is made from stocked substrate so it ships sooner.

PRACTICAL NOTES

The cathode's carbon paper is not a separate option.

- Carbon paper is the substrate. The cathode ships coated with the catalyst you choose, Pt/C or PtRu/C. As both cost the same, you can have a quotation before you decide on the catalyst.

i NOTICE

Every published figure was measured in alkaline KOH.

- We have never run these electrodes in a neutral or chloride-containing electrolyte. In those conditions treat the datasheet values as a reference point, not a prediction.
- There is no separate research grade and no coating developed for chloride service. The line is the anode and the cathode.

Made to order

What we can make

Size and thickness to your specification, within 300 mm long by 200 mm wide. The same applies to both anode and cathode.

Minimum order	From a single sheet, with no minimum order value.
Lead time	Two weeks for a standard format and up to two months for a custom one, which takes longer because the substrate has to be brought in first. Tell us early if you have a test schedule.
Inspection before shipment	Dimensions and thickness measured and every piece visually inspected, custom orders included.

PRACTICAL NOTES

You can cut it to the size you need. The laboratory format is made to be cut.

- Cut on a flat backing with a sharp blade in one pass and do not crush the edge. A crushed edge changes the local thickness, and that shows up as a sealing failure in the cell.
- Clear the dust afterwards.
- Our inspection covers the dimensions and thickness of the sheet as shipped. Check the size of the pieces you cut yourself.

What to put in your order

ITEM	HOW TO STATE IT
Electrode	Anode (HXP-an) or cathode (HXP-ca)
Format	The format name together with its size and thickness. A name on its own costs an extra round of confirmation
Cathode catalyst	Pt/C or PtRu/C. If you have not decided, say so
Quantity	The number of sheets. If you will cut them, add the piece size and count and we will work out how many standard sheets that takes
If custom	Length, width and thickness, within 300 mm long by 200 mm wide
Where it will run	Whether the electrolyte is alkaline or something else
Schedule	The date your testing starts

NOTICE

Ask if you need a condition that is not in the table.

- Send us the application, the cell design, the quantity and the schedule, and we will tell you whether it is possible and when.

04 Cell assembly overview

HXP-an · HXP-ca · updated 2026-09-30

The route from received electrodes to a test cell and its first measurement, on one page. Values such as clamping torque and the measurement sequence are in the electrode operation note; this chapter covers the order of work and the decisions people most often get wrong.

LAYOUT **Anode below · cathode above** PRE-TREATMENT · ACTIVATION **None**

CLAMPING VALUES **Depend on your hardware**

HOW TO READ THIS CHAPTER

First time

Look at the sequence table in the first section, then follow the link on each row for the values. Read the gasket section before you assemble.

Done this before

Go back to the gasket section. Most leaks and performance problems start there.

The sequence at a glance

STEP	WHAT TO DO	DETAILS
1. Inspect	Check for creases, tears, catalyst delamination and crushed edges. Do not build a cell with a damaged sheet	Receiving · inspection
2. Cut	If needed, cut to your active area: on a flat backing, in one pass, then clear the dust	Formats · made to order
3. Stack up	Anode at the bottom, cathode on top. Lay HXP-ca with its catalyst-layer face towards the membrane (HXP-an has no orientation). The electrolyte circulates on the anode side. Insulate the end plates with a PTFE sheet	Note · cell assembly
4. Gaskets	Settle the thickness by clamping trials. See the next section	This chapter · gaskets
5. Clamp	Tighten to the assembly guide for your cell hardware. Do not carry stack clamping conditions over to a cell	Note · cell assembly
6. Electrolyte and heat-up	Circulate 0.1 M KOH and bring it to 50 °C. Confirm the temperature actually reached, not the setpoint	Note · operating conditions
7. Start up	There is no separate activation step. Bring it to rated current and start measuring once the voltage has settled	Note · start-up

8. Measure

Follow the measurement sequence, and match the conditions before comparing with the datasheet

Checking performance and reading data

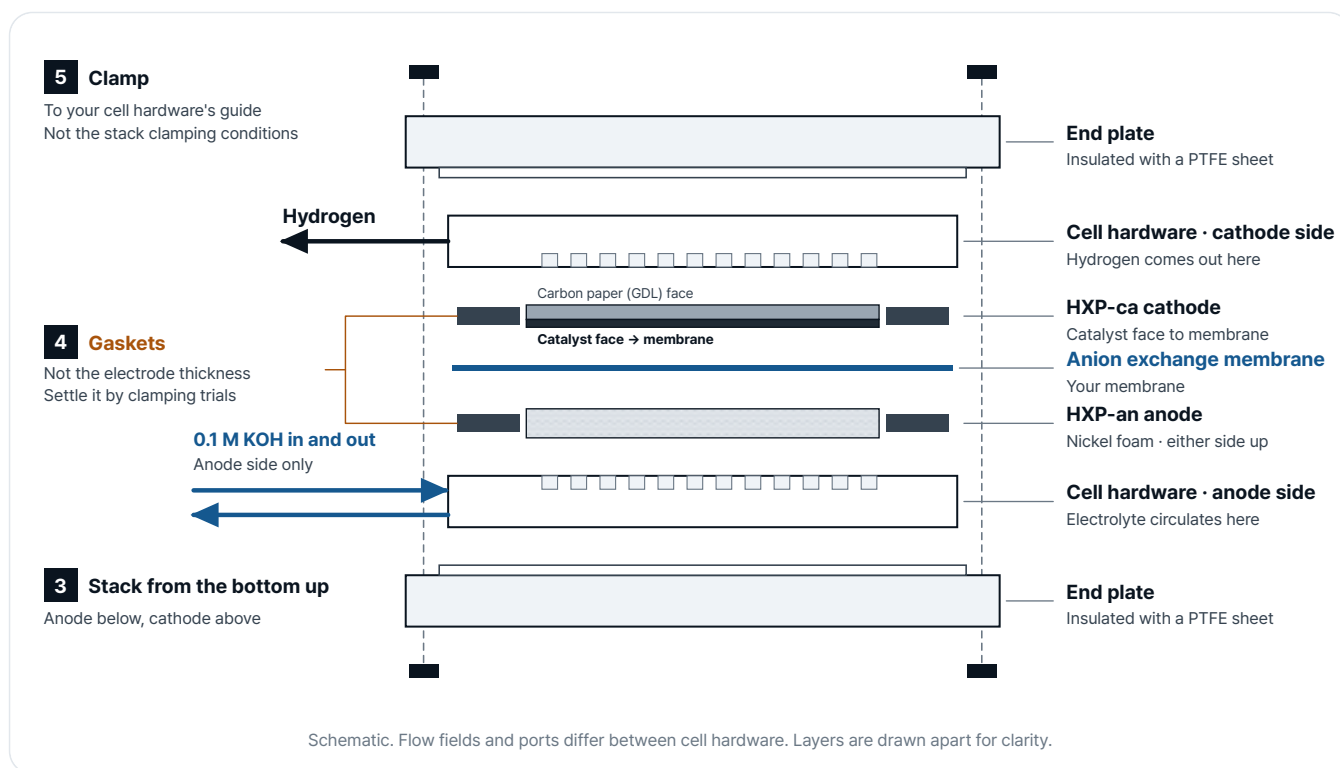


Figure 4-1 Stacking a test cell. Numbers match the steps in the table above. Schematic; flow fields and ports differ between cell hardware.

Gaskets: the most common failure

When a cell leaks or underperforms, the gasket is more often the cause than the electrode. Hold to two things.

Seating

O-rings ride out of their seat and the MEA gasket shrinks inwards. Push them back into place after seating.

Thickness

Do not simply match it to the electrode thickness. A nickel-foam anode compresses a great deal when clamped, by an amount that depends on the material. Try a few thicknesses, clamp each, and settle on one by checking for leaks and for cell performance.

PRACTICAL NOTES

Keep the sealing faces clear.

- Offcuts, dust or a crushed edge caught on a sealing face will leak there. Wipe the sealing faces once before assembly.

NOTICE

We do not give a recommended gasket thickness or compression figure.

- It depends on the gasket material and the cell design and can only be settled by measurement. If the thickness you need falls between the two standard electrode thicknesses, see the formats chapter.

What you do not need to do

- Pre-treatment. Electrodes ship cleaned and dried.
- Activation. There is no separate activation step; bring the cell to temperature and run at rated current.

PRACTICAL NOTES

Do not spend time looking for a procedure that does not exist.

- Some other makers' electrodes come with an activation procedure. These do not. If your numbers are off, look at the conditions and the assembly before thinking about activation.

05 Checking performance and reading data

HXP-an · HXP-ca · updated 2026-09-30

How to read the curves and figures in the datasheets, and how to compare them with your own measurements. Values taken under different conditions cannot be compared side by side; this chapter is about matching those conditions first.

RULE FOR COMPARING **Like with like only** PUBLISHED FIGURES **All in alkaline KOH**

WHEN COMPARING **With a fresh electrode**

HOW TO READ THIS CHAPTER

First time

First find, in the table in the first section, which condition the figure you want to compare belongs to. If your conditions differ, read the sections after it.

Done this before

The check list in the section on comparing your measurement with the datasheet is enough.

Which condition each published figure belongs to

DATA	WHAT WAS MEASURED	CONDITIONS
HXP-an datasheet performance charts	Anode catalyst activity, compared with the bare nickel-foam substrate	Three-electrode half-cell · 0.3 M KOH · room temperature · Tafel without iR correction
HXP-ca datasheet Tafel slope	Slope of overpotential against log current density for the cathode reaction (mV/dec)	Three-electrode · 0.3 M KOH · room temperature · N ₂ purge
HXP-ca datasheet single-cell curves	Cell performance with Pt/C and PtRu/C cathodes, anode HXP-an	0.3 M KOH · 60 °C
HXP-ca datasheet 3-cell stack	Voltage change per hour for the two cathode catalysts	50 A constant current
Accelerated durability (anode and cathode)	Whether performance survives cycling	1.0 ↔ 0.05 A/cm ² · 5 s · 10,000 cycles
HXS-2 and HXS-30 stack curves	Performance of stacks built with HXP electrodes	0.1 M KOH · 50 °C · atmospheric pressure

Every published figure was measured in alkaline KOH.

- In a neutral or chloride-containing electrolyte, treat the datasheet values as a reference point, not a prediction.

Half-cell values and cell values do not sit side by side

A three-electrode half-cell test measures the potential of a single working electrode against a reference electrode. A cell voltage contains the equilibrium voltage for splitting water, the overpotentials of both anode and cathode, and the resistive losses in the membrane, ionomer, contacts and electrolyte. A half-cell Tafel slope or potential therefore cannot be compared directly with a cell voltage. Uncorrected solution resistance can still affect a half-cell measurement.

Use half-cell values	To compare catalysts: how different they are on the same substrate under the same conditions.
Use cell and stack values	To see what voltage it takes under the conditions you will use. The membrane and cell design are part of the result.

Comparing your measurement with the datasheet

With a different temperature or electrolyte concentration, the same electrode gives a different cell voltage at the same current density. Match the following before you compare.

- Temperature: the temperature the cell actually reached, not the setpoint.
- Electrolyte concentration. It differs from chart to chart in the datasheets; check the table above.
- The area behind the current density. State which area you divided by; a different basis turns the same cell into a different curve.
- Whether iR correction was applied, and the measurement mode: galvanostatic or potentiostatic, and the scan rate.
- Settling: whether you measured after the voltage had settled at rated current.
- Electrode condition: fresh, or already run.

PRACTICAL NOTES

With good performance, the instrument often reaches its current limit before 1.8 V.

- If the current stops rising, first check the instrument's current-limit indication and the actual current. If it has reached the limit, lower the upper voltage limit and measure again, and check that the lower range also stays within the limit. The value to use is in the measurement sequence section of the note.

 NOTICE

The values here come from our own test conditions.

- With a different cell design, membrane and ionomer, or test rig, the same numbers may not reproduce. Send us your conditions and we will compare them with ours.

06 Specifications and reference

HXP-an · HXP-ca · updated 2026-09-30

How the HXP anode (HXP-an) and cathode (HXP-ca) look, their specifications, and the terms used in this handbook.

Intended use

HXP-an is the oxygen-evolution anode and HXP-ca the hydrogen-evolution cathode, for use in AEM water electrolysis cells and stacks. Follow Receiving and storage for handling and storage, and the cell assembly chapter for assembly and operation.

Product views



Figure 6-1 HXP-an anode



Figure 6-2 HXP-ca cathode

Specifications

The specifications below are the same values as the product page and datasheet. They are beginning-of-life values unless stated otherwise.

HXP-an · Anode

Material	Ni-Fe @ Ni foam
Catalyst	NiFe LDH (OER)
Pore	130 ppi
Porosity	95-98%
Test condition	0.3 M KOH · room temperature (3-electrode)
Standard format · laboratory grade	200 × 300 mm · thickness $300 \pm 20 \mu\text{m}$
Standard format · stack grade	100 × 100 mm · thickness $3.0 \pm 0.2 \text{ mm}$
Custom	Custom size and thickness available ($L \leq 300 \text{ mm}$ · $W \leq 200 \text{ mm}$)

Minimum order	One sheet · no minimum order value
Lead time	Standard 2 weeks · custom up to 2 months
Outgoing inspection	Dimension and thickness measurement, visual inspection of every sheet
Fabrication	Grown directly on a Ni foam substrate (binder-free)
Specific surface area (BET)	Approx. 25× that of Ni foam
Tafel slope	98.7 mV/dec (three-electrode)
Accelerated stress (AST)	10,000 cycles completed ($1.0 \leftrightarrow 0.05 \text{ A/cm}^2 \cdot 5 \text{ s}$)

HXP-ca · Cathode

Material	Pt/C·PtRu/C + binder (catalyst layer) · carbon paper (GDL)
Catalyst loading	0.2 mgPGM/cm ² (XRF) · PtRu based on total Pt+Ru PGM mass
Thickness	260 ± 20 µm
Area density	105 ± 10 g/m ²
Test condition	0.3 M KOH · room temperature (3-electrode)
Standard format	200 × 300 mm · total thickness 260 ± 20 µm
Custom	Custom size and thickness available ($L \leq 300 \text{ mm} \cdot W \leq 200 \text{ mm}$)
Minimum order	One sheet · no minimum order value
Lead time	Standard 2 weeks · custom up to 2 months
Options	Pt/C · PtRu/C
Tafel slope	PtRu/C 45.7 · Pt/C 52.2 mV/dec (three-electrode)
Catalyst layer	Low surface roughness (minimises membrane damage)
Accelerated stress (AST)	10,000 cycles completed ($1.0 \leftrightarrow 0.05 \text{ A/cm}^2 \cdot 5 \text{ s}$)

Terms

TERM	MEANING
AEM	Anion exchange membrane: a membrane that passes hydroxide ions (OH ⁻).
KOH	Potassium hydroxide, used as a 0.1 M solution for the electrolyte.
DI water	Deionised water. Quality is judged by conductivity (μS/cm at 25 °C).
MEA	Membrane electrode assembly: the electrodes and membrane that make up the heart of a cell.
BoP	Balance of plant: everything around the stack, such as power, pumps, tank, heat exchanger, piping, sensors and controls.
barg	Gauge pressure in bar, relative to atmosphere.
NL/h	Gas volume per hour in litres at standard conditions (0 °C, 1 atm).
BOL	Beginning of life. Specifications are BOL values unless stated otherwise.
SDS	Safety data sheet. Check it before handling KOH.

Manufacturer

Manufacturer	HydroXpand Inc.
Address	3F, 59 Dongtansandan 6-gil, Hwaseong-si, Gyeonggi-do 18487, Republic of Korea
Contact	+82 70-4110-1201 · info@hydroxpand.com · hydroxpand.com

Troubleshooting

HXP-an · HXP-ca · updated 2026-09-30

What to check first when something looks wrong with the electrodes or your test cell. The cause is usually the conditions or the assembly rather than the electrode.

LOOK FIRST AT **Conditions and gaskets** ONE AT A TIME **Change one thing, then measure again**

WHEN YOU CONTACT US **Seven conditions and photos**

HOW TO READ THIS CHAPTER

First time

Find the line for what you are seeing in the find-by-symptom table. If your numbers differ from the datasheet, start with the conditions.

Done this before

Go to the section on what to send, and contact us with it ready.

Find by symptom

WHAT YOU SEE	SUSPECT FIRST	WHAT TO DO
A received electrode has creases, tears or delamination	Crushing in transit, a manufacturing defect	Do not build a cell with it; send us photos. Format and appearance defects are replaced free of charge
The assembled cell leaks electrolyte	A gasket out of its seat or shrunk, debris on a sealing face, a crushed edge	Take it apart, reseal the gaskets and wipe the sealing faces. If it still leaks, settle the gasket thickness again
Cell voltage higher than the datasheet at the same current density	HXP-ca assembled upside down (GDL face to the membrane), temperature not reached, a different concentration, too little settling, under-clamping, a different area basis	First check that the HXP-ca catalyst-layer face is towards the membrane. Then match the conditions using the list in the performance chapter and measure again
A room-temperature measurement does not match the datasheet	Different measurement conditions	The datasheet cell curves were measured at temperature. Compare again under the same conditions
Current stops rising before 1.8 V	The instrument's current limit	Check the current-limit indication and the actual current; if it is the limit, lower the upper voltage limit and measure

WHAT YOU SEE	SUSPECT FIRST	WHAT TO DO
Values differ from the datasheet in a neutral or chloride electrolyte	Published figures are for alkaline conditions	Treat the datasheet as a reference point only

PRACTICAL NOTES

Change one thing at a time.

- Change the temperature and the gasket together and you cannot tell which one it was. Change one, measure again, then move on.

What to send

With the following to hand, our engineer can reproduce the same conditions and work through the cause with you.

GROUP	CONTENTS
Electrode	Anode or cathode, the format and size, the catalyst if it is a cathode (Pt/C or PtRu/C), and the date received
Conditions	The temperature actually reached, electrolyte concentration, settling time, clamping torque, and the membrane and ionomer
Measurement	Measurement mode and scan rate, the area basis for current density, whether iR correction was applied, and the raw data
Evidence	Photos of the electrode, the gaskets and the opened cell

NOTICE

Performance and life after assembly are outside the warranty.

- The warranty covers conformity to specification at receipt. We will still work through the cause with you.