

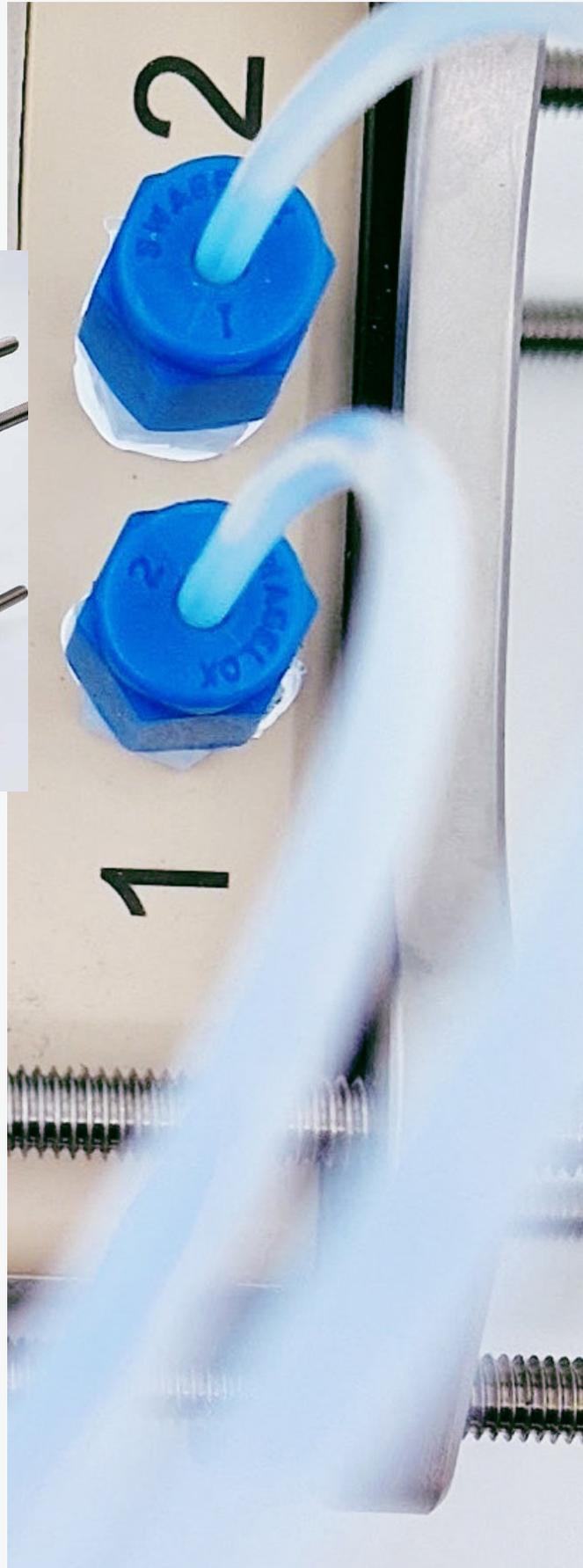


2025

FLOW CELLS

BROCHURE: THE X-STACK

# REDOX FLOW



Most  
**Flexible**  
Electrolysis Stack  
for *Research*

# The X-Stack

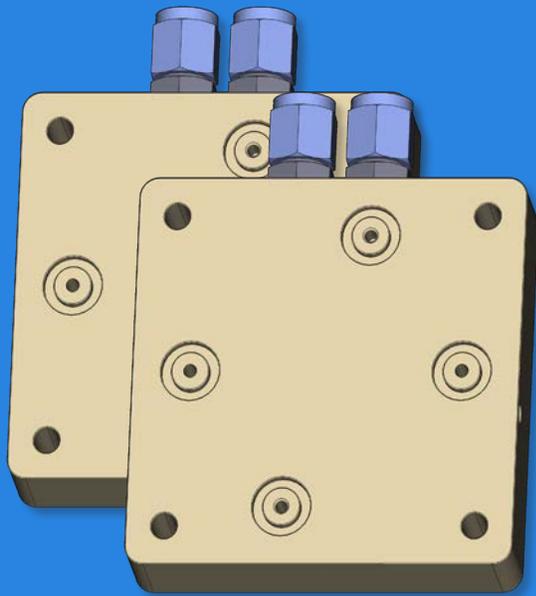
The X-Stack builds on more than a decade of redox-flow expertise to deliver a stack platform designed for maximum flexibility, precision, and reliability. Whether you are testing new electrodes, membranes, or complete cell designs, the X-Stack adapts easily to your experimental needs.

Electrode compression can be precisely tuned with exchangeable spacers. The stack can be supplied with a variety of bipolar plate materials, such as nickel, stainless steel, titanium copper, platinum coated titanium and gold coated titanium - ensuring compatibility diverse chemistries. It is designed for optimal performance, minimizing pressure losses while keeping shunt currents low.

## What makes it a great choice for R&D?

- Most flexible stack for electrolysis research
- 25 cm<sup>2</sup> active area
- Flow-field or flat-plate design
- Configurable up to 9 cells
- Works with any electrode thickness or material
- Individual cell voltages can be measured directly on bipolar plate
- Accurate temperature measurement
- High chemical resistance across full pH range

# Components & Configuration



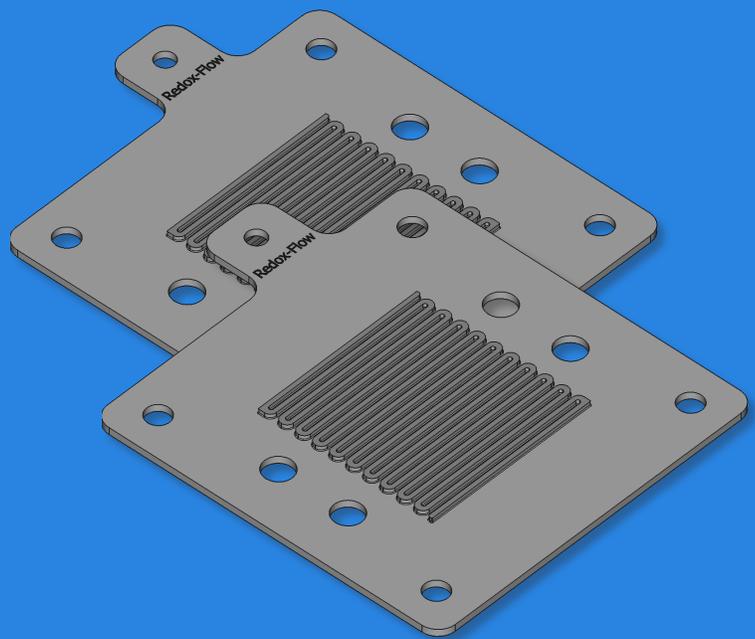
## Flow Bodies

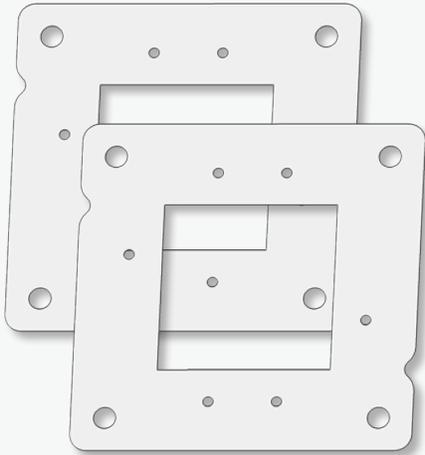
Material: PEEK or PTFE

## Anode and cathode current collectors & bipolar plates

Material: nickel, stainless steel (316L), titanium, copper, platinum-coated titanium, gold-coated titanium

Flow field area: 5 x 5 cm, or flat bipolar plates





### Cover gaskets

Two sets of cover gaskets per cell.

Material: VITON, EPDM, PTFE

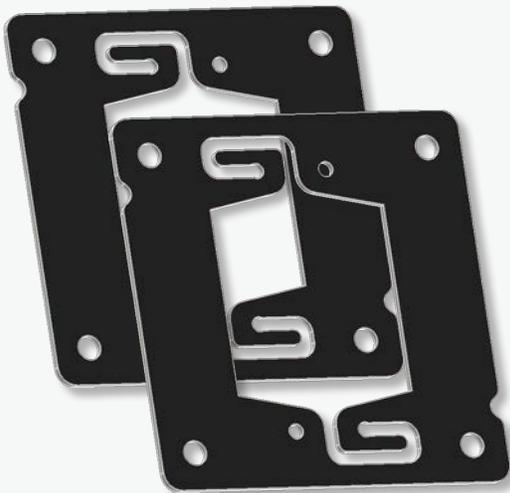
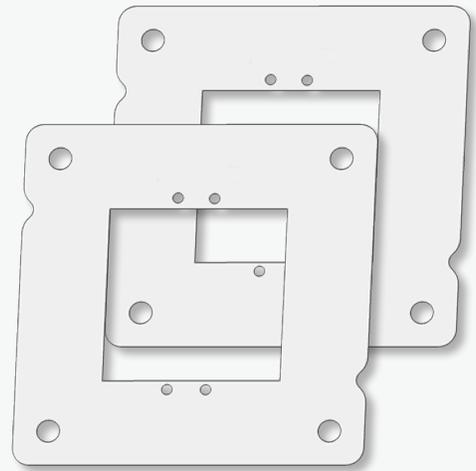
Thickness: 0.05 mm, 0.1 mm, 0.25 mm, 0.5 mm, 1 mm

### Porous separator sealing gaskets

For thick porous separators to prevent leaking through the separator.

Material: VITON, EPDM, PTFE

Thickness: 0.1 mm, 0.25 mm, 0.5 mm, 1 mm



### Flow field gaskets

One set per cell.

Material: EPDM, VITON, or PTFE

Thickness: 0.5 mm, 1 mm, 1.5 mm, 2 mm

# About the individual cells

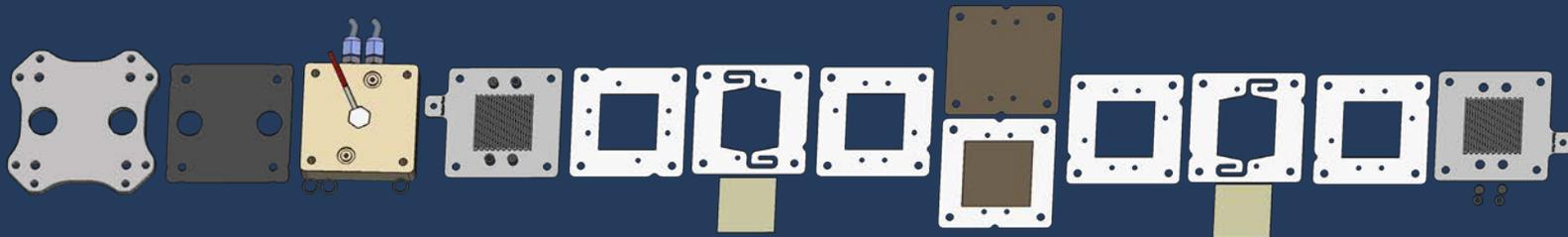
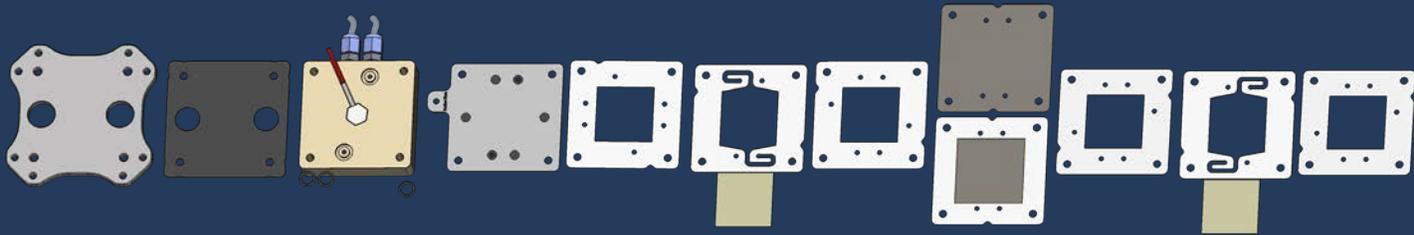
## Modular Electrolysis Cell for Versatile Flow Applications

The X-Stack is a high-performance, modular electrolysis cell designed for a wide range of electrochemical applications in flow. It is especially suited for research and development where flexibility, chemical compatibility, and ease of configuration are essential. The design allows users to adapt the cell to specific experimental needs without switching platforms.

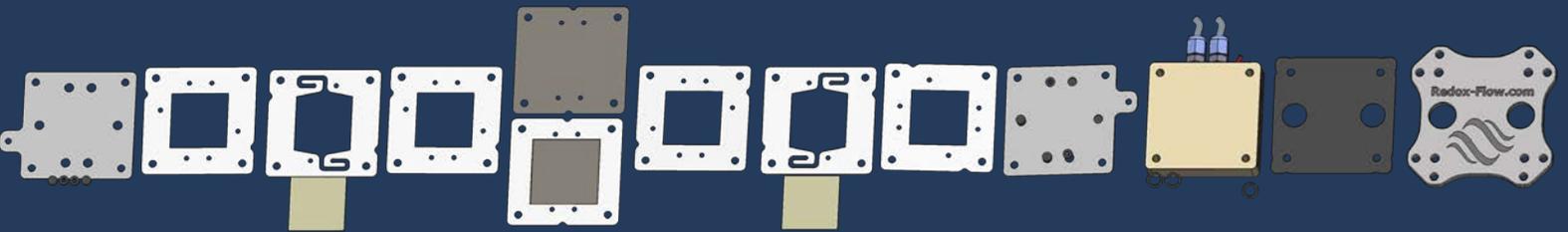
### Key Features and Flexibility

- Fully modular design with interchangeable current collectors
- Choice of flat surface or flow-field collectors, which can be combined in asymmetric configurations
- Bipolar plates in nickel, stainless steel, titanium copper, platinum-coated titanium, and gold-coated titanium
- Compatible with both ion exchange membranes and porous separators
- Operates with a wide variety of electrolytes, including acidic, neutral, alkaline and organic solvents
- Designed for high chemical resistance, minimal leaching or catalyst poisoning
- Suitable for operation at elevated temperatures up to 95°C

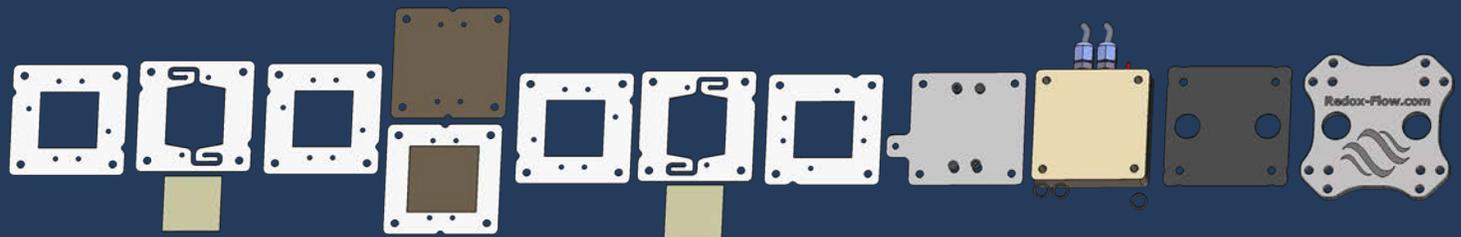


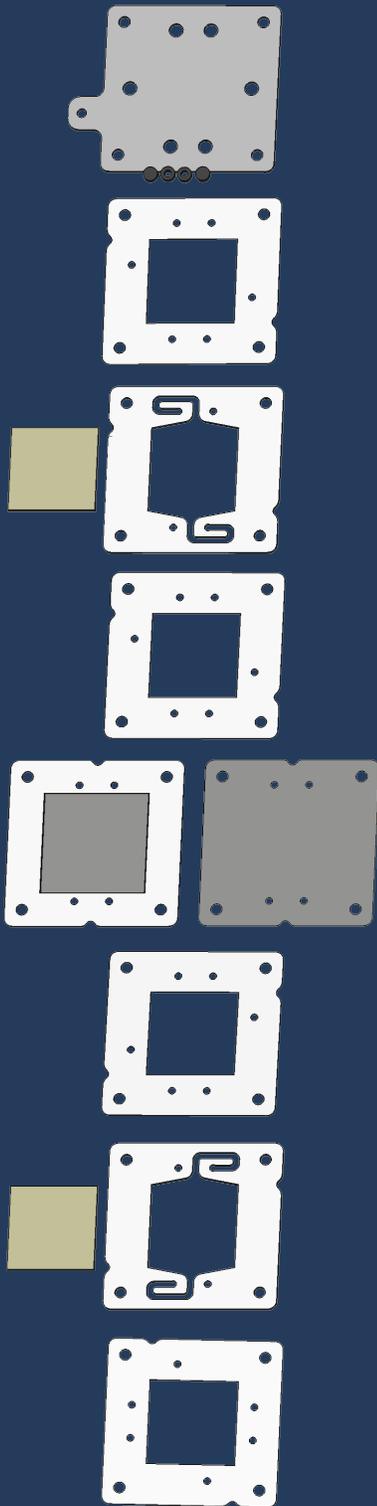


Gasket configuration with two cells  
**With flow field area**



Gasket configuration with two cells  
**With flat surface bipolar plates**





## Repeating cell structure

The stack can be configured with up to 9 cells. Each cell is built up around a membrane or separator with an electrode on each side and a bipolar plate.

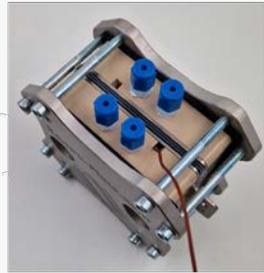
The electrodes (5×5 cm) are placed within a set of gaskets, consisting of cover gaskets and a central flow-field gaskets, specifically designed for the X-Stack for best performance. Hence for each cell, 4 cover gaskets and 2 flow-field gaskets are needed. The combined thickness of the cover gaskets and flow-field gaskets on each side defines the desired compressed thickness of the electrodes.

# Temperature Control

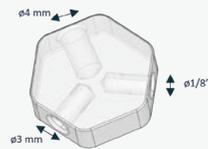
The X-Cell includes an integrated temperature measurement system. A metal sensor block is embedded in the PEEK flow body and pressed against the current collector to enable accurate temperature readings. It supports common thermometer and thermocouple sizes (3 mm, 4 mm, and 1/8").



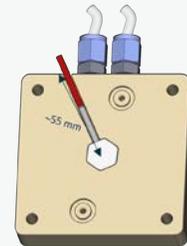
Mounting with rigid thermometer



Mounting with thermocouple



Thermometer holder



Thermometer, holder & PEEK block (metal current collector is mounted on top)

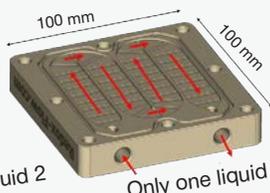
## Temperature Control Unit

This system can be used in combination with a dedicated temperature control setup based on a flow heat exchanger principle. To the best of our knowledge, similar products cannot be found by any other companies in the field.

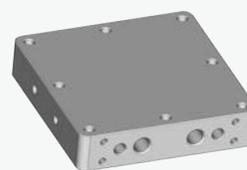
PEEK flow body variant 1



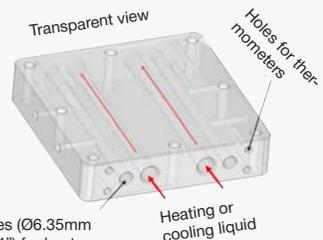
PEEK flow body variant 2



Metal heating/cooling block



Holes (Ø6.35mm - 1/4") for heat



Our solution comes as three different configurations that are based on the same components and can be interchanged. All options are based on a PEEK flow body and metal block shown above. The PEEK body contains one (*variant 1*) or two separate (*variant 2*) flow chambers for heating/cooling one or two independent liquids, respectively. The liquids in the experimental setup are circulated through the PEEK flow body and placed up against a metal heating/cooling plate, whereby heat is transferred to or from the liquids in the PEEK flow body. The metal plate is separated from the liquids by a thin PTFE sheet, whereby corrosive/oxidative solutions also can be heated without corroding the metal plate.

Besides the possibility for placing the metal block on a heating plate, it also comes with holes for heat cartridges, cooling liquids, and thermometers.

## REDOX FLOW

# Variants



## X-Stack with flat surface

The X-Stack is the result of nearly a decade of development in flow redox chemistry. Built for component testing, stack optimization, upscaling, and demonstration, it can be configured with up to nine cells. Electrodes ( $\geq 1$  mm thickness) of any material can be used, with compression easily adjusted by spacer thickness. A wide selection of bipolar plate materials is available, such as nickel, stainless steel, titanium, copper, platinum-coated titanium, and gold-coated titanium. The stack is engineered to balance low pressure drop with minimal shunt currents, ensuring stable and efficient operation.

## X-Stack with flow field

The X-Stack FF (Flow field) is a variant of the X-Stack Flat, designed with interdigitated flow fields in the bipolar plates. This enables reliable testing with very thin electrodes, while the Flat version is recommended for electrodes that are  $\geq 1$  mm thick. Both variants support up to nine cells and are ideal for component testing, stack property evaluation, upscaling, and demonstration.



# Accessories

## INLINE PRESSURE UNIT



Pressure Measurement Unit that can be connected to flow battery or electrolyser cell.

- Compact, inline design for direct pressure measurement
- Monitor hydraulic resistance of electrodes with high accuracy
- Integrated temperature sensing for added diagnostics
- Built from chemically highly resistant materials

## FLOW-THROUGH ELECTRODE HOLDER



Flow through inline unit for measurement of e.g. pH, ORP, or reference potential.

- Fits a wide range of electrode diameters (3–18 mm)
- Compatible with our Luggin capillary electrolyser cell for precise reference potential measurement
- Durable, chemically resistant construction

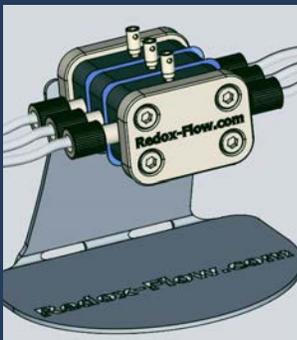
## UV/VIS FIBER OPTICAL FLOW CELL



UV/VIS Optical flow-cell with a variable optical path length connects with standard fiber based spectrometers using SMA 905 connectors.

- Adjustable optical path length (0.05–8 mm) for maximum flexibility
- Supports high flow rates (>100 ml/min) with minimal pressure loss from unique design with hydraulic bypass

## OPEN CIRCUIT VOLTAGE CELL



Flexible and chemically resistant OCV cell that can be readily integrated into your measurement setup.

- Integrated reference cell for accurate anode/cathode potential measurement
- Multifunctional design for OCV and overpotential studies
- Easy integration into existing setups with internal reference electrolyte chamber
- Durable graphite flow bodies ensure chemical resistance and stability

# Application Areas

The X-Stack supports a broad range of electrochemical processes, including:

- Alkaline water electrolysis
- PEM and AEM water electrolysis
- CO<sub>2</sub> electrolysis and electrochemical reduction
- Electrochemical metal recovery and refining
- Desalination and ion removal
- Organic electrosynthesis and non-aqueous systems
- Redox flow battery testing
- General-purpose electrochemical flow testing

## Technical Specifications

Active Area: 25 cm<sup>2</sup> (5 cm x 5 cm)

Bipolar plates: Standard materials for current collectors: nickel, stainless steel, titanium, copper, platinum-coated titanium, gold-coated titanium

Electrode thicknesses  $\geq$  0.1 mm

Flow body made of PEEK or PTFE

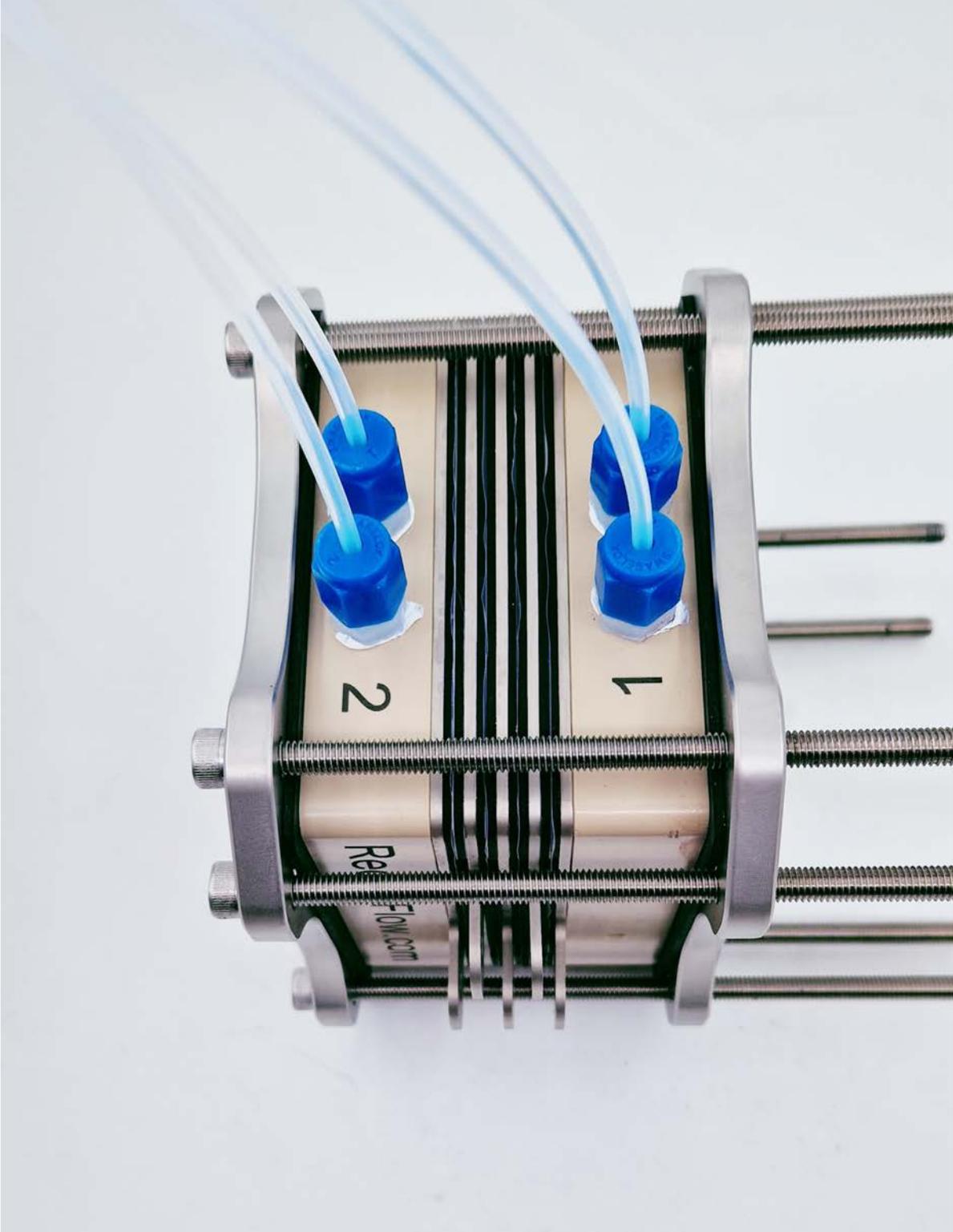
With or without flow field area

Stainless steel end plates

Swagelok fittings for tight connection to 1/4" tubing

Comes ready-to-use as on pictures but without membranes and electrodes

*We accommodate custom requests for active area sizes, materials for current collectors, and tubing dimension. For this, submit a request on [www.redox-flow.com](http://www.redox-flow.com).*





Got any questions?  
Feel free to contact us!



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