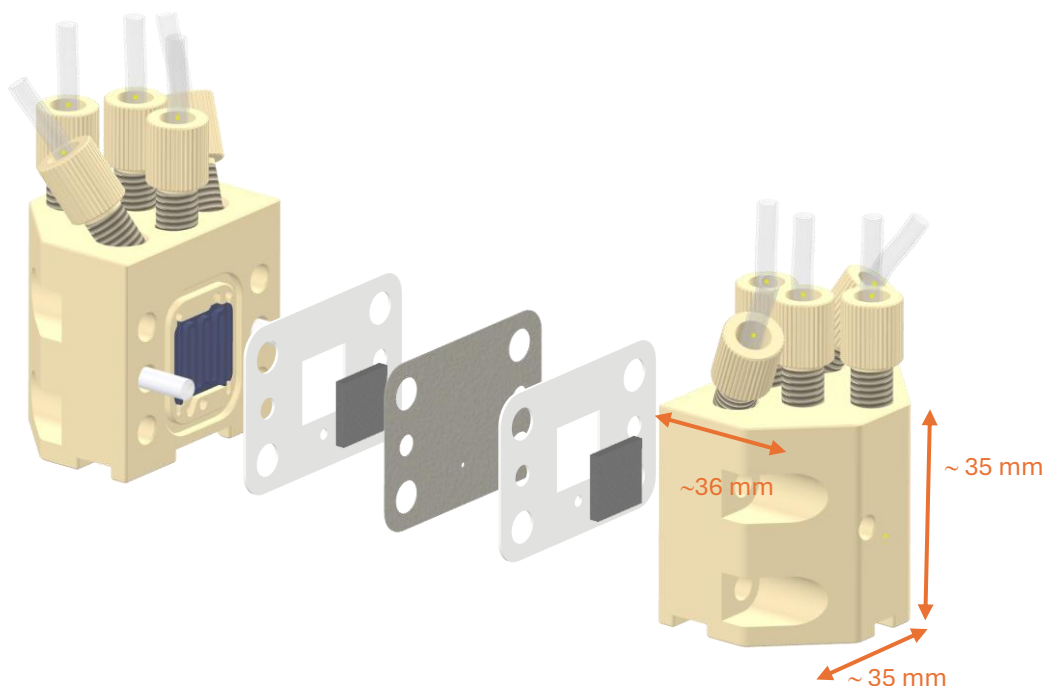


M-cell : 1 cm² Multipurpose electrochemical cell

-Overview & assembly manual



Version date	March 10, 2026
Manual version	1.0 - visit www.redox-flow.com for updated versions and spare parts
Notes	This equipment is intended for research purposes only and can be applied for different purposes. There is no guarantee on performance, corrosion or lifetime of the equipment. See https://redox-flow.com/termsandconditions/ for more information.

Overall operation principles

General description

The M-Cell is a unique multipurpose electrochemical cell with a 1 cm² active area designed for a wide range of electrochemical research and development applications. Its versatility allows it to be used for many different systems, including flow batteries, water electrolysis (AWE, AEM, PEM), electrodialysis, CO₂ reduction, and conventional half-cell measurements such as cyclic voltammetry. The specific application is primarily determined by the exchangeable current collectors, which are available as standard in graphite, nickel, titanium, and stainless steel (other materials are available on request). This modular design allows the cell to be adapted to a wide range of electrochemical environments and electrode materials.

Reference electrodes

Another key feature of the M-Cell is the possibility of implementing multiple reference electrode configurations. All configurations are based on Luggin capillary-type arrangements, allowing the reference electrode to be positioned outside the cell while guiding the measurement point to defined locations inside the cell. The Luggin capillary system allows reference electrode positioning with spatial precision better than approximately 0.2 mm, enabling highly reproducible electrode potential measurements. This is particularly important when studying electrode overpotentials and other localized electrochemical phenomena.

Supporting products

The M-Cell has been co-developed together with the *Multiport Electrolyte Reservoir*, which enables operation in e.g. a flushable and/or sealed oxygen-free or CO₂ filled environment, while also allowing temperature control, sampling, and flexible electrolyte management. Depending on the electrolyte and materials used, the system can typically be operated at temperatures of up to at least 95 °C.

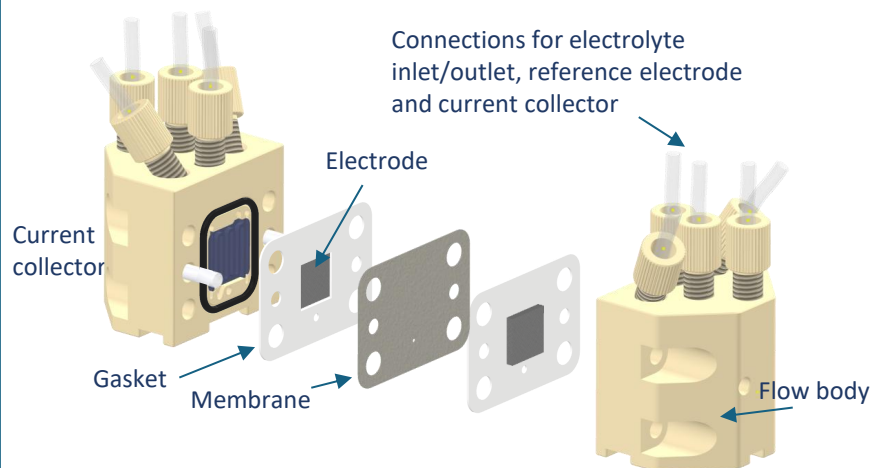
Chemical compatibility

To ensure chemical compatibility and minimize contamination from corrosion or dissolution, all non-active components of the cell are manufactured from corrosion-resistant polymers, including PEEK, PTFE, EPDM, and VITON. Detailed descriptions of cell assembly, operating configurations, and application examples are provided in the remaining sections of this manual.

Operation principles

The M-cell can be assembled in three fundamental operation modes (1,2 and 3) and are described below and on next page

1. Closed cell operation



1. Closed cell operation - This is the standard configuration, similar to conventional electrochemical flow cells. The electrodes are separated by a membrane or separator, and electrolyte is circulated through each half-cell. Reference electrode measurements can be done in several ways. Measurement points or areas are guided by channel in the cell and gaskets.

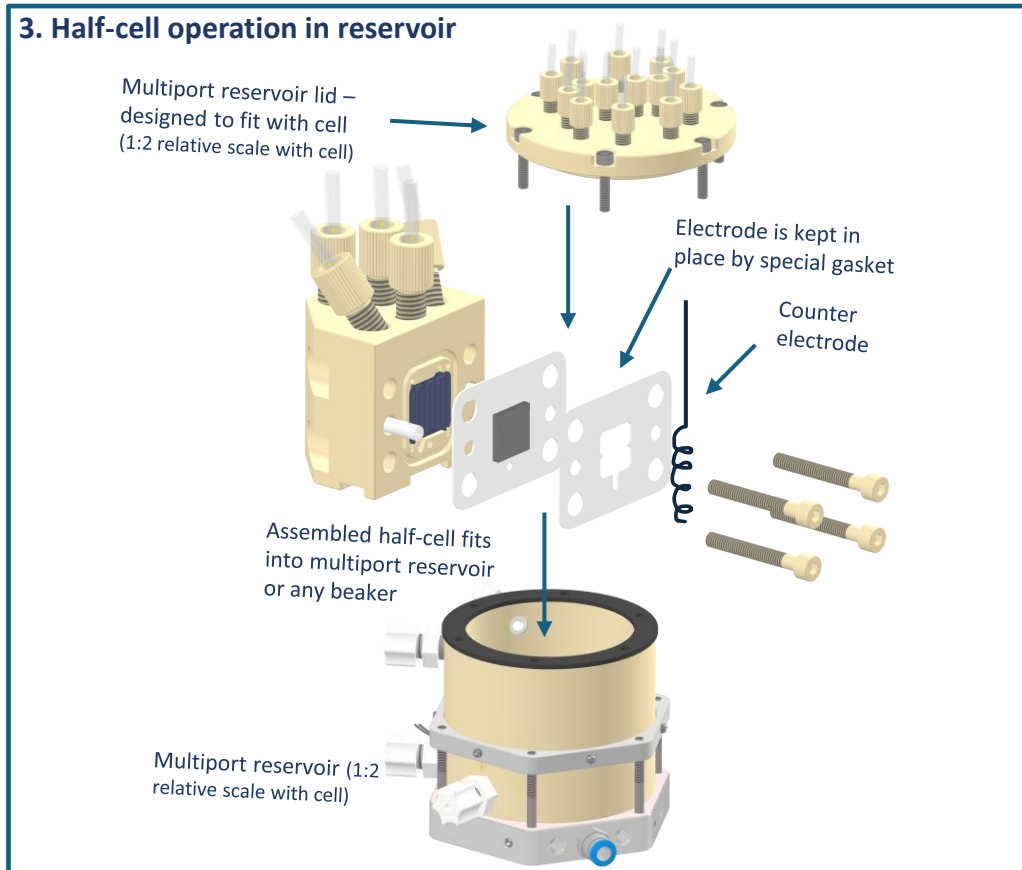
Overall operation principles

2. Open cell operation in reservoir



2. Open cell operation – In this configuration, the cell is immersed in a common electrolyte reservoir, and the electrolyte is circulated through an open gasket between the electrodes. This mode of operation is particularly suitable for applications such as water electrolysis and is performed without a membrane or separator to probe electrode performance only. NOTE: Configuration is similar to normal half-cell operation.

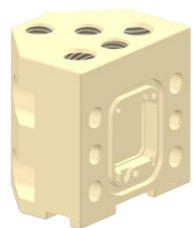
3. Half-cell operation in reservoir



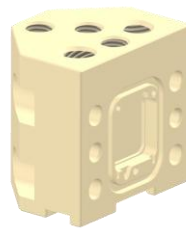
3. Half-cell operation – This configuration is similar to a standard 3-electrode electrochemical setup. Here the electrode in the flow cell is the working electrode and the counter electrode is any material of choice. A key unique feature of this setup compared to normal 3-electrode setups, is (i) the very accurate determination of the reference electrode measurement point (< 0.2 mm) (ii) robust geometry that ensures that working, counter and reference electrode is always in the same geometry and makes measurements reproducible (iii) The possibility to create flow inside the working electrode which enables advanced studies of electrochemical kinetics similar to that of rotating disk electrodes without many of its limitations.

Overview of components

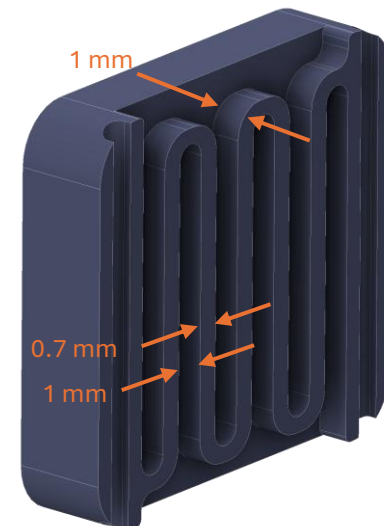
Gasket variations – comes in variable thicknesses and materials (PTFE, EPDM, VITON) – see www.redox-flow.com for available variants



Flow body without threads



Flow body with threads



Current collector (picture not in scale with other components) in different materials – standard materials are Graphite, Ti, Ni and 316 L – for other materials make inquiry (www.redox-flow.com)



Small o-ring (VITON or EPDM)



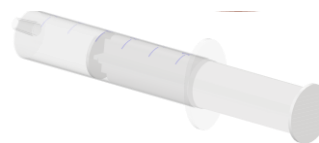
Large o-ring (VITON or EPDM)



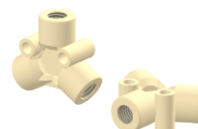
20 mm alignment bar (1/8" OD tube)



M4 PEEK bolts



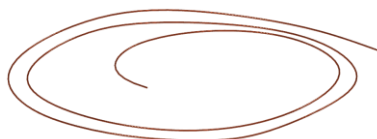
Syringe



Y connectors for tubes



Hand tool for small PEEK fittings



Wire \varnothing 0.7mm in Ti, 316L, Ni (as standard materials)



1/8" OD PTFE tube



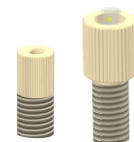
1/16" OD PTFE tube



Tweezer



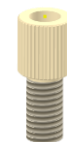
Wire quick connectors



Small & large PEEK fittings



1/8" ferrules for PEEK fittings



PEEK plug (with out hole)

General assembly

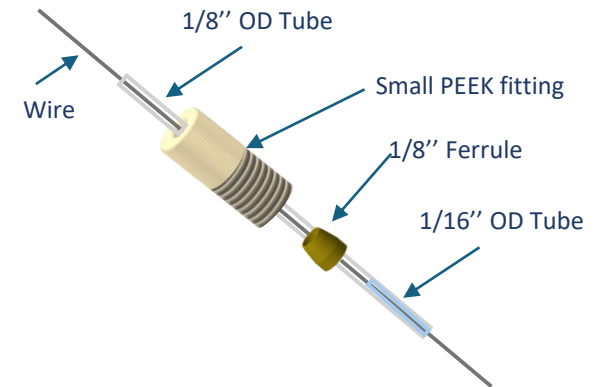
1. Cut Wire ($\phi 0.7$ mm) in a selected material (typically Ni, Ti or 316L) > 10cm

2. Cut 1/8" OD Tube - about 5 cm shorter than wire

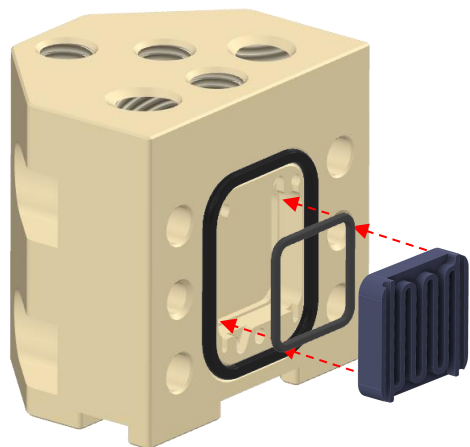
3. Cut 1/16" OD Tube ~ 1cm

4. Insert 1/16" tube into the end of the 1/8" tube

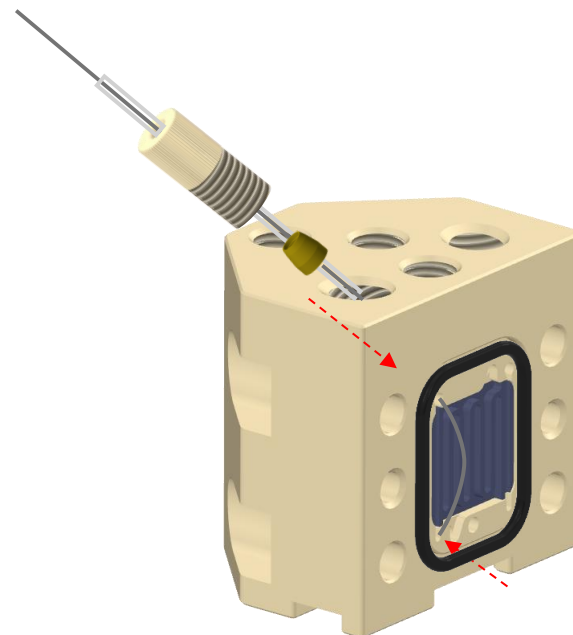
5. Insert wire into the combined 1/16" and 1/8" tube



6. Mount small PEEK fitting and 1/8" Ferrule.
NOTE: The short 1 cm 1/16 OD tube at the end of the 1/8" tube now functions as a sleeve that ensures a leak free electrical connection when the ferrule is compressed around the assembly
NOTE: Two wire assemblies are needed for each half-cell.

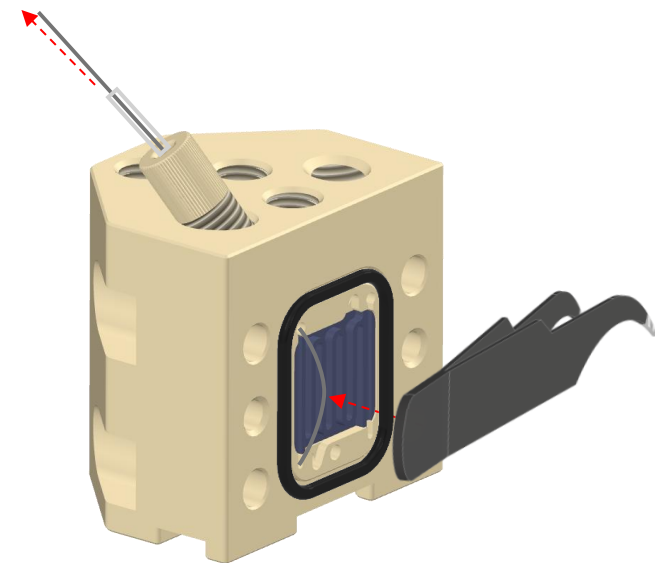


- 1. Small o-ring is inserted into the flow body.**
NOTE: It has to fit into the thin groove that runs along the edges of the inside of the square area.
- 2. Large O-ring is inserted**
NOTE: The large O-ring is only used for the *closed cell operation*. For *open cell* and *half-cell* operation it is left out. It is left out to prevent gasket deformation.
- 3. Current collector is inserted**

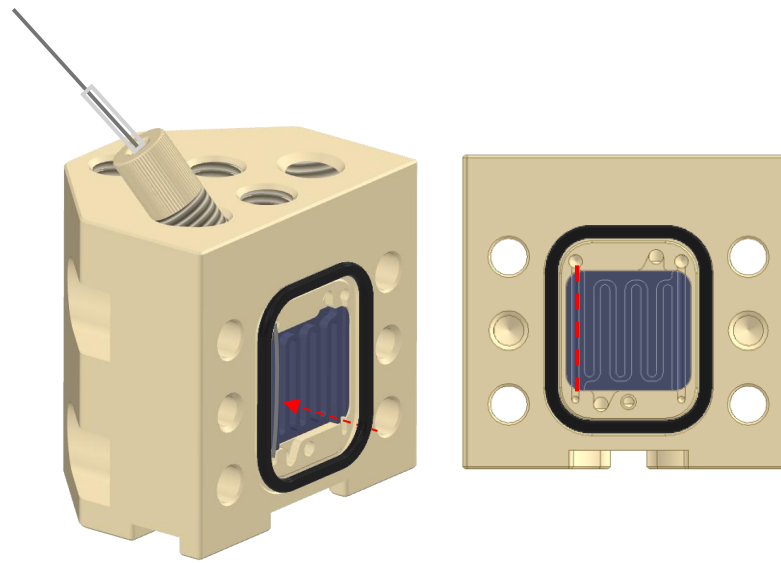


- 4. Wire is inserted through the port from the top and inserted into the hole at the bottom (~2 mm deep).**
NOTE: Ensure that the wire is elevated 2-4 mm from the current collector in a smooth round arc.
- 5. Fitting with wire and ferrule is screwed slightly into flow body**
IMPORTANT: Do not tighten, only turn it a few times until it stays in the thread

General assembly

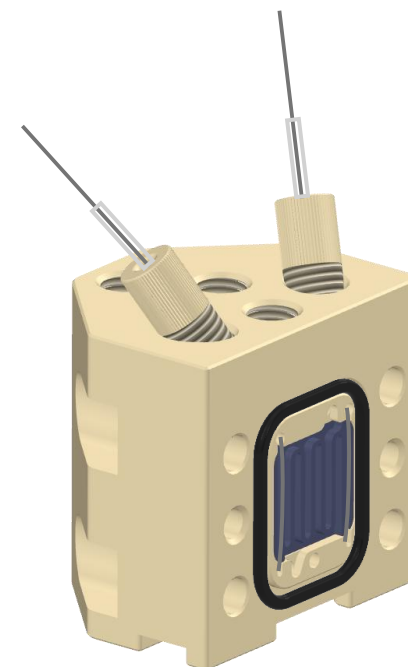


1. With a flat tool (e.g. flat side of the tweezers) push the wire into the current collector. Excess wire will be pushed out of the cell



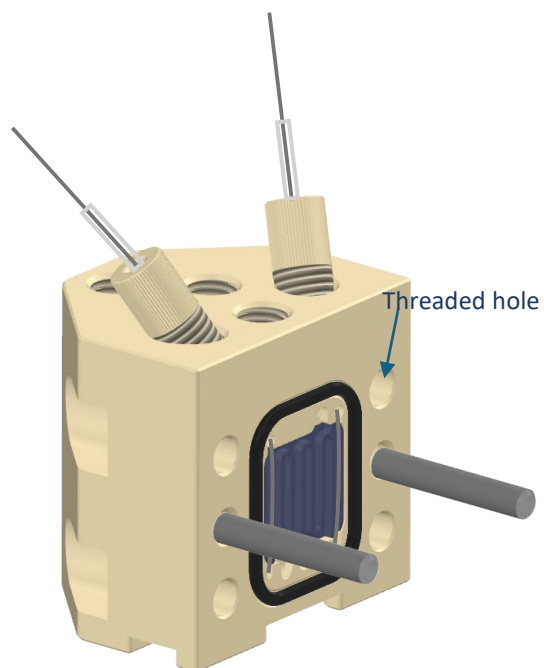
2. Figure above shows the end-result, where the wire is pushed smoothly into the groove (indicated by red dotted line to the right)

3. Make a final tightening of the fitting
NOTE: Do not overtighten

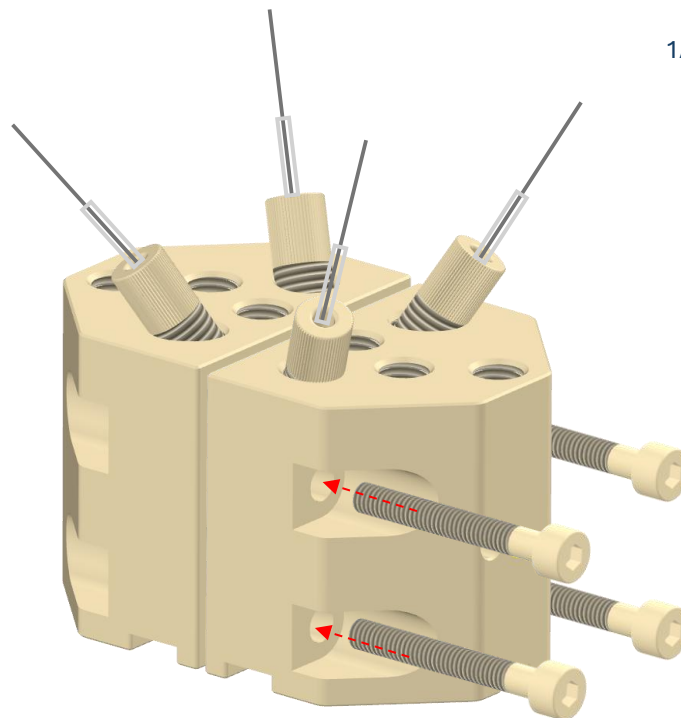


4. Repeat the previous steps to insert the second wire. The final result is displayed in figure above. The assembly should now be robust with wires and current collector not being loose.

General assembly



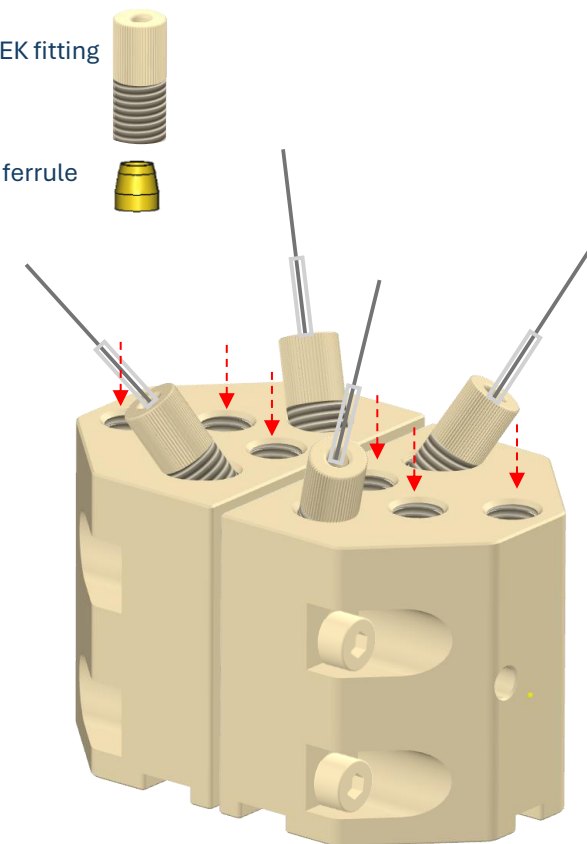
1. Insert alignment bars in flow body with threaded holes.
2. Cell is now ready for assembly – see detailed information about use of different gaskets in the following section



3. After assembly of electrodes and gaskets, the final assembly of the cell is made, by inserting the PEEK bolts
4. Cell is cross-tightened by hand. Stop tightening when torque increases.
5. Control integrity of cross-tightening by measuring distance between flow bodies with caliber. Variation in distance between all corners should be within ± 0.1 mm

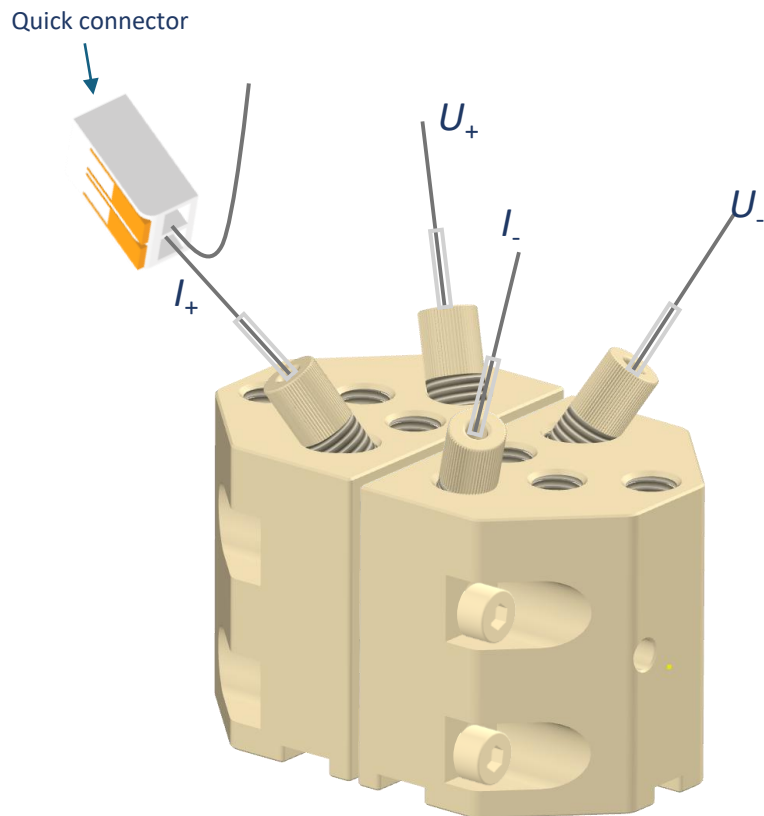
Small PEEK fitting

1/8" ferrule



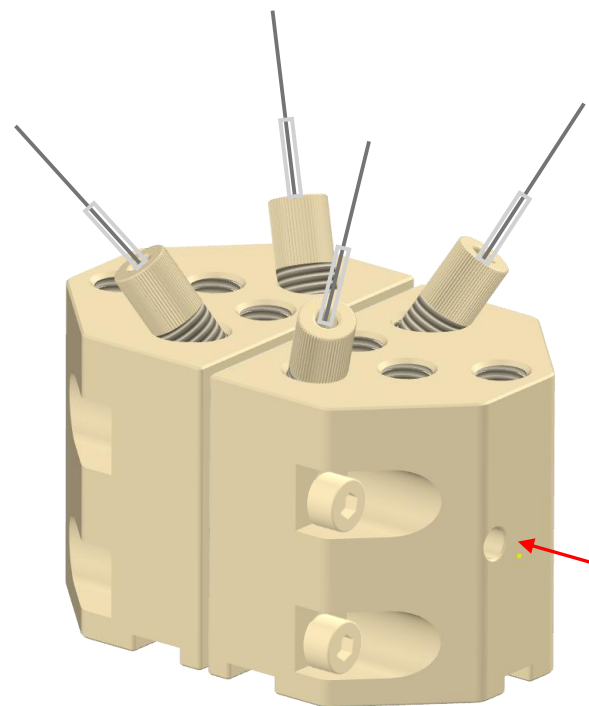
6. Connect the rest of the tubes and close holes that are not used with PEEK plugs.

Electrical connections



1. Always use 4-wire configurations as shown in the figure above
2. It is recommended to use quick connectors to connect current and sense wires to power source. The quick connectors ensures fast and robust connections.

Temperature sensor



3. $\varnothing 3.4$ mm hole on back can be used for inserting thermometers

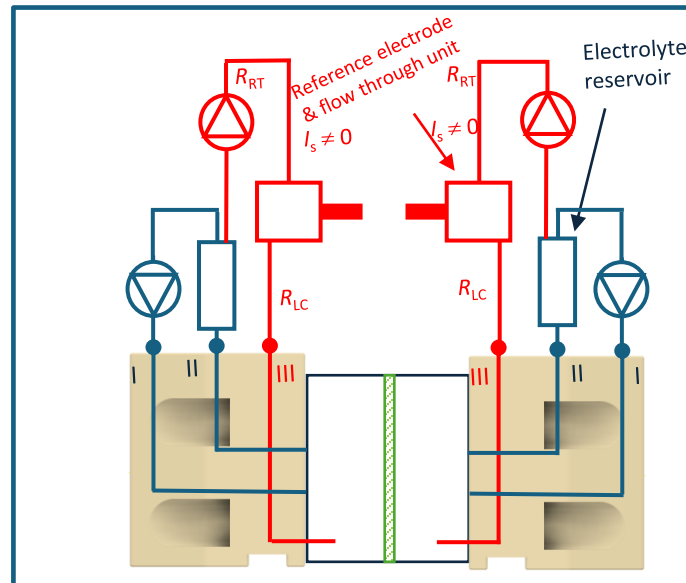
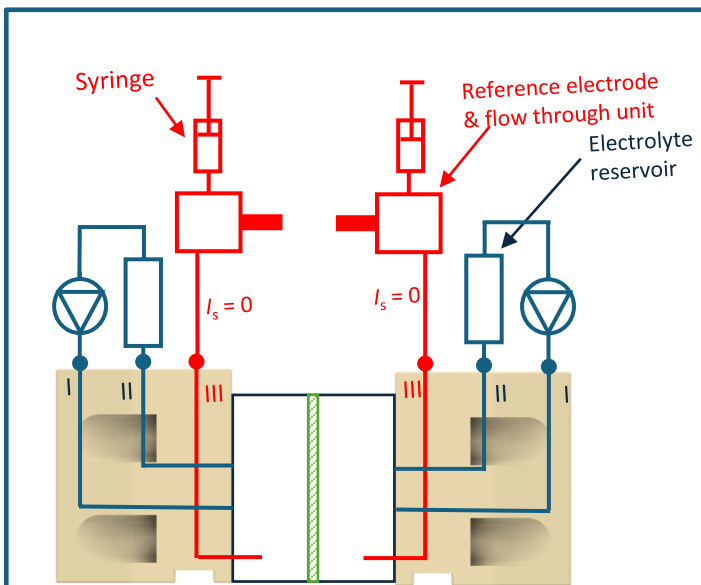
Overview of assembly configurations

The table shows an overview of the general cell assembly possibilities and typical applications. For the configurations (A, B, C) a detailed description of the assembly, gasket types and reference electrode configurations are described in the following pages.

Overall operation principle	Configuration	Typical applications
Closed cell operation	A: Closed cell without reference electrodes	<ul style="list-style-type: none"> • Flow batteries • Electrolysis • CO₂ reduction
	B: Closed cell with individual anode & cathode reference electrodes	<ul style="list-style-type: none"> • Electrolysis • CO₂ reduction • Flow batteries
	C: Closed cell with reference electrode on membrane	<ul style="list-style-type: none"> • Electrolysis • CO₂ reduction
Open cell operation	D: Open cell without reference electrodes	<ul style="list-style-type: none"> • Electrolysis • CO₂ reduction
	E: Open cell with individual anode & cathode reference electrodes	<ul style="list-style-type: none"> • Electrolysis • CO₂ reduction
	F: Open cell with one common reference electrode	<ul style="list-style-type: none"> • Electrolysis • CO₂ reduction
Half cell operation	G: Half-cell operation with reference electrode	<ul style="list-style-type: none"> • Cyclic voltammetry • Half-cell battery testing • Half-cell electrolyser testing • Half-cell CO₂ reduction
Specialized reference electrode configurations	H: Specialized reference electrode configurations	
Three-compartment operation	I: Three-compartment operation	<ul style="list-style-type: none"> • CO₂ reduction • Electrodialysis

General considerations on reference electrodes measurements

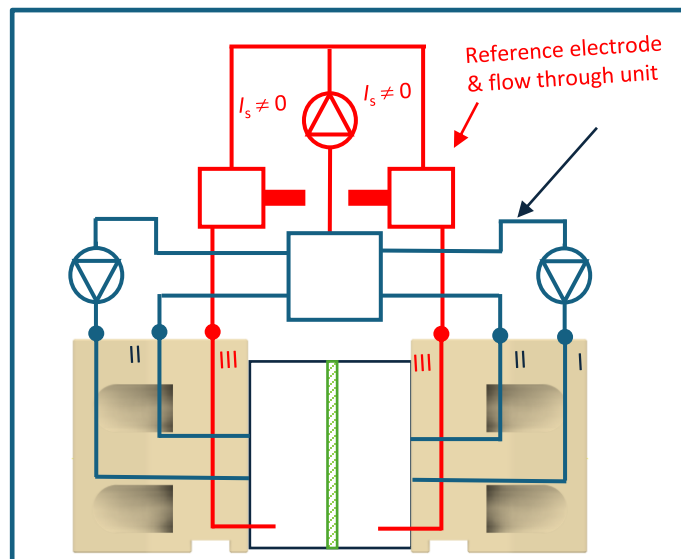
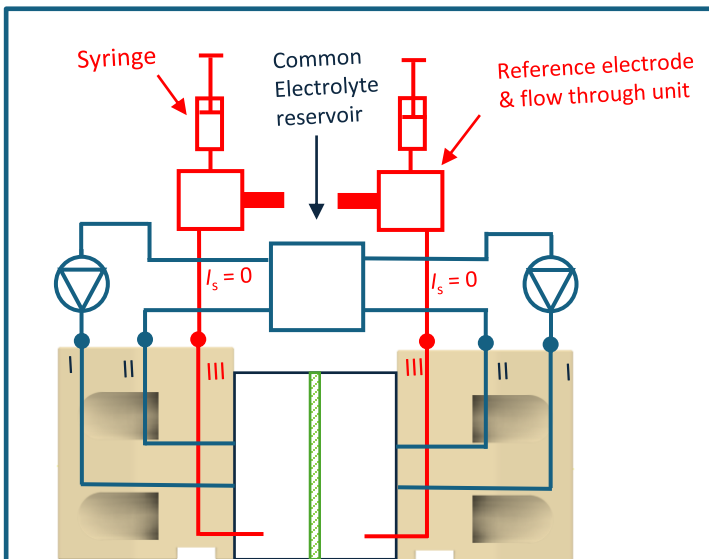
1. Dead-end operation - no shunt currents



2. Pump operation – possible shunt currents

See description of illustrations on next page

3. Dead-end operation - no shunt currents



4. Pump operation – possible shunt currents

General considerations on reference electrodes measurements

Scope

The general considerations for reference electrode measurements in the 1 cm² cell are primarily focused on electrolysis and other non-reversible electrochemical systems, where the main objective is to determine anode and cathode overpotentials.

For reversible systems, such as flow batteries, reference electrodes are typically used to measure both electrode overpotentials and liquid potentials. For such applications, it is recommended to place the reference electrodes in-line in the main hydraulic circuits and is not in scope here. Further details can be found in the white paper *Measurement of Overpotentials and Liquid Potentials in Flow Batteries* available at www.redox-flow.com.

Reference electrode circuits

Figures 1–4 (on preceding page) show four configurations consisting of a main hydraulic circuit (blue) and reference electrode circuits (red). In all configurations, Luggin capillary-type arrangements are used, where the reference electrode is placed outside the cell and mounted in a flow-through reference electrode holder (red square). The reference electrode measurement point is guided through channels in the gaskets (Luggin capillaries) to defined points or areas inside the cell.

Reference electrode measurements with dead ends (syringe)

Figures 1 and 3 show configurations where the reference electrode circuit is filled with electrolyte using a syringe, creating a dead-end circuit.

In Case 1, two separate electrolyte reservoirs are used, while Case 3 uses a common reservoir. Because the circuit is a dead end, no shunt currents (I_s) can occur and no mitigation is required.

However, the long-term stability of this configuration is lower. Depending on operating conditions (current, temperature, electrolyte composition, electrode type, etc.), gas bubbles from electrolysis may enter the reference electrode circuit, which can introduce noise or disrupt the measurement.

Reference electrode circuits with flowing electrolyte (pump)

To prevent bubble accumulation, electrolyte may instead be continuously pumped from the reservoir through the reference electrode holder and into the measurement point inside the cell.

In Case 2, two separate reservoirs are used, while Case 4 uses a common reservoir. In these configurations, the potential at the reservoir and at the measurement point generally differs. As a result, shunt currents (I_s) may flow through the reference electrode circuit and influence the measured potential.

The effect is typically smaller in Case 2 (separate reservoirs) than in Case 4 (common reservoir). The influence can be minimized by ensuring that the electrolyte resistance between the reservoir and the reference electrode (R_{RT}) is much larger than the resistance between the reference electrode and the measurement point (Luggin capillary, R_{LC}).

For example, this can be achieved using:

-2 m tubing (1/16" OD / 1/32" ID) between reservoir and reference electrode

-20 cm tubing (1/8" OD / 1/16" ID) as the Luggin capillary

In this case, $R_{RT}/R_{LC} \approx 40$.

In most systems, the potential difference between the measurement point and reservoir is <100 mV, resulting in a shunt-current error of approximately:

$$100 \text{ mV} \times \frac{1}{40} \approx 2.5 \text{ mV}$$

In extreme cases (especially with a common reservoir), the potential difference may exceed 500 mV, resulting in errors above 12.5 mV, which may be too high.

The shunt current effect can be easily verified during electrolysis. Operate the cell at constant current for approximately 1 minute with the reference circuit connected to the reservoir ($I_s \neq 0$). Then disconnect the tube from the reservoir or close it with a clamp for about 1 minute ($I_s = 0$). The shunt-current effect will appear immediately as a change in the reference electrode potential.

Flow rate considerations

When operating the reference electrode circuit with a pump, the flow rate should remain low, typically 0.5–2 mL min⁻¹. At these flow rates the pressure drop in the long 1/16" tubing is small, and heating of the reference electrode is avoided when the reservoir or cell operates at elevated temperatures.

Pump options

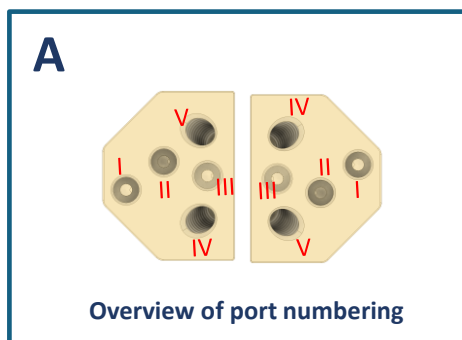
Flow in the reference electrode circuit can be provided either by a separate pump or by using a multi-head peristaltic pump. In the latter case, larger tubing (higher flow) can be used for the main circuits, while smaller tubing (lower flow) can be used for the reference electrode circuit.

For further information on suitable configurations, please contact www.redox-flow.com.

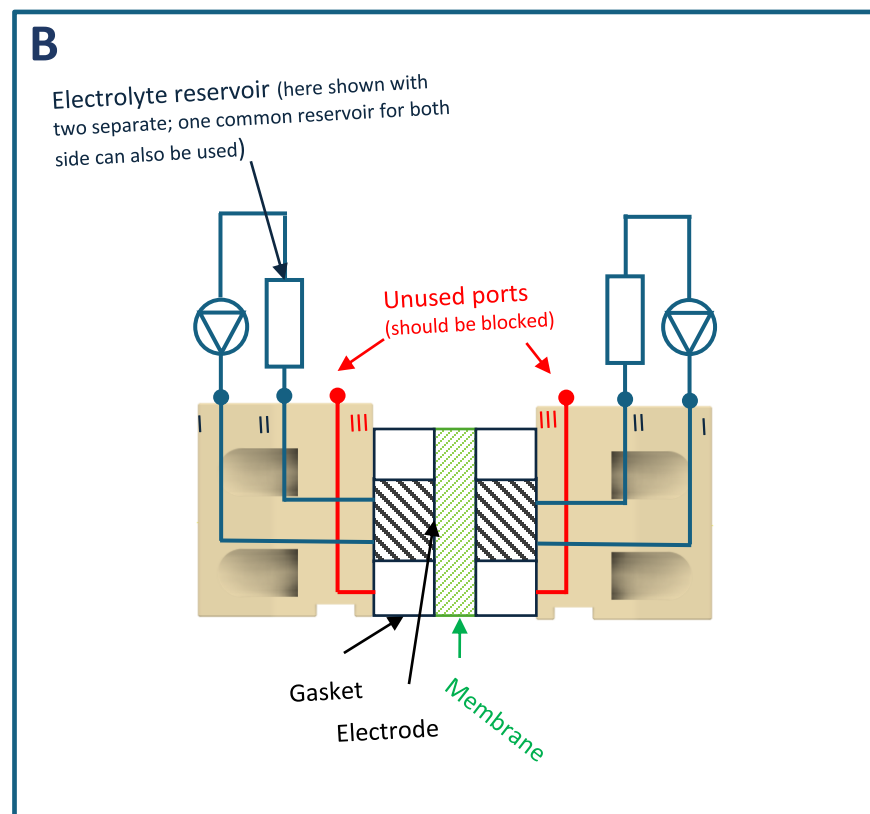
Configuration A: Closed cell without reference electrodes

Hydraulic circuits

General: Figure A shows the port numbering of the 1 cm² cell. Ports V and IV are used for electrical current and voltage connections on each side of the cell. Ports I and II are used for the main electrolyte flow through each half-cell (blue circuit). Port III in this configuration is not used and should be sealed off with a plug.



In general, liquid should be pumped from the reservoir (either separate or common) into the cell through port I and returned to the reservoir through port II.



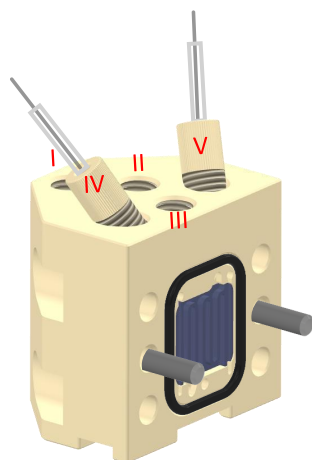
Configuration A: Closed cell without reference electrodes

Assembly

1. Gasket (G1) is mounted.

NOTE: (i) Multiple gaskets of this type may be stacked. Together they define the final compressed thickness of the electrode.

(ii) Optimal compression depends on the electrode material and application. To ensure good electrical contact between electrode and current collector compression must be $> 0\%$.

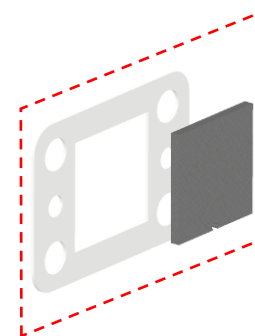


2. Electrode is mounted.

3.I. Dense membrane is mounted

NOTE: Only follow this step if dense membranes are used.

OR



3.II. (i) Porous separator gasket (G2) is mounted.

(ii) Porous separator is inserted

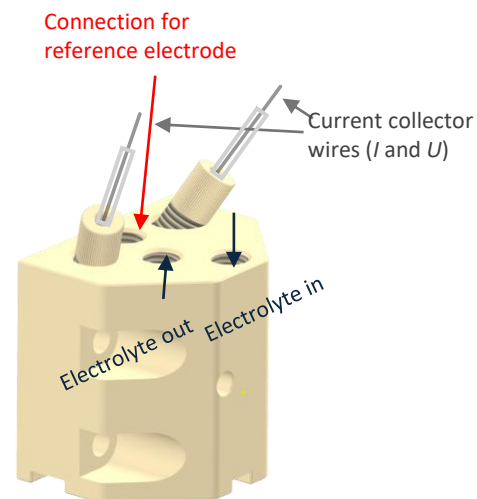
NOTE: To prevent internal leaks, the gasket must be 0.05 mm to 0.1 mm thinner than the separator.

NOTE: Only follow this step if porous separators are used. The separator gasket prevents external leakage.

4. Gasket (G1) is mounted.

NOTE: As in step 1, several gaskets of this type can be combined.

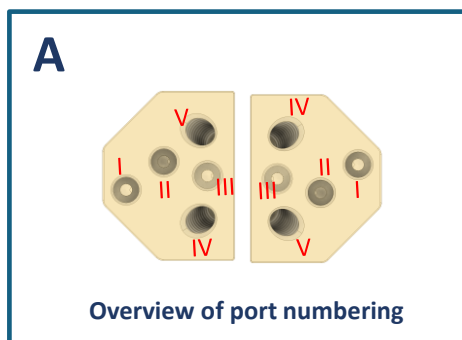
5. Electrode is mounted.



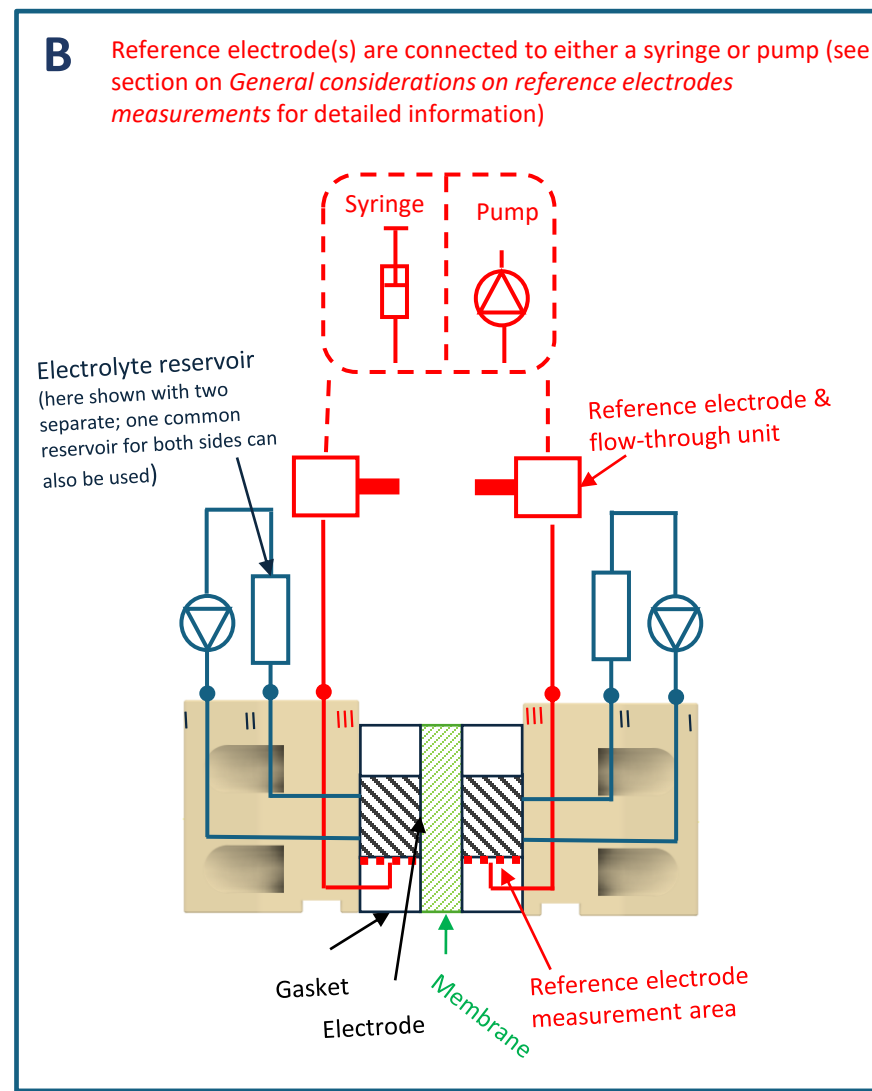
Configuration B: Closed cell with individual anode & cathode reference electrodes

Hydraulic circuits

General: Figure A shows the port numbering of the 1 cm² cell. Ports V and IV are used for electrical current and voltage connections on each side of the cell. Ports I and II are used for the main electrolyte flow through each half-cell (blue circuit). Port III is used for the (red) reference electrode circuit(s).



In general, liquid should be pumped from the reservoir (either separate or common) into the cell through port I and returned to the reservoir through port II. The reference electrode measurement area inside the cell is indicated by the red dotted lines at the bottom of the electrodes. The measured potential corresponds to the average through-plane potential of the electrode in this region. The exact measurement area is defined by the gasket configuration used.



Configuration B: Closed cell with individual anode & cathode reference electrodes

Assembly

1. Gasket (G3) is mounted.

NOTE: (i) Multiple gaskets of this type may be stacked. Together they define the final compressed thickness of the electrode.

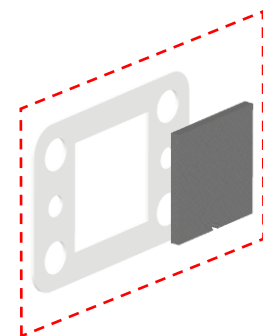
(ii) Optimal compression depends on the electrode material and application. To ensure good electrical contact between electrode and current collector compression must be $> 0\%$.

2. Electrode is mounted.

3.I. Dense membrane is mounted

NOTE: Only follow this step if dense membranes are used.

OR



3.II. (i) Porous separator gasket (G2) is mounted.

(ii) Porous separator is inserted

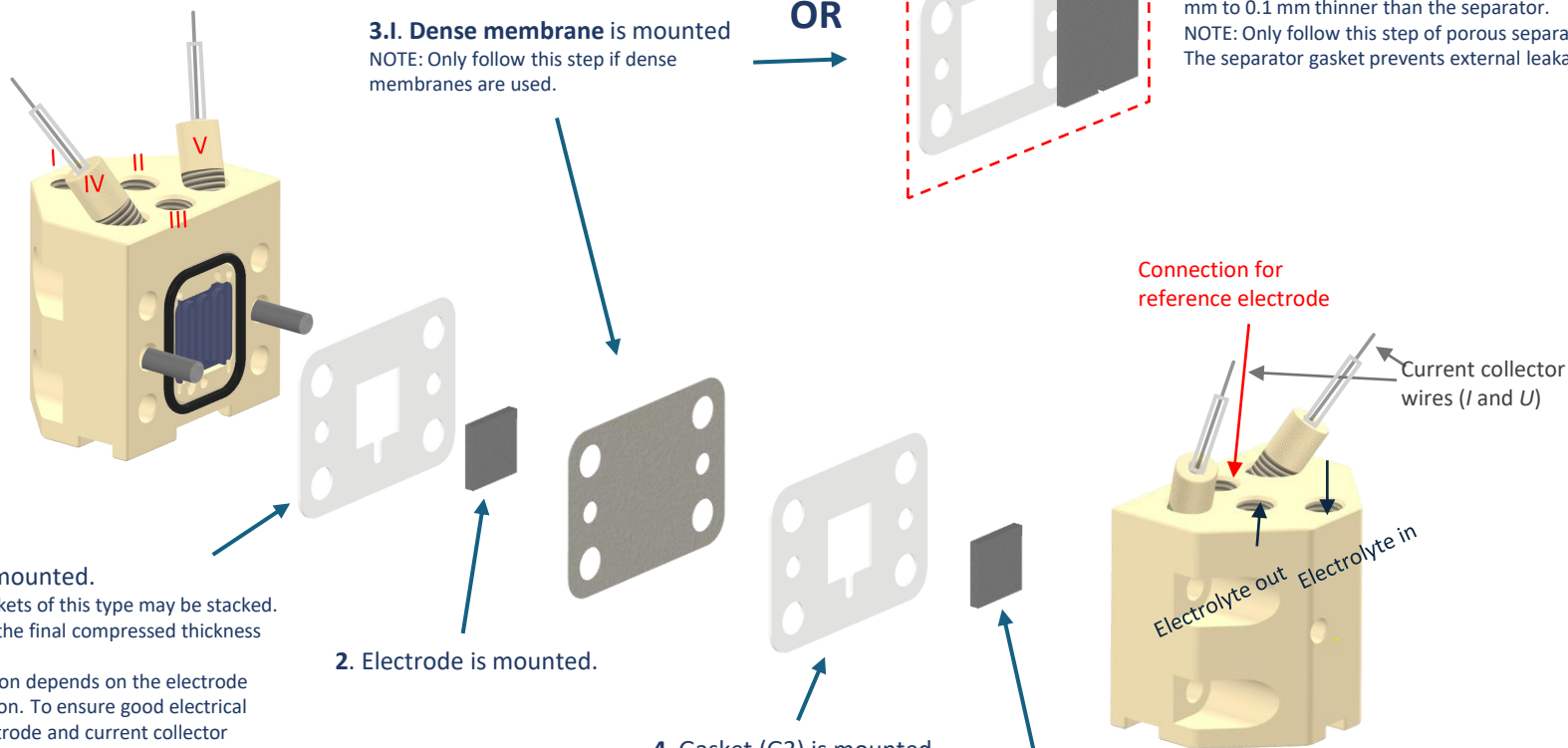
NOTE: To prevent internal leaks, the gasket must be 0.05 mm to 0.1 mm thinner than the separator.

NOTE: Only follow this step of porous separator are used. The separator gasket prevents external leakage.

4. Gasket (G3) is mounted.

NOTE: As in step 1, several gaskets of this type can be combined.

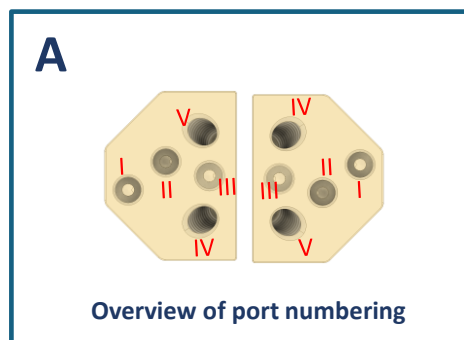
5. Electrode is mounted.



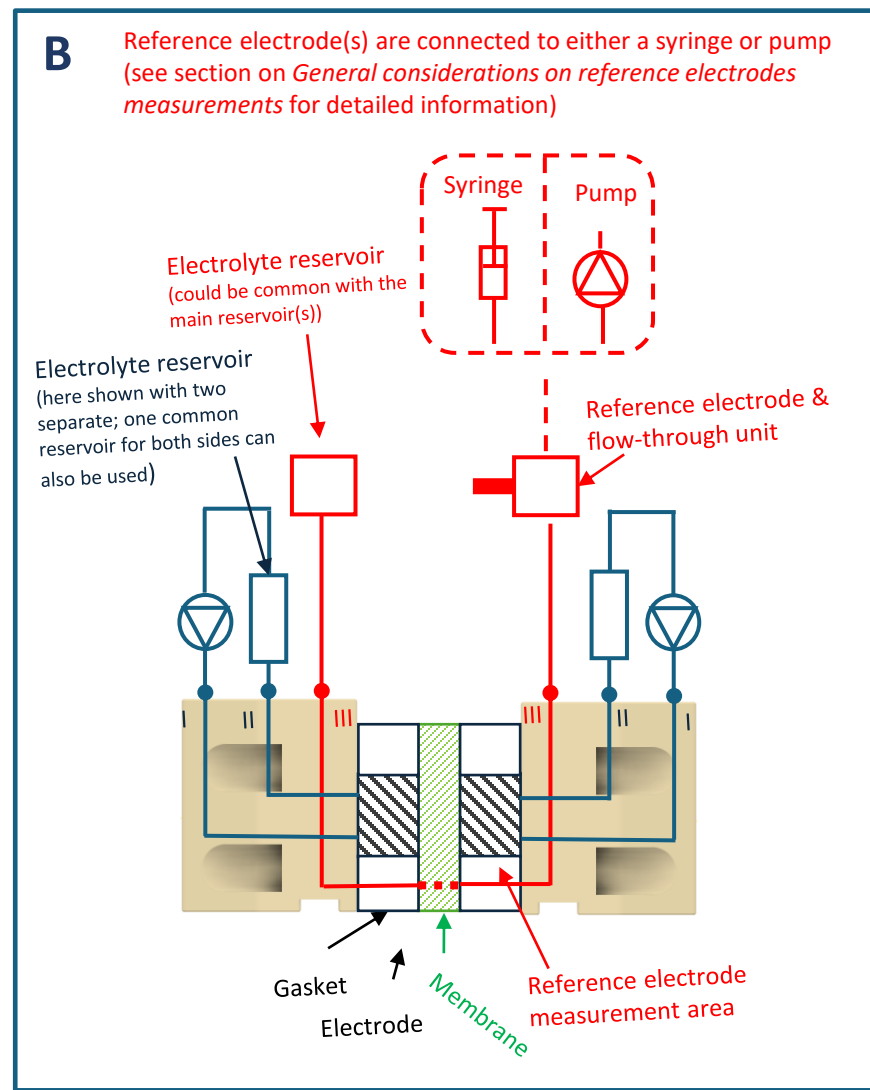
Configuration C: Closed cell with reference electrode on membrane

Hydraulic circuits

General: Figure A shows the port numbering of the 1 cm² cell. Ports V and IV are used for electrical current and voltage connections on each side of the cell. Ports I and II are used for the main electrolyte flow through each half-cell (blue circuit). Ports III are used for the (red) reference electrode circuit(s).



In general, liquid should be pumped from the reservoir (either separate or common) into the cell through port I and returned to the reservoir through port II. The reference electrode measurement area inside the cell is indicated by the red dotted lines through the membrane/separator. The measured potential corresponds to an average through-plane potential of the membrane/separator in this region. The exact measurement area is defined by the gasket configuration used. In this configuration, the reference electrode can be used for both the anode and cathode at the same time, however, there will be voltage contribution from the voltage drop through the membrane/separator. The magnitude and distribution between anode/cathode can be measured by high frequency EIS.



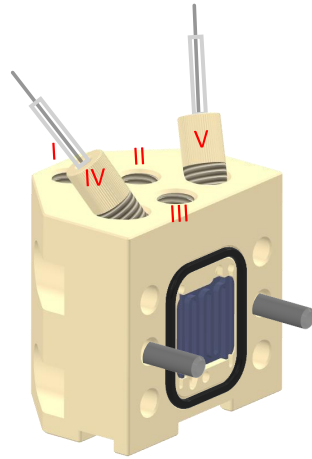
Configuration C: Closed cell with reference electrode on membrane

Assembly

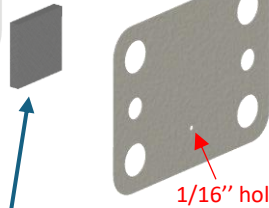
1. Gasket (DD) is mounted.

NOTE: (i) Multiple gaskets of this type may be stacked. Together they define the final compressed thickness of the electrode.

(ii) Optimal compression depends on the electrode material and application. To ensure good electrical contact between electrode and current collector compression must be > 0 %.



2. Electrode is mounted.

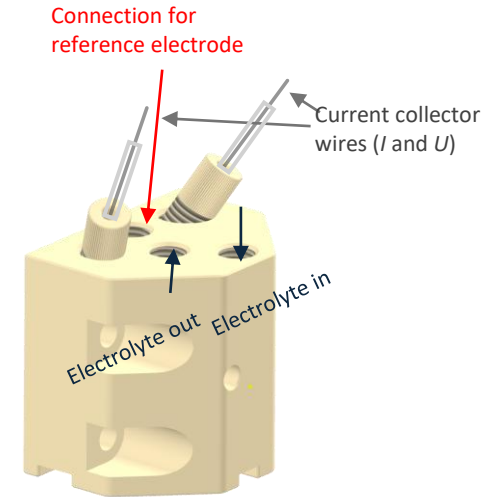


4. Gasket (G4) is mounted.

NOTE: As in step 1, several gaskets of this type can be combined.



5. Electrode is mounted.

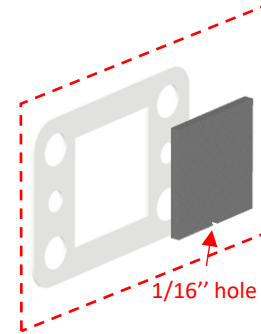


3.I. Dense membrane is mounted

NOTE: Only follow this step if dense membranes are used.

NOTE: A small hole (1/16") should be made in the membrane at the same spot as in the preceding gasket. This hole enables the circuit for the reference electrode measurement.

OR



3.II. (i) Porous separator gasket (G2) is mounted.

(ii) Porous separator is inserted
NOTE: To prevent internal leaks, the gasket must be 0.05 mm to 0.1 mm thinner than the separator.

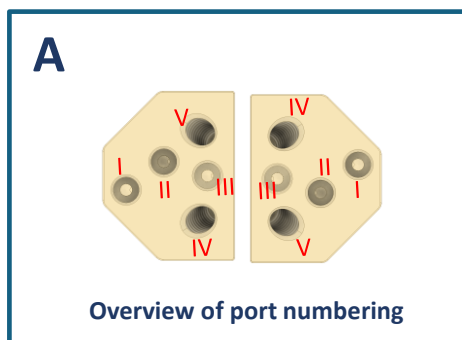
NOTE: Only follow this step of porous separator are used. The separator gasket prevents external leakage.

NOTE: A small hole (1/16") should be made in the membrane at the same spot as in the preceding gasket. This hole enables the circuit for the reference electrode measurement.

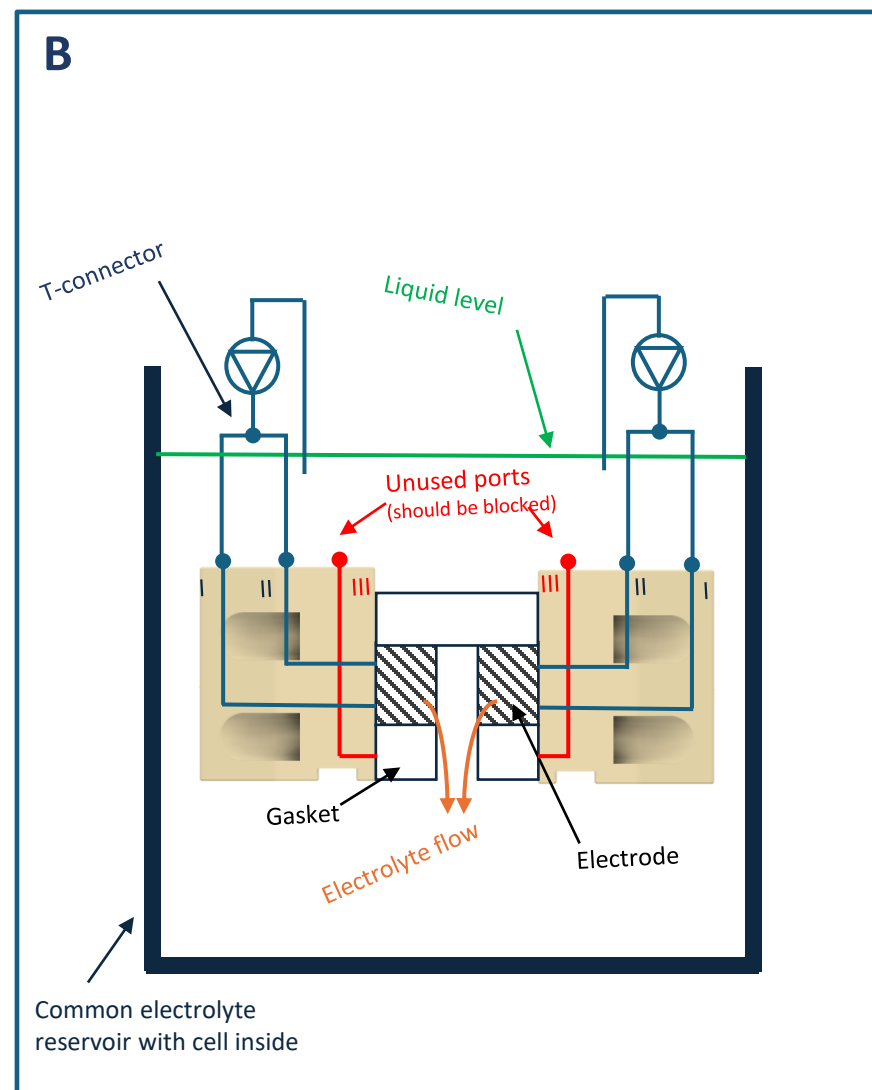
Configuration D: Open cell without reference electrodes

Hydraulic circuits

General: Figure A shows the port numbering of the 1 cm² cell. Ports V and IV are used for electrical current and voltage connections on each side of the cell. Ports I and II are used for the main electrolyte flow through each half-cell (blue circuit). Port III is in this configuration not used and should be sealed off with a plug.



In general, liquid should be pumped from the reservoir (either separate or common) into the cell through port I and returned to the reservoir through port II.



Configuration D: Open cell without reference electrodes

Assembly

3. Spacer gasket (G5) is mounted. NOTE: Function is to create a space between electrode and allow flow out in between the electrode.

NOTE: The indents in corners and sides are to keep the electrode in place

NOTE: Multiple gaskets of this type may be stacked, but for thickness below 0.25mm – 0.5 mm there is an increasing risk for a short circuit between the electrodes

NOTE: Gasket can also be rotated 180° to have the electrolyte outlet at the top OR combine two gaskets with outlets towards both the bottom and top.

1. Gasket (G1) is mounted.

NOTE: (i) Multiple gaskets of this type may be stacked. Together they define the final compressed thickness of the electrode.

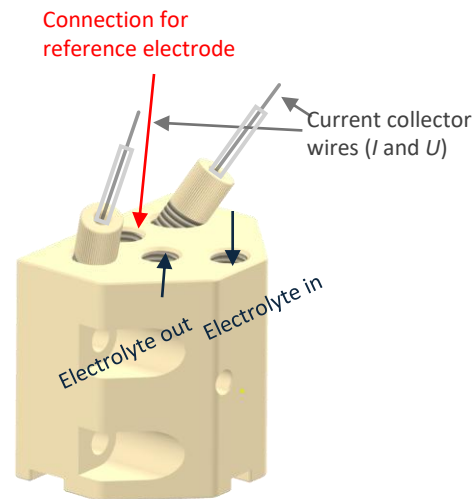
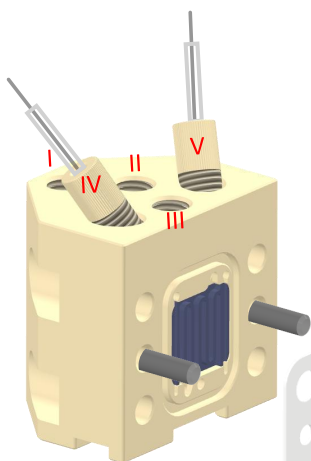
(ii) Optimal compression depends on the electrode material and application. To ensure good electrical contact between electrode and current collector compression must be > 0 %.

2. Electrode is mounted.

4. Gasket (G1) is mounted.

NOTE: As in step 1, several gaskets of this type can be combined.

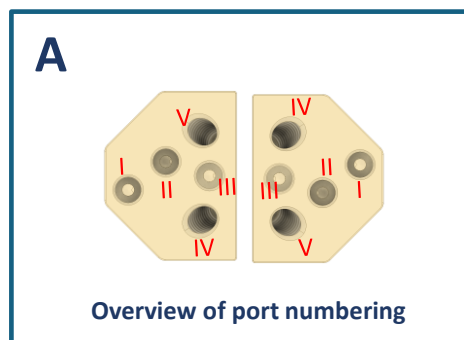
5. Electrode is mounted.



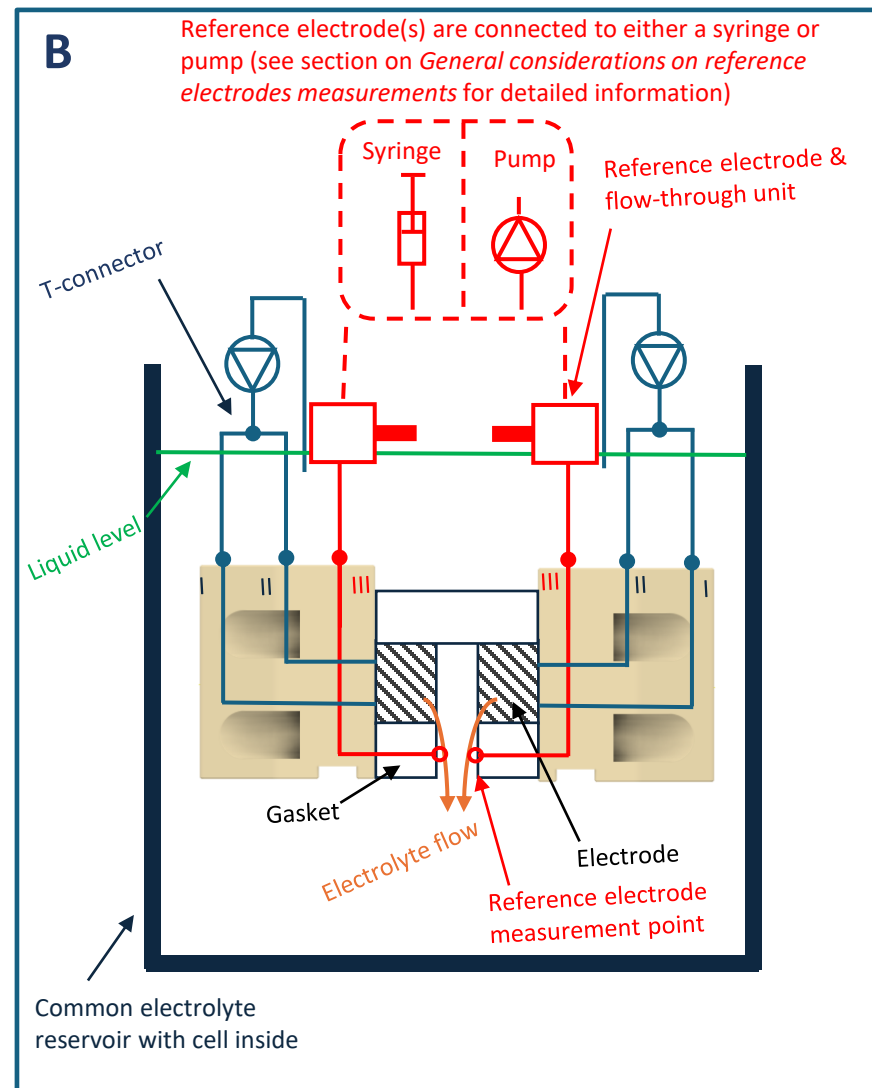
Configuration E: Open cell with individual anode & cathode reference electrodes

Hydraulic circuits

General: Figure A shows the port numbering of the 1 cm² cell. Ports V and IV are used for electrical current and voltage connections on each side of the cell. Ports I and II are used for the main electrolyte flow through each half-cell (blue circuit). Ports III are used for the (red) reference electrode circuit(s).



In general, liquid should be pumped from the common reservoir into both ports I and II in the cell. If flow is reversed (pumping from cell) and it is during electrolysis this can lead to cavitation like behavior (no/low flow rate) because of the bubbles in the liquid. The reference electrode measurement points are indicated by the red hollow points at the lower part of the gaskets. The measured potential corresponds to the potential at the surface of the electrodes.



Configuration E: Open cell with individual anode & cathode reference electrodes

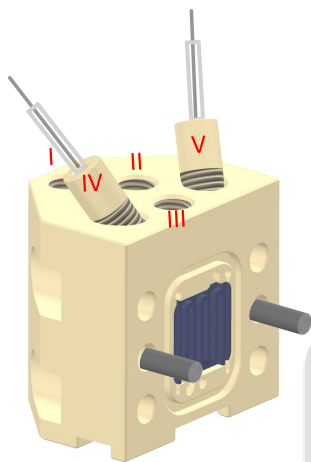
Assembly

3. Spacer gasket (G5) is mounted. NOTE: Function is to create a space between electrode and allow flow out in between the electrode.

NOTE: The indents in corners and sides are to keep the electrode in place

NOTE: Multiple gaskets of this type may be stacked, but for thickness below 0.25mm – 0.5 mm there is an increasing risk for a short circuit between the electrodes

NOTE: Gasket can also be rotated 180° to have the electrolyte outlet at the top OR combine two gaskets with outlets towards both the bottom and top.



1. Gasket (G4) is mounted.

NOTE: (i) Multiple gaskets of this type may be stacked. Together they define the final compressed thickness of the electrode.

(ii) Optimal compression depends on the electrode material and application. To ensure good electrical contact between electrode and current collector compression must be > 0 %.

2. Electrode is mounted.

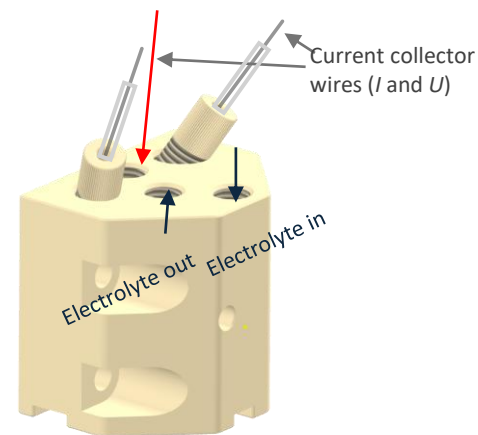
4. Gasket (G4) is mounted.

NOTE: As in step 1, several gaskets of this type can be combined.

5. Electrode is mounted.

Connection for reference electrode

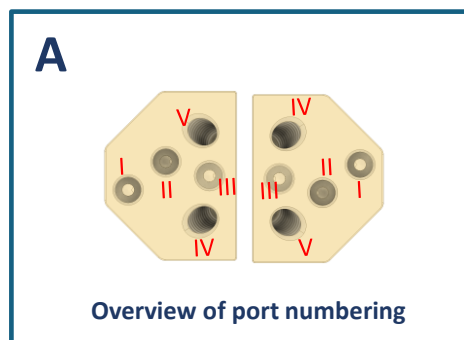
Current collector wires (I and U)



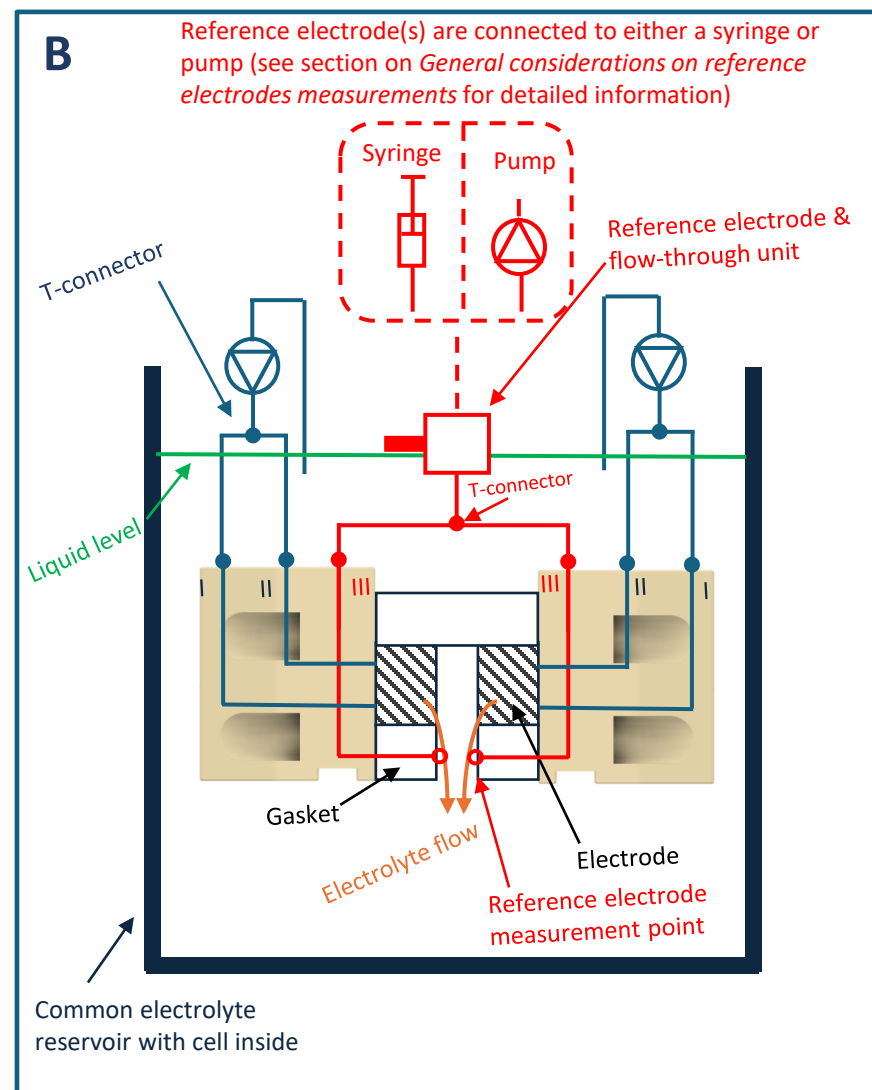
Configuration F: Open cell with one common reference electrode

Hydraulic circuits

General: Figure A shows the port numbering of the 1 cm² cell. Ports V and IV are used for electrical current and voltage connections on each side of the cell. Ports I and II are used for the main electrolyte flow through each half-cell (blue circuit). Ports III are used for the (red) reference electrode circuit.

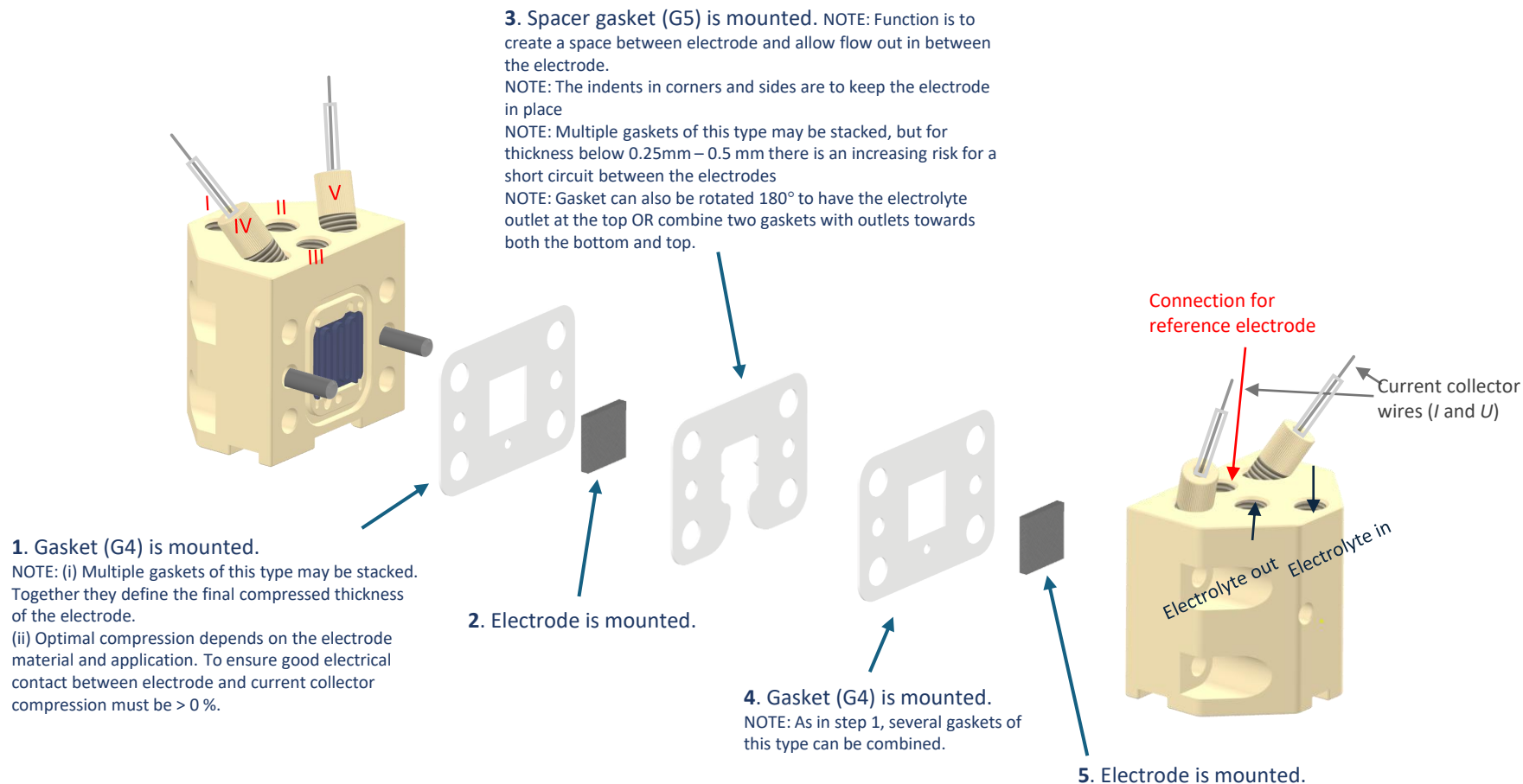


In general, liquid should be pumped from the common reservoir into both ports I and II in the cell. If flow is reversed (pumping from cell) and it is during electrolysis this can lead to cavitation like behavior (no/low flow rate) because of the bubbles in the liquid. The Luggin capillaries are connected by a T to a common reference electrode. The reference electrode measurement is the average between the two red hollow points at the lower part of the gaskets. This effectively corresponds to the potential in the liquid half-way between the two half-cells. In this configuration, the reference electrode can be used for both the anode and cathode at the same time. However, there will be voltage contribution from the voltage drop through the liquid with an approximate 50/50 distribution for each side. The magnitude and distribution between anode/cathode can be measured by high frequency EIS.



Configuration F: Open cell with one common reference electrode

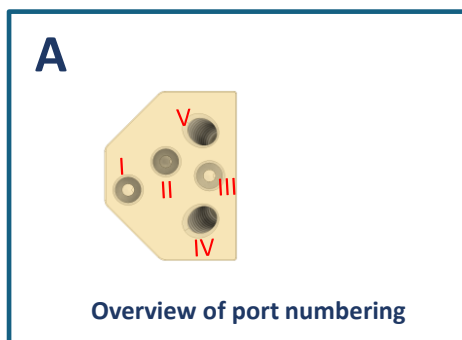
Assembly



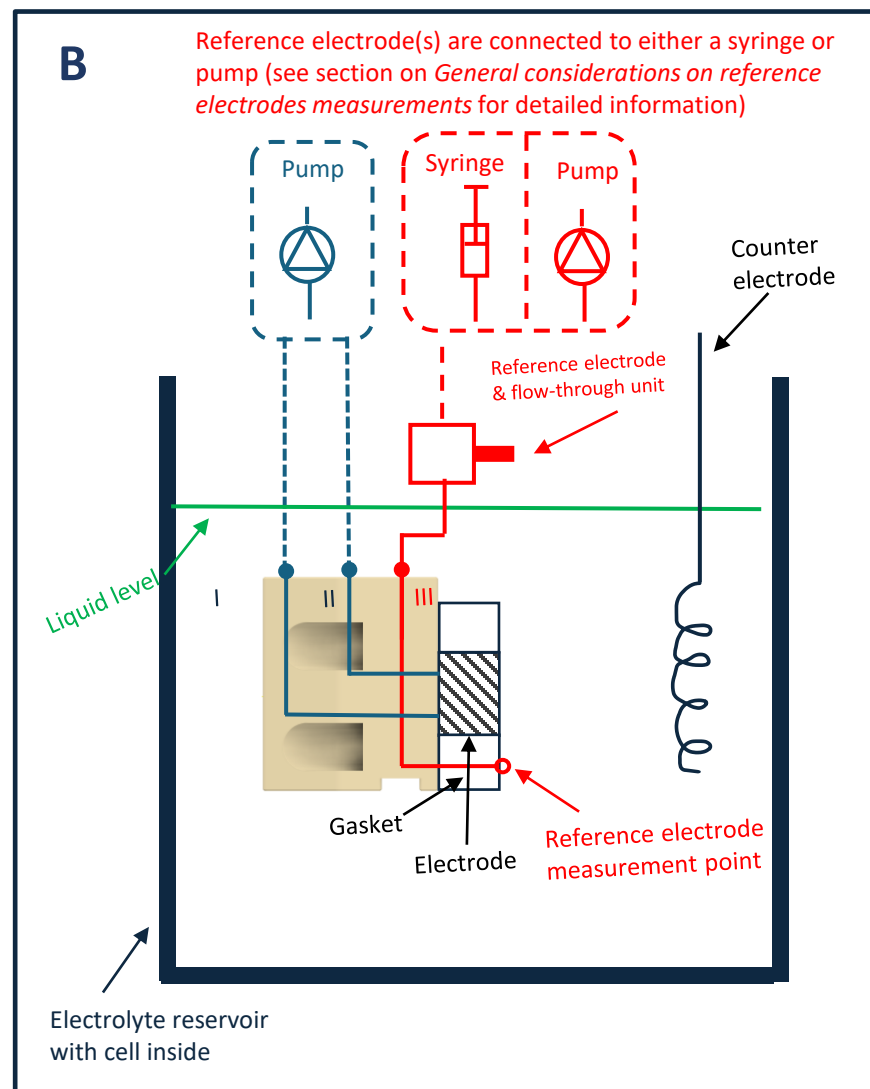
Configuration G-1: Half-cell operation with reference electrode

Hydraulic circuits

General: Figure A shows the port numbering of the 1 cm² cell. Ports V and IV are used for electrical current and voltage connections on each side of the cell. Ports I and II are used for the main electrolyte flow through each half-cell (blue circuit). Ports III are used for the (red) reference electrode circuit.

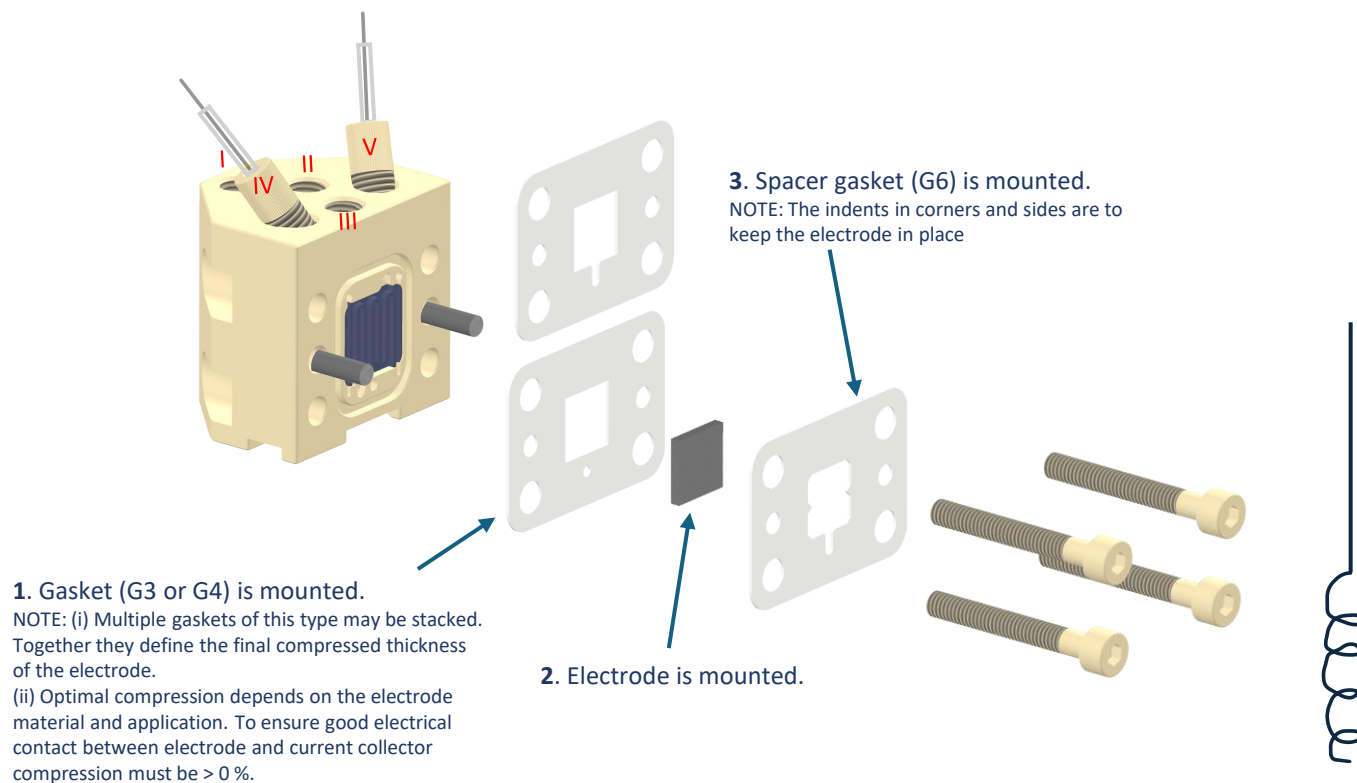


In general, liquid should be pumped from the common reservoir into both ports I and II in the cell. If flow is reversed (pumping from cell) and it is during electrolysis this can lead to cavitation like behavior (no/low flow rate) because of the bubbles in the liquid. The Luggin capillaries are connected by a T to a common reference electrode. The reference electrode measurement is the average between the two red hollow points at the lower part of the gaskets. This effectively corresponds to the potential in the liquid half-way between the two half-cells. In this configuration, the reference electrode can be used for both the anode and cathode at the same time. However, there will be voltage contribution from the voltage drop through the liquid with an approximate 50/50 distribution for each side. The magnitude and distribution between anode/cathode can be measured by high frequency EIS.



Configuration G-1: Half-cell operation with reference electrode

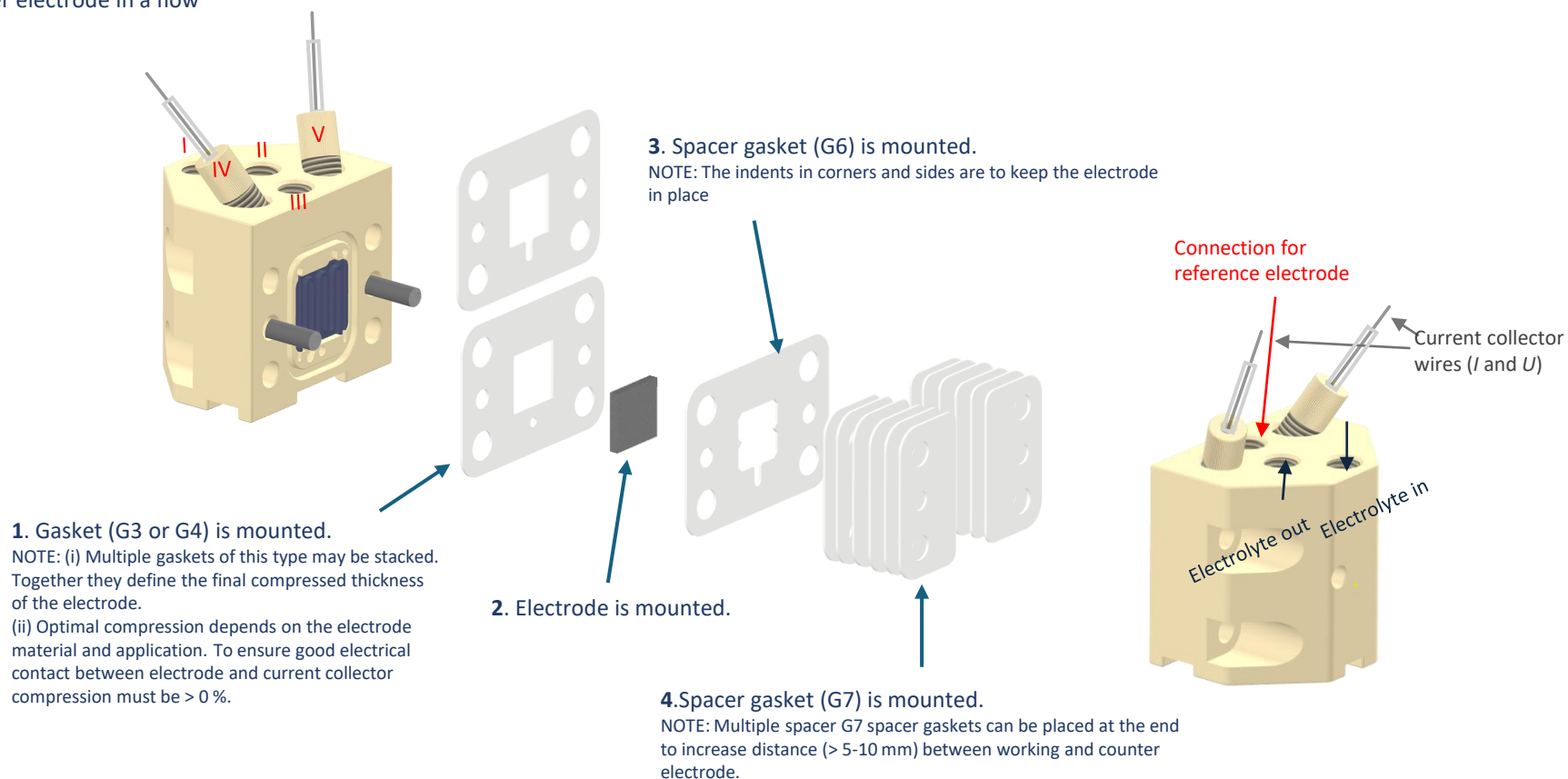
Assembly



Configuration G-2: Half-cell operation with reference electrode

Assembly

This assembly is functionally the same as Configuration G-1, however with the difference that the wire counter electrode is replaced by a counter electrode in a flow body

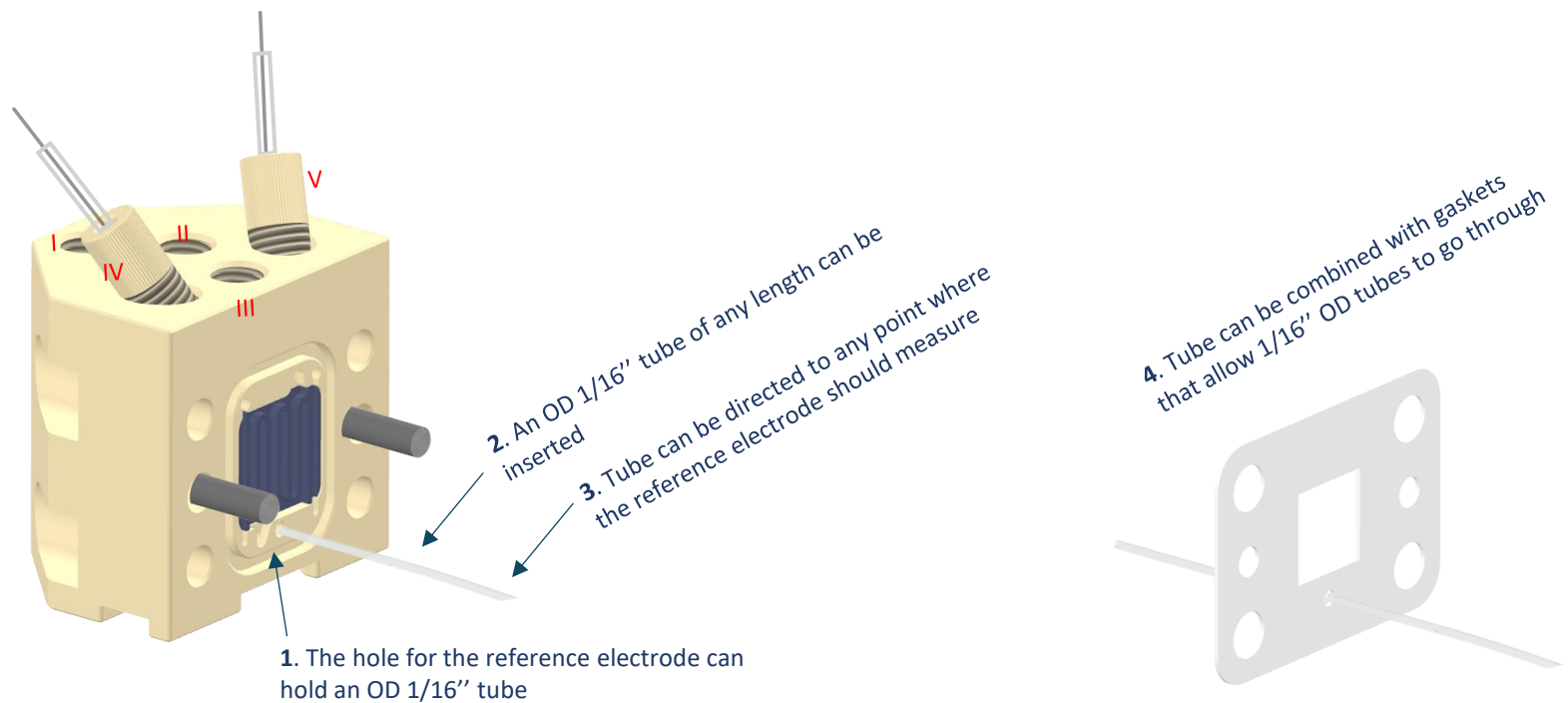


Configuration H: General reference electrode placement

Assembly

An additional key feature of the M-cell, is the additional possibility of using a 1/16" OD tube as a Luggin capillary that will enable reference electrode measurements at almost any point.

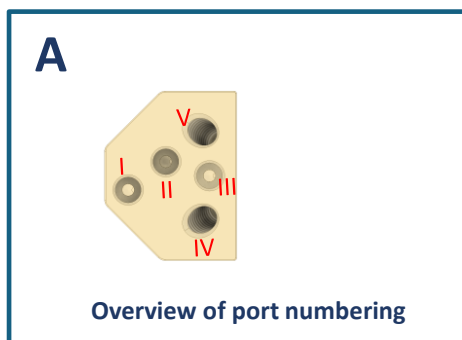
Examples below show the general principles.



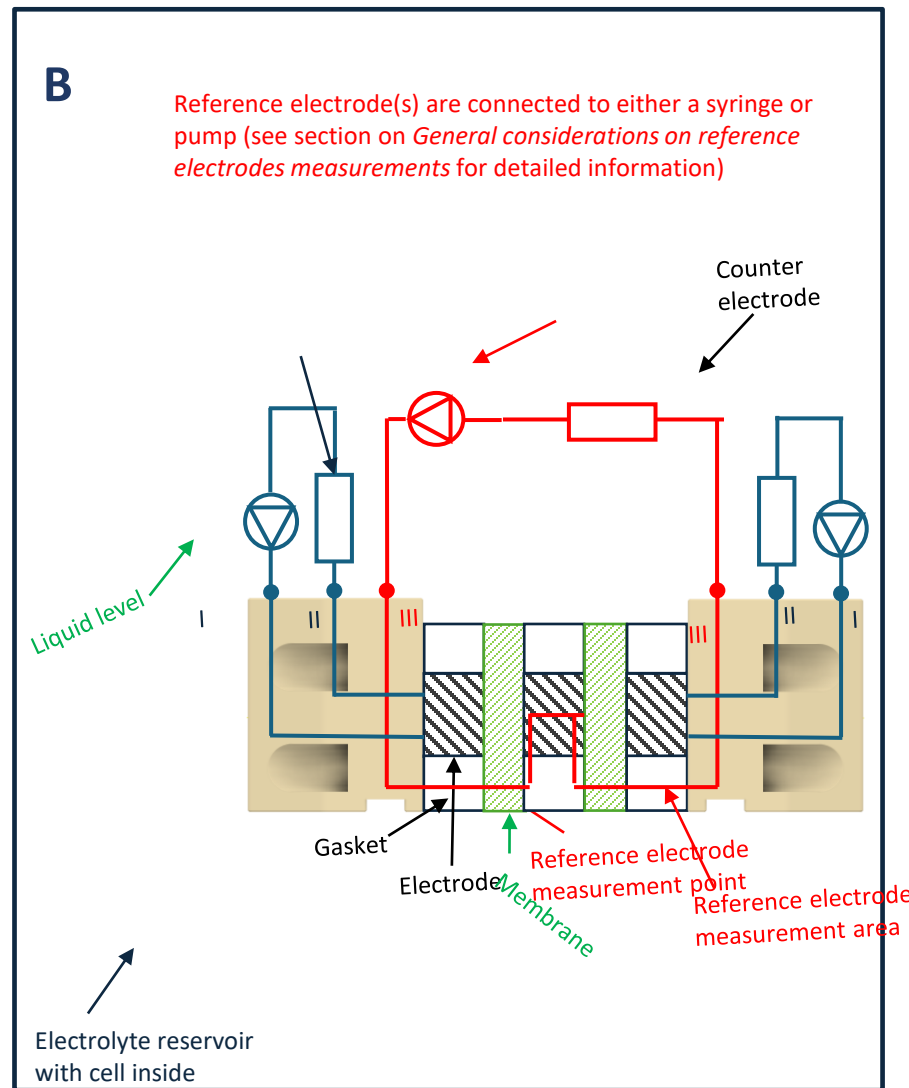
Configuration I: Three compartment operation

Hydraulic circuits

General: Figure A shows the port numbering of the 1 cm² cell. Ports V and IV are used for electrical current and voltage connections on each side of the cell. Ports I and II are used for the main electrolyte flow through each half-cell (blue circuit). Ports III are used for the (red) reference electrode circuit.



In general, liquid should be pumped from the common reservoir into both ports I and II in the cell. If flow is reversed (pumping from cell) and it is during electrolysis this can lead to cavitation like behavior (no/low flow rate) because of the bubbles in the liquid. The Luggin capillaries are connected by a T to a common reference electrode. The reference electrode measurement is the average between the two red hollow points at the lower part of the gaskets. This effectively corresponds to the potential in the liquid half-way between the two half-cells. In this configuration, the reference electrode can be used for both the anode and cathode at the same time. However, there will be voltage contribution from the voltage drop through the liquid with an approximate 50/50 distribution for each side. The magnitude and distribution between anode/cathode can be measured by high frequency EIS.



Configuration I: Three compartment operation

Assembly

