S-Cell – Flow Battery Test Cell

Overview & assembly manual

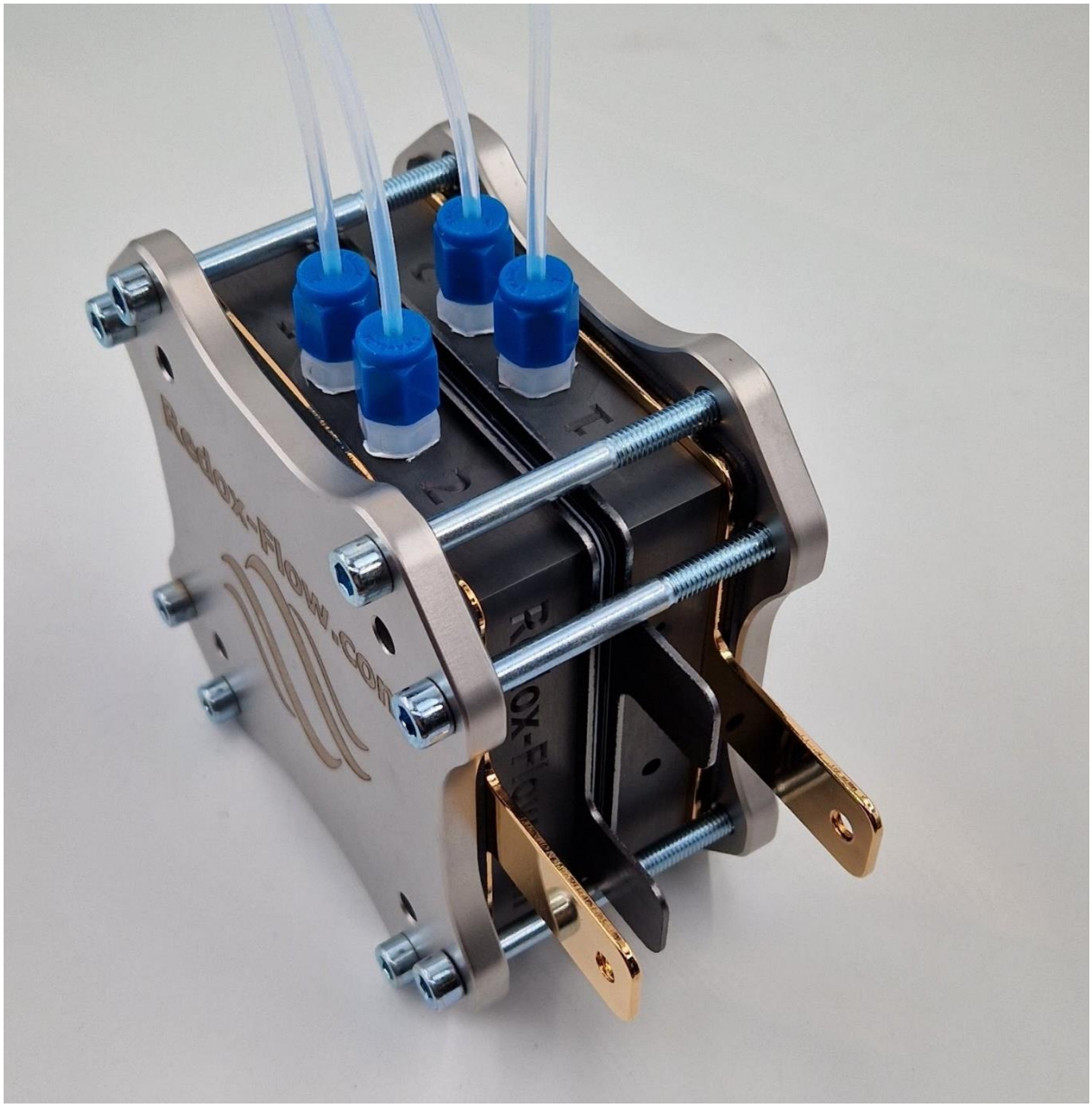
Redox Flow
www.redox-flow.com

Notes

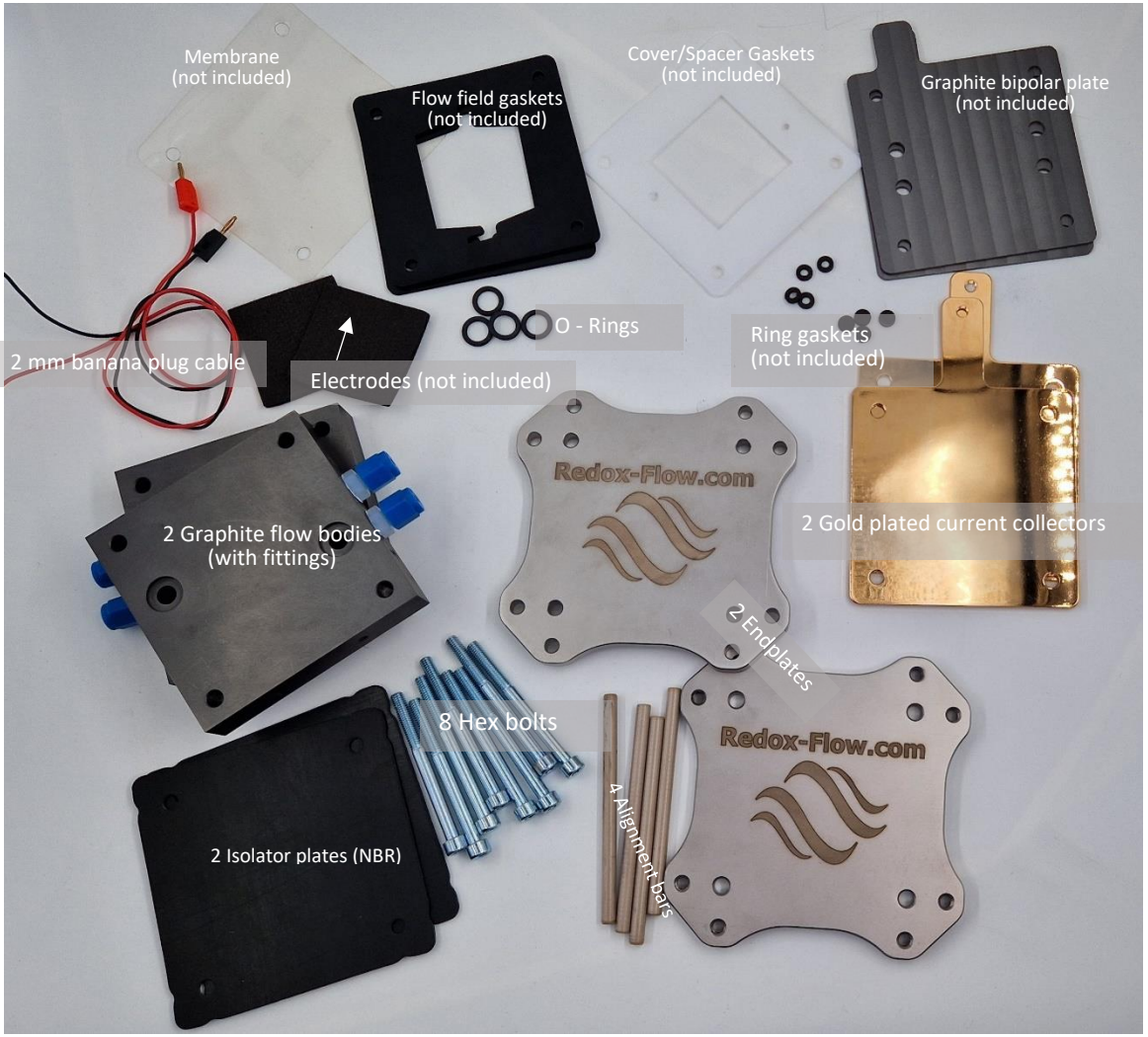
This electrolyser cell is intended for research purposes only and can be assembled in several ways.

There is no warranty on performance, corrosion, or lifetime on the items. It is purely for research purposes.

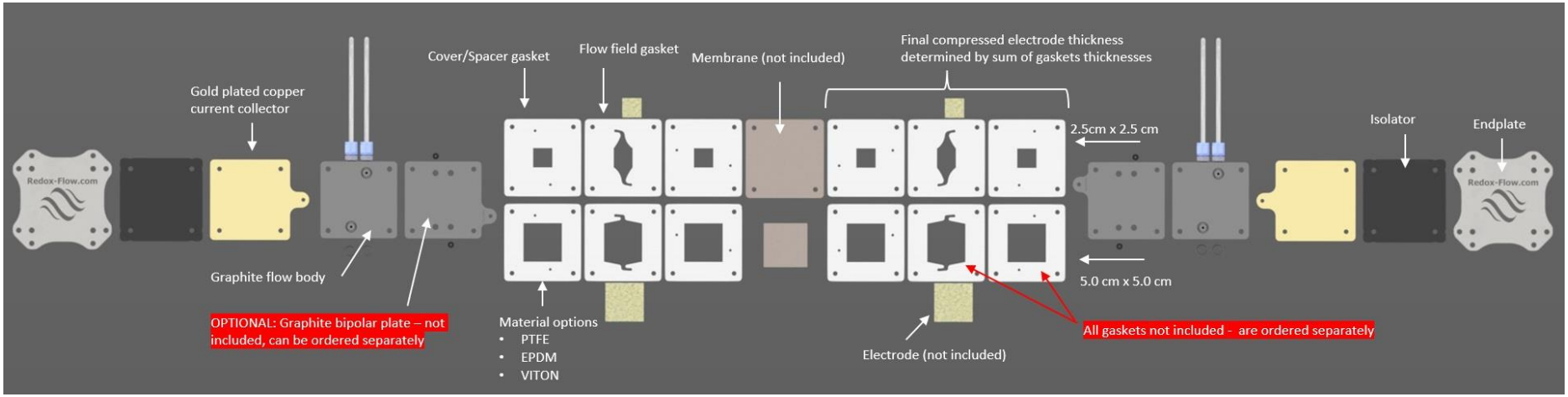
Version 2.0 – May 5, 2024



Overview of included components



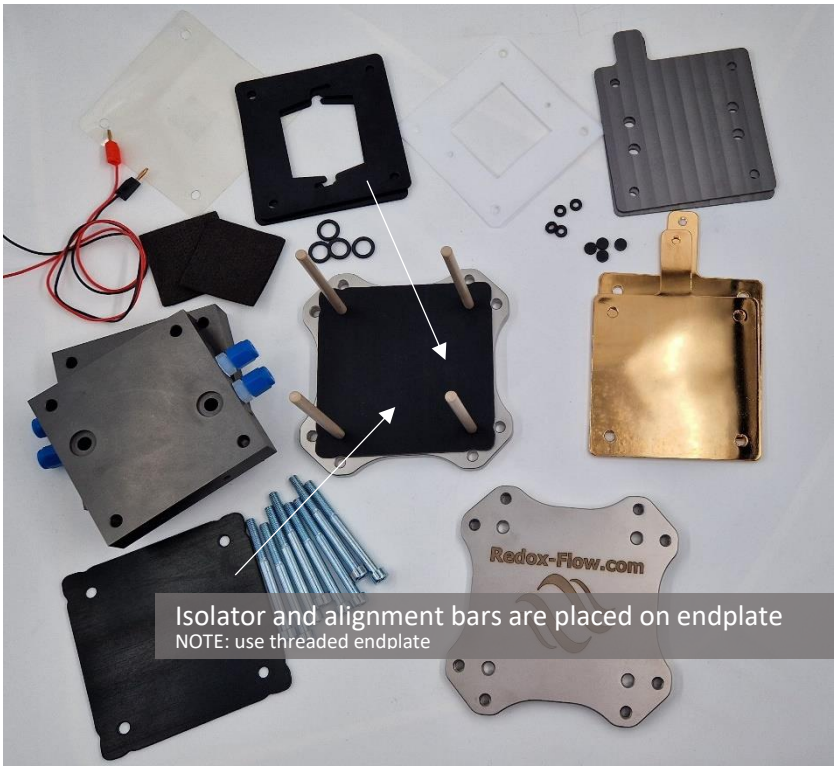
Overview of variants

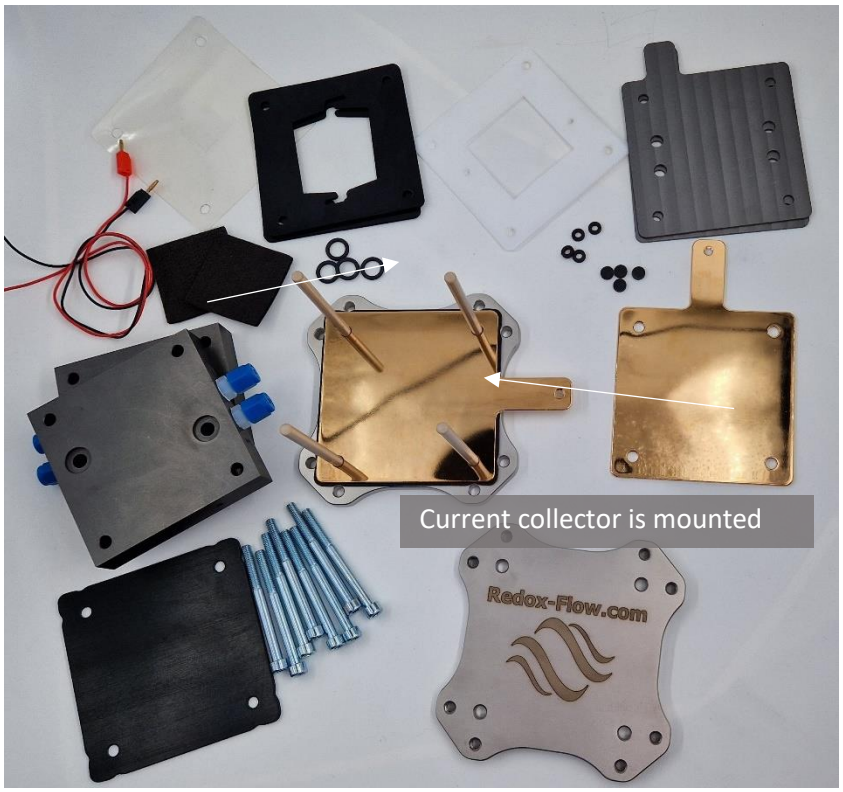


Overview of variants with and without graphite bipolar plates. Assembly is from left to rigth – top shows 2.5cm x 2.5cm while bottom shows 5cm x 5cm assembly.

Assembly with flat current collectors

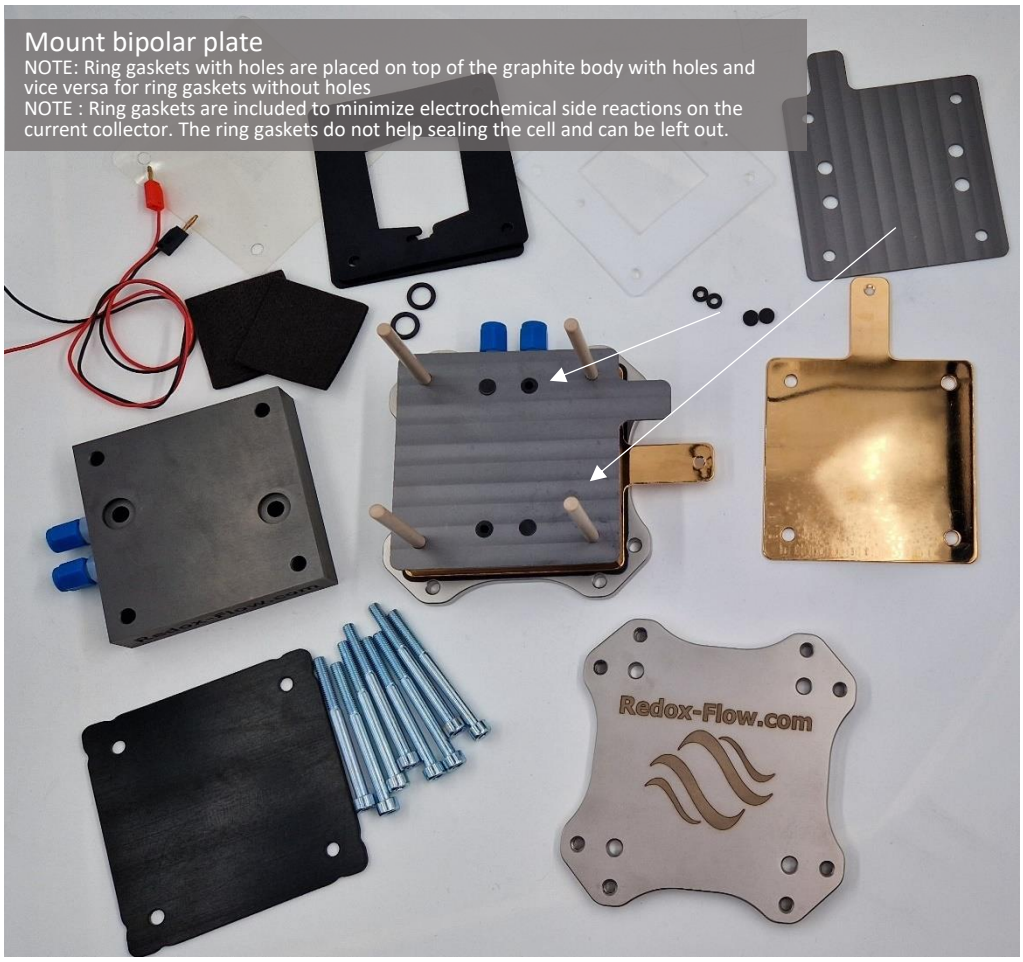
The following is an example on a 5.0 cm x 5.0 cm cell. NOTE: The order of assembly does not strictly need to follow this assembly manual. Depending on use and experience it can be done in different order.



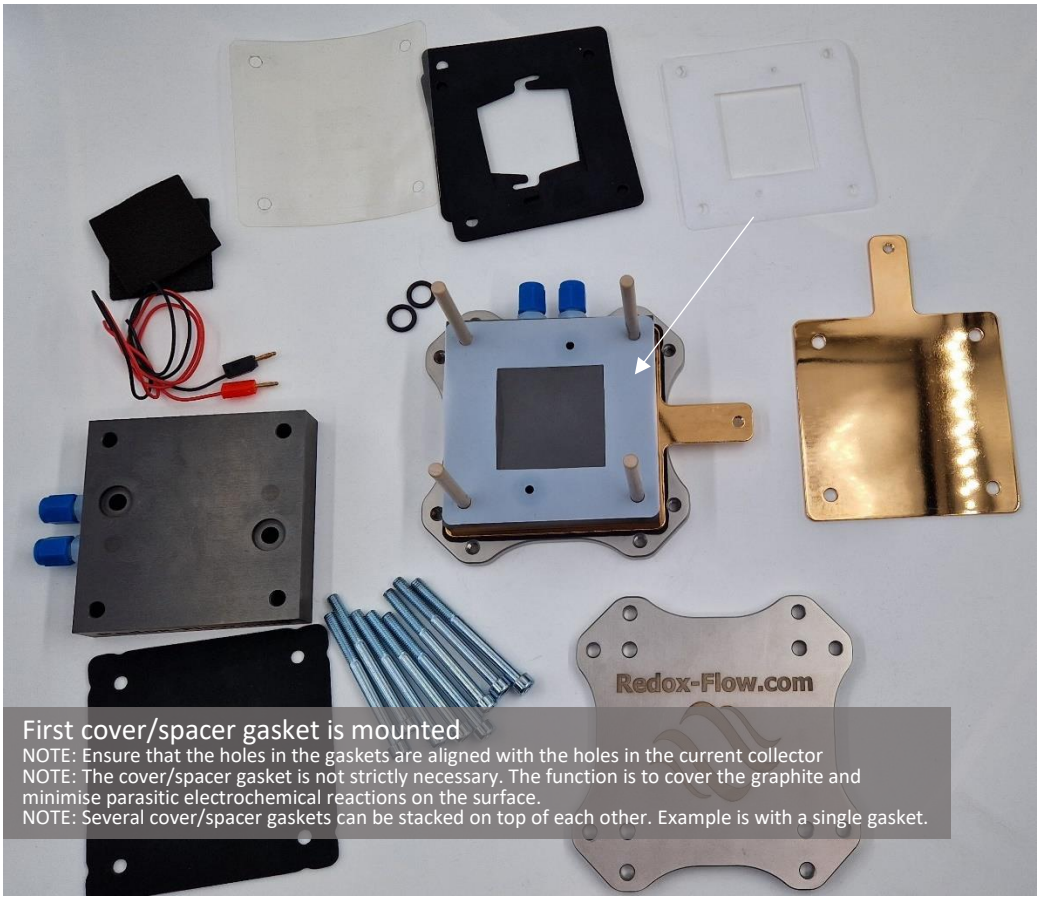


Graphite flow body is mounted
NOTE: Remember to include O-rings in the flow body.

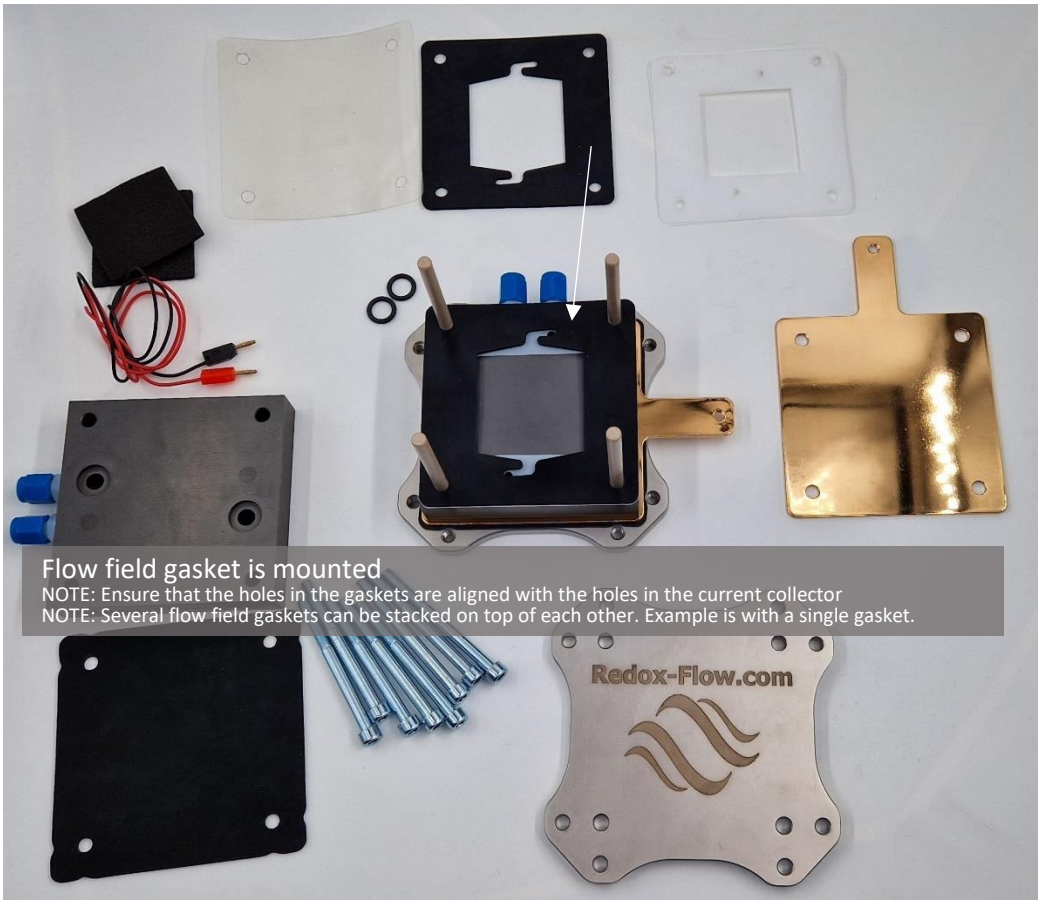
The following is only for assemblies where a bipolar plate is used. If not used continue to the next part of the assembly



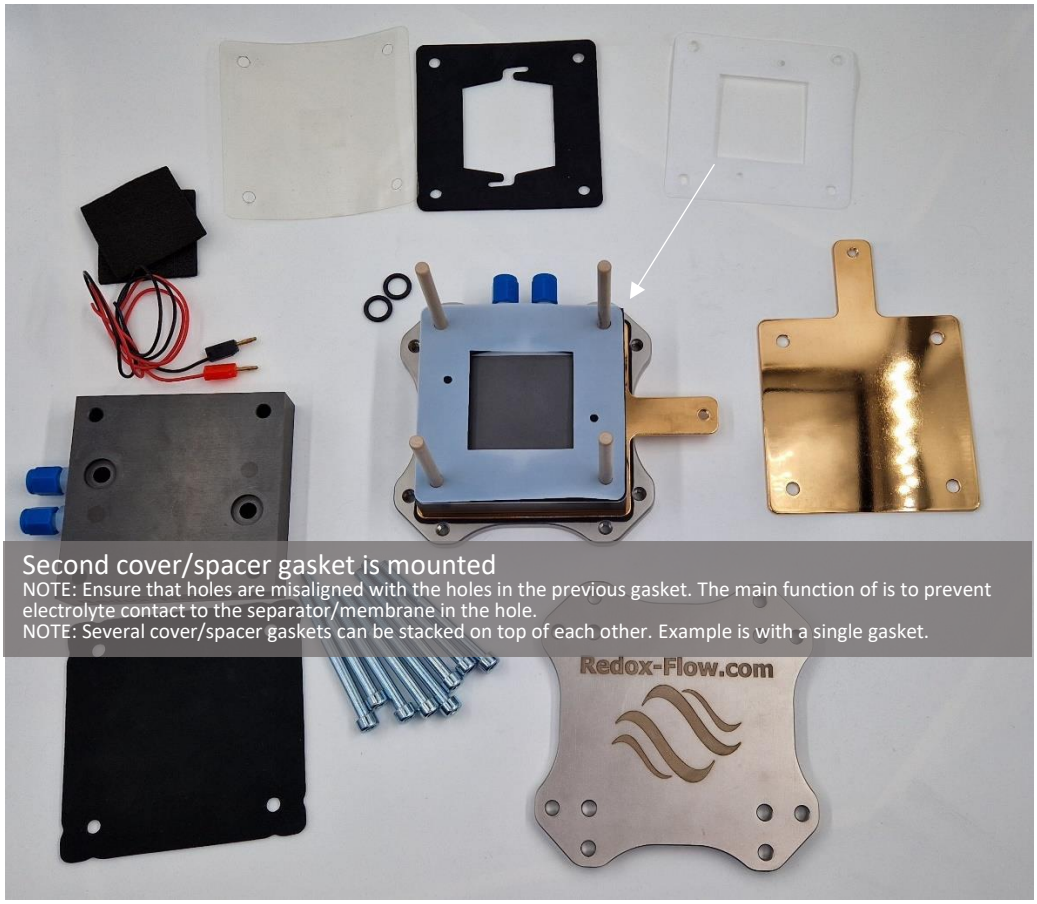
End of bipolar plate assembly. From here the assembly is the same for both assemblies.



First cover/spacer gasket is mounted
NOTE: Ensure that the holes in the gaskets are aligned with the holes in the current collector
NOTE: The cover/spacer gasket is not strictly necessary. The function is to cover the graphite and minimise parasitic electrochemical reactions on the surface.
NOTE: Several cover/spacer gaskets can be stacked on top of each other. Example is with a single gasket.



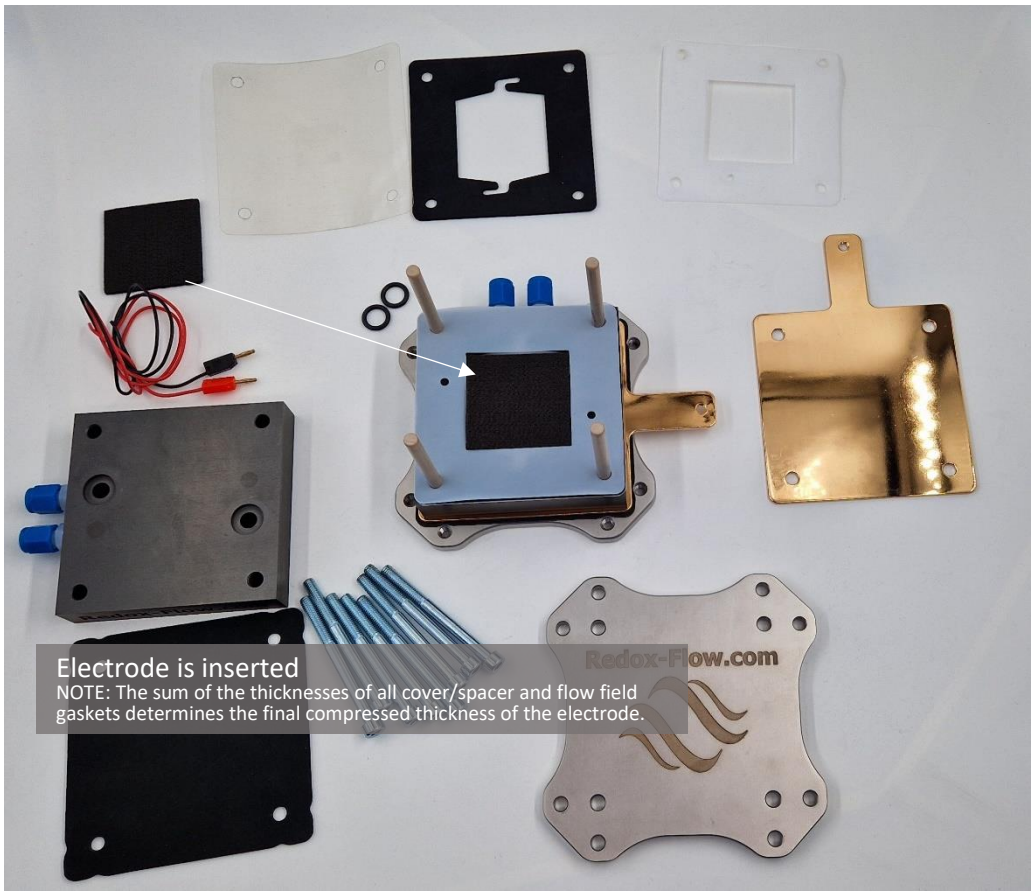
Flow field gasket is mounted
NOTE: Ensure that the holes in the gaskets are aligned with the holes in the current collector
NOTE: Several flow field gaskets can be stacked on top of each other. Example is with a single gasket.



Second cover/spacer gasket is mounted

NOTE: Ensure that holes are misaligned with the holes in the previous gasket. The main function of is to prevent electrolyte contact to the separator/membrane in the hole.

NOTE: Several cover/spacer gaskets can be stacked on top of each other. Example is with a single gasket.

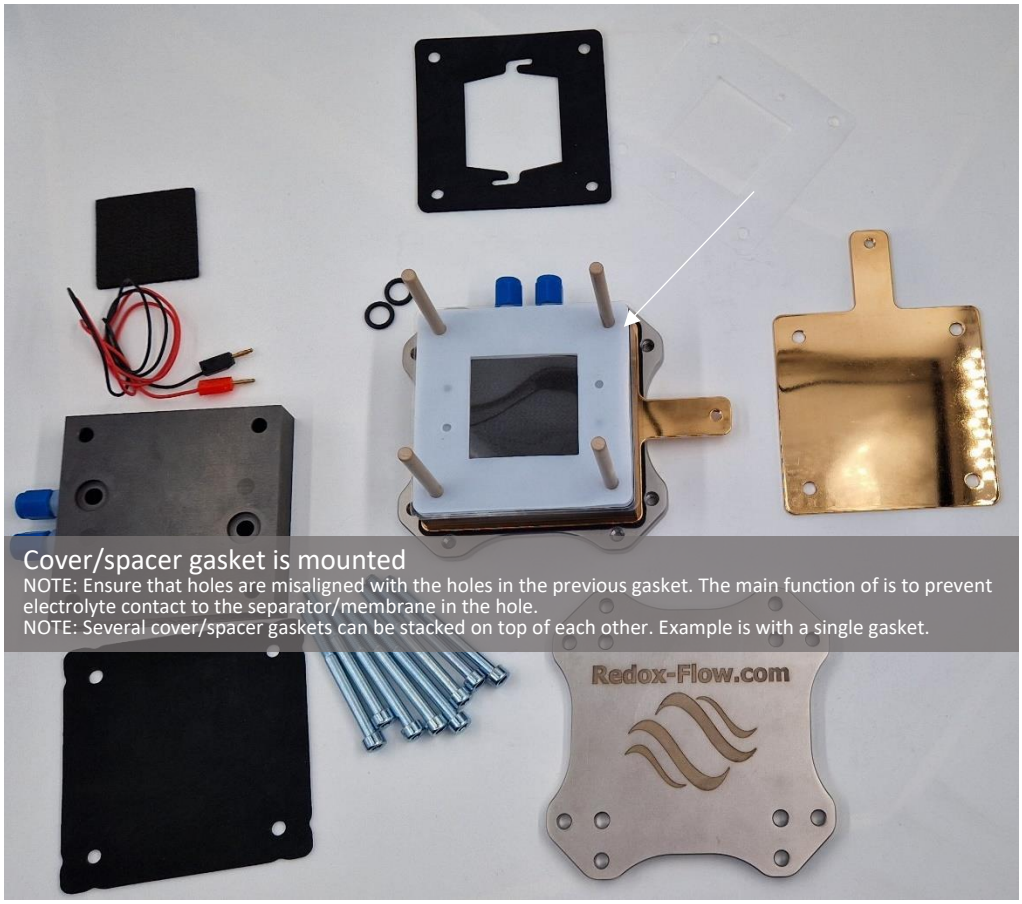


Electrode is inserted

NOTE: The sum of the thicknesses of all cover/spacer and flow field gaskets determines the final compressed thickness of the electrode.

Membrane is mounted

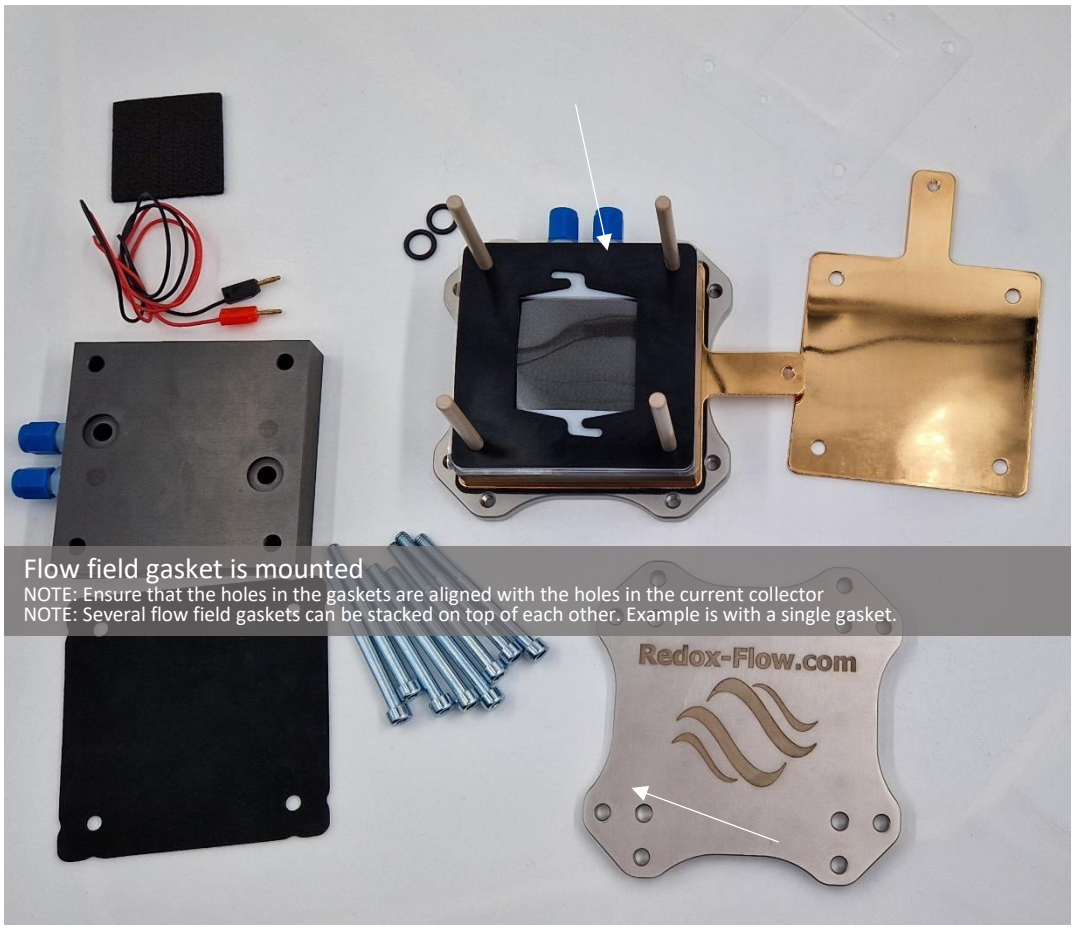
NOTE: The membrane does not need to fill the whole area of the cell (10cm x 10 cm) smaller pieces can be used.



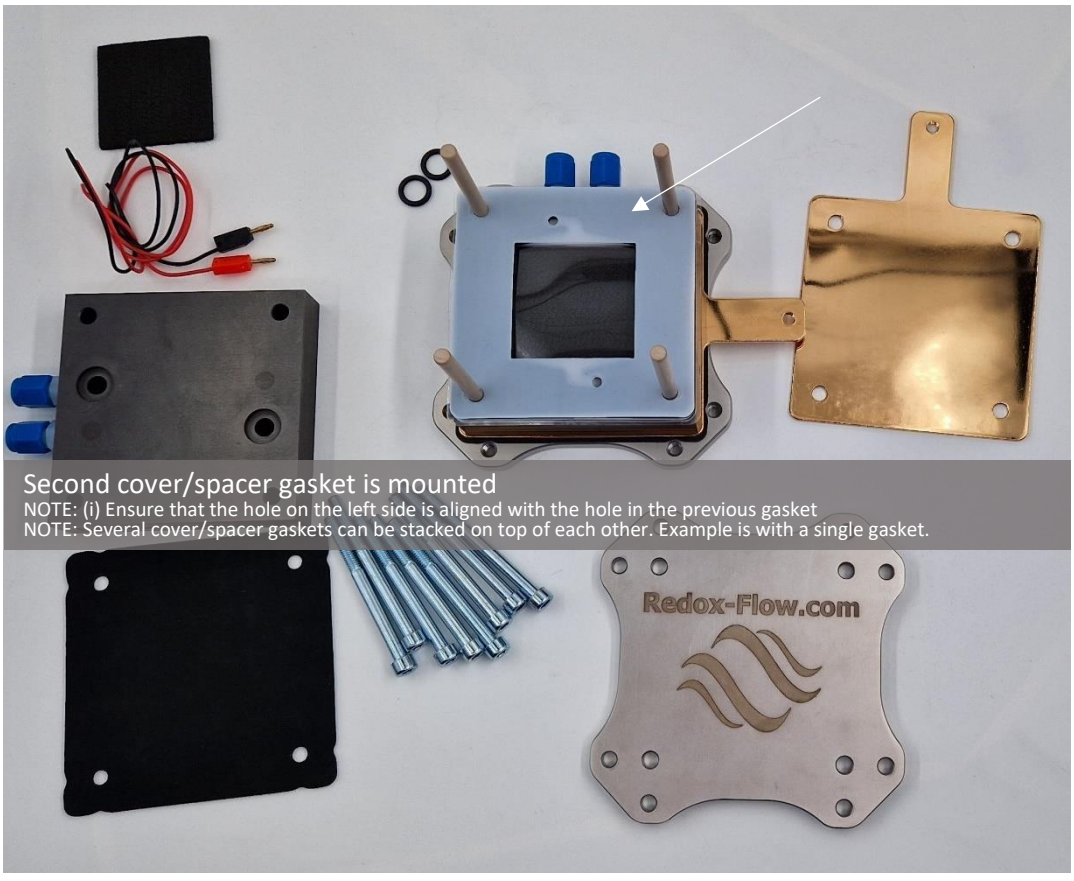
Cover/spacer gasket is mounted

NOTE: Ensure that holes are misaligned with the holes in the previous gasket. The main function of is to prevent electrolyte contact to the separator/membrane in the hole.

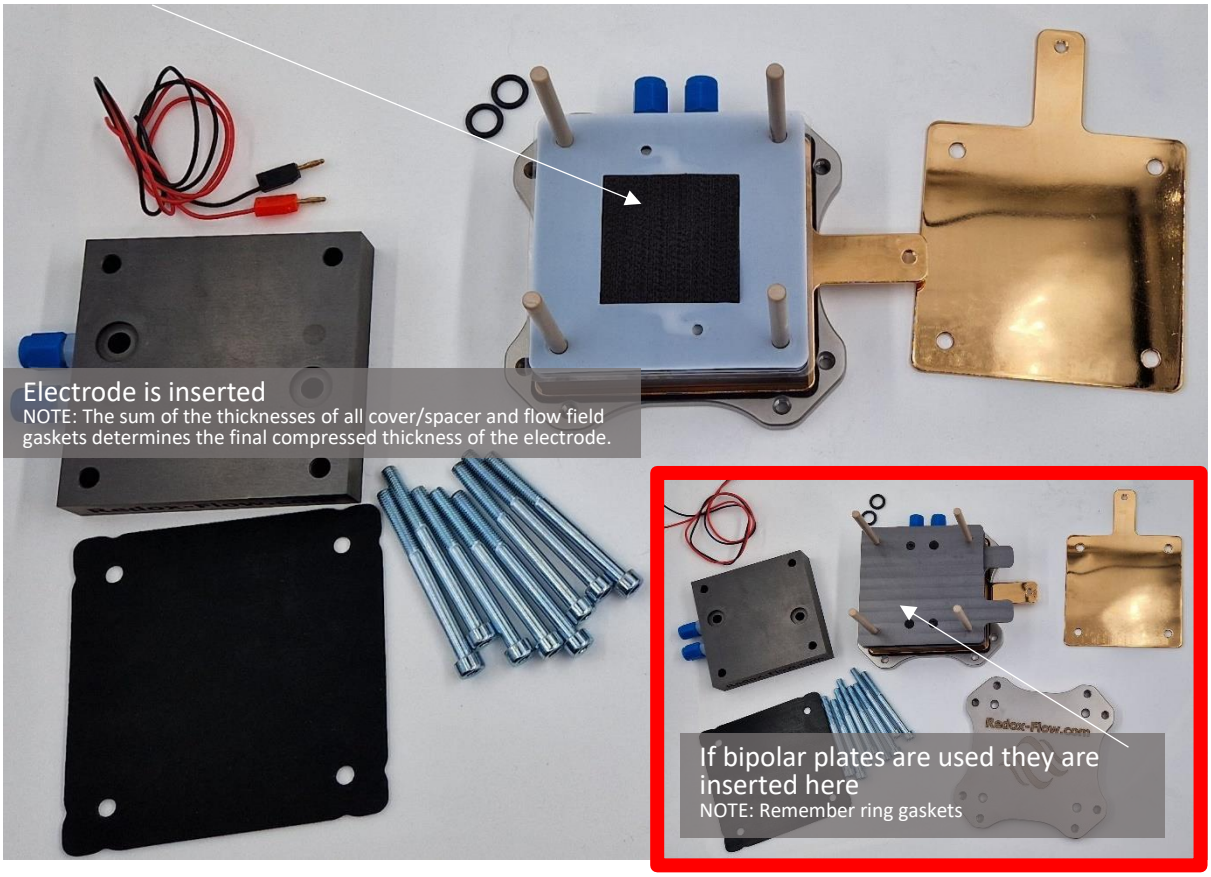
NOTE: Several cover/spacer gaskets can be stacked on top of each other. Example is with a single gasket.



Flow field gasket is mounted
NOTE: Ensure that the holes in the gaskets are aligned with the holes in the current collector
NOTE: Several flow field gaskets can be stacked on top of each other. Example is with a single gasket.



Second cover/spacer gasket is mounted
NOTE: (i) Ensure that the hole on the left side is aligned with the hole in the previous gasket
NOTE: Several cover/spacer gaskets can be stacked on top of each other. Example is with a single gasket.


Electrode is inserted
NOTE: The sum of the thicknesses of all cover/spacer and flow field gaskets determines the final compressed thickness of the electrode.
If bipolar plates are used they are inserted here
NOTE: Remember ring gaskets
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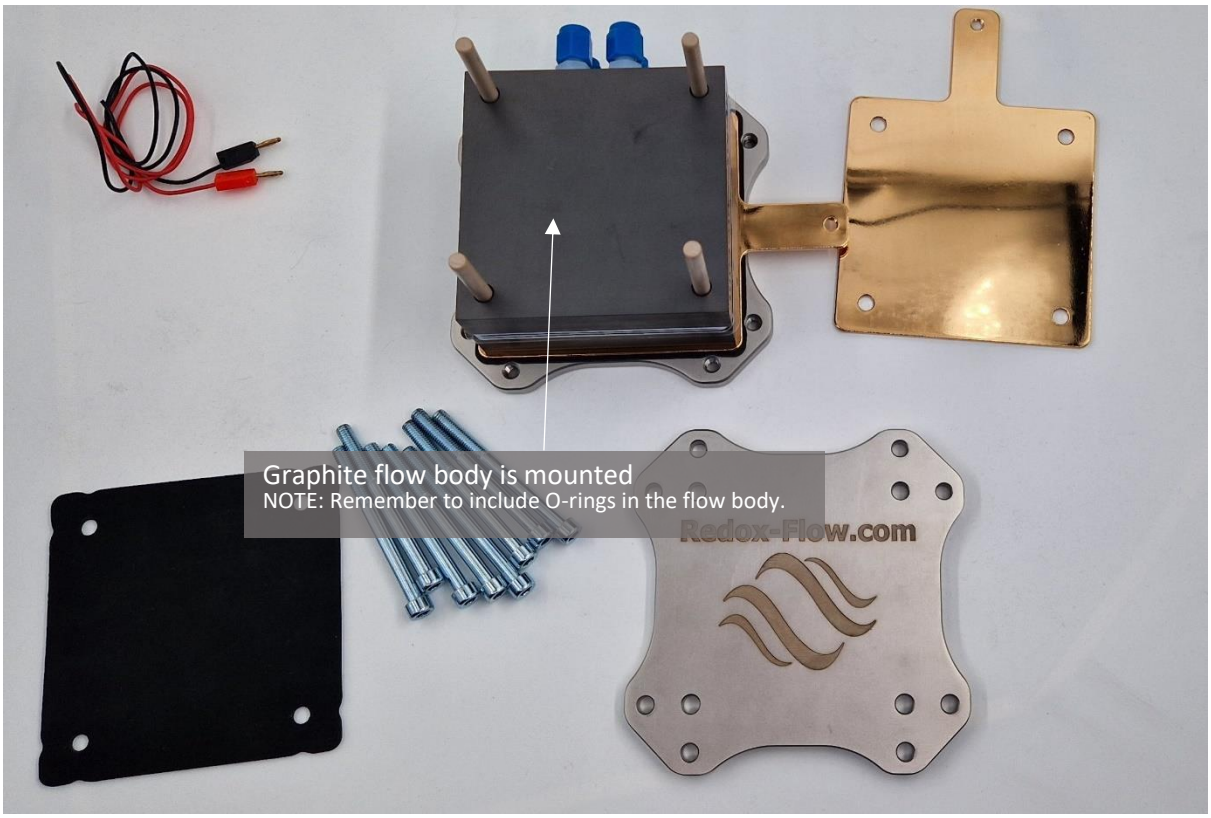
Graphite flow body is mounted
NOTE: Remember to include O-rings in the flow body.
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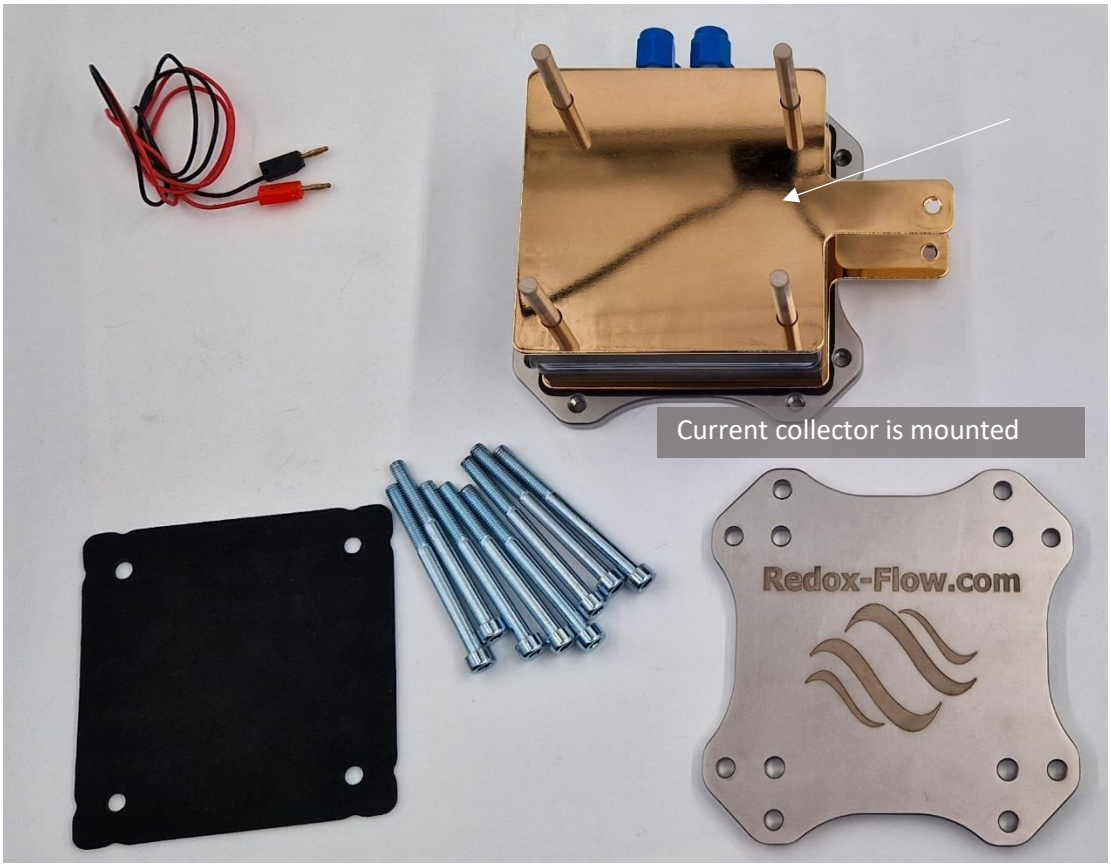
Current collector is mounted
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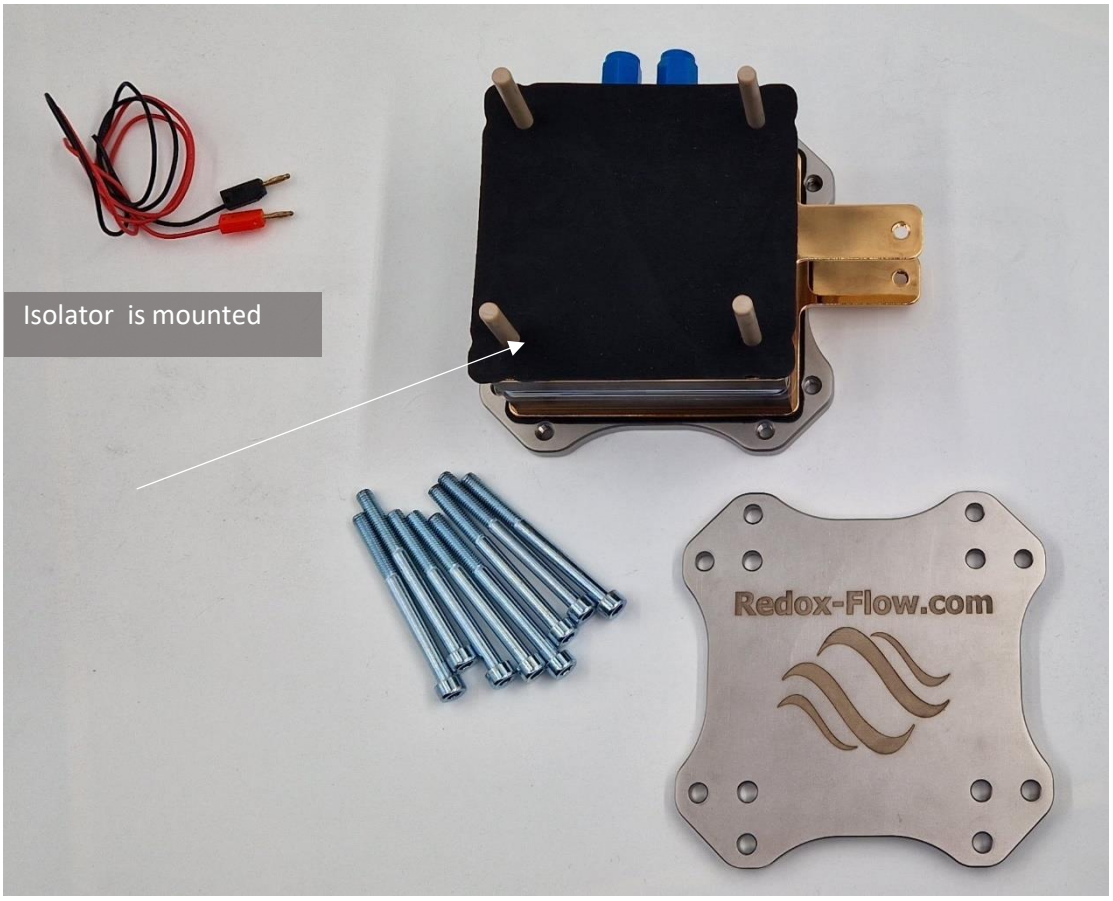
Isolator is mounted
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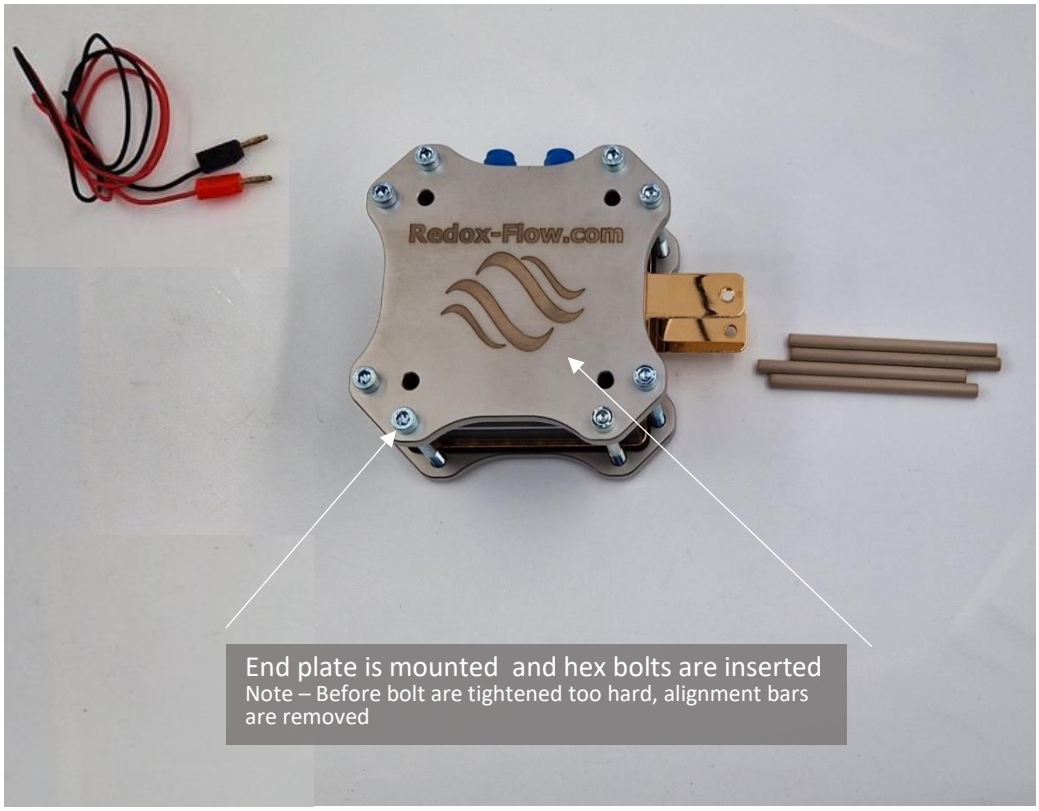
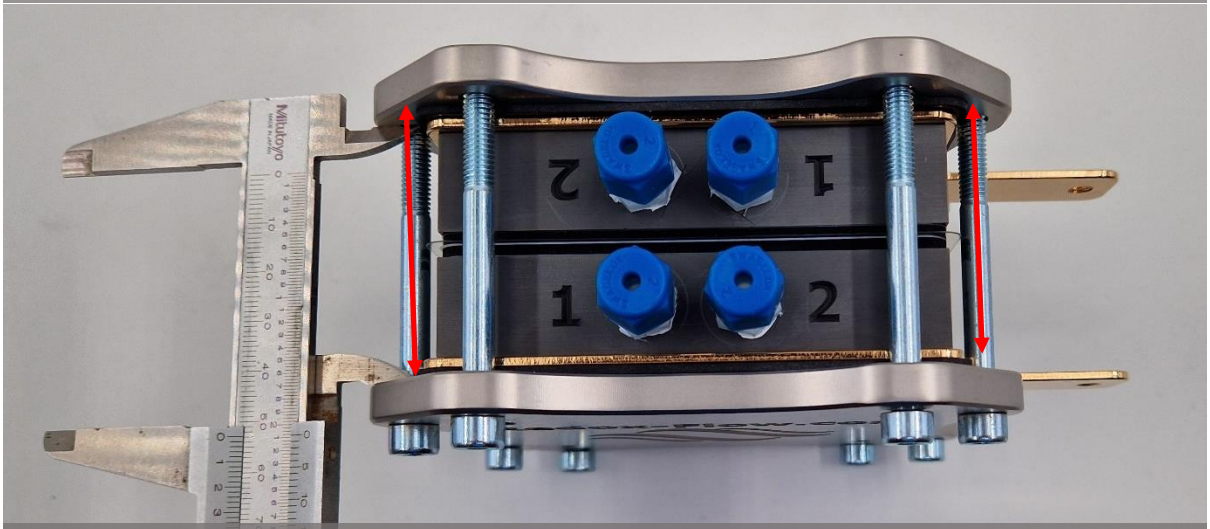


End plate is mounted and hex bolts are inserted
Note – Before bolt are tightened too hard, alignment bars are removed

Hex bolts are cross tightened up to 6 Nm
NOTE: Remember to pull out alignment bars before the cell is too tight

STEP 1 - IS VERY IMPORTANT FOR A TIGHT SEALING FOF THE CELL

STEP 2 - IS VERY IMPORTANT FOR A TIGHT SEALING FOF THE CELL

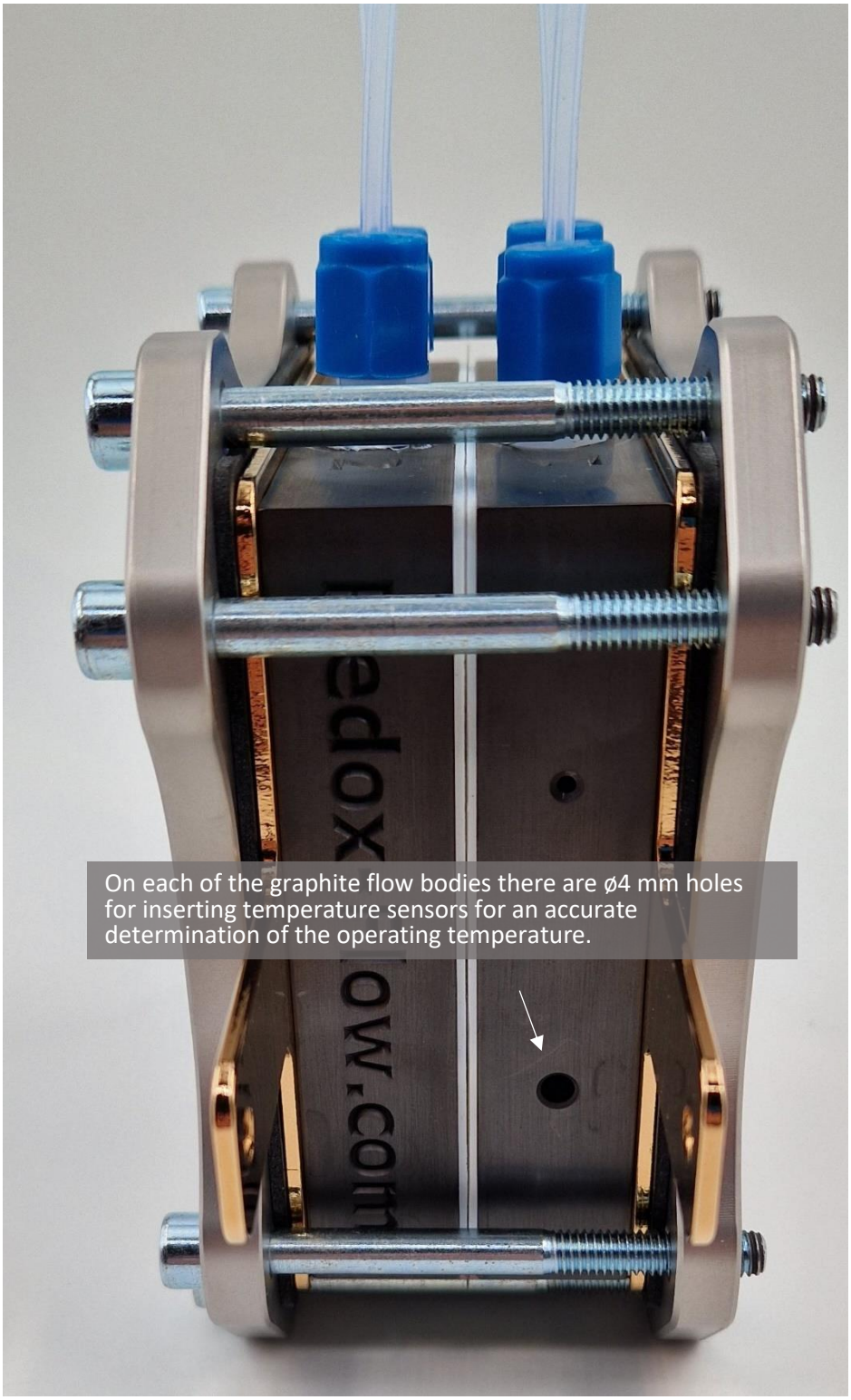


Quality of the cross tightened is checked by measuring the distance between the endplates at all four corners. The distance should not vary more than 0.1-0.2mm.
NOTE: Step 1 and 2 can be performed iteratively.

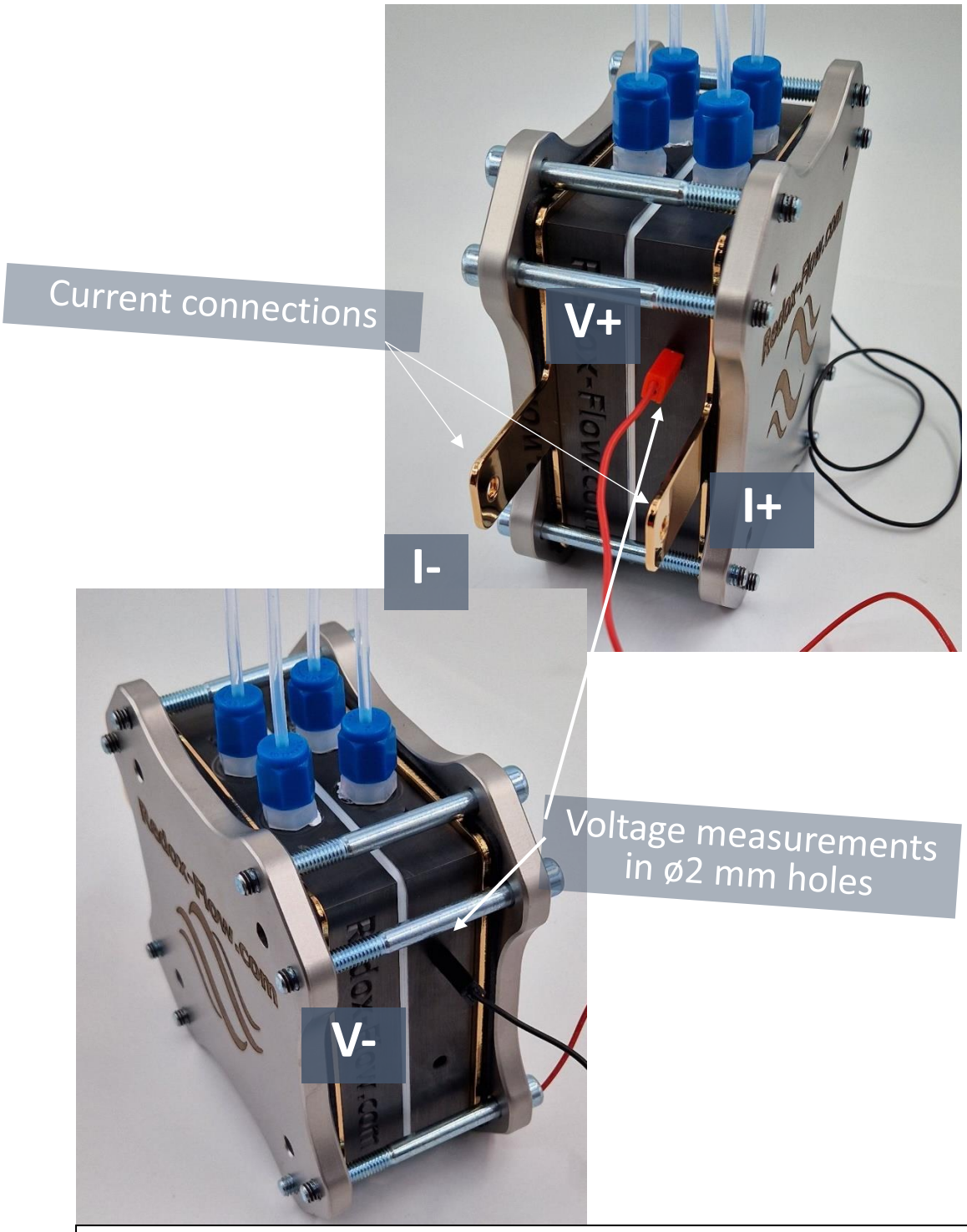
MEASUREMENT WITH CALIBER IS PARAMOUNT FOR A TIGHT SEALING – IT IS NOT THE TORQUE THAT SEALS THE CELL IT IS A CORRECT ALLIGNMENT OF THE FLOW BODIES

NOTE: If very thin electrodes/gaskets or only hard PTFE gaskets are used, sealing may be more difficult. Here tiny amounts of silicon based sealing grease can be applied to the gaskets. After applying the sealing grease to the gaskets, wipe it of with a dust free or lens cloth

Application notes – Temperature sensors



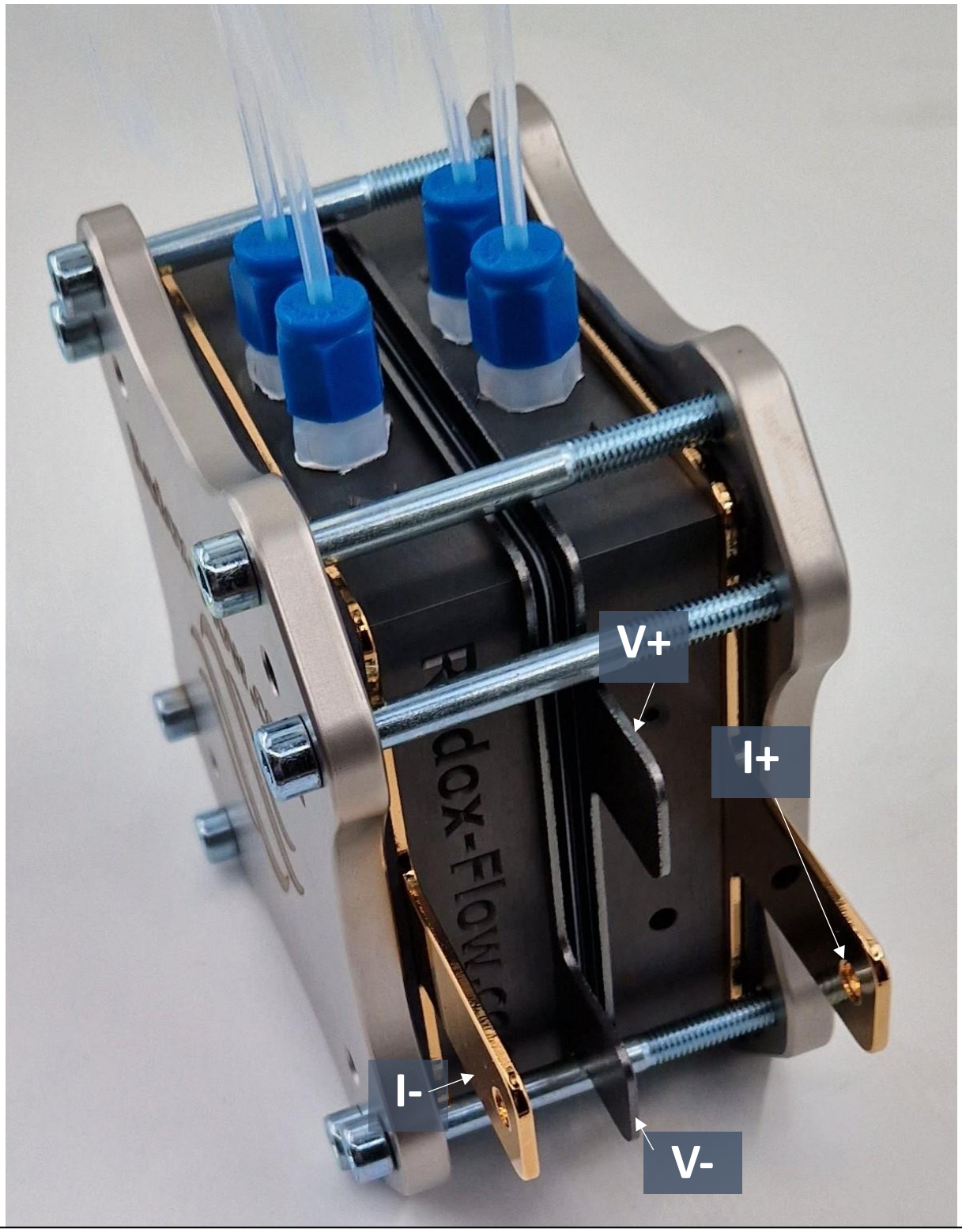
Application notes – Electrical connections without bipolar plates



NOTES:

1. If high currents are applied, it is paramount to have good electrical connection to the current collectors through e.g. cable lugs.
2. Voltage can also be measured on current collectors, but will include contact resistance between current collectors and graphite body.

Application notes – Electrical connections with bipolar plates



NOTES:

If high currents are applied, it is paramount to have good electrical connection to the current collectors through e.g. cable lugs.