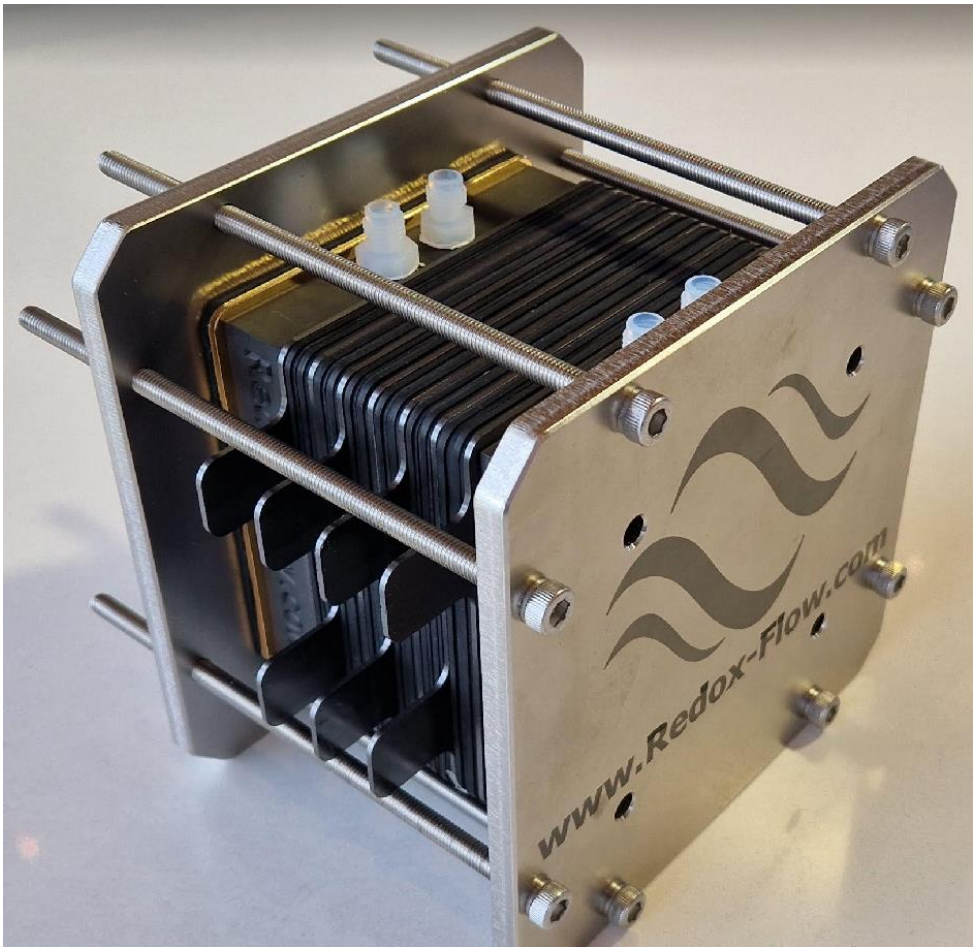
S-Cell-Stack – Flow Battery test stack

Overview & assembly manual

Redox Flow
www.redox-flow.com



Redox Flow
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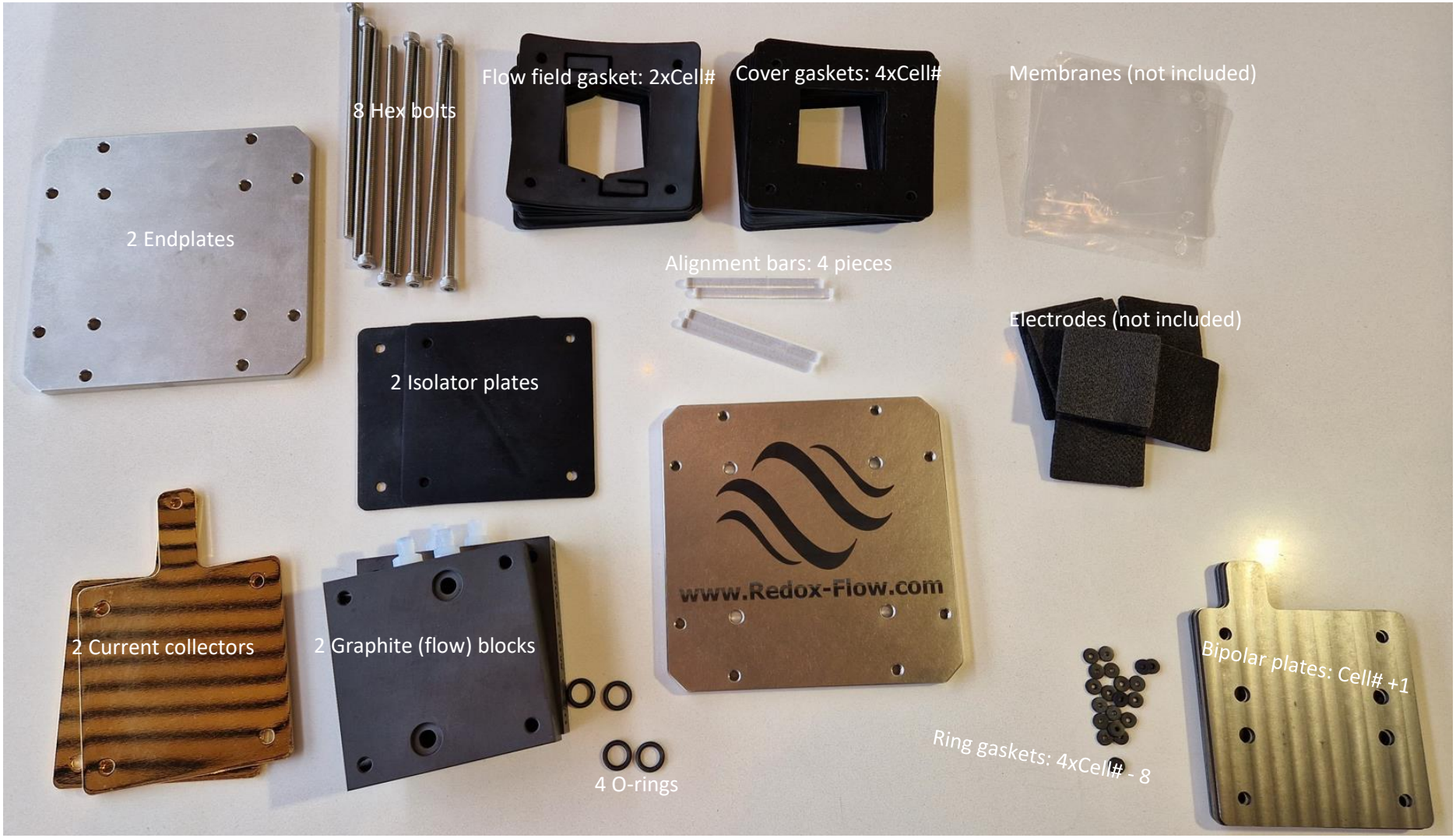
Overview of included components



Notes

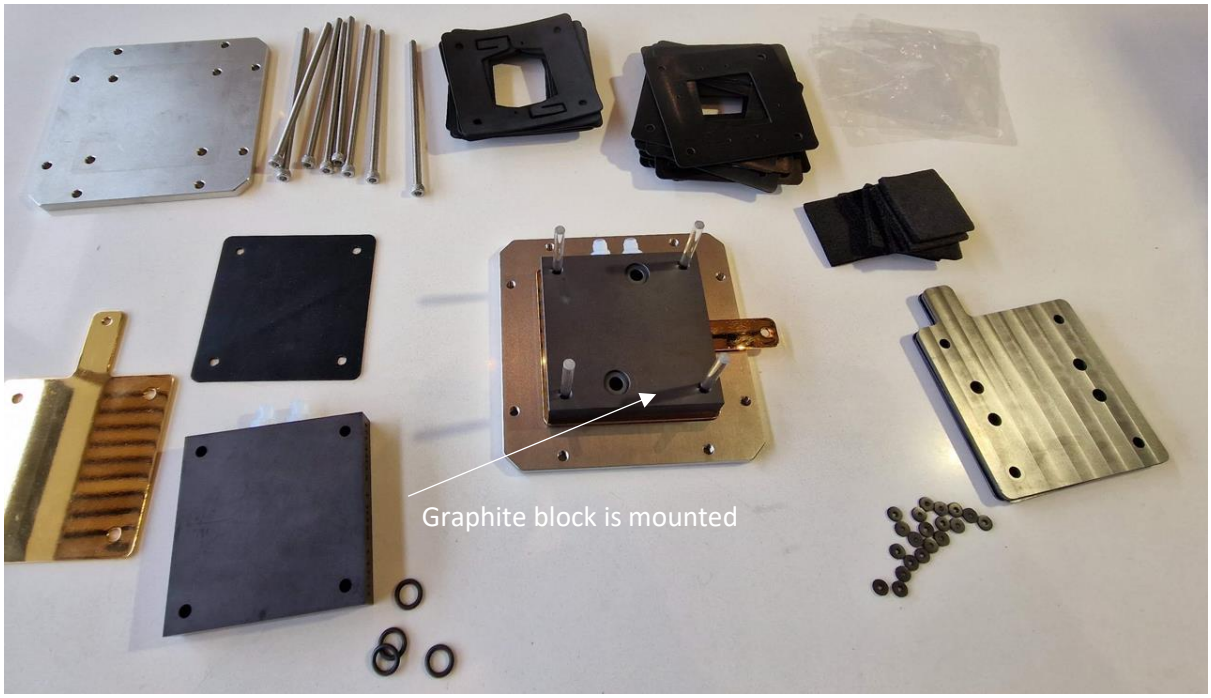
This cell is intended for research purposes only and can be used for many different purporses. This is also reflected in the number of different parts and ways it can be assembled. The following manual is a guide where 2 ‘cover gaskets’ and 1 ‘flow field gasket’ is used per half cell.

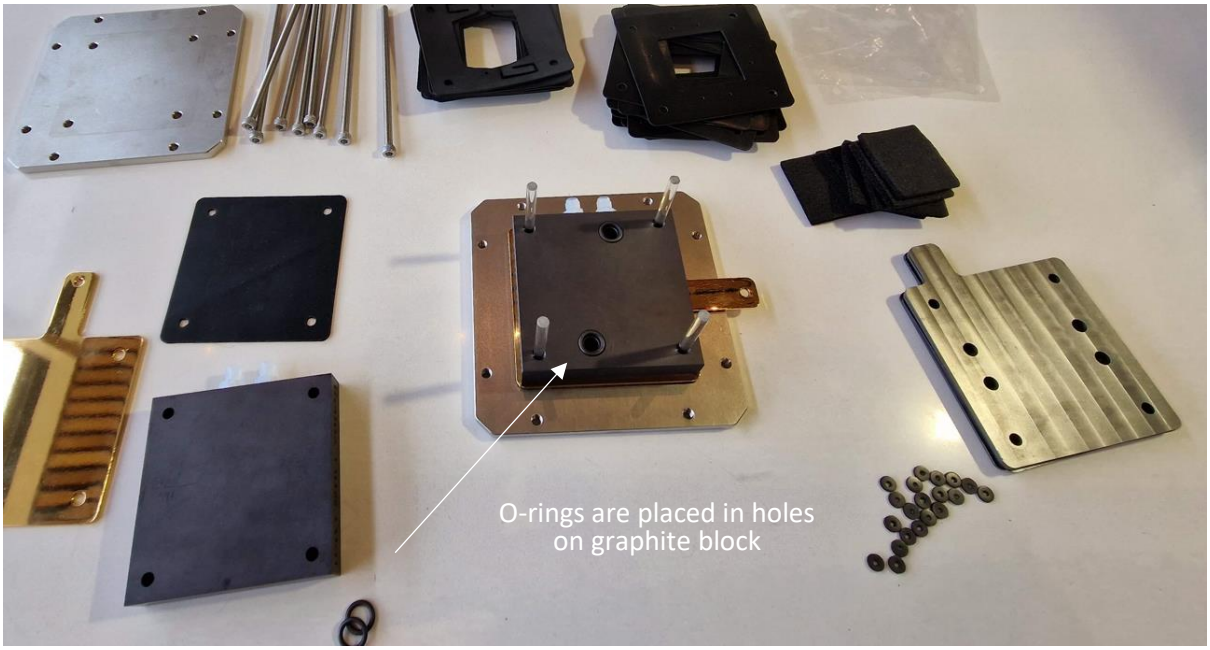
There is no garantuee on performance, corrosion or lifetime on this items. It is purely for research purposes.

Assembly

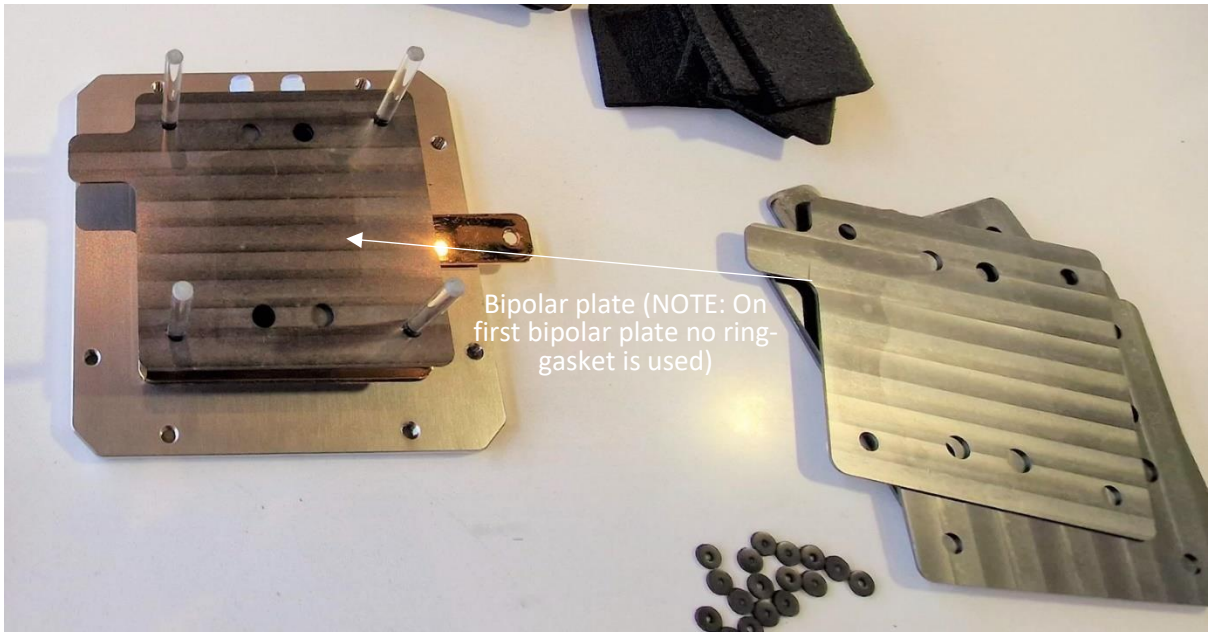

Isolator and alignment bars are placed on endplate
(remember to use endplate with thread in)

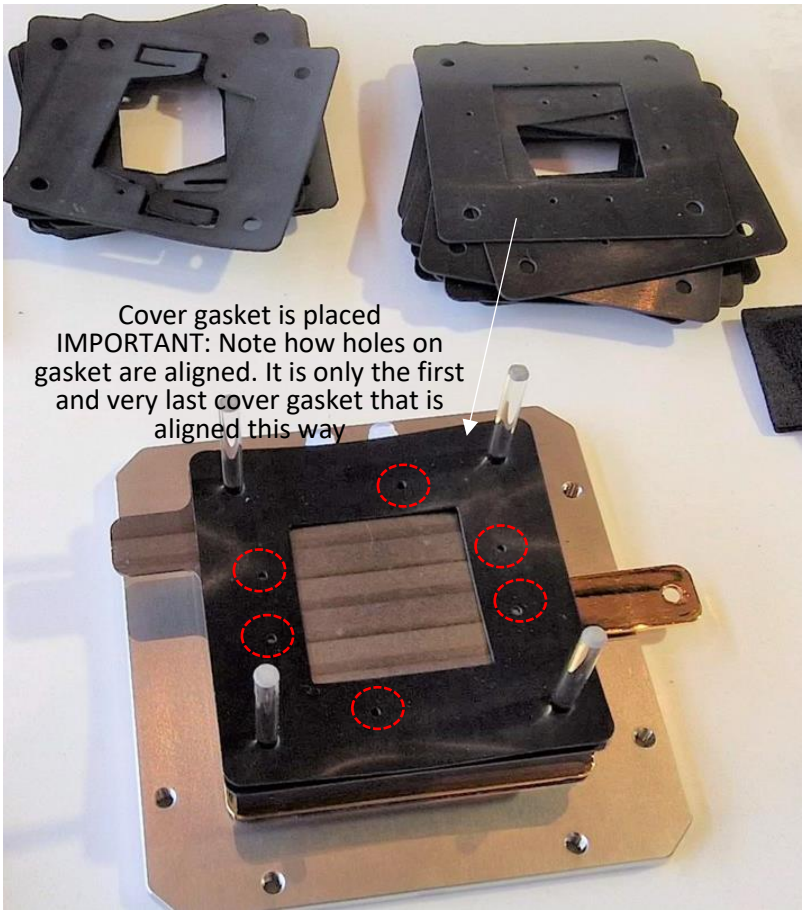

Current collector is placed
on isolator

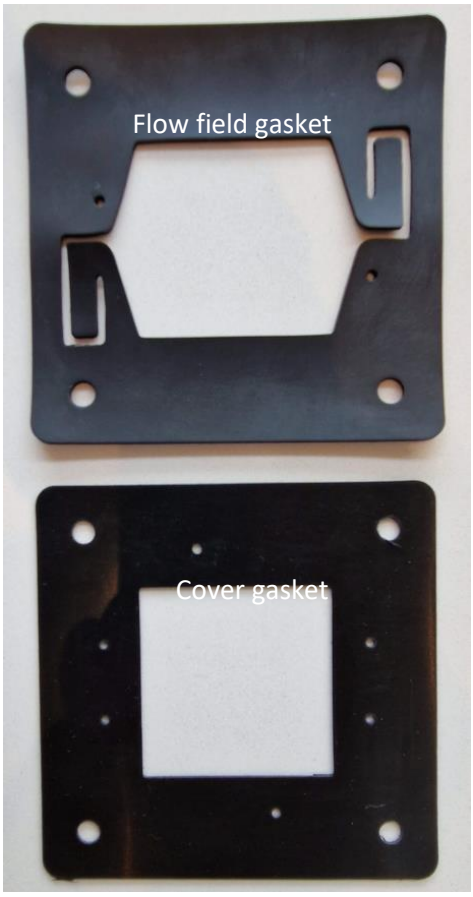

Graphite block is mounted

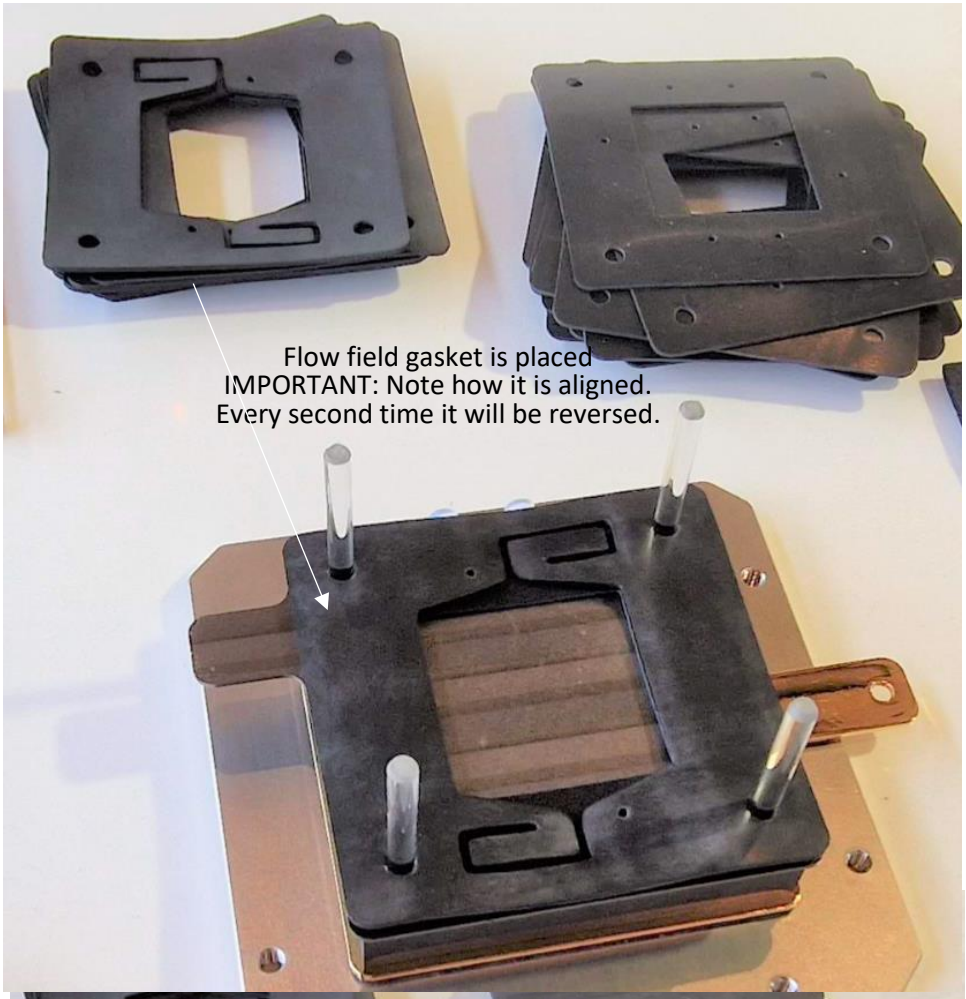

O-rings are placed in holes
on graphite block

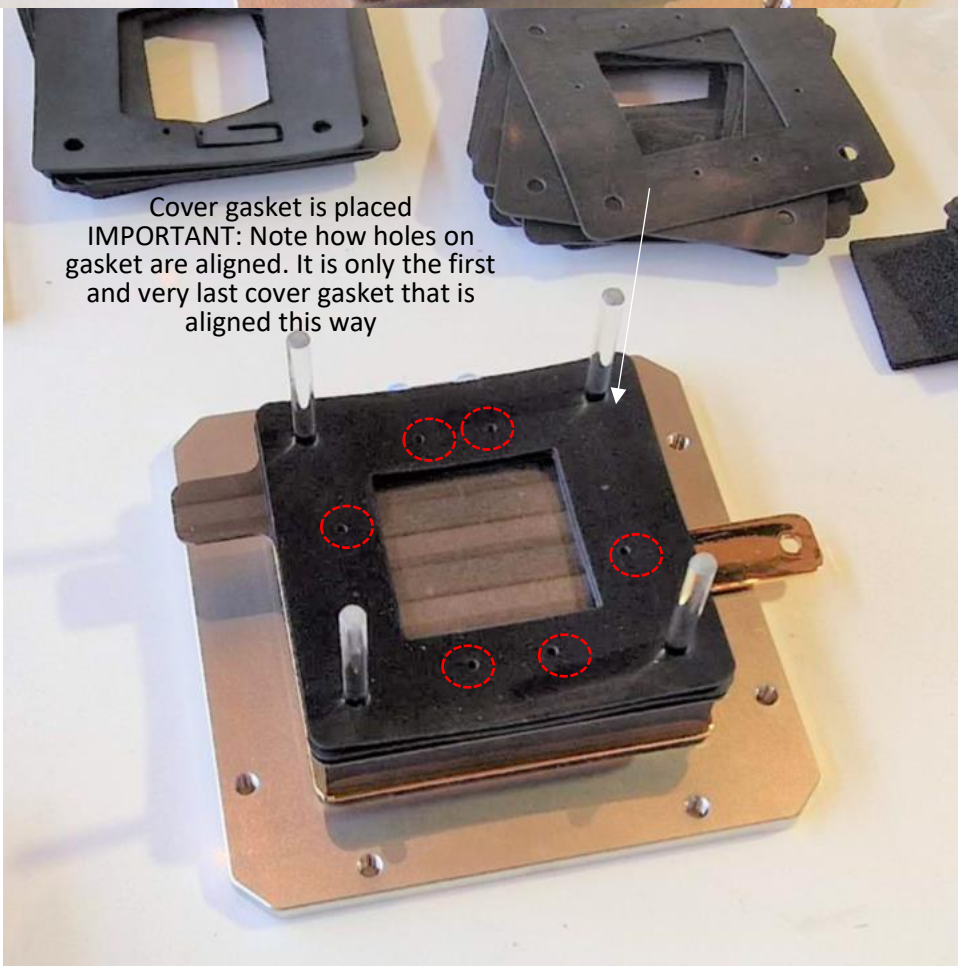
Assembly 1st Cell

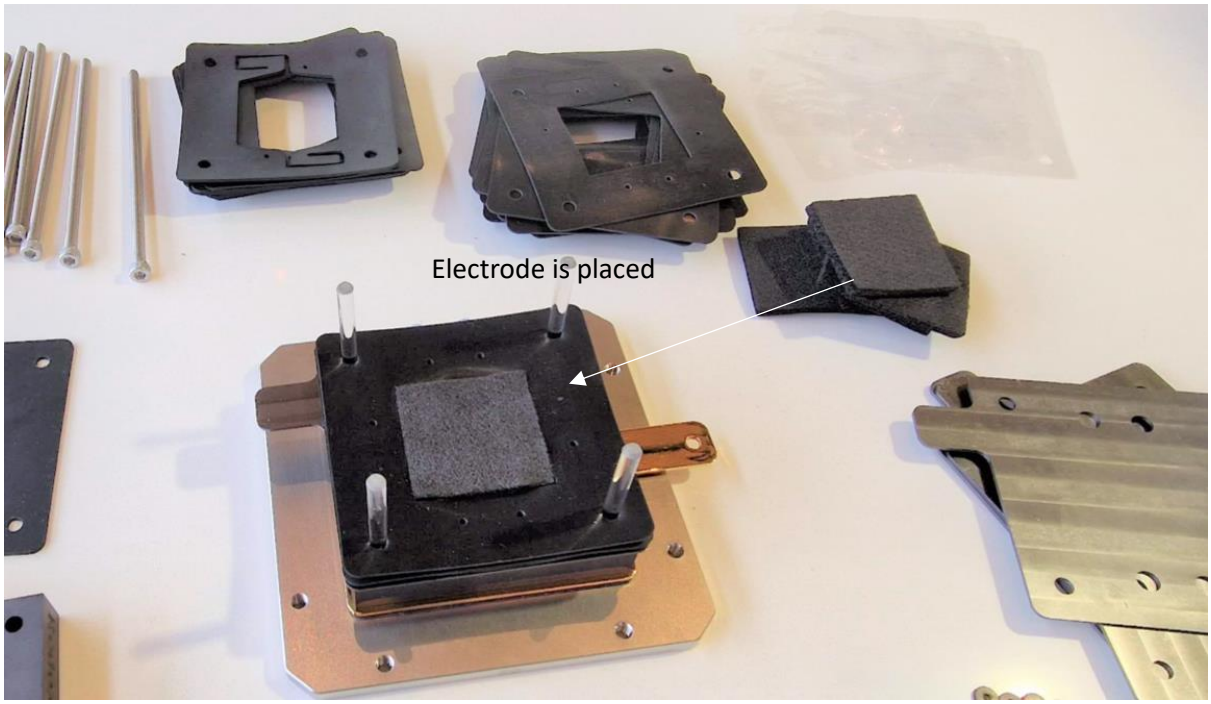


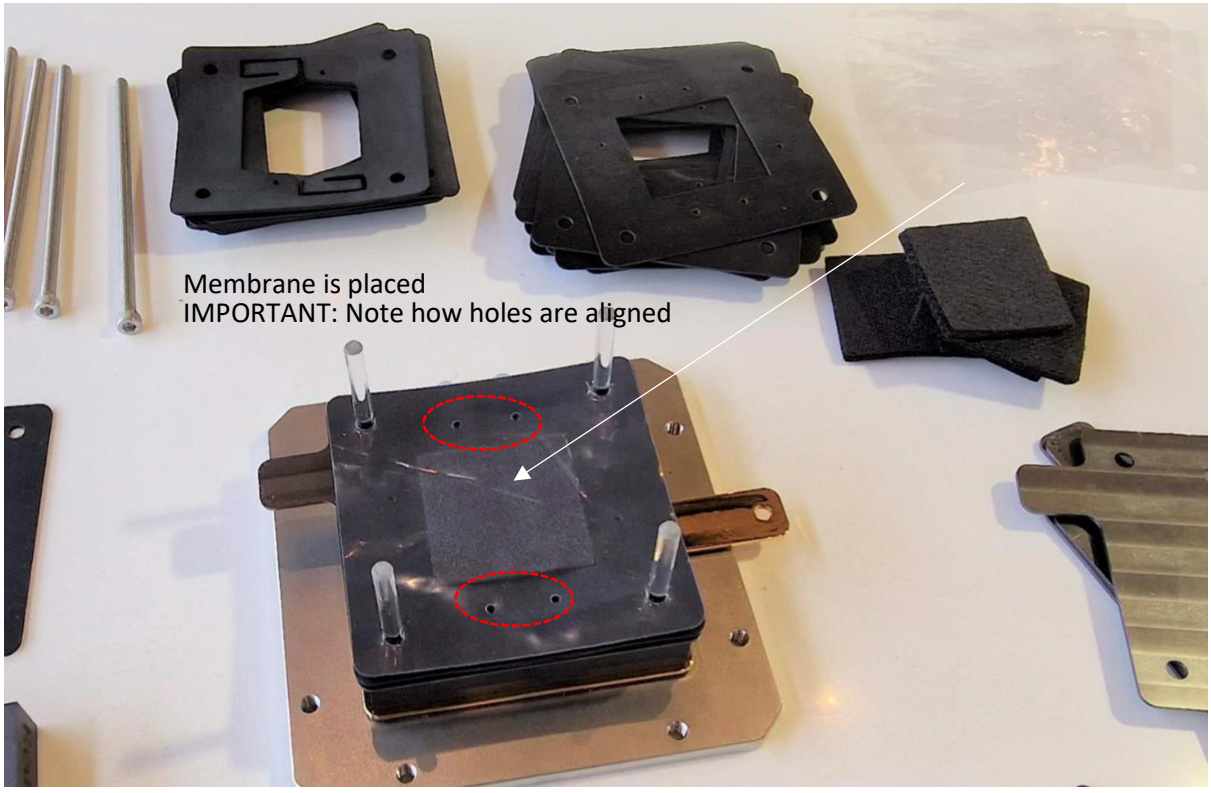


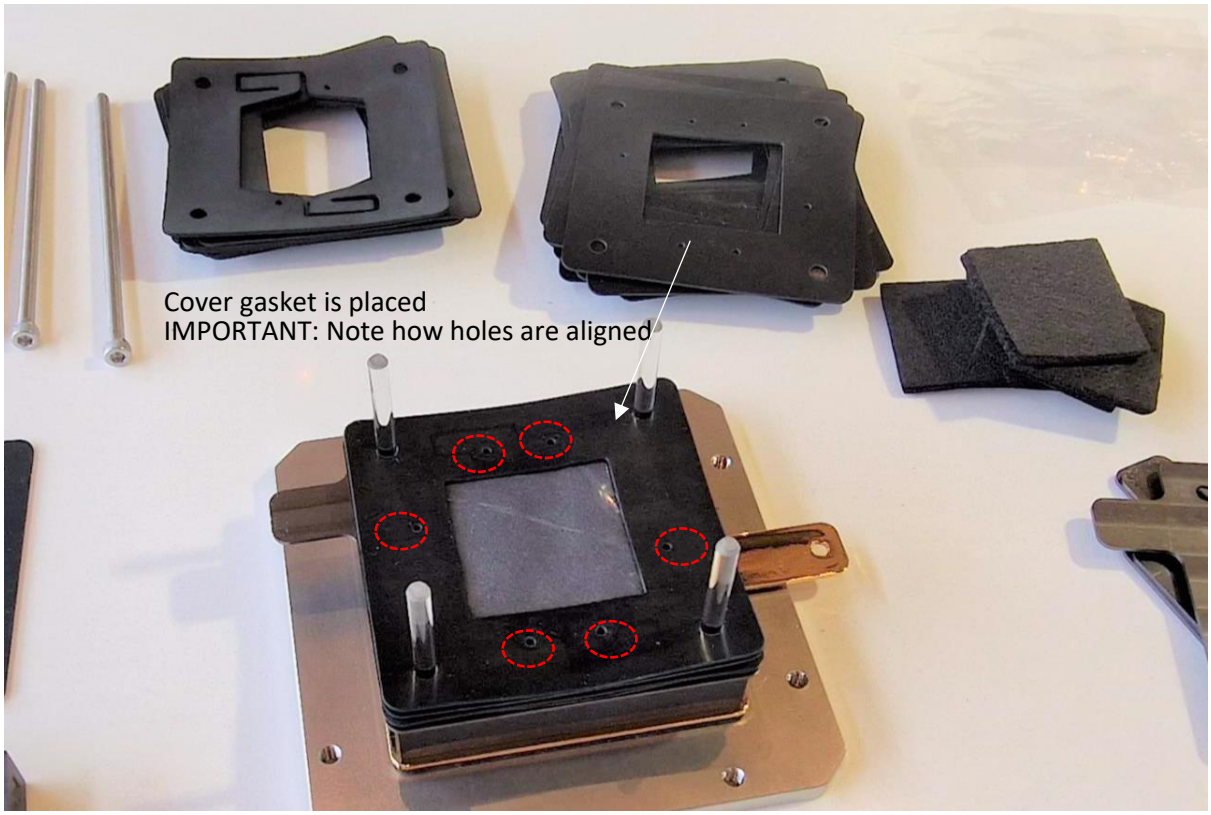


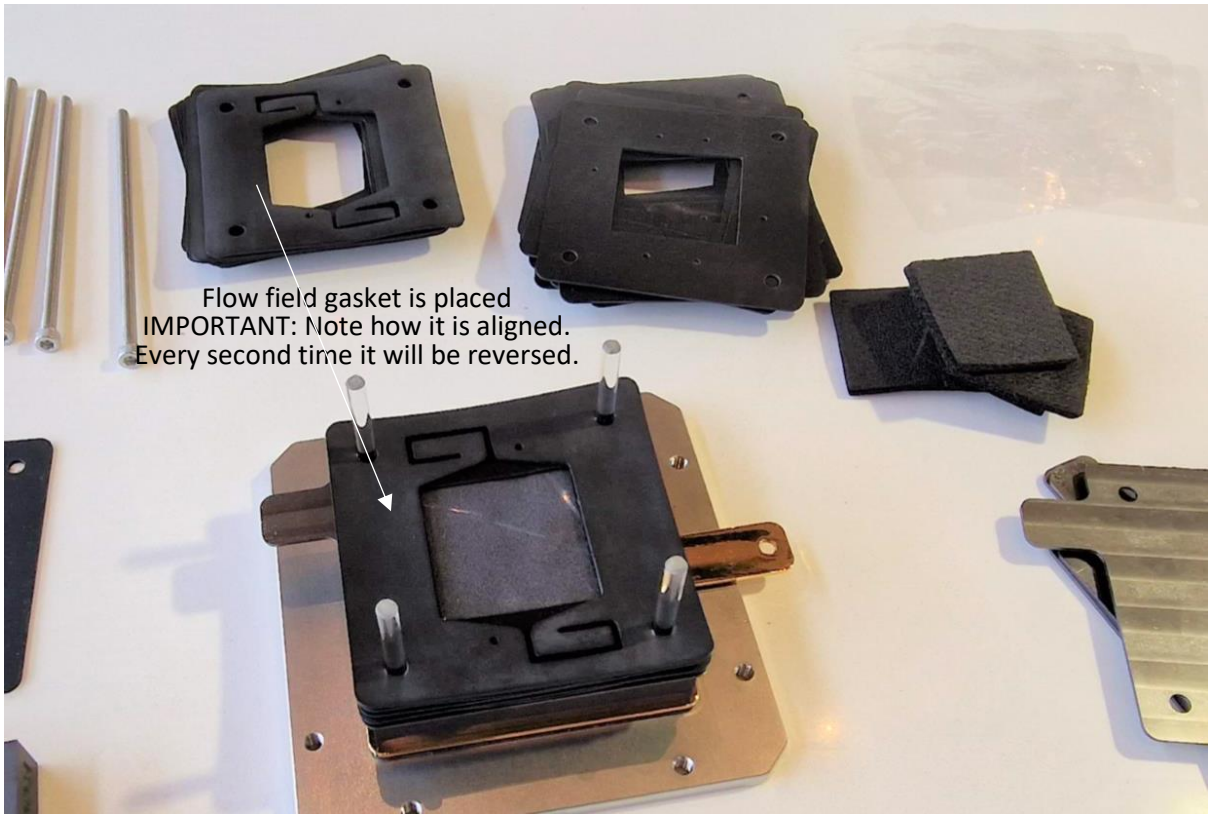

Flow field gasket is placed
IMPORTANT: Note how it is aligned.
Every second time it will be reversed.

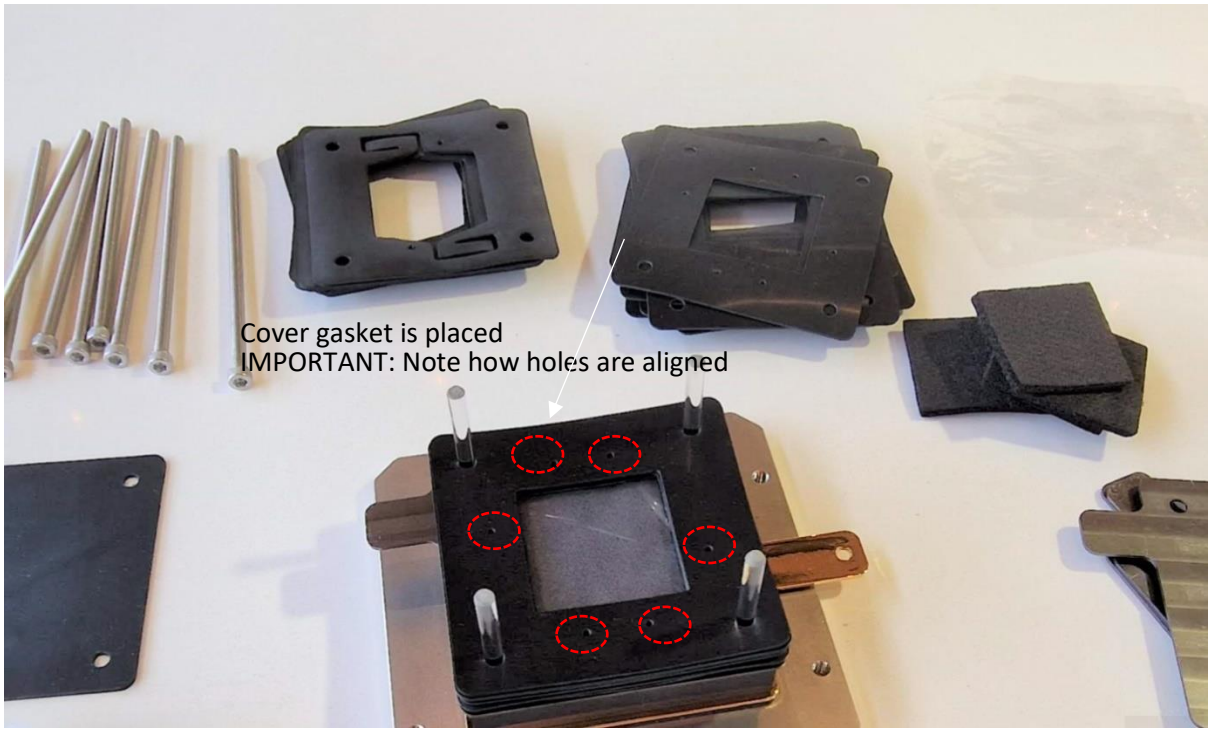

Cover gasket is placed
IMPORTANT: Note how holes on gasket are aligned. It is only the first and very last cover gasket that is aligned this way

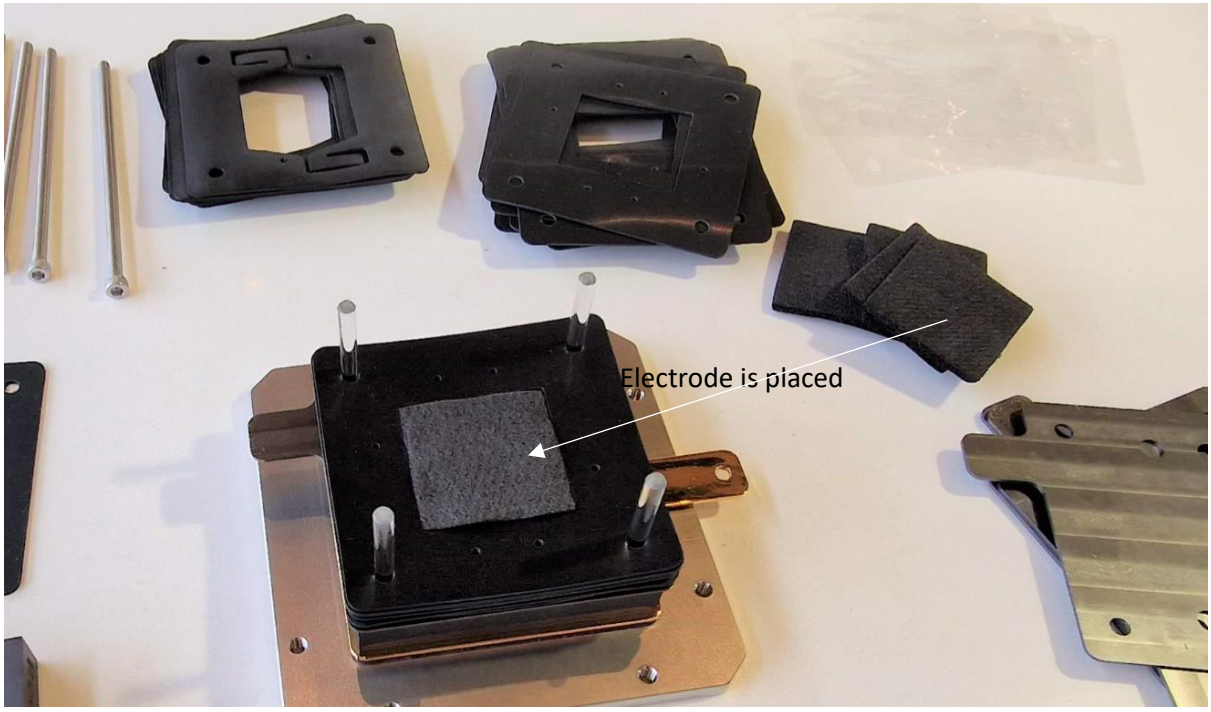

Electrode is placed

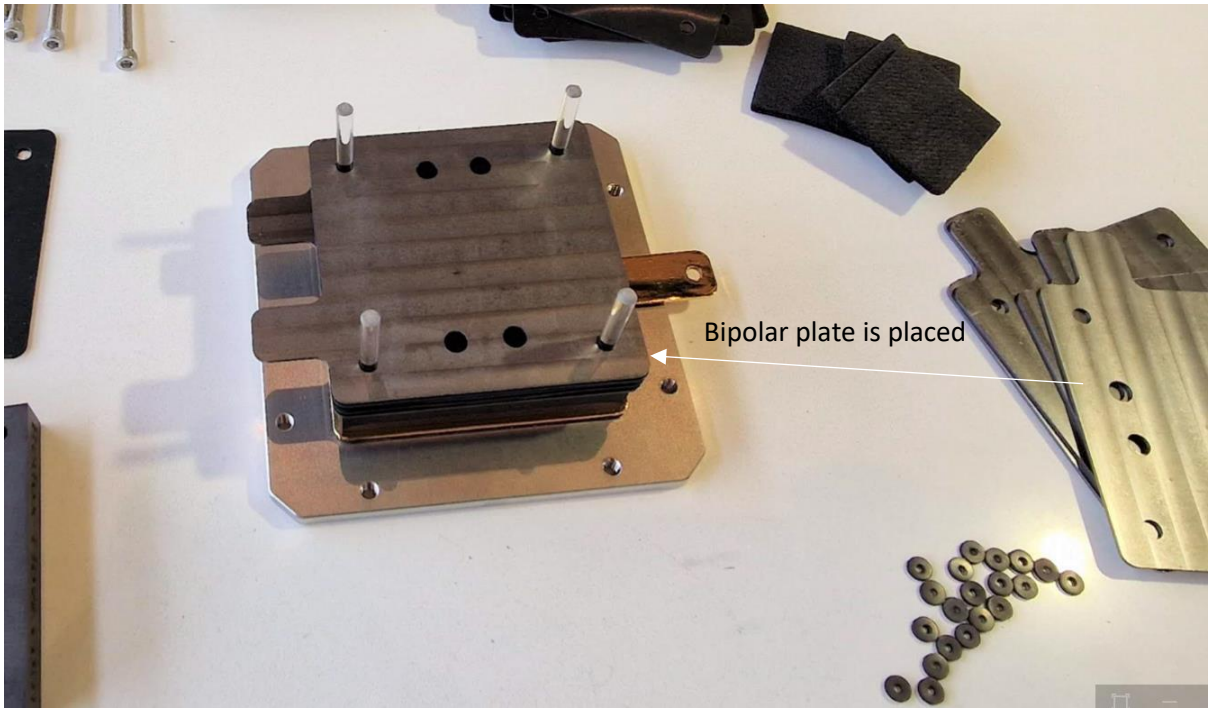

Membrane is placed
IMPORTANT: Note how holes are aligned

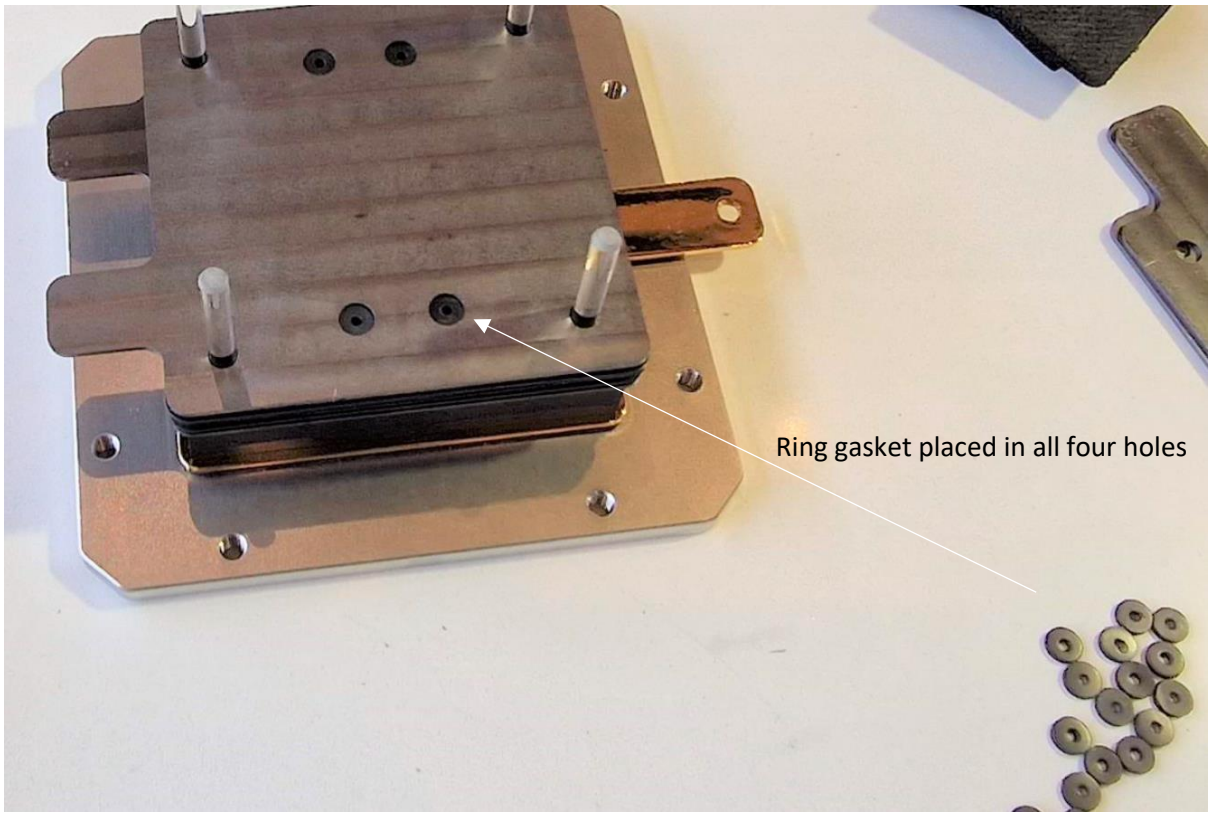

Cover gasket is placed
IMPORTANT: Note how holes are aligned


Flow field gasket is placed
IMPORTANT: Note how it is aligned.
Every second time it will be reversed.

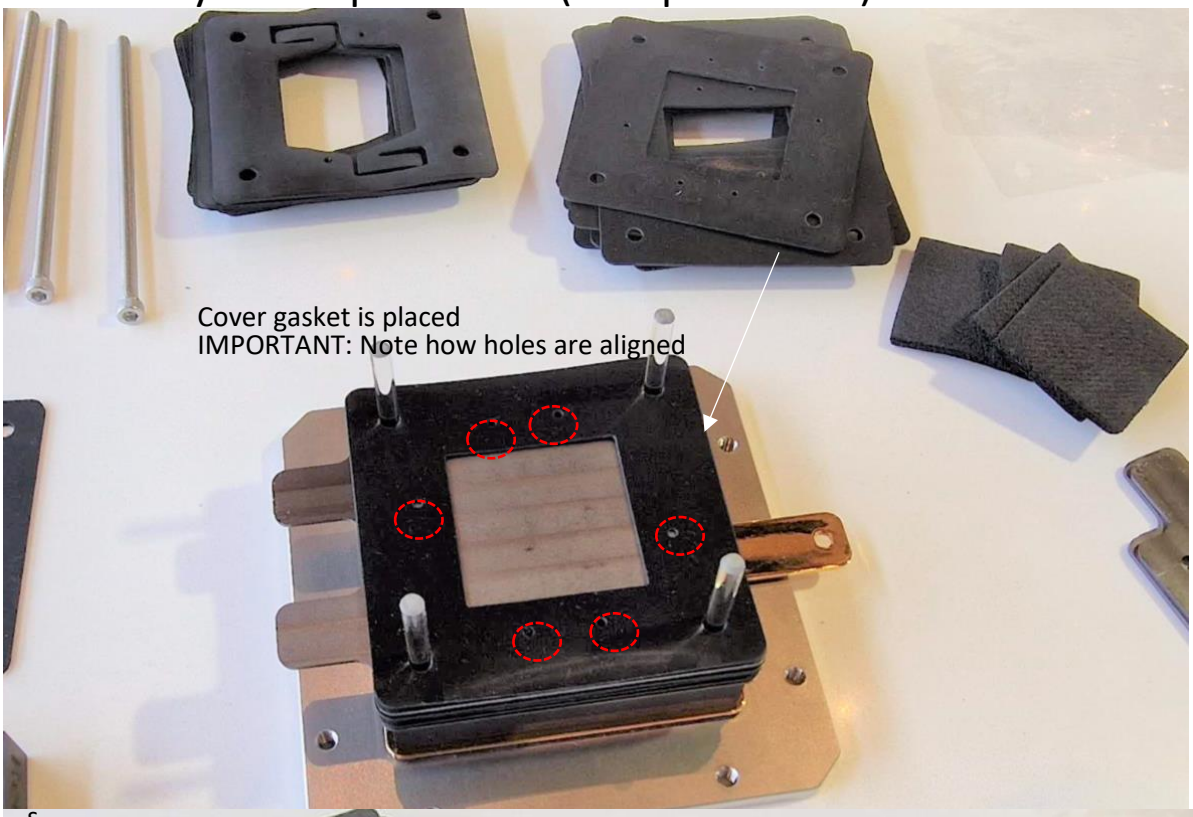

Cover gasket is placed
IMPORTANT: Note how holes are aligned


Electrode is placed

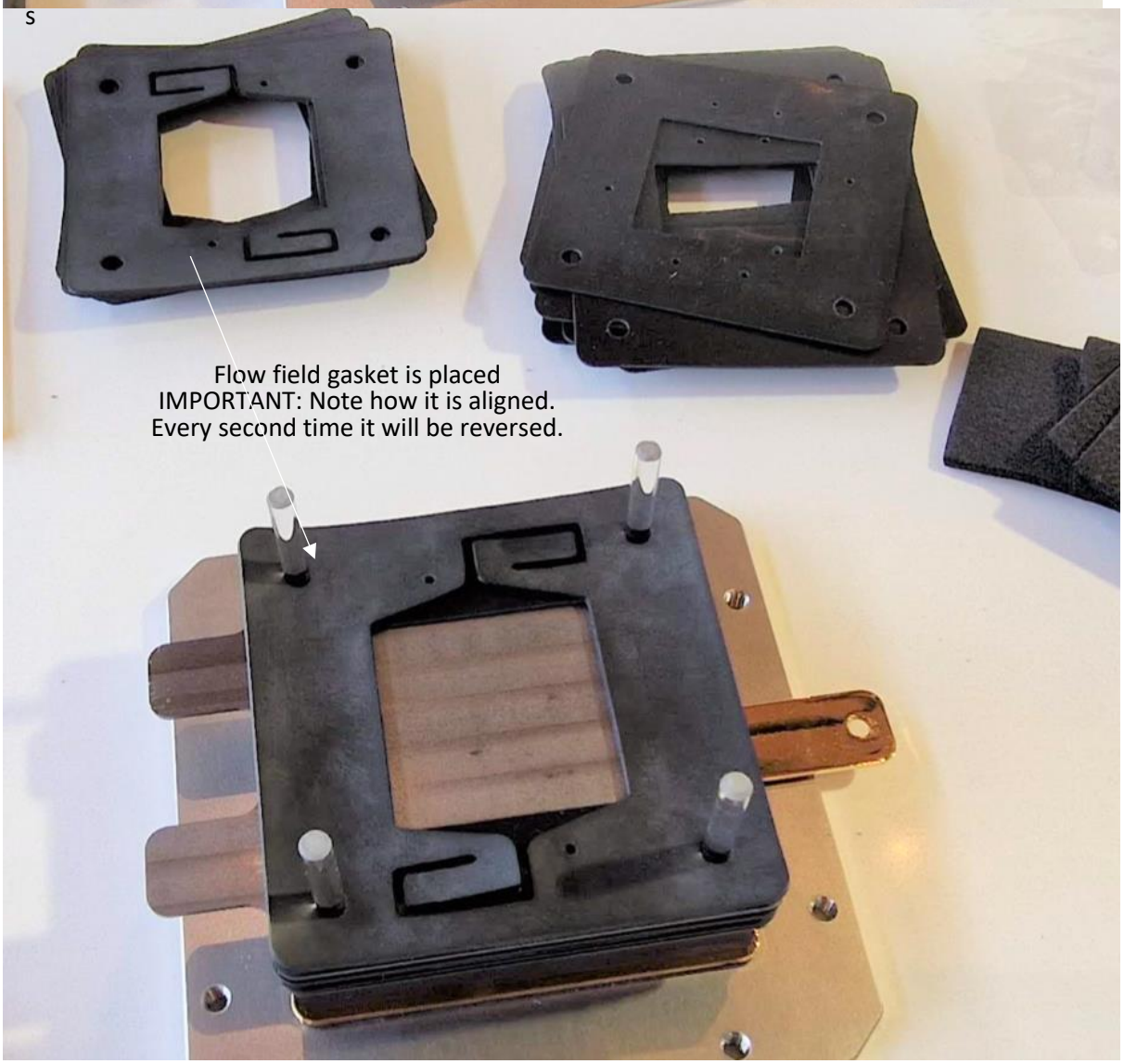

Bipolar plate is placed

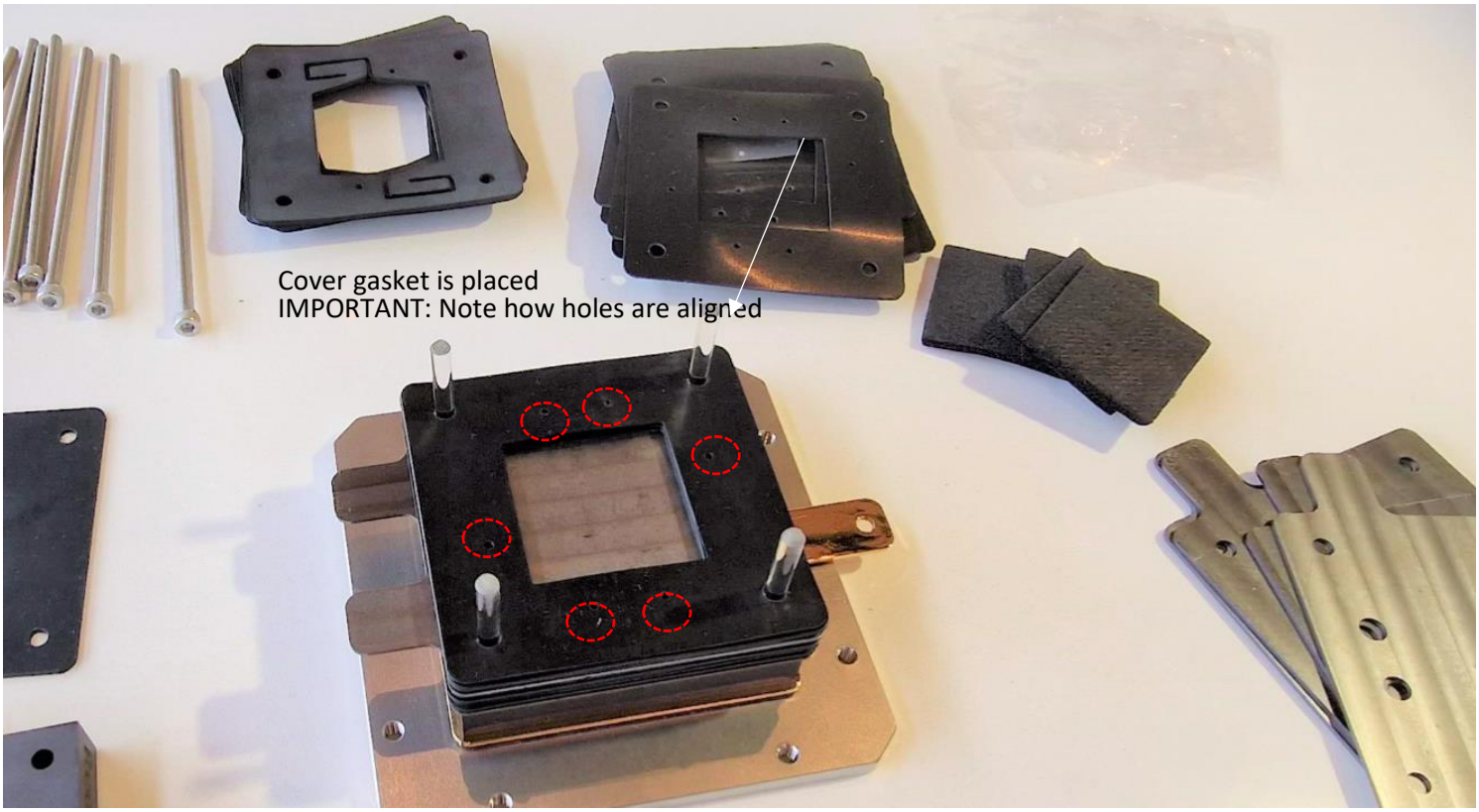

Ring gasket placed in all four holes

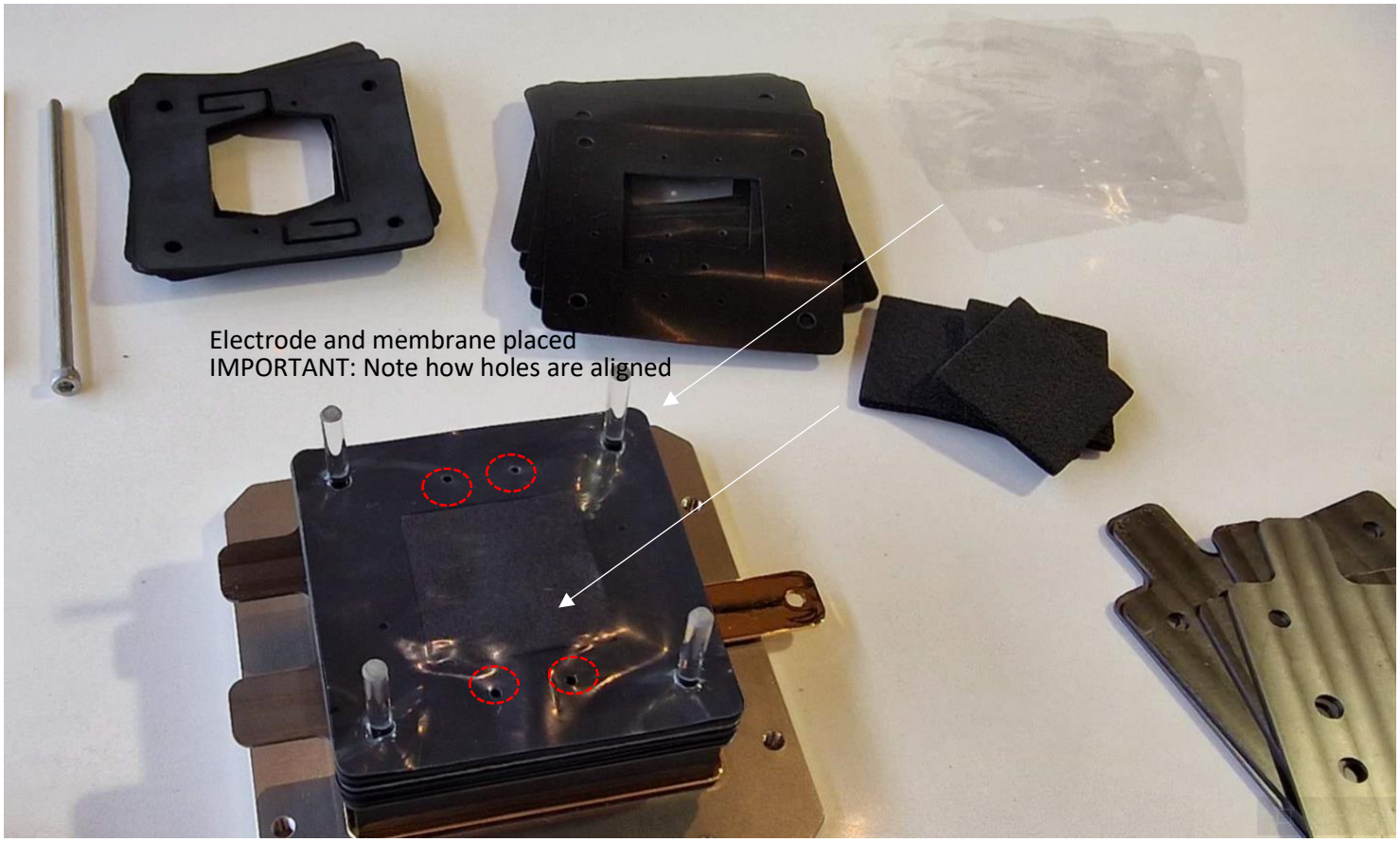
Assembly subsequent cells (except last cell)

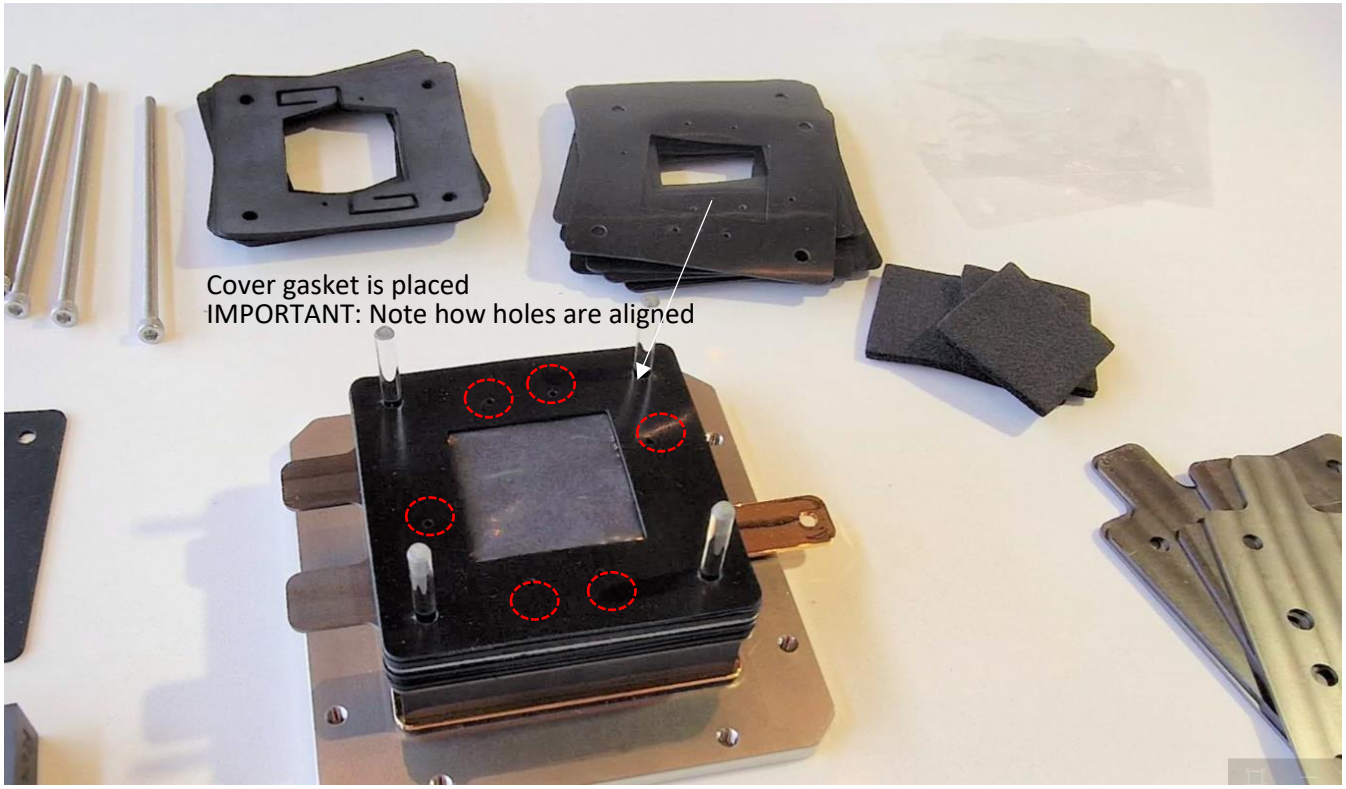


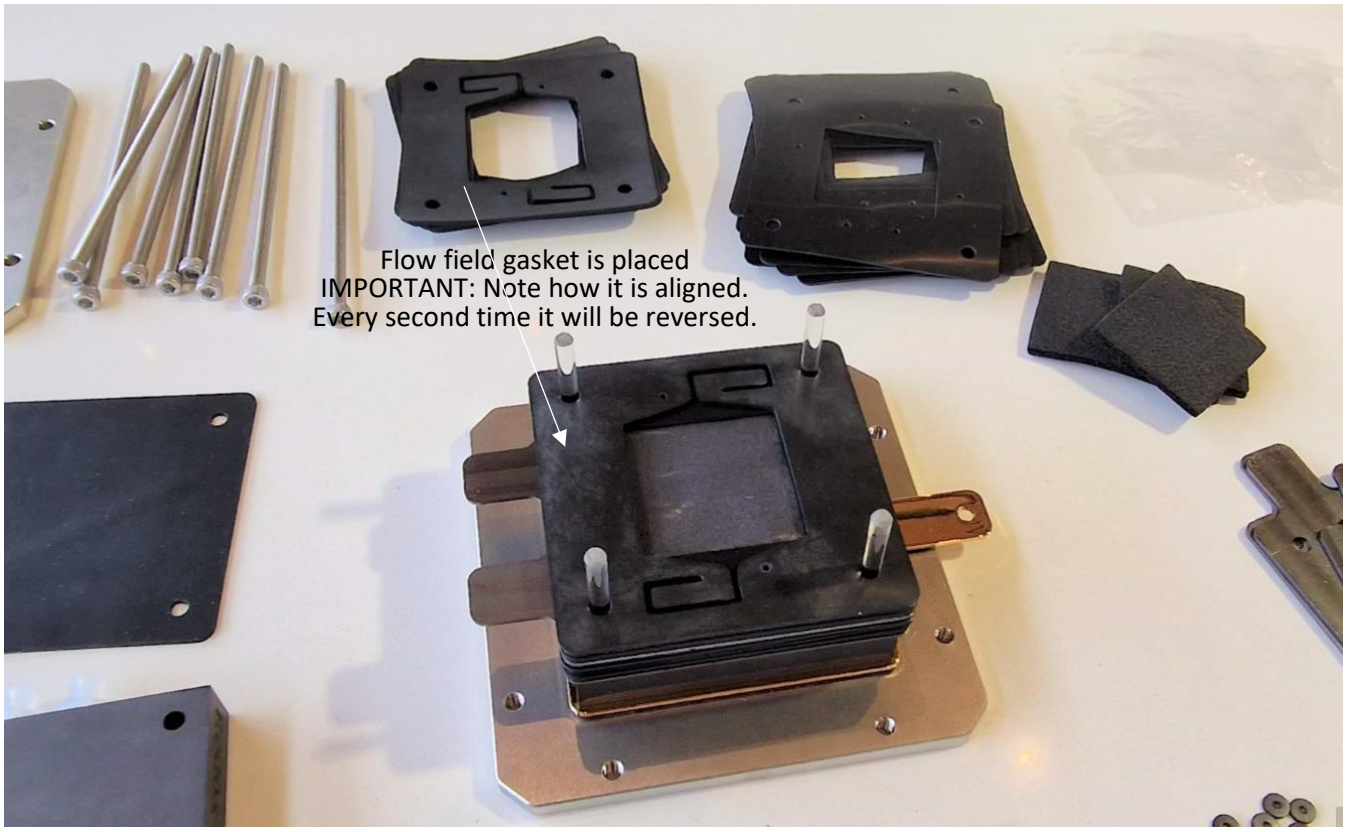
S

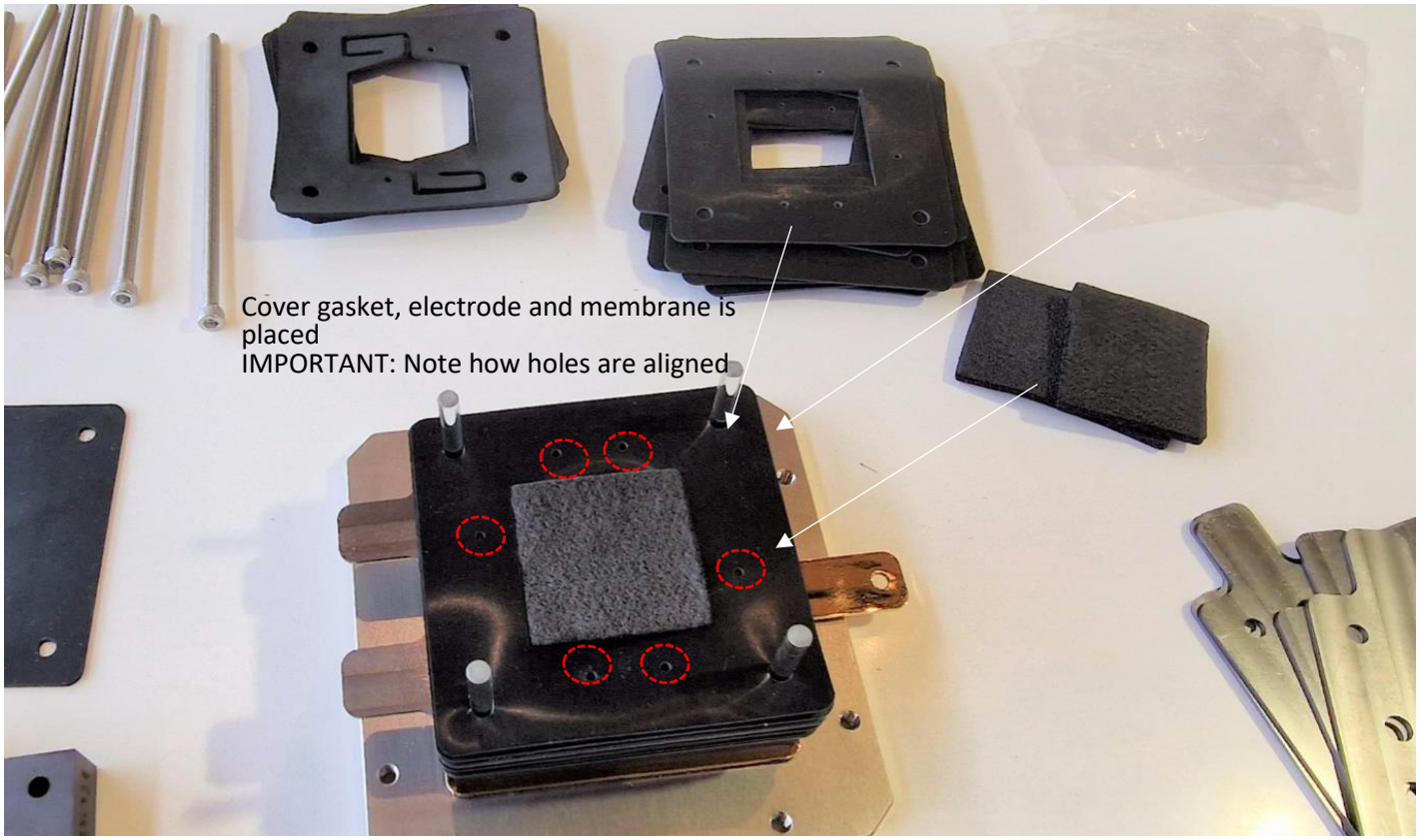


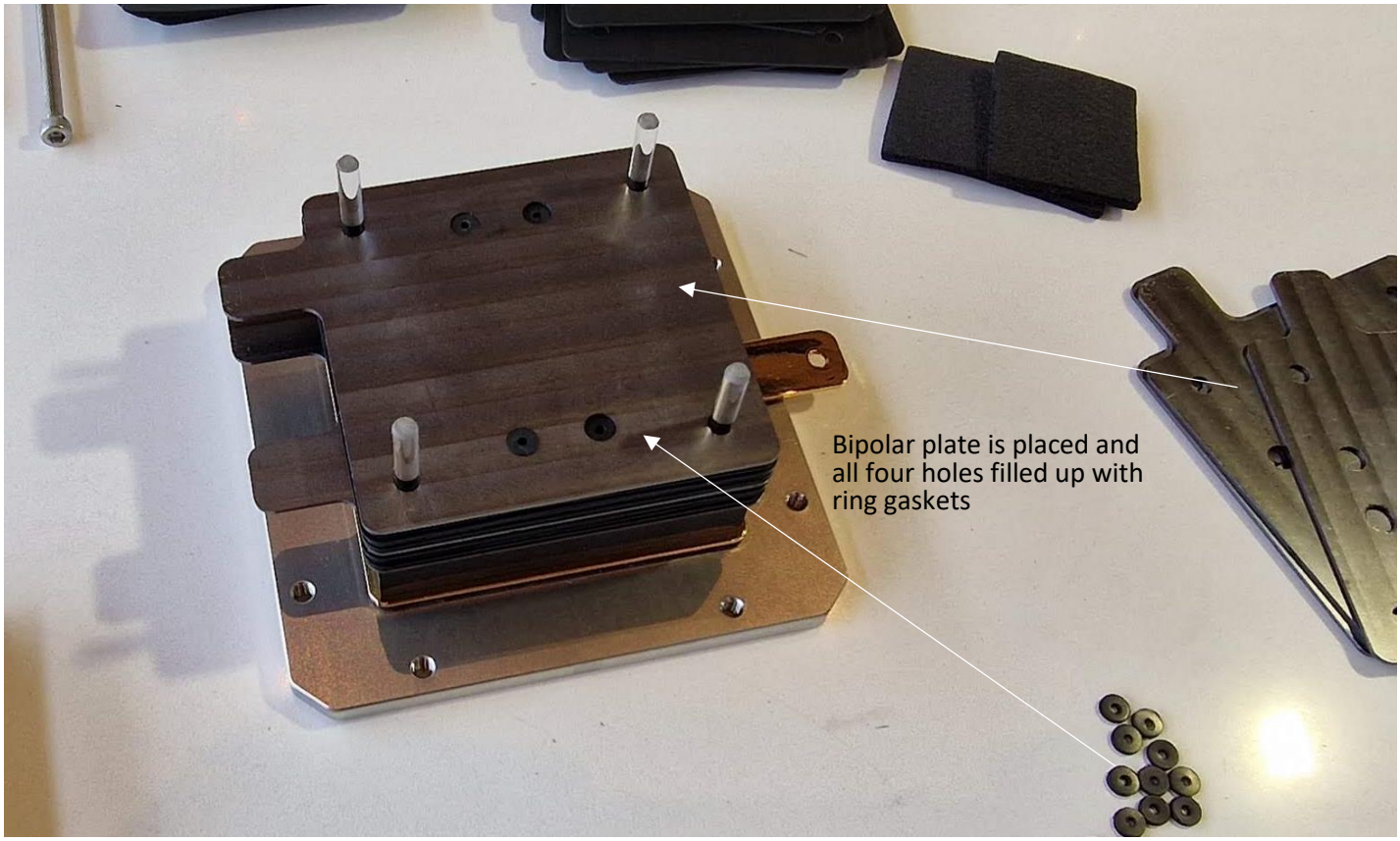

Cover gasket is placed
IMPORTANT: Note how holes are aligned


Electrode and membrane placed
IMPORTANT: Note how holes are aligned

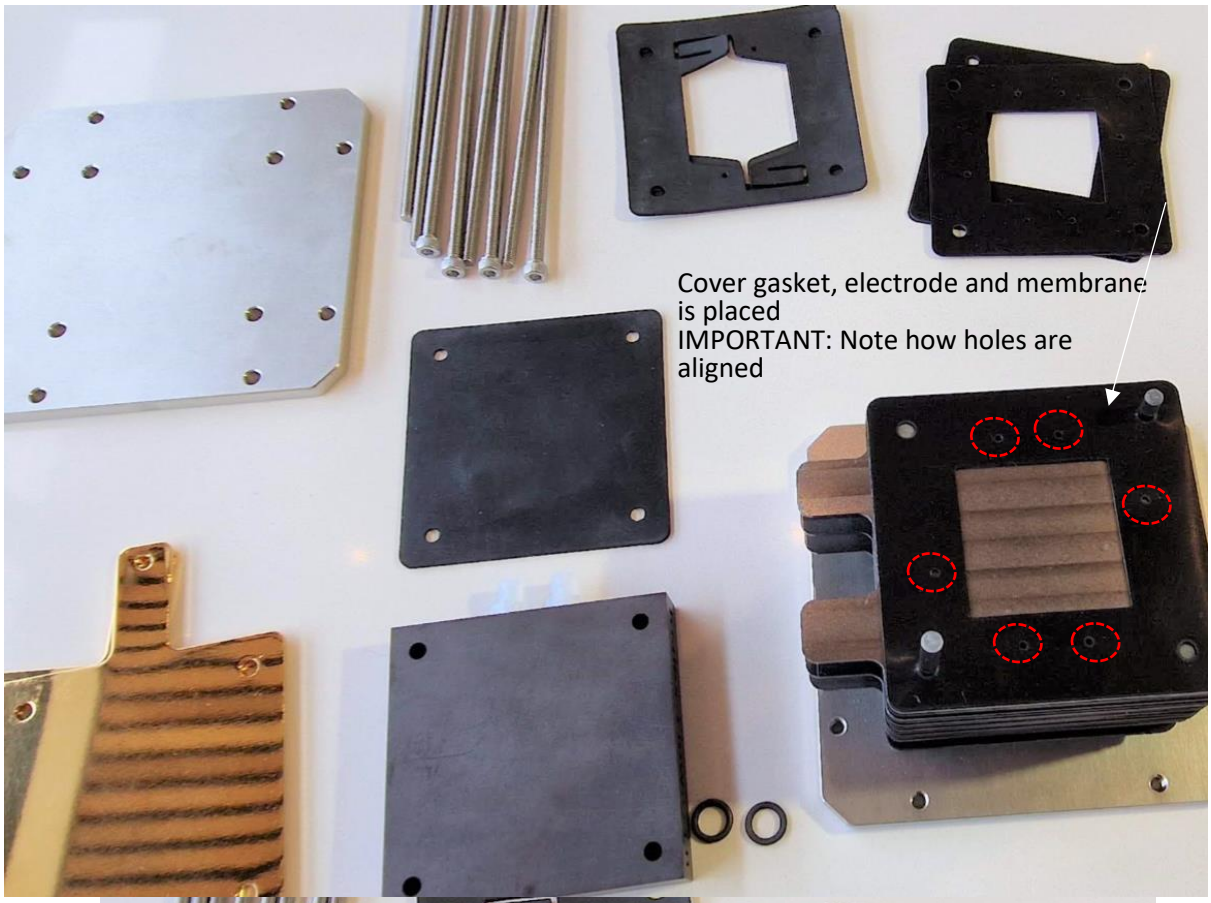

Cover gasket is placed
IMPORTANT: Note how holes are aligned

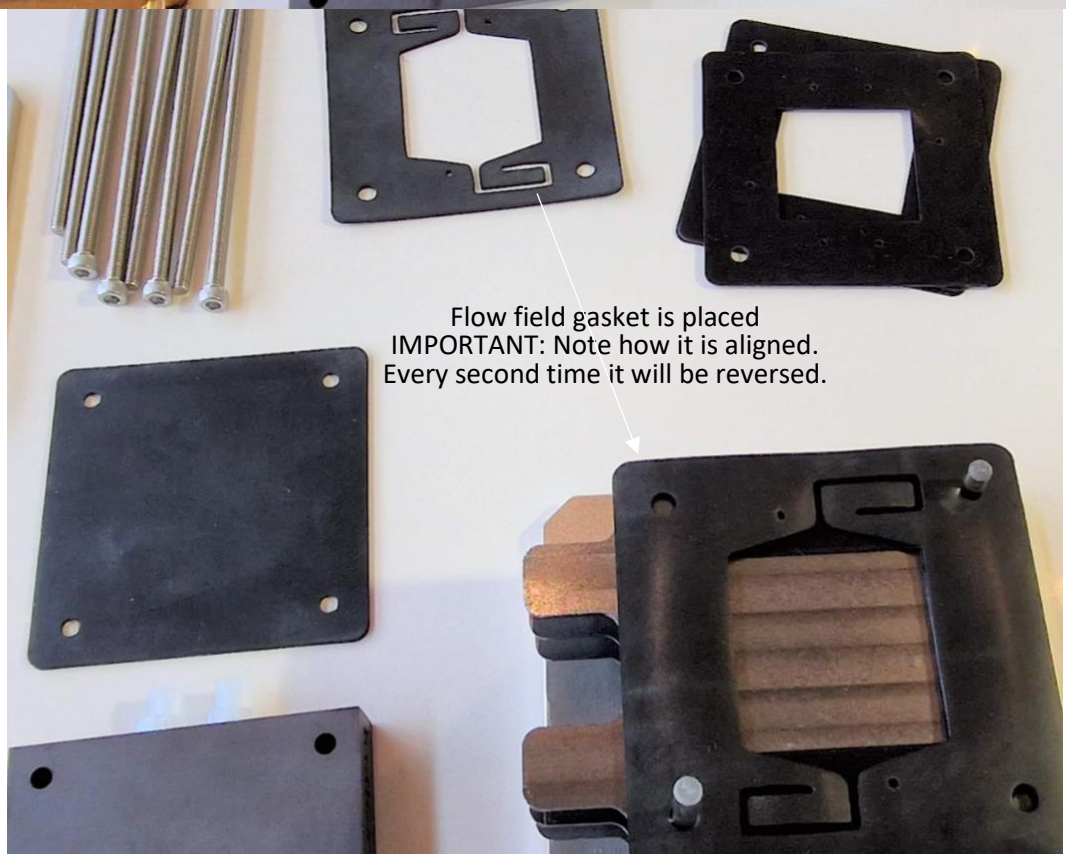

Flow field gasket is placed
IMPORTANT: Note how it is aligned.
Every second time it will be reversed.

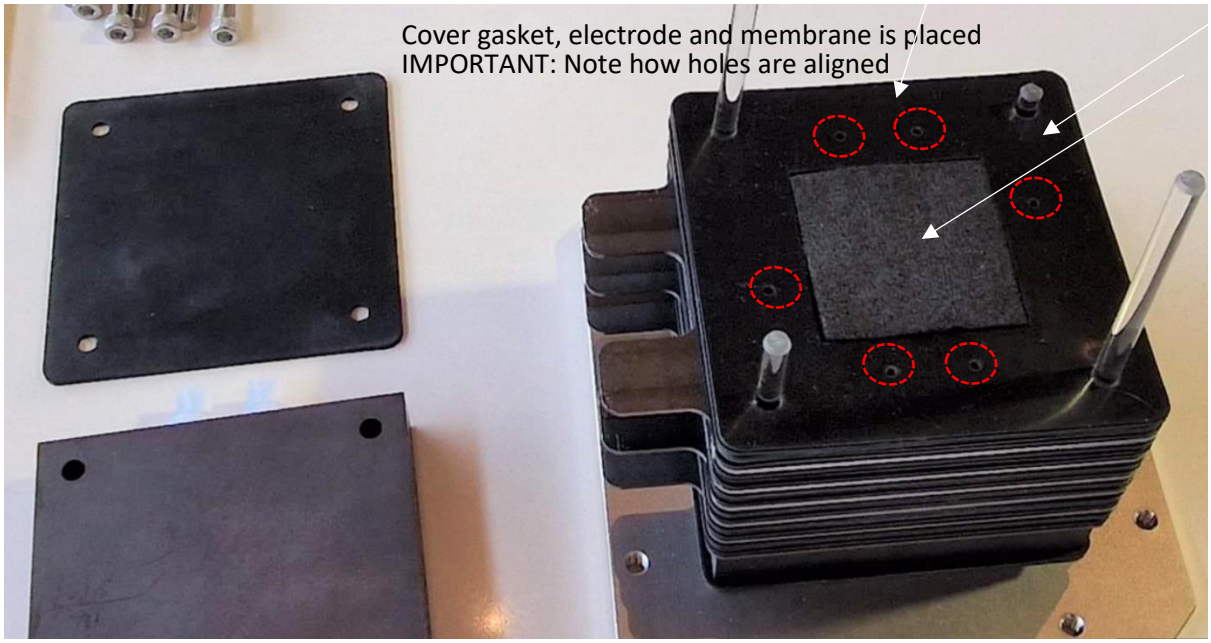

Cover gasket, electrode and membrane is placed
IMPORTANT: Note how holes are aligned

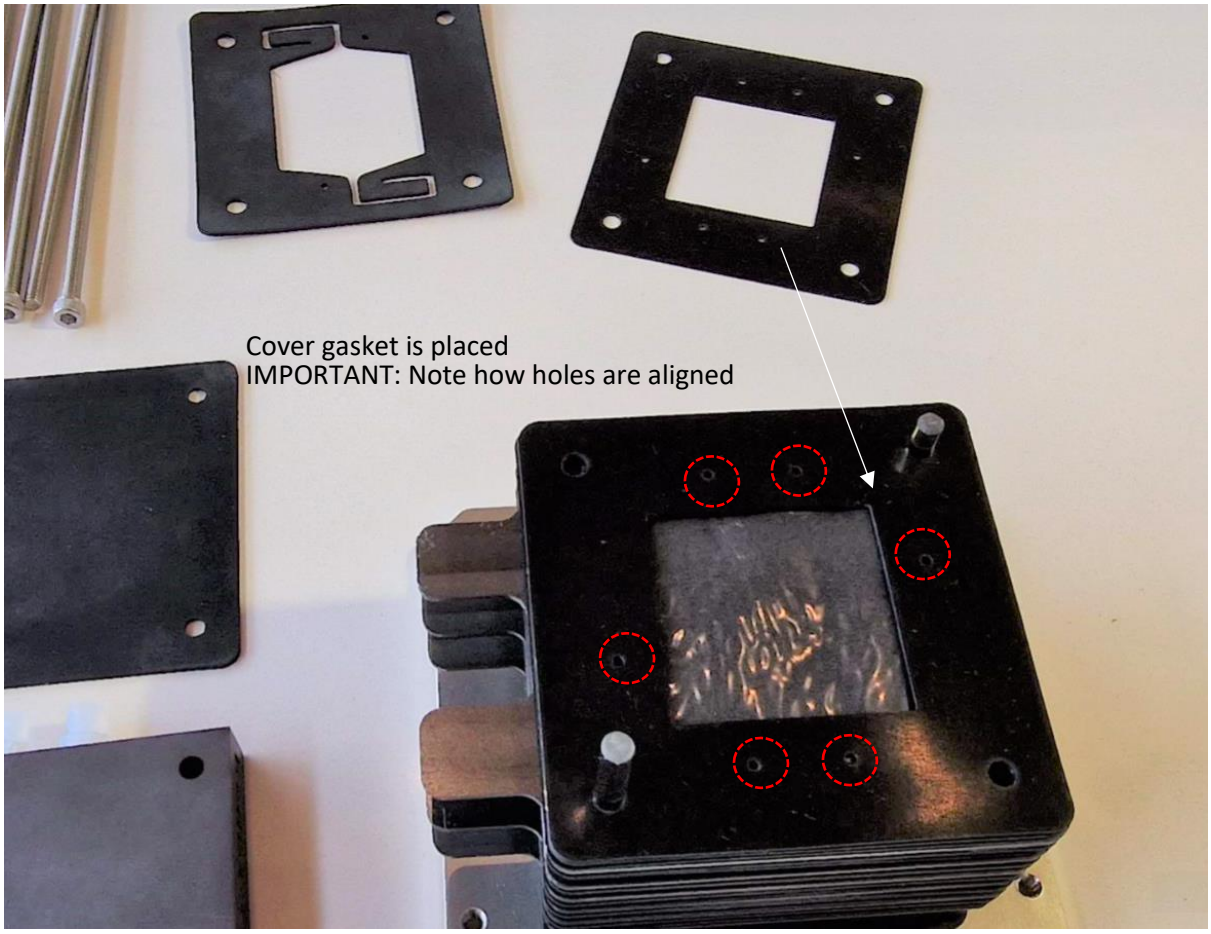

Bipolar plate is placed and all four holes filled up with ring gaskets

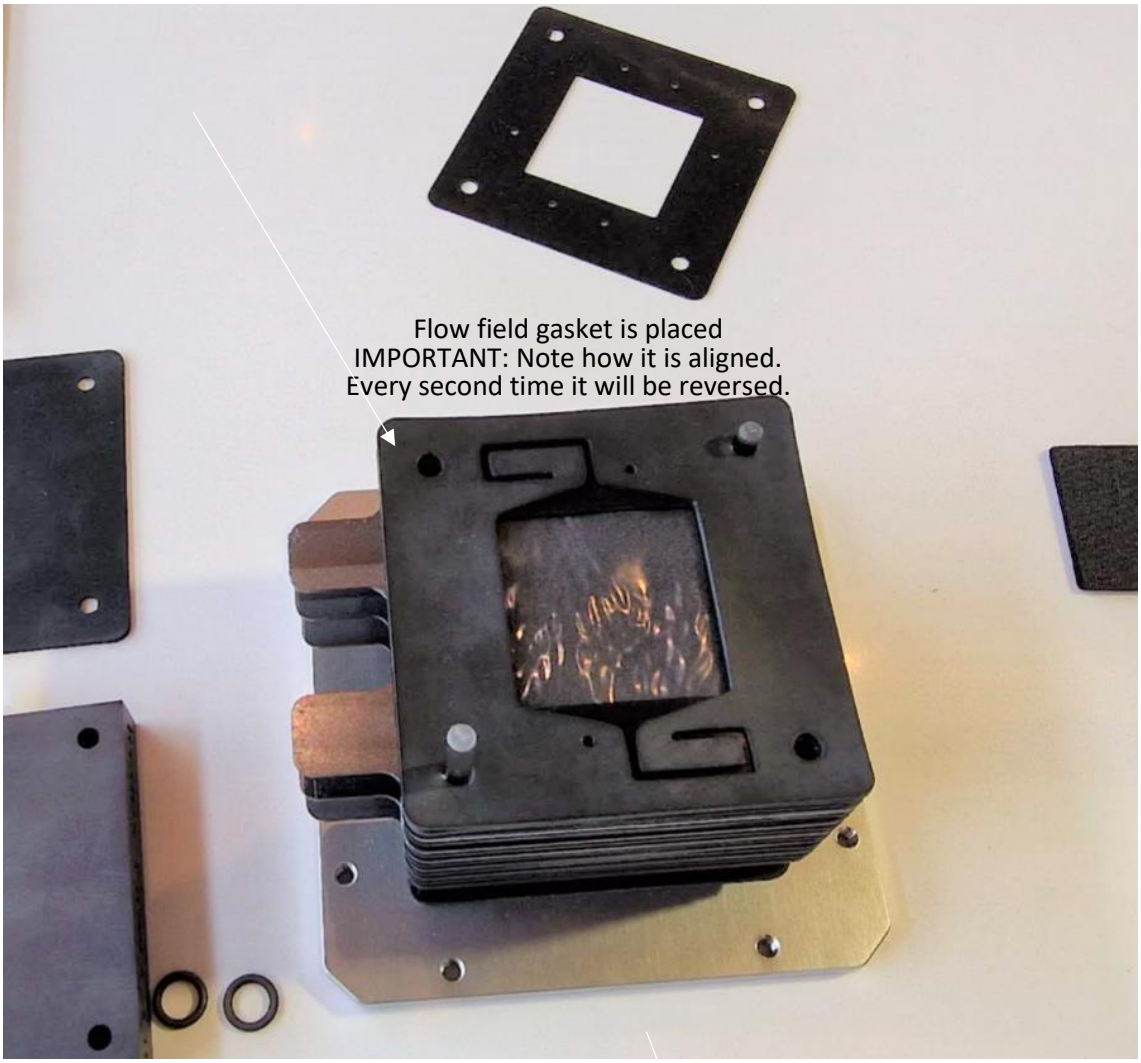
Assembly last Cell

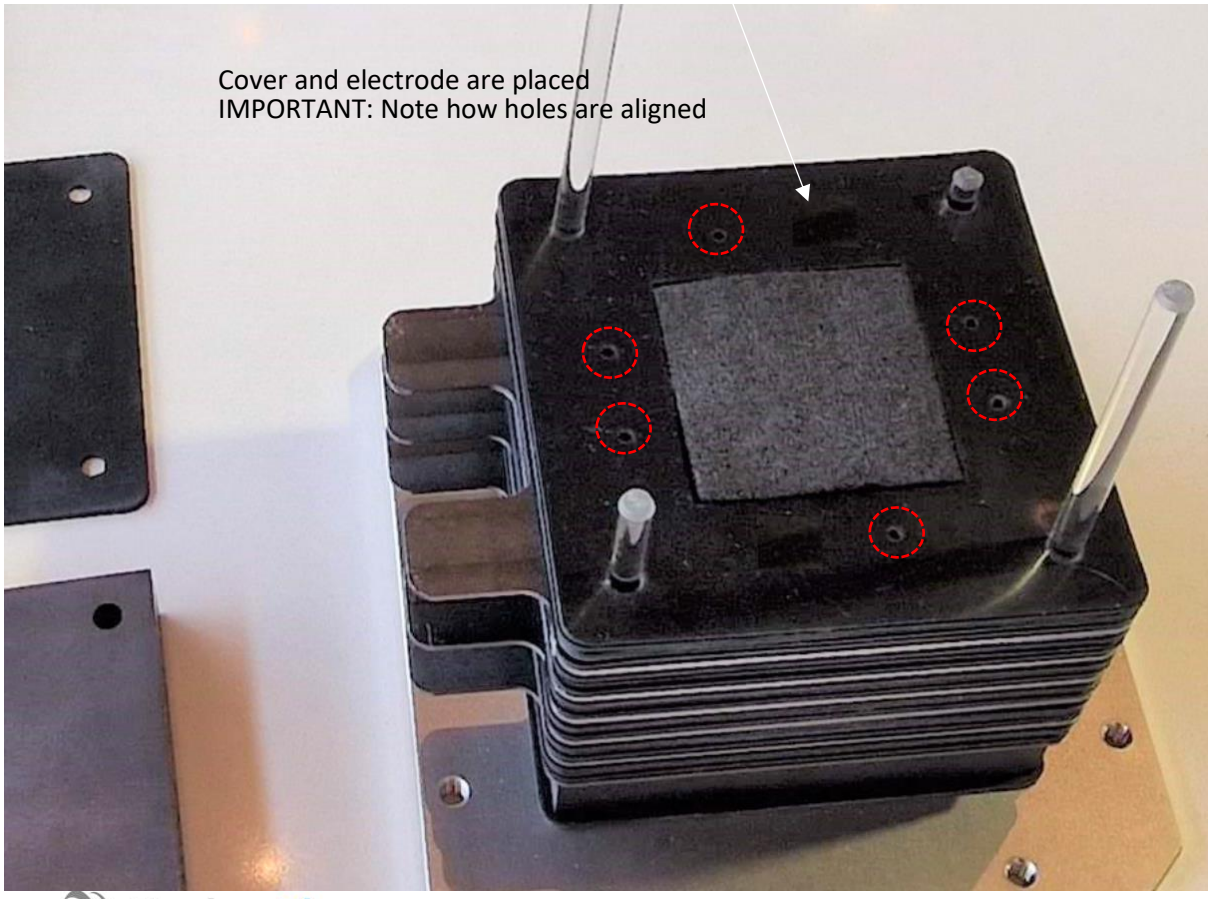




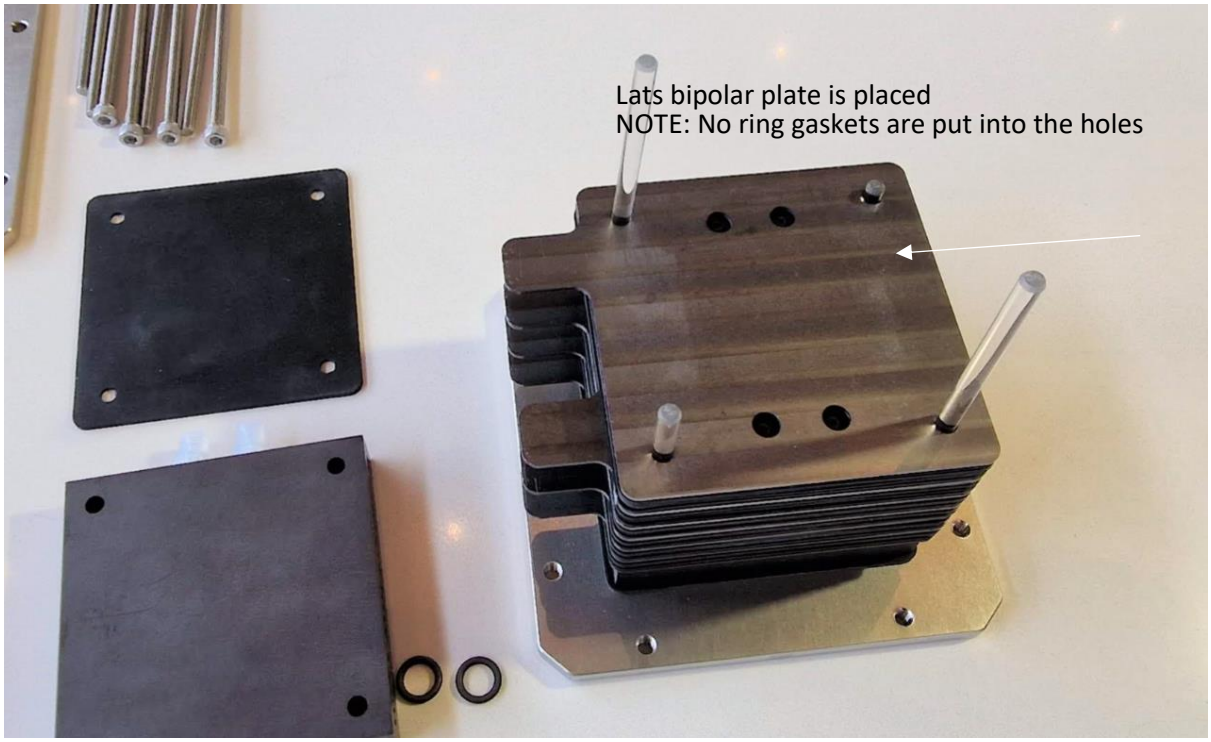

Cover gasket, electrode and membrane is placed
IMPORTANT: Note how holes are aligned

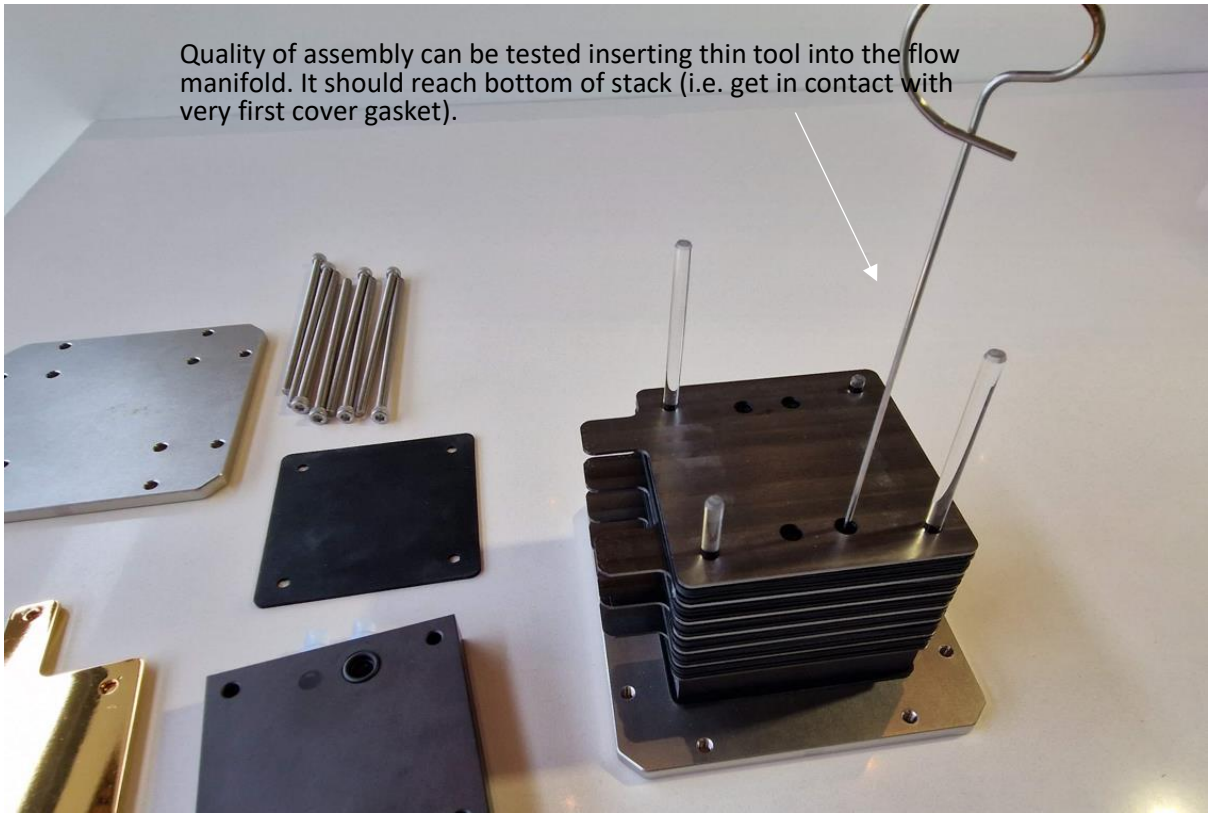

Cover gasket is placed
IMPORTANT: Note how holes are aligned

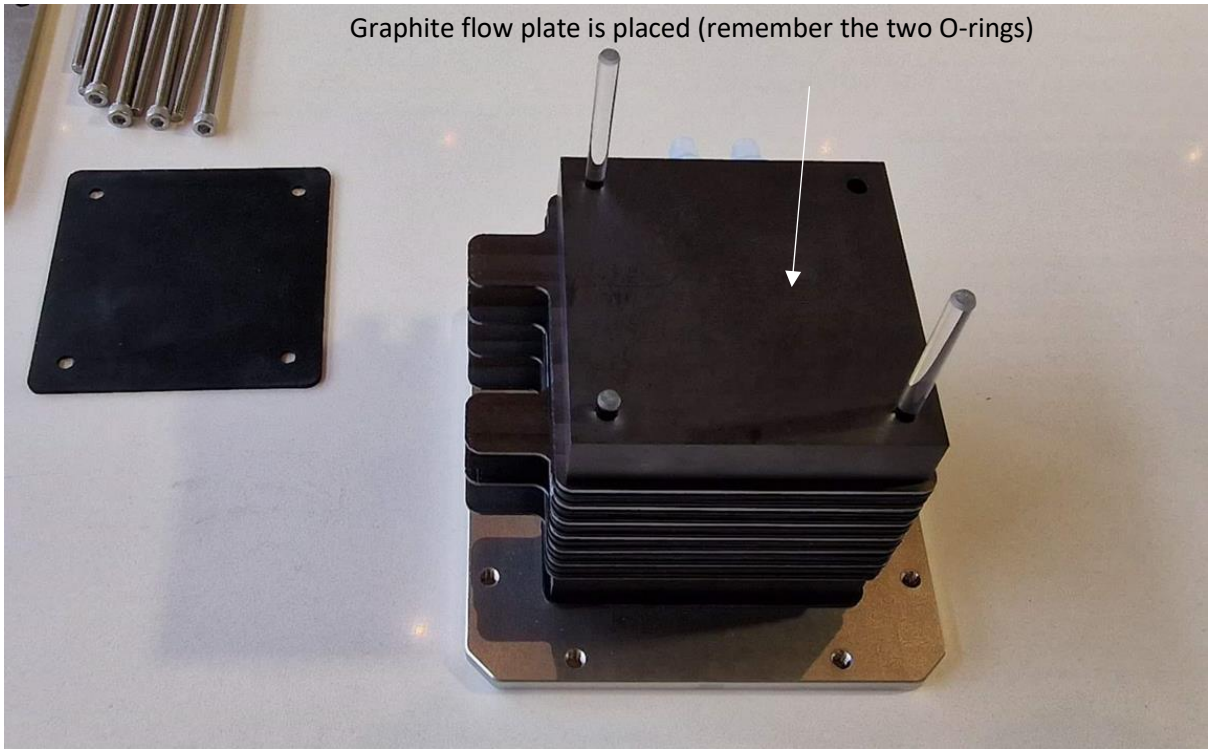

Flow field gasket is placed
IMPORTANT: Note how it is aligned.
Every second time it will be reversed.

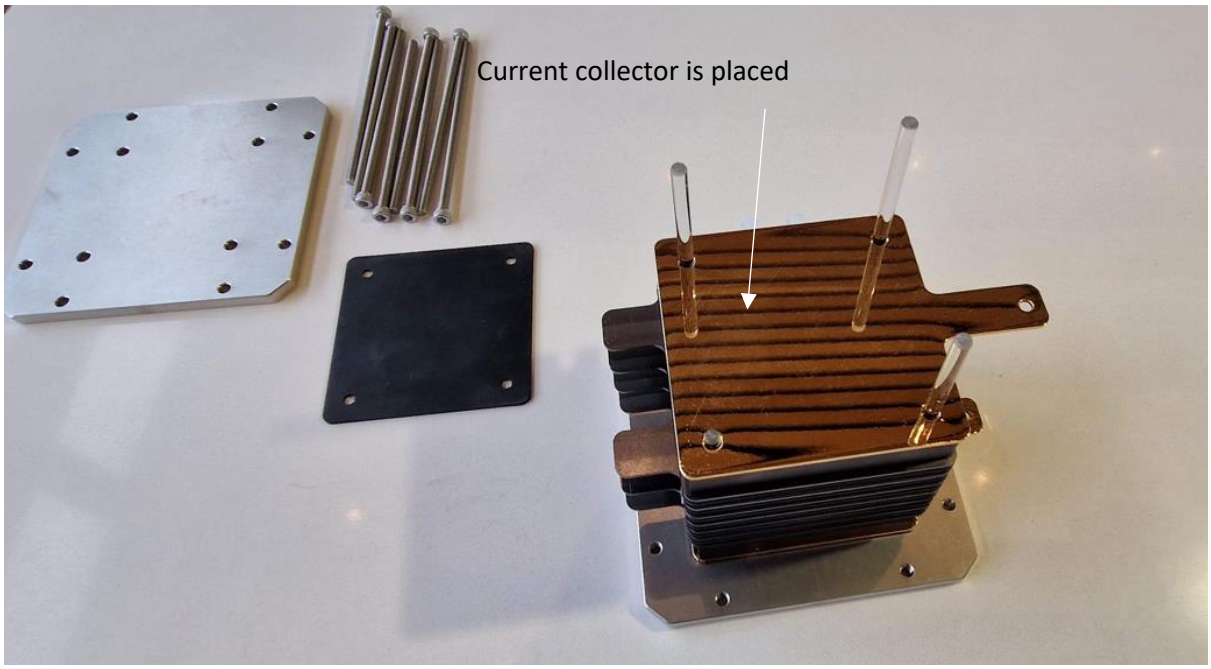

Cover and electrode are placed
IMPORTANT: Note how holes are aligned

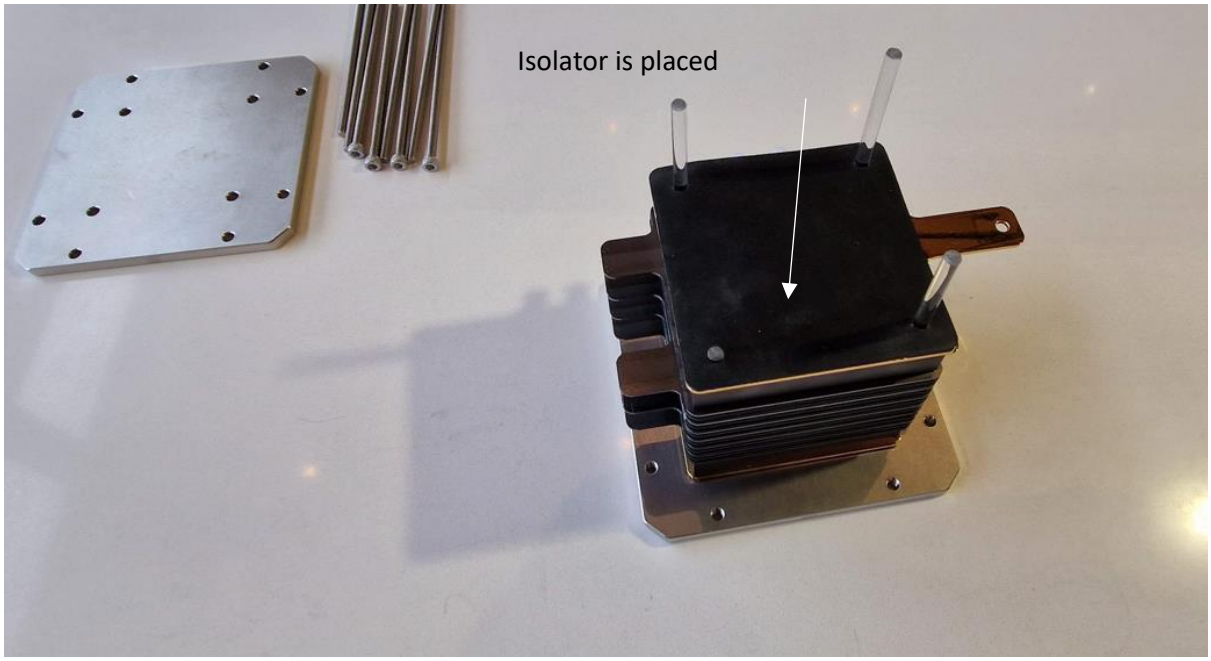
Assembly last parts

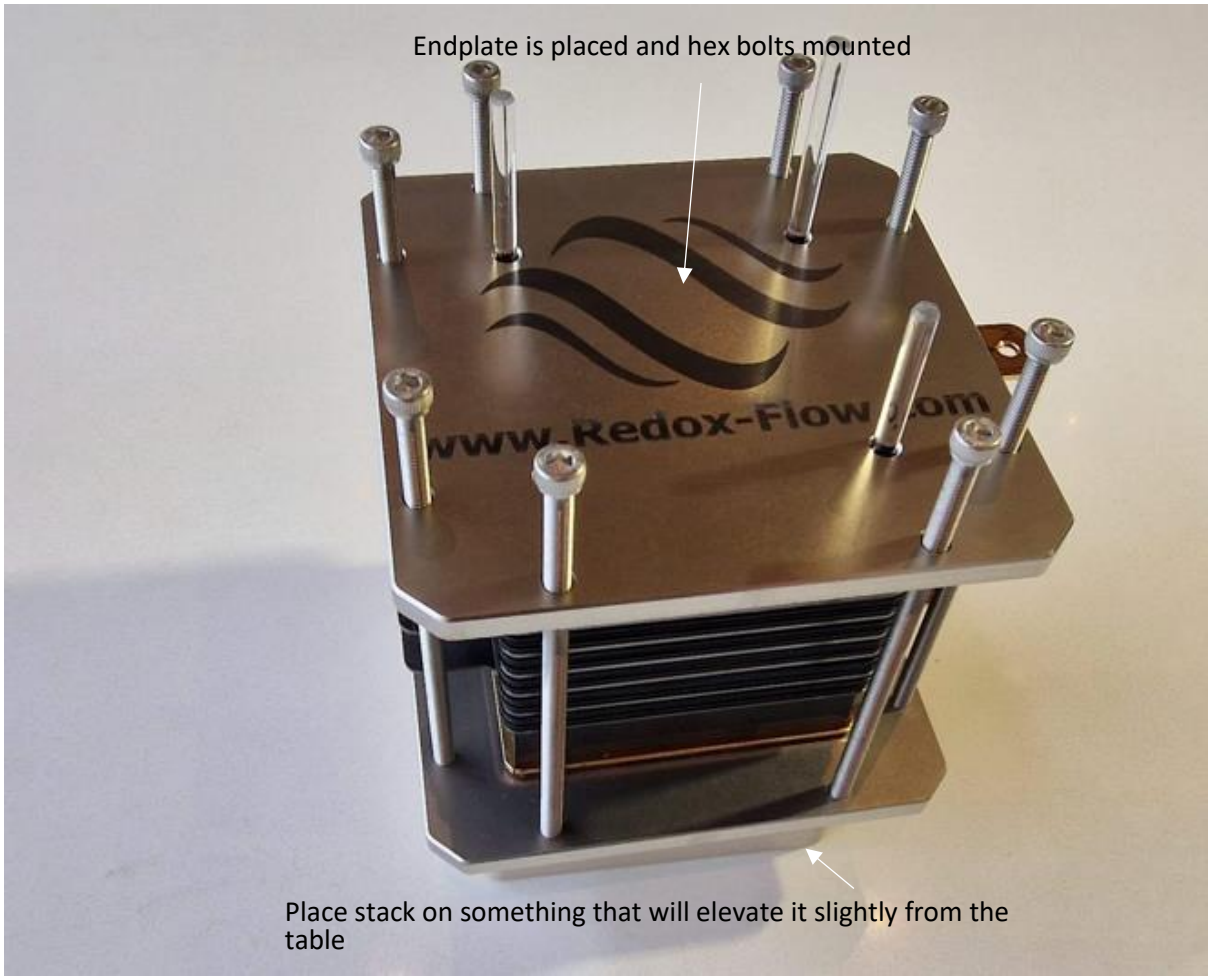


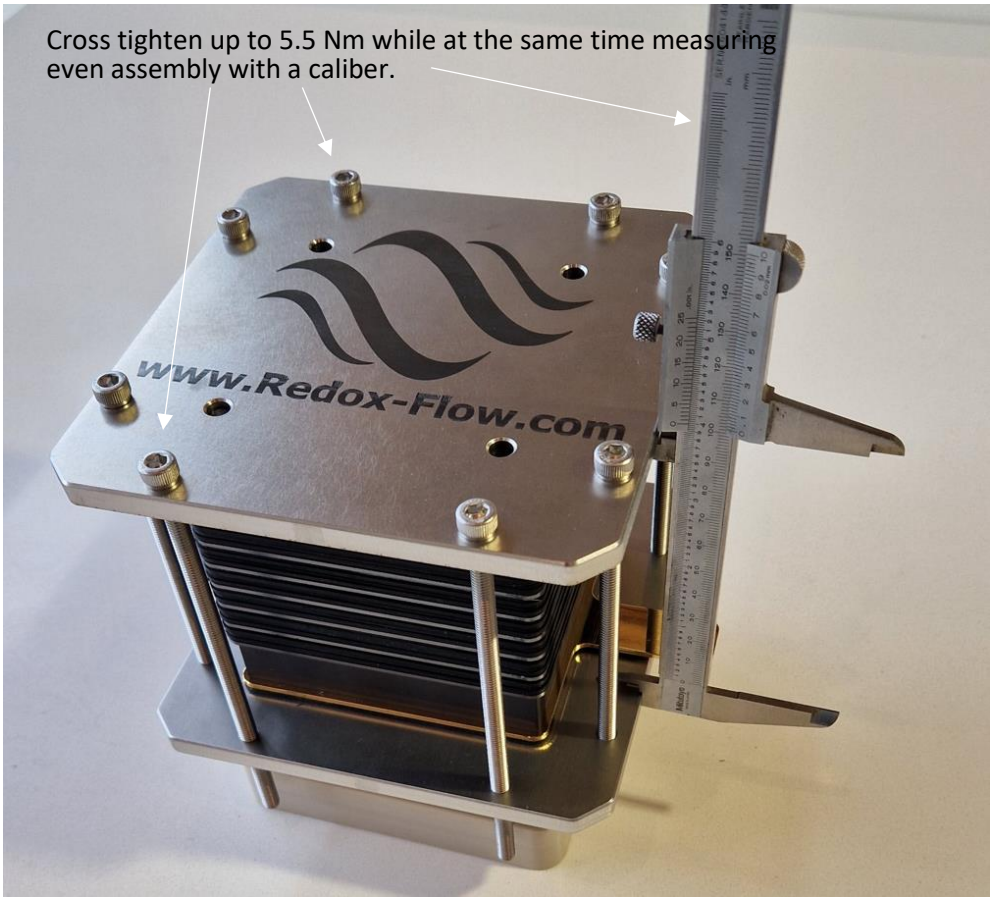


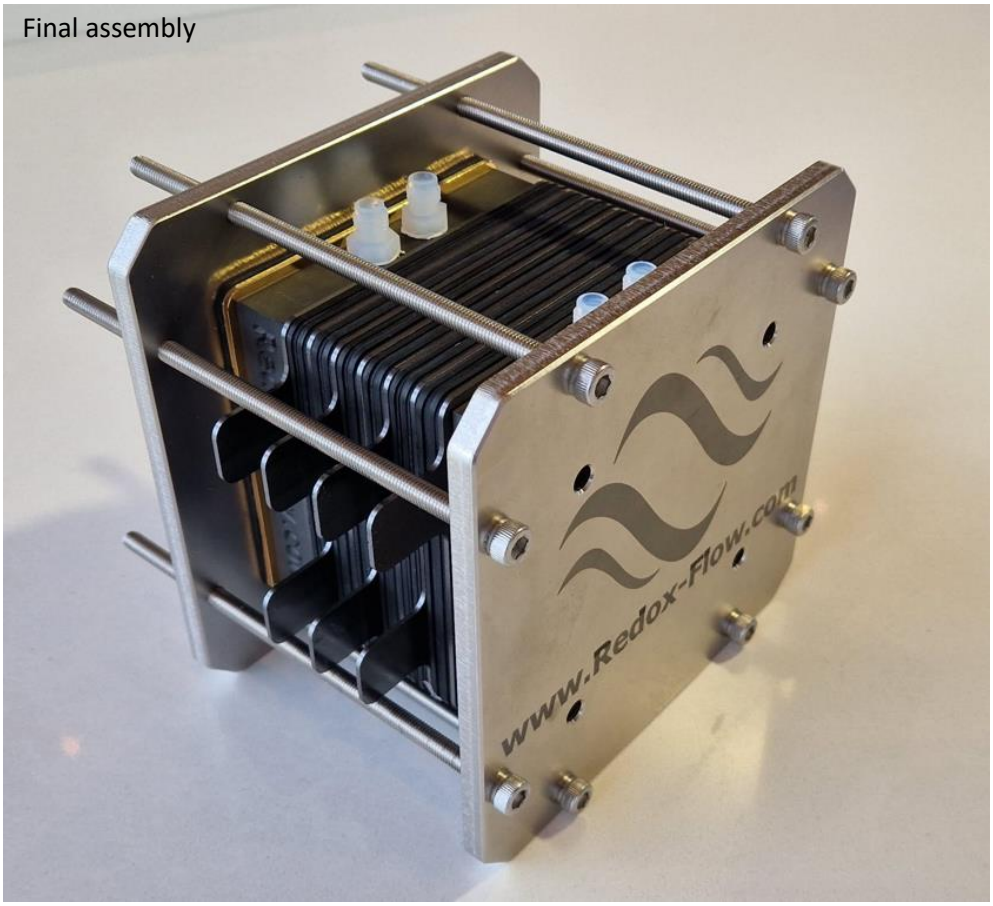

Graphite flow plate is placed (remember the two O-rings)


Current collector is placed

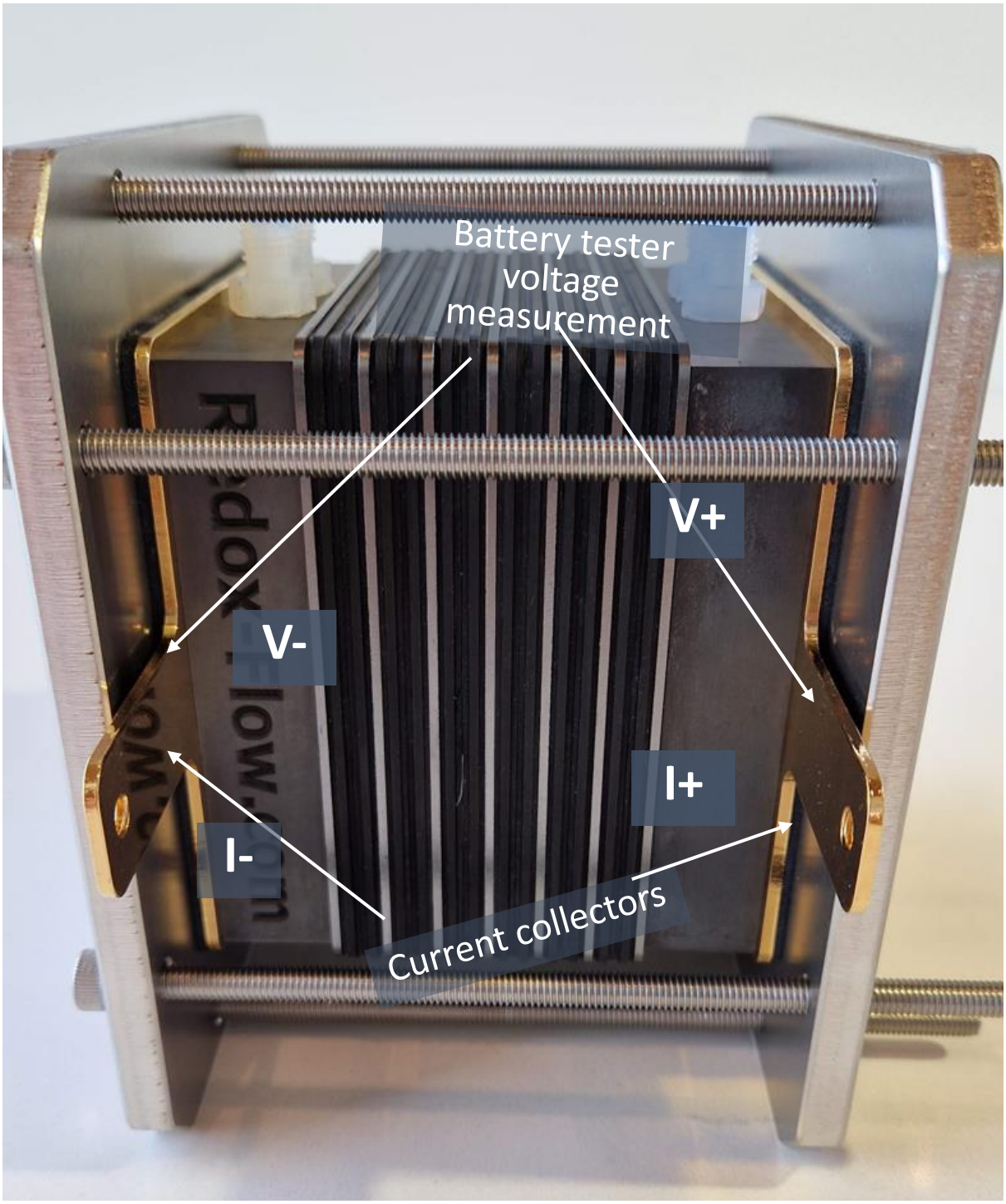

Isolator is placed


Endplate is placed and hex bolts mounted
Place stack on something that will elevate it slightly from the table


Cross tighten up to 5.5 Nm while at the same time measuring even assembly with a caliber.
www.Redox-Flow.com


Final assembly
www.Redox-Flow.com

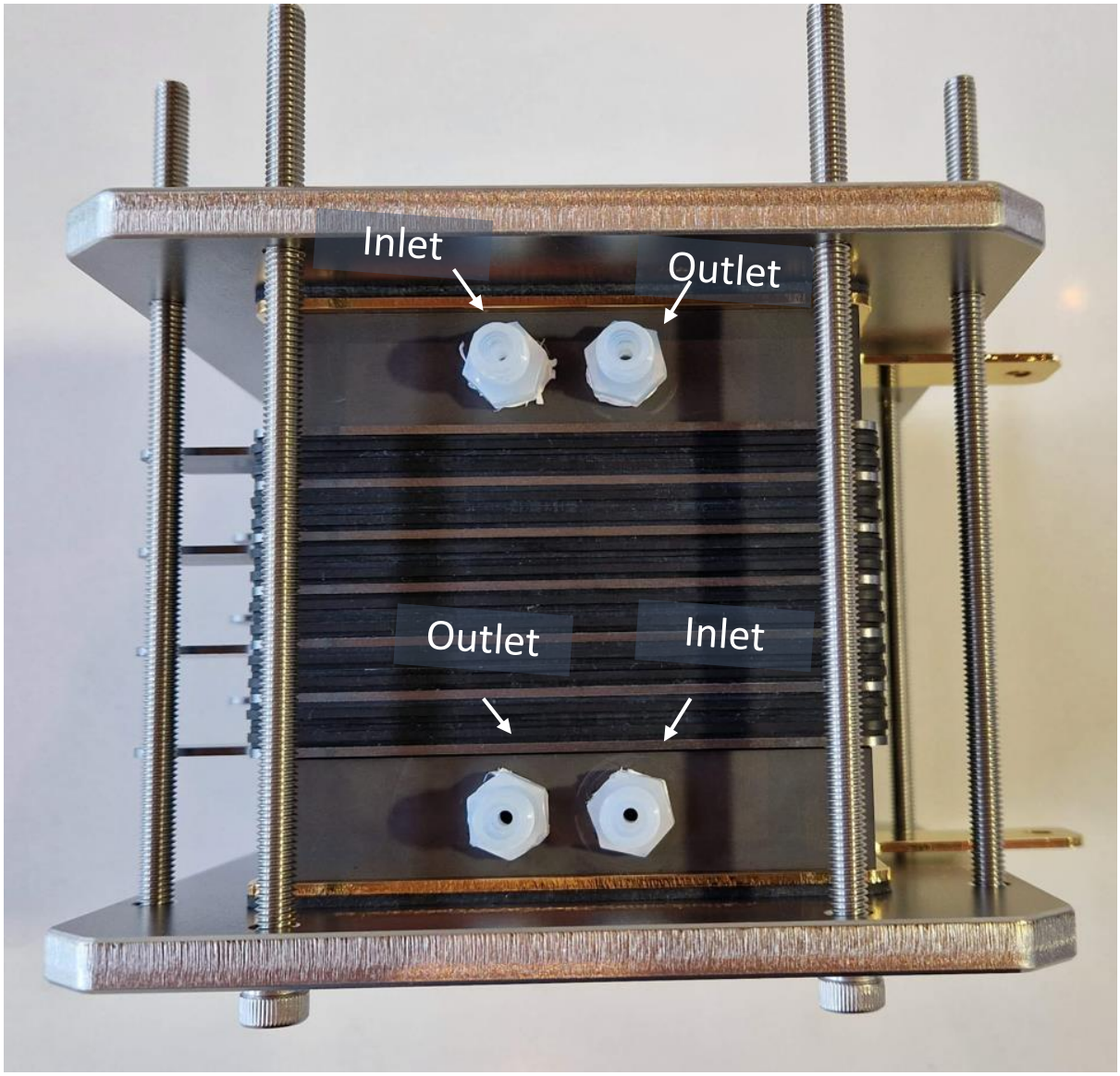
Electrical connections



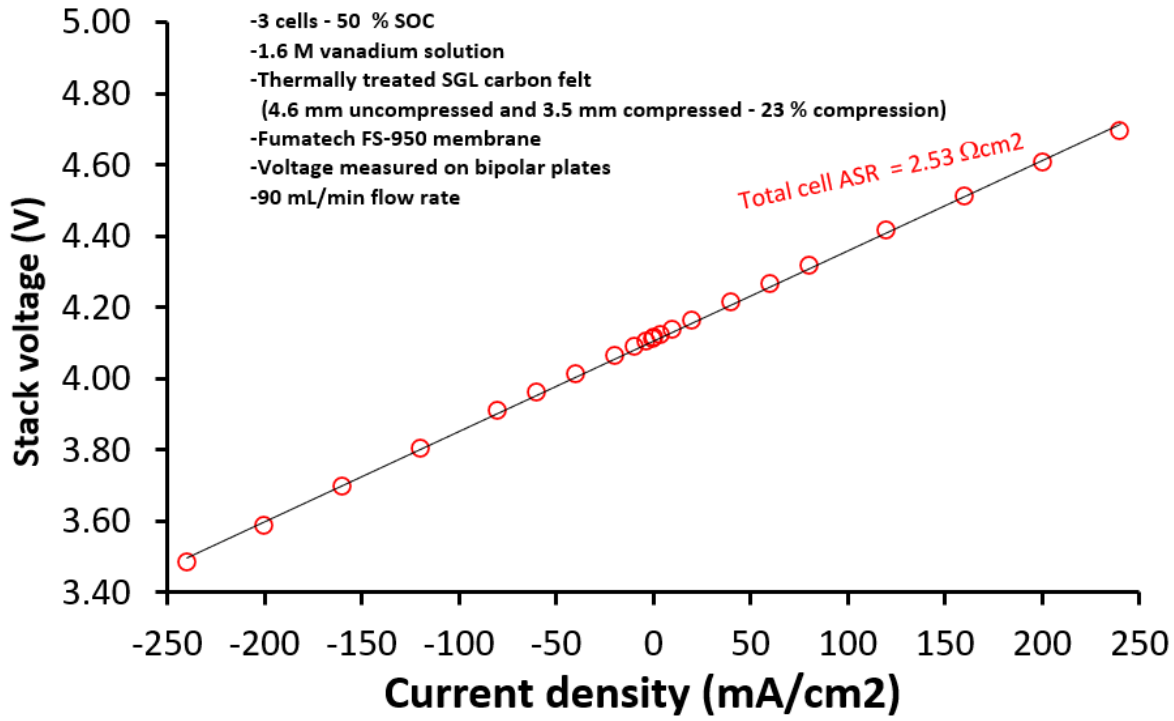

Redox-Flow.com
Individual voltage measurement on bipolar plate in each cell

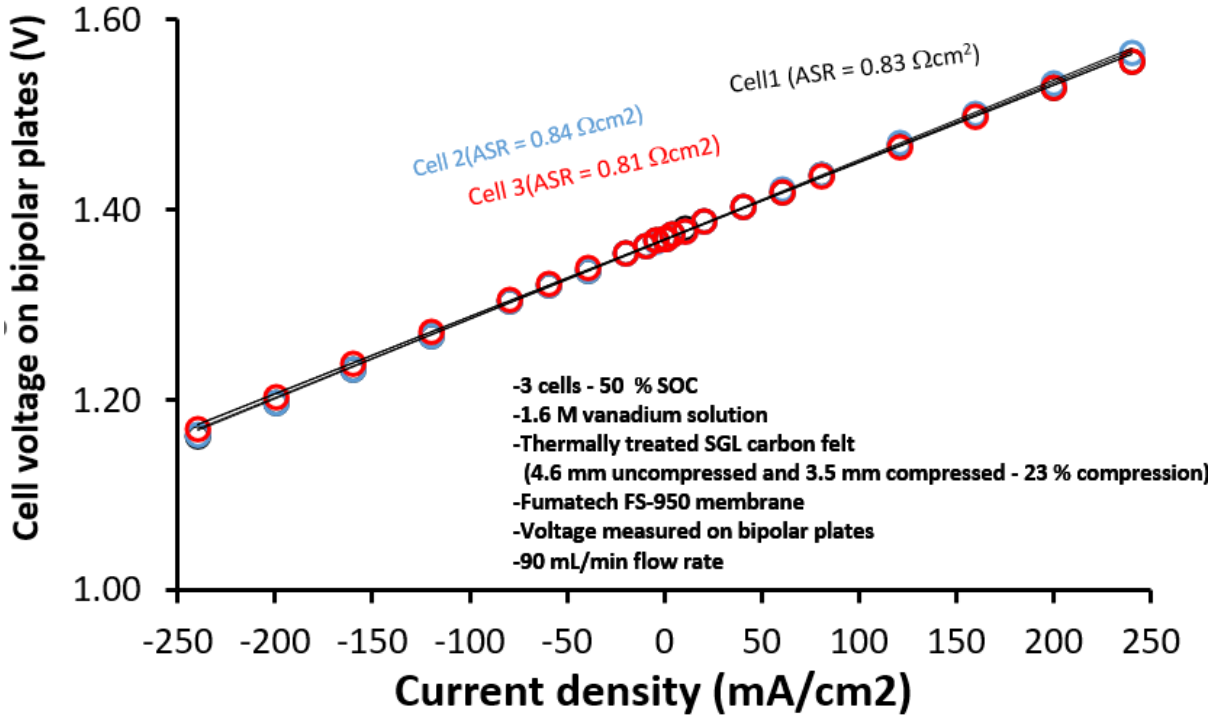
Hydraulic connections

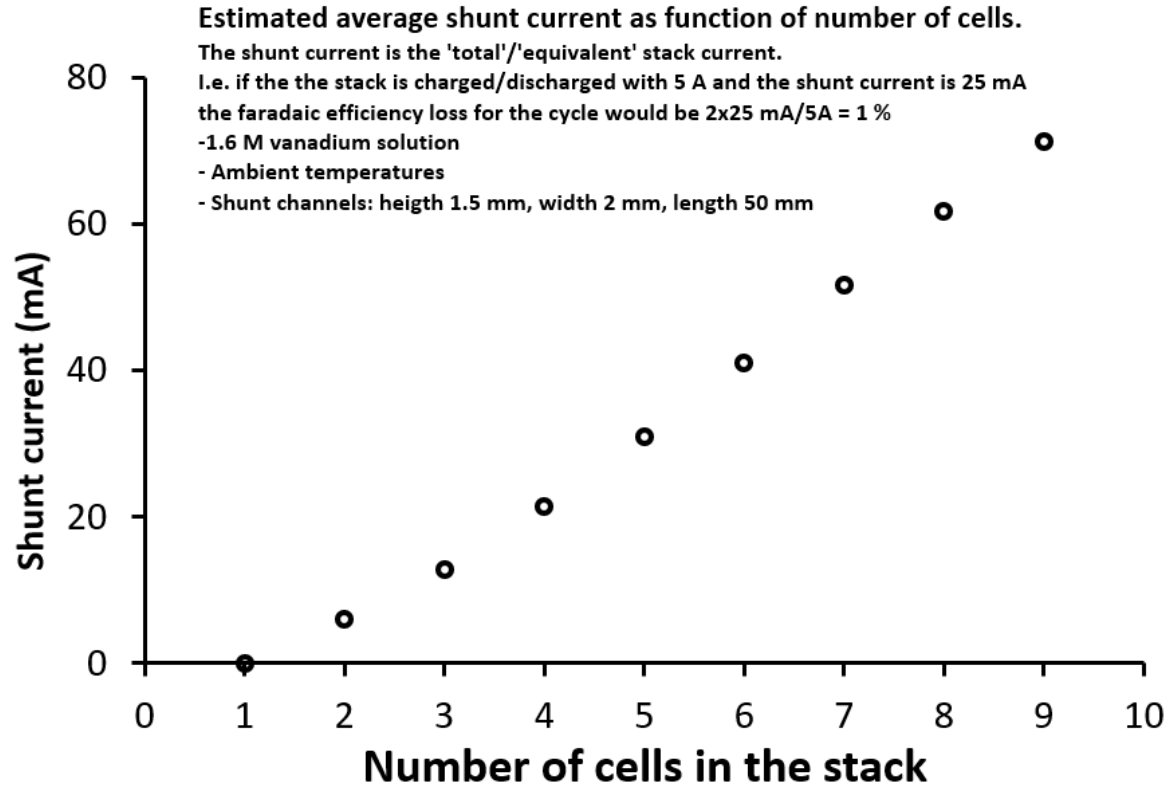
- Inlet is at the ‘bottom’ of each cell, while outlet is at top. This is the most efficient way to remove gas/air bubbles.

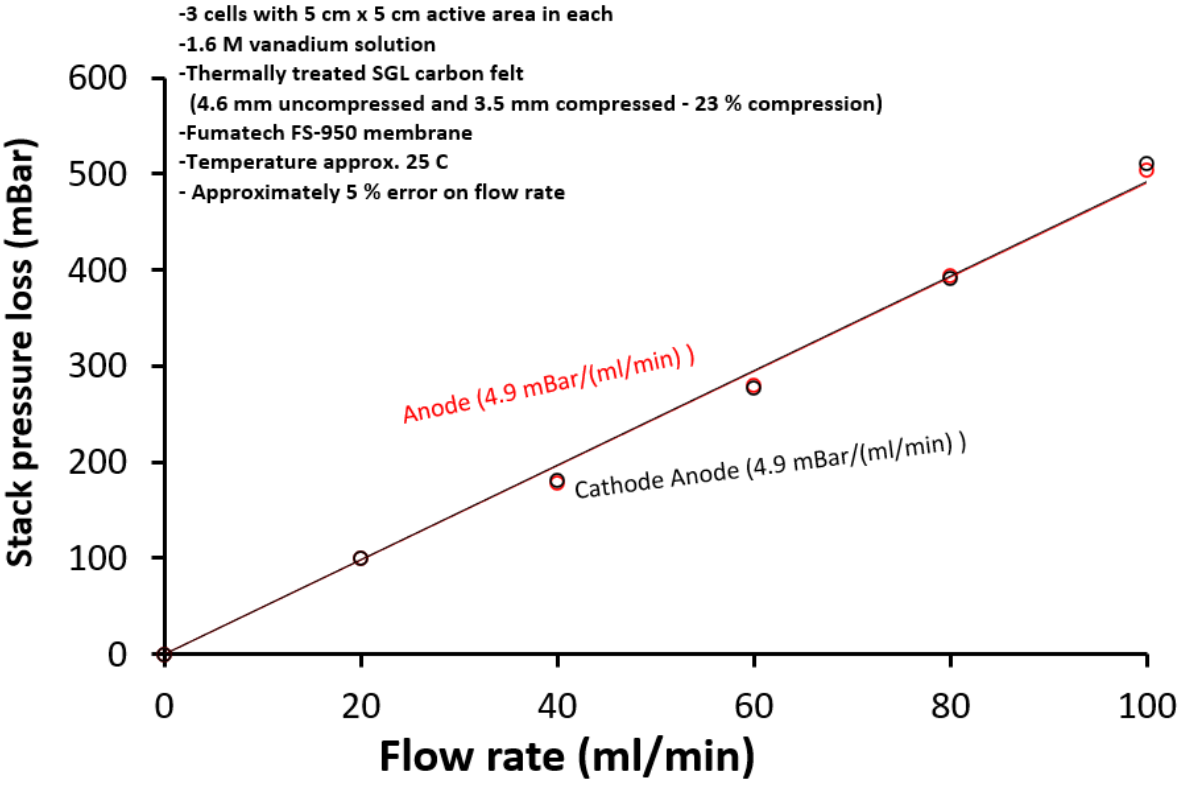


Typical performance (1.6 M Vanadium)






Estimated average shunt current as function of number of cells.
The shunt current is the 'total'/'equivalent' stack current.
I.e. if the the stack is charged/discharged with 5 A and the shunt current is 25 mA
the faradaic efficiency loss for the cycle would be 2x25 mA/5A = 1 %
-1.6 M vanadium solution
- Ambient temperatures
- Shunt channels: heigth 1.5 mm, width 2 mm, length 50 mm
Shunt current (mA)
0
20
40
60
80
0
1
2
3
4
5
6
7
8
9
10
Number of cells in the stack


-3 cells with 5 cm x 5 cm active area in each
-1.6 M vanadium solution
-Thermally treated SGL carbon felt
(4.6 mm uncompressed and 3.5 mm compressed - 23 % compression)
-Fumatech FS-950 membrane
-Temperature approx. 25 C
- Approximately 5 % error on flow rate
Stack pressure loss (mBar)
0
100
200
300
400
500
600
Anode (4.9 mBar/(ml/min))
Cathode Anode (4.9 mBar/(ml/min))
0
20
40
60
80
100
Flow rate (ml/min)