

# User Manual

Release 3.81

## **ECC-Std**

Electrochemical test cell



The information in this manual has been carefully checked and believed to be accurate; however, no responsibility is assumed for inaccuracies.

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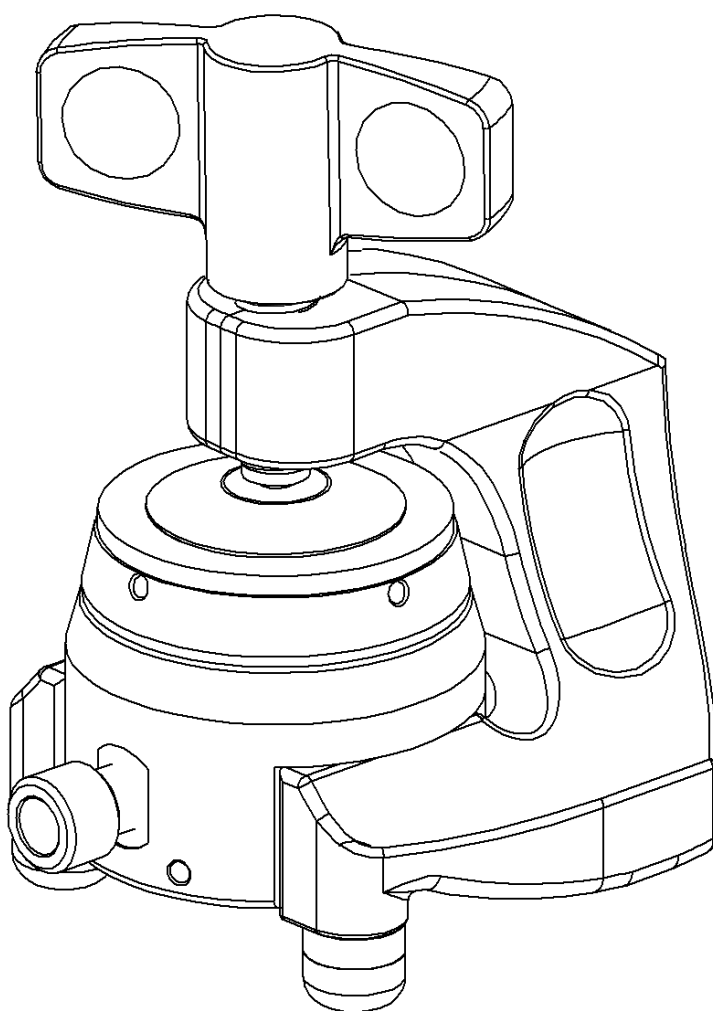
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## 1 Product description

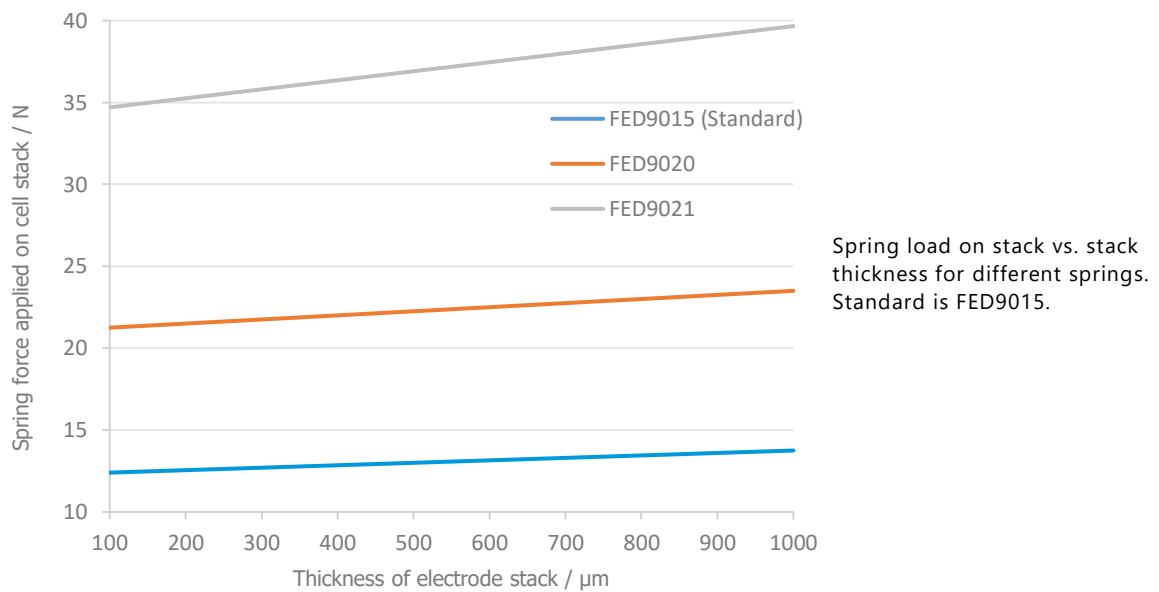
The ECC-Std electrochemical cell is a standard test cell for the characterization of lithium ion battery systems as well as other aprotic chemistries. With the ECC cell design we have adapted the advantages of the industry's standard button (coin) cell while avoiding its serious shortcomings for everyday lab usage.

The ECC cell design is the result of many years' experience and iterative improvement in lithium ion battery and supercapacitor electrode testing. It is perfectly suited for voltammetry and impedance as well as cycle life testing.



## Features

- High precision 18 mm diameter sandwich geometry with <0.1 mm electrode concentricity
- Reliable sealing with PE seals and 4-fold cutting rings
- Easy and reliable electrolyte filling
- Fast assembly and dismantling, and easy cleaning of cell components
- Electrodes are easily accessible for post-mortem analysis
- Reusable cell components except for PE seal
- Small and defined electrolyte volume down to 0.05 cm<sup>3</sup>
- Adjustable, reproducible and homogeneous mechanical pressure on electrodes



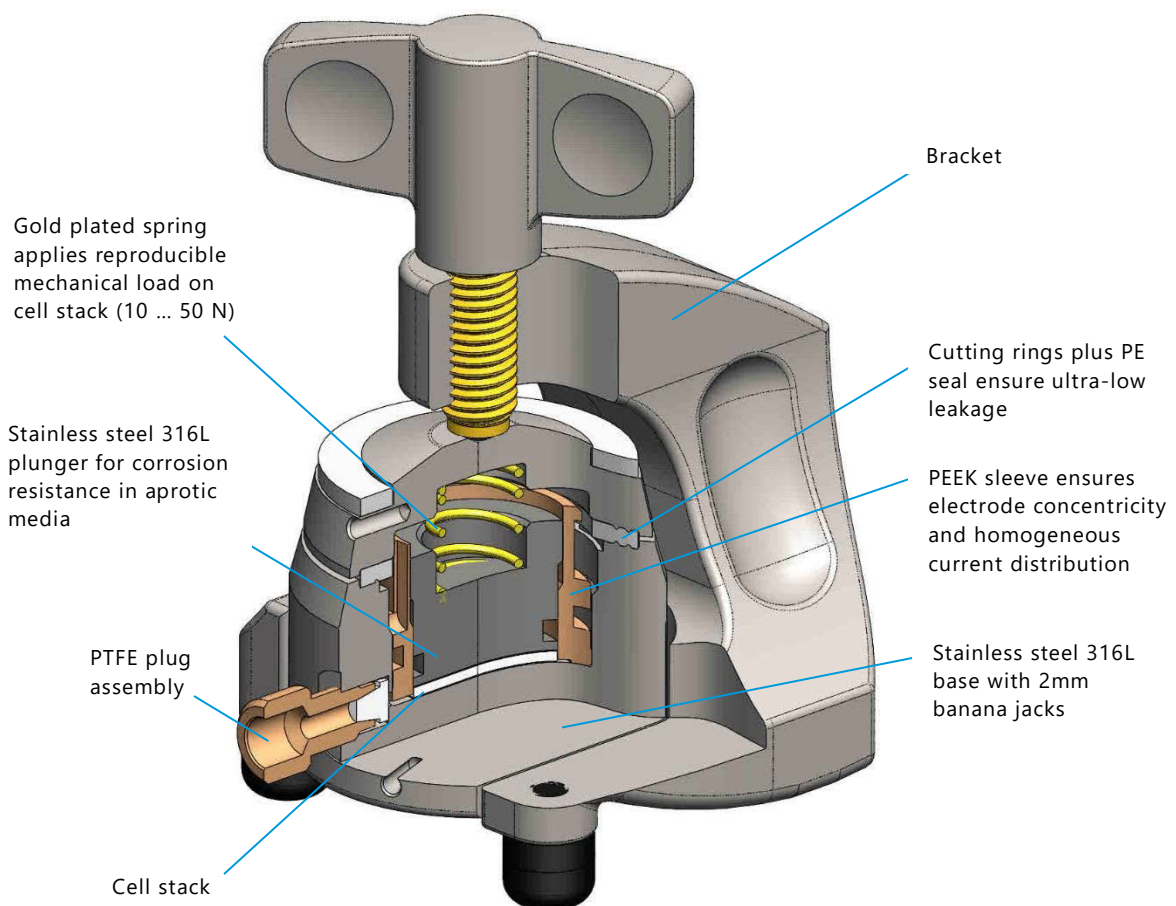
- Materials in media contact are stainless steel 316L and PEEK (other materials on request)
- Modular cell construction with many interchangeable components.
- Dedicated tools available to ease cell assembly and operation
- Optional upgrade kit for using a reference electrode

## 2 ECC-Std assembly

The ECC-Std electrochemical cell may be assembled either with thick glass fiber or with thin technical separator (such as Celgard 2325). Hereafter the two modes are referred to as AAA mode (with the glass fiber separator and the two adjacent electrodes having the same 18 mm diameter) or ABA mode (with the separator being oversized compared to the two adjacent electrodes).

When using air sensitive electrodes like metallic lithium, the cell is being assembled and filled with electrolyte inside a glove box. Prior to assembly, all cell components are to be dried overnight in vacuum at 120 °C.

To minimize parasitic currents, the upper electrode (in contact with the piston) should be at more positive potentials than the lower electrode (in contact with the cell base). We hereafter refer to the upper electrode as cathode, and to the lower electrode as anode.



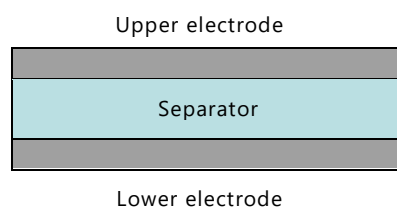
## 2.1 Safety precautions

Use proper safety precautions when using hazardous electrode materials and electrolytes. Wear protective glasses and gloves to protect you against electrolyte that may accidentally spill out during disassembly. Upon cell disassembly, dispose all materials properly. Metallic lithium and some insertion compounds may decompose heavily in contact with water and other solvents, and can cause fire.

**Note:** The assembly has to take place under the protective atmosphere in a glove box.

## 2.2 Assembly Steps for AAA mode

This assembly mode is recommended for half-cell tests against lithium metal. It is also suitable for full cell tests. In the AAA mode the cell is assembled with a thick fiber cloth (fleece) separator having the same 18 mm diameter as the two adjacent electrodes. The cell is filled with the electrolyte by dropping a given volume of electrolyte directly onto the separator (0.15 to 0.5 ml, depending on the separator and electrodes used). Only when applying the spring load upon final cell closure, a defined amount of electrolyte is squeezed out of the separator and soaks the two adjacent electrodes. The confinement of the cell stack by an insulating sleeve ensures a homogeneous current distribution and thus makes this configuration ideal for impedance measurements.



1. Close the side opening of the cell base with the provided PTFE-plug.
2. Insert the plunger into the sleeve and place the plunger/sleeve assembly onto the workbench with the contact face of the plunger pointing upwards.
3. Place the working electrode (cathode) and the cloth separator into the assembly.
4. Dispense a defined amount of electrolyte onto the separator, and place the counter electrode on top inside the sleeve.
5. Push the cell base over the assembly, press onto the plunger, and turn the cell around into the upright position.
6. Mount the spring and the PE seal.
7. Attach the cell lid, insert the cell into the bracket, and tighten the wing nut.

**Note:** The adequate amount of electrolyte depends on the porosity and thickness of the components used, and thus has to be determined in pre-tests. The amount must be smaller than the absorption capacity of the separator in its uncompressed state. For the standard 1.5 mm thick glass fiber separator and standard Li-ion electrodes with <0.1mm thickness, an electrolyte amount of 0.5 ml is appropriate.

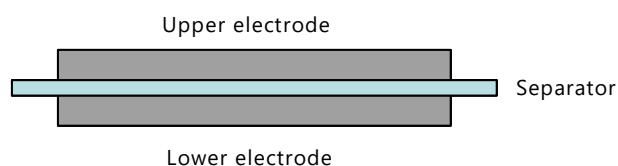
## 2.3 Assembly Steps for ABA full cell mode

This procedure is recommended for standard Li-ion battery materials in combination with thin technical separators like Celgard 2325 (25  $\mu\text{m}$  thick). In the ABA assembly mode the two electrodes are both 18 mm, and the separator is 24 mm in diameter in order to prevent a short circuit along the edge of the separator.

In a first step, the anode is centrally adhered (glued) to the bottom of the cell base. Second, the Celgard separator is placed on top of the anode inside the cell base.

Third, the cathode is placed into the plunger/sleeve assembly, and soaked with some excess of electrolyte. Third, this assembly is pushed from below into the cell base into which anode and separator have been placed before. This way, the electrolyte is sucked into the initially dry separator and anode by capillary forces.

A dedicated loading tool is optionally available to ease the cell assembly with polyolefine separators. <http://el-cell.com/products/accessories-tools/ecc-celload>



1. Close the side opening of the cell base with the provided PTFE-plug.
2. Insert the plunger into the sleeve and place the plunger/sleeve assembly onto the workbench.
3. Place the anode into the plunger/sleeve assembly with the current collector foil facing upwards.
4. Charge a pipette with 100  $\mu\text{L}$  of electrolyte and place a tiny drop of the electrolyte onto the back of the anode. We recommend using an adjustable volume pipette with disposable tip.
5. Grab the plunger/sleeve assembly and support the plunger with your fingertip. Then push the cell base over the assembly, press firmly onto the plunger, and remove the plunger/sleeve assembly. The anode is now centrally adhered (glued) to the bottom of the cell base.
6. Push the Celgard separator into the cell base
7. Again, insert the plunger into the sleeve and place the plunger/sleeve assembly onto the workbench
8. Place the cathode onto the plunger/sleeve assembly, with the current collector foil facing downwards.
9. Dispense the electrolyte onto the cathode.



10. Again, grab the plunger/sleeve assembly and support the plunger with your fingertip. Then push the cell base (with the anode and separator located inside) over the assembly, press onto the plunger, and turn the cell into the upright position.
11. Mount the spring and the PE seal.
12. Attach the cell lid, insert the cell into the bracket, and tighten the wing nut.

### 3 Disassembly and Cleaning

After use, disassemble the test cell in the reverse order of assembly. Dispose electrodes and electrolyte properly. Clean wetted cell parts with deionized water and/or other appropriate detergent wash and solvent. PEEK sleeve, cell base and plunger may be additionally cleaned in an ultrasonic bath. After cleaning with water, dry parts with compressed air. Before building a new cell, dry parts overnight at 80°C under vacuum. This treatment is essential for the PEEK sleeve, as the PEEK polymer may absorb water.

Cell base and plunger may be additionally treated with aqueous nitric acid (20%, 2 hours at room temperature). Do not apply this treatment to any other cell parts.

#### Notes:

- Protect yourself against chemical hazards. Electrolyte may spill out during cleaning. Electrode materials and electrolyte may react with ambient atmosphere or solvents used for cleaning. Wear appropriate protection equipment, goggles and gloves.
- Clean all cell parts right after disassembly. Leaving cell parts in contact with ambient atmosphere while still being wetted with electrolyte may result in severe corrosion.

#### Sleeve removing tool

The sleeve can be easily removed with the sleeve removing tool. First detach the PTFE Plug assembly, then position the tool beneath the rim of the sleeve and lift it out of the cell base.



**NOTE:** Leaving cell parts in contact with ambient atmosphere while still being wetted with electrolyte may result in severe corrosion.

## 4 Unpacking

Check the contents of the packages against the list given below to verify that you have received all of the components. Contact the factory if anything is missing or damaged. NOTE: Damaged shipments must remain with the original packaging for freight company inspection.

### List of Components

1. **ECC-Std test cell**
2. PE-Seal (10 pcs) [ECC1-00-0053-A/X](#)
3. Sleeve Removing Tool [ECC1-00-0092-A](#)
4. Glass fiber separator 18 mm x 1.55 mm (10 pcs) [ECC1-01-0012-C/X](#)
5. Separator (Celgard 2325) 24 mm x 0.025 mm (10pcs) [ECC1-01-0022-D/X](#)

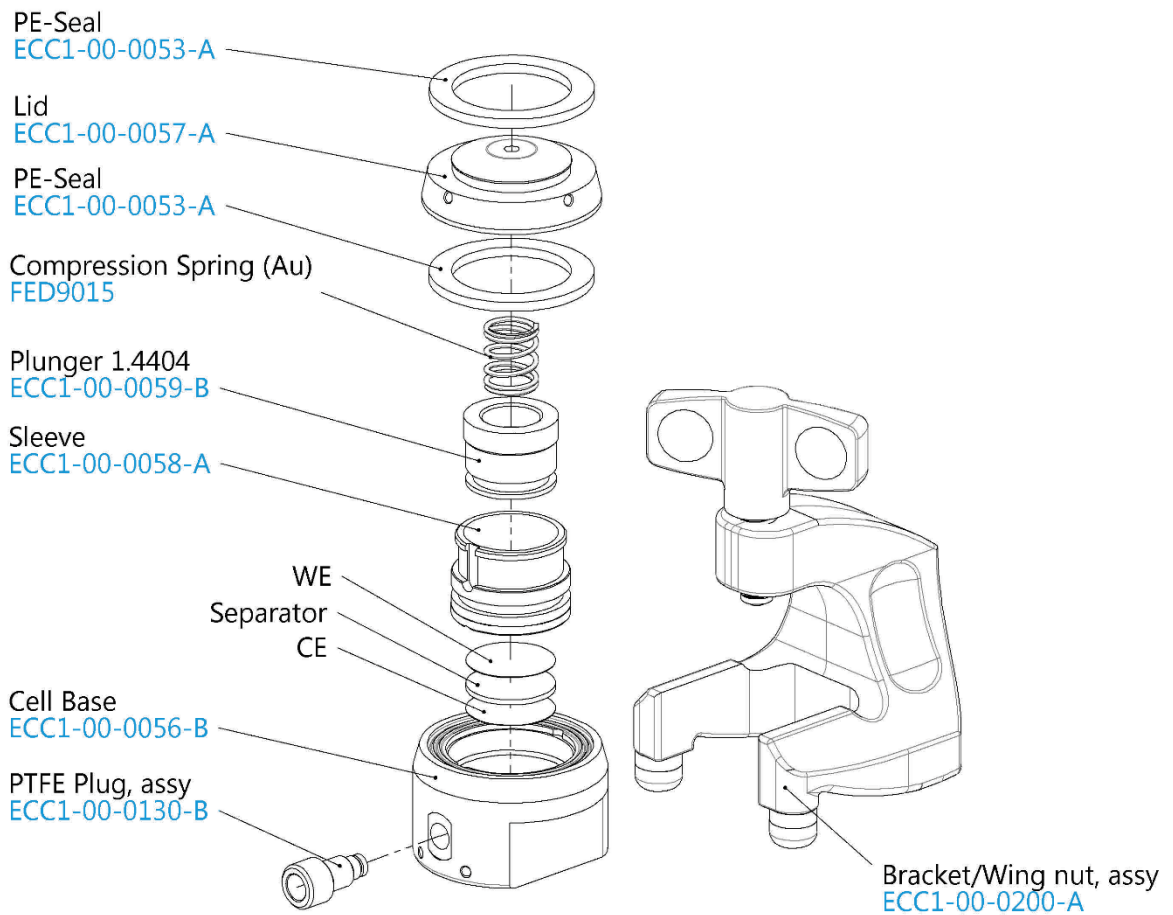
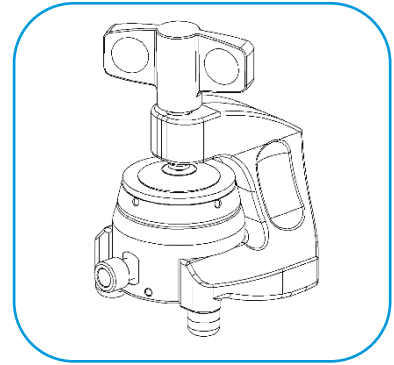
## 5 Technical data

- Height: 90 mm  
Width: 54 mm  
Depth: 70 mm
- Weight: 640 g
- Temperature range: -40 to +80 °C (150 °C)\*
- Electrolyte volume min: 0.05 cm<sup>3</sup>

*\*with optional Heat Resistance Set [ECC1-01-0040-A](#)*

## 5 Spare parts and consumables

### ECC-Std test cell



## 6 Technical support

Technical support for this product is exclusively provided by EL-Cell GmbH.

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## 7 Warranty

For a period of one year from the date of shipment, EL-Cell GmbH (hereinafter Seller) warrants the goods to be free from defect in material and workmanship to the original purchaser. During the warranty period, Seller agrees to repair or replace defective and/or nonconforming goods or parts without charge for material or labor, or, at the Seller's option, demand return of the goods and tender repayment of the price. Buyer's exclusive remedy is repair or replacement of defective and nonconforming goods, or, at Seller's option, the repayment of the price.

Seller excludes and disclaims any liability for lost profits, personal injury, interruption of service, or for consequential incidental or special damages arising out of, resulting from, or relating in any manner to these goods.

This Limited Warranty does not cover defects, damage, or nonconformity resulting from abuse, misuse, neglect, lack of reasonable care, modification, or the attachment of improper devices to the goods. This Limited Warranty does not cover expendable items. This warranty is void when repairs are performed by a non-authorized person or service center. At Seller's option, repairs or replacements will be made on site or at the factory. If repairs or replacements are to be made at the factory, Buyer shall return the goods prepaid and bear all the risks of loss until delivered to the factory. If Seller returns the goods, they will be delivered prepaid and Seller will bear all risks of loss until delivery to Buyer. Buyer and Seller agree that this Limited Warranty shall be governed by and construed in accordance with the laws of Germany.

The warranties contained in this agreement are in lieu of all other warranties expressed or implied, including the warranties of merchantability and fitness for a particular purpose.

This Limited Warranty supersedes all prior proposals or representations oral or written and constitutes the entire understanding regarding the warranties made by Seller to Buyer. This Limited Warranty may not be expanded or modified except in writing signed by the parties hereto.