EL-CELL®
electrochemical test equipment

User Manual

Release 1.1

PAT-Cell-Press II

Electrochemical test cell

Disclaimer

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The information provided in this documentation includes general descriptions and/or technical characteristics regarding the equipment performance described herein. This documentation cannot correctly evaluate the suitability or reliability of the equipment for any specific application by any user. It should not be relied upon as a substitute for such evaluation. It is the responsibility of each such user or installer to conduct a thorough and comprehensive risk assessment, evaluation, and testing of the equipment for their specific application. EL-Cell GmbH cannot be held responsible or liable for misuse of the information.

All relevant state, regional, and local safety regulations must always be complied with when installing and using this device. Only the manufacturer is authorized to perform repairs on components for safety reasons and to ensure compliance with the documented system data.

Disregarding this information may result in injury or damage to the equipment.

Manufacturer and Customer Service

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Please always quote the serial number on the nameplate when contacting customer service.

Shipping Address for Repairs

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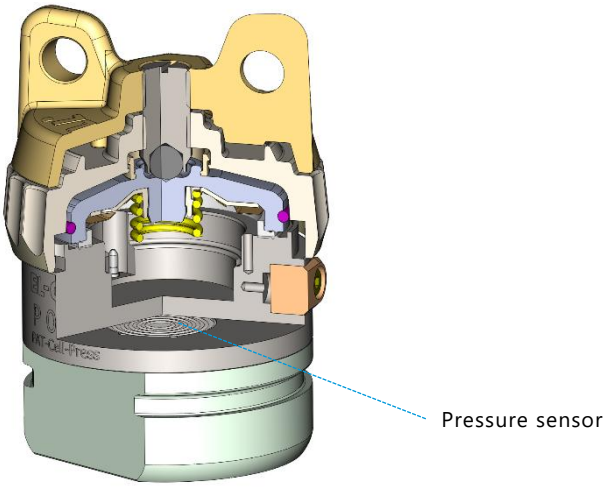
Please contact our customer service department before making a return. Without a completed decontamination report or RMA, we will not open or process shipments.

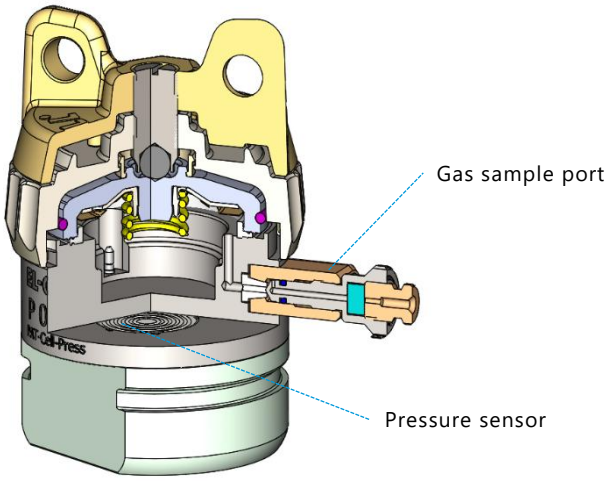
Content

1 Product Description

The PAT-Cell-Press II is a pressure test cell for measuring gas evolution during the electrochemical cycle. It is a cableless test cell using the PAT-Core concept. As an option, the PAT-Cell-Press II is also available with a gas sample port for drawing gas.



PAT-Cell-Press



PAT-Cell-Press S

1.1 Features

- PAT-Core design with or without reference electrode
- Pressure sensor, pressure range of 0 to 3 bar abs
- Temperature sensor, -20 °C to 80 °C
- Optional gas sample port
- Dead volume with PAT-Core installed: 3.565 cm^3
- Helium leak tested*
- Can be used in a single-channel configuration together with the PAT-Stand-1 in combination with the PAT-Tester-x.
- Can be used in a multi-channel configuration in the PAT-Tester-i-16

*The PAT-Cell-Press II has been tested for leakage at the factory. For an empty cell, pressurized with air through the sample port using a syringe, at 2 bar absolute, at 50°C, the pressure decay after 24 hours is guaranteed to be less than 0.3 mbar per hour when using a PE seal, and less than 0.02 mbar per hour when using an Al seal.

2 Variants

PAT-Cell-Press II

Features

Gas pressure sensor, 0 to 3 bar abs

PAT-Cell-Press II S

Features

Gas pressure sensor, 0 to 3 bar abs

Gas sample port

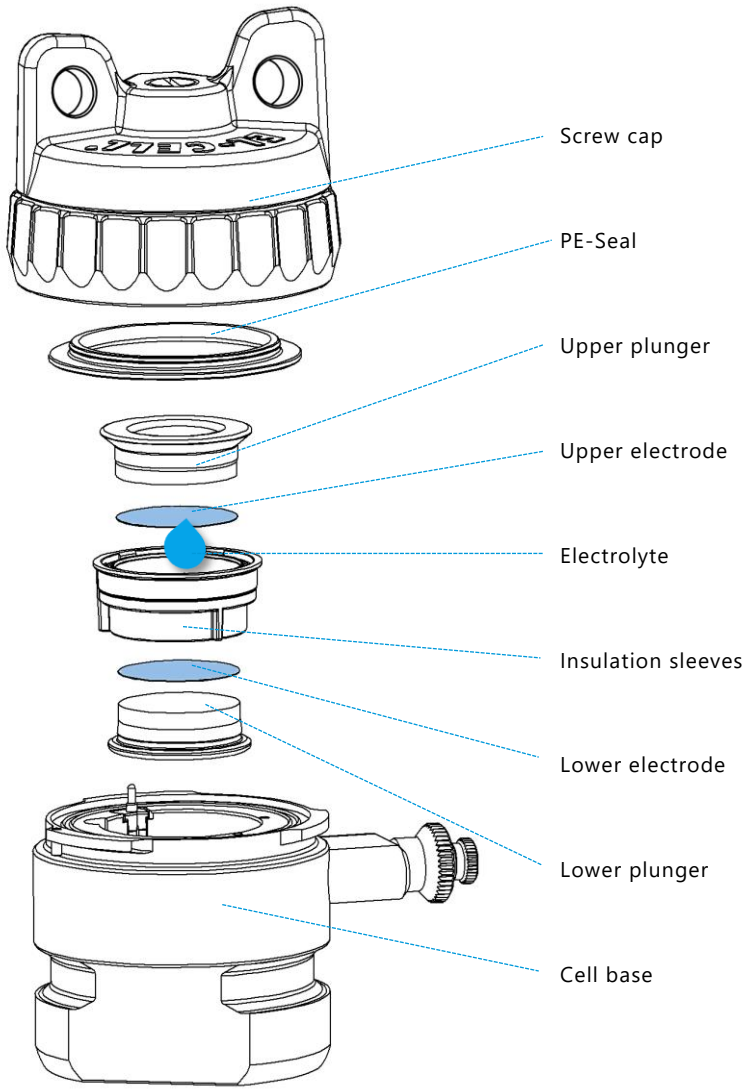
3 Safety Precautions

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

4 Assembling the PAT-Cell-Press II

This section describes how to assemble the PAT-Cell-Press II test cell. A separate manual provides a more detailed description of the PAT-Core.

Note: The assembly must occur under the protective atmosphere in a glove box.



1. Put the **insulation sleeve** onto the worktop with the smaller side pointing upwards.

2. Insert the **lower electrode** into the sleeve with the active layer facing downwards.

3. Attach the **lower plunger**. The lower plunger is available in different gap sizes to account for the thickness of the electrodes and separator used.

4. Turn the assembly upside down.

5. Align the sleeve's contact spring with the horizontal contact pin inside the **cell base**. Then, the assembly is inserted into the cell base.

6. With a pipette, evenly dispense approximately 100 µL of **electrolyte** on top of the separator. Note: The optimum amount of electrolyte will depend on the separator's thickness and porosity and the electrodes used.

7. Insert the **upper electrode** into the insulation sleeve with the active layer facing downwards.

8. Attach the **upper plunger**.

9. Insert a new **sealing ring** into the screw cap (PE or metal seal) or place it on the cellbase (flat metal sealings, see chapter 4.1.1)

10. Attach the **screw cap** to the cell base with the wing nut fully released.

11. Tighten the wing nut clockwise to seal the cell.

4.1 Using metal sealing rings

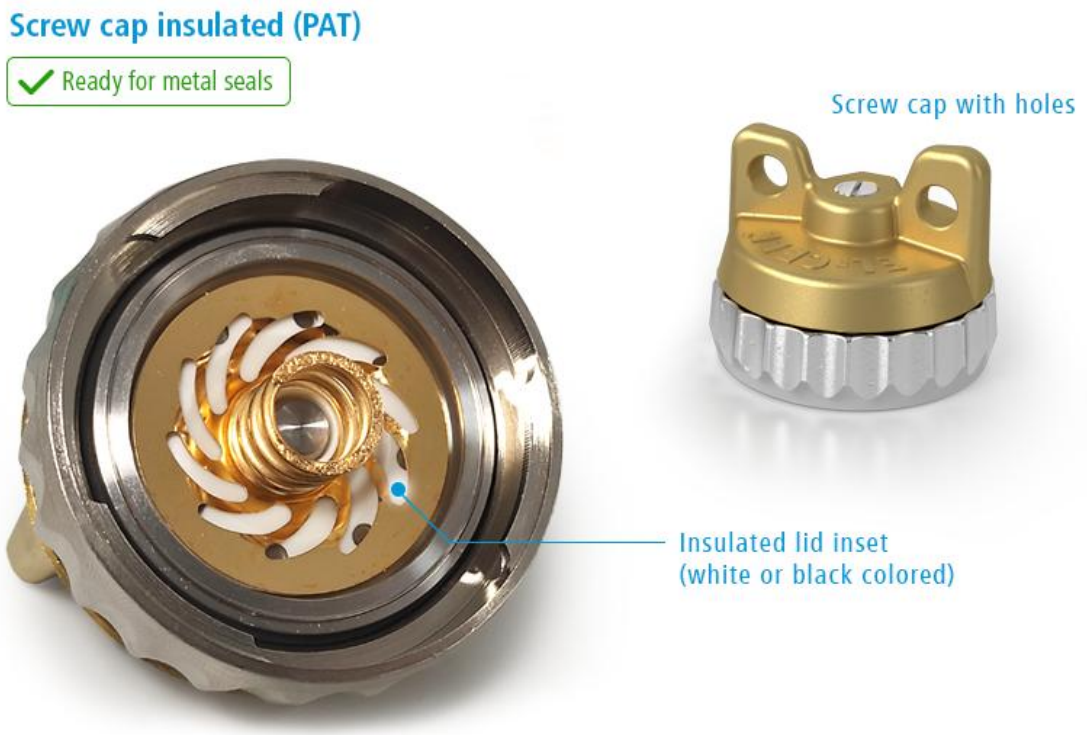
NOTICE

Please note when using metal sealing rings:

Make sure that a compatible lid for metal seals is installed. It can be recognized by the following two features.

- It has two holes on the top.
- It features a white or black inset made of PPS in the lid.

As the two holes can also be found on older cell lids without insulation, you should always check whether the inset is present. Non-compatible cell lids have no inset at all. The use of a non-compatible screw cap can result in a short circuit.



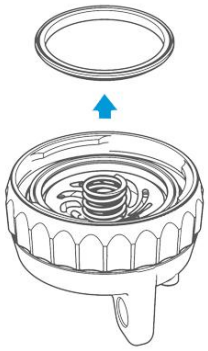
4.1.1 Installing metal sealing rings

When fitting the metal sealing ring, please note the differences between the available products. Whilst the aluminium sealing ring ECC1-00-0232-G is pressed into the lid, the flat metal seals ECC1-00-0232-M (Cu) and ECC1-00-0232-N (Al) are fitted differently.

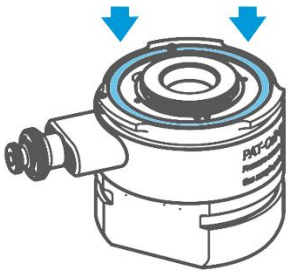
ECC1-00-0232-G: Insertion into the lid

Flat sealing rings ECC1-00-0232-M (left) and ECC1-00-0232-N (right): Placing on the cell base

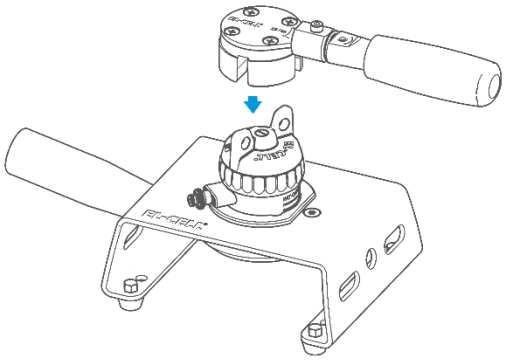
For assembly, follow the steps below when installing the cell inside the glovebox:



1. If present, first remove the sealing ring from the cell lid.



2. Place the new flat sealing ring on top of the cell base.



1. Place the cell lid on top and tighten the cell using the torque wrench from the Metal Seal Mounting Kit. We recommend inserting the cell into the assembly block.

5 Disassembly and Cleaning

When working with aprotic, moisture-sensitive electrolytes such as $LiPF_6$, it is best to leave the cell base and lid in the glove box and only expose the PAT-Core components to room air for cleaning or disposal. Note that excess electrolytes may leak from the PAT-Core, causing contamination in the cell base and on the contact pins. For standard electrodes and standard separators, use 100 µl electrolyte.

If the cell base is contaminated with electrolyte, clean it in the glove box with a cloth and a battery-compatible solvent such as DMC.

If the cell base or lid has been in contact with ambient air or is being used for the first time, it must be dried in a vacuum at 80°C for at least 12 hours before use.

Stainless steel plungers can be cleaned with water, acetone, or ethanol. If necessary, persistent stains can be removed with aqueous nitric acid (20%, 2 hours at room temperature).

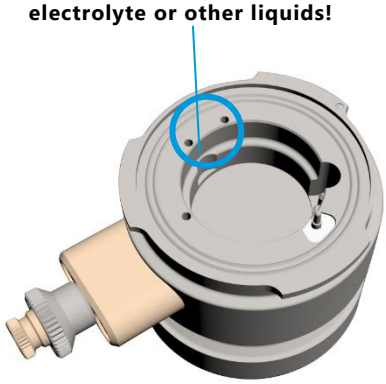
Insulating sleeves made of PP are intended for single use. Insulating sleeves made of PEEK or PPS can be cleaned with water, acetone, or ethanol and are reusable after careful drying (120°C, vacuum, >12 hours).

Never immerse the cell base in liquid. In particular, avoid contact with the electronic components on the bottom of the cell base with liquid. The two adjacent holes at the top of the cell base (circled in the picture below) connect to the laser-welded pressure sensor inside the lower part.

No liquids must enter these holes during cell assembly, operation, and cleaning to avoid corrosion.

Refer to the troubleshooting section for assistance if liquid enters one of the holes.

Holes towards the stainless steel membrane of the laser welded pressure sensor. **Avoid contact with electrolyte or other liquids!**



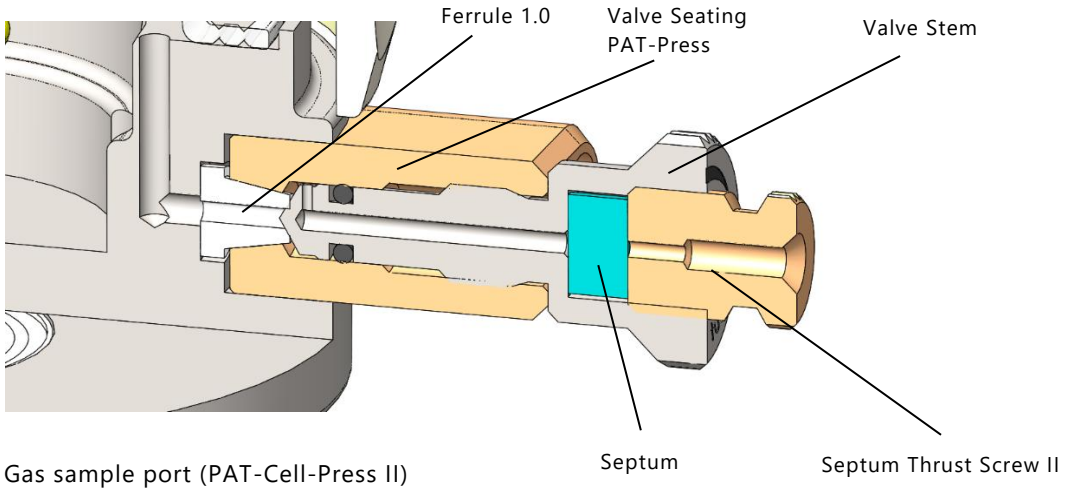
Notes:

Protect yourself against chemical hazards. Electrolytes may spill out during cleaning, and electrode materials and electrolytes may react with the ambient atmosphere or solvents used for cleaning. Wear appropriate protective equipment, such as goggles and gloves.

Clean all cell parts right after disassembly. Leaving cell parts in contact with the ambient atmosphere while still being wetted with electrolytes may result in severe corrosion.

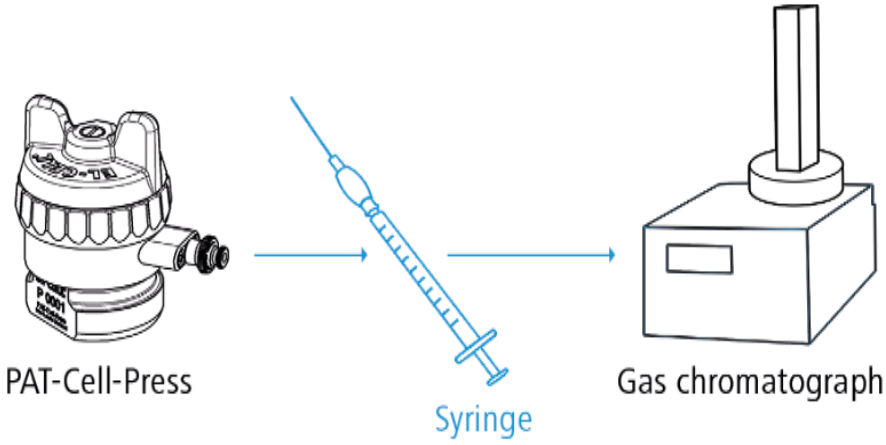
6 Sample Valve with Septum Port (if installed)

The gas sample valve draws gas samples for further characterization from the test cell's head space.



Gas sample port (PAT-Cell-Press II)
ECC1-00-0155-C

In the closed state, the valve spindle is seated on the PTFE ferrule, preventing bleeding through the pierced septum.



6.1 How to Draw Gas Samples

1. Pierce the septum with a sample syringe appropriate for the subsequent gas analysis, e.g., a gas chromatograph. We recommend using a syringe with a pencil-point needle to prevent clogging when the septum of the sample port is pierced. The equipment includes a 1 ml syringe (LAB0024) and a pencil-point needle (LAB0039).

2. Open the valve by turning the valve handle counter-clockwise by approximately. 90 degrees

3. Fill the syringe by drawing back the syringe piston.

4. Close the valve by turning the valve handle clockwise till finger-tight, and remove the syringe.

Note: Do not connect the sample port directly or permanently to an external device.

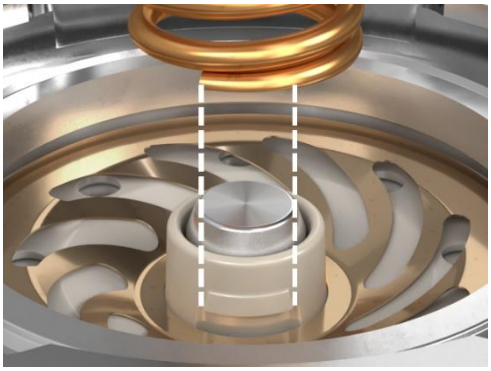
7 Changing the Lid Spring

The lid spring can be changed to allow different forces to be applied to the cell stack. Other springs are available; see Chapter 11 for more information.

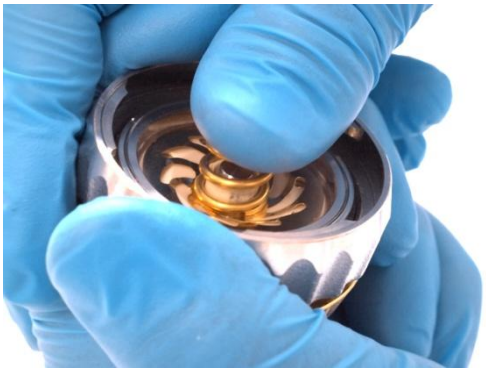
Follow these steps to change the spring in the Screw Cap Insulated (PAT).

Remove the installed spring with a suitable tool (e.g., the back end of tweezers or a screwdriver). Be careful not to damage the PEEK part of the pin.

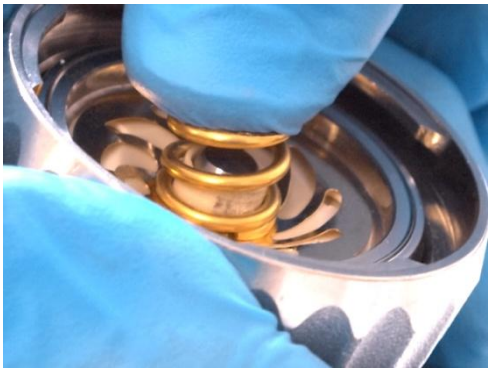
Note: The pin used to attach the spring has both a high and a low lug.



Position the new spring so that it is aligned with the high lug, as shown in the image.



Now press the spring onto the pin until it touches the disc spring.



Check that the spring is seated correctly by bending it slightly in all directions.

8 Unpacking

Check the contents of the package against the list below to verify that you have received all the required components. Contact EL-CELL if anything is missing or damaged.

NOTE: Damaged shipments must remain in their original packaging for inspection by the freight company.

List of components PAT-Cell-Press II

- PAT-Cell-Press II without PAT-Core
- Sealing ring PE (10x) ECC1-00-0232-A/X

Note: The PAT-Cell-Press II is shipped with an inserted PE seal that serves only as a transport lock. Replace the sealing ring before operating the cell.

The components of the PAT-Core (insulation sleeves and plungers) must be purchased separately.

List of components PAT-Cell-Press II S

- PAT-Cell-Press II without PAT-Core
- Septum (10x) ECC1-00-0097-B/X
- Syringe 1ml (w/o Luerlock) LAB0024
- Spinal needle pencil-point (27g) LAB0039
- Sealing ring PE (10x) ECC1-00-0232-A/X
- Ferrule 1.0 (2x) ECC1-00-0029-B/2

Note: The PAT-Cell-Press II is shipped with an inserted PE seal that serves only as a transport lock. Replace the sealing ring before operating the cell.

The components of the PAT-Core (insulation sleeves and plungers) must be purchased separately.

9 Technical Data

Diameter: **49.5 mm**

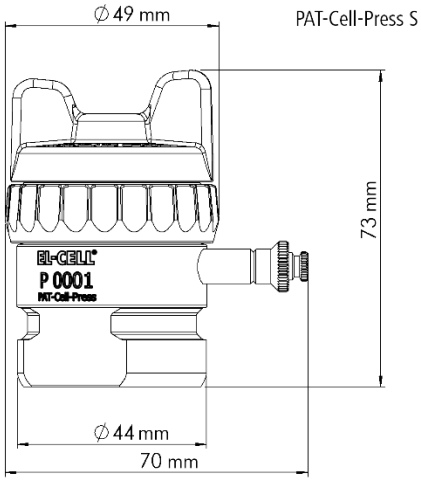
Height: **73 mm**

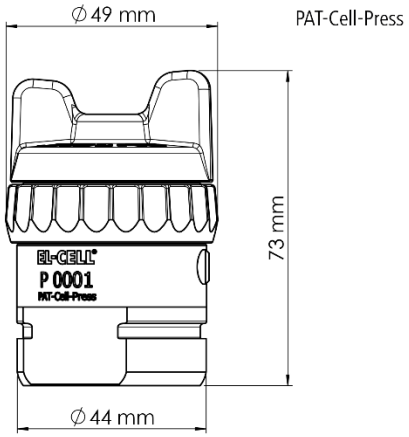
Width: **70 mm / 49.5 mm** (with/without Sample port)

Electrode diameter: **18 mm**

Temperature operation range: **-20 to +80°C**

Dead volume: **3.565ml / 8.144 ml** (with inserted PAT-Core / without PAT-Core)





9.1 Spring forces in relation to the thickness of the upper electrode:

Lid Spring	Force applied to the cell stack*
FED9028 (default)	40 N ± 10%
FED9079	105 N ±10% if used with an aluminum lid seal 115 N ±10% if used with a PE lid seal
FED9052	7 N ± 30%

- * These values apply to an upper electrode thickness ranging from 0 to 0.8 mm. Within this range, the electrode thickness has no significant influence on the force.

10 Compatible Devices

10.1 Compatible Docking Stations

Device	Charge/Discharge/ EIS	Read Sensor Data (Pressure, Temperature)
PAT-Clamp-1	Yes	Yes
PAT-Stand-1	Yes	Yes
PAT-Stand-1 U	Yes	Not supported
PAT-Stand-4	Yes	Not supported
PAT-Stand-16	Yes	Yes
PAT-Chamber-16	Yes	Not supported
PAT-Heater-4	Not supported	Not supported

10.2 Compatible Potentiostats/Battery Testers

Device	Charge/Discharge/ EIS	Read Sensor Data (Pressure, Temperature)
PAT-Tester-x-8	Yes	Yes
PAT-Tester-i-16	Yes	Yes
Third-party Potentiostats	Yes	Not supported

11 Consumables

- Sealing ring PTFE (10x) ECC1-00-0232-B/X
- Sealing ring PE (100x) ECC1-00-0232-A/C
- Sealing ring Al (10x) ECC1-00-0232-G/X
- Sealing ring, Al (10 pcs) ECC1-00-0232-N/X
- Sealing ring, Cu (10 pcs) ECC1-00-0232-M/X

12 Accessories

Compression spring (Au), FED9079

- This optional lid spring applies the following force to the cell stack:

- 105 N ±10% if used with an aluminum lid seal
- 115 N ±10% if used with PE lid seal.

These values apply to an upper electrode thickness ranging from 0 to 0.8 mm. Within this range, the electrode thickness has no significant influence on the force.

- Compression spring 1,6x11, 6x8, L: 11,33 (Au, 5 pcs), Order no.: FED9079/V

Compression spring (Au), FED9052

This optional lid spring applies a force of 7 N ± 30% to the cell stack:

This value applies to an upper electrode thickness ranging from 0 to 0.8 mm. Within this range, the electrode thickness has no significant influence on the force.

- Compression spring 0.85x9.25x12.5x2.31 (Au) (5pcs) Order no.: FED9052/V

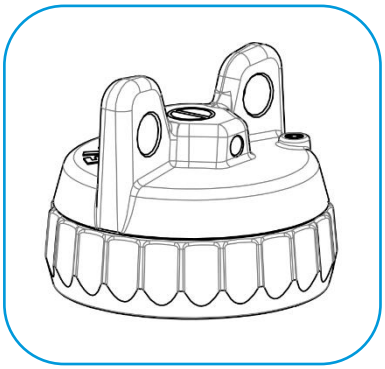
Metal seal mounting kit

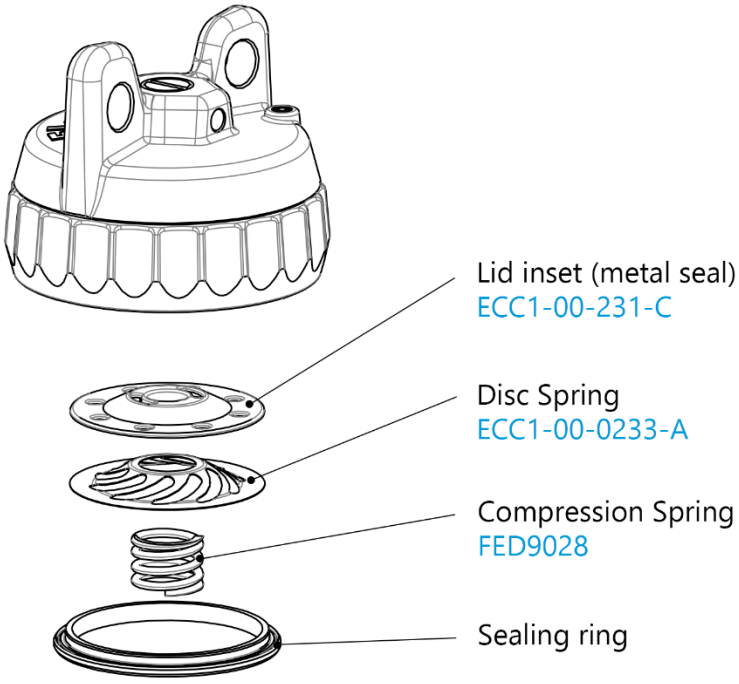
This toolkit is designed to ensure the correct installation when using metal lid seals. The assembly block holds the cell in place, while the torque wrench enables you to secure the cell lid with the recommended torque.

- Metal seal mounting kit, order no.: ECC1-02-0040-A

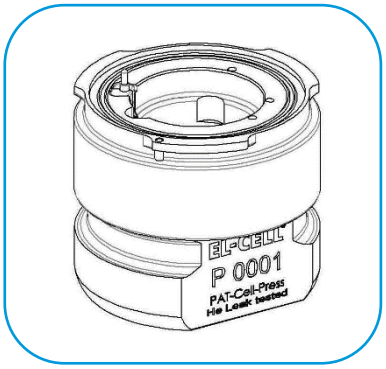
13 Spare Parts

Screw cap insulated (PAT), complete
ECC1-00-0236-D

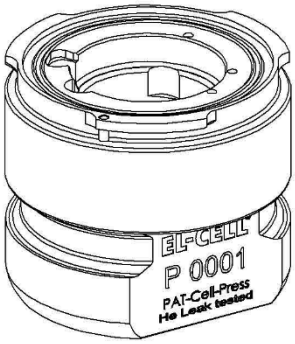


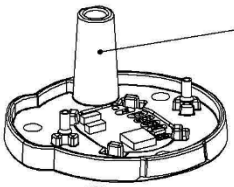


Cell base GTMS (PAT-Press), assy
ECC1-00-0255-A



Spring contact pin holder, assy
ECC1-00-0410-A



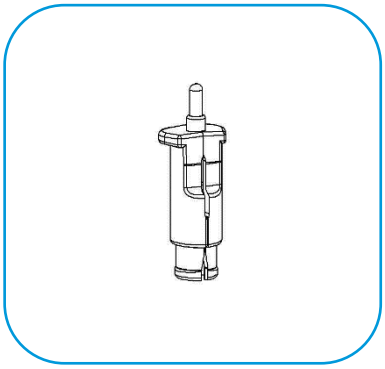


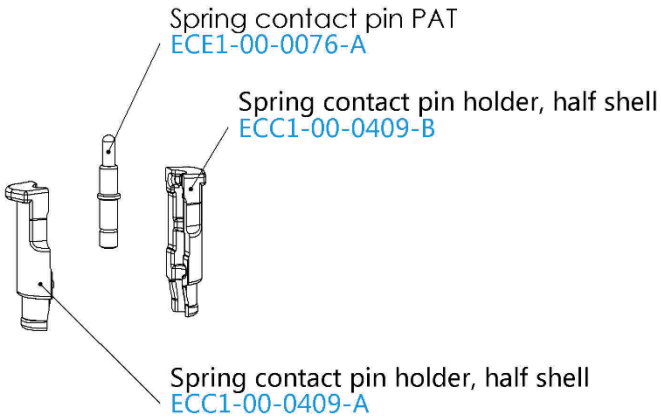
EEPROM holder, assy (PAT-Press)
ECC1-00-0249-D

Countersunk screw
DIN 965-M3x20 TX

Spring contact pin holder, assy

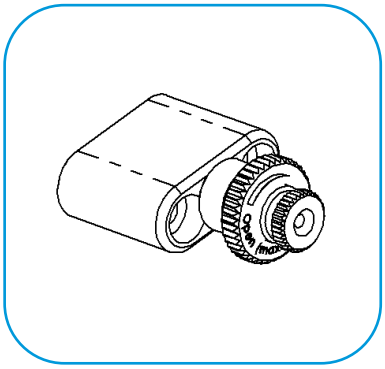
ECC1-00-0410-A

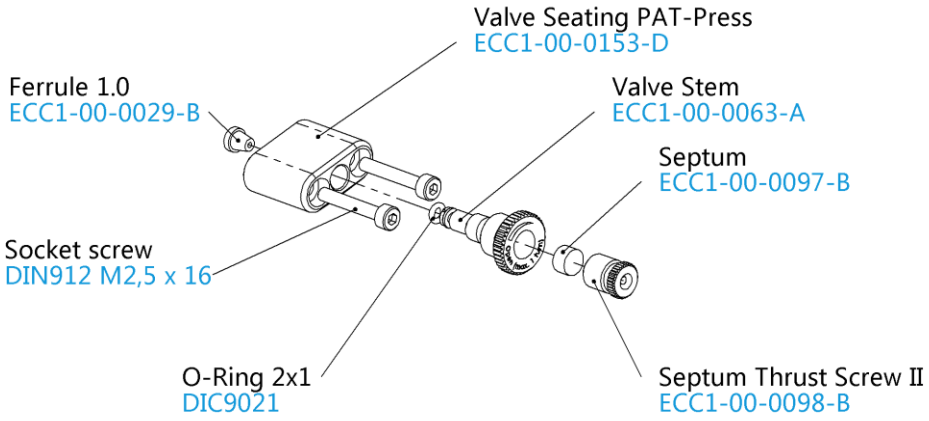




Gas sample port (PAT-Press), assy

ECC1-00-0155-C





14 Troubleshooting

What can I do if an electrolyte has entered one of the holes in the cell base?

Please only attempt this in an emergency, as there is a risk of damaging the cell. Flush the holes with an appropriate solvent (e.g., distilled water) by applying low pressure. Afterward, the cell base should be dried overnight at 80 °C to remove any liquid residues.

15 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 if unauthorized persons or service centers perform repairs. 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, the Buyer shall return the goods prepaid and bear all risks of loss until they are delivered to the factory. If the Seller returns the goods, they will be delivered prepaid, and the Seller will bear all risks of loss until delivery to the 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.