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## Battery Limits



## Electrolyser 4.1

Please study these battery limits carefully before unpacking, installing, and operating the device.

Rev. 02 – April 2024



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02

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EL4.1 – Battery Limits

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## CHANGE HISTORY

Rev.	Status	Date	Revision memo	Created/changed by
00	IFP	01/10/2023	First version	Philipp Endres
01	IFP	06/10/2023	Edited/Proofread for clarity	Beth De Felici
02	IFP	16/04/2024	Updated voltage range / Updated fuses specs	Beth De Felici



## PREFACE

Thank you for choosing Enapter. Please study these battery limits carefully before unpacking, installing, and operating the device.

If you have any further questions, please contact the Enapter customer support team. Quote the device serial number and hardware number on the back of the device to help identify your product quickly.

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## SCOPE OF THE DOCUMENT

This document must be read and understood in addition to the owner's manual which is also available on [handbook.enapter.com](http://handbook.enapter.com). Reading this document does not replace the thorough studying of the owner's manual.

The purpose of this document is to define and describe the battery limits of the Electrolyser 4.1. It illustrates the physical interface ports of the device to allow the operator to integrate it with the other equipment that composes their system.

This document applies to all Enapter devices with the following product code: ELE4105XXXXXSV00

## APPROVED USE

This device must only be operated for its intended purpose according to the specifications and instructions provided in the owner's manual. This document is intended as ancillary information only. Keep this document in a safe place and readily available. It is the operator's responsibility to ensure that an installed device is always in proper condition. Please observe any additional local requirements applicable to the installation and operation of the device.

**Improper use of the device can result in serious injuries and damage to the environment.**



- ≡ Always use the device according to the specifications described in this document.
- ≡ Ensure that this document is always accessible.
- ≡ Make sure you have read and understood this document in its entirety.
- ≡ Comply with all safety instructions and warnings.



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- ≡ Store this document and other documentation in a safe and accessible place and pass them on to future owners and operators of the device.
- ≡ Comply with all relevant local safety guidelines, rules, directives, and regulations.
- ≡ Enapter does not guarantee efficiency, safety, and functionality in case of modifications not described in this document.
- ≡ Enapter is not responsible for any damage caused by the device or to the device based on improper operation or setup.

## TERMS

The following terms are used in this document:

- ≡ **Device:** Device means the unit, including its hardware and software as well as contained materials and substances.
- ≡ **System:** System means the combination of devices, tubes, pipes, and equipment from Enapter and other manufacturers which are connected physically, logically, or in any other way to produce, store, use, transfer, or convert hydrogen and related substances.
- ≡ **Operator:** The operator is the responsible person in charge who operates, installs, connects, maintains, and/or owns the device, its subcomponents, and additional components. To simplify reading, this document only refers to the operator to distinguish from Enapter but may also include the user, customer, client, owner, installer, instructor, system integrator, or persons who are responsible for the safe operation of the device.



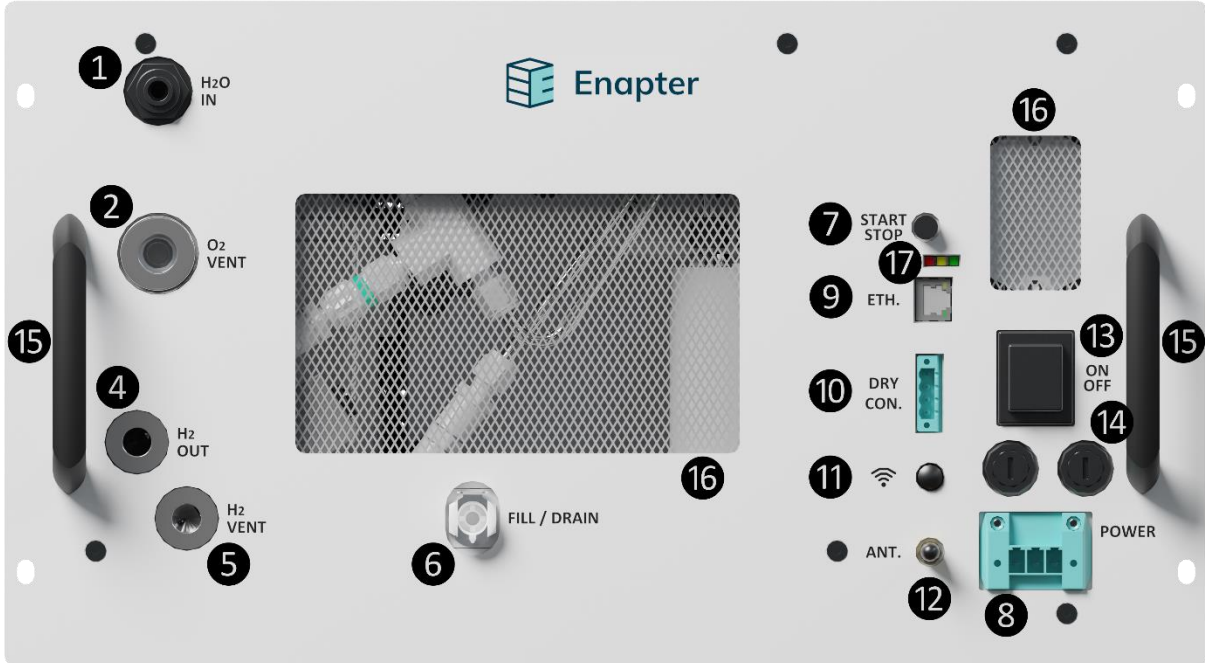
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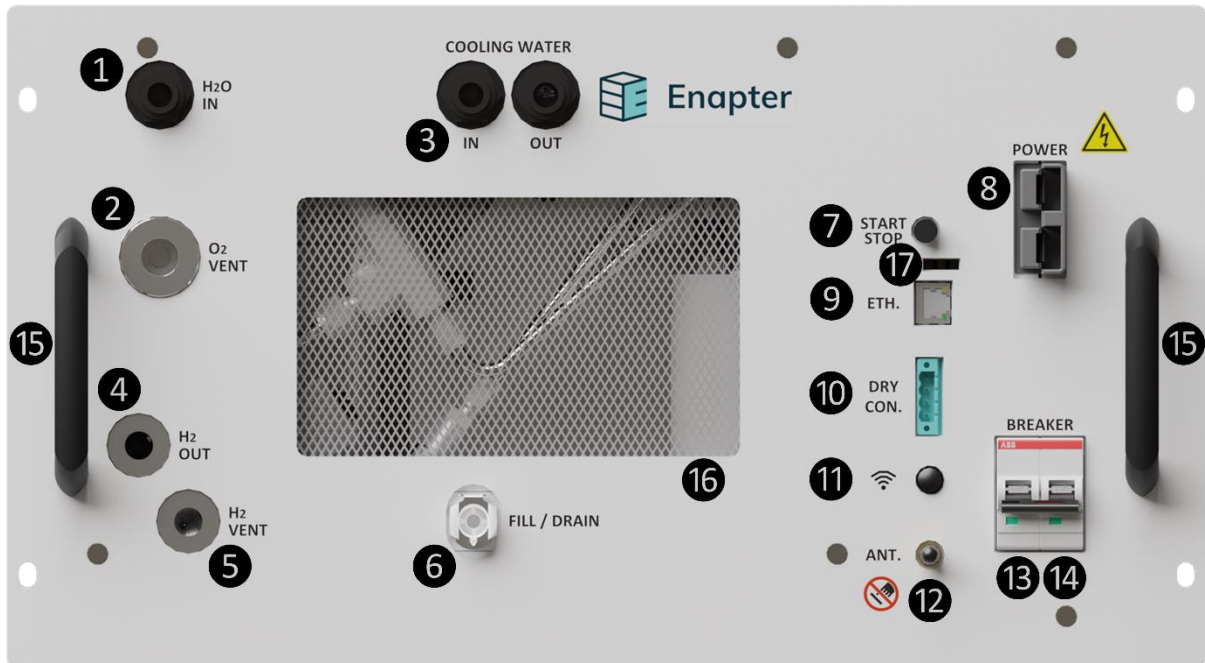


# 1. DEVICE INTERFACES

The following figure shows the position of the EL4.1's physical interfaces.



EL4.1 air cooled AC version front view



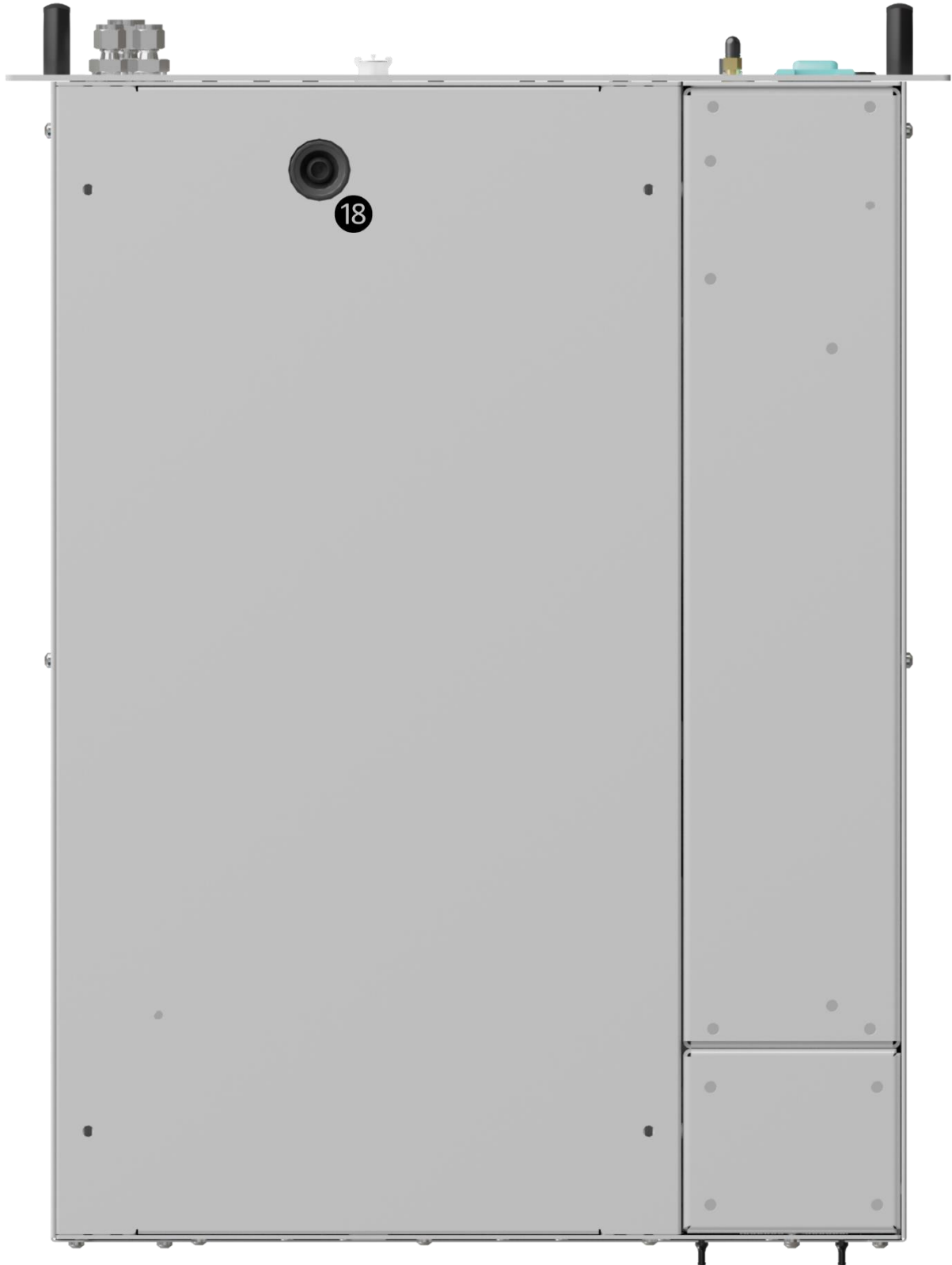
EL4.1 liquid cooled DC version front view



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*EL4.1 bottom view*



## 2. INTERFACE SPECIFICATIONS

The following interfaces described refer to the figures above. Not meeting these requirements may result in higher degradation and damage to the device. The requirements in this document must always be met. However, this document does not contain the complete list of requirements for each interface. For more information, please refer to the owner’s manual.

NOTE: The device is under continuous improvement and the technical specifications might be subject to change. Please make sure to refer to our website for the most recent specifications.

### 2.1 H<sub>2</sub>O IN

This inlet port is used for the automatic refilling of highly purified, demineralized water for the electrolysis process.

Name	H <sub>2</sub> O IN
Direction	Pressurized input
Fitting Type	10 mm push-fit female bulkhead connector
Fitting Material	POM (Polyoxymethylene)
Fluid	Recommended ASTM D1193-06 Type II or Type III but at least Type IV <sup>1</sup> with <ul style="list-style-type: none"> <li>- Total Organic Carbon (TOC) &lt;1000ppb</li> <li>- Total Silica &lt; 500ppb</li> <li>- Acidity &lt; 0.1meq/l (according to D1067)</li> <li>- Conductivity &lt; 5µS/cm</li> </ul>
Flowrate	Refilling speed up to 1 L/min periodically, 0.42 L/h water consumption in average
Pressure	1-4 barg
Temperature	5-55 °C

- ≡ Make sure to not exceed the stated limits, especially do not exceed the maximum inlet pressure.

### 2.2 O<sub>2</sub> VENT

This outlet port is directly connected to the electrolyte tank and allows the produced O<sub>2</sub> to leave the device. Apart from the produced O<sub>2</sub>, about 38 g/h of H<sub>2</sub>O condenses in the line, and this is dependent on the ambient temperature, vent line material, and insulation. Furthermore, some trace of H<sub>2</sub> (<2% concentration) can be contained in the gaseous vent output. The O<sub>2</sub> vent additionally serves as an overflow port if too much water or electrolyte has been provided.

Name	O <sub>2</sub> VENT
Direction	Input and output
Fitting Type	¾" bspp female port
Fitting Material	KOH and heat resistant material like Stainless Steel 316L
Fluid	O <sub>2</sub> + H <sub>2</sub> O vapor + H <sub>2</sub> (<2%)





Flowrate	Up to 0.25 Nm <sup>3</sup> /h (O <sub>2</sub> ) + ~38 g/h (H <sub>2</sub> O) at 25 °C ambient temperature
Pressure	<0.5 barg
Temperature	20-55 °C in average, sometimes up to 58 °C

- ≡ Make sure to not exceed the stated limits, making especially sure that the pressure drop that happens downstream the O<sub>2</sub> vent outlet port does not exceed 0.1 bar. The device must be able to always expel and take in gases.
- ≡ Make sure that this line is expelling safely into the atmosphere.
- ≡ Make sure to install an appropriate water trap at the lowest point of the O<sub>2</sub> vent line to allow the H<sub>2</sub>O to drain freely.
- ≡ Make sure to connect O<sub>2</sub>, H<sub>2</sub> and KOH compatible and heat resistant materials only.

### 2.3 COOLING WATER IN / OUT

Please be aware that this interface might not be available on your device.

This inlet/outlet port allows the device to be cooled via an external cooling loop. Temperature, pressure, and flowrate must be calculated depending on the individual setup.

Name	COOLING IN / OUT
Direction	Pressurized input / output
Fitting Type	10 mm push-fit female bulkhead connector
Fitting Material	POM (Polyoxymethylene)
Fluid	Clean water or a water-glycol mixture with up to 50% glycol
Flowrate	1-2 L/min non continuous depending on the temperature
Input pressure	1-4 barg
Input temperature	5-40 °C depending on the pressure and flowrate
Output temperature	<50 °C depending on input temperature

- ≡ Make sure to not exceed the stated limits, especially do not exceed the maximum inlet pressure.
- ≡ Make sure to only provide cleaned fluids, free of particles and install the water filter shipped with each device right before the COOLING IN port.

### 2.4 H<sub>2</sub> OUT

This outlet port releases the produced H<sub>2</sub>. H<sub>2</sub> downstream of that port will not flow back through the device.

Name	H <sub>2</sub> OUT
Direction	Pressurized output
Fitting Type	¼" bspp female port
Fitting Material	Stainless Steel 316L



Fluid	H <sub>2</sub> + 1000 ppm of H <sub>2</sub> O + <5 ppm O <sub>2</sub> (35 barg version) / H <sub>2</sub> + 12000 ppm of H <sub>2</sub> O + <5 ppm O <sub>2</sub> (8 barg version)
Flowrate	0.3-0.5 Nm <sup>3</sup> /h during hydrogen production
Pressure	Up to 35 barg (35 barg version) / Up to 8 barg (8 barg version)
Temperature	<58 °C

- ≡ Make sure to not exceed the stated limits, especially do not exceed the maximum outlet pressure by attaching pressurized tanks or sudden purges.
- ≡ Make sure to connect H<sub>2</sub> compatible and pressure resistant materials only.

## 2.5 H<sub>2</sub> VENT

This outlet port allows water which has been extracted from the H<sub>2</sub> to leave the device. This venting happens twice during ramp up, every 6 h during operation (35 barg version) / every 1.5 h (8 barg version) and once during ramp down.

Name	H <sub>2</sub> VENT
Direction	Input and pressurized output
Fitting Type	¼" bspp female port
Fitting Material	Stainless Steel 316L
Fluid	H <sub>2</sub> + H <sub>2</sub> O
Flowrate	Up to 35 NL/s (transient)
Pressure	Up to 35 barg (transient) (35 barg version) / Up to 8 barg (transient) (8 barg version)
Temperature	<58 °C

- ≡ Make sure you do not exceed the stated limits, making especially sure that there is no pressure building up in this line. The device must be able to always expel gases. Install the check valve which is included in the shipment directly at the output.
- ≡ Make sure that this line is expelling safely into the atmosphere.
- ≡ Make sure to install an appropriate water drainage system to not exceed 0.2 barg of pressure drops in the pipe at the lowest point of the H<sub>2</sub> vent line to allow the H<sub>2</sub>O to drain freely.
- ≡ Make sure to connect H<sub>2</sub> and KOH compatible and pressure resistant materials only.

## 2.6 FILL / DRAIN

This inlet/outlet port is used to fill up the device with electrolyte and to drain it again for maintenance.

Name	FILL / DRAIN
Direction	Input and output non-pressurized
Fitting Type	10 mm CPC quick connector
Fitting Material	POM (Polyoxymethylene)



Fluid	Aqueous KOH solution (1% concentration)
Flowrate	Up to 0.6 L/min
Pressure	Atmospheric
Temperature	5-55 °C
Manual filling volume	2 L – 1.54 % KOH concentration
Manual draining volume	Up to 4 L of KOH solution with up to 2 % KOH concentration

- ≡ Make sure to connect KOH compatible materials only.
- ≡ Hold the electrolyte bag above the device in order to fill it.
- ≡ Hold the electrolyte bag below the device in order to drain it.

## 2.7 START / STOP

This button allows the operator to start and stop the hydrogen production.

- ≡ Make sure to never start the device without proper installation, inspection, and approval according to all relevant local safety guidelines, rules, directives, and regulations.

## 2.8 POWER

This inlet port allows the power supply of the device.

Name	POWER
Direction	Input
Fitting Type	PCB 3-pin 7.62 mm pitch female socket (AC version) / 2-pin 16 mm <sup>2</sup> AMP Power Series - 23.5 mm TYCO ELECTRONICS (DC version)
Fitting Material	PA (Polyamide)
Fluid	Electric current
Current	0-16 A (AC version) / 0-50 A (DC version)
Voltage	208-240 V (AC version) / <2> 48 – 60 V (DC version)
Frequency	50/60 Hz (AC version)

- ≡ Make sure to always follow the stated limits.
- ≡ Keep in mind that the device’s production rate is not controlled by adjusting the voltage or power supply of the device.

## 2.9 ETHERNET

This port allows reading and writing monitoring, as well as control registers of the device via Modbus TCP/IP.

Name	ETH
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Fitting Type	RJ45 Female Ethernet port
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## 2.10 DRY CON

This port allows external devices to power cut the stack inside the electrolyser.

Name	DRY CON.
Direction	Input and output
Fitting Type	PCB 4-pin 5.08 mm pitch female socket (<2.5 mm <sup>2</sup> cross section cables)
Fitting Material	PA (Polyamide)
Fluid	Electric current
Maximum input resistance and current for closed status (S1, COM1)	0.1 kΩ – 1 mA
Maximum output resistance and current in closed status (S2, COM2)	0.01 kΩ – 250 mA

≡ Make sure to not exceed the stated limits.

## 2.11 WIFI BUTTON

The WiFi button allows the operator to switch on/off the WiFi of the device.

## 2.12 ANTENNA

The antenna port allows the operator to install an antenna for better WiFi connection.

## 2.13 ON/OFF BUTTON / BREAKER

This button is used to switch on/off the device. Please be aware that this interface might not be available on your device.

## 2.14 THERMAL OVERCURRENT CIRCUIT BREAKERS

The interface allows the operator to manually reset them by pressing the integrated button in case the contacts open.

Name	Thermal overcurrent circuit breakers
Fitting Type	240 V, 16 A <2>

## 2.15 HANDLEBARS

The handlebars allow the operator to lift and move the device.

## 2.16 FRONT MESH

The front mesh allows air to enter the device and allows appropriate cooling and ensures that no H<sub>2</sub> is accumulating inside the device in case of an H<sub>2</sub> leakage.



- ☰ Make sure to always keep the mesh free of dust and dirt.

## 2.17 LED

The LED shows the status of the device. For more information, please refer to [handbook.enapter.com](http://handbook.enapter.com).

## 2.18 LEAKAGE DRAIN HOLE

The leakage drain hole allows the operator to drain the tray in case of an electrolyte or water leakage.

Name	Leakage Drain Hole
Direction	Output
Fitting Type	Sealing Plug GPN 915
Fitting Material	PHT
Fluid	KOH, water



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