van werven

infra & recycling

Powerhub

Technische specificaties en gebruikershandleiding

580/1160kWh

samen werken aan échte oplossingen

Inhoudsopgave

Inleiding

Zoek je een tijdelijke, krachtige stroomvoorziening, waardoor jij je project emissievrij kan uitvoeren? De Powerhub is dé oplossing voor locaties zonder vaste of te kleine netaansluiting. Deze mobiele Powerhub levert energie aan grond-, weg-, en waterbouw, bedrijfspanden en logistieke hubs – stil, betrouwbaar en direct inzetbaar. Binnen vijf minuten is hij operationeel en je hebt geen diesel aggregaat nodig. De Powerhub is beschikbaar is verschillende uitvoeringen, van 150 kWh tot 1160 kWh.

In dit document lees je alles over de technische specificaties van onze verschillende Powerhubs.
De specificaties van de Powerhub 150 kWh vind je in een ander document.

Op de verhuur van de Powerhubs zijn de algemene voorwaarden van Van Werven van toepassing. Voor een veilige en optimale werking mag de Powerhub uitsluitend gebruikt worden zoals beschreven in de gebruikershandleiding.

Specificaties

Continu vermogen output	300kVA/600kVa
Continu vermogen input	300kVA/600kVa
Batterij capaciteit	580/1.160kWh
Afmetingen (lxbxh)	642 x 250 x 247 cm (20ft)
Gewicht Powerhub 580kWh - 300kVa	12.800 kg
Gewicht Powerhub 1.160kWh - 300kVa	17.025 kg
Gewicht Powerhub 1.160kWh - 600kVa	19.500 kg
Frequentie (400VAC)	50Hz (+/- 10%)
Vermogensfactor	>0,85% bij volledige belasting
Celtechnologie	LFP
Batterij voltage	600 - 780VDC
Batterij compartimenten	8
Brandblussystemen	8
Temperatuur	-15°C tot +50°C
Overige veiligheidsvoorzieningen	Overspanning, overstroom, kortsluiting, digitale spanningsbewaking per cel, meerdere thermische bewakingssystemen per module, actieve isolatie-bewaking, batterijveiligheidssensor
Certificaten	CE, EN50549-1, IEC62619. EMC61000-6-7, ISO9001, Pack and cell UL1973, UL9540A, UN38.3

Bedieningsoverzicht

Output aansluitingen

1x	Powerlock 5P, 433A, 400VAC
2x	CEE socket 5P, 32A, 400VAC
2x	CEE socket 5P, 63A, 400VAC
1x	CEE socket 2P, 16A, 400VAC
1x	CCS2 1x180kW / 2x90kW
3x	Hulpaggregaat
1x	Zonnepaneelconnector (Harting®)
1x	RJ45 (Optie EMS)

Input aansluiting

1x	Powerlock 5P, 433A, 400VAC
1x	CCS2 inlet 250A DC ±180kW (optie)
1x	Type2 inlet 22kW AC (optie)

Verplaatsingsmethode

De Powerhub 1160 kWh is op verschillende manieren te vervoeren. Dat kan met een vrachtwagen die is uitgerust met een haakarm- of kabelsysteem. Daarnaast is het mogelijk om de Powerhub te verplaatsen met een hijssysteem, zoals een kraan.

Gemakkelijk te vervoeren met een haakarm- of kabelsysteem.

Eenvoudig te verplaatsen met een hijssysteem en flexibel inzetbaar op elke locatie - ideaal voor grond-, weg- en waterbouw projecten.

Eenvoudig intern te verplaatsen op projectlocaties, met behulp van een aanhanger.

Powerhub

Gebruikershandleiding

580/1160kWh

Version: 20241105
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1. Introduction

1.1 General

First of all, congratulations on the purchase of your new DENS PowerHub. DENS proudly presents a unique battery system — a system that uses batteries to store energy for later use — developed to be unmatched in performance, safety, and energy density. The DENS PowerHub is highly versatile, allowing you to fully benefit from this high-tech battery system developed and produced in the Netherlands. Whether it's for grid-connected applications or Off-Grid use — an electrical system operating independently from the power grid — for charging vehicles or other equipment.

1.2 Purpose

This manual is developed to ensure the safe and correct use of the DENS PowerHub. Operating, adjusting, and moving the DENS PowerHub may only be performed by authorized personnel. Maintenance and repairs must be carried out using original parts, which helps extend the lifespan of the DENS PowerHub. Maintenance and repairs may only be performed by certified service technicians (see section 1.3 Intended Users).

The DENS PowerHub may only be used by authorized users. The authorized user is responsible for keeping the DENS PowerHub away from unauthorized users.

If you have any questions about the DENS PowerHub or this manual, please contact:
service@dens.one or +31 (0) 85 273 6022

1.3 Intended User(s)

This manual is intended for users of the DENS PowerHub. Only authorized users may operate the DENS PowerHub.

Authorized Users:
Authorized persons/users are personnel permitted to install and operate the DENS PowerHub as described in this manual. They must meet the following requirements:

- The user has permission from the owner/manager of the DENS PowerHub to operate and/or
- install it.
- The user has read this manual and is aware of the dangers and risks of using the DENS Power Hub. They must always act in accordance with this manual.
- The user has been trained in the use of the DENS PowerHub.
- The user is familiar with the required PPE (Personal Protective Equipment) and always adheres to the PPE regulations at the DENS PowerHub location.
- The user knows the location and use of the available fire extinguishers.
- The user is familiar with the local emergency plan.

Authorized Drivers:
The DENS PowerHub falls under ADR regulations (European Agreement concerning the International Carriage of Dangerous Goods by Road). This means it may only be transported by certified drivers. The authorized driver must also meet the requirements of an authorized user to handle the DENS PowerHub connections.

Authorized Electricians:
Some actions, such as installing a grounding rod, require a certified electrician. This refers to personnel employed as electricians with at least a vocational (MBO) education in electrical engineering.

Owner/Manager:
The person or organization that has purchased and owns the DENS PowerHub
Service Technicians:
A service technician is authorized to make modifications to the DENS PowerHub, such as disconnecting components to resolve malfunctions. They must be officially authorized by DENS.

Unauthorized Persons:
Anyone who does not meet the above qualifications is considered unauthorized. Authorized persons under the influence of alcohol, drugs, or other intoxicants are immediately classified as unauthorized. Unauthorized persons are strictly prohibited from using the DENS PowerHub.

1.4 How to Use This Manual

This manual is the leading document for instructions on how to use the DENS PowerHub. It must be studied by all authorized users. The manual uses symbols, explained below:

⚠ Warning
- Bullet point

This document also uses endnotes [a1] to further explain terms. See the glossary at the end of the manual for definitions. Endnotes are added the first time a term appears

2. Technical Specifications and Certification

2.1 Type Number

This manual applies to the DENS PowerHub with one of the following type numbers:

- PH-20-300-580
- PH-20-300-725
- PH-20-300-1160
- PH-20-300-1450
- PH-20-300-1595
- PH-20-300-1740
- PH-20-300-2030
- PH-20-300-2320

2.2 Specifications of the DENS PowerHub

Specification	Value
Power output	300 kVA (kilovolt-ampere
Battery capacity	580 kWh – 2320 kWh
Housing type	Flatrack container
External dimensions	642 cm (L) × 250 cm (W) × 247 cm (H)
Weight	17,250 kg – 28,550 kg

3. General Safety Instructions

The DENS PowerHub is designed to be used safely. The responsibility for safety lies with the authorized user of the DENS PowerHub. Before performing any procedure or operating technique, it is the responsibility of the authorized user to ensure it is safe to do so.

Improper use of high-voltage equipment — devices that operate at high voltages — can cause electric shock or fire, potentially resulting in death, serious injury, or significant property damage. Always operate the DENS PowerHub in accordance with the rules and guidelines of NEN3140.

Warning:

- ⚠ Read and understand all safety measures and warnings before using the DENS PowerHub.
- ⚠ Failure to follow the instructions, procedures, and safety measures in this manual increases
- ⚠ the risk of accidents and injuries.
- ⚠ Do not use the DENS PowerHub in unsafe conditions.
- ⚠ Ensure the DENS PowerHub is protected from unauthorized use and shielded from unauthorized users and animals.
- ⚠ Do not use the DENS PowerHub outdoors during severe weather conditions such as thunder storms, heavy rain, hail, snow, or winds of force 6 or higher.
- ⚠ Maintenance or repair work may only be performed when the DENS PowerHub is deactivated.
- ⚠ Do not connect devices that demand or supply more or less power than the DENS PowerHub
- ⚠ can handle.
- ⚠ Never connect or disconnect plugs while the connection is live.
- ⚠ Power sources (e.g., grid, solar panels, wind turbines, generators), cables, and power consumers (devices using power from the DENS PowerHub) must match in voltage and current.
- ⚠ Always check specifications before use.
- ⚠ Install and use the DENS PowerHub only in accordance with relevant national or local standards.
- ⚠ The DENS PowerHub falls under ADR9 and PGS37 regulations.
- ⚠ This is a UPS product of category C2. In residential environments, it may cause radio interference, in which case the user may need to take additional measures.

3.1 Emergency Stop Button

In case of an emergency, the emergency stop button on the DENS PowerHub must be used. When pressed, it disconnects power from all connections. The emergency stop button is located in the **HMI (Human Machine Interface)** and is accessible from both the outside and inside of the DENS PowerHub (see Figure 1).

If you need to use the emergency stop while the HMI is closed, first flip up the cover of the emergency button.

Figuur 1: Noodknop HMI dicht (links) open (rechts)

Warning:

⚠ Familiarize yourself with the location of the emergency stop button.

⚠ Emergency stop controls are for emergency use only.

⚠ Do not use the emergency stop for regular shutdown procedures.

⚠ Do not use the DENS PowerHub again until the issue that triggered the emergency stop has been identified and resolved.

⚠ When the emergency stop is activated, the charging process to and from the DENS PowerHub stops. However, the system still contains stored energy and may remain hazardous.

3.2 Personal Protective Equipment (PPE)

When working with or around the DENS PowerHub, appropriate Personal Protective Equipment (PPE) must always be worn. PPE requirements may vary by worksite. If you are unsure of the required PPE at your location, consult the local safety officer before use.

3.3 Power Cables

To use the DENS PowerHub, power cables are required. Carefully inspect all cables before use. The power source, cables, and power-consuming equipment must match in voltage and current. Always verify specifications before connecting.
Note: DENS does not supply power cables. Users are responsible for providing the correct cables.

Check at least the following:

- Outer insulation is not worn or cut
- No part of the cable is kinked or crushed.
- The cable and connector are suitable for the DENS PowerHub and the intended application.

- Do not use damaged cables.
- Wiring must be well-maintained and routed safely to avoid hazards or damage.
- Do not use (il)legal adapters that may overload the system.
- Request maintenance for loose or frayed wires from your equipment service team.
- Close the HMI door when access to connections or the control panel is no longer needed to
- prevent unauthorized access.
- Always disconnect power by switching off the main switch before moving cables or modifying circuits.

3.4 Fire Safety

If ignition occurs within the DENS PowerHub, it creates a hazardous situation that can be dangerous to nearby people and objects. Always keep the DENS PowerHub away from **ignition sources —** anything that can start a fire. Smoking is prohibited near the unit, and a minimum distance of **10 meters** must be maintained between the DENS PowerHub and any combustion engines/generators or other ignition sources.

In the event of an **external fire** (a fire not fueled by the DENS PowerHub), users must be familiar with how to operate the fire extinguisher. Inspect the extinguisher for damage or defects and maintain it regularly. Follow the instructions on the extinguisher label.

The DENS PowerHub uses **lithium iron phosphate (LFP)** batteries, which are significantly safer in terms of fire risk than standard lithium-ion batteries. Multiple tests have been conducted in collaboration with the fire department to try to ignite the battery packs — all unsuccessful to date. However, fire can never be completely ruled out.

Each battery segment in the DENS PowerHub is equipped with a **fire suppression system** and **gas sensors**. If signs of fire — such as smoke or flames — are detected, press the emergency stop button, move away from the unit, evacuate the area, and contact emergency services (NL: 112), followed by the service technician.

3.5 Residual Current Device (RCD)

The DENS PowerHub is equipped with **residual current devices (RCDs)**. If there is a fault in the insulation of connected equipment or cables, a **leakage current** may occur. If the leakage current exceeds a certain threshold, the RCD will trip and disconnect power from the system.

Safe and efficient operation of electrical equipment is only possible if it is properly operated and maintained. For the RCDs to function correctly, a **ground connection** must be established — either via an existing connection or a separate **grounding rod**.

If no grid is connected and installing a grounding rod is not possible, the insulation monitor can be used instead (see section 3.6). For more on grounding, see section 5.3

3.6 Insulation Monitor

The DENS PowerHub includes a built-in **insulation monitor**. This device ensures that if an insulation fault occurs, the system will shut down. The insulation protection is always active unless manually disabled via the control panel — which should only be done in specific situations.

When starting up, the PowerHub checks whether it is connected to a grid or needs to generate its own. If no grid is detected, it starts in **grid mode**, generating its own network. In this mode, there are two safety options:

1. **Use of RCDs (TN system)**: RCDs trip when leakage current is too high. This requires a grounding rod.
2. **Use of insulation monitor (IT system)**: Continuously measures insulation resistance. If the value is too low, it indicates a short circuit. Most users operate well on an IT system, but systems with their own insulation monitoring may interfere, causing the insulation monitor to shut down the power. In that case, a grounding rod must be used (see option 1).

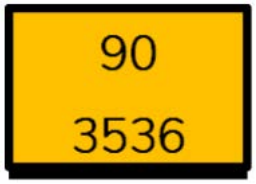
3.7 Safety Symbols and Product Markings

Figure 2: Hazard Label Class 9

On all four sides of the DENS PowerHub, hazard labels of **model number 9** are affixed. These labels indicate that the DENS PowerHub may pose a danger during transport. Class 9 is a category for miscellaneous dangerous substances. The DENS PowerHub falls under this class due to the large quantity of lithium iron phosphate batteries in the system.

Additionally, both side panels of the DENS PowerHub display the following symbol:

Figure 3: Hazard Label UN 3536



This label indicates that the DENS PowerHub is classified under **UN 3536** according to ADR regulations. This means that transporting the DENS PowerHub can pose hazardous situations. Contact the service technician or authorized driver for more information.

Note:
The DENS PowerHub may only be transported by a certified driver in possession of ADR documentation.

3.8 Risk Factors and Potential Consequences

While using the DENS PowerHub, various hazardous situations may arise. As a user, you must be able to recognize these dangers, understand the consequences, and know how to respond. If you have questions about specific situations or procedures, contact the safety officer or service technician.

Examples of potential hazards and how to respond:

Disconnecting 300 kVA connections under load

Improper handling may cause disconnection of cables carrying high voltage and current, potentially creating an arc flash that can harm users and bystanders.

Possible consequences:

- Arc flashes
- Electrocution
- Serious or fatal injuries
- Damage to the DENS PowerHub and nearby objects
- Toxic gas release

Short circuit due to water

Internal water contact can cause short circuits. If RCDs keep tripping, keep your distance and contact the service technician. Call emergency services if signs of fire appear.

Possible consequences:

- Heat buildup in the battery
- Fire
- Pressure buildup or explosion
- Release of hazardous gases

Lightning strike

A lightning strike can cause internal damage to the batteries. Do not touch the unit (especially if no grounding rod is installed), keep your distance, and contact the service technician. Call emergency services if fire is suspected.

Possible consequences:

- Heat buildup
- Fire
- Explosion
- Toxic gas release

Charging process error

Overcharging, deep discharging, or other charging errors can damage the system. Press the emergency stop if such errors occur. Call emergency services if fire is suspected.

Possible consequences:

- Heat buildup
- Fire
- Explosion
- Toxic gas release

External fire
External fires can heat the batteries, increasing explosion risk and toxic gas release. If safe, remove the fire source, press the emergency stop, and contact emergency services and the service technician. Otherwise, evacuate the area.

Mechanical impact
External mechanical force can damage the batteries, causing short circuits or leaks. Do not move the object that caused the impact. Press the emergency stop, evacuate, and contact emergency services.

Drop damage
Dropping the unit can cause internal damage. If safe, press the emergency stop, evacuate, and contact the service technician and emergency services.

Chemical contamination (mixed storage)
If harmful substances come into contact with the DENS PowerHub, keep your distance and contact the service technician.
Examples of harmful substances:

- Corrosive gases and liquids
- Electrically conductive substances
- Flammable or toxic materials
- Substances outside the temperature range

Piercing of the DENS PowerHub
If a vehicle or object pierces the unit, evacuate immediately. Do not remove the object. Press the emergency stop, warn others, and contact emergency services.

Warnings:

⚠ Never place the DENS PowerHub in an enclosed space or under a roof with less than 3 meters clearance.

⚠ Do not smoke or allow sparks near the unit.

⚠ The system must be re-inspected by DENS before it can be used again.

⚠ Never block the ventilation grilles.

3.9 Emergency Plan

At any location where the DENS PowerHub is used or stored, a current **emergency plan** must be available that complies with **PGS37** guidelines. This plan should address how to manage incidents, accidents, and protect users and bystanders.

The plan must include procedures for:

- **Thermal runaway** — an exothermic reaction in lithium iron phosphate batteries that poses safety risks.
- **Leaking electrolyte** — how to respond if battery fluids escape.

4. Product Description

4.1 General Description

The purpose of the DENS PowerHub is to store electrical energy, make it transportable, and supply it to various power consumers and markets. The DENS PowerHub can be charged at one location, transported, and discharged at another. This allows you to provide electrical energy to applications that are not connected to the power grid.

You can also connect the DENS PowerHub to the grid to supply surplus energy or to support applications when the grid lacks sufficient capacity. The DENS PowerHub is suitable for various use cases. Contact your service technician if you have questions about your specific application.

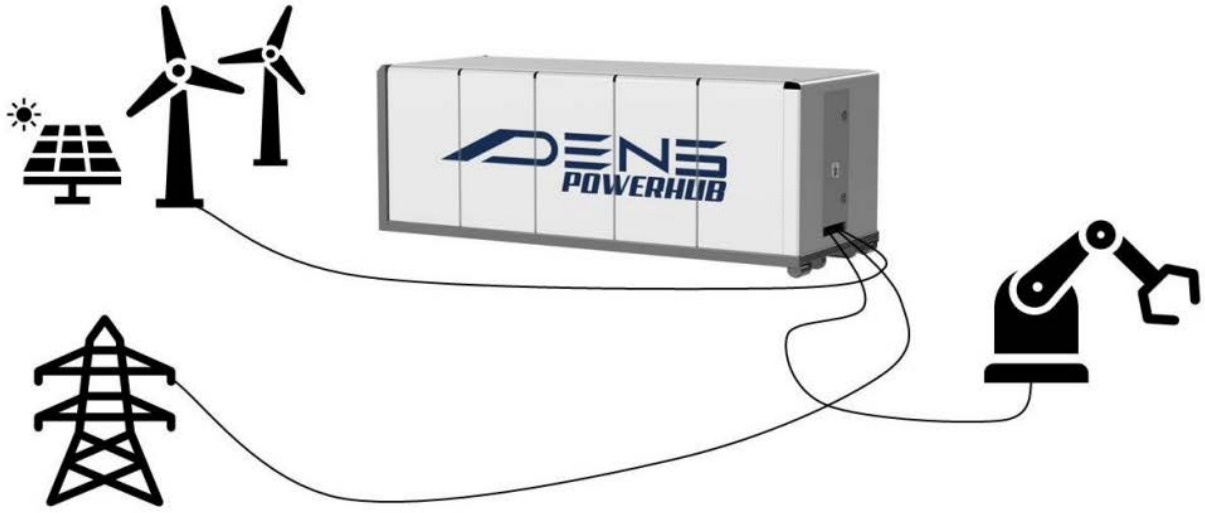
The DENS PowerHub consists of multiple **compartmentalized battery systems** that are interconnected. The stored energy is made available via a **transformer** and **charger** integrated into the **HMI (Human Machine Interface)**.

The DENS PowerHub supports the following applications:

- Connection to the power grid
- Connection to power consumers
- Connection to power sources

These applications are illustrated in **Figure 4**.

The DENS PowerHub is flexible in its use. You do not need to use all applications simultaneously — you can choose one or two specific ones.



4.2 Subsystems

The DENS PowerHub consists of several subsystems, each with its own function. As a user, you should only interact with the HMI and the charger. Interaction includes pressing buttons, operating switches, using control panels, and connecting/disconnecting cables.

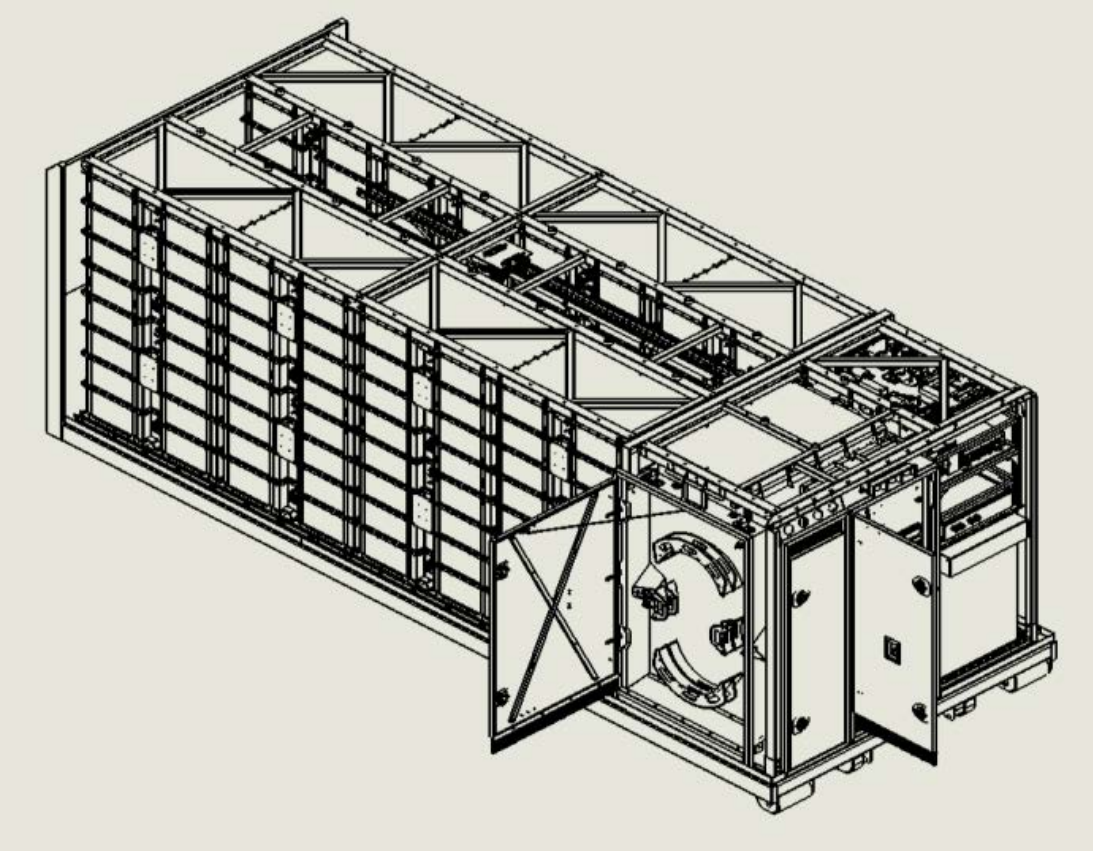
Warning:

⚠ Subsystems can be (life-)threatening if handled incorrectly.

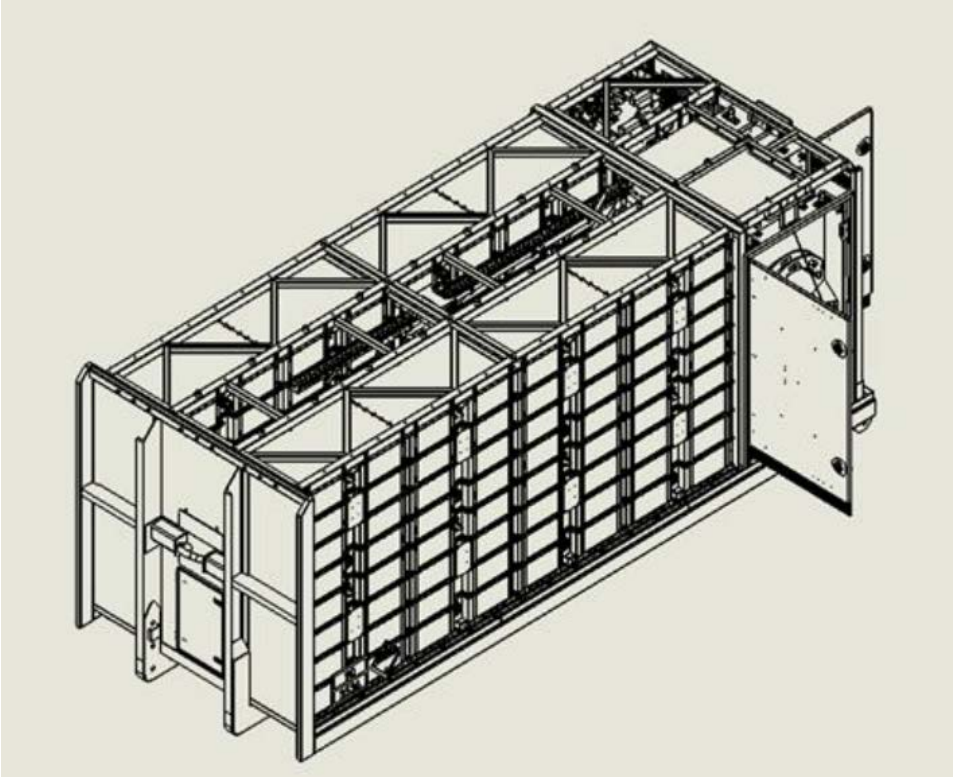
The DENS PowerHub includes the following systems:

1. HMI (Human Machine Interface)
2. Power Cabinet Charger – directs the correct voltage and current to the charger
3. Charger
4. Batteries
5. Cooling Radiators – regulate internal temperature
6. Hook Arm Eye – for loading/unloading
7. Inverter Box – converts DC to AC
8. Transformer – separates and adjusts voltage between circuits
9. Hook Arm Body – structural support for transport

Figures 5 and 6 in the manual show the layout of these subsystems.



Figuur 5: DENS PowerHub subsystemen voor/zij aanzicht

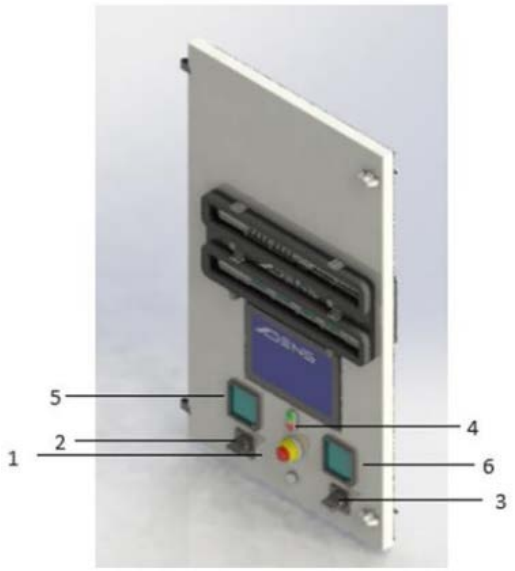


Figuur 6: DENS PowerHub subsystemen achter/zij aanzicht (zonder batterijen)

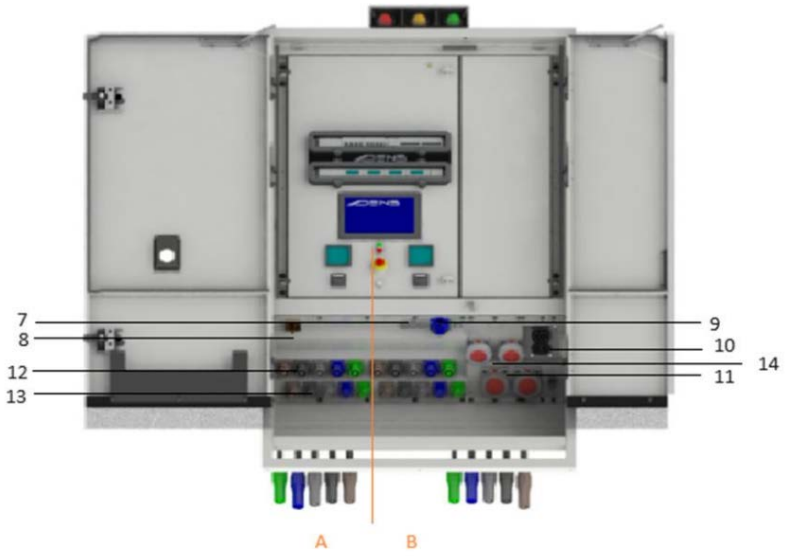
1. HMI
2. Power Cabinet Charger
3. Charger
4. Batterijen
5. Koeling radiatoren
6. Haakarm oog
7. Transformator 300 kVA
8. Omvormer box
9. Haakarm body

4.2.1 HMI (Human Machine Interface)

Voor het gebruik van de DENS PowerHub is het bedienen van de HMI van belang. Via de HMI kunnen de gewenste instellingen geselecteerd worden en kan de DENS PowerHub verder bediend worden via het bedieningspaneel. Ook zijn in de HMI alle te gebruiken aansluitingen aanwezig en kunt u hier de gewenste aansluitingen maken voor uw applicatie. Zorg ervoor dat u zich als Gebruiker bekend maakt met de aanwezige aansluitingen en het gebruik van de HMI. Hieronder zijn alle onderdelen van de HMI weergegeven.



Figuur 7: HMI vooraanzicht Open



Figuur 8: HMI schuin onder aanzicht

1:	Noodknop	7:	AUX aansluiting
2:	Hoofdschakelaar A	8:	Aardingmoer
3:	Hoofdschakelaar B	9:	B3 , 230V 16A aansluiting (shuko)
4:	Start / stop knop	10:	CCS2 laad aansluiting (om Powerhub op te laden)
5:	KWH meter A	11:	B1,2,4 & 5, 400V 63A aansluiting
6:	KWH meter B	12:	Powerlocks in, 300KVA , links A , rechts B
		13:	Powerlocks uit, 300KVA, links A , rechts B
		14:	B4 & 5, 400V 32A aansluiting

⚠ [1] De noodknop is toegankelijk met zowel de HMI-deur open en dicht. Zie Read and understand all safety measures and warnings before using the DENS PowerHub.
⚠ Failure to follow the instructions, procedures, and safety measures in this manual increases
⚠ the risk of accidents and injuries.
⚠ Do not use the DENS PowerHub in unsafe conditions.
⚠ Ensure the DENS PowerHub is protected from unauthorized use and shielded from unauthorized users and animals.
⚠ Do not use the DENS PowerHub outdoors during severe weather conditions such as thunder storms, heavy rain, hail, snow, or winds of force 6 or higher.
⚠ Maintenance or repair work may only be performed when the DENS PowerHub is deactivated.
⚠ Do not connect devices that demand or supply more or less power than the DENS PowerHub
⚠ can handle.
⚠ Never connect or disconnect plugs while the connection is live.
⚠ Power sources (e.g., grid, solar panels, wind turbines, generators), cables, and power consumers (devices using power from the DENS PowerHub) must match in voltage and current.
⚠ Always check specifications before use.
⚠ Install and use the DENS PowerHub only in accordance with relevant national or local standards.
⚠ The DENS PowerHub falls under ADR9 and PGS37 regulations.
⚠ This is a UPS product of category C2. In residential environments, it may cause radio interference, in which case the user may need to take additional measures.

3.1 , over wanneer u de noodknop dient te gebruiken.
[2] Hoofdschakelaar A (de)activeert de aansluiting van kant A
[3] Hoofdschakelaar B (de)activeert de aansluiting van kant B
[5] Toont het voltage/stroom en verbruik op kant A
[6] Toont het voltage/stroom en verbruik op kant B
[7] Via de Aux aansluitingen (3x) kan externe apparatuur aan/uit geschakeld worden (zoals zonnepanelen/generatoren). Alleen in overleg met Dens aansluiten!
[8] Met de aardingsmoer dient u verbinding te maken met een geslagen aardingspen.
[9] Met gebruik van de B3,230V 16A aansluiting kunt u de DENS PowerHub ontladen wanneer aangesloten aan verschillende applicaties.
[10] Met de CCS2 ingang kan de DENS Powerhub opgeladen worden met zowel een AC lader als een DC snellader.
[11] Met gebruik van de B1, B2, 400V 63A aansluitingen kunt u de DENS PowerHub ontladen wanneer aangesloten aan verschillende applicaties.
[12] Met gebruik van de Power Locks, 300 KVA aansluitingen kunt u een aansluiting met het elektriciteitsnet maken. De 5 aansluitingen links zijn voor kant A. De aansluitingen rechts hiervan

voor kant B
[13] Met gebruik van de Power Locks, 300 KVA aansluitingen kunt u de DENS PowerHub ontladen wanneer aangesloten aan verschillende applicaties. De 5 aansluitingen links zijn voor kant A. De aansluitingen rechts hiervan voor kant B.
[14] Met gebruik van de B4, B5, 400V 32A aansluitingen kunt u de DENS PowerHub ontladen wanneer aangesloten aan verschillende applicaties.

⚠ Sluit alleen kabels en machines aan bij de aansluitingen waarvan de DENS PowerHubaansluiting ook binnen de specificaties valt van de kabel en/of machine.

⚠ Stroom leveren door kabels en aan machines met vermogens/stroomsterktes/spanningen die buiten de specificaties vallen van deze kabels en machines kan gevaarlijke oververhitting veroorzaken.

4.2.2 Power Cabinet Charger

This cabinet converts incoming power to the correct voltage and current for the charger.

⚠ **Users should not interact with this component.** Contact a service technician if needed.

4.2.3 Charger

The charger connects to the DENS PowerHub via the HMI and supplies power to electric vehicles. It has **two CCS2 connectors** that together provide up to **150 kW DC**.

- Always use undamaged cables.
- Keep the charging connector clean.
- The charger has a control panel showing current, charging time, and power per connection. 4.2.4

4.2.4 Batteries

The batteries store the energy. The DENS PowerHub uses **lithium iron phosphate (LFP)** batteries, equipped with a **fire prevention system**.

⚠ **Users should not interact with the batteries.** Contact a service technician if service is needed.

4.2.5 Cooling Radiators
These regulate the internal temperature of the DENS PowerHub.

⚠ **No user interaction required.** Contact a service technician if needed

4.2.6 Hook Arm Eye

Used for loading and unloading the DENS PowerHub. See section 5.2 for instructions.

4.2.7 Inverter Box

Converts internal DC voltage to the desired AC voltage.

⚠ **No user interaction required.** Contact a service technician if needed.

4.2.8 Transformer

Ensures safe separation of electrical circuits and supports up to 300 kVA continuous.

⚠ **No user interaction required.** Contact a service technician if needed.

4.2.9 Hook Arm Body

The structural frame that supports the DENS PowerHub during loading/unloading.

- Regular inspection and measurement of the hook are required.
- Apply **high-pressure grease** or **copper grease** to reduce friction.

4.3 Residual Current Devices (RCDs)

The **HMI** is equipped with **residual current devices (RCDs)**. As described in section **3.5**, leakage current may occur during use, which can trigger an RCD.

To operate the DENS PowerHub safely, you must be aware of the different RCDs and their locations.

As explained in section **4.2.1 HMI**, the RCDs are located on the front of the HMI at position [6], where you'll also find the meters. Here, you have access to RCDs **B1, B2, B3, B4, B5, and B6.**

A diagram in **Figure 10** shows which RCD is connected to which outlet.

The RCDs for the **300 kVA connections** are located inside the HMI. To access the interior, you need a key. Contact DENS to obtain this key.

⚠ You may not open the HMI without permission from a DENS-authorized technician. Inside the HMI, there are live cables and busbars (copper strips that conduct electricity).

⚠ Do not touch the busbars when working inside the HMI.

⚠ Do not make any changes inside the HMI without explicit permission from DENS or a service technician.

5. Installation

5.1 Selecting the Location for the DENS PowerHub

Choosing the right location is crucial when placing the DENS PowerHub. The environment and surface must meet several requirements to avoid risks. The DENS PowerHub may only be placed at a location that meets the following conditions:

Location Requirements:

- Do **not** place the DENS PowerHub in an enclosed space or under a roof with less than **3 meters** of vertical clearance (in accordance with **PGS 37-1** guidelines for lithium iron phosphate
- battery systems).
- The location must be **restricted to authorized users only**
- The **ground surface** must not have a slope greater than **10%** in any direction.
- The ground must be able to **support the full weight** of the DENS PowerHub.
- The **entire base** of the DENS PowerHub must be in contact with the ground.
- There must be **no water pooling** deeper than 1 cm under the unit.
- The surface must provide **sufficient grip** to keep the unit stationary at all times (except during loading/unloading).
- Ensure **easy access** for transport vehicles to load/unload the unit.
- The DENS PowerHub must **not obstruct** any access or exit routes.
- Maintain a **minimum clearance of 5 meters** around the unit for access and service.
- The **emergency stop button** must always be safely accessible.
- The unit must be **reachable by emergency services** at all times.
- Personnel working near the unit must always have a **clear escape route** to a safe area.
- Do not use the unit in locations where the temperature exceeds **40°C** or drops below **-20°C**.
- The unit must be protected from external risks such as **explosions, fire, collisions, or lightning.**
- Do not place the unit in areas where **liquids may accumulate** above 1 cm.
- Ensure **adequate air circulation** in case of release of corrosive or toxic substances.
- Maintain a **minimum distance of 5 meters** from transport routes. If this is not possible, the unit must be shielded and secured.

Warnings:

- If the unit is damaged by extreme weather, contact the service team and **do not use** the PowerHub.
- In case of extreme weather, the **owner/manager** is responsible for securing the unit.
- If a **grounding rod** is required, the soil must be approved by a certified electrician.
- If you plan to place the unit on another planet or non-terrestrial surface, contact DENS first.
- The **center of gravity** is not always in the middle of the unit.
- Optimal operating temperature: **15–35°C**.
- Vehicles exceeding **15 km/h** or carrying objects that could pierce the unit (e.g., forklift tines) pose a high risk. The user and owner are responsible for protection.

These requirements apply for the **entire duration** the unit is on-site.

⚠ Only allow **qualified drivers** (as defined in section 1.3) to transport and place the unit.

⚠ The **Checklist for Loading the Energy Storage System** (see appendix) must be completed before transport.

After placement, recheck the location against the above criteria. Additionally, verify:

- No **mechanical damage** (e.g., dents, cracks, holes).
- Correct **electrical connections** are available for the intended use.
- At least **5 meters** of space between the unit and buildings (10 meters if buildings lack fireresistant walls).
- The unit is placed on a **safe surface and work environment**.
- A **properly installed grounding rod** or functioning insulation monitoring is in place.
- **Fire extinguishers** are checked and within reach.
- All users have the correct **PPE** and meet the authorized user requirements.
- All users have read the manual and understand the risks.

⚠ If any of the above conditions are not met, the DENS PowerHub **must not be used** until all issues are resolved.

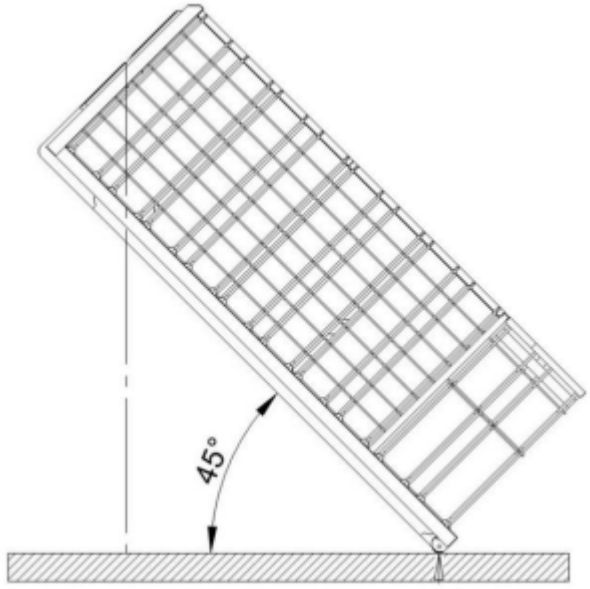
5.2.1 Loading

The DENS PowerHub is equipped with a **hook-lift eye and body** (see section 4.2.6). These allow the unit to be attached to the hook-lift system.

Follow the correct hook-lift procedure as provided by the system supplier.

After loading, check the following:

- The DENS PowerHub must be pulled **straight** onto the truck — not at an angle.
- During transport, the **hook-lift eye must not bear the load.** The unit must rest on its **base surface.**
- The unit must be **secured in all directions** (forward, sideways, backward) and remain stationary during transport.
- The maximum tilt angle during loading is **45°** (see Figure 11 in the manual).



Figuur 11: Maximale hoek van tillen haakarm procedure

5.2.2 Unloading

Before unloading, verify that the **placement location** meets all requirements listed in section 5.1.

Only an **authorized driver** may perform the unloading. This must be done using the **hook-lift system** and the correct procedure as provided by the system supplier.

After placement, recheck the location using the checklist in section 5.1.

Warning:

⚠ Check for any obstacles or hazards before unloading. Remove them before proceeding.

⚠ DENS is not liable for any damage caused during loading, unloading, or transport.

5.3 Installing a Grounding Rod

Always install a **grounding rod** unless the DENS PowerHub is properly connected to the power grid. If installing a rod is not possible, the **insulation monitoring system** may be used instead.

Important Notes:

- **The grounding rod mus**t be installed and tested by a **certified electrician** (as defined in section 1.3).
- If you do not have a certified electrician on staff, you must hire one and ensure they are properly instructed and authorized to work with the DENS PowerHub.

How to Connect the Grounding Rod:

- The DENS PowerHub is equipped with a **grounding nut** at position **[10]** on the HMI (see section 4.2.1).
- The certified electrician must connect the properly installed grounding rod to this nut.
- After installation, the electrician must **verify the grounding connection** and submit **proof of functionality**.

Once the grounding connection is verified, **disable the insulation monitoring system** via the settings menu.

5.4 Connecting the DENS PowerHub to the Power Grid (300 kVA)

You have the option to connect the DENS PowerHub to the **electricity grid**. Before doing so, verify that the grid connection meets all requirements set by your **grid operator**. Contact your grid operator for confirmation.

Also ensure that the DENS PowerHub is suitable for the intended grid connection. If in doubt, contact your **service technician** or grid operator.

⚠ Always follow the **local safety regulations** and **work instructions** from both the grid operator and DENS. The safety rules of the grid operator take precedence during installation.

Only authorized users may perform the installation.
Once the DENS PowerHub is placed at the correct location and all checklist items are verified, you may proceed with the installation.

Required Equipment:

- Cables that match the specifications of both the **grid connection** and the DENS PowerHub's **Power Locks**:
- **[12] Power Locks, 300 kVA B**
- **[13] Power Locks, 300 kVA A**
  (See section 4.2.1 HMI)

Warnings:

⚠ Inspect all cables for damage before use.

⚠ Ensure the DENS PowerHub is within the specifications of the cables and connections.

⚠ Be alert for signs of fire and follow the general safety instructions (see section 3).

⚠ Only switch on the main switch after all cables are properly connected.

Step-by-Step: Connecting to the Grid (300 kVA)

1. Turn off the system and all **main switches**.
2. Connect the grid to the **Power Locks, 300 kVA B**.
3. Turn on **main switch B**.
4. Press the **start button**.
5. Wait for the DENS PowerHub to detect the grid connection.
6. Press the **start button** again.
7. Wait for the system to fully boot up.
8. Use the **settings menu** to configure your desired grid settings..

The DENS PowerHub is now connected to the grid.
Use the connections on **main switch B** for 300 kVA output.

5.5 Installing the Charger

Installing the charger on the DENS PowerHub may only be done by **authorized users**. Once the unit is placed at the correct location and all checklist items are verified, the charger can be installed.

If you received a PowerHub with a charger, it is usually **pre-installed**. If you see cables running from the bottom of the HMI to the **[15] Power Locks, 300 kVA C** connection, the charger is already connected.

⚠ Previous users may have disconnected the charger to connect other equipment (e.g., a generator). Follow these steps to reconnect it.

How to Connect the Charger:

Use the cables running from the charger to the HMI and connect them to the **[15] Power Locks, 300 kVA C** (see section 4.2.1 HMI).

Warnings:

⚠ Inspect all cables for damage before use.

⚠ Always be alert for signs of fire and follow the general safety instructions (see section 3).

⚠ Only switch on the main switch after all cables are properly connected.

Step-by-Step: Connecting the Charger

1. Set the DENS PowerHub to **standby mode** or turn it off.
2. Ensure all **main switches are off**.
3. Connect the charger cables to the **Power Locks, 300 kVA C** (located under the HMI).
4. Press the **power button**.
5. Wait for the system to **fully boot up**.
6. Turn on **main switch B**.
7. Press the **start button**.

The charger is now installed and ready for use. You'll know it's active when the **charger lights turn on**.

6. Operation and Usage

The DENS PowerHub is easy to operate. A quick start guide is also located on the inside of the control panel door. Before activating the system, always go through the installation checklist.

If there is visible damage to the exterior or suspected tampering, immediately contact DENS at +31 (0)85 273 52 15 or service@dens.one.

⚠ The DENS PowerHub may only be activated if all conditions from section 5 (Installation) are met.

Each connection mentioned in this section refers to the numbered ports described in section 4.2.1 HMI.

The total power used must not exceed the inverter capacity (265 kW / 300 kVA). The system is protected against overcurrent both overall and per connection. These protections are accessible via panel [6] on the HMI.

If an RCD trips due to leakage current, you can reset it by flipping the switch upward (see section 3.5).

⚠ DENS is not liable for damage or claims resulting from improper use, maintenance, or unauthorized modifications.

6.1 Applications of the DENS PowerHub

The system supports:

- Connection to the electricity grid (300 kVA)
- Connection to Off-Grid power sources
- Connection to Off-Grid power consumers

The internal temperature of the PowerHub will match the ambient temperature when not in use. This affects performance.

Optimal operating temperature:

- Charging: 0 to 50°C
- Discharging: -20 to 50°C
- Best performance: 10 to 35°C

Below 0°C, charging is not possible. Discharging is limited below -20°C.

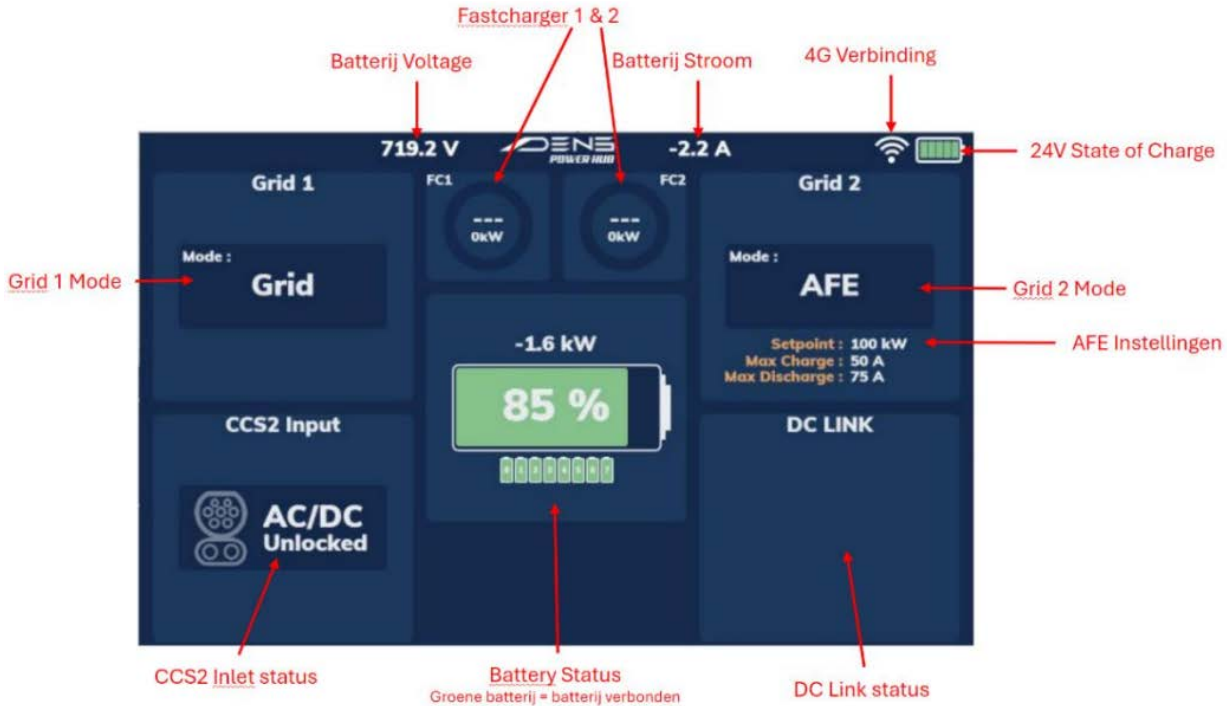
6.2 Control Panel

The DENS PowerHub is equipped with a touchscreen control panel. As a user, you can configure settings for your specific application here. These settings are available once the system is powered on.

6.3.1 Home menu

When the DENS PowerHub starts up, the control panel displays the **Home Menu**.
A visual overview of the menu and its functions is shown in **Figure 13**.

- The **top bar** displays the **battery voltage** and **current**



Figuur 13: Home menu

A negative current means the battery is discharging.

- The battery status in the center shows the State of Charge (SoC) — the remaining capacity.
- The 4G icon indicates whether the system is connected to the internet.

This connection allows DENS to remotely monitor the system.

- The 24V battery SoC shows the charge level of the internal battery needed to start the system.
- You can also see the status of each **battery module**:
  - **Green** = active
  - **Red** = inactive

Battery modules are activated automatically based on demand.

6.3.2 Grid Settings (Electricity Grid Configuration)

When the DENS PowerHub is connected to the **electricity grid**, you can manage this connection via the **control panel**. To access this menu, press the **"GRID"** button on the touchscreen.

Figure 14 in de handleiding toont een voorbeeld van dit menu.

Available Modes:

- **Grid**
- **AFE (Active Front End)**
- **Supp. Grid (Supporting Grid)**

The Grid mode has no configurable settings.
In **AFE mode**, you can configure how much current (in amperes) the PowerHub receives from or returns to the grid.

AFE Settings:

- Set the **maximum and minimum current**.
- A **negative value** means the PowerHub is feeding power back into the grid.
- If the current exceeds the set limits, the PowerHub will **automatically disconnect** from the grid.

⚠ **Important**

The DENS PowerHub cannot receive power from the grid if the Max Charge is set to 0 A.

Figuur 14: Home menu bedieningspaneel

Warnings:

⚠ Do **not exceed** the current rating of the connected cables.

Only **disconnect** the grid connection when the **voltage is removed**

6.3.3 On Board Charger (CCS2)

When you press the **CCS2** button in the selection menu, you'll see the **settings and status** of the CCS2 port. The system automatically detects whether a **DC** or **AC** charger is connected.

Display Overview:

- The **status bar** in the middle shows the current charging speed (in blue).
- You can set a **charging limit** at the bottom of the screen.

Note: Both your charger and the DENS PowerHub have their own limits. The actual charging speed may be lower than the limit you set.

Lock Status:

- On the left, you'll see the **lock status** of the CCS2 port.
- The port is **locked** as soon as a plug is correctly inserted.
- To unlock the port, press the **STOP** button.

Figuur 15: CCS2 menu

6.3.4 Fast Charger Operation

The final option in the control panel menu is the **Fast Charger**. When you select this option, the **Fast Charger screen** appears.

Per Charger Displayed Information:

- **Status of the charger:**
  - **Gray** = no connection
  - **Green** = connected
  - **Blue** = charging
  - **Red** = error
- In the center of the screen, you'll see:
  - The **State of Charge (SoC)** of the connected vehicle
  - The **MAC address** of the device
  - The **charging speed**

To stop charging, you must first select the correct charger.
Charging Limit:
▪ The charging limit applies to the combined output of all chargers.
▪ You can set this limit manually in the interface.

Figuur 16: Fast Charger menu

6.4 Using the Charger (Off-Grid)

Once the charger has been installed as described in **section 5.5**, it can be used in **Off-Grid mode**.

Steps to Use the Charger:

1. Plug one of the two charger connectors into your application (e.g., an electric vehicle).
2. The charger will automatically detect the connection and activate the circuit.
3. On the charger's control panel, select the port you want to monitor.
4. The panel will display:
   - **Charging power**
   - **State of charge (SoC)** of the connected device
   - **Energy delivered (kWh)**
   - **Charging duration**

To Stop Charging:

1. First, **disconnect the voltage** from the outlet.
2. Press **"End of Charge"** on the charger control panel.
3. Remove the plug from your application.
4. Store the plug properly to prevent damage.

6.5 Connecting DENS PowerHub Outputs (Off-Grid)

Once the DENS PowerHub is placed at the correct location and all checklist items are verified, you can configure it for **Off-Grid applications**.

In Off-Grid mode, the PowerHub is **not connected to the electricity grid**. Therefore, it is essential that either:

- A **grounding rod** is installed, **or**
- The **insulation monitoring system** is active.

Steps to Connect Off-Grid Outputs:

1. Verify that the DENS PowerHub is properly grounded.
2. Ensure main switch B is turned off.
3. Connect the cables for your desired application.
4. Set the DENS PowerHub to standby mode (if not already active).
5. Press the start button.
6. Turn main switch B to on.

The DENS PowerHub will now supply power to the connected applications.

Warnings:

⚠ Inspect all cables for damage before use.

⚠ Ensure the DENS PowerHub is within the specifications of the connected cables and equipment.

⚠ Always be alert for signs of fire and follow the general safety instructions (see section 3).

If the **RCDs trip** after activating the main switch, the application may not be compatible.
Double-check the selected mode, the condition of the equipment and cables, and their compatibility with the PowerHub. If the issue persists, contact the **service technician**.

6.6 ABC – Always Be Charging

If the DENS PowerHub is **not in use** at a location, it is recommended to **always connect it to the grid**. This ensures that the **battery modules remain balanced**, which helps maintain performance and longevity.

Steps to Enable ABC Mode:

1. Connect **all PowerLocks**.
2. Briefly press the **START** button.

The LED will start blinking — wait until it stays on continuously.

3. On the **touchscreen**, go to **Settings**.
4. Set the **Maximum Charge** (up to 400 A).
5. Set the **Current Setpoint** to the desired charging current.
6. Turn **main switch B** to **ON**.
7. Briefly press the **START** button again.

Wait until the LED stays **solid green**.

The DENS PowerHub is now in **ABC mode** and will maintain battery health by staying charged when idle.

Warnings:

⚠ If the **insulation monitoring system** was disabled, **reactivate it** before disconnecting the grid or grounding rod.

⚠ **Only disconnect cables** after all main switches are turned off.

6.7 Shutdown Procedure:

1. Turn off all **power sources** and **connected devices**.
2. Briefly press the **shutdown button** to return the system to **standby mode**.

This disconnects the battery circuits from the output systems, but the HMI control panel remains active.

3. Press and hold the **shutdown button** for **5 seconds** to fully power down the HMI.

The entire DENS PowerHub is now shut down.

4. Turn all **main switches** to the **OFF** position.
5. Disconnect all **cables** from the HMI.

If you press the shutdown button for less than 5 seconds, the system enters standby mode.
You can always switch between **standby** and **fully off** as needed.

7. Inspection and Maintenance Intervals

All inspection, maintenance, adjustment, and repair work on the DENS PowerHub must be carried out **only by personnel trained and authorized by DENS**.
If you believe maintenance is needed or have questions, please contact DENS.

7.1 Inspection and Maintenance Intervals

- Maintenance and inspection tasks must be performed **annually**.
- During these tasks, the system will be **out of service** and unavailable for use.
- Maintenance is scheduled and communicated **at least two weeks in advance**.
- Work is carried out by:
    - A **DENS-certified maintenance partner**, or
    - **In-house personnel** trained by DENS for the specific systems.

7.2 Annual Inspection and Maintenance by DENS

DENS will perform a **yearly service** in consultation with the client to ensure compliance with **PGS37 regulations** and DENS internal standards.

7.3 Inspection Tasks Include:

- Checking the **functionality of the energy storage units**
- Inspecting the **electrical installation**
- Inspecting subsystems (filters, external damage, pressure relief)
- Servicing the **climate control**, **cooling**, and **heating systems**
- Servicing the **fire suppression system** (Aerosol)
- Servicing the **inverters**
- Servicing the **transformers**
- Verifying all electrical components according to **NEN3140**

These inspections must be performed at a **DENS workshop** or an **authorized maintenance partner**.

7.4 Reporting

After the work is completed, a **work order** will be issued in accordance with **NEN2767** (Dutch standard for condition assessment).

- Any recommendations in the report must be followed to extend the lifespan of the DENS Power Hub.
- DENS also maintains the following documentation:
    - Design drawings/schematics
    - User manual
    - System information sheet
    - Logbook
    - Maintenance protocol
    - Commissioning inspection report

8. Storage

8.1 Storage

Long-term storage can have adverse effects on the DENS PowerHub.
These effects can be minimized through proper preparation and storage.

Warning:
All required maintenance activities must be completed before the storage period begins.
You must also adhere to the annual inspection and maintenance schedule during storage.

The storage location of the DENS PowerHub must meet the following requirements:

- The DENS PowerHub may not be placed in an enclosed space or (partially) under a canopy with less than 3 meters of clearance between the top of the DENS PowerHub and the bottom of the canopy, in accordance with PGS 37-1 (Storage and transport requirements for lithium iron phosphate battery systems).
- Place the DENS PowerHub in a location accessible only to authorized users.
- The ground surface must not have a slope greater than 10% in any direction.
- The ground must provide sufficient support for the weight of the DENS PowerHub.
- The entire bottom surface of the DENS PowerHub must be in contact with the ground.
- The ground must not have water accumulation deeper than 1 cm.
- The ground must provide sufficient grip to ensure the DENS PowerHub remains stationary at all times, except during loading and unloading.
- Ensure good accessibility for transport vehicles to load and unload the DENS PowerHub.
- The DENS PowerHub must not obstruct any access or exit routes.
- Ensure at least 5 meters of space around the DENS PowerHub for access and service.
- The emergency stop button must always be accessible without risk.
- The DENS PowerHub must always be accessible to service and/or emergency services.
- Personnel working on or around the DENS PowerHub must always have a clear escape route to a safe area.
- The DENS PowerHub must not be used in locations where the temperature exceeds 40°C or drops below -20°C.
- The DENS PowerHub must be protected from external risks such as explosions, fire, collisions, lightning strikes, etc.
- It is prohibited to place the DENS PowerHub in locations where water or other liquids may accumulate above 1 cm.
- Place the DENS PowerHub in a location with adequate air circulation in case of release of corrosive or toxic substances.
- Ensure the camera arm (if present) is folded before moving the DENS PowerHub.
- The DENS PowerHub must be at least 5 meters away from transport routes. If this is not possible, it must be shielded and secured against vehicles.
- Preferably store the DENS PowerHub in an environment between 15°C and 35°C.

Warning:

⚠ If the DENS PowerHub is damaged by extreme weather conditions, contact service technicians and do not use the unit.

⚠ The center of gravity of the DENS PowerHub is not always in the middle.

⚠ In case of extreme weather conditions that may damage the DENS PowerHub, the owner is responsible for securing the unit.

⚠ If a grounding rod is required, the soil must be approved by a qualified electrician.

Before and during storage, the following steps must be checked:

- Verify that the storage location meets and continues to meet the above requirements.
- Charge the DENS PowerHub to at least 30% before storage.
- Ensure the DENS PowerHub is completely shut down according to the shutdown procedure before storage.
- During storage, the DENS PowerHub must be recharged to at least 30% once per month.

8.2 Transport of the DENS PowerHub

For loading and unloading the DENS PowerHub, refer to section **5.2 Loading/Unloading the DENS PowerHub**.

Always check all applicable local, national, and international regulations for transporting a **lithium iron phosphate battery**.
Transporting a damaged or recalled Li-ion battery may be restricted or prohibited under certain conditions.

- The DENS PowerHub falls under **hazard class UN3536**.
- The DENS PowerHub may only be picked up and set down using the designated lifting system on the truck.
- The DENS PowerHub may only be transported by a truck specifically designed for this purpose. See dimension and weight specifications.
- The driver must meet the requirements of an **authorized driver**, as described in section 1.3 Intended User.
- It is not permitted to walk or sit on the roof.
- The DENS PowerHub may only be moved using a suitable hook-lift truck equipped with container locking and **ADR9 certification**.
- Transport the DENS PowerHub over road surfaces that can support the weight/pressure of the vehicle plus the DENS PowerHub without damage.

Before departure, the authorized driver must review and complete the following documents (see appendix):

- Checklist for loading the Energy Storage System (EOS)
- ADR transport document
- Characteristics of the vehicle transporting the DENS PowerHub

At the front and rear of the transport unit, a **black-bordered orange sign** (15 mm thick border) measuring **40 cm wide and 30 cm high** must be affixed.
(These signs must be removed once the DENS PowerHub has been unloaded.)

- The sign must be made of **metal** and must withstand at least **15 minutes of fire**.
- A **transport unit** is defined as a truck including any trailer or semi-trailer.

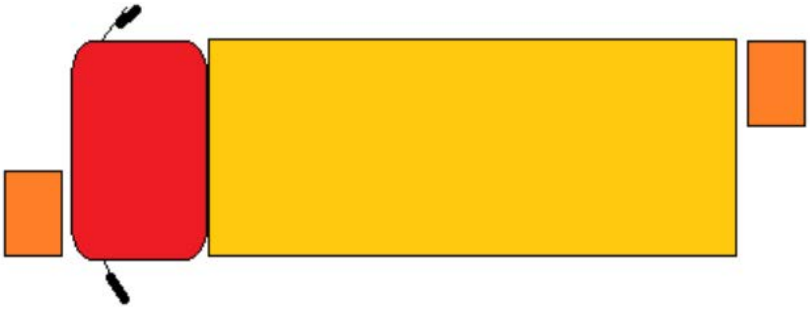
Placing the orange signs is a **shared responsibility** between the authorized user and the authorized driver.

Example:
(Figure 17: Illustration of orange signs on a truck)
Be sure to check the appendix for:

- Checklist for loading the Energy Storage System
- Characteristics and labeling of the Energy Storage System (EOS)
- Characteristics of the vehicle transporting the EOS
- ADR transport document

These documents must be **correctly completed and verified** before transport.

Example



Figuur 17: weergave oranjeborden vrachtwagen

9. Malfunctions and Repairs

9.1 Type Number

Each DENS PowerHub is uniquely identified by a type number and serial number, which are indicated on a nameplate attached to the HMI. This information is required when reporting malfunctions, ordering spare parts, or requesting service or warranty work.

9.2 Handling Malfunctions

Malfunctions or emergencies must be reported as follows:

- During office hours (Mon–Fri, 08:00–17:00) via **+31 (0)85 273 60 22** or **service@dens.one**

A malfunction report must include at least the following:

- Type and serial number (found on the nameplate in the HMI)
- Description of the issue
- Name and phone number of the on-site contact person

DENS will be notified by the user of a malfunction or emergency involving the machine in question. A DENS engineer will first attempt to resolve the issue remotely. If on-site work is required, the engineer will be on-site within 24 hours in consultation with the client.

For malfunctions and emergencies, labor hours, travel costs, and replacement parts will be charged based on actual costs, unless the issue is covered under warranty.

9.3 Repairs

If the damage is significant and requires multiple parts to be replaced and the system to be retested, the DENS PowerHub will be transported to the DENS workshop at the owner's expense.

A quote will be provided to the owner detailing the necessary work and parts to be replaced. Only after written approval from the owner will the ordering of parts begin.

9.4 Repair Reporting

After the work is completed, a work order will be sent detailing the technician's findings, the work performed, and, if applicable, a list of parts used.

DENS also maintains a repair and maintenance logbook in which all modifications are recorded.

9.5 Invoicing

After written approval of the repair quote, if the total amount exceeds €500, an invoice for 50% of the total amount will be issued immediately.

Repairs that can be performed on-site will be invoiced based on actual time and materials.

10. Warranties

DENS provides a **24-month warranty** on its systems, provided the system is used in accordance with the manual and a maintenance contract has been concluded with DENS or a DENS-authorized partner.

10.1 Hardware Warranty

DENS offers a 24-month warranty on all hardware components, **excluding the battery modules**.

10.2 Battery Module Warranty

The battery modules are covered by a warranty of **24 months or 4000 cycles**, whichever comes first.

- One cycle is defined as a full 100% discharge and recharge of a battery.
- Partial discharges and recharges (e.g., 50% discharge followed by a full recharge) count as half a cycle.

The battery modules must be used in accordance with the manual.
Warranties are void immediately in the event of improper use.

Improper use is defined in the manual and includes, but is not limited to:

- Incorrect state of charge
- Physical shocks
- Operation outside the specified temperature range

11. Decommissioning and Environment

Please consult **DENS** and local regulations regarding the disposal of materials from or within the DENS PowerHub.

- Most **iron and steel** components can be collected by companies specialized in scrap metal recycling.
- Some components, such as e**lectrical cables, electronic accessories, and plastics**, require specialized handling.
- This specialized handling also applies to the **battery box** and any remaining liquids in the unit.

At the end of the DENS PowerHub's service life, DENS will take back the system in coordination with the owner.

The system will be dismantled into various subcomponents, all of which are **individually recyclable**. These include, for example:

- Steel
- Cabling
- Electrical components
- Battery cells

For the recycling of battery cells, DENS collaborates with partners (to be determined).
These partners can reduce battery cells using **thermal and/or chemical dissolution techniques** into valuable individual components essential for battery production, such as:

- Lithium iron phosphate
- Cobalt
- Nickel
- Copper

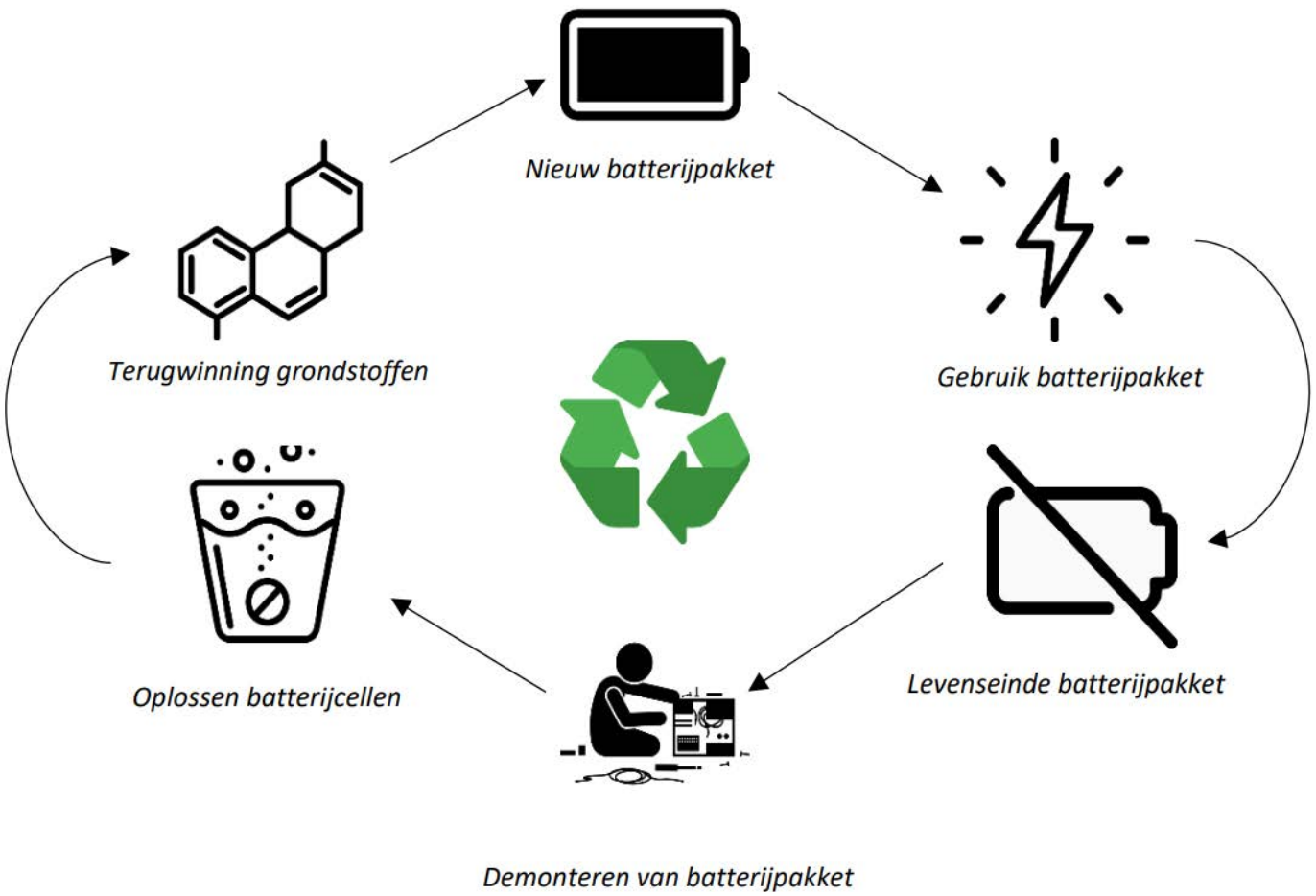
These components are recovered **independently** and can later be reused in the production of new battery cells.

Lifecycle overview:

- New battery pack
- Battery pack in use
- End of life
- Dismantling
- Cell dissolution
- Raw material recovery

Warning:

⚠ Always consult specialists in advance regarding the disposal of materials from the DENS PowerHub



12. Disclaimer

During the creation of this manual, every effort has been made to ensure the accuracy of its content. In line with DENS's policy of continuous product improvement, **DENS reserves the right to unilaterally modify** the manual without prior notice or explanation.

DENS is **not obligated** to update the contents of the manual.
The content is provided for informational purposes only.

DENS **explicitly disclaims all warranties** regarding the accuracy, reliability, completeness, usability, and timeliness of the content in this manual.
The **entire risk** associated with actions described in the manual lies with the user.

Use, maintenance, and repairs of the DENS PowerHub must be carried out **in accordance with this manual**.
Maintenance and repairs must be performed using **original parts**.

If modifications, repairs, or maintenance are carried out:

- in violation of this manual,
- by a party not recognized or qualified by DENS,
- or using non-original parts,

then **the warranty becomes void**.

DENS is **not liable** for any defects, claims, or warranty requests resulting from:

- improper use,
- improper maintenance or repair,
- or any modification of the DENS PowerHub from its original delivered state.

This includes, but is not limited to, use, maintenance, and repairs that contradict this manual

Regulation for transporting Powerhub Systems

580/1160kWh

Date: May 21th 2025, version 01

Transport of a Powerhub

Legal requirements apply to the transport of litium cells and/ or batteries

- The transport is subject to ADR obligations
- Depending of the type of lithium cell or battery and/or how this cell or battery is used, the correct UN number applies
- Code UN3536 applies to the Powerhub (UN3536: Lithium batteries built into charging unit)

Characteristics and labeling of the Energey Storage System (ESS)

A hazard label model number 9 must be visible.

On both sides of the EOS, an orange sign with a black border (15 mm thick) must be affixed, measuring 40 cm wide and 30 cm high. This sign must be divided into two halves by a black stripe (15 mm thick). The lower half must display the numbers '3536' (10 cm high), which is the UN code. The upper half must display the numbers '90', which indicates the hazard class.
The sign must be made of metal and must be able to withstand fire for at least 15 minutes.
The sign is standardly affixed by DENS to every Powerhub and may not be removed.

Characteristics of the vehicle transporting the EOS

- An orange sign with a black border (15 mm thick), measuring 40 cm wide and 30 cm high, must be affixed to the front and rear of the transport unit as soon as the EOS (Powerhub) is loaded.
- The signs must be removed once the EOS or Powerhub has been unloaded. The sign must be made of metal and must be able to withstand fire for at least 15 minutes

Transport unit: A truck or tractor unit including any trailer or semi-trailer attached to it.

- **The placement of the orange signs is a shared responsibility of the loader and the driver.**

Checklist for Loading Energy Storage System (Powerhub)
Compliance with the regulations is the responsibility of the packer, consignor, and carrier. However, the party requesting the pickup also shares responsibility for ensuring the rules are followed:

- The driver must review the "Checklist for Loading Energy Storage System" before each trip (see attached below);
- The consignor must regularly conduct spot checks to verify that the carrier is complying with legal requirements;
- For each transport, the "ADR Transport Document" must be completed in advance (see attached below);
- The consignor is obligated to verify that the carrier has completed the document;
- The transport document, along with the completed checklist, must be documented by the carrier;
- A copy of the transport document and the spot check checklists must be documented by the consignor;
- If irregularities are found during an inspection en route, both parties may be required to present their documentation.
    - **Delivery from DENS location:**
    - **DENS provides a fully completed ADR transport document.**

DENS will review the checklist with the driver for each first transport; thereafter, only on a random sampling basis.
Customer-specific information will be provided separately by DENS:

- The correct content to complete the ADR document, including type numbers and weights;
- The correct content to complete the CMR/AVC document.CMR is voor internationaal vervoer en AVC voor binnenlandstransport. De regel in vak 6 t/m 12 "UN-nummer gevolgd door de officiële vervoersnaam en (eventueel) de technische benaming (deze moet tussen haakjes), modelnummer van etiket, verpakkingsgroep, vervoerscategorie (tunnelcode)" dient

In the language of the country of dispatch and, in the case of cross-border transport, in a second language: English, German, or French.

Voorbeeld CMR/AVC Vervoersdocument