



Standard Technical Specifications with regard to Shore Power Units for Inland Navigation

Authors: OPSN and partners / members of the Onshore Power Supply Network

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1. Development of the standard

In 2022, a market consultation was carried out by the *Walstroomcollectief*¹ (Shore Power Group). The purpose of this market consultation was to gather information to best prepare a possible future tender for shore power facilities.

The market consultation provides benefits for all parties involved. The clients in the *Walstroomcollectief* establish what is possible, what is going on in the market and who are potential contractors. This market consultation helps to formulate the requirements and characteristics of the requested service and product in such a way that these can be properly offered by the market. In addition, the information received was used to determine the most appropriate tender procedure.

This market consultation also made it possible to gain a good understanding of the market's degree of interest and what is possible and impossible within the market and in terms of services provided. For the participants involved, there is the added advantage of having, at an early stage, an overall picture of the *Walstroomcollectief* as a partnership and the objectives it sets. For example, the market can influence requirements that the commissioning parties of the *Walstroomcollectief* include in the tender documents. By doing so, suppliers contribute to improving the success rate of the possible tender.

In addition, the purpose of the market consultation was to:

- Get participants involved and interested at an early stage in the possible tender.
- Test the guiding principles and assumptions of the *Walstroomcollectief* among participants.
- Test the *Walstroomcollectief's* ideas and possible solutions with participants.
- Gain insight into the experience available and the choice on the market.
- Get an idea of the visions, suggestions and ideas from participants.
- Get an idea of the market's interest in the possible assignment.

One of the things that emerged from the market consultation is that there is a need for standards. This need exists among parties that install shore power, parties that offer shore power (ports) and users of shore power. The users, ports and suppliers all feel the need for standardisation of the technical specifications with regard to shore power units for inland navigation. Several market players organised as the Onshore Power Supply Network (OPSN) have jointly worked on a standard technical specification document for shore power units used in inland navigation.

To create the present document, an existing specification document was discussed in a number of plenary sessions. Experts in the various fields then worked together to actually draft the standard.

2. How to use this standard

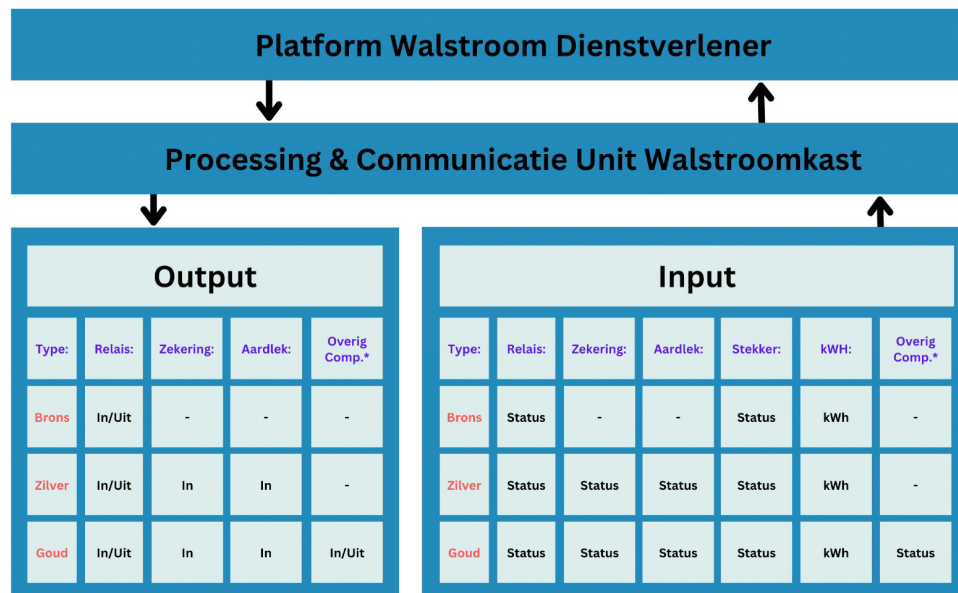
A shore power unit for inland navigation need not always be the same for every location. At certain locations, for example, a facility will be used more intensively than at another, or there are different requirements regarding, for example, remote control for a facility. Therefore, this standard does not aim to set up the same unit at every location. However, it does provide guidance for making the right choices when installing a shore power unit. The various working groups have identified three types of shore-based power facilities for inland navigation. These are as follows: Bronze, Silver and Gold.

¹ The *Walstroomcollectief* (Shore Power Group) is an informal collaboration between port companies, provinces, port municipalities and waterway authorities with the aim of installing the right shore power facility at the right location. The *Nederlandse Vereniging van Binnenhavens* (Dutch Association of Inland Ports) and the *Koninklijke Binnenvaart Nederland* is a strategic partner of the *Walstroomcollectief*. The partners are keenly aware that port development must be done in a sustainable way. They also realise that collective - truly collaborative - development has substantial advantages. Port Solutions Rotterdam B.V. (PSR) leads this group.

The functionalities² of the three types for new shore power units can be described as follows:

- Bronze: transaction, connecting and disconnecting and consumption registration.
- Silver: the functionalities of Bronze + remaining functionality on the exterior of the unit + remote control by technical help desk.
- Gold: the functionalities of Silver + temperature and humidity + voltage monitoring/emergency power supply (UPS).

Figure 1 shows a schematic diagram of this system.



* Met overige componenten worden hier bijvoorbeeld bedoeld: temperatuur en vochtigheid, ventilatoren, kastverlichting en -verwarming. Volledige besturing op afstand is hiermee mogelijk.

*Other components here include, for instance, temperature and humidity, ventilation devices, cabinet lights and heating. Full remote control is thus possible.

[Platform Walstroom Dienstverlener: Shore Power Service Provider Platform

Processing & Communicatie Unit Walstroomkast: Processing & Communication Unit Shore Power Unit

Output: Output

Input: Input

Type: Type

Relais: Relay

Zekering: Circuit-breaker

Aardlek: Earth leakage

Overige Comp.: Other Components

Stekker: Plug

kWh: kWh

Brons: Bronze

Zilver: Silver

Goud: Gold

In/Uit: In/Out

In: In

Status: Status]

Figure 1: Schematic diagram showing the functionalities of each type of shore power unit.

Where a distinction is desirable or necessary in these technical specifications, it will be specified in relation to the subject.

3. Disclaimer

The information and guidelines contained in this standard have been compiled with the utmost care. Nevertheless, it should be emphasised that the user is entirely responsible for any use of this standard. The objective of this standard is to provide general information and guidance. Users are advised to check whether the standard is relevant to their specific situation before applying it.

Neither the authors of the standard, nor any other party involved, shall be liable for any damage, loss or inconvenience arising from the use of the information contained in the standard. This includes, but is not limited to, direct or indirect damage, consequential damages, lost profits, loss of data or any other damage.

The user acknowledges that standards and best practices may evolve and change over time. Therefore, it is recommended to regularly check for and apply updates, and make changes to ensure that the information is up

² In addition to the above-mentioned types, there are several options possible; however, this may compromise the desired one-to-one interchangeability of the controller. This because of the number of inputs and outputs on the controller or the underlying local software.

to date. By using this standard, the user agrees to this disclaimer and accepts full responsibility for the interpretation and application of its contents.

4. Technical specification document

A technical specification is an essential document in the context of technical projects and tenders. This document acts as the blueprint for the request for quote for an inland navigation shore power unit and contains detailed information on the requirements, specifications and standards to be met. The technical specification document provides a clear framework for all parties involved, such as clients, contractors and suppliers, and serves as a basis for evaluating bids and executing the project.

4.1 Basis for these requirements

The requirements described below apply only to shore power units connected to the grid operator's low-voltage distribution network.

4.2 Regulations

Regulations vary depending on the country or region in which a shore power facility is to be provided. Please note that it is at the discretion of the contracting authority to decide whether these requirements should be included in the request for quote.

Rules governing shore power providers in Flanders:

- GREI/AREI "General Regulations on Electrical Installations".
- TRDE "Technical Regulations for the Distribution of Electricity in the Flemish, Walloon or Brussels-Capital Regions".
- Reference C1/107 Synergrid "General Technical Requirements relating to the Connection of a User to the Low-Voltage Distribution Network".
https://www.synergrid.be/images/downloads/20240821_C1_107_NL.pdf.

Rules governing shore power providers in the Netherlands:

- NEN 1010: Electrical installations for low-voltage - Dutch implementation of the HD-IEC 60364 series.

When connecting a vessel, it is preferable to do so according to NEN 1010:2020 Appendix 730.A - Figure 730.A.2 and Figure 730.A.4. In these examples, an isolation transformer is included in the vessel's installation. This isolation transformer prevents galvanic currents in the PE conductor from the vessel to the shore and thus unwanted corrosion.

This specification document is intended for making shore power connections fed from TT and TN systems. An IT system feeding a shore power connection is outside the scope of this specification document.

4.3 Standards and guidelines

Standards and guidelines vary depending on the country or region in which a shore power facility is to be provided. Please note that it is at the discretion of the contracting authority to decide whether these requirements should be included in the request for quote.

Following standards and guidelines are applicable to this specification document when used in Flanders:

- 2006/95/EC Low Voltage Directive.
- EN 50470 Electricity metering equipment.
- EN 60695 The fire hazard of electrotechnical products.
- EN 60529 Degrees of protection provided by enclosures (IP Code).
- EN 60947-2: Low-voltage switchgear and controlgear.
- IEC 617 Graphical symbols for diagrams.
- IEC 60255-3 Time-current characteristic curves for protective relays.
- IEC-80005-3 Utility connections in port – Low voltage shore connections.
- C33-323 Power transmission cables.
- HD 308S2-2001 Harmonisation of cable core colours.
- EN 61439 The new standard for low-voltage switchgear and controlgear assemblies.
- EN 15869-1 and -2 Safety requirements for electrical shore connections.

- NBN EN 15869:2019 Inland navigation vessels – Electrical shore connection, three phase current 400 V, up to 63 A, 50 Hz (EN 15869: 2019-2020, up to 125 A, latest version, Part 1: General Requirements/Part 2: On-shore unit, additional requirements).
- ROHS compliance.

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- ROHS compliance.
- NEN 1010 Low-voltage electrical installations - Dutch implementation of the HD-IEC 60364 series.

4.4 Structural requirements

The shore power unit opens on the landside for safety reasons. A pictogram is to be affixed on the back side facing the water. On both sides of the cabinet it is possible to draw power.

Each cabinet should be located at least 1.5 m from the water's edge and installed exactly as indicated on the construction plan. Any modification to the planned layout shall be submitted to the waterway authority/port for prior approval.

The cabinet should be properly installed; neither subsidence nor misalignment should occur for a period of at least ten years. It shall be installed applying good engineering practice³.

4.5 Cabinets for shore power units

Cabinets

The contractor shall provide a conceptual design of the shore power unit which shall be of the roadside cabinet type. The geometry shall be calculated according to the equipment it contains.

General guidelines:

- Manufactured from GRP sandwich⁴ panels or 304⁵ stainless steel sheets, according to an informed choice of the supplier.
- Wall thickness in case of GRP sandwich 20 mm (2 mm GRP/16 mm PU/2 mm GRP).
- Wall thickness in case of 304 stainless steel 2 mm.
- RAL colour specified by the clients.
- With an anti-graffiti coating, if available in chosen RAL colour, with a minimum thickness of 100 µm.
- Vandal resistant with a minimum grade of IK-10.

³ **Note to the contracting authority:** A stainless steel foundation is easier to work with (lighter) than concrete and is therefore to be preferred. The stainless steel foundation shall extend to a depth of approx. 750 to 800 mm. If a GRP (Glass-fibre Reinforced Plastic) casing is chosen, a standard GRP ground-mounted plinth would be a good option. The plinth is partially buried and the cabinet extends beyond the plinth's edge. The cable gland must be accessible for any necessary technical intervention or power cable replacement without breaking it open.

⁴ GRP sandwich is very suitable for this type of shore power applications. It is often used in offshore applications, in the (petro)chemical industry and for bridges and locks.

⁵ If stainless steel is chosen, it is recommended to use 316 stainless steel in saltwater and saline water environments as well as in areas with (heavy) industry.

- Minimum sheet thickness 2 mm.
- Internal insulation for walls, roof and floor at least 20 mm.
- Degree of protection IP43⁶.
- Room for four connection points.
- Doors, associated hardware and lift-off hinges in 316 stainless steel or 304 stainless steel.
- Lever espagnolette lock bolt suitable for a half Euro profile cylinder.
- Sendzimir (galvanised steel) mounting panel.
- Removable gland plate with various cut-outs for cabling.
- Side panel with openings for:
 - Indicators (D = 30 mm for recessed LED).
 - Electricity connection.
 - Operation (D = 30 mm for recessed pushbuttons).

Locks

If the power switchgear is installed outside, both parts in the section containing the technical components should be locked. A triangle key is used on the vessel side to access the connections. A Euro profile is used for the control section.

LED lighting

Integrated LED lights, suitable for safe operation and intervention, are installed at the top of both sides of the cabinet where the offtake points are located. The LED lighting is switched on and off via a mechanical door switch or a PIR switch.

4.6 Technical specifications

The contractor shall ensure compliance with all standards and regulations necessary to ensure that the installation operates safely and reliably, including, inter alia, devices providing protection against short-circuit current and overload, and protection to individuals. The regulations to be applied have to be submitted to and approved by the client before work is started.

In the Netherlands, the requirements of NEN 1010 and supplementary Chapter 730 must be complied with.

Shore power units are constructed by a certified switchgear manufacturer in accordance with EN 61439-1 and EN 61439-2. The circuit diagram shall be designed in a logical manner and in such a way that work on each part of the installation can be carried out in safe conditions.

This will be proven to the client with a routine test report before starting work.

Each shore power unit essentially contains the following equipment:

- The electrical connection, 230 volts, 50 Hz is fitted with general protection devices.
- The power offtake points.
- An energy meter per offtake point.
- A residual current device per offtake point.
- The necessary electrical protection devices.
- Remote Terminal Unit (RTU) freely available on the market.
- Terminal blocks.
- Contactors.
- UPS supply (for type Gold shore power unit).
- Cabinet panel lights + a panel socket.
- Panel heating.
- Ventilation.

⁶ If the degree of protection is IP43, there is sufficient ventilation (natural draught). For a higher degree of protection, IP54/IP55, a roof plate including a fan could be applied (under the roof) with openings on the sidewalls, with rain hood on the outside and "sealed" on the inside with fine mesh and filter cloth. In practice, the control section is usually of protection class IP54; for the boatmaster's section, IP43 protection class is sufficient.

- 4 indicator lights LED type per offtake point.
- 1 indicator light LED type per shore power facility.
- LED lighting.

Each power offtake point and each part of the circuits is effectively and selectively protected against short circuits and overloads (circuit-breakers and automatic switches) and indirect contact. All protective devices, associated supply cables and protection conductors are calculated. Thermal load, short-circuit current, the conditions for protection against indirect contact according to AREI (Flemish), the voltage drop and the selectivity between circuit-breakers are taken into account.

In the Netherlands, the requirements in NEN 1010 apply.

Feedback of zero voltage detection and switching off due to a fault must be provided.

All circuit-breakers, automatic switches and contactors have auxiliary contacts, so that a specific fault is displayed and reported via a management platform.

Power offtake can be started and stopped without general access to the cabinet. The parameter setting can be adjusted via a Technical Platform. The charging cable plug should be locked into the charging point from the moment the boatmaster plugs in and logs on. It will stay locked until the boatmaster logs off. In the case of a data link, charging point and/or power failure, the boatmaster him-/herself must be able to disconnect the plug of his/her charging cable. When the power supply to the vessel is restored after a power outage, the plug will be relocked, and the charging process is restarted.

All protections of the power offtake points are individually accessible to the end user (boatmaster), without having to open the cabinet. The protection devices of the power offtake points can be locally reset a set number of times (standard twice) without general access to the cabinet. Moreover, for the Silver and Gold unit types, each protection of the power offtake points can also be reset remotely. This is to prevent the technical services from having to make unnecessary journeys.

Devices with a short-circuit capacity less than 10kA – in accordance with industry standard EN 60947-2 – are never used, even if the calculations allow lower values. Where the calculations require devices with a higher short-circuit capacity, these must be provided. The (direct or indirect) surge protection to be installed is based on the outcome of the risk analysis and the location of the facility. The latter data shall be provided by the client.

All incoming and outgoing external cables pass through numbered DIN rail terminal blocks.

The inside of each shore power cabinet is fitted with lights with door switch operation, one socket, branched off before the main power switch and labelled with an engraved plate: "Always under power".

The construction and equipment of shore power units are illustrated by a diagram or plan, as part of the documentation provided upon completion of the cabinet.

Components of shore power units

Protective devices

- Equipped with thermal-magnetic overload and short circuit protection.
- Easy to install.
- Availability of a Product Environmental Profile (PEP EcoPassport).
- Certified by bodies accredited for that purpose in accordance with EN 60898 or EN 60947-2.
- Reference temperature for thermal control: 40 °C.
- Durability (O-F): Electrical: 10,000 cycles, Mechanical: 20,000 cycles.
- Adjusted tripping curve C and breaking capacity.
- Class 2 insulation.
- Operating voltage: up to 400V AC, insulation voltage: 500V, pollution grade: level 3, impulse voltage: 6kV
- Optional immunised differential protection/earth leakage protection, possibly as an addition for increasing operational continuity, especially in aggressive environments and grids.

- Optional auxiliaries are possible: power status and off-mode indicator, shunt, undervoltage and overcurrent trip.
- Some locations require the installation of a surge arrester as well; this depends on the location.

Energy meter

An energy meter shall be provided for each power offtake point. It shall comply with at least the following requirements:

- EN 50470 (MID) Directive; MID certification should be submitted.
- Suitable for billing purposes.
- Accuracy class for voltage, current, active power and active energy is Class B or higher in accordance with EN 50470.
- Faults, errors and overloads are reported.
- Can be directly connected.
- Option to apply two different fees.
- Both the single-phase and the three-phase version are of the same range.
- At least one configuration device/software, including programming cable, is provided for analysing faults, calibration and verification/setting of parameters.
- All meters have the same hardware and the same firmware version.
- Stored values retain their values; even after power failure.
- Total energy consumption cannot be reset, in accordance with standard EN 50470.

Controller

The controller should meet at least the following specifications:

- Data transmission by fibre optic or mobile communication, with fixed IP address, to be confirmed by the client.
- Real-time monitoring of consumption per location.
- Be able to receive notification of all error messages.
- A secure IoT protocol should be available to connect management systems etc.
- The number of controller connection points depends on the type of unit chosen, see sections below, namely: controller - Type 1 (BRONZE), controller - Type 2 (SILVER) and controller - Type 3 (GOLD).
- If, for whatever reason, the data link between the unit and the back-office system breaks down, all events relating to transactions should be stored locally for a period of at least one week and, when the connection is restored, sent to the back-office system with the time stamp on which the event occurred.

There are three types of shore power units that are described in Chapter 2 of this document. The choice of the type of shore power unit will affect the controller in a shore power unit. Therefore, this section provides a breakdown by type of cabinet as described in Chapter 2. The following basic units apply to all controllers:

Table 1

Basic units for controllers

Protocols	DNP 3.0 future OCPP 2.1
Standards	IEC 61132-2 / EN/ IEC 61000-4-2
Ambient temperature	0-60 °C

The shore power installation consists of hardware and software component for the control and communication of the system. For this purpose, a data exchange platform is used, which is managed by an external service provider. The current platform is compatible with DNP3.0; however, it must also allow for future migration to OCPP 2.1.

Controller - Type 1 (BRONZE)

The basic functionality is to switch the shore power unit on or off via a user platform. This prevents accidental activation and at the same time allows direct one-to-one communication with the end user.

The socket detects whether a plug is connected to it before a transaction can be started. This is necessary for safety reasons and for being able to support 'pulling the plug' as a method of stopping.

MID-certified meters are used to monitor and record the amount of kWh consumed.

In addition, the controller must also transmit information about the presence of a plug in the socket, as well as the relay status, so that the presence of voltage in the socket is visible.

The boatmaster initiates a transaction, after which the controller automatically switches on the relay to supply power directly to the vessel, without having to press another button.

The transaction can be terminated via the user platform or by removing the plug ('pulling the plug').

The user can only restore or reset the circuit-breaker/earth leakage protection if these devices can be operated from the outside. If this is not the case and a problem occurs on the vessel (such as short circuit, overload or earth leakage), a technician or harbour master needs to intervene.

Controller - Type 2 (SILVER)

In addition to the functionalities of the Bronze type, this particular type of cabinet offers additional features. Here, the circuit-breaker/earth leakage protection can be reset using a pushbutton on the cabinet, because of the presence of a power actuator inside the cabinet.

The boatmaster initiates a transaction via the user platform, after which the controller automatically switches on the relay to supply power the vessel directly, without the need to push another button.

If a short circuit, overload or earth leakage occurs on the vessel and the protection system is triggered, the boatmaster has the option to perform a reset using the pushbutton up to three times. After the third shutdown, the socket is blocked. Unblocking can only be done by a reset performed by the technical help desk or by an automatic reset after a preset time, provided there is no plug in the socket.

The controller sends various signals:

- Presence of a plug in the socket.
- Relay status.
- Fault messages in case of overload or earth leakage.
- Presence of control voltage.
- Voltage presence at the cabinet and the consumption by the vessel via the MID meters.

Controller - Type 3 (GOLD)

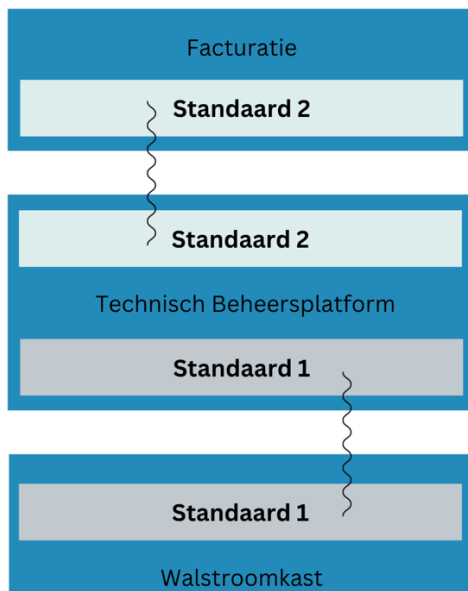
In addition to the functionalities for monitoring and supplying power to the vessel (as offered by the Silver-type), the Gold-type shore power unit also provides more sophisticated possibilities to transmit and monitor various parameters of the unit itself. These include:

- Monitoring and adjusting the temperature and humidity inside the cabinet.
- Monitoring the status of the control voltages.
- Monitoring the status of the UPS (Uninterruptible Power Supply) and its backup battery.
- Where applicable, cabinet door status monitoring (open or closed).
- Other additional options.

The purpose of this type of shore power unit is to enable fully remote “management” of the unit, minimising the need for a technician on site. In the event that a technician is still required, the technician receives information about the current status of the unit in advance and can assemble the equipment that he will need (if available).

Communication protocol

A communication protocol is based on a three-layer model (see Figure 2 below).



[Facturatie: Invoicing Standaard 2: Standard 2
 Technisch Beheersplatform: Technical Management Platform
 Standaard 1: Standard 1 Walstroomkast: Shore power unit]

Figure 2: Schematic diagram of the three-layer model.

The three layers are as follows:

- Layer 1: Shore power units.
- Layer 2: Technical management system.
- Layer 3: Invoicing.

This specification document describes communication between the shore power units and the technical management system (standard 1 in Figure 2). Communication is done using DNP 3.0 or OCPP 2.1.

Interface

The interface between the shore power units and the technical management system is described by reference to the distinction between three types of units: Bronze, Silver and Gold, as set out in Chapter 2.

Table 2

Interface between the shore power unit and the technical management system

	Bronze type of unit	Silver type of unit	Gold type of unit
Commands	To/from the unit	To/from the unit	To/from the unit
		Reset the unit	Reset the unit
			Other
Status reports	Plug connected	Plugs connected	Plugs connected
		Relay status	Relay status
		Overload error	Overload error
		Main voltage present	Main voltage present
			UPS + battery status
			Cabinet door status
Measurements	Energy meter	Energy meter	Energy meter
			Cabinet temperature
			Cabinet humidity
			Other

UPS supply

Please note that this is optional and not required for the operation of the shore power unit. It is at the discretion of the contracting authority to decide whether this requirement should be included in the request for quote.

An uninterruptible power supply (UPS) shall be provided to supply power the controller, warning lights, status indicator lights, cabinet panel lights and alarm circuits. The UPS shall meet the following requirements:

- Immediate takeover of the power supply to the controller.
- Maintenance-free.
- Noise at 1 m at full power less than 70 dB(a).
- Control panel with LEDs and/or LCD display.
- Built-in protection against overload.
- Manual bypass switch.
- Automatic bypass (switches on in case of rectifier failure, overload or short-circuit current) on the user side or when the input power falls outside the tolerances of the UPS device.
- Dynamic voltage regulation (less than 5 ms).
- Required autonomy = 4 hours.

The batteries are of the sealed lead acid type according to DIN 43534. The electrolyte is fixed in the form of a thixotropic gel. No maintenance or inspection is required. The service life is at least 10 years with 80% residual capacity, independent of the number of charge and discharge cycles. The battery is protected against deep discharge according to DIN 43539.

The UPS system is protected against any kind of overload, short-circuit and overheating: in each of the cases mentioned below (the indicators) it is automatically switched off. Inputs and outputs are protected by resettable circuit-breakers.

Indicators:

- Power supply switched on, load connected to the rectifier.
- Overload
- Temperature threshold exceeded.
- Battery disconnected.
- Battery discharged.
- End of battery autonomy.
- Load of the group (0 to 150%).

Contacts: (potential-free)

- Alarm 1 (pre-alarm): battery provides power.
- Alarm 2 (alarm requiring immediate action): no-break power system not available.

The UPS system shall meet the following standards:

- IEC 950.
- IEC 801 (VDE 0843).
- IEC 801-2 (Level 4).
- IEC 801-4 (Level 4).
- VDE 0871-4.

Surge protection, lightning

Type 3 conductors should be installed as close as possible to the power-consuming devices.

Energy coordination between lightning and surge arresters must be ensured in accordance with NBN EN 62305-4, both on the power and data side. When using conductors from the same family grouped by the manufacturers, this may be demonstrated by a certificate issued by the manufacturer. If lightning and surge arresters from different manufacturers are used, proof must be provided by means of tests or calculations to demonstrate energy coordination. At least the following criteria have to be met:

- Combined Type 1/Type 2.

- 4-pole modular combined lightning and surge arresters for 230/400V TT and TN-S systems, consisting of a base part and plug-in protection modules with remote signalling contact (potential-free changeover contact).
- Type 1 conductor according to EN 61643-11.
- RADAX-flow spark gap technology with flow current limitation.
- Easy replacement of protection modules due to anti-vibration release buttons.
- Status indicator of each protection module (operating state/ fault indication) in the inspection window.
- Encapsulated, non-venting design.
- Maximum permissible operating voltage: 255 V AC.
- Protection level: ≤ 1.5 kV.
- Surge current caused by lightning (10/350): 100 kA.
- Follow current quenching capacity (L-N): 50 kA eff.
- Follow current quenching capacity (N-PE): 100 kA eff.
- Follow current limitation/selectivity: no tripping of a 20 A gL/gG fuse up to 50 kA eff. prospective short-circuit current.
- Response time: ≤ 100 ns.
- Temporary overvoltage (L-N): ≤ 440 V / 5 sec.
- Temporary overvoltage (N-PE): $\leq 1,200$ V / 200 ms.
- Energy coordination according to EN 62305-4 with Type 2 and Type 3 conductors of the same family, as well as direct coordination with terminal devices.
- Device suitable for mounting on a 35 mm rail in accordance with DIN 43880, 8 modules, clean coding for modules.
- Terminal blocks suitable for penetration wiring with conductors up to 125A.
- Remote signalling contact: potential-free changeover contact.

Earthing

All metal trusses are earthed using two earthing conductors with a minimum cross-sectional area of 6 mm².

Similarly, all cabinets, power switchgear, frames, pedestals etc. with electrical devices that are part of the shore power unit are connected to earth in accordance with the requirements set out in NEN 1010.

4.7 Layout

Numbering

All terminal blocks, conductors and cables, both inside and outside, are indelibly numbered on each terminal strip. The conductors are numbered by means of irreversible ferrules that are pushed over the conductors.

This numbering is done in a logical manner. It is necessary to ensure that corresponding terminal blocks of identical but distinct installations bear the same number and that the installation itself is being marked each time by an identification number added to the number. Each terminal block is numbered on both sides.

4.8 Identification

Cable and wire section identification

Each wire should be identified in an indelible manner with plastic rings at both ends. Cables should be labelled on both ends by a label holder fixed in place with cable ties to the outer sheath of the cables. The cable numbers should correspond to the cable list and diagrams described in the Annex containing the CAD guidelines.

Identification of the offtake point

Each shore power unit is equipped with a control pilot contact. A unique identification number shall be located below or above each offtake point by means of an engraved plate.

4.9 Installation requirements

Appropriate technologies should be included in the design to ensure that maximum operational reliability and availability are achieved and maintained.

In case of wireless communication:

The contractor shall check in advance whether a wireless network is possible on site and submit the measurements and results in writing to the client. He shall ask the network operators about the network coverage in the area around the technical installation and for SLAs which he shall submit. The contractor shall conclude the necessary agreements with all telecom operators.

4.10 Operation of the shore power unit

The user checks on site or through the app whether the desired offtake point is available and no faults are reported.

Four LED type indicator lights are installed above each power offtake point, which unambiguously indicate the status of the offtake point on site. In addition, an indicator light of the LED type is installed on each facility that signals the status of the entire unit. These are shown in summary form in Table 3.

Table 3

Type of LED lights at a shore power facility and power offtake point

Power offtake point	1 green LED light	Flashing	Authorisation requested
		Steady-burning	Authorisation OK
Power offtake point	1 red LED light	Flashing	Error in installation aboard vessel
		Steady-burning	Definitive error
Power offtake point	1 red LED light	Steady-burning	Internal error in power offtake point
Power offtake point	1 red LED light	Steady-burning	Communication error
Shore power facility	1 red LED light	Steady-burning	Error entire unit or no connection

The procedure for connecting and disconnecting should be drafted precisely and succinctly in the languages determined by the client, and displayed on and affixed to the cabinet in a durable manner.

4.11 Pictogram

The proposed pictogram (size 300 x 300 mm) for use on the shore power unit is as follows:



Figure 3: Proposed pictogram.