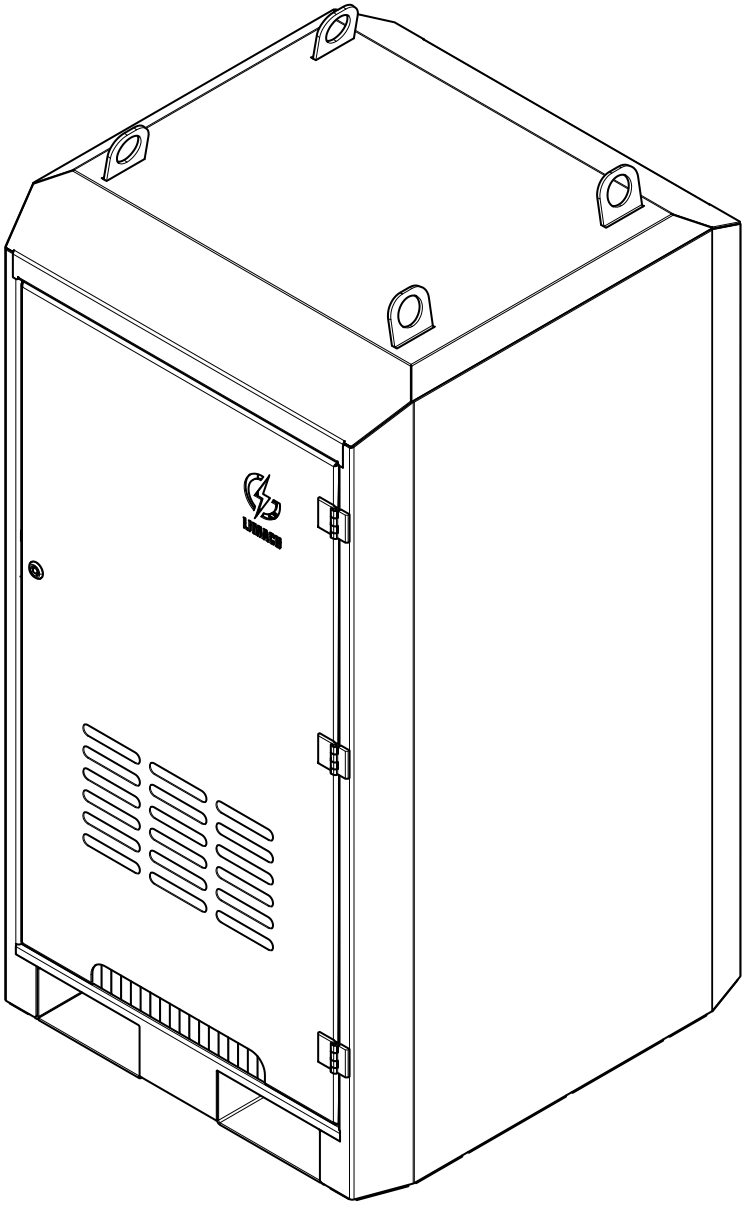
LIMACH®

User Manual

PSHV20



Documentnumber: MU000026

Version 1.1 English

Copyright

PREFACE

INTRODUCTION

This is the Limach user manual for the PSHV20.

- Only start to use the PSHV20 after having read and understood this entire user manual.
- Obey all safety instructions.
- This user manual is intended for users.

SAFETY

Only personnel that meet these conditions can do the procedures in this user manual.

- Know this user manual.
- Know the technical manual of auxiliary machines and tools.
- Know all safety aspects of auxiliary machines and tools.
- Know the local statutory labor, safety protocols and laws.
- Always obey these protocols and laws.

OTHER MANUALS

This user manual gives no (or only partly) information about usage of auxiliary machines and tools needed to use the machine. Refer to the correct user manuals for instructions about the correct use and safe operation of these tools and machines.

EDITORIAL METHOD

Safety signs

DANGER

DANGERS identify a dangerous situation. If you ignore the manual instructions, it WILL cause serious or lethal injury to personnel and it CAN cause serious damage to the product.

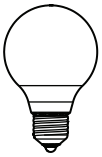
WARNING

WARNINGS identify a dangerous situation. If you ignore the manual instructions, it CAN cause serious or lethal injury to personnel and it CAN cause serious damage to the product.

CAUTION

CAUTIONS warn to obey the manual instructions. If you ignore the manual instructions, it can cause injury to personnel and it can cause damage to the product.

NOTE
NOTES give extra information and identify potential problems.



TIP
TIPS make suggestions or instructions to do some tasks easier.

References

A reference to a **section**, **table** or **figure** always includes the chapter number and a dot.

For example: Refer to section 2.2, '*Safety instructions*'.

The numbers between square brackets are **reference numbers** in a figure. These *are only valid in the (sub)section* of that figure.

For example: Turn the shaft [1] around its axis.

If a subsection has two or more figures, the **reference number** includes the figure number.

For example: Turn the shaft [1] (figure 3.2) around its axis.

The numbers between parentheses are **part numbers**.

For example: Remove the bolts (6).

Footnotes

An asterisk (*) identifies a footnote. Footnotes usually occurs in tables and formulas. If more than one footnote are on the same page, the symbol shows two or three times.

Types of lists

Table P.1 Types of lists

Step by step instructions	Choices	Enumerations
Do:	Select option:	These parts:
1 First step	♦ A	☛ A
2 Second step	♦ B	☛ B
3 Third step	♦ C	☛ C

DOCUMENT HISTORY

Table P.2 Document history

Release date	Version	Comment
04-11-2025	Version 1.0	New release
13-04-2026	Version 1.1	Small improvements

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LIST OF FIGURES

1 INTRODUCTION

1.1 ABOUT THIS USER MANUAL

Keep this user manual with the power station.

1.2 INTENDED USE

This user manual gives the procedures for the PSHV20. It gives important information to use the power station correctly. It also contains important safety procedures and precautions to prevent accidents to personnel and damage to the equipment.

Read the instructions carefully before you use the PSHV20. Make sure that you know its operation routines.

1.3 UNINTENDED USE

WARNING
Do not use the PSHV20 for any purpose other than that for which the power station was originally designed.

It is hazardous to use a PSHV20:
- In an environment the power station was not designed for
- Under conditions the power station was not designed to do work in.

1.4 OPERATING CONDITIONS

1.4.1 Scope of application

Only use the power station under normal conditions for the areas of application shown in this manual.

Take special safety precautions and/or install the correct power station equipment when you use the power station:
- For other applications than given in this manual
- In an environment that can pose dangerous situations
- In an environment that contains explosive gases
- In an environment that contains flammable substances
- In an environment that contains asbestos-containing dust particles.

Refer to the manufacturer/dealer for more information.

1.4.2 Environmental requirements

Always think about the environment during operation, servicing and doing maintenance of the power station. Always obey all applicable local and national environmental protocols.

1.5 SERVICE AND SPARE PARTS

Contact your dealer for maintenance and/or spare parts. Maintenance should be recorded in the maintenance log at the back of this user manual.

1.6 DISCLAIMER

In all cases not mentioned in this manual, concerning the use and safety of the power station, Limach assumes no responsibility for health damage or damage to the power station caused by accidental, improper, irresponsible or other use of the power station.

1.7 ABBREVIATIONS

Table 1.1 Abbreviations

Abbreviation	Full
AC	Alternating Current
DC	Direct Current
ECU	Electronic Control Unit
HV-box	High Voltage box
LV-box	Low Voltage box
MSD	Manual Service Disconnect
PDU-box	Power Distribution Unit box
SoC	State of Charge

1.8 CONTACT INFORMATION

Limach®

Address
Faradaystraat 17
6718 XT Ede
The Netherlands

Phone numbers
Main number : +31 85 0438 353
Service number : +31 6 104 081 36

Digital
www.limach.nl
info@limach.nl

2 SAFETY

2.1 INTRODUCTION

Make sure that you obey the general safety instructions and precautions in this chapter. In each chapter are safety instructions as well.

WARNING
All personnel must understand and obey these safety instructions.

2.2 SAFETY INSTRUCTIONS

WARNING
Only connect or disconnect cables from the battery packs if the main switch is set to OFF.

WARNING
Battery packs should only be opened by qualified Limach employees.

- All personnel must know where to find emergency equipment.
- All personnel must understand the emergency procedures.
- Always use the correct tools and equipment.
- Always wear suitable protective clothing.
- Examine the power station for defects before you operate it.
- Make sure that the work area is clear of unnecessary personnel and equipment.
- Make sure that there is no maintenance in progress before you operate the power station.
- Make sure that there is no risk to personnel or equipment before you operate the power station.
- Never do work with greasy or oiled hands.
- Never operate the power station in an explosive or flammable environment.
- Never operate the power station under the influence of alcohol, medication or other narcotics.
- Only qualified personnel can operate the power station.
- Only use the power station for the purpose that it is designed for.
- Operate the power station in a stable physical and mental condition.
- Tell all defects to a supervisor immediately.

2.2.1 Environment

- Discard all materials in an environmentally friendly way.
- Used batteries are dangerous to the environment.

3 DESCRIPTION

3.1 INTRODUCTION

The Limach power station can be used ***only in combination with*** a 400 V Limach battery pack. The Limach power station has two operating modes: charging and discharging. These are exclusive, meaning either charging or discharging.

3.2 TYPE PLATES

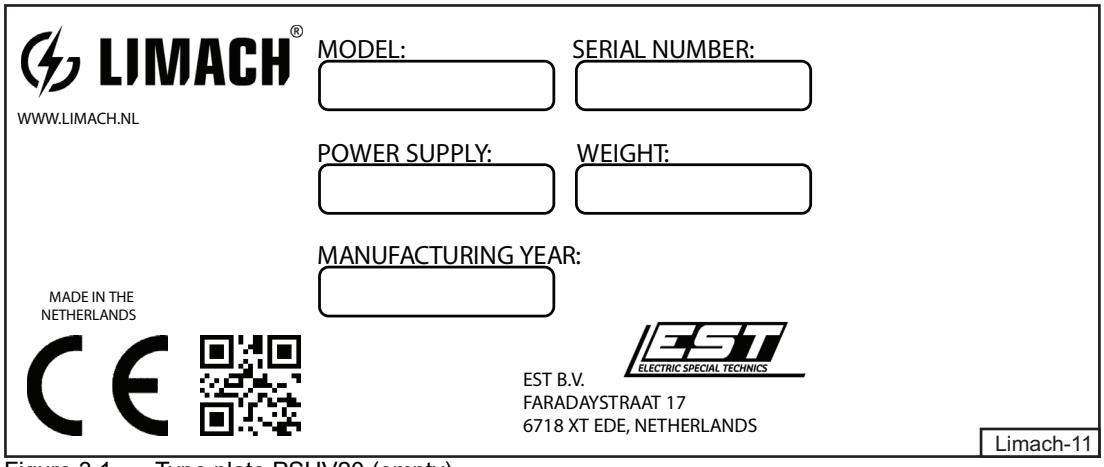

Figure 3.1 Type plate PSHV20 (empty)

3.3 SPECIAL TOOLS

Key to open door

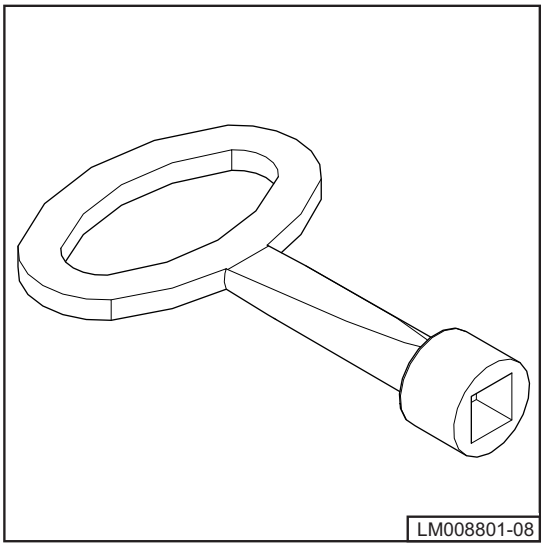

Figure 3.2 Key

3.4 PRIMARY PARTS

3.4.1 Overview

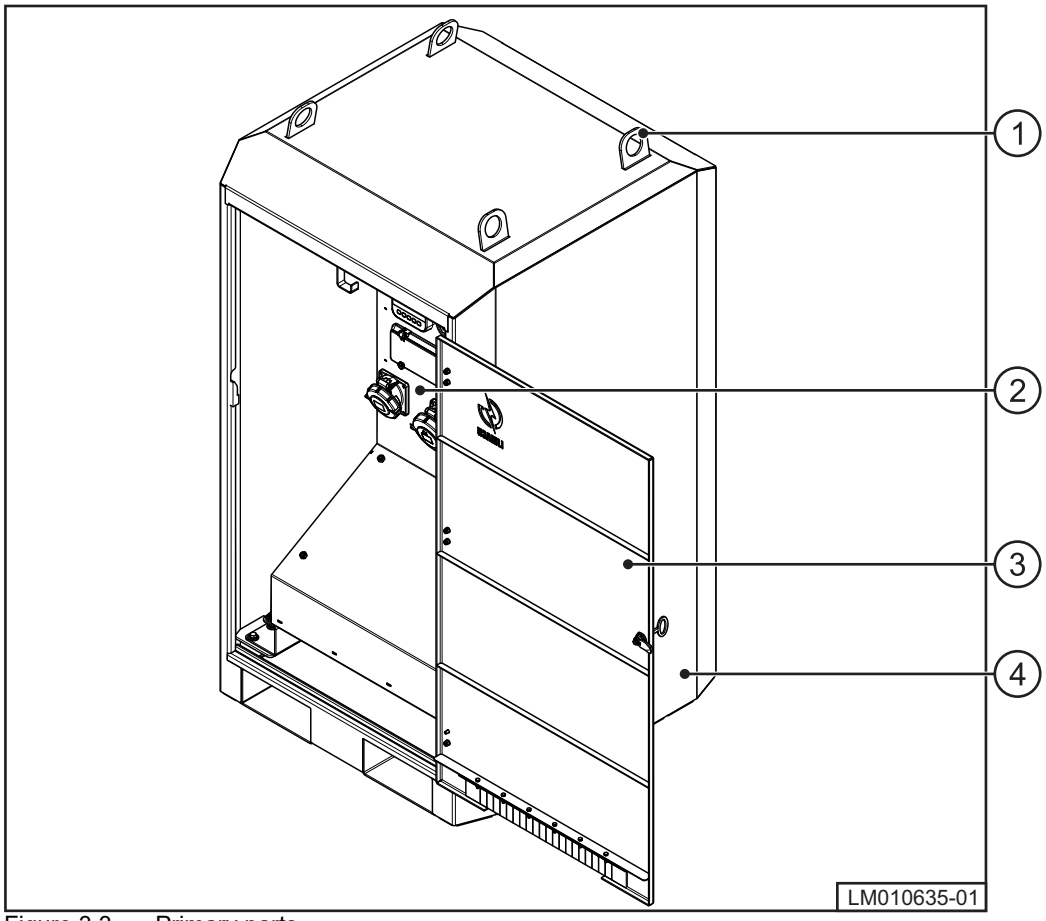

Figure 3.3 Primary parts
1 Lifting point (four lifting points)
2 Instrument panel
3 Door
4 Cabinet

The PSHV20 includes these primary parts:

- Lifting points
- Instrument panel
- Door
- Cabinet

3.4.2 Instrument panel

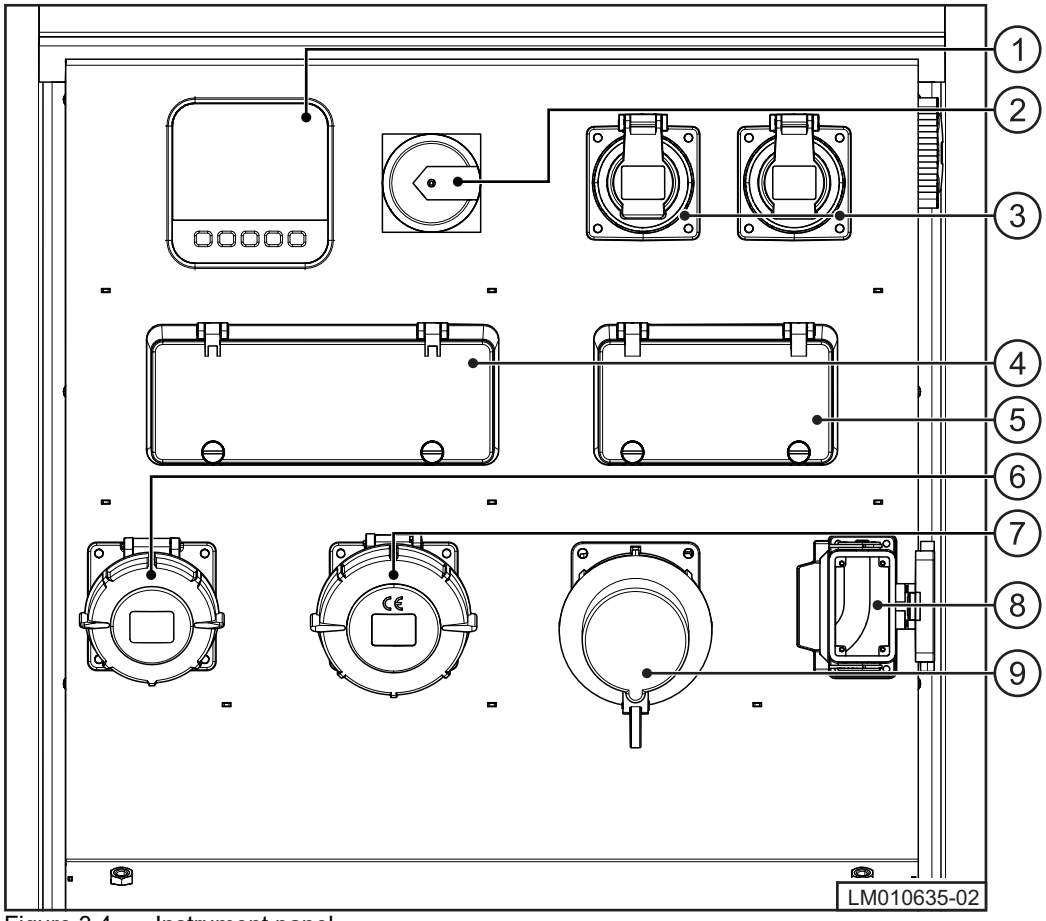

Figure 3.4 Instrument panel

1 User interface / display
2 Main power switch
3 230 V power sockets
4 Circuit breakers
5 Circuit breakers
6 400 V, 16 A power socket
7 400 V, 32 A power socket
8 Battery pack connector
9 400 V, 32 A power inlet

3.5 USER INTERFACE / DISPLAY

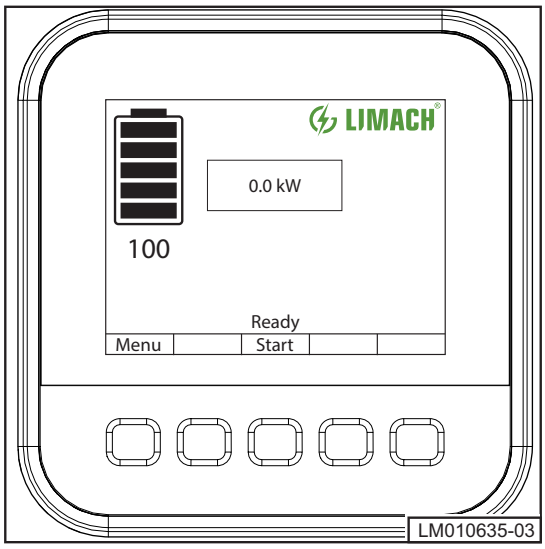

Figure 3.5 User interface

Menu options:

- Main
- Errors
- Settings

Max charge power (1-20 kW)	The maximum power at which the power station will charge the battery pack.
Discharge stop SoC (0-100%)	The state of charge of the battery at which the power station will stop the discharge mode.

3.6 FUNCTIONS

Charging

Charging the battery pack (from the power grid).

Discharging

Using the battery pack as an energy source.

4 TRANSPORT AND STORAGE

4.1 GENERAL NOTES

CAUTION

Make sure that installing, aligning, attaching and moving the power station on a semi-trailer or other vehicle agrees with the applicable legal provisions and regulations of the applicable country. Refer to the manufacturer/dealer for more information.

CAUTION

Safety and protect all power station parts correctly to prevent damage during transport and storage.

CAUTION

Prevent damage and corrosion to the power station during transport and storage.

4.2 WEIGHT AND SIZE

For the weight and size of the power station, refer to Appendix A, '*Technical specifications*'.

4.3 TRANSPORT

4.3.1 General

WARNING

Make sure that there is no oil, mud, or ice on the ramps and platforms. Oil, mud, or ice can cause the power station to move accidentally.

4.3.2 Preparation

Make sure that these items are ready:

- Forklift
- Anti-slip mat
- Straps

4.3.3 Lifting the power station

Use the lifting points to lift the power station. Refer to figure 3.3, '*Primary parts*'.

4.4 STORAGE CONDITIONS

Temperature : -40°C – 70°C
Humidity : ≤ 95%

5 OPERATION

WARNING
Only use the Limach power station in combination with a 400 V Limach battery pack.

5.1 EMERGENCY STOP PROCEDURE

Set the main power switch to the “OFF” position.

5.2 GENERAL NOTES

- The power station has two operating modes: charging and discharging. These are exclusive, either charging or discharging.
- The power station contains an internal 24V (2×12V) battery. This is only recharged when the power station is actively charging or discharging.
- When the main switch of the power station is turned on, it will detect whether the power station is connected to the power grid. If this is the case, it will automatically switch to charging mode. If the power station is not connected to the power grid, it will switch to discharge mode after approximately 10 seconds and generate 400VAC.
- When charging or discharging is stopped using the stop button on the screen, the power station will go into standby mode (note that the internal battery may discharge in this mode). The power station can be restarted by pressing the start button on the screen. Again, the power station will detect whether it is connected to the power grid.

5.3 OPERATION PROCEDURES

5.3.1 Charging

NOTE
Make sure that the power station is NOT connected to the power grid.

1 Set the main power switch to the “OFF” position.
2 Connect the battery pack with the correct cable (8 in figure 3.4, ’*Instrument panel*’).
3 Connect the power station to the power grid (9 in figure 3.4, ’*Instrument panel*’).
4 Set the main power switch to the “ON” position.

The power station will now start charging the battery pack.

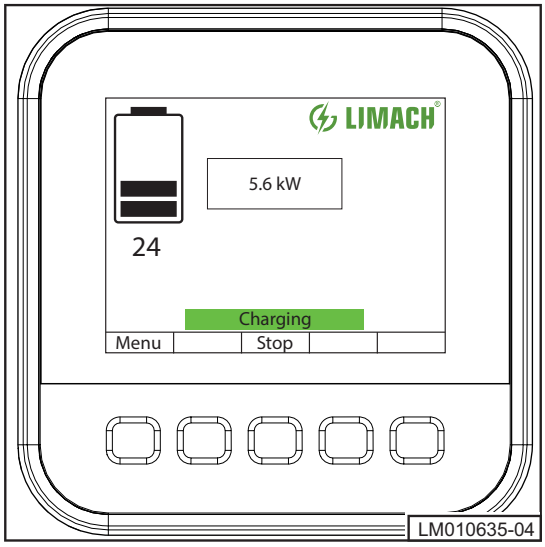

Figure 5.1 Charging screen

5.3.2 Discharging

1 Set the main power switch to the “OFF” position.
2 Connect the battery pack to the power station.

NOTE
Make sure that the power station is NOT connected to the power grid.

NOTE
Make sure that no electricity consumers are connected to the power station.

3 Set the main power switch to the “ON” position.

4 Wait until “Discharging” appears on the main screen.

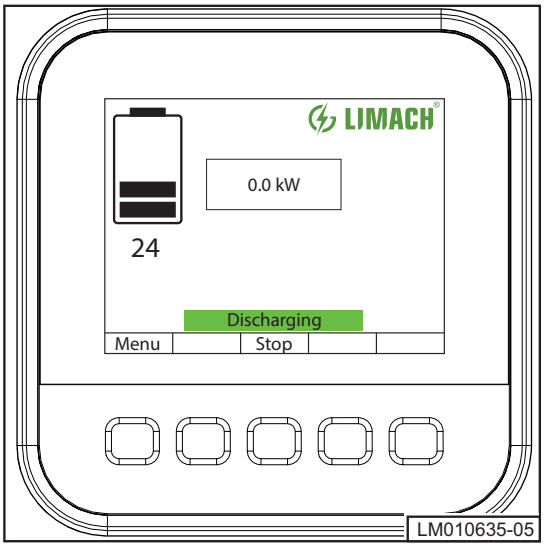

Figure 5.2 Discharging screen

5 Connect electricity consumers to the power station.

5.4 STOPPING

NOTE
Always set the main power switch to "OFF" after stopping the power station. The internal battery does not charge while the power station is inactive.

5.4.1 For a short period

1 Select the option "Stop" (middle button, refer to figure 5.2, '*Discharging screen*').
2 Set the main power switch to the "OFF" position.

5.4.2 For a long period

1 Select the option "Stop" (middle button, refer to figure 5.2, '*Discharging screen*').
2 Set the main power switch to the "OFF" position.
3 Disconnect all cables from the power station.
4 Close the cabinet door.

5.5 MENU OPTIONS

5.5.1 Showing errors

1 Push the button below "Menu".
2 Push the button below ">" until *Errors* is selected.
3 Push the button below "enter".

For a list of error codes, refer to Appendix B, '*Error codes*'.

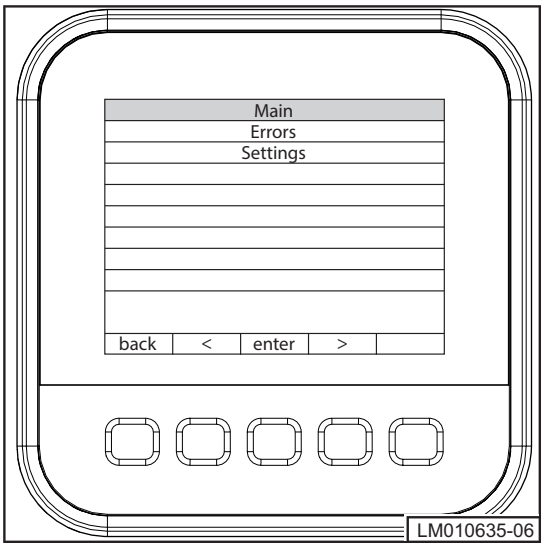

Figure 5.3 Menu screen

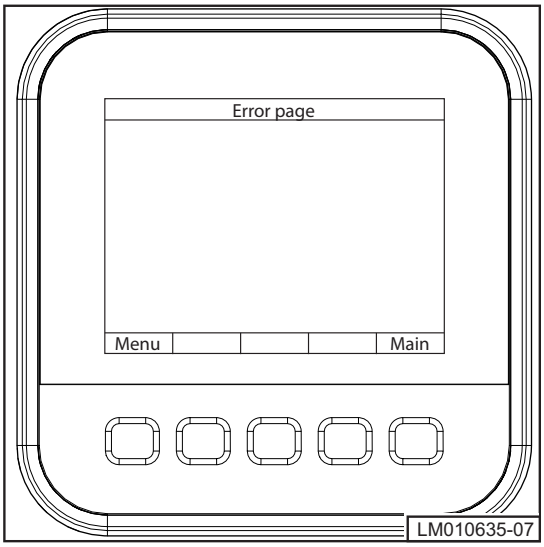

Figure 5.4 Error page screen

5.5.2 Changing settings

1 Push the button below “Menu”.
2 Push the button below “>” until *Settings* is selected.
3 Push the button below “enter”.

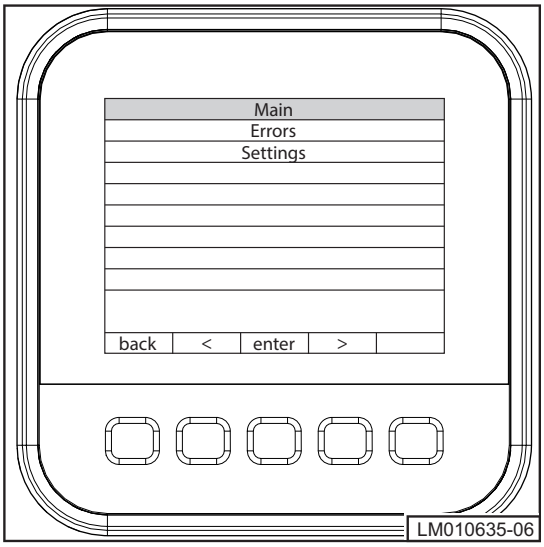

Figure 5.5 Menu screen

Max charge power (1-20 kW)

The maximum power at which the power station will charge the battery pack.

Discharge stop SoC (0-100%)

The state of charge of the battery at which the power station will stop the discharge mode.

- Use “scroll” to toggle between the settings.
- Use “-” and/or “+” to adjust the value.

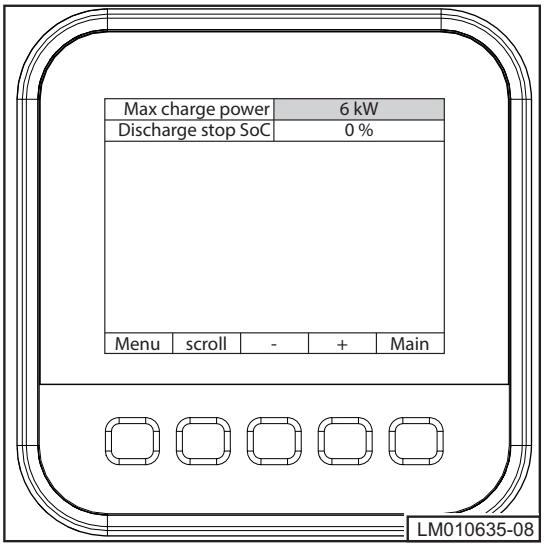

Figure 5.6 Settings screen

NOTE
When a setting is changed, it is saved immediately.

6 MAINTENANCE

6.1 SCHEDULED MAINTENANCE

CAUTION

The time between maintenance inspections is not to exceed four weeks.

The maintenance procedures and their frequency are:

Table 6.1 Maintenance schedule

Time interval	Procedure	Information
8-10 hours	Visual inspection	Section 6.2.1
1 year (with clean environment)	Replace filters	Section 6.2.2

6.2 MAINTENANCE PROCEDURES

6.2.1 Visual examination

Walk around the power station and:

- Look for visible damage, cracks
- Look for loose connections
- Make sure that decals are undamaged and legible.

6.2.2 Replace filters

1 Remove the safety bolts [1] from the hatch.
2 Remove the hatch [2].

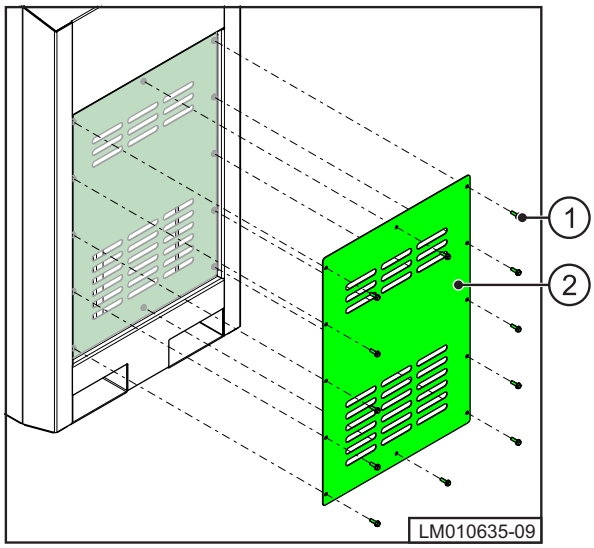

Figure 6.1 Removing hatch

3 Push the fan front down and pull the top outwards to open it.
4 Pull out the filter.
5 Install a new filter.
6 Make sure that the top side points outwards. This side is marked “TOP FRONT”.
7 Close the fan front.

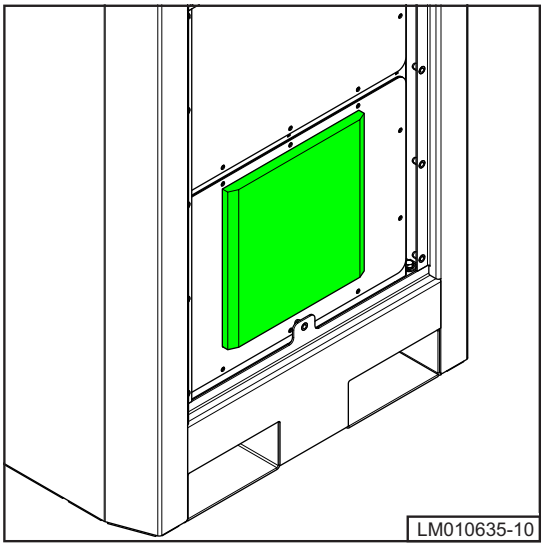

Figure 6.2 Replacing fan filter

8 Remove the bolts from the lower cover plate.
9 Remove the lower cover plate.

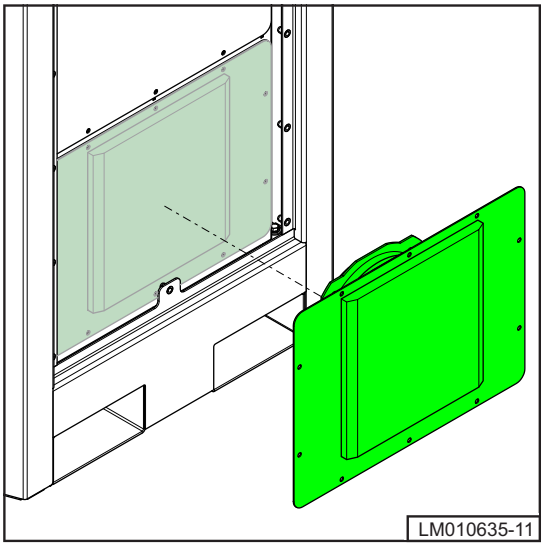

Figure 6.3 Removing lower cover plate

10 Remove the bolts from the airflow bracket.
11 Remove the airflow bracket.

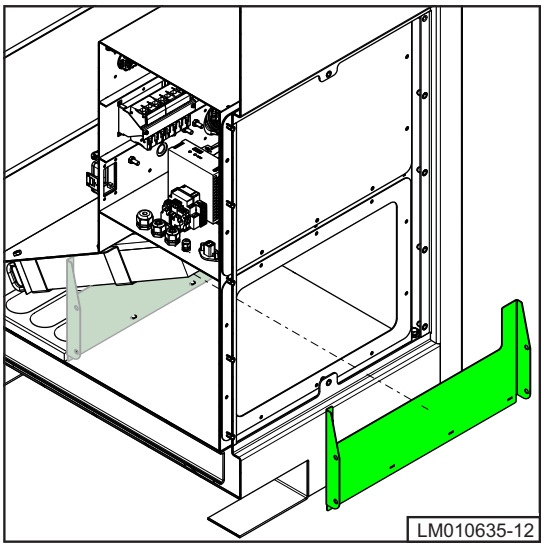

Figure 6.4 Removing airflow bracket

12 Turn the filter top plate upwards.

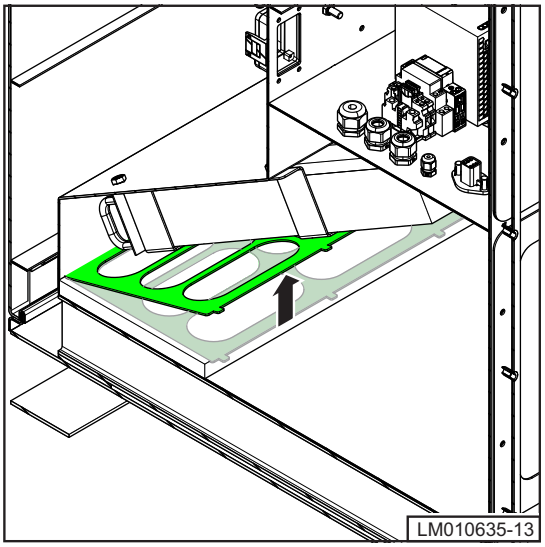

Figure 6.5 Turning filter top plate up

13 Remove the filter.

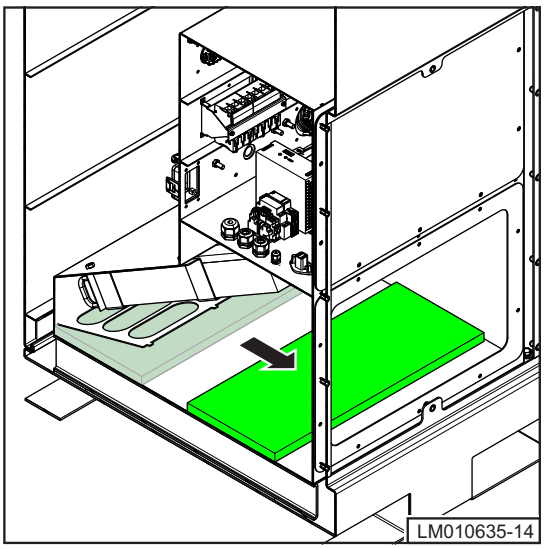

Figure 6.6 Removing filter

14 Install a new filter.
15 Install the airflow bracket.
16 Install the lower cover plate.
17 Install the hatch.

7 SCRAPPING

All materials must be disposed of according to applicable local (legal) regulations.

8 TROUBLESHOOTING

If a problem occurs, do these steps:

1 End the active charging/discharging session.
2 Set the main power switch to “OFF”.
3 When charging is required: Connect the power station to the power grid. When discharging is required: Disconnect power station from the power grid.
4 Wait for five seconds.
5 Set the main power switch to “ON”.

If the problem still exists, call your supplier.

APPENDIX A TECHNICAL SPECIFICATIONS

A.1 GENERAL

Table A.1 General specifications

Quantity	Number	Unit
Weight total (housing and power station)	264	kg
Weight housing	162	kg
Weight power station	102	kg
Height (cabinet)	1449	mm
Height (including lifting points)	1526	mm
Depth	815	mm
Width	795	mm

A.2 ELECTRICAL SYSTEM

A.2.1 AC/DC mode (charging)

Table A.2 AC/DC mode (charging) – Input data

Quantity	Number	Unit
Input voltage range	3×260 – 530	V AC
De-rating	3×309 – 260	V AC
Input current range	3×0 – 38	A
Inrush current limitation	50	A
Frequency range	50 – 60 (±10)	Hz
Power factor (50% – 100% output load)	>0.99	–

Table A.3 AC/DC mode (charging) – Output data

Quantity	Number	Unit
Output voltage range	150 – 500	V DC
De-rating	273 – 150	V DC
Output current range	0 – 73	A
Nominal power	20	kW
De-rating (Temperature)	>55	°C
Power factor	>0.8	–

A.2.2 DC/AC mode (discharging)

Table A.4 DC/AC mode (discharging) – Input data

Quantity	Number	Unit
Input voltage range	200 – 1000	V DC
De-rating	273 – 200	V DC
Input current range	0 – 73	A

Table A.5 DC/AC mode (discharging) – Output data

Quantity	Number	Unit
Output voltage range	3×400	V AC
Output frequency	50	Hz
Output power	max. 19.8	kVA
Total harmonic distortion factor	<3	%
Power factor (leading and lagging)	0.8 – 1	–
Power grid AC	L1, L2, L3, N, PE	–

APPENDIX B ERROR CODES

Table B.1 Error codes

Severity*	Code	Display text	Description
info	4096	PLC Waiting for Powerpack	The power station is on without connection with a battery pack.
error	4097	PLC Grid contactor welded	Grid contactor in the power station has welded.
error	4098	PLC Neutral contactor welded	Neutral contactor in the power station has welded.
warning	8192	PACK was forcefully disconnected	Because of an error the battery pack disconnected.
warning	8193	PACK isolation not ok	Isolation of the connected battery pack is not working.
error	8194	PACK Neg contactor welded	Negative contactor of the power station has welded in a closed state. Can't turn of connection, look out for live voltage on connectors.
warning	8195	PACK Setting Neg contactor timed out	Negative contactor of the power station has welded in a open position.
error	8196	PACK Pos contactor welded	Positive contactor of the battery pack has welded in a closed state. Can't turn of connection, look out for live voltage on connectors.
warning	8197	PACK Setting Pos contactor timed out	Positive contactor of the battery pack has welded in a open state. Can't be operated, service needed.
error	8198	PACK Precharge timeout	Battery pack pre-charge sequence timed out. Try again or contact a service person.
error	8199	PACK interlock fault	Battery pack shutdown, because the battery interlock isn't connected properly.
error	8200	PACK external interlock fault	Battery pack shutdown, because of a problem in the external interlock system.
error	8201	PACK coverswitch fault	Battery pack shutdown, because the cover switch isn't connected. Make sure battery pack is closed up properly before restarting.
warning	8448	BAT no CAN communication	Battery pack has lost communication with its batteries.
warning	8449	BAT must charge	Battery pack can't be discharged further. Charging required for longevity of the batteries.
warning	8450	BAT must discharge	Battery pack can't be charged further.
error	8451	BAT system error	Battery pack shut down because of a system error in its batteries.
error	8452	BAT nodes missing	Battery pack can't operate because of a missing battery node.
warning	8704	IO NMT heartbeat stopped	Battery pack can't run because it lost connection with it's IO module.
warning	8705	IO not receiving status data	Battery pack can't run because it lost connection with it's IO module.
warning	8960	VOLT.DEV. no CAN communication	Battery pack can't run because it lost connection with it's voltage measuring device.
warning	12288	ACDC converter no CAN communication	Power station has no communication with the AC/DC convert and can't start up.

Table B.1 Error codes (Continued)

Severity*	Code	Display text	Description
error	12289	ACDC Short circuit at output	AC/DC converter shut down because of a short circuit at output.
error	12290	ACDC Abnormal discharge	AC/DC converter shut down because of abnormal discharge.
error	12291	ACDC Module in error	AC/DC converter shut down because the converter gave a system error.
error	12292	ACDC shut down for protection	AC/DC converter shut down to protect itself from a fatal error. For example, due to input/output voltage, or under voltage/over voltage, or over temperature.
error	12293	ACDC Fan error, no cooling	AC/DC converter shut down because of a error in the fans.
error	12294	ACDC Temperature threshold exceeded	AC/DC converter shut down because the converter exceeded a temperature of 78°C.
error	12295	ACDC Overvoltage on output	AC/DC converter shut down because of a voltage over 1036V on the output.
warning	12296	ACDC Limited Power	AC/DC converter is running with limited power because of high temperatures or low input voltage.
error	12297	ACDC One phase lost on input	AC/DC converter shut down because one phase on the input was lost.
warning	12298	ACDC Asymmetry in AC input	Asymmetry in the AC input of the AC/DC converter.
error	12299	ACDC Undervoltage on input	AC/DC converter shut down because voltage under 260V AC on the input.
error	12300	ACDC Overvoltage on input	AC/DC converter shut down because of a voltage over 535V on the input.
info	12301	ACDC Power Factor Correction is OFF	PFC circuit of the AC/DC converter is off.
error	12302	ACDC AC Overload	AC/DC converter shut down because of overload on the AC in off-grid mode.
error	12303	ACDC Emergency Stop	AC/DC converter put itself in emergency stop. Module possibly broken.

* I = Information; E = Error; W = Warning

APPENDIX C MAINTENANCE LOG

Table C.1 Maintenance log

Date	Running hours	Maintenance Type	Autograph and stamp

Table C.1 Maintenance log (Continued)

Date	Running hours	Maintenance Type	Autograph and stamp