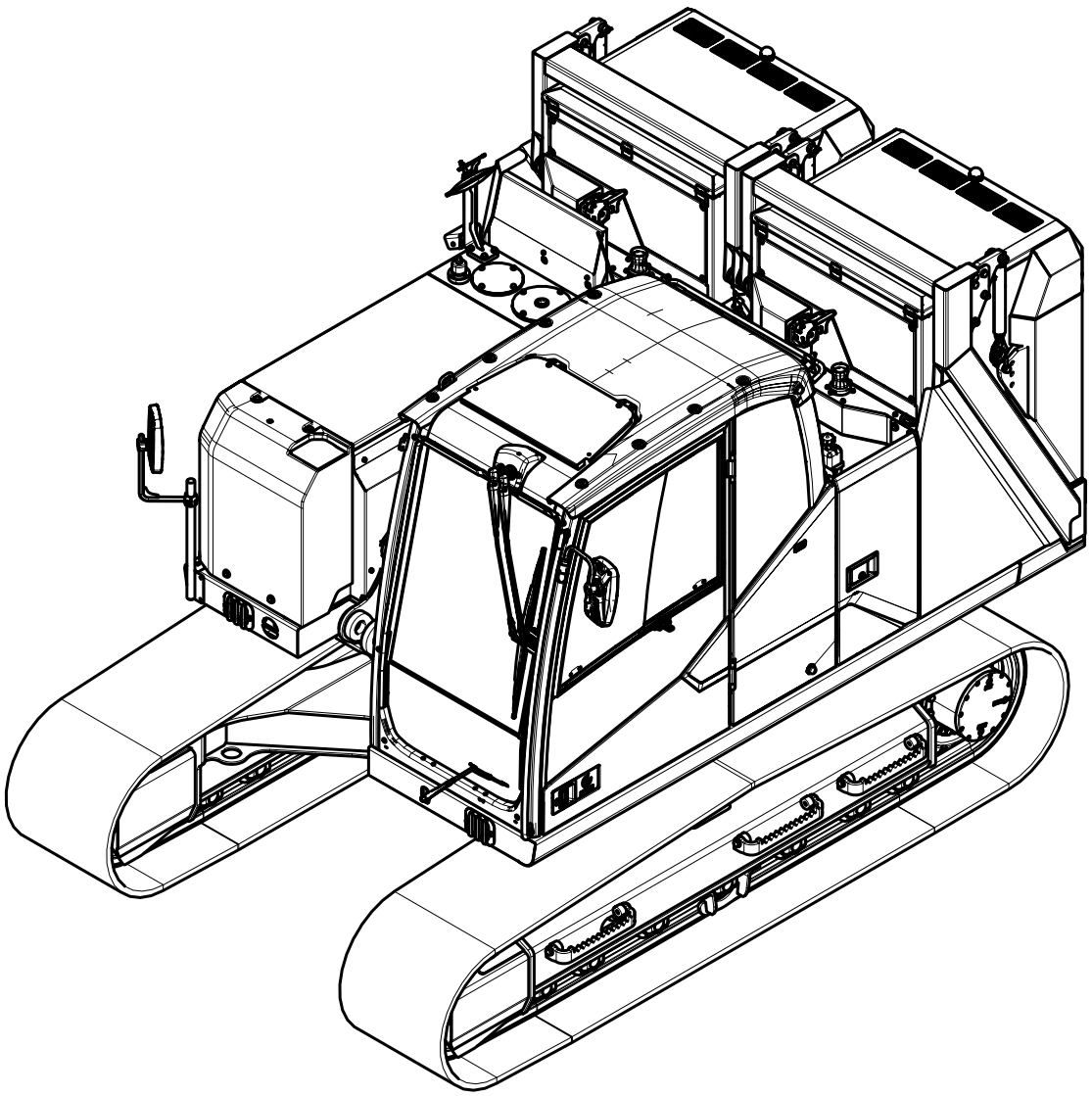
LIMACH®

User Manual

E140.4



Document number: MU000016

Version 1.1 English

Copyright

PREFACE

INTRODUCTION

This is the Limach user manual for the E140.4.

- Only start to use the E140.4 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.

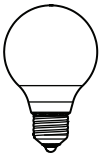
WARNING

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
17-06-2025	Version 1.0	New release
17-11-2025	Version 1.1	Update

TABLE OF CONTENTS

3 DESCRIPTION

4 TRANSPORT AND STORAGE

5 OPERATION

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 ABOUT THIS USER MANUAL

This user manual is intended to supplement the Volvo EC140E user manual. Keep this user manual with the machine.

1.2 INTENDED USE

This user manual gives the procedures for the Limach parts of the E140.4 electric excavator. It gives important information to use the machine 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 E140.4. Make sure that you know its operation routines.

1.3 UNINTENDED USE

WARNING
Do not use the E140.4 for any purpose other than that for which the machine was originally designed.

It is hazardous to use a E140.4:
- In an environment the machine was not designed for
- Under conditions the machine was not designed to do work in.

1.3.1 Scope of application

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

Take special safety precautions and/or install the correct machine equipment when you use the machine:
- 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.

1.3.2 Environmental requirements

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

1.4 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.

1.5 DISCLAIMER

In all cases not mentioned in this manual or in the Volvo Operator's Manual, concerning the use and safety of the machine, Limach assumes no responsibility for health damage or damage to the machine caused by accidental, improper, irresponsible or other use of the machine.

1.6 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

1.7 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 FEATURES

Push down the safety lever on the left armrest in the cabin to stop the machine directly.

2.3 PERSONAL PROTECTIVE EQUIPMENT

2.3.1 During operation

- Safety shoes (according EN-ISO 20345:2022)
- Work clothing (according EN-ISO 20471:2016)

2.3.2 During maintenance

- Safety shoes (according EN-ISO 20345:2022)
- Work clothing(according EN-ISO 20471:2016)
- Safety helmet
- Safetyglasses
- Work gloves (according EN 420:2003+A1:2009)
- Work gloves for electrical work (according EN 60903)

2.4 SAFETY INSTRUCTIONS

WARNING
The machine operates at a dangerous nominal voltage of 540 V. Always make sure that the machine is de-energized according to applicable guidelines before working on the machine.

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

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

2.4.1 During operation

- All personnel must know where to find emergency equipment.
- All personnel must understand the emergency procedures.
- All personnel must understand the procedures and signals used to swap the batteries.
- Always use the correct tools and equipment.
- Always wear suitable protective clothing.
- Do not stand in front of or behind the machine when the machine is operating.
- Examine the machine for defects before you operate it.
- Make sure that the operator is well rested.
- 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 machine.
- Make sure that there is no risk to personnel or equipment before you operate the machine.
- Make sure that there is good visibility in all directions.
- Never do work with greasy or oiled hands.
- Never operate the machine in an explosive or flammable environment.
- Never operate the machine under the influence of alcohol, medication or other narcotics.
- Only qualified personnel can operate the machine.
- Only use the machine for the purpose that it is designed for.
- Operate the horn before you start operation.
- Operate the machine in a stable physical and mental condition.
- Tell all defects to a supervisor immediately.

2.4.2 During maintenance

- Obey all safety instructions in the previous section.
- Do not change the machine in any way except when the manufacturer gave written approval.
- Let the machine cool down before maintenance.
- Make sure that all electrical supplies are set to **off** and cannot be accidentally set to **on**.
- Make sure that the area is clear of unnecessary personnel and equipment.
- Only qualified personnel can do maintenance on the machine.
- Only use approved parts for the machine or to replace defective parts.
- Release the pressure from pressurized systems before doing maintenance.

- Tighten nuts and bolts to standard torque figures for their diameter and thread unless specific torque figures are given.
- Never adjust a pressure relief valve to a higher pressure than recommended by the manufacturer.

2.4.3 Environment

- Discard all materials in an environmentally friendly way.
- Make sure that you do not spill any oil or fluids.
- Collect drained oil and fluids in appropriate containers.
- Remove all liquid before disposing of used filters.
- Put used filters that contain hazardous materials in the bag supplied with the new filter.
- Used batteries are dangerous to the environment.
- Used rags, gloves, and other cleaning materials are dangerous to the environment.

2.5 WARNING SYMBOLS

2.5.1 Order signs

Wear protective clothing

Wear eye protection

Wear foot protection

Wear protective gloves

Wear head protection

Wear a face shield

Wear ear protection

Wear respiratory protection

Operate horn

Refer to instruction manual

2.5.2 Warning signs

Electricity hazard

Explosive materials

Overhead or suspended load

Floor-level obstacle

Battery charging

Drop or fall hazard

Forklift truck and other industrial vehicles

Slippery surface

Crushing by moving parts

Step down

2.5.3 Prohibition signs

General prohibition sign

Do not touch

No smoking

No heavy load

No open flame

No activated mobile phone

No access for forklift trucks and industrial vehicles

Do not walk or stand here

3 DESCRIPTION

3.1 INTRODUCTION

The design of the E140.4 uses information from Volvo and is based on a protracted hands-on experience with excavators in the field.

3.2 DRAWINGS

This manual contains these drawings:

- Electrical system
- Hydraulic system

3.3 INSTALLATION OPTIONS

The machine has these options:

- Beam
  - Single beam
  - Double beam
- Tracks
  - Normal width
  - Large width

3.4 TYPE PLATES

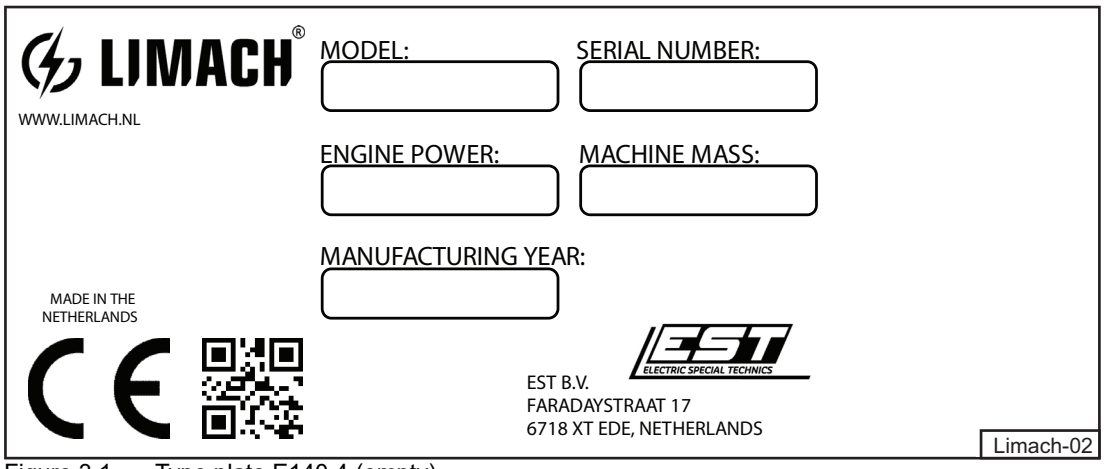


Figure 3.1 Type plate E140.4 (empty)

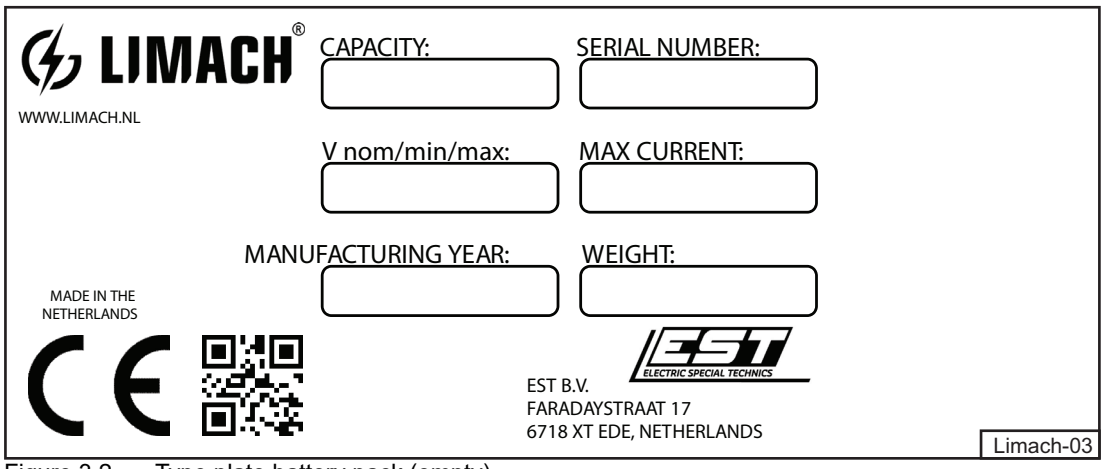


Figure 3.2 Type plate battery pack (empty)

3.5 SPECIAL TOOL

Key to open charging ports

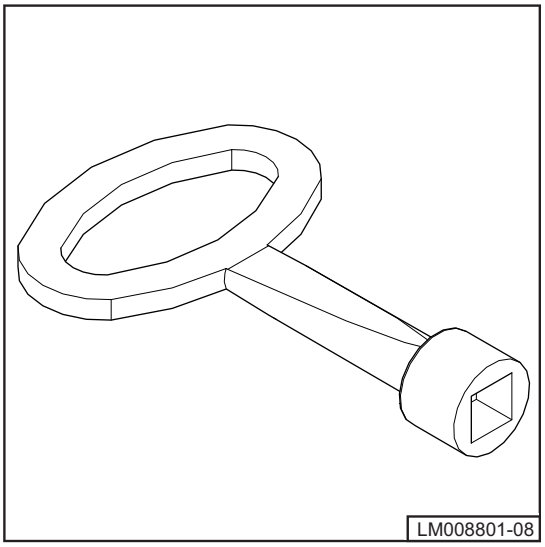


Figure 3.3 Key

3.6 PRIMARY PARTS

3.6.1 Overview

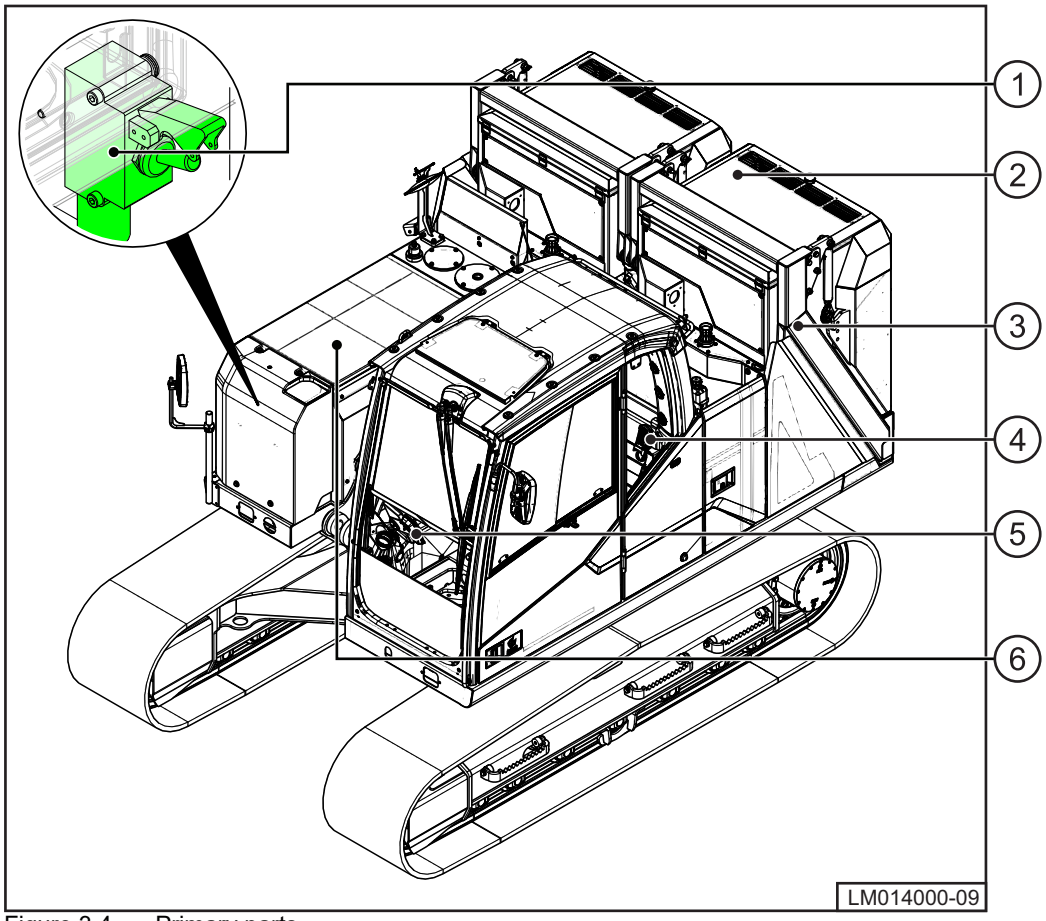


Figure 3.4 Primary parts

1 Main power switch
2 Battery packs
3 Battery swap system
4 Battery swap system remote control
5 Limach display
6 Motor and cooling system

The E140.4 always includes these primary parts:

- Main power switch
- Battery packs
- Battery swap system
- Battery swap system remote control
- Limach display
- Motor and cooling system

3.6.2 Main power switch

The location of the main power switch is below the motor cover, below the LV-box.

3.6.3 Battery packs

The E140.4 uses 600 V battery packs. For detailed information see the related manual.

3.6.4 Battery swap system

The battery swap system uses the machine's 24V battery.

CAUTION

Do not use the system too often in succession. When the 24V battery runs low, the battery swap system can no longer be operated. In this case, the display shows the message "24V battery low".

The machine has three sensors for each battery pack that monitor the presence and locking of the related battery pack:

- Battery pack presence sensor
- Locking status left locking pin
- Locking status of right locking pin

The battery pack presence sensor senses if a battery pack is on the machine. The locking status sensors sense if the corresponding locking pin is in the 'locked' position. If only one of the two locking pins is in the 'locked' position, the battery pack is still locked. The locking status is also visible on the remote control when the battery swap system is active.

3.6.5 Battery swap system remote control

The battery swap system can only be used with the radio remote control. The remote control charger is located in the cabin.

Table 3.1 Battery swap system remote control

No	Type	Description
1	LED	Indicator contact
2	LED and button	Lift the left battery pack on board
3	LED and button	Lift the right battery pack on board
4	LED and button	Unlock the left battery pack
5	LED and button	Unlock the right battery pack
6	LED and button	Lock the left battery pack
7	LED and button	Lock the right battery pack
8	LED and button	Lift the left battery pack from board
9	LED and button	Lift the right battery pack from board
10	Button	Emergency stop / On-Off button

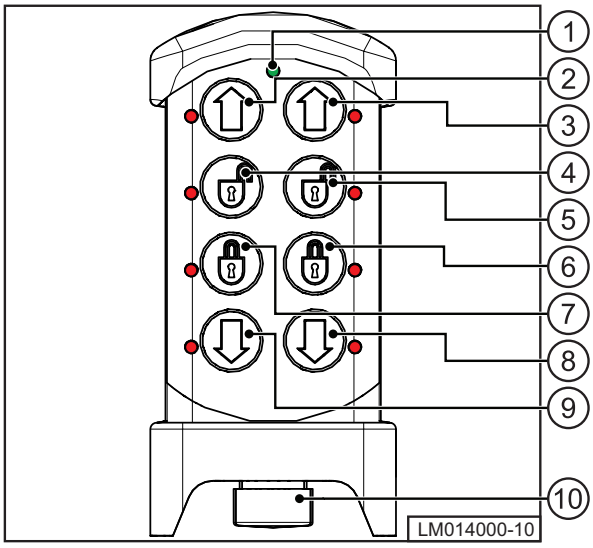


Figure 3.5 Battery swap system remote control

The LEDs adjacent to the lock- and unlock buttons indicate the locking status of the battery pack. In case the LED for locking *and* the LED for unlocking are on at the same time (for the same battery pack), the system thinks that the battery pack is locked, but one of the locking status sensors does not sense the lock. Readjust the locking sensors.

NOTE
Operation of lifting and lowering is possible only when a battery pack is disconnected and unlocked.

3.6.6 Limach display

In addition to the Volvo display, the E140.4 has a display that shows various information about the electrical system.

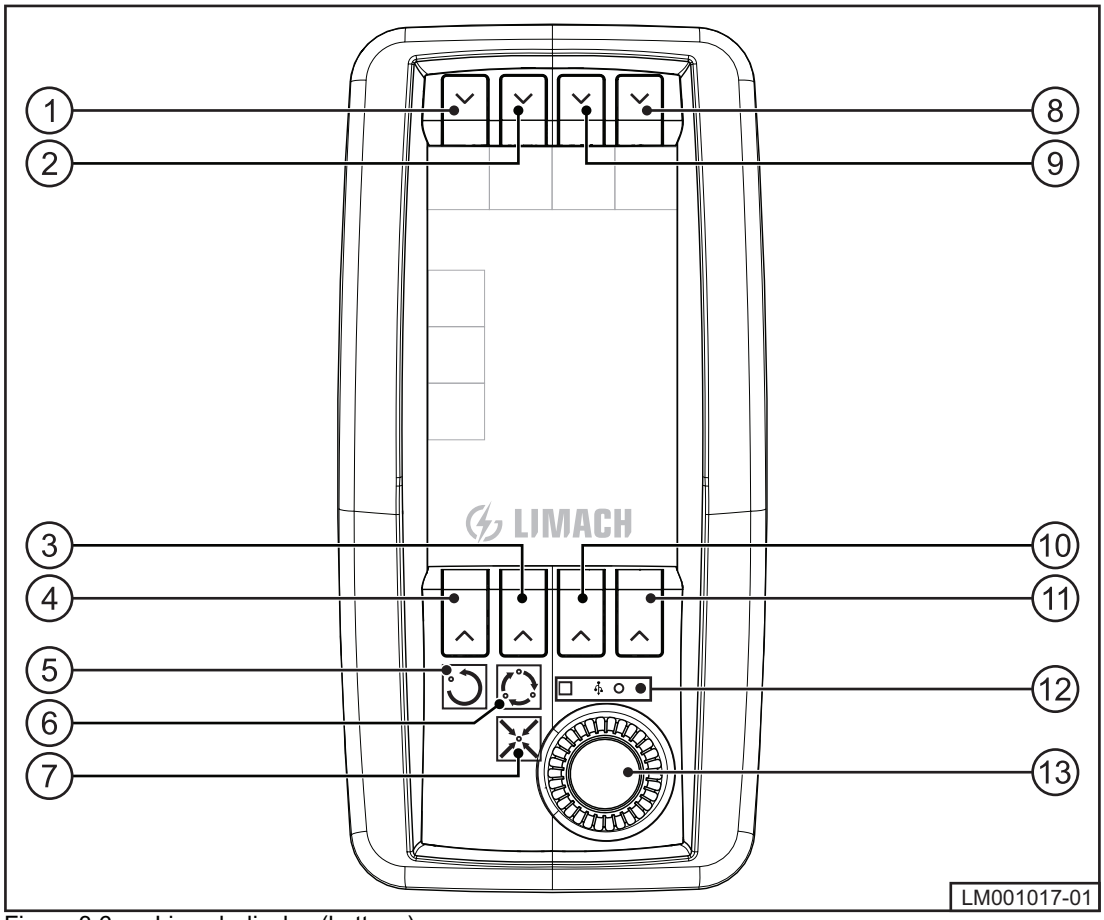


Figure 3.6 Limach display (buttons)

Table 3.2 Limach display (buttons) legend

No	Function	Description
1	Software button	Opens the item on the screen under the button
2	Software button	Opens the item on the screen under the button
3	Software button	Opens the item on the screen above the button
4	Software button	Opens the item on the screen above the button
5	Not applicable	–
6	Not applicable	–
7	Not applicable	–
8	Software button	Opens the item on the screen under the button

Table 3.2 Limach display (buttons) legend (Continued)

No	Function	Description
9	Software button	Opens the item on the screen under the button
10	Software button	Opens the item on the screen above the button
11	Software button	Opens the item on the screen above the button
12	LED	Not applicable
13	Navigation button	Opens the main menu

The main screen:

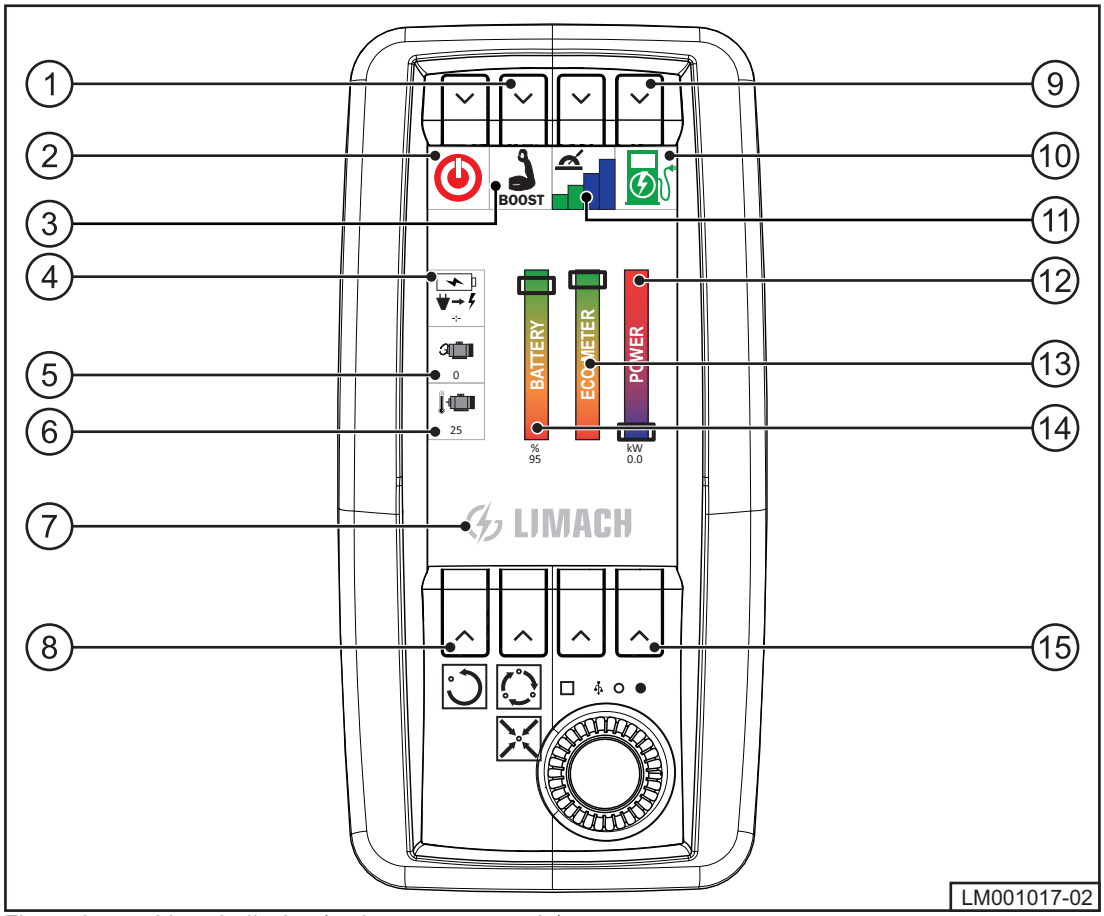


Figure 3.7 Limach display (main screen example)

Table 3.3 Limach display (main screen

No	Function	Description
1	Boost button (option)	Push button to activate the boost function
2	Power icon	♦ Red : Stand-by ♦ Green : Ready for operation or operating
3	Boost icon	♦ Not applicable
4	Remaining battery capacity	Expected remaining working hours
5	Electric motor speed	Shows the electric motor speed
6	Electric motor temperature	Shows the electric motor temperature

Table 3.3 Limach display (main screen (Continued)

No	Function	Description
7	Notifications	Shows notifications (if applicable) ♦ Error : Error message (red) ♦ Info : Information (blue) ♦ Warning: Warning (orange)
8	Acknowledge button In menu: Return button	Acknowledge and hide notification Return to the previous menu
9	Charging button	Push button to stop or interrupt charging
10	Charging icon	♦ Visible : Battery pack charging active ♦ Invisible: Battery pack charging not active
11	Throttle icon	Shows the throttle position
12	Power bar	Shows the currently used power in kW
13	Eco-meter	Indicates whether eight hours of work can be done with current consumption and based on full battery capacity
14	Battery capacity	Shows the remaining battery capacity in %
15	OK-button	Scroll through notifications

Turn the navigation button clockwise to go to the battery pack screen.

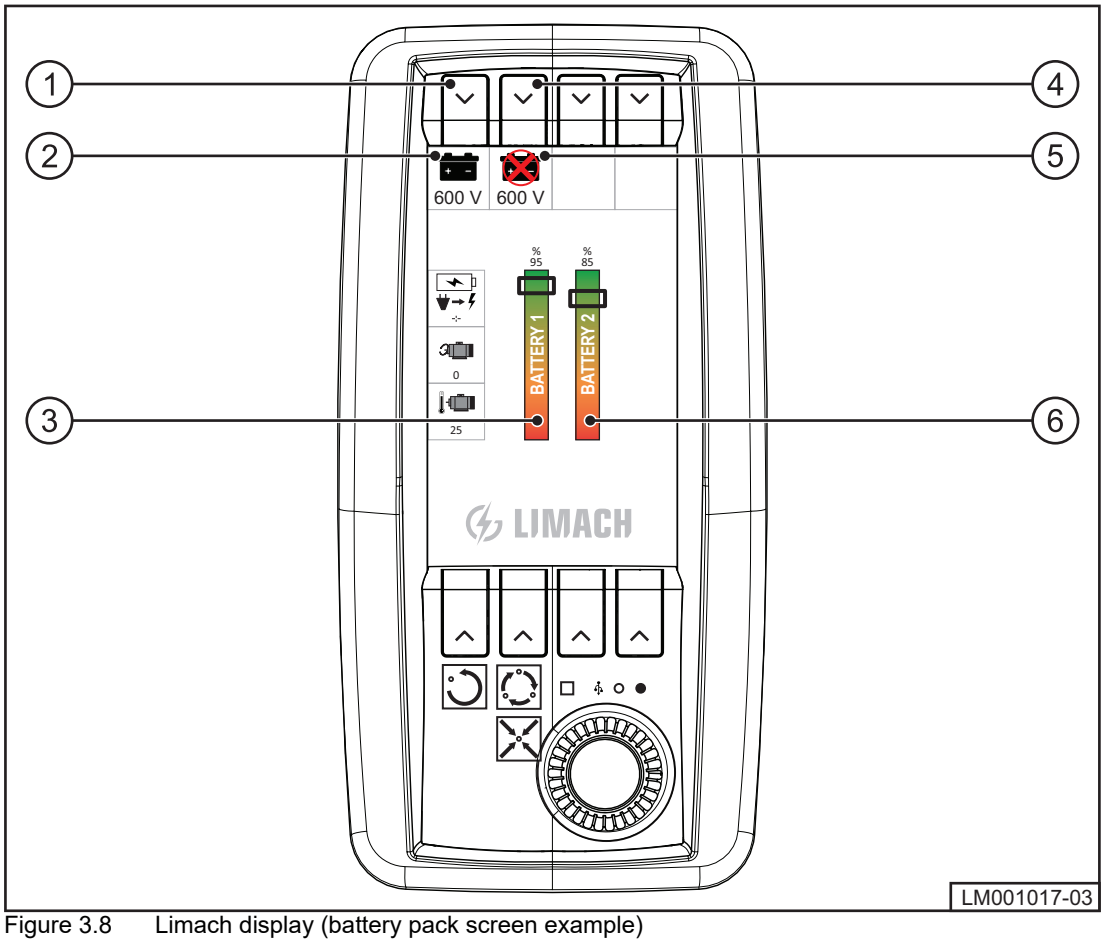


Figure 3.8 Limach display (battery pack screen example)

Table 3.4 Limach display (battery pack screen)

No	Function	Description
1	Switch to active button	Push the button to switch to the left battery pack (left battery pack must be present, connected, and inactive)
2	Active battery pack icon	♦ Invisible: Left battery pack absent, not connected, or in error ♦ Battery : Left battery pack is active ♦ Red cross: Left battery pack is inactive
3	Capacity of the left battery pack	Shows the remaining battery capacity in % ♦ Invisible: Left battery pack is absent ♦ Black and white: Left battery packis present but unconnected ♦ Colored : Left battery pack is present and connected
4	Switch to active button	Push the button to switch to the right battery pack (right battery pack must be present, connected, and inactive)
5	Active battery pack icon	♦ Invisible: Right battery pack absent, not connected, or in error ♦ Battery : Right battery pack is active ♦ Red cross: Right battery pack is inactive
6	Capacity of the right battery pack	Shows the remaining battery capacity in % ♦ Invisible: Right battery pack is absent ♦ Black and white: Right battery packis present but unconnected ♦ Colored : Right battery pack is present and connected

3.6.7 Motor and cooling

For the motor specifications, refer to Appendix A, '*Technical specifications*'.

Automatic idle control

If you do not operate the joysticks and pedals for a period, the automatic idle control will decrease the motor speed to the idle speed. This decreases consumption and noise in the cabin.

NOTE
Idle control only operates when the option is enabled in the Volvo controls. Refer to the Volvo operator's manual.

Automatic motor stop

If you do not give any operating commands for a period, the automatic motor stop will automatically switch off the motor. The default value for this period is five minutes and can only be adjusted with the Volvo service tool. Refer to an authorized Limach workshop.

Conditions for automatic motor stop:
- The safety lever is up.
- The position of the motor speed control knob was not changed.

One minute before the automatic motor stop, the information screen on the instrument panel (combination instrument) shows a message. To prevent an automatic motor stop:
- Push the [Esc] key on the keypad.
- Turn the motor speed control knob.

CAUTION
Let the motor operate on idle speed before stopping it after operating the machine with a high motor load.

3.7 ELECTRICAL SYSTEM

WARNING
Only certified and authorized personnel can do maintenance or repairs of the electrical systems.

3.7.1 Low voltage system

The low voltage electrical system contains:
- A Limach display
- A Limach ECU
- An I-ECU (Volvo display/instruments)
- A W-ECU (control unit for CareTrack, optional)
- A CCM (control unit for the climate system)
- A GPMECU (control unit for the machine)
- A HMICU (control unit for the instruments)
- A machine monitoring system
- A LV-box
- An electric motor for the battery swap system
- A battery swap system remote control

3.7.2 High voltage system

The high voltage electrical system is fully shielded. Water-resistant, double-locking wiring harness connectors make sure that the connections stay corrosion free. The main relays and solenoid valves have protection to prevent damage. A main power switch is standard equipment.

The high voltage electrical system contains:

- The charging sockets
- A DC/DC converter
- A motor controller
- A PDU box
- A heater
- An air conditioning compressor
- An electric motor
- The HV cables between the components.

3.8 HYDRAULIC SYSTEM

WARNING

Only certified and authorized personnel can do maintenance or repairs of the hydraulic systems.

3.9 COMMUNICATION SYSTEM

WARNING

Only certified and authorized personnel can do maintenance or repairs of the communication systems.

The Telematics module transmits information such as the location of the machine to a central point. This information allows early recognition of machine problems.
When the main power switch is set to ‘OFF’, the machine will no longer consume power. This means that the machine's telematics module is no longer supplied with power. It will then continue to operate on its internal battery for another seven days.

After these seven days, the location and other parameters of the machine can no longer be monitored until the machine is started again.

4 TRANSPORT AND STORAGE

4.1 GENERAL NOTES

CAUTION

Make sure that installing, aligning, attaching and moving the machine 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 machine parts correctly to prevent damage during transport and storage.

CAUTION

Prevent damage and corrosion to the machine during transport and storage.

4.2 WEIGHT AND SIZE

For the weight and size of the machine, 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 machine to move accidentally.

CAUTION

Select low motor speed and low driving speed to move the machine on and off the low loader/semi-trailer.

CAUTION

Use the related key on the keyboard to stop the automatic idle control. If the automatic idle control is not stopped, the speed can increase during movements of the machine.

Warning: crushing hazard

4.3.2 Preparation

Make sure that these items are ready:

- Forklift
- Anti-slip mat
- Straps

4.3.3 Lifting the machine

The Volvo lifting points:

1 Remove the motor cover frame rear plate.

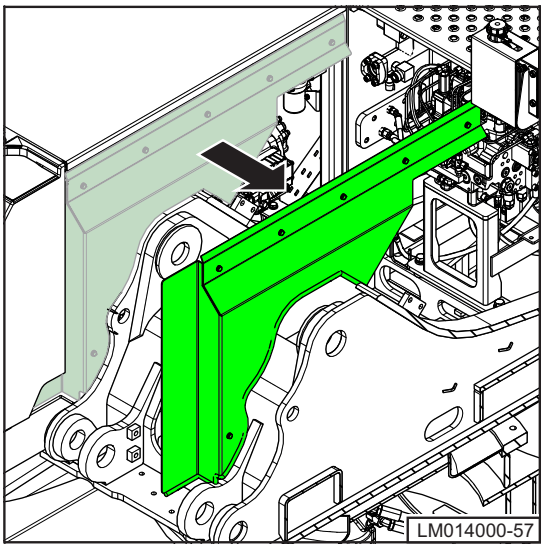


Figure 4.1 Remove the motor cover frame rear plate

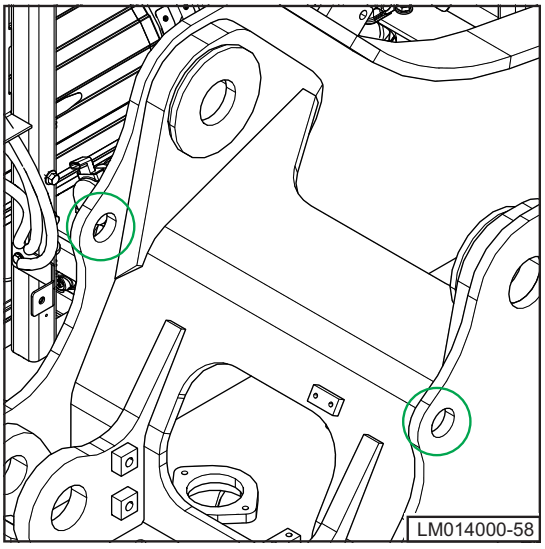


Figure 4.2 Volvo lifting points

The Limach lifting point:

2 Remove both battery packs from the machine.

3 Remove the right cover plate.

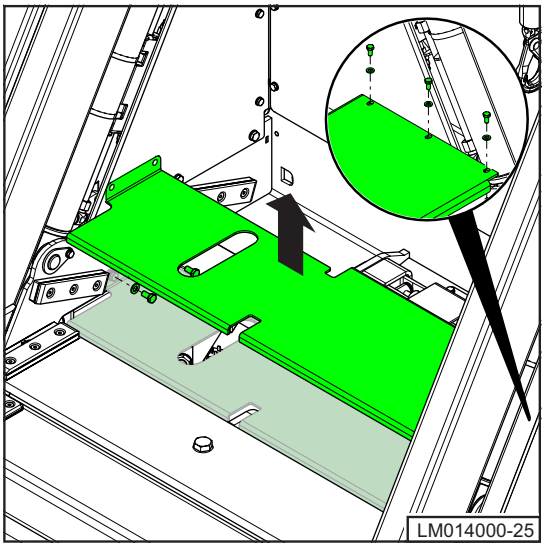


Figure 4.3 Remove the cover plate

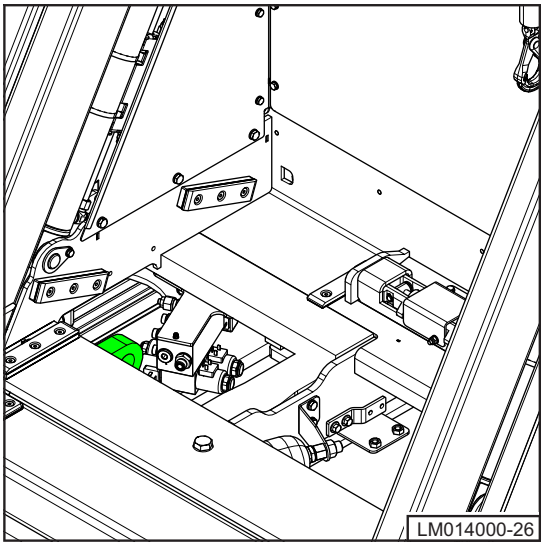


Figure 4.4 Lifting point below the cover plate

4.4 STORAGE CONDITIONS

4.4.1 Machine

If not using the machine for an extended period of time:

1 Stop the air conditioning, radio, all lights and all electrical accessories.

2 Park the machine in a dry and clean area in the recommended position*.

3 Cylinders should be retracted, and visible blanket of cylinder rods should be treated with anti-corrosion lubricant.

4 Apply anti-corrosion protection and grease where necessary.

5 Close windows and doors.

6 Set the machine's main power switch to ‘OFF’.

* Refer to the Volvo operator's manual.

7 Wait until the LED above the switch goes off. It may take several seconds for the main relay to stop.
8 Remove the 12 V batteries.
9 Examine at least once a month:
   a that there is no damage to the paint and corrosion protection
   b the state of the surface of all cylinder rods
   c that there is no corrosion on the machine
   d the level and freezing point in the windscreen washer system
   e whether the color of the hydraulic oil has not changed
   f the grease layer at all lubrication points
   g the condition of the grease in the slewing ring
   h whether the upholstery, mats and insulation are dry.

4.4.2 Battery pack

If you are not using the machine or a battery pack for an extended period of time, we recommend these steps:

1 Make sure that the SoC of the battery pack is more than 50%.
2 Set the battery pack main power switch to ‘OFF’.
3 Do **not** connect the machine or battery pack permanently to a charging cable during storage.
4 Examine the SoC of the battery pack at least once a month. If it is below 20%, recharge the machine or battery pack until the SoC is above 50% again.
   Ideally, the ambient temperature during storage should be between 10°C and 25°C.

Table 4.1 State of Charge (SOC%)

State of charge (SOC%)	Storage time/time to deep discharge (failure)
50%	1 year
25%	8 months
5%	40 days
2%	30 days
0%	10 days

4.5 PREPARING FOR USE

4.5.1 Machine

Do the steps in section 6.5, ’*Preparing for use*’.

4.5.2 Battery pack

Set the battery pack main power switch to ‘ON’.

5 OPERATION

CAUTION
Do not set the main power switch of the battery pack to 'OFF' when the battery pack is on the machine.

5.1 EMERGENCY STOP PROCEDURE

Push down the red safety lever in the cabin to stop the machine immediately. The control levers/joysticks for doing the work and driving hydraulics are disabled (no movement of the machine possible).

To continue work, pull the safety lever back to the unlocked position. The motor speed will increase to the previous value.

5.2 OPERATION PROCEDURES

5.2.1 Checks before operation

To use the machine, the main power switch must be in the 'ON' position. Also, the service switch on the lower left by the seat must be ON. The motor cover must be closed.

- Remove/scrape any ice from the windows.
- Clear the area around the motor, battery and radiator of any dust.
- Examine hydraulic oil level and fill if necessary.
- Examine the machine for any loose or defective parts or leaks that could cause damage.
- Examine the frame and track chains for cracks.
- Make sure that hatches and cover plates are closed.
- Make sure that any fire extinguisher is properly filled.
- Examine boarding steps and handles for damage or loose parts. Make any necessary repairs.
- Make sure that no bystanders are in the working area of the machine.
- Adjust the driver's seat and put on the seat belt.
- Clean and adjust the mirrors.
- Make sure that the work lights and other lights are functioning properly.
- Examine the operation of the quick coupler for attachments (extra equipment).

5.2.2 Starting

WARNING

Always put the safety lever in the locked position (down) before starting the motor or getting up from the driver's seat.

1 Close the motor cover.
2 Open the cabin door.
3 Set the service switch to the ‘ON’ position.

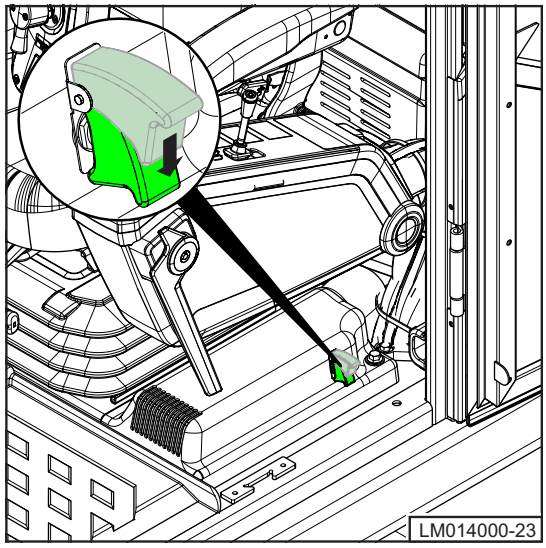


Figure 5.1 Service switch to the ‘ON’ position

4 Turn the motor speed control knob to the low speed position.
5 Turn the ignition key to position “1”.

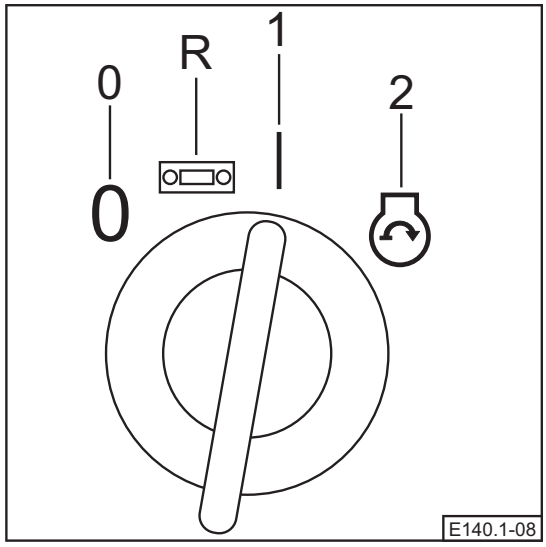


Figure 5.2 Ignition key to position “1”

6 Sound the horn to let employees and bystanders know you are starting the machine.

7 Wait until the “power” icon is green.
8 Pull up the safety lever to start the motor.

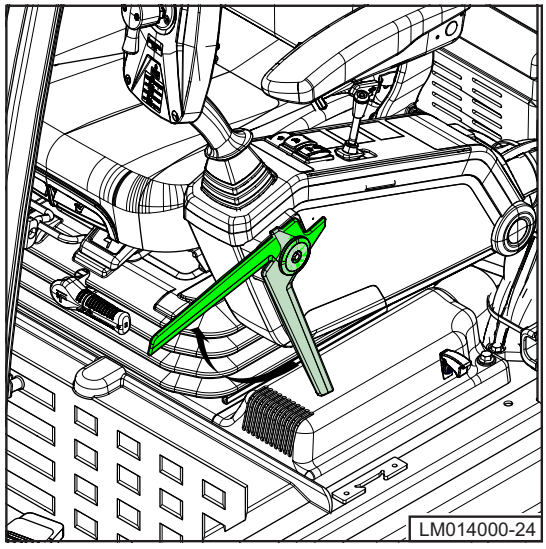


Figure 5.3 Safety lever up

9 Allow the machine to get the correct temperature.

5.2.3 Checks during operation

1 Make sure that the gauges on the instrument panels are in order.
2 Make sure that there is sufficient battery capacity in the batteries.

5.3 STOPPING

NOTE
Park the machine on level ground. If you park the machine on a slope, use logs to lock the tracks and put the bucket teeth into the ground.

5.3.1 For a short period

- The 24V battery is not automatically recharged when the power is off.
- When the power is off, as many systems as possible are set to ‘OFF’ to save energy.
- When the power is off for longer than a set time, the Limach systems will turn off completely, minimizing energy consumption.

If you are not using the machine or a battery pack for less than three days, we recommend these steps:

1 Park the machine with the excavator equipment piston rods fully retracted. This protects them from moisture, dust and damage. Lower the bucket with the teeth to the ground.
2 Park the machine on a firm and level ground, away from heat, sparks or flames, in an ambient temperature of -40°C to +70°C (ideal is +15°C to 25°C) and near a charging facility (a distribution box is not recommended).

3 Make sure that all switches and controls are in the ‘OFF’ or ‘neutral’ position.
4 Remove the ignition key.
5 Make sure that the cooling system and washer fluid reservoir contain sufficient antifreeze.
6 Close and lock the windows, door and shutters.
7 Make sure that the SoC of the battery packs is more than 50%.
8 Set the service switch to ‘OFF’.

5.3.2 For a long period

If you do not use the machine or a battery pack for more than three days, refer to section 4.4, ’*Storage conditions*’.

5.4 OPERATION LIMACH DISPLAY

5.4.1 Main menu

- Push the navigation button to open the main menu.
- Push the navigation button to open a sub menu.
- Close the sub menu by pushing the button under the RETURN icon.
- Return to the main menu by clicking the RETURN icon again.

Table 5.1 Menu structure

Main menu	Sub menu	Description
1. Swap powerpack	Enable system	Enables battery swap system
	Disable system	Disables battery swap system
2. Powerpack L	BMS state	State code of the BMS of the batteries
	Powerpack Current	Current flowing from or to left battery pack
	Charge demand	Maximum charge current left battery pack
	Max discharge	Max discharge current of left battery pack
	Isolation corr	Corrected isolation value (kΩ)
	Isolation pos	Isolation value on HV+ (kΩ)
	Isolation neg	Isolation value on HV- (kΩ)
	Cell temp min	Min cell temperature of left battery pack
	Cell temp max	Max cell temperature of left battery pack

Table 5.1 Menu structure (Continued)

Main menu	Sub menu	Description
3. Powerpack R	BMS state	State code of the BMS of the batteries
	Powerpack current	Current flowing from or to right battery pack
	Charge demand	Max charge current of right battery pack
	Max discharge	Max discharge current of right battery pack
	Isolation corr	Corrected isolation value (kΩ)
	Isolation pos	Isolation value on HV+ (kΩ)
	Isolation neg	Isolation value on HV- (kΩ)
	Cell temp min	Min cell temperature of right battery pack
	Cell temp max	Max cell temperature of right battery pack
4. Motor	RPM Feedback	Actual motor speed
	Torque	Actual torque (Nm)
	Phase current	Motor phase current
	Controller T	Motor controller temperature
5. Sensors	Oil temp	Oil temperature in tank
	Ambient temp	Ambient temperature reported by Volvo
	Coolant temp in	Coolant temperature before radiator
	Coolant temp out	Coolant temperature after radiator
	Oil temp in	Oil temperature before radiator
	Oil temp out	Oil temperature after radiator
6. Maintenance	kWh total	Total kWh consumed
	kWh trip	kWh consumed since last trip reset
	Contact hours	Hour-counter of contact on
	Motor hours	Hours main motor has run
	Idling (s)	Number of seconds auto-idle was active
	24V battery	24V battery level
7. Settings	Charge pwr max kW	Maximum charge power. Only valid for charging through the charge port on the machine.
	Charge max%	Charge battery packs until this state of charge. Only valid for charging through the charge port on the machine.
	Auto off (s)	When no activity has been detected while motor is running, motor will be stopped. Safety lockout lever needs to be toggled to run the motor again.
	Auto-shutdown (s)	When no activity has been detected, electric drivetrain is turned off after this timeout.
	Limp home	Limp home mode activation
8. Counters	Reset kWh trip	Reset kWh trip counter
9. About	Version: vX.Y.Z	Software version number of machine.

5.4.2 Starting battery pack

The machine needs one battery pack to function yet it can hold two battery packs. To interchange between the two battery packs:

1 Turn the Navigation button [3] clockwise to go to the battery pack screen (visible in the figure).

The icon of the not operating battery pack shows a red cross [2].

2 Push the button above the icon [1] to start the battery pack.

The other battery pack will stop.

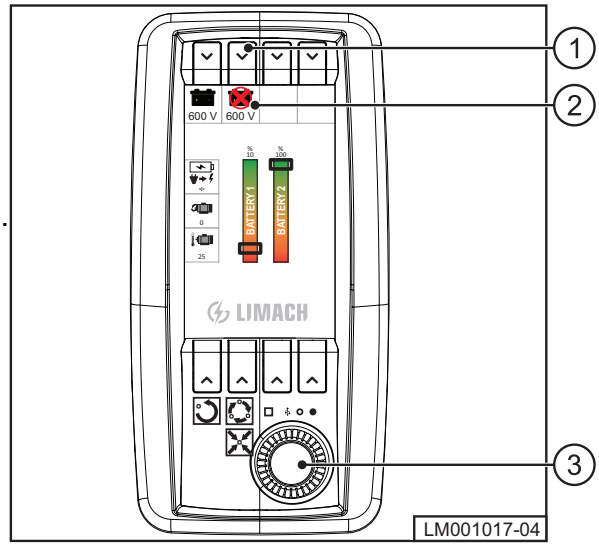


Figure 5.4 Starting battery pack

NOTE
With only one battery pack on the machine, the power is restricted. To function properly, two battery packs must be present and locked. They need not both be charged.

5.5 OPERATION BATTERY SWAP SYSTEM

5.5.1 Description

Only the radiographic remote control can operate the battery swap system. The charger of the remote control is in the cabin.

NOTE
Make sure that the cigarette lighter plug is connected and that the remote control is put correctly into the holder to charge it.

Table 5.2 Battery swap system remote control

No	Type	Description
1	LED	Indicator contact
2	LED and button	Lift the left battery pack on board
3	LED and button	Lift the right battery pack on board
4	LED and button	Unlock the left battery pack
5	LED and button	Unlock the right battery pack
6	LED and button	Lock the left battery pack
7	LED and button	Lock the right battery pack
8	LED and button	Lift the left battery pack from board
9	LED and button	Lift the right battery pack from board
10	Button	Emergency stop / On-Off button

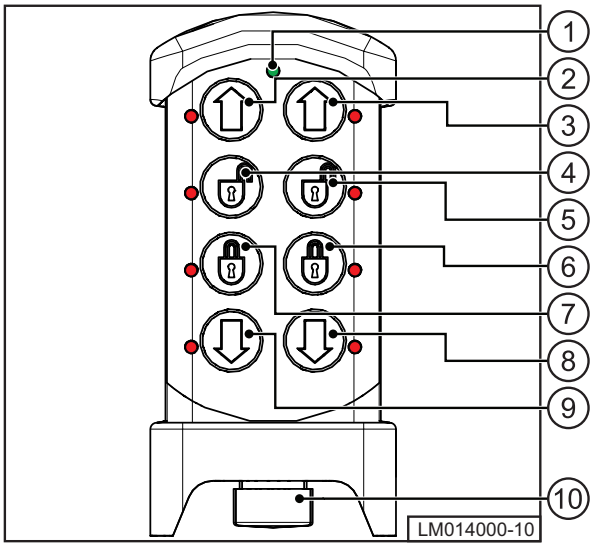


Figure 5.5 Battery swap system remote control

NOTE
The LEDs adjacent to the lock- and unlock buttons indicate the locking status of the battery pack. In case the LED for locking and the LED for unlocking are on at the same time (for the same battery pack), the system thinks that the battery pack is locked, but one of the locking status sensors does not sense the lock. Readjust the locking sensors.

NOTE
Operation of lifting and lowering is possible only when a battery pack is disconnected and unlocked.

5.5.2 Starting

To start the battery swap system:

1 Turn the ignition key to position “0”.
2 Wait for the Limach display to stop.

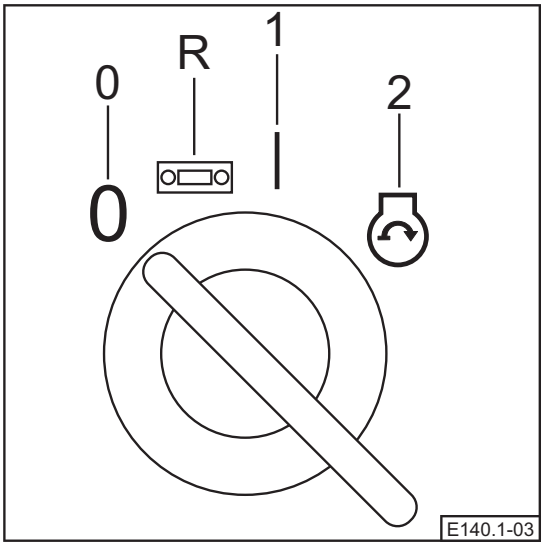


Figure 5.6 Ignition key to position “0”

3 Climb onto the machine.

4 Remove the round black plug from the battery pack to be swapped.

If the plug is still connected, the battery pack can be locked/ unlocked but the lift/lower movements are blocked.

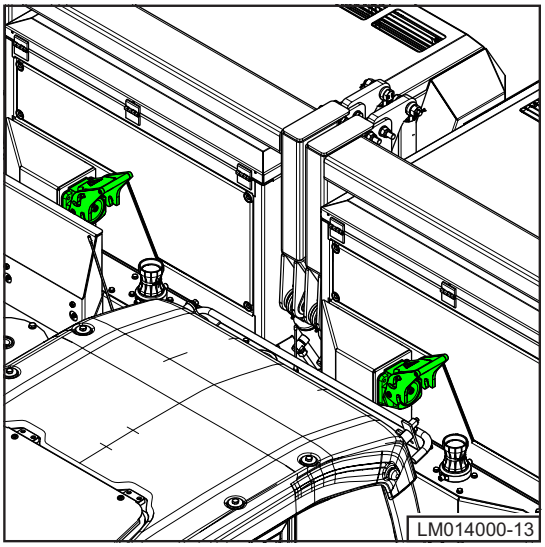


Figure 5.7 Sockets on the battery packs

5 Close the power sockets on the battery packs.

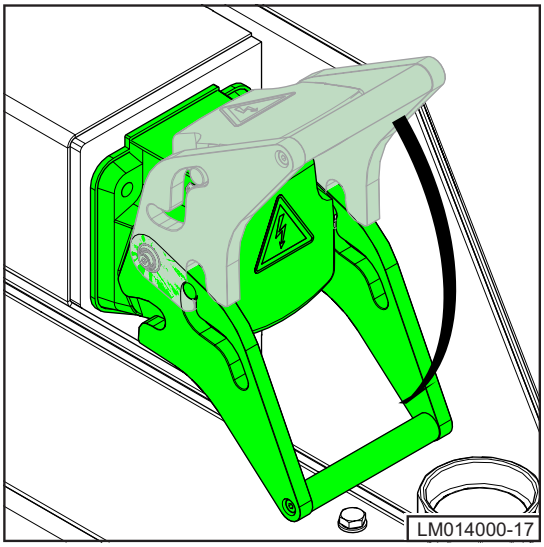


Figure 5.8 Close power socket

6 Push the emergency stop button on the remote control.

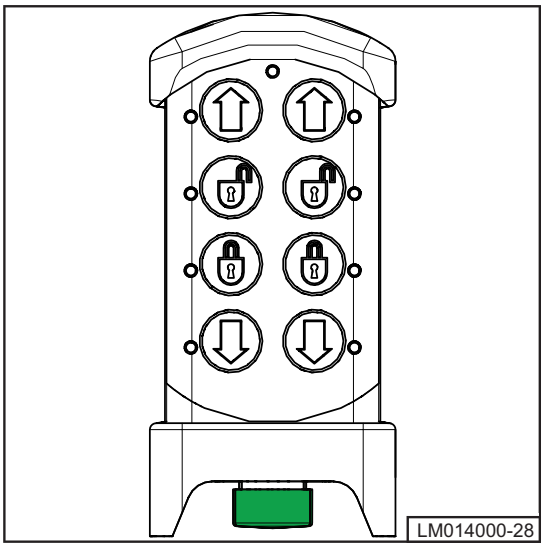


Figure 5.9 Emergency stop button

7 Turn the ignition key to position “1”.

8 Wait for the Limach display has fully started.

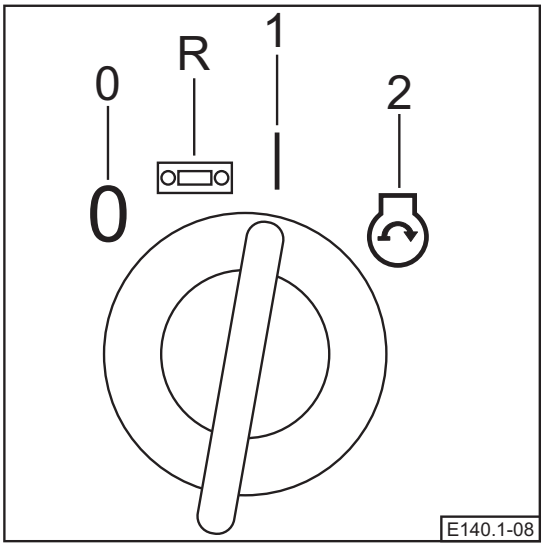


Figure 5.10 Ignition key to position “1”

9 Push the navigation button on the Limach display.

10 Select menu-option “*Swap battery*”.

11 Select menu-option “*Enable system*”.

12 Turn the emergency stop button out.
This will start the remote control.

The bottom two LEDs will now flash red.

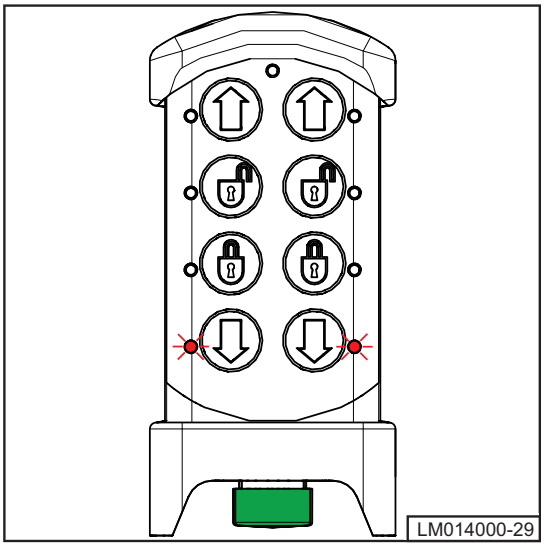


Figure 5.11 Emergency stop button and LEDs

13 Push and hold the bottom two buttons (2× down arrow) of the remote control at the same time until the remote beeps.
14 After the beep, release the buttons.

The green LED at the top center comes on continuously.

The locking status of each of the battery packs is shown by LEDs next to the lock and unlock buttons.

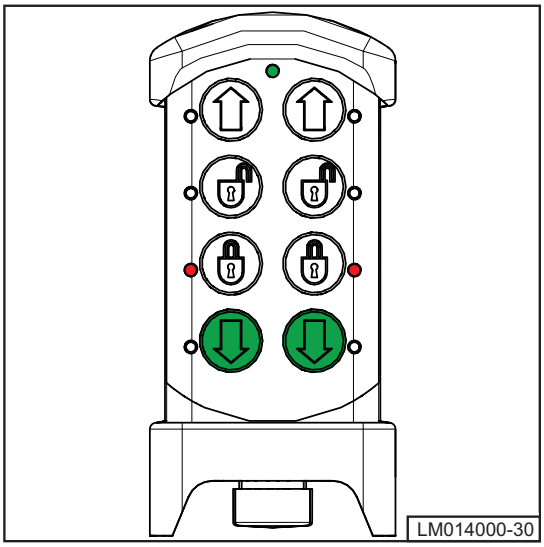


Figure 5.12 Connecting the remote control

The battery swap system is ready for use.

NOTE
If the green LED at the top center flashes green, the remote control cannot contact the base station. Repeat these steps to try again.

5.5.3 Operation

WARNING
Always push the emergency stop button on the remote control when someone is within the motion area of the battery swap system. This makes sure that the hydraulic pump is disabled at all times. To use the remote control again, do steps 12 and 13 of section 5.5.2, 'Starting'.

Lifting

To put a battery pack on the machine:

1 Attach the lifting hooks correctly to the battery pack.
Lifting a battery pack is possible only if the locking pins are in the unlocked state.
2 Push and hold the up-arrow of the battery pack to lift the battery pack onto the machine.
Try to lift the battery pack onto the machine in one smooth movement. If you stop while lifting, the battery pack may start to move. That will make it harder to lift the battery pack onto the machine properly.
3 Make sure that the battery pack is correctly aligned in its position.
4 Push the lock-button on the battery pack to lock it.

CAUTION

Make sure that the LED next to the locking button comes on to show that the battery pack is locked.

Removing

To remove a battery pack from the machine:

1 Remove the round black plug from the battery pack.
2 Push the unlock button on the remote control to unlock the battery pack.

CAUTION

Make sure that the LED next to the unlocking button comes on to show that the battery pack is unlocked.

3 Push and hold the down arrow on the remote control until the battery pack is stable.
4 Make sure that there is no tension on the lifting chains.
5 Push the emergency stop button on the remote control to stop it.
6 Disconnect the lifting hooks from the battery pack.

Stopping

The battery swap system is automatically deactivated when the ignition key is set to position “0”.

To stop the battery swap system and use the machine:

1 Push the emergency stop button on the remote control to stop it.
2 Put the remote control correctly into its holder in the cabin.
3 We recommend that you turn the ignition key to position “0”.
4 Insert the round black plug into the battery packs.
5 Turn the ignition key to position “1”.
6 If the ignition key has not been turned to position “0” in step 3:
  a Push the navigation button on the Limach display.
  b Select menu-option “*Swap battery*”.
  c Select menu-option “*Disable system*”.

5.6 CHARGING THE BATTERY PACKS

NOTE

Local regulations may be applicable for the use of approved electric charging points.

Always use a Limach approved cable for charging.

5.6.1 On the machine

NOTE
On the machine, only DC-charging is possible.

To charge the battery packs on the machine:

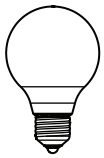
1 Make sure that the ignition key is set to “0”.
2 Make sure that the battery pack main power switch is set to ‘ON’ (cap closed).
3 Make sure that the main power switch is set to ‘ON’.
4 Make sure that the service switch is set to ‘ON’.
5 Make sure that the charging cable is not damaged.
6 Connect the charging cable to a power source as close to a distribution box as possible.

WARNING
Do not use an extension cable.

7 Put the charging plug in the machine's charging port.
The status LEDs* come on. They may be:

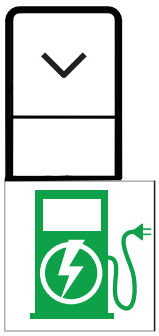
- Red: the battery pack has an error. Make sure that the MSD is set in the correct position and start this procedure again.
- Green continuously: the battery pack is fully charged.
- Green blinking: the ignition key is not set to “0”.
- Blue and then blinking blue: the battery pack is charging.
- Blue continuously: the battery pack waits for charging until the two battery packs are equally charged.

NOTE
If one off the status LED does not come on, the battery pack has not been detected.



TIP
The Limach display shows the progress of charging the battery packs.

* The left LED is for the left battery pack and the right LED is for the right battery pack. If the LED does not come on, the battery pack is missing.



To stop charging the battery packs on the machine:

1 On the Limach display, push the button above the charging icon to stop charging.

5.6.2 Stand alone

NOTE
On the battery pack, DC-charging and AC-charging is possible.

To charge the battery pack:

1 Make sure that the battery pack main power switch is set to ‘ON’ (cap closed).
2 Make sure that the charging cable is not damaged.
3 Connect the charging cable to a power source as close to a distribution box as possible.
4 Put the charging plug in the charging port of the battery pack.
The status LED comes on. It may be:
- Red: the battery pack has an error. Make sure that the MSD is set in the correct position and start this procedure again.
- Green continuously: the battery pack is fully charged.
- Green and then blinking blue the battery pack is charging.

To stop charging the battery pack:

1 Push the *stop charging* button on the battery pack.

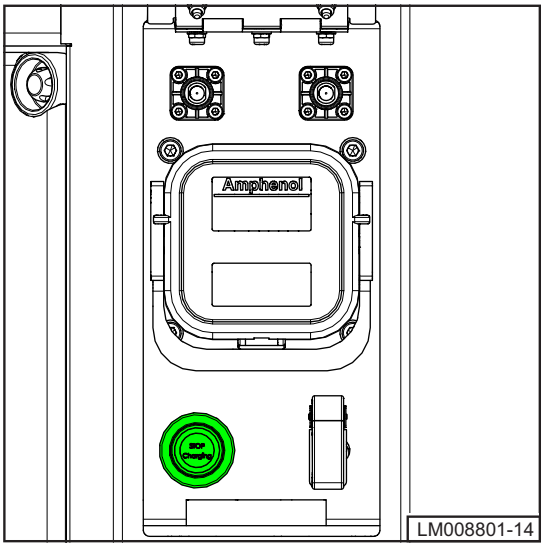


Figure 5.13 Stop charging button

5.7 OPTIMAL CONDITION OF BATTERIES

This section describes how to keep the battery pack of your Limach machine or battery pack(s) in optimal condition.

5.7.1 State of charge

The State of Charge (SoC) shows in a percentage how full the battery pack is. This SoC is visible in the Limach display on the machine. The SoC value plays an important role in keeping the battery pack in optimal condition.

5.7.2 Daily use

The machine's battery pack remains in the most optimal condition when the SoC remains between 10% and 90%. This means stop running at 10% and not charging beyond 90%. In practice, the machine is put on the charger at the end of the working day so that full capacity is available the next day. Structurally running empty to 0% can affect the life of the battery pack.

WARNING
When the battery is completely discharged, recharge it as soon as possible to avoid the possibility of deep discharge and permanent damage!

NOTE
Local regulations may apply to the use of approved electric charging stations.

Always use a Limach-approved cable for charging.

5.8 LIMP HOME MODE

The limp home mode allows the machine to drive a limited distance when both battery packs are depleted.

To activate the limp home mode:

1 On the Limach display, select menu option “7. Settings”.
2 Scroll down to “Limp home”.
3 Push the navigation button to activate the check box.
On the main screen the message: “Limp home active”.

5.9 PARKING HEATER (OPTIONAL)

For operation of the parking heater, refer to the Volvo operator's manual.

The parking heater functions only if:

- Main power switch is set to ‘ON’.
- Ignition key is set to “0”.
- Battery packs are connected.
- Battery packs are not charging.
- Battery packs have no malfunction.

6 MAINTENANCE

CAUTION

Make sure that the main power switch of the battery pack is set to 'OFF' before removing the MSD.

6.1 PREPARING FOR MAINTENANCE

6.1.1 De-energizing

DANGER

This procedure can only be done by authorized persons who have completed high voltage training!

1 Walk around the machine to observe any peculiarities about the machine.

2 Make sure that the safety lever is down.

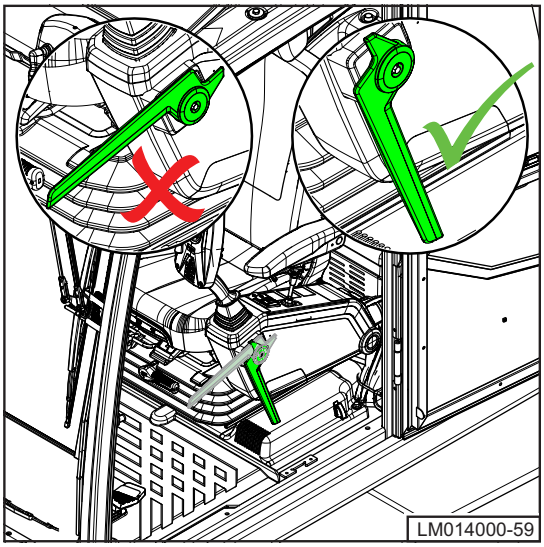
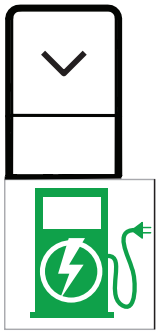


Figure 6.1 Safety lever down



3 When the machine is charging:

a On the Limach display, push the button above the charging icon to stop charging.

b Remove the charging plug from the machine's charging port.

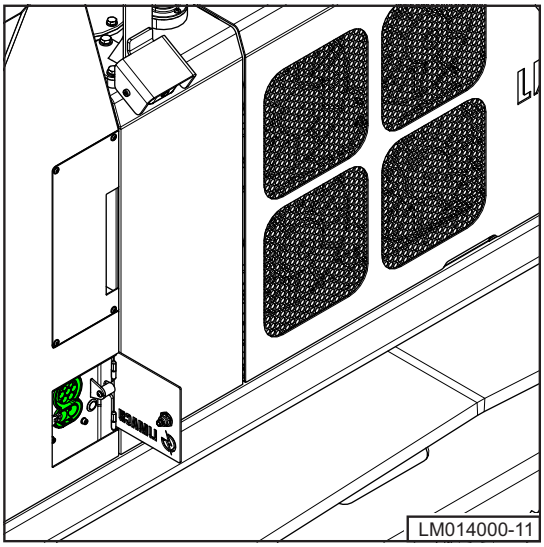


Figure 6.2 Charging port

4 Safety the area at least two meters around the machine so that unauthorized persons know that it is not permitted to get access to the machine while it is in maintenance.

5 Open the door on the battery pack.

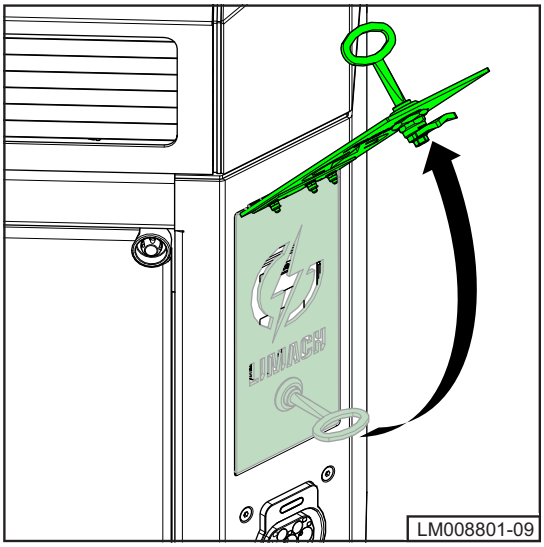


Figure 6.3 Open battery pack door

6 Put the battery pack main power switch to the ‘OFF’ position:
   a Lift the cover [1] of the battery pack main power switch.
   b Put the lever [2] of the battery pack main power switch in the top position.

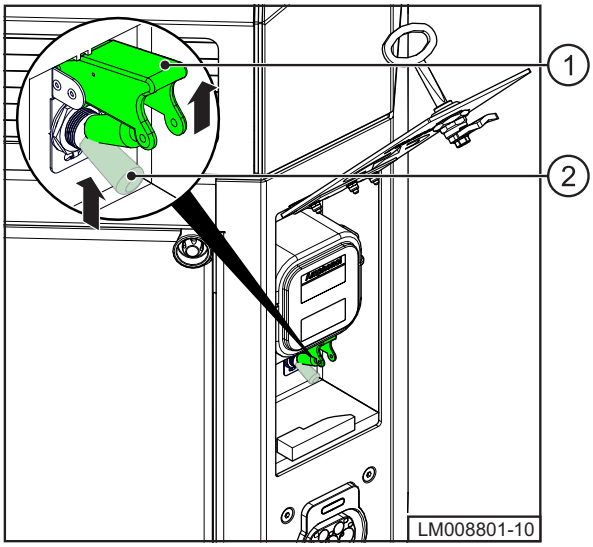


Figure 6.4 Battery pack main power switch to ‘OFF’

7 Turn the lever of the MSD forward.
8 Remove the MSD and keep it so no one can put it back.

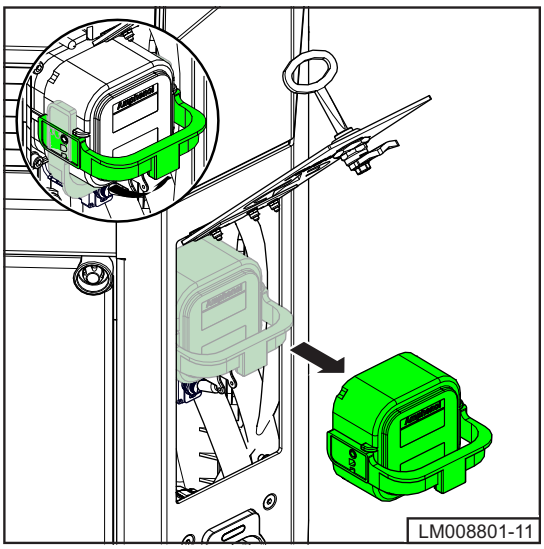


Figure 6.5 Taking MSD out of the battery pack

9 Close the door of the battery pack.
10 Repeat steps 5 to 9 for the second battery pack (if applicable).

11 Climb onto the machine.
12 Remove the round black plugs from the battery packs.

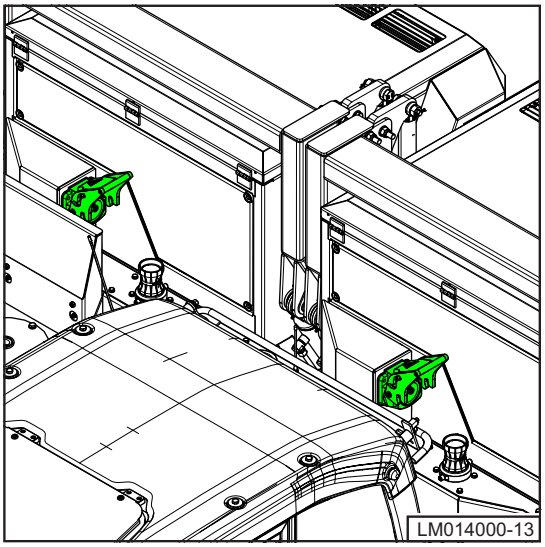


Figure 6.6 Sockets on the battery packs

13 Close the power sockets on the battery packs.

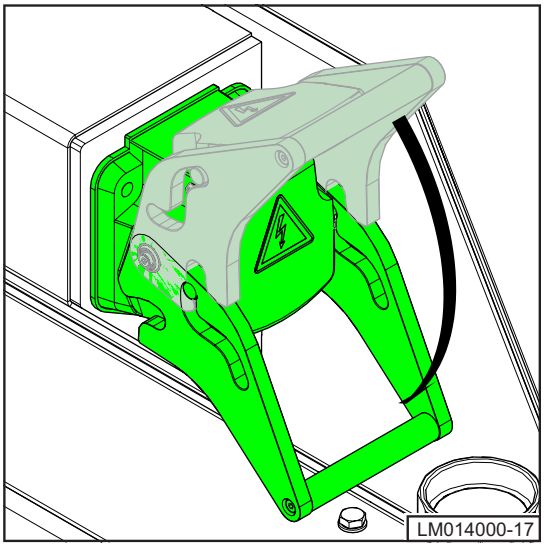


Figure 6.7 Close power socket

14 Use the battery swap system to put the right battery pack off the machine.

The high voltage box (PDU box) is located behind the hood which is behind this battery pack.

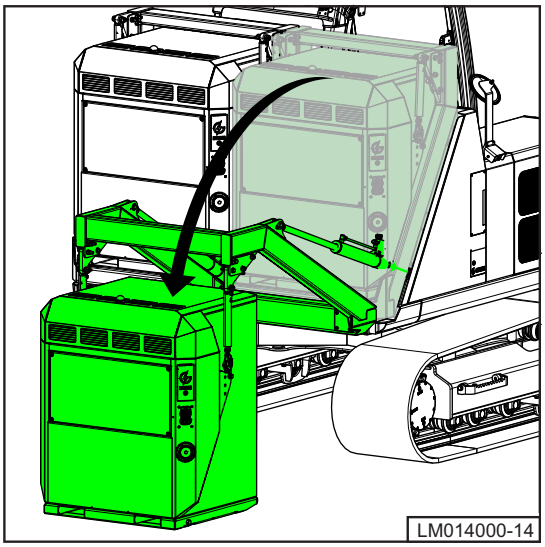


Figure 6.8 Putting the right battery pack off the machine

15 Turn the ignition key to position “0”.
16 Remove the ignition key.

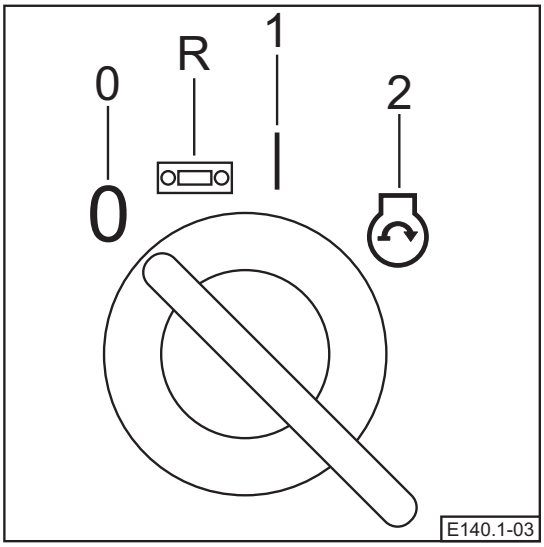


Figure 6.9 Ignition key to position “0”

NOTE
Keep the ignition key with you so no one can start the machine.

17 Set the service switch to the ‘OFF’ position:
   a Lift the cover of the service switch.
   b Put the lever of the service switch in the top position.

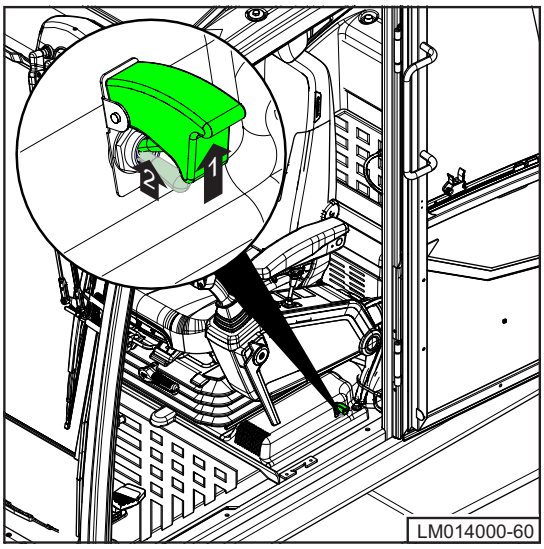


Figure 6.10 Service switch to the ‘OFF’ position

18 Open the motor cover on the right side.

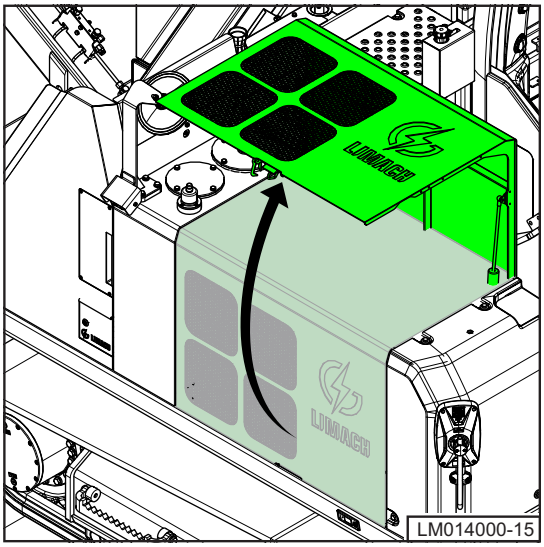


Figure 6.11 Open motor cover

19 Set the main power switch to the ‘OFF’ position.
The LED will turn off.

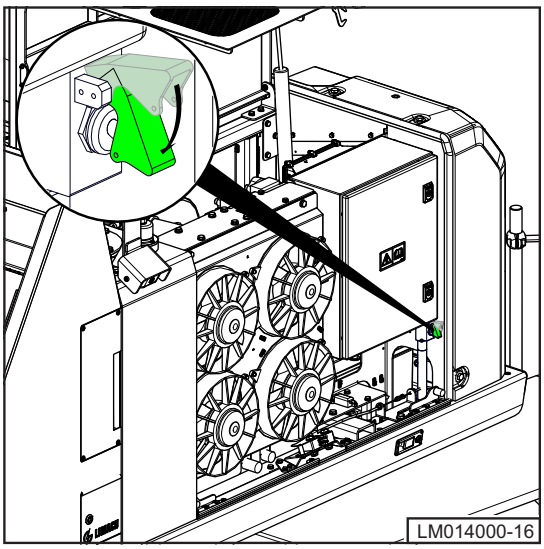


Figure 6.12 Main power switch to ‘OFF’

20 Wait 30 minutes for the capacitors in the components to discharge or use a discharge resistor.

21 Remove the eight bolts [2] and washers [3] that hold the rear hydraulic line shield [1] to the adjacent shields.

22 Remove the rear hydraulic line shield.

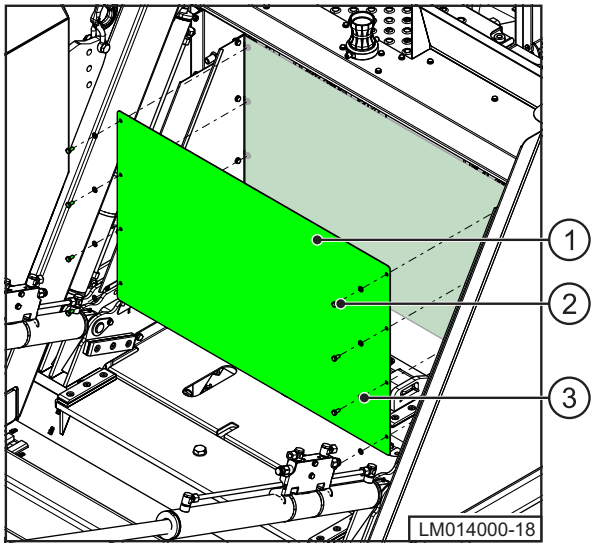


Figure 6.13 Remove rear hydraulic line shield

23 Put on the face shield and put on insulated gloves before opening the PDU box.

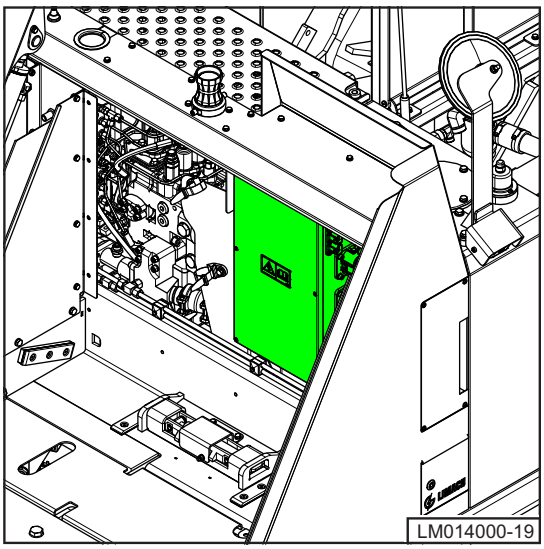


Figure 6.14 PDU box

24 Open the PDU box.

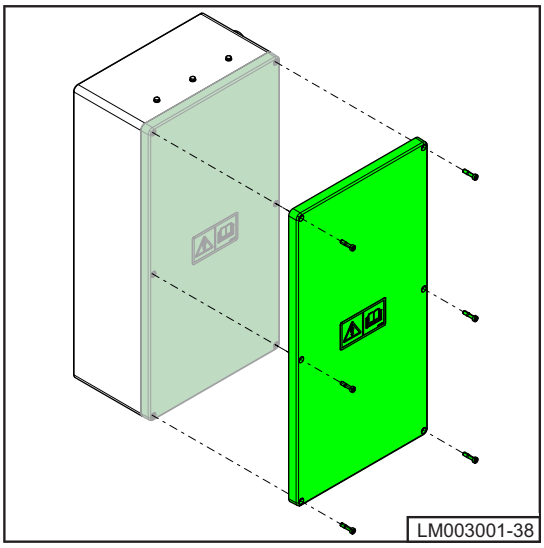


Figure 6.15 Open PDU box

Proving that the machine is de-energized

25 Make sure that the two-pole voltage tester is working:
Hold the poles of the tester together.
If the bipolar voltage tester is working it will beep.

26 Put one side of the two-pole voltage tester on the **HV+** terminal [2].

27 Put the other side of the two-pole voltage tester on the **HV-** terminal [1].

The machine is de-energized when the two-pole voltage tester reads **0 V**.

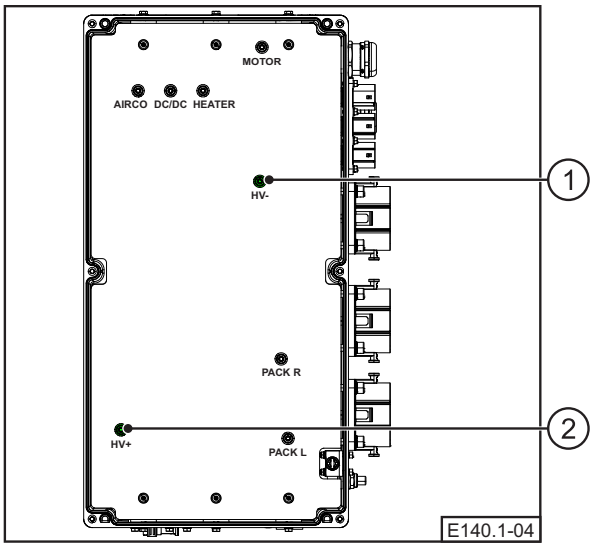


Figure 6.16 Measuring on the incoming HV+ bus bar

28 Put one side of the two-pole voltage tester on the **HV-** terminal [1].

29 Put the other side of the two-pole voltage tester on the **PACK L** terminal [2].

The machine is de-energized when the two-pole voltage tester reads **0 V**.

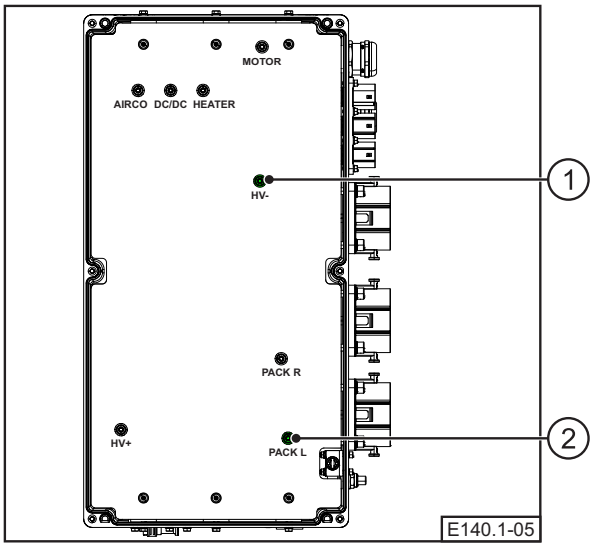


Figure 6.17 Measuring on the pack left bus bar

30 Put one side of the two-pole voltage tester on the **HV-** terminal [1].
31 Put the other side of the two-pole voltage tester on the **PACK R** terminal [2].

The machine is de-energized when the two-pole voltage tester reads **0 V**.

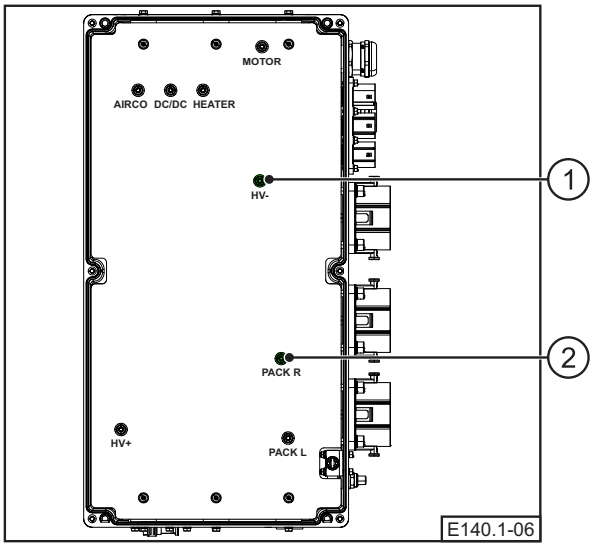


Figure 6.18 Measuring on the pack right bus bar

32 Put one side of the two-pole voltage tester on the **HV-** terminal [2].
33 Put the other side of the two-pole voltage tester on the **MOTOR** terminal [1].

The machine is de-energized when the two-pole voltage tester reads **0 V**.

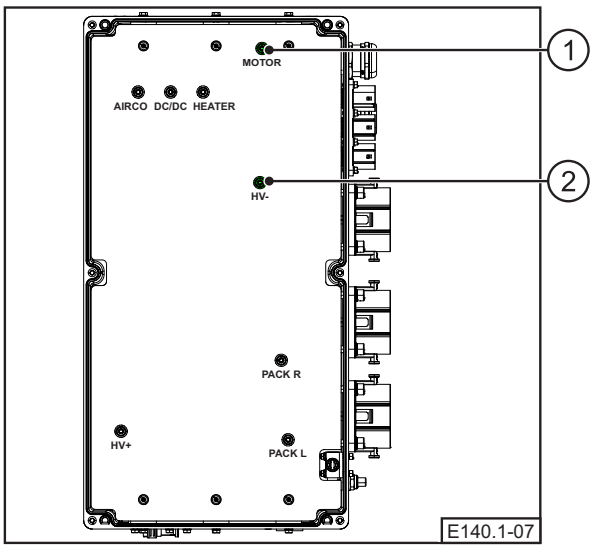


Figure 6.19 Measuring after the motor contactor

If the two-pole voltage tester shows a voltage higher than 0 V in any of the tests, the machine is not de-energized. Wait longer (or discharge the machine) and repeat steps 25 through 33.

6.1.2 Hydraulic system pressure release

Sometimes it is necessary to release pressure from the hydraulic system. For example, replacing a component on the boom.

1 Turn the ignition key to position “0”.
2 Move the safety lever up to release the hydraulic system.
3 Turn the ignition key to position “1”.
4 Move the roller switch on the joysticks from left to right.
5 Move the joysticks in all directions to release residual pressure.

6.2 SCHEDULED MAINTENANCE

6.2.1 Schedule

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 [hours]	Procedure	Information
8-10	Visual inspection	Section 6.3.1
	Seat belt check	Volvo manual
	Hydraulic oil level check	Volvo manual
	Windshield washer fluid level check	Section 6.3.2
	Tracks check	Volvo manual
	Lighting system check	Section 6.3.3
	Lubricate individual parts	Volvo manual
	Test run	Section 6.3.4
40-50	Lubricate battery swap system	Section 6.4
	Lubricate machine parts	Volvo manual
	Track tension check	Volvo manual
250	Air conditioning cleaning	Volvo manual
	Oil level check final reduction gear	Volvo manual
	Lubricate turntable bearing	Volvo manual
	Air conditioning filter cleaning	Volvo manual
	Coolant level check	Volvo manual*
500	Replace air conditioning filter	Volvo manual
	Radiators cleaning	Volvo manual*
	Lubricate turntable housing	Volvo manual
	Replace return filter hydraulic oil reservoir	Volvo manual
1000	Replace air conditioning main filter	Volvo manual
	Lubricate cabin door hinges	Volvo manual
	Replacing hydraulic oil servo filter element	Volvo manual*
	Replacing oil final reduction gear	Volvo manual
2000	Replacing hydraulic oil	Volvo manual
6000	Replacing coolant	Volvo manual*

Table 6.1 Maintenance schedule (Continued)

Time interval [hours]	Procedure	Information
When needed	Machine cleaning	Volvo manual
	Paint maintenance	Volvo manual
	Touch up paintwork damage	Volvo manual
	Replace bucket teeth	Volvo manual

* The location of the parts has changed.

6.2.2 Tools

The tools that are needed are:
- Standard tools
- Suitable lifting equipment
- Oil drain container

Other components:
- Cleaning fluid
- Grease/oil
- Loctite® 243

6.3 EXAMINATION PROCEDURES

6.3.1 Visual examination

Walk around the machine and:
- Look for visible damage, cracks and/or wear
- Look for oil or coolant leaks
- Look for loose connections
- Make sure that decals are undamaged and legible.

6.3.2 Examine windshield washer fluid level

NOTE
Add antifreeze to the windshield washer fluid if it freezes. Obey the manufacturer's recommendations applicable to the prevailing temperatures.

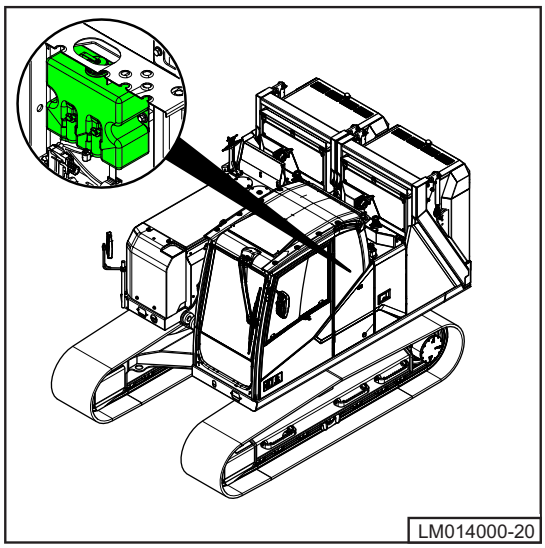


Figure 6.20 Washer fluid tank

6.3.3 Examine lighting system

- Remove any trace of dirt from the lights so that they are clearly visible on the work area.
- Make sure that the work lights are correctly installed.
- Make sure that they are lit correctly.

6.3.4 Test run

Before testing:

1 Remove all anti-corrosion agents.
2 Remove the protective caps from the cylinder rods.
3 Operate the machine until the components have normal operating temperatures.

Do these steps:

4 Operate all hydraulic functions to their final stop at all speeds.
5 Operate the swing system, swing the upper carriage at least half a turn in either direction.
6 Make sure that all instruments, control lights and other lights are working.
7 Examine functionality of controls, doors, windows, sealing plates, hatches, etc.
8 Make sure that there are no water or oil leaks. Tighten connections and fittings as necessary for inspection.
9 Make sure that all pipes and hoses run through the machine correctly and without interference.
10 Examine the operation of the Limach display.
11 Examine the operation of the wipers and washers.

6.4 LUBRICATION BATTERY SWAP SYSTEM

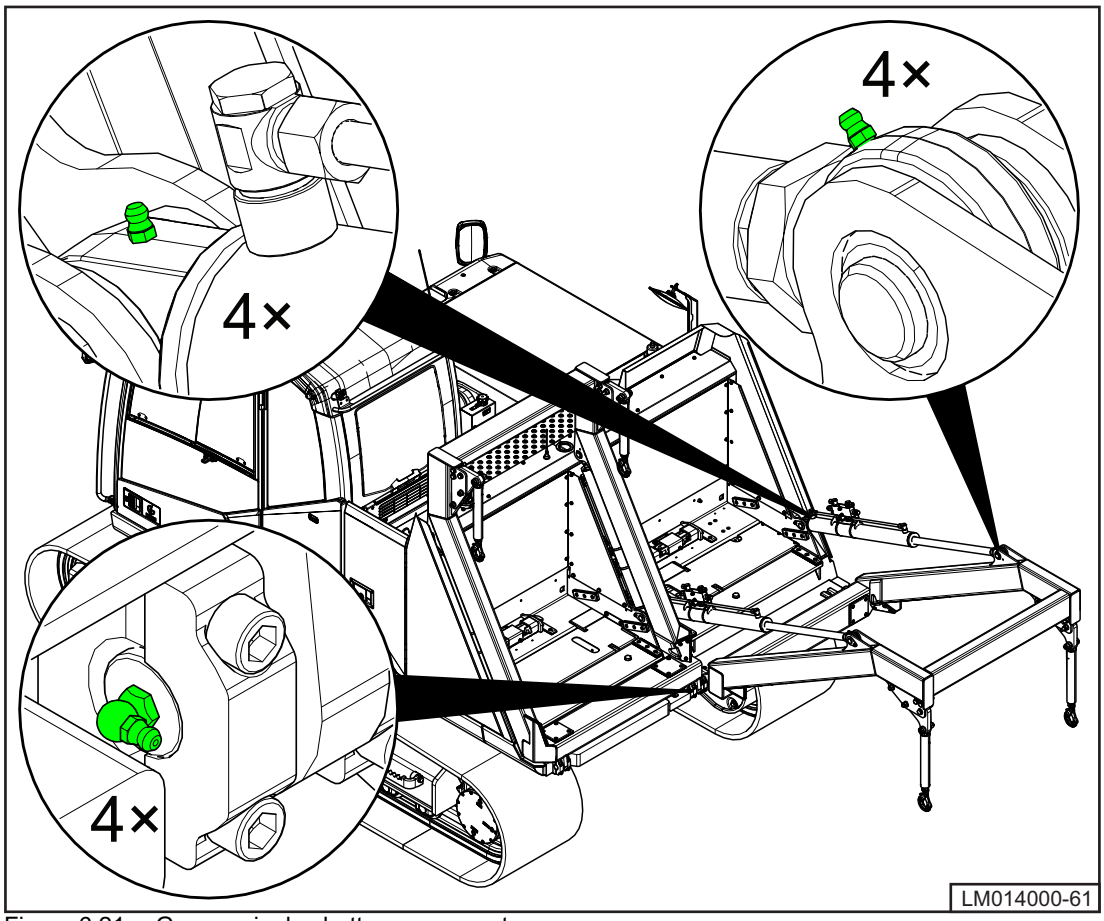


Figure 6.21 Grease nipples battery swap system

6.5 PREPARING FOR USE

1 Close the PDU box.
2 Tighten the six screws.

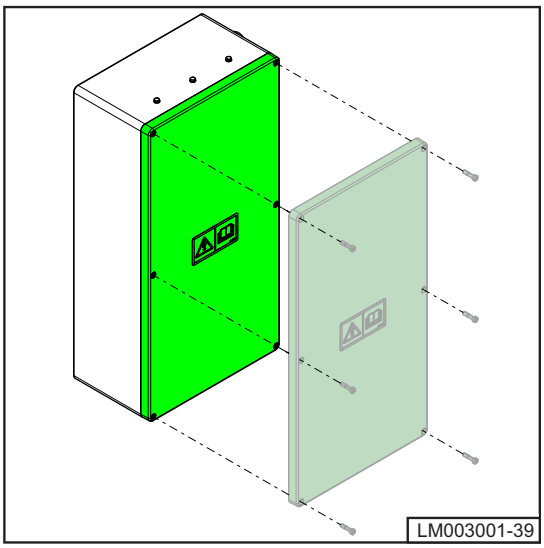


Figure 6.22 Close PDU box

3 Put the rear hydraulic line shield [1] in position against the adjacent hydraulic line shields.
4 Make sure that the bolt holes align.
5 Install eight M8×16 hexagon head bolts [2] (with M8 washers [3]).
6 Tighten the bolts.

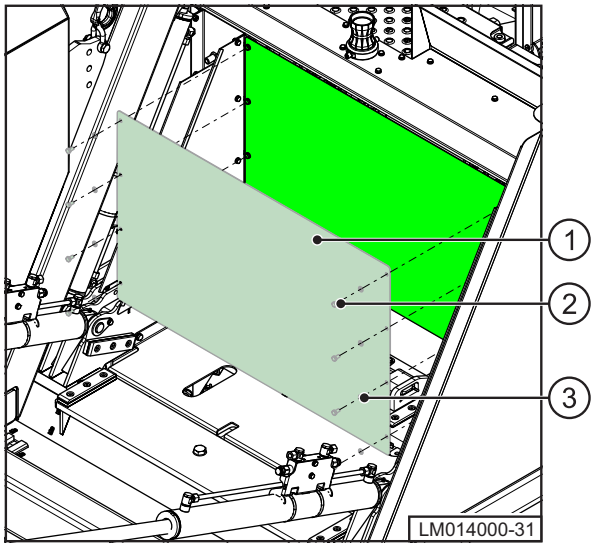


Figure 6.23 Install rear hydraulic line shield

7 Set the main power switch to the ‘ON’ position.
The LED will come on.

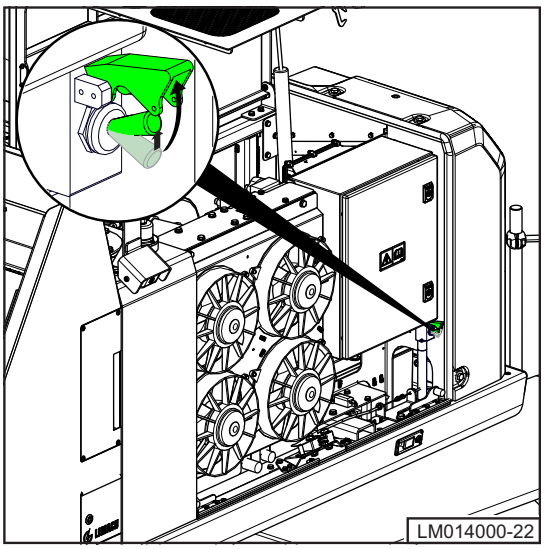


Figure 6.24 Main power switch to ‘ON’

8 Close the motor cover.

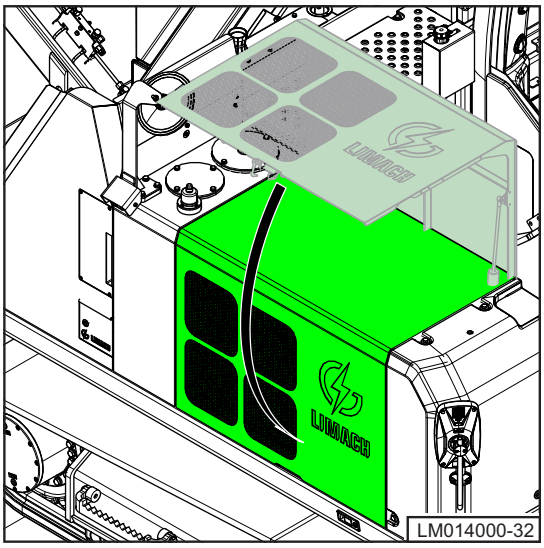


Figure 6.25 Close motor cover

9 Insert the ignition key.
10 Turn the ignition key to position “1”.

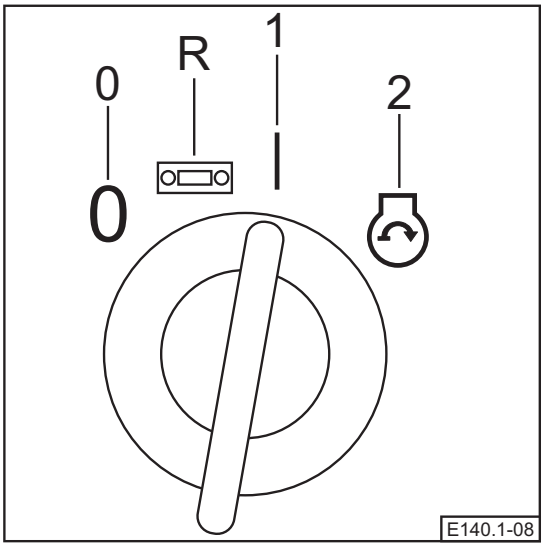


Figure 6.26 Ignition key to “1”

11 Use the battery swap system to put the right battery pack on the machine.

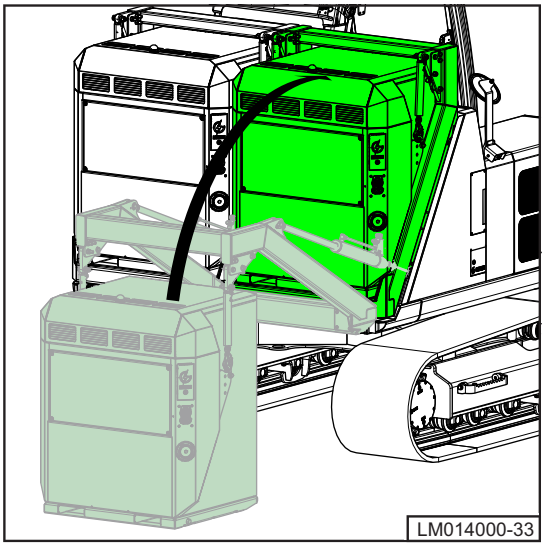


Figure 6.27 Putting the right battery pack on the machine

12 Climb onto the machine.
13 Open the power sockets on the battery packs.

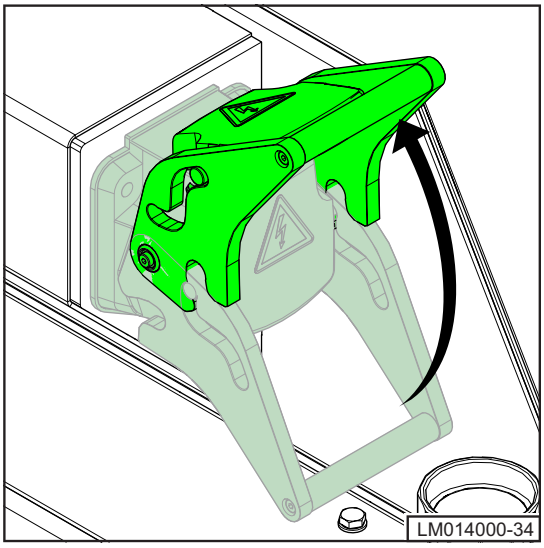


Figure 6.28 Open power socket

14 Connect the round black plugs to the battery packs.

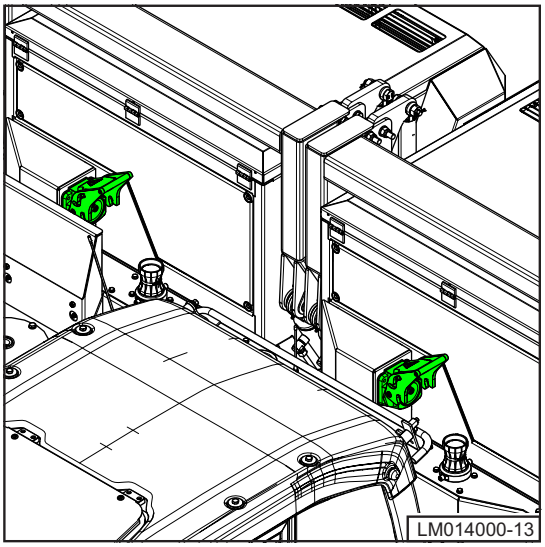


Figure 6.29 Sockets on the battery packs

15 Open the door on the battery pack.

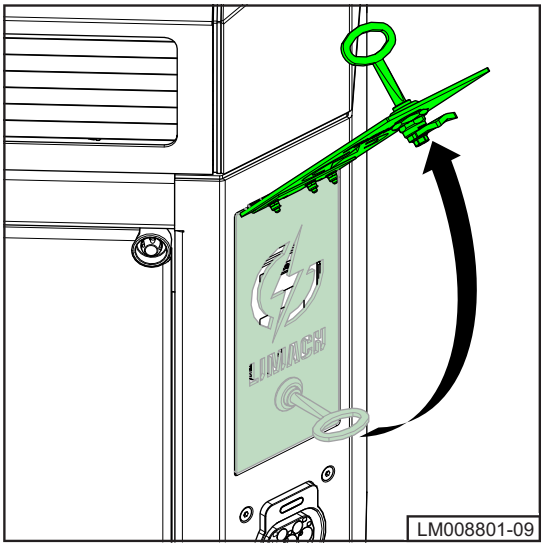


Figure 6.30 Open battery pack door

16 Install the MSD.
17 Turn the lever of the MSD down.

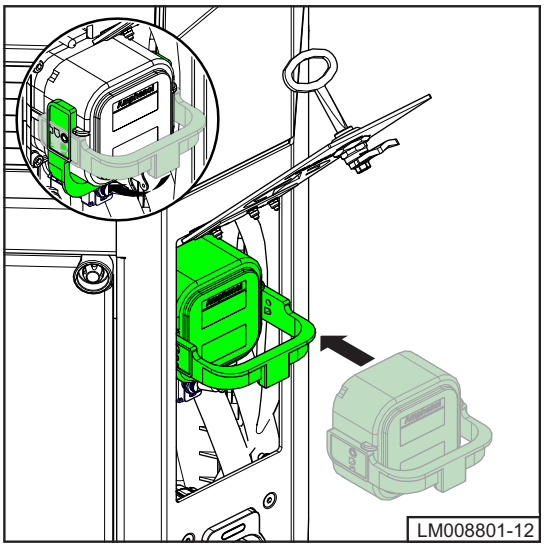


Figure 6.31 Putting MSD in the battery pack

18 Put the battery pack main power switch to the ‘ON’ position.

The LED blinks green.

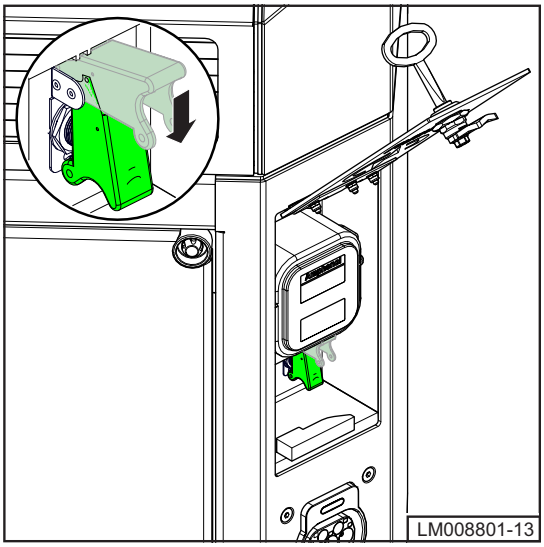


Figure 6.32 Battery pack main power switch to ‘ON’

19 Close the door of the battery pack.

20 Repeat steps 15 to 19 for the second battery pack (if applicable).

21 Set the service switch to the ‘ON’ position.

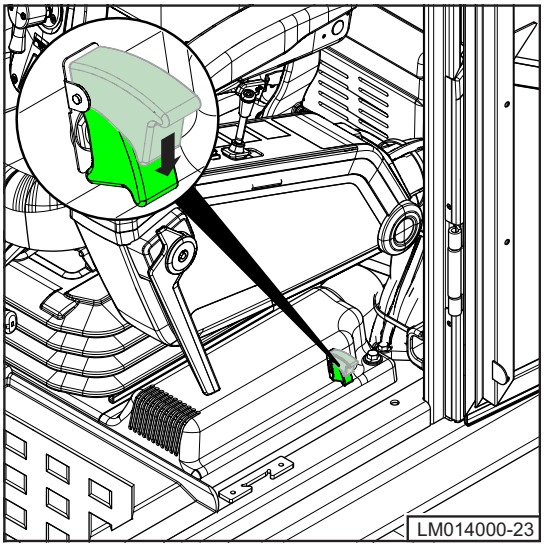


Figure 6.33 Service switch to the ‘ON’ position

7 SCRAPPING

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

8 TROUBLESHOOTING

Use table 8.1, *'Troubleshooting'* as an aid to fault diagnosis.

Table 8.1 Troubleshooting

Problem	Possible cause	Solution
Air conditioning does not function	Battery pack main power switch is set to 'OFF'	Set battery pack main power switch to 'ON'.
	Ignition key is not set to "1"	Set ignition key to "1".
	Main power switch is set to 'OFF'	Set main power switch to 'ON'.
	Safety lever is down	Pull up the safety lever.
	Service switch is set to 'OFF'	Set service switch to 'ON'.
Battery is locked and unlocked on battery swap system remote control	Locking sensors are incorrectly adjusted	Readjust the locking sensors.
Battery pack cannot be lifted and lowered	Battery pack is locked	Unlock the battery pack.
	Battery pack is still connected to the machine	Disconnect the battery pack from the machine.
Battery pack is not working	Battery pack had an remote update	1 Set battery pack main power switch to 'OFF'. 2 Set battery pack main power switch to 'ON'.
Battery packs do not charge	Battery pack main power switch is set to 'OFF'	Set battery pack main power switch to 'ON'.
	Battery packs are fully charged (green LEDs continuously)	–
	Ignition key is not set to "0" (green LEDs blinking)	Set ignition key to "0".
	Main power switch is set to 'OFF'	Set main power switch to 'ON'.
Battery swap system does not function	24 V battery empty	Charge 24 V battery.
	Ignition key is not set to "1"	Set ignition key to "1".
Charging plug does not disconnect and display is off	–	1 Set ignition key to "1". 2 On the Limach display, push the button above the charging icon.
	–	1 Set ignition key to "1" 2 Set main power switch to 'OFF'. 3 Wait until the LED is off 4 Set main power switch to 'ON'.

Table 8.1 Troubleshooting (Continued)

Problem	Possible cause	Solution
Machine does not function on full capacity	One of the battery packs is not locked	Lock the second battery pack.
	Only one battery pack is on the machine	Put the second battery pack on the machine.
Parking heater does not function	Battery packs are charging	Stop charging the battery packs.
	Ignition key is not set to “0”	Set ignition key to “0”.
	Main power switch is set to ‘OFF’	Set main power switch to ‘ON’.
	SOC is below 5%	Charge battery pack(s).
Remote control does not charge	The cigarette lighter plug of the charger is not connected	Connect the cigarette lighter plug.

APPENDIX A TECHNICAL SPECIFICATIONS

A.1 GENERAL

Table A.1 General specifications

Magnitude	Quantity	Unit
Weight (single boom and normal tacks)	15700	kg
Height	4010	mm
Length	2950	mm
Width	3045	mm
Max lifting capacity	2200	kg

A.2 ELECTRICAL SYSTEM

Table A.2 Electrical system specifications

Magnitude	Quantity	Unit
Nominal voltage	540	V
Max motor power	157	kWh
Max electrical power	139.44	kWh
Max hydraulic power	85.73	kWh
Nominal motor power at max speed (2000 rpm)	86	kWh
Nominal motor power according to graph	106	kWh
Nominal motor power according to table	82	kWh
Nominal Power on type plate and CE declaration	110	kWh
DC charging max power	90	kW

A.3 BATTERY PACK

Table A.3 Battery pack specifications

Magnitude	Quantity	Unit
Gross capacity	189.6	kWh
Nominal voltage	537.6	V
Min voltage	475.2	V
Max voltage	626.4	V
Nominal current*	177	A

Table A.3 Battery pack specifications (Continued)

Magnitude	Quantity	Unit
Peak current*	354	A
DC charging	up to 90	kW
AC charging	230 V up to 6.6 kW	–

* @50% SoC, 25°C

A.4 THROTTLE POSITION

Table A.4 Throttle position specifications

Position	Normal	ECO	Unit
P	2000	2000	rpm
H	1900	1805	rpm
G1	1800	1710	rpm
G2	1700	1615	rpm
G3	1600	1520	rpm
G4	1550	1425	rpm
F1	1500	1400	rpm
F2	1300	1300	rpm
I1	1100	1100	rpm
I2	950	950	rpm

APPENDIX B ERROR CODES

Table B.1 Error codes

Severity	Code	Display text	Description
Warning	1.0.1	Powerpack empty	Battery pack seems to be empty. Battery pack indicates that no current may be drawn from the pack.
Info	1.0.2	Powerpack low SoC	State-of-charge of the active battery pack has passed the info threshold (default < 15%)
Warning	1.0.3	Powerpack low SoC	State-of-charge of the active battery pack has passed the warning threshold (default < 5%)
Warning	1.0.6	Motor derated	Motor RPM is limited due to incorrect locking of one of the battery packs.
Error	1.0.7	Pack L not locked	Left battery pack is not locked.
Error	1.0.8	Pack R not locked	Right battery pack is not locked.
Warning	1.0.17	Motor derated	Motor RPM is limited due to high oil temperature.
Warning	1.0.9	Fan 1 IO error	Internal error. Contact dealer.
Warning	1.0.10	Fan 1 IO error	Internal error. Contact dealer.
Warning	1.0.11	Fan 1 IO error	Internal error. Contact dealer.
Warning	1.0.12	Fan 1 IO error	Internal error. Contact dealer.
Warning	1.0.13	24V battery low	24V battery is low. Make sure that a battery pack is present, connected and correctly locked.
Error	1.0.15	PDU interlock	Check all HV connectors on machine PDU. Contact dealer.
Error	1.0.16	External interlock	HV Interlock loop error. Contact dealer.
Info	1.0.18	Release safety lever	Deactivate the safety lockout lever once to be able to run the motor again.
Warning	1.0.19	Left pack missing	Left battery pack not detected.
Warning	1.0.20	Right pack missing	Right battery pack not detected.
Error	1.0.21	DC Motor overheated	Swapping system motor is overheated. Let motor cool down.
Warning	1.0.22	No active powerpack	There is currently no battery pack selected. Make sure that a battery pack is connected, locked and selected in the battery overview in the Limach display.
Error	1.0.23	Powerpack empty	Battery pack is empty (state-of-charge is 0%). Charge battery pack or switch to other battery pack.
Error	1.0.24	Chargeplug present	Charge plug is inserted in machine while contact is on. To charge, turn contact switch off.
Info	1.0.25	[L] Check locking	Locking sensor inconsistency. Check locking sensors of left battery pack.
Info	1.0.26	[R] Check locking	Locking sensor inconsistency. Check locking sensors of right battery pack.
Info	1.0.28	Battery swap active	Informational message that swapping system is active and machine cannot be operated normally.
Info	1.0.29	Limp home active	Informational message that limp home function is activated. Machine operation is limited. Turning off and on the contact switch deactivates limp home.
Error	2.0.1	Double HV connection	Internal error. Contact dealer.
Error	2.0.2	No powerpacks	No battery pack to activate. Check battery pack connections.
Warning	2.0.10	PP switching blocked	Machine contactors welded. Contact dealer.

Table B.1 Error codes (Continued)

Severity	Code	Display text	Description
Warning	2.0.11	Two weld pins conn.	Machine contactors welded. Contact dealer.
Warning	3.1.1	[L] CAN comm down	
Warning	3.1.2	[L] not reacting	
Warning	3.1.3	[L] No powerpack	
Warning	3.1.5	[L] not locked	
Warning	3.1.6	[L] weld pin io error	
Warning	3.1.7	[L] Welded contactor	
Warning	3.1.8	[L] Mach. time out	
Error	3.1.10	[L] Disconnect powerpack!	
Error	3.1.11	[L] Forcefully disconnect	
Warning	3.1.20	[L] Heater no comm	
Warning	3.1.21	[L] Gas sensor no comm	
Warning	3.1.22	[L] Charge cont. welded	
Warning	3.1.23	[L] Main cont. welded	
Warning	3.1.24	[L] replace light arrester	
Warning	3.1.25	[L] isolation fault	
Warning	3.1.26	[L] temp sensor fail	
Warning	3.1.27	[L] 12V battery low	
Error	3.1.60	[L] No comm battery	
Error	3.1.61	[L] No comm heatpump	
Error	3.1.62	[L] No comm isolation	
Error	3.1.63	[L] No comm obc	
Error	3.1.64	[L] HVIL loop broken	
Error	3.1.65	[L] Coolant res low left	
Error	3.1.66	[L] Coolant res low right	
Error	3.1.67	[L] Charge cont welded	
Error	3.1.68	[L] Main cont welded	
Warning	3.3.1	[R] CAN comm down	"
Warning	3.3.2	[R] not reacting	
Warning	3.3.3	[R] No powerpack	
Warning	3.3.5	[R] not locked	
Warning	3.3.6	[R] weld pin io error	
Warning	3.3.7	[R] Welded contactor	
Warning	3.3.8	[R] Mach. time out	
Error	3.3.10	[R] Disconnect powerpack!	
Error	3.3.11	[R] Forcefull disconnect	
Warning	3.3.20	[R] Heater no comm	
Warning	3.3.21	[R] Gas sensor no comm	

Table B.1 Error codes (Continued)

Severity	Code	Display text	Description
Warning	3.3.22	[R] Charge cont. welded	
Warning	3.3.23	[R] Main cont. welded	
Warning	3.3.24	[R] replace light arrester	
Warning	3.3.25	[R] isolation fault	
Warning	3.3.26	[R] temp sensor fail	
Warning	3.3.27	[R] 12V battery low	
Error	3.3.60	[R] No comm battery	
Error	3.3.61	[R] No comm heatpump	
Error	3.3.62	[R] No comm isolation	
Error	3.3.63	[R] No comm obc	
Error	3.3.64	[R] HVIL loop broken	
Error	3.3.65	[R] Coolant res low left	
Error	3.3.66	[R] Coolant res low right	
Error	3.3.67	[R] Charge cont welded	
Error	3.3.68	[R] Main cont welded	
Error	4.0.1	Chg contactor + error	Charge contactor coil error.
Error	4.0.2	Chg contactor - error	Charge contactor coil error.
Error	4.0.3	Chg contactor welded	Charge contactor welded.
Error	4.0.4	Chg contactor welded	Charge contactor welded.
Error	4.0.5	Chg contactor + TO	Charge contactor - timeout.
Error	4.0.6	Chg contactor - TO	Charge contactor - timeout.
Error	5.3.1	Oil temp sensor	Oil temperature sensor data missing.
Info	5.3.2	Oil temp high, check fan	Oil temperature passed the warning threshold (default 60°C)
Error	5.3.3	Oil temp critical	Oil temperature passed the critical threshold (default 80°C). Machine operation limited.
Error	5.4.1	Coolant sensor [IN]	Coolant temperature sensor connection error. Radiator inlet.
Warning	5.4.2	Coolant temp high [IN]	Coolant temperature radiator inlet passed warning threshold.
Error	5.5.1	Coolant sensor [OUT]	Coolant temperature sensor connection error. Radiator outlet.
Warning	5.5.2	Coolant temp high [OUT]	Coolant temperature radiator outlet passed warning threshold.
Warning	5.6.1	Oil sensor [IN]	Oil temperature sensor connection error. Radiator inlet.
Error	6.3.1	MC Comm. loss	Motor(controller) fault.
Error	6.3.2	MC Torque over limit	Motor(controller) fault.
Error	6.3.3	MC HVIL error	Motor(controller) fault.
Error	6.3.4	MC Active discharge error	Motor(controller) fault.
Error	6.3.5	MC Motor temp sensor	Motor(controller) fault.
Error	6.3.6	MC Controller temp sensor	Motor(controller) fault.
Error	6.3.9	MC Motor temp	Motor(controller) fault.
Error	6.3.10	MC Controller temp	Motor(controller) fault.
Error	6.3.11	MC HV Overvoltage	Motor(controller) fault.

Table B.1 Error codes (Continued)

Severity	Code	Display text	Description
Error	6.3.12	MC HV Undervoltage	Motor(controller) fault.
Error	6.3.13	MC Overcurrent	Motor(controller) fault.
Error	6.3.14	MC Overload	Motor(controller) fault.
Error	6.3.17	MC LV Undervoltage	Motor(controller) fault.
Error	6.3.18	MC IGBT fault	Motor(controller) fault.
Error	6.3.19	MC Resolver fault	Motor(controller) fault.
Error	6.3.20	MC Current sensor fault	Motor(controller) fault.
Error	6.3.21	MC DC Sensor fault	Motor(controller) fault.
Error	6.3.22	MC VCU Comm break	Motor(controller) fault.
Error	6.3.23	MC Motor overspeed	Motor(controller) fault.
Error	6.3.24	MC Phase lost	Motor(controller) fault.
Error	6.3.25	MC Motor overtemp	Motor(controller) fault.
Error	6.3.26	MC Controller overtemp	Motor(controller) fault.
Error	6.3.27	MC HV Overvoltage	Motor(controller) fault.
Error	6.3.28	MC HV Undervoltage	Motor(controller) fault.
Error	6.3.29	MC Phase overcurrent	Motor(controller) fault.
Error	6.3.30	MC Motor overload	Motor(controller) fault.
Error	6.3.33	MC not responding	Motor(controller) fault.
Error	6.3.34	MC Ignition error	Motor(controller) fault.
Error	6.3.35	MC Power error	Motor(controller) fault.
Warning	9.1.1	CC HVAC Volvo	CAN connection to Volvo system interrupted.
Info	9.2.1	No airco selected	Configuration error.
Info	9.2.2	Airco not responding	No CAN data from air-conditioning.
Error	9.2.3	Airco shutdown	Airco was unexpectedly turned off.
Error	9.2.4	Airco is in error	Airco reports an error state.
Warning	9.3.1	Heater not responding	Heater CAN connection error.
Warning	9.3.2	Heater Temporary locked	Heater locked due to fault.
Warning	9.3.3	Heater HV Undervoltage	Heater high voltage level is too low.
Warning	9.3.4	Heater HV Overvoltage	Heater high voltage level is too high.
Warning	9.4.5	Heater LV Undervoltage	Heater low voltage level is too low.
Warning	9.3.6	Heater LV Overvoltage	Heater low voltage level is too high.
Warning	9.3.7	Heater core overheating	Heater hardware is overheated.
Warning	9.3.8	Heater coolant overheating	Heater coolant temperature too high.
Error	9.3.9	Heater permanently locked	Heater not functional.
Error	10.0.1	DC/DC IO error PWR	Connection to DC/DC converter broken.
Error	10.0.2	DC/DC IO error UNIT	Connection to DC/DC converter broken.
Error	10.0.3	DC/DC Not responding	No CAN communication with DC/DC converter.

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

INDEX

M

P

S

T