

ABB SOLAR INVERTERS

PVS800-57B central inverters

Commissioning and maintenance manual



List of related manuals

Hardware manuals and guides

PVS800-57B central inverters hardware manual

Code (English)

[3AXD50000048300](#)

PVS800-57B central inverters commissioning and maintenance manual

[3AXD50000048331](#)

Firmware manuals and guides

PVS800-57B central inverters firmware manual

[3AXD50000048332](#)

Option manuals and guides

ACx-AP-x assistant control panels user's manual

[3AUA0000085685](#)

BCU-02/12/22 control units hardware manual

[3AUA0000113605](#)

Drive composer start-up and maintenance PC tool user's manual

[3AUA0000094606](#)

FENA-01/-11/-21 Ethernet adapter module user's manual

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FSCA-01 RS-485 adapter module user's manual

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Commissioning and maintenance manual

PVS800-57B central inverters






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1

Safety instructions



Contents of this chapter

This chapter contains the safety instructions which you must obey when you install and operate the inverter and do maintenance on the inverter. Obey these safety instructions to prevent injury or death, or damage to the equipment.

Use of warnings

Warnings tell you about conditions which can cause injury or death, or damage to the equipment. They also tell you how to prevent the danger.

The manual uses these warning symbols:

	Electricity warning – Electrical hazards which can cause injury or death, or damage to the equipment.
	General warning – Conditions, other than those caused by electricity, which can cause injury or death, or damage to the equipment.
	Electrostatic sensitive devices warning – Risk of electrostatic discharge which can cause damage to the equipment.
	Hearing loss warning – Risk of hearing loss due to high volumes. Use hearing protection.

Installation and maintenance safety

■ Electrical safety

These warnings are for all personnel who work on the inverter, its input and output cables, the transformer or photovoltaic generator.



WARNING! Obey these instructions to prevent injury or death, or damage to the equipment.

- **If you are not a qualified electrician, do not do electrical installation or maintenance work.**
- Obey all installation safety standards. This can require, among other things, the use of personal protection equipment (PPE), such as arc-proof clothing, arc-proof masks, protective footwear, protective gloves, eye protection and hearing protection. High power inverter installations have high fault currents. Select appropriate arc-proof clothing (for example, in the US, a rating of 40 cal/cm² is required).
- Standard IEC/EN 62109-2 (section 4.8.3.6) requires that, as the inverter is not provided with full protection against shock hazards on the photovoltaic array, you install and use the inverter in a closed electrical operating area. There is no RCD protection inside the inverter.
- Do not do work on the photovoltaic generator, or the inverter, or its input or output cables, when the inverter is connected to an electrical power system or to the photovoltaic generator. Voltage may be present when the panels are exposed to light.
- Before you do work in the inverter cabinet, isolate the AC line cables and busbars from the electrical power system with the disconnecter of the power system transformer. Also, isolate the inverter from the photovoltaic generator with the safety switch of the generator or by other means. The optional AC disconnecter or optional breaker do not isolate the AC output cables and terminals of the inverter from the electrical power system. The optional DC disconnecter does not isolate the DC input fuses, cables or terminals from the DC voltage supplied by the photovoltaic generator. There are service access areas that remain energized during service, but sufficient guards are provided for indirect contact.
- There are more than one live circuits. Refer to the single line diagram.
- Before you do work in the inverter cabinet, turn off or isolate the auxiliary voltage supply from the inverter.
- The inverter auxiliary power can be supplied from an external source (standard) or from internal auxiliary power transformers. Make sure that auxiliary power is disconnected.
- Do not operate the inverter with the doors open, even in fault tracking conditions. The inverter doors act as arc hazard protection. If a highly unlikely arc flash incident happens when the inverter doors are open, even the arc-flash proof protection equipment might not provide sufficient protection.
- Before you do work on the inverter, apply a temporary grounding for work (AC and DC side).
- Do not work on the control cables when power is applied to the inverter or to the external control circuits. Externally supplied control circuits can cause dangerous voltages in the inverter even when the main power on the inverter is off.
- Live parts in the inverter cabinet are protected against direct contact when all protective plastic covers and metallic shrouds are in place.

- Do not do insulation or voltage withstand tests on the inverter or inverter modules.
- The installation must be done according to the local requirements (for example, ANSI/NFPA 70, Canadian Electrical Code, and so on).
- Utility interconnection may require approval from the authority with local jurisdiction.

Note: With DC side functional grounding (negative as standard, positive functional grounding optional), one of the poles of the photovoltaic generator is grounded, and therefore, the other pole has full voltage against ground (up to 1000 V).

Grounding

These instructions are for all personnel who are responsible for the grounding of the inverter.



WARNING! Obey these instructions to prevent injury or death, damage to the equipment and electromagnetic interference.

- Only qualified electricians are permitted to do grounding work.
- Always ground the inverter and adjoining equipment. Correct grounding also decreases electromagnetic emissions and interference. Follow the site's policy on disconnecting the inverter from AC and DC.
- The minimum cross section of the grounding conductor must be at least half of the cross section of the line conductor or fulfill the local regulations. Refer to standard IEC 60364-5-54.
- In a multiple-inverter installation, connect each inverter separately to the protective earth (PE) busbar of the switch board or the transformer.
- Avoid grounding loops and keep grounding cables at least 0.5 m (20 in) away from the AC cables, as current can be generated to a grounding loop by the electromagnetic coupling from the supply cables.
- When you use shielded AC power cables, connect the cable shields to the protective earth (PE) to meet safety regulations.
- External EMC filters are not permitted at the AC output of the inverter.
- Do not install the inverter on a TN (grounded) system.

Note:

- You can use power cable shields as grounding conductors only if their conductivity is sufficient.
- The normal touch current of the inverter can be more than 3.5 mA AC or 10 mA DC. Use a fixed protective earth connection. Refer to standard IEC/EN 62109, 5.2.5.

Electric welding



WARNING! Do not fasten the cabinet by electric welding and do not do any welding work on the inverter housing when inverters are installed. The welding circuit can cause damage to electronic circuits in the cabinet. It can also cause damage to the doors or the cabinet itself. ABB does not assume any liability for damages caused by electric welding.



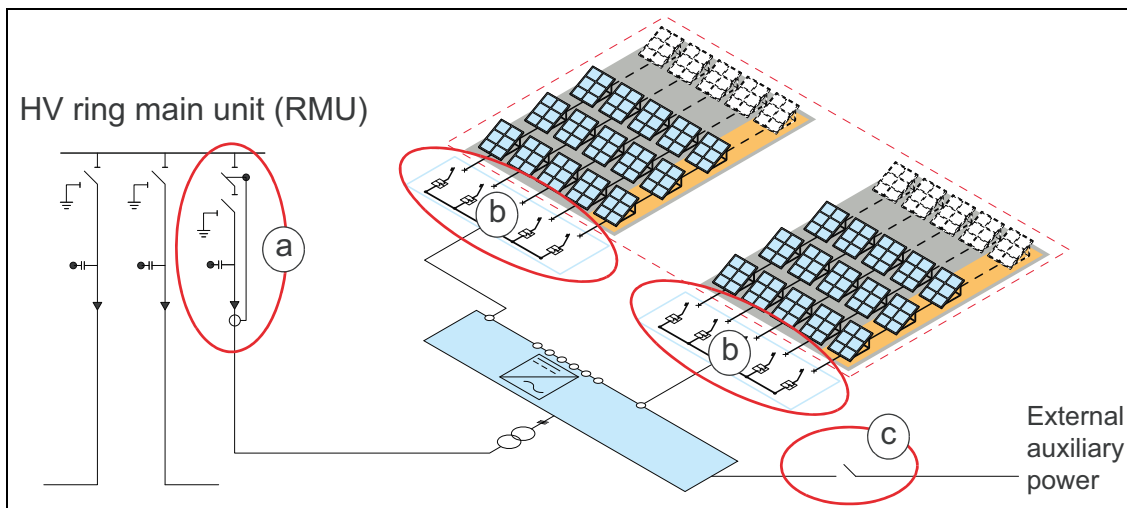
■ Electrical safety precautions

These precautions are for all personnel who work on the inverter, its input and output cables, the transformer or the photovoltaic modules.

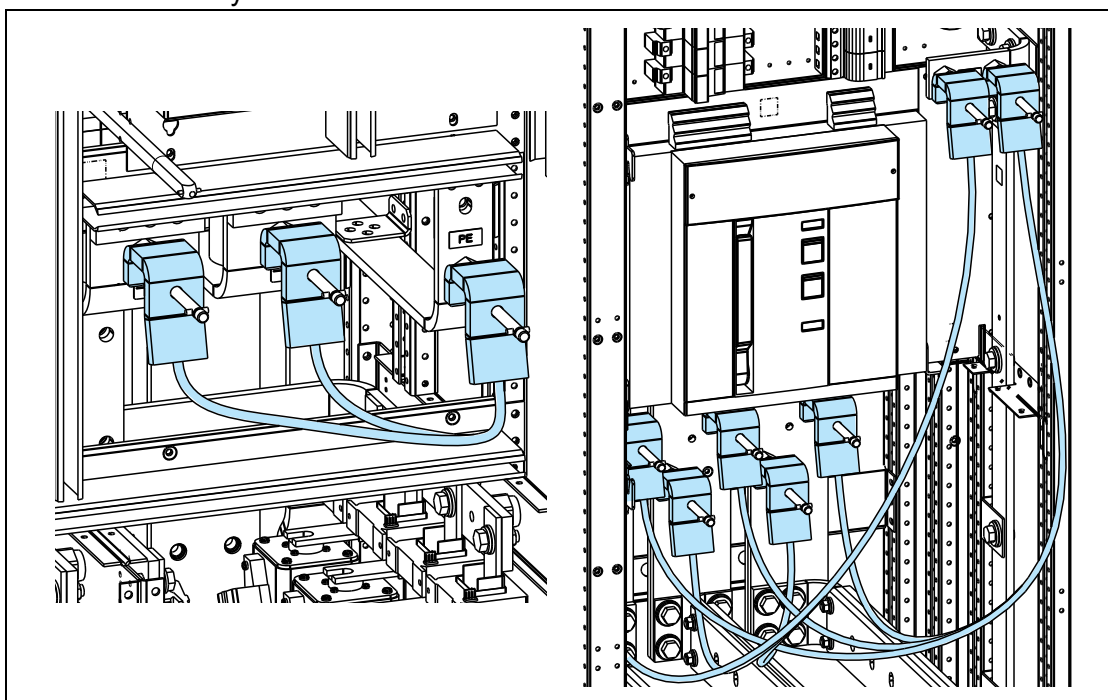


WARNING! Obey these instructions to prevent injury or death, or damage to the equipment. You must be a qualified electrician to do installation and maintenance work. Review these steps before you do installation or maintenance work on the inverter.

1. Prepare for the work. Make sure that you have a work order. Select the applicable personal protective equipment.
2. Clearly identify the work location and equipment. Make sure that there is an escape route available in case of an emergency.
3. Disconnect all power sources and secure against reconnection. (Not all disconnectors provide sufficient isolation against voltage surges.)
 - Disconnect the inverter from the AC supply (normally a disconnect or a breaker on the HV side of the main transformer), because the optional AC disconnect or breaker of the inverter do not remove the voltage from the AC output busbars of the inverter (a).
 - Disconnect the inverter from the DC power supply (usually the DC switches of the solar array junction boxes or the DC combiner box), because the optional DC disconnect does not remove the voltage from the inverter input DC busbars or fuses (b).
 - Disconnect the possible UPS or other auxiliary external power supplies (c).
 - Make sure that reconnection is not possible. Lock all of the disconnectors in the open position and attach a warning notice to them (lockout-tagout).
 - After you disconnect the inverter, wait for at least 5 minutes to let the capacitors discharge before you continue.



4. Make sure that there is no voltage present.
 - Use a voltage detector with nominal voltage of 1000 V DC and minimum withstand voltage of 2000 V DC (in rare fault cases the voltage on the DC terminal can be two times the system voltage). The detector must have a self-testing feature to ensure that it works correctly. Notice the weather conditions of the site when you do the measurements: do not measure in wet conditions. Do not use a multimeter.
 - Make sure that the voltage between the inverter AC output terminals (L1, L2, L3) and the grounding (PE) busbar is close to 0 V. Measure every phase-to-phase and phase-to-ground voltage (L1-L2, L1-L3, L2-L3, L1-GND, L2-GND and L3-GND).
 - Make sure that the voltage between the inverter power module UDC+ and UDC- terminals and the grounding (PE) busbar is close to 0 V.
 - Make sure that the voltage between the DC input terminals DC+ and DC- and the grounding (PE) busbar is close to 0 V.
5. Install temporary grounding. Connect the AC and DC busbars to the PE with a temporary grounding tool. Temporary grounding must withstand the available short circuit current of the AC or DC supply. One temporary grounding device may not be enough on the AC side. 25 mm ball grounding terminals are provided in some cases. The temporary grounding cables must be dimensioned to withstand the prospective current of the system until the upstream protection device clears the fault current. The temporary grounding cables should be tied tightly to the busbars or the frame unit as the forces of the short circuit current can cause the temporary grounding cables to move hazardously.



6. Protect any other energized parts in the work location against contact. Take special precautions when you work near bare conductors.
7. Ask the person in charge of work for a permit to work. After you finish the work, make sure that the inverter is clean from inside and that all the tools have been removed from inside the inverter, remove the temporary grounding and inform the person responsible that the work is complete. After you make sure that the voltage can be connected, close all the doors of the inverter, and close the disconnectors. When connecting voltage back on, do not stand right next to the inverter. Also make sure that there is an escape route available in case of an emergency.

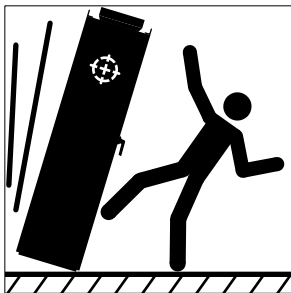
General safety

These instructions are for all personnel who do work on the inverter.



WARNING! Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

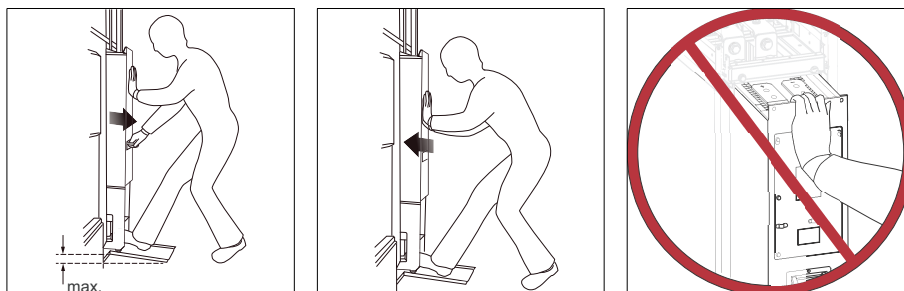
- Keep the inverter in its package until you install it. After unpacking, protect the inverter from dust, debris and moisture.
- Use the required personal protective equipment: safety shoes with metal toe cap, safety glasses, protective gloves, etc.
- Lift the cabinet with a lifting device. Use the designated lifting points.
- The lifting beams attached to the cabinet are heavy. Be careful when removing or installing the beams. Whenever possible, use a lifting device attached to the designated lifting points.
- Secure the inverter cabinet to the floor to prevent it from toppling over. The cabinet has a high center of gravity. When you pull out heavy components or power modules, there is a risk of overturning. Secure the cabinet also to the wall when necessary.



- Do not stand or walk on the cabinet roof. Make sure that nothing presses against the roof, side or back plates or door. Do not store anything on the roof while the inverter is in operation.
- Make sure that the debris from the installation work does not go into the inverter. Electrically conductive debris in the unit can cause damage.
- Be careful of the cooling fan blades. The fans can operate for a few seconds after you disconnect the electrical supply. Do not stick fingers or other objects into the fans.
- Be careful of hot surfaces. Some parts in the inverter cabinet, such as the heat exchangers are hot after you disconnect the electrical supply.
- Be careful when handling an inverter module. The module overturns easily because it is heavy and has a high center of gravity. Whenever possible, secure the module with chains. Do not tilt the module. Do not leave an unsupported module unattended, especially on a sloping floor.



- Do not use the module extraction/installation ramp with plinth heights that exceed the maximum permitted height.
- Secure the module extraction/installation ramp carefully.
- Push the module into the cabinet and pull it from the cabinet carefully preferably with help from another person. Keep a constant pressure with one foot on the base of the module to prevent the module from falling on its back. Keep your fingers away from the edges of the front flange of the module.



- Do not open the doors of the inverter when water, sand or dust can blow into the unit. Water, sand or dust in the inverter can cause damage in the unit.

Printed circuit boards



WARNING! Use a grounding wristband when you handle the printed circuit boards. Do not touch the boards unnecessarily. The boards have components that are sensitive to electrostatic discharge.



Fiber optic cables



WARNING! Obey these instructions to prevent injury or death, or damage to the equipment.

- Handle the fiber optic cables with care.
- When you disconnect the cables, hold the connector, not the cable.
- Do not touch the ends of the fibers with bare hands as the ends are extremely sensitive to dirt.
- Do not bend the fiber optic cables too tightly. The minimum permitted bend radius is 35 mm (1.4 in.).

Safe start-up and operation

These warnings are for all personnel who commission, plan the operation or operate the inverter.



WARNING! Obey these instructions to prevent injury or death, or damage to the equipment.

- Keep all doors of the inverter closed during operation. It is good safety practice to keep inverter and inverter housing doors locked to prevent unauthorized access. Give the keys only to authorized personnel.
- Before you start the inverter, close the optional AC and DC disconnectors, auxiliary power main switch +AC-Q30 and connect possible external auxiliary power sources.
- During operation, do not open the AC or DC disconnectors.
- Before you adjust the inverter and put it into service, make sure that all of the equipment is suitable for operation.
- The maximum permitted number of power-ups by applying power is five in ten minutes.
- Do not use the inverter in a manner not specified in this manual.
- Do not stay close to the inverter while the inverter is starting up or in running state. Adjust the start-up delay in a way that you have sufficient time to vacate the inverter room.

Note:

- This inverter is intended for operation in an environment with a maximum ambient temperature of 60 °C (140 °F).
 - If the **Inverter enable** signal is active, and the Start command is active, the inverter starts immediately after a fault reset. For more information, see the *PVS800-57B central inverters Firmware manual* (3AXD50000048332 [English]).
-



Introduction to the manual

Contents of this chapter

This chapter describes the intended audience and contents of the manual. It has a flowchart of the steps to examine the delivery, and install and commission the inverter. The flowchart refers to sections in this manual and in other manuals.

Applicability

This manual is applicable to PVS800-57B central inverters.

Target audience

This manual is intended for persons who plan the installation of, install, commission, use and service the inverter. Read the manual before you do work on the inverter. You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

Contents of the manual

Safety instructions – Safety instructions for the installation, commissioning, operation and maintenance of the inverter.

Introduction to the manual – Introduction to the manual.

Storing, lifting and transporting – How to store, lift and move the inverter.

Mechanical installation – The mechanical installation of the inverter.

Electrical installation – The electrical installation of the inverter.

Installation checklist – A list to check the mechanical and electrical installation of the inverter.

Start-up and operation – The start-up procedure and the operation of the inverter.

Hardware status – The fault tracing possibilities of the inverter.

Maintenance – The preventive maintenance instructions of the inverter.

Related documents

Refer to the inner front cover.

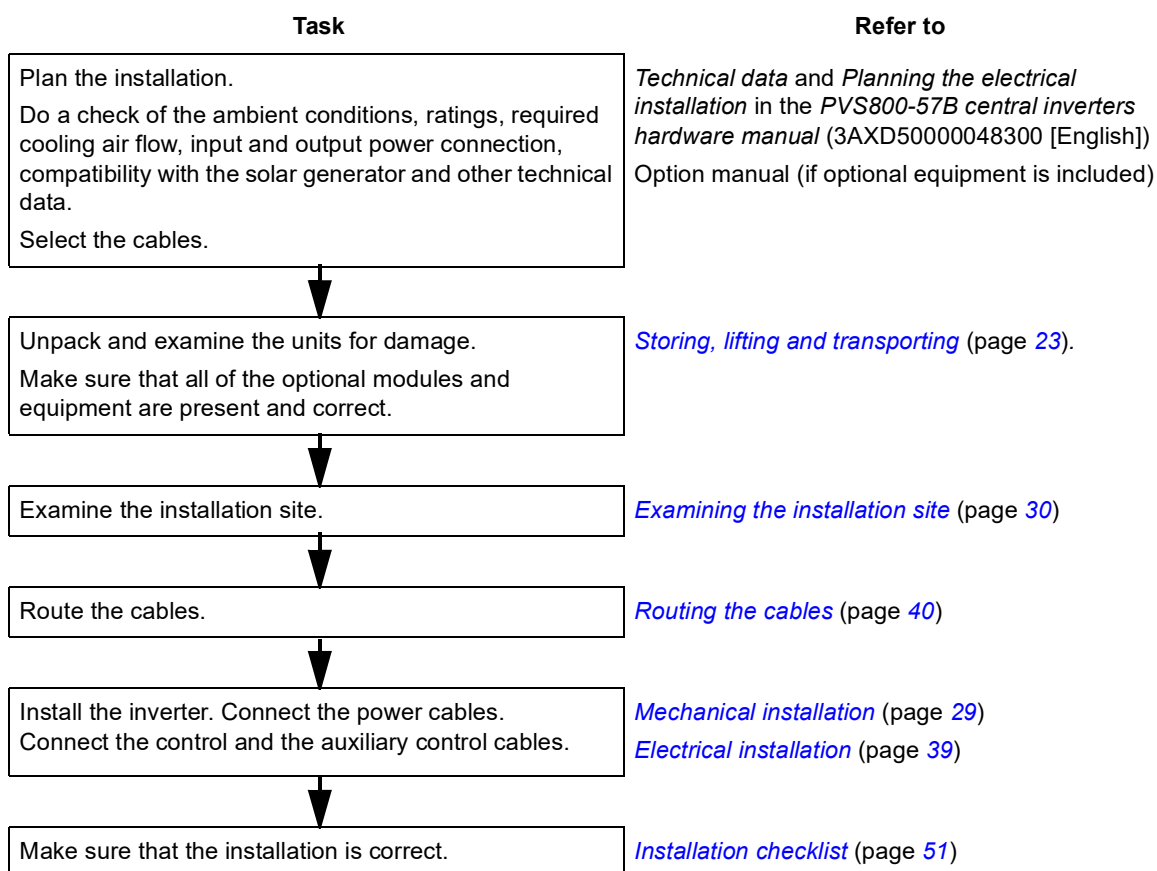
Categorization by frame size and option code

Some instructions, diagrams, technical data, dimensions and options apply only to specific units. To identify the unit, refer to the type designation labels on the unit.

The instructions and technical data which concern optional components are marked with option codes, for example, +K475. The options included in the inverter can be identified from the type designation label.

For information on the type designation labels, refer to the *PVS800-57B central inverters hardware manual* (3AXD50000048300 [English]).

Quick installation, commissioning and operation flowchart



Terms and abbreviations

Term/Abbreviation	Explanation
AC500	ABB programmable logic controller (PLC) series
ACS-AP-I	Control panel type
BAMU	Auxiliary measuring unit
BCU	Control unit
BINT	Power module interface board
CPU	Central processing unit
CS	Control section
DC input	Connection point from solar array to inverter. One input consists of one positive and one negative terminal.
DDCS	Distributed drives communication system; a protocol used in optical fiber communication inside and between ABB drives and inverters.
EMC	Electromagnetic compatibility
FENA	Optional Ethernet adapter module for EtherNet/IP, Modbus TCP and PROFINET IO protocols
Frame (size)	Relates to the construction type of the component in question. The term is often used in reference to a group of components that share a similar mechanical construction.
FSCA	Optional Modbus RTU adapter module
HMI	Human-machine interface
IGBT	Insulated gate bipolar transistor; a voltage-controlled semiconductor type widely used in inverters due to its easy controllability and high switching frequency.
Inverter	A cabinet-built device containing all inverter modules together with their control electronics, and I/O and auxiliary components. The inverter module converts the DC voltage to AC voltage. Its operation is controlled by switching the IGBTs.
I/O	Input/Output
LCL	Line filter
MCB	Miniature/Main circuit breaker
MGND	Solar array and grounding monitoring board
MIRU	Solar array insulation resistance measuring unit
MPPT	Maximum power point tracking. Inverter software function that automatically operates the photovoltaic generator at its maximum power point.
Photovoltaic cell, generator, module, string, array and array junction box	In this manual, solar power system components based on photovoltaic effect are called solar cell, solar module, solar array, solar string and solar array junction box as defined below.
PLC	Programmable logic controller
PSL2	Protocol used in optical fiber communication inside ABB drives and inverters
PV	Photovoltaic
R8i	Inverter power module

Term/Abbreviation	Explanation
RCD	Residual current device
SCADA	Supervisory control and data acquisition
Solar array	Group of parallel-connected solar strings
Solar array junction box	Device that connects outputs of multiple solar source circuits (strings) into a combined output circuit or circuits
Solar cell	Device that converts light directly into electricity by the photovoltaic effect
Solar generator	The total of all solar strings of a solar power supply system, which are electrically interconnected
Solar module	Packaged interconnected assembly of solar cells
Solar string	Circuit of series-connected solar modules
THD	Total harmonic distortion

3

Storing, lifting and transporting

Contents of this chapter

This chapter tells you how to store, lift and move the inverter.

Moving the inverter

You can move the inverter with a crane from the lifting beams on the roof or with a forklift from the base of the inverter.

Always move the inverter in the upright position.



WARNING! Obey these instructions to prevent physical injury or death, or damage to the equipment:

- Use only authorized lifting equipment and personnel.
 - Do not let anybody go under the load.
 - Do not stand on the roof when you attach the lifting slings or during lifting.
 - Do not let slings or hooks to fall onto the roof.
-

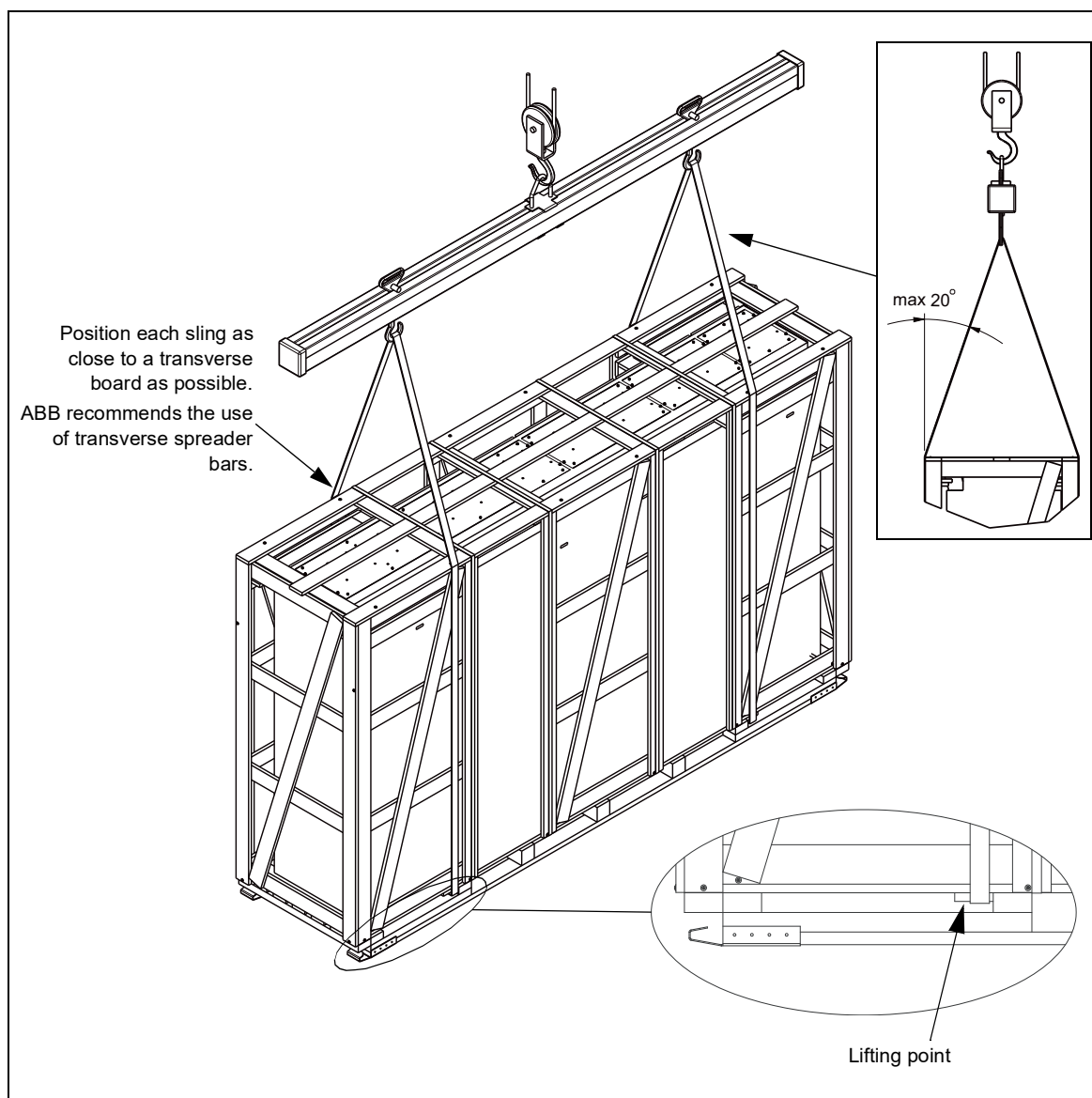
Storing the inverter

- To prevent damage to the inverter, keep it in the protective packaging.
 - Store the inverter in the upright position. Do not put it on its side or back.
 - To prevent condensation in the inverter, store it indoors in a dry (heated) warehouse.
 - If the inverter is removed from the protective packaging and condensation is possible in the storage area:
 - Supply power to the internal heaters to keep the inside temperature of the inverter above the outside temperature.
 - If power is not available, add humidity desiccant bags inside the inverter. Use desiccant bags, if the unit is stored for more than two weeks without electric heaters. Use 200 grams (7 oz) of desiccant per week. For example, for four weeks of storage, use 800 g (28 oz) of desiccant bags. Replace the bags with fresh bags every four weeks and do not open the doors unnecessarily during the storage period. Examples of suitable container desiccants: Xdry desiccants “H model” or Clariant “Container Dri@ll-Pole”. When the inverter leaves the factory, it has desiccant bags inside.
 - The air inlets and outlets of the inverter are sealed. If it is not required, do not open or remove any protective packaging.
 - If the inverter is stored outside for an extended period, this can cause damage to the protective packaging.
 - Make sure that the ground under the inverter is solid, flat, dry and vegetation-free. Make sure that the ground gives support to the inverter evenly from below. There must be no twisting or stress. Do not put the inverter onto bare ground because this can lead to paint damage and corrosion.
 - Keep the inverter on the wooden support beams.
-

Lifting the inverter in the shipping package

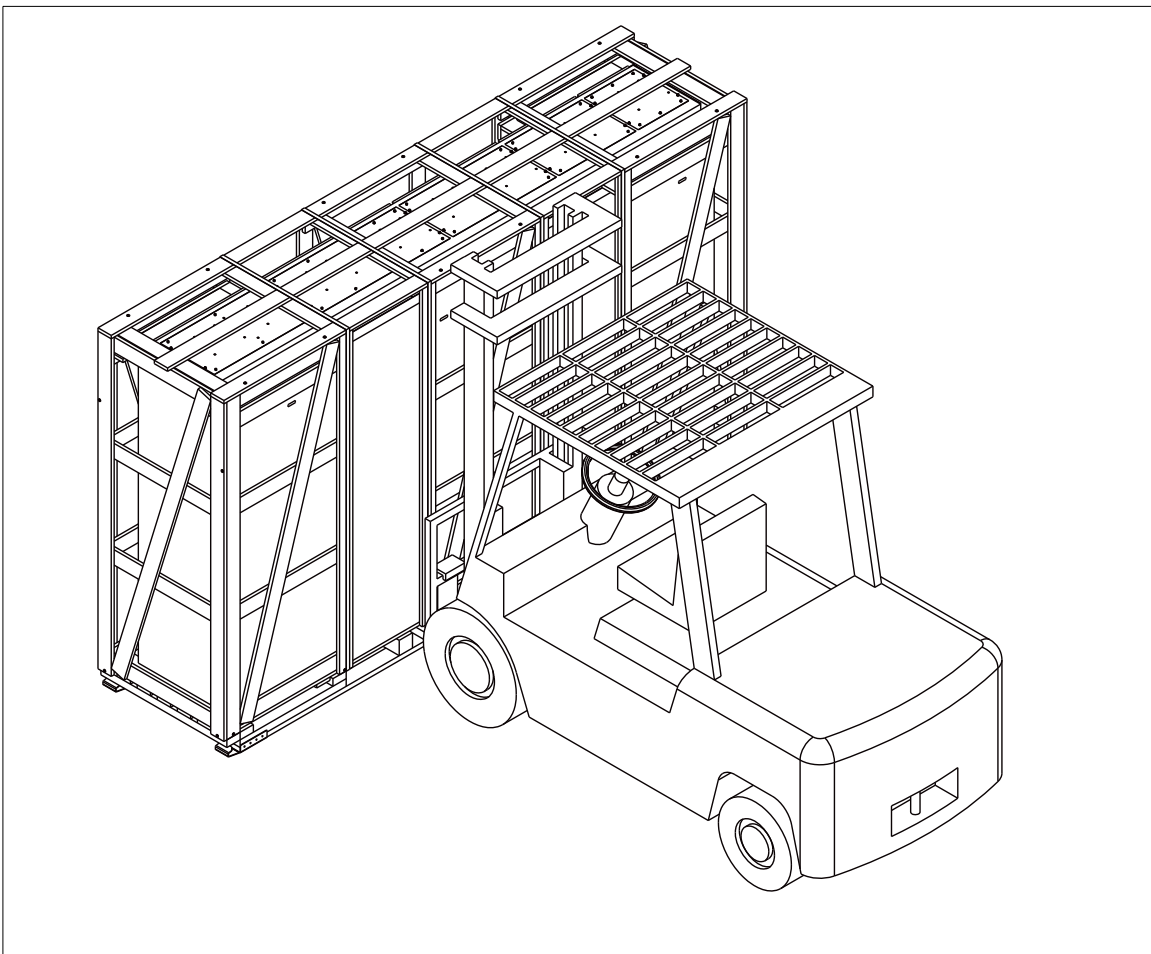
■ With a crane

- Lift the inverter in its shipping packaging. If you remove the packaging, protect the inverter from scratches and dents.
- Make sure that the slings have sufficient loading capacity.
- The minimum length of each sling is 1.6 m (5.3 ft).
- Adjust the lengths of the lifting slings to make sure that the inverter does not tilt.
- Attach a guide wire to a bottom corner of the inverter to prevent rotation.

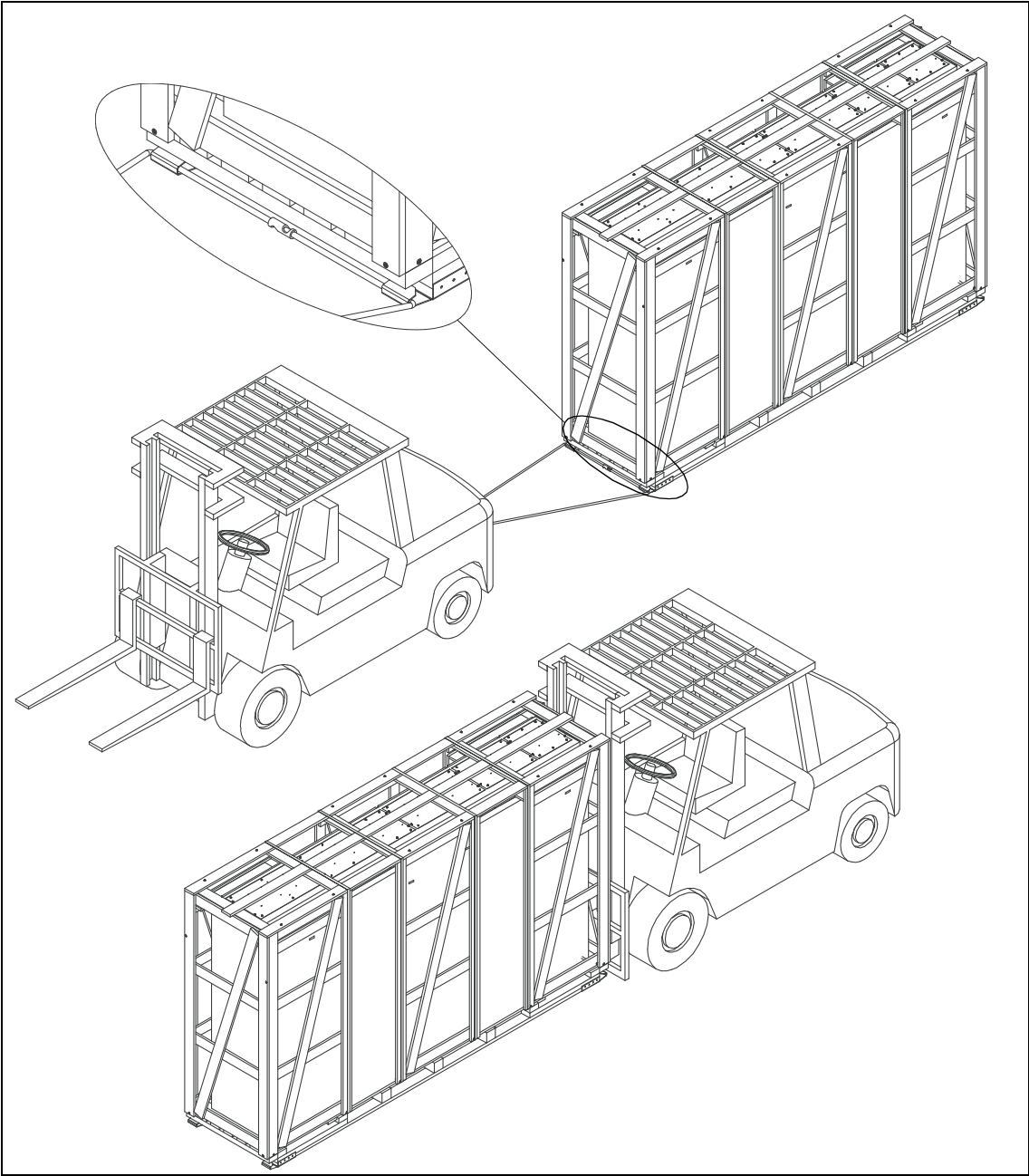


■ **With a forklift truck**

- Lift the inverter in its shipping packaging. If you remove the packaging, protect the inverter from scratches and dents.
- Lift the inverter from the lifting holes on the base of the inverter.
- Make sure that the forklift truck has sufficient loading capacity.
- Always lift the inverter so that its center of mass is centered on the lifting equipment.
- When you lift or move the inverter, make sure that the inverter does not tilt.
- Be careful when you move the unit as the center of gravity of the inverter is high.



■ Moving the crate with a forklift



Transporting the inverter



WARNING! Keep the transportation height as low as possible. Make sure that the total height of the transportation is not above the maximum permitted height for the planned route.

Do not use too much force with cargo straps even when the inverter is in its shipping package. Too much force can cause damage to the inverter frame.

To prevent damage to the inverter, do not put cargo straps over the inverter when it is not in the shipping package.

Do not throw hooks over the roof. This can damage the paint and lead to corrosion.

Obey these instructions:

- Transport the inverter in its shipping packaging. If you remove the packaging, protect the inverter from scratches and dents.
 - Transportation on a closed or weather protected space such as a truck trailer is recommended. If you transport it on an open bed, protect the inverter with temporary weather protection.
-

4

Mechanical installation

Contents of this chapter

This chapter describes the mechanical installation of the inverter. Obey all local regulations.

Safety

Refer to [Safety instructions](#) on page 9.

For instructions on how to move the inverter, refer to [Storing, lifting and transporting](#) on page 23.

Required tools

The tools required to move the inverter, fasten it to the foundation and tighten the connections:

- Crane, forklift or pallet truck (with sufficient load capacity), and iron bar, jack and rollers.
- Pozidriv and Torx (2.5...6 mm) screwdrivers
- Torque wrench
- Set of wrenches and sockets



WARNING! Standing or walking on the cabinet roof is not permitted. If necessary, use a ladder, work platform, or equivalent equipment when doing work on the inverter. Make sure that the equipment is safe to use for the work. Make sure also that the equipment is permitted by the local health and safety regulations for the work. Falling from height can cause serious injury or death.



Unpacking

Before the delivery check and the installation, unpack the inverter from the transportation and storage package. Be careful to not cause damage to the inverter.

To prevent damage to the inverter, unpack the inverter as late as possible before the installation.

Remove the transport package as follows:

1. Remove the screws that attach the wooden parts of the transport crate together.
2. Remove the wooden parts.
3. Remove screws that attach the clamps that hold the inverter cabinet on the transport pallet. Remove the clamps.
4. Remove the plastic wrapping.

Examining the delivery

The inverter delivery contains:

- Inverter cabinet
- Option modules (if ordered)
- Appropriate inverter manuals and option module manuals
- Delivery documents
- Loose items: floor mounting brackets, screw kits, module extraction/installation ramp

Make sure that the delivery has no signs of damage. Mark and record any damage carefully and contact the local ABB representative immediately. Repair any damaged paint.

Manuals and other loose parts are delivered inside the inverter. Before you start to install or operate the inverter, read the type designation label of the inverter to make sure that the delivery is correct. Refer to *PVS800-57B central inverters hardware manual* (3AXD50000048300 [English]). Record possible deviations carefully and contact the local ABB representative immediately.

Examining the installation site

Refer to *PVS800-57B central inverters hardware manual* (3AXD50000048300 [English]) for the permitted operating conditions and the dimension drawings.

Examine the installation site:

- The installation site has sufficient ventilation and cooling.
- The ambient conditions of the inverter meet the specifications.
- The wall behind the unit is of non-flammable material.
- There is sufficient free space above the inverter to enable cooling air flow, service and maintenance.
- The surface that the unit is installed on is of non-flammable material, as smooth as possible, and strong enough to support the weight of the unit. Measure the incline of the floor with a spirit level. The maximum permitted incline is 5 mm (0.2 in) for every 3 m (10 ft). Level the installation site, because the cabinet does not have adjustable feet.



Note: The module extraction/installation ramp included with the inverter is only suitable for a height difference of 50 mm (1.97 in) maximum (the standard plinth height of the inverter).

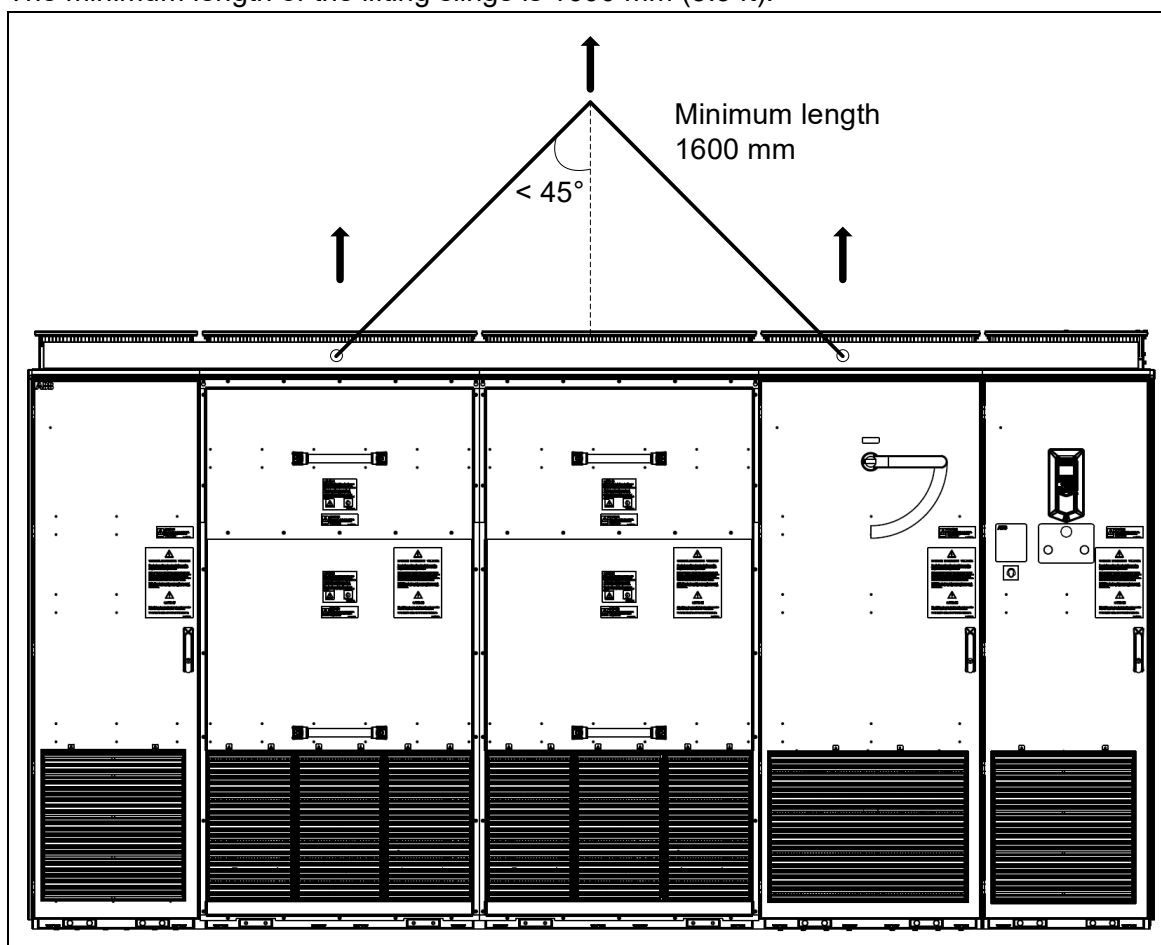
■ Moving the unpacked inverter cabinet

Lifting the cabinet with a crane

Lift the inverter cabinet using its lifting beams. You can remove the lifting beams after the cabinet is in its final position. If you remove the lifting beams, seal their mounting holes to retain the degree of protection.

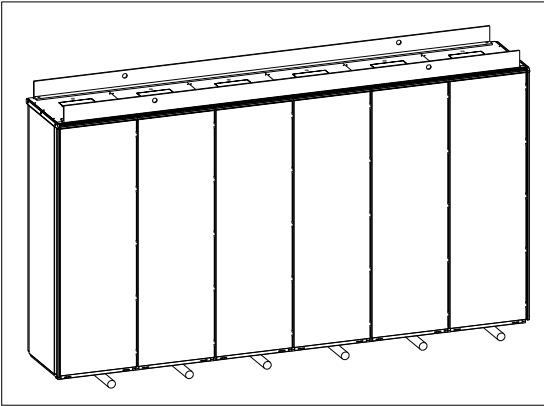
The distance between the lifting holes in the lifting beam is 2150 mm (7 ft).

The minimum length of the lifting slings is 1600 mm (5.3 ft).



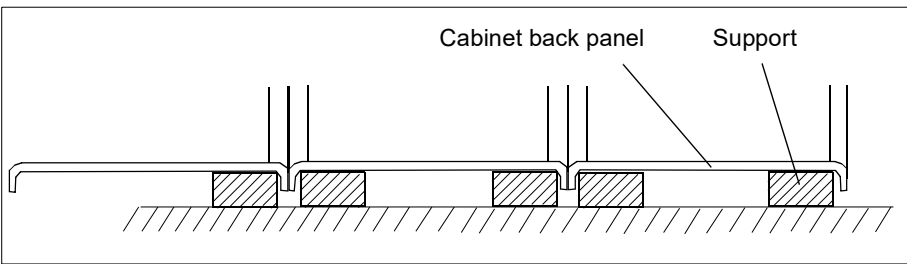
Moving the cabinet on rollers

Lay the cabinet on the rollers and move it carefully until close to its final location. Lift the unit with a crane, forklift, pallet truck or jack to remove the rollers.



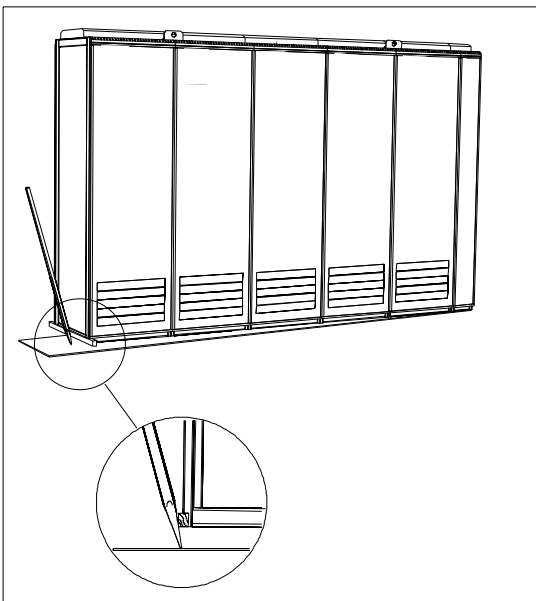
Moving the cabinet on its back

Support the cabinet from below alongside the cubicle seams.



Final placement of the cabinet

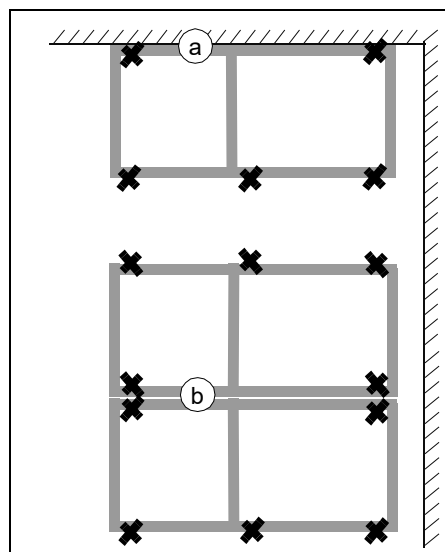
Move the cabinet into its final position with a slate bar (spud bar). Put a piece of wood between the edge of the cabinet and the bar to protect the cabinet frame.



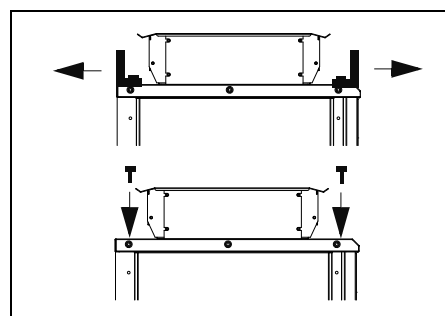
Fastening the cabinet to the floor and wall or roof

■ General rules

- Install the inverter in an upright vertical position.
- You can install the cabinet with its back against a wall (a), or back-to-back with another unit (b).
- To adjust the height of the cabinet, use metal shims between the cabinet bottom and the floor.
- It is not recommended to drill through the inverter cabinet. Conductive debris inside the inverter cabinet can cause damage.



- Removing the lifting beams:
 - You must remove the lifting beams after the inverter unit is installed to the correct installation place.
 - After you remove the lifting beams, install and tighten the bolts to the lifting beam mounting holes. This is necessary to keep the degree of protection of the cabinet.



WARNING! Do not fasten the cabinet by electric welding. ABB does not assume any liability for damages caused by electric welding as the welding circuit can cause damage to electronic circuits in the cabinet.

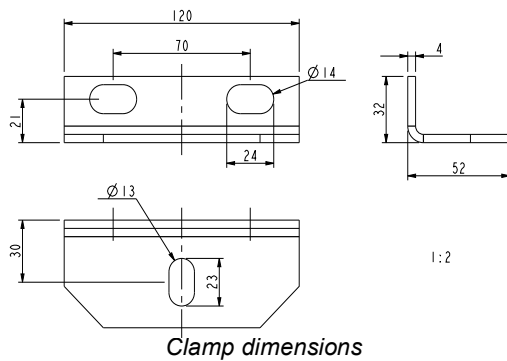
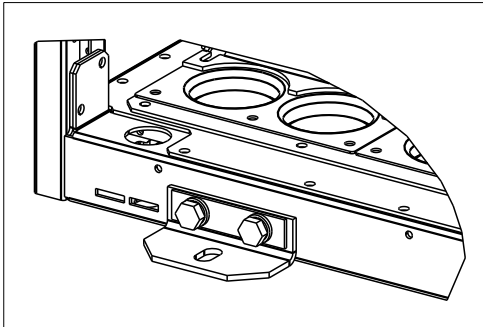


Fastening methods

Fasten the cabinet to the floor with the clamps included along the edge of the cabinet bottom.

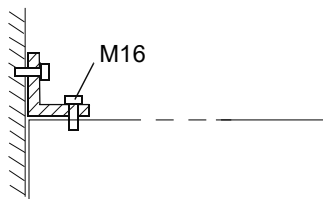
Clamping

Floor clamping



Insert the clamps into the twin slots along the front and rear edges of the cabinet frame body and fasten them to the floor with a M12 bolt. The recommended maximum distance between the clamps in the front edge is 800 mm (31.5 in).

Wall clamping



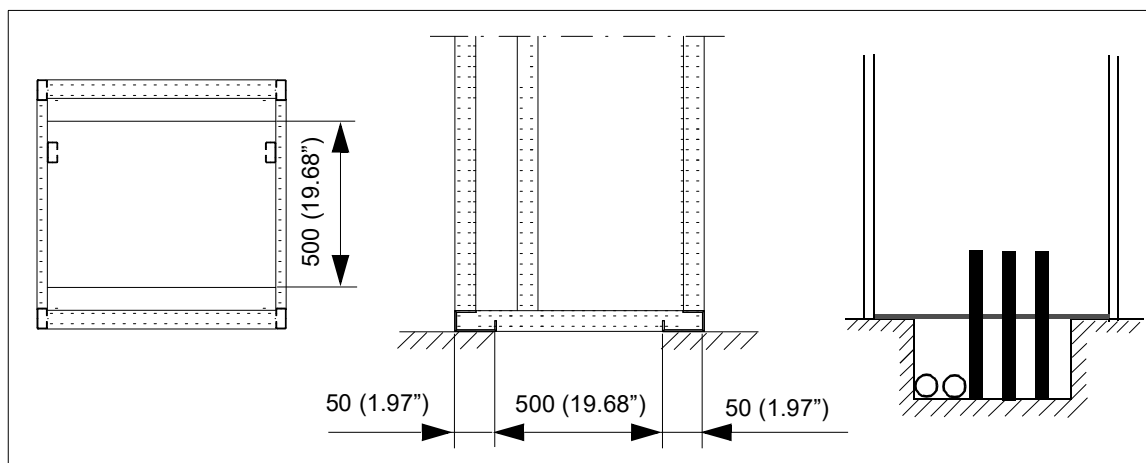
If floor mounting at the back is not possible, attach the top of the cabinet to the wall. Use L-brackets (not included in the delivery) bolted to the lifting beam fastening holes.

Miscellaneous

■ Cable duct in the floor below the cabinet

You can make a cable duct below the 500 mm (19.68 in) wide middle part of the cabinet. The cabinet weight lies on the two 50 mm (1.97 in) wide transverse sections which the floor must carry.

Prevent the cooling air flow from the cable duct to the cabinet by bottom plates. To ensure the degree of protection for the cabinet, use the original bottom plates that were delivered with the unit. With user-defined cable entries, take care of the degree of protection, fire protection and EMC compliance.



■ Ventilation

The air inlets of the installation space must supply a sufficient volume of cooling air. For the minimum air flow values, refer to *PVS800-57B central inverters hardware manual* (3AXD50000048300 [English]).

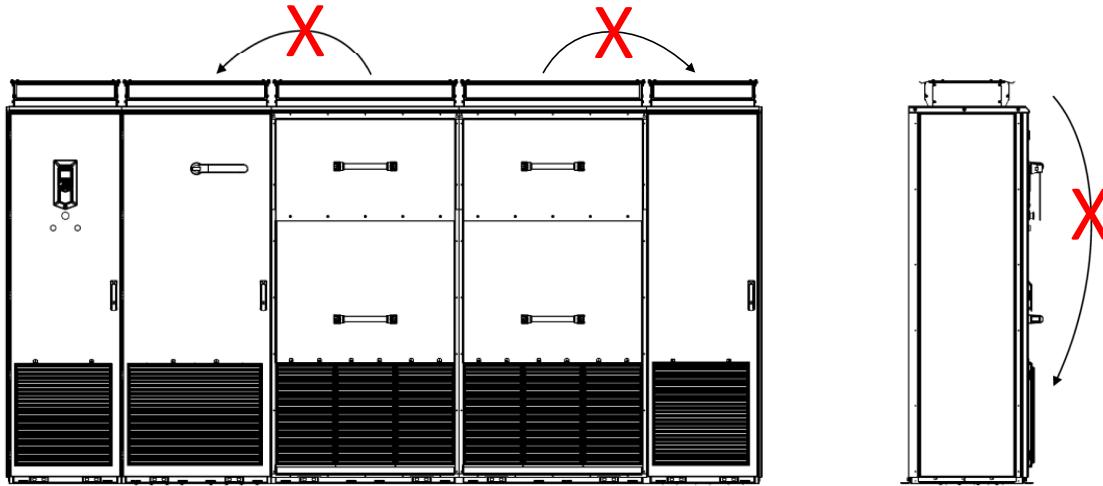


WARNING! Make sure that the incoming air is sufficiently clean. If not, dust goes into the cabinet. The outlet filter on the cabinet roof prevents dust from going out. The collected dust can cause inverter malfunction and danger of fire.



Preventing the recirculation of hot air

To prevent hot air recirculation outside the inverter, make sure that the exhaust air flows away from the air inlets. Make sure that the hot air from the inverter module cabinet does not flow into the adjacent cabinets.



WARNING! When installing the air ducts, do not do any drilling to the inverter cabinet. Debris from drilling can cause serious damage to the inverter.

Ventilation duct at the air outlet of the cabinet

The ventilation system must keep the static pressure in the air outlet duct sufficiently below the pressure of the room where the inverter is located, so that the cabinet fans can produce the required air flow through the cabinet. Make sure that no dirty or moist air flows back to the inverter, even during off-time or when you do maintenance on the inverter.

Calculating the required static pressure difference

You can calculate the required static pressure difference between the exit air duct and the inverter installation room as follows:

$$\Delta p_s = (1.5 \dots 2) \cdot p_d$$

Where:

$$p_d = 0.5 \cdot \rho \cdot v_m^2$$

$$v_m = q \div A_c$$

Definitions	
p_d	Dynamic pressure
ρ	Air density (kg/m ³)
v_m	Average air velocity in the exit duct(s) (m/s)
q	Rated air flow of the inverter (m ³ /s)
A_c	Cross-sectional area of the exit duct(s) (m ²)

Example

The cabinet has 3 exit openings of 315 mm diameter. The rated air flow of the cabinet is 4650 m³/h.

Convert millimeters to meters as follows: 315 mm ÷ 1000 = 0.315 m

Convert air flow from m³/h to m³/s as follows: 4650 m³/h ÷ 3600 = 1.3 m³/s

Calculate the required static pressure difference as follows (assuming the air density is 1.1 kg/m³):

$$A_c = 3 \cdot (0.315 \text{ m})^2 \cdot \pi \div 4 = 0.234 \text{ m}^2$$

$$v_m = q \div A_c = 1.3 \text{ m}^3/\text{s} \div 0.234 \text{ m}^2 = 5.5 \text{ m/s}$$

$$p_d = 0.5 \cdot \rho \cdot v_m^2 = 0.5 \cdot 1.1 \text{ kg/m}^3 \cdot (5.5 \text{ m/s})^2 = 16.6 \text{ Pa}$$

$$\Delta p_s = (1.5...2) \cdot p_d = 1.5...2 \cdot 16.6 \text{ Pa} = 25...33 \text{ Pa}$$

The required pressure in the exit air duct is 25...33 Pa below the pressure in the room.

For more information, contact ABB.





5

Electrical installation

Contents of this chapter

This chapter describes the electrical installation of the inverter.

Insulation test

■ Inverter

The inverter is tested for insulation at the factory. Do not do voltage tolerance or insulation resistance tests on any part of the inverter.

■ AC output cables

Make sure that the insulation of the AC output cable obeys the local regulations before you connect it to the inverter.

■ Photovoltaic generator

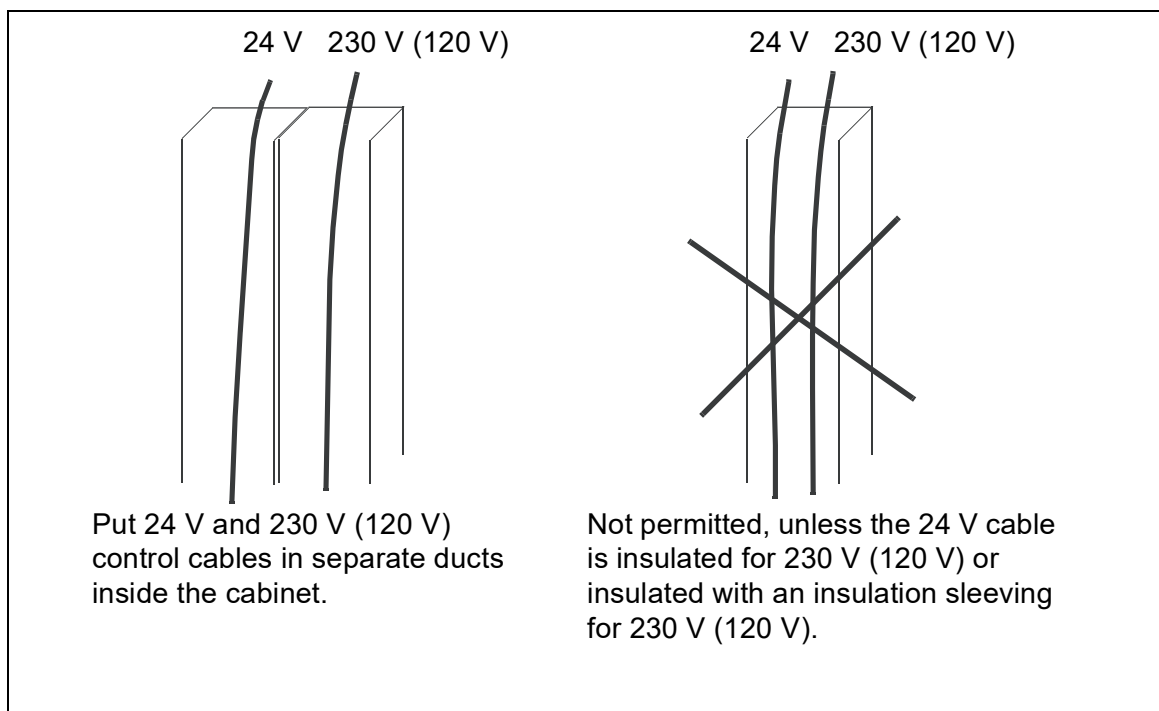
Make sure that the insulation of the photovoltaic generator obeys the local regulations and the manufacturer instructions. The photovoltaic generator must be completely disconnected from the inverter during the insulation test.



■ Routing the cables

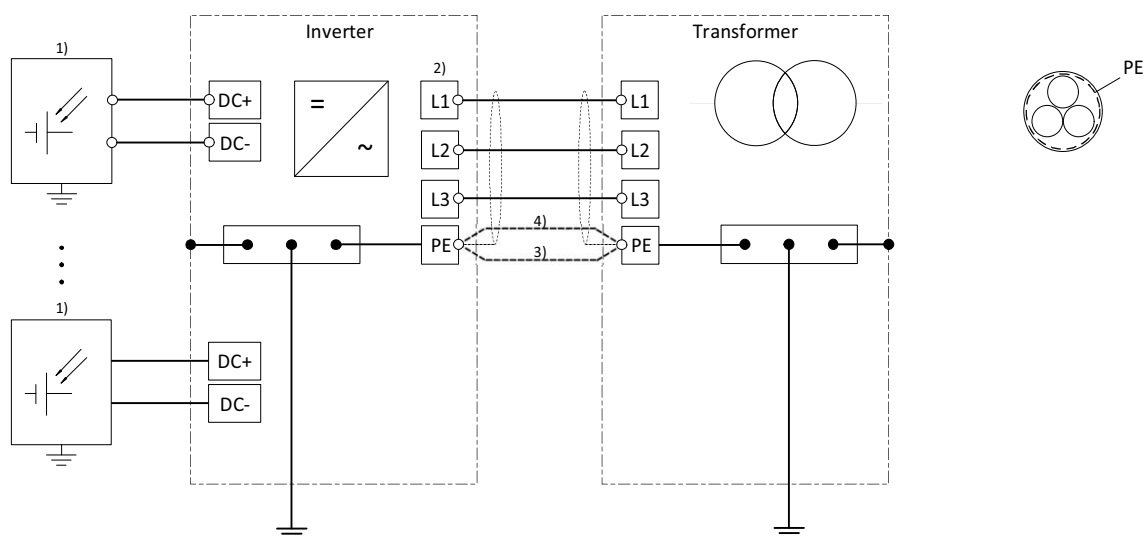
When you route the cables:

- Install the DC power, AC power and control cables on separate routes.
- Make sure that the metallic cable trays are electrically bonded to each other and to the ground.
- Make sure that there is 500 mm (20 in) of separation between the power cables and the control cables.
- If the control cables cross the power cables, set them at angle as close to 90 degrees as possible.
- If you use four-conductor AC cabling, install the phase cables symmetrically and near each other. Asymmetrical installation can induce current in the grounding cables and metal structures.



Connecting the power cables

■ Connection diagram

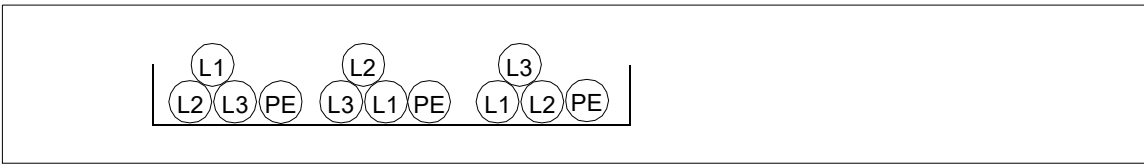


- 1) Solar array junction box.
- 2) If you use shielded cable, 360-degree grounding is recommended at the cabinet entry. Ground the other end of the input cable shield or PE conductor at the transformer.
- 3), 4) If you use shielded cable (which is recommended) and the conductivity of the shield is < 50% of the conductivity of the phase conductor, use a separate PE cable (3) or a cable with a grounding conductor (4).

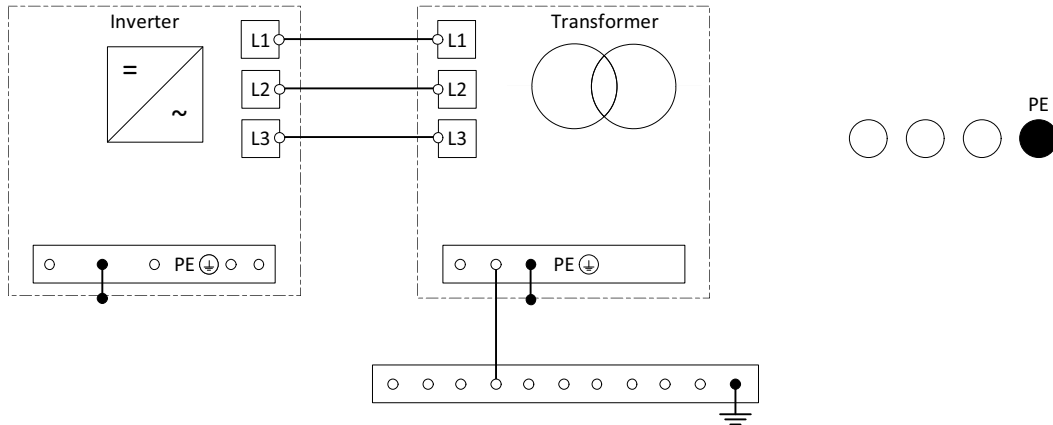


■ Connection diagram of a four-conductor system

Arrange the cables as shown to get a current distribution that is as equal as possible.



Connect single-core cables without concentric protective shielding (armor) as shown.



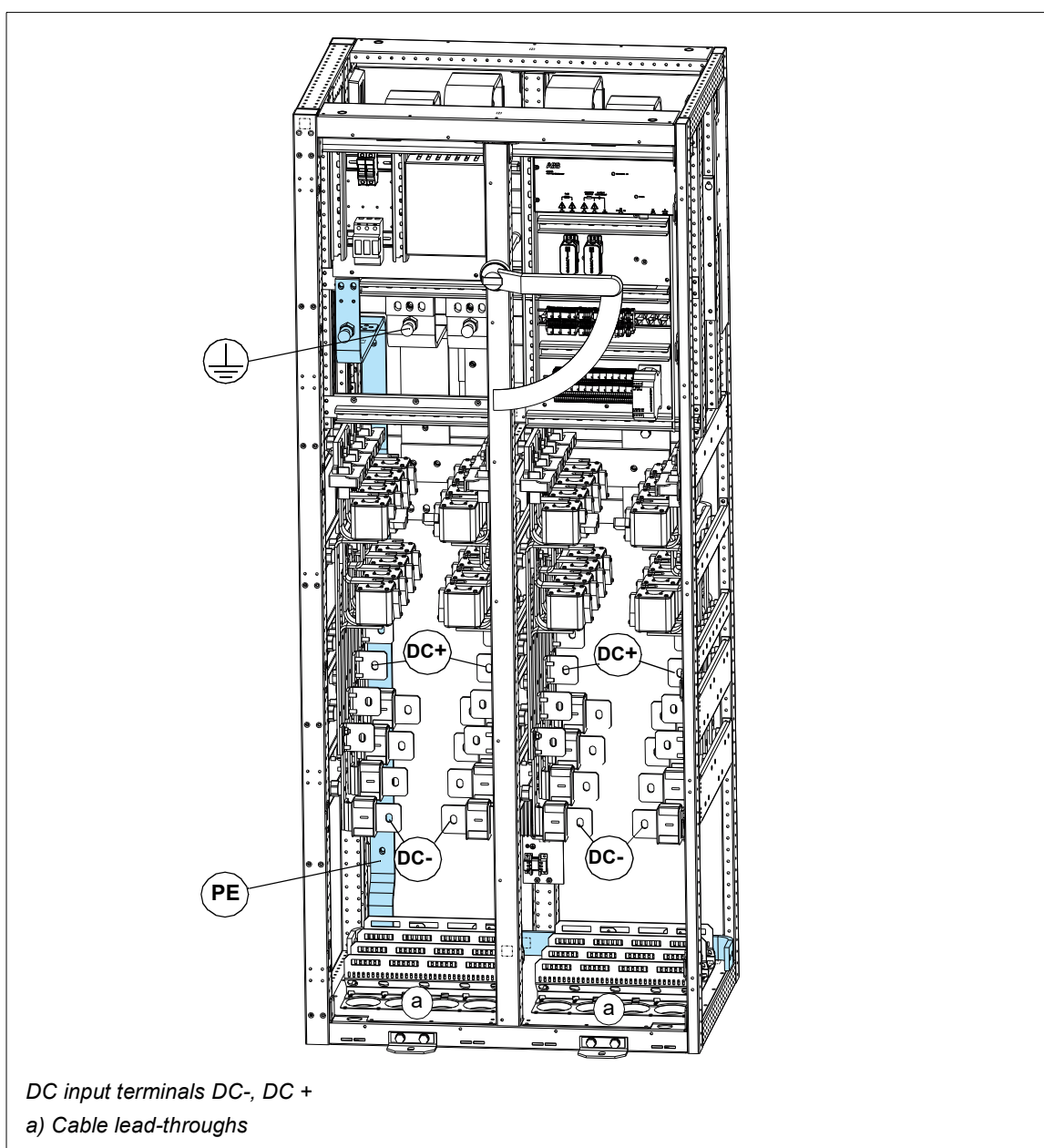
WARNING! Ground all conductive cable supports, cable clamps and individual conductive items close to cables, such as cable trays.



■ DC input cable connection procedure

Refer to the dimension drawings in the *PVS800-57B central inverters hardware manual* (3AXD50000048300 [English]).

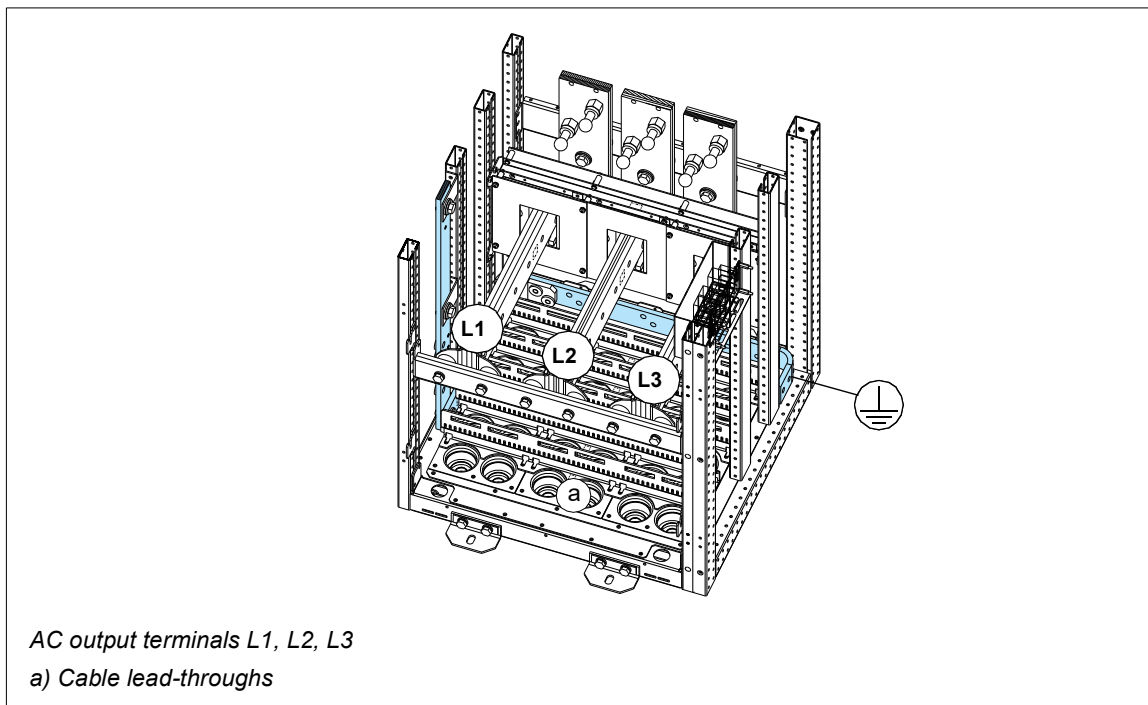
1. Remove the shroud from the input power terminals.
2. Put the cable(s) into the inside of the cabinet.
3. If it is a shielded cable, connect the shield to the cabinet grounding busbar with a cable lug.
4. Connect the DC- conductor to terminal DC- and the DC+ conductor to terminal DC+.
5. If there is a separate PE conductor, connect it to the cabinet grounding terminal.
6. Refit the shroud onto the input power terminals.



■ AC output cable connection procedure

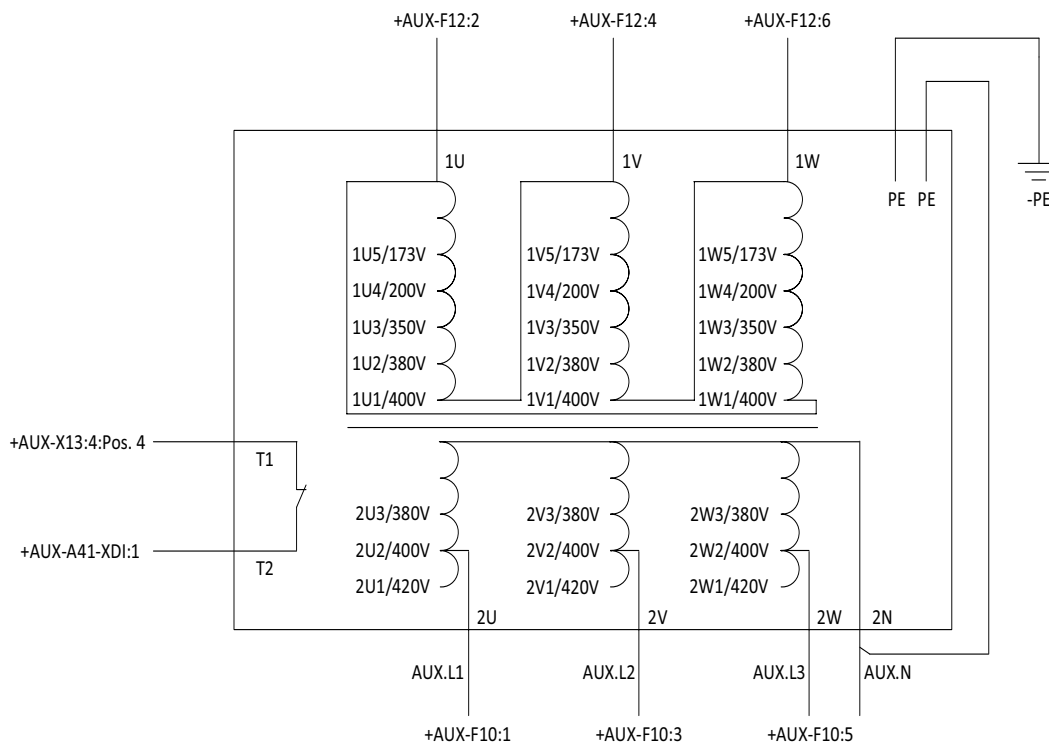
Refer to the dimension drawings in the *PVS800-57B central inverters hardware manual* (3AXD50000048300 [English]).

1. Remove the shroud from the output power terminals.
2. Put the cable(s) into the cabinet.
3. If it is a shielded cable, prepare the cable ends and do the 360° grounding at the cabinet entry. Connect the twisted shield of the AC output cable(s) to the cabinet PE (ground) busbar with a cable lug.
4. Connect the phase conductors to terminals L1, L2 and L3.
5. If it is present, connect the separate PE/grounding conductor to the cabinet PE (ground) busbar.
6. Install the shroud on to the output power terminals.



Checking the settings of the auxiliary voltage transformer

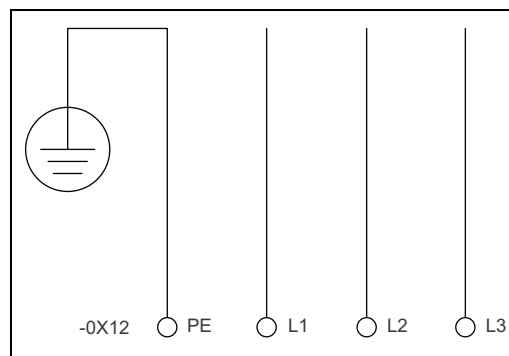
The connections of the optional auxiliary voltage transformer (T10) are made at the factory. Make sure that the connections agree with the selected option code (+G396, +G397). If not, change the connection wire to the correct voltage terminal.



■ 3-phase power output (optional)

The inverter has a 3-phase power output for an auxiliary power transformer when option G429 is selected.

- Voltage: Same as inverter output
- Can be connected only to IT (ungrounded) systems



Connecting the control cables

Default I/O connection diagram

Control I/O connection diagram					
Terminal	Type	Rating		Functionality	
X2	+	+24 V DC	+24 V DC		Power distribution
	-	0 V DC	0 V DC		Power distribution
	1	User DI1	24 V DC		
	2	User DI2	24 V DC		
	3	User DI3	24 V DC		
	4	User DI4	24 V DC		
	5	User DI5	24 V DC		
	6	User DI6	24 V DC		
	7	User DI7	24 V DC		
	8	User RO1	24 V DC		
	9	User AI2		+	
	10	User AI2	4–20 mA	-	
	11	User AI3		+	
	12	User AI3	4–20 mA	-	

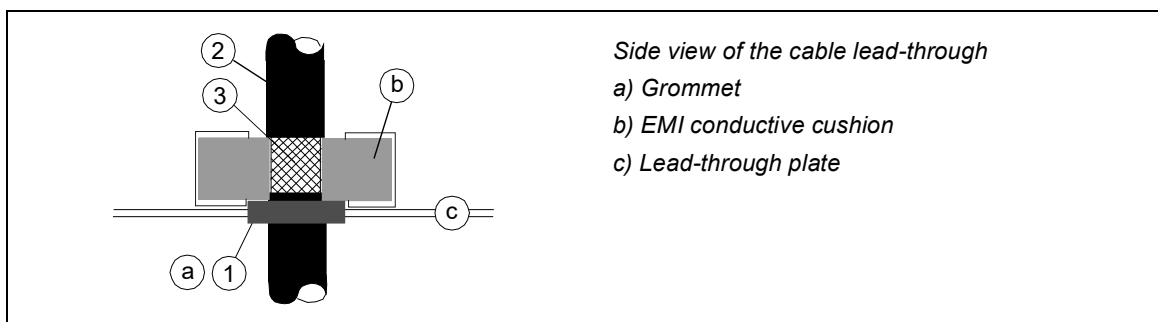
You can freely configure the I/O signals with different fault names and reactions. Refer to the *PVS800-57B central inverters firmware manual* (3AXD50000048332 [English]).

Connection procedure

360-degree grounding at the cabinet lead-through for the control cables:

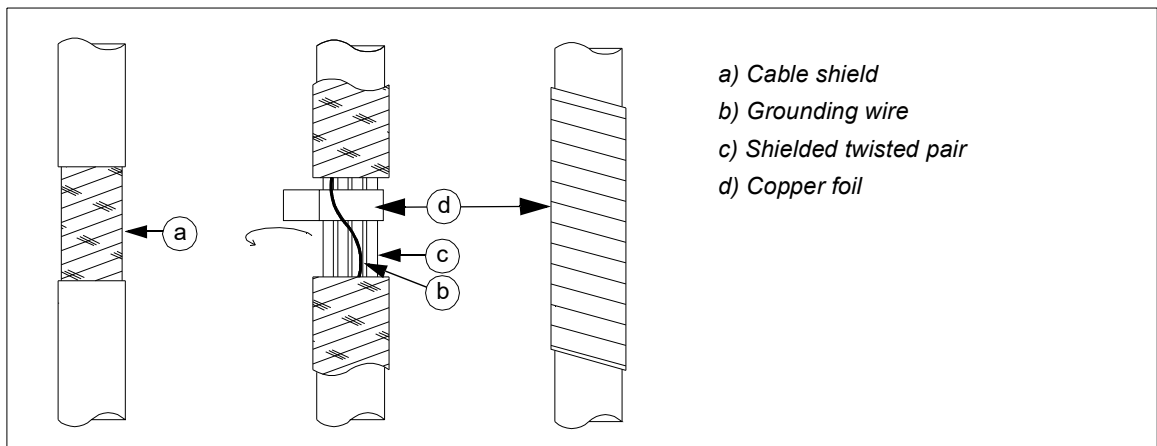
Make sure that a proper environmental seal remains after the installation.

1. Cut adequate holes in the rubber grommets in the lead-through plate.
2. Put the cables through the grommets into the cabinet.
3. Strip the plastic sheath of the cable above the lead-through plate just enough to ensure proper connection of the bare shield.



Note: If the outer surface of the shield is non-conductive:

- Cut the shield at the midpoint of the bare part. Do not cut the conductors or the grounding wire (if present).
- Turn the shield inside out to expose its conductive surface.
- Cover the turned shield and the stripped cable with copper foil to make the shielding continuous.



Connecting the cables to the I/O terminals

Connect the conductors to the appropriate terminals of the I/O section (refer to [Default I/O connection diagram](#) on page 46). At the terminal block, use shrink tubing or insulating tape to contain any stray strands. Especially for multiple shields, you can also terminate the shield with a lug and fasten it with a screw to the nearest grounding clamp. Leave the other end of the shield unconnected or ground it indirectly through a high-frequency capacitor, for example, 3.3 nF/630 V. You can also ground the shield directly at both ends, if they are *in the same ground line* with no significant voltage drop between the end points. Tighten the screws to secure the connection.

Keep signal wire pairs twisted as close to the terminals as possible. Twisting the wire with its return wire reduces disturbances caused by inductive coupling.

Fast power off circuit

The FPO circuit is powered from the 24 V DC circuit which is connected directly to the Fast Power Off switch (S20). The Fast Power Off switch is a locking type (twist release) push button equipped with two NC (normally closed) contacts.

The NC contact connects to the main contactor enable relays (-K11) through the relay output of the main control board. All of the contactor control signals from the PLC connect to the contactor coils through the enable relay contacts. Power section has an enable relay, which all are in parallel downstream of the common FPO switch.

In addition to the interlockings on the hardware side, the software prevents inverter operation, if the Fast Power Off switch is pushed.

■ Startup after FPO

The startup procedure:

1. Release the FPO switch before startup.
2. Reset the fault. The inverter restarts when all other reconnection conditions are fulfilled.



Connecting a PC

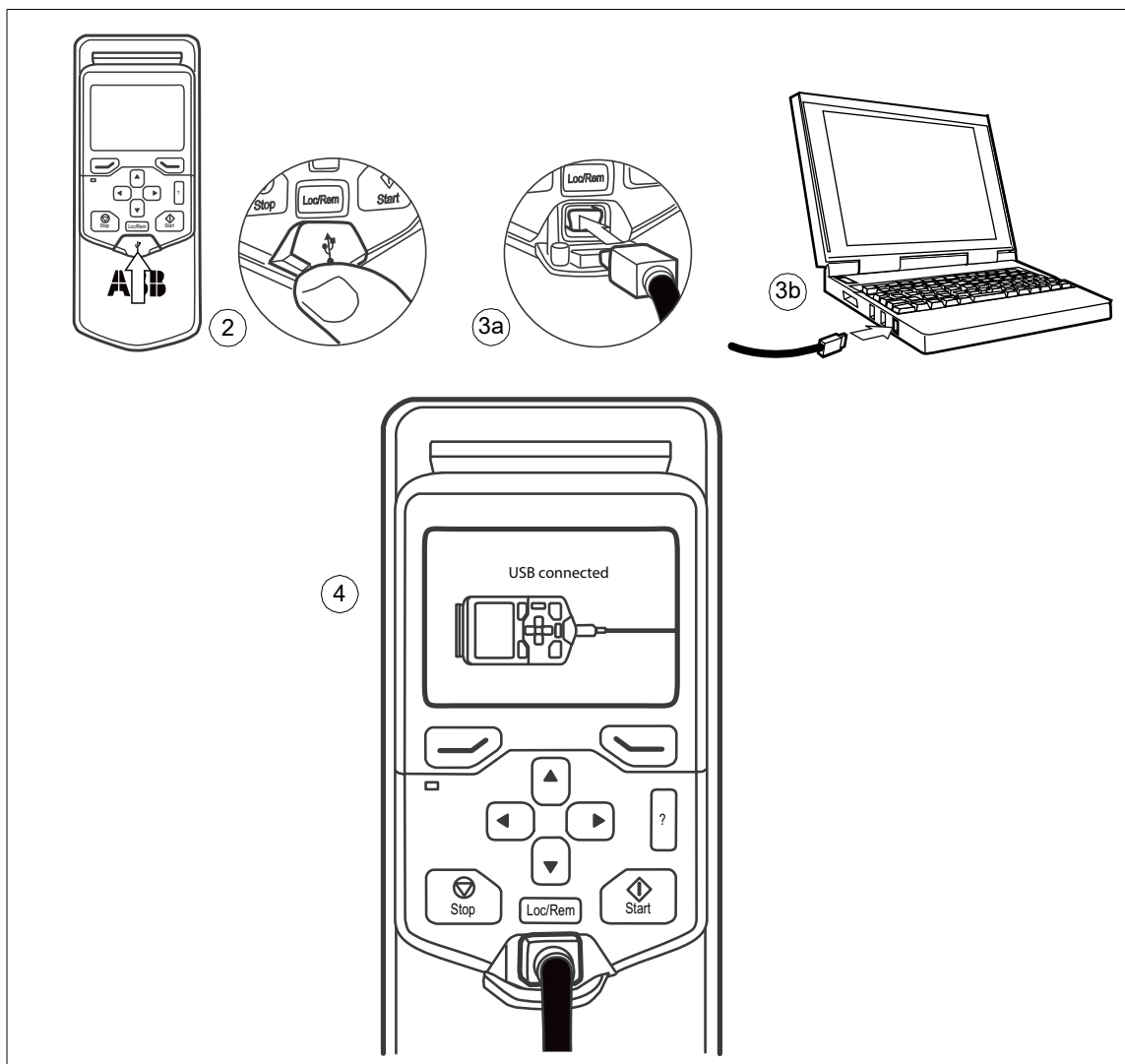
You can connect a PC (for example, using the Drive composer PC tool) to the inverter as follows:

1. Connect an ACS-AP-I control panel to the inverter control unit either with an Ethernet cable, or by inserting the control panel into the panel holder (if present).



WARNING! Do not connect the PC directly to the control panel Ethernet connector of the inverter.

2. Open the USB connector cover on the front of the control panel.
3. Connect a USB cable (Type A to Type Mini-B) between the USB connector on the control panel (3a) and a free USB port on the PC (3b).
4. The panel will display an indication when the connection is active.



Refer to the documentation of the PC tool for setup instructions. Refer to *ACx-AP-x assistant control panels user's manual* (3AUA0000085685 [English]) for instructions on using the control panel.

Installing fieldbus adapter modules

Pay attention to the free space required by the cabling or terminals coming to the option modules.

1. Disconnect the inverter from the supply, lock out the disconnecting device, and make sure by measuring that there is no voltage present.
2. Switch off any potentially dangerous control voltages coming to the inverter. Make sure by measuring that the I/O terminals of the control unit (especially the relay output terminals) are safe.
3. Insert the module into a free option module slot on the control unit.
4. Tighten the mounting screw of the module.
5. Connect the necessary wiring to the module following the instructions given in the documentation of the module and section [Connecting the control cables](#) on page 46.
6. Examine the installation and make sure that it is safe to reconnect power.
7. Configure the module. Refer to the instructions given in the documentation of the module as well as the applicable firmware manual.





6

Installation checklist

Contents of this chapter

This chapter contains a list for checking the mechanical and electrical installation of the inverter.

Warnings



WARNING! Obey the instructions in chapter [Safety instructions](#). If you ignore them, injury or death, or damage to the equipment can occur.

Checklist

Do the steps in section [Electrical safety precautions](#) on page 12 before you start the work. Go through the checklist together with another person.

Make sure that ...	<input checked="" type="checkbox"/>
Mechanical installation (refer to chapter Mechanical installation)	
There is sufficient free space in front of the unit.	<input type="checkbox"/>
The ambient operating conditions are permitted.	<input type="checkbox"/>
The unit is properly fastened to the floor.	<input type="checkbox"/>
The cooling air is clean and it is able to flow freely in through the inlet air ducts and grilles and out of the exhaust air ducts and grilles.	<input type="checkbox"/>
Electrical installation (refer to chapter Electrical installation)	
The inverter (including cables) is grounded properly and the earthing electrodes are constructed properly.	<input type="checkbox"/>
The AC line voltage matches the nominal output voltage of the inverter.	<input type="checkbox"/>
The AC transformer is suitable for use with the inverter (refer to the <i>PVS800-57B central inverters hardware manual</i> (3AXD50000048300 [English])).	<input type="checkbox"/>
The insulation of the assembly is sufficient (refer to Insulation test on page 39).	<input type="checkbox"/>
The AC power system is an IT (ungrounded) system.	<input type="checkbox"/>
The AC power connections at L1, L2 and L3 and their tightening torques are correct.	<input type="checkbox"/>
The DC power cable connections at DC+ and DC– and their tightening torques are correct.	<input type="checkbox"/>
The AC and DC power cable lead-throughs are sealed properly.	<input type="checkbox"/>
The auxiliary and control cables are routed away from the power cables (refer to Routing the cables on page 40).	<input type="checkbox"/>
The auxiliary power supply cable connections from the inverter at X1 and X4 and their tightening torques are correct.	<input type="checkbox"/>
The external control connections to the inverter are correct (including the fieldbus and connections at X2).	<input type="checkbox"/>
The cable connections at the junction box and their tightening torques are correct.	<input type="checkbox"/>
There are no tools, foreign objects or dust inside the modules or the cabinet.	<input type="checkbox"/>
All of the shrouds and covers are in place.	<input type="checkbox"/>
All of the doors and door filters are in place.	<input type="checkbox"/>
All of the cooling fan power plugs are connected.	<input type="checkbox"/>

7

Start-up and operation

Contents of this chapter

This chapter describes the start-up procedure of the inverter.



WARNING! Only qualified electricians are permitted to do the work described in this chapter.

Start-up procedure

Tasks	<input checked="" type="checkbox"/>
Safety	
WARNING! Obey the safety instructions during the installation and start-up procedure. Refer to chapter Safety instructions on page 9.	<input type="checkbox"/>
Primary and ambient conditions	
Make sure that the mechanical and electrical installation of the inverter is correct. Refer to section Installation checklist on page 51.	<input type="checkbox"/>
Make sure that the insulation of the assembly is sufficient. Refer to section Insulation test on page 39. If the insulation is not sufficient, the optional insulation resistance monitoring cannot be tuned properly.	<input type="checkbox"/>
Make sure that the ambient conditions for start-up, temperature, humidity, altitude etc. are within the limits. Refer to <i>PVS800-57B central inverters hardware manual</i> (3AXD50000048300 [English]).	<input type="checkbox"/>
Set up the cabinet heater: Set the maximum temperature settings of the thermostats according to the schematic drawings. If the inverter is installed in a very humid environment, and there is a delay before commissioning without auxiliary power, use the cabinet heaters for several days before you do the commissioning.	<input type="checkbox"/>











<p>Make sure that there is sufficient light for the inverter to be able to feed power to the AC power system (grid).</p> <p>There must be enough light so that the solar generator is able to feed power to the inverter. This allows you to make sure that the inverter operates correctly. You can set the parameter during the dark hours. You can do a test of the inverter modulation without power from the photovoltaic arrays.</p>	<input type="checkbox"/>
<p>Measure separately that the polarity of all DC inputs are correct. Test each junction box separately, connect and disconnect one by one. Make sure to use a minimum of 1000 V tester during this procedure.</p> <p>Check the DC input polarity</p> <ol style="list-style-type: none"> 1. Make sure that all the combiner box breakers are open. 2. Verify with the voltage detector that there is no voltage at any of the DC bus input terminals. 3. Close the breaker of the first combiner box. Verify with the voltage detector that the polarity of the DC+ and DC- terminal is correct. 4. Make sure that the DC voltage between + and - is in the correct voltage range of the inverter. Also make sure that the voltage to ground of DC- and DC+ are in the same value range (for a 1000 V DC system it should be approximately 500 V DC). This check ensures that the impedance value to ground is similar for DC+ and DC-. 5. Disconnect the breaker of the combiner box. 6. Repeat the steps 3 to 5 for all the other combiner boxes separately. 	<input type="checkbox"/>
<p>Make sure that the open circuit DC voltage from the solar generator is in the correct range for the inverter (for example, 600...900 V DC).</p> <p>You can make an estimate of the expected DC voltage: Use the open circuit voltage of the solar modules and the number of modules in a string.</p>	<input type="checkbox"/>
<p>Make sure that there is only one insulation monitoring for the inverter in the same galvanically connected IT system.</p>	<input type="checkbox"/>
<p>Make sure that the settings of the insulation monitoring device suit the installation and obey the local regulations. The trip limit is adjusted to 30 kohm at the factory. Refer to the <i>PVS800-57B central inverters firmware manual</i> (3AXD50000048332 [English]).</p> <p>More information:</p> <ul style="list-style-type: none"> • Circuit diagrams delivered with the inverter. 	<input type="checkbox"/>
Set-up the current transducers (option +G417) for all DC inputs	
<p>Set up the DC input current monitoring and adjust the monitoring settings.</p> <p>Refer to the <i>PVS800-57B central inverters firmware manual</i> (3AXD50000048332 [English]).</p>	<input type="checkbox"/>
Parameter settings before the first start	
<p>Make the parameter settings needed before the first start according to the firmware manual.</p> <p>Refer to the start-up section of the firmware manual.</p>	<input type="checkbox"/>
First start (local control mode)	
<p>Disable the external communications, for example, for the data logger, plant controller or SCADA system.</p>	<input type="checkbox"/>
<p>Release the fast power off switch.</p>	<input type="checkbox"/>
<p>Set the auxiliary power to on. Measure that the auxiliary power level is correct before switching on the auxiliary circuit breakers of the auxiliary circuit one by one. If auxiliary power supply is internal, main supply must be on before you switch on the auxiliaries.</p> <p>The control boards and the control panel should “wake up”. If there are no active faults, the inverter is in the stand-by mode.</p> <p>There may be faults and warnings on the display. They are reset during the next steps.</p>	<input type="checkbox"/>
<p>In very humid or cold conditions, the thermostat and hygostat in the control cabinet start the heaters and prevent the start-up of auxiliary power supplies, until the control cabinet temperature increases to a sufficient level, and the humidity decreases to the set level. This can take up to one day. Keep the inverter doors closed during this time.</p>	<input type="checkbox"/>



Close the optional manual DC main switches. Make sure that the DC voltage of the solar generator is equal to the value of the parameter 208.01 DC Input Voltage. If the voltages are different, do not start the inverter. Contact your local ABB representative.	<input type="checkbox"/>
Close the optional manual AC main switches, or with optional AC breakers (+F296), set parameter 214.02 to "Close". Verify the AC voltage from parameters 190.06 to 190.08. If the AC voltage is different from the grid value, do not start the inverter. Contact your local ABB representative.	<input type="checkbox"/>
<p>Check the DC input grounding impedance</p> <ol style="list-style-type: none"> 1. Make sure that all the combiner box breakers are open. 2. Use the voltage detector to make sure that there is no voltage at the DC bus input terminal. 3. Set parameter 210.01 Grounding mode to Off. 4. Close the breaker of the first combiner box. Read the insulation resistance value from parameter 210.29 Insulation resistance. This value should be at least some Mohms. You can adjust the measurement time with parameter 210.31 Minimum Riso measurement time. 5. Close the next combiner box breaker and repeat the steps 3 and 4 for all the other combiner boxes. 6. Once all the photovoltaic strings are connected, set parameter 210.01 Grounding mode to Automatic. Make sure that the value of parameter 210.14 Total grounding current is not more than some hundreds mA. 7. Use the voltage detector to make sure that the voltage between DC- and ground is zero. If the voltage is not zero, the grounding relay of the inverter has not yet grounded the system. Make sure that the settings of the insulation monitoring device are correct for the installation and obey the local regulations. The trip limit is adjusted to 3 kohm at the factory. 	<input type="checkbox"/>
<u>Units with functional grounding (negative as standard, positive with option +F283):</u> Force grounding with parameter 210.01 Grounding mode. Verify the grounding current from parameter 210.14 Total grounding current. If faults or warnings occur, refer to the PVS800-57B central inverters firmware manual (3AXD50000048332 [English]).	<input type="checkbox"/>
Set the grounding mode to Automatic with parameter 210.01 Grounding mode, and configure the grounding to suit the local requirements. Refer to the PVS800-57B central inverters firmware manual (3AXD50000048332 [English]).	<input type="checkbox"/>
Set the grid code according to the local requirements. Refer to the PVS800-57B central inverters firmware manual (3AXD50000048332 [English]).	<input type="checkbox"/>
Adjust parameters 174.01 and 174.02 "M1-2 connected DC inputs" according to the actual input connection configuration.	<input type="checkbox"/>
Make sure that there are no faults or warnings active. If faults or warnings occur, refer to the PVS800-57B central inverters firmware manual (3AXD50000048332 [English]).	<input type="checkbox"/>
<p>Set parameter 189.01 Inverter operation to "Enable", and start the inverter.</p> <p>A normal starting procedure:</p> <p>After the start command, the inverter goes from the "Initialize" to the "Disconnected" state (refer to parameter 173.02 Inverter main state). If there is sufficient DC voltage, and the ground impedance is within range, the inverter goes to the "Connecting" state after the delay set in parameter 213.10 Delay for first start.</p> <p>In this state inverter charges the DC capacitors from the AC output and synchronizes to the grid. The DC contactor closes. The inverter goes to the MPPT state and starts to produce active power to the AC output. When there is not enough DC voltage or power available, the inverter goes to the "Disconnecting" state after the delay set in parameter 213.13 Disconnection delay in wake-up.</p>	<input type="checkbox"/>
<p>Make sure that the inverter operates properly from the following actual value parameters in the master control program:</p> <ul style="list-style-type: none"> • 101.01 DC Voltage • 101.12 POWER • 174.31...174.94, where the active input parameters depend on the DC input options (+G417). <p>The DC voltage should decrease from the open circuit voltage and the active power should match the line current and the AC voltage.</p>	<input type="checkbox"/>
Disable inverter operation to stop the inverter.	<input type="checkbox"/>



Set up fieldbus control	
Connect the external communications, for example, for the data logger, plant controller or SCADA system. Obey the safety instructions in the PVS800-57B manuals.	<input type="checkbox"/>
Configure the network interface to match with the local network. Refer to the PVS800-57B central inverters firmware manual (3AXD50000048332 [English]).	<input type="checkbox"/>
Set the fieldbus parameters according to the external controller. Refer to the PVS980-58 central inverters firmware manual (3AXD50000048332 [English]) and the fieldbus adapter module manual.	<input type="checkbox"/>
Make sure that the inverter can be seen from the external controller.	<input type="checkbox"/>
Make sure that the plant controller receives the correct values from the inverter and sends the correct values to the inverter.	<input type="checkbox"/>
Register the inverter	
<p>Fill in a commissioning report to register the inverter.</p> <p>The report is on the InstalledBase web page: https://businessapps.abb.com/sites/DrivesIB4/Pages/</p> <p>If you cannot access the InstalledBase, submit a Membership Request on the InstalledBase main page. Note that InstalledBase is only for ABB internal or ABB partner use.</p> <p>It is recommended to attach the parameter lists and back-up files of the inverter and master control program to the report.</p>	<input type="checkbox"/>
Hints on using the assistant control panel	
<p>The two commands at the bottom of the display (in the figure on the right, Options and Menu), show the functions of the two softkeys  and  located below the display.</p> <p>The commands assigned to the softkeys vary depending on the context.</p> <p>Use keys , ,  and  to move the cursor and/or change values depending on the active view.</p> <p>Key  shows a context-sensitive help page.</p> <p>For more information, see <i>ACx-AP-x assistant control panels user's manual</i> (3AUA0000085685 [English]).</p>	

Starting and stopping the inverter

■ Inverter control with parameter

To enable inverter operation, set the value of parameter 189.01 Inverter operation to Enable. You can edit the parameter value directly in the parameter group 189 Inverter Control with the control panel, or with a computer through USB or SCADA.

During the first start-up, ABB recommends that you:

1. Limit the output using the parameter 130.75 External power limit
2. Let the inverter run for a few minutes at limited power
3. Make sure that there are no loud noises or vibrations.

Gradually increase the power output limit up to the desired power.

8

Hardware status

Contents of this chapter

This chapter describes the hardware signals that can be used to track faults. Refer to the *PVS800-57B central inverters firmware manual* for (3AXD50000048332 [English]) warning and fault descriptions, status parameters, etc.

LEDs

The table tells the location, name, color and meaning of the LED indicators in the inverter.

Where	LED	Color	Indication
Control panel	Status LED	Green, cont.	The inverter operates normally. The control unit is powered and +24 V is supplied to the control panel.
		Green, flicker	Data is transferred between the PC tool and the inverter via USB.
		Green, blink	There is an active warning in the inverter.
		Red	There is an active fault in the inverter.
AUX cabinet door	Push button and status LED	Green	AC breaker closed / push to close
		Red	AC breaker open / push to open

Where	LED	Color	Indication
Control unit BCU-12	BATT OK	Green	The battery voltage of the real-time clock is OK (more than 2.8 V). When the LED off: <ul style="list-style-type: none"> • The battery voltage is less than 2.8 V • The battery is missing • The control unit is not powered
	PWR OK	Green	The internal voltage is correct.
	FAULT	Red	The control program indicates that the equipment is faulty. Refer to the firmware manual.
	WRITE	Yellow	Writing to SD card in progress.
AC500	PWR	Green	The AC500 unit is powered.
	RUN	Green	The AC500 program is running.
	ERR	Red	An error or warning detected by the AC500 firmware.
MIRU-01	POWER	Green	The MIRU-01 unit is powered.
	ERROR	Red	An error detected by the MIRU-01 firmware.
	STATUS	Green	The status of the insulation resistance measurement: <ul style="list-style-type: none"> • Slow flash (1/s): Measurement ready • Rapid flash (5/s): Measurement not ready
	DISABLE	Red	Insulation resistance measurement is disabled.
MGND-01	POWER	Green	The MGND-01 is powered.
	GROUNDING STATUS	Green	The grounding voltage is OK (<50 V DC)
BAMU-11	POWER	Green	The BAMU-11 unit is powered.
	LINK FAULT	Red	There is an error on the board or an error in the PSL2 link.
	U2 > 60V	Yellow	The input voltages (U2, V2 and W2) are more than 60 V.
	U1 > 60V	Yellow	The input voltages (U1, V1 and W1) are more than 60 V.

Warning and fault messages

Refer to the *PVS800-57B central inverters firmware manual* (3AXD50000048332 [English]).

9

Maintenance

Contents of this chapter

This chapter contains the preventive maintenance instructions of the inverter.

Maintenance intervals

If the inverter is installed in a suitable environment, it requires only minimum maintenance. The tables list the routine maintenance intervals recommended by ABB.

The recommended maintenance intervals and component replacement are based on specified operational and environmental conditions. ABB recommends annual inverter inspections to ensure the highest reliability and optimum performance. For more detailed maintenance information, refer to the maintenance instructions, product manuals and the ABB website: www.abb.com/solarinverters.

The designed life time of the inverter is 25 years. If the inverter is planned to be used longer than its designed life time, additional maintenance and component replacements are recommended. Contact ABB for more details.

After the product warranty expires, you can choose to not follow the recommended preventive maintenance plan. The preventive maintenance plan is, however, a prerequisite for ABB service contracts.

■ Descriptions of symbols

Action	Description
I	Visually examine and do maintenance if it is necessary.
P	On/off-site work (commissioning, tests, measurements, etc.)
R	Replace the component.

Recommended annual maintenance actions by the user

ABB recommends that you do these annual inspections to ensure the highest reliability and optimum performance of the inverter.

Target / task	Action
Connections and environment	
Environment check	I
Cabinet door filters IP41	R
Spare parts	
Spare parts	I
DC circuit capacitors reforming, spare modules and spare capacitors	P
Inspections by the user	
IP41 air inlet and outlet grills	I
Inspection of dustiness, corrosion, and temperature inside the cabinet. Cleaning, if needed.	I
Overall cleanliness of inverter (e.g. cabinet door sealings, function of cooling fans, main circuit terminals)	I
Other	
Air circuit breaker maintenance	I

Recommended maintenance intervals

Component	Years from start-up									
	1	3	6	9	12	15	18	21	24	
Connections and environment										
Heat sink cleaning ¹⁾		I	I	I	I	I	I	I	I	I
Cleanliness of power connections of the inverter module. Clean if necessary. ¹⁾		I	I	I	I	I	I	I	I	I
Tightness of the AC and DC terminals ²⁾	I			I			I			
Main cooling fans and control										
Main cooling fan, inverter unit				R			R			
BFPS module internal power supply boards				R			R			
Cooling fan, LCL-filter unit				R			R			
Cooling fan of R8i inverter unit PCBs				R			R			
Cabinet cooling fans										
Cabinet cooling fans				R			R			
Inverter unit										
BINT, BGDR, BDPS module internal circuit boards					R					R
Flat ribbon cables (module internal circuit boards)					R					R
Common, control panel and control unit batteries										
BCU control unit battery (Real-time clock)			R		R		R			R
Control panel battery (Real-time clock)				R			R			
Buffers and power supplies										
Auxiliary power supplies					R					R
Auxiliary buffers					R					R

3AXD10000605550

1) Always when inverter module is replaced, check the cleanliness and condition of power connection and heat sink. Cleaning if needed.

2) Check the tightness of the main circuit terminals during commissioning. See the recommended tightness in the Hardware manual. If the inverter installation conditions require, check the tightness more often. Obey the local regulations.

Maintenance tasks

■ Examining the environment

- Make sure that the installation environment of the inverter is according to the requirements.
- Make sure that the inverters are installed according to ABB recommendations. For more information, refer to [Mechanical installation](#) on page 29 and the *PVS800-57B central inverters hardware manual* (3AXD50000048300 [English]).
- Make sure that there is sufficient space around the unit for maintenance tasks.
- Make sure that the unit is correctly fastened to the installation surface.
- Make sure that the doors are closed.

■ Cleaning the cabinet



WARNING! Obey the safety instructions, page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.



WARNING! Use a vacuum cleaner with an antistatic hose and nozzle. Using a normal vacuum cleaner creates static discharges which can damage circuit boards.

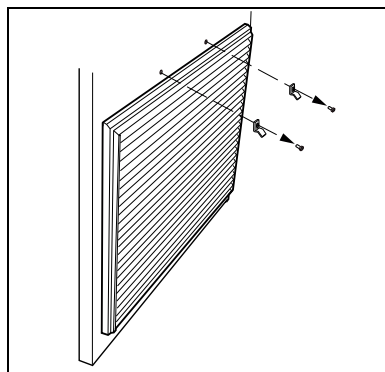
1. Stop the inverter and do the steps in [Electrical safety precautions](#) on page 12 before you start the work.
 2. Clean the interior of the cabinet with a soft brush and a vacuum cleaner.
 3. Clean the air inlets of the fans.
 4. Examine the air inlet grills of the cabinet. Replace them when necessary.
-

■ Replacing the cabinet door air filters and cleaning the grilles

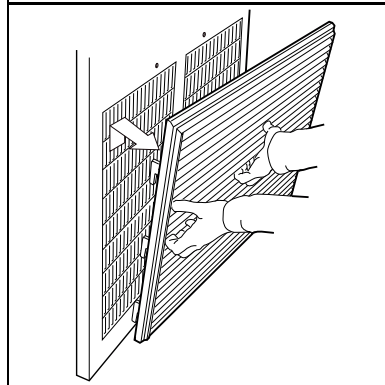


WARNING! Obey the safety instructions, page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

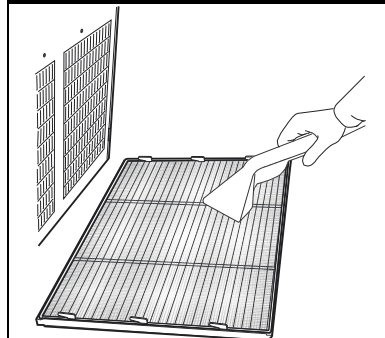
1. Stop the inverter and do the steps in *Electrical safety precautions* on page 12 before you start the work.
2. Remove the grille fasteners.



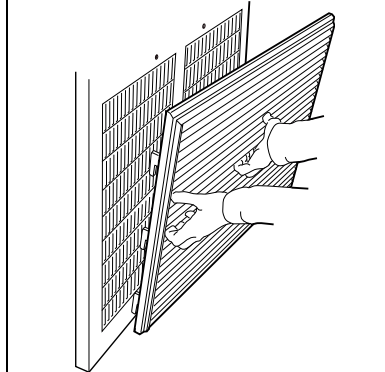
3. Remove the grilles one by one.
4. Remove the dirty air filters from the grilles.



5. Clean the grilles with a vacuum cleaner.
Do not use a pressure washer or pressurized air.
6. Wipe the grilles clean and let them dry.
7. Install the new air filters in the grilles.



8. Install the grilles.



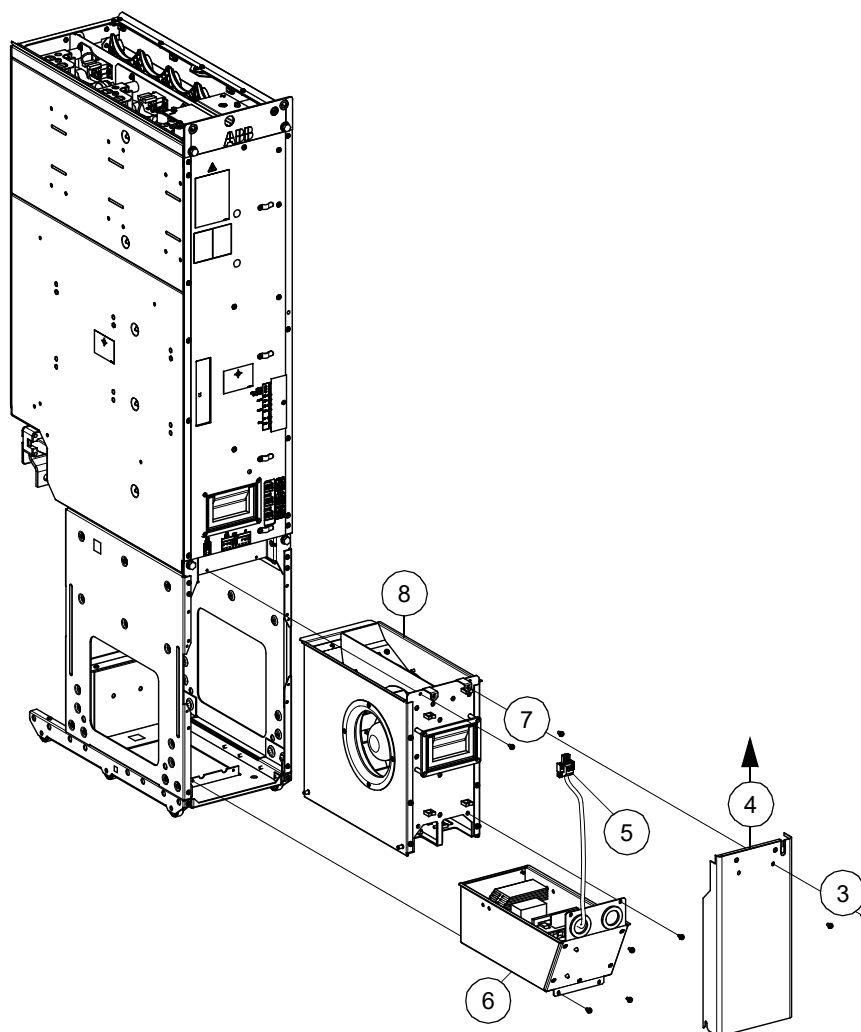
Fans

■ Replacing the power module cooling fans



WARNING! Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in [Electrical safety precautions](#) on page 12.
2. Open the cover plates of the ISU cabinet.
3. Remove the screws that hold the cover plate of the fan unit.
4. Lift the cover plate slightly to release it.
5. Disconnect the fan wiring.
6. Remove the power supply unit below the fan unit.
7. Remove the screws from the fan unit.
8. Pull out the fan unit.
9. Install a new fan unit in reverse order.



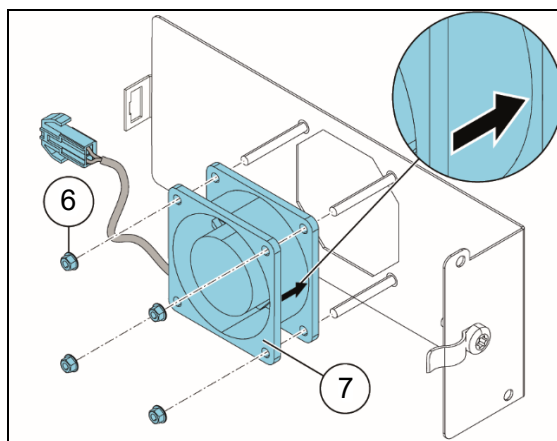
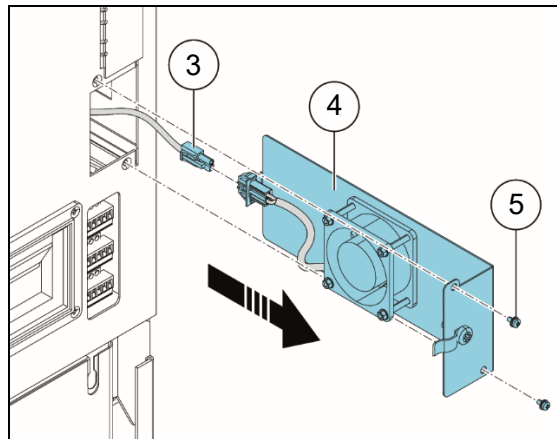
■ Replacing the power module board compartment fan

The R8i module has a fan to cool the circuit board compartment. You can access the fan from the front of the module.



WARNING! Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in [Electrical safety precautions](#) on page 12.
2. Open the cover plates of the ISU cabinet.
3. Remove the two M4×12 (T20) screws that lock the fan holder.
4. Pull the fan holder out of the module.
5. Disconnect the fan cable.
6. Remove the four M3 (5.5 mm) nuts that hold the fan.
7. Remove the fan from the fan holder.
8. Put the fan onto the threaded studs on the fan holder with the airflow direction arrow pointing towards the fan holder.
9. Install and tighten the four M3 (5.5 mm) nuts that hold the fan.
10. Connect the fan cable.
11. Align and push the fan holder into the module.
12. Install and tighten the two M4×12 (T20) screws.

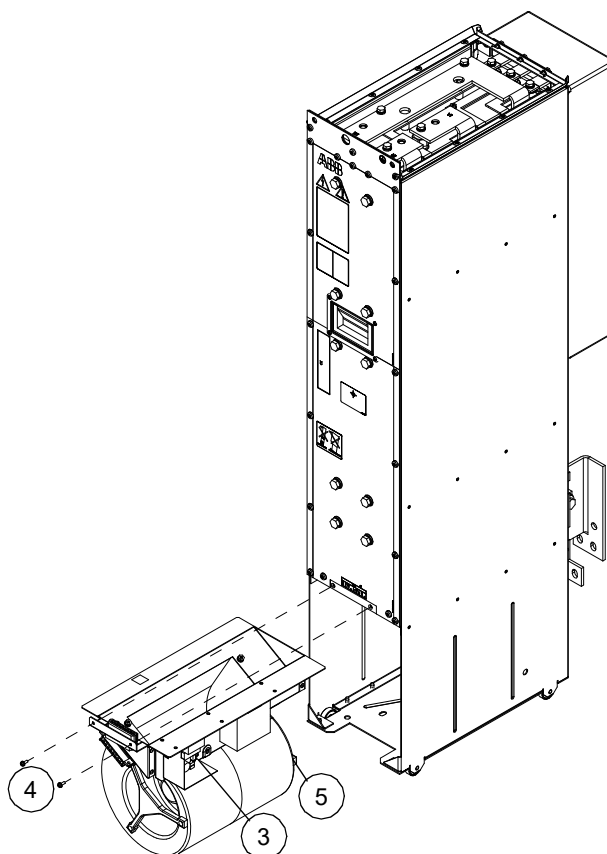


■ Replacing the LCL filter cooling fans



WARNING! Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in *Electrical safety precautions* on page 12.
2. Open the ISU cabinet cover plates.
3. Disconnect the power and control cables of the LCL cooling fans.
4. Loosen the locking screws of the LCL cooling fan.
5. Pull the fan out.
6. Install the new LCL cooling fan.
7. Tighten the screws.
8. Connect the power and control cables of the LCL cooling fans.
9. Attach the ISU cabinet cover plates.
10. Apply auxiliary power to the inverter and check that all of the cooling fans start.

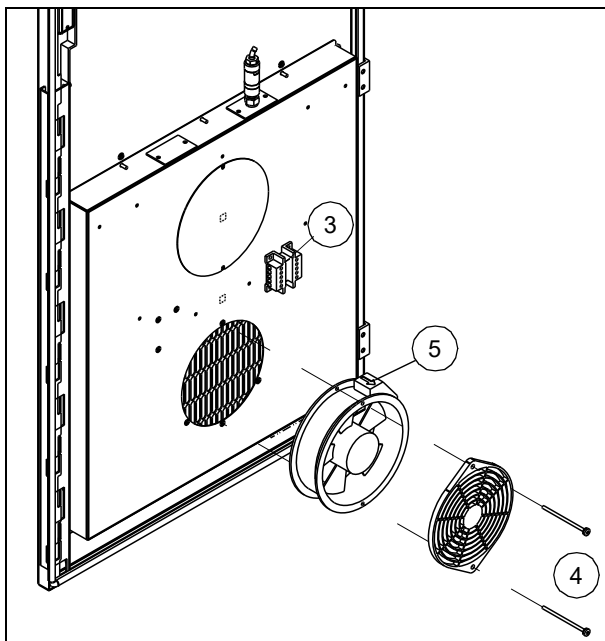


■ Replacing the AUX cabinet cooling fan



WARNING! Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in *Electrical safety precautions* on page 12.
2. Open the AUX cabinet door.
3. Disconnect the power connector of the cooling fan.
4. Remove the 2 screws that hold the cooling fan and finger guard.
5. Disconnect the fan wiring.
6. Remove the cooling fan.
7. Install the new cooling fan.
8. Install the finger guard and install and tighten the 2 screws.
9. Connect the fan wiring and power connector of the cooling fan.



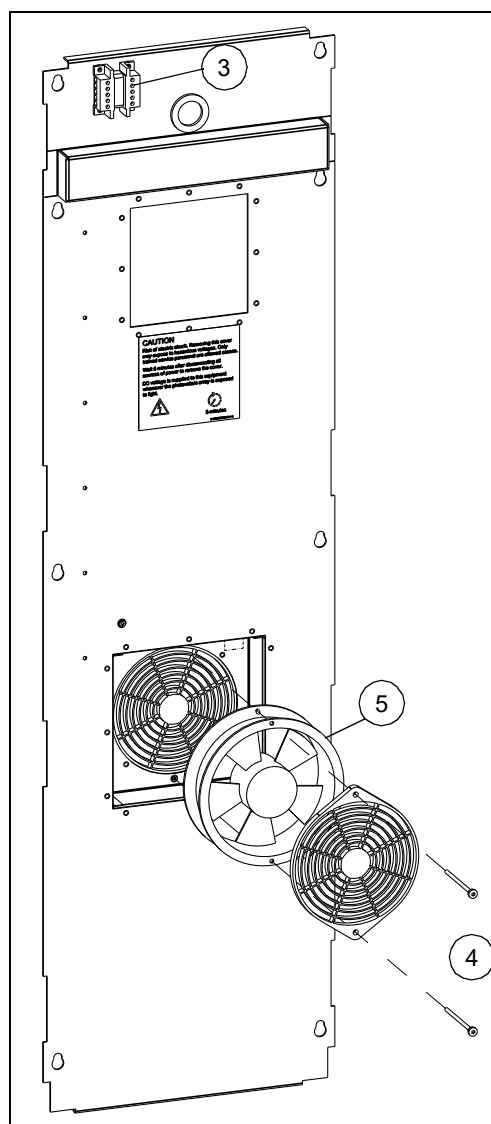
■ Replacing the DC cabinet cooling fans

The cooling fans of the DC cabinet are mounted on the protective metal panel in the cabinet. Depending on the number of DC inputs there are two or three cooling fans.



WARNING! Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in *Electrical safety precautions* on page 12.
2. Open the DC cabinet door.
3. Disconnect the power connector of the cooling fan.
4. Remove the 2 screws that hold the cooling fan and finger guard.
5. Disconnect the fan wiring.
6. Remove the cooling fan.
7. Install the new cooling fan.
8. Install the finger guard and install and tighten the 2 screws.
9. Connect the fan wiring and power connector of the cooling fan.



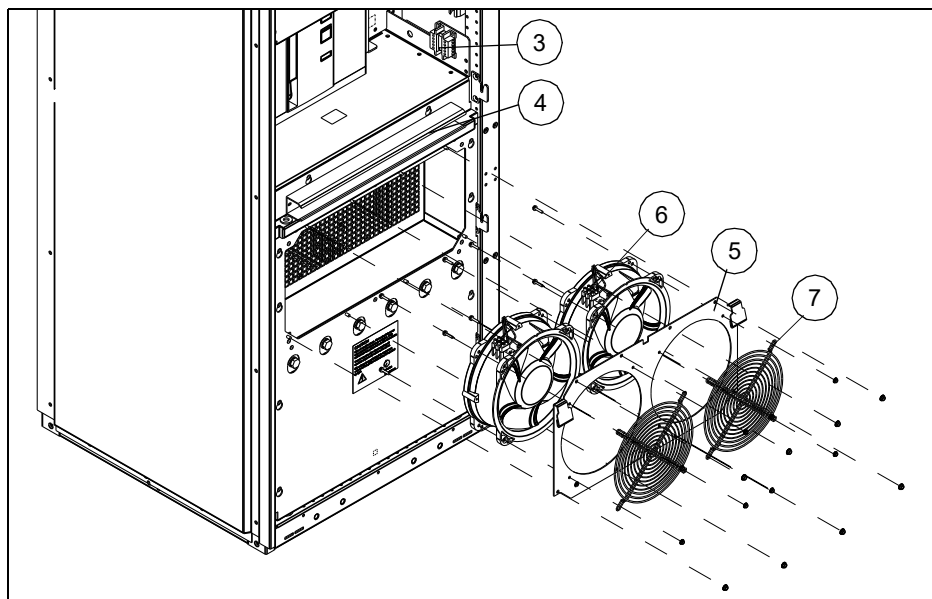
■ Replacing the AC cabinet cooling fans

The cooling fans of the AC cabinet are mounted on the protective metal panel in the cabinet.



WARNING! Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in [Electrical safety precautions](#) on page 12.
2. Open the AC cabinet door.
3. Disconnect the power connector of the cooling fans.
4. Remove the cover of the cable tray above the fan assembly and take out the cables.
5. Remove the 8 screws that hold the fan assembly.
6. Disconnect the fan wiring.
7. Remove the 4 screws that hold each cooling fan and finger guard.
8. Remove the cooling fans.
9. Install the new cooling fans.
10. Install the finger guard and install and tighten the 4 screws for each fan.
11. Connect the fan wiring.
12. Put the fan assembly into position.
13. Install and tighten the 8 screws that hold the fan assembly.
14. Install the cover of the cable tray.
15. Connect the power connector of the cooling fans.



Replacing the inverter power module

The inverter power module can be replaced only by a technician who is authorized by ABB.

■ Removing the inverter module(s)

To allow more room for cabling work, the inverter modules can be removed completely instead of only the fan carriages.

Refer to the drawings below.



WARNING! Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Before you start, stop the inverter and do the steps in *Electrical safety precautions* on page 12.
 2. Open the inverter module cubicle door.
 3. Remove the shroud at the top of the cubicle.
 4. Disconnect the terminal block [X30] at the top of the module.
 5. Remove the DC busbars from the module. Make a note of the order and position of the screws and washers.
 6. Disconnect the wiring connected to the terminals on the front of the module (including fiber-optic cabling). Move the disconnected wiring aside.
 7. Attach the module extraction/installation ramp (included) to the base of the cabinet so that the tabs on the mounting bracket enter the slots on the ramp.
-



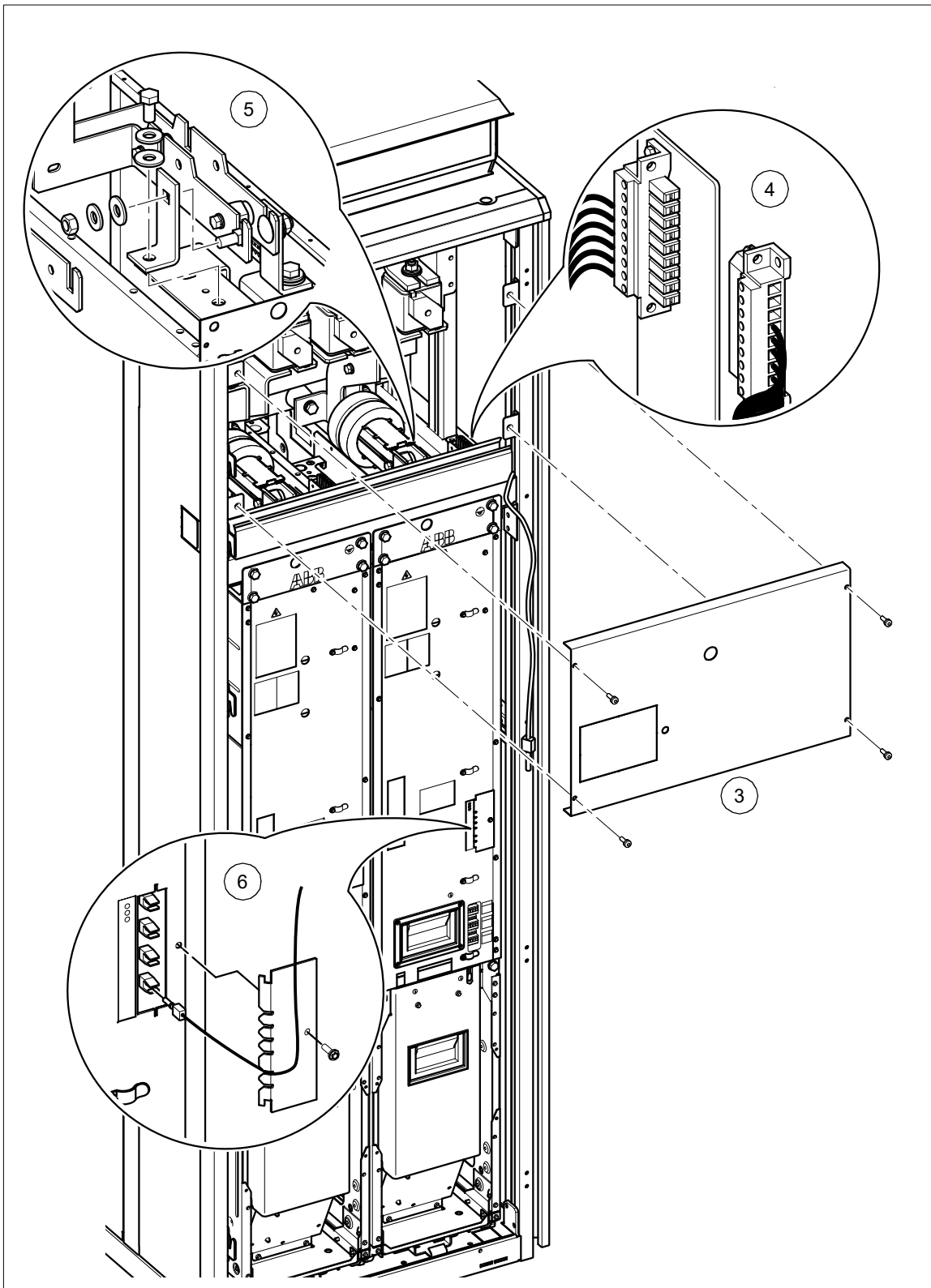
WARNING! Do not use the ramp included in the inverter delivery with plinth heights over 50 mm (1.97 in).

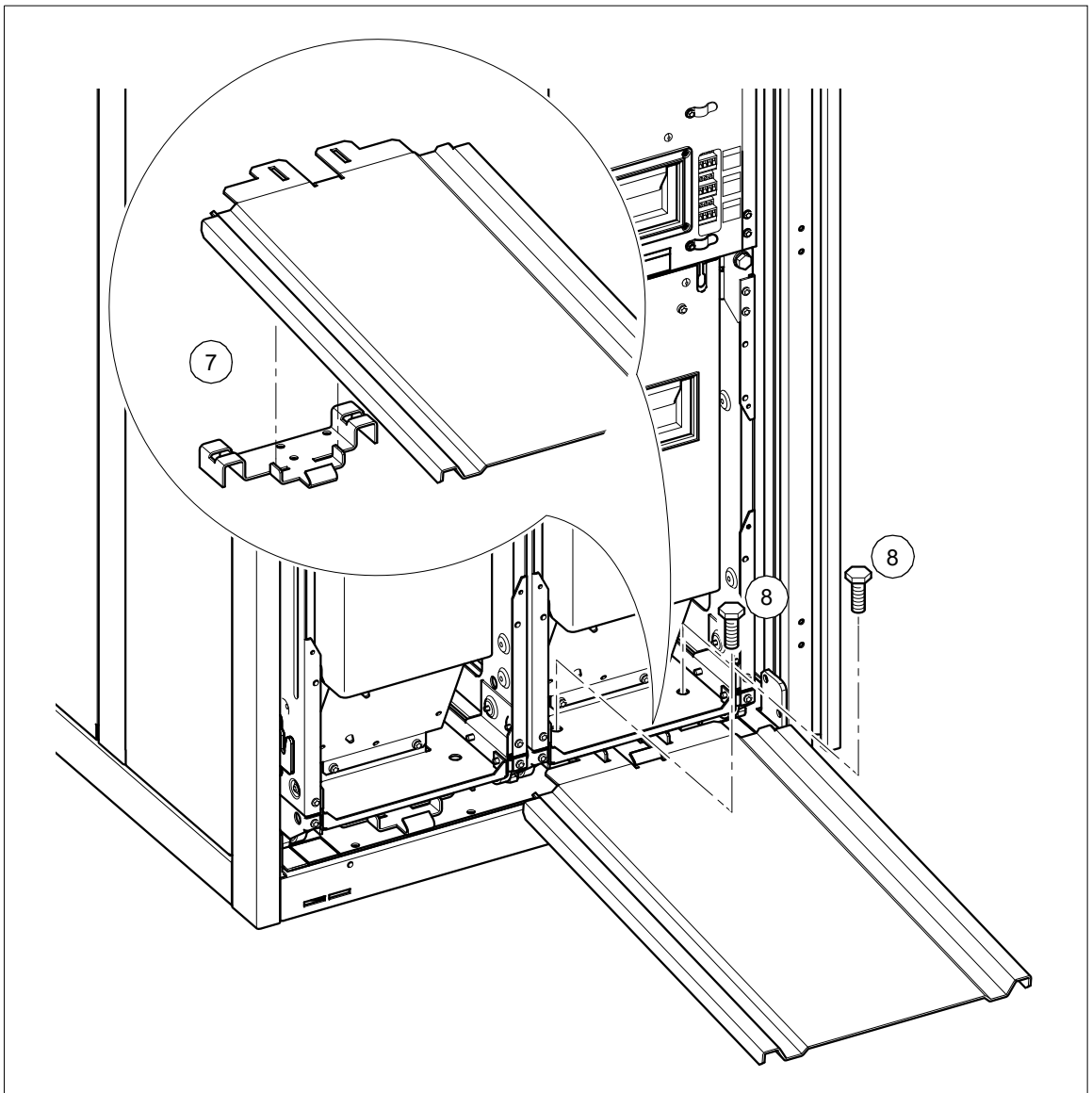
8. Remove the two screws at the bottom front of the module.
-

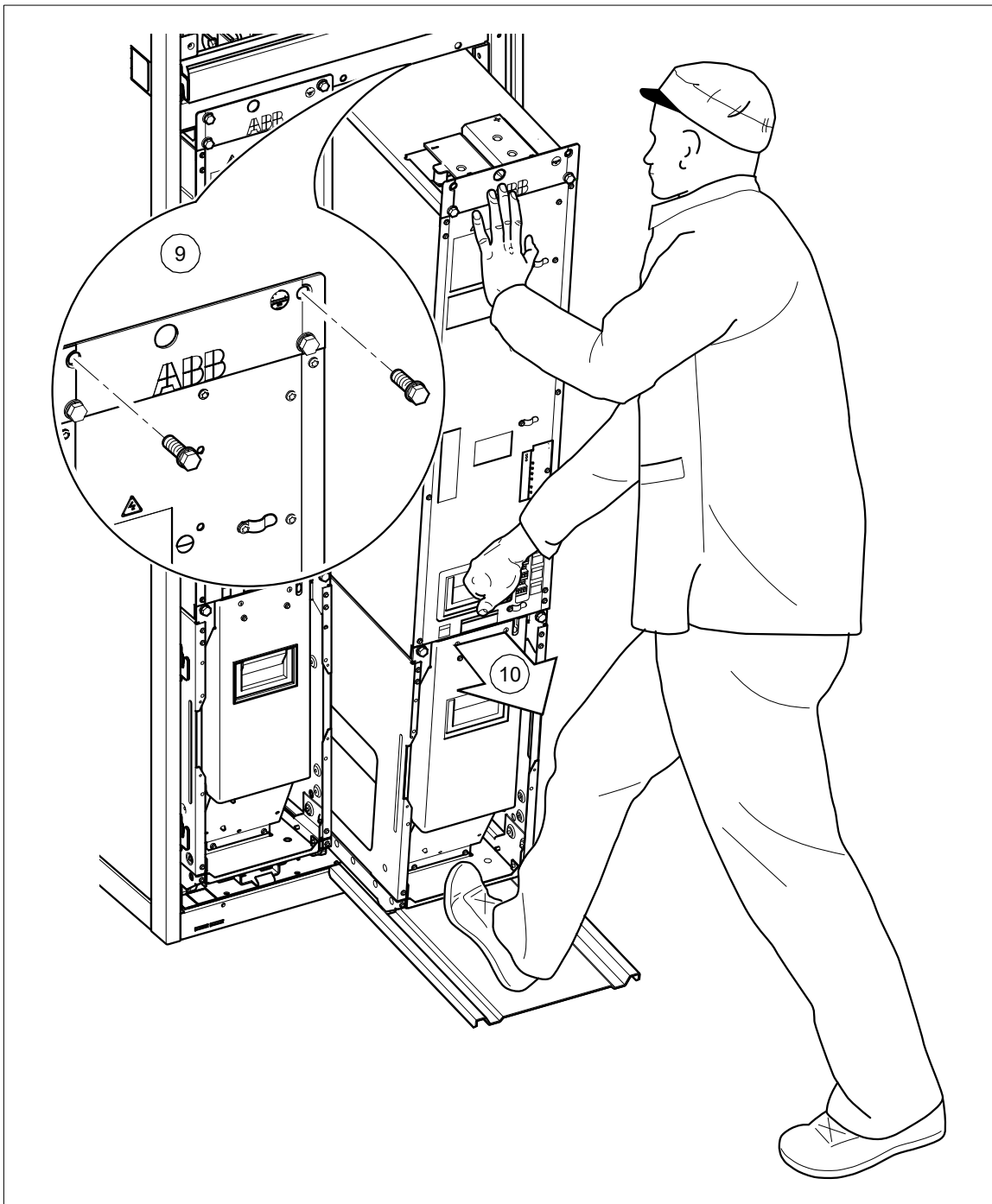


WARNING! Before you continue, make sure that the cabinet is level, or put chocks against the wheels of the module.

9. Remove the two screws at the top front of the module.
 10. Pull the module carefully out along the ramp. While pulling on the handle with your right hand, keep a constant pressure with one foot on the base of the module to prevent the module from falling on its back.
 11. Move the module into a safe location outside the immediate work area and make sure it cannot topple over. Put chocks against the wheels of the module if the floor is not completely level.
 12. Repeat the procedure for the other inverter modules.
-







■ Installing the inverter module into the cubicle



WARNING! Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.

1. Make sure that there are no tools, debris or any foreign objects in the cubicle.
2. If not already in place, attach the module extraction/installation ramp (included) to the base of the cabinet so that the tabs on the mounting bracket enter the slots on the ramp.
3. Push the module up the ramp and back into the cubicle.
 - **Keep your fingers away from the edge of the module front plate to avoid pinching.**
 - **Keep a constant pressure with one foot on the base of the module to prevent the module from falling on its back.**
4. Secure the top front of the module with two screws. Tighten to 22 N·m (16 lbf·ft).
5. Secure the bottom front of the module with two screws. Tighten to 22 N·m (16 lbf·ft).
6. Remove the ramp.
7. Attach the DC busbars to the module. Tighten to 70 N·m (52 lbf·ft).
8. Reconnect terminal block [X30] at the top of the module.
9. Reconnect the wiring and fiber optic cables to the terminals on the front of the module.
10. Repeat the procedure for the other inverter modules.
11. Reinstall the shroud near the top of the cubicle.

Heat sink cleaning



WARNING! Obey the safety instructions on page 9. If you ignore the instructions, physical injury or death, or damage to the equipment can occur.



WARNING! Do not use compressed air or a vacuum cleaner on other parts of the unit to prevent ESD damage.

Clean the heat sink of the module when you replace the fan assembly. To clean the heat sink:

1. Remove the fan assembly. Refer to [Replacing the power module cooling fans](#) on page 63.
2. Blow clean and dry compressed air through the heat sink from bottom to top.
3. Use a vacuum cleaner with an ESD-protected nozzle at the top to catch the dust.

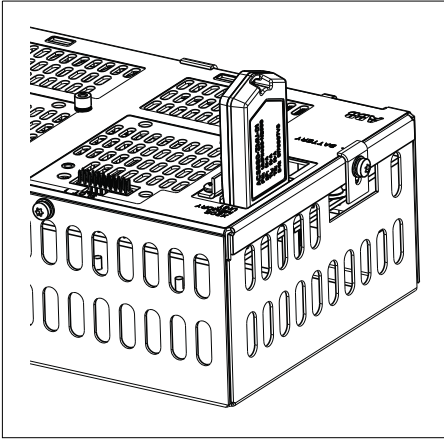
Memory unit

When you replace the BCU-12 control unit, you can move the memory unit to the new control unit to keep the firmware and parameter settings.



WARNING! Do not remove or insert the memory unit when the control unit is powered.

To remove the memory unit, loosen the fastening screw and pull the memory unit out.



Replacing the BCU control unit battery

Replace the real-time clock battery, if the *BATT OK* LED is not on when the control unit is powered on.

1. Loosen the fastening screw and remove the battery.
2. Install the new BR2032 battery.
3. Dispose of the old battery according to local disposal rules or applicable laws.
4. Set the real-time clock.

Replacing the control panel battery

1. Turn the lid on the back of the panel counter-clockwise until the lid opens.
2. Replace the battery with a new CR2032 battery.
3. Put the lid back and tighten it by turning it clockwise.
4. Dispose of the old battery according to local disposal rules or applicable laws.

Spare parts

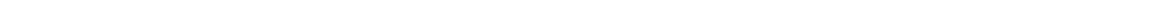
■ Storing spare parts

Make sure that the spare parts are stored properly.

When not being actively worked on, store the spare parts in their original containers or bags, if it is possible.

■ **DC circuit capacitors reforming, spare modules, and spare capacitors**

If there are spare modules or separate spare DC circuit capacitors, ABB recommends that you reform the capacitors annually. Refer to *Capacitor reforming instructions* (3BFE64059629 [English]).





Further information

For more information on ABB products and services for solar applications, navigate to www.abb.com/solarinverters.



abb.com/solar