ABB INDUSTRIAL DRIVES

ACS880-07CLC drives

Hardware manual

ACS880-07CLC drives

Hardware manual

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3AXD50000131457 Rev B
EN
Original instructions
EFFECTIVE: 2022-08-12

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1

Safety instructions

Contents of this chapter

This chapter contains the safety instructions which you must obey when you install, start-up, operate and do maintenance work on the drive. If you ignore the safety instructions, injury, death or damage can occur.

Use of warnings and notes

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. Notes draw attention to a particular condition or fact, or give information on a subject.

The manual uses these warning symbols:

WARNING!
Electricity warning tells about hazards from electricity which can cause injury or death, or damage to the equipment.

WARNING!
General warning tells about conditions other than those caused by electricity, which can cause injury or death, or damage to the equipment.

WARNING!
Electrostatic sensitive devices warning tells you about the risk of electrostatic discharge which can cause damage to the equipment.

General safety in installation, start-up and maintenance

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

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

- Keep the drive in its package until you install it. After unpacking, protect the drive from dust, debris and moisture.
- Use the required personal protective equipment: safety shoes with metal toe cap, safety glasses, protective gloves and long sleeves, etc. Some parts have sharp edges.
- Lift a heavy drive with a lifting device. Use the designated lifting points. See the dimension drawings.
- Incorrect lifting can cause danger or damage. Obey the local laws and regulations applicable to lifting, such as requirements for planning the lift, for capacity and condition of lifting equipment, and for training of personnel.
- The lifting bars attached to large drive cabinets are heavy. Be careful when removing or reinstalling the bars. Whenever possible, use a lifting device attached to the designated lifting points.
- Attach the drive 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. Attach 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 drive is in operation.
- Be careful when handling a tall 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 leave an unsupported module unattended especially on a sloping floor.

- Beware of hot surfaces. Some parts, such as heatsinks of power semiconductors, and brake resistors, remain hot for a while after disconnection of the electrical supply.
- Make sure that debris from drilling, cutting and grinding does not go into the drive during installation. Electrically conductive debris inside the drive can cause damage or malfunction.
- Make sure that there is sufficient cooling. See the technical data.
- Keep the cabinet doors closed when the drive is powered. With the doors open, a risk of a potentially fatal electric shock, arc flash or high-energy arc blast exists. If you cannot avoid working on a powered drive, obey the local laws and regulations on live working (including – but not limited to – electric shock and arc protection).
- Before you adjust the drive operation limits, make sure that the motor and all driven equipment can operate throughout the set operation limits.
- Before you activate the automatic fault reset or automatic restart functions of the drive control program, make sure that no dangerous situations can occur. These functions reset the drive automatically and continue operation after a fault or supply break. If these functions are activated, the installation must be clearly marked as defined in IEC/EN/UL 61800-5-1, subclause 6.5.3, for example, "THIS MACHINE STARTS AUTOMATICALLY".
- The maximum number of drive power-ups is five in ten minutes. Too frequent power-ups can damage the charging circuit of the DC capacitors.
- If you have connected safety circuits to the drive (for example, Safe torque off or emergency stop), validate them at start-up. See separate instructions for the safety circuits.

Note:

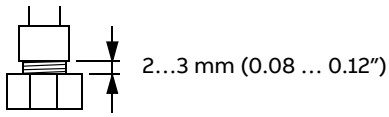
- If you select an external source for the start command and it is on, the drive will start immediately after fault reset unless you configure the drive for pulse start. See the firmware manual.
- If the drive is in remote control mode, you cannot stop or start the drive with the control panel.
- Only authorized persons are allowed to repair a malfunctioning drive.

Work on the liquid cooling system

These instructions are intended for all personnel that do installation, commissioning and maintenance work on the liquid cooling system.

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

- Use the required personal protective equipment. See the Safety data sheet for Antifrogen® L coolant by Clariant (www.clariant.com) for the instructions on the respiratory, hand and eye protection when handling the coolant.
- Beware of hot, high-pressure coolant (6 bar, max. 50 °C) that is present in the internal cooling circuit when it is in operation. Before you disconnect a pipe, release the pressure. Close the appropriate stop valve(s). If necessary, stop the cooling circuit pumps.
- Avoid skin contact with coolant. If coolant splashes onto the skin or in the eyes, rinse immediately with plenty of water. Do not syphon it by mouth. If you swallow or get it into the eyes, seek medical advice.
- Before the drive power up, make sure that the internal cooling circuit is filled up with coolant, and the cooling is in operation (coolant is circulating).
- Make sure that coolant meets the ABB specification. See the appropriate hardware manual of the drive/unit.
- To avoid breaking the coolant pipes, do not overtighten the nuts of the unions. Leave 2 to 3 millimeters (0.08 to 0.12 inches) of thread visible.



- Do not drain coolant into the sewer system.
- If you need to store the drive in temperature below -15 °C (5 °F), drain the cooling circuit, or make sure that it is filled with the coolant specified by ABB.
- Drives with the cooling unit: Do not open the cooling unit pump inlet or outlet valves before filling up the coolant circuit. The pumps are filled with a mixture at the factory to prevent corrosion and the valves are closed at the factory.
- Drives with the cooling unit: Do not run the cooling unit pump dry.

Electrical safety in installation, start-up and maintenance

Electrical safety precautions

These electrical safety precautions are for all personnel who do work on the drive, motor cable or motor.

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

If you are not a qualified electrical professional, do not do installation or maintenance work.

Do these steps before you begin any installation or maintenance work.

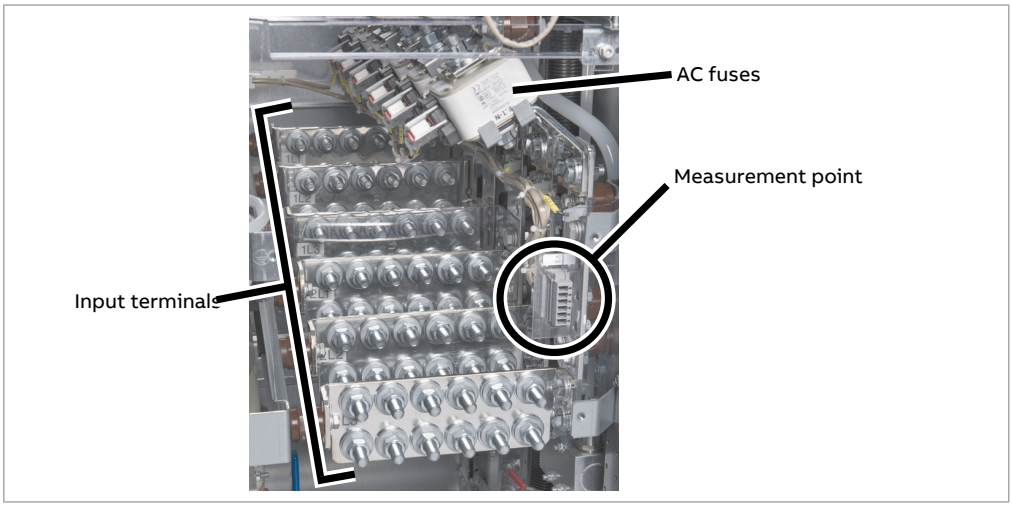
1. Clearly identify the work location and equipment.
2. Disconnect all possible voltage sources. Make sure that re-connection is not possible. Lock out and tag out.
   - Open the main disconnecting device of the drive.
   - Open the charging switch if present.

     WARNING!
     The charging switch is not necessarily located within or nearby the drive cubicle.

   - Open the disconnector of the supply transformer. (The main disconnecting device in the drive cabinet does not disconnect the voltage from the AC input power busbars of the drive cabinet.)
   - Open the auxiliary voltage switch-disconnector (if present), and all other possible disconnecting devices that isolate the drive from dangerous voltage sources.
   - In the liquid cooling unit (if present), open the switch-disconnector of the cooling pumps.
   - If you have a permanent magnet motor connected to the drive, disconnect the motor from the drive with a safety switch or by other means.
   - Disconnect all dangerous external voltages from the control circuits.
   - After you disconnect power from the drive, always wait 5 minutes to let the intermediate circuit capacitors discharge before you continue.
3. Protect any other energized parts in the work location against contact.
4. Take special precautions when close to bare conductors.
5. Measure that the installation is de-energized. Use a quality voltage tester. If the measurement requires removal or disassembly of shrouding or other cabinet structures, obey the local laws and regulations applicable to live working (including – but not limited to – electric shock and arc protection).
   - Before and after measuring the installation, verify the operation of the voltage tester on a known voltage source.
   - Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is zero.
     - Open the door(s) of the supply module cubicle(s).
     - Locate the measurement points (XACx) in front of each array of input terminals. Each input terminal is connected to a specific pin of the measurement point. For example, a drive with six supply modules has

two supply module cubicles, and three measurement points (XAC1, XAC2, XAC3). The picture below shows a cubicle with two modules.



- Measure the voltage of each individual pin of each measurement point against PE.
- If the voltage of all pins of all measurement points is zero, remove the plastic shroud(s) from in front of the input terminals.
- Working from outside to inside, measure the voltage between each input terminal and PE.

WARNING!
Do not touch the AC fuses or the busbars they are connected to.

- Make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is zero.
  Important! Repeat the measurement also with the DC voltage setting of the tester. Measure between each phase and ground. There is a risk of dangerous DC voltage charging due to leakage capacitances of the motor circuit. This voltage can remain charged for a long time after the drive power-off. The measurement discharges the voltage.
- Make sure that the voltage between the drive DC terminals (UDC+ and UDC-) and the grounding (PE) terminal is zero. In cabinet-built drives, measure between the drive DC busbars (+ and -) and the grounding (PE) busbar.

WARNING!
The busbars inside the cabinet of liquid-cooled drives are partially coated. Measurements made through the coating are potentially unreliable, so only measure at uncoated portions. Note that the coating does not constitute a safe or touch-proof insulation.

6. Install temporary grounding as required by the local regulations.
7. Ask for a permit to work from the person in control of the electrical installation work.

Additional instructions and notes

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

If you are not a qualified electrical professional, do not do installation or maintenance work.

- Keep the cabinet doors closed when the drive is powered. With the doors open, a risk of a potentially fatal electric shock, arc flash or high-energy arc blast exists.
- Make sure that the electrical power network, motor/generator, and environmental conditions agree with the drive data.
- Do not do insulation or voltage withstand tests on the drive.
- If you have a cardiac pacemaker or other electronic medical device, keep away from the area near motor, drive, and the drive power cabling when the drive is in operation. There are electromagnetic fields present which can interfere with the function of such devices. This can cause a health hazard.
- ABB does not recommend attaching the cabinet by arc welding. If you have to, obey the welding instructions in the drive manuals.

Note:

- When the drive is connected to the input power, the motor cable terminals and the DC bus are at a dangerous voltage.
  The brake circuit, including the brake chopper (option +D150) and brake resistor (option +D151) are also at a dangerous voltage.
  After disconnecting the drive from the input power, these remain at a dangerous voltage until the intermediate circuit capacitors have discharged.
- External wiring can supply dangerous voltages to the relay outputs of the control units of the drive.
- The Safe torque off function does not remove the voltage from the main and auxiliary circuits. The function is not effective against deliberate sabotage or misuse.

Optical components

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

- Handle the fiber optic cables with care.
- When you unplug the fiber optic cables, always hold the connector, not the cable itself.
- 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 allowed bend radius is 35 mm (1.4 in).

Printed circuit boards

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

Grounding

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

WARNING!
Obey these instructions. If you ignore them, injury or death, or equipment malfunction can occur, and electromagnetic interference can increase.

If you are not a qualified electrical professional, do not do grounding work.

- Always ground the drive, the motor and adjoining equipment. This is necessary for the personnel safety.
- Make sure that the conductivity of the protective earth (PE) conductors is sufficient and that other requirements are met. See the electrical planning instructions of the drive. Obey the applicable national and local regulations.
- When using shielded cables, make a 360° grounding of the cable shields at the cable entries to reduce electromagnetic emission and interference.
- In a multiple-drive installation, connect each drive separately to the protective earth (PE) busbar of the power supply.

General safety in operation

These instructions are for all personnel that operate the drive.

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

- Keep the cabinet doors closed when the drive is powered. With the doors open, a risk of a potentially fatal electric shock, arc flash or high-energy arc blast exists.
- If you have a cardiac pacemaker or other electronic medical device, keep away from the area near motor, drive, and the drive power cabling when the drive is in operation. There are electromagnetic fields present which can interfere with the function of such devices. This can cause a health hazard.
- Give a stop command to the drive before you reset a fault. If you have an external source for the start command and the start is on, the drive will start immediately after the fault reset, unless you configure the drive for pulse start. See the firmware manual.
- Before you activate the automatic fault reset or automatic restart functions of the drive control program, make sure that no dangerous situations can occur. These functions reset the drive automatically and continue operation after a fault or supply break. If these functions are activated, the installation must be clearly marked as defined in IEC/EN/UL 61800-5-1, subclause 6.5.3, for example, "THIS MACHINE STARTS AUTOMATICALLY".

Note:

- The maximum number of drive power-ups is five in ten minutes. Too frequent power-ups can damage the charging circuit of the DC capacitors. If you need to start or stop the drive, use the control panel keys or commands through the I/O terminals of the drive.
- If the drive is in remote control mode, you cannot stop or start the drive with the control panel.

Additional instructions for permanent magnet motor drives

Safety in installation, start-up, maintenance

These are additional warnings concerning permanent magnet motor drives. The other safety instructions in this chapter are also valid.

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

If you are not a qualified electrical professional, do not do installation or maintenance work.

- Do not do work on the drive when a rotating permanent magnet motor is connected to it. A rotating permanent magnet motor energizes the drive including its input and output power terminals.

Before installation, start-up and maintenance work on the drive:

- Stop the drive.
- Disconnect the motor from the drive with a safety switch or by other means.
- If you cannot disconnect the motor, make sure that the motor cannot rotate during work. Make sure that no other system, like hydraulic crawling drives, can rotate the motor directly or through any mechanical connection like belt, nip, rope, etc.
- Do the steps in section Electrical safety precautions (page 19).
- Install temporary grounding to the drive output terminals (T1/U, T2/V, T3/W). Connect the output terminals together as well as to the PE.

During the start-up:

- Make sure that the motor cannot run overspeed, for example, driven by the load. Motor overspeed causes overvoltage that can damage or destroy the capacitors in the intermediate circuit of the drive.

Safety in operation

WARNING!
Make sure that the motor cannot run overspeed, for example, driven by the load. Motor overspeed causes overvoltage that can damage or destroy the capacitors in the intermediate circuit of the drive.

2

Introduction to the manual

Contents of this chapter

This chapter describes the manual. It contains a flowchart of steps in checking the delivery, installing and starting up the drive. The flowchart refers to chapters/sections in this manual and to other manuals.

Target audience

This manual is intended for people who plan the installation, install, commission and do maintenance work on the drive, or create instructions for the end user of the drive concerning the installation and maintenance of the drive.

Read the manual before you work on the drive. You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

Categorization by frame size and option code

Some instructions, technical data and dimension drawings which concern only certain frame sizes are marked with the symbol of the frame size. The frame size indicates the number of power modules that form the supply and inverter units respectively.

For example, the marking “2×D8D + 2×R8i” refers to a drive that has a supply unit consisting of two frame D8D supply modules and an inverter unit consisting of two frame R8i inverter modules. The frame size is marked on the type designation label, and can also be determined from the type code.

The instructions, technical data and dimension drawings which only concern certain optional selections are marked with option codes (such as "+E205"). The options included in the drive can be identified from the option codes visible on the type designation label. The option selections are listed in section Type designation key (page 50).

Use of component designations

Some device names in the manual include the component designation in brackets (for example, [Q20]). This will help you to identify the components in the circuit diagrams of the drive.

Quick installation, commissioning and operation flowchart

Task	See
Plan the electrical installation and acquire the accessories needed (cables, fuses, etc.). Check the ratings, required cooling air flow, input power connection, compatibility of the motor, motor connection, and other technical data.	Guidelines for planning the electrical installation (page 75) Technical data (page 181)
⬇	
Check the installation site.	Ambient conditions (page 203)
⬇	
Unpack and check the drive (only intact units may be started up). Make sure that all necessary optional modules and equipment are present and correct. Install the drive mechanically.	Mechanical installation (page 55)
⬇	
Route the cables.	Routing the cables (page 91)
⬇	
Connect the power cables. Connect the control cables.	Electrical installation (page 99)
⬇	
Check the installation.	Installation checklist (page 141) If the drive has been non-operational for more than one year, reform the DC link capacitors. See Converter module capacitor reforming instructions (3BFE64059629 [English]).
⬇	
Start the drive up.	Start-up (page 143)
⬇	
Operate the drive: start, stop, speed control etc.	ACS880 quick start-up guide, firmware manual

Terms and abbreviations

Term/ Abbreviation	Description
BCU	Type of control unit
Drive	Frequency converter for controlling AC motors
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
FEN-01	Optional TTL incremental encoder interface module
FEN-11	Optional TTL absolute encoder interface module
FEN-21	Optional resolver interface module
FEN-31	Optional HTL incremental encoder interface module
FIO-11	Optional analog I/O extension module
FPTC-01	Optional thermistor protection module
FPTC-02	Optional ATEX-certified thermistor protection module for potentially explosive atmospheres
Frame, frame size	Physical size of the drive or power module
FSO-12, FSO-21	Functional safety modules (not available for the ACS880-07CLC at the time of publishing)
IGBT	Insulated gate bipolar transistor
Inverter unit	Inverter module(s) under control of one control unit, and related components. One inverter unit typically controls one motor.
Power module	Common term for drive module, inverter module, supply module, brake chopper module etc.
RFI	Radio-frequency interference
STO	Safe torque off (IEC/EN 61800-5-2)
Supply unit	Supply module(s) under control of one control unit, and related components.

Related manuals

You can find manuals and other product documents in PDF format on the Internet at www.abb.com/drives/documents.

The code and link below open an online listing of the manuals applicable to this product.

ACS880-07CLC manuals

3

Operation principle and hardware description

Contents of this chapter

This chapter briefly describes the operation principle and construction of the drive.

Operation principle

The ACS880-07CLC is a liquid-cooled cabinet-installed drive for controlling asynchronous AC induction motors, permanent magnet synchronous motors and AC induction servomotors.

The drive consists of several cubicles that contain the supply and motor terminals, 1 to 8 diode supply module(s), 1 to 8 inverter modules, and optional equipment. The actual arrangement of the cubicles varies from type to type and the selected options.

The diode supply unit of the drive is uncontrolled: it cannot control the DC link voltage or limit the charging current of the DC link capacitors at the power-up.

Notes:

- The installer must provide an external main disconnecting device which meets the local safety regulations.
- The installer must provide an external main contactor or breaker as the drive does not have an internal main contactor or breaker.
- The installer must either provide an external charging circuit, or specify option +F272 for a built-in charging circuit. The external charging circuit can, for example, be combined into one unit that also magnetizes the supply transformer.
- The supply unit of the drive does not have the means to control, limit or cut off the load current.

- The installer must arrange for overload and short-circuit protection of the supply cable, typically with fuses.
- The supply unit of the drive does not have AC or DC chokes. Therefore, the installer must arrange for a sufficient inductance at the AC side of each supply module with suitable cabling. The minimum length of the supply cable per each supply module is 5 meters (16.4 feet). The inductances between the parallel-connected supply modules must be identical, ie. the cabling to each module must be identical in regard to cable type and length.

Charging

A charging circuit powers up the DC capacitors of the drive smoothly. Discharged capacitors cannot be directly connected to full supply voltage. The charging current must be limited until the capacitors are charged and ready for normal use.

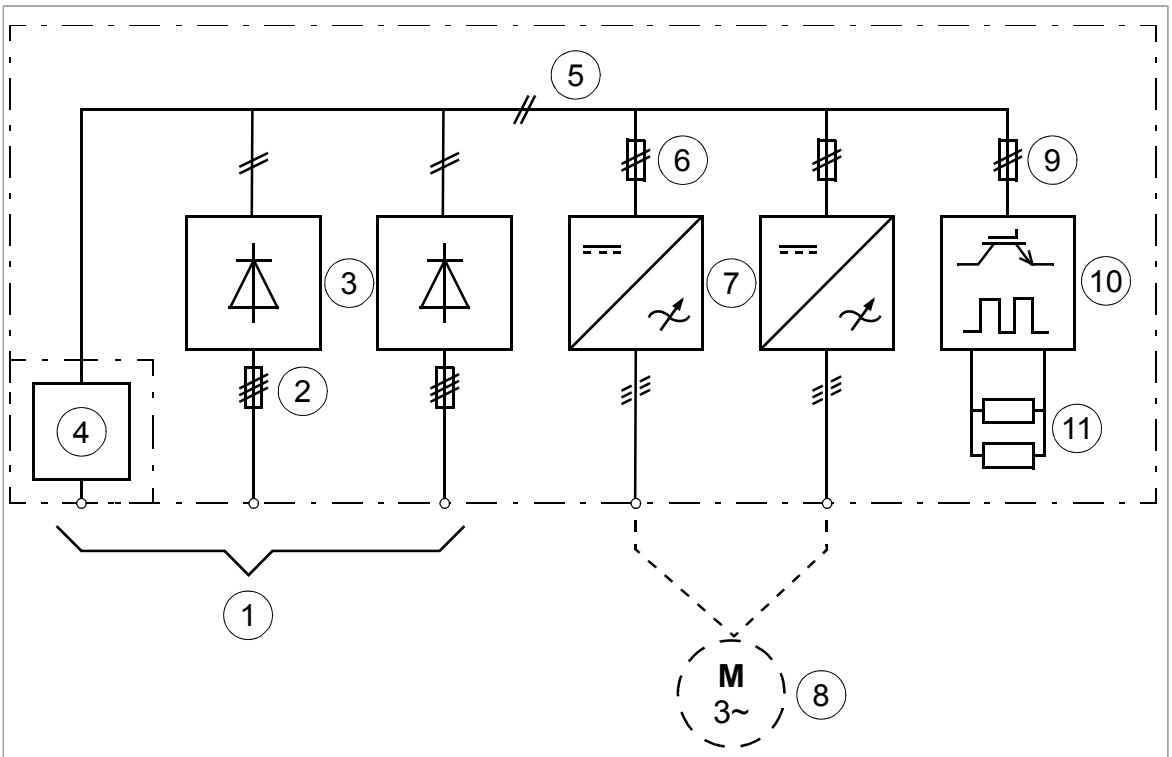
An internal charging circuit is available by specifying option +F272. Drives with +F272 have a charging switch on the supply unit cubicle door as well as terminals for the connection of a 3-phase supply for the charging circuit.

Drives without +F272 must be charged through an external charging circuit. If practical, the circuit can be combined with the transformer magnetizing circuit.

Overview diagrams

This section contains examples of main circuit overview diagrams. The diagrams show the power line connection, and the connections between the parts of the drive.

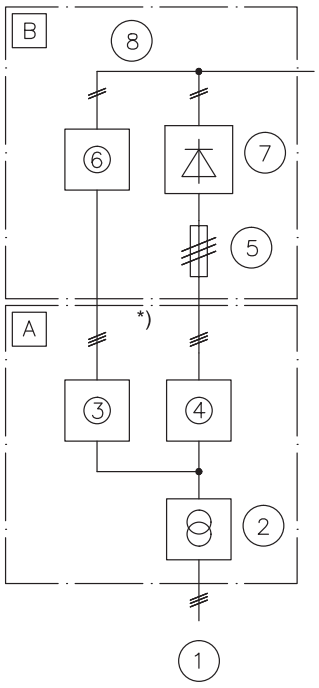
Overview diagram of the drive



1	AC supply. See detailed diagrams below.
2	AC fuses. Installed at the input of each supply module.
3	Supply modules. Depending on drive type, there is only one module, or several modules connected in parallel.
4	Charging circuit. The drive must be fitted with a charging circuit so that the DC capacitors of the drive are smoothly charged at power-up. See section Charging (page 30).
5	DC bus
6	Inverter DC fuses
7	Inverter modules. Converts direct current and voltage to alternating current and voltage. Depending on drive type, there is only one module, or several modules connected in parallel.
8	Motor
9	Brake chopper DC fuses [1)]
10	Brake chopper.[1)] Conducts surplus energy from the intermediate DC circuit of the drive to the brake resistor when necessary. The chopper operates when the DC voltage exceeds a certain maximum limit. The voltage rise is typically caused by deceleration (braking) of a high inertia motor.
11	Brake resistors[1)]

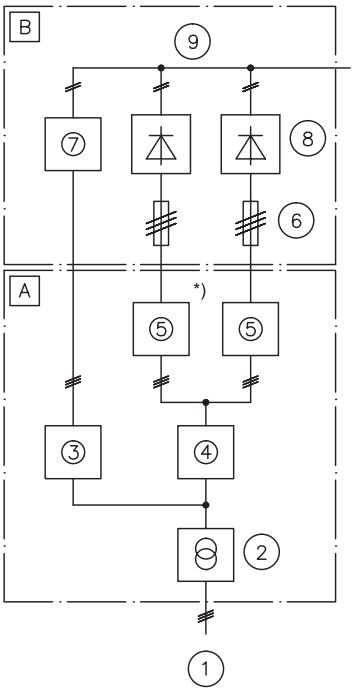
1) The illustration shows a 1-phase brake unit. Three-phase dynamic brake units are also available. See chapter Resistor braking (page 255)

Supply connection detail – one D8D module, 6-pulse connection, internal charging



1	Medium voltage / low voltage switchboard
A	External installation outside drive cabinet
2	Supply transformer
3	Charging switchgear including: • Disconnecting device
4	Dedicated supply switchgear including: • Disconnecting device • Breaker/contactor • Overcurrent and short-circuit protection of input cabling
B	Supply module cubicle of drive
5	AC fuses for protecting supply unit against short circuit
6	Internal charging kit (option +F272)
7	Diode supply module
8	DC link
*Minimum length of supply cabling: 5 m (16.4 ft)	

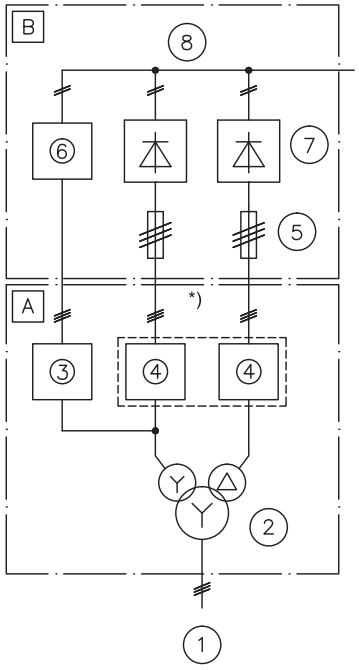
Supply connection detail – two D8D modules, 6-pulse connection, internal charging



1	Medium voltage / low voltage switchboard
A	External installation outside drive cabinet
2	Supply transformer
3	Charging switchgear including: • Disconnecting device
4	Dedicated supply switchgear including: • Disconnecting device • Breaker/contactor
5	Overcurrent and short-circuit protection of input cabling
B	Supply module cubicle of drive
6	AC fuses for protecting supply unit against short circuit
7	Internal charging kit (option +F272)
8	Diode supply modules
9	DC link

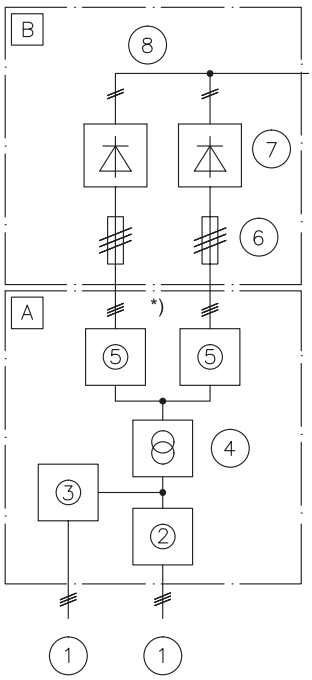
*Each module must have its own input AC cable with a minimum length of 5 m (16.4 ft). Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges.

Supply connection detail – two D8D modules, 12-pulse connection, internal charging



1	Medium voltage / low voltage switchboard
A	External installation outside drive cabinet
2	Supply transformer
3	Charging switchgear including: • Disconnecting device
4	Interlocked, dedicated supply switchgear including: • Disconnecting device • Breaker/contactor • Overcurrent and short-circuit protection of input cabling
B	Supply module cubicle of drive
5	AC fuses for protecting supply unit against short circuit
6	Internal charging kit (option +F272)
7	Diode supply modules
8	DC link
*Each module must have its own input AC cable with a minimum length of 5 m (16.4 ft). Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges.	

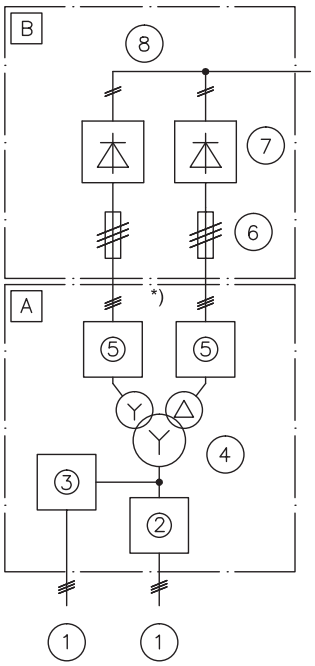
Supply connection detail – two D8D modules, 6-pulse connection, external charging and pre-magnetizing



1	Medium voltage / low voltage switchboard
A	External installation outside drive cabinet
2	Switchgear including: • Disconnecting device • Breaker/contactor
3	Combined transformer pre-magnetizing circuit and drive charging circuit
4	Supply transformer
5	Overcurrent and short-circuit protection of input cabling
B	Supply module cubicle of drive
6	AC fuses for protecting supply unit against short circuit
7	Diode supply modules
8	DC link

*Each module must have its own input AC cable with a minimum length of 5 m (16.4 ft). Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges.

Supply connection detail – two D8D modules, 12-pulse connection, external charging and pre-magnetizing



1	Medium voltage / low voltage switchboard
A	External installation outside drive cabinet
2	Switchgear including: • Disconnecting device • Breaker/contactor
3	Combined transformer pre-magnetizing circuit and drive charging circuit
4	Supply transformer
5	Overcurrent and short-circuit protection of input cabling
B	Supply module cubicle of drive
6	AC fuses for protecting supply unit against short circuit
7	Diode supply modules
8	DC link

*Each module must have its own input AC cable with a minimum length of 5 m (16.4 ft). Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges.

6-pulse, 12-pulse and 24-pulse connections

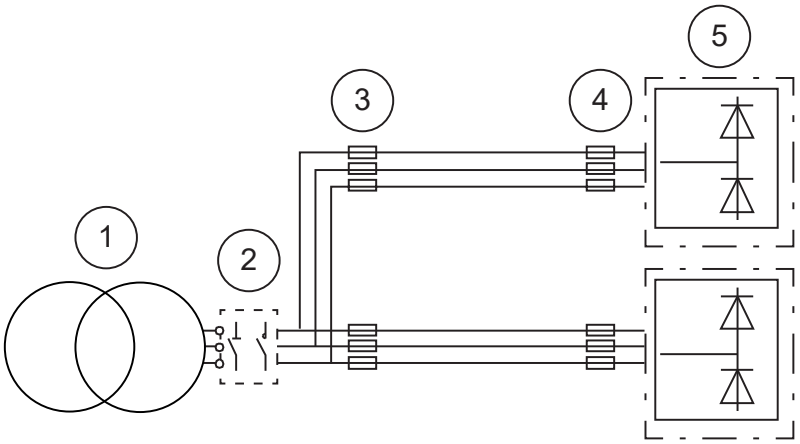
The figure below illustrates the difference between 6-pulse and 12-pulse AC supply connections. 6-pulse connection is standard.

Some drive types are available as a 12-pulse version (option +A004), some as a 24-pulse version (option +A006).

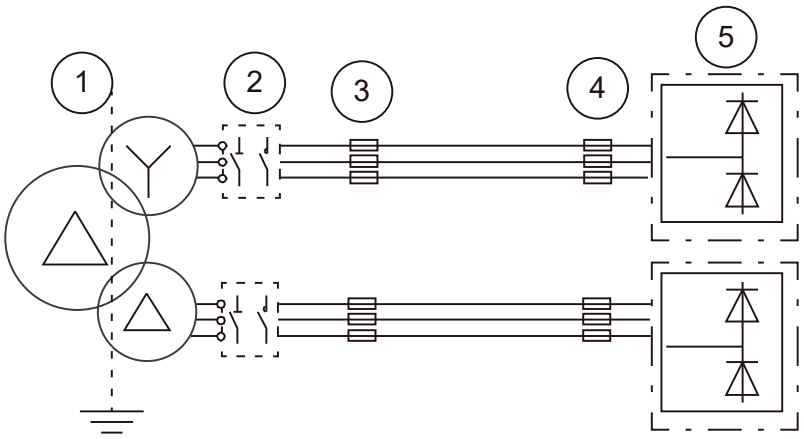
The 12-pulse supply connection eliminates the fifth and seventh harmonics, which substantially reduces the harmonic distortion of the line current and the conducted emissions.

The 12-pulse connection requires a three-winding transformer, or two separate transformers. There is a phase shift of 30-degrees between the two 6-pulse supply lines, which are connected to different supply modules through electrically separate switching equipment.

6-pulse connection



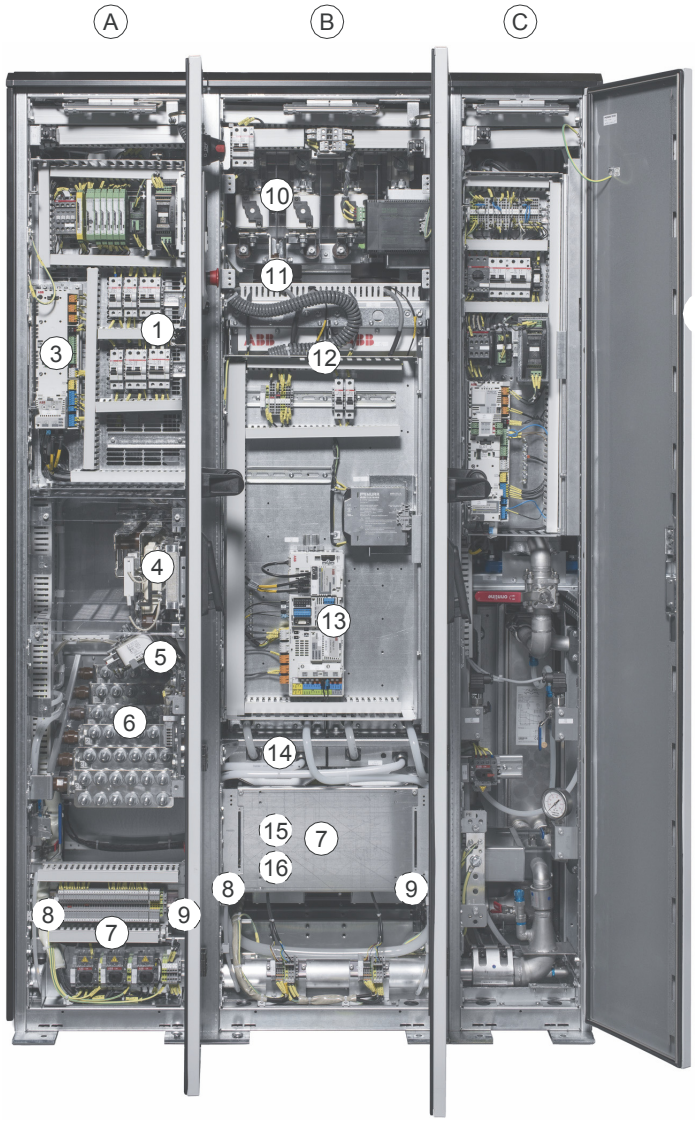
12-pulse connection



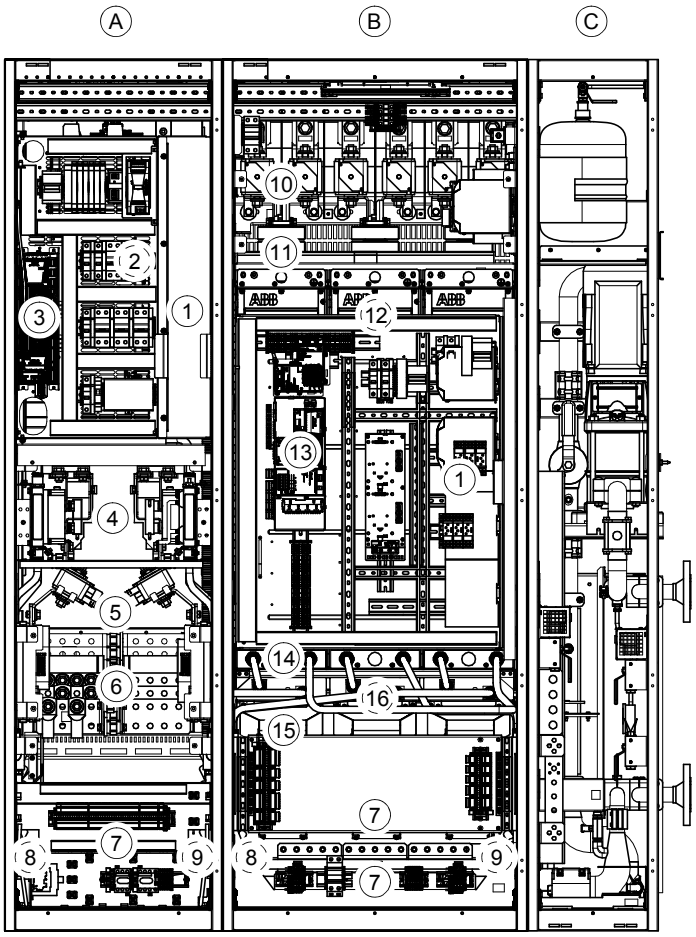
1	Supply transformer
2	Switching equipment and fuses
3	Fuses for protecting input cabling
4	AC fuses for protecting supply unit against short circuit
5	Diode supply modules

Cabinet line-up and layout examples

Frame 2×D8D+2×R8i



Frame 3×D8D+3×R8i

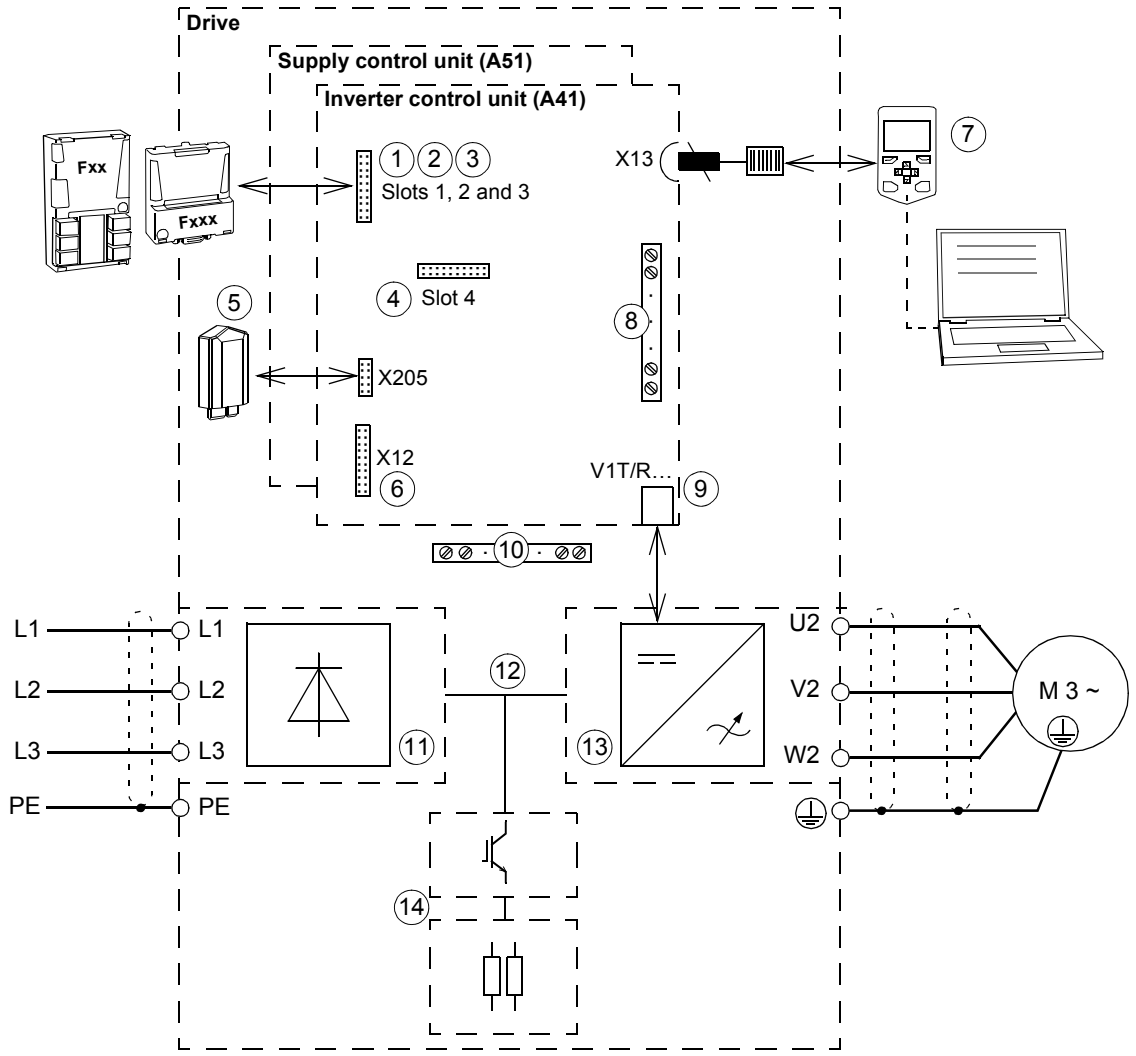


No.	Description
A	Supply module cubicle
B	Inverter module cubicle
C	Optional liquid cooling unit. See *ACS880-1007LC liquid cooling unit user's manual* (3AXD50000129607 [English]).
1	Swing-out frame for installation of control equipment. The frame is hinged and can be turned aside.
2	(Behind the swing-out frame) Fan and air-to-liquid heat exchanger. The fan forces air inside the cubicle through the heat exchanger. See chapter Internal cooling circuit (page 171).
3	ZCU-14 supply control unit. See chapter Control units of the drive (page 123).
4	Frame D8D supply modules
5	AC fuses
6	Input terminals. Each supply module has its own input terminals, and must be cabled individually and identically from the supply switchgear. The input cables must be at least 5 meters (16.4 ft) in length.
7	Mounting plates with terminal blocks for customer connections and space for auxiliary equipment
8	(Behind the mounting plate) Inlet manifold with stop and drain valve. See chapter Internal cooling circuit (page 171).
9	(Behind the mounting plate) Outlet manifold with stop and drain valve. See chapter Internal cooling circuit (page 171).
10	DC fuses
11	Common mode filters installed on the DC busbars

12	(Behind the swing-out frame) Inverter modules
13	BCU-x2 inverter control unit. See chapter Control units of the drive (page 123).
14	Air-to-liquid heat exchanger installed below each inverter module. See chapter Internal cooling circuit (page 171).
15	(Behind mounting plate) Fan. Forces air inside the cubicle through the heat exchanger. See chapter Internal cooling circuit (page 171).
16	(Behind mounting plate and inverter module fans) Output terminals. Each inverter module must be individually connected to the motor using separate cables unless the drive is equipped with option +H359 (common motor terminal cubicle) or +H366 (common output terminals).

Overview of power and control connections

The diagram shows the power connections and control interfaces of the drive.



1 2 3 4	Option modules can be inserted into slots 1, 2, 3 and 4 as follows: **Module type** — **Slots** Analog and digital I/O extension modules — 1, 2, 3 Feedback interface modules — 1, 2, 3 Fieldbus communication modules — 1, 2, 3 RDCO-04 DDCS communication option module (standard equipment). As standard, a fiber optic link connects the supply and inverter control units. — 4 Additional modules can be installed on an optional FEA-03 extension adapter connected to an RDCO module on slot 4.
5	Memory unit
6	Connection for FSO safety functions module (not available at the time of publishing)
7	Control panel and PC connection
8	Terminal blocks on the inverter control unit.
9	Fiber optic link to each inverter module.

10	Terminal blocks for customer connections installed in the drive cabinet.
11	Supply unit (consisting of one or more supply modules)
12	DC intermediate link
13	Inverter unit (consisting of one or more inverter modules)
14	Optional brake chopper (+D150) and resistors (+D151)

Door switches and lights

No.	Description
1	Run enable switch for the drive (S21). The switch has to be set to "1" for the drive to start. Turning the switch into the off position will stop the drive.
2	Emergency stop push button (with emergency stop options only)
3	Emergency stop active light and reset (with emergency stop options only)
4	Charging switch (with charging circuit option only). At start-up, the charging switch is closed. After the DC voltage rises to operating level, the supply control unit opens the charging circuit, and the main supply voltage can be connected to the drive.
The layout depends on the options selected.	

Control panel

The ACS-AP-W is the user interface of the drive. It provides the essential controls such as Start/Stop/Direction/Reset/Reference, and the parameter settings for the inverter control program.

The control panel can be removed by pulling it forward by the top edge and reinstalled in reverse order. For the use of the control panel, see ACS-AP-I, -S, -W and ACH-AP-H,

-W Assistant control panels user's manual (3AUA0000085685 [English]) and the firmware manual.

Control by PC tools

There is a USB connector on the front of the panel that can be used to connect a PC to the drive. When a PC is connected to the control panel, the control panel keypad is disabled.

Descriptions of options

Note: All options are not available for all drive types, are not compatible with some other options, or require additional engineering.

Degree of protection

The standard degree of protection is IP42 (UL type 1). IP54 (UL type 12) is available as option +B055.

Definitions

According to IEC/EN 60529, the degree of protection is indicated by an IP code where the first numeral means protection against ingress of solid foreign objects, and the second numeral protection against ingress of water. The IP codes of the standard cabinet and options covered in this manual are defined below.

IP code	The equipment is protected ...	
	First numeral	Second numeral
IP42	against ingress of solid foreign objects > 1 mm	against dripping (15° tilting) water
IP54	dust-protected	against splashing water

Marine construction (option +C121)

The option includes the following accessories and features:

- reinforced mechanics
- grab railings
- door flush bolt which allows the door to open 90 degrees and prevents it from slamming close
- self-extinctive materials
- flat bars at base of the cabinet for fastening
- fastening brackets at the top of the cabinet.

Additional wire markings may be required for classification. See section Wire markings (page 46).

UL Listed (option +C129)

The cabinet contains the following accessories and features:

- top entry and exit with US cable conduit entries (plain plate without ready-made holes)
- all components UL/CSA Listed/Recognized
- maximum supply voltage 600 V
- US-type main switch and fuses.

Plinth height (options +C164 and +C179)

These options specify a plinth height of 100 mm (+C164) or 200 mm (+C179).

Resistor braking (options +D150 and +D151)

See chapter Resistor braking (page 255).

d*u*/d*t* filter

The d*u*/d*t* filter protects the motor insulating system by reducing the voltage rise speed at the motor terminals. The filter also protects the motor bearings by reducing the bearing currents.

More information on when the option is required: See section Examining the compatibility of the motor and drive (page 78).

Cabinet heater with external supply (option +G300)

The option contains:

- heating elements in the cubicles or supply/inverter modules
- load switch for providing electrical isolation during service
- miniature circuit breaker for overcurrent protection
- terminal block for external power supply.

The heater prevents condensation inside the cabinet when the drive is not in operation. The power output of the heating elements increases when the surrounding air temperature is low and decreases when the surrounding air temperature is high. The customer must stop the heating when it is not needed by disconnecting the heater supply voltage.

The customer must supply the heater from an external 110…240 V AC power source.

For the actual wiring, see the circuit diagrams delivered with drive.

Cabinet lighting (option +G301)

This option contains LED lighting fixtures in each cubicle (except joining and brake resistor cubicles) and a 24 V DC power supply. The lighting is powered from the same external 110…240 V AC power source as the cabinet heater (option +G300).

Output for motor space heater (option +G313)

The option contains:

- load switch for providing electrical isolation during service
- miniature circuit breaker for overcurrent protection
- terminal block for heater and external heater supply connection.

When the drive is powered (and not faulted), the heater is switched off. Otherwise, the heater is controlled by the external supply voltage.

The power and voltage of the heater depend on the motor.

See also:

- Supplying power for the auxiliary circuits (page 95)
- circuit diagrams delivered with drive for the actual wiring.

Halogen-free wiring and materials (option +G330)

The option provides halogen-free cable ducts, control wires and wire sleeves, thus reducing toxic fire gases.

Wire markings

Standard wiring

Color

The standard color of the wiring is black, with the following exceptions:

- PE wiring: Yellow/Green, or yellow/green sleeving
- UPS input wiring (option +G307): Orange
- Pt100 sensor wiring with ATEX-certified thermal protection (option +nL514): Light blue.

Markings

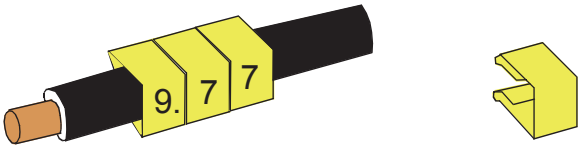
As standard, wires and terminals are marked as follows:

- Main circuit terminals: Connector identifier (eg. "U1") marked on terminal, or on insulating material close to the terminal. Input and output main circuit cables are not marked.
- Plug-in connectors of wire sets (except those that require special tools to disconnect) are labeled with connector designation (eg. "X1"). The marking is either directly on the connector, or near the connector on printed sleeving or tape.
- Grounding busbars are marked with stickers.
- Fiber optic cable pairs and data cables have component designation and connector designations (eg. "A1:V1", "A1:X1") marked with rings or tape.
- Data cables are marked with tape.
- Ribbon cables are marked with either labels or tape.
- Customer-specific (engineered) wiring (option +P902) is not marked.

Additional wire markings

The following additional wire markings are available.

Option	Additional markings
+G338 (class A1)	Equipment pin identifiers are marked with printing (or equivalent) on conductors that connect to equipment, or are part of the wiring between power modules. (Short, obvious connections, main circuit conductors, and conductors going to terminal blocks or plug-type connectors are not marked.) 
+G339 (class A2)	Equipment pin identifiers are marked with printing (or equivalent) on conductors that connect to equipment or terminal blocks, or are part of the wiring between power modules. Main circuit conductors are marked with white tape or printing. (Short, obvious connections, or conductors going to plug-type connectors are not marked.) 

Option	Additional markings
+G340 (class A3)	Single wires not attached to plug-in connectors are marked with component pin numbers on snap-on or ring markers. Plug-in connectors are marked with an identification label placed on the wires near the connector (individual wires are not marked). Short, obvious connections are not marked. PE wires are not marked unless connected directly to components. 
+G341 (class B1)	Equipment designations and pin identifiers are marked with snap-on markers (or equivalent) on conductors that connect to equipment, terminal blocks or detachable plug-type connectors, or are part of the wiring between power modules. Fiber optic cables are marked in the same way. Plug-type connector identifications are marked on labels near the connectors. The label holders are attached around conductor bundles. Main circuit conductors are marked with white tape or printing. Short and obvious connections are marked with printing (or equivalent) only.  **Note:** Even wires with equipment and pin identifiers printed on the wire insulation are marked with rings or tubing.
+G342 (class C1)	Single wires connected to components, between modules, or to terminal blocks are marked with component identification and pin numbers for both ends. The marking is printed on sleeving or, if necessary, snap-on markers. Plug-in connectors are marked with an identification label (or snap-on markers) placed on the wires near the connector (individual wires are not marked). Short, obvious connections are not marked. PE wires are not marked unless connected directly to components. 

Bottom cable entry/exit (options +H350 and +H352)

For UL Listed (+C129) units, the default input and output cabling direction is through the roof of the cabinet. The bottom entry (+H350) and bottom exit (+H352) options provide power and control cable entries at the floor of the cabinet. The entries are equipped with grommets and 360° grounding hardware.

For non-UL Listed units, bottom entry/exit is the default cabling arrangement.

Cable conduit entry (option +H358)

The option provides US/UK conduit plates (plain 3 mm thick steel plates without any ready-made holes).

Common motor terminal cubicle (option +H359)

As standard, each inverter module must be individually cabled to the motor. This option provides an additional cubicle containing a single set of terminals for the motor cables.

The width of the cubicle and the size of the terminals within depend on the power rating of the drive.

Common output terminals (option +H366)

As standard, each inverter module must be individually cabled to the motor. This option adds bridging that connects the outputs of multiple (in practice, two or three) inverter modules mounted in the same cubicle. The bridging balances the motor current between the modules, which allows more cabling options. For example, it is possible to use a number of cables that could not otherwise be evenly distributed between the inverter modules.

WARNING!
The bridging can carry the nominal output of one inverter module. In case of three parallel modules, ensure that the load capacity of the bridging is not exceeded. For example, if the cabling connects to the output busbars at one module only, use the module in the middle.

Note: The +H366 option only interconnects the outputs of inverter modules within the same cubicle, not modules installed in different cubicles. Therefore, when the drive has more than three inverter modules, make sure that the load is distributed evenly between the modules:

- In case of two inverter cubicles of two modules, connect the same number of cables to each cubicle.
- In case of one inverter cubicle with three modules and another with two, each cubicle requires a number of cables proportional to the number of modules within. For example, connect three out of five (or six out of ten, etc.) cables to the cubicle with three modules, the remaining two out of five (four out of ten) cables to the cubicle with two modules.

Additional terminal block X504 (option +L504)

The standard terminal blocks of the drive control unit are wired to the additional terminal block at the factory for customer control wiring. The terminals are spring loaded.

Note: The optional modules inserted in the slots of the control unit are not wired to the additional terminal block. The customer must connect the optional module control wires directly to the modules.

Cables accepted by the terminals of the additional I/O terminal block:

- solid wire 0.2 … 2.5 mm^2 (24…12 AWG)
- stranded wire with ferrule 0.25 … 2.5 mm^2 (24…12 AWG)
- stranded wire without ferrule 0.2 … 2.5 mm^2 (24…12 AWG).

Starter for auxiliary motor fan (options +M600…M610)

What the option contains

The option provides switched and protected connections for 3-phase auxiliary motor fans. Each fan connection is equipped with:

- fuses
- a manual motor starter switch with an adjustable current limit
- a contactor controlled by the drive, and
- terminal block X601 for customer connections.

Description

The output for the auxiliary fan is wired from the 3-phase supply voltage to terminal block X601 through a motor starter switch and a contactor. The contactor is operated by the drive. The 230 V AC control circuit is wired through a jumper on the terminal block; the jumper can be replaced by an external control circuit.

The starter switch has an adjustable trip current limit, and can be opened to permanently switch the fan off.

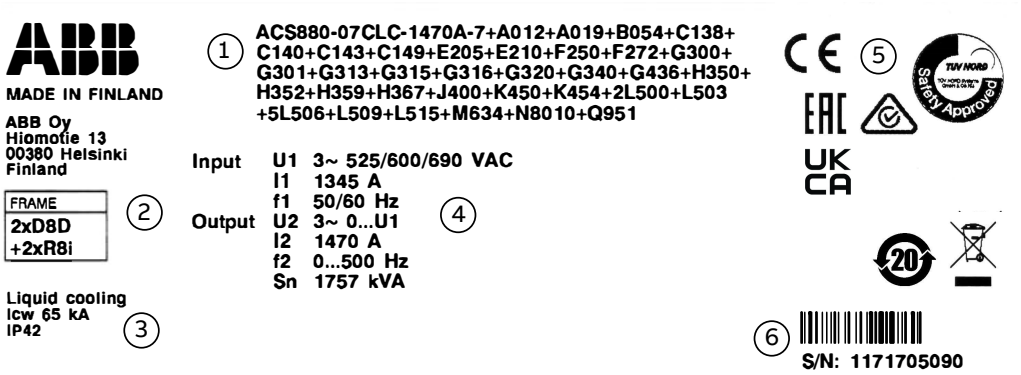
The statuses of both the starter switch and the fan contactor are wired to the terminal block.

See the circuit diagrams delivered with the drive for the actual wiring.

Type designation label

The type designation label includes ratings, appropriate markings, a type designation and a serial number, which allow the identification of each unit. A sample label is shown below.

Quote the complete type designation and serial number when contacting technical support.



1	Type designation (see section Type designation key)
2	Frame size
3	Short-time withstand current rating (see chapter Technical data (page 181)); degree of protection; UL/CSA specifications
4	Ratings. See also chapter Technical data (page 181).
5	Valid markings
6	Serial number. The first digit of the serial number refers to the manufacturing plant. The next four digits refer to the unit's manufacturing year and week, respectively. The remaining digits complete the serial number so that there are no two units with the same number.

Type designation key

The type designation contains information on the specifications and configuration of the drive. The first digits from left express the basic drive type. The optional selections are given thereafter, separated by plus signs, eg, +E202. Codes preceded by a zero (eg. +0J400) indicate the absence of the specified feature. The main selections are described below. Not all selections are available for all types. For more information, refer to the ordering instructions available separately on request.

Code	Description
Basic code	
ACS880	Product series
ACS880-07CLC	Default configuration: liquid-cooled cabinet-installed drive, marine type approval, 50 Hz supply frequency, no main switch or breaker, no input chokes, connection for 230 V AC auxiliary voltage, no capacitor pre-charging circuit, halogen-free wiring, ACS-AP-W assistant control panel (with Bluetooth), EMC filter (category 3, 2nd Environment), du/dt filters, common mode filtering, ACS880 primary control program, Safe torque off function, cubicle heater elements, coated circuit boards, bottom entry and exit of cables, multilingual door device label sticker, USB memory stick containing circuit diagrams, dimension drawings and manuals.
Size	
xxxxx	Refer to the rating tables
Voltage range	

Code	Description
7	525…690 V AC. This is indicated in the type designation label as typical input voltage levels (3~ 525/600/690 V AC)

Option codes

Code	Description
A004	12-pulse supply connection
A006	24-pulse supply connection
A012	50 Hz supply frequency
A013	60 Hz supply frequency
B054	IP42 (UL Type 1 Filtered)
B055	IP54 (UL Type 12)
C121	Marine construction. See section Marine construction (option +C121) (page 44).
C129	UL Listed (evaluated to both U.S. and Canadian safety requirements). See section UL Listed (option +C129) (page 44).
C138	ACS880-1007LC cooling unit as part of line-up
C139	ACS880-1007LC cooling unit separate from line-up (stand-alone)
C140	Single-pump cooling unit
C141	Redundant (twin-pump) cooling unit
C142	Pipe connection through bottom
C144	Pipe connection on left
C146	External cooling circuit suitable for sea water
C164	Plinth height 100 mm. See section Plinth height (options +C164 and +C179) (page 44).
C176	Door hinges on left
C179	Plinth height 200 mm. See section Plinth height (options +C164 and +C179) (page 44).
C205	Marine product certification issued by DNV GL
C206	Marine product certification issued by the American Bureau of Shipping (ABS)
C207	Marine product certification issued by Lloyd's Register (LR)
C209	Marine product certification issued by Bureau Veritas
C213	Cooling unit pumps can run simultaneously
C228	Marine product certification issued by China Classification Society (CCS)
C229	Marine product certification issued by Russian Maritime Register of Shipping (RS)
C242	2-way valve in a dedicated cubicle
D150	Brake choppers
D151	Brake resistors
E205	du/dt filtering
E210	EMC/RFI filter for 2nd environment TN (grounded) or IT (ungrounded) system, category C3
F271	Output grounding terminals
F272	Internal charging circuit
G300	Cabinet and module heating elements (external supply). See section Cabinet heater with external supply (option +G300) (page 45).
G301	Cabinet lighting. See section Cabinet lighting (option +G301) (page 45).
G304	Control (auxiliary) voltage 115 V AC

Code	Description
G313	Output for motor space heater (external supply)
G314	Aluminum busbars
G315	Tin-plated copper DC busbars
G316	Cable supply conductors
G320	Control (auxiliary) voltage 230 V AC
G330	Halogen-free wiring and materials
G331	Emergency stop push button on the door (red)
G338	Wire marking class A1. See section Wire markings (page 46).
G339	Wire marking class A2. See section Wire markings (page 46).
G340	Wire marking class A3. See section Wire markings (page 46).
G341	Wire marking class B1. See section Wire markings (page 46).
G342	Wire marking class C1. See section Wire markings (page 46).
H350	Power cabling entry from bottom. See section Bottom cable entry/exit (options +H350 and +H352) (page 47).
H352	Power cabling exit from bottom. See section Bottom cable entry/exit (options +H350 and +H352) (page 47).
H358	Cable gland plates (3 mm steel, undrilled)
H359	Common motor terminal cubicle. See section Common motor terminal cubicle (option +H359) (page 47).
H364	Cable gland plates (3 mm aluminum, undrilled)
H366	Common output terminals (for inverter modules mounted in the same cubicle). See section Descriptions of options (page 44).
H367	Control cabling through floor of cabinet
J400	ACS-AP-W control panel (with Bluetooth)
K450	Panel bus (control of several units from one control panel)
K451	FDNA-01 DeviceNet™ adapter module
K454	FPBA-01 PROFIBUS DP adapter module
K457	FCAN-01 CANopen adapter module
K458	FSCA-01 RS-485 (Modbus/RTU) adapter module
K462	FCNA-01 ControlNet™ adapter module
K469	FECA-01 EtherCAT adapter module
K470	FEPL-02 Ethernet POWERLINK adapter module
K473	FENA-11 Ethernet adapter module for EtherNet/IP™, Modbus TCP and PROFINET IO protocols
K475	FENA-21 Ethernet adapter module for EtherNet/IP™, Modbus TCP and PROFINET IO protocols, 2-port
L500	FIO-11 analog I/O extension module
L501	FIO-01 digital I/O extension module
L502	FEN-31 HTL incremental encoder interface module
L503	FDCO-01 optical DDCS communication adapter module
L504	Additional I/O terminal block. See section Additional terminal block X504 (option +L504) (page 48).
L508	FDCO-02 optical DDCS communication adapter module
L509	RDCO-04 optical DDCS communication for BCU control unit (4xTransmitter/Receiver)
L525	FAIO-01 analog I/O extension module

Code	Description
L526	FDIO-01 digital I/O extension module
M600	Starter for auxiliary motor fan, trip limit 1 … 1.6 A
M601	Starter for auxiliary motor fan, trip limit 1.6 … 2.5 A
M602	Starter for auxiliary motor fan, trip limit 2.5 … 4 A
M603	Starter for auxiliary motor fan, trip limit 4 … 6.3 A
M604	Starter for auxiliary motor fan, trip limit 6.3 … 10 A
M605	Starter for auxiliary motor fan, trip limit 10…16 A
M606	Starter for auxiliary motor fan, trip limit 16…20 A
M610	Starter for auxiliary motor fan, trip limit 20…25 A
M633	Pump motor in delta connection
M634	Pump motor in star connection
N5000	Winder control program
N5050	Crane control program
N5100	Winch control program
N5200	PCP (Progressive Cavity Pump) control program
N5300	Test bench control program
N5600	ESP (Electrical Submersible Pump) control program
N7502	Control program for synchronous reluctance motors (SynRM)
N8010	IEC 61131-3 application programmability
P913	Special color (RAL Classic)
Q951	Emergency stop (category 0) with safety relays, by opening the main breaker/contactor
Q954	Earth fault monitoring for IT (ungrounded) systems
Q984	Emergency stop button monitoring

4

Mechanical installation

Contents of this chapter

This chapter describes the mechanical installation procedure of the drive.

Examining the installation site

Examine the installation site. Make sure that:

- The installation site is sufficiently ventilated or cooled to remove heat from the drive. See the technical data.
- The ambient conditions of the drive meet the specifications. See the technical data.
- The material behind, above and below the drive is non-flammable.
- There is sufficient free space above the drive for cooling, maintenance, and operation of the pressure relief (if present).
- The floor that the drive cabinet is installed on is of non-flammable material, as smooth as possible, and strong enough to support the weight of the unit. Check the floor flatness with a spirit level. The maximum allowed deviation from the surface level is 5 mm (0.2 in) in every 3 meters (10 ft). Level the installation site, if necessary, as the cabinet is not equipped with adjustable feet.

Necessary tools

The tools required for moving the unit to its final position, fastening it to the floor and wall and tightening the connections are listed below:

- crane, fork-lift or pallet truck (check load capacity!), slate/spud bar, jack and rollers
- Pozidriv and Torx screwdrivers

- torque wrench
- set of wrenches or sockets.

Examining the delivery

The drive delivery contains:

- drive cabinet line-up
- optional modules (if ordered) installed onto the control unit(s) at the factory
- appropriate drive and optional module manuals
- delivery documents.

Make sure that there are no signs of damage. Before attempting installation and operation, see the information on the type designation labels of the drive to verify that the delivery is of the correct type.

Moving and unpacking the drive

Move the drive in its original packaging to the installation site as shown below to avoid damaging the cabinet surfaces and door devices. When you are using a pallet truck, check its load capacity before you move the drive.

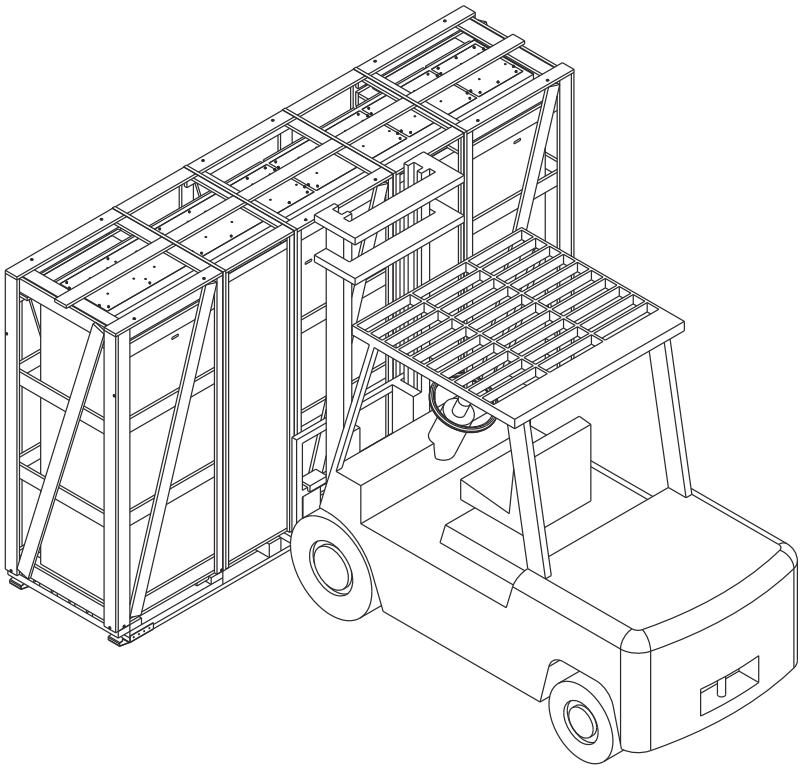
The drive cabinet is to be moved in the upright position.

The center of gravity of the cabinet is high. Be therefore careful when moving the unit. Avoid tilting.

Moving the drive in its packaging

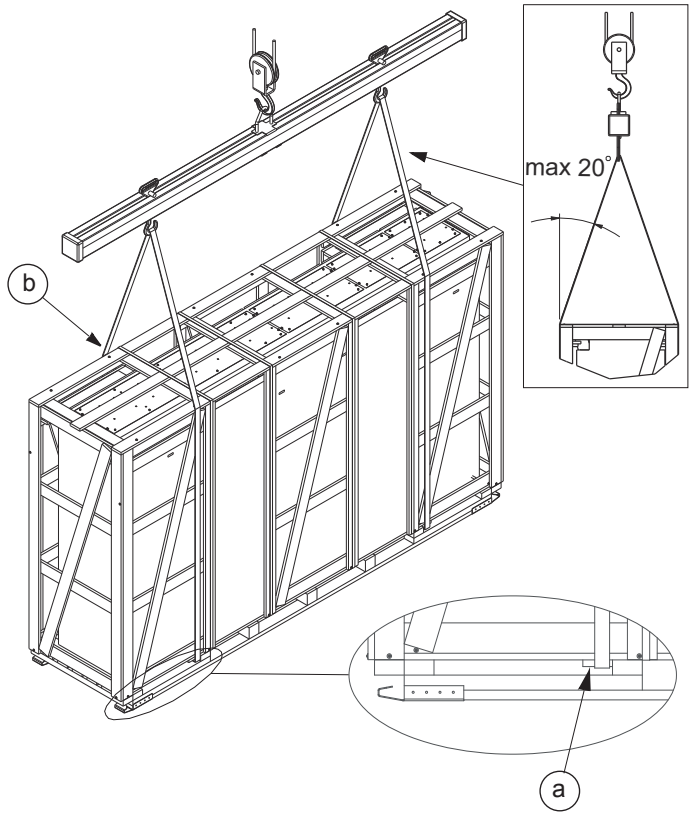
Lifting the crate with a forklift

WARNING!
Incorrect lifting can cause danger or damage. Obey the local laws and regulations applicable to lifting, such as requirements for planning the lift, for capacity and condition of lifting equipment, and for training of personnel.



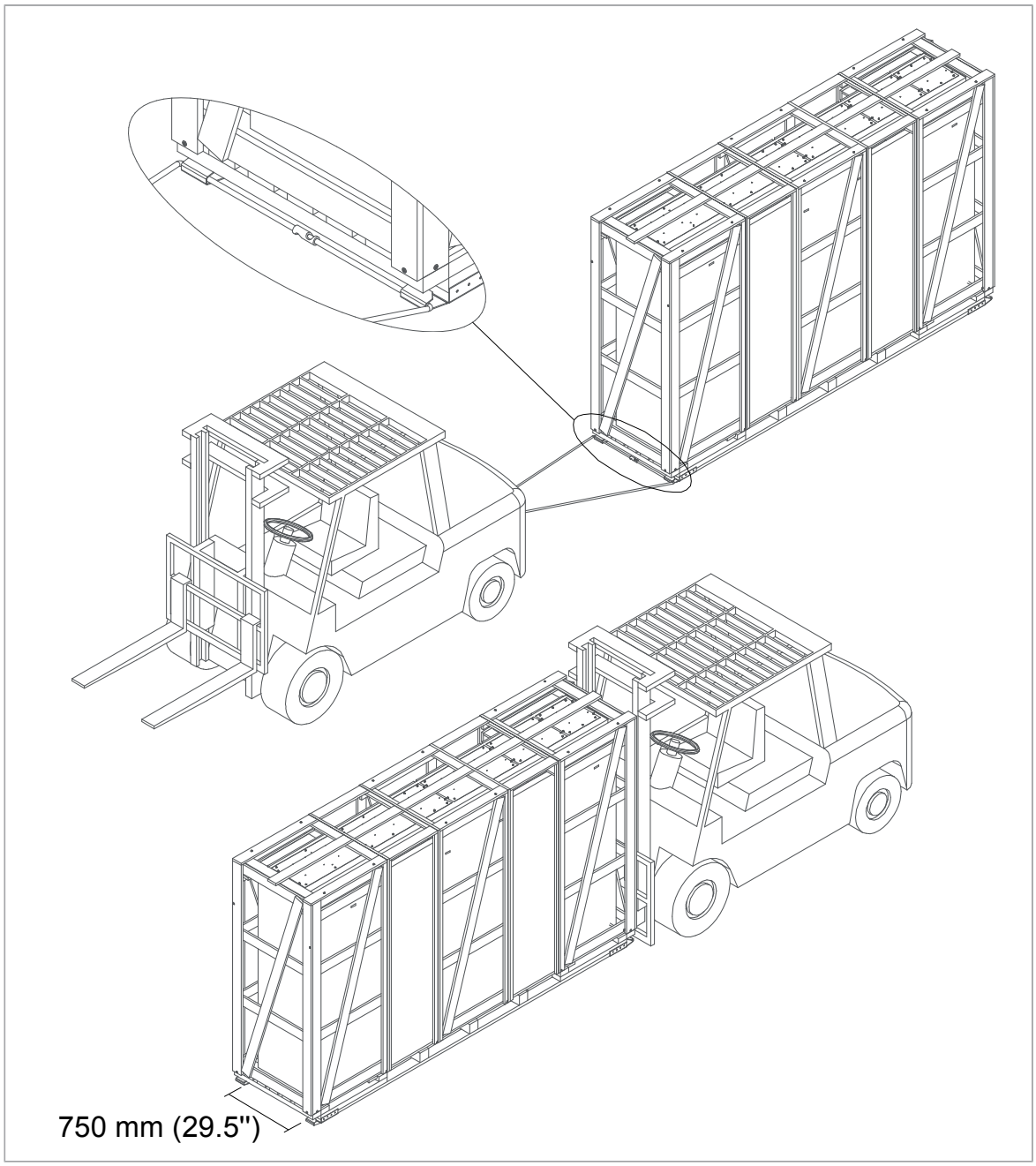
Lifting the crate with a crane

WARNING!
Incorrect lifting can cause danger or damage. Obey the local laws and regulations applicable to lifting, such as requirements for planning the lift, for capacity and condition of lifting equipment, and for training of personnel.



a	Lifting point
b	Optimal position for the lifting sling: as close to the traverse board as possible

Moving the crate with a forklift



Removing the transport package

Remove the transport package as follows:

1. Undo the screws that attach the wooden parts of the transport crate to each other.
2. Remove the wooden parts.
3. Remove the clamps with which the drive cabinet is mounted onto the transport pallet by undoing the fastening screws.
4. Remove the plastic wrapping.

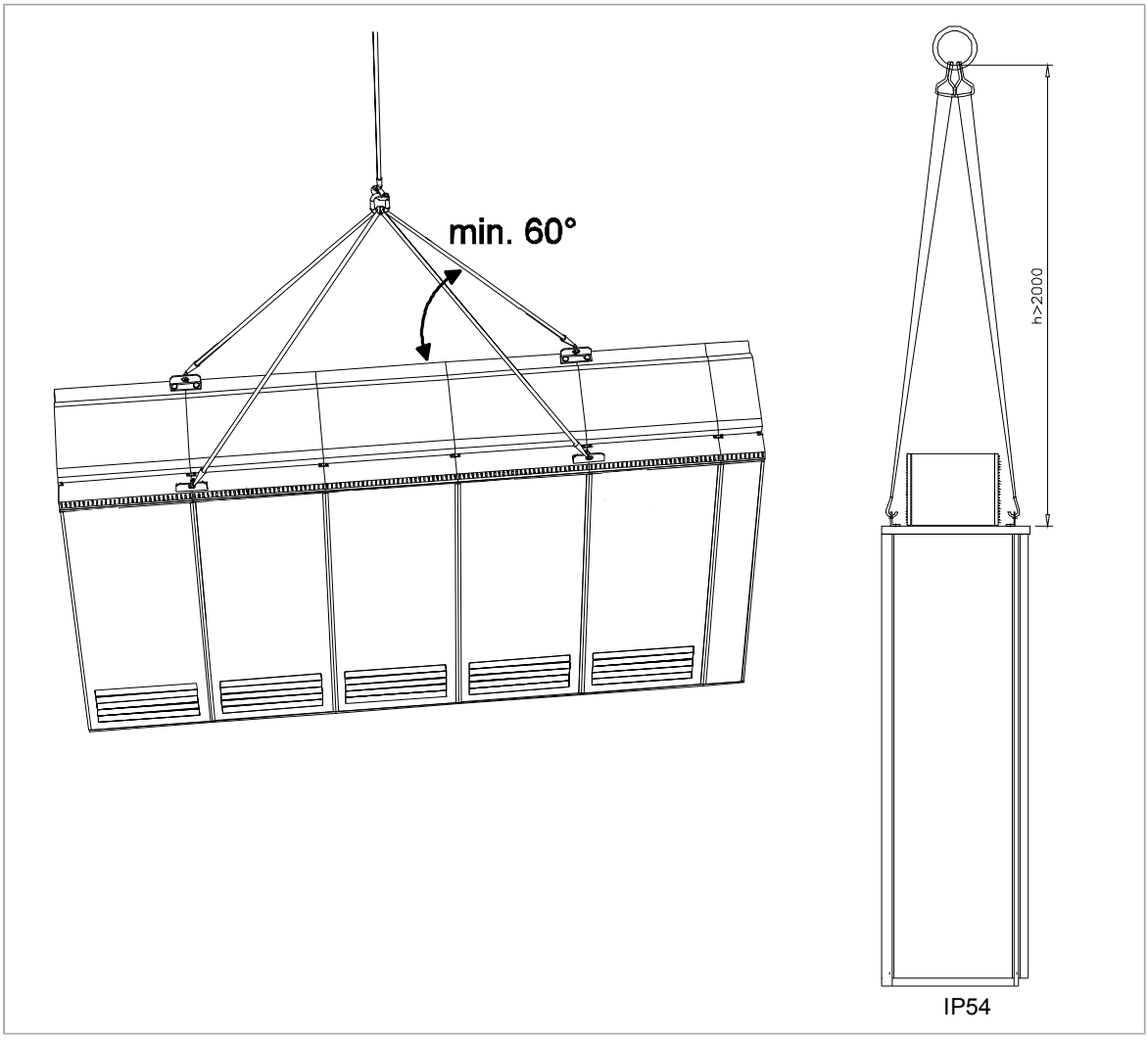
Moving the unpacked drive cabinet

Lifting the cabinet with a crane

WARNING!
Incorrect lifting can cause danger or damage. Obey the local laws and regulations applicable to lifting, such as requirements for planning the lift, for capacity and condition of lifting equipment, and for training of personnel.

Lift the drive cabinet by its designated lifting points. Depending on the size of the cabinet, it has either bolt-on lifting lugs, or lifting bars with lifting holes.

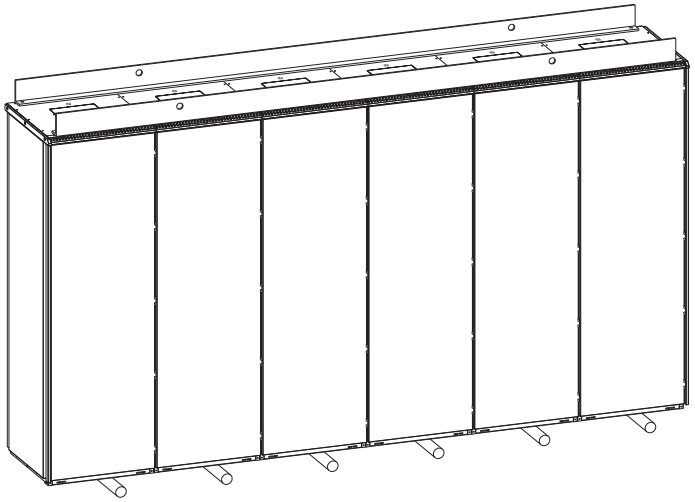
Note: The minimum allowed height of the lifting slings with IP54 units is 2 meters (6’7”).



Moving the cabinet on rollers

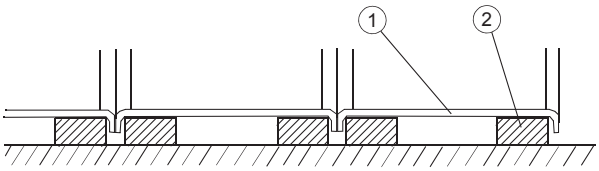
WARNING!
Do not move marine versions (option +C121) on rollers.

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



Moving the cabinet on its back

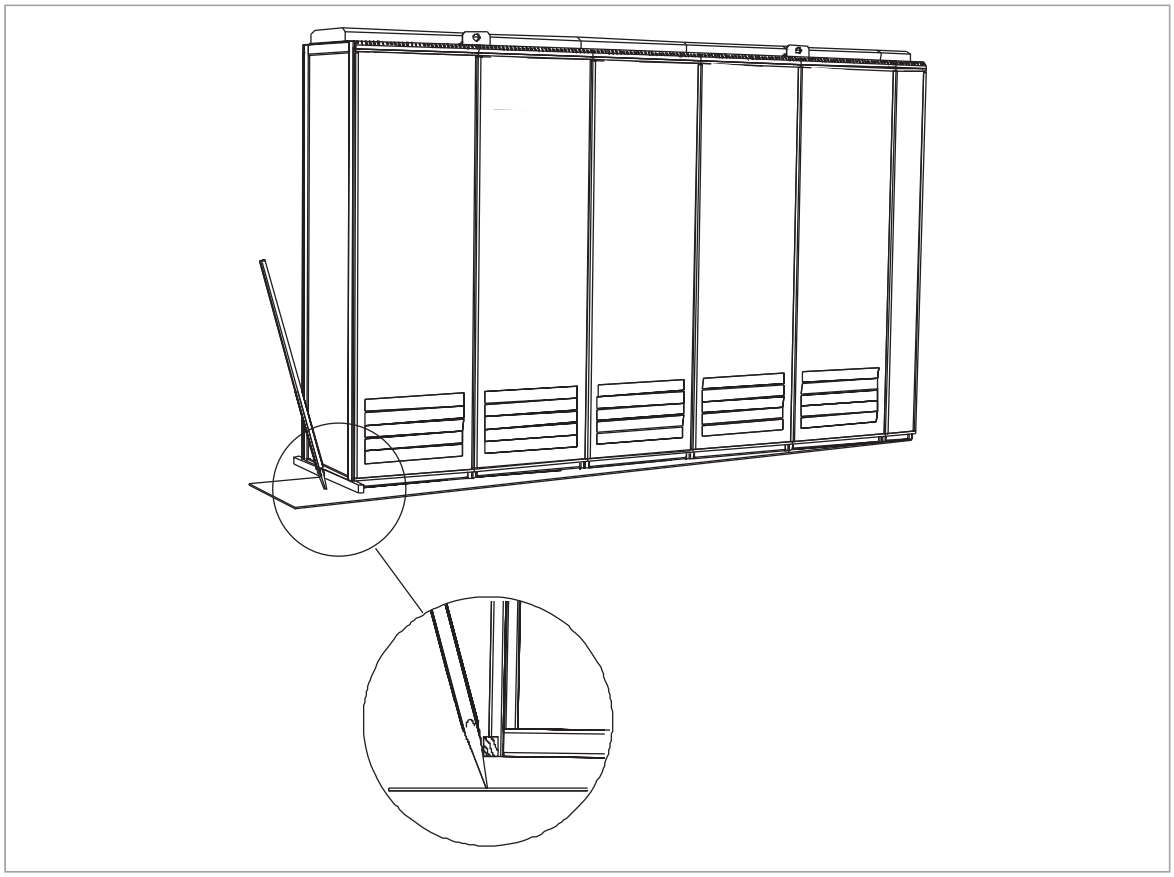
If the cabinet needs to be laid on its back, support the cabinet from below alongside the cubicle seams.



1	Cabinet back panel
2	Support

Final placement of the cabinet

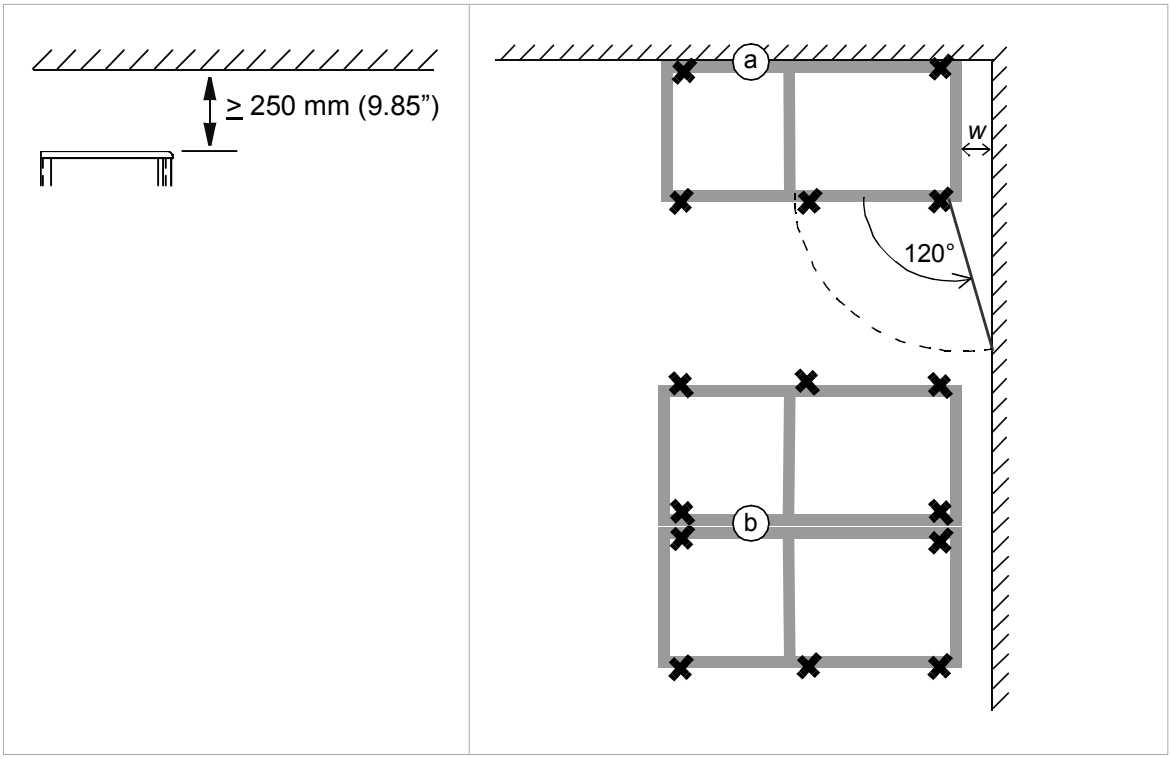
Move the cabinet into its final position with a slate bar (spud bar). Place a piece of wood between the edge of the cabinet and the bar to protect the cabinet frame.



Attaching the cabinet to the floor and wall or roof

General rules

- The drive must be installed in an upright vertical position.
- Leave 250 mm (9.85”) of free space above the cabinet for maintenance, and to allow pressure relief operation.
- The cabinet can be installed with its back against a wall (a), or back-to-back with another unit (b).
- Leave some space (*w*) at the side where the cabinet outmost hinges are to allow the doors to open sufficiently. The doors must open 120° to allow module replacement.



Note 1: Any height adjustment must be done before attaching the cabinet sections to the floor or to each other. Height adjustment can be done by using metal shims between the cabinet bottom and floor.

Note 2: Depending on the size of the cabinet, it has either bolt-on lifting eyes, or lifting bars with lifting holes. Bolt-on lifting eyes need not be removed unless the holes are used for attaching the cabinet. If the cabinet is delivered with lifting bars, either remove them or let them remain attached to the cabinet. If removed, store the bars for decommissiong. If the lifting bars have been removed, plug any unused holes using the existing bolts and sealing rings included. Tighten to 70 N·m (52 lbf·ft).

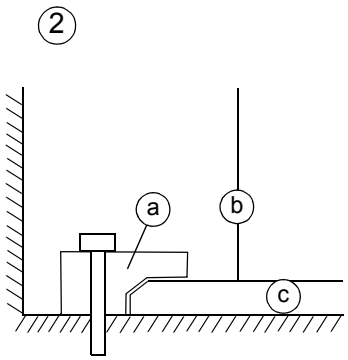
WARNING!
Do not stand or walk on the cabinet roof. Make sure that nothing presses against the roof, side or back plates or door. Do not store anything on the roof while the drive is in operation.

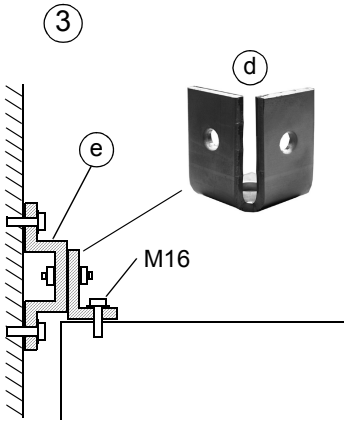
Attaching the cabinet (marine units)

See the dimension drawing delivered with the drive for details of the fastening points.

Fasten the cabinet to the floor and roof (wall) as follows:

1. Bolt the unit to the floor through the flat bars at the base of the cabinet using M10 or M12 screws.
2. If there is not enough room behind the cabinet for installation, clamp (a) the rear edges of the flat bars (c) to the floor. See the figure below.
3. Attach corner brackets (d) to the lifting eye holes. Fasten the corner brackets to the rear wall and/or roof with suitable hardware such as U-brackets (e).



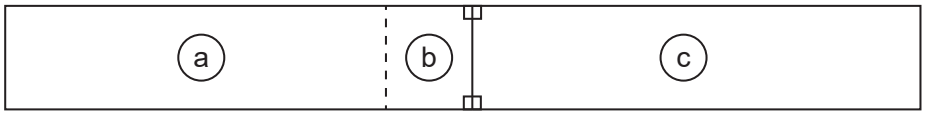


a	Clamp (not included)	d	Corner bracket (included)
b	Back panel of cabinet	e	U-bracket (not included)
c	Flat bars at base of cabinet	-	-

Joining cabinet sections together

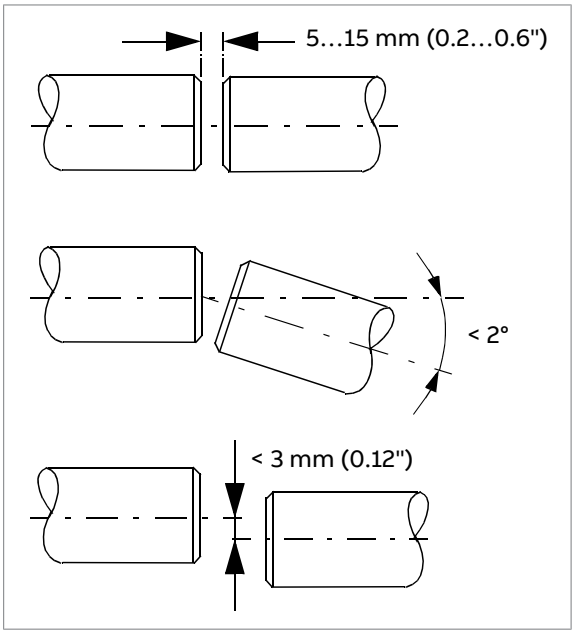
Wide cabinet line-ups are delivered in multiple sections. The sections must be joined together at the installation site. There is a joining cubicle at the end of a section for this purpose. The screws for joining the sections are in a plastic bag inside the cabinet.

1. Attach the first section to the floor.
2. Remove any plates covering the rear post of the joining cubicle.
3. Slide Axilock connectors onto the coolant pipes at the joint.
4. Align the two sections. The illustration below shows the placement of the sections.

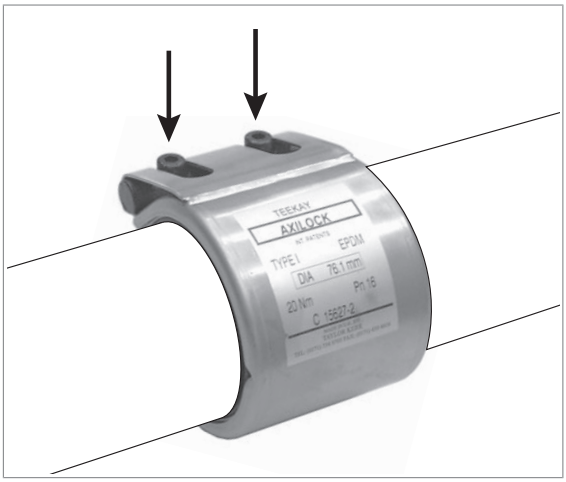


a	First section
b	Joining cubicle
c	Second section

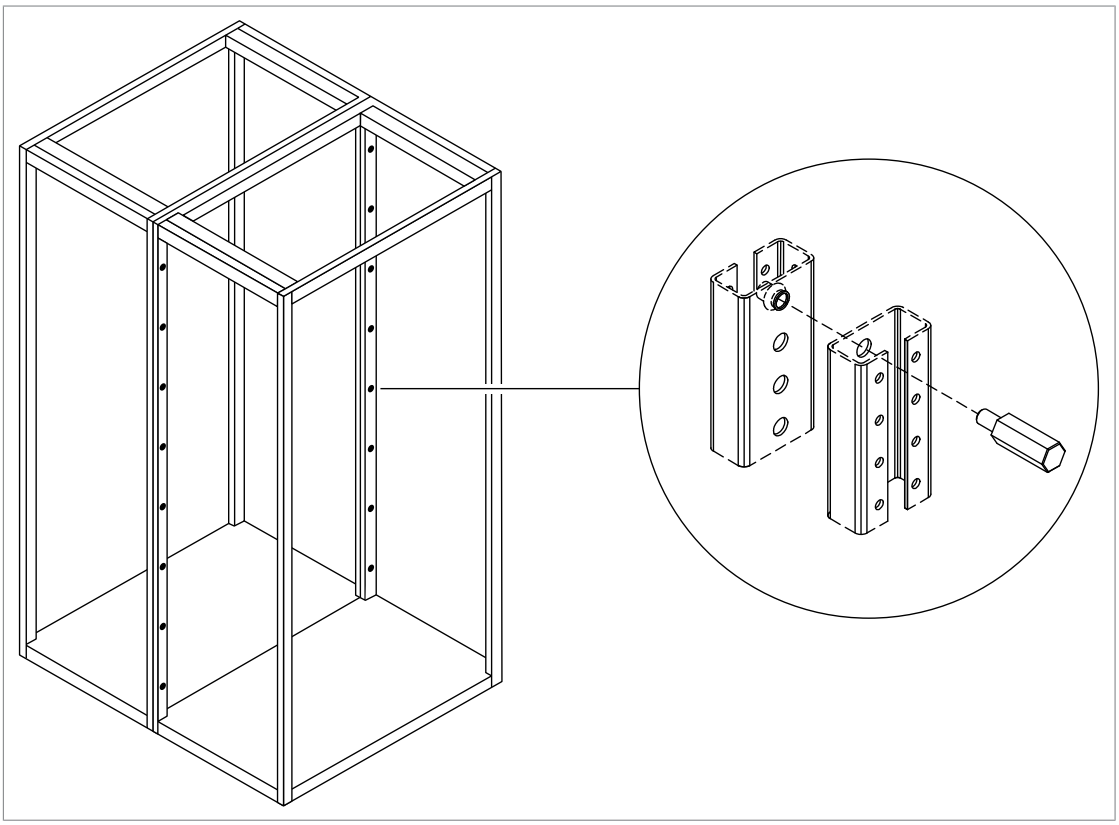
The coolant pipe ends must be aligned as shown below.



5. Center the Axilock connectors onto the gaps between coolant pipe ends. Tighten the connector screws to the torque indicated on the connector label.



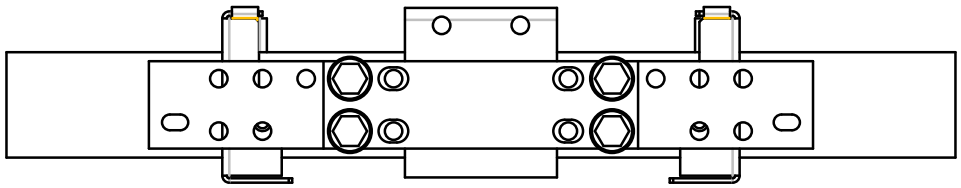
6. Attach the front and rear posts of the joining cubicle to the posts of the other section with 16 screws (8 per post). Tighten the screws to 5 N·m (3.7 lbf·ft).



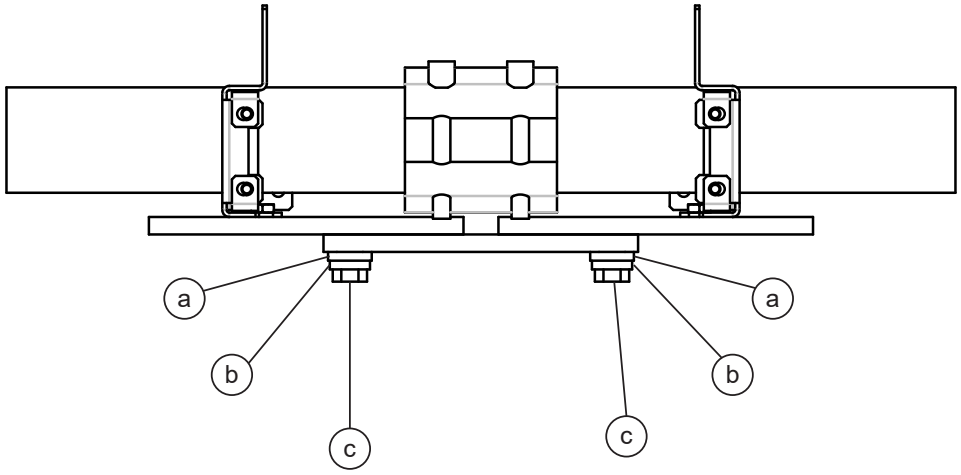
7. Attach the second section to the floor.

8. Connect the PE (ground) busbars using the M10 bolts included. Tighten to 35…40 N·m (25…30 lbf·ft).

Side



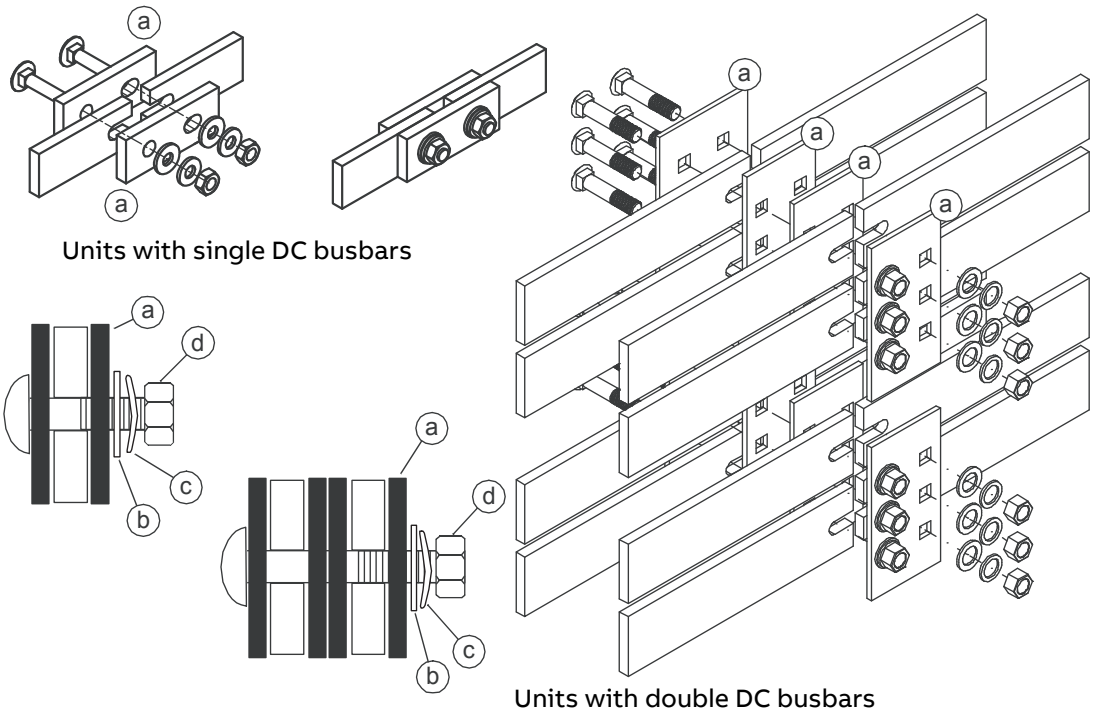
Above



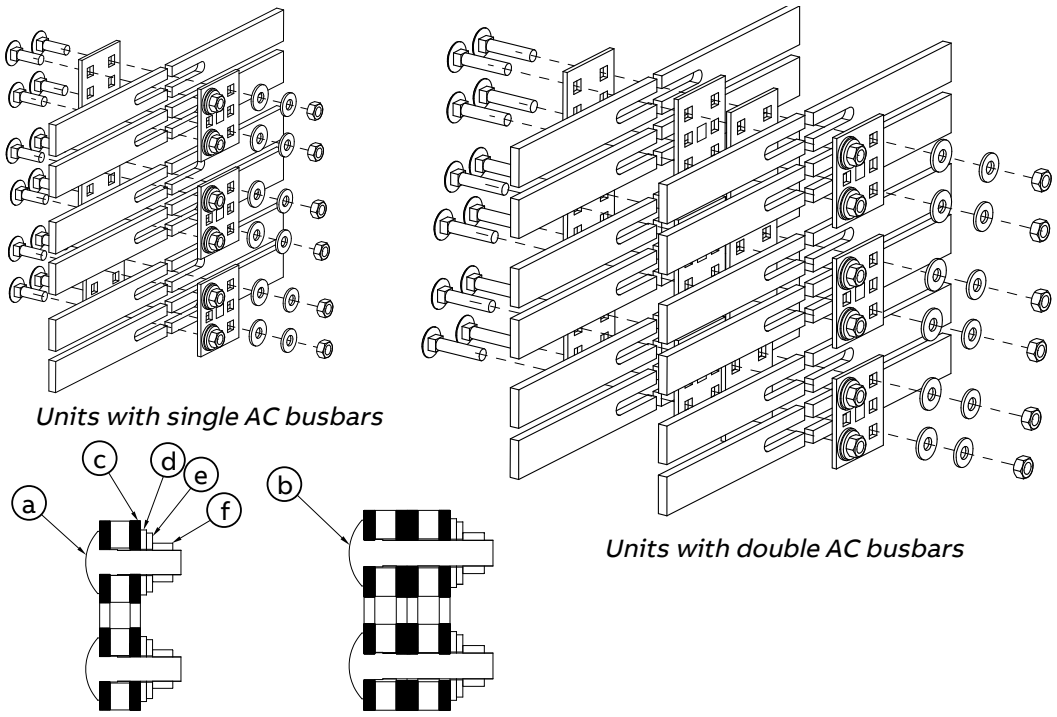
a	Plain washer
b	Spring washer
c	Bolt

9. Remove the shroud covering the DC busbars in the joining cubicle.

10. Connect the DC and AC busbars. Tighten the bolts to 55…70 N·m (40…50 lbf·ft).



a	Joint piece
b	Plain washer with electroplated zinc coating and blue chromate passivation
c	Spring washer with mechanically sprayed zinc coating
d	Nut (M12)



a	Bolt (M12)
b	Bolt (M12)
c	Joint piece
d	Plain washer with electroplated zinc coating and blue chromate passivation
e	Spring washer with mechanically sprayed zinc coating
f	Nut (M12)

WARNING!
Make sure that you install the washers in the correct order, as shown in the illustration. For example, placing an unpassivated zinc-coated spring washer directly against the joint piece will cause corrosion.

WARNING!
Do not use any joining parts other than those delivered with the unit. The parts are carefully selected to match the material of the busbars. Other parts or materials can form a galvanic couple and cause corrosion.

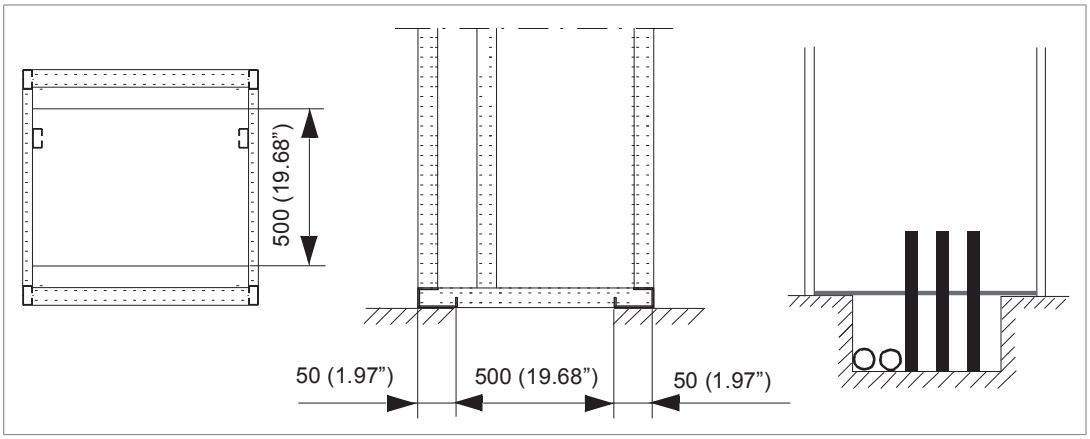
11. Reinstall any shrouding removed earlier.
12. Repeat procedure for any further sections.

Miscellaneous

Cable duct in the floor below the cabinet

A cable duct can be constructed below the 500 mm wide middle part of the cabinet. The cabinet weight lies on the two 50 mm 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 delivered with the unit. With user-defined cable entries, take care of the degree of protection, fire protection and EMC compliance.



Arc welding

ABB does not recommend attaching the cabinet by arc welding. However, if arc welding is the only option, connect the return conductor of the welding equipment to the cabinet frame at the bottom within 0.5 meters (1'6") of the welding point.

Note: The cabinet frame is zinc-plated.

WARNING!
Make sure that the return wire is connected correctly. Welding current must not return via any component or cabling of the drive. If the welding return wire is connected improperly, the welding circuit can damage electronic circuits in the cabinet.

WARNING!
Do not inhale the welding fumes.

Lifting lugs and bars

Certificate of conformity

The certificate is available in ABB Library at www.abb.com/drives/documents (document number 3AXD10001061361).

Declarations of conformity

ABB

EU Declaration of Conformity

Machinery Directive 2006/42/EC

We
Manufacturer: ABB Oy
Address: Hiomotie 13, 00380 Helsinki, Finland.
Phone: +358 10 22 11
declare under our sole responsibility that the following products:

Lifting bars, identified with material codes

64300971	64301284	64301411	64485342
64301047	64301306	64456695	64485351
64301063	64301314	64456725	64485369
64301080	64301322	64456822	64485377
64301101	64301331	64456881	64485458
64301136	64301349	64456890	68775558
64301152	64301357	64456920	68775540
64301187	64301365	64485296	3AUA5000013498
64301209	64301373	64485300	3AUA5000013504
64301250	64301381	64485318	3AUA0000055356
64301268	64301390	64485326	3AXD50000435524
64301276	64301403	64485334	3AXD50000435548

Lifting lugs, identified with material codes

64302621	64327151

used for lifting the following **frequency converters** and **frequency converter components**

ACS800LC	types **–x7LC, LC multidrives, -x07LC**
ACS580, ACH580, ACQ580	types **-07**
ACS880	types **–x7, multidrives, -x07, -xx07**
ACS880LC	types **–x7LC, LC multidrives, -x07LC, -xx07**

identified with serial numbers beginning with 1 or 8

1/2 3AXD10000665649 rev.A

are in conformity with all the relevant lifting accessory requirements of EU Machinery Directive 2006/42/EC.

Person authorized to compile the technical file:
Name and address: Vesa Tiihonen, Hiomotie 13, 00380 Helsinki, Finland

Helsinki, 16 Dec 2019

Signed for and on behalf of:

Peter Lindgren
Vice President, ABB Oy

Vesa Tiihonen
Manager, Product Engineering and Quality

Declaration of Conformity

Supply of Machinery (Safety) Regulations 2008

We
Manufacturer: ABB Oy
Address: Hiomotie 13, 00380 Helsinki, Finland.
Phone: +358 10 22 11

declare under our sole responsibility that the following products:

Lifting bars, identified with material codes

64300971	64301284	64301411	64485342
64301047	64301306	64456695	64485351
64301063	64301314	64456725	64485369
64301080	64301322	64456822	64485377
64301101	64301331	64456881	64485458
64301136	64301349	64456890	68775558
64301152	64301357	64456920	68775540
64301187	64301365	64485296	3AUA5000013498
64301209	64301373	64485300	3AUA5000013504
64301250	64301381	64485318	3AUA0000055356
64301268	64301390	64485326	3AXD50000435524
64301276	64301403	64485334	3AXD50000435548

Lifting lugs, identified with material codes

64302621	64327151

used for lifting the following **frequency converters** and **frequency converter components**

ACS800LC	types **–x7LC, LC multidrives, -x07LC**
ACS580, ACH580, ACQ580	types **-07**
ACS880	types **–x7, multidrives, -x07, -xx07**
ACS880LC	types **–x7LC, LC multidrives, -x07LC, -xx07**

identified with serial numbers beginning with 1 or 8

are in conformity with all the relevant lifting accessory requirements of the Supply of Machinery (Safety) Regulations 2008.

Authorized to compile the technical file: ABB Oy, Hiomotie 13, 00380 Helsinki, Finland

Helsinki, 28 May 2021

Signed for and on behalf of:

Peter Lindgren
Vice President, ABB Oy

Vesa Tiihonen
Manager, Reliability and Quality, ABB Oy

5

Guidelines for planning the electrical installation

Contents of this chapter

This chapter contains instructions for planning the electrical installation of the drive. Some instructions are mandatory to follow in every installation, others provide useful information that only concerns certain applications.

Limitation of liability

The installation must always be designed and made according to applicable local laws and regulations. ABB does not assume any liability whatsoever for any installation which breaches the local laws and/or other regulations. Furthermore, if the recommendations given by ABB are not followed, the drive may experience problems that the warranty does not cover.

Selecting the supply transformer

The drive does not have input chokes. Thus, the supply transformer (or generator) must be dimensioned according to the apparent power of the drive (S_n) and the supply transformer impedance Z_k(trafo). The supply nominal impedance Z_k must be at least 5% calculated with nominal apparent power of the supply modules. In a 6-pulse system, the transformer's nominal short-circuit impedance must be according to the following equation. The same impedance requirement also applies to a generator when used as the supply.

$$\frac{S_n}{S_n(\text{trafo})} \times Z_k(\text{trafo}) \geq 5\%$$

Definitions

S_n ACS880-07CLC nominal apparent power

S_n(trafo) Transformer or generator nominal apparent power

Z_k(trafo) Transformer or generator nominal short-circuit impedance

Example:

Drive type: ACS880-07CLC-1660A-7 → S_n = 1984 kVA

Transformer nominal power is, for example, 2500 kVA

$$Z_k(\text{trafo}) \geq \frac{2500\ \text{kVA}}{1984\ \text{kVA}} \times 5\%$$

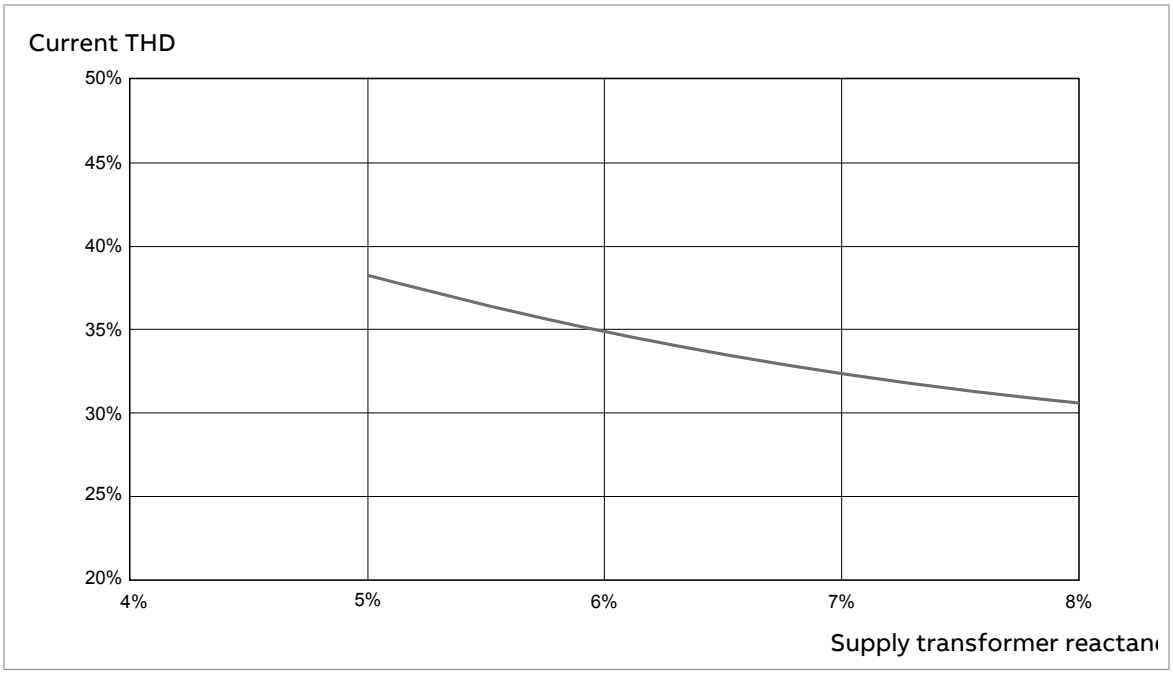
→ Z_k(trafo) ≥ 6.3%

The same rule also applies to 12-pulse transformers when the nominal values are calculated based on the total power of the 12-pulse transformer. If the nominal values are calculated per 6-pulse windings (power per winding is half of the power of the 12-pulse transformer), then half of the reactance (≥ 2.5%) is sufficient.

If the necessary transformer impedance Z_k cannot be fulfilled, it is also possible to install a separate 3-phase AC choke in addition to transformer (or generator) impedance to reach the necessary minimum impedance of 5%. Separate chokes are not available from ABB.

Note: Since the drive does not have input chokes, the THD currents and voltages have to be taken into account when dimensioning the system. If necessary, it is also possible to install a separate 3-phase AC choke to reach lower THD levels.

The diagram below shows the typical current THD at nominal current in relation to supply transformer impedance in a 6-pulse connection.



Selecting the main supply disconnecting device

You must equip the drive with a main supply disconnecting device which meets the local safety regulations. You must be able to lock the disconnecting device to the open position for installation and maintenance work.

European Union and United Kingdom

To comply with European Union directives and United Kingdom regulations related to standard EN 60204-1, the disconnecting device must be one of these types:

- switch-disconnector of utilization category AC-23B (IEC 60947-3)
- disconnector that has an auxiliary contact that in all cases causes switching devices to break the load circuit before the opening of the main contacts of the disconnector (EN 60947-3)
- circuit-breaker suitable for isolation in accordance with IEC 60947-2.

North America

Installations must be compliant with NFPA 70 (NEC)[1)] and/or Canadian Electrical Code (CE) along with state and local codes for your location and application.

[1)] National Fire Protection Association 70 (National Electric Code).

Other regions

The disconnecting device must conform to the applicable local safety regulations.

Selecting the main contactor or breaker

The installer must provide an external main contactor or breaker as the drive does not have an internal main contactor or breaker.

Obey these guidelines when you select the main contactor (breaker):

- Dimension the contactor (breaker) according to the nominal voltage and current of the drive. Also consider the environmental conditions such as ambient temperature.
- Select contactor/breaker with utilization category AC-1 (number of operations under load) according to IEC 60947-4, Low-voltage switch gear and control gear.
- Consider the application life time requirements.

See also section Relay contact data for control of external main contactor/breaker (page 200).

Examining the compatibility of the motor and drive

Use asynchronous AC induction motors, permanent magnet synchronous motors, AC induction servomotors or ABB synchronous reluctance motors (SynRM motors) with the drive.

Select the motor size and drive type from the rating table on basis of the AC line voltage and motor load. You can find the rating table in the appropriate hardware manual. You can also use the DriveSize PC tool.

Make sure that the motor can be used with an AC drive. See Requirements tables (page 78). For basics of protecting the motor insulation and bearings in drive systems, see Protecting the motor insulation and bearings (page 78).

Note:

- Consult the motor manufacturer before using a motor with nominal voltage that differs from the AC line voltage connected to the drive input.
- The voltage peaks at the motor terminals are relative to the supply voltage of the drive, not to the drive output voltage.

Protecting the motor insulation and bearings

The drive employs modern IGBT inverter technology. Regardless of frequency, the drive output comprises pulses of approximately the drive DC bus voltage with a very short rise time. The pulse voltage can almost double at the motor terminals, depending on the attenuation and reflection properties of the motor cable and the terminals. This can cause additional stress on the motor and motor cable insulation.

Modern variable speed drives with their fast rising voltage pulses and high switching frequencies can generate current pulses that flow through the motor bearings. This can gradually erode the bearing races and rolling elements.

d*u*/d*t* filters protect motor insulation system and reduce bearing currents. Common mode filters mainly reduce bearing currents. Insulated N-end (non-drive end) bearings protect the motor bearings.

Requirements tables

These tables show how to select the motor insulation system and when a drive d*u*/d*t* and common mode filters and insulated N-end (non-drive end) motor bearings are required. Ignoring the requirements or improper installation may shorten motor life or damage the motor bearings and voids the warranty.

Requirements for ABB motors, P_n < 100 kW (134 hp)

See also Abbreviations (page 82).

Motor type	Nominal AC line voltage	Requirement for	
		Motor insulation system	ABB d*u*/d*t* and common mode filters, insulated N-end motor bearings
			P_n < 100 kW and frame size < IEC 315
			P_n < 134 hp and frame size < NEMA 500
Random-wound M2_, M3_ and M4_	U_n ≤ 500 V	Standard	-
	500 V < U_n ≤ 600 V	Standard	+ d*u*/d*t*
		Reinforced	-
	600 V < U_n ≤ 690 V (cable length ≤ 150 m)	Reinforced	+ d*u*/d*t*
	600 V < U_n ≤ 690 V (cable length > 150 m)	Reinforced	-
Form-wound HX_ and AM_	380 V < U_n ≤ 690 V	Standard	n.a.
Old [1] form-wound HX_ and modular	380 V < U_n ≤ 690 V	Check with the motor manufacturer.	+ N + d*u*/d*t* with voltages over 500 V + CMF
Random-wound HX_ and AM_ [2]	0 V < U_n ≤ 500 V	Enamelled wire with fiber glass taping	+ N + CMF
	500 V < U_n ≤ 690 V		+ N + d*u*/d*t* + CMF
HDP	Consult the motor manufacturer.		

[1] manufactured before 1.1.1998

[2] For motors manufactured before 1.1.1998, check for additional instructions with the motor manufacturer.

Requirements for ABB motors, $P_n \geq 100$ kW (134 hp)

See also Abbreviations (page 82).

Motor type	Nominal AC line voltage	Requirement for		
		Motor insulation system	ABB du/dt and common mode filters, insulated N-end motor bearings	
			100 kW ≤ P_n < 350 kW or IEC 315 ≤ frame size < IEC 400	P_n ≥ 350 kW or frame size ≥ IEC 400
			134 hp ≤ P_n < 469 hp or NEMA 500 ≤ frame size ≤ NEMA 580	P_n ≥ 469 hp or frame size > NEMA 580
Random-wound M2_, M3_ and M4_	U_n ≤ 500 V	Standard	+ N	+ N + CMF
	500 V < U_n ≤ 600 V	Standard	+ N + du/dt	+ N + du/dt + CMF
		Reinforced	+ N	+ N + CMF
	600 V < U_n ≤ 690 V (cable length ≤ 150 m)	Reinforced	+ N + du/dt	+ N + du/dt + CMF
	600 V < U_n ≤ 690 V (cable length > 150 m)	Reinforced	+ N	+ N + CMF
Form-wound HX_ and AM_	380 V < U_n ≤ 690 V	Standard	+ N + CMF	P_n < 500 kW: +N + CMF
				P_n ≥ 500 kW: +N + du/dt + CMF
Old[1] form-wound HX_ and modular	380 V < U_n ≤ 690 V	Check with the motor manufacturer.	+ N + du/dt with voltages over 500 V + CMF	
Random-wound HX_ and AM_ [2]	0 V < U_n ≤ 500 V	Enamelled wire with fiber glass taping	+ N + CMF	
	500 V < U_n ≤ 690 V		+ N + du/dt + CMF	
HDP	Consult the motor manufacturer.			

1) manufactured before 1.1.1998
2) For motors manufactured before 1.1.1998, check for additional instructions with the motor manufacturer.

Requirements for non-ABB motors, P_n < 100 kW (134 hp)

See also Abbreviations (page 82).

Motor type	Nominal AC line voltage	Requirement for	
		Motor insulation system	ABB du/dt and common mode filters, insulated N-end motor bearings
			P_n < 100 kW and frame size < IEC 315
			P_n < 134 hp and frame size < NEMA 500
Random-wound and form-wound	U_n ≤ 420 V	Standard: $\hat{U}_{LL}$ = 1300 V	-
	420 V < U_n ≤ 500 V	Standard: $\hat{U}_{LL}$ = 1300 V	+ du/dt
		Reinforced: $\hat{U}_{LL}$ = 1600 V, 0.2 µs rise time	-
	500 V < U_n ≤ 600 V	Reinforced: $\hat{U}_{LL}$ = 1600 V	+ du/dt
		Reinforced: $\hat{U}_{LL}$ = 1800 V	-
	600 V < U_n ≤ 690 V	Reinforced: $\hat{U}_{LL}$ = 1800 V	+ du/dt
		Reinforced: $\hat{U}_{LL}$ = 2000 V, 0.3 µs rise time [1)]	-

1) If the intermediate DC circuit voltage of the drive is increased from the nominal level due to long term resistor braking cycles, check with the motor manufacturer if additional output filters are needed.

Requirements for non-ABB motors, $P_n \geq 100$ kW (134 hp)

See also Abbreviations (page 82).

Motor type	Nominal AC line voltage	Requirement for		
		Motor insulation system	ABB du/dt and common mode filters, insulated N-end motor bearings	
			100 kW ≤ P_n < 350 kW or IEC 315 ≤ frame size < IEC 400	P_n ≥ 350 kW or frame size ≥ IEC 400
			134 hp ≤ P_n < 469 hp or NEMA 500 ≤ frame size ≤ NEMA 580	P_n ≥ 469 hp or frame size > NEMA 580
Random-wound and form-wound	U_n ≤ 420 V	Standard: $\hat{U}_{LL}$ = 1300 V	+ N or CMF	+ N + CMF
	420 V < U_n ≤ 500 V	Standard: $\hat{U}_{LL}$ = 1300 V	+ du/dt + (N or CMF)	+ N + du/dt + CMF
		Reinforced: $\hat{U}_{LL}$ = 1600 V, 0.2 µs rise time	+ N or CMF	+ N + CMF
	500 V < U_n ≤ 600 V	Reinforced: $\hat{U}_{LL}$ = 1600 V	+ du/dt + (N or CMF)	+ N + du/dt + CMF
		Reinforced: $\hat{U}_{LL}$ = 1800 V	+ N or CMF	+ N + CMF
	600 V < U_n ≤ 690 V	Reinforced: $\hat{U}_{LL}$ = 1800 V	+ du/dt + N	+ N + du/dt + CMF
		Reinforced: $\hat{U}_{LL}$ = 2000 V, 0.3 µs rise time [1)]	+ N + CMF	+ N + CMF

1) If the intermediate DC circuit voltage of the drive is increased from the nominal level due to long term resistor braking cycles, check with the motor manufacturer if additional output filters are needed.

Abbreviations

Abbr.	Definition
U_n	Nominal AC line voltage
$\hat{U}_{LL}$	Peak line-to-line voltage at motor terminals which the motor insulation must withstand
P_n	Motor nominal power
du/dt	du/dt filter at the output of the drive
CMF	Common mode filter of the drive
N	N-end bearing: insulated motor non-drive end bearing
n.a.	Motors of this power range are not available as standard units. Consult the motor manufacturer.

Availability of d*u*/d*t* filter and common mode filter by drive type

Product type	Availability of d*u*/d*t* filtering	Availability of common mode filtering (CMF)
ACS880-07CLC	Standard	Standard

Additional requirements for explosion-safe (EX) motors

If you use an explosion-safe (EX) motor, obey the rules in the requirements table above. In addition, consult the motor manufacturer for any further requirements.

Additional requirements for ABB motors of types other than M2_, M3_, M4_, HX_ and AM_

Use the selection criteria given for non-ABB motors.

Additional requirements for braking applications

When the motor brakes the machinery, the intermediate circuit DC voltage of the drive increases, the effect being similar to the motor supply voltage increasing by up to 20 percent. Consider this voltage increase when specifying the motor insulation requirements if the motor will be braking a large part of its operation time.

Example: Motor insulation requirement for a 400 V AC line voltage application must be selected as if the drive were supplied with 480 V.

Additional requirements for ABB high-output and IP23 motors

The rated output power of high output motors is higher than what is stated for the particular frame size in EN 50347 (2001).

This table shows the requirements for protecting the motor insulation and bearings in drive systems for ABB random-wound motor series (for example, M3AA, M3AP and M3BP).

Nominal AC supply voltage	Requirement for			
	Motor insulation system	ABB d*u*/d*t* and common mode filters, insulated N-end motor bearings		
		P_n < 100 kW	100 kW ≤ P_n < 200 kW	P_n ≥ 200 kW
		P_n < 140 hp	140 hp ≤ P_n < 268 hp	P_n ≥ 268 hp
U_n ≤ 500 V	Standard	-	+ N	+ N + CMF
500 V < U_n ≤ 600 V	Standard	+ d*u*/d*t*	+ d*u*/d*t* + N	+ d*u*/d*t* + N + CMF
	or			
	Reinforced	-	+ N	+ N + CMF
600 V < U_n ≤ 690 V	Reinforced	+ d*u*/d*t*	+ d*u*/d*t* + N	+ d*u*/d*t* + N + CMF

Additional requirements for non-ABB high-output and IP23 motors

The rated output power of high-output motors is higher than what is stated for the particular frame size in EN 50347 (2001).

If you plan to use a non-ABB high-output motor or an IP23 motor, consider these additional requirements for protecting the motor insulation and bearings in drive systems:

- If motor power is below 350 kW: Equip the drive and/or motor with the filters and/or bearings according to the table below.
- If motor power is above 350 kW: Consult the motor manufacturer.

Nominal AC supply voltage	**Requirement for**		
	Motor insulation system	**ABB d*u*/d*t* and common mode filters, insulated N-end motor bearings**	
		P_n < 100 kW or frame size < IEC 315	**100 kW < P_n < 350 kW or IEC 315 < frame size < IEC 400**
		P_n < 134 hp or frame size < NEMA 500	**134 hp < P_n < 469 hp or NEMA 500 < frame size < NEMA 580**
$U_n \leq 420$ V	Standard: $\hat{U}_{LL}$ = 1300 V	+ N or CMF	+ N or CMF
420 V < U_n < 500 V	Standard: $\hat{U}_{LL}$ = 1300 V	+ d*u*/d*t* + (N or CMF)	+ N + d*u*/d*t* + CMF
	or		
	Reinforced: $\hat{U}_{LL}$ = 1600 V, 0.2 microsecond rise time	+ N or CMF	+ N or CMF
500 V < $U_n \leq 600$ V	Reinforced: $\hat{U}_{LL}$ = 1600 V	+ d*u*/d*t* + (N or CMF)	+ N + d*u*/d*t* + CMF
	or		
	Reinforced: $\hat{U}_{LL}$ = 1800 V	+ N or CMF	+ N + CMF
600 V < $U_n \leq 690$ V	Reinforced: $\hat{U}_{LL}$ = 1800 V	+ N + d*u*/d*t*	+ N + d*u*/d*t* + CMF
	Reinforced: $\hat{U}_{LL}$ = 2000 V, 0.3 microsecond rise time [1)]	+ N + CMF	+ N + CMF

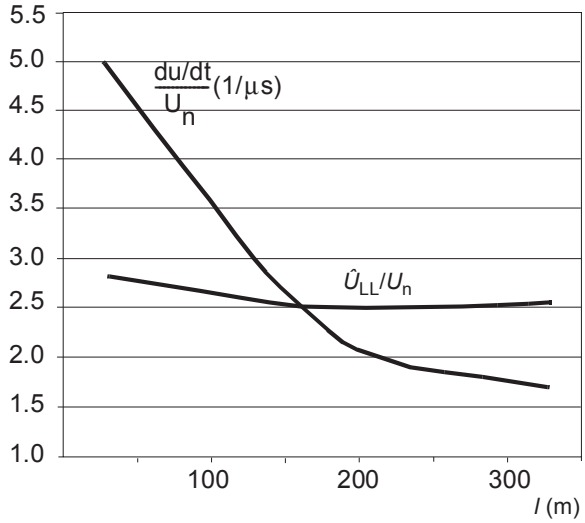
1) If the intermediate DC circuit voltage of the drive is increased from the nominal level due to long term resistor braking cycles, check with the motor manufacturer if additional output filters are needed.

Additional data for calculating the rise time and the peak line-to-line voltage

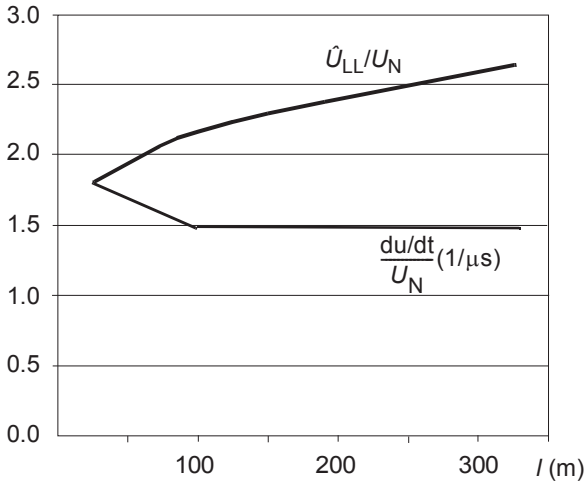
The diagrams below show the relative peak line-to-line voltage and rate of change of voltage as a function of the motor cable length. If you need to calculate the actual peak voltage and voltage rise time considering the actual cable length, proceed as follows:

- Peak line-to line voltage: Read the relative $\hat{U}_{LL}/U_n$ value from the diagram below and multiply it by the nominal supply voltage (U_n).
- Voltage rise time: Read the relative values $\hat{U}_{LL}/U_n$ and (d*u*/d*t*)/U_n from the diagram below. Multiply the values by the nominal supply voltage (U_n) and substitute into equation t = 0.8 · $\hat{U}_{LL}$/(d*u*/d*t*).

Inverter without du/dt filter



Inverter with du/dt filter



l	Motor cable length
$\hat{U}_{LL}/U_N$	Relative peak line-to-line voltage (du/dt filter in use)
$(du/dt)/U_N$	Relative d*u*/d*t* value (du/dt filter in use)

Note: $\hat{U}_{LL}$ and d*u*/d*t* values are approximately 20% higher during resistor braking.

Additional note for sine filters

A sine filter also protects the motor insulation system. The peak phase-to-phase voltage with a sine filter is approximately $1.5 \cdot U_n$.

Selecting the power cables

General rules

Select the input power and motor cables according to local regulations. Obey these rules:

- Select a cable capable of carrying the nominal current.
- Select a cable rated for at least 70 °C maximum permissible temperature of conductor in continuous use.
- The inductance and impedance of the PE conductor/cable (grounding wire) must be rated according to permissible touch voltage appearing under fault conditions (so that the fault point voltage will not rise excessively when a ground fault occurs).
- 600 V AC cable is accepted for up to 500 V AC. 750 V AC cable is accepted for up to 600 V AC. For 690 V AC rated equipment, the rated voltage between the conductors of the cable should be at least 1 kV.
- With US installations, consider the additional US requirements.

Use symmetrical shielded input power cables. The cabling has to be identical (length and cross-sectional area) between all the parallel-connected supply modules. Each module must have its own shielded 3-conductor input AC cable with the minimum length of 5 m (16.4 ft). This ensures uniform loading of all the three input phases. Single-conductor cables cannot be used.

Use symmetrical shielded motor cable. Ground motor cable shields 360° at both ends. Keep the motor cable and its PE pigtail (twisted shield) as short as possible to reduce high-frequency electromagnetic emissions.

Note: When continuous metal conduit is employed, shielded cable is not required. The conduit must have bonding at both ends.

The protective conductor must always have an adequate conductivity. Unless local wiring regulations state otherwise, the cross-sectional area of the protective conductor must agree with the conditions that require automatic disconnection of the supply required in 411.3.2. of IEC 60364-4-41:2005 and be capable of withstanding the prospective fault current during the disconnection time of the protective device. The cross-sectional area of the protective conductor can either be selected from the table below or calculated according to 543.1 of IEC 60364-5-54.

This table shows the minimum cross-sectional area related to the phase conductor size according to IEC 61800-5-1 when the phase conductor and the protective conductor are made of the same metal. If this is not so, the cross-sectional area of the protective earthing conductor shall be determined in a manner which produces a conductance equivalent to that which results from the application of this table.

Cross-sectional area of the phase conductors S (mm^2)	Minimum cross-sectional area of the corresponding protective conductor Sp (mm^2)
$S \leq 16$	S
$16 < S \leq 35$	16
$35 < S$	S/2

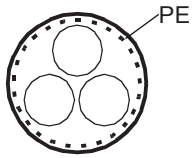
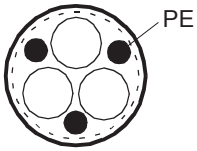
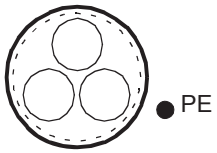
Typical power cable sizes

See chapter Technical data for the typical power cable sizes for each drive type.

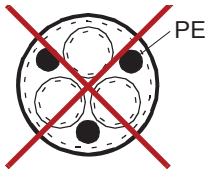
Alternative power cable types

Recommended power cable types

This section presents the recommended cable types. Check with local / state / country electrical codes for allowance.

Cable type	Use as input power cabling	Use as motor cabling
 Symmetrical shielded cable with three phase conductors and a concentric PE conductor as shield.	Yes.	Yes.
 Symmetrical shielded cable with three phase conductors and symmetrically constructed PE conductor, and a shield.	Yes.	Yes.
 Symmetrical shielded cable with three phase conductors and a shield, and a separate PE conductor/cable	Yes. A separate PE conductor is required if the shield does not agree with the PE conductor requirements. **Note:** If the shield size is smaller than 10 mm^2 Cu (or 16 mm^2 Al), you need two PE conductors typically, for example, the shield and a separate conductor/cable. This is due to the safety regulations related to the leakage current. See IEC/EN 61800-5-1, or the drive safety instructions for more information.	Yes. A separate PE conductor is required if the shield does not agree with the PE conductor requirements.

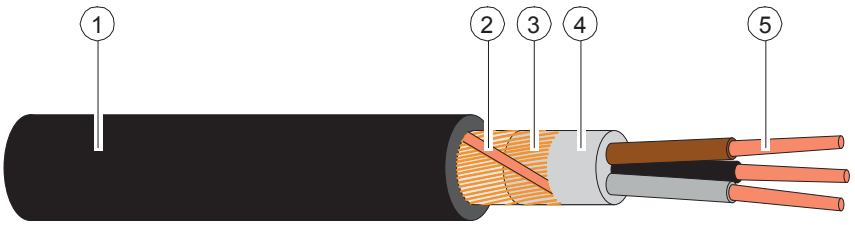
Not allowed power cable types

Cable type	Use as input power cabling	Use as motor cabling
 Symmetrical shielded cable with individual shields for each phase conductor	No	No

Power cable shield

If the cable shield is used as the sole PE conductor, make sure that its conductivity agrees with the PE conductor requirements.

To effectively suppress radiated and conducted radio-frequency emissions, the cable shield conductivity must be at least 1/10 of the phase conductor conductivity. The requirements are easily met with a copper or aluminum shield. The minimum requirement of the motor cable shield of the drive is shown below. It consists of a concentric layer of copper wires with an open helix of copper tape or copper wire. The better and tighter the shield, the lower the emission level and bearing currents.



1	Insulation jacket
2	Helix of copper tape or copper wire
3	Copper wire screen
4	Inner insulation
5	Cable core

Grounding requirements

This section gives general requirements for grounding the drive. When you plan the grounding of the drive, obey all the applicable national and local regulations.

The conductivity of the protective earth conductor(s) must be sufficient.

Unless local wiring regulations state otherwise, the cross-sectional area of the protective earth conductor must agree with the conditions that require automatic disconnection of the supply required in 411.3.2 of IEC 60364-4-41:2005 and be capable of withstanding the prospective fault current during the disconnection time of the protective device. The cross-sectional area of the protective earth conductor must be selected from the table below or calculated according to 543.1 of IEC 60364-5-54.

This table shows the minimum cross-sectional area of the protective earth conductor related to the phase conductor size according to IEC/UL 61800-5-1 when the phase conductor(s) and the protective earth conductor are made of the same metal. If this is not so, the cross-sectional area of the protective earth conductor must be

determined in a manner which produces a conductance equivalent to that which results from the application of this table.

Cross-sectional area of the phase conductors S (mm^2)	Minimum cross-sectional area of the corresponding protective earth conductor S_p (mm^2)
S ≤ 16	S [1)]
16 < S ≤ 35	16
35 < S	S/2

1) For the minimum conductor size in IEC installations, refer to Additional grounding requirements – IEC.

If the protective earth conductor is not part of the input power cable or input power cable enclosure, the minimum permitted cross-sectional area is:

- 2.5 mm^2 if the conductor is mechanically protected,
  or
- 4 mm^2 if the conductor is not mechanically protected. If the equipment is cord-connected, the protective earth conductor must be the last conductor to be interrupted if there is a failure in the strain relief mechanism.

Additional grounding requirements – IEC

This section gives grounding requirements according to standard IEC/EN 61800-5-1.

Because the normal touch current of the drive is more than 3.5 mA AC or 10 mA DC:

- the minimum size of the protective earth conductor must comply with the local safety regulations for high protective earth conductor current equipment, and
- you must use one of these connection methods:
  1. a fixed connection and:
     - a protective earth conductor with a minimum cross-sectional area of 10 mm^2 Cu or 16 mm^2 Al (as an alternative when aluminum cables are permitted),
       or
     - a second protective earth conductor of the same cross-sectional area as the original protective earth conductor,
       or
     - a device that automatically disconnects the supply if the protective earth conductor is damaged.
  2. a connection with an industrial connector according to IEC 60309 and a minimum protective earth conductor cross-section of 2.5 mm^2 as part of a multi-conductor power cable. Sufficient strain relief must be provided.

If the protective earth conductor is routed through a plug and socket, or similar means of disconnection, it must not be possible to disconnect it unless power is simultaneously removed.

Note: You can use power cable shields as grounding conductors only when their conductivity is sufficient.

Additional grounding requirements – UL (NEC)

This section gives grounding requirements according to standard UL 61800-5-1.

The protective earth conductor must be sized as specified in Article 250.122 and table 250.122 of the National Electric Code, ANSI/NFPA 70.

For cord-connected equipment, it must not be possible to disconnect the protective earth conductor before power is removed.

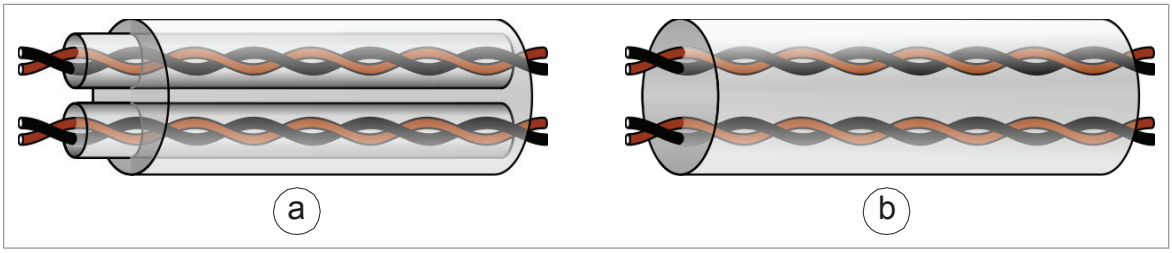
Selecting the control cables

Shielding

Only use shielded control cables.

Use a double-shielded twisted pair cable for analog signals. ABB recommends this type of cable also for the pulse encoder signals. Use one individually shielded pair for each signal. Do not use common return for different analog signals.

A double-shielded cable (a) is the best alternative for low-voltage digital signals, but single-shielded (b) twisted pair cable is also acceptable.



Signals in separate cables

Run analog and digital signals in separate, shielded cables. Do not mix 24 V DC and 115/230 V AC signals in the same cable.

Signals that can be run in the same cable

If their voltage does not exceed 48 V, relay-controlled signals can be run in the same cables as digital input signals. The relay-controlled signals should be run as twisted pairs.

Relay cable

The cable type with braided metallic shield (for example ÖLFLEX by LAPPKABEL, Germany) has been tested and approved by ABB.

Control panel to drive cable

Use EIA-485, Cat 5e (or better) cable with male RJ-45 connectors. The maximum length of the cable is 100 m (328 ft).

PC tool cable

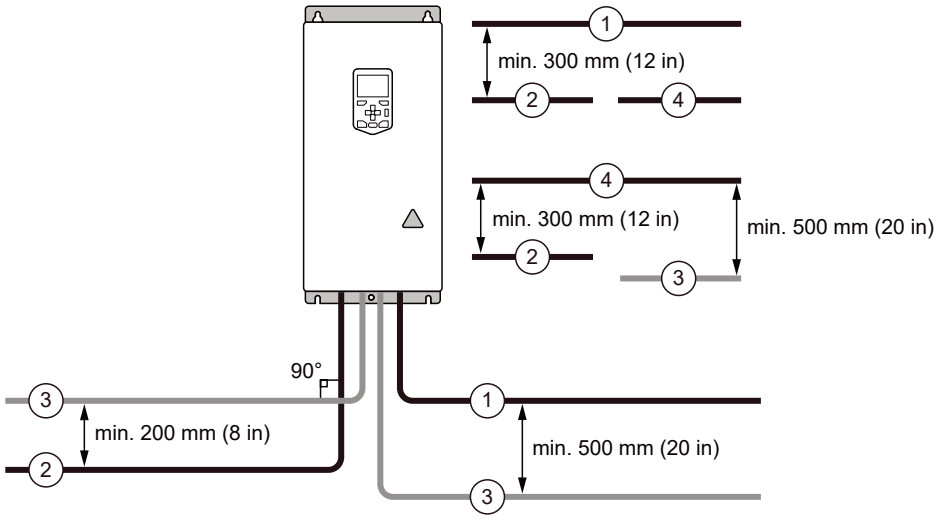
Connect the Drive Composer PC tool to the drive through the USB port of the control panel. Use a USB Type A (PC) - Type Mini-B (control panel) cable. The maximum length of the cable is 3 m (9.8 ft).

Routing the cables

General guidelines – IEC

- Route the motor cable away from other cables. Motor cables of several drives can be run in parallel installed next to each other.
- Install the motor cable, input power cable and control cables on separate trays.
- Avoid long parallel runs of motor cables with other cables.
- Where control cables must cross power cables, make sure that they are arranged at an angle as near to 90 degrees as possible.
- Do not run extra cables through the drive.
- Make sure that the cable trays have good electrical bonding to each other and to the grounding electrodes. Aluminum tray systems can be used to improve local equalizing of potential.

The following figure illustrates the cable routing guidelines with an example drive.



1	Motor cable
2	Input power cable
3	Control cable
4	Brake resistor or chopper cable (if any)

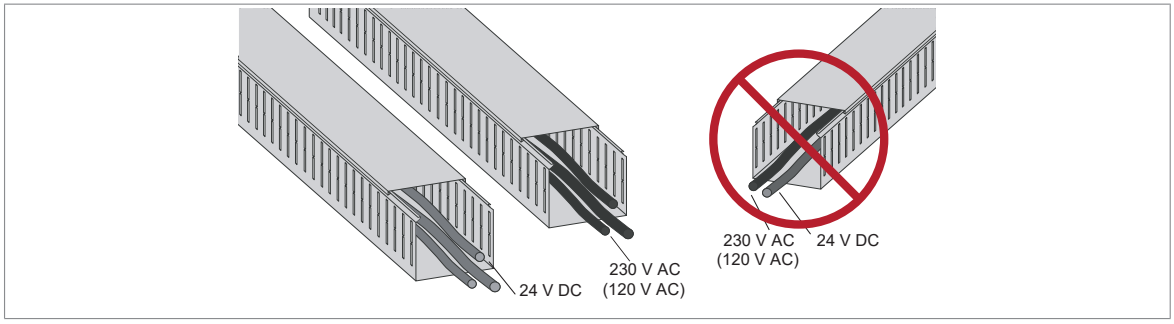
Continuous motor cable shield/conduit or enclosure for equipment on the motor cable

To minimize the emission level when safety switches, contactors, connection boxes or similar equipment are installed on the motor cable between the drive and the motor:

- Install the equipment in a metal enclosure.
- Use either a symmetrical shielded cable, or install the cabling in a metal conduit.
- Make sure that there is a good and continuous galvanic connection in the shield/conduit between drive and motor.
- Connect the shield/conduit to the protective ground terminal of the drive and the motor.

Separate control cable ducts

Put 24 V DC and 230 V AC (120 V AC) control cables in separate ducts, unless the 24 V DC cable is insulated for 230 V AC (120 V AC) or insulated with an insulation sleeving for 230 V AC (120 V AC).



Protecting the drive, input power cable, motor and motor cable in short circuit situations and against thermal overload

Protecting the input cabling and the drive upon a short-circuit

To protect the input cable in short-circuit situations, install fuses or a suitable circuit breaker at the supply side of the cabling.

The drive is equipped with fuses as standard. In case of a short-circuit inside the drive, the fuses protect the drive, restrict drive damage, and prevent damage to adjoining equipment.

Protecting the motor and motor cable in short-circuits

The drive protects the motor cable and motor in a short-circuit situation when:

- the motor cable is sized correctly
- the motor cable type complies with the motor cable selection guidelines by ABB
- the cable length does not exceed the allowed maximum length specified for the drive
- the setting of parameter 99.10 Motor nominal power in the drive is equal with the value given on the motor rating plate.

The electronic power output short-circuit protection circuitry meets the requirements of IEC 60364-4-41 2005/AMD1.

Protecting the drive and the power cables against thermal overload

The drive protects itself and the input and motor cables against thermal overload when the cables are sized according to the nominal current of the drive. No additional thermal protection devices are needed.

WARNING!
If the drive is connected to multiple motors, use a separate circuit breaker or fuses for protecting each motor cable and motor against overload. The drive overload protection is tuned for the total motor load. It may not trip due to an overload in one motor circuit only.

Protecting the motor against thermal overload

According to regulations, the motor must be protected against thermal overload and the current must be switched off when overload is detected. The drive includes a motor thermal protection function that protects the motor and switches off the current when necessary. Depending on a drive parameter value, the function either monitors a calculated temperature value (based on a motor thermal model) or an actual temperature indication given by motor temperature sensors.

The motor thermal protection model supports thermal memory retention and speed sensitivity. The user can tune the thermal model further by feeding in additional motor and load data.

The most common temperature sensor types are PTC or Pt100.

For more information, see the firmware manual.

Protecting the motor against overload without thermal model or temperature sensors

Motor overload protection protects the motor against overload without using motor thermal model or temperature sensors.

Motor overload protection is required and specified by multiple standards including the US National Electric Code (NEC) and the common UL/IEC 61800-5-1 standard in conjunction with UL/IEC 60947-4-1. The standards allow for motor overload protection without external temperature sensors.

The protection feature of the drive allows the user to specify the class of operation in the same manner as the overload relays are specified in standards UL/IEC 60947-4-1 and NEMA ICS 2.

The motor overload protection supports thermal memory retention and speed sensitivity.

For more information, see drive firmware manual.

Protecting the drive against ground faults

The drive is equipped with an internal ground fault protective function to protect the unit against ground faults in the motor and motor cable. This function is not a personnel safety or a fire protection feature. See the firmware manual for more information.

An optional ground fault monitoring device (+Q954) is available for IT (ungrounded) systems. The option includes a ground fault indicator on the drive cabinet door.

Residual current device compatibility

The drive is suitable for use with residual current devices of Type B.

Note: As standard, the drive contains capacitors connected between the main circuit and the frame. These capacitors and long motor cables increase the ground leakage current and may cause nuisance faults in residual current devices.

Implementing the emergency stop function

You can order the drive with an emergency stop function (option).

See the appropriate option manual for more information.

Option code	User's manual	Manual code (English)
+Q951	Emergency stop, stop category 0 (using main contactor/breaker and Safe torque off)	3AUA0000709830
+Q951+Q984	Emergency stop, stop category 0 (using main contactor/breaker) with push button monitoring	3AXD50000328659

Implementing the Safe torque off function

See chapter The Safe torque off function (page 231).

Implementing the power loss ride-through function

If the incoming supply voltage is cut off, the drive will continue to operate by utilizing the kinetic energy of the rotating motor. The drive will be fully operational as long as the motor rotates and generates energy to the drive.

If the drive is equipped with a main contactor or breaker, it restores the drive input power after a short break. The contactor re-connects after the break automatically.

Note: If the power loss lasts so long that the drive trips on undervoltage, a fault reset and a fresh start command is required to continue operation.

Implement the power-loss ride-through function as follows:

1. Enable the power-loss ride-through function of the drive (parameter 30.31).
2. Enable the automatic restart of the motor after a short power supply break:
   - Set the start mode to automatic (parameter 21.01 or 21.19, depending on the motor control mode being used).
   - Define the automatic restart time (parameter 21.18).

WARNING!
Make sure that a flying restart of the motor will not cause any danger. If you are in doubt, do not implement the power loss ride-through function.

Implementing a bypass connection

If bypassing is required, employ mechanically or electrically interlocked contactors between the motor and the drive and between the motor and the power line. Make sure with interlocking that the contactors cannot be closed simultaneously. The installation must be clearly marked as defined in IEC/EN/UL 61800-5-1, subclause 6.5.3, for example, "THIS MACHINE STARTS AUTOMATICALLY".

Bypass connection is available as a factory-installed option for some cabinet-installed drive types. Consult ABB for more information.

WARNING!
Never connect the drive output to the electrical power network. The connection may damage the drive.

Supplying power for the auxiliary circuits

The customer/installer must provide the auxiliary voltage from an external supply to the drive.

The user must supply these options from external power sources:

- +G300/+G301: Cabinet heaters and/or lighting
- +G313: Power supply connection for a motor space heater output

For the voltages and fuse sizes, refer to the circuit diagrams delivered with the drive.

Using power factor compensation capacitors with the drive

Power factor compensation is not needed with AC drives. However, if a drive is to be connected in a system with compensation capacitors installed, note the following restrictions.

WARNING!
Do not connect power factor compensation capacitors or harmonic filters to the motor cables (between the drive and the motor). They are not meant to be used with AC drives and can cause permanent damage to the drive or themselves.

If there are power factor compensation capacitors in parallel with the input of the drive:

1. Do not connect a high-power capacitor to the power line while the drive is connected. The connection will cause voltage transients that may trip or even damage the drive.
2. If capacitor load is increased/decreased step by step when the AC drive is connected to the power line, make sure that the connection steps are low enough not to cause voltage transients that would trip the drive.
3. Make sure that the power factor compensation unit is suitable for use in systems with AC drives, ie, harmonic generating loads. In such systems, the compensation unit should typically be equipped with a blocking reactor or harmonic filter.

Using a safety switch between the drive and the motor

ABB recommends to install a safety switch between the permanent magnet motor and the drive output. The switch is needed to isolate the motor from the drive during maintenance work on the drive.

Implementing the control of a contactor between drive and motor

Implementing the control of the output contactor depends on the motor control mode and stopping method selected.

When you select the DTC motor control mode and the motor ramp stop mode, use this operation sequence to open the contactor:

1. Give a stop command to the drive.
2. Wait until the drive decelerates the motor to zero speed.
3. Open the contactor.

WARNING!
If DTC motor control mode is in use, do not open the output contactor while the drive controls the motor. The motor control operates faster than the contactor, and tries to maintain the load current. This can cause damage to the contactor.

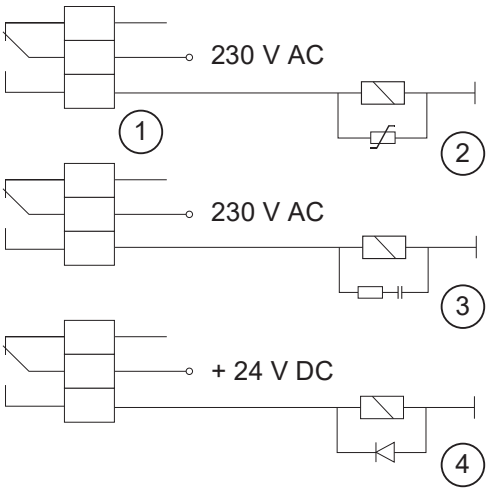
When you select the DTC motor control mode and the motor coast stop mode, you can open the contactor immediately after the drive has received the stop command. This is the case also if you use the scalar motor control mode.

Protecting the contacts of relay outputs

Inductive loads (relays, contactors, motors) cause voltage transients when switched off.

The relay contacts on the drive control unit are protected with varistors (250 V) against overvoltage peaks. In spite of this, it is highly recommended that inductive loads are equipped with noise attenuating circuits (varistors, RC filters [AC] or diodes [DC]) to minimize the EMC emission at switch-off. If not suppressed, the disturbances may connect capacitively or inductively to other conductors in the control cable and form a risk of malfunction in other parts of the system.

Install the protective component as close to the inductive load as possible. Do not install protective components at the relay outputs.



1	Relay output
2	Varistor
3	RC filter
4	Diode

Implementing a motor temperature sensor connection

WARNING!
IEC 61800-5-1 requires double or reinforced insulation between live parts and accessible parts when:

- the accessible parts are not conductive, or
- the accessible parts are conductive, but not connected to the protective earth.

Obey this requirement when you plan the connection of the motor temperature sensor to the drive.

You have these implementation alternatives:

1. If there is double or reinforced insulation between the sensor and the live parts of the motor: You can connect the sensor directly to the analog/digital input(s) of the drive. See the control cable connection instructions. Make sure that the voltage does not exceed the maximum allowed voltage over the sensor.
2. If there is basic insulation between the sensor and the live parts of the motor, or if the insulation type is not known, you can connect the sensor to the drive via an option module. The sensor and the module must form a double or reinforced insulation between the motor live parts and the drive control unit. See Connecting a motor temperature sensor to the drive through an option module (page 97). Make sure that the voltage does not exceed the maximum allowed voltage over the sensor.
3. If there is basic insulation between the sensor and the live parts of the motor, or if the insulation type is not known: You can connect a sensor to a digital input of the drive via an external relay. The sensor and the relay must form a double or reinforced insulation between the motor's live parts and the digital input of the drive. Make sure that the voltage does not exceed the maximum allowed voltage over the sensor.

Connecting a motor temperature sensor to the drive through an option module

This table shows:

- option module types that you can use for the motor temperature sensor connection
- insulation or isolation level that each option module forms between its temperature sensor connector and other connectors
- temperature sensor types that you can connect to each option module
- temperature sensor insulation requirement in order to form, together with the insulation of the option module, a reinforced insulation between the motor live parts and the drive control unit.

Option module		Temperature sensor type			Temperature sensor insulation requirement
Type	**Insulation/Isolation**	**PTC**	**KTY**	**Pt100, Pt1000**	
FIO-11	Galvanic isolation between sensor connector and drive control unit connector. No isolation between sensor connector and other I/O connectors.	x	x	x	Reinforced insulation
FIO-21	Galvanic isolation between sensor connector and other connectors (including drive control unit connector).	x	x	x	Reinforced insulation
FEN-01	Galvanic isolation between sensor connector and drive control unit connector. No isolation between sensor connector and TTL encoder emulation output.	x	-	-	Reinforced insulation
FEN-11	Galvanic isolation between sensor connector and drive control unit connector. No isolation between sensor connector and TTL encoder emulation output.	x	x	-	Reinforced insulation
FEN-21	Galvanic isolation between sensor connector and drive control unit connector. No isolation between sensor connector and TTL encoder emulation output.	x	x	-	Reinforced insulation
FEN-31	Galvanic isolation between sensor connector and drive control unit connector. No isolation between sensor connector and other connectors.	x	x	-	Reinforced insulation
FAIO-01	Basic insulation between sensor connector and drive control unit connector. No insulation between sensor connector and other I/O connectors.	x	x	x	Reinforced or basic insulation. With basic insulation, the other I/O connectors of the option module must be kept disconnected.
FPTC-01/02 [1)]	Reinforced insulation between sensor connector and other connectors (including drive control unit connector).	x	-	-	No special requirement

1) Suitable for use in safety functions (SIL2 / PL c rated).

For more information, refer to the applicable option module user's manual.

6

Electrical installation

Contents of this chapter

This chapter gives instructions on the wiring of the drive.

Warnings

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

Measuring the insulation

- **Measuring the insulation resistance of the drive**

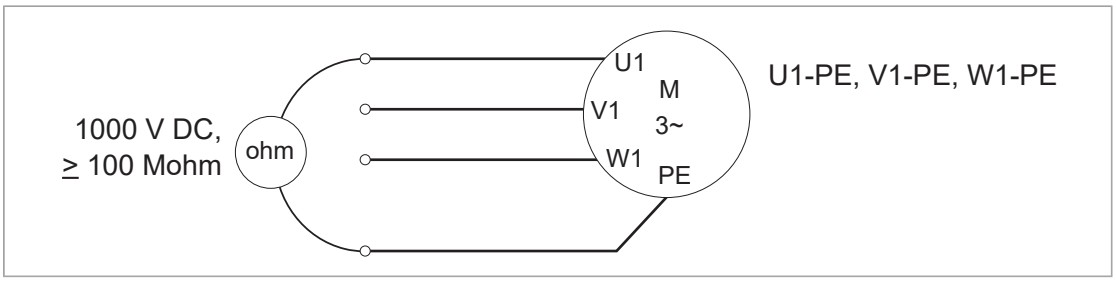
WARNING!
Do not do any voltage withstand or insulation resistance tests on any part of the drive as testing can damage the drive. Every drive has been tested for insulation between the main circuit and the chassis at the factory. Also, there are voltage-limiting circuits inside the drive which cut down the testing voltage automatically.

Measuring the insulation resistance of the motor and motor cable

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

1. Do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Make sure that the motor cable is disconnected from the drive output terminals.
3. Measure the insulation resistance between each phase conductor and the protective earth conductor. Use a measuring voltage of 1000 V DC. The insulation resistance of an ABB motor must be more than 100 Mohm (reference value at 25 °C [77 °F]). For the insulation resistance of other motors, refer to the manufacturer's instructions.

   Note: Moisture inside the motor reduces the insulation resistance. If you think that there is moisture in the motor, dry the motor and do the measurement again.



Measuring the insulation resistance of the input power cable

Before you connect the input power cable to the drive, measure its insulation resistance according to local regulations.

Connecting the control cables

See chapter Control units of the drive (page 123) for the default I/O connections of the inverter unit (with the ACS880 primary control program). The default I/O connections can be different with some hardware options, see the circuit diagrams delivered with the drive for the actual wiring. For other control programs, see their firmware manuals.

WARNING!
The alarm indication connections of optional ground fault monitoring (+Q954) at terminal block X22.2 are decisive voltage class DVC-C. Do not connect these terminals to, for example, the 24 V DC circuit.

Control cable connection procedure

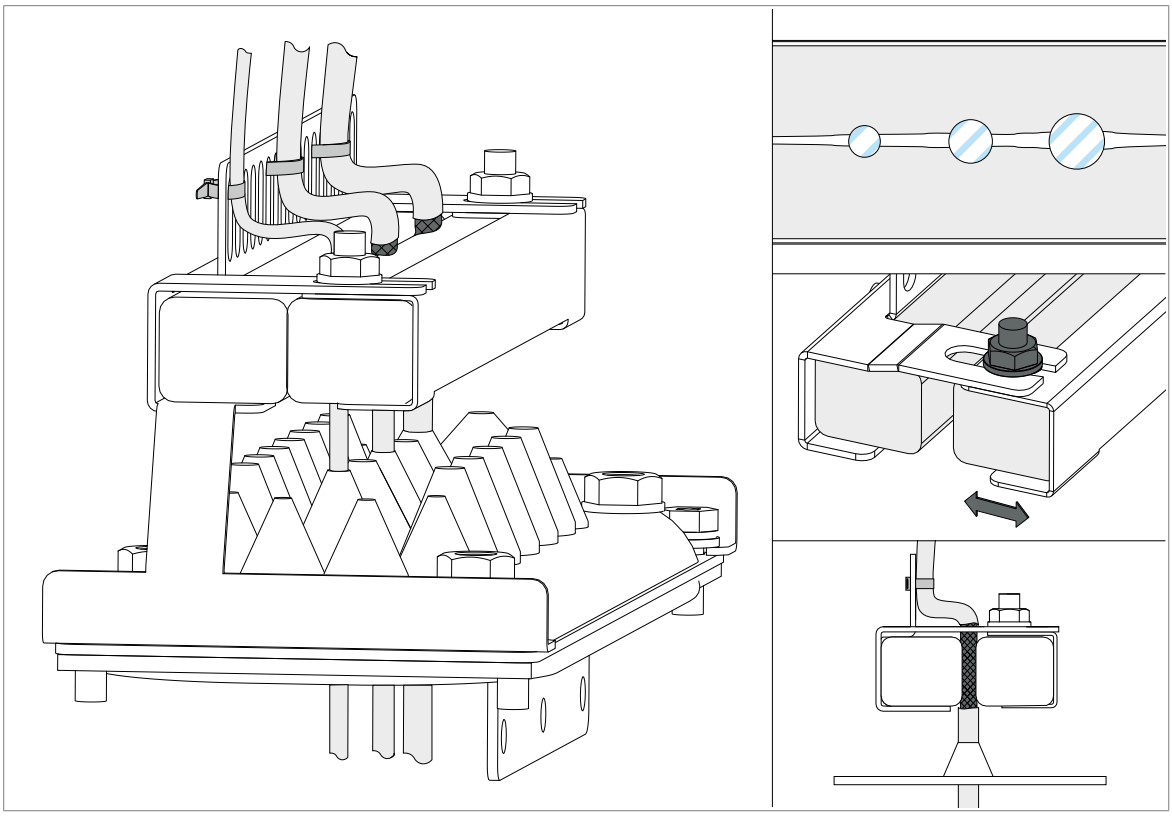
WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur.

1. Do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Run the control cables into the cabinet as described in section Grounding the outer shields of the control cables 360° at the cabinet entry.
3. Route the control cables as described in section Routing the control cables inside the cabinet (page 102).
4. Connect the control cables as described in section Connecting control cabling (page 103).

Grounding the outer shields of the control cables 360° at the cabinet entry

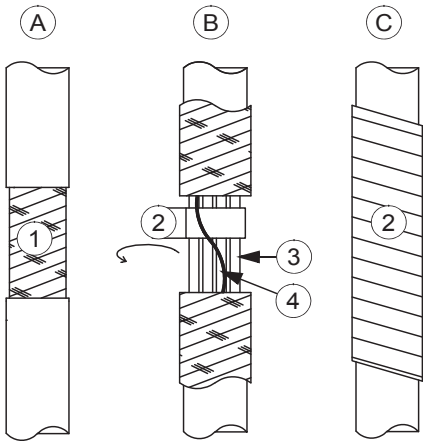
Ground the outer shields of all control cables 360 degrees with the EMI conductive cushions at the cabinet entry. The grounding principle is the same for top and bottom entry cables. The illustrations show the bottom entry. The actual design details can vary.

1. If necessary, remove the shrouding in front of the cable entry.
2. Put the cables in sequence from the smallest to the largest. This will help to achieve a good contact with the cushions.
3. Loosen the tightening bolts of the EMI conductive cushions and pull them apart.
4. Cut holes in the grommets and put the cables through the grommets.
5. Peel the insulation from the part of the cable that will be in contact with the EMI conductive cushion.
6. Put the cables between the cushions and attach them with cable ties for strain relief.
7. Move the cushions back together.
8. Tighten the bolts to make sure that the EMI conductive cushions press tightly around the peeled part of the cables.



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

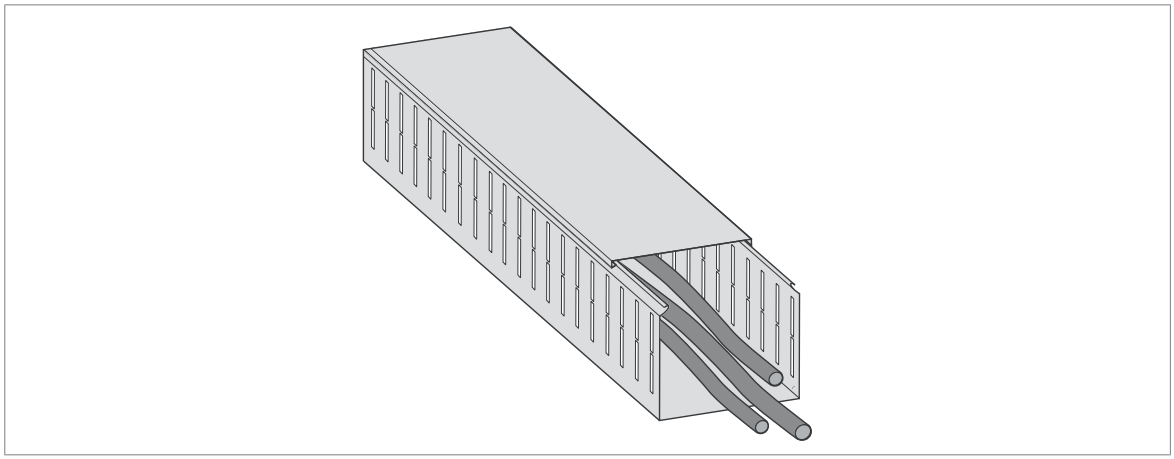
- Cut the shield at the midpoint of the peeled part. Be careful not to cut the conductors or the grounding wire.
- Turn the conductive side of the shield inside out over the insulation.
- Cover the exposed shield and the peeled cable with copper foil to keep the shielding continuous.



A	Stripped cable
B	Conductive surface of the shield exposed
C	Stripped part covered with copper foil
1	Cable shield
2	Copper foil
3	Shielded twisted pair
4	Grounding wire

Routing the control cables inside the cabinet

Use the existing trunking in the cabinet where possible. Use sleeving if cables are laid against sharp edges. When running cables to or from a swing-out frame, leave enough slack at the hinge to allow the frame to open fully.



Connecting control cabling

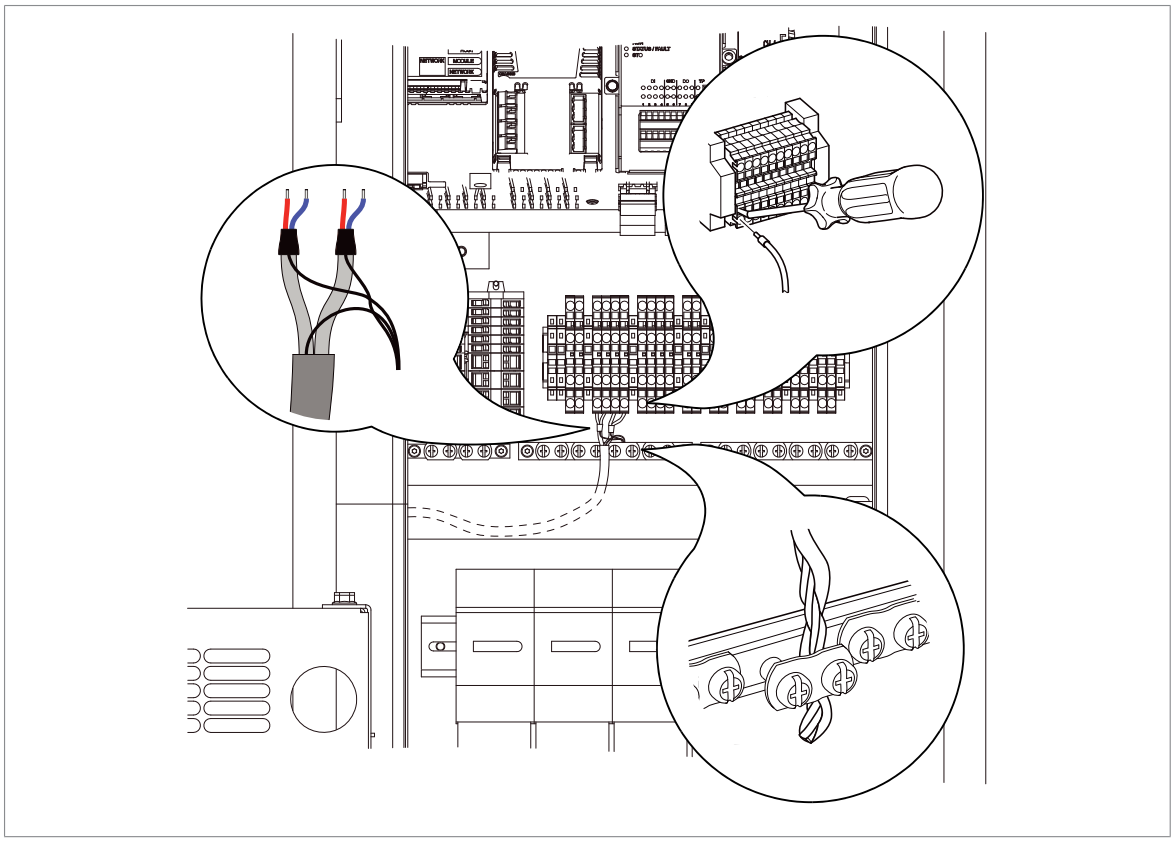
Connect the conductors to the appropriate terminals. Refer to the wiring diagrams delivered with the drive.

With option +L504, the terminals of the inverter control unit are available on terminal block X504.

Obey these instructions:

- Connect the inner twisted pair shields and all separate grounding wires to the grounding clamps near the terminals.
- Ground the outer shield of the cable at the cable entry, not at the grounding clamps near the terminals.
- Keep any signal wire pairs twisted as close to the terminals as possible. Twisting the wire with its return wire reduces disturbances caused by inductive coupling.
- At the other end of the cable, leave the shields unconnected or ground them indirectly via a high-frequency capacitor with a few nanofarads, eg. 3.3 nF / 630 V. The shield can also be grounded directly at both ends if they are in the same ground line with no significant voltage drop between the end points.

The drawing below represents the grounding of the control cabling when connecting to a terminal block inside the cabinet. The grounding is done in the same way when connecting directly to a component such as the control unit.



Connecting the motor cables (units without common motor terminal cubicle)

On units without a common motor terminal cubicle, the motor cables connect to busbars located in the inverter module cubicles. To access the terminals, the cooling fans and other equipment in front of the terminals must be removed from the cubicle.

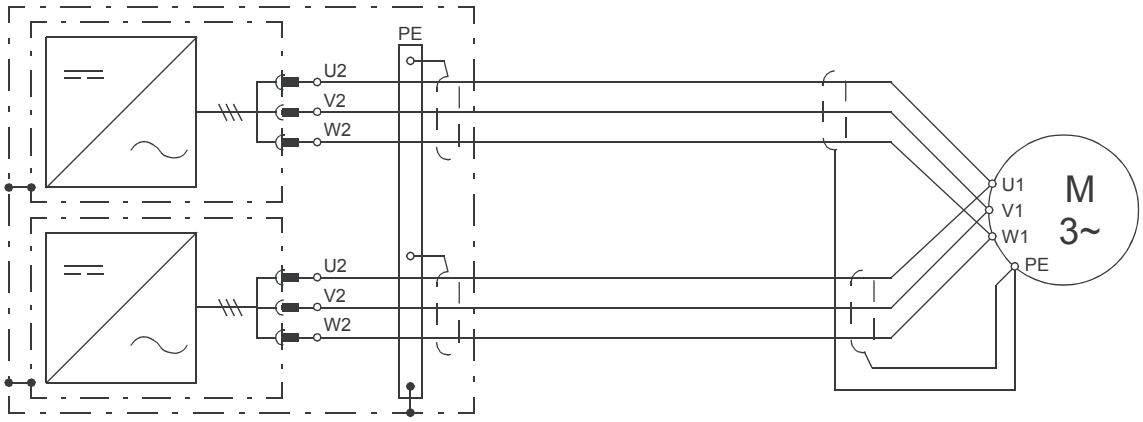
The location and dimensions of the busbars are visible in the dimension drawings delivered with the drive, and in the dimension drawing examples shown in this manual.

If the drive is equipped with a common motor terminal cubicle (option +H359), follow the instructions in section Connecting the motor cables (units with common motor terminal cubicle) (page 110).

Motor connection diagram (without option +H366)

All parallel-connected inverter modules are to be cabled separately to the motor.

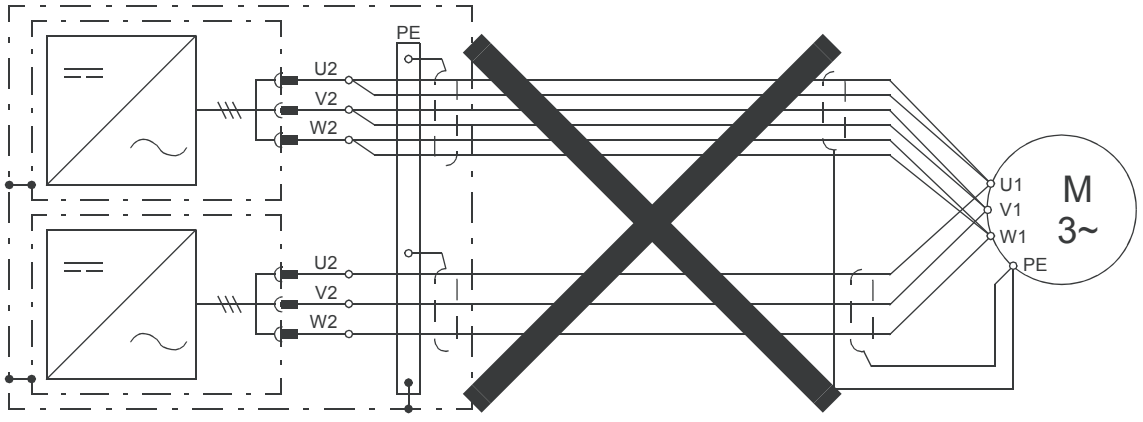
360° earthing is to be used at the cable entries.



Inverter unit cubicle(s)

The recommended cable types are given in the technical data.

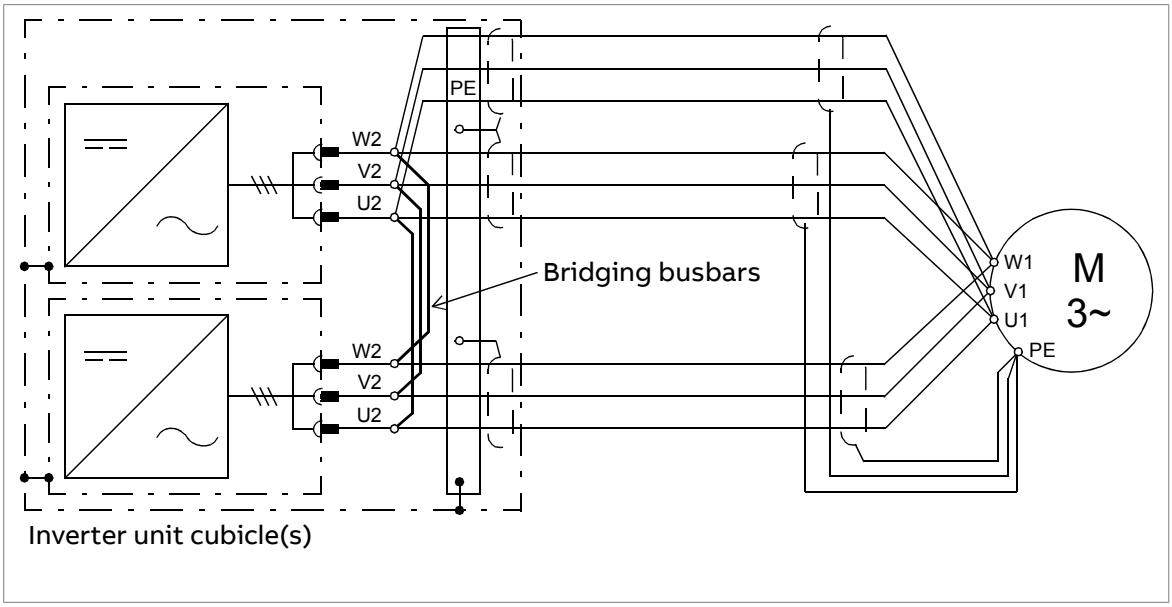
WARNING!
The cabling from all inverter modules to the motor must be physically identical considering cable type, cross-sectional area, and length.



Inverter unit cubicle(s)

Motor connection diagram (with option +H366)

With option +H366, the output busbars of the inverter modules within the same cubicle are connected by bridging busbars. The bridging balances the motor current between the modules, which allows more cabling options. For example, it is possible to use a number of cables that could not otherwise be evenly distributed between the inverter modules.



The recommended cable types are given in the technical data.

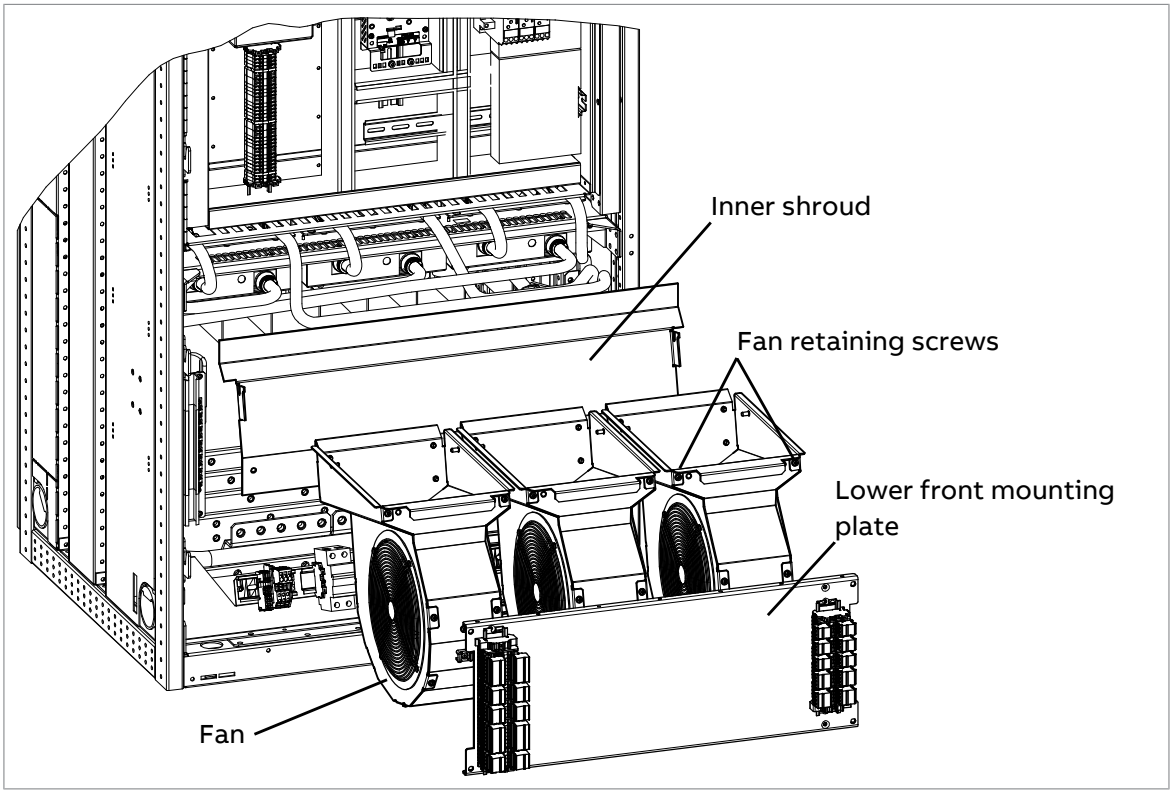
WARNING!
The bridging can carry the nominal output of one inverter module. In case of three parallel modules, ensure that the load capacity of the bridging is not exceeded. For example, if the cabling connects to the output busbars at one module only, use the module in the middle.

Note: The +H366 option only interconnects the outputs of inverter modules within the same cubicle, not modules installed in different cubicles. Therefore, when the drive has multiple inverter cubicles (ie. two cubicles of two modules each), make sure that the motor cabling is identical for both cubicles.

Procedure

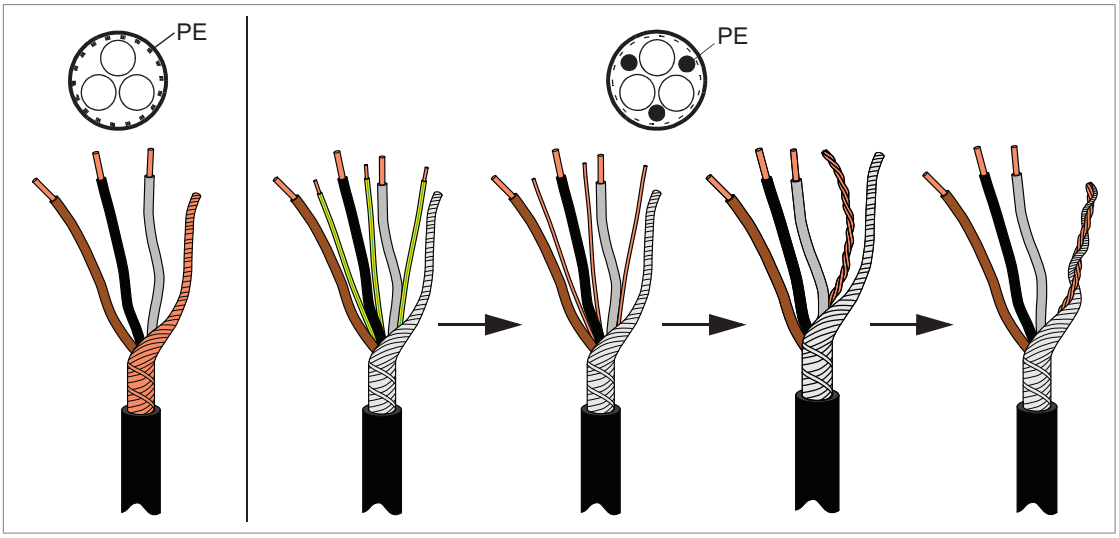
WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur.

The illustration below shows the parts to be removed.

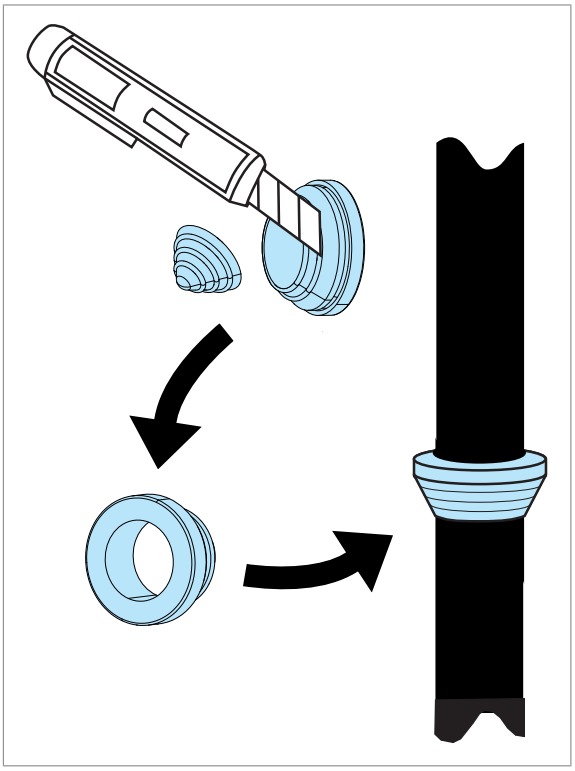


1. Do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Open the inverter module cubicle door.
3. Remove the outer shroud at the lower part of the cubicle (not shown).
4. Disconnect the wiring from the lower front mounting plate. Remove the plate.
5. Disconnect the wiring from the cooling fans.
6. Remove the two retaining screws of each fan.
7. Pull each fan outwards to separate them from the heat exchanger housing.
8. Remove the inner shroud.
9. Peel off 3 … 5 cm (1.2 … 2 inches) of the outer insulation of the cables above the cable entry plate for 360° high-frequency grounding.
10. Prepare the ends of the cables.

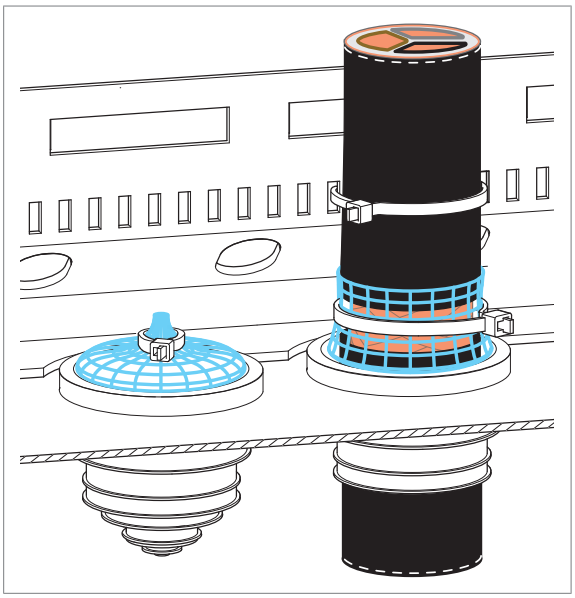
WARNING!
Apply grease to stripped aluminum conductors before attaching them to non-coated aluminum cable lugs. Obey the grease manufacturer's instructions. Aluminum-aluminum contact can cause oxidation in the contact surfaces.



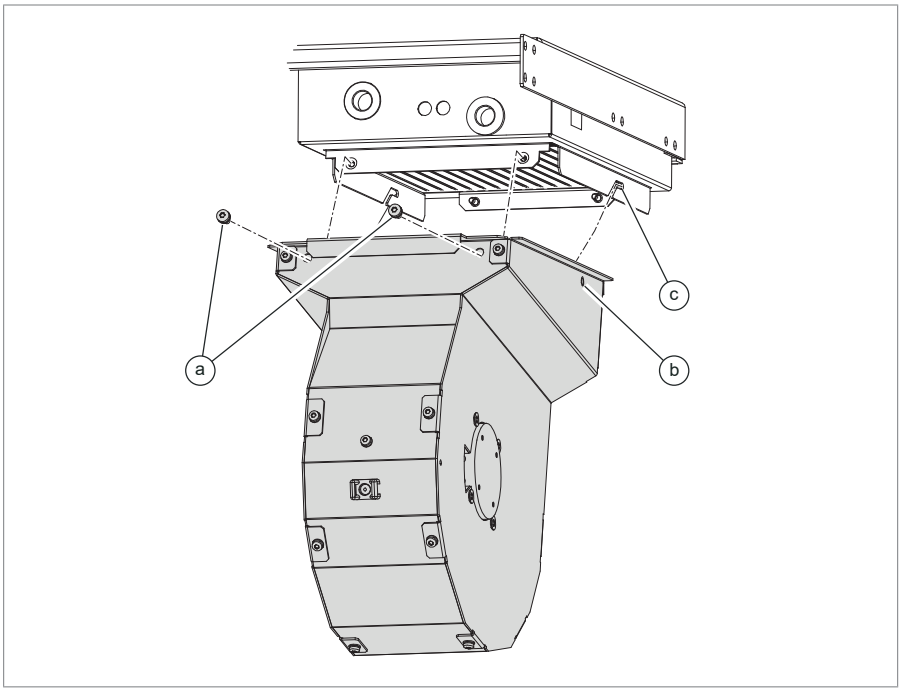
11. Remove the rubber grommets from the cable entries for the cables to be connected. Cut adequate holes into the rubber grommets. Slide the grommets onto the cables. Slide the cables into the cubicle through the conductive sleeves and attach the grommets to the holes.



12. Attach the conductive sleeves to the cable shields with cable ties. Tie up the unused conductive sleeves with cable ties.

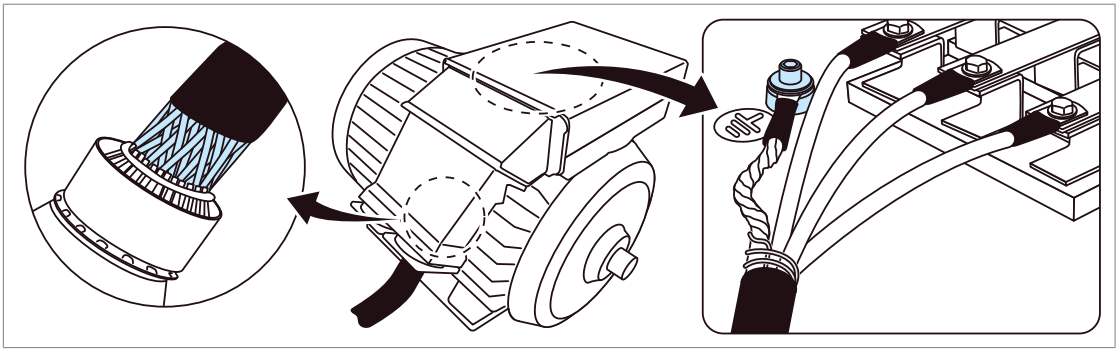


13. Connect the twisted shields of the cables to the PE busbar of the cabinet.
14. Connect the phase conductors of the cables to the appropriate terminals. Tighten the screws to the torque given in section Tightening torques (page 209).
15. Install the inner shroud.
16. With each fan, align the guide pins (b) at the rear of the fan cowling with the slots (c) in the module bottom guide, then reinstall the retaining screws (a).



17. Install the lower front mounting plate. Connect the wiring to the components on the mounting plate.
18. Install the outer shroud.

19. Make sure there are no tools, debris or any other foreign objects in the cubicle. Close the cubicle door.
20. At the motor, connect the cables according to instructions from the motor manufacturer. Pay special attention to the phase order. For minimum radio-frequency interference, ground the cable shield 360 degrees at the cable entry of the motor terminal box, or ground the cable by twisting the shield so that the flattened shield is wider than 1/5 of its length.



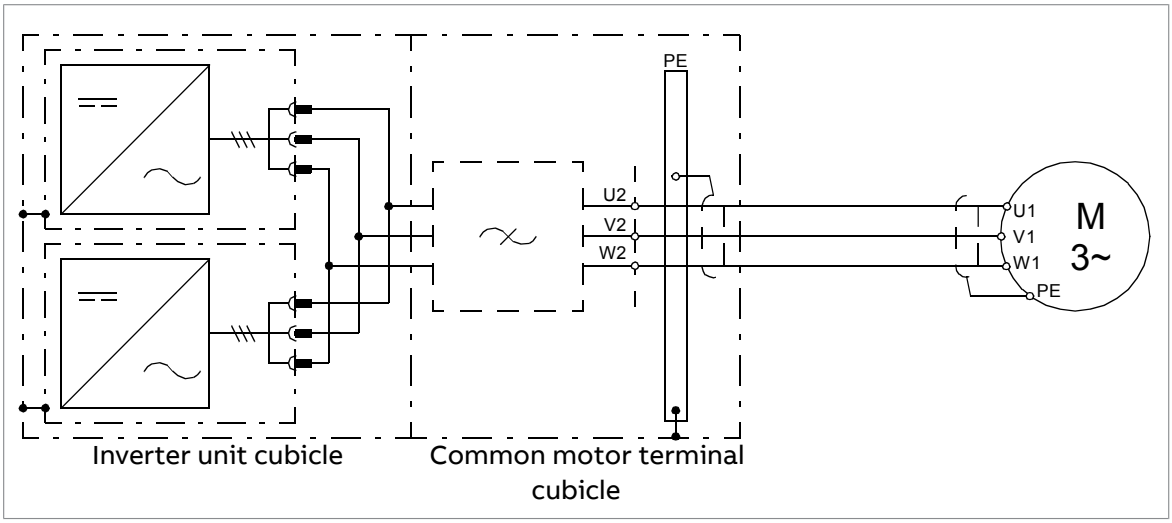
Connecting the motor cables (units with common motor terminal cubicle)

Output busbars

If the drive is equipped with option +H359, the motor cables connect to a common motor terminal cubicle.

The location and dimensions of the busbars are visible in the dimensional drawings delivered with the drive.

Connection diagram

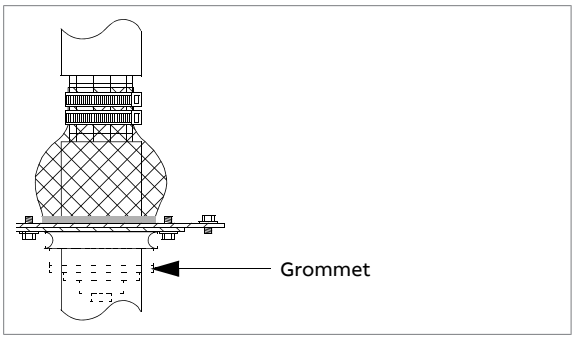


The recommended cable types are given in the technical data.

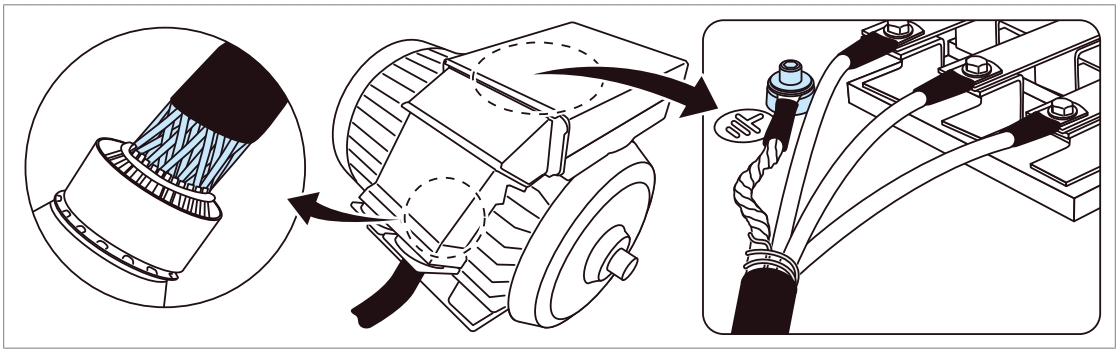
Procedure

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

1. Do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Open the door of the cubicle and remove the shrouding.
3. Lead the cables into the cubicle. Make the 360° earthing arrangement at the cable entry as shown.



4. Cut the cables to suitable length. Strip the cables and conductors.
5. Twist the cable screens into bundles and connect the bundles to the PE busbar in the cubicle.
6. Connect any separate ground conductors/cables to the PE busbar in the cubicle. See Drives cabinets_Connecting cable lug to a busbar.xml.
7. Connect the phase conductors to the output terminals. Use the tightening torques specified in section Tightening torques (page 209).
8. Refit any shrouding removed earlier and close the cubicle doors.
9. At the motor, connect the cables according to instructions from the motor manufacturer. Pay special attention to the phase order. For minimum radio-frequency interference, ground the cable shield 360 degrees at the cable entry of the motor terminal box, or ground the cable by twisting the shield so that the flattened shield is wider than 1/5 of its length.



Connecting an external brake resistor assembly

See chapter Resistor braking (page 255).

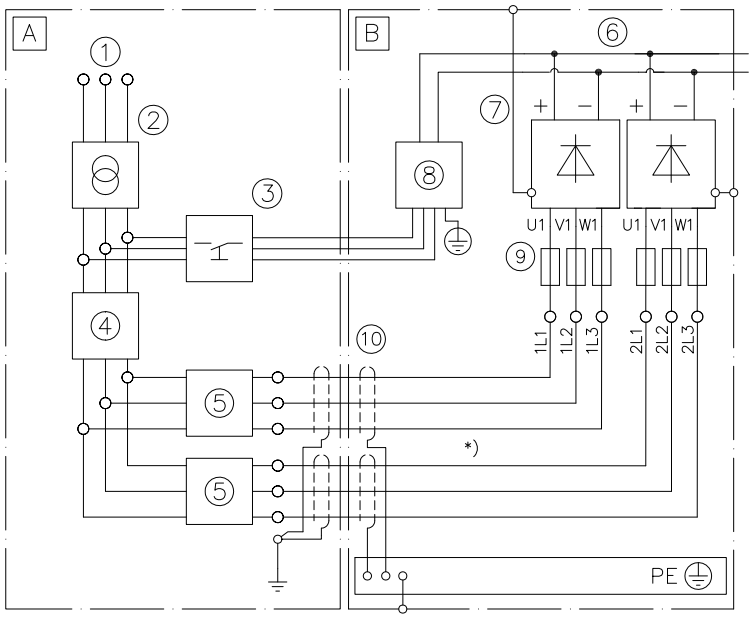
For the location of the terminals, refer to the dimension drawings delivered with the unit or the dimension drawing examples in this manual.

Connecting the input power cables

Connection diagrams

The connection diagrams below show the input power connections as well as the external equipment required. The diagrams are simplified. The designer of the drive system must provide the final, detailed circuit diagrams to the installer.

Connection diagram – 2×D8D, 6-pulse, internal charging

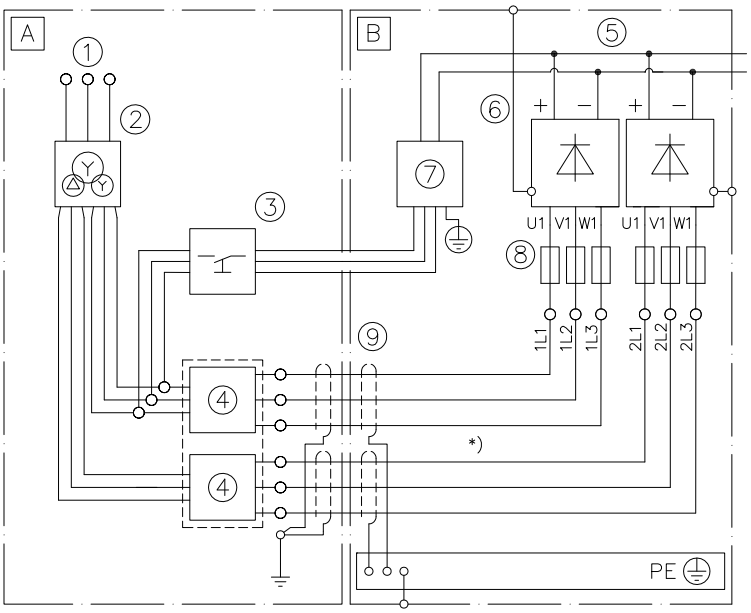


A	External installation outside drive cabinet	B	Supply unit cubicle of drive
1	Medium voltage/low voltage switchboard	6	DC link
2	Supply transformer	7	Supply modules
3	Charging switchgear including: • Disconnecting device	8	Charging circuit (option +F272)
4	Supply switchgear including: • Disconnecting device • Breaker/contactor	9	AC fuses
5	Overcurrent and short-circuit protection of input cabling	10	360 degrees grounding

Note: *) Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges. Required minimum length of the cables is 5 meters.

For cable and component selection information, see chapter Guidelines for planning the electrical installation.

Connection diagram – 2×D8D, 12-pulse, internal charging

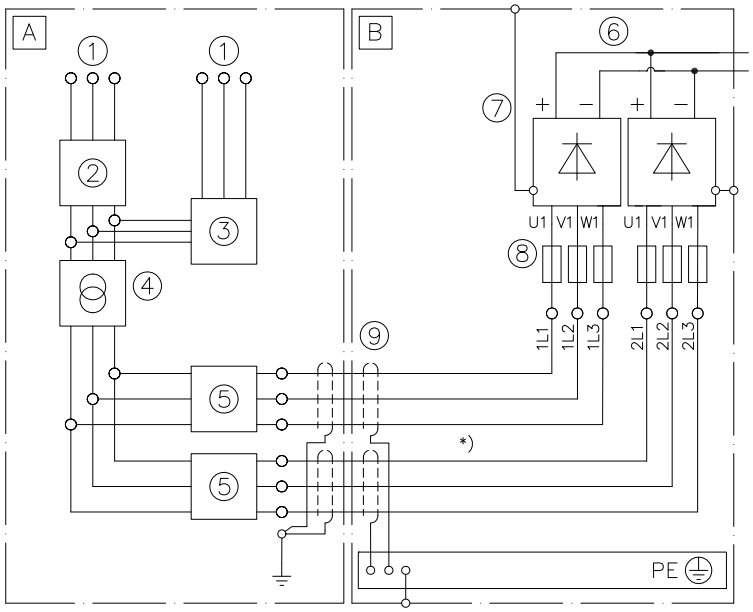


A	External installation outside drive cabinet	B	Supply unit cubicle of drive
1	Medium voltage/low voltage switchboard	5	DC link
2	Supply transformer	6	Supply modules
3	Charging switchgear including: • Disconnecting device	7	Charging circuit (option +F272)
4	Interlocked dedicated supply unit switchgear including: • Disconnecting device • Breaker/contactor • Overcurrent and short-circuit protection of input cabling	8	AC fuses
		9	360 degrees grounding

Note: *) Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges. Required minimum length of the cables is 5 meters.

For cable and component selection information, see chapter Guidelines for planning the electrical installation.

Connection diagram – 2×D8D, 6-pulse, external charging and pre-magnetizing

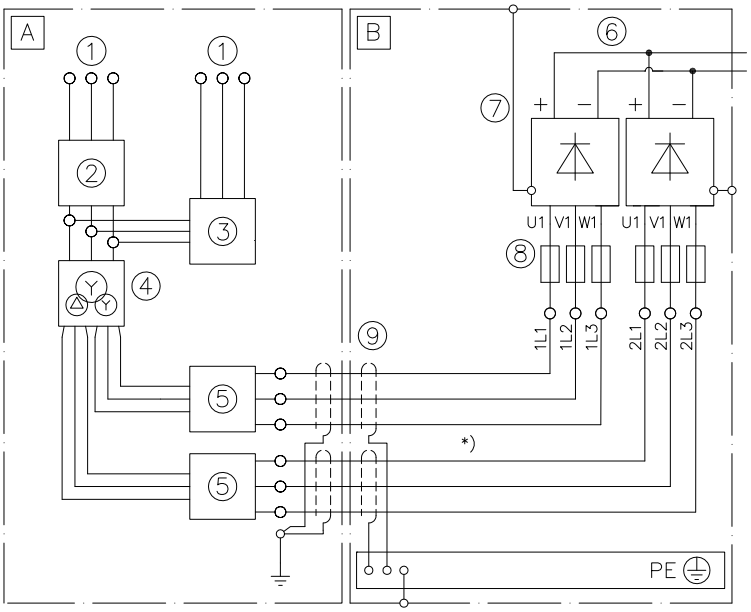


A	External installation outside drive cabinet	B	Supply unit cubicle of drive
1	Medium voltage/low voltage switchboard	6	DC link
2	Switchgear including: • Disconnecting device • Breaker/contactor	7	Supply modules
3	Combined transformer pre-magnetizing circuit and drive charging circuit	8	AC fuses
4	Supply transformer	9	360 degrees grounding
5	Overcurrent and short-circuit protection of input cabling		

Note: *) Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges. Required minimum length of the cables is 5 meters.

For cable and component selection information, see chapter Guidelines for planning the electrical installation.

Connection diagram – 2×D8D, 12-pulse, external charging and pre-magnetizing



A	External installation outside drive cabinet	B	Supply unit cubicle of drive
1	Medium voltage/low voltage switchboard	6	DC link
2	Switchgear including: • Disconnecting device • Breaker/contactor	7	Supply modules
3	Combined transformer pre-magnetizing circuit and drive charging circuit	8	AC fuses
4	Supply transformer	9	360 degrees grounding
5	Overcurrent and short-circuit protection of input cabling		

Note: *) Use symmetrical supply cabling to ensure equal current sharing between parallel diode bridges. Required minimum length of the cables is 5 meters.

For cable and component selection information, see chapter Guidelines for planning the electrical installation.

Layout of the input cable connection terminals and cable entries

The location and dimensions of the busbars are visible in the dimensional drawings delivered with the drive. Alternatively, see the example dimension drawings in the manual.

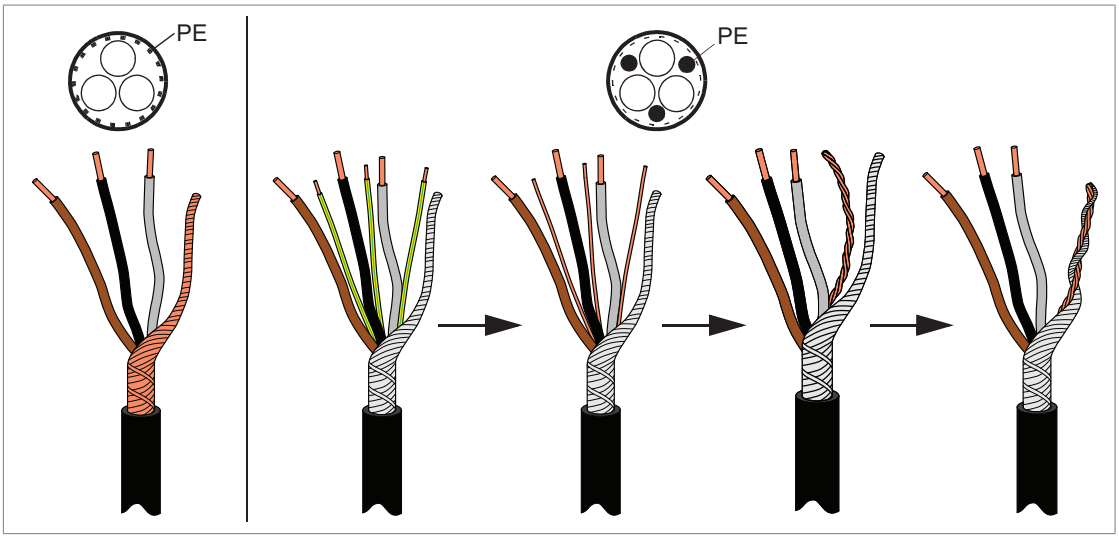
Connection procedure

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

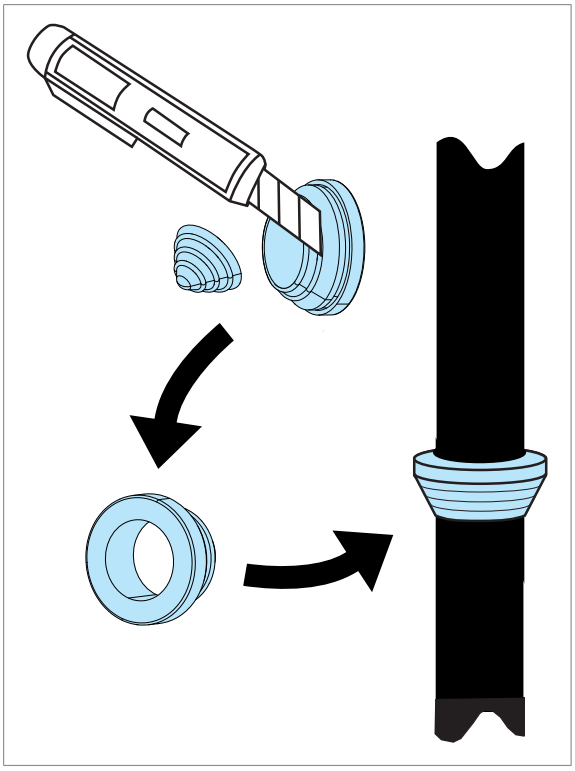
1. Do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Open the door of the incoming cubicle.

3. Remove the shrouding covering the input terminals.
4. Peel off 3 … 5 cm (1.2 … 2 inches) of the outer insulation of the cables above the cable entry plate for 360° high-frequency grounding.
5. Prepare the ends of the cables.

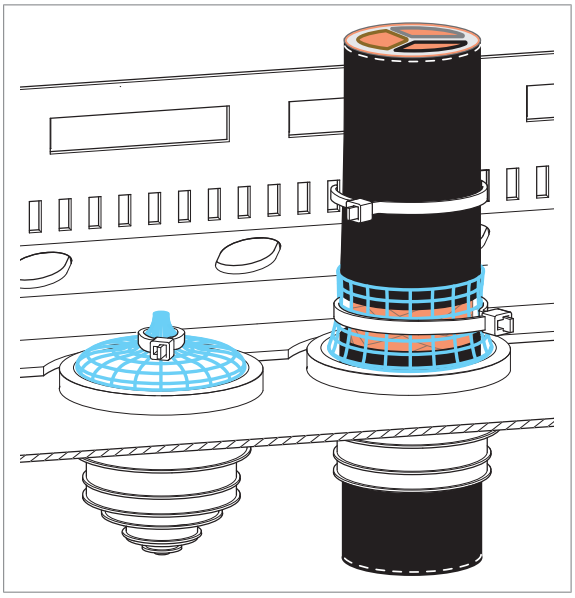
WARNING!
Apply grease to stripped aluminum conductors before attaching them to non-coated aluminum cable lugs. Obey the grease manufacturer's instructions. Aluminum-aluminum contact can cause oxidation in the contact surfaces.



6. Remove rubber grommets from the cable entries for the cables to be connected. Cut adequate holes into the rubber grommets. Slide the grommets onto the cables. Slide the cables into the cubicle through the conductive sleeves and attach the grommets to the holes.



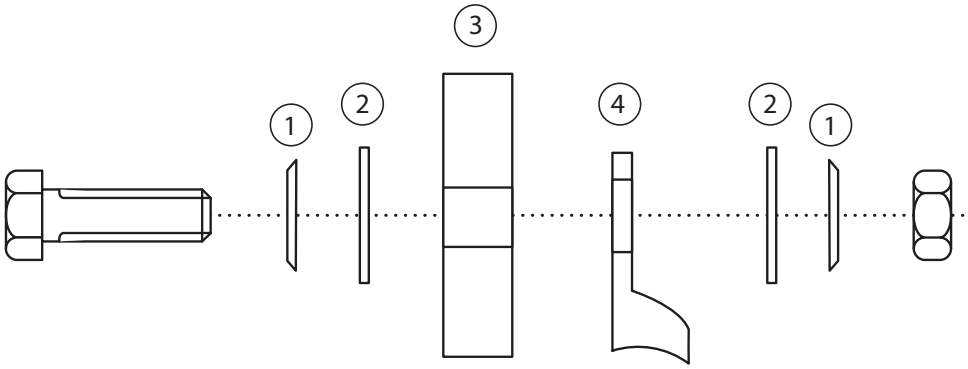
7. Attach the conductive sleeves to the cable shields with cable ties. Tie up the unused conductive sleeves with cable ties.



8. Connect the twisted shields of the cables to the PE busbar of the cabinet.
9. Connect the phase conductors of the input cable to the L1, L2 and L3 terminals. (With 12-pulse connection, the terminals are 1L1, 1L2 and 1L3 for one 6-pulse supply line, 2L1, 2L2 and 2L3 for the other.) See Connecting cable lug to a busbar (page 118). Tighten the screws to the torque given under Tightening torques (page 209).
10. Reinstall the shrouding removed earlier.
11. Close the cubicle door.

Connecting cable lug to a busbar

Use the bolts, nuts and washers delivered with the drive. See the figure below. Tighten the cable lug to the torque specified for the connection.



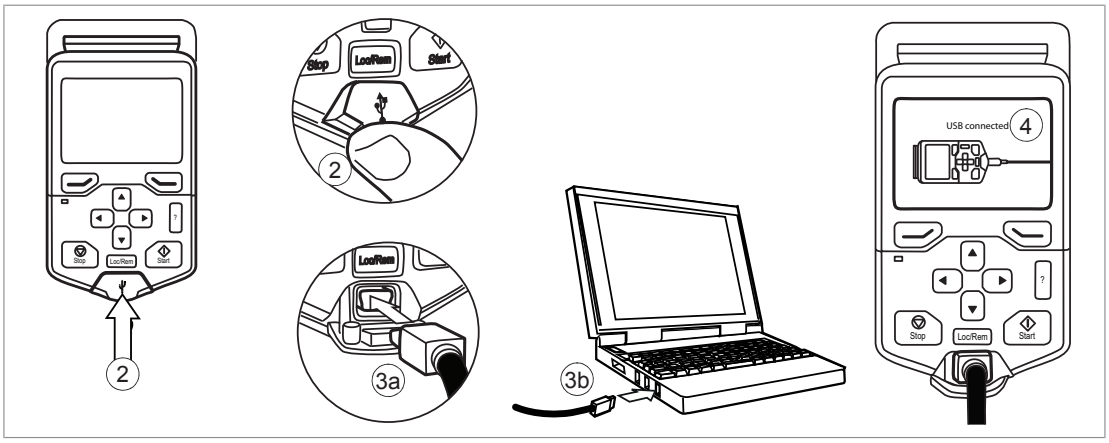
1	Spring washer
2	Flat washer
3	Busbar
4	Cable lug

Connecting a PC

WARNING!
Do not connect the PC directly to the control panel connector of the control unit as this can cause damage.

A PC (with, for example, the Drive composer PC tool) can be connected as follows:

1. Connect a ACS-AP-… or ACH-AP-… control panel to the unit either
   - by inserting the control panel into the panel holder or platform, or
   - by using an Ethernet (eg, Cat 5e) networking cable.
2. Remove the USB connector cover on the front of the control panel.
3. Connect an 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 whenever the connection is active.
5. See the documentation of the PC tool for setup instructions.



Panel bus (Control of several units from one control panel)

One control panel (or PC) can be used to control several drives (or inverter units, supply units etc.) by constructing a panel bus. This is done by daisy-chaining the panel connections of the drives. Some drives have the necessary (twin) panel connectors in the control panel holder; those that do not require the installation of an FDPI-02 module (available separately). For further information, see the hardware description and FDPI-02 diagnostics and panel interface user's manual (3AUA0000113618 [English]).

The maximum allowed length of the cable chain is 100 m (328 ft).

1. Connect the panel to one drive using an Ethernet (for example Cat 5e) cable.
   - Use Menu - Settings - Edit texts - Drive to give a descriptive name to the drive
   - Use parameter 49.01* to assign the drive with a unique node ID number
   - Set other parameters in group 49* if necessary
   - Use parameter 49.06* to validate any changes.

   *The parameter group is 149 with supply (line-side), brake or DC/DC converter units.

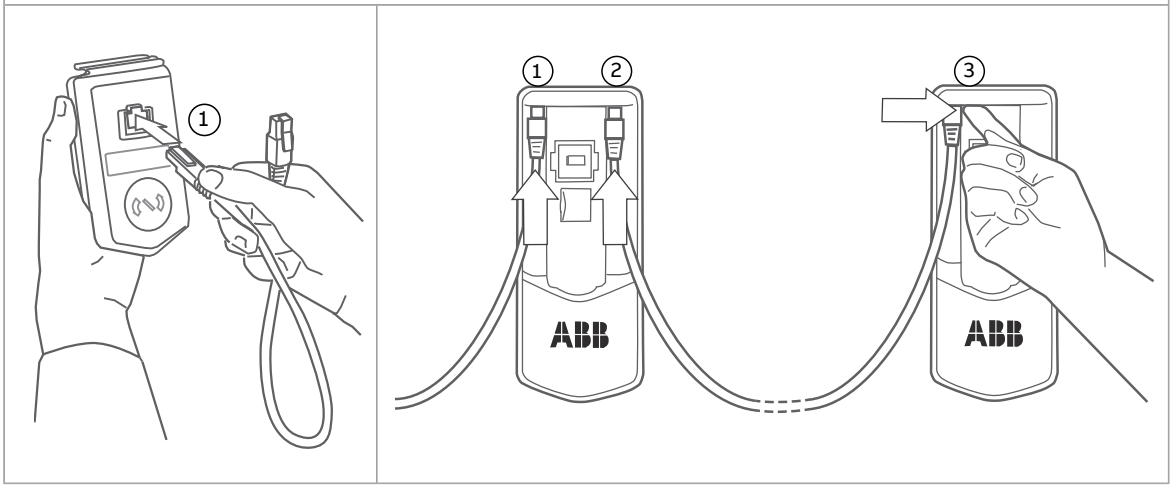
   Repeat the above for each drive.
2. With the panel connected to one unit, link the units using Ethernet cables.

3. Switch on the bus termination on the drive that is farthest from the control panel in the chain.
   - With drives that have the panel mounted on the front cover, move the terminating switch into the outer position.
   - With an FDPI-02 module, move termination switch S2 into the TERMINATED position.

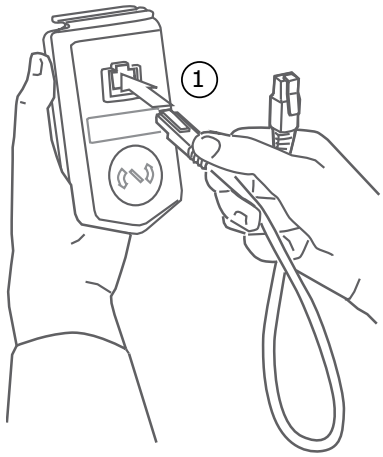
   Make sure that bus termination is off on all other drives.
4. On the control panel, switch on the panel bus functionality (Options - Select drive - Panel bus). The drive to be controlled can now be selected from the list under Options - Select drive.

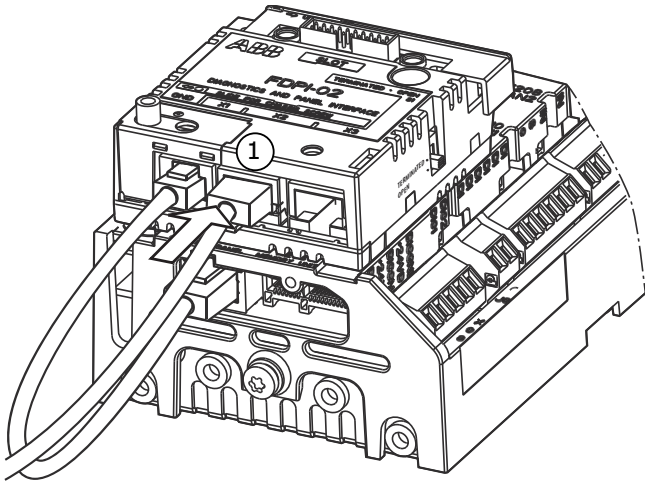
If a PC is connected to the control panel, the drives on the panel bus are automatically displayed in the Drive Composer PC tool.

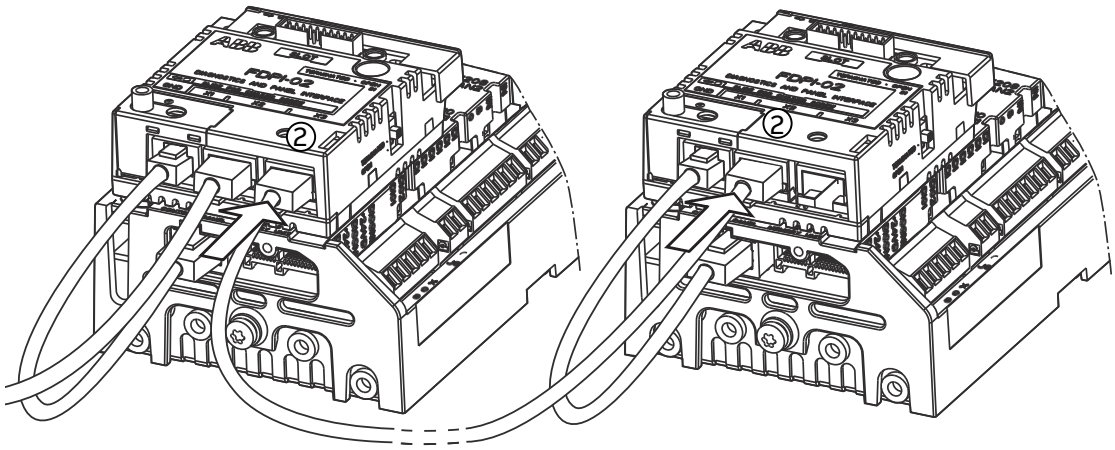
With twin connectors in the control panel holder:

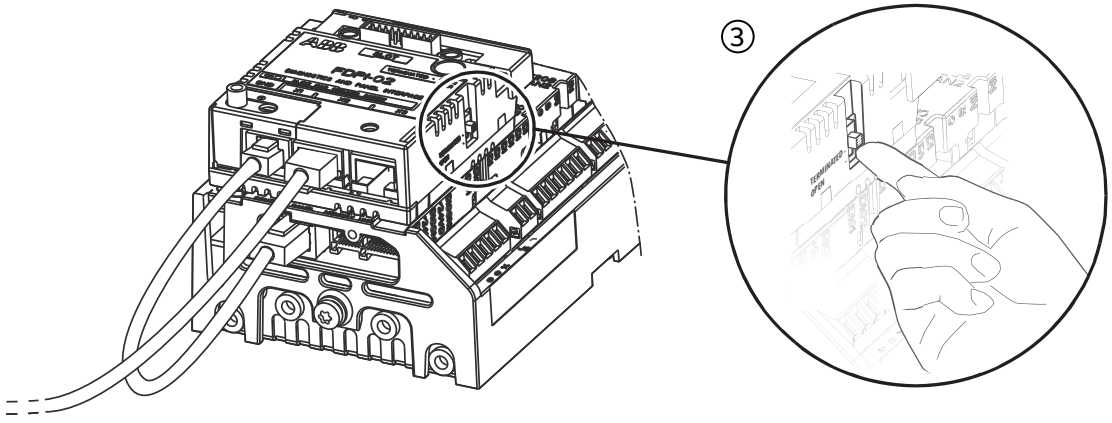


With FDPI-02 modules:









Installing option modules

Mechanical installation of I/O extension, fieldbus adapter and pulse encoder interface modules

See hardware description for the available slots for each module. Install the option modules as follows:

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

1. Stop the drive and do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Open the door of the auxiliary control cubicle (ACU).
3. Remove the shrouding at the top of the cubicle.
4. Locate the inverter control unit (A41).
5. Insert the module carefully into its position on the control unit.
6. Fasten the mounting screw.

   Note: The screw secures and grounds the module. It is essential for fulfilling the EMC requirements and for proper operation of the module.

Wiring of option modules

See the appropriate optional module manual for specific installation and wiring instructions.

7

Control units of the drive

Contents of this chapter

This chapter

- describes the connections of the control unit(s) used in the drive,
- contains the specifications of the inputs and outputs of the control unit(s).

General

The supply unit of the drive is controlled by a dedicated ZCU-14 control unit (component designation A51). The ZCU-14 unit consists of a ZCON control board contained in a plastic housing.

The inverter unit of the drive is controlled by a dedicated BCU-x2 control unit (component designation A41). The BCU-x2 consists of a BCON control board (and a BIOC I/O connector board and power supply board) built in a metal housing.

In this manual, the name "BCU-x2" represents the control unit types BCU-02 and BCU-12. These have a different number of power module connections (2 and 7 respectively) but are otherwise similar.

ZCU-14 default I/O connection diagram

The diagram shows the control connections of the supply unit, and the default meaning or use of the signals in the supply unit control program.

Relay outputs		**XRO1…XRO3**
XRO1: **Charging** (Charging contactor control) 250 V AC / 30 V DC 2 A	NO	3
	COM	2
	NC	1
XRO2: **Fault(-1)** / **Started** [1] 250 V AC / 30 V DC 2 A	NO	3
	COM	2
	NC	1
XRO3: **MCB** (Main contactor/breaker control) 250 V AC / 30 V DC 2 A	NO	3
	COM	2
	NC	1
Power supply		**XPOW**
24 V DC, 2 A	GND	2
	+24VI	1
Reference voltage and analog inputs		**J1, J2, XAI**
AI1/AI2 current/voltage selection	AI1: U	AI2: U
	AI1: I	AI2: I
Not in use by default 0(4)…20 mA, R_{in} = 100 ohm [2]	AI2-	7
	AI2+	6
Not in use by default 0(2)…10 V, R_{in} > 200 kohm [3]	AI1-	5
	AI1+	4
Ground	AGND	3
-10 V DC, R_L 1…10 kohm	-VREF	2
10 V DC, R_L 1…10 kohm	+VREF	1
Analog outputs		**XAO**
Zero (not in use by default) (0…20 mA, R_L < 500 ohm)	AGND	4
	AO2	3
Zero (not in use by default) (0…20 mA, R_L < 500 ohm)	AGND	2
	AO1	1
Distributed I/O bus		**J3, XD2D**
Termination (ON on units at end of link)	ON ▪ OFF	
Distributed I/O bus for cooling fan monitoring	Shield	4
	BGND	3
	A	2
	B	1
XSTO connector		**XSTO**
For the supply unit to start, both IN1 and IN2 must be connected to OUT. **Note:** De-energizing this input will stop the supply unit but will not constitute a true Safe torque off (STO) function.	IN2	4
	IN1	3
	SGND	2
	OUT	1
Digital inputs		**XDI**
Fault reset (0⟶1 = reset)	DI6	6
Not in use / **Ground fault** [4]	DI5	5
Auxiliary circuit breaker fault (0 = tripped)	DI4	4
MCB feedback (1 = main breaker/contactor closed)	DI3	3
Run enable (1 = Run enable on)	DI2	2
Temperature fault (0 = overtemperature)	DI1	1
Digital input/outputs		**XDIO**
Input: **AC fuse monitoring** (0 = tripped)	DIO2	2
Not in use / Input: **Brake chopper fault** (0 = fault) [5]	DIO1	1
Ground selection [6]	▪	
Auxiliary voltage output, digital input interlock		**XD24**
Digital input/output ground	DIOGND	5
+24 V DC 200 mA [7]	+24VD	4
Digital input ground (common)	DICOM	3
+24 V DC 200 mA [7]	+24VD	2
Emergency stop (0 = actuated)	DIIL	1
Safety functions module connection (not used)		**X12**
Control panel connection		**X13**
Memory unit connection		**X205**

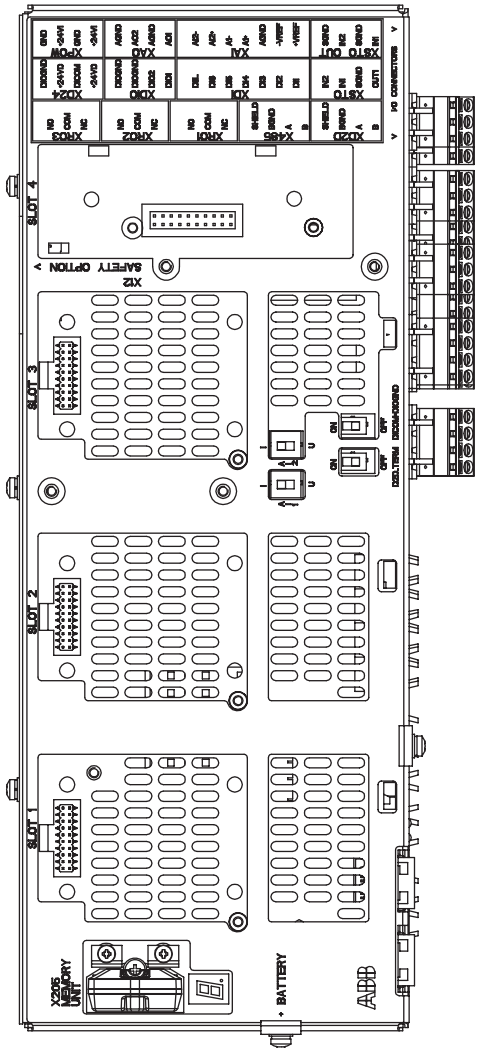
Note: Wire sizes and tightening torques: 0.5…2.5 mm^2 (24…12 AWG) and 0.5 N·m (5 lbf·in) for both stranded and solid wire.

1. **Started** (Cooling unit control) if the drive is equipped with optional cooling unit.
2. Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by jumper **J2**. Change of setting requires reboot of control unit.
3. Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by jumper **J1**. Change of setting requires reboot of control unit.
4. **Ground fault** if the drive is equipped with optional ground fault monitoring.
5. **Brake chopper fault** if the drive is equipped with optional brake chopper.
6. Determines whether DICOM is separated from DIOGND (ie. common reference for digital inputs floats). See also section ZCU-1x ground isolation diagram (page 139).

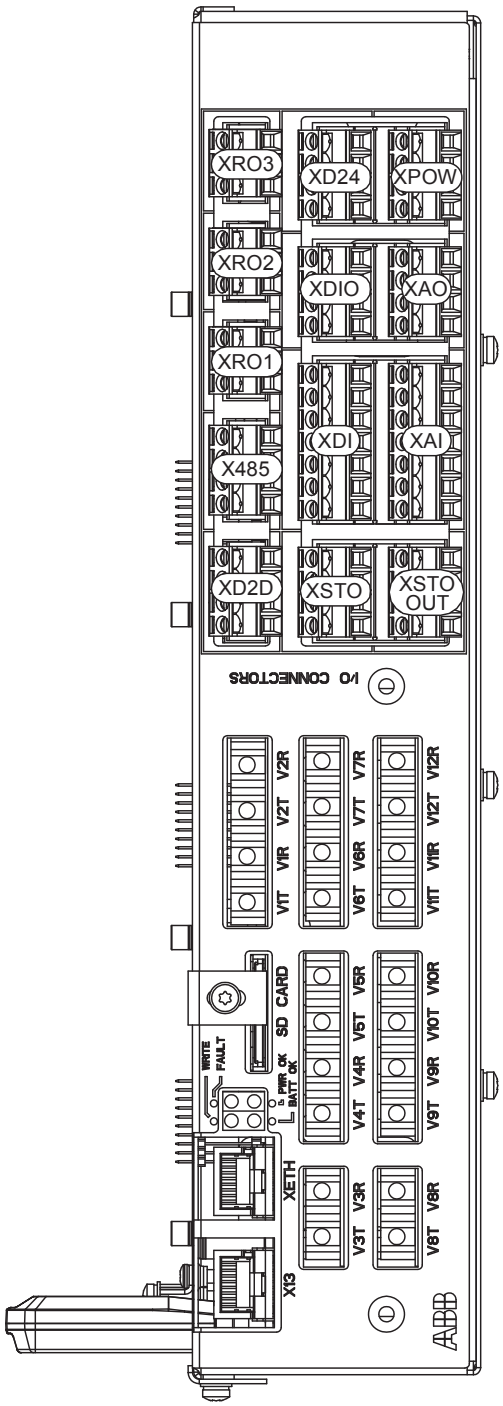
   DICOM connected to DIOGND  DICOM and DIOGND separate 

7. Total load capacity of these outputs is 4.8 W (200 mA / 24 V) minus the power taken by DIO1 and DIO2.

BCU-x2 layout



	Description
I/O	I/O terminals (see following diagram)
SLOT 1	I/O extension, encoder interface or fieldbus adapter module connection. (This is the sole location for an FDPI-02 diagnostics and panel interface.)
SLOT 2	I/O extension, encoder interface or fieldbus adapter module connection
SLOT 3	I/O extension, encoder interface or fieldbus adapter connection
SLOT 4	RDCO-0x DDCS communication option module connection
X205	Memory unit connection
BATTERY	Holder for real-time clock battery (BR2032)
AI1	Mode selector for analog input AI1 (I = current, U = voltage)
AI2	Mode selector for analog input AI2 (I = current, U = voltage)
D2D TERM	Termination switch for drive-to-drive link (D2D)
DICOM= DIOGND	Ground selection. Determines whether DICOM is separated from DIOGND (ie. the common reference for the digital inputs floats). See the ground isolation diagram.
7-segment display Multicharacter indications are displayed as repeated sequences of characters	
o	(“U” is indicated briefly before “o”.) Control program running
U	Control program startup in progress
L	(Flashing) Firmware cannot be started. Memory unit missing or corrupted
1	Firmware download from PC to control unit in progress
2	At power-up, the display may show short indications of eg. “1”, “2”, “b” or “U”. These are normal indications immediately after power-up. If the display ends up showing any other value than those described, it indicates a hardware failure.



	Description
XAI	Analog inputs
XAO	Analog outputs
XDI	Digital inputs, Digital input interlock (DIIL)
XDIO	Digital input/outputs
XD2D	Drive-to-drive link
XD24	+24 V output (for digital inputs)
XETH	Ethernet port – Not in use
XPOW	External power input
XRO1	Relay output RO1
XRO2	Relay output RO2
XRO3	Relay output RO3
XSTO	Safe torque off connection (input signals)
XSTO OUT	Safe torque off connection (to inverter modules)
X12	(On the opposite side) Not in use
X13	Control panel / PC connection
X485	Not in use
V1T/V1R, V2T/V2R	Fiber optic connection to modules 1 and 2 (VxT = transmitter, VxR = receiver)
V3T/V3R … V7T/V7R	Fiber optic connection to modules 3…7 (BCU-12/22 only) (VxT = transmitter, VxR = receiver)
V8T/V8R … V12T/V12R	Fiber optic connection to modules 8…12 (BCU-22 only) (VxT = transmitter, VxR = receiver)
SD CARD	Data logger memory card for inverter module communication
BATT OK	Real-time clock battery voltage is higher than 2.8 V. If the LED is off when the control unit is powered, replace the battery.
FAULT	The control program has generated a fault. See the firmware manual of the supply/inverter unit.
PWR OK	Internal voltage supply is OK
WRITE	Writing to memory card in progress. Do not remove the memory card.

Default I/O diagram of the inverter control unit (A41)

The table below describes the use of the connections in the inverter unit. Under normal circumstances, the factory-made wiring should not be changed.

The wire size accepted by all screw terminals (for both stranded and solid wire) is 0.5 … 2.5 mm² (22…12 AWG). The tightening torque is 0.45 N·m (4 lbf·in).

Terminal			Description	
XD2D			Drive-to-drive link	
1	1	B	Drive-to-drive link. Refer to section The XD2D connector (page 133).	
2	2	A		
3	3	BGND		
4	4	Shield		
ON OFF	D2D.TERM		Drive-to-drive link termination switch. Must be set to ON when the inverter unit is the first or last unit in the drive-to-drive (D2D) link. On intermediate units, set termination to OFF.	
X485			RS485 connection	
5	5	B	Not in use by default	
6	6	A		
7	7	BGND		
8	8	Shield		
XRO1, XRO2, XRO3			Relay outputs	
11	11	NC	Norm. closed	XRO1: **Ready** (Energized = Ready) 250 V AC / 30 V DC, 2 A
12	12	COM	Common	
13	13	NO	Norm. open	
21	21	NC	Norm. closed	XRO2: **Running** (Energized = Running) 250 V AC / 30 V DC, 2 A
22	22	COM	Common	
23	23	NO	Norm. open	
31	31	NC	Norm. closed	XRO3: **Fault (-1)** (Energized = No fault) 250 V AC / 30 V DC, 2 A
32	32	COM	Common	
33	33	NO	Norm. open	
XSTO, XSTO OUT			Safe torque off	
1	1	OUT	XSTO: Factory connection. Both circuits must be closed for the drive to start (IN1 and IN2 must be connected to OUT). Refer to chapter The Safe torque off function.	
2	2	SGND		
3	3	IN1		
4	4	IN2		
5	5	IN1	XSTO OUT: Safe torque off output to inverter modules.	
6	6	SGND		
7	7	IN2		
8	8	SGND		
XDI			Digital inputs	

Terminal			Description
1 2 3 4 5 6 7	1	DI1	Stop (0) / Start (1)
	2	DI2	Forward (0) / Reverse (1)
	3	DI3	Reset
	4	DI4	Acceleration & deceleration select [1]
	5	DI5	Constant speed 1 select (1 = on) [2]
	6	DI6	Not in use by default.
	7	DIIL	Run enable [3]
XDIO			Digital input/outputs
1 2 3 4	1	DIO1	Output: Ready
	2	DIO2	Output: Running
	3	DIOGND	Digital input/output ground
	4	DIOGND	Digital input/output ground
XD24			Auxiliary voltage output
5 6 7 8	5	+24VD	+24 V DC 200 mA [4]
	6	DICOM	Digital input ground
	7	+24VD	+24 V DC 200 mA [4]
	8	DIOGND	Digital input/output ground
ON OFF	DICOM=DIOGND		Ground selection switch. Determines whether DICOM is separated from DIOGND (ie, common reference for digital inputs floats). ON: DICOM connected to DIOGND. OFF: DICOM and DIOGND separate.
XAI			Analog inputs, reference voltage output
1 2 3 4 5 6 7	1	+VREF	10 V DC, R_L 1 … 10 kohm
	2	-VREF	-10 V DC, R_L 1 … 10 kohm
	3	AGND	Ground
	4	AI1+	Speed reference. 0(2)…10 V, R_{in} > 200 kohm [5]
	5	AI1-	
	6	AI2+	Not in use by default. 0(4)…20 mA, R_{in} = 100 ohm [6]
	7	AI2-	
– U	AI1		AI1 current/voltage selection switch
– U	AI2		AI2 current/voltage selection switch
XAO			Analog outputs
1 2 3 4	1	AO1	**Motor speed rpm** 0 … 20 mA, R_L < 500 ohm
	2	AGND	
	3	AO2	**Motor current** 0 … 20 mA, R_L < 500 ohm
	4	AGND	
XPOW			External power input
1 2 3 4	1	+24VI	24 V DC, 2.05 A Two supplies can be connected for redundancy.
	2	GND	
	3	+24VI	
	4	GND	
X12			Safety functions module connection
X13			Control panel connection

Terminal	Description
X205	Memory unit connection

1) 0 = Acceleration/deceleration ramps defined by parameters 23.12/23.13 in use.
1 = Acceleration/deceleration ramps defined by parameters 23.14/23.15 in use.

2) Constant speed 1 is defined by parameter 22.26.

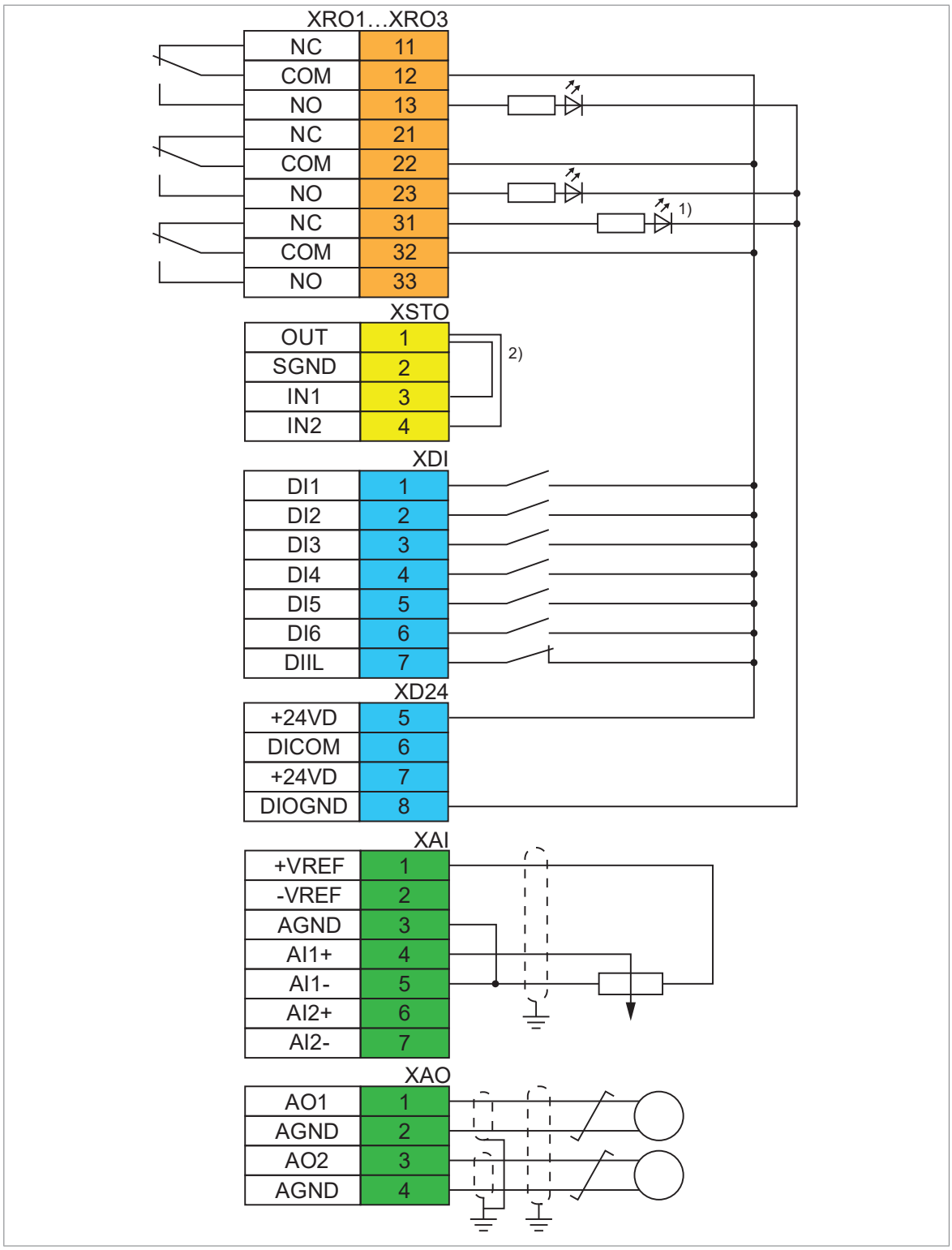
3) The DIIL input is configured to stop the unit when the input signal is removed. This input does not have a SIL or PL classification.

4) Total load capacity of these outputs is 4.8 W (200 mA at 24 V) minus the power taken by DIO1 and DIO2.

5) Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by switch AI1. Change of setting requires reboot of control unit.

6) Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by switch AI2. Change of setting requires reboot of control unit.

The diagram below shows the default I/O connections on the inverter control unit (A41).



1) Fault

2) If necessary, you can connect an emergency stop button to the XSTO terminal. Refer to chapter The Safe torque off function.

Additional information on the connections

External power supply for the control unit (XPOW)

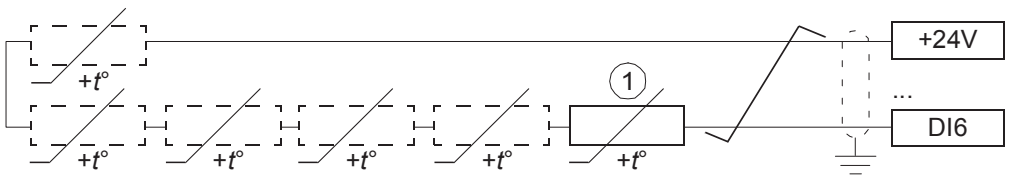
The control unit is powered from a 24 V DC, 2 A supply through terminal block XPOW. With a type BCU control unit, a second supply can be connected to the same terminal block for redundancy.

Using an external supply is recommended if

- the control unit needs to be kept operational during input power breaks, for example, because of continuous fieldbus communication
- immediate restart is needed after a power break (that is, no control unit power-up delay is allowed).

DI6 as a PTC sensor input

PTC sensors can be connected to this input for motor temperature measurement as follows. The sensor can alternatively be connected to a FEN encoder interface module or FPTC thermistor protection module (option +L536) or PTC relay (option +L505). Refer to section Implementing a motor temperature sensor connection (page 97). At the sensor end of the cable, leave the shields unconnected or ground them indirectly via a high-frequency capacitor with a few nanofarads, for example 3.3 nF / 630 V. The shield can also be grounded directly at both ends if they are in the same ground line with no significant voltage drop between the end points. See the firmware manual of the inverter unit for parameter settings.

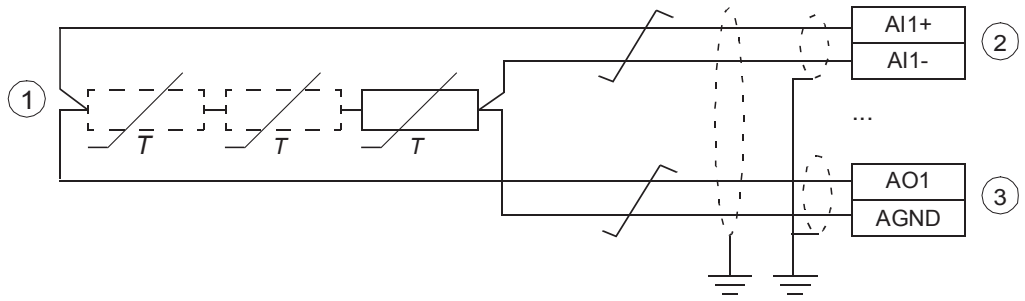


1	One to six PTC thermistors connected in series

WARNING!
As the inputs pictured above are not insulated according to IEC 60664, the connection of the motor temperature sensor requires double or reinforced insulation between motor live parts and the sensor. Make sure that the voltage does not exceed the maximum allowed voltage over the PTC sensor.

AI1 or AI2 as a Pt100, Pt1000, PTC or KTY84 sensor input

Sensors for motor temperature measurement can be connected between an analog input and output, an example connection is shown below. (Alternatively, you can connect the KTY to an FIO-11 or FAIO-01 analog I/O extension module or a FEN encoder interface module.) Refer to section Implementing a motor temperature sensor connection (page 97). At the sensor end of the cable, leave the shields unconnected or ground them indirectly via a high-frequency capacitor with a few nanofarads, for example 3.3 nF / 630 V. The shield can also be grounded directly at both ends if they are in the same ground line with no significant voltage drop between the end points.



1	One, two or three Pt100, Pt1000 or PTC sensors; or one KTY84 sensor
2	Set the input type to voltage with the appropriate switch or jumper on the control unit. Make the corresponding setting in the control program in parameter group 12 Standard AI.
3	Select the excitation mode in parameter group 13 Standard AO.

WARNING!
As the inputs pictured above are not insulated according to IEC/EN 60664, the connection of the motor temperature sensor requires double or reinforced insulation between motor live parts and the sensor. Make sure that the current does not exceed the maximum allowed current through the Pt100/Pt1000 sensor.

DIIL input

The DIIL input is used for the connection of safety circuits. The input is parametrized to stop the unit when the input signal is lost.

Note: This input is NOT SIL or PL certified.

The XD2D connector

Note: On the ACS880-07CLC, the XD2D connector on the supply control unit (A51) is reserved for cooling fan monitoring. See CIO-01 I/O module for distributed I/O bus control user's manual (3AXD50000126880 [English]).

The XD2D connector provides an RS-485 connection that can be used for

- basic master/follower communication with one master drive and multiple followers,
- fieldbus control through the embedded fieldbus interface (EFB), or
- drive-to-drive (D2D) communication implemented by application programming.

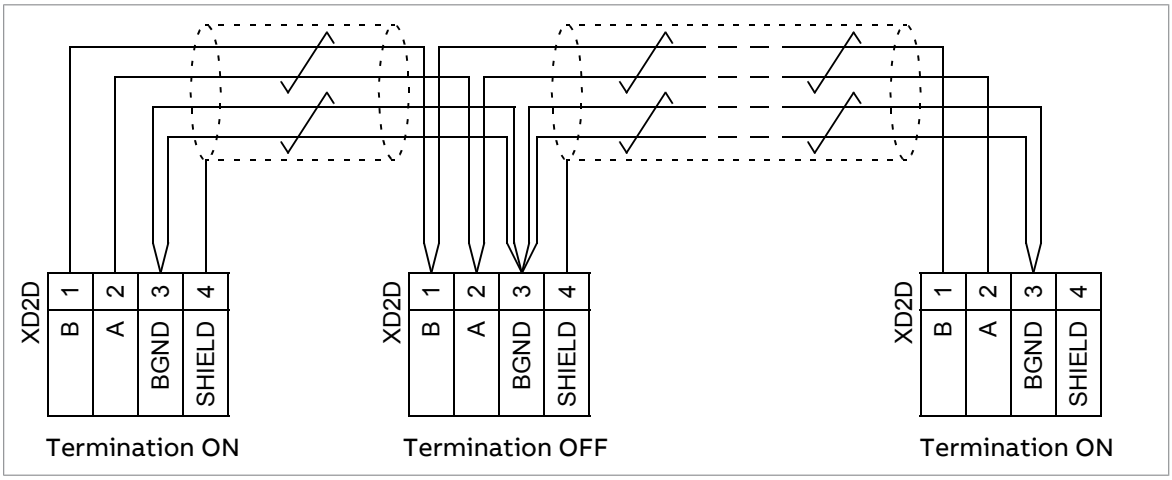
See the firmware manual of the drive for the related parameter settings.

Enable bus termination on the units at the ends of the drive-to-drive link. Disable bus termination on the intermediate units.

Use a high-quality shielded twisted-pair cable for the wiring, fro exmple, Belden 9842. The nominal impedance of the cable should be 100 … 165 ohm. You can use one pair for the data wiring and another pair or a wire for the grounding. Avoid unnecessary loops and parallel runs near power cables.

The following diagram shows the wiring between control units.

ZCU-14, BCU-x2



Safe torque off (XSTO, XSTO OUT)

See chapter The Safe torque off function (page 231).

Note: The XSTO input only acts as a true Safe torque off input on the inverter control unit. De-energizing the IN1 and/or IN2 terminals of other units (supply, DC/DC converter, or brake unit) will stop the unit but not constitute a true safety function.

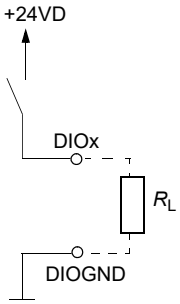
FSO safety functions module connection (X12)

Not in use at the time of publishing.

SDHC memory card slot

The BCU-x2 has an on-board data logger that collects real-time data from the power modules to help fault tracing and analysis. The data is stored onto the SDHC memory card inserted into the SD CARD slot and can be analyzed by ABB service personnel.

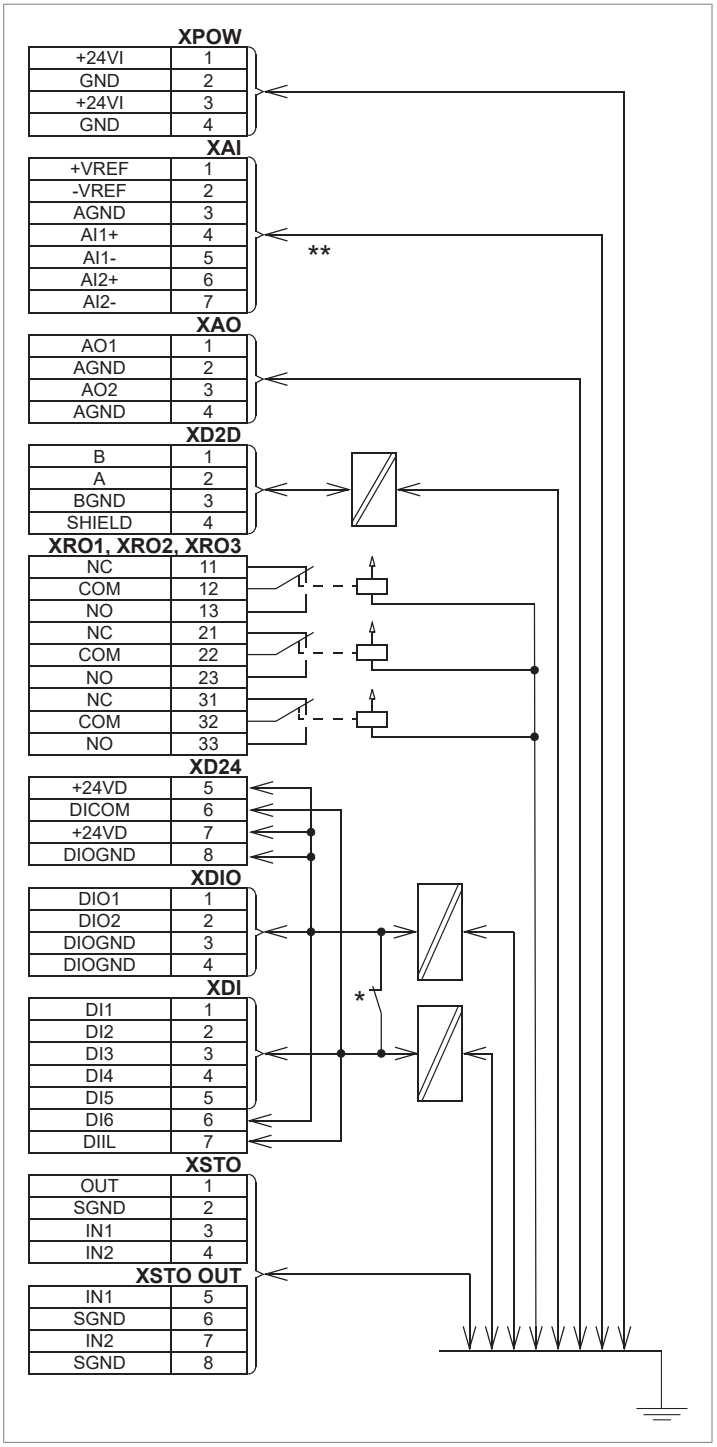
Connector data

Power supply (XPOW)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) 24 V (±10%) DC, 2 A External power input. Two supplies can be connected to the BCU-x2 for redundancy.
Relay outputs RO1…RO3 (XRO1…XRO3)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) 250 V AC / 30 V DC, 2 A Protected by varistors
+24 V output (XD24:2 and XD24:4)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) Total load capacity of these outputs is 4.8 W (200 mA / 24 V) minus the power taken by DIO1 and DIO2.
Digital inputs DI1…DI6 (XDI:1…XDI:6)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) 24 V logic levels: “0” < 5 V, “1” > 15 V R_{in}: 2.0 kohm Input type: NPN/PNP (DI1…DI5), PNP (DI6) Hardware filtering: 0.04 ms, digital filtering up to 8 ms DI6 (XDI:6) can alternatively be used as an input for a PTC sensor. "0" > 4 kohm, "1" < 1.5 kohm. I_{max}: 15 mA (DI1…DI5), 5 mA (DI6)
Start interlock input DIIL (XD24:1 [ZCU-1x], XDI:7 [BCU-x2])	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) 24 V logic levels: "0" < 5 V, "1" > 15 V R_{in}: 2.0 kohm Input type: NPN/PNP Hardware filtering: 0.04 ms, digital filtering up to 8 ms
Digital inputs/outputs DIO1 and DIO2 (XDIO:1 and XDIO:2) Input/output mode selection by parameters. DIO1 can be configured as a frequency input (0…16 kHz with hardware filtering of 4 microseconds) for 24 V level square wave signal (sinusoidal or other wave form cannot be used). DIO2 can be configured as a 24 V level square wave frequency output. See the firmware manual, parameter group 111/11.	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) As inputs: 24 V logic levels: "0" < 5 V, "1" > 15 V. R_{in}: 2.0 kohm. Filtering: 1 ms. As outputs: Total output current from +24VD is limited to 200 mA 
Reference voltage for analog inputs +VREF and -VREF (XAI:1 and XAI:2)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) 10 V ±1% and -10 V ±1%, R_{load} 1…10 kohm Maximum output current: 10 mA

Analog inputs AI1 and AI2 (XAI:4 … XAI:7). Current/voltage input mode selection by jumpers (ZCU-1x) or switches (BCU-x2)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) Current input: -20…20 mA, R_{in} = 100 ohm Voltage input: -10…10 V, R_{in} > 200 kohm Differential inputs, common mode range ±30 V Sampling interval per channel: 0.25 ms Hardware filtering: 0.25 ms, adjustable digital filtering up to 8 ms Resolution: 11 bit + sign bit Inaccuracy: 1% of full scale range
Analog outputs AO1 and AO2 (XAO)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) 0…20 mA, R_{load} < 500 ohm Frequency range: 0…300 Hz (ZCU-1x), 0…500 Hz (BCU-x2) Resolution: 11 bit + sign bit Inaccuracy: 2% of full scale range
XD2D connector	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) Physical layer: RS-485 Transmission rate: 8 Mbit/s Cable type: Shielded twisted-pair cable with a twisted pair for data and a wire or another pair for signal ground (nominal impedance 100 … 165 ohm, for example Belden 9842) Maximum length of link: 50 m (164 ft) Termination by jumper (ZCU-1x) or switch (BCU-x2)
RS-485 connection (X485) (BCU-x2 only)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) Physical layer: RS-485 Cable type: Shielded twisted-pair cable with a twisted pair for data and a wire or another pair for signal ground (nominal impedance 100 … 165 ohm, for example Belden 9842) Maximum length of link: 50 m (164 ft)
Safe torque off connection (XSTO)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) Input voltage range: -3…30 V DC Logic levels: "0" < 5 V, "1" > 17 V. **Note:** For the unit to start, both connections must be “1”. This applies to all control units (including drive, inverter, supply, brake, DC/DC converter etc. control units), but true Safe torque off functionality is only achieved through the XSTO connector of the drive/inverter control unit. Current consumption: 66 mA (continuous) per STO channel per R8i module EMC (immunity) according to IEC 61326-3-1 and IEC 61800-5-2 See also chapter The Safe torque off function (page 231).
Safe torque off output (XSTO OUT) (BCU-x2 only)	Connector pitch 5 mm, wire size 0.5 … 2.5 mm^2 (22…12 AWG) Tightening torque 0.45 N·m (4 lbf·in) To STO connector of inverter module.
Control panel connection (X13)	Connector: RJ-45 Cable length < 100 m (328 ft)

Ethernet connection (XETH) (BCU-x2 only)	Connector: RJ-45 This connection is not supported by the firmware.
SDHC memory card slot (SD CARD) (BCU-x2 only)	Memory card type: SDHC Maximum memory size: 4 GB
The terminals of the control unit fulfill the Protective Extra Low Voltage (PELV) requirements. The PELV requirements of a relay output are not fulfilled if a voltage higher than 48 V is connected to the relay output.	

BCU-x2 ground isolation diagram

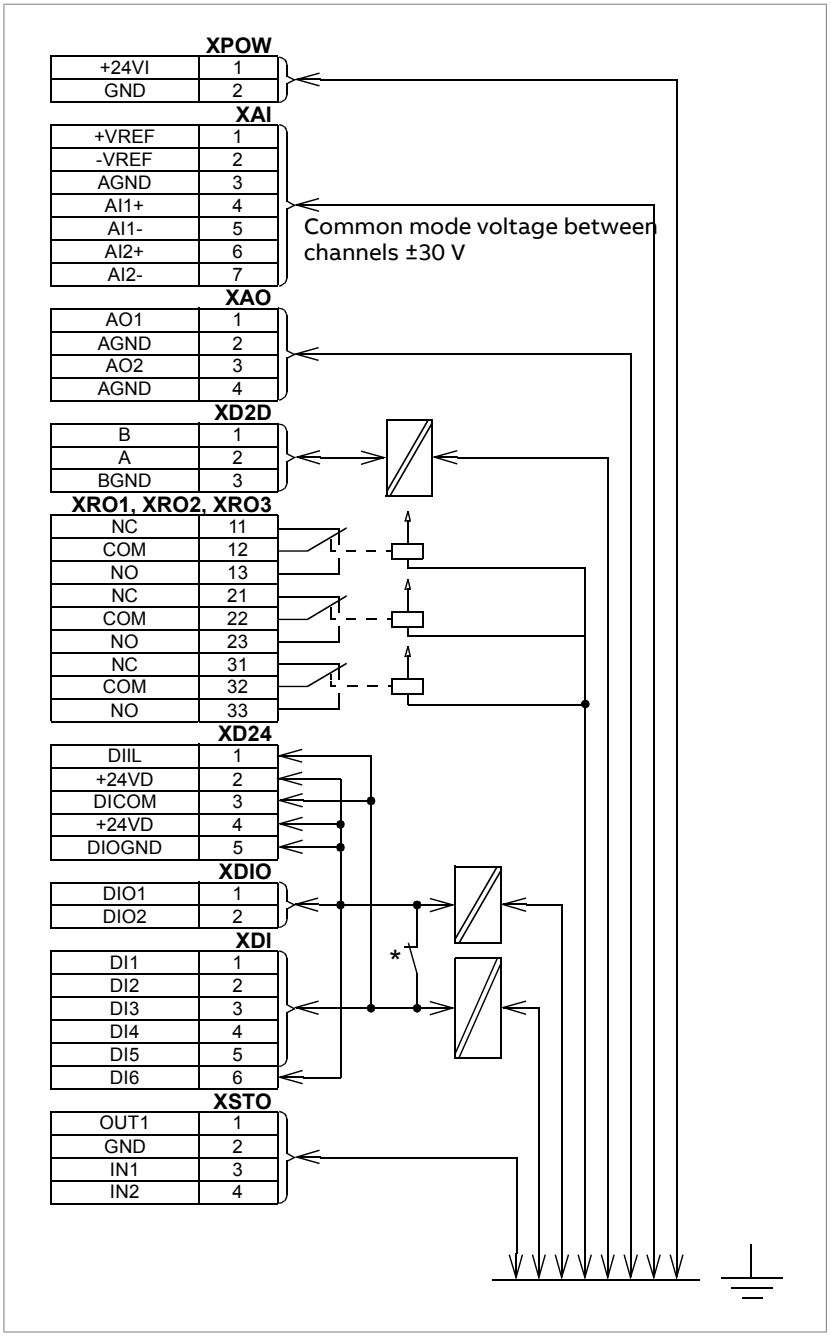


***Ground selector (DICOM=DIOGND) settings**

DICOM=DIOGND: ON All digital inputs share a common ground (DICOM connected to DIOGND). This is the default setting.
DICOM=DIOGND: OFF Ground of digital inputs DI1…DI5 and DIIL (DICOM) is isolated from DIO signal ground (DIOGND). Isolation voltage 50 V.

**The maximum common mode voltage between each AI input and AGND is +30 V

ZCU-1x ground isolation diagram



* Ground selector (J6) settings

• [• •]

All digital inputs share a common ground (DICOM connected to DIOGND). This is the default setting.

• [• •]

Ground of digital inputs DI1…DI5 and DIIL (DICOM) is isolated from DIO signal ground (DIOGND). Isolation voltage 50 V.

8

Installation checklist

Contents of this chapter

This chapter contains a checklist for the mechanical and electrical installation of the drive.

Checklist

Examine the mechanical and electrical installation of the drive before start-up. Go through the checklist together with another person.

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

WARNING!
Stop the drive and do the steps in section Electrical safety precautions (page 19) before you start the work.

Make sure that ...	☑
The ambient operating conditions meet the drive ambient conditions specification and enclosure rating (IP code).	☐
The supply voltage matches the nominal input voltage of the drive. See the type designation label.	☐
The insulation resistance of the input power cable, motor cable and motor is measured according to local regulations and the manuals of the drive.	☐
The drive cabinet is attached to the floor, and if necessary due to vibration etc, also by its top to the wall or roof.	☐

Make sure that ...	☑
If the drive is connected to a network other than a symmetrically grounded TN-S system: You have done all the required modifications (for example, you may need to disconnect the EMC filter or ground-to-phase varistor). See the electrical installation instructions.	☐
There is an adequately sized protective earth (ground) conductor(s) between the drive and the switchboard, the conductor is connected to correct terminal, and the terminal is tightened to the correct torque. Grounding has also been measured according to the regulations.	☐
The input power cable is connected to the correct terminals, the phase order is correct, and the terminals are tightened to the correct torque.	☐
There is an adequately sized protective earth (ground) conductor between the motor and the drive. The conductor is connected to the correct terminal, and the terminal is tightened to the correct torque. Grounding has also been measured according to the regulations.	☐
The motor cable is connected to the correct terminals, the phase order is correct, and the terminals are tightened to the correct torque.	☐
The motor cable is routed away from other cables.	☐
No power factor compensation capacitors are connected to the motor cable.	☐
If an external brake resistor is connected to the drive: There is an adequately sized protective earth (ground) conductor between the brake resistor and the drive, and the conductor is connected to the correct terminal, and the terminals are tightened to the correct torque. Proper grounding has also been measured according to the regulations.	☐
If an external brake resistor is connected to the drive: The brake resistor cable is connected to the correct terminals, and the terminals are tightened to the correct torque.	☐
If an external brake resistor is connected to the drive: The brake resistor cable is routed away from other cables.	☐
The control cables are connected to the correct terminals, and the terminals are tightened to the correct torque.	☐
The voltage setting of the auxiliary voltage transformers (if any) is correct. See the electrical installation instructions.	☐
If a drive bypass connection will be used: The Direct On Line contactor of the motor and the drive output contactor are either mechanically and/or electrically interlocked, that is, they cannot be closed at the same time. A thermal overload device must be used for protection when bypassing the drive. Refer to local codes and regulations.	☐
There are no tools, foreign objects or dust from drilling inside the drive.	☐
The cover(s) of the motor connection box are in place. Cabinet shrouds are in place and doors are closed.	☐
The motor and the driven equipment are ready for power-up.	☐
The coolant connections between cubicles (if any) and to the cooling circuit are tight.	☐
If the drive is equipped with a cooling unit: Make sure that the mechanical and electrical installation of the cooling unit is completed. Refer to the cooling unit documentation.	☐

9

Start-up

Contents of this chapter

This chapter contains the start-up and switch-off procedures of the drive.

Start-up procedure

The tasks which are needed in certain cases only are marked with underlining, and option codes are given in brackets. Default device designations (if any) are given in brackets after the name, for example “main switch-disconnector [Q1]”. The same device designations are also used in the circuit diagrams.

These instructions cannot and do not cover all possible start-up tasks of a customized drive. Always refer to the delivery-specific circuit diagrams when proceeding with the start-up.

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

Note: For certain options (such as functional safety options +Q950, +Q951, +Q952, +Q957, +Q963, +Q964, +Q978, +Q979), additional start-up instructions are given in their separate manuals.

If the drive is equipped with a cooling unit, also refer to its manual.

Action	☑
Safety	
WARNING! Obey the safety instructions during the start-up procedure. See chapter Safety instructions (page 15).	☐

Action	☑
Checks/Settings with no voltage connected	
Make sure that the disconnector of the supply transformer is locked to the open position (i.e., voltage is not connected to the drive, and cannot be connected to the drive accidentally).	☐
Make sure that the main switch-disconnector is open, or the main breaker is racked out. Both are external customer equipment. **Note:** 12-pulse and 24-pulse units may have multiple switch-disconnectors or breakers – check that all are open before you proceed.	☐
Check the mechanical and electrical installation of the drive. See Installation checklist (page 141).	☐
Check the settings of breakers/switches in the auxiliary circuits. See the circuit diagrams delivered with the drive.	☐
Check that the auxiliary voltage selector [X59] on the front plate of the inverter modules is set according to actual auxiliary voltage (230 or 115 V AC).	☐
Disconnect any unfinished or uninspected auxiliary voltage (115/230 V AC) cables that lead from the terminal blocks to the outside of the equipment.	☐
Check that both channels of the Safe torque off circuit connected to the STO inputs of both the supply control unit [A51] and the inverter control unit [A41] are closed. Refer to the wiring diagrams delivered with the drive.	☐
Drives with ground fault monitoring for IT (ungrounded) systems (option +Q954): Adjust the settings of the ground fault monitor to suit the installation. See the circuit diagrams of the delivery and IRDH275B Ground Fault Monitor Operating Manual by Bender (code: TGH1386en).	☐
Powering up the auxiliary circuit of the drive	
Make sure that it is safe to connect voltage. Make sure that: • nobody is working on the drive or circuits that have been wired from outside into the drive cabinet • the cover of the motor terminal box is in place.	☐
Drives with an ACS880-1007LC cooling unit (as part of line-up or standalone): Do the start-up tasks of the cooling unit. Refer to ACS880-1007LC liquid cooling unit user's manual (3AXD50000129607 [English]).	☐
Close the circuit breakers and/or fuse disconnectors supplying the auxiliary voltage circuits.	☐
Close the cabinet doors.	☐
Close the main breaker of the supply transformer.	☐
Switch on the auxiliary voltage [Q20]. Also switch on the voltage to any other externally-supplied options (such as the cooling fan supply, lighting, heating). If the drive is equipped with a cooling unit, close the main switch of the coolant pump [Q200].	☐
Setting up the supply unit parameters	
Check the voltage range setting in parameter 195.01 Supply voltage. For more information on setting up the supply control program, refer to ACS880 diode supply control program firmware manual (3AUA0000103295 [English]). If you need more information on the use of the control panel, refer to ACS-AP-I, -S, -W and ACH-AP-H, -W Assistant control panels user's manual (3AUA0000085685 [English]).	☐
Setting up the inverter unit parameters, and performing the first start	
Set up the inverter control program. See the appropriate start-up guide and/or firmware manual. There is a separate start-up guide only for some control programs.	☐
Make sure that parameter 95.09 Switch fuse controller is set to Disabled.	☐
Drives with a brake chopper (option +D150): See chapter Resistor braking (page 255).	☐
Drives with an fieldbus adapter module (optional): Set the fieldbus parameters. Activate the appropriate assistant (if present) in the control program, or see the user's manual of the fieldbus adapter module, and the drive firmware manual. Check that the communication works between the drive and the PLC.	☐

Action	☑
Drives with an encoder interface module (optional): Set the encoder parameters. Activate the appropriate assistant (if present) in the control program, or see the user's manual of the encoder interface module, and the drive firmware manual.	☐
Powering up the main circuit of the drive	
Set the Run enable switch into the "1" position. Close the charging switch [Q3].	☐
On-load checks	
Start the motor to perform the ID run. Starting will close the main contactor or main breaker.	☐
Check that the cooling fans rotate freely in the right direction, and the air flows upwards.	☐
Check that the motor starts. stops and follows the speed reference in the correct direction when controlled with the control panel.	☐
Check that the motor starts. stops and follows the speed reference in the correct direction when controlled through the customer-specific I/O or fieldbus.	☐
Drives in which the Safe torque off control circuit is in use: Test and validate the operation of the Safe torque off function. See section Start-up including validation test (page 239).	☐
Drives with an emergency stop circuit (option +Q951): Test and validate the operation of the emergency-stop circuit. See the delivery specific circuit diagrams and wiring, start-up and operating instructions of the option.	☐

Switching off the drive

1. Stop the motor.
2. Turn the Run enable switch (S21) to the off (0) position to deactivate the Run enable signal and to switch the main contactor/breaker off.

10

Fault tracing

Contents of this chapter

This chapter describes the fault tracing possibilities of the drive.

Control unit LEDs

LED	Color	Indication
BATT OK	Green	Battery voltage of the real-time clock is OK (higher than 2.8 V). When the LED is not lit, • battery voltage is below 2.8 V, • the battery is missing, or • the control unit is not powered.
PWR OK	Green	Internal voltage OK
FAULT	Red	The control program indicates that the equipment is faulty. See the appropriate firmware manual.
WRITE	Yellow	Writing to SD card in progress.

Control panel and panel platform/holder LEDs

The ACS-AP-… control panel has a status LED. The control panel mounting platform or holder has two status LEDs. For their indications, see the following table.

Location	LED	Indication
Control panel	Continuous green	The unit is functioning normally.
	Flickering green	Data is transferred between the PC and the unit through the USB connection of the control panel.
	Blinking green	There is an active warning in the unit.
	Continuous red	There is an active fault in the unit.
	Blinking red	There is a fault that requires the stopping and restarting of the drive/converter/inverter.
	Blinking blue (ACS-AP-W only)	The Bluetooth interface is enabled, in discoverable mode, and ready for pairing.
	Flickering blue (ACS-AP-W only)	Data is being transferred through the Bluetooth interface of the control panel.
Control panel mounting platform or holder (with the control panel removed)	Red	There is an active fault in the unit.
	Green	Power supply for the control unit is OK.

Warning and fault messages

See the firmware manual for the descriptions, causes and remedies of the drive control program warning and fault messages.

11

Maintenance

Contents of this chapter

This chapter contains maintenance instructions.

Maintenance intervals

The tables below show the maintenance tasks which can be done by the end user. The complete maintenance schedule is available on the Internet (https://new.abb.com/drives/services/maintenance/preventive-maintenance). For more information, consult your local ABB Service representative (www.abb.com/searchchannels).

Description of symbols

Action	Description
I	Inspection (visual inspection and maintenance action if needed)
P	Performance of on/off-site work (commissioning, tests, measurements or other work)
R	Replacement

Recommended maintenance intervals after start-up

Maintenance task/object	Years from start-up													
	0	1	2	3	4	5	6	7	8	9	10	11	12	...
Coolant														
Coolant draining and replacement							R						R	
Checking coolant quality			P		P		P		P		P		P	

Maintenance task/object	Years from start-up													
	0	1	2	3	4	5	6	7	8	9	10	11	12	...
Checking coolant antifreeze concentration		P	P	P	P	P	P	P	P	P	P	P	P	P
Cooling fans														
Supply module cubicle fan (230 V)										R				
Supply module cubicle fan (115 V)							R						R	
Inverter module fan (230 V)										R				
Inverter module fan (115 V)							R						R	
Batteries														
Control panel battery										R				
Control unit battery							R						R	
Connections and environment														
Quality of supply voltage		P	P	P	P	P	P	P	P	P	P	P	P	P
Spare parts														
Spare parts		I	I	I	I	I	I	I	I	I	I	I	I	I
DC circuit capacitor reforming (spare inverter modules and spare capacitors)		P	P	P	P	P	P	P	P	P	P	P	P	P
Inspections														
Checking tightness of cable and busbar terminals. Tightening if needed.		I	I	I	I	I	I	I	I	I	I	I	I	I
Checking ambient conditions (dustiness, corrosion, temperature)		I	I	I	I	I	I	I	I	I	I	I	I	I
Checking coolant pipe connections		I	I	I	I	I	I	I	I	I	I	I	I	I
Functional safety														
Safety function test	I See the maintenance information of the safety function.													
Safety component expiry (Mission time, T_M)	20 years													

Note:

- Maintenance and component replacement intervals are based on the assumption that the equipment is operated within the specified ratings and ambient conditions. ABB recommends annual drive inspections to ensure the highest reliability and optimum performance.
- Long term operation near the specified maximum ratings or ambient conditions may require shorter maintenance intervals for certain components. Consult your local ABB Service representative for additional maintenance recommendations.

Cooling fans

The lifespan of the cooling fans of the drive depends on the running time, ambient temperature and dust concentration. See the firmware manual for the actual signal which indicates the running time of the cooling fan. Reset the running time signal after fan replacement.

Replacement fans are available from ABB. Do not use other than ABB specified spare parts.

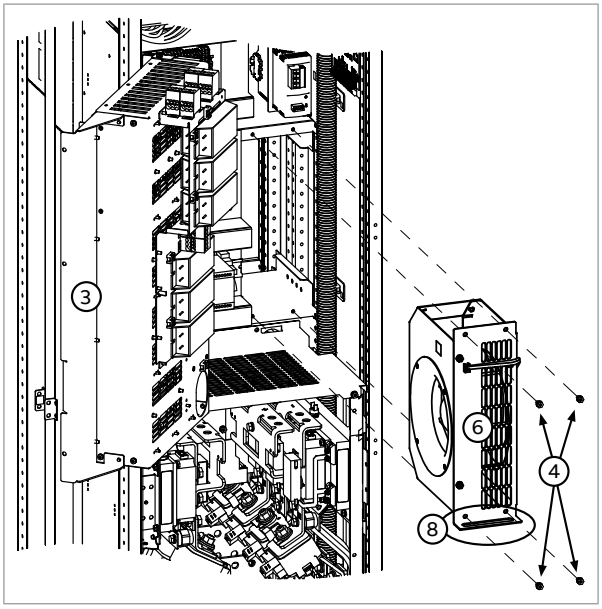
Replacing the cooling fan in the supply module cubicle

WARNING!
Read the safety instructions given in *Safety instructions for ACS880 liquid-cooled multidrive cabinets and modules* (3AXD50000048633 [English]). If you ignore them, injury or death, or damage to the equipment can occur.

WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

Refer to the drawing below.

1. Stop the drive and do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Open the door to the supply module cubicle.
3. Open the swing-out frame.
4. Remove the retaining screws of the fan box.
5. Disconnect the fan wiring.
6. Pull out the fan box.
7. Disassemble the fan box to access the fan.
8. Install a new fan in reverse order. Note the orientation of the fan box.



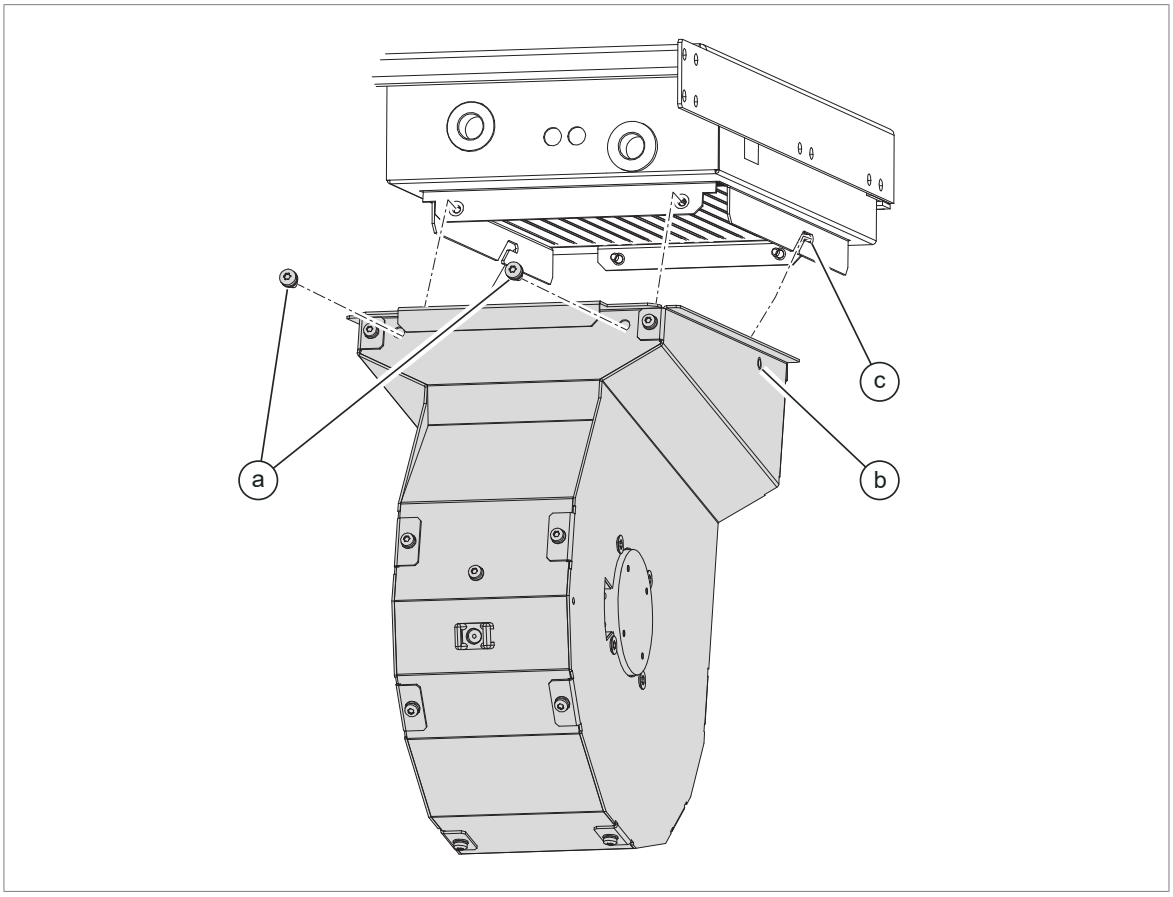
Replacing the cooling fan of an inverter module

WARNING!
Read the safety instructions given in chapter Safety instructions. If you ignore them, injury or death, or damage to the equipment can occur.

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

1. Stop the drive and do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Remove any shrouding in front of the cooling fan in case of marine construction (+C121).
3. Disconnect the fan wiring. Remove the CIO module.
4. Undo the two retaining screws (a).
5. Pull the fan outwards to separate it from the heat exchanger housing.
6. Install new fan in reverse order. Align the guide pins (b) at the rear of the fan cowling with the slots (c) in the module bottom guide, then reinstall the retaining screws (a).

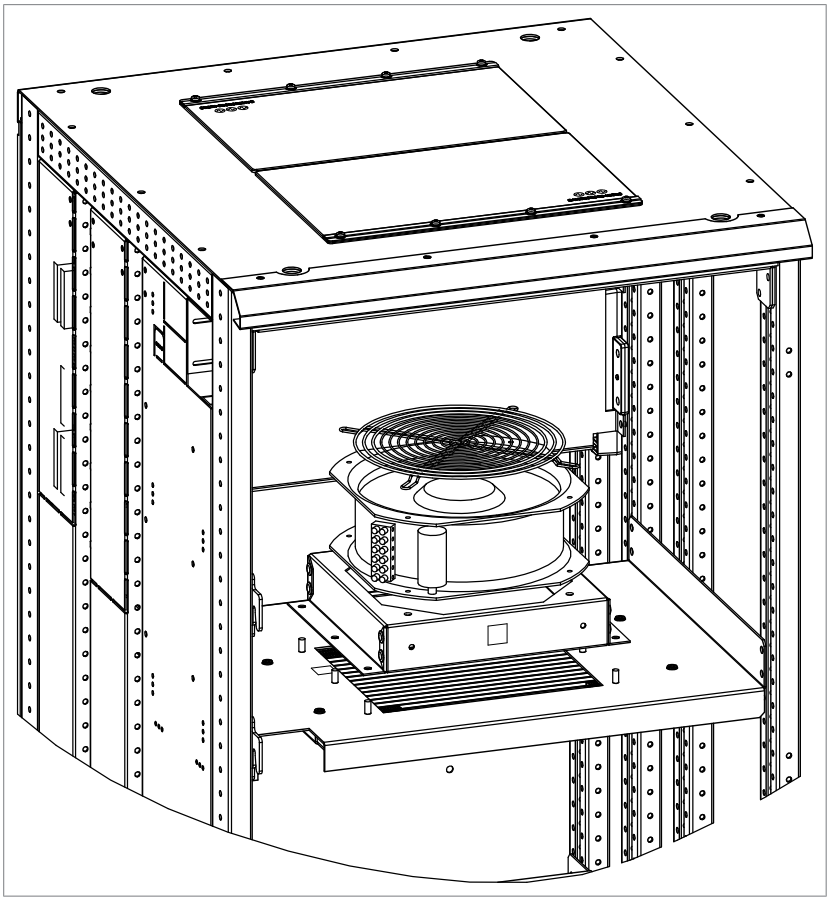


Replacing the common motor terminal cubicle fan

WARNING!
Obey the safety instructions of the drive. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrical professional, do not do installation, commissioning or maintenance work.

WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

1. Stop the drive and do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Remove any shrouding in front of the cooling fan.
3. Disconnect the fan wiring. Remove the CIO module.
4. Undo the fastening screws.
5. Pull the fan housing up and out.
6. Install a new fan in reverse order to the above.

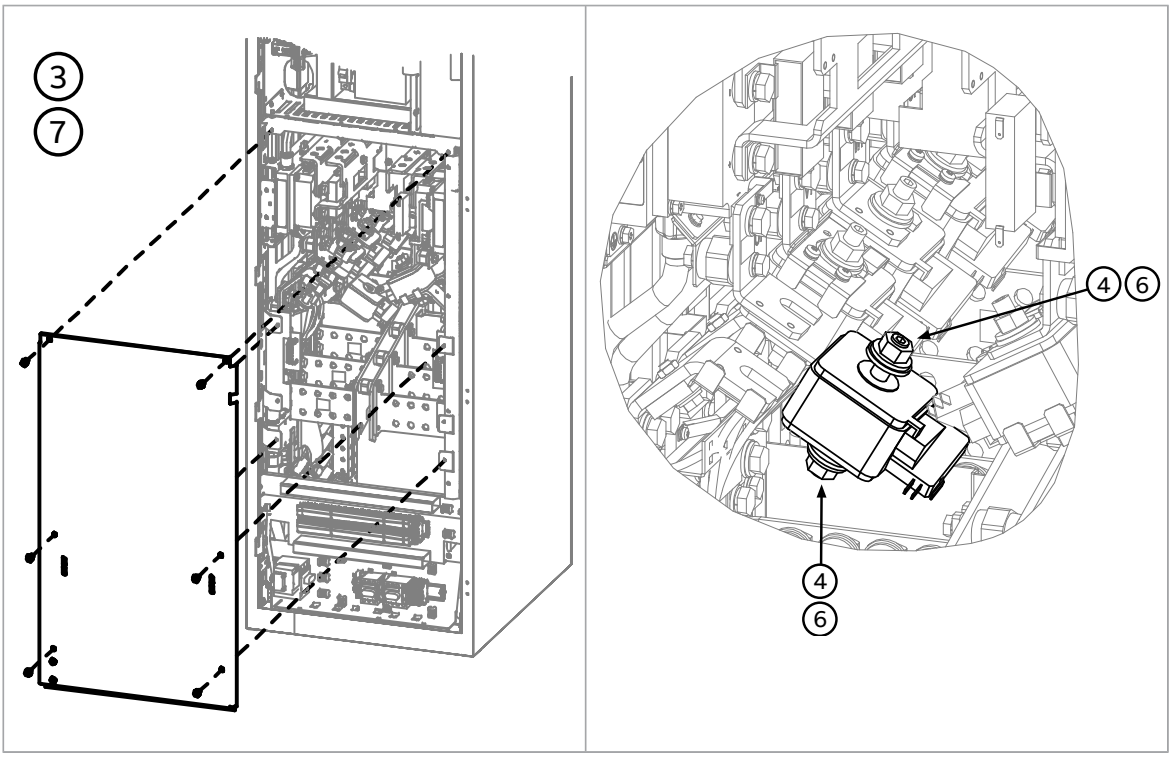


Fuses

Replacing the AC fuses

WARNING!
Wear protective gloves and long sleeves. Some parts have sharp edges.

1. Stop the drive and do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Open the door of the supply module cubicle.
3. Remove the shroud at the lower part of the cubicle.
4. Slacken the nuts of the fuses until you can slide the fuse blocks out. Make note of the order of the washers.
5. Move the screws, nuts and washers from the old fuse blocks to the new fuse blocks. Make sure to keep the washers in the original order.
6. Slide the new fuse blocks into place. Tighten the nuts to 50 N·m (37 lbf·ft) (Bussmann fuses) or 46 N·m (34 lbf·ft) (Ferraz Shawmut fuses).
7. Re-install the shrouding removed earlier and close the door.

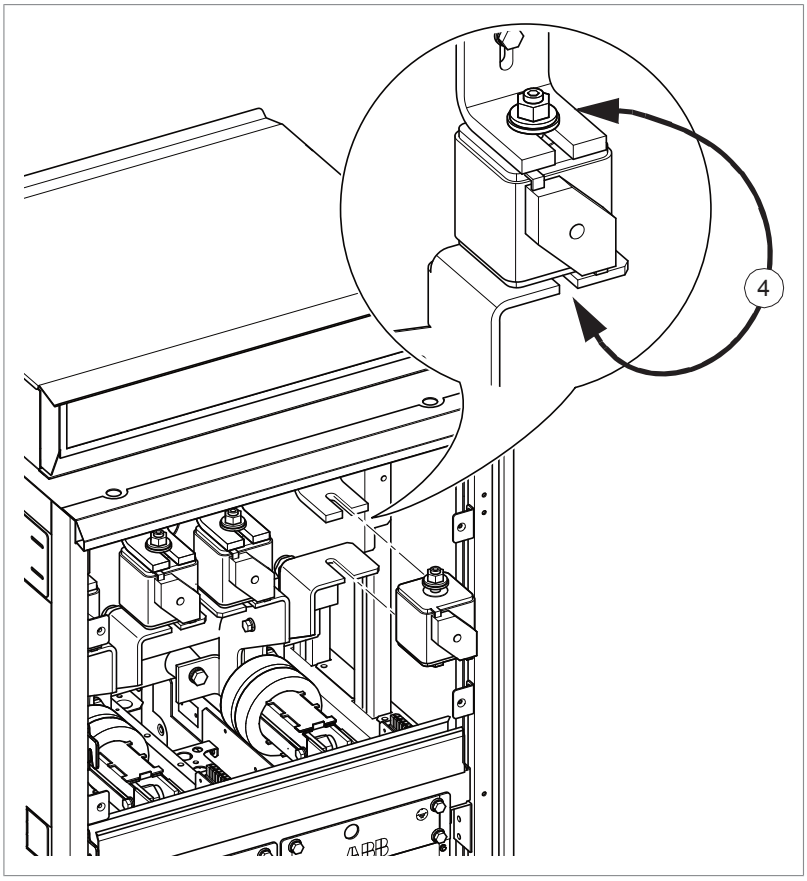


Replacing the DC fuses

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

WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

1. Stop the drive and do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Open the door of the module cubicle.
3. Remove the shrouding in front of the fuses (upper part of the cabinet).
4. Check the condition of the fuses. In case of a blown fuse, replace all fuses with similar fuses.
5. Slacken the nuts of the headless screws of the fuses, and slide out the fuse blocks.
6. Make note of the order of the washers on the screws.
7. Remove the screws, nuts and washers from the old fuses and attach them to the new fuses. Make sure to keep the washers in the original order.
8. Insert the new fuses into their slots in the cubicle. Pre-tighten the nuts first by hand or by applying a torque of no more than 5 N·m (3.7 lbf·ft).
9. Tighten the nuts to torque as follows:
   - Cooper-Bussmann fuses: 50 N·m (37 lbf·ft)
   - Mersen (Ferraz-Shawmut): 46 N·m (34 lbf·ft)
   - Other: Refer to the fuse manufacturer’s instructions
10. Attach the shrouding (if any) and close the door.


4

Supply and inverter modules

Replacing a supply module

WARNING!
Read the safety instructions given in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

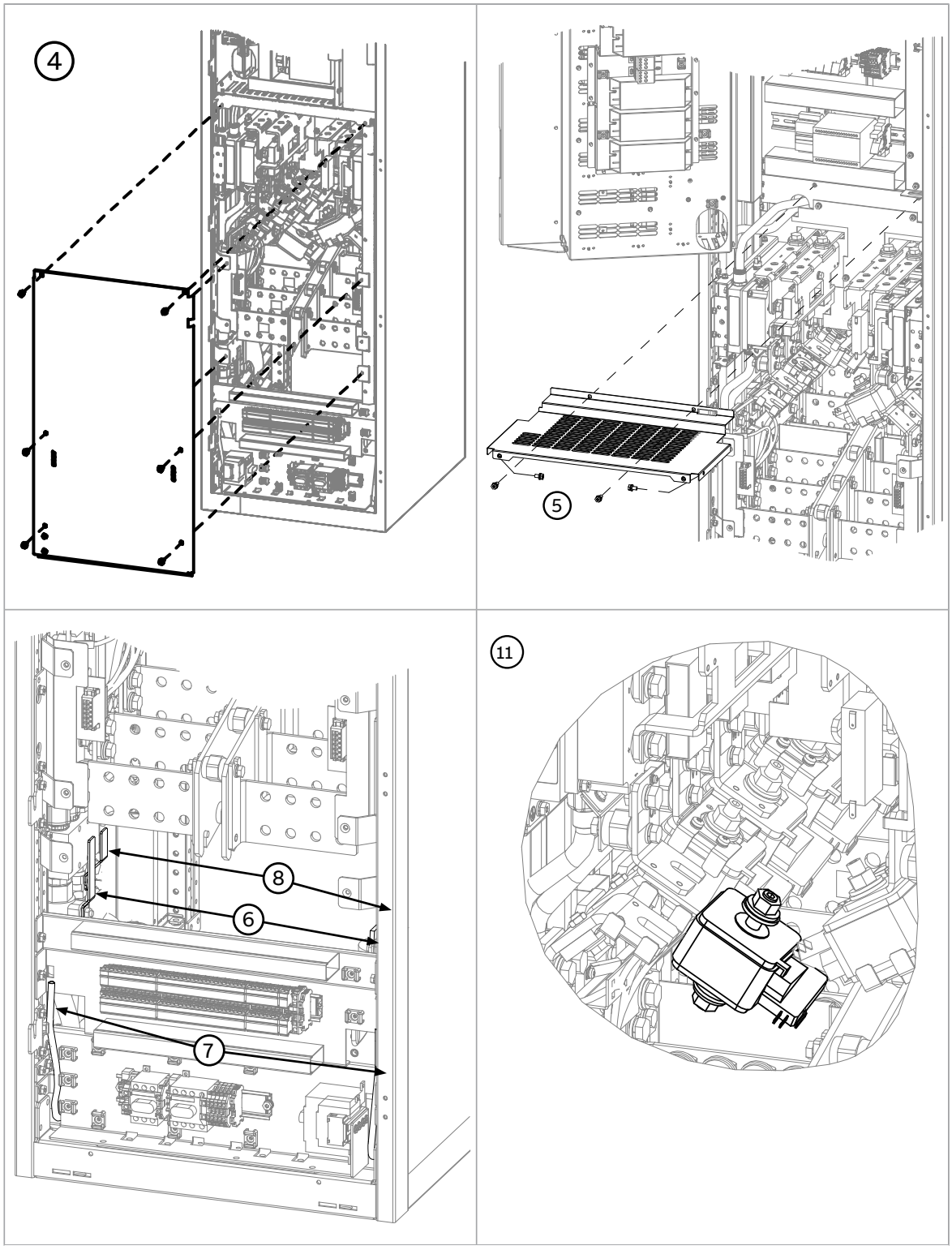
WARNING!
Hot, pressurized coolant may be present in the cooling circuit. Do not work on any section of the cooling system before it has been depressurized and drained.

WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

The removal of a module mounted at the rear requires that the module at the front (if present) is removed first.

Refer to the drawings below.

1. Stop the drive and do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Open the door to the supply module cubicle.
3. Open the swing-out frame.
4. Remove the shroud at the lower part of the cubicle.
5. Remove the shroud above the supply modules. Note that two of the screws are fastened from below.
6. Close the inlet and outlet valves of the supply cubicle.
7. Lead the drain hoses into a suitable container.
8. Open the drain valves located behind the inlet and outlet valves. Make sure the ends of the hoses are not immersed at any point of the draining so that air can displace the coolant in the system. Wait until all coolant has drained.
9. Disconnect the wiring from the thermal switch on the module.
10. Disconnect the coolant pipes from the module.
11. Slacken the nuts of the AC fuse blocks and slide the fuses out.
12. Remove the DC bus screws.
13. Remove the four mounting screws of the module and lift the module out.
14. If you need to remove the module in the rear, remove the shroud between the front and rear modules.
15. Remove the transverse beam.
16. Remove the insulator plate.
17. Repeat steps 9 to 13 for the module in the rear.
18. Reinstall the modules in reverse order to the above. See also Filling up and bleeding the internal cooling circuit (page 174).


4
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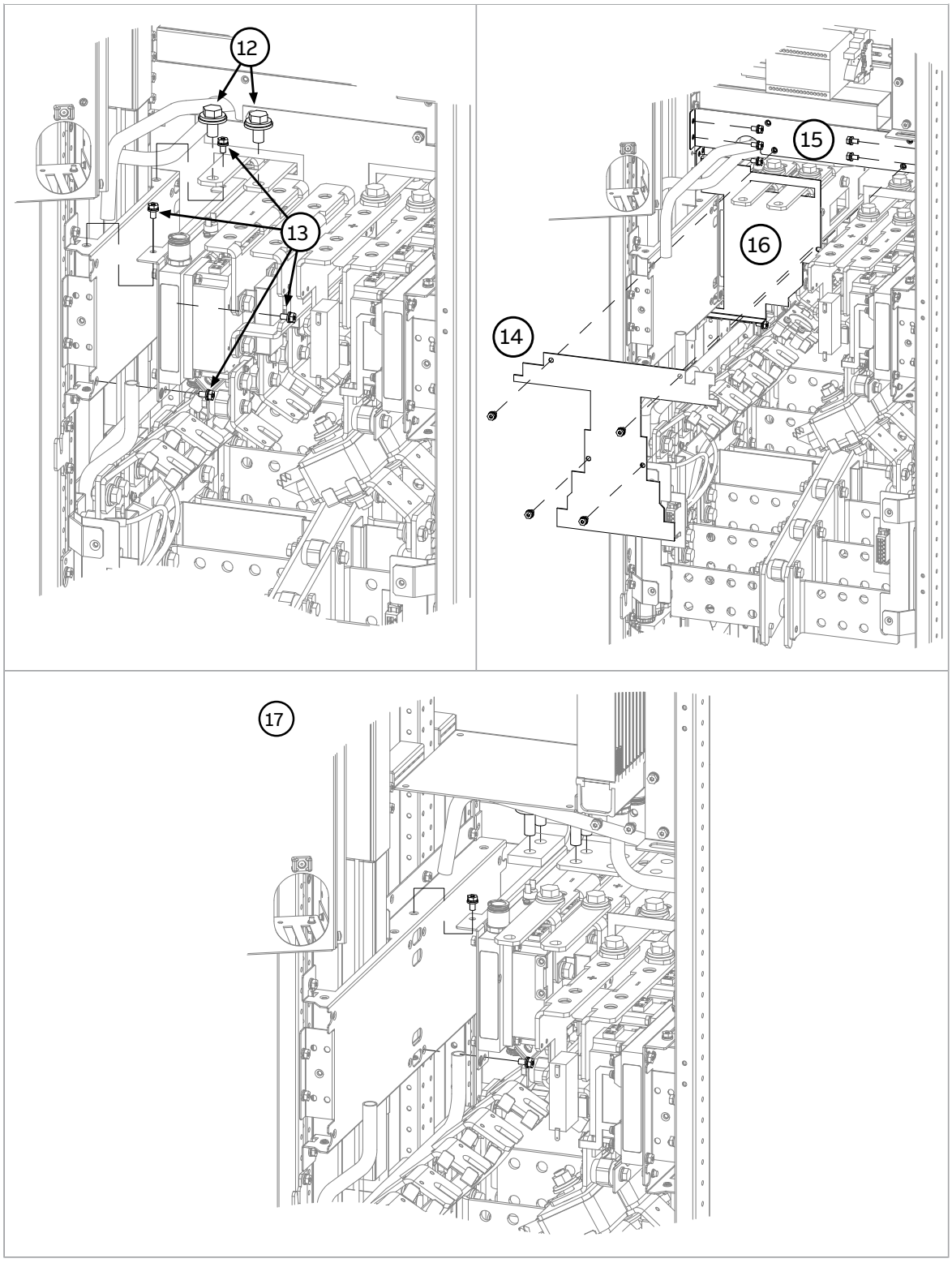
12
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17

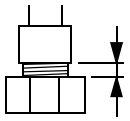
Replacing an inverter module

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

WARNING!
Make sure that the replacement module has exactly the same type code as the old module.

WARNING!
Beware of hot coolant. Do not work on the liquid cooling system until the pressure is lowered down by stopping the pumps and draining the coolant. High-pressure warm coolant (6 bar, max. 50 °C) is present in the internal cooling circuit when it is in operation.

WARNING!
To avoid breaking the coolant pipes, do not overtighten the nuts of the unions. Leave 2 to 3 millimeters (0.08 to 0.12 inches) of thread visible.

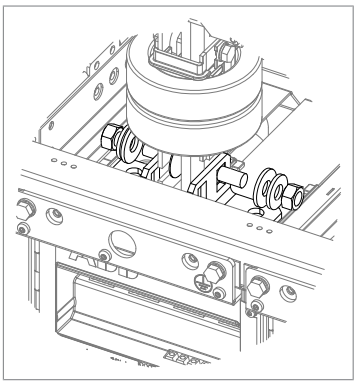


WARNING!
Use the required personal protective equipment. Wear protective gloves and long sleeves. Some parts have sharp edges.

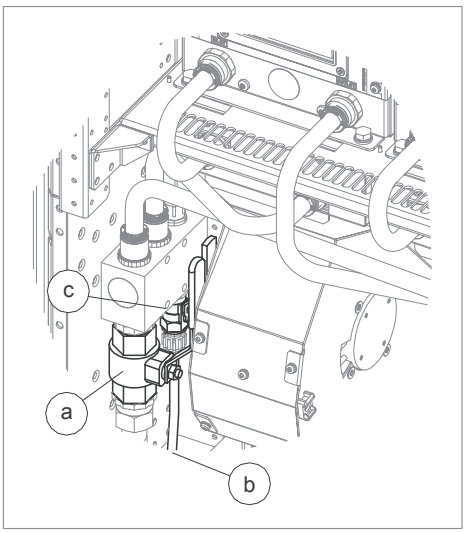
Removing the module

1. Do the steps in section Electrical safety precautions (page 19).
2. Assemble the service platform delivered with the drive. For instructions, see *Assembling the service platform for R8iLC cabinets.*
3. Remove the shrouding in front of the module.
4. Undo the locking screws of the swing-out frame (if present) and open it.
5. Unplug the wiring from the module and move it aside. Use cable ties to keep the wiring out of the way.

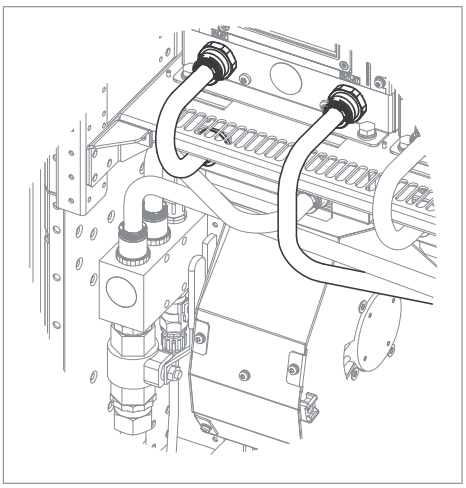
6. Remove the L-shaped DC busbars at the top of the module. Make note of the orientation of the screws as well as the order of the washers.



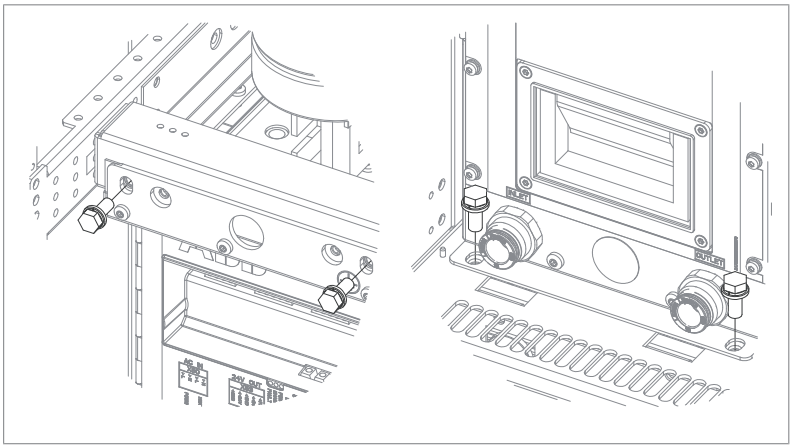
7. Close the inlet valve (a) and outlet valve (located on the right-hand side of the cubicle). Lead the drain hoses (b, on both sides of the cubicle) into a suitable container. Open the drain valves (c, on both sides of the cubicle). This will drain all modules in the cubicle.



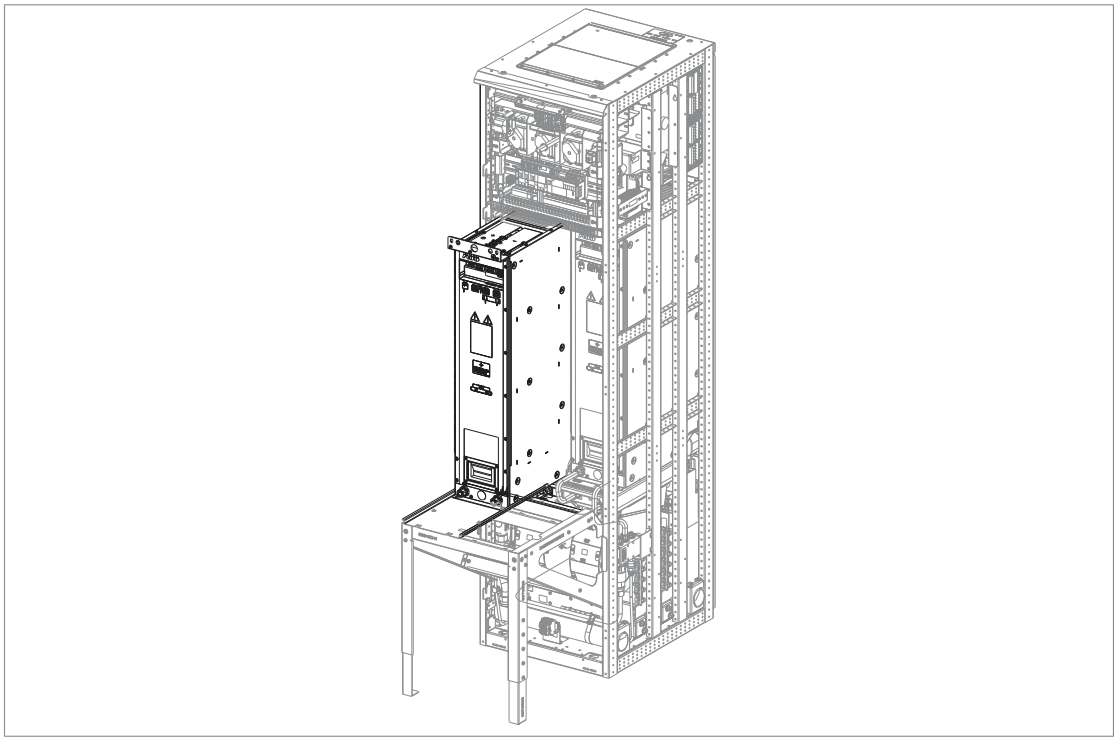
8. After the module has drained, disconnect the piping from the module.



9. Remove the module retaining screws at the top and the bottom of the module.



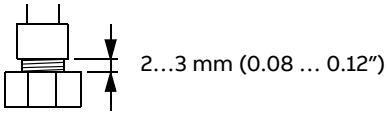
10. Pull the module carefully out onto the service platform. Keep the module secured to a hoist or equivalent to prevent the module from falling. For information on using the lifting device, see Converter module lifting device for drive cabinets hardware manual (3AXD50000210268 [English]).



Reinstalling the module

1. Push the module carefully into its bay.
2. Fasten the retaining screws at the top and the bottom of the module.
3. Reinstall the DC busbars at the top of the module.
4. Reconnect the coolant pipes to the module.

WARNING!
To avoid breaking the coolant pipes, do not overtighten the nuts of the unions. Leave 2 to 3 millimeters (0.08 to 0.12 inches) of thread visible.



5. Reconnect the control wiring to the module.
6. Fill up the cooling system. For instructions, see section Filling up and bleeding the internal cooling circuit.
7. Close the swing-out frame (if present). Reinstall all shrouds removed earlier.
8. If the Safe torque off function is in use, perform a validation test as described under Start-up including validation test (page 239).

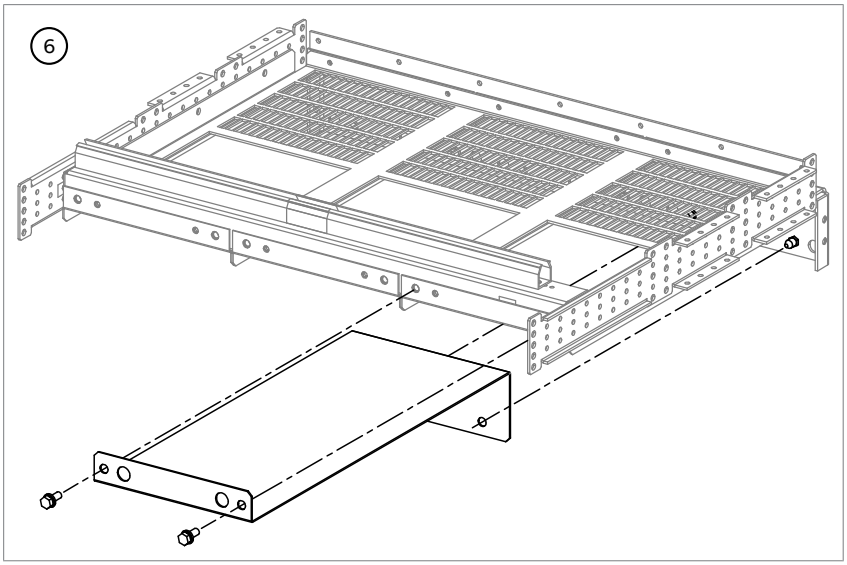
Activating the reduced run of the inverter unit

A “reduced run” function is available for inverter units consisting of parallel-connected inverter modules. The function makes it possible to continue operation with limited current even if one (or more) module is out of service, for example, because of maintenance work. In principle, reduced run is possible with only one module, but the physical requirements of operating the motor still apply; for example, the modules remaining in use must be able to provide the motor with enough magnetizing current.

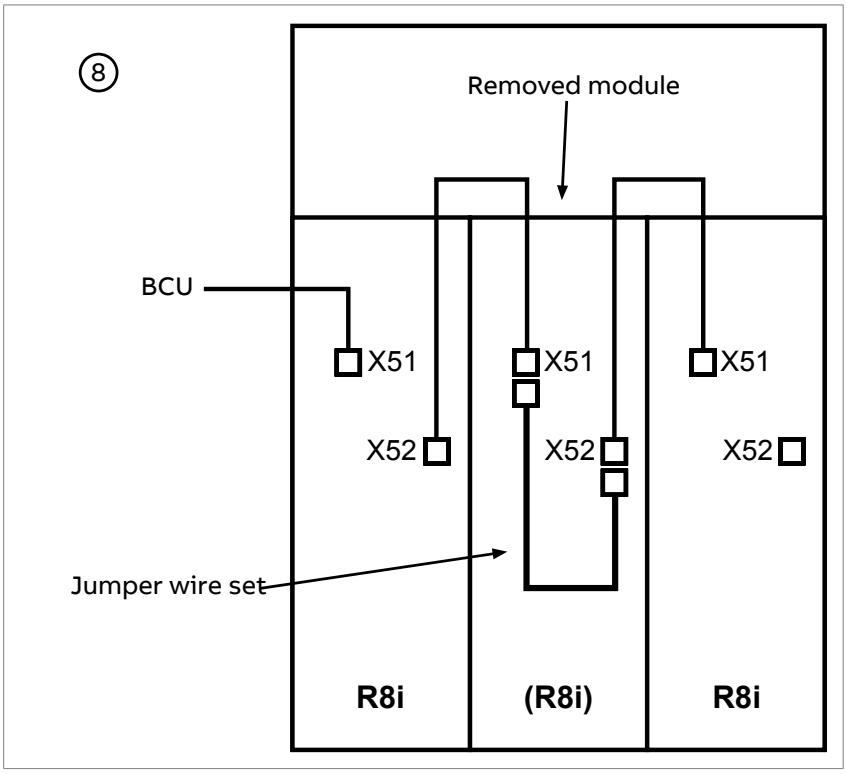
Note: The wiring accessories and the air baffle needed during the procedure are included in the delivery, and separately available from ABB.

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

1. Stop the drive and do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Remove the shrouding above the module bay (in front of the DC fuses).
3. Remove the DC fuses and the busbar assembly connecting the fuses to the inverter module. Store these parts – they are to be reinstalled only with the inverter module. Make note of the order of washers.
4. Remove the faulty module from its bay. See the module replacement instructions.
5. Plug the coolant pipes disconnected from the module using the plugs that are included in the drive delivery.
6. Install the air baffle (included) to the underside of the top module guide. Align the holes at the rear edge of the baffle with the guide pins of the rear support. Fasten the front edge of the baffle to the module mounting holes using the module mounting screws (2 × M8). Tighten to 9 N·m (6.6 lbf·ft).



7. If the inverter control unit (A41) is powered from the faulty module, connect the power supply wiring to another module using the extension wire set included.
8. If the Safe torque off (STO) function is in use, install the jumper wire set included in the STO wiring in place of the missing module. (This is not needed if the module was the last on the STO wire chain.)



9. Open the circuit breaker of the cooling fan of the removed module. Disconnect the control and power wiring of the fan.
10. Cover or remove the cooling fan.
11. Deactivate the control IOs of the fan in parameters *206.20 … 206.23*.
12. Reinstall all shrouding removed earlier.

Note: Do not reinstall the DC fuses or busbars but store them elsewhere until the module can be reinstalled.

13. In case the inverter unit has a DC switch/disconnector with a charging circuit, locate the BSFC-xx charging controller. On the controller, disable the channel of the removed module by using the appropriate DIP switch.
14. Switch on the power to the drive.
15. Enter the number of inverter modules present into parameter *95.13 Reduced run mode*.
16. Reset all faults and start the drive.
17. If the Safe torque off (STO) function is in use, perform a validation test. See the instructions in chapter The Safe torque off function (page 231).

The maximum current is now automatically limited according to the new inverter configuration. A mismatch between the number of detected modules (parameter *95.14*) and the value set in *95.13* will generate a fault.

Returning the module

1. Install the module in reverse order. Use the following tightening torques:
   - DC busbar assembly to upper insulators (2 × M8): 9 N·m (6.6 lbf·ft)
   - DC busbar assembly to lower insulators (2 × M10): 18 N·m (13.3 lbf·ft)
   - Fuses to DC busbars: 50 N·m (37 lbf·ft) (Bussmann), 46 N·m (34 lbf·ft) (Mersen/Ferraz-Shawmut)
   - Module to cabinet frame (4 × M8): 22 N·m (16 lbf·ft)
   - DC busbar assembly to module DC input (2 × M12): 70 N·m (52 lbf·ft)
2. Remove the plugs from the coolant pipes and reconnect the pipes to the module. See the module replacement instructions.
3. Restore the original wiring (STO and control unit power supply whenever needed).
4. Reinstall any removed fan(s). Reconnect the control and power supply wiring of the fan.
5. Set parameter *95.13* to 0 to disable the reduced run function.
6. Activate the control IOs of the fan in parameters *206.20 … 206.23*.
7. If the Safe torque off (STO) function is in use, perform an acceptance test. See the instructions in chapter The Safe torque off function (page 231).

Capacitors

The DC link of the drive contains several electrolytic capacitors. Operating time, load, and surrounding air temperature have an effect on the life of the capacitors. Capacitor life can be extended by decreasing the surrounding air temperature.

Capacitor failure is usually followed by damage to the unit and an input cable fuse failure, or a fault trip. If you think that any capacitors in the drive have failed, contact ABB.

Reforming the capacitors

The capacitors must be reformed if the drive has not been powered (either in storage or unused) for a year or more. The manufacturing date is on the type designation label. For information on reforming the capacitors, refer to Capacitor reforming instructions (3BFE64059629 [English]).

Control panel

Refer to ACS-AP-I, -S, -W and ACH-AP-H, -W Assistant control panels user's manual (3AUA0000085685 [English]).

Control units

BCU control unit types

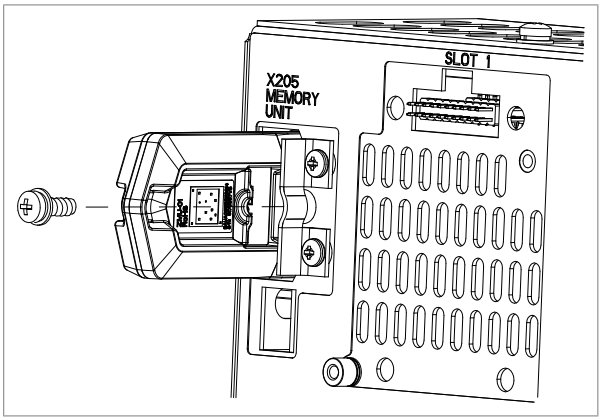
There are three variants of the BCU control unit used in ACS880 drives: BCU-02, BCU-12 and BCU-22. These have a different number of converter module connections (2, 7 and 12 respectively) but are otherwise identical. The three BCU types are interchangeable as long as the number of connections is sufficient. For example, the BCU-22 can be used as a direct replacement for both BCU-02 and BCU-12.

Replacing the memory unit

After replacing a control unit, you can keep the existing parameter settings by transferring the memory unit from the defective control unit to the new control unit.

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

1. Stop the drive and do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Make sure that the control unit is not powered.
3. Remove the fastening screw and pull the memory unit out.
4. Install a memory unit in reverse order.

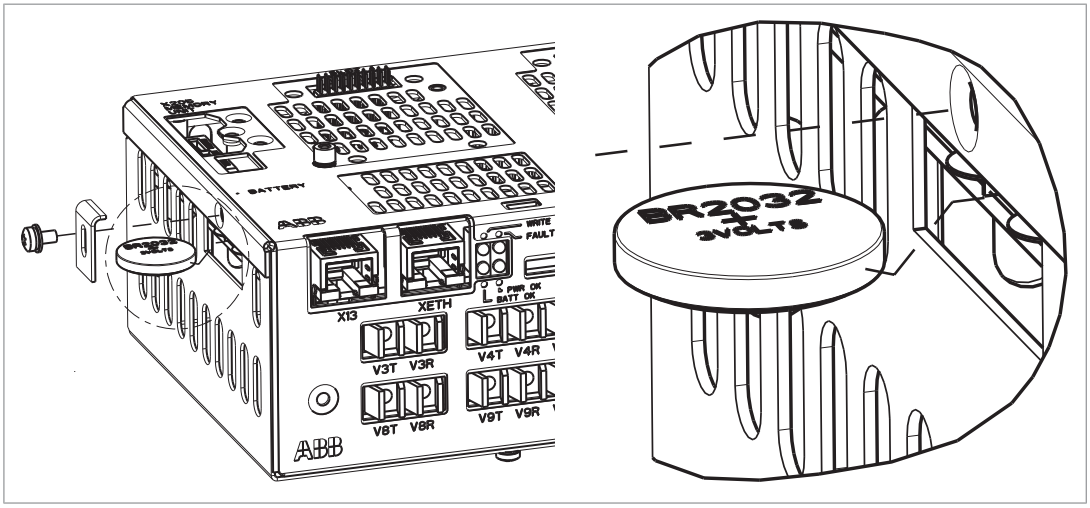


Replacing the BCU control unit battery

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

1. Stop the drive and do the steps in section Electrical safety precautions (page 19) before you start the work.
2. Undo the fastening screw and remove the battery.
3. Replace the battery with a new BR2032 battery.

4. Dispose of the old battery according to local disposal rules or applicable laws.
5. Set the real-time clock.



Functional safety components

The mission time of functional safety components is 20 years which equals the time during which failure rates of electronic components remain constant. This applies to the components of the standard Safe torque off circuit as well as any modules, relays and, typically, any other components that are part of functional safety circuits.

The expiry of mission time terminates the certification and SIL/PL classification of the safety function. The following options exist:

- Renewal of the whole drive and all optional functional safety module(s) and components.
- Renewal of the components in the safety function circuit. In practice, this is economical only with larger drives that have replaceable circuit boards and other components such as relays.

Note that some of the components may already have been renewed earlier, restarting their mission time. The remaining mission time of the whole circuit is however determined by its oldest component.

Contact your local ABB service representative for more information.

12

Internal cooling circuit

Contents of this chapter

The cooling system of a liquid-cooled drive consists of two circuits: the internal cooling circuit and the external cooling circuit. The internal cooling circuit covers the heat-generating electrical components of the drive and transfers the heat to the cooling unit. In the cooling unit, the heat is transferred to the external cooling circuit which is usually part of a larger external cooling system. This chapter deals with the internal cooling circuit.

Applicability

The information in this chapter is applicable to cabinet-built ACS880 liquid-cooled drives. Except where otherwise indicated, the information is also applicable to drives built out of ACS880 liquid-cooled multidrive modules.

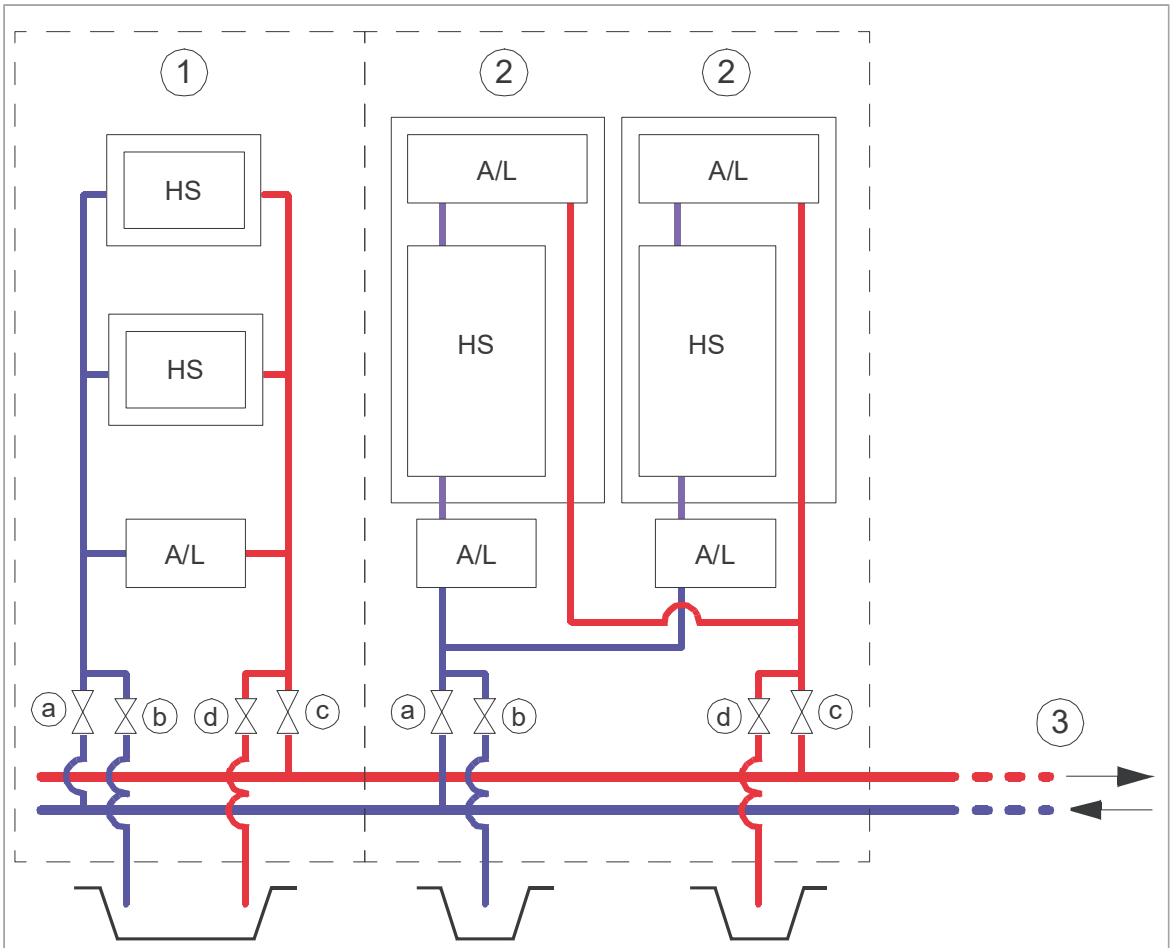
Internal cooling system

Each cubicle has an inlet and an outlet manifold, fitted with a stop valve and a drain valve. The stop valves can be closed to isolate all modules in the cubicle from the main cooling circuit.

In cabinet line-ups built by ABB, valves are color-coded:

- Blue – Open during operation
- Red – Closed during operation

The following diagram shows the coolant pipe connections in a drive system consisting of a supply unit and an inverter unit. Other units, such as brake units, DC/DC converter units have similar cooling arrangements. Other cubicles containing components that require cooling may also contain heat exchangers.



1	Supply modules. The drawing shows the configuration of a diode supply unit with two modules, ie. there is a common air-to-liquid exchanger in the cubicle. With an IGBT supply unit, each module has a dedicated air-to-liquid exchanger as shown for item 2.
2	Inverter modules
3	To/From cooling unit
A/L	Air-to-liquid heat exchanger
HS	Heat sink
a	Inlet valve
b	Inlet-side drain valve
c	Outlet valve
d	Outlet-side drain valve

The coolant used with ACS880 liquid-cooled drive systems is Antifrogen® L 25% or 50% mixture. See Coolant specification (page 176).

Connection to a cooling unit

Connection to an ACS880-1007LC cooling unit

Refer to ACS880-1007LC cooling unit user's manual (3AXD50000129607 [English]).

Connection to a custom cooling unit

General requirements

Equip the system with an expansion vessel to damp pressure rise due to volume changes when the temperature varies. Equip the system with a pump that provides a nominal flow and pressure. Keep the pressure within the limits specified in Technical data (page 176). Install a pressure regulator to make sure that the maximum permissible operating pressure is not exceeded.

Install a bleed valve at the highest point of the cooling circuit, and a drain valve at the lowest point.

The materials that can be used are listed in Cooling circuit materials (page 178).

Coolant temperature control

The temperature of the coolant in the internal cooling circuit must be kept within the limits specified in Technical data (page 176). Note that the minimum temperature is dependent on ambient temperature and relative humidity.

Filling up and bleeding the internal cooling circuit

Both the drive and coolant must be at room temperature before filling up the cooling circuit.

WARNING!
Make sure that the maximum permissible operating pressure is not exceeded. When necessary regulate the pressure to appropriate level by draining excess coolant out of the system.

WARNING!
Bleeding of the cooling circuit is very important and has to be done with great care. Air bubbles in the cooling circuit may reduce or completely block coolant flow and lead to overheating. Let the air out of the cooling system while filling in coolant and, eg. after any power module replacements.

Drive line-ups with an ACS880-1007LC cooling unit

Obey the filling up and bleeding instructions in ACS880-1007LC cooling unit user's manual (3AXD50000129607 [English]).

Drive line-ups with a custom cooling unit

Note:

- In filling up the system, the drain valves in the line-up are used only to vent the air from the circuit so that it can be displaced by the coolant. The actual bleeding of the circuit must be done via an external bleed valve installed at the highest point of the cooling circuit. The most practical location for the valve is usually near or at the cooling unit.
- Observe the instructions given by the manufacturer of the cooling unit. Pay special attention to filling up and bleeding the pumps properly as they may be damaged if operated when dry.
- Draining coolant into the sewer system is not allowed.

1. Open the bleed valve at the cooling unit.
2. Open the inlet valve and the outlet-side drain valve of one cubicle. Keep the outlet valve and the inlet-side drain valve closed.
3. Attach a hose to the outlet-side drain valve and lead it into a suitable container.
4. Fill the circuit with coolant. For coolant specification, see Coolant specification (page 176).
   To minimize foaming, do not exceed the filling flow rate of 5 l/min (1.3 US gallon/min).
5. As the piping and modules in the cubicle fills up, coolant starts to flow from the hose. Let some coolant flow out, then close the drain valve.
6. Close the inlet valve.
7. Repeat steps 2 to 6 for all cubicles in the line-up.
8. Open the inlet and outlet valves in all cubicles. Let any air remaining in the system out through the bleed valve at the cooling unit.

9. Close the bleed valve at the cooling unit.
10. Continue to fill in coolant until a base pressure of 100…150 kPa is achieved.
11. Open the bleed valve of the pump to let out any air.
12. Re-check the pressure and add coolant if necessary.
13. Start the coolant pump. Let any air remaining in the system out through the bleed valve at the cooling unit.
14. After one to two minutes, stop the pump or block the coolant flow with a valve.
15. Re-check the pressure and add coolant if necessary.
16. Repeat steps 13 to 15 a few times until all air is let out of the cooling circuit. Listen for a humming sound and/or feel the piping for vibration to find out if there is still air left in the circuit.

Draining the internal cooling circuit

The modules in each cubicle can be drained through the drain valves without draining the whole internal cooling circuit.

WARNING!
Hot, pressurized coolant can be present in the cooling circuit. Do not work on the cooling circuit before the pressure is released by stopping the pumps and draining coolant.

1. Attach hoses to each drain valve in the cubicle to be drained. Lead the hoses into a suitable container. Make sure the ends of the hoses are not immersed in coolant at any point so that air can displace the coolant in the system.
2. Open the drain valves. Wait until all coolant has drained.

   Note: Draining coolant into the sewer system is not allowed.
3. If required, dry the piping with compressed oil-free air of less than 6 bar.
4. If the drive is to be stored in temperatures below 0 °C (32 °F),
   - dry the cooling circuit with air,
   - fill the cooling circuit with coolant specified under Coolant specification (page 176).
   - drain the cooling circuit again.

Maintenance intervals

As a general rule, the quality of the coolant should be checked at intervals of two years. This can be done by distributors of Antifrogen® L (see www.clariant.com) if a 250 milliliter sample is provided.

Technical data

Coolant specification

Coolant type

Antifrogen® L (by Clariant International Ltd, www.clariant.com) 25% or 50% mixture, available from Clariant distributors and ABB Service representatives.

Note: Do not dilute the coolant. It is ready to use.

Antifrogen® L 25% mixture is usable in storage temperatures down to -16 °C (3.2 °F). Antifrogen® L 50% mixture is usable in storage temperatures down to -40 °C (-40 °F).

Note that operation below 0 °C (32 °F) is not permitted regardless of the freezing point of the coolant.

WARNING!
The warranty does not cover damage that occurs from the use of incorrect coolant.

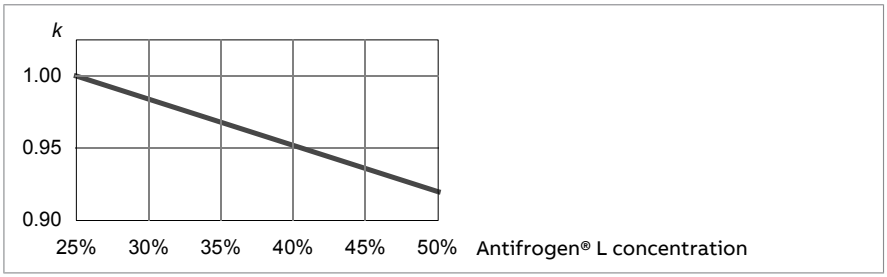
Temperature limits

Ambient temperature: See the technical data of the drive/unit.

Freeze protection: The freezing point of the coolant is determined by the concentration of heat transfer fluid in the mixture.

The higher the concentration of heat transfer fluid, the higher the viscosity of the coolant. This results in a higher pressure loss in the system. See Pressure limits (page 178).

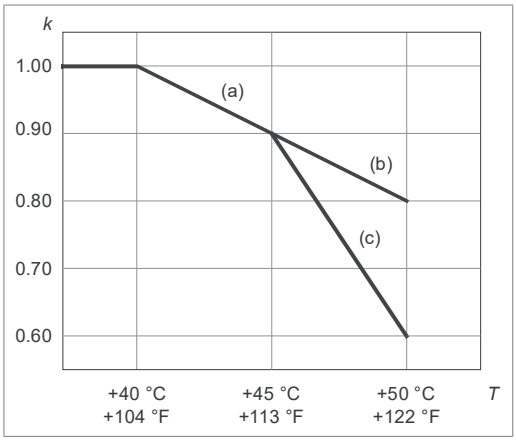
The nominal current ratings of drive system modules apply to an Antifrogen® L / water solution of 25/75% (volume). With the Antifrogen® L concentration between 25% and 50%, the drive output current must be derated by 1/3 percentage point per 1 p.p. increase in Antifrogen® L concentration. The drawing below shows the derating factor *(k)* in relation to Antifrogen® L concentration.



Incoming coolant temperature:

- 0…40 °C (32…104 °F): no drive output current derating required
- 40…45 °C (104…113 °F): drive output current must be derated by 2 percentage points per 1 °C (1.8 °F) temperature increase, as shown by curve (a).
- 45…50 °C (113…122 °F):
  - If components with a maximum operating temperature of 55 °C (131 °F) are installed in the same space as the drive modules, drive output current must be derated by 6 percentage points per 1 °C (1.8 °F) temperature increase, as shown by curve (c).
  - If there are no components with a maximum operating temperature of 55 °C (131 °F) installed in the same space as the drive modules, drive output current must be derated by 2 percentage points per 1 °C (1.8 °F) temperature increase, as shown by curve (b).

The drawing below shows the derating factor *(k)* in relation to coolant temperature.



1-phase (NBRW-669) brake modules (option +D150): 0…50 °C (32…122 °F): no current derating required

Condensation is not permitted. The minimum coolant temperature to avoid condensation (at an atmospheric pressure of 1 bar) is shown below as a function of relative humidity (RH) and ambient temperature (T_{air}).

T_{air} (°C)	Min. $T_{coolant}$ (°C)				
	RH = 95%	RH = 80%	RH = 65%	RH = 50%	RH = 40%
5	4.3	1.9	-0.9	-4.5	-7.4
10	9.2	6.7	3.7	-0.1	-3.0
15	14.2	11.5	8.4	4.6	1.5
20	19.2	16.5	13.2	9.4	6.0
25	24.1	21.4	17.9	13.8	10.5
30	29.1	26.2	22.7	18.4	15.0
35	34.1	31.1	27.4	23.0	19.4
40	39.0	35.9	32.2	27.6	23.8
45	44.0	40.8	36.8	32.1	28.2
50	49.0	45.6	41.6	36.7	32.8
55	53.9	50.4	46.3	42.2	37.1
	= Not permitted as standard but the coolant temperature must be 0 °C (32 °F) or more.				
Example:	At an air temperature of 45 °C and relative humidity of 65% the coolant temperature must not be less than +36.8 °C				

Maximum temperature rise: Depends on heat losses and mass flow. Typically 10 °C (18 °F) with nominal losses and flow.

Pressure limits

Base pressure: 250 kPa (recommended); 300 kPa (maximum). “Base pressure” denotes the pressure of the system compared with the atmospheric pressure when the cooling circuit is filled with coolant.

Air counterpressure in expansion vessel (with ACS880-1007LC cooling unit): 80 kPa

Design pressure (PS): 600 kPa

Nominal pressure difference: 120 kPa with Antifrogen® L 25% coolant solution, 140 kPa with Antifrogen® L 50% coolant solution. This has to be taken into account when dimensioning the liquid cooling circuit.

Maximum pressure difference: 160 kPa

Coolant flow rate limits

The maximum coolant flow rate for all drive equipment is 1.3 × nominal. See the technical data chapter for nominal values.

Cooling circuit materials

Materials used in the internal cooling circuit are listed below.

- stainless steel AISI 316L (UNS 31603)
- heavy gauge aluminum
- plastic materials such as PA, PEX and PTFE

  Note: PVC hoses are not suitable for use with antifreeze.
- rubber gasketing NBR (nitrile rubber).

WARNING!
If you connect external piping to the internal cooling circuit, use only materials that are specified above. Other materials can cause galvanic corrosion. If the external piping contains other materials, use a cooling unit with a heat exchanger (for example, ACS880-1007LC) to keep the external piping separate from the internal cooling circuit.

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Technical data

Contents of this chapter

This chapter contains the technical specifications of the drive, for example, the ratings, fuse data, sizes and technical requirements, provisions for fulfilling the requirements for CE and other markings.

Ratings

The nominal ratings for the drives with 50 Hz and 60 Hz supply are given below. The definitions are described below the table.

ACS880-07CLC-...	Input rating	Output ratings										
		No-overload use					Light-overload use			Heavy-duty use		
	I_1	I_2	I_{max}	P_N		S_N	I_{Ld}	P_{Ld}		I_{Hd}	P_{Hd}	
	A	A	A	kW	hp	kVA	A	kW	hp	A	kW	hp
U_N = 690 V, 6-pulse connection												
0390A-7	357	390	585	355	400	466	374	355	350	292	250	300
0430A-7	394	430	645	400	450	514	413	355	450	322	250	300
0480A-7	439	480	720	450	500	574	461	400	450	359	315	350
0530A-7	485	530	795	500	550	633	509	450	500	396	355	400
0600A-7	549	600	900	560	600	717	576	560	600	449	400	450
0670A-7	613	670	1005	630	700	801	643	630	700	501	450	500
0750A-7	686	750	1125	710	800	896	720	710	700	561	500	600
0850A-7	778	850	1275	800	900	1016	816	800	900	636	560	600
1030A-7	943	1030	1545	1000	1000	1231	989	900	1000	770	710	800
1170A-7	1071	1170	1755	1100	1250	1398	1123	1100	1250	875	800	900
1310A-7	1199	1310	1965	1200	1250	1566	1258	1200	1250	980	900	1000

ACS880-07CLC-...	Input rating	Output ratings										
		No-overload use					Light-overload use			Heavy-duty use		
	I_1	I_2	I_{max}	P_N		S_N	I_{Ld}	P_{Ld}		I_{Hd}	P_{Hd}	
	A	A	A	kW	hp	kVA	A	kW	hp	A	kW	hp
1470A-7	1345	1470	2205	1400	1500	1757	1411	1200	1500	1100	1000	1000
1660A-7	1519	1660	2490	1600	1750	1984	1594	1400	1750	1242	1200	1250
1940A-7	1775	1940	2910	1800	2000	2319	1862	1800	2000	1451	1400	1500
2180A-7	1995	2180	3270	2000		2605	2093	2000		1631	1400	1750
2470A-7	2261	2470	3705	2300		2952	2371	2300		1848	1800	2000
2880A-7	2636	2880	4320	2700		3442	2765	2700		2154	2000	
3260A-7	2984	3260	4890	3000		3896	3130	3000		2438	2300	
U_N = 690 V, 12-pulse connection												
0530A-7+A004	485	530	795	500	550	633	509	450	500	396	355	400
0600A-7+A004	549	600	900	560	600	717	576	560	600	449	400	450
0670A-7+A004	613	670	1005	630	700	801	643	630	700	501	450	500
0750A-7+A004	686	750	1125	710	800	896	720	710	700	561	500	600
0850A-7+A004	778	850	1275	800	900	1016	816	800	900	636	560	600
1030A-7+A004	943	1030	1545	1000	1000	1231	989	900	1000	770	710	800
1170A-7+A004	1071	1170	1755	1100	1250	1398	1123	1100	1250	875	800	900
1310A-7+A004	1199	1310	1965	1200	1250	1566	1258	1200	1250	980	900	1000
1470A-7+A004	1345	1470	2205	1400	1500	1757	1411	1200	1500	1100	1000	1000
1660A-7+A004	1519	1660	2490	1600	1750	1984	1594	1400	1750	1242	1200	1250
1940A-7+A004	1775	1940	2910	1800	2000	2319	1862	1800	2000	1451	1400	1500
2180A-7+A004	1995	2180	3270	2000		2605	2093	2000	TBA	1631	1400	1750
2470A-7+A004	2261	2470	3705	2300		2952	2371	2300	TBA	1848	1800	2000
2880A-7+A004	2636	2880	4320	2700		3442	2765	2700	TBA	2154	2000	
3260A-7+A004	2984	3260	4890	3000		3896	3130	3000	TBA	2438	2300	
3580A-7+A004	3276	3580	5370	3400		4279	3437	3200	TBA	2678	2600	
4050A-7+A004	3707	4050	6075	3800		4840	3888	3800	TBA	3029	2800	
4840A-7+A004	4430	4840	7260	4400		5784	4646	4400	TBA	3620	3500	
5650A-7+A004	5171	5650	8475	5200		6752	5424	5200	TBA	4226	4000	
6460A-7+A004	5912	6460	9690	6000		7720	6202	6000	TBA	4832	4700	
U_N = 690 V, 24-pulse connection												
2470A-7+A006	2261	2470	3705	2300		2952	2371	2300		1848	1800	
3260A-7+A006	2984	3260	4890	3000		3896	3130	3000		2438	2300	
4840A-7+A006	4430	4840	7260	4400		5784	4646	4400		3620	3500	
5650A-7+A006	5171	5650	8475	5200		6752	5424	5200		4226	4000	
6460A-7+A006	5912	6460	9690	6000		7720	6202	6000		4832	4700	

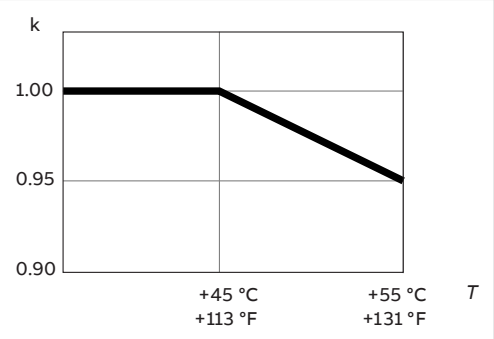
Definitions

U_N	Supply voltage range
I_1	Nominal rms input current
I_2	Nominal output current (available continuously with no over-loading)
I_{max}	Maximum output current. Available for 10 seconds at start, then as long as allowed by drive temperature.
P_N	Typical motor power in no-overload use.
S_N	Apparent power in no-overload use
I_{Ld}	Continuous rms output current allowing 10% overload for 1 minute every 5 minutes
P_{Ld}	Typical motor power in light-overload use
I_{Hd}	Continuous rms output current allowing 50% overload for 1 minute every 5 minutes
P_{Hd}	Typical motor power in heavy-duty use
Note 1: The ratings apply at an ambient air temperature of 45 °C (113 °F) and a coolant temperature of 40 °C (104 °F). **Note 2:** To achieve the rated motor power given in the table, the rated current of the drive must be higher than or equal to the rated motor current. The DriveSize dimensioning tool available from ABB is recommended for selecting the drive, motor and gear combination.	

Derating

Surrounding air temperature derating

In the temperature range +45…55 °C (+113…131 °F), the rated output current is derated by 0.5 percentage points for every added 1 °C (1.8 °F). The output current can be calculated by multiplying the current given in the rating table by the derating factor *(k)*:



Coolant temperature derating

See section Temperature limits (page 176).

Antifreeze content derating

See section Temperature limits (page 176).

Altitude derating

At altitudes from 0 to 2000 m (0 to 6562 ft), no derating is required. For altitudes above 2000 m (6562 ft), contact ABB.

Switching frequency derating

In the switching frequency range 3.0 … 7.5 kHz, the output current is derated by 8 percentage points for each kHz. For example, the derating factor for 5 kHz is 0.84.

Output frequency derating

Below the output frequency of 12 Hz, the output current is derated by 3.5 percentage points per each Hz. For example, the derating factor for 9 Hz is 0.895.

Above the output frequency of 150 Hz, the output current is derated by 1 percentage point per each 10 Hz. For example, the derating factor for 175 Hz is 0.975.

Frame sizes and power module types

ACS880-07CLC-...	Frame size	Supply modules used		Inverter modules used	
		Qty	Type	Qty	Type
U_N = 690 V, 6-pulse connection					
0390A-7	1×D8D + 1×R8i	1	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0390A-7
0430A-7	1×D8D + 1×R8i	1	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0430A-7
0480A-7	1×D8D + 1×R8i	1	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0480A-7
0530A-7	1×D8D + 1×R8i	1	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0530A-7
0600A-7	1×D8D + 1×R8i	1	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0600A-7
0670A-7	1×D8D + 1×R8i	1	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0670A-7
0750A-7	1×D8D + 1×R8i	1	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0750A-7
0850A-7	1×D8D + 1×R8i	1	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0850A-7
1030A-7	2×D8D + 2×R8i	2	ACS880-304LC-0820A-7+A019	2	ACS880-104LC-0530A-7
1170A-7	2×D8D + 2×R8i	2	ACS880-304LC-0820A-7+A019	2	ACS880-104LC-0600A-7
1310A-7	2×D8D + 2×R8i	2	ACS880-304LC-0820A-7+A019	2	ACS880-104LC-0670A-7
1470A-7	2×D8D + 2×R8i	2	ACS880-304LC-0820A-7+A019	2	ACS880-104LC-0750A-7
1660A-7	2×D8D + 2×R8i	2	ACS880-304LC-0820A-7+A019	2	ACS880-104LC-0850A-7
1940A-7	3×D8D + 3×R8i	3	ACS880-304LC-0820A-7+A019	3	ACS880-104LC-0670A-7
2180A-7	3×D8D + 3×R8i	3	ACS880-304LC-0820A-7+A019	3	ACS880-104LC-0750A-7
2470A-7	3×D8D + 3×R8i	3	ACS880-304LC-0820A-7+A019	3	ACS880-104LC-0850A-7
2880A-7	4×D8D + 4×R8i	4	ACS880-304LC-0820A-7+A019	4	ACS880-104LC-0750A-7
3260A-7	4×D8D + 4×R8i	4	ACS880-304LC-0820A-7+A019	4	ACS880-104LC-0850A-7
U_N = 690 V, 12-pulse connection					
0530A-7+A004	2×D8D + 1×R8i	2	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0530A-7
0600A-7+A004	2×D8D + 1×R8i	2	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0600A-7
0670A-7+A004	2×D8D + 1×R8i	2	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0670A-7
0750A-7+A004	2×D8D + 1×R8i	2	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0750A-7

ACS880-07CLC-...	Frame size	Supply modules used		Inverter modules used	
		Qty	Type	Qty	Type
0850A-7+A004	2×D8D + 1×R8i	2	ACS880-304LC-0820A-7+A019	1	ACS880-104LC-0850A-7
1030A-7+A004	2×D8D + 2×R8i	2	ACS880-304LC-0820A-7+A019	2	ACS880-104LC-0530A-7
1170A-7+A004	2×D8D + 2×R8i	2	ACS880-304LC-0820A-7+A019	2	ACS880-104LC-0600A-7
1310A-7+A004	2×D8D + 2×R8i	2	ACS880-304LC-0820A-7+A019	2	ACS880-104LC-0670A-7
1470A-7+A004	2×D8D + 2×R8i	2	ACS880-304LC-0820A-7+A019	2	ACS880-104LC-0750A-7
1660A-7+A004	2×D8D + 2×R8i	2	ACS880-304LC-0820A-7+A019	2	ACS880-104LC-0850A-7
1940A-7+A004	4×D8D + 3×R8i	4	ACS880-304LC-0820A-7+A019	3	ACS880-104LC-0670A-7
2180A-7+A004	4×D8D + 3×R8i	4	ACS880-304LC-0820A-7+A019	3	ACS880-104LC-0750A-7
2470A-7+A004	4×D8D + 3×R8i	4	ACS880-304LC-0820A-7+A019	3	ACS880-104LC-0850A-7
2880A-7+A004	4×D8D + 4×R8i	4	ACS880-304LC-0820A-7+A019	4	ACS880-104LC-0750A-7
3260A-7+A004	4×D8D + 4×R8i	4	ACS880-304LC-0820A-7+A019	4	ACS880-104LC-0850A-7
3580A-7+A004	6×D8D + 5×R8i	6	ACS880-304LC-0820A-7+A019	5	ACS880-104LC-0750A-7
4050A-7+A004	6×D8D + 5×R8i	6	ACS880-304LC-0820A-7+A019	5	ACS880-104LC-0850A-7
4840A-7+A004	6×D8D + 6×R8i	6	ACS880-304LC-0820A-7+A019	6	ACS880-104LC-0850A-7
5650A-7+A004	8×D8D + 7×R8i	8	ACS880-304LC-0820A-7+A019	7	ACS880-104LC-0850A-7
6460A-7+A004	8×D8D + 8×R8i	8	ACS880-304LC-0820A-7+A019	8	ACS880-104LC-0850A-7
U_N = 690 V, 24-pulse connection					
2470A-7+A006	4×D8D + 3×R8i	4	ACS880-304LC-0820A-7+A019	3	ACS880-104LC-0850A-7
3260A-7+A006	4×D8D + 4×R8i	4	ACS880-304LC-0820A-7+A019	4	ACS880-104LC-0850A-7
4840A-7+A006	8×D8D + 6×R8i	8	ACS880-304LC-0820A-7+A019	6	ACS880-104LC-0850A-7
5650A-7+A006	8×D8D + 7×R8i	8	ACS880-304LC-0820A-7+A019	7	ACS880-104LC-0850A-7
6460A-7+A006	8×D8D + 8×R8i	8	ACS880-304LC-0820A-7+A019	8	ACS880-104LC-0850A-7

Fuses

AC fuses

Notes:

- Fuses with higher current rating than the recommended ones must not be used.
- Fuses from other manufacturers can be used if they meet the ratings and the melting curve of the fuse does not exceed the melting curve of the fuse mentioned in the table.

ACS880-07CLC-...	Ultrarapid (aR) fuses at supply module input					
	Qty	A	A^2s at 660 V	V	Manufacturer	Type
U_N = 690 V, 6-pulse connection						
0390A…0850A-7	3	1400	2450000	690	Bussmann	170M6467
1030A…1660A-7	6					
1940A…2470A-7	9					
2880A…3260A-7	12					
U_N = 690 V, 12-pulse connection						
0530A…1660A-7+A004	6	1400	2450000	690	Bussmann	170M6467
1940A…3260A-7+A004	12					
3580A…4840A-7+A004	18					
5650A…6460A-7+A004	24					
U_N = 690 V, 24-pulse connection						
2470A…3260A-7+A006	12	1400	2450000	690	Bussmann	170M6467
4840A…6460A-7+A006	24					

DC fuses

The drive has DC fuses at the input of each inverter module.

Notes:

- Fuses with higher current rating than the recommended ones must not be used.
- Fuses from other manufacturers can be used if they meet the ratings and the melting curve of the fuse does not exceed the melting curve of the fuse mentioned in the table.

ACS880-07CLC-...	DC fuses at inverter module input				
	Qty	A	V	Manufacturer	Type
U_N = 690 V, 6-pulse connection					
0390A-7	2	800	1250	Bussmann	170M6546
0430A-7					
0480A-7	2	900	1100	Bussmann	170M6547

ACS880-07CLC-...	DC fuses at inverter module input				
	Qty	A	V	Manufacturer	Type
0530A-7	2	1000	1100	Bussmann	170M6548
0600A-7	2	1100	1000	Bussmann	170M6549
0670A-7	2	1250	1100	Bussmann	170M6500
0750A-7	2	1400	1100	Bussmann	170M6501
0850A-7					
1030A-7	4	1000	1100	Bussmann	170M6548
1170A-7	4	1100	1000	Bussmann	170M6549
1310A-7	4	1250	1100	Bussmann	170M6500
1470A-7	4	1400	1100	Bussmann	170M6501
1660A-7	4				
1940A-7	6	1250	1100	Bussmann	170M6500
2180A-7	6	1400	1100	Bussmann	170M6501
2470A-7	6				
2880A-7	8				
3260A-7	8				
U_N = 690 V, 12-pulse connection					
0530A-7+A004	2	1000	1100	Bussmann	170M6548
0600A-7+A004	2	1100	1000	Bussmann	170M6549
0670A-7+A004	2	1250	1100	Bussmann	170M6500
0750A-7+A004	2	1400	1100	Bussmann	170M6501
0850A-7+A004					
1030A-7+A004	4	1000	1100	Bussmann	170M6548
1170A-7+A004	4	1100	1000	Bussmann	170M6549
1310A-7+A004	4	1250	1100	Bussmann	170M6500
1470A-7+A004	4	1400	1100	Bussmann	170M6501
1660A-7+A004					
1940A-7+A004	6	1250	1100	Bussmann	170M6500
2180A-7+A004	6	1400	1100	Bussmann	170M6501
2470A-7+A004	6				
2880A-7+A004	8				
3260A-7+A004	8				
3580A-7+A004	10				
4050A-7+A004	10				
4840A-7+A004	12				
5650A-7+A004	14				
6460A-7+A004	16				
U_N = 690 V, 24-pulse connection					

ACS880-07CLC-...	DC fuses at inverter module input				
	Qty	A	V	Manufacturer	Type
2470A-7+A006	6	1400	1100	Bussmann	170M6501
3260A-7+A006	8				
4840A-7+A006	12				
5650A-7+A006	14				
6460A-7+A006	16				

Brake chopper DC fuses

Optional (+D150) single-phase brake choppers have two DC fuses each. The fuse type is Bussmann 170M5146 (630 A 1250 V).

For the fuses of three-phase dynamic brake units, see ACS880-607LC 3-phase dynamic brake units hardware manual (3AXD50000581627 [English]).

Dimensions and weights

See chapter Dimensions (page 211).

Free space requirements

The values are as required by cooling, maintenance and/or operation of the pressure relief (if present). Also obey the general mechanical installation instructions.

Front		Sides		Above	
mm	in.	mm	in.	mm	in.
1000	39	0	0	250	9.85

Cooling data and noise

ACS880-07CLC-...	Coolant flow		Heat dissipation	Noise
	l/min	US gal/min	kW	dB(A)
U_N = 690 V, 6-pulse connection				
0390A-7	28	7.4	8.6	67
0430A-7	28	7.4	9.3	67
0480A-7	28	7.4	10	67
0530A-7	28	7.4	11	67
0600A-7	28	7.4	13	67
0670A-7	28	7.4	14	67
0750A-7	28	7.4	16	67
0850A-7	28	7.4	18	67
1030A-7	54	14.3	22	69
1170A-7	54	14.3	25	69
1310A-7	54	14.3	27	69
1470A-7	54	14.3	31	69
1660A-7	54	14.3	35	69

ACS880-07CLC-...	Coolant flow		Heat dissipation	Noise
	l/min	US gal/min	kW	dB(A)
1940A-7	72	19	41	71
2180A-7	72	19	46	71
2470A-7	72	19	53	71
2880A-7	98	26	61	72
3260A-7	98	26	69	72
U_N = 690 V, 12-pulse connection				
0530A-7+A004	38	10.0	11	67
0600A-7+A004	38	10.0	13	67
0670A-7+A004	38	10.0	14	67
0750A-7+A004	38	10.0	16	67
0850A-7+A004	38	10.0	18	67
1030A-7+A004	54	14.3	22	69
1170A-7+A004	54	14.3	25	69
1310A-7+A004	54	14.3	27	69
1470A-7+A004	54	14.3	31	69
1660A-7+A004	54	14.3	35	69
1940A-7+A004	82	22	41	71
2180A-7+A004	82	22	46	71
2470A-7+A004	82	22	53	71
2880A-7+A004	98	26	61	72
3260A-7+A004	98	26	69	72
3580A-7+A004	126	33	76	73
4050A-7+A004	126	33	87	74
4840A-7+A004	142	38	104	74
5650A-7+A004	170	45	121	75
6460A-7+A004	186	49	138	75
U_N = 690 V, 24-pulse connection				
2470A-7+A006	82	22	53	71
3260A-7+A006	98	26	69	72
4840A-7+A006	154	41	103	74
5650A-7+A006	170	45	121	75
6460A-7+A006	186	49	138	75

Input cable sizes

This table gives typical cable sizes for:

- Marine-type cable with copper conductors such as Nexans MPRXCX® FLEXISHIP® EMC 0.6/1 (1.2) kV
- Industrial-type aluminum and copper cable types. The cable sizing is based on max. 9 cables laid on the cable trays side by side, three ladder type trays one on top of the other, ambient temperature 30 °C (EN 60204-1 and IEC 60364-5-52). A correction factor K = 0.70 is used.

ACS880-07CLC-...	Marine-type cable	Industrial-type cable		
	Copper	Aluminum with XLPE insulation	Aluminum with PVC insulation	Copper with PVC insulation
	mm²	mm²	mm²	mm²
U_N = 690 V, 6-pulse connection				
0390A-7	3 × (3 × 95)	2 × (3 × 120 + 41 Cu)	2 × (3 × 185 + 57 Cu)	2 × (3 × 150 + 70)
0430A-7	3 × (3 × 95)	2 × (3 × 150 + 41 Cu)	2 × (3 × 240 + 72 Cu)	2 × (3 × 150 + 70)
0480A-7	3 × (3 × 95)	2 × (3 × 185 + 57 Cu)	2 × (3 × 240 + 72 Cu)	2 × (3 × 150 + 70)
0530A-7	3 × (3 × 95)	2 × (3 × 185 + 57 Cu)	3 × (3 × 150 + 41 Cu)	2 × (3 × 185 + 95)
0600A-7	4 × (3 × 95)	2 × (3 × 240 + 72 Cu)	3 × (3 × 185 + 57 Cu)	2 × (3 × 240 + 120)
0670A-7	4 × (3 × 95)	3 × (3 × 150 + 41 Cu)	3 × (3 × 240 + 72 Cu)	3 × (3 × 150 + 70)
0750A-7	5 × (3 × 95)	3 × (3 × 185 + 57 Cu)	3 × (3 × 240 + 72 Cu)	3 × (3 × 185 + 95)
0850A-7	5 × (3 × 95)	3 × (3 × 240 + 72 Cu)	4 × (3 × 185 + 57 Cu)	4 × (3 × 150 + 70)
1030A-7	2 × 3 × (3 × 95)	2 × 2 × (3 × 185 + 57 Cu)	2 × 3 × (3 × 150 + 41 Cu)	2 × 2 × (3 × 185 + 95)
1170A-7	2 × 4 × (3 × 95)	2 × 2 × (3 × 240 + 72 Cu)	2 × 3 × (3 × 185 + 57 Cu)	2 × 2 × (3 × 240 + 120)
1310A-7	2 × 4 × (3 × 95)	2 × 3 × (3 × 150 + 41 Cu)	2 × 3 × (3 × 240 + 72 Cu)	2 × 2 × (3 × 240 + 120)
1470A-7	2 × 5 × (3 × 95)	2 × 3 × (3 × 185 + 57 Cu)	2 × 3 × (3 × 240 + 72 Cu)	2 × 3 × (3 × 185 + 95)
1660A-7	2 × 5 × (3 × 95)	2 × 3 × (3 × 240 + 72 Cu)	2 × 4 × (3 × 185 + 57 Cu)	2 × 3 × (3 × 185 + 95)
1940A-7	3 × 4 × (3 × 95)	3 × 4 × (3 × 120 + 41 Cu)	3 × 3 × (3 × 240 + 72 Cu)	3 × 2 × (3 × 240 + 120)
2180A-7	3 × 4 × (3 × 120)	3 × 4 × (3 × 150 + 41 Cu)	3 × 3 × (3 × 240 + 72 Cu)	3 × 3 × (3 × 150 + 70)
2470A-7	3 × 4 × (3 × 120)	3 × 4 × (3 × 150 + 41 Cu)	3 × 4 × (3 × 185 + 57 Cu)	3 × 3 × (3 × 185 + 95)
2880A-7	4 × 3 × (3 × 150)	4 × 3 × (3 × 185 + 57 Cu)	4 × 3 × (3 × 240 + 72 Cu)	4 × 3 × (3 × 150 + 70)
3260A-7	4 × 4 × (3 × 150)	4 × 3 × (3 × 240 + 72 Cu)	–	4 × 3 × (3 × 185 + 95)
U_N = 690 V, 12-pulse connection				
0530A-7+A004	2 × 2 × (3 × 95)	2 × (3 × 185 + 57 Cu)	2 × 2 × (3 × 95 + 29 Cu)	2 × (3 × 185 + 95)
0600A-7+A004	2 × 2 × (3 × 95)	2 × (3 × 240 + 72 Cu)	2 × 2 × (3 × 120 + 41 Cu)	2 × (3 × 240 + 120)

ACS880-07CLC-...	Marine-type cable	Industrial-type cable		
	Copper	Aluminum with XLPE insulation	Aluminum with PVC insulation	Copper with PVC insulation
	mm²	mm²	mm²	mm²
0670A-7+A004	2 × 2 × (3 × 95)	2 × 2 × (3 × 95 + 29 Cu)	2 × 2 × (3 × 150 + 41 Cu)	2 × 2 × (3 × 95 + 50)
0750A-7+A004	2 × 3 × (3 × 95)	2 × 2 × (3 × 120 + 41 Cu)	2 × 2 × (3 × 185 + 57 Cu)	2 × 2 × (3 × 120 + 70)
0850A-7+A004	2 × 3 × (3 × 95)	2 × 2 × (3 × 150 + 41 Cu)	2 × 2 × (3 × 185 + 57 Cu)	2 × 2 × (3 × 150 + 70)
1030A-7+A004	2 × 3 × (3 × 95)	2 × 2 × (3 × 185 + 57 Cu)	2 × 3 × (3 × 150 + 41 Cu)	2 × 2 × (3 × 185 + 95)
1170A-7+A004	2 × 4 × (3 × 95)	2 × 2 × (3 × 240 + 72 Cu)	2 × 3 × (3 × 185 + 57 Cu)	2 × 2 × (3 × 240 + 120)
1310A-7+A004	2 × 4 × (3 × 95)	2 × 3 × (3 × 150 + 41 Cu)	2 × 3 × (3 × 240 + 72 Cu)	2 × 2 × (3 × 240 + 120)
1470A-7+A004	2 × 5 × (3 × 95)	2 × 3 × (3 × 185 + 57 Cu)	2 × 4 × (3 × 185 + 57 Cu)	2 × 3 × (3 × 185 + 95)
1660A-7+A004	2 × 5 × (3 × 95)	2 × 3 × (3 × 240 + 72 Cu)	2 × 4 × (3 × 185 + 57 Cu)	2 × 3 × (3 × 185 + 95)
1940A-7+A004	4 × 3 × (3 × 95)	4 × 2 × (3 × 185 + 57 Cu)	4 × 2 × (3 × 240 + 72 Cu)	4 × 2 × (3 × 150 + 70)
2180A-7+A004	4 × 3 × (3 × 120)	4 × 2 × (3 × 240 + 72 Cu)	4 × 3 × (3 × 185 + 57 Cu)	4 × 2 × (3 × 185 + 95)
2470A-7+A004	4 × 3 × (3 × 120)	4 × 2 × (3 × 240 + 72 Cu)	4 × 3 × (3 × 185 + 57 Cu)	4 × 2 × (3 × 240 + 120)
2880A-7+A004	4 × 3 × (3 × 150)	4 × 3 × (3 × 185 + 57 Cu)	4 × 3 × (3 × 240 + 72 Cu)	4 × 3 × (3 × 150 + 70)
3260A-7+A004	4 × 4 × (3 × 150)	4 × 3 × (3 × 240 + 72 Cu)	–	4 × 3 × (3 × 185 + 95)
3580A-7+A004	6 × 4 × (3 × 95)	6 × 2 × (3 × 240 + 72 Cu)	6 × 3 × (3 × 185 + 57 Cu)	6 × 2 × (3 × 240 + 120)
4050A-7+A004	6 × 4 × (3 × 95)	6 × 3 × (3 × 150 + 41 Cu)	6 × 3 × (3 × 240 + 72 Cu)	6 × 3 × (3 × 150 + 70)
4840A-7+A004	6 × 4 × (3 × 120)	6 × 3 × (3 × 240 + 72 Cu)	6 × 4 × (3 × 185 + 57 Cu)	6 × 3 × (3 × 185 + 95)
5650A-7+A004	8 × 3 × (3 × 150)	8 × 3 × (3 × 185 + 57 Cu)	8 × 3 × (3 × 240 + 72 Cu)	8 × 3 × (3 × 150 + 70)
6460A-7+A004	8 × 4 × (3 × 150)	8 × 3 × (3 × 240 + 72 Cu)	–	8 × 3 × (3 × 185 + 95)
U_N = 690 V, 24-pulse connection				
2470A-7+A006	4 × 3 × (3 × 120)	4 × 2 × (3 × 240 + 72 Cu)	4 × 3 × (3 × 185 + 57 Cu)	4 × 2 × (3 × 240 + 120)
3260A-7+A006	4 × 4 × (3 × 150)	4 × 3 × (3 × 240 + 72 Cu)	–	4 × 3 × (3 × 185 + 95)
4840A-7+A006	6 × 4 × (3 × 120)	8 × 3 × (3 × 150 + 41 Cu)	8 × 3 × (3 × 185 + 57 Cu)	6 × 3 × (3 × 185 + 95)
5650A-7+A006	8 × 3 × (3 × 150)	8 × 3 × (3 × 185 + 57 Cu)	8 × 3 × (3 × 240 + 72 Cu)	8 × 3 × (3 × 150 + 70)
6460A-7+A006	8 × 4 × (3 × 150)	8 × 3 × (3 × 240 + 72 Cu)	–	8 × 3 × (3 × 185 + 95)

Output cable sizes

This table gives typical cable sizes for:

- Marine-type cable with copper conductors such as Nexans MPRXCX® FLEXISHIP® EMC 0.6/1 (1.2) kV
- Industrial-type aluminum and copper cable types. The cable sizing is based on max. 9 cables laid on the cable trays side by side, three ladder type trays one on top of the other, ambient temperature 30 °C (EN 60204-1 and IEC 60364-5-52). A correction factor K = 0.70 is used.

ACS880-07CLC-...	Marine-type cable	Industrial-type cable	
	Copper	Aluminum with PVC insulation	Copper with PVC insulation
	mm²	mm²	mm²
U_N = 690 V, 6-pulse connection			
0390A-7	3 × (3 × 95)	2 × (3 × 185 + 57 Cu)	2 × (3 × 150 + 70)
0430A-7	3 × (3 × 95)	2 × (3 × 240 + 72 Cu)	2 × (3 × 150 + 70)
0480A-7	3 × (3 × 95)	3 × (3 × 150 + 41 Cu)	2 × (3 × 185 + 95)
0530A-7	4 × (3 × 95)	3 × (3 × 185 + 57 Cu)	2 × (3 × 240 + 120)
0600A-7	4 × (3 × 95)	3 × (3 × 240 + 72 Cu)	2 × (3 × 240 + 120)
0670A-7	4 × (3 × 120)	3 × (3 × 240 + 72 Cu)	3 × (3 × 185 + 95)
0750A-7	4 × (3 × 120)	4 × (3 × 185 + 57 Cu)	3 × (3 × 185 + 95)
0850A-7	4 × (3 × 120)	4 × (3 × 240 + 72 Cu)	4 × (3 × 150 + 70)
1030A-7	2 × 4 × (3 × 95)	2 × 3 × (3 × 185 + 57 Cu)	2 × 2 × (3 × 240 + 120)
1170A-7	2 × 4 × (3 × 95)	2 × 3 × (3 × 185 + 57 Cu)	2 × 2 × (3 × 240 + 120)
1310A-7	2 × 4 × (3 × 95)	2 × 4 × (3 × 150 + 41 Cu)	2 × 3 × (3 × 150 + 70)
1470A-7	2 × 4 × (3 × 120)	2 × 4 × (3 × 185 + 57 Cu)	2 × 3 × (3 × 185 + 95)
1660A-7	2 × 4 × (3 × 120)	2 × 4 × (3 × 240 + 72 Cu)	2 × 3 × (3 × 240 + 120)
1940A-7	3 × 4 × (3 × 95)	3 × 3 × (3 × 240 + 72 Cu)	3 × 3 × (3 × 150 + 70)
2180A-7	3 × 4 × (3 × 120)	3 × 4 × (3 × 185 + 57 Cu)	3 × 3 × (3 × 185 + 95)
2470A-7	3 × 4 × (3 × 150)	3 × 4 × (3 × 240 + 72 Cu)	3 × 3 × (3 × 240 + 120)
2880A-7	4 × 4 × (3 × 120)	4 × 4 × (3 × 185 + 57 Cu)	4 × 3 × (3 × 185 + 95)
3260A-7	4 × 4 × (3 × 150)	4 × 4 × (3 × 240 + 72 Cu)	4 × 3 × (3 × 240 + 120)
U_N = 690 V, 12-pulse connection			
0530A-7+A004	4 × (3 × 95)	3 × (3 × 185 + 57 Cu)	2 × (3 × 240 + 120)
0600A-7+A004	4 × (3 × 95)	3 × (3 × 240 + 72 Cu)	2 × (3 × 240 + 120)
0670A-7+A004	4 × (3 × 120)	3 × (3 × 240 + 72 Cu)	3 × (3 × 185 + 95)
0750A-7+A004	4 × (3 × 120)	4 × (3 × 185 + 57 Cu)	3 × (3 × 185 + 95)
0850A-7+A004	4 × (3 × 120)	4 × (3 × 240 + 72 Cu)	4 × (3 × 150 + 70)
1030A-7+A004	2 × 4 × (3 × 95)	2 × 3 × (3 × 185 + 57 Cu)	2 × 2 × (3 × 240 + 120)
1170A-7+A004	2 × 4 × (3 × 95)	2 × 3 × (3 × 185 + 57 Cu)	2 × 2 × (3 × 240 + 120)
1310A-7+A004	2 × 4 × (3 × 95)	2 × 4 × (3 × 150 + 41 Cu)	2 × 3 × (3 × 150 + 70)
1470A-7+A004	2 × 4 × (3 × 120)	2 × 4 × (3 × 185 + 57 Cu)	2 × 3 × (3 × 185 + 95)
1660A-7+A004	2 × 4 × (3 × 120)	2 × 4 × (3 × 240 + 72 Cu)	2 × 3 × (3 × 240 + 120)
1940A-7+A004	3 × 4 × (3 × 95)	3 × 3 × (3 × 240 + 72 Cu)	3 × 3 × (3 × 150 + 70)

ACS880-07CLC-...	Marine-type cable	Industrial-type cable	
	Copper	Aluminum with PVC insulation	Copper with PVC insulation
	mm²	mm²	mm²
2180A-7+A004	3 × 4 × (3 × 120)	3 × 4 × (3 × 185 + 57 Cu)	3 × 3 × (3 × 185 + 95)
2470A-7+A004	3 × 4 × (3 × 150)	3 × 4 × (3 × 240 + 72 Cu)	3 × 3 × (3 × 240 + 120)
2880A-7+A004	4 × 4 × (3 × 120)	4 × 4 × (3 × 185 + 57 Cu)	4 × 3 × (3 × 185 + 95)
3260A-7+A004	4 × 4 × (3 × 150)	4 × 4 × (3 × 240 + 72 Cu)	4 × 3 × (3 × 240 + 120)
3580A-7+A004	5 × 4 × (3 × 120)	5 × 4 × (3 × 185 + 57 Cu)	5 × 3 × (3 × 185 + 95)
4050A-7+A004	5 × 4 × (3 × 150)	5 × 4 × (3 × 240 + 72 Cu)	5 × 3 × (3 × 240 + 120)
4840A-7+A004	6 × 4 × (3 × 150)	6 × 4 × (3 × 240 + 72 Cu)	6 × 4 × (3 × 150 + 70)
5650A-7+A004	7 × 4 × (3 × 150)	7 × 4 × (3 × 240 + 72 Cu)	7 × 3 × (3 × 240 + 120)
6460A-7+A004	8 × 4 × (3 × 150)	8 × 4 × (3 × 240 + 72 Cu)	8 × 4 × (3 × 185 + 95)
U_N = 690 V, 24-pulse connection			
2470A-7+A006	3 × 4 × (3 × 150)	3 × 4 × (3 × 240 + 72 Cu)	3 × 3 × (3 × 240 + 120)
3260A-7+A006	4 × 4 × (3 × 150)	4 × 4 × (3 × 240 + 72 Cu)	4 × 3 × (3 × 240 + 120)
4840A-7+A006	6 × 4 × (3 × 150)	6 × 4 × (3 × 240 + 72 Cu)	6 × 4 × (3 × 150 + 70)
5650A-7+A006	7 × 4 × (3 × 150)	7 × 4 × (3 × 240 + 72 Cu)	7 × 3 × (3 × 240 + 120)
6460A-7+A006	8 × 4 × (3 × 150)	8 × 4 × (3 × 240 + 72 Cu)	8 × 4 × (3 × 185 + 95)

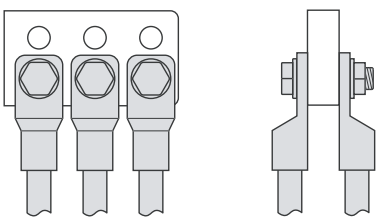
Terminal and cable entry data for the power cables

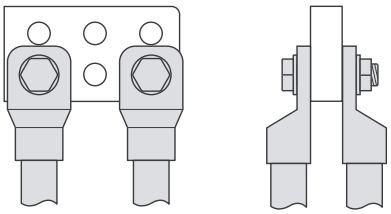
The locations and sizes of the cable entries are shown in the dimension drawings delivered with the drive, and the dimension drawing examples in this manual.

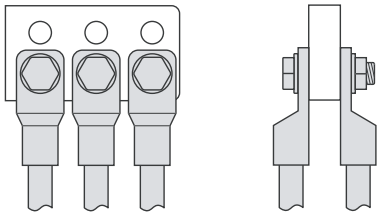
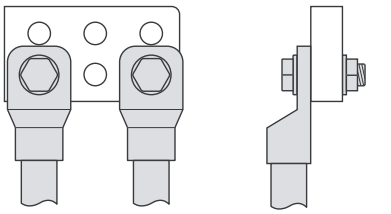
Busbar terminal material: Tin-plated copper.

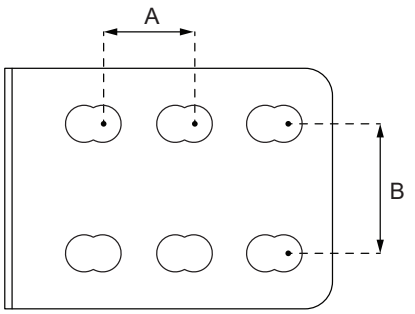
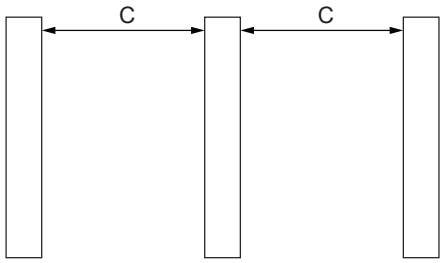
Terminal data for the motor cables

The maximum number of motor cables depends on the cable size, cable material, number of inverter modules and on the inverter unit cubicle width. Before you select motor cable sizes, check the inverter unit construction from the project-specific dimension drawings and use the tables below to determine the connection capability.

Maximum number of 3-phase motor cables (copper) for each inverter module, n×R8i with cable exit from bottom					
Cable cross section (mm²)	Copper compression cable lugs (DIN 46235)				Connection method
	1×R8i (300 mm cubicle)	1×R8i (400 mm cubicle)	2×R8i (500 mm cubicle)	3×R8i (700 mm cubicle)	
50	4 (6*)	6	5 (6*)	5 (6*)	
70	4 (6*)	6	5 (6*)	5 (6*)	
95	4 (6*)	6	5 (6*)	5 (6*)	

Maximum number of 3-phase motor cables (copper) for each inverter module, n×R8i with cable exit from bottom					
Cable cross section (mm^2)	Copper compression cable lugs (DIN 46235)				Connection method
	1×R8i (300 mm cubicle)	1×R8i (400 mm cubicle)	2×R8i (500 mm cubicle)	3×R8i (700 mm cubicle)	
120	4	4	4	4	
150	4	4	4	4	
185	4	4	4	4	
240	4	4	4	4	
300	-	-	-	-	-
* Requires additional engineering. Standard cable entry plate not suitable.					

Maximum number of 3-phase motor cables (aluminum) for each inverter module, n×R8i with cable exit from bottom					
Cable cross section (mm^2)	Aluminum compression cable lugs (DIN 46329)				Connection method
	1×R8i (300 mm cubicle)	1×R8i (400 mm cubicle)	2×R8i (500 mm cubicle)	3×R8i (700 mm cubicle)	
50	4 (6*)	6	5 (6*)	5 (6*)	
70	4 (6*)	6	5 (6*)	5 (6*)	
95	4 (6*)	6	5 (6*)	5 (6*)	
120	4	6	5	5	
150	4	6	5	5	
185	4	6	5	5	
240	2	2	2	2	
300	2*	2*	2*	2*	
* Requires additional engineering. Standard cable entry plate not suitable.					

Output terminal dimensions, n×R8i							
Distance between adjacent holes, horizontal (A)		Distance between adjacent holes, vertical (B)		Maximum distance between terminal surfaces (C)		Maximum cable lug diameter (including possible shrink hose)	
mm	in	mm	in	mm	in	mm	in
30.5*	1.2*	44.5	1.75	67	2.63	29	1.14
Side view 				Front view 			
* The maximum cable lug width for the leftmost hole is 42 mm (1.65 in).							

Terminal data for the supply and inverter control units

See chapter Control units of the drive (page 123).

Terminal data for block X504

Cables accepted by the terminals:

- solid wire 0.08 … 4 mm^2 (28…12 AWG)
- stranded wire with ferrule 0.14 … 2.5 mm^2 (24…12 AWG)
- stranded wire without ferrule 0.08 … 2.5 mm^2 (28…12 AWG).

Stripping length: 10 mm (0.4 in).

Electrical power network specification

Voltage (U_1)	690 V units: IEC: 525…690 V AC 3-phase ± 10% In corner-grounded TN systems: 525…600 V AC UL/CSA: 525…600 V AC This is indicated in the type designation label as typical input voltage levels (3~ 525/600/690 V AC).
Network type	TN (grounded) and IT (ungrounded) systems
Frequency	50/60 Hz, variation ± 5% of nominal frequency
Imbalance	Max. ± 3% of nominal phase-to-phase input voltage
Short-circuit withstand strength (IEC/EN 61439-1)	Rated peak withstand current (I_{pk}): 143 kA Rated short-time withstand current (I_{cw}): 65 kA/1 s

Short-circuit current protection (UL 508A, CSA C22.2 No. 14-13)	The drive is suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes at 600 V maximum when the input cable is protected with class T fuses.
Fundamental power factor (cos phi_1)	0.97 … 0.98 (at nominal load)
Transformer specification for 12-pulse supply (IEC 60076-1:2011)	Connection: Dy 11 d0 or Dyn 11 d0 Phase shift between secondaries: 30° electrical Voltage difference between secondaries: < 0.5% Short-circuit impedance of secondaries: > 5% Short-circuit impedance difference between secondaries: ≤ 10% of the percentage impedance To avoid a potentially destructive DC voltage level in an earth fault situation, grounding of the secondaries is not allowed. Static shielding is recommended.

Motor connection data

Motor types	Asynchronous AC induction motors, permanent magnet synchronous motors and AC induction servomotors, ABB synchronous reluctance (SynRM) motors
Voltage (U_2)	0 … U_1, 3-phase symmetrical, U_{max} at the field weakening point
Frequency (f_2)	0…500 Hz • For higher operational output frequencies, please contact your local ABB representative. • Operation outside the range of 12…150 Hz requires derating. See the derating information.
Current	See the rating tables.
Switching frequency	3 kHz (typical). The switching frequency can vary per frame and voltage. For exact values, contact your local ABB representative.
Maximum recommended motor cable length	500 m (1640 ft). **Note:** Longer cables cause a motor voltage decrease which limits the available motor power. The decrease depends on the motor cable length and characteristics. Contact ABB for more information. **Note:** With motor cables longer than 150 m (492 ft) the EMC Directive requirements may not be fulfilled.

External auxiliary voltage connections

Control voltage supply

ACS880-07CLC-…	Control voltage supply (230/115 V)					
	Power requirement approx.	Minimum short-circuit current		Cable size recommendation		Terminal torque (Q20, ABB OT40)
		230 V	115 V	230 V	115 V	
	VA	A	A	mm²	mm²	N·m (lbf·in)
0390A-7 0430A-7 0480A-7 0530A-7 (+A004) 0600A-7 (+A004) 0670A-7 (+A004) 0750A-7 (+A004) 0850A-7 (+A004)	1330	125	190	3 × 2.5 / 2.5	3 × 6 / 6	0.8 (7.1)

ACS880-07CLC-...	Control voltage supply (230/115 V)					
	Power requirement approx.	Minimum short-circuit current		Cable size recommendation		Terminal torque (Q20, ABB OT40)
		230 V	115 V	230 V	115 V	
	VA	A	A	mm²	mm²	N·m (lbf·in)
1030A-7 (+A004) 1170A-7 (+A004) 1310A-7 (+A004) 1470A-7 (+A004) 1660A-7 (+A004)	1380	125	190	3 × 2.5 / 2.5	3 × 6 / 6	0.8 (7.1)
1940A-7 (+A004) 2180A-7 (+A004) 2470A-7 (+A004) (+A006)	1440	125	190	3 × 2.5 / 2.5	3 × 6 / 6	0.8 (7.1)
2880A-7 (+A004) 3260A-7 (+A004) (+A006)	1490	125	190	3 × 2.5 / 2.5	3 × 6 / 6	0.8 (7.1)
3580A-7+A004 4050A-7+A004	1550	125	240	3 × 2.5 / 2.5	3 × 6 / 6	0.8 (7.1)
4840A-7+A004 4840A-7+A006	1600	125	240	3 × 2.5 / 2.5	3 × 6 / 6	0.8 (7.1)
5650A-7+A004 5650A-7+A006	1660	125	240	3 × 2.5 / 2.5	3 × 6 / 6	0.8 (7.1)
6460A-7+A004 6460A-7+A006	1710	125	240	3 × 2.5 / 2.5	3 × 6 / 6	0.8 (7.1)

Cooling fan supply

ACS880-07CLC-...	Cooling fan supply (230/115 V)					
	Power requirement approx.	Minimum short-circuit current		Cable size recommendation		Terminal torque (Q22, ABB OT40)
		230 V	115 V	230 V	115 V	
	VA	A	A	mm²	mm²	N·m (lbf·in)
0390A-7 0430A-7 0480A-7 0530A-7 (+A004) 0600A-7 (+A004) 0670A-7 (+A004) 0750A-7 (+A004) 0850A-7 (+A004)	810	125	125	3 × 2.5 / 2.5	3 × 2.5 / 2.5	0.8 (7.1)
1030A-7 (+A004) 1170A-7 (+A004) 1310A-7 (+A004) 1470A-7 (+A004) 1660A-7 (+A004)	1110	125	155	3 × 2.5 / 2.5	3 × 2.5 / 2.5	0.8 (7.1)
1940A-7 2180A-7 2470A-7	1410	125	190	3 × 2.5 / 2.5	3 × 6 / 6	0.8 (7.1)
1940A-7+A004 2180A-7+A004 2470A-7+A004 2470A-7+A006	1410	125	240	3 × 2.5 / 2.5	3 × 6 / 6	0.8 (7.1)
2880A-7 (+A004) 3260A-7 (+A004) (+A006)	1720	125	240	3 × 2.5 / 2.5	3 × 6 / 6	0.8 (7.1)

ACS880-07CLC-...	Cooling fan supply (230/115 V)					
	Power requirement approx.	Minimum short-circuit current		Cable size recommendation		Terminal torque (Q22, ABB OT40)
		230 V	115 V	230 V	115 V	
	VA	A	A	mm²	mm²	N·m (lbf·in)
3580A-7+A004 4050A-7+A004	2380	190	385	3 × 6 / 6	3 × 10 / 10	0.8 (7.1)
4840A-7+A004 4840A-7+A006	2680	190	385	3 × 6 / 6	3 × 10 / 10	0.8 (7.1)
5650A-7+A004 5650A-7+A006	2980	240	385	3 × 6 / 6	3 × 10 / 10	0.8 (7.1)
6460A-7+A004 6460A-7+A006	3290	240	385	3 × 6 / 6	3 × 10 / 10	0.8 (7.1)

Charging circuit supply

ACS880-07CLC-...	Charging circuit supply (525…690 V)		
	Minimum short-circuit current	Cable size recommendation	Terminal torque (Q3, ABB OS40)
	A	mm²	N·m (lbf·in)
0390A-7 0430A-7 0480A-7 0530A-7(+A004) 0600A-7(+A004) 0670A-7(+A004) 0750A-7(+A004) 0850A-7(+A004) 1030A-7(+A004) 1170A-7(+A004) 1310A-7(+A004) 1470A-7(+A004) 1660A-7(+A004) 1940A-7 2180A-7 2470A-7	90	3 × 2.5 / 2.5	2.0 (18)
1940A-7+A004 2180A-7+A004 2470A-7+A004 2470A-7+A006 2880A-7(+A004) 3260A-7(+A004)(+A006) 3580A-7+A004 4050A-7+A004 4840A-7+A004	140	3 × 6 / 6	2.0 (18)
4840A-7+A006 5650A-7+A004 5650A-7+A006 6460A-7+A004 6460A-6+A006	240	3 × 10 / 10	2.0 (18)

Lighting and heating supply

ACS880-07CLC-...	Lighting and heating supply (230/115 V)					
	Power requirement approx.	Minimum short-circuit current		Cable size recommendation		Terminal torque (Q95, ABB OT40)
		230 V	115 V	230 V	115 V	
	VA	A	A	mm²	mm²	N·m (lbf·in)
All types	990	60	125	3 × 1.5 / 1.5	3 × 2.5 / 2.5	0.8 (7.1)

Relay contact data for control of external main contactor/breaker

General

The external main contactor or breaker is controlled by the drive through relay K3. The relay has one normally-open (NO) and one normally-closed (NC) contact.

Emergency stop options add a relay (K640) to the drive. To trip the main breaker upon an emergency stop, one of the output switchover contacts of the relay must be wired to the undervoltage coil.

The contacts of both relays are wired to a terminal block in the drive cubicle; see the drive-specific circuit diagrams for details. The external voltage switched by the contacts is to be connected to the same terminal block.

K3 contact data

- Rated operational AC current (I_e) (IEC/EN 60947-5-1 AC 15):
  - 24…127 V, 50/60 Hz: 6 A
  - 220…240 V, 50/60 Hz: 4 A
  - 400…440 V, 50/60 Hz: 3 A
  - 500 V, 50/60 Hz: 2 A
  - 690 V, 50/60 Hz: 2 A
- Rated making/breaking capacity (IEC/EN 60947-5-1 AC 15): 10 × I_e AC
- Rated operational DC current (I_e) (IEC/EN 60947-5-1 DC 13):
  - 24 V DC: 6 A / 144 W
  - 48 V DC: 2.8 A / 134 W
  - 72 V DC: 1 A / 72 W
  - 110 V DC: 0.55 A / 60 W
  - 125 V DC: 0.55 A / 69 W
  - 220 V DC: 0.27 A / 60 W
  - 250 V DC: 0.27 A / 68 W
  - 400 V DC: 0.15 A / 60 W
  - 500 V DC: 0.13 A / 65 W
  - 600 V DC: 0.1 A / 60 W
- Rated short-time withstand current: 100 A for 1.0 s, 140 A for 0.1 s
- Minimum switching capacity: 12 V / 3 mA

K640 contact data

- Switching power: 3 VA or 3 W minimum, 2000 VA or 200 W maximum
- Switching capacity, AC (IEC/EN 60947-5-1 AC 15):
  - NC: 230 V, 1 A
  - NO: 230 V, 3 A
- Switching capacity, DC (IEC/EN 60947-5-1 DC 13):
  - NC / NO: 24 V, 2 A
- Switching capacity (UL 508): R300

Efficiency

97.8 … 97.9% at nominal power level depending on drive type

The efficiency is not calculated according to the ecodesign standard IEC 61800-9-2.

Energy efficiency data (ecodesign)

Energy efficiency data according to IEC-61800-9-2 is available from https://ecodesign.drivesmotors.abb.com and from ACS880-07CLC drives energy efficiency data (EU ecodesign) supplement (3AXD50000788415 [English]).

Optical components

The specifications of the optic cable are as follows:

- Storage temperature: -55 … +85 °C (-67 … +185 °F)
- Installation temperature: -20 … +70 °C (-4 … +158 °F)
- Maximum short-term tensile force: 50 N (11.2 lbf)
- Minimum short-term bend radius: 25 mm (1.0 in)
- Minimum long-term bend radius: 35 mm (1.4 in)
- Maximum long-term tensile load: 1 N (3.6 ozf)
- Flexing: Max. 1000 cycles

ABB drive products in general utilize 5 and 10 MBd (megabaud) optical components from Avago Technologies' Versatile Link range. Note that the optical component type is not directly related to the actual communication speed.

Note: The optical components (transmitter and receiver) on a fiber optic link must be of the same type.

Plastic optical fiber (POF) cables can be used with both 5 MBd and 10 MBd optical components. 10 MBd components also enable the use of Hard Clad Silica (HCS®) cables, which allow longer connection distances thanks to their lower attenuation. HCS® cables cannot be used with 5 MBd optical components.

The maximum lengths of fiber optic links for POF and HCS® cables are 20 and 200 meters (65.6 ft and 656 ft) respectively.

Protection classes

Degrees of protection (IEC/EN 60529)	IP42 (standard), IP54 (option +B055)
Enclosure types (UL50)	UL Type 1 (standard), UL Type 12 (option +B055). For indoor use only.
Overvoltage category (IEC/EN 60664-1)	III, except for auxiliary power connections (fan, control, heating, lighting, cooling unit pump etc) which are category II.
Protective class (IEC/EN 61800-5-1)	I

Ambient conditions

Environmental limits for the drive are given below. The drive is to be used in a heated, indoor, controlled environment.

	Operation installed for stationary use	**Storage in the protective package**	**Transportation in the protective package**
Installation site altitude	0…2000 m (0…6562 ft) above sea level. For altitudes over 2000 m, contact ABB. Output derated above 1000 m (3281 ft).	-	-
Air temperature	0 … +45 °C (+32 … +113 °F), no condensation allowed. Output derated in the range +45 … +55 °C (+113 … +131 °F). For UL and CSA compliant installations, the maximum surrounding air temperature is 40 °C (104 °F).	-40 … +70 °C (-40 … +158 °F)	-40 … +70 °C (-40 … +158 °F)
Relative humidity	Max. 95%	Max. 95%	Max. 95%
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination	IEC/EN 60721-3-3:2002 Chemical gases: Class 3C2 Solid particles: Class 3S2. No conductive dust allowed.	IEC 60721-3-1:1997 Chemical gases: Class 1C2 Solid particles: Class 1S3 (packing must support this, otherwise 1S2)	IEC 60721-3-2:1997 Chemical gases: Class 2C2 Solid particles: Class 2S2
Pollution degree IEC/EN 60664-1	2		
Vibration IEC/EN 61800-5-1 IEC 60068-2-6:2007, EN 60068-2-6:2008	IEC/EN 60721-3-3:2002 10…57 Hz: max. 0.075 mm amplitude 57…150 Hz: 1 *g* Units with marine construction (option +C121): Max. 1 mm (0.04 in) (5 … 13.2 Hz), max. 0.7 *g* (13.2 … 100 Hz) sinusoidal	IEC/EN 60721-3-1:1997 10…57 Hz: max. 0.075 mm amplitude 57…150 Hz: 1 *g*	IEC/EN 60721-3-2:1997 2…9 Hz: max. 3.5 mm amplitude 9…200 Hz: 10 m/s^2 (32.8 ft/s^2)
Shock IEC 60068-2-27:2008, EN 60068-2-27:2009	Not allowed	With packing max. 100 m/s^2 (328 ft/s^2) 11 ms	With packing max. 100 m/s^2 (328 ft/s^2) 11 ms

Colors

RAL Classic 7035, RAL Classic 9017.

Materials

Drive

Refer to Recycling instructions and environmental information for ACS880 cabinet-installed drives and multidrive modules (3AXD50000153909 [English]).

Packaging of drive

- Plywood[1)]
- Wood
- PET (strapping)
- PE (VCI foil)
- Metal (fixing clamps, screws)
- VCI emitter capsules
- Clay desiccant.

1) Seaworthy package only

Packaging of options

- Cardboard
- Kraft paper
- PP (straps)
- PE (foil, bubble wrap)
- Plywood, wood (only for heavy components).

Materials vary according to the item type, size and shape. Typical package consists of a cardboard box with paper filling or bubble wrap. ESD-safe packing materials are used for printed circuit boards and similar items.

Manuals

Printed product manuals are recyclable paper. Product manuals are available on the Internet.

Disposal

The main parts of the drive can be recycled to preserve natural resources and energy. Product parts and materials should be dismantled and separated.

Generally all metals, such as steel, aluminum, copper and its alloys, and precious metals can be recycled as material. Plastics, rubber, cardboard and other packaging material can be used in energy recovery. Printed circuit boards and large electrolytic capacitors need selective treatment according to IEC 62635 guidelines. To aid recycling, plastic parts are marked with an appropriate identification code.

Contact your local ABB distributor for further information on environmental aspects and recycling instructions for professional recyclers. End of life treatment must follow international and local regulations. See ACS880 cabinet-installed drives and multidrive modules recycling instructions and environmental information (3AXD50000153909 [English]).

Applicable standards

Standard	Information
European electrical safety	
EN 61800-5-1:2007 + A1:2017 + A11:2021 IEC 61800-5-1:2007 + Amd1:2016	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements – Electrical, thermal and energy
EMC performance	
EN 61800-3:2004 + A1:2012 *IEC 61800-3 ed. 2.1 (2007 + Amd1:2011)	Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods *For compliance with IEC 61800-3 ed. 3.0 (2017), please contact ABB.
IEC 60533:2015	Electrical and electronic installations in ships - Electromagnetic compatibility (EMC) - Ships with a metallic hull
Product requirements in North America	
UL 508A: 2nd edition	Industrial Control Panels
CSA C22.2 No. 14-18, 13th edition	Industrial Control Equipment
Enclosure and environmental protection	
EN 60529:1991 + A2:2013 + AC:2019 IEC 60529:1989 + Amd1:1999 + Amd2:2013	Degrees of protection provided by enclosures (IP code)
UL 50: 12th edition	Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 50E: 1st edition	Enclosures for Electrical Equipment, Environmental Considerations
CSA C22.2 No. 94.1-15	Enclosures for Electrical Equipment, Non-Environmental Considerations
CSA C22.2 No. 94.2-15	Enclosures for Electrical Equipment, Environmental Considerations

Markings

These markings are attached to the drive:

CE	CE mark Product complies with the applicable European Union legislation. For fulfilling the EMC requirements, see the additional information concerning the drive EMC compliance (IEC/EN 61800-3).
UKCA	UKCA (UK Conformity Assessed) mark Product complies with the applicable United Kingdom’s legislation (Statutory Instruments). Marking is required for products being placed on the market in Great Britain (England, Wales and Scotland).
c UL us LISTED	UL Listed mark for USA and Canada Product has been tested and evaluated against the relevant North American standards by the Underwriters Laboratories. Valid with rated voltages up to 600 V.
TÜV NORD Safety Approved	TÜV Safety Approved mark (functional safety) Product contains Safe torque off and possibly other (optional) safety functions which are certified by TÜV according to the relevant functional safety standards. Applicable to drives and inverters; not applicable to supply, brake or DC/DC converter units or modules.

EAC	EAC (Eurasian Conformity) mark Product complies with the technical regulations of the Eurasian Customs Union. EAC mark is required in Russia, Belarus and Kazakhstan.

	Electronic Information Products (EIP) symbol including an Environment Friendly Use Period (EFUP). Product is compliant with the People's Republic of China Electronic Industry Standard (SJ/T 11364-2014) about hazardous substances. The EFUP is 20 years. China RoHS II Declaration of Conformity is available from https://library.abb.com.

	RCM mark Product complies with Australian and New Zealand requirements specific to EMC, telecommunications and electrical safety. For fulfilling the EMC requirements, see the additional information concerning the drive EMC compliance (IEC/EN 61800-3).

	WEEE mark At the end of life the product should enter the recycling system at an appropriate collection point and not placed in the normal waste stream.

EMC compliance (IEC/EN 61800-3)

Definitions

EMC stands for Electromagnetic Compatibility. It is the ability of electrical/electronic equipment to operate without problems within an electromagnetic environment. Likewise, the equipment must not disturb or interfere with any other product or system within its locality.

First environment includes establishments connected to a low-voltage network which supplies buildings used for domestic purposes.

Second environment includes establishments connected to a network not supplying domestic premises.

Drive of category C1: drive of rated voltage less than 1000 V and intended for use in the first environment.

Drive of category C2: drive of rated voltage less than 1000 V and intended to be installed and started up only by a professional when used in the first environment.

Note: A professional is a person or organization having necessary skills in installing and/or starting up power drive systems, including their EMC aspects.

Drive of category C3: drive of rated voltage less than 1000 V and intended for use in the second environment and not intended for use in the first environment.

Drive of category C4: drive of rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment.

Category C3

The drive complies with the standard with the following provisions:

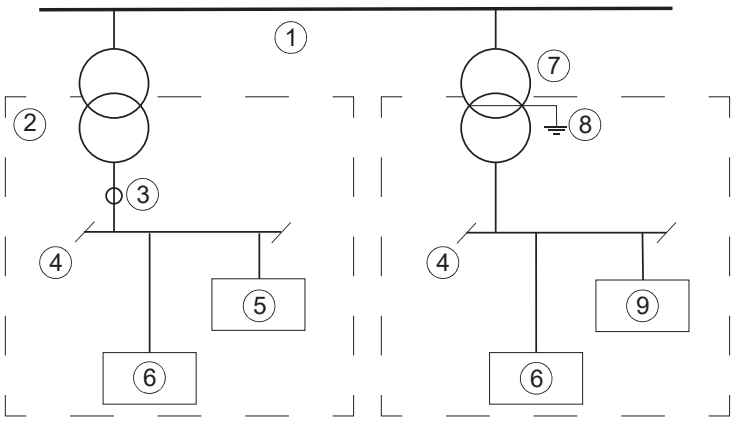
1. The drive is installed according to the instructions given in the appropriate drive hardware manual.
2. Maximum motor cable length is 100 meters (328 ft).

WARNING!
A drive of category C3 is not intended to be used on a low-voltage public network which supplies domestic premises. Radio frequency interference is expected if the drive is used on such a network.

Category C4

The drive complies with the C4 category with these provisions:

1. It is made sure that no excessive emission is propagated to neighboring low-voltage networks. In some cases, the natural suppression in transformers and cables is sufficient. If in doubt, a supply transformer with static screening between the primary and secondary windings can be used.



1	Medium voltage network	6	Equipment
2	Neighboring network	7	Supply transformer
3	Point of measurement	8	Static screen
4	Low voltage	9	Drive
5	Equipment (victim)	-	-

2. An EMC plan for preventing disturbances is drawn up for the installation. A template is available in Technical guide No. 3 EMC compliant installation and configuration for a power drive system (3AFE61348280 [English]).
3. The motor and control cables are selected, and routed according to the electrical planning guidelines of the drive. The EMC recommendations are obeyed.
4. The drive is installed according to its installation instructions. The EMC recommendations are obeyed.

WARNING!
A drive of category C4 is not intended to be used on a low-voltage public network which supplies domestic premises. Radio frequency interference is expected if the drive is used on such a network.

UL checklist

WARNING!
Operation of this drive requires detailed installation and operation instructions provided in the hardware and software manuals. The manuals are provided in electronic format in the drive package or on the Internet. Keep the manuals with the drive at all times. Hard copies of the manuals can be ordered through the manufacturer.

- Make sure that the drive type designation label includes the applicable marking.
- **DANGER - Risk of electric shock.** After disconnecting the input power, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you start working on the drive, motor or motor cable.
- The drive is to be used in a heated, indoor controlled environment. The drive must be installed in clean air according to the enclosure classification. Cooling air must be clean, free from corrosive materials and electrically conductive dust.
- The maximum surrounding air temperature is 45 °C at rated output current. The output current is derated for 45…55 °C.

  Note: For cabinet-built drives, the maximum surrounding air temperature is 40 °C (104 °F).
- The drive is suitable for use in a circuit capable of delivering not more than 100 kA rms symmetrical amperes, 600 V maximum when protected by the UL fuses given elsewhere in this chapter.
- The cables located within the motor circuit must be rated for at least 75 °C in UL-compliant installations.
- The input cable must be protected with fuses or circuit breakers. These protective devices provide branch circuit protection in accordance with the national regulations (National Electrical Code (NEC) or Canadian Electrical Code). Obey also any other applicable local or provincial codes.
- **WARNING!**
  The opening of the branch-circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electric shock, current-carrying parts and other components of the device should be examined and replaced if damaged.
- The drive is equipped with UL listed fuses which provide branch circuit protection in accordance with the National Electrical Code (NEC) and Canadian Electrical Code.
  The fuses are listed elsewhere in this chapter.
- The drive provides motor overload protection. The protection is not enabled when the drive leaves the ABB factory. For enabling the protection, see the firmware manual.
- The drive overvoltage category according to IEC 60664-1 is III, except for auxiliary power connections (fan, control, heating, lighting, cooling unit pump etc) which are of category II.

Tightening torques

Unless a tightening torque is specified in the text, the following torques can be used.

Electrical connections

Size	Torque	Strength class
M3	0.5 N·m (4.4 lbf·in)	4.6...8.8
M4	1 N·m (9 lbf·in)	4.6...8.8
M5	4 N·m (35 lbf·in)	8.8
M6	9 N·m (6.6 lbf·ft)	8.8
M8	22 N·m (16 lbf·ft)	8.8
M10	42 N·m (31 lbf·ft)	8.8
M12	70 N·m (52 lbf·ft)	8.8
M16	120 N·m (90 lbf·ft)	8.8

Mechanical connections

Size	Max. torque	Strength class
M5	6 N·m (53 lbf·in)	8.8
M6	10 N·m (7.4 lbf·ft)	8.8
M8	24 N·m (17.7 lbf·ft)	8.8

Insulation supports

Size	Max. torque	Strength class
M6	5 N·m (44 lbf·in)	8.8
M8	9 N·m (6.6 lbf·ft)	8.8
M10	18 N·m (13.3 lbf·ft)	8.8
M12	31 N·m (23 lbf·ft)	8.8

Cable lugs

Size	Max. torque	Strength class
M8	15 N·m (11 lbf·ft)	8.8
M10	32 N·m (23.5 lbf·ft)	8.8
M12	50 N·m (37 lbf·ft)	8.8

Disclaimers

Generic disclaimer

The manufacturer shall have no obligation with respect to any product which (i) has been improperly repaired or altered; (ii) has been subjected to misuse, negligence or accident; (iii) has been used in a manner contrary to the manufacturer’s instructions; or (iv) has failed as a result of ordinary wear and tear.

Cybersecurity disclaimer

This product can be connected to and communicate information and data via a network interface. The HTTP protocol, which is used between the commissioning tool (Drive Composer) and the product, is an unsecured protocol. For independent and continuous operation of product such connection via network to commissioning tool is not necessary. However it is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, prevention of physical access, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Notwithstanding any other provision to the contrary and regardless of whether the contract is terminated or not, ABB and its affiliates are under no circumstances liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

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Dimensions

Cabinet line-up dimensions

The drive consists of cubicles built into a cabinet line-up. The table below shows the width and weight of basic drive types without options (for example, the cooling unit is not included). The table is followed by selected dimension drawing examples.

The dimensions are in millimeters (for inches, divide by 25.4).

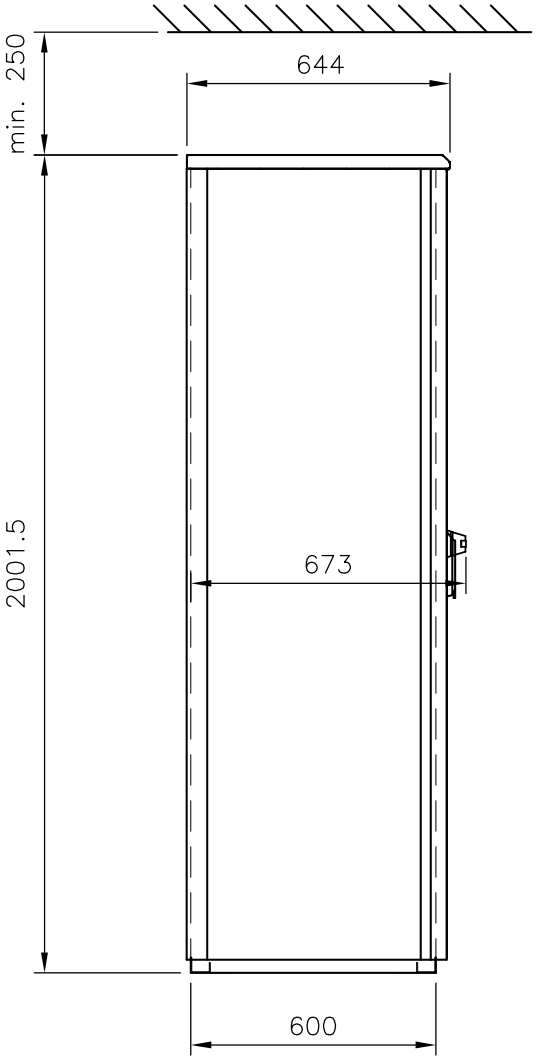
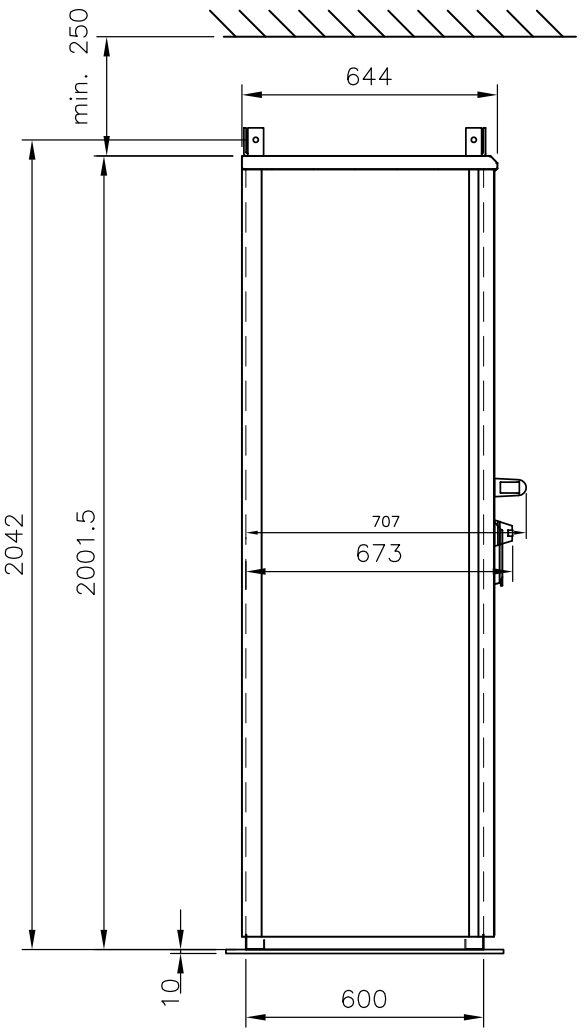
The data given is preliminary. ABB reserves the right to modify the design at any time without notice. Consult ABB for up-to-date, drive-specific information.

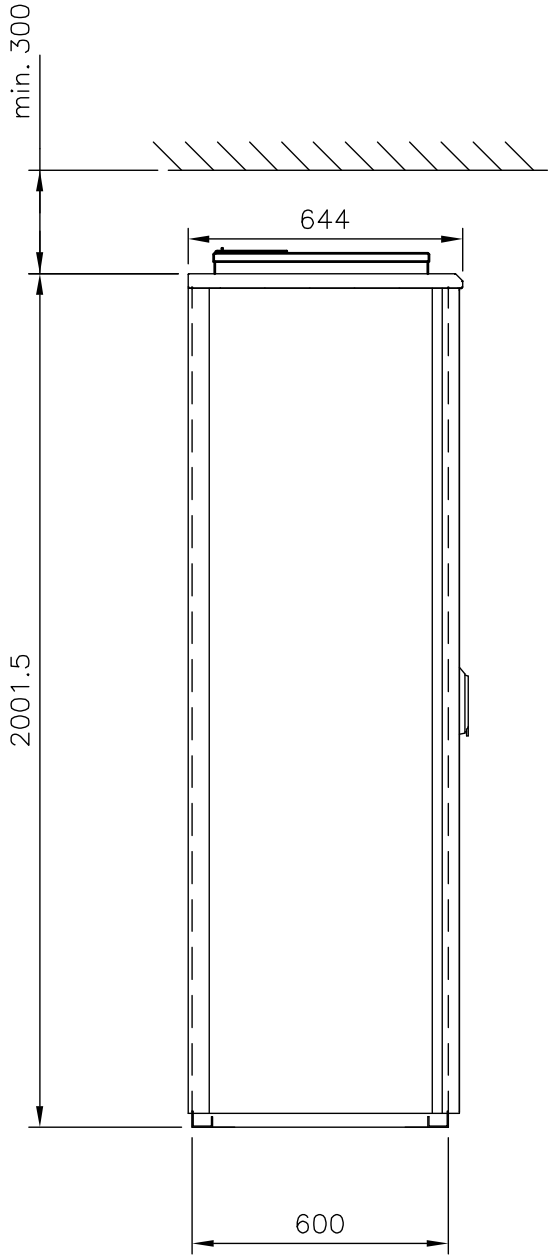
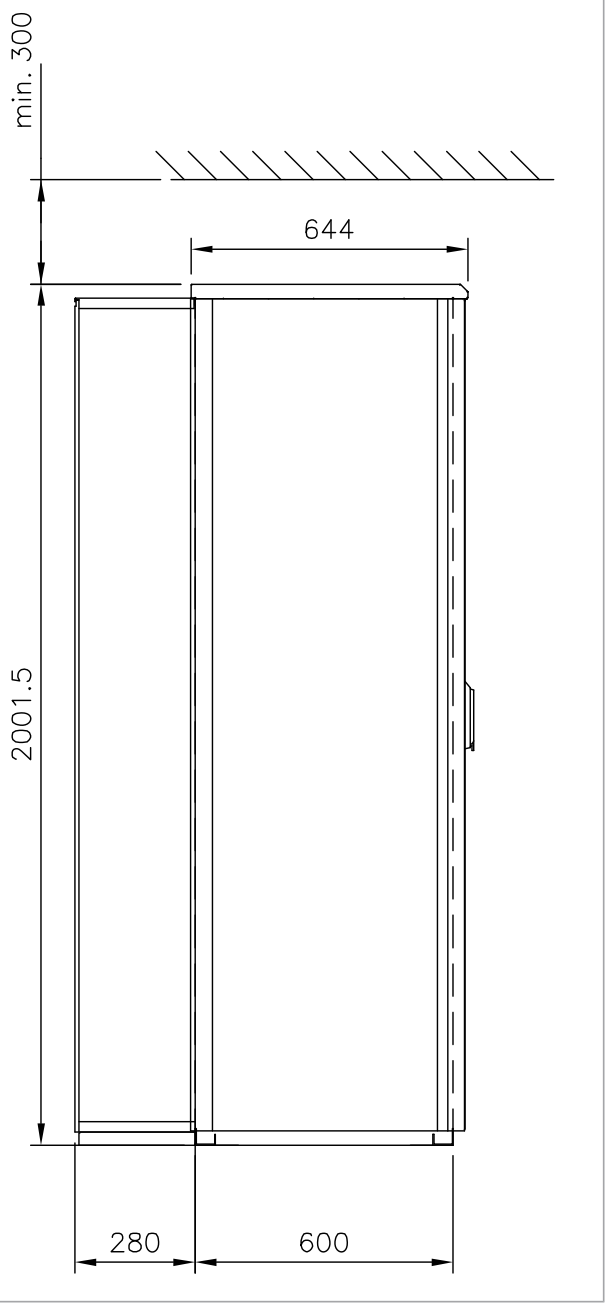
ACS880-07CLC-...	Width	Weight	
	mm	kg	lbs
U_N = 690 V, 6-pulse connection			
0390A-7	730	560	1235
0430A-7	730	560	1235
0480A-7	730	560	1235
0530A-7	730	560	1235
0600A-7	730	560	1235
0670A-7	730	560	1235
0750A-7	730	560	1235
0850A-7	730	560	1235
1030A-7	930	710	1565
1170A-7	930	710	1565
1310A-7	930	710	1565
1470A-7	930	710	1565
1660A-7	930	710	1565
1940A-7	1230	1030	2270

ACS880-07CLC-...	Width	Weight	
	mm	kg	lbs
2180A-7	1230	1030	2270
2470A-7	1230	1030	2270
2880A-7	1530	1290	2845
3260A-7	1530	1290	2845
U_N = 690 V, 12-pulse connection			
0530A-7+A004	730	560	1235
0600A-7+A004	730	560	1235
0670A-7+A004	730	560	1235
0750A-7+A004	730	560	1235
0850A-7+A004	730	560	1235
1030A-7+A004	930	710	1565
1170A-7+A004	930	710	1565
1310A-7+A004	930	710	1565
1470A-7+A004	930	710	1565
1660A-7+A004	930	710	1565
1940A-7+A004	1230	1030	2270
2180A-7+A004	1230	1030	2270
2470A-7+A004	1230	1030	2270
2880A-7+A004	1530	1290	2845
3260A-7+A004	1530	1290	2845
3580A-7+A004	2230	1890	4165
4050A-7+A004	2230	1890	4165
4840A-7+A004	2430	2060	4540
5650A-7+A004	2730	2320	5115
6460A-7+A004	2930	2490	5490
U_N = 690 V, 24-pulse connection			
2470A-7+A006	1230	1030	2270
3260A-7+A006	1530	1290	2845
4840A-7+A006	2430	2060	4540
5650A-7+A006	2730	2320	5115
6460A-7+A006	2930	2490	5490

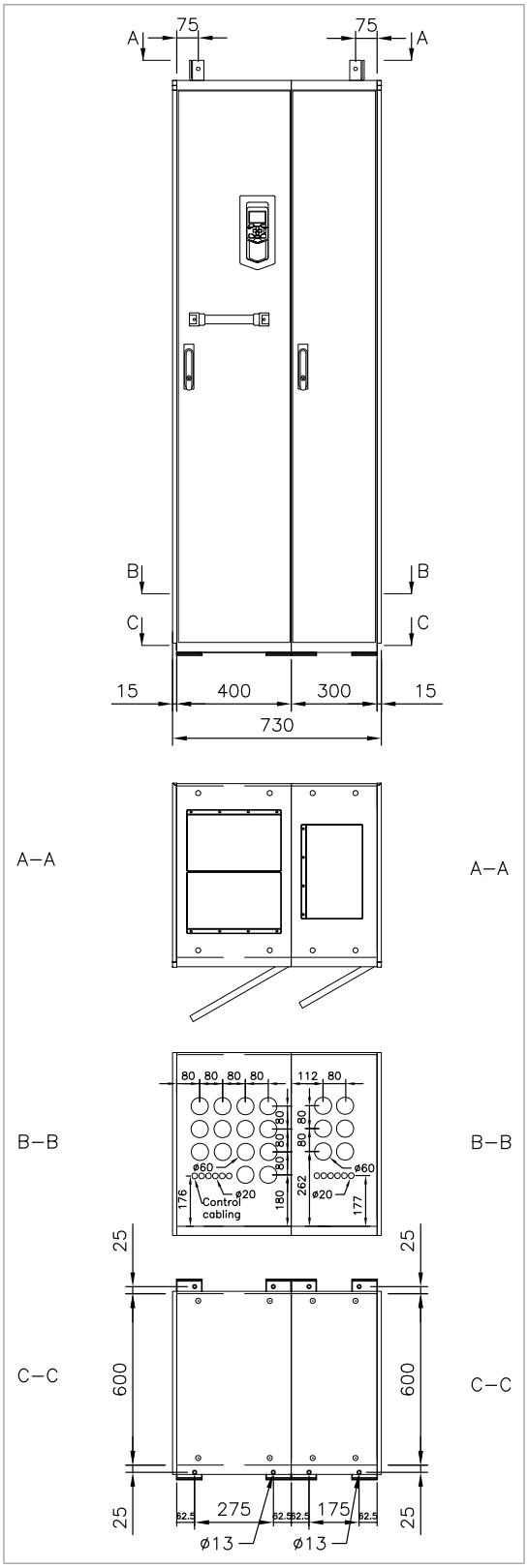
Dimension drawing examples

Cabinet height and depth

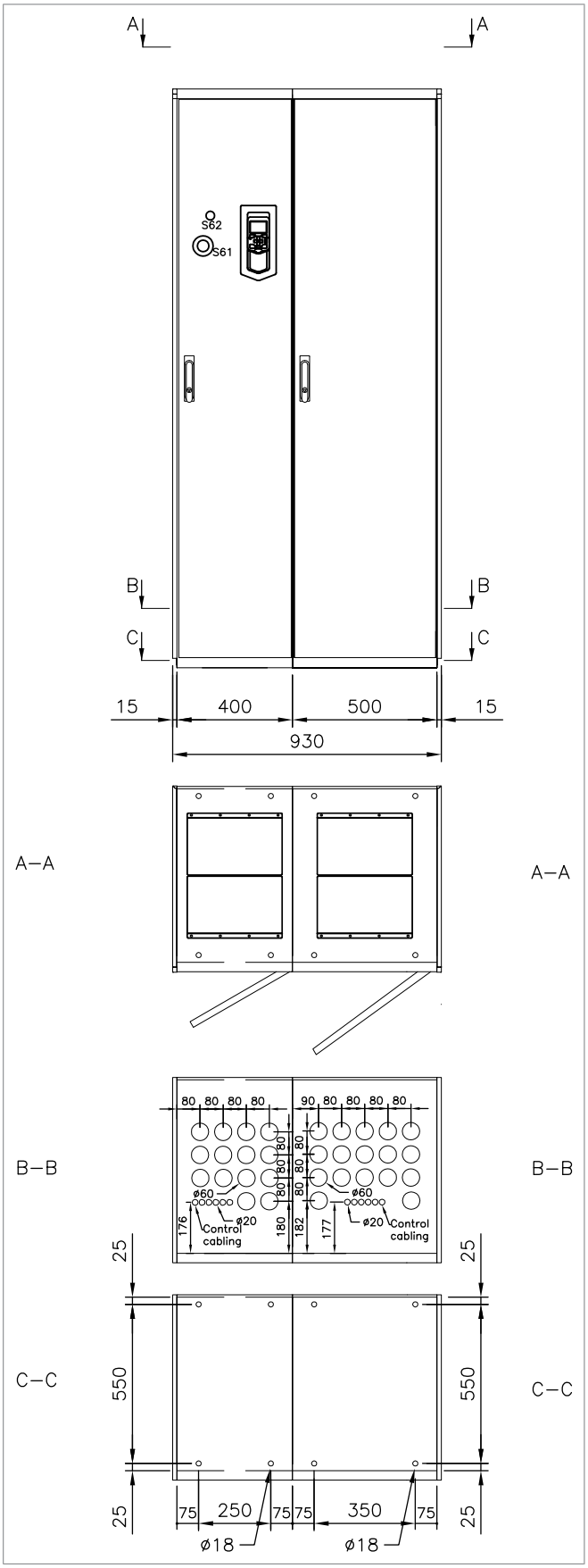
Side view, bottom cable exit	Side view, marine construction (option +C121), bottom cable exit
	

Side view, top cable exit with common motor terminal cubicle	Side view, top cable exit without common motor terminal cubicle
	

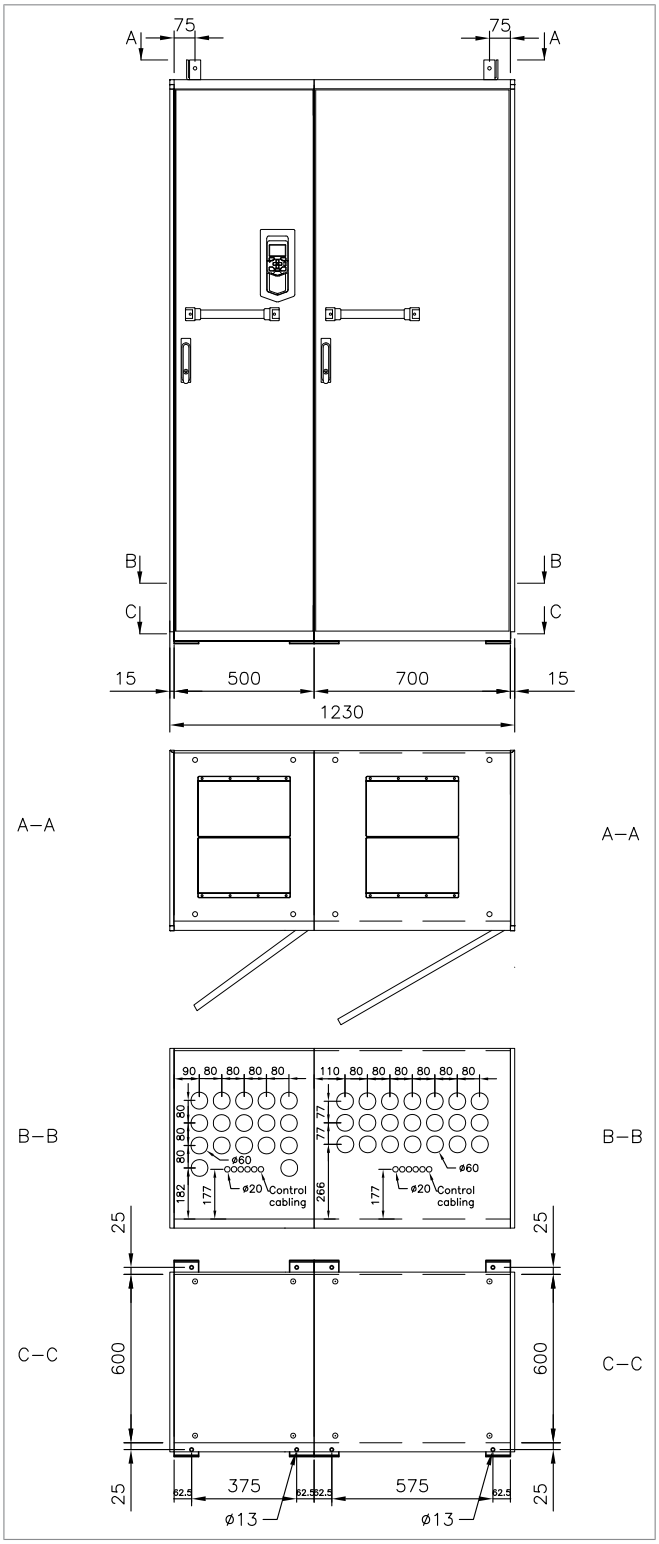
ACS880-07CLC-0390A-7 +C121 (marine construction)



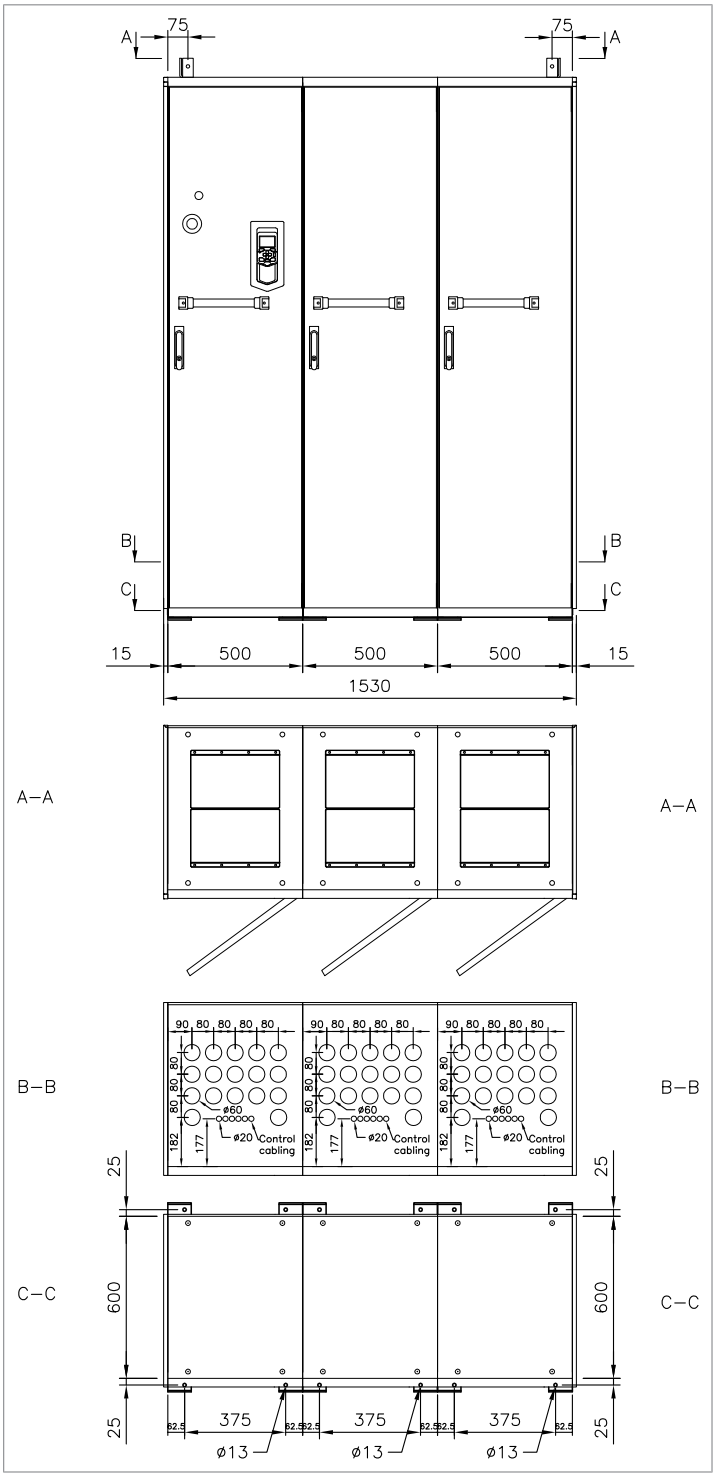
ACS880-07CLC-1310A-7



ACS880-07CLC-2180A-7 +C121 (marine construction)



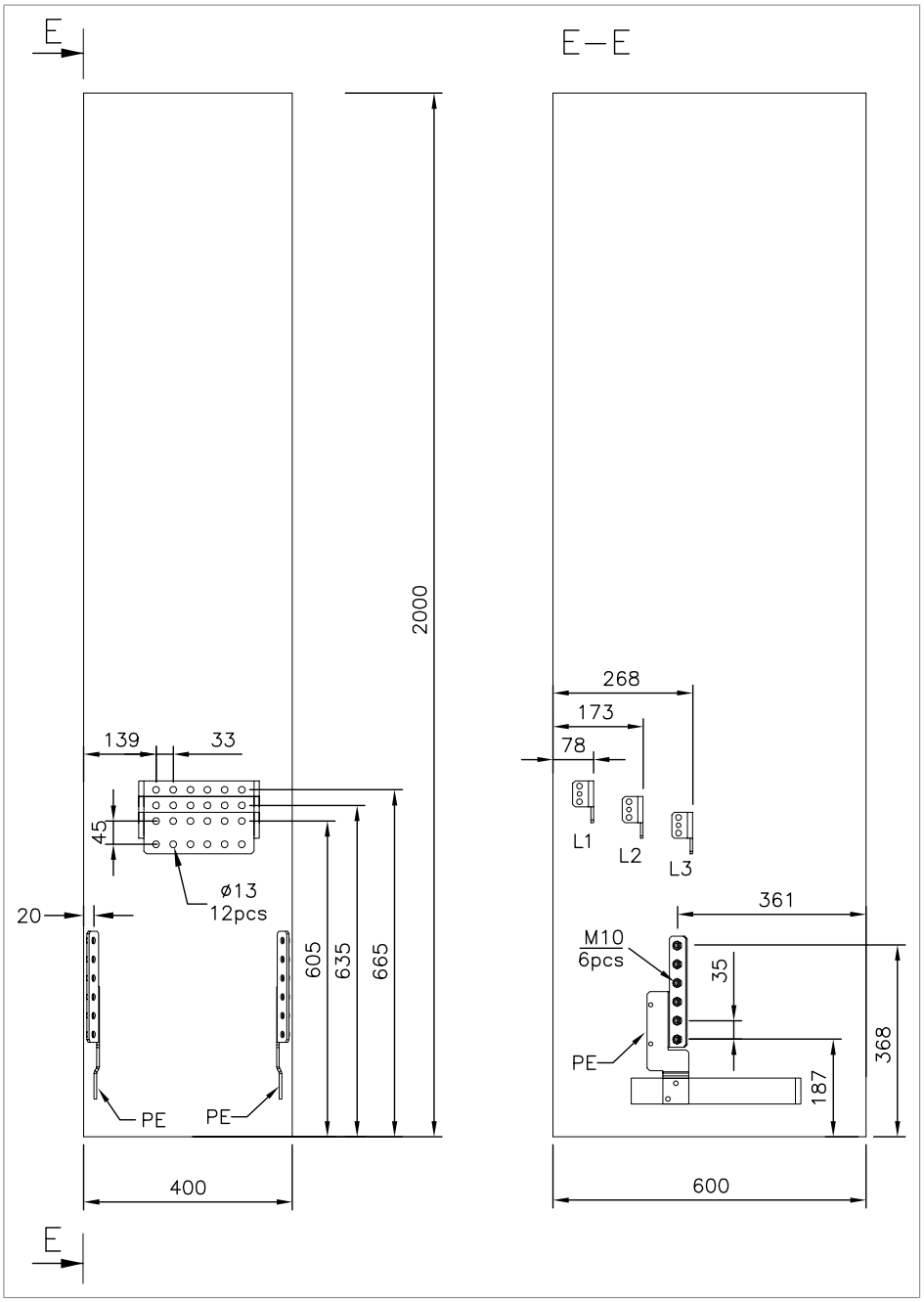
ACS880-07CLC-3260A-7 +C121 (marine construction)



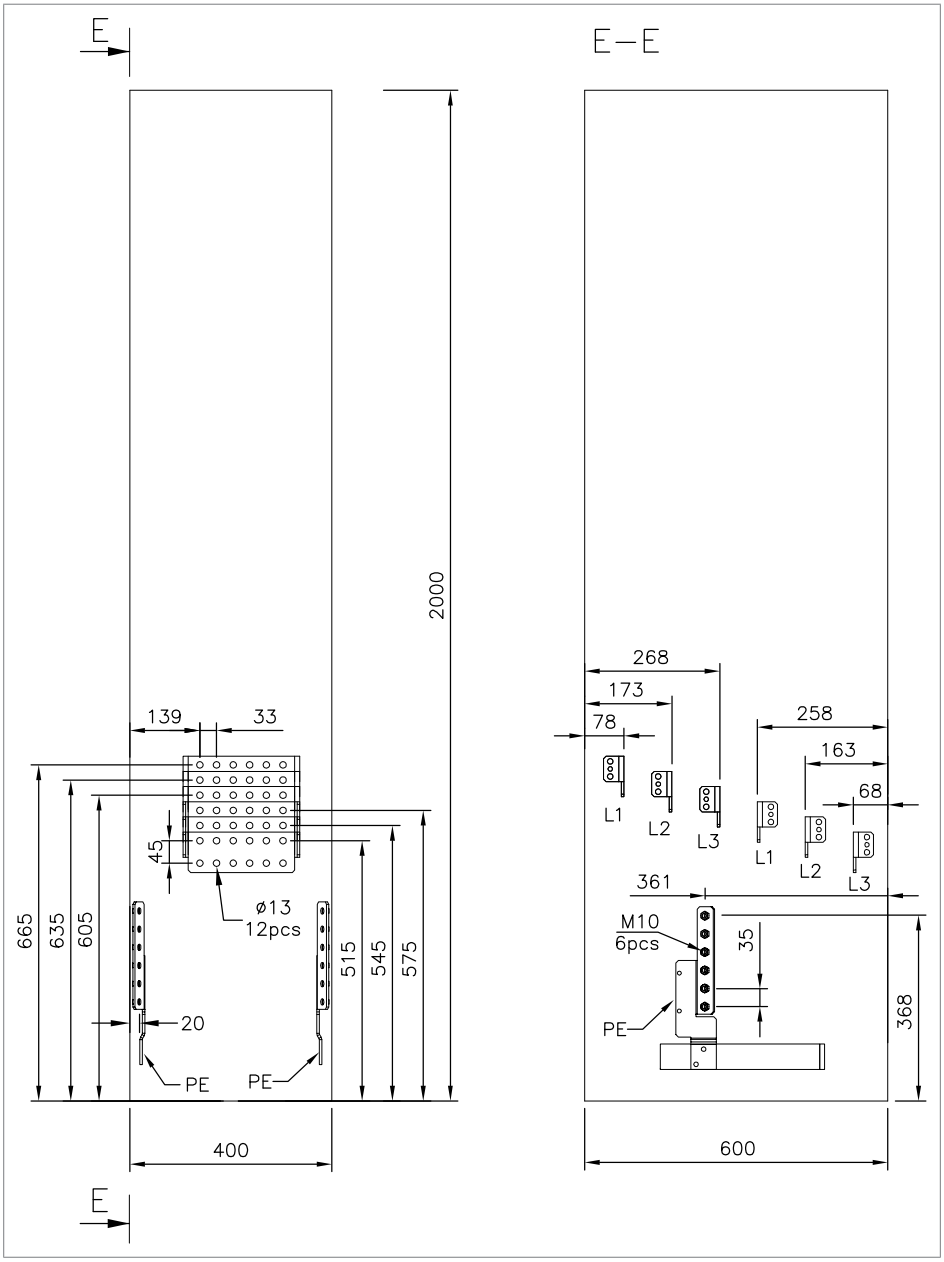
Location and size of input terminals

Drives with up to four supply modules have one supply module cubicle while drives with more modules have two. For the quantity of supply modules in each drive type, see Frame sizes and power module types (page 185).

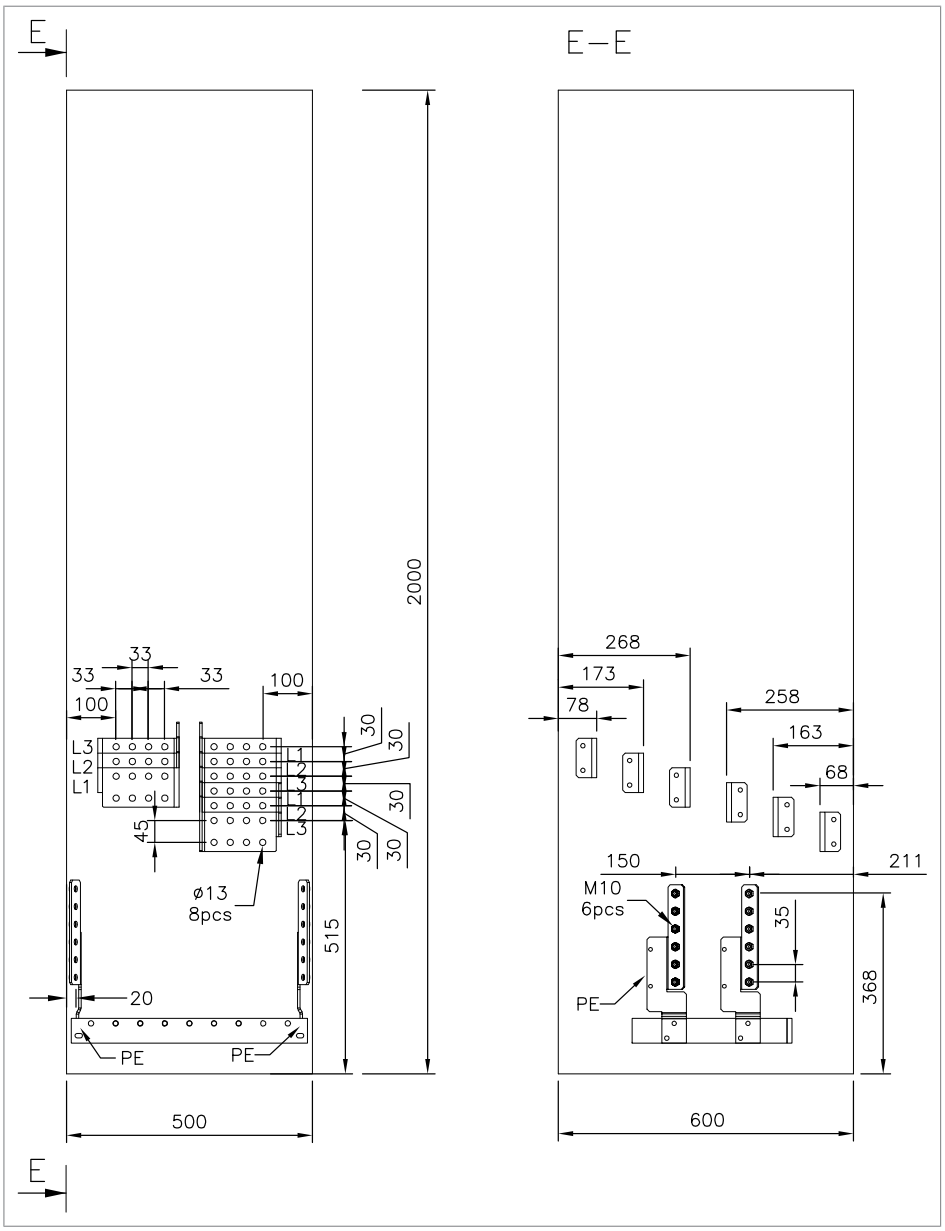
- **1×D8D**



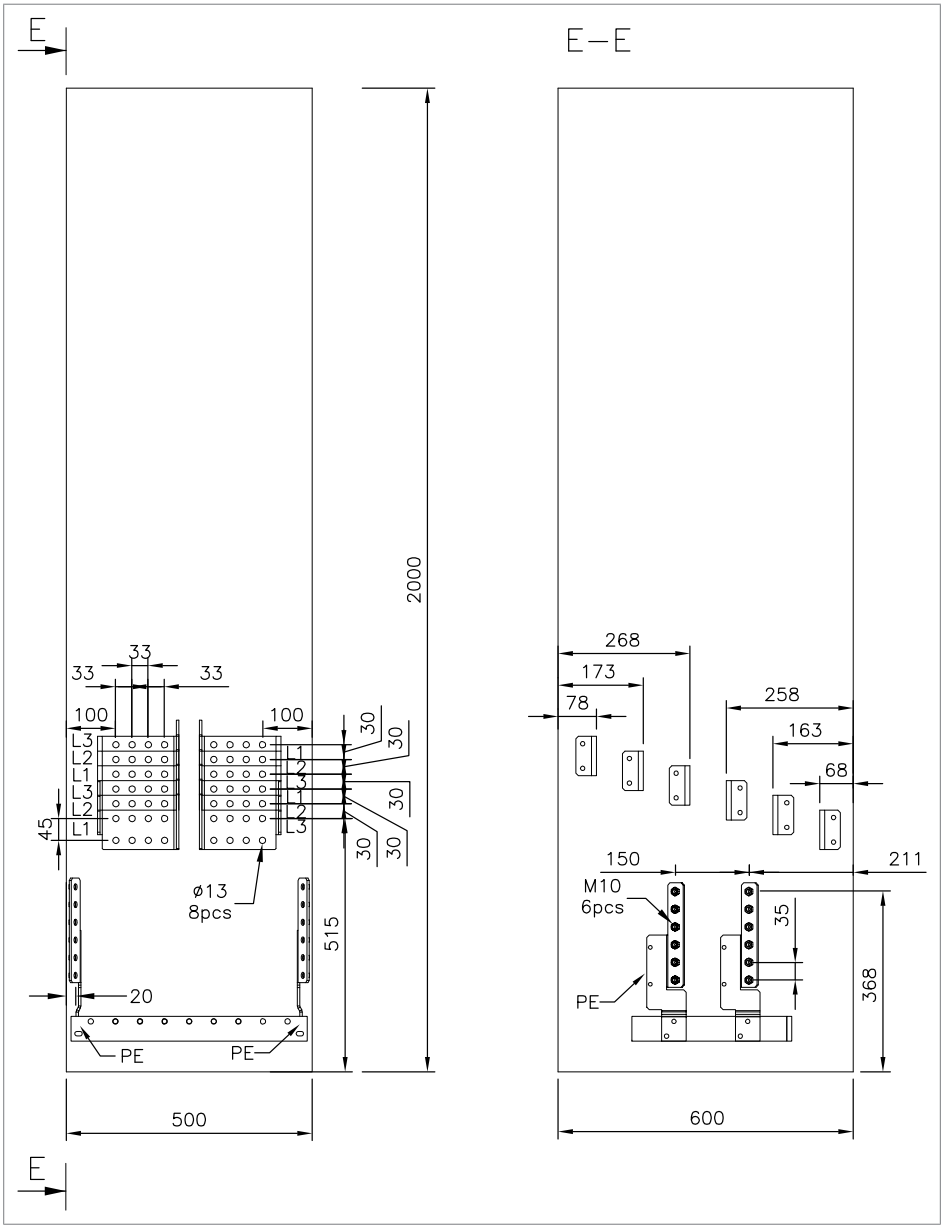
2×D8D


E
E–E
2000
139
33
45
ø13
12pcs
665
635
605
515
545
575
20
PE
PE
400
E
268
173
78
258
163
68
L1
L2
L3
L1
L2
L3
361
M10
6pcs
35
PE
368
600

3×D8D


E
E–E
2000
33
33
33
100
100
100
L3
L2
L1
30
30
30
30
30
45
ø13
8pcs
515
20
PE
PE
500
268
173
78
258
163
68
150
211
M10
6pcs
35
368
PE
600
E

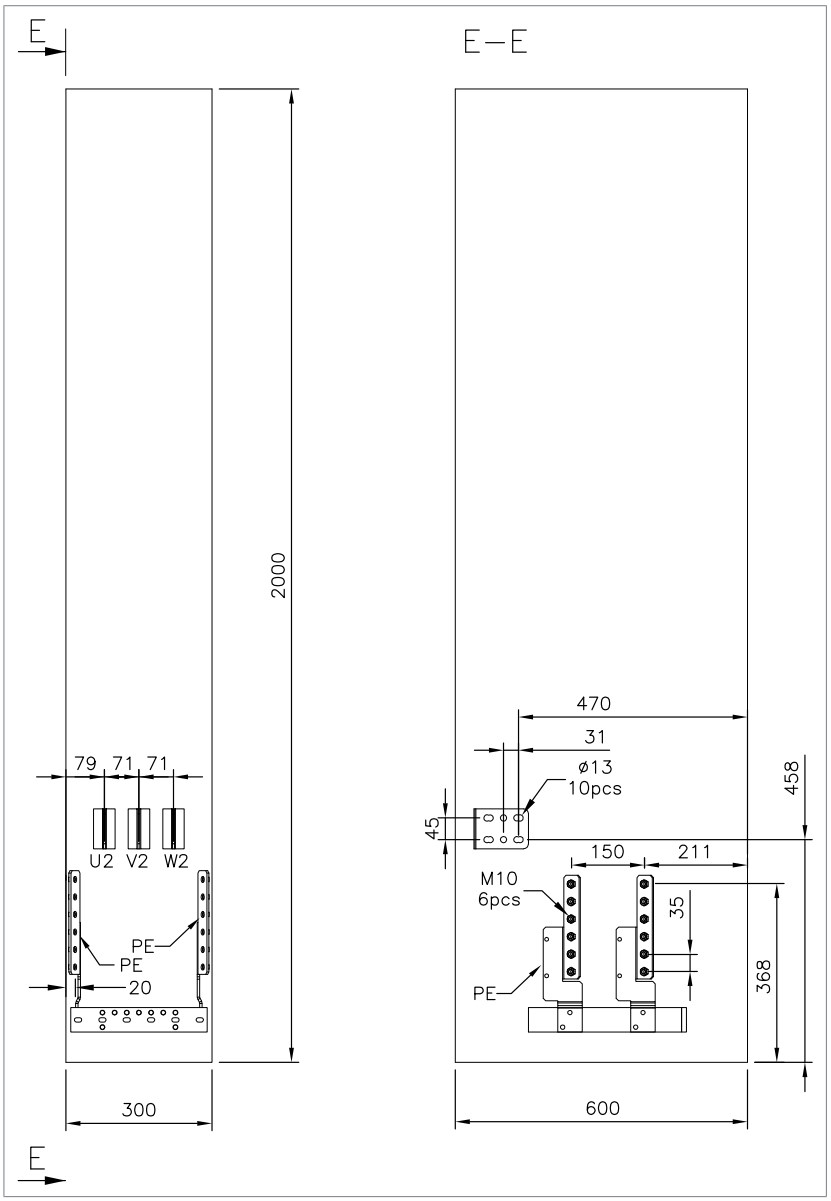
4×D8D


E
E–E
2000
33
33
33
100
100
30
30
30
30
30
30
L3
L2
L1
L1
L2
L3
45
ø13
8pcs
515
20
PE
PE
500
268
173
78
258
163
68
150
211
M10
6pcs
35
PE
368
600
E

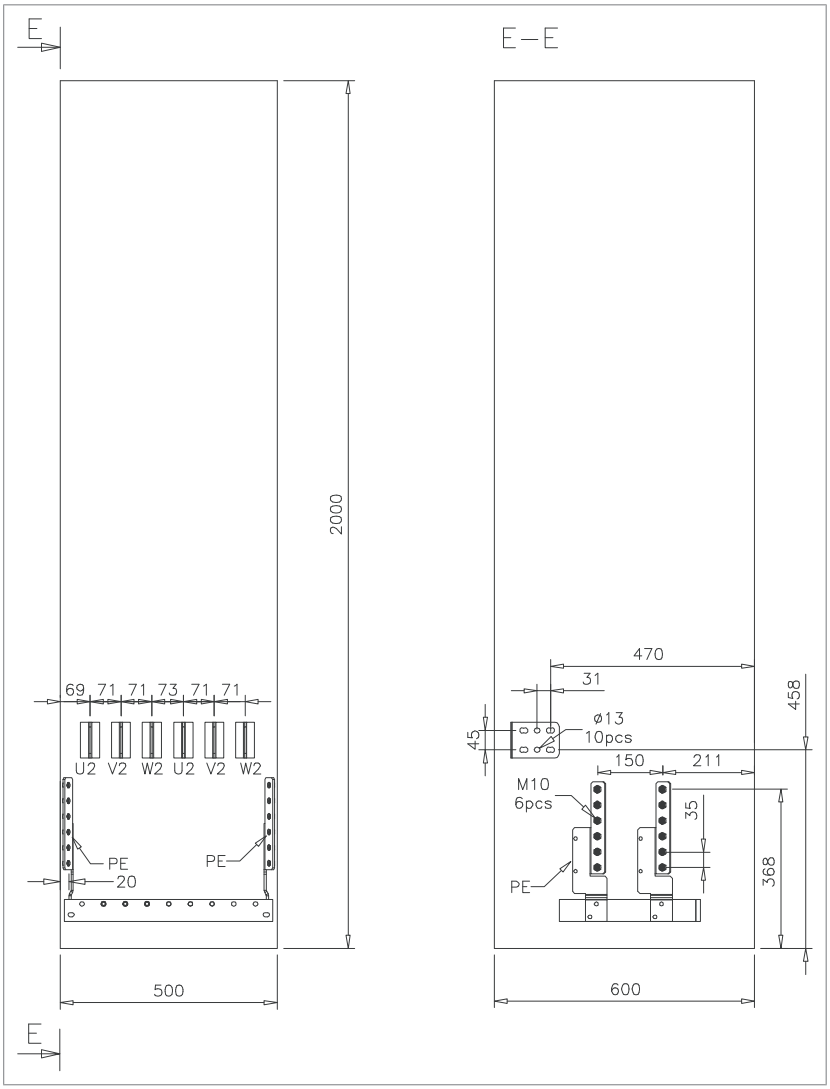
Location and size of output terminals

Units without common motor terminal cubicle

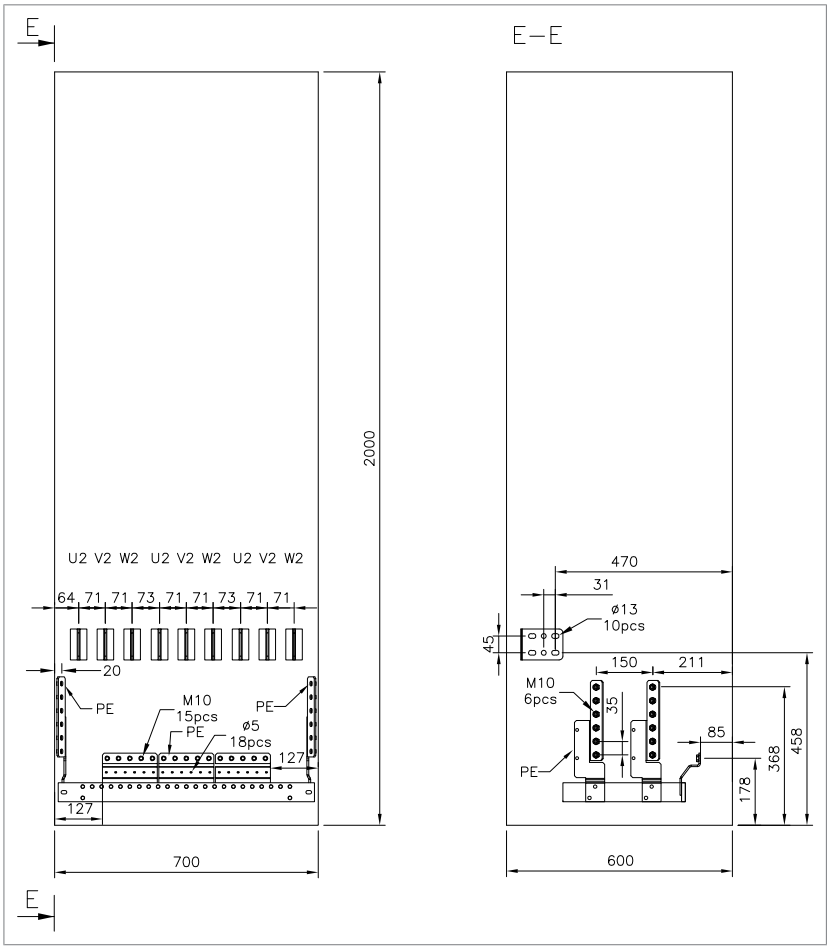
Inverter module cubicle with one R8i module, bottom cable exit



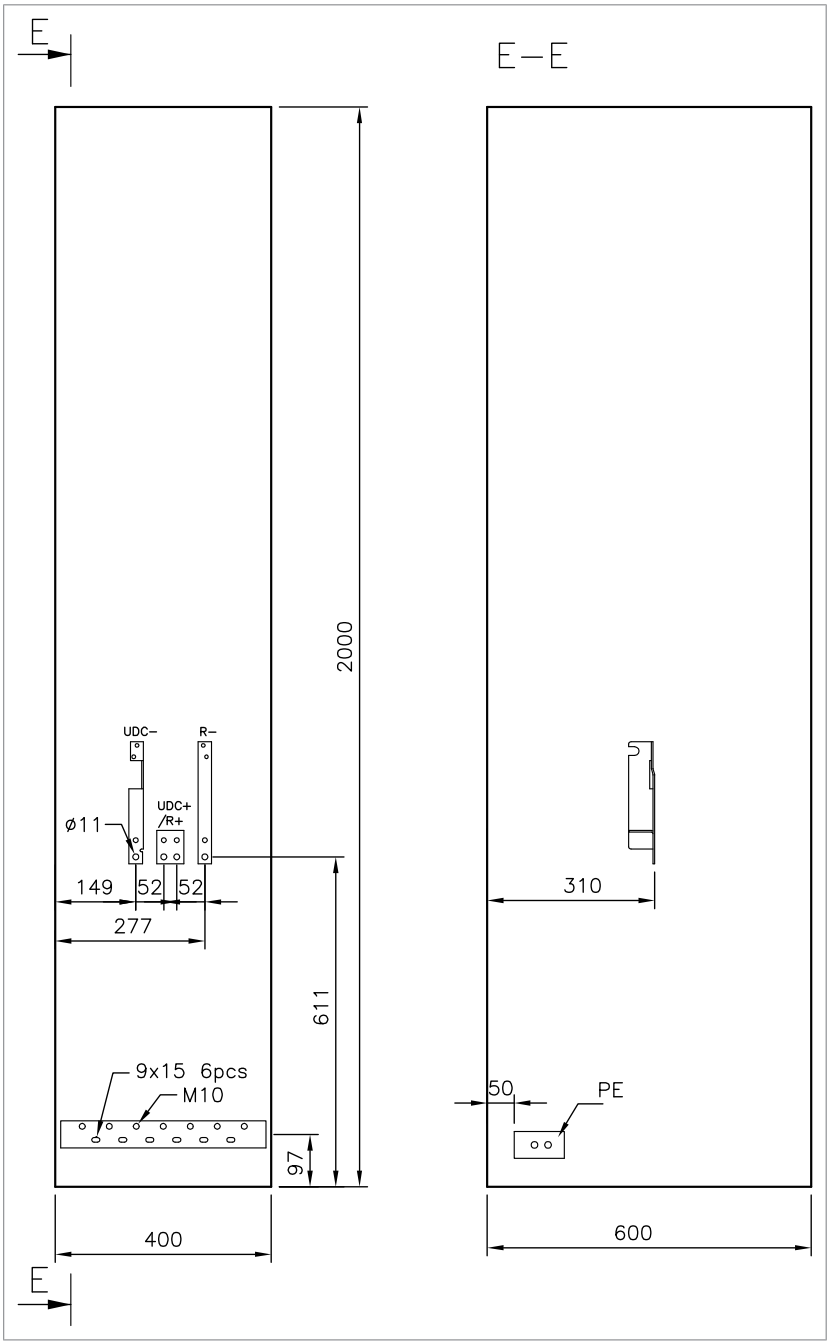
Inverter module cubicle with two R8i modules, bottom cable exit



Inverter module cubicle with three R8i modules, bottom cable exit



Brake chopper cubicle

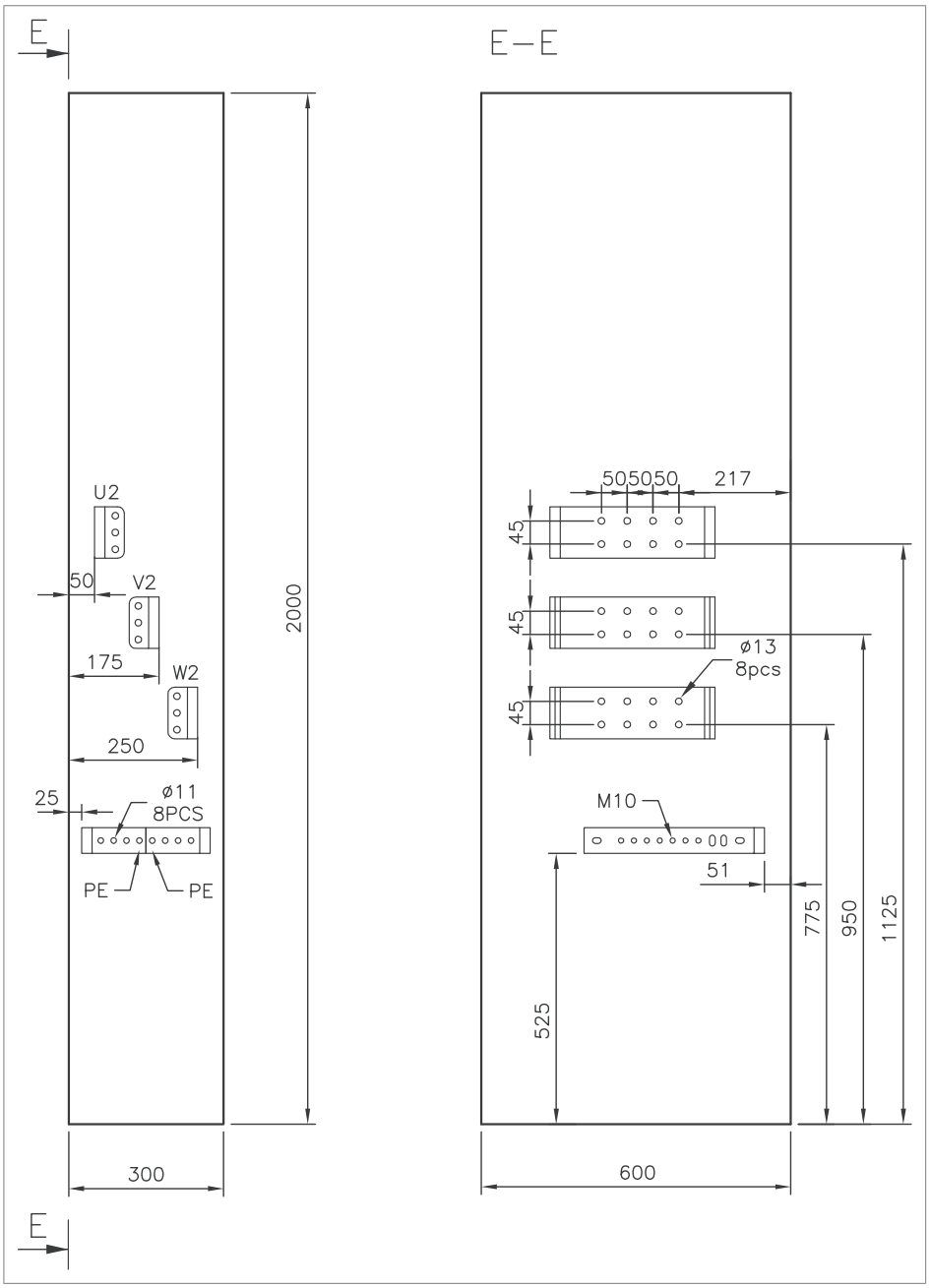


Units with common motor terminal cubicle (+H359)

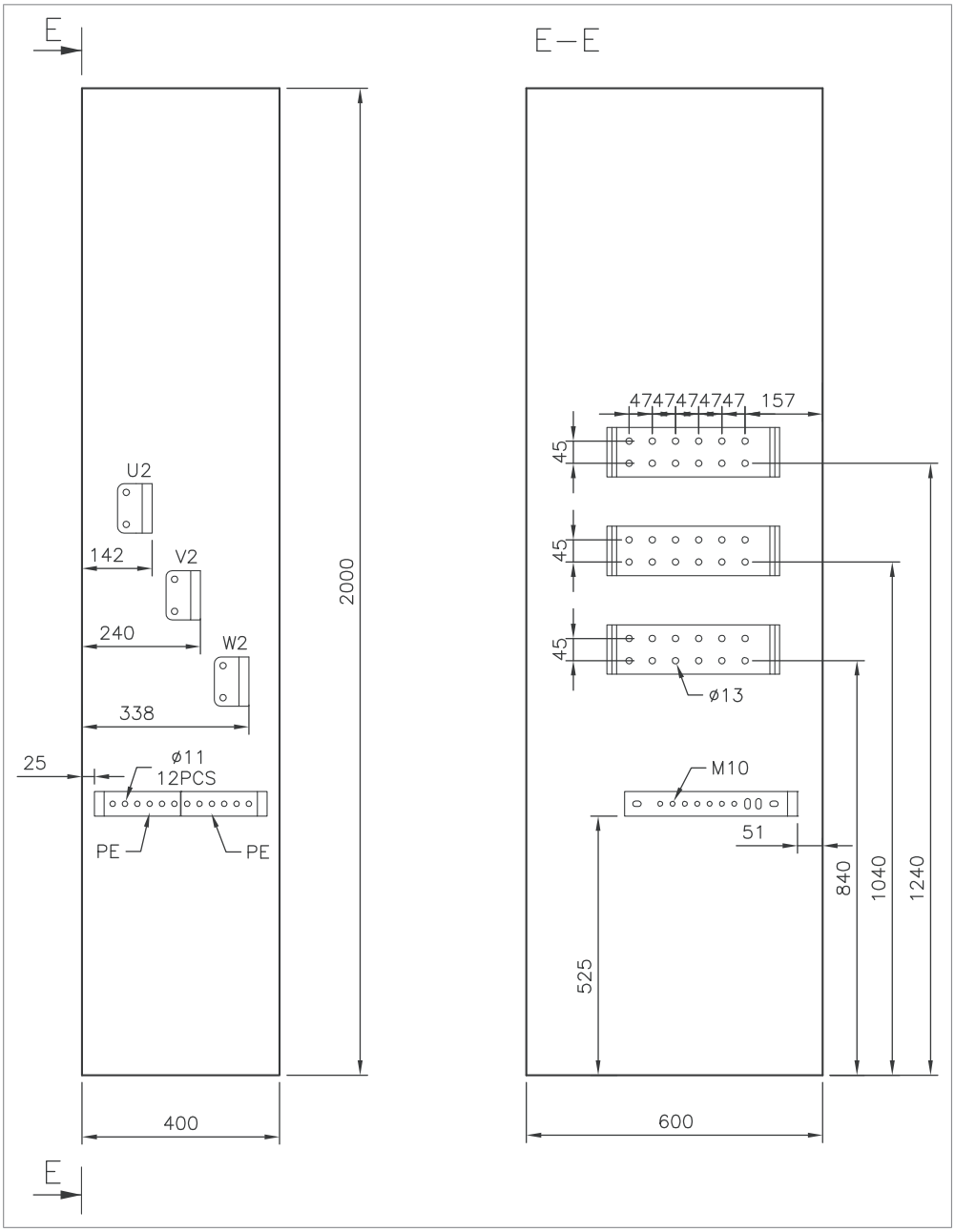
Note: The cubicles used with ACS880-07CLC are:

- 300 mm with types up to -1170A-7
- 400 mm with types -1310A-7 to -2470A-7
- 500 mm with types -2880A-7 and -3260A-7
- 600 mm with type -3580A-7
- 400 + 400 mm with types -4050A-7 and -4840A-7
- 400 + 600 mm with types -5650A-7 and -6460A-7.

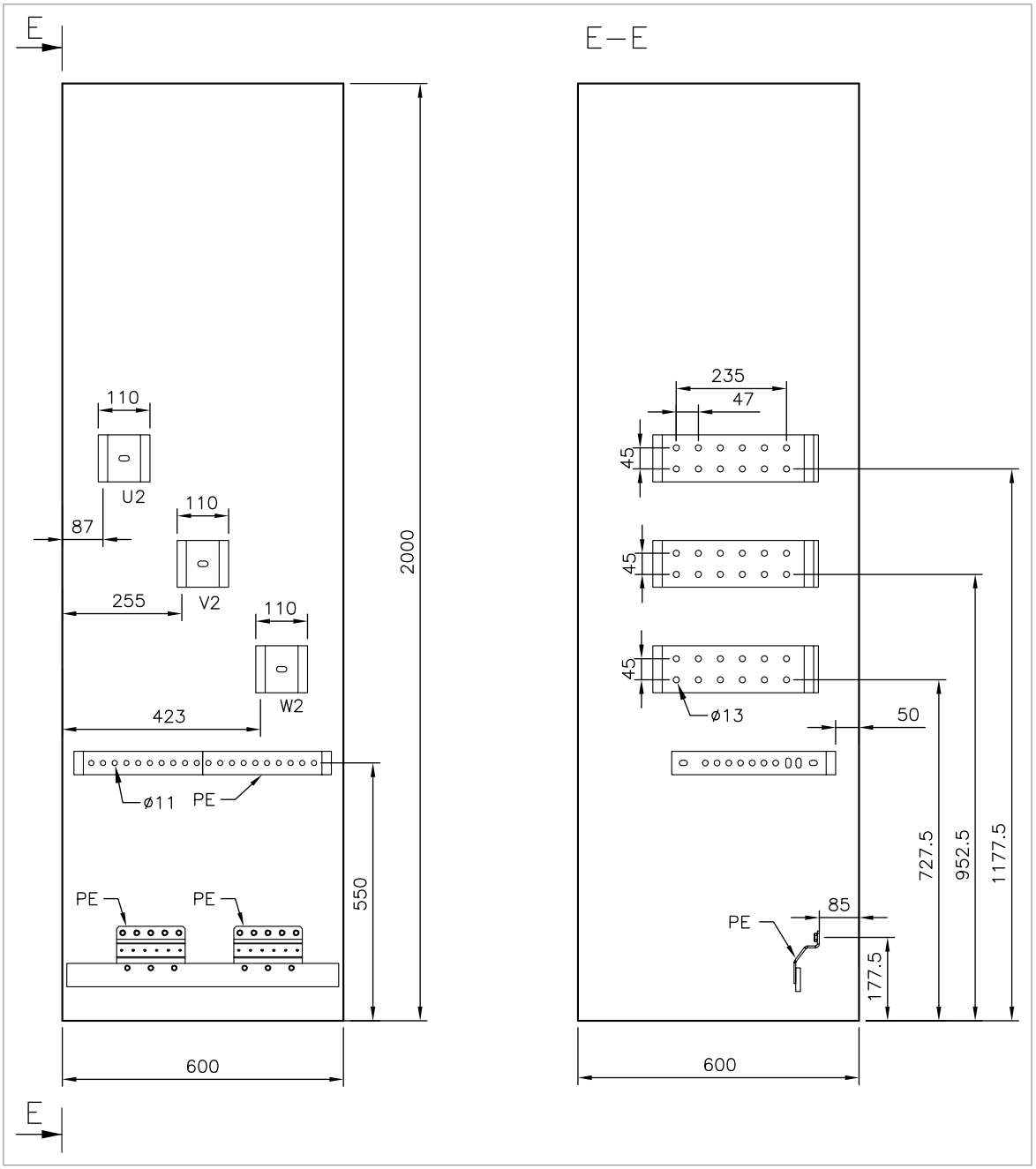
Cubicle width 300 mm, bottom cable exit



Cubicle width 400 mm, bottom cable exit



Cubicle width 600 mm, bottom cable exit



15

The Safe torque off function

Contents of this chapter

This chapter describes the Safe torque off (STO) function of the drive and gives instructions for its use.

Description

WARNING!
In case of parallel-connected drives or dual-winding motors, the STO must be activated on each drive to remove the torque from the motor.

The Safe torque off function can be used, for example, as the final actuator device of safety circuits (such as an emergency stop circuit) that stop the drive in case of danger. Another typical application is a prevention of unexpected start-up function that enables short-time maintenance operations like cleaning or work on non-electrical parts of the machinery without switching off the power supply to the drive.

When activated, the Safe torque off function disables the control voltage for the power semiconductors of the drive output stage, thus preventing the drive from generating the torque required to rotate the motor. If the motor is running when Safe torque off is activated, it coasts to a stop.

The Safe torque off function has a redundant architecture, that is, both channels must be used in the safety function implementation. The safety data given in this manual is calculated for redundant use, and does not apply if both channels are not used.

The Safe torque off function complies with these standards:

Standard	Name
IEC 60204-1:2016 EN 60204-1:2018	Safety of machinery – Electrical equipment of machines – Part 1: General requirements

Standard	Name
IEC 61000-6-7:2014	Electromagnetic compatibility (EMC) – Part 6-7: Generic standards – Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations
IEC 61326-3-1:2017	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems
IEC 61511-1:2017	Functional safety – Safety instrumented systems for the process industry sector
IEC 61800-5-2:2016 EN 61800-5-2:2007	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional
IEC 62061:2021 EN 62061:2021	Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems
EN ISO 13849-1:2015	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
EN ISO 13849-2:2012	Safety of machinery – Safety-related parts of control systems – Part 2: Validation

The function also corresponds to Prevention of unexpected start-up as specified by EN ISO 14118:2018 (ISO 14118:2017), and Uncontrolled stop (stop category 0) as specified in EN/IEC 60204-1.

Compliance with the European Machinery Directive and the UK Supply of Machinery (Safety) Regulations

The Declarations of conformity are shown at the end of this chapter.

Wiring

For the electrical specifications of the STO connection, see the technical data of the control unit.

Activation switch

In the wiring diagrams, the activation switch has the designation [K]. This represents a component such as a manually operated switch, an emergency stop push button switch, or the contacts of a safety relay or safety PLC.

- In case a manually operated activation switch is used, the switch must be of a type that can be locked out to the open position.
- The contacts of the switch or relay must open/close within 200 ms of each other.

Cable types and lengths

- ABB recommends double-shielded twisted-pair cable.
- Maximum cable lengths:
  - 300 m (1000 ft) between activation switch [K] and drive control unit
  - 60 m (200 ft) between multiple drives
  - 60 m (200 ft) between external power supply and first control unit
  - 30 m (100 ft) between control unit and last inverter module in the chain.

Note: A short-circuit in the wiring between the switch and an STO terminal causes a dangerous fault. Therefore, it is recommended to use a safety relay (including wiring diagnostics) or a wiring method (shield grounding, channel separation) which reduces or eliminates the risk caused by the short-circuit.

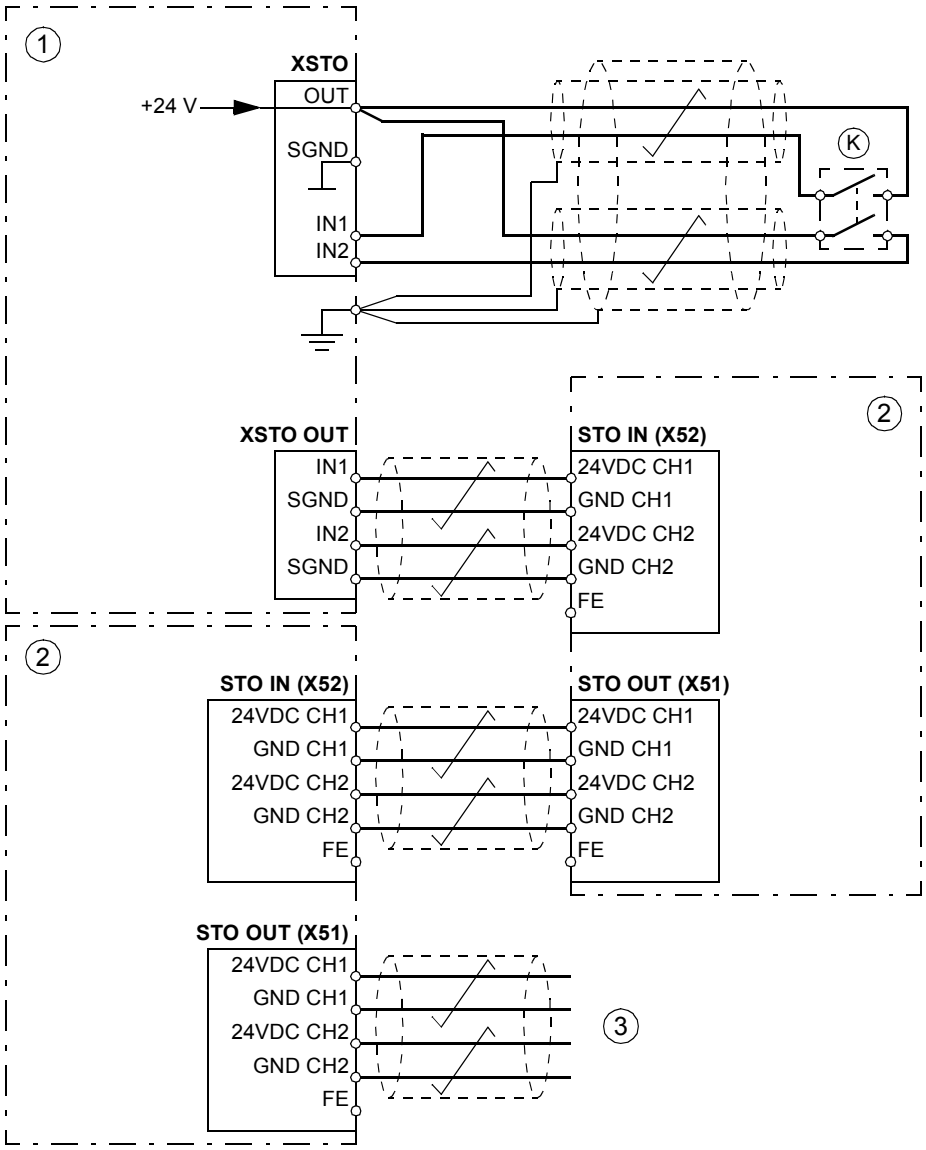
Note: The voltage at the STO input terminals of the control unit (or frame R8i inverter module) must be at least 17 V DC to be interpreted as “1”.

The pulse tolerance of the input channels is 1 ms.

Grounding of protective shields

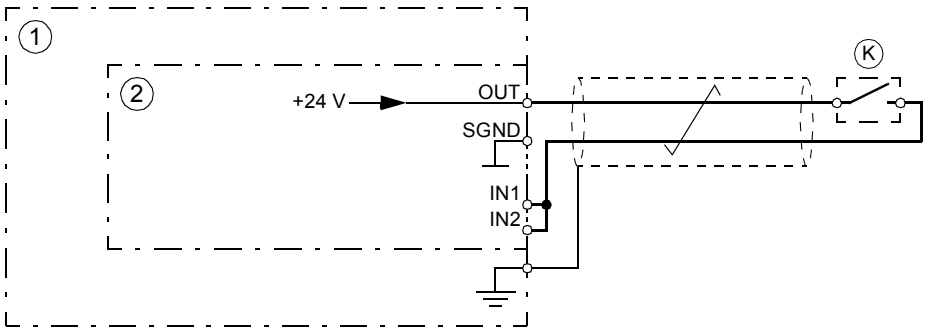
- Ground the shield in the cabling between the activation switch and the control unit at the control unit only.
- Ground the shield in the cabling between two control units at one control unit only.
- Do not ground the shield in the cabling between control unit and inverter module, or between inverter modules.

Dual-channel connection with internal power supply



1	Drive control unit
2	Inverter module(s)
3	To remaining inverter modules
K	Activation switch

Single-channel connection of activation switch



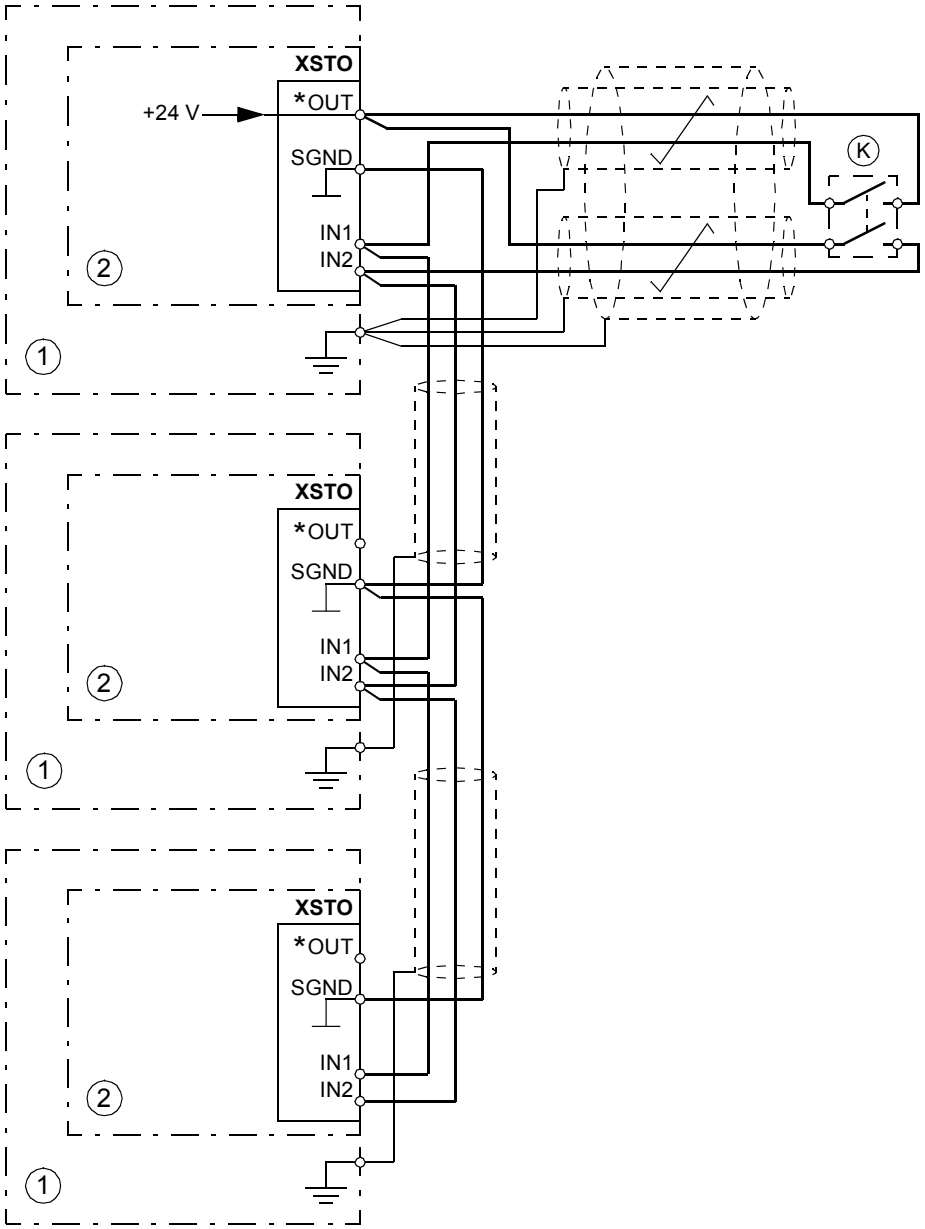
Note:

- Both STO inputs (IN1, IN2) must be connected to the activation switch. Otherwise, no SIL/PL classification is given.
- Pay special attention to avoiding any potential failure modes for the wiring. For example, use shielded cable. For measures for fault exclusion of wiring, see eg. EN ISO 13849-2:2012, table D.4.

1	Drive
2	Control unit
K	Activation switch **Note:** A single-channel activation switch can limit the SIL/PL capability of the safety function to a lower level than the SIL/PL capability of the STO function of the drive.

Multiple drives

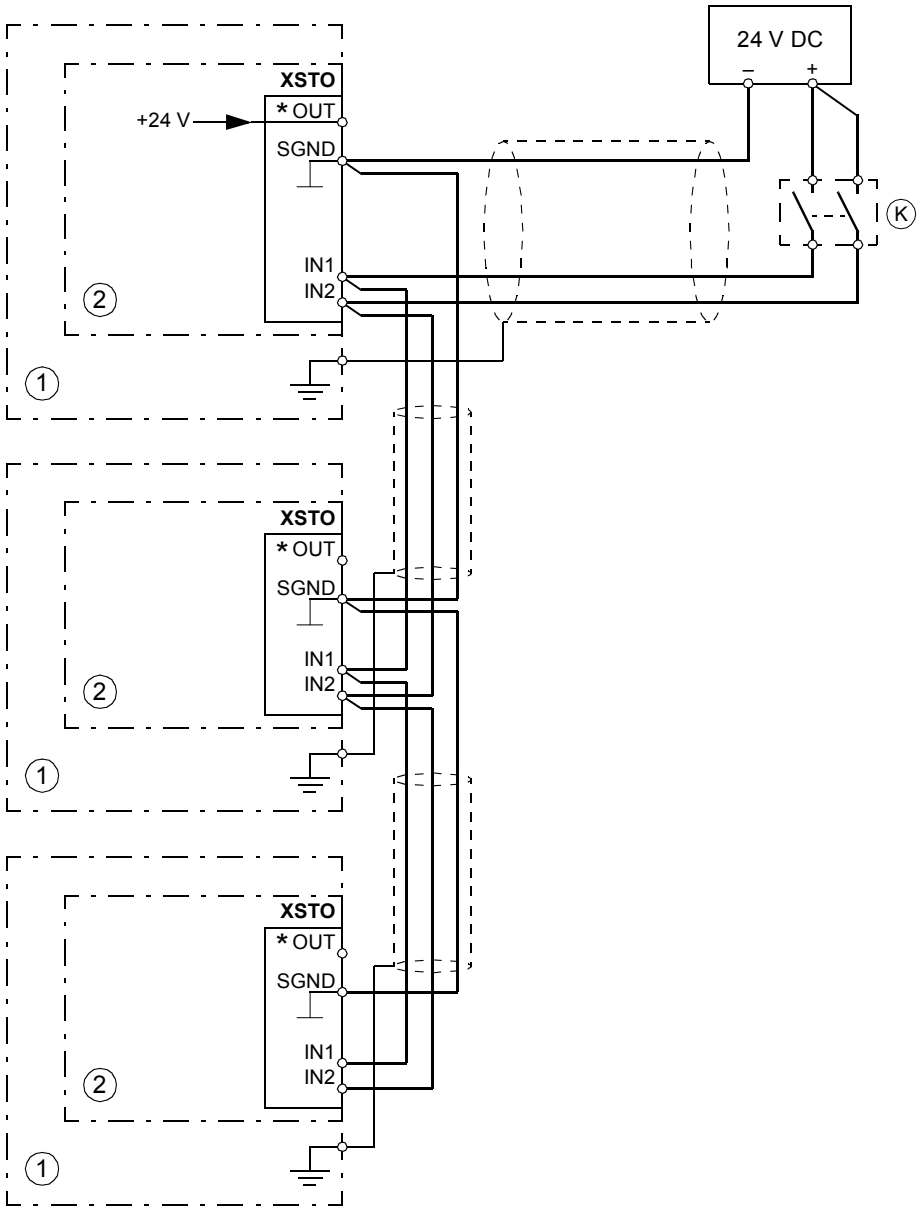
Internal power supply



1	Drive
2	Control unit
K	Activation switch

* Terminal designation may vary depending on drive type

External power supply



1	Drive
2	Control unit
K	Activation switch

* Terminal designation may vary depending on drive type

Operation principle

1. The Safe torque off activates (the activation switch is opened, or safety relay contacts open).
2. The STO inputs of the drive control unit de-energize.
3. The control unit cuts off the control voltage from the output IGBTs.
4. The control program generates an indication as defined by parameter 31.22 (see the firmware manual of the drive).
   The parameter selects which indications are given when one or both STO signals are switched off or lost. The indications also depend on whether the drive is running or stopped when this occurs.

   Note: This parameter does not affect the operation of the STO function itself. The STO function will operate regardless of the setting of this parameter: a running drive will stop upon removal of one or both STO signals, and will not start until both STO signals are restored and all faults reset.

   Note: The loss of only one STO signal always generates a fault as it is interpreted as a malfunction of STO hardware or wiring.
5. The motor coasts to a stop (if running). The drive cannot restart while the activation switch or safety relay contacts are open. After the contacts close, a reset may be needed (depending on the setting of parameter 31.22). A new start command is required to start the drive.

Start-up including validation test

To ensure the safe operation of a safety function, validation is required. The final assembler of the machine must validate the function by performing a validation test. The test must be performed

1. at initial start-up of the safety function
2. after any changes related to the safety function (circuit boards, wiring, components, settings, replacement of inverter module, etc.)
3. after any maintenance work related to the safety function
4. after a drive firmware update
5. at the proof test of the safety function.

Competence

The validation test of the safety function must be carried out by a competent person with adequate expertise and knowledge of the safety function as well as functional safety, as required by IEC 61508-1 clause 6. The test procedures and report must be documented and signed by this person.

Validation test reports

Signed validation test reports must be stored in the logbook of the machine. The report shall include documentation of start-up activities and test results, references to failure reports and resolution of failures. Any new validation tests performed due to changes or maintenance shall be logged into the logbook.

Validation test procedure

After wiring the Safe torque off function, validate its operation as follows.

Note: If the drive is equipped with safety option +L513, +L514, +L536, +L537, +Q950, +Q951, +Q952, +Q957, +Q963, +Q964, +Q965, +Q978, +Q979 or +Q984, also do the procedure shown in the documentation of the option.

If an FSO or FSPS module is installed, refer to its documentation.

Note: All inverter modules of the drive must be powered and connected to the STO circuit during the validation test.

Action	☑
WARNING! Obey the safety instructions. If you ignore them, injury or death, or damage to the equipment can occur.	☐
Make sure that the motor can be run and stopped freely during start-up.	☐
Stop the drive (if running), switch the input power off and isolate the drive from the power line using a disconnector.	☐
Check the STO circuit connections against the wiring diagram.	☐
Close the disconnector and switch the power on.	☐

Action	☑
Test the operation of the STO function when the motor is stopped. • Give a stop command for the drive (if running) and wait until the motor shaft is at a standstill. Make sure that the drive operates as follows: • Open the STO circuit. The drive generates an indication if one is defined for the 'stopped' state in parameter 31.22 (see the firmware manual). • Give a start command to verify that the STO function blocks the drive's operation. The motor should not start. • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Test the operation of the STO function when the motor is running. • Start the drive and make sure the motor is running. • Open the STO circuit. The motor should stop. The drive generates an indication if one is defined for the 'running' state in parameter 31.22 (see the firmware manual). • Reset any active faults and try to start the drive. • Make sure that the motor stays at a standstill and the drive operates as described above in testing the operation when the motor is stopped. • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Test the operation of the failure detection of the drive. The motor can be stopped or running. • Open the 1st input channel of the STO circuit. If the motor was running, it should coast to a stop. The drive generates an FA81 fault indication (see the firmware manual). • Give a start command to verify that the STO function blocks the drive's operation. The motor should not start. • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally. • Open the 2nd input channel of the STO circuit. If the motor was running, it should coast to a stop. The drive generates an FA82 fault indication (see the firmware manual). • Give a start command to verify that the STO function blocks the drive's operation. The motor should not start. • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Document and sign the validation test report which verifies that the safety function is safe and accepted for operation.	☐

Use

1. Open the activation switch, or activate the safety functionality that is wired to the STO connection.
2. The STO inputs on the drive control unit de-energize, and the control unit cuts off the control voltage from the output IGBTs.
3. The control program generates an indication as defined by parameter 31.22 (see the firmware manual of the drive).
4. The motor coasts to a stop (if running). The drive will not restart while the activation switch or safety relay contacts are open.
5. Deactivate the STO by closing the activation switch, or resetting the safety functionality that is wired to the STO connection.
6. Reset any faults before restarting.

WARNING!
The Safe torque off function does not disconnect the voltage of the main and auxiliary circuits from the drive. Therefore maintenance work on electrical parts of the drive or the motor can only be carried out after isolating the drive from the supply and all other voltage sources.

WARNING!
The Safe torque off functionality is only achieved through the XSTO connector of the inverter control unit (A41). True Safe torque off functionality is not achieved through the XSTO connectors of other control units (such as the supply control unit or the brake control unit).

The Safe torque off function is supported by any ACS880 inverter or drive control program. It is not supported by supply, DC/DC converter or brake firmware.

WARNING!
The drive cannot detect or memorize any changes in the STO circuitry when the drive control unit is not powered. If both STO circuits are closed and a level-type start signal is active when the power is restored, it is possible that the drive starts without a fresh start command. Take this into account in the risk assessment of the system.

WARNING!
Permanent magnet or synchronous reluctance [SynRM] motors only:

In case of a multiple IGBT power semiconductor failure, the drive can produce an alignment torque which maximally rotates the motor shaft by 180/*p* degrees (with permanent magnet motors) or 180/2*p* degrees (with synchronous reluctance [SynRM] motors) regardless of the activation of the Safe torque off function. *p* denotes the number of pole pairs.

Notes:

- If a running drive is stopped by using the Safe torque off function, the drive will cut off the motor supply voltage and the motor will coast to a stop. If this causes

danger or is not otherwise acceptable, stop the drive and machinery using the appropriate stop mode before activating the Safe torque off function.

- The Safe torque off function overrides all other functions of the drive.
- The Safe torque off function is ineffective against deliberate sabotage or misuse.
- The Safe torque off function has been designed to reduce the recognized hazardous conditions. In spite of this, it is not always possible to eliminate all potential hazards. The assembler of the machine must inform the final user about the residual risks.

Maintenance

After the operation of the circuit is validated at start-up, the STO function shall be maintained by periodic proof testing. In high demand mode of operation, the maximum proof test interval is 20 years. In low demand mode of operation, the maximum proof test interval is 10 years; see section Safety data (page 246).

There are two alternative procedures for proof testing:

1. Perfect proof testing. It is assumed that all dangerous failures of the STO circuit are detected during the test. PFD_{avg} values for STO with the perfect proof testing procedure are given in the safety data section.
2. Simplified proof testing. This procedure is faster and simpler than perfect proof testing. Not all dangerous failures of the STO circuit are detected during the test. The PFD_{avg} value for STO with the simplified proof testing procedure is given in the safety data section.

Note: The proof testing procedures are only valid for proof testing (periodic test, item 5 under section Start-up including validation test) but not for re-validation after changes made in the circuit. Re-validation (items 1…4 under Start-up including validation test) must be done according to the initial validation procedure.

Note: See also the Recommendation of Use CNB/M/11.050 (published by the European co-ordination of Notified Bodies) concerning dual-channel safety-related systems with electromechanical outputs:

- When the safety integrity requirement for the safety function is SIL 3 or PL e (cat. 3 or 4), the proof test for the function must be performed at least every month.
- When the safety integrity requirement for the safety function is SIL 2 (HFT = 1) or PL d (cat. 3), the proof test for the function must be performed at least every 12 months.

The STO function of the drive does not contain any electromechanical components.

In addition to proof testing, it is a good practice to check the operation of the function when other maintenance procedures are carried out on the machinery.

Include the Safe torque off operation test described above in the routine maintenance program of the machinery that the drive runs.

If any wiring or component change is needed after start-up, or the parameters are restored, do the test given in section Validation test procedure (page 239).

Use only spare parts approved by ABB.

Record all maintenance and proof test activities in the machine logbook.

Competence

The maintenance and proof test activities of the safety function must be carried out by a competent person with adequate expertise and knowledge of the safety function as well as functional safety, as required by IEC 61508-1 clause 6.

Perfect proof test procedure

Action	☑
WARNING! Obey the safety instructions. If you ignore them, injury or death, or damage to the equipment can occur.	☐
Test the operation of the STO function. If the motor is running, it will stop during the test. • Give a stop command for the drive (if running) and wait until the motor shaft is at a standstill. Make sure that the drive operates as follows: • Open the STO circuit. The drive generates an indication if one is defined for the 'stopped' state in parameter 31.22 (see the firmware manual). • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Test the operation of the failure detection of the drive. The motor can be stopped or running. • Open the 1st input channel of the STO circuit. If the motor was running, it should coast to a stop. The drive generates an FA81 fault indication (see the firmware manual). • Close the STO circuit. • Reset any active faults. • Open the 2nd input channel of the STO circuit. If the motor was running, it should coast to a stop. The drive generates an FA82 fault indication (see the firmware manual). • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Document and sign the test report to verify that the safety function has been tested according to the procedure.	☐

Simplified proof test procedure

Action	☑
WARNING! Obey the safety instructions. If you ignore them, injury or death, or damage to the equipment can occur.	☐
Test the operation of the STO function. If the motor is running, it will stop during the test. • Give a stop command for the drive (if running) and wait until the motor shaft is at a standstill. Make sure that the drive operates as follows: • Open the STO circuit. The drive generates an indication if one is defined for the 'stopped' state in parameter 31.22 (see the firmware manual). • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Document and sign the test report to verify that the safety function has been tested according to the procedure.	☐

Fault tracing

The indications given during the normal operation of the Safe torque off function are selected by drive control program parameter 31.22.

The diagnostics of the Safe torque off function cross-compare the status of the two STO channels. In case the channels are not in the same state, a fault reaction function is performed and the drive trips on an FA81 or FA82 fault. An attempt to use the STO in a non-redundant manner, for example activating only one channel, will trigger the same reaction.

See the firmware manual of the drive control program for the indications generated by the drive, and for details on directing fault and warning indications to an output on the control unit for external diagnostics.

Any failures of the Safe torque off function must be reported to ABB.

Safety data

The safety data for the Safe torque off function is given below.

Note: The safety data is calculated for redundant use, and applies only if both STO channels are used.

Frame size	SIL	SC	PL	PFH (T_1 = 20 a) (1/h)	PFD_{avg}			$MTTF_D$ (a)	DC (%)	SFF (%)	Cat.	HFT	CCF	T_M (a)	PFH_{diag} (1/h)	λ_{Diag_s} (1/h)	λ_{Diag_d} (1/h)
					Perfect proof test		Simplified proof test										
					T_1 = 5 a	T_1 = 10 a	T_1 = 5 or 10 a										
R8i	3	3	e	1.21E-10	2.66E-06	5.31E-06	1.06E-05	23970	≥90	>99	3	1	80	20	2.13E-09	1.84E-07	2.14E-07
2×R8i	3	3	e	1.21E-10	2.66E-06	5.31E-06	1.06E-05	16330	≥90	>99	3	1	80	20	2.92E-09	3.02E-07	2.92E-07
3×R8i	3	3	e	1.21E-10	2.66E-06	5.31E-06	1.06E-05	12390	≥90	>99	3	1	80	20	3.71E-09	4.19E-07	3.71E-07
4×R8i	3	3	e	1.21E-10	2.66E-06	5.31E-06	1.06E-05	9980	≥90	>99	3	1	80	20	4.50E-09	5.36E-07	4.50E-07
5×R8i	3	3	e	1.21E-10	2.66E-06	5.31E-06	1.06E-05	8360	≥90	>99	3	1	80	20	5.28E-09	6.54E-07	5.29E-07
6×R8i	3	3	e	1.21E-10	2.66E-06	5.31E-06	1.06E-05	7190	≥90	>99	3	1	80	20	6.07E-09	7.71E-07	6.07E-07
7×R8i	3	3	e	1.21E-10	2.66E-06	5.31E-06	1.06E-05	6310	≥90	>99	3	1	80	20	6.86E-09	8.88E-07	6.86E-07
8×R8i	3	3	e	1.29E-10	2.85E-06	5.31E-06	1.06E-05	5620	≥90	>99	3	1	80	20	7.65E-09	1.01E-06	7.65E-07
3AXD10000078136 J																	

- The following temperature profile is used in safety value calculations:
  - 670 on/off cycles per year with ΔT = 71.66 °C
  - 1340 on/off cycles per year with ΔT = 61.66 °C
  - 30 on/off cycles per year with ΔT = 10.0 °C
  - 32 °C board temperature at 2.0% of time
  - 60 °C board temperature at 1.5% of time
  - 85 °C board temperature at 2.3% of time.
- The STO is a type B safety component as defined in IEC 61508-2.
- Relevant failure modes:
  - The STO trips spuriously (safe failure)
  - The STO does not activate when requested
  - A fault exclusion on the failure mode “short circuit on printed circuit board” has been made (EN 13849-2, table D.5). The analysis is based on an assumption that one failure occurs at one time. No accumulated failures have been analyzed.
- STO response times:
  - STO reaction time (shortest detectable break): 1 ms
  - STO response time: 2 ms (typical), 25 ms (maximum)
  - Fault detection time: Channels in different states for longer than 200 ms
  - Fault reaction time: Fault detection time + 10 ms.
- Indication delays:
  - STO fault indication (parameter 31.22) delay: < 500 ms
  - STO warning indication (parameter 31.22) delay: < 1000 ms.

Terms and abbreviations

Term or abbreviation	Reference	Description
Cat.	EN ISO 13849-1	Classification of the safety-related parts of a control system in respect of their resistance to faults and their subsequent behavior in the fault condition, and which is achieved by the structural arrangement of the parts, fault detection and/or by their reliability. The categories are: B, 1, 2, 3 and 4.
CCF	EN ISO 13849-1	Common cause failure (%)
DC	EN ISO 13849-1	Diagnostic coverage (%)
HFT	IEC 61508	Hardware fault tolerance
$MTTF_D$	EN ISO 13849-1	Mean time to dangerous failure: (Total number of life units) / (Number of dangerous, undetected failures) during a particular measurement interval under stated conditions
PFD_{avg}	IEC 61508	Average probability of dangerous failure on demand, that is, mean unavailability of a safety-related system to perform the specified safety function when a demand occurs
PFH	IEC 61508	Average frequency of dangerous failures per hour, that is, average frequency of a dangerous failure of a safety related system to perform the specified safety function over a given period of time
PFH_{diag}	IEC/EN 62061	Average frequency of dangerous failures per hour for the diagnostic function of STO
PL	EN ISO 13849-1	Performance level. Levels a…e correspond to SIL
Proof test	IEC 61508, IEC 62061	Periodic test performed to detect failures in a safety-related system so that, if necessary, a repair can restore the system to an "as new" condition or as close as practical to this condition

Term or abbreviation	Reference	Description
SC	IEC 61508	Systematic capability (1…3)
SFF	IEC 61508	Safe failure fraction (%)
SIL	IEC 61508	Safety integrity level (1…3)
STO	IEC/EN 61800-5-2	Safe torque off
T_1	IEC 61508-6	Proof test interval. T_1 is a parameter used to define the probabilistic failure rate (PFH or PFD) for the safety function or subsystem. Performing a proof test at a maximum interval of T_1 is required to keep the SIL capability valid. The same interval must be followed to keep the PL capability (EN ISO 13849) valid. See also section Maintenance.
T_M	EN ISO 13849-1	Mission time: the period of time covering the intended use of the safety function/device. After the mission time elapses, the safety device must be replaced. Note that any T_M values given cannot be regarded as a guarantee or warranty.
λ_{Diag_d}	IEC 61508-6	Dangerous failure rate (per hour) of the diagnostics function of STO
λ_{Diag_s}	IEC 61508-6	Safe failure rate (per hour) of the diagnostics function of STO

TÜV certificate

The TÜV certificate is available on the Internet at www.abb.com/drives/documents.

Declarations of conformity

EU Declaration of Conformity

Machinery Directive 2006/42/EC

We
Manufacturer: ABB Oy
Address: Hiomotie 13, 00380 Helsinki, Finland.
Phone: +358 10 22 11
declare under our sole responsibility that the following products:

Frequency converters and **frequency converter components**

ACS880-04, -14, -34	(frames nxR8i)
ACS880-04XT, -04FXT	
ACS880-07, -17, -37, -107	
ACS880-104	
ACS880 multidrives	
ACS880-104LC	(690V, frames nxR7i and nxR8i)
ACS880-07CLC, -07LC, -17LC, -37LC, -107LC	(690V, frames nxR7i and nxR8i)
ACS880 liquid-cooled multidrives	

identified with serial numbers beginning with 1 or 8

with regard to the safety functions

Safe torque off

Safe motor temperature with FPTC-01 module (option code +L536)

Safe Stop 1 (SS1-t) with FSPS-21 module (+Q986)

Safe stop 1 (SS1-t and **SS1-r), Safe stop emergency, Safely-limited speed, Safe maximum speed, Safe brake control, Prevention of unexpected start-up**, with FSO-12 module (option code +Q973)

Safe stop 1 (SS1-t and **SS1-r), Safe stop emergency, Safely-limited speed, Safe maximum speed, Safe brake control, Safe Speed monitor, Safe direction, Prevention of unexpected start-up**, with FSO-21 and FSE-31 modules (option codes +Q972 and +L521)

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ACS880-07, -17, -37, -07CLC, -07LC, -17LC, -37LC, ACS880 multidrives and **ACS880 liquid-cooled multidrives: Prevention of unexpected start-up** (option codes +Q950; +Q957), **Emergency stop** (option codes +Q951; +Q952; +Q963; +Q964; +Q978; +Q979), **Safely-limited speed** (option codes +Q965; Q966)

are in conformity with all the relevant safety component requirements of EU Machinery Directive 2006/42/EC, when the listed safety functions are used for safety component functionality.

The following harmonized standards have been applied:

EN 61800-5-2:2007	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional
EN 62061:2021	Safety of machinery – Functional safety of safety-related control systems
EN ISO 13849-1:2015	Safety of machinery – Safety-related parts of control systems. Part 1: General principles for design
EN ISO 13849-2:2012	Safety of machinery – Safety-related parts of the control systems. Part 2: Validation
EN 60204-1:2018	Safety of machinery – Electrical equipment of machines – Part 1: General requirements

The following other standard has been applied:

IEC 61508:2010, parts 1-3	Functional safety of electrical / electronic / programmable electronic safety-related systems
IEC 61800-5-2:2016	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional

The products referred in this Declaration of conformity fulfil the relevant provisions of other European Union Directives which are notified in Single EU Declaration of conformity 3AXD10000497305.

Authorized to compile the technical file: ABB Oy, Hiomotie 13, 00380 Helsinki, Finland

Helsinki, 23 Jun 2022

Signed for and on behalf of:

Peter Lindgren
Vice President, ABB Oy

Vesa Tiihonen
Manager, Reliability and Quality, ABB Oy

Declaration of Conformity

Supply of Machinery (Safety) Regulations 2008

We
Manufacturer: ABB Oy
Address: Hiomotie 13, 00380 Helsinki, Finland.
Phone: +358 10 22 11

declare under our sole responsibility that the following products:

Frequency converters and **frequency converter components**

ACS880-04, -14, -34	(frames nxR8i)
ACS880-04XT, -04FXT	
ACS880-07, -17, -37, -107	
ACS880-104	
ACS880 multidrives	
ACS880-104LC	(690V, frames nxR7i and nxR8i)
ACS880-07CLC, -07LC, -17LC, -37LC, -107LC	(690V, frames nxR7i and nxR8i)
ACS880 liquid-cooled multidrives	

identified with serial numbers beginning with 1 or 8

with regard to the safety functions

Safe torque off

Safe motor temperature with FPTC-01 module (option code +L536)

Safe Stop 1 (SS1-t) with FSPS-21 module (+Q986)

Safe stop 1 (SS1-t and **SS1-r), Safe stop emergency, Safely-limited speed, Safe maximum speed, Safe brake control, Prevention of unexpected start-up**, with FSO-12 module (option code +Q973)

Safe stop 1 (SS1-t and **SS1-r), Safe stop emergency, Safely-limited speed, Safe maximum speed, Safe brake control, Safe Speed monitor, Safe direction, Prevention of unexpected start-up**, with FSO-21 and FSE-31 modules (option codes +Q972 and +L521)

3AXD10001326695 Rev. B

ACS880-07, -17, -37, -07CLC, -07LC, -17LC, -37LC, ACS880 multidrives and **ACS880 liquid-cooled multidrives: Prevention of unexpected start-up** (option codes +Q950; +Q957), **Emergency stop** (option codes +Q951; +Q952; +Q963; +Q964; +Q978; +Q979), **Safely-limited speed** (option codes +Q965; Q966)

are in conformity with all the relevant safety component requirements of the Supply of Machinery (Safety) Regulations 2008, when the listed safety functions are used for safety component functionality.

The following designated standards have been applied:

EN 61800-5-2:2007	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional
EN 62061:2005 + AC:2010 + A1:2013 + A2:2015	Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems
EN ISO 13849-1:2015	Safety of machinery – Safety-related parts of control systems. Part 1: General principles for design
EN ISO 13849-2:2012	Safety of machinery – Safety-related parts of the control systems. Part 2: Validation
EN 60204-1:2018	Safety of machinery – Electrical equipment of machines – Part 1: General requirements

The following other standards have been applied:

EN 61508:2010, parts 1-3	Functional safety of electrical / electronic / programmable electronic safety-related systems
EN 61800-5-2:2017	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional

The products referred in this declaration of conformity fulfil the relevant provisions of other UK statutory requirements, which are notified in a single declaration of conformity 3AXD10001346556.

Authorized to compile the technical file:
ABB Limited, Daresbury Park, Cheshire, United Kingdom, WA4 4BT

Helsinki, 23 Jun 2022

Signed for and on behalf of:

Peter Lindgren
Vice President, ABB Oy

Vesa Tiihonen
Manager, Reliability and Quality, ABB Oy

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Resistor braking

The brake units available for the drive are:

- Single-phase, on/off-controlled brake chopper indicated by option codes +D150 (chopper) and +D151 (resistors)
- Three-phase ACS880-607LC 3-phase dynamic brake units with control of current and power by modulation.

For more information, refer to

- ACS880-607LC 1-phase brake units hardware manual (3AXD50000481491 [English])
- ACS880-607LC 3-phase dynamic brake units hardware manual (3AXD50000581627 [English]).

Further information

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/searchchannels.

Product training

For information on ABB product training, navigate to new.abb.com/service/training.

Providing feedback on ABB manuals

Your comments on our manuals are welcome. Navigate to new.abb.com/drives/manuals-feedback-form.

Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet at www.abb.com/drives/documents.

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