ABB industrial drives

Supplement
ACS880-01 +P940/+P944 drives for cabinet installation (0.55 to 250 kW, 0.75 to 350 hp)

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List of related manuals

Drive hardware manuals and guides	Code (English)
ACS880-01 hardware manual	*3AUA0000078093*
ACS880-01 quick installation guide for frames R1 to R3	*3AUA0000085966*
ACS880-01 quick installation guide for frames R4 and R5	*3AUA0000099663*
ACS880-01 quick installation guide for frames R6 to R9	*3AUA0000099689*
ACS880-01 +P940/+P944 drives for cabinet installation supplement	*3AUA0000145446*
ACS880-01 assembly drawings for cable entry boxes of IP21 frames R5 to R9	*3AUA0000119627*
ACS-AP-x assistant control panels user's manual	*3AUA0000085685*
Vibration dampers for ACS880-01 drives (frames R4 and R5, option +C131) installation guide	*3AXD50000010497*
Vibration dampers for ACS880-01 drives (frames R6 to R9, option +C131) installation guide	*3AXD50000013389*
ACS880-01 +C132 marine type-approved drives supplement	*3AXD50000010521*
Flange mounting kit installation supplement	*3AXD50000019100*
Flange mounting kit quick installation guide for ACS880-01 and ACS580-01 frames R6 to R9	*3AXD50000019099*
Flange mounting kit quick installation guide for ACS880-01 frames R1 to R3	*3AXD50000026158*
Flange mounting kit quick installation guide for ACS880-01 frames R4 to R5	*3AXD50000026159*

Drive firmware manuals and guides	
ACS880 primary control program firmware manual	*3AUA0000085967*
Quick start-up guide for ACS880 drives with primary control program	*3AUA0000098062*

Option manuals and guides
Manuals and quick guides for I/O extension modules, fieldbus adapters, etc.

You can find manuals and other product documents in PDF format on the Internet. See section *Document library on the Internet* on the inside of the back cover. For manuals not available in the Document library, contact your local ABB representative.

The code below opens an online listing of the manuals applicable to this product.

ACS880-01 manuals

Supplement

ACS880-01 +P940/+P944 drives for cabinet installation
(0.55 to 250 kW, 0.75 to 350 hp)

3AUA0000145446 Rev C
EN
EFFECTIVE: 2015-06-25

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7. Installation checklist

8. Technical data

9. Dimension drawings

Further information

1

Safety instructions

What this chapter contains

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

Use of warnings

Warnings tell you about conditions which can cause injury or death, or damage to the equipment. They also tell you how to prevent the danger. The manual uses these warning symbols.

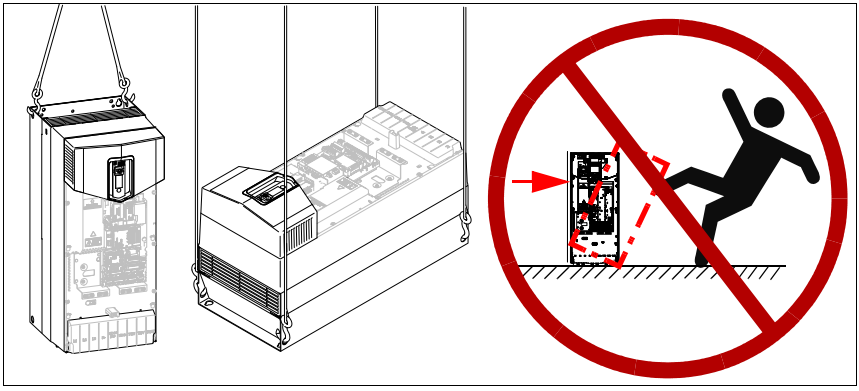
	**Electricity warning** tells about hazards from electricity which can cause injury or death, or damage to the equipment.
	**General warning** tells about conditions, other than those caused by electricity, which can cause injury or death, or damage to the equipment.
	**Electrostatic sensitive devices 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 that install the drive module and do maintenance work on it.

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

- Wear protective gloves and long sleeves. Some parts have sharp edges.
- Use safety shoes with a metal toe cap to avoid foot injury.
- Handle the drive module carefully.
- Heavy drive modules with high center of gravity (frames R6…R9):
  - Lift the drive with a lifting device. Use the lifting eyes of the drive.
- Do not tilt the drive.



- Beware of hot surfaces. Some parts, such as heatsinks of power semiconductors, remain hot for a while after disconnection of the electrical supply.
- Keep the drive module in its package or protect it otherwise from dust and burr from drilling and grinding until you install it. Protect also the installed drive against dust and burr. Electrically conductive debris inside the drive can cause damage or malfunction.
- Do not cover the air inlet and outlet of the drive when it runs.
- Vacuum clean the area below the drive before the start-up to prevent the drive cooling fan from drawing the dust inside the drive.
- Make sure that there is sufficient cooling. See section *Losses, cooling data and noise* in the hardware manual.
- Before you connect voltage to the drive, make sure that the cabinet doors are closed. Keep the doors closed during the operation. Obey the panel builder's instructions.

- 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 automatic fault reset 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.
- 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.
- Make sure that any safety circuits (for example, emergency stop and Safe torque off) are validated in start-up. See chapter *Start-up* in the hardware manual for reference of the validation instructions.

Note:

- If you select an external source for 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.
- When the control location is not set to Local, the stop key on the control panel will not stop the drive.
- Only authorized persons are allowed to repair a malfunctioning drive.

Electrical safety in installation, start-up and maintenance

Precautions before electrical work

These warnings are for all personnel that 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 electrician, do not do installation or maintenance work. Go through these steps before you begin any installation or maintenance work.

1. Clearly identify the work location.
2. Disconnect all possible voltage sources.
   - Open the main disconnector of the drive.
   - Open the disconnector of the supply transformer as the main disconnector of the drive does not remove the voltage from the input busbars of the drive.
   - Make sure that reconnection is not possible. Lock the disconnectors to open position and attach a warning notice to them.
   - Disconnect any external power sources from the control circuits before you do work on the control cables.
   - After you disconnect the drive, always wait for 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 multimeter with an impedance of at least 1 Mohm.
   - Make sure that the voltage between the drive module input power terminals (L1, L2, L3) and the grounding (PE) busbar is close to 0 V.
   - Make sure that the voltage between the drive module UDC+ and UDC- terminals and the grounding (PE) busbar is close to 0 V.
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 electrician, do not do installation or maintenance work.
- Do not install a drive with EMC filter option +E200 or +E202 on an ungrounded power system or a high resistance-grounded (over 30 ohms) power system.
- Do not connect the drive to a voltage higher than what is on the type designation label. If you do, the brake chopper starts to operate which causes the overheating of the brake resistor (if present). Overvoltage can also cause the motor to rush to its maximum speed.
- Do not secure the drive module by riveting or welding. We do not recommend that you secure the cabinet by arc welding.
- Do not do insulation or voltage withstand tests on the drive or drive modules.

Note:

- The motor cable terminals of the drive are at a dangerous voltage when the input power is on, regardless of whether the motor is running or not.
- The DC bus and brake resistor terminals (UDC+, UDC-, R+ and R-) are at a dangerous voltage.
- External wiring can supply dangerous voltages to the terminals of relay outputs (XRO1, XRO2 and XRO3).
- 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.

WARNING! Use a grounding wrist band when you handle the 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 electrician, do not do grounding work.
- Always ground the drive, the motor and adjoining equipment. This is necessary for the personnel safety. Proper grounding also reduces electromagnetic emission and interference.
- Make sure that the conductivity of the grounding conductors is sufficient. See section *Selecting the power cables* in the hardware manual. Obey the local regulations.
- Connect the power cable shields to protective earth (PE) of the drive to make sure of personnel safety.
- Make a 360° grounding of the power and control cable shields at the cable entries to suppress electromagnetic disturbances.
- In a multiple-drive installation, connect each drive separately to the protective earth (PE) busbar of the switch board or the transformer.

Note:

- You can use power cable shields as grounding conductors only when their conductivity is sufficient.
- As the normal touch current of the drive is higher than 3.5 mA AC or 10 mA DC, you must use a fixed protective earth connection and
  - a cross-section of the protective earthing conductor of at least 10 mm^2 Cu or 16 mm^2 Al,

or

  - automatic disconnection of the supply in case of discontinuity of the protective earthing conductor,

or

  - a second protective earthing conductor of the same cross-sectional area as the original protective earthing conductor.

See standard EN 61800-5-1, 4.3.5.5.2.

Additional instructions for permanent magnet motor drives

Safety in installation, start-up and 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 and equipment malfunction can occur.

- Do not do work on the drive when the permanent magnet motor is rotating. A rotating permanent magnet motor energizes the drive including its input power terminals.

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

- Stop the motor.
- 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 felt, nip, rope, etc.
- Measure that the installation is de-energized.
  - Use a multimeter with an impedance of at least 1 Mohm.
  - Make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is close to 0 V.
  - Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is close to 0 V.
  - Make sure that the voltage between the drive module UDC+ and UDC- terminals and the grounding (PE) busbar is close to 0 V.
- 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.
- Make sure that the operator cannot run the motor over the rated speed. Motor overspeed causes overvoltage can damage or explode the capacitors in the intermediate circuit of the drive.

2

Introduction to the supplement

What this chapter contains

This chapter describes the supplement.

Applicability

This supplement is applicable for the ACS880-01 with options +P940 and +P944 (drive modules). It is a supplement to *ACS880-01 hardware manual* (3AUA0000078093 [English].

Target audience

This supplement is intended for people who plan the installation and install the drive module into a customer-designed cabinet. Read the supplement before you work on the drive. You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

The supplement is written for readers worldwide. Both SI and imperial units are shown.

Purpose of the supplement

The supplement tells you how to install the drive module into a cabinet.

Contents of the manual

The chapters of the supplement are briefly described below.

Safety instructions gives safety instructions for the installation, start up, operation and maintenance of the drive.

Introduction to the supplement introduces the manual.

Hardware description describes the drive.

Guidelines for planning the cabinet installation gives guideline for planning drive cabinets and installing the drive module into a user-defined cabinet. The chapter gives cabinet layout examples and free space requirements around the module for cooling.

Mechanical installation describes how to install the basic drive module mechanically.

Electrical installation gives instructions on wiring the drive.

Installation checklist contains lists for checking the mechanical and electrical installation of the drive.

Technical data gives technical data of the drive module.

Dimension drawings contains dimension drawings of the drive module.

Related manuals

See *List of related manuals* on the inside of the front cover.

3

Hardware description

What this chapter contains

This chapter briefly describes the construction of the ACS880-01 +P940 drive module. For the operation principle and type code description, see *the hardware manual.*

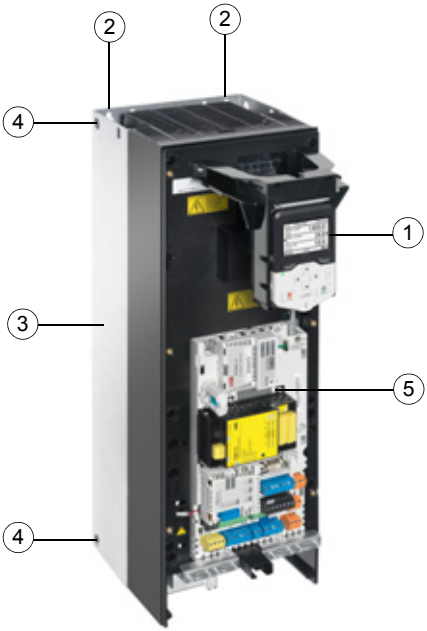
Product overview

The ACS880-01 +P940 is a drive module without front cover to be installed in a customer’s cabinet.

The ACS880-01 +P944 is a drive module with front cover to be installed in a customer’s cabinet.

Layout of option +P940 (IP20, UL Open Type)

The components of the drive module are shown below (view of frame R5).



1 Control panel
2 Four attaching points at the back of the drive
3 Heatsink
4 Lifting holes
5 Control unit

Layout of option +P944 (IP20, UL Open Type)

The components of the drive module are shown below (view of frame R5).

6 Control panel
7 Front cover
8 Cable entry box
9 Four fastening points at the back of the unit
10 Heatsink
11 Lifting holes

4

Guidelines for planning the cabinet installation

What this chapter contains

This chapter gives guidelines for planning drive cabinets and installing the drive module into a user-defined cabinet. The chapter gives example cabinet layouts and refers to free space requirements around the module for cooling. The guidelines are essential for the safe and trouble-free use of the drive system.

Limitation of liability

You must always plan and make the installation 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.

Installation position of the drive module

The drive module must be installed in an upright position. Vibration dampers are not needed in cabinet installations.

Basic requirements for the cabinet

Use a cabinet which

- has a frame sturdy enough to carry the weight of the drive components, control circuitry and other equipment installed in it
- protects the user and drive module against contact and agrees with the requirements for dust and humidity
- has sufficient air inlet and outlet gratings that allow free flow of cooling air through the cabinet. This is critical for proper cooling of the drive module.

Planning the layout of the cabinet

Plan a spacious layout to ensure easy installation and maintenance. Sufficient cooling air flow, obligatory clearances, cables and cable support structures all require space.

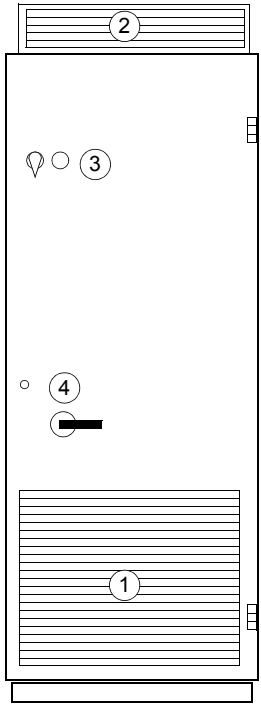
Place the control board(s) away from:

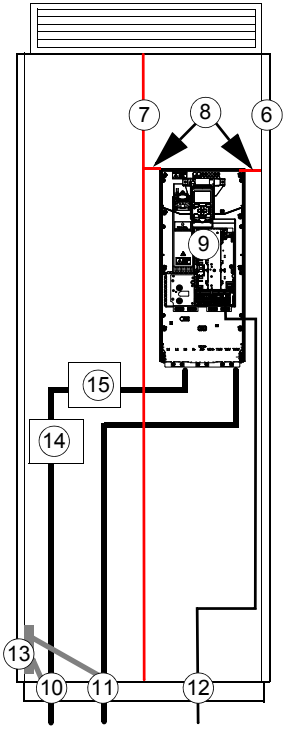
- main circuit components such as contactors, switches and power cables
- hot parts (heat sink, air outlet of the drive module).

Layout example

An example cabinet layout is shown below.

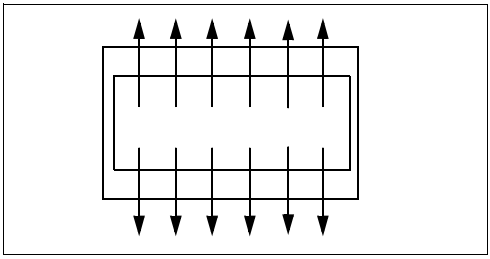
Note: The sizes of the air inlet and outlet gratings are critical for proper cooling of the drive module. For losses and cooling data requirements, see the hardware manual.





Door closed		Door open	
1	Air inlet	9	Drive module with control unit and control panel
2	Air outlet	10	Input power cable including the protective ground conductor (PE) of the drive
3	Contactor control switch and emergency stop switch (connected to the contactor control circuit inside the cabinet)	11	Motor cable including the protective ground conductor
4	Operating handle of the disconnector	12	External control cables
6	Supporting frame of the cabinet	13	Cabinet grounding busbar (PE)
7	Vertical air baffle that separates the cool and hot areas (leak-proof lead-throughs)	14	Disconnector and fuses
8	Horizontal air baffles	15	Contactor

Roof air flow viewed from top:



Arranging the grounding inside the cabinet

Arrange the grounding of the drive module by leaving the contact surfaces of the fastening points unpainted (bare metal-to-metal contact). The module frame will be grounded to the PE busbar of the cabinet via the fastening surfaces, screws and the cabinet frame. Alternatively, use a separate grounding conductor between the PE terminal of the drive module and the PE busbar of the cabinet.

Ground also the other components in the cabinet according to the principle above.

Selecting the busbar material and preparation of the joints

Note the following when you use busbars:

- We recommend tin-plated copper but you can also use aluminium
- Remove the oxide layer from aluminium busbar joints and apply suitable anti-oxidant joint compound.

Tightening torques

Use these torques to grade 8.8 screws (with or without joint compound) that tighten electric contacts:

Screw size	Torque
M5	3.5 N·m (2.6 lbf·ft)
M6	9 N·m (6.6 lbf·ft)
M8	20 N·m (14.8 lbf·ft)
M10	40 N·m (29.5 lbf·ft)
M12	70 N·m (52 lbf·ft)
M16	180 N·m (133 lbf·ft)

Planning the attaching of the cabinet

Note the following when you plan the attaching of the cabinet:

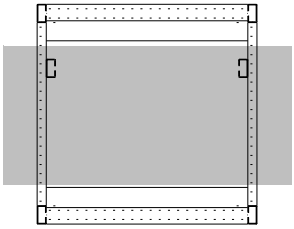
- Attach the cabinet to the floor from the front and to the floor or wall from the back.
- Always attach the drive module from its mounting points to the cabinet. For details, see the module installation instructions.

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

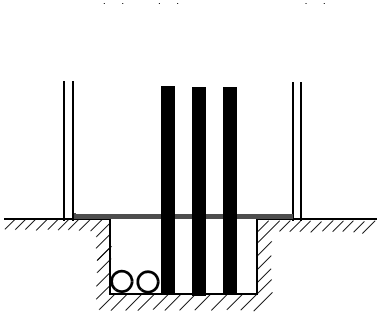
Planning the cabinet placement on a cable channel

Note the following when you plan to place the cabinet on a cable channel:

- The cabinet structure must be sturdy enough. If the whole cabinet base is not supported from below, the cabinet weight will lie on the sections that the floor carries.
- Equip the cabinet with a sealed bottom plate and cable lead-throughs to ensure the degree of protection and to prevent the cooling air flow from the cable channel into the cabinet.



The carrying structure on a cable channel



Cabinet side view with a bottom plate

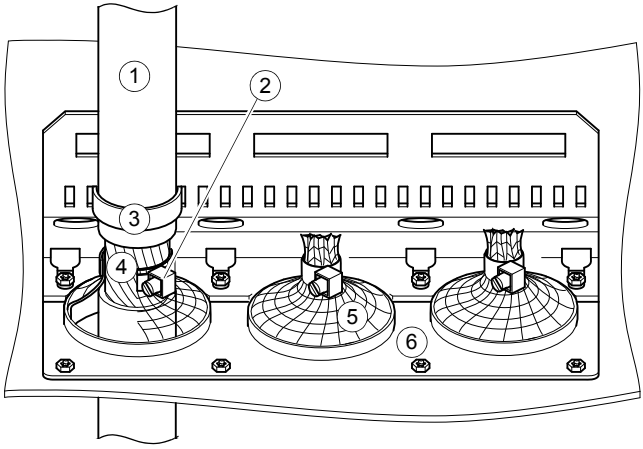
Planning the electromagnetic compatibility (EMC) of the cabinet

Note the following when you plan the electromagnetic compatibility of the cabinet:

- Generally, the fewer and smaller the holes in the cabinet, the better the interference attenuation. The maximum recommended diameter of a hole in

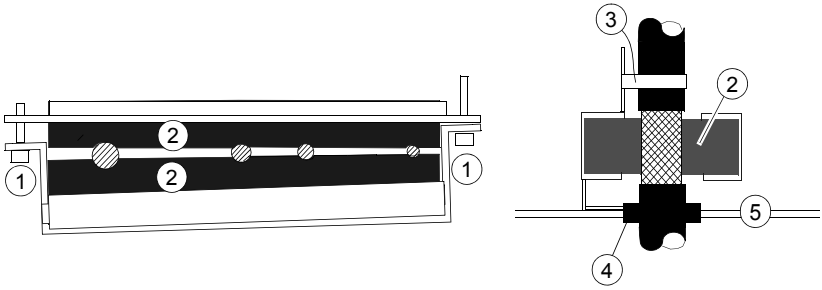
galvanic metal contact in the covering cabinet structure is 100 mm (3.94 in). Pay special attention to the cooling air inlet and outlet gratings.

- The best galvanic connection between the steel panels is achieved by welding them together as no holes are necessary. If welding is not possible, we recommend to leave the seams between the panels **unpainted** and equipped with special conductive EMC strips to provide adequate galvanic connection. Usually, reliable strips are made of flexible silicon mass covered with a metal mesh. The non-tightened touch-contact of the metal surfaces is not sufficient, so a conductive gasket between the surfaces is required. The maximum recommended distance between assembly screws is 100 mm (3.94 in).
- Construct sufficient high-frequency grounding network in the cabinet to avoid voltage differences and forming of high-impedance radiator structures. A good high-frequency grounding is made with short flat copper braids for low inductance. One-point high-frequency grounding cannot be used due to the long distances inside the cabinet.
- 360° high frequency grounding of the cable shields at the cable lead-throughs improves the EMC shielding of the cabinet.
- We recommend 360° high frequency grounding of the motor cable shields at their entries. The grounding can be implemented by a knitted wire mesh screening as shown below.



1	Cable
2	Cable tie
3	Strain relief
4	Bare cable shield
5	Knitted wire mesh

- We recommend 360° high frequency grounding of the control cable shields at their entries. The shields can be grounded by means of conductive shielding cushions pressed against the cable shield from both directions as shown below.



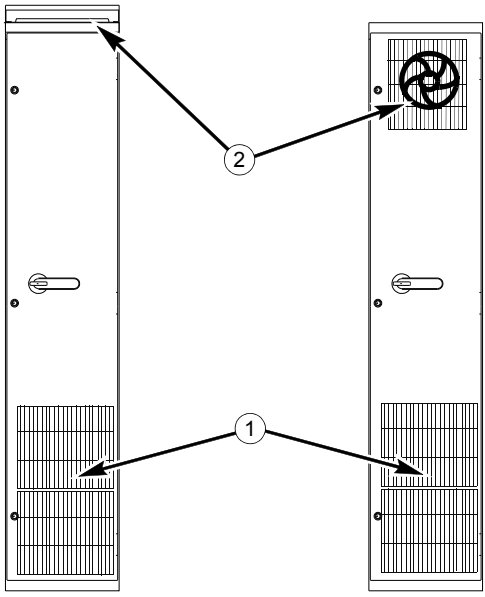
1	Tightening screw
2	EMI conductive cushion
3	Strain relief
4	Grommet
5	Lead-through plate

Planning the cooling

Note the following guidelines when you plan the cooling of the cabinet:

- Ventilate the installation site sufficiently so that the cooling air flow and ambient temperature requirements of the drive module are met, see the hardware manual. The internal cooling fan of the drive module rotates at a constant speed thus blowing constant air flow through the module. Whether the same amount of air must be replaced all the time in the facility depends on how much heat must be removed.
- Make sure that the temperature of the cooling air that goes into the drive does not exceed +40 °C (+104 °F).
- Leave enough free space around the components to ensure sufficient cooling. Observe the minimum clearances given for each component. For the required free space around the drive module, see page *34*.
- Also ventilate the heat dissipated by cables and other additional equipment.
- **Make sure that the air inlets and outlets are large enough to allow sufficient air flow in and out of the cabinet.** This is critical for correct cooling of the drive module. See section *Minimum air inlet and outlet grating sizes* on page *31*.
- Equip the air inlets and outlets with gratings that
  - guide the air flow
  - protect against contact
  - prevent water splashes from entering the cabinet.

- The drawing below shows two typical cabinet cooling solutions. The air inlet is at the bottom of the cabinet, while the outlet is at the top, either on the upper part of the door or on the roof. We recommend that the air outlet is on the cabinet door. Use an extra exhaust fan if the air outlet is on the cabinet door.



1 Air inlet
2 Air outlet

- The internal cooling fans of the drive module and reactors/chokes are usually sufficient to keep the component temperatures low enough in IP22 cabinets.
- In IP54 cabinets, thick filter mats are used to prevent water splashes from entering the cabinet. This requires the installation of additional cooling equipment, such as a hot air exhaust fan.

Minimum air inlet and outlet grating sizes

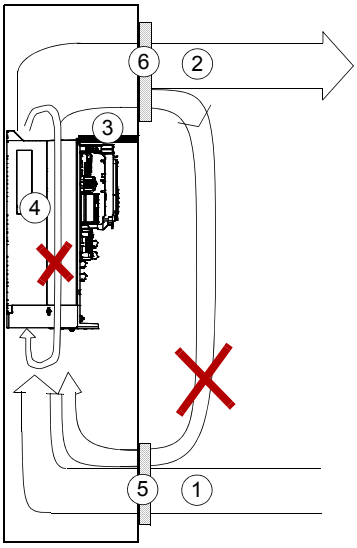
Frame size	Minimum effective area of cabinet air inlet (cm^2)		Minimum effective area of cabinet air outlet (cm^2)	
	IP22	IP54	IP22	IP54
R1	175	250	350	550
R2	225	350	450	700
R3	275	450	550	900
R4	350	550	700	1100
R5	400	650	800	1250
R6	475	750	950	1500
R7	650	1100	1300	2000
R8	1000	1600	2000	3200
R9	1500	2400	3000	4800

Preventing the recirculation of hot air

Prevent hot air circulation outside the cabinet by leading the outcoming hot air away from the area where the inlet air to the cabinet is taken. Possible solutions are listed below:

- gratings that guide air flow at the air inlet and outlet
- air inlet and outlet at different sides of the cabinet
- cool air inlet in the lower part of the front door, and an extra exhaust fan on the roof of the cabinet.

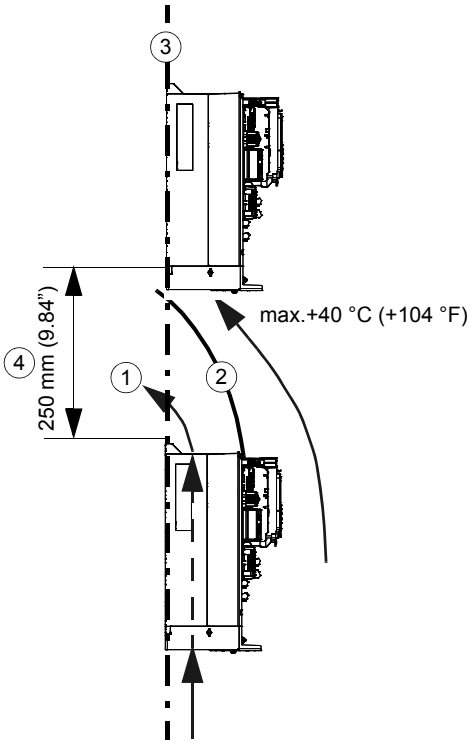
Prevent hot air circulation inside the cabinet with leak-proof air baffles or an extra fan at the inlet or outlet of the cabinet. If you use a fan, we recommend an inlet fan with a filter. Such a fan causes an overpressure inside the cabinet which helps to keep the dust out. No gaskets are usually required.



1 Main air flow in
2 Main air flow out
3 Air baffle plate
4 Drive
5 Air inlet filter
6 Air outlet filter

Installing drives above one another

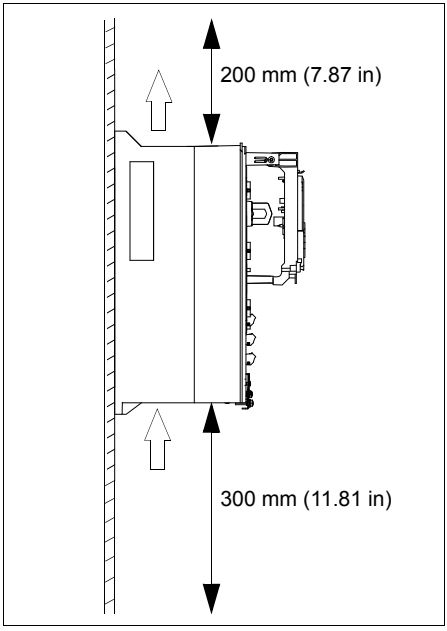
Make sure that the outlet cooling air flows away from the drive above.



1 Air flow through the drive
2 Air baffle
3 Mounting plate that allows air through flow
4 Minimum spacing between the drives

Required free space

The required free space at the top and bottom of the drive module is shown below. The free space is needed for making sure that sufficient cooling air flows through the module and the module cools correctly.



Mounting the control panel on the cabinet door

The control panel can be mounted on the cabinet door using a DPMP-01 mounting platform (option +J410) or a DPMP-02 mounting platform.

DPMP-01 door mounting kit

Planning the use of cubicle heaters

Use a cubicle heater if there is a risk of condensation in the cabinet. Although the primary function of the heater is to keep the air dry, it may also be required for heating at low temperatures.

Planning cabling outside the cabinet

See section *Routing the cables* in the hardware manual.

Installing ABB common mode filters (option +E208)

Common mode filter kits are available from ABB. For drive modules, without the cable entry box, hang the common mode filter ring on the cabinet structure. For the dimensions of the ring and routing of the motor cable through the ring, see

Common mode filter kit for ACS880-01 drives (frame R6, option +E208) installation guide	*3AXD50000015178*
Common mode filter kit for ACS880-01 drives (frame R7, option +E208) installation guide	*3AXD50000015179*
Common mode filter kit for ACS880-01 drives (frame R8, option +E208) installation guide	*3AXD50000015180*
Common mode filter kit for ACS880-01 drives (frame R9, option +E208) installation guide	*3AXD50000015201*

5

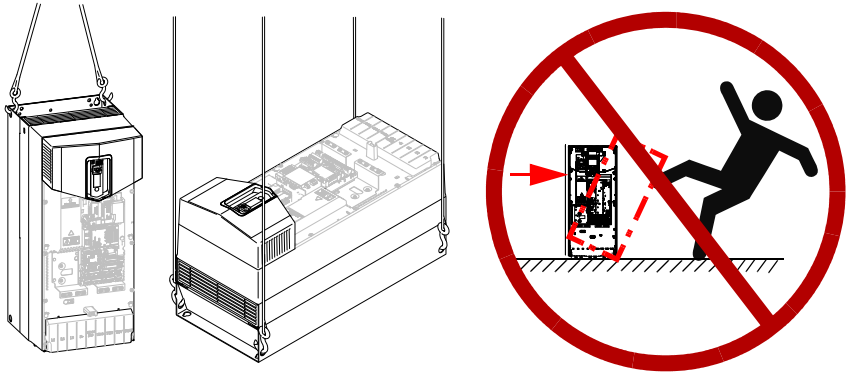
Mechanical installation

What this chapter contains

This chapter gives guidelines for the mechanical installation of the drive module into a cabinet.

Safety

WARNING! For frame sizes R6 to R9: Use the lifting eyes of the drive when you lift the drive. Do not tilt the drive. **The drive is heavy and its center of gravity is high. An overturning drive can cause physical injury.**



Examining the installation site

The drive modules can be installed tightly side by side.

Make sure that the installation site agrees with these requirements:

- The installation site has sufficient ventilation to prevent overheating of the drive. See section *Losses, cooling data and noise* in the hardware manual.
- The operation conditions of the drive agree with the specifications in section *Ambient conditions* in the hardware manual.
- The mounting plate is vertical, not flammable and strong enough to hold the weight of the drive module. See section *Necessary tools* on page *38*.
- The material below the installation is not flammable.
- There is enough free space above and below the drive for cooling air flow, service and maintenance. See pages *34* and *67*. There is enough free space in front of the drive for operation, service and maintenance.

Necessary tools

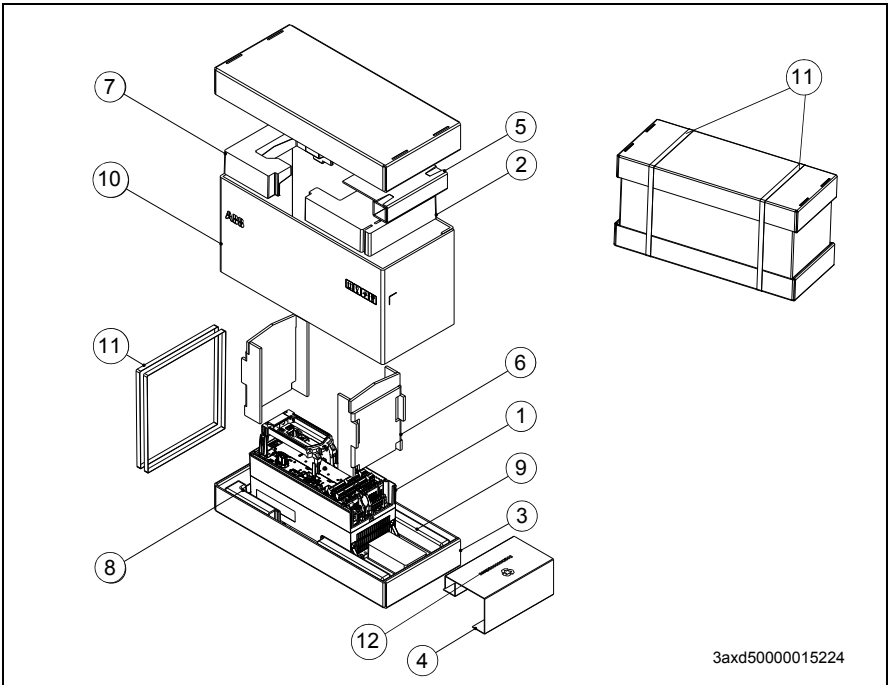
- Drill and drill bits
- Screwdriver and/or wrench with bits.

Moving the drive module

Move the transport package by pallet truck to the installation site.

Unpacking and examining the delivery (frames R1 to R2)

This illustration shows the layout of the transport package. Examine that all items are present and there are no signs of damage. Read the data on the type designation label of the drive to make sure that the drive is of the correct type.



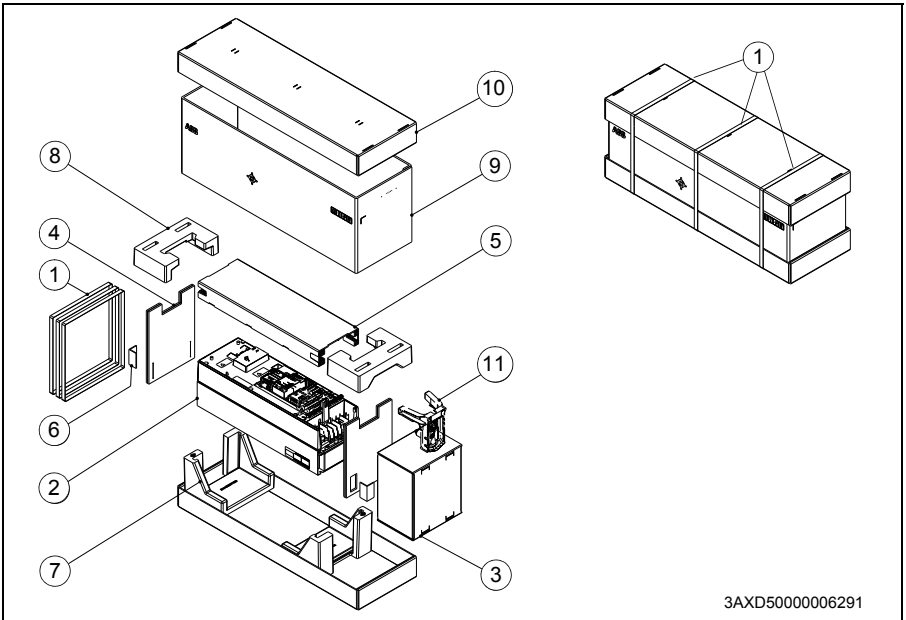
Item	Description	Item	Description
1	Drive with factory installed options. Cable shelves in a plastic bag.	7…9	Cushion
2	Cushion	10	Cardboard sleeve
3	Cardboard tray	11	PET straps
4…6	Cardboard support	12	Printed quick guides and manuals, multilingual residual voltage warning sticker, manuals CD

To unpack:

- Cut the straps.
- Remove the top cardboard cover and cushions.
- Lift the cardboard sleeve.
- Remove the cardboard supports.
- Lift the drive module.

Unpacking and examining the delivery (frames R3 and R5)

This illustration shows the layout of the transport package. Examine that all items are present and there are no signs of damage. Read the data on the type designation label of the drive to make sure that the drive is of the correct type.



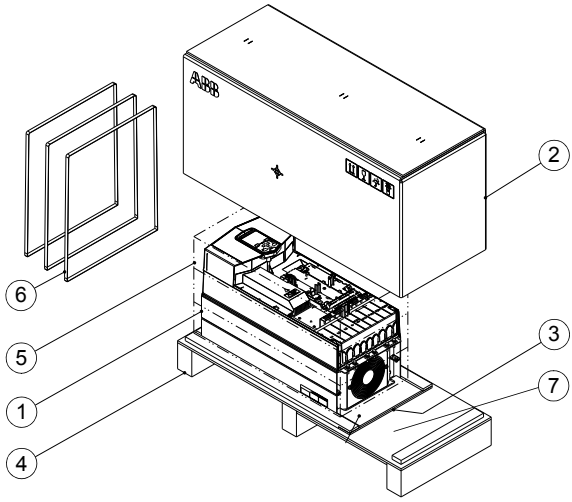
Item	Description	Item	Description
1	PET straps	6	Edge board support
2	Drive with factory installed options. Cable shelves in a plastic bag.	7, 8	Cushion
3	Printed quick guides and manuals, multilingual residual voltage warning sticker and manuals CD inside the box	9	Cardboard sleeve
4	Cardboard support	10	Top cardboard cover
5	Cardboard spacer	11	Control panel holder in frames R4 and R5

To unpack:

- Cut the straps.
- Remove the top cardboard cover and cushions.
- Lift the cardboard sleeve.
- Remove the cardboard supports.
- Attach lifting hooks to the lifting eyes of the drive module. Lift the drive module with a hoist.

Unpacking and examining the delivery (frames R6 to R9)

This illustration shows the layout of the transport package. Examine that all items are present and there are no signs of damage. Read the data on the type designation label of the drive to make sure that the drive is of the correct type.



3axd50000012445

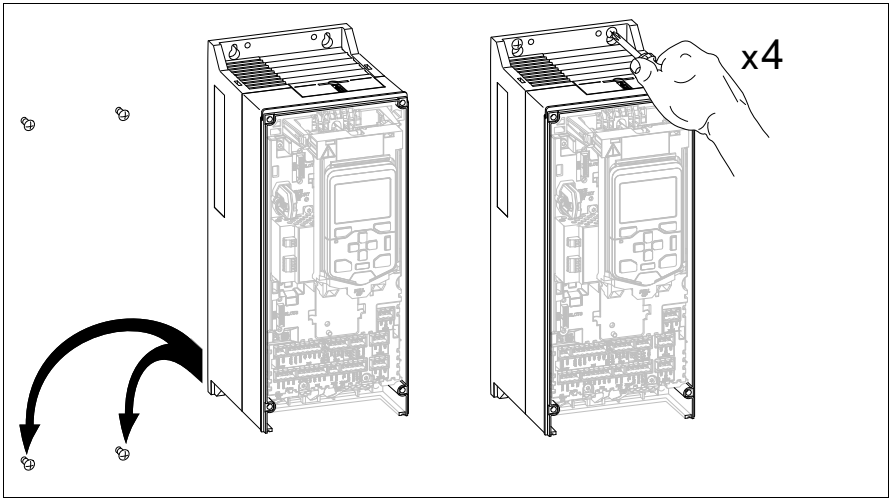
Item	Description	Item	Description
1	Drive with factory installed options	5	VCI bag
2	Cardboard cover	6	Straps
3	Stopper	7	Printed quick guides and manuals CD and multilingual residual voltage warning sticker
4	Pallet tray	-	-

To unpack:

- Cut the straps.
- Remove the top cardboard cover.
- Attach lifting hooks to the lifting eyes of the drive module. Lift the drive module with a hoist.

Installing the drive

1. See the dimensions in chapter *Dimension drawings*. Mark the locations for the four mounting holes.
2. Start the screws or bolts into the mounting holes.
3. Position the drive onto the screws.
4. Tighten the screws in the wall securely.



6

Electrical installation

What this chapter contains

This chapter tells you how to install the power and control cables to the drive module. For other electrical installation instructions that concern the drive, see the hardware manual

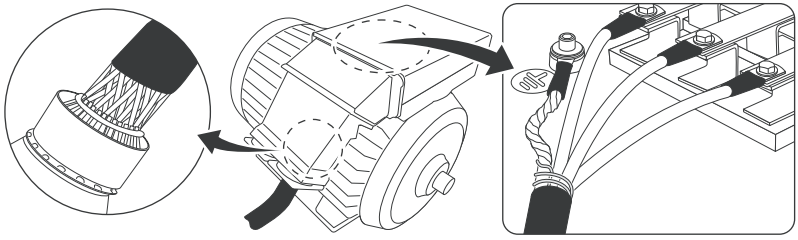
Warnings

WARNING! Only qualified electricians are allowed to carry out the work described in this chapter. Obey the safety instructions given in chapter *Safety instructions*. If you ignore them, injury or death or damage to the equipment can occur.

Connecting the motor cable at the motor end

Connect the motor cable at the motor end.

For minimum radio frequency interference, ground the motor cable shield 360 degrees at the motor terminal box.



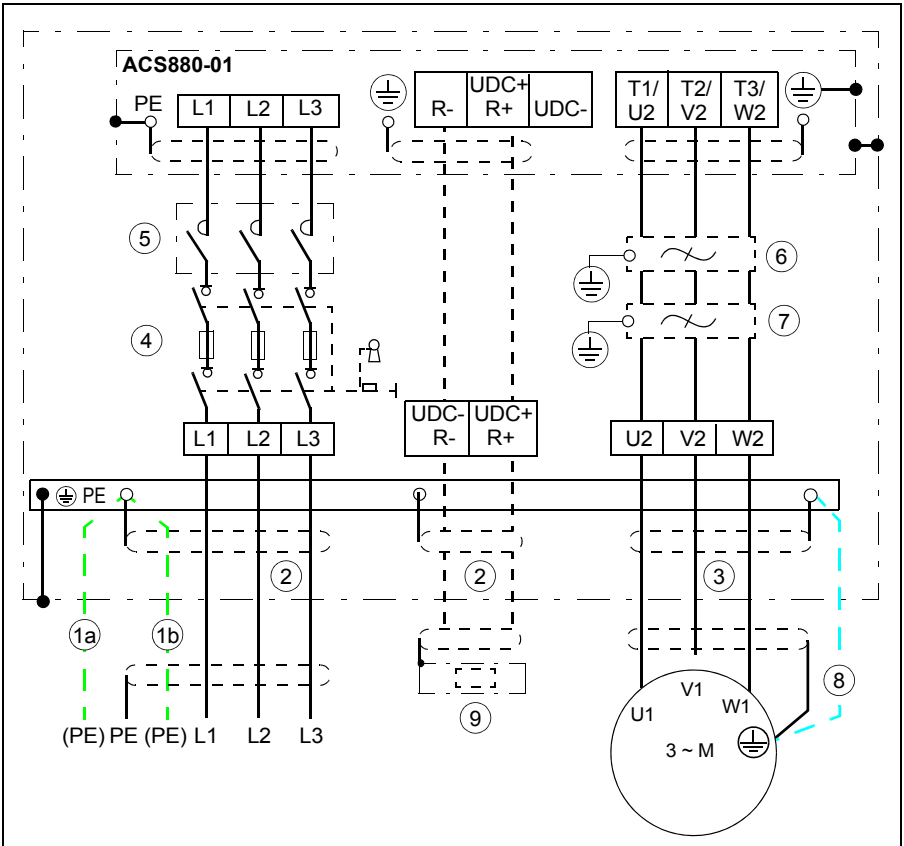
Checking the insulation of the assembly

See the hardware manual

Attaching the residual voltage warning sticker

See the hardware manual

Power cable connection diagram



1	Use a separate grounding PE cable (1a) or a cable with a separate PE conductor (1b) if the conductivity of the shield does not meet the requirements for the PE conductor.
2	We recommend 360-degree grounding if shielded cable is used. Ground the other end of the input cable shield or PE conductor at the distribution board.
3	We require 360-degree grounding.
4	Switch-disconnector and fuses. See section *Selecting the supply disconnecting device* in the hardware manual.

5	Line contactor (optional)
6	Common mode filter (option +E208)
7	du/dt filter or sine filter (optional)
8	Use a separate grounding cable if the shield does not meet the requirements of IEC 61439-1 and there is no symmetrically constructed grounding conductor in the cable. See the hardware manual.
9	External brake resistor

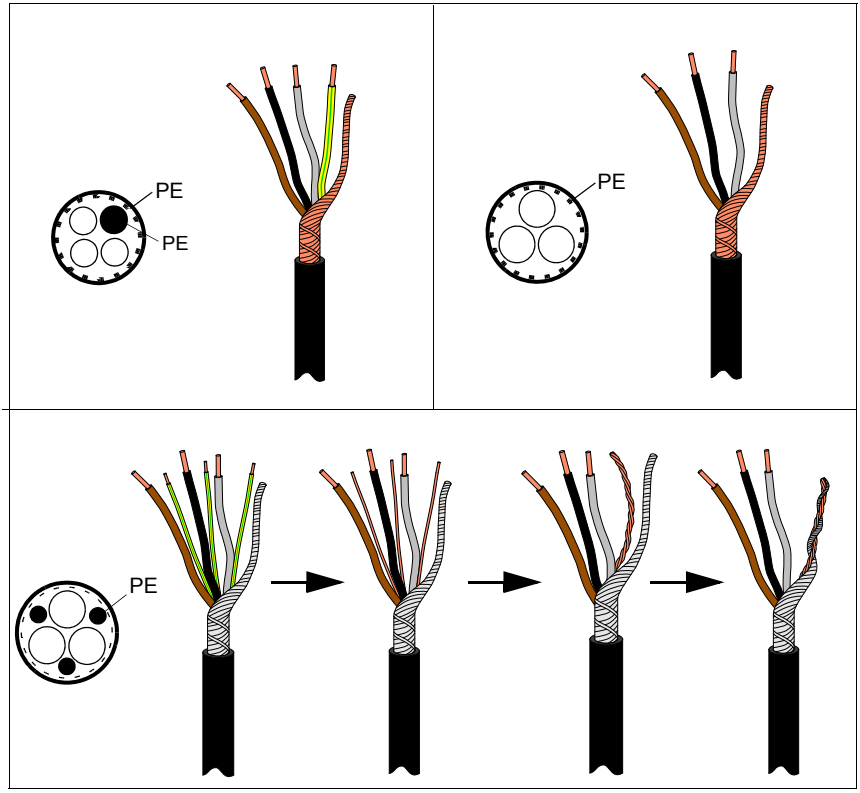
Note:

If there is a symmetrically constructed grounding conductor on the motor cable in addition to the conductive shield, connect the grounding conductor to the grounding terminal at the drive and motor ends.

Do not use an asymmetrically constructed motor cable for motors above 30 kW. Connecting its fourth conductor at the motor end increases bearing currents and causes extra wear.

Power cable connection procedure (IEC)

1. Do the steps in section *Safety instructions* on page *9* before you start the work.
2. Open the cabinet door.
3. Peel off 3 to 5 cm of the outer insulation of the cables above the lead-through plate of the cabinet for the 360° high-frequency grounding. See page *28*.
4. If fire insulation is used, make an opening in the mineral wool sheet according to the diameter of the cable.
5. Put the cables through the lead-throughs with the conductive sleeves.
6. Attach the conductive sleeves to the cable shields with cable ties.
7. Seal the slot between the cable and mineral wool sheet (if used) with sealing compound (eg, CSD-F, ABB brand name DXXT-11, code 35080082).
8. Tie up the unused conductive sleeves with cable ties.
9. Prepare the ends of the cables.



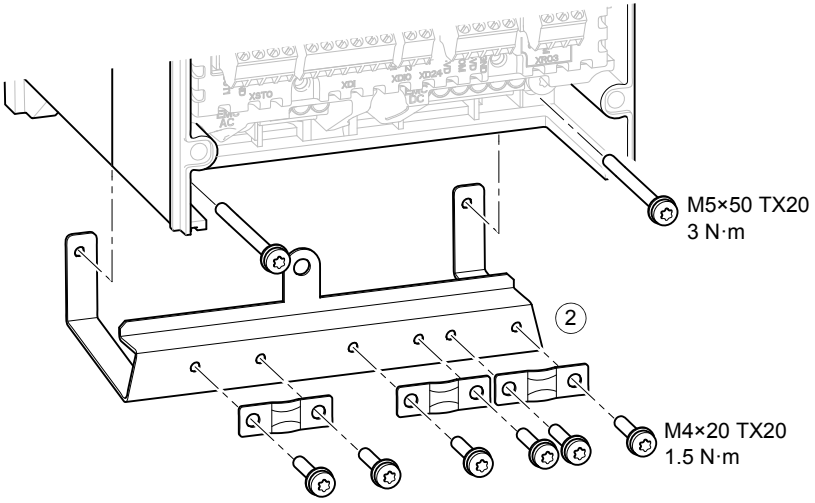
10. Connect the twisted shields of the power cables to the ground bar of the cabinet and the phase conductors to the drive module terminals. See

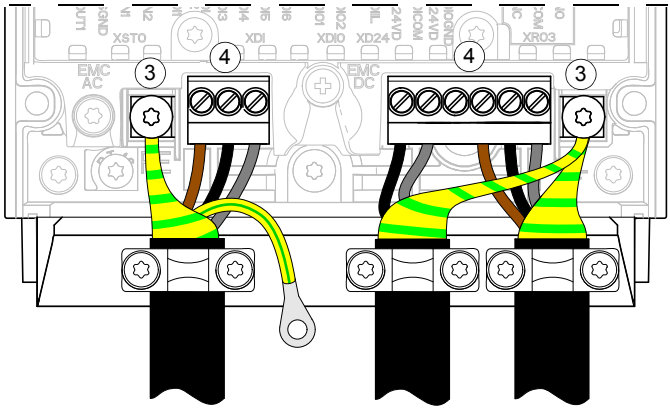
Frame	Section	Page
R2	*Installing the drive module shelves and connecting the cables – frame R2*	*47*
R3	*Installing the drive module shelves and connecting the cables – frame R3*	*51*
R4, R5	*Installing the drive module shelves and connecting the cables – frame R4 and R5*	*55*
R6…R9	*Installing the drive module shelves and connecting the cables – frame R6 and R9*	*60*

Installing the drive module shelves and connecting the cables – frame R2

1. Go through steps 1 to 9 in section *Power cable connection procedure (IEC)* on page *45*.
2. Attach the mechanical support self for the power cables to the drive module.
3. Connect the twisted shields of the power cables to the grounding terminals.
4. Connect the phase conductors of the input cable to the L1, L2 and L3 terminals and the phase conductors of the motor cable to the T1/U, T2/V and T3/W terminals. Connect the brake resistor conductors (if present) to the R+ and R- terminals. Tighten the screws to the torque given in the figure below.
5. Install the shelves for grounding the additional PE conductor of the input cable and the pair-cable shields and grounding wires of the control cables.
6. Connect the additional PE conductor of the input cable to the grounding shelf.
7. Go to section *Connecting the control cables – frames R1 and R2* on page *50*.

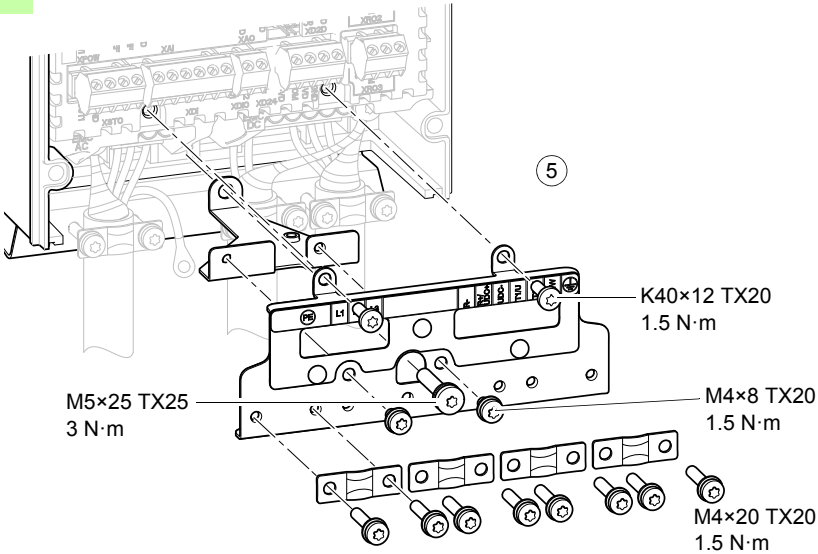
R1, R2

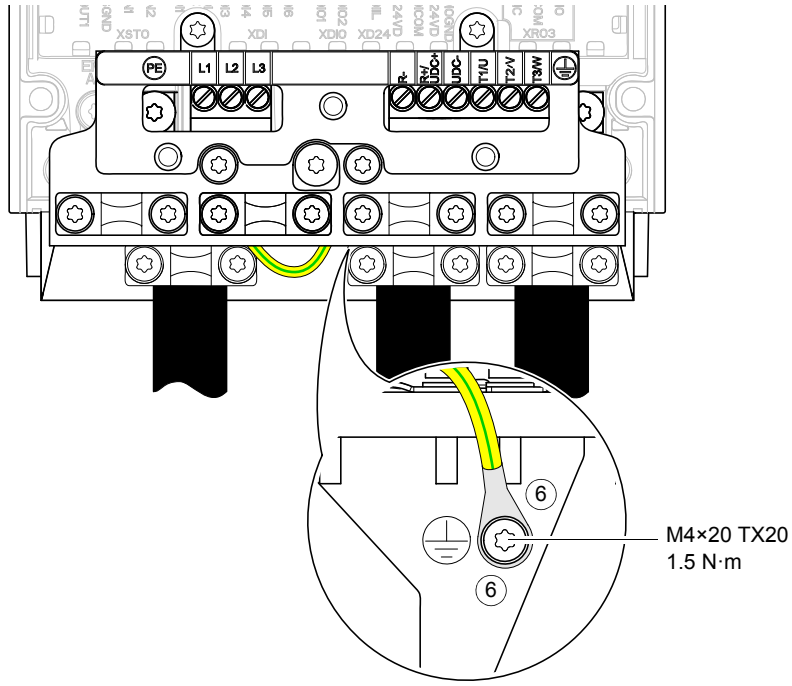




L1, L2, L3, T1/U, T2/V, T3/W, R-, R+/UDC+, UDC	⏚
0.6 N·m	1.8 N·m

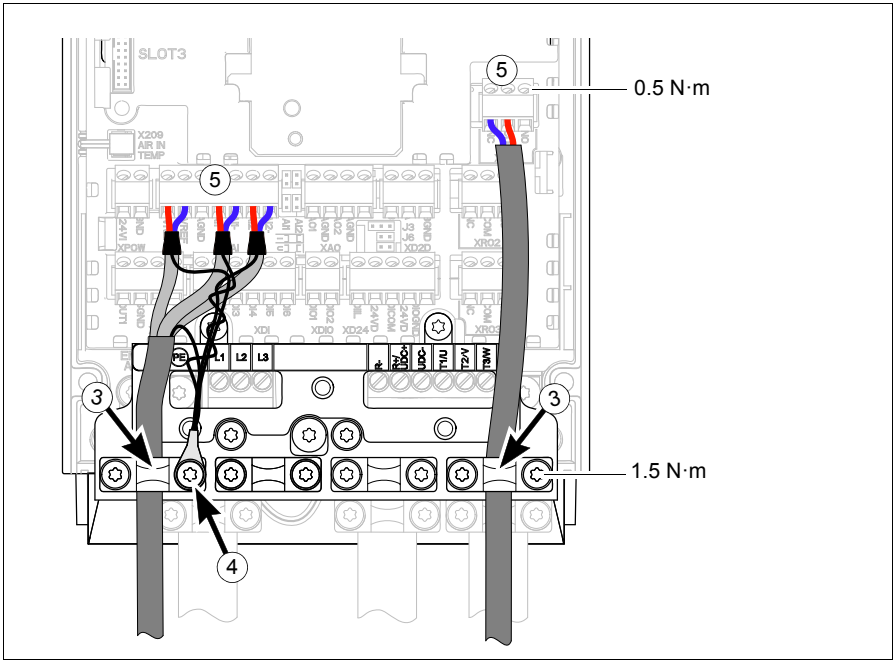
R1, R2


5
K40×12 TX20
1.5 N·m
M5×25 TX25
3 N·m
M4×8 TX20
1.5 N·m
M4×20 TX20
1.5 N·m


XSTO
XDI
XDIO
XD24
XR03
PE
L1
L2
L3
T1/U
T2/V
T3/W
6
6
M4×20 TX20
1.5 N·m

Connecting the control cables – frames R1 and R2

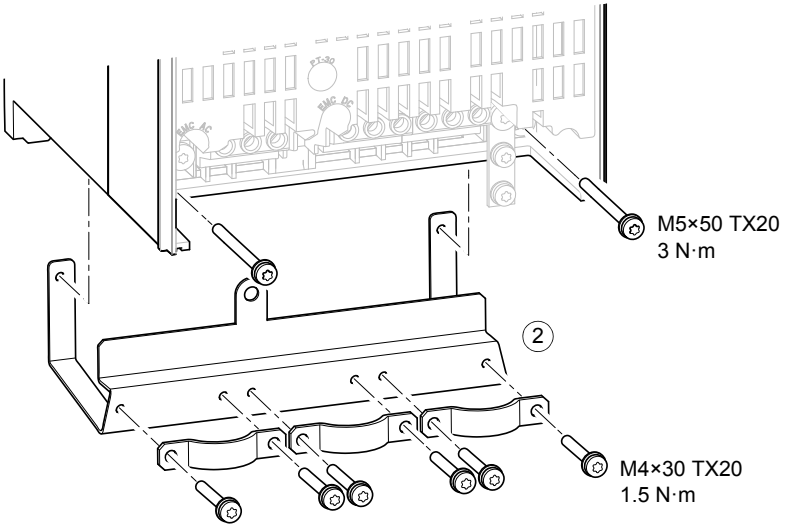
1. Strip the cable ends and cut to suitable length (note the extra length of the grounding conductors).
2. Ground the outer shields of all control cables 360 degrees at the cabinet lead-through.
3. Secure the cables mechanically at the clamps.
4. Ground the pair-cable shields to the clamps. Leave the other end of the shields unconnected or ground them indirectly via a high-frequency capacitor with a few nanofarads, eg, 3.3 nF / 630 V.
5. Connect the conductors to the appropriate terminals of the control board (see section *Default I/O connections* in the hardware manual).
6. Wire the optional modules if included in the delivery.

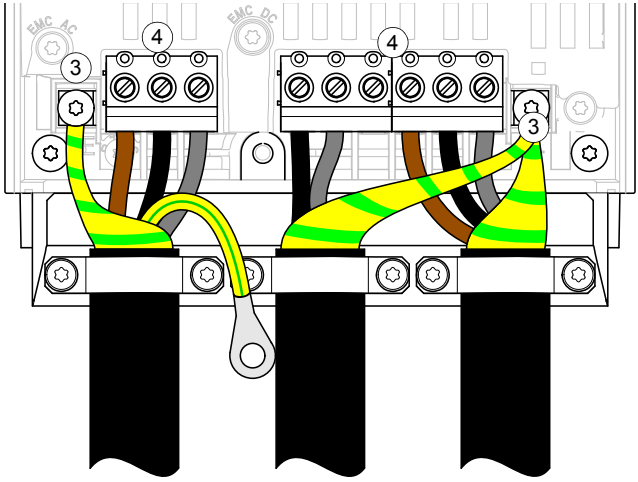


Installing the drive module shelves and connecting the cables – frame R3

1. Go through steps 1 to 9 in section *Power cable connection procedure (IEC)* on page *45*.
2. Attach the mechanical support self for the power cables to the drive module.
3. Connect the twisted shields of the power cables to the grounding terminals.
4. Connect the phase conductors of the input cable to the L1, L2 and L3 terminals and the phase conductors of the motor cable to the T1/U, T2/V and T3/W terminals. Connect the brake resistor conductors (if present) to the R+ and R- terminals. Tighten the screws to the torque given in the figure below.
5. Install the shelves for grounding the additional PE conductor of the input cable and the pair-cable shields and grounding wires of the control cables.
6. Connect the additional PE conductor of the input cable to the grounding shelf.
7. Go to section *Connecting the control cables – frame R3* on page *54*.

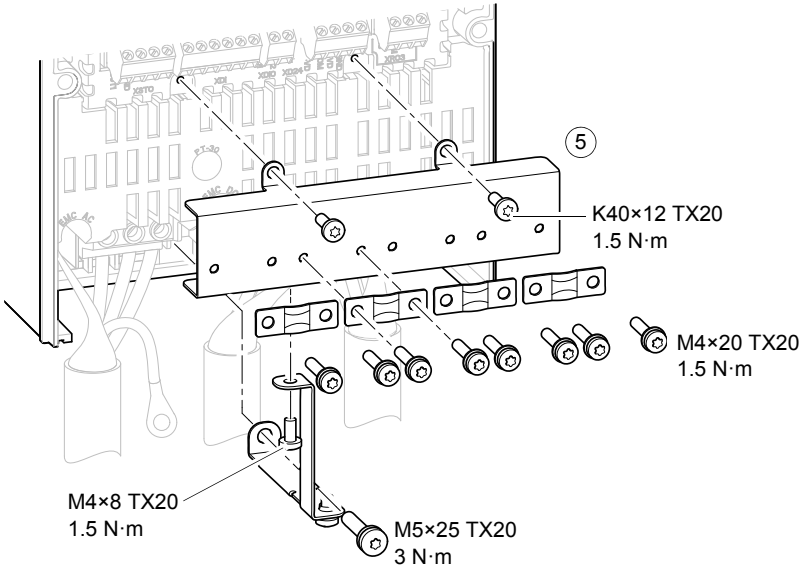
R3

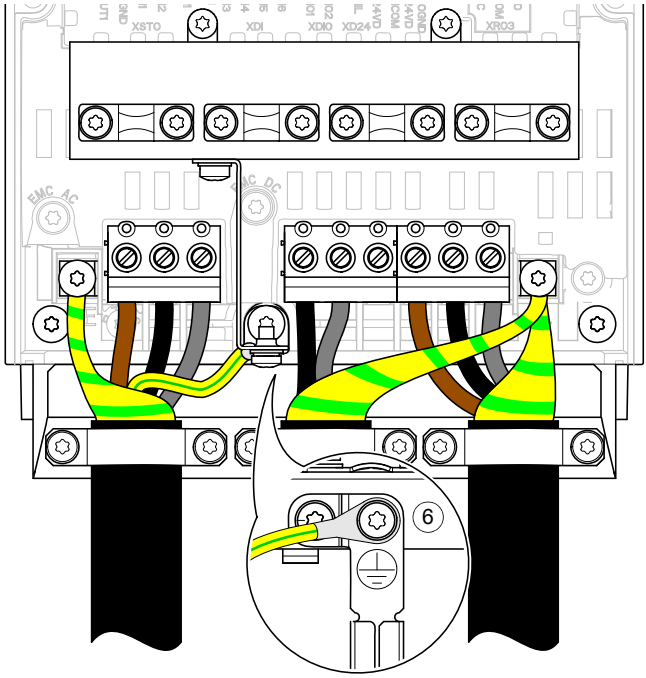




L1, L2, L3, T1/U, T2/V, T3/W, R-, R+/UDC+, UDC	⏚ (
0.6 N·m	1.8 N·m

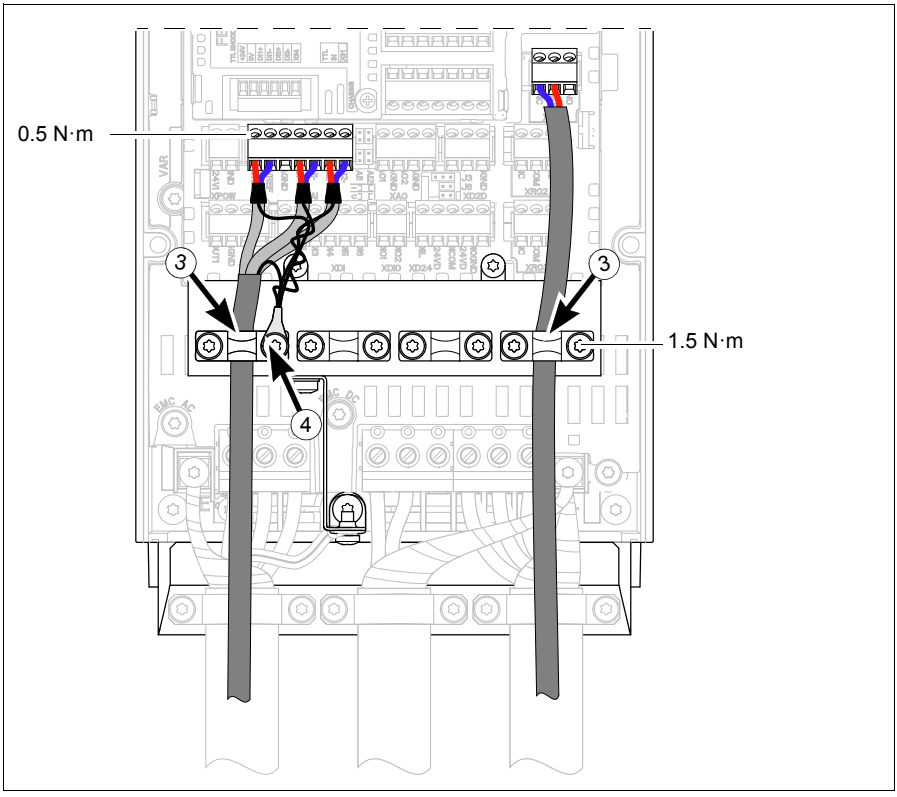
R3





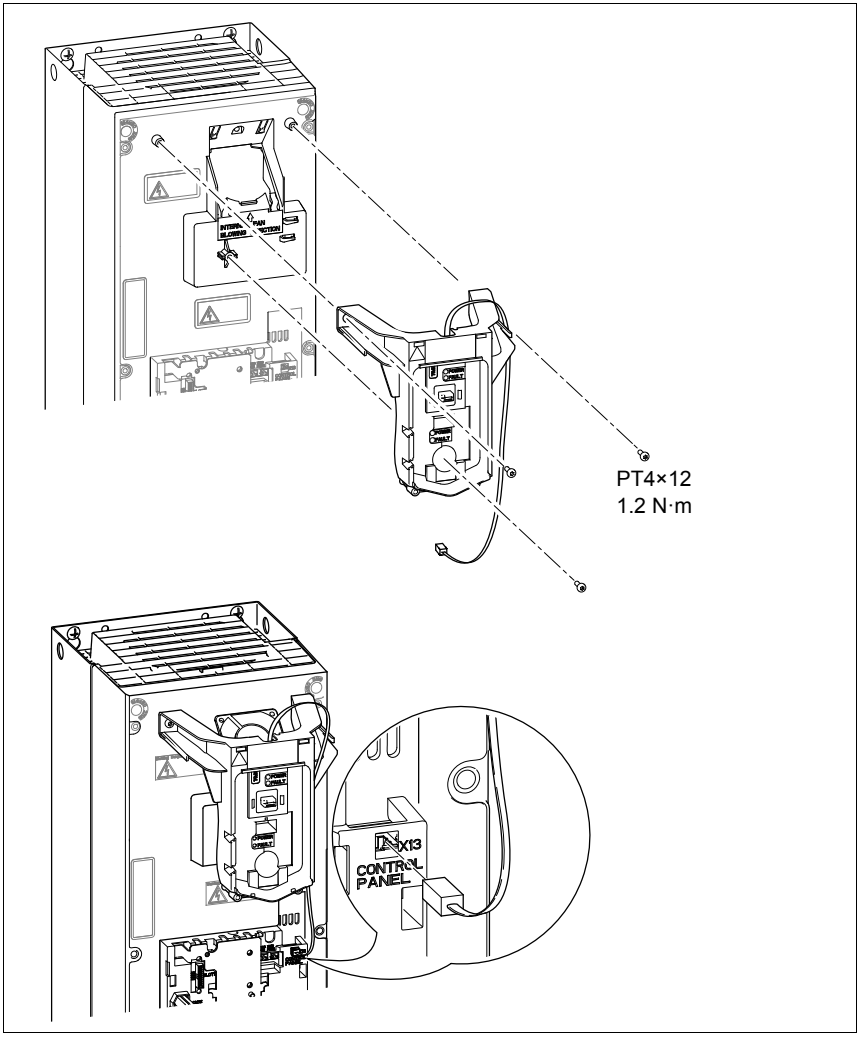
Connecting the control cables – frame R3

1. Strip the cable ends and cut to suitable length (note the extra length of the grounding conductors).
2. Ground the outer shields of all control cables 360 degrees at the cabinet lead-through.
3. Secure the cables mechanically at the clamps.
4. Ground the pair-cable shields to the clamps. Leave the other end of the shields unconnected or ground them indirectly via a high-frequency capacitor with a few nanofarads, eg, 3.3 nF / 630 V.
5. Connect the conductors to the appropriate terminals of the control board (see section *Default I/O connections* in the hardware manual).
6. Wire the optional modules if included in the delivery.

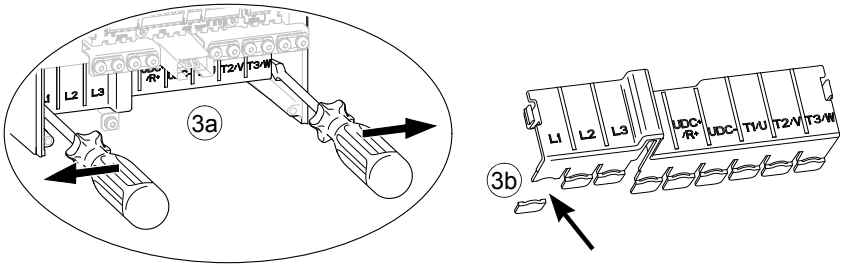


Installing the drive module shelves and connecting the cables – frame R4 and R5

1. Go through steps 1 to 9 in section *Power cable connection procedure (IEC)* on page *45*.
2. Install the control panel holder.

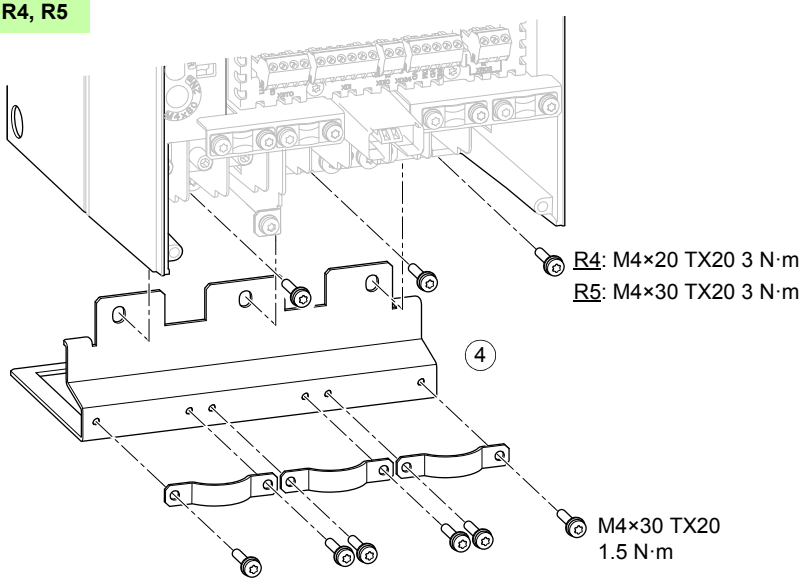


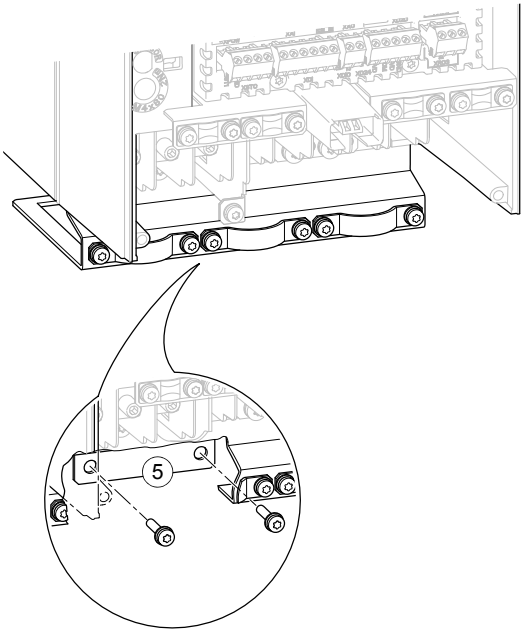
3. Remove the shroud on the power cable terminals by releasing the clips and lifting the shroud up from the sides with a screwdriver (a). Knock out holes in the shroud for the cables to be installed (b).



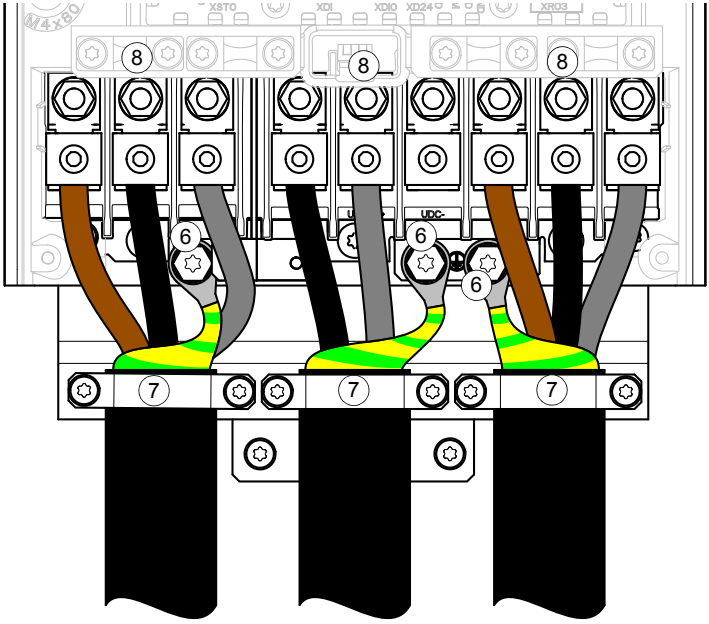
4. Attach the mechanical support self for the power cables to the drive module. **Note**: This shelf is not included with option +C135.
5. Attach the mechanical support self for the power cables to the mounting plate. **Note**: This shelf is not included with option +C135.
6. Connect the twisted shields of the power cables to the grounding terminals.
7. Attach the power cables with the clamps to the power cable support shelf or, with option +C135, to the flange bottom bracket.
8. Connect the phase conductors of the input cable to the L1, L2 and L3 terminals and the phase conductors of the motor cable to the T1/U, T2/V and T3/W terminals. Connect the brake resistor conductors (if present) to the R+ and R- terminals. Tighten the screws to the torque given in the figure below.
9. Reinstall the shroud on the power terminals.
10. Go to section *Connecting the control cables – frames R4 and R5* on page *59*.

R4, R5

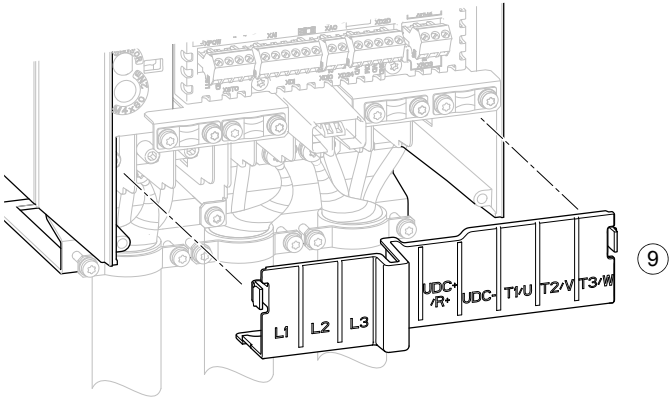




R4, R5

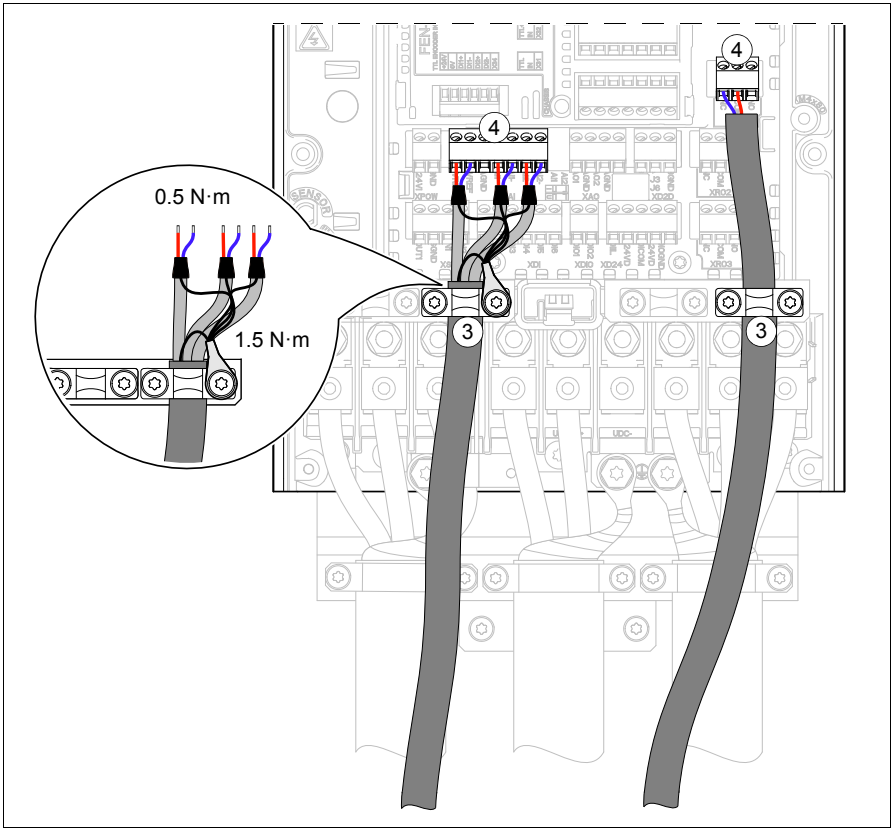


	L1, L2, L3, T1/U, T2/V, T3/W, R-, R+/UDC+, UDC	⏚
R4	3.3 N·m	2.9 N·m
R5	5.6 N·m	2.9 N·m



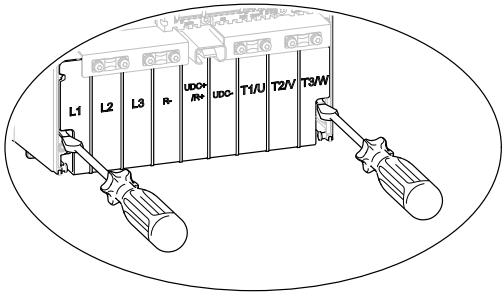
Connecting the control cables – frames R4 and R5

1. Strip the cable ends and cut to suitable length (note the extra length of the grounding conductors).
2. Ground the outer shields of all control cables 360 degrees at the cabinet lead-through.
3. Secure the cables mechanically at the clamps.
4. Ground the pair-cable shields to the clamps. Leave the other end of the shields unconnected or ground them indirectly via a high-frequency capacitor with a few nanofarads, eg, 3.3 nF / 630 V.
5. Connect the conductors to the appropriate terminals of the control board (see section *Default I/O connections* in the hardware manual).
6. Wire the optional modules if included in the delivery



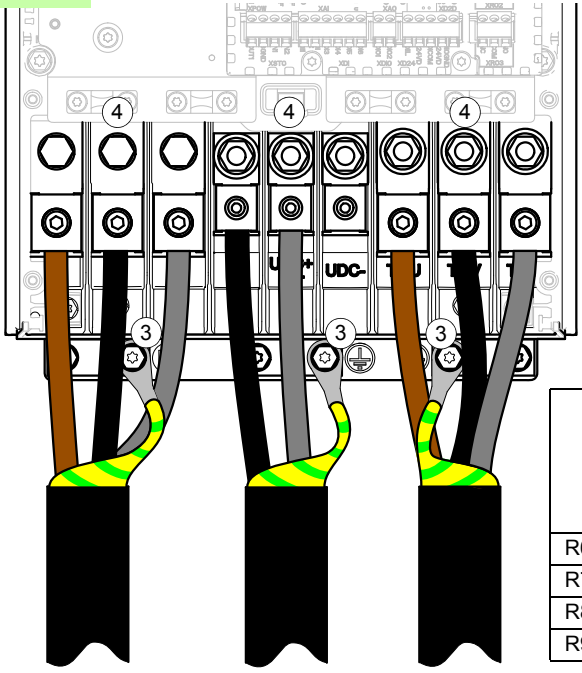
Installing the drive module shelves and connecting the cables – frame R6 and R9

1. Go through steps 1 to 9 in section *Power cable connection procedure (IEC)* on page *45*.
2. Remove the shroud on the power cable terminals by releasing the clips and lifting the shroud up from the sides with a screwdriver (a). Knock out holes in the shroud for the cables to be installed (b).



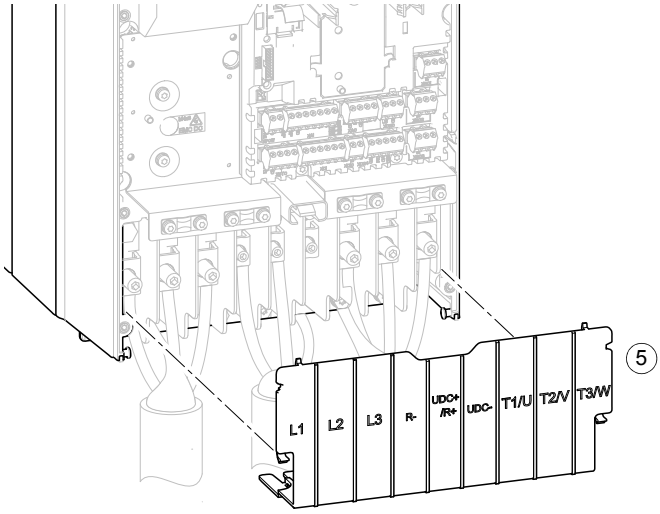
3. Connect the twisted shields of the power cables under the grounding clamps or with cable lugs to the grounding clamp screws.
4. Connect the phase conductors of the input cable to the L1, L2 and L3 terminals and the phase conductors of the motor cable to the T1/U, T2/V and T3/W terminals. Connect the brake resistor conductors (if present) to the R+ and R- terminals. Tighten the screws to the torque given in the figure below.
5. Reinstall the shroud on the power terminals.
6. Go to section *Connecting the control cables – frames R6 and R9* on page *62*.

R6…R9



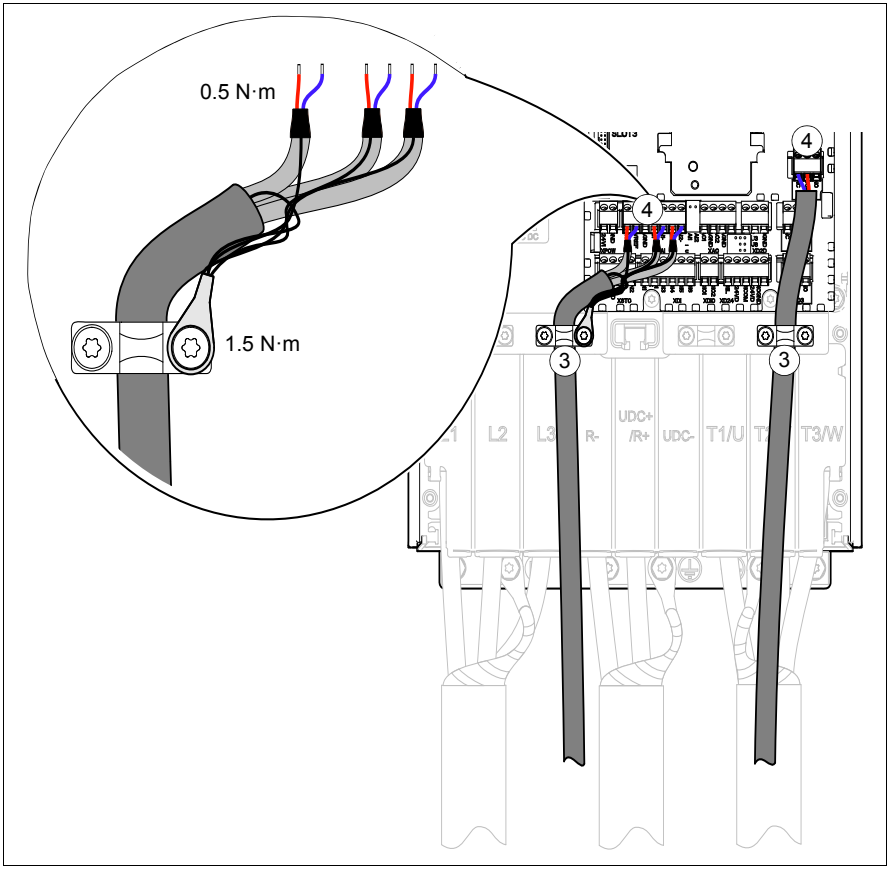
	L1, L2, L3, T1/U, T2/V, T3/W	R-, R+/UDC+, UDC-	⏚
	(N·m)	(N·m)	(N·m)
R6	30	20	9.8
R7	40 (30*)	30	9.8
R8	40	40	9.8
R9	70	70	9.8

* 525…690 V



Connecting the control cables – frames R6 and R9

1. Strip the cable ends and cut to suitable length (note the extra length of the grounding conductors).
2. Ground the outer shields of all control cables 360 degrees at the cabinet lead-through.
3. Sequre cables mechanically at the clamps.
4. Ground the pair-cable shields to the clamps. Leave the other end of the shields unconnected or ground them indirectly via a high-frequency capacitor with a few nanofarads, eg, 3.3 nF / 630 V.
5. Connect the conductors to the appropriate terminals of the control board (see section *Default I/O connections* in the hardware manual).
6. Wire the optional modules if included in the delivery.



7

Installation checklist

What this chapter contains

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

Installation checklist

Go through the checklist below together with another person.

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

Check that …	☑
Cabinet construction	
The drive module is attached correctly to the cabinet. (See chapters *Guidelines for planning the cabinet installation* and *Mechanical installation*.)	☐
Mechanical joints are tightened and not broken.	☐
Parts are clean and painted surfaces not scratched. The cabinet frame and parts which are in metal to metal contact with the frame (for example seams, component fixing points on assembly plates, back of control unit mounting plate) are **not** finished with non-conducting paint or material.	☐
Degree of protection (IPxx)	☐

Check that …	☑
Drive option modules and other components	
Type and number of option modules and other equipment is correct. Option modules and other equipment are not damaged.	☐
Option modules and terminals are labelled correctly.	☐
The placement of option modules and other equipment inside the cabinet and on the cabinet door is correct.	☐
The mounting of option modules and other equipment is correct.	☐
Internal cabling of the cabinet assembly	
Main circuit: • AC supply input cabling is ok. • AC output cabling is ok. • Supply for brake resistor (if used) is ok.	☐
Cable types, cross-sections, colors and optional markings are correct.	☐
Cabling is not susceptible to interference. Check the twisting of cables and cable routes.	☐
Connection of cables to devices, terminal blocks and drive module circuit boards: • Cables are connected to terminals tight enough. (Pull the conductors to check.) • Cable termination on terminals chaining is done correctly. • Bare conductors are not too far outside the terminal causing an insufficient clearance or loss of shielding against contact. • The control unit is wired properly to the drive module. • The control panel cable is connected correctly.	☐
Cables are not lying against sharp edges or bare live parts. Bending radius of fiber optic cables is at least 3.5 cm (1.38 in.).	☐
The type, markings, insulation plates and cross connections of terminal blocks are correct.	☐
Grounding and protection	
The grounding colors, cross-section and grounding points of modules and other equipment agree with the circuit diagrams. No long routes for pigtails.	☐
Connections of PE cables and busbars are tight enough. Pull the cable to test that it does not loosen. No long routes for pigtails.	☐
Doors equipped with electrical equipment are grounded. No long grounding routes. From EMC standpoint best result is achieved with a flat copper braid.	☐

Check that …	☑
Fans that can be touched are shrouded.	☐
Live parts inside the doors are protected against direct contact to at least IP2x.	☐
Labels	
The type designation and instruction labels and warning are made according to the local regulations and placed correctly.	☐
Switches and doors	
Mechanical switches, main disconnecting switch and cabinet doors function correctly.	☐
Installation of the cabinet	
The drive cabinet has been attached to floor and also from top to the wall or roof.	☐
The ambient operating conditions agree with the specifications given in chapter *Technical data* in the hardware manual.	☐
The cooling air will flow freely in and out of the drive cabinet, and air recirculation inside the cabinet will not be possible (air baffle plates are on place).	☐
If the drive module has been stored over one year: The electrolytic DC capacitors in the DC link of the drive have been reformed. See *Converter module capacitor reforming instructions* (3BFE64059629 [English]).	☐
There is an adequately sized protective ground conductor between the drive and the switchboard.	☐
There is an adequately sized protective ground conductor between the motor and the drive.	☐
All protective ground conductors have been connected to the appropriate terminals and the terminals have been tightened. (Pull the conductors to check.)	☐
The enclosures of the equipment in the cabinet have proper galvanic connection to the cabinet protective earth (ground) busbar; The connection surfaces at the fastening points are bare (unpainted) and the connections are tight, or separate grounding conductors have been installed.	☐
The supply voltage agrees with the nominal input voltage of the drive. Check the type designation label.	☐
The input power cable has been connected to the appropriate terminals, the phase order is right, and the terminals have been tightened. (Pull the conductors to check.)	☐
Appropriate AC fuses and a main disconnector have been installed.	☐

Check that …	☑
The motor cable has been connected to the appropriate terminals, the phase order is right, and the terminals have been tightened. (Pull the conductors to check.)	☐
The brake resistor (if present) has been connected to the appropriate terminals, and the terminals have been tightened. (Pull the conductors to check.)	☐
The motor cable (and brake resistor cable, if present) has been routed away from other cables.	☐
No power factor compensation capacitors have been connected to the motor cable.	☐
The control cables (if any) have been connected to the appropriate terminals, and the terminals have been tightened. (Pull the conductors to check.)	☐
If a drive bypass connection is used: The direct-on-line contactor of the motor and the drive output contactor are either mechanically or electrically interlocked, ie, cannot be closed simultaneously.	☐
There are no tools, foreign objects or dust from drilling inside the drive module and the cabinet.	☐
All shrouds and cover of the motor connection box are in place. Cabinet doors have been closed.	☐
The motor and the driven equipment are ready for start.	☐

12

Technical data

What this chapter contains

This chapter contains some technical data of the drive module. For other data, see the hardware manual.

Dimensions. weights and free space requirements

+P940								
Frame	**IP20**				**UL Open Type**			
	H	**W**	**D**	**Weight**	**H**	**W**	**D**	**Weight**
	mm	mm	mm	kg	in.	in.	in.	lb
R1	376	155	226	5.7	14.80	6.10	8.88	12
R2	376	155	249	7.2	14.80	6.10	9.78	16
R3	436	173	256	9.4	17.17	6.81	10.09	21
R4	563	203	333	16.1	22.17	7.99	13.12	36
R5	653	203	333	19.3	25.70	7.99	13.12	43
R6	593	252	357	38.8	22.35	9.92	14.07	85
R7	645	284	365	47.6	25.39	11.18	14.35	105
R8	724	300	386	58.6	28.0	11.81	15.21	129
R9	723	380	413	85.2	28.46	14.96	16.27	188

+P944								
Frame	**IP20**				**UL Open Type**			
	H	**W**	**D**	**Weight**	**H**	**W**	**D**	**Weight**
	mm	mm	mm	kg	in.	in.	in.	lb
R1	376	155	226	6.1	14.80	6.10	8.91	13
R2	376	155	249	7.6	14.80	6.10	9.82	17
R3	436	173	261	9.9	17.17	6.81	10.29	22

+P944								
Frame	IP20				UL Open Type			
	H	W	D	Weight	H	W	D	Weight
	mm	mm	mm	kg	in.	in.	in.	lb
R4	563	203	274	16.8	22.17	7.99	10.80	37
R5	653	203	274	20.2	25.70	7.99	10.77	45
R6	593	252	357	39.8	22.35	9.92	14.07	88
R7	645	284	365	48.6	25.39	11.18	14.35	107
R8	724	300	386	59.8	28.0	11.81	15.21	132
R9	723	380	413	86.6	28.46	14.96	16.27	191

3AXD00000588487

H Height

W Width

D Depth

Note: For more information on dimensions, see chapter *Dimension drawings*.

200 mm (7.87 in.) free space is required at top of the drive module.

300 mm (11.81 in.) free space is required at bottom of the drive module.

Degree of protection

IP20 (UL Open Type)

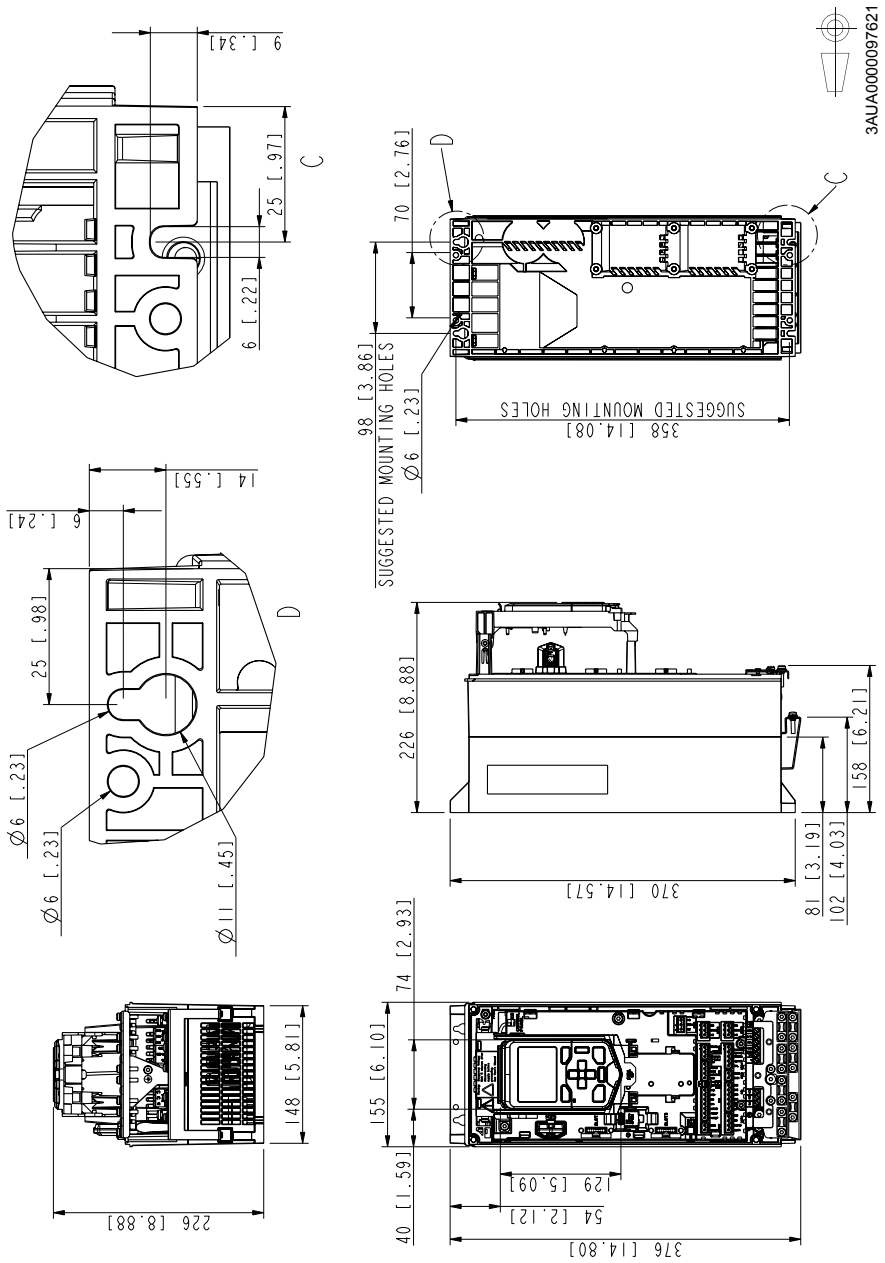
13

Dimension drawings

What this chapter contains

This chapter contains dimension drawings of the drive module.

R1 (Option +P940, IP20, UL Open Type)



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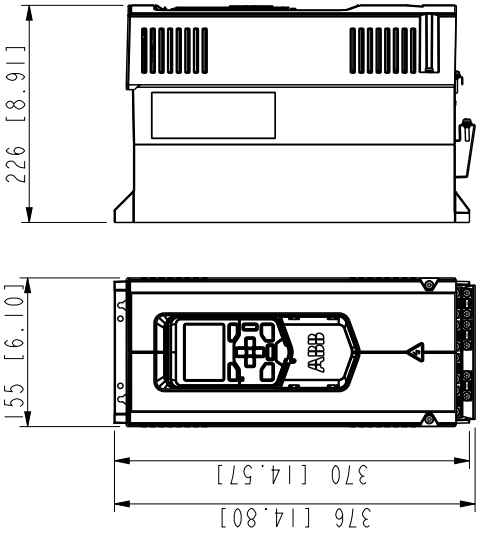
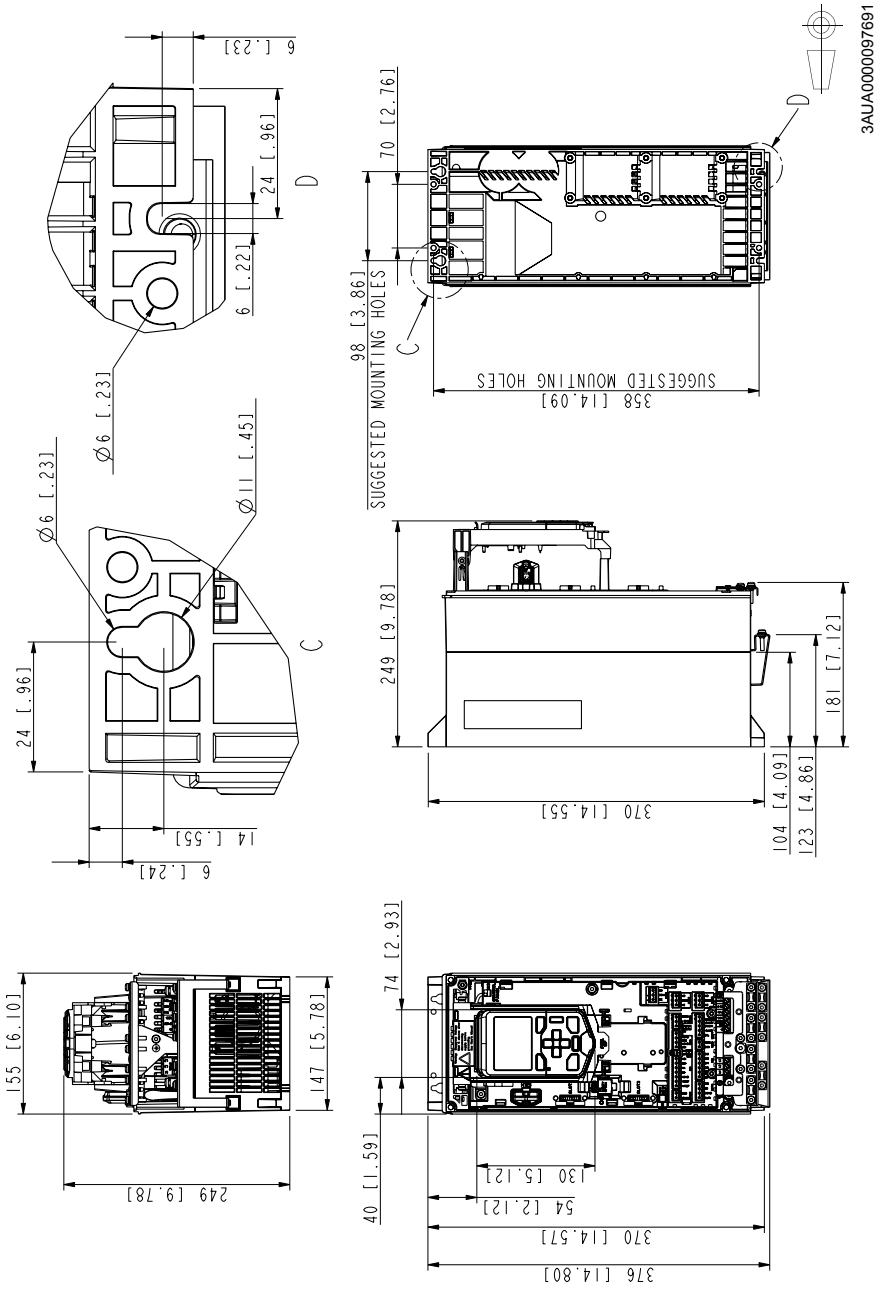


R2 (Option +P940, IP20, UL Open Type



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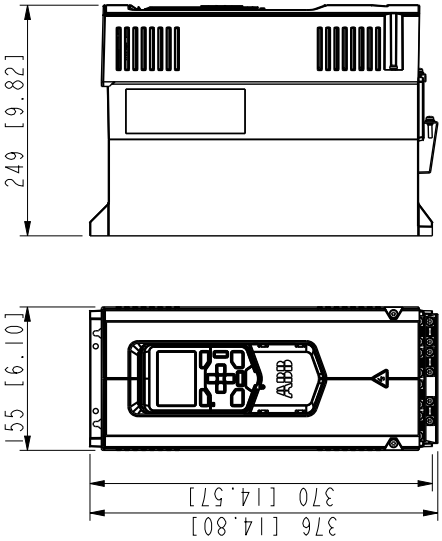

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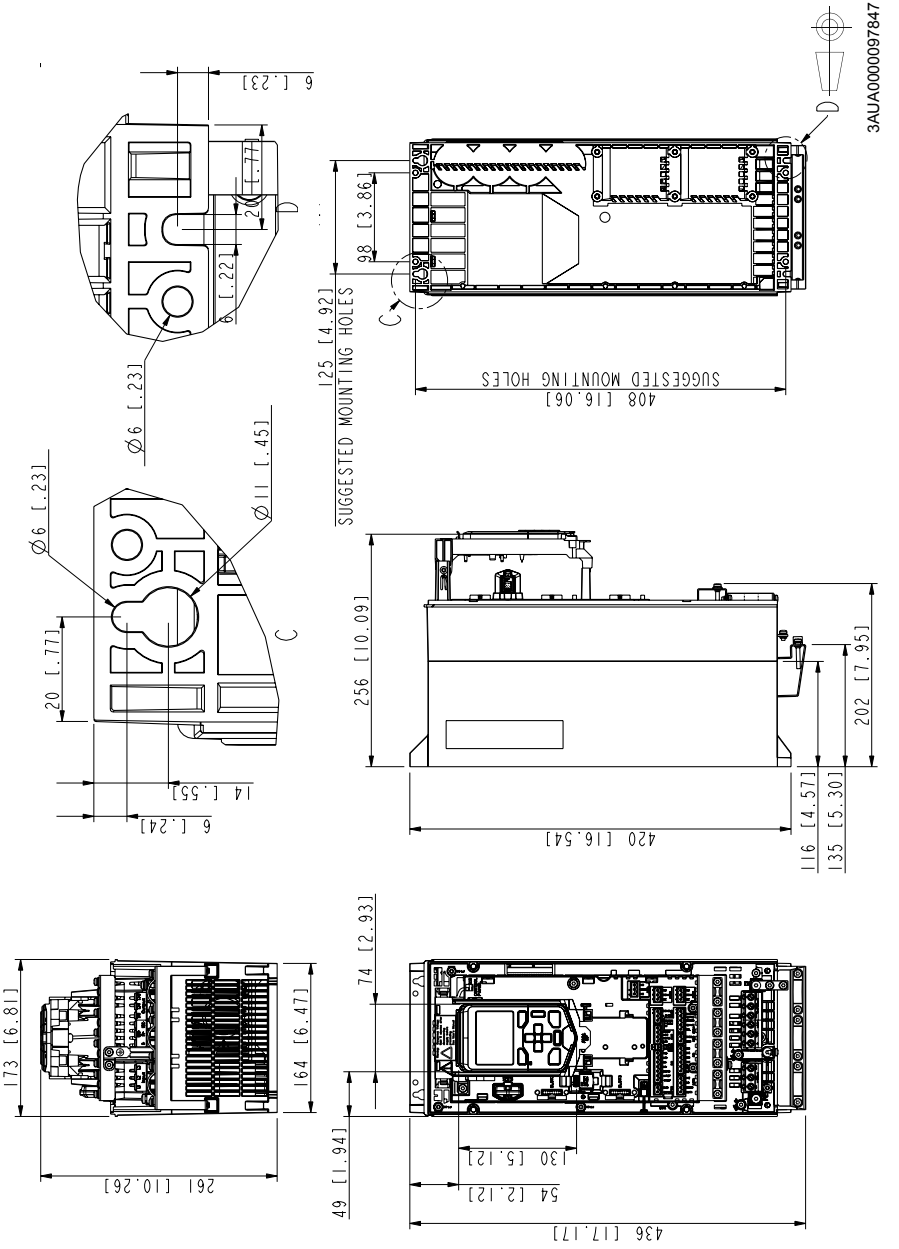

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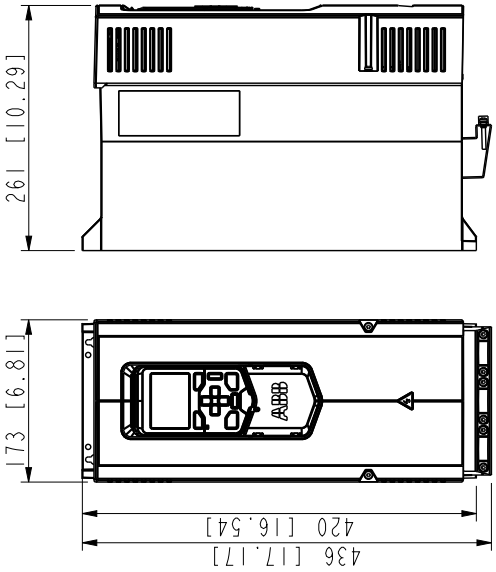

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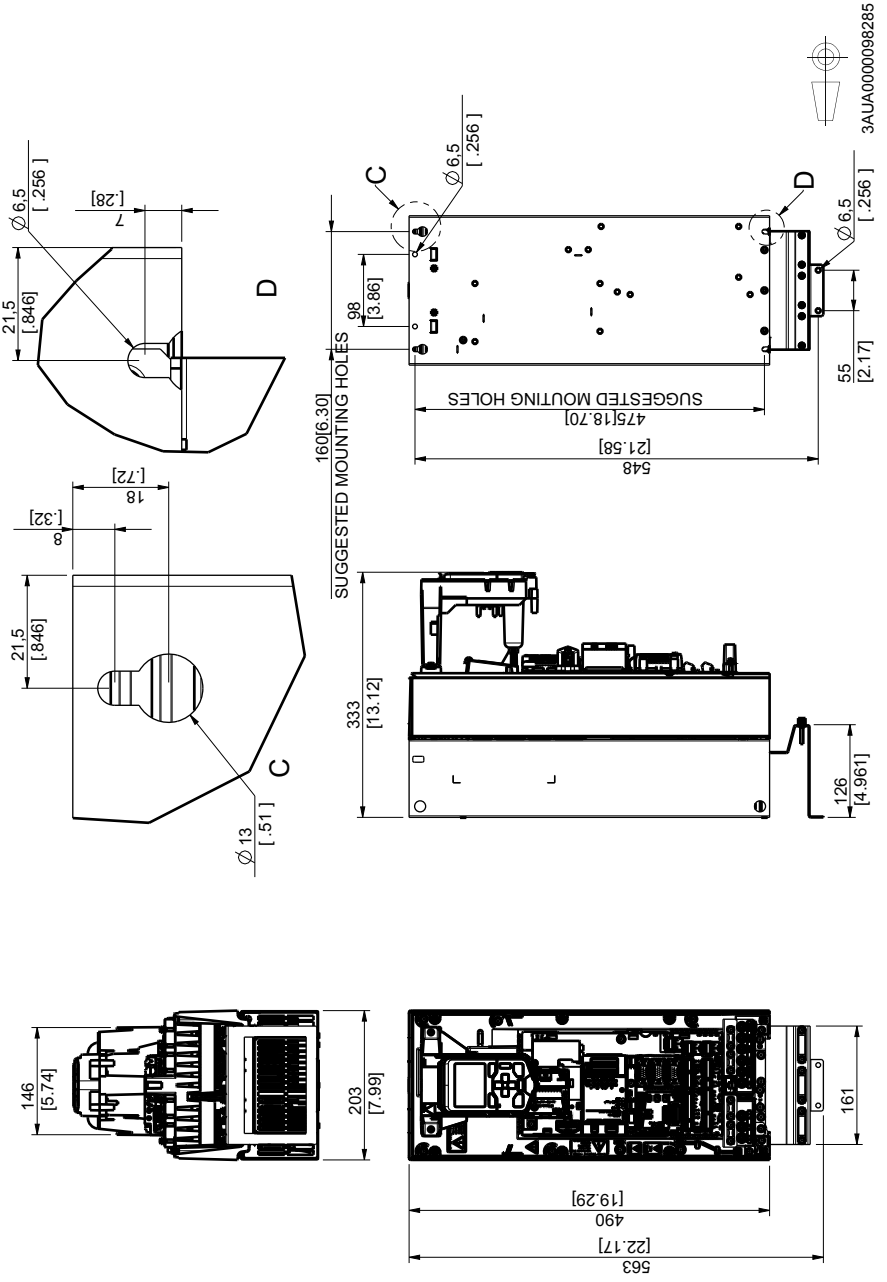

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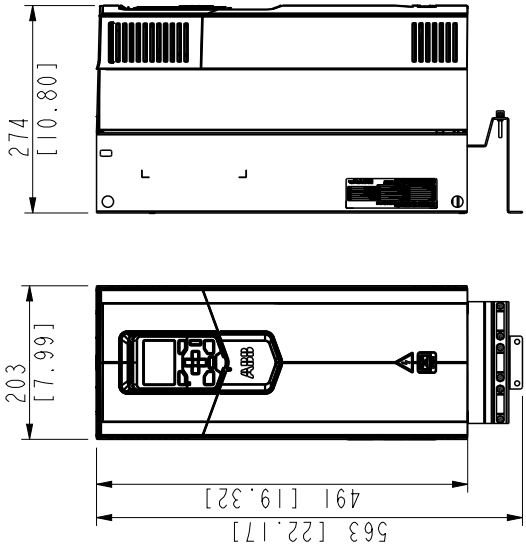

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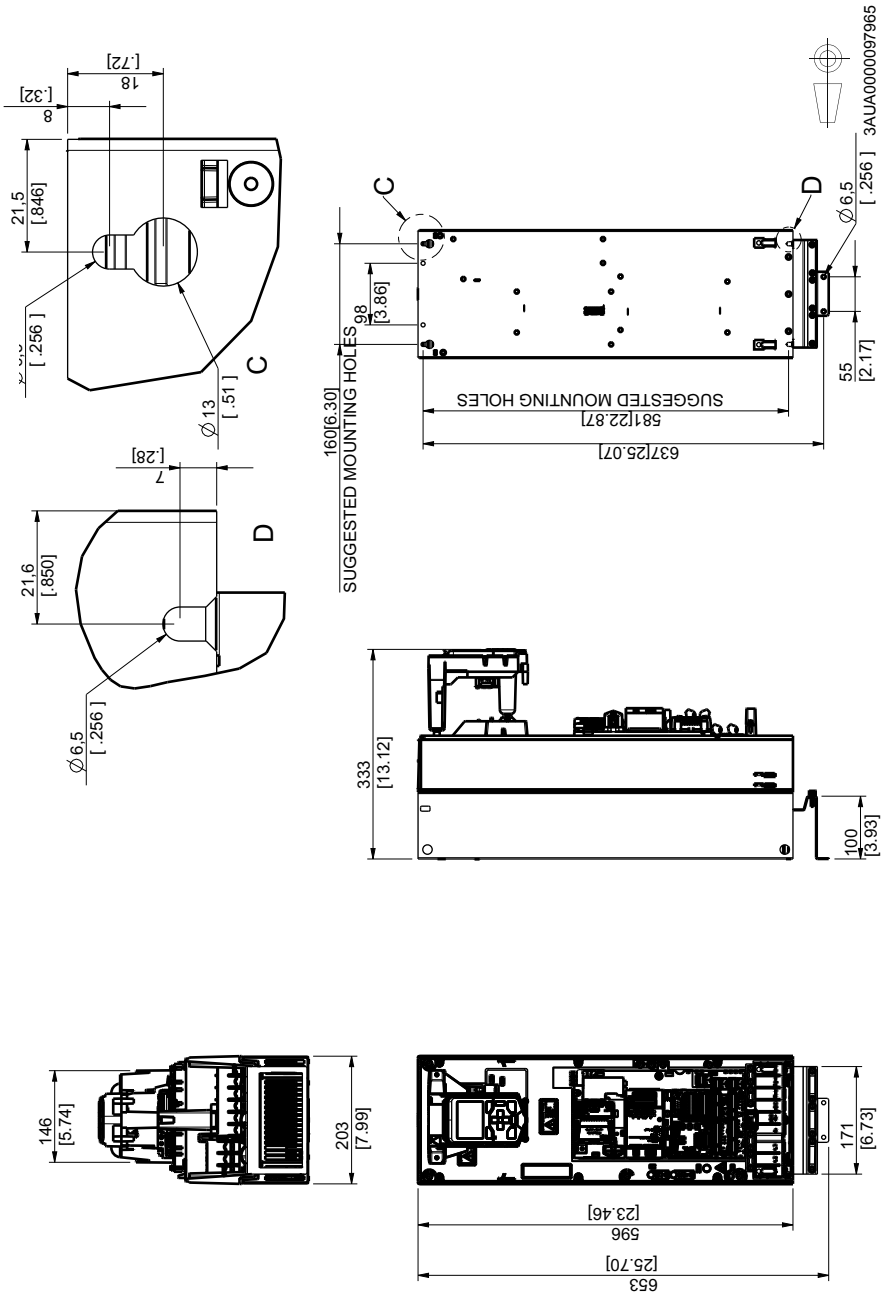

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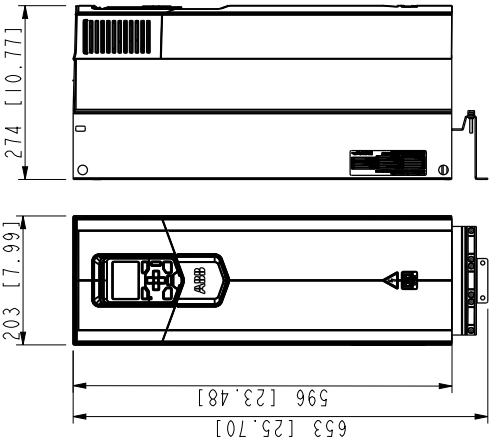

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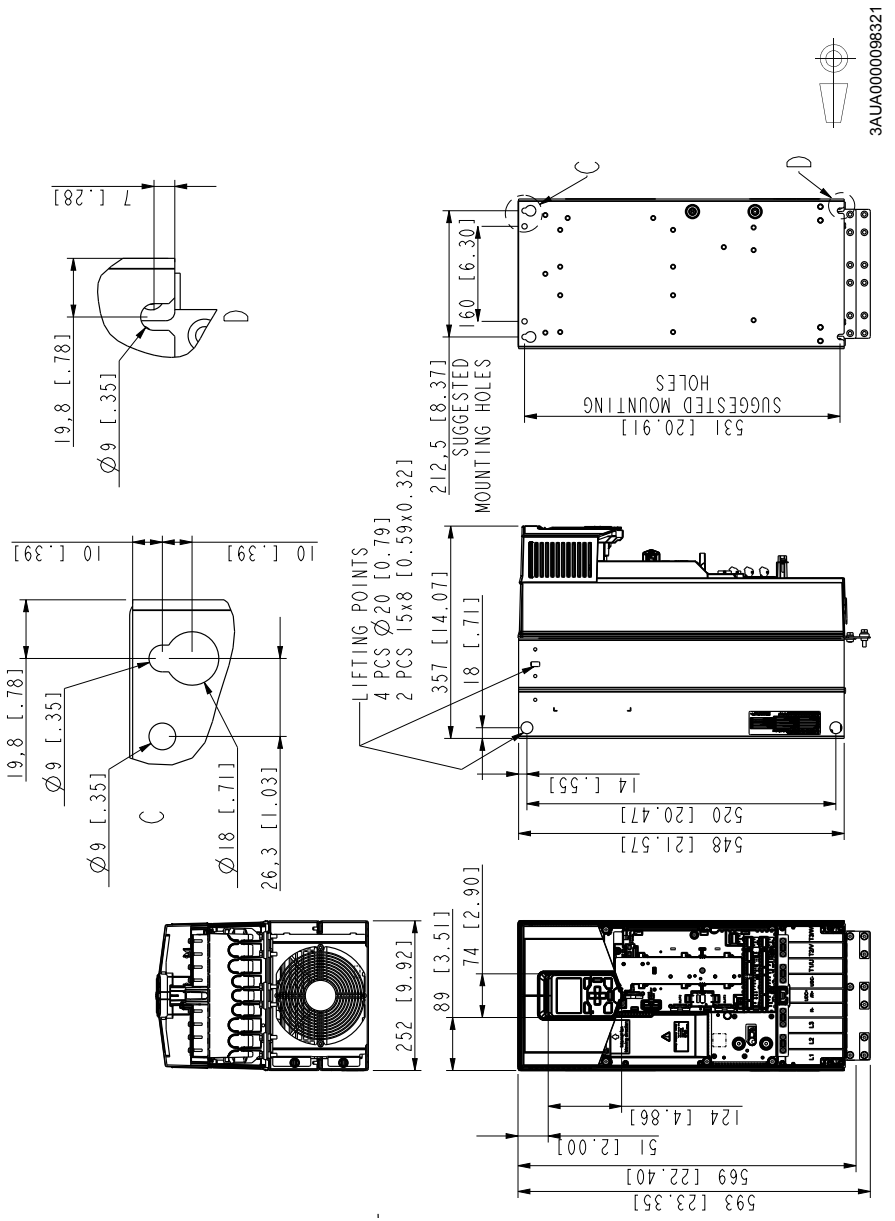

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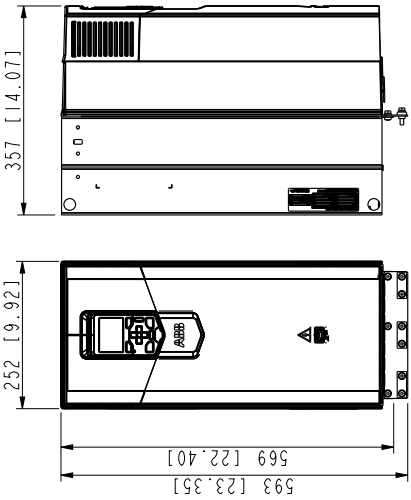

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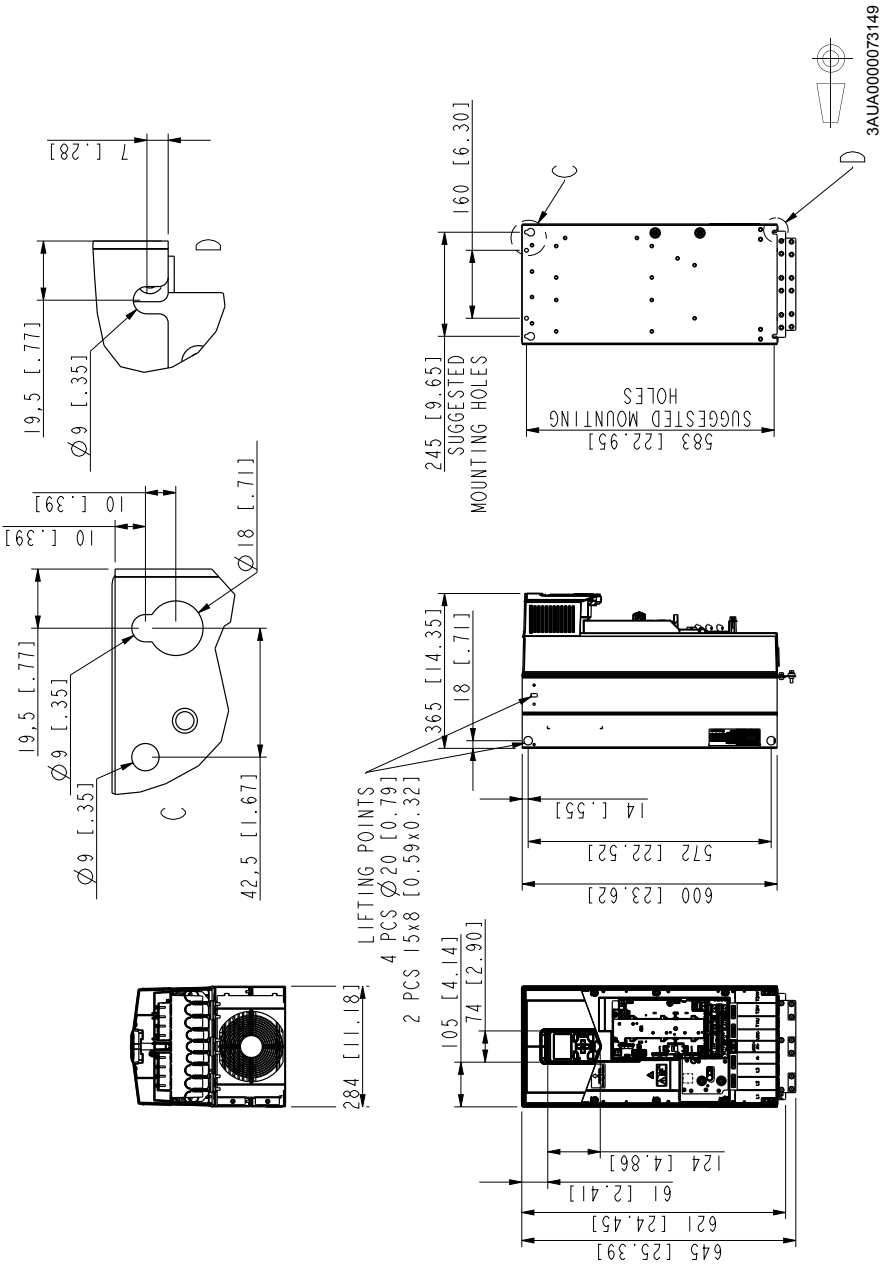

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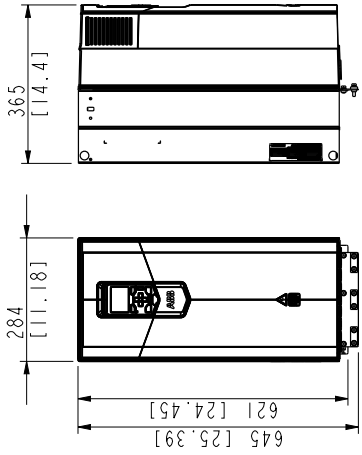

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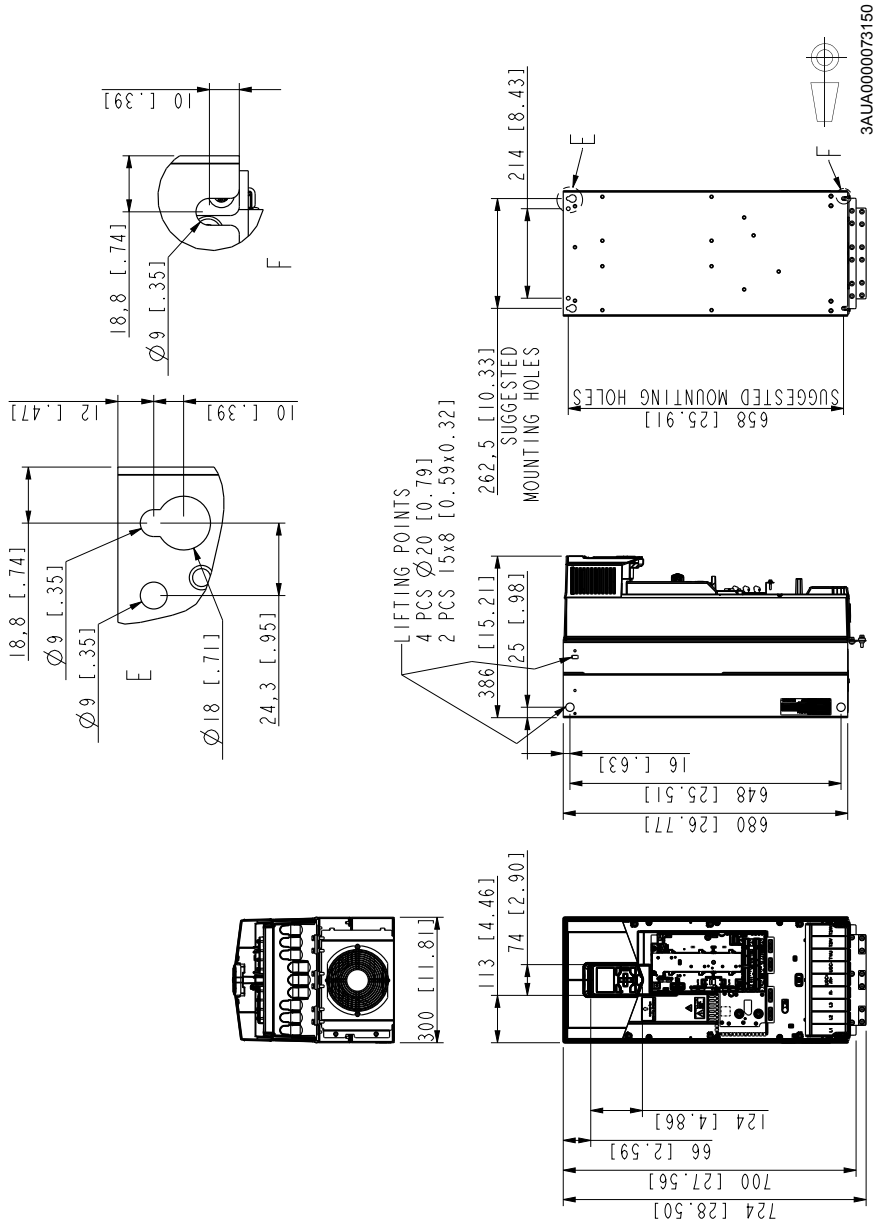

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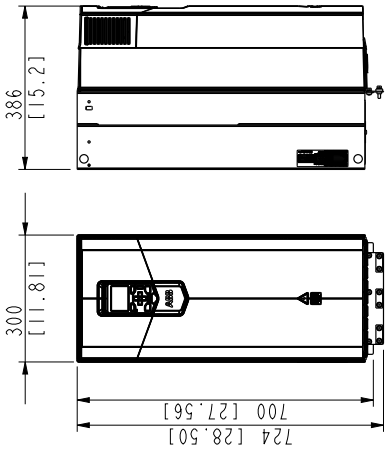

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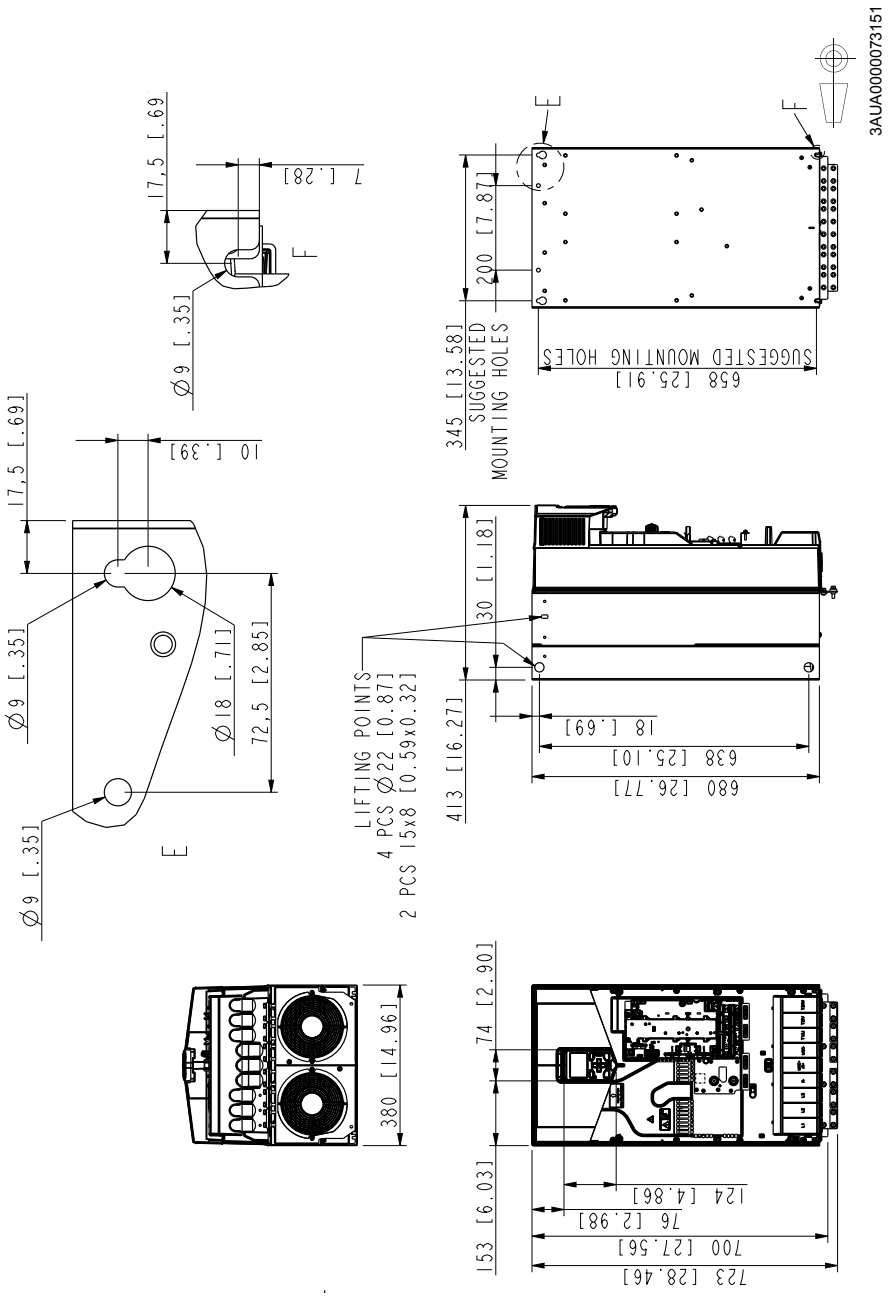

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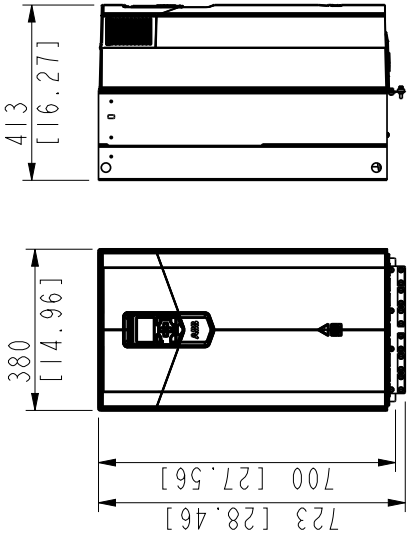

Further information

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.

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