

ABB industrial drives

Hardware manual

ACS880-04 drive modules (200 to 710 kW, 300 to 700 hp)



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List of related manuals

Drive hardware manuals and guides

Code (English)

ACS880-04 drive modules (200 to 710 kW, 300 to 700 hp) hardware manual	3AUA0000128301
ACS880-04 drive modules (200 to 710 kW, 300 to 700 hp) quick installation guide	3AXD50000009366
ACS-AP-x Assistant control panels user's manual	3AUA0000085685
ACS880-01/04 +C132 marine type-approved drives supplement	3AXD50000010521

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

DPMP-01 mounting platform for ACS-AP control panel installation guide	3AUA0000100140
DPMP-02/03 mounting platform for ACS-AP-X control panels installation guide	3AUA0000136205
FSO-12 safety functions module user's manual	3AXD50000015612
ACS880 ATEX-certified Safe disconnection function application guide	3AUA0000132231
ACS880-01 drives and ACS880-04 drive modules common DC systems application guide	3AUA0000127818
FOCH du/dt filters hardware manual	3AFE68577519
Sine filters hardware manual	3AXD50000016814
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 QR code below opens an online listing of the manuals applicable to this product.



[ACS880-04 manuals](#)

Video: <http://www.youtube.com/watch?v=IhKOSx3HmzQ>

Hardware manual

ACS880-04 drive modules
(200 to 710 kW, 300 to 700 hp)

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1

Safety instructions



Contents of this chapter

This chapter contains the safety instructions which you must obey when you install and operate the drive and do maintenance 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:

	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.

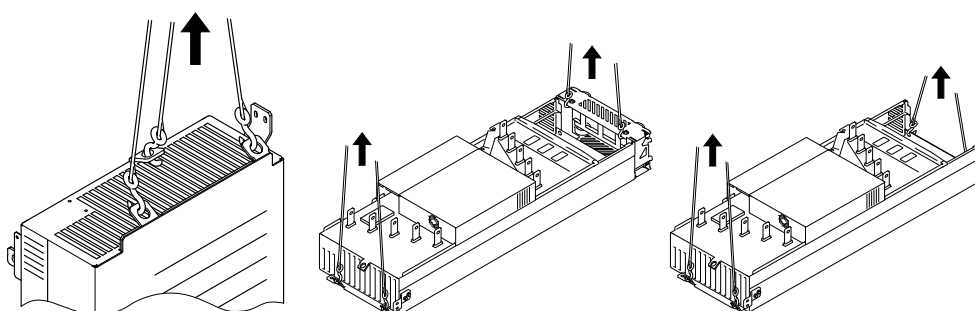
General safety in installation, start-up and maintenance

These instructions are for all personnel that install the drive module and do maintenance work on it.

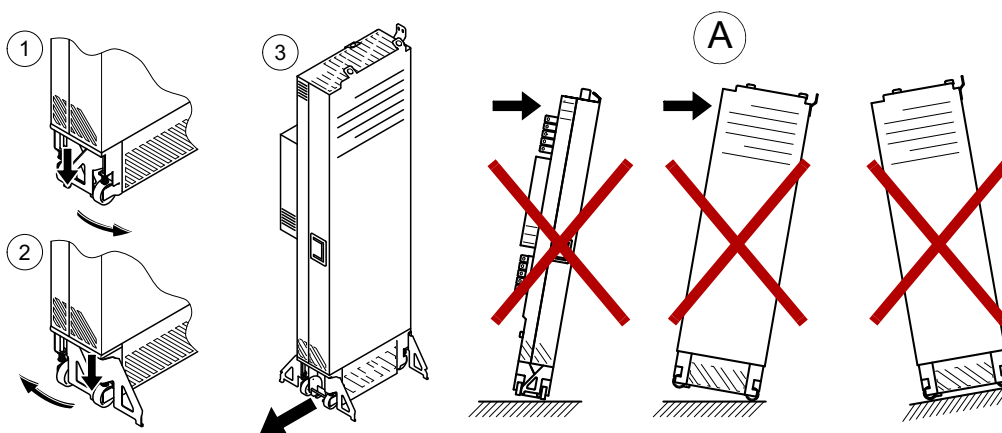


WARNING! Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

- Use protective gloves when working on the drive module.
- Handle the drive module carefully:
 - Use safety shoes with a metal toe cap to prevent foot injury.
 - Lift the drive module only by the lifting lugs.



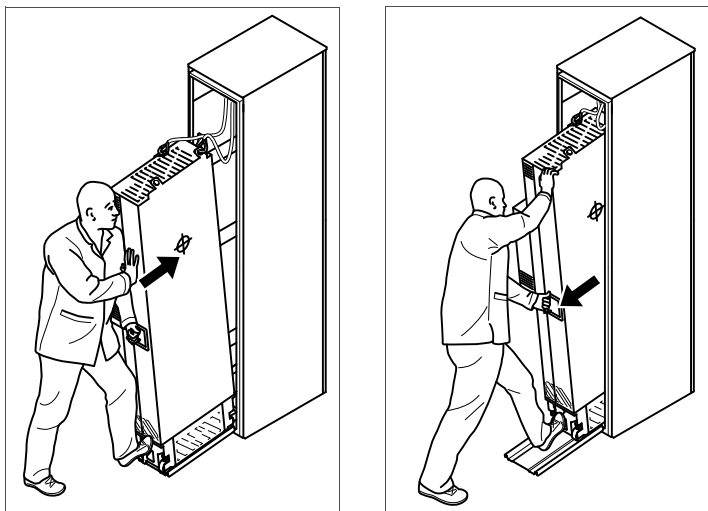
- Make sure that the module does not topple over when you move it on the floor: Open the support legs by pressing each leg a little down (1, 2) and turning it aside. Whenever possible secure the module also with chains.
- Do not tilt the drive module (A). It is **heavy** and its **center of gravity is high**. The module overturns from a sideways tilt of 5 degrees. Do not leave the module unattended on a sloping floor.



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- Do not use the module installation ramp with plinth heights which exceed the maximum height marked on the ramp. (The maximum plinth height is 50 mm [1.97 in] when the telescopic ramp is fully retracted and 150 mm [5.91 in] when the ramp is fully extended.)
- Attach the module installation ramp carefully.

- To prevent the drive module from falling, attach its top lifting lugs with chains to the cabinet frame before you push the module into the cabinet and pull it from the cabinet. Work carefully preferably with help from another person as shown below. Keep a constant pressure with one foot on the base of the module to prevent the module from falling on its back



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- Beware of hot surfaces. Some parts, such as heatsinks of power semiconductors, remain hot for a while after disconnection of the electrical supply.
- Make sure that debris from borings and grindings does not enter the drive during the installation. Electrically conductive debris inside the drive may cause damage or malfunction.
- Make sure that there is sufficient cooling.
- 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 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.
- 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](#) 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.



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 disconnect of the drive.
 - Open the disconnect of the supply transformer as the main disconnect of the drive does not remove the voltage from the input busbars of the drive.
 - Make sure that reconnection is not possible. Lock the disconnects 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/U1, L2/V1, L3/W1) 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.
- 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.



WARNING! Obey these instructions. If you ignore them, equipment malfunction and damage to the fiber optic cables can occur.

- Handle the fiber optic cables with care.
- When you unplug the 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).

■ 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](#) on page 71. 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. 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 belt, 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/U2, T2/V2, T3/W2) and the grounding (PE) busbar is close to 0 V.
 - Make sure that the voltage between the drive input power terminals (L1/U1, L2/V1, L3/W1) 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/U2, T2/V2, T3/W2). 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 manual

Contents of this chapter

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

Target audience

This manual is intended for persons who

- plan the cabinet assembly of the drive module and install the module into a user-defined cabinet
- plan the electrical installation of the drive cabinet
- make instructions for the end user of the drive concerning the mechanical installation of the drive cabinet, connection of power and control cables to the cabinet-installed drive and maintenance of the drive.

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

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

Contents of the manual

This manual contains the instructions and information for the basic drive module configuration. The chapters of the manual are briefly described below.

Safety instructions gives safety instructions for the installation, commissioning, operation and maintenance of the drive module.

Introduction to the manual introduces the manual.

Operation principle and hardware description describes the drive module.

Guidelines for planning the cabinet installation guides in 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.

Guidelines for planning the electrical installation instructs in the motor and cable selection, protections and cable routing.

Installation instructions gives the basic installation instructions that are common for the different installation procedures.

Installation example of the standard drive module configuration describes the installation process of a standard drive module in a Rittal 600 mm wide cabinet.

Installation example with full cabling panels (option +H381) describes the installation process of a drive module with full cabling panels in a Rittal 400 mm wide cabinet.

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

Start-up refers to the start-up instructions of the cabinet-installed drive.

Fault tracing describes the LED indications and refers to the fault tracing instructions of the drive.

Maintenance contains maintenance instructions.

Ordering information gives ordering information on additional components available from ABB for the drive module installation.

Technical data contains the technical specifications of the drive module, eg, the ratings, sizes and technical requirements, provisions for fulfilling the requirements for CE and other markings.

Dimension drawings contains dimension drawings of the drive module installed into a Rittal TS 8 cabinet.

Example circuit diagram shows an example circuit diagram for a cabinet-installed drive module.

Safe torque off function describes the Safe torque off function of the drive and gives instructions on its implementing.

Resistor braking describes selection, protection and wiring of optional brake choppers and resistors. The chapter also contains technical data.

du/dt and sine filters describes how to select du/dt filters for the drive.

Step-by-step drawings for an installation example of standard drive configuration with option +E208 in Rittal TS 8 600 mm wide cabinet shows how to install the drive module in a Rittal TS 8 cabinet.

Step-by-step drawings for installing full cabling panels (option +H381) in a Rittal TS 8 400 mm wide cabinet shows how to install full cabling panels to a Rittal TS 8 cabinet.

[Step-by-step drawings for a flat installation example in Rittal TS 8 600 mm wide cabinet](#) shows how to install the drive module in a Rittal TS 8 cabinet.

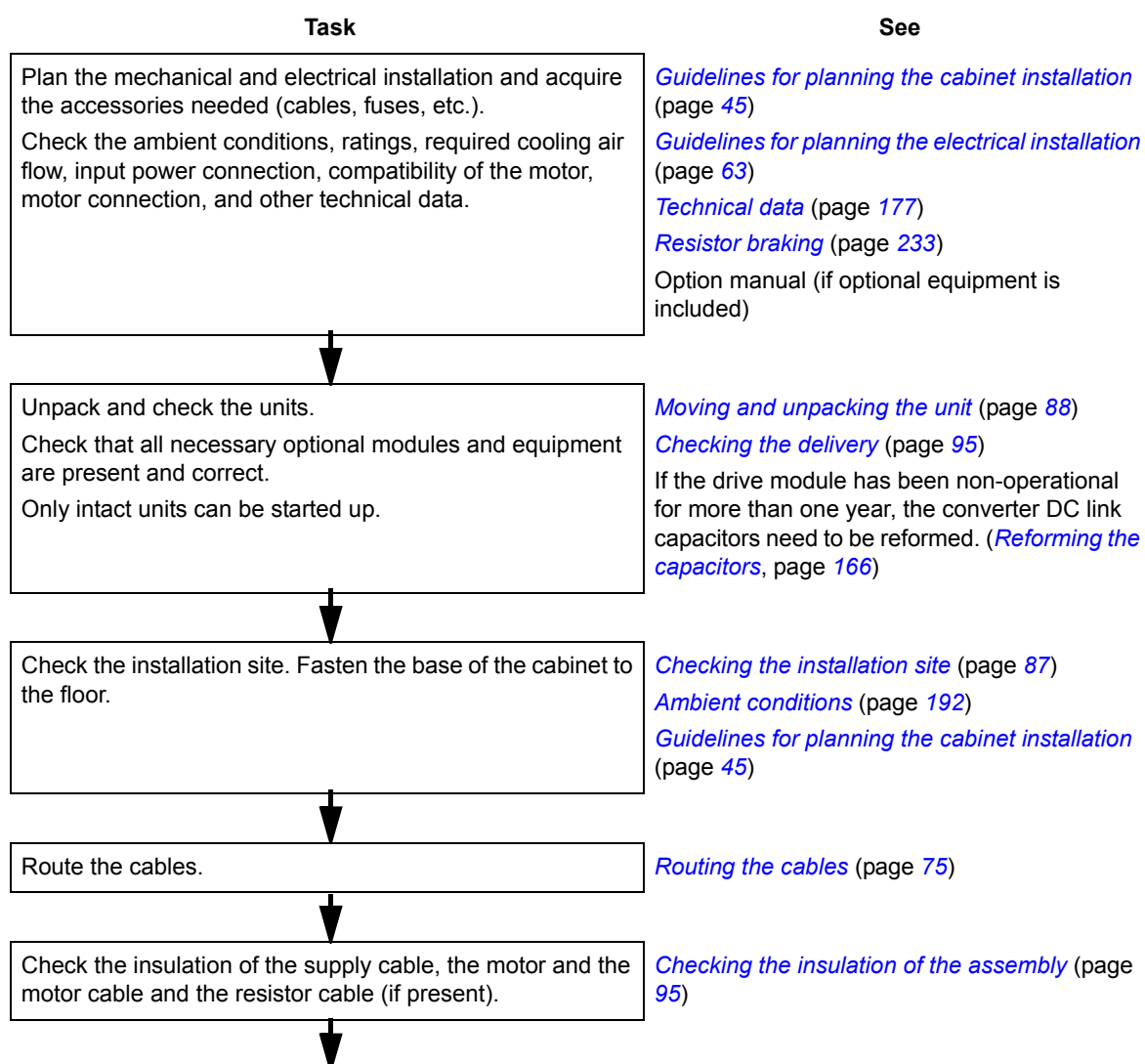
[Step-by-step drawings for option +H391 installation example in Rittal TS 8 600 mm wide cabinet](#) shows how to install drive module with option +H391 to a Rittal TS 8 cabinet.

Categorization by frame size and option code

The instructions, technical data and dimension drawings which concern only certain drive frame sizes are marked with the symbol of the frame size (R10 or R11). The frame size is marked on the type designation label.

The instructions and technical data which concern only certain optional selections are marked with option codes, eg, +J410. 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](#) on page 41.

Quick installation, commissioning and operating flowchart



Task

See

Standard drive modules

- Install the additional components into the cabinet: for example, main disconnect, main contactor, main AC fuses, etc..
- Install the drive module into the cabinet.
- Connect the motor cables to the drive module terminals.
- Connect the brake resistor and DC connection cables (if any) to the drive module terminals.
- If the main disconnect is installed into the cabinet, connect it to the drive module terminals and the input power cabling to the disconnect.
- Connect the cables from the drive module to the external control unit and install the control unit into the cabinet.

[Installing the drive module into a cabinet](#) (page 127)

[Connecting the power cables and installing the shrouds](#) (page 127)

[Connecting the external control unit to the drive module](#) (page 106)

[Mounting the external control unit](#) (page 108)

Manuals for any optional equipment



Drive modules with optional cabling panels (+H381)

- Install the cabling panels into the cabinet.
- Install the additional components into the cabinet: for example, main disconnect, main contactor, main AC fuses, etc..
- If the main disconnect is installed into the cabinet, connect the input power cabling to it.
- Connect the input power cables and motor cables to the cabling panel terminals.
- Connect the brake resistor and DC connection cables (if any) to the cabling panel terminals.
- Install the drive module into the cabinet.
- Fasten the cabling panel busbars to the drive module busbars.
- Drive modules with an external drive control unit: Connect the cables from the drive module to the control unit and install the control unit into the cabinet.

[Installing the mechanical accessories into the cabinet](#) (page 135)

[Modular design of Rittal TS8 cabinets](#) (page 147)

[Connecting the power cables](#) (page 101)

[Installing the drive module into the cabinet](#) (page 139)

[Connecting the external control unit to the drive module](#) (page 106)

[Mounting the external control unit](#) (page 108)

Manuals for any optional equipment



Drive modules without full-size output cable connection terminals (option +0H371) and IP20 shrouds (option +0B051):

- Install the additional components into the cabinet: for example, main PE busbar, main disconnect, main contactor, main AC fuses, etc..
- Install the drive module into the cabinet.
- Connect the power cabling between the drive module and the rest of the main circuit components in the cabinet (if any).
- Connect the input power cables and motor cables to the drive cabinet.
- Connect the brake resistor and DC connection cables (if any) to the drive cabinet.

Drive modules with an external drive control unit: Connect the cables from the drive module to the control unit and install the control unit into the cabinet.

[Installing the mechanical accessories into the cabinet](#) (page 135)

[Connecting the power cables](#) (page 101)

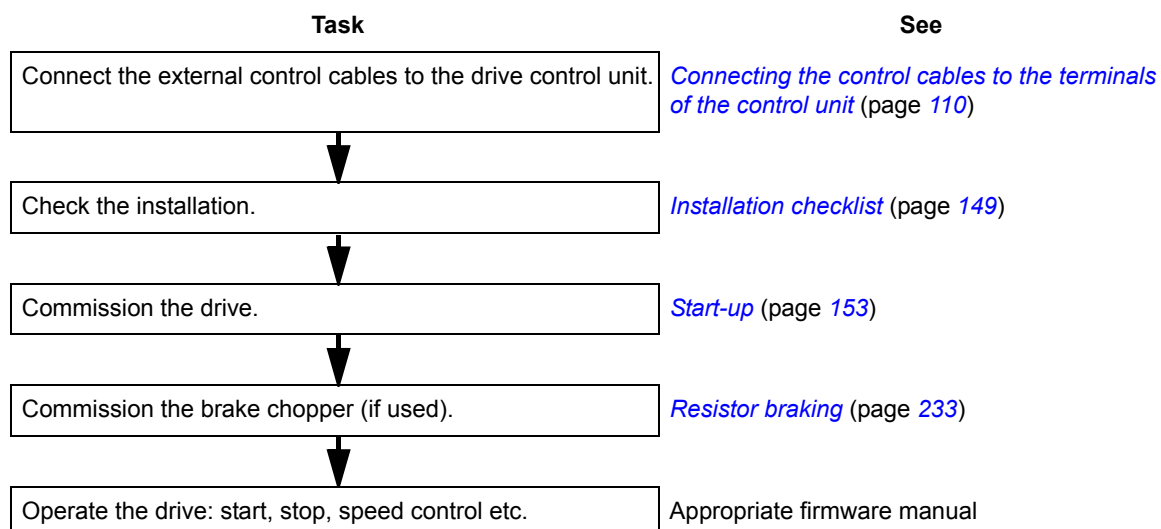
[Installing the drive module into the cabinet](#) (page 139)

[Connecting the external control unit to the drive module](#) (page 106)

[Mounting the external control unit](#) (page 108)

Manuals for any optional equipment





Terms and abbreviations

Term/Abbreviation	Explanation
AIBP	Input bridge protection board
BPOW	Power supply board
BFPS	Fan power supply board
BGDR	Gate driver board
CMF	Common mode filtering
DDCS	Distributed drives communication system; a protocol used in optical fiber communication
DTC	Direct torque control
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
FAIO-01	Optional analog I/O extension module
FCAN-01	Optional CANopen adapter module
FCNA-01	Optional ControlNet fieldbus adapter module
FDCO-0x	Optional optical DDCS communication module
FDIO-01	Optional digital I/O extension module
FDNA-01	Optional DeviceNet™ fieldbus adapter module
FEA-03	Optional I/O extension and encoder module adapter
FECA-01	Optional EtherCAT adapter module
FEN-01	Optional TTL encoder interface module
FEN-11	Optional absolute encoder interface module
FEN-21	Optional resolver interface module
FEN-31	Optional HTL encoder interface module
FENA-11	Optional high performance Ethernet/IP™, Modbus/TCP and PROFINET IO adapter module

Term/Abbreviation	Explanation
FENA-21	Optional high performance Ethernet/IP™, Modbus/TCP and PROFINET IO adapter module, 2-port
FEPL-01	Optional Ethernet POWERLINK fieldbus adapter module
FIO-01	Optional digital I/O extension module
FIO-11	Optional analog I/O extension module
FLON-01	Optional LonWorks® adapter module
FPBA-01	Optional PROFIBUS DP adapter module
Frame (size)	Size of the drive module. The drive modules described in this manual are of frame size R10 and R11.
FSCA-01	Optional Modbus RTU adapter module
FSO	Optional safety functions module
HTL	High-threshold logic
IGBT	Insulated gate bipolar transistor; a voltage-controlled semiconductor type widely used in converters due to their easy controllability and high switching frequency.
I/O	Input/Output
IT system	Type of supply network that has no (low-impedance) connection to ground/earth.
PLC	Programmable logic controller
RFI	Radio-frequency interference
SAFUR	Series of optional brake resistors
STO	Safe torque off
SOIA	Optical interface adapter board
TN system	Type of supply network that provides a direct connection to ground (earth).
TTL	Transistor-transistor logic
ZBIB	Adapter board connected to the control board in the control unit (ZCU)
ZCON	Control board. The external I/O control signals are connected to the control board, or optional I/O extensions installed on it.
ZCU	Drive control unit which contains the ZCON control board
ZINT	Main circuit board
ZMU	The memory unit attached to the control unit of the drive

3

Operation principle and hardware description

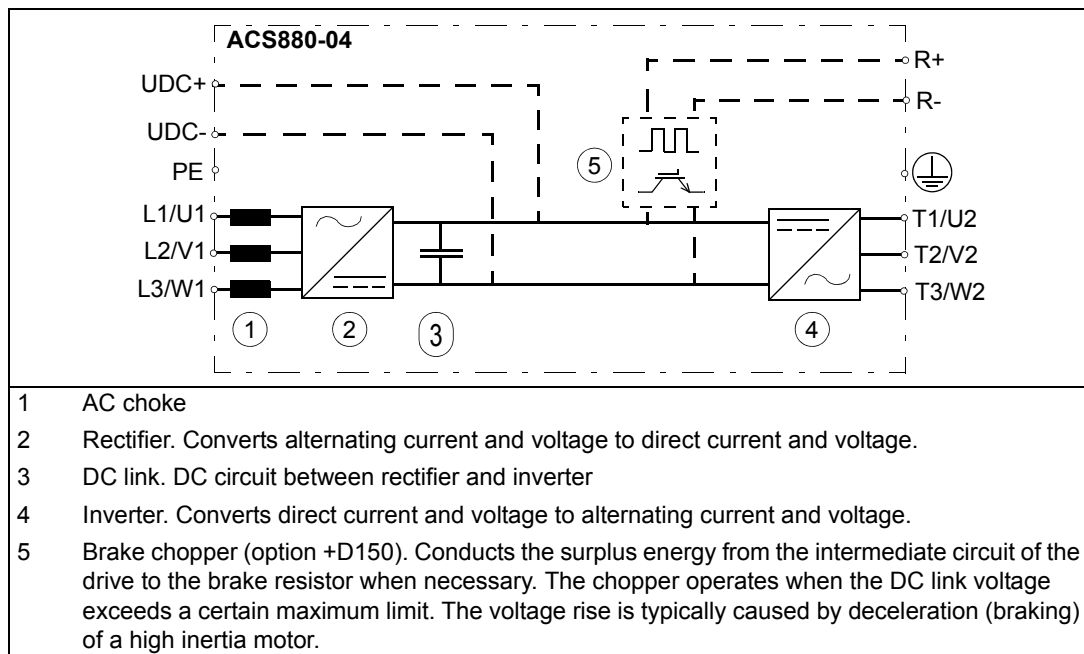
Contents of this chapter

This chapter describes the operating principle and construction of the drive module.

Product overview

The ACS880-04 is a drive module for controlling asynchronous AC induction motors, permanent magnet motors, AC induction servomotors and ABB synchronous reluctance motors (SynRM motors).

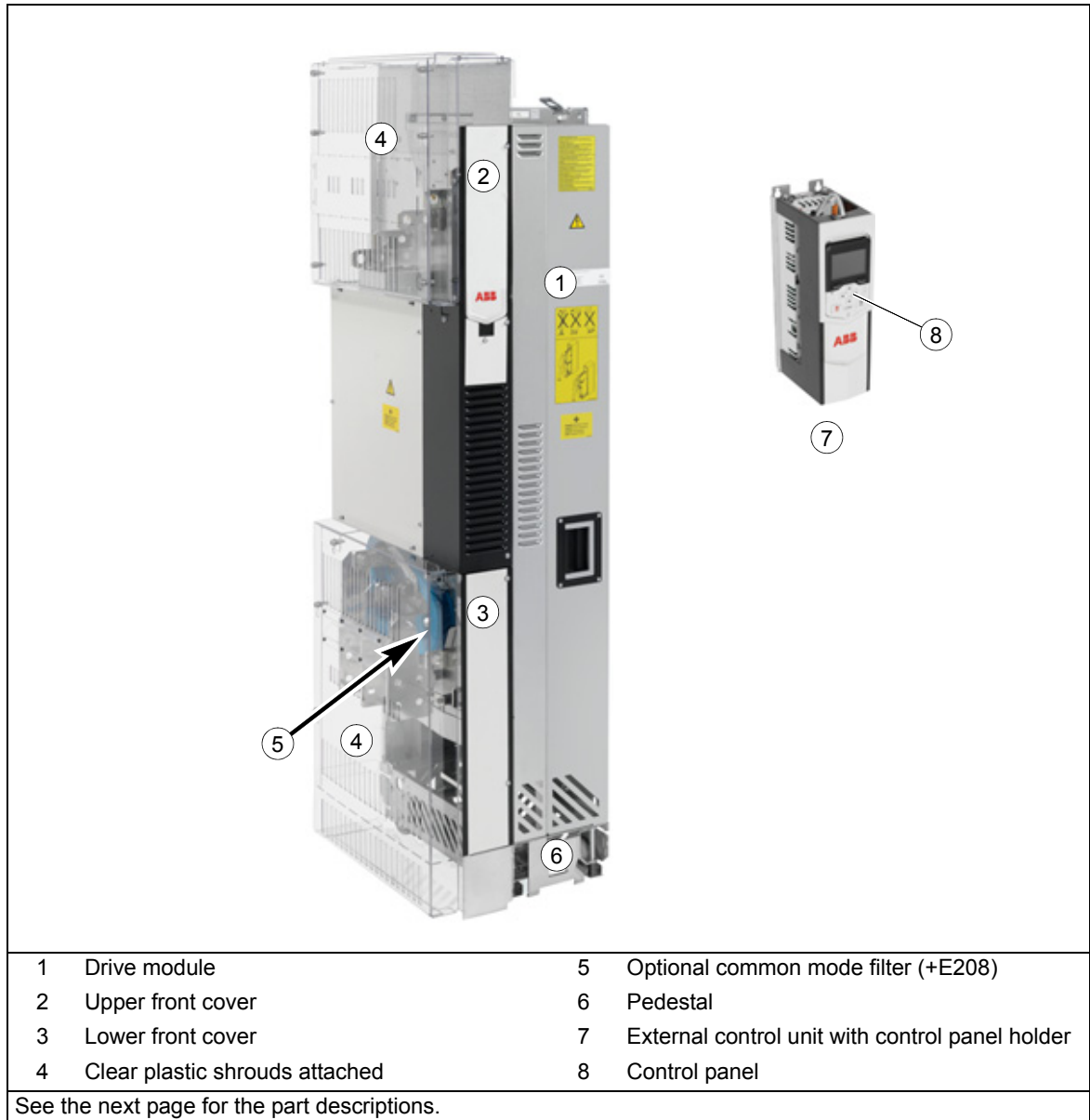
The main circuit of the drive module is shown below.

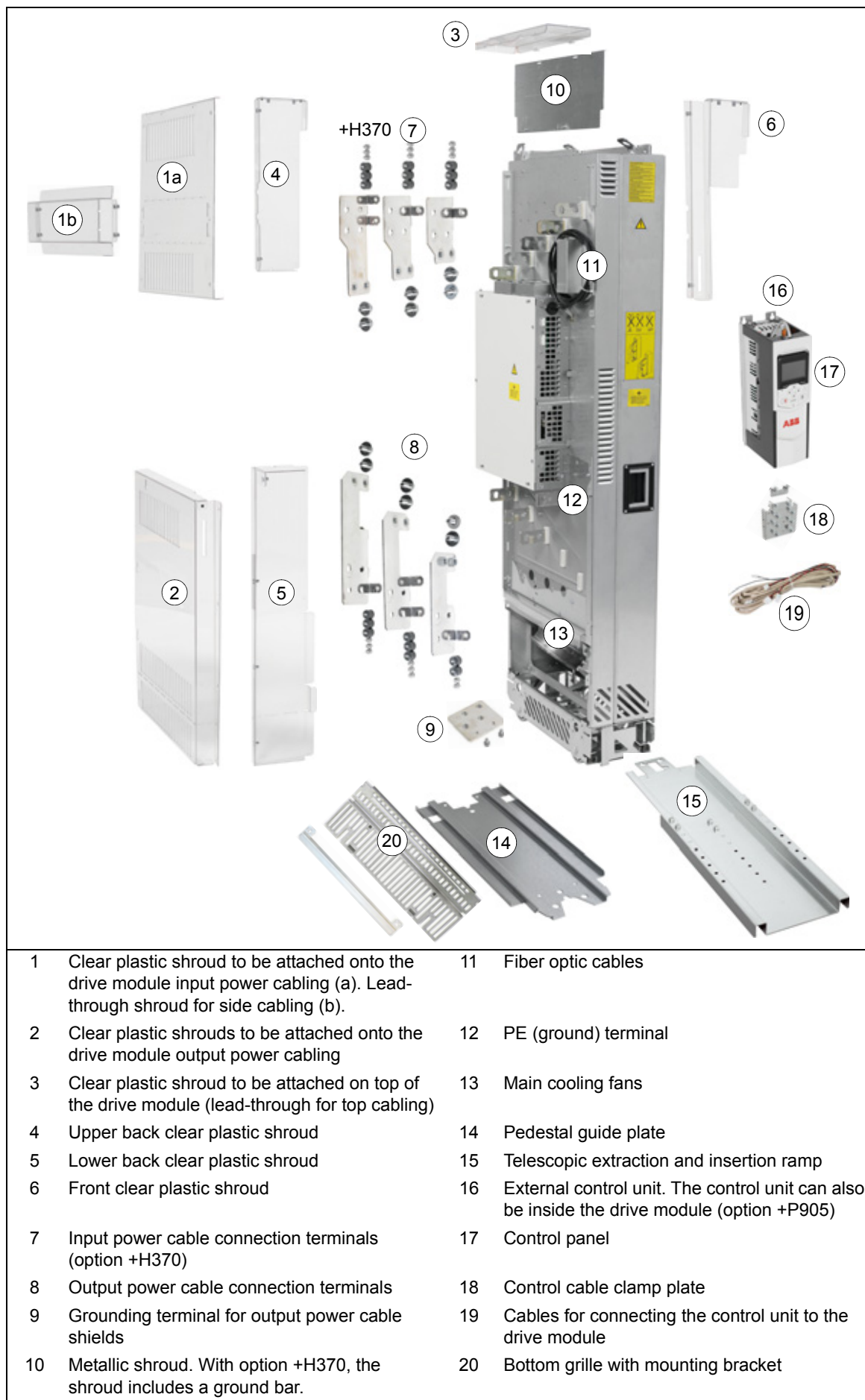


Layout

■ Standard drive module configuration with option +E208

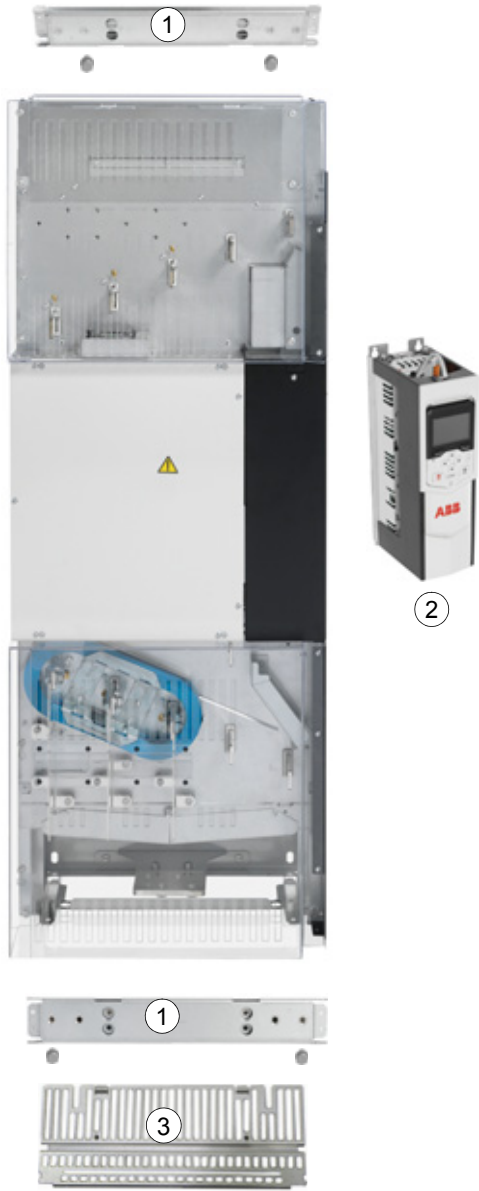

The assembled standard drive module configuration with option +E208 is shown below.



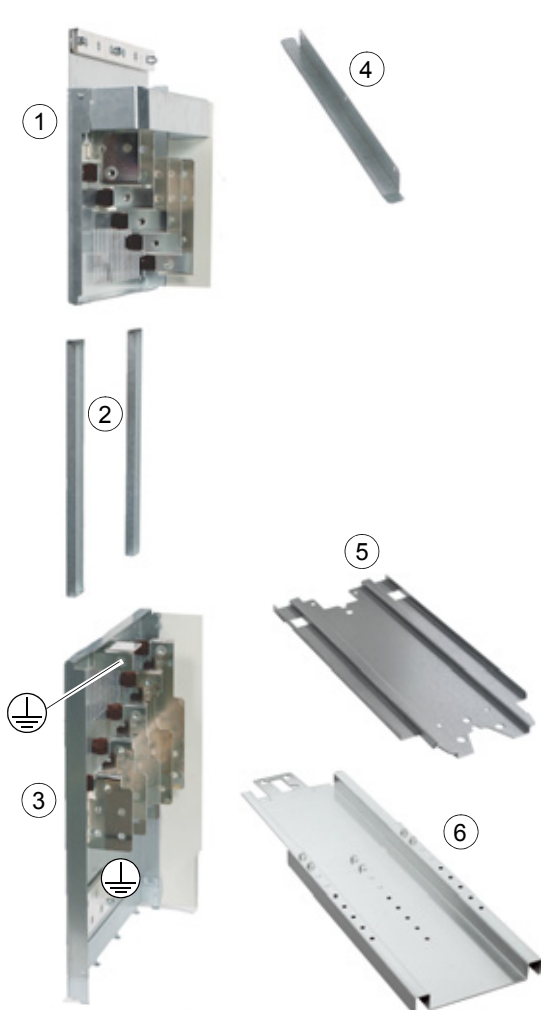
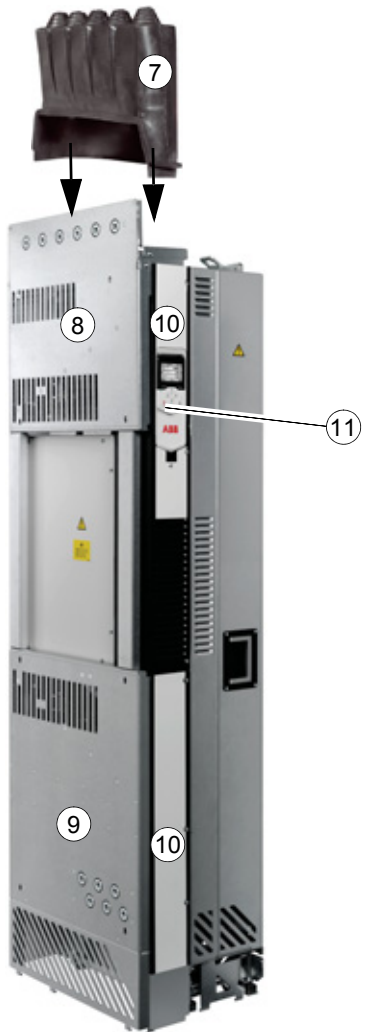


■ Drive module for flat mounting (option +C173)

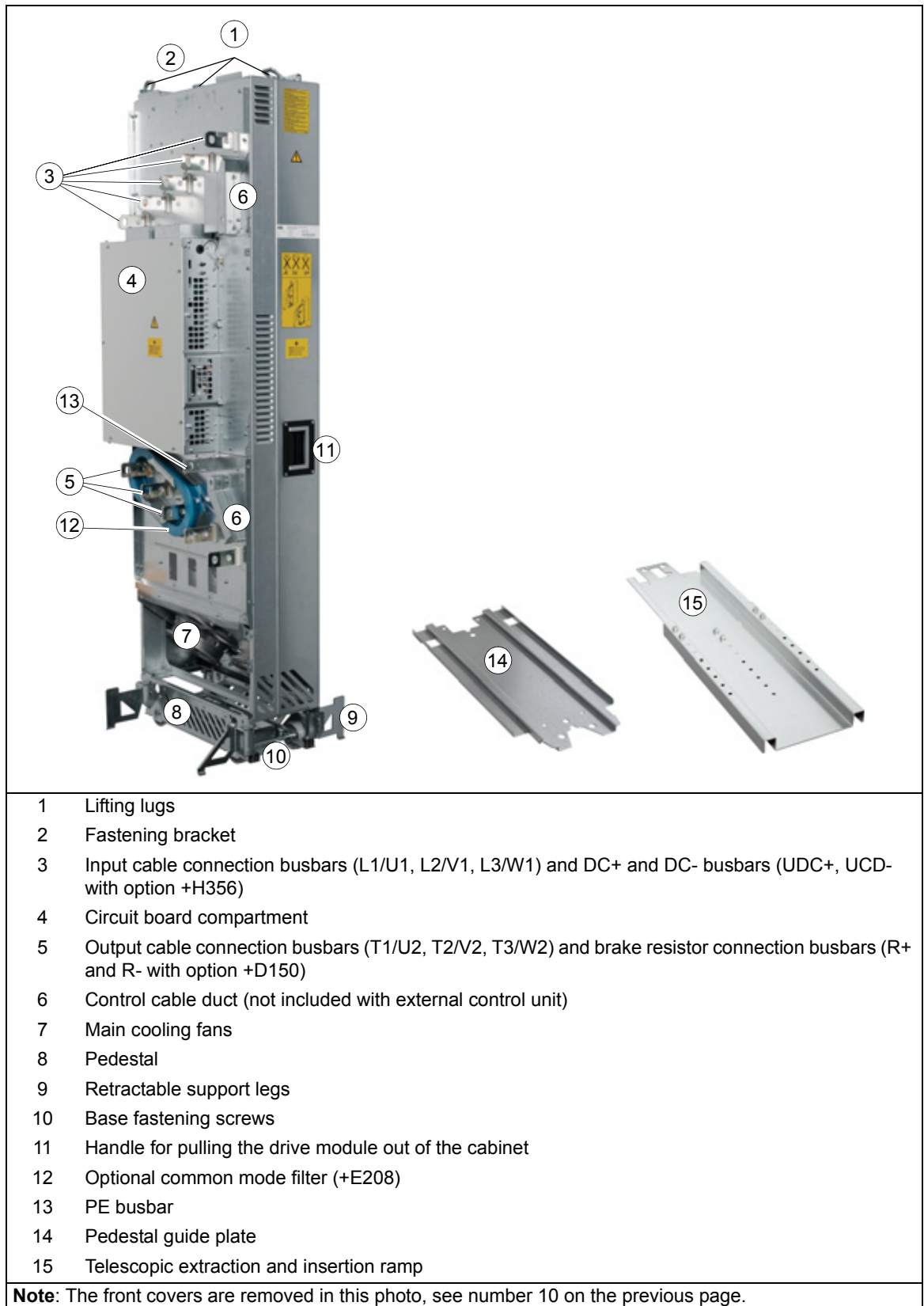
Front view of an assembled drive module for flat mounting is shown below. Option +C173 adds flat mounting brackets to the standard drive module configuration. Option +0H354 removes the pedestal and option +0P919 the installation ramp. You must cut the lower part of the output cabling clear plastic shroud off when no pedestal is in use.

	
Flat mounting position (front view)	Side view
<p>1 Flat mounting bracket (two pcs). The brackets are installed to the mounting plate with 2×8 screws. Four combi screws for installing the drive module to the brackets are included in the delivery.</p> <p>2 External control unit with control panel holder and control panel</p>	<p>3 Bottom grille to be installed to the base of the drive module for IP20 degree of protection</p> <p>4 Grounding terminal for output cabling is better visible in this photo than on page 31.</p>
See section Standard drive module configuration with option +E208 on page 31 for the part descriptions.	

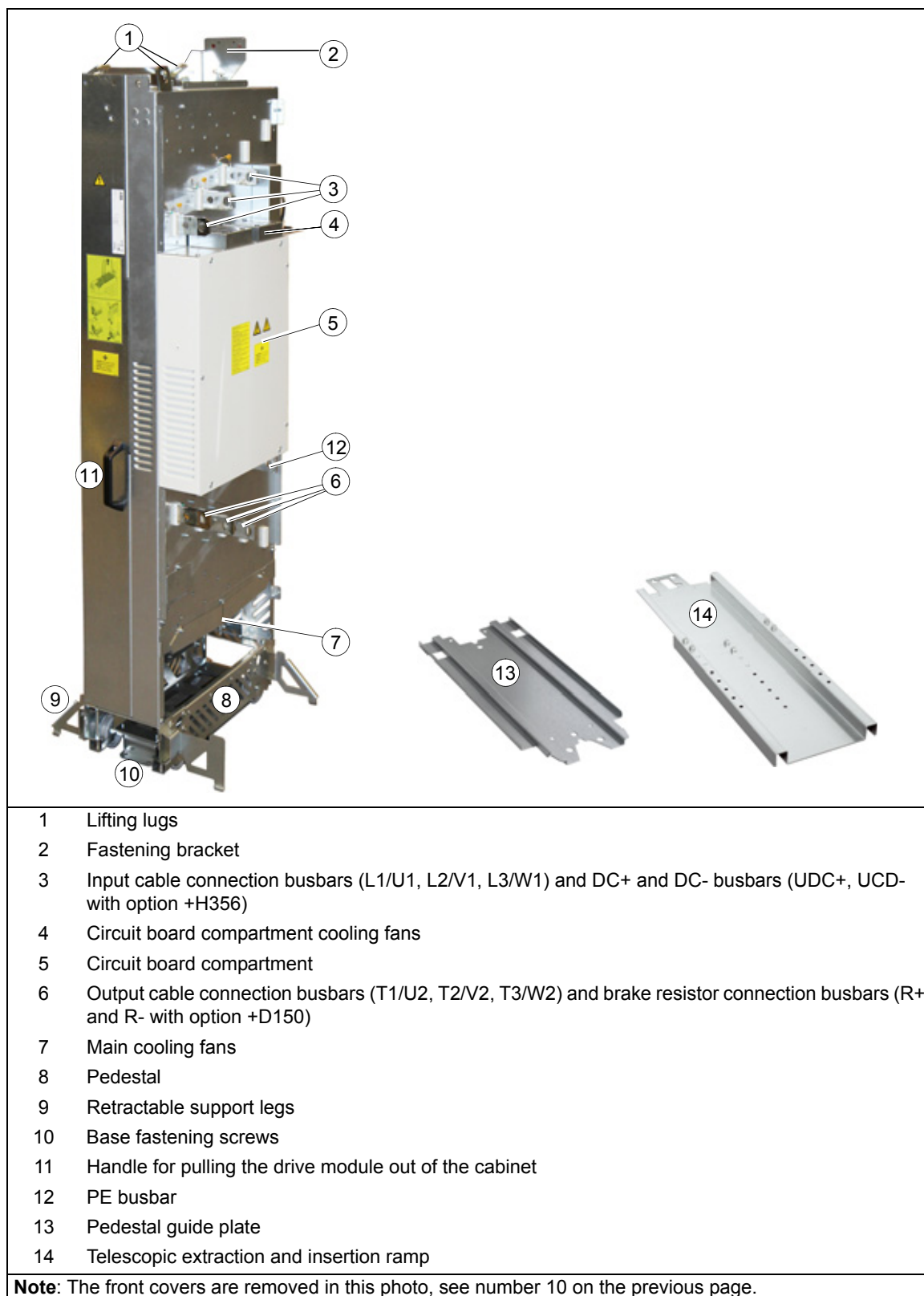
■ Drive module with full power cabling panels (option +H381)

	
Accessories	Assembled drive module
1 Input power cabling panel	7 Rubber grommet
2 Side guides	8 Input power cabling panel to be attached to the drive cabinet
3 Output power cabling panel	9 Output power cabling panel to be attached to the drive cabinet
4 Top guide plate	10 Front cover
5 Pedestal guide plate	11 Internal control unit (option +P905) and control panel holder mounted on the drive module (option +J414)
6 Telescopic extraction and insertion ramp	- -

■ **Drive module without full-size output cable connection terminals (option +0H371) and IP20 shrouds (option +0B051)**



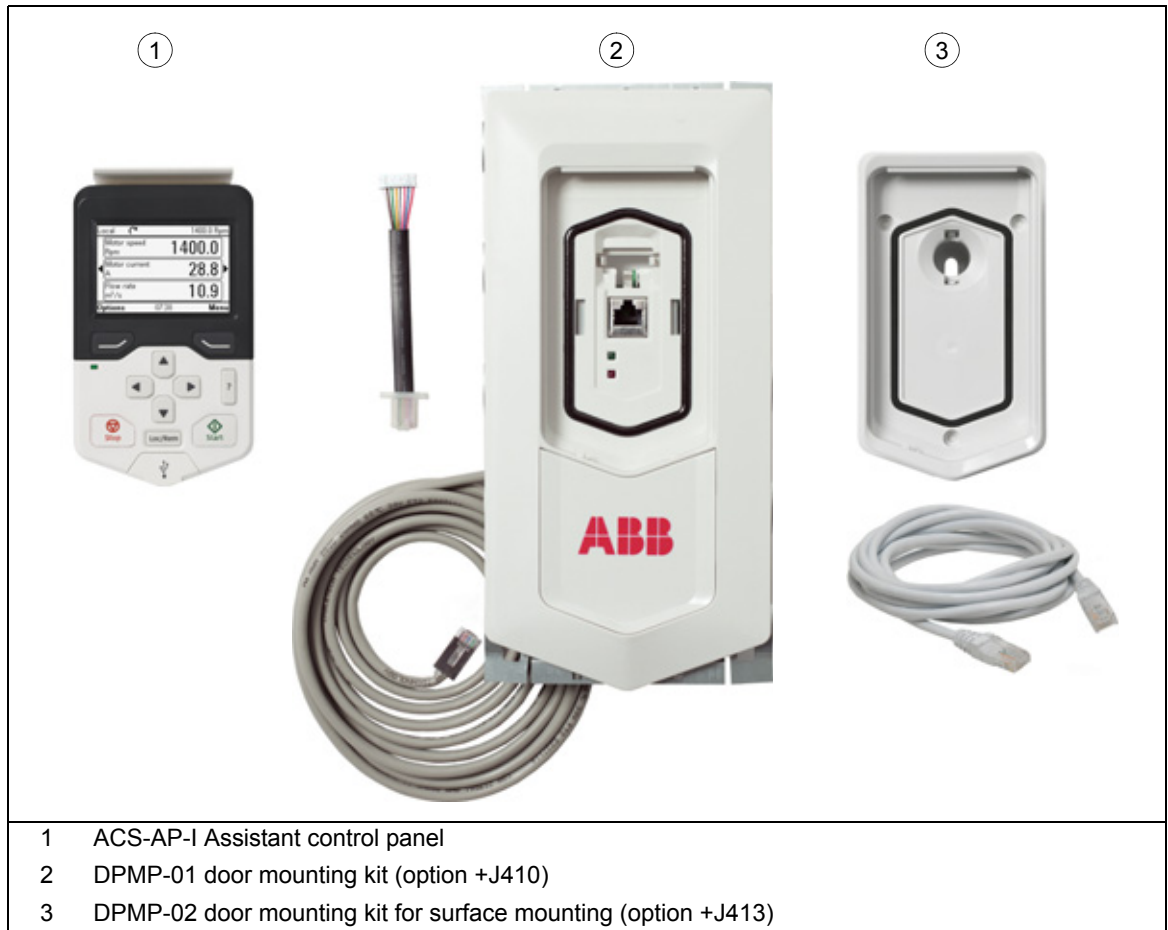
■ **Drive module configuration with power cable connection terminals on the right-hand side (option +H391)**



■ Control unit

See section [Standard drive module configuration with option +E208](#) on page 31.

■ Control panel



In the standard drive module configuration, the control panel is located in the control panel holder of the external control unit.

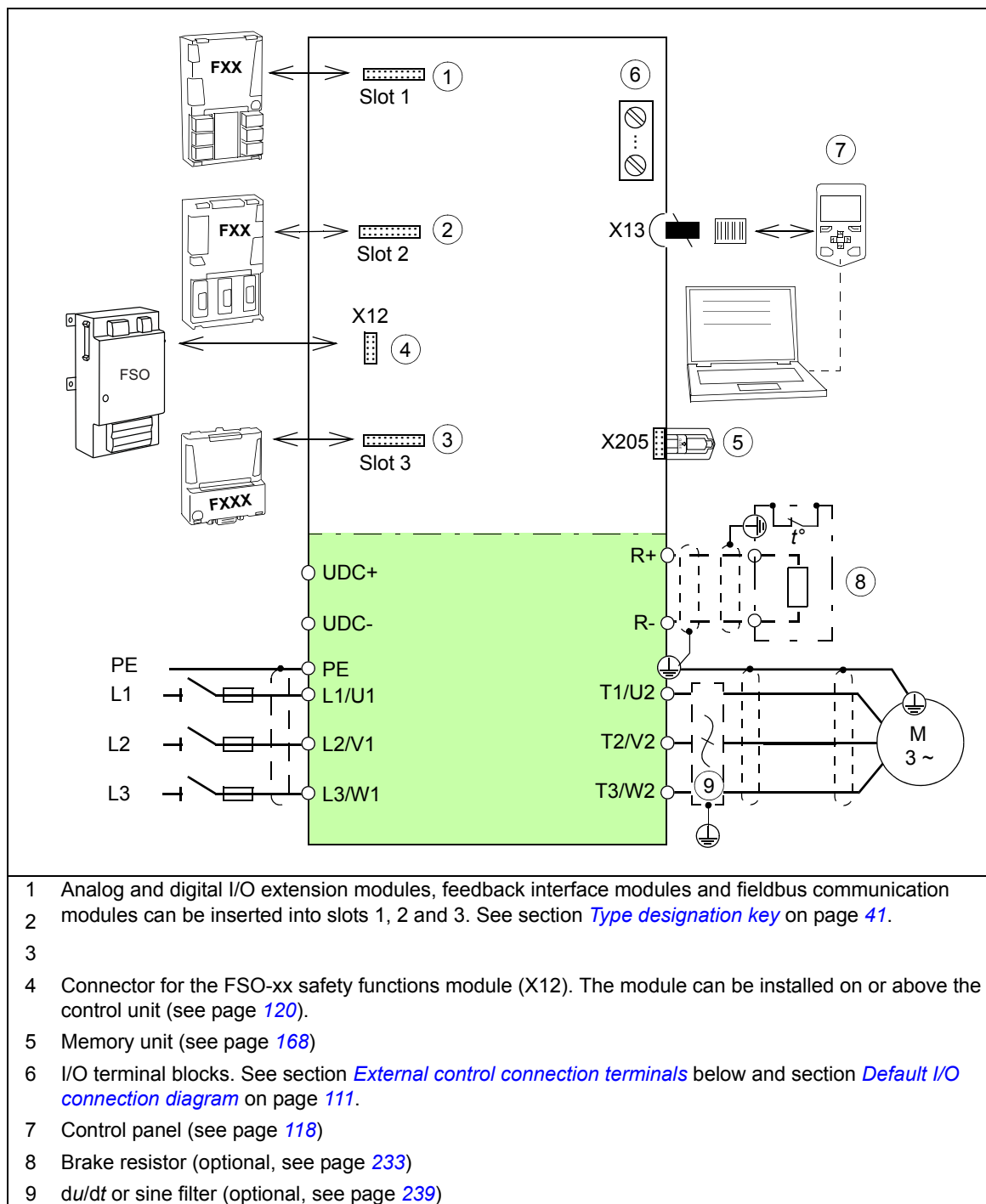
The control panel can be mounted on the cabinet door using a DPMP-01 mounting platform (option +J410) or a DPMP-02 mounting platform (option +J413).

When the control unit is inside the drive module (option +P905), the control panel can be mounted on the drive module (option +J414).

For the use of the control panel, see the firmware manual or *ACS-AP-X assistant control panels user's manual* (3AUA0000085685 [English]).

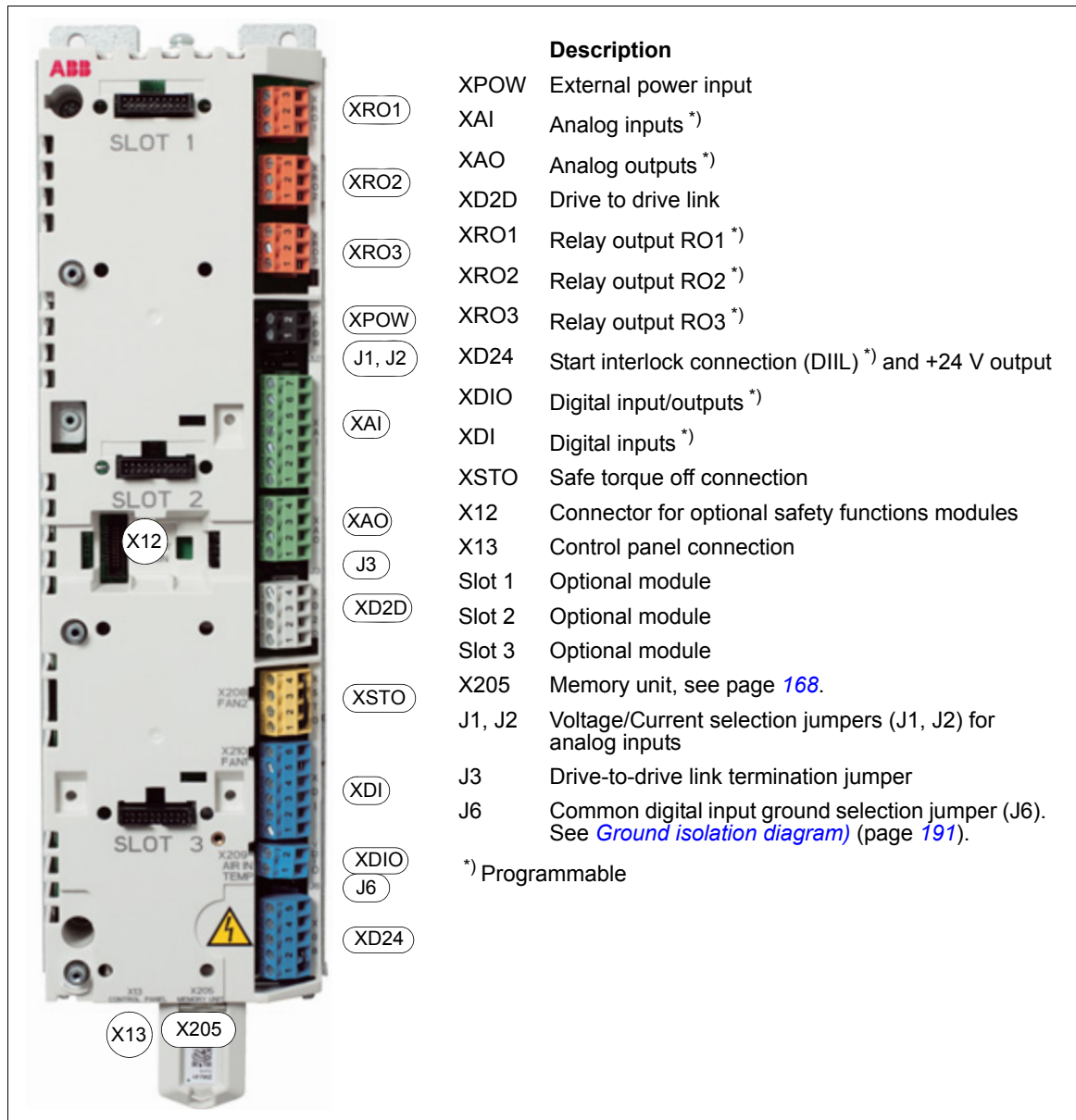
Overview of power and control connections

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



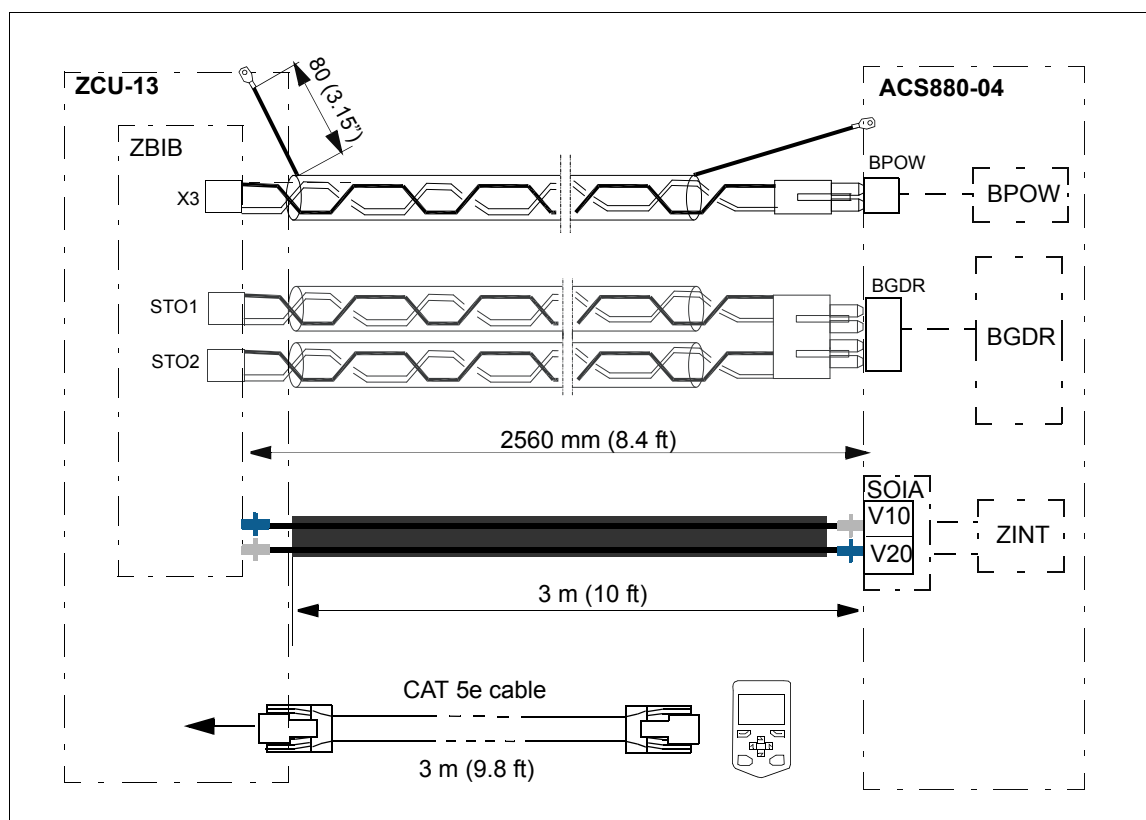
■ External control connection terminals

The layout of the external control connection terminals on the drive module control are shown below.



External control unit connection cables

The cables that are delivered with the drive module for connecting the drive module and control panel to the external control unit are shown below. See sections [Connecting the external control unit to the drive module](#) (page 106) and [Connecting a control panel](#) (page 118) for the actual connections.



Type designation label

The type designation label includes a rating, markings, a type designation and a serial number, which allow individual recognition of each drive module. The type designation label is located on the front cover. An example label is shown below.

 MADE IN FINLAND	1 ACS880-04-505A-3+E210+K473+Q973	 4
FRAME R10 2	3 Input U1 3~ 400 V AC I1 505 A f1 50/60 Hz Output U2 3~ 0...U1 I2 505 A f2 0...500 Hz Sn 350 kVA	5 S/N: 1151100572

IP20
UL open type
Icc 65 kA

- Type designation, see section [Type designation key](#) on page 41.
- Frame size
- Ratings
- Valid markings
- 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 module. The first digits from left express the basic configuration. The optional selections are given thereafter, separated by plus signs, eg, +J410. The main selections are described below. Not all selections are available for all types. For more information, refer to *ACS880 Ordering Information* (3AXD10000014923), available on request.

Code	Description
Basic code, eg, ACS880-04-880A-3	
Product series	
ACS880	ACS880 product series
Type	
-04	When no options are selected: drive module to be installed in a cabinet, IP20 (UL open type), bookshelf mounting with pedestal, external control unit, control panel and panel holder, build-in choke, full-size output cable connection terminals, no EMC filter, no DC connection busbars, clear plastic shrouds for covering the input power and motor cable connections, ACS880 primary control program, Safe torque off function, coated boards, printed multilingual quick installation and start-up guides, CD containing all manuals with all available languages.
Size	
xxxA	Refer to the rating tables, page 177 .
Voltage range	
-3	380...415 V
-5	380...500 V
-7	525...690 V
Option codes (plus codes)	
Construction, pedestal and cabling	
0B051	No IP20 shrouds for cabling area (not to be used with option +H381)
C173	Flat mounting. Includes flat mounting brackets. Not to be used with options +H381, +H391 and +P905.
0H354	No pedestal. Requires option +0P919. Not with option +H381.
H356	DC connection busbars
H370	Full-size input power cable connection terminals and PE busbar. Not to be used with option +H381.
0H371	No full-size output power cable connection terminals (not to be used with option +H381).
H381	Full power cabling panels to be attached to a cabinet. The drive module can be pulled from the cabinet for maintenance without disconnecting the power cables. Degree of protection IP20. (Not to be used with options +0B051, +C173, 0H354 and 0H371.)
H391	Power cable connection terminals on the right-hand side of the drive module. Includes accessories for mounting the drive module in the back to front position. Not to be used with options +P905, +H381 and +C173.
0P919	No installation ramp
Control panel and control unit	
P905	Internal control unit (inside the drive module).
0J400	No control panel and no control panel holder. Note: You need at least one loose control panel to be able to commission the drive.
J410	DPMP-01 door mounting kit (flush mounting) for the control panel. Includes a control panel mounting platform, an IP54 cover and a 3-meter panel connection cable.
J413	DPMP-02 door mounting kit (surface mounting) for the control panel. Includes a control panel mounting platform, an IP65 cover and a 3-meter panel connection cable.
J414	Control panel holder mounted on the drive module (requires option +P905).
Filters	
E200	EMC filter for second environment TN (grounded) system, category C3. Available for ACS880-04-xxxx-7 types only.
E201	EMC filter for second environment IT (ungrounded) system, category C3. Available for ACS880-04-xxxx-7 types only.

42 Operation principle and hardware description

Code	Description
E202	EMC filter for first environment TN (grounded) system, category C2. Requires option +E208. Available for ACS880-04-xxxx-3 and -5 types only.
E208	Common mode filter
E210	EMC filter for second environment TN (grounded) and IT (ungrounded)) systems, category C3. Available for ACS880-04-xxxx-3 and -5 types only.
Resistor braking	
D150	Brake chopper
Fieldbus adapter modules	
K451	FDNA-01 DeviceNet™ fieldbus adapter module
K452	FLON-01 LonWorks® fieldbus adapter module
K454	FPBA-01 PROFIBUS DP fieldbus adapter module
K457	FCAN-01 CANopen fieldbus adapter module
K458	FSCA-01 Modbus adapter module
K462	FCNA-01 ControlNet fieldbus adapter module
K469	FECA-01 EtherCAT® fieldbus adapter module
K470	FEPL-02 Ethernet POWERLINK fieldbus adapter module
K473	FENA-11 EtherNet/IP™, Modbus/TCP and PROFINET IO fieldbus adapter module
K475	FENA-21 EtherNet/IP™, Modbus/TCP and PROFINET IO fieldbus adapter module, 2-port
I/O extension and feedback interface modules	
L500	FIO-11 analog I/O extension module
L501	FIO-01 digital I/O extension module
L502	FEN-31 HTL encoder interface module
L515	FEA-03 F-series extension adapter
L516	FEN-21 resolver interface module
L517	FEN-01 TTL encoder interface module
L518	FEN-11 absolute encoder interface module
L503	FDCO-01 optical DDCS communication module
L508	FDCO-02 optical DDCS communication module
L515	FEA-03 I/O extension and encoder module adapter
L525	FAIO-01 analog I/O extension module
L526	FDIO-01 digital I/O extension module
Control program	
N7502	Enables setting of synchronous reluctance motor parameters in the drive control program.
Programmability	
N8010	Drive application programming (CODESYS)
Safety	
Q973	FSO-12 safety functions module
Q971	ATEX-certified Safe motor disconnection function using the drive Safe torque off function
Warranty	
P904	Extended warranty 24/30
Paper manuals. Note: The delivered manual set can include manuals in English if the translation is not available.	
R700	English
R701	German
R702	Italian
R703	Dutch
R704	Danish
R705	Swedish
R706	Finnish

Code	Description
R707	French
R708	Spanish
R709	Portuguese (spoken in Portugal)
R711	Russian
R713	Polish
R714	Turkish

4

Guidelines for planning the cabinet installation

Contents of this chapter

This chapter guides in 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. These 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 positions of the drive module

You can put the drive module in the bookshelf or flat position or on its back in a cabinet.

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

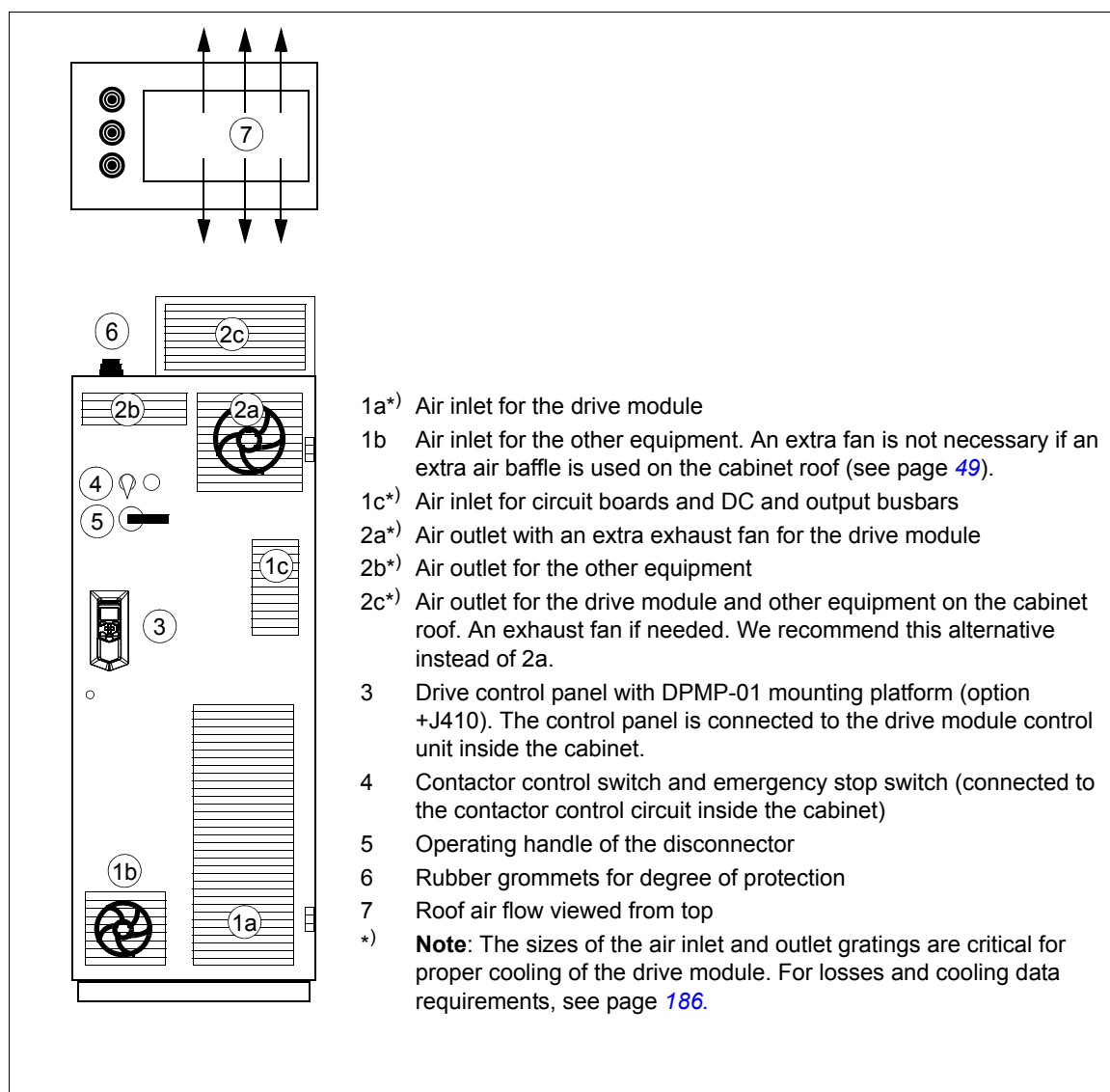
Plan a spacious layout to ensure easy installation and maintenance. Sufficient cooling air flow, obligatory clearances, cables and cable support structures all require space.

Place the control board(s) away from:

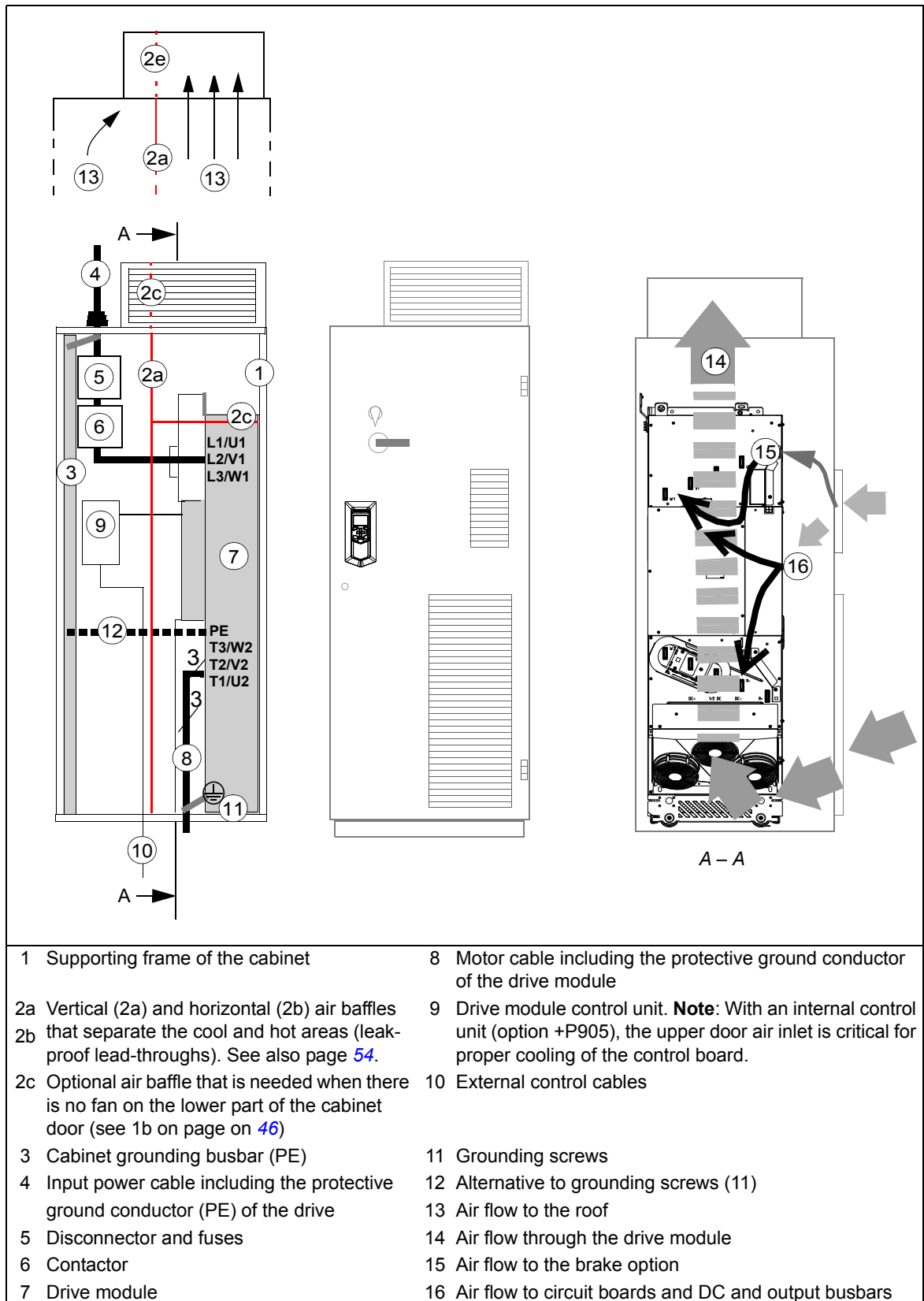
- main circuit components such as contactors, switches and power cables
- hot parts (heat sink, air outlet of the drive module).

Layout example, door closed

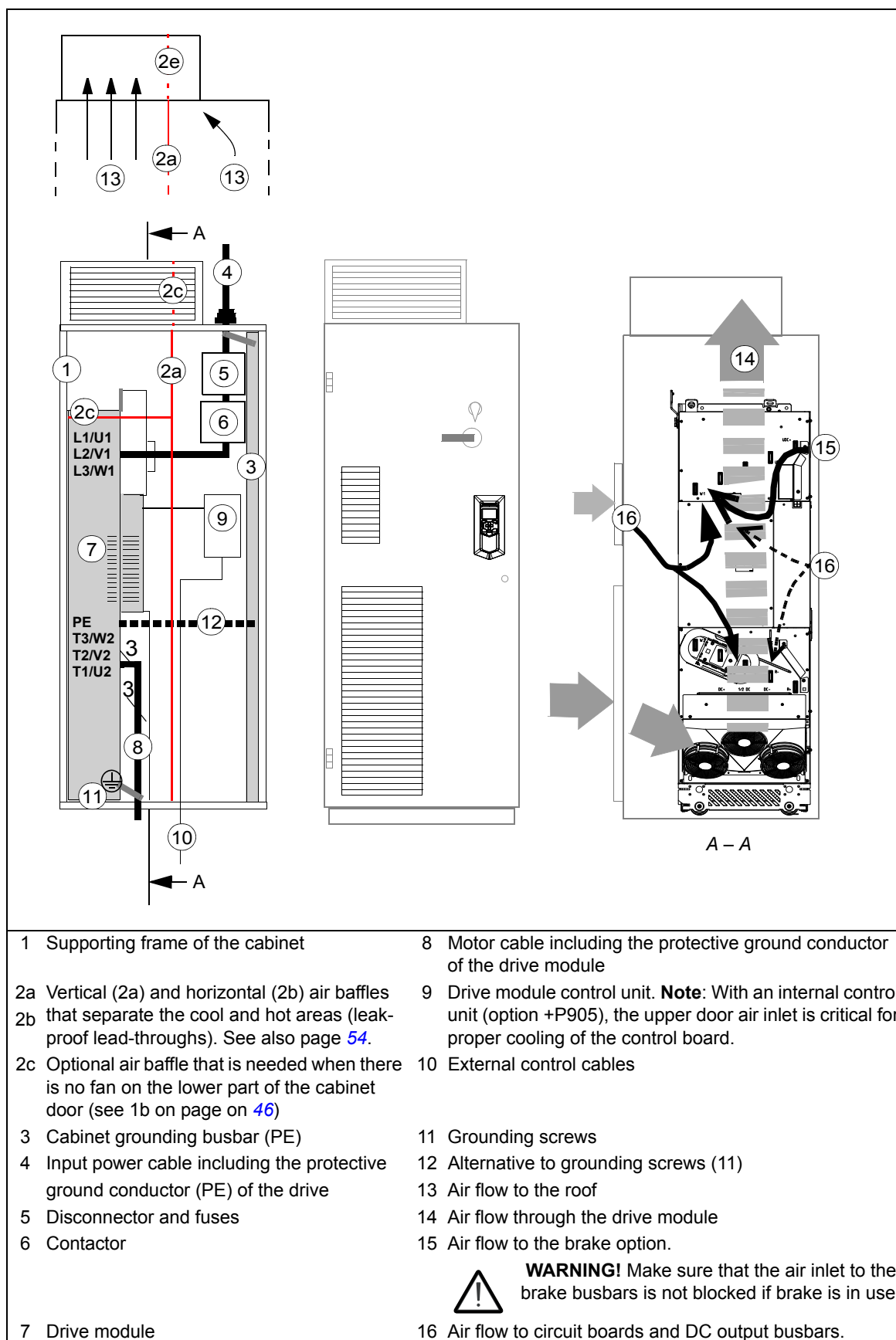
This diagram shows a cabinet layout example with the input power cable lead-through from top and the motor cable lead-through from bottom.



■ Layout example, door open (standard drive module configuration)

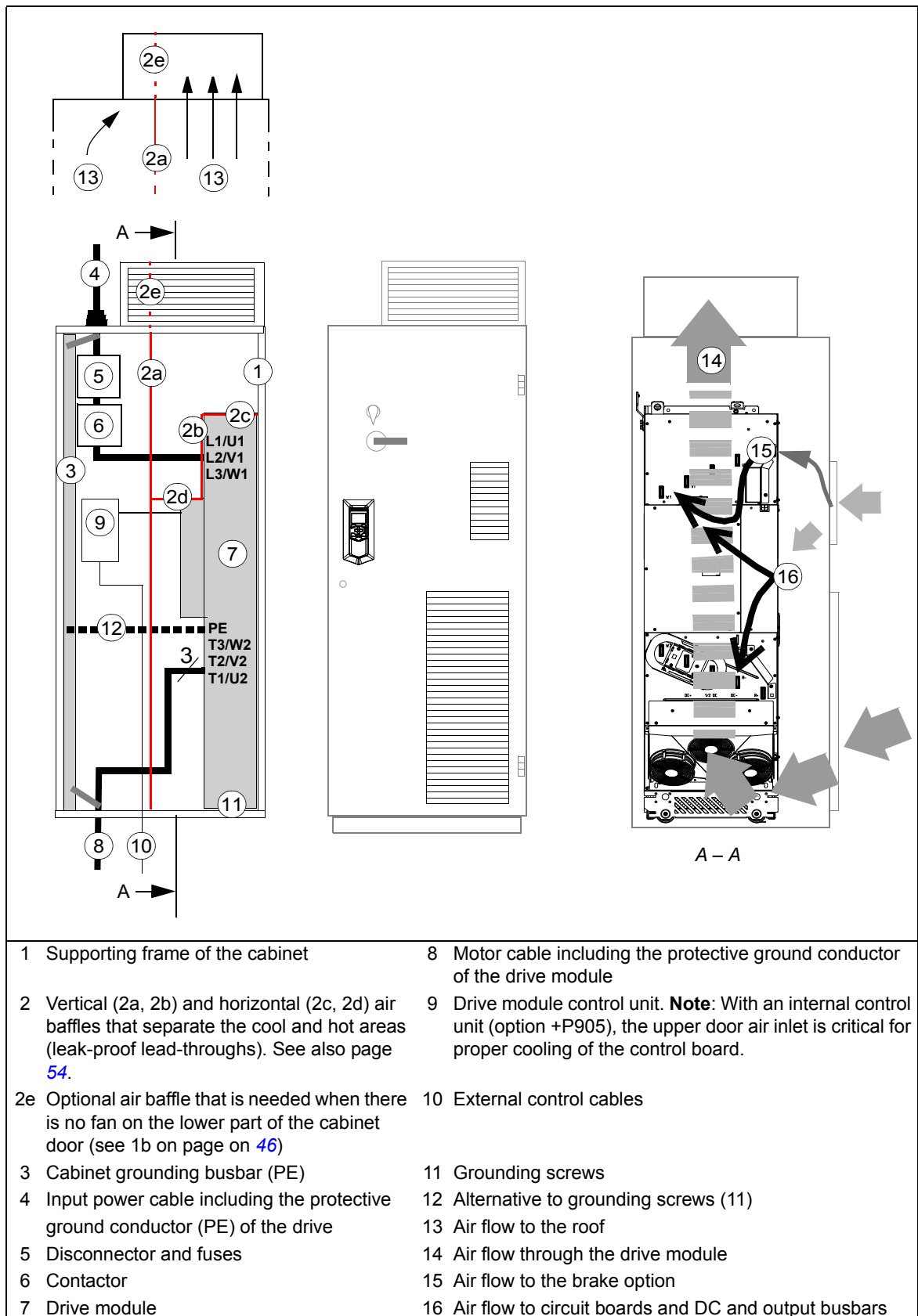


Layout example, door open (option +H391)



■ Layout example, door open (option +0B051)

This diagram shows a layout example for drive modules with no IP20 shrouds (option +0B051) or no cabling panels (option +H381 not included).



Note 1: The power cable shields can also be grounded to the drive module grounding terminals.

Note 2: See also section [Required free space](#), page 60.

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:

- Tin-plated copper is recommended but aluminum can also be used.
- The oxide layer from aluminum busbar joints must be removed and suitable anti-oxidant joint compound applied.

Tightening torques

Apply the following 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 fastening of the cabinet

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

- Fasten the cabinet to the floor from the front and to the floor or wall from the back.
- Always fasten the drive module from its fastening points to the cabinet. For details, see the module installation instructions.



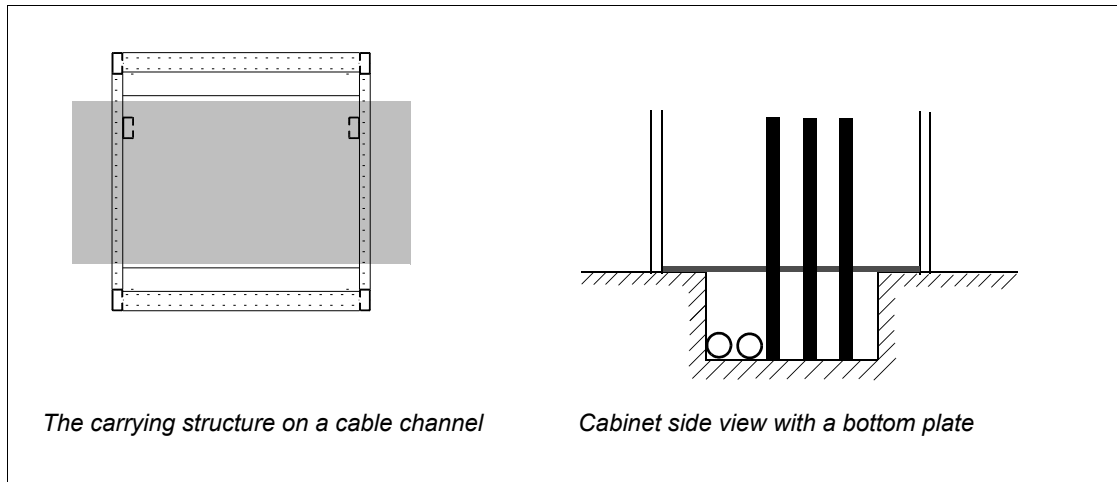
WARNING! Do not fasten the cabinet by electric welding. ABB does not assume any liability for damages caused by electric welding as the welding circuit can damage electronic circuits in the cabinet.

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.

Note: When the bottom grille and clear plastic shrouds around the motor cables are installed, the degree of protection of the drive module from bottom side is IP20.

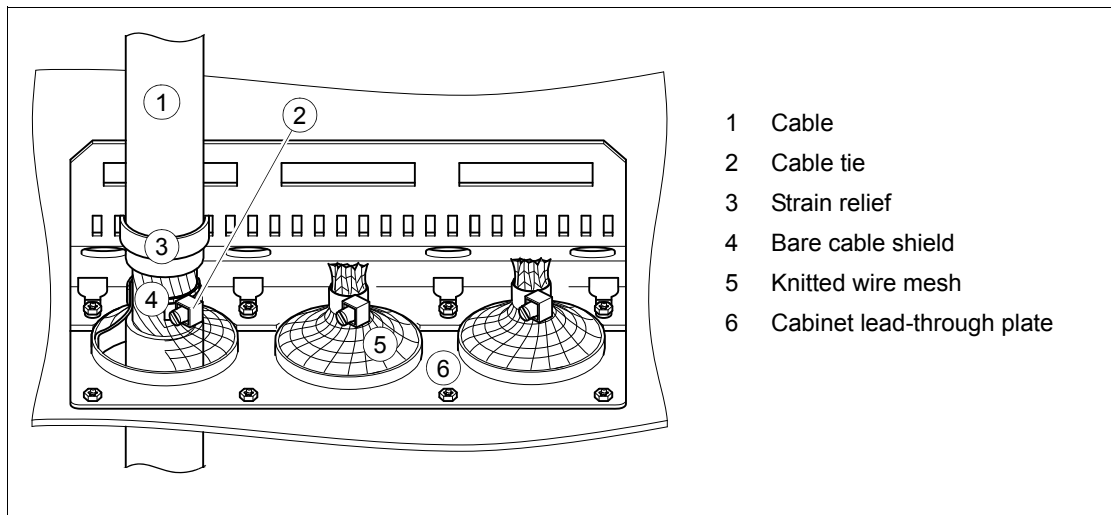


Planning the electromagnetic compatibility (EMC) of the cabinet

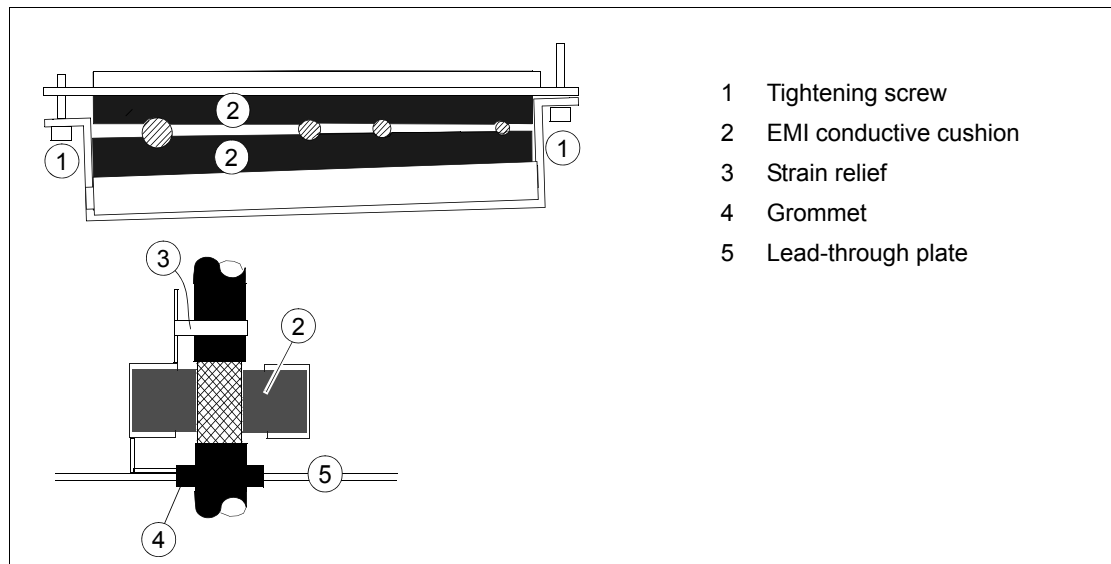
Note the following when you plan the electromagnetic compatibility of the cabinet:

- 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.



- 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:

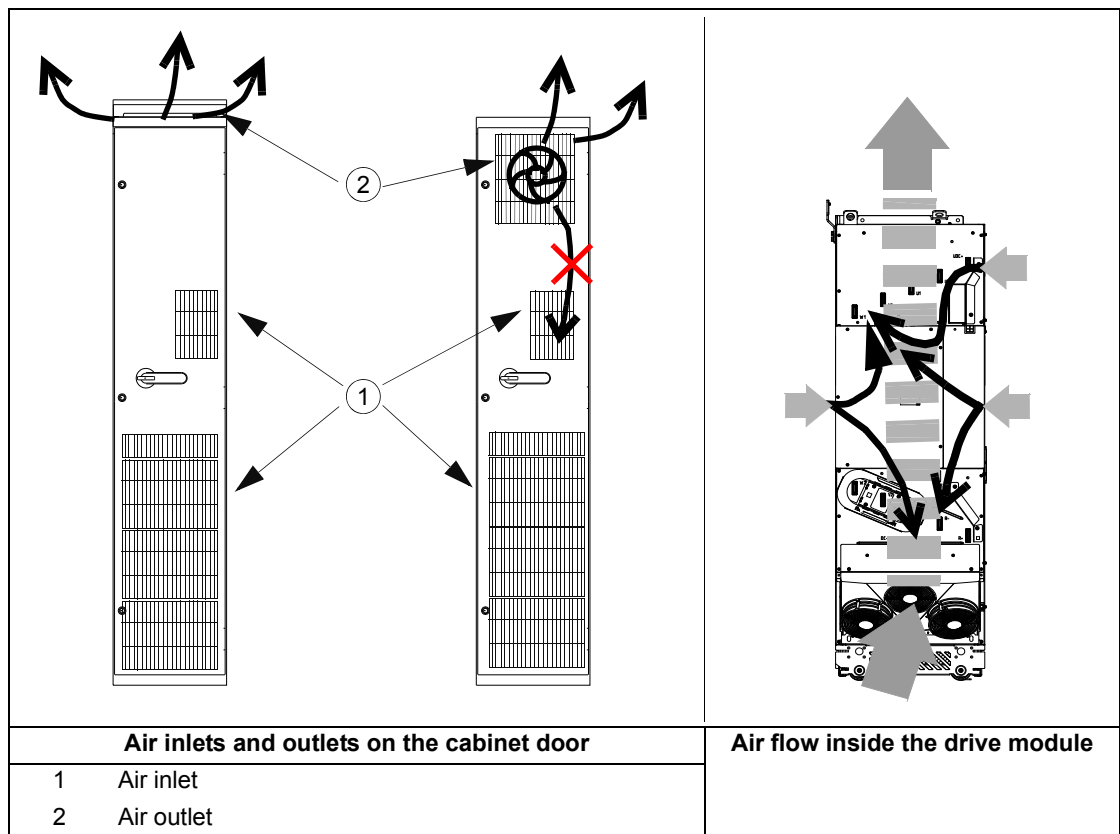


Planning the cooling

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 pages [186](#) and [192](#). 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.
- 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 [60](#).
- 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 proper cooling of the drive module. Minimum air inlets are four Rittal air filters (SK 3243.200 for a 600 mm wide cabinet) or two ABB air inlet filters (see section [Cabinet ventilation](#) on page 170
- 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 roof. Use an extra exhaust fan if the air outlet is on the cabinet door.



- The internal cooling fans of the drive modules 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.

Preventing the recirculation of hot air

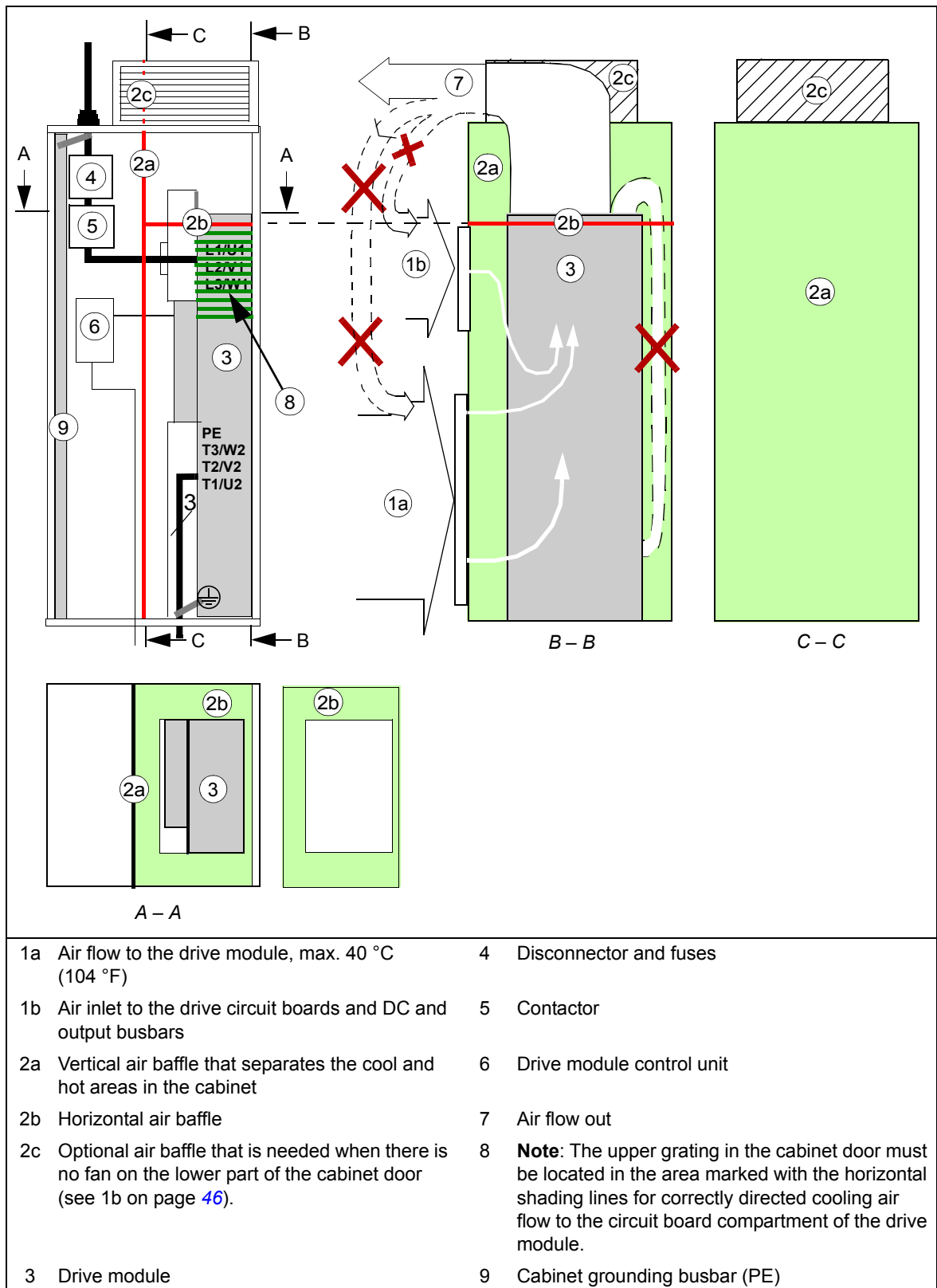
Prevent hot air circulation outside the cabinet by leading the outcoming hot air away from the area where the inlet air to the cabinet is taken. Possible solutions are listed below:

- 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, for example, leak-proof air baffles. No gaskets are usually required.

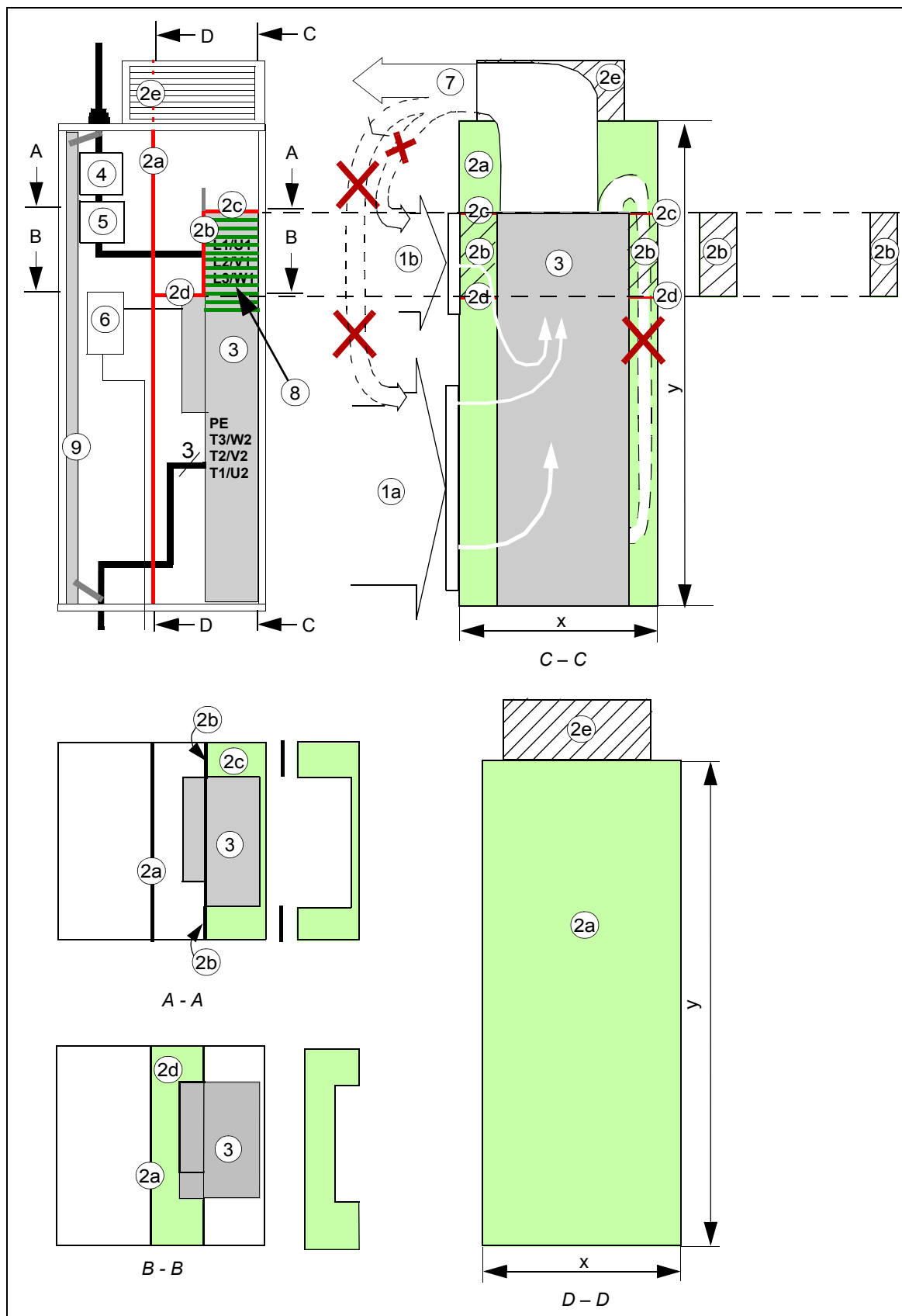
■ Bookshelf mounting (standard drive module configuration)

This diagram shows the air baffle position inside an example cabinet. For dimensions of the baffle, see page 217.



■ Bookshelf mounting (option +0B051)

This diagram shows air baffle positions inside an example cabinet. For the descriptions, see the next page.



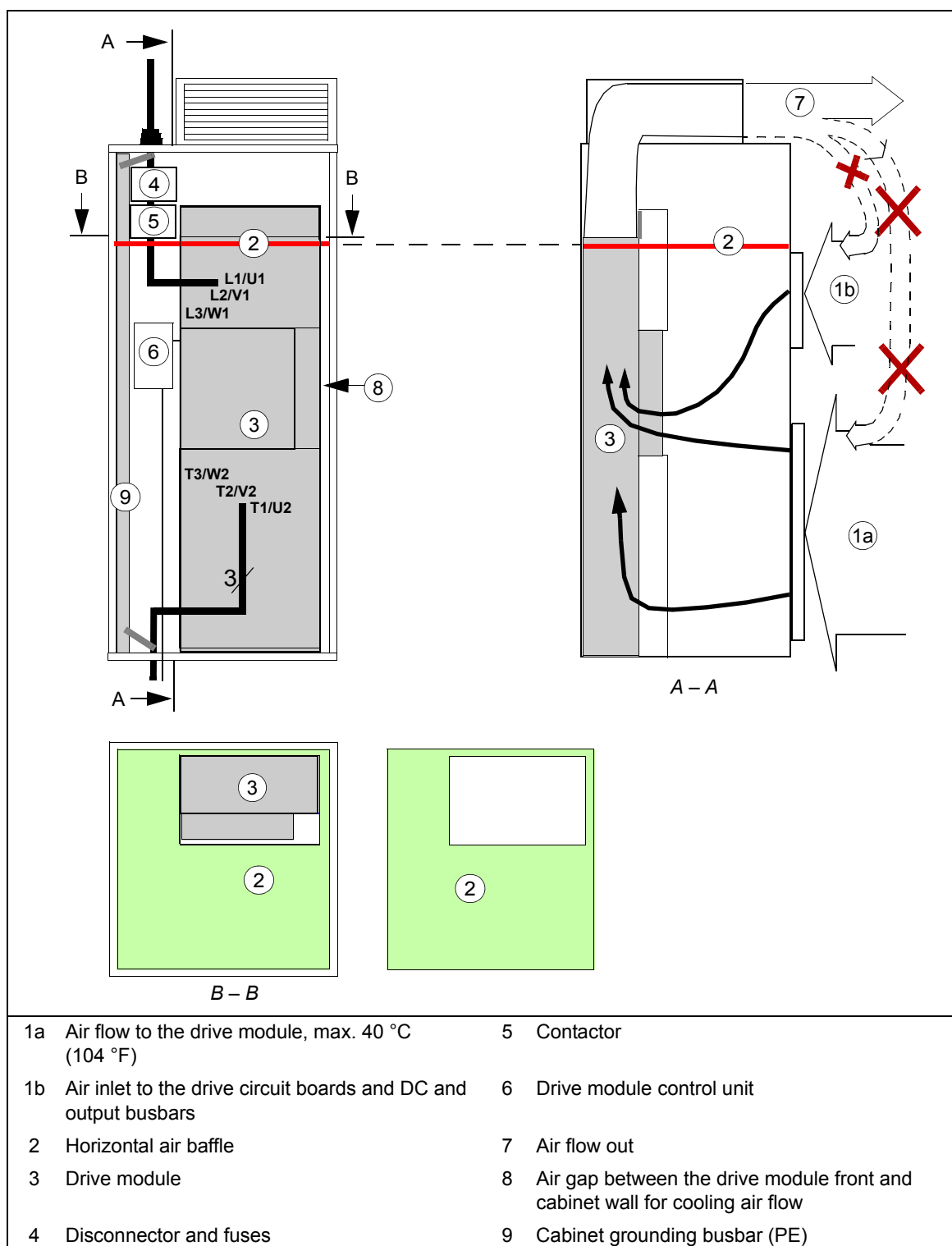
1a	Air flow to the drive module, max. 40 °C (104 °F)	3	Drive module
1b	Air inlet to the drive circuit boards and DC and output busbars	4	Disconnecter and fuses
2a	Vertical air baffle that separates the cool and hot areas in the cabinet	5	Contactors
2b	Vertical air baffle	6	Drive module control unit
2c	Upper horizontal air baffle	7	Air flow out
2d	Lower horizontal air baffle	8	Note: The upper grating in the cabinet door must be located in the area marked with the horizontal shading lines for correctly directed cooling air flow to the circuit board compartment of the drive module.
2e	Optional air baffle that is needed when there is no fan on the lower part of the cabinet door (see 1b on page 46).	9	Cabinet grounding busbar (PE)

■ Bookshelf mounting (option +H381)

See chapter [Step-by-step drawings for installing full cabling panels \(option +H381\) in a Rittal TS 8 400 mm wide cabinet](#) on page 245 and dimension drawings on page 218.

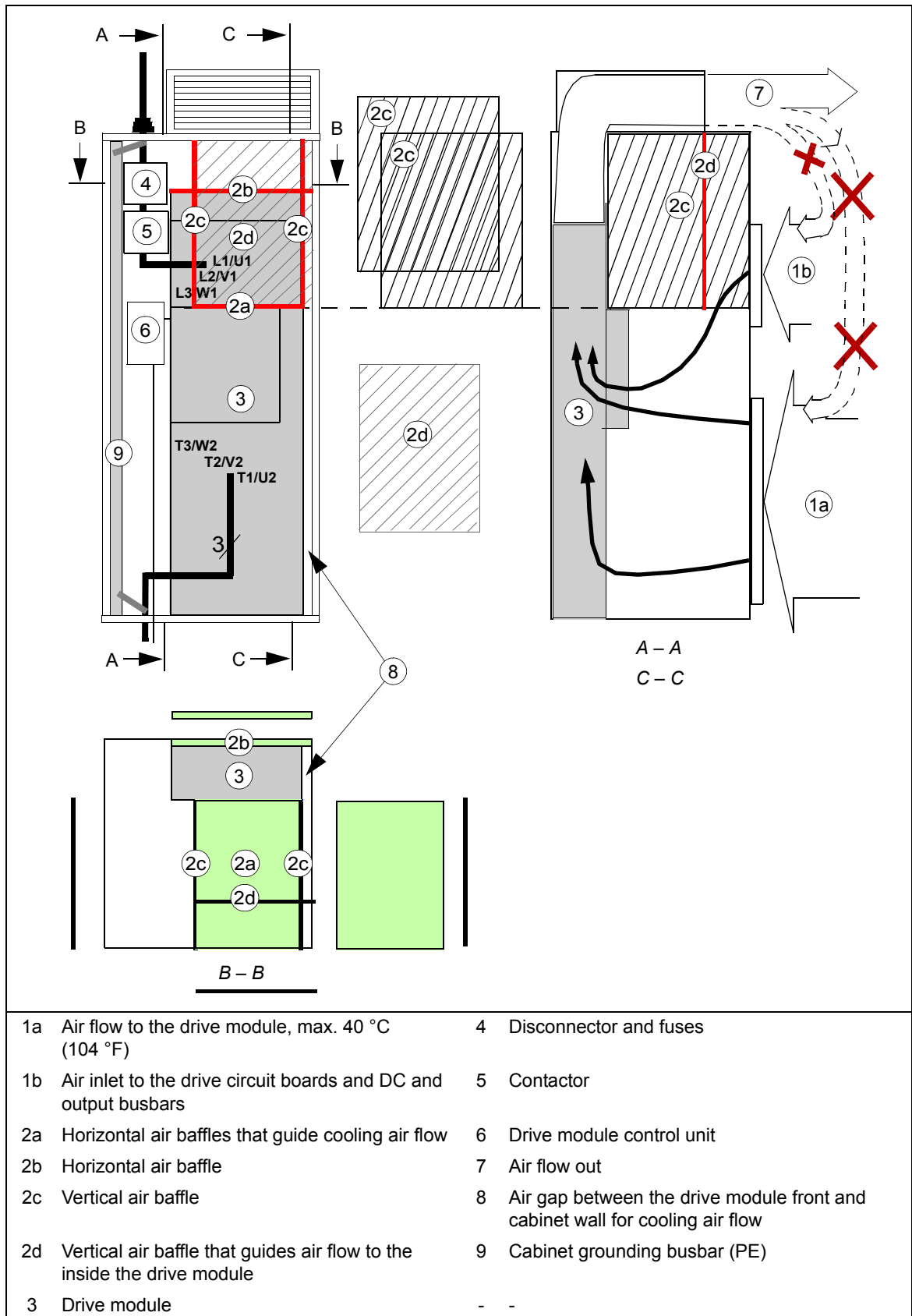
Flat mounting (option +C173)

This diagram shows air baffle positions inside an example cabinet. For dimensions of the baffle, see page 217.



■ Flat mounting (option +C173+0B051)

This diagram shows air baffle positions inside an example cabinet.

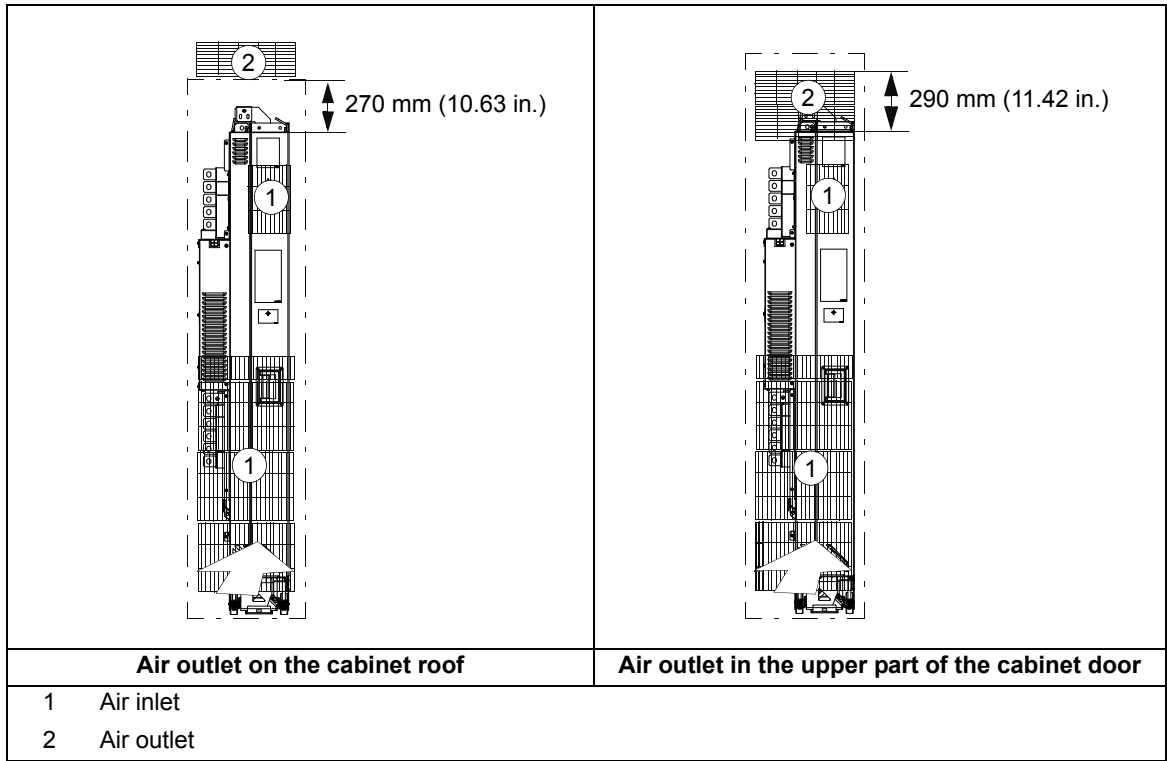


Required free space

Free space around the drive module is needed for ensuring that sufficient cooling air flows through the module and the module cools correctly.

Free space at the top of the drive module

The required free space at the top of the drive module is shown below.



Free space around the drive module

20 mm (0.79 in.) free space around the drive module is required from the cabinet back panel and front door. No free space for cooling is required on the left- and right-hand sides of the module.

The module can be installed in a cabinet with the following dimensions:

- width 400 mm (15.75 in.)
- depth 600 mm (23.62 in.)
- height 2000 mm (78.74 in.).

Other installation positions

Contact your local ABB representative for more information.

Drive module on its back

If you install the drive module on its back, make sure that the hot cooling air that flows upwards from the module does not cause danger.

Planning the placement of the control panel

Note the following alternatives when you plan the placement of the control panel:

- When the control unit is inside the drive module (option +P905), the control panel can be integrated in the drive module (option +J414).
- The control panel can be mounted onto the cabinet door using a control panel mounting platform (option +J410). For the installation instructions, refer to *DPMP-01 mounting platform for ACS-AP control panel* (3AUA0000100140 [English]) or *DPMP-02 mounting platform for ACS-AP-X control panel* (3AUA0000136205 [English]).

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.

ABB air inlet and outlet kits

See section [Cabinet ventilation](#) on page 170.

5

Guidelines for planning the electrical installation

Contents of this chapter

This chapter contains the instructions that you must obey when you select the motor, cables, protections, cable routing and way of operation for the drive system.

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 obeyed, the drive can experience problems that the warranty does not cover.

Selecting the supply disconnecting device

Install a hand-operated input disconnecting device between the AC power source and the drive. The disconnecting device must be of a type that can be locked to the open position for installation and maintenance work.

European Union

To agree with the European Union Directives, according to standard EN 60204-1, *Safety of Machinery*, the disconnecting device must be one of the following types:

- switch-disconnector of utilization category AC-23B (EN 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 EN 60947-2.

Other regions

The disconnecting device must conform to the applicable safety regulations.

Selecting the main contactor

If a main contactor is used, its utilization category (number of operations under load) must be AC-1 according to IEC 60947-4, *Low-voltage switchgear and controlgear*. Select the contactor according to the nominal voltage and current of the drive.

Examining the compatibility of the motor and drive

Use an asynchronous AC induction motor, permanent magnet motor, AC induction servomotor or ABB synchronous reluctance motor (SynRM motor) with the drive. Several induction motors can be connected at a time.

Select the motor size and drive type from the rating tables in chapter [Technical data](#) on basis of the AC line voltage and motor load. Use the DriveSize PC tool if you need to tune the selection more in detail.

Make sure that the motor withstands the maximum peak voltage in the motor terminals, see the [Requirements table](#) on page 66. For basics of protecting the motor insulation and bearings in drive systems, refer to section [Protecting the motor insulation and bearings](#) below.

Note:

- Consult the motor manufacturer before you use a motor which nominal voltage 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 the drive output voltage.
 - If the motor and drive are not of the same size, consider the following operation limits of the drive control program:
 - motor nominal voltage range $1/6 \dots 2 \cdot U_N$
 - motor nominal current range $1/6 \dots 2 \cdot I_N$ of the drive in DTC control and $0 \dots 2 \cdot I_N$ in scalar control. The control mode is selected by a drive parameter.
-

■ Protecting the motor insulation and bearings

The drive uses modern IGBT inverter technology. Regardless of frequency, the drive output has pulses of approximately the drive DC bus voltage with a very short rise time. Up to twice bus voltage can be at the motor terminals, depending on the attenuation and reflection properties of the motor cable and the terminals. The increased voltage 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.

Optional du/dt filters protect motor insulation system and reduce bearing currents. Optional common mode filters mainly reduce bearing currents. Insulated N-end (non-drive end) bearings protect the motor bearings.

■ Requirements table

The following table shows how to select the motor insulation system and when optional ABB du/dt filters, insulated N-end (non-drive end) motor bearings and ABB common mode filters are required. Failure of the motor to fulfil the following requirements or improper installation may shorten motor life or damage the motor bearings and voids the motor warranty.

Motor type	Nominal AC supply voltage	Requirement for		
		Motor insulation system	ABB du/dt and common mode filters, insulated N-end motor bearings	
			$100\text{ kW} \leq P_N < 350\text{ kW}$ or $\text{IEC } 315 \leq \text{frame size} < \text{IEC } 400$	$P_N \geq 350\text{ kW}$ or frame size $\geq \text{IEC } 400$
			$134\text{ hp} \leq P_N < 469\text{ hp}$ or $\text{NEMA } 500 \leq \text{frame size} \leq \text{NEMA } 580$	$P_N \geq 469\text{ hp}$ or frame size $> \text{NEMA } 580$
ABB motors				
Random-wound M2_, M3_ and M4_	$U_N \leq 500\text{ V}$	Standard	+ N	+ N + CMF
	$500\text{ V} < U_N \leq 600\text{ V}$	Standard	+ N + du/dt	+ N + du/dt + CMF
		or		
		Reinforced	+ N	+ N + CMF
	$600\text{ V} < U_N \leq 690\text{ V}$ (cable length $\leq 150\text{ m}$)	Reinforced	+ N + du/dt	+ N + du/dt + CMF
	$600\text{ V} < U_N \leq 690\text{ V}$ (cable length $> 150\text{ m}$)	Reinforced	+ N	+ N + CMF
Form-wound HX_ and AM_	$380\text{ V} < U_N \leq 690\text{ V}$	Standard	+ N + CMF	$P_N < 500\text{ kW}$: +N + CMF
				$P_N \geq 500\text{ kW}$ +N + du/dt + CMF
Old* form-wound HX_ and modular	$380\text{ V} < U_N \leq 690\text{ V}$	Check with the motor manufacturer.	+ N + du/dt with voltages over 500 V + CMF	
Random-wound HX_ and AM_**	$0\text{ V} < U_N \leq 500\text{ V}$	Enamelled wire with fiber glass taping	+ N + CMF	
	$500\text{ V} < U_N \leq 690\text{ V}$		+ N + du/dt + CMF	
HDP	Consult the motor manufacturer.			

* manufactured before 1.1.1998

** For motors manufactured before 1.1.1998, check for additional instructions with the motor manufacturer.

Motor type	Nominal AC supply voltage	Requirement for			
		Motor insulation system	ABB du/dt and common mode filters, insulated N-end motor bearings		
			$100\text{ kW} \leq P_N < 350\text{ kW}$ or $\text{IEC } 315 \leq \text{frame size} < \text{IEC } 400$	$P_N \geq 350\text{ kW}$ or $\text{frame size} \geq \text{IEC } 400$	
			$134\text{ hp} \leq P_N < 469\text{ hp}$ or $\text{NEMA } 500 \leq \text{frame size} \leq \text{NEMA } 580$	$P_N \geq 469\text{ hp}$ or $\text{frame size} > \text{NEMA } 580$	
Non-ABB motors					
Random-wound and form-wound	$U_N \leq 420\text{ V}$	Standard: $\dot{U}_{LL} = 1300\text{ V}$	+ N or CMF	+ N + CMF	
	$420\text{ V} < U_N \leq 500\text{ V}$	Standard: $\dot{U}_{LL} = 1300\text{ V}$	+ du/dt + (N or CMF)	+ N + du/dt + CMF	
		or			
		Reinforced: $\dot{U}_{LL} = 1600\text{ V}$, 0.2 microsecond rise time	+ N or CMF	+ N + CMF	
	$500\text{ V} < U_N \leq 600\text{ V}$	Reinforced: $\dot{U}_{LL} = 1600\text{ V}$	+ du/dt + (N or CMF)	+ N + du/dt + CMF	
		or			
		Reinforced: $\dot{U}_{LL} = 1800\text{ V}$	+ N or CMF	+ N + CMF	
	$600\text{ V} < U_N \leq 690\text{ V}$	Reinforced: $\dot{U}_{LL} = 1800\text{ V}$	+ du/dt + N	+ N + du/dt + CMF	
		Reinforced: $\dot{U}_{LL} = 2000\text{ V}$, 0.3 microsecond rise time ***	N + CMF	+ N + CMF	

*** If the intermediate DC circuit voltage of the drive is increased from the nominal level by resistor braking, check with the motor manufacturer if additional output filters are needed in the applied drive operation range.

The abbreviations used in the table are defined below.

Abbreviation	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 (option +E208)
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.

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 the braking applications

When the motor brakes the machinery, the intermediate circuit DC voltage of the drive increases, the effect being similar to increasing the motor supply voltage by up to 20 percent. Consider this voltage increase when you specify the motor insulation requirements if the motor is 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 ABB random-wound motor series (for example, M3AA, M3AP and M3BP).

Nominal AC supply voltage	Requirement for		
	Motor insulation system	ABB du/dt and common mode filters, insulated N-end motor bearings	
		$100 \text{ kW} \leq P_N < 200 \text{ kW}$	$P_N \geq 200 \text{ kW}$
		$140 \text{ hp} \leq P_N < 268 \text{ hp}$	$P_N \geq 268 \text{ hp}$
$U_N \leq 500 \text{ V}$	Standard	+ N	+ N + CMF
$500 \text{ V} < U_N \leq 600 \text{ V}$	Standard	+ du/dt + N	+ du/dt + N + CMF
	or		
	Reinforced	+ N	+ N + CMF
$600 \text{ V} < U_N \leq 690 \text{ V}$	Reinforced	+ du/dt + N	+ du/dt + 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. The table below shows the requirements for random-wound and form-wound non-ABB motors with nominal power smaller than 350 kW. For bigger motors, consult the motor manufacturer.

Nominal AC supply voltage	Requirement for	
	Motor insulation system	ABB du/dt filter, insulated N-end bearing and ABB common mode filter
		100 kW ≤ P_N < 350 kW or IEC 315 ≤ frame size < IEC 400
		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 + CMF
420 V < $U_N \leq 500$ V	Standard: $\hat{U}_{LL} = 1300$ V	+ N + du/dt + CMF
	or	
	Reinforced: $\hat{U}_{LL} = 1600$ V, 0.2 microsecond rise time	+ N + CMF
500 V < $U_N \leq 600$ V	Reinforced: $\hat{U}_{LL} = 1600$ V	+ du/dt + N + CMF
	or	
	Reinforced: $\hat{U}_{LL} = 1800$ V	+ N + CMF
600 V < $U_N \leq 690$ V	Reinforced: $\hat{U}_{LL} = 1800$ V	+ N + du/dt + CMF
	Reinforced: $\hat{U}_{LL} = 2000$ V, 0.3 microsecond rise time	N + CMF

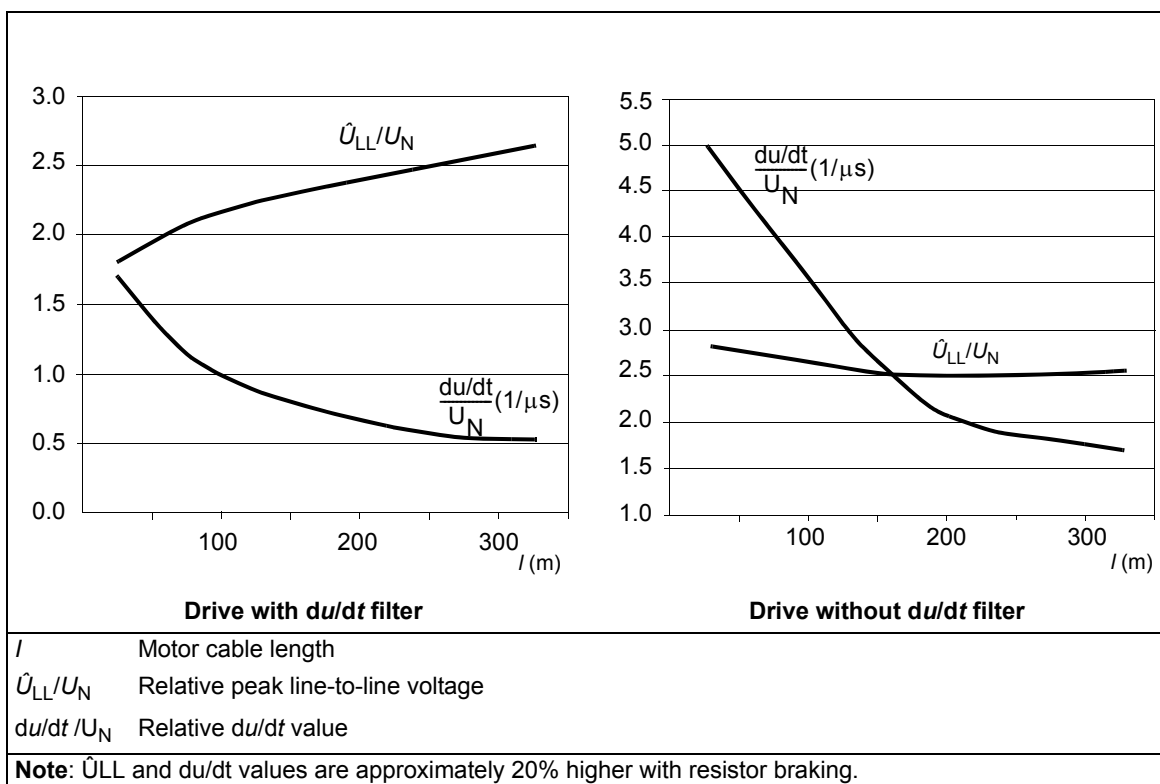
*** If the intermediate DC circuit voltage of the drive is increased from the nominal level by resistor braking, check with the motor manufacturer if additional output filters are needed in the applied drive operation range.

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 with and without a du/dt filter in use.

To calculate the actual peak voltage for a certain cable length read the relative \hat{U}_{LL}/U_N value from the appropriate diagram and multiply it by the nominal supply voltage (U_N).

To calculate the actual voltage rise time for a certain cable length read the relative values \hat{U}_{LL}/U_N and $(du/dt)/U_N$ from the appropriate diagram. Multiply the values by the nominal supply voltage (U_N) and substitute into equation $t = 0.8 \cdot \hat{U}_{LL}/(du/dt)$.



Additional note for sine filters

Sine filters protect the motor insulation system. Therefore, the du/dt filter can be replaced with a sine filter. The peak phase-to-phase voltage with the sine filter is approximately $1.5 \cdot U_N$.

Additional note for common mode filters

Common mode filters are available as plus code option +E208.

Selecting the power cables

■ General rules

Select the input power and motor cables according to local regulations:

- Select a cable capable of carrying the drive nominal current. See section [Ratings](#) (page 177) for the rated currents.
- Select a cable rated for at least 70 °C (158 °F) maximum permissible temperature of conductor in continuous use. For US, see [Additional US requirements](#), page 74.
- 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.

Use symmetrical shielded motor cables (see page 74). 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.

A four-conductor system is allowed for input cabling, but shielded symmetrical cable is recommended.

Compared to a four-conductor system, the use of symmetrical shielded cable reduces electromagnetic emission of the whole drive system as well as the stress on motor insulation, bearing currents and wear.

The protective conductor must always have an adequate conductivity. The table below shows the minimum cross-sectional area related to the phase conductor size according to IEC 61439-1 when the phase conductor and the protective conductor are made of the same metal.

Cross-sectional area of the phase conductors S (mm ²)	Minimum cross-sectional area of the corresponding protective conductor S_p (mm ²)
$S \leq 16$	S
$16 < S \leq 35$	16
$35 < S \leq 400$	$S/2$
$400 < S \leq 800$	200

■ Typical power cable sizes

The table below gives copper and aluminum cable types with concentric copper shield for the drives with nominal current. See also [Terminal and lead-through data for the power cables](#) on page 186.

Drive type ACS880- 04-	IEC ¹⁾		US ²⁾	
	Cu cable type	Al cable type	Cu cable type	Al cable type
	mm ²	mm ²	AWG/kcmil	AWG/kcmil
$U_N = 400\text{ V}$				
505A-3	3 × (3×95)	3 × (3×150)	2×500 MCM or 3×250 MCM	2×700 MCM or 3×350 MCM
585A-3	3 × (3×120)	3 × (3×185)	2×600 MCM or 3×300 MCM	3×400 MCM or 4×250 MCM
650A-3	3 × (3×150)	3 × (3×240)	2×700 MCM or 3×350 MCM	3×400 MCM or 4×250 MCM
725A-3	3 × (3×185)	4 × (3×185)	3×500 MCM or 4×300 MCM	3×500 MCM or 4×300 MCM
820A-3	3 × (3×240)	4 × (3×240)	3×600 MCM or 4×400 MCM	3×700 MCM or 4×500 MCM
880A-3	3 × (3×240)	4 × (3×240)	3×600 MCM or 4×400 MCM	4×500 MCM
$U_N = 500\text{ V}$				
460A-5	3 × (3×95)	3 × (3×150)	2×400 MCM or 3×4/0	2×600 MCM or 3×300 MCM
503A-5	3 × (3×95)	3 × (3×150)	2×500 MCM or 3×250 MCM	2×700 MCM or 3×350 MCM
583A-5	3 × (3×120)	3 × (3×185)	2×600 MCM or 3×300 MCM	3×500 MCM or 4×300 MCM
635A-5	3 × (3×150)	3 × (3×240)	2×700 MCM or 3×350 MCM	3×600 MCM or 4×400 MCM
715A-5	3 × (3×185)	4 × (3×185)	3×500 MCM or 4×300 MCM	3×600 MCM or 4×400 MCM
820A-5	3 × (3×240)	4 × (3×240)	3×600 MCM or 4×400 MCM	4×500 MCM
880A-5	3 × (3×240)	4 × (3×240)	3×600 MCM or 4×400 MCM	4×500 MCM
$U_N = 690\text{ V}$				
330A-7	2 × (3×120)	3 × (3×120)	2×250 MCM or 3×2/0	2×350 MCM or 3×4/0
370A-7	2 × (3×120)	3 × (3×120)	2×300 MCM or 3×3/0	2×400 MCM or 3×4/0
430A-7	2 × (3×95)	2 × (3×120)	2×350 MCM or 3×4/0	2 × 500 MCM or 3 × 250 MCM
425A-7	3 × (3×95)	3 × (3×120)	2×350 MCM or 3×4/0	2×500 MCM or 3×250 MCM
470A-7	3 × (3×95)	3 × (3×150)	2×400 MCM or 3×4/0	2×600 MCM or 3×300 MCM
522A-7	3 × (3×120)	3 × (3×185)	2×500 MCM or 3×250 MCM	2×700 MCM or 3×350 MCM
590A-7	3 × (3×150)	3 × (3×185)	2×600 MCM or 3×300 MCM	3×500 MCM or 4×300 MCM
650A-7	3 × (3×150)	3 × (3×240)	2×700 MCM or 3×350 MCM	3×500 MCM or 4×300 MCM
721A-7	3 × (3×185)	4 × (3×185)	3×500 MCM or 4 × 3 00 MCM	3×600 MCM or 4×400 MCM

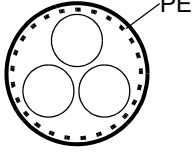
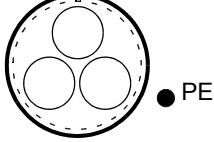
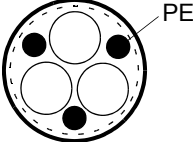
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- 1) The cable sizing is based on max. 9 cables laid on a cable ladder side by side, three ladder type trays one on top of the other, ambient temperature 30 °C (86 °F) PVC insulation, surface temperature 70 °C (158 °F) (EN 60204-1 and IEC 60364-5-52). For other conditions, dimension the cables according to local safety regulations, appropriate input voltage and the load current of the drive.
- 2) The cable sizing is based on NEC Table 310-16 for copper wires, 75 °C (167 °F) wire insulation at 40 °C (104 °F) ambient temperature. Not more than three current-carrying conductors in raceway or cable or earth (directly buried). For other conditions, dimension the cables according to local safety regulations, appropriate input voltage and the load current of the drive.


■ Alternative power cable types

The recommended and not allowed power cable types to be used with the drive are presented below.

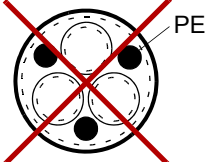
Recommended power cable types

	<p>Symmetrical shielded cable with three phase conductors and a concentric PE conductor as shield. The shield must agree with the requirements of IEC 61439-1, see page 71. Check with local / state / country electrical codes for allowance.</p>
	<p>Symmetrical shielded cable with three phase conductors and a concentric PE conductor as shield. A separate PE conductor is required if the shield does not agree with the requirements of IEC 61439-1, see page 71.</p>
	<p>Symmetrical shielded cable with three phase conductors and symmetrically constructed PE conductor, and a shield. The PE conductor must agree with the requirements of IEC 61439-1, see page 71.</p>

Power cable types for restricted use

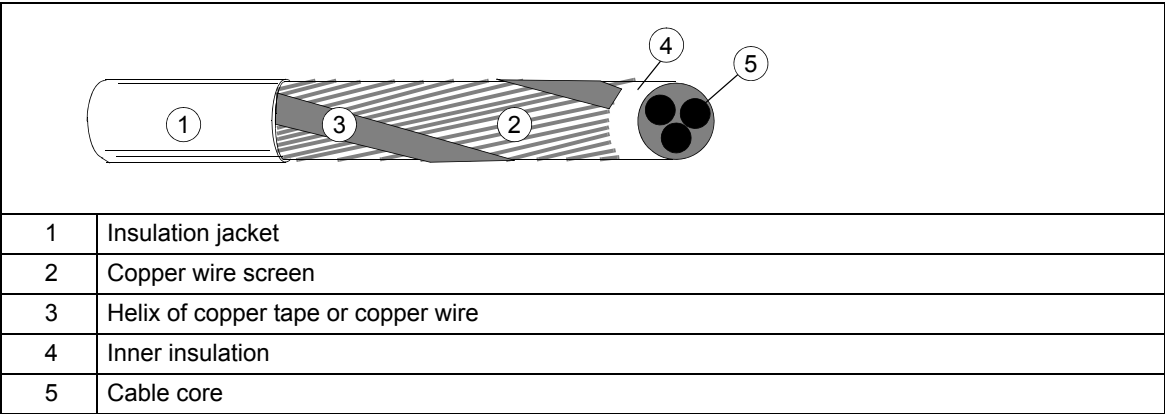
	<p>A four-conductor system (three phase conductors and a protective conductor on a cable tray) is not allowed for motor cabling (allowed for input cabling).</p>
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Not allowed power cable types

	<p>Symmetrical shielded cable with individual shields for each phase conductor is not allowed on any cable size for input and motor cabling.</p>
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■ **Motor cable shield**

If the motor cable shield is used as the sole protective earth conductor of the motor, make sure that the conductivity of the shield is sufficient. See subsection *General rules* above, or IEC 61439-1. 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.



■ **Additional US requirements**

Use type MC continuous corrugated aluminum armor cable with symmetrical grounds or shielded power cable for the motor cables if metallic conduit is not used. For the North American market, 600 V AC cable is accepted for up to 500 V AC. 1000 V AC cable is required above 500 V AC (below 600 V AC). For drives rated over 100 amperes, the power cables must be rated for 75 °C (167 °F).

Conduit

Couple separate parts of a conduit together: bridge the joints with a ground conductor bonded to the conduit on each side of the joint. Also bond the conduits to the drive enclosure and motor frame. Use separate conduits for input power, motor, brake resistor, and control wiring. When conduit is employed, type MC continuous corrugated aluminum armor cable or shielded cable is not required. A dedicated ground cable is always required.

Note: Do not install motor wiring from more than one drive in the same conduit.

Armored cable / shielded power cable

Six conductor (3 phases and 3 ground) type MC continuous corrugated aluminum armor cable with symmetrical grounds is available from the following suppliers (trade names in parentheses):

- Anixter Wire & Cable (Philsheath)
- BICC General Corp (Philsheath)
- Rockbestos Co. (Gardex)
- Oaknite (CLX).

Shielded power cables are available from Belden, LAPPKABEL (ÖLFLEX) and Pirelli.

Planning the braking system

See chapter [Resistor braking](#).

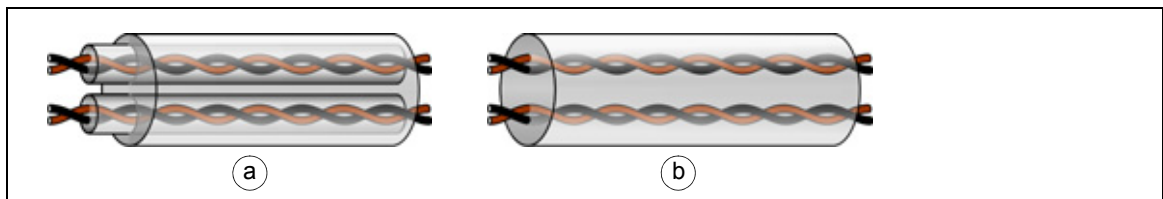
Selecting the control cables

■ Shielding

All control cables must be shielded.

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

A double-shielded cable (figure a below) 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. Never mix 24 V DC and 115/230 V AC signals in the same cable.

■ Signals allowed to be run in the same cable

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

■ Relay cable type

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

■ Control panel cable length and type

In remote use, the cable connecting the control panel to the drive must not exceed three meters (10 ft). Cable type: shielded CAT 5e or better Ethernet patch cable with RJ-45 ends.

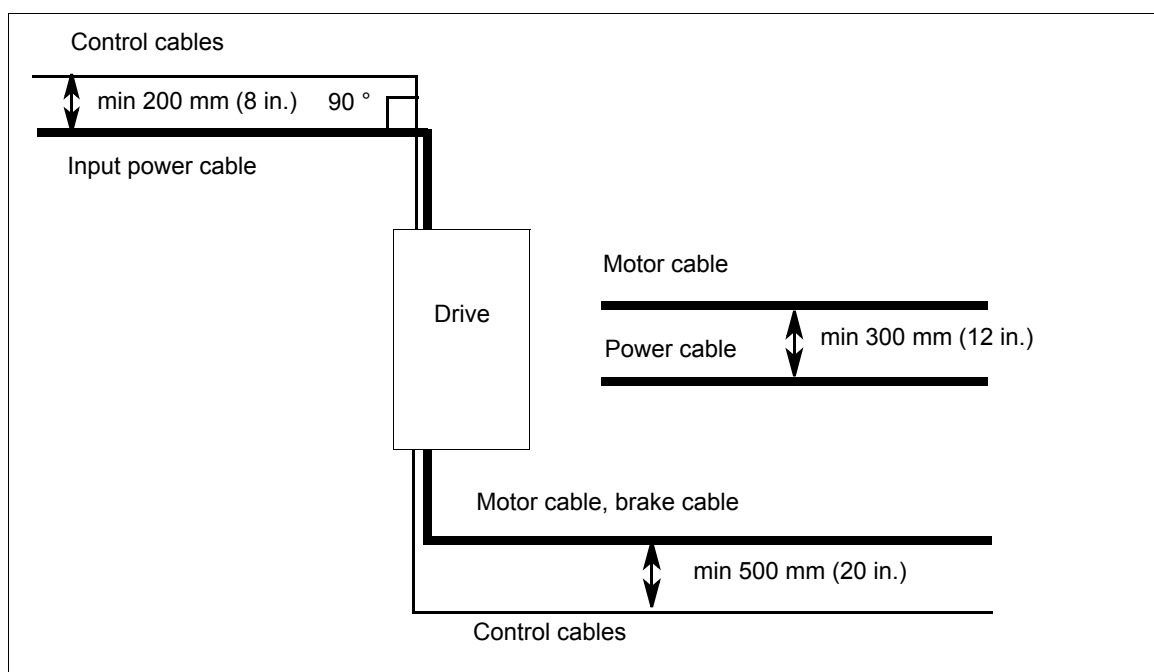
■ Routing the cables

Route the motor cable away from other cable routes. Motor cables of several drives can be run in parallel when installed next to each other. The motor cable, input power cable and control cables should be installed on separate trays. Avoid long parallel runs of motor cables with other cables in order to decrease electromagnetic interference caused by the rapid changes in the drive output voltage.

Where control cables must cross power cables, make sure they are arranged at an angle as near to 90 degrees as possible. Do not install extra cables through the drive.

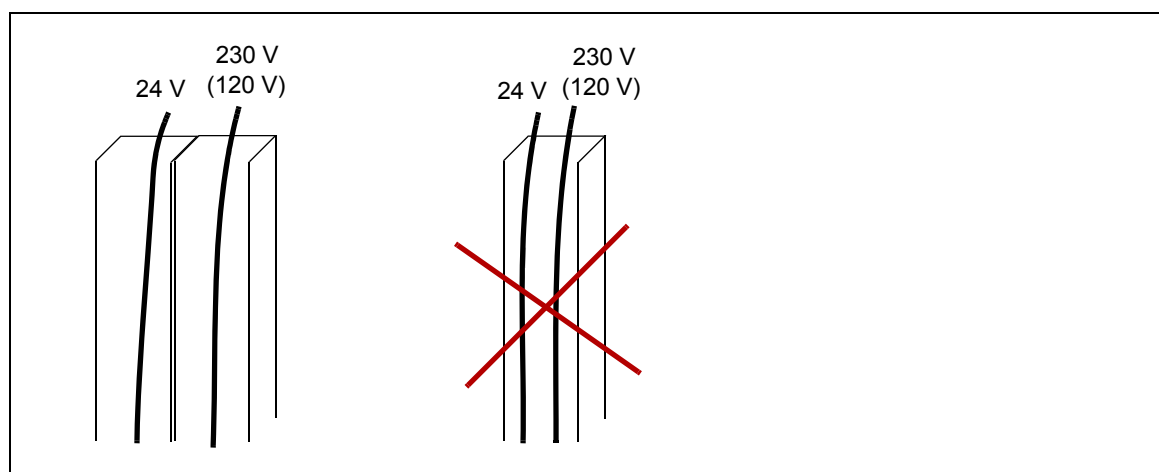
The cable trays must have good electrical bonding to each other and to the grounding electrodes. Aluminum tray systems can be used to improve local equalizing of potential

A diagram of the cable routing is shown below.



■ Separate control cable ducts

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



■ Continuous motor cable shield or enclosure for equipment in the motor cable

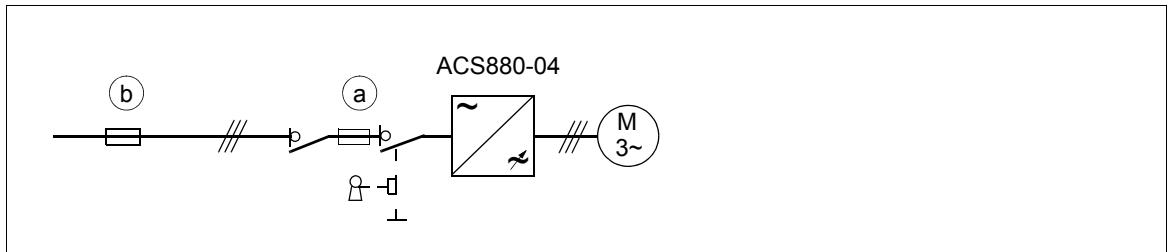
To minimize the emission level when safety switches, contactors, connection boxes or similar equipment are installed on the motor cable between the drive and the motor:

- European Union: Install the equipment in a metal enclosure with 360 degree grounding for the shields of both the incoming and outgoing cable, or connect the shields of the cables otherwise together.
- US: Install the equipment in a metal enclosure in a way that the conduit or motor cable shielding runs consistently without breaks from the drive to the motor.

Implementing thermal overload and short-circuit protection

■ Protecting the drive and input power cable in short-circuits

Protect the drive with fuses (a) and the input cable with fuses (b) or a circuit breaker as shown below:



Size the fuses or the circuit breaker at the distribution board according to local regulations for the input cable protection. Select the fuses for the drive according to the instructions given in chapter *Technical data*. The fuses for the drive protection will restrict drive damage and prevent damage to adjoining equipment in case of a short-circuit inside the drive.

Note: If the fuses for the drive protection are placed at the distribution board and the input cable is dimensioned according to the nominal input current of the drive given in the rating table on page 177, the fuses will protect also the input cable in short-circuit situations, restrict drive damage and prevent damage to adjoining equipment in case of a short-circuit inside the drive. No separate fuses for the input cable protection are needed.

Circuit breakers

The protective characteristics of circuit breakers depend on the type, construction and settings of the breakers. There are also limitations pertaining to the short-circuit capacity of the supply network. Your local ABB representative can help you in selecting the breaker type when the supply network characteristics are known.

Note: Circuit breakers must not be used without fuses in the USA.



WARNING! Due to the inherent operating principle and construction of circuit breakers, independent of the manufacturer, hot ionized gases can escape from the breaker enclosure in case of a short-circuit. To ensure safe use, pay special attention to the installation and placement of the breakers. Obey the manufacturer's instructions.

ABB has tested these circuit breakers with the drive. Fuses must be used with other circuit breakers.

Drive module type	Frame size	ABB molded case circuit breaker (Tmax)	
		Product ID (Type)	kA ¹⁾
U _N = 400 V			
ACS880-04-505A-3	R10	1SDA054412R1 (T5H 630 PR221DS-LS/I In=630 3p F F)	30
ACS880-04-585A-3	R10	1SDA069428R1 (T6V 800 PR221DS-LS/I In=800 3p F F)	30
ACS880-04-650A-3	R10	1SDA069428R1 (T6V 800 PR221DS-LS/I In=800 3p F F)	30

Drive module type	Frame size	ABB molded case circuit breaker (Tmax)	
		Product ID (Type)	kA ¹⁾
ACS880-04-725A-3	R11	1SDA062770R1 (T7H 1000 PR231/P LS/I In=1000A 3p F F)	50
ACS880-04-820A-3	R11	1SDA062770R1 (T7H 1000 PR231/P LS/I In=1000A 3p F F)	50
ACS880-04-880A-3	R11	1SDA062770R1 (T7H 1000 PR231/P LS/I In=1000A 3p F F)	50
U_N = 500 V			
ACS880-04-460A-5	R10	1SDA054412R1 (T5H 630 PR221DS-LS/I In=630 3p F F)	30
ACS880-04-503A-5	R10	1SDA054412R1 (T5H 630 PR221DS-LS/I In=630 3p F F)	30
ACS880-04-583A-5	R10	1SDA054412R1 (T5H 630 PR221DS-LS/I In=630 3p F F)	30
ACS880-04-635A-5	R10	1SDA069428R1 (T6V 800 PR221DS-LS/I In=800 3p F F)	30
ACS880-04-715A-5	R11	1SDA062770R1 (T7H 1000 PR231/P LS/I In=1000A 3p F F)	50
ACS880-04-820A-5	R11	1SDA062770R1 (T7H 1000 PR231/P LS/I In=1000A 3p F F)	50
ACS880-04-880A-5	R11	1SDA062770R1 (T7H 1000 PR231/P LS/I In=1000A 3p F F)	50
U_N = 690 V			
ACS880-04-330A-7	R10	1SDA054412R1 (T5H 630 PR221DS-LS/I In=630 3p F F)	30
ACS880-04-370A-7	R10	1SDA054412R1 (T5H 630 PR221DS-LS/I In=630 3p F F)	30
ACS880-04-430A-7	R10	1SDA054412R1 (T5H 630 PR221DS-LS/I In=630 3p F F)	30
ACS880-04-425A-7	R11	1SDA054412R1 (T5H 630 PR221DS-LS/I In=630 3p F F)	30
ACS880-04-470A-7	R11	1SDA054412R1 (T5H 630 PR221DS-LS/I In=630 3p F F)	30
ACS880-04-522A-7	R11	1SDA069428R1 (T6V 800 PR221DS-LS/I In=800 3p F F)	40
ACS880-04-590A-7	R11	1SDA069428R1 (T6V 800 PR221DS-LS/I In=800 3p F F)	40
ACS880-04-650A-7	R11	2)	2)
ACS880-04-721A-7	R11	2)	2)

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¹⁾ Maximum allowed rated conditional short-circuit current (IEC 61439-1) of the electrical power network

²⁾ Contact your local ABB representative

■ 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 dimensioned according to the nominal current of the drive. No additional protection devices are needed.

■ Protecting the drive and the input power and motor cables against thermal overload

The drive protects itself and the input and motor cables against thermal overload when the cables are dimensioned 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 user can tune the thermal model further by feeding in additional motor and load data.

The most common temperature sensors are:

- motor sizes IEC 180...225: thermal switch, eg, Klixon
- motor sizes IEC 200...250 and larger: PTC or Pt100.

See the firmware manual for more information on the motor thermal protection, and the connection and use of the temperature sensors.

Protecting the drive against ground faults

The drive is equipped with an internal ground fault protective function to protect the drive against ground faults in the motor and motor cable in TN (grounded) networks. This is not a personal safety or a fire protection feature. The ground fault protective function can be disabled with a parameter, refer to the firmware manual.

Measures for protection in case of direct or indirect contact, such as separation from the environment by double or reinforced insulation or isolation from the supply system by a transformer, can be applied.

■ Residual current device compatibility

The drive is suitable to be used with residual current devices of Type B.


Note: The EMC filter of the drive includes capacitors connected between the main circuit and the frame. These capacitors and long motor cables increase the ground leakage current and can cause fault current circuit breakers to function.

Connecting drive modules to a common DC system

See *ACS880-01 drives and ACS880-04 drive modules common DC systems application guide* (3AUA0000127818 [English]).

Implementing the Emergency stop function

For safety reasons, install the emergency stop devices at each operator control station and at other operating stations where emergency stop may be needed. You can implement the emergency stop function using the Safe torque off function of the drive module (see chapter [Safe torque off function](#) on page 223). Design the emergency stop according to relevant standards.

Note: Pressing the stop key  on the control panel of the drive does not generate an emergency stop of the motor or separate the drive from dangerous potential.

Implementing the Safe torque off function

See chapter [Safe torque off function](#) on page 223.

Implementing the ATEX-certified Safe motor disconnection function (option +Q971)

With option +Q971, the drive provides ATEX-certified safe motor disconnection without contactor using the drive Safe torque off function. For more information, see *ACS880 ATEX-certified Safe disconnection function application guide* (3AUA0000132231 [English]).

Implementing safety functions provided by the FSO safety functions module (option +Q973)

The drive can be equipped with an FSO-12 safety functions module (option +Q973) which enables the implementation of functions such as Safe brake control (SBC), Safe stop 1 (SS1), Safe stop emergency (SSE), Safely limited speed (SLS) and Safe maximum speed (SMS).

The settings of the FSO module are at default when delivered from the factory. The wiring of the safety circuit and configuration of the FSO module are the responsibility of the machine builder.

The FSO module reserves the standard Safe torque off (STO) connection of the drive control unit. STO can still be utilized by other safety circuits through the FSO.

For wiring instructions, safety data and more information on the functions provided by the options, see *FSO-12 safety functions module user's manual* (3AXD50000015612 [English]).

Declaration of Conformity

See page [195](#).

Implementing the Power loss ride-through function

Implement the power loss ride-through function as follows:

1. Check that the power-loss ride-through function of the drive is enabled with parameter **30.31 Undervoltage control** in the ACS880 primary control program.
2. If the installation is equipped with a main contactor, prevent its tripping at the input power break. For example, use a time delay relay (hold) in the contactor control circuit.



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

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 three phase 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, ensure that the connection steps are low enough not to cause voltage transients that would trip the drive.
3. Check 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.

Implementing a safety switch between the drive and the motor

We recommended that you install a safety switch between the permanent magnet motor and the drive output. The switch is needed to isolate the motor during any maintenance work on the drive.

Using a contactor between the drive and the motor

Implementing the control of the output contactor depends on how you select the drive to operate. See also section [Implementing a bypass connection](#) on page 82.

When you have selected to use DTC motor control mode and motor ramp stop, open the contactor as follows:

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

When you have selected to use DTC motor control mode and motor coast stop, or scalar control mode, open the contactor as follows:

1. Give a stop command to the drive.
2. Open the contactor.



WARNING! When the DTC motor control mode is in use, never open the output contactor while the drive controls the motor. The DTC motor control operates extremely fast, much faster than it takes for the contactor to open its contacts.

When the contactor starts opening while the drive controls the motor, the DTC control will try to maintain the load current by immediately increasing the drive output voltage to the maximum. This will damage, or even burn the contactor completely.

Implementing a bypass connection

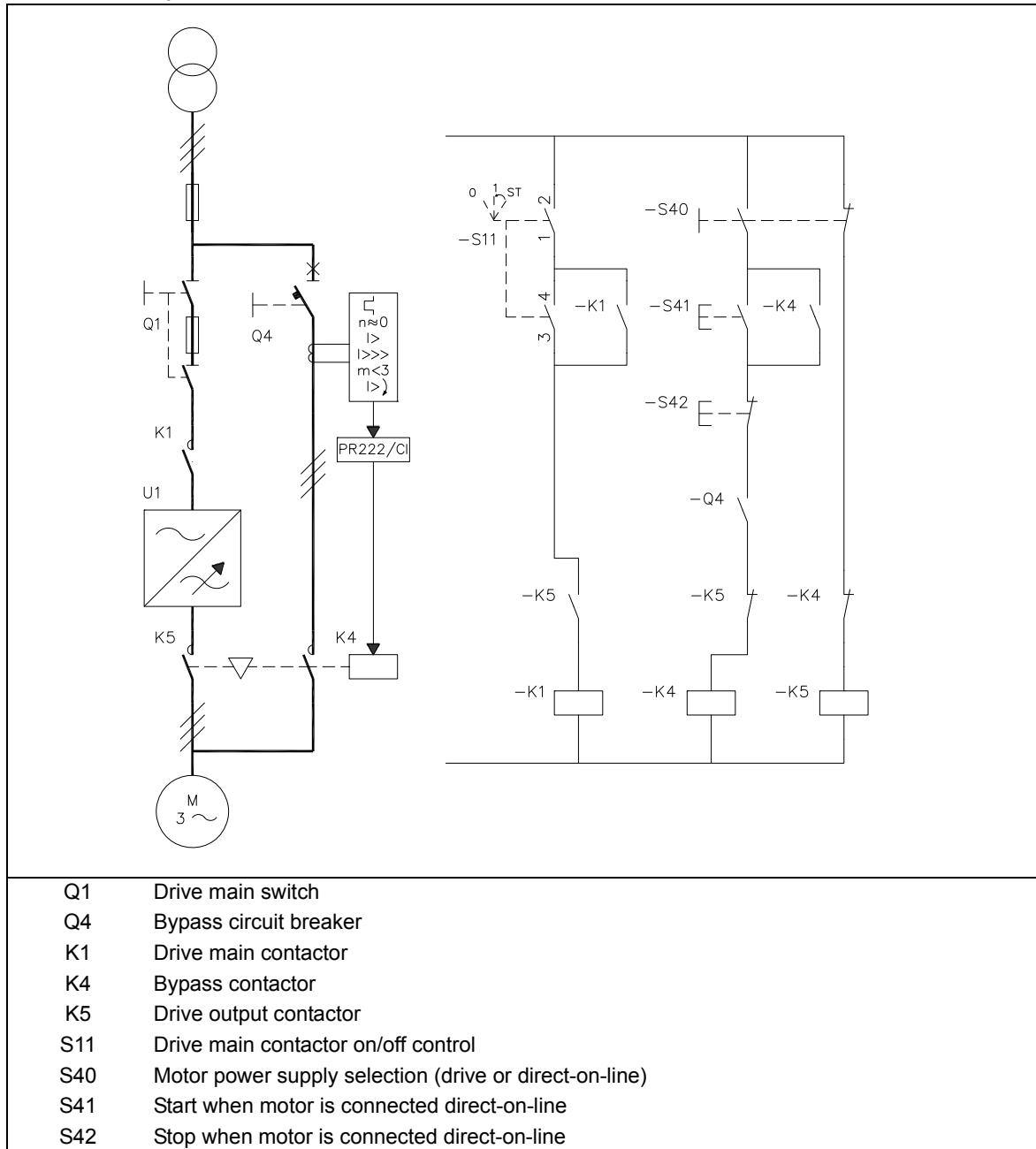
If bypassing is required, employ mechanically or electrically interlocked contactors between the motor and the drive and between the motor and the power line. Ensure with interlocking that the contactors cannot be closed simultaneously.



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

■ Example bypass connection

An example bypass connection is shown below.



Switching the motor power supply from drive to direct-on-line

1. Stop the drive and the motor with the drive control panel (drive in the local control mode) or the external stop signal (drive in the remote control mode).
2. Open the main contactor of the drive with S11.
3. Switch the motor power supply from the drive to direct-on-line with S40.
4. Wait for 10 seconds to allow the motor magnetization to die away.
5. Start the motor with S41.

Switching the motor power supply from direct-on-line to drive

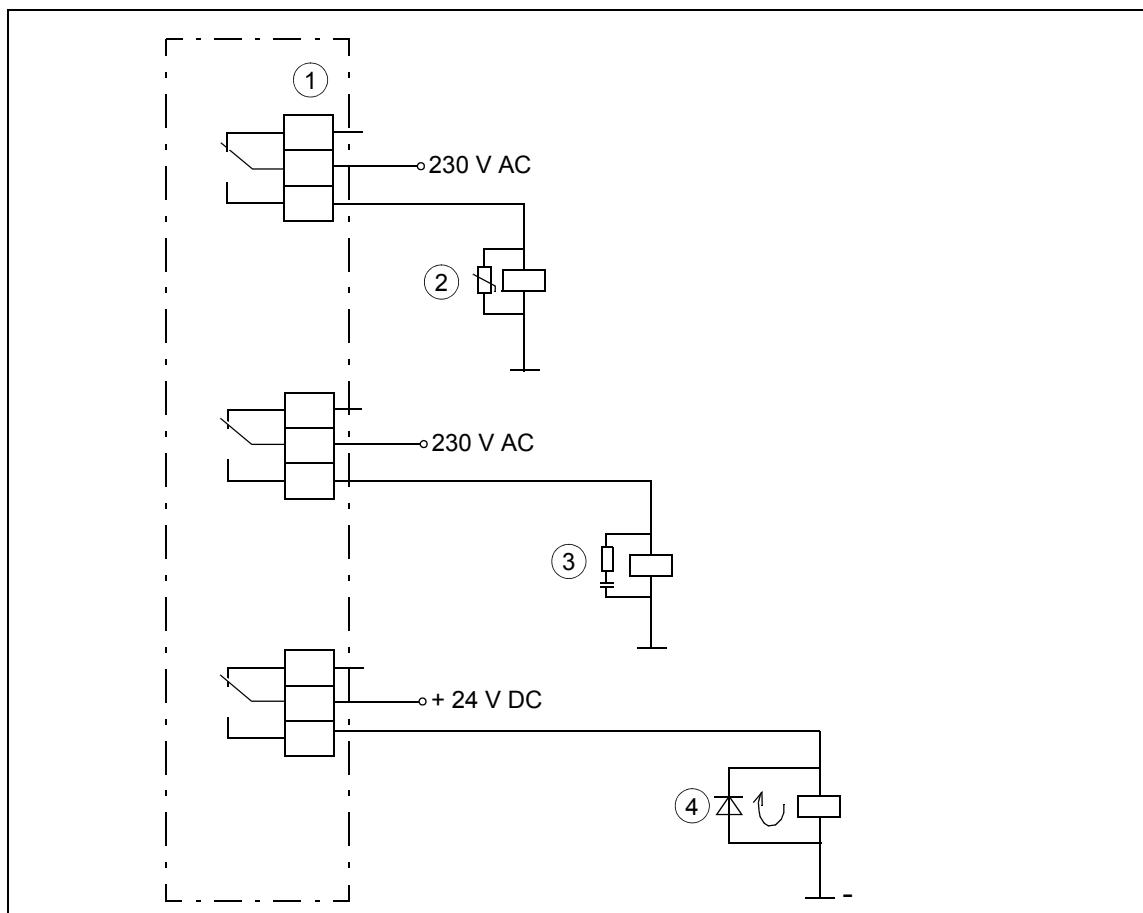
1. Stop the motor with S42.
2. Switch the motor power supply from direct-on-line to the drive with S40.
3. Close the main contactor of the drive with switch S11 (-> turn to position ST for two seconds and leave to position 1).
4. Start the drive and the motor with the drive control panel (drive in the local control mode) or the external start signal (drive in the remote 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]) in order 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 outputs; 2) Varistor; 3) RC filter; 4) diode

Connecting a motor temperature sensor to the drive I/O



WARNING! IEC 60664 requires double or reinforced insulation between live parts and the surface of accessible parts of electrical equipment which are either non-conductive or conductive but not connected to the protective earth.

To fulfil this requirement, the connection of a thermistor (and other similar components) to the inputs of the drive can be implemented in three alternate ways:

1. There is double or reinforced insulation between the thermistor and live parts of the motor.
2. Circuits connected to all digital and analog inputs of the drive are protected against contact and insulated with basic insulation (the same voltage level as the drive main circuit) from other low voltage circuits.
3. An external thermistor relay is used. The insulation of the relay must be rated for the same voltage level as the main circuit of the drive. For connection, see the firmware manual.

See section *AI1 and AI2 as Pt100, Pt1000, PTC and KTY84 sensor inputs (XAI, XAO)* on page 113 or section *DI6 (XDI:6) as PTC sensor input* on page 114.

This table shows what sensor types you can connect to the drive I/O extension and encoder interface modules. These modules require double or reinforced insulation between live parts and the surface of accessible parts of electrical equipment

Option module	Temperature sensor type		
	PTC	KTY	Pt100, Pt1000
FIO-11	-	X	X
FEN-xx	X	-	-
FEN-11, FEN-21, FEN-31	X	X	-
FAIO-01	-	X	X

Note: The inaccuracy of the drive analog inputs for Pt100 sensors is 10 °C (50 °F). If more accuracy is needed, use the FAIO-01 analog I/O extension module (option +L525). It forms double insulation.

Example circuit diagram

See page [221](#).

6

Installation instructions

Contents of this chapter

This chapter contains the general installation instructions for the drive module. The chapter refers to the installation example chapters which contain instructions that depend on the selected drive configuration.



Safety



WARNING! If you are not a qualified electrician do not do the installation work described in this chapter. Obey the instructions in chapter [Safety instructions](#). If you ignore them, injury or death, or damage to the equipment can occur.

Checking the installation site

The material below the drive must be non-flammable and strong enough to carry the weight of the drive.

See section [Ambient conditions](#) on page 192 for the allowed ambient conditions and section [Losses, cooling data and noise](#) on page 186 for the required cooling air.

Moving and unpacking the unit

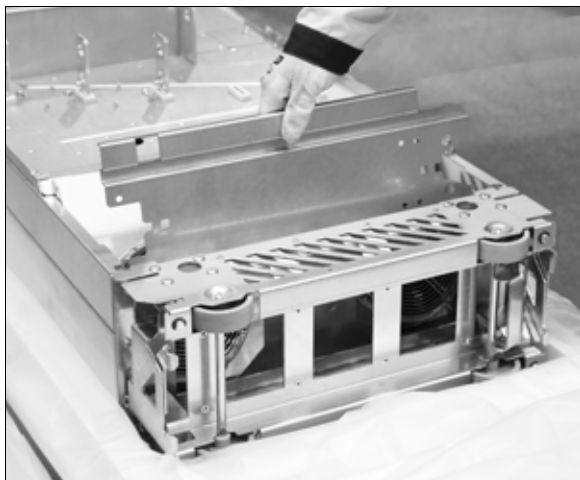


WARNING! Obey the safety instructions in chapter [Safety instructions](#). If you ignore them, injury or death, or damage to the equipment can occur.

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

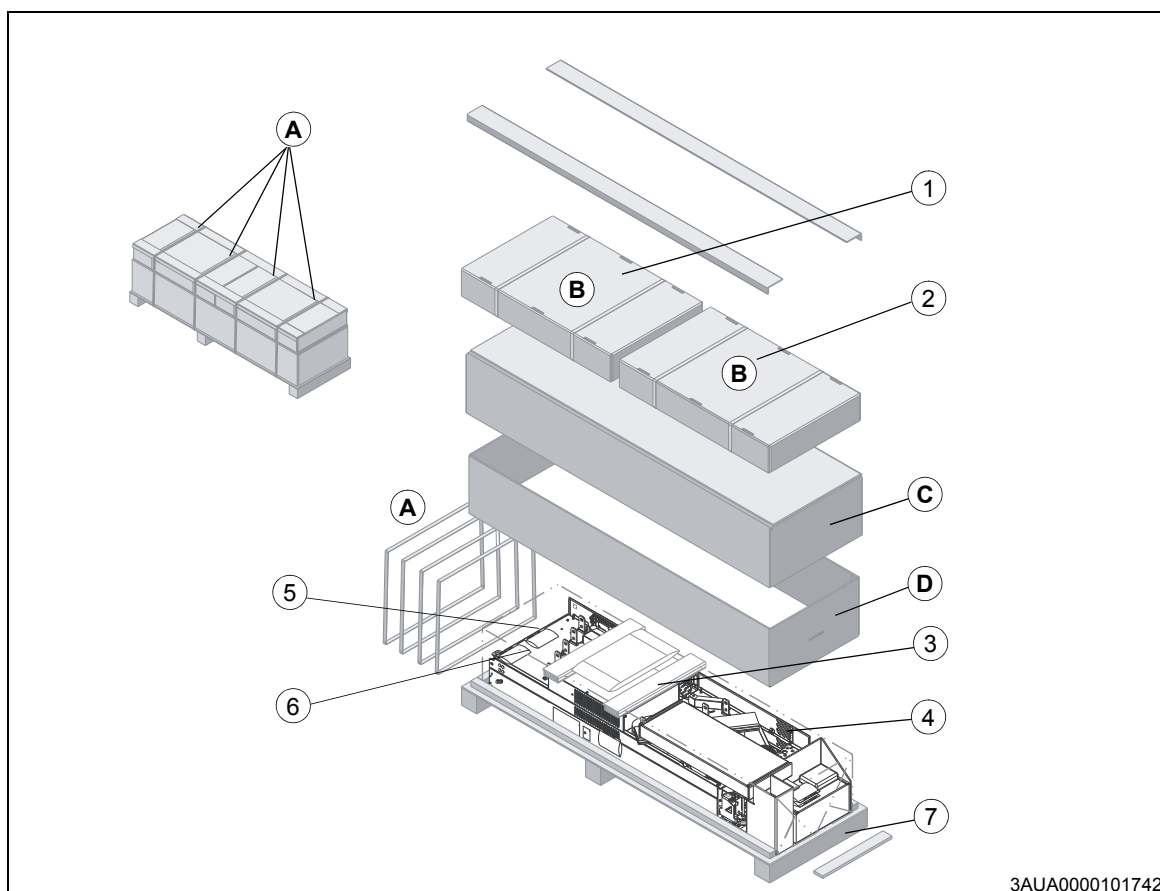
Unpack the package as follows (see the package drawing on page [89](#)):

- Cut the bands (A).
- Unpack the additional boxes (B).
- Remove the outer sheathing by lifting it (C).
- Remove the sheathing by lifting it (D).
- Remove the pedestal guide plate (not included with options +0H354 and +0P919) as shown below.



- Insert lifting hooks to the drive module lifting eyes and lift the module to the installation place.

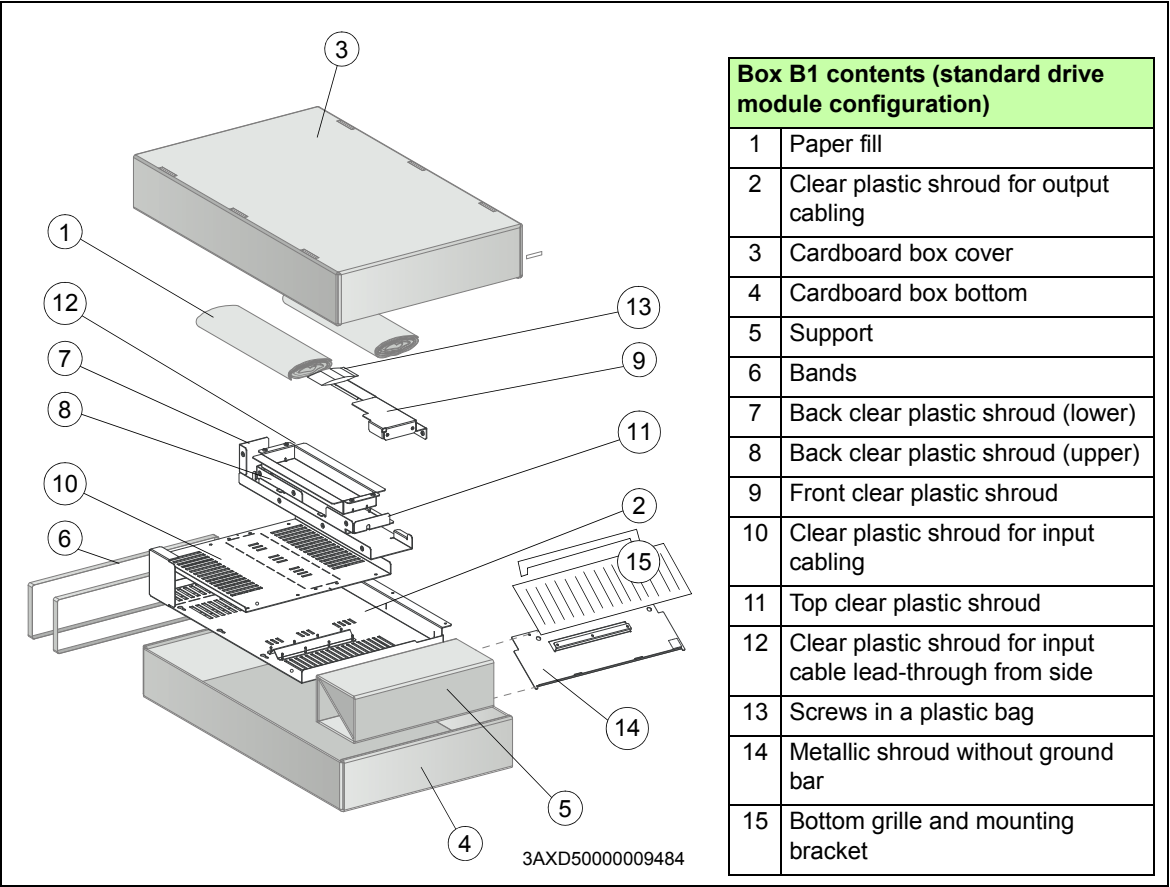
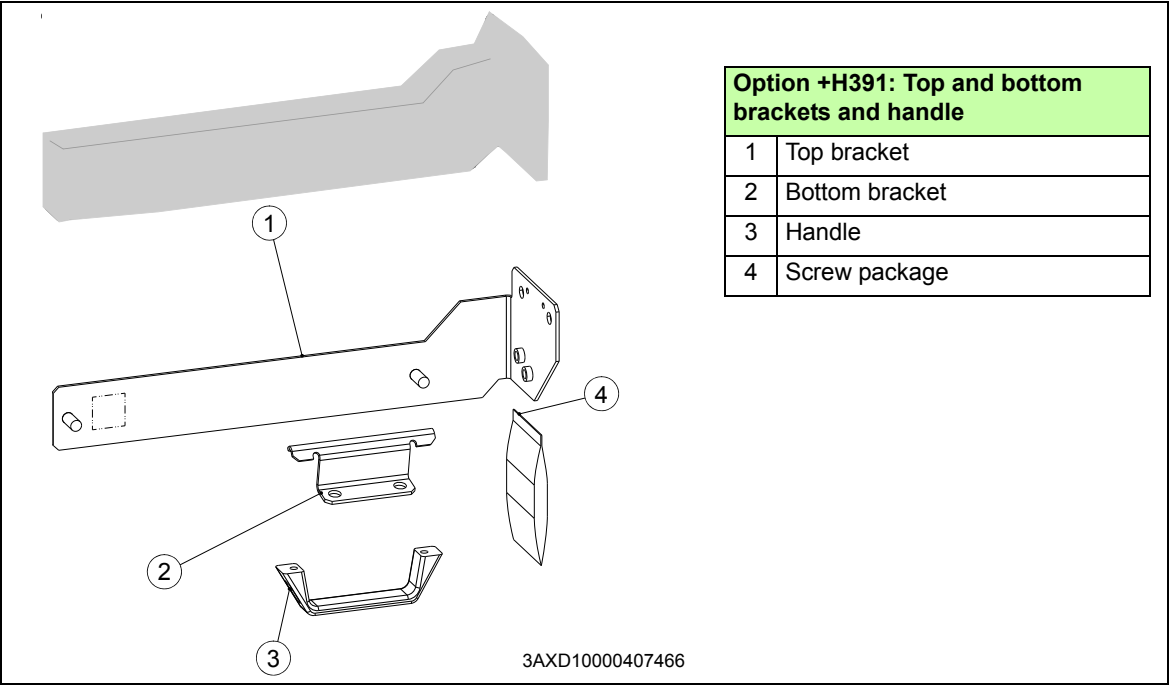
■ Package drawings

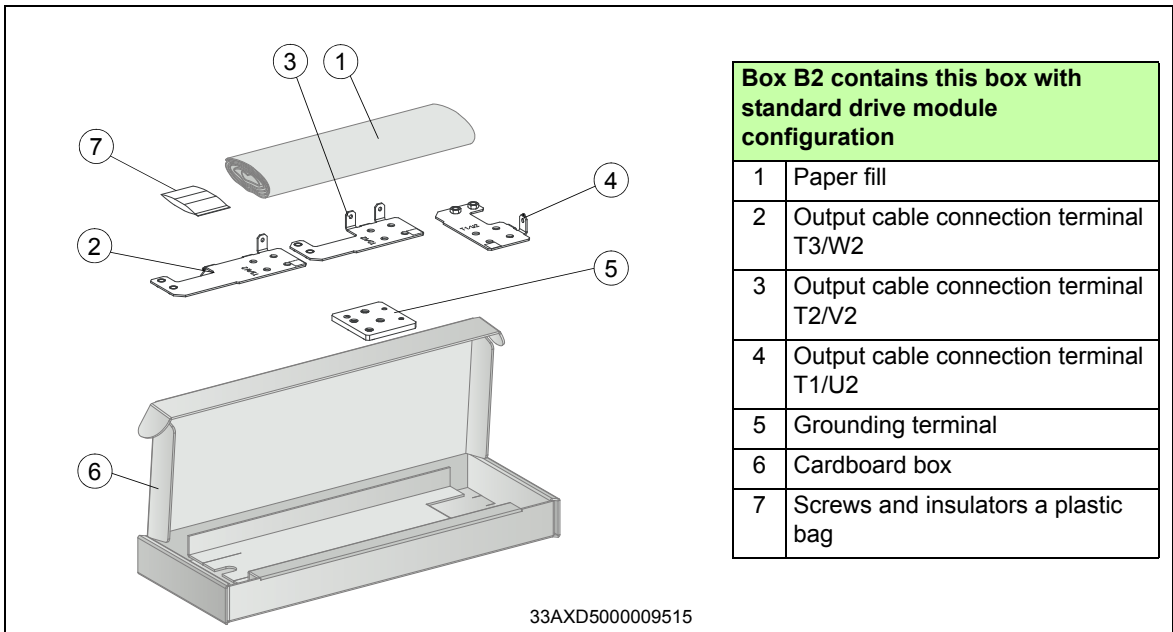
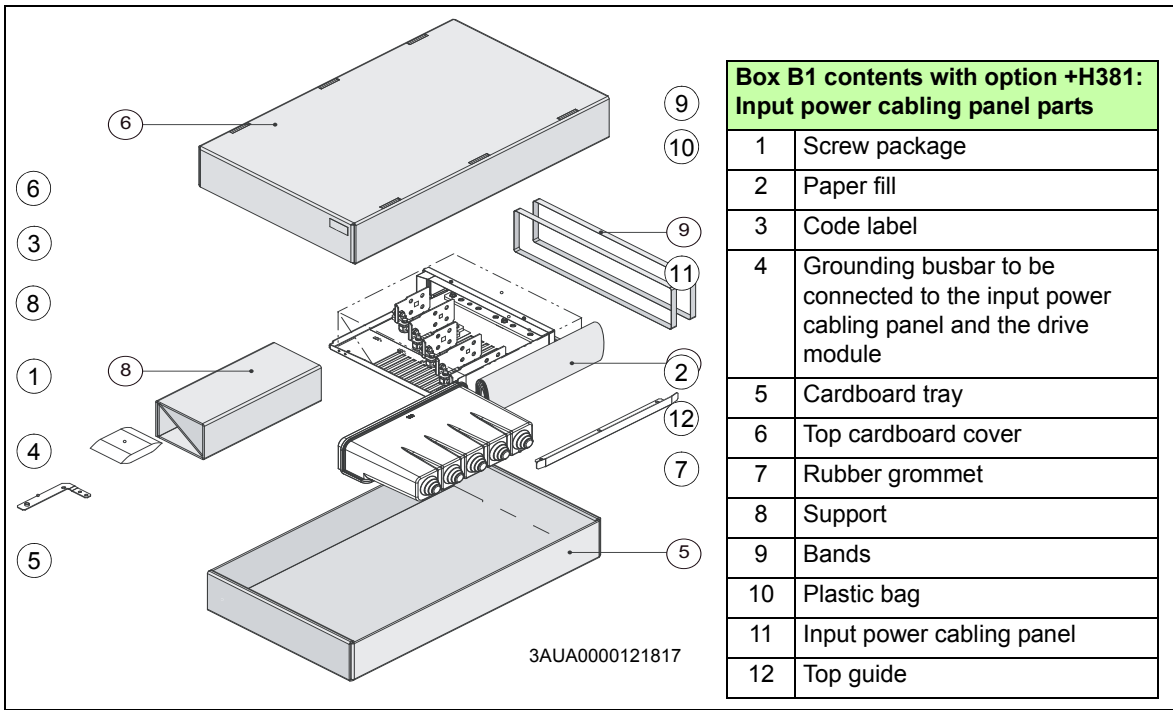


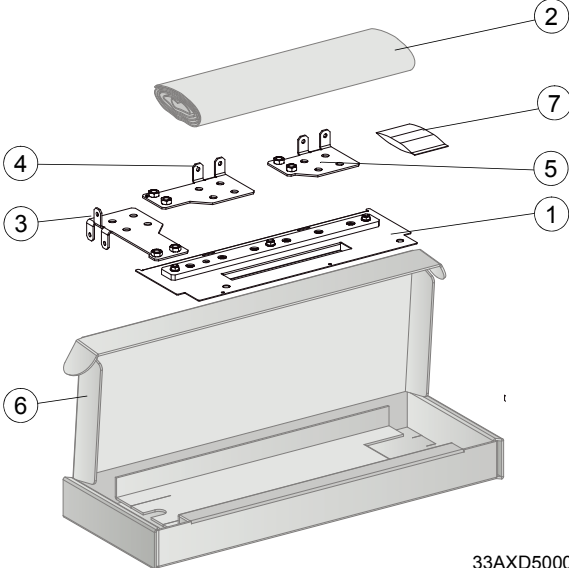
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Transport package contents

1	<p><u>With standard drive module configuration:</u> Clear plastic shrouds.</p> <p><u>With option +H381:</u> Input cabling panel parts.</p> <p>See below for the box contents.</p>
2	<p><u>With standard drive module configuration:</u> Output cable connection terminals. <u>With option +H370</u> also Input cable connection terminals.</p> <p><u>With option +H381:</u> Output cabling panel parts.</p> <p>See below for the box contents.</p>
3	Plywood support
4	Drive module with factory installed options and multilingual residual voltage warning sticker, top guide plate, pedestal guide plate, telescopic ramp package, fastening screws in a plastic bag, external control unit with control cable clamp plate and factory installed optional modules, control panel and cable or control panel with door mounting kit (option +J410), delivery documents, printed multilingual installation and start-up quick guides and manuals CD. Other printed manuals with option +R700.
5	<u>With option +C173:</u> Back fastening bars
6	With option +H391: Accessories for mounting
7	Pallet



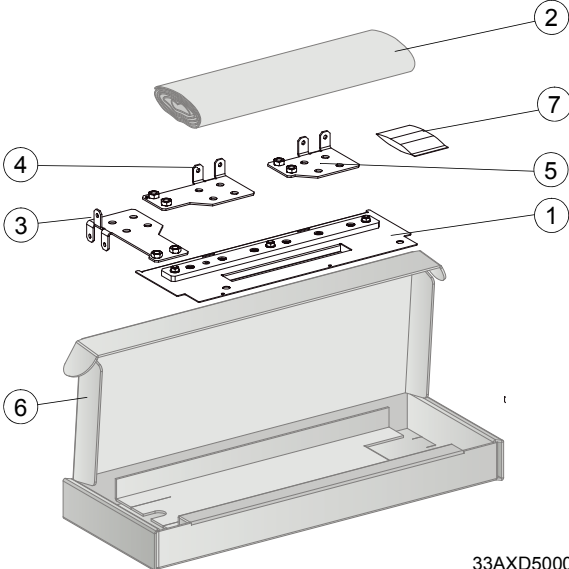




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Box B2 contains additionally this box with option +H370

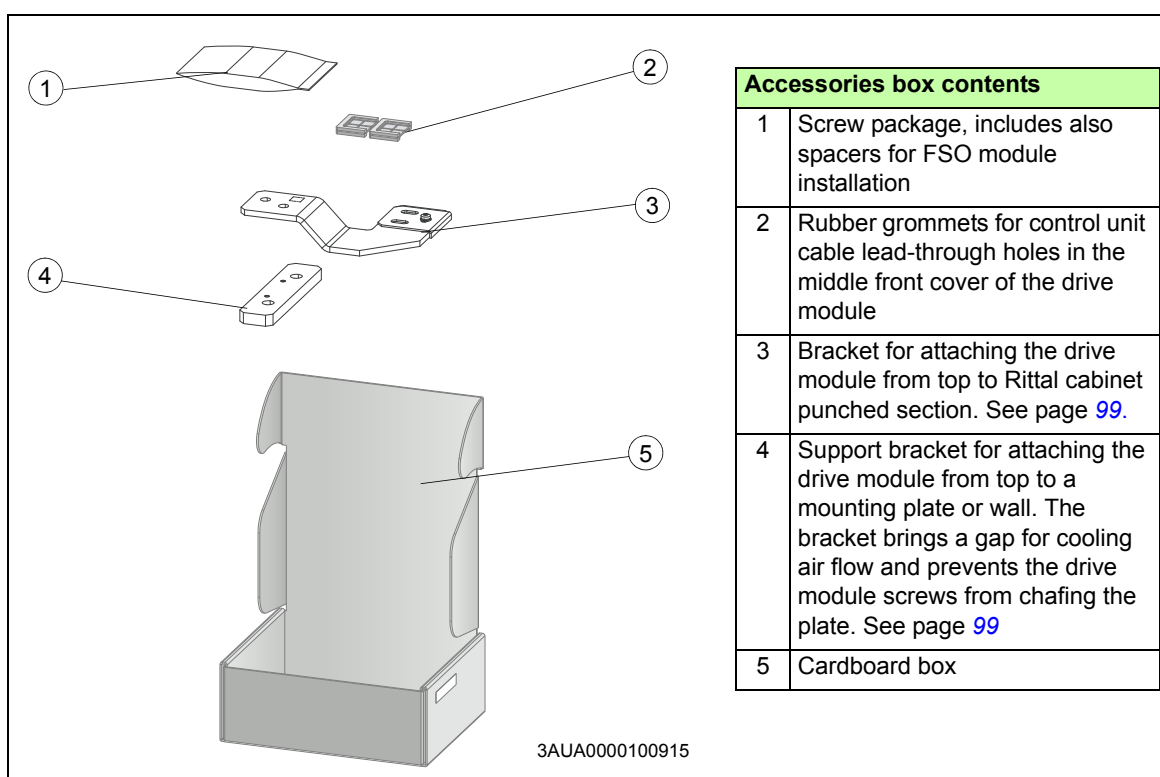
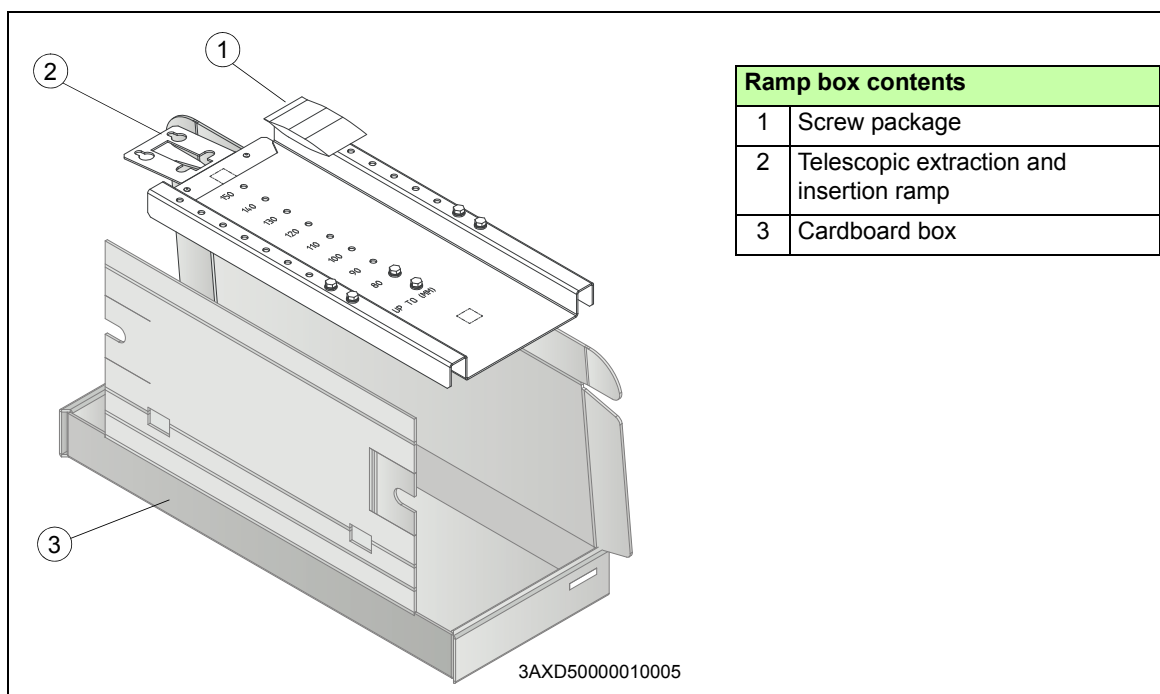
1	Metallic shroud with ground bar
2	Paper fill
3	Input cable connection terminal L3/W1
4	Input cable connection terminal L2/V1
5	Input cable connection terminal L1/U1
6	Cardboard box
7	Screws and insulators in a plastic bag

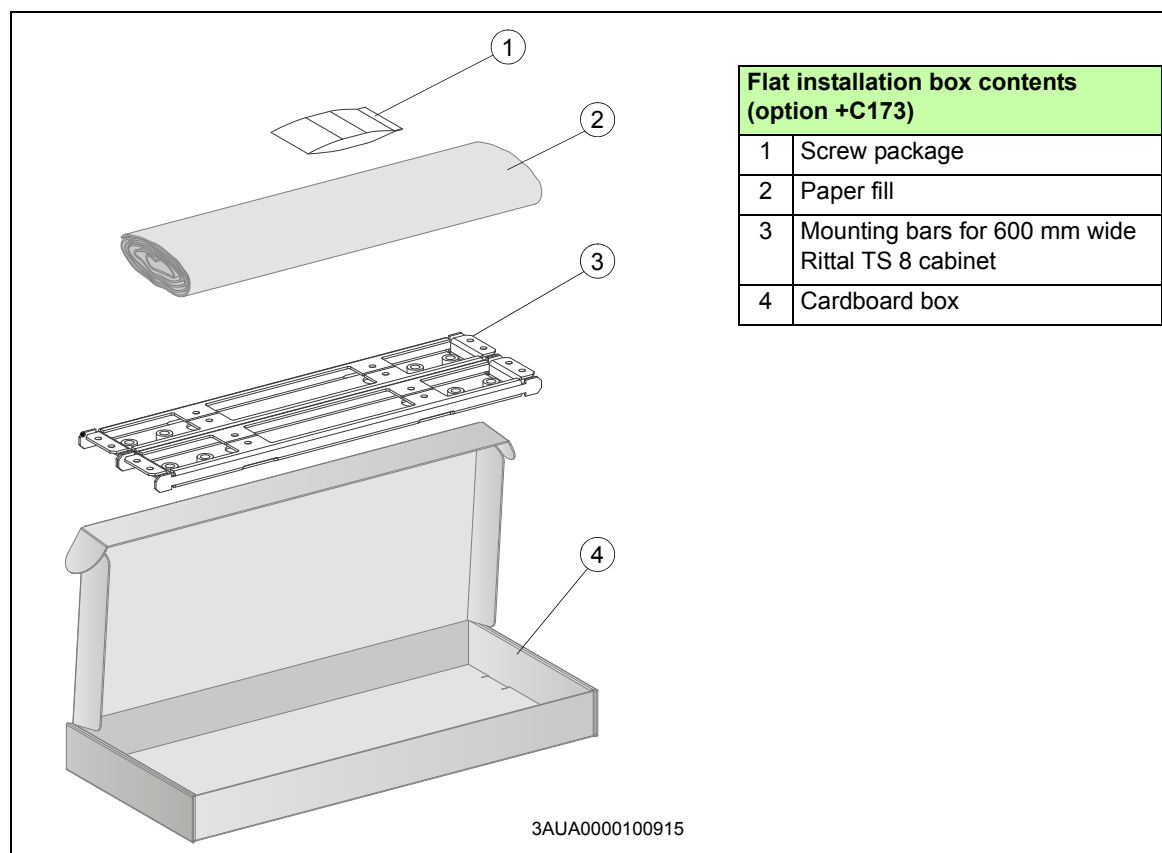


33AXD5000009522

Box B2 contains additionally this box with option +H370

1	Metallic shroud with ground bar
2	Paper fill
3	Input cable connection terminal L3/W1
4	Input cable connection terminal L2/V1
5	Input cable connection terminal L1/U1
6	Cardboard box
7	Screws and insulators in a plastic bag





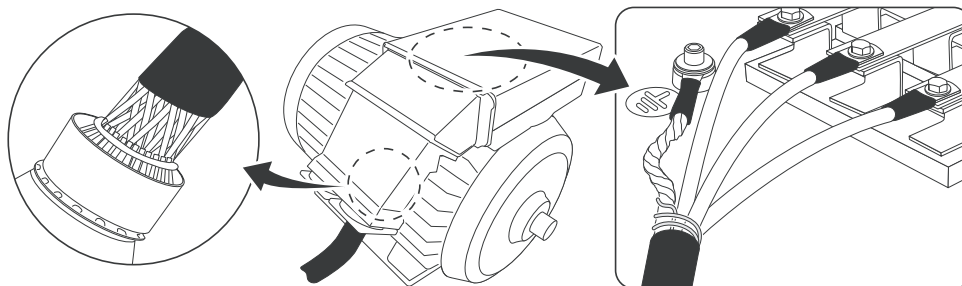
Checking the delivery

Check that all items listed in section [Moving and unpacking the unit](#) are present.

Check that there are no signs of damage. Before attempting installation and operation, check the information on the type designation label of the drive to verify that the unit is of the correct type.

Installing the motor cable at the motor end

Ground the motor cable shield 360 degrees at the lead-through of the motor terminal box.



Checking the insulation of the assembly

■ Drive

Do not make any voltage tolerance 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.

■ Input cable

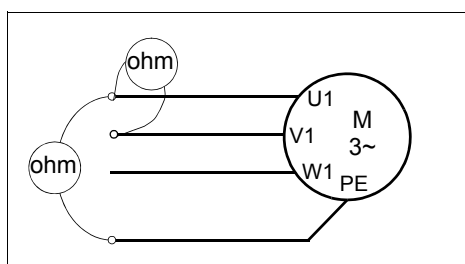
Check the insulation of the input cable according to local regulations before connecting it to the drive.



■ Motor and motor cable

Check the insulation of the motor and motor cable as follows:

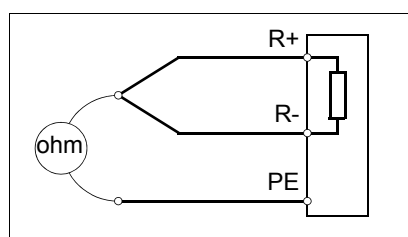
1. Check that the motor cable is disconnected from the drive output terminals T1/U2, T2/V2 and T3/W2.
2. Measure the insulation resistance between each phase conductor and then between each phase conductor and the Protective Earth conductor using a measuring voltage of 1000 V DC. The insulation resistance of an ABB motor must exceed 100 Mohm (reference value at 25 °C or 77 °F). For the insulation resistance of other motors, consult the manufacturer's instructions. **Note:** Moisture inside the motor casing will reduce the insulation resistance. If you suspect moisture, dry the motor and repeat the measurement.



■ Brake resistor and resistor cable

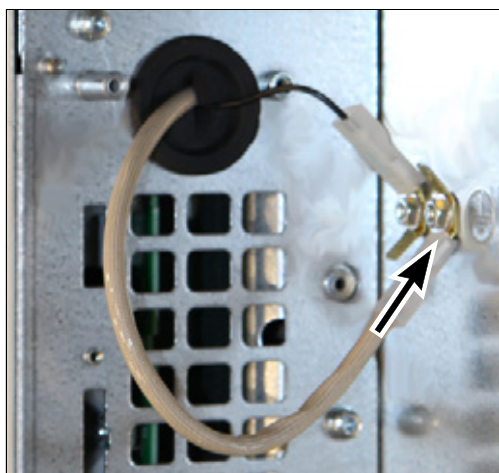
Check the insulation of the brake resistor assembly (if present) as follows:

1. Check that the resistor cable is connected to the resistor, and disconnected from the drive output terminals R+ and R-.
2. At the drive end, connect the R+ and R- conductors of the resistor cable together. Measure the insulation resistance between the conductors and the PE conductor by using a measuring voltage of 1 kV DC. The insulation resistance must be higher than 1 Mohm.



Checking the compatibility with IT (ungrounded) systems

EMC filters +E200 and +E202 are not suitable for use in an IT (ungrounded) system. If the drive is equipped with filter +E200, disconnect the filter grounding wire before connecting the drive to the supply network. Insulate the end of the wire and attach it. The wire is located behind the middle front cover.



WARNING! If a drive with EMC filter +E200 or +E202 is installed on an IT system (an ungrounded power system or a high resistance-grounded [over 30 ohm] power system), the system will be connected to earth potential through the EMC filter capacitors of the drive. This can cause danger, or damage the drive.

Installation alternatives

You can install the drive module into a cabinet using different procedures depending on the drive configuration. Obey the general power and control cable installation instructions that we give in this chapter and see the installation example of your drive configuration in the following chapters.

■ Standard drive module configuration (bookshelf mounting)

For an installation example on how to install the drive module with clear plastic shrouds into a Rittal TS 8 cabinet, see chapter [Installation example of the standard drive module configuration](#) on page 125. See also *ACS880-04 drive modules (200 to 710 kW, 300 to 700 hp) quick installation guide* (3AXD50000009366 [English]).

■ Drive module configuration for flat mounting (option +C173)

You can attach the module to the cabinet mounting plate in flat position

- with bolts through the mounting holes at the top and bottom of the module,
- or you can, first, attach the mounting brackets delivered with option +C173 to the cabinet mounting plate and then attach the drive module to the mounting brackets with screws.

See the dimension drawing for frame R10 on page 204 or for frame R11 on page 213.

Note for option +0H354 (no pedestal): Make sure that the cabinet mounting plate and frame are strong enough to carry the weight of the drive module. See section [Dimensions, weights and free space requirements](#) on page 185.

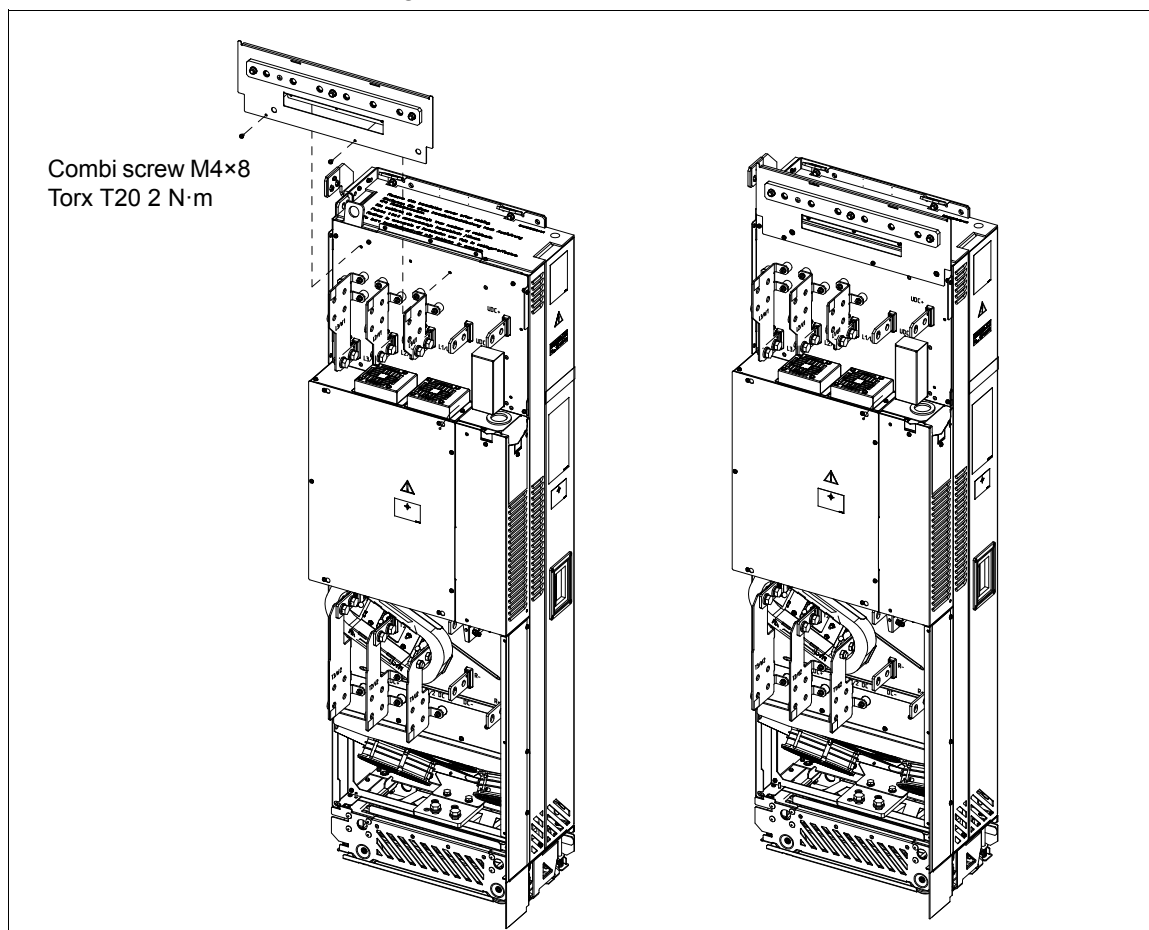


For an installation example on how to install the drive module without pedestal in flat position in a Rittal TS 8 cabinet, see appendix [Step-by-step drawings for a flat installation example in Rittal TS 8 600 mm wide cabinet](#) on page 247.

■ Optional input power cable connection terminals and ground busbar assembly (+H370)

Connect the input power cable connection terminals as shown in chapter [Step-by-step drawings for an installation example of standard drive configuration with option +E208 in Rittal TS 8 600 mm wide cabinet](#) on page 241.

Install the metallic shroud with ground bar as shown below.



■ Drive module with full cabling panels (option +H381)

For an installation example of the drive module with full cabling panels (option +H381) into a Rittal cabinet including power cable connection procedure, see chapter [Installation example with full cabling panels \(option +H381\)](#), page 133.

Note: This installation alternative is not possible without pedestal (with option +0H354).

■ Drive module without full-size output cable connection terminals (option +0H371) and IP20 shrouds (option +0B051)

The power cables can be connected directly to the drive module input and output terminals with cable lugs or by busbars. The drive module can also be installed self standing on the floor in an electrical equipment room when the power cable terminals and electrical parts are protected against contact and the drive module is grounded properly.

■ Drive module configuration with power cable connection terminals on the right-hand side (option +H391)

For an installation example of the drive module with option +H391 into a Rittal cabinet, see chapter [Step-by-step drawings for option +H391 installation example in Rittal TS 8 600 mm wide cabinet](#) on page 249. Otherwise, install the drive module as the standard drive module configuration.

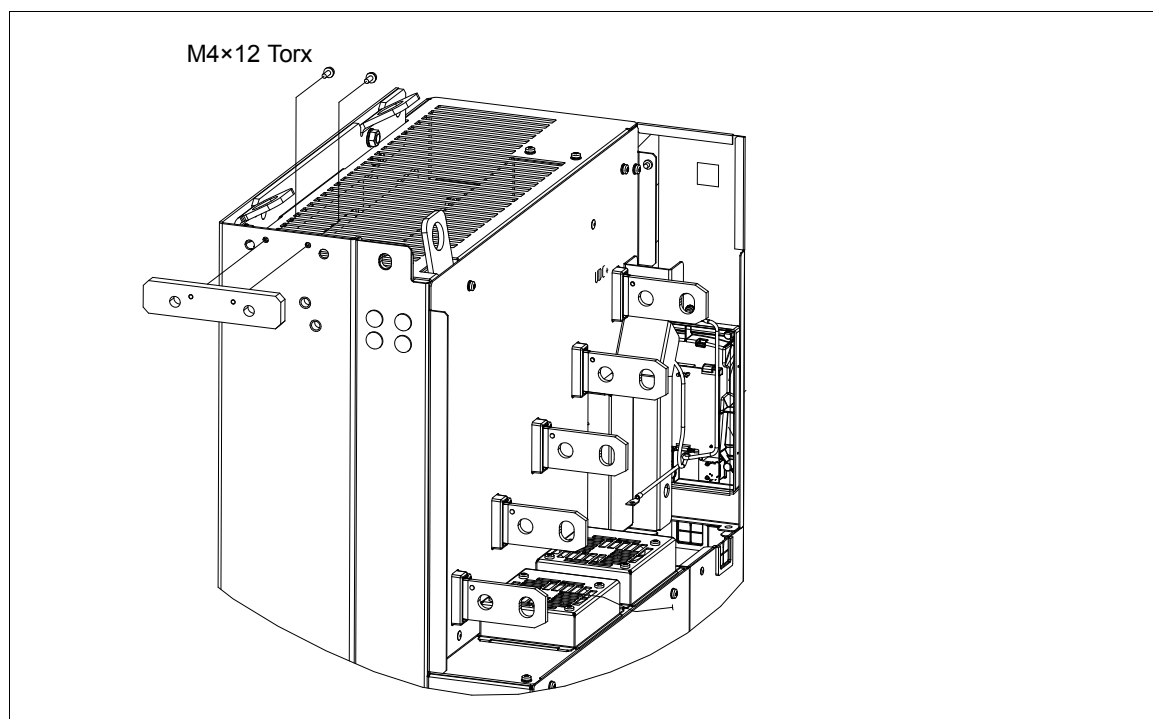
■ Drive module without pedestal (option +0H354)

The drive module without pedestal can be mounted on a wall or a cabinet with four screws through the fastening holes at the top and bottom of the module.

Make sure that the cabinet mounting plate and frame are strong enough to carry the weight of the drive module. See section [Dimensions, weights and free space requirements](#) on page 185.

■ Attaching the drive module to a mounting plate or wall

Use the support bracket if you attach the drive module directly to a mounting plate or wall. The support bracket prevents the drive module screws from chafing against the plate.



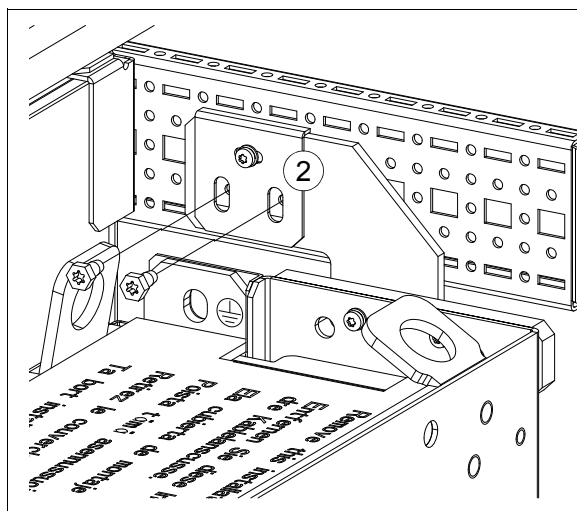
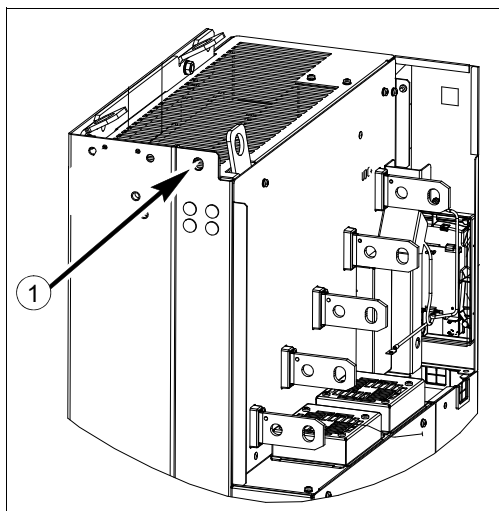
■ Attaching the drive module to a mounting plate or wall (option +H391)

See chapter [Step-by-step drawings for option +H391 installation example in Rittal TS 8 600 mm wide cabinet](#) on page 249.

■ Alternatives for grounding the drive module

You can ground the drive module from its top back to the cabinet frame with these alternatives:

1. from the grounding hole
2. to a Rittal punched section: with the fastening bracket.

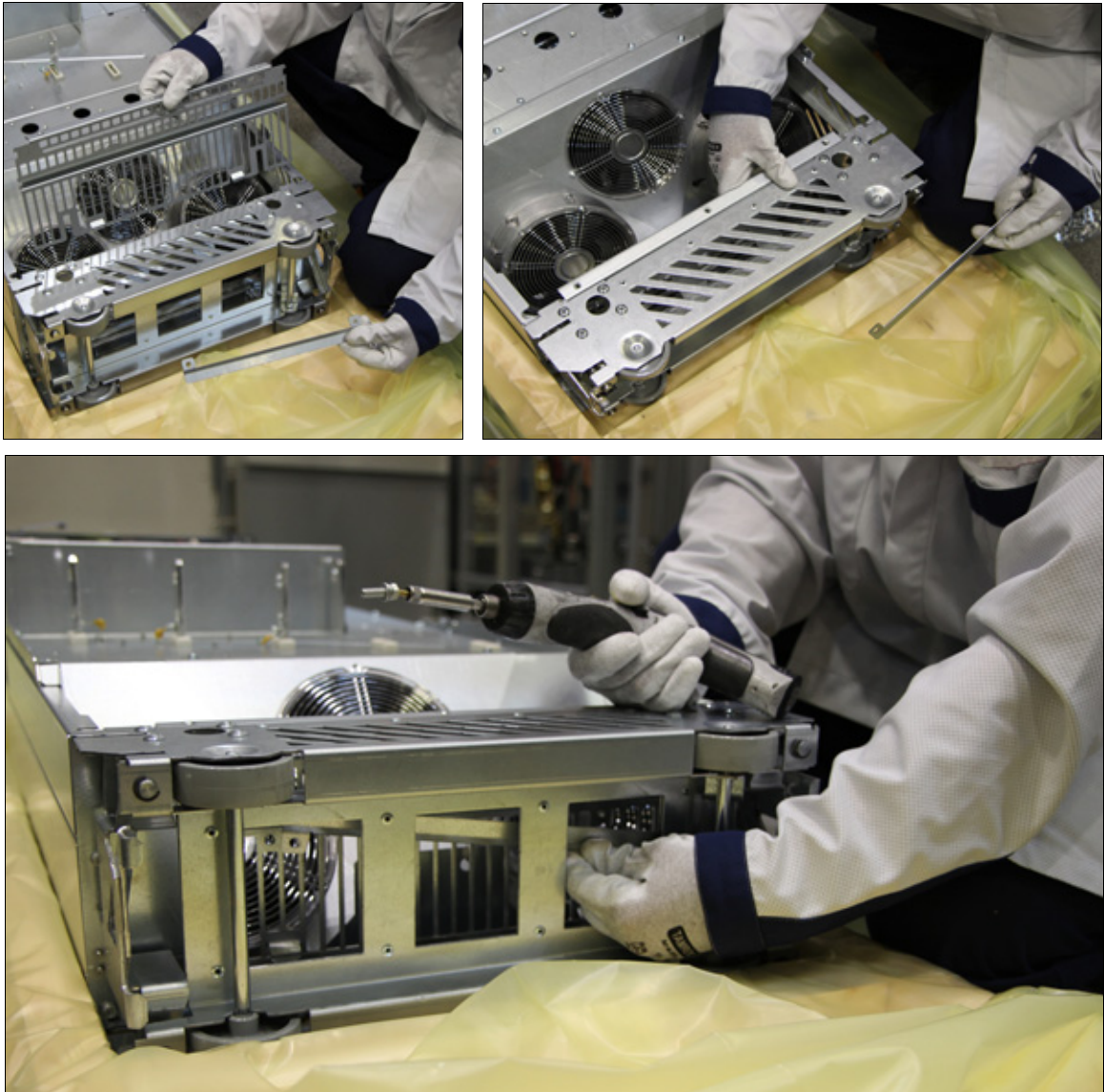


Tapping screw M6×12 Torx T30 (Hex) 9 N·m



■ Installing the bottom grille for IP20 degree of protection

If IP20 degree of protection is needed from the bottom side, install the bottom grille as shown below.



Installing the EMC filter (option +E202)

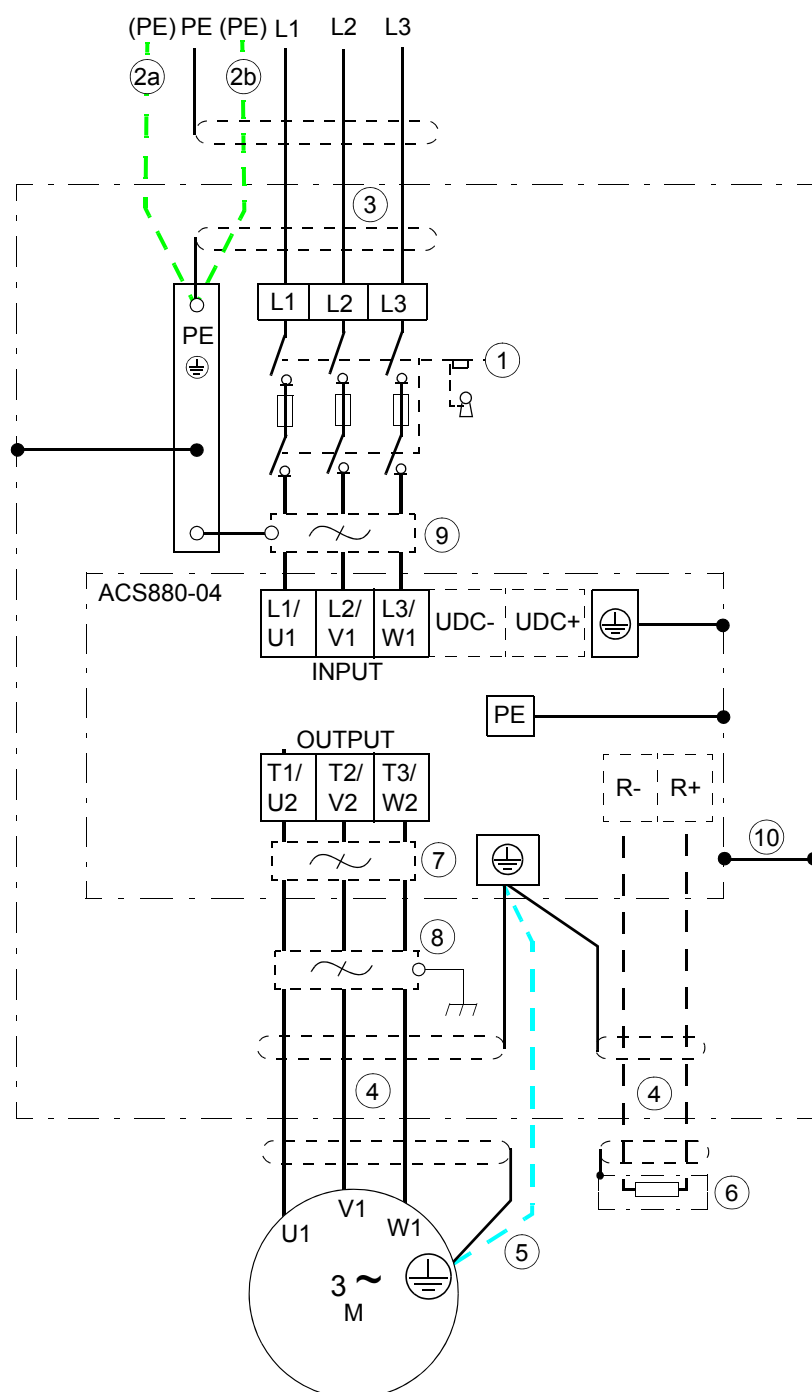
See *ARFI-10 EMC filter installation guide* (3AFE 68317941 [English]).

Connecting the power cables



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

■ Power cable connection diagram



- 1 For alternatives, see section [Selecting the supply disconnecting device](#) on page 64. In the installing example of this chapter, the disconnecting device is not in the same cubicle with the drive module.
- 2 If a shielded cable is used (not required but recommended) and the conductivity of the shield is < 50% of the conductivity of the phase conductor, use a separate PE cable (2a) or a cable with a grounding conductor (2b).
- 3 We recommend 360-degree grounding at the cabinet entry if a shielded cable is used. Ground the other end of the input cable shield or PE conductor at the distribution board.
- 4 We recommend 360-degree grounding at the cabinet entry, see page 51.
- 5 Use a separate grounding cable if the conductivity of the cable shield is < 50% of the conductivity of the phase conductor and there is no symmetrically constructed grounding conductor in the cable (see page 73).

- 6 External brake resistor (optional, see page 233)
- 7 Common mode filter (optional, see page 66)
- 8 du/dt filter (optional, see page 239)
- 9 EMC filter (option +E202, see page 101)
- 10 The drive module frame must be connected to the cabinet frame. See section [Arranging the grounding inside the cabinet](#) on page 50 and [Alternatives for grounding the drive module](#) on page 99.

Note:

If there is a symmetrically constructed grounding conductor in 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. Connecting its fourth conductor at the motor end increases bearing currents and causes extra wear.

■ Power cable connection procedure



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



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

1. Run the motor cables from the motor to the cabinet. Ground the cable shields 360° at the lead-through plate.
2. Twist the cable shields of the motor cables into bundles and connect them and any separate ground conductors or cables to the ground terminal of the drive module or to the cabinet ground bar.
3. Connect the phase conductors of the motor cables to terminals T1/U2, T2/V2 and T3/W2 of the drive module. For the tightening torques, see page 186.
4. Drive modules with option +D150: Run the power cables from the brake resistor to the cabinet. Ground the cable shield (if present) 360° at the lead-through plate. Connect the conductors to the R+ and R- terminals. For the tightening torques, see page 186.
5. Make sure that all power is disconnected and reconnection is not possible. Use proper safe disconnect procedures according to local codes.
6. Run the input cables from the supply source to the cabinet. Ground the cable shields 360° at the lead-through plate.
7. Twist the cable shields of the input cables into bundles and connect them and any separate ground conductors or cables to the drive module ground terminal or to the cabinet PE busbar.
8. Connect the phase conductors of the input cables to terminals L1/U1, L2/V1 and L3/W1 of the drive module. For the tightening torques, see page 186.

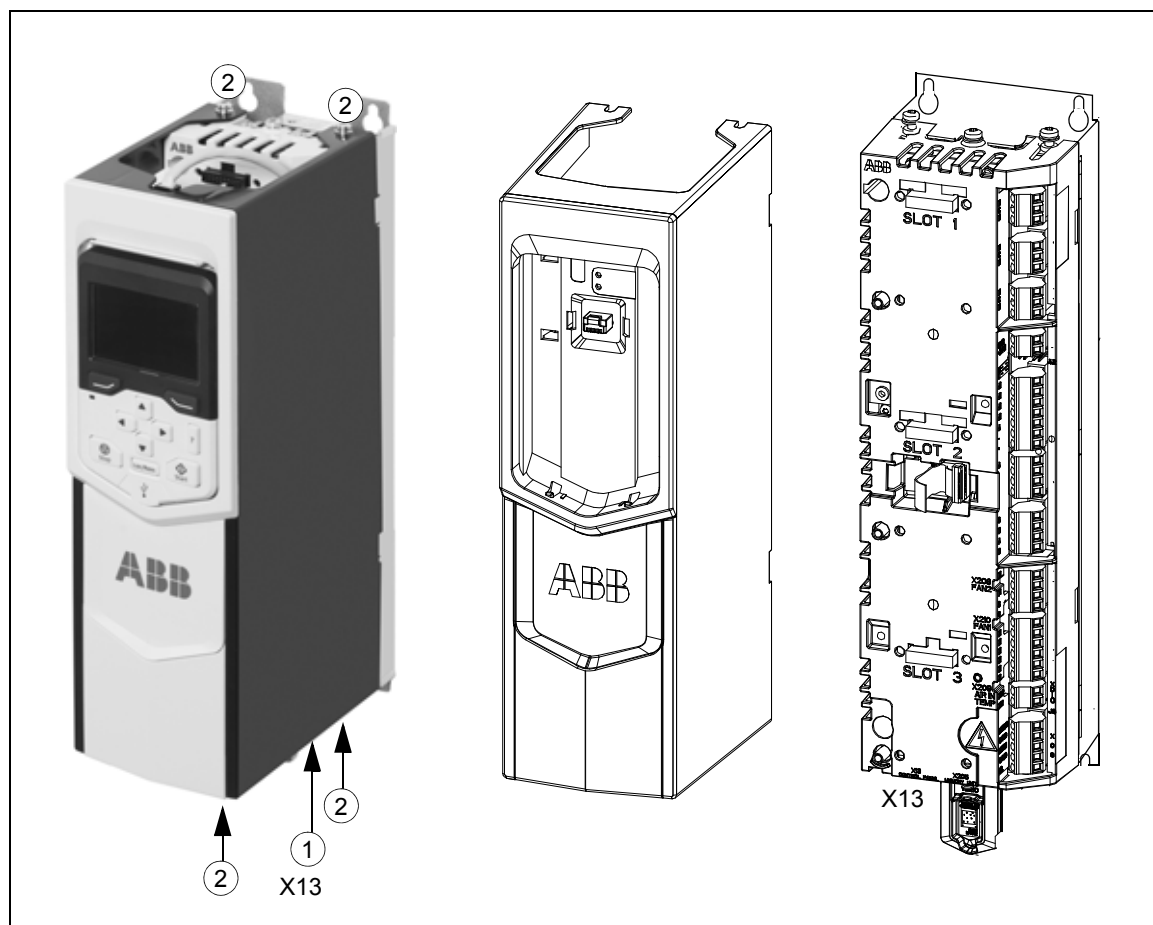
■ DC connection

The UDC+ and UDC– terminals are intended for common DC configurations of a number of drives, allowing regenerative energy from one drive to be utilized by the other drives in the motoring mode. See *ACS880-01 drives and ACS880-04 drive modules common DC systems application guide* (3AUA0000127818 [English]).



Removing the control panel holder from the external control unit

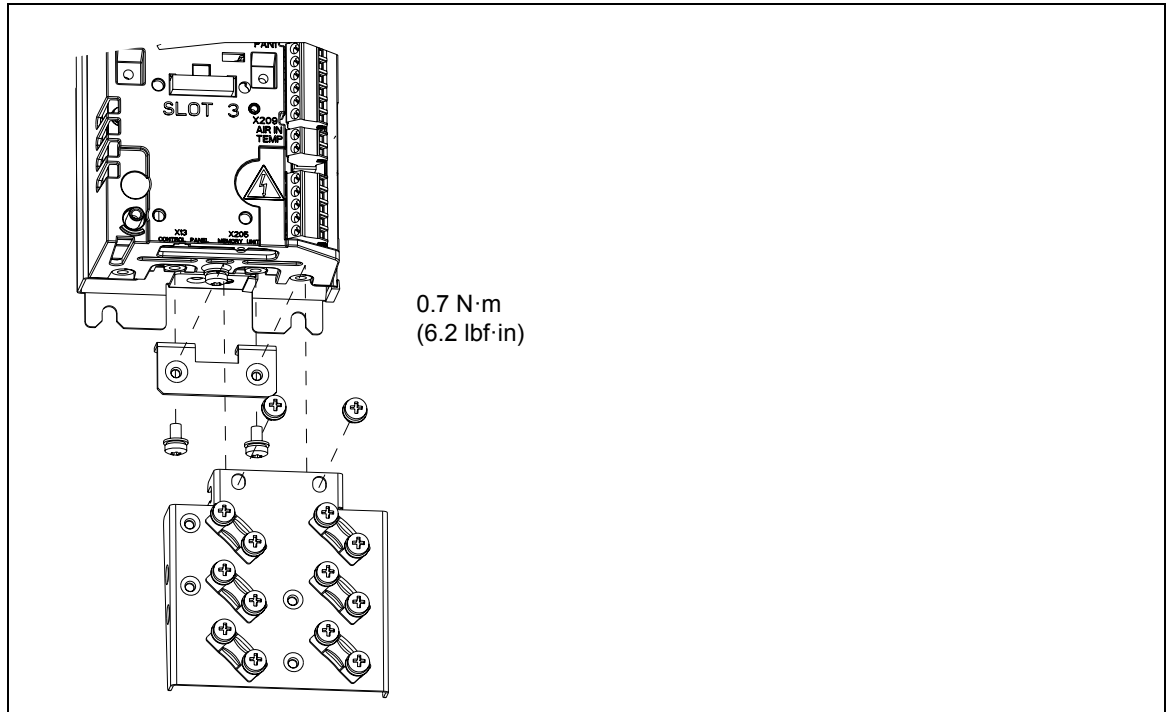
1. Disconnect the control panel cable from connector X13 on the control unit.
2. Loosen the mounting screws of the control panel holder and take the holder off.



Fastening the control cable clamp plate

Fasten the control cable clamp plate either to the top or base of the control unit with four screws as shown below.

Note: If you install the FSO-xx safety functions module above the control unit, fasten the control cable clamp plate on the base of the control unit. See section [Installing the FSO safety functions module \(option +Q973\)](#) on page 120.



Connecting the external control unit to the drive module



WARNING! Handle the fiber optic cables with care. When unplugging optic cables, always grab the connector, not the cable itself. Do not touch the ends of the fibers with bare hands as the fiber is extremely sensitive to dirt.

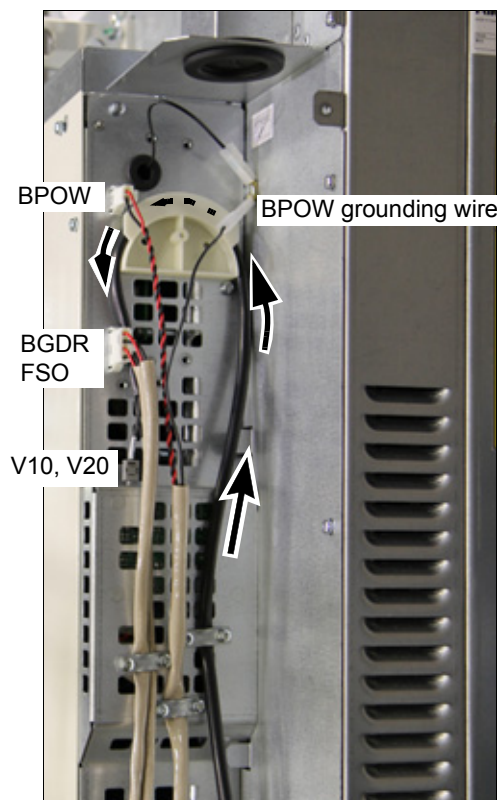
■ Routing the control unit cables into the drive module

Route the control unit connection cables to the drive module through the slot in the middle front cover at the front or left side. First, remove the plate which covers the slot. Then, install the rubber grommet from the accessories box item 2 in the drawing, page [93](#)).

■ Connections to the drive module

- Connect power supply cable of the control unit to the BPOW connector and the ground wire of the cable to the ground terminal.
- Connect the BGDR cable to the BGDR connector.
- For drive modules with SOIA board, connect the fiber optic cables to the V20 and V10 connectors.

Secure the cables at the clamps as shown below.



■ Connections to the control unit

Connect the fiber optic, power supply and BGDR cables to the external control unit as follows:

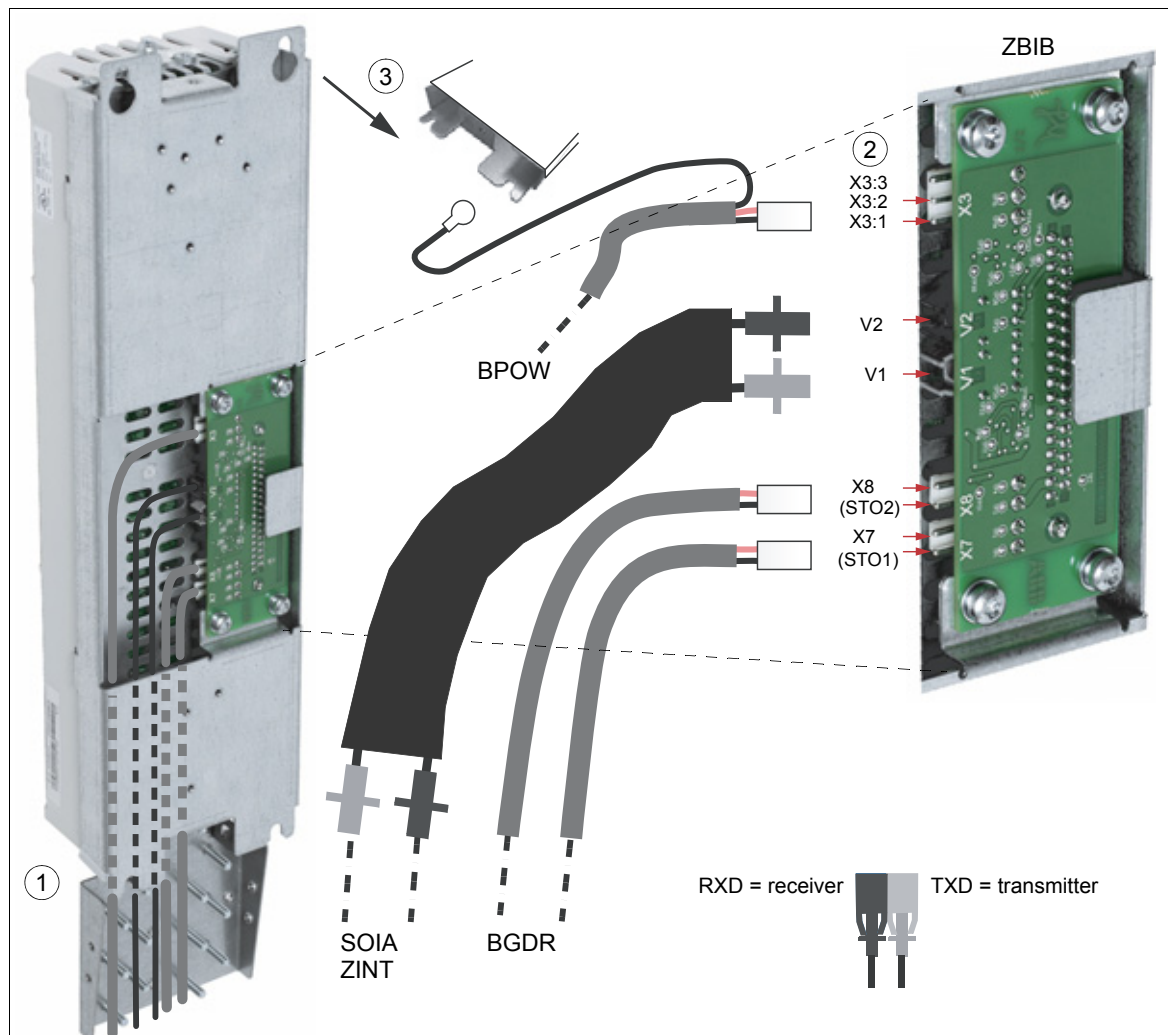
1. Thread the cables inside the back frame of the control unit.
2. Connect the cables to the ZBIB board terminals.

BPOW	ZBIB
X3: 1	X3: 1
X3: 2	X3: 2
X3: 3 (not used)	X3: 3 (not used)

ZINT/SOIA	ZBIB
ZINT: V1; SOIA: V10	V1
ZINT: V2; SOIA: V20	V2

BGDR	ZBIB
X7 (STO1)	X7 (STO1)
X8 (STO2)	X8 (STO2)

3. Connect the BPOW cable grounding wire to the grounding terminal at the back top or bottom of the control unit.

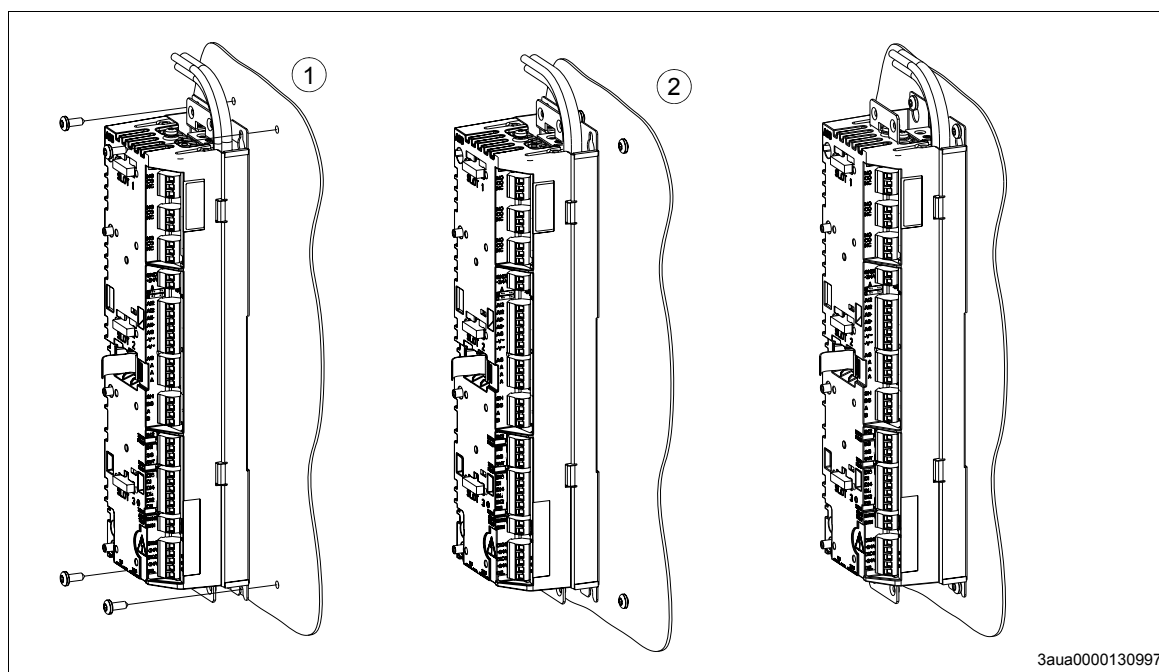


Mounting the external control unit

The drive control unit can be fastened on a mounting plate through the fastening holes in its back or by using a DIN rail.

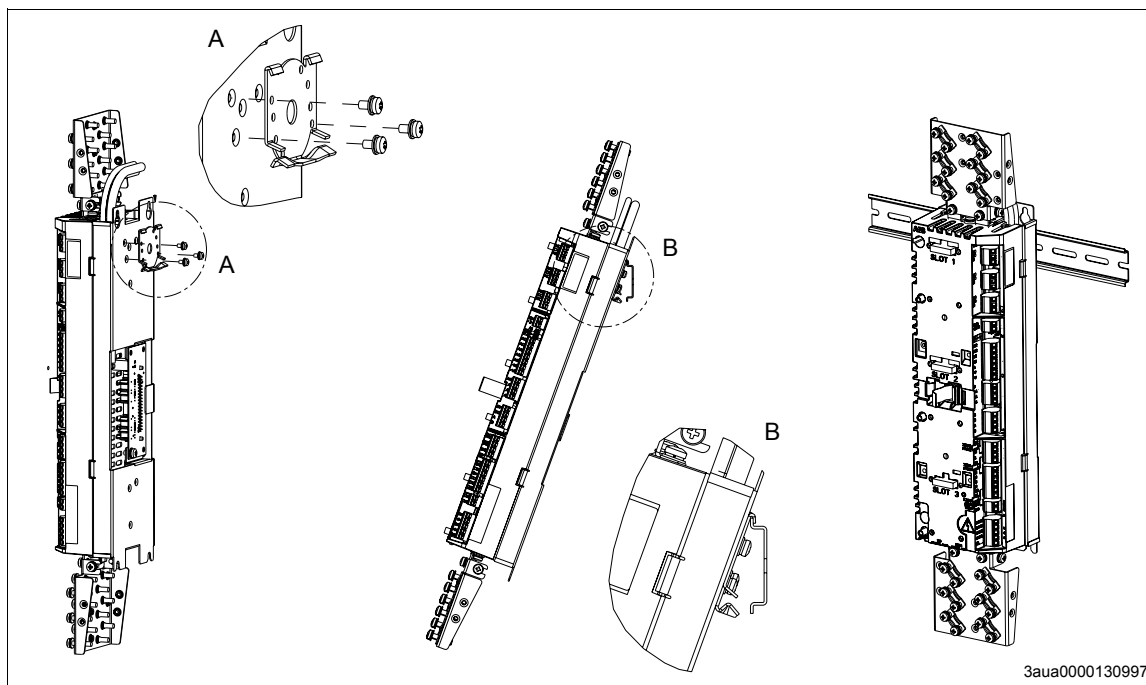
■ Mounting the external control unit to wall

1. Fasten the fastening screws in the wall.
2. Lift the unit onto the screws and tighten the screws.



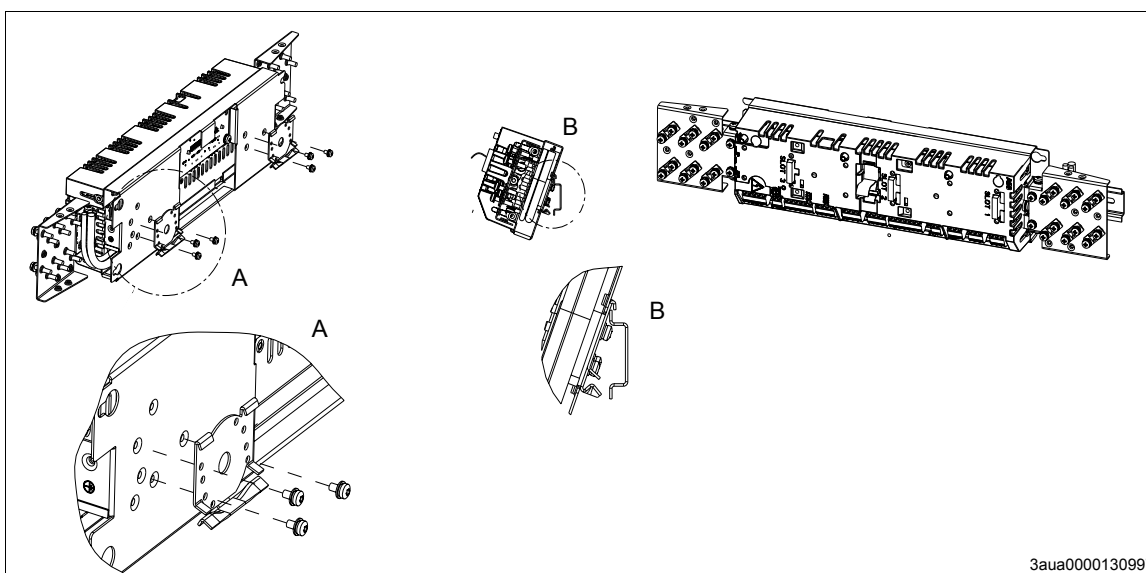
■ Mounting the external control unit vertically on a DIN rail

1. Fasten the latch (A) to the back of the control unit with three screws.
2. Click the control unit to the rail as shown below (B).

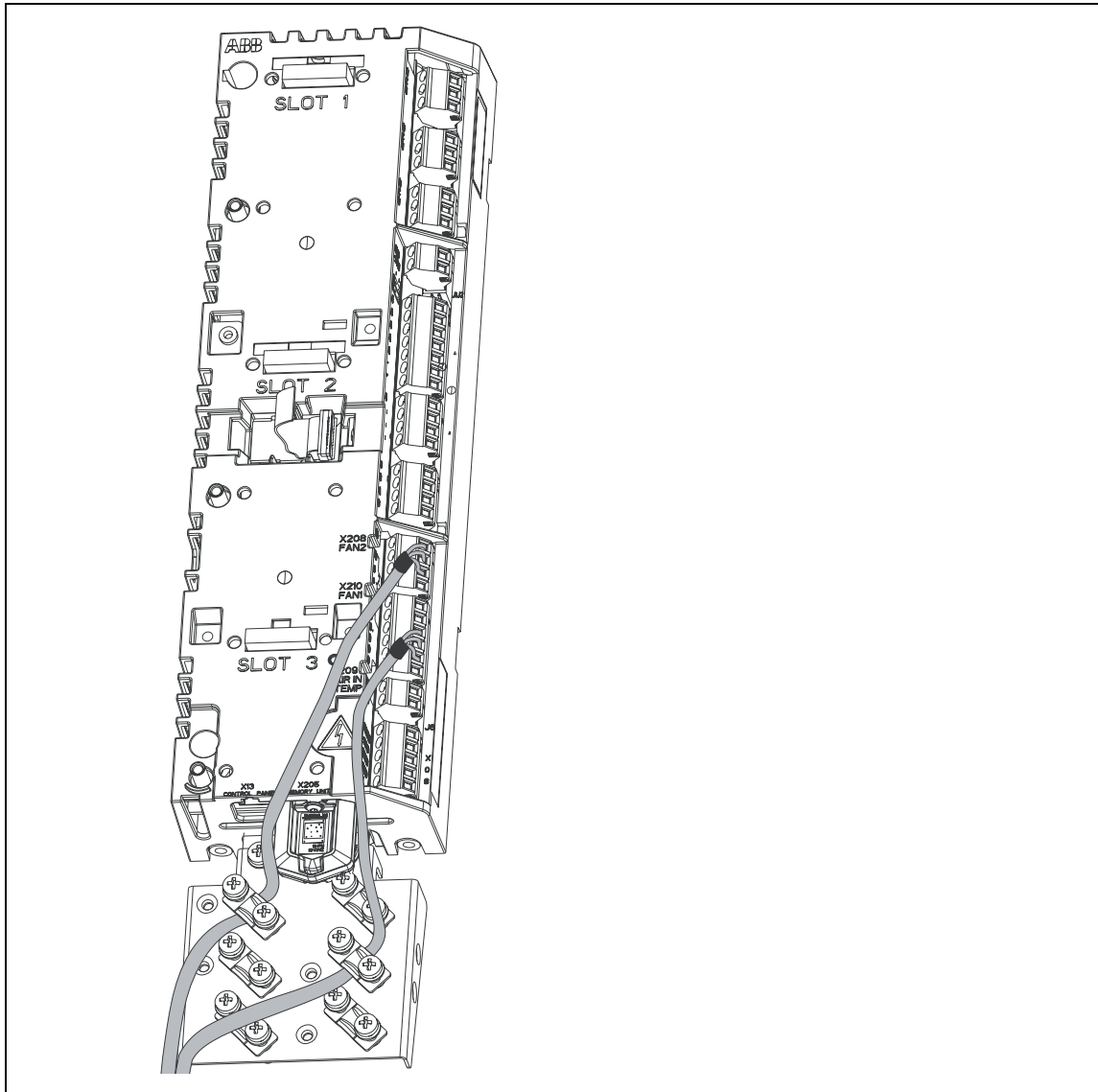


■ Mounting the control unit horizontally on a DIN rail

1. Fasten the latches (A) to the back of the control unit with three screws.
2. Click the control unit to the rail as shown below (B).

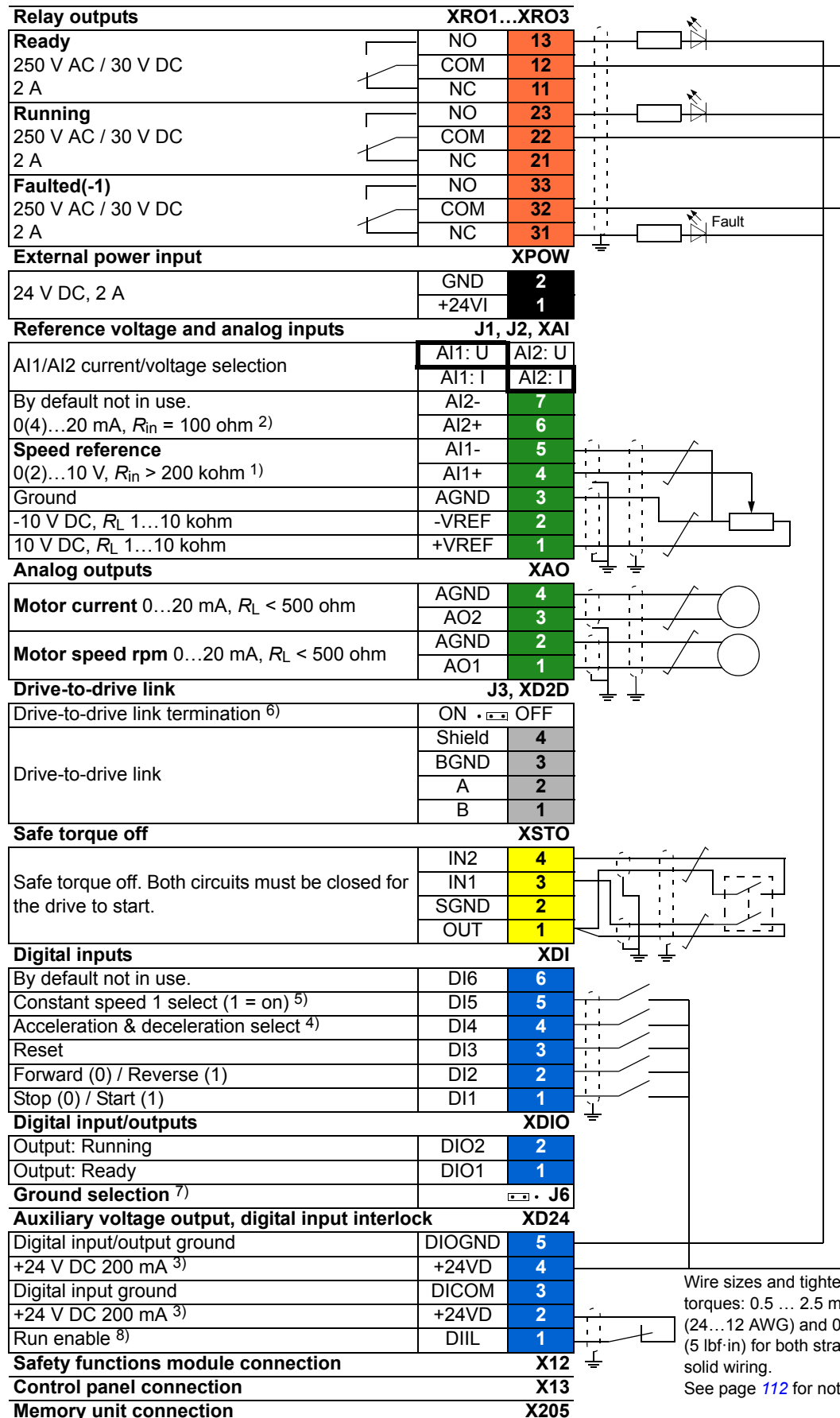


1. Route the cables to the control unit as shown below.





- Note:** 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.

■ Default I/O connection diagram



Notes:

- 1) Current [0(4)...20 mA, $R_{in} = 100 \text{ ohm}$] or voltage [0(2)...10 V, $R_{in} > 200 \text{ kohm}$] input selected by jumper J1.
Change of setting requires reboot of control unit.
- 2) Current [0(4)...20 mA, $R_{in} = 100 \text{ ohm}$] or voltage [0(2)...10 V, $R_{in} > 200 \text{ kohm}$] input selected by jumper J2.
Change of setting requires reboot of control unit.
- 3) Total load capacity of these outputs is 4.8 W (200 mA / 24 V) minus the power taken by DIO1 and DIO2.
- 4) 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.
- 5) Constant speed 1 is defined by parameter 22.26.
- 6) Must be set to ON when the drive is the last unit on the drive-to-drive (XD2D) link.
- 7) Determines whether DICOM is separated from DIOGND (ie. common reference for digital inputs floats).
See also [Ground isolation diagram](#) on page 191.
 • DICOM connected to DIOGND. •  DICOM and DIOGND separate.
- 8) See section [DIIL input \(XD24:1\)](#) on page 114.

External power supply for the control unit

External +24 V (2 A) power supply for the control unit can be connected to terminal block XPOW. Using an external supply is recommended if

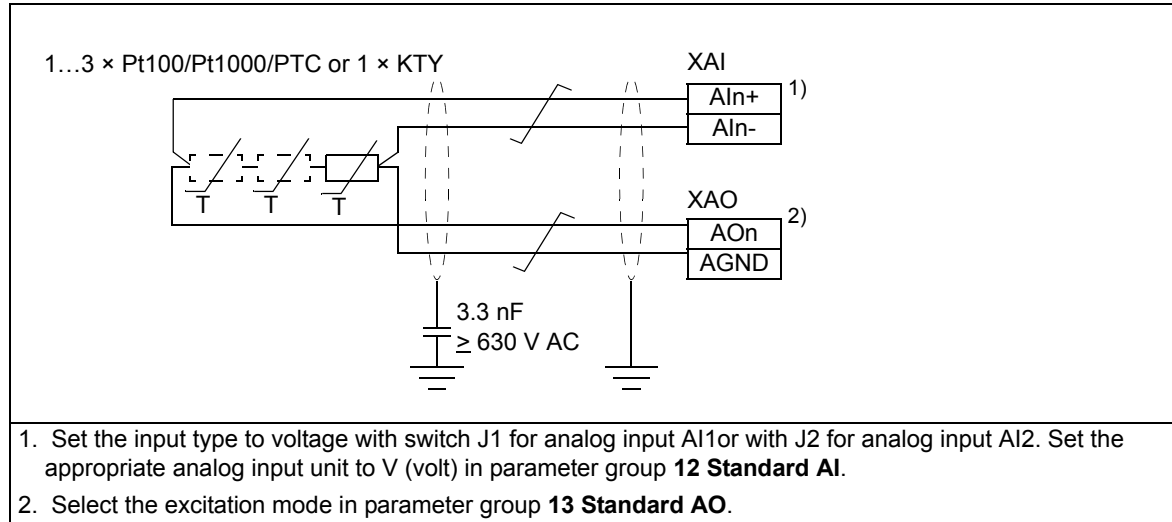
- the control board needs to be kept operational during input power breaks, for example, due to uninterrupted fieldbus communication
- immediate restart is needed after power breaks (that is, no control board power up delay is allowed).

See also the firmware manual, parameter **95.04**.



AI1 and AI2 as Pt100, Pt1000, PTC and KTY84 sensor inputs (XAI, XAO)

Three Pt100, Pt1000 or PTC sensors or one KTY84 sensor for motor temperature measurement can be connected between an analog input and output as shown below. Do not connect both ends of the cable shields directly to ground. If a capacitor cannot be used at one end, leave that end of the shield unconnected.

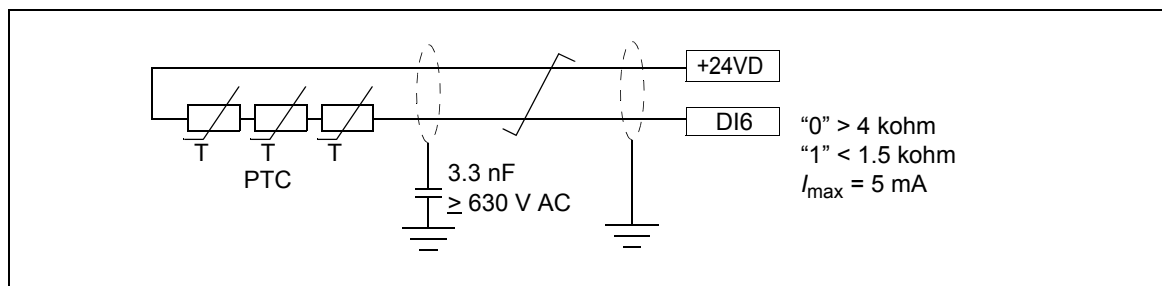


WARNING! As the inputs pictured above are not insulated according to IEC 60664, the connection of the motor temperature sensor requires double or reinforced insulation between motor live parts and the sensor. If the assembly does not fulfill the requirement, the I/O board terminals must be protected against contact and must not be connected to other equipment or the temperature sensor must be isolated from the I/O terminals.



DI6 (XDI:6) as PTC sensor input

PTC sensors can be connected to this input for motor temperature measurement as follows. The sum of the sensor resistances must not exceed the threshold resistance of the digital input at the motor normal operating temperature. Do not connect both ends of the cable shield directly to ground. If a capacitor cannot be used at one end, leave that end of the shield unconnected. See the firmware manual for the parameter settings.



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. If the assembly does not fulfill the requirement, the I/O board terminals must be protected against contact and must not be connected to other equipment or the temperature sensor must be isolated from the I/O terminals.

DIIL input (XD24:1)

The DIIL input can be used for the connection of safety circuits. By default, the input is parametrized to stop the drive when the input signal is lost.

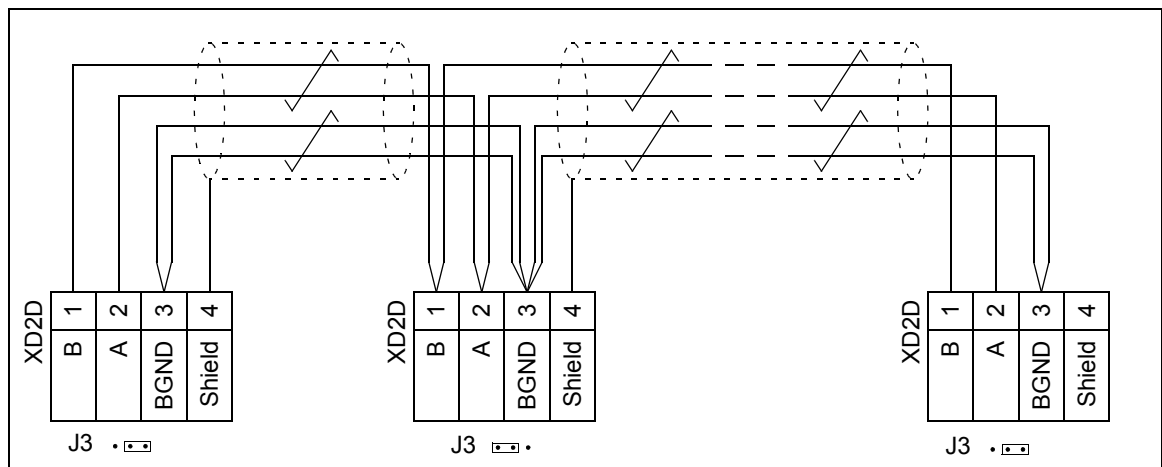
Drive-to-drive link (XD2D)

The drive-to-drive link is a daisy-chained RS-485 transmission line that allows basic master/follower communication with one master drive and multiple followers.

Set termination activation jumper J3 next to this terminal block to the ON position on the drives at the ends of the drive-to-drive link. On intermediate drives, set the jumper to the OFF position.

Use shielded twisted-pair cable (~100 ohm, for example, PROFIBUS-compatible cable) for the wiring. For best immunity, high quality cable is recommended. Keep the cable as short as possible; the maximum length of the link is 100 meters (328 ft). Avoid unnecessary loops and running the cable near power cables (such as motor cables).

The following diagram shows the wiring of the drive-to-drive link.



Safe torque off (XSTO)

For the drive to start, both connections (OUT1 to IN1 and IN2) must be closed. By default, the terminal block has jumpers to close the circuit. Remove the jumpers before connecting an external Safe torque off circuitry to the drive.

See also chapter [Safe torque off function](#) on page 223.

Safety functions (X12)

See section [Installing the FSO safety functions module \(option +Q973\)](#) on page 120 and *FSO-12 safety functions module user's manual* (3AXD50000015612 [English]).

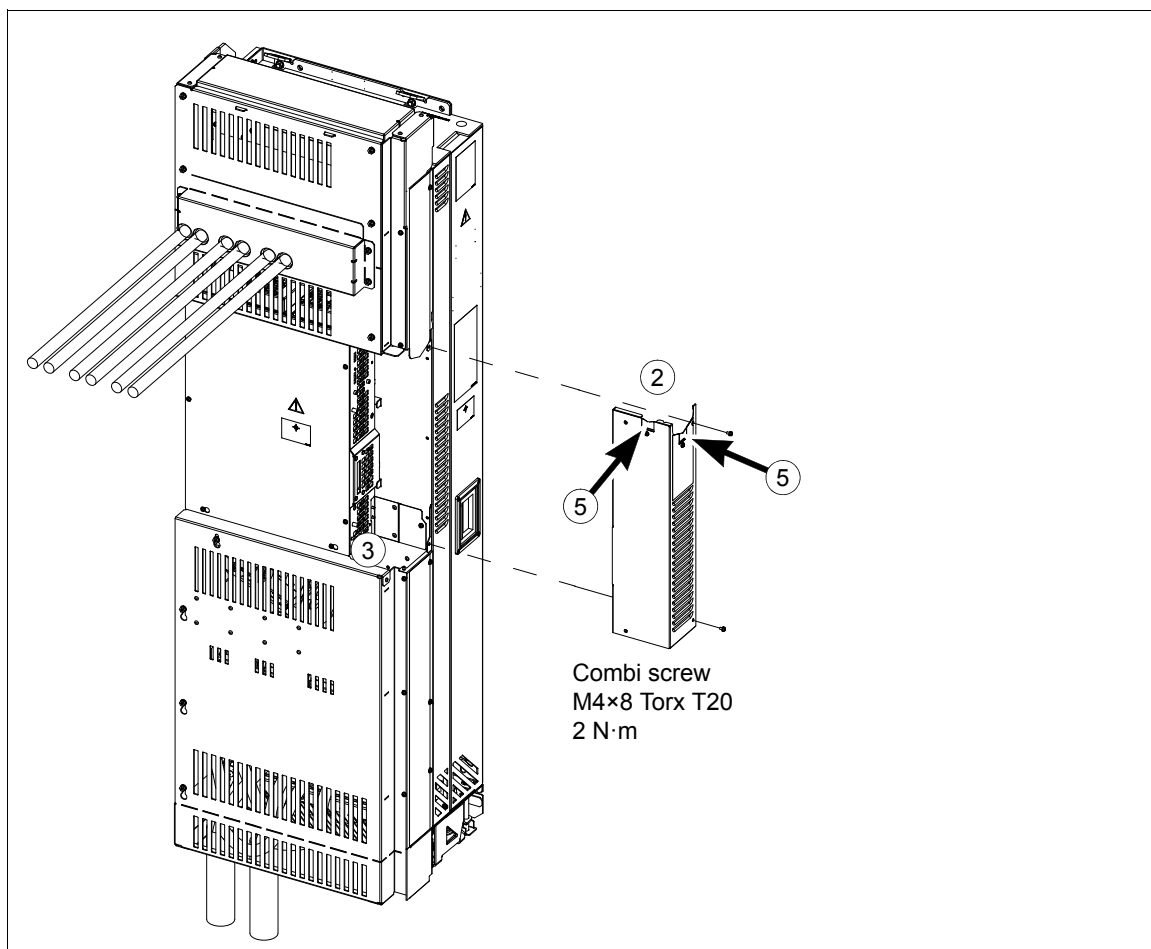
■ Installing the control panel holder back onto the external control unit

Install the control panel holder back onto the external control unit in reverse order to removing it, see section [Removing the control panel holder from the external control unit](#) on page 104.



■ Connecting the control cables to the internal control unit (option +P905)

1. Ground the outer control cable shields 360 degrees at the cabinet lead-through plate (recommendation).
2. Remove the middle front cover of the drive module (view of standard drive module configuration below).
3. Fasten the clamp plate to the top of the control unit with two screws from front, see [Fastening the control cable clamp plate](#) on page 105.
4. Fasten the optional modules if not fastened already.
5. Remove the cover plate from the control cable lead-through and put the rubber grommet in its place. Put the control cables through the grommet.
Note: If you route the control cables from top or bottom instead of front or side, you need to make holes for the lead-throughs to the clear plastic shrouds.
6. Ground the control cables at the clamp plate as described in Step 2 in section [Connecting the control cables to the terminals of the control unit](#) on page 110.
7. Connect the conductors to the appropriate detachable terminals of the control unit (see page 111). Use shrink tubing or insulating tape to contain any stray strands. Tighten the screws to secure the connection.
Note: 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.
8. Install the middle front cover back.



■ Connecting the control cables to the internal control unit (options +P905 and +0B051)

1. Remove the middle front cover of the drive module.
2. Fasten the clamp plate to the control unit with two screws from front, see [Fastening the control cable clamp plate](#) on page 105.
3. Fasten the optional modules if not fastened already.
4. Lead the control cables inside the drive cabinet.
5. Route the control cables along the control cable duct from bottom or top to the control unit. A view of a drive module with full cabling panels option +H381 is shown below.
6. Ground the outer control cable shields 360 degrees at the cabinet lead-through plate (recommendation).
7. Ground the control cables at the clamp plate as described in Step 2 in section [Connecting the control cables to the terminals of the control unit](#) on page 110.
8. Connect the conductors to the appropriate detachable terminals of the control unit (see page 111). Use shrink tubing or insulating tape to contain any stray strands. Tighten the screws to secure the connection.
Note: 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.

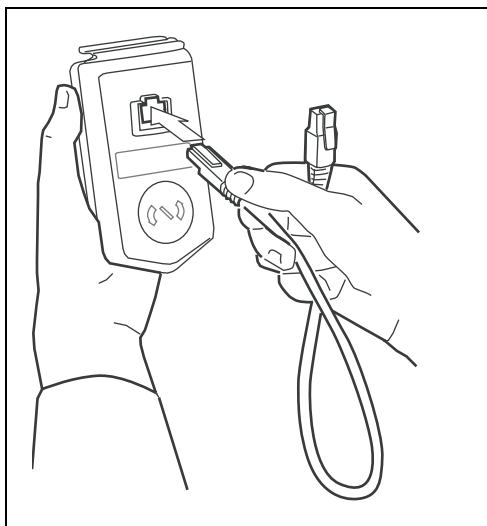


Connecting a control panel

With external control unit and control panel holder mounted on the drive module (option +J414), put the control panel on the control panel holder.

With door mounting kit (option +J410)), connect the control panel to the control unit as follows:

1. Connect an Ethernet cable to the RJ-45 connector of the control panel.
2. Connect the other end of the cable to the X13 connector of the control unit.



Controlling several drives from one control panel through panel bus

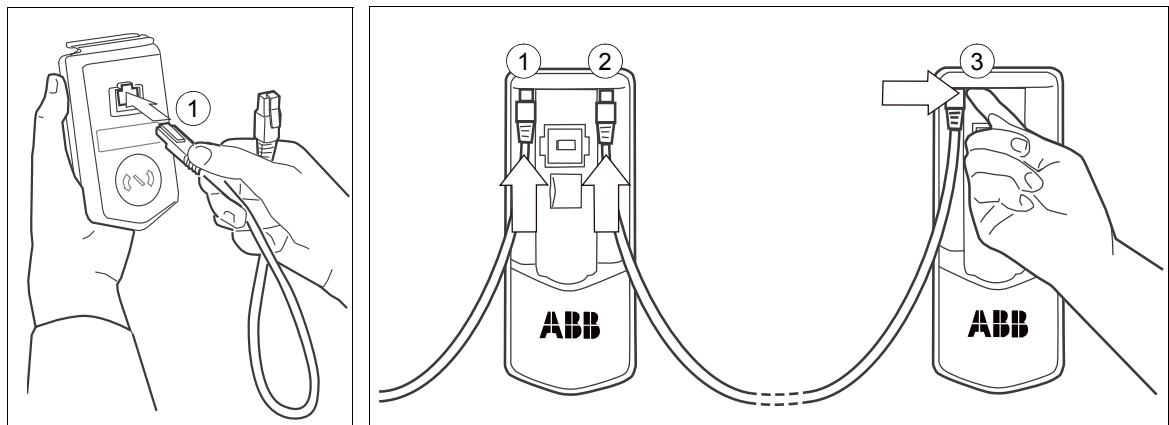
One control panel (or PC) can be used to control several drives by constructing a panel bus.

1. Connect the panel to one drive using an Ethernet (eg. CAT5E) 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.

Repeat the above for each drive.

2. With the panel connected to one drive, link the drives together using Ethernet cables. (Each panel platform has two connectors.)
3. In the last drive, switch bus termination on by moving the terminating switch into the outer position. Termination should be 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 tool.



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



Connecting a PC

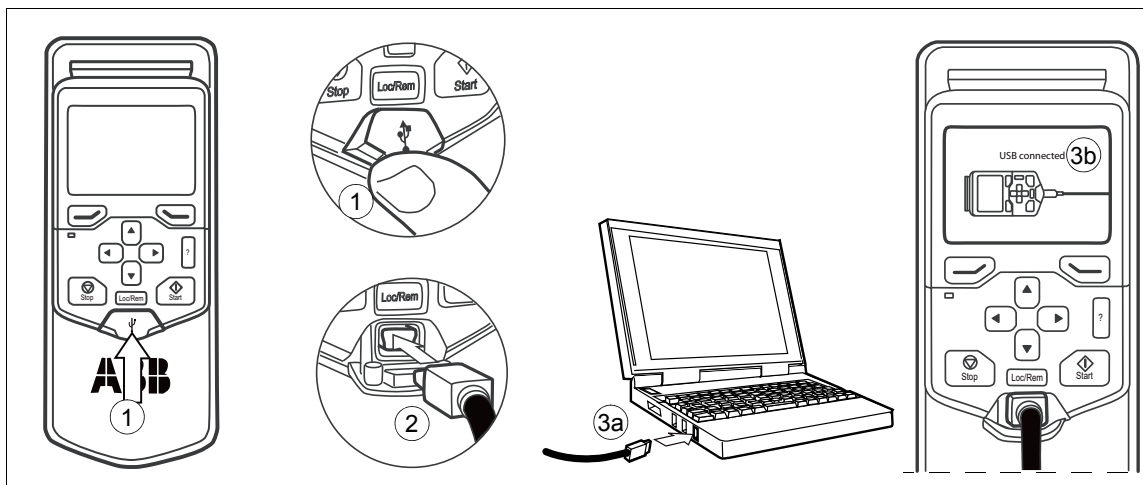
You need a control panel to connect a PC to the drive module. Connect the control panel to the drive control unit as described in section [Connecting a control panel](#) on page 118.



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

To connect a PC to the control panel with a USB data cable (USB Type A <-> USB Type Mini-B):

1. Lift the USB connector cover on the control panel from bottom upwards.
2. Insert the USB cable Mini-B plug in the control panel USB connector.
3. Insert the USB cable A-plug in the USB connector of the PC (a). -> The panel displays: USB connected (b).



Note 1: When a PC is connected to the control panel, the control panel keypad is disabled. In this case, the control panel acts as a USB-RS485 adapter.

Installing optional modules

■ Installing the FSO safety functions module (option +Q973)

Install the FSO safety functions module either in Slot 2 of the control unit or above the control unit. If you install the module above the control unit, install the control cable clamp plate on the base of the control unit (see page 105).

Note: Install the FSO safety functions module before you install any other optional modules on the control unit.

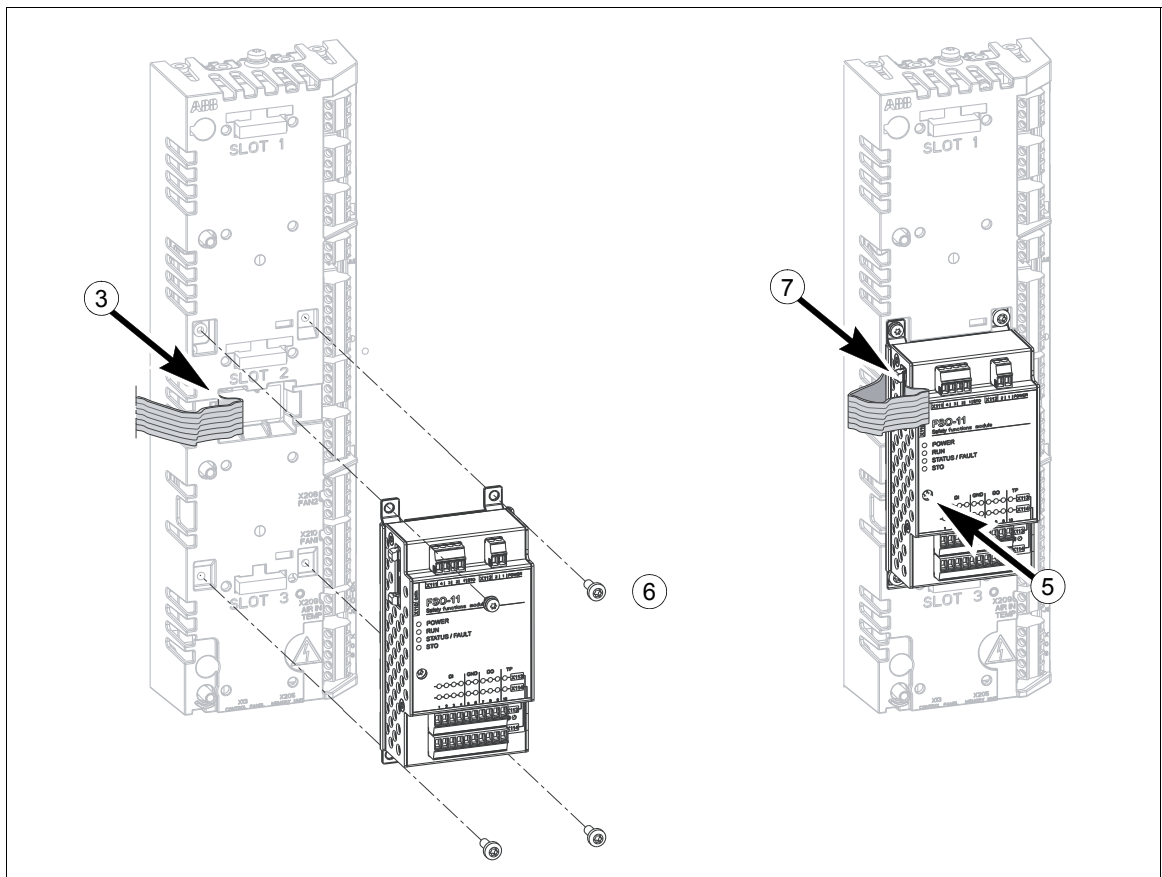
For information on the electrical installation of the FSO module, see *FSO-12 safety functions module user's manual* (3AXD50000015612 [English]).

Case 1: FSO safety functions module on Slot 2



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

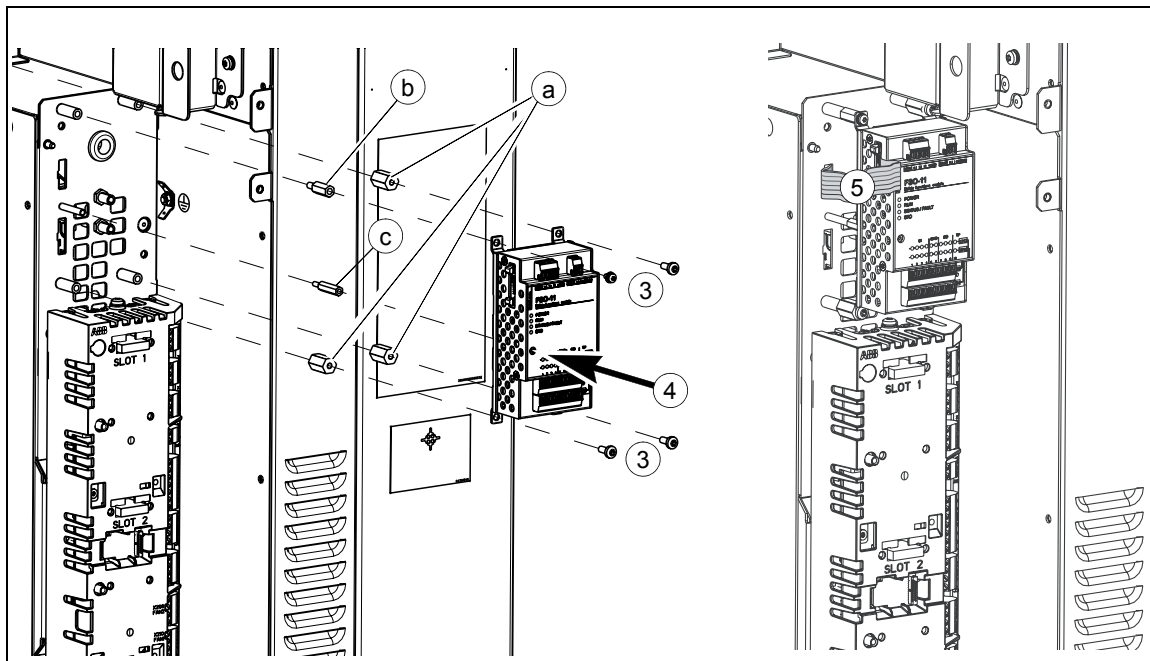
1. Stop the drive and do the steps in section [Precautions before electrical work](#) on page 18 before you start work.
2. If the bottom plate of the FSO module looks different from that in the drawing below, remove the bottom plate and attach the alternative bottom plate from the FSO package to module.
3. Connect the FSO data cable to connector X12 on the control unit.
4. Put the FSO module into its position.
5. Tighten the FSO module electronics grounding screw. **Note:** The screw tightens the connections and grounds the module. It is essential for fulfilling the EMC requirements and for proper operation of the module.
6. Fasten the module with four screws.
7. Connect the FSO data cable to FSO connector X110.



Case 2: FSO safety functions module above the control unit

WARNING! Obey the safety 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 [Precautions before electrical work](#) on page 18 before you start work.
2. If the bottom plate of the FSO module looks different from that in the drawing below, remove the bottom plate and attach the alternative bottom plate from the FSO package to module.
3. Attach the FSO module with four screws above the control unit as shown below. Use spacers (a and b) which are included in the accessories box (see page 93).
Note: The FSO module is grounded through the spacer (b).
4. Tighten the FSO electronics grounding screw. Use a grounding spacer (c) which is included in the accessories box (see page 93).
Note: The screw tightens the connections and grounds the module electronics. It is essential for fulfilling the EMC requirements and for proper operation of the module.
5. Connect the FSO data cable to FSO connector X110 and to connector X12 on the control unit.



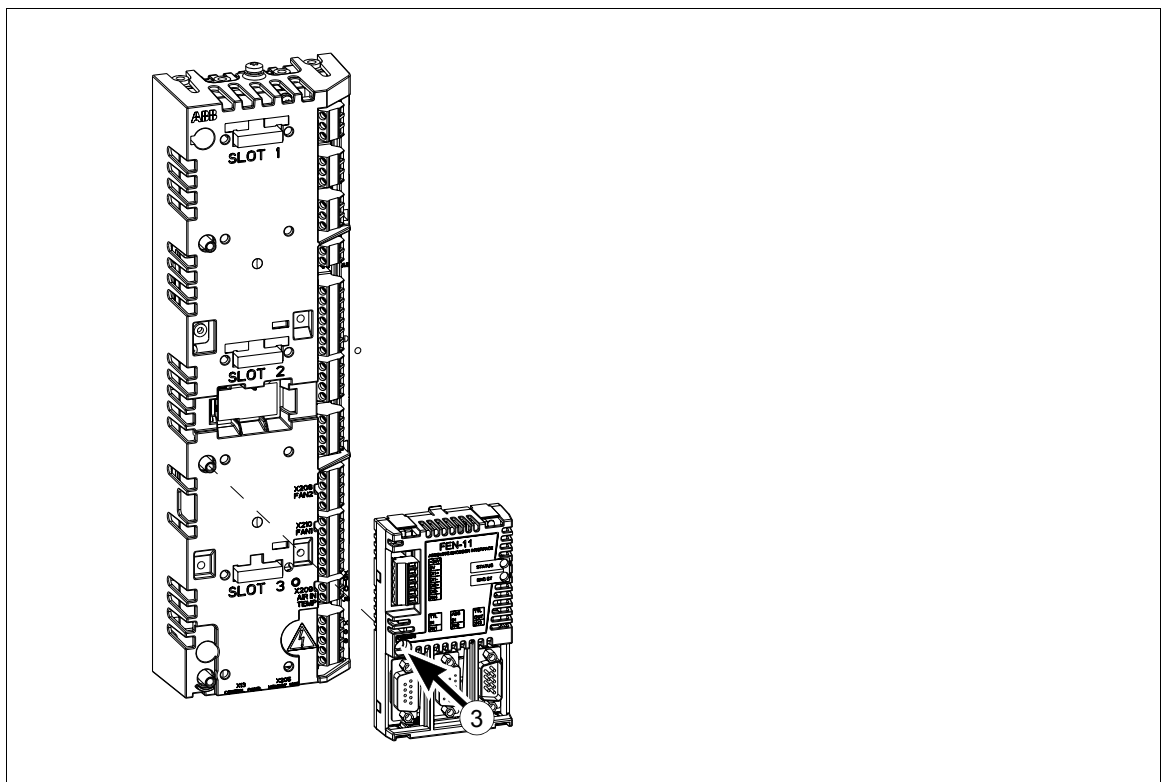
■ Installing I/O extension, fieldbus adapter and pulse encoder interface modules

See page 38 for the available slots for each module.



WARNING! Obey the safety 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 [Precautions before electrical work](#) on page 18 before you start work.
2. Insert the module carefully into its position on the control unit.
3. Tighten the grounding screw torque of 0.8 N·m. **Note:** The screw tightens the connections and grounds the module. It is essential for fulfilling the EMC requirements and for proper operation of the module.



Wiring the optional modules

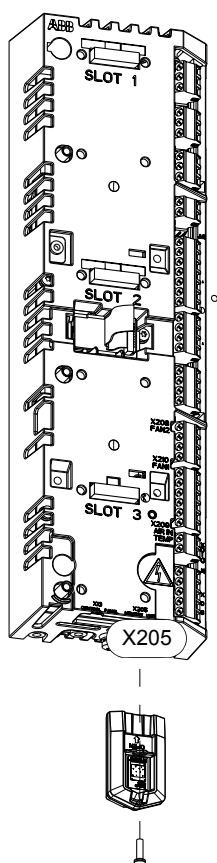
See the appropriate optional module manual for specific installation and wiring instructions.

Connecting the memory unit



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 [Precautions before electrical work](#) on page [18](#) before you start work.
2. Insert the memory unit to the X205 terminal on the control unit.
3. Fasten the memory unit with one screw.



7

Installation example of the standard drive module configuration



Contents of this chapter

In this chapter, the drive module is installed in a 600 mm wide Rittal TS 8 cabinet in a bookshelf way of mounting. The module is placed in an upright position on the cabinet bottom with its front facing the cabinet door. Available alternative ABB parts are also given.

Limitation of liability

Always obey the general rules given in this chapter and local laws and regulations. ABB does not assume any liability whatsoever for any installation which breaches local laws and/or other regulations.

Safety



WARNING! If you are not a qualified electrician do not do the installation work described in this chapter. Obey the instructions in chapter [Safety instructions](#). If you ignore them, injury or death, or damage to the equipment can occur.

Required parts

Drive module standard parts		
<ul style="list-style-type: none"> • Drive module • Fastening bracket • Pedestal guide plate • Telescopic extraction and insertion ramp • Fastening screws and insulators in a plastic bag • External control unit 		
Rittal parts / Alternative ABB parts		
Rittal part code	Qty (pcs)	Description
TS 8606.500	1	Enclosure without mounting plate, bottom plates and side panels.
TS 7967.000 (one set = four pieces) / ABB 3AUA0000117003 (IP20) ABB 3AUA0000117008 (IP42)	1	Spacers for roof plates. / ABB roof Note: For alternative ABB outlet kits, see section Air outlet kits on page 172.
TS 8612.160	5	Punched section with mounting flange, outer mounting level for 600 mm horizontal
TS 4396.500		Support rails
SK 3243.200 / ABB 3AUA0000117003 (IP20) ABB 3AUA0000117008 (IP42)	4 / 2	Air filter 323 mm × 323 mm. Remove the filter mats. For alternative ABB air filters, see section Air inlet kits page 170.
Customer-made parts (not ABB or Rittal products)		
Air baffles	2	See section Preventing the recirculation of hot air on page 54.

Required tools

- Set of screw drivers (Torx and Pozidriv)
- Set of metric magnetic-end hexagon sockets
- Torque wrench
- Step drill bit for drilling the holes in the clear plastic shroud for input power cables.

Overall flowchart of the installation process

Step	Task	For instructions, see
1	Install the Rittal parts, drive bottom guide plate and loose drive options in the drive module cubicle.	Installing the drive module into a cabinet on page 127 and installation drawings on page 241.
2	Install the auxiliary components (such as mounting plates, air baffles, switches, busbars etc.).	The component manufacturer's instructions Preventing the recirculation of hot air on page 54.
	Attach the drive module to the cabinet	Step-by-step drawings for an installation example of standard drive configuration with option +E208 in Rittal TS 8 600 mm wide cabinet on page 241.
3	Connect the power cables and clear plastic shrouds to the drive module.	Connecting the power cables and installing the shrouds on page 127

5	Mount the external control unit.	Mounting the external control unit , page 108
6	Connect the control cables.	Connecting the control cables to the terminals of the control unit , page 110
7	Install the remaining parts, for example, cabinet doors, side plates, etc.	The component manufacturer's instructions. Installing the roof and door (Rittal parts) on page 129

Installing the drive module into a cabinet

See a video of the installation at YouTube:




<http://www.youtube.com/watch?v=IhKOSx3HmzQ>

See appendix [Step-by-step drawings for an installation example of standard drive configuration with option +E208 in Rittal TS 8 600 mm wide cabinet](#) on page 241 and [ACS880-04 quick installation guide](#) (3AXD50000009366 [English]).

- Install the punched section to the back of the cabinet frame.
- Install the bottom grille to the drive module for IP20 degree of protection from bottom if there is no leak-proof bottom plate in the cabinet. See page 101.
- Install the support rails and pedestal guide plate to the cabinet bottom frame.
- Install the telescopic insertion ramp to the pedestal guide plate.
- Remove the sheeting from the clear plastic shrouds from both sides.
- Install the top metallic shroud to the drive module.
- Install the back shrouds to the drive module.
- To prevent the drive module from falling, attach its lifting lugs with chains to the cabinet frame.
- Push the drive module carefully into the cabinet along the telescopic insertion ramp.
- Remove the ramp.
- Fasten the drive module to the pedestal guide plate.
- Fasten the drive module from top to the punched section at the cabinet back. **Note:** The fastening bracket grounds the drive module to the cabinet frame.
- Install the air baffles.






Connecting the power cables and installing the shrouds

Step	Task (motor cables)
1	Install the grounding terminal to the drive module base.
2	Run the motor cables to the cabinet. Ground the cable shields 360 degrees at the cabinet lead-through
3	Connect the twisted shields of the motor cables to the grounding terminal
4	<p>Screw in and tighten the insulators to the drive module by hand. Install the T3/W2 connection terminal to the insulators.</p> <p>  WARNING! Do not use longer screws or bigger tightening torque than given in the installation drawing. They can damage the insulator and cause dangerous voltage to be present at the module frame.</p> <p></p>
5	Connect the phase T3/W2 conductors to the T3/W2 terminal.
6	Install the T2/V2 connection terminal to the insulators See the warning in step 4.

Step	Task (motor cables)
7	Connect the phase T2/V2 conductors to the T2/V2 connection terminal.
8	Install the T1/U2 connection terminal to the insulators. See the warning in step 4.
9	Connect the phase T1/U2 conductors to the T1/U2 terminal.
10	Remove the plastic sheeting from the output clear plastic shrouds from both sides.
11	Install the shrouds to the drive module.
12	Install the lower front cover to the drive module.

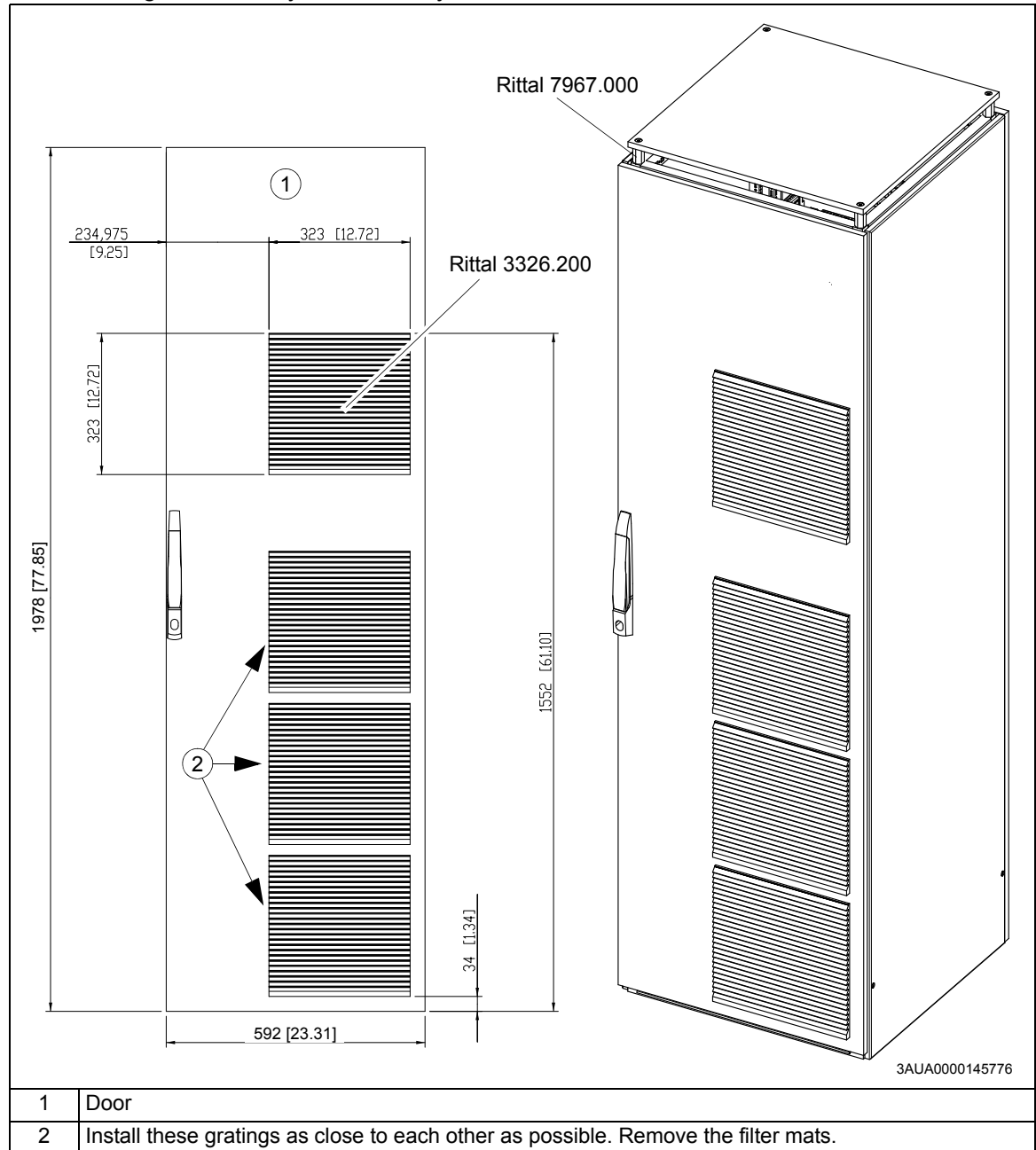
Step	Task (input cables)
1	Ground the input cable shields (if present) 360 degrees at the cabinet lead-through.
2	Connect the twisted shields of the input cables and separate ground cable (if present) to the cabinet grounding busbar.
3	<p>Step drill carefully sufficiently big holes to the lead-through clear plastic shroud for the cables to the connected. Align the holes in the vertical direction according to the alignment holes in the shroud. Smooth the hole edges.</p> <p>Remove the plastic sheeting from both sides of the shroud.</p> <p>Attach the cables firmly to the cabinet frame to prevent chafing against the hole edges.</p>
4	Put the conductors of the input cables through the drilled holes in the clear plastic shroud.
5	<u>For drive modules without option +H370:</u> Connect the input cable conductors to the drive module L1/U1, L2/V1 and L3/W1 connection busbars, Go to step 12.

For option +H370: Do steps 6 to 11.

6	<p>Screw in and tighten the insulators to the drive module by hand. Install the L1/U1 connection terminal to the insulators.</p> <div style="display: flex; align-items: center;">   <div style="margin-left: 10px;"> <p>WARNING! Do not use longer screws or bigger tightening torque than given in the installation drawing. They can damage the insulator and cause dangerous voltage to be present at the module frame.</p>  </div> </div>
7	Connect the L1/U1 conductors to the L1/U1 connection terminal.
8	Install the L2/V1 connection terminal to the insulators. See the warning in step 5.
9	Connect the L2/V1 conductors to the L2/V1 connection terminal.
10	Install the L3/W1 connection terminal to the insulators. See the warning in step 5.
11	Connect the L3/W1 conductors to the L3/W1 connection terminal.
12	Install the lead-through clear plastic shroud. Install the front clear plastic shroud and upper front cover. Remove the cardboard protective covering from the drive module air outlet.
13	Install the side and top clear plastic shrouds to the drive module.

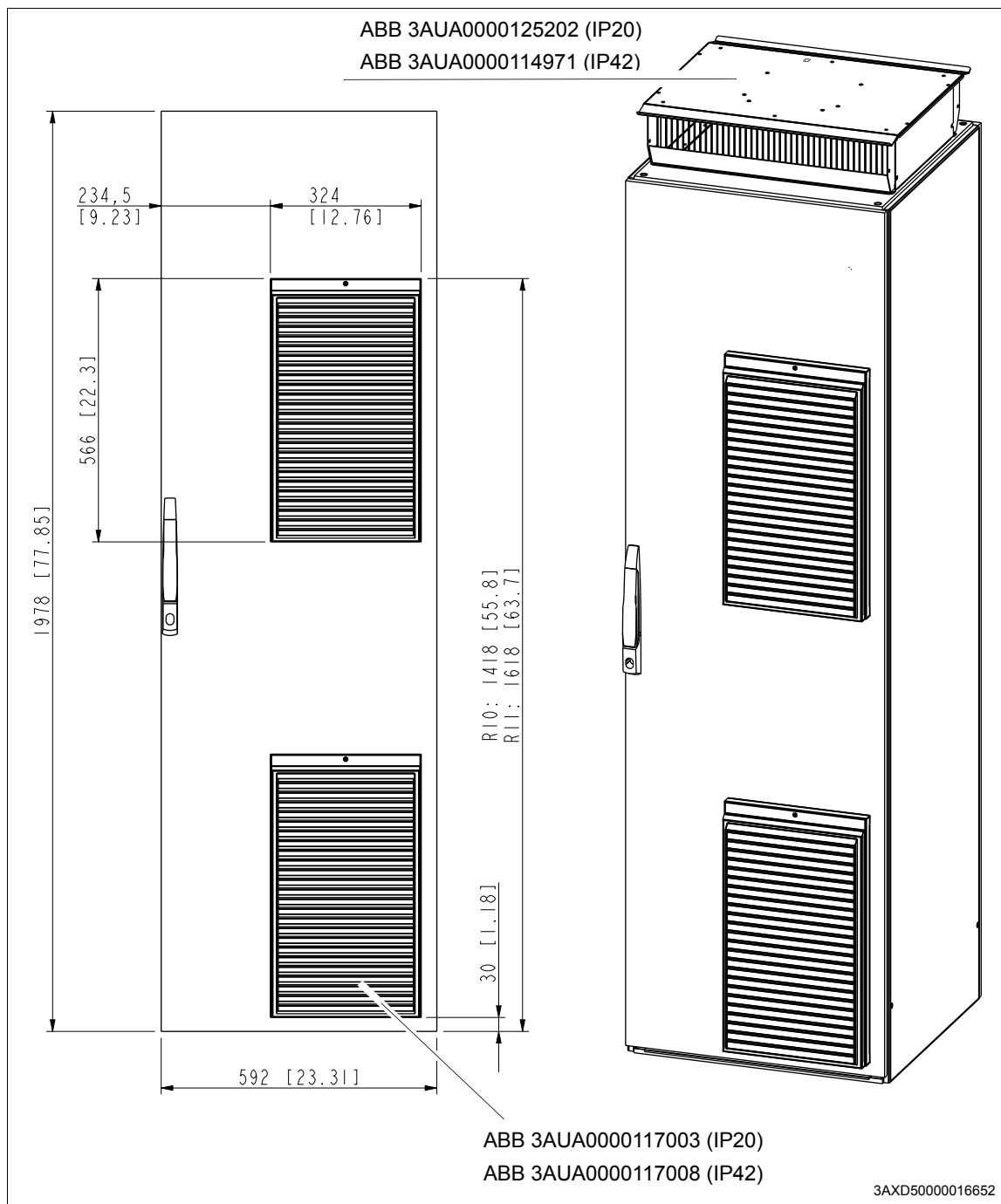


This drawing shows a layout tested by ABB.



Installing the roof and door (ABB air filters and roof)

This drawing shows a layout tested by ABB.



■ Removing the protective covering from the drive module air outlet



WARNING! Remove the protective covering from the top of the drive module after the installation. If the covering is not removed, the cooling air cannot flow freely through the module and the drive will run to overtemperature.



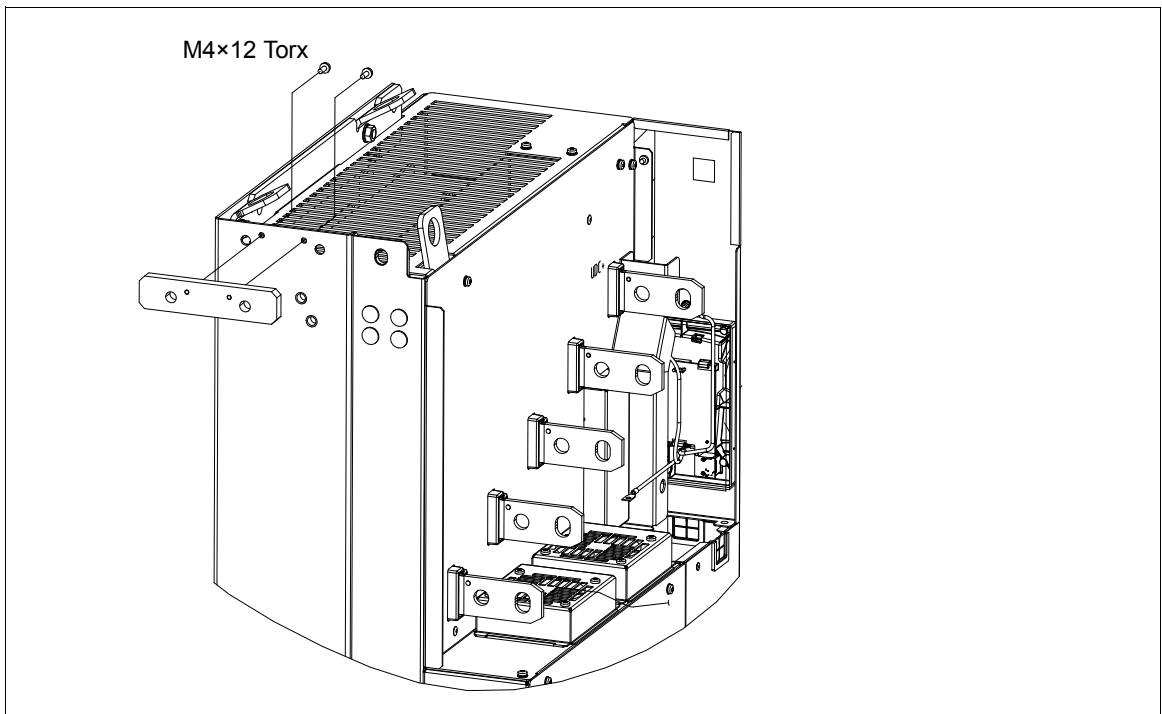
Miscellaneous

■ Input power cable lead-through from top

If you run the input cables from top to the drive module, drill the lead-through holes to the top clear plastic shroud.

■ Attaching the drive module to a mounting plate

Use the assembly support if you attach the drive module directly to the cabinet back plate. The support prevents the drive module screws from chafing the plate.





8

Installation example with full cabling panels (option +H381)

Contents of this chapter

In this chapter, the drive module is installed in a 400 mm wide Rittal TS 8 cabinet in a bookshelf way. The module is placed in an upright position on the cabinet bottom with its front facing the cabinet door. Cabinet space for the additional components can be made by connecting two or more TS8 cabinets together. Available alternative ABB parts are also given.

Limitation of liability

Always obey the general rules given in this chapter and local laws and regulations. ABB does not assume any liability whatsoever for any installation which breaches local laws and/or other regulations.

Safety



WARNING! If you are not a qualified electrician do not do the installation work described in this chapter. Obey the instructions in chapter [Safety instructions](#). If you ignore them, injury or death, or damage to the equipment can occur.

Required parts

The parts are used in this installation example:

Drive module standard parts		
<ul style="list-style-type: none"> • Drive module • Top guide plate • Fastening bracket • Grounding busbar • Pedestal guide plate • Telescopic extraction and insertion ramp • Fastening screws in a plastic bag • External control unit 		
Drive module options		
Option code	Qty (pcs)	Description
+H381	1	Full power cabling panels
+P905	1	Internal control unit (inside the drive module)
Rittal parts / Alternative ABB parts		
Rittal part code	Qty (pcs)	Description
TS 8406.510	1	Enclosure without mounting plate, bottom plates and side panels.
TS 8106.235	1	Side panels for the cabinet
SZ/DK 7967.000 (one set = four pieces) / ABB 3AUA0000125201 (IP20) ABB 3AUA0000114967 (IP42)	1	Spacers for roof plate / ABB roof Note: For alternative ABB outlet kits, see section Air outlet kits on page 172.
TS 8612.160	5	Punched section with mounting flange, outer mounting level for 600 mm horizontal
TS 8612.140	3	Punched section with mounting flange, outer mounting level for 400 mm horizontal
SK 3243.200 / ABB 3AUA0000117002 (IP20) ABB 3AUA0000117007 (IP42)	4 / 2	Air filter 323 mm × 323 mm. Remove the filter mat according to the manufacturer's instructions. Note: For alternative ABB air filters, see section Air inlet kits page 170.
TS 4396.500	3	Support rail (alternative to a customer-made bottom plate)
Customer-made parts (not ABB or Rittal products)		
Air baffles	2	See section Air baffles for option +H381 in Rittal TS 8 400 mm wide cabinet installation on page 218 for the dimension drawings of the air baffles required in the cabinet.
Cabinet bottom plate (alternative to Rittal support rails)	1	See section Bottom plate for option +H381 in Rittal TS 8 400 mm wide cabinet installation on page 215 for the dimension drawing of a customer-made bottom plate.

Required tools

- Set of screw drivers (Torx and Pozidriv)
- Set of metric magnetic-end hexagon sockets
- Torque wrench with a 500 mm (20 in.) or 2 × 250 mm (2 × 10 in.) long extension bar

Overall flowchart of the installation process

Step	Task	For instructions, see
1	Install the Rittal parts and drive module mechanical accessories into the cabinet.	Installing the mechanical accessories into the cabinet on page 135 and appendix Step-by-step drawings for installing full cabling panels (option +H381) in a Rittal TS 8 400 mm wide cabinet on page 245
3	Connect the power cables to the cabling panels.	Connecting the power cables , page 136.
4	Install the drive module into the cabinet.	Installing the drive module into the cabinet , page 139
5	Install the external control unit.	Mounting the external control unit , page 108
6	Connect the control cables.	Connecting the control cables to the terminals of the control unit , page 110
7	Install the remaining parts, for example, cabinet doors, side plates, etc.	The component manufacturer's instructions

Installing the mechanical accessories into the cabinet

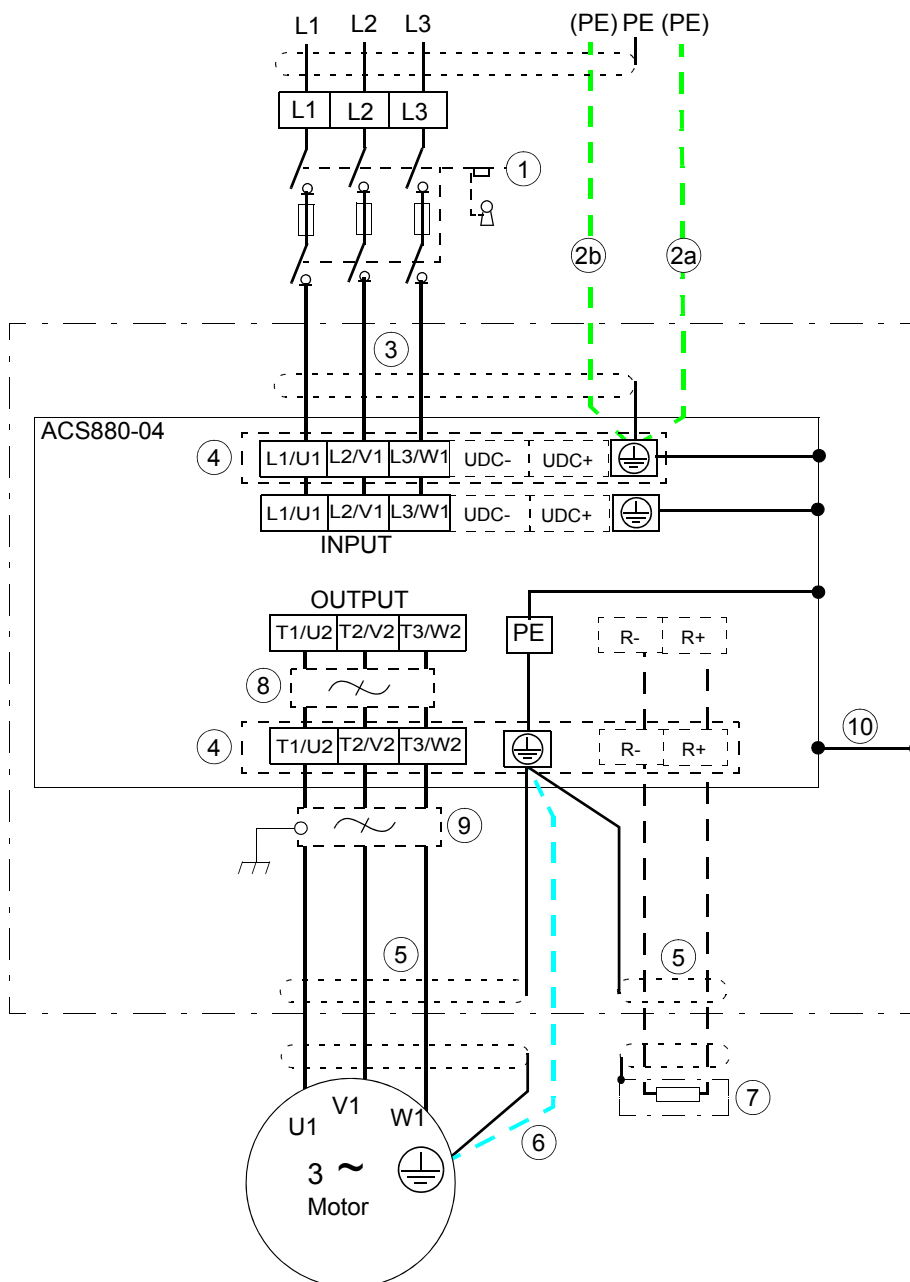
Install the mechanical accessories into the cabinet as shown in appendix [Step-by-step drawings for installing full cabling panels \(option +H381\) in a Rittal TS 8 400 mm wide cabinet](#) on page 245.

If you do not use Rittal support rails on the bottom of the cabinet but make an own bottom plate instead, see the dimension drawing on page 215 for the correct dimensions. **Note:** If the thickness of the bottom plate is not 2.5 mm (0.1 in.), adjust the dimensions accordingly.



Connecting the power cables

Connection diagram



- 1 For alternatives, see section [Selecting the supply disconnecting device](#) on page 64. In the installing example of this chapter, the disconnecting device is not in the same cubicle with the drive module.
- 2 If a shielded cable is used (not required but recommended) and the conductivity of the shield is < 50% of the conductivity of the phase conductor, use a separate PE cable (2a) or a cable with a grounding conductor (2b).
- 3 We recommend 360-degree grounding at the cabinet entry if a shielded cable is used. Ground the other end of the input cable shield or PE conductor at the distribution board.
- 4 Input and output power cabling panels (option +H381)
- 5 We recommend 360-degree grounding at the cabinet entry, see page 51.
- 6 Use a separate grounding cable if the conductivity of the cable shield is < 50% of the conductivity of the phase conductor and there is no symmetrically constructed grounding conductor in the cable (see page 73).

- 7 External brake resistor (optional, see page 233).
- 8 Common mode filter (optional, see page 66).
- 9 du/dt filter (optional, see page 239).
- 10 The drive module frame must be connected to the cabinet frame. See section [Arranging the grounding inside the cabinet](#) on page 50 and [Alternatives for grounding the drive module](#) on page 99.

Note:

If there is a symmetrically constructed grounding conductor in 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. Connecting its fourth conductor at the motor end increases bearing currents and causes extra wear.

■ Power cable connection procedure



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

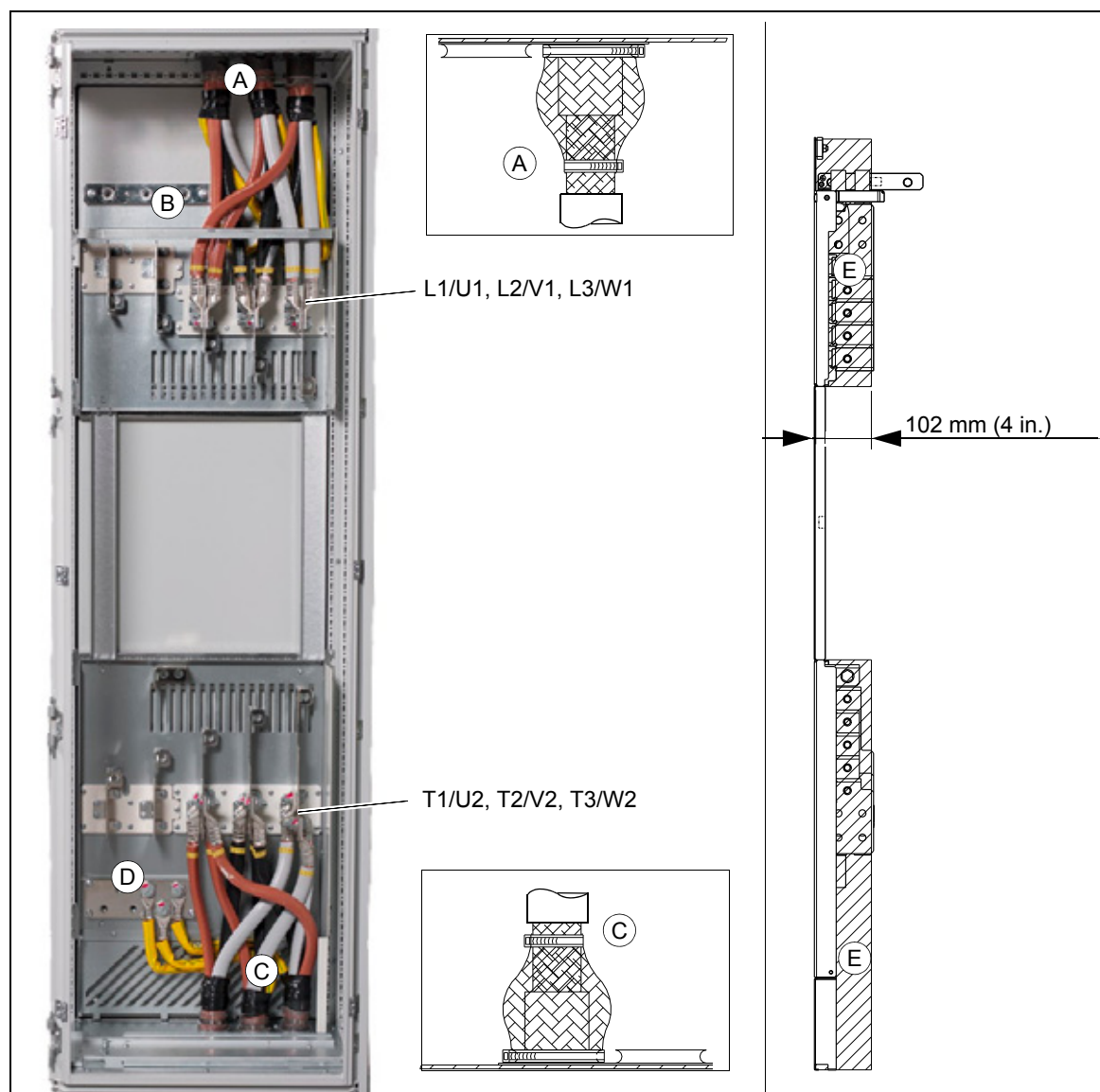
1. Run the motor cables from the motor to the cabinet. Ground the cable shields 360° at the lead-through plate.
2. Twist the cable shields of the motor cables into bundles and connect them and any separate ground conductors or cables to the ground busbar of the output power cabling panel.
3. Connect the phase conductors of the motor cables to terminals T1/U2, T2/V2 and T3/W2 of the output cabling panel. For the tightening torques, see page 186.
4. Drive modules with option +D150: Run the power cables from the brake resistor to the cabinet. Ground the cable shield (if present) 360° at the lead-through plate. Connect the conductors to the R+ and R- terminals. For the tightening torques, see page 186.
5. Make sure that all power is disconnected and reconnection is not possible. Use proper safe disconnect procedures according to local codes.
6. Run the input cables from the supply source to the cabinet. Ground the cable shields 360° at the lead-through plate.
7. Twist the cable shields of the input cables into bundles and connect them and any separate ground conductors or cables to grounding busbar of the input cabling panel.
8. Connect the phase conductors of the input cables to terminals L1/U1, L2/V1 and L3/W1 of the input cabling panel. For the tightening torques, see page 186.



An example installation is shown below.



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



View without cabinet side plate in place.

A) 360-degree grounding at the lead-through plate for the input power cables

B) Grounding busbar of the input power cabling panel

C) 360-degree grounding at the lead-through plate for the output power cables

D) Grounding busbar of the output power cabling panel

E) Allowed space for power cables. **Note:** The input and output power cables must fit inside the area marked with diagonal lines to prevent chafing of the cables when the drive module is inserted into the cabinet.

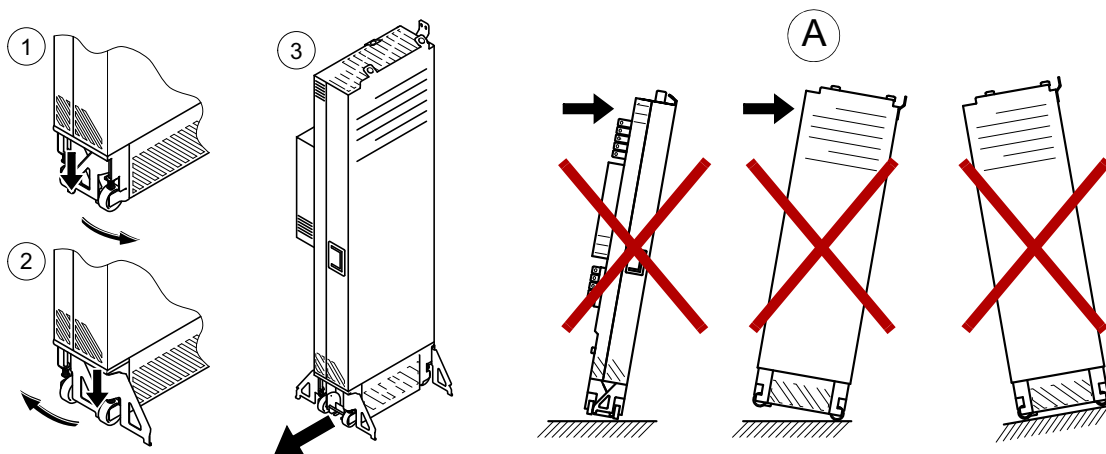
Installing the drive module into the cabinet



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

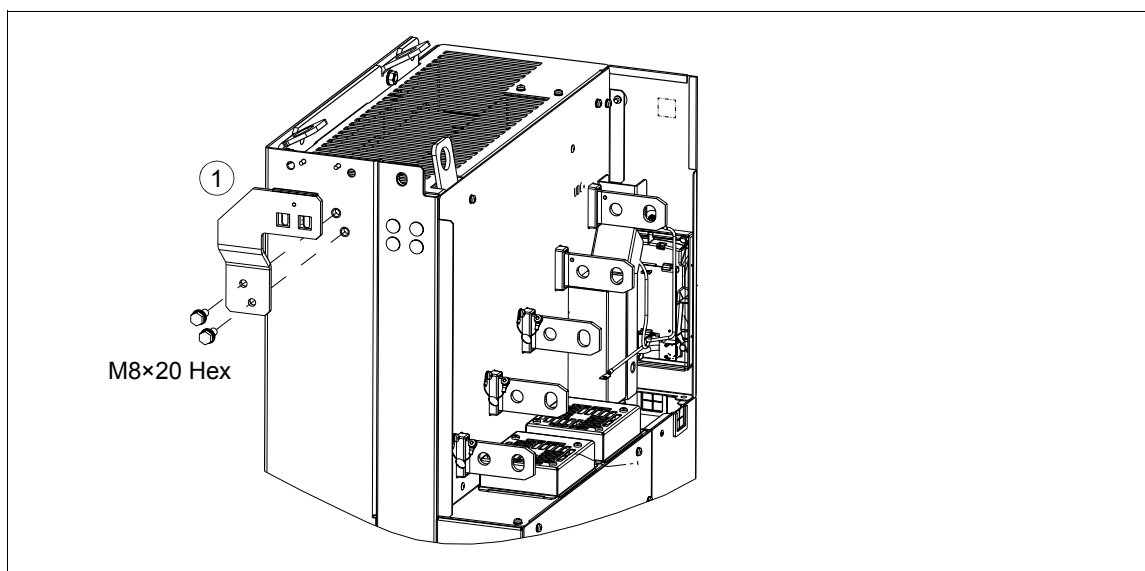
Handle the drive module carefully. Make sure that the module does not fall down when moving it on the floor and during installation and maintenance work: Open the support legs by pressing each leg a little down and turning it aside (1, 2). When ever possible secure the module also with chains from top.

Do not tilt the drive module (A). It is **heavy** and its **center of gravity is high**. The module will overturn from a sideways tilt of 5 degrees. Do not leave the module unattended on a sloping floor.



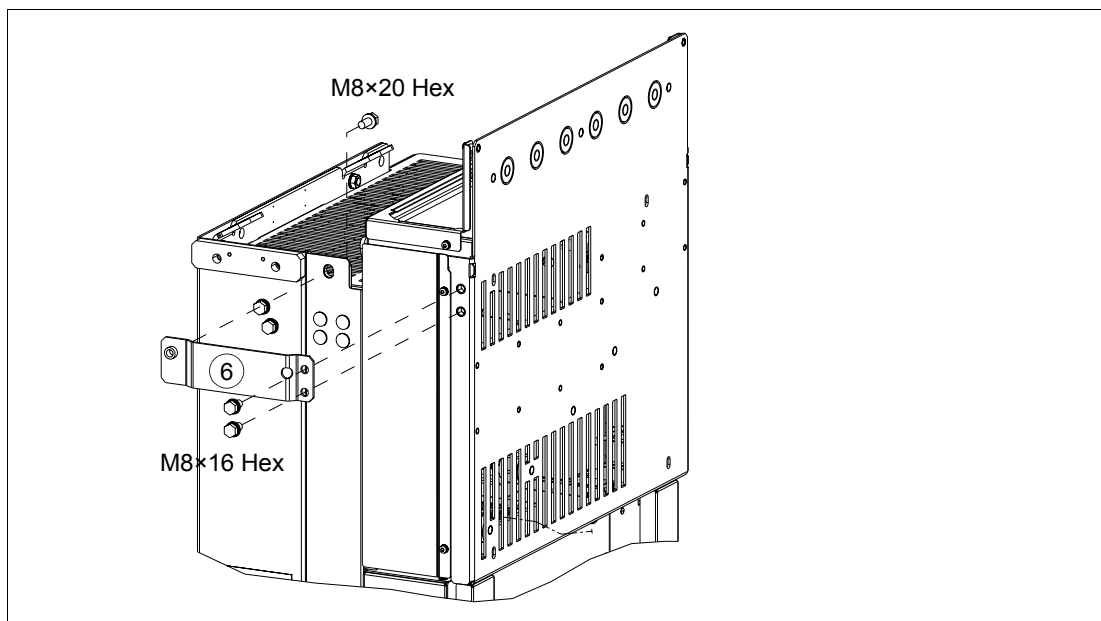
■ Installation procedure

1. Attach the mounting bracket to the drive module. **Note:** This bracket will ground the drive module to the cabinet frame.

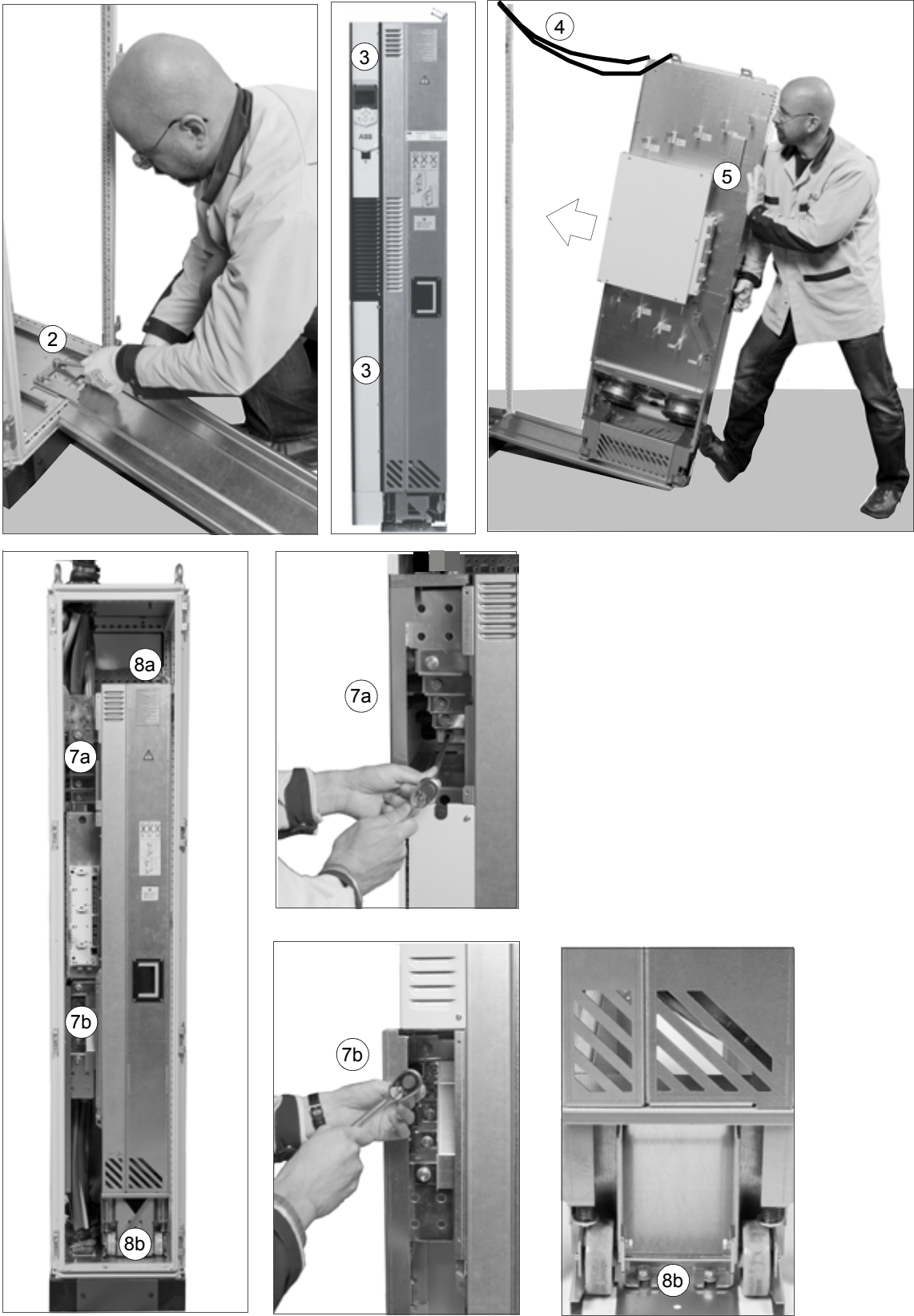


2. Install the telescopic extraction and insertion ramp to the cabinet base with two screws.
3. Remove the upper and lower left-hand side front covers of the drive module (M4x8 combi screws, 2 N·m).

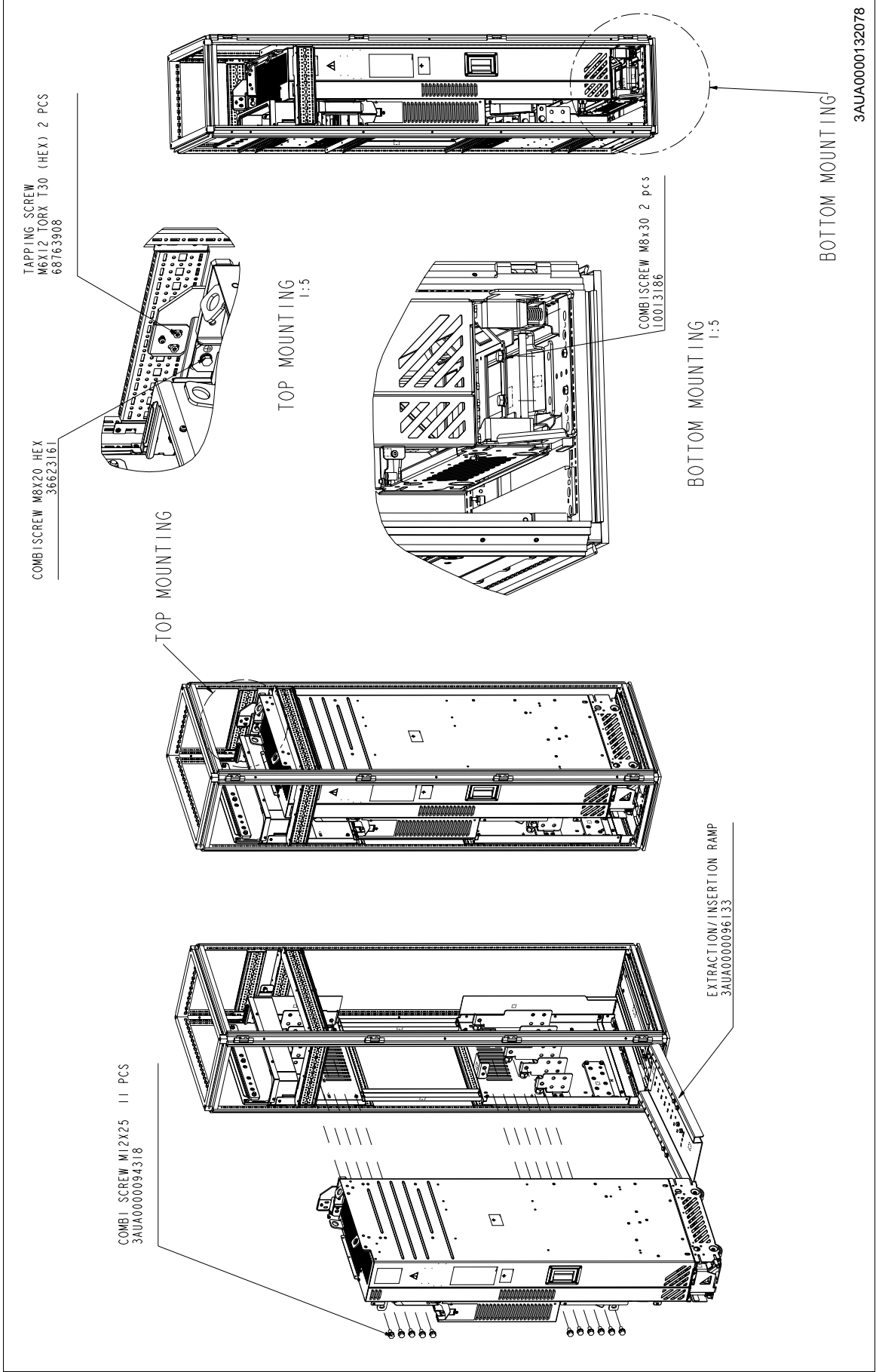
4. Attach the drive module lifting lugs to the cabinet frame with chains.
5. Push the drive module carefully into to the cabinet preferably with the help from another person.
6. Attach the grounding busbar that has been previously attached to the input cabling panel to the drive module. **Note:** The design of the grounding busbar can be different from what is shown in the figure.



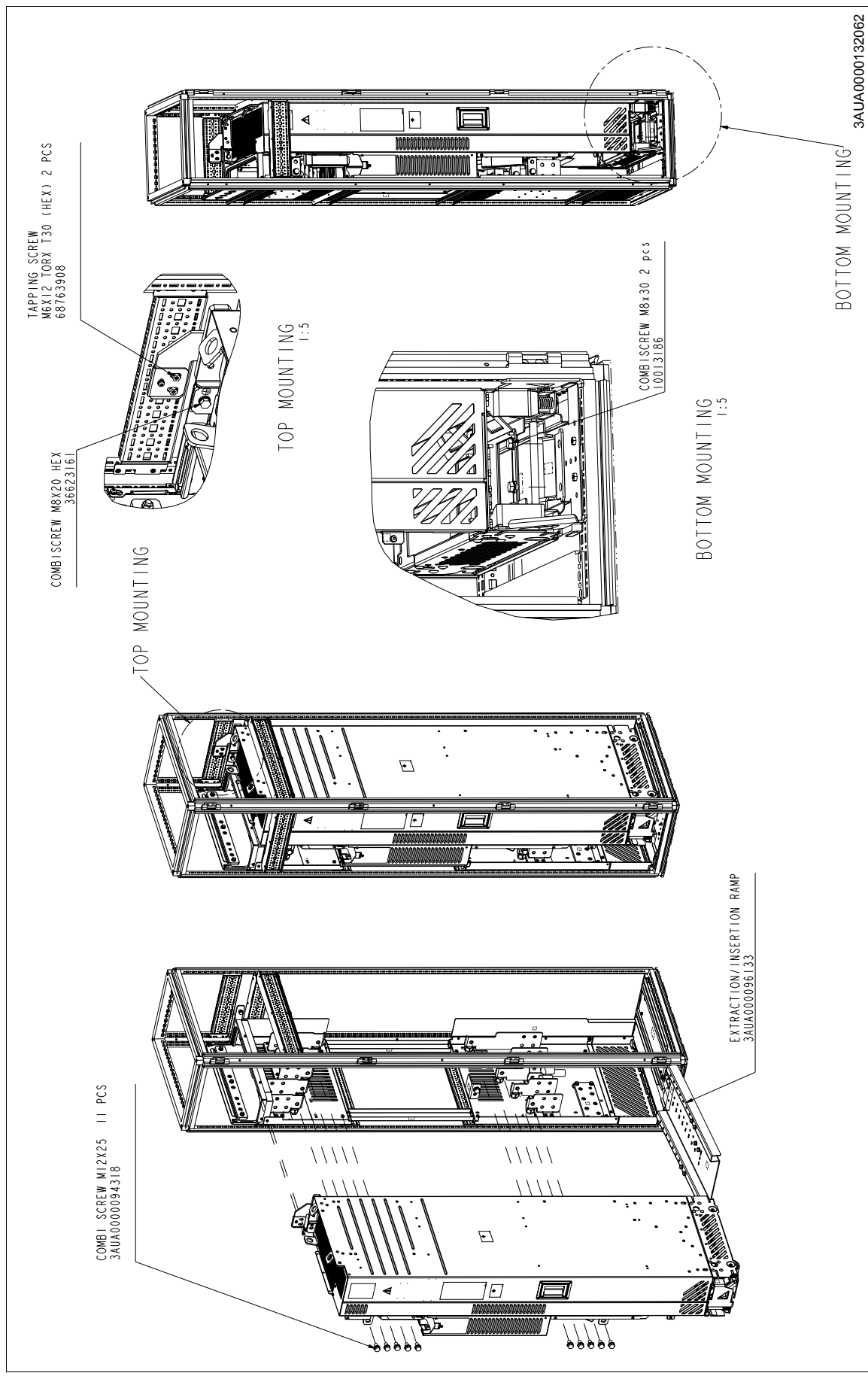
7. Connect the busbars of the drive module to the busbars of the cabling panels (M12 combi screw, 70 N·m [52 lbf·ft]).
8. Attach the drive module to the cabinet from top and bottom, see page 142 (frame R10) or page 145 (frame R11). **Note:** The top fastening bracket grounds the drive module to the cabinet frame.
9. Attach the cabinet roof on the spacers and the side panels, see page 144.
10. Remove the filter mats from the air filters according to Rittal's instructions. Install the filters to the cabinet door, see page 144.
11. Drive modules with an external control unit: Put back the removed front covers of the drive module on the power cable sections, and connect the control cables (see section [Connecting the control cables to the terminals of the control unit](#) on page 110). Drive modules with an internal control unit (option +P905): Connect the control cables to the control unit (see section [Connecting the control cables to the internal control unit \(options +P905 and +OB051\)](#) on page 117), connect the control panel cable and put back the removed front covers of the drive module.



Assembly drawing of installing the drive module to the cabinet (frame R10)

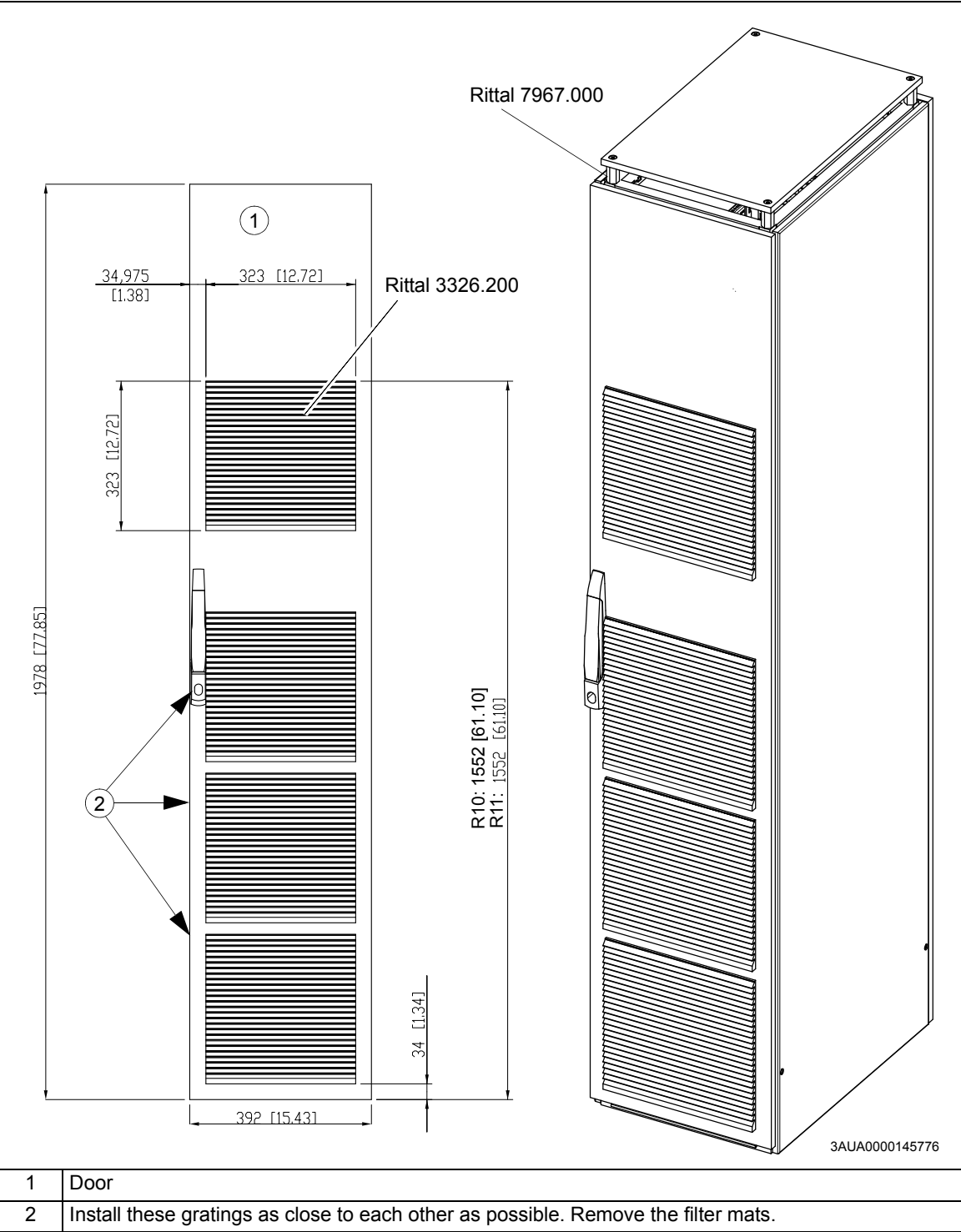


Assembly drawing of installing the drive module to the cabinet (frame R11)



Assembly drawing of installing the roof and door

This drawing shows a layout tested by ABB. If you use ABB air filters, place them vertically in the positions shown in the drawing on page 130.



■ Removing the protective covering from the drive module air outlet



WARNING! Remove the protective covering from the top of the drive module after the installation. If the covering is not removed, the cooling air cannot flow freely through the module and the drive will run to overtemperature.



Miscellaneous

■ Installations with input and motor cables of size $4 \times 240 \text{ mm}^2$ per phase

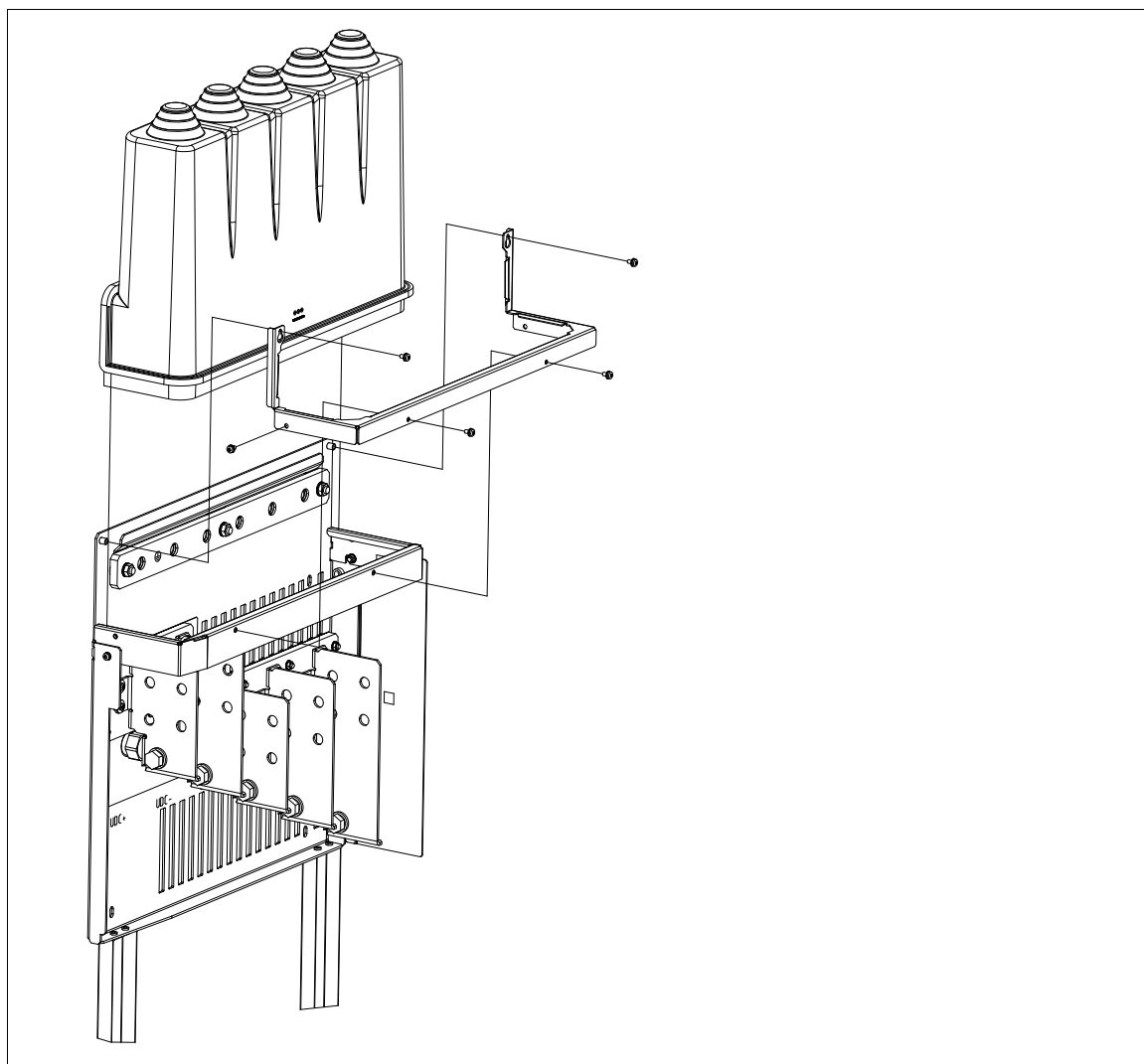
If resistor cables are to be connected, the lower side plate of the output cabling panel must be removed and the resistor cables lead from side to the terminals of the output cabling panel.



■ Installing the rubber grommet

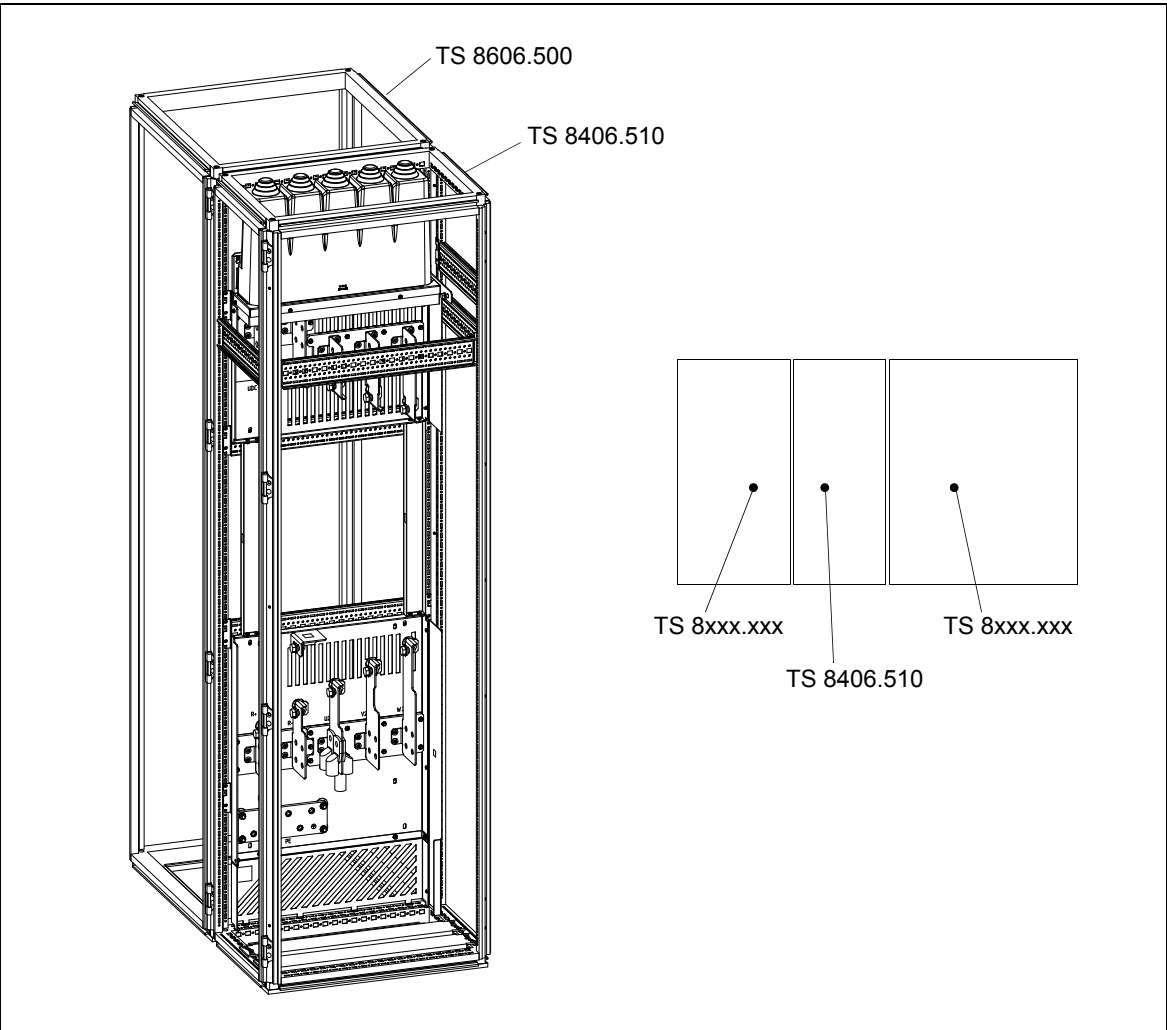
To get IP20 degree of protection for the drive module, install the input power cables through the rubber grommet. Install the grommet as follows:

1. Cut adequate holes into the grommet for the input power cables.
2. Put the cables through the grommet.
3. Attach the grommet to the input cabling panel with five M4x8 Torx T20 screws as shown below.



■ Modular design of Rittal TS8 cabinets

The design of the drive module with optional cabling panels (+H381) is optimized to the Rittal TS 8406.510 cabinet. To make space for the additional components, connect two or more TS8 cabinets together. An example is shown below.



Rittal code	Qty (pcs)	Description
TS 8406.510	1	Enclosure without mounting plate. Includes frame, door, side and back panels.
TS 8606.500	1	Enclosure without mounting plate. Includes frame, door, side and back panels.
8800.410 – One set	6	Baying clamp for connecting the cabinet frames
8800.430 – One set	4	Angular baying bracket for connecting the cabinet frames
8800.860 – One set	1	Baying cover top if two cabinet roofs are connected



9

Installation checklist

Contents of this chapter

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 ...	<input checked="" type="checkbox"/>
Cabinet construction	
The drive module is fastened properly to the cabinet. (See chapters Guidelines for planning the cabinet installation , Installation example of the standard drive module configuration and Installation example with full cabling panels (option +H381))	<input type="checkbox"/>
Mechanical joints are tightened and not broken.	<input type="checkbox"/>
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.	<input type="checkbox"/>
Degree of protection (IPxx)	<input type="checkbox"/>

Check that ...	<input checked="" type="checkbox"/>
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.	<input type="checkbox"/>
Optional modules and terminals are labelled correctly.	<input type="checkbox"/>
The placement of optional modules and other equipment inside the cabinet and on the cabinet door is correct.	<input type="checkbox"/>
The mounting of optional modules and other equipment is correct.	<input type="checkbox"/>
Internal cabling of the cabinet assembly	
Main circuit: <ul style="list-style-type: none"> • AC supply input cabling is ok. • AC output cabling is ok. • Supply for brake resistor (if used) is ok. 	<input type="checkbox"/>
Cable types, cross-sections, colours and optional markings are correct.	<input type="checkbox"/>
Cabling is not susceptible to interference. Check the twisting of cables and cable routes.	<input type="checkbox"/>
Connection of cables to devices, terminal blocks and drive module circuit boards: <ul style="list-style-type: none"> • Cables are connected to terminals tight enough by pulling the cable. • 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 properly. 	<input type="checkbox"/>
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.).	<input type="checkbox"/>
The type, markings, insulation plates and cross connections of terminal blocks are correct.	<input type="checkbox"/>
Grounding and protection	
The grounding colors, cross-section and grounding points of modules and other equipment match the circuit diagrams. No long routes for pigtails.	<input type="checkbox"/>
Connections of PE cables and busbars are tight enough. Pull the cable to test that it does not loosen. No long routes for pigtails.	<input type="checkbox"/>
Doors equipped with electrical equipment are grounded. No long grounding routes. From EMC standpoint best result is achieved with a flat copper braid.	<input type="checkbox"/>
Fans that can be touched are shrouded.	<input type="checkbox"/>
Live parts inside the doors are protected against direct contact to at least IP2x.	<input type="checkbox"/>
Labels	
The type designation labels and warning and instruction stickers are made according to the local regulations and placed correctly.	<input type="checkbox"/>
Switches and doors	
Mechanical switches, main disconnecting switch and cabinet doors function properly.	<input type="checkbox"/>

Check that ...	<input checked="" type="checkbox"/>
Installation of the cabinet	
The drive cabinet has been attached to floor and also from top to the wall or roof.	<input type="checkbox"/>
The ambient operating conditions agree with the specifications given in chapter <i>Technical data</i> .	<input type="checkbox"/>
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).	<input type="checkbox"/>
<u>If the drive module has been stored over one year:</u> The electrolytic DC capacitors in the DC link of the drive have been reformed. See page 166.	<input type="checkbox"/>
There is an adequately sized protective ground conductor between the drive and the switchboard.	<input type="checkbox"/>
There is an adequately sized protective ground conductor between the motor and the drive.	<input type="checkbox"/>
All protective ground conductors have been connected to the appropriate terminals and the terminals have been tightened. (Pull the conductors to check.)	<input type="checkbox"/>
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.	<input type="checkbox"/>
The supply voltage matches the nominal input voltage of the drive. Check the type designation label.	<input type="checkbox"/>
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.)	<input type="checkbox"/>
Appropriate AC fuses and a main disconnecter have been installed.	<input type="checkbox"/>
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.)	<input type="checkbox"/>
The brake resistor (if present) has been connected to the appropriate terminals, and the terminals have been tightened. (Pull the conductors to check.)	<input type="checkbox"/>
The motor cable (and brake resistor cable, if present) has been routed away from other cables.	<input type="checkbox"/>
No power factor compensation capacitors have been connected to the motor cable.	<input type="checkbox"/>
The control cables (if any) have been connected to the appropriate terminals, and the terminals have been tightened. (Pull the conductors to check.)	<input type="checkbox"/>
<u>If a drive bypass connection is used:</u> The direct-on-line contactor of the motor and the drive output contactor are either mechanically or electrically interlocked, ie, cannot be closed simultaneously.	<input type="checkbox"/>
There are no tools, foreign objects or dust from drilling inside the drive module.	<input type="checkbox"/>
All shrouds and cover of the motor connection box are in place. Cabinet doors have been closed.	<input type="checkbox"/>
The motor and the driven equipment are ready for start.	<input type="checkbox"/>

10

Start-up

Contents of this chapter

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

Start-up procedure

1. Only qualified electricians are allowed to start-up the drive.
2. Make sure that the installation of the drive module has been checked according to the checklist in chapter [Installation checklist](#), and that the motor and driven equipment are ready for start.
3. Perform the start-up tasks instructed by the cabinet-installer of the drive module.
4. Switch the power on, setup the drive control program, and perform the first start of the drive and motor. See the appropriate start-up guide or firmware manual. If you need more information on the use of the control panel, see *ACS-AP-x Assistant control panels user's manual* (3AUA0000085685 [English]).
 - For drives with resistor braking (option +D151), see also section *Start-up* on page 236.
 - For option +N7502, see also *ACS880 drives with SynRM motors (option +N7502) supplement* (3AUA0000145506 [English]).
 - For drives with ABB du/dt filter, check that bit 13 of parameter **95.20 HW options word 1** is switched on.
 - For drives with ABB sine filter, check that parameter **95.15 Special HW settings** is set to **ABB sine filter**. For other sine filters, see *Sine filter hardware manual* (3AXD50000016814 [English]).
 - For drives with ABB motors in explosive atmospheres, see also *ACS880 drives with ABB motors in explosive atmospheres* (3AXD50000019585 [English]).



5. For drive modules in which the Safe torque off function is in use: Test and validate the operation of the Safe torque off function. See section [Start-up including acceptance test](#) on page [228](#).
6. For drive modules with an FSO-12 safety functions module (option +Q973): Test and validate the operation of the safety functions. See the delivery-specific circuit diagrams and *FSO-12 safety functions module user's manual* (3AXD50000015612 [English]).



11

Fault tracing

Contents of this chapter

This chapter describes the fault tracing possibilities of the drive.

LEDs with options +J410

Where	LED	Color	When the LED is lit
Control panel mounting platform	POWER	Green	Control unit is powered and +15 V is supplied to the control panel.
	FAULT	Red	Drive in fault state.

Warning and fault messages

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

12

Maintenance

Contents of this chapter

This chapter contains maintenance instructions of the drive module.

Maintenance intervals

If installed in an appropriate environment, the drive requires very little maintenance. The table below lists the routine maintenance intervals recommended by ABB. The recommended maintenance intervals and component replacements are based on specified operational and environmental conditions.

Note: Long-term operation near the specified maximum ratings or environmental conditions may require shorter maintenance intervals for certain components.

The tables below contain user tasks. For tasks to be performed by ABB and more details on the maintenance, consult your local ABB Service representative. On the Internet, go to www.abb.com/searchchannels

■ Descriptions of symbols

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

■ Recommended annual maintenance actions by the user

ABB recommends these annual inspections to ensure the highest reliability and optimum performance.

Action	Target
I	IP22 and IP42 air inlet and outlet meshes on the cabinet doors

Action	Target
R	IP54 air filters on the cabinet doors
P	Quality of supply voltage
I	Spare parts
P	Capacitor reforming, spare modules and spare capacitors
I	Tightness of terminals
I	Dustiness, corrosion or temperature
I	Heat sink cleaning

■ Recommended maintenance intervals after start-up

Component	Years from start-up							
	3	6	9	12	15	18	20	21
Cooling								
Main cooling fan of drive module			R			R		
Circuit board compartment cooling fans of drive module		R		R		R		
Aging								
Battery for control panel and ZCU control unit			R			R		

4FPS10000239703

Cabinet

■ Cleaning the interior of the cabinet



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



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

1. Stop the drive and do the steps in section [Precautions before electrical work](#) on page [18](#) before you start the work.
2. Make sure that the drive is disconnected from the power line and all other precautions described under [Grounding](#) on page [20](#) have been taken into consideration.
3. When necessary, clean the interior of the cabinet with a soft brush and a vacuum cleaner.

Heatsink

The module heatsink fins pick up dust from the cooling air. The drive runs into overtemperature warnings and faults if the heatsink is not clean.

■ Cleaning the interior of the heatsink

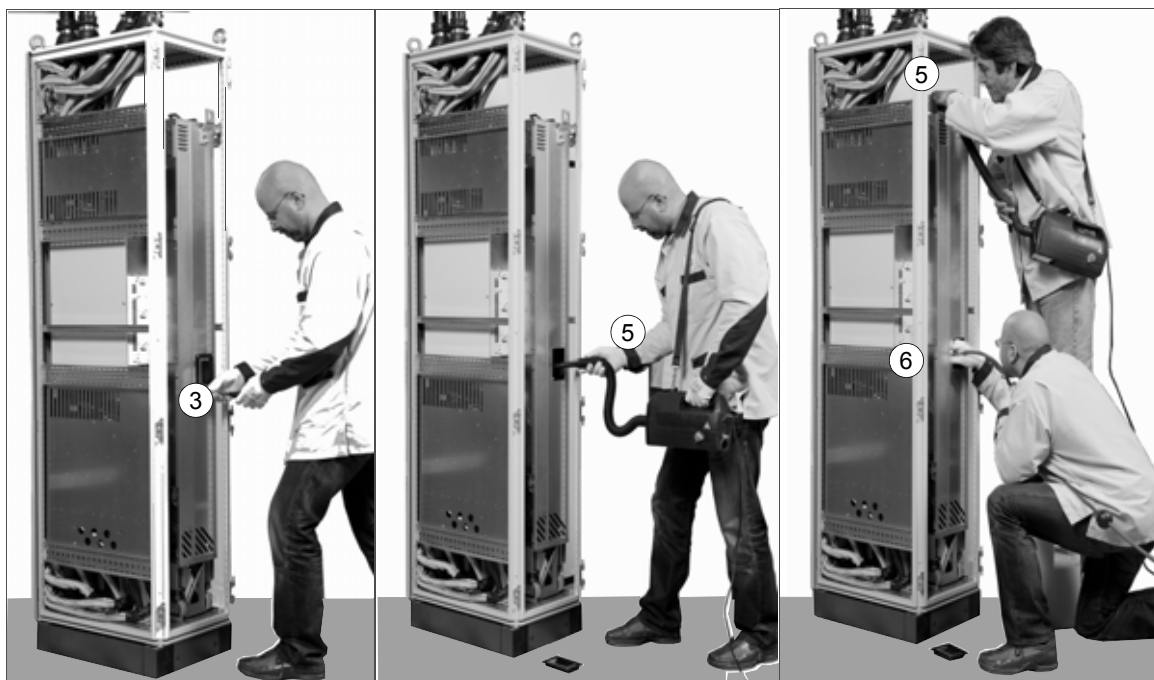


WARNING! Obey the safety instructions in chapter [Safety instructions](#). If you ignore them, injury or death, or damage to the equipment can occur.



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

1. Stop the drive and do the steps in section [Precautions before electrical work](#) on page [18](#) before you start the work.
2. Make sure that the drive is disconnected from the power line and all other precautions described under [Grounding](#) on page [20](#) have been taken into consideration.
3. Undo the fastening screws of the handle plate of the drive module.
4. Remove the handle plate.
5. Vacuum the interior of the heatsink from the opening.
6. Blow clean compressed air (not humid or oily) upwards from the opening and, at the same time, vacuum from the top of the drive module.



Fans

The actual lifespan depends on the running time of the fan, ambient temperature and dust concentration. See the firmware manual for the actual signal which indicates the running time of the cooling fan. For resetting the running time signal after a fan replacement, please contact ABB.

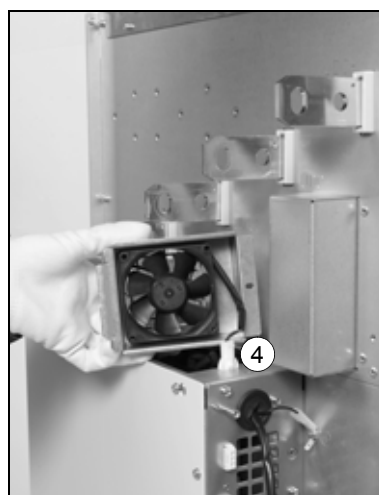
Replacement fans are available from ABB. Do not use other than ABB specified spare parts.

■ Replacing the circuit board compartment cooling fan



WARNING! Obey the safety 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 [Precautions before electrical work](#) on page [18](#) before you start the work.
2. Remove the drive module out of the cabinet. See section [Replacing the standard drive module](#) on page [162](#), or for drive modules with option +H381, see section [Replacing the drive module with option +H381](#) on page [164](#).
3. Undo the fastening screw of the fan enclosure.
4. Unplug the power supply cable of the fan.
5. Install the new fan in reverse order to the above.
6. Reset the counter in group 5 in the primary control program.

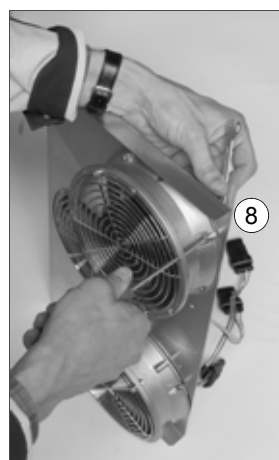


■ Replacing the main cooling fans



WARNING! Obey the safety 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 [Precautions before electrical work](#) on page [18](#) before you start the work.
2. Remove the drive module out of the cabinet. See section [Replacing the standard drive module](#) on page [162](#), or for drive modules with option +H381, see section [Replacing the drive module with option +H381](#) on page [164](#).
3. Open the support legs of the pedestal.
4. Undo the two screws that fasten the fan assembly plate.
5. Tilt the fan assembly plate down.
6. Disconnect the power supply wires of the fans.
7. Remove the fan assembly from the drive module.
8. Undo the fastening screws of the fan(s) and remove the fan(s) from the assembly plate.
9. Install the new fan(s) in reverse order to the above.
10. Reset the counter in group 5 in the primary control program.

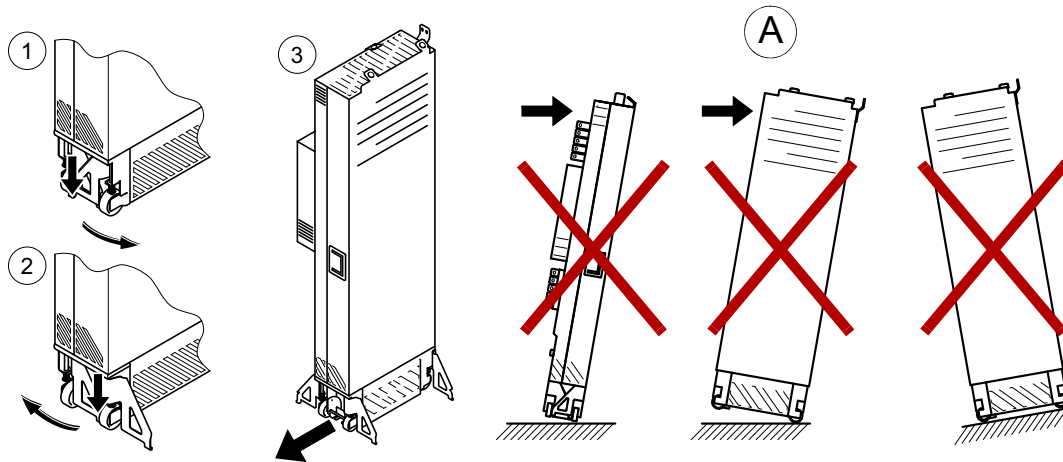


Replacing the standard drive module

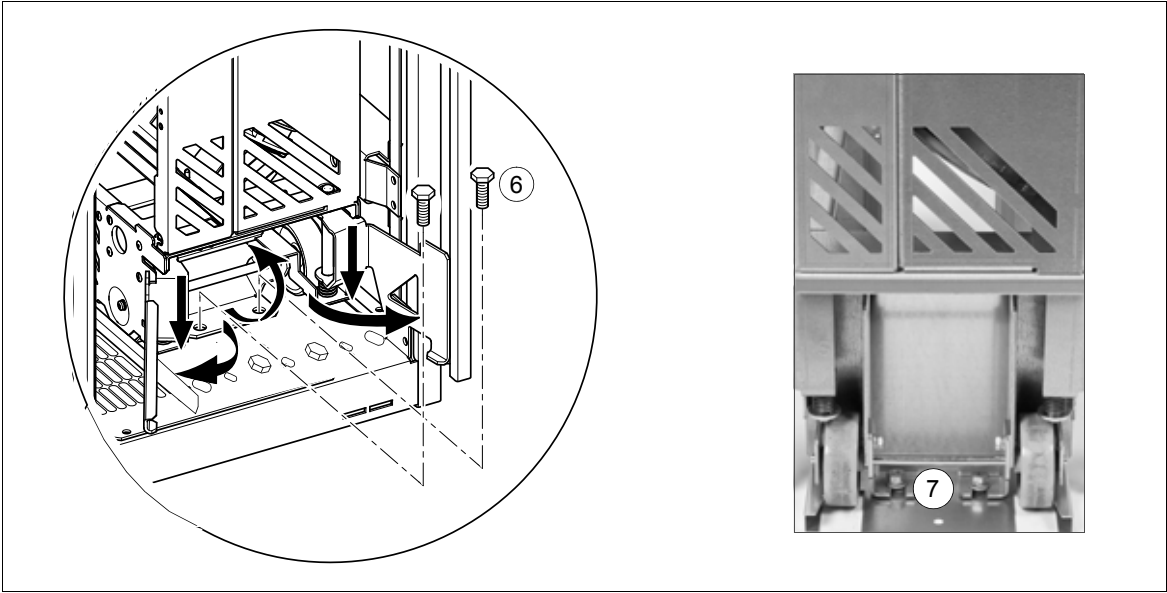


WARNING! Obey the safety instructions in chapter [Safety instructions](#). If you ignore them, injury or death, or damage to the equipment can occur.

- Handle the drive module carefully:
 - Use safety shoes with a metal toe cap to prevent foot injury.
 - Lift the drive module only by the lifting lugs.
 - Make sure that the module does not topple over when you move it on the floor: Open the support legs by pressing each leg a little down (1, 2) and turning it aside. Whenever possible secure the module also with chains.
 - Do not tilt the drive module (A). It is **heavy** and its **center of gravity is high**. The module overturns from a sideways tilt of 5 degrees. Do not leave the module unattended on a sloping floor.



1. Stop the drive and do the steps in section [Precautions before electrical work](#) on page [18](#) before you start the work.
2. Make sure that all other precautions described under [Grounding](#) on page [20](#) have been taken into consideration.
3. Remove the clear plastic shrouds on the power cables and parts in front of the drive module (if present).
4. Disconnect the power cables.
5. Disconnect the power supply, BGDR and fiber optic cables from the drive module.
6. Disconnect the power supply cable and the fiber optic cables from the external control unit and coil them on the top of the drive module.
7. Remove the screws that attach the drive module to the cabinet at the top and behind the front support legs.
8. Attach the extraction ramp to the cabinet base with two screws.
9. To prevent the drive module from falling, attach its top lifting lugs with chains with chains to the cabinet frame.
10. Pull the drive module carefully out of the cabinet preferably with help from another person.
11. Install the new module in reverse order to the above.

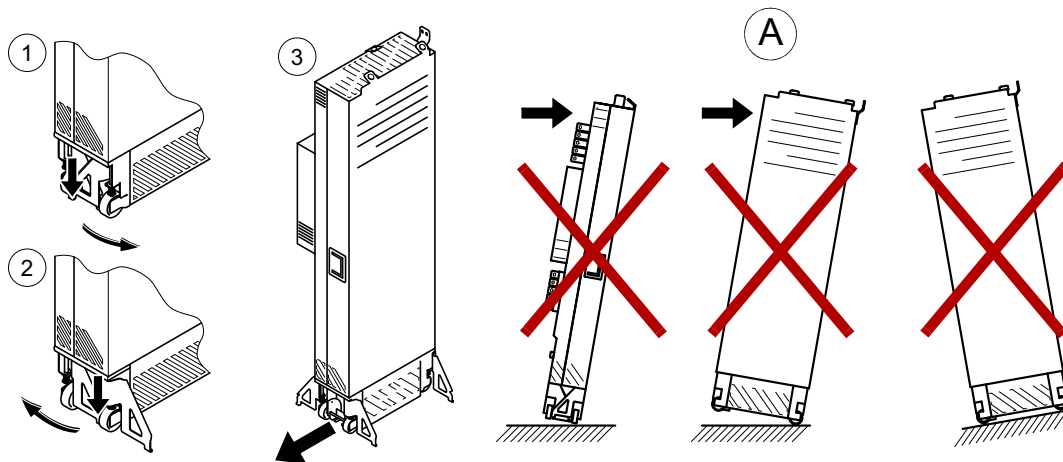


Replacing the drive module with option +H381



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

- Handle the drive module carefully:
 - Use safety shoes with a metal toe cap to prevent foot injury.
 - Lift the drive module only by the lifting lugs.
 - Make sure that the module does not topple over when you move it on the floor: Open the support legs by pressing each leg a little down (1, 2) and turning it aside. Whenever possible secure the module also with chains.
 - Do not tilt the drive module (A). It is **heavy** and its **center of gravity is high**. The module overturns from a sideways tilt of 5 degrees. Do not leave the module unattended on a sloping floor.



1. Stop the drive and do the steps in section [Precautions before electrical work](#) on page [18](#) before you start the work.
2. Make sure that all other precautions described under [Grounding](#) on page [20](#) have been taken into consideration.
3. Remove the left-hand side upper and lower front covers of the drive module by undoing the fastening screws. M4×10 combi screws, 2 N·m.
For drive modules with an internal control unit (option +P905) and control panel (option +J414): Remove the control panel and the control panel cable from the internal control unit.
4. Disconnect the drive module busbars from the input cabling panel. Combi screw M12, 70 N·m (52 lbf·ft).
5. Disconnect the drive module busbars from the output cabling panel. Combi screw M12, 70 N·m (52 lbf·ft).
6. Undo the screws that fasten the drive module to the cabinet at the top (a) and behind the front support legs (b).
7. Remove the front air baffle.
8. Attach the extraction ramp to the cabinet base with two screws.

9. Disconnect the power supply cable and the fiber optic cables from the external control unit and coil them on the top of the drive module.
For drive modules with an internal control unit (option +P905): Detach the control unit from the drive module by undoing the fastening screws below the optional modules and turn the control unit and the cables aside. (Alternatively remove the clamp plate, and disconnect the cables from the control unit.)
10. To prevent the drive module from falling, attach its top lifting lugs with chains with chains to the cabinet frame.
11. Pull the drive module carefully out of the cabinet preferably with help from another person.
12. Install the new module in reverse order to the above.



Capacitors

The drive intermediate circuit employs several electrolytic capacitors. Their lifespan depends on the operating time of the drive, loading and ambient temperature. The lifespan of the capacitor can be prolonged by lowering the ambient temperature.

It is not possible to predict a capacitor failure. The capacitor failure is usually followed by damage to the unit and an input cable fuse failure, or a fault trip. Contact ABB if a capacitor failure is suspected. Replacements are available from ABB. Do not use other than ABB specified spare parts.

■ Reforming the capacitors

If the drive module has been stored for a year or more, reform the capacitors. See page [40](#) for information on finding out the manufacturing date. For the reforming instructions, see *Converter modules with electrolytic DC capacitors in the DC link, capacitor reforming instructions* (3BFE64059629 [English]).

Replacing the control panel battery

The battery is housed on the rear of the control panel. Replace it with a new CR 2032 battery. Dispose the old battery according to local disposal rules or applicable laws.

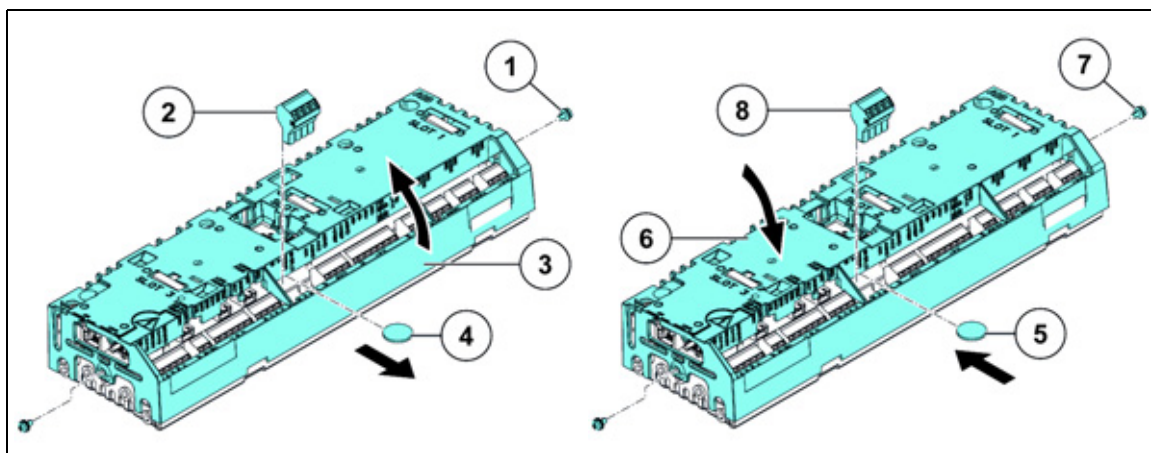


Replacing the control unit battery

Stop the drive and do the steps in section *Precautions before electrical work* on page 18 before you start the work.

To replace the control unit battery:

1. Remove the M4x8 (T20) screws at the ends of the control unit.
2. To see the battery, remove the XD2D terminal block.
3. Carefully lift the edge of the control unit cover on the side with the I/O terminal blocks.
4. Carefully pull the battery out of the battery holder.
5. Carefully put a new CR2032 battery into the battery holder.
6. Close the control unit cover.
7. Tighten the M4x8 (T20) screws.
8. Install the XD2D terminal block.



Memory unit

When a drive module is replaced, the parameter settings can be retained by transferring the memory unit from the defective drive module to the new module. The memory unit is located in the control unit, see page 38.

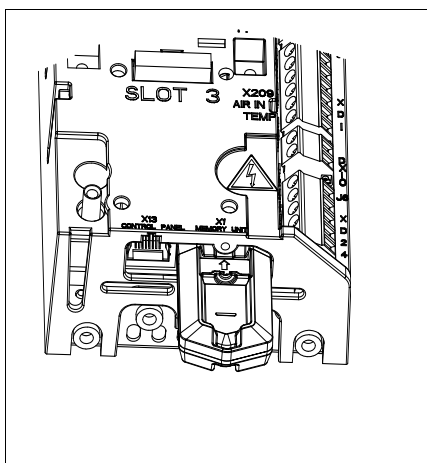


WARNING! Do not remove or insert the memory unit when the drive module is powered.

After power-up, the drive scans the memory unit. If a different control program or different parameter settings are detected, they are copied to the drive. This can take several minutes.

To remove the memory unit:

1. Remove the fastening screw.
2. Pull the memory unit out.



13

Ordering information

Contents of this chapter

This chapter gives ordering information on additional components available from ABB for the drive module installation.

Notes:

- This chapter only lists the installation accessories available from ABB. All other parts must be sourced from a third party by the system integrator. For a listing, refer to the kit-specific installation instructions available at <https://www151.abb.com/spaces/lvacdrivesengineeringsupport/content>. For access, contact your local ABB representative.
- See the installation examples for Rittal cabinet tested by ABB in section *Installing the roof and door (Rittal parts)* on page 129 and in section *Assembly drawing of installing the roof and door* on page 144, or dimension your own cabinet.

Output (du/dt) filters

See section *du/dt filters* on page 239.

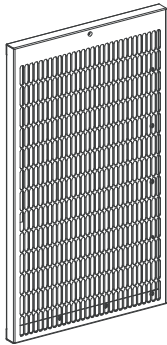
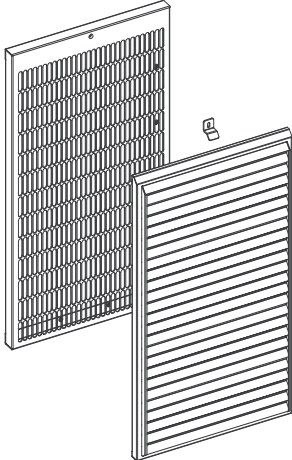
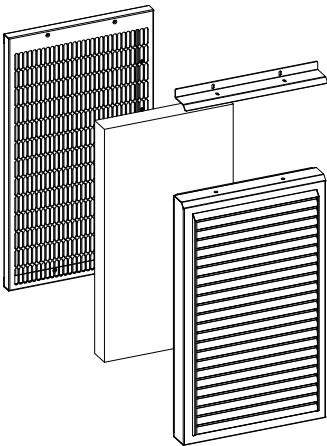
Sine filters

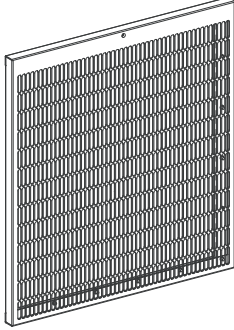
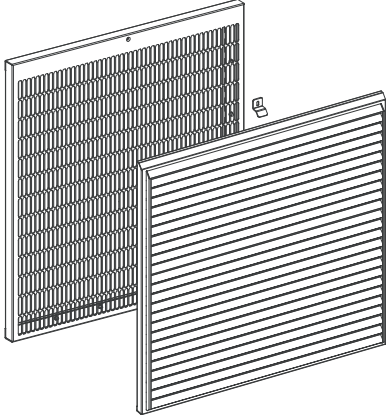
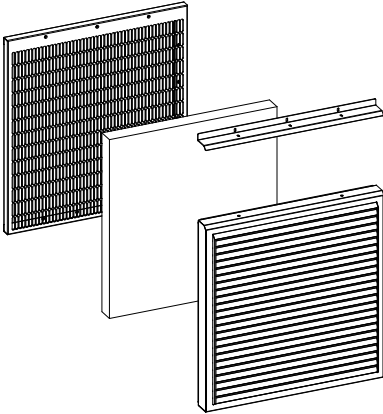
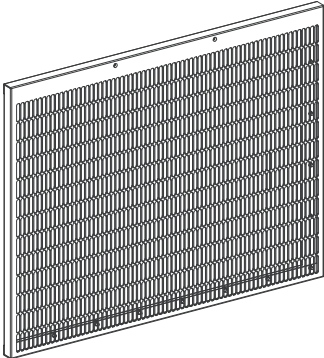
See section *Sine filters* on page 240.

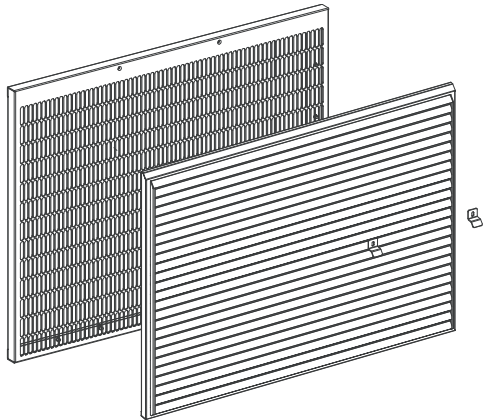
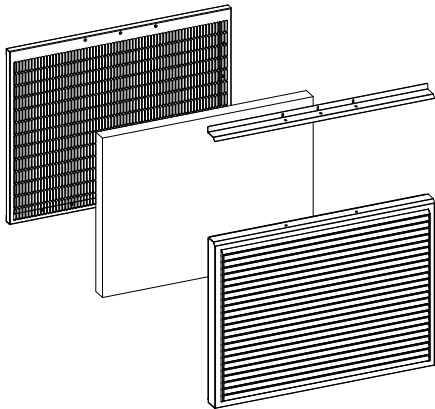
Cabinet ventilation

■ Air inlet kits

Mounting screws are included.

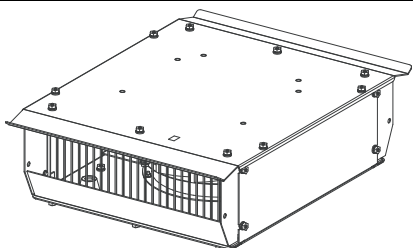
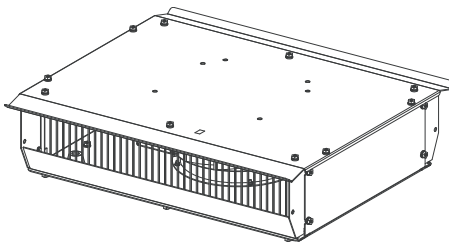
Enclosure width / Degree of protection	Kit code	Ordering code	Illustration
400 mm / IP20	A-4-X-021	3AUA0000117002	 <p>Instruction code: 3AUA0000116879</p>
400 mm / IP42	A-4-X-024	3AUA0000117007	 <p>Instruction code: 3AUA0000116873</p>
400 mm / IP54	A-4-X-027	3AXD50000009184	 <p>Instruction code: 3AXD50000009989</p>

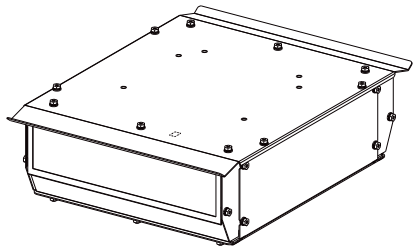
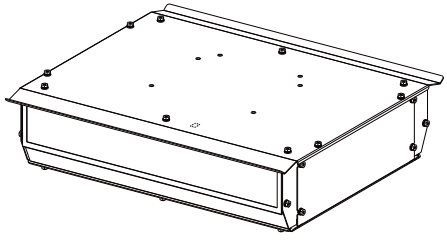
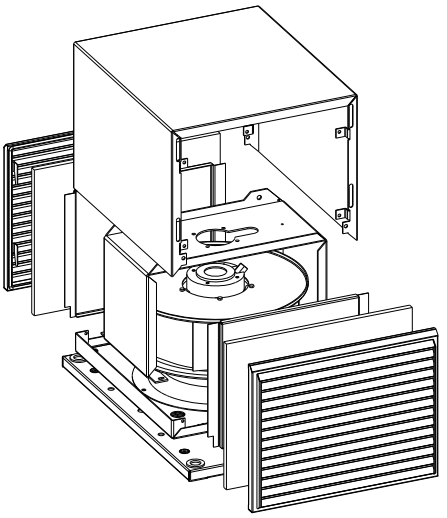
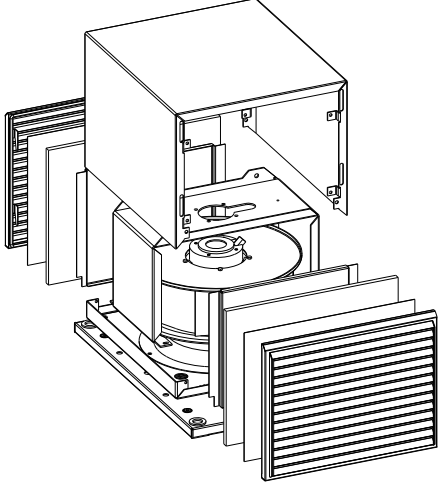
Enclosure width / Degree of protection	Kit code	Ordering code	Illustration
600 mm / IP20	A-6-X-022	3AUA0000117003	 <p>Instruction code: 3AUA0000116880</p>
600 mm / IP42	A-6-X-025	3AUA0000117008	 <p>Instruction code: 3AUA0000116874</p>
600 mm / IP54	A-6-X-028	3AXD50000009185	 <p>Instruction code: 3AXD50000009990</p>
800 mm / IP20	A-8-X-023	3AUA0000117005	 <p>Instruction code: 3AUA0000116887</p>

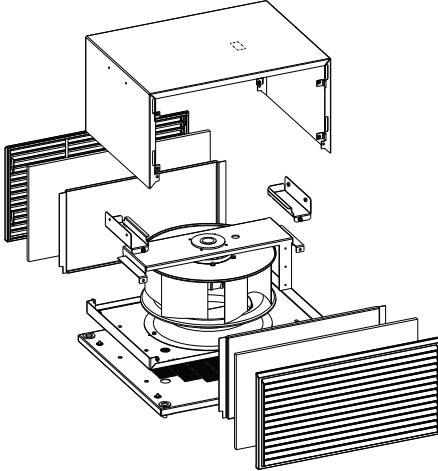
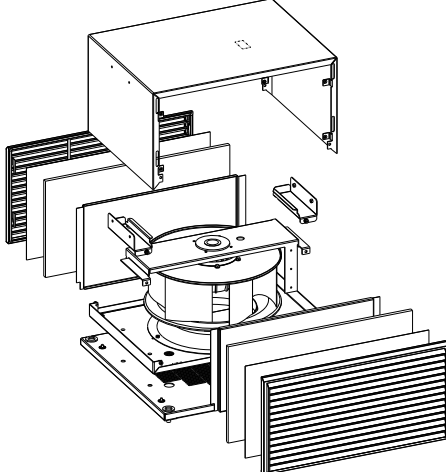
Enclosure width / Degree of protection	Kit code	Ordering code	Illustration
800 mm / IP42	A-8-X-026	3AUA0000117009	 <p>Instruction code: 3AUA0000116875</p>
800 mm / IP54	A-8-X-029	3AXD50000009186	 <p>Instruction code: 3AXD50000010001</p>

■ Air outlet kits

Note: The fan is to be ordered separately.

Enclosure width / Degree of protection	Qty	Kit code	Ordering code	Illustration
400 mm / IP20	1	A-4-X-062	3AUA0000125201	 <p>Instruction code: 3AXD50000001982 Note: Fan to be ordered separately</p>
800 mm / IP20	2			
600 mm / IP20	1	A-6-X-063	3AUA0000125202	 <p>Instruction code: 3AXD50000001980 Note: Fan to be ordered separately</p>

Enclosure width / Degree of protection	Qty	Kit code	Ordering code	Illustration
400 mm / IP42	1	A-4-X-060	3AUA0000114967	 <p>Instruction code: 3AUA0000115290 Note: Fan to be ordered separately</p>
800 mm / IP42	2			
600 mm / IP42	1	A-6-X-061	3AUA0000114971	 <p>Instruction code: 3AUA0000115152 Note: Fan to be ordered separately</p>
400 mm / IP54 (IEC)	1	A-4-X-064	3AXD50000009187	 <p>Instruction code: 3AXD50000010284 Note: Fan to be ordered separately</p>
800 mm / IP54 (IEC)	2			
400 mm / IP54 (UL)	1	A-4-X-067	3AXD50000010362	 <p>Instruction code: 3AXD50000010284 Note: Fan to be ordered separately</p>
800 mm / IP54 (UL)	2			

Enclosure width / Degree of protection	Qty	Kit code	Ordering code	Illustration
600 mm / IP54 (IEC)	1	A-6-X-065	3AXD50000009189	 <p>Instruction code: 3AXD50000010004 Note: Fan to be ordered separately</p>
600 mm / IP54 (UL)	1	A-6-X-066	3AXD50000010327	 <p>Instruction code: 3AXD50000010004 Note: Fan to be ordered separately</p>

Cooling fans

One or two cooling fans are to be installed inside the air outlet compartment to ensure sufficient cooling of the cabinet.

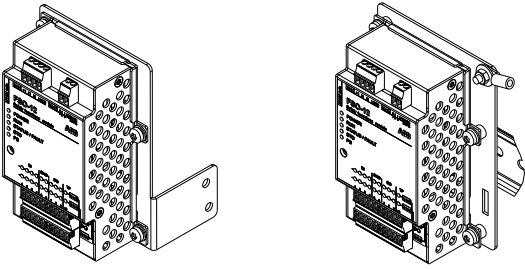
Enclosure width / Degree of protection	Component		Qty	Ordering code
	Name	Data		
IEC				
400 mm, 600 mm / IP20, IP42	Fan	R3G225-RD05-03 (230 V)	1	3AXD50000000592
	Connector	SPB2,5/7 (2.5 mm2, 12AWG)	1	3AXD50000000723
	Connector	SC 2,5-RZ/7 (2.5 mm2, 12AWG)	1	3AXD50000000724
400 mm / IP54	Fan	CRBB/4-315/112D ML	1	3AXD50000006934
	Capacitor	MSB MKP 6/603/E1679	1	3AXD50000006959
	Connector	SPB2,5/7 (2.5 mm2, 12AWG)	1	3AXD50000000723
	Connector	SC 2,5-RZ/7 (2.5 mm2, 12AWG)	1	3AXD50000000724

Enclosure width / Degree of protection	Component		Qty	Ordering code
	Name	Data		
600 mm / IP54	Fan	CRBB/4-400/188	1	3AXD50000006111
	Capacitor	MSB MKP 12/603/E1679	1	3AXD50000006885
	Connector	SPB2,5/7 (2.5 mm2, 12AWG)	1	3AXD50000000723
	Connector	SC 2,5-RZ/7 (2.5 mm2, 12AWG)	1	3AXD50000000724
800 mm / IP20, IP42	Fan	R3G225-RD05-03 (230 V)	2	3AXD50000000592
	Connector	SPB2,5/7 (2.5 mm2, 12AWG)	2	3AXD50000000723
	Connector	SC 2,5-RZ/7 (2.5 mm2, 12AWG)	2	3AXD50000000724
800 mm / IP54	Fan	CRBB/4-315/112D ML	2	3AXD50000006934
	Capacitor	MSB MKP 6/603/E1679	2	3AXD50000006959
	Connector	SPB2,5/7 (2.5 mm2, 12AWG)	2	3AXD50000000723
	Connector	SC 2,5-RZ/7 (2.5 mm2, 12AWG)	2	3AXD50000000724
UL				
400 mm, 600 mm / IP20, IP42	Fan	R2E225-RA92-17 (230 V)	1	3AXD50000000514
	Capacitor	MSB MKP 3,5/603/E1679	1	3AXD50000000882
	Connector	SPB2,5/7 (2.5 mm2, 12AWG)	1	3AXD50000000723
	Connector	SC 2,5-RZ/7 (2.5 mm2, 12AWG)	1	3AXD50000000724
400 mm / IP54	Fan	CRBB/4-315/112D ML	1	3AXD50000006934
	Capacitor	MSB MKP 6/603/E1679	1	3AXD50000006959
	Connector	SPB2,5/7 (2.5 mm2, 12AWG)	1	3AXD50000000723
	Connector	SC 2,5-RZ/7 (2.5 mm2, 12AWG)	1	3AXD50000000724
600 mm / IP54	Fan	CRBB/4-400/188	1	3AXD50000006111
	Capacitor	MSB MKP 12/603/E1679	1	3AXD50000006885
	Connector	SPB2,5/7 (2.5 mm2, 12AWG)	1	3AXD50000000723
	Connector	SC 2,5-RZ/7 (2.5 mm2, 12AWG)	1	3AXD50000000724
800 mm / IP20, IP42	Fan	R2E225-RA92-17 (230 V)	2	3AXD50000000514
	Capacitor	MSB MKP 3,5/603/E1679	2	3AXD50000000882
	Connector	SPB2,5/7 (2.5 mm2, 12AWG)	2	3AXD50000000723
	Connector	SC 2,5-RZ/7 (2.5 mm2, 12AWG)	2	3AXD50000000724
800 mm / IP54	Fan	CRBB/4-315/112D ML	2	3AXD50000006934
	Capacitor	MSB MKP 6/603/E1679	2	3AXD50000006959
	Connector	SPB2,5/7 (2.5 mm2, 12AWG)	2	3AXD50000000723
	Connector	SC 2,5-RZ/7 (2.5 mm2, 12AWG)	2	3AXD50000000724

EMC filter +E202

Order code: 68241561

FSO accessories kit

Kit code	Ordering code	Illustration
A-X-X-279	3AXD50000025495	 <p>Instruction code: 3AXD50000025583</p>

Retrofit accessory kits

Kit	Option code	Ordering code
Common mode filter kit	E208	3AXD50000026145
Full size cable connection terminals for input power cables	H370	3AXD50000019542
Full size cable connection terminals for output power cables	*	3AXD50000019544
For frame R10: Full power cabling panels to be attached to a cabinet (IP20)	H381	3AXD50000019546
For frame R11: Full power cabling panels to be attached to a cabinet (IP20)	H381	3AXD50000019533
Power cable connection terminals on the right-hand side of the drive module	H391	3AXD50000025765
Flat mounting	C173	3AXD50000019535
For frame R10: IP20 shrouds for covering the input and motor cabling area	**	3AXD50000019537
For frame R11: IP20 shrouds for covering the input and motor cabling area	**	3AXD50000019538

* The drive module is delivered with full size cable connection terminals for output power cables as standard. They can be excluded with option +0H371.

** The drive module is delivered with IP20 shrouds for covering the input and motor cabling area as standard. The shrouds can be excluded with option +0B051.

Contents of this chapter

Marine type-approved drives (option +C132)

Ratings

IEC RATINGS											
Drive type ACS880-04-	Frame size	Input current	Output ratings								
			Nominal use					Light-duty use		Heavy-duty use	
		I_{1N}	I_{max}	I_{max_start}	I_N	P_N	S_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
		A	A	A	A	kW	kVA	A	kW	A	kW
$U_N = 400\text{ V}$											
505A-3	R10	505	560	671	505	250	350	485	250	361	200
585A-3	R10	585	730	828	585	315	405	575	315	429	250
650A-3	R10	650	730	954	650	355	450	634	355	477	250
725A-3	R11	725	1020	1100	725	400	502	715	400	566	315
820A-3	R11	820	1020	1100	820	450	568	810	450	625	355
880A-3	R11	880	1100	1100	880	500	610	865	500	725 *	400
$U_N = 500\text{ V}$											

IEC RATINGS											
Drive type ACS880-04-	Frame size	Input current	Output ratings								
			Nominal use					Light-duty use		Heavy-duty use	
		I_{1N}	I_{\max}	I_{\max_start}	I_N	P_N	S_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
		A	A	A	A	kW	kVA	A	kW	A	kW
460A-5	R10	460	560	671	460	315	398	450	315	330	200
503A-5	R10	503	560	671	503	355	436	483	315	361	250
583A-5	R10	583	730	828	583	400	505	573	400	414	250
635A-5	R10	635	730	954	635	450	550	623	450	477	315
715A-5	R11	715	850	1100	715	500	619	705	500	566	400
820A-5	R11	820	1020	1100	820	560	710	807	560	625	450
880A-5	R11	880	1100	1100	880	630	762	857	560	697**	500
$U_N = 690\text{ V}$											
330A-7	R10	330	480	510	330	315	394	320	315	255	250
370A-7	R10	370	520	650	370	355	442	360	355	325	315
430A-7	R10	430	540	720	430	400	514	420	400	360***	355
425A-7	R11	425	520	720	425	400	508	415	400	360	355
470A-7	R11	470	655	830	470	450	562	455	450	415	400
522A-7	R11	522	685	910	522	500	624	505	500	455	450
590A-7	R11	590	800	1010	590	560	705	571	560	505	500
650A-7	R11	650	825	1100	650	630	777	630	630	571***	560
721A-7	R11	721	825	1100	721	710	862	705	630	571***	560

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NEMA RATINGS												
Drive type ACS880-04-	Frame size	Input current	Maximum current		Output ratings							
					App. power	Light-duty use			Heavy-duty use			
		I_{1N}	I_{max}	I_{max_start}		S_N	I_{Ld}	P_{Ld}		I_{Hd}	P_{Hd}	
		A	A	A		kVA	A	kW	hp	A	kW	hp
$U_N = 460\text{ V}$												
503A-5	R10	503	560	671	436	483	315	400	361	250	300	
583A-5	R10	583	730	828	505	573	400	450	414	250	350	
635A-5	R10	635	730	954	550	623	450	500	477	315	400	
715A-5	R11	715	850	1100	619	705	500	600	566	400	450	
820A-5	R11	820	1020	1100	710	807	560	700	625	450	500	
880A-5	R11	880	1100	1100	762	857	560	700	697**	500	600	
$U_N = 600\text{ V}$												
330A-7	R10	330	480	510	394	336	320	350	255	250	250	
370A-7	R10	370	520	650	442	382	360	400	325	300	300	
430A-7	R10	430	540	720	514	424	415	450	360***	350	350	
425A-7	R11	425	520	720	508	415	415	450	360	350	350	
470A-7	R11	470	655	830	562	472	455	500	415	450	450	
522A-7	R11	522	685	910	624	528	505	550	455	450	450	
590A-7	R11	590	800	1010	705	571	571	600	505	500	500	
650A-7	R11	650	825	1100	777	630	630	700	571***	560	600	
721A-7	R11	721	825	1100	862	705	630	700	571***	560	600	

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U_N	Nominal voltage of the drive
I_{1N}	Nominal input current (rms) at 40 °C (104 °F)
S_N	Apparent power (no overload)
I_{max}	Maximum output current. Available for 10 seconds at start, otherwise as long as allowed by drive temperature. 140% ... 200% of I_{Hd} , depending on power rating.

I_{\max_start}	Maximum output current at start. Available for two seconds only at start every seven seconds if start current limit is activated by parameter 30.15 Maximum start current .
I_N	Continuous rms output current. No overload capability at 40 °C (104 °F)
P_N	Typical motor 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 for light-overload use.
I_{Hd}	Continuous rms output current allowing 50% overload for 1 minute every 5 minutes
*	Continuous rms output current allowing 40% overload for 1 minute every 5 minutes
**	Continuous rms output current allowing 45% overload for 1 minute every 5 minutes
***	Continuous rms output current allowing 44% overload for 1 minute every 5 minutes
P_{Hd}	Typical motor power for heavy-duty use.
<p>Note: 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 power ratings apply to most IEC 34 motors at the nominal voltage of the drive.</p> <p>We recommend to select the drive, motor and gear combination for the required motion profile with the DriveSize dimensioning tool available from ABB.</p>	

■ When is derating needed

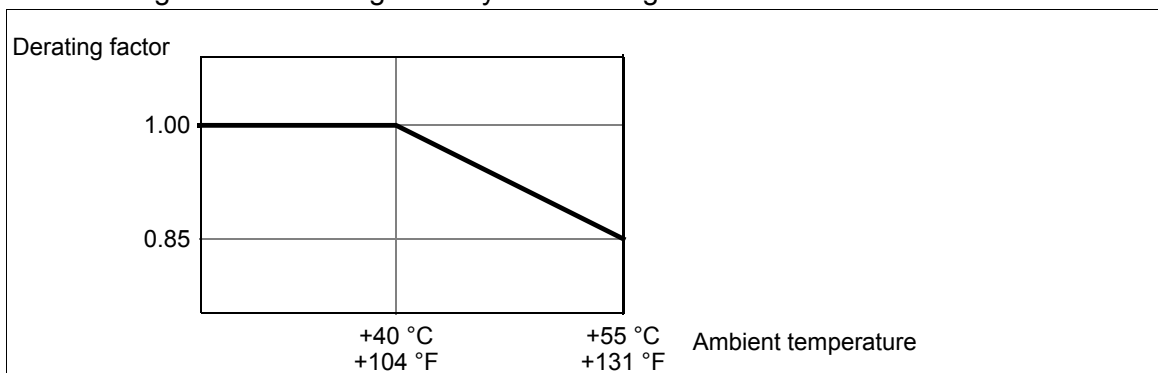
Derate the continuous output current of the drive if

- ambient temperature exceeds +40 °C (+104 °F) or
- drive is installed higher than 1000 m (3280 ft) above sea level
- switching frequency is other than default.

Note: The final derating factor is a multiplication of all applicable derating factors.

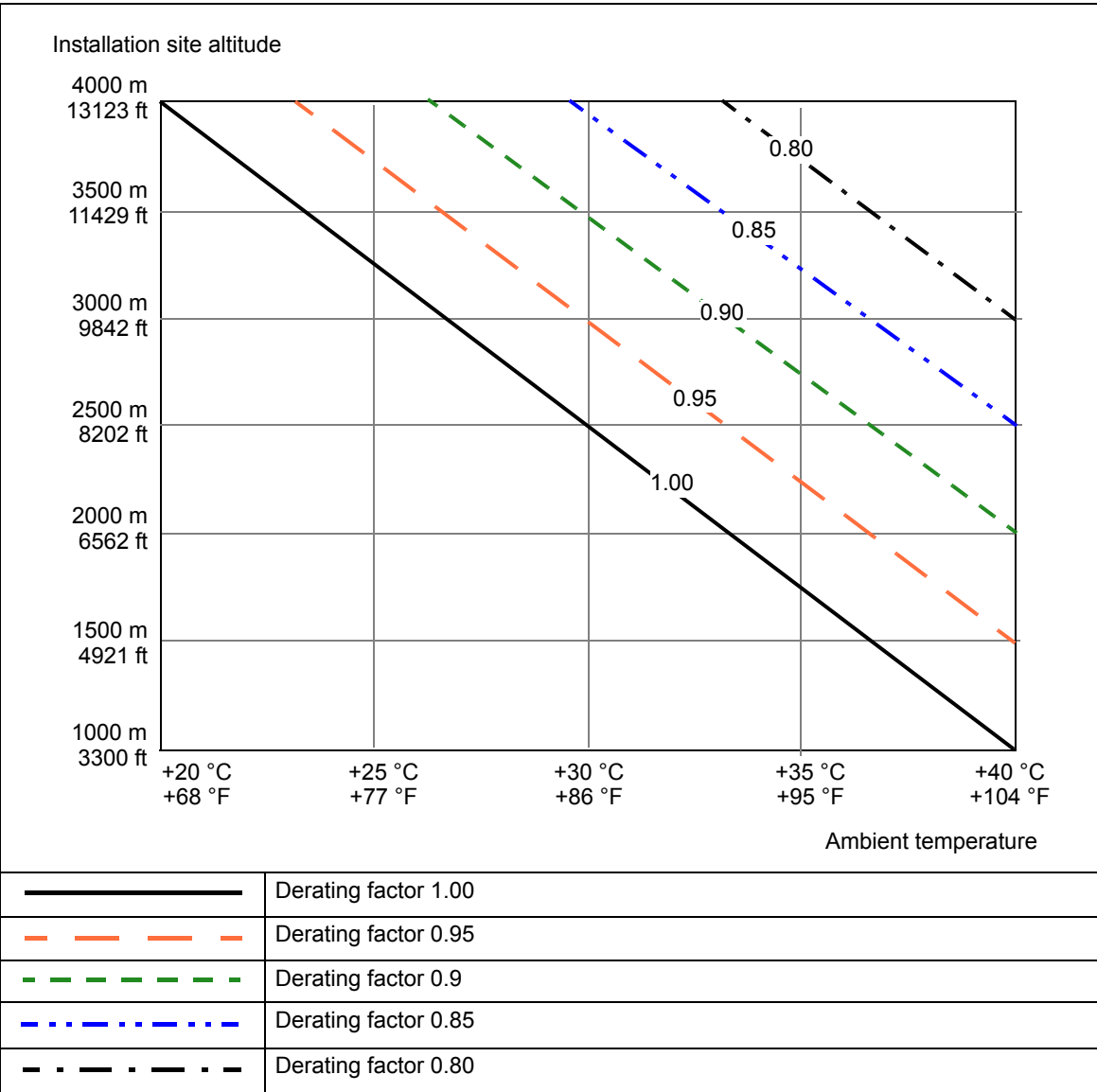
■ Ambient temperature derating

In the temperature range +40...55 °C (+104...131 °F), the rated output current is derated by 1% for every added 1 °C (1.8 °F) as follows. Calculate the output current by multiplying the current given in the rating table by the derating factor.



Altitude derating

At altitudes from 1000 to 4000 m (3300 to 13123 ft) above sea level, the derating is 1% for every 100 m (328 ft). If ambient temperature is below +40 °C (+104 °F), the derating can be reduced by 1.5% for every 1 °C reduction in temperature. For a more accurate derating, use the DriveSize PC tool. A few altitude derating curves are shown below.



Deratings for special settings in the drive control program

Enabling special settings in the drive control program can require output current derating.

Ex motor, sine filter, low noise

Table below gives the deratings for these cases:

- drive is used with an ABB motor for explosive atmospheres (Ex) and **EX motor** in **Parameter 95.15 Special HW settings** is enabled
- sine filter given in the selection table on page 240 is used and **ABB sine filter** in **Parameter 95.15 Special HW settings** is enabled
- **Low noise optimization** is selected in **Parameter 97.09 Switching freq mode**.

With other than recommended sine filters (see section [Sine filters](#) on page 240) and non-ABB Ex motors, contact ABB.

Drive module type ACS880-04-	Output ratings for special settings											
	Ex motor (ABB Ex motor)				ABB sine filter				Low noise mode			
	Nominal use		Light-duty use	Heavy-duty use	Nominal use		Light-duty use	Heavy-duty use	Nominal use		Light-duty use	Heavy-duty use
	I_N	P_N	I_{Ld}	I_{Hd}	I_N	P_N	I_{Ld}	I_{Hd}	I_N	P_N	I_{Ld}	I_{Hd}
	A	kW	A	A	A	kW	A	A	A	kW	A	A
$U_N = 400\text{ V}$												
505A-3	479	250	459	345	470	250	450	340	390	200	370	290
585A-3	551	250	389	287	540	250	518	383	437	250	419	311
650A-3	613	315	432	319	600	315	576	425	485	250	466	346
725A-3	667	355	471	351	647	355	628	468	519	250	496	390
820A-3	753	400	534	388	731	400	712	517	587	315	562	431
880A-3	809	450	570	450	785	450	760	600	630	355	600	500*
$U_N = 500\text{ V}$												
460A-5	437	250	427	316	430	250	419	311	357	250	345	265
503A-5	478	315	458	345	470	315	450	340	390	250	370	290
583A-5	531	355	509	364	514	355	487	347	400	250	380	298
635A-5	579	400	553	419	560	400	530	400	410	250	392	298
715A-5	657	450	641	522	637	450	620	507	462	315	428	362
820A-5	753	500	734	576	730	500	710	560	530	355	490	400
880A-5	768	500	747	594	730	500	710	560	550	400	510	410
$U_N = 690\text{ V}$												
330A-7	310	250	300	217	303	250	293	204	232	200	222	157
370A-7	348	315	338	276	340	315	330	260	260	250	250	200
430A-7	378	355	368	315	360	355	350	300*	290	250	280	236*
425A-7	373	363	363	312	356	351	346	296	287	247	277	233
470A-7	388	355	376	335	360	355	349	308	270	250	261	238
522A-7	431	400	417	370	400	355	388	342	300	250	290	262
590A-7	485	450	470	449	450	400	436	385	340	315	330	300
650A-7	575	500	555	480	550	500	530	450*	450	400	430	350*
721A-7	593	500	574	480	550	500	530	450*	450	400	430	350*

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U_N	Nominal voltage of the drive
I_N	Continuous rms output current. No overload capability at 40 °C (104 °F)
P_N	Typical motor 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 for light-overload use.
I_{Hd}	Continuous rms output current allowing 50% overload for 1 minute every 5 minutes
*	Continuous rms output current allowing 44% overload for 1 minute every 5 minutes

High speed mode

Selection **High speed mode** of parameter **95.15 Special HW settings** improves control performance at high output frequencies. We recommend it to be selected with output frequency of 120 Hz and above.

This table gives the drive module ratings for 120 Hz output frequency and the maximum output frequency for the drive ratings when **High speed mode** in parameter **95.15 Special HW settings** is enabled: With output frequencies smaller than this recommended maximum output frequency, the current derating is less than the values given in the table. Contact ABB for operation above the recommended maximum output frequency or for the output current derating with output frequencies above 120 Hz and below the maximum output frequency.

Drive module type ACS880-04-	Deratings with selection High speed mode of parameter 95.15 Special HW settings									
	120 Hz output frequency					Maximum output frequency				
		Nominal use		Light-duty use	Heavy-duty use		Nominal use		Light-duty use	Heavy-duty use
	f	I_N	P_N	I_{Ld}	I_{Hd}	f_{max}	I_N	P_N	I_{Ld}	I_{Hd}
	Hz	A	kW	A	A	Hz	A	kW	A	A
$U_N = 400\text{ V}$										
505A-3	120	505	250	485	361	500	390	200	370	290
585A-3	120	585	315	575	429	500	437	250	419	311
650A-3	120	650	355	634	477	500	485	250	466	346
725A-3	120	725	400	715	566	500	519	250	496	390
820A-3	120	820	450	810	625	500	587	315	562	431
880A-3	120	880	500	865	725*	500	630	355	600	500*
$U_N = 500\text{ V}$										
460A-5	120	460	315	450	330	500	357	250	345	265
503A-5	120	503	355	483	361	500	390	250	370	290
583A-5	120	583	400	573	414	500	400	250	380	298
635A-5	120	635	450	623	477	500	410	250	392	298
715A-5	120	715	500	705	566	500	462	315	428	362
820A-5	120	820	560	807	625	500	530	355	490	400
880A-5	120	880	630	857	697*	500	550	400	510	410
$U_N = 690\text{ V}$										
330A-7	120	330	315	320	255	375	232	200	222	157
370A-7	120	370	355	360	325	375	260	250	250	200
430A-7	120	430	400	420	360*	375	290	250	280	236*
425A-7	120	425	400	415	360		287	247	277	233
470A-7	120	470	450	455	415	375	270	250	261	238
522A-7	120	522	500	505	455	375	300	250	290	262
590A-7	120	590	560	571	505	375	340	315	330	300
650A-7	120	650	630	630	571*	375	450	400	430	350*
721A-7	120	721	710	705	571*	375	450	400	430	350*


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f	Output frequency
f_{max}	Maximum output frequency with High speed mode
U_N	Nominal voltage of the drive
I_N	Continuous rms output current. No overload capability at 40 °C (104 °F)

P_N	Typical motor 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 for light-overload use.
I_{Hd}	Continuous rms output current allowing 50% overload for 1 minute every 5 minutes
*	Continuous rms output current allowing 40% overload for 1 minute every 5 minutes

Fuses (IEC)

aR fuses for protection against short-circuit in the input power cable or drive are listed below.

Ultrarapid (aR) fuses							
Drive type ACS880-04-	Input current (A)	Fuse					
		A	A ² s	V	Manufacturer	Type DIN 43620 	Size
U _N = 400 V							
505A-3	505	800	490000	690	Bussmann	170M6812D	DIN3
585A-3	585	1000	985000	690	Bussmann	170M6814D	DIN3
650A-3	650	1000	985000	690	Bussmann	170M6814D	DIN3
725A-3	725	1250	2150000	690	Bussmann	170M8554D	DIN3
820A-3	820	1600	4150000	690	Bussmann	170M8557D	DIN3
880A-3	880	1600	4150000	690	Bussmann	170M8557D	DIN3
U _N = 500 V							
460A-5	460	630	490000	690	Bussmann	170M6810D	DIN3
503A-5	503	800	490000	690	Bussmann	170M6812D	DIN3
583A-5	583	1000	985000	690	Bussmann	170M6814D	DIN3
635A-5	635	1000	985000	690	Bussmann	170M6814D	DIN3
715A-5	715	1250	2150000	690	Bussmann	170M8554D	DIN3
820A-5	820	1600	4150000	690	Bussmann	170M8557D	DIN3
880A-5	880	1600	4150000	690	Bussmann	170M8557D	3
U _N = 690 V							
330A-7	330	700	320000	690	Bussmann	170M6811D	3
370A-7	370	900	720000	690	Bussmann	170M6813D	3
430A-7	430	1000	985000	690	Bussmann	170M6814D	3
425A-7	425	1000	985000	690	Bussmann	170M6814D	3
470A-7	470	1100	1400000	690	Bussmann	170M6892D	3
522A-7	522	1250	2150000	690	Bussmann	170M8554D	3
590A-7	590	1400	2700000	690	Bussmann	170M8555D	3
650A-7	650	1500	3350000	690	Bussmann	170M8556D	3
721A-7	721	1500	3350000	690	Bussmann	170M8556D	3

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Note 1: See also [Implementing thermal overload and short-circuit protection](#) on page 77.

Note 2: In multicable installations, install only one fuse per phase (not one fuse per conductor).

Note 3: Fuses with higher current rating than the recommended ones must not be used. Fuses with lower current rating can be used.

Note 4: Fuses from other manufacturers can be used if they agree with the ratings and the melting curve of the fuse does not exceed the melting curve of the fuse mentioned in the table.

Fuses (UL)

UL fuses for branch circuit protection per NEC are listed below. **Check that the operating time of the fuse is below 0.1 seconds.** The operating time depends on the fuse type, supply network impedance and the cross-sectional area, material and length of the supply cable. The fuses must be of the “non-time delay” type. Obey local regulations.

Drive type ACS880-04-	Input current (A)	Fuse				
		A	V	Manufacturer	UL class	Type
U _N = 400 V						
505A-3	505	600	600	Bussmann	T	JJS-600
585A-3	585	800	600	Ferraz	L	A4BY800
650A-3	650	800	600	Ferraz	L	A4BY800
725A-3	725	800	600	Ferraz	L	A4BY800
820A-3	820	900	600	Ferraz	L	A4BY900
880A-3	880	1000	600	Ferraz	L	A4BY1000
U _N = 460 V						
460A-5	460	600	500	Bussmann	T	JJS-500
503A-5	503	600	600	Bussmann	T	JJS-600
583A-5	583	800	600	Ferraz	L	A4BY800
635A-5	635	800	600	Ferraz	L	A4BY800
715A-5	715	800	600	Ferraz	L	A4BY800
820A-5	820	900	600	Ferraz	L	A4BY900
880A-5	880	1000	600	Ferraz	L	A4BY1000
U _N = 600 V						
330A-7	330	500	600	Bussmann	T	JJS-500
370A-7	370	500	600	Bussmann	T	JJS-500
430A-7	430	500	600	Bussmann	T	JJS-500
425A-7	425	500	600	Bussmann	T	JJS-500
470A-7	470	600	600	Bussmann	T	JJS-600
522A-7	522	600	600	Bussmann	T	JJS-600
590A-7	590	800	600	Ferraz	L	A4BY800
650A-7	650	800	600	Ferraz	L	A4BY800
721A-7	721	800	600	Ferraz	L	A4BY800

Note 1: See also [Implementing thermal overload and short-circuit protection](#) on page 77.

Note 2: In multicable installations, install only one fuse per phase (not one fuse per conductor).

Note 3: Fuses with higher current rating than the recommended ones must not be used. Fuses with lower current rating can be used.

Note 4: Fuses from other manufacturers can be used if they agree with the ratings and the melting curve of the fuse does not exceed the melting curve of the fuse mentioned in the table.

Dimensions, weights and free space requirements

Standard drive module configuration								
Frame size	Height		Width		Depth		Weight*	
	mm	in	mm	in	mm	in	kg	lb
R10	1541	60.67	350	14.82	506	19.92	161	355
R11	1741	68.54	350	14.82	506	19.92	199	439

Optional selection +0B051+0H371 (without shrouds and full-size output power cable connection terminals)								
Frame size	Height		Width		Depth		Weight*	
	mm	in	mm	in	mm	in	kg	lb
R10	1462	57.56	305	12.01	506	19.92	156	345
R11	1662	65.43	305	12.01	506	19.92	194	429

Optional selection +H381 (full power cabling panels)								
Frame size	Height		Width		Depth		Weight*	
	mm	in	mm	in	mm	in	kg	lb
R10	1590	62.62	329	12.95	516	20.31	196	432
R11	1740	68.52	329	12.95	516	20.31	233	514

* approximate (depends on the selected options)

The weight of the cabling panels of option +H381 is 30 kg (66 lb)

Weight of optional selections														
Frame size	+0H354		+E208		+D150		+H356		+0H371		+H370		+0B051	
	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb
R10	-7	-15	3	7	10	22	2	4	-2.9	-6	2.9	6	-1.5	-3
R11	-7	-15	3	7	9	20	2	4	-2.9	-6	2.9	6	-1.5	-3

Height of drive module without pedestal (option +H354)		
Frame size	mm	in
R10/R11	-100	-3.94

Additional depth with option +C173 when the mounting brackets are used: 18.5 mm (0.73 in.)

For requirements of free space around the drive module, see page [60](#).

Losses, cooling data and noise

Drive type	Frame size	Air flow		Heat dissipation W	Noise dB(A)
		m ³ /h	ft ³ /min		
U _N = 400 V					
ACS880-04-505A-3	R10	1200	707	5602	72
ACS880-04-585A-3	R10	1200	707	6409	72
ACS880-04-650A-3	R10	1200	707	8122	72
ACS880-04-725A-3	R11	1200	707	8764	72
ACS880-04-820A-3	R11	1200	707	9862	72
ACS880-04-880A-3	R11	1420	848	10578	71
U _N = 500 V					
ACS880-04-460A-5	R10	1200	707	4403	72
ACS880-04-503A-5	R10	1200	707	5602	72
ACS880-04-583A-5	R10	1200	707	6409	72
ACS880-04-635A-5	R10	1200	707	8122	72
ACS880-04-715A-5	R11	1200	707	8764	72
ACS880-04-820A-5	R11	1420	848	9862	71
ACS880-04-880A-5	R11	1420	848	10578	71
U _N = 690 V					
ACS880-04-330A-7	R10	1200	707	4403	72
ACS880-04-370A-7	R10	1200	707	5602	72
ACS880-04-430A-7	R10	1200	707	6409	72
ACS880-04-425A-7	R10	1200	707	6409	72
ACS880-04-470A-7	R11	1200	707	8122	72
ACS880-04-522A-7	R11	1200	707	8764	72
ACS880-04-590A-7	R11	1200	707	9862	72
ACS880-04-650A-7	R11	1420	848	10578	71
ACS880-04-721A-7	R11	1420	848	10578	71

The cooling air temperature rises 30 degrees Celsius when it goes through the drive module if the temperature of the input cooling air is 40 degrees Celsius.

Terminal and lead-through data for the power cables

The maximum accepted cable size is $4 \times (3 \times 240) \text{ mm}^2$ or $4 \times (3 \times 500 \text{ AWG})$. Screw size for connecting busbars to the drive module input and output busbars: M12, tightening torque 50...75 N·m.

Units with optional cabling panels (+H381)

The maximum accepted cable size is $4 \times (3 \times 240) \text{ mm}^2$ or $4 \times (3 \times 500 \text{ AWG})$. The cabling panels are connected to the drive module busbars with M12 serpress nuts, tightening torque 30 N·m (20 lbf·ft).

Input, motor and brake resistor cable terminal sizes and tightening torques are given below.

L1/U1, L2/V1, L3/W1, T1/U2, T2/V2, T3/W2, UDC+, UDC-, R+, R-				Grounding busbar			
Screw		Tightening torque		Screw		Tightening torque	
		N·m	lbf·ft			N·m	lbf·ft
M12	1/2	50...75	37...55	M10	3/8	30...44	22...32

Two-hole 1/2 inch diameter cable lugs can be used.

■ Units without full-size output cable connection terminals (+0H371) and with a common mode filter (+E208)

It is possible to use the maximum cable size (4 × [3 × 240] mm² or 4 × [(3 × 500 AWG)]) only with special cable lugs and additional insulation. For more information, contact your local ABB representative.

Terminal data for the control cables

See page [111](#).

Electrical power network specification

Voltage (U_1)	ACS880-04-xxxx-3 drive modules: 380...415 V AC phase +10%/-15% ACS880-04-xxxx-5 drive modules: 380...500 V AC 3-phase +10%/-15% ACS880-04-xxxx-7 drive modules: 525...690 V AC 3-phase +10%/-15%
Network type	TN (grounded) and IT (ungrounded) systems
Short-circuit withstand strength (IEC 61439-1)	Maximum allowable prospective short-circuit current is 65 kA when by the fuses given in the fuse table. For the maximum allowable prospective short-circuit current with circuit breakers, see section Protecting the drive and input power cable in short-circuits on page 77 .
Short-circuit current protection (UL 508A)	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 by the fuses given in the fuse table.
Short-circuit current protection (CSA C22.2 No. 14-05)	The drive is suitable for use on a circuit capable of delivering not more than 100 kA rms symmetrical amperes at 600 V maximum when by the fuses given in the fuse table.
Frequency	48 to 63 Hz, maximum rate of change 17%/s
Imbalance	Max. ± 3% of nominal phase to phase input voltage
Fundamental power factor (cos ϕ_1)	0.98 (at nominal load)

Motor connection data

Motor types	Asynchronous AC induction motors, permanent magnet motors, AC induction servomotors and ABB synchronous reluctance motors (SynRM motors)					
Voltage (U_2)	0 to U_1 , 3-phase symmetrical, U_{\max} at the field weakening point					
Frequency	DTC mode: 0 to $3.2 \cdot f_f$. Maximum frequency 500 Hz (120 Hz with du/dt or sine filter). Low motor noise mode is recommended with high frequencies (see also the firmware manual).					
	$f_f = \frac{U_N}{U_m} \cdot f_m$					
	f_f : frequency at field weakening point; U_N : electrical power system voltage; U_m : nominal motor voltage; f_m : nominal motor frequency					
Frequency resolution	0.01 Hz					
Current	See section Ratings .					
Frequency	0...500 Hz					
	<u>For drives with du/dt filter:</u> 120 Hz					
	<u>For drives with sine filter:</u> 120 Hz					
Switching frequency	3 kHz (typically)					
Maximum recommended motor cable length	<table><tr><th>DTC control</th><th>Scalar control</th></tr><tr><td>500 m (1640 ft)</td><td>500 m (1640 ft)</td></tr></table>		DTC control	Scalar control	500 m (1640 ft)	500 m (1640 ft)
DTC control	Scalar control					
500 m (1640 ft)	500 m (1640 ft)					
	Note: Motor cable longer than 100 m (328 ft) is allowed but then the EMC Directive requirements of Category C3 may not be fulfilled.					

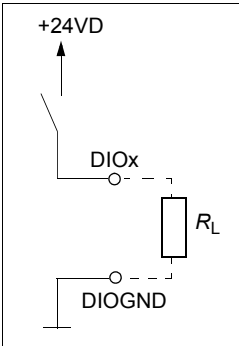
Brake resistor connection data

See page [233](#).

DC connection data

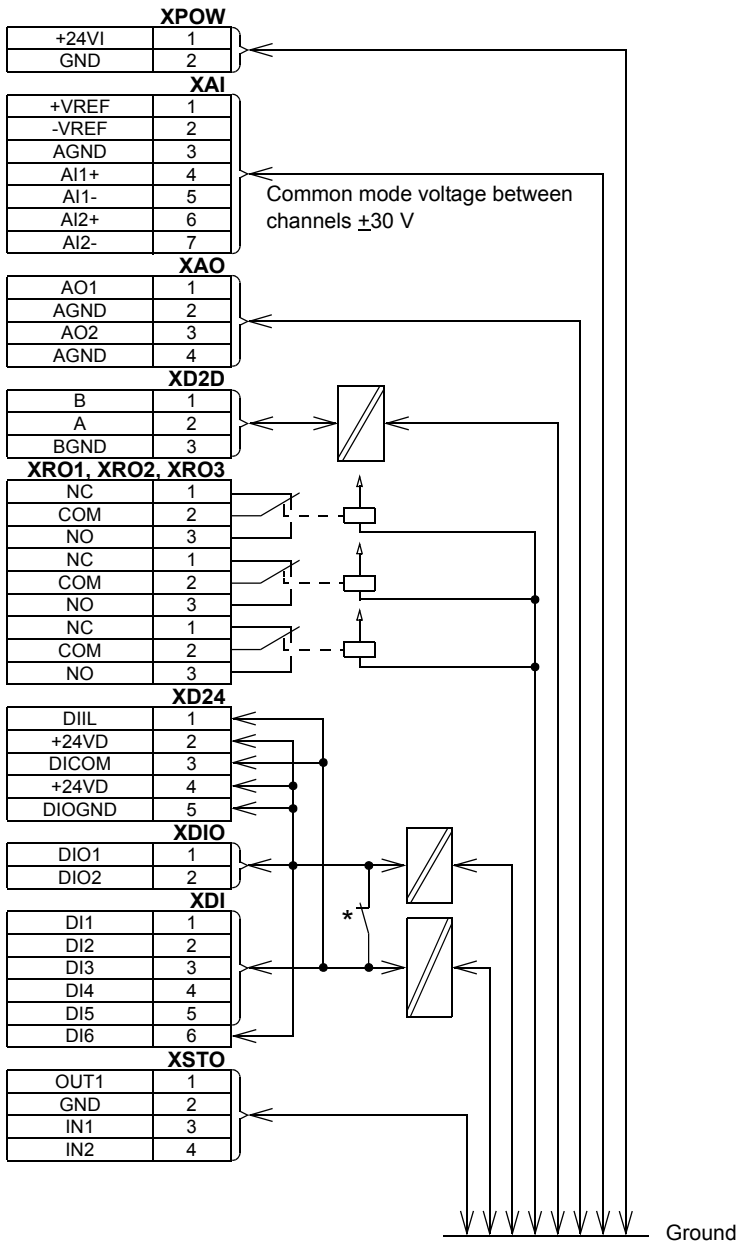
Drive type	I_{DC} (A)	Capacitance (mF)
$U_N = 400\text{ V}$		
ACS880-04-505A-3	640	14
ACS880-04-585A-3	714	14
ACS880-04-650A-3	870	14
ACS880-04-725A-3	909	21
ACS880-04-820A-3	1033	21
ACS880-04-880A-3	1120	21
$U_N = 500\text{ V}$		
ACS880-04-460A-5	487	14
ACS880-04-503A-5	640	14
ACS880-04-583A-5	714	14
ACS880-04-635A-5	870	14
ACS880-04-715A-5	909	21
ACS880-04-820A-5	1033	21
ACS880-04-880A-5	1120	21
$U_N = 690\text{ V}$		
ACS880-04-330A-7	429	4.7
ACS880-04-370A-7	481	4.7
ACS880-04-430A-7	559	4.7
ACS880-04-425A-7	553	9.3
ACS880-04-470A-7	611	9.3
ACS880-04-522A-7	679	9.3
ACS880-04-590A-7	767	9.3
ACS880-04-650A-7	845	9.3
ACS880-04-721A-7	937	9.3

Control unit connection data (ZCU-14)

Power supply (XPOW)	<p>24 V ($\pm 10\%$) DC, 2 A</p> <p>External power supply in. With some drive module sizes, not used as the control unit is supplied from the drive module.</p> <p>Connector pitch 5 mm, wire size 2.5 mm²</p>
Relay outputs RO1...RO3 (XRO1...XRO3)	<p>Connector pitch 5 mm, wire size 2.5 mm²</p> <p>250 V AC / 30 V DC, 2 A</p> <p>Protected by varistors</p>
+24 V output (XD24:2 and XD24:4)	<p>Connector pitch 5 mm, wire size 2.5 mm²</p> <p>Total load capacity of these outputs is 4.8 W (200 mA / 24 V) minus the power taken by DIO1 and DIO2.</p>
Digital inputs DI1...DI6 (XDI:1...XDI:6)	<p>Connector pitch 5 mm, wire size 2.5 mm²</p> <p>24 V logic levels: "0" < 5 V, "1" > 15 V</p> <p>R_{in}: 2.0 kohm</p> <p>Input type: NPN/PNP (DI1...DI5), NPN (DI6)</p> <p>Hardware filtering: 0.04 ms, digital filtering up to 8 ms</p> <p>DI6 (XDI:6) can alternatively be used as an input for 1...3 PTC thermistors.</p> <p>"0" > 4 kohm, "1" < 1.5 kohm</p> <p>I_{max}: 15 mA (for DI6 5 mA)</p>
Start interlock input DIL (XD24:1)	<p>Connector pitch 5 mm, wire size 2.5 mm²</p> <p>24 V logic levels: "0" < 5 V, "1" > 15 V</p> <p>R_{in}: 2.0 kohm</p> <p>Input type: NPN/PNP</p> <p>Hardware filtering: 0.04 ms, digital filtering up to 8 ms</p>
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 11.	<p>Connector pitch 5 mm, wire size 2.5 mm²</p> <p><u>As inputs:</u></p> <p>24 V logic levels: "0" < 5 V, "1" > 15 V</p> <p>R_{in}: 2.0 kohm</p> <p>Filtering: 0.25 ms</p> <p><u>As outputs:</u></p> <p>Total output current from +24VDis limited to 200 mA</p>
	
Reference voltage for analog inputs +VREF and -VREF (XAI:1 and XAI:2)	<p>Connector pitch 5 mm, wire size 2.5 mm²</p> <p>10 V $\pm 1\%$ and -10 V $\pm 1\%$, R_{load} 1...10 kohm</p>
Analog inputs AI1 and AI2 (XAI:4 ... XAI:7). Current/voltage input mode selection by jumpers.	<p>Connector pitch 5 mm, wire size 2.5 mm²</p> <p>Current input: -20...20 mA, R_{in}: 100 ohm</p> <p>Voltage input: -10...10 V, R_{in}: > 200 kohm</p> <p>Differential inputs, common mode range ± 30 V</p> <p>Sampling interval per channel: 0.25 ms</p> <p>Hardware filtering: 0.25 ms, adjustable digital filtering up to 8 ms</p> <p>Resolution: 11 bit + sign bit</p> <p>Inaccuracy: 1% of full scale range.</p> <p>Inaccuracy for Pt100 sensors: 10 °C (50 °F)</p>
Analog outputs AO1 and AO2 (XAO)	<p>Connector pitch 5 mm, wire size 2.5 mm²</p> <p>0...20 mA, R_{load} < 500 ohm</p> <p>Frequency range: 0...300 Hz</p> <p>Resolution: 11 bit + sign bit</p> <p>Inaccuracy: 2% of full scale range</p>

Drive-to-drive link (XD2D)	Connector pitch 5 mm, wire size 2.5 mm ² Physical layer: RS-485 Termination by jumper
Safe torque off connection (XSTO)	Connector pitch 5 mm (0.2 in), wire size 2.5 mm ² (14 AWG) Input voltage range: -3...30 V DC Logic levels: "0" < 5 V, "1" > 19 V For the drive to start, both connections must be closed (OUT1 to IN1 and IN2). Current consumption: 50 mA (+24 V DC, continuous) per STO channel EMC (immunity) according to IEC 61326-3-1
Control panel / PC connection (X13)	Connector: RJ-45 Cable length < 3 m

Ground isolation diagram)



* Ground selector (J6) settings

<input checked="" type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> (ZCU-14)
All digital inputs share a common ground (DICOM connected to DIOGND). This is the default setting.
<input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/> (ZCU-14)
Ground of digital inputs DI1...DI5 and DIIL (DICOM) is isolated from DIO signal ground (DIOGND). Isolation voltage 50 V.

Control panel type

ACS-AP-I assistant control panel

Efficiency

Approximately 98% at nominal power level

Degree of protection

IP20 (UL Open Type), requires installation of bottom grille for standard drive module configuration and option +H0354, see page 101. With option +0B051: IP00 (UL Open Type).

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	For TN and TT neutral-grounded network systems and IT non-corner grounded network systems: 0 to 4000 m (13123 ft) above sea level For TN, TT and IT corner-grounded network systems: 0 to 2000 m (6561 ft) above sea level Above 1000 m [3281 ft]), see page 179.	-	-
Air temperature	-15 to +55 °C (5 to 131 °F). No frost allowed. See page 179.	-40 to +70 °C (-40 to +158 °F)	-40 to +70 °C (-40 to +158 °F)
Relative humidity	5 to 95%	Max. 95%	Max. 95%
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination levels (IEC 60721-3-3, IEC 60721-3-2, IEC 60721-3-1)	No conductive dust allowed.		
	Chemical gases: Class 3C2 Solid particles: Class 3S2	Chemical gases: Class 1C2 Solid particles: Class 1S3	Chemical gases: Class 2C2 Solid particles: Class 2S2
Atmospheric pressure	70 to 106 kPa 0.7 to 1.05 atmospheres	70 to 106 kPa 0.7 to 1.05 atmospheres	60 to 106 kPa 0.6 to 1.05 atmospheres
Vibration (IEC 60068-2-6. Test Fc)	Max. 0.1 mm (0.004 in.) (10 to 57 Hz), max. 10 m/s ² (33 ft/s ²) (57 to 150 Hz) sinusoidal	Max. 1 mm (0.04 in.) (5 to 13.2 Hz), max. 7 m/s ² (23 ft/s ²) (13.2 to 100 Hz) sinusoidal	Max. 3.5 mm (0.14 in.) (2 to 9 Hz), max. 15 m/s ² (49 ft/s ²) (9 to 200 Hz) sinusoidal
Shock (IEC 60068-2-27)	Not allowed	Max. 100 m/s ² (330 ft./s ²), 11 ms	Max. 100 m/s ² (330 ft./s ²), 11 ms
Free fall	Not allowed	100 mm (4 in.) for weight over 100 kg (220 lb)	100 mm (4 in.) for weight over 100 kg (220 lb)

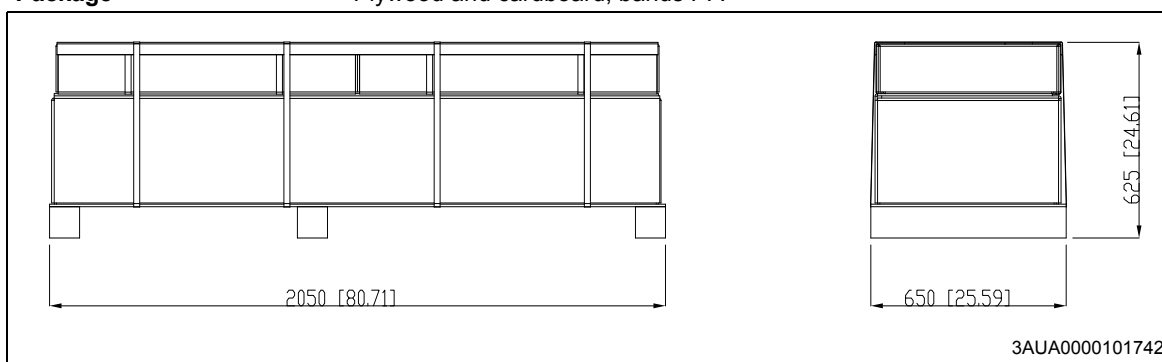
Materials

Drive enclosure

- PC/ABS 2.5 mm, color NCS 1502-Y (RAL 9002 / PMS 420 C)
- hot-dip zinc coated steel sheet 1.5 to 2.5 mm, thickness of coating 100 micrometers, color NCS 1502-Y

Package

Plywood and cardboard, bands PP.

**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 DC capacitors (C1-1 to C1-x) 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.

Applicable standards

The drive complies with the following standards.	
EN 61800-5-1:2007	<i>Adjustable speed electrical power drive systems. Part 5-1: Safety requirements – electrical, thermal and energy</i>
EN 60204-1:2006 + A1:2010	<i>Safety of machinery. Electrical equipment of machines. Part 1: General requirements.</i> Provisions for compliance: The final assembler of the machine is responsible for installing <ul style="list-style-type: none"> - emergency-stop device - supply disconnecting device - IP00 drive module into a cabinet.
IEC/EN 60529:1991 + A2:2013	<i>Degrees of protection provided by enclosures (IP code)</i>
EN 61800-3:2004 +A1:2012	<i>Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods</i>
UL 508C (3rd edition)	<i>UL Standard for Safety, Power Conversion Equipment, third edition</i>
CSA-C22.2 No. 0-10	<i>General Requirements - Canadian Electrical Code, Part II</i>
CSA C22.2 No. 14-13	<i>Industrial Control Equipment</i>
CSA C22.2 No. 274-13	<i>Adjustable speed drives</i>

CE marking

A CE mark is attached to the drive to verify that the unit follows the provisions of the European Low Voltage, EMC and RoHS Directives. The CE marking also verifies that the drive, in regard to its safety functions (such as Safe torque off), conforms with the Machinery Directive as a safety component.

■ Compliance with the European Low Voltage Directive

The compliance with the European Low Voltage Directive has been verified according to standards EN 60204-1 and EN 61800-5-1.

■ **Compliance with the European EMC Directive**

The EMC Directive defines the requirements for immunity and emissions of electrical equipment used within the European Union. The EMC product standard (EN 61800-3:2004) covers requirements stated for drives. See section [Compliance with EN 61800-3:2004](#) below.

■ **Compliance with the European RoHS Directive**

The RoHS Directive defines the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Compliance with the European Machinery Directive

The drive is an electronic product which is covered by the European Low Voltage Directive. However, the drive includes the Safe torque off function and can be equipped with other safety functions for machinery which, as safety components, are in the scope of the Machinery Directive. These functions of the drive comply with European harmonized standards such as EN 61800-5-2. The declaration of conformity is shown below.

Declaration of Conformity



Declaration of Conformity

(According to Machinery Directive 2006/42/EC)

Manufacturer: ABB Oy, Drives
Address: Hiomotie 13, P.O Box 184, FIN-00381 Helsinki, Finland.

hereby declares that product

ACS880-04 (frames R10 and R11)

with regard to the following safety functions

Safe torque off

Safe stop 1 (with option code +Q973)

Safe stop emergency (with option code +Q973)

Safely-limited speed (with option code +Q973)

Safe maximum speed (with option code +Q973)

Safe brake control (with option code +Q973)

fulfils all the relevant safety component requirements of EC Machinery Directive 2006/42/EC, when the listed safety functions are used for safety component functionality.

The following harmonized standards below were used:

EN 61800-5-2: 2007	<i>Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional</i>
EN 62061: 2005 + A1: 2013	<i>Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems</i>
EN ISO 13849-1: 2008 + AC: 2009	<i>Safety of machinery – Safety-related parts of control systems. Part 1: General requirements</i>
EN ISO 13849-2: 2012	<i>Safety of machinery – Safety-related parts of the control systems. Part 2: Validation</i>
EN 60204-1: 2006 + AC: 2010	<i>Safety of machinery – Electrical equipment of machines – Part 1: General requirements</i>

Other used standards:

IEC 61508 ed. 2: 2010	Functional safety of electrical / electronic / programmable electronic safety-related systems
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Declaration of Conformity

(According to Machinery Directive 2006/42/EC)

The products referred in this Declaration of Conformity fulfil the relevant provisions of the Low Voltage Directive 2006/95/EC and EMC Directive 2004/108/EC. Declaration of conformity according to these directives is available from the manufacturer.

Person authorized to compile the technical file:

Name: Risto Mynttinen

Address: P.O. Box 184, FIN-00381 Helsinki, Finland

Helsinki, 9 Jan 2014

A handwritten signature in blue ink, appearing to read 'Mika Kulju', is written over the printed name.

Mika Kulju

Vice President

ABB Oy

Compliance with EN 61800-3:2004

■ Definitions

EMC stands for **E**lectromagnetic **C**ompatibility. 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 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 C2

The drive complies with the standard with the following provisions:

1. The drive is equipped with EMC filter +E202 / ARFI-10 and common mode filter (+E208).
2. The motor and control cables are selected as specified in the hardware manual.
3. The drive is installed according to the instructions given in the hardware manual.
4. Maximum motor cable length is 150 meters.

WARNING! The drive may cause radio interference if used in residential or domestic environment. The user is required to take measures to prevent interference, in association to the requirements for the CE compliance listed above, if necessary.

Note: Do not install a drive equipped with EMC filter +E202 grounding wire connected on IT (ungrounded) systems. The supply network becomes connected to ground potential through the EMC filter capacitors which may cause danger or damage to the unit.

■ Category C3

The drive complies with the standard with the following provisions:

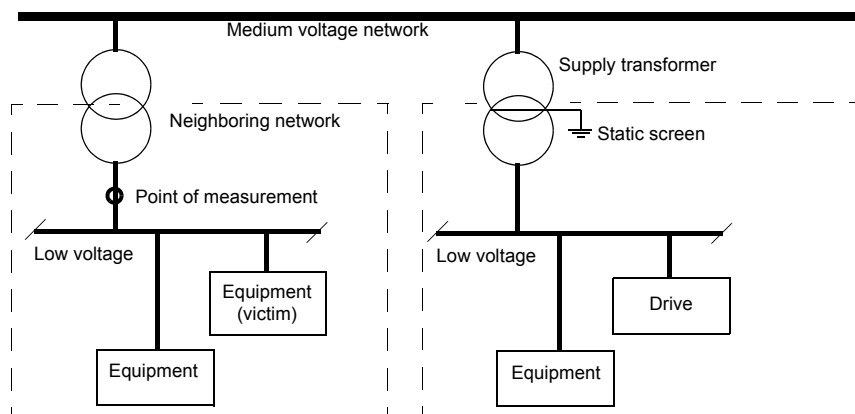
1. The drive is equipped with EMC filter +E200, +E201 or +E210.
2. The motor and control cables are selected as specified in the hardware manual.
3. The drive is installed according to the instructions given in the hardware manual.
4. Maximum motor cable length is 100 meters.

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

If the provisions under [Category C3](#) cannot be met, the requirements of the standard can be met as follows:

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



2. An EMC plan for preventing disturbances is drawn up for the installation. A template is available from the local ABB representative.
3. The motor and control cables are selected as specified in the hardware manual.
4. The drive is installed according to the instructions given in the hardware manual.

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 marking

The drive modules are cULus Listed.

CSA marking

The drive modules are CSA marked.

Ⓢ “C-tick” marking

The drive modules are “C-tick” marked.

“C-tick” marking is required in Australia and New Zealand. A “C-tick” mark is attached to the 380...500 V drives to verify compliance with the relevant standard (IEC 61800-3:2004), mandated by the Trans-Tasman Electromagnetic Compatibility Scheme.

For fulfilling the requirements of the standard, see section [Compliance with EN 61800-3:2004](#) on page 197.

EAC marking

The drive has EAC certification. EAC marking is required in Russia, Belarus and Kazakhstan.

Approvals

The drive is marine type approved. For more information, see *ACS880-01/04 +C132 marine type-approved drives supplement* (3AXD50000010521 [English]).

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.

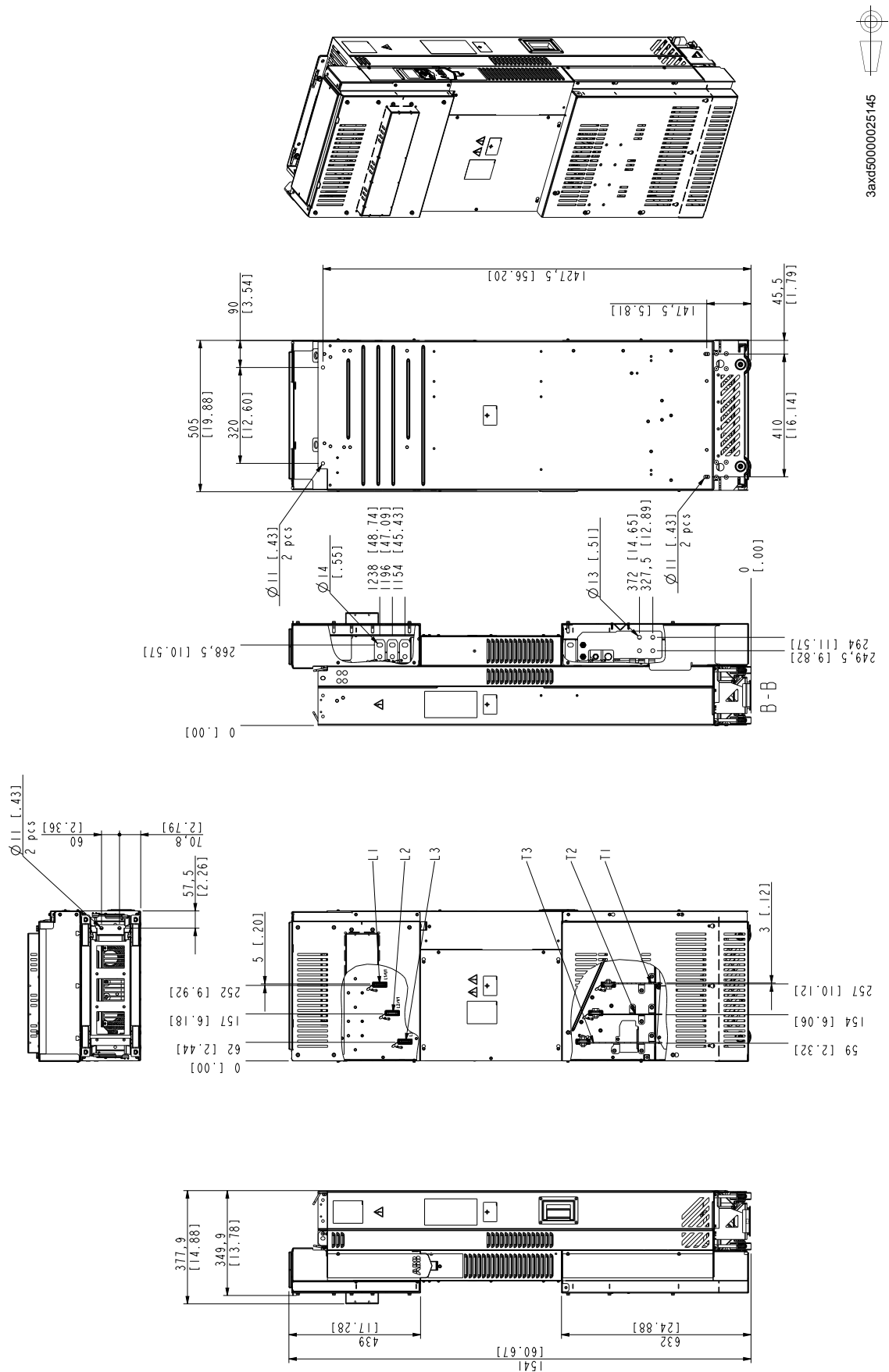
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Dimension drawings

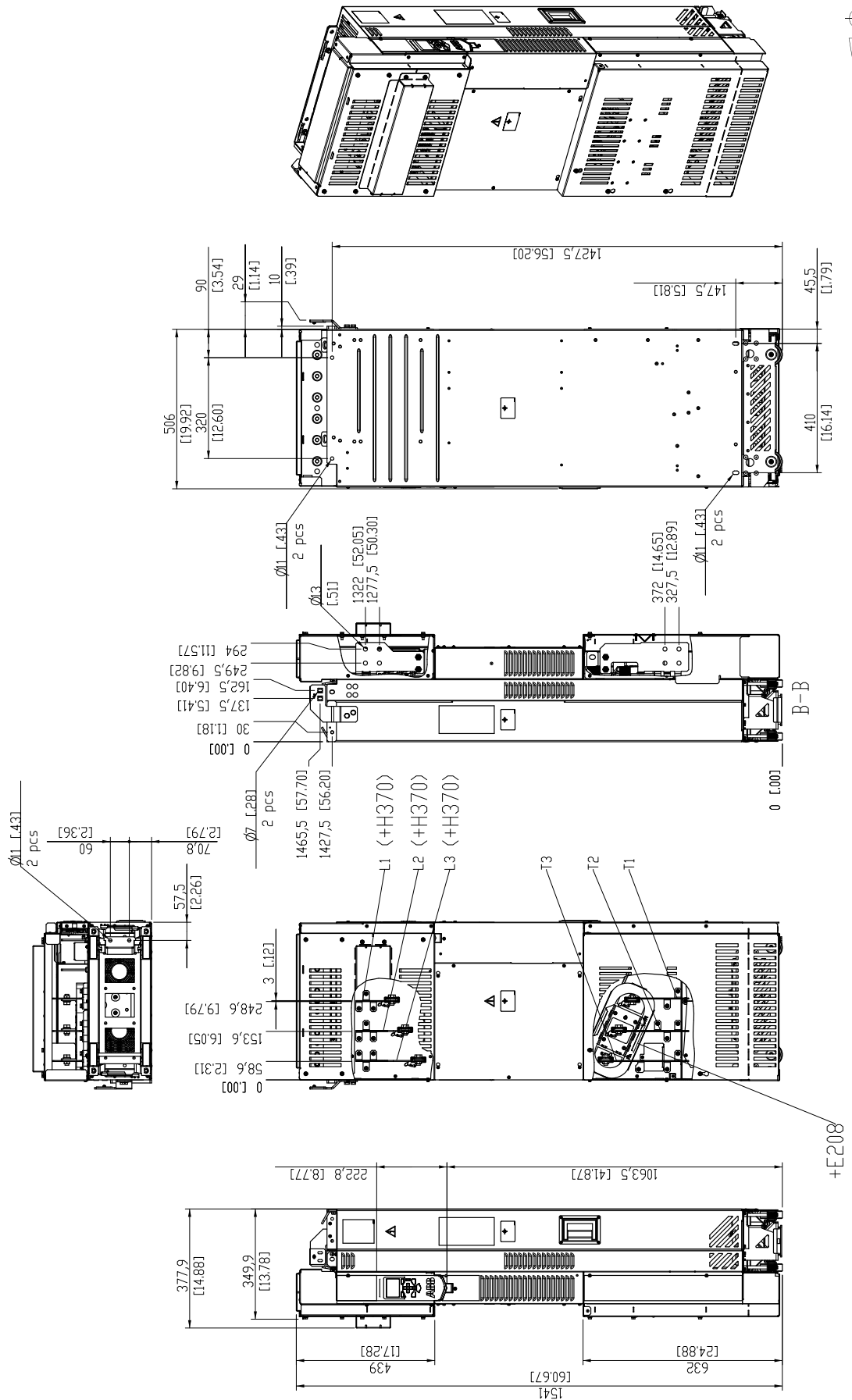
Contents of this chapter

This chapter contains dimension drawings of the drive modules with optional parts for Rittal TS 8 cabinet assembly.

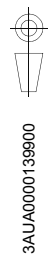
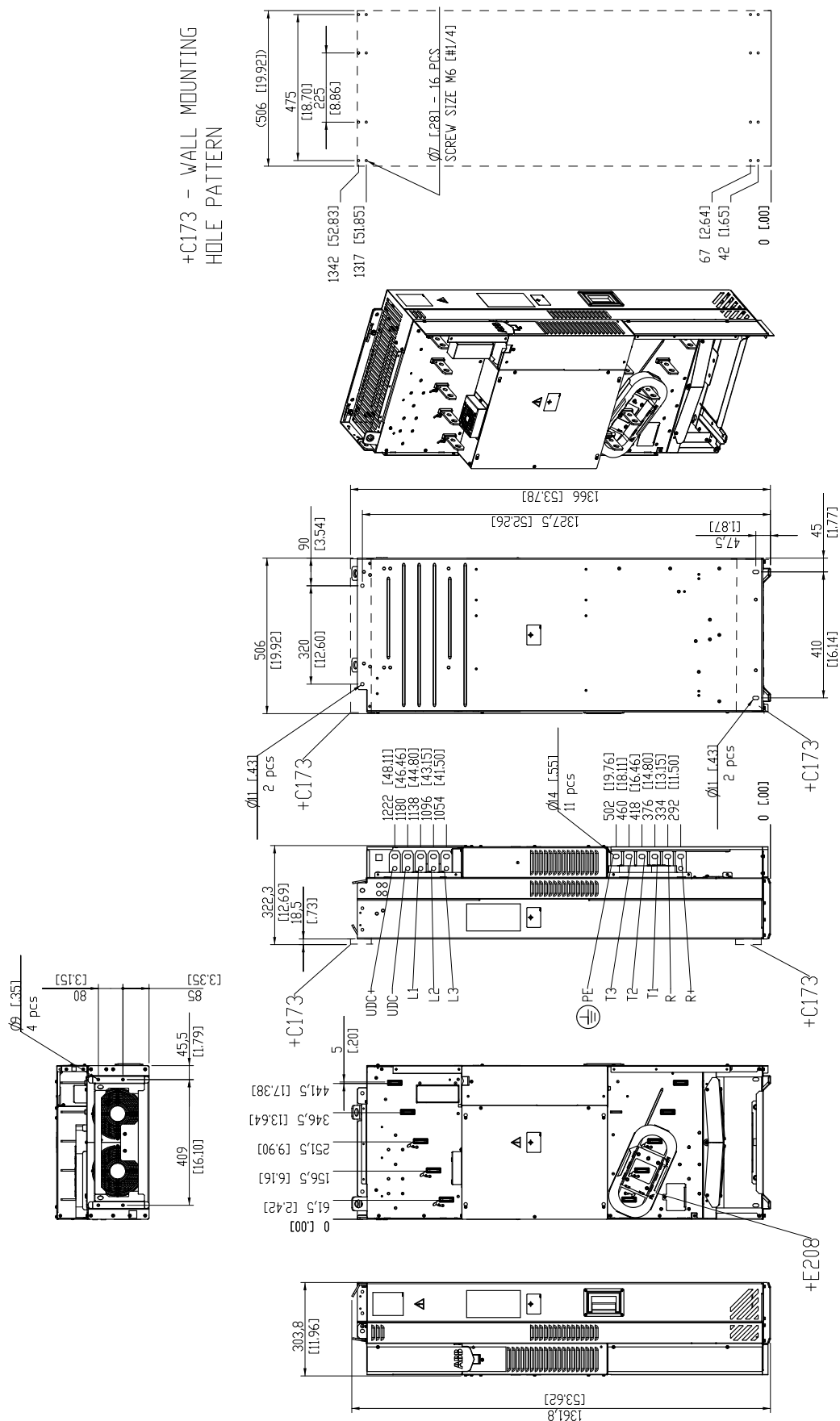
R10 – Standard configuration



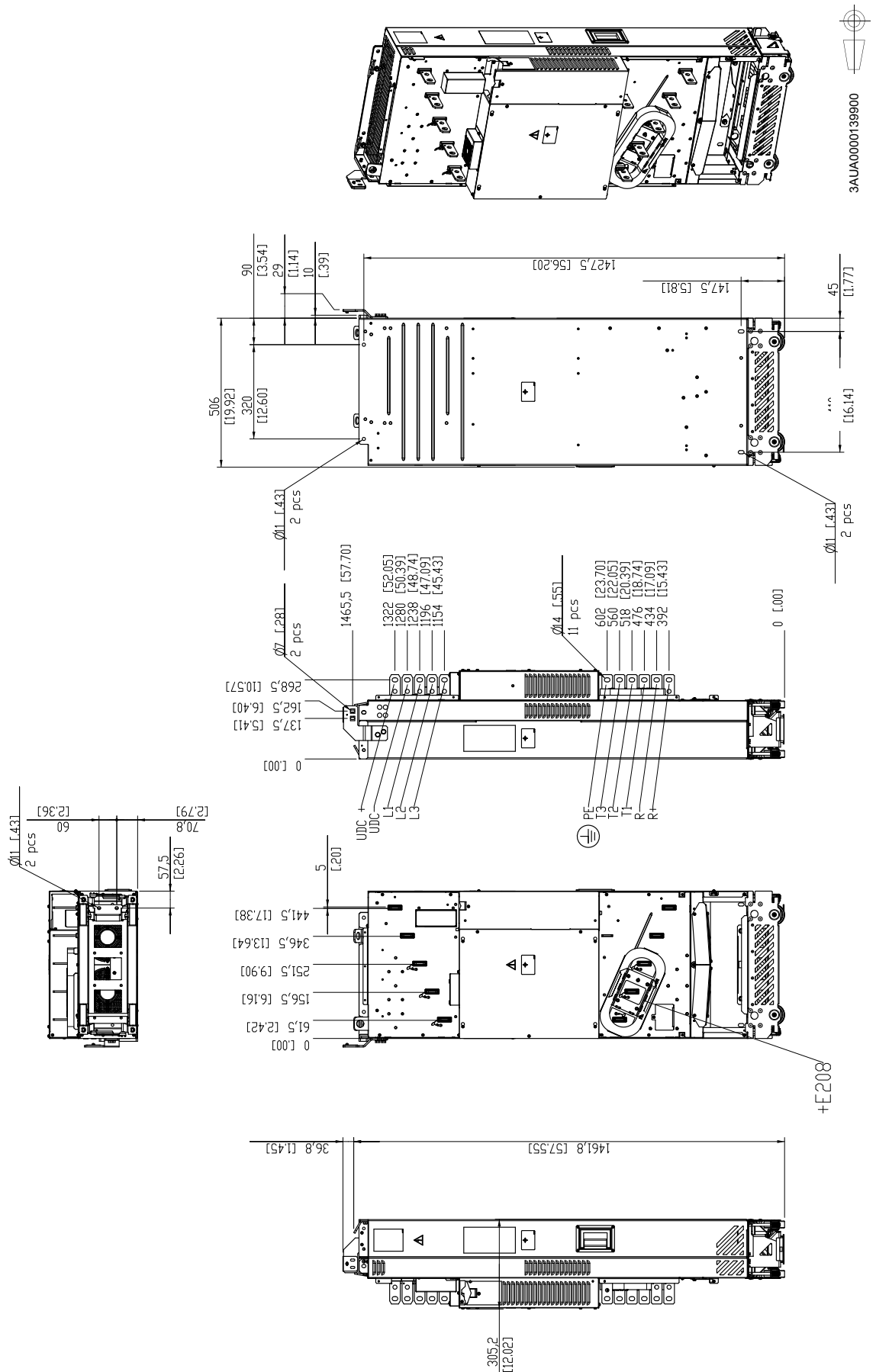
R10 with options +E208+H370+J414+P905

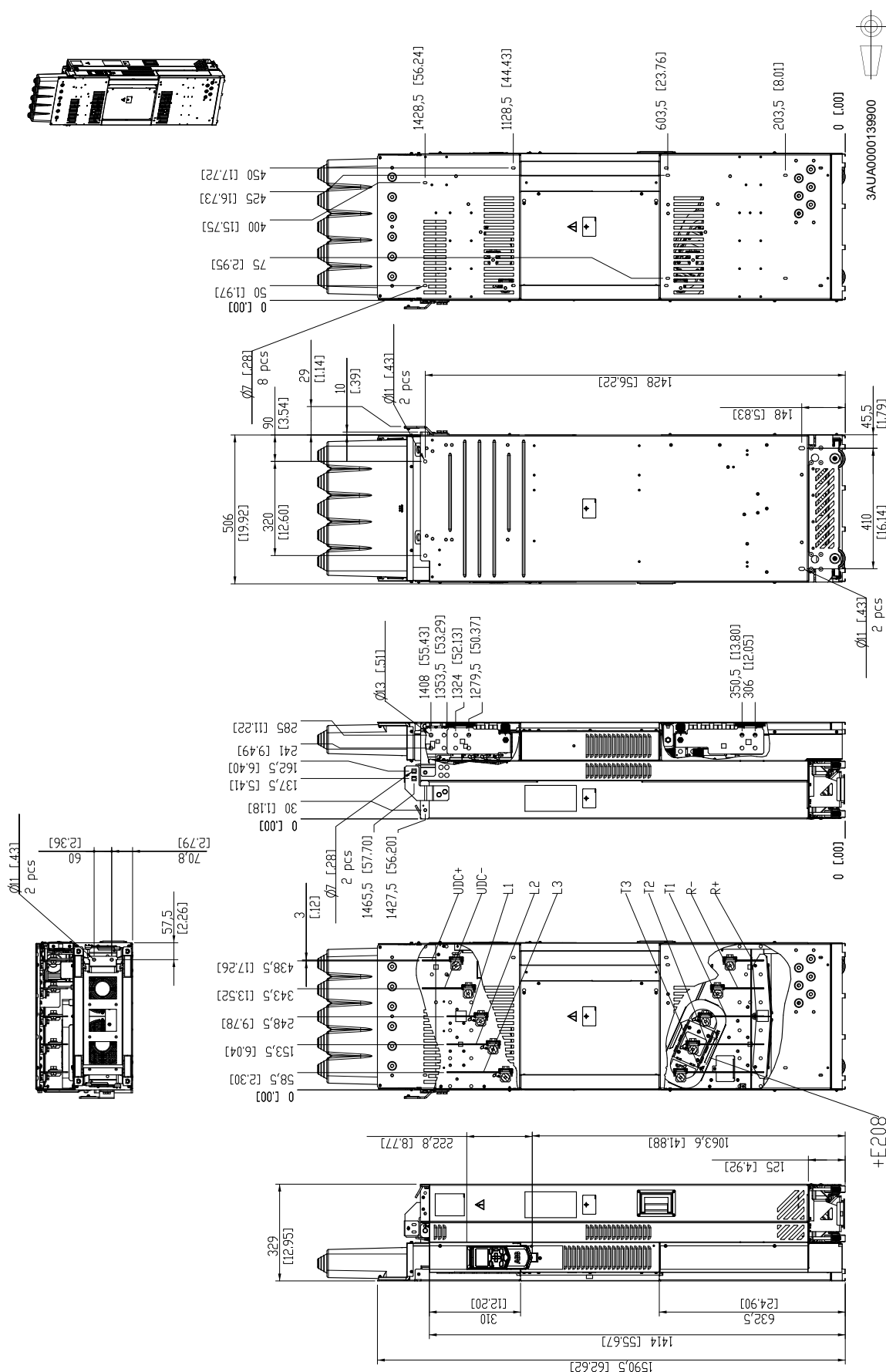


R10 with options +0B051+C173+E208+H356+0H354+0H371

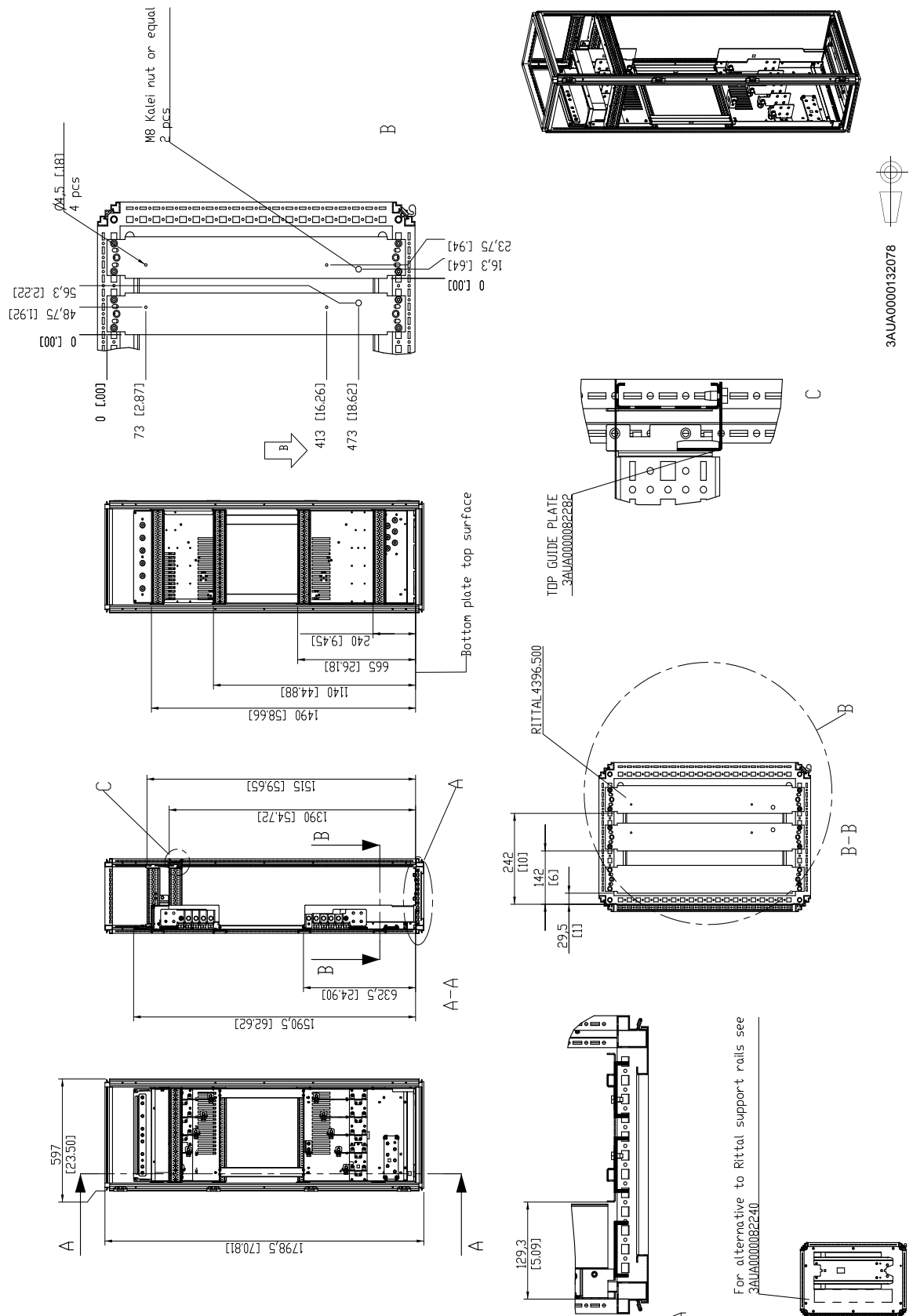


R10 with options +0B051+E208+H356+0H371

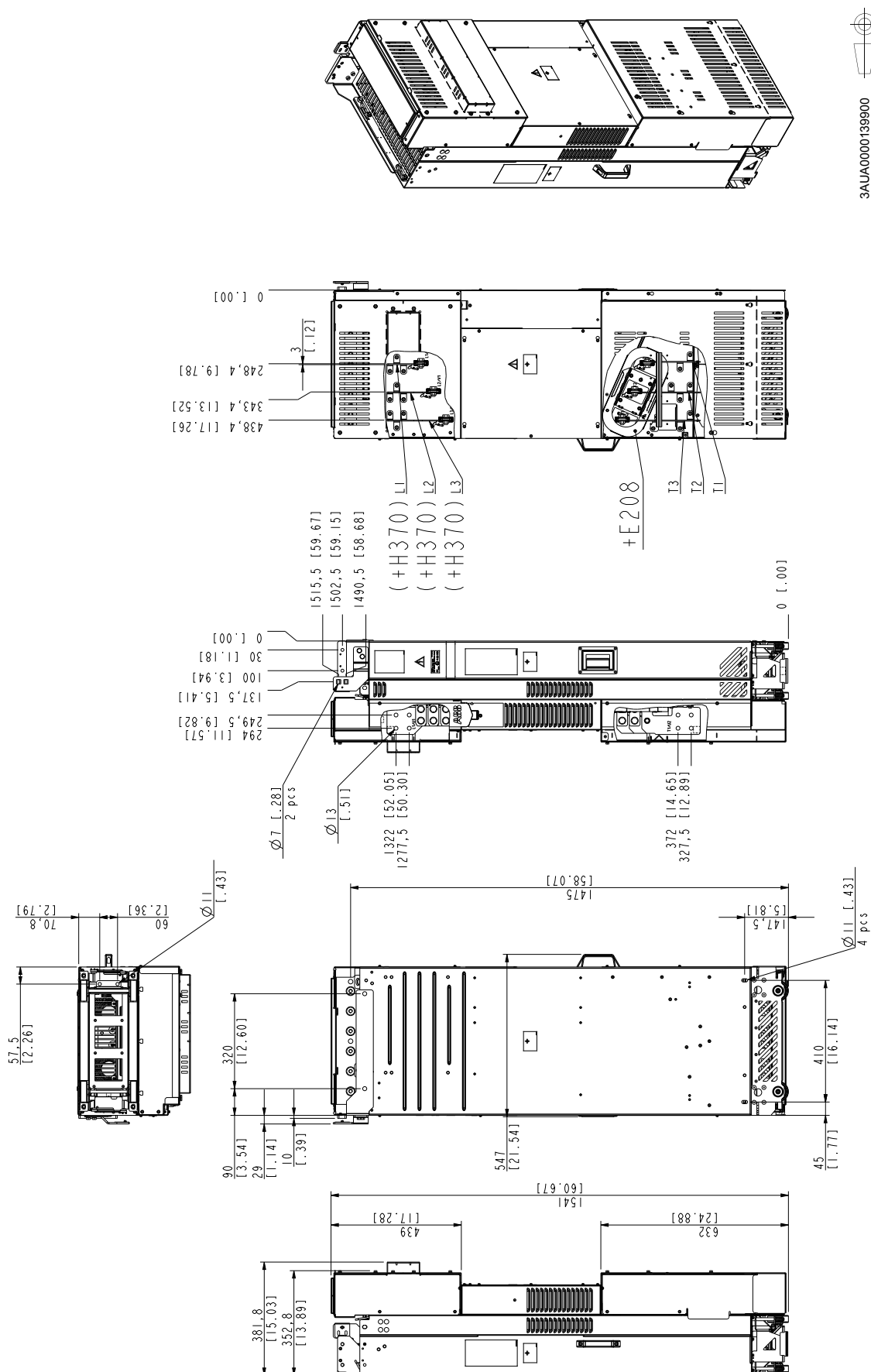




R10 – Cabling panels (+H381) installed into a Rittal TS 8 cabinet

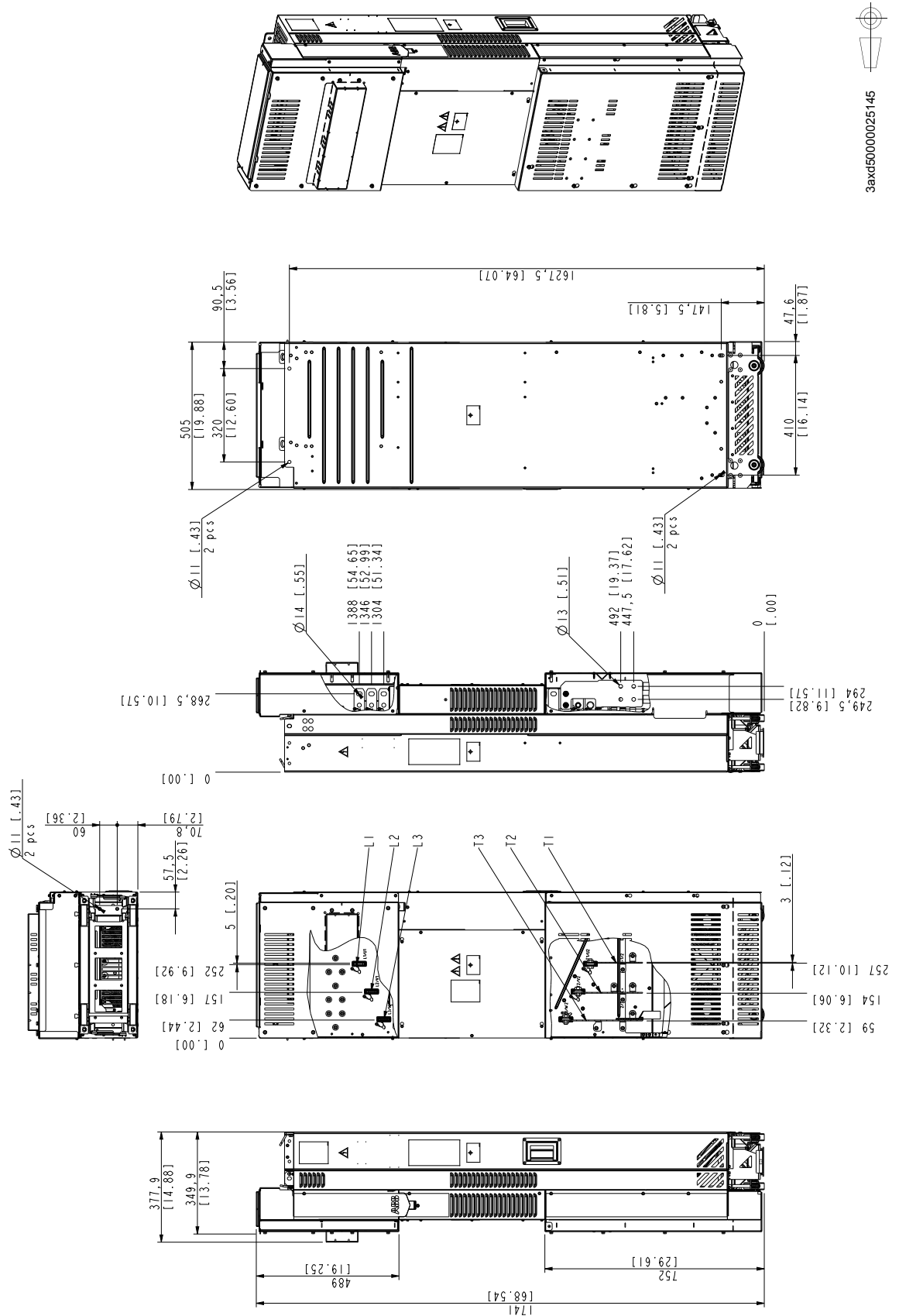


Frame R10 with options +E208+H370+H391+0J400

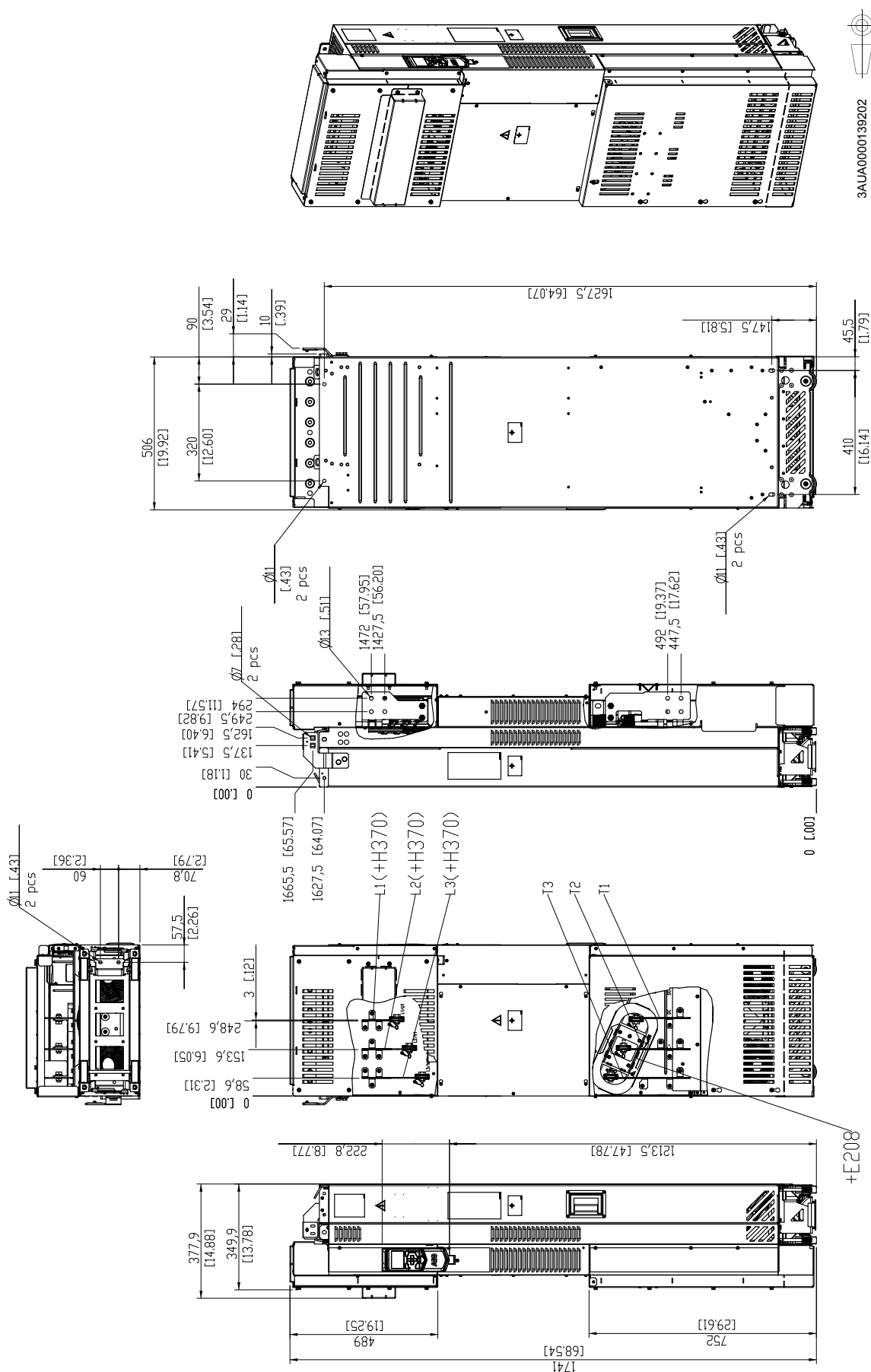


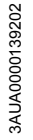
3AUA0000139900

R11 – Standard configuration



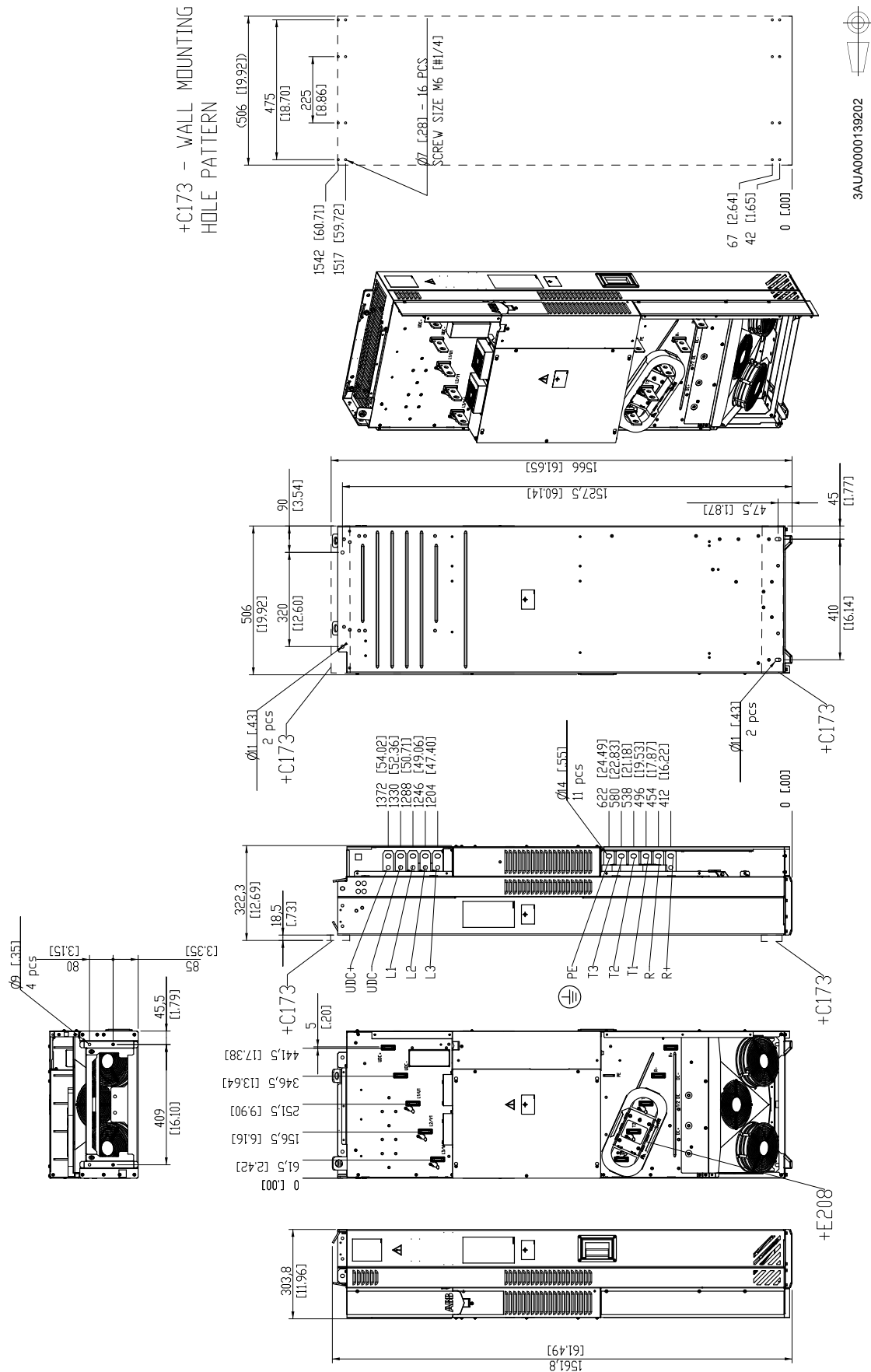
R11 with options +E208+H370+J414+P905





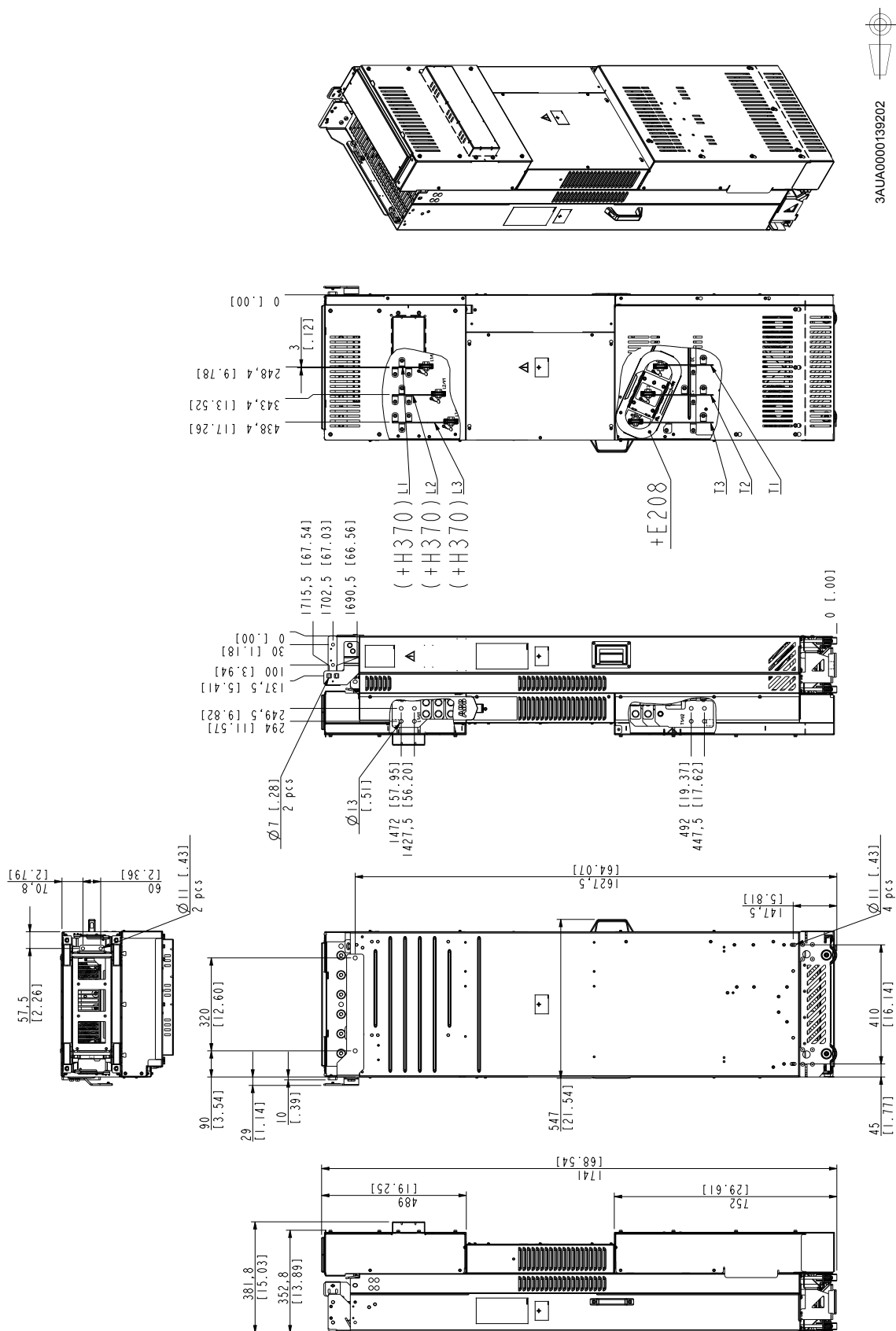


R11 with options +0B051+C173+E208+H356+0H354+0H371



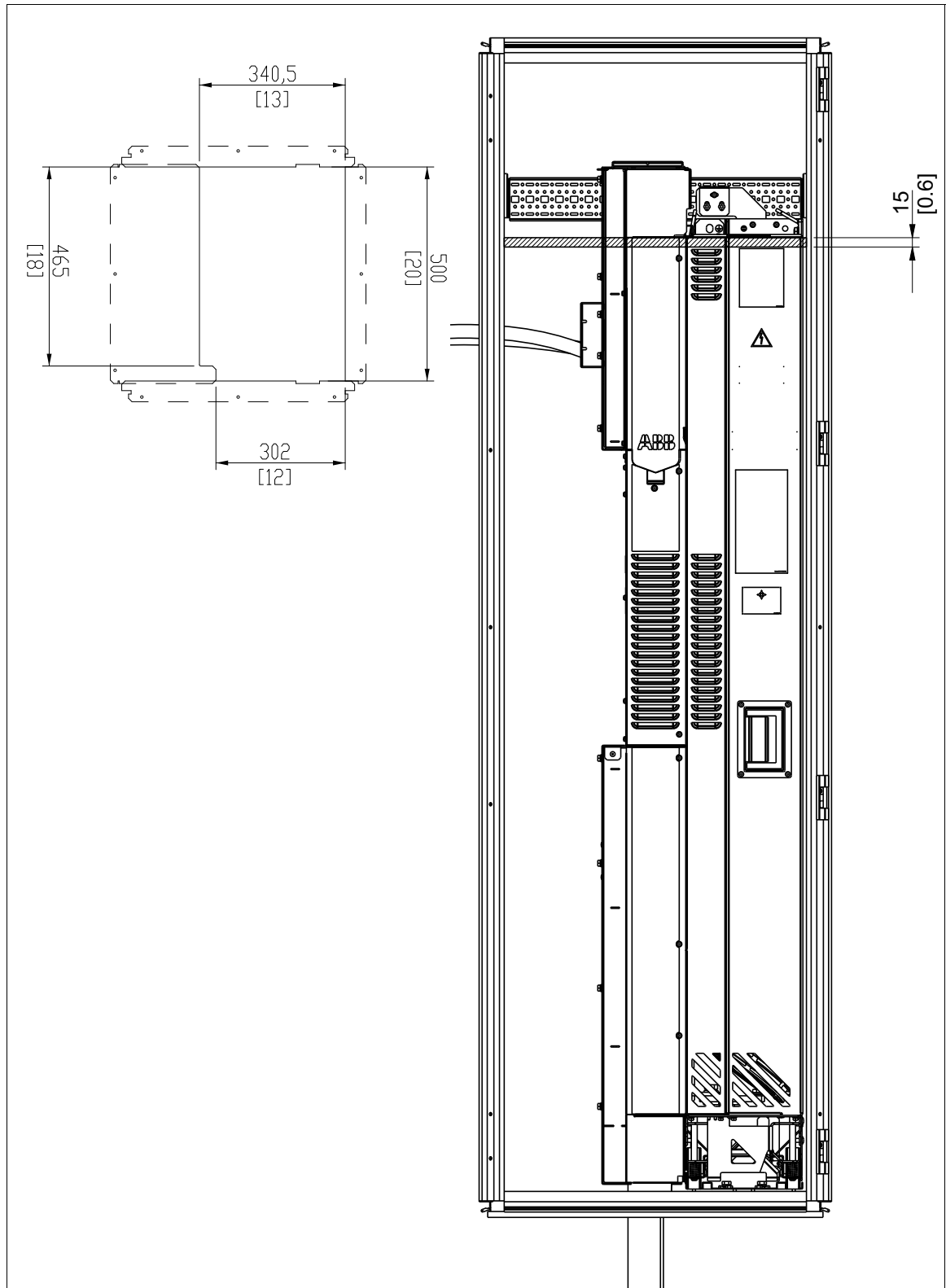


Frame R11 with options +E208+H370+H391+0J400



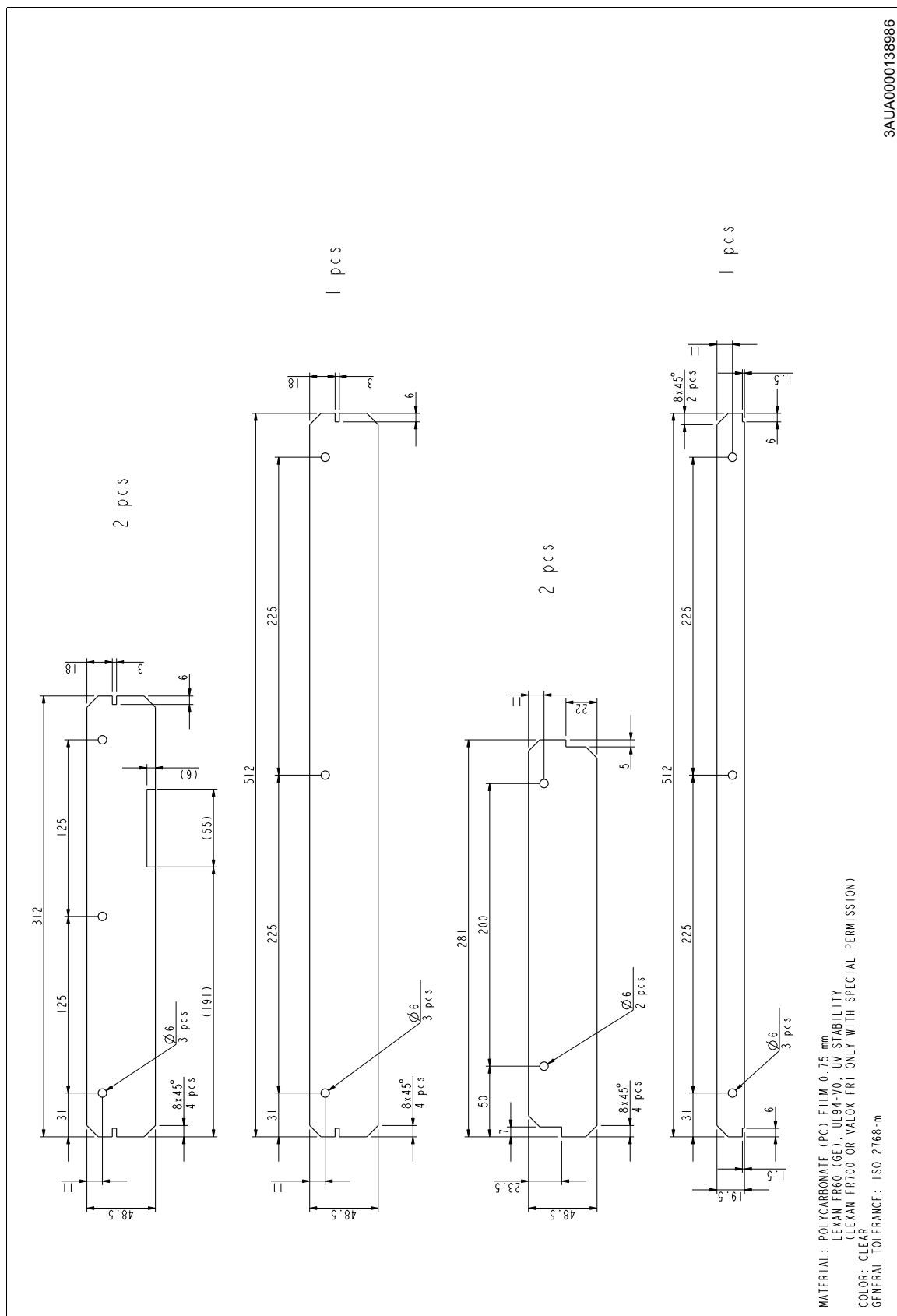
Air baffles for the standard drive module and option +C173

This drawing shows the dimensions of the hole in the air baffle around the standard drive module and flat mounting option +C173. The drawing also shows the correct vertical location area of the air baffle as measured from the top grill.

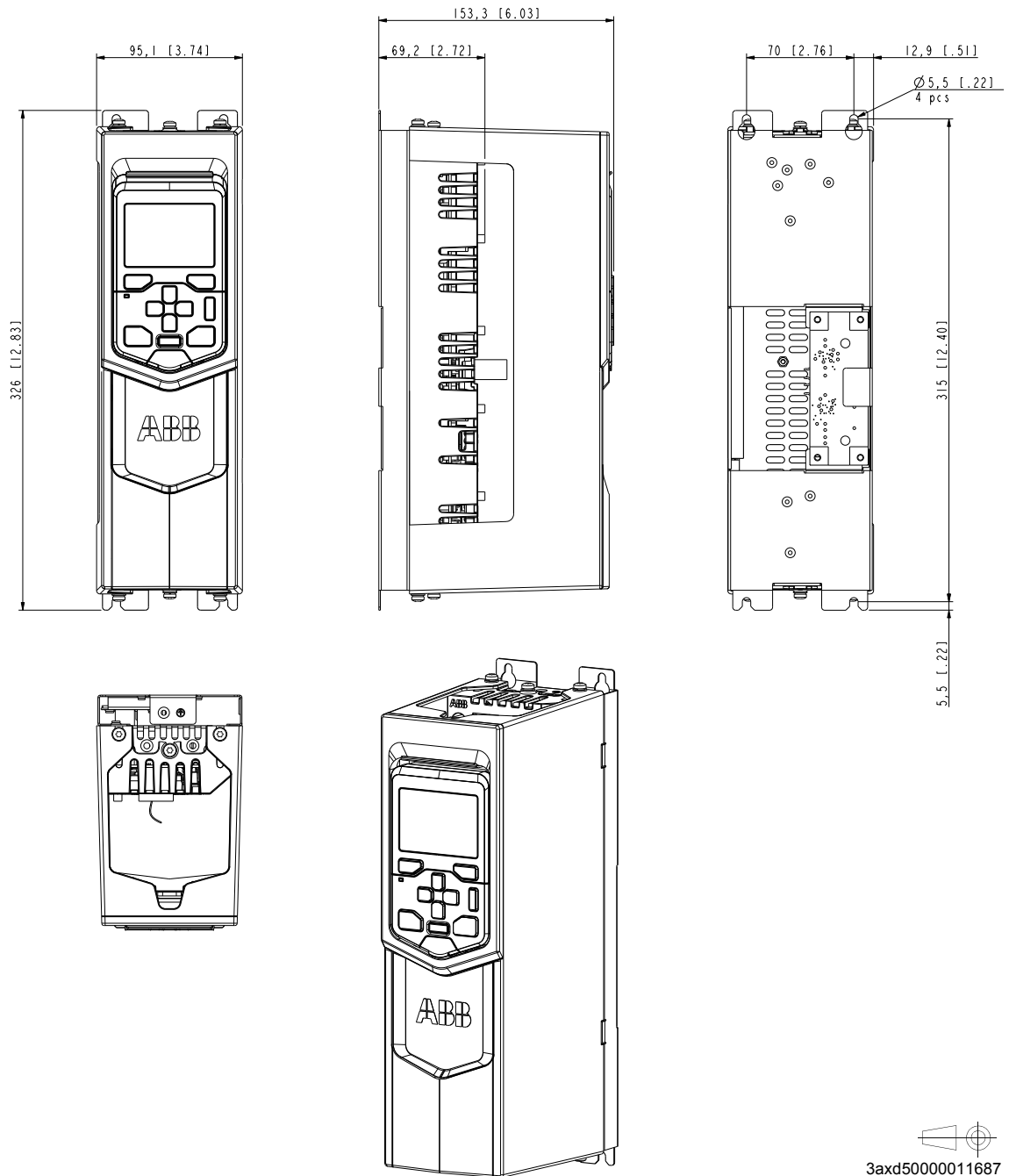


Air baffles for option +H381 in Rittal TS 8 400 mm wide cabinet installation

Note: These air baffles are not ABB parts.



External control unit



16

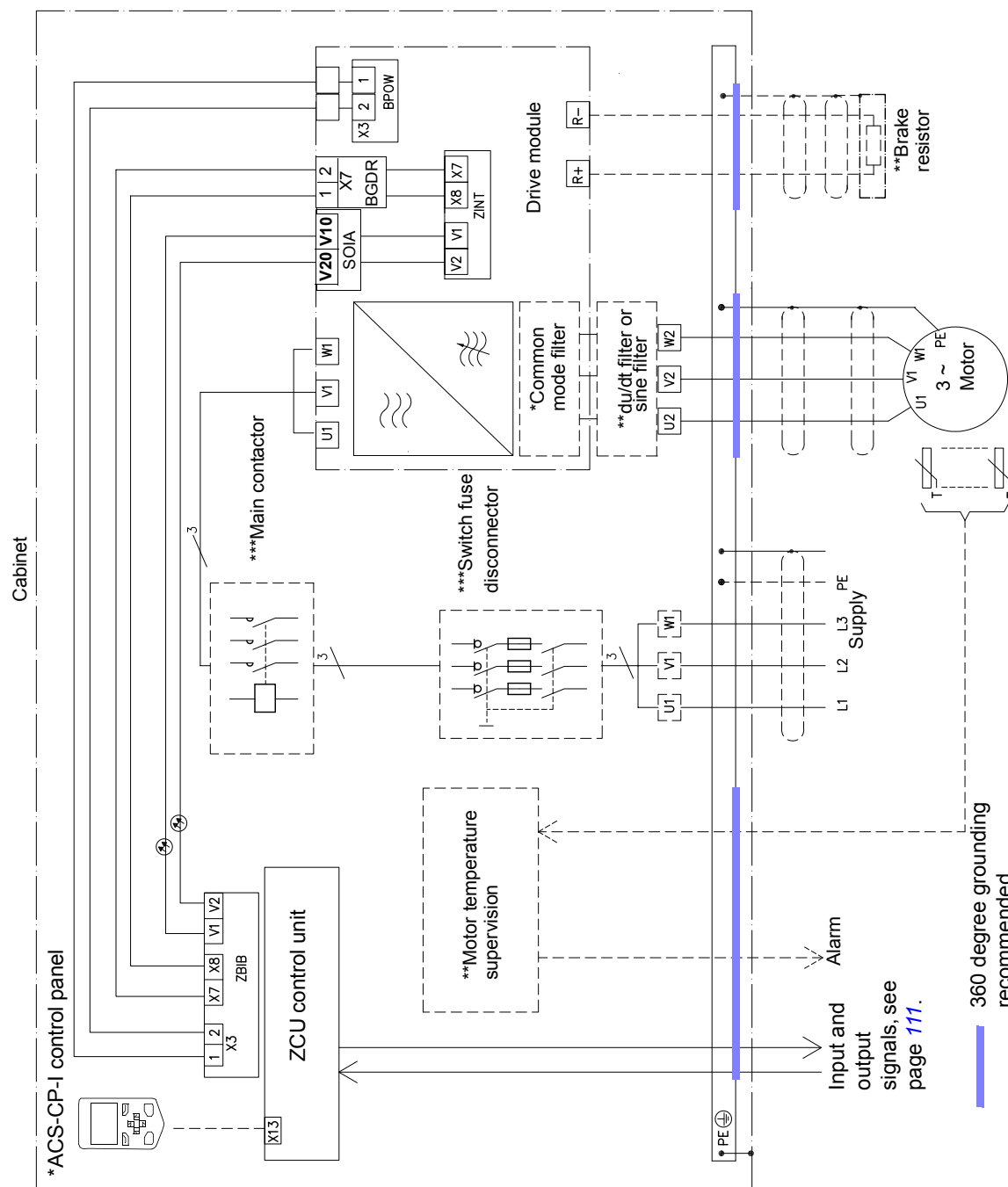
Example circuit diagram

Contents of this chapter

This chapter shows an example circuit diagram for a cabinet-installed drive module.

Example circuit diagram

This diagram is an example for the main wiring of a drive cabinet. Note that the diagram includes components which are not included in a basic delivery (* plus code options, ** other options, *** to be acquired by the customer).



17

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

The Safe torque off function can be used, for example, to construct safety or supervision circuits that stop the drive in case of danger (such as an emergency stop circuit). Another possible application is a prevention of unexpected start-up switch 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 of the power semiconductors of the drive output stage (A, see diagram below), 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 of the drive complies with these standards:

Standard	Name
EN 60204-1:2006 + AC:2010	<i>Safety of machinery – Electrical equipment of machines – Part 1: General requirements</i>
IEC 61326-3-1:2008	<i>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</i>

Standard	Name
IEC 61508-1:2010	<i>Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements</i>
IEC 61508-2:2010	<i>Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems</i>
IEC 61511:2003	<i>Functional safety – Safety instrumented systems for the process industry sector</i>
IEC/EN 61800-5-2:2007	<i>Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional</i>
IEC/EN 62061:2005 + AC:2010	<i>Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems</i>
EN ISO 13849-1:2008 + AC:2009	<i>Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design</i>
EN ISO 13849-2:2012	<i>Safety of machinery – Safety-related parts of control systems – Part 2: Validation</i>

The function also corresponds to Prevention of unexpected start-up as specified by EN 1037:1995 + A1:2008 and Uncontrolled stop (stop category 0) as specified in EN 60204-1:2006 + AC:2010.

■ Compliance with the European Machinery Directive

See section [Compliance with the European Machinery Directive](#) on page 194.

Wiring

The following diagrams present examples of Safe torque off wiring for

- a single drive (page 225)
- multiple drives (page 226)
- multiple drives when an external 24 V DC power supply is used (page 227).

For information on the specifications of the STO input, see section [Default I/O connection diagram](#) on page 111.

■ Activation switch

In the wiring diagrams below, 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.
- An FSO-xx safety functions module can also be used. For more information, see the FSO-xx module documentation.

■ Cable types and lengths

We recommend double-shielded twisted-pair cable (see page 75).

Maximum cable lengths:

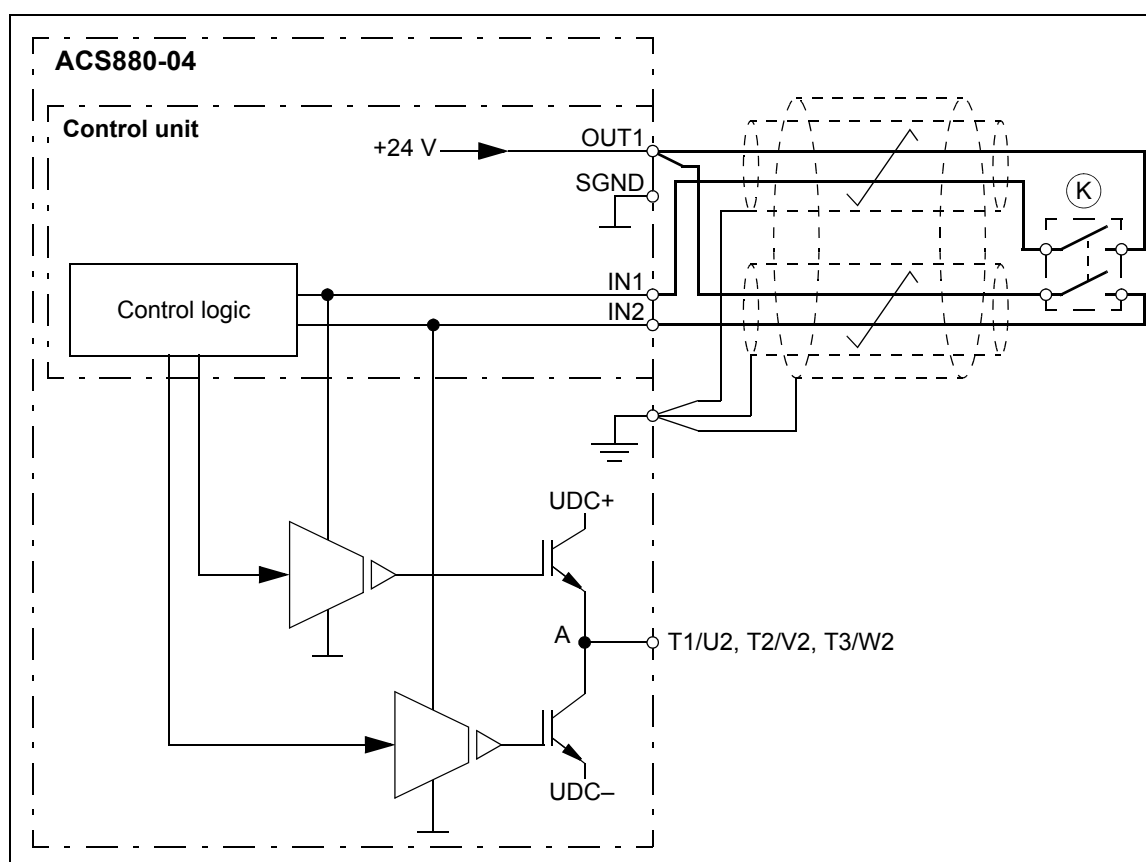
- 30 m (100 ft) between activation switch [K] and drive control unit
- 60 m (200 ft) between multiple drives
- 60 m (200 ft) between external power supply and first drive.

Note that the voltage at the INx terminals of each control unit must be at least 17 V DC to be interpreted as “1”.

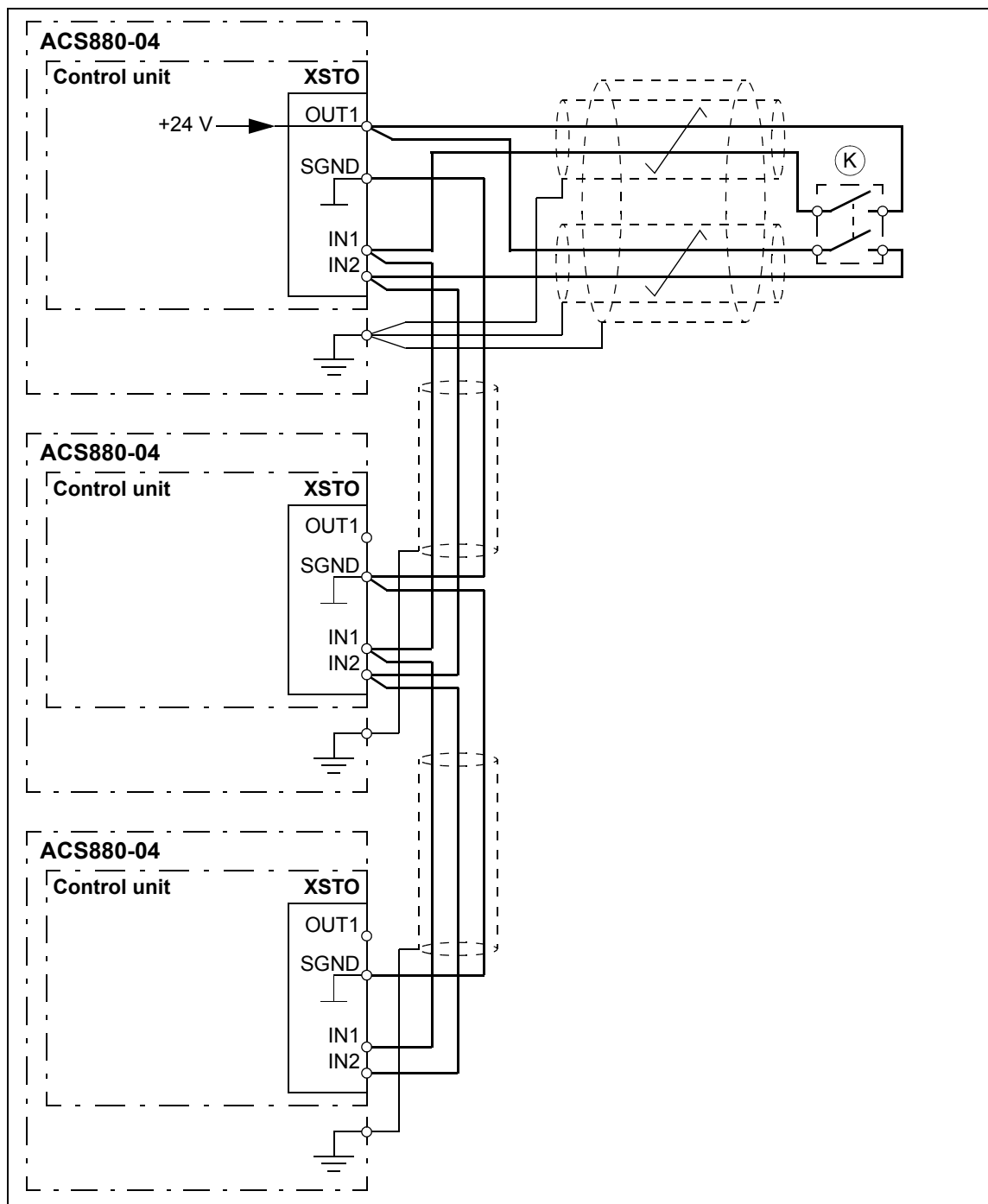
■ Grounding of protective shields

- Ground the shield in the cabling between the activation switch and the control unit at the control unit.
- Ground the shield in the cabling between two control units at one control unit only.

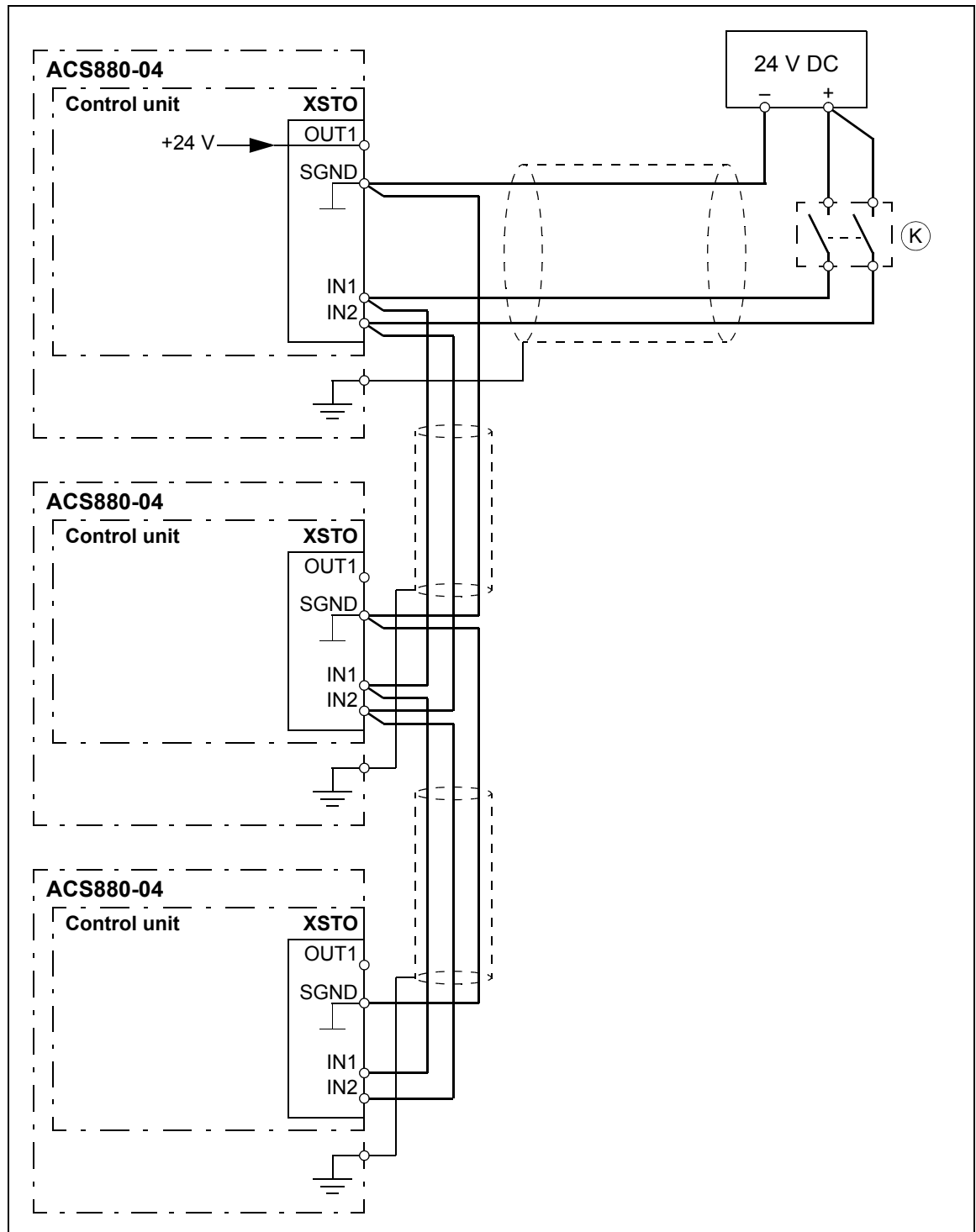
■ Single drive (internal power supply)



■ Multiple drives (internal power supply)



- **Multiple drives (external power supply)**



Operation principle

1. The Safe torque off activates (the activation switch is opened, or safety relay contacts open).
2. STO inputs on the drive control unit de-energize.
3. The control unit cuts off the control voltage from the drive IGBTs.
4. The control program generates an indication as defined by parameter **31.22** (refer to the firmware manual of the drive).
5. Motor coasts to stop (if running). The drive cannot restart while the activation switch or safety relay contacts are open. After the contacts close, a new start command is required to start the drive.

Start-up including acceptance 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 an acceptance test. The acceptance test must be performed

- at initial start-up of the safety function
- after any changes related to the safety function (circuit boards, wiring, components, settings, etc.)
- after any maintenance work related to the safety function.

Competence

The acceptance 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.


Acceptance test reports

Signed acceptance 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 acceptance tests performed due to changes or maintenance shall be logged into the logbook.

Acceptance test procedure

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

Note: If an FSO-xx safety functions module is installed, refer to its documentation.

Action		<input checked="" type="checkbox"/>
	WARNING! Obey the safety instructions in chapter Safety instructions . If you ignore them, injury or death, or damage to the equipment can occur.	<input type="checkbox"/>
Ensure that the drive can be run and stopped freely during start-up.		<input type="checkbox"/>
Stop the drive (if running), switch the input power off and isolate the drive from the power line by a disconnecter.		<input type="checkbox"/>
Check the Safe torque off circuit connections against the wiring diagram.		<input type="checkbox"/>
Close the disconnecter and switch the power on.		<input type="checkbox"/>

Action	<input checked="" type="checkbox"/>
<p>Test the operation of the STO function when the motor is stopped.</p> <ul style="list-style-type: none"> • Give a stop command for the drive (if running) and wait until the motor shaft is at a standstill. <p>Ensure that the drive operates as follows:</p> <ul style="list-style-type: none"> • Open the STO circuit. The drive generates an indication if one is defined for 'stopped' state in parameter 31.22 (see the firmware manual). • Give a start command to verify that the STO function blocks the operation of the drive. The motor should not start. • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally. 	<input type="checkbox"/>
<p>Test the operation of the STO function when the motor is running.</p> <ul style="list-style-type: none"> • Start the drive and ensure the motor is running. • Open the STO circuit. The motor should stop. The drive generates an indication if one is defined for 'running' state in parameter 31.22 (see the firmware manual). • Reset any active faults and try to start the drive. • Ensure 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. 	<input type="checkbox"/>
Document and sign the acceptance test report which verifies that the safety function is safe and accepted for operation.	<input type="checkbox"/>

Use

1. Open the activation switch, or activate the safety functionality that is wired to the STO connection.
2. STO inputs on the drive control unit de-energize, and the drive control unit cuts off the control voltage from the drive IGBTs.
3. The control program generates an indication as defined by parameter **31.22** (refer to the firmware manual of the drive).
4. Motor coasts to 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 main supply.



WARNING! (With permanent magnet motors only) In case of a multiple IGBT power semiconductor failure, the drive system can produce an alignment torque which maximally rotates the motor shaft by $180/p$ degrees regardless of the activation of the Safe torque off function. p denotes the number of pole pairs.

Notes:

- If the Safe torque off function is activated when the drive is running, the control voltage of the power semiconductors is cut off and the motor coasts 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 2 years. The test procedure is given in section [Acceptance test procedure](#) (page 228).

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, follow the test given in section [Acceptance test procedure](#) on page 228.

Use only ABB approved spare parts.

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.

Fault tracing

The indications given during the normal operation of the Safe torque off function are selected by drive 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 “STO hardware failure” fault. An attempt to use the

STO in a non-redundant manner, for example activating only one channel, triggers the same reaction.

See the drive firmware manual 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

Note: The safety data is calculated for redundant use, and does not apply if both STO channels are not used.

Frame size	IEC 61508						
	SIL	SC	PFH _D (1/h)	HFT	SFF (%)	Lifetime (Years)	PFD (T ₁ = 20 a)
R10, R11	3	3	6.60E-09	1	99.85	20	4.89E-05

Frame size	EN/ISO 13849-1					IEC 62061	IEC 61511
	PL	CCF (%)	MTTF _d (Years)	DC* (%)	Cat.	SILCL	SIL
R10, R11	e	80	428.32 a	≥99	4	3	3

According to Table E1 EN/ISO 13849-1

- The following temperature profile is used in safety value calculations:

- 670 on/off cycles per year with $\Delta T = 71.66\text{ }^{\circ}\text{C}$
- 1340 on/off cycles per year with $\Delta T = 61.66\text{ }^{\circ}\text{C}$
- 30 on/off cycles per year with $\Delta T = 10.0\text{ }^{\circ}\text{C}$
- 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 A 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 reaction time (shortest detectable break): 1 ms
- STO response time: 2 ms (typical), 5 ms (maximum)
- Fault detection time: Channels in different states for longer than 200 ms
- Fault reaction time: Fault detection time + 10 ms
- STO fault indication (parameter 31.22) delay: < 500 ms
- STO warning indication (parameter 31.22) delay: < 1000 ms

■ Abbreviations

Abbr.	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
FIT	IEC 61508	Failure in time: 1E-9 hours
HFT	IEC 61508	Hardware fault tolerance
MTTF _d	EN ISO 13849-1	Mean time to dangerous failure: (The total number of life units) / (the number of dangerous, undetected failures) during a particular measurement interval under stated conditions
PFD	IEC 61508	Probability of failure on demand
PFH _D	IEC 61508	Probability of dangerous failures per hour
PL	EN ISO 13849-1	Performance level. Levels a...e correspond to SIL
SC	IEC 61508	Systematic capability
SFF	IEC 61508	Safe failure fraction (%)
SIL	IEC 61508	Safety integrity level (1...3)
SILCL	IEC/EN 62061	Maximum SIL (level 1...3) that can be claimed for a safety function or subsystem
SS1	IEC/EN 61800-5-2	Safe stop 1
STO	IEC/EN 61800-5-2	Safe torque off
T1	IEC 61508	Proof test interval. See also section 230 on page 230 .

18

Resistor braking

Contents of this chapter

This chapter describes how to select, protect and wire brake choppers and resistors. The chapter also contains the technical data.

Operation principle and hardware description

The drive can be equipped with optional built-in brake chopper (+D150). Brake resistors are available as add-on kits.

The brake chopper handles the energy generated by a decelerating motor. The chopper connects the brake resistor to the intermediate DC circuit whenever the voltage in the circuit exceeds the limit defined by the control program. Energy consumption by the resistor losses lowers the voltage until the resistor can be disconnected.

Planning the braking system

■ Selecting the default brake circuit components

1. Calculate the maximum power generated by the motor during braking (P_{\max}).
2. Select a suitable drive, brake chopper and brake resistor combination for the application from the rating table on page [237](#). The braking power of the chopper must be greater or equal than the maximum power generated by the motor during the braking.
3. Check the resistor selection. The energy generated by the motor during a 400-second period must not exceed the resistor heat dissipation capacity E_R .

Note: If the E_R value is not sufficient, it is possible to use a four-resistor assembly in

which two standard resistors are connected in parallel, two in series. The E_R value of the four-resistor assembly is four times the value specified for the standard resistor.

■ Selecting a custom resistor

If you use a resistor other than the default resistor, make sure that:

1. The resistance of the custom resistor is greater or equal than the resistance of the default resistor in the rating table on page 237:

$$R \geq R_{\min}$$

where

R Resistance of the custom resistor.



WARNING! Never use a brake resistor with a resistance smaller than R_{\min} . The drive and the chopper are not able to handle the overcurrent caused by the low resistance.

R_{\min} Resistance of the default resistor

2. The load capacity of the custom resistor is higher than the instantaneous maximum power consumption of the resistor when it is connected to the drive DC link voltage by the chopper:

$$P_r > \frac{U_{DC}^2}{R}$$

where

P_r Load capacity of the custom resistor

U_{DC} Drive DC link voltage.

1.35 · 1.25 · 415 V DC (when supply voltage is 380 to 415 V AC)

1.35 · 1.25 · 500 V DC (when supply voltage is 440 to 500 V AC) or

1.35 · 1.25 · 690 V DC (when supply voltage is 525 to 690 AC)

R Resistance of the custom resistor

■ Selecting and routing the external brake resistor cables

Use the same cable type for the resistor cabling as for the drive input cabling to ensure that the input fuses also protect the resistor cable. Alternatively, a two conductor shielded cable with the same cross-sectional area can be used.

Minimizing electromagnetic interference

Obey these rules in order to minimize electromagnetic interference caused by the rapid current changes in the resistor cables:

- Shield the braking power line completely, either by using shielded cable or a metallic enclosure. Unshielded single-core cable can only be used if it is routed inside a cabinet that efficiently suppresses the radiated emissions.
- Install the cables away from other cable routes.
- Avoid long parallel runs with other cables. The minimum parallel cabling separation distance should be 0.3 meters.
- Cross the other cables at right angles.
- Keep the cable as short as possible in order to minimize the radiated emissions and stress on chopper IGBTs. The longer the cable the higher the radiated emissions, inductive load and voltage peaks over the IGBT semiconductors of the brake chopper.

Maximum cable length

The maximum length of the resistor cable(s) is 10 m (33 ft).

EMC compliance of the complete installation

Note: ABB has not verified that the EMC requirements are fulfilled with external user-defined brake resistors and cabling. The EMC compliance of the complete installation must be considered by the customer.

Placing the brake resistors

Install the resistors outside the drive module in a place where they will cool.

Arrange the cooling of the resistor in a way that:

- no danger of overheating is caused to the resistor or nearby materials
- the temperature of the room the resistor is located in does not exceed the allowed maximum.

Supply the resistor with cooling air/water according to the resistor manufacturer's instructions.



WARNING! The materials near the brake resistor must be non-flammable. The surface temperature of the resistor is high. Air flowing from the resistor is of hundreds of degrees Celsius. If the exhaust vents are connected to a ventilation system, ensure that the material withstands high temperatures. Protect the resistor against contact.

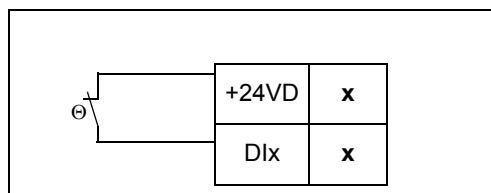
■ Protecting the system against thermal overload

The brake chopper protects itself and the resistor cables against thermal overload when the cables are dimensioned according to the nominal current of the drive. The drive control program includes a resistor and resistor cable thermal protection function which can be tuned by the user. See the firmware manual.

A main contactor is not required for protecting against resistor overheating when the resistor is dimensioned according to the instructions and the internal brake chopper is in use. The drive will disable power flow through the input bridge if the chopper remains conductive in a fault situation but the charging resistor may fail.

Note: If an external brake chopper (outside the drive module) is used, a main contactor is always required.

A thermal switch (standard in ABB resistors) is required for safety reasons. The thermal switch cable must be shielded and may not be longer than the resistor cable. Wire the switch to a digital input on the drive control unit as shown in the figure below.



■ Protecting the resistor cable against short-circuits

The input fuses will also protect the resistor cable when it is identical with the input cable.

Mechanical installation of external brake resistors

All brake resistors must be installed outside the drive. Obey the resistor manufacturer's instructions.

Electrical installation

■ Checking the insulation of the assembly

Obey the instructions given in section [Brake resistor and resistor cable](#) on page 96.

■ Connection diagram

See section [Connection diagram](#) on page 102.

■ Connection procedure

- Connect the resistor cables to the R+ and R- terminals in the same way as the other power cables. If a shielded three-conductor cable is used, cut the third conductor and ground the twisted shield of the cable (protective earth conductor of the resistor assembly) at both ends.
- Connect the thermal switch of the brake resistor as described in section [Protecting the system against thermal overload](#) on page 235.

Start-up

Set the following parameters (ACS880 primary control program):

- Disable the overvoltage control of the drive by parameter **30.30 Overvoltage control**.
- Set parameter **31.01 External event 1 source** to point to the digital input where the thermal switch of the brake resistor is wired.
- Set parameter **31.02 External event 1 type** to **Fault**.
- Enable the brake chopper by parameter **43.06 Brake chopper enable**. If **Enabled with thermal model** is selected, set also the brake resistor overload protection parameters **43.08** and **43.09** according to the application.
- Check the resistance value of parameter **43.10 Brake resistance**.

With these parameter settings, the drive stops by coasting at brake resistor overtemperature. For settings of other control programs, see the appropriate firmware manual.



WARNING! If the drive is equipped with a brake chopper but the chopper is not enabled by the parameter setting, the internal thermal protection of the drive against resistor overheating is not in use. In this case, the brake resistor must be disconnected.

Note: Some brake resistors are coated with oil film for protection. At the start-up, the coating burns off and produces a little bit of smoke. Ensure proper ventilation at the start-up.

Technical data

Ratings

Drive type	Internal brake chopper		Example brake resistor(s)			
	P_{brcont}	R_{min}	Type	R	E_R	P_{Rcont}
	kW	ohm		ohm	kJ	kW
$U_N = 400\text{ V}$						
ACS880-04-505A-3	250	2.0	2xSAFUR125F500	2.00	7200	18
ACS880-04-585A-3	315	1.3	2xSAFUR200F500	1.35	10800	27
ACS880-04-650A-3	315	1.3	2xSAFUR200F500	1.35	10800	27
ACS880-04-725A-3	400	0.7	3xSAFUR200F500	0.90	16200	40
ACS880-04-820A-3	400	0.7	3xSAFUR200F500	0.90	16200	40
ACS880-04-880A-3	400	0.7	3xSAFUR200F500	0.90	16200	40
$U_N = 500\text{ V}$						
ACS880-04-460A-5	250	2.0	2xSAFUR125F500	2.00	7200	18
ACS880-04-503A-5	250	2.0	2xSAFUR125F500	2.00	7200	18
ACS880-04-583A-5	315	1.3	2xSAFUR200F500	1.35	10800	27
ACS880-04-635A-5	315	1.3	2xSAFUR200F500	1.35	10800	27
ACS880-04-715A-5	400	0.7	3xSAFUR200F500	0.90	16200	40
ACS880-04-820A-5	400	0.7	3xSAFUR200F500	0.90	16200	40
ACS880-04-880A-5	400	0.7	3xSAFUR200F500	0.90	16200	40
$U_N = 690\text{ V}$						
ACS880-04-330A-7	285	2.2	SAFUR200F500	2.70	3600	13
ACS880-04-370A-7	285	2.2	SAFUR200F500	2.70	3600	13
ACS880-04-430A-7	285	2.2	SAFUR200F500	2.70	3600	13
ACS880-04-425A-7	350	2.0	2xSAFUR125F500	2.0	7200	18
ACS880-04-470A-7	350	2.0	2xSAFUR125F500	2.0	7200	18
ACS880-04-522A-7	350	2.0	2xSAFUR125F500	2.0	7200	18
ACS880-04-590A-7	400	1.8	2xSAFUR125F500	2.0	7200	18
ACS880-04-650A-7	400	1.8	2xSAFUR125F500	2.0	7200	18
ACS880-04-721A-7	400	1.8	2xSAFUR125F500	2.0	7200	18

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P_{brcont} Maximum continuous braking power. The braking is considered continuous if the braking time exceeds 30 seconds.

R_{min} The minimum allowed resistance value of the brake resistor

R Resistance value for the listed resistor assembly

E_R Short energy pulse that the resistor assembly withstands every 400 seconds

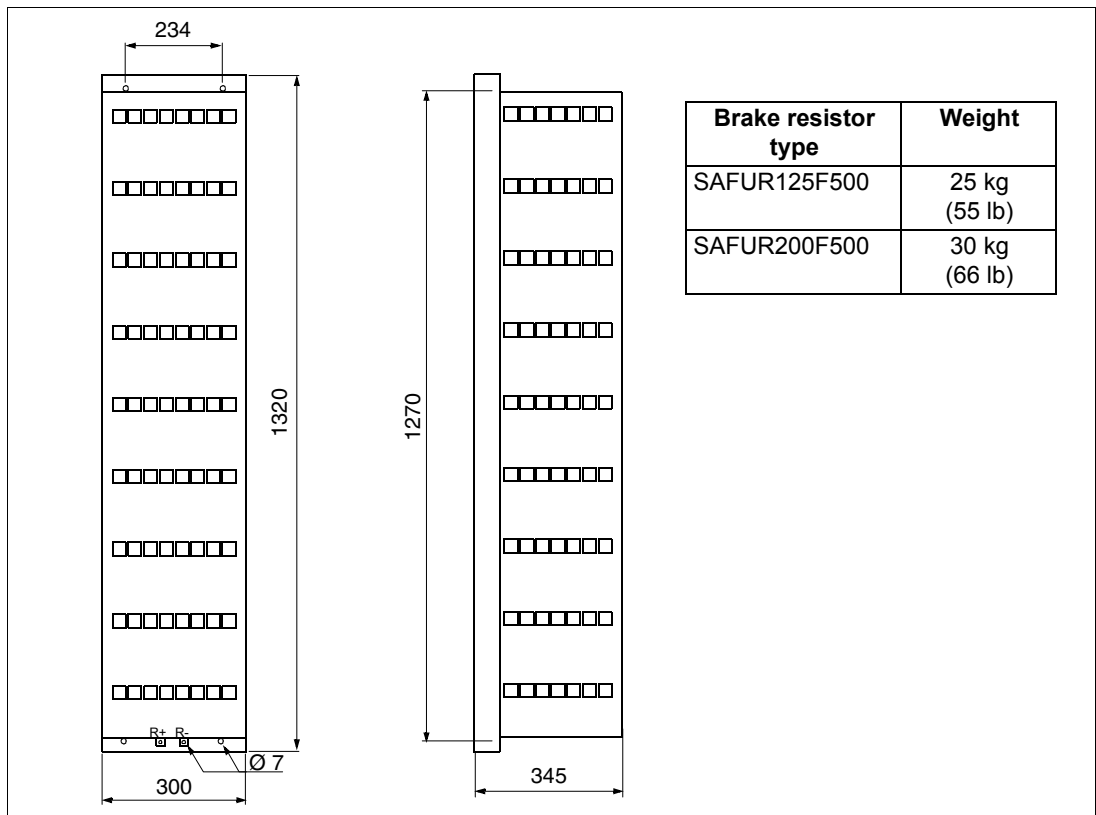
P_{Rcont} Continuous power (heat) dissipation of the resistor when placed correctly

The ratings apply at an ambient temperature of 40 °C (104 °F). For 690 V data, please contact your local ABB representative.

■ **SAFUR resistors**

The degree of protection of SAFUR resistors is IP00. The resistors are not UL listed. The thermal time constant of the resistors is 555 seconds.

Dimensions and weights



■ **Terminals and cable lead-through data**

See section [Terminal and lead-through data for the power cables](#) on page 186.

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du/dt and sine filters

Contents of this chapter

This chapter describes how to select du/dt and sine filters for the drive.

du/dt filters

■ When is a du/dt filter needed?

See section [Examining the compatibility of the motor and drive](#), page 64.

■ Selection table

du/dt filter types for the drive modules are given below.

Drive module type ACS880-04-	du/dt filter type	Drive module type ACS880-04-	du/dt filter type	Drive module type ACS880-04-	du/dt filter type
$U_N = 400\text{ V}$		$U_N = 500\text{ V}$		$U_N = 690\text{ V}$	
505A-3	FOCH0610-70	460A-5	FOCH0610-70	330A-7	FOCH-0610-70
585A-3	FOCH0610-70	503A-5	FOCH0610-70	370A-7	FOCH-0610-70
650A-3	FOCH0610-70	583A-5	FOCH0610-70	430A-7	FOCH-0610-70
725A-3	FOCH0875-70	635A-5	FOCH0610-70	425A-7	FOCH-0610-70
820A-3	FOCH0875-70	715A-5	FOCH0875-70	470A-7	FOCH-0610-70
880A-3	FOCH0875-70	820A-5	FOCH0875-70	522A-7	FOCH-0610-70
-	-	880A-5	FOCH0875-70	590A-7	FOCH-0610-70
-	-	-	-	650A-7	FOCH-0875-70
-	-	-	-	721A-7	FOCH-0875-70

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Ordering codes

Filter type	ABB ordering code
FOCH-0610-70	68550483
FOCH-0875-70	3AUA0000125245

Description, installation and technical data of the FOCH filters

See *FOCH du/dt filters hardware manual* (3AFE68577519 [English]).

Sine filters

When is a sine filter needed?

See section [Examining the compatibility of the motor and drive](#), page 64.

Selection table

Sine filter types for the drive modules are given below.

Drive module type ACS880-04-	Sine filter type	Drive module type ACS880-04-	Sine filter type	Drive module type ACS880-04-	Sine filter type
$U_N = 400\text{ V}$		$U_N = 500\text{ V}$		$U_N = 690\text{ V}$	
505A-3	NSIN900-6	460A-5	NSIN900-6	330A-7	NSIN485-6
585A-3	NSIN900-6	503A-5	NSIN900-6	370A-7	NSIN485-6
650A-3	NSIN900-6	583A-5	NSIN900-6	430A-7	NSIN485-6
725A-3	NSIN900-6	635A-5	NSIN900-6	425A-7	NSIN485-6
820A-3	NSIN900-6	715A-5	NSIN900-6	470A-7	NSIN900-6
880A-3	NSIN900-6	820A-5	NSIN900-6	522A-7	NSIN900-6
-	-	880A-5	NSIN900-6	590A-7	NSIN900-6
-	-	-	-	650A-7	NSIN900-6
-	-	-	-	721A-7	NSIN900-6

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Ordering codes

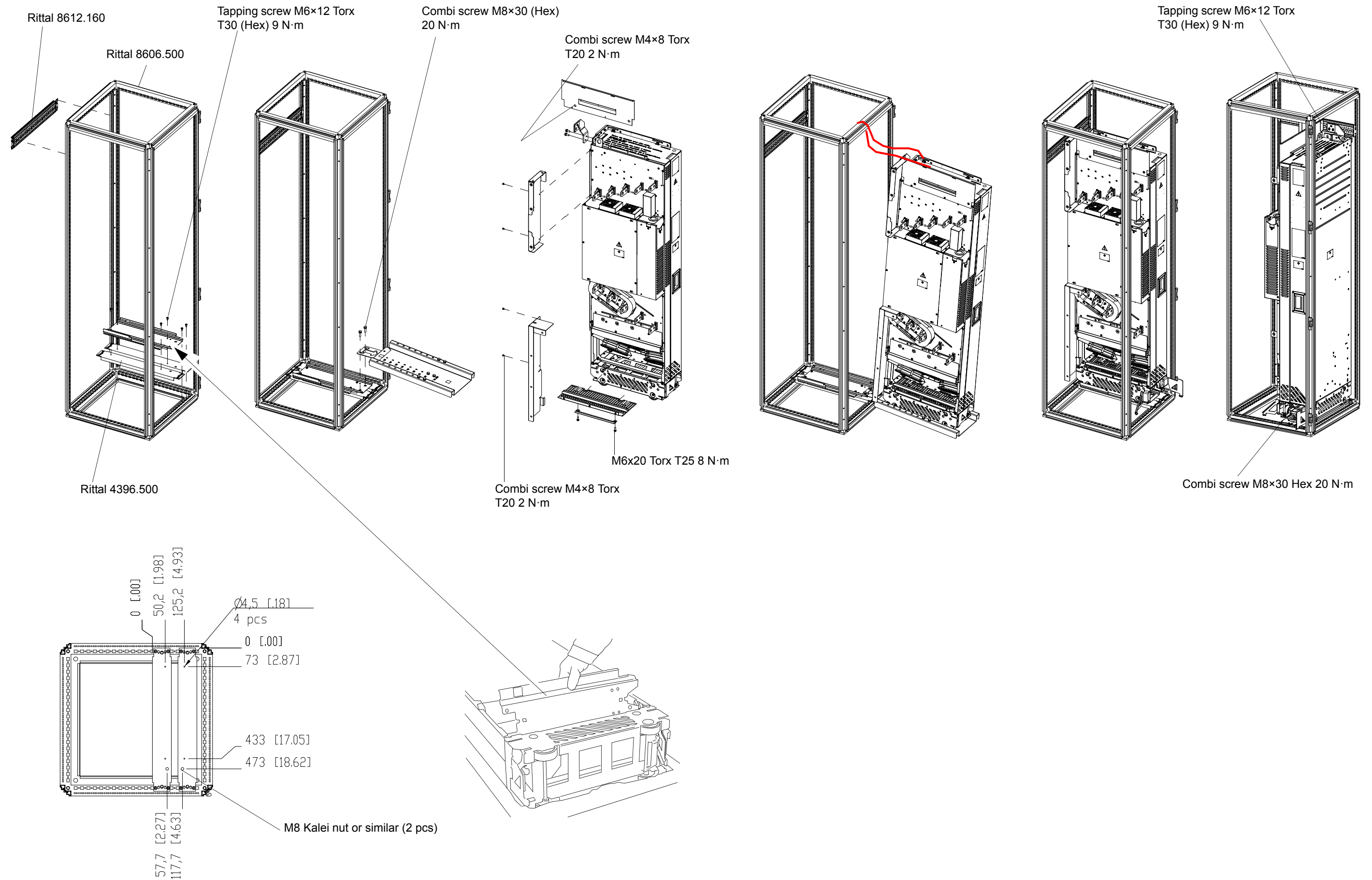
Filter type	ABB ordering code
NSIN485-6	64254936
NSIN900-6	64254961

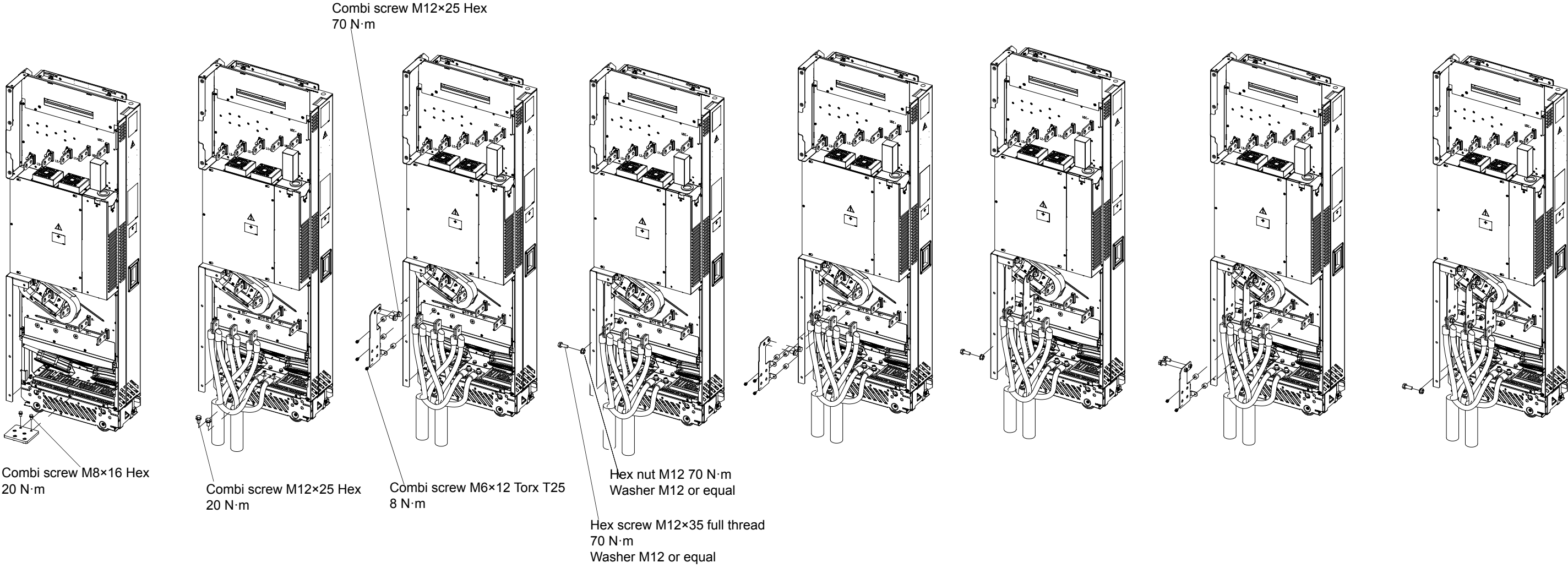
Derating

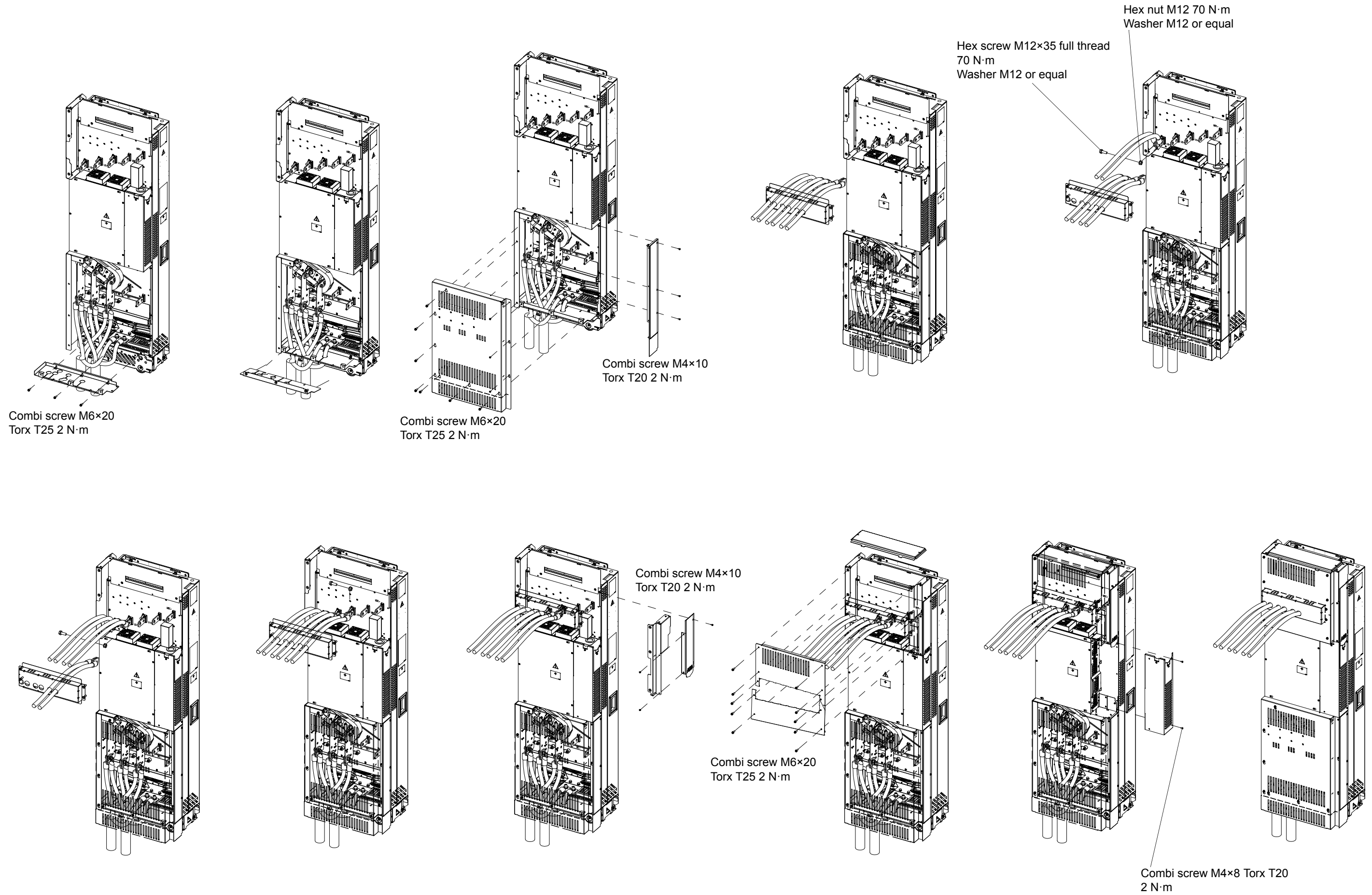
See section [Deratings for special settings in the drive control program](#) on page 180.

Description, installation and technical data of the sine filters

See *Sine filters hardware manual* (3AXD50000016814 [English]). For more information, contact ABB.







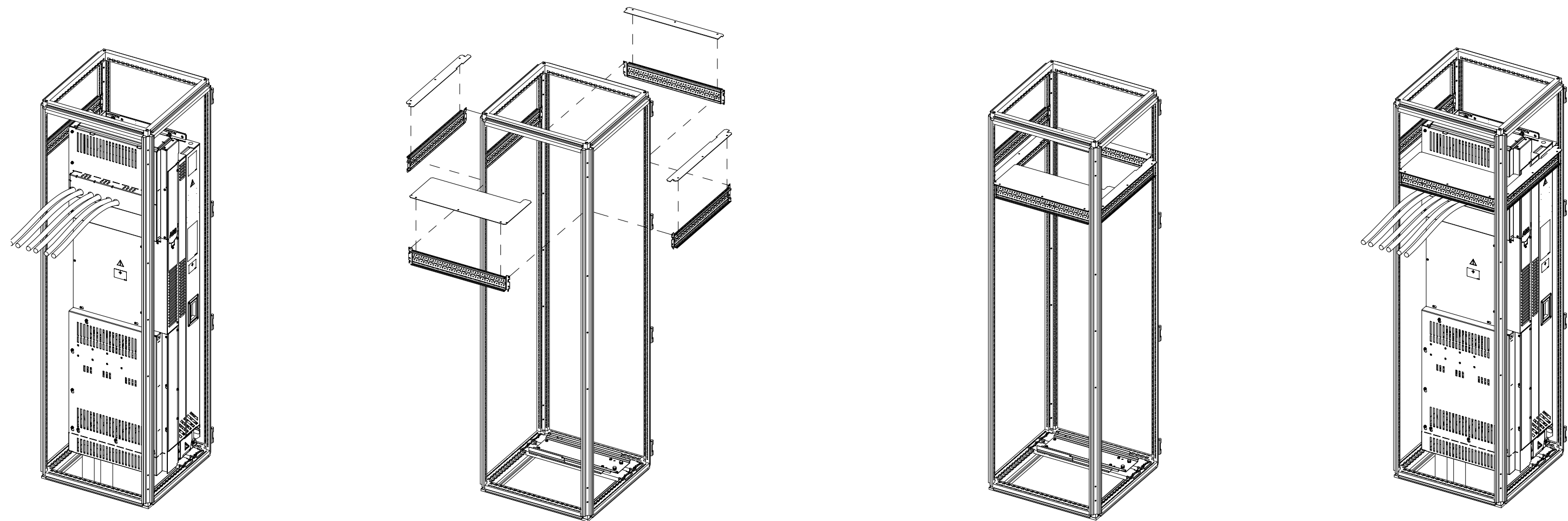
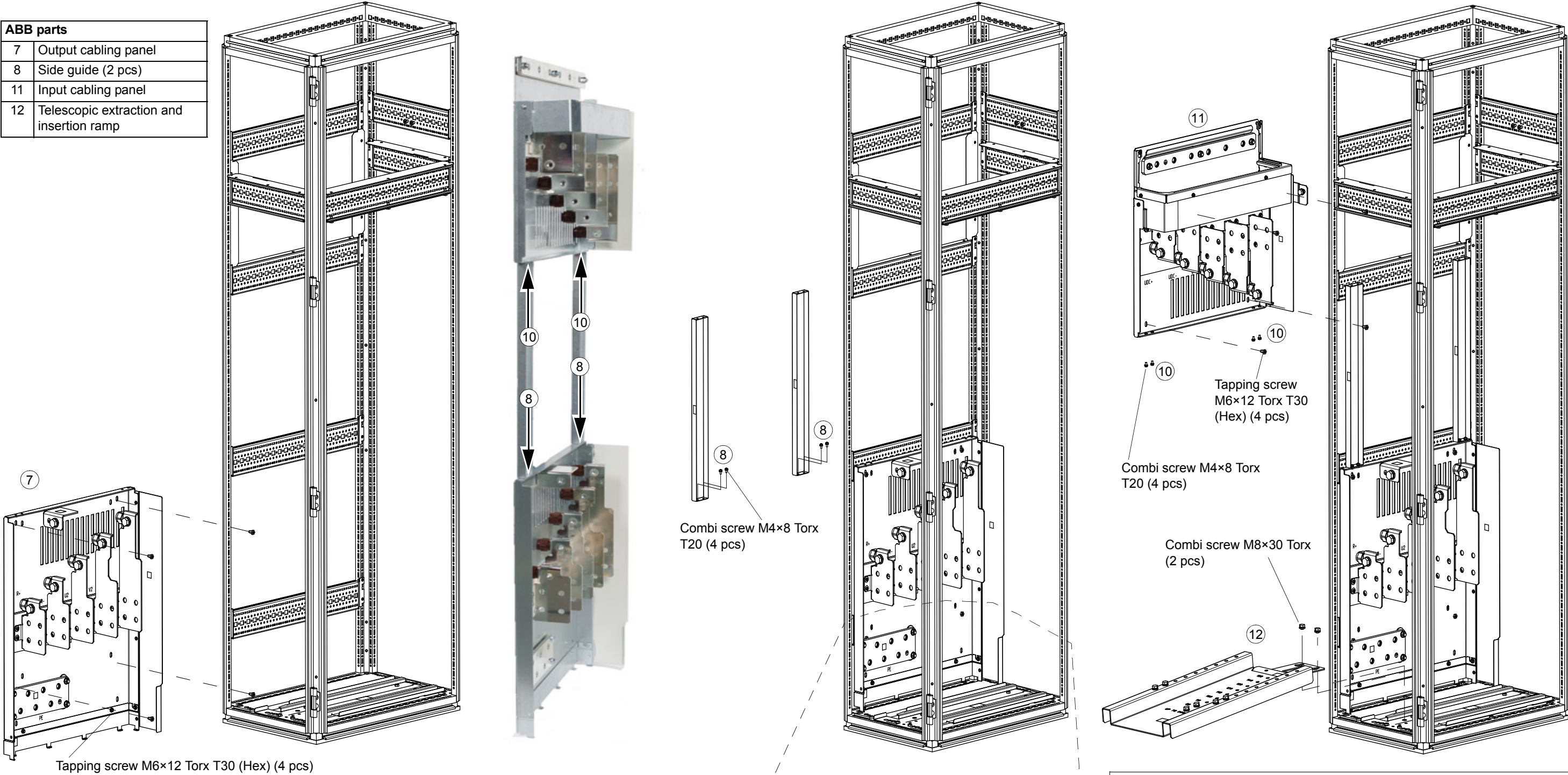
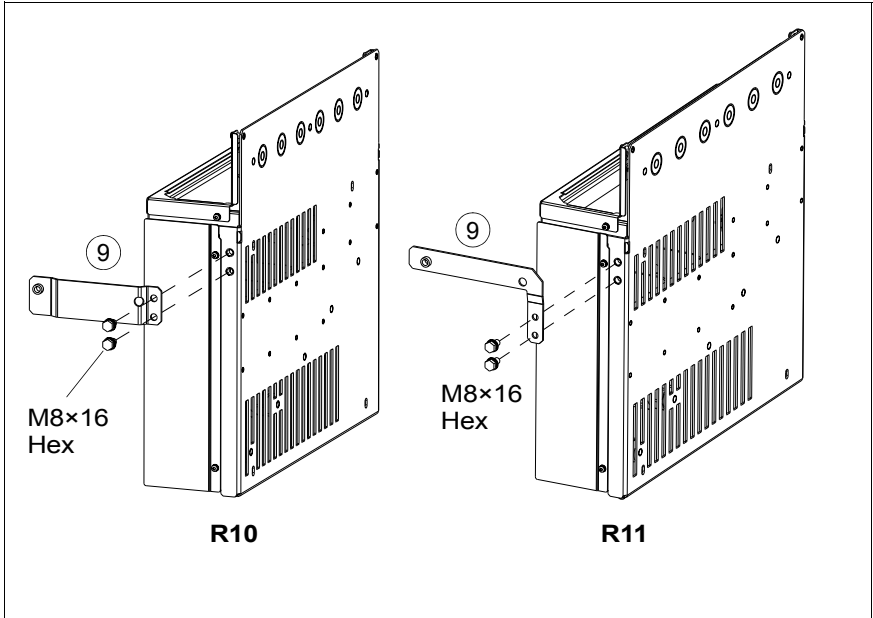
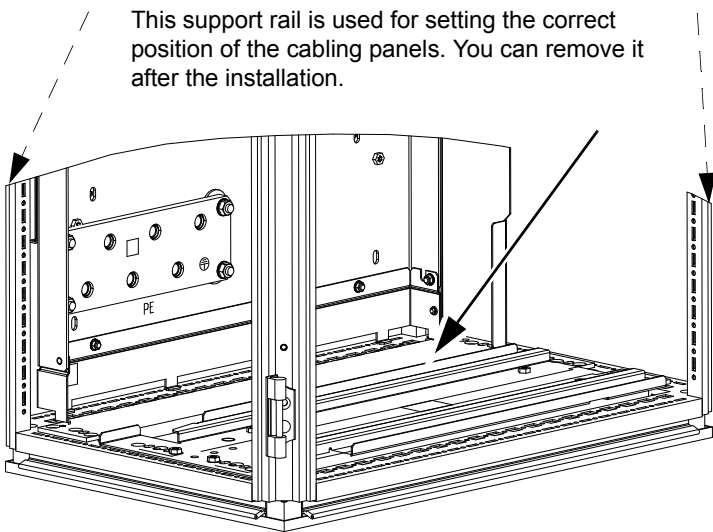
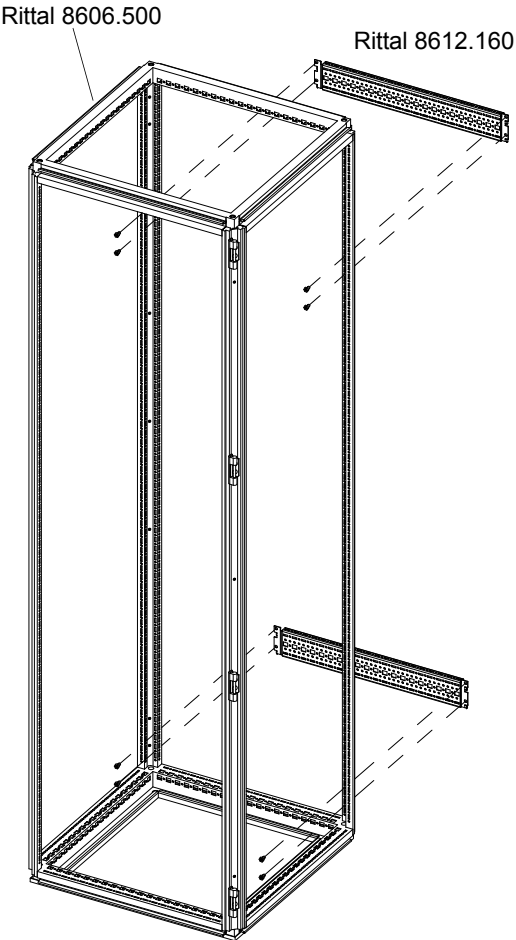


ABB parts	
7	Output cabling panel
8	Side guide (2 pcs)
11	Input cabling panel
12	Telescopic extraction and insertion ramp

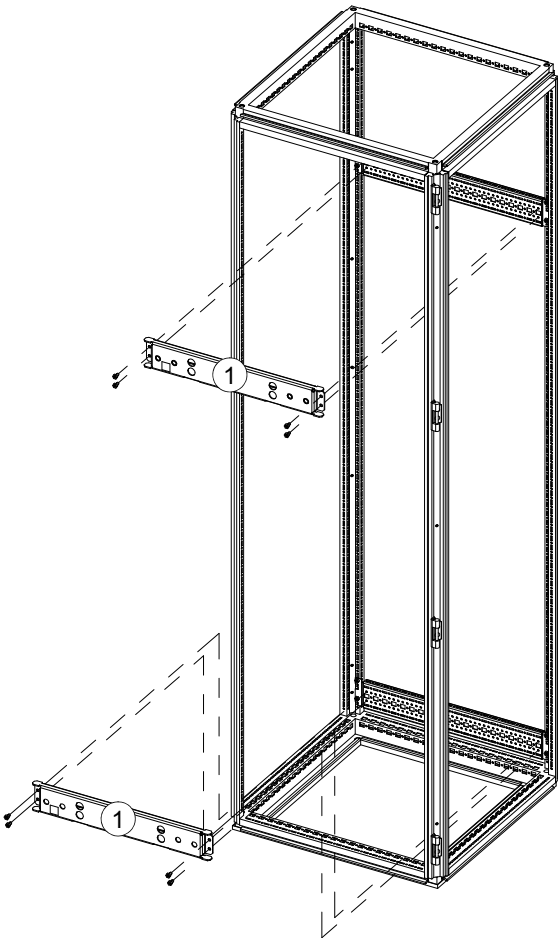


- 7. Install the output cabling panel. **Note:** After you have installed the output cabling panel, you can remove the support rail that lies under the panel if there is not enough space for cables.
- 8. Install the side guides to the output cabling panel (2 screws for each side guide).
- 9. Attach the grounding busbar to the input cabling panel. Back view is shown below.
- 10. Install the side guides to the input cabling panel (2 screws for each side guide).
- 11. Attach the input cabling panel to the punched section.
- 12. Install the Telescopic extraction and insertion ramp

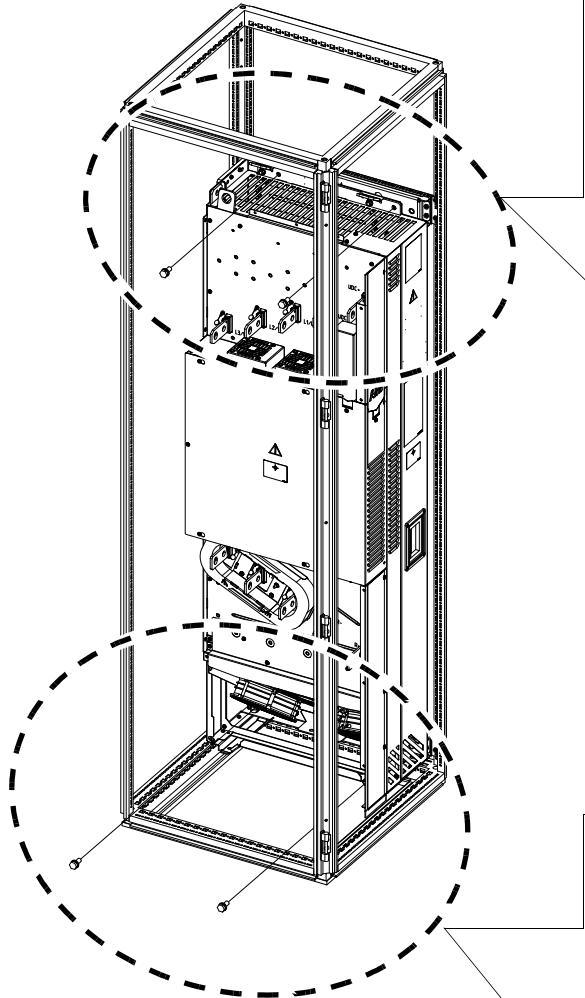
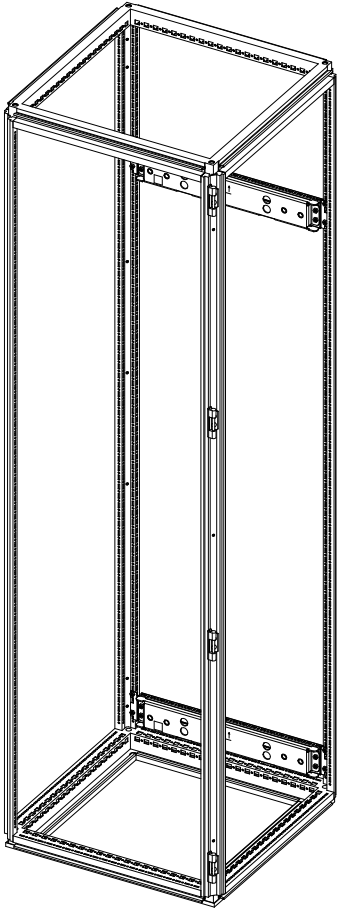




Tapping screw M6×12 Torx T30 (Hex) 9 N·m



Tapping screw M6×12 Torx T30 (Hex) 9 N·m



Combi screw M10×25 Hex 40 N·m

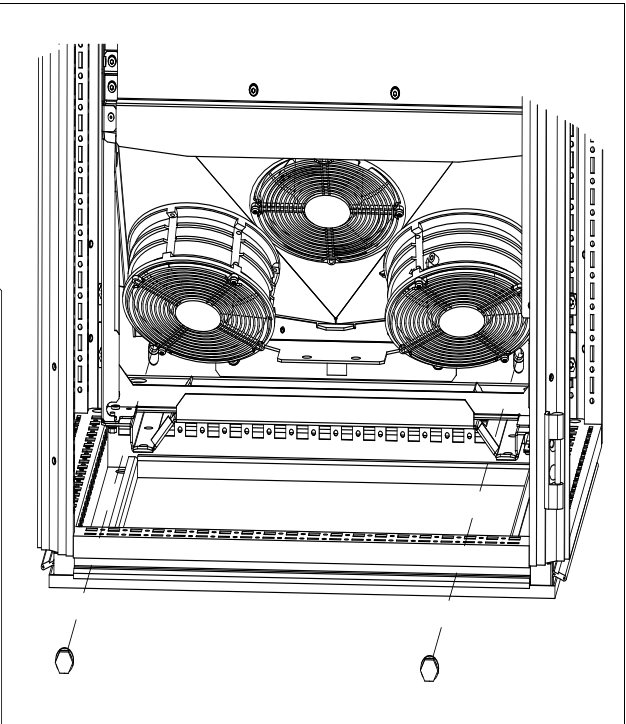
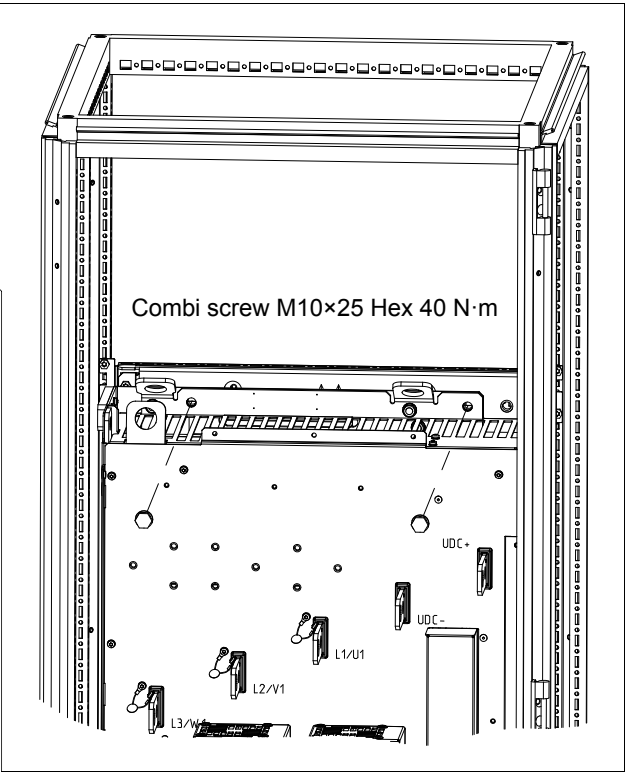
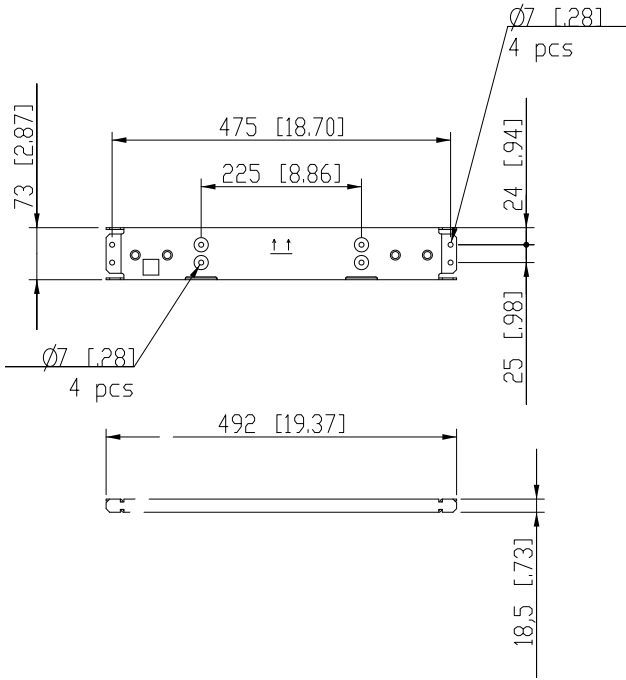
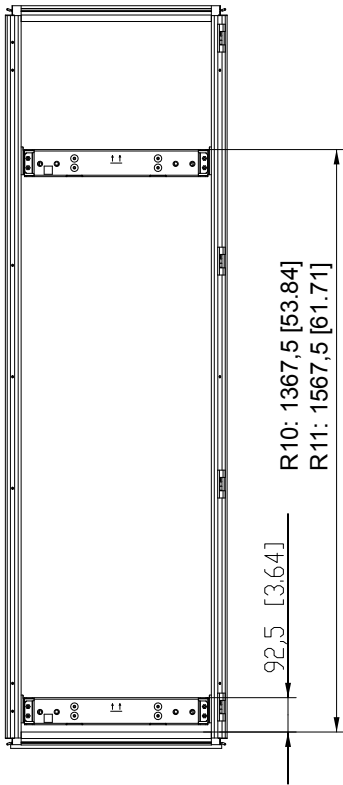


ABB parts	
1	Mounting bracket of flat mounting option +C173
-	No pedestal (option +0H354)



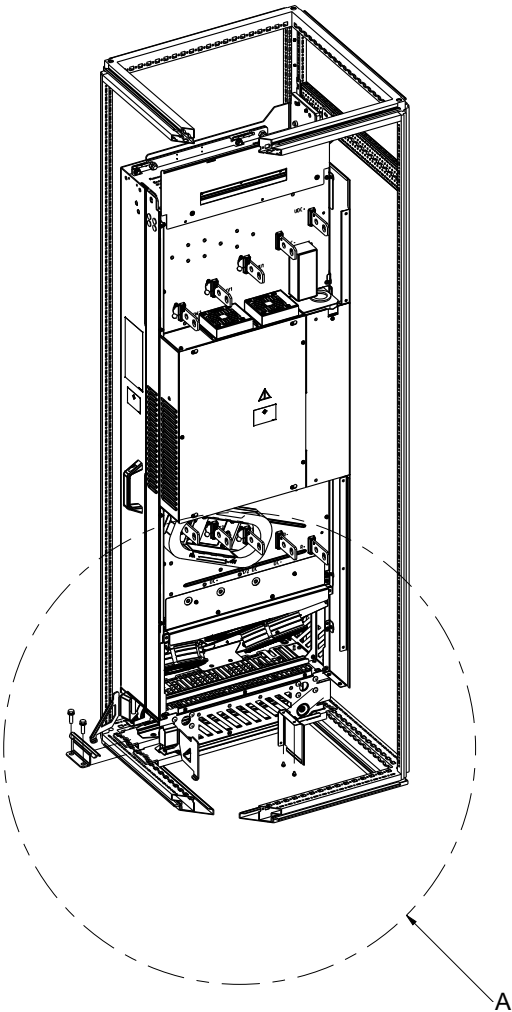
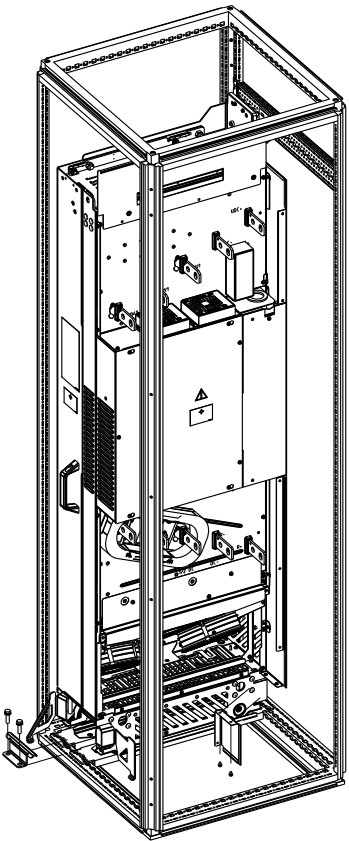
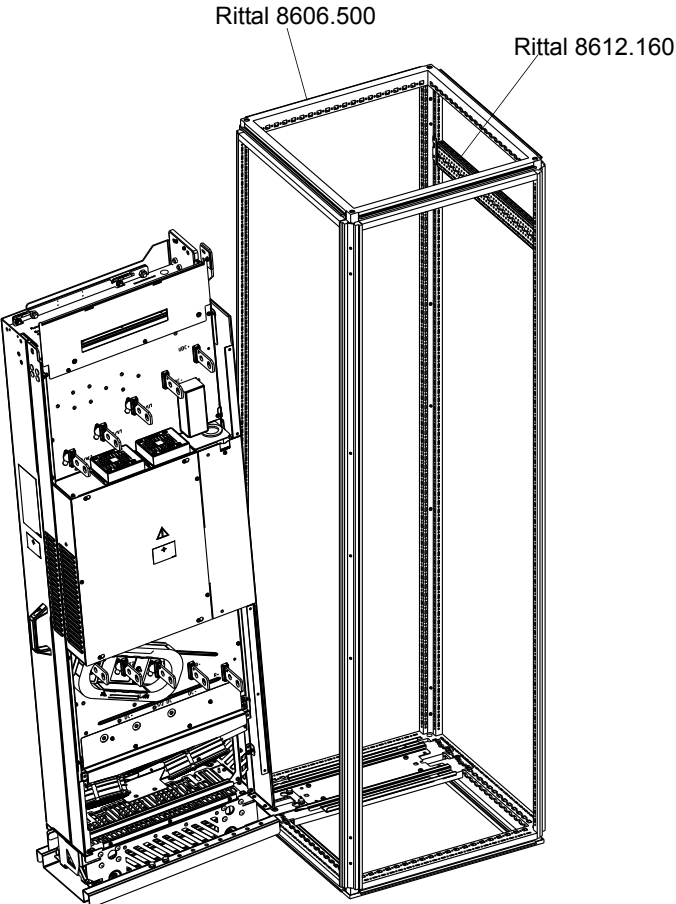
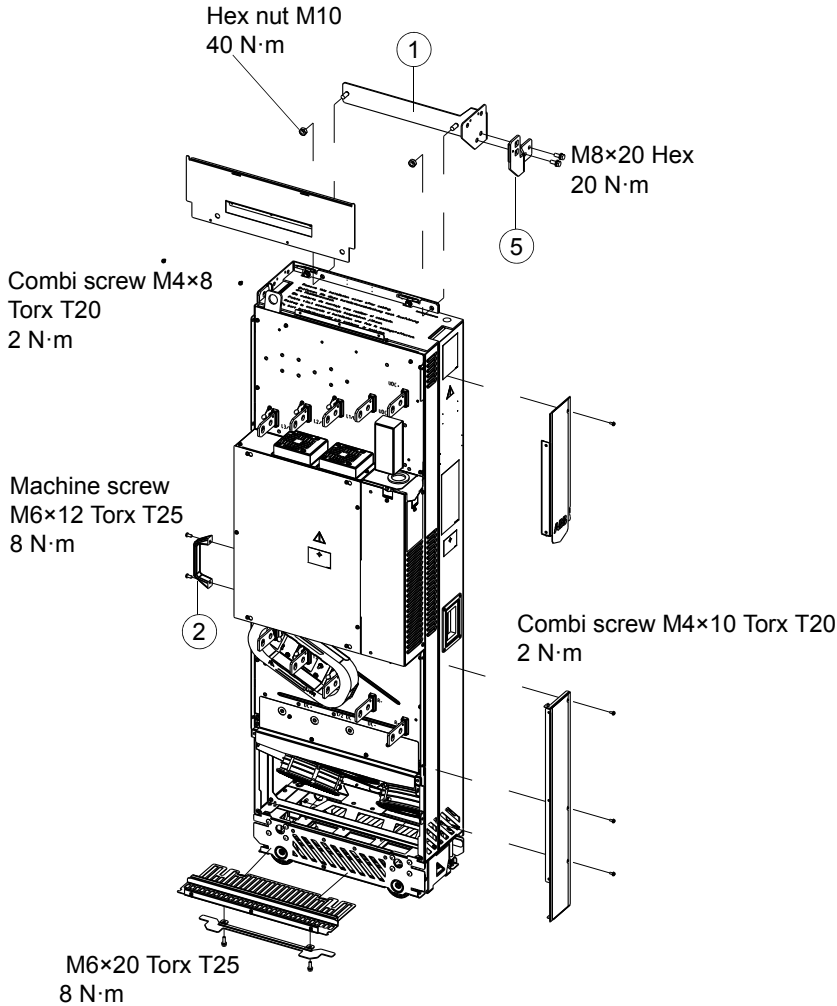
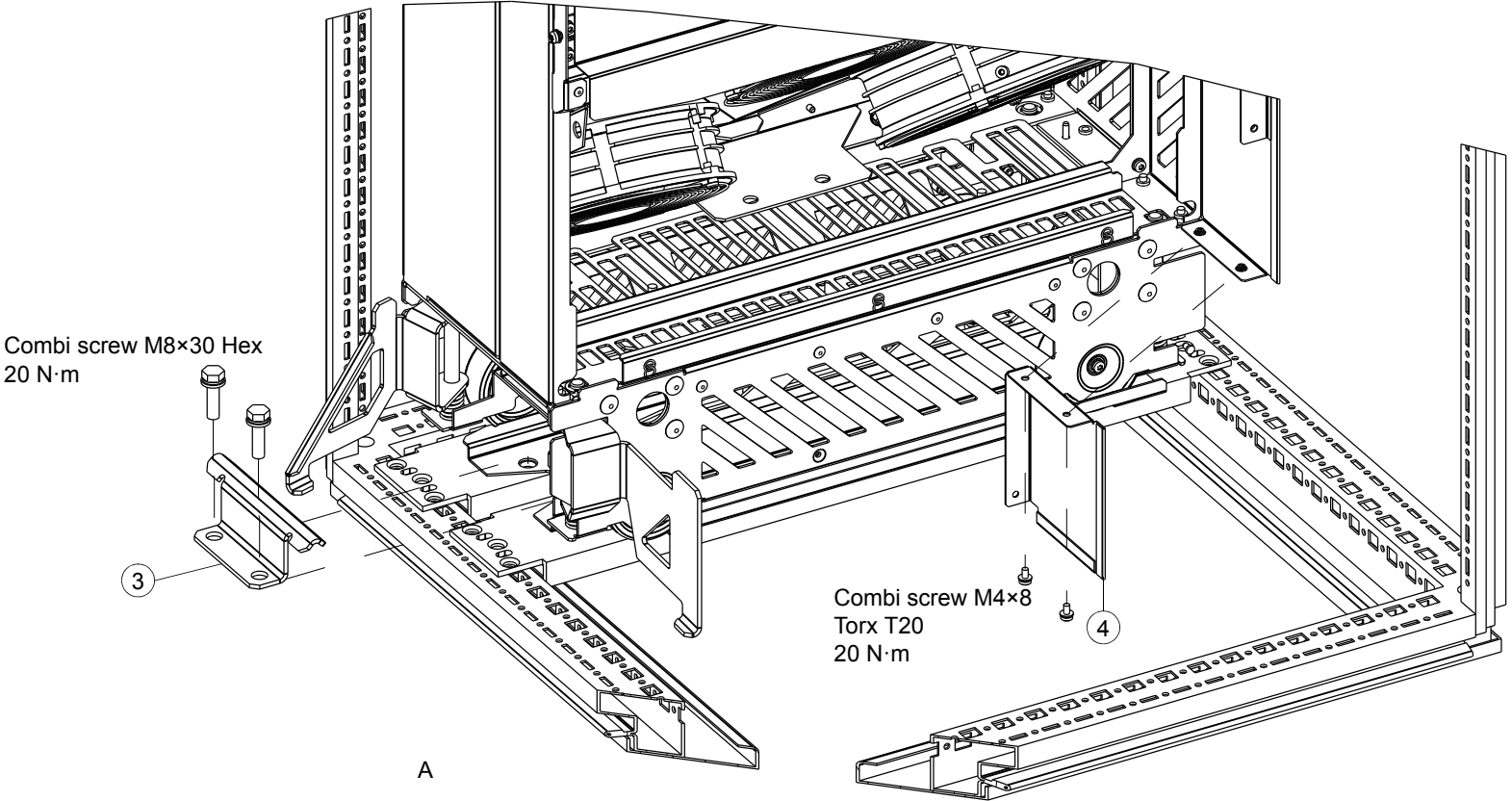


	ABB parts for option +H391
1	Support for back top mounting bracket
2	Handle
3	Bottom mounting bracket
ABB standard parts	
4	Lowest back cover plate
5	Back top mounting bracket



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 www.abb.com/drives and select *ABB University*.

Providing feedback on ABB Drives manuals

Your comments on our manuals are welcome. Go to www.abb.com/drives and select *Document Library – Manuals feedback form (LV AC drives)*.

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Contact us

www.abb.com/drives

www.abb.com/drivespartners

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