ABB industrial drives

Hardware manual
ACS880-04XT drive module packages (500 to 1200 kW)

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List of related manuals

Drive hardware manuals and guides	Code (English)
Drive/converter/inverter safety instructions	Multilingual code: *3AXD50000037978*
ACS880-04XT drive module packages (500 to 1200 kW) hardware manual	*3AXD50000025169*
ACS-AP-x Assistant control panels user's manual	*3AUA0000085685*
BCU-02/12/22 control units hardware manual	*3AUA0000113605*

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*
ACS880+C132 marine type-approved drive modules and module packages supplement	*3AXD50000037752*
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*
FPTC-01 thermistor protection module (option +L536) for ACS880 drives user's manual	*3AXD50000027750*
FPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (option +L537+Q971) for ACS880 drives user's manual	*3AXD50000027750*
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.

Videos:

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

https://www.youtube.com/watch?v=aql6e2qc1xY

Hardware manual

ACS880-04XT drive module packages
(500 to 1200 kW)

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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:

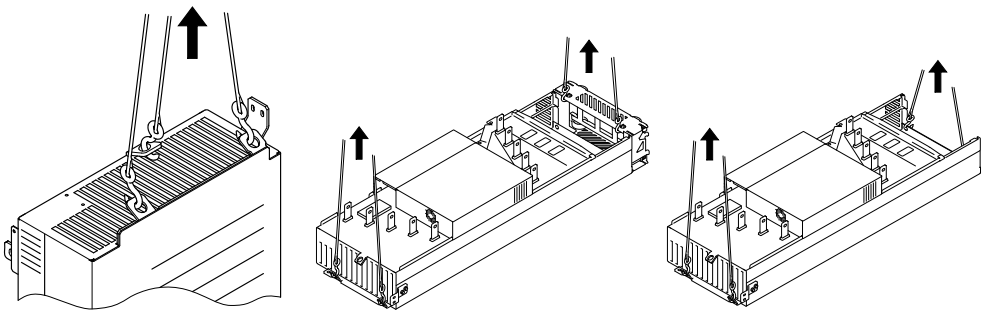
	Electricity warning tells about hazards from electricity which can cause injury or death, or damage to the equipment.
	General warning tells about conditions, other than those caused by electricity, which can cause injury or death, or damage to the equipment.
	Electrostatic sensitive devices warning tells you about the risk of electrostatic discharge which can cause damage to the equipment.

General safety in installation, start-up and maintenance

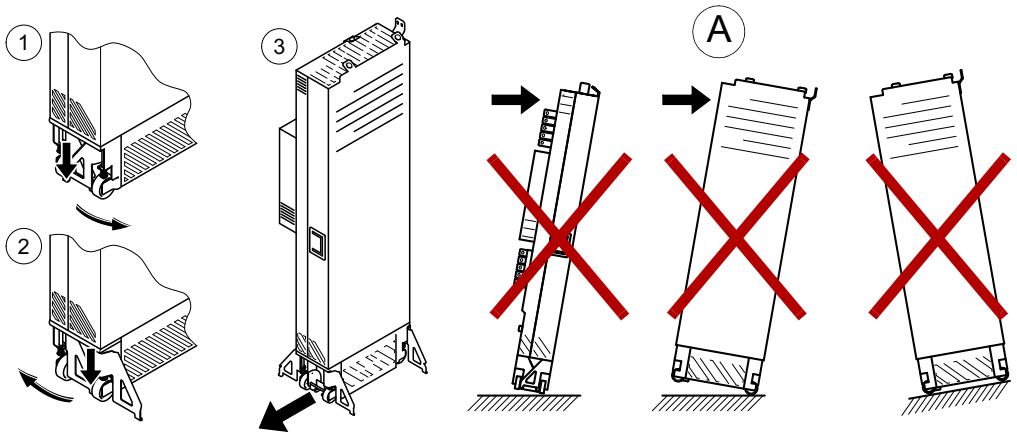
These instructions are for all personnel that install the drive module and do maintenance work on it.

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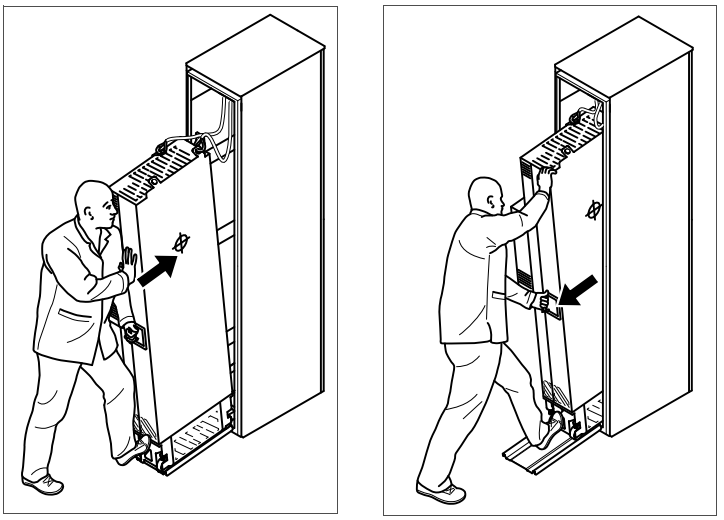
  - Do not use the module installation ramp with plinth heights which exceed the maximum height marked on the ramp. (The maximum plinth height is 50 mm [1.97 in] when the telescopic ramp is fully retracted and 150 mm [5.91 in] when the ramp is fully extended.)
  - Attach the module installation ramp carefully.

- 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 disconnector of the drive.
   - Open the disconnector of the supply transformer as the main disconnector of the drive does not remove the voltage from the input busbars of the drive.
   - Make sure that reconnection is not possible. Lock the disconnectors to open position and attach a warning notice to them.
   - Disconnect any external power sources from the control circuits before you do work on the control cables.
   - After you disconnect the drive, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you continue.
3. Protect any other energized parts in the work location against contact.
4. Take special precautions when close to bare conductors.
5. Measure that the installation is de-energized.
   - Use a multimeter with an impedance of at least 1 Mohm.
   - Make sure that the voltage between the drive module input power terminals (L1/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 *75*. 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 felt, nip, rope, etc.
- Measure that the installation is de-energized.
  - Use a multimeter with an impedance of at least 1 Mohm.
  - Make sure that the voltage between the drive output terminals (T1/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 modules and install the modules 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 you work 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 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 gives instructions 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 – standard, optional IP20 shrouds and power cable connection terminals describes the installation process of a drive module in a 600 mm wide Rittal TS 8 cabinet in a bookshelf way of mounting.

Installation example with option "Full power cabling panels to be attached to a cabinet (IP20)" 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 unit.

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 d*u*/d*t* filters for the drive.

Step-by-step drawings for an installation example of drive module with optional IP20 shrouds and input and output terminals 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) in a Rittal TS 8 400 mm wide cabinet shows how to install a drive module with full cabling panels into 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 flat position into a Rittal TS 8 cabinet.

Step-by-step drawings for option "Power cable connection terminals on the right-hand side of the drive module" installation example in Rittal TS 8 600 mm wide cabinet shows how to install drive module with option "Power cable connection terminals on the right-hand side of the drive module" into 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, +E200. 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
Plan the mechanical and electrical installation and acquire the accessories needed (cables, fuses, etc.). Check the ambient conditions, ratings, required cooling air flow, input power connection, compatibility of the motor, motor connection, and other technical data.	*Guidelines for planning the cabinet installation* (page *47*) *Guidelines for planning the electrical installation* (page *69*) *Technical data* (page *177*) *Resistor braking* (page *223*) Option manual (if optional equipment is included)
↓	
Unpack and check the units. Check that all necessary optional modules and equipment are present and correct. Only intact units can be started up.	*Moving and unpacking the unit* (page *92*) *Checking the delivery* (page *98*) If the drive module has been non-operational for more than one year, the converter DC link capacitors need to be reformed. (*Reforming the capacitors*, page *165*)
↓	
Check the installation site. Fasten the base of the cabinet to the floor.	*Checking the installation site* (page *91*) *Ambient conditions* (page *186*) *Guidelines for planning the cabinet installation* (page *47*)
↓	
Route the cables.	*Routing the cables* (page *80*)
↓	

Task	See
Check the insulation of the supply cable, the motor and the motor cable and the resistor cable (if present).	*Checking the insulation of the assembly* (page *98*)
↓	
Standard drive modules • Install the additional components into the cabinet: for example, main disconnector, main contactor, main AC fuses, etc.. • Install the drive module into the cabinet. • Connect the motor cables to the drive module terminals. • Connect the DC connection cables and brake resistors (if any) to the drive module terminals. • If the main disconnector is installed into the cabinet, connect it to the drive module terminals and the input power cabling to the disconnector. • 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 option “Full power cabling panels to be attached to a cabinet (IP20)” • Install the cabling panels into the cabinet. • Install the additional components into the cabinet: for example, main disconnector, main contactor, main AC fuses, etc.. • If the main disconnector 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 DC connection cables and the brake resistor (if any) cables to the cabling panel terminals. • Install the drive module into the cabinet. • Fasten the cabling panel busbars to the drive module busbars. • 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 *133*) *Modular design of Rittal TS8 cabinets (page 146)* *Connecting the power cables* (page *134*) *Installing the drive module into the cabinet* (page *138*) *Connecting the control unit to the drive module* (page *112*) *Mounting the external control unit* (page *108*) Manuals for any optional equipment
↓	
Connect the external control cables to the drive control unit.	*Connecting the control cables to the terminals of the control unit* (page *113*)
↓	
Check the installation.	*Installation checklist* (page *147*)
↓	
Commission the drive.	*Start-up* (page *151*)
↓	
Commission the brake chopper (if used).	*Resistor braking* (page *223*)
↓	
Operate the drive: start, stop, speed control etc.	Appropriate firmware manual

Terms and abbreviations

Term/Abbreviation	Explanation
AIBP	Input bridge protection board
BCU	Drive control unit
BPOW	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
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

Term/Abbreviation	Explanation
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
ZINT	Main circuit board

3

Operation principle and hardware description

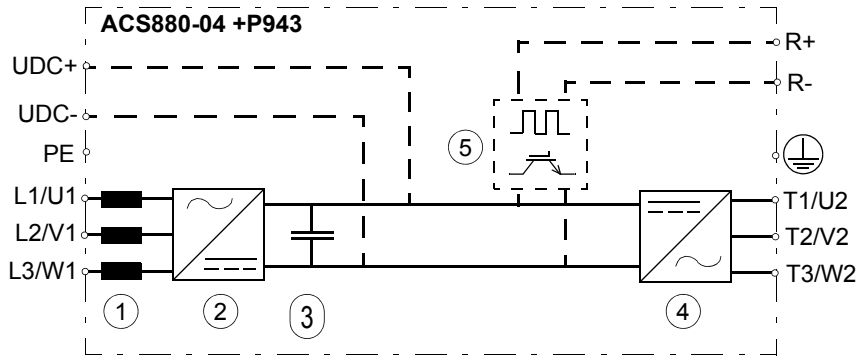
Contents of this chapter

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

Product overview

The ACS880-04XT is a drive module package (drive) for controlling asynchronous AC induction motors, permanent magnet motors, AC induction servomotors. The drive consists of two drive modules (ACS880-04 +P943) and a separate control unit.

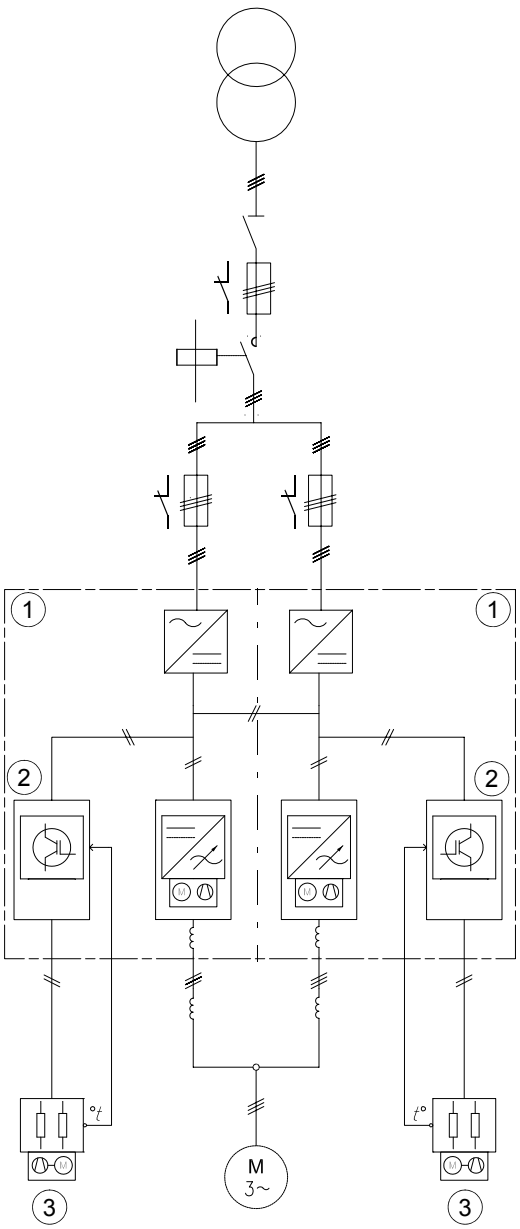
The main circuit of the drive module is shown below.

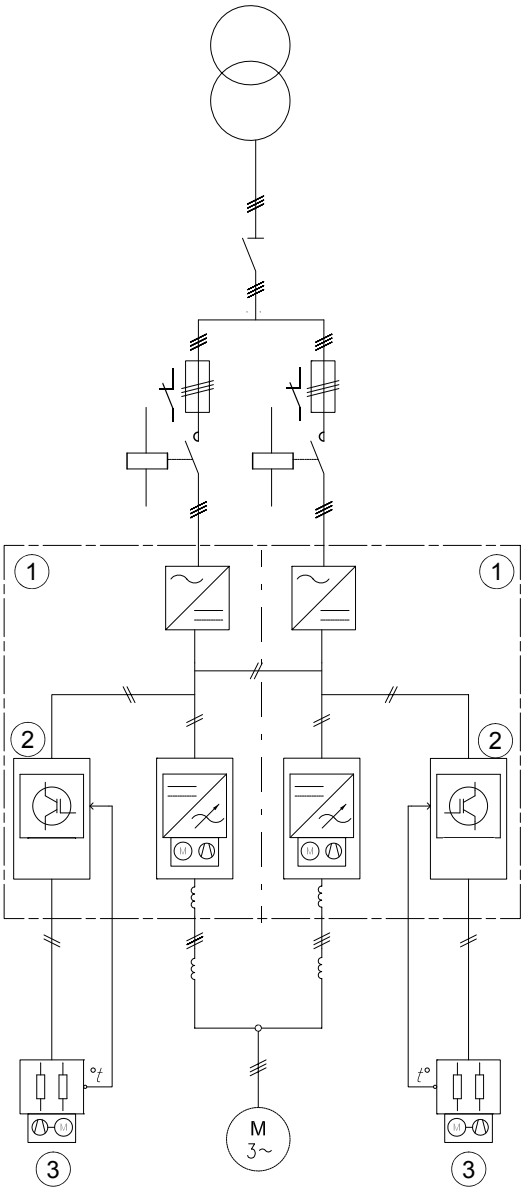


1	AC choke
2	Rectifier. Converts alternating current and voltage to direct current and voltage.
3	DC link. DC circuit between rectifier and inverter
4	Inverter. Converts direct current and voltage to alternating current and voltage.
5	Brake chopper (option +D150). Conducts the surplus energy from the intermediate circuit of the drive to the brake resistor when necessary. The chopper operates when the DC link voltage exceeds a certain maximum limit. The voltage rise is typically caused by deceleration (braking) of a high inertia motor.

Drive connection examples

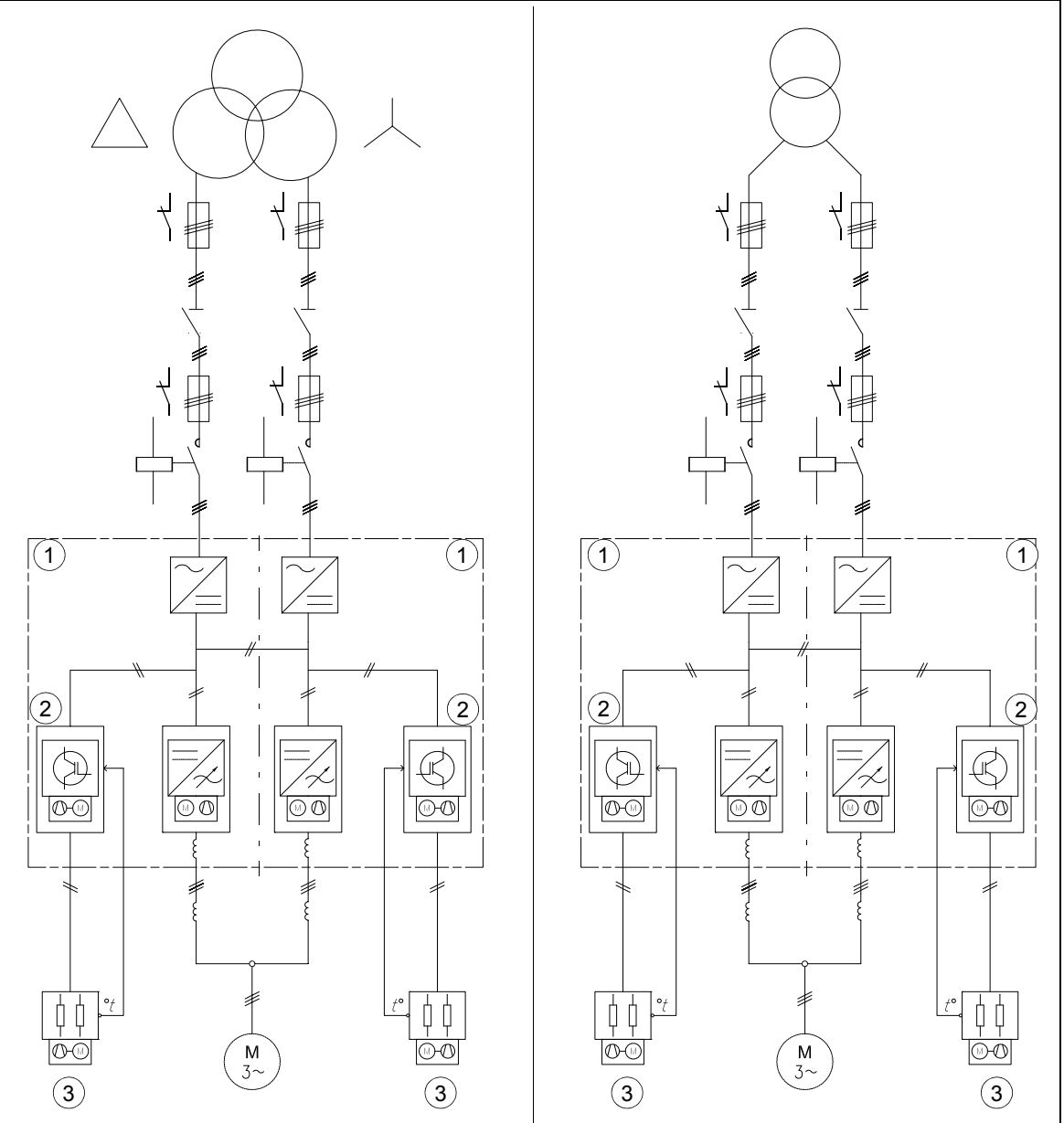
6-pulse connection	6-pulse connection
No additional protection for the input and motor cables against thermal overload is needed.	No additional protection for the input and motor cables against thermal overload is needed. **WARNING!** Make sure that both contactors close at the same time. Otherwise, the charging current will flow through one module only and damage to the module can occur.





1 Drive module
2 Brake chopper (option +D150)
3 External brake resistors

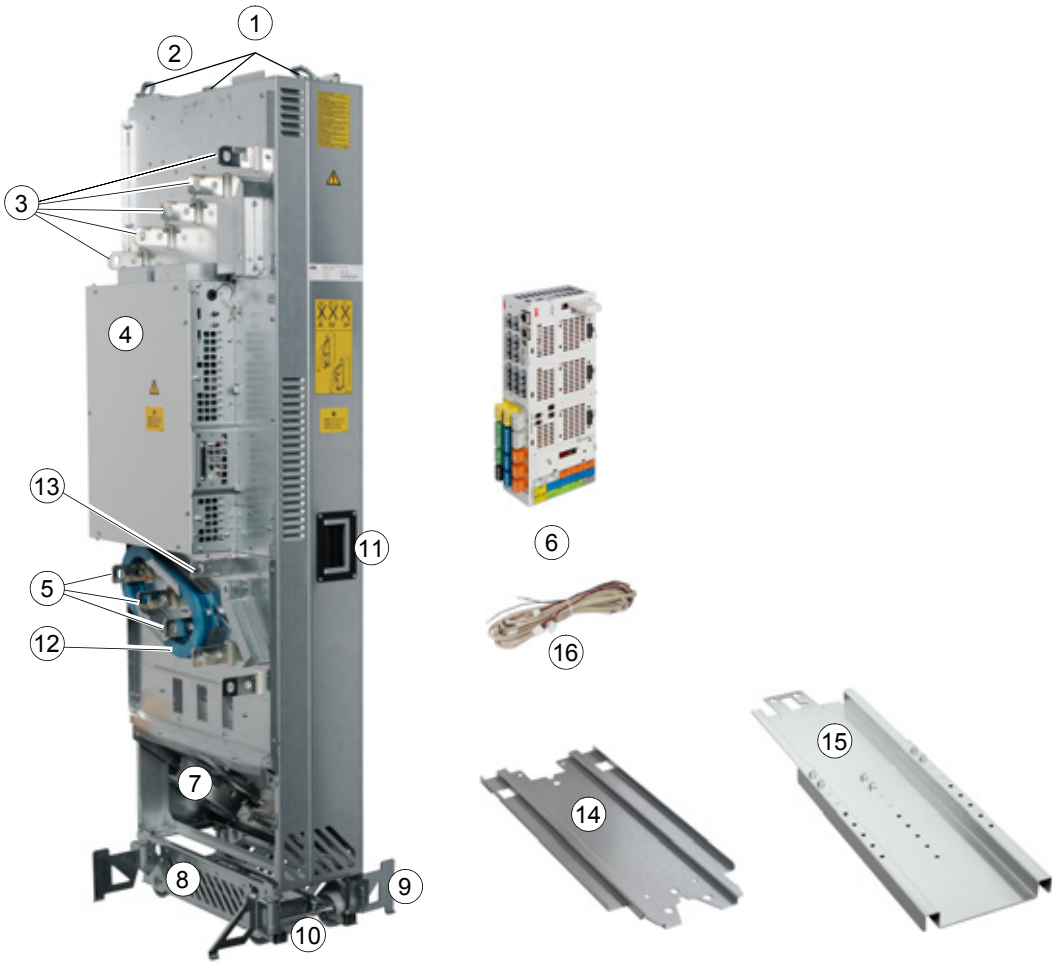
12-pulse connection	6-pulse connection
Protection against thermal overload for the input cables with fuses is needed. **WARNING!** Make sure that both contactors close at the same time. Otherwise, the charging current will flow through one module only and damage to the module can occur.	Protection against thermal overload for the input cables with fuses is needed. **WARNING!** Make sure that both contactors close at the same time. Otherwise, the charging current will flow through one module only and damage to the module can occur.



1 Drive module
2 Brake chopper (option +D150)
3 External brake resistors

Layout

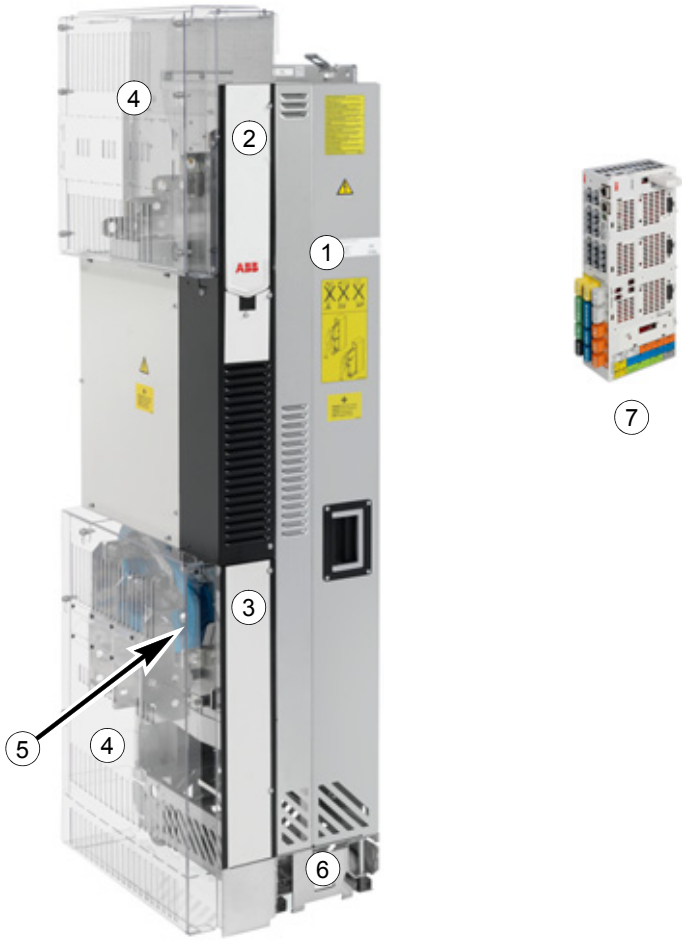
Standard drive module configuration



1	Lifting lugs
2	Fastening bracket
3	Input cable connection busbars (L1/U1, L2/V1, L3/W1) and DC+ and DC- busbars
4	Circuit board compartment
5	Output cable connection busbars (T1/U2, T2/V2, T3/W2) and brake resistor connection busbars (R+ and R- with option +D150)
6	External control unit
7	Main cooling fans
8	Pedestal
9	Retractable support legs
10	Base fastening screws
11	Handle for pulling the drive module out of the cabinet
12	Common mode filter (+E208)
13	PE busbar
14	Pedestal guide plate
15	Telescopic extraction and insertion ramp
16	Cables for connecting the control unit to the drive modules

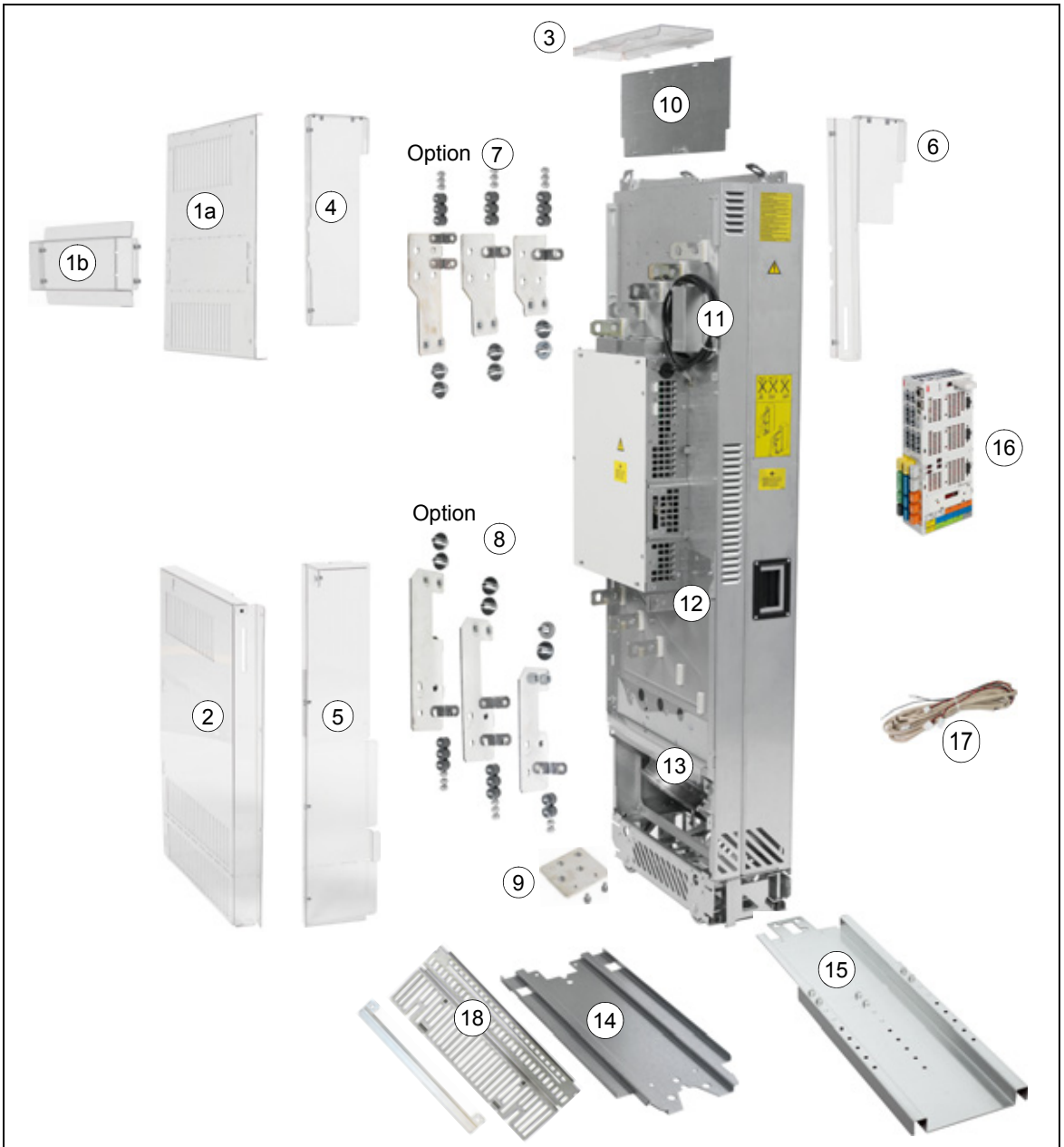
Note: The front covers are removed in this photo, see numbers 2 and 3 on the next page.

Drive module configuration with IP20 shrouds (option) and full-size output cable connection terminals (option)



1	Drive module	5	Common mode filter (+E208)
2	Upper front cover	6	Pedestal
3	Lower front cover	7	External control unit
4	Clear plastic shrouds attached	-	-

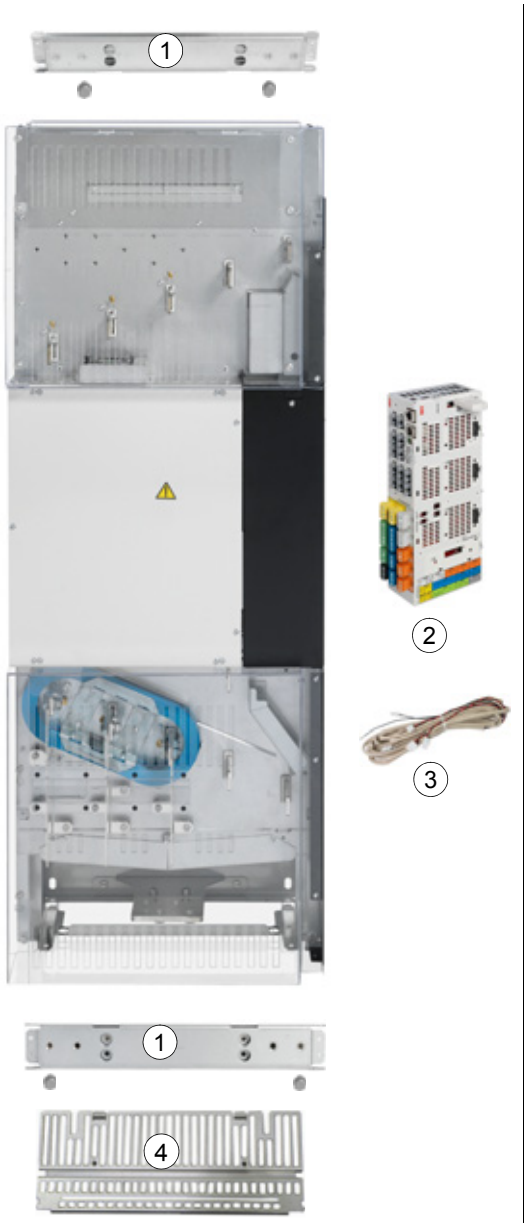
See the next page for the part descriptions.



1	Clear plastic shroud to be attached onto the drive module input power cabling (a). Lead-through shroud for side cabling (b).	10	Metallic shroud. With optional full-size input power cable connection terminals, the shroud includes a ground bar.
2	Clear plastic shrouds to be attached onto the drive module output power cabling	11	Fiber optic cables
3	Clear plastic shroud to be attached on top of the drive module (lead-through for top cabling)	12	PE (ground) terminal
4	Upper back clear plastic shroud	13	Main cooling fans
5	Lower back clear plastic shroud	14	Pedestal guide plate
6	Front clear plastic shroud	15	Telescopic extraction and insertion ramp
7	Full-size input power cable connection terminals (option)	16	External control unit
8	Full-size output power cable connection terminals (option)	17	Cables for connecting the control unit to the drive modules
9	Grounding terminal for output power cable shields	18	Bottom grille with mounting bracket

Drive module for flat mounting (option) with IP20 shrouds (option)

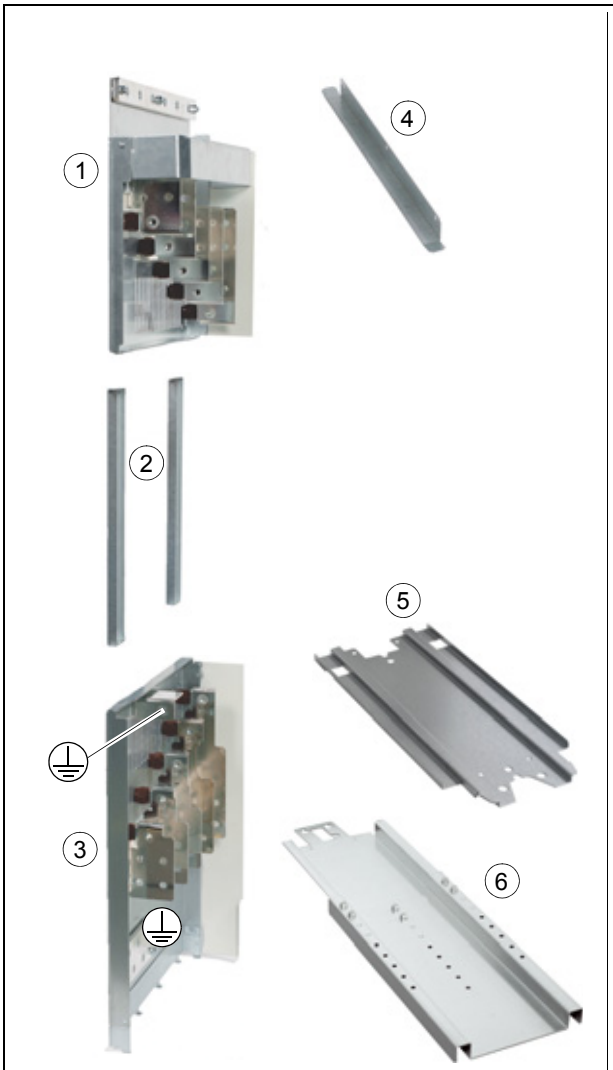
Front view of an assembled drive module for flat mounting is shown below. This option adds flat mounting brackets to the standard drive module configuration. The pedestal has been removed in this assembly. You must cut the lower part of the output cabling clear plastic shroud off when no pedestal is in use.

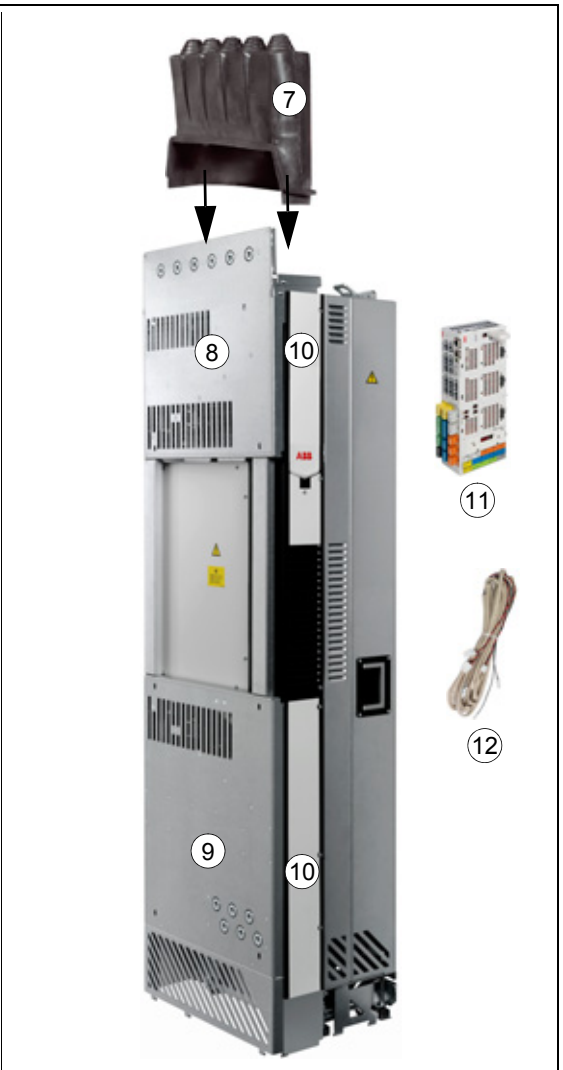


Flat mounting position (front view)		Side view	
1	Flat mounting bracket (two pcs). The brackets are installed to the mounting plate with 2×8 screws. Four combi screws for installing the drive module to the brackets are included in the delivery.	4	Bottom grille to be installed to the base of the drive module for IP20 degree of protection
2	External control unit	5	Grounding terminal for output cabling is better visible in this photo than on page *34*.
3	Cables for connecting the control unit to the drive modules		

See section *Drive module configuration with IP20 shrouds (option) and full-size output cable connection terminals (option)* on page *34* for the part descriptions.

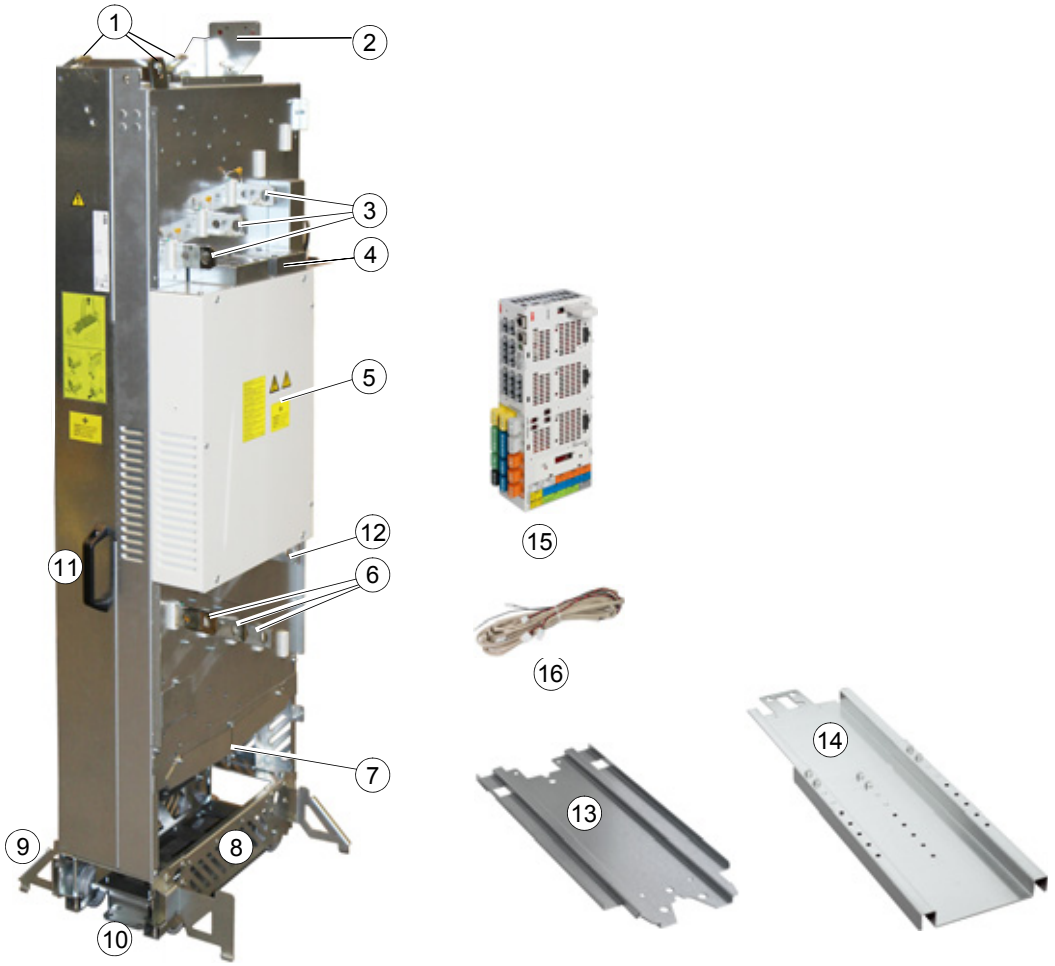
Drive module with full power cabling panels (option)





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	External control unit
6	Telescopic extraction and insertion ramp	12	Cables for connecting the control unit to the drive modules

Drive module configuration with power cable connection terminals on the right-hand side of the drive module (option)



1	Lifting lugs
2	Fastening bracket
3	Input cable connection busbars (L1/U1, L2/V1, L3/W1) and DC+ and DC- busbars
4	Circuit board compartment cooling fans
5	Circuit board compartment
6	Output cable connection busbars (T1/U2, T2/V2, T3/W2) and brake resistor connection busbars (R+ and R- with option +D150)
7	Main cooling fans
8	Pedestal
9	Retractable support legs
10	Base fastening screws
11	Handle for pulling the drive module out of the cabinet
12	PE busbar
13	Pedestal guide plate
14	Telescopic extraction and insertion ramp
15	External control unit
16	Cables for connecting the control unit to the drive modules

Note: The front covers are removed in this photo, see numbers 2 and 3 on page *34*.

Control unit

See section *Drive module configuration with IP20 shrouds (option) and full-size output cable connection terminals (option)* on page *34*.

Control panel

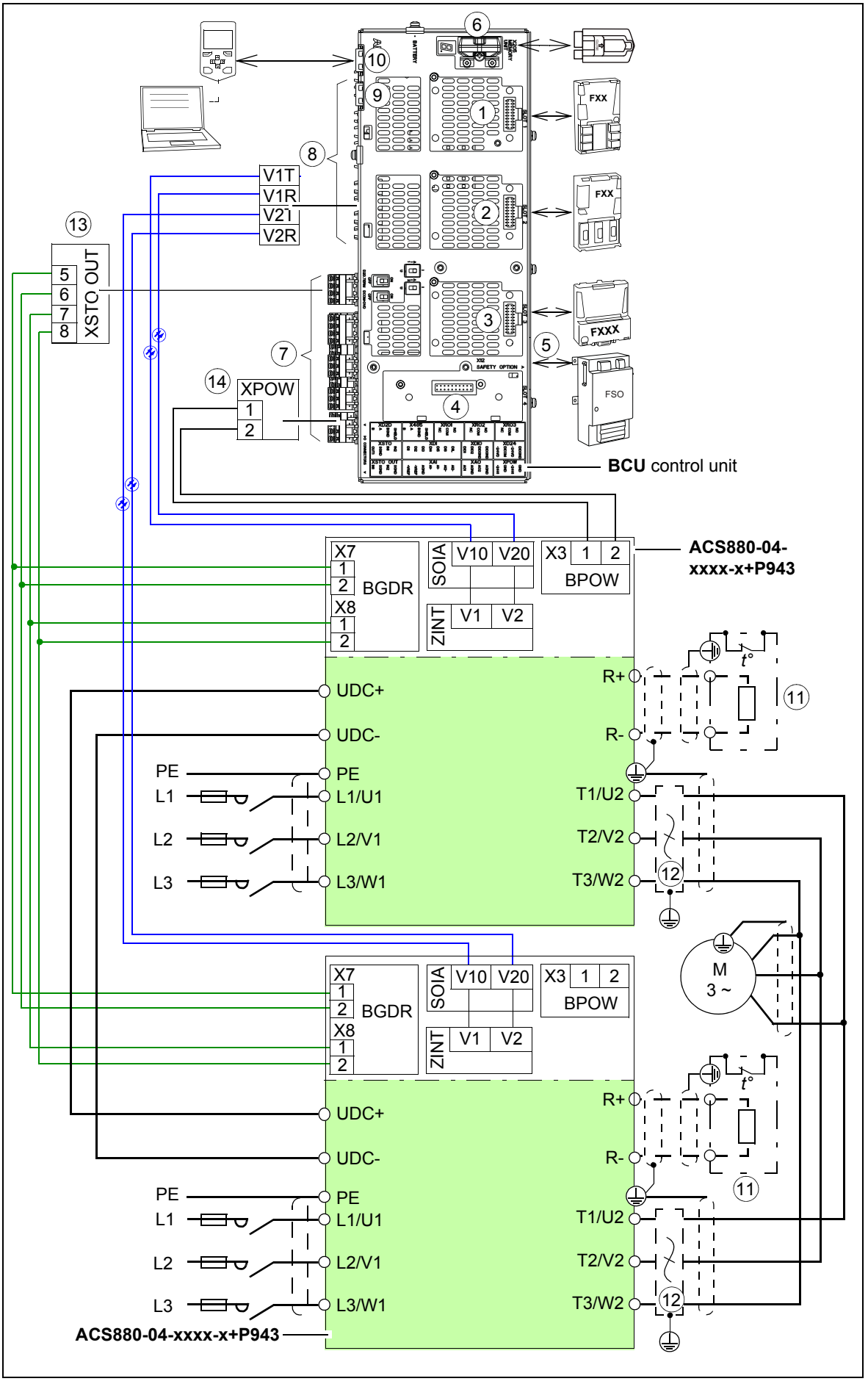
1	ACS-AP-I Assistant control panel (option)
2	DPMP-01 door mounting kit (option)

The control panel is ordered separately and can be mounted on the cabinet door using optional DPMP-01 mounting platform.

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

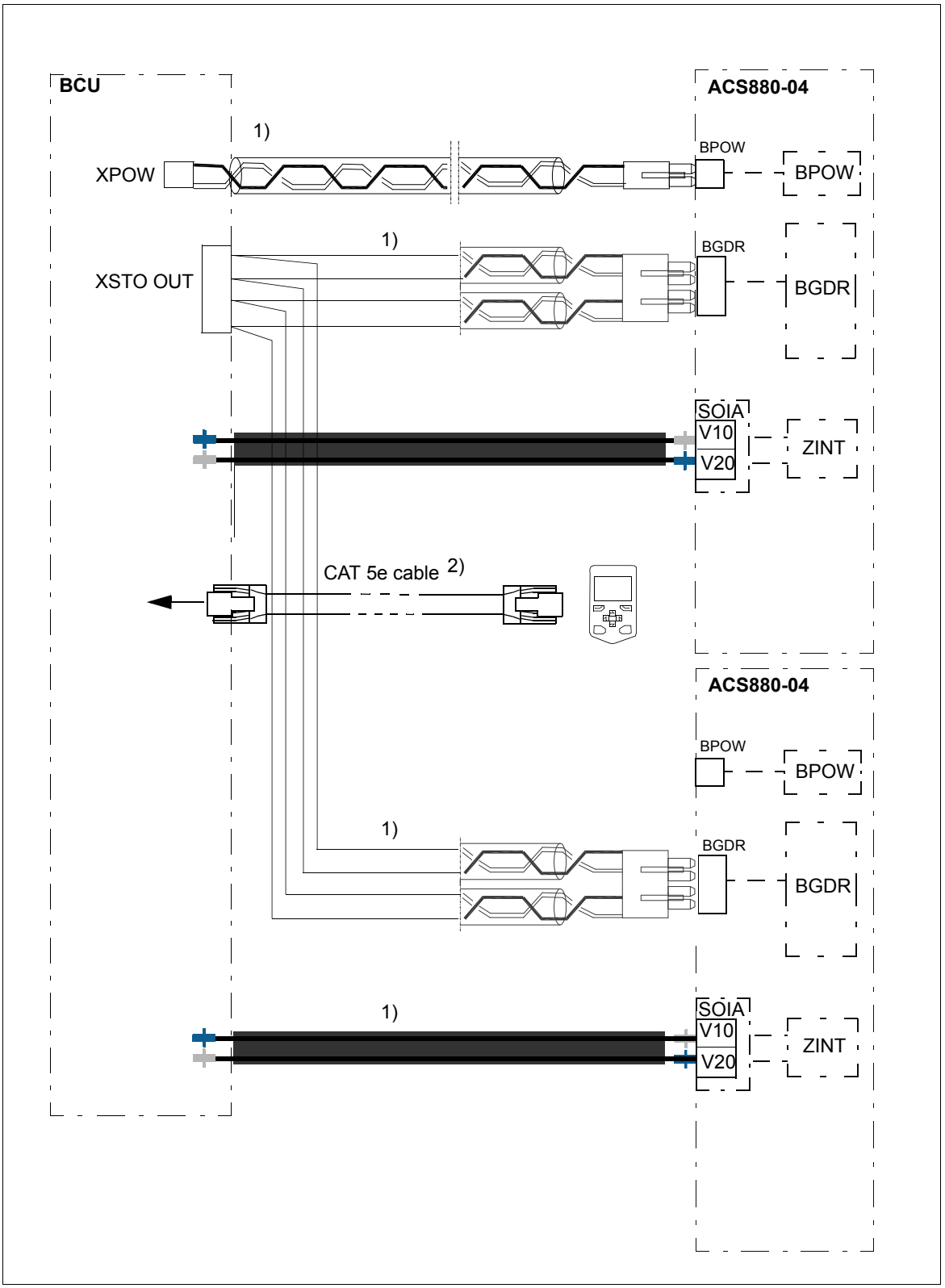
The diagram below shows the power connections and control interfaces of the drive unit.


6
10
9
1
FXX
8
V1T
V1R
V2I
V2R
2
FXX
13
5
6
7
8
XSTO OUT
3
FXXX
5
7
XPOW
14
1
2
4
FSO
BCU control unit
X7
1
2
BGDR
X8
1
2
SOIA
V10
V20
ZINT
V1
V2
X3
1
2
BPOW
ACS880-04-
xxxx-x+P943
UDC+
UDC-
PE
L1
L2
L3
PE
L1/U1
L2/V1
L3/W1
R+
R-
T1/U2
T2/V2
T3/W2
t°
11
12
M
3 ~
ACS880-04-xxxx-x+P943

1, 2,3	Analog and digital I/O extension modules, feedback interface modules and fieldbus communication modules can be inserted into slots 1, 2 and 3. See section *Type designation key* on page *45*.
4	Slot 4 for RDCO-0x
5	Connector X12 for the FSO-xx safety functions module
6	Memory unit (see page *165*)
7	I/O terminal blocks. See section *Default I/O connection diagram* on page *114*.
8	Fiber optic links to the drive modules
9	Ethernet interface
10	Control panel
11	Brake resistor (optional, see page *223*)
12	d*u*/d*t* or sine filter (optional, see page *229*)
13	XSTO OUT terminals are wired to BGDR connectors if Safe torque off function is taken into use. See chapter *Safe torque off function* (page *213*).
14	The BCU control unit can be powered from one or both drive modules or from an external uninterruptible power source.

External control unit connection cables

The cables for connecting the drive module and control panel to the control unit are shown below. The length of the cables is 3 meters (9.8 feet). See sections *Connecting the control unit to the drive module* (page *112*) and *Connecting a control panel* (page *119*) for the actual connections.



1) These cables are included in the delivery as standard.

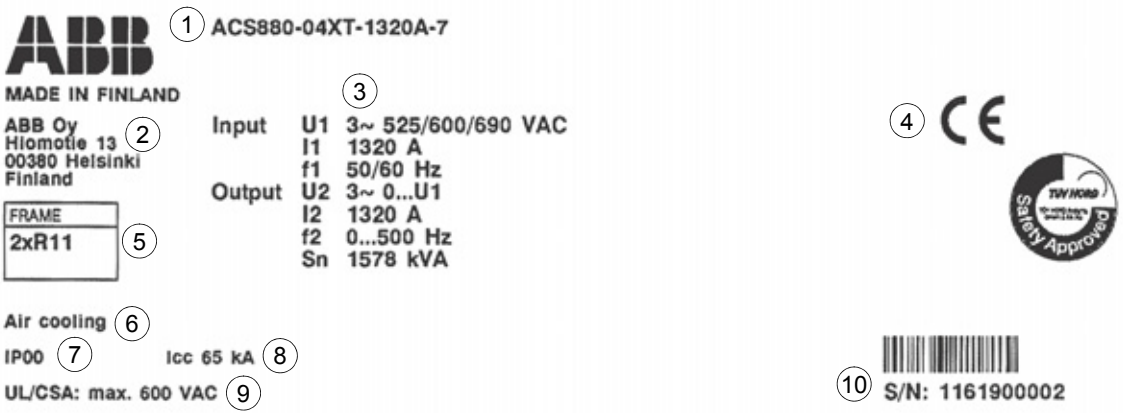
2) This cable must be ordered separately, see page *168* for DPMP-01 door mounting kit.

Type designation labels

A type designation label is attached to the drive modules. The type designation label of the drive module package is delivered in an envelope.

Drive module package label

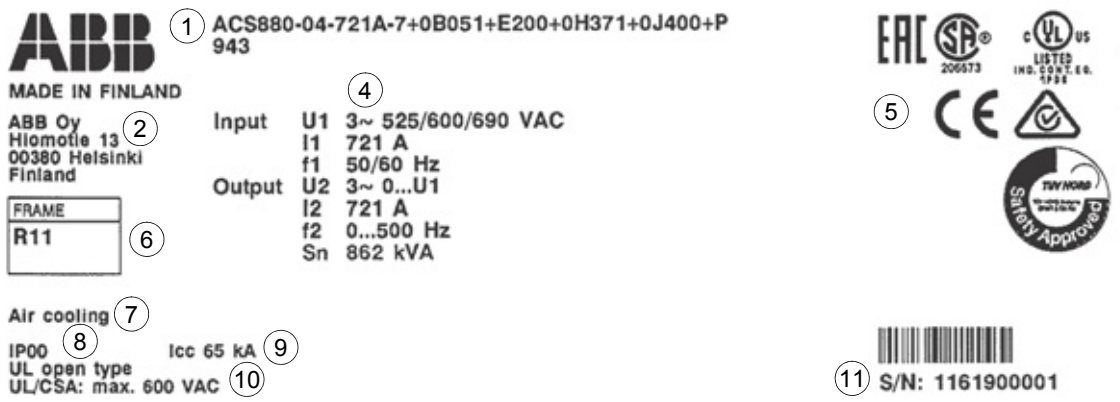
The type designation label includes a rating, markings, a type designation and a serial number, which allow individual recognition of each drive module package. An example label is shown below.



1	Type designation, see section *Type designation key* on page *45*.
2	Manufacturer's address
3	Frame size
4	Ratings. See section *Ratings* on page *177*, section *Electrical power network specification* on page *185* and section *Motor connection data* on page *185*.
5	Valid markings
6	Cooling method
7	Degree of protection
8	Short-circuit withstand strength. See section *Electrical power network specification* on page *185*.
9	Maximum input voltage (UL/CSA). See section *Electrical power network specification* on page *185*.
10	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.

Drive module label

The type designation label includes a rating, markings, a type designation and a serial number, which allow individual recognition of each drive module.



1	Type designation, see section *Type designation key* on page *45*.
2	Manufacturer's address
4	Ratings. See section *Ratings* on page *177*, section *Modules used* on page *182*, section *Electrical power network specification* on page *185* and section *Motor connection data* on page *185*.
5	Valid markings
6	Frame size
7	Cooling method
8	Degree of protection
9	Short-circuit withstand strength. See section *Electrical power network specification* on page *185*.
10	Maximum input voltage (UL/CSA). See section *Electrical power network specification* on page *185*.
11	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, +E200. The main selections are described below. Not all selections are available for all types.

Code	Description
Drive module package code, eg, ACS880-04XT-1610A-5. Drive module code, eg, ACS8880-04-880A-5+P943	
Product series	
ACS880	ACS880 product series
Type	
-04XT	When no options are selected: two drive modules to be installed in a cabinet, IP00 (UL open type), bookshelf mounting with pedestal, external control unit, cables for connecting the control unit to the drive module, build-in input choke, no EMC filter, terminals for input, motor and DC connection, common mode filter (+E208), ACS880 primary control program, Safe torque off function, coated boards, memory stick containing all manuals with all available languages.
Size	
xxxxA	Refer to the rating tables, page *177*.
Voltage range	
-3	380…415 V. This is indicated in the type designation label as typical input voltage level 3 ~ 400 V AC.
-5	380…500 V. This is indicated in the type designation label as typical input voltage levels 3 ~ 400/480/500 V AC.
-7	525…690 V. This is indicated in the type designation label as typical input voltage levels 3 ~ 525/600/690 V AC.
Option codes (plus codes). These codes are printed on the type designation label of the drive modules.	
Construction, pedestal and cabling	
C132	Marine type-approved drive module
P943	Drive module for parallel connection (standard).
Filters	
E200	EMC filter for second environment TN (grounded) system, category C3. Available for ACS880-04XT-xxxx-7 types only.
E201	EMC filter for second environment IT (ungrounded)) system, category C3. Available for ACS880-04XT-xxxx-7 types only.
E208	Common mode filter. Included as standard.
E210	EMC filter for second environment TN (grounded) and IT (ungrounded)) systems, category C3. Available for ACS880-04XT-xxxx-3 and -5 types only.
Resistor braking	
D150	Brake chopper
Safety	
Q971	ATEX-certified Safe motor disconnection function using the drive Safe torque off function. This option code is printed only on the type designation label of the drive module package.
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

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.

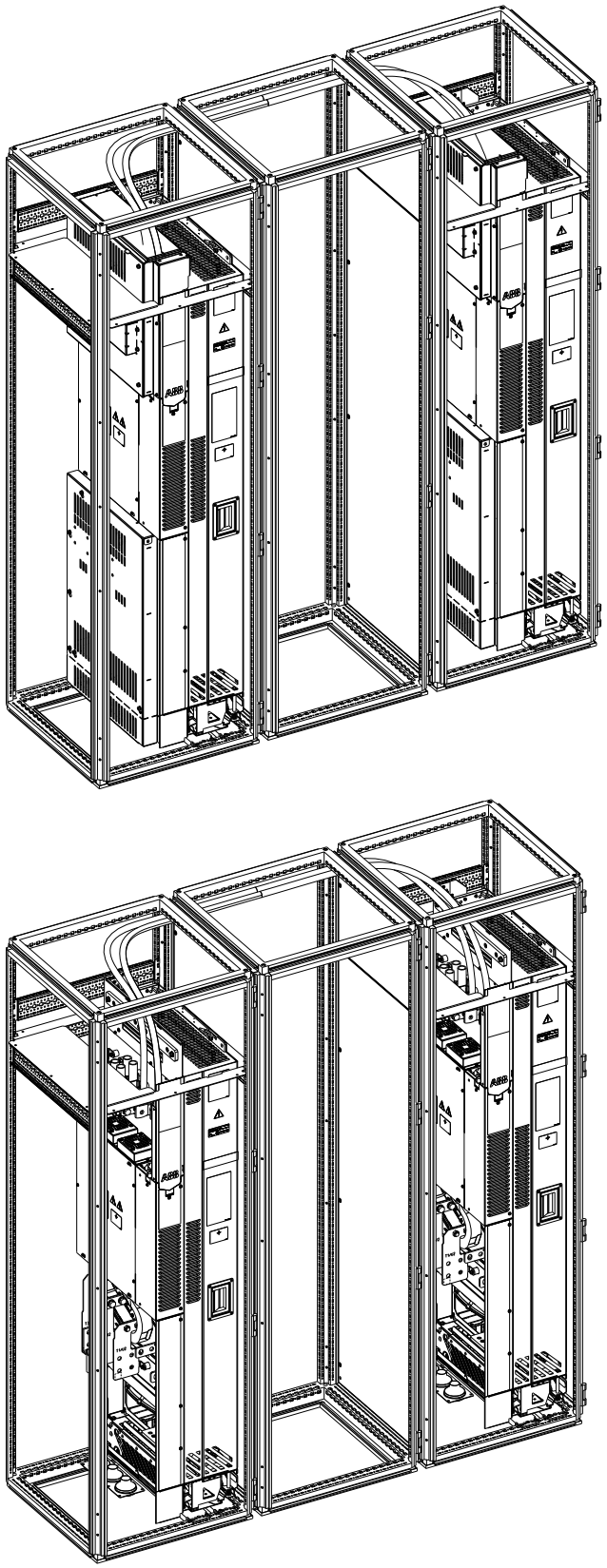
Planning the layout of the cabinet

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 with IP20 shrouds (option)



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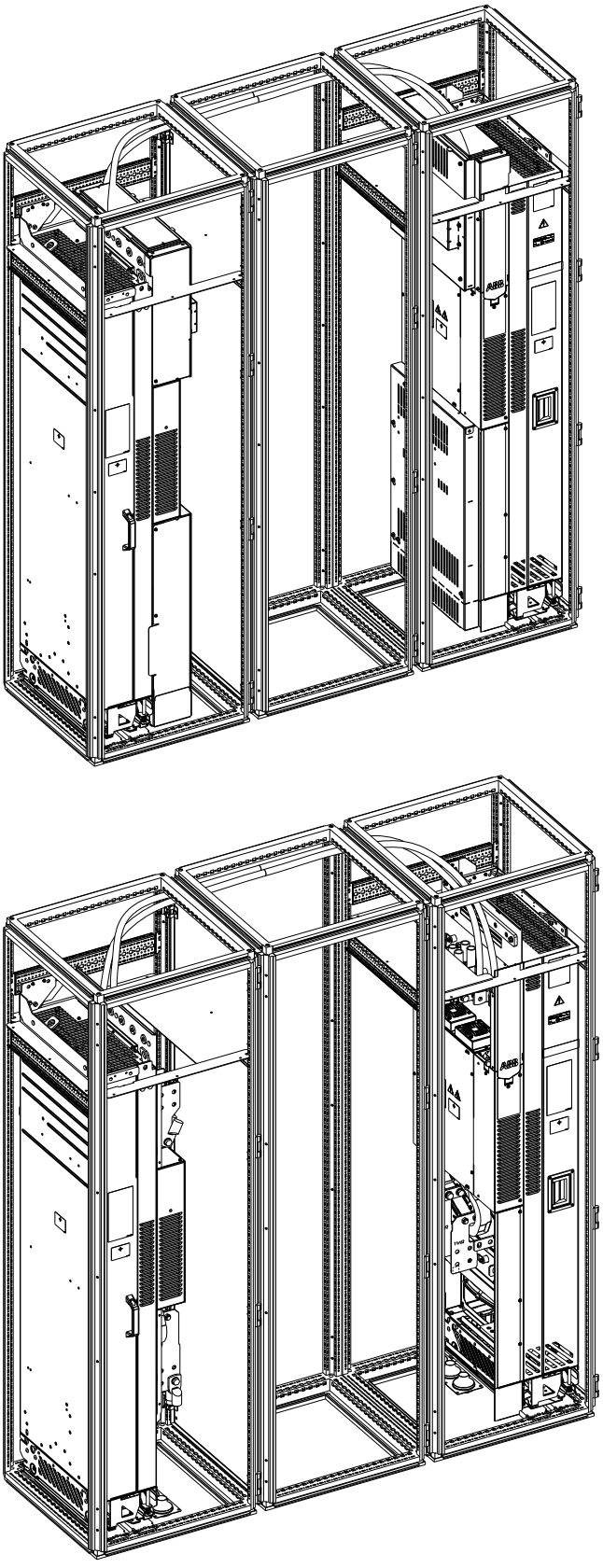
Layout example with IP20 shrouds (option) and one “drive module with power cable connection terminals on the right-hand side” (option)



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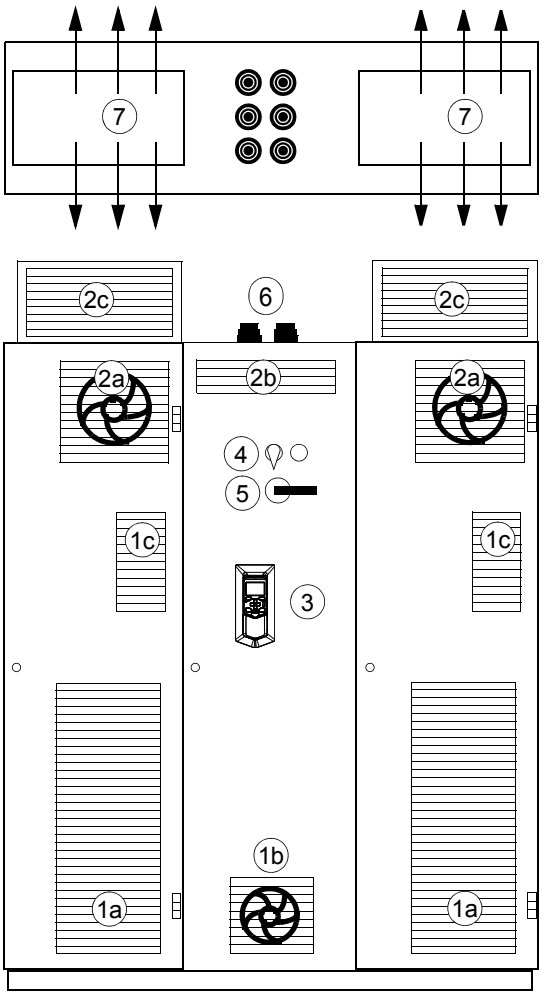
Layout example, doors closed

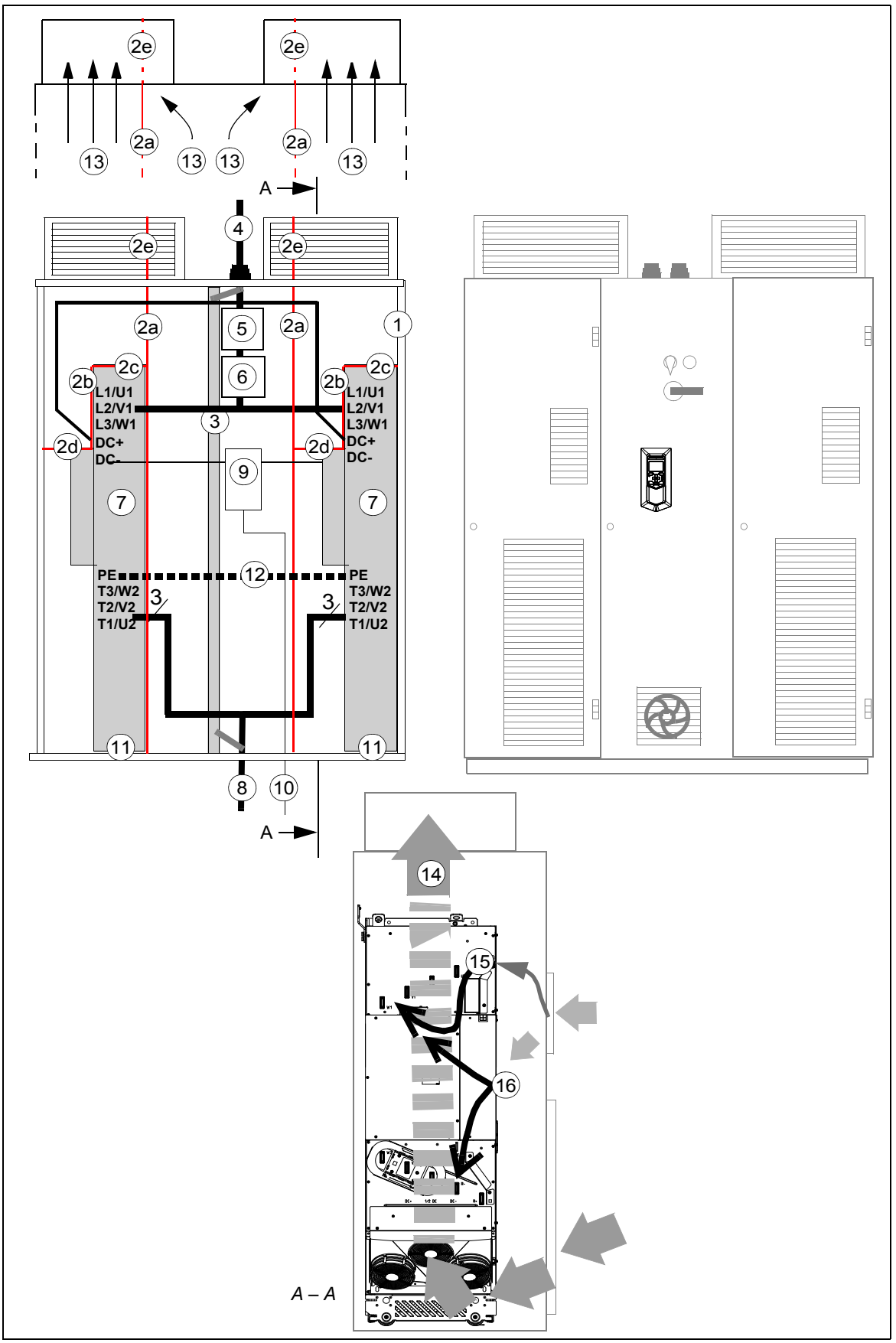
This diagram shows a cabinet layout example with the input power cable lead-through from top and the motor cable lead-through from bottom.



1a*) Air inlet for the drive module
1b Air inlet for the other equipment
1c*) Air inlet for circuit boards and DC and output busbars
2a*) Air outlet with an extra exhaust fan for the drive module
2b*) Air outlet for the other equipment
2c*) Air outlet for the drive module and other equipment on the cabinet roof. An exhaust fan if needed. We recommend this alternative instead of 2a.
3 Drive control panel with DPMP-01 mounting platform (option). The control panel is connected to the drive module control unit inside the cabinet.
4 Contactor control switch and emergency stop switch (connected to the contactor control circuit inside the cabinet)
5 Operating handle of the disconnector
6 Rubber grommets for degree of protection
7 Roof air flow viewed from top
*) **Note**: The sizes of the air inlet and outlet gratings are critical for proper cooling of the drive module. For losses and cooling data requirements, see page *184.*

Layout example, doors open (standard configuration)

This diagram shows a layout example for standard drive modules



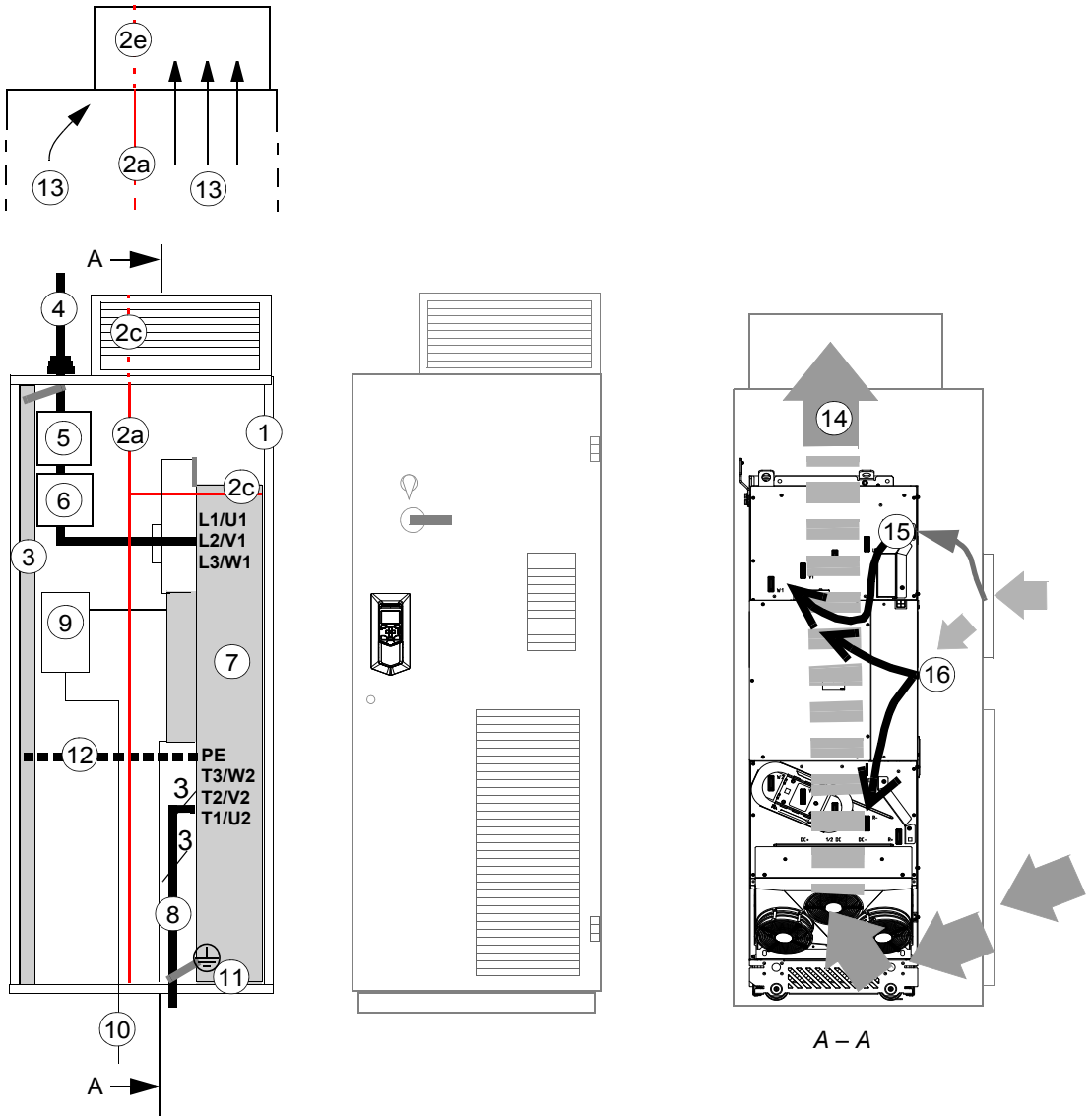
1	Supporting frame of the cabinet	8	Motor cable including the protective ground conductor of the drive module
2	Vertical (2a, 2b) and horizontal (2c, 2d) air baffles that separate the cool and hot areas (leak-proof lead-throughs). See also page *60*.	9	Drive module control unit
2e	Optional air baffle that is needed when there is no fan on the lower part of the cabinet door (see 1b on page on *51*)	10	External control cables
3	Cabinet grounding busbar (PE)	11	Grounding screws
4	Input power cable including the protective ground conductor (PE) of the drive	12	Alternative to grounding screws (11)
		13	Air flow to the roof
5	Disconnector and fuses	14	Air flow through the drive module
6	Contactor	15	Air flow to the brake option
7	Drive module	16	Air flow to circuit boards and DC and output busbars

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 *66*.

Layout example, doors open with IP20 shrouds (option)

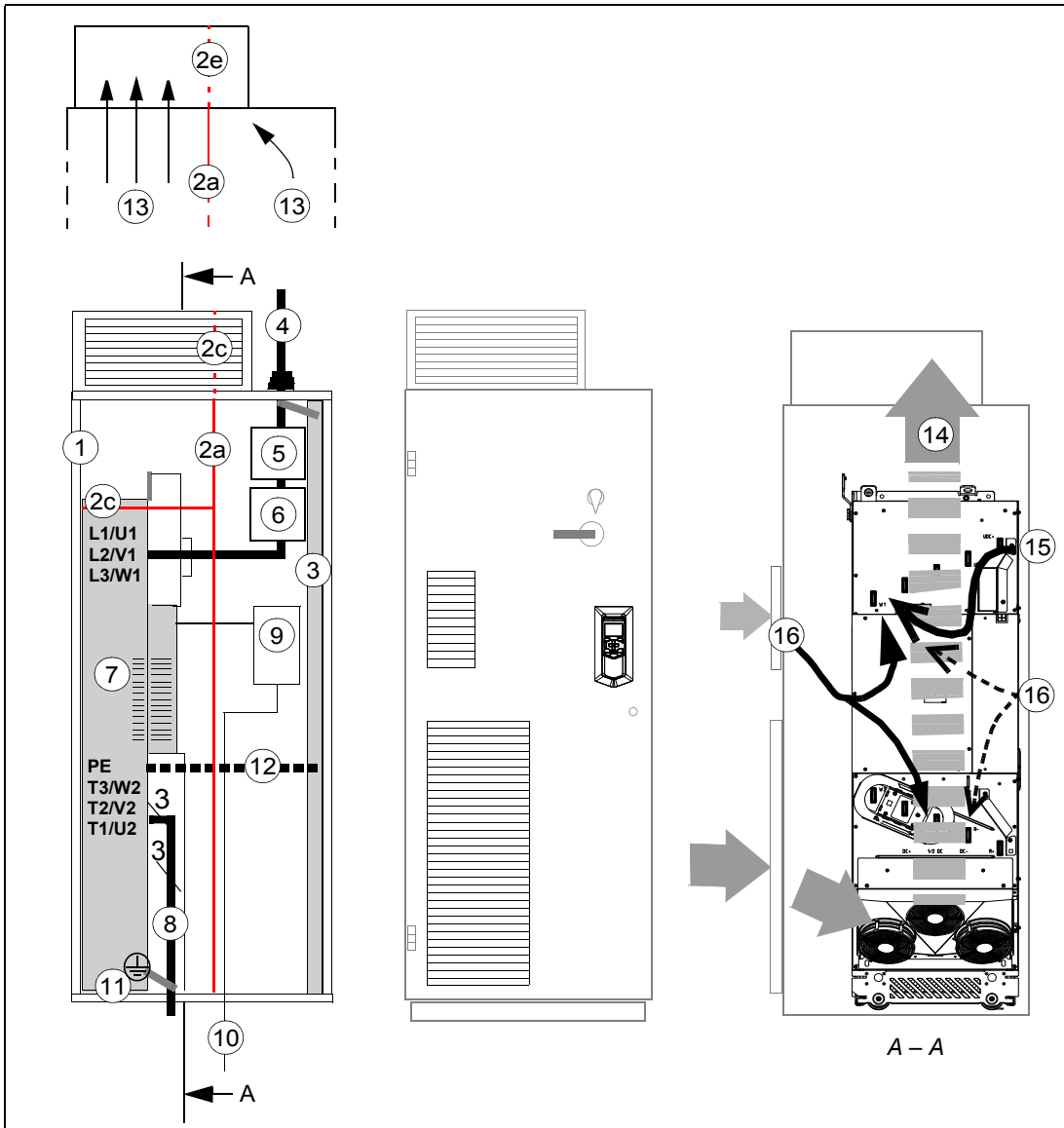
Layout example for one module is shown below.



1	Supporting frame of the cabinet	8	Motor cable including the protective ground conductor of the drive module
2a 2b	Vertical (2a) and horizontal (2b) air baffles that separate the cool and hot areas (leak-proof lead-throughs). See also page *60*.	9	Drive module control unit
2c	Optional air baffle that is needed when there is no fan on the lower part of the cabinet door (see 1b on page on *51*)	10	External control cables
3	Cabinet grounding busbar (PE)	11	Grounding screws
4	Input power cable including the protective ground conductor (PE) of the drive	12	Alternative to grounding screws (11)
		13	Air flow to the roof
5	Disconnector and fuses	14	Air flow through the drive module
6	Contactor	15	Air flow to the brake option
7	Drive module	16	Air flow to circuit boards and DC and output busbars

Layout example, doors open with IP20 shrouds (option) and “drive module with power cable connection terminals on the right-hand side” (option)

Layout example for one drive module is shown below.



1	Supporting frame of the cabinet	8	Motor cable including the protective ground conductor of the drive module
2a 2b	Vertical (2a) and horizontal (2b) air baffles that separate the cool and hot areas (leak-proof lead-throughs). See also page *60*.	9	Drive module control unit
2c	Optional air baffle that is needed when there is no fan on the lower part of the cabinet door (see 1b on page on *51*)	10	External control cables
3	Cabinet grounding busbar (PE)	11	Grounding screws
4	Input power cable including the protective ground conductor (PE) of the drive	12	Alternative to grounding screws (11)
		13	Air flow to the roof
5	Disconnector and fuses	14	Air flow through the drive module

6 Contactor	15 Air flow to the brake option. **WARNING!** Make sure that the air inlet to the brake busbars is not blocked if brake is in use.
7 Drive module	16 Air flow to circuit boards and DC output busbars.

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:

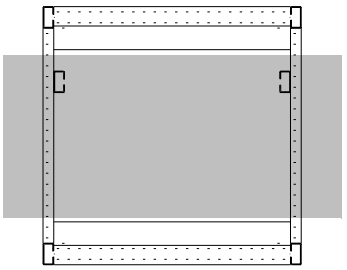
- Fasten the cabinet to the floor from the front and to the floor or wall from the back.
- Always fasten the drive module from its fastening points to the cabinet. For details, see the module installation instructions.

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.

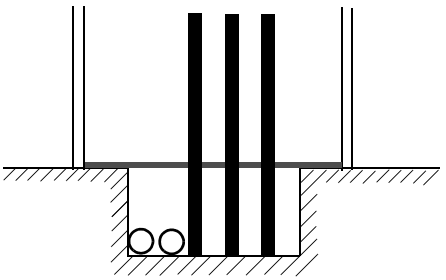
Planning the cabinet placement on a cable channel

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.



The carrying structure on a cable channel



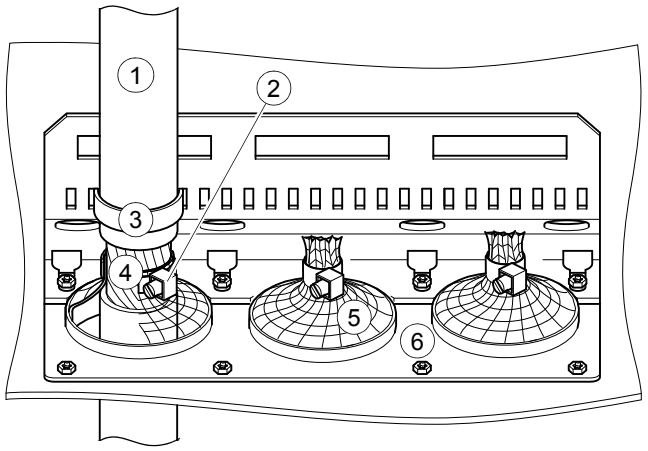
Cabinet side view with a bottom plate

Planning the electromagnetic compatibility (EMC) of the cabinet

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

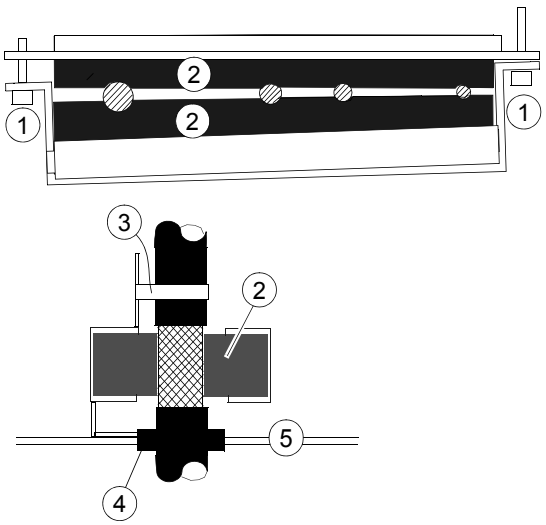
- Generally, the fewer and smaller the holes in the cabinet, the better the interference attenuation. The maximum recommended diameter of a hole in galvanic metal contact in the covering cabinet structure is 100 mm (3.94 in). Pay special attention to the cooling air inlet and outlet gratings.
- The best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

- We recommend 360° high frequency grounding of the motor cable shields at their entries. The grounding can be implemented by a knitted wire mesh screening as shown below.



1 Cable
2 Cable tie
3 Strain relief
4 Bare cable shield
5 Knitted wire mesh
6 Cabinet lead-through plate

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



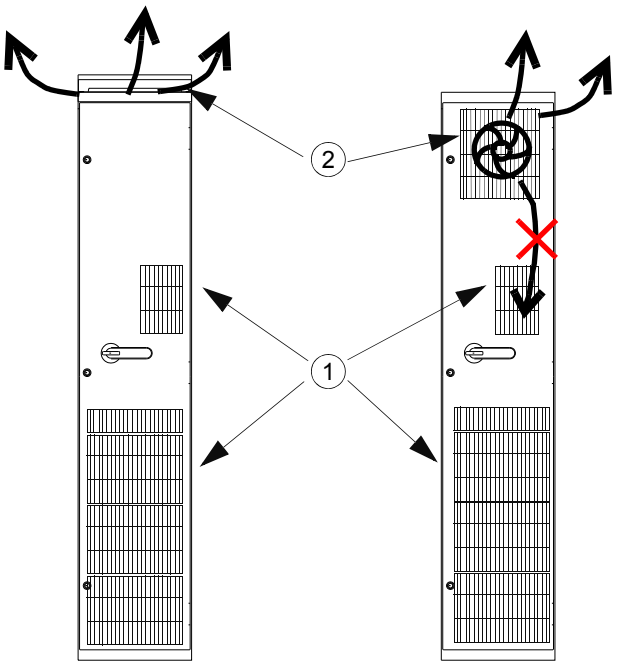
1 Tightening screw
2 EMI conductive cushion
3 Strain relief
4 Grommet
5 Lead-through plate

Planning the cooling

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

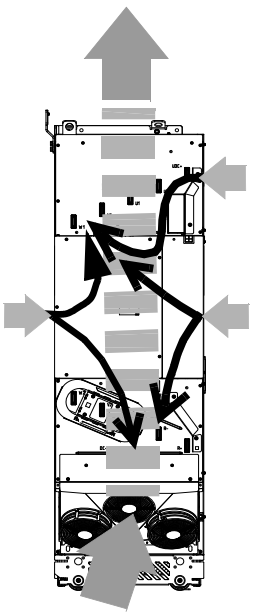
- Ventilate the installation site sufficiently so that the cooling air flow and ambient temperature requirements of the drive module are met, see pages *184* and *186*. The internal cooling fan of the drive module rotates at a constant speed thus blowing constant air flow through the module. Whether 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 *66*.
- 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 *169*).
- 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.



Air inlets and outlets on the cabinet door

1	Air inlet
2	Air outlet



Air flow inside the drive module

- 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:

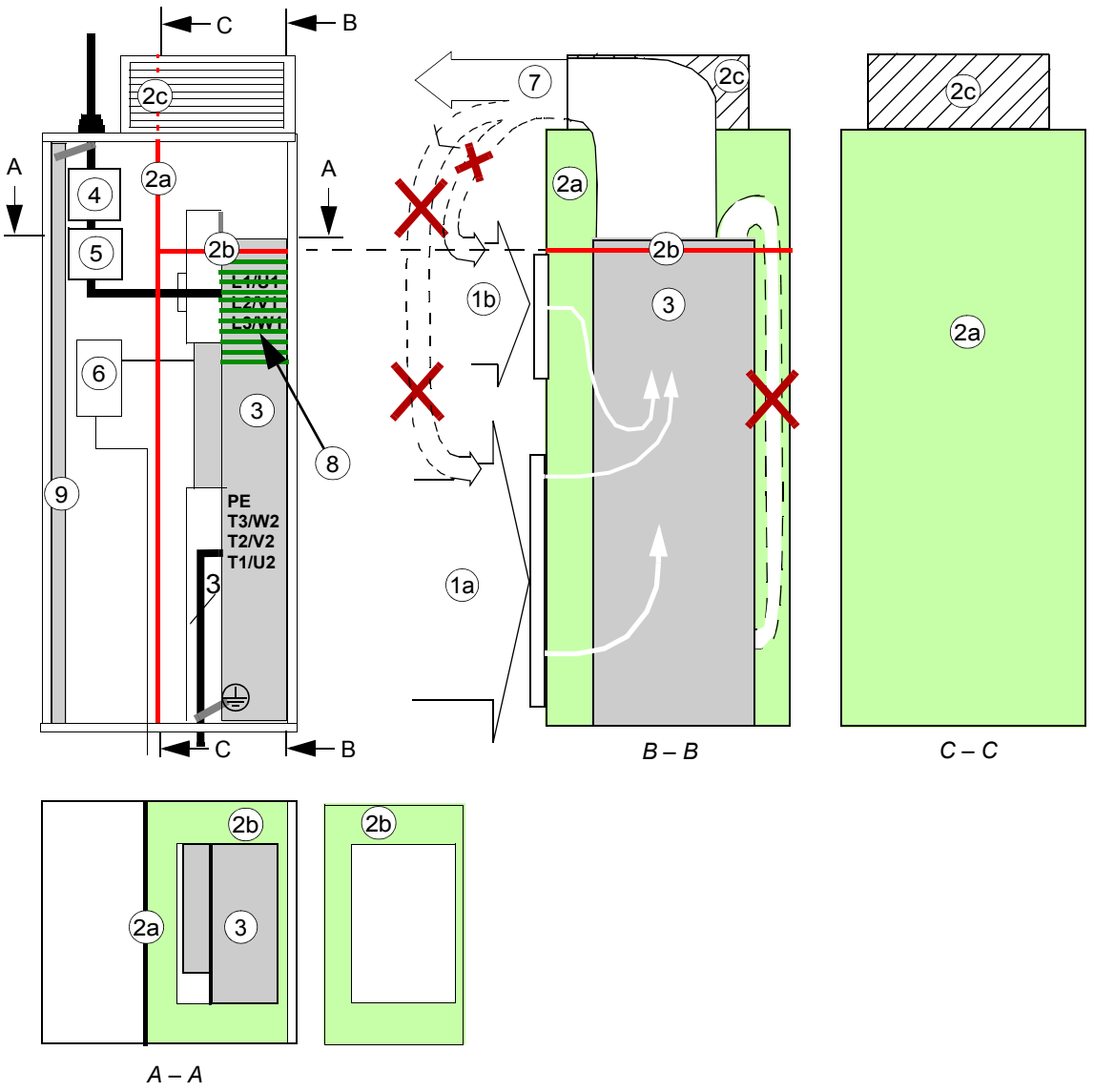
- gratings that guide air flow at the air inlet and outlet
- air inlet and outlet at different sides of the cabinet
- cool air inlet in the lower part of the front door, and an extra exhaust fan on the roof of the cabinet.

Prevent hot air circulation inside the cabinet with, for example, leak-proof air baffles. No gaskets are usually required.

The following sections show how to place the air baffles for one drive module.

Bookshelf mounting with IP20 shrouds (option)

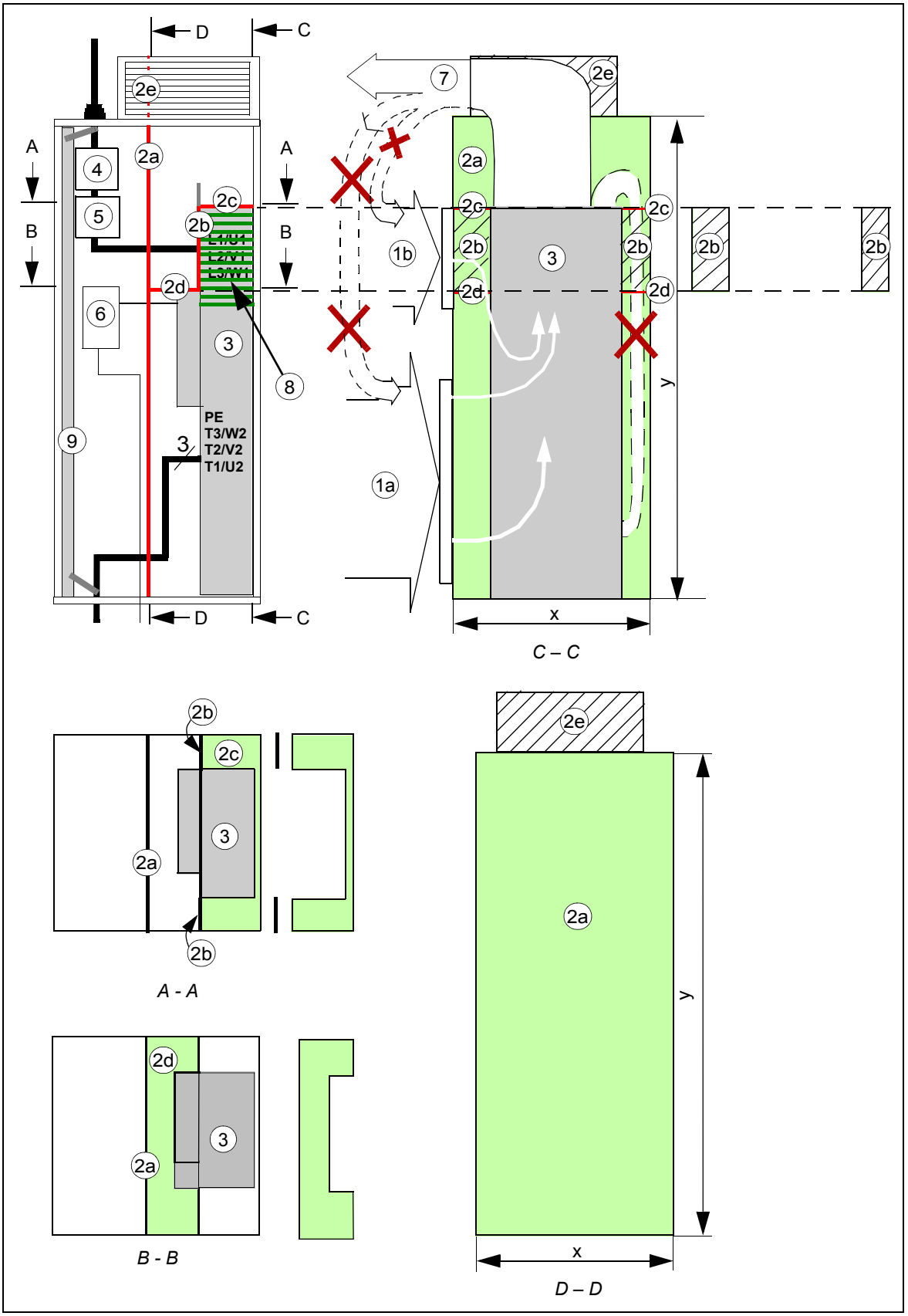
This diagram shows the air baffle position inside an example cabinet. For dimensions of the baffle, see page *209*.



1a	Air flow to the drive module, max. 40 °C (104 °F)	4	Disconnector and fuses
1b	Air inlet to the drive circuit boards and DC and output busbars	5	Contactor
2a	Vertical air baffle that separates the cool and hot areas in the cabinet	6	Drive module control unit
2b	Horizontal air baffle	7	Air flow out
2c	Optional air baffle that is needed when there is no fan on the lower part of the cabinet door (see 1b on page *51*).	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.
3	Drive module	9	Cabinet grounding busbar (PE)

Bookshelf mounting (standard drive module configuration)

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



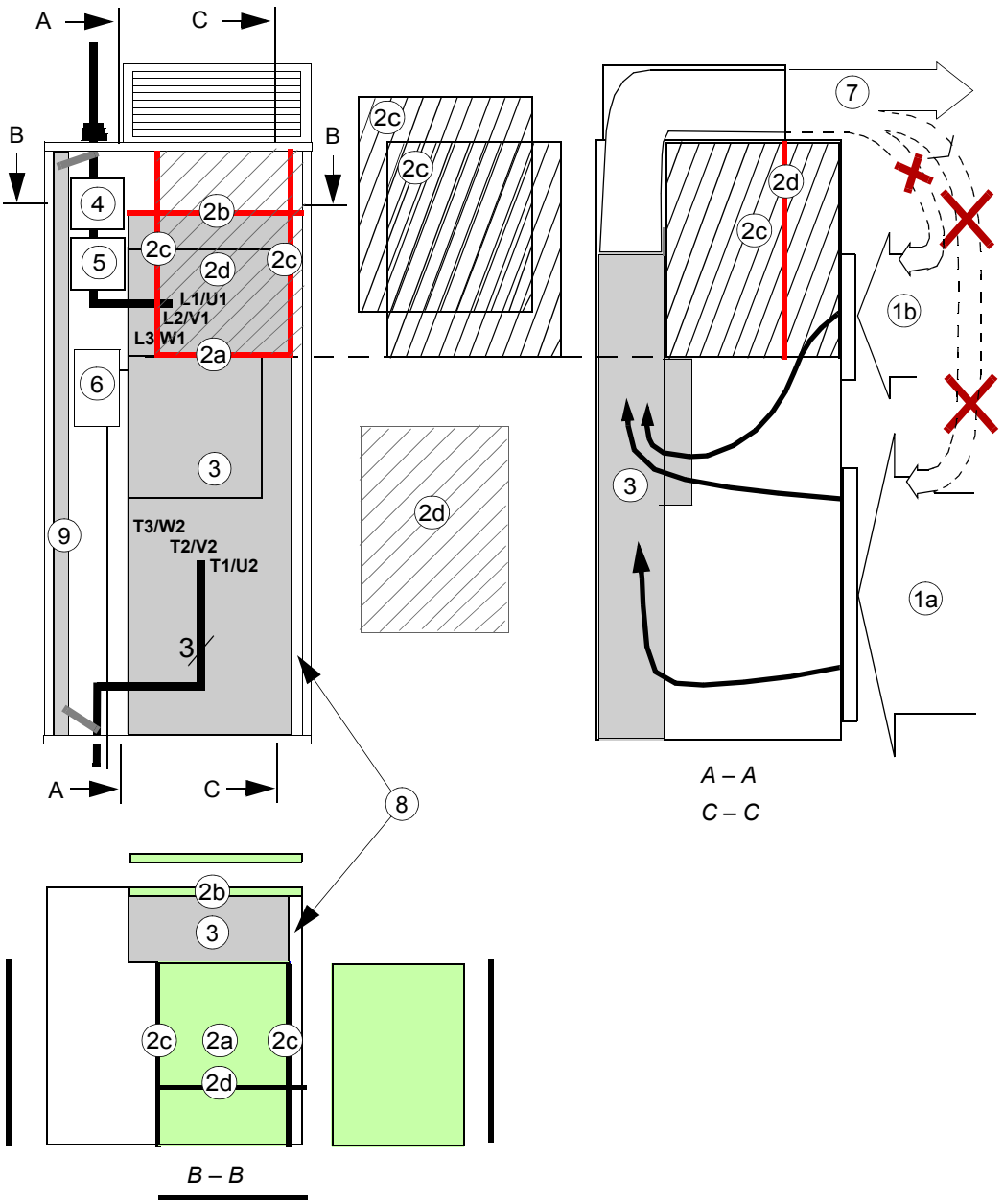
1a	Air flow to the drive module, max. 40 °C (104 °F)	3	Drive module
1b	Air inlet to the drive circuit boards and DC and output busbars	4	Disconnector and fuses
2a	Vertical air baffle that separates the cool and hot areas in the cabinet	5	Contactor
2b	Vertical air baffle	6	Drive module control unit
2c	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 *51*).	9	Cabinet grounding busbar (PE)

Bookshelf mounting with option “Full power cabling panels to be attached to a cabinet (IP20)”

See chapter *Step-by-step drawings for installing full cabling panels (option) in a Rittal TS 8 400 mm wide cabinet* on page *237* and dimension drawing for frame R10 on page *200* or dimension drawing for frame R11 on page *206*.

Flat mounting (option)

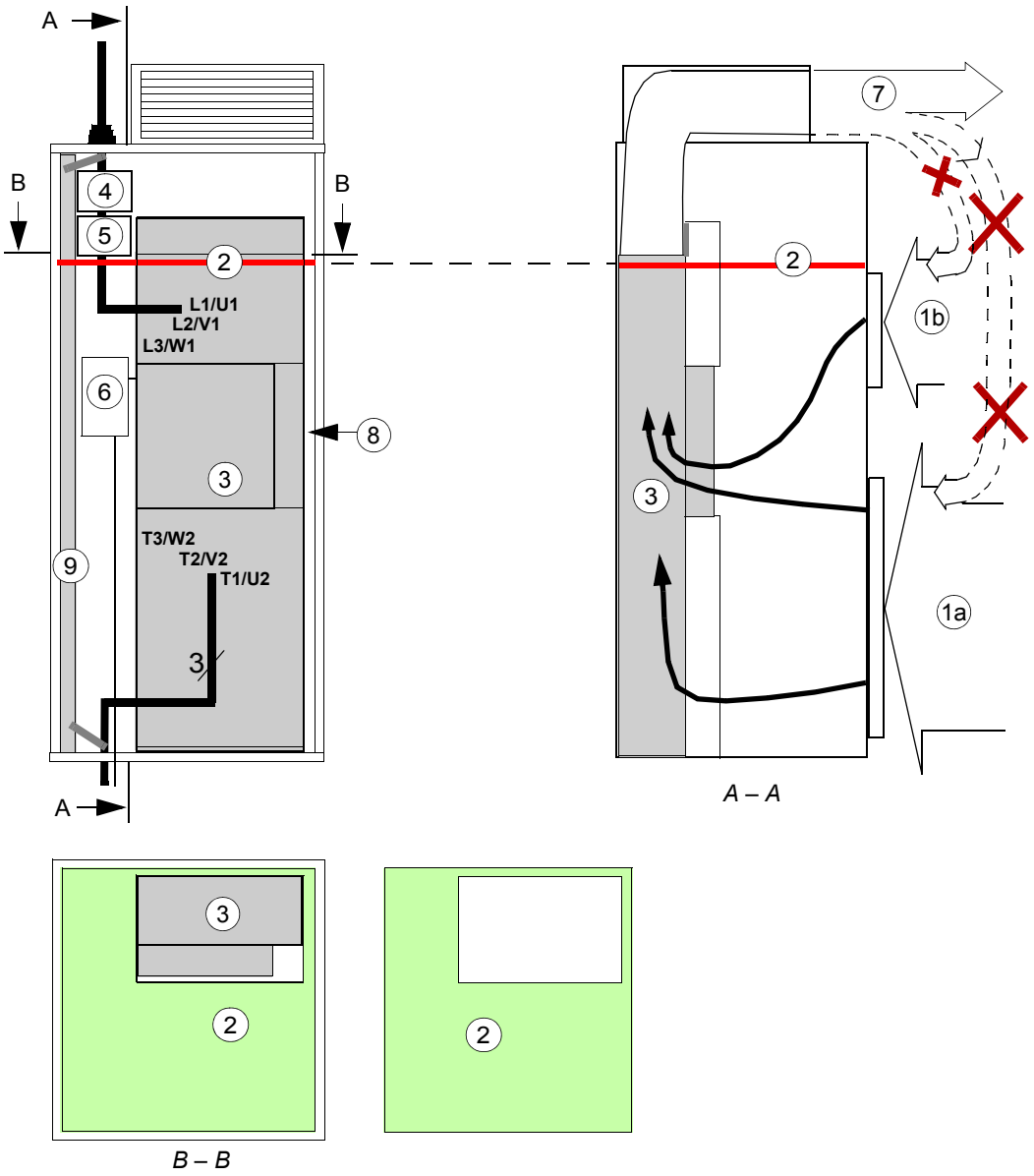
This diagram shows air baffle positions inside an example cabinet.



1a	Air flow to the drive module, max. 40 °C (104 °F)	4	Disconnector and fuses
1b	Air inlet to the drive circuit boards and DC and output busbars	5	Contactor
2a	Horizontal air baffles that guide cooling air flow	6	Drive module control unit
2b	Horizontal air baffle	7	Air flow out
2c	Vertical air baffle	8	Air gap between the drive module front and cabinet wall for cooling air flow
2d	Vertical air baffle that guides air flow to the inside the drive module	9	Cabinet grounding busbar (PE)
3	Drive module	-	-

Flat mounting (option) with IP20 shrouds (option)

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



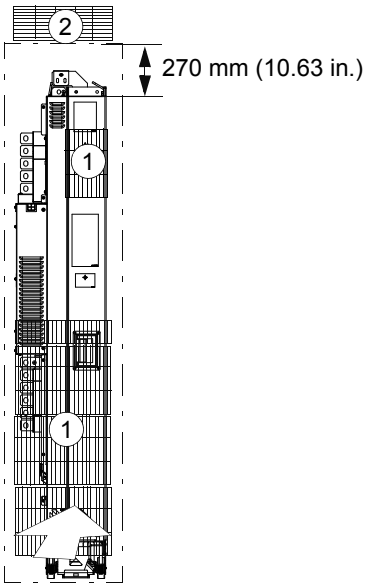
1a	Air flow to the drive module, max. 40 °C (104 °F)	5	Contactor
1b	Air inlet to the drive circuit boards and DC and output busbars	6	Drive module control unit
2	Horizontal air baffle	7	Air flow out
3	Drive module	8	Air gap between the drive module front and cabinet wall for cooling air flow
4	Disconnector and fuses	9	Cabinet grounding busbar (PE)

Required free space

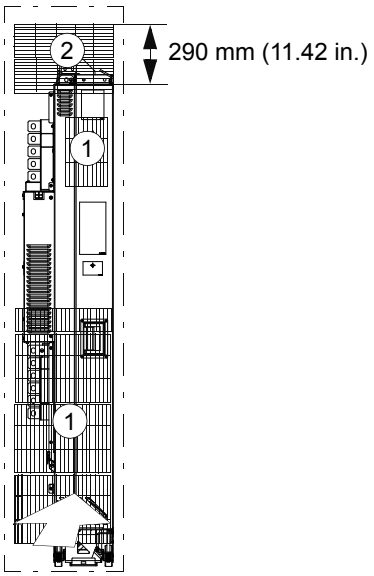
Free space around the drive module is needed for ensuring that sufficient cooling air flows through the module and the module cools correctly.

Free space at the top of the drive module

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



Air outlet on the cabinet roof



Air outlet in the upper part of the cabinet door

1	Air inlet
2	Air outlet

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

The control panel can be mounted onto the cabinet door using a control panel mounting platform (option). For the installation instructions, refer to *DPMP-01 mounting platform for ACS-AP control panel* (3AUA0000100140 [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 *169*.

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*. One main contactor for the drive, or contactors for both drive modules can be used if they are closed simultaneously. See section *Drive connection examples* on page *31*. Select the contactor according to nominal voltage of the drive and the drive or drive module current.

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 *71*. 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 ... 2 · U_N
  - motor nominal current range 1/6 ... 2 · I_N of the drive in DTC control and 0 ... 2 · 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 d*u*/d*t* 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 d*u*/d*t* filters, insulated N-end (non-drive end) motor bearings and ABB common mode filters are required. Failure of the motor to fulfill 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 d*u*/d*t* and common mode filters, insulated N-end motor bearings**
ABB motors			
Random-wound M2_, M3_ and M4_	$U_N \leq$ 500 V	Standard	+ N + CMF [1]
	500 V < $U_N \leq$ 600 V	Standard	+ N + d*u*/d*t* + CMF
		or	
		Reinforced	+ N + CMF [1]
	600 V < $U_N \leq$ 690 V (cable length ≤ 150 m)	Reinforced	+ N + d*u*/d*t* + CMF
	600 V < $U_N \leq$ 690 V (cable length > 150 m)	Reinforced	+ N + CMF [1]
Form-wound HX_ and AM_	380 V < $U_N \leq$ 690 V	Standard	P_N < 500 kW: +N + CMF [1]
			$P_N \geq$ 500 kW +N + d*u*/d*t* + CMF
Old* form-wound HX_ and modular	380 V < $U_N \leq$ 690 V	Check with the motor manufacturer.	
Random-wound HX_ and AM_ **	0 V < $U_N \leq$ 500 V	Enamelled wire with fiber glass taping	+ N + CMF [1]
	500 V < $U_N \leq$ 690 V		+ N + d*u*/d*t* + 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.

[1] See also section *When is a du/dt filter needed?* on page 229.

Motor type	Nominal AC supply voltage	Requirement for	
		Motor insulation system	ABB d*u*/d*t* and common mode filters, insulated N-end motor bearings
Non-ABB motors			
Random-wound and form-wound	$U_N \leq 420$ V	Standard: $\hat{U}_{LL}$ = 1300 V	+ N + CMF [1]
	420 V < $U_N \leq 500$ V	Standard: $\hat{U}_{LL}$ = 1300 V	+ N + d*u*/d*t* + CMF
		or	
		Reinforced: $\hat{U}_{LL}$ = 1600 V, 0.2 microsecond rise time	+ N + CMF [1]
	500 V < $U_N \leq 600$ V	Reinforced: $\hat{U}_{LL}$ = 1600 V	+ N + d*u*/d*t* + CMF
		or	
		Reinforced: $\hat{U}_{LL}$ = 1800 V	+ N + CMF [1]
	600 V < $U_N \leq 690$ V	Reinforced: $\hat{U}_{LL}$ = 1800 V	+ N + d*u*/d*t* + CMF
		Reinforced: $\hat{U}_{LL}$ = 2000 V, 0.3 microsecond rise time ***	+ N + CMF [1]

*** 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.

[1] See also section *When is a du/dt filter needed?* on page *229*.

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
d*u*/d*t*	d*u*/d*t* filter at the output of the drive
CMF	Common mode filter (option +E208)
N	N-end bearing (Insulated motor non-drive end bearing)

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**
$U_N \leq 500$ V	Standard	+ N + CMF [1)]
500 V < $U_N \leq 600$ V	Standard	+ d*u*/d*t* + N + CMF
	or	
	Reinforced	+ N + CMF [1)]
600 V < $U_N \leq 690$ V	Reinforced	+ d*u*/d*t* + N + CMF

[1)] See also section *When is a du/dt filter needed?* on page *229*.

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 d*u*/d*t* filter, insulated N-end bearing and ABB common mode filter**
$U_N \leq 420$ V	Standard: $\hat{U}_{LL}$ = 1300 V	+ N + CMF [1)]
420 V < $U_N \leq 500$ V	Standard: $\hat{U}_{LL}$ = 1300 V	+ N + d*u*/d*t* + CMF
	or	
	Reinforced: $\hat{U}_{LL}$ = 1600 V, 0.2 microsecond rise time	+ N + CMF [1)]
500 V < $U_N \leq 600$ V	Reinforced: $\hat{U}_{LL}$ = 1600 V	+ d*u*/d*t* + N + CMF
	or	
	Reinforced: $\hat{U}_{LL}$ = 1800 V	+ N + CMF [1)]
600 V < $U_N \leq 690$ V	Reinforced: $\hat{U}_{LL}$ = 1800 V	+ N + d*u*/d*t* + CMF
	Reinforced: $\hat{U}_{LL}$ = 2000 V, 0.3 microsecond rise time ***	N + CMF [1)]

*** 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.

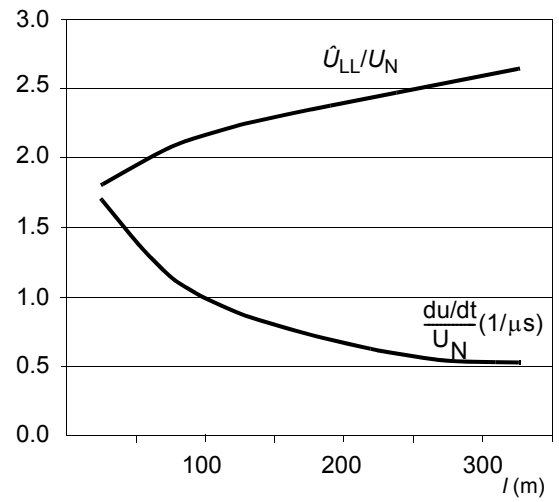
[1)] See also section *When is a du/dt filter needed?* on page *229*.

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

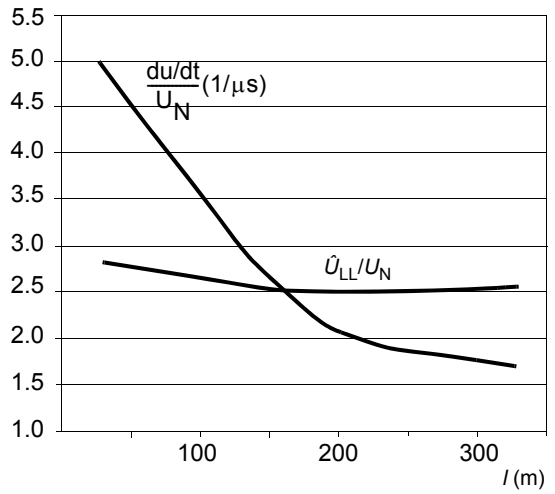
The diagrams below show the relative peak line-to-line voltage and rate of change of voltage as a function of the motor cable length with and without a d*u*/d*t* filter in use.

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 (d*u*/d*t*)/U_N from the appropriate diagram. Multiply the values by the nominal supply voltage (U_N) and substitute into equation $t = 0.8 \cdot \hat{U}_{LL}/(du/dt)$.



Drive with d*u*/d*t* filter



Drive without d*u*/d*t* filter

l	Motor cable length
$\hat{U}_{LL}/U_N$	Relative peak line-to-line voltage
d*u*/d*t* /U_N	Relative d*u*/d*t* value

Note: ÛLL and du/dt values are approximately 20% higher with resistor braking.

Additional note for sine filters

Sine filters protect the motor insulation system. Therefore, the d*u*/d*t* 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 filter is included in the standard drive module delivery.

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 *79*.
- 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 *79*). 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 tables below give copper and aluminum cable types with concentric copper shield for the drive modules with nominal current. See also *Terminal and lead-through data for the power cables* on page *184*.

Drive type ACS880-04XT-	IEC[1] input and motor cabling			
	Cabling per drive module [2]		Common cabling for the drive modules [3]	
	Cu cable type	Al cable type	Cu cable type	Al cable type
	mm^2	mm^2	mm^2	mm^2
U_N = 400 V				
1190A-3	3 × (3 × 150)	3 × (3 × 240)	4 × (3 × 150)	4 × (3 × 240)
1610A-3	3 × (3 × 240)	4 × (3 × 240)	4 × (3 × 240)	5 × (3 × 240)
U_N = 500 V				
1160A-5	3 × (3 × 150)	3 × (3 × 240)	4 × (3 × 150)	4 × (3 × 240)
1610A-5	3 × (3 × 240)	4 × (3 × 240)	4 × (3 × 240)	5 × (3 × 240)
U_N = 690 V				
0810A-7	2 × (3 × 95)	2 × (3 × 120)	4 × (3 × 95)	4 × (3 × 120)
1080A-7	3 × (3 × 150)	3 × (3 × 185)	4 × (3 × 150)	4 × (3 × 185)
1320A-7	3 × (3 × 185)	4 × (3 × 185)	4 × (3 × 185)	5 × (3 × 185)

Drive type ACS880-04XT-	IEC[1] external[*] DC cabling between drive modules	
	Cu cable type **	Al cable type **
	mm^2	mm^2
U_N = 400 V		
1190A-3	2 × (3 × 150)	2 × (3 × 240)
1610A-3	2 × (3 × 240)	2 × (3 × 240)
U_N = 500 V		
1160A-5	2 × (3 × 150)	2 × (3 × 240)
1610A-5	2 × (3 × 240)	2 × (3 × 240)
U_N = 690 V		
0810A-7	2 × (3 × 95)	2 × (3 × 120)
1080A-7	2 × (3 × 150)	2 × (3 × 185)
1320A-7	2 × (3 × 185)	2 × (3 × 185)

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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) See page *32*.

3) The supply cables are connected to a common switch or breaker, see page *31*. The whole input current flows through common cabling and you can use the recommended cables for that. The connection from the switch to the drive modules inside the cabinet can be made with busbars.

*) The table gives DC cable types when the cables are outside the cabinet. For DC cables inside the cabinet, select a cable capable of carrying 2/3 of the drive continuous output current.

**) Connection (2 × (3 × xxx)): two phase conductors of one three-phase cable between the DC+ terminals of the drive modules and two phase conductors of the second three-phase cable between the DC- terminals of the drive modules. The third phase conductors unconnected.

Drive type ACS880-04XT-	US[1] input and motor cabling			
	Cabling per drive module [2]		Common cabling for the drive modules [3]	
	Cu cable type	Al cable type	Cu cable type	Al cable type
	AWG/kcmil	AWG/kcmil	AWG/kcmil	AWG/kcmil
U_N = 400 V				
1190A-3	2 × 700 or 3 × 350	2 × 700 or 3 × 350	3 × 700 or 5 × 350	4 × 700 or 6 × 350
1610A-3	3 × 600 or 4 × 400	4 × 500	5 × 600 or 6 × 400	6 × 500
U_N = 500 V				
1160A-5	2 × 700 or 3 × 350	2 × 700 or 3 × 350	3 × 700 or 5 × 350	4 × 700 or 6 × 350
1610A-5	3 × 600 or 4 × 400	4 × 500	5 × 600 or 6 × 400	6 × 500
U_N = 690 V				
0810A-7	2 × 350 or 3 × 4/0	2 × 500 or 3 × 250	3 × 350 or 5 × 4/0	3 × 500 or 5 × 250
1080A-7	2 × 600 or 3 × 350	3 × 500 or 4 × 300	3 × 600 or 4 × 350	4 × 500 or 6 × 300
1320A-7	3 × 500 or 4 × 300	3 × 600 or 4 × 400	4 × 500 or 6 × 300	5 × 600 or 6 × 400

Drive type ACS880-0XT-	US[1] external[*] DC cabling between drive modules	
	Cu cable type [**]	Al cable type [**]
	AWG/kcmil	AWG/kcmil
U_N = 400 V		
1190A-3	2 × 700	2 × 400
1610A-3	2 × 400	2 × 500
U_N = 500 V		
1160A-5	2 × 700	2 × 400
1610A-5	2 × 400	2 × 500
U_N = 690 V		
0810A-7	1 × 350	1 × 500
1080A-7	2 × 600	2 × 300
1320A-7	2 × 300	2 × 400

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1) 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.

2) See page *32*.

3) The supply cables are connected to a common switch or breaker, see page *31*. The whole input current flows through common cabling and you can use the recommended cables for that. The connection from the switch to the drive modules inside the cabinet can be made with busbars.

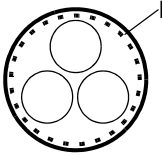
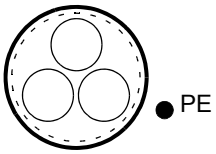
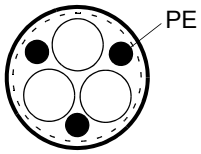
*) The table gives DC cable types when the cables are outside the cabinet. For DC cables inside the cabinet, select a cable capable of carrying 2/3 of the drive continuous output current.

**) Connection (1× xxx): One phase conductor of the three-phase cable between the DC+ terminals of the drive modules and another phase conductor of the three-phase cable between the DC- terminals of the drive modules. The third phase conductor unconnected.
Connection (2 × xxx): two phase conductors of one three-phase cable between the DC+ terminals of the drive modules and two phase conductors of the second three-phase cable between the DC- terminals of the drive modules. The third phase conductors unconnected.

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

	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 *75*. Check with local / state / country electrical codes for allowance.
	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 *75*.
	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 *75*.

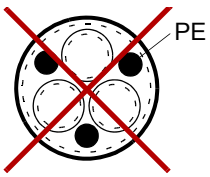
Power cable types for restricted use

	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).

Recommended DC cable type

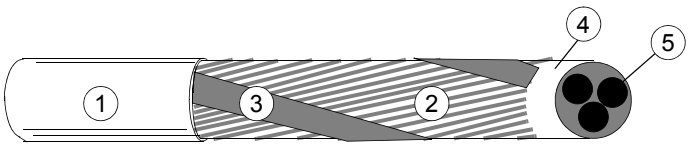
Unshielded single-core DC cable can be used inside the cabinet. If the DC cables are run outside the cabinet, use shielded three-core cables. The shield is connected only at one end. Maximum length is four meters.

Not allowed power cable types

	Symmetrical shielded cable with individual shields for each phase conductor is not allowed on any cable size for input and motor cabling.

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.



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

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*.

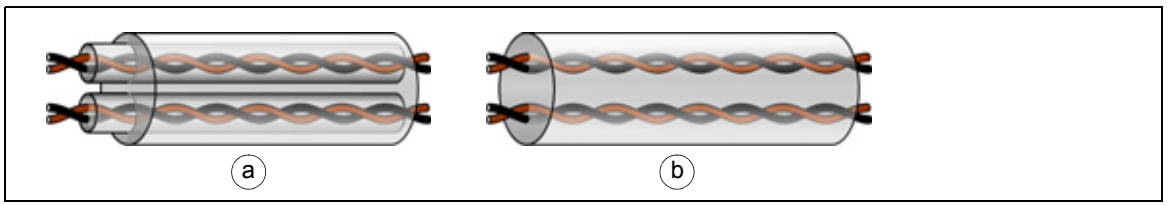
Selecting the control cables

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.

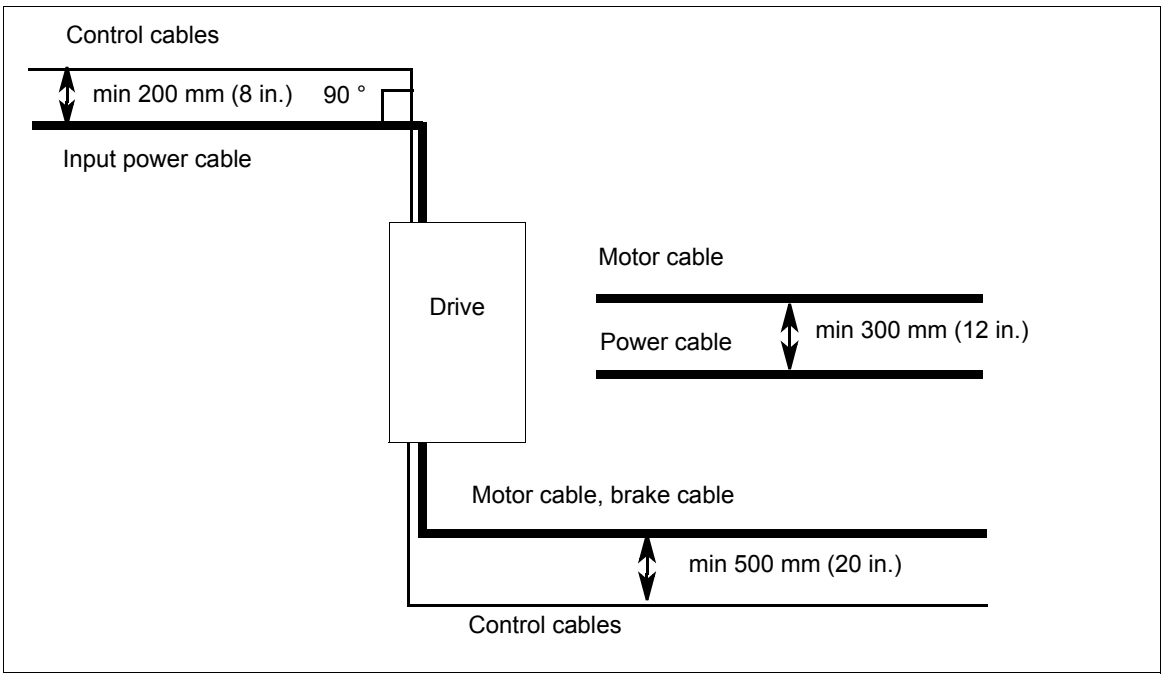
Routing the cables

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.

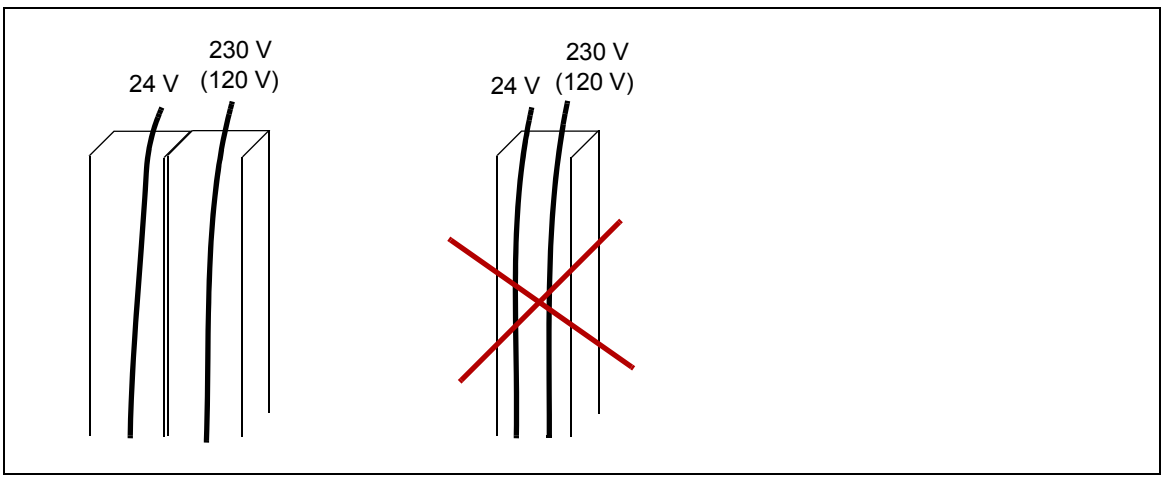
The cable trays must have good electrical bonding to each other and to the grounding electrodes. Aluminum tray systems can be used to improve local equalizing of potential

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 and the input cable with fuses or a circuit breaker with current restriction. See section *Drive connection examples* on page *31*.

Equip the fuses with blown fuse indicators for stopping the drive.

Size the fuses or the circuit breaker 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.

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.

You can use the circuit breakers listed below. Other circuit breakers can be used with the drive if they provide the same electrical characteristics. ABB does not assume any liability whatsoever for the correct function and protection with circuit breakers not listed below. Furthermore, if the recommendations given by ABB are not obeyed, the drive can experience problems that the warranty does not cover.

Note: Fuses must be used with circuit breakers in the USA.

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
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

Drive module type	Frame size	ABB molded case circuit breaker (Tmax)	
		Product ID (Type)	kA [1]
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)

3AXD00000588487

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

2) Contact your local ABB representative

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.

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

See section *Drive connection examples* on page *31*.

The drive protects itself and the 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.

In 6-pulse connection with a common main circuit breaker, the drive protects the input cables against thermal overload when the cables are dimensioned according to the nominal current of the drive.

For 12-pulse connection and 6-pulse connection with individual circuit breakers, use gG fuses with blown fuse indicators for the thermal protection of the input cables. Wire the indicators to stop the drive in case of a blown fuse.

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

We do not recommend to connect the drive modules to a common DC system.

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 *213*). 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 *213*.

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])
- *FPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (option +L537 +Q971) user's manual* (3AXD50000027782 [English])

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

The drive can be equipped with an FSO-12 safety functions module (option) 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 *190*.

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 *87*.

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.

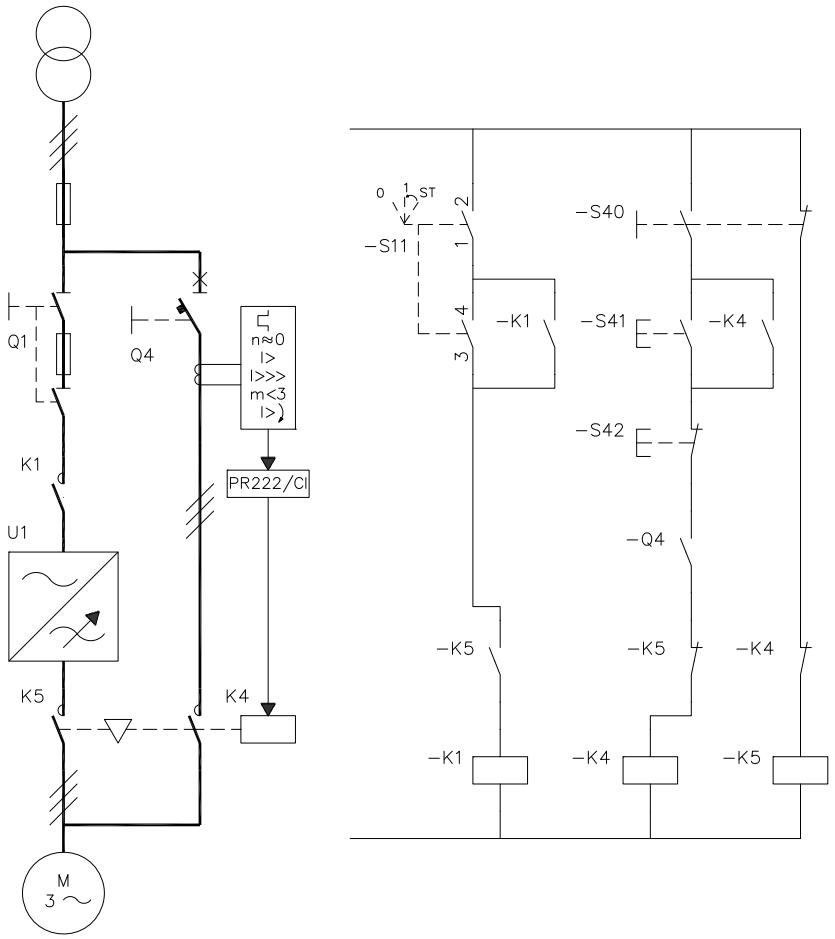
Implementing a bypass connection

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.



Q1	Drive main switch
Q4	Bypass circuit breaker
K1	Drive main contactor
K4	Bypass contactor
K5	Drive output contactor
S11	Drive main contactor on/off control
S40	Motor power supply selection (drive or direct-on-line)
S41	Start when motor is connected direct-on-line
S42	Stop when motor is connected direct-on-line

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

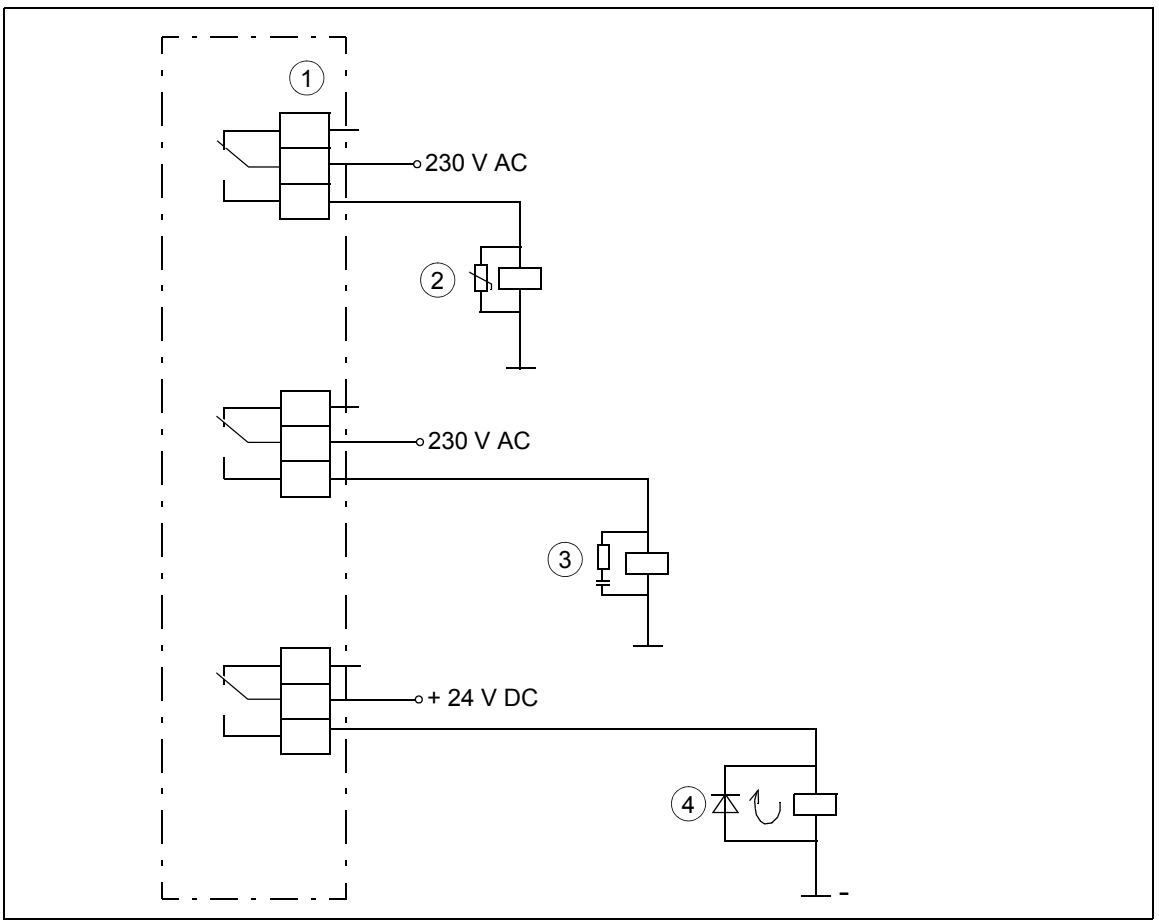
1. Stop the motor with S42.
2. Switch the motor power supply from direct-on-line to the drive with S40.
3. Close the main contactor of the drive with switch S11 (-> turn to position ST for two seconds and leave to position 1).
4. Start the drive and the motor with the drive control panel (drive in the 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.
4. Thermistor protection module FPTC-01 or FPTC-02 is used.

See section *AI1 and AI2 as Pt100, Pt1000, PTC and KTY84 sensor inputs (XAI, XAO)* on page *117* or section *DI6 (XDI:6) as PTC sensor input* on page *116*.

This table shows what sensor types you can connect to the drive I/O extension and encoder interface modules.

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	X

* These modules require double or reinforced insulation between live parts and the surface of accessible parts of electrical equipment

** These modules do not require double or reinforced insulation between live parts and the surface of accessible parts of electrical equipment

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).

Example circuit diagram

See page *211*.

6

Installation instructions

Contents of this chapter

This chapter contains the general installation instructions for the drive modules.

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 *186* for the allowed ambient conditions and section *Losses, cooling data and noise* on page *184* for the required cooling air.

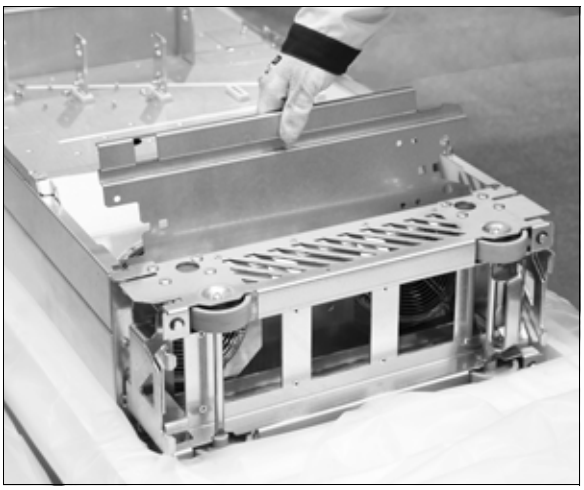
Moving and unpacking the unit

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

The drive modules are packed into two similar transport packages tied together with bands. Move the transport packages by pallet truck to the installation site.

Unpack the package as follows (see the package drawing on page *93*):

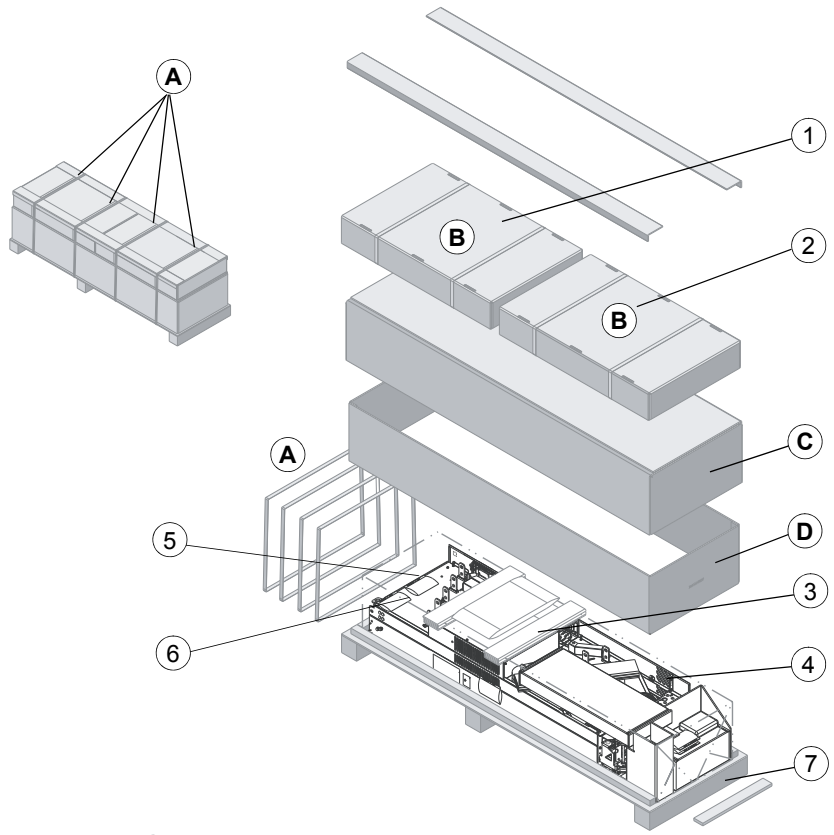
- Cut the bands (A).
- Unpack the additional boxes (B).
- Remove the outer sheathing by lifting it (C).
- Remove the sheathing by lifting it (D).
- Remove the pedestal guide plate as shown below.



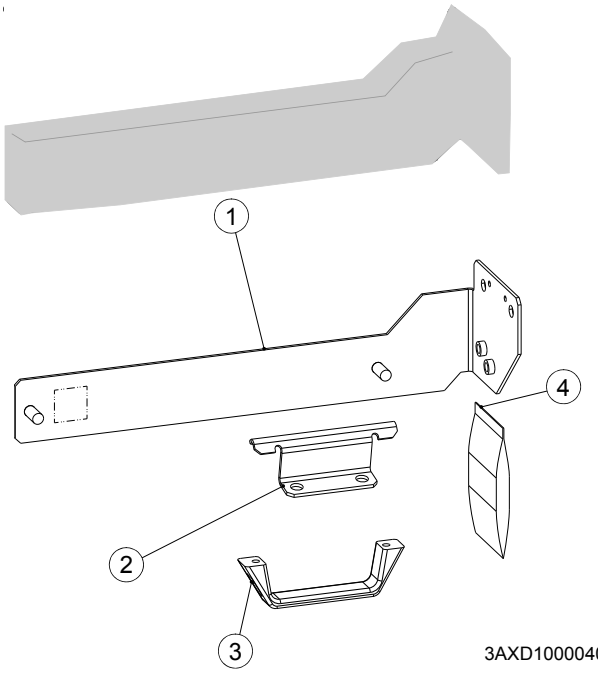
- Insert lifting hooks to the drive module lifting eyes and lift the module to the installation place.

Package drawings

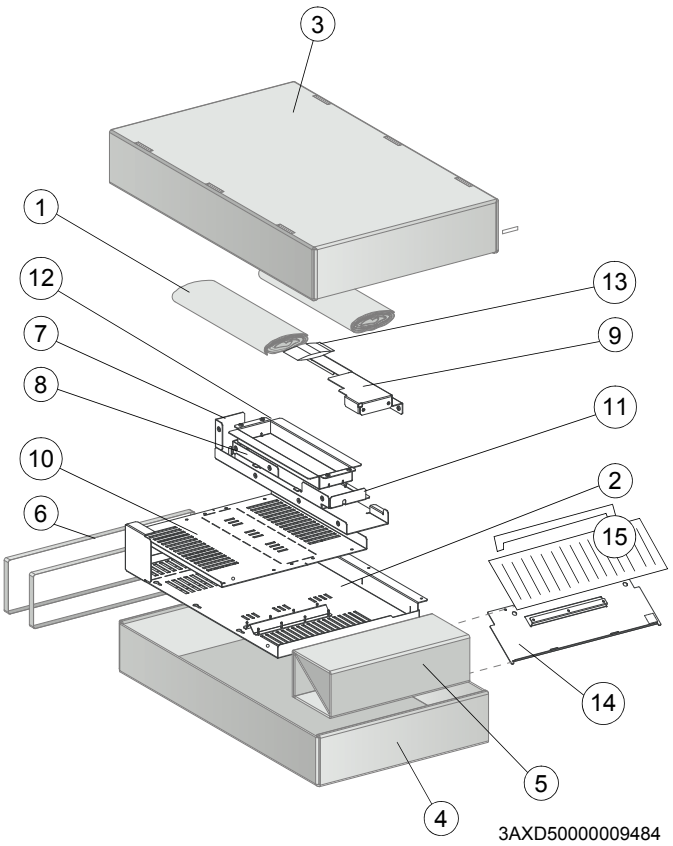
The package of one drive module is shown below.



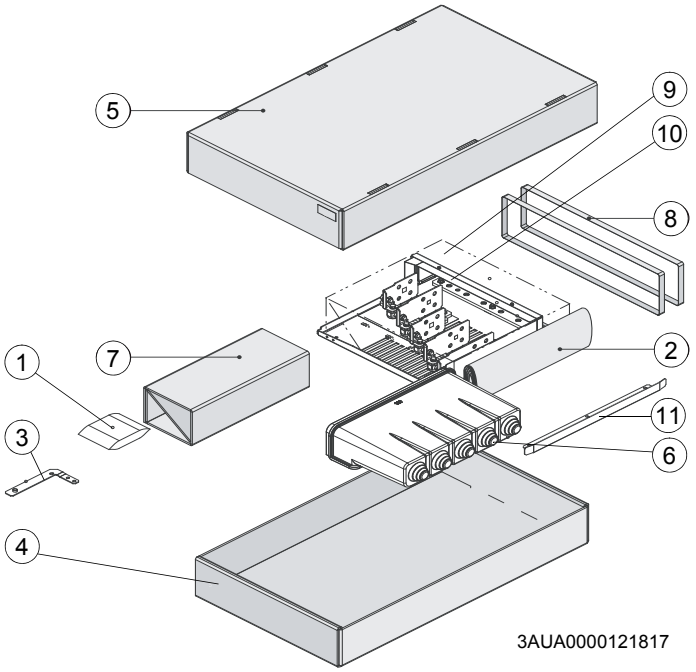
Transport package contents	
1	With option “IP20 shrouds for covering the input and motor cabling area”: Clear plastic shrouds. With option “Full power cabling panels to be attached to a cabinet (IP20)”: Input cabling panel parts. See below for the box contents.
2	With option “Full size output cable connection terminals”: Output cable connection terminals. With option “Full size input cable connection terminals and PE busbar”: Input cable connection terminals. With option “Full power cabling panels to be attached to a cabinet (IP20)”: Output cabling panel parts. See below for the box contents.
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 and factory installed optional modules, control panel and cable or control panel with door mounting kit (option), delivery documents, printed multilingual start-up quick guide and memory stick containing all manuals. Other printed manuals if ordered.
5	With option “Flat mounting”: Back fastening bars
6	With option “Power cable connection terminals on the right-hand side”: Accessories for mounting.
7	Pallet



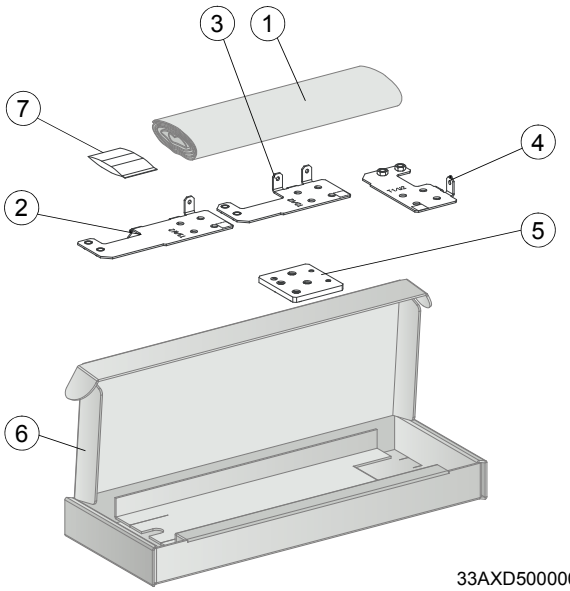
With option “Power cable connection terminals on the right-hand side”: Top and bottom brackets and handle (item 6 in the package drawing on the previous page)	
1	Top bracket
2	Bottom bracket
3	Handle
4	Screw package



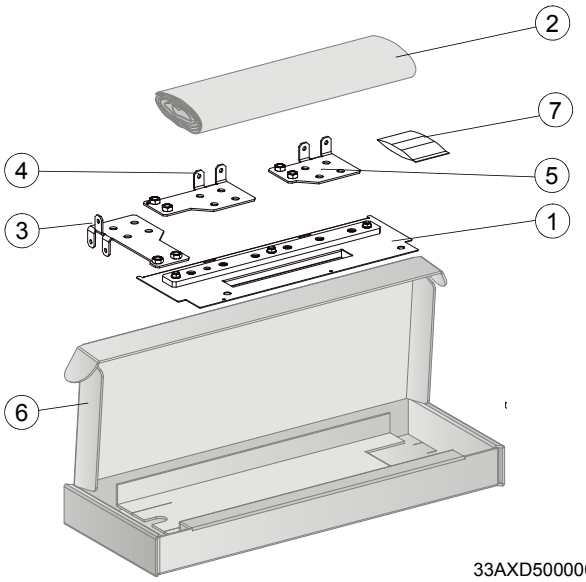
Box B1 contents with option “IP20 shrouds for covering the input and motor cabling area”	
1	Paper fill
2	Clear plastic shroud for output cabling
3	Cardboard box cover
4	Cardboard box bottom
5	Support
6	Bands
7	Back clear plastic shroud (lower)
8	Back clear plastic shroud (upper)
9	Front clear plastic shroud
10	Clear plastic shroud for input cabling
11	Top clear plastic shroud
12	Clear plastic shroud for input cable lead-through from side
13	Screws in a plastic bag
14	Metallic shroud without ground bar
15	Bottom grille and mounting bracket



Box B1 contents with option “Full power cabling panels to be attached to a cabinet (IP20)”: Input power cabling panel parts	
1	Screw package
2	Paper fill
3	Input power cabling panel
4	Cardboard tray
5	Top cardboard cover
6	Support
7	Bands
8	Plastic bag
9	Rubber grommet
10	Grounding busbar to be connected to the input power cabling panel and the drive module



Box B2 contains this box with option “Full size output cable connection terminals”	
1	Paper fill
2	Output cable connection terminal T3/W2
3	Output cable connection terminal T2/V2
4	Output cable connection terminal T1/U2
5	Grounding terminal
6	Cardboard box
7	Screws and insulators a plastic bag



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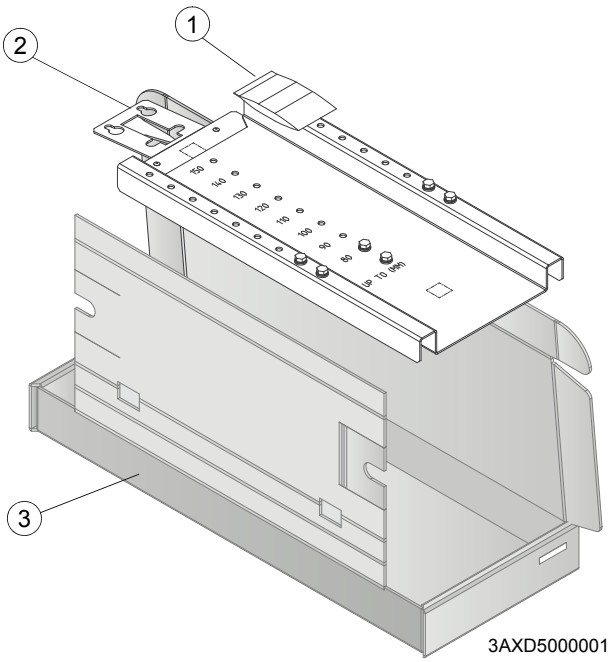
Box B2 contains additionally this box with option “Full size input cable connection terminals and PE busbar”	
1	Metallic shroud with ground bar
2	Paper fill
3	Input cable connection terminal L3/W1
4	Input cable connection terminal L2/V1
5	Input cable connection terminal L1/U1
6	Cardboard box
7	Screws and insulators in a plastic bag



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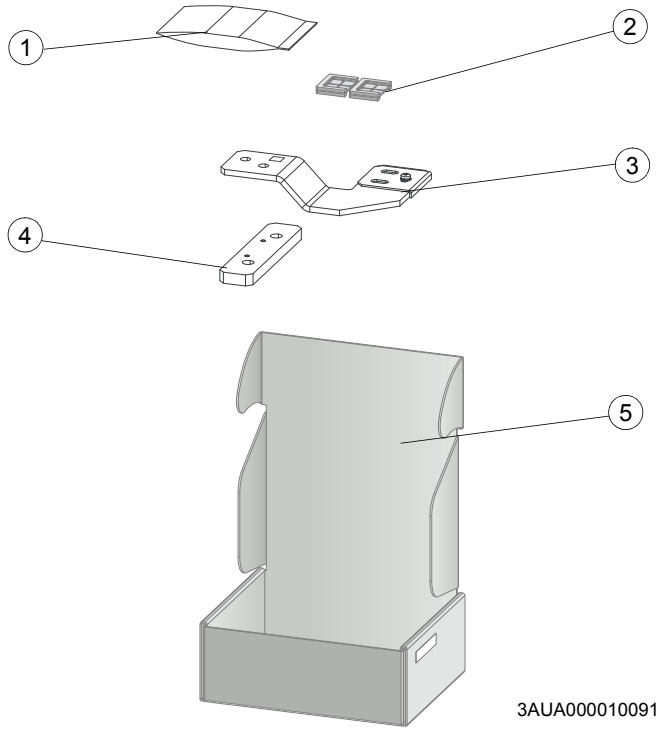
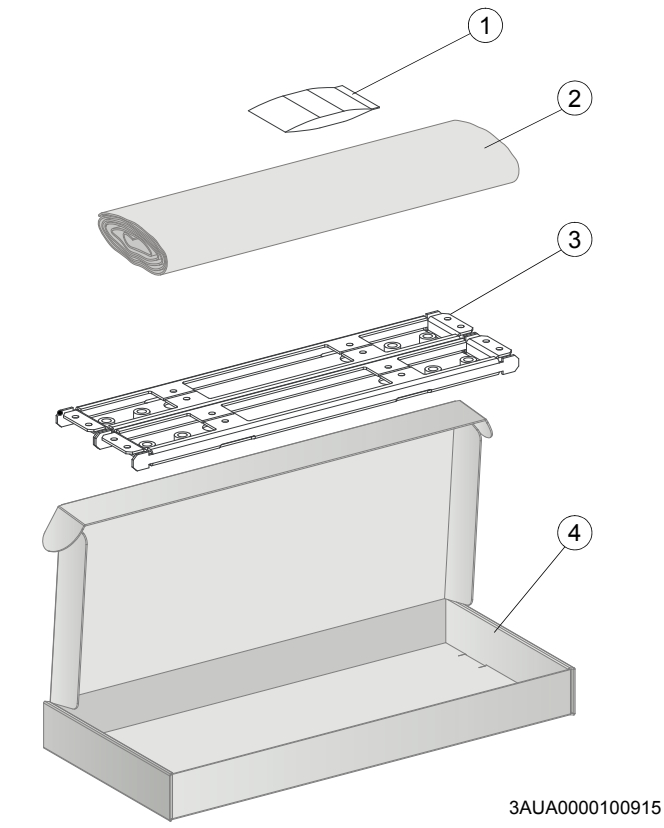
Ramp box contents	
1	Screw package
2	Telescopic extraction and insertion ramp
3	Cardboard box



Accessories box contents	
1	Screw package, includes also spacers for FSO module installation
2	Rubber grommets for control unit cable lead-through holes in the middle front cover of the drive module
3	Bracket for attaching the drive module from top to Rittal cabinet punched section. See page *104*.
4	Support bracket for attaching the drive module from top to a mounting plate or wall. The bracket brings a gap for cooling air flow and prevents the drive module screws from chafing the plate. See page *103*.
5	Cardboard box



Flat installation box contents (“Flat mounting” option)	
1	Screw package
2	Paper fill
3	Mounting bars for 600 mm wide Rittal TS 8 cabinet
4	Cardboard box

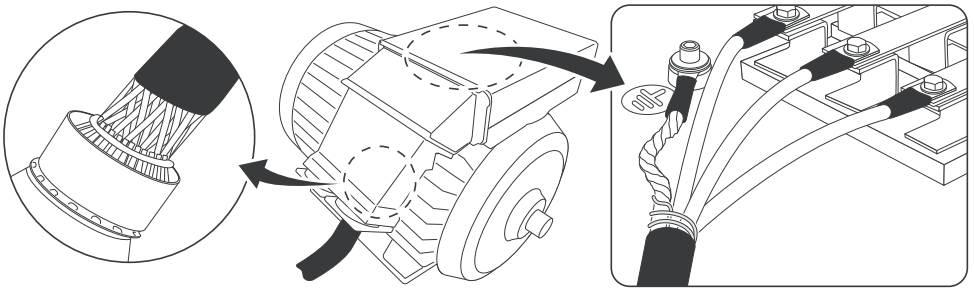
Checking the delivery

Check that all items listed in section *Moving and unpacking the unit* on page *92* 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.

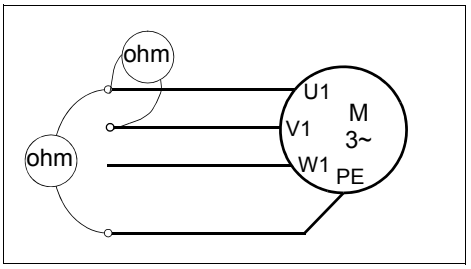
Input cable

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:

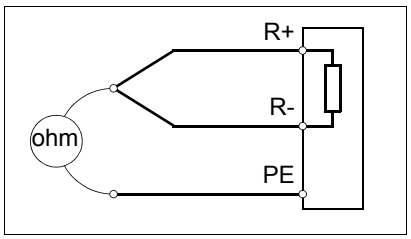
1. Check that the motor cable is disconnected from the drive output terminals T1/U2, T2/V2 and T3/W2.
2. Measure the insulation resistance between each phase conductor and then between each phase conductor and the Protective Earth conductor using a measuring voltage of 1000 V DC. The insulation resistance 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

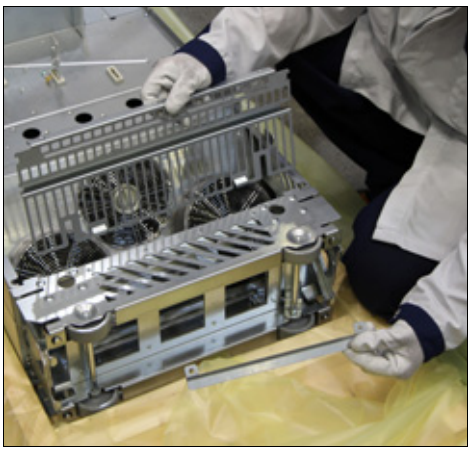
Check the insulation of the brake resistor assembly (if present) as follows:

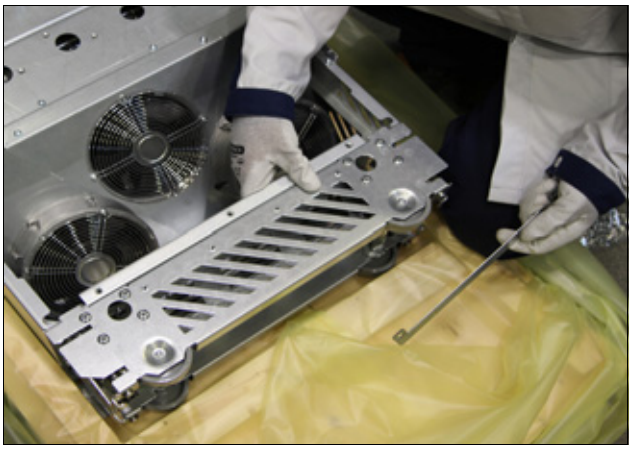
1. Check that the resistor cable is connected to the resistor, and disconnected from the drive output terminals R+ and R-.
2. At the drive end, connect the R+ and R- conductors of the resistor cable together. Measure the insulation resistance between the conductors and the PE conductor by using a measuring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

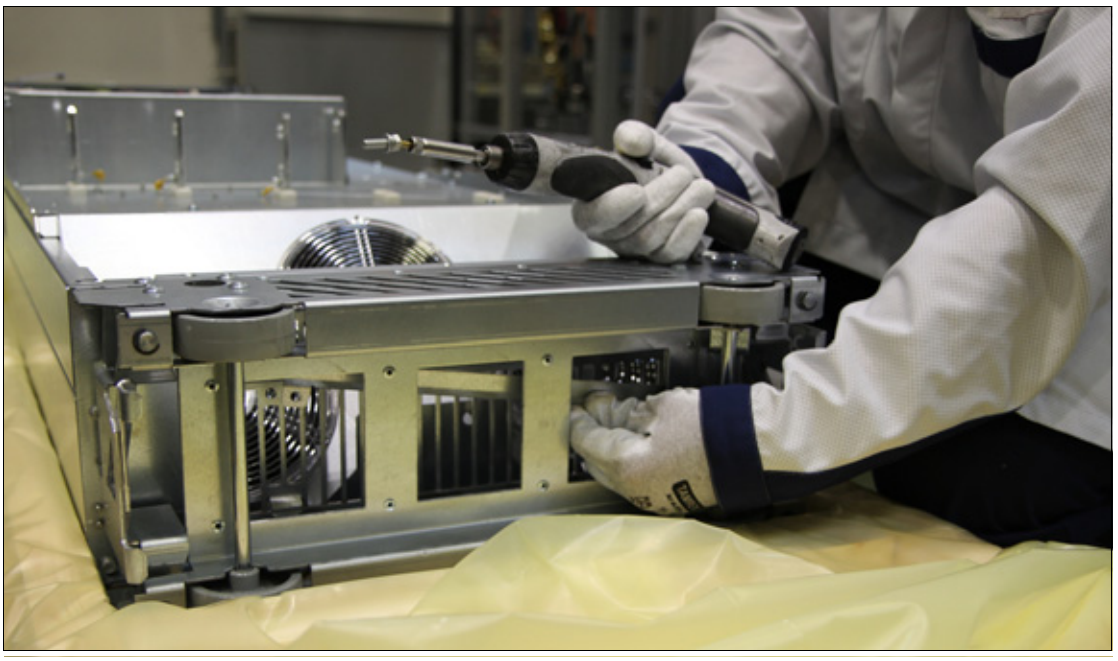


Installing the bottom grille for IP20 degree of protection

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

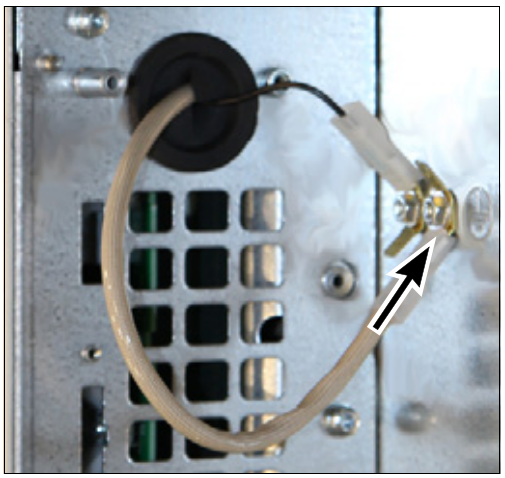






Checking the compatibility with IT (ungrounded) systems

EMC filter +E200 is 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 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

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. For an installation example, see *Installation example – standard, optional IP20 shrouds and power cable connection terminals* on page *123*.

Flat mounting

You can attach the drive module with option “Flat mounting” 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 the option to the cabinet mounting plate and then attach the drive module to the mounting brackets with screws.

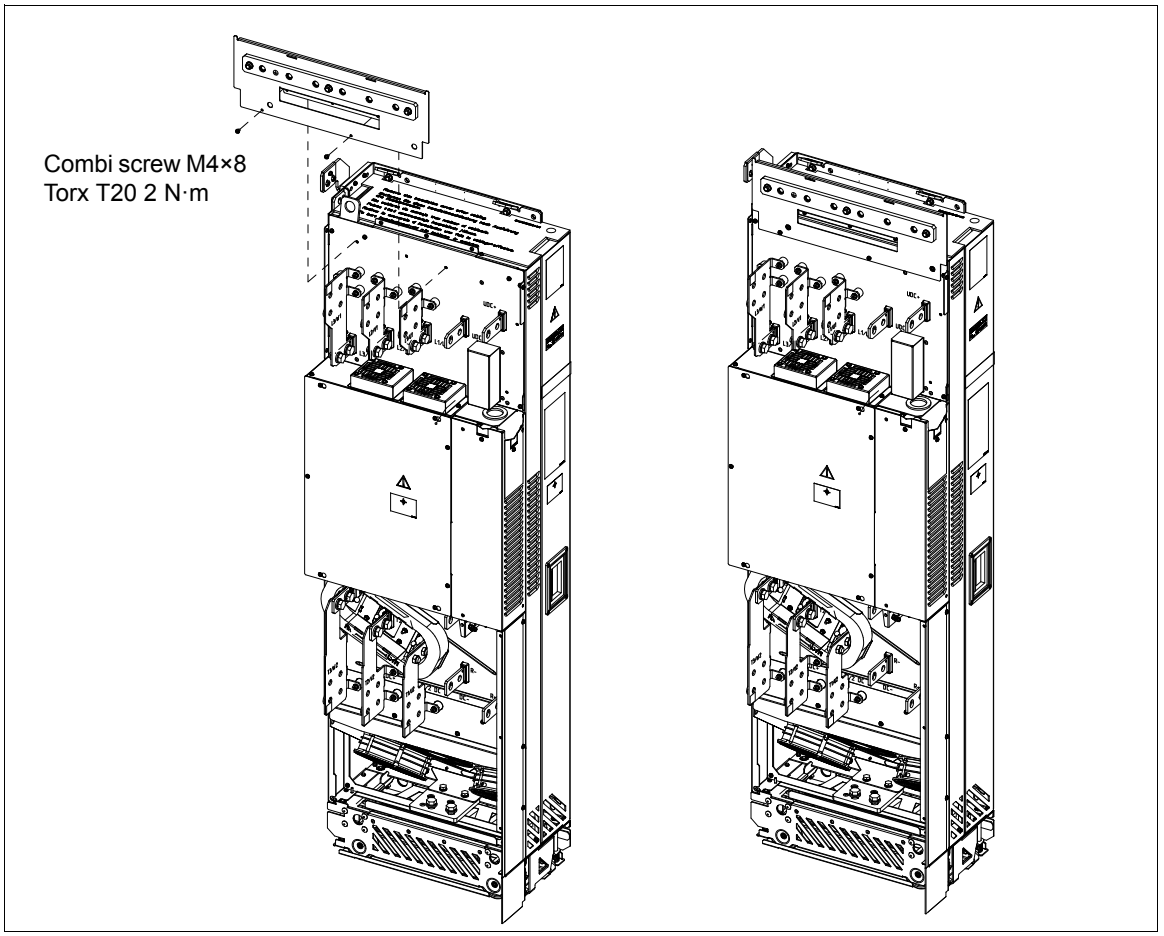
See the dimension drawing for frame R10 on page *201* or for frame R11 on page *207*.

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 *239*.

Option “Full-size input power cable connection terminals and PE (ground) busbar”

Connect the input power cable connection terminals as shown in chapter *Step-by-step drawings for an installation example of drive module with optional IP20 shrouds and input and output terminals in Rittal TS 8 600 mm wide cabinet* on page *233*.

Install the metallic shroud with ground bar as shown below.



Option “Full power cabling panels to be attached to a cabinet (IP20)”

For an installation example of the drive module with option “Full power cabling panels to be attached to a cabinet (IP20)” into a Rittal cabinet including power cable connection procedure, see chapter *Step-by-step drawings for installing full cabling panels (option) in a Rittal TS 8 400 mm wide cabinet* page *237*.

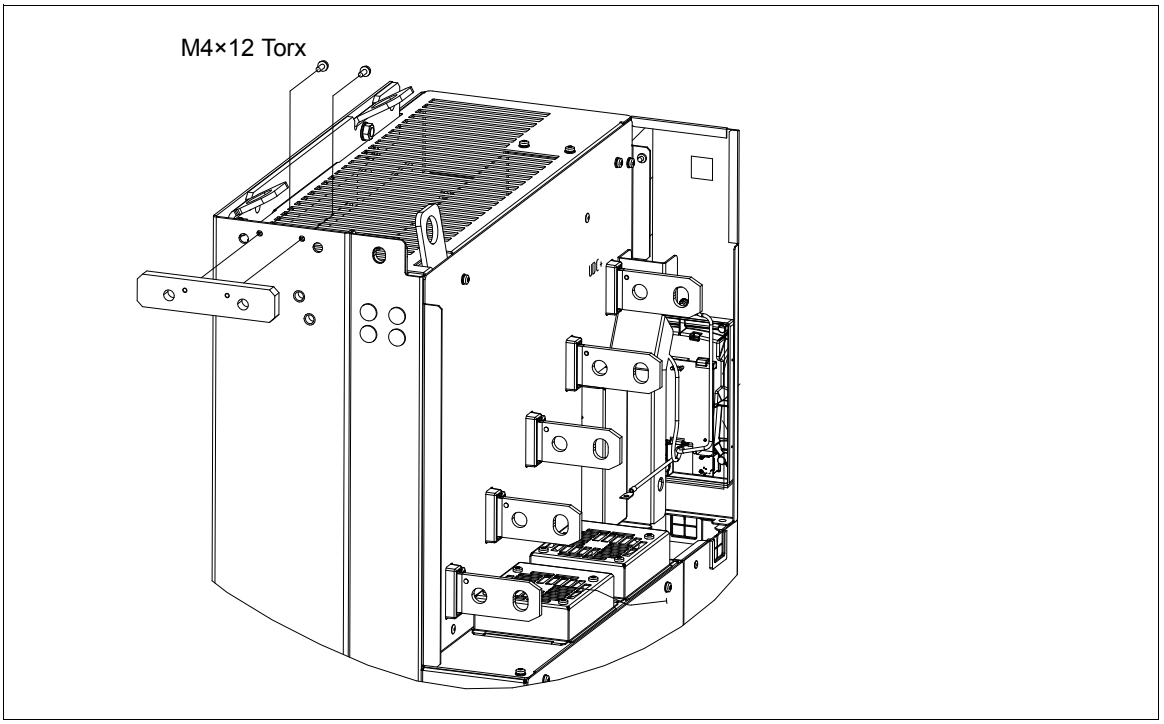
Option “Power cable connection terminals on the right-hand side of the drive module”

For an installation example of the drive module with option “Power cable connection terminals on the right-hand side of the drive module” into a Rittal cabinet, see chapter *Step-by-step drawings for option “Power cable connection terminals on the right-hand side of the drive module” installation example in Rittal TS 8 600 mm wide cabinet* on page *241*.

Otherwise, install the drive module as the standard drive module configuration.

Attaching the drive module to a mounting plate or wall

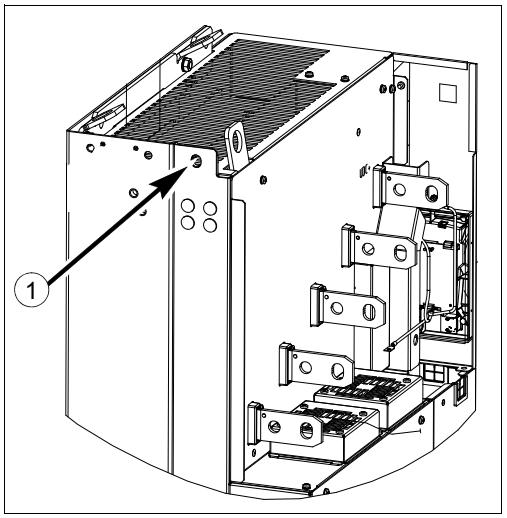
Use the support bracket if you attach the drive module directly to a mounting plate or wall. The support bracket prevents the drive module screws from chafing against the plate.

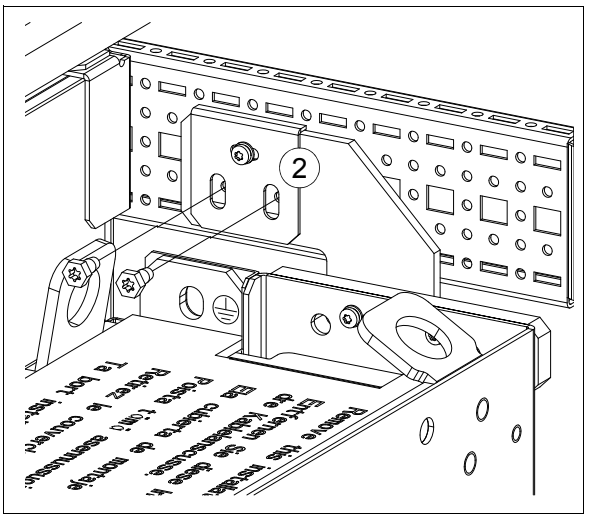


Alternatives for grounding the drive module

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 ARFI-10 EMC filter (option)

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

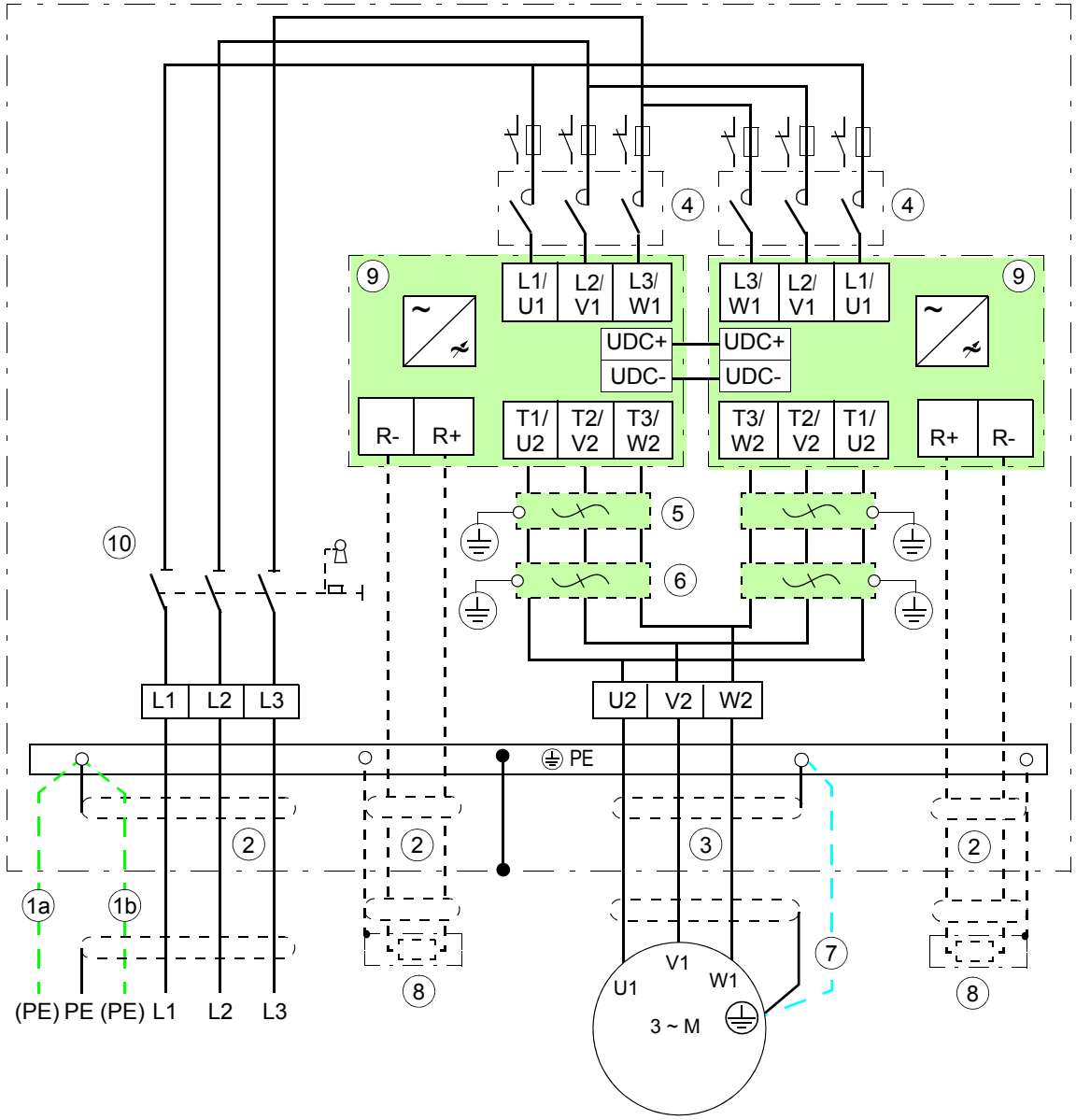
Attaching the type designation label

Attach the drive module package type designation label delivered with the drive modules to the cabinet door.

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 example (6-pulse)



1	Use a separate grounding PE cable (1a) or a cable with a separate PE conductor (1b) if the conductivity of the shield does not meet the requirements for the PE conductor (see page *75*).
2	360-degree grounding is recommended if shielded cable is used. Ground the other end of the input cable shield or PE conductor at the distribution board.
3	360-degree grounding is required.
4	Line contactor
5	Common mode filter
6	du/dt filter or sine filter (options)
7	Use a separate grounding cable if the shield does not meet the requirements of IEC 61439-1 (see page *75*) and there is no symmetrically constructed grounding conductor in the cable (see page *79*).
8	External brake resistor
9	Drive module
10	Switch-disconnector and separate fuses or switch fuse

Note 1: If there is a symmetrically constructed grounding conductor on the motor cable in addition to the conductive shield, connect the grounding conductor to the grounding terminal at the drive and motor ends.

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

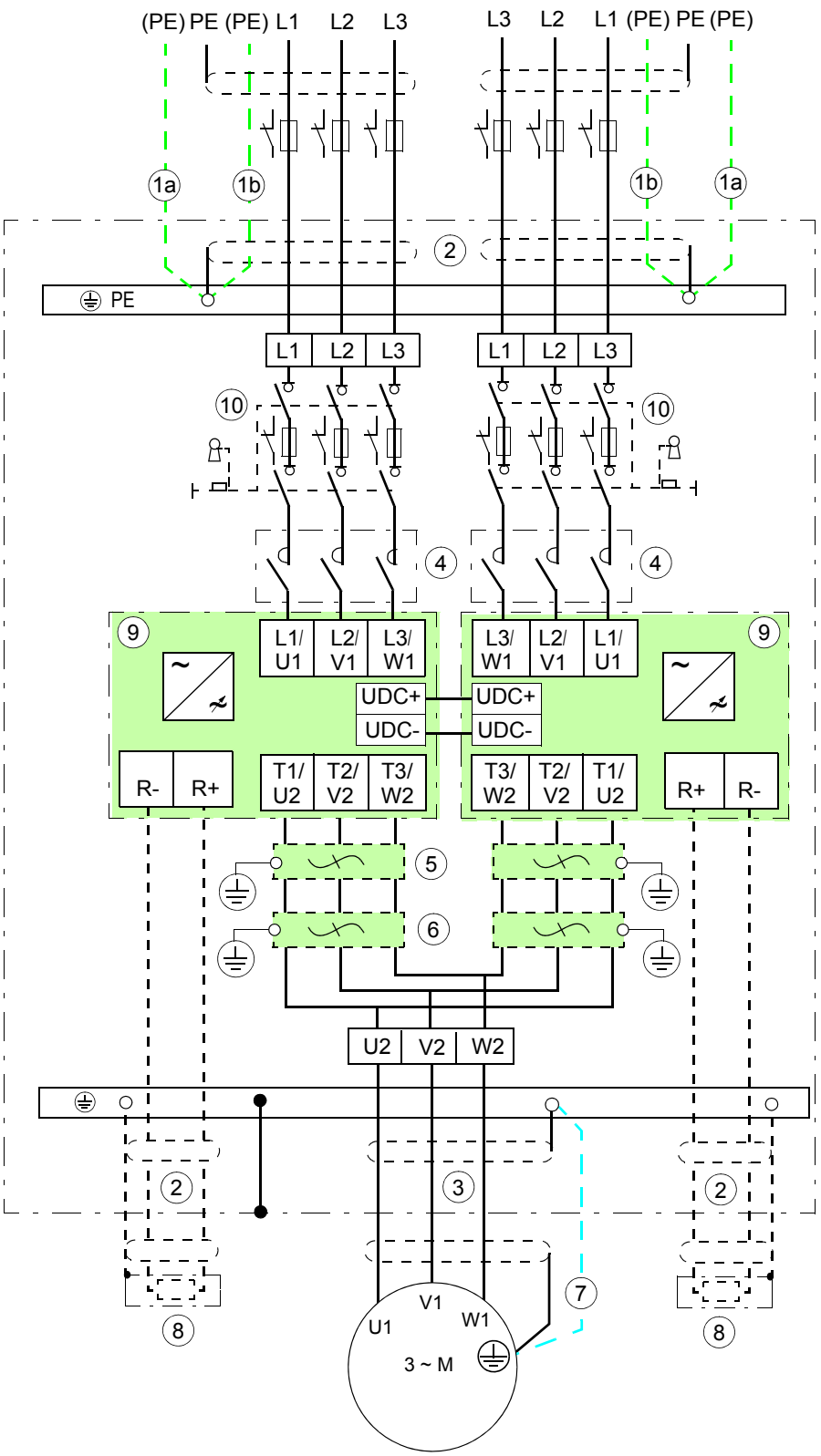
Note 2: The minimum allowed motor cable length without optional output filters is 20 m.

Note 3: Maximum cable length of the DC cables is 4 m.

Note 4: In this connection, the drive protects the input cables against thermal overload.

Note 5: Motor cables must be installed symmetrically to the common motor.

Power cable connection diagram example (6-pulse and 12-pulse)



1 Use a separate grounding PE cable (1a) or a cable with a separate PE conductor (1b) if the conductivity of the shield does not meet the requirements for the PE conductor (see page 75).

2	360-degree grounding is recommended if shielded cable is used. Ground the other end of the input cable shield or PE conductor at the distribution board.
3	360-degree grounding is required.
4	Line contactor
5	Common mode filter
6	du/dt filter or sine filter (options)
7	Use a separate grounding cable if the shield does not meet the requirements of IEC 61439-1 (see page *75*) and there is no symmetrically constructed grounding conductor in the cable (see page *79*).
8	External brake resistor
9	Drive module
10	Switch-disconnector and separate fuses or switch fuse

Note 1: If there is a symmetrically constructed grounding conductor on the motor cable in addition to the conductive shield, connect the grounding conductor to the grounding terminal at the drive and motor ends.

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

Note 2: The minimum allowed motor cable length without optional output filters is 20 m.

Note 3: Maximum cable length of the DC cables is four meters.

Note 4: Protect the input cables with additional fuses or circuit breaker against thermal overload.

Note 5: Motor cables must be installed symmetrically to the common motor.

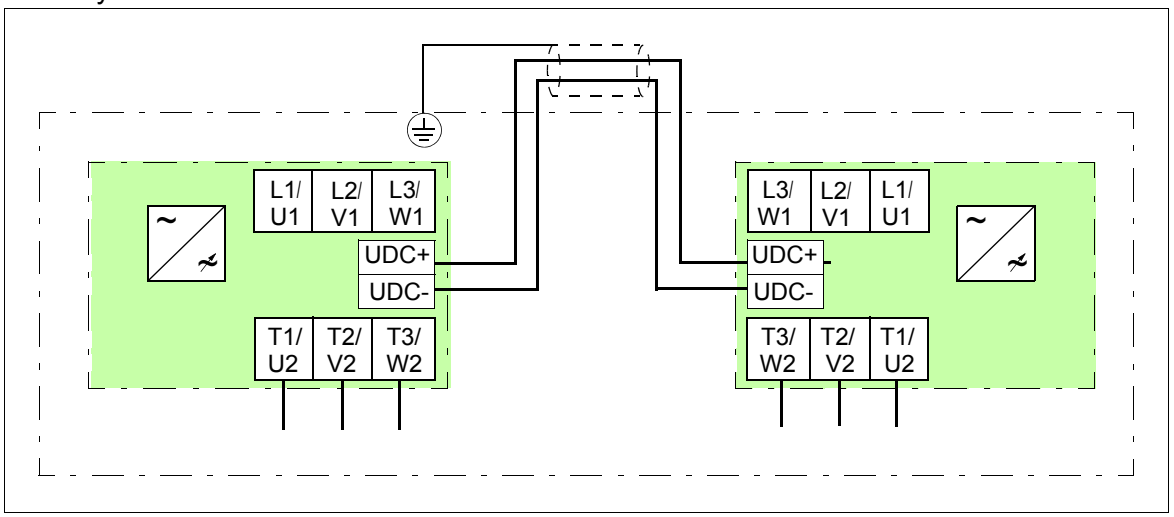
Power cable connection procedure

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 symmetrically to terminals T1/U2, T2/V2 and T3/W2 of the drive module. For the tightening torques, see page *184*.
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 *184*.
5. Connect the UDC+ terminals of the drive modules together. Connect the UDC- terminals of the drive modules together. For the tightening torques, see page *184*.

If the DC cables are run outside the cabinet, ground the cable shield 360° at one end only.

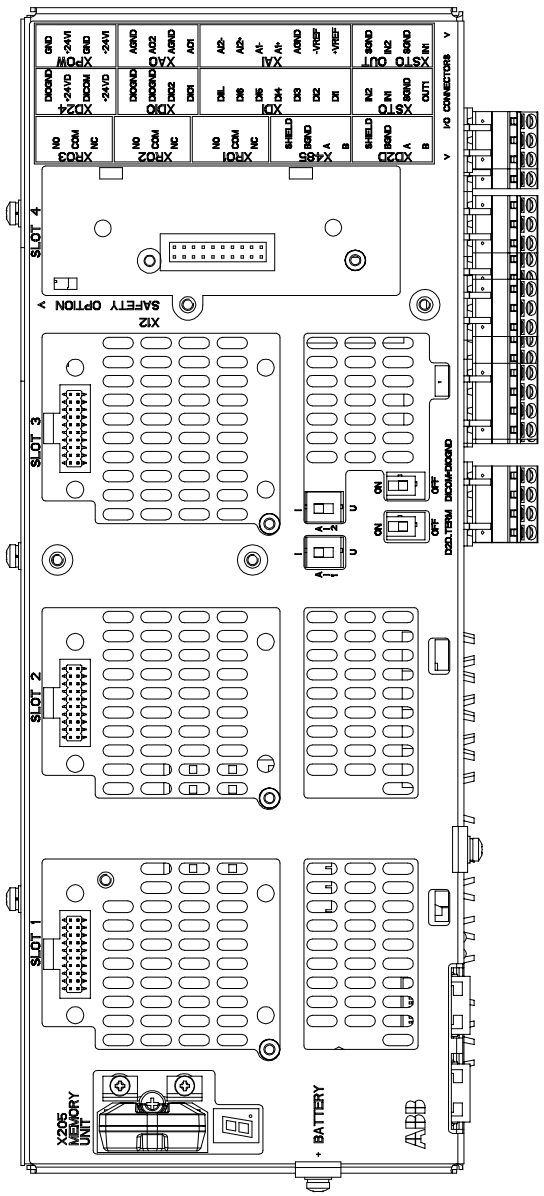


6. Make sure that all power is disconnected and reconnection is not possible. Use proper safe disconnect procedures according to local codes.
7. Run the input cables from the supply source to the cabinet. Ground the cable shields 360° at the lead-through plate.
8. Twist the cable shields of the input 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.
9. 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 *184*.

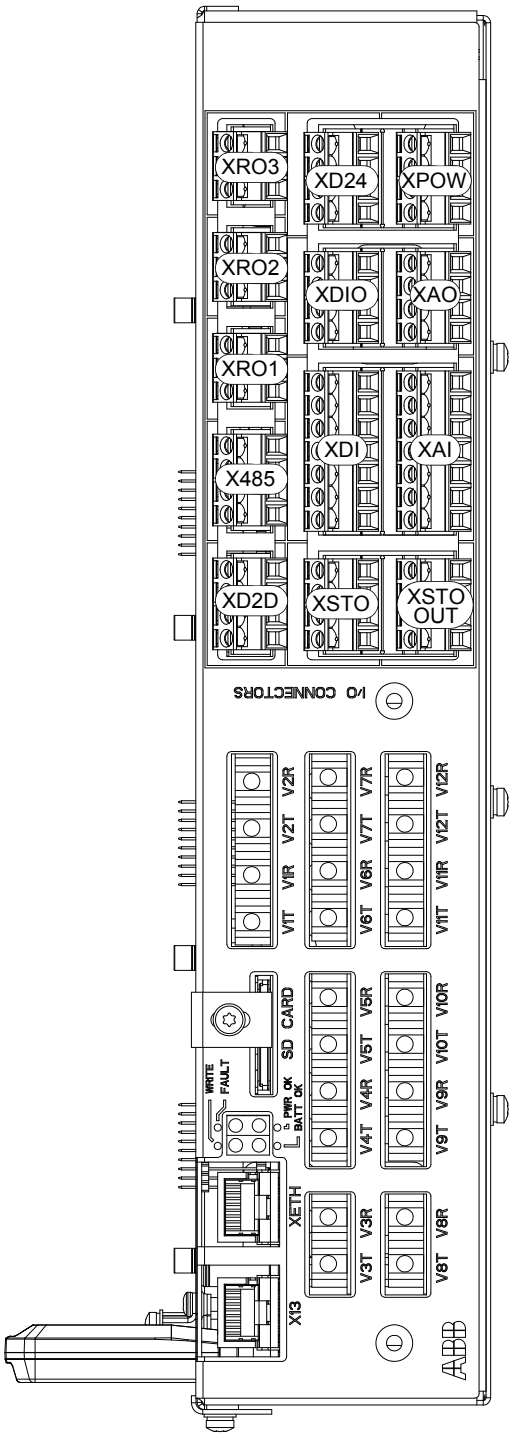
Mounting the external control unit

See *BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English]).

Layout and connections of the control unit



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



	Description
XAI	Analog inputs
XAO	Analog outputs
XDI	Digital inputs, Digital input interlock (DIIL)
XDIO	Digital input/outputs
XD2D	Drive-to-drive link
XD24	+24 V output (for digital inputs)
XETH	Ethernet port (eg. for PC communication)
XPOW	External power input
XRO1	Relay output RO1
XRO2	Relay output RO2
XRO3	Relay output RO3
XSTO	Safe torque off connection (input signals)
XSTO OUT	Safe torque off connection (to drive modules)
X12	(On the opposite side) Connection for FSO-xx safety functions module (optional)
X13	Control panel connection
X485	Not in use

V1T/V1R, V2T/V2R	Fiber optic connection to drive modules 1 and 2 (VxT = transmitter, VxR = receiver)
V3T/V3R … V7T/V7R	Not in use
V8T/V8R … V12T/V12R	Not in use

SD CARD	Data logger memory card for drive module communication

BATT OK	Real-time clock battery voltage is higher than 2.8 V. If the LED is off when the control unit is powered, replace the battery.
FAULT	The control program has generated a fault. See the firmware manual of the drive modules.
PWR OK	Internal voltage supply is OK
WRITE	Writing to memory card in progress. Do not remove the memory card.

Connecting the 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.

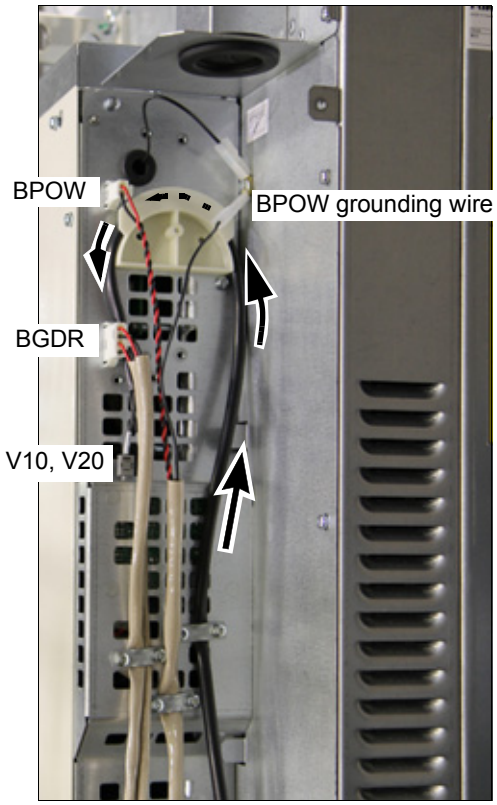
Routing the control unit cables into the drive module

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 97).

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 control unit as follows:.

BPOW	BCU control unit
X3: 1	XPOW:1 (+24VI)
X3: 2	XPOW:2 (GND)
X3: 3 (not used)	-
BGDR	**BCU control unit**
Drive module 1	**(connector XSTO OUT)**
X7:1	5 (IN1)
X7:2	6 (SGND)
X8:1	7 (IN2)
X8:2	8 (SGND)
Drive module 2	**(connector XSTO OUT)**
X7:1	5 (IN1)
X7:2	6 (SGND)
X8:1	7 (IN2)
X8:2	8 (SGND)

ZINT/SOIA	BCU control unit
Drive module 1	
ZINT: V1; SOIA: V10	V1T
ZINT: V2; SOIA: V20	V1R
Drive module 2	
ZINT: V1; SOIA: V10	V2T
ZINT: V2; SOIA: V20	V2R

Connecting the control cables to the terminals of the control unit

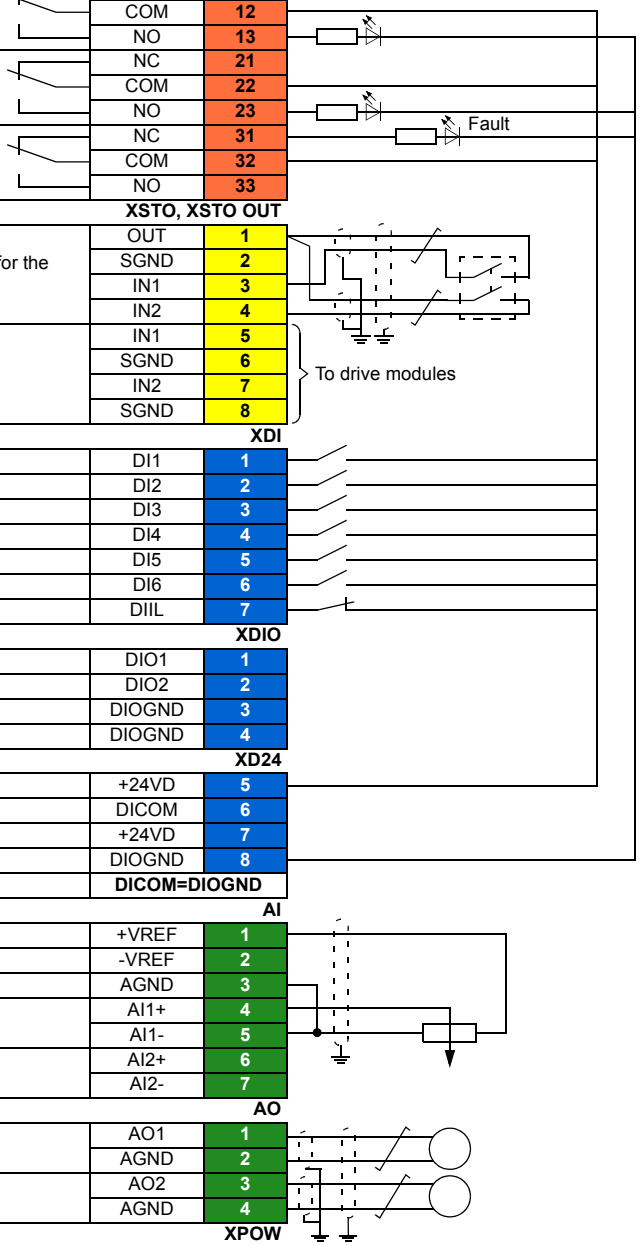
Control cable connection procedure

1. Route the cables to the control unit.
2. Strip the cable ends and conductors. When connecting to the drive I/O, use electrical tape or shrink tubing to contain the strands. Elsewhere, twist the outer shield strands into a bundle, crimp a lug onto it and connect it to the nearest chassis grounding point.
3. Connect the conductors to the appropriate detachable terminals of the control unit, see page *114.*

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. Keep the shields continuous as close to the terminals of the control unit as possible. Leave the other end of the shield unconnected or ground it indirectly via a few nanofarads high-frequency capacitor, eg, 3.3 nF / 630 V. The shield can also be grounded directly at both ends if they are in the same ground line with no significant voltage drop between the end points.

Default I/O connection diagram

Drive-to-drive link		**XD2D**
Drive-to-drive link [1]	B	1
	A	2
	BGND	3
	Shield	4
RS485 connection		**X485**
Not in use	B	5
	A	6
	BGND	7
	Shield	8
Relay outputs		**XRO1…XRO3**
Ready 250 V AC / 30 V DC 2 A	NC	11
	COM	12
	NO	13
Running 250 V AC / 30 V DC 2 A	NC	21
	COM	22
	NO	23
Faulted(-1) 250 V AC / 30 V DC 2 A	NC	31
	COM	32
	NO	33
Safe torque off		**XSTO, XSTO OUT**
Safe torque off input. Both circuits must be closed for the drive to start. [2]	OUT	1
	SGND	2
	IN1	3
	IN2	4
Safe torque off output to drive modules [2]	IN1	5
	SGND	6
	IN2	7
	SGND	8
Digital inputs		**XDI**
Stop (0) / Start (1)	DI1	1
Forward (0) / Reverse (1)	DI2	2
Reset	DI3	3
Acceleration & deceleration select [3]	DI4	4
Constant speed 1 select (1 = on) [4]	DI5	5
By default not in use.	DI6	6
Run enable [5]	DIIL	7
Digital input/outputs		**XDIO**
Output: Ready	DIO1	1
Output: Running	DIO2	2
Digital input/output ground	DIOGND	3
Digital input/output ground	DIOGND	4
Auxiliary voltage output		**XD24**
+24 V DC 200 mA [6]	+24VD	5
Digital input ground	DICOM	6
+24 V DC 200 mA [6]	+24VD	7
Digital input/output ground	DIOGND	8
Ground selection switch [7]	**DICOM=DIOGND**	
Analog inputs, reference voltage output		**AI**
10 V DC, R_L 1…10 kohm	+VREF	1
-10 V DC, R_L 1…10 kohm	-VREF	2
Ground	AGND	3
Speed reference 0(2)…10 V, R_{in} > 200 kohm [8]	AI1+	4
	AI1-	5
By default not in use. 0(4)…20 mA, R_{in} = 100 ohm [9]	AI2+	6
	AI2-	7
Analog outputs		**AO**
Motor speed rpm 0…20 mA, R_L < 500 ohm	AO1	1
	AGND	2
Motor current 0…20 mA, R_L < 500 ohm	AO2	3
	AGND	4
External power input		**XPOW**
24 V DC, 2.05 A Two supplies can be connected for redundancy.	+24VI	1
	GND	2
	+24VI	3
	GND	4
Safety functions module connection		**X12**
Control panel connection		**X13**
Memory unit connection		**X205**



Notes:

The wire size accepted by all screw terminals (for both stranded and solid wire) is 0.5 … 2.5 mm^2 (24…12 AWG). The torque is 0.5 N·m (5 lbf·in).

[1] See section *Drive-to-drive link* (page *117*).

[2] See chapter *Safe torque off* (page *118*).

[3] 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.

[4] Constant speed 1 is defined by parameter 22.26.

[5] See section *DIIL input (XD24:1)* (page *116*).

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

[7] Determines whether DICOM is separated from DIOGND (ie. common reference for digital inputs floats; in practice, selects whether the digital inputs are used in current sinking or sourcing mode). See also *BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English]) **DICOM = DIOGND** ON: DICOM connected to DIOGND. OFF: DICOM and DIOGND separate.

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

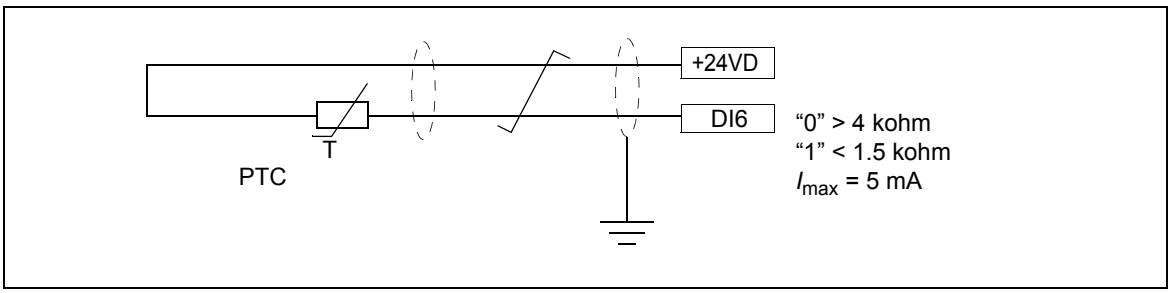
[9] Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} > 200 kohm] input selected by switch **AI2**. Change of setting requires reboot of control unit.

External power supply for the control unit (XPOW)

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

DI6 (XDI:6) as PTC sensor input

A PTC sensor 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.



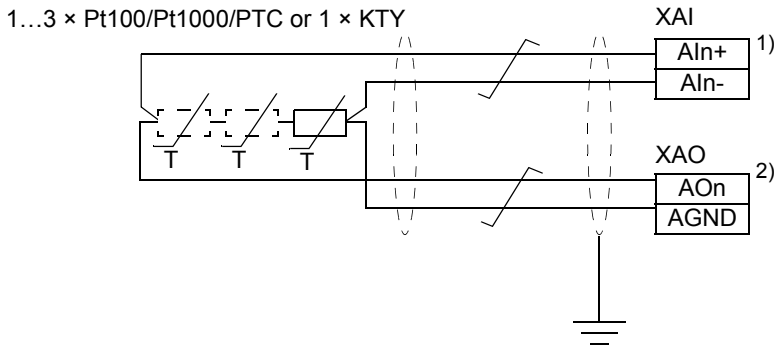
WARNING! As the inputs pictured above are not insulated according to IEC 60664, the connection of the motor temperature sensor requires double or reinforced insulation between motor live parts and the sensor. If the assembly does not fulfill the requirement, the I/O board terminals must be protected 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 used for the connection of safety circuits. By default, the input is parametrized to stop the drive when the input signal is lost.

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.



1. Set the input type to voltage with switch J1 for analog input AI1or with J2 for analog input AI2. Set the appropriate analog input unit to V (volt) in parameter group **12 Standard AI**.
2. Select the excitation mode in parameter group **13 Standard AO**.

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.

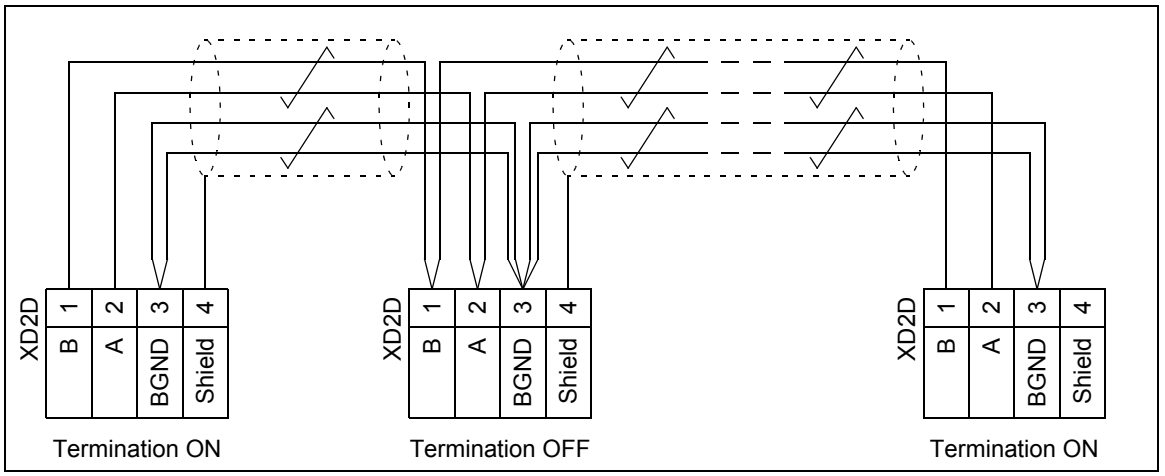
Drive-to-drive link

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 switch D2D.TERM to the ON position on the drives at the ends of the drive-to-drive link. On intermediate drives, set the switch 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 50 meters (164 ft). Avoid unnecessary loops and running the cable near power cables (such as motor cables). Ground the cable shields as described in section *Connecting the control cables to the terminals of the control unit* on page *113*.

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



Safe torque off

This input can be used to implement a safe torque off function. See chapter *Safe torque off* (page *118*).

Safety functions module connection (X12)

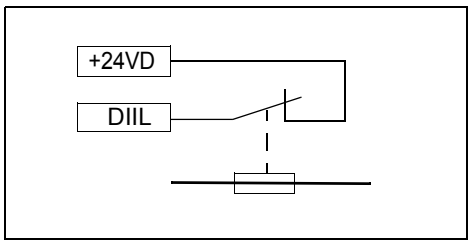
See section *Implementing safety functions provided by the FSO safety functions module (option)* on page *85*, and *FSO-12 safety functions module user's manual* (3AXD50000015612 [English]).

SDHC memory card slot

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

Wiring the microswitches of the fuses

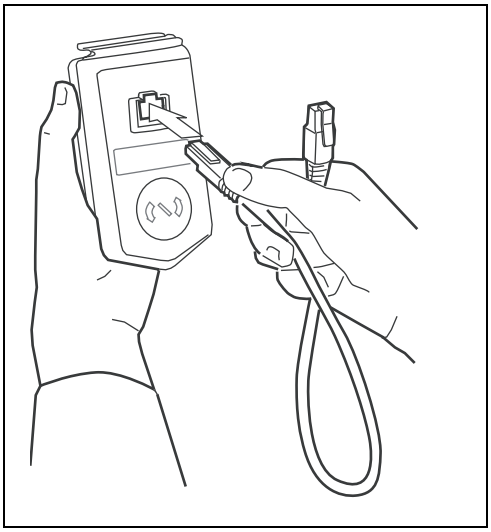
Wire the microswitches of the drive input fuses to the DIIL input as shown below or to an external switch for stopping the drive in case of fuse burning.



Connecting a control panel

With DPMP-01 door mounting platform (option), 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.



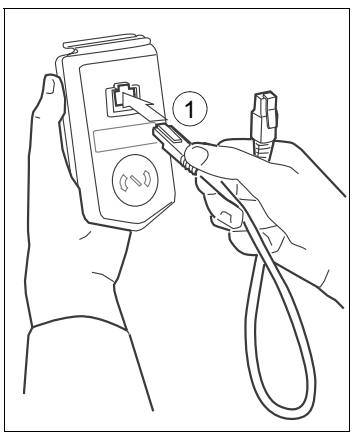
Controlling several drives from one control panel through panel bus

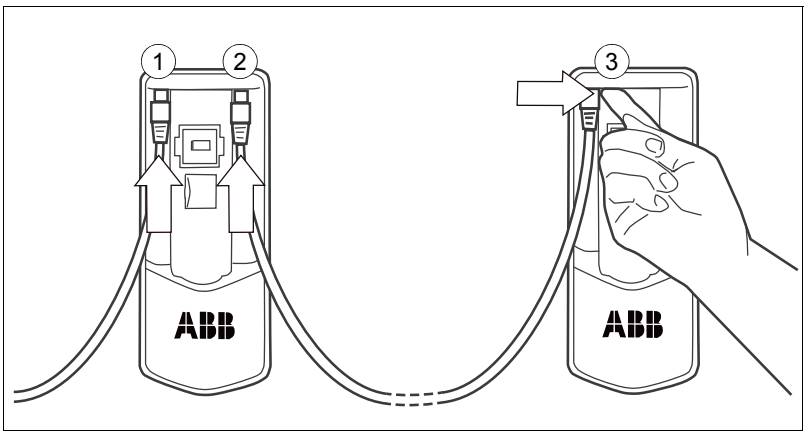
One control panel (or PC) can be used to control several drive module packages by constructing a panel bus. Each drive module package must be equipped with a control panel mounting platform or an FDPI-02 module (available separately). For further information, see *FDPI-02 diagnostics and panel interface user's manual* (3AUA0000113618 [English]).

1. Connect the panel to one drive module package using an Ethernet (eg. CAT5E) cable.
   - Use **Menu** – **Settings** – **Edit texts** – **Drive** to give a descriptive name to the unit
   - Use parameter **49.01** to assign the unit 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 unit.
2. With the panel connected to one drive module package, link the drive module packages together using Ethernet cables. (Each panel platform has two connectors.)
3. In the last package, switch bus termination on. With a panel platform, move the terminating switch into the outer position. (With an FDPI-02 module, move termination switch S2 into the TERMINATED position.) Termination should be off on all other packages.
4. On the control panel, switch on the panel bus functionality (**Options** – **Select drive** – **Panel bus**). The unit to be controlled can now be selected from the list under Options – Select drive.

If a PC is connected to the control panel, the drive module 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).

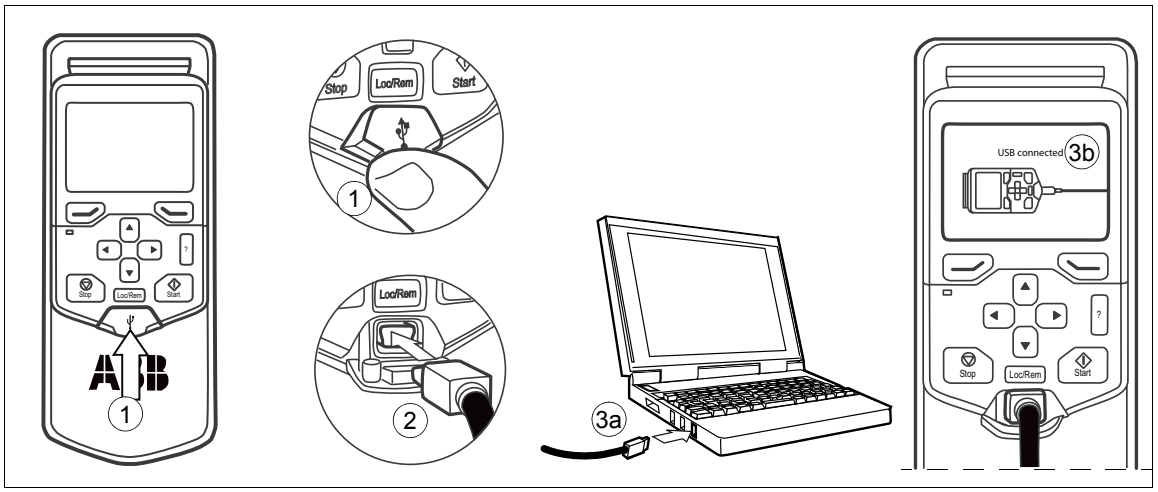
Connecting a PC

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 *119*.

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

See *BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English]).

Installing FSO safety functions module

See *BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English]).

Connecting the memory unit

See *BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English]).

7

Installation example – standard, optional IP20 shrouds and power cable connection terminals

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		
• 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 *171*.
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 *169*.
Customer-made parts (not ABB or Rittal products)		
Air baffles	2	See section *Preventing the recirculation of hot air* on page *60*.

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 125 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 drive module with optional IP20 shrouds and input and output terminals in Rittal TS 8 600 mm wide cabinet* on page *233*. *Connecting the power cables and installing the IP20 shrouds (if present) on page 126.*
3	For the standard drive module configuration, connect the power cables to the drive module output and input busbars. For option "Full size output cable connection terminals and PE busbar", connect the output power cable terminals and motor cables. For option "IP20 shrouds for covering the input and motor cabling area", connect the shrouds onto the motor cabling area and while connecting the input cables onto the input cabling area. For option "Full size input cable connection terminals and PE busbar", connect the input power cable terminals and input cables.	
5	Mount the external control unit.	*BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English])
6	Connect the control cables.	*Connecting the control cables to the terminals of the control unit,* page *113.*
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 *128*.

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 drive module with optional IP20 shrouds and input and output terminals in Rittal TS 8 600 mm wide cabinet* on page *233*.

- 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 *100*.
- 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 IP20 shrouds (if present)

Step	Task (motor cables, standard drive module configuration)
4	Run the motor cables to the cabinet. Ground the cable shields 360 degrees at the cabinet lead-through
5	Connect the twisted shields of the motor cables to the grounding terminal of the drive module.
6	Connect the phase T3/W2 conductors to the T3/W2 busbar.
7	Connect the phase T2/V2 conductors to the T2/V2 busbar.
8	Connect the phase T1/U2 conductors to the T1/U2 busbar.

Step	Task (DC cables)
1	Connect the UDC+ terminals of the drive modules together. Connect the UDC- terminals of the drive modules together. If the DC cables are run outside the cabinet, ground the cable shield 360° at one end only.

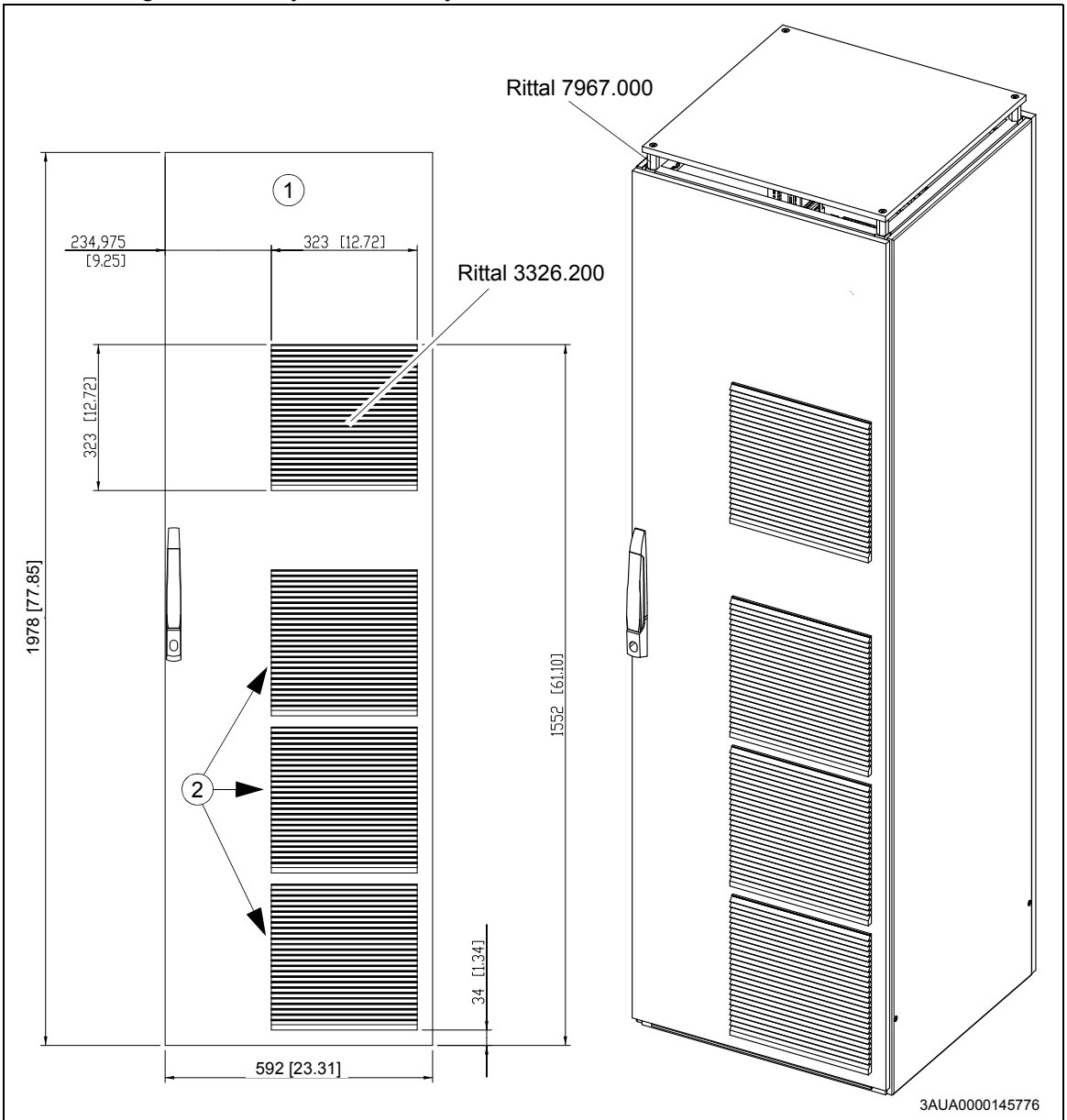
Step	Task (motor cables, options “Full size output cable connection terminals” and “IIP20 shrouds for covering the motor cabling area” included)
1	Install the grounding terminal to the drive module base.
2	Run the motor cables to the cabinet. Ground the cable shields 360 degrees at the cabinet lead-through
3	Connect the twisted shields of the motor cables to the grounding terminal
4	Screw in and tighten the insulators to the drive module by hand. Install the T3/W2 connection terminal to the insulators. **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.
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.
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, options “Full size input cable connection terminals and PE busbar” and IP20 shrouds for covering the input cabling area” included
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.

Step	Task (input cables, options “Full size input cable connection terminals and PE busbar” and IP20 shrouds for covering the input cabling area” included
3	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. Remove the plastic sheeting from both sides of the shroud. Attach the cables firmly to the cabinet frame to prevent chafing against the hole edges.
4	Put the conductors of the input cables through the drilled holes in the clear plastic shroud.
5	For drive modules without option “Full size input cable connection terminals and PE busbar”: Connect the input cable conductors to the drive module L1/U1, L2/V1 and L3/W1 connection busbars, Go to step 12.
For option “Full size input cable connection terminals and PE busbar”: Do steps 6 to 11.	
6	Screw in and tighten the insulators to the drive module by hand. Install the L1/U1 connection terminal to the insulators. **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.
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.

Installing the roof and door (Rittal parts)

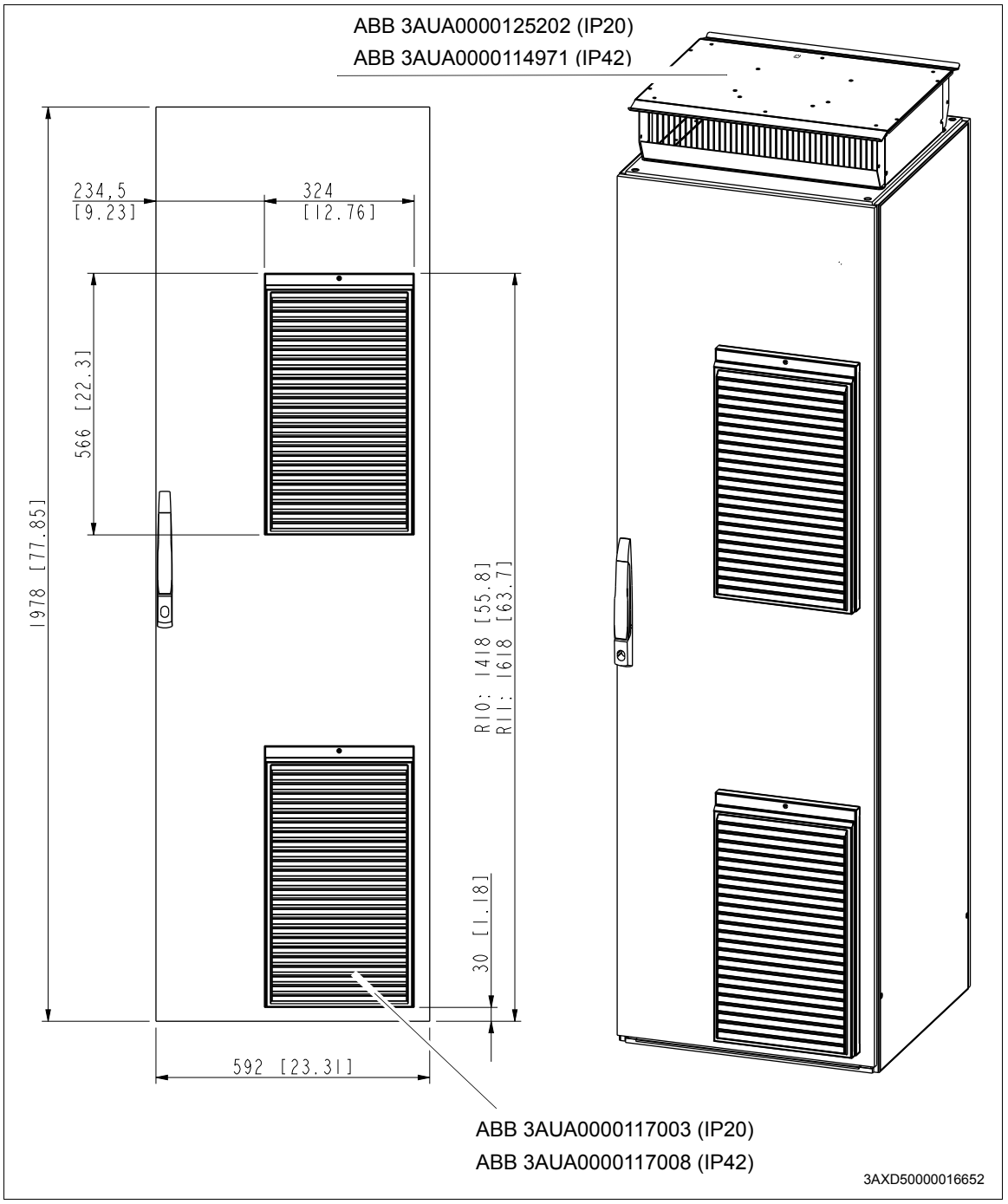
This drawing shows a layout tested by ABB.



1	Door
2	Install these gratings as close to each other as possible. Remove the filter mats.

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.

8

Installation example with option “Full power cabling panels to be attached to a cabinet (IP20)”

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		
• 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**
3AXD50000024520 for frame R10, 3AXD50000024561 for frame R11	1	Full power cabling panels
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 *171*.
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 *169*.
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 “Full power cabling panels to be attached to a cabinet (IP20)” in Rittal TS 8 400 mm wide cabinet installation* on page *210* 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 “Full power cabling panels to be attached to a cabinet (IP20)” in Rittal TS 8 400 mm wide cabinet installation* on page *208* 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 *133* and appendix *Step-by-step drawings for installing full cabling panels (option) in a Rittal TS 8 400 mm wide cabinet* on page *237.*
3	Connect the power cables to the cabling panels.	*Connecting the power cables,* page *134.*
4	Install the drive module into the cabinet.	*Installing the drive module into the cabinet,* page *138*
5	Install the external control unit.	*BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English])
6	Connect the control cables.	*Connecting the control cables to the terminals of the control unit* on page *110.*
7	Install the remaining parts, for example, cabinet doors, side plates, etc.	The component manufacturer’s instructions

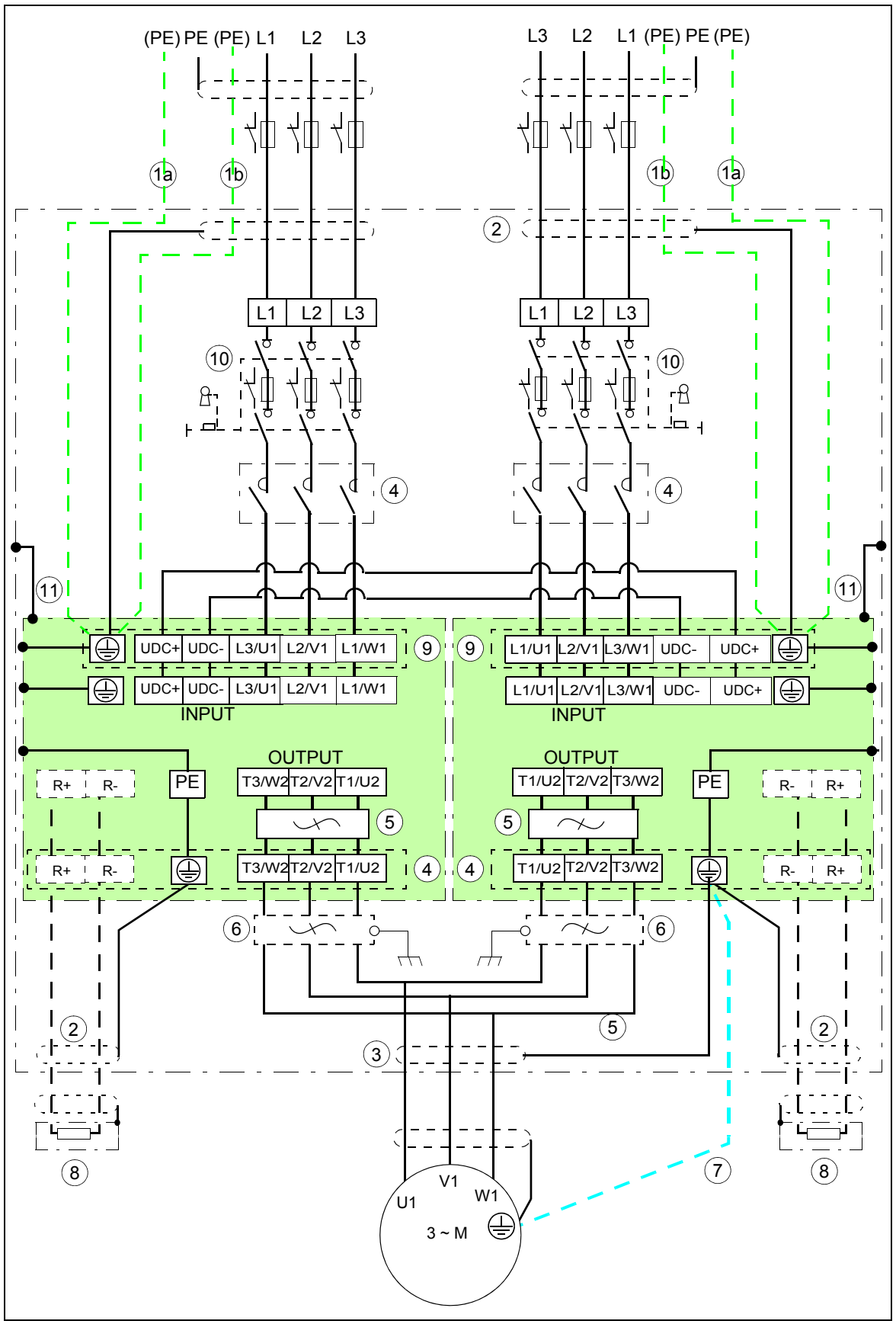
Installing the mechanical accessories into the cabinet

Install the mechanical accessories into the cabinet as shown in appendix *Step-by-step drawings for installing full cabling panels (option) in a Rittal TS 8 400 mm wide cabinet* on page *237.*

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 *208* 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

Power cable connection diagram example (6-pulse and 12-pulse)



1	Use a separate grounding PE cable (1a) or a cable with a separate PE conductor (1b) if the conductivity of the shield does not meet the requirements for the PE conductor (see page *75*).
2	360-degree grounding is recommended if shielded cable is used. Ground the other end of the input cable shield or PE conductor at the distribution board.
3	360-degree grounding is required.
4	Line contactor
5	Common mode filter
6	du/dt filter or sine filter (options)
7	Use a separate grounding cable if the shield does not meet the requirements of IEC 61439-1 (see page *75*) and there is no symmetrically constructed grounding conductor in the cable (see page *79*).
8	External brake resistor
9	Drive module
10	Switch-disconnector and separate fuses or switch fuse
11	The drive module frame must be connected to the cabinet frame. See section *Arranging the grounding inside the cabinet* on page *56* and *Alternatives for grounding the drive module* on page *104*.

Note:

Note 1: If there is a symmetrically constructed grounding conductor on the motor cable in addition to the conductive shield, connect the grounding conductor to the grounding terminal at the drive and motor ends.

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

Note 2: The minimum allowed motor cable length without optional output filters is 10 m.

Note 3: Maximum cable length of the DC cables is four meters.

Note 4: Protect the input cables with additional fuses or circuit breaker against thermal overload.

Note 5: Motor cables must be installed symmetrically to the common motor.

Power cable connection procedure

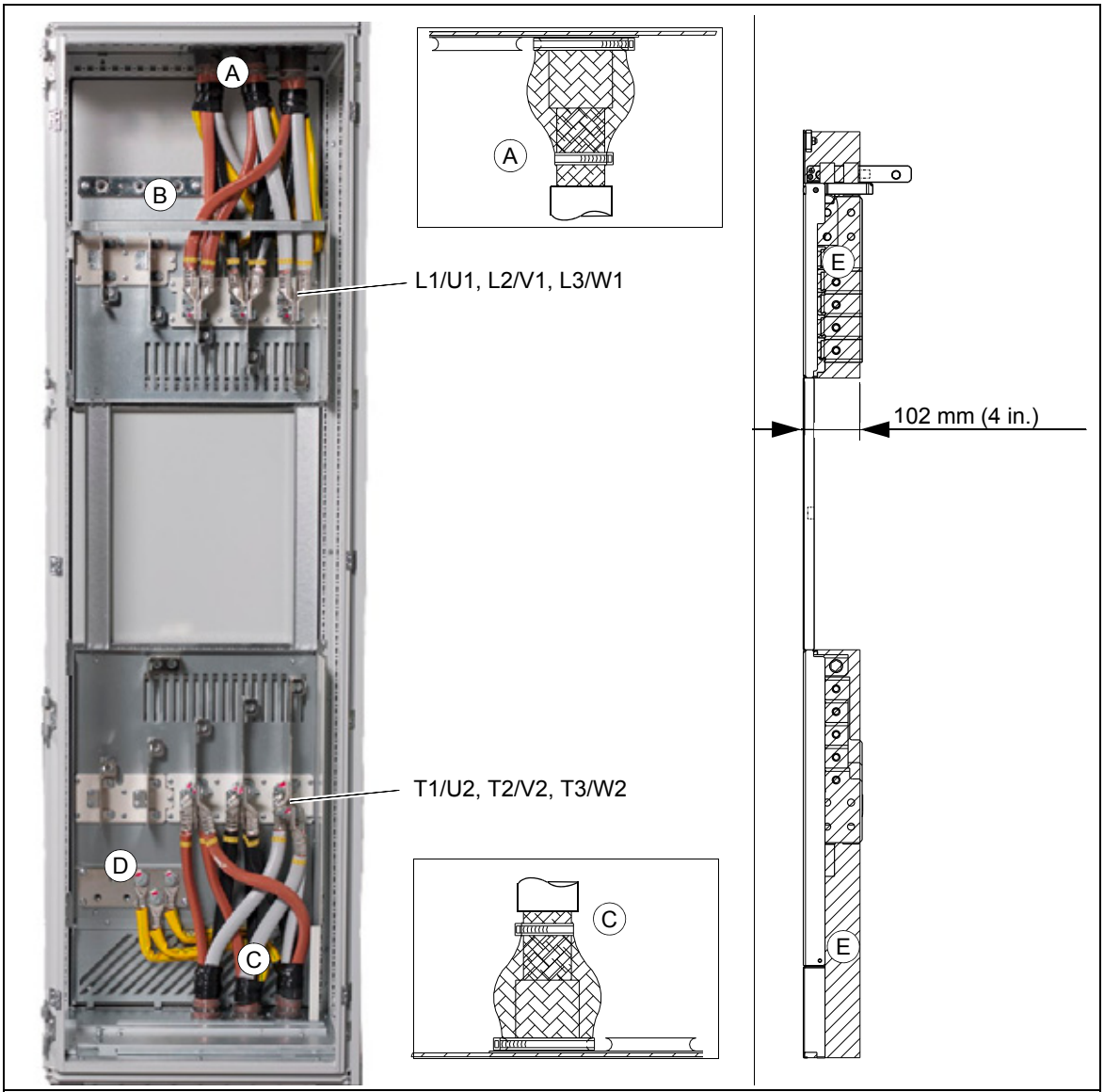
WARNING! Obey the safety instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

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 *184*.
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 *184*.
5. Connect the UDC+ terminals of the drive modules together. Connect the UDC- terminals of the drive modules together. For the tightening torques, see page *184*. If the DC cables are run outside the cabinet, ground the cable shield 360° at one end only.
6. Make sure that all power is disconnected and reconnection is not possible. Use proper safe disconnect procedures according to local codes.
7. Run the input cables from the supply source to the cabinet. Ground the cable shields 360° at the lead-through plate.

8. 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.
9. 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 *184*.

An example installation without DC cabling 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

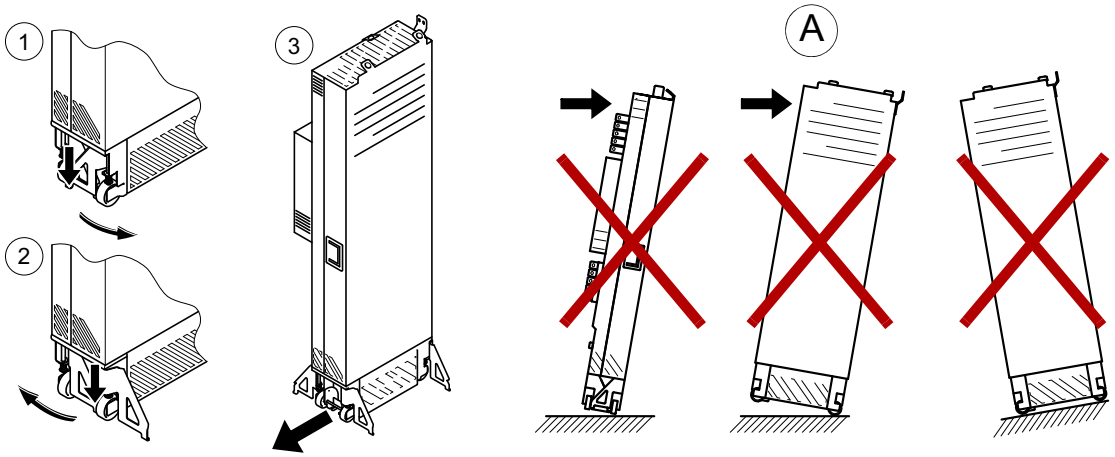
E) Allowed space for power cables. **Note:** The input and output power cables must fit inside the area marked with diagonal lines to prevent chafing of the cables when the drive module is inserted into the cabinet.

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.

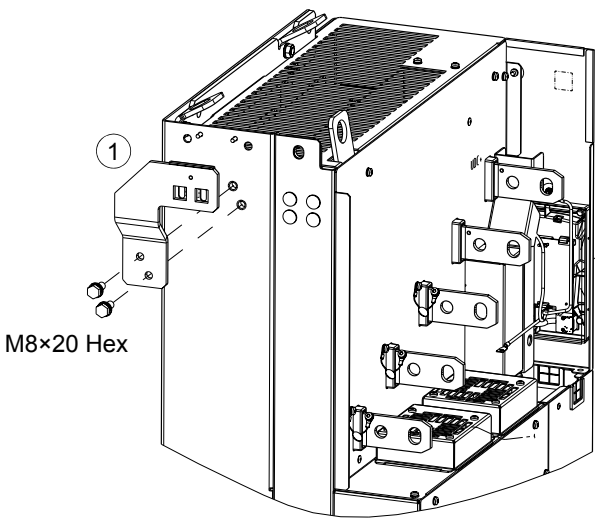
Handle the drive module carefully. Make sure that the module does not fall down when moving it on the floor and during installation and maintenance work: Open the support legs by pressing each leg a little down and turning it aside (1, 2). When ever possible secure the module also with chains from top.

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.



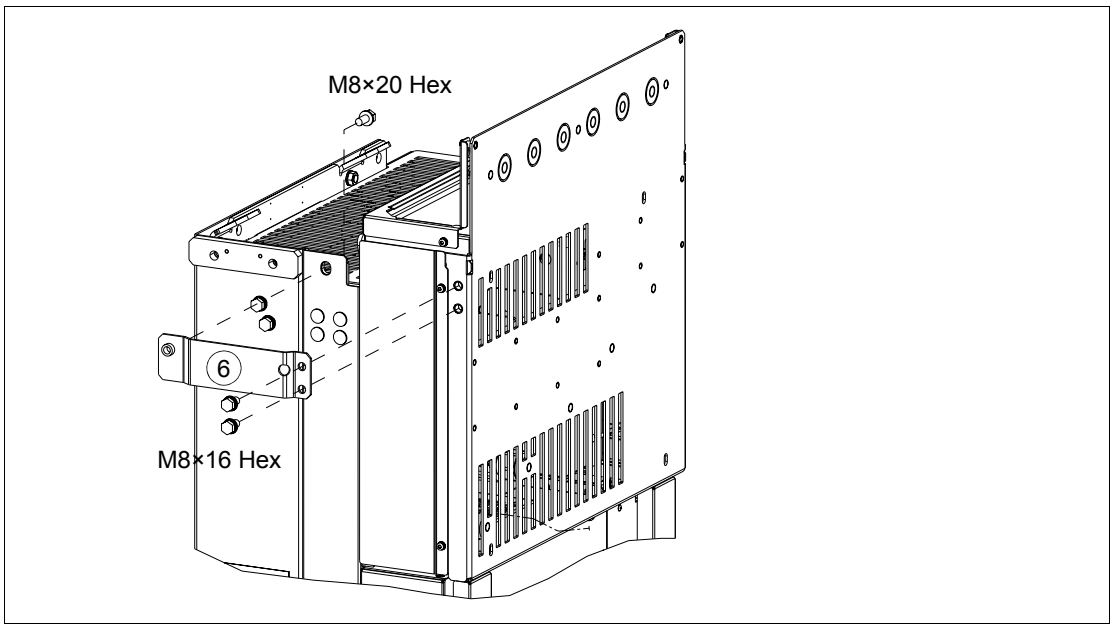
Installation procedure

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



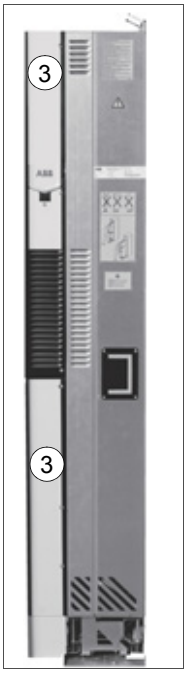
2. Install the telescopic extraction and insertion ramp to the cabinet base with two screws.
3. Remove the upper and lower left-hand side front covers of the drive module (M4×8 combi screws, 2 N·m).

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 *141* (frame R10) or page *144* (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 *143*.
10. Remove the filter mats from the air filters according to Rittal’s instructions. Install the filters to the cabinet door, see page *143*.
11. 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 *113*).

2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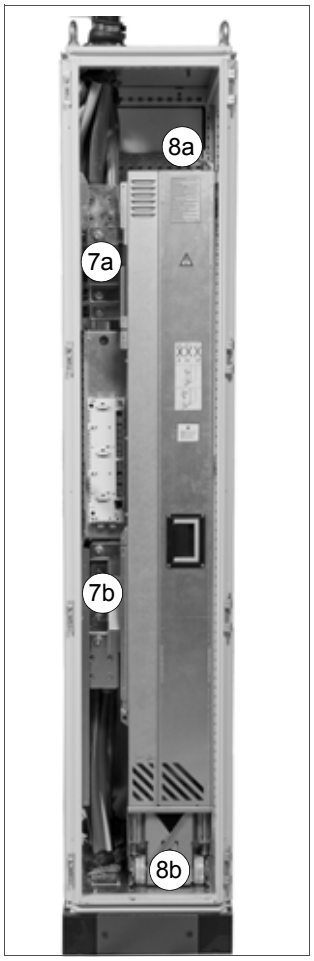
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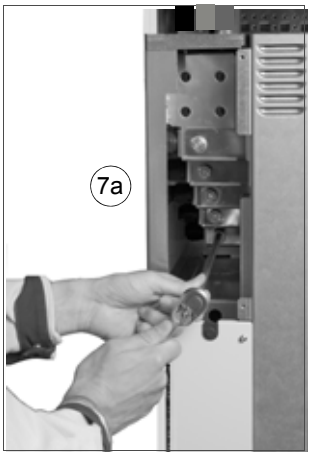
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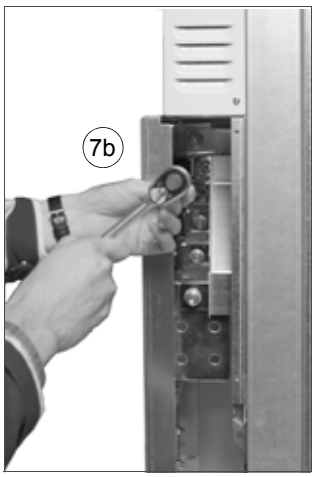
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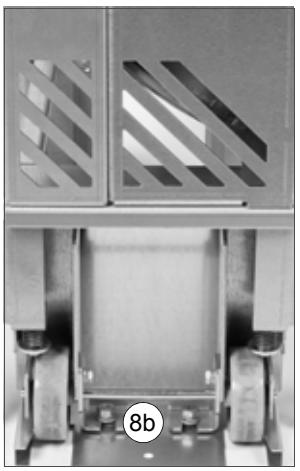
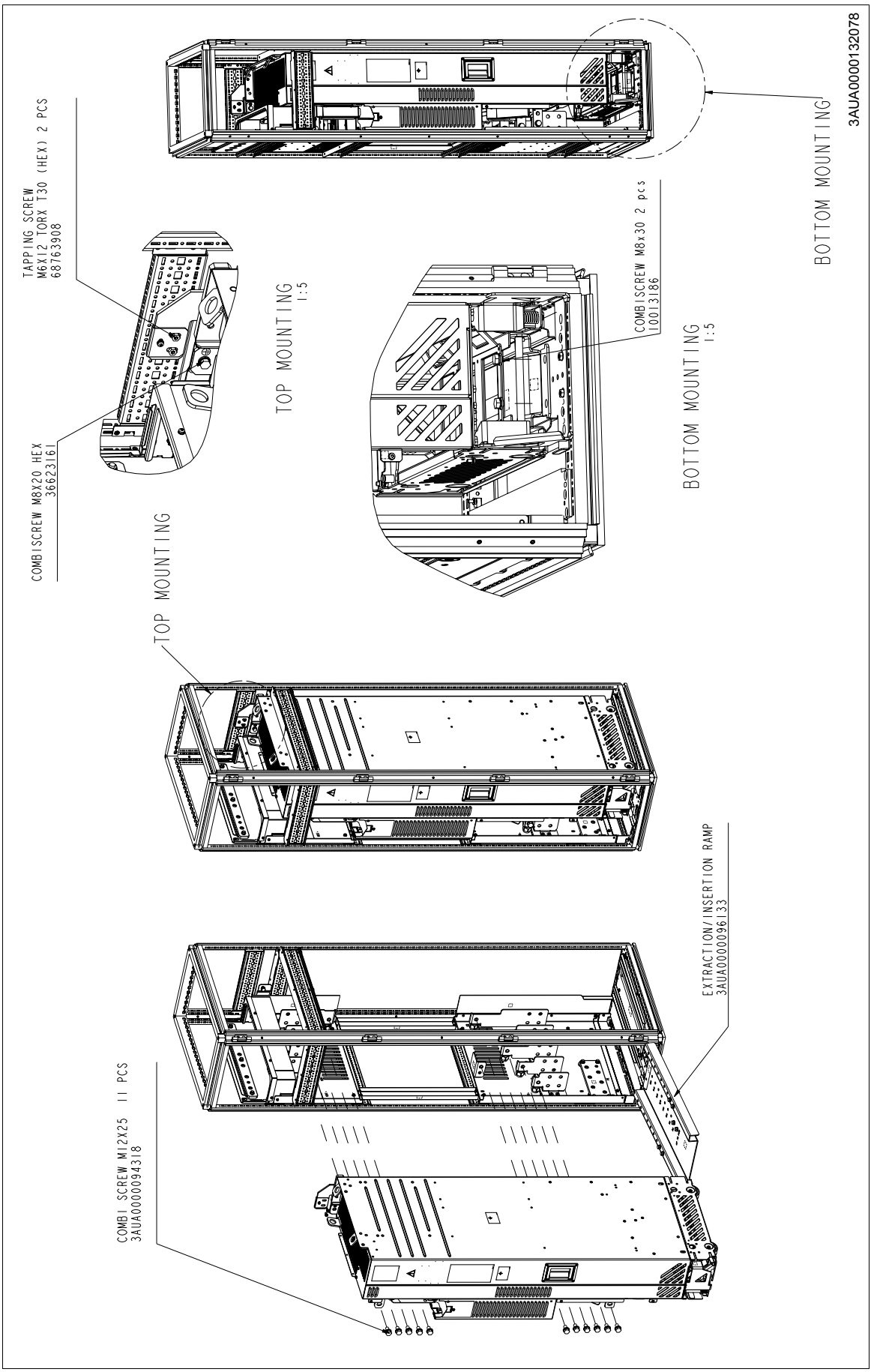
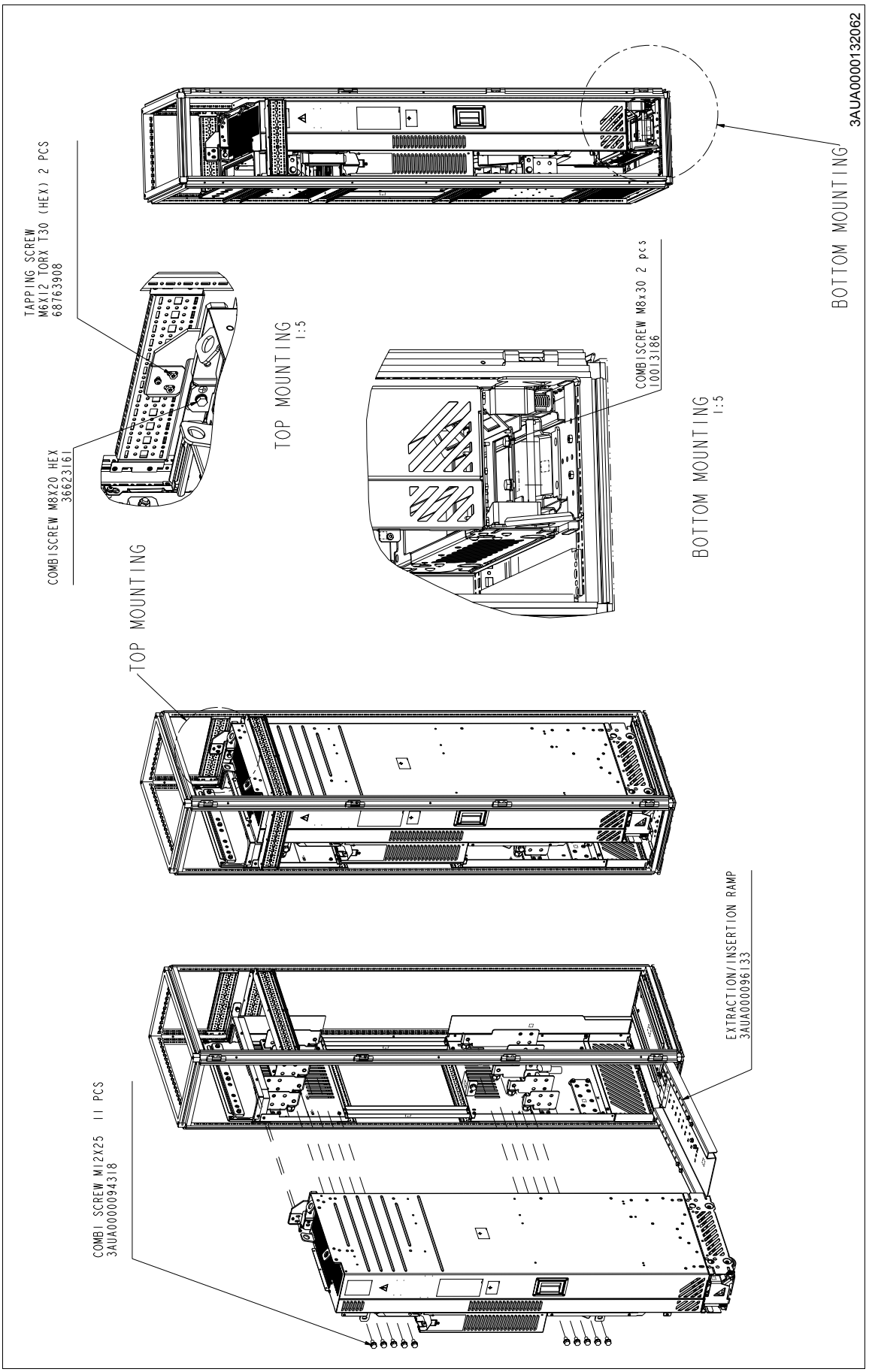

8b

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

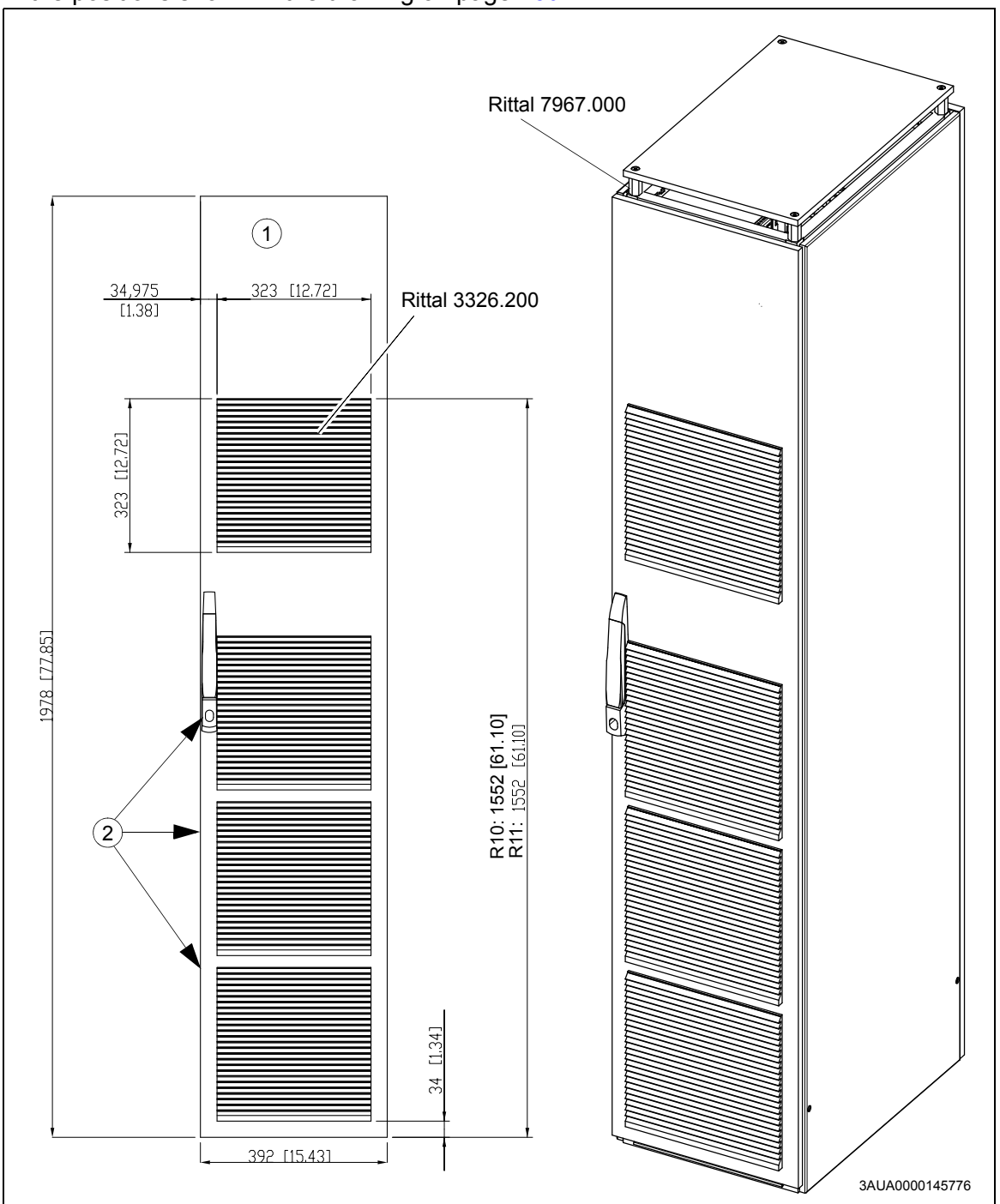


Assembly drawing of installing the drive module to the cabinet (frame R11)



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*.



1	Door
2	Install these gratings as close to each other as possible. Remove the filter mats.

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

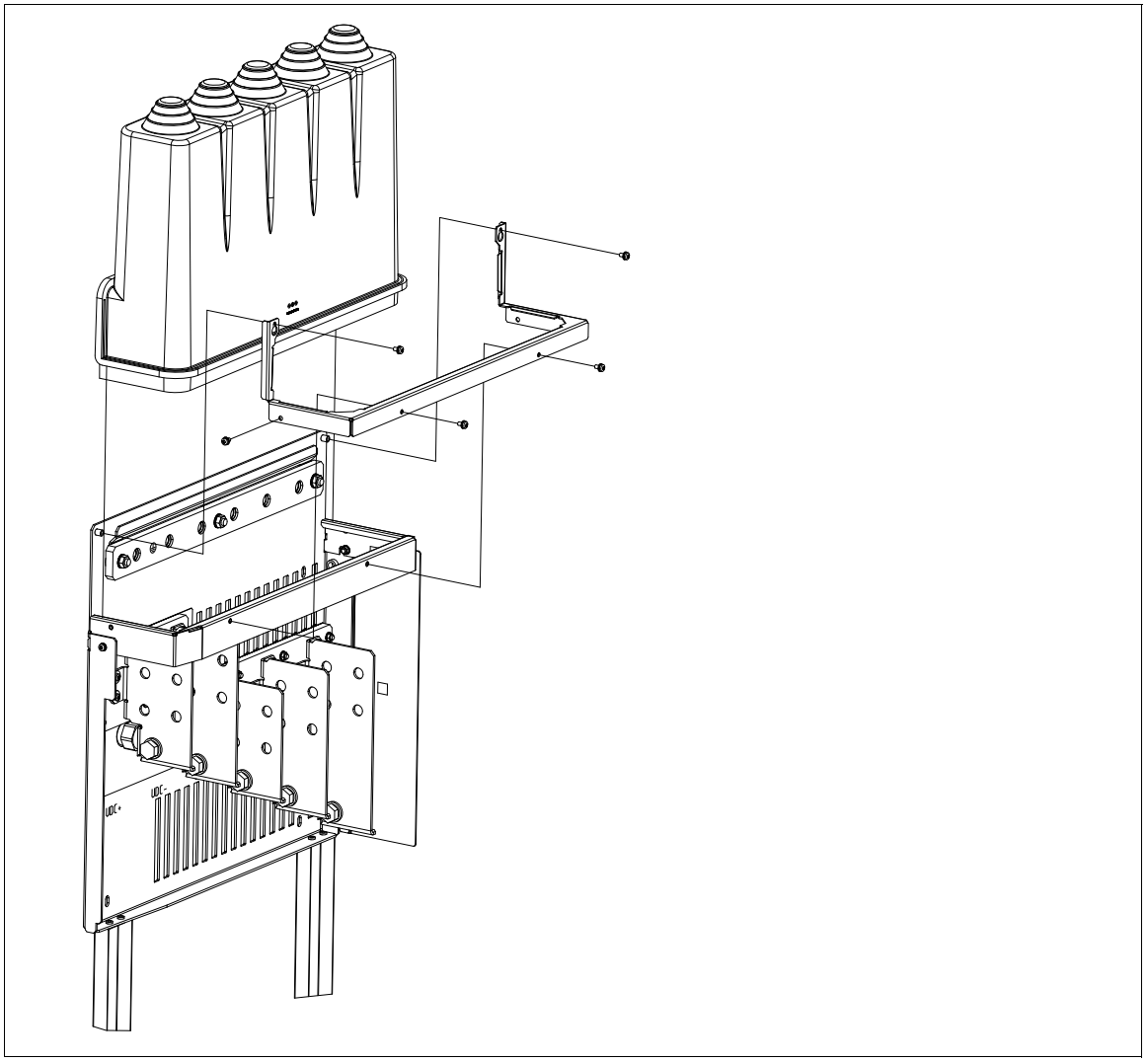
Installations with input and motor cables of size 4 × 240 mm^2 per phase

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

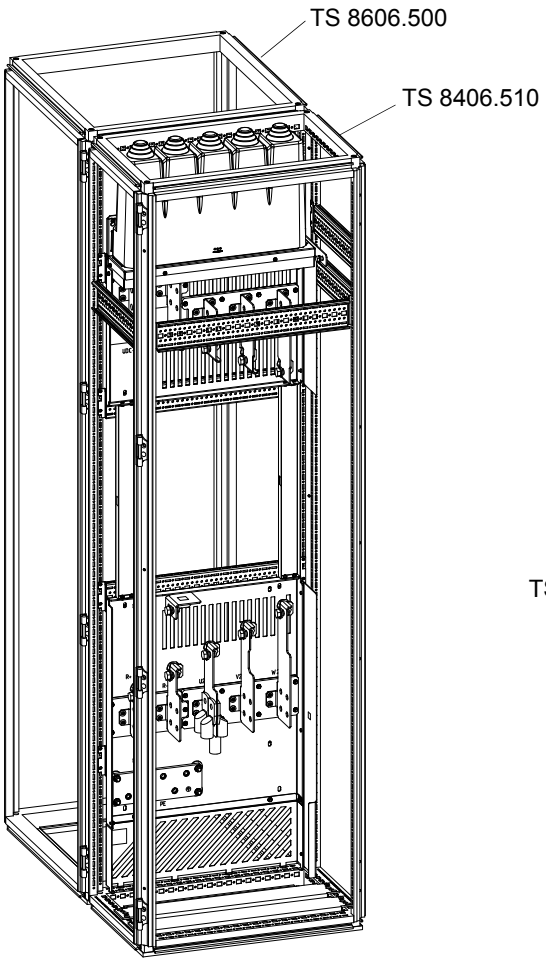
To get IP20 degree of protection for the drive module, install the input power cables through the rubber grommet. Install the grommet as follows:

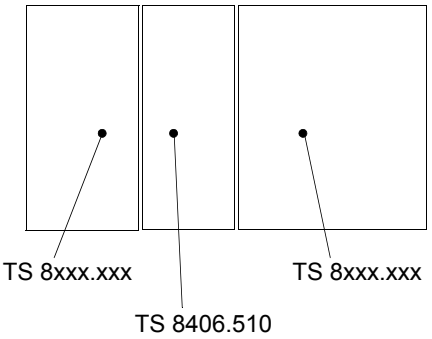
1. Cut adequate holes into the grommet for the input power cables.
2. Put the cables through the grommet.
3. Attach the grommet to the input cabling panel with five M4x8 Torx T20 screws as shown below.



Modular design of Rittal TS8 cabinets

The design of the drive module with option “Full power cabling panels to be attached to a cabinet (IP20)” 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 …	☑
Cabinet construction	
The drive module is fastened properly to the cabinet. (See chapters *Guidelines for planning the cabinet installation* and *Step-by-step drawings for installing full cabling panels (option) in a Rittal TS 8 400 mm wide cabinet*)	☐
Mechanical joints are tightened and not broken.	☐
Parts are clean and painted surfaces not scratched. The cabinet frame and parts which are in metal to metal contact with the frame (for example seams, component fixing points on assembly plates, back of control unit mounting plate) are **not** finished with non-conducting paint or material.	☐
Degree of protection (IPxx)	☐

Check that …	☑
Drive option modules and other components	
Type and number of option modules and other equipment is correct. Option modules and other equipment are not damaged.	☐
Optional modules and terminals are labelled correctly.	☐
The placement of optional modules and other equipment inside the cabinet and on the cabinet door is correct.	☐
The mounting of optional modules and other equipment is correct.	☐
Internal cabling of the cabinet assembly	
Main circuit: • DC cabling is ok. • AC supply input cabling is ok. • AC output cabling is ok. • Supply for brake resistor (if used) is ok.	☐
Cable types, cross-sections, colours and optional markings are correct.	☐
Cabling is not susceptible to interference. Check the twisting of cables and cable routes.	☐
Connection of cables to devices, terminal blocks and drive module circuit boards: • Cables are connected to terminals tight enough 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.	☐
Cables are not lying against sharp edges or bare live parts. Bending radius of fiber optic cables is at least 3.5 cm (1.38 in.).	☐
The type, markings, insulation plates and cross connections of terminal blocks are correct.	☐
Grounding and protection	
The grounding colors, cross-section and grounding points of modules and other equipment match the circuit diagrams. No long routes for pigtails.	☐
Connections of PE cables and busbars are tight enough. Pull the cable to test that it does not loosen. No long routes for pigtails.	☐
Doors equipped with electrical equipment are grounded. No long grounding routes. From EMC standpoint best result is achieved with a flat copper braid.	☐
Fans that can be touched are shrouded.	☐
Live parts inside the doors are protected against direct contact to at least IP2x.	☐
Labels	
The type designation labels and warning and instruction stickers are made according to the local regulations and placed correctly.	☐
Switches and doors	
Mechanical switches, main disconnecting switch and cabinet doors function properly.	☐

Check that …	☑
Installation of the cabinet	
The drive cabinet has been attached to floor and also from top to the wall or roof.	☐
The ambient operating conditions agree with the specifications given in chapter *Technical data*.	☐
The cooling air will flow freely in and out of the drive cabinet, and air recirculation inside the cabinet will not be possible (air baffle plates are on place).	☐
If the drive module has been stored over one year: The electrolytic DC capacitors in the DC link of the drive have been reformed. See page *165*.	☐
There is an adequately sized protective ground conductor between the drive and the switchboard.	☐
There is an adequately sized protective ground conductor between the motor and the drive.	☐
All protective ground conductors have been connected to the appropriate terminals and the terminals have been tightened. (Pull the conductors to check.)	☐
The enclosures of the equipment in the cabinet have proper galvanic connection to the cabinet protective earth (ground) busbar; The connection surfaces at the fastening points are bare (unpainted) and the connections are tight, or separate grounding conductors have been installed.	☐
The supply voltage matches the nominal input voltage of the drive. Check the type designation label.	☐
The input power cable has been connected to the appropriate terminals, the phase order is right, and the terminals have been tightened. (Pull the conductors to check.)	☐
Appropriate AC fuses and a main disconnector have been installed.	☐
The motor cable has been connected to the appropriate terminals, the phase order is right, and the terminals have been tightened. (Pull the conductors to check.)	☐
The brake resistor (if present) has been connected to the appropriate terminals, and the terminals have been tightened. (Pull the conductors to check.)	☐
The motor cable (and brake resistor cable, if present) has been routed away from other cables.	☐
No power factor compensation capacitors have been connected to the motor cable.	☐
The control cables (if any) have been connected to the appropriate terminals, and the terminals have been tightened. (Pull the conductors to check.)	☐
If a drive bypass connection is used: The direct-on-line contactor of the motor and the drive output contactor are either mechanically or electrically interlocked, ie, cannot be closed simultaneously.	☐
There are no tools, foreign objects or dust from drilling inside the drive module.	☐
All shrouds and cover of the motor connection box are in place. Cabinet doors have been closed.	☐
The motor and the driven equipment are ready for start.	☐

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]).

In addition to the parameter settings required by the application, make the following settings for the drive module package:

- Set **95.04 Control board supply** according to how the drive control unit is powered.
- Set parameter **95.09 Fuse switch control** to **Disable**.
- Select the drive module type in parameter **95.31 Parallel connection rating id**.
- Reboot the control unit either by cycling the power, or by parameter **96.08 Control board boot**.
- For drives with resistor braking (option), see also section *Start-up* on page *227*.
- 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]).

5. For drives with ABB motors in explosive atmospheres, see also *ACS880 drives with ABB motors in explosive atmospheres* (3AXD50000019585 [English]).
6. 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 *217*.
7. For drive modules with an FSO-12 safety functions module (option): 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 option DPMP-01

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 modules.

Maintenance intervals

The table below shows the maintenance tasks which can be done by the end user. The complete maintenance schedule is available on the Internet (www.abb.com/drivesservices).For more information, consult your local ABB Service representative (www.abb.com/searchchannels).

The maintenance and component replacement intervals are based on the assumption that the equipment is operated within the specified ratings and ambient conditions. ABB recommends annual drive inspections to ensure the highest reliability and optimum performance.

Note: Long term operation near the specified maximum ratings or ambient conditions may require shorter maintenance intervals for certain components. Consult your local ABB Service representative for additional maintenance recommendations.

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
R	IP54 air filters on the cabinet doors
P	Quality of supply voltage
I	Spare parts
P	DC circuit capacitors reforming, spare modules and spare capacitors
I	Tightness of terminals
I	Dustiness, corrosion and 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		
NSIN filter cooling fan		R		R		R		R
Aging								
BCU control unit battery (real-time clock)		R		R		R		
Control panel battery (real-time clock)			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

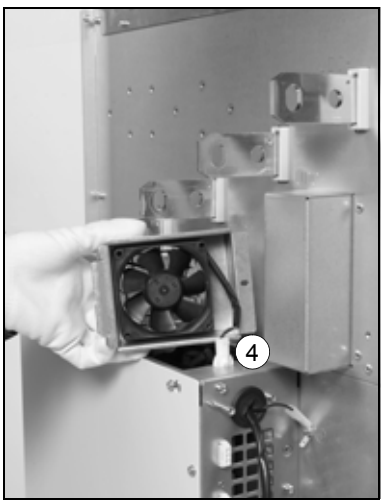
The actual lifespan depends on the running time of the fan, ambient temperature and dust concentration. See the firmware manual for the actual signal which indicates the running time of the cooling fan. For resetting the running time signal after a fan replacement, please contact ABB.

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 and drive module with option "IP20 shrouds for covering the input and motor cabling area"* on page *161*, or for drive modules with option *Replacing the drive module with option "Full power cabling panels to be attached to a cabinet (IP20)"* on page *163*.
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 and drive module with option "IP20 shrouds for covering the input and motor cabling area"* on page *161*, or for drive modules with option "Full power cabling panels to be attached to a cabinet (IP20)", see section *Replacing the drive module with option "Full power cabling panels to be attached to a cabinet (IP20)"* on page *163*.
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.

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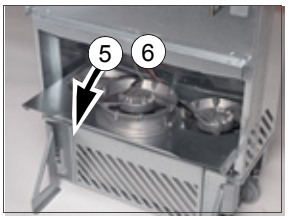
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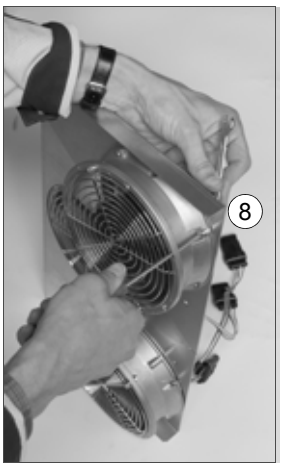
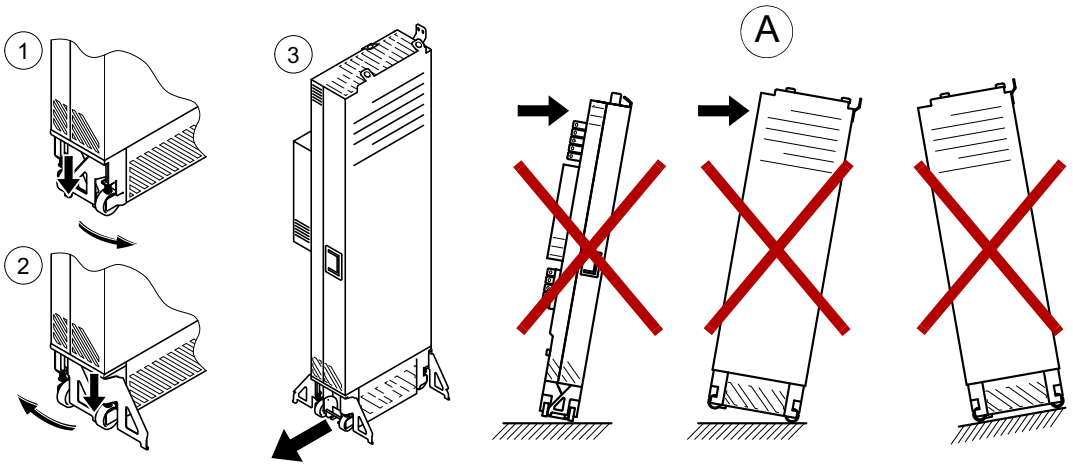

8

Replacing the standard drive module and drive module with option “IP20 shrouds for covering the input and motor cabling area”

Note: The replacement module must be of the same type as the original module: same type code and same option codes.

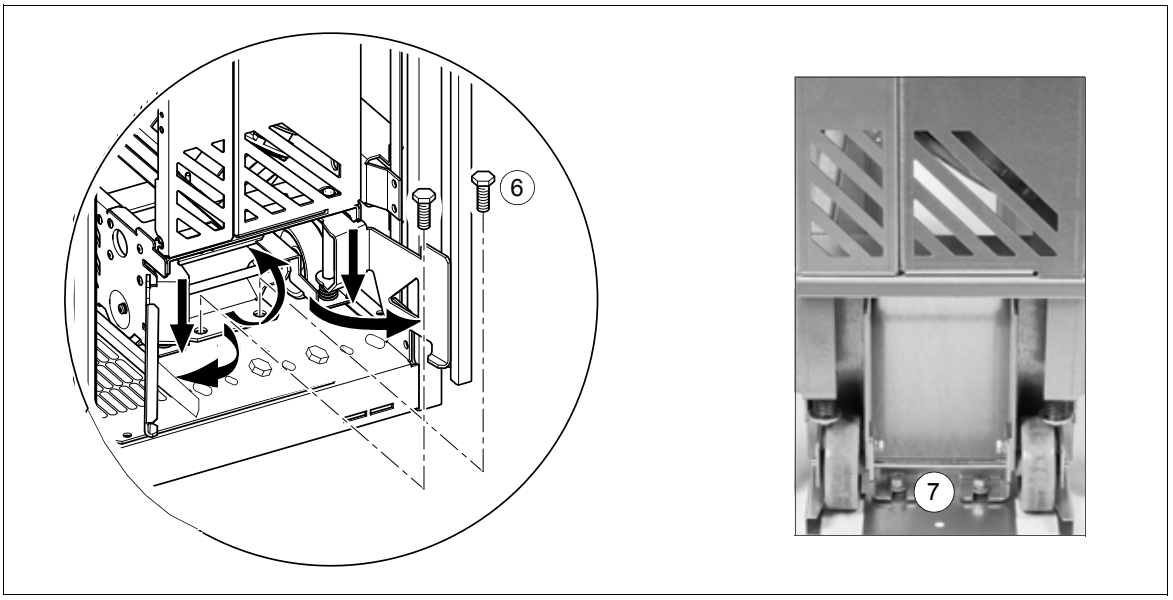
WARNING! Obey the safety instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

- 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.

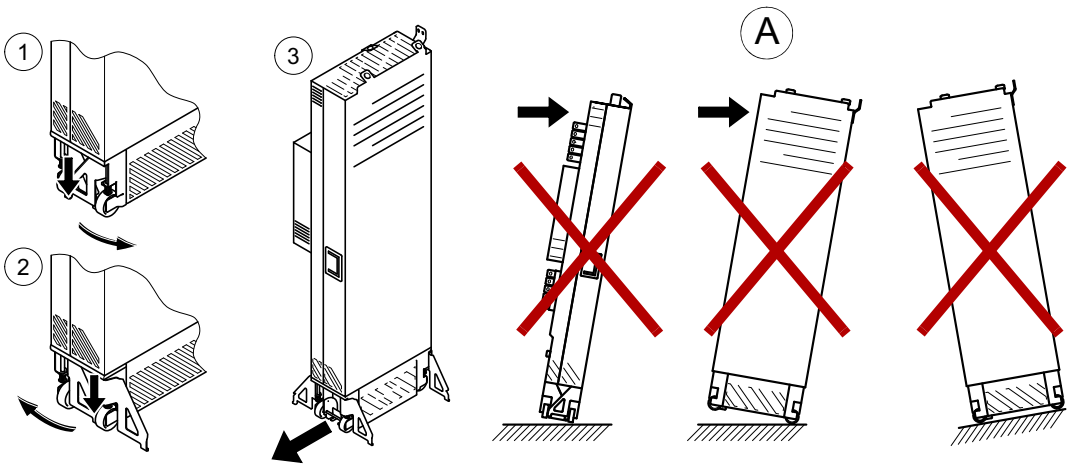


Replacing the drive module with option “Full power cabling panels to be attached to a cabinet (IP20)”

Note: The replacement module must be of the same type as the original module: same type code and same option codes.

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.
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.

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 *43* 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 real-time clock battery

See *BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English]).

Replacing the memory unit

See *BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English]).

Replacing the SD/SDHC memory card

See *BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English]).

Replacing the control unit

See *BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English]). The spare part control units are of type BCU-22. It can be used for replacing the BCU-02.

Reduced run

A “reduced run” function makes it possible to continue operation with one drive module if the other module is out of service, for example, because of maintenance work. In principle, reduced run is possible with only one module, but the physical requirements of operating the motor still apply; the remaining module in use must be able to provide the motor with enough magnetizing current.

Starting reduced run operation

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. If the control unit is powered from the faulty module, connect the control unit to another 24 V DC power supply. We strongly recommend using an external power supply with parallel-connected drive modules.
3. Disconnect all cables from the module to be serviced and remove it from its bay. See section *Replacing the standard drive module and drive module with option “IP20 shrouds for covering the input and motor cabling area”* on page *161* or section *Replacing the drive module with option “Full power cabling panels to be attached to a cabinet (IP20)”* on page *163*.
4. Switch on the power to the remaining drive module.
5. Enter the number of drive modules present into parameter **95.13 Reduced run mode.**
6. Reset all faults and start the drive module. The maximum current is now automatically limited according to the new drive module configuration. A mismatch between the number of detected modules (95.14) and the value set in 95.13 will generate a fault.
7. If the STO function is in use, validate it as described in chapter *Safe torque off function* (page *213*).

Resuming normal operation

WARNING! Repeat the steps described in section *Precautions before electrical work* on page *18*. If you ignore them, injury or death, or damage to the equipment can occur.

1. Reinstall the module into its bay.
2. Switch on the power to the drive module package.
3. Enter “0” into parameter **95.13 Reduced run mode.**
4. If the STO function is in use, validate it as described in chapter *Safe torque off function* (page *213*).

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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 *128* and in section *Assembly drawing of installing the roof and door* on page *143*.

ACS-AP-I control panel

The control panel is not included with the drive module but must be ordered separately. One control panel is required for the commissioning of an ACS880 drive system, even if the Drive composer PC tool is used.

For more information on the control panel, see *ACS-AP-x assistant control panels user's manual* (3AUA0000085685 [English]). See also sections *Control panel* (page *39*) and *Controlling several drives from one control panel through panel bus* (page *120*).

The control panel can be mounted on the cabinet door with the help of a door mounting kit.

Type	Description	Ordering code	Illustration
ACS-AP-I	Control panel	3AUA0000088311	
DPMP-01	Door mounting kit for flush mounting. Includes a control panel mounting platform, an IP54 cover and a 3-meter panel connection cable.	3AUA0000108878	

Brake resistors

See section *SAFUR resistors* on page *228*.

Output (du/dt) filters

See section *du/dt filters* on page *229*.

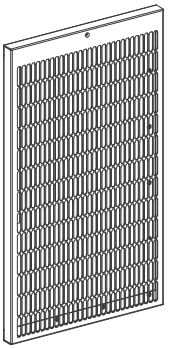
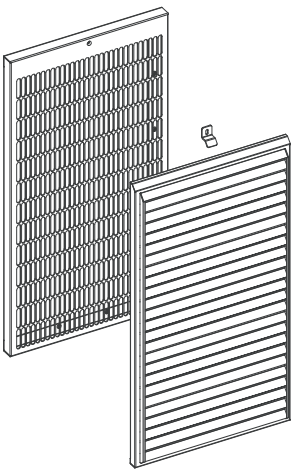
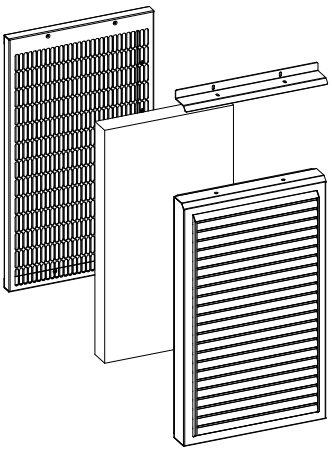
Sine filters

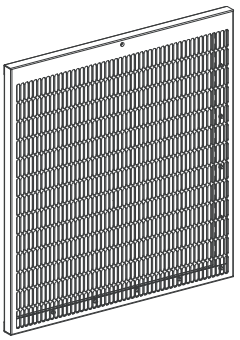
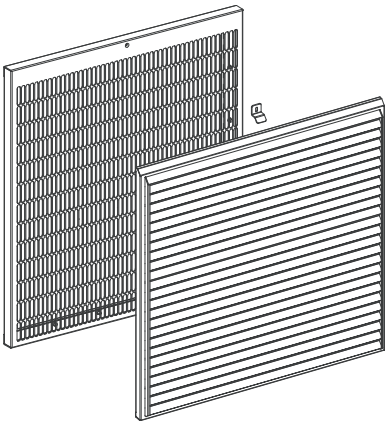
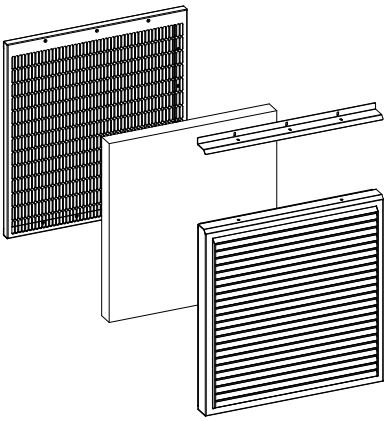
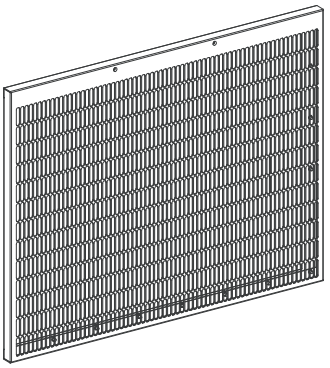
See section *Sine filters* on page *230*.

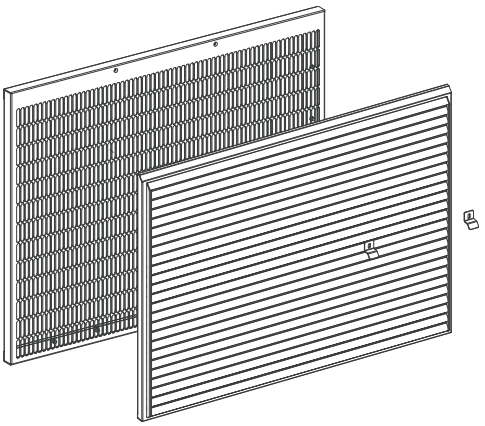
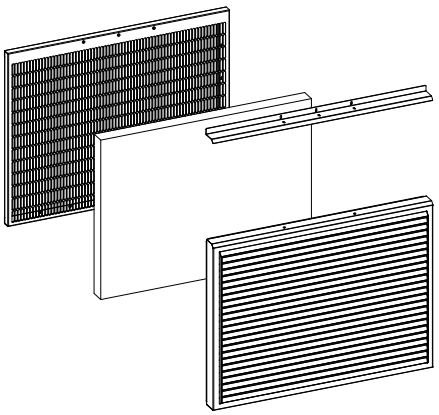
Cabinet ventilation

Air inlet kits

Mounting screws are included.

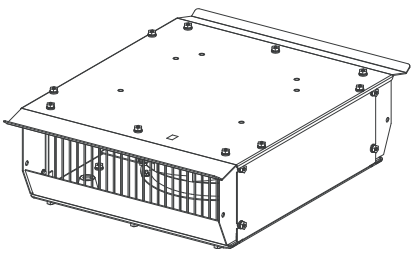
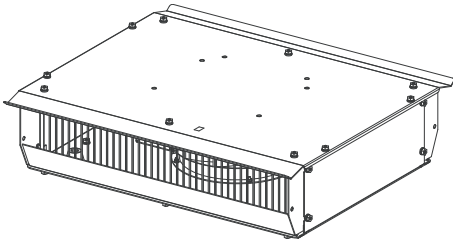
Enclosure width / Degree of protection	Kit code	Ordering code	Illustration
400 mm / IP20	A-4-X-021	3AUA0000117002	 Instruction code: 3AUA0000116879
400 mm / IP42	A-4-X-024	3AUA0000117007	 Instruction code: 3AUA0000116873
400 mm / IP54	A-4-X-027	3AXD50000009184	 Instruction code: 3AXD50000009989

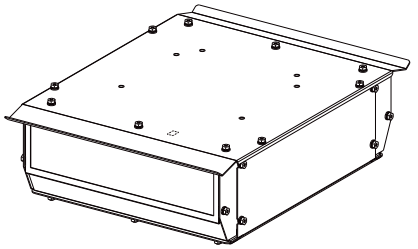
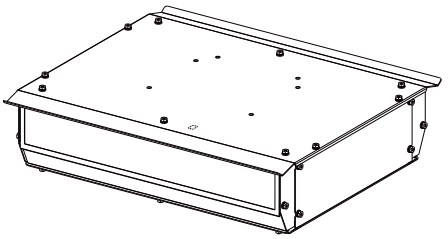
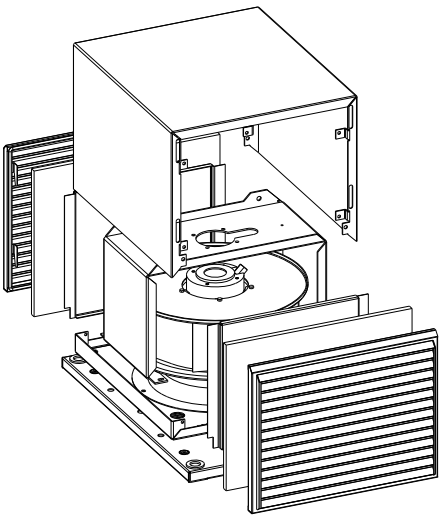
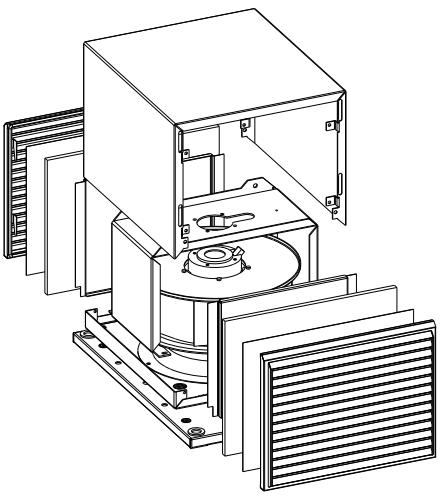
Enclosure width / Degree of protection	Kit code	Ordering code	Illustration
600 mm / IP20	A-6-X-022	3AUA0000117003	 Instruction code: 3AUA0000116880
600 mm / IP42	A-6-X-025	3AUA0000117008	 Instruction code: 3AUA0000116874
600 mm / IP54	A-6-X-028	3AXD50000009185	 Instruction code: 3AXD50000009990
800 mm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

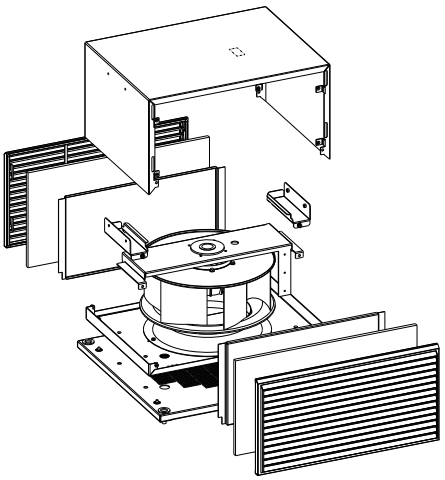
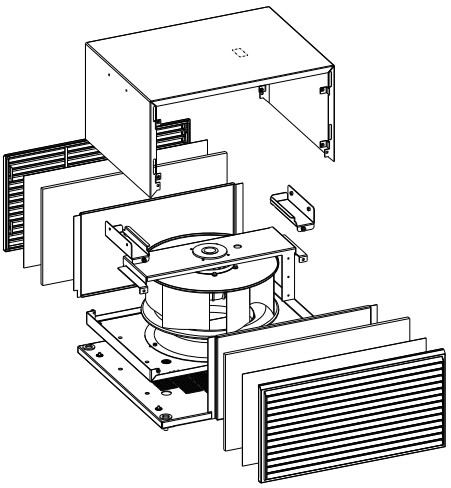
Enclosure width / Degree of protection	Kit code	Ordering code	Illustration
800 mm / IP42	A-8-X-026	3AUA0000117009	 Instruction code: 3AUA0000116875
800 mm / IP54	A-8-X-029	3AXD50000009186	 Instruction code: 3AXD50000010001

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	3AUA0000125203	 Instruction code: 3AXD50000001982 **Note:** Fan to be ordered separately
800 mm / IP20	2			
600 mm / IP20	1	A-6-X-063	3AUA0000125204	 Instruction code: 3AXD50000001980 **Note:** Fan to be ordered separately

Enclosure width / Degree of protection	Qty	Kit code	Ordering code	Illustration
400 mm / IP42	1	A-4-X-060	3AUA0000114968	 Instruction code: 3AUA0000115290 **Note:** Fan to be ordered separately
800 mm / IP42	2			
600 mm / IP42	1	A-6-X-061	3AUA00001149789	 Instruction code: 3AUA0000115152 **Note:** Fan to be ordered separately
400 mm / IP54 (IEC)	1	A-4-X-064	3AXD50000009187	 Instruction code: 3AXD50000010284 **Note:** Fan to be ordered separately
800 mm / IP54 (IEC)	2			
400 mm / IP54 (UL)	1	A-4-X-067	3AXD50000010362	 Instruction code: 3AXD50000010284 **Note:** Fan to be ordered separately
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	 Instruction code: 3AXD50000010004 **Note:** Fan to be ordered separately
600 mm / IP54 (UL)	1	A-6-X-066	3AXD50000010327	 Instruction code: 3AXD50000010004 **Note:** Fan to be ordered separately

Cooling fans

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

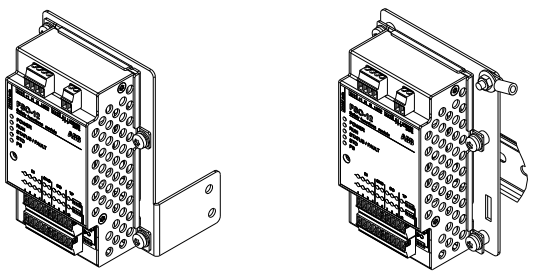
Enclosure width / Degree of protection	Component		Qty	Ordering code
	Name	Data		
IEC				
400 mm / IP54	Fan	CRBB/4-315/112D ML	1	3AXD50000006934
	Capacitor	MSB MKP 6/603/E1679	1	3AXD50000006959
	Connector	SPB2,5/7 (2.5 mm2, 12AWG)	1	3AXD50000000723
	Connector	SC 2,5-RZ/7 (2.5 mm2, 12AWG)	1	3AXD50000000724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

Enclosure width / Degree of protection	Component		Qty	Ordering code
	Name	Data		
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 ARFI-10

Order code: 68241561

FSO accessories kit

Kit code	Ordering code	Illustration
A-X-X-279	3AXD50000025495	 Instruction code: 3AXD50000025583

Accessory kits

Kit	Ordering code
Full size input cable connection terminals and PE busbar. Not to be used with full power cabling panels which are to be attached to a cabinet.	3AXD50000024518
Full size output cable connection terminals. Not to be used with full power cabling panels which are to be attached to a cabinet.	3AXD50000024519
For frame R10: Full power cabling panels to be attached to a cabinet (IP20)	3AXD50000024520
For frame R11: Full power cabling panels to be attached to a cabinet (IP20)	3AXD50000024561
Power cable connection terminals on the right-hand side of the drive module. Not to be used with full power cabling panels which are to be attached to a cabinet. Not to be used with flat mounting.	3AXD50000026152
Flat mounting. Not to be used with full power cabling panels which are to be attached to a cabinet. Not to be used with power cable connection terminals on the right-hand side of the drive module.	3AXD50000024562
For frame R10: IP20 shrouds for covering the input and motor cabling area. Not to be used with full power cabling panels which are to be attached to a cabinet.	3AXD50000024563
For frame R11: IP20 shrouds for covering the input and motor cabling area. Not to be used with full power cabling panels which are to be attached to a cabinet.	3AXD50000024564

14

Technical data

Contents of this chapter

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

Ratings

The ratings of the drive module packages with 50 Hz and 60 Hz supply are given below.

IEC RATINGS											
Drive type ACS880-04XT-	**Frame size**	**Input current**	**Output ratings**								
			Nominal use					**Light-duty use**		**Heavy-duty use**	
		I_1	I_{max}	I_{max_start}	I_2	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 V											
1190A-3	2×R10	1190	1343	1755	1190	630	824	1167	630	878	500
1610A-3	2×R11	1610	2024	2024	1610	900	1115	1570	900	1274*	710
U_N = 500 V											
1160A-5	2×R10	1160	1343	1755	1160	800	1005	1146	800	878	630
1610A-5	2×R11	1610	2024	2024	1610	1000	1394	1570	1000	1274**	900
U_N = 690 V											
0810A-7	2×R10	810	1168	1356	810	800	968	791	710	678*	630
1080A-7	2×R11	1080	1472	1858	1080	1000	1291	1051	1000	929	900
1320A-7	2×R11	1320	1509	2024	1320	1200	1578	1297	1200	1051***	1000

3AXD10000363510

NEMA RATINGS											
Drive type ACS880-04XT-	**Frame size**	**Input current**	**Max. current**		**Output ratings**						
					App. power	**Light-duty use**			**Heavy-duty use**		
		I_1	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 V											
1160A-5	2×R10	1160	1343	1755	1005	1146	710	1000	878	630	700
1610A-5	2×R11	1610	2024	2024	1394	1570	1000	1250	1274**	900	1000
U_N = 600 V											
0810A-7	2×R10	810	1168	1356	968	791	800	800	678*	630	700
1080A-7	2×R11	1080	1472	1858	1291	1051	1000	1000	929	900	1000
1320A-7	2×R11	1320	1509	2024	1578	1297	1200	1250	1051***	1000	1000

3AXD10000363510

U_N	Nominal voltage of the drive. For input voltage range, see section *Electrical power network specification* on page *185*.
I_1	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_2	Continuous rms output current. No overload capability at 40 °C (104 °F). This is indicated in the type designation label as output current I_2.
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.
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. We recommend to select the drive, motor and gear combination for the required motion profile with the DriveSize dimensioning tool available from ABB.	

When is derating needed

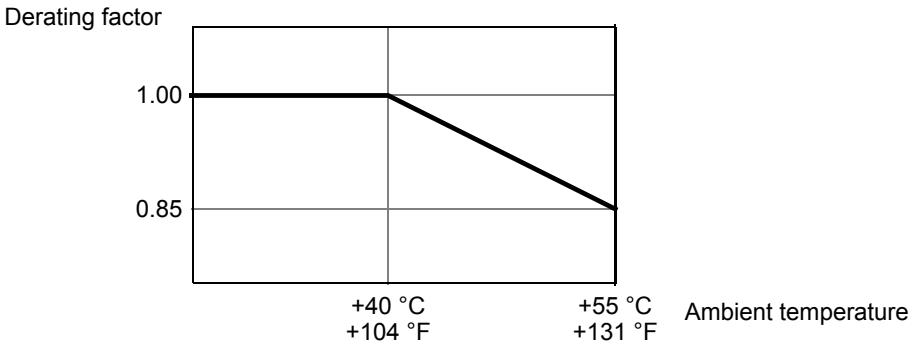
Derate the continuous output current of the drive if

- 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.

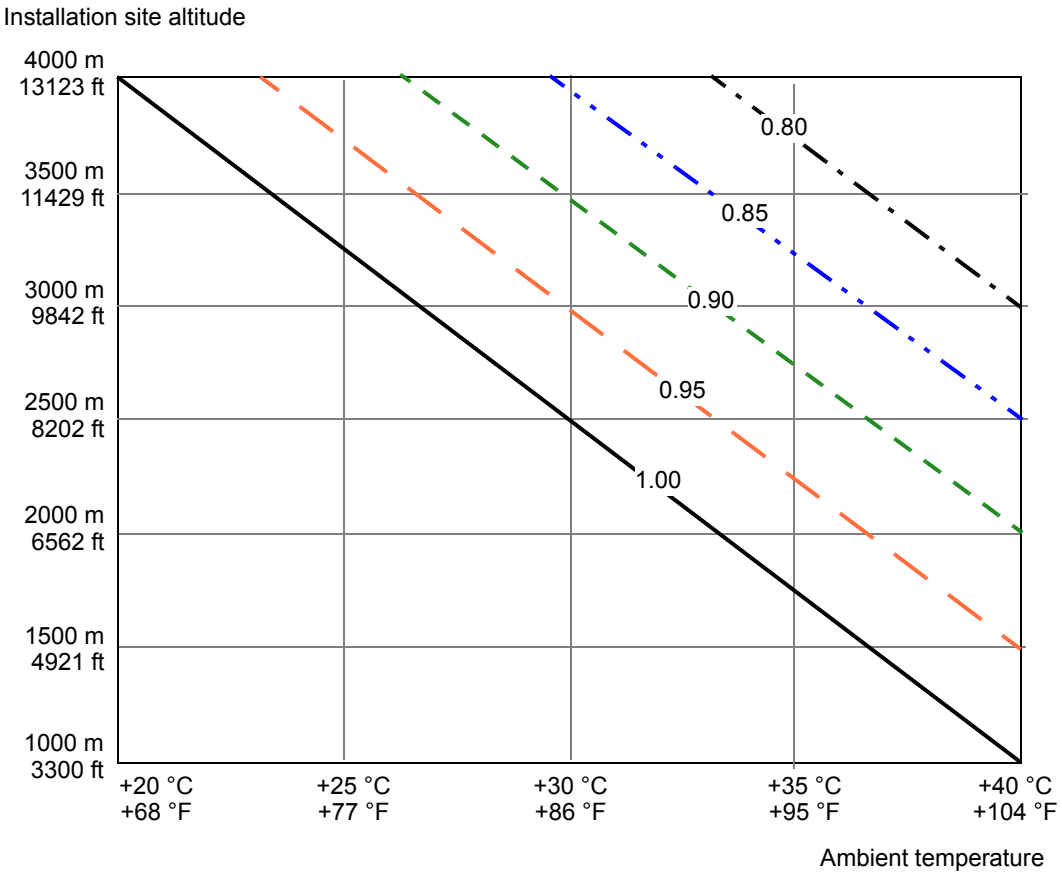
Ambient temperature derating

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.



	Derating factor 1.00
	Derating factor 0.95
	Derating factor 0.9
	Derating factor 0.85

– · — · — · –	Derating factor 0.80

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 *230* 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 *230*) and non-ABB Ex motors, contact ABB.

Drive type ACS880-04XT-	**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 V												
1190A-3	1128	580	795	587	1104	580	1060	782	892	460	857	637
1610A-3	1489	828	1049	828	1444	828	1398	1104	1159	653	1104	920***
U_N= 500 V												
1160A-5	1065	736	1018	771	1030	736	975	736	754	460	721	548
1610A-5	1413	920	1374	1093	1343	920	1306	1030	1012	736	938	754
U_N= 690 V												
0810A-7	712	669	693	593	662	653	644	552***	534	460	515	434
1080A-7	892	828	865	826	828	736	802	708	626	580	607	552
1320A-7	1091	920	1056	883***	1012	920	975	828***	828	736	791	644***

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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 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
*	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 type ACS880-04XT-	**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 V										
1190A-3	120	1190	650	1167	878	500	892	460	857	637
1610A-3	120	1610	915	1592	1334*	500	1159	653	1104	920*
U_N= 500 V										
1160A-5	120	1160	822	1146	878	500	754	460	721	548
1610A-5	120	1610	1153	1577	1282*	500	1012	736	938	754
U_N= 690 V										
0810A-7	120	810	753	791	678*	375	546	471	528	445*
1080A-7	120	1080	1025	1051	929	375	626	580	607	552
1320A-7	120	1320	1300	1297	1051*	375	828	736	791	644*

3AXD10000363510

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
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

Modules used

Drive type	Drive module	
	Type	Qty + size
U_N = 400 V		
ACS880-04XT-1190A-3	ACS880-04-650A-3+P943	2×R10
ACS880-04XT-1610A-3	ACS880-04-880A-3+P943	2×R11
U_N = 500 V		
ACS880-04XT-1160A-5	ACS880-04-635A-5+P943	2×R10
ACS880-04XT-1610A-5	ACS880-04-880A-5+P943	2×R11
U_N = 690 V		
ACS880-04XT-0810A-7	ACS880-04-430A-7+P943	2×R10
ACS880-04XT-1080A-7	ACS880-04-590A-7+P943	2×R11
ACS880-04XT-1320A-7	ACS880-04-721A-7+P943	2×R11

Fuses (IEC)

aR fuses by Cooper Bussmann for protection against short-circuit in the input power cable of drive are listed below.

Ultrarapid (aR) fuses per drive module						
Drive type	Input current (A)	Fuse				
		A	A^2s	V	Type DIN 43620	Size
U_N = 400 V						
ACS880-04XT-1190A-3	1190	1000	985 000	690	170M6814D	3
ACS880-04XT-1610A-3	1610	1600	4 150 000	690	170M8557D	3
U_N = 500 V						
ACS880-04XT-1160A-5	1160	1000	985 000	690	170M6814D	3
ACS880-04XT-1610A-5	1610	1600	4 150 000	690	170M8557D	3
U_N = 690 V						
ACS880-04XT-0810A-7	810	1000	985 000	690	170M6814D	3
ACS880-04XT-1080A-7	1080	1400	2 700 000	690	170M8555D	3
ACS880-04XT-1320A-7	1320	1500	3 350 000	690	170M8556D	3

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Note 1: See also *Implementing thermal overload and short-circuit protection* on page *82*.

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 per drive module 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 ACS880-04XT-	Input current (A)	Fuse per drive module				
		A	V	Manufacturer	UL class	Type
U_N = 400 V						
1190A-3	1190	800	600	Mersen	L	A4BY800
1610A-3	1610	1000	600	Mersen	L	A4BY1000
U_N = 500 V						
1160A-5	1160	800	600	Mersen	L	A4BY800
1610A-5	1610	1000	600	Mersen	L	A4BY1000
U_N = 690 V						
0810A-7	810	500	600	Cooper Bussmann	T	JJS-500
1080A-7	1080	800	600	Mersen	L	A4BY800
1320A-7	1320	800	600	Mersen	L	A4BY800

Note 1: See also *Implementing thermal overload and short-circuit protection* on page *82*.

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

Drive module with option “IP20 shrouds for covering the input and motor cabling area”								
Frame size	Height		Width		Depth		Weight*	
	mm	in	mm	in	mm	in	kg	lb
R10	1541	60.67	350	14.82	505	19.88	161	355
R11	1741	68.54	350	14.82	505	19.88	199	439

Standard drive module configuration								
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	156	429

Option “Full power cabling panels to be attached to a cabinet (IP20)”								
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“Full power cabling panels to be attached to a cabinet (IP20)” is 30 kg (66 lb)

Additional depth with option “Flat mounting” 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 per drive module		Heat dissipation per drive module	Noise	
					Drive module	Drive
		m^3/h	ft^3/min	W	dB(A)	dB(A)
U_N = 400 V						
ACS880-04XT-1190A-3	2×R10	1200	707	8122	72	75
ACS880-04XT-1610A-3	2×R11	1420	848	10578	71	74
U_N = 500 V						
ACS880-04XT-1160A-5	2×R10	1200	707	8122	72	75
ACS880-04XT-1610A-5	2×R11	1420	848	10578	71	74
U_N = 690 V						
ACS880-04XT-0810A-7	2×R10	1200	707	6409	72	75
ACS880-04XT-1080A-7	2×R11	1200	848	9862	72	75
ACS880-04XT-1320A-7	2×R11	1420	848	10578	71	74

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

Standard drive module configuration

It is possible to use the maximum cable size (4 × [3 × 240] mm^2 or 4 ×[(3 × 500 AWG]) only with special cable lugs and additional insulation. For more information, contact your local ABB representative.

Drive modules with full-size cable connection terminals (options)

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

Drive modules with option “Full power cabling panels to be attached to a cabinet (IP20)”

The maximum accepted cable size is 4 × (3 × 240) mm^2 or 4 × (3 × 500 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.

Terminal data for the control cables

See page 111.

Electrical power network specification

Voltage (U_1)	ACS880-04XT-xxxx-3 drives: 380…415 V AC 3-phase +10%/-15%. This is indicated in the type designation label as typical input voltage level 3 ~ 400 V AC. ACS880-04XT-xxxx-5 drives: 380...500 V AC 3-phase +10%/-15%. This is indicated in the type designation label as typical input voltage levels 3 ~ 400/480/500 V AC. ACS880-04XT-xxxx-7 drives: 525…690 V AC 3-phase +10%/-15%. This is indicated in the type designation label as typical input voltage levels 3 ~ 525/600/690 V AC.
Network type	TN (grounded) and IT (ungrounded) systems
Short-circuit withstand strength I_{cc} (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 82.
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 ($f_{1)}$)	50/60 Hz. Variation ±5% of the nominal frequency.
Imbalance	Max. ± 3% of nominal phase to phase input voltage
Fundamental power factor (cos phi$_1$)	0.98 (at nominal load)
Transformer for 12-pulse supply	According to IEC60076-1:2011 Connection: Dy 11 d0 or Dyn 11 d0 Phase shift between secondaries: 30° electrical Voltage difference between secondaries: < 0.5% Short-circuit impedance of secondaries: > 5% Short-circuit impedance difference between secondaries: ≤10% of the percentage impedance No grounding of the secondaries allowed. Static shield recommended

Motor connection data

Motor types	Asynchronous AC induction motors, permanent magnet motors and AC induction servomotors.
Voltage (U_2)	0…U_1, 3-phase symmetrical, U_{max} at the field weakening point
Frequency resolution	0.01 Hz
Current	See section *Ratings.*
Frequency ($f_{2)}$)	0…500 Hz For drives with du/dt filter: 200 Hz For drives with sine filter: 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>300 m (984 ft)</td><td>300 m (984 ft)</td></tr></table> **Note**: Motor cable longer than 100 m (328 ft) is allowed but then the EMC Directive requirements of Category C3 may not be fulfilled.
Minimum allowed motor cable length	For drive modules without du/dt filter: 2 m (7 ft) from each drive module to the motor or 4 m (13 ft) between the drive modules. The motor cabling must be symmetrical. See also section *When is a du/dt filter needed?* on page 229.

Brake resistor connection data

See page 223.

Control unit connection data (BCU-02)

BCU-02/12/22 control units hardware manual (3AUA0000113605 [English])

Control panel type

ACS-AP-I assistant control panel

Efficiency

Approximately 98% at nominal power level

Protection classes

Degree of protection (IEC/EN 60529)	IP00. With option “IP20 shrouds for covering the input and motor cabling area”: IP20, requires installation of bottom grille. With option “Full power cabling panels to be attached to a cabinet (IP20)”: IP20.
Enclosure type (UL 508C)	UL Open Type
Overvoltage category (IEC 60664-1)	III

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 Output derated above 1000 m [3281 ft]), see page *178*.	-	-
Surrounding air temperature	-15 to +55 °C (5 to 131 °F). No condensation allowed. Output derated in the range +40 … +55 °C (+104 … +131 °F). See page *178*.	-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.		

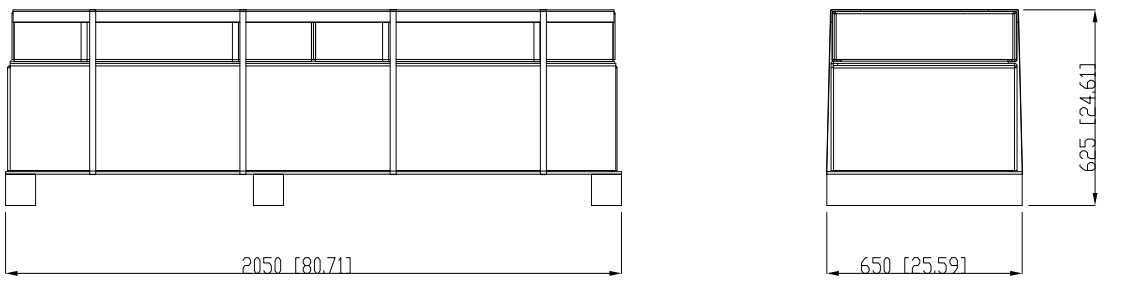
Contamination levels	IEC/EN 60721-3-3:2002: Classification of environmental conditions- Part 3-3: Classification of groups of environmental parameters and their severities - Stationary use of weather protected locations	IEC 60721-3-1:1997	IEC 60721-3-2:1997
Chemical gases	Class 3C2	Class 1C2	Class 2C2
Solid particles	Class 3S2. No conductive dust allowed.	Class 1S3. (packing must support this, otherwise 1S2)	Class 2S2
Pollution degree	2		
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 60068-2-6:2007, EN 60068-2-6:2008 *Environmental testing Part 2: Tests –Test Fc: Vibration (sinusoidal)*	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 60068-2-27:2008, EN 60068-2-27:2009 *Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock*	Not allowed	With packing max. 100 m/s^2 (330 ft./s^2), 11 ms	With packing 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. The package of one drive module is shown below.



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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	*Adjustable speed electrical power drive systems. Part 5-1: Safety requirements – electrical, thermal and energy*
EN 60204-1:2006 + A1:2010	*Safety of machinery. Electrical equipment of machines. Part 1: General requirements*. Provisions for compliance: The final assembler of the machine is responsible for installing - emergency-stop device - supply disconnecting device - IP00 drive module into a cabinet.
IEC/EN 60529:1991 + A2:2013	*Degrees of protection provided by enclosures (IP code)*
EN 61800-3:2004 +A1:2012	*Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods*
UL 508C (3rd edition)	*UL Standard for Safety, Power Conversion Equipment, third edition*
CSA-C22.2 No. 0-10	*General Requirements - Canadian Electrical Code, Part II*
CSA C22.2 No. 14-13	*Industrial Control Equipment*
CSA C22.2 No. 274-13	*Adjustable speed drives*

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 cabinet builder is in charge for the compliance of the drive with the European EMC Directive. For information on items to consider, see section *Compliance with EN 61800-3:2004* on page *192*.

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

EU Declaration of Conformity

(According to Machinery Directive 2006/42/EC)

We

Manufacturer: ABB Oy, Drives
Address: Hiomotie 13, P.O Box 184, 00381 Helsinki, Finland.
Phone: +358 10 22 11

declare under our sole responsibility that the following products

ACS880-04, -14, -34	**380V – 690V (frames nxR8i)**
ACS880-04XT	**380V – 690V (frames 2xR10** and **2xR11)**
ACS880-07	**380V – 690V (frames R6 – R11** and **nxR8i)**
ACS880-17, -37	**380V – 690V (frames nxR8i)**
ACS880-104	**380V – 690V (frames R1i – nxR8i)**
ACS880 multidrives	**380V – 690V (inverter frames R1i – nxR8i)**

with regard to the safety functions

Safe torque off

Safe motor temperature (option code +L536)

Safe stop 1, Safe stop emergency, Safely-limited speed, Safe maximum speed, Safe brake control, Prevention of unexpected start-up, with FSO-12 module (option code +Q973)

ACS880-07, -17, -37 and ACS880 multidrives: Prevention of unexpected start-up (option codes +Q950; +Q957), **Emergency stop** (option codes +Q951; +Q952; +Q963; +Q964; +Q978; +Q979), **Safely-limited speed** (option code +Q966)

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

EU Declaration of Conformity

(According to Machinery Directive 2006/42/EC)

The following harmonized standards below were used:

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

Other used standards:

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

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: Vesa Tiihonen
Address: P.O. Box 184, 00381 Helsinki, Finland

Helsinki, 20 Oct 2015

Peter Lindgren
Vice President
ABB Oy

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Compliance with EN 61800-3:2004

Definitions

EMC stands for **E**lectro**m**agnetic **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 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 ARFI-10 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:

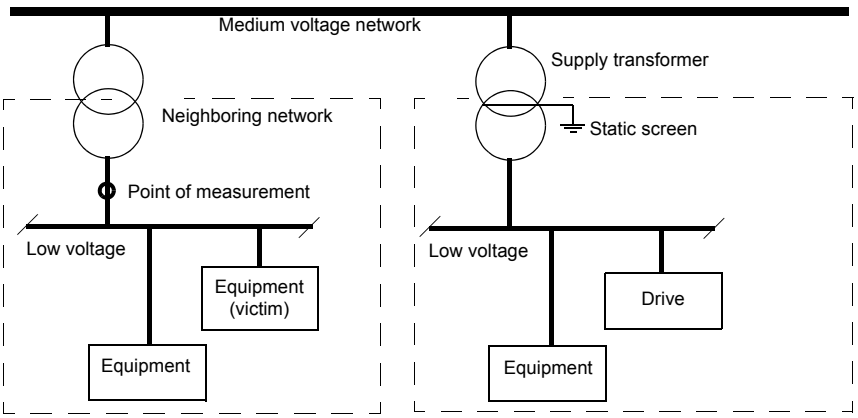
1. The drive is equipped with EMC filter +E200, +E201 or +E210.
2. The motor and control cables are selected as specified in the hardware manual.
3. The drive is installed according to the instructions given in the hardware manual.
4. Maximum motor cable length is 100 meters.

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

Drive modules are cULus Listed.

UL checklist

- Make sure that the drive type designation label includes the cULus Listed marking.
- **CAUTION - Risk of electric shock**. After disconnecting the input power, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you start working on the drive, motor or motor cable.
- The drive is to be used in a heated, indoor controlled environment. The drive must be installed in clean air according to the enclosure classification. Cooling air must be clean, free from corrosive materials and electrically conductive dust.
- The maximum surrounding air temperature is 40 °C (104 °F) at rated current. The current is derated for 40 to 55 °C (104 to 131 °F).
- The drive is suitable for use in a circuit capable of delivering not more than 100,000 rms symmetrical amperes, 600 V maximum when protected by the UL fuses given in the table on page *183*. The ampere rating is based on tests done according to the appropriate UL standard.

- The cables located within the motor circuit must be rated for at least 75 °C (167 °F) in UL-compliant installations.
- Integral solid state short circuit protection does not provide branch circuit protection. The input cable must be protected with fuses. Suitable IEC fuses are listed on page xx and UL classified fuses on page xx. These fuses provide branch circuit protection in accordance with the National Electrical Code (NEC) and Canadian Electrical Code. For installation in the United States, also obey any other applicable local codes. For installation in Canada, also obey any applicable provincial codes.

  Note: Circuit breakers must not be used without fuses in the USA. See page *82* for suitable circuit breakers.
- The drive provides motor overload protection. For the adjustments, see the firmware manual.
- For drive overvoltage category, see page *186*. For pollution degree, see page *187*.

CSA marking

Drive modules are CSA marked.

RCM marking

RCM marking is required in Australia and New Zealand. An RCM mark is attached to the drive modules 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 *192*.

EAC marking

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

Cyber security disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

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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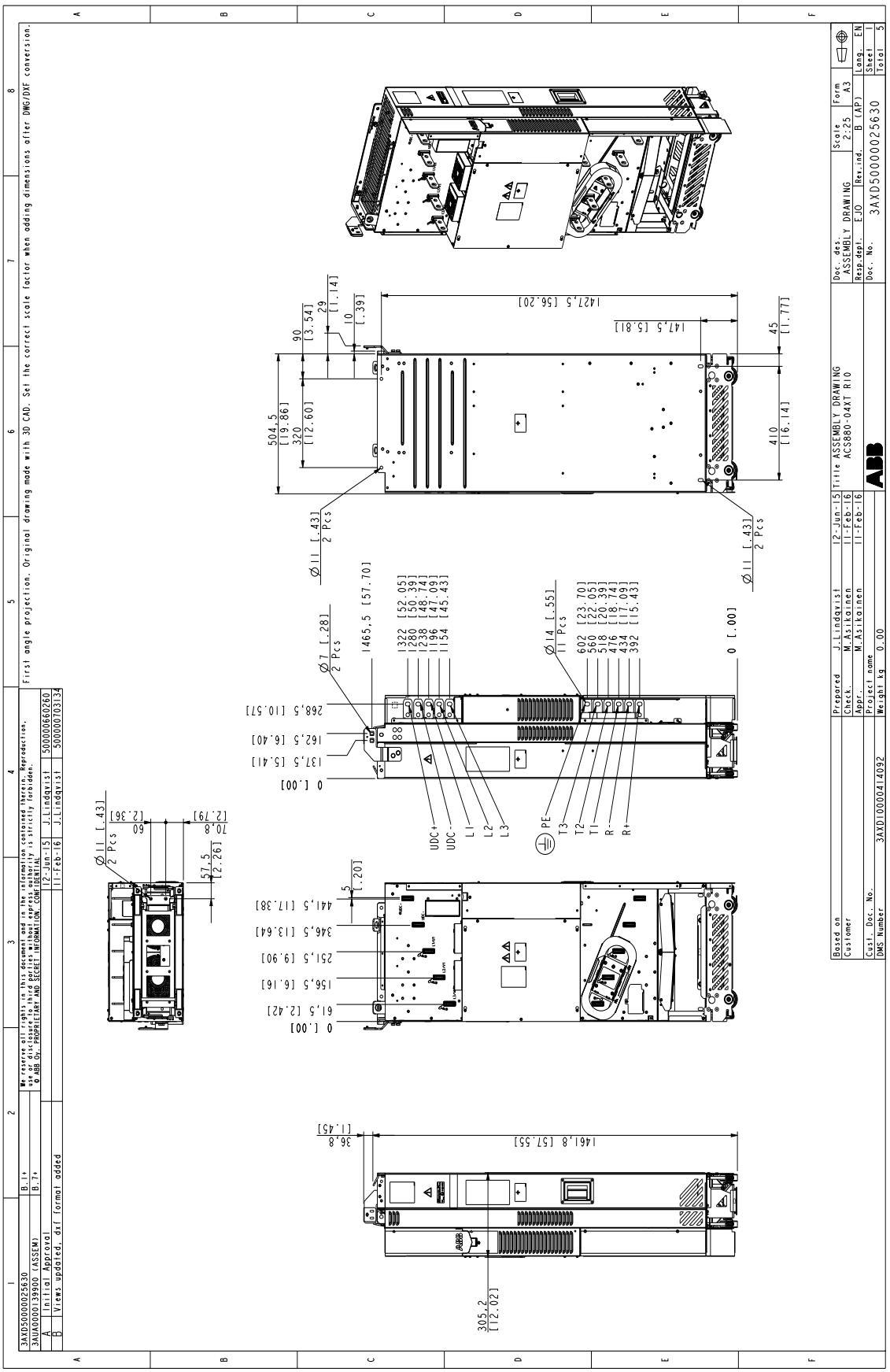
Dimension drawings

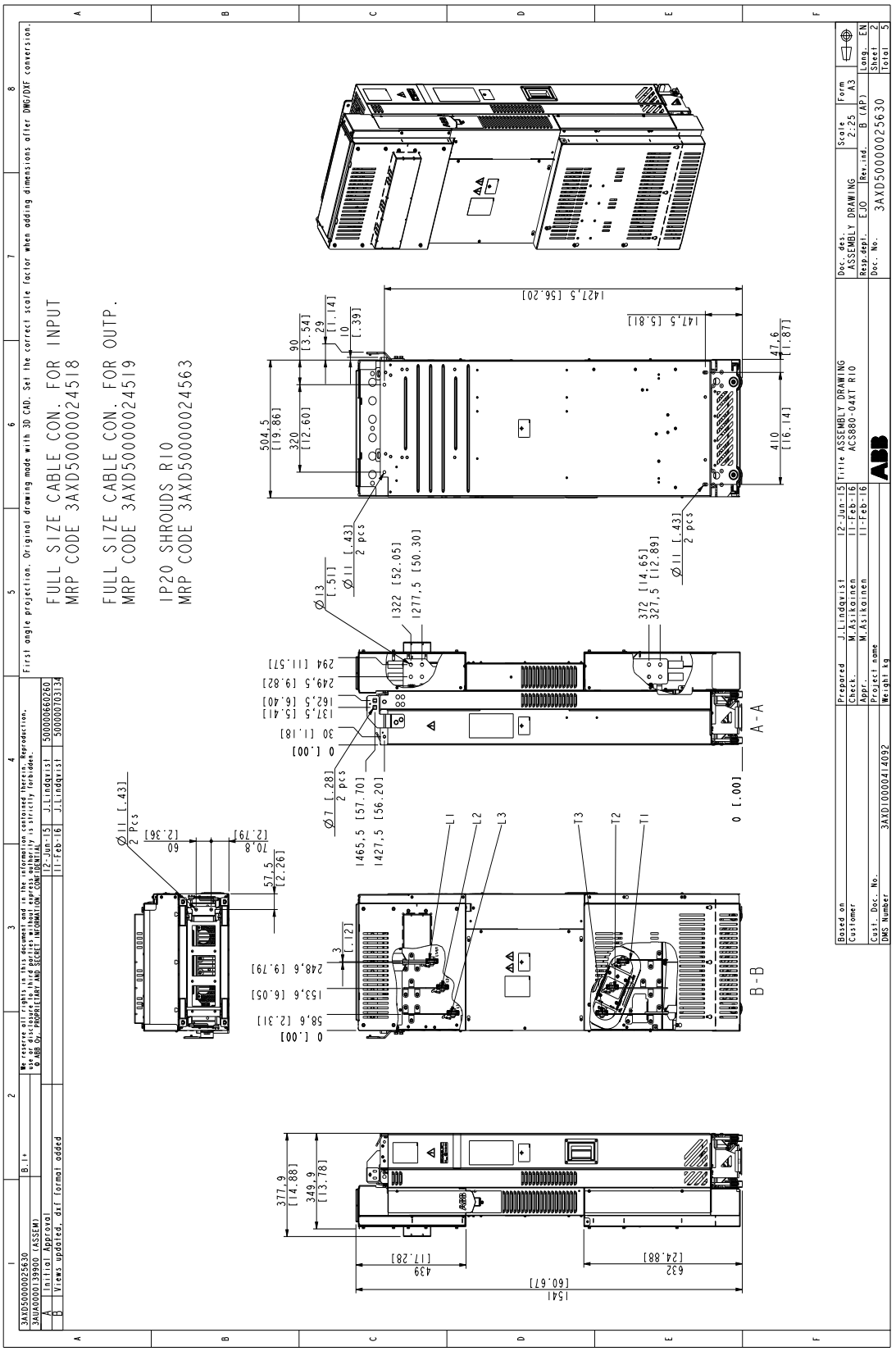
Contents of this chapter

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

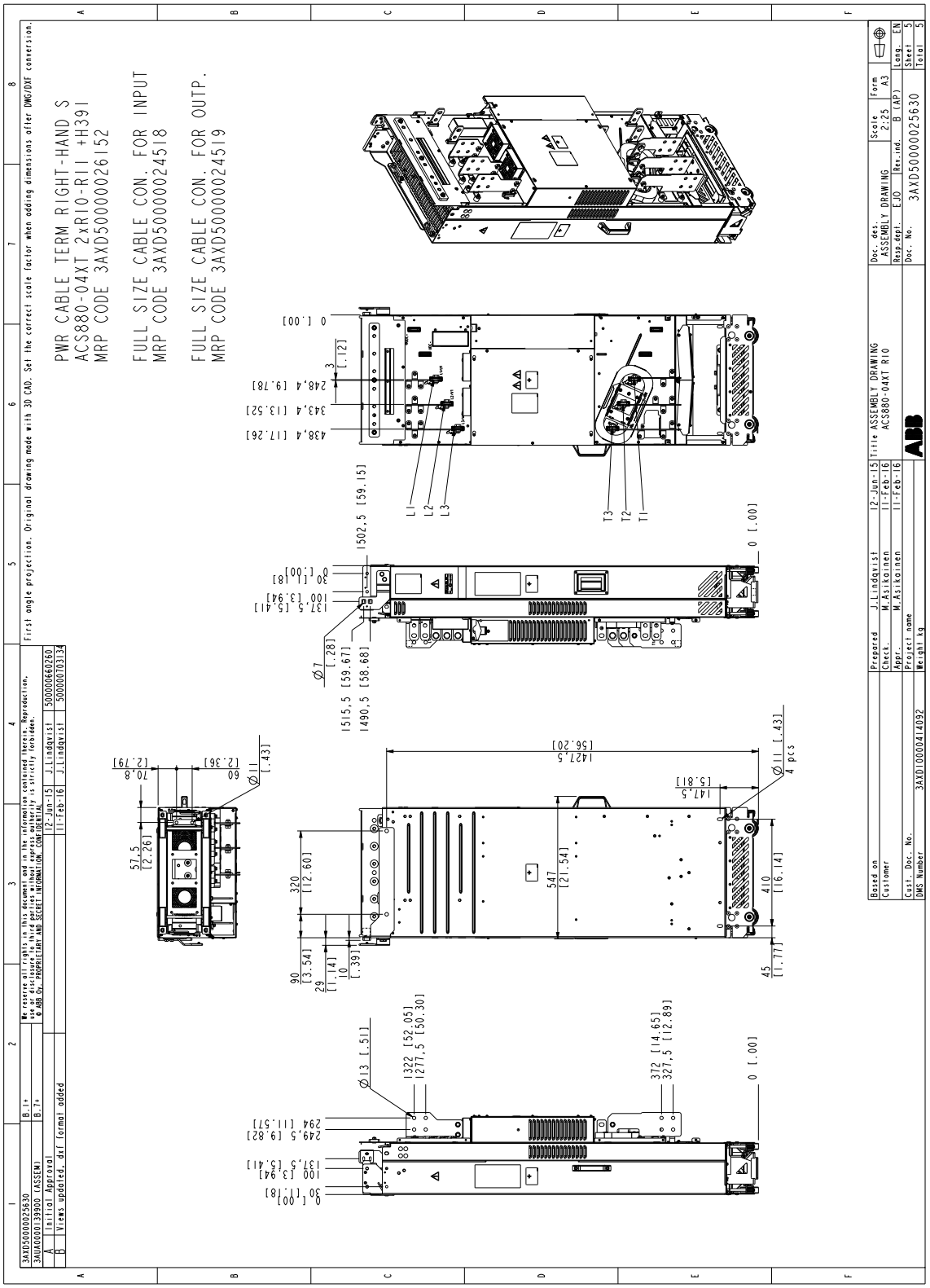
R10 with option +D150



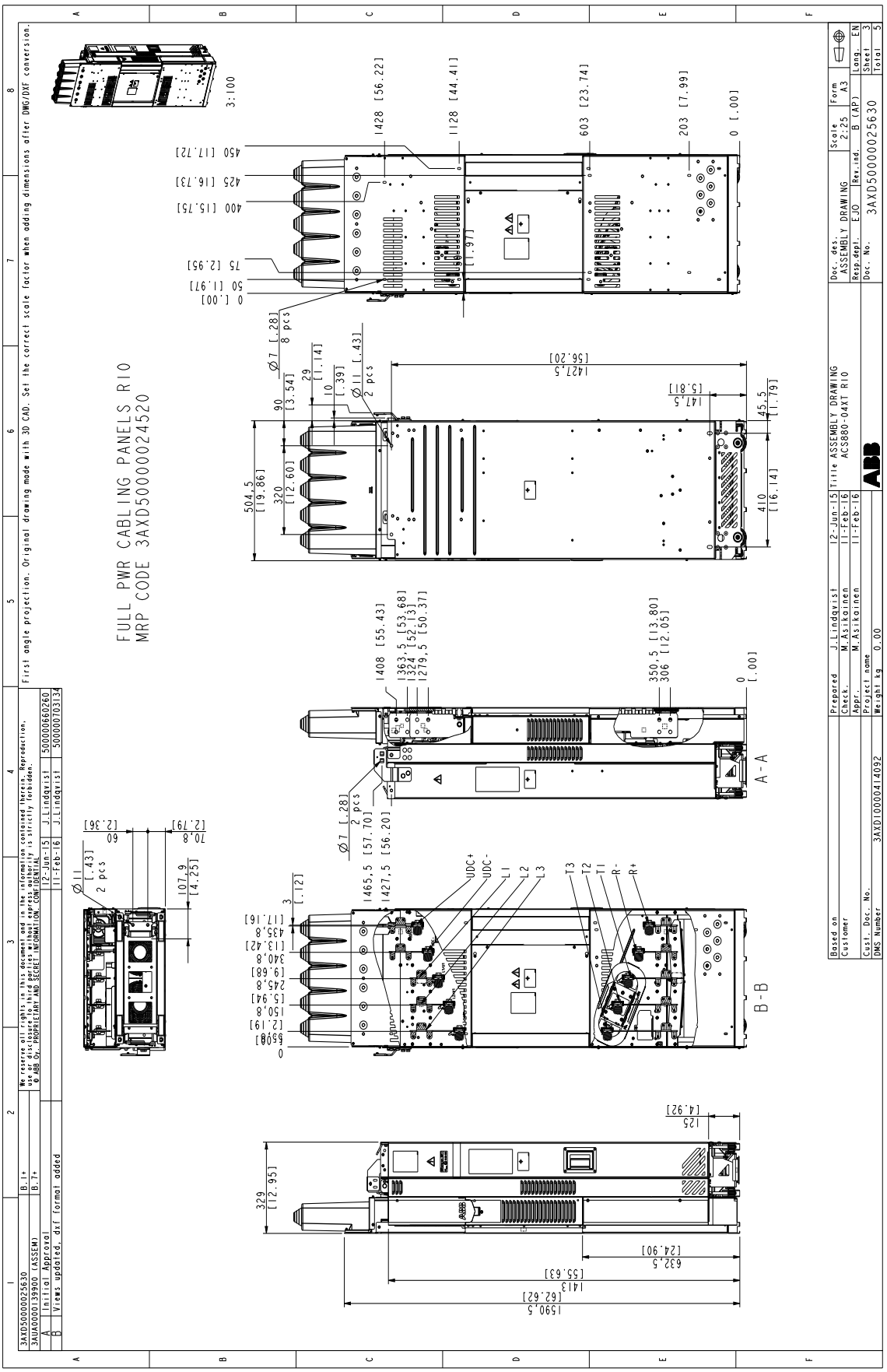
R10 with options “Full size input and output cable connection terminals and PE busbar” and “IP20 shrouds for covering the input and motor cabling area”



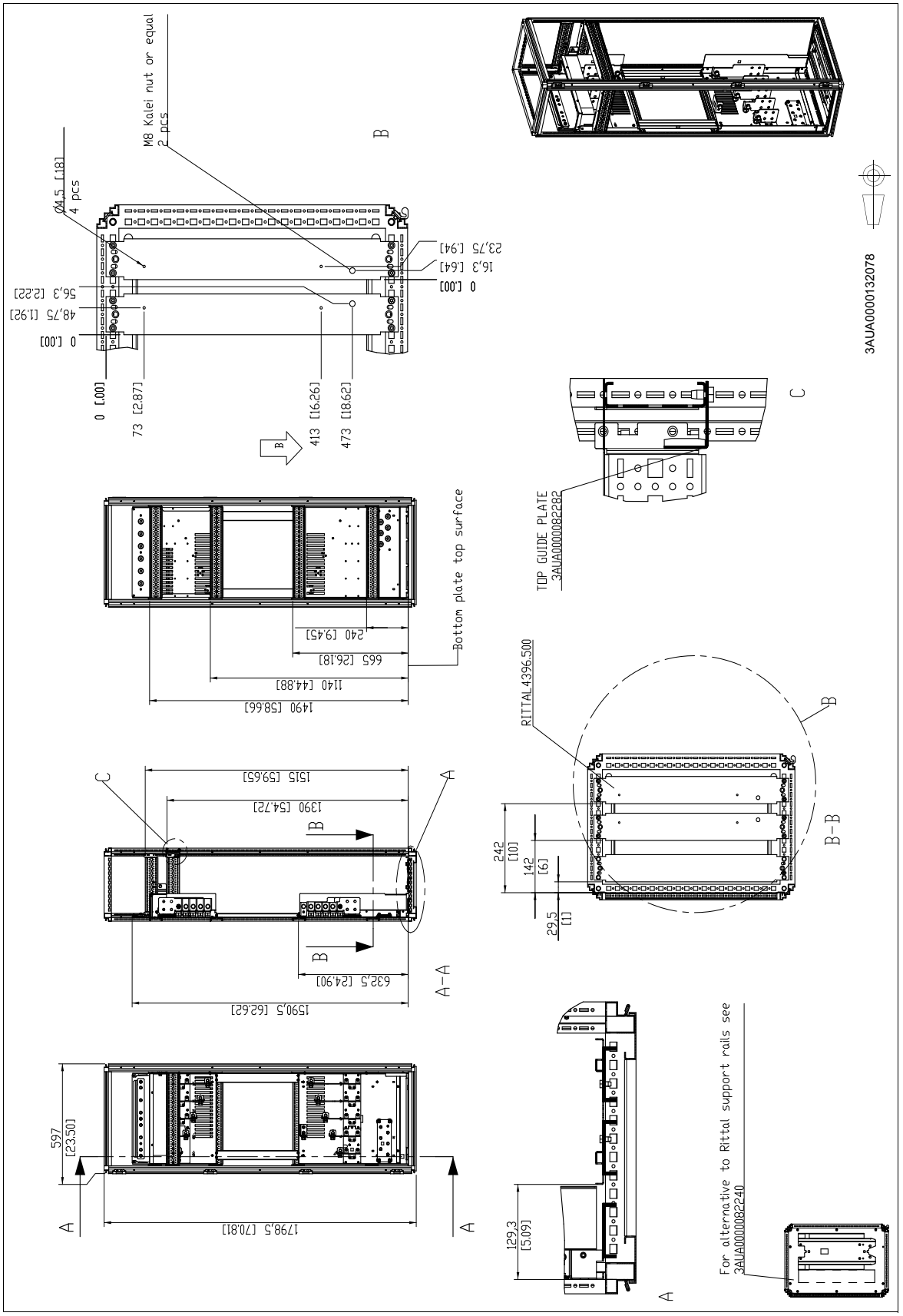
R10 with options “Full size input and output cable connection terminals and PE busbar” and “Power cable connection terminals on the right-hand side of the drive module”



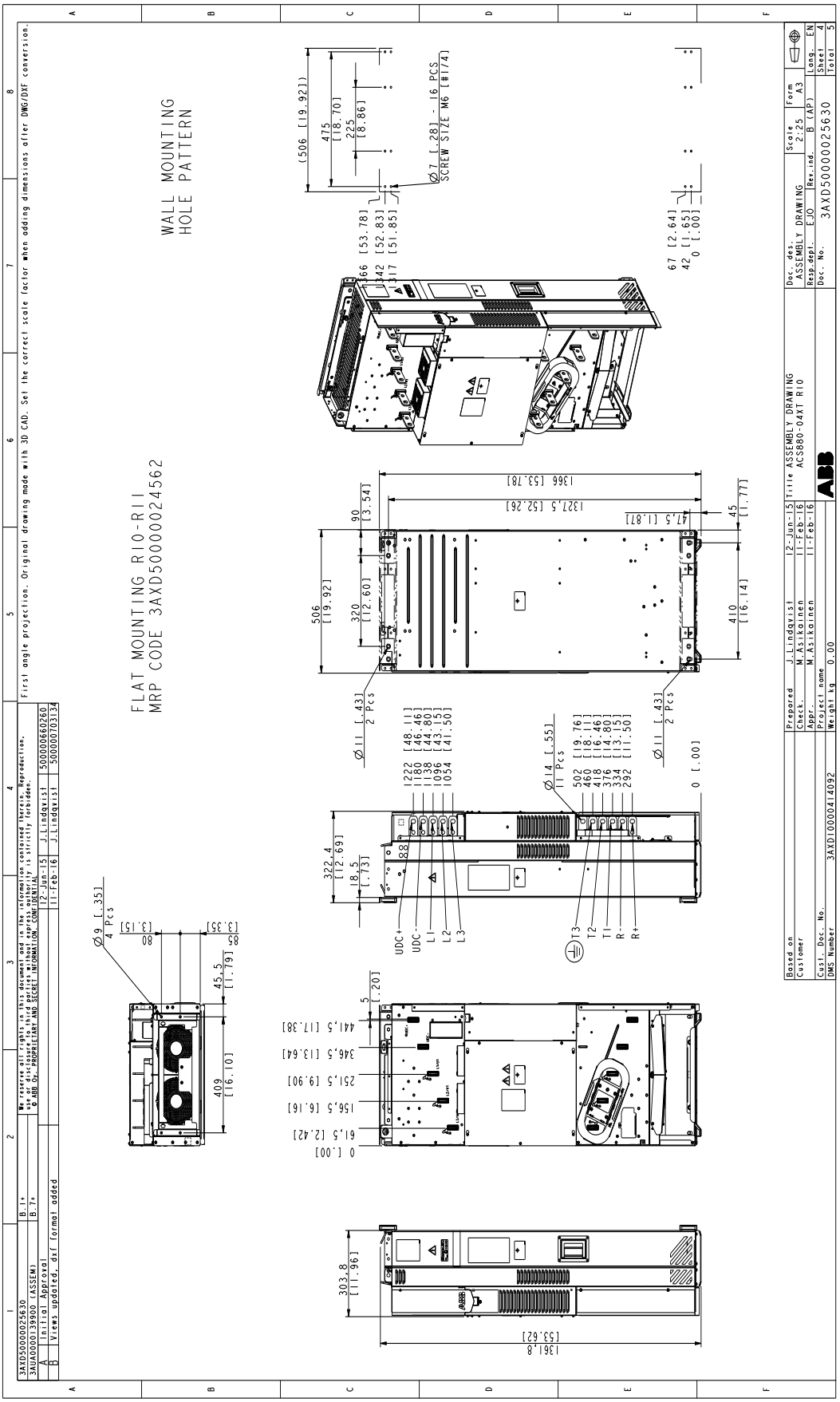
R10 with option “Full power cabling panels”



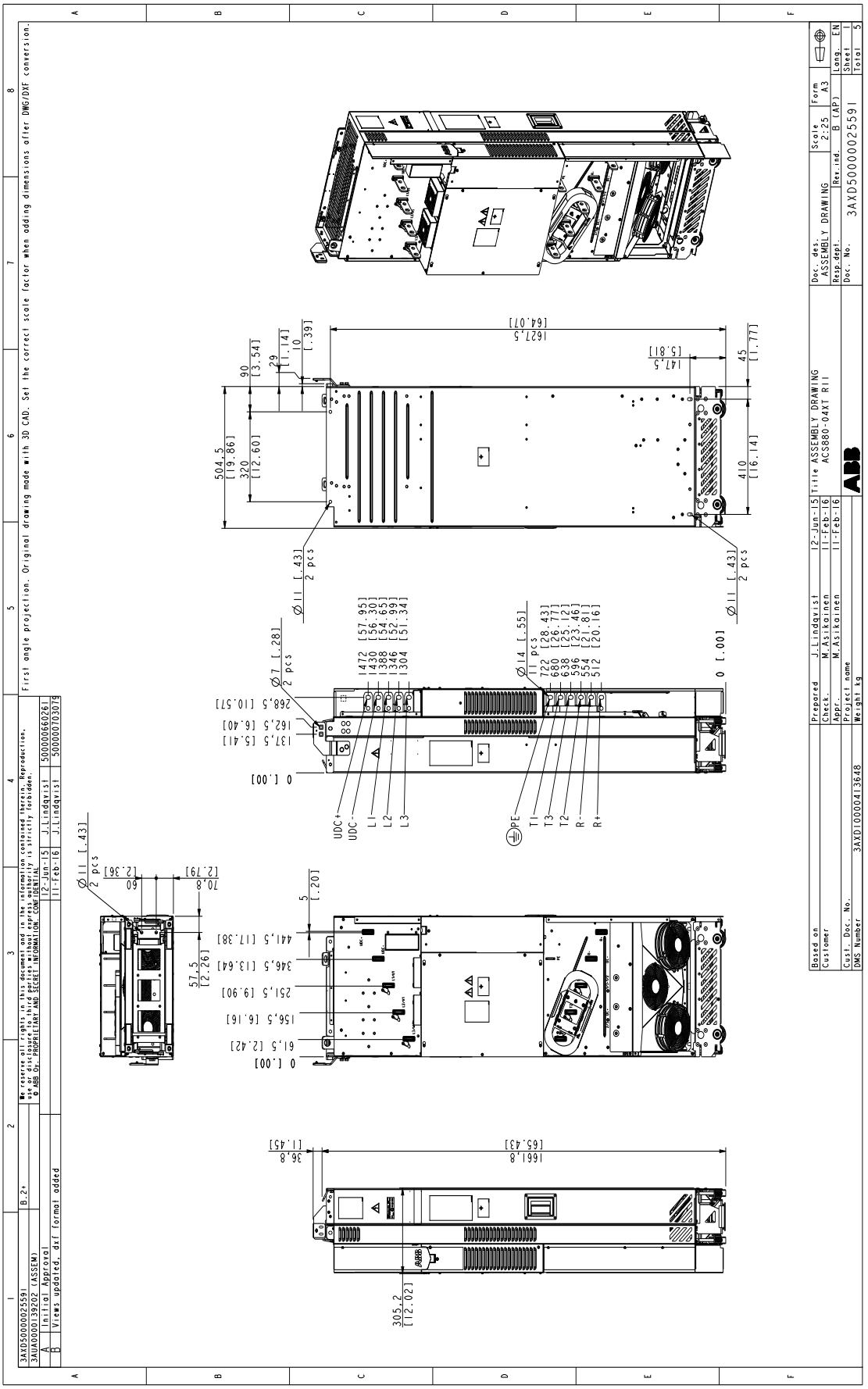
R10 with option “Full power cabling panels to be attached to a cabinet (IP20)” installed into a Rittal TS 8 cabinet



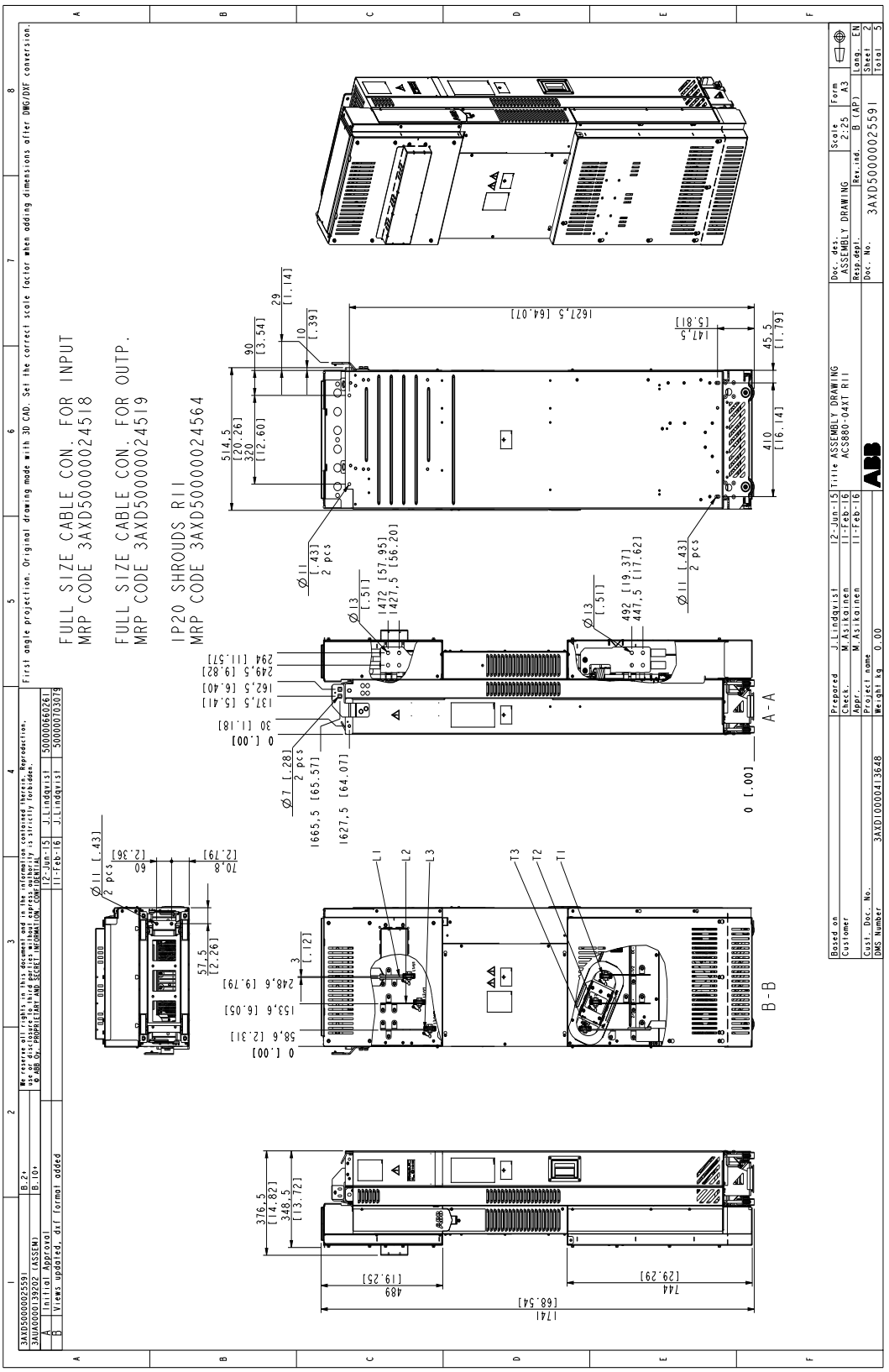
R10 with option “Flat mounting”



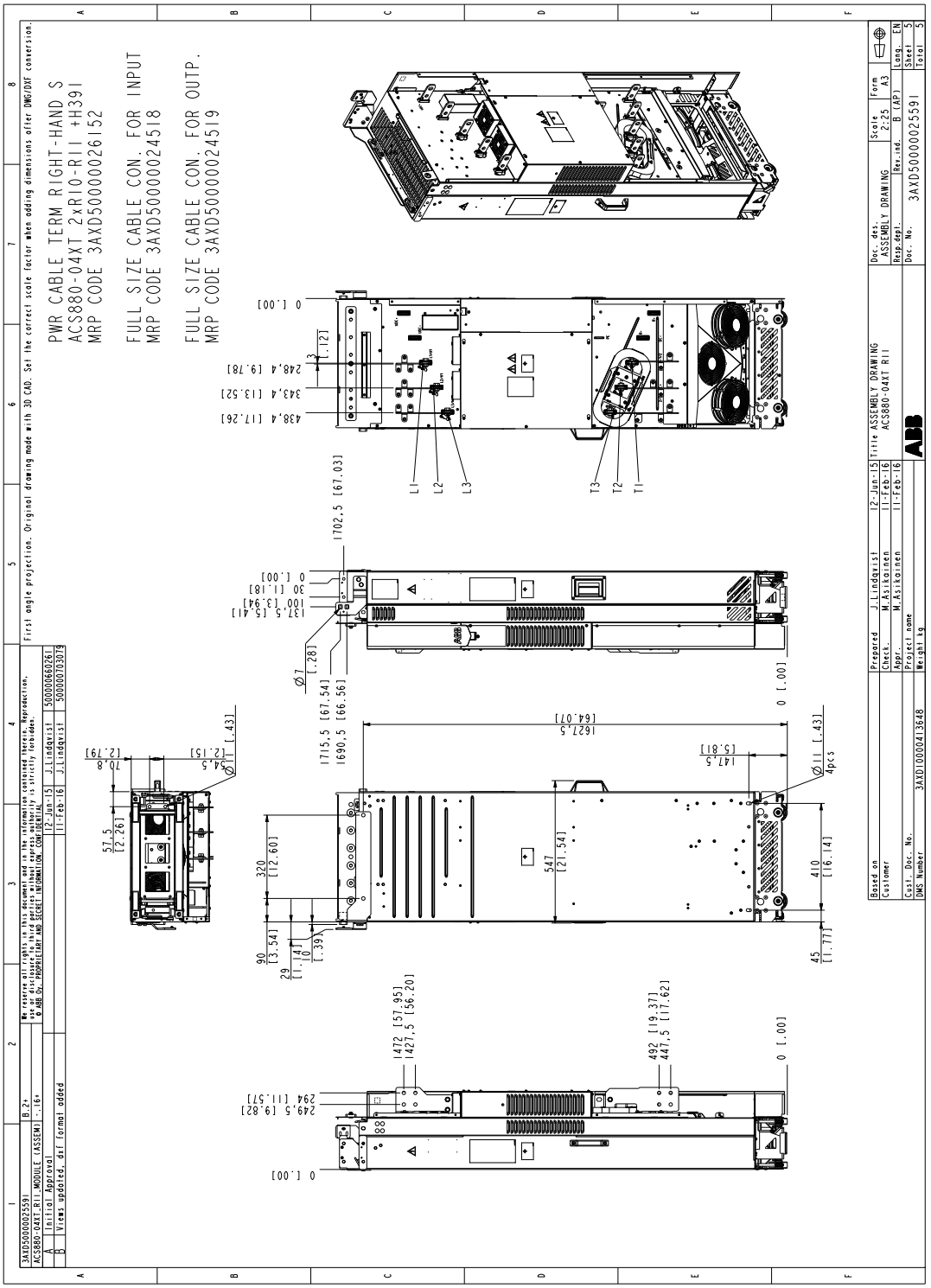
R11 with option +D150



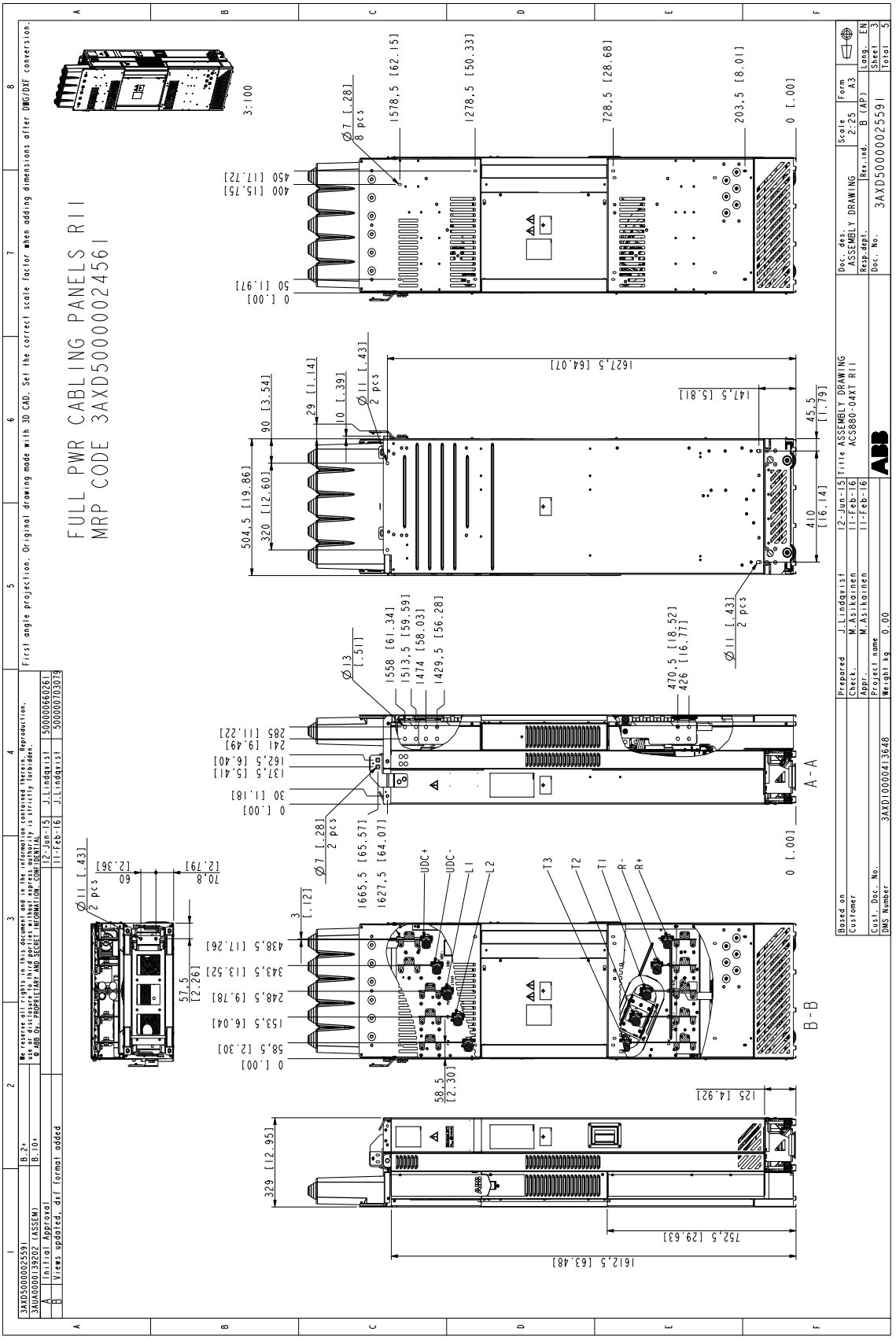
R11 with options “Full size input and output cable connection terminals and PE busbar” and “IP20 shrouds for covering the input and motor cabling area”



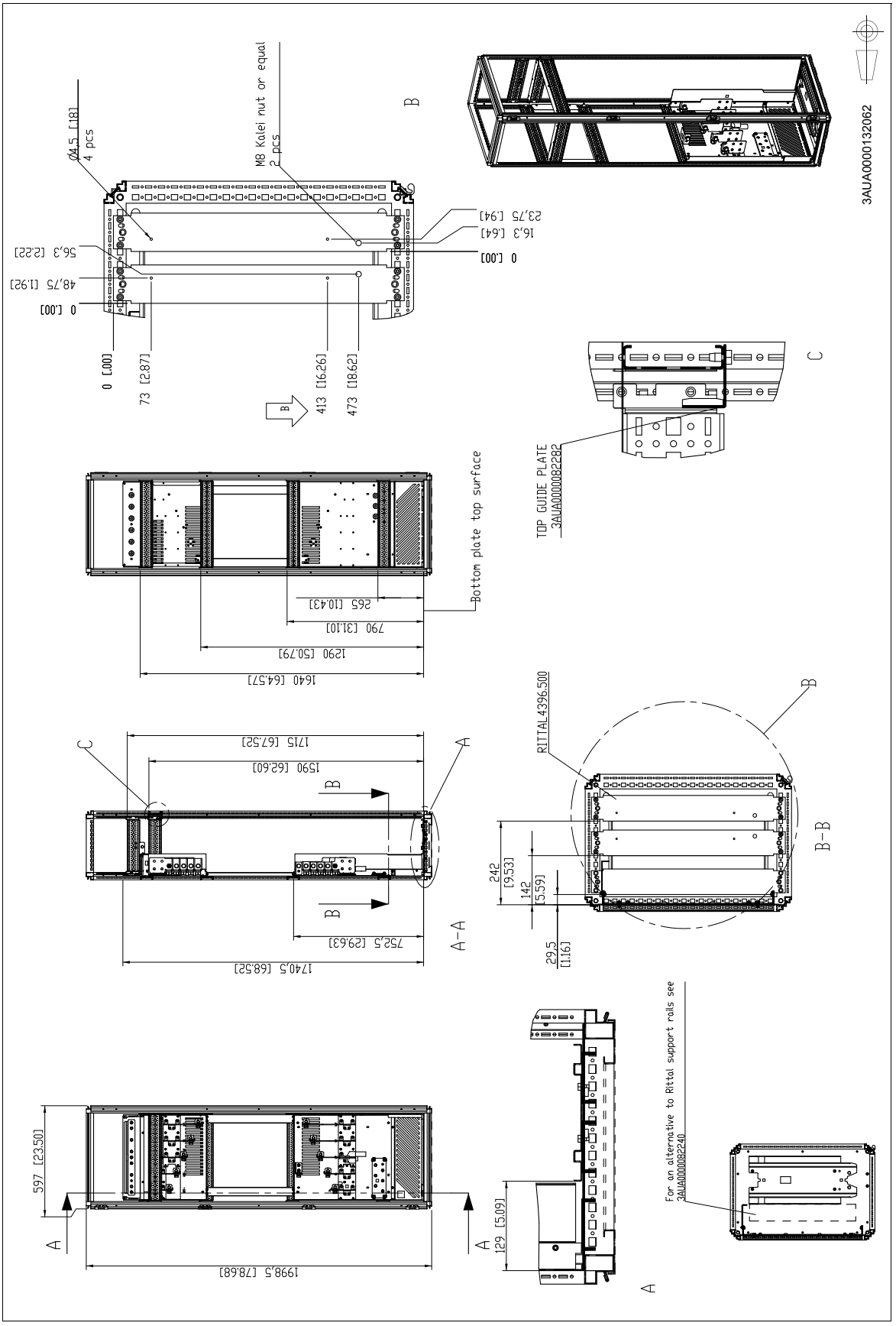
R11 with options “Full size input and output cable connection terminals and PE busbar” and “Power cable connection terminals on the right-hand side of the drive module”



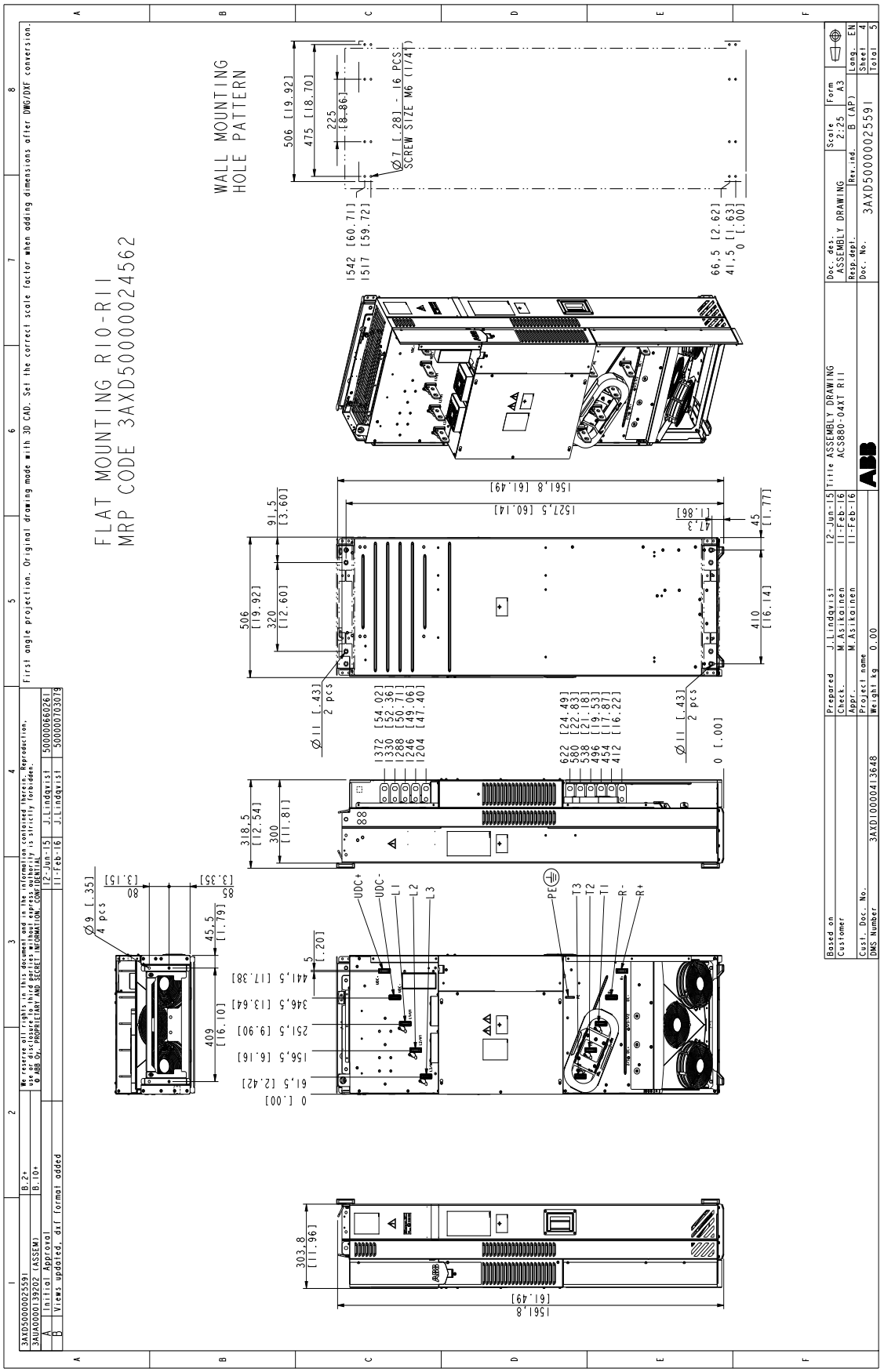
R11 with option “Full power cabling panels”



Frame R11 with option “Full power cabling panels to be attached to a cabinet (IP20) installed into a Rittal TS 8 cabinet”

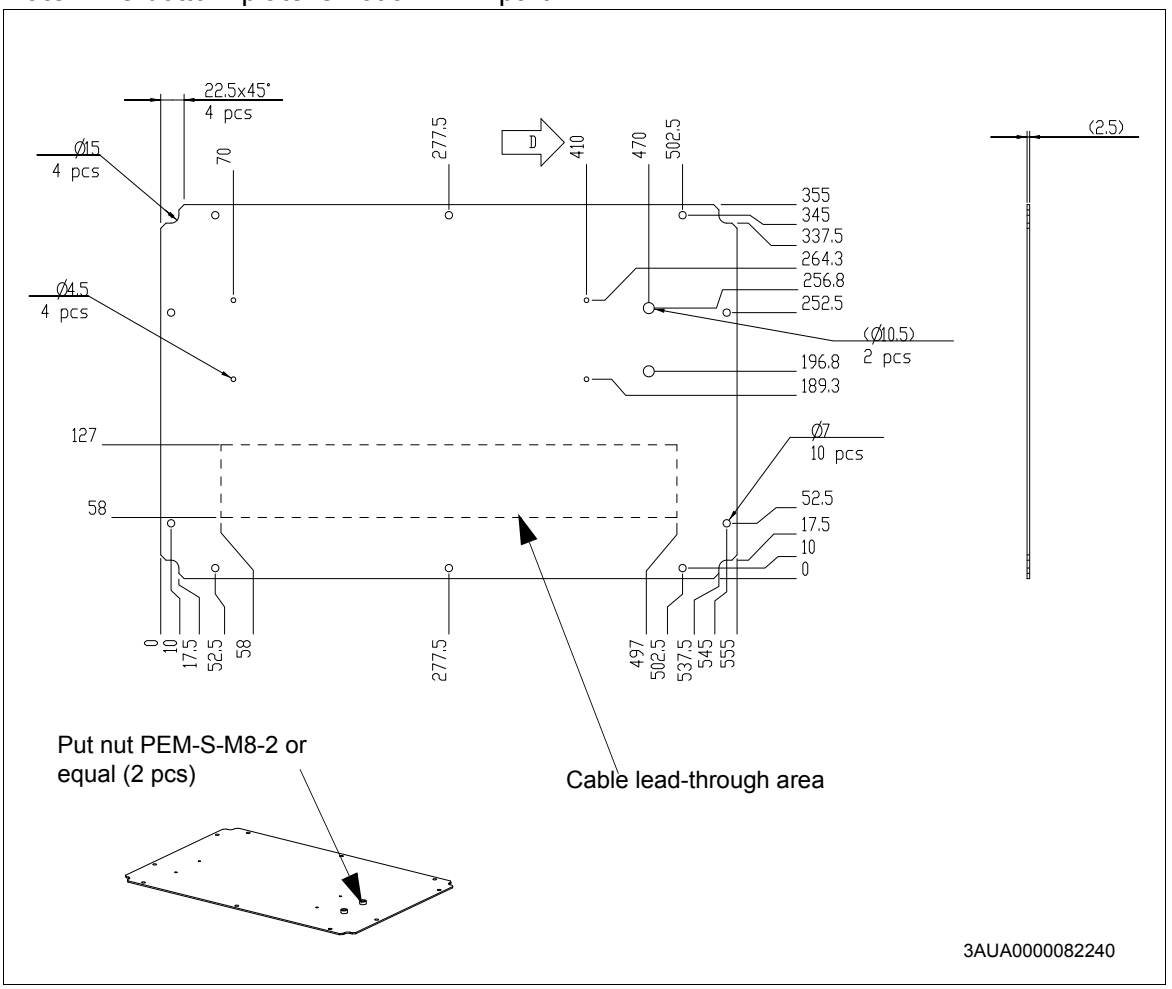


R11 with option “Flat mounting”



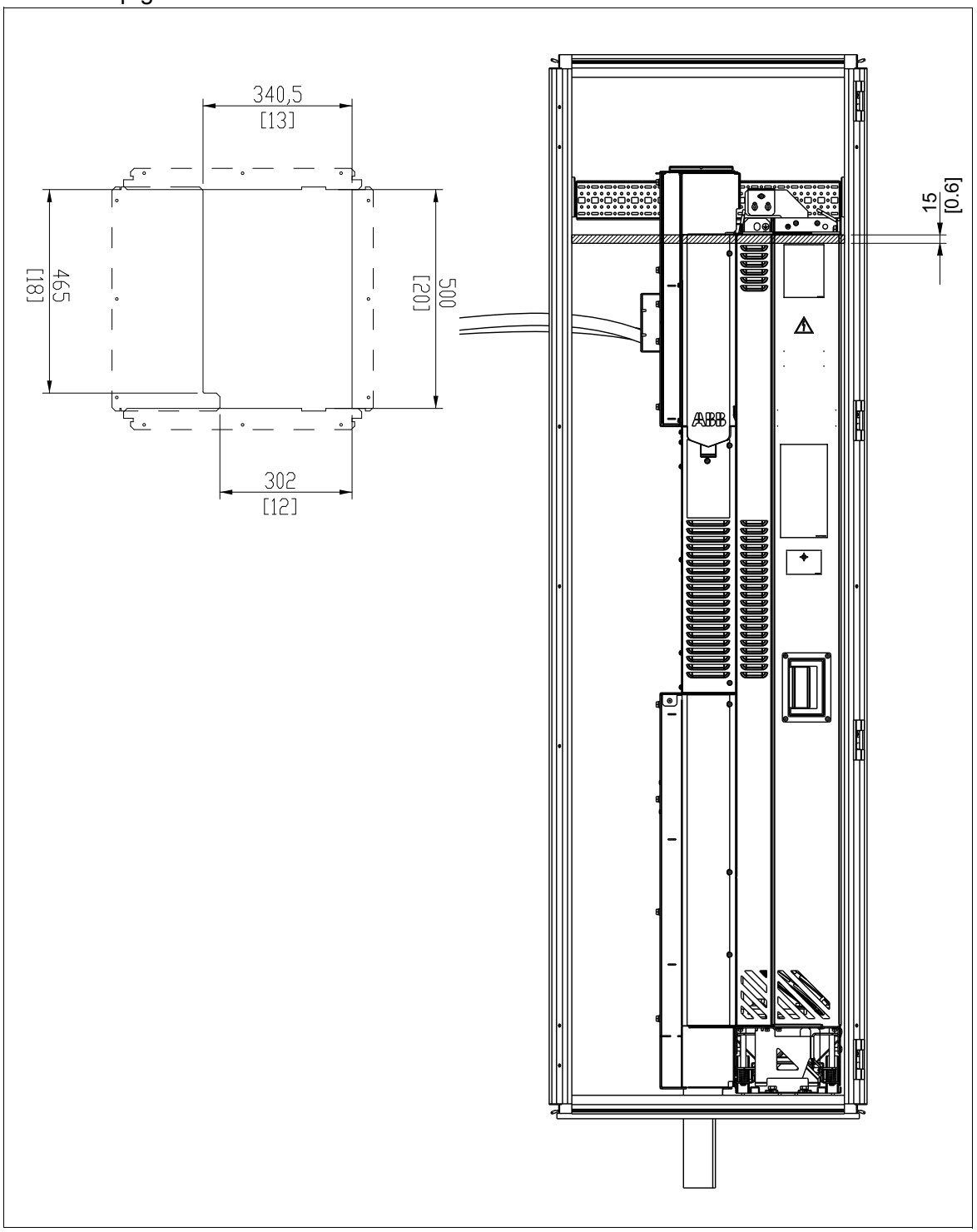
Bottom plate for option “Full power cabling panels to be attached to a cabinet (IP20)” in Rittal TS 8 400 mm wide cabinet installation

Note: The bottom plate is not an ABB part.



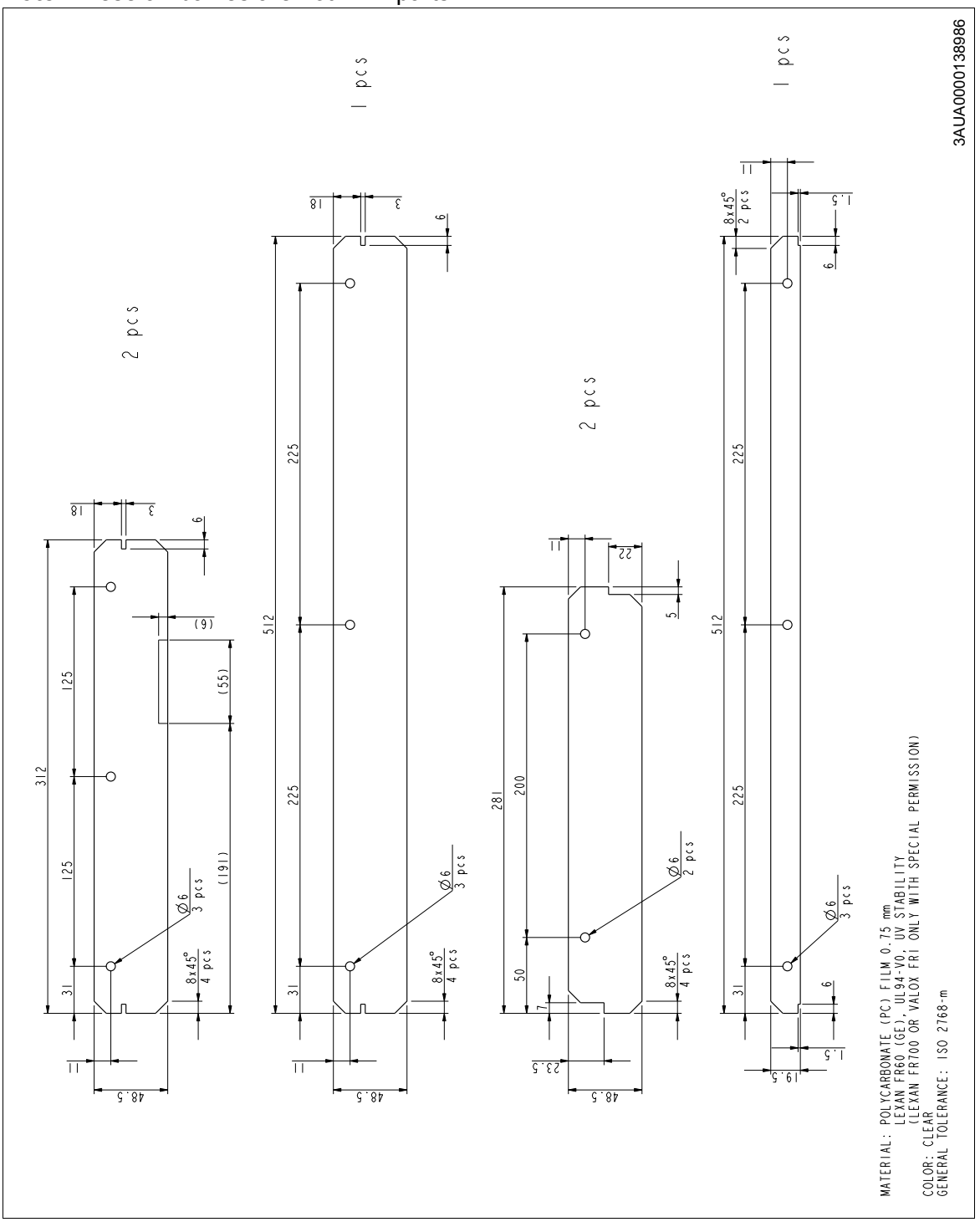
Air baffles for the drive module with options “IP20 shrouds for covering the input and motor cabling area” and “Flat mounting”

This drawing shows the dimensions of the hole in the air baffle around the drive module. The drawing also shows the correct vertical location area of the air baffle as measured from the top grill.



Air baffles for option “Full power cabling panels to be attached to a cabinet (IP20)” in Rittal TS 8 400 mm wide cabinet installation

Note: These air baffles are not ABB parts.



External control unit

See *BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English]).

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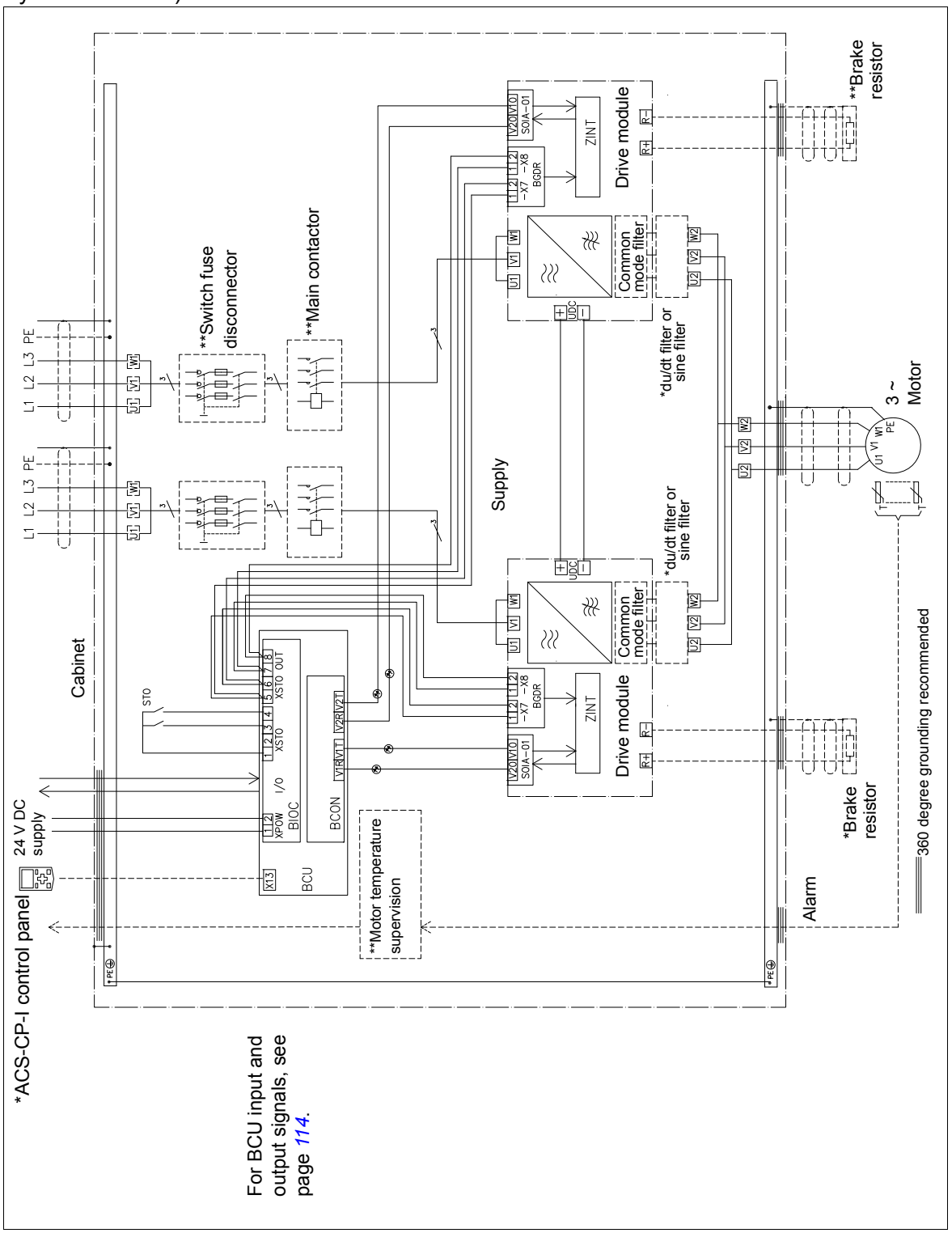
Example circuit diagram

Contents of this chapter

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

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 (* option, ** to be acquired by the customer).



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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, 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	*Safety of machinery – Electrical equipment of machines – Part 1: General requirements*
IEC 61326-3-1:2008	*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*

Standard	Name
IEC 61508-1:2010	*Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements*
IEC 61508-2:2010	*Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems*
IEC 61511:2003	*Functional safety – Safety instrumented systems for the process industry sector*
IEC/EN 61800-5-2:2007	*Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional*
EN 62061:2005 + A1:2013 IEC 62061:2005 + A1:2012	*Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*
EN ISO 13849-1:2008 + AC:2009	*Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*
EN ISO 13849-2:2012	*Safety of machinery – Safety-related parts of control systems – Part 2: Validation*

The function also corresponds to Prevention of unexpected start-up as specified by EN 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 *189*.

Wiring

The following diagrams present examples of Safe torque off wiring for

- *Drive unit (two drive modules, internal power supply)* on page *215*
- *Drive unit (two drive modules, external power supply)* on page *216*.

See also section *Overview of power and control connections* (page *39*).

For information on the specifications of the STO input, see *BCU-02/12/22 control units hardware manual* (3AUA0000113605 [English]).

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 *80*).

Maximum cable lengths:

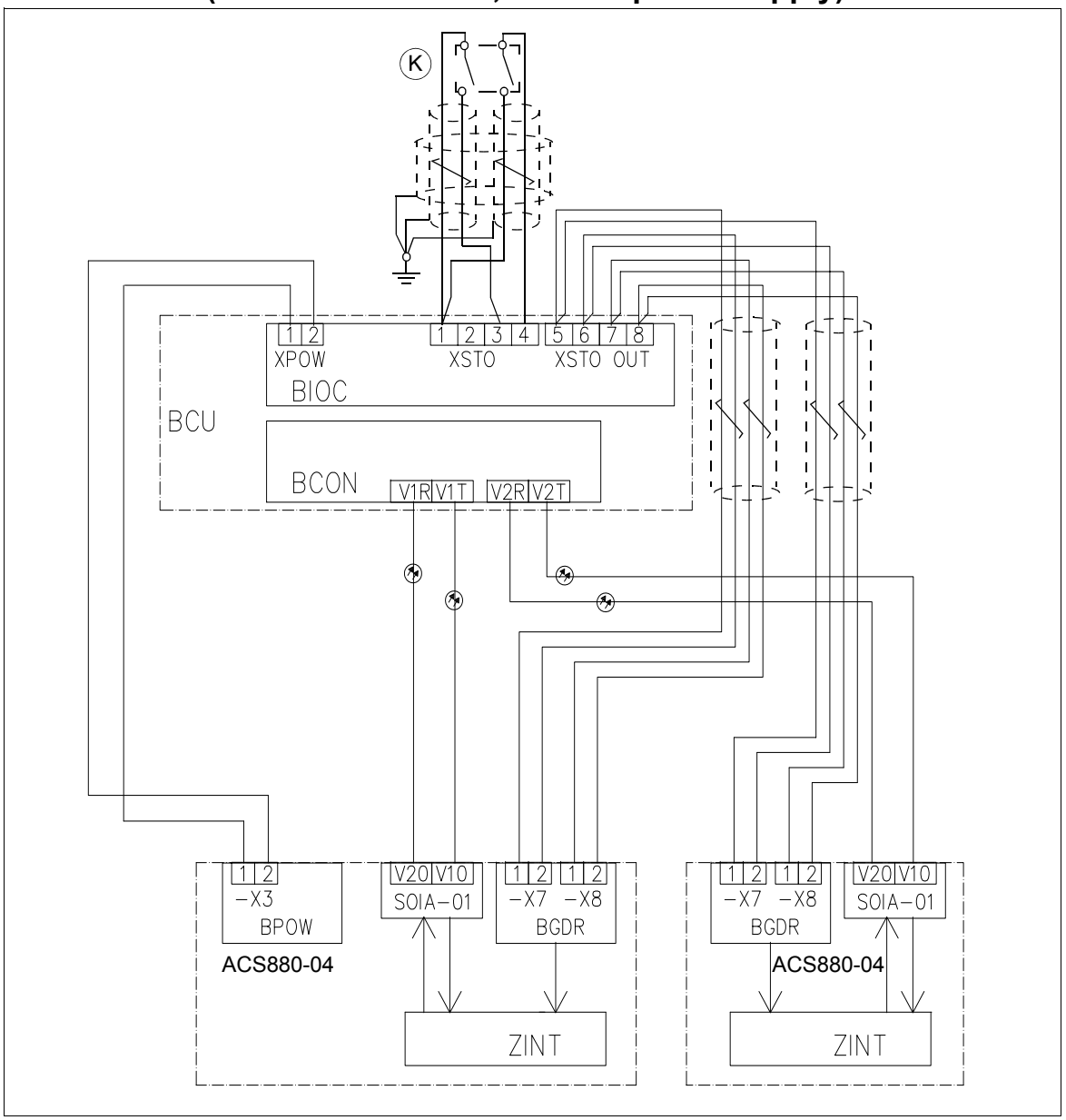
- 30 m (100 ft) between activation switch [K] and drive control unit
- 60 m (200 ft) between multiple drives
- 60 m (200 ft) between external power supply and first drive.

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

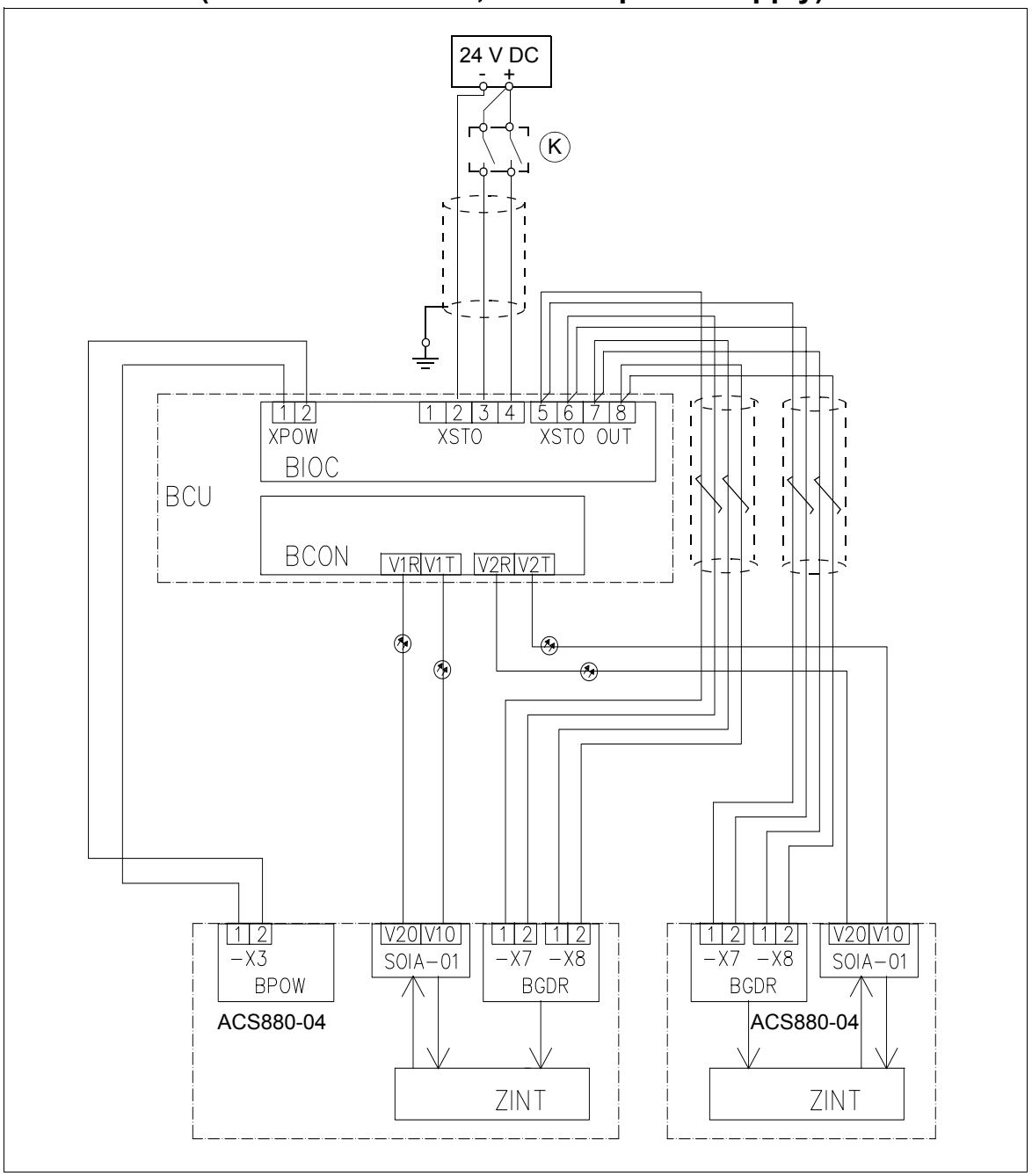
Grounding of protective shields

- 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.

Drive unit (two drive modules, internal power supply)



Drive unit (two drive modules, 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	☑
WARNING! Obey the safety instructions in chapter *Safety instructions.* If you ignore them, injury or death, or damage to the equipment can occur.	☐
Ensure that the drive can be run and stopped freely during start-up.	☐
Stop the drive (if running), switch the input power off and isolate the drive from the power line by a disconnector.	☐
Check the Safe torque off circuit connections against the wiring diagram.	☐
Close the disconnector and switch the power on.	☐
Test the operation of the STO function when the motor is stopped. • Give a stop command for the drive (if running) and wait until the motor shaft is at a standstill. Ensure that the drive operates as follows: • 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.	☐

Action	☑
Test the operation of the STO function when the motor is running. • 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.	☐
Document and sign the acceptance test report which verifies that the safety function is safe and accepted for operation.	☐

Use

1. Open the activation switch, or activate the safety functionality that is wired to the STO connection.
2. 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 *217*).

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 *217*.

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 (T_1 = 20 a) (1/h)	HFT	SFF (%)	Lifetime (Years)	PFD (T_1 = 2 a)
2×R10, 2×R11	3	3	1.17E-10	1	>99	20	1.03E-06

Frame size	EN/ISO 13849-1					IEC 62061	IEC 61511
	PL	CCF (%)	$MTTF_d$ (Years)	DC* (%)	Cat.	SILCL	SIL
2×R10, 2×R11	e	65	16210	≥90	3	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 $\triangle T$ = 71.66 °C
  - 1340 on/off cycles per year with $\triangle T$ = 61.66 °C
  - 30 on/off cycles per year with $\triangle T$ = 10.0 °C
  - 32 °C board temperature at 2.0% of time
  - 60 °C board temperature at 1.5% of time
  - 85 °C board temperature at 2.3% of time
- The STO is a type 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	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 *219* on page *219*.

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 dive 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 227. 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 *227*:

   $$R \geq R_{min}$$

   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.

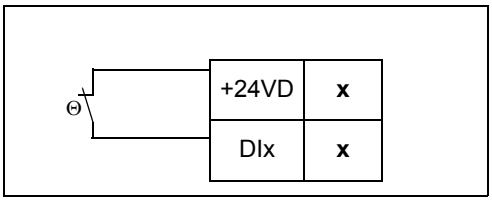
Protecting the system against thermal overload

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 *99*.

Connection diagram

See section *Power cable connection diagram example (6-pulse)* on page *105*.

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 endsConnect resistor cables to the R+ and R- terminals of both drive modules 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.
  Note: It is not possible to use only one brake chopper in the drive module package, brake resistors must be connected to both drive modules.
- Connect the thermal switch of the brake resistor as described in section *Protecting the system against thermal overload* on page *225*.

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 ACS880-04XT-	Drive module type ACS8880-04-	Internal brake chopper per drive module		Example brake resistor(s) per drive module			
		P_{brcont}	R_{min}	Type	R	E_R	P_{Rcont}
		kW	ohm		ohm	kJ	kW
U_N = 400 V							
1190A-3	650A-3+P943	315	1.3	2xSAFUR200F500	1.35	10800	27
1610A-3	880A-3+P943	400	0.7	3xSAFUR200F500	0.90	16200	40
U_N = 500 V							
1160A-5	635A-5+P943	315	1.3	2xSAFUR200F500	1.35	10800	27
1610A-5	880A-5+P943	400	0.7	3xSAFUR200F500	0.90	16200	40
U_N = 690 V							
0810A-7	430A-7+P943	285	2.2	SAFUR200F500	2.70	3600	13
1080A-7	590A-7+P943	400	1.8	2xSAFUR125F500	2.0	7200	18
1320A-7	721A-7+P943	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

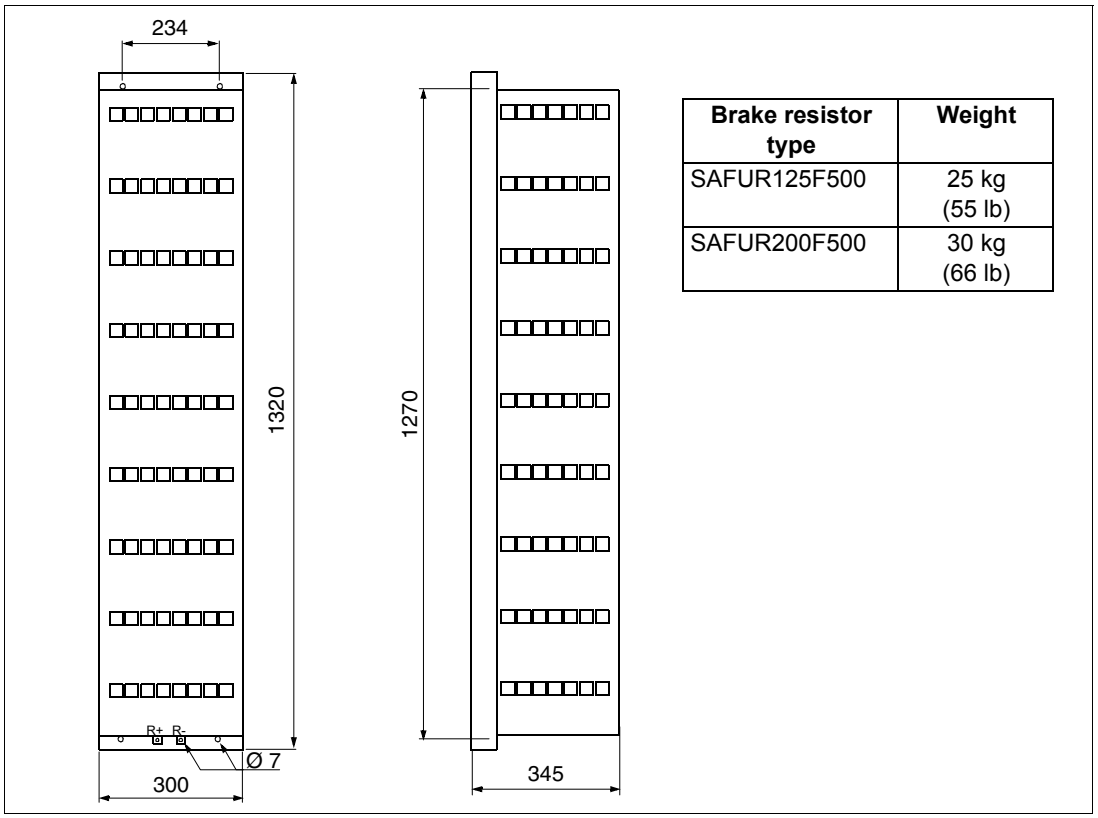
P_{Rcont} Continuous power (heat) dissipation of the resistor when placed correctly

The ratings apply at an ambient temperature of 40 °C (104 °F).

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



Brake resistor type	Weight
SAFUR125F500	25 kg (55 lb)
SAFUR200F500	30 kg (66 lb)

Ordering codes

Brake resistor type	ABB ordering code
SAFUR125F500	68759285
SAFUR200F500	68759340

Terminals and cable lead-through data

See section *Terminal and lead-through data for the power cables* on page *184*.

19

d*u*/d*t* and sine filters

Contents of this chapter

This chapter describes how to select d*u*/d*t* and sine filters for the drive.

d*u*/d*t* filters

When is a d*u*/d*t* filter needed?

See section *Examining the compatibility of the motor and drive*, page *70*.

Note for drive modules with motor cable length less than 20 m (65 ft) from each drive module before connecting them together: In addition to the requirements given in section *Requirements table* on page *71*, du/dt filters are required at the outputs of the drive modules for equalization of drive module currents. See also section *Motor connection data* on page *185* for the minimum motor cable length. If there is no du/dt filter and the motor cable length from each drive module is less than 20 m (65 ft), select a motor the nominal current of which is 15% (typical value) less than the nominal current of the drive or run the motor only up to 85% of its nominal current.

Selection table

d*u*/d*t* filter types for the drive modules are given below.

Drive module type ACS880-04-	d*u*/d*t* filter type	Drive module type ACS880-04-	d*u*/d*t* filter type	Drive module type ACS880-04-	d*u*/d*t* filter type
U_N = 400 V		U_N = 500 V		U_N = 690 V	
650A-3	FOCH0610-70	635A-5	FOCH0610-70	430A-7	FOCH-0610-70
880A-3	FOCH0875-70	880A-5	FOCH0875-70	590A-7	FOCH-0610-70
-	-	-	-	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 *70*.

Selection table

Sine filter types for the drive modules are given below.

Drive module		Sine filter per drive module						
		Filter type NSIN	$I_{cont.max}$	$P_{cont.max}$	Heat dissipation *	Air flow		
						Drive	Filter	Total
Type ACS8880-04-	Frame		A	W	kW	m^3/h	m^3/h	m^3/h
U_N = 400 V								
650A-3+P943	R10	900-6	600	315	11	1200	2020	3220
880A-3+P943	R11	900-6	785	450	15	1420	1800	3220
U_N = 500 V								
635A-5+P943	R10	900-6	560	400	11	1200	2020	3220
880A-5+P943	R11	900-6	730	500	15	1420	2020	3440
U_N = 690 V								
430A-7+P943	R10	485-6	360	355	10	1200	720	1920
590A-7+P943	R11	900-6	450	400	14	1200	2020	3220
721A-7+P943	R11	900-6	550	500	15	1420	2020	3440

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* Combined value for drive and filter

Ordering codes

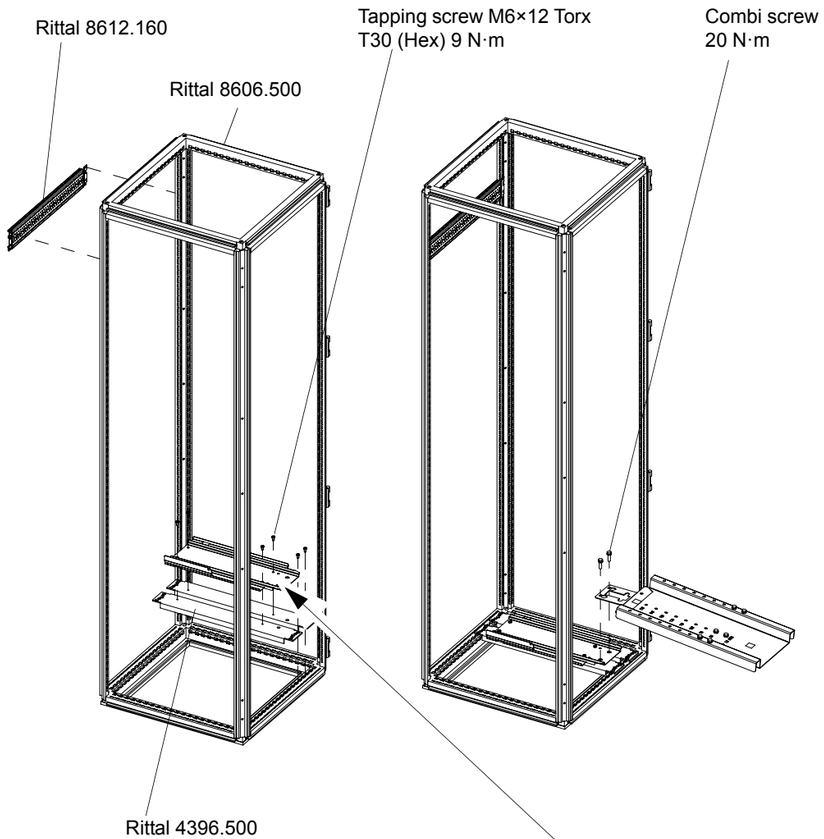
Filter type	ABB ordering code
NSIN485-6	64254936
NSIN900-6	64254961

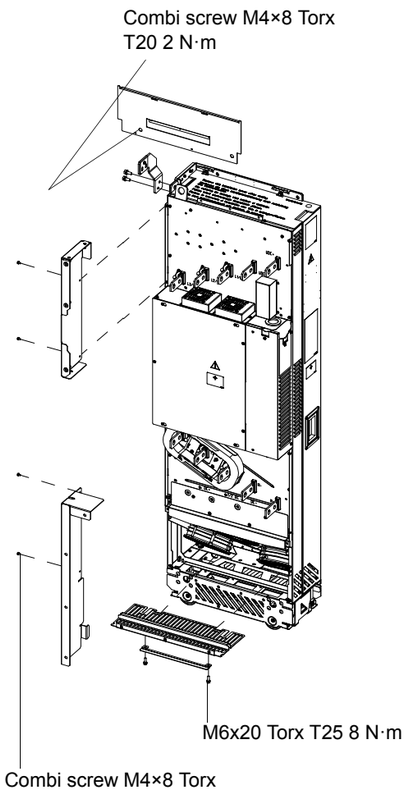
Derating

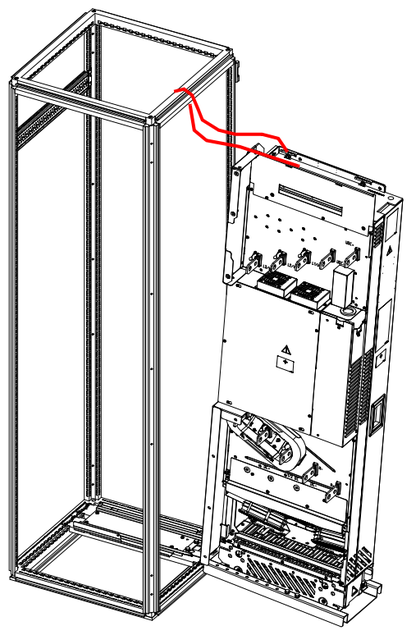
See section *Deratings for special settings in the drive control program* on page *180*.

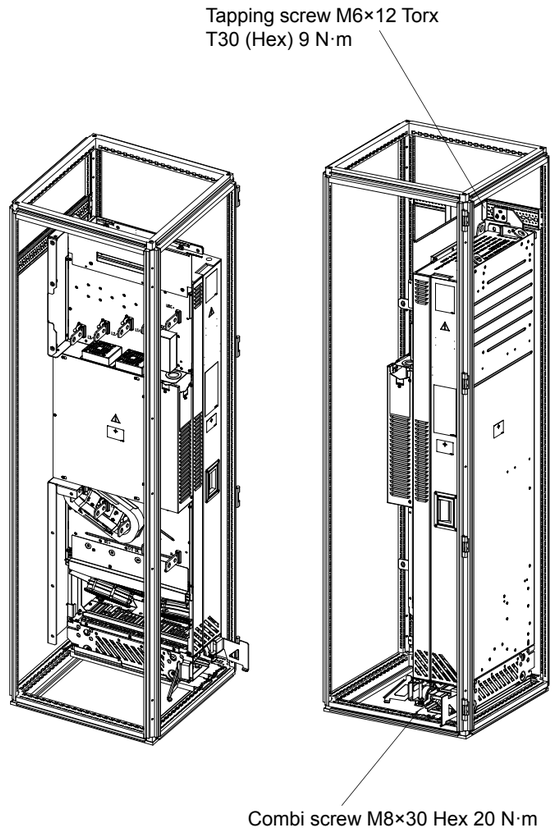
Description, installation and technical data of the sine filters

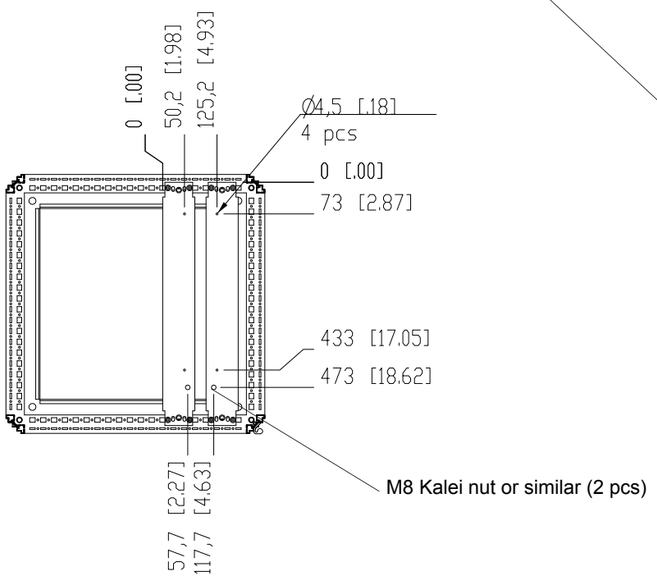
See *Sine filters hardware manual* (3AXD50000016814 [English]). For more information, contact ABB.

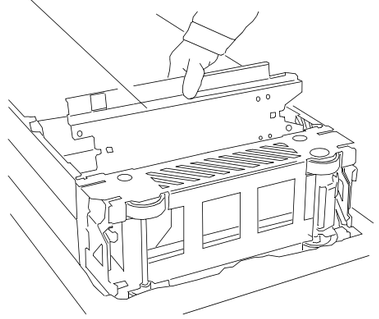

Rittal 8612.160
Rittal 8606.500
Tapping screw M6×12 Torx
T30 (Hex) 9 N·m
Combi screw M8×30 (Hex)
20 N·m
Rittal 4396.500

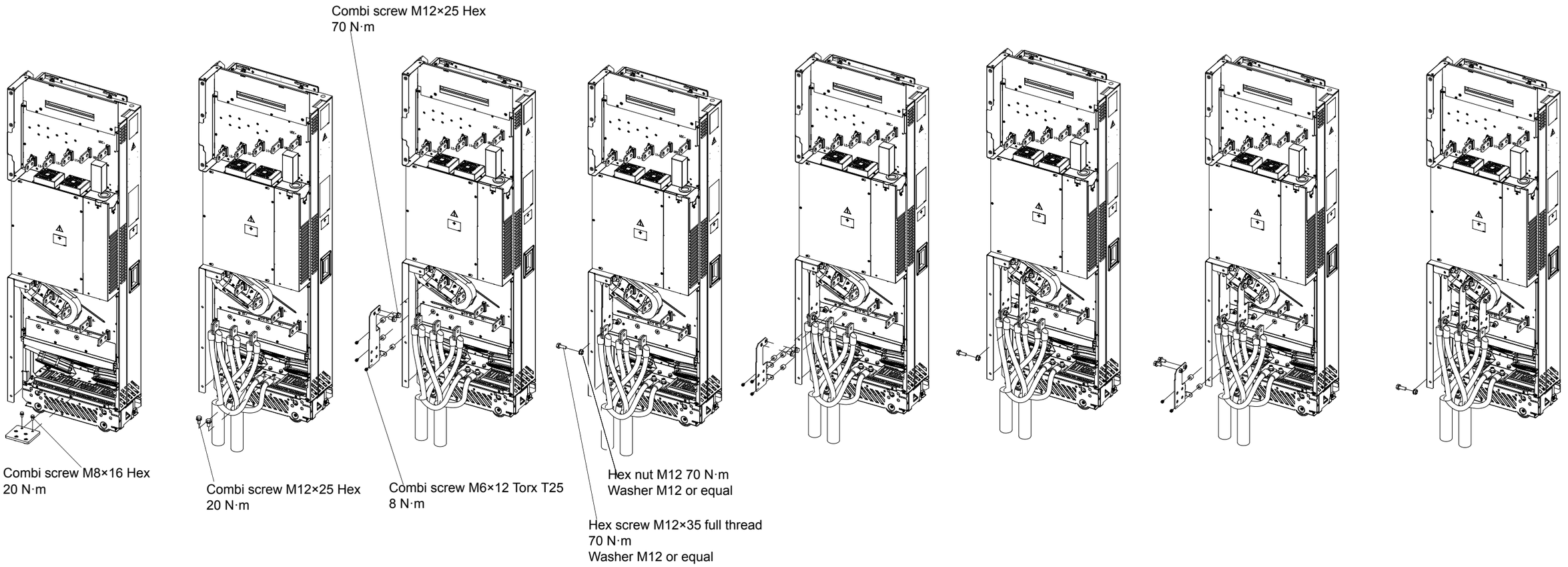

Combi screw M4×8 Torx
T20 2 N·m
M6x20 Torx T25 8 N·m
Combi screw M4×8 Torx
T20 2 N·m

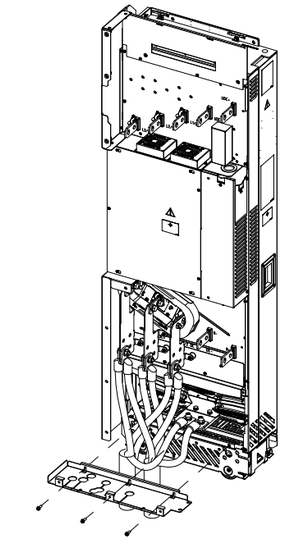



Tapping screw M6×12 Torx
T30 (Hex) 9 N·m
Combi screw M8×30 Hex 20 N·m

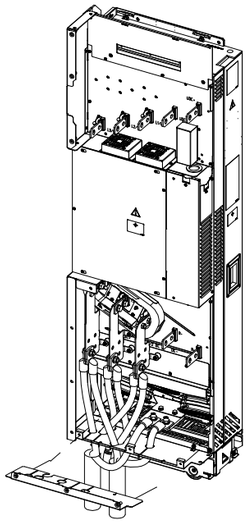

0 [.00]
50,2 [1.98]
125,2 [4.93]
Ø4,5 [.18]
4 pcs
0 [.00]
73 [2.87]
433 [17.05]
473 [18.62]
57,7 [2.27]
117,7 [4.63]
M8 Kalei nut or similar (2 pcs)

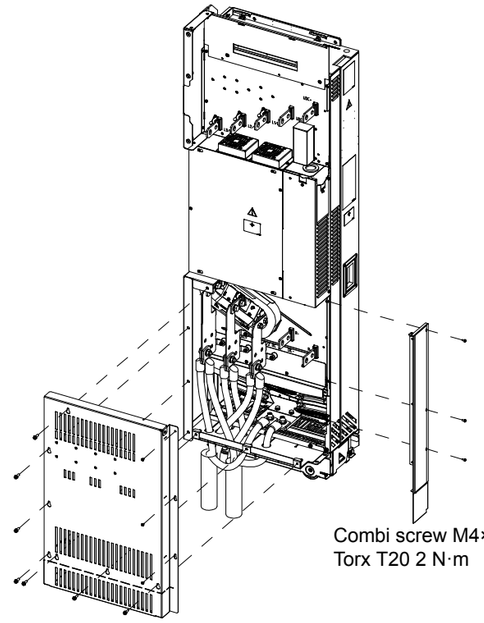



Combi screw M12×25 Hex
70 N·m
Combi screw M8×16 Hex
20 N·m
Combi screw M12×25 Hex
20 N·m
Combi screw M6×12 Torx T25
8 N·m
Hex nut M12 70 N·m
Washer M12 or equal
Hex screw M12×35 full thread
70 N·m
Washer M12 or equal



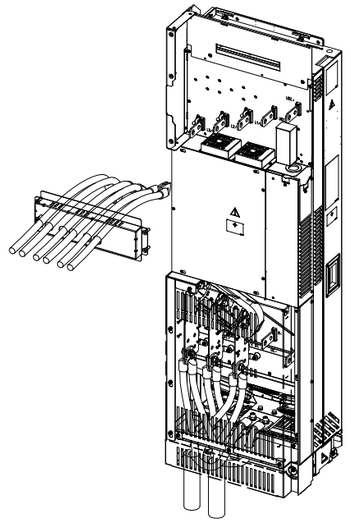
Combi screw M6×20
Torx T25 2 N·m





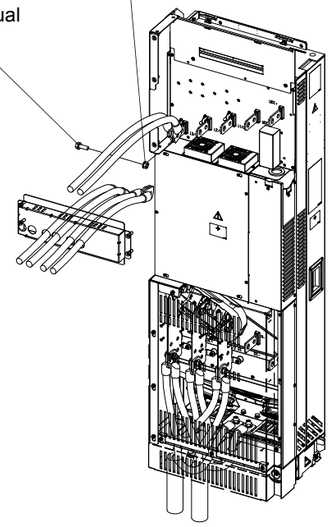
Combi screw M6×20
Torx T25 2 N·m

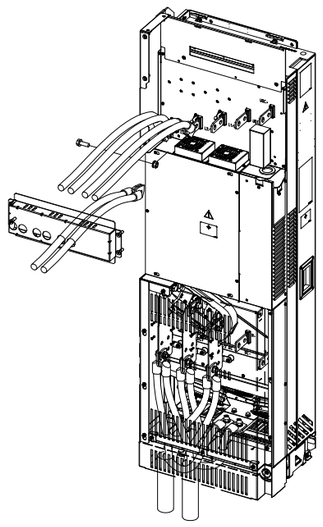
Combi screw M4×10
Torx T20 2 N·m

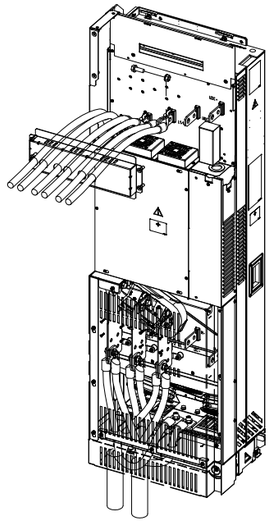


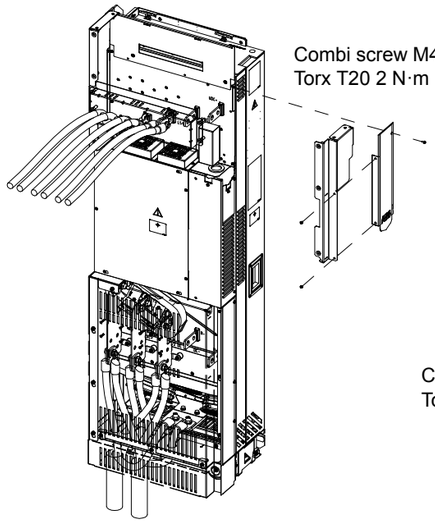
Hex screw M12×35 full thread
70 N·m
Washer M12 or equal

Hex nut M12 70 N·m
Washer M12 or equal

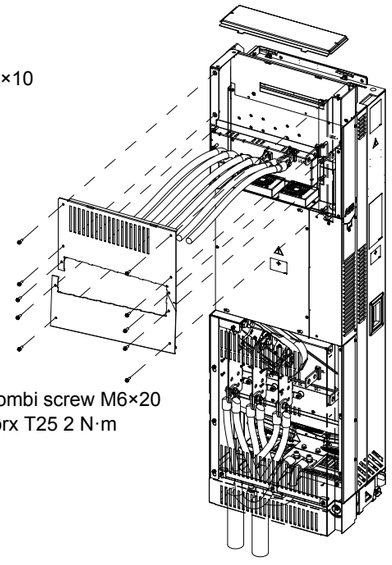




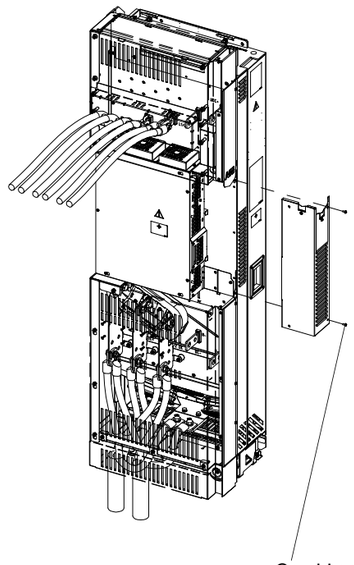




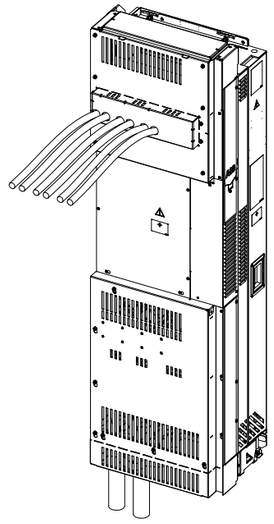
Combi screw M4×10
Torx T20 2 N·m

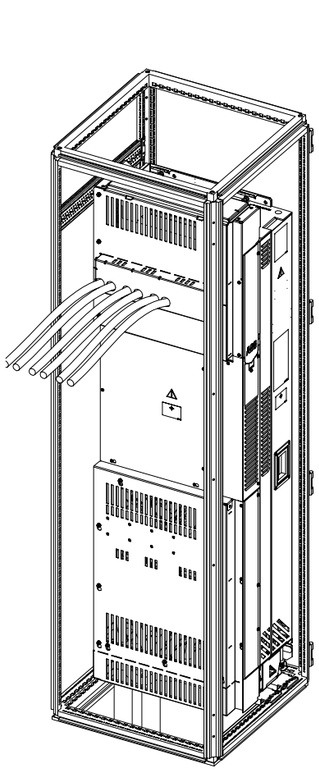


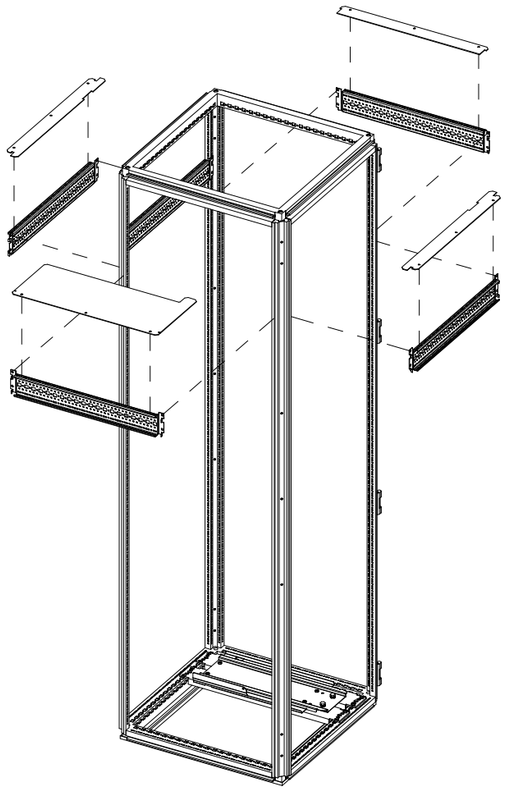
Combi screw M6×20
Torx T25 2 N·m

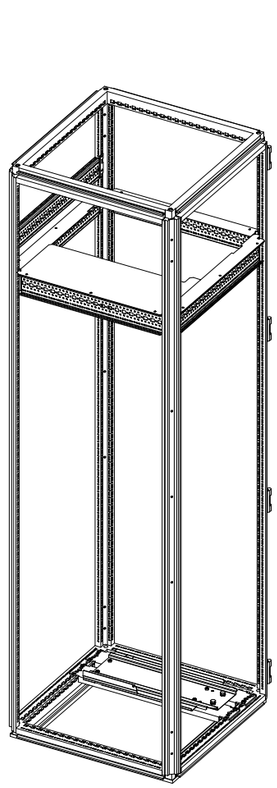


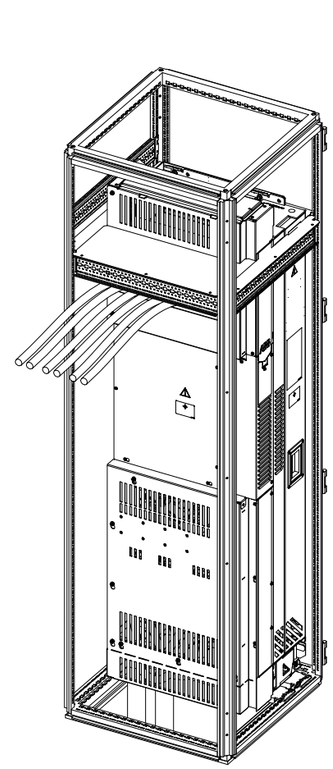
Combi screw M4×8 Torx T20
2 N·m











Step-by-step drawings for installing full cabling panels (option) in a Rittal TS 8 400 mm wide cabinet

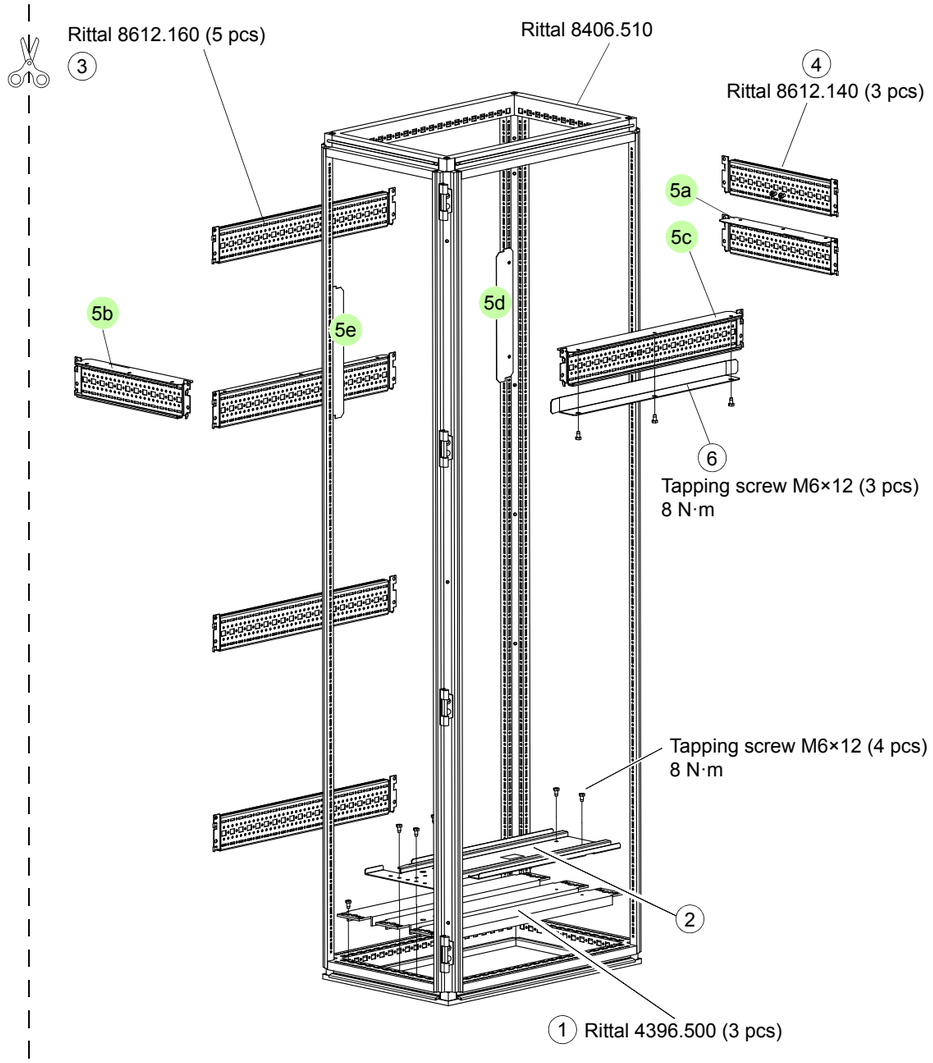


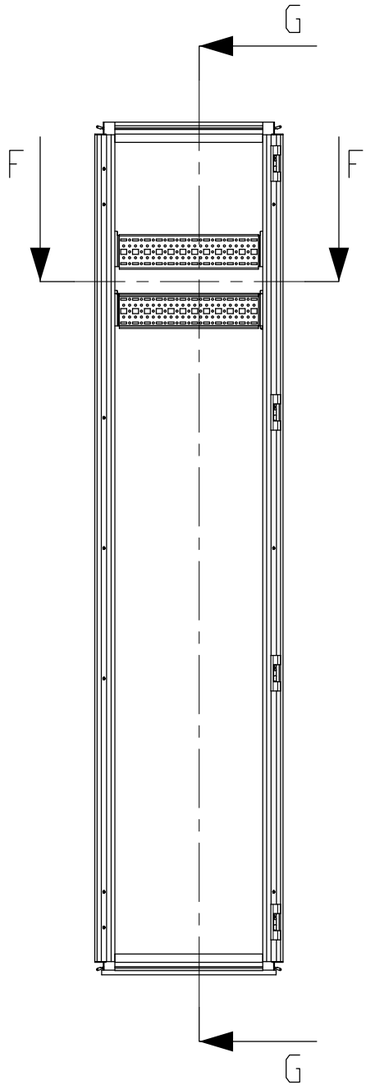
ABB parts	
2	Pedestal guide plate
6	Top guide plate
Customer-made parts (not ABB or Rittal products)	
5	Air baffle

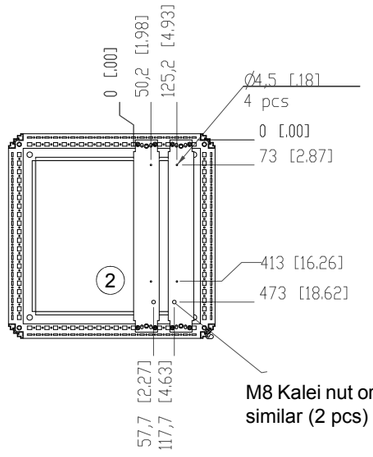
Installation procedure

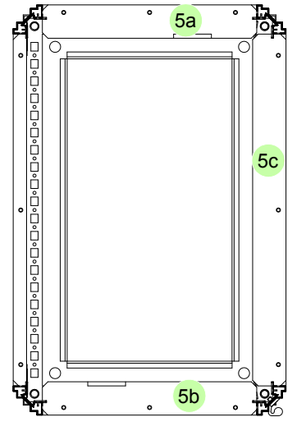
See the dimension drawing on page *207* (frame R10) or page *214* (frame R11) for the positions of the parts to be installed. See page *218* for the dimensions of the air baffles.

1. Install three Rittal support rails (TS 4396.500) on the bottom of the cabinet.
2. Install the pedestal guide onto the support rails.
3. Install the Rittal punched sections TS 8612.160 (5 pcs).
4. Install the Rittal punched sections TS8612.140 (3 pcs).
5. Install the air baffles.
6. Install the top guide plate.

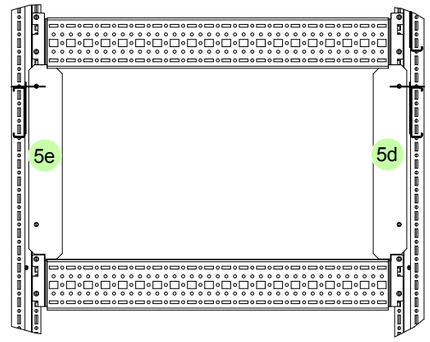
Go to step 7 on the next page.







F - F



G - G

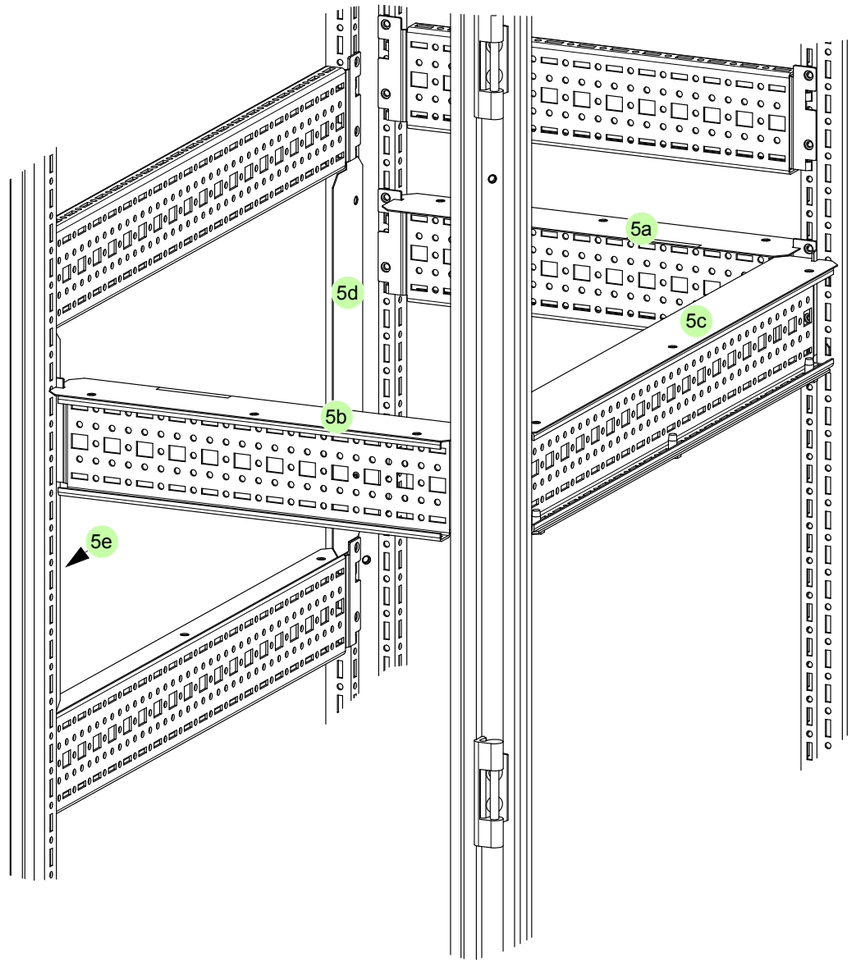


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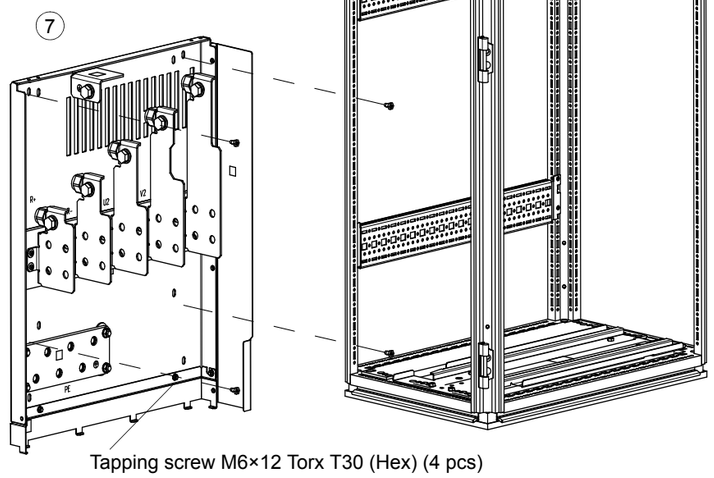
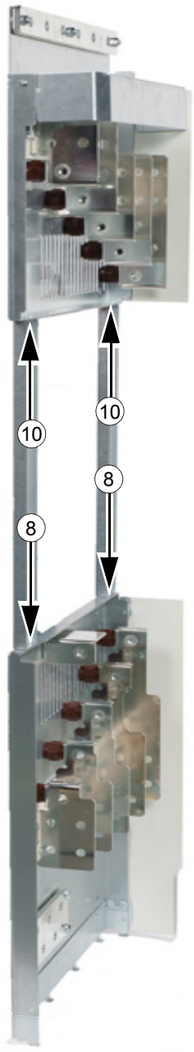
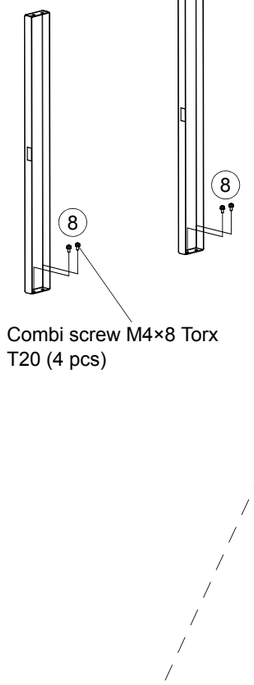
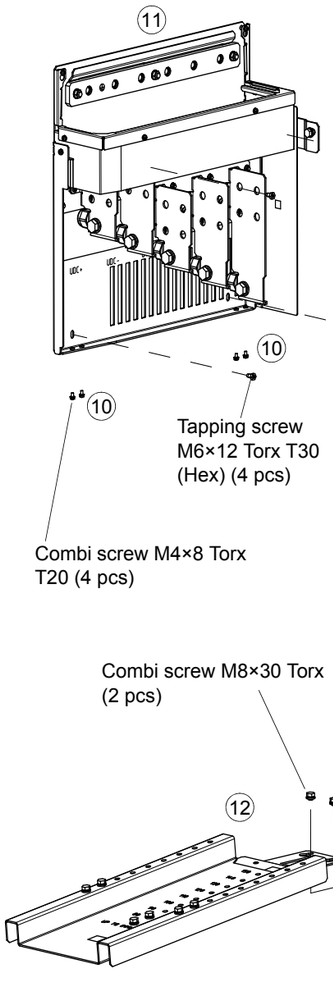
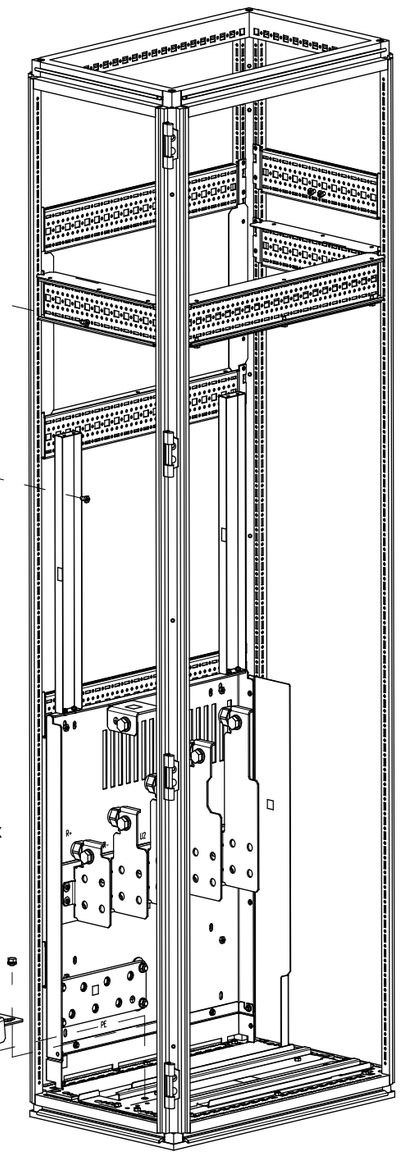
ABB parts	
7	Output cabling panel
8	Side guide (2 pcs)
11	Input cabling panel
12	Telescopic extraction and insertion ramp





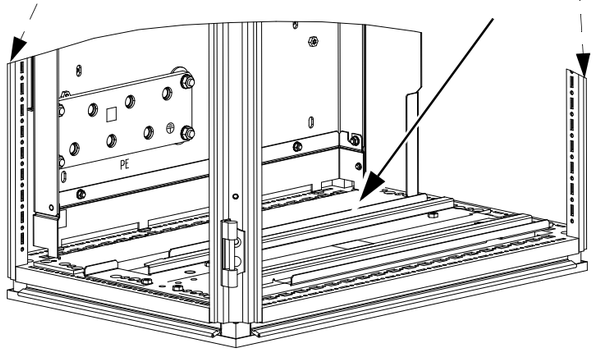


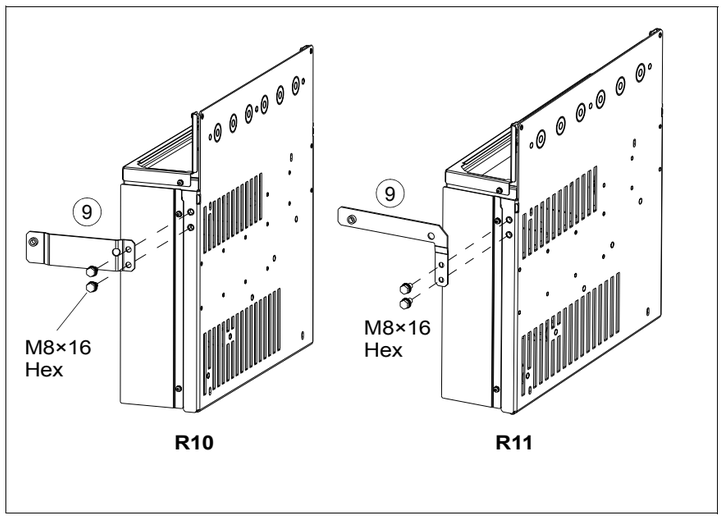


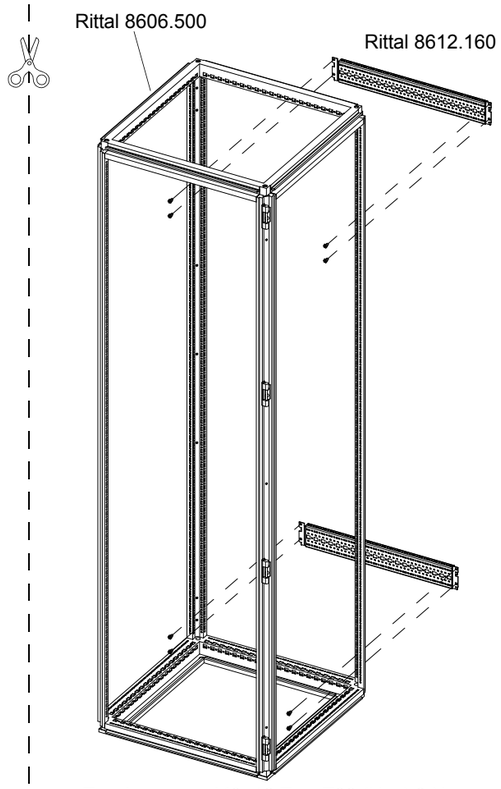


1. Install the output cabling panel. **Note**: After you have installed the output cabling panel, you can remove the support rail that lies under the panel if there is not enough space for cables.
2. Install the side guides to the output cabling panel (2 screws for each side guide).
3. Attach the grounding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

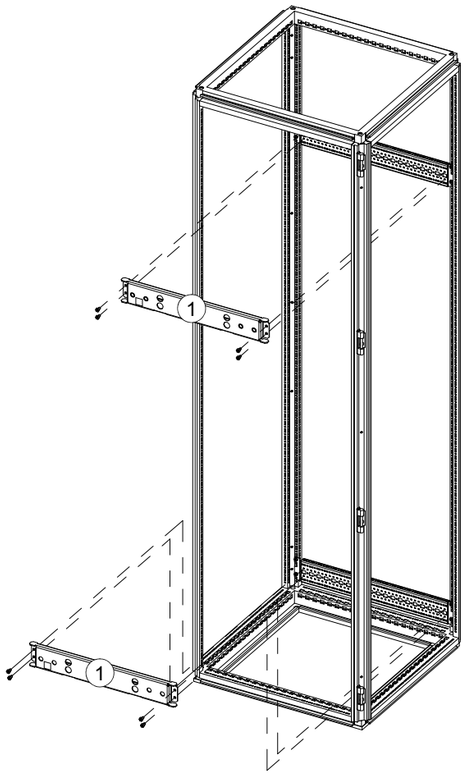
This support rail is used for setting the correct position of the cabling panels. You can remove it after the installation.



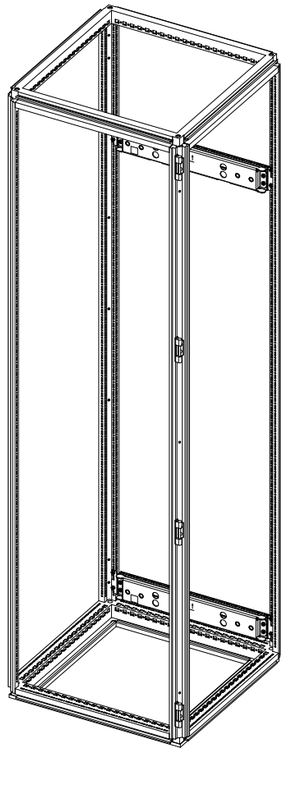


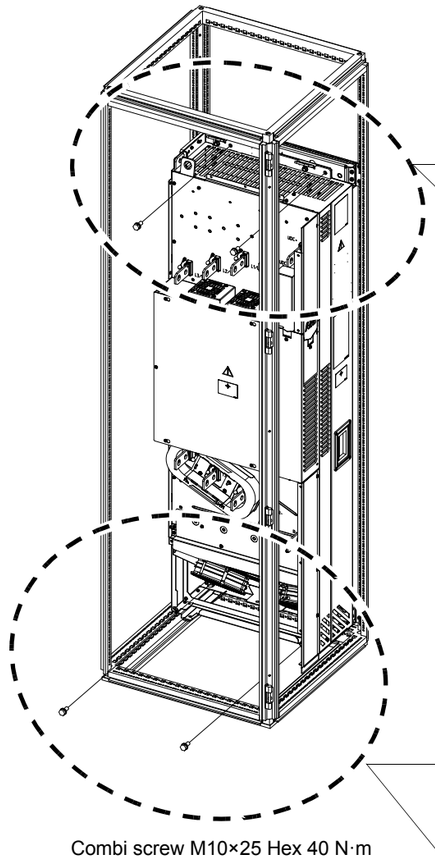


Tapping screw M6×12 Torx T30 (Hex) 9 N·m

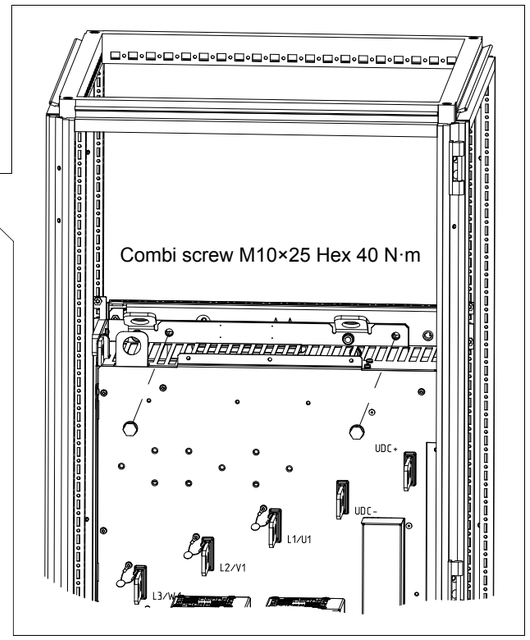


Tapping screw M6×12 Torx T30 (Hex) 9 N·m





Combi screw M10×25 Hex 40 N·m



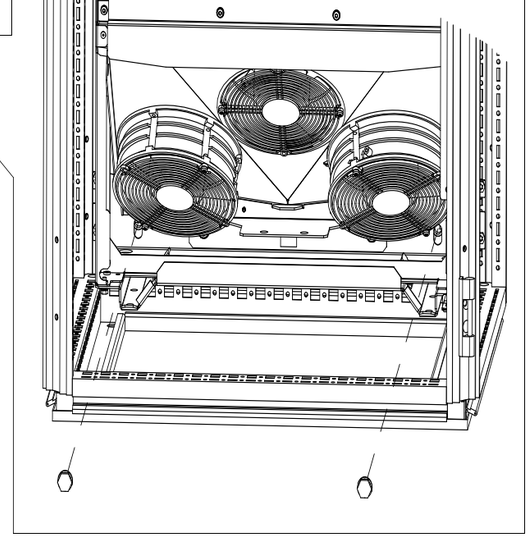
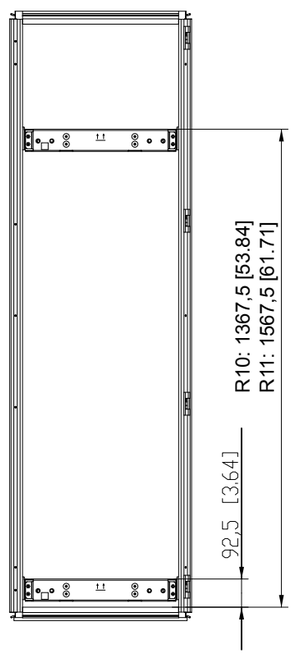
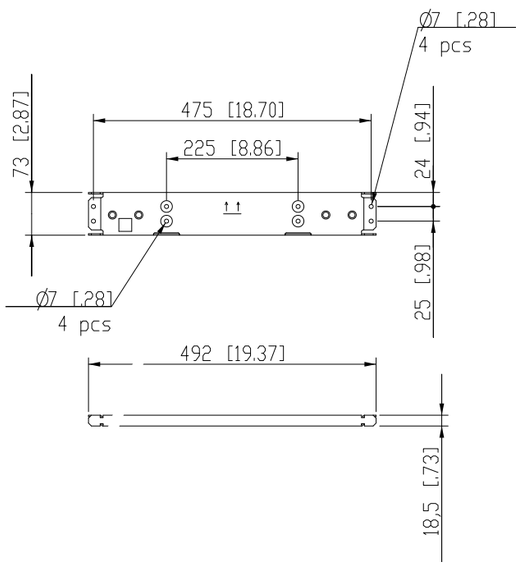
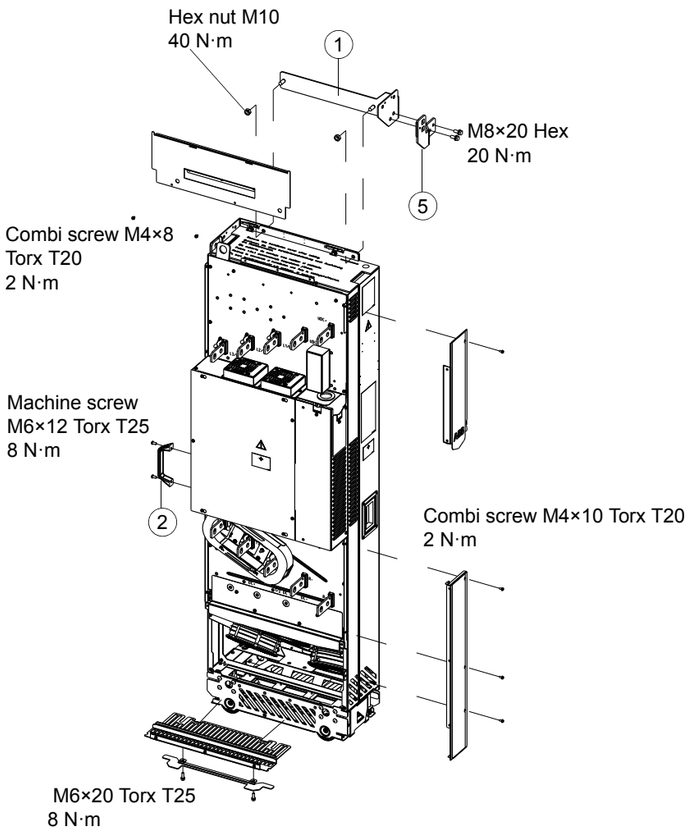
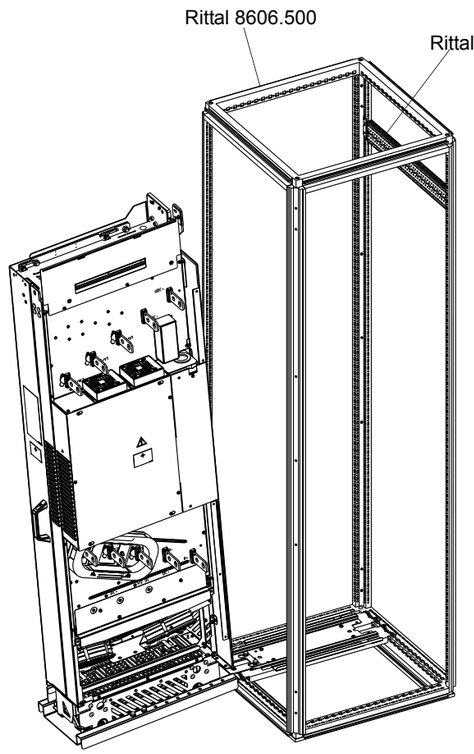


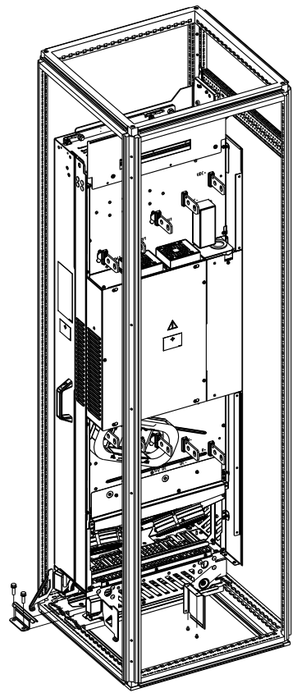
ABB parts	
1	Mounting bracket of option “Flat mounting”
-	No pedestal











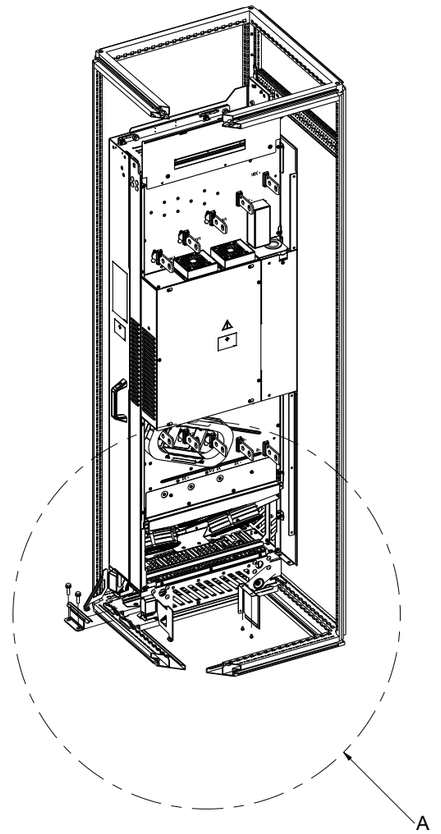
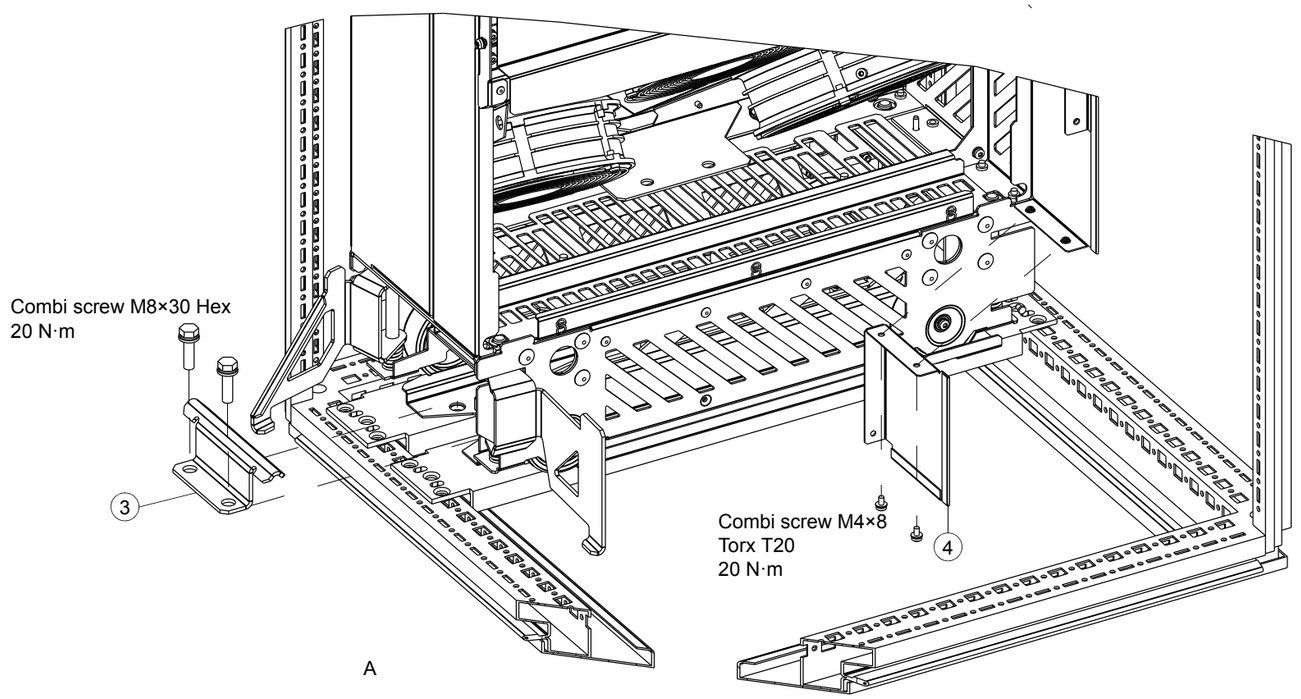


	ABB parts for option “Power cable connection terminals on the right-hand side of the drive module”
1	Support for back top mounting bracket
2	Handle
3	Bottom mounting bracket
	ABB standard parts
4	Lowest back cover plate
5	Back top mounting bracket

For cabling, see layout example on page *55*.



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.

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