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ABB INDUSTRIAL DRIVES

# ACS880-207LC IGBT supply units

## Hardware manual





# ACS880-207LC IGBT supply units

Hardware manual

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6. Start-up and operation





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*Further information*





# 1

## Introduction to the manual

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### Contents of this chapter

This chapter describes the manual. It gives information on the markings and component designations, and also the terms and abbreviations that are used in the manual. This chapter also includes a list of related manuals.

### Applicability

The manual is applicable to liquid-cooled, cabinet-installed ACS880-207LC IGBT supply units that form a part of an ACS880 multidrive system.

### Safety instructions

Follow all safety instructions delivered with the drive.

- Read the **complete safety instructions** before you install, commission, use or service the drive. The complete safety instructions are given in *ACS880 liquid-cooled multidrive cabinets and modules safety instructions* (3AXD50000048633 [English]).
- Read the **software-function-specific warnings and notes** before changing the default settings of a function. For each function, the warnings and notes are given in the section describing the related user-adjustable parameters.
- Read the **task-specific safety instructions** before starting the task. See the section describing the task.

### Target audience

This manual is intended for people who plan the installation, install, start up and service the drive, or create instructions for the end user of the drive concerning the installation and maintenance of the drive.

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

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

## Purpose of the manual

This manual helps in installing, commissioning, using and maintaining a multidrive with an IGBT supply unit.

## Categorization by frame size and option code

Some instructions and technical data which concern only certain unit or frame sizes are marked with the size identifier. The frame size indicates the number of power modules that form the supply unit.

The unit size can be identified from the basic code visible on the type designation label, for example, ACS880-207LC-4360A-7 where 4360A is the unit size. The option codes of the unit are listed after the plus sign. Section [Type designation key \(page 31\)](#) explains the type designation code in detail. The frame size is marked on the type designation label, and can also be determined from the type code.

The instructions and technical data which only concern certain optional selections are marked with option codes (such as +E205). The options included in the drive can be identified from the option codes visible on the type designation label. The option selections are listed in section [Type designation key \(page 31\)](#).

## Use of component designations

Some device names in the manual include the item designation in brackets, for example [Q20], to make it possible to identify the components in the circuit diagrams of the drive.

## Terms and abbreviations

Term/ Abbreviation	Description
ACS-AP-x	Assistant control panel
BCON	Type of control board
BCU	Type of control unit
Cabinet	An enclosure that consists of one or more cubicles
CIO	I/O module for controlling cabinet fans
Control board	Circuit board in which the control program runs
Control unit	Control board built in a housing (often rail-mountable)
Cubicle	One section of a cabinet-installed drive. A cubicle is typically behind a door of its own.
DC link	DC circuit between rectifier and inverter
DDCS	Distributed drives communication system protocol
DI	Digital input
Drive	Frequency converter for controlling AC motors
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
FAIO-01	Optional analog I/O extension module
FCAN	Optional CANopen® adapter module
FCNA-01	Optional ControlNet™ adapter module

<b>Term/ Abbreviation</b>	<b>Description</b>
FDIO-01	Optional digital I/O extension module
FDNA-01	Optional DeviceNet™ adapter module
FDPI	Diagnostics and panel interface board
FEA-03	Optional I/O extension adapter
FECA-01	Optional EtherCAT® adapter module
FEN-01	Optional TTL incremental encoder interface module
FENA-11	Optional Ethernet adapter module for EtherNet/IP™, Modbus TCP® and PROFINET IO® protocols
FENA-21	Optional Ethernet adapter module for EtherNet/IP™, Modbus TCP® and PROFINET IO® protocols, 2-port
FEPL-02	Optional Ethernet POWERLINK adapter module
FIO-01	Optional digital I/O extension module
FIO-11	Optional analog I/O extension module
FPBA-01	Optional PROFIBUS DP® adapter module
Frame, frame size	Physical size of the drive or power module
FSCA-01	Optional RS-485 (Modbus/RTU) adapter
FSO-12, FSO-21	Optional functional safety modules
IGBT	Insulated gate bipolar transistor
IGBT supply unit	IGBT supply module(s) under control of one control board, and related components.
Intermediate circuit	DC circuit between rectifier and inverter
Inverter unit	Inverter module(s) under control of one control board, and related components. One inverter unit typically controls one motor.
ISU	IGBT supply unit
LCL filter	Inductor-capacitor-inductor filter
Multidrive	Drive for controlling several motors which are typically coupled to the same machinery. Includes one supply unit, and one or several inverter units.
Parameter	In the drive control program, user-adjustable operation instruction to the drive, or signal measured or calculated by the drive. In some (for example fieldbus) contexts, a value that can be accessed as an object, eg, variable, constant, or signal.
PE	Protective earth (ground)
PLC	Programmable logic controller
Power module	Common term for drive module, inverter module, supply module, brake chopper module etc.
PTC	Positive temperature coefficient
RDCO-0x	DDCS communication module
STO	Safe torque off (IEC/EN 61800-5-2)

## Related documents

Manual	Code
<b>General manuals</b>	
<i>ACS880 liquid-cooled multidrive cabinets and modules safety instructions</i>	3AXD50000048633
<i>ACS880 liquid-cooled multidrive cabinets and modules electrical planning instructions</i>	3AXD50000048634
<i>ACS880 liquid-cooled multidrive cabinets mechanical installation instructions</i>	3AXD50000048635
<i>CIO-01 I/O module for distributed I/O bus control user's manual</i>	3AXD50000126880
<b>Supply unit manuals</b>	
<i>ACS880-207LC IGBT supply units hardware manual</i>	3AXD50000174782
<i>ACS880 IGBT supply control program firmware manual</i>	3AUA0000131562
<i>ACS880 multidrives, Optimal grid control (option +N8053) supplement</i>	3AXD50000220717
<i>Optimal grid control of ACS880 IGBT supply control program supplement</i>	3AXD50000164745
<b>Inverter unit manuals</b>	
<i>ACS880-107LC inverter units hardware manual</i>	3AXD50000196111
<i>ACS880 primary control program firmware manual</i>	3AUA0000085967
<i>ACS880 primary control program quick start-up guide</i>	3AUA0000098062
Manuals for application programs (Crane, Winder, etc.)	
<b>Brake unit and DC/DC converter unit manuals</b>	
<i>ACS880-607LC 1-phase brake units hardware manual</i>	3AXD50000481491
<i>ACS880 (3-phase) brake control program firmware manual</i>	3AXD50000020967
<i>ACS880-1607LC DC/DC converter units hardware manual</i>	3AXD50000431342
<i>ACS880 DC/DC converter control program firmware manual</i>	3AXD50000024671
<b>Option manuals</b>	
<i>ACS880-1007LC liquid cooling unit user's manual</i>	3AXD50000129607
<i>ACS880 +C132 marine type-approved cabinet-built drives supplement</i>	3AXD50000039629
<i>ACS-AP-x assistant control panels user's manual</i>	3AUA0000085685
<i>Drive composer start-up and maintenance PC tool user's manual</i>	3AUA0000094606
Manuals for I/O extension modules, fieldbus adapters, safety options etc.	

You can find manuals on the Internet. See [www.abb.com/drives/documents](http://www.abb.com/drives/documents). For manuals not available in the document library, contact your local ABB representative.



# Operation principle and hardware description

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## Contents of this chapter

This chapter describes the operation basics and the hardware of the IGBT supply unit (ACS880-207LC).

## Operation principle

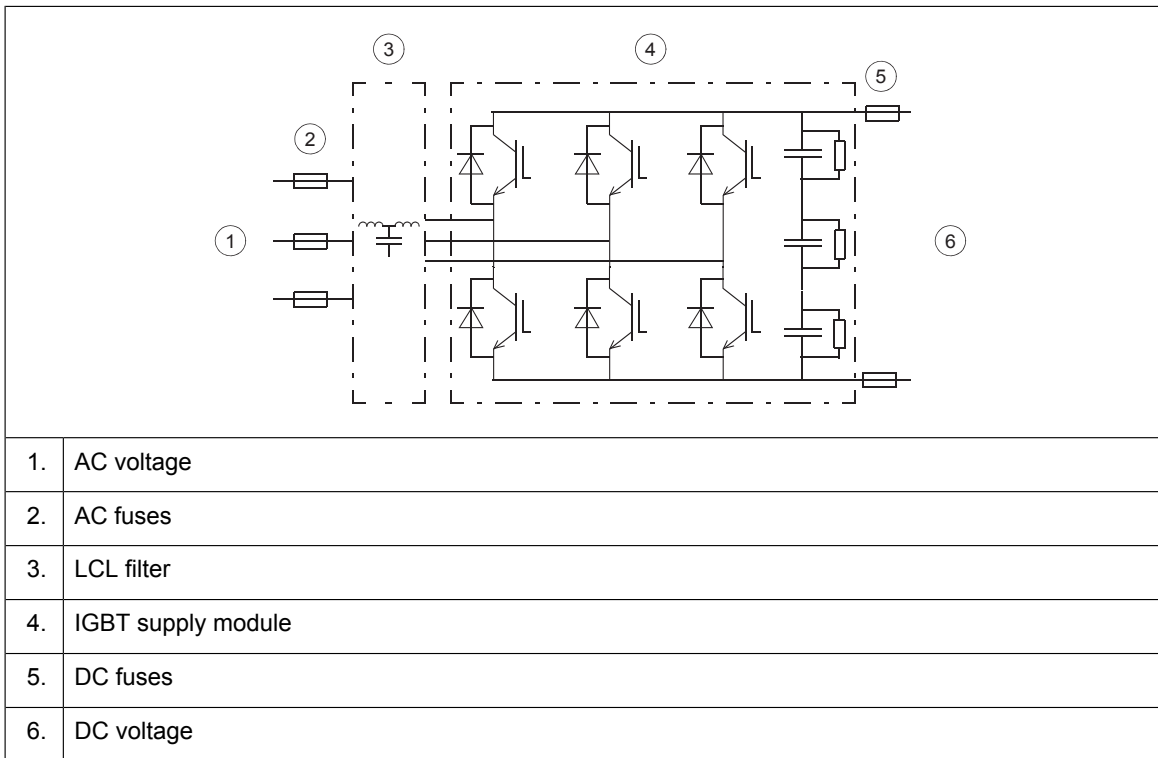
IGBT supply unit rectifies three-phase AC current to direct current for the intermediate DC link of the drive. The intermediate DC link supplies the inverters that run the motors. There can be one inverter unit only (single drives) or several inverter units (multidrives) connected to the intermediate circuit.

The LCL filter is an essential part of the IGBT supply unit. The supply module does not work without the filter. It suppresses the AC voltage distortion and current harmonics. The high AC inductance smooths the line voltage waveform distorted by the high-frequency switching of the converter. Capacitive component of the filter effectively filters the high-frequency (over 1 kHz) harmonics.

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### ■ Simplified main circuit diagram

The following figure shows the simplified main circuit diagram of the rectifier.



### ■ Charging

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

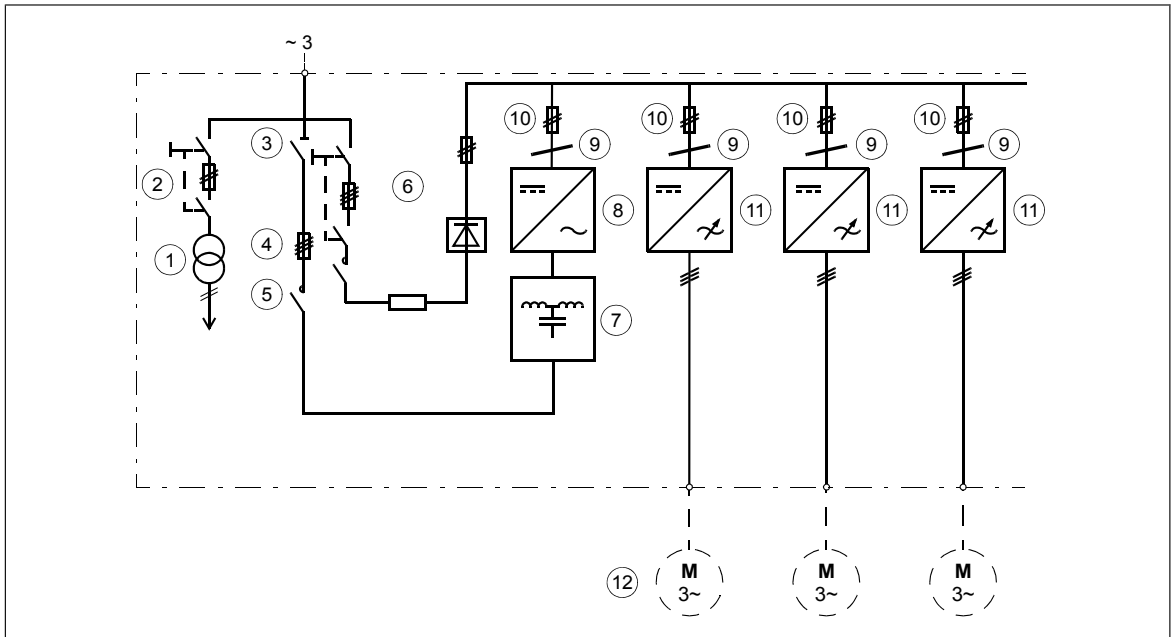
In cabinet-installed units, a resistive charging circuit consisting of fuses, a contactor and charging resistors is used. The resistive charging circuit is in use after power-up as long as DC voltage has risen to a predefined level.

The control program has a function for controlling the charging circuit. For further information, see the firmware manual.



## Overview diagram of the drive

This diagram shows a simplified diagram of a drive with IGBT supply unit and inverter unit.



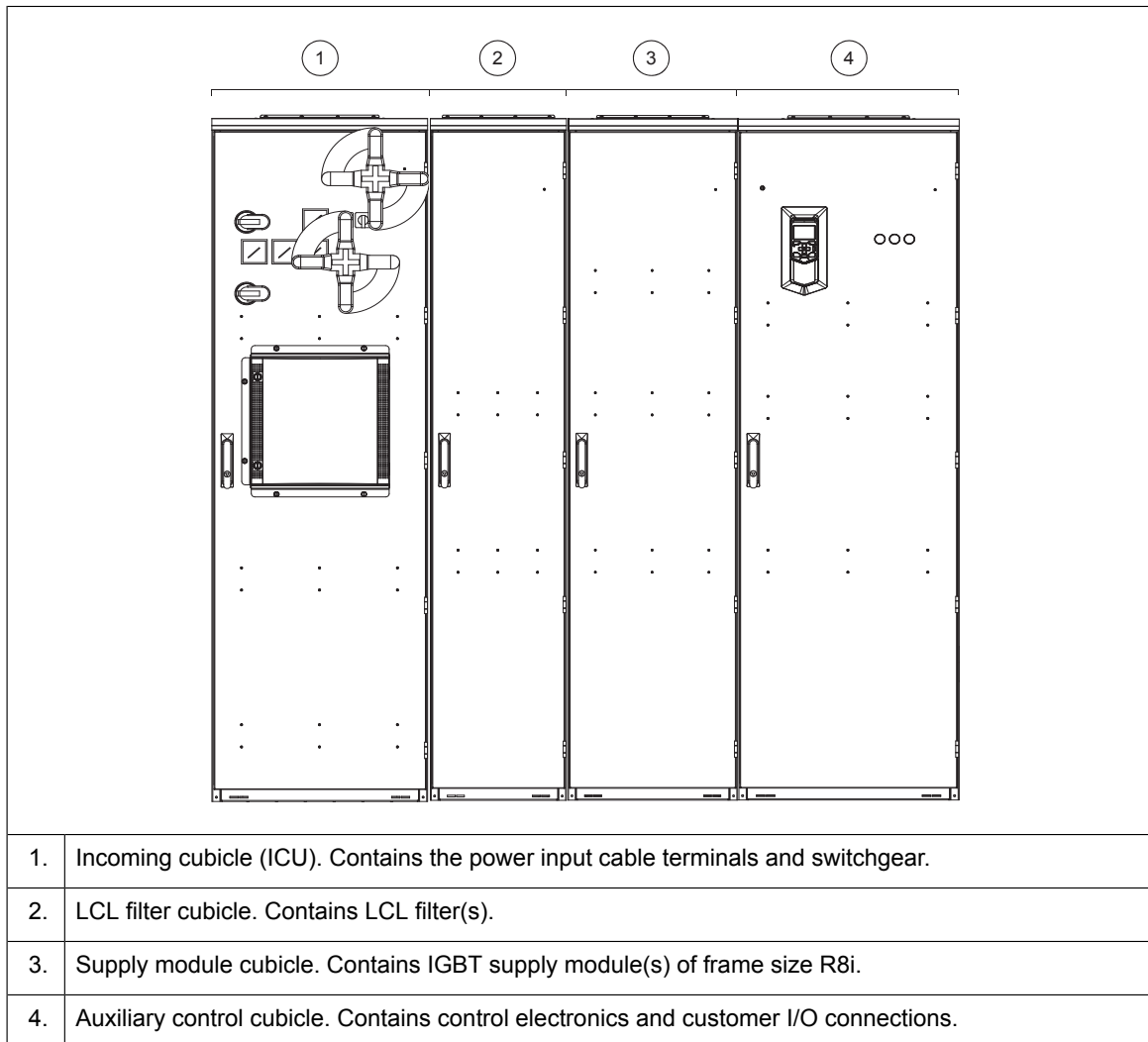
1.	Auxiliary voltage transformer ([T21], option +G344)
2.	Auxiliary voltage switch [Q21]
3.	Main switch-disconnector ([Q1], option +F253) (standard, always with +F250)
4.	AC fuses [F1]
5.	Main contactor ([Q2], option +F250) (standard, always with +F253)
6.	Charging circuit
7.	LCL filter [R03]
8.	IGBT supply module [T01]
9.	Common mode filter [R1]
10.	DC fuses [F2]
11.	Inverter modules [T11]
12.	Motor(s)

## Layout drawings

This section contains layout drawings of cubicles that are included in a supply unit. The components, layout and size of the cubicles vary depending on the supply unit size and selected options.

### ■ Supply unit

This drawing shows an example of an IGBT supply unit. Cables enter the cabinet through the bottom.



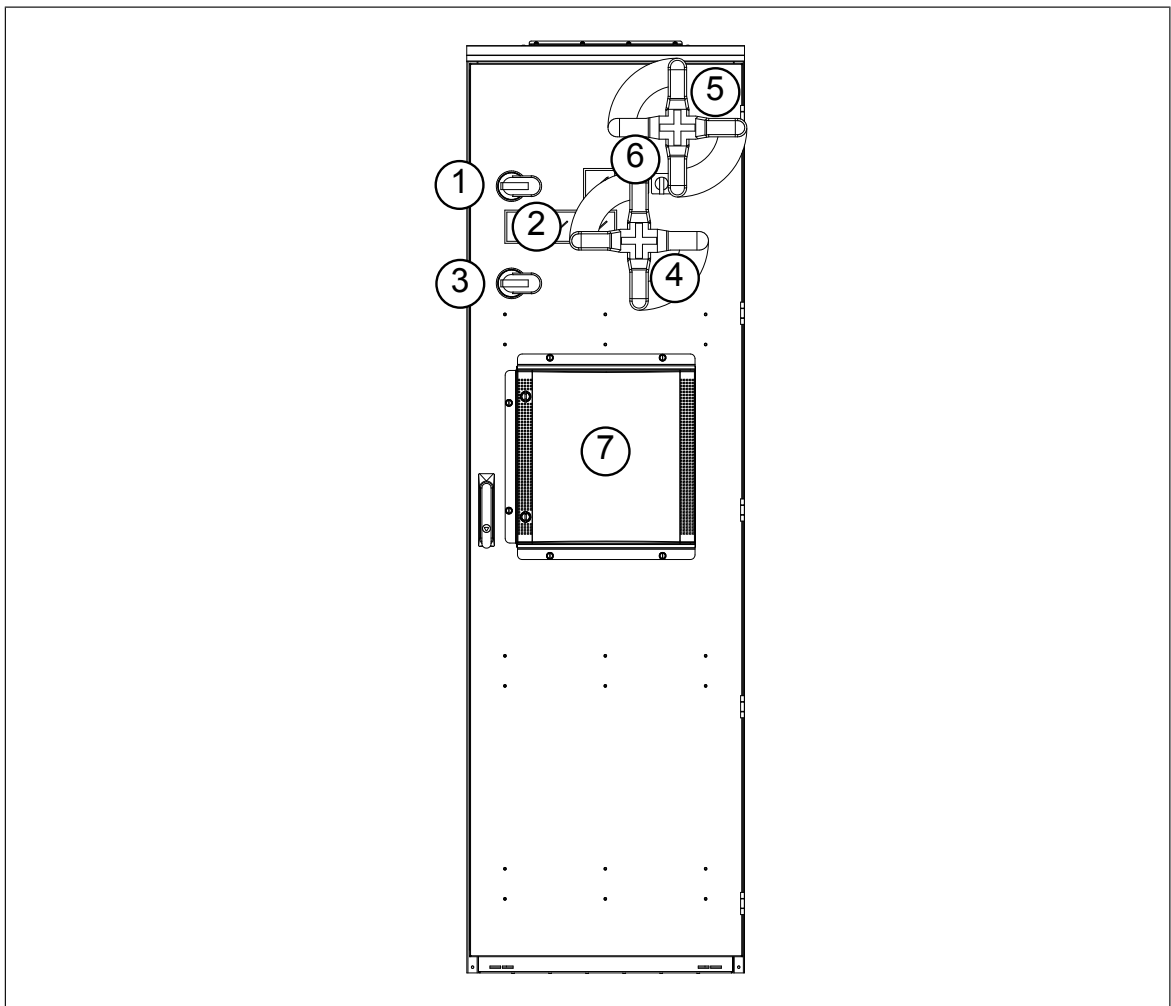
## ■ Incoming cubicle

This section shows examples of incoming cubicle layout. The cubicle contains the main switching and disconnecting devices. The input power cables are connected to the incoming cubicle through cabinet bottom. The components, layout and size vary depending on the supply unit size and selected options.

IPU cubicle does not contain main disconnecting device (main switch-disconnector or main circuit breaker), but is otherwise similar.

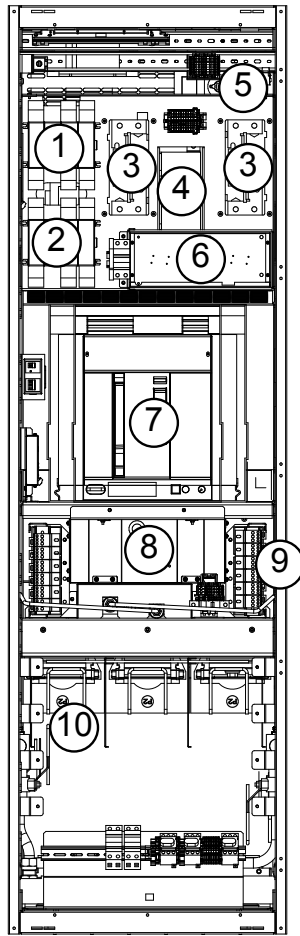
Supply units with high power can contain two incoming cubicles. Then only one of them contains charging components, otherwise the cubicles are similar.

### Door closed



1.	Auxiliary voltage disconnecter
2.	Meters
3.	Charging circuit disconnecter, AC side
4.	<u>Option +F259</u> : Grounding switch
5.	Charging circuit disconnecter, DC side
6.	Operating switch
7.	<u>Option +F255</u> : Main circuit breaker

**Door open**



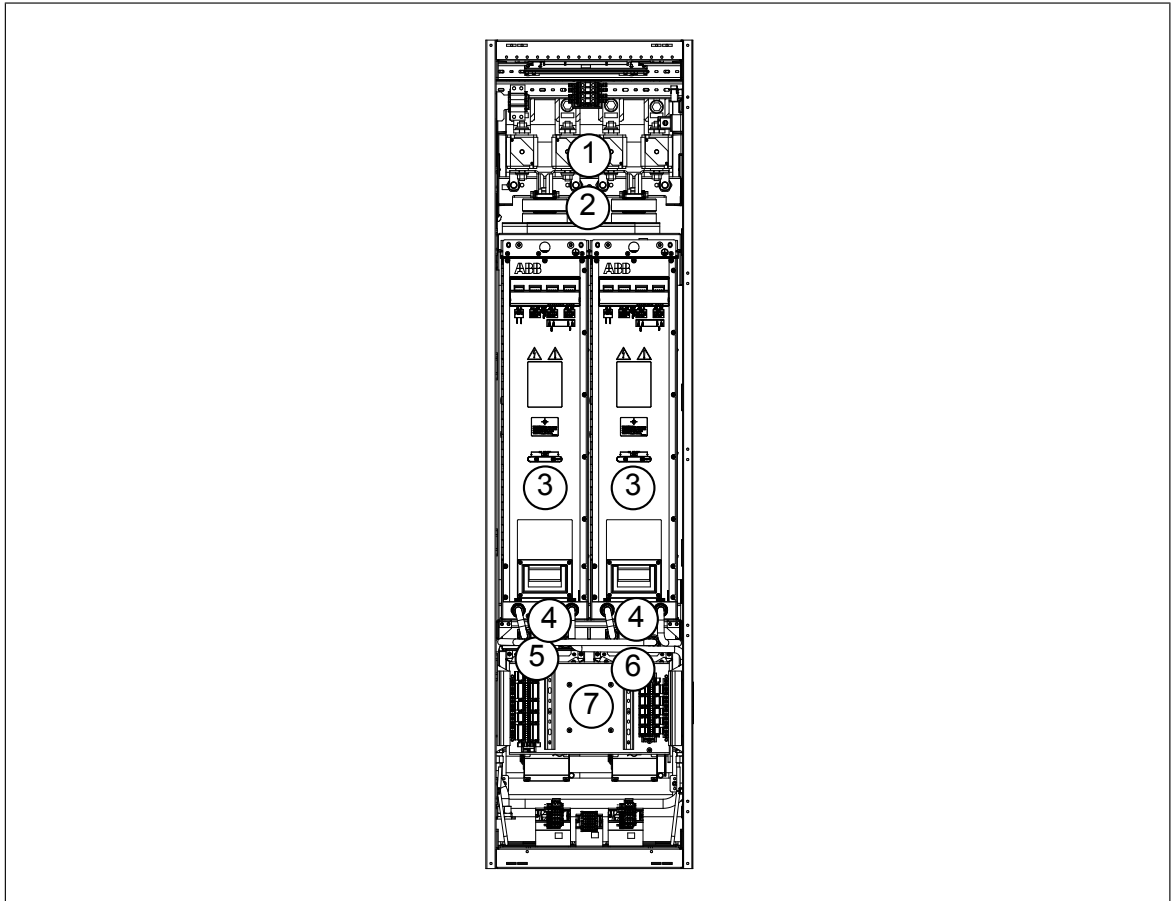
1.	Auxiliary voltage disconnector
2.	Charging circuit disconnector, AC side
3.	DC fuses
4.	<u>Option +F259</u> : Grounding switch
5.	Charging circuit disconnector, DC side
6.	BAMU measurement unit
7.	<u>Option +F255</u> : Main circuit breaker
8.	Cooling fan and heat exchanger
9.	Charging resistors
10.	Input power cable terminals [L1, L2, L3]

## ■ Supply module cubicle

This section shows an example of supply module cubicle layout. The cubicle contains IGBT supply modules.

There are no switches or devices on the cabinet door.

### Door open

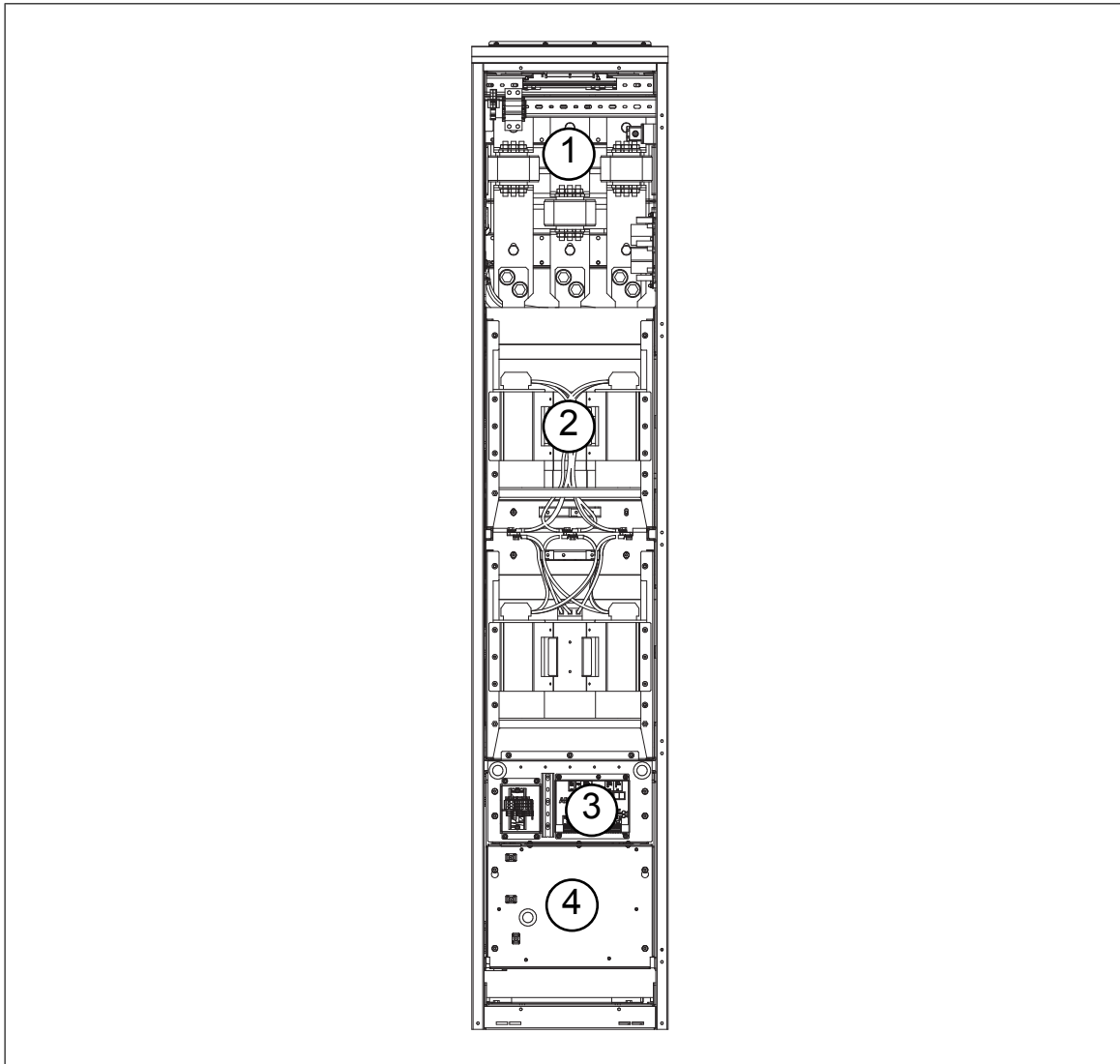


1.	DC fuses
2.	Common mode filters
3.	IGBT supply module of frame size R8i
4.	Coolant connections
5.	Air-to-liquid heat exchanger installed below each module
6.	(Behind the mounting plate) Fan. Forces air inside the cubicle through the heat exchanger.
7.	Mounting plate with terminal blocks for customer connections

## ■ Filter cubicle

This section shows an example of LCL filter cubicle layout. The cubicle contains LCL filter(s). There are no switches or devices on the cabinet door.

### Door open

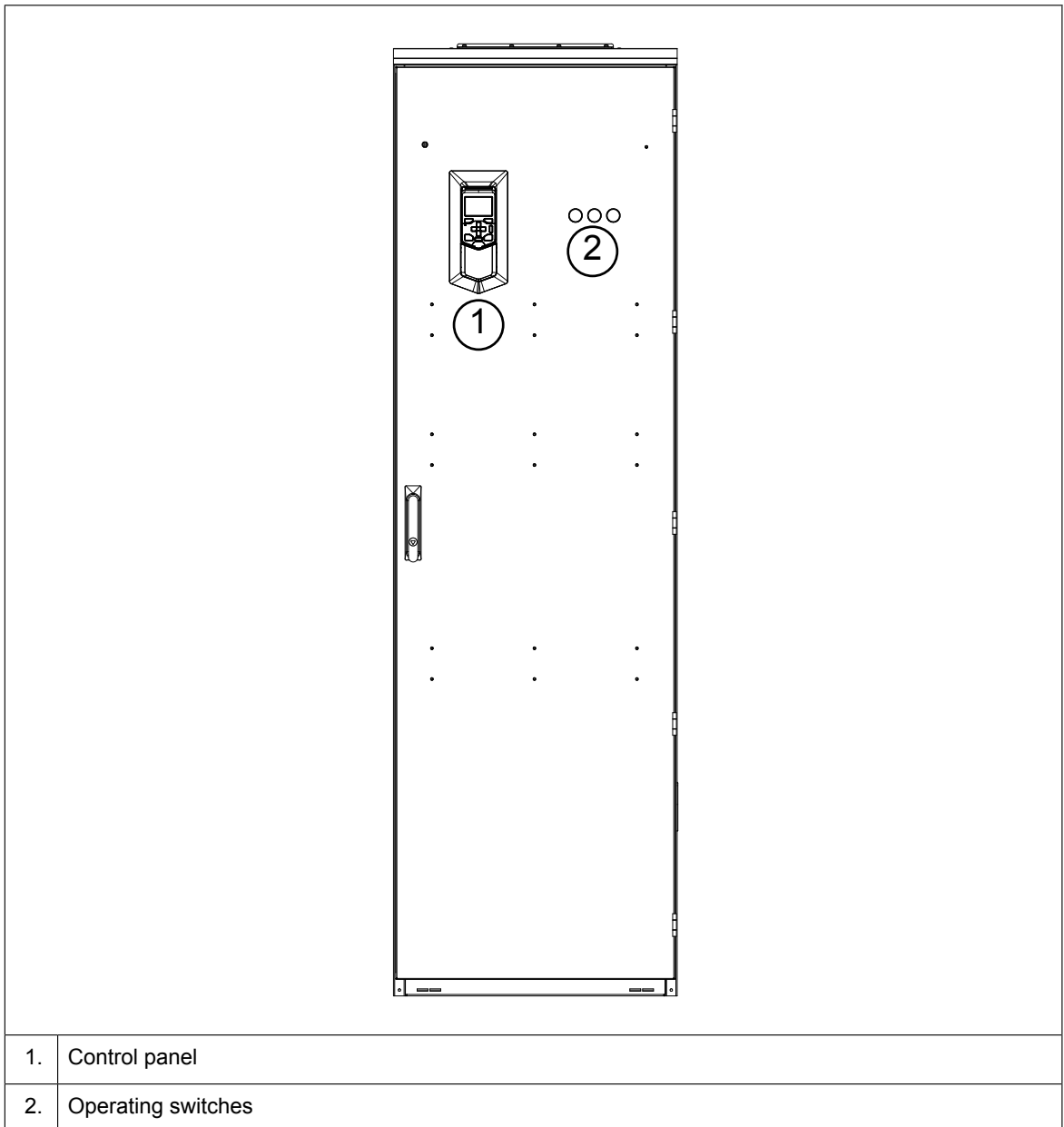


1.	AC fuses
2.	Capacitors. Inductors are located behind the capacitors.
3.	CIO-01 I/O module
4.	Cooling fan and heat exchanger

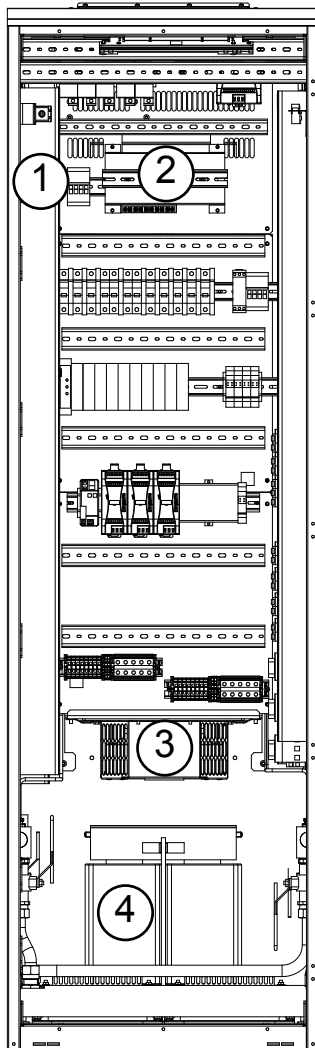
### ■ Auxiliary control cubicle

This section shows an example of auxiliary control cubicle layout. The composition and size of the cubicle vary depending on the selected options.

#### Door closed



**Door open**



1.	CIO-01 I/O module
2.	BCU control unit
3.	Cooling fan and heat exchanger
4.	Transformer. Two transformers can also be behind the assembly plates.



## **Overview of power and control connections**

Input power connections of the IGBT supply unit are terminals L1, L2 and L3 located in the lower part of the incoming cubicle. Power cables enter the cabinet via lead-throughs on the floor of the cubicle as standard. A cabinet-installed supply unit is typically controlled using the local control devices installed on the cabinet door. No additional control connections are needed. However, it is possible to:

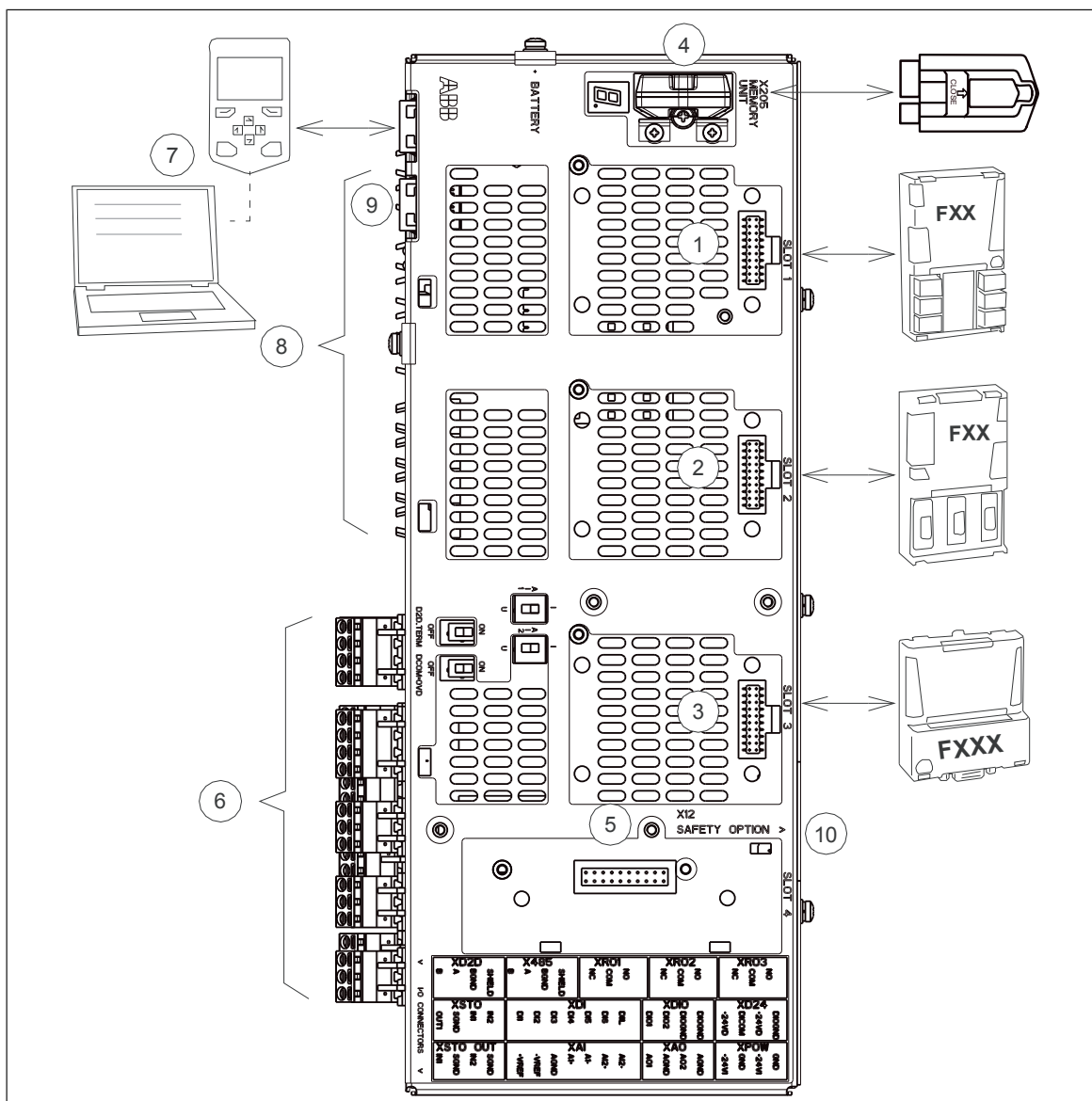
- control the unit through the control panel and the fieldbus
- read the status information through the control panel, fieldbus and relay output
- halt the unit with an externally wired emergency stop button (if the unit is equipped with an emergency stop option).

The supply unit I/O control interface is mostly in internal use.

---

■ Overview of the control connections of the BCU control unit

The diagram shows the control connections and interfaces of the BCU control unit.



<p>1 Analog and digital I/O extension modules and fieldbus communication modules can be inserted into slots 1, 2 and 3.</p>	<p>7 Control panel.</p>
<p>4 Memory unit</p>	<p>8 Fiber optic links to power modules (inverter, supply, brake or converter)</p>
<p>5 Slot 4 for RDCO-0x</p>	<p>9 Ethernet port. Not in use.</p>
<p>6 Terminal blocks.</p>	<p>10 Safety option interface. Only in use for the inverter units.</p>

## Supply unit control devices

Run enable is the main control signal of the supply unit. The control program reads it from digital input DI2. You can control the signal, for example, with an operating switch installed on the supply module cubicle door, and wired to DI2. When the digital input DI2 is on, it is also possible to control the Run enable signal from a control panel, through fieldbus interface, or from the inverter unit.

For other control signals, see the firmware manual and the I/O connection diagram.

### ■ Main switch-disconnector / breaker

The supply unit is equipped with a main switch-disconnector ([Q1], option +F253) or a main breaker in high powers ([Q1], option +F255) as standard. With this device, you can isolate the main circuit of the drive from the power line. The switch has an operating handle on the cabinet door. The main breaker is withdrawable: to disconnect the drive, crank the breaker out with a separate loose handle (included in the delivery).



#### **WARNING!**

The switch/breaker does not isolate the input power terminals, AC voltage meters ([P5], option +G334) or the auxiliary circuit from the power line. To isolate auxiliary voltage, use the auxiliary voltage switch [Q21]. To isolate the input power terminals and AC voltage meters, open the main breaker of the supply transformer. Especially in case of a circuit breaker the main circuit breaker does not isolate the charging circuit. To isolate the charging circuit, use the charging switch [Q3].

---

#### **Note:**

The earthing/grounding switch ([Q9], option +F259) and the main switch-disconnector are electrically interlocked: only one of the switches can be closed at a time. To close the switches, you must also have the auxiliary control voltage on.

### ■ Auxiliary voltage switch

The supply unit is equipped with an auxiliary voltage switch [Q21] as standard. Using the switch, you can disconnect the auxiliary circuit from the power line. The switch has an operating handle on the cabinet door.

### ■ Grounding switch

The supply unit can be equipped with an optional grounding switch ([Q9], option +F259). Using the switch, you can temporarily ground the main AC busbars of the supply unit during the maintenance work. The switch has an operating handle on the cabinet door.



#### **WARNING!**

The grounding switch [Q9] grounds the main AC busbars between the main breaker and the LCL filter module. It does not ground the input power terminals or auxiliary circuits.

---

#### **Note:**

The grounding switch and the main switch-disconnector ([Q1], option +F253) are electrically interlocked: only one of the switches can be closed at a time. To close the switches, you must also have the auxiliary control voltage on.

---

### ■ Charging switch

The charging switch [Q3] is a standard device.

To charge the drive, the charging switch must be closed. The charging switch does not control the charging circuit, it just provides power to the charging circuitry. The charging circuit is controlled by the charging contactor [Q4], which is controlled by the control unit.

The charging switch has an operating handle on the cabinet door.

### ■ Operating switch

The operating switch [S21] is a standard device.

By default, the operating switch controls the unit as follows:

- The ENABLE/RUN position: The control program closes the charging contactor [Q4] and the main DC link is charged. After the DC link is charged, the main contactor [Q2] is closed and the charging contactor [Q4] opened. The supply module starts operating.
- The OFF position: The control program opens the main contactor and the supply module stops rectifying.

### ■ ACS-AP-x control panel

With the control panel, you can:

- start and stop the supply unit with the start and stop keys of the panel (in local control mode of the panel)
- view and reset the fault and warning messages, and view the fault history
- view actual signals
- change parameter settings
- change between local and external control.

The Run enable command at digital input DI2 must be on (1) so that the supply unit can be started and stopped with the control panel in the local mode. That is the case when the operating switch [S21] is switched to the on (1) position.

To change between local and remote control mode, press the Loc/Rem key of the control panel. For the instructions on the use of the panel, see *ACX-AP-x Assistant control panels user's manual* (3AUA0000085685 [English]). For the parameter settings, see the firmware manual.

### ■ Local charging control switch

The cabinet can be equipped with a local charging control switch [S4]. Position "1" enables closing of the DC switch-disconnector [Q11].

### ■ DC switch-disconnector

The supply unit can be equipped with a DC switch-disconnector [Q11] which allows the isolation of the unit from the DC link. Before the unit is reconnected to the DC link, the capacitors of the supply module(s) must be charged through a charging circuit.

#### **Note:**

If the unit consists of multiple supply module cubicles, each cubicle is equipped with a DC switch-disconnector and charging circuit. The DC switch-disconnector controls only the supply modules within that particular cubicle.

---

### ■ Charging switch for unit charging

Before closing the DC switch-disconnector [Q11], the user closes the charging switch for DC-DC unit charging [Q10]. After the precharging completes, the DC switch-disconnector [Q11] can be closed, and the charging switch [Q10] opened.

#### Note:

The charging switch [Q10] must be opened before the supply unit can be started.



**WARNING!** Do not operate the DC switch-disconnectors under load.

---



**WARNING!** Do not operate the DC fuse disconnectors under load or under voltage.

---



**WARNING!** With frame n×R8i units, both the DC switch-disconnector [Q11] and the charging switch [Q10] must be opened to disconnect the inverter unit from the DC link.

---

### ■ DC switch-disconnector for line-up charging

The supply unit can be equipped with a DC switch-disconnector for line-up charging [Q40]. DC switch-disconnector [Q40] is needed for isolating the line-up charging circuit from the DC link when the supply unit has the DC switch disconnector [Q11] and AC-DC line-up charging circuit.

### ■ PC connection

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

### ■ Fieldbus control

You can control the supply unit through a fieldbus interface if the unit is equipped with an optional fieldbus adapter, and when you have configured the control program for fieldbus control with the parameters. For information on the parameters, see the firmware manual.

#### Note:

To be able to switch the main contactor or breaker and the supply unit on and off (Run enable signal) through fieldbus, the Run enable command at digital input DI2 must be on (1). That is the case when the operating switch [S21] is switched to the on (1) position.

---

## Cooling system

See chapter *Internal cooling circuit*.

### ■ Coolant connectors

The coolant pipe inlet and outlet connectors are located at the bottom front of the IGBT supply module. The connectors are for 16/13 millimeter PA (polyamide) pipe.



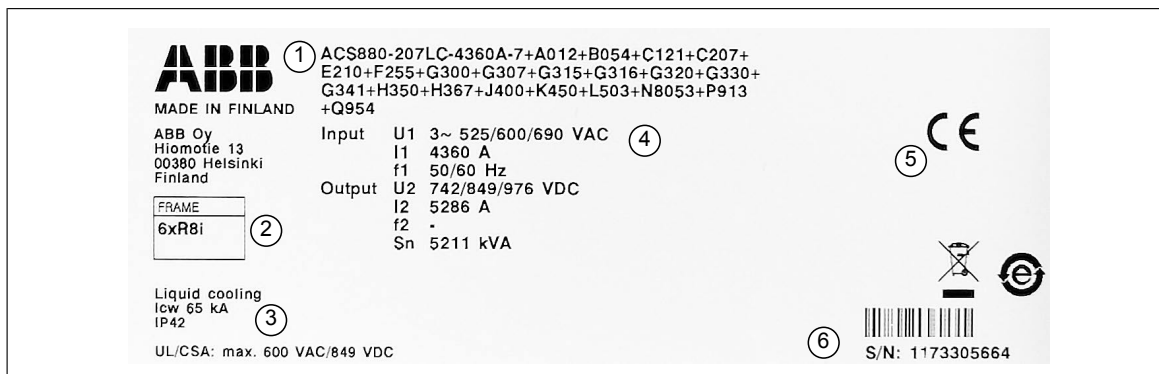
#### WARNING!

For a reliable connection, the end of the pipe entering the connector must be completely intact for a length of at least 5 cm (2 in). Make sure the pipe is perfectly round where it enters the connector, and not deformed eg. by any bends nearby. The piping must not exert any tension or torque on the connector.

## Type designation label(s)

Each IGBT supply unit has a type designation label attached onto the inside of the cubicle door. The type designation label includes the ratings, appropriate markings, a type designation and a serial number of the unit. Example label is shown below.

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



1	Type designation (see section <i>Type designation key (page 31)</i> ).
2	Frame size
3	Short-time withstand current rating (see chapter <i>Technical data</i> ); degree of protection; UL/CSA specifications
4	Ratings. See also chapter <i>Technical data</i> .
5	Valid markings. See <i>Electrical planning instructions for ACS880 liquid-cooled multidrive cabinets and modules (3AXD50000048634 [English])</i> .
6	Serial number. The first digit of the serial number refers to the manufacturing plant. The next four digits refer to the unit's manufacturing year and week, respectively. The remaining digits complete the serial number so that there are no two units with the same number.

## Type designation key

The type designation contains information on the specifications and configuration of the supply unit. The first digits from left express the basic supply unit type. The optional selections are given thereafter, separated by plus signs, eg, +F255. The main selections are described below. Note that all selections are not available for all types.

Code	Description
<b>Basic code</b>	
ACS880	Product series
ACS880-207LC	Default configuration: liquid-cooled cabinet-installed IGBT supply unit, IP42 (UL Type 1), 50 Hz supply frequency, no main switch or breaker, connection for 230 V AC auxiliary voltage, ACS-AP-W assistant control panel, EMC filter (category 3, 2nd Environment), du/dt limitation by choke, ACS880 IGBT supply control program, BAMU auxiliary measurement unit (+G442) when the option +C186 is not selected, coated circuit boards, bottom entry and exit of cables with lead-through-type entries, multilingual door device label sticker, USB memory stick containing circuit diagrams, dimension drawings and manuals.
<b>Size</b>	
xxxxx	Refer to the rating table.
<b>Voltage range</b>	
3	380...415 V AC. This is indicated in the type designation label as typical input voltage level (3~ 400 V AC).
5	380...500 V AC. This is indicated in the type designation label as typical input voltage levels (3~ 400/480/500 V AC).
7	525...690 V AC. This is indicated in the type designation label as typical input voltage levels (3~ 525/600/690 V AC).
<b>Option codes (plus codes)</b>	
<b>Supply connection</b>	
A013	60 Hz supply frequency
<b>Degree of protection</b>	
B055	IP54 (UL Type 12)
<b>Construction</b>	
C121	Marine construction
C129	UL Listed
C132	Marine type approved
C164	Plinth height 100 mm
C176	Door hinges on left
C179	Plinth height 200 mm
C205	Marine product certification issued by DNV GL
C206	Marine product certification issued by the American Bureau of Shipping (ABS)
C207	Marine product certification issued by Lloyd's Register (LR)
C209	Marine product certification issued by Bureau Veritas
C228	Marine product certification issued by China Classification Society (CCS)
C229	Marine product certification issued by Russian Maritime Register of Shipping (RS)
C238	300 mm wide IPU cubicle
C239	400 mm wide IPU cubicle
C240	600 mm wide IPU cubicle
C241	800 mm wide IPU cubicle

### 32 Operation principle and hardware description

<b>Code</b>	<b>Description</b>
C245	1000 mm wide IPU cubicle
C243	Additional voltage measurement for optimal grid control
<b>Filters</b>	
E205	du/dt filtering by choke
E210	2nd environment, C3, grounded (TN) and ungrounded (IT) networks
<b>Line options</b>	
F250	Main (line) contactor
F253	Main switch-disconnector
F255	Main (air) circuit breaker
F259	Grounding (earthing) switch
F274	100 kA short circuit rating
F286	DC switch
<b>Cabinet equipment</b>	
C186	Current and voltage measurements with BAMU measurement unit
G300	Cabinet and module heating elements (external supply)
G301	Cabinet lighting
G304	115 V AC control voltage
G307	Terminals for connecting external control voltage (230 V AC or 115 V AC, eg. UPS)
G314	DC bus material: aluminum
G315	DC bus material: tin-plated copper
G316	Supply connection by cables
G317	Supply connection by busbars
G320	230 V AC control voltage
G330	Halogen-free wiring and materials
G331	Emergency stop push button on the door (red)
G332	Electrical disconnect push button on the door (black, opens main contactor / main circuit breaker)
G333	Meters for A, V, kW and kWh
G334	V-meter with selector switch
G335	A-meter in one phase
G336	Arc monitoring, 1 loop, Rea 101, including cable
G337	Arc monitoring current sensing unit
G338	Additional wire markings
G339	
G340	
G341	
G342	
G343	Corrosion coupon in auxiliary control cubicle
G344	Auxiliary voltage transformer
G426	Arc monitoring unit, extension for 2 loops, Rea 105
G432	Frequency monitoring device
G442	BAMU auxiliary measurement unit
J410	Control panel connection kit



Code	Description
K450	Panel bus
<b>Cabling</b>	
H350	Supply cabling direction down
H351	Supply cabling direction up
H358	Cable gland plates (Steel 3 mm, undrilled)
H364	Cable gland plates (Aluminum 3 mm, undrilled)
H367	Control cable entry through the floor of cabinet
H368	Control cable entry through the roof of cabinet
<b>Fieldbus adapters and other communication options</b>	
K451	FDNA-01 DeviceNet™ adapter module
K454	FPBA-01 PROFIBUS DP adapter module
K457	FCAN-01 CANopen adapter module
K458	FSCA-01 RS-485 (Modbus/RTU) adapter module
K462	FCNA-01 ControlNet™ adapter module
K469	FECA-01 EtherCAT adapter module
K470	FEPL-02 Ethernet POWERLINK adapter module
K473	FENA-11 Ethernet adapter module for EtherNet/IP™, Modbus TCP and PROFINET IO protocols
K475	FENA-21 Ethernet adapter module for EtherNet/IP™, Modbus TCP and PROFINET IO protocols, 2-port
K480	Ethernet switch for PC tool and control network
K483	Ethernet switch with optical link for PC tool and control network
K493	Ethernet switch for PROFINET
K494	Ethernet switch with optical link for PROFINET
<b>I/O extensions</b>	
L500	FIO-11 analog I/O extension module
L501	FIO-01 digital I/O extension module
L503	FDCO-01 optical DDCS communication adapter module
L508	FDCO-02 optical DDCS communication adapter module
L509	RDCO-04, DDCS communication adapter module
L525	FAIO-01 analog I/O extension module
L526	FDIO-01 digital I/O extension module
<b>Control program</b>	
N8010	IEC 61131-3 application programmability
N8053	Optimal grid control mode in ACS880 IGBT supply control program. See <i>Optimal grid control of ACS880 IGBT supply control program supplement</i> (3AXD50000164745 [English]).
<b>Specialties</b>	
P913	Special color
<b>Safety functions</b>	
Q951	Emergency stop (category 0) by opening the main contactor / main circuit breaker
Q952	Emergency stop (category 1) by opening the main contactor / main circuit breaker
Q954	Ground fault monitoring for IT (ungrounded) systems
Q959	Supply transformer breaker disconnect push button (black, wired to terminals) on the door
Q963	Stop category 0 without opening main contactor / main circuit breaker

### 34 Operation principle and hardware description

Code	Description
Q964	Stop category 1 without opening main contactor / main circuit breaker
Q979	Emergency stop (configurable for category 0 or 1) by activating the Safe torque off function
Q984	E-stop button monitoring
<b>Full set of printed manuals in the selected language</b>	
<b>Note:</b> The delivery may include manuals in English if the requested language is not available.	
R700	English
R701	German
R702	Italian
R703	Dutch
R704	Danish
R705	Swedish
R706	Finnish
R707	French
R708	Spanish
R709	Portuguese
R711	Russian

**Weak supply networks:** In weaker supply networks with a short-circuit ratio less than 8, it is highly recommended to add an additional BAMU auxiliary measurement unit to the drive. In such kind of networks, there is risk of unnecessary DC overvoltage tripping due to disturbances caused by probable high voltage THD in the supply voltage. Short-circuit ratio is defined as the supply network's apparent short-circuit power  $S_{k,net}$  related to the drive's nominal apparent power  $S_n$  ( $S_{k,net} / S_n < 8$ ).

---

# 3

## Electrical installation

---

### Contents of this chapter

This chapter instructs how to check the insulation of the assembly and how to install the input power cables and control cables. The information is valid for cabinet-installed ACS880-207LC supply units.

### Required tools

The tools required for tightening the connections are listed below:

- Pozidriv and Torx screwdrivers
- torque wrench
- set of wrenches or sockets.

### Electrical safety precautions

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



#### **WARNING!**

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

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

Go through these steps before you begin any installation or maintenance work.

---

1. Keep the cabinet doors closed when the drive is powered. With the doors open, a risk of a potentially fatal electric shock, arc flash or high-energy arc blast exists.
  2. Clearly identify the work location and equipment.
-

3. Disconnect all possible voltage sources. Lock out and tag out.
  - Open the main disconnecting device of the drive.
  - Open the charging switch if present.
  - Open the disconnecter of the supply transformer. (The main disconnecting device in the drive cabinet does not disconnect the voltage from the AC input power busbars of the drive cabinet.)
  - Close the grounding switch or switches ([Q9], option +F259) if present. Do not use excessive force as the switch has electromagnetic interlocking.
  - If the drive is equipped with a DC/DC converter unit (optional): Open the DC switch/disconnector ([Q11], option +F286) of the DC/DC converter. Open the disconnecting device of the energy storage connected to the DC/DC converter unit (outside the drive cabinet).
  - Open the auxiliary voltage switch-disconnector (if present), and all other possible disconnecting devices that isolate the drive from dangerous voltage sources.
  - In the liquid cooling unit (if present), open the motor protective circuit breaker(s) of the cooling pumps.
  - If you have a permanent magnet motor connected to the drive, disconnect the motor from the drive with a safety switch or by other means.
  - Make sure that re-connection is not possible. Lock out and tag out.
  - Disconnect any dangerous external voltages from the control circuits.
  - After you disconnect power from the drive, always wait 5 minutes to let the intermediate circuit capacitors discharge before you continue.
4. Protect any other energized parts in the work location against contact.
5. Take special precautions when close to bare conductors.
6. Measure that the installation is de-energized. If the measurement requires removal or disassembly of shrouding or other cabinet structures, obey the local laws and regulations applicable to live working (including – but not limited to – electric shock and arc protection).
  - Use a multimeter with an impedance greater than 1 Mohm.
  - Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is close to 0 V.
  - Make sure that the voltage between the drive DC busbars (+ and -) and the grounding (PE) busbar is close to 0 V.
  - If you have a permanent magnet motor connected to the drive, make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is close to 0 V.



**WARNING!**

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

7. Ask the person in control of the electrical installation work for a permit to work.



**WARNING!** In case of DC bus remaining alive, Personal Protective Equipment (PPE) of Level 2 is required for doing maintenance. Note that this is valid for work on every cabinet of the device.

## Isolation from AC supply networks

1. Clearly identify the work location.
2. Disconnect all possible voltage sources.
  - Open the main switch-disconnector [Q1], or rack out the main breaker [Q1] of the drive (whichever is present). Note that some drives have two switch-disconnectors or main breakers [Q1.1 and Q1.2].
  - Open the disconnector of the supply transformer as the main disconnecting device of the drive does not remove the voltage from the input busbars of the drive or from the voltmeter (option +G334), or BAMU auxiliary measurement unit, auxiliary control voltage switch [Q21], charging circuit disconnector [Q4] or others.
  - 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 input power terminals and the grounding (PE) busbar is close to 0 V.
6. Install temporary grounding as required by the local regulations. Close the grounding switch (option +F259, [Q9]) if present, or connect the AC and DC busbars to PE with a temporary grounding tool.
7. Ask for a permit to work from the person in control of the electrical installation work.



## Isolation from common DC bus

In case of units with DC voltage remaining: if there are several power sources for the DC bus, the supply unit which shall be isolated must be equipped with a DC switch-disconnector (option +F286). In order to isolate the supply unit from the live DC bus, open the DC switch-disconnector [Q11] and also the charging switch [Q10] in EVERY cubicle containing supply modules. In addition, open the DC switch-disconnector of the AC circuit [Q40].

1. Clearly identify the work location.
2. Disconnect all possible voltage sources. Note that energy to the DC bus can also be fed back by motors, energy storages, etc.
  - 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 input power terminals and the grounding (PE) busbar is close to 0 V.
6. Install temporary grounding as required by the local regulations. Connect the DC busbars to PE with a temporary grounding tool.
7. Ask for a permit to work from the person in control of the electrical installation work.

## Checking the insulation of the assembly

### ■ Checking the insulation of the drive system



#### **WARNING!**

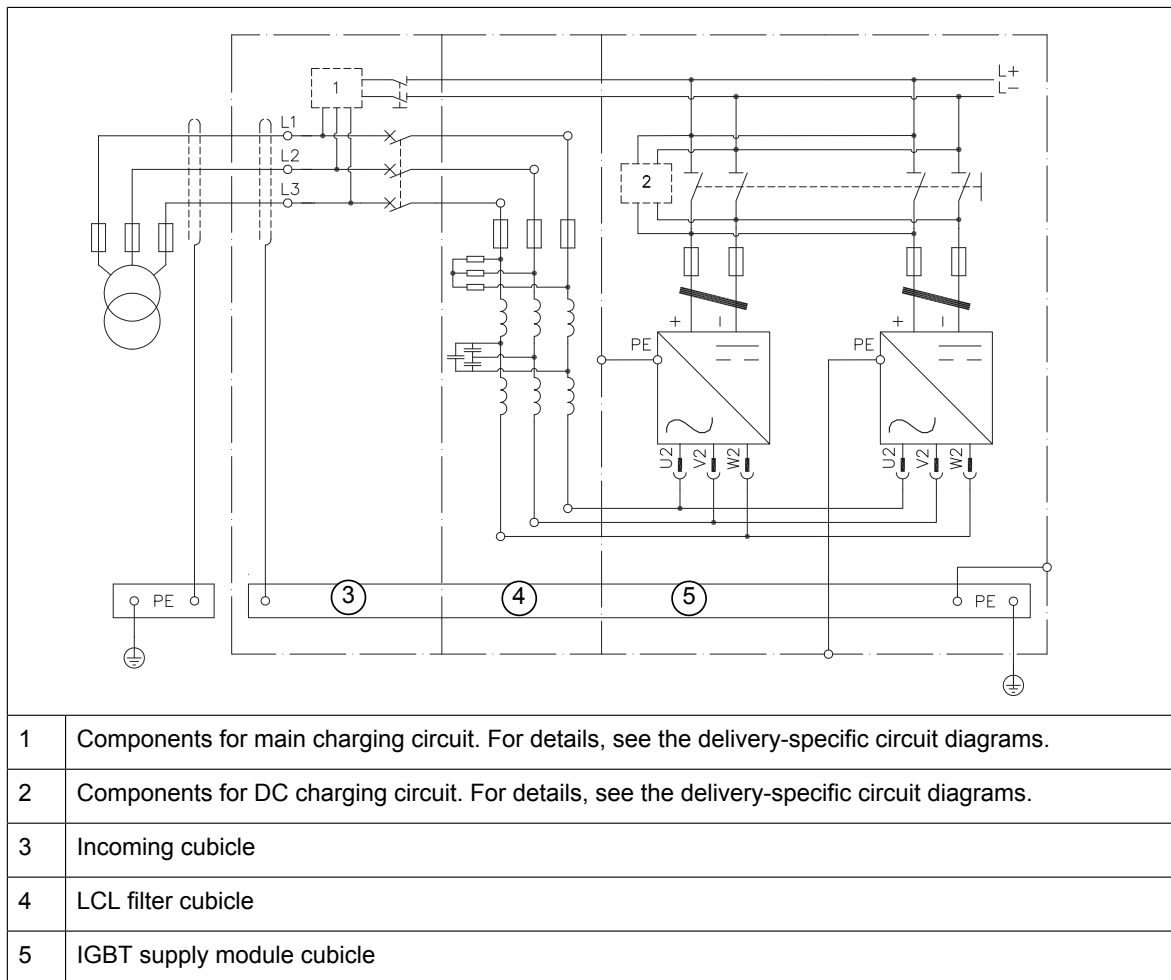
Do not make any voltage withstand or insulation resistance tests on any part of the drive as testing can damage the drive. Every drive has been tested for insulation between the main circuit and the chassis at the factory. Also, there are voltage-limiting circuits inside the drive which cut down the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

### ■ Checking the insulation of the input cable

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

## Connecting the input power cables

### ■ Connection diagram



### Notes:

For the conductivity requirements for the shield and the PE conductor, see *ACS880 liquid-cooled multidrives and multidrive modules planning the electrical installation* (3AXD50000048634 [English]).

For the cable selection instructions, see *Electrical planning instructions for ACS880 liquid-cooled multidrive cabinets and modules* (3AXD50000048634 [English]).

### ■ Connection procedure



#### WARNING!

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

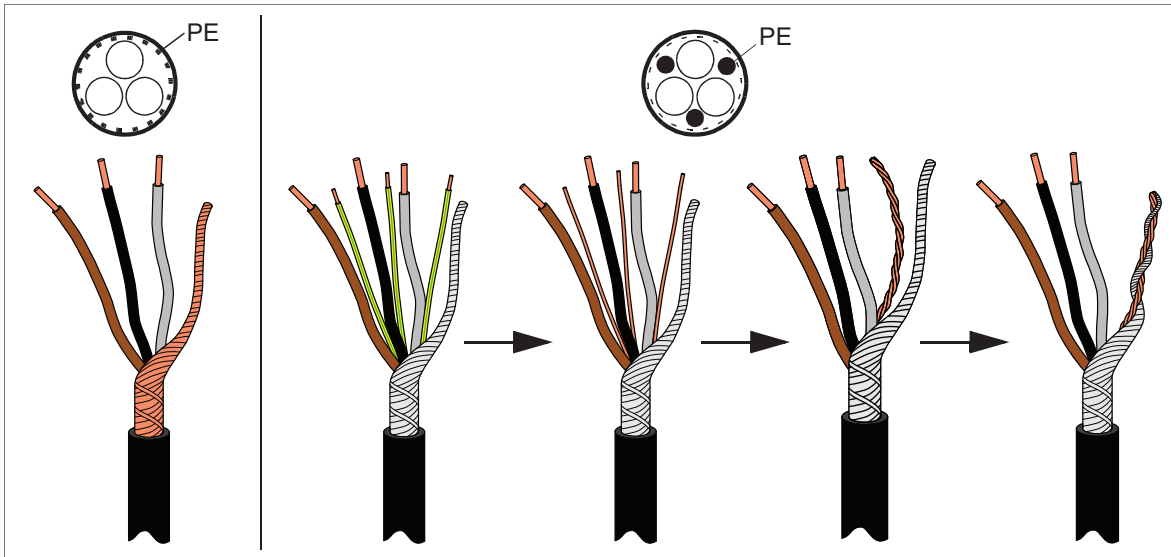
1. Do the steps in section *Electrical safety precautions* (page 35) before you start the work.
2. Open the door of the incoming cubicle.
3. Remove the shrouding covering the input terminals.
4. Peel off 3...5 cm (1.2 ... 2 in) of the outer insulation of the cables above the lead-through plate for 360° high-frequency grounding.

5. Prepare the ends of the cables.

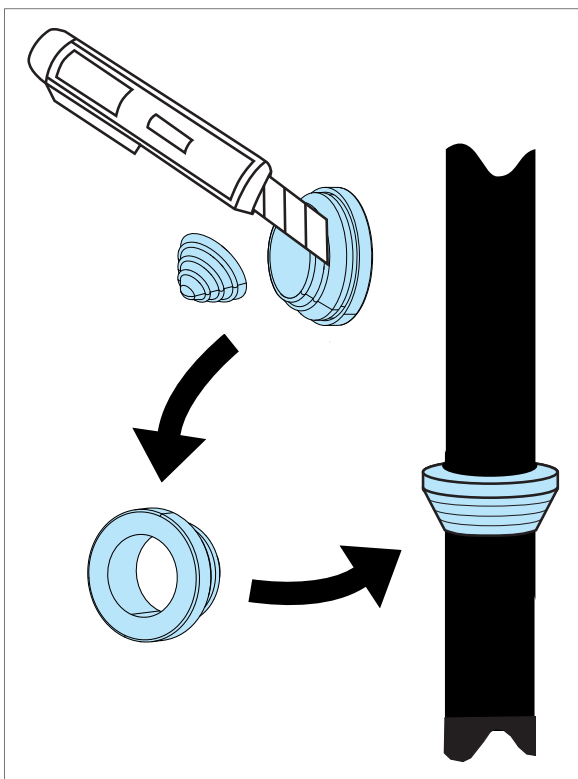


**WARNING!**

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

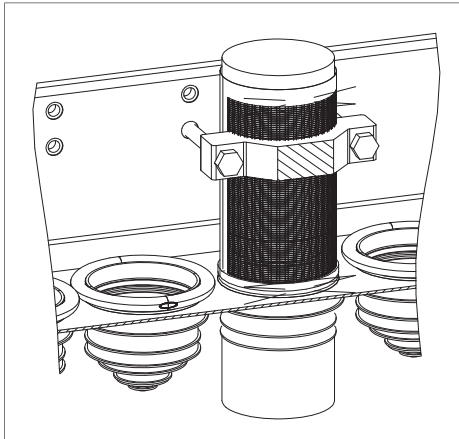


6. If fire insulation is used, make an opening in the mineral wool sheet according to the diameter of the cable.
7. Remove rubber grommets from the cable entries for the cables to be connected. Cut adequate holes into the rubber grommets. Slide the grommets onto the cables. Slide the cables into the cubicle through the conductive sleeves and attach the grommets to the holes.

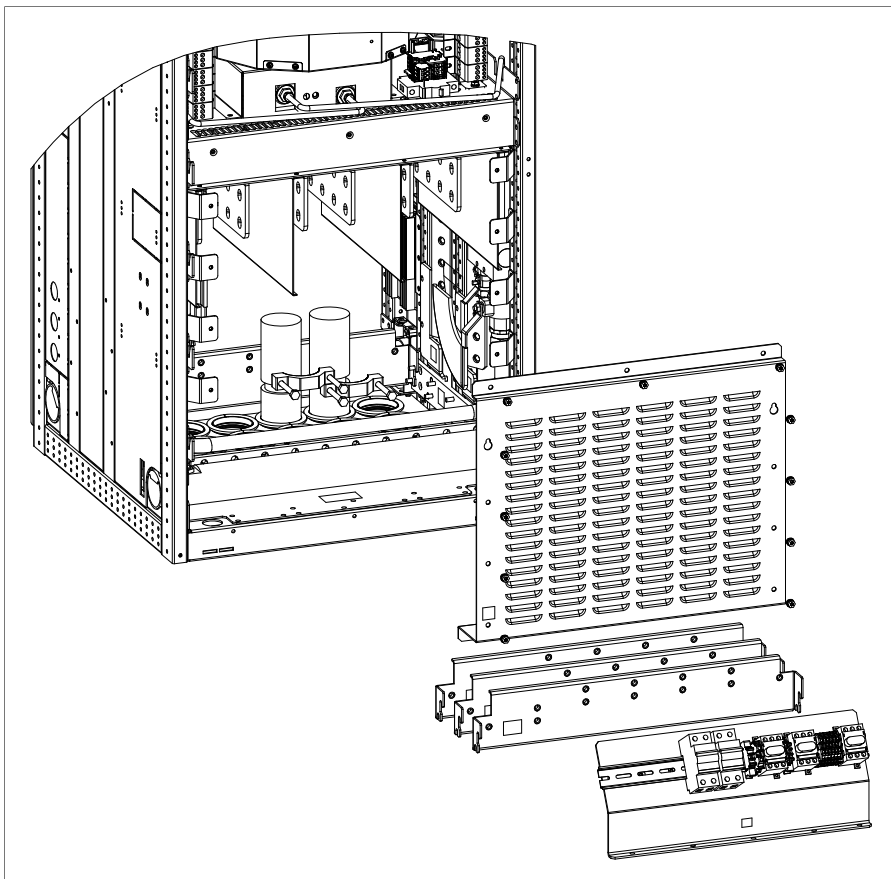




8. Attach the conductive sleeves to the cable shields with cable ties. Tie up the unused conductive sleeves with cable ties.



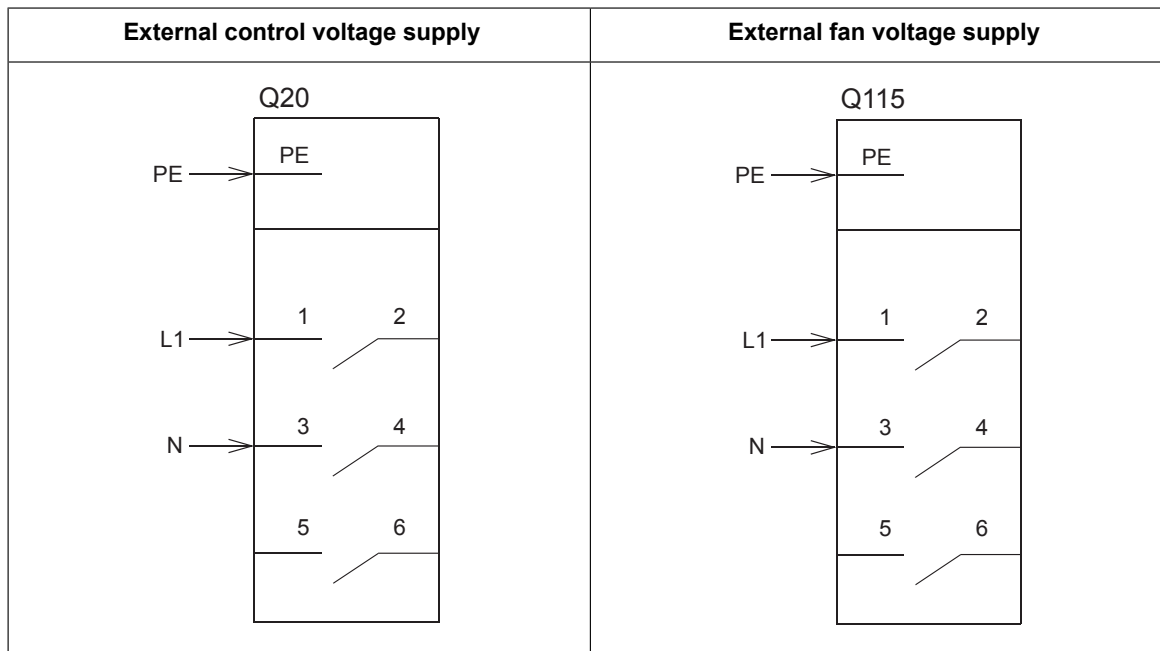
9. Seal the gap between the cable and mineral wool sheet (if used) with sealing compound (eg. CSD-F, ABB brand name DXXT-11, code 35080082).
10. Connect the twisted shields of the cables to the PE busbar of the cabinet. Tighten the screws to the torque given under *Tightening torques (page 101)*.
11. Connect the phase conductors of the input cable to the L1, L2 and L3 terminals. Tighten the screws to the torque given under *Tightening torques (page 101)*.
12. Reinstall the shrouding removed earlier.
13. Close the cubicle door.



## Connecting the external power supply cable for the auxiliary circuit

The customer/installer must provide the auxiliary voltage from an external supply to the drive. For details, see the delivery-specific circuit diagrams.

### ■ Connection diagram

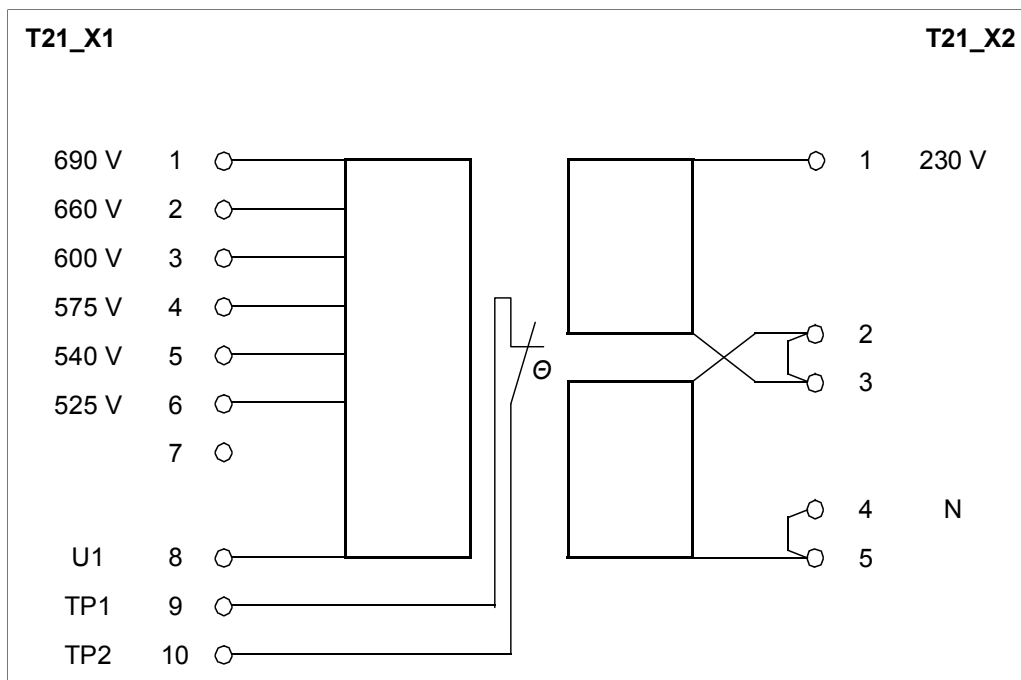


## Checking the settings of the auxiliary voltage transformer (option +G344)

Check the tap settings of all auxiliary voltage transformers. Transformer T21 is optional equipment; T115 and T125 are present depending on drive configuration.

The voltage settings of transformer T21 are made at terminal blocks T21\_X1/X2 and T115\_X1/X2 respectively. For cabinet layout, see chapter [Operation principle and hardware description](#).

### ■ T21 tap settings (690 V units)

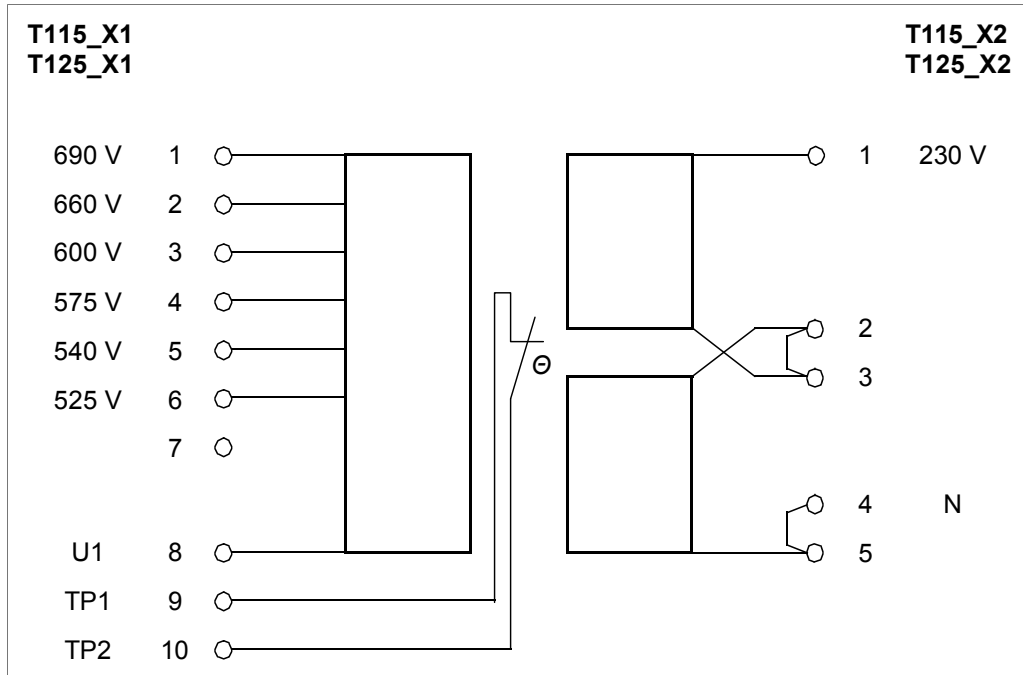


## Checking the settings of the cooling fan transformer

Check the tap settings of all cooling fan transformers. Cooling fan transformers T115 and T125 are present depending on drive configuration. If the delivery contains an incoming unit, the cooling fan transformer connections are made at the factory. The connection of the primary winding of the fan transformer depends on the actual system voltage.

The voltage settings of cooling fan transformers T115 and T125 are made at terminal blocks T115\_X1/X2 and T125\_X1/X2 respectively.

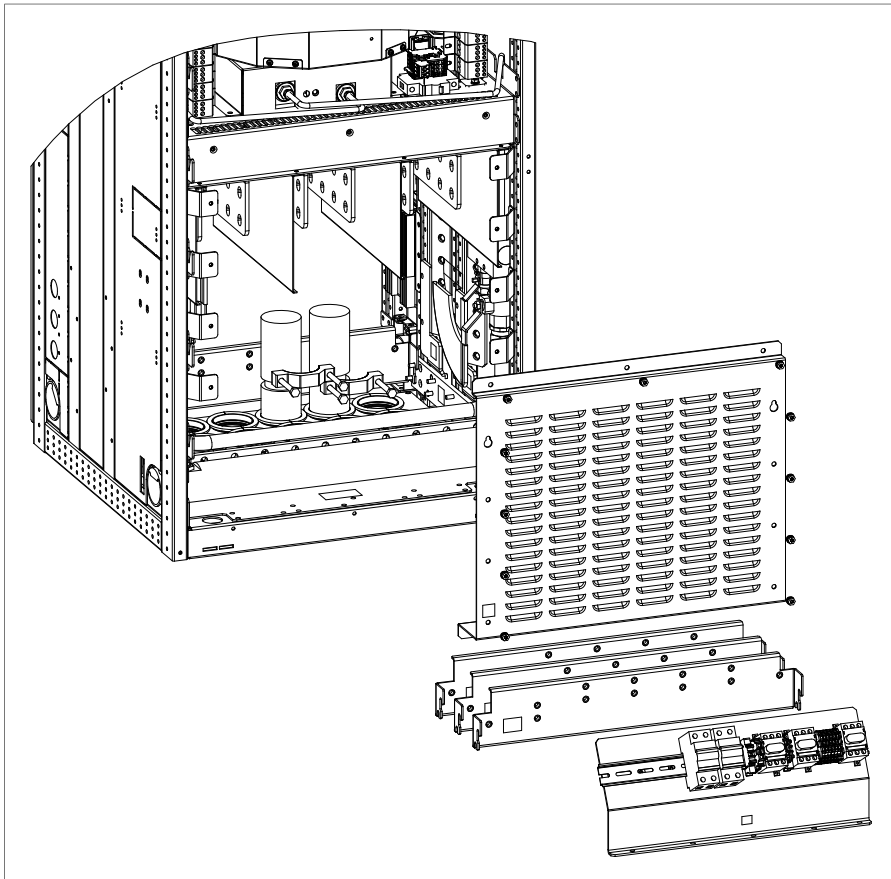
### ■ T115 and T125 tap settings (690 V units)



## Connecting the power supply cable for the charging circuit

If the delivery contains an incoming unit, the charging circuit connections are made at the factory. The charging circuit components are located in the incoming cubicle. If the delivery contains an IPU unit, see the delivery-specific circuit diagrams for wiring.

Activate and tune the charging function in the control program. For information on tuning the parameters, see *ACS880 IGBT supply control program firmware manual* (3AUA0000131562 [English]).



## Connecting the control cables for the supply unit

### ■ Connection diagram

See the delivery-specific circuit diagrams, and the default I/O diagram.

### ■ Connection procedure



#### **WARNING!**

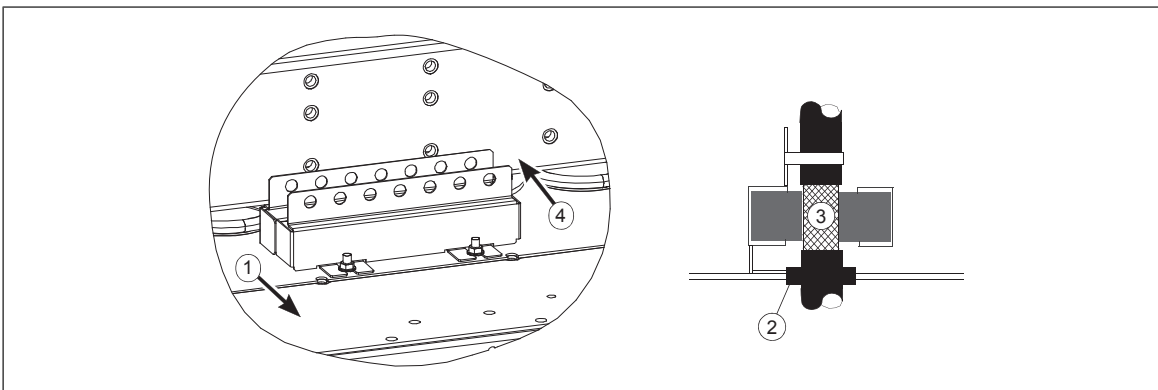
Obey the instructions in *Safety instructions for ACS880 liquid-cooled multidrive cabinets and modules* (3AXD50000048633 [English]). If you ignore them, injury or death, or damage to the equipment can occur.

1. Stop the drive (if running) and do the steps in section [Electrical safety precautions \(page 35\)](#) before you start the work.
2. Run the control cables into the cabinet as described in section [Grounding the outer shields of the control cables at the cabinet entry](#) below.
3. Route the control cables as described in section [Routing the control cables inside the cabinet \(page 48\)](#).
4. Connect the control cables as described in section [Connecting control cabling \(page 49\)](#).

### Grounding the outer shields of the control cables at the cabinet entry

Ground the outer shields of all control cables 360 degrees at the EMI conductive cushions as follows (example constructions are shown below, the actual hardware may vary):

1. Loosen the tightening screws of the EMI conductive cushions and pull the cushions apart.
2. Cut adequate holes to the rubber grommets in the entry plate and put the cables through the grommets and the cushions.
3. Strip off the cable plastic sheath above the entry plate just enough to ensure proper connection of the bare shield and the EMI conductive cushions.
4. Tighten the two tightening screws so that the EMI conductive cushions press tightly round the bare shield.

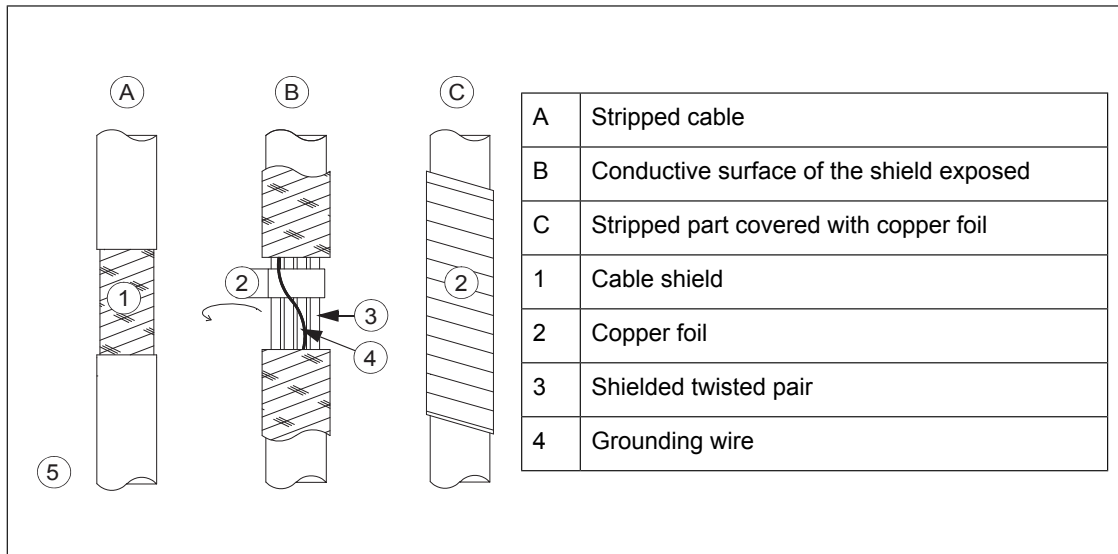


**Note 1:** Keep the shields continuous as close to the connection terminals as possible. Secure the cables mechanically at the entry strain relief.

**Note 2:** If the outer surface of the shield is non-conductive:

- Cut the shield at the midpoint of the bare part. Be careful not to cut the conductors or the grounding wire (if present).
- Turn the shield inside out to expose its conductive surface.

- Cover the turned shield and the stripped cable with copper foil to keep the shielding continuous.

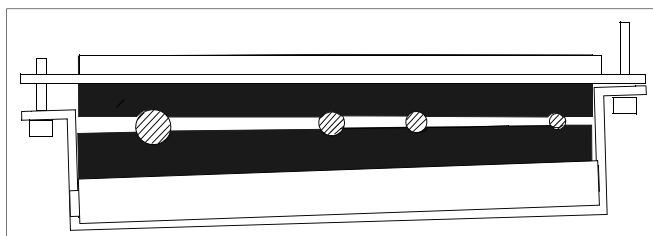


**Note for top entry of cables:** When each cable has its own rubber grommet, sufficient IP and EMC protection can be achieved. However, if very many control cables come to one cabinet, plan the installation beforehand as follows:

1. Make a list of the cables coming to the cabinet.
2. Sort the cables going to the left into one group and the cables going to the right into another group to avoid unnecessary crossing of cables inside the cabinet.
3. Sort the cables in each group according to size.
4. Group the cables for each grommet as follows ensuring that each cable has a proper contact to the cushions on both sides.

Cable diameter in mm	Max. number of cables per grommet
≤ 13	4
≤ 17	3
< 25	2
≥ 25	1

5. Arrange the bunches according to size from thickest to the thinnest between the EMI conductive cushions.



6. If more than one cable go through a grommet, seal the grommet by applying Loctite 5221 (catalogue number 25551) inside the grommet.

### **Routing the control cables inside the cabinet**

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





## Connecting control cabling

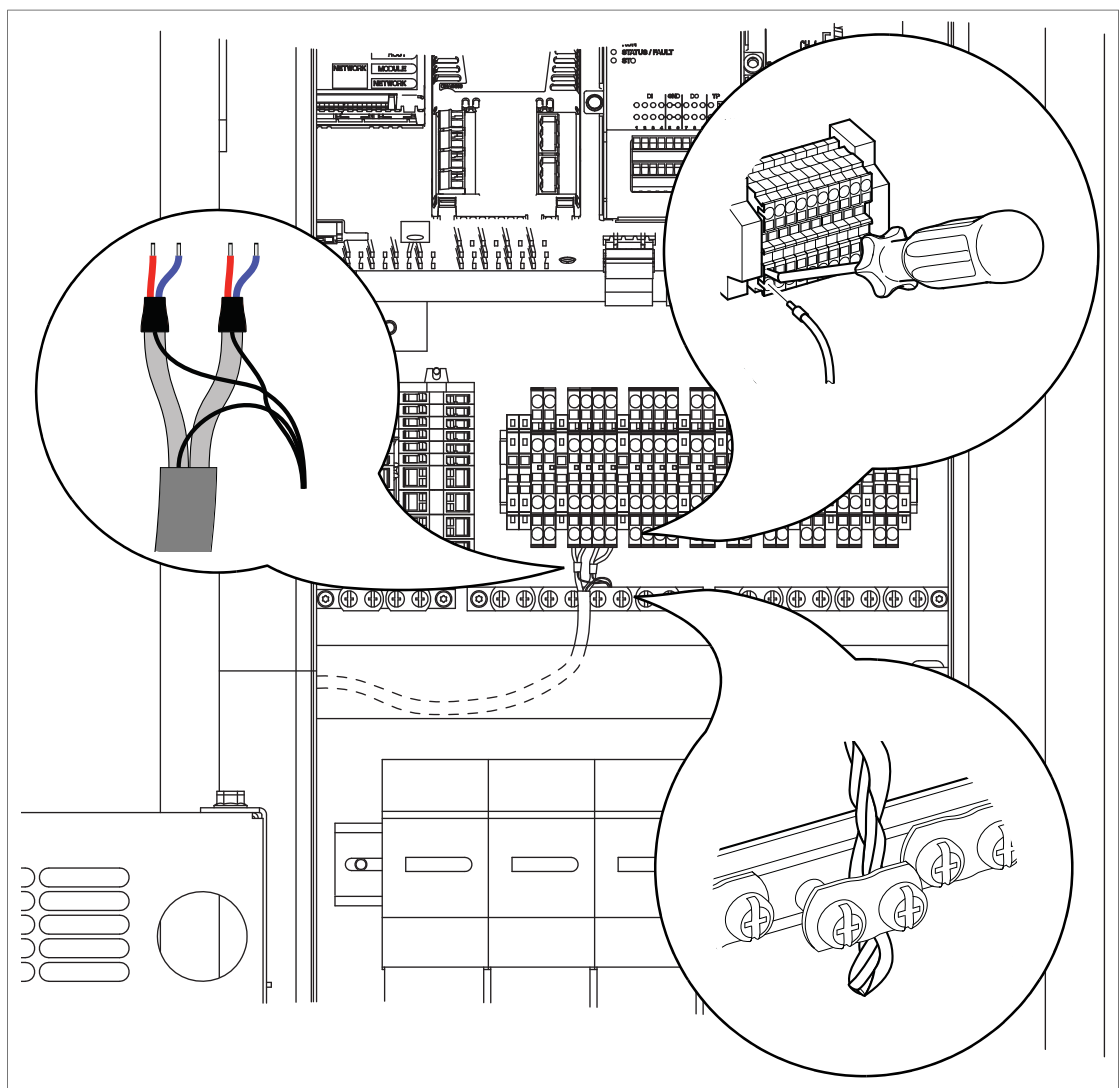
Connect the conductors to the appropriate terminals. Refer to the wiring diagrams delivered with the drive.

Connect the inner twisted pair shields and all separate grounding wires to the grounding clamps closest to the terminals.

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

### Notes:

- Do not ground the outer shield of the cable here since it is grounded at the lead-through.
- Keep any signal wire pairs twisted as close to the terminals as possible. Twisting the wire with its return wire reduces disturbances caused by inductive coupling.



At the other end of the cable, leave the shields unconnected or ground them indirectly via a high-frequency capacitor with a few nanofarads, eg. 3.3 nF / 630 V. The shield can also be grounded directly at both ends if they are in the same ground line with no significant voltage drop between the end points.

## Powering the heating and lighting equipment (options +G300 and +G301)

See the circuit diagrams delivered with the supply unit. Cabinet heaters and/or lighting (230 or 115 V AC, options +G300/+G301) are to be supplied from external power sources.

Connect the external power supply wires for the cabinet heater and lighting to terminal block X22 at the mounting plate.

### ■ Connection diagram

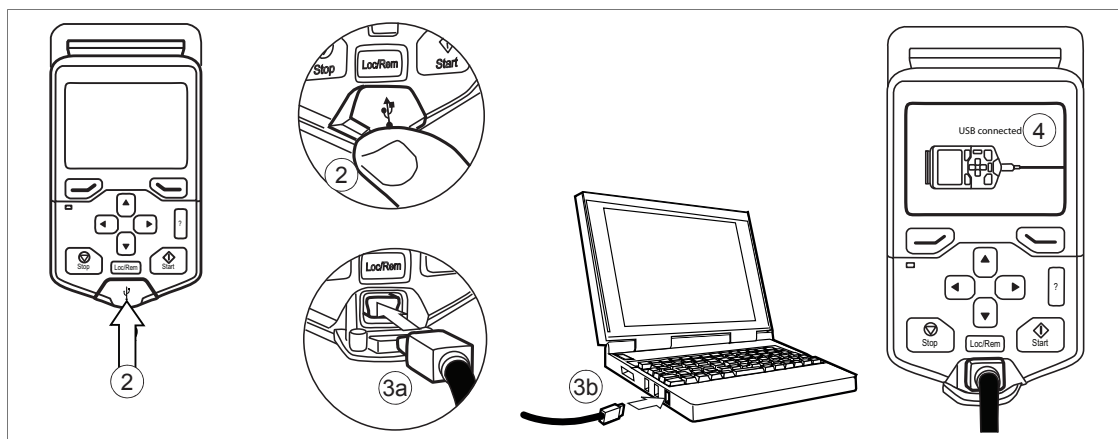
External heating voltage supply		External lighting voltage supply	
X22:47 X22:48	Internal wiring of the cabinet heating: heating supply off/fault = contact open	X22:49 X22:50	Internal wiring of the cabinet lighting: lighting supply off/fault = contact open



## Connecting a PC

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

1. Connect an ACx-AP-x control panel to the unit either
  - by inserting the control panel into the panel holder or platform (if present), or
  - by using an Ethernet (eg, Cat 5e) networking cable.
2. Remove the USB connector cover on the front of the control panel.
3. Connect an USB cable (Type A to Type Mini-B) between the USB connector on the control panel (3a) and a free USB port on the PC (3b).
4. The panel will display an indication whenever the connection is active.



5. See the documentation of the PC tool for setup instructions.

## Installing optional modules



### WARNING!

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

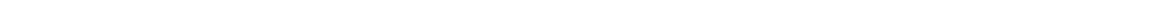
### Note:

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

1. Repeat the steps described in section [Electrical safety precautions \(page 35\)](#).
2. Ensure by measuring that the I/O terminals of the control unit (especially the relay output terminals) are safe.
3. Insert the module into a free option module slot on the control unit.
4. Fasten the module. For instructions, see the documentation of the optional module.
5. Connect the necessary wiring to the module following the instructions given in the documentation of the module.
6. Tighten the grounding screw to a torque of 0.8 N·m.

### Note:

The screw tightens the connections and grounds the module. It is essential for fulfilling the EMC requirements and for proper operation of the module.





## Control units of the drive

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### Contents of this chapter

This chapter

- describes the connections of the control unit,
- contains the specifications of the inputs and outputs of the control unit.

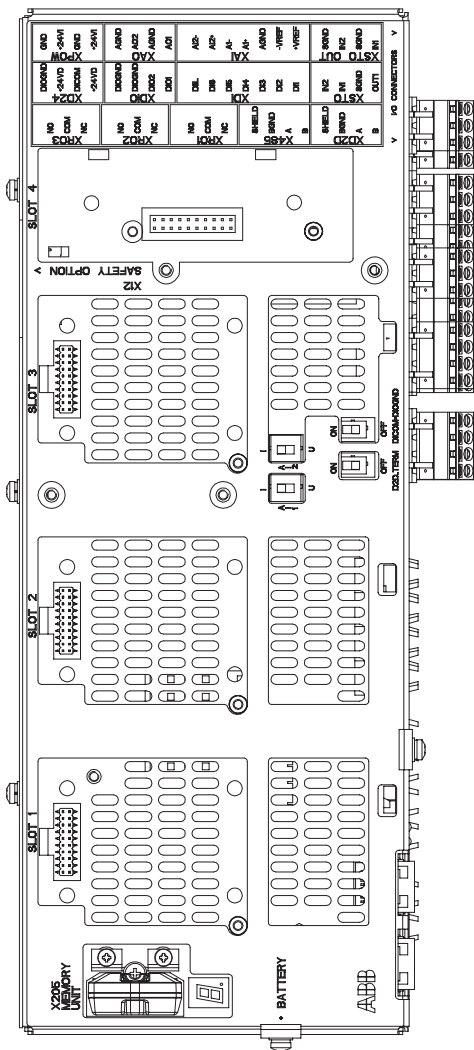
### General

The BCU-x2 control unit is used with frame size R8i and multiples. The BCU-x2 consists of a BCON-12 control board (and a BIOC-01 I/O connector board and power supply board) built in a metal housing. The control unit is connected to the IGBT supply module(s) by fiber optic cables.

In this manual, the name “BCU-x2” represents the control unit types BCU-02, BCU-12 and BCU-22. These have a different number of power module connections (2, 7 and 12 respectively) but are otherwise similar.

---

# BCU-x2 control unit layout and connections



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







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

## Default I/O diagram of the supply control unit

The diagram below shows the default I/O connections on the supply control unit (A51), and describes the use of the connections in the supply unit. Under normal circumstances, the factory-made wiring should not be changed.

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

<b>XD2D</b>		<b>Drive-to-drive link</b>
1	B	Drive-to-drive link (not in use by default)
2	A	
3	BGND	
4	Shield	
<b>D2D.TERM</b>		<b>Drive-to-drive link termination <sup>1)</sup></b>
<b>X485</b>		<b>RS485 connection</b>
5	B	Not in use (not in use by default)
6	A	
7	BGND	
8	Shield	
<b>XRO1...XRO3</b>		<b>Relay outputs</b>
11	NC	 XRO1: <b>Charging</b> <sup>2)</sup> (Energized = Closes charging contactor.) 250 V AC / 30 V DC / 2 A
12	COM	
13	NO	
21	NC	 XRO2: <b>Fault(-1)</b> <sup>3)</sup> (Energized = Indicates no fault.) 250 V AC / 30 V DC / 2 A
22	COM	
23	NO	
31	NC	 XRO3: <b>MCB ctrl</b> <sup>2)</sup> (Energized = Closes main contactor/breaker.) 250 V AC / 30 V DC / 2 A
32	COM	
33	NO	
<b>XSTO</b>		<b>XSTO connector</b>
1	OUT	 XSTO connector. Both circuits (power module, control unit) must be closed for the supply unit to start. (IN1 and IN2 must be connected to OUT.) <sup>4)</sup>
2	SGND	
3	IN1	
4	IN2	
5	IN1	Not in use
6	SGND	
7	IN2	
8	SGND	
<b>XDI</b>		<b>Digital inputs</b>
1	DI1	Temp fault <sup>3)</sup> (0 = overtemperature)
2	DI2	Run / enable <sup>3)</sup> (1 = run / enable)
3	DI3	MCB fb <sup>2)</sup> (0 = main contactor/breaker open)
4	DI4	Not in use by default. Can be used for eg, auxiliary circuit breaker fault
5	DI5	Not in use by default. Can be used for eg, earth fault monitoring.
6	DI6	Reset <sup>3)</sup> (0 -> 1 = fault reset)
7	DIIL	Not in use by default. Can be used for eg, emergency stop.
<b>XDIO</b>		<b>Digital input/outputs</b>
1	DIO1	Not in use by default
2	DIO2	Not in use by default
3	DIOGND	Digital input/output ground
4	DIOGND	Digital input/output ground
<b>XD24</b>		<b>Auxiliary voltage output</b>
5	+24VD	+24 V DC 200 mA <sup>5)</sup>
6	DICOM	Digital input ground
7	+24VD	+24 V DC 200 mA <sup>5)</sup>
8	DIOGND	Digital input/output ground
<b>DICOM=DIOGND</b>		<b>Ground selection switch <sup>6)</sup></b>
<b>XAI</b>		<b>Analog inputs, reference voltage output</b>
1	+VREF	10 V DC, $R_L$ 1...10 kohm
2	-VREF	-10 V DC, $R_L$ 1...10 kohm
3	AGND	Ground
4	AI1+	Not in use by default.
5	AI1-	0(2)...10 V, $R_{in} > 200$ kohm <sup>7)</sup>
6	AI2+	Not in use by default.
7	AI2-	0(4)...20 mA, $R_{in} = 100$ ohm <sup>8)</sup>
<b>XAO</b>		<b>Analog outputs</b>
1	AO1	<b>Zero</b> <sup>3)</sup> 0...20 mA, $R_L < 500$ ohm
2	AGND	
3	AO2	<b>Zero</b> <sup>3)</sup> 0...20 mA, $R_L < 500$ ohm
4	AGND	
<b>XPOW</b>		<b>External power input</b>
1	+24VI	24 V DC, 2.05 A
2	GND	
3	+24VI	
4	GND	
<b>X12</b>		<b>Safety functions module connection</b> (not in use in supply units)
<b>X13</b>		<b>Control panel connection</b>
<b>X205</b>		<b>Memory unit connection</b>

### Notes:

1) Must be set to ON when the supply unit is the first or last unit on the drive-to-drive (D2D) link. On intermediate units, set termination to OFF.



- 2) Use of the signal in the control program. When parameter 120.30 External charge enable has value Yes (default setting), the control program reserves this I/O terminal for external charging circuit control and monitoring, and parameters 110.24 RO1 source and 110.30 RO3 source are write-protected. If the value is No, you can use the I/O terminal for other purposes.
- 3) Use of the signal in the control program (fixed). See also the delivery-specific circuit diagrams.
- 4) This input only acts as a true Safe torque off input in inverter control units. In other applications (such as a supply or brake unit), de-energizing the IN1 and/or IN2 terminal will stop the unit but not constitute a true safety function.
- 5) Total load capacity of these outputs is 4.8 W (200 mA at 24 V) minus the power taken by DIO1 and DIO2.
- 6) Determines whether DICOM is separated from DIOGND (ie, common reference for digital inputs floats).  
**DICOM=DIOGND ON:** DICOM connected to DIOGND. **OFF:** DICOM and DIOGND separate.
- 7) Current [0(4)...20 mA,  $R_{in} = 100 \text{ ohm}$ ] or voltage [0(2)...10 V,  $R_{in} > 200 \text{ kohm}$ ] input selected by switch AI1. Change of setting requires reboot of control unit.
- 8) Current [0(4)...20 mA,  $R_{in} = 100 \text{ ohm}$ ] or voltage [0(2)...10 V,  $R_{in} > 200 \text{ kohm}$ ] input selected by switch AI2. Change of setting requires reboot of control unit.

## External power supply for the control unit (XPOW)

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

## The XD2D connector

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

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

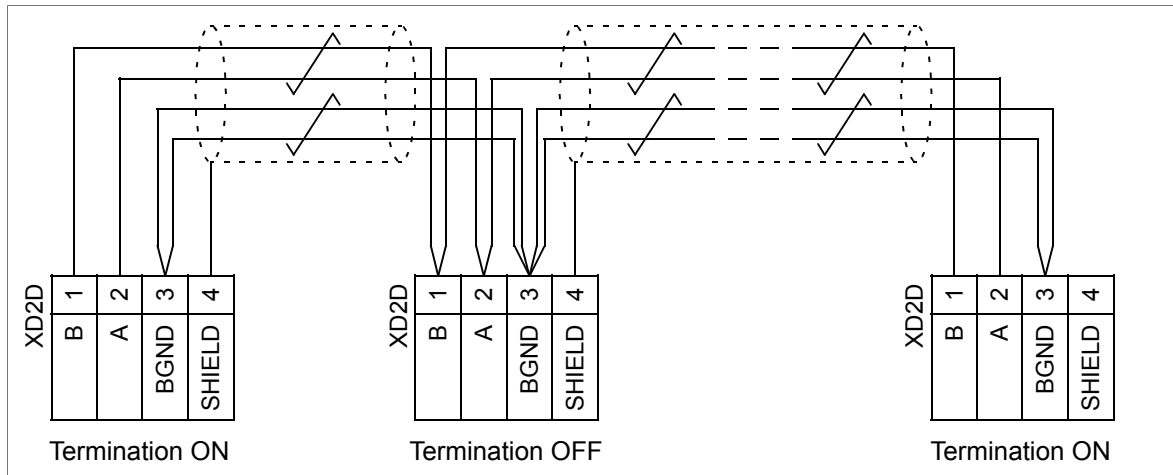
See the firmware manual of the drive for the related parameter settings.

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

Use shielded twisted-pair cable with a twisted pair for data and a wire or another pair for signal ground (nominal impedance 100 to 165 ohm, for example Belden 9842) for the wiring. For best immunity, ABB recommends high quality cable. Keep the cable as short as possible. Avoid unnecessary loops and parallel runs near power cables such as motor cables.

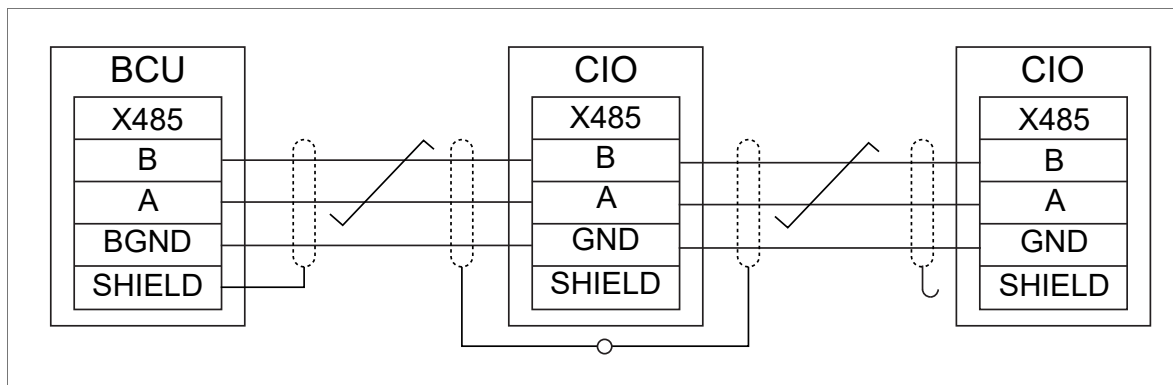
The following diagram shows the wiring between control units.

### BCU-x2



### The X485 connector

The X485 provides a connection for optional CIO-01 I/O module. The following diagram shows the wiring for the CIO module.



### Safe torque off (XSTO, XSTO OUT)

**Note:**

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

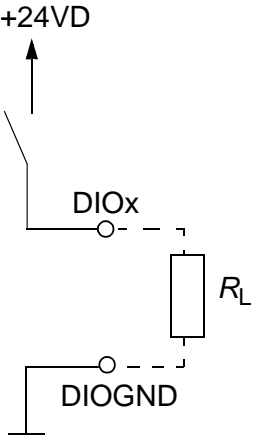
### FSO-xx safety functions module connection (X12)

See the user manual of the FSO-xx module. Note that the FSO-xx safety functions module is not in use in supply (or DC/DC converter or brake) units.

### SDHC memory card slot

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

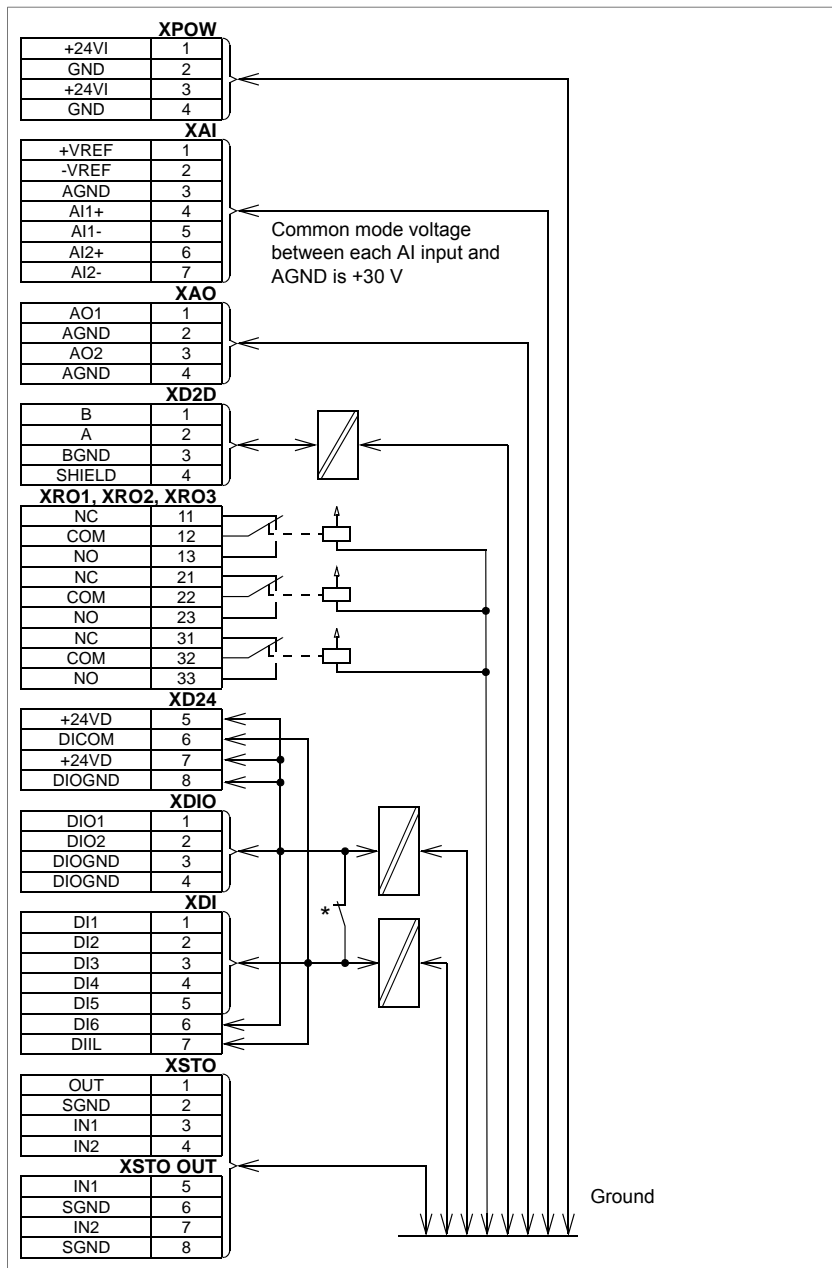
## Connector data

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

## 60 Control units of the drive

Analog inputs AI1 and AI2 (XAI:4 ... XAI:7). Current/voltage input mode selection by switches	Connector pitch 5 mm, wire size 2.5 mm <sup>2</sup> Current input: -20...20 mA, $R_{in} = 100 \text{ ohm}$ Voltage input: -10...10 V, $R_{in} > 200 \text{ kohm}$ Differential inputs, common mode range $\pm 30 \text{ V}$ Sampling interval per channel: 0.25 ms Hardware filtering: 0.25 ms, adjustable digital filtering up to 8 ms Resolution: 11 bit + sign bit Inaccuracy: 1% of full scale range
Analog outputs AO1 and AO2 (XAO)	Connector pitch 5 mm, wire size 2.5 mm <sup>2</sup> 0...20 mA, $R_{load} < 500 \text{ ohm}$ Frequency range: 0...500 Hz Resolution: 11 bit + sign bit Inaccuracy: 2% of full scale range
XD2D connector	Connector pitch 5 mm, wire size 2.5 mm <sup>2</sup> Physical layer: RS-485 Termination by switch
RS-485 connection (X485)	Connector pitch 5 mm, wire size 2.5 mm <sup>2</sup> Physical layer: RS-485
Safe torque off connection (XSTO)	Connector pitch 5 mm, wire size 2.5 mm <sup>2</sup> Input voltage range: -3...30 V DC Logic levels: "0" < 5 V, "1" > 17 V.  <b>Note:</b> For the unit to start, both connections must be "1". This applies to all control units (including drive, inverter, supply, brake, DC/DC converter etc. control units), but true Safe torque off functionality is only achieved through the XSTO connector of the drive/inverter control unit.  EMC (immunity) according to IEC 61326-3-1
Safe torque off output (XSTO OUT)	Connector pitch 5 mm, wire size 2.5 mm <sup>2</sup> To STO connector of inverter module.
Control panel connection (X13)	Connector: RJ-45 Cable length < 3 m
Ethernet connection (XETH)	Connector: RJ-45 This connection is not supported by the firmware.
SDHC memory card slot (SD CARD)	Memory card type: SDHC Maximum memory size: 4 GB
The terminals of the control unit fulfill the Protective Extra Low Voltage (PELV) requirements. The PELV requirements of a relay output are not fulfilled if a voltage higher than 48 V is connected to the relay output.	

## ■ BCU-x2 ground isolation diagram



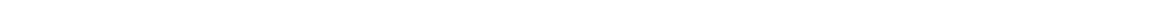
### \*Ground selector (DICOM=DIOGND) settings

DICOM=DIOGND: ON

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

DICOM=DIOGND: OFF

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





# Installation checklist of the drive

## Contents of this chapter

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

## Checklist

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



**WARNING!**

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

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



**WARNING!**

Stop the drive and do the steps in section *Electrical safety precautions (page 35)* before you start the work.

<b>Make sure that ...</b>	<input checked="" type="checkbox"/>
The ambient operating conditions meet the drive ambient conditions specification, and enclosure rating (IP code or UL enclosure type).	<input type="checkbox"/>
The supply voltage matches the nominal input voltage of the drive. See the type designation label.	<input type="checkbox"/>
The drive cabinet has been attached to floor, and if necessary due to vibration etc, also by its top to the wall or roof.	<input type="checkbox"/>
<u>If the drive is connected to a network other than a symetrically grounded TN-S system:</u> Check the compatibility. See the electrical installation instructions in the supply unit manual.	<input type="checkbox"/>
There is an adequately sized protective earth (ground) conductor between the drive and the switchboard, the conductor has been connected to appropriate terminal, and the terminal has been tightened to the proper torque. Proper grounding has also been measured according to the regulations.	<input type="checkbox"/>

64 Installation checklist of the drive

<b>Make sure that ...</b>	<input checked="" type="checkbox"/>
The input power cable has been connected to the appropriate terminals, the phase order is right, and the terminals have been tightened to the proper torque.	<input type="checkbox"/>
There is an adequately sized protective earth (ground) conductor between the motor and the drive, and the conductor has been connected to appropriate terminal, and the terminal has been tightened to the proper torque. (Pull on the conductors to check.). Proper grounding has also been measured according to the regulations.	<input type="checkbox"/>
The motor cable has been connected to the appropriate terminals, the phase order is right, and the terminals have been tightened to the proper torque.	<input type="checkbox"/>
The motor cable has been routed away from other cables.	<input type="checkbox"/>
No power factor compensation capacitors have been connected to the motor cable.	<input type="checkbox"/>
The control cables have been connected to the appropriate terminals, and the terminals have been tightened to the proper torque.	<input type="checkbox"/>
The voltage setting of the auxiliary voltage transformers (if any) is correct. See the electrical installation instructions.	<input type="checkbox"/>
<u>If a drive bypass connection will be used:</u> The direct-on-line contactor of the motor and the drive output contactor are either mechanically and/or electrically interlocked, ie, cannot be closed simultaneously. A thermal overload device must be used for protection when bypassing the drive. Refer to local codes and regulations.	<input type="checkbox"/>
There are no tools, foreign objects or dust from drilling inside the drive.	<input type="checkbox"/>
Cover(s) of the motor connection box are in place. Cabinet shrouds are in place and doors are closed.	<input type="checkbox"/>
The motor and the driven equipment are ready for start.	<input type="checkbox"/>
The coolant connections between cubicles (if any) and to the cooling circuit are tight.	<input type="checkbox"/>
<u>If the drive is equipped with a cooling unit:</u> Refer to the cooling unit documentation for specific tasks.	<input type="checkbox"/>



# 6

## Start-up and operation

---

### Contents of this chapter

This chapter describes the start-up procedure of the IGBT supply unit. The information is valid for cabinet-installed ACS880-207LC IGBT supply units.

**Note:**

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

The underlined tasks are needed for certain cases only. The option codes (if any) are given in brackets. The default device designations (if any) are given in square brackets. For example: Supply unit with the grounding switch ([Q9], option +F259). The same device designations are also used in the circuit diagrams, typically.

### Safety

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**WARNING!**

Only qualified electricians are allowed to do the work described in this chapter. Obey all safety instructions in *Safety instructions for ACS880 liquid-cooled multidrive cabinets and modules* (3AXD50000048633 [English]) and section *Electrical safety precautions* (page 35). If you ignore the safety instructions, injury or death, or damage to the equipment can occur.


---



## Start-up procedure

<b>Action</b>	<input checked="" type="checkbox"/>
<b>Checks/Settings with no voltage connected</b>	
Ensure that the disconnecter of the supply transformer is locked to the off (0) position, ie. no voltage is, and cannot be connected to the drive inadvertently.	<input type="checkbox"/>
Make sure that the main disconnecting device of the supply unit is open and locked: <ul style="list-style-type: none"> <li>• <u>Drives with a main switch-disconnector ([Q1.], option +F253)</u>: Open the main switch-disconnector of the drive.</li> <li>• <u>Drives with a main breaker ([Q1], option +F255)</u>: Crank the main breaker to DISCONNECTED position.</li> </ul>	<input type="checkbox"/>
Drive with the <u>grounding switch ([Q9] . option +F259)</u> : Close the grounding switch.	<input type="checkbox"/>
 <b>WARNING!</b> Do not use excessive force. Check the inter-lockings if you cannot turn the switch. See the delivery-specific circuit diagrams.	
Make sure that the charging disconnecter [Q3] and the DC switch-disconnector for line-up charging [Q40] (if present) are open.	<input type="checkbox"/>
Open the auxiliary voltage switch [Q21].	<input type="checkbox"/>
Check the mechanical and electrical installation. See chapter <i>Installation checklist of the drive</i> .	<input type="checkbox"/>
Check the settings of breakers/switches in the auxiliary circuits. See the delivery-specific circuit diagrams.	<input type="checkbox"/>
Disconnect any unfinished or uninspected auxiliary voltage (115/230 V AC) cables that lead from the terminal blocks to the outside of the equipment.	<input type="checkbox"/>
<u>Drives with ground fault monitoring for IT (ungrounded) systems (option +Q954)</u> : Adjust the settings of the ground fault monitor to suit the installation. See the circuit diagrams of the delivery and <i>IRDH275B Ground Fault Monitor Operating Manual</i> by Bender (code: TGH1386en).	<input type="checkbox"/>
<b>Powering up the auxiliary circuit</b>	
Make sure that it is safe to connect voltage. Ensure that <ul style="list-style-type: none"> <li>• nobody is working on the unit or circuits that have been wired from outside into the cabinet</li> <li>• the cover of the motor terminal box is in place.</li> </ul>	<input type="checkbox"/>
<u>Drives with a voltmeter ([P5], option +G334)</u> : Make sure that the circuit breaker of the measuring circuit (F5.1) is closed.	<input type="checkbox"/>
Close the circuit breakers and/or fuse disconnectors supplying the auxiliary voltage circuits.	<input type="checkbox"/>
Close the cabinet doors.	<input type="checkbox"/>
Close the main breaker of the supply transformer.	<input type="checkbox"/>
Close the auxiliary voltage switch [Q21]. Also switch on the voltage to any other externally-supplied options (such as the cooling fan supply, lighting, heating).	<input type="checkbox"/>
<b>Starting and checking the cooling system</b>	
Fill up and bleed the internal cooling circuit. Start the cooling unit up. See <i>Filling up and bleeding the internal cooling circuit (page 112)</i> . <u>If the drive is equipped with a cooling unit (ACS880-1007LC)</u> : Start up and power up the cooling unit. See <i>ACS880-1007LC liquid cooling unit user's manual (3AXD50000129607 [English])</i> and the delivery-specific circuit diagrams.	<input type="checkbox"/>
Check the cooling system for leaks. Make sure that cooling circuit joints at the shipping split joining cubicles are tight and that all drain valves have been closed.	<input type="checkbox"/>
Make sure that the coolant can flow freely in all cubicles. Make sure that drive system cools down. See <i>ACS880-1007LC liquid cooling unit user's manual (3AXD50000129607 [English])</i> .	<input type="checkbox"/>
Install all shrouds (if removed) and close the cabinet doors.	<input type="checkbox"/>
<b>Setting up the supply unit parameters</b>	



<b>Action</b>	<input checked="" type="checkbox"/>
<p>Check the voltage range setting in parameter <i>195.01 Supply voltage</i>.</p> <p>For more information on setting up the supply control program, see the <i>ACS880 IGBT supply control program firmware manual</i> (3AUA0000131562 [English]).</p> <p>For more information on setting up the Optimal grid control mode, see <i>Optimal grid control of ACS880 IGBT supply control program supplement</i> (3AXD50000164745 [English]).</p> <p>For more information on setting up the distributed I/O bus, see <i>ACS880 distributed I/O bus supplement</i> (3AXD50000126880 [English]).</p> <p>If you need more information on the use of the control panel, see the <i>ACX-AP-x Assistant control panels user's manual</i> (3AUA0000085685 [English]).</p>	<input type="checkbox"/>
<u>Drives with a fieldbus adapter module (optional)</u> : Set the fieldbus parameters. Activate the fieldbus adapter module in the control program. See the user's manual of the fieldbus adapter module, and <i>ACS880 IGBT supply control program firmware manual</i> (3AUA0000131562 [English]). Check that the communication works between the drive and the PLC.	<input type="checkbox"/>
Make sure that the control panel [A51] is in the remote mode (Loc/Rem key of the panel). Otherwise no external control (operating switch on the cabinet door, or fieldbus adapter) is possible.	<input type="checkbox"/>
<b>Powering up the main circuit of the drive</b>	
<u>Drive with the grounding switch ([Q9] . option +F259)</u> : Open the grounding switch.	<input type="checkbox"/>
<u>Drives with a DC switch-disconnector ([Q11] option +F286)</u> : Make sure that all DC switch-disconnectors [Q11] are closed and charging switches [Q10] are open in all IGBT supply module cubicles. See also <a href="#">Additional instructions for closing the DC switch-disconnector (page 68)</a> .	<input type="checkbox"/>
<ul style="list-style-type: none"> <li>• <u>Drives with a main switch-disconnector ([Q1], option +F253)</u>: Close the main switch-disconnector.</li> <li>• <u>Drives with a main breaker ([Q1], option +F255)</u>: Crank the main breaker in.</li> </ul> <p> <b>WARNING!</b> Do not use excessive force. Check the inter-lockings if you cannot close the disconnecting device. See the delivery-specific circuit diagrams.</p>	<input type="checkbox"/>
Close the charging disconnecter [Q3] and the DC switch-disconnector for line-up charging [Q40] (if present).	<input type="checkbox"/>
Turn the operating switch [S21] to the ON (1) position to activate the run enable signal. The main contactor or breaker closes. If this is not the case, use possible additional main contactor/breaker control signal(s) to close it. See the delivery-specific circuit diagrams and the supply unit firmware manual.	<input type="checkbox"/>
<b>On-load checks</b>	
Validate the operation of safety functions if any (for example, emergency stop). See the delivery-specific circuit diagrams and function-specific manuals.	<input type="checkbox"/>
<u>Drives with an emergency stop circuit (options +Q951, +Q952, +Q963, +Q964, +Q978, +Q979)</u> : Test and validate the operation of the emergency-stop circuit. See the delivery specific circuit diagrams and wiring, start-up and operating instructions of the option.	<input type="checkbox"/>



### ■ Additional instructions for closing the DC switch-disconnector

If the DC bus is not alive and the main DC switch-disconnector [Q11] is in OFF position, the main DC switch-disconnector [Q11] is mechanically locked to OFF position by interlock [K11]. In order to get the supply unit started there are two possibilities: the DC bus is powered up by another supply unit (if applicable), or the DC bus must be powered by means of the local charging control switch [S4], which forces the charging circuit on.

IGBT supply modules can then be charged as follows:

#### **Note:**

Before local operation of the charging circuit via local charging control switch [S4], make sure that the main breaker(s) of the supply unit is racked in and the DC switch-disconnector for line-up charging [Q40] is closed.

- Force the charging circuit of the unit on via setting the local charging control switch [S4] to position “1”.
- Wait for a few seconds for the DC bus charging up to nominal voltage level.
- Charge the IGBT supply modules: close the charging switch [Q10] of the units that are to be powered up.
- After the IGBT supply modules are charged and the charging light [P11] on the cabinet door illuminates, the lock of DC switch-disconnector [Q11] is released. The main DC switch-disconnector [Q11] can now be closed, and the charging switch [Q10] opened.
- Repeat this for all IGBT supply module cubicles belonging to this supply unit.
- After that, set the local charging control switch [S4] back into OPEN position and the DC bus will be discharged again.

When the DC switch-disconnector [Q11] is in ON position, follow the normal start-up procedure to charge the line-up and to start the operation of the supply unit.





# Maintenance

---

## Contents of this chapter

This chapter instructs how to maintain the IGBT supply unit and how to interpret its fault indications. The information is valid for cabinet-installed ACS880-207LC IGBT supply units.

---

## 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](http://www.abb.com/drivesservices)). For more information, consult your local ABB Service representative ([www.abb.com/searchchannels](http://www.abb.com/searchchannels)).

Maintenance task/object	Years from start-up													
	0	1	2	3	4	5	6	7	8	9	10	11	12	...
<b>Coolant</b>														
Coolant draining and replacement							R							R
Checking coolant quality			P		P		P		P		P		P	
Checking coolant antifreeze concentration		P	P	P	P	P	P	P	P	P	P	P	P	P
<b>Coolant pump</b>														
Pump							R							R
Pump motor							R							R
Expansion tank							R							R
<b>Cooling fans</b>														
Supply module fan (230 V)										R				
Supply module fan (115 V)							R							R
<b>Batteries</b>														
Control panel battery										R				
Control unit battery							R							R
<b>Connections and environment</b>														
Quality of supply voltage		P	P	P	P	P	P	P	P	P	P	P	P	P
<b>Spare parts</b>														
Spare parts		I	I	I	I	I	I	I	I	I	I	I	I	I
DC circuit capacitor reforming (spare modules and spare capacitors)		P	P	P	P	P	P	P	P	P	P	P	P	P
<b>Inspections</b>														
Checking tightness of cable and busbar terminals. Tightening if needed.		I	I	I	I	I	I	I	I	I	I	I	I	I
Checking ambient conditions (dustiness, corrosion, temperature)		I	I	I	I	I	I	I	I	I	I	I	I	I
Checking coolant pipe connections		I	I	I	I	I	I	I	I	I	I	I	I	I

### Symbols

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

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.

## Maintenance timers and counters

The control program has maintenance timers and counters that can be configured to generate a warning when a pre-defined limit is reached. Each timer/counter can be set to monitor any parameter. This feature is especially useful as a service reminder. For more information, see the firmware manual.

## Cabinet

### ■ Cleaning the interior of the cabinet

---

**WARNING!**

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

---

**WARNING!**

Use a vacuum cleaner with an antistatic hose and nozzle, and wear a grounding wristband. Otherwise an electrostatic charge might build up and damage the circuit boards.

---

1. Stop the drive and do the steps in section [Electrical safety precautions \(page 35\)](#) before you start the work.
  2. Open the cabinet door.
  3. Clean the interior of the cabinet. Use a vacuum cleaner and a soft brush.
  4. Clean the air inlets of the fans and air outlets of the modules (top).
  5. Clean the air inlet gratings (if any) on the door.
  6. Close the door.
-

## Power connections

### ■ Retightening the power connections

---



**WARNING!**

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

---

1. Repeat the steps described in section *Electrical safety precautions (page 35)*.
  2. Check the tightness of the cable connections. Use the tightening torques given in the technical data.
-



## Fuses

### ■ Replacing the supply unit AC fuses

---

**WARNING!**

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

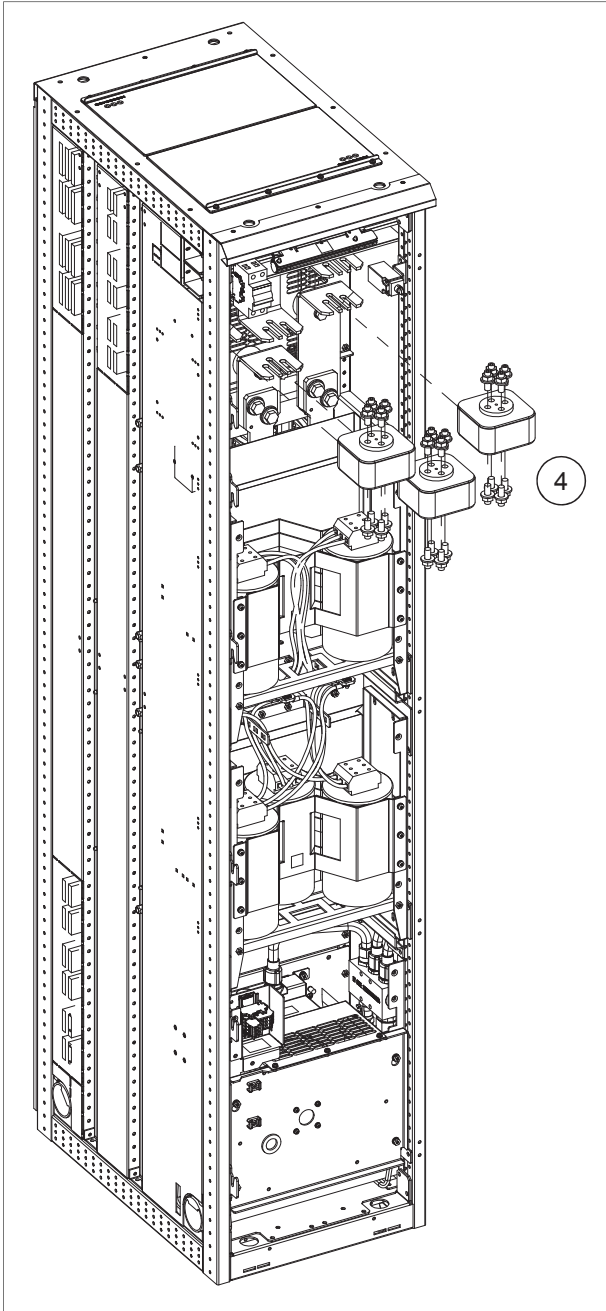
---

**WARNING!**

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

---

1. Repeat the steps described in section [Electrical safety precautions \(page 35\)](#) before you start the work.
  2. Open the door of the LCL filter cubicle.
  3. Remove the shrouding in front of the fuses (if any).
  4. Check the condition of the fuses. In case of a blown fuse, replace all fuses with similar fuses: slacken the nuts of the fuses and pull the fuses out. Do not unscrew the nuts completely, not to drop them inside the cubicle. Tighten the nuts first by hand or applying maximum 5 N·m force. Tightening torques for M12 nuts are 50 N·m (37 lbf·ft) for Cooper Bussmann fuses, and 46 N·m (34 lbf·ft) for Mersen (Ferraz-Shawmut) fuses.
  5. Attach the shrouding (if any) and close the door.
-



## ■ Replacing the supply unit DC fuses



### WARNING!

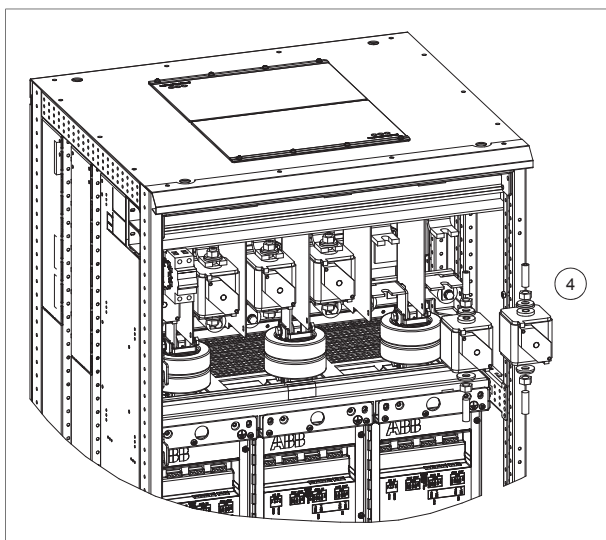
Read the safety instructions given in *Safety instructions for ACS880 liquid-cooled multidrive cabinets and modules (3AXD50000048633 [English])*. If you ignore them, injury or death, or damage to the equipment can occur.



### WARNING!

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

1. Repeat the steps described in section *Electrical safety precautions (page 35)* before you start the work.
2. Open the door of the module cubicle.
3. Remove the shrouding in front of the fuses (if any).
4. Check the condition of the fuses. In case of a blown fuse, replace all fuses with similar fuses: slacken the nuts of the fuses and pull the fuses out. Do not unscrew the nuts completely, not to drop them inside the module(s) below. Tighten the nuts first by hand or applying maximum 5 N·m force. Tightening torques for M12 nuts are 50 N·m (37 lbf·ft) for Bussmann fuses, and 46 N·m (34 lbf·ft) for Ferraz Shawmut fuses.
5. Attach the shrouding (if any) and close the door.



## Fans

The life span of the cooling fan 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. Reset the running time signal after fan replacement.

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

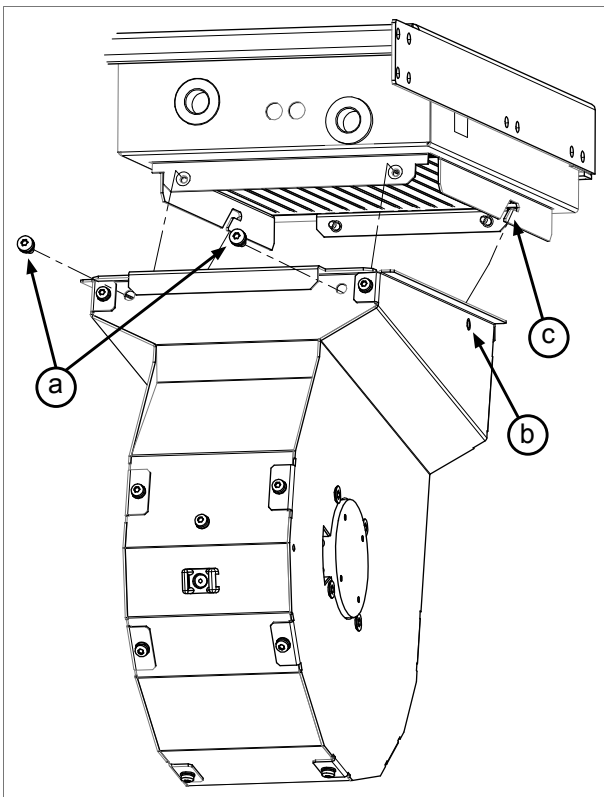
## ■ Replacing the heat exchanger fan in the supply module cubicle



### WARNING!

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

1. Repeat the steps described in section *Electrical safety precautions (page 35)*.
2. Remove any shrouding in front of the cooling fan.
3. Disconnect the fan wiring.
4. Undo the two retaining screws (a).
5. Pull the fan outwards to separate it from the heat exchanger housing.
6. Install new fan in reverse order. Align the guide pins (b) at the rear of the fan cowling with the slots (c) in the module bottom guide, then reinstall the retaining screws (a).



## ■ Replacing the heat exchanger fan in the filter cubicle



### WARNING!

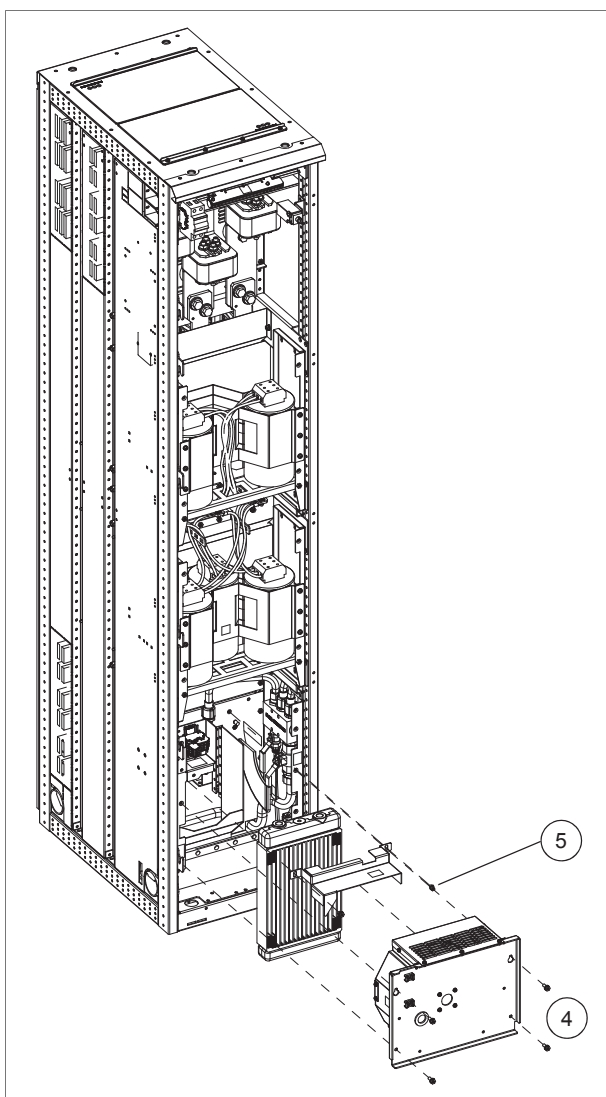
Read the safety instructions given in *Safety instructions for ACS880 liquid-cooled multidrive cabinets and modules (3AXD50000048633 [English])*. If you ignore them, injury or death, or damage to the equipment can occur.



### WARNING!

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

1. Repeat the steps described in section *Electrical safety precautions (page 35)* before you start the work.
2. Remove the shrouding in front of the fan (if any).
3. Disconnect the fan wiring.
4. Remove the four screws and pull the fan unit out.
5. Remove the two screws in front of the heat exchanger.
6. Install a new fan in reverse order.



## ■ Replacing the fan in the incoming cubicle

---



**WARNING!**

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

---

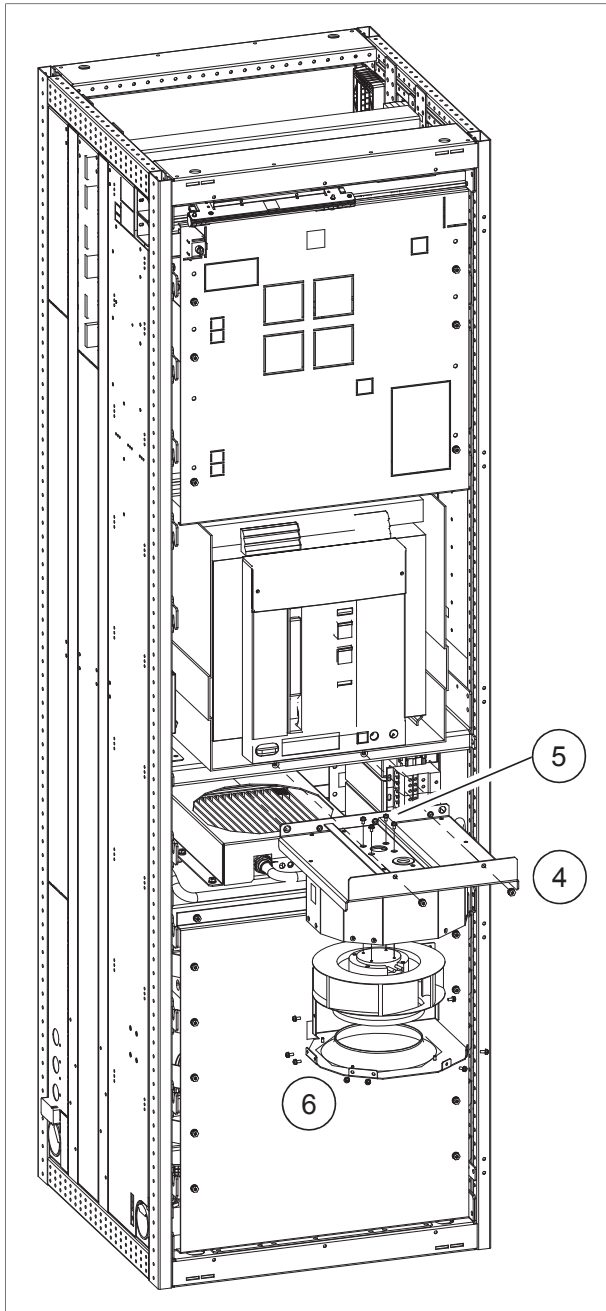


**WARNING!**

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

---

1. Repeat the steps described in section *Electrical safety precautions (page 35)* before you start the work.
  2. Remove the shrouding in front of the fan (if any).
  3. Disconnect the fan wiring.
  4. Remove the two screws and slide the fan unit out.
  5. Remove the four screws to detach the fan from the fan unit.
  6. Remove the eight screws surrounding the fan unit.
  7. Install a new fan in reverse order.
-



## ■ Replacing the fan in the auxiliary control cubicle

Auxiliary control cubicle has a fan in the lower part of the cubicle.



### **WARNING!**

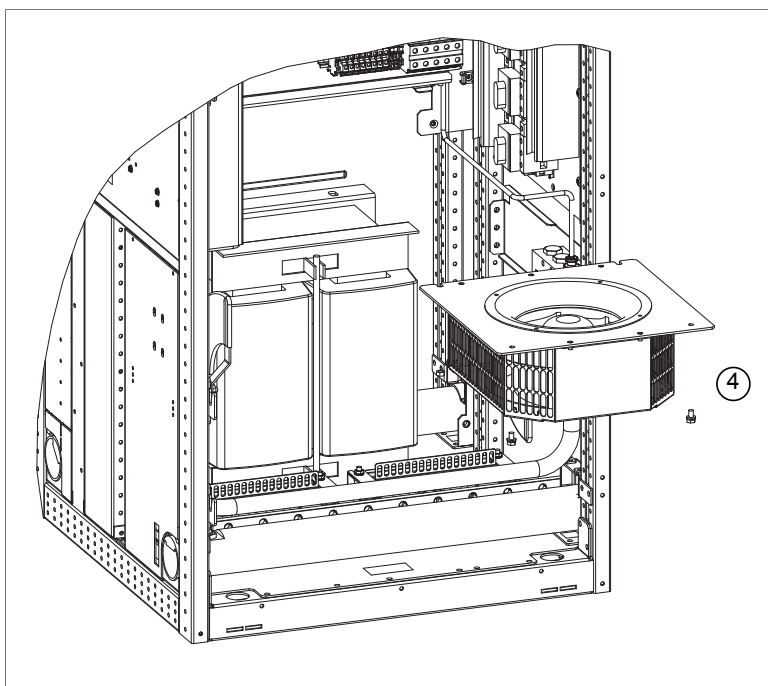
Read the safety instructions given in *Safety instructions for ACS880 liquid-cooled multidrive cabinets and modules* (3AXD50000048633 [English]). If you ignore them, injury or death, or damage to the equipment can occur.



### **WARNING!**

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

1. Repeat the steps described in section [Electrical safety precautions \(page 35\)](#) before you start the work.
2. Open the door of the auxiliary control cubicle.
3. Disconnect the fan wiring.
4. Remove the fastening screws of the fan collar and slide the fan with the collar out.
5. Detach the fan from the collar and replace the fan.
6. Install the new fan in reverse order.





## Supply modules

### ■ Replacing the supply module

---

**WARNING!**

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

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

---

**WARNING!**

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

---

**WARNING!**

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

---

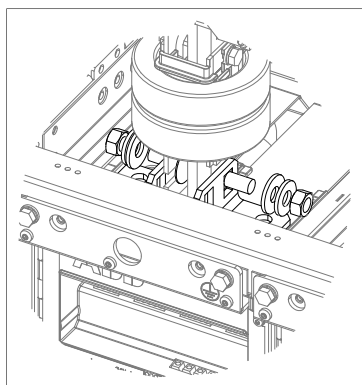
**WARNING!**

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

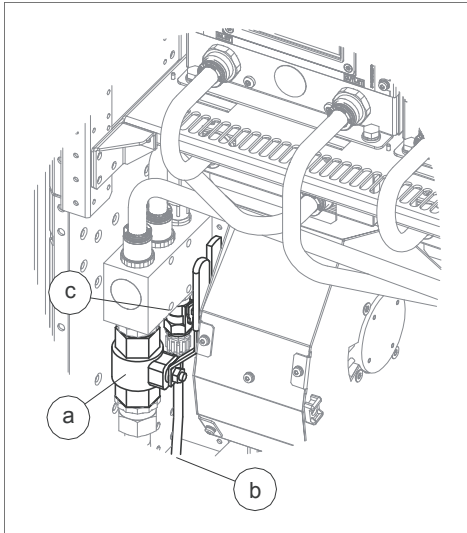
---

### Removing the module

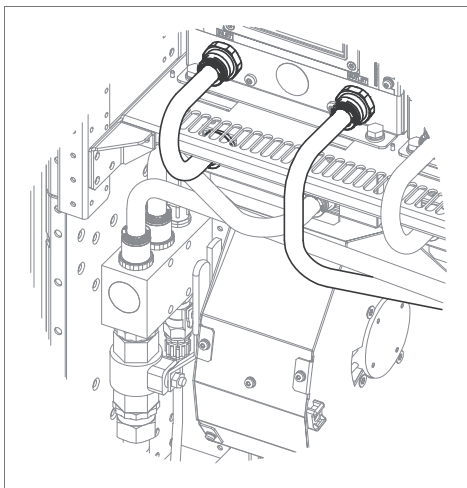
1. Repeat the steps described in section Electrical safety precautions.
2. Remove the shrouding in front of the module.
3. Undo the locking screws of the swing-out frame (if present) and open it.
4. Unplug the wiring from the module and move it aside. Use cable ties to keep the wiring out of the way.
5. Remove the L-shaped DC busbars at the top of the module. Make note of the orientation of the screws as well as the order of the washers.



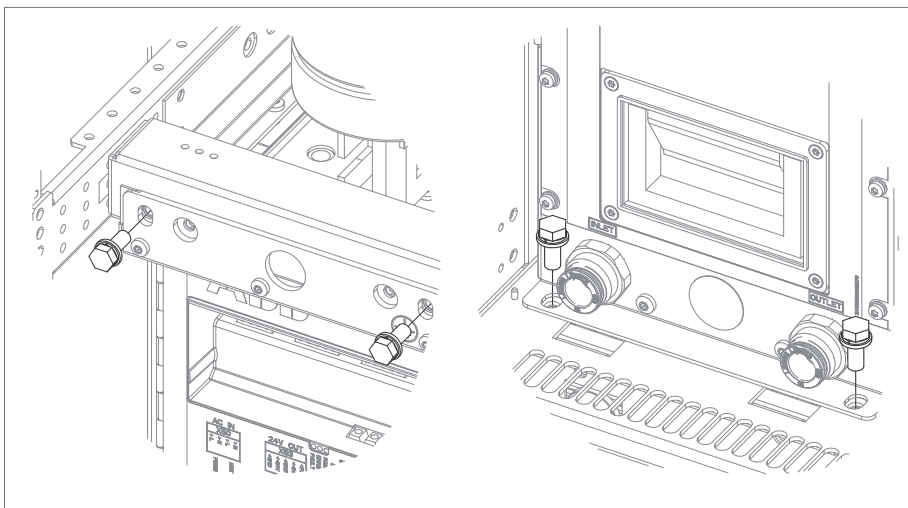
6. Close the inlet valve (a) and outlet valve (located on the right-hand side of the cubicle) valves. Lead the drain hoses (b, on both sides of the cubicle) into a suitable container. Open the drain valves (c, on both sides of the cubicle). This will drain all modules in the cubicle.



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



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



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

### **Reinstalling the module**

1. Push the module carefully into its bay.
  2. Fasten the retaining screws at the top and the bottom of the module.
  3. Reinstall the DC busbars at the top of the module.
  4. Reconnect the coolant pipes to the module.
  5. Reconnect the control wiring to the module.
  6. Fill up the cooling system. For instructions, see section *Filling up and bleeding the internal cooling circuit*.
  7. Close the swing-out frame (if present). Reinstall all shrouds removed earlier.
-

## LCL filters

### ■ Replacing the capacitors of the LCL filter



**WARNING!**

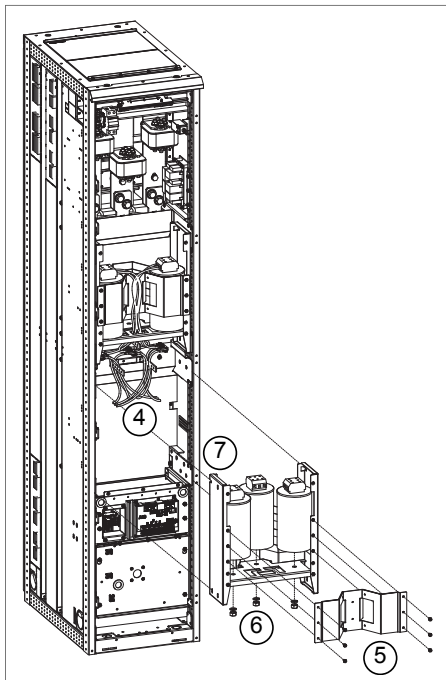
Read the safety instructions given in *Safety instructions for ACS880 liquid-cooled multidrive cabinets and modules* (3AXD50000048633 [English]). If you ignore them, injury or death, or damage to the equipment can occur.



**WARNING!**

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

1. Repeat the steps described in section *Electrical safety precautions (page 35)* before you start the work.
2. Open the door of the LCL filter cubicle.
3. Remove the shrouding in front of the capacitors (if any).
4. Disconnect the wiring of the capacitors.
5. Remove the six fastening screws in front of the capacitor unit.
6. Remove the three bolts below each capacitor.
7. Remove the four screws of the capacitor unit and slide the capacitor unit out.
8. Install the new capacitor unit in reverse order.
9. Attach the shrouding (if any) and close the door.



## Charging resistors

### ■ Replacing the charging resistors

Charging resistors are located next to the cooling fan of the incoming cubicle.

**WARNING!**

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

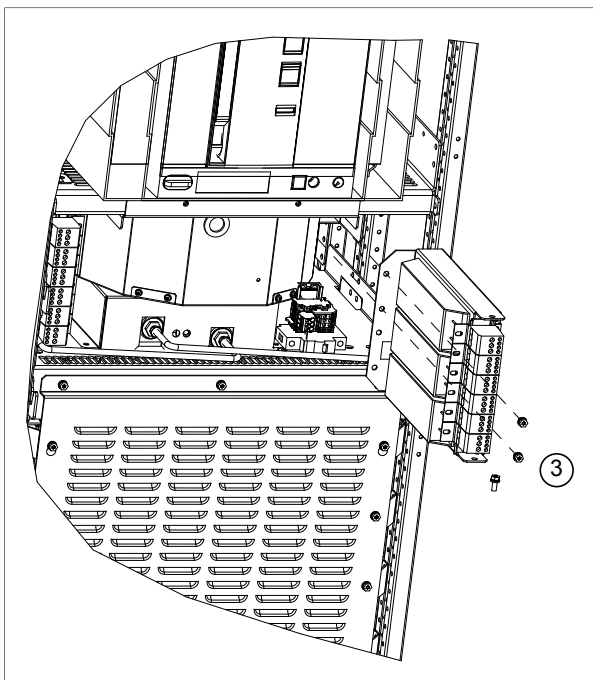
---

**WARNING!**

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

---

1. Repeat the steps described in section [Electrical safety precautions \(page 35\)](#) before you start the work.
2. Open the door of the incoming cubicle.
3. Remove the fastening screws of the charging resistor unit: two screws on the back and one screw on the front part of the charging resistor unit. Slide the resistor unit out.
4. Detach the charging resistors from the unit and replace the charging resistors.
5. Install the new charging resistors in reverse order.



## Capacitors of the DC circuit

The DC circuit of the power modules of the drive contain several electrolytic capacitors. Their lifespan depends on the operating time of the drive, loading and ambient temperature. Capacitor life can be prolonged by lowering the ambient temperature.

Capacitor failure is usually followed by damage to the unit and an input cable fuse failure, or a fault trip. Contact ABB if capacitor failure is suspected. Replacements are available from ABB. Do not use other than ABB specified spare parts. Contact an ABB service representative for spare parts and repair services.

### ■ Reforming the capacitors

The capacitors must be reformed if the drive has not been powered (either in storage or unused) for a year or more. The manufacturing date is on the type designation label. For information on reforming the capacitors, see *Converter module capacitor reforming instructions* (3BFE64059629 [English]) in the ABB Library (<https://library.abb.com/en>).

If the drive module has been stored for one to three years, turn on the mains power for 30 minutes without load, then continue as usual.

If the drive module has been stored for less than a year, continue as usual.

### ■ Replacing the capacitors

See separate service manual by ABB Service.

## Control panel

For detailed information on the control panel, see *ACx-AP-x assistant control panels user's manual* (3AUA0000085685 [English]).

### ■ Cleaning the control panel

Use a soft damp cloth to clean the control panel. Avoid harsh cleaners which could scratch the display window.

### ■ Replacing the control panel battery

For instructions on how to replace the control panel battery, see the separate *ACx-AP-x assistant control panels user's manual* document (3AUA0000085685 [English]).

## Memory unit

### ■ Replacing the memory unit

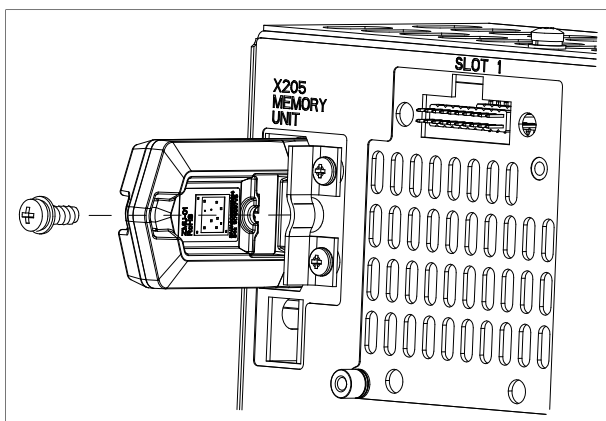
After replacing a control unit, you can retain the existing parameter settings by transferring the memory unit from the defective control unit to the new control unit.

**WARNING!**

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

---

1. Stop the drive and do the steps in section *Electrical safety precautions (page 35)* before you start the work.
2. Make sure that the control unit is not powered.
3. Undo the fastening screw and pull the memory unit out.
4. Install a memory unit in reverse order.



## LEDs

This table shows the LEDs visible on the BCU-xx control unit.

LED	Color	Indication
BATT OK	Green	Battery voltage of the real-time clock is OK (higher than 2.8 V). When the LED is not lit, <ul style="list-style-type: none"> <li>• battery voltage is below 2.8 V,</li> <li>• the battery is missing, or</li> <li>• the control unit is not powered.</li> </ul>
PWR OK	Green	Internal voltage OK
FAULT	Red	The control program indicates that the equipment is faulty. See the appropriate firmware manual.
WRITE	Yellow	Writing to SD card in progress.

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

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

Frame R8i modules have three LEDs. For their indications, see the following table.

Location	LED	Indication
R8i module	FAULT (continuous red)	There is an active fault in the module.
	ENABLE / STO (continuous green)	The module is ready for use.
	ENABLE / STO (continuous yellow)	XSTO connectors are de-energized.
	POWER OK (continuous green)	Supply voltage of the internal circuit boards is OK (> 21 V).





## Technical data

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### Contents of this chapter

This chapter contains the technical data valid for the cabinet-installed ACS880-207LC IGBT supply units.

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## Ratings

The nominal ratings for are given below. The definitions are described below the table.

ACS880-207LC-	Basic module type ACS880-104LC-	Frame size	No-overload use						Light-overload use		Heavy-duty use	
			$I_1$	$I_N$	$I_{max}$	$I_{max}$	$P_N$	$S_N$	$I_{Ld}$	$P_{Ld}$	$I_{Hd}$	$P_{Hd}$
			A (AC)	A (DC)	A (AC)	A (DC)	kW (DC)	kVA	A (DC)	kW (DC)	A (DC)	kW (DC)
<b><math>U_N = 690 V</math></b>												
0360A-7	0390A-7	1×R8i	360	436	540	655	426	430	419	409	327	319
0400A-7	0430A-7	1×R8i	400	485	600	727	473	478	466	454	363	354
0450A-7	0480A-7	1×R8i	450	546	680	818	532	538	524	511	408	398
0480A-7	0530A-7	1×R8i	480	582	720	873	568	574	559	545	435	425
0560A-7	0600A-7	1×R8i	560	679	840	1018	663	669	652	636	508	496
0620A-7	0670A-7	1×R8i	620	752	930	1128	734	741	722	704	562	549
0700A-7	0750A-7	1×R8i	700	849	1050	1273	828	837	815	795	635	620
0770A-7	0850A-7	1×R8i	770	934	1160	1400	911	920	896	875	698	681
0930A-7	0530A-7	2×R8i	930	1128	1400	1691	1100	1111	1083	1056	843	823
1090A-7	0600A-7	2×R8i	1090	1322	1640	1982	1290	1303	1269	1238	989	965
1180A-7	0670A-7	2×R8i	1180	1431	1770	2146	1396	1410	1374	1340	1070	1044
1360A-7	0750A-7	2×R8i	1360	1649	2040	2473	1609	1625	1583	1545	1233	1204
1500A-7	0850A-7	2×R8i	1500	1819	2250	2728	1775	1793	1746	1704	1360	1328
1800A-7	0670A-7	3×R8i	1800	2182	2700	3274	2130	2151	2095	2045	1633	1593
2020A-7	0750A-7	3×R8i	2020	2449	3030	3674	2390	2414	2351	2294	1832	1788
2220A-7	0850A-7	3×R8i	2220	2692	3330	4038	2627	2653	2584	2522	2013	1965
2670A-7	0750A-7	4×R8i	2670	3237	4010	4856	3159	3191	3108	3033	2422	2363
2930A-7	0850A-7	4×R8i	2930	3553	4400	5329	3467	3502	3411	3328	2657	2593
3320A-7	0750A-7	5×R8i	3320	4025	4980	6038	3928	3968	3864	3771	3011	2938
3840A-7	0750A-7	6×R8i	3840	4656	5760	6984	4543	4589	4470	4362	3483	3398
4360A-7	0850A-7	6×R8i	4360	5286	6540	7930	5159	5211	5075	4952	3954	3859
5240A-7	0750A-7	8×R8i	5240	6353	7860	9530	6200	6262	6099	5952	4752	4637
5810A-7	0850A-7	8×R8i	5810	7045	8720	10567	6874	6944	6763	6599	5269	5142

### ■ Definitions

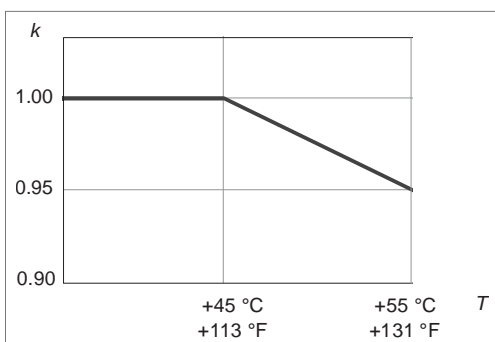
$U_N$	Supply voltage range
$I_1$	Nominal rms current
$I_N$	Nominal current (available continuously with no over-loading)
$I_{max}$	Maximum current. Available for 10 seconds at start, then as long as allowed by drive temperature.
$P_N$	Typical power in no-overload use
$S_N$	Nominal apparent power
$I_{Ld}$	Continuous rms current allowing 10% overload for 1 minute every 5 minutes
$P_{Ld}$	Typical power in light-overload use
$I_{Hd}$	Continuous rms current allowing 50% overload for 1 minute every 5 minutes

$P_{Hd}$	Typical power in heavy-duty use
<p><b>Note 1:</b> The ratings apply at an ambient air temperature of 45 °C (113 °F) and a coolant temperature of 40 °C (104 °F).</p> <p><b>Note 2:</b> To achieve the rated power given in the table, the rated current must be higher than or equal to the rated current. For dimensioning, use DriveSize dimensioning tool available from ABB.</p>	

## ■ Derating

### Ambient temperature derating

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



### Altitude derating

At altitudes from 1000 to 4000 m (3281 to 13123 ft) above sea level, the output current derating is 1 percentage point for every added 100 m (328 ft). For example, the derating factor for 1500 m (4921 ft) is 0.95.

For a more accurate derating, use the DriveSize PC tool.

### Coolant temperature derating

See section [Temperature limits \(page 114\)](#).

### Antifreeze content derating

See section [Temperature limits \(page 114\)](#).

### Switching frequency derating

Switching frequencies other than default can require output current derating. Contact ABB for more information.

## Type equivalence table

ACS880-207LC-...	Modules used			LCL filter	
	ACS880-104LC-...	DC capacitance (mF)	Qty	LCL filter type	Qty
<b><math>U_N = 690 \text{ V}</math></b>					
0360A-7	0390A-7	6.0	1	BLCL-15LC-7	1
0400A-7	0430A-7	6.0	1	BLCL-15LC-7	1
0450A-7	0480A-7	6.0	1	BLCL-15LC-7	1
0480A-7	0530A-7	6.0	1	BLCL-15LC-7	1
0560A-7	0600A-7	9.0	1	BLCL-15LC-7	1
0620A-7	0670A-7	9.0	1	BLCL-15LC-7	1
0700A-7	0750A-7	9.0	1	BLCL-15LC-7	1
0770A-7	0850A-7	9.0	1	BLCL-15LC-7	1
0930A-7	0530A-7	12.0	2	BLCL-24LC-7	1
1090A-7	0600A-7	18.0	2	BLCL-24LC-7	1
1180A-7	0670A-7	18.0	2	BLCL-24LC-7	1
1360A-7	0750A-7	18.0	2	BLCL-25LC-7	1
1500A-7	0850A-7	18.0	2	BLCL-25LC-7	1
1800A-7	0670A-7	27.0	3	BLCL-24LC-7	2
2020A-7	0750A-7	27.0	3	BLCL-24LC-7	2
2220A-7	0850A-7	27.0	3	BLCL-24LC-7	2
2670A-7	0750A-7	36.0	4	BLCL-25LC-7	2
2930A-7	0850A-7	36.0	4	BLCL-25LC-7	2
3320A-7	0750A-7	45.0	5	BLCL-24LC-7	3
3840A-7	0750A-7	45.0	6	BLCL-24LC-7	4
4360A-7	0850A-7	54.0	6	BLCL-24LC-7	4
5240A-7	0750A-7	63.0	8	BLCL-25LC-7	4
5810A-7	0850A-7	72.0	8	BLCL-25LC-7	4

## Fuses

### ■ Main circuit AC fuses

ACS880-207LC-...	AC fuses				
	Qty	A	V	Manufacturer	Type
<b><math>U_N = 690 \text{ V}</math></b>					
0360A-7	3	630	690	Bussmann	170M6410
0400A-7	3	700	690	Bussmann	170M6411
0450A-7	3	800	690	Bussmann	170M6412
0480A-7	3	800	690	Bussmann	170M6412
0560A-7	3	900	690	Bussmann	170M6413
0620A-7	3	1000	690	Bussmann	170M6414
0700A-7	3	1250	690	Bussmann	170M6416
0770A-7	3	1400	690	Bussmann	170M6417
0930A-7	3	1600	690	Bussmann	170M7061
1090A-7	3	2000	690	Bussmann	170M7062
1180A-7	3	2000	690	Bussmann	170M7062
1360A-7	3	2500	690	Bussmann	170M7063
1500A-7	3	2500	690	Bussmann	170M7063
1800A-7	6	1600	690	Bussmann	170M7061
2020A-7	6	2000	690	Bussmann	170M7062
2220A-7	6	2000	690	Bussmann	170M7062
2670A-7	6	2500	690	Bussmann	170M7063
2930A-7	6	2500	690	Bussmann	170M7063
3320A-7	9	2000	690	Bussmann	170M7062
3840A-7	12	1600	690	Bussmann	170M7061
4360A-7	12	2000	690	Bussmann	170M7062
5240A-7	12	2500	690	Bussmann	170M7063
5810A-7	12	2500	690	Bussmann	170M7063

## ■ Main circuit DC fuses

The IGBT supply unit has DC fuses at the output of each IGBT supply module.

### Notes:

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

ACS880-207LC-...	DC fuses				
	Qty	A	V	Manufacturer	Type
<b><math>U_N = 690 \text{ V}</math></b>					
0360A-7	2	800	1250	Bussmann	170M6546
0400A-7	2	800	1250	Bussmann	170M6546
0450A-7	2	900	1100	Bussmann	170M6547
0480A-7	2	1000	1100	Bussmann	170M6548
0560A-7	2	1100	1000	Bussmann	170M6549
0620A-7	2	1250	1100	Bussmann	170M6500
0700A-7	2	1400	1100	Bussmann	170M6501
0770A-7	2	1400	1100	Bussmann	170M6501
0930A-7	4	1000	1100	Bussmann	170M6548
1090A-7	4	1100	1000	Bussmann	170M6549
1180A-7	4	1250	1100	Bussmann	170M6500
1360A-7	4	1400	1100	Bussmann	170M6501
1500A-7	4	1400	1100	Bussmann	170M6501
1800A-7	6	1250	1100	Bussmann	170M6500
2020A-7	6	1400	1100	Bussmann	170M6501
2220A-7	6	1400	1100	Bussmann	170M6501
2670A-7	8	1400	1100	Bussmann	170M6501
2930A-7	8	1400	1100	Bussmann	170M6501
3320A-7	10	1400	1100	Bussmann	170M6501
3840A-7	12	1400	1100	Bussmann	170M6501
4360A-7	12	1400	1100	Bussmann	170M6501
5240A-7	16	1400	1100	Bussmann	170M6501
5810A-7	16	1400	1100	Bussmann	170M6501

## Dimensions, weights and free space requirements

### ■ Dimensions and weights

See the dimension drawing.

### ■ Free space requirements

The values are as required by cooling, maintenance and/or operation of the pressure relief (if present).

Front		Sides		Above	
mm	in	mm	in	mm	in
1500	5.90	0	0	250	9.85

## Losses, cooling data and noise

ACS880-207LC-...	Coolant flow		Heat dissipation		Coolant quantity (total)	Noise <sup>1)</sup>
	l/min	US gal/min	into coolant (kW)	into air (kW)	l	dB(A)
<b><math>U_N = 690 \text{ V}</math></b>						
0360A-7	52	13.7	8.9	0.2	8.1	58
0400A-7	52	13.7	9.8	0.3	8.1	58
0450A-7	52	13.7	11.1	0.3	8.1	58
0480A-7	52	13.7	12.0	0.3	8.1	58
0560A-7	52	13.7	14.1	0.4	8.1	58
0620A-7	52	13.7	15.7	0.4	8.1	58
0700A-7	52	13.7	18.4	0.5	8.1	58
0770A-7	52	13.7	20.9	0.5	8.1	58
0930A-7	88	23.2	21.3	0.5	11.3	59
1090A-7	88	23.2	25.3	0.6	11.3	59
1180A-7	88	23.2	28.6	0.7	11.8	59
1360A-7	88	23.2	31.0	0.8	11.8	59
1500A-7	88	23.2	35.1	0.9	11.8	59
1800A-7	144	38.0	39.3	1.0	18.7	61
2020A-7	144	38.0	45.6	1.2	18.7	61
2220A-7	144	38.0	51.7	1.3	18.7	61
2670A-7	160	42.3	58.6	1.5	23.6	61
2930A-7	160	42.3	66.2	1.7	23.6	61
3320A-7	216	57.1	73.8	1.9	30.0	62
3840A-7	264	69.7	83.8	2.1	34.1	63
4360A-7	280	74.0	100.6	2.6	37.4	63
5240A-7	296	78.2	113.9	2.9	43.3	64
5810A-7	312	82.4	130.3	3.3	46.6	64

<sup>1)</sup> Measured in a hemi-anechoic room in accordance with ISO 9614-2 standard.

## **Internal cooling circuit data**

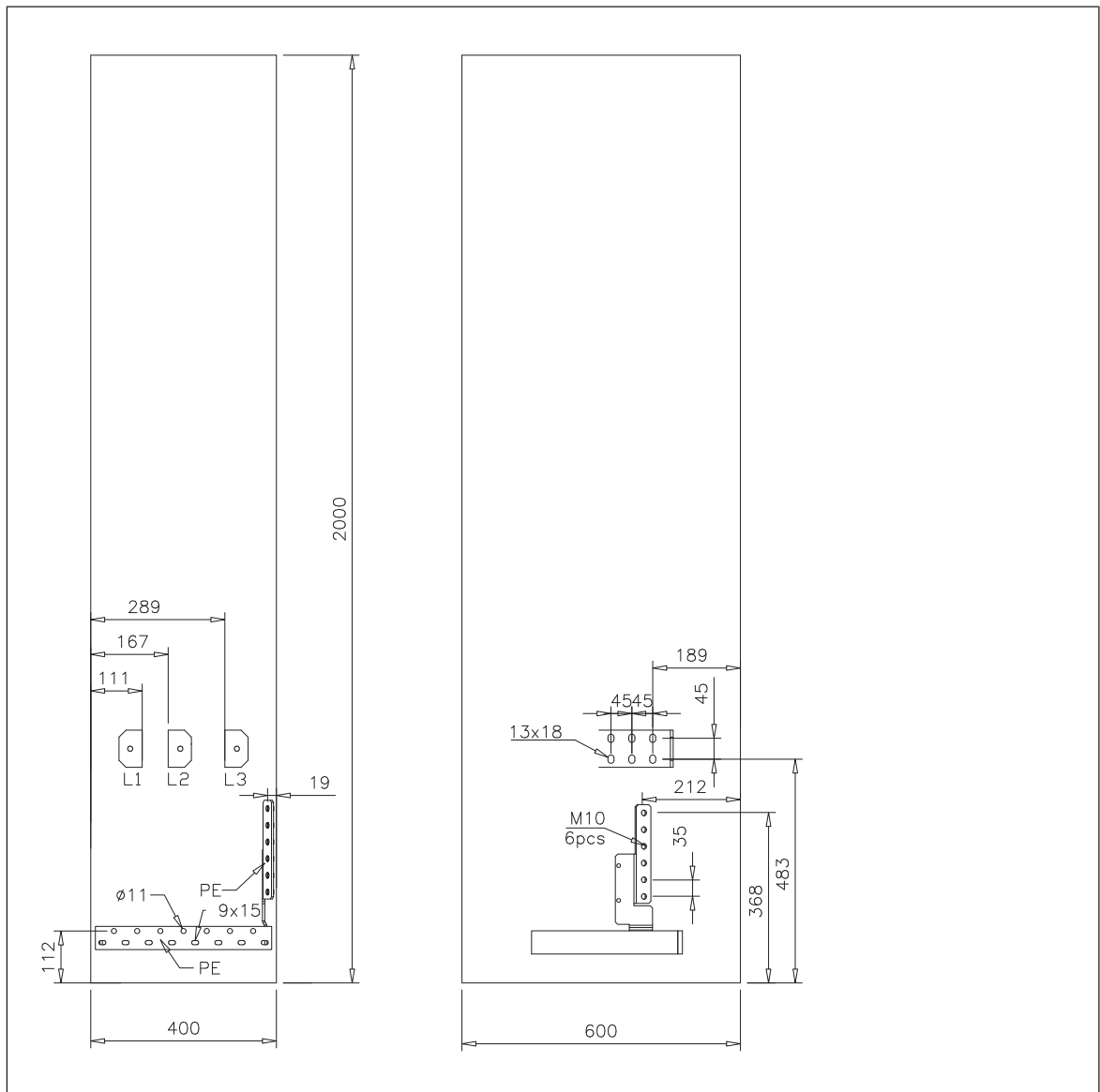
See chapter [Internal cooling circuit](#).



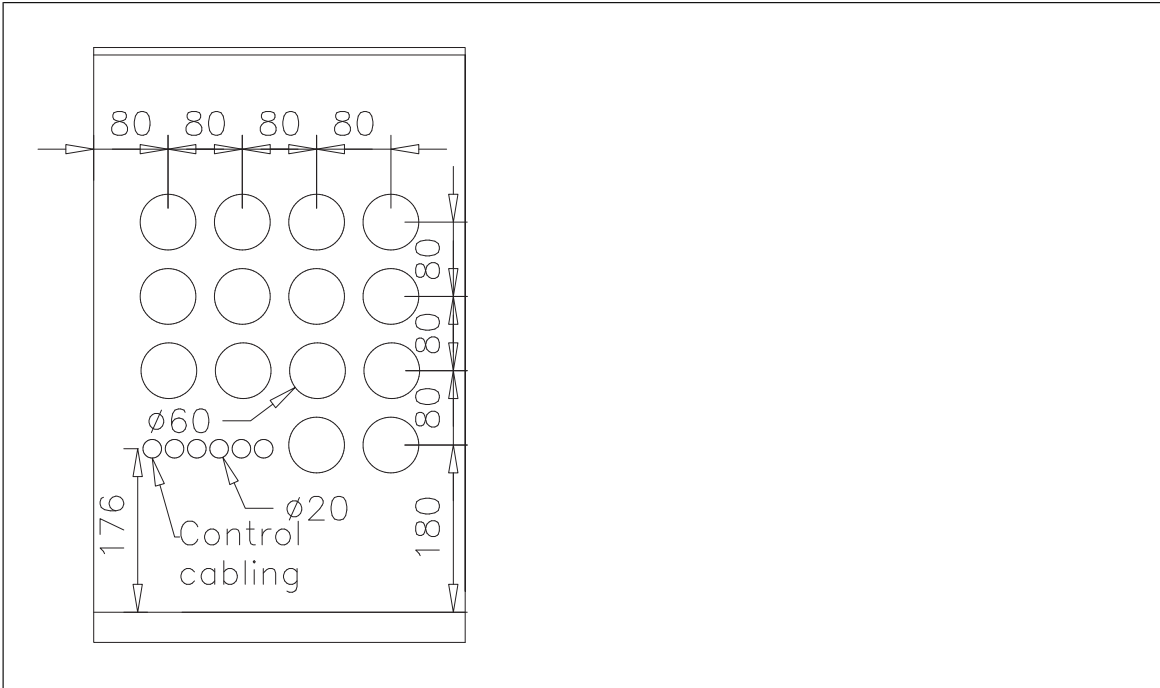
## Terminal and lead-through data for the input power cable

These drawings (from front, side and above) show the terminal and lead-through dimensions for incoming and input cubicles. The dimensions are given in millimeters. Tightening torque for the cable lug connection depends on the bolt size and type. See section [Tightening torques \(page 101\)](#).

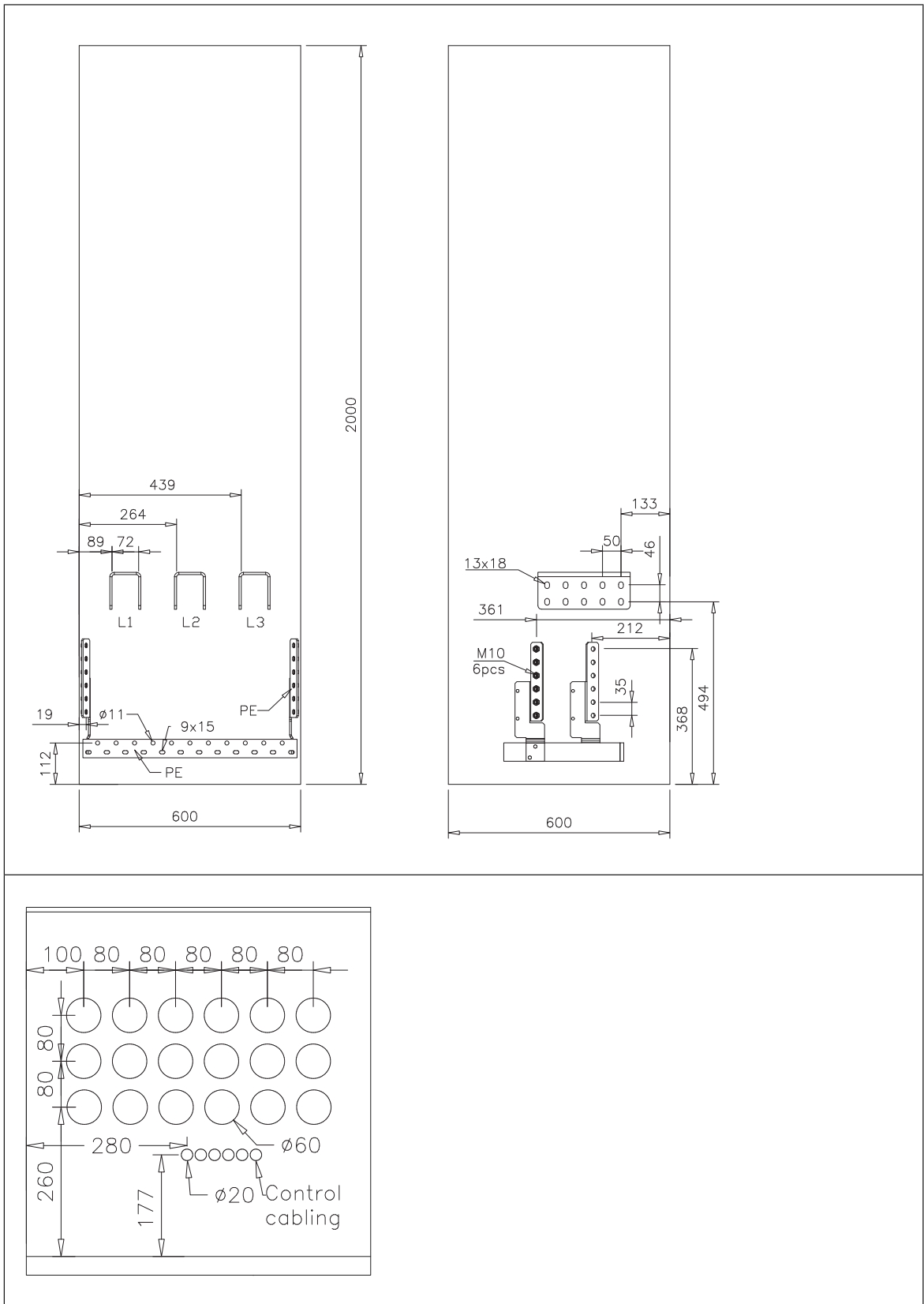
### ■ 400 mm wide input cubicle



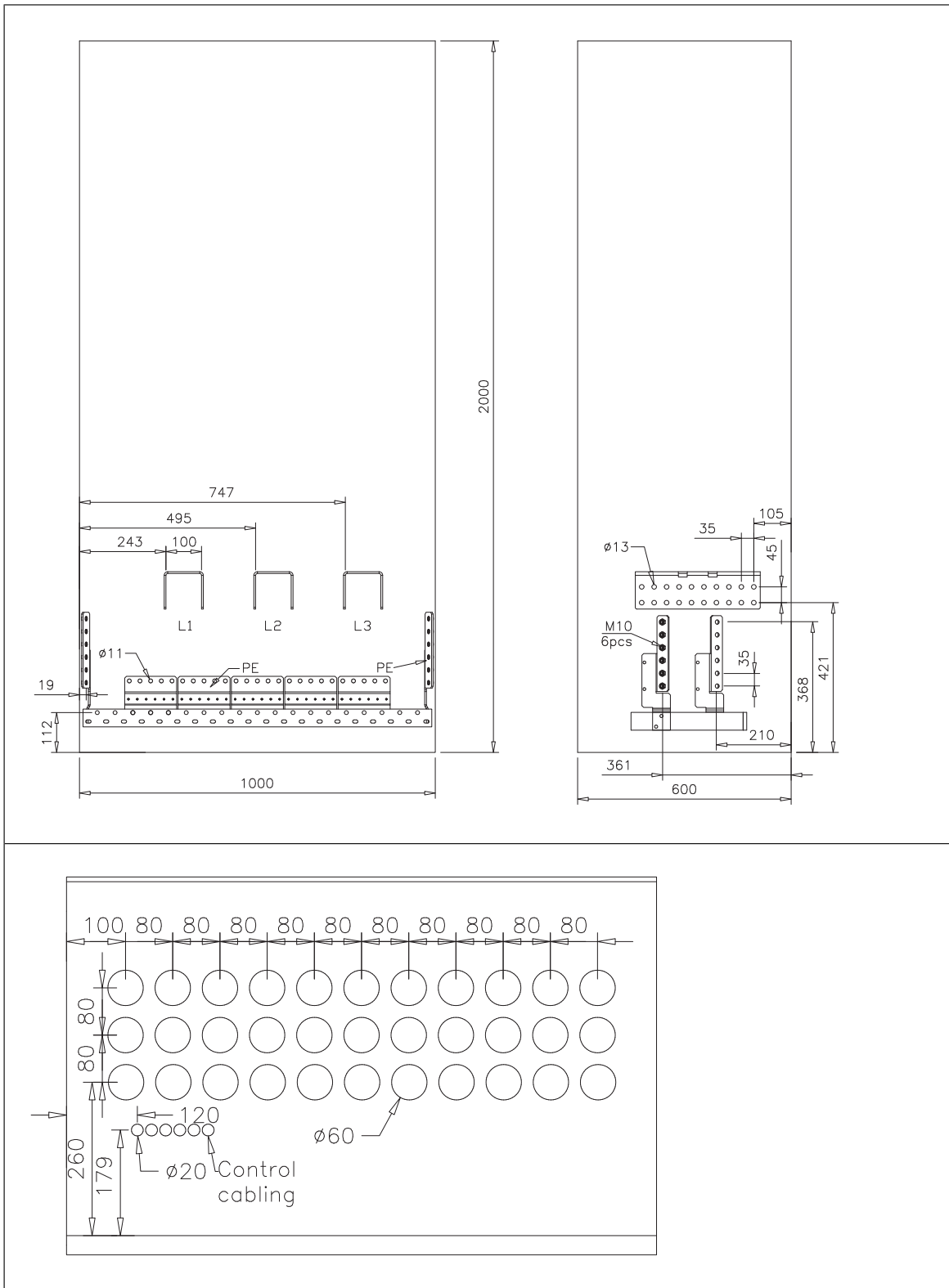
98 Technical data



■ 600 mm wide incoming cubicle or input cubicle



■ 1000 mm wide input cubicle



## Tightening torques

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

### ■ Electrical connections

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

### ■ Mechanical connections

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

### ■ Insulation supports

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

### ■ Cable lugs

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

## Terminal data for the control cables

See chapter [Control units of the drive](#).

## Typical power cable sizes

The tables below give current carrying capacity ( $I_{Lmax}$ ) for aluminum and copper PVC/XLPE insulated cables. A correction factor  $K = 0.70$  is used. Time const is the temperature time constant of the cable.

The cable sizing is based on max. 9 cables laid on the cable trays side by side, three ladder type trays one on top of the other, ambient temperature 30 °C (EN 60204-1 and IEC 60364-5-52).

Aluminum cable		PVC insulation Conductor temperature 70°		XLPE insulation Conductor temperature 90°	
Size	∅ [mm]	$I_{Lmax}$ [A]	Time const. [s]	$I_{Lmax}$ [A]	Time const. [s]
3 × 35 + 10 Cu	26	67	736	84	669
3 × 50 + 15 Cu	29	82	959	102	874
3 × 70 + 21 Cu	32	105	1182	131	1079
3 × 95 + 29 Cu	38	128	1492	159	1376
3 × 120 + 41 Cu	41	148	1776	184	1637
3 × 150 + 41 Cu	44	171	2042	213	1881
3 × 185 + 57 Cu	49	196	2422	243	2237
3 × 240 + 72 Cu	54	231	2967	286	2740
3 × 300 + 88 Cu	58	267	3478	330	3229
2 × (3 × 70 + 21 Cu)	2 × 32	210	1182	262	1079
2 × (3 × 95 + 29 Cu)	2 × 38	256	1492	318	1376
2 × (3 × 120 + 41 Cu)	2 × 41	297	1776	368	1637
2 × (3 × 150 + 41 Cu)	2 × 44	343	2042	425	1881
2 × (3 × 185 + 57 Cu)	2 × 49	392	2422	486	2237
2 × (3 × 240 + 72 Cu)	2 × 54	462	2967	572	2740
2 × (3 × 300 + 88 Cu)	2 × 58	533	3478	659	3229
3 × (3 × 150 + 41 Cu)	3 × 44	514	2042	638	1881
3 × (3 × 185 + 57 Cu)	3 × 49	588	2422	728	2237
3 × (3 × 240 + 72 Cu)	3 × 54	693	2967	859	2740
3 × (3 × 300 + 88 Cu)	3 × 58	800	3478	989	3229
4 × (3 × 185 + 57 Cu)	4 × 49	784	2422	971	2237
4 × (3 × 240 + 72 Cu)	4 × 54	924	2967	1145	2740
4 × (3 × 300 + 88 Cu)	4 × 58	1067	3478	1319	3229
5 × (3 × 185 + 57 Cu)	5 × 49	980	2422	1214	2237
5 × (3 × 240 + 72 Cu)	5 × 54	1155	2967	1431	2740
5 × (3 × 300 + 88 Cu)	5 × 58	1333	3478	1648	3229
6 × (3 × 240 + 72 Cu)	6 × 54	1386	2967	1718	2740
6 × (3 × 300 + 88 Cu)	6 × 58	1600	3478	1978	3229
7 × (3 × 240 + 72 Cu)	7 × 54	1617	2967	2004	2740
7 × (3 × 300 + 88 Cu)	7 × 58	1867	3478	2308	3229
8 × (3 × 240 + 72 Cu)	8 × 54	1848	2967	2290	2740
8 × (3 × 300 + 88 Cu)	8 × 58	2133	3478	2637	3229
9 × (3 × 240 + 72 Cu)	9 × 54	2079	2967	2577	2740
9 × (3 × 300 + 88 Cu)	9 × 58	2400	3478	2967	3229
10 × (3 × 240 + 72 Cu)	10 × 54	2310	2967	2867	2740
10 × (3 × 300 + 88 Cu)	10 × 58	2667	3478	3297	3229

Copper cable		PVC insulation Conductor temperature 70°		XLPE insulation Conductor temperature 90°	
Size	∅ [mm]	I <sub>Lmax</sub> [A]	Time const. [s]	I <sub>Lmax</sub> [A]	Time const. [s]
3 × 1.5 + 1.5	13	13	85	16	67
3 × 2.5 + 2.5	14	18	121	23	88
(3 × 4 + 4)	16	24	175	30	133
3 × 6 + 6	18	30	251	38	186
3 × 10 + 10	21	42	359	53	268
3 × 16 + 16	23	56	514	70	391
3 × 25 + 16	24	71	791	89	598
3 × 35 + 16	26	88	1000	110	760
3 × 50 + 25	29	107	1308	134	990
3 × 70 + 35	32	137	1613	171	1230
3 × 95 + 50	38	167	2046	209	1551
3 × 120 + 70	41	193	2441	241	1859
3 × 150 + 70	44	223	2820	279	2139
3 × 185 + 95	50	255	3329	319	2525
3 × 240 + 120	55	301	4073	376	3099
3 × 300 + 150	58	348	4779	435	3636
2 × (3 × 70 + 35)	2 × 32	274	1613	342	1230
2 × (3 × 95 + 50)	2 × 38	334	2046	418	1551
2 × (3 × 120 + 70)	2 × 41	386	2441	482	1859
2 × (3 × 150 + 70)	2 × 44	446	2820	558	2139
2 × (3 × 185 + 95)	2 × 50	510	3329	638	2525
2 × (3 × 240 + 120)	2 × 55	602	4073	752	3099
2 × (3 × 300 + 150)	2 × 58	696	4779	869	3636
3 × (3 × 120 + 70)	3 × 41	579	2441	723	1859
3 × (3 × 150 + 70)	3 × 44	669	2820	837	2139
3 × (3 × 185 + 95)	3 × 50	765	3329	957	2525
3 × (3 × 240 + 120)	3 × 55	903	4073	1128	3099
3 × (3 × 300 + 150)	3 × 58	1044	4779	1304	3636
4 × (3 × 150 + 70)	4 × 44	892	2820	1116	2139
4 × (3 × 185 + 95)	4 × 50	1020	3329	1276	2525
4 × (3 × 240 + 120)	4 × 55	1204	4073	1504	3099
4 × (3 × 300 + 150)	4 × 58	1391	4779	1304	3636
5 × (3 × 185 + 95)	5 × 50	1275	3329	1595	2525
5 × (3 × 240 + 120)	5 × 55	1505	4073	1880	3099
5 × (3 × 300 + 150)	5 × 58	1739	4779	2173	3636
6 × (3 × 185 + 95)	6 × 50	1530	3329	1914	2525
6 × (3 × 240 + 120)	6 × 55	1806	4073	2256	3099
6 × (3 × 300 + 150)	6 × 58	2087	4779	2608	3636
7 × (3 × 240 + 120)	7 × 55	2107	4073	2632	3099
7 × (3 × 300 + 150)	7 × 58	2435	4779	3043	3636
8 × (3 × 240 + 120)	8 × 55	2408	4073	3008	3099
8 × (3 × 300 + 150)	8 × 58	2783	4779	3477	3636

## Electrical power network specification

Voltage ( $U_1$ )	690 V units: 525...690 V AC 3-phase $\pm 10\%$ (525...600 V AC $\pm 10\%$ in UL/CSA installations, or corner-grounded TN systems). This is indicated in the type designation label as typical input voltage levels (3~ 525/600/690 V AC).											
Network type	TN (grounded) and IT (ungrounded) systems											
Frequency	50/60 Hz, variation $\pm 5\%$ of nominal frequency											
Imbalance	Max. $\pm 3\%$ of nominal phase-to-phase input voltage											
Short-circuit withstand strength (IEC/EN 61439-1)	IEC/EN 61439-1:2009 <b>Supply units with R8i module(s):</b> Supply units with ABB-defined main breaker and fuses: Rated peak withstand current ( $I_{pk}$ ): 143 kA Rated short-time withstand current ( $I_{cw}$ ): 65 kA/1 s											
Short-circuit current protection (UL 508A, CSA C22.2 No. 14-13)	The drive is suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes at 600 V maximum when the input cable is protected with class T fuses.											
Fundamental power factor ( $\cos \phi_1$ )	0.99											
Harmonic distortion	Harmonics are below the limits defined in IEEE519. <table border="1" style="margin: 10px auto; width: 80%;"> <thead> <tr> <th><math>R_{sc}</math></th> <th>THD Voltage [%]</th> <th>THD Current [%]</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>3</td> <td>2.5<sup>1)</sup></td> </tr> <tr> <td>100</td> <td>0.8</td> <td>2.5</td> </tr> </tbody> </table> $THD = \sqrt{\sum_{n=2}^{50} \left(\frac{I_n}{I_N}\right)^2}$ $I_n \text{ } n^{\text{th}} \text{ harmonic component}$ $I_N \text{ nominal current}$ <p>1) Other loads may influence the THD value.            THD = Total Harmonic Distortion (THD). The voltage THD depends on the short-circuit ratio (<math>R_{sc}</math>). The spectrum of the distortion also contains interharmonics.  <math>R_{sc} = I_{sc}/I_N</math>  <math>I_{sc}</math> = short-circuit current at point of common coupling (PCC)  <math>I_N</math> = IGBT supply unit nominal current</p>			$R_{sc}$	THD Voltage [%]	THD Current [%]	20	3	2.5 <sup>1)</sup>	100	0.8	2.5
$R_{sc}$	THD Voltage [%]	THD Current [%]										
20	3	2.5 <sup>1)</sup>										
100	0.8	2.5										

## Control unit connection data (BCU)

See chapter [Control units of the drive](#).

## Efficiency

Efficiency	98.2...98.8% at nominal power level depending on drive type
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## Protection classes

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



## Ambient conditions

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

	<b>Operation installed for stationary use</b>	<b>Storage in the protective package</b>	<b>Transportation in the protective package</b>
<b>Installation site altitude</b>	0...2000 m (0...6562 ft) above sea level. For altitudes over 2000 m, contact ABB.  Output derated above 1000 m (3281 ft).	-	-
<b>Air temperature</b>	0 ... +45 °C (+32 ... +113 °F), no condensation allowed. Output derated in the range +45 ... +55 °C (+113 ... +131 °F).	-40 to +70 °C (-40 to +158 °F)	-40 to +70 °C (-40 to +158 °F)
<b>Relative humidity</b>	Max. 95%	Max. 95%	Max. 95%
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
<b>Contamination</b>	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  Chemical gases: Class 3C2  Solid particles: Class 3S2. No conductive dust allowed.	IEC 60721-3-1:1997 Chemical gases: Class 1C2  Solid particles: Class 1S3 (packing must support this, otherwise 1S2)	IEC 60721-3-2:1997 Chemical gases: Class 2C2  Solid particles: Class 2S2
<b>Vibration</b> IEC/EN 61800-5-1 IEC 60068-2-6:2007, EN 60068-2-6:2008 Environmental testing Part 2: Tests –Test Fc: Vibration (sinusoidal)	IEC/EN 60721-3-3:2002 10...57 Hz: max. 0.075 mm amplitude 57...150 Hz: 1 g  Units with marine construction (option +C121): Max. 1 mm (0.04 in) (5 ... 13.2 Hz), max. 0.7 g (13.2 ... 100 Hz) sinusoidal	IEC/EN 60721-3-1:1997 10...57 Hz: max. 0.075 mm amplitude 57...150 Hz: 1 g	IEC/EN 60721-3-2:1997 2...9 Hz: max. 3.5 mm amplitude 9...200 Hz: 10 m/s <sup>2</sup> (32.8 ft/s <sup>2</sup> )
<b>Shock</b> 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 <sup>2</sup> (328 ft/s <sup>2</sup> ) 11 ms	With packing max. 100 m/s <sup>2</sup> (328 ft/s <sup>2</sup> ) 11 ms

## Materials

<b>Cabinet</b>	<ul style="list-style-type: none"> <li>• Zinc coated steel sheet</li> <li>• Polyester thermosetting powder coating on visible surfaces, color RAL 7035 and RAL 9017</li> </ul>
<b>Busbars for user power connections</b>	Tin-plated copper
<b>Liquid cooling system</b>	See <a href="#">Cooling circuit materials (page 116)</a>
<b>Fire safety of materials (IEC 60332-1)</b>	Insulating materials and non-metallic items: mostly self-extinctive
<b>Package</b>	<p>Standard package:</p> <ul style="list-style-type: none"> <li>• timber, polyethylene sheet (thickness 0.15 mm), stretch film (thickness 0.023 mm), PP tape, PET strap, sheet metal (steel)</li> <li>• for land and air transport when planned storage time is less than 2 months or when storage can be arranged in clean and dry conditions less than 6 months</li> <li>• can be used when products will not be exposed to corrosive atmosphere during transport or storage</li> </ul> <p>Container package:</p> <ul style="list-style-type: none"> <li>• timber, VCI sheet film (PE, thickness 0.10 mm), VCI stretch film (PE, thickness 0.04 mm), VCI emitter bags, PP tape, PET strap, sheet metal (steel)</li> <li>• for sea transport in containers</li> <li>• recommended for land and air transport when storage time prior to installation exceeds 6 months or storage is arranged in partially weather-protected conditions</li> </ul> <p>Seaworthy package:</p> <ul style="list-style-type: none"> <li>• timber, plywood, VCI sheet film (PE, thickness 0.10 mm), VCI stretch film (PE, thickness 0.04 mm), VCI emitter bags, PP tape, PET strap, sheet metal (steel)</li> <li>• for sea transport with or without containerization</li> <li>• for long storage periods in environments where roofed and humidity-controlled storage cannot be arranged</li> </ul> <p>Cabinets are fastened to the pallet with screws and braced from the top end to the package walls to prevent swaying inside the package. Package elements are attached to each other with screws.</p>
<b>Disposal</b>	<p>The main parts of the drive can be recycled to preserve natural resources and energy. Product parts and materials should be dismantled and separated. Generally all metals, such as steel, aluminum, copper and its alloys, and precious metals can be recycled as material. Plastics, rubber, cardboard and other packaging material can be used in energy recovery. Printed circuit boards and large electrolytic capacitors need selective treatment according to IEC 62635 guidelines. To aid recycling, plastic parts are marked with an appropriate identification code. Contact your local ABB distributor for further information on environmental aspects and recycling instructions for professional recyclers. End of life treatment must follow international and local regulations.</p>

## Standards

See *ACS880 liquid-cooled multidrives and multidrive modules planning the electrical installation* (3AXD50000048634 [English]).

## Markings

See *ACS880 liquid-cooled multidrives and multidrive modules planning the electrical installation* (3AXD50000048634 [English]).

## Compliance with the EN 61800-3 (2004)

See *ACS880 liquid-cooled multidrives and multidrive modules planning the electrical installation* (3AXD50000048634 [English]).

## Approvals

See *ACS880 liquid-cooled multidrives and multidrive modules planning the electrical installation* (3AXD50000048634 [English]).

## Disclaimers

### ■ Generic disclaimer

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

### ■ Cybersecurity disclaimer

This product 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.

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# 9

## Internal cooling circuit

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### Contents of this chapter

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

### Applicability

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

### Internal cooling system

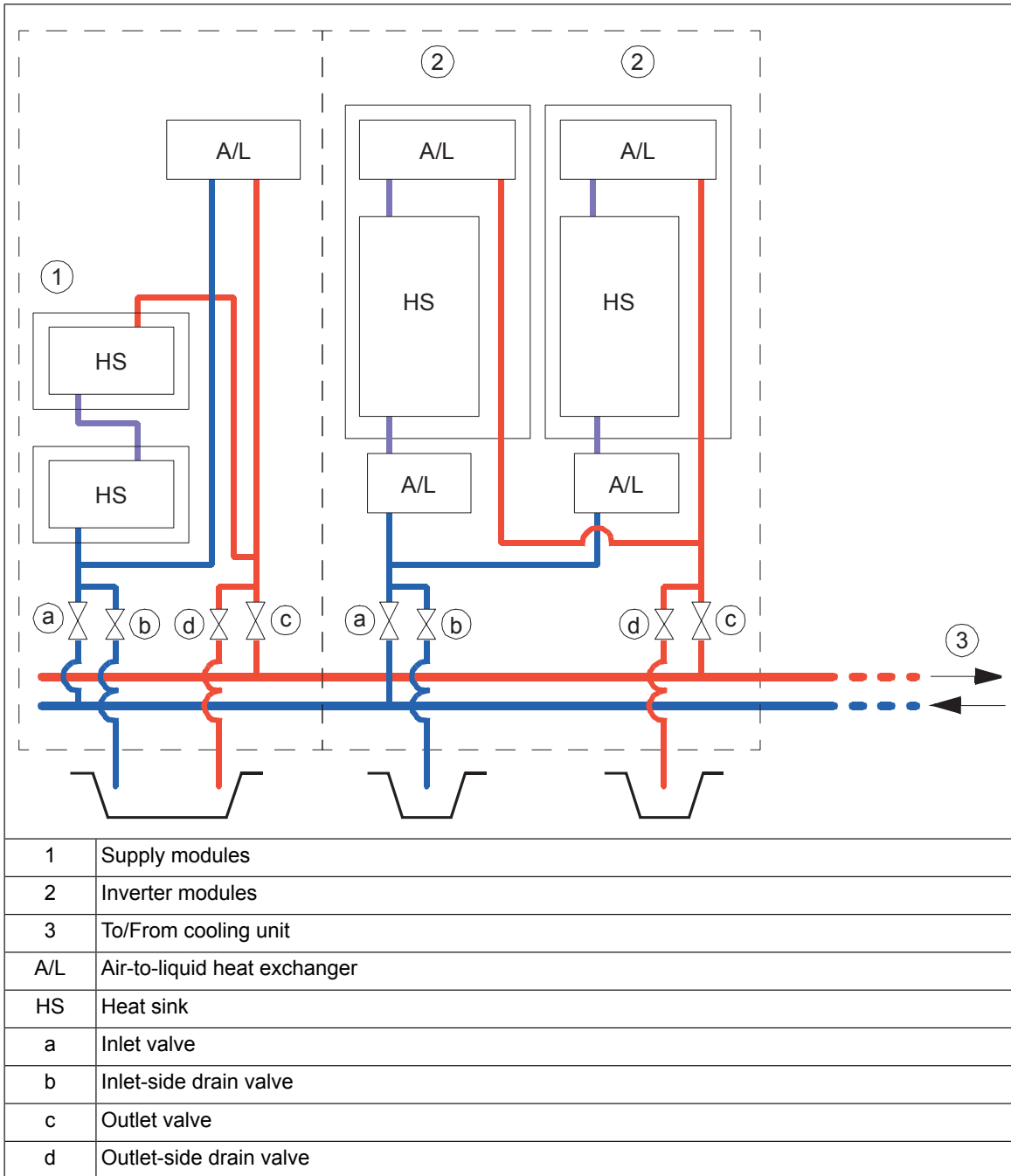
**Note:** This section describes cabinet-built, liquid-cooled ACS880 drives. The information in this section can be used as guidelines for building a drive system out of ACS880 liquid-cooled modules.

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

The following diagram shows the coolant pipe connections in a drive system consisting of a supply unit and an inverter unit.

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110 Internal cooling circuit



The coolant used with ACS880 liquid-cooled drive systems is Antifrogen® L 25% or 50% water mixture. See [Coolant specification \(page 114\)](#).

## Connection to a cooling unit

### ■ Connection to an ACS880-1007LC cooling unit

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

### ■ Connection to a custom cooling unit

#### General requirements

Equip the system with an expansion tank to damp pressure rise due to volume changes when the temperature varies. Equip the system with a pump that provides a nominal flow and pressure. Keep the pressure within the limits specified in *Technical data (page 114)*. Install a pressure regulator to make sure that the maximum permissible operating pressure is not exceeded.

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

The materials that can be used are listed in *Cooling circuit materials (page 116)*.

#### Coolant temperature control

The temperature of the coolant in the internal cooling circuit must be kept within the limits specified in *Technical data (page 114)*. Note that the minimum temperature is dependent on ambient temperature and relative humidity.

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## Filling up and bleeding the internal cooling circuit

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

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### WARNING!

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

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### WARNING!

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

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

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

### ■ Drive line-ups with a custom cooling unit

#### Note:

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

1. Open the bleed valve at the cooling unit.
2. Open the inlet valve and the outlet-side drain valve of one cubicle. Keep the outlet valve and the inlet-side drain valve closed.
3. Attach a hose to the outlet-side drain valve and lead it into a suitable container.
4. Fill the circuit with coolant. For coolant specification, see [Coolant specification \(page 114\)](#).

**Note:** To minimize foaming, do not exceed the filling flow rate of 5 l/min (1.3 US gallon/min).

5. As the piping and modules in the cubicle fills up, coolant starts to flow from the hose. Let some coolant flow out, then close the drain valve.
  6. Close the inlet valve.
  7. Repeat steps 2 to 6 for all cubicles in the line-up.
  8. Open the inlet and outlet valves in all cubicles. Let any air remaining in the system out through the bleed valve at the cooling unit.
  9. Close the bleed valve at the cooling unit.
  10. Continue to fill in coolant until a base pressure of 100...150 kPa is achieved.
  11. Open the bleed valve of the pump to let out any air.
  12. Re-check the pressure and add coolant if necessary.
-



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

## Draining the internal cooling circuit

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



### WARNING!

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

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

**Note:** Draining coolant into the sewer system is not allowed.

3. If required, dry the piping with compressed oil-free air of less than 6 bar.
4. If the drive is to be stored in temperatures below 0 °C (32 °F),
  - dry the cooling circuit with air,
  - fill the cooling circuit with coolant specified under *Coolant specification (page 114)*.
  - drain the cooling circuit again.

## Maintenance intervals

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

## Technical data

### ■ Coolant specification

#### Coolant type

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

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

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

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



### WARNING!

The warranty does not cover damage occurring from use of improper coolant.

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### ■ Temperature limits

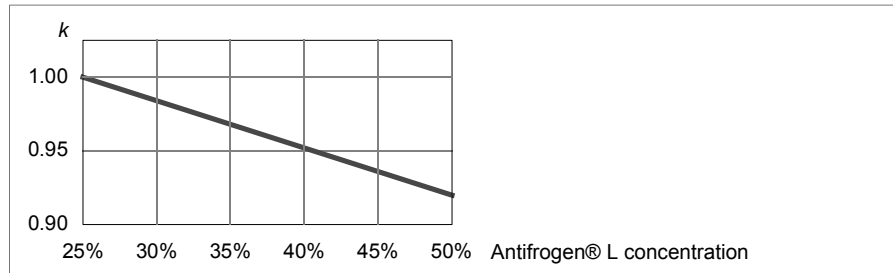
**Ambient temperature:** See the technical data of the drive/unit.

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

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The higher the concentration of heat transfer fluid, the higher the viscosity of the coolant. This results in a higher pressure loss in the system. See *Pressure limits* (page 116).

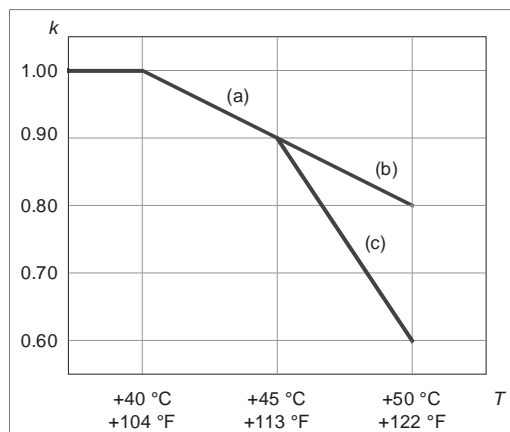
The nominal current ratings of drive system modules apply to an Antifrogen® L / water solution of 25/75% (volume). With the Antifrogen® L concentration between 25% and 50%, the drive output current must be derated by 1/3 percentage point per 1 p.p. increase in Antifrogen® L concentration. The drawing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



**Incoming coolant temperature:**

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

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



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

$T_{air}$ (°C)	Min. $T_{coolant}$ (°C)				
	RH = 95%	RH = 80%	RH = 65%	RH = 50%	RH = 40%
5	4.3	1.9	-0.9	-4.5	-7.4

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

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

### ■ Pressure limits

**Base pressure:** 100 ... 150 kPa (recommended); 200 kPa (maximum). "Base pressure" denotes the pressure of the system compared with the atmospheric pressure when the cooling circuit is filled with coolant.

**Air counterpressure in the expansion tank:** 40 kPa

**Design pressure (PS):** 600 kPa

**Nominal pressure difference** (between main in/out lines): 120 kPa with 25/75% (volume) coolant solution, 150 kPa with 50/50% (volume) coolant solution. This has to be taken into account when dimensioning the liquid cooling circuit.

**Maximum pressure difference** (between main in/out lines): 200 kPa

### ■ Coolant flow rate limits

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

### ■ Cooling circuit materials

Materials used in the internal cooling circuit are listed below. These are also the only materials that can be used in the external cooling circuit.

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

**Note:** PVC hoses are not suitable for use with antifreeze.

- rubber gasketing NBR (nitrile rubber).



**WARNING!**

If connecting external piping to the internal cooling circuit, use only materials that are specified above. Copper, brass or bronze must not be used under any circumstances. Even minor dissolution of copper can cause copper precipitation on aluminum and subsequent galvanic corrosion. The liquid cooling system must not contain any zinc (eg. galvanized pipes).

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If the plant incorporates normal iron pipes or cast iron accessories (eg. motor housings), a cooling unit with a heat exchanger (such as the ACS880-1007LC) must be used to separate the systems.

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# Further information

## **Product and service inquiries**

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to [www.abb.com/searchchannels](http://www.abb.com/searchchannels).

## **Product training**

For information on ABB product training, navigate to [new.abb.com/service/training](http://new.abb.com/service/training).

## **Providing feedback on ABB manuals**

Your comments on our manuals are welcome. Navigate to [new.abb.com/drives/manuals-feedback-form](http://new.abb.com/drives/manuals-feedback-form).

## **Document library on the Internet**

You can find manuals and other product documents in PDF format on the Internet at [www.abb.com/drives/documents](http://www.abb.com/drives/documents).



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