ACS800

Hardware Manual
ACS800-07 Drives (45 to 560 kW)
ACS800-U7 Drives (50 to 600 hp)

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List of related manuals

Drive hardware manuals and guides	Code (English)
ACS800-07/U7 Dimensional Drawings 45 to 560 kW (50 to 600 hp)	*3AFE64775421*
ACS800-07/U7 drives (45 to 560 kW, 50 to 600 hp) Hardware Manual	*3AFE64702165*

Drive firmware manuals and guides	
ACS800 Standard Control Program Firmware Manual	*3AFE64527592*
ACS800 System Control Program Firmware Manual	*3AFE64670646*
ACS800 Control Program Template Firmware Manual	*3AFE64616340*
ACS800 Master/Follower Application Guide Supplement to Firmware Manual for ACS800 Standard Application Program	*3AFE64590430*
ACS800 Pump Control Program Firmware Manual	*3AFE68478952*
ACS800 Extruder Control Program Supplement	*3AFE64648543*
ACS800 Centrifuge Control Program Supplement	*3AFE64667246*
ACS800 Traverse Control Program Supplement	*3AFE64618334*
ACS800 Crane Control Program Firmware Manual	*3BSE011179*
ACS800 Adaptive Programming Application Guide	*3AFE64527274*

Option manuals and guides	
Safety options for ACS800 cabinet-installed drives (+Q950, +Q951, +Q952, +Q963, +Q964, +Q967 and +Q968) Wiring, start-up and operation instructions	*3AUA0000026238*
Cabinet Options for ACS800-07/U7/17/37 Description	*3AUA0000053130*
ACS800-07 Drives (45 to 560 kW) Air Intake from Below Kit Installation Instructions	*3AFE68505241*
ATEX-certified thermal motor protection functions for ACS800 cabinet-installed drives (+L513+Q971 and +L514+Q971) Safety, wiring, start-up and operation instructions	*3AUA0000082378*
Manuals and quick guides for I/O extension modules, fieldbus adapters, etc.	

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

ACS800-07 (< 500kW) manuals

ACS800-07 Drives
45 to 560 kW
ACS800-U7 Drives
50 to 600 hp

Hardware Manual

3AFE64702165 Rev I
EN
EFFECTIVE: 2013-08-28

Safety instructions

What this chapter contains

This chapter contains the safety instructions which you must follow when installing, operating and servicing the drive. If ignored, physical injury or death may follow, or damage may occur to the drive, the motor or driven equipment. Read the safety instructions before you work on the unit.

Use of warnings and notes

There are two types of safety instructions throughout this manual: warnings and notes. Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment. They also tell you how to avoid the danger. Notes draw attention to a particular condition or fact, or give information on a subject. The warning symbols are used as follows:

Dangerous voltage warning warns of high voltage which can cause physical injury and/or damage to the equipment.

General warning warns about conditions, other than those caused by electricity, which can result in physical injury and/or damage to the equipment.

Electrostatic discharge warning warns of electrostatic discharge which can damage the equipment.

Hot surface warning warns of hot surfaces which can cause physical injury.

Installation and maintenance work

These warnings are intended for all who work on the drive, motor cable or motor.

WARNING! Ignoring the following instructions can cause physical injury or death, or damage to the equipment:.

- **Only qualified electricians are allowed to install and maintain the drive.**
- Never work on the drive, motor cable or motor when main power is applied. After switching off the power, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you start working on the drive, the motor or the motor cable.

  Always ensure by measuring with a multimeter (impedance at least 1 Mohm) that:

  1. Voltage between drive input phases L1, L2 and L3 and the frame is close to 0 V.
  2. Voltage between terminals UDC+ and UDC- and the frame is close to 0 V.
- Do not work on the control cables when power is applied to the drive or to the external control circuits. Externally supplied control circuits may cause dangerous voltages inside the drive even when the main power on the drive is switched off.
- Do not make any insulation or voltage withstand tests on the drive or drive modules.
- When reconnecting the motor cable, always check that the phase order is correct.
- After maintaining or modifying a drive safety circuit or changing circuit boards inside the module, retest the functioning of the safety circuit according to the start-up instructions.
- Do not change the electrical installations of the drive except for the essential control and power connections. Changes may affect the safety performance or operation of the drive unexpectedly. All customer-made changes are on the customer's responsibility.

Note:

- The disconnecting device (means) of the drive does not isolate the input cables and busbars from the main AC supply. Before working inside the cabinet, isolate the input cables and busbars from the main supply with the disconnecting device at the distribution board or with the disconnector of the supply transformer.
- The motor cable terminals on the drive are at a dangerously high voltage when the input power is on, regardless of whether the motor is running or not.
- The brake control terminals (UDC+, UDC-, R+ and R- terminals) carry a dangerous DC voltage (over 500 V).

- Depending on the external wiring, dangerous voltages [115 V, 220 V or 230 V] may be present on the terminals of relay outputs RO1 to RO3 or on the optional AGPS board (Prevention of unexpected start-up).
- The Prevention of unexpected start-up function (option +Q950) does not remove the voltage from the main and auxiliary circuits.
- The Safe torque off function (option +Q968) does not remove the voltage from the main and auxiliary circuits.
- At installation sites above 2000 m (6562 ft), the terminals of the RMIO board and optional modules attached to the board do not fulfil the Protective Extra Low Voltage (PELV) requirements stated in EN 50178.

Grounding

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

WARNING! Ignoring the following instructions can cause physical injury, death or equipment malfunction and increase electromagnetic interference.

- Ground the drive, the motor and adjoining equipment to ensure personnel safety in all circumstances, and to reduce electromagnetic emission and interference.
- Make sure that grounding conductors are adequately sized as required by safety regulations.
- In a multiple-drive installation, connect each drive separately to protective earth (PE).
- Do not install a drive with EMC filter option +E202 on an ungrounded power system or a high resistance-grounded (over 30 ohms) power system.

Note:

- Power cable shields are suitable for equipment grounding conductors only when adequately sized to meet safety regulations.
- As the normal leakage current of the drive is higher than 3.5 mA AC or 10 mA DC (stated by EN 50178, 5.2.11.1), a fixed protective earth connection is required.

Mechanical installation and maintenance

These instructions are intended for all who install and service the drive.

WARNING! Ignoring the following instructions can cause physical injury or death, or damage to the equipment:

- Cover the drive when installing to ensure that dust from borings and grindings or foreign objects do not enter the drive. Electrically conductive dust inside the unit may cause damage or lead to malfunction.
- Ensure sufficient cooling.
- Welding of the cabinet frame is not recommended. However, if electric welding is the only way to mount the cabinet, follow the instructions given in chapter *Mechanical installation*. Ensure that welding fumes are not inhaled. If the welding return wire is connected improperly, the welding circuit may damage electronic circuits in the cabinet.
- When removing the module from the cabinet and manoeuvring it outside the cabinet, prevent it from toppling over by securing it. The drive module is heavy and has a high centre of gravity.

- Beware of hot surfaces. Some parts, such as heatsinks of power semiconductors, remain hot for a while after disconnection of the electrical supply.

Printed circuit boards

WARNING! Ignoring the following instructions can cause damage to the printed circuit boards:

- The printed circuit boards contain components sensitive to electrostatic discharge. Wear a grounding wrist band when handling the boards. Do not touch the boards unnecessarily.

Fibre optic cables

WARNING! Ignoring the following instructions can cause equipment malfunction and damage to the fibre optic cables:

- Handle the fibre optic cables with care. When unplugging optic cables, always grab the connector, not the cable itself. Do not touch the ends of the fibres with bare hands as the fibre is extremely sensitive to dirt. The minimum allowed bend radius is 35 mm (1.4 in.).

Operation

These warnings are intended for all who plan the operation of the drive or operate the drive.

WARNING! Ignoring the instructions can cause physical injury or death or damage to the equipment.

- Before adjusting the drive and putting it into service, make sure that the motor and all driven equipment are suitable for operation throughout the speed range provided by the drive. The drive can be adjusted to operate the motor at speeds above and below the speed provided by connecting the motor directly to the power line.
- Do not activate automatic fault reset functions of the Standard Control Program if dangerous situations can occur. When activated, these functions will reset the drive and resume operation after a fault.
- Do not control the motor with the disconnecting device (disconnecting means); instead, use the control panel keys and , or commands via the I/O board of the drive. The maximum allowed number of charging cycles of the DC capacitors (i.e. power-ups by applying power) is five in ten minutes.

Note:

- If an external source for start command is selected and it is ON, the drive (with Standard Control Program) will start immediately after fault reset unless the drive is configured for 3-wire (a pulse) start/stop.
- When the control location is not set to Local (L not shown in the status row of the display), the stop key on the control panel will not stop the drive. To stop the drive using the control panel, press the LOC/REM key and then the stop key .

Permanent magnet synchronous motor

These are additional warnings concerning permanent magnet synchronous motor drives. Ignoring the instructions can cause physical injury or death, or damage to the equipment.

Installation and maintenance work

WARNING! Do not work on the drive when the permanent magnet synchronous motor is rotating. Also, when the supply power is switched off and the inverter is stopped, a rotating permanent magnet synchronous motor feeds power to the intermediate circuit of the drive and the supply connections become live.

Before installation and maintenance work on the drive:

- Stop the motor.
- Ensure that the motor cannot rotate during work. Prevent the start-up of any drives in the same mechanical group by opening the Prevention of unexpected start-up switch (option +Q950) or Safe torque off switch (option +Q968) and padlocking it. Make sure that no other system, like hydraulic crawling drives, are able to rotate the motor directly or through any mechanical connection like felt, nip, rope, etc.
- Ensure that there is no voltage on the drive power terminals:
  Alternative 1) Disconnect the motor from the drive with a safety switch or by other means. Measure that there is no voltage present on the drive input or output terminals (L1, L2, L3, U2, V2, W2, UDC+, UDC-).
  Alternative 2) Measure that there is no voltage present on the drive input or output terminals (L1, L2, L3, U2, V2, W2, UDC+, UDC-). Ground the drive output terminals temporarily by connecting them together as well as to the PE.
  Alternative 3) If possible, both of the above.

Start-up and operation

WARNING! Do not run the motor over the rated speed. Motor overspeed leads to overvoltage which may damage or explode the capacitors in the intermediate circuit of the drive.

Controlling a permanent magnet synchronous motor is only allowed using the control program for Permanent Magnet Synchronous Machine Drive.

Note concerning permanent magnet motor drives in case of a multiple IGBT power semiconductor failure: In spite of the activation of the Safe torque off (option +Q968) or the Prevention of unexpected start-up (option +Q950) function, the drive system can produce an alignment torque which maximally rotates the motor shaft by 180/*p* degrees. *p* denotes the pole pair number.

Table of contents

Planning the electrical installation

Electrical installation

Motor control and I/O board (RMIO)

Installation checklist and start-up

Maintenance

Technical data

Dimensional drawings

Resistor braking

Further information

Introduction to the manual

What this chapter contains

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

Target audience

This manual is intended for people who plan the installation, install, commission, use and service the drive. Read the manual before working on the drive. The reader is 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. Special US instructions for installations within the United States that must be performed per the National Electrical Code and local codes are marked with (US).

Categorization according to the frame size

Some instructions, technical data and dimensional drawings which concern only certain frame sizes are marked with the symbol of the frame size R2, R3... or R8. The frame size is not marked on the drive designation label. To identify the frame size of your drive, see the rating tables in chapter *Technical data*.

Categorization according to the option code

The instructions, technical data and dimensional drawings which concern only certain optional selections are marked with option codes, eg, +E205. The options included in the drive can be identified from the option codes visible on the type designation label of the drive. The option code selections are listed in chapter *Operation principle and hardware description* under *Type designation key*.

Contents

The chapters of this manual are briefly described below.

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

Introduction to the manual introduces this manual.

Operation principle and hardware description describes the drive.

Mechanical installation shows how to move and unpack the delivery and how to fasten the cabinet to the floor.

Planning the electrical installation instructs on the motor and cable selection, the protections and the cable routing.

Electrical installation instructs how to wire the drive.

Motor control and I/O board (RMIO) shows external control connections to the motor control and I/O board and its specifications.

Installation checklist and start-up helps in checking the mechanical and electrical installation of the drive.

Maintenance contains preventive maintenance instructions.

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

Dimensional drawings contains the dimensional drawings of the drive.

Resistor braking describes how to select, protect and wire optional brake choppers and resistors. The chapter also contains technical data.

Installation and commissioning flowchart

Task	See
Identify the frame size of your drive: R6, R7 or R8.	*Technical data / IEC data* or *NEMA data*
Plan the installation. Check the ambient conditions, ratings, required cooling air flow, input power connection, compatibility of the motor, motor connection, and other technical data. Select the cables.	*Technical data* *Planning the electrical installation* Option manual (if optional equipment is included)
Unpack and check the units. Check that all necessary optional modules and equipment are present and correct. Only intact units may be started up.	*Mechanical installation: Moving the unit, Before installation* If the converter has been non-operational for more than one year, the converter DC link capacitors need to be reformed. Ask ABB for instructions.
Check the installation site.	*Mechanical installation*: *Before installation* *Technical data*
If the drive is about to be connected to an IT (ungrounded) system, check that the drive is not equipped with EMC filter +E202.	*Operation principle and hardware description*: *Type designation key*. For instructions on how to disconnect the EMC filtering, contact ABB.
Route the cables.	*Planning the electrical installation*: *Routing the cables*
Check the insulation of the motor and the motor cable.	*Electrical installation*: *Checking the insulation of the assembly*
Install the drive. Connect the power cables. Connect the control and the auxiliary control cables.	*Mechanical installation, Electrical installation, Resistor braking* (optional)
Check the installation.	*Installation checklist and start-up*
Commission the drive.	*Installation checklist and start-up*, appropriate firmware manual
Commission the optional brake chopper (if present).	*Resistor braking*

Terms and abbreviations

Term/Abbreviation	Definition
ABRC	Brake chopper control board
ADPI	Diagnostics and panel interface board
AGDR	Gate driver control board
AGPS	Power supply board for IGBT gate driver boards. Used in implementation of the optional Prevention of unexpected start-up function.
AIBP	Input bridge protection board
AIMA	I/O module adapter.
AINP	Input bridge control board
AINT	Main circuit board
APOW	Power supply board
ASTO	Safe torque off board
DDCS	Distributed drives communication system; a protocol used in optical fiber communication.
DTC	Direct torque control
EMC	Electromagnetic compatibility
EMI	Electromagnetic interference
IGBT	Insulated gate bipolar transistor
IT system	Type of supply network that has no (low-impedance) connection to ground/ earth.
NAIO	Analogue I/O extension module
NDIO	Digital I/O extension module
NRFC	EMC filter board
NTAC	Pulse encoder interface module
PE	Protective earth
PELV	Protective extra low voltage
POUS	Prevention of unexpected start-up
RDCO	Satellite board that mounts on the RMIO board to increase the number of DDCS channels available.
RDCU	Drive control unit
RFI	Radio-frequency interference
RMIO	Supply/motor control and I/O board
RRIA	Resolver adapter module
RTAC	Pulse encoder adapter module
STO	Safe torque off
THD	Total harmonic distortion
TN system	Type of supply network that provides a direct connection to ground (earth).

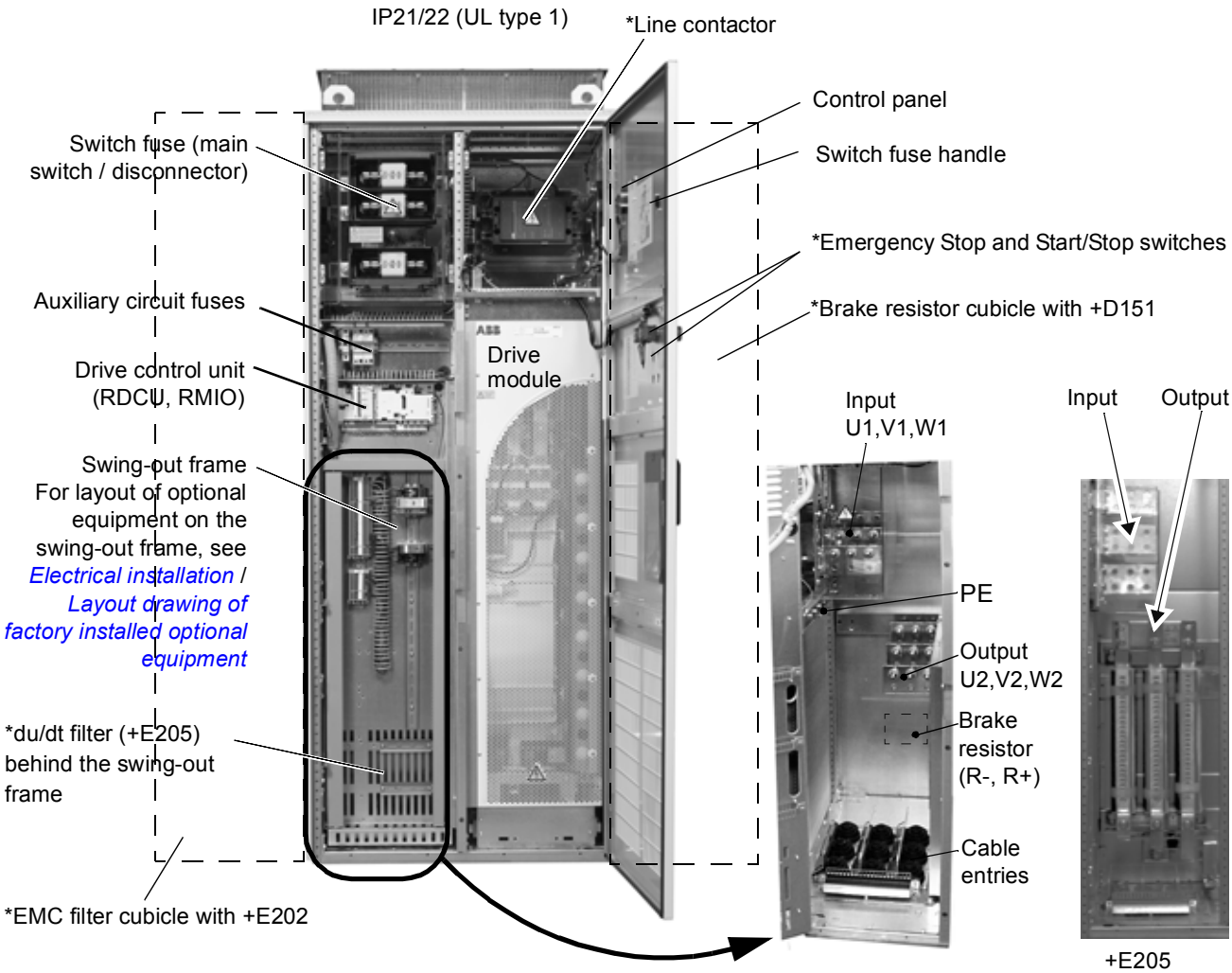
Operation principle and hardware description

What this chapter contains

This chapter describes the construction and operating principle of the drive in short.

Product overview

The ACS800-07/U7 is a cabinet-installed drive for controlling AC motors.



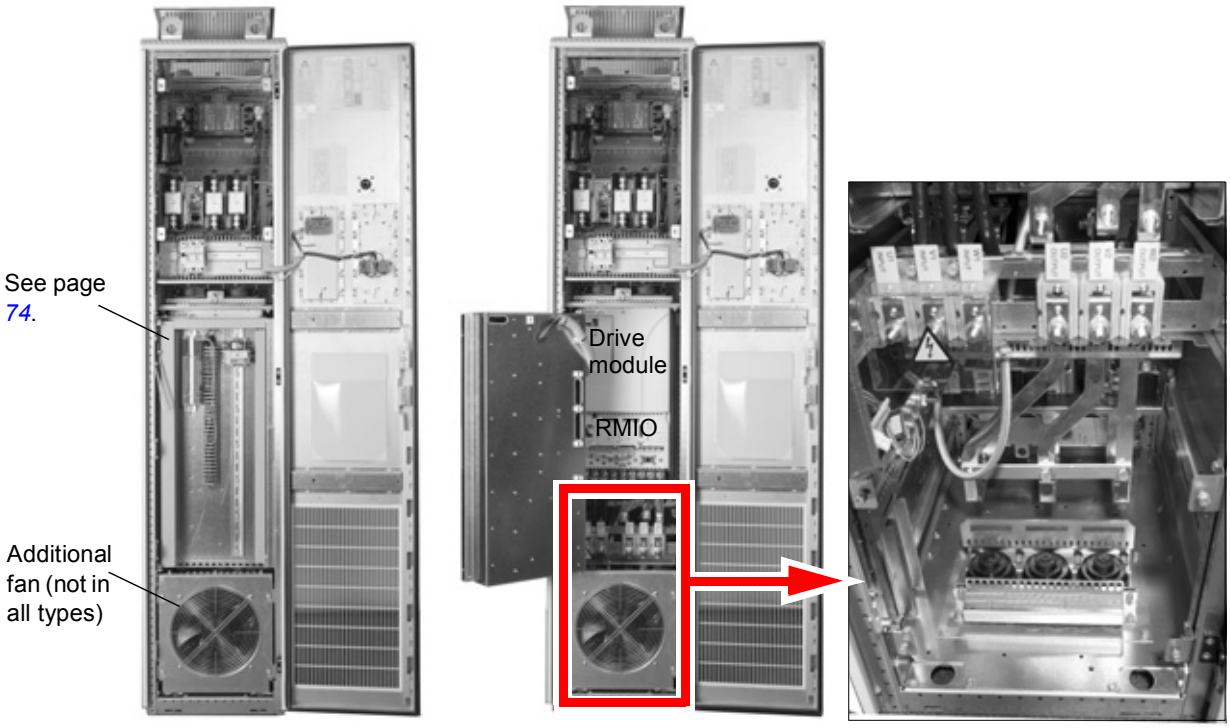
Power and signal cable terminals, and du/dt filter (+E205), behind the swing-out frame

* Denotes optional equipment not present on all units.

View of frame size R8

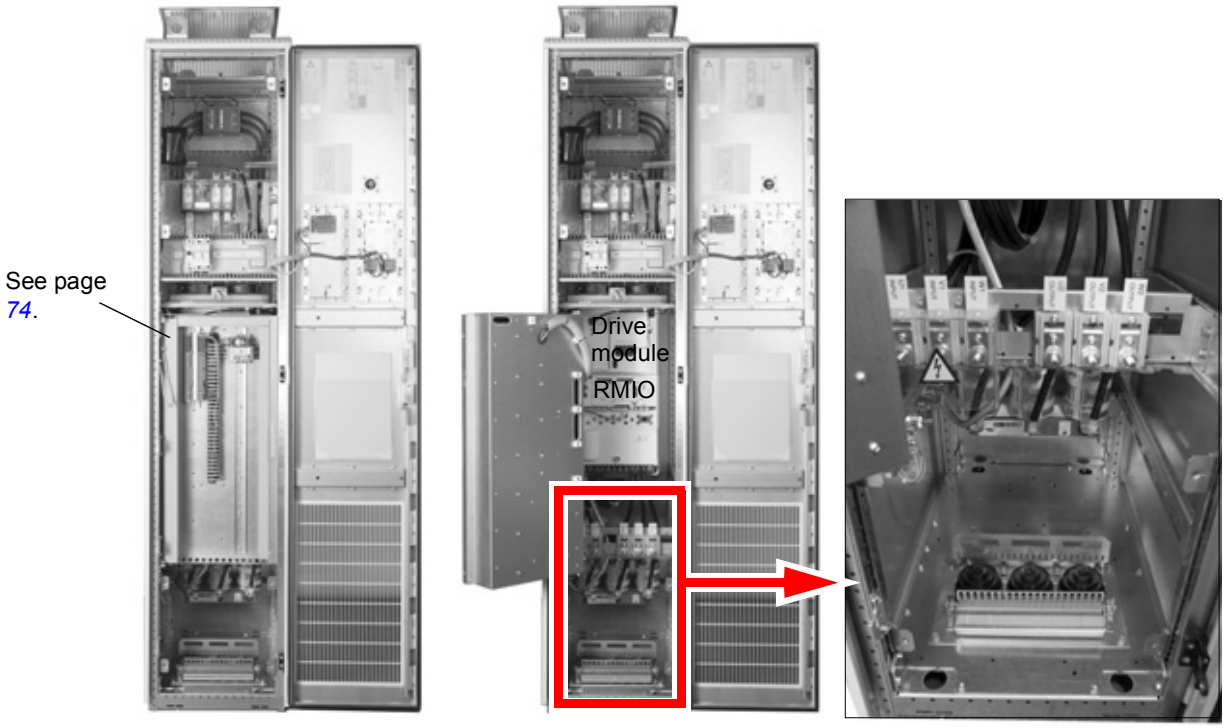
Note: The input terminals are located in the EMC filter cubicle with +E202.

IP21/22



View of frame size R6 without shrouds

Power cable terminals



View of frame size R5 without shrouds

Power cable terminals

Type designation key

The type designation key contains information on the specifications and configuration of the drive. The first digits from left express the basic configuration (eg, ACS800-07-0170-5). The optional selections are given thereafter, separated by + signs (eg, +E202). The main selections are described below. Not all selections are available for all types. For more information, refer to *ACS800 Ordering Information* (EN code: 64556568, available on request).

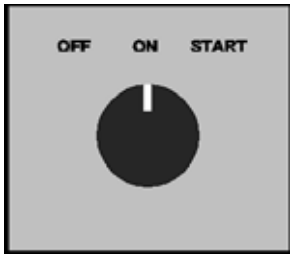
Selection	Alternatives	
Product series	ACS800 product series	
Type	07	cabinet built. When no options are selected: IP21 (UL type1), main switch fuse with aR fuses, 230 V AC control voltage, control panel CDP 312R, no EMC filter, standard software, bottom entry and exit of cables, cable lead through entry, boards without coating, one set of default language documents.
	U7	cabinet built (USA). When no options are selected: UL type1 (IP21), US type main switch fuse, 115 V AC control voltage, control panel CDP 312R, no EMC filter, standard software (US), top entry and exit of cables, cable conduit entry, common mode filter in R8, one set of default language documents.
Size	See *Technical data: IEC data* or *NEMA data*.	
Voltage range (nominal rating in bold)	3	380/**400**/415 V AC
	5	380/400/415/440/460/480/**500** V AC
	7	525/575/600/**690** V AC
Optional selections	Eg, ACS800-07-0170-5+E202	
Degree of protection	+B053	IP22 (UL type 1)
	+B054	IP42 (UL type 2)
	+B055	IP54 (UL type 12)
	+B059	IP54R with connection to air outlet duct
Construction	+C121	marine construction (reinforced mechanics and fastening, marking of conductors according to class A1, door handles, self-extinctive materials)
	+C129	UL listed (for ACS800-07 units only): US type main switch fuse, 115 V AC control voltage, US cable conduit entry, all components UL listed/recognized, max. supply voltage 600 V.
	+C134	CSA marked. US/CSA type main switch fuse, bottom entry and exit, 115 V AC control voltage, all components UL/CSA listed/ recognized, max. supply voltage 600 V.
Resistor braking	+D150	brake chopper (external resistor)
	+D151	brake resistor
Filter	+E200	EMC/RFI filter for second environment TN (grounded) system
	+E202	EMC/RFI filter for first environment TN (grounded) system, restricted (A limits)
	+E210	EMC/RFI filter for second environment TN/IT (grounded/ ungrounded) system
	+E205	du/dt filter
	+E206	sine filter
	+E208	common mode filter
Line options	+F250	line contactor
	+F251	gG line fuses

Selection	Alternatives	
Cabinet options	+G300	cabinet heater (external supply)
	+G304	115 V AC control voltage
	+G307	terminals for external control voltage (UPS)
	+G313	output for motor heater (external supply)
	+G330	halogen-free materials and control wiring
	+G338	wire marking class A1
	+G339	wire marking class A2
	+G340	wire marking class A3
	+G341	wire marking class B1
	+G342	wire marking class C1
Cabling	+H351	top entry
	+H353	top exit
	+H350	bottom entry
	+H352	bottom exit
	+H356	DC cable connection busbars
	+H358	cable conduit entry (US and UK version)
Fieldbus	+Kxxx	Refer to *ACS800 Ordering Information* (EN code: 64556568).
I/O	+L504	additional terminal block X2
	+L505	thermistor relay (1 or 2 pcs)
	+L506	Pt100 relay (3, 5 or 8 pcs)
	+Lxxx	Refer to *ACS800 Ordering Information* (EN code: 64556568).
Starter for auxiliary motor fan	+M600	1...1.6 A
	+M601	1.6...2.5 A
	+M602	2.5...4 A
	+M603	4...6.3 A
	+M604	6.3...10 A
	+M605	10...16 A
Control program	+Nxxx	Refer to *ACS800 Ordering Information* (EN code: 64556568).
Language of manual	+Rxxx	
Specialities	+P901	coated boards
	+P902	customized
	+P904	extended warranty
	+P913	special colour
	+P912	seaworthy packing
	+P929	container packing
Safety features	+Q950	Prevention of unexpected start-up
	+Q951	Emergency stop of category 0 with opening the main contactor/ breaker (+F250 required)
	+Q952	Emergency stop of category 1 with opening the main contactor/ breaker (+F250 required)
	+Q963	Emergency Stop, Category 0 without opening the main contactor/ breaker
	+Q964	Emergency Stop, Category 1 without opening the main contactor/ breaker (SS1)
	+Q968	Safe torque off STO with a safety relay
	+Q954	Earth fault monitoring for IT (ungrounded) systems
	+Q971	ATEX certified safety functions

Main circuit and control

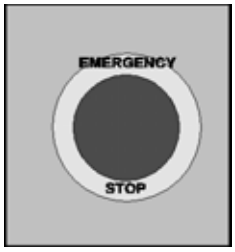
Door switches

The following switches are mounted on the cabinet door:



Operating switch (units with main contactor only)

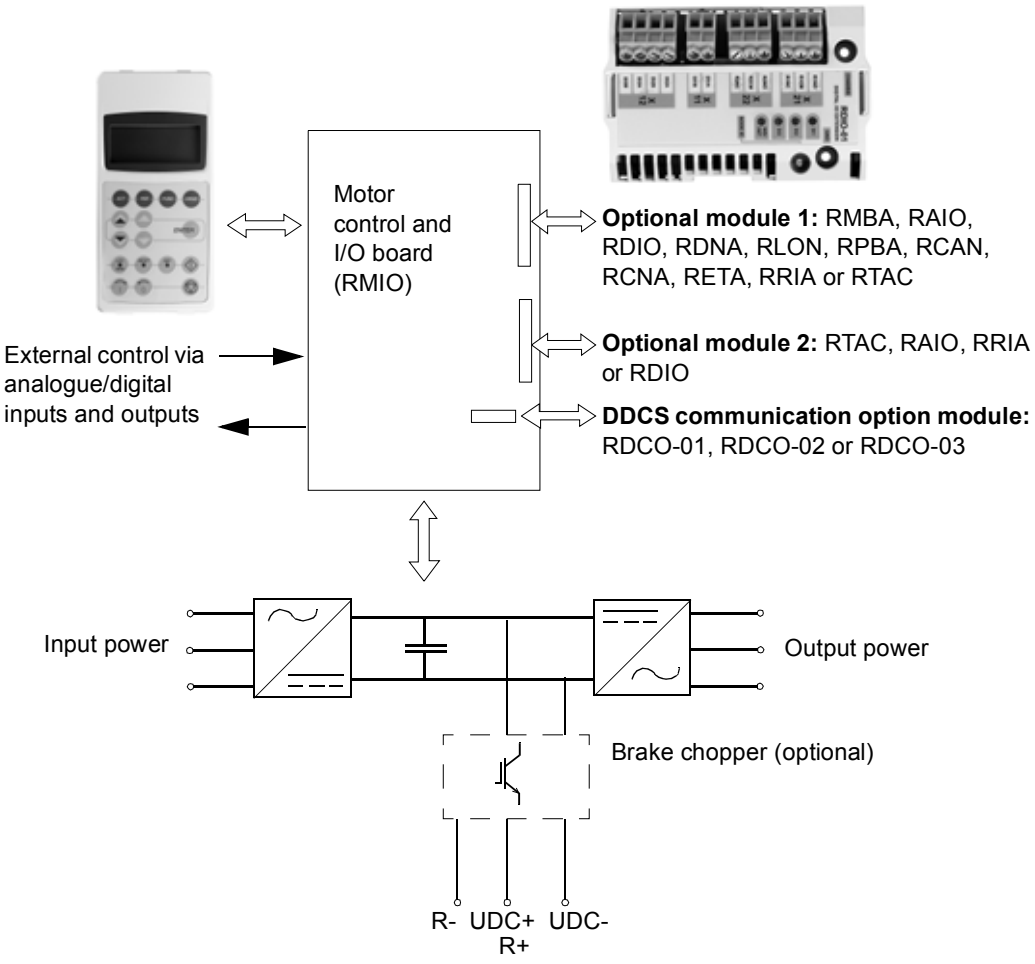
“START” position closes the main contactor; “ON” position keeps the main contactor closed; “OFF” position opens the main contactor.



Emergency stop button (optional)

Diagram

This diagram shows the control interfaces and the main circuit of the drive.



Operation

This table describes the operation of the main circuit in short.

Component	Description
six-pulse rectifier	converts the three-phase AC voltage to DC voltage
capacitor bank	energy storage which stabilizes the intermediate circuit DC voltage
six-pulse IGBT inverter	converts the DC voltage to AC voltage and vice versa. The motor operation is controlled by switching the IGBTs.

Printed circuit boards

The drive contains the following printed circuit boards as standard:

- main circuit board (AINT)
- motor control and I/O board (RMIO) with a fibre optic link to the AINT board
- input bridge control board (AINP)
- input bridge protection board (AIBP) which includes varistors and snubbers for the thyristors
- power supply board (APOW)
- gate driver control board (AGDR)
- diagnostics and panel interface board (ADPI)
- EMC filter boards (NRFC) with option +E202
- brake chopper control board (ABRC) with option +D150

Motor control

The motor control is based on the Direct torque control (DTC) method. Two phase currents and DC link voltage are measured and used for the control. The third phase current is measured for earth fault protection.

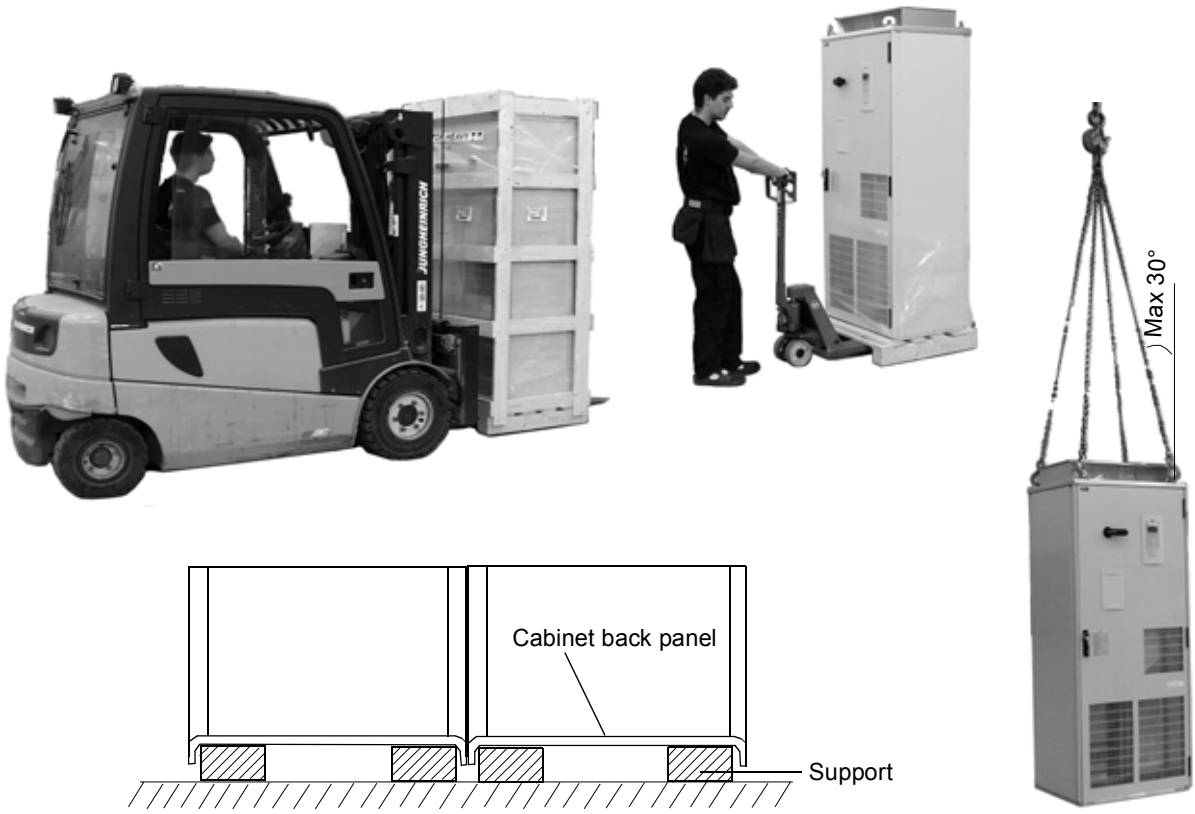
Mechanical installation

What this chapter contains

This chapter describes the mechanical installation procedure of the drive.

Moving the unit

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



View of cabinet laid on its back

It is allowed to tilt the drive if required, or move it on its back when supported properly from below. **Note:** It is not allowed to move a unit with sine filter (+E206) on its back.

WARNING! Lift the drive by the upper part only using the lifting lugs/bars attached to the top of the unit.

Before installation

Delivery check

The drive delivery contains:

- drive cabinet including factory installed options such as optional modules (inserted onto the RMIO board in the RDCU unit)
- residual voltage warning stickers
- hardware manual
- appropriate firmware manuals and guides
- appropriate optional module manuals
- delivery documents.

Check that there are no signs of damage. Before attempting installation and operation, check the information on the type designation label of the drive to verify that the unit is of the correct type. The label includes an IEC and NEMA rating, C-UL US, and CSA markings, a type designation key and a serial number, which allow individual recognition of each unit. 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 serial number.

The type designation label is located on the front cover and the serial number label inside the unit. Example labels are shown below.

Type designation label

Serial number label

Requirements for the installation site

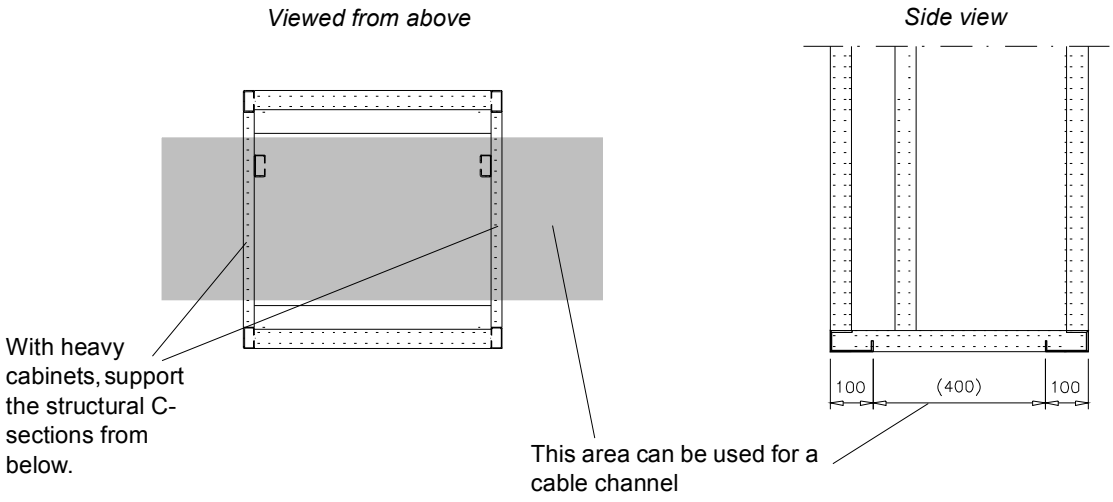
Check the installation site according to the requirements below. See *ACS800-07/U7 Dimensional Drawings* [3AFE64775421 (English)] for frame details. See chapter *Technical data* for the allowed operation conditions of the drive.

Cooling air flow

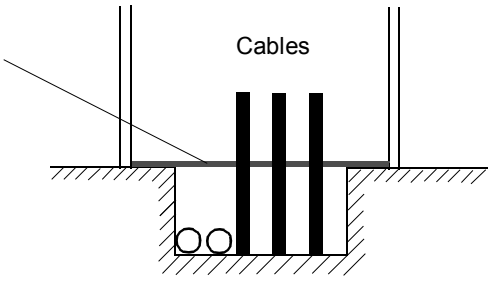
Provide the drive with the amount of clean cooling air given in chapter *Technical data* section *IEC data* or *NEMA data*.

Cable channel in the floor below the cabinet

A cable channel can be constructed below the 400 mm wide middle part of the cabinet. The cabinet weight lies on the two 100 mm wide transverse sections which the floor must carry.

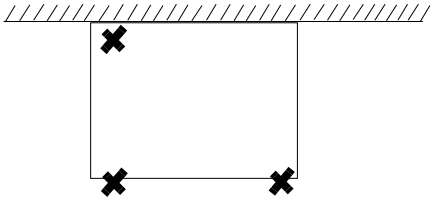


Prevent the cooling air flow from the cable channel to the cabinet by bottom plates. To ensure the degree of protection for the cabinet use the original bottom plates delivered with the unit. With user-defined cable entries take care of the degree of protection, fire protection and EMC compliance.

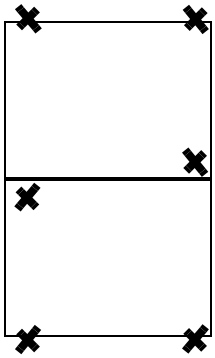


Fastening the cabinet to the floor and wall (non-marine units)

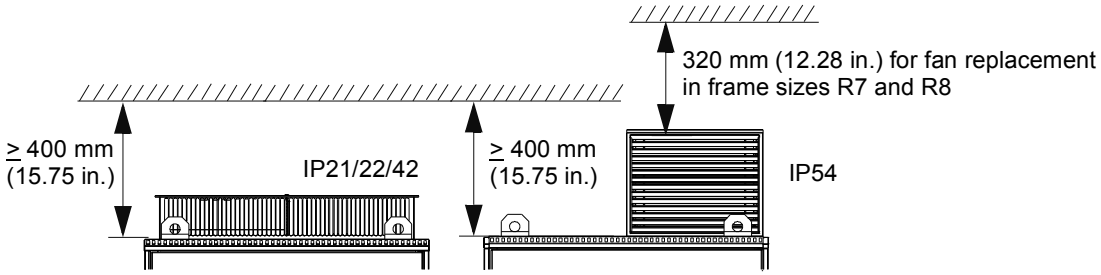
Fasten the cabinet to the floor either with the outside fastening brackets from front and back, or by the fastening holes inside the cabinet. When fastening at the back is not possible, fasten the cabinet at the top using L-brackets bolted to the holes of the lifting lugs (M16 bolt). The cabinet can be fastened against a wall or back to back with another cabinet. See chapter *Dimensional drawings* for the horizontal and vertical fastening points. Height adjustment can be done by using metal shims between the bottom frame and floor.



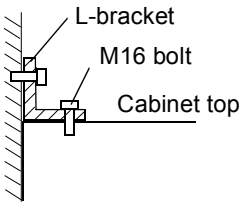
Fastening points when installed back against wall



Fastening points when installed back against back



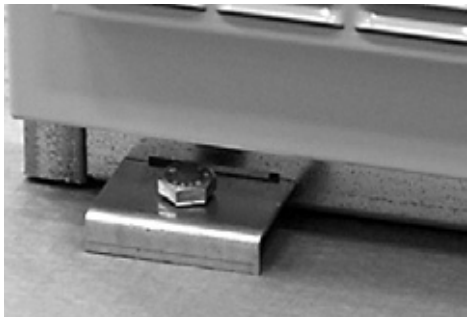
Top clearance



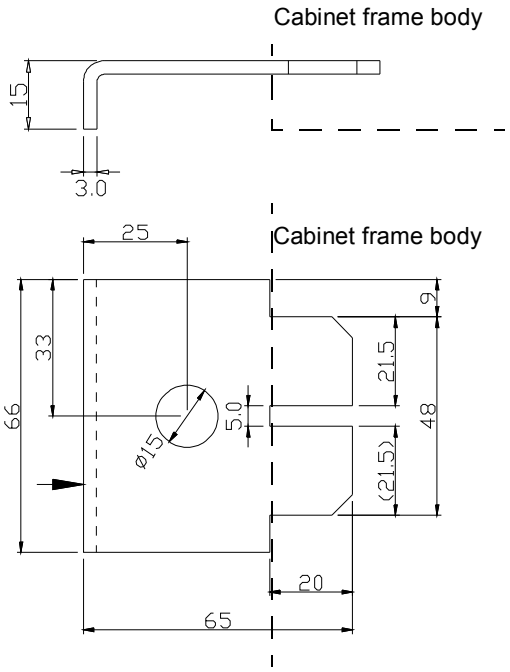
Fastening the cabinet at the top by using L-brackets (side view)

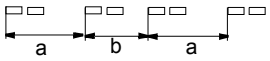
Fastening the cabinet with the outside brackets

Insert the bracket into the longitudinal hole in the edge of the cabinet frame body and fasten it with a bolt to the floor.



Dimensions of the fastening bracket:

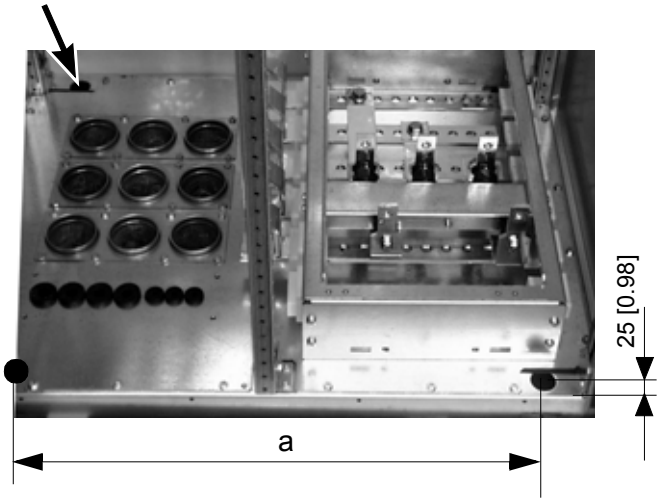


Cubicle width mm [in.]	Fastening hole distance in mm [in.] 
200 [7.87]	
400 [15.75]	a: 250 [9.84]
600 [23.62]	a: 450 [17.71]
800 [31.50]	a: 650 [25.29]
1000 [39.37]	a: 350 [13.78], b: 150 [5.91], a: 350 [13.78]
1200 [47.24]	a: 450 [17.71], b: 150 [5.91], a: 450 [17.71]

Fastening bolt: M10 to M12 (3/8” to 1/2”).

Fastening the cabinet through the holes inside the cabinet

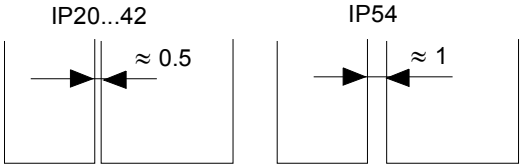
The cabinet can be fastened to the floor using the fastening holes inside the cabinet, if they are available and accessible. The maximum allowed distance between the fastening points is 800 mm (31.50 in.).



Side plates of the cabinet: 15 mm

Back plate of the cabinet: 10 mm

Gap between the 200 mm, 400 mm, 600 mm, 800 mm, 1000 mm and 1500 mm cubicles:



Cubicle width mm [in.]	Fastening hole distance in mm [in.] a b a ∅ 31 mm [1.22]
200 [7.87]	a: 50 [1.97]
400 [15.75]	a: 250 [9.84]
600 [23.62]	a: 450 [17.71]
800 [31.50]	a: 650 [25.29]
1000 [39.37]	a: 350 [13.78], b: 150 [5.91], a: 350 [13.78]
1200 [47.24]	a: 450 [17.71], b: 150 [5.91], a: 450 [17.71]

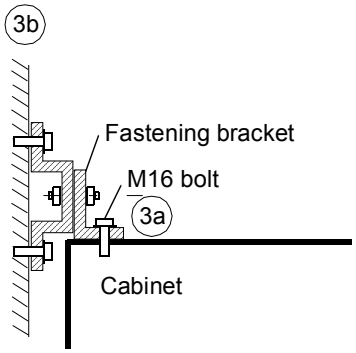
Fastening bolt: M10 to M12 (3/8” to 1/2”).

Fastening the cabinet to the floor and roof/wall (marine units)

See *ACS800-07/U7 Dimensional Drawings* [3AFE64775421 (English)] for the locations of the fastening holes in the flat bars below the cabinet and for fastening points at the top of the cabinet. Top fastening brackets are included in the delivery.

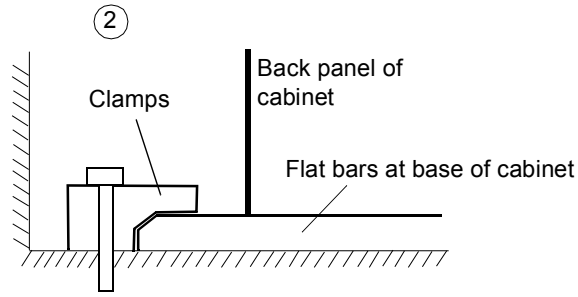
Fasten the cabinet to the floor and roof (wall) as follows:

1. Bolt the unit to the floor through the holes in each flat bar at the base of the cabinet using M10 or M12 screws.
2. If there is not enough room behind the cabinet for installation, clamp the rear ends of the flat bars.
3. Remove the lifting lugs and bolt the fastening brackets into the lifting lug holes (a). Fasten the top of the cabinet to the rear wall and/or roof with brackets (b).



Fastening bracket

Fastening the cabinet at the top with brackets (side view)



Clamping the cabinet to the floor at the back

Electric welding

It is not recommended to fasten the cabinet by welding.

Cabinets without flat bars at the base (non-marine versions)

If the preferred fastening methods (clamping or bolting through the holes inside the cabinet) cannot be used, proceed as follows:

- Connect the return conductor of the welding equipment to the cabinet frame at the bottom within 0.5 metres of the welding point.

Cabinets with flat bars at the base (marine versions)

If the fastening cannot be done using screws, proceed as follows:

- Weld only on the flat bar under the cabinet, not the cabinet frame itself.
- Clamp the welding electrode onto the flat bar about to be welded or onto the floor within 0.5 metres of the welding point.

WARNING! If the welding return wire is connected improperly, the welding circuit may damage electronic circuits in the cabinet. The thickness of the zinc coating of the cabinet frame is 100 to 200 micrometres; on the flat bars the coating is approximately 20 micrometres. Ensure that the welding fumes are not inhaled.

Planning the electrical installation

What this chapter contains

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

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

Motor selection and compatibility

1. Select the motor according to the rating tables in chapter *Technical data*. Use the DriveSize PC tool if the default load cycles are not applicable.
2. Check that the motor ratings lie within the allowed ranges of the drive control program:
   - motor nominal voltage is 1/2 ... 2 · U_N of the drive
   - motor nominal current is 1/6 ... 2 · I_{2hd} of the drive in DTC control and 0 ... 2 · I_{2hd} in scalar control. The control mode is selected by a drive parameter.

3. Check that the motor voltage rating meets the application requirements:

If the drive is equipped with …	… and …	… then the motor voltage rating should be …
diode supply	no resistor braking is in use	U_N
	frequent or long term brake cycles will be used	U_{ACeq1}

U_N = rated input voltage of the drive
U_{ACeq1} = $U_{DC}/1.35$
U_{DC} = the maximum DC link voltage of the drive in V DC.
For resistor braking: U_{DC}= 1.21 × nominal DC link voltage.
(**Note:** Nominal DC link voltage is U_N × 1.35 or U_N × 1.41 in V DC.)

See also section *Additional requirements for the braking applications* on page *42*.

4. Consult the motor manufacturer before using a motor in a drive system where the motor nominal voltage differs from the AC power source voltage.
5. Ensure that the motor insulation system withstands the maximum peak voltage in the motor terminals. See the *Requirements table* below for the required motor insulation system and drive filtering.

   Example 1: When the supply voltage is 440 V and a drive with a diode supply is operating in motor mode only, the maximum peak voltage in the motor terminals can be approximated as follows: 440 V · 1.35 · 2 = 1190 V. Check that the motor insulation system withstands this voltage.

   Example 2: When the supply voltage is 440 V and the drive is equipped with an IGBT supply, the maximum peak voltage in the motor terminals can be approximated as follows: 440 V · 1.41 · 2 = 1241 V. Check that the motor insulation system withstands this voltage.

Protecting the motor insulation and bearings

The output of the drive comprises – regardless of output frequency – pulses of approximately 1.35 times the equivalent mains network voltage with a very short rise time. This is the case with all drives employing modern IGBT inverter technology.

The voltage of the pulses can be almost double at the motor terminals, depending on the attenuation and reflection properties of the motor cable and the terminals. This in turn can cause additional stress on the motor and motor cable insulation.

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

The stress on motor insulation can be avoided by using optional ABB du/dt filters. du/dt filters also reduce bearing currents.

To avoid damage to motor bearings, the cables must be selected and installed according to the instructions given in the hardware manual. In addition, insulated N-end (non-drive end) bearings and output filters from ABB must be used according to the following table. Two types of filters are used individually or in combinations:

- optional du/dt filter (protects motor insulation system and reduces bearing currents).
- common mode filter (mainly reduces bearing currents).

Requirements table

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

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

* manufactured before 1.1.1998

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

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

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

The abbreviations used in the table are defined below.

Abbr.	Definition
U_N	Nominal AC line voltage
$\hat{U}_{LL}$	Peak line-to-line voltage at motor terminals which the motor insulation must withstand
P_N	Motor nominal power
du/dt	du/dt filter at the output of the drive (option +E205)
CMF	Common mode filter (option +E208)
N	N-end bearing: insulated motor non-drive end bearing
n.a.	Motors of this power range are not available as standard units. Consult the motor manufacturer.

Additional requirements for explosion-safe (EX) motors

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

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

Use the selection criteria given for non-ABB motors.

Additional requirements for the braking applications

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

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

Additional requirements for ABB high-output and IP23 motors

The rated output power of high output motors is higher than what is stated for the particular frame size in EN 50347:2001. This table shows the requirements for ABB random-wound motor series (for example, M3AA, M3AP and M3BP).

Nominal mains voltage (AC line voltage)	**Requirement for**			
	Motor insulation system	**ABB du/dt and common mode filters, insulated N-end motor bearings**		
		P_N < 100 kW	**100 kW ≤ P_N < 200 kW**	**P_N ≥ 200 kW**
		P_N < 140 hp	**140 hp ≤ P_N < 268 hp**	**P_N ≥ 268 hp**
$U_N \leq 500$ V	Standard	-	+ N	+ N + CMF
500 V < $U_N \leq 600$ V	Standard	+ du/dt	+ du/dt + N	+ du/dt + N + CMF
	or			
	Reinforced	-	+ N	+ N + CMF
600 V < $U_N \leq 690$ V	Reinforced	+ du/dt	+ du/dt + N	+ du/dt + N + CMF

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

The rated output power of high output motors is higher than what is stated for the particular frame size in EN 50347:2001. The table below shows the requirements for random-wound and form-wound non-ABB motors.

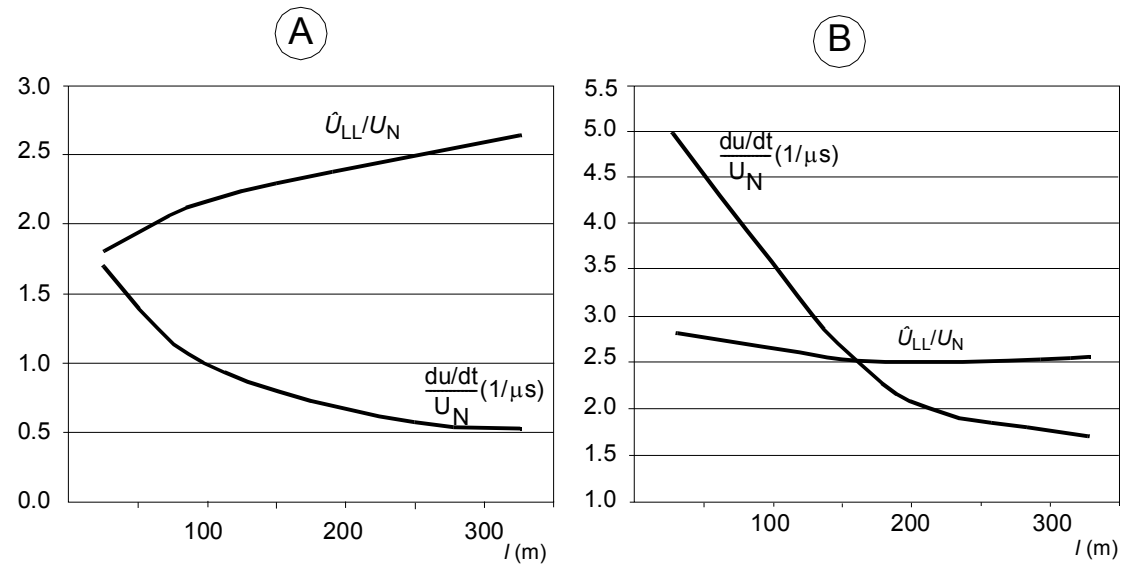
Nominal AC line voltage	**Requirement for**		
	Motor insulation system	**ABB d*u*/d*t* filter, insulated N-end bearing and ABB common mode filter**	
		P_N < 100 kW or frame size < IEC 315	**100 kW ≤ P_N < 350 kW or IEC 315 ≤ frame size < IEC 400**
		P_N < 134 hp or frame size < NEMA 500	**134 hp ≤ P_N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

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

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

If you need to calculate the actual peak voltage and voltage rise time considering the actual cable length, proceed as follows:

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



A	Drive with du/dt filter
B	Drive without du/dt filter
l	Motor cable length
$\hat{U}_{LL}/U_N$	Relative peak line-to-line voltage
(du/dt)/U_N	Relative du/dt value
Note: ÛLL and du/dt values are approximately 20% higher with resistor braking.	

Additional note for sine filters

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

Additional note for common mode filters

Common mode filter is available as a plus code option (+E208) or as a separate kit (one box including three rings for one cable).

Permanent magnet synchronous motor

Only one permanent magnet synchronous motor can be connected to the inverter output.

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

Supply connection

Disconnecting device (disconnecting means)

The drive is equipped with a hand-operated input disconnecting device (disconnecting means) which isolates the drive and the motor from the AC power as standard. The disconnecting device does not, however, isolate the input busbars from the AC power. Therefore, during installation and maintenance work on the drive, the input cables and busbars must be isolated from the input power with a disconnector at the distribution board or at the supplying transformer.

EU

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

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

US

The disconnecting means must conform to the applicable safety regulations.

Fuses

See section *Thermal overload and short-circuit protection* on page *46*.

Main contactor

If used, dimension the contactor according to the nominal voltage and current of the drive. The utilization category (IEC 947-4) is AC-1.

Thermal overload and short-circuit protection

Thermal overload protection of the drive and the input and motor cables

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

WARNING! If the drive is connected to multiple motors, a separate thermal overload switch or a circuit breaker must be used for protecting each cable and motor. These devices may require a separate fuse to cut off the short-circuit current.

Thermal overload protection of the motor

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

The most common temperature sensors are:

- motor sizes IEC180…225: thermal switch (for example, Klixon)
- motor sizes IEC200…250 and larger: PTC or Pt100.

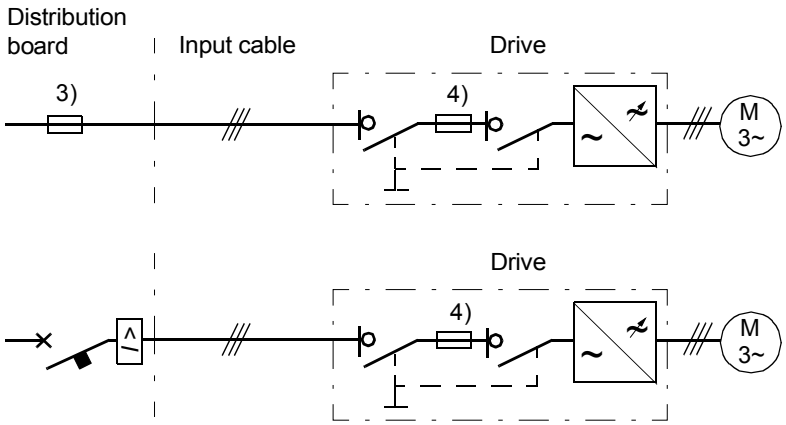
See the firmware manual for more information on the motor thermal protection, and the connection and use of the temperature sensors.

Protection against short-circuit in the motor cable

The drive protects the motor cable and motor in a short-circuit situation when the motor cable is dimensioned according to the nominal current of the drive. No additional protection devices are needed.

Protection against short-circuit inside the drive or in the supply cable

Arrange the protection according to the following guide lines.

Circuit diagram	Drive type	Short-circuit protection
DRIVE IS EQUIPPED WITH INPUT FUSES		
	ACS800-07 ACS800-U7	Protect the input cable with fuses or a circuit breaker according to local regulations. See footnotes 3) and 4).

1) Size the fuses according to instructions given in chapter *Technical data*. The fuses will protect the input cable in short-circuit situations, restrict drive damage and prevent damage to adjoining equipment in case of a short-circuit inside the drive.

2) Circuit breakers which have been tested by ABB with the ACS800 can be used. Fuses must be used with other circuit breakers. Contact your local ABB representative for the approved breaker types and supply network characteristics.

   The protective characteristics of circuit breakers depend on the type, construction and settings of the breakers. There are also limitations pertaining to the short-circuit capacity of the supply network.

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

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

3) Size the fuses according to local safety regulations, appropriate input voltage and the rated current of the drive (see chapter *Technical data)*.

4) ACS800-07 units with enclosure extension are equipped with aR fuses as standard. ACS800-U7 units are equipped with T/L fuses as standard. The fuses restrict drive damage and prevent damage to adjoining equipment in case of a short-circuit inside the drive.

Ground fault protection

The drive is equipped with an internal ground fault protective function to protect the unit against ground faults in the motor and motor cable. This is not a personal safety or a fire protection feature. The ground fault protective function can be disabled with a parameter, refer to the appropriate *ACS800 Firmware Manual*.

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

Emergency stop devices

For safety reasons, install the emergency stop devices at each operator control station and at other operating stations where emergency stop may be needed.

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

An emergency stop function is optionally available for stopping and switching off the whole drive. Two stop categories according to IEC/EN 60204-1:1997 are available: immediate removal of power (Category 0 for ACS800-07/U7) and controlled emergency stop (Category 1 for ACS800-07/U7).

Restarting after an emergency stop

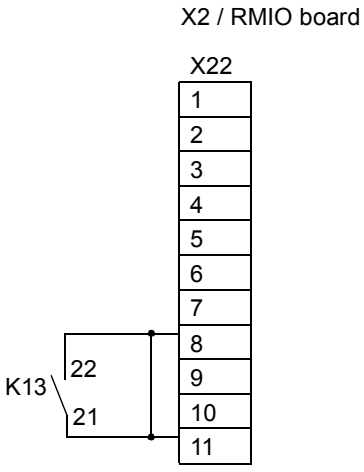
After an emergency stop, the emergency stop button must be released and the drive started by turning the operating switch of the drive from position “ON” to “START”.

Power-loss ride-through function

The power-loss ride-through function is activated when parameter 20.06 UNDERVOLTAGE CTRL is set to ON (default in Standard Control Program).

ACS800-07/U7 units with line contactor (+F250)

The power-loss ride-through function is enabled by connecting RMIO board terminals X22:8 and X22:11 with a jumper.



Prevention of unexpected start-up

The ACS800-07/U7 drives can be equipped with an optional Prevention of unexpected start-up function (POUS) according to standards IEC/EN 60204-1:2006+AC:2010, ISO/DIS 14118:2000 and EN 1037:1996.

The Prevention of unexpected start-up function disables the control voltage of the power semiconductors, thus preventing the inverter from generating the AC voltage required to rotate the motor. By using this function, short-time operations (like cleaning) and/or maintenance work on non-electrical parts of the machinery can be performed without switching off the AC power supply to the drive.

The operator activates the Prevention of unexpected start-up function by opening a switch on a control desk. An indicating lamp on the control desk will light, signalling that the prevention is active. The switch can be locked out.

The user must install on a control desk near the machinery:

- switching/disconnecting device for the circuitry. “Means shall be provided to prevent inadvertent, and/or mistaken closure of the disconnecting device.” EN 60204-1:1997.
- indicating lamp; ON = starting the drive is prevented, OFF = drive is operative.

For connections to the drive, see the circuit diagram delivered with the drive.

WARNING! The Prevention of unexpected start-up function does not disconnect the voltage of the main and auxiliary circuits from the drive. Therefore maintenance work on electrical parts of the drive or the motor can only be carried out after isolating the drive system from the main supply.

Note: The Prevention of unexpected start-up function is not intended for stopping the drive. If the Prevention of unexpected start-up function is activated when the drive is running, the control voltage of the power semiconductors is cut off and the motor coasts to a stop.

For more information, see *Safety options for ACS800 cabinet-installed drives (+Q950, +Q951, +Q952, +Q963, +Q964, +Q967 and +Q968) Wiring, start-up and operation instructions* (3AUA0000026238 [English]).

Safe torque off (STO)

The drive supports the Safe torque off (STO) function according to standards EN 61800-5-2:2007; EN/ISO 13849-1:2008, IEC 61508 ed. 1, and EN 62061:2005+AC:2010. The function also corresponds to an uncontrolled stop in accordance with category 0 of EN 60204-1 and Prevention of unexpected start-up of EN 1037.

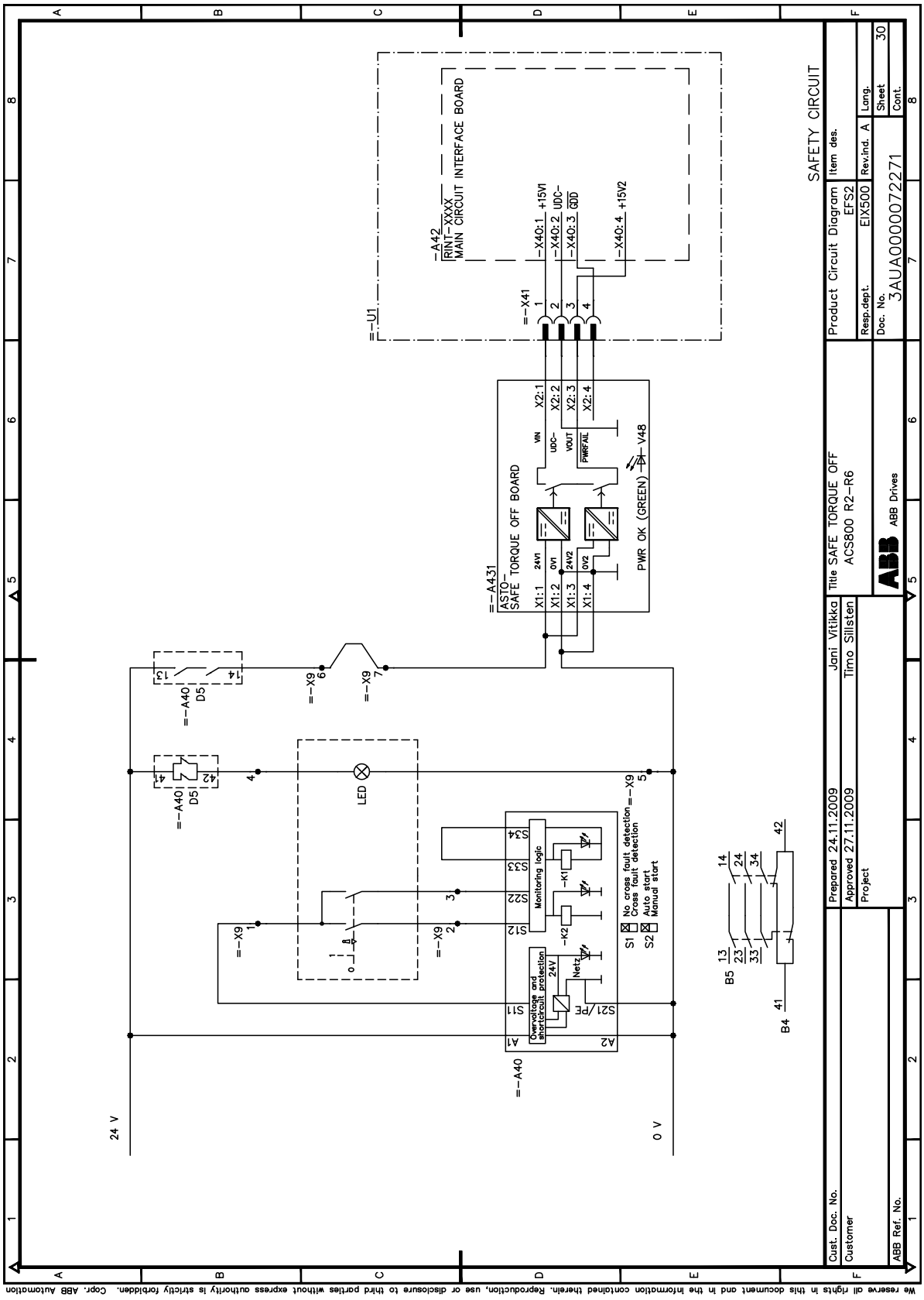
The STO may be used where power removal is required to prevent an unexpected start. The function disables the control voltage of the power semiconductors of the drive output stage, thus preventing the power feed to the connected motor (see the diagram below). By using this function, short-time operations (like cleaning) and/or maintenance work on non-electrical parts of the machinery can be performed without switching off the power supply to the drive.

WARNING! The Safe torque off function does not disconnect the voltage of the main and auxiliary circuits from the drive. Therefore maintenance work on electrical parts of the drive or the motor can only be carried out after isolating the drive system from the main supply.

Note: The Safe torque off function can be used for stopping the drive in emergency stop situations. In the normal operating mode, use the Stop command instead. If a running drive is stopped by using the function, the control voltage of the power semiconductors is cut off and the motor coasts to a stop. If this is not acceptable, eg, causes danger, the drive and machinery must be stopped using the appropriate stopping mode before using this function.

Note concerning permanent magnet motor drives in case of a multiple IGBT power semiconductor failure: In spite of the activation of the Safe torque off function (option +Q968) or the Prevention of unexpected start-up (option +Q950) function, the drive system can produce an alignment torque which maximally rotates the motor shaft by 180/*p* degrees. *p* denotes the pole pair number.

For more information, see *Safety options for ACS800 cabinet-installed drives (+Q950, +Q951, +Q952, +Q963, +Q964, +Q967 and +Q968) Wiring, start-up and operation instructions* (3AUA0000026238 [English]).


SAFETY CIRCUIT
Product Circuit Diagram
EFS2
Item des.
Resp.dept.
EIX500
Rev.ind. A
Lang.
Doc. No.
3AUA0000072271
Sheet 30
Cont.
Title SAFE TORQUE OFF
ACS800 R2-R6
Jani Vitikka
Timo Sillsten
Prepared 24.11.2009
Approved 27.11.2009
Project
Cust. Doc. No.
Customer
ABB Ref. No.
ABB Drives
=-U1
-A42
RINT-XXXX
MAIN CIRCUIT INTERFACE BOARD
=-X41
-X40:1 +15V1
-X40:2 UDC-
-X40:3 GD
-X40:4 +15V2
=-A431
ASTO-
SAFE TORQUE OFF BOARD
X1:1 24V1
X1:2 0V1
X1:3 24V2
X1:4 0V2
VIN X2:1
UDC- X2:2
VOUT X2:3
PWRFAIL X2:4
PWR OK (GREEN) V48
=-A40
D5
=-X9
LED
=-A40
Overvoltage and shortcircuit protection
Monitoring logic
24V
Netz
-K1
-K2
S1 No cross fault detection
Cross fault detection
S2 Auto start
Manual start
B5
B4
24 V
0 V
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Selecting the power cables

General rules

Dimension the mains (input power) and motor cables **according to local regulations**:

- The cable must be able to carry the drive load current. See chapter *Technical data* for the rated currents.
- The cable must be rated for at least 70 °C (158 °F) maximum permissible temperature of conductor in continuous use. For US, see *Additional US requirements*.
- The inductance and impedance of the PE conductor/cable (grounding wire) must be rated according to permissible touch voltage appearing under fault conditions (so that the fault point voltage will not rise excessively when a ground fault occurs).
- 600 V AC cable is accepted for up to 500 V AC. 750 V AC cable is accepted for up to 600 V AC. For 690 V AC rated equipment, the rated voltage between the conductors of the cable should be at least 1 kV.

For drive frame size R5 and larger, or motors larger than 30 kW (40 hp), symmetrical shielded motor cable must be used (figure below). A four-conductor system can be used up to frame size R4 with up to 30 kW (40 hp) motors, but shielded symmetrical motor cable is always recommended. The shield(s) of motor cable(s) must have 360° bonding at both ends.

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

A four-conductor system is allowed for input cabling, but shielded symmetrical cable is recommended. To operate as a protective conductor, the shield conductivity must be as follows when the protective conductor is made of the same metal as the phase conductors:

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

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

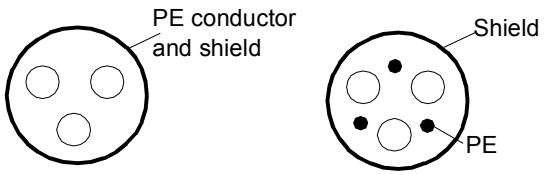
The motor cable and its PE pigtail (twisted shield) should be kept as short as possible in order to reduce high-frequency electromagnetic emission, as well as stray currents outside the cable and capacitive current (relevant in power range below 20 kW).

Alternative power cable types

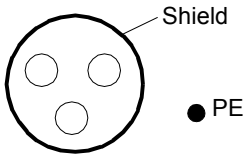
Power cable types that can be used with the drive are represented below.

Recommended

Symmetrical shielded cable: three phase conductors and a concentric or otherwise symmetrically constructed PE conductor, and a shield

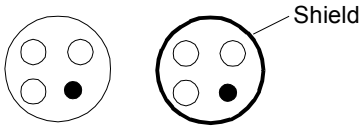


A separate PE conductor is required if the conductivity of the cable shield is < 50% of the conductivity of the phase conductor.



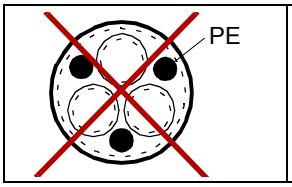
A four-conductor system: three phase conductors and a protective conductor

Not allowed for motor cables



Not allowed for motor cables with phase conductor cross section larger than 10 mm^2 [motors > 30 kW (40 hp)].

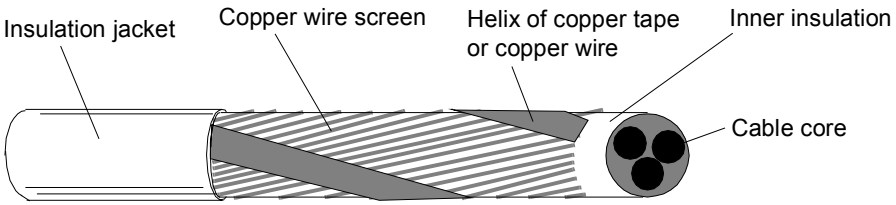
The following power cable type is not allowed.



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

Motor cable shield

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



Additional US requirements

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

Conduit

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

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

Armored cable / shielded power cable

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

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

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

Power factor compensation capacitors

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

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

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

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

Equipment connected to the motor cable

Installation of safety switches, contactors, connection boxes, etc.

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

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

Bypass connection

WARNING! Never connect the supply power to the drive output terminals U2, V2 and W2. If frequent bypassing is required, employ mechanically connected switches or contactors. Mains (line) voltage applied to the output can result in permanent damage to the unit.

Using a contactor between the drive and the motor

Implementing the control of the output contactor depends on how you select the drive to operate.

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

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

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

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

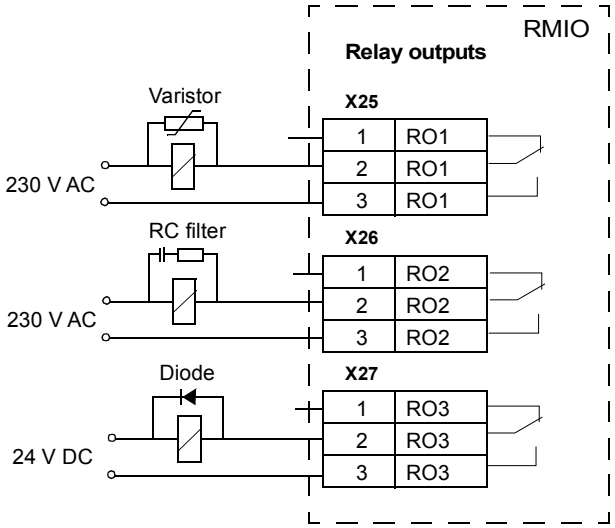
WARNING! When the DTC motor control mode is in use, never open the output contactor while the drive controls the motor. The DTC motor control operates extremely fast, much faster than it takes for the contactor to open its contacts. When the contactor starts opening while the drive controls the motor, the DTC control will try to maintain the load current by immediately increasing the drive output voltage to the maximum. This will damage, or even burn the contactor completely.

Protecting the relay output contacts and attenuating disturbances in case of inductive loads

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

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

Install the protective component as close to the inductive load as possible. Do not install protective components at the RMIO board terminal block.

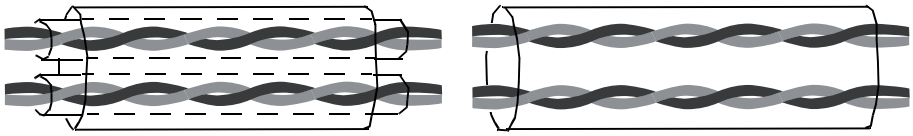


Selecting the control cables

All control cables must be shielded.

Use a double-shielded twisted pair cable (Figure a, for example, JAMAK by Draka NK Cables, Finland) for analogue signals. This type of cable is recommended for the pulse encoder signals also. Employ one individually shielded pair for each signal. Do not use common return for different analogue signals.

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



a
A double-shielded twisted pair cable

b
A single-shielded twisted pair cable

Run analogue and digital signals in separate, shielded cables.

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

Never mix 24 V DC and 115/230 V AC signals in the same cable.

Relay cable

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

Control panel cable

In remote use, the cable connecting the control panel to the drive must not exceed 3 metres (10 ft). The cable type tested and approved by ABB is used in control panel option kits.

Connection of a motor temperature sensor to the drive I/O

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

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

1. There is double or reinforced insulation between the thermistor and live parts of the motor.
2. Circuits connected to all digital and analogue inputs of the drive are protected against contact and insulated with basic insulation (the same voltage level as the drive main circuit) from other low voltage circuits.
3. An external thermistor relay is used. The insulation of the relay must be rated for the same voltage level as the main circuit of the drive. For connection, see the appropriate *ACS800 Firmware Manual*.

Installation sites above 2000 metres (6562 feet)

WARNING! Protect against direct contact when installing, operating and servicing the RMIO board wiring and optional modules attached to the board. The Protective Extra Low Voltage (PELV) requirements stated in EN 50178 are not fulfilled at altitudes above 2000 m (6562 ft).

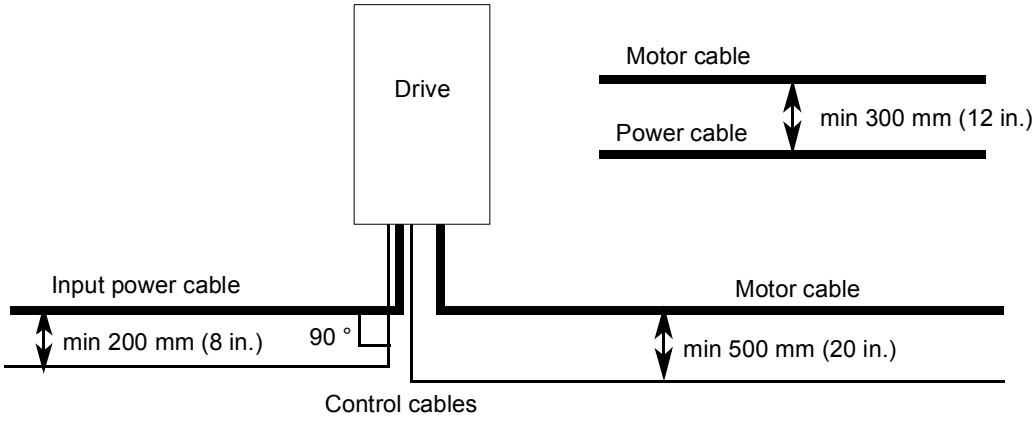
Routing the cables

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

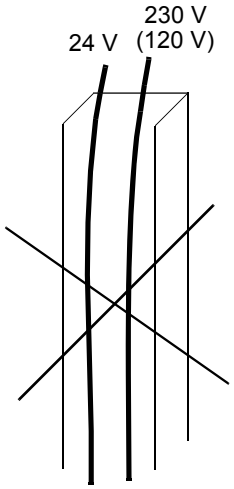
Where control cables must cross power cables make sure they are arranged at an angle as near to 90 degrees as possible. Do not run extra cables through the drive.

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

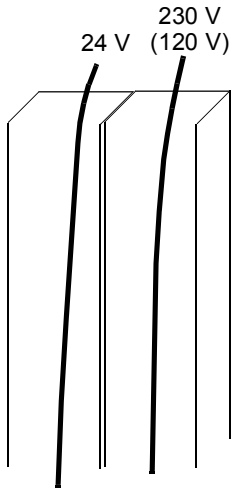
A diagram of the cable routing is shown below.



Control cable ducts



Not allowed unless the 24 V cable is insulated for 230 V (120 V) or insulated with an insulation sleeving for 230 V (120 V).



Lead 24 V and 230 V (120 V) control cables in separate ducts inside the cabinet.

Electrical installation

What this chapter contains

This chapter describes the electrical installation procedure of the drive.

WARNING! Only qualified electricians are allowed to carry out the work described in this chapter. Follow the *Safety instructions* on the first pages of this manual. Ignoring the safety instructions can cause injury or death.

Before installation

IT (ungrounded) systems

A drive equipped with no EMC filter or with EMC filter +E210 is suitable for IT (ungrounded systems). If the drive is equipped with EMC filter +E202, disconnect the filter before connecting the drive to an ungrounded system. For detailed instructions on how to do this, please contact your local ABB representative.

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

Checking the insulation of the assembly

Drive

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

Input cable

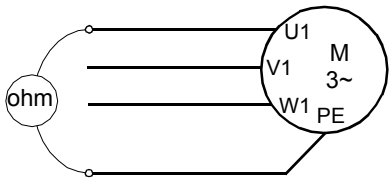
Check the insulation of the input cable according to local regulations before connecting it to the drive.

Motor and motor cable

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

1. Check that the motor cable is disconnected from the drive output terminals U2, V2 and W2.

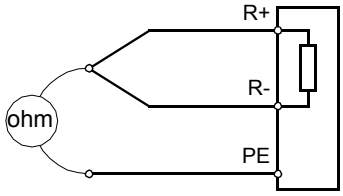
2. Measure the insulation resistance between each phase conductor and the Protective Earth conductor using a measuring voltage of 1000 V DC. The insulation resistance of an ABB motor must exceed 100 Mohm (reference value at 25 °C or 77 °F). For the insulation resistance of other motors, please consult the manufacturer's instructions. **Note:** Moisture inside the motor casing will reduce the insulation resistance. If moisture is suspected, dry the motor and repeat the measurement.



Brake resistor assembly

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

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

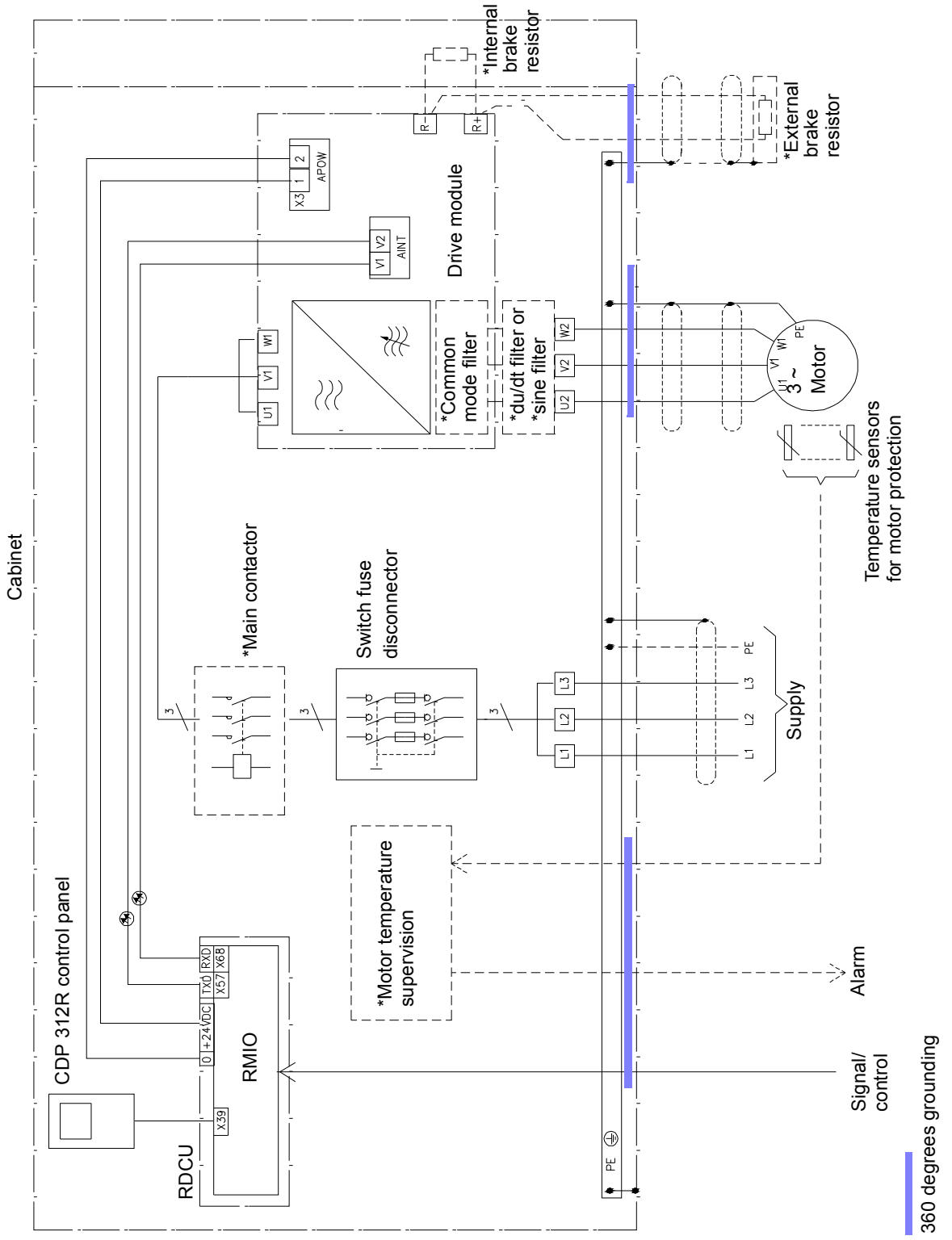


Warning sticker

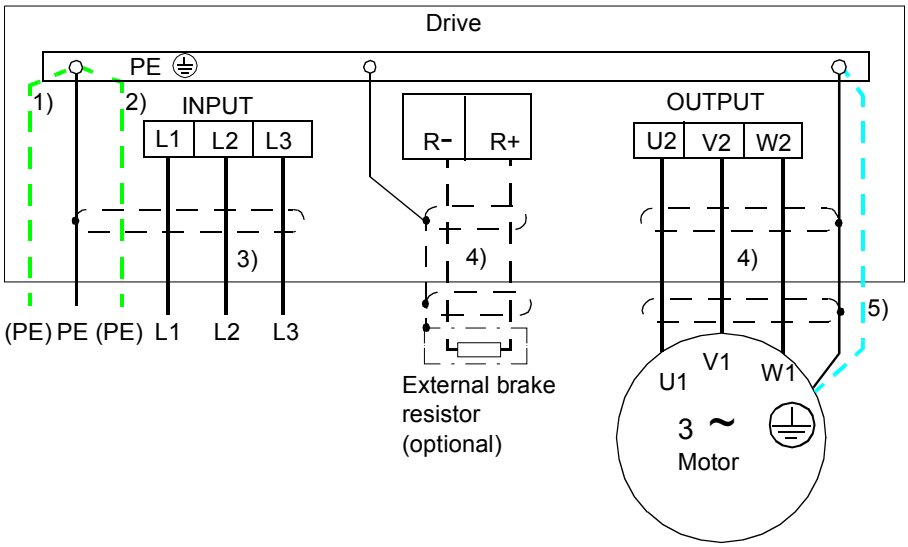
A multi-language sticker is attached onto the drive module cover. Attach the warning sticker in the local language onto the cover of the drive module.

Example wiring diagram

The diagram below presents an example for the main wiring. Note that the diagram includes optional components (marked *) which are not always included in the delivery.



Power cable connection diagram



1), 2)

If shielded cable is used (not required but recommended), use a separate PE cable (1) or a cable with a grounding conductor (2) if the conductivity of the input cable shield is < 50% of the conductivity of the phase conductor.

Ground the other end of the input cable shield or PE conductor at the distribution board.

3) 360 degrees grounding recommended if shielded cable

4) 360 degrees grounding required

5) Use a separate grounding cable if the conductivity of the cable shield is < 50% of the conductivity of the phase conductor and there is no symmetrically constructed grounding conductor in the cable (see *Planning the electrical installation* / *Selecting the power cables*).

Note:

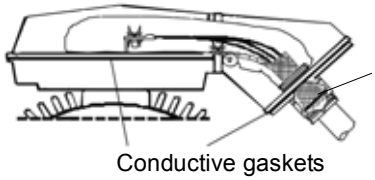
If there is a symmetrically constructed grounding conductor in the motor cable in addition to the conductive shield, connect the grounding conductor to the grounding terminal at the drive and motor ends.

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

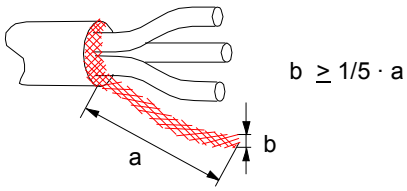
Grounding of the motor cable shield at the motor end

For minimum radio frequency interference:

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

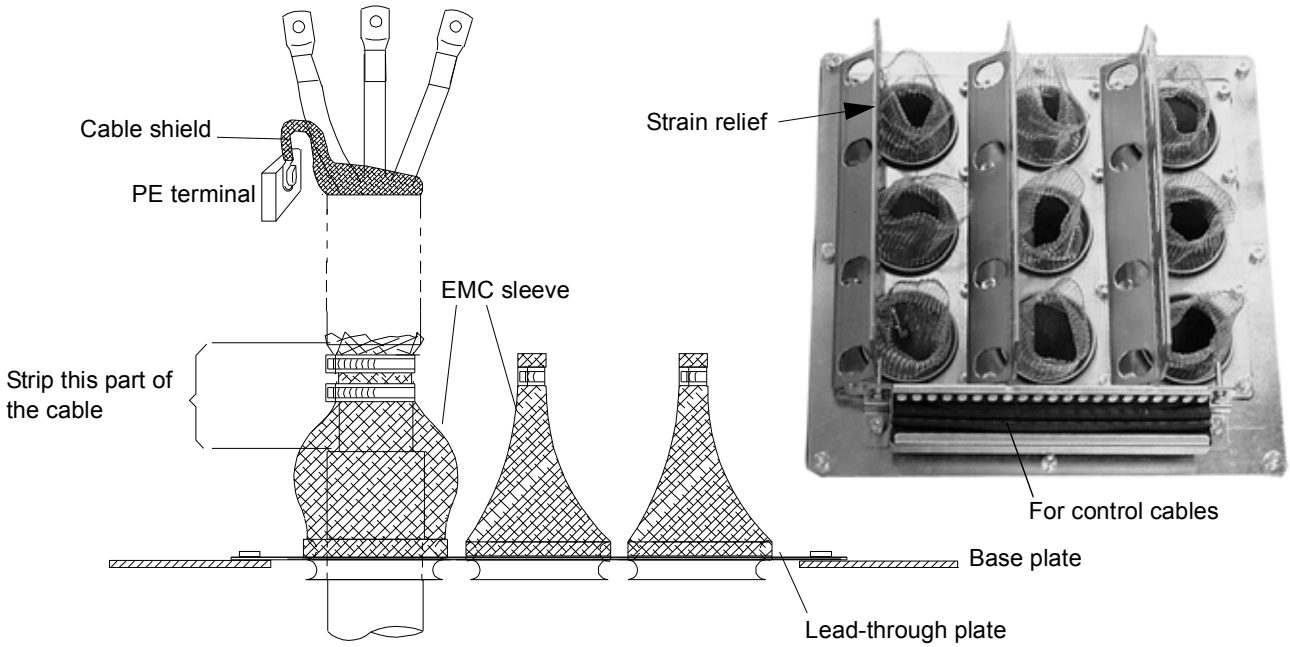


- or ground the cable by twisting the shield as follows: flattened width ≥ 1/5 · length.



Connecting the power cables

1. Open the swing-out frame.
2 Remove the additional cabinet cooling fan (if any). See section *Replacing the additional fan at the lower part of the cubicle (R6 with du/dt filter, +E205)* on page *100*.
3. If fire insulation is used, make an opening in the mineral wool sheet according to the diameter of the cable.
4. Cut adequate holes to the rubber grommet (if present) in the lead-through plate and lead the cable through the grommet and the conductive sleeve (if present) into the cabinet.
5. Strip the cable.
6. Connect the twisted shield of the cable to the PE terminal of the cabinet.
7. Connect the phase conductors of the input cable to the L1, L2 and L3 terminals and the phase conductors of the motor cable to the U2, V2 and W2 terminals.
8. Peel off 3 to 5 cm of the outer insulation of the cable above the lead-through plate for the 360° high-frequency earthing.
9. Fasten the conductive sleeve to the cable shield with cable ties.
10. Seal the slot between the cable and mineral wool sheet (if used) with sealing compound (for example, CSD-F, ABB brand name DXXT-11, code 35080082).
11. Tie up the unused conductive sleeves with cable ties.

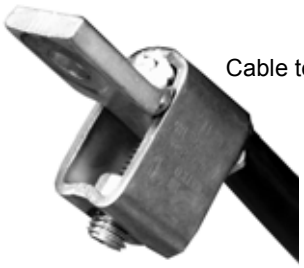


Additional instructions for frame size R6

Cable terminals R+ and R-

Power cable conductors of sizes 95 to 185 mm^2 (3/0 to 350 AWG) are connected to the cable terminals as follows:

- Undo the fastening screw of the terminal.
- Connect the conductor to the terminal.
- Screw the terminal to the original location.



Cable terminal

WARNING! If the wire size is less than 95 mm^2 (3/0 AWG), a cable lug must be used. A cable of wire size less than 95 mm^2 (3/0 AWG) connected to this terminal will loosen and may damage the drive.

Cable lug installations to R+ and R- screws

Cables of sizes 16 to 70 mm^2 (6 to 2/0 AWG) can be connected to the screws with cable lugs. Isolate the ends of the cable lugs with insulating tape or shrink tubing. To meet UL requirements, use UL listed cable lugs and tools given below or corresponding.

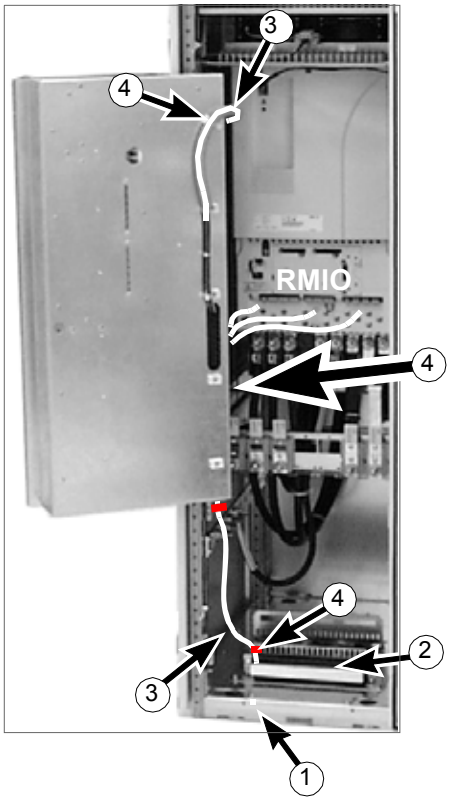
Wire size	**Compression lug**		**Crimping tool**		
kcmil/AWG	Manufacturer	Type	Manufacturer	Type	No. of crimps
6	Burndy	YAV6C-L2	Burndy	MY29-3	1
	Ilsco	CCL-6-38	Ilsco	ILC-10	2
4	Burndy	YA4C-L4BOX	Burndy	MY29-3	1
	Ilsco	CCL-4-38	Ilsco	MT-25	1
2	Burndy	YA2C-L4BOX	Burndy	MY29-3	2
	Ilsco	CRC-2	Ilsco	IDT-12	1
	Ilsco	CCL-2-38	Ilsco	MT-25	1
1	Burndy	YA1C-L4BOX	Burndy	MY29-3	2
	Ilsco	CRA-1-38	Ilsco	IDT-12	1
	Ilsco	CCL-1-38	Ilsco	MT-25	1
	Thomas & Betts	54148	Thomas & Betts	TBM-8	3
1/0	Burndy	YA25-L4BOX	Burndy	MY29-3	2
	Ilsco	CRB-0	Ilsco	IDT-12	1
	Ilsco	CCL-1/0-38	Ilsco	MT-25	1
	Thomas & Betts	54109	Thomas & Betts	TBM-8	3
2/0	Burndy	YAL26T38	Burndy	MY29-3	2
	Ilsco	CRA-2/0	Ilsco	IDT-12	1
	Ilsco	CCL-2/0-38	Ilsco	MT-25	1
	Thomas & Betts	54110	Thomas & Betts	TBM-8	3

Connecting the control cables

Routing the cables (frame sizes R5 and R6)

Run the cables to the inside of the cabinet through the grommets (1) and the EMI conductive cushions (2) to the swing-out frame or the RMIO board as shown below.

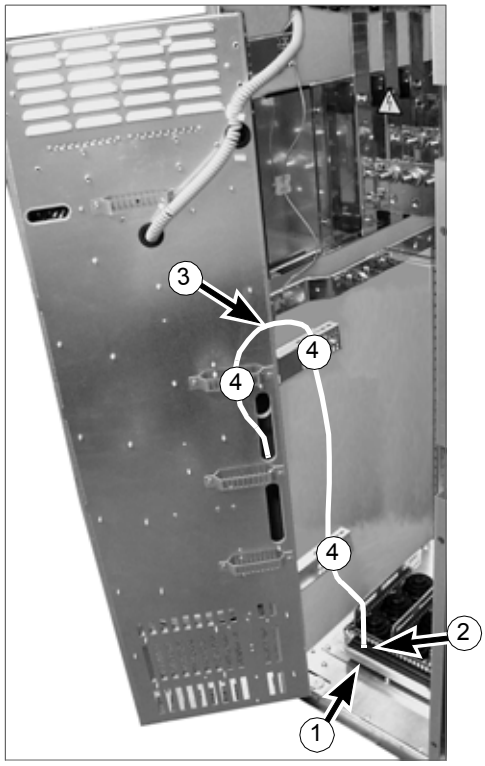
Use sleeving wherever the cables are laid against sharp edges. Leave some slack in the cable at the hinge (3) to allow the frame to open fully. Tie the cables to the braces (4) to provide strain relief.



Routing the cables (frame sizes R7 and R8)

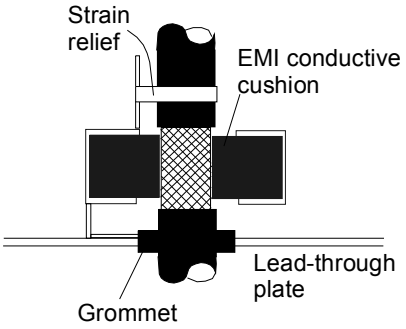
Run the cables to the inside of the cabinet through the grommets (1) and the EMI conductive cushions (2) to the swing-out frame as shown below.

Use sleeving wherever the cables are laid against sharp edges. Leave some slack in the cable at the hinge (3) to allow the frame to open fully. Tie the cables to the braces (4) to provide strain relief.

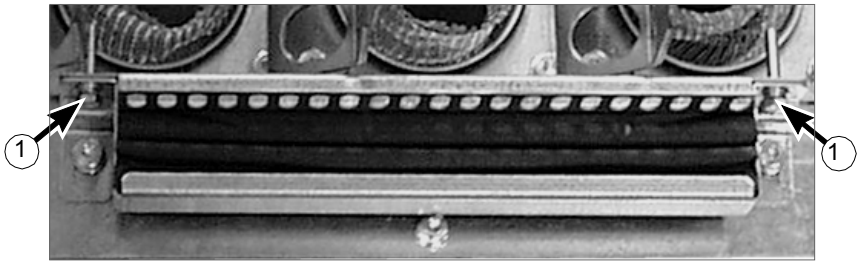


360 degrees EMC grounding at the cable entry

1. Loosen the fastening screws of the *EMI conductive cushions* and pull the cushions apart.
2. Cut adequate holes to the rubber grommets in the lead-through plate and lead the cables through the grommets and the cushions into the cabinet.



Side view



View from above

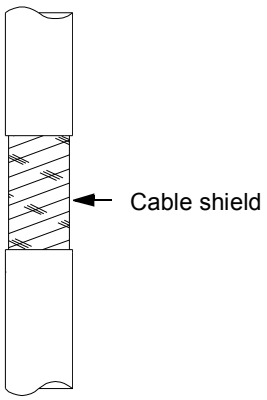
3. Strip off the cable plastic sheath above the lead-through plate just enough to ensure proper connection of the bare shield and the *EMI conductive cushions*.
4. Tighten the two fastening screws (1) so that the *EMI conductive cushions* press tightly round the bare shield.

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

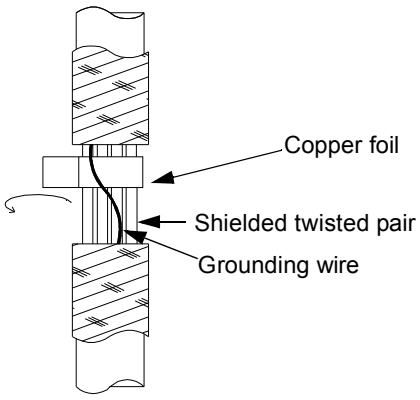
   •Cut the shield at the midpoint of the bare part. Be careful not to cut the conductors or the grounding wire (if present).

   •Turn the shield inside out to expose its conductive surface.

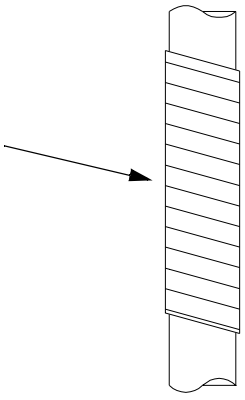
   •Cover the turned shield and the stripped cable with copper foil to keep the shielding continuous.



Stripped cable



Conductive surface of the shield exposed



Stripped part covered with copper foil

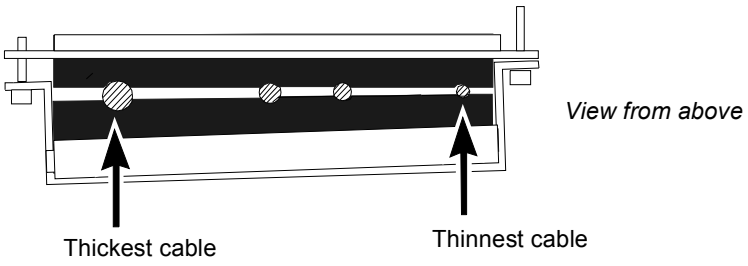
Special for top entry

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:

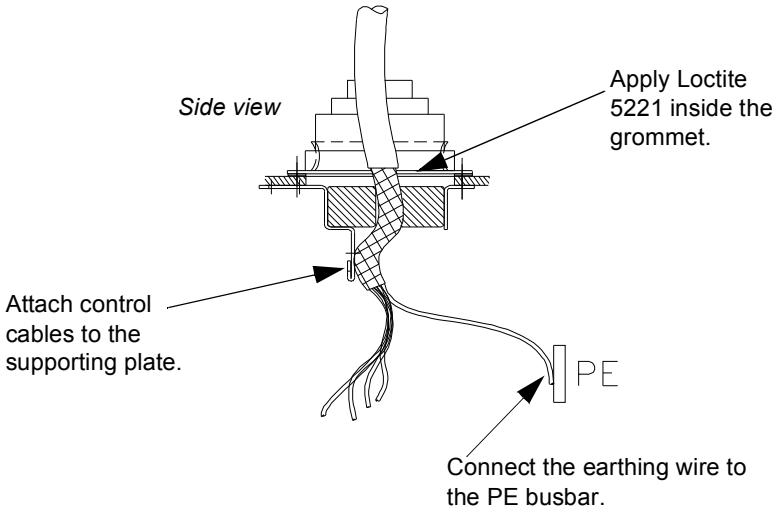
1. Make a list of the cables coming to the cabinet.
2. Sort the cables going to the left into one group and the cables going to the right into another group to avoid unnecessary crossing of cables inside the cabinet.
3. Sort the cables in each group according to size.
4. Group the cables for each grommet 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. Divide the bunches so that cables will be arranged according to size between the *EMI conductive cushions*.

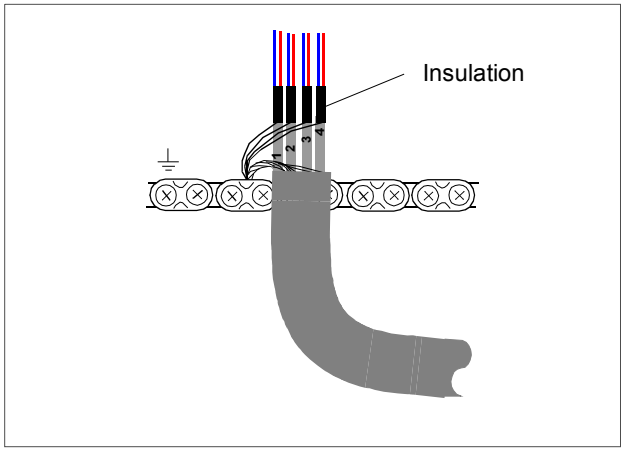


6. If more than one cable go through a grommet, the grommet must be sealed by Loctite 5221 (catalogue number 25551).

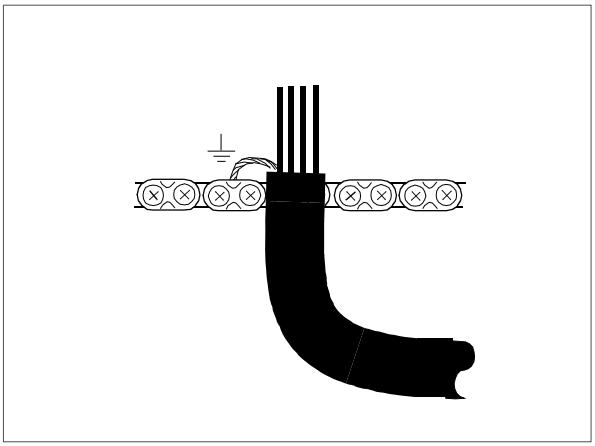


Connecting the cables to the I/O terminals

Connect the conductors to the appropriate detachable terminals of the RMIO board or optional terminal X2 [see chapter *Motor control and I/O board (RMIO)*]. Tighten the screws to secure the connection.



Double-shielded cable



Single-shielded cable

Single-shielded cable: Twist the grounding wires of the outer shield and connect them to the nearest grounding clamp. Double-shielded cable: Connect the inner shields and the grounding wires of the outer shield to the nearest grounding clamp.

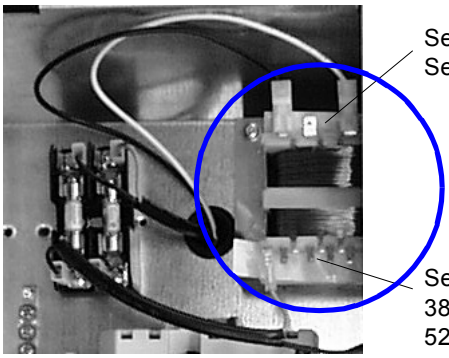
Do not connect shields of different cables to the same grounding clamp.

Leave the other end of the shield unconnected or ground it indirectly via a few nanofarads high-frequency capacitor (for example, 3.3 nF / 630 V). The shield can also be grounded directly at both ends if they are *in the same ground line* with no significant voltage drop between the end points.

Keep the signal wire pairs twisted as close to the terminals as possible. Twisting the wire with its return wire reduces disturbances caused by inductive coupling.

Settings of the cooling fan transformer

The voltage transformer of the cooling fan is located at the top right-hand corner of the drive module. Remove the front cover for adjusting the settings and replace the cover after setting.



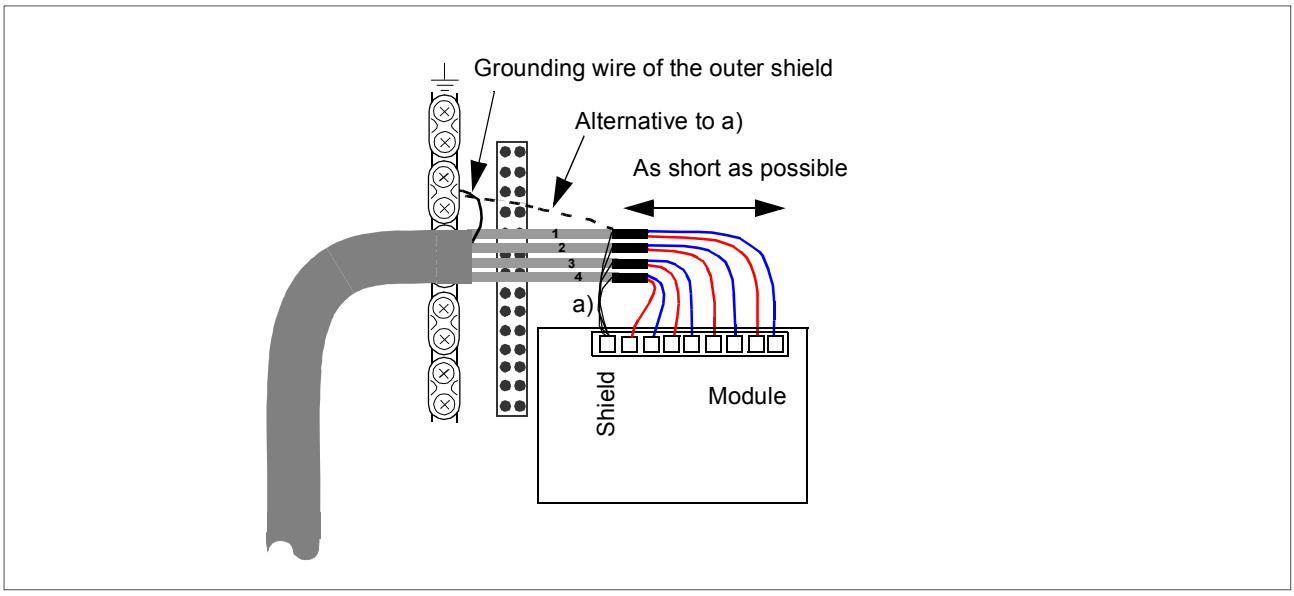
Set to 220 V if the supply frequency is 60 Hz.
Set to 230 V if the supply frequency is 50 Hz.

Set according to the supply voltage:
380 V, 400 V, 415 V, 440 V, 480 V or 500 V; or
525 V, 575 V, 600 V, 660 V or 690 V.

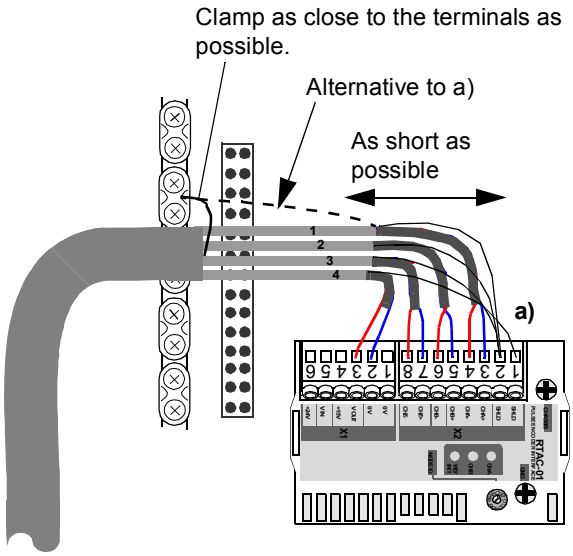
Installation of optional modules

The optional module (such as a fieldbus adapter, an I/O extension module and the pulse encoder interface) is inserted in the optional module slot of the RMIO board in the RDCU unit and fixed with two screws. See the appropriate optional module manual for the cable connections.

Cabling of I/O and fieldbus modules



Pulse encoder module cabling



Note 1: If the encoder is of unisolated type, ground the encoder cable at the drive end only. If the encoder is galvanically isolated from the motor shaft and the stator frame, ground the encoder cable shield at the drive and the encoder end.

Note 2: Twist the pair cable wires.

Note 3: The grounding wire of the outer shield of the cable can alternatively be connected to the SHLD terminal of the RTAC module.

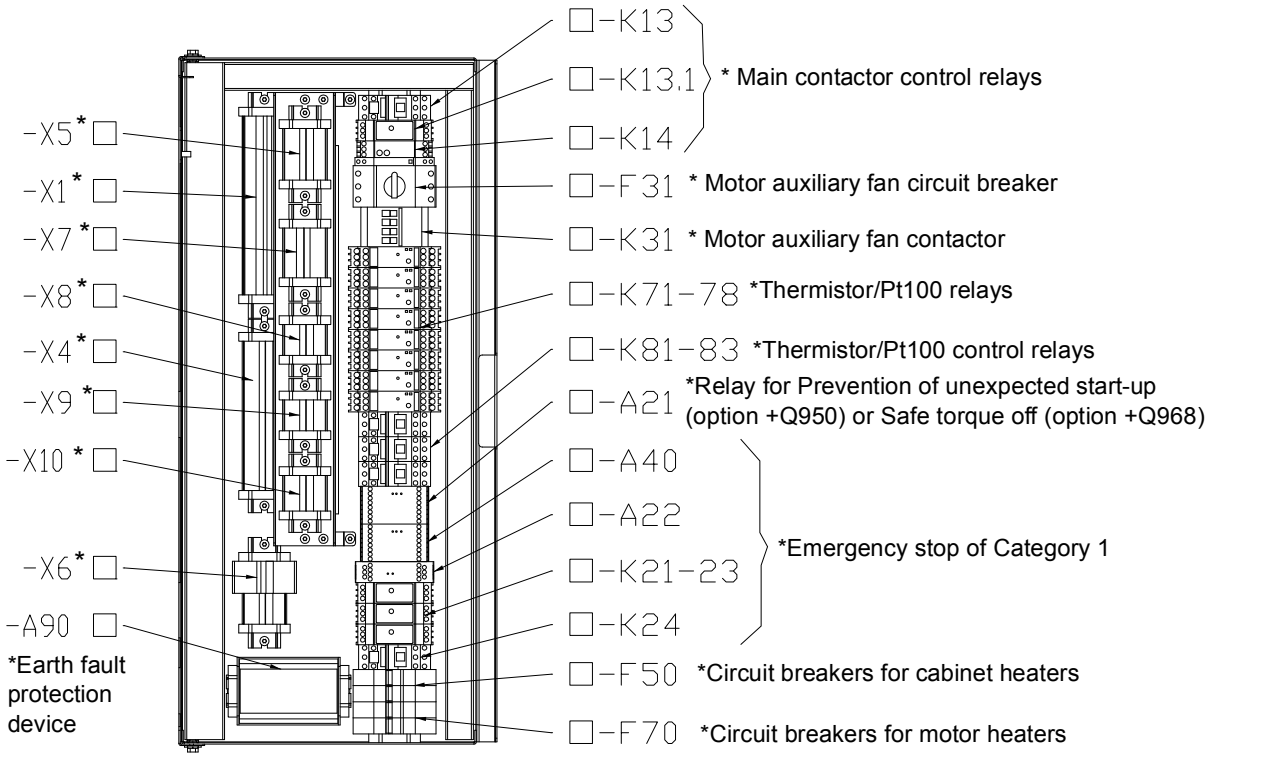
Fibre optic link

A DDCS fibre optic link is provided via the RDCO optional module for PC tools, master/follower link, NDIO, NTAC, NAIO, AIMA I/O module adapter and fieldbus adapter modules of type Nxxx. See *RDCO User's Manual* [3AFE64492209 (English)] for the connections. Observe colour coding when installing fibre optic cables. Blue connectors go to blue terminals, and grey connectors to grey terminals.

When installing multiple modules on the same channel, connect them in a ring.

Layout drawing of factory installed optional equipment

Frame sizes R5 and R6



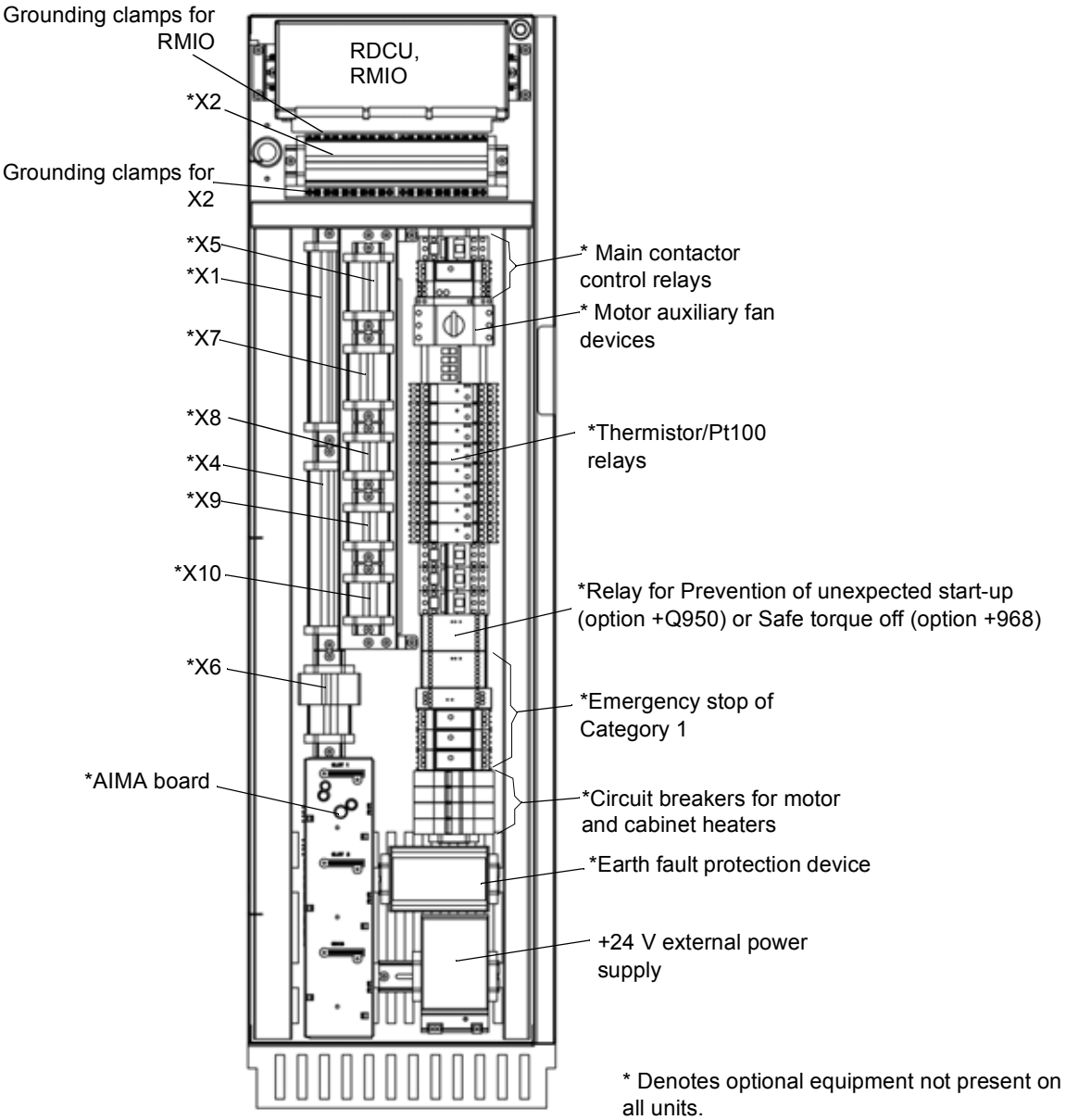
Swing-out frame (front view)

* Denotes optional equipment not present on all units.

Additional terminal blocks

*X1	line contactor control and auxiliary voltage supply
*X2	RMIO/RDCU
*X4	temperature supervision
*X5	cabinet heaters
*X6	motor auxiliary fan supply
*X7	motor heater
*X8	emergency stop of Category 1
*X9	Prevention of unexpected start-up (option +Q950) or Safe torque off (option +Q968)
*X10	earth fault protection

Frame size R7 and R8



Swing-out frame (front view)

64744291 A

For additional terminal blocks X1 to X10, see *Additional terminal blocks*.

Installation of brake resistors (units with brake chopper option)

See chapter *Resistor braking*. Connect the resistor as shown in section *Power cable connection diagram* above.

Motor control and I/O board (RMIO)

What this chapter contains

This chapter shows

- external control connections to the RMIO board for the ACS800 Standard Control Program (Factory Macro)
- specifications of the inputs and outputs of the board.

Note on optional terminal block X2

The connections for the RMIO board shown below apply also to optional terminal block X2 available for the ACS800-07. The terminals of the RMIO board are wired to terminal block X2 internally.

Terminals of X2 accept cables from 0.5 to 4.0 mm^2 (22 to 12 AWG). Tightening torque for screw terminals is 0.4 to 0.8 Nm (0.3 to 0.6 lbf ft). For disconnecting wires from spring terminals, use a screw driver with a blade thickness of 0.6 mm (0.024 in.) and width of 3.5 mm (0.138 in.), for example, PHOENIX CONTACT SZF 1-0,6X3,5.

Note on terminal labelling

Optional modules (Rxxx) may have identical terminal designations with the RMIO board.

Note on external power supply

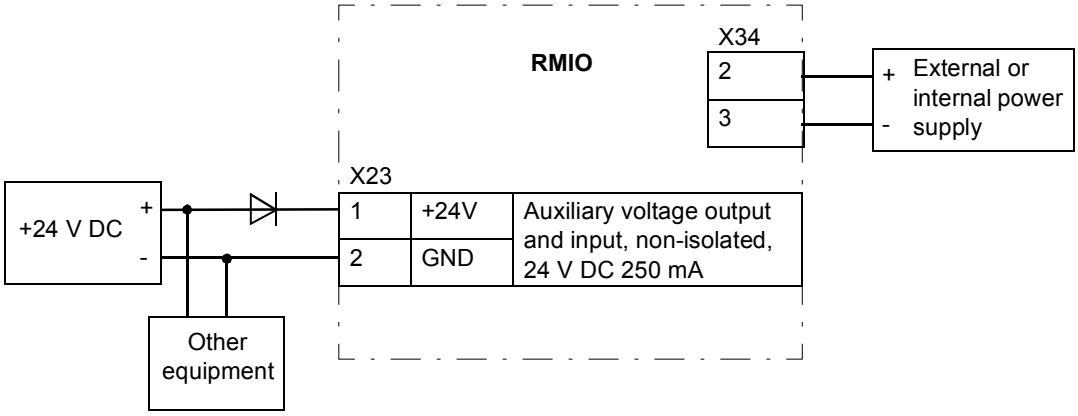
External +24 V power supply for the RMIO board is recommended if

- the application requires a fast start after connecting the input power supply
- fieldbus communication is required when the input power supply is disconnected.

The RMIO board can be supplied from an external power source via terminal X23 or X34 or via both X23 and X34. The internal power supply to terminal X34 can be left connected when using terminal X23.

WARNING! If the RMIO board is supplied from an external power source via terminal X34, the loose end of the cable removed from the RMIO board terminal must be secured mechanically to a location where it cannot come into contact with electrical parts. If the screw terminal plug of the cable is removed, the wire ends must be individually insulated.

WARNING! If the RMIO board is powered from two power supplies (connected to X23 and X34), and the external power supply connected to X23 is also used to power external equipment, equip the RMIO branch of the circuit with a diode as shown below. The diode ensures that the RMIO board will not be damaged by overcurrent in case the external power supply fails.



Parameter settings

In Standard Control Program, set parameter 16.09 CTRL BOARD SUPPLY to EXTERNAL 24V if the RMIO board is powered from an external supply.

External control connections (non-US)

External control cable connections to the RMIO board for the ACS800 Standard Control Program (Factory Macro) are shown below. For external control connections of other control macros and programs, see the appropriate *Firmware Manual*.

RMIO

Terminal block size:

cables 0.3 to 3.3 mm^2 (22 to 12 AWG)

Tightening torque:

0.2 to 0.4 Nm

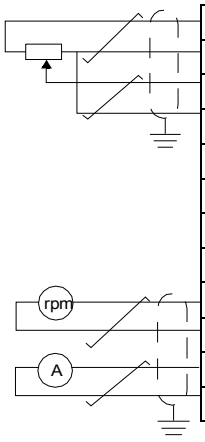
(0.2 to 0.3 lbf ft)

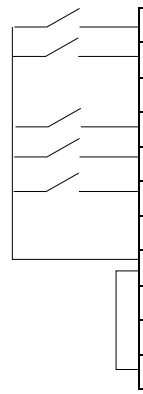
X2*

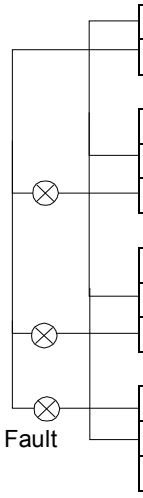
Terminal block size:

solid wire: 0.08 to 4 mm^2
standard wire with ferrule:
0.25 to 2.5 mm^2
standard wire without ferrule:
0.08 to 2.5 mm^2

(28 to 12 AWG)







Fault

X2*	RMIO		
X20	X20		
1	1	VREF-	Reference voltage -10 V DC, 1 kohm ≤ R_L ≤ 10 kohm
2	2	AGND	
X21	X21		
1	1	VREF+	Reference voltage 10 V DC, 1 kohm ≤ R_L ≤ 10 kohm
2	2	AGND	
3	3	AI1+	Speed reference 0(2) ... 10 V, R_{in} = 200 kohm
4	4	AI1-	
5	5	AI2+	By default, not in use. 0(4) ... 20 mA, R_{in} = 100 ohm
6	6	AI2-	
7	7	AI3+	By default, not in use. 0(4) ... 20 mA, R_{in} = 100 ohm
8	8	AI3-	
9	9	AO1+	Motor speed 0(4)...20 mA ≙ 0...motor nom. speed, R_L ≤ 700 ohm
10	10	AO1-	
11	11	AO2+	Output current 0(4)...20 mA ≙ 0...motor nom. current, R_L ≤ 700 ohm
12	12	AO2-	
X22	X22		
1	1	DI1	Stop/Start
2	2	DI2	Forward/Reverse [1]
3	3	DI3	Not in use
4	4	DI4	Acceleration & deceleration select [2]
5	5	DI5	Constant speed select [3]
6	6	DI6	Constant speed select [3]
7	7	+24VD	+24 V DC max. 100 mA
8	8	+24VD	
9	9	DGND1	Digital ground
10	10	DGND2	Digital ground
11	11	DIIL	Start interlock (0 = stop) [4]
X23	X23		
1	1	+24V	Auxiliary voltage output and input, non-isolated, 24 V DC 250 mA [5]
2	2	GND	
X25	X25		
1	1	RO1	Relay output 1: ready
2	2	RO1	
3	3	RO1	
X26	X26		
1	1	RO2	Relay output 2: running
2	2	RO2	
3	3	RO2	
X27	X27		
1	1	RO3	Relay output 3: fault (-1)
2	2	RO3	
3	3	RO3	

* optional terminal block

[1] Only effective if par. 10.03 is set to REQUEST by the user.

[2] 0 = open, 1 = closed

DI4	Ramp times according to
0	parameters 22.02 and 22.03
1	parameters 22.04 and 22.05

[3] See par. group 12 CONSTANT SPEEDS.

DI5	DI6	Operation
0	0	Set speed through AI1
1	0	Constant speed 1
0	1	Constant speed 2
1	1	Constant speed 3

[4] See parameter 21.09 START INTRL FUNC.

[5] Total maximum current shared between this output and optional modules installed on the board.

External control connections (US)

External control cable connections to the RMIO board for the ACS800 Standard Control Program (Factory Macro US version) are shown below. For external control connections of other control macros and programs, see the appropriate *Firmware Manual*.

RMIO

Terminal block size:

cables 0.3 to 3.3 mm^2 (22 to 12 AWG)

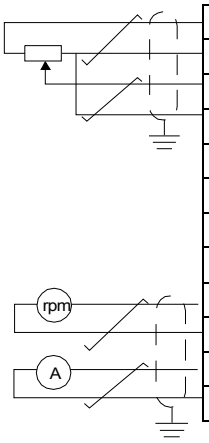
Tightening torque:

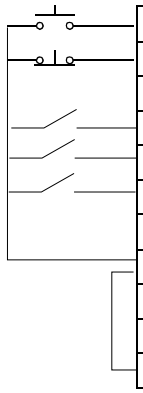
0.2 to 0.4 Nm (0.2 to 0.3 lbf ft)

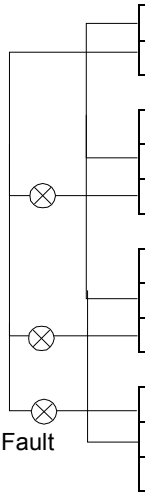
X2*

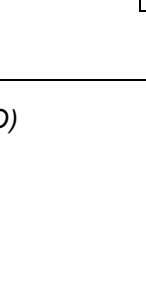
Terminal block size:

solid wire: 0.08 to 4 mm^2
standard wire with ferrule:
0.25 to 2.5 mm^2
standard wire without ferrule:
0.08 to 2.5 mm^2
(28 to 12 AWG)









X2*		RMIO			
X20		X20			
1	– –	1	VREF-	Reference voltage -10 V DC, 1 kohm ≤ R_L ≤ 10 kohm	
2	– –	2	AGND		
X21		X21			
1	– –	1	VREF+	Reference voltage 10 V DC, 1 kohm ≤ R_L ≤ 10 kohm	
2	– –	2	AGND		
3	– –	3	AI1+	Speed reference 0(2) ... 10 V, R_{in} = 200 kohm	
4	– –	4	AI1-		
5	– –	5	AI2+	By default, not in use. 0(4) ... 20 mA, R_{in} = 100 ohm	
6	– –	6	AI2-		
7	– –	7	AI3+	By default, not in use. 0(4) ... 20 mA, R_{in} = 100 ohm	
8	– –	8	AI3-		
9	– –	9	AO1+	Motor speed 0(4)...20 mA ≙ 0...motor nom. speed, R_L ≤ 700 ohm	
10	– –	10	AO1-		
11	– –	11	AO2+	Output current 0(4)...20 mA ≙ 0...motor nom. current, R_L ≤ 700 ohm	
12	– –	12	AO2-		
X22		X22			
1	– –	1	DI1	Start (⌐‾)	
2	– –	2	DI2	Stop (‾⌐)	
3	– –	3	DI3	Forward/Reverse [1]	
4	– –	4	DI4	Acceleration & deceleration select [2]	
5	– –	5	DI5	Constant speed select [3]	
6	– –	6	DI6	Constant speed select [3]	
7	– –	7	+24VD	+24 V DC max. 100 mA	
8	– –	8	+24VD		
9	– –	9	DGND1	Digital ground	
10	– –	10	DGND2	Digital ground	
11	– –	11	DIIL	Start interlock (0 = stop) [4]	
X23		X23			
1	– –	1	+24V	Auxiliary voltage output and input, non-isolated, 24 V DC 250 mA [5]	
2	– –	2	GND		
X25		X25			
1	– –	1	RO1	Relay output 1: ready	
2	– –	2	RO1		
3	– –	3	RO1		
X26		X26			
1	– –	1	RO2	Relay output 2: running	
2	– –	2	RO2		
3	– –	3	RO2		
X27		X27			
1	– –	1	RO3	Relay output 3: fault (-1)	
2	– –	2	RO3		
3	– –	3	RO3		

* optional terminal block

[1] Only effective if par. 10.03 is set to REQUEST by the user.

[2] 0 = open, 1 = closed

DI4	Ramp times according to
0	parameters 22.02 and 22.03
1	parameters 22.04 and 22.05

[3] See par. group 12 CONSTANT SPEEDS.

DI5	DI6	Operation
0	0	Set speed through AI1
1	0	Constant speed 1
0	1	Constant speed 2
1	1	Constant speed 3

[4] See parameter 21.09 START INTRL FUNC.

[5] Total maximum current shared between this output and optional modules installed on the board.

RMIO board specifications

Analogue inputs

	With Standard Control Program two programmable differential current inputs (0 mA / 4 mA ... 20 mA, R_{in} = 100 ohm) and one programmable differential voltage input (-10 V / 0 V / 2 V ... +10 V, R_{in} = 200 kohm).
	The analogue inputs are galvanically isolated as a group.
Insulation test voltage	500 V AC, 1 min
Max. common mode voltage between the channels	±15 V DC
Common mode rejection ratio	$\geq$ 60 dB at 50 Hz
Resolution	0.025% (12 bit) for the -10 V ... +10 V input. 0.5% (11 bit) for the 0 ... +10 V and 0 ... 20 mA inputs.
Inaccuracy	±0.5% (Full Scale Range) at 25 °C (77 °F). Temperature coefficient: ±100 ppm/°C (±56 ppm/°F), max.

Constant voltage output

Voltage	+10 V DC, 0, -10 V DC ± 0.5% (Full Scale Range) at 25 °C (77 °F). Temperature coefficient: ±100 ppm/°C (±56 ppm/°F) max.
Maximum load	10 mA
Applicable potentiometer	1 kohm to 10 kohm

Auxiliary power output

Voltage	24 V DC ± 10%, short-circuit proof
Maximum current	250 mA (shared between this output and optional modules installed on the RMIO)

Analogue outputs

	Two programmable current outputs: 0 (4) to 20 mA, $R_L \leq$ 700 ohm
Resolution	0.1% (10 bit)
Inaccuracy	±1% (Full Scale Range) at 25 °C (77 °F). Temperature coefficient: ±200 ppm/°C (±111 ppm/°F) max.

Digital inputs

	With Standard Control Program six programmable digital inputs (common ground: 24 V DC, -15% to +20%) and a start interlock input. Group isolated, can be divided in two isolated groups (see *Isolation and grounding diagram* below).
	Thermistor input: 5 mA, < 1.5 kohm $\hat{=}$ “1” (normal temperature), > 4 kohm $\hat{=}$ “0” (high temperature), open circuit $\hat{=}$ “0” (high temperature).
	Internal supply for digital inputs (+24 V DC): short-circuit proof. An external 24 V DC supply can be used instead of the internal supply.
Insulation test voltage	500 V AC, 1 min
Logical thresholds	< 8 V DC $\hat{=}$ “0”, > 12 V DC $\hat{=}$ “1”
Input current	DI1 to DI 5: 10 mA, DI6: 5 mA
Filtering time constant	1 ms

Relay outputs

	Three programmable relay outputs
Switching capacity	8 A at 24 V DC or 250 V AC, 0.4 A at 120 V DC
Minimum continuous current	5 mA rms at 24 V DC
Maximum continuous current	2 A rms
Insulation test voltage	4 kV AC, 1 minute

DDCS fibre optic link

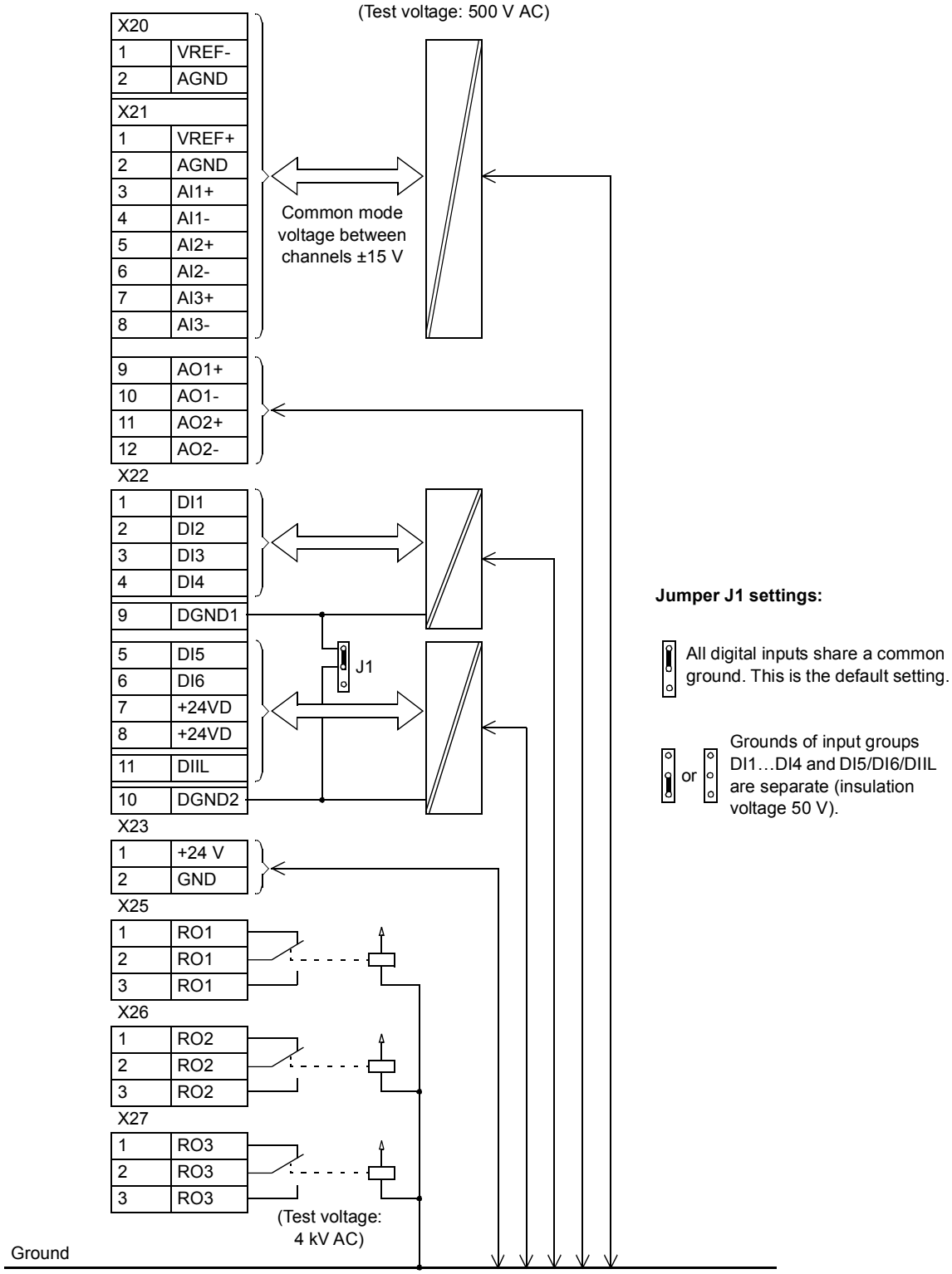
	With optional communication adapter module RDCO. Protocol: DDCS (ABB Distributed Drives Communication System)

24 V DC power input

Voltage	24 V DC ± 10%
Typical current consumption (without optional modules)	250 mA
Maximum current consumption	1200 mA (with optional modules inserted)

The terminals on the RMIO board as well as on the optional modules attachable to the board fulfil the Protective Extra Low Voltage (PELV) requirements stated in EN 50178 provided that the external circuits connected to the terminals also fulfil the requirements and the installation site is below 2000 m (6562 ft). Above 2000 m (6562 ft), see page 59.

Isolation and grounding diagram



Installation checklist and start-up

What this chapter contains

This chapter contains a list for checking the mechanical and electrical installation and the start-up procedure of the drive.

Checklist

Check the mechanical and electrical installation of the drive before start-up. Go through the checklist below together with another person. Read the *Safety instructions* on the first pages of this manual before you work on the unit.

Check that ...	
MECHANICAL INSTALLATION	
The ambient operating conditions are allowed. See *Mechanical installation, Technical data: IEC data* or *NEMA data, Ambient conditions*.	☐
The unit is fixed properly on floor and a vertical non-flammable wall. See *Mechanical installation.*	☐
The cooling air will flow freely.	☐
ELECTRICAL INSTALLATION See *Planning the electrical installation, Electrical installation.*	
The motor and the driven equipment are ready for start. See *Planning the electrical installation: Motor selection and compatibility, Technical data: Motor connection*.	☐
The +E202 EMC filter capacitors are disconnected if the drive is connected to an IT (ungrounded) system.	☐
The capacitors are reformed if stored over one year, refer to *ACS 600/800 Capacitor Reforming Guide* [64059629 (English)].	☐
The drive is grounded properly.	☐
The mains (input power) voltage matches the drive nominal input voltage.	☐
The mains (input power) connections at L1, L2 and L3 and their tightening torques are OK. See *Technical data* / *Cable entries*.	☐
Appropriate mains (input power) fuses and disconnector are installed.	☐
The motor connections at U2, V2 and W2 and their tightening torques are OK. See *Technical data* / *Cable entries*.	☐
The motor cable is routed away from other cables.	☐
Voltage setting of the cooling fan transformer	☐
Setting of the auxiliary voltage transformer T10 (if present). For location, see *Maintenance* / *Cabinet layout*.	☐
Voltage setting of the IP54 fan transformer T15 (if present). For location, see *Maintenance* / *Cabinet layout*.	☐
Voltage setting of the brake resistor fan transformer (if present).	☐
There are no power factor compensation capacitors in the motor cable.	☐

Check that ...	
The external control connections inside the drive are OK.	☐
Mains (input power) voltage cannot be applied to the output of the drive (with bypass connection).	☐
Drive, motor connection box and other covers are in place.	☐

Start-up procedure

	Action	Additional information
Safety		
☐	Only qualified electricians are allowed to start-up the drive. The safety instructions must be followed during the start-up procedure.	See chapter *Safety instructions.*
Checks with no voltage connected		
☐	Check the tuning of the insulation monitoring device.	Optional device. See delivery specific circuit diagrams and *IRDH265 Operating Manual* by Bender (code: TGH1249).
☐	Pt100 settings (if present)	
Starting the drive		
☐	Close the switch fuse (main disconnector).	
☐	Units with line contactor: Close the contactor by turning the start switch on the cabinet door from OFF into the START position for 2 seconds. Leave the switch to ON position.	
Control program set-up		
☐	Follow the instructions in the *Firmware Manual* to start up the drive and to set the drive parameters.	
On-load checks		
☐	Check that the Prevention of unexpected start-up function (option +Q950, if installed) works. For instructions, see *Safety options for ACS800 cabinet-installed drives (+Q950, +Q951, +Q952, +Q963, +Q964, +Q967 and +Q968) Wiring, start-up and operation instructions* (3AUA0000026238 [English]).	Optional function. See delivery specific circuit diagrams.
☐	Check that the cooling fans rotate freely in the right direction, and the air flows upwards.	A paper sheet set on the intake (door) gratings stays. The fans run noiselessly.
☐	Check the direction of rotation of the motor.	
☐	Check the correct operation of the emergency-stop circuits from each operating location. For instructions, see *Safety options for ACS800 cabinet-installed drives (+Q950, +Q951, +Q952, +Q963, +Q964, +Q967 and +Q968) Wiring, start-up and operation instructions* (3AUA0000026238 [English]).	Optional function. See delivery specific circuit diagrams.
☐	Check that the Safe torque off function (option +Q968, if installed) works. For instructions, see *Safety options for ACS800 cabinet-installed drives (+Q950, +Q951, +Q952, +Q963, +Q964, +Q967 and +Q968) Wiring, start-up and operation instructions* (3AUA0000026238 [English]).	Optional function. See delivery specific circuit diagrams.

Control panel

The user interface of the drive is the control panel (type CDP 312R). For more information on using the control panel, see the firmware manual delivered with the drive.

Removing the control panel

To remove the control panel from the panel holder, press down the locking clip and pull the panel out.

Maintenance

What this chapter contains

This chapter contains preventive maintenance instructions.

Safety

WARNING! Read the *Safety instructions* on the first pages of this manual before performing any maintenance on the equipment. Ignoring the safety instructions can cause injury or death.

Maintenance intervals

If installed in an appropriate environment, the drive requires very little maintenance. This table lists the routine maintenance intervals recommended by ABB.

Interval	Maintenance	For instruction, see section
Every year when stored	Capacitor reforming	*Reforming*
Every year	IP54 air filter change	*Checking and replacing the air filters*
	IP42 air filter check and change if necessary	
	IP22 air filter check and change if necessary	
	Cleanliness check	*Heatsink*
Every 6 years	Cabinet cooling fan change (frame sizes R5 and R6)	*Replacing the cabinet fans (R5 and R6)*
Every 6 years	Cabinet cooling fan change (frame size R8)	*Replacing the cabinet fans (frame size R8 only)*
Every 6 years	Change of additional cabinet cooling fan on the roof (frame sizes R7 and R8)	*Replacing the additional cabinet fan (frame sizes R7 and R8 only with IP22 and IP42 when cabling: bottom entry/exit)*
Every 6 years	Change of additional cabinet cooling fan at the bottom (frame sizes R7 and R8)	*Replacing the additional cabinet fan (frame sizes R7 and R8 only with IP22 and IP42 when cabling: top entry and bottom exit, bottom entry and top exit or top entry/exit)*
Every 6 years	Change of optional brake resistor (1xSAFUR and 2xSAFUR) cabinet fan (option +D151) Change of optional du/dt filter fan of types ACS800-07-0120-3 and ACS800-07-0140-5 (option +E205)	-

Interval	Maintenance	For instruction, see section
Every 6 years	IP54 and IP54R fan change (option +B055 and option +B059) (frame sizes R6, R7 and R8)	*Replacing the IP54 (UL type 12) fan in frame size R6 (option +B055 and +B059)* or *Replacing the IP54 (UL type 12) fan in frame sizes R7 and R8 (option +B055 and +B059)*
Every 6 years	Drive module cooling fan change (frame sizes R5 and R6)	*Replacing the drive module fan (R5 and R6)*
Every 6 years	Drive module cooling fan change (frame size R7)	*Replacing the drive module fan (R7)*
Every 6 years	Drive module cooling fan change (frame size R8)	*Replacing the drive module fan (R8)*
Every 9 years	Capacitor change	*Capacitors*

Consult your local ABB Service representative for more details on the maintenance. On the Internet, go to http://www.abb.com/searchchannels.

Required tools for maintenance

- 3 mm screw driver
- torque wrench with 500 mm (20 in.) or 2 x 250 mm (2 x 10 in.) extension bar
- 19 mm socket
  for frame size R7: 13 mm magnetic end socket
  for frame size R8: 17 mm magnetic end socket.

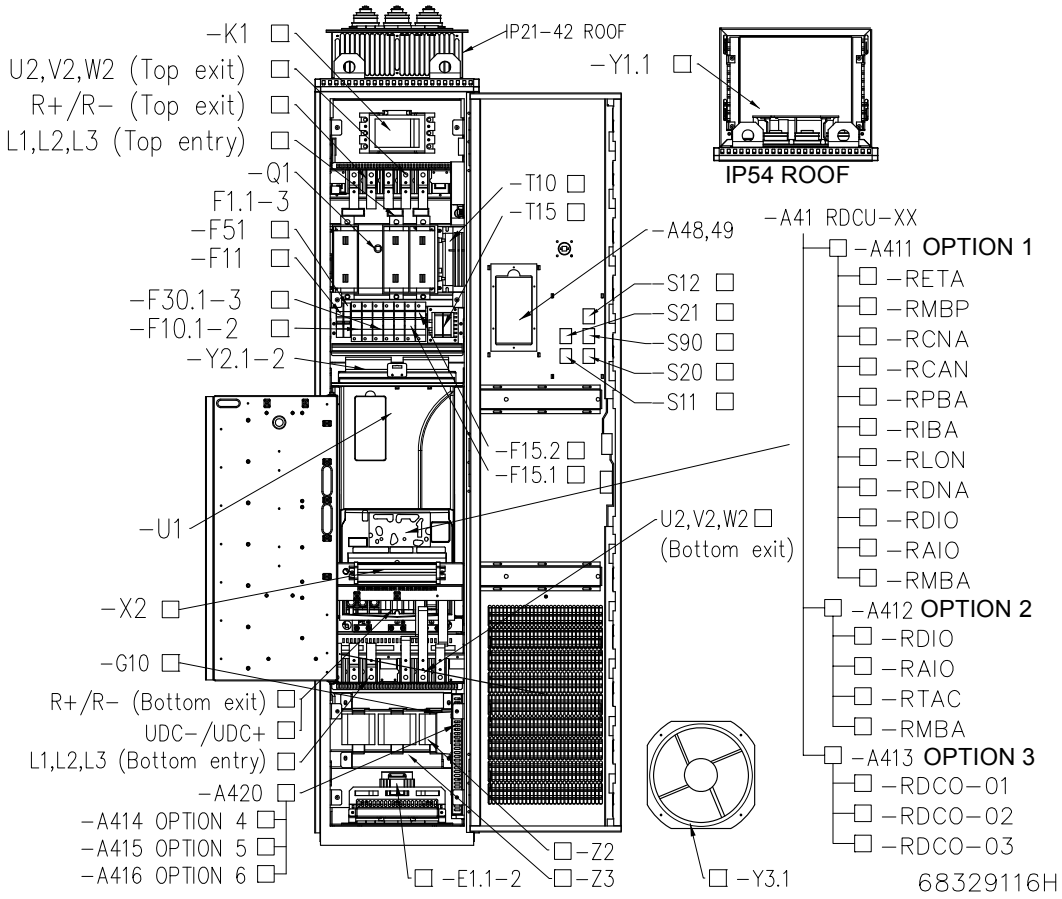
Screw	Grade	Tool	Tightening torque	
		mm	Nm	lbf ft
M4	8.8	7	2	1.46
M5	8.8	8	4	3
M6	8.8	10	6...9	4...7
M8	8.8	13	15...22	11...16
M10	8.8	17	30...44	22...32
M12	8.8	19	50...75	37...55

Cabinet layout

Cabinet layout stickers are shown below. The symbols are described under *Designations*.

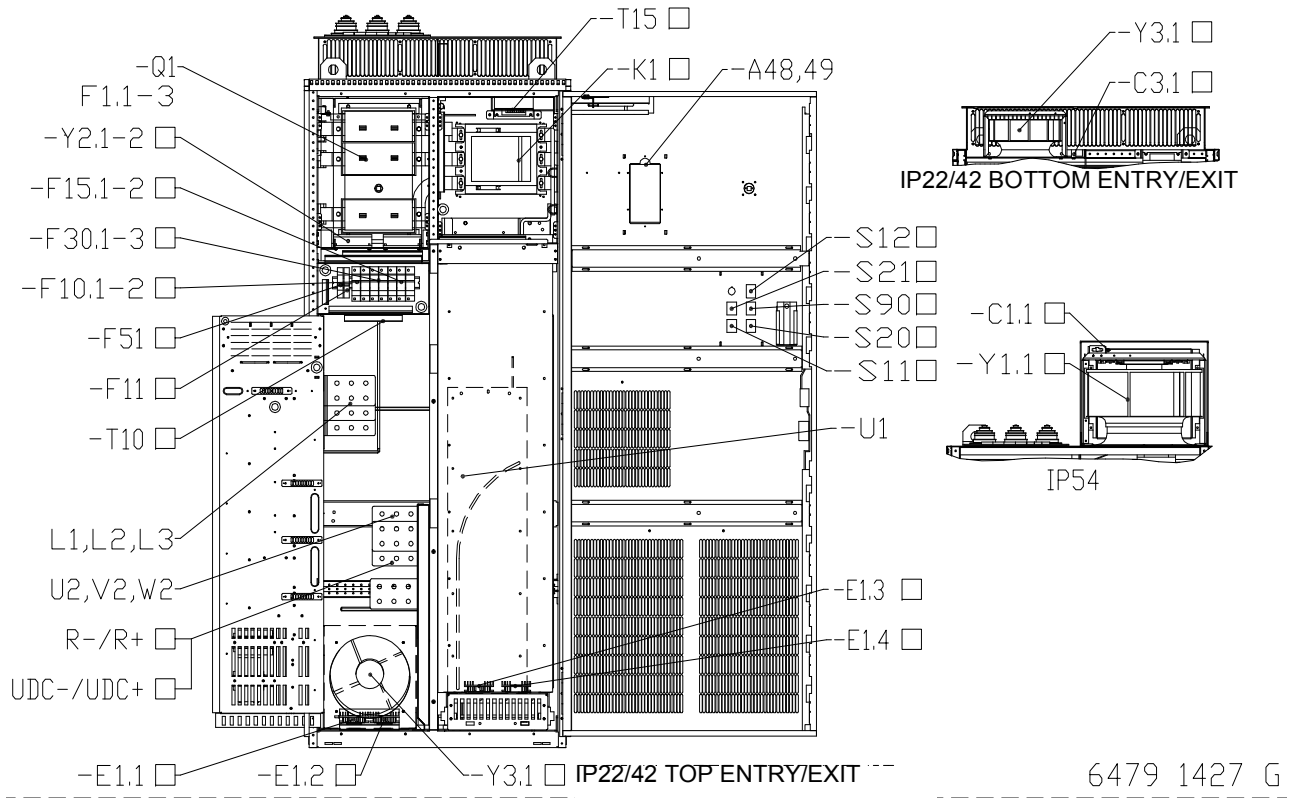
Frame sizes R5 and R6

The options included are marked with x at the factory.



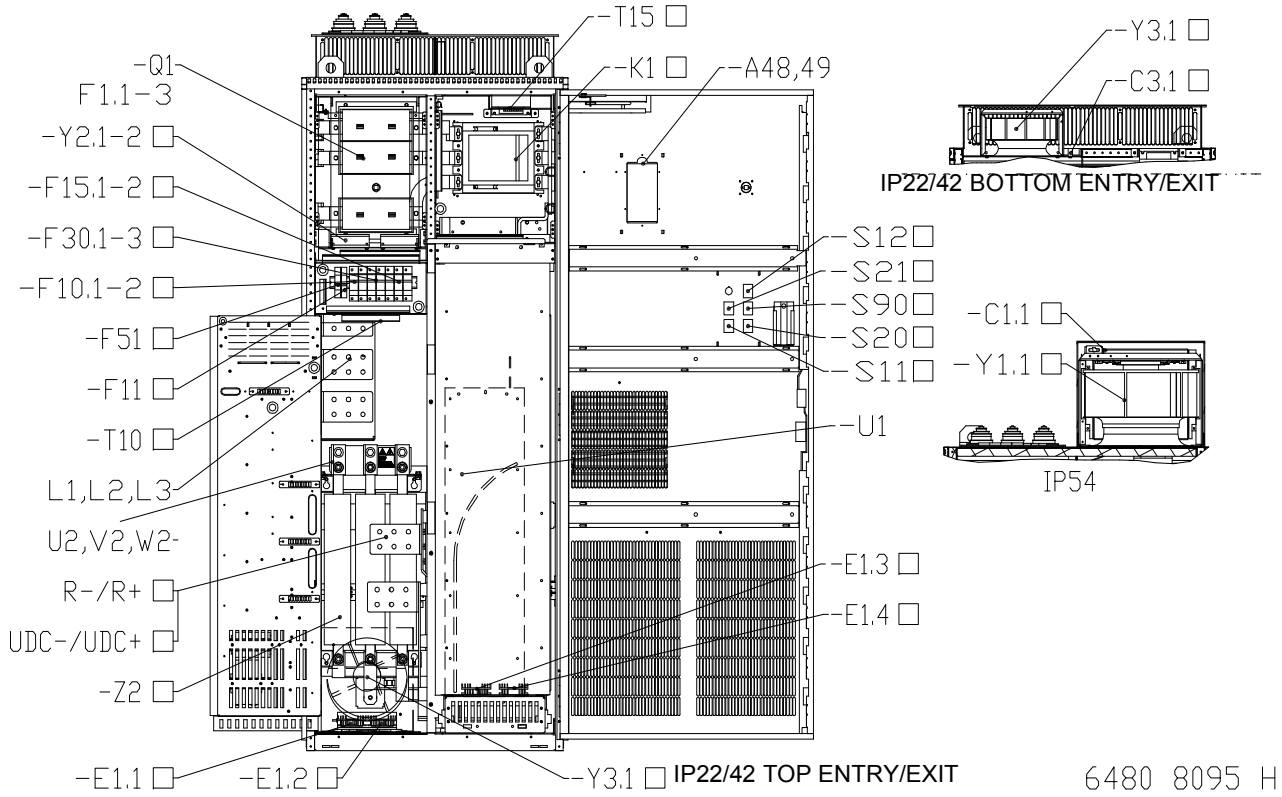
Frame sizes R7 and R8 without du/dt filter

The options included are marked with x at the factory.



Frame sizes R7 and R8 with du/dt filter

The options included are marked with x at the factory.



Designations

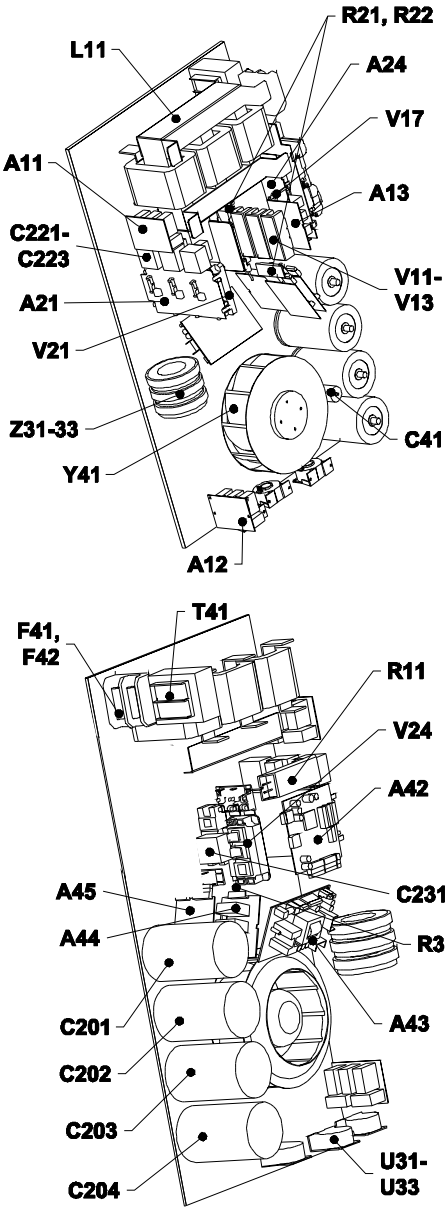
Designation	Component
A48,49	Control panel mounting platform, control panel
C1, C3	Fan capacitor
E1	Cabinet heater
F10.1-2	Auxiliary voltage transformer fuses
F11	Circuit breaker
F15.1-2	IP22/42/54 fan fuses
F30.1-3	Motor auxiliary fan fuses
F51	Circuit breaker
G10	+24 VDC external power supply
K1	Line contactor
Q1, F1.1 -3	Switch fuse
S11	Start/Stop switch
S20	Emergency Stop switch
S21	Emergency Stop reset
S90	Earth fault reset
T10	Auxiliary voltage transformer
T15	IP54 fan transformer
U1	Drive module
X2	Additional terminal block for RMIO board
Y1.1	IP54 fan
Y2	Additional cabinet fan
Y3.1	IP22/42 fan
Z2	du/dt filter

Layout of the drive module

The layout stickers of the drive module are shown below. The stickers show all possible components. Not all of them are present in each delivery. Components that need to be changed regularly are listed below:

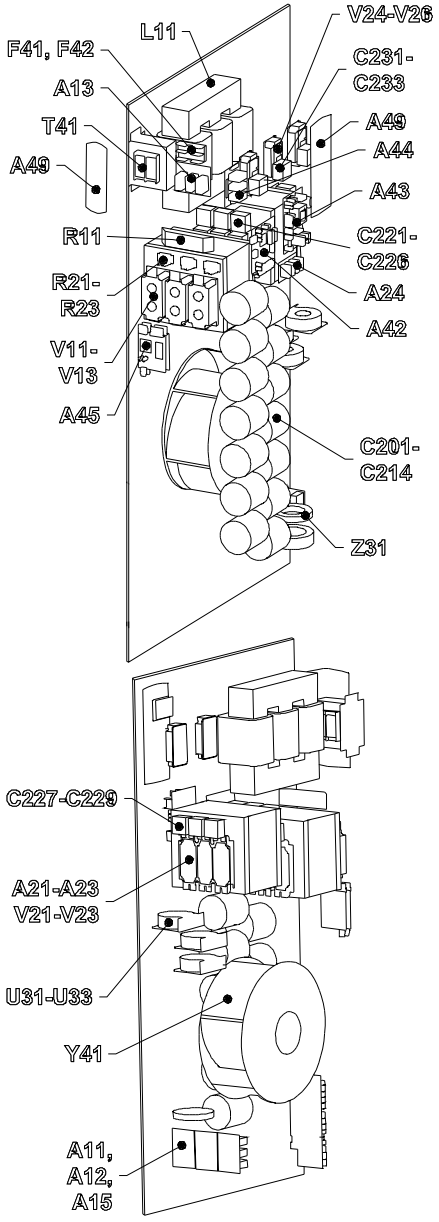
Designation	Component
Y41	Cooling fan
C_	Capacitors

R7



Code: 64572261

R8



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Checking and replacing the air filters

Check the air filters and replace if necessary (see chapter *Technical data* for the correct filter types). The inlet (door) filters can be accessed by removing the fastener(s) at the top of the grating, then lifting the grating and pulling it away from the door. The outlet (roof) filter in IP54 units can be accessed by pulling the grating upwards.

Air filter mat

Heatsink

Check the cleanliness of the cabinet and the surroundings. When necessary, clean the interior of the cabinet with a soft brush and a vacuum cleaner.

The module heatsink fins pick up dust from the cooling air. The drive runs into overtemperature warnings and faults if the heatsink is not clean. When necessary, contact ABB for cleaning of the heatsink (frame sizes R7 and R8).

In frame size R6, proceed as follows:

1. Remove the cooling fan (see section *Fans*).
2. Remove the drive module from the cabinet.
3. Blow dry clean compressed air from bottom to top and simultaneously use a vacuum cleaner at the air outlet to trap the dust. **Note:** Prevent dust from entering adjoining equipment.
4. Replace the cooling fan.

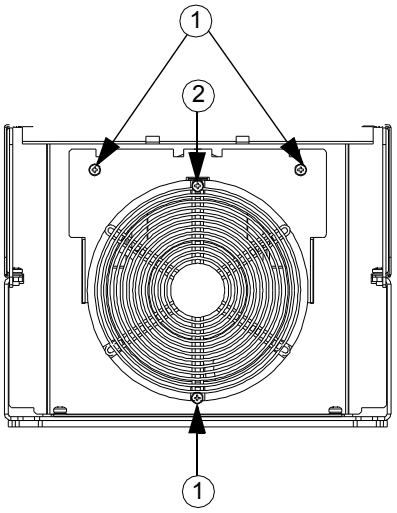
Fans

The lifespan of the cooling fan depends on the running time of the fan, ambient temperature and dust concentration. See the appropriate ACS800 firmware manual for the actual signal which indicates the running time of the cooling fan.

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

Replacing the drive module fan (R5 and R6)

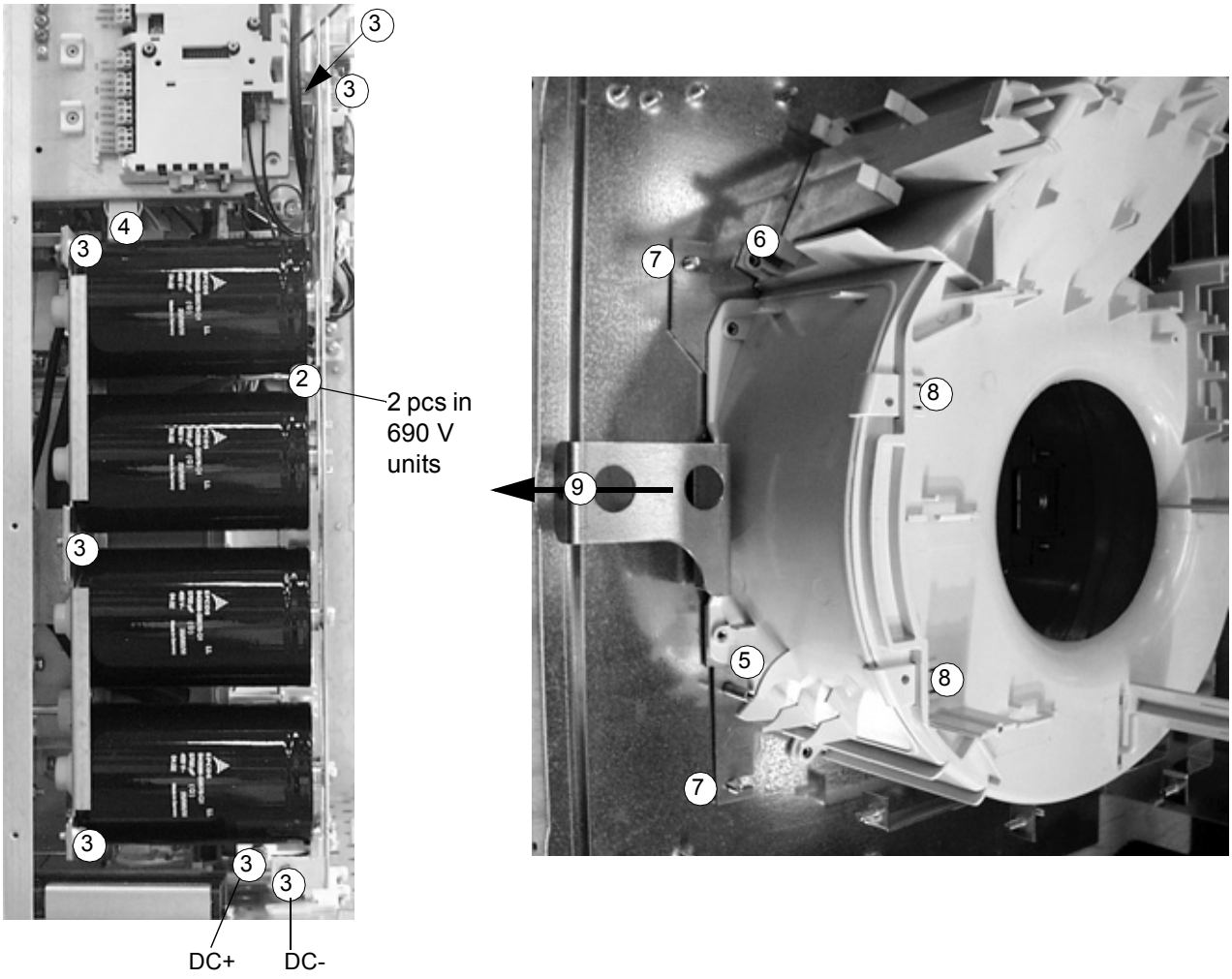
To remove the fan, undo the fixing screws. Disconnect the cable. Install the fan in reverse order.



Bottom view

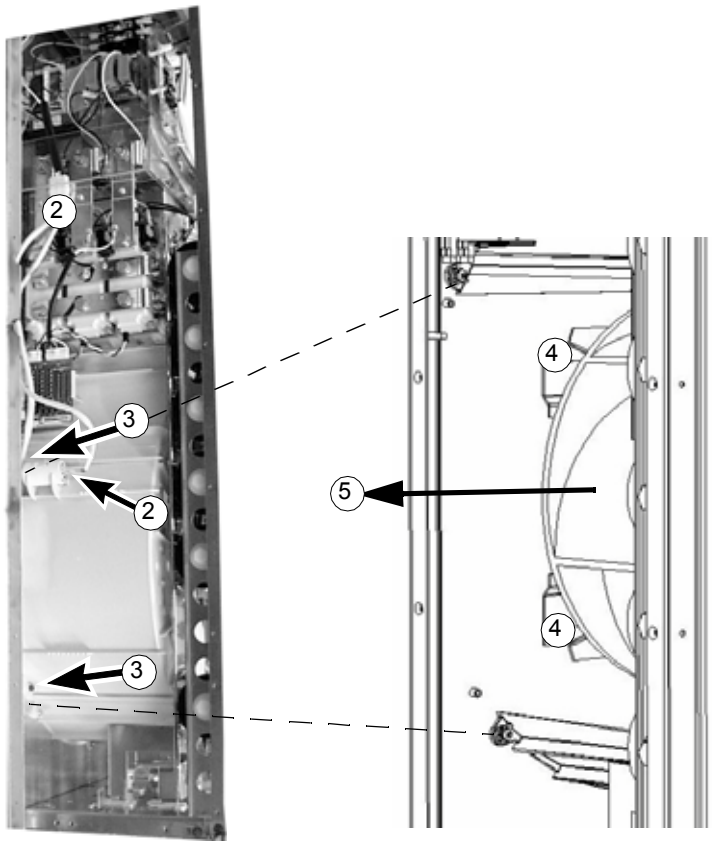
Replacing the drive module fan (R7)

1. Remove the front cover.
2. Disconnect the discharging resistor wire(s).
3. Remove the DC capacitor pack by undoing the red fixing screws and pulling the pack out.
4. Disconnect the fan supply wires (detachable connector).
5. Disconnect the fan capacitor wires.
6. Disconnect the AINP board wires from connectors X1 and X2.
7. Undo the red fixing screws of the fan cassette.
8. Press the snap-on holders to release the side cover.
9. Lift the handle and pull the fan cassette out.
10. Install the new fan and fan capacitor in reverse order to the above.



Replacing the drive module fan (R8)

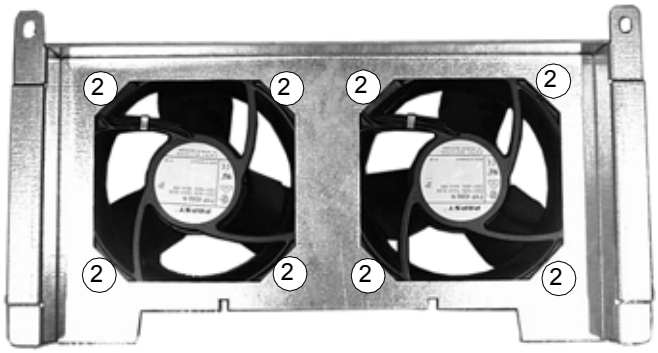
1. Remove the front cover.
2. Disconnect the fan capacitor and power supply wires.
3. Undo the red fastening screws of the plastic side cover of the fan. Shift the cover to the right to free its right-hand edge and lift the cover off.
4. Undo the red fastening screws of the fan.
5. Lift the fan out of the cabinet.
6. Install the new fan and fan capacitor in reverse order to the above.



Replacing the cabinet fans (R5 and R6)

Replacing the fans at upper part of the cubicle

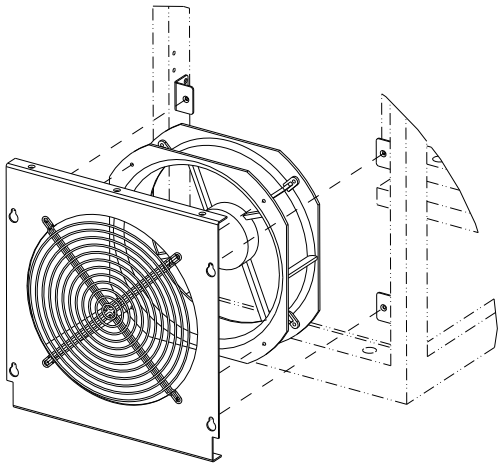
1. Remove the fan cassette from the cabinet as shown in section *Replacing the drive module (R5 and R6) on page 108.*
2. Undo the fastening screws of the fans.
3. Install the new fans in reverse order to the above.



Fan cassette
(view from below)

Replacing the additional fan at the lower part of the cubicle (R6 with du/dt filter, +E205)

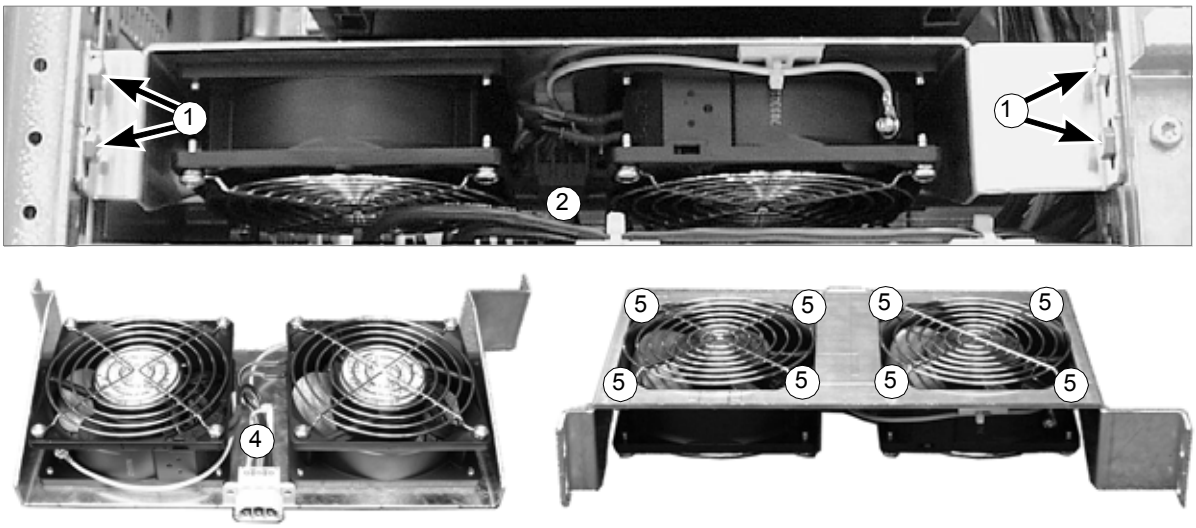
1. Remove the screws that mount the support frame of the fan to the cabinet frame.
2. Pull the fan support frame outwards and disconnect the fan supply wires (detachable connector).
3. Remove the fan frame from the cabinet.
4. Remove the screws that mount the fan to the fan frame.
5. Install a new fan in reverse order.



Replacing the cabinet fans (frame size R8 only)

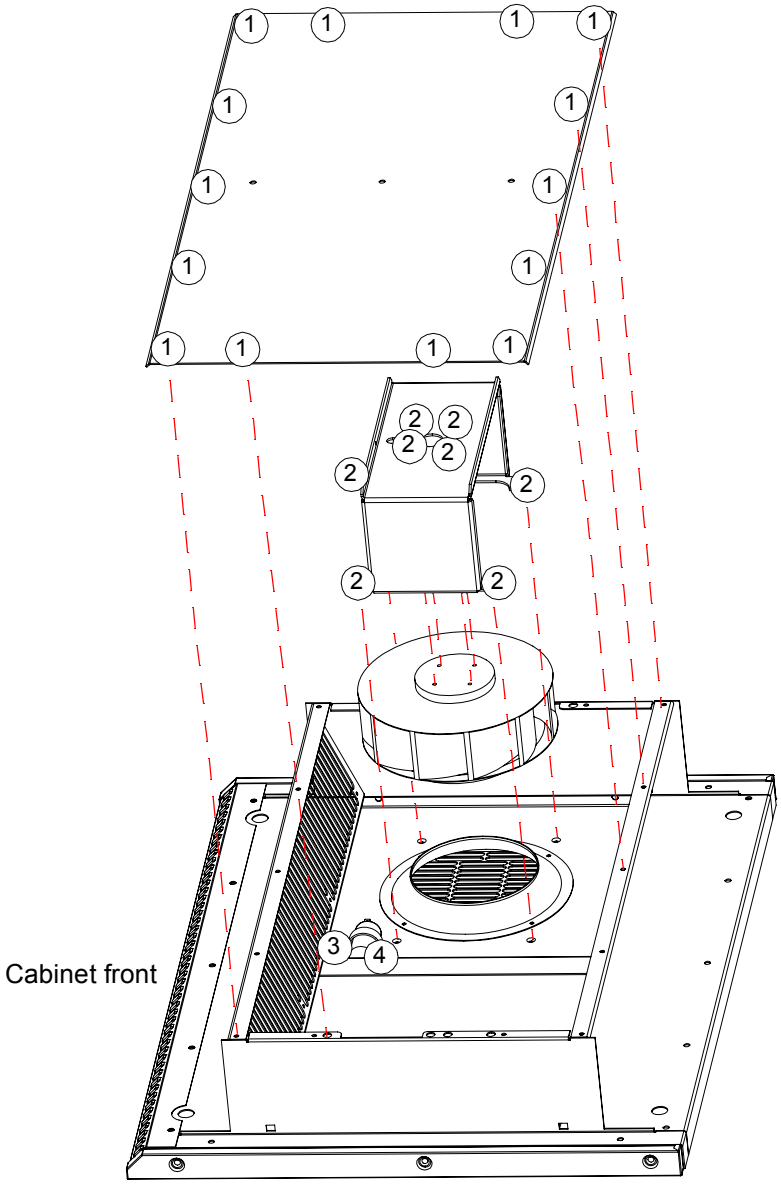
For location of the cabinet fans, see section *Cabinet layout* on page *91*.

1. Undo the fastening screws.
2. Disconnect the fan supply wires (detachable connector at the back edge of the fan cassette).
3. Pull the fan cassette out.
4. Disconnect the fan wires from the terminal.
5. Undo the fastening screws of the fans.
6. Install the new fans in reverse order to the above.



Replacing the additional cabinet fan (frame sizes R7 and R8 only with IP22 and IP42 when cabling: bottom entry/exit)

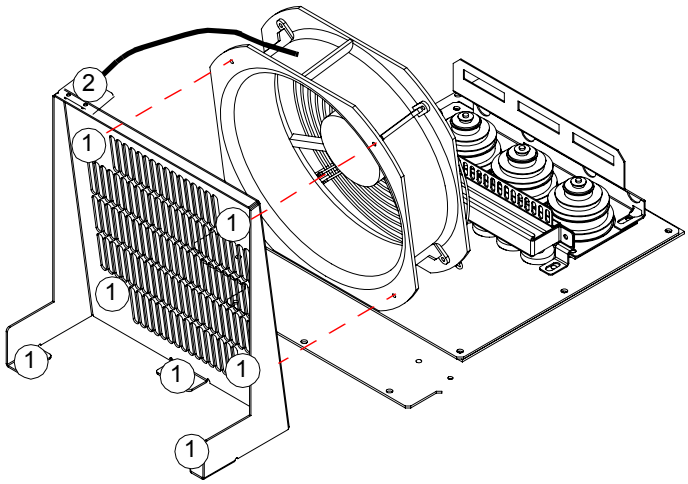
1. Remove the top plate of the cabinet roof by undoing the fastening screws.
2. Remove the fan cover by undoing the fastening screws.
3. Disconnect the fan supply wires (detachable connector) and undo the cable ties on the fan cover.
4. Remove the fan capacitor by undoing the fastening screw of the clamp.
5. Pull the fan out.
6. Install the new fan and fan capacitor in reverse order to the above.



Pro/E: 6469 4952 (cab-r7-8_roof_fan_bot-ee.asm), 6471 7154

Replacing the additional cabinet fan (frame sizes R7 and R8 only with IP22 and IP42 when cabling: top entry and bottom exit, bottom entry and top exit or top entry/exit)

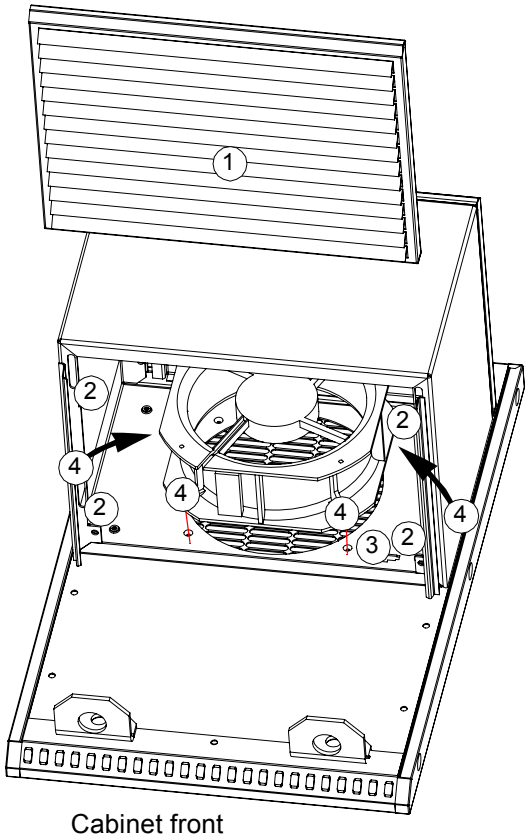
1. Remove the shroud by undoing the fastening screws.
2. Disconnect the fan supply wires (detachable connector).
3. Remove the fan capacitor by undoing the fastening screw of the clamp.
4. Install the new fan and fan capacitor in reverse order to the above.



Pro/E: 6828 4759

Replacing the IP54 (UL type 12) fan in frame size R6 (option +B055 and +B059)

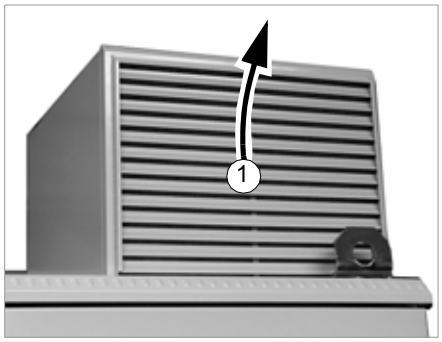
1. Remove the front grating of the fan cubicle by lifting it upwards.
2. Remove the shroud by undoing the fastening screws.
3. Disconnect the fan supply wires (detachable terminal).
4. Undo the fastening screws of the fan.
5. Install the new fan in reverse order to the above.

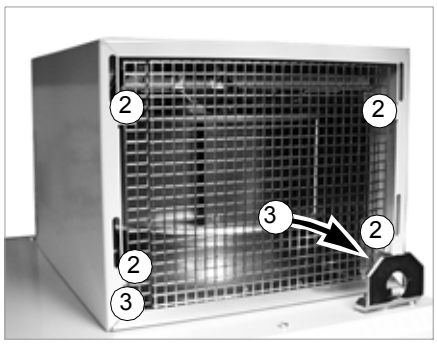


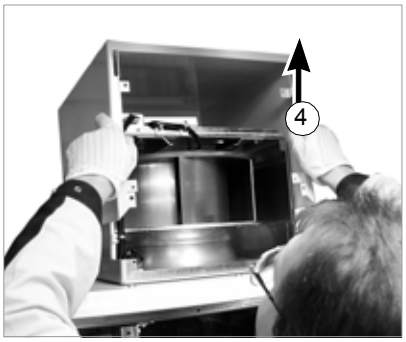
Pro/E: 64784803A_ip54_roof-400, 64784803I_ip54_roof-400_b-ee

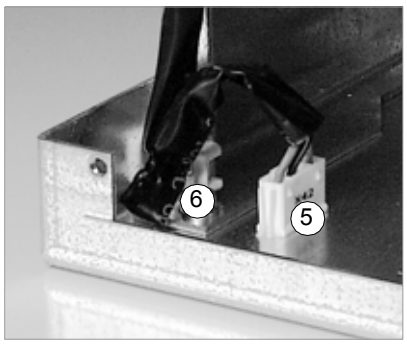
Replacing the IP54 (UL type 12) fan in frame sizes R7 and R8 (option +B055 and +B059)

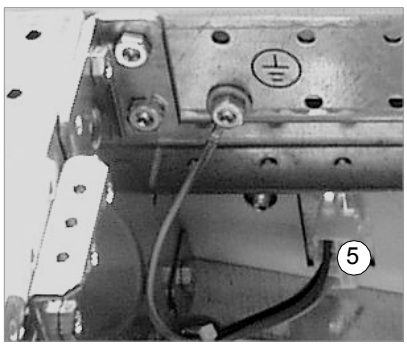
1. Remove the front and back gratings of the fan cubicle by lifting them upwards.
2. Remove the shrouds by undoing the fastening screws.
3. Undo the fastening screws of the side/top cover of the fan.
4. Lift the side/top cover of the fan off.
5. Disconnect the fan supply wire connector from the cabinet roof (on top and inside the cabinet).
6. Undo the fastening screws of the fan cassette at each corner.
7. Lift the fan cassette off.
8. Undo the cable ties on the top of the fan cassette.
9. Disconnect the cables (detachable terminals).
10. Remove the fan capacitor by undoing the fastening screw of the clamp.
11. Undo the fastening screws of the fan.
12. Pull the fan out.
13. Install the new fan and fan capacitor in reverse order to the above. Ensure that the fan is centred and rotates freely.

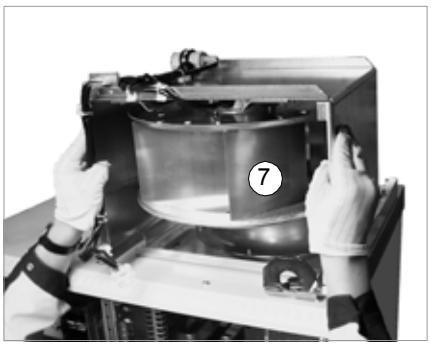


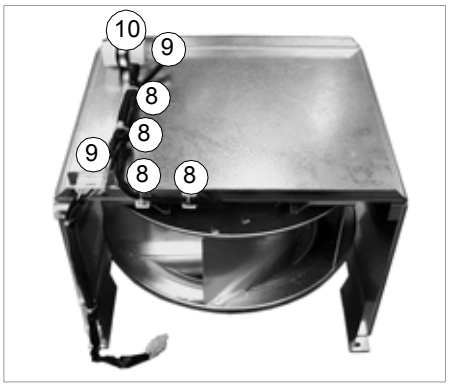


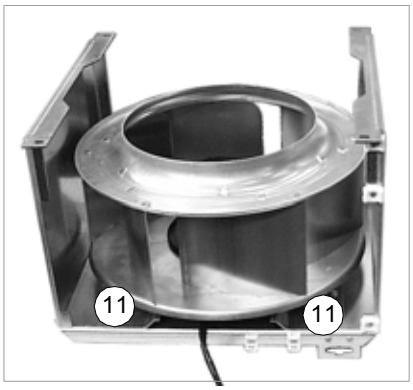


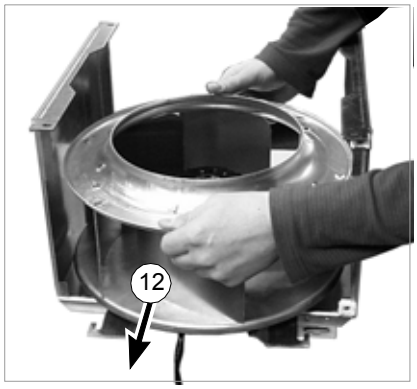












Capacitors

The drive intermediate circuit employs 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.

It is not possible to predict a capacitor failure. 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.

Reforming

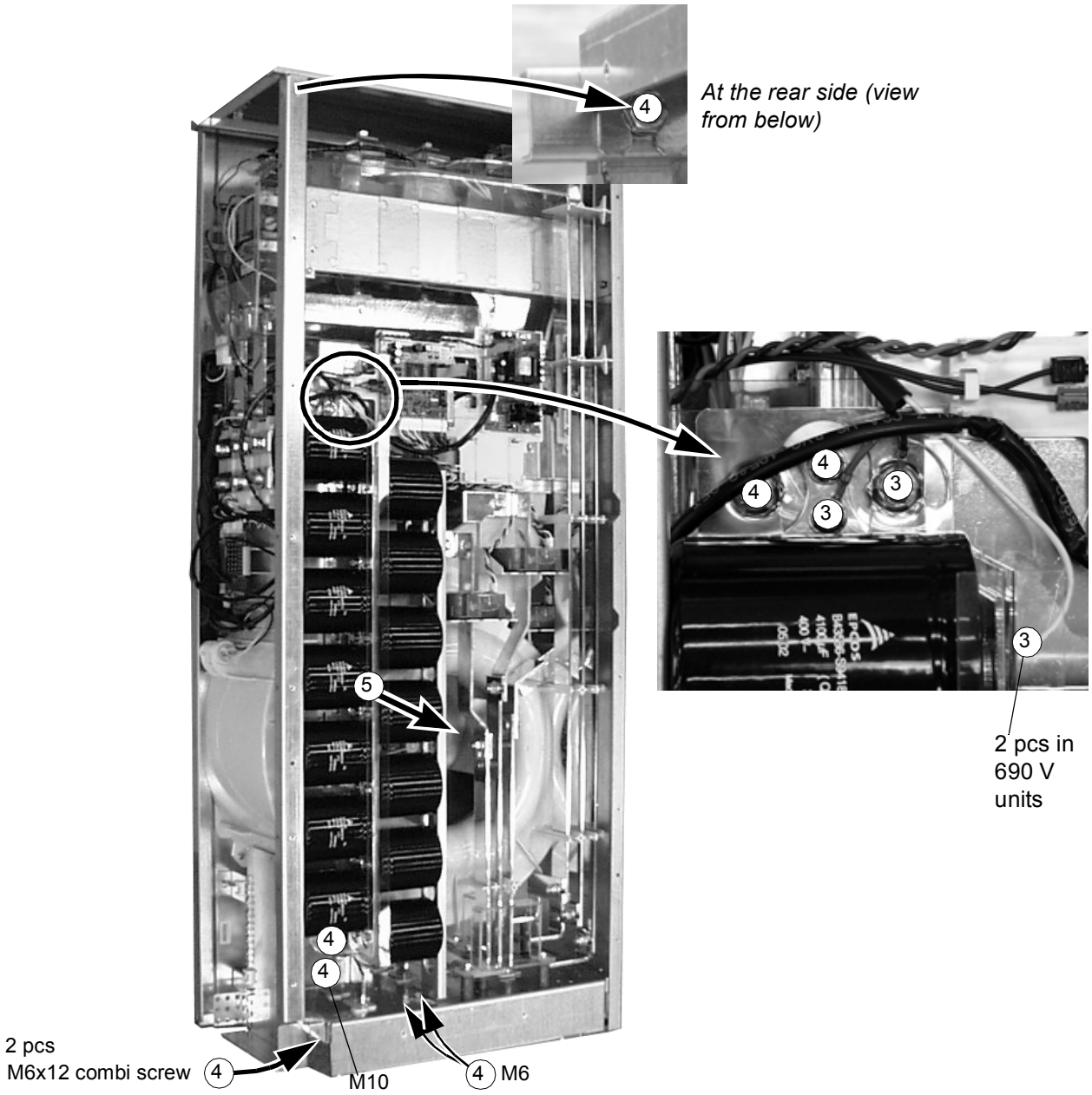
Reform (re-age) spare part capacitors once a year according to *ACS 600/800 Capacitor Reforming Guide* [code: 64059629 (English)].

Replacing the capacitor pack (R7)

Replace the capacitor pack as described in section *Replacing the drive module fan (R7)* on page *98*.

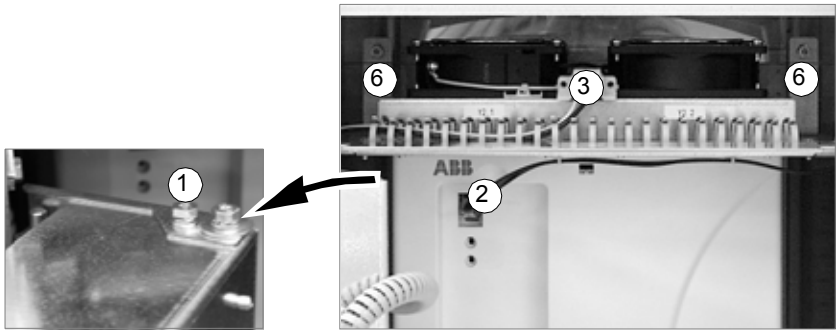
Replacing the capacitor pack (R8)

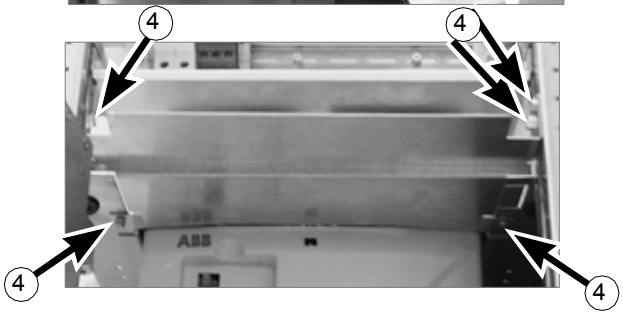
1. Remove the module from the cabinet as described in section *Replacing the drive module (R7 and R8)* on page *111.*
2. Remove the front cover. Remove the profiled side plate.
3. Disconnect the discharging resistor wires.
4. Undo the red fastening screws.
5. Lift the capacitor pack out.
6. Install the new capacitor pack in reverse order to the above.

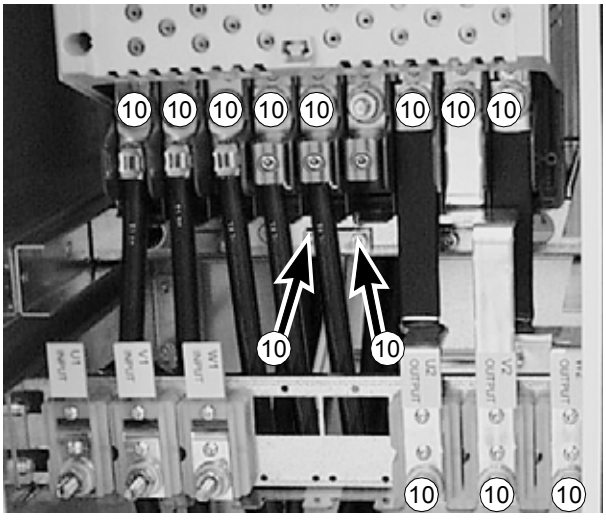


Replacing the drive module (R5 and R6)

1. Open the swing-out frame. Undo screw (1) to open the swing-out frame wide.
2. Disconnect the control panel cable.
3. Disconnect the fan wires (detachable terminal).
4. Undo the fastening screws of the air baffle and fan cassette, and pull the air baffle out.
5. Pull the fan cassette out.
6. Remove the shroud at the top of the module by undoing the fastening screws.
7. Remove the shrouds in the lower part of the cabinet.
8. Remove the additional fan (if any). See *Replacing the additional fan at the lower part of the cubicle (R6 with du/dt filter, +E205)* on page *100*.
9. Disconnect the control cables by detaching the RMIO board terminals.
10. Disconnect the power busbars and cables.
    Note: Drives with safety functions (options +Q963, Q964, +Q965, +Q966 or +Q968): Disconnect the STO cable from the module.

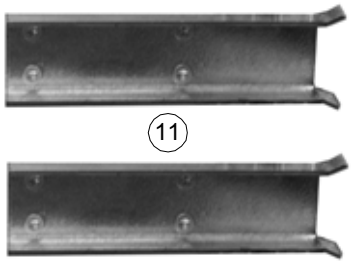


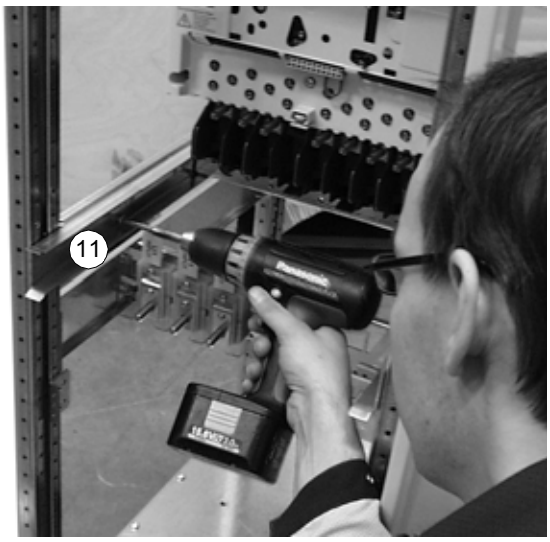


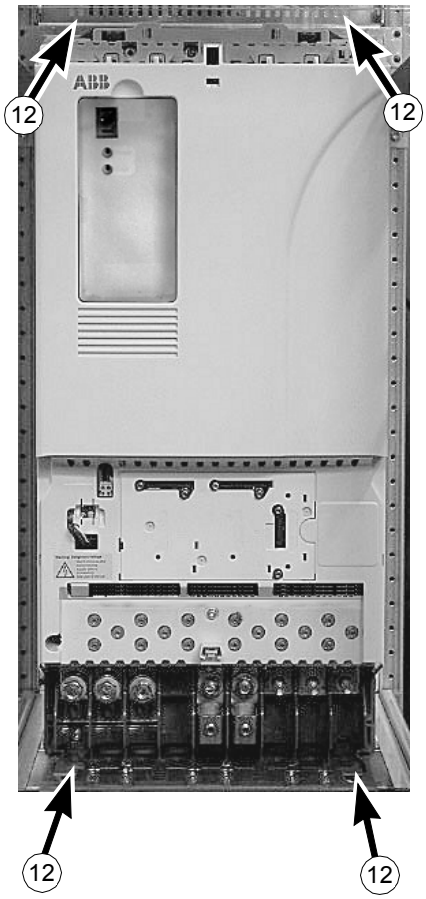


11. Fasten the slide rails at the bottom of the cabinet to the sides of the cabinet.
12. Undo the fastening screws of the module. Use a torque wrench with an extension bar.
13. R5: Lift the module out. R6: Slide the module out onto a pallet truck.
14. Install the new module in reverse order to the above.
15. Remove the protective film from the top of the drive module after the installation.

WARNING! If the protective film is not removed, the cooling air cannot flow freely through the module and the drive will run to overtemperature.


11


11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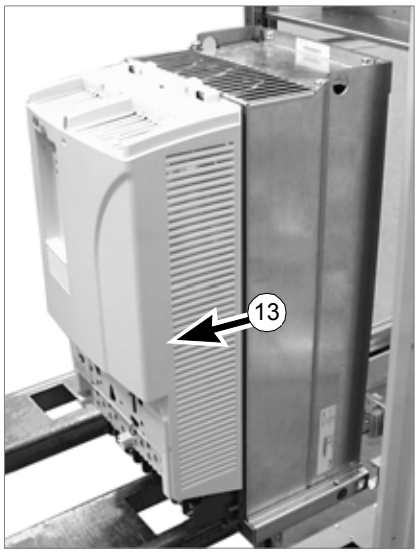
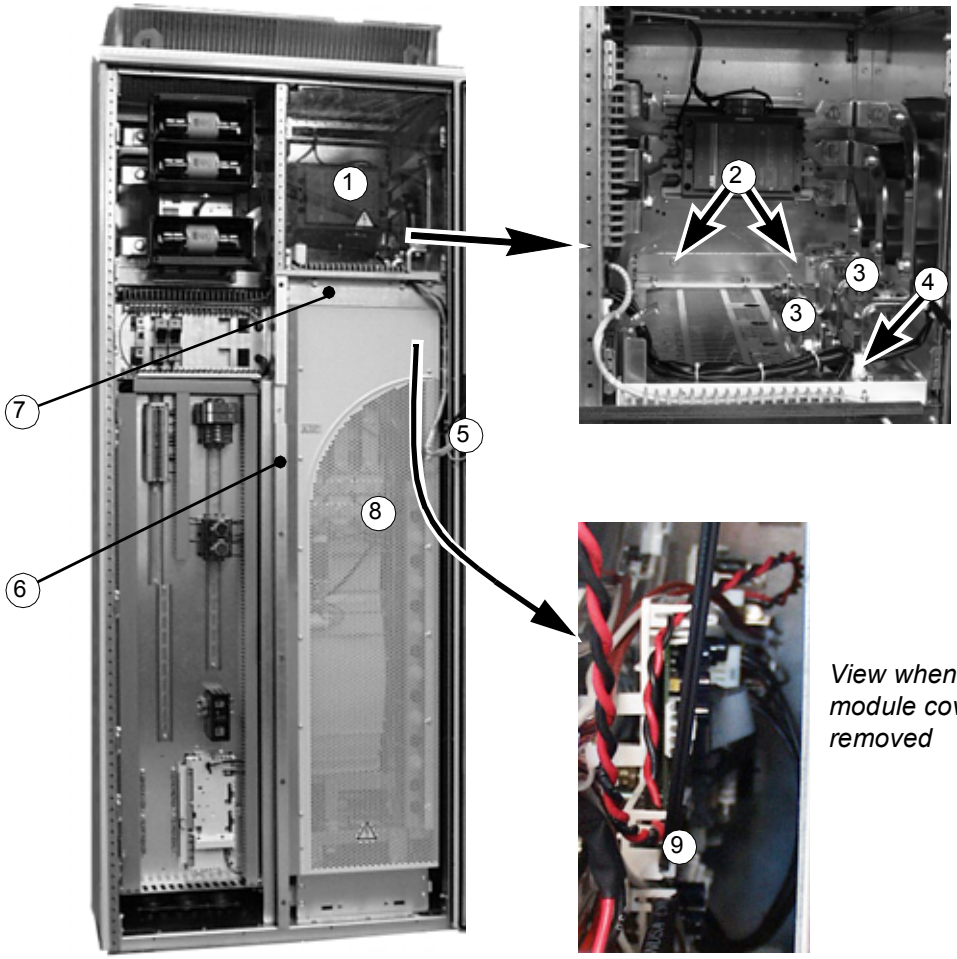

13

Replacing the drive module (R7 and R8)

1. Remove the shroud.
2. Undo the fastening screws.
3. Disconnect the input power busbars from the module.
4. Disconnect the power supply cable from the APOW board.
5. Disconnect the door wires.
6. Remove the air guide.
7. Remove the fastening bracket.
8. Remove the front cover of the module.
9. Disconnect the fibre optic cables from the AINT board and mark down the terminals for reconnecting.
   Note: Drives with safety functions (options +Q963, Q964, +Q965, +Q966 or +Q968): Disconnect the STO cable from the module.

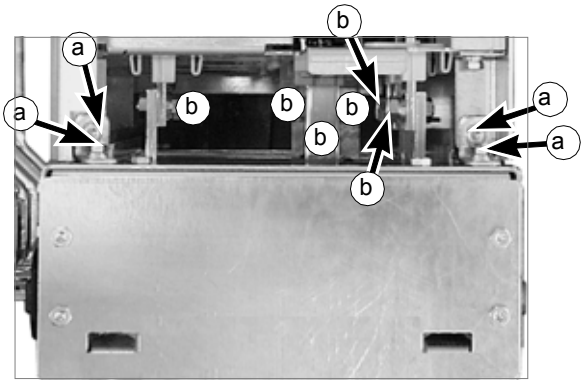


View when the module cover is removed

Photos of frame size R8

10. Disconnect the pedestal from the module by undoing the fastening (a) and busbar connecting (b) screws.

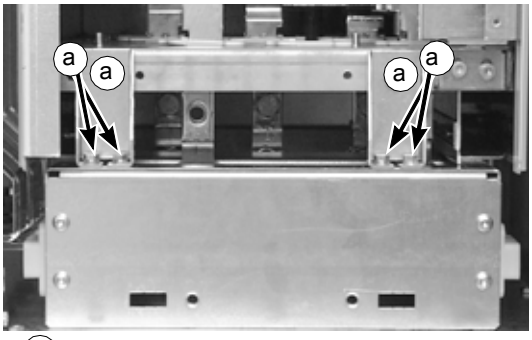
Frame size R7



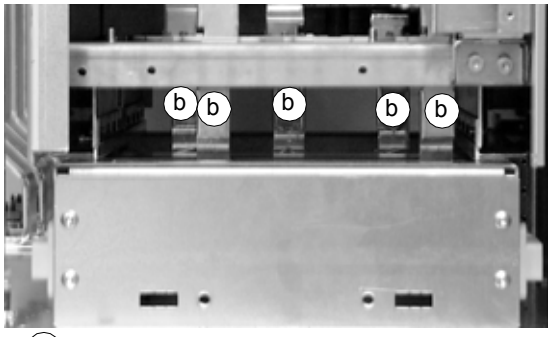
(a) M6 combi screw
Tightening torque: 5 Nm (3.7 lbf ft)

(b) M8x25 combi screw
Tightening torque: 15...22 Nm (11...16 lbf ft)

Frame size R8



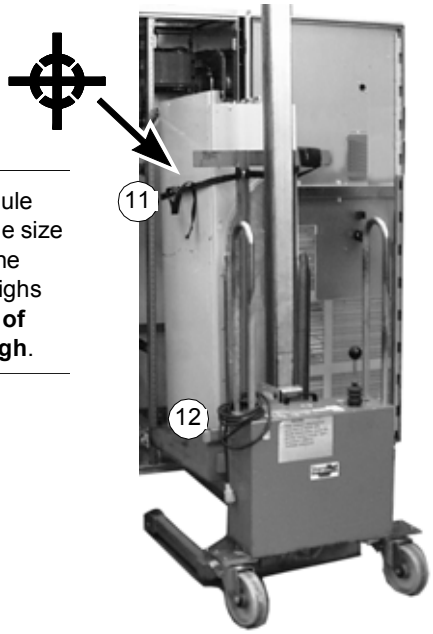
(a) M6x16 combi screws
Tightening torque: 5 Nm (3.7 lbf ft)



(b) M10x25 combi screws
Tightening torque: 30...44 Nm (22...32 lbf ft)

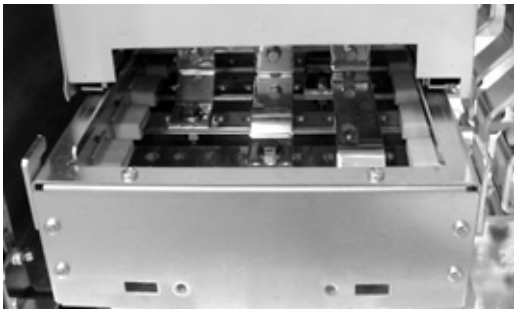
11.Secure the module to a fork lift.

12.Pull the module from the cabinet onto the fork lift.



WARNING! Secure the module properly. The module of frame size R7 weighs 90 kg (198 lb). The module of frame size R8 weighs 200 kg (441 lb). **The centre of gravity of the module is high**.

13.Install the new module in reverse order to the above.



The module is slid in on the pedestal rails (view from back, the back plate of the cabinet removed)

WARNING! Fastening of screws (a) is important because the screws are required for the grounding of the drive.

14.Remove the protective covering from the top of the drive module after the installation.

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

LEDs

This table describes LEDs of the drive.

Where	LED	When the LED is lit
RMIO board	Red	Drive in fault state
	Green	The power supply on the board is OK.
Control panel mounting platform	Red	Drive in fault state
	Green	The main + 24 V power supply for the control panel and the RMIO board is OK.
AINT board	V204 (green)	+5 V voltage of the board is OK.
	V309 (red)	Prevention of unexpected start-up (option +Q950) or Safe torque off (option +Q968) is ON.
	V310 (green)	IGBT control signal transmission to the gate driver control boards is enabled.

Technical data

What this chapter contains

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

IEC data

Ratings

The IEC ratings for the ACS800-07 with 50 Hz and 60 Hz supplies are given below. The symbols are described below the table.

ACS800-07 type	Nominal ratings		No-overload use	Light-overload use		Heavy-duty use		Frame size	Air flow	Heat dissipation
	$I_{cont.max}$ A	I_{max} A	$P_{cont.max}$ kW	I_{2N} A	P_N kW	I_{2hd} A	P_{hd} kW		m^3/h	W
Three-phase supply voltage 380 V, **400 V** or 415 V										
-0075-3	145	170	75	141	75	100	45	R5	405	1440
-0100-3	166	202	90	155	75	115	55	R6	405	1940
-0120-3	202	282	110	184	90	141	75	R6	405	2310
-0135-3	225	326	110	220	110	163	90	R6	405	2810
-0165-3	260	326	132	254	132	215	110	R6	405	3260
-0205-3	290	351	160	285	160	234	132	R6	405	4200
-0260-3	445	588	200	440	200	340	160	R8	1220	6600
-0320-3	521	588	250	516	250	370	200	R8	1220	7150
-0400-3	602	840	315	590	315	477	250	R8	1220	8100
-0440-3	693	1017	355	679	355	590 [2)]	315	R8	1220	8650
-0490-3	720	1017	400	704	400	635 [3)]	355	R8	1220	9100

ACS800-07 type	Nominal ratings		No-overload use	Light-overload use		Heavy-duty use		Frame size	Air flow	Heat dissipation
	$I_{cont.max}$ A	I_{max} A	$P_{cont.max}$ kW	I_{2N} A	P_N kW	I_{2hd} A	P_{hd} kW		m^3/h	W
Three-phase supply voltage 380 V, 400 V, 415 V, 440 V, 460 V, 480 V or **500** V										
-0105-5	145	170	90	141	90	100	55	R5	405	2150
-0120-5	157	202	90	145	90	113	75	R6	405	2310
-0140-5	180	282	110	163	110	141	90	R6	405	2810
-0165-5	225	326	132	220	132	163	110	R6	405	3260
-0205-5	260	326	160	254	160	215	132	R6	405	3800
-0255-5	290	351	200	285	200	234	160	R6	405	4500
-0320-5	440	588	250	435	250	340	200	R8	1220	6850
-0400-5	515	588	315	510	315	370	250	R8	1220	7800
-0440-5	550	840	355	545	355	490	315	R8	1220	7600
-0490-5	602	840	400	590	400	515 [2)]	355	R8	1220	8100
-0550-5	684	1017	450	670	450	590 [2)]	400	R8	1220	9100
-0610-5	718	1017	500	704	500	632 [3)]	450	R8	1220	9700
Three-phase supply voltage 525 V, 550 V, 575 V, 600 V, 660 V or **690** V										
-0070-7	79	104	75	73	55	54	45	R6	405	1220
-0100-7	93	124	90	86	75	62	55	R6	405	1650
-0120-7	113	172	110	108	90	86	75	R6	405	1960
-0145-7	134	190	132	125	110	95	90	R6	405	2660
-0175-7	166	245	160	155	132	131	110	R6	405	3470
-0205-7	190	245	160	180	160	147	132	R6	405	4180
-0260-7	175/230*	326	160/200*	175/212*	160/200*	163	160	R7	540	4800
-0320-7	315	433	315	290	250	216	200	R8	1220	6150
-0400-7	353	548	355	344	315	274	250	R8	1220	6650
-0440-7	396	656	400	387	355	328	315	R8	1220	7400
-0490-7	445	775	450	426	400	387	355	R8	1220	8450
-0550-7	488	853	500	482	450	426	400	R8	1220	8300
-0610-7	560	964	560	537	500	482	450	R8	1220	9750

00096931

[1)] 50% overload is available for one minute every 5 minutes if ambient temperature is less than 25 °C (77 °F). If ambient temperature is 40 °C (104 °F), max. available overload is 37%.

[2)] 50% overload is available for one minute every 5 minutes if ambient temperature is less than 30 °C (86 °F). If ambient temperature is 40 °C (104 °F), max. available overload is 40%.

[3)] 50% overload is available one minute every 5 minutes if ambient temperature is less than 20 °C (68 °F). If ambient temperature is 40 °C (104 °F), max. available overload is 30%.

[4)] Higher value is valid if ambient temperature is less than 35 °C (95 °F).

* Higher value applicable if output frequency is above 41 Hz

** MANUFACTURED ON SPECIAL ORDER ONLY

Symbols

Nominal ratings

$I_{cont.max}$ continuous rms output current. No overload capability at 40 °C (104 °F).

I_{max} maximum output current. Available for 10 s at start, otherwise as long as allowed by drive temperature.

Typical ratings:

No-overload use

$P_{cont.max}$ typical motor power. The power ratings apply to most IEC 60034 motors at the nominal voltage, 400 V, 500 V or 690 V.

Light-overload use (10% overload capability)

I_{2N} continuous rms current. 10% overload is allowed for one minute every 5 minutes.

P_N typical motor power. The power ratings apply to most IEC 60034 motors at the nominal voltage, 400 V, 500 V or 690 V.

Heavy-duty use (50% overload capability)

I_{2hd} continuous rms current. 50% overload is allowed for one minute every 5 minutes.

P_{hd} typical motor power. The power ratings apply to most IEC 60034 motors at the nominal voltage, 400 V, 500 V or 690 V.

Sizing

The current ratings are the same regardless of the supply voltage within one voltage range. To achieve the rated motor power given in the table, the rated current of the drive must be higher than or equal to the rated motor current.

Note 1: The maximum allowed motor shaft power is limited to $1.5 \cdot P_{hd}$, $1.1 \cdot P_N$ or $P_{cont.max}$ (whichever value is greatest). If the limit is exceeded, motor torque and current are automatically restricted. The function protects the input bridge of the drive against overload. If the condition exists for 5 minutes, the limit is set to $P_{cont.max}$.

Note 2: The ratings apply at an ambient temperature of 40 °C (104 °F). At lower temperatures the ratings are higher (except I_{max}).

Note 3: Use the DriveSize PC tool for a more accurate dimensioning if the ambient temperature is below 40 °C (104 °F) or the drive is loaded cyclically.

Derating

The load capacity (current and power) decreases if the installation site altitude exceeds 1000 metres (3281 ft), or if the ambient temperature exceeds 40 °C (104 °F).

Temperature derating

In the temperature range +40 °C (+104 °F) to +50 °C (+122 °F), the rated output current is decreased 1 % for every additional 1 °C (1.8 °F). The output current is calculated by multiplying the current given in the rating table by the derating factor.

Example If the ambient temperature is 50 °C (+122 °F), the derating factor is 100% - 1 $\frac{\%}{°C}$ · 10 °C = 90% or 0.90. The output current is then $0.90 \cdot I_{2N}$, $0.90 \cdot I_{2hd}$ or $0.90 \cdot I_{cont.max}$.

Altitude derating

At altitudes from 1000 to 4000 m (3281 to 13123 ft) above sea level, the derating is 1% for every 100 m (328 ft). For a more accurate derating, use the DriveSize PC tool. See *Installation sites above 2000 metres (6562 feet)* on page *59*.

Fuses

The drive is equipped with aR fuses as standard. Standard aR fuses and optional gG fuses for protection against short-circuit in the input power cable or drive are listed below. Either fuse type may be used if it operates rapidly enough. Choose between gG and aR fuses according to the table under *Quick guide for selecting between gG and aR fuses* on page *122,* or verify the operating time by **checking that the short-circuit current of the installation is at least the value given in the fuse table**. The short-circuit current can be calculated as follows:

$$I_{k2\text{-}ph} = \frac{U}{2 \cdot \sqrt{R_c^2 + (Z_k + X_c)^2}}$$

where

$I_{k2\text{-}ph}$ = short-circuit current in symmetrical two-phase short-circuit

U = network line-to-line voltage (V)

R_c = cable resistance (ohm)

$Z_k = z_k \cdot U_N^2/S_N$ = transformer impedance (ohm)

z_k = transformer impedance (%)

U_N = transformer rated voltage (V)

S_N = nominal apparent power of the transformer (kVA)

X_c = cable reactance (ohm).

Calculation example

Drive:

- ACS800-07-0260-3
- supply voltage U = 410 V

Transformer:

- rated power S_N = 3000 kVA
- rated voltage (drive supply voltage) U_N = 430 V
- transformer impedance z_k = 7.2%.

Supply cable:

- length = 170 m
- resistance/length = 0.112 ohm/km
- reactance/length = 0.0273 ohm/km.

$$Z_k = z_k \cdot \frac{U_N^2}{S_N} = 0.072 \cdot \frac{(430\ \text{V})^2}{3000\ \text{kVA}} = 4.438\ \text{mohm}$$

$$R_c = 170\ \text{m} \cdot 0.112\ \frac{\text{ohm}}{\text{km}} = 19.04\ \text{mohm}$$

$$X_c = 170\ \text{m} \cdot 0.0273\ \frac{\text{ohm}}{\text{km}} = 4.641\ \text{mohm}$$

$$I_{k2\text{-}ph} = \frac{410\ \text{V}}{2 \cdot \sqrt{(19.04\ \text{mohm})^2 + (4.438\ \text{mohm} + 4.641\ \text{mohm})^2}} = 9.7\ \text{kA}$$

The calculated short-circuit current 9.7 kA is higher than the minimum short-circuit current of the drive gG fuse type OFAF3H500 (8280 A). -> The 500 V gG fuse (ABB Control OFAF3H500) can be used.

Notes concerning the fuse tables

Note 1: See also section *Thermal overload and short-circuit protection* on page *46*. For UL recognized fuses, see section *NEMA data* on page *125*.

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

Note 3: Larger fuses than the recommended ones must not be used.

Note 4: 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.

Ultrarapid (aR) fuses

ACS800-07 size	Input current A	Min. short-circuit current [1] A	Fuse					
			A	A^2s	V	Manufacturer	Type DIN 43620 	Size
Three-phase supply voltage 380 V, **400 V** or 415 V								
-0075-3	142	1630	315	84 500	690	Bussmann	170M1572D	DIN00
-0100-3	163	1280	315	52 000	690	Bussmann	170M3817D	DIN1
-0120-3	198	1810	400	115 000	690	Bussmann	170M3819D	DIN1
-0135-3	221	2210	500	155 000	690	Bussmann	170M5810D	DIN2
-0165-3	254	2620	550	215 000	690	Bussmann	170M5811D	DIN2
-0205-3	286	2620	550	215 000	690	Bussmann	170M5811D	DIN2
-0260-3	438	4000	800	490 000	690	Bussmann	170M6812D	DIN3
-0320-3	501	5550	1000	985 000	690	Bussmann	170M6814D	DIN3
-0400-3	581	7800	1250	2 150 000	690	Bussmann	170M8554D	DIN3
-0440-3	674	8850	1400	2 700 000	690	Bussmann	170M8555D	DIN3
-0490-3	705	8850	1400	2 700 000	690	Bussmann	170M8555D	DIN3
Three-phase supply voltage 380 V, 400 V, 415 V, 440 V, 460 V, 480 V or **500** V								
-0105-5	142	1630	315	84 500	690	Bussmann	170M1572D	DIN00
-0120-5	155	1280	315	52 000	690	Bussmann	170M3817D	DIN1
-0140-5	180	1810	400	115 000	690	Bussmann	170M3819D	DIN1
-0165-5	222	2210	500	155 000	690	Bussmann	170M5810D	DIN2
-0205-5	256	2620	550	215 000	690	Bussmann	170M5811D	DIN2
-0255-5	286	2620	550	215 000	690	Bussmann	170M5811D	DIN2
-0320-5	424	4000	800	490 000	690	Bussmann	170M6812D	DIN3
-0400-5	498	5550	1000	985 000	690	Bussmann	170M6814D	DIN3
-0440-5	543	7800	1250	2 150 000	690	Bussmann	170M8554D	DIN3
-0490-5	590	7800	1250	2 150 000	690	Bussmann	170M8554D	DIN3
-0550-5	669	8850	1400	2 700 000	690	Bussmann	170M8555D	DIN3
-0610-5	702	8850	1400	2 700 000	690	Bussmann	170M8555D	DIN3
Three-phase supply voltage 525 V, 550 V, 575 V, 600 V, 660 V or **690** V								
-0070-7	79	520	125	8 250	690	Bussmann	170M1568D	000
-0100-7	91	695	160	16 500	690	Bussmann	170M1569D	000
-0120-7	112	750	200	15 000	690	Bussmann	170M3815D	DIN1
-0145-7	131	1520	350	73 000	690	Bussmann	170M3818D	DIN1
-0175-7	162	1520	350	73 000	690	Bussmann	170M3818D	DIN1
-0205-7	186	1610	400	79 000	690	Bussmann	170M5808D	DIN2
-0260-7	217	1610	400	79 000	690	Bussmann	170M5808D	DIN2
-0320-7	298	3010	630	295 000	690	Bussmann	170M5812D	DIN2
-0400-7	333	2650	630	220 000	690	Bussmann	170M6810D	DIN3
-0440-7	377	4000	800	490 000	690	Bussmann	170M6812D	DIN3
-0490-7	423	4790	900	720 000	690	Bussmann	170M6813D	DIN3
-0550-7	468	4790	900	720 000	690	Bussmann	170M6813D	DIN3
-0610-7	533	5550	1000	985 000	690	Bussmann	170M6814D	DIN3

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A^2s value for -7 units at 690 V

[1] minimum short-circuit current of the installation

Optional gG fuses

ACS800-07 size	Input current	Min. short-circuit current [1]	Fuse					
	A	A	A	A^2s	V	Manufacturer	Type	IEC size
Three-phase supply voltage 380 V, **400 V** or 415 V								
-0075-3	142	2400	160	200000	500	ABB Control	OFAF00H160	00
-0100-3	163	2850	200	350 000	500	ABB Control	OFAF1H200	1
-0120-3	198	3300	224	420 000	500	ABB Control	OFAF1H224	1
-0135-3	221	3820	250	550 000	500	ABB Control	OFAF1H250	1
-0165-3	254	4510	315	1100000	500	ABB Control	OFAF2H315	2
-0205-3	286	4510	315	1100000	500	ABB Control	OFAF2H315	2
-0260-3	438	8280	500	2 900 000	500	ABB Control	OFAF3H500	3
-0320-3	501	10200	630	4 000 000	500	ABB Control	OFAF3H630	3
-0400-3	581	10200	630	4 000 000	500	ABB Control	OFAF3H630	3
-0440-3	674	13500	800	7 400 000	500	ABB Control	OFAF3H800	3
-0490-3	705	13500	800	7 400 000	500	ABB Control	OFAF3H800	3
Three-phase supply voltage 380 V, 400 V, 415 V, 440 V, 460 V, 480 V or **500** V								
-0105-5	142	2400	160	200000	500	ABB Control	OFAF00H160	00
-0120-5	155	2850	200	350 000	500	ABB Control	OFAF1H200	1
-0140-5	180	2850	200	350 000	500	ABB Control	OFAF1H200	1
-0165-5	222	3820	250	550 000	500	ABB Control	OFAF1H250	1
-0205-5	256	4510	315	1100000	500	ABB Control	OFAF2H315	2
-0255-5	286	4510	315	1100000	500	ABB Control	OFAF2H315	2
-0320-5	424	8280	500	2 900 000	500	ABB Control	OFAF3H500	3
-0400-5	498	10200	630	4 000 000	500	ABB Control	OFAF3H630	3
-0440-5	543	10200	630	4 000 000	500	ABB Control	OFAF3H630	3
-0490-5	590	10200	630	4 000 000	500	ABB Control	OFAF3H630	3
-0550-5	669	13500	800	7 400 000	500	ABB Control	OFAF3H800	3
-0610-5	702	13500	800	7 400 000	500	ABB Control	OFAF3H800	3
Three-phase supply voltage 525 V, 550 V, 575 V, 600 V, 660 V or **690** V								
-0070-7	79	1050	80	52200	690	ABB Control	OFAA0GG80	0
-0100-7	91	1480	100	93000	690	ABB Control	OFAA1GG100	1
-0120-7	112	1940	125	126000	690	ABB Control	OFAA1GG125	1
-0145-7	131	2400	160	220000	690	ABB Control	OFAA1GG160	1
-0175-7	162	2850	200	350000	690	ABB Control	OFAA1GG200	1
-0205-7	186	3820	250	700000	690	ABB Control	OFAA2GG250	2
-0260-7	217	3820	250	700 000	690	ABB Control	OFAA2GG250	2
-0320-7	298	4510	315	820 000	690	ABB Control	OFAA2GG315	2
-0400-7	333	6180	400	1 300 000	690	ABB Control	OFAA3GG400	3
-0440-7	377	8280	500	3 800 000	690	ABB Control	OFAA3H500	3
-0490-7	423	8280	500	3 800 000	690	ABB Control	OFAA3H500	3
-0550-7	468	8280	500	3 800 000	690	ABB Control	OFAA3H500	3
-0610-7	533	10800	630	10 000 000	690	Bussmann	630NH3G-690 *	3

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* rated breaking capacity only up to 50 kA

[1] minimum short-circuit current of the installation

Quick guide for selecting between gG and aR fuses

The table below is a short cut in selecting between gG and aR fuses. The combinations (cable size, cable length, transformer size and fuse type) in the table fulfil the minimum requirements for the proper operation of the fuse.

ACS800-07 size	Cable type		Supply transformer minimum apparent power S_N (kVA)					
	Copper	Aluminium	Maximum cable length with gG fuses			Maximum cable length with aR fuses		
			10 m	50 m	100 m	10 m	100 m	200 m
Three-phase supply voltage 380 V, **400 V** or 415 V								
-0075-3	3×70 Cu	3×95 Al	130	140	160	99	99	140
-0100-3	3×95 Cu	3×120 Al	150	160	190	120	120	140
-0120-3	3×120 Cu	3×185 Al	170	190	210	140	140	140
-0130-3	3×150 Cu	3×240 Al	200	220	250	160	160	160
-0165-3	3×185 Cu	3×240 Al	240	260	310	180	180	200
-0205-3	3×240 Cu	2 × (3x120) Al	240	260	310	200	200	200
-0260-3	3 × (3×70) Cu	3 × (3×120) Al	430	460	560	310	310	310
-0320-3	3 × (3×95) Cu	2 × (3×240) Al	530	600	750	350	350	440
-0400-3	3 × (3×120) Cu	3 × (3×185) Al	530	600	750	410	470	660
-0440-3	3 × (3×150) Cu	3 × (3×240) Al	700	770	930	470	530	730
-0490-3	3 × (3×150) Cu	3 × (3×240) Al	700	770	930	490	530	730
Three-phase supply voltage 380 V, 400 V, 415 V, 440 V, 460 V, 480 V or **500** V								
-0105-5	3×70 Cu	3×95 Al	160	170	190	130	130	150
-0120-5	3×95 Cu	3×120 Al	190	200	220	140	140	150
-0140-5	3×95 Cu	3×150 Al	190	200	220	160	160	160
-0150-5	3×120 Cu	3×185 Al	220	230	250	180	180	180
-0165-5	3x150 Cu	3x240 Al	250	260	290	200	200	200
-0205-5	3×185 Cu	3×240 Al	290	320	360	230	230	230
-0255-5	3×240 Cu	2 × (3×120) Al	290	320	360	250	250	250
-0320-5	2 × (3×120) Cu	3 × (3×95) Al	530	570	670	370	370	370
-0400-5	2 × (3×150) Cu	2 × (3×240) Al	660	720	840	440	440	480
-0440-5	3 × (3×95) Cu	3 × (3×150) Al	660	720	840	500	570	760
-0490-5	3 × (3×120) Cu	3 × (3×185) Al	660	720	840	520	570	760
-0550-5	2 × (3×240) Cu	3 × (3×240) Al	880	980	1200	580	670	880
-0610-5	3 × (3×150) Cu	3 × (3×240) Al	880	980	1200	610	670	880
Three-phase supply voltage 525 V, 550 V, 575 V, 600 V, 660 V or **690** V								
-0070-7	3×25 Cu	3×50 Al	95	95	99	95	95	95
-0100-7	3×35 Cu	3×50 Al	130	140	150	110	110	110
-0120-7	3×50 Cu	3×70 Al	180	180	190	140	140	140
-0145-7	3×70 Cu	3×95 Al	220	220	240	160	160	160
-0175-7	3×95 Cu	3×120 Al	260	260	280	200	200	200
-0205-7	3×95 Cu	3×150 Al	340	360	390	230	230	230
-0260-7	3×150 Cu	3×185 Al	340	360	390	260	260	260
-0320-7	3×240 Cu	2 × (3×120) Al	400	410	430	360	360	360
-0400-7	3×240 Cu	3 × (3×70) Al	550	570	610	400	400	400
-0440-7	2 × (3×120) Cu	2 × (3×150) Al	730	780	860	460	460	460
-0490-7	2 × (3×120) Cu	3 × (3×95) Al	730	780	860	510	510	510
-0550-7	2 × (3×150) Cu	3 × (3×120) Al	730	780	860	560	560	560
-0610-7	3 × (3×95) Cu	3 × (3×150) Al	960	1000	1100	640	640	640

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Note 1: The supply transformer minimum power in kVA is calculated with a z_k value of 6% and frequency 50 Hz.

Note 2: The table is not intended for transformer selection - that must be done separately.

The following parameters can effect on the correct operation of the protection:

- cable length, i.e. the longer the cable the weaker the fuse protection, as the long cable limits the fault current
- cable size, i.e. the smaller the cable cross-section the weaker the fuse protection, as the small cable size limits the fault current
- transformer size, i.e the smaller the transformer the weaker the fuse protection, as the small transformer limits the fault current
- transformer impedance, i.e. the higher the z_k the weaker the fuse protection as high impedance limits the fault current.

The protection can be improved by installing a larger supply transformer and/or bigger cables, and in most cases by selecting aR fuses instead of gG fuses. Selection of smaller fuses improves the protection, but may also affect the fuse life time and lead to unnecessary operation of the fuses.

In case of any uncertainty regarding the drive protection, please contact your local ABB.

Cable types

The table below gives copper and aluminium cable types for different load currents. Cable sizing is based on max. 9 cables laid on a cable ladder side by side, three ladder type trays one on top of the other, ambient temperature 30 °C (86 °F), PVC insulation, surface temperature 70 °C (158 °F) (EN 60204-1 and IEC 60364-5-52:2001). For other conditions, size the cables according to local safety regulations, appropriate input voltage and the load current of the drive.

Copper cables with concentric copper shield		**Aluminium cables with concentric copper shield**	
Max. load current A	**Cable type** mm^2	**Max. load current** A	**Cable type** mm^2
56	3×16	69	3×35
71	3×25	83	3×50
88	3×35	107	3×70
107	3×50	130	3×95
137	3×70	151	3×120
167	3×95	174	3×150
193	3×120	199	3×185
223	3×150	235	3×240
255	3×185	214	2 × (3×70)
301	3×240	260	2 × (3×95)
274	2 × (3×70)	302	2 × (3×120)
334	2 × (3×95)	348	2 × (3×150)
386	2 × (3×120)	398	2 × (3×185)
446	2 × (3×150)	470	2 × (3×240)
510	2 × (3x185)	522	3 × (3×150)
602	2 × (3×240)	597	3 × (3×185)
579	3 × (3×120)	705	3 × (3×240)
669	3 × (3×150)		
765	3 × (3×185)		
903	3 × (3×240)		

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Cable entries

Mains, motor and brake resistor cable terminal sizes (per phase), maximum accepted cable and tightening torques are given below.

Frame size	L1, L2, L3, U2, V2, W2, UDC+/R+, UDC-, R-					Earthing PE	
	Number of holes per phase	Hole diameter mm	Max. wire size mm^2	Screw	Tightening torque Nm	Screw	Tightening torque Nm
R5 [1]	1	60	185	M10	20...40	M10	30...44
R6 [2]	1	60	185	M10	20...40	M10	30...44
R7	3	60	1×240 or 2×185	M12	50...75	M10	30...44
R8	3	60	3×240	M12	50...75	M10	30...44

1) external brake resistor (+D150) and DC connection terminals: wire size 6…70 mm^2, screw M8, tightening torque 15 Nm

2) external brake resistor (+D150) and DC connection terminals: wire size 95…185 mm^2, screw M10, tightening torque 40 Nm

Dimensions, weights and noise

Frame size	Height [1]		Width [2]	Depth [5]	Weight	Noise
	IP21/22/42 mm	IP54 mm	mm	mm	kg	dB
R5	2130	2315	430	689	300	63
R6	2130	2315	430	689	300	63
R7	2130	2315	830 [3]	689	400	71
R8	2130	2315	830 [4]	689	500	72

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1) in marine applications (+C121) extra height: 10 mm from the fastening bar at the bottom of the cabinet

2) extra width for units with brake resistors (+D151): SAFURxxxFxxx 400 mm, 2xSAFURxxxFxxx 800 mm, 4xSAFURxxxFxxx 1600 mm

3) extra width for units with EMC filter (+E202): 200 mm

4) extra width for units with EMC filter (+E202): 400 mm

5) in marine applications (+C121) depth with fastening bars: 700 mm

NEMA data

Ratings

The NEMA ratings for the ACS800-U7 and ACS800-07 with 60 Hz supplies are given below. The symbols are described below the table. For sizing, derating and 50 Hz supplies, see section *IEC data*.

ACS800-U7 type ACS800-07 type	I_{max}	Normal use		Heavy-duty use		Frame size	Air flow	Heat dissipation
		I_{2N}	P_N	I_{2hd}	P_{hd}			
	A	A	hp	A	hp		ft^3/min	BTU/Hr
Three-phase supply voltage 380 V, 400 V, 415 V, 440 V, **460 V**, 480 V								
-0100-5	164	124	100	96	75	R6	238	6610
-0120-5	202	157	125	124	100	R6	238	7890
-0140-5	282	180	150	156	125	R6	238	9600
-0165-5	326	220	150	165	125	R6	238	11140
-0205-5	326	245	200	215	150	R6	238	12980
-0270-5 **	480	316	250	240	200	R8	718	15350
-0300-5 **	568	361	300	302	250	R8	718	18050
-0320-5	588	435	350	340	250	R8	718	23250
-0400-5	588	510	400	370	300	R8	718	26650
-0440-5	840	545	450	490	400	R8	718	25950
-0490-5	840	590	500	515 [3]	450	R8	718	27600
-0550-5	1017	670	550	590 [3]	500	R8	718	31100
-0610-5	1017	718 [4]	600	590 [3]	500	R8	718	33000
Three-phase supply voltage 525 V, **575 V** or 600 V								
-0070-7	104	73	60	54	50	R6	238	4200
-0100-7	124	86	75	62	60	R6	238	5650
-0120-7	172	108	100	86	75	R6	238	6700
-0145-7	190	125	125	99	100	R6	238	9100
-0175-7	245	155	150	131	125	R6	238	11850
-0205-7	245	192	200	147	150	R6	238	14300
-0260-7	326	175/212*	150/200*	163	150	R7	318	16400
-0320-7	433	290	300	216	200	R8	718	21050
-0400-7	548	344	350	274	250	R8	718	22750
-0440-7	656	387	400	328	350 [2]	R8	718	25300
-0490-7	775	426	450	387	400	R8	718	28900
-0550-7	853	482	500	426	450	R8	718	28350
-0610-7	964	537	500	482	500	R8	718	33300

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[1] available if ambient temperature is less than 30 °C (86 °F). If ambient temperature is 40 °C (104 °F), I_{2N} is 286 A.

[2] special 4-pole high-efficiency NEMA motor

[3] 50% overload is allowed for one minute every five minutes if ambient temperature is less than 30 °C (86 °F). 40% overload is allowed if ambient temperature is 40 °C (104 °F).

[4] available if ambient temperature is less than 30 °C (86 °F). If ambient temperature is 40 °C (104 °F), I_{2N} is 704 A.

* higher value available if output frequency is above 41 Hz

** ACS800-U7 types only

Symbols

I_{max}	maximum output current. Available for 10 s at start, otherwise as long as allowed by drive temperature.
Normal use (10% overload capability)	
I_{2N}	continuous rms current. 10% overload is typically allowed for one minute every 5 minutes.
P_N	typical motor power. The power ratings apply to most 4-pole NEMA rated motors (460 V or 575 V).
Heavy-duty use (50% overload capability)	
I_{2hd}	continuous rms current. 50% overload is typically allowed for one minute every 5 minutes.
P_{hd}	typical motor power. The power ratings apply to most 4-pole NEMA rated motors (460 V or 575 V).

Note: The ratings apply at an ambient temperature of 40 °C (104 °F). At lower temperatures the ratings are higher.

Sizing

See page *117*.

Derating

See page *117*.

Fuses

For branch circuit protection per NEC, the drive is equipped with UL class T or L fuses listed below. Fast acting class T/L or faster fuses are recommended in the USA.

Check from the fuse time-current curve that the operating time of the fuse is below 0.1 seconds. The operating time depends on the supply network impedance and the cross-sectional area and length of the supply cable. The short-circuit current can be calculated as shown in section *Fuses* on page *118*.

Note 1: See also *Planning the electrical installation*: *Thermal overload and short-circuit protection*.

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

Note 3: Larger fuses than the recommended ones must not be used.

Note 4: 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.

Note 5: Circuit breakers must not be used without fuses.

UL class T or L fuses

ACS800-U7 type	Input current	Fuse				
	A	A	V	Manufacturer	Type	UL class
Three-phase supply voltage 380 V, 400 V, 415 V, 440 V, **460 V** or 480 V						
-0100-5	121	150	600	Bussmann	JJS-150	T
-0120-5	155	200	600	Bussmann	JJS-200	T
-0140-5	179	225	600	Bussmann	JJS-225	T
-0165-5	218	300	600	Bussmann	JJS-300	T
-0205-5	243	350	600	Bussmann	JJS-350	T
-0270-5	293	500	600	Bussmann	JJS-500	T
-0300-5	331	500	600	Bussmann	JJS-500	T
-0320-5	397	500	600	Bussmann	JJS-500	T
-0400-5	467	600	600	Bussmann	JJS-600	T
-0440-5	501	800	600	Ferraz	A4BY800	L
-0490-5	542	800	600	Ferraz	A4BY800	L
-0550-5	614	800	600	Ferraz	A4BY800	L
-0610-5	661	800	600	Ferraz	A4BY800	L
Three-phase supply voltage 525 V, **575 V** or 600 V						
-0070-7	70	100	600	Bussmann	JJS-100	T
-0100-7	82	125	600	Bussmann	JJS-125	T
-0120-7	103	150	600	Bussmann	JJS-150	T
-0145-7	121	200	600	Bussmann	JJS-200	T
-0175-7	150	200	600	Bussmann	JJS-200	T
-0205-7	188	250	600	Bussmann	JJS-250	T
-0260-7	199	300	600	Bussmann	JJS-300	T
-0320-7	273	500	600	Bussmann	JJS-500	T
-0400-7	325	500	600	Bussmann	JJS-500	T
-0440-7	370	500	600	Bussmann	JJS-500	T
-0490-7	407	600	600	Bussmann	JJS-600	T
-0550-7	463	600	600	Bussmann	JJS-600	T
-0610-7	513	700	600	Ferraz	A4BY700	L

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Cable types

Cable sizing is based on NEC Table 310-16 for copper wires, 75 °C (167 °F) wire insulation at 40 °C (104 °F) ambient temperature. Not more than three current-carrying conductors in raceway or cable or earth (directly buried). For other conditions, dimension the cables according to local safety regulations, appropriate input voltage and the load current of the drive.

Copper cables with concentric copper shield	
Max. load current A	**Cable type** AWG/kcmil
57	6
75	4
88	3
101	2
114	1
132	1/0
154	2/0
176	3/0
202	4/0
224	250 MCM or 2 × 1
251	300 MCM or 2 × 1/0
273	350 MCM or 2 × 2/0
295	400 MCM or 2 × 2/0
334	500 MCM or 2 × 3/0
370	600 MCM or 2 × 4/0 or 3 × 1/0
405	700 MCM or 2 × 4/0 or 3 × 2/0
449	2 × 250 MCM or 3 × 2/0
502	2 × 300 MCM or 3 × 3/0
546	2 × 350 MCM or 3 × 4/0
590	2 × 400 MCM or 3 × 4/0
669	2 × 500 MCM or 3 × 250 MCM
739	2 × 600 MCM or 3 × 300 MCM
810	2 × 700 MCM or 3 × 350 MCM
884	3 × 400 MCM or 4 × 250 MCM
1003	3 × 500 MCM or 4 × 300 MCM
1109	3 × 600 MCM or 4 × 400 MCM
1214	3 × 700 MCM or 4 × 500 MCM

Cable entries

Input, motor and brake resistor cable terminal sizes (per phase) and tightening torques are given below. Two-hole 1/2 inch diameter cable lugs can be used.

Frame size		L1, L2, L3, U2, V2, W2, UDC+/R+, UDC-, R-		Earthing PE	
	Max. cable kcmil/AWG	Screw	Tightening torque lbf ft	Screw	Tightening torque lbf ft
R6	350 MCM	3/8	14.8...29.5	3/8	22...32
R7	2 × 250 MCM	1/2	37...55	3/8	22...32
R8	3 × 700 MCM	1/2	37...55	3/8	22...32

Dimensions, weights and noise

Frame size	Height [1]		Width [2]	Depth [5]	Weight	Noise
	UL type 1 in.	UL type 12 in.	 in.	 in.	 lb	 dB
R6	84.22	91.08	16.93	27.28	700	63
R7	84.22	91.08	32.92 [3]	27.28	900	71
R8	84.22	91.08	32.92 [4]	27.28	1100	72

1) in marine applications (+C121) extra height: 0.39 in. from the fastening bar at the bottom of the cabinet

2) extra width for units with brake resistors (+D151): SAFURxxxFxxx 15.75 in., 2xSAFURxxxFxxx 19.68 in., 4xSAFURxxxFxxx 62.99 in.

3) extra width for units with EMC filter (+E202): 7.87 in.

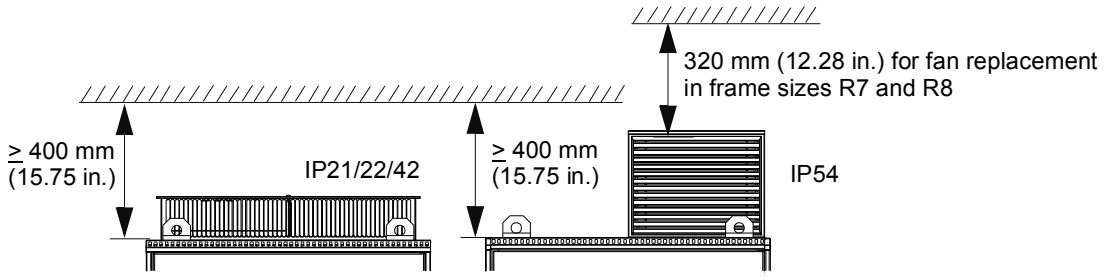
4) extra width for units with EMC filter (+E202): 15.75 in.

5) in marine applications (+C121) depth with fastening bars: 27.56 in.

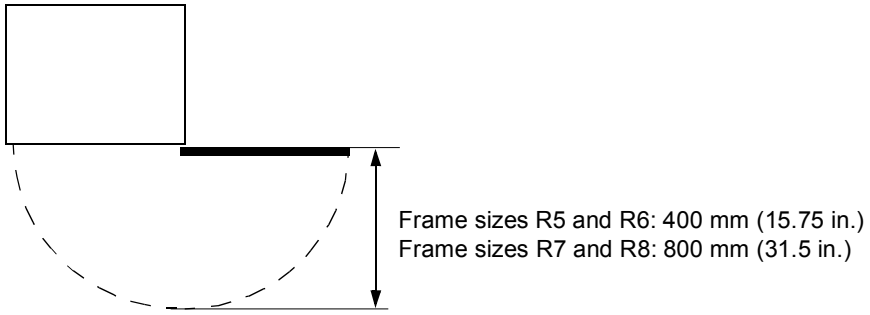
Free space around the unit

Frame size	Required free space around the unit for cooling					
	Front		Side		Above*	
	mm	in.	mm	in.	mm	in.
R5	150	5.91	-	-	400	15.75
R6	150	5.91	-	-	400	15.75
R7	150	5.91	-	-	400	15.75
R8	150	5.91	-	-	400	15.75

* measured from the base plate of the cabinet top



Space requirement for the door opening:



Input power connection

Voltage (U_1)

380/400/415 VAC 3-phase ± 10% for 400 VAC units

380/400/415/440/460/480/500 VAC 3-phase ± 10% for 500 VAC units

525/550/575/600/660/690 VAC 3-phase ± 10% for 690 VAC units

Rated short-time and peak withstand current

IEC 60439-1

I_{cw} / 1 sec.	I_{pk}
50 kA	105 kA

UL 508A, CSA C22.2 No. 14-05

US and Canada: The drive is suitable for use in a circuit capable of delivering not more than 100,000 symmetrical amperes (rms) at 600 V maximum.

Frequency

48 to 63 Hz, maximum rate of change 17%/s

Imbalance

Max. ± 3% of nominal phase to phase input voltage

Fundamental power factor (cos phi$_1$)

0.98 (at nominal load)

Motor connection

Voltage (U_2)

0 to L_1, 3-phase symmetrical, U_{max} at the field weakening point

Frequency

DTC mode: 0 to 3.2 · f_{FWP}. Maximum frequency 300 Hz.

$$f_{FWP} = \frac{U_{Nmains}}{U_{Nmotor}} \cdot f_{Nmotor}$$

f_{FWP}: frequency at field weakening point; U_{Nmains}: mains (input power) voltage; U_{Nmotor}: nominal motor voltage; f_{Nmotor}: nominal motor frequency

Frequency resolution

0.01 Hz

Current

See section *IEC data*.

Power limit

1.5 · P_{hd}, 1.1 · P_N or $P_{cont.max}$ (whichever value is greatest)

Nominal motor frequency

8 to 300 Hz

Switching frequency

3 kHz (average). In 690 V units 2 kHz (average).

Maximum recommended motor cable length

Type code (EMC equipment)	Max. motor cable length	
	DTC control	Scalar control
-	300 m (984 ft)	300 m (984 ft)
+E202 *, +E210 *	100 m (328 ft)	100 m (328 ft)

* Motor cable longer than 100 m (328 ft) is allowed but then the EMC Directive requirements may not be fulfilled.

Efficiency

Approximately 98% at nominal power level

Cooling

Method Internal fan, flow direction from front to top

Filter material

	Inlet (door)	Outlet (roof)
IP22 / IP42 units	airTex G150 288 mm x 292 mm 688 mm x 521 mm	-
IP54 units	Luftfilter/airComp 300-50 288 mm x 292 mm 688 mm x 521 mm	Luftfilter/airTex G150 2 pcs: 398 mm x 312 mm

Free space around the unit See *Free space around the unit*.

Cooling air flow See *IEC data.*

Degrees of protection

IP21 (UL type 1), IP22 (UL type 1), IP42 (UL type 2),
IP54 (UL type 12 for indoor use only), IP54R

Ambient conditions

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

	Operation installed for stationary use	**Storage** in the protective package	**Transportation** in the protective package
Installation site altitude	0 to 4000 m (13123 ft) above sea level [above 1000 m (3281 ft), see section *Derating*]. Cabinets with option +Q968: 0 to 2000 m (6562 ft)	-	-
Air temperature	-15 to +50 °C (5 to 122 °F). No frost allowed. See section *Derating.*	-40 to +70 °C (-40 to +158 °F)	-40 to +70 °C (-40 to +158 °F)
Relative humidity	5 to 95%	Max. 95%	Max. 95%
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination levels (IEC 60721-3-3, IEC 60721-3-2, IEC 60721-3-1)	No conductive dust allowed.		
	Boards without coating: Chemical gases: Class 3C1 Solid particles: Class 3S2 **Boards with coating:** Chemical gases: Class 3C2 Solid particles: Class 3S2	**Boards without coating:** Chemical gases: Class 1C2 Solid particles: Class 1S3 **Boards with coating:** Chemical gases: Class 1C2 Solid particles: Class 1S3	**Boards without coating:** Chemical gases: Class 2C2 Solid particles: Class 2S2 **Boards with coating:** Chemical gases: Class 2C2 Solid particles: Class 2S2
Atmospheric pressure	70 to 106 kPa 0.7 to 1.05 atmospheres	70 to 106 kPa 0.7 to 1.05 atmospheres	60 to 106 kPa 0.6 to 1.05 atmospheres
Vibration (IEC 60068-2)	Max. 1 mm (0.04 in.) (5 to 13.2 Hz), max. 7 m/s^2 (23 ft/s^2) (13.2 to 100 Hz) sinusoidal	Max. 1 mm (0.04 in.) (5 to 13.2 Hz), max. 7 m/s^2 (23 ft/s^2) (13.2 to 100 Hz) sinusoidal	Max. 3.5 mm (0.14 in.) (2 to 9 Hz), max. 15 m/s^2 (49 ft/s^2) (9 to 200 Hz) sinusoidal
Shock (IEC 60068-2-27)	Not allowed	Max. 100 m/s^2 (330 ft./s^2), 11 ms	Max. 100 m/s^2 (330 ft./s^2), 11 ms
Free fall	Not allowed	100 mm (4 in.) for weight over 100 kg (220 lb)	100 mm (4 in.) for weight over 100 kg (220 lb)

Materials

Cabinet	Hot-dip zinc coated 1.5 mm thick steel sheet (thickness of coating approximately 20 micrometres). Polyester thermosetting powder coating (thickness approximately 80 micrometres) on visible surfaces. Colour RAL 7035 light beige semigloss.
Busbars	Tin-plated copper
Fire safety of materials (IEC 60332-1)	Insulating materials and non-metallic items mostly self-extinctive
Package	Wood. Plastic covering of the package: PE-LD, bands PP or steel.
Disposal	The drive contains raw materials that should be recycled to preserve energy and natural resources. The package materials are environmentally compatible and recyclable. All metal parts can be recycled. The plastic parts can either be recycled or burned under controlled circumstances, according to local regulations. Most recyclable parts are marked with recycling marks. If recycling is not feasible, all parts excluding electrolytic capacitors and printed circuit boards can be landfilled. The DC capacitors (C1-1 to C1-x) contain electrolyte and the printed circuit boards contain lead, both of which are classified as hazardous waste within the EU. They must be removed and handled according to local regulations. For further information on environmental aspects and more detailed recycling instructions, please contact your local ABB distributor.

Applicable standards

	The drive complies with the standards below. The compliance with the European Low Voltage Directive is verified according to standards EN 61800-5-1 and EN 60204-1.
• IEC/EN 61800-5-1:2007	*Adjustable speed electrical power drive systems. Part 5-1: Safety requirements – electrical, thermal and energy*
• EN 60204-1:2006 + A1:2009	*Safety of machinery. Electrical equipment of machines. Part 1: General requirements.* Provisions for compliance: The final assembler of the machine is responsible for installing emergency-stop device.
• EN 60529:1991	*Degrees of protection provided by enclosures (IP code)*
• IEC 60664-1:2007	*Insulation coordination for equipment within low-voltage systems. Part 1: Principles, requirements and tests.*
• EN 61800-3:2004	*Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods*
• UL 508C (2010)	*UL Standard for Safety, Power Conversion Equipment, second edition*
• UL 508A (2010)	*UL Standard for Industrial Control Panels, first edition*
• NEMA 250 (2003)	*Enclosures for Electrical Equipment (1000 Volts Maximum)*
• CSA C22.2 No. 14-13 (2013)	*Industrial control equipment*
• GOST R 51321-1:2007	*Low-voltage switchgear and control gear assemblies. Part 1 – Requirements for typetested and partially type-tested assemblies – General technical requirements and methods of tests*

CE marking

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

Compliance with the European Low Voltage Directive

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

Compliance with the European EMC Directive

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

Compliance with the European Machinery Directive

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

Compliance with EN 61800-3:2004

Definitions

EMC stands for **E**lectro**m**agnetic **C**ompatibility. It is the ability of electrical/electronic equipment to operate without problems within an electromagnetic environment. Likewise, the equipment must not disturb or interfere with any other product or system within its locality.

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

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

Drive of category C2: drive of rated voltage less than 1000 V and intended to be installed and commissioned only by a professional when used in the first environment. **Note:** A professional is a person or organisation having necessary skills in installing and/or commissioning power drive systems, including their EMC aspects.

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

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

Category C2

The drive complies with the standard with the following provisions:

1. The drive is equipped with EMC filter E202.
2. The motor and control cables are selected as specified in the *Hardware Manual*.
3. The drive is installed according to the instructions given in the *Hardware Manual*.
4. Maximum cable length is 100 metres.

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

Note: It is not allowed to install a drive equipped with EMC filter E202 on IT (unearthed) systems. The supply network becomes connected to earth potential through the EMC filter capacitors which may cause danger or damage the unit.

Category C3

The drive complies with the standard with the following provisions:

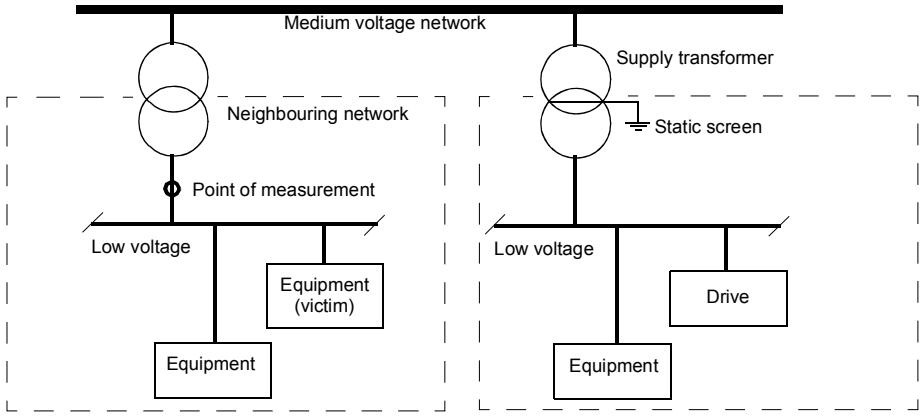
1. The drive is equipped with EMC filter E200 [suitable for TN (earthed) systems] or E210 [suitable for TN (earthed) and IT (unearthed) systems].
2. The motor and control cables are selected as specified in the *Hardware Manual*.
3. The drive is installed according to the instructions given in the *Hardware Manual*.
4. Maximum cable length is 100 metres.

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

Category C4

If the provisions under *Category C3* cannot be met, the requirements of the standard can be met as follows:

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



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

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

“C-tick” marking

“C-tick” marking is required in Australia and New Zealand. A “C-tick” mark is attached to each drive in order to verify compliance with the relevant standard (EN 61800-3:2004 – *Adjustable speed electrical power drive systems – Part 3: EMC product standard including specific test methods*), mandated by the Trans-Tasman Electromagnetic Compatibility Scheme. See section *Compliance with EN 61800-3:2004* on page *134*.

GOST-R certificate of conformity

The drive has been given a GOST-R certificate of conformity.

UL marking

The ACS800-U7 and the ACS800-07+C129 are cULus Listed. The approval is valid with rated voltages (up to 600 V).

UL checklist

- The drive is to be used in a heated, indoor controlled environment. The drive must be installed in clean air according to enclosure classification. Cooling air must be clean, free from corrosive materials and electrically conductive dust. See section *Ambient conditions* for specific limits.
- The maximum ambient air temperature is 40 °C (104 °F) at rated current. The current is derated for 40 to 55 °C (104 to 131 °F).
- The drive is suitable for use in a circuit capable of delivering not more than 100,000 rms symmetrical amperes, 600 V maximum when protected by the UL classified fuses. The ampere rating is based on tests done according to the appropriate UL standard.
- The cables located within the motor circuit must be rated for at least 75 °C (167 °F) in UL-compliant installations.
- The input cable must be protected with fuses. Circuit breakers must not be used without fuses in the USA. Suitable IEC (class aR) fuses and UL (class T) fuses are listed in this manual. For suitable circuit breakers, contact your local ABB representative.
- For installation in the United States, branch circuit protection must be provided in accordance with the National Electrical Code (NEC) and any applicable local codes. To fulfill this requirement, make sure that the drive is cULus Listed.
- For installation in Canada, branch circuit protection must be provided in accordance with the Canadian Electrical Code and any applicable provincial codes. To fulfill this requirement, make sure that the drive is cULus Listed.
- The drive provides overload protection in accordance with the National Electrical Code (NEC).
- ABB brake choppers, when applied with appropriately sized brake resistors, will allow the drive to dissipate regenerative energy (normally associated with quickly decelerating a motor). Proper application of the brake chopper is defined in chapter *Resistor braking*.

CSA marking

The ACS800-07+C134 is CSA certified. The approval is valid with rated voltages (up to 600 V).

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.

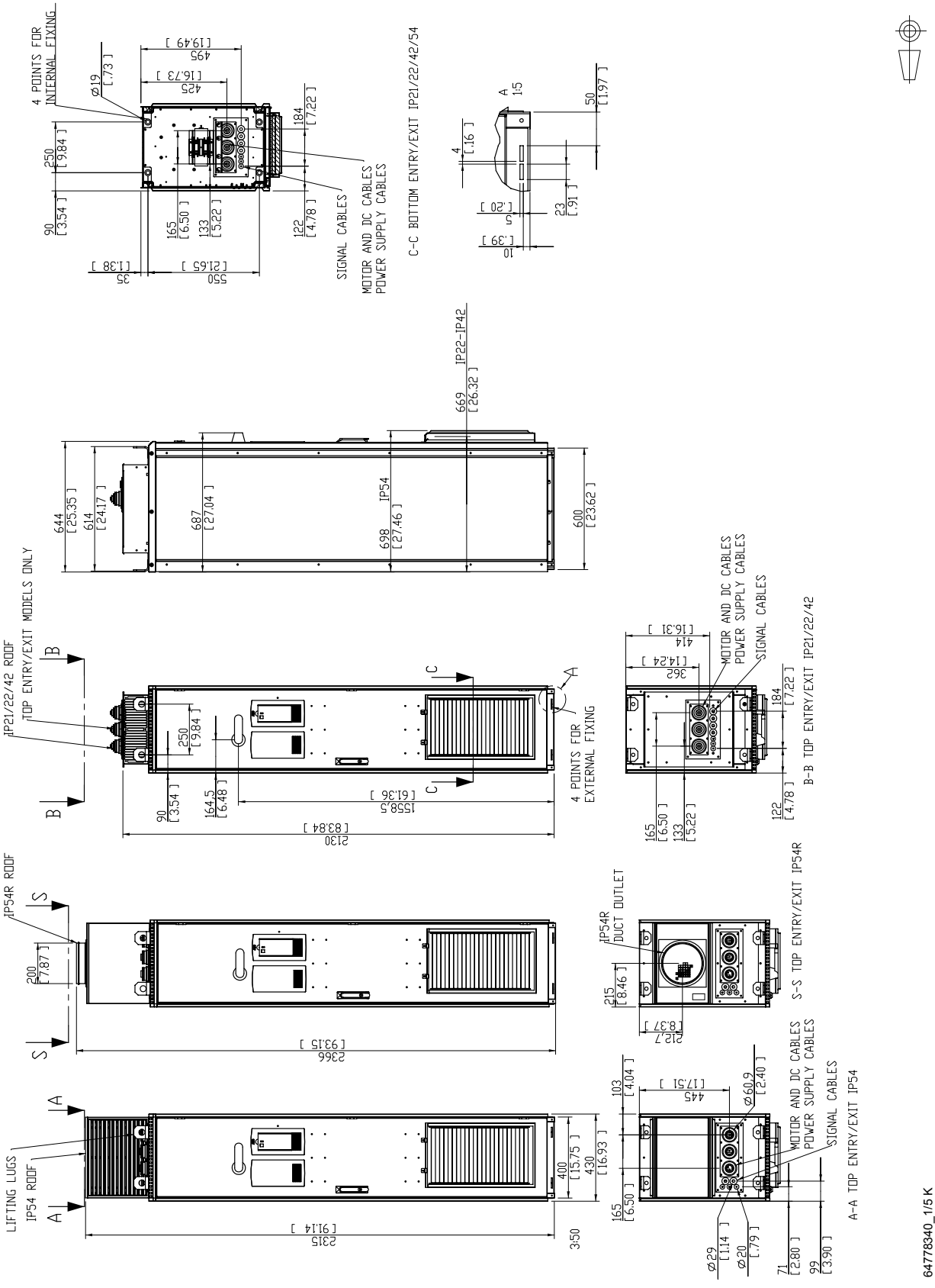
Dimensional drawings

Example dimensional drawings with dimensions in millimetres and [inches] are shown below.

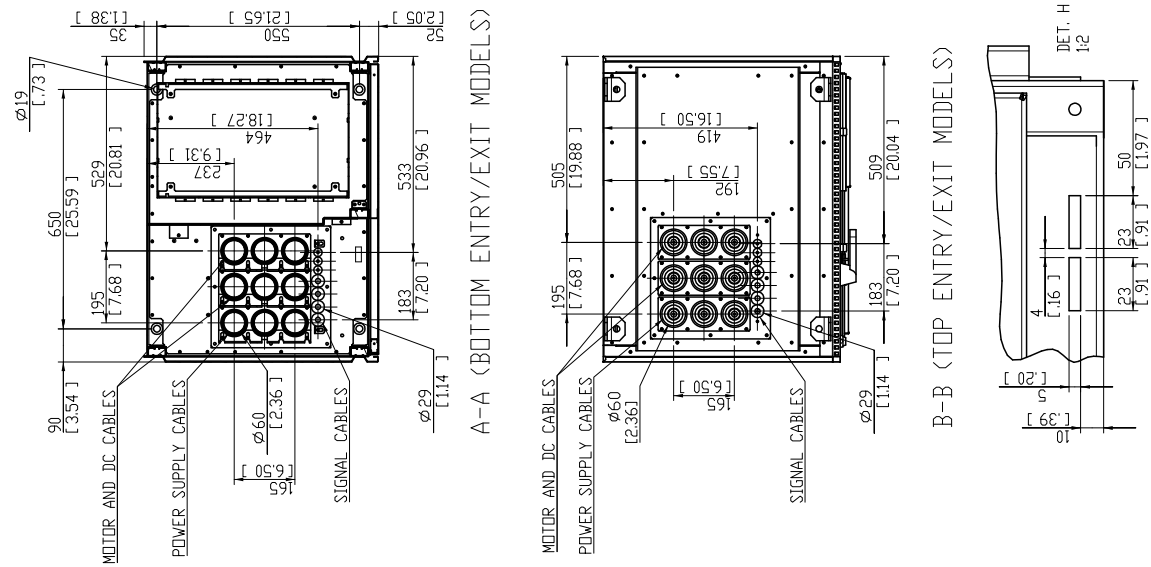
See *ACS800-07/U7 Dimensional Drawings* [3AFE 64775421 (English)] for

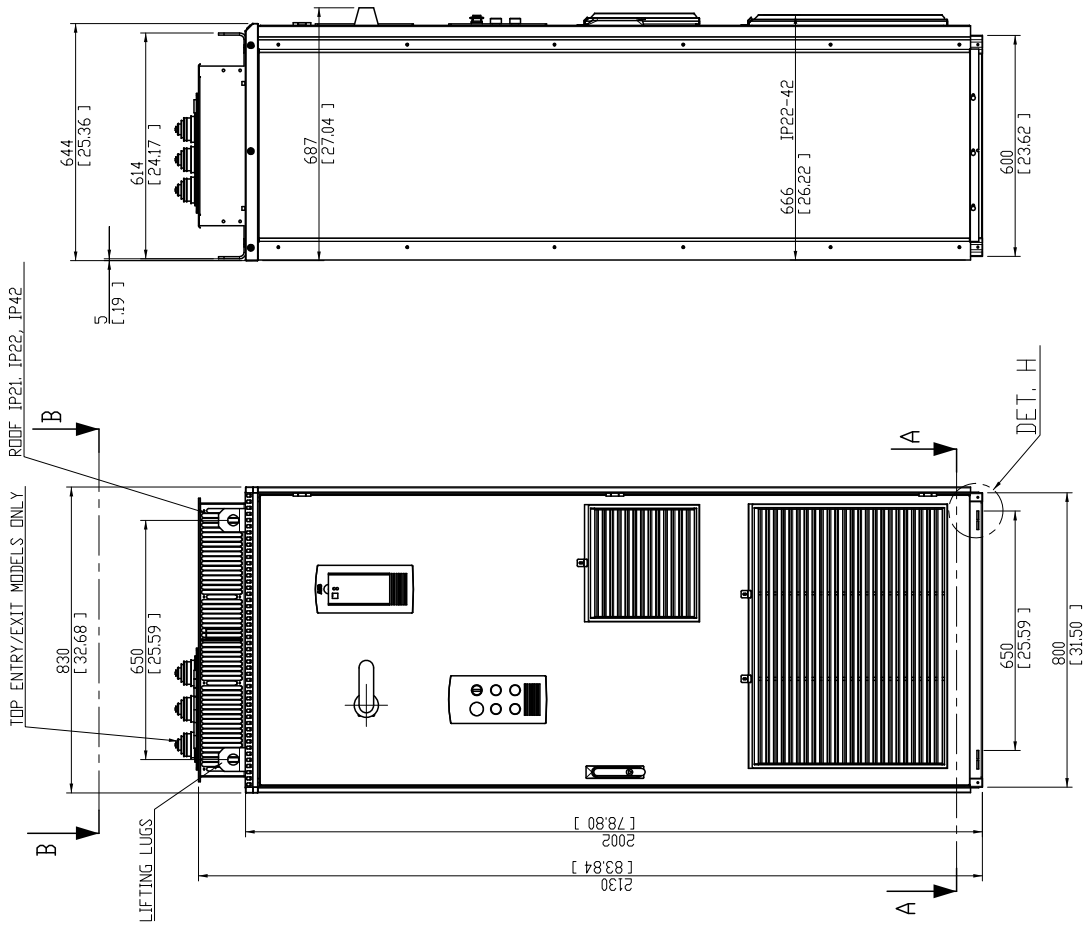
- location of cable connection terminals
- units with EMC filter, du/dt filter and brake resistors
- marine units
- US drawings.

Frame sizes R5 and R6



Frame sizes R7 and R8





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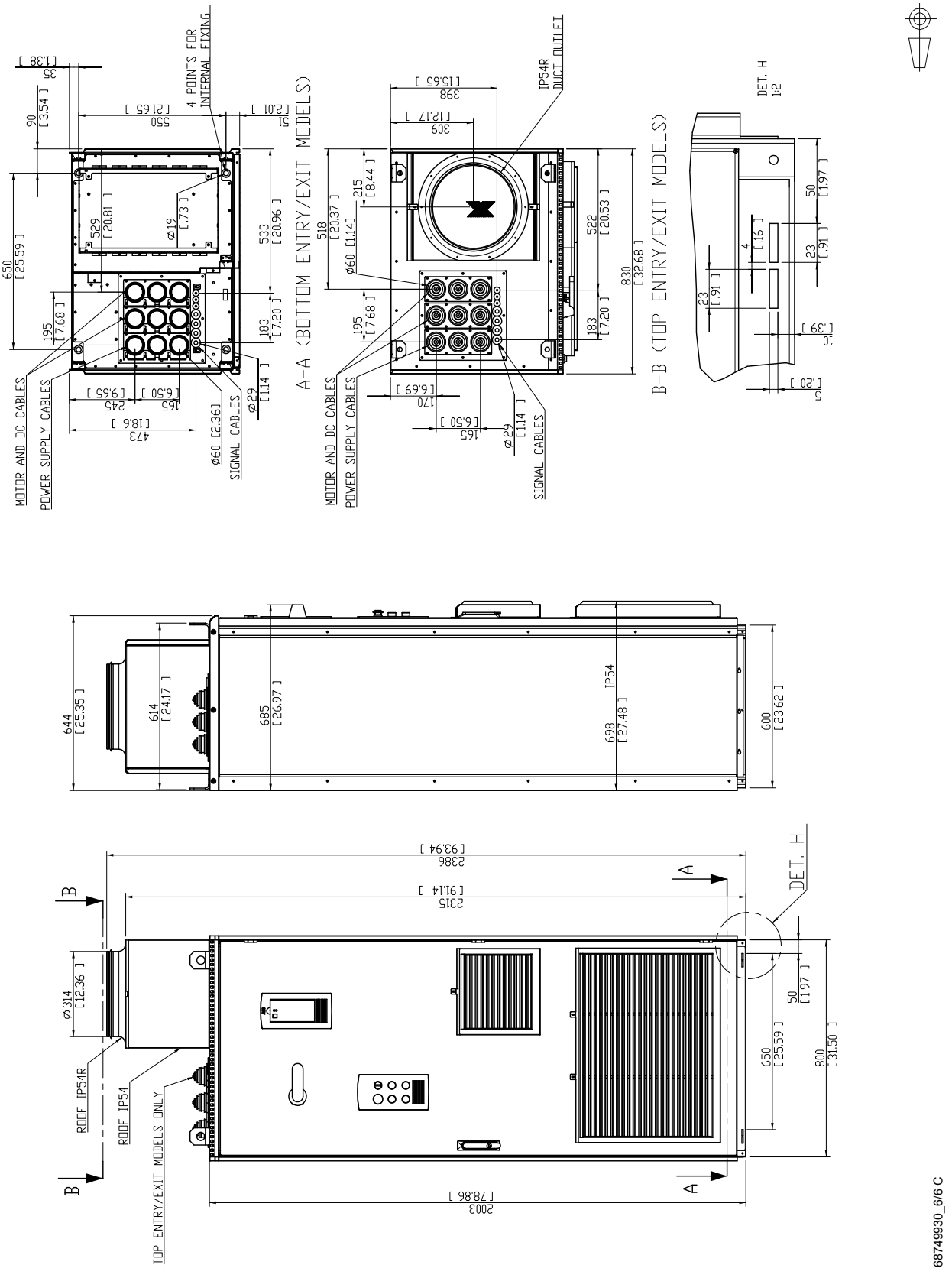
IP54 and IP54R units of frame sizes R7 and R8



Resistor braking

What this chapter contains

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

Availability of brake choppers and resistors

Brake choppers are optionally available as built-in units, indicated in the type code by +D150.

Resistors are available as add-on kits or factory installed (+D151).

How to select the correct drive/chopper/resistor combination

1. Calculate the maximum power *(P_{max})* generated by the motor during braking.
2. Select a suitable drive / brake chopper / brake resistor combination for the application according to the following tables (take account of other factors in the drive selection also). The following condition must be met:

   $$P_{br} \geq P_{max}$$

   where

   P_{br} denotes P_{br5}, P_{br10}, P_{br30}, P_{br60}, or P_{brcont} depending on the duty cycle.

3. Check the resistor selection. The energy generated by the motor during a 400-second period must not exceed the resistor heat dissipation capacity E_R.

   If the E_R value is not sufficient, it is possible to use a four-resistor assembly in which two standard resistors are connected in parallel, two in series. The E_R value of the four-resistor assembly is four times the value specified for the standard resistor.

Note: A resistor other than the standard resistor can be used provided that:

- its resistance is not lower than the resistance of the standard resistor.

WARNING! Never use a brake resistor with a resistance below the value specified for the particular drive / brake chopper / resistor combination. The drive and the chopper are not able to handle the overcurrent caused by the low resistance.

- the resistance does not restrict the braking capacity needed, that is,,

$$P_{max} < \frac{U_{DC}^2}{R}$$

where

P_{max}	maximum power generated by the motor during braking
U_{DC}	voltage over the resistor during braking, eg,
	1.35 · 1.2 · 415 VDC (when supply voltage is 380 to 415 VAC),
	1.35 · 1.2 · 500 VDC. (when supply voltage is 440 to 500 VAC) or
	1.35 · 1.2 · 690 VDC (when supply voltage is 525 to 690 VAC).
R	resistor resistance (ohm)

- the heat dissipation capacity *(E_R)* is sufficient for the application (see step 3 above).

Optional brake chopper and resistor(s)

The nominal ratings for dimensioning the brake resistors for the ACS800-07/U7 are given below at an ambient temperature of 40 °C (104 °F).

ACS800-07/U7 type	Frame size	Braking power of the chopper and the drive				Brake resistor(s)			
		5/60 s P_{br5} (kW)	10/60 s P_{br10} (kW)	30/60 s P_{br30} (kW)	P_{brcont} (kW)	Type	R (ohm)	E_R (kJ)	P_{Rcont} (kW)
400 V units									
-0075-3	R5	-	-	-	70	SAFUR80F500	6	2400	6
-0100-3	R6	-	-	-	83	SAFUR125F500	4	3600	9
-0120-3	R6	-	-	-	113	SAFUR125F500	4	3600	9
-0135-3	R6	-	-	-	132	SAFUR200F500	2.70	5400	13.5
-0165-3	R6	-	-	-	132	SAFUR200F500	2.70	5400	13.5
-0205-3	R6	-	-	-	160	SAFUR200F500	2.70	5400	13.5
-0260-3	R8	240	240	240	173	2XSAFUR210F575	1.70	8400	21
-0320-3	R8	300	300	300	143	2xSAFUR200F500	1.35	10800	27
-0400-3	R8	375	375	273	130	4xSAFUR125F500	1.00	14400	36
-0440-3	R8	473	355	237	120	4xSAFUR210F575	0.85	16800	42
-0490-3	R8	500	355	237	120	4xSAFUR210F575	0.85	16800	42
500 V units									
-0105-5*	R5	-	-	-	83	SAFUR80F500	6	2400	6
-0120-5	R6	-	-	-	113	SAFUR125F500	4	3600	9
-0140-5	R6	-	-	-	135	SAFUR125F500	4	3600	9
-0165-5	R6	-	-	-	160	SAFUR125F500	4	3600	9
-0205-5	R6	-	-	-	160	SAFUR125F500	4	3600	9
-0255-5*	R6	-	-	-	200	SAFUR200F500	2.7	5400	13.5
-0270-5**	R8	240	240	240	240	2xSAFUR125F500	2.00	7200	18
-0300-5**	R8	280	280	280	280	2xSAFUR125F500	2.00	7200	18
-0320-5	R8	300	300	300	300	2xSAFUR125F500	2.00	7200	18
-0400-5	R8	375	375	375	234	2XSAFUR210F575	1.70	8400	21
-0440-5	R8	473	473	450	195	2xSAFUR200F500	1.35	10800	27
-0490-5	R8	480	480	470	210	2xSAFUR200F500	1.35	10800	27
-0550-5	R8	600	400 [4)]	300	170	4xSAFUR125F500	1.00	14400	36
-0610-5	R8	600 [3)]	400 [4)]	300	170	4xSAFUR125F500	1.00	14400	36

ACS800-07/U7 type	Frame size	Braking power of the chopper and the drive				Brake resistor(s)			
		5/60 s P_{br5} (kW)	10/60 s P_{br10} (kW)	30/60 s P_{br30} (kW)	P_{brcont} (kW)	Type	R (ohm)	E_R (kJ)	P_{Rcont} (kW)
690 V units									
-0070-7	R6	-	-	-	45	SAFUR90F575	8.00	1800	4.5
-0100-7	R6	-	-	-	55	SAFUR80F500	6.00	2400	6
-0120-7	R6	-	-	-	75	SAFUR80F500	6.00	2400	6
-0145-7	R6	-	-	-	160	SAFUR80F500	6.00	2400	6
-0175-7	R6	-	-	-	160	SAFUR80F500	6.00	2400	6
-0205-7	R6	-	-	-	160	SAFUR80F500	6.00	2400	6
-0260-7	R7	135 5)	120	100	80	SAFUR80F500	6.00	2400	6
-0320-7	R8	300	300	300	260	SAFUR200F500	2.70	5400	13.5
-0400-7	R8	375	375	375	375	SAFUR200F500	2.70	5400	13.5
-0440-7	R8	430	430	430	385	SAFUR200F500	2.70	5400	13.5
-0490-7	R8	550	400	315	225	2xSAFUR125F500	2.00	7200	18
-0550-7	R8	550	400	315	225	2xSAFUR125F500	2.00	7200	18
-0610-7	R8	550	400	315	225	2xSAFUR125F500	2.00	7200	18

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P_{br5} Maximum braking power of the drive with the specified resistor(s). The drive and the chopper will withstand this braking power for 5 seconds per minute.

P_{br10} The drive and the chopper will withstand this braking power for 10 seconds per minute.

P_{br30} The drive and the chopper will withstand this braking power for 30 seconds per minute.

P_{brcont} The drive and the chopper will withstand this continuous braking power. The braking is considered continuous if the braking time exceeds 30 s.

Note: Check that the braking energy transmitted to the specified resistor(s) in 400 seconds does not exceed E_R.

R Resistance value for the resistor assembly. **Note:** This is also the minimum allowed resistance for the brake resistor.

E_R Short energy pulse that the resistor assembly withstands every 400 seconds. This energy will heat the resistor element from 40 °C (104 °F) to the maximum allowable temperature.

P_{Rcont} Continuous power (heat) dissipation of the resistor when placed correctly. Energy E_R dissipates in 400 seconds.

* ACS800-0x types only

** ACS800-Ux types only

1) 240 kW possible if ambient temperature is below 33 °C (91 °F)

2) 160 kW possible if ambient temperature is below 33 °C (91 °F)

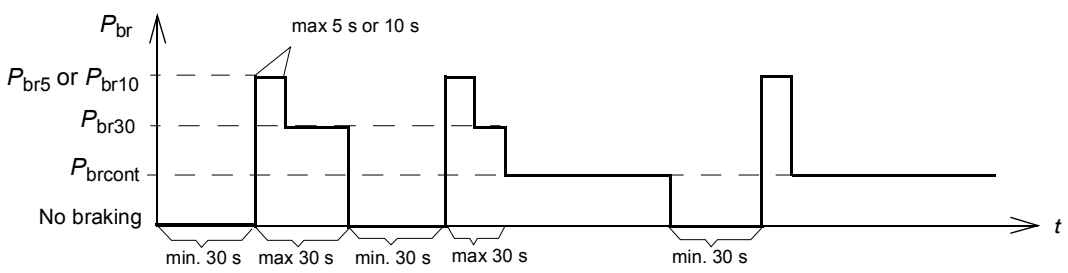
3) 630 kW possible if ambient temperature is below 33 °C (91 °F)

4) 450 kW possible if ambient temperature is below 33 °C (91 °F)

5) 160 kW possible if ambient temperature is below 33 °C (91 °F)

Combined braking cycles for R7:

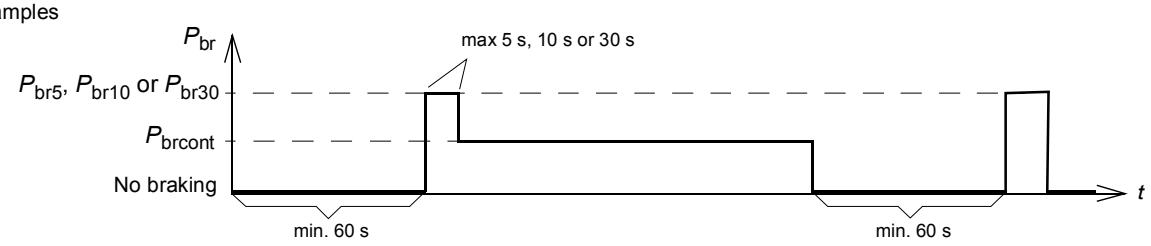
Examples



- After P_{br5}, P_{br10} or P_{br30} braking, the drive and the chopper will withstand P_{brcont} continuously.
- P_{br5}, P_{br10} or P_{br30} braking is allowed once every minute.
- After P_{brcont} braking, there has to be a pause of at least 30 seconds without any braking if the subsequent braking power is greater than P_{brcont}.
- After P_{br5} or P_{br10} braking, the drive and the chopper will withstand P_{br30} within a total braking time of 30 seconds.
- P_{br10} braking is not acceptable after P_{br5} braking.

Combined braking cycles for R8:

Examples



- After P_{br5}, P_{br10} or P_{br30} braking, the drive and the chopper will withstand P_{brcont} continuously. (P_{brcont} is the only allowed braking power after P_{br5}, P_{br10} or P_{br30}.)
- P_{br5}, P_{br10} or P_{br30} braking is allowed once every minute.
- After P_{brcont} braking, there has to be a pause of at least 60 seconds without any braking if the subsequent braking power is greater than P_{brcont}.

All brake resistors must be installed outside the converter module. The resistors are built in an IP00 metal frame. The 2xSAFUR and 4xSAFUR resistors are connected in parallel. **Note:** The SAFUR resistors are not UL listed.

Resistor installation and wiring

All resistors must be installed outside the drive module in a place where they will cool.

WARNING! The materials near the brake resistor must be non-flammable. The surface temperature of the resistor is high. Air flowing from the resistor is of hundreds of degrees Celsius. Protect the resistor against contact.

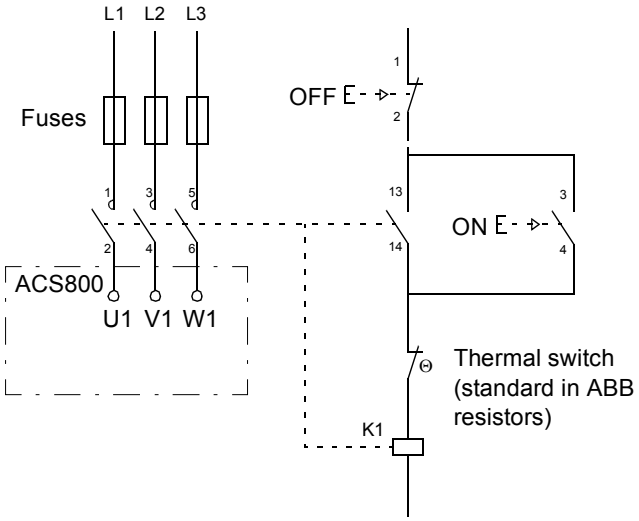
Use the cable type used for drive input cabling (refer to chapter *Technical data*) to ensure the input fuses will also protect the resistor cable. Alternatively, two-conductor shielded cable with the same cross-sectional area can be used. The maximum length of the resistor cable(s) is 10 m (33 ft). For the connections, see the power connection diagram of the drive.

If ordered, the resistors are factory installed in a cubicle(s) next to the drive cabinet.

Protection of frame size R5

It is highly recommended to equip the drive with a main contactor for safety reasons. Wire the contactor so that it opens in case the resistor overheats. This is essential for safety since the drive will not otherwise be able to interrupt the main supply if the chopper remains conductive in a fault situation.

Below is a simple example wiring diagram.

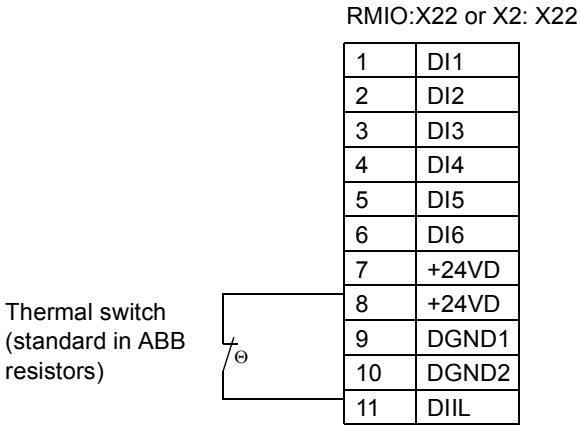


Protection of frame sizes R6, R7 and R8

A main contactor is not required for protecting against resistor overheating when the resistor is dimensioned according to the instructions and the internal brake chopper is in use. The drive will disable power flow through the input bridge if the chopper remains conductive in a fault situation. **Note:** If an external brake chopper (outside the drive module) is used, a main contactor is always required.

A thermal switch (standard in ABB resistors) is required for safety reasons. The cable must be shielded and not longer than the resistor cable.

With Standard Control Program, wire the thermal switch as shown below. By default, the drive will stop by coasting when the switch opens.



For other control programs, the thermal switch may be wired to a different digital input. Programming of the input to trip the drive by “EXTERNAL FAULT” may be needed. See the appropriate firmware manual.

Brake circuit commissioning

For Standard Control Program:

- Enable the brake chopper function (parameter 27.01).
- Switch off the overvoltage control of the drive (parameter 20.05).
- Check the resistance value setting (parameter 27.03).
- Frame sizes R6, R7 and R8: Check the setting of parameter 21.09. If stop by coasting is required, select OFF2 STOP.

For the use of the brake resistor overload protection (parameters 27.02...27.05), consult an ABB representative.

WARNING! If the drive is equipped with a brake chopper but the chopper is not enabled by parameter setting, the brake resistor must be disconnected because the protection against resistor overheating is then not in use.

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

For settings of other control programs, see the appropriate *Firmware Manual*.

Further information

Product and service inquiries

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

Product training

For information on ABB product training, navigate to www.abb.com/drives and select *Training courses*.

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