

ACS 5X0

Hardware Manuals
ACS5X0-07 Drives (1.1 ~ 110 kW)



ABB

ACS 5X0 Drive Manuals*

* ACS5X0 represents ACS550 or ACS510 in this Manual.

HARDWARE MANUALS (appropriate manual is included in the delivery)

ACS5X0-07 Hardware Manual 1.1 ~110 kW

ACS5X0-07 Dimension Drawing 1.1 ~110 kW

- Safety instructions
- Mechanical installation planning
- Electrical installation planning
- Mechanical and electrical installation
- Maintenance
- Technical data
- Dimensional drawings
- Resistor braking

General Manuals

ACS 550-01 User Manual 1.1 ~110 kW

ACS 510-01 User Manual 1.1 ~110 kW

OPTION MANUALS (delivered with optional equipment)

Fieldbus Adapters, I/O Extension Modules etc.

ACS5X0-07 Drives
1.1 ~ 110 kW

Hardware Manuals

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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.

Installation and maintenance work

These warnings are intended for all who work on the drive, motor cable or motor. Ignoring the instructions can cause physical injury or death.

WARNING!



- **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 U1, V1 and W3 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.

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 disconnecter 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-, BRK+, BRK- 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.

WARNING!



- Cover the drive when installing to ensure that dust from drilling or foreign objects do not enter the drive. Electrically conductive dust inside the unit may cause damage or lead to malfunction.
 - Ensure sufficient cooling.
 - It is not recommended to fasten the cabinet by welding.
 - 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.
-



WARNING! 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.

Grounding

These instructions are intended for all who are responsible for the grounding of the drive. Incorrect grounding can cause physical injury, death or equipment malfunction and increase electromagnetic interference.

WARNING!



- Ground the drive, the motor and adjoining equipment to ensure personnel safety in all circumstances, and to reduce electromagnetic emission and pick-up.
- 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).
- The grounding bolt must be removed when install a drive on an ungrounded power system or a high resistance-grounded (over 30 ohms) power system, (See ACS5X0 User Manual).

Note:



- Power cable shields are suitable for equipment grounding conductors only when adequately sized to meet safety regulations.

Operation

These warnings are intended for all who plan the operation of the drive or operate the drive. Ignoring the instructions can cause physical injury or death or damage the equipment.

WARNING!



- 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 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 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 (REM shown on the left of the top row of the LCD screen), 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 .
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About this 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.

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 R1, R2... or R6. 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](#).

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.

About this manual introduces this manual.

ACS5X0-07 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.

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

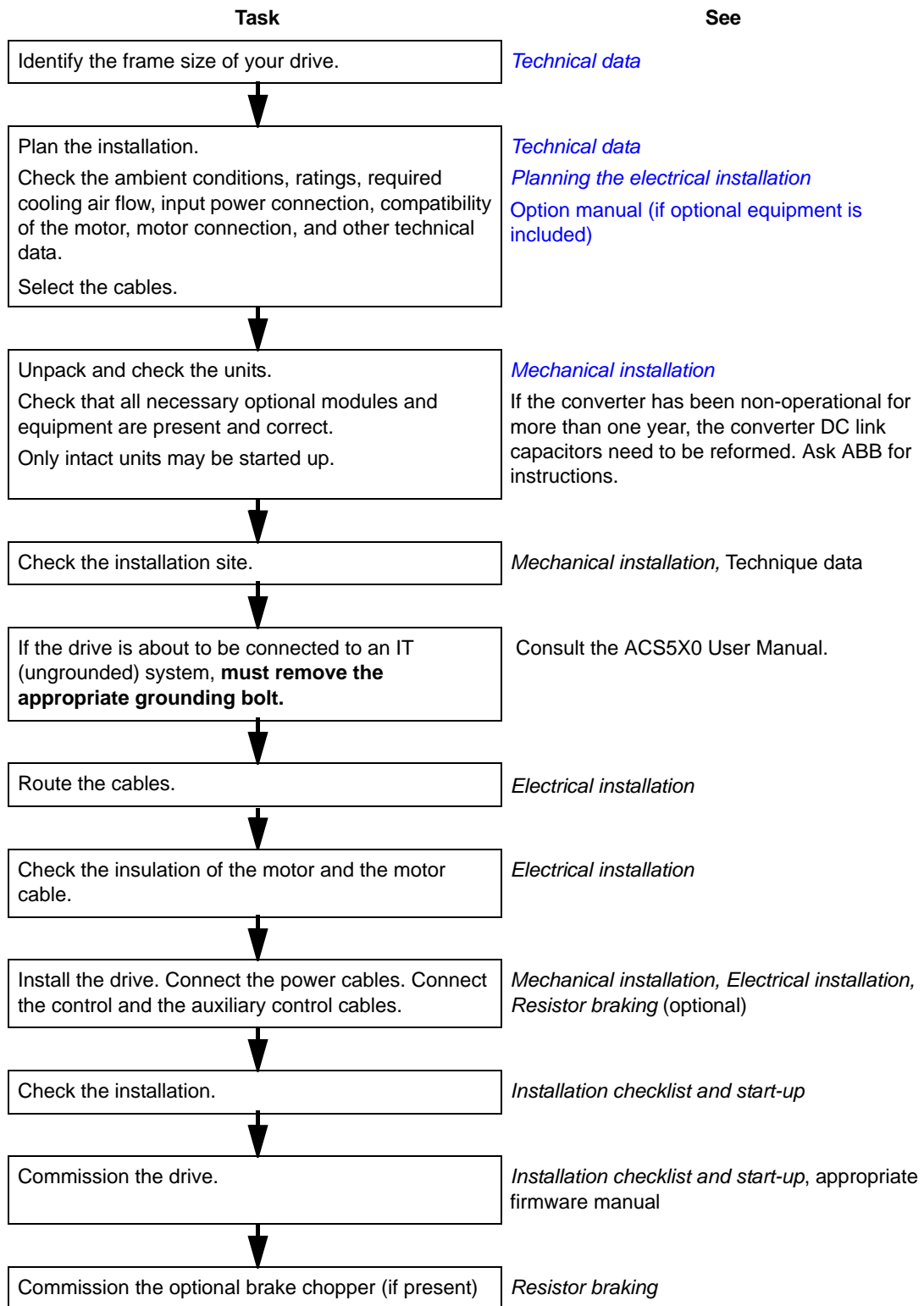
Maintenance contains preventive maintenance instructions.

Technical data contains the technical specifications of the drive, e.g. 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



Inquiries

Address any inquiries about the product to the local ABB representative, quoting the type code and the serial number of the unit. If the local ABB representative cannot be contacted, address inquiries to the manufacturing facility. (See the back cover of this manual for the detailed address and the phone number.)

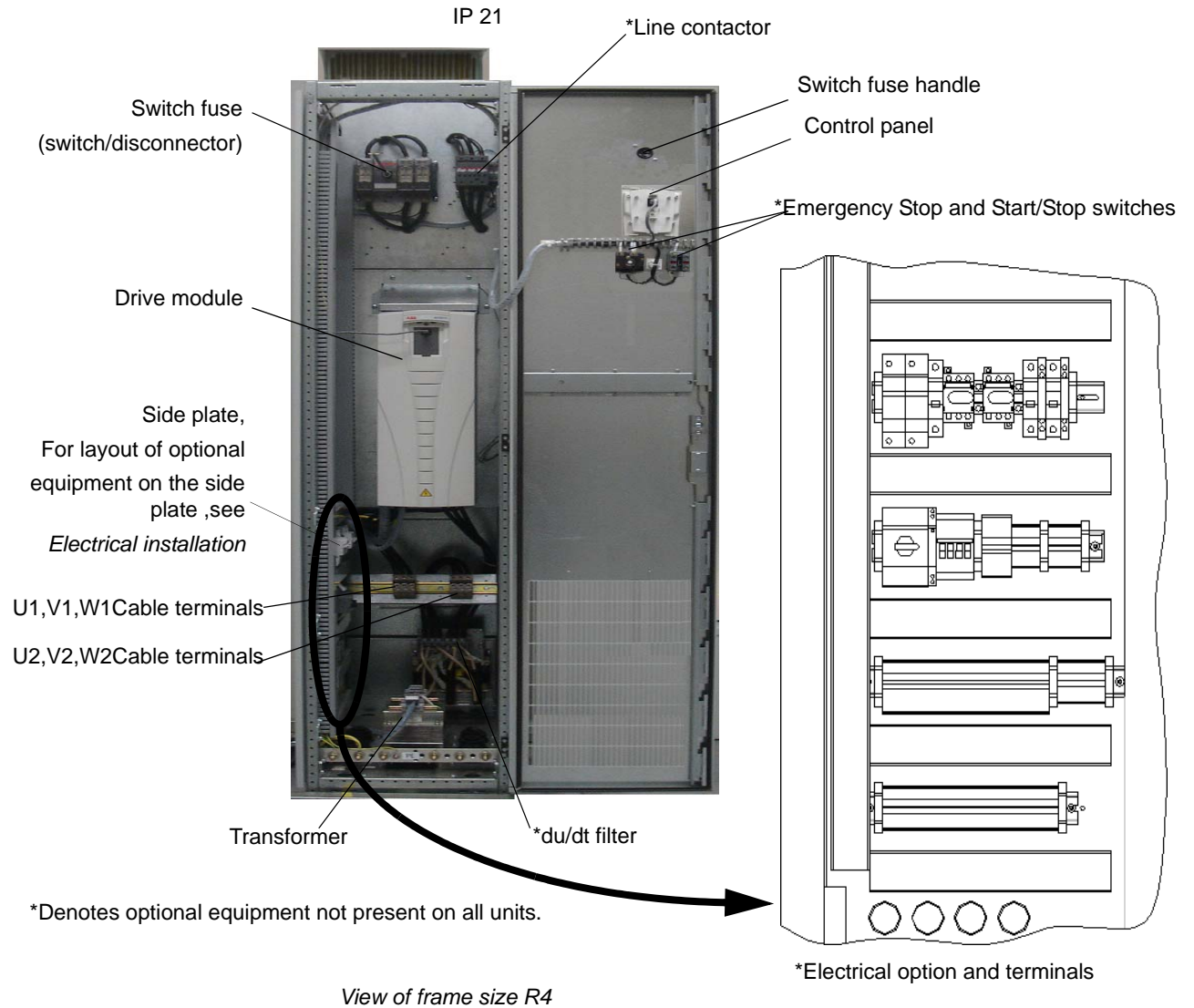
ACS5X0-07

What this chapter contains

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

ACS5X0-07

ACS5X0-07 is a cabinet-installed drive of ACS5X0 series



Type code

The type code contains information on the specifications and configuration of the drive.

For example: **ACS550-07-04A1/023A-4+B055**

ACS550-07-04A1/023A-4 denotes the basic configuration. The optional selections are given thereafter, separated by + signs (e.g. +B055, denotes IP54).

The main selections are described below.

Selection	Alternatives	
Product series	ACS 5X0 product series	
Type	-07	Cabinet built. Main function: 400mm cabinet (R5/R6:600mm cabinet), When no options are selected: IP 21, switch fuse with gG fuses, main cable input/output terminals, control panel ACS-CP-D, bottom entry and exit of cables, one set of manuals.
Size	For example:-04A1/023A (denotes the rating output current of the two drive module are 4.1A and 23A) For more information, refer to <i>Technical data: IEC rating</i> and <i>ACS5X0 Ordering Information</i>	
Voltage range	-4	380~480V
+ options		
Degree of protection	+B053 +B054 +B055	IP 22 (When selected, cabinet R3-R6 with a cooling fan duct) IP 42 (When selected, cabinet R3-R6 with a cooling fan duct) IP 54 (When selected, all type of cabinets are with a cooling fan duct)
Resistor braking	+D150 +D151	Brake chopper +braking resistor When selected, a 400mm cabinet will be added This option is noneffective for IP54 This option is noneffective for cabinet R1/R2
Filter	+E205	Du/dt filter (When selected, cabinet R3-R6 with a cooling fan duct)
Line options	+F250 +Q951 +F255	Line contactor + emergency stop (immediate removal of power) Moulded case circuit breaker(type Tmax, instead of switch OS and fuse link)
Cabinet options	+G300 +G307 +G313	Cabinet heater (defend low temperature, moistureproof, external supply) Terminals for external control voltage (UPS) Output for motor heater (external supply)
Cabling	+H351 +H353	Top entry + top exit
Fieldbus	+K451 +K452 +K454 +K457 +K462	DeviceNet adapter RDNA-01 LONWorks adapter RLON-01 Profibus-DP adapter RPBA-01 CANOpen adapter RCAN-01 ControlNet adapter RCNA-01
I/O expand	+L511 +L504 +L502	Relay output expand module OREL-01 Additional I/O terminal Pulse encoder interface OTAC-01
Language of manual	+R700	English document
Control panel	+J404	Basic control panel ACS-CP-C
Starter for auxiliary motor fan	+M600 +M601 +M602 +M603 +M604 +M605	1...1.6 A 1.6...2.5 A 2.5...4 A 4...6.3 A 6.3...10 A 10...16 A

In the table above, not all selections are available for all types. For more information, refer to *ACS 5X0 Ordering Information* or available on request.

Main circuit and control

Door switches

The following switches are mounted on the cabinet door:



Operating switch
(units with main contactor only)

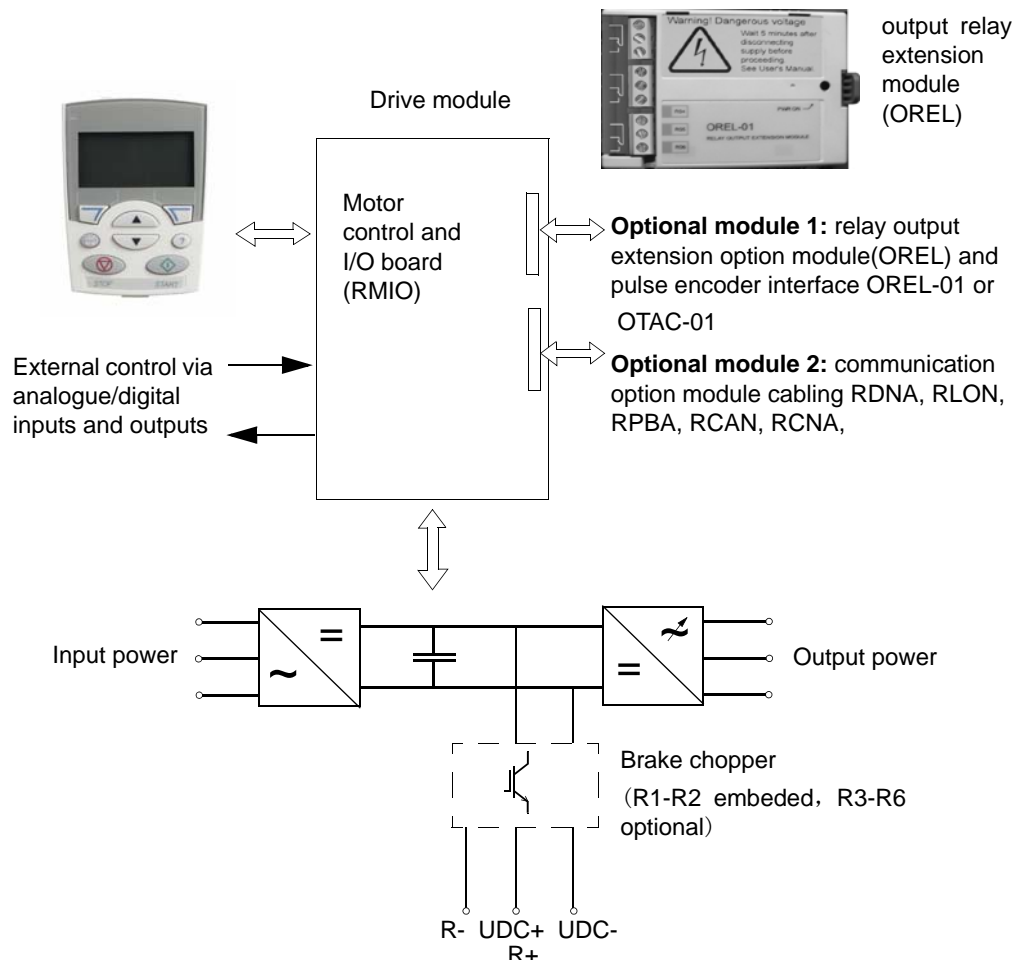
“2” position closes the main contactor; “1” position keeps the main contactor closed; “0” position opens the main contactor.



Emergency stop button (units with main contactor only)

Diagram of the main circuit and control

This diagram shows the control interfaces and the main circuit of the drive.(drive module in the cabinet).



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.

Motor control mode

The drive ACS550-07 contains the following motor control modes as standard:

Vector speed control mode

Vector torque control mode

Scalar control mode

The drive ACS510-07 only support scalar control mode.

Mechanical installation

What this chapter contains

This chapter describes the mechanical installation procedure of the drive.

Moving the unit

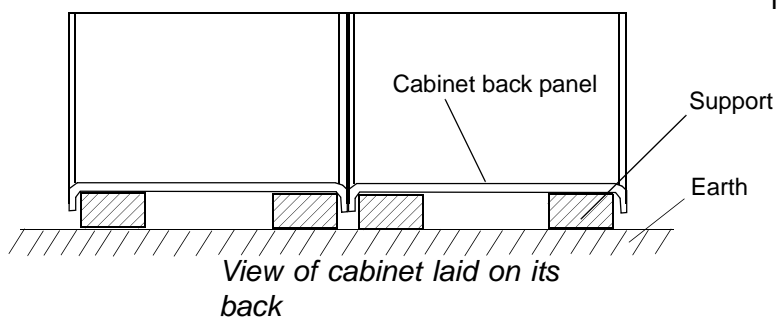
Move the transport package by truck and pallet truck to the installation site.



Move the cabinet by pallet truck



lift the drive by crane



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:

factory installed options, residual voltage warning stickers, hardware manual, user's manual, 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 the technical data of the drive, Type designation label

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

ABB Drives	Technical Data
	Input
ACS550-07-157A-4 +K454+F250+Q951+M603	U1 3~380...480 V
	I1 157 A
	f1 48...63 Hz
 3062820048	Output
	U2 3~0...U1 V
	I2 157 A
	f2 0...500 Hz

Type designation label(example)

Requirements for the installation site

Check the installation site according to the requirements below:

Refer to *Dimensional Drawings* for frame details.

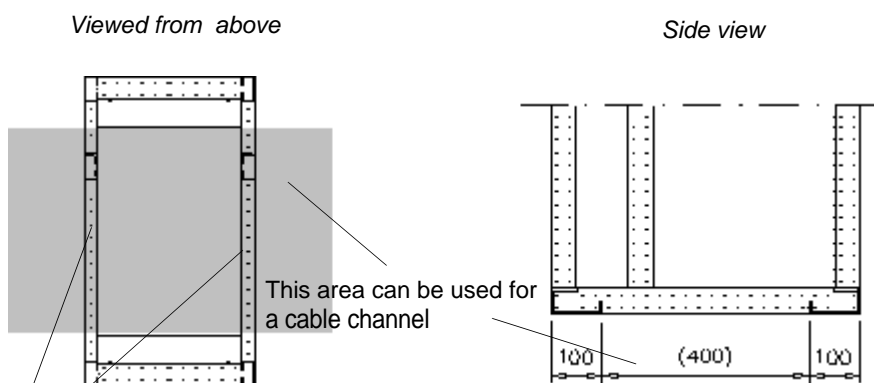
See *Technical data* for the allowed operation conditions of the drive.

Cooling air flow

Provide the drive with the amount of clean cooling air given in *Technical data* of ACS550/ACS510

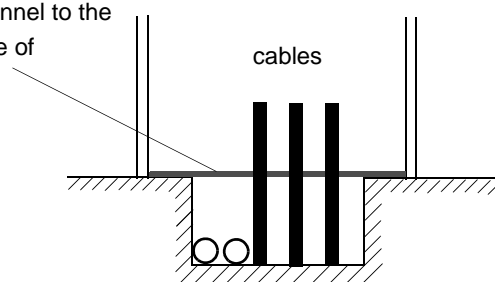
Cable channel in the floor below the cabinet

A cable channel can be constructed below the 400 mm wide middle part of the cabinet.



With heavy cabinets, support the structural C-sections from below.

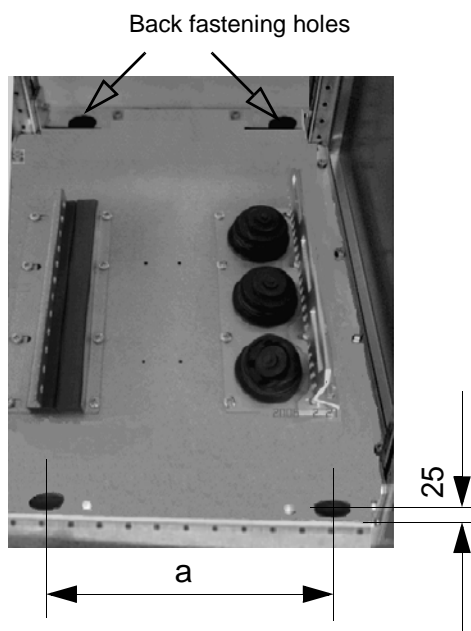
Prevent the cooling air flow from the cable channel to the cabinet by bottom plates. To ensure the degree of

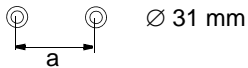


Fastening the cabinet

ABB recommend the manner of fastening the cabinet : by the fastening 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.

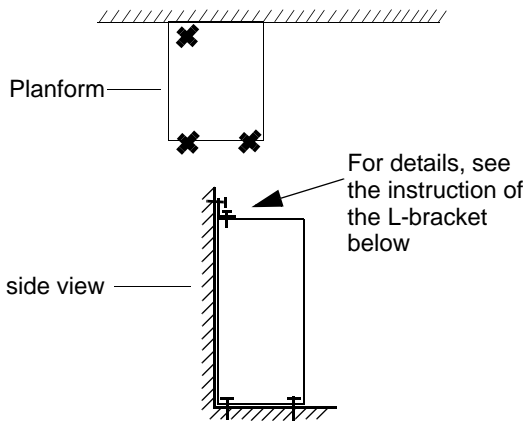


Cubicle width	Fastening hole distance in mm [in.]
mm	
400	a: 250
600	a: 450
800	a: 650

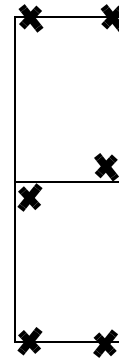
Fastening bolt: M10 to M12 .

Nonstandard manners to fastening the cabinet

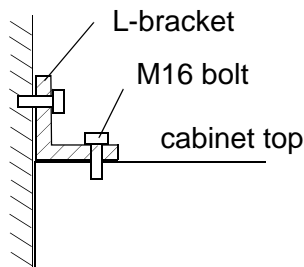
See diagram a and b shown below for the nonstandard methods to fastening the cabinet.



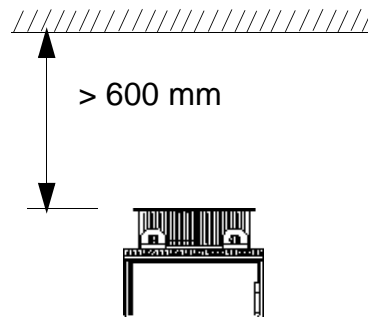
a: Fastening points when installed back against wall



b: Fastening points when installed back against back



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



> 600mm between roof and the cabinet top

Electric welding

Welding of the cabinet frame is not recommended by ABB.



WARNING! If the welding return wire is connected improperly, the welding circuit may damage electronic circuits in the cabinet.

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. Always follow local regulations.

Note: If the recommendations given by ABB are not followed, the drive may experience problems that the warranty does not cover.

To which products this chapter applies

This chapter applies to the ACS550-07 and ACS510-07.

Motor selection

Select the three-phase AC induction motor must according to the rating tables in chapter *Technical Data*.



WARNING! The running is forbidden if the motor rating input voltage less than the 1/2 drive rating voltage. The nominal current is $0 \dots 2 \cdot I_{2hd}$.

Supply connection

Disconnecting device (means)

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

Fuses

See section [Thermal overload and short-circuit protection](#).

Thermal overload and short-circuit protection

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.

Mains cable (AC line cable) short-circuit protection

Always protect the input cable with fuses. Size the fuses according to local safety regulations, appropriate input voltage and the rated current of the drive (see *Technical Data*).

When placed at the distribution board, standard IEC gG or UL T 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.

Operating time of the fuses

Check that the operating time of the fuse is below 0.5 seconds. The operating time depends on the fuse type, supply network impedance and the cross-sectional area, material and length of the supply cable. The US fuses must be of the “non-time delay” type.

For fuse ratings, see *Technical Data*.

Circuit breakers (TBD)

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.

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 the motor cable. This is not a personal safety or a fire protection feature.

The ground fault protective function can be disabled with a parameter(30.17)

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. Pressing the STOP key on the control panel of the drive does not generate:

- an emergency stop of the motor
- separate the drive from dangerous potential.

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 maximum permissible temperature of conductor in continuous use. For US, see section [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).

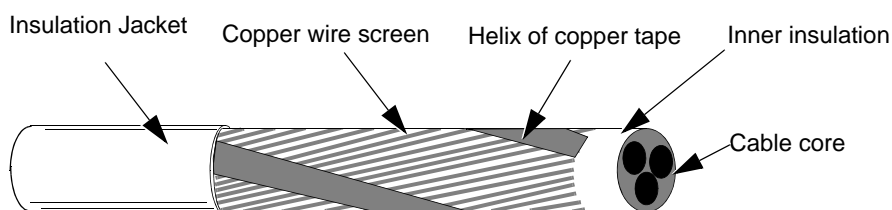
- 600 VAC cable is accepted for up to 500 VAC.

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
$16 < S \leq 36$	16
$36 < S$	$S/2$

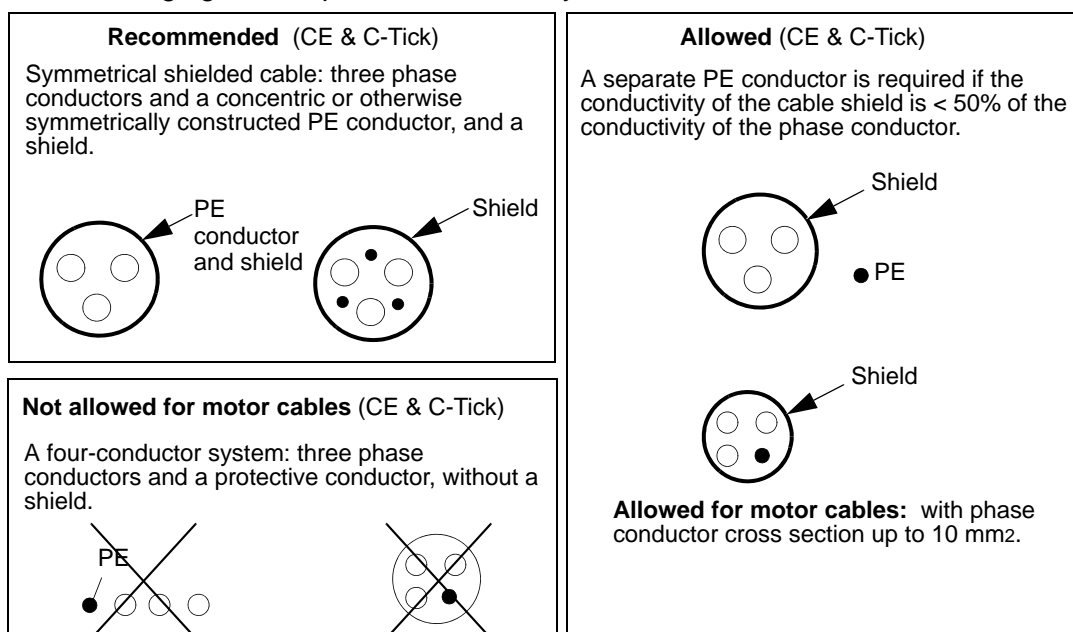
Motor cable shield

The motor cable must be a symmetrical three conductor cable with a concentric PE conductor or a four conductor cable with a concentric shield, however, a symmetrical constructed PE conductor is always recommended. The following figure shows the minimum requirement for the motor cable screen (for example, MCMK, NK Cables).



Recommendation for Conductor Layout

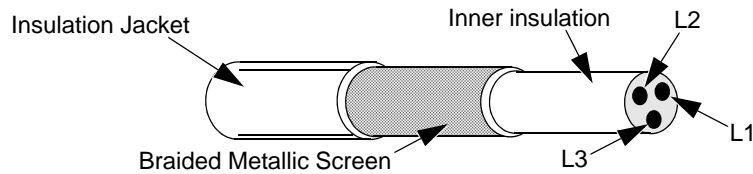
The following figure compares conductor layout features in motor cables.



Effective motor cable shield

The general rule for cable screen effectiveness is: the better and tighter the cable's screen, the lower the radiated emission level. The following figure shows an example of an effective construction (for example, Ölflex-Servo-FD 780 CP,

Lappkabel or MCCMK, NK Cables).



Conduit

Where conduits must be coupled together, bridge the joint with a ground conductor bonded to the conduit on each side of the joint. Bond the conduits also to the drive enclosure. Use separate conduits for input power, motor, brake resistors, and control wiring. Do not run motor wiring from more than one drive in the same conduit.

Armored cable / shielded power cable

The motor cables can be run in the same cable tray as other 460 V or 600 V power wiring. Control and signal cables must not be run in the same tray as power cables.

Equipment connected to the motor cable

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

In general circumstances, do not install any switches or electrical equipments in the motor cable. To minimize the emission level when safety switches, contactors, connection boxes or similar equipment are installed in the motor cable (i.e. between the drive and the motor), 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, and 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



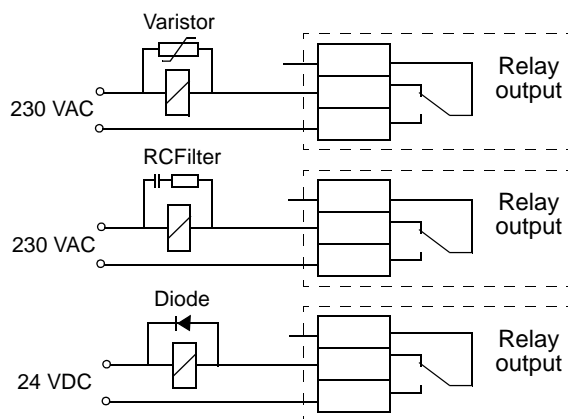
WARNING! Never connect the supply power to the drive output terminals U2, V2 and W2. If frequent bypassing is required, employ mechanically connected switches or contactors. Mains (line) voltage applied to the output can result in permanent damage to the unit.

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

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

it is highly recommended to equip inductive loads with noise attenuating circuits [varistors, RC filters (AC) or diodes (DC)] in order to minimize the 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.

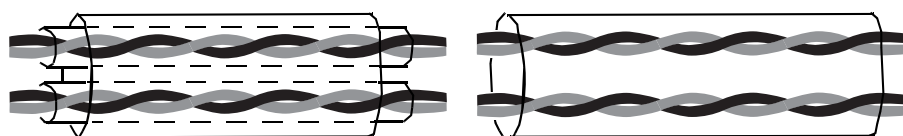


Selecting the control cables

All control cables must be shielded.

Use a double-shielded twisted pair cable (Figure a). 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 multipair cable (Figure b) is also usable.



a
A double-shielded twisted pair cable

b
A single-shielded twisted multipair 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 VDC and 115/230 VAC signals in the same cable.

Relay cable

The cable type with braided metallic screen is recommended.

Control panel cable

In remote use, the cable connecting the control panel to the drive must not exceed 3 metres (10 ft).

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 ACS 550 *User's Manual* or ACS 510 *User's manual*.

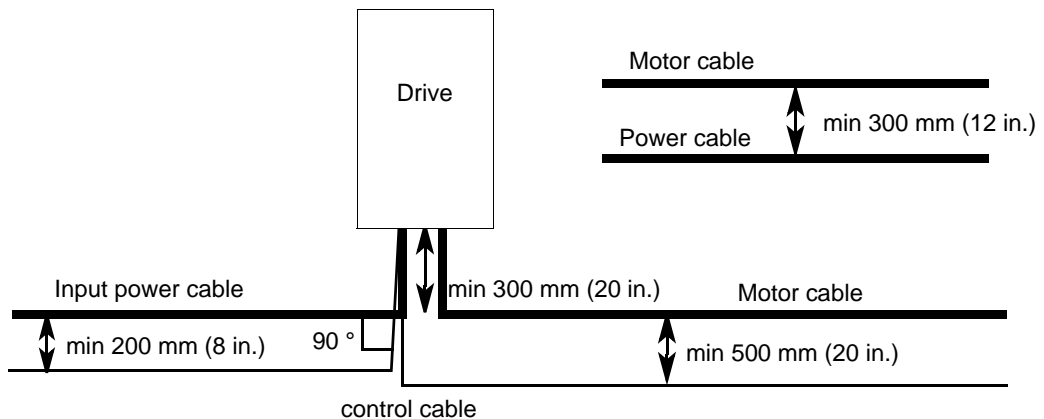
Routing the cables

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.

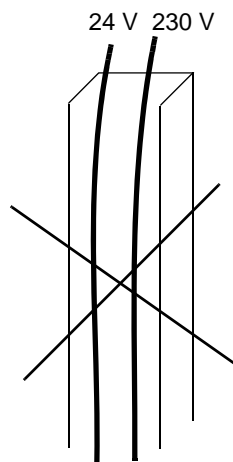
Where control cables must cross power cables make sure they are arranged at an angle as near to 90 degrees as possible.

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.

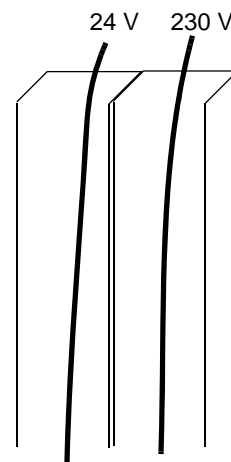


Control cable ducts



Not allowed manner:

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



Allowed manner:

Lead 24 V and 230 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! The work described in this chapter may only be carried out by a qualified electrician. Follow the [Safety instructions](#) on the first pages of this manual. Ignoring the safety instructions can cause injury or death.

Make sure that the drive is disconnected from the mains (input power) during installation. If the drive is already connected to the mains, wait for 5 min after disconnecting mains power.

Checking the insulation of the assembly

IT (ungrounded) systems

For floating networks (also known as IT, ungrounded, or impedance/resistance grounded networks):

- Disconnect the ground connection to the internal RFI filters:
 - ACS510-01, frame sizes R1...R4: Remove both the EM1 and EM3 screws (See *power cable connection diagram* of User's manual).
 - Frame sizes R5...R6: Remove both the F1 and F2 screws (See *power cable connection diagram* of User's manual).
 - Where EMC requirements exist, check for excessive emission propagated to neighboring low voltage networks. In some cases, the natural suppression in transformers and cables is sufficient. If in doubt, use a supply transformer with static screening between the primary and secondary windings.
-

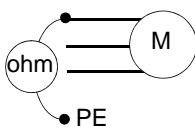


WARNING! If a drive is installed on an IT system [an ungrounded power system or a high resistance-grounded (over 30 ohms) power system], the system will be connected to earth potential through the EMC filter capacitors of the drive. This may cause danger or damage the unit.

Checking the insulation of the assembly

Every drive has been tested for insulation between the main circuit and the chassis (2500 V rms 50 Hz for 1 second) at the factory. Therefore, do not make any voltage tolerance or insulation resistance tests (e.g. hi-pot or megger) on any part of the drive. Check the insulation of the assembly as follows.

1. Check that the motor cable is disconnected from the drive output terminals U2, V2 and W2.
2. Measure the insulation resistances of the motor cable and the motor between each phase and the Protective Earth by using a measuring voltage of 1 kV DC. The insulation resistance must be higher than 1 Mohm.





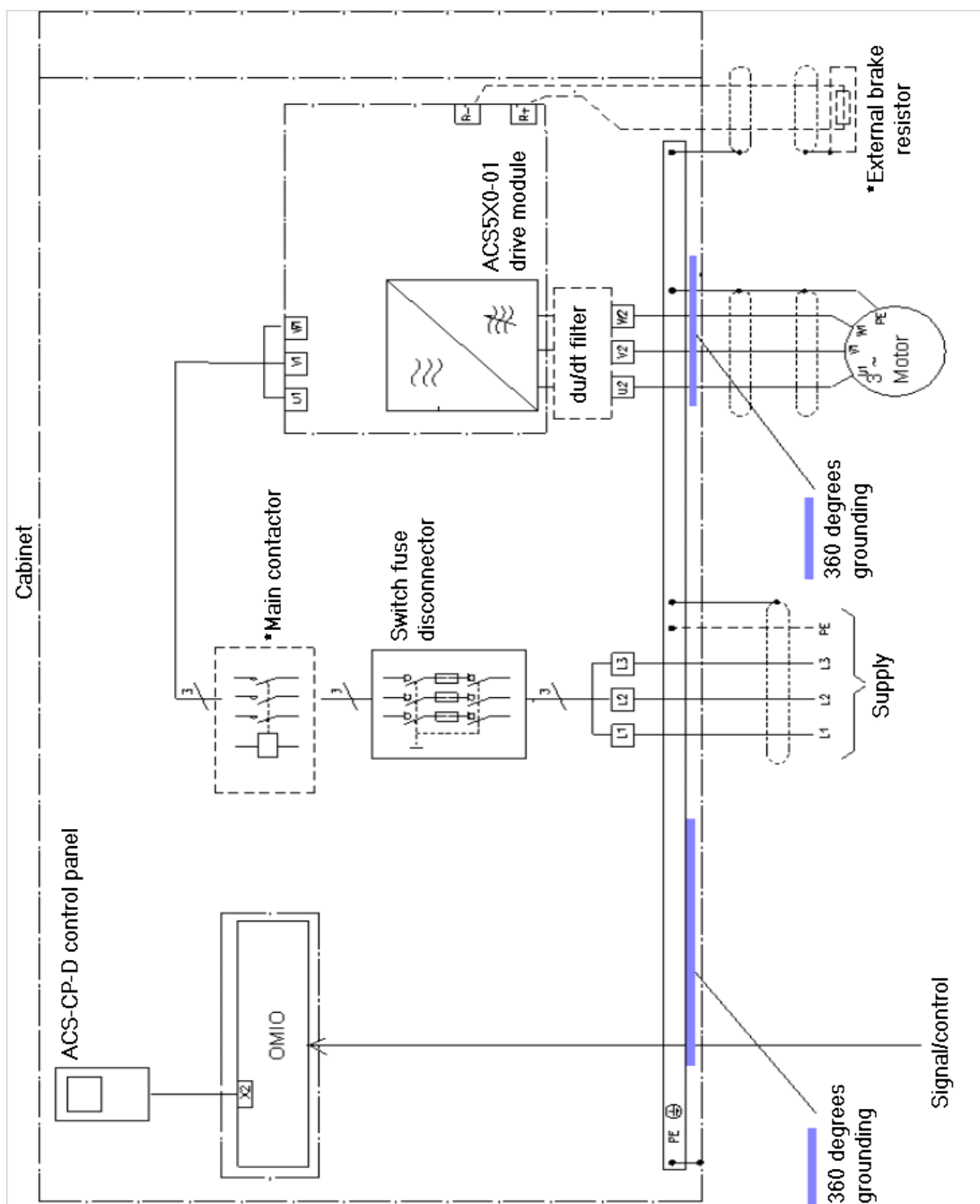
WARNING! Check the insulation before connecting the drive to the mains. Make sure that the drive is disconnected from the mains (input power).

Warning sticker

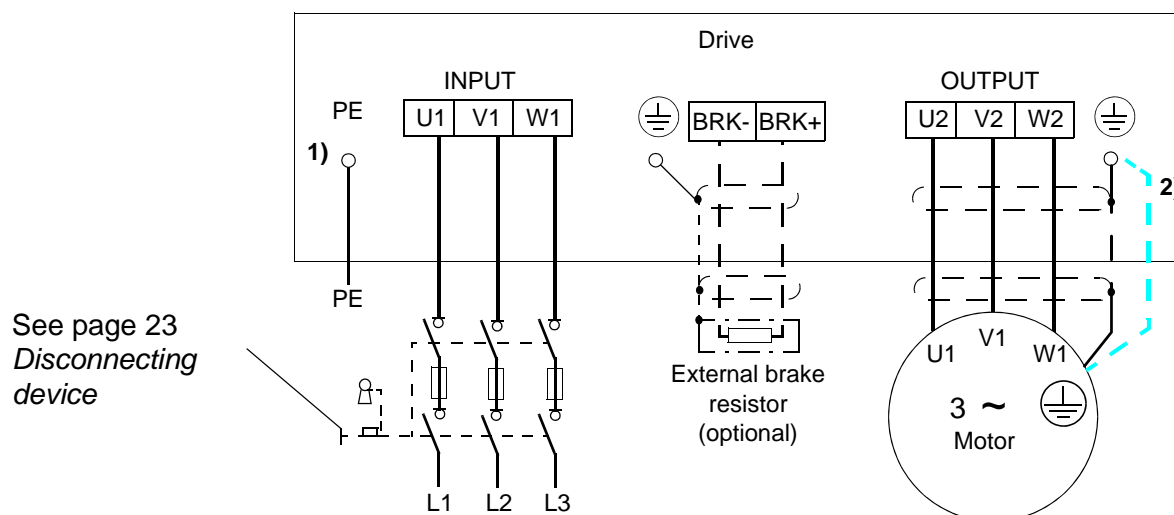
A multi-language sticker is attached onto the drive module cover. Attach the warning sticker in the local language onto the cover of the drive module.

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) Ground the other end of the PE conductor at the distribution board.

2) Use a separate grounding cable if the conductivity of the cable shield is not good (less than the conductivity of the phase conductor) and there is no symmetrically constructed grounding conductor in the cable (see page 24 [Selecting the power cables](#)).

Note:

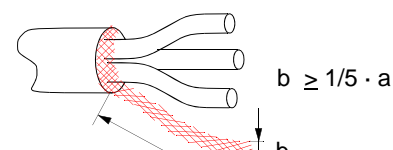
Do not use an asymmetrically constructed motor cable.

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.

Grounding of the motor cable shield at the motor end

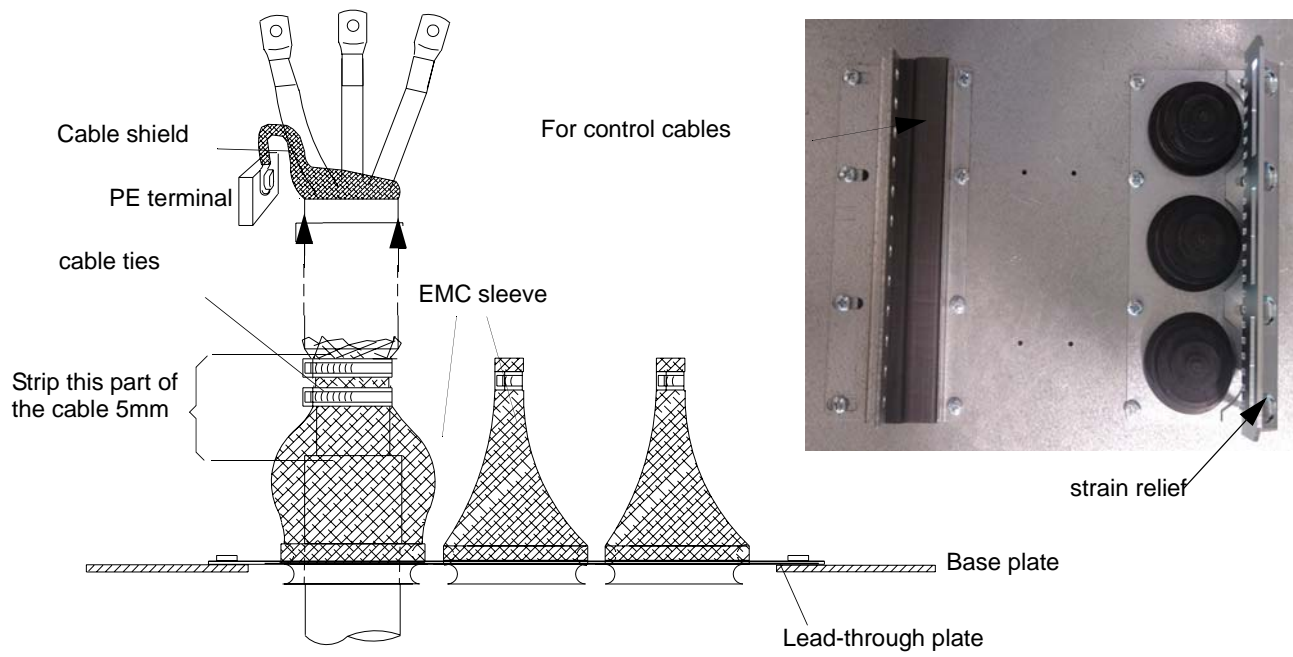
For minimum radio frequency interference:

- twisting the shield as flattened width $> 1/5 \cdot \text{length}$.
- ground the cable shield 360 degrees at the lead-through of the motor terminal box.



Connecting the power cables

1. Open the swing-out frame.
2. If fire insulation is used, make an opening in the mineral wool sheet according to the diameter of the cable.
3. 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.
4. Strip the cable.
5. Connect the twisted shield of the cable to the PE terminal of the cabinet.
6. Connect the phase conductors of the input cable to the U1, V1 and W1 terminals and the phase conductors of the motor cable to the U2, V2 and W2 terminals.
7. Peel off 3 to 5 cm of the outer insulation of the cable above the lead-through plate for the 360° high-frequency earthing.
8. Fasten the conductive sleeve to the cable shield with cable ties.
9. Seal the slot between the cable and mineral wool sheet (if used) with sealing compound.
10. Tie up the unused conductive sleeves with cable ties.



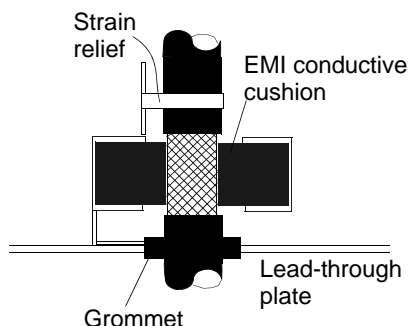
Additional instructions for frame size R6

See ACS 550 User's manual or ACS 510 User's manual [Input power connections](#) part.

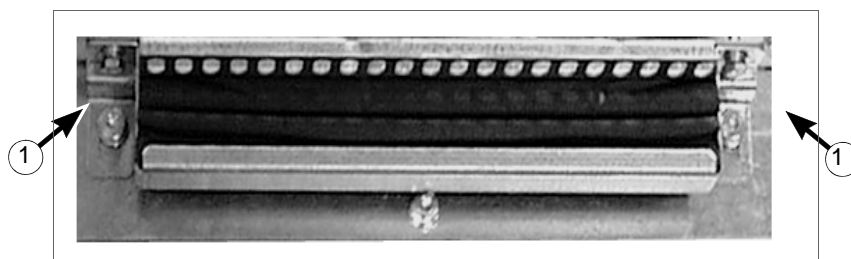
Connecting the control cables

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

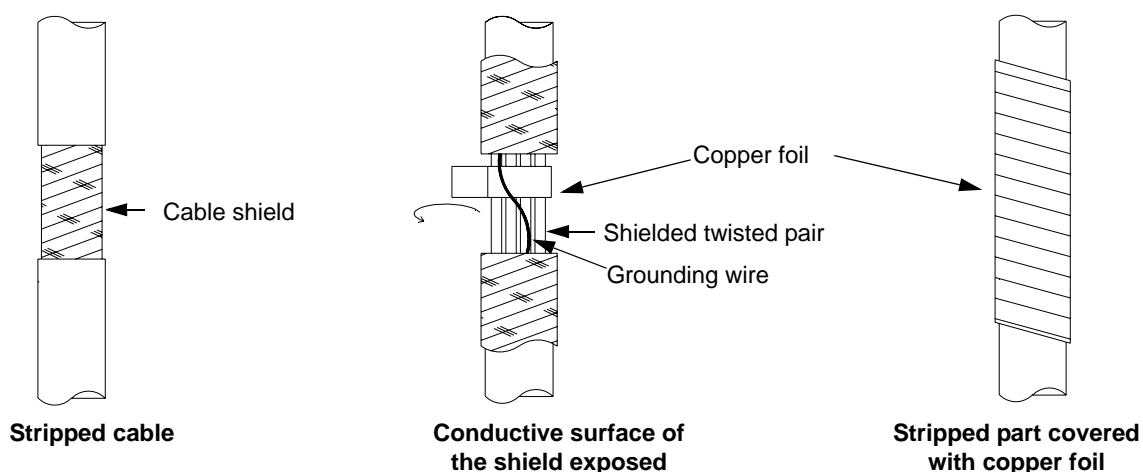


View from above

3. Strip off the cable plastic sheath above the lead-through plate just enough to ensure proper connection of the bare shield.
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.



Special for top entry

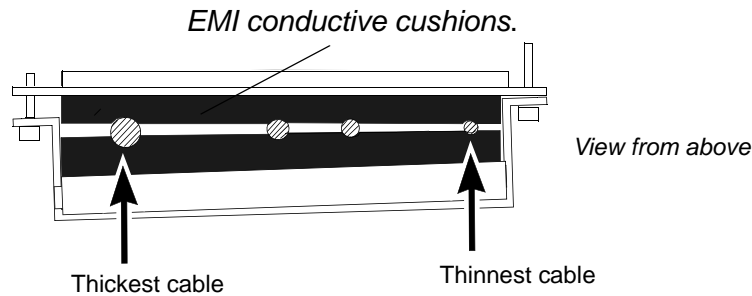
When each cable has its own rubber grommet, sufficient IP and EMC protection can be achieved. However, if very many control cables come to one cabinet, plan the installation beforehand as follows:

1. Make a list of the cables coming to the cabinet.

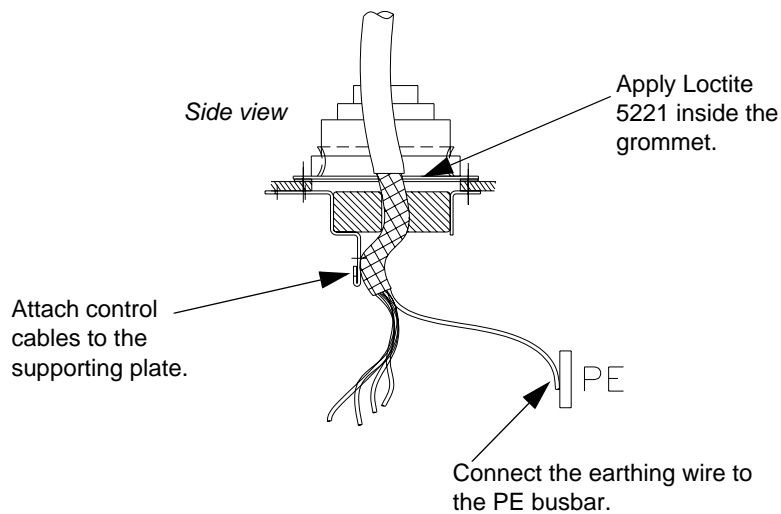
2. Sort the cables going to the left into one group and the cables going to the right into another group to avoid unnecessary crossing of cables inside the cabinet.
3. Sort the cables in each group according to size.
4. Group the cables for each grommet as follows ensuring that each cable has a proper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



Connecting the cables to the I/O terminals

Connect the conductors to the appropriate detachable terminals of the OMIO board or optional terminal X2.

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 (e.g. 3.3 nF / 3000V). The shield can also be

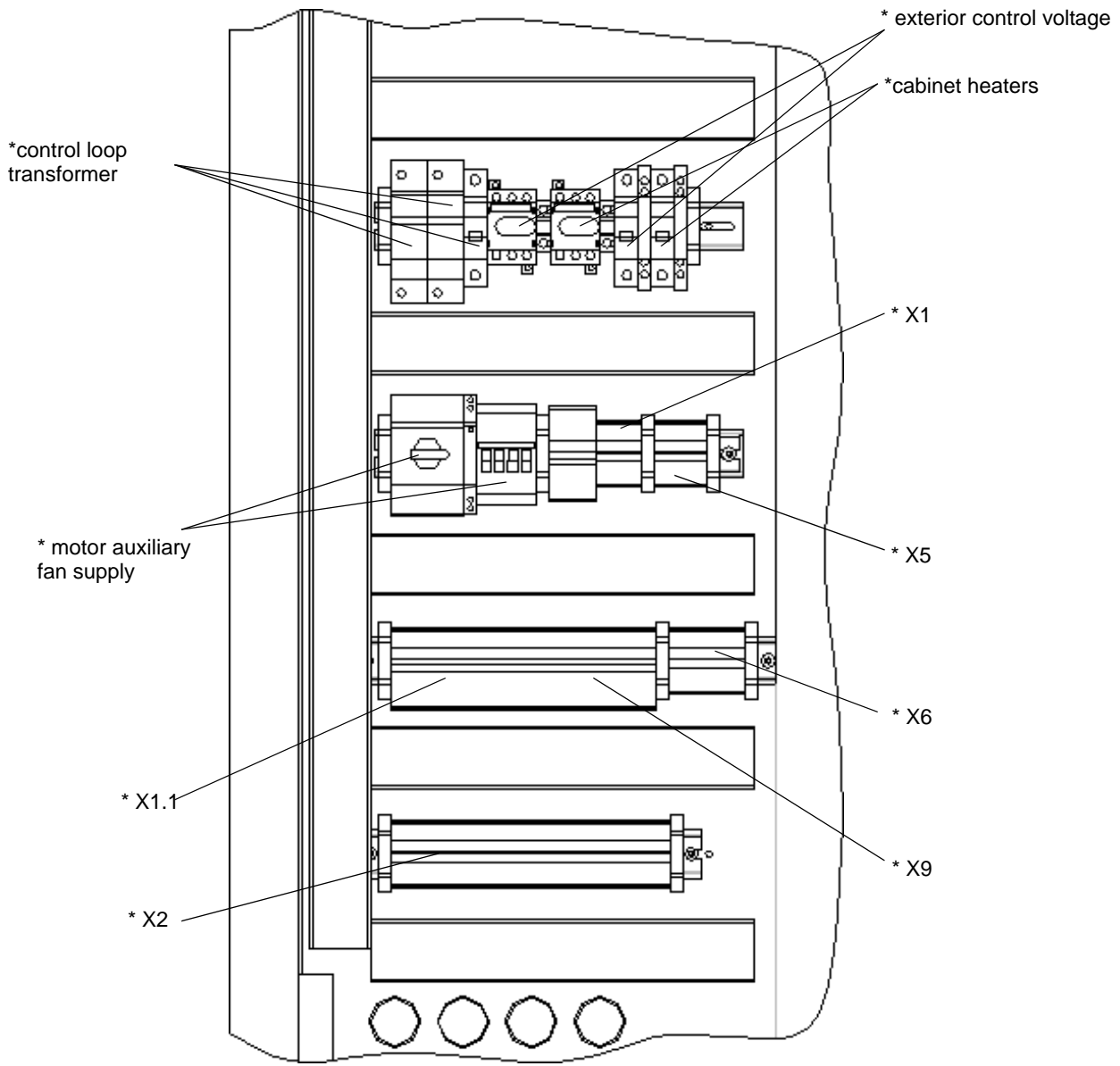
grounded directly at both ends if they are *in the same ground line* with no significant voltage drop between the end points.

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.

Installation of optional modules

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

Layout drawing of factory installed optional equipment



Swing-out frame (side view)

* Denotes optional equipment not present on all units.

Additional terminal blocks	
*X1	230VAC auxiliary voltage supply
*X1.1	line contactor control
*X2	OMIO
*X5	cabinet heaters
*X6	motor auxiliary fan supply
*X9	extension module OREL/OTAC

Installation of brake resistors (units with brake chopper option)

See [Resistor braking](#). Connect the resistor as shown in section [Power cable connection diagram](#) above.

Installation checklist and start-up

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	
MECHANICAL INSTALLATION	
The ambient operating conditions are allowed. See Mechanical installation , <i>Technical data: Ratings capacitance, Ambient conditions</i> .	<input type="checkbox"/>
The unit is fixed properly on floor and a vertical non-flammable wall. See Mechanical installation .	<input type="checkbox"/>
The cooling air will flow freely.	<input type="checkbox"/>
The motor and the driven equipment are ready for start. See Planning the electrical installation: Motor selection and compatibility , <i>Technical data: Motor connection</i> .	<input type="checkbox"/>
The EMC filter capacitors are disconnected by removing EMC screws.(EM1. EM3. F1. F2.) See page 33, if the drive is connected to an IT (ungrounded) system.	<input type="checkbox"/>
The drive is grounded properly.	<input type="checkbox"/>
The mains (input power) voltage matches the drive nominal input voltage.	<input type="checkbox"/>
The mains (input power) connections at U1, V2 and W3 and their tightening torques are OK. See <i>Technical data / Cable entries</i> .	<input type="checkbox"/>
Appropriate mains (input power) fuses and disconnectors are installed.	<input type="checkbox"/>
The motor connections at U2, V2 and W2 and their tightening torques are OK. See <i>Technical data / Cable entries</i> .	<input type="checkbox"/>
The motor cable is routed away from other cables.	<input type="checkbox"/>
There are no tools, foreign objects or dust from drilling inside the drive.	<input type="checkbox"/>
There are no power factor compensation capacitors in the motor cable.	<input type="checkbox"/>
Mains (input power) voltage cannot be applied to the output of the drive (with bypass connection).	<input type="checkbox"/>
Drive, motor connection box and other covers are in place.	<input type="checkbox"/>

Start-up procedure

Action	Additional information
<p>Safety</p> <p><input type="checkbox"/> Only qualified electricians are allowed to start-up the drive. The safety instructions must be followed during the start-up procedure.</p>	<p>See chapter Safety instructions.</p>
<p>Starting the drive</p> <p><input type="checkbox"/> Close the switch fuse (main disconnect).</p>	
<p><input type="checkbox"/> Units with line contactor: Close the contactor by turning the start switch on the cabinet door from 0 into 2 position for 2 seconds. Leave the switch to 1 position.</p>	
<p>Application program set-up</p> <p><input type="checkbox"/> Follow the instructions in the <i>User Manual</i> to start up the drive and to set the drive parameters.</p>	
<p>On-load checks</p> <p><input type="checkbox"/> Check the direction of rotation of the motor.</p> <p><input type="checkbox"/> Check the correct operation of the emergency-stop circuits from each operating location.</p>	

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	IP 54 air filter change	See R3/R4 / IP 54
	IP 42 air filter check and change if necessary	See R3/R4 / IP 42 .
	Cleanliness check	See Heatsink .
Every 5 years	Drive module cooling fan change	See Fans
Every 10 years	Batteries of control panel change	See Batteries .
	Capacitor change	See Capacitors .

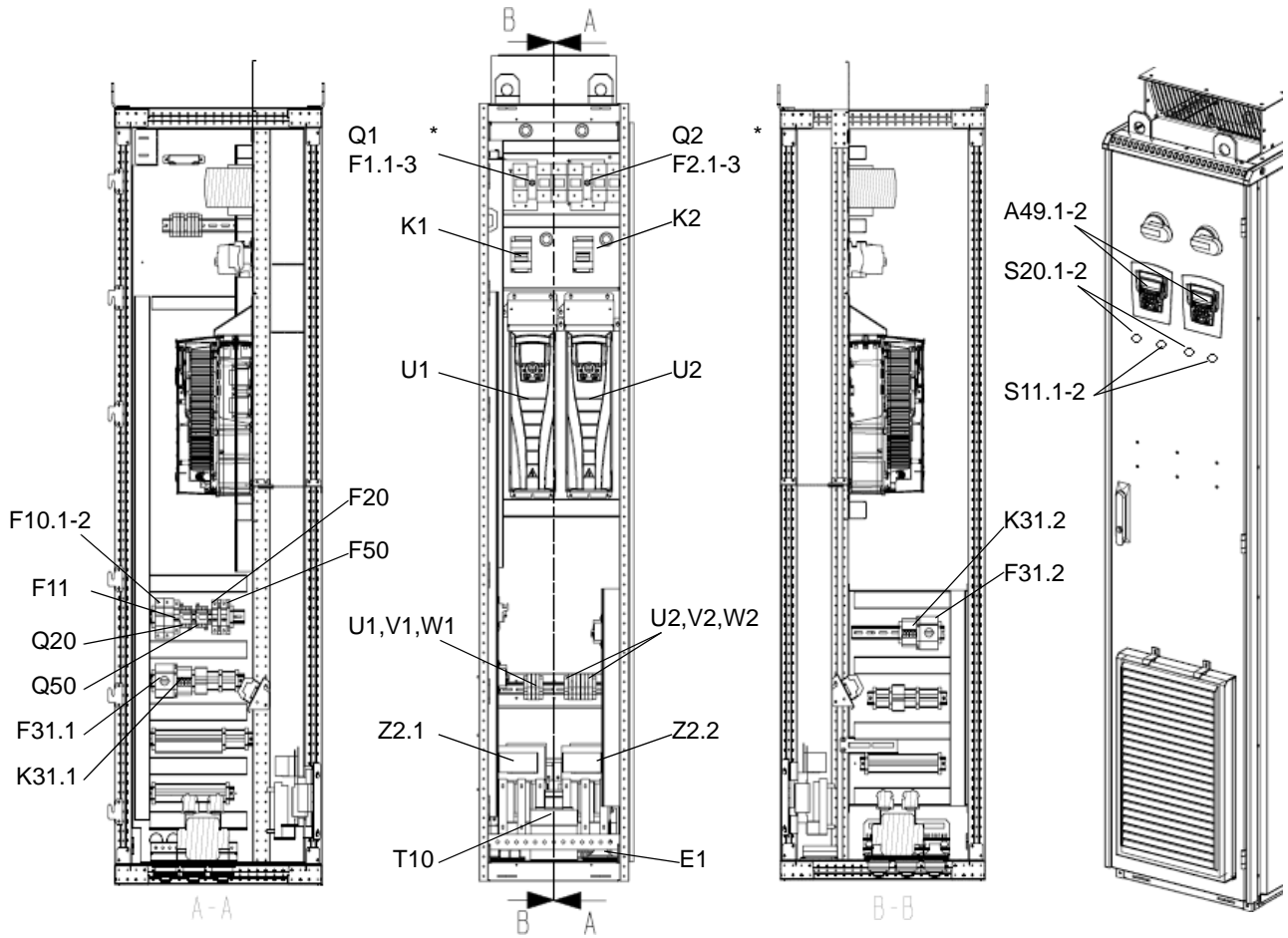
Required tools for maintenance

- 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

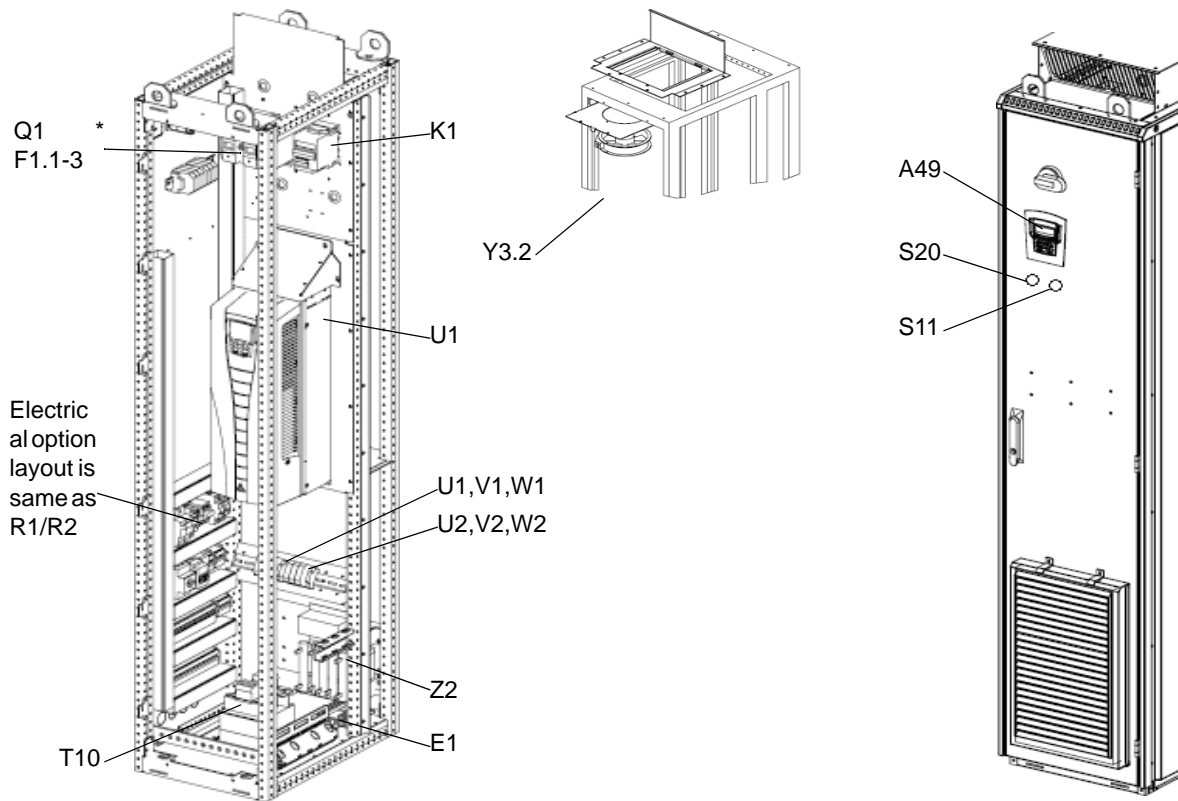
Screw	Grade	Tool	Tightening torque		
			mm	Nm	lbf ft
M4	8.8	7		2	1.46
M5	8.8	8		4	3
M6	8.8	10		6...9	4...7
M8	8.8	13		15...22	11...16
M10	8.8	17		30...44	22...32
M12	8.8	19		50...75	37...55

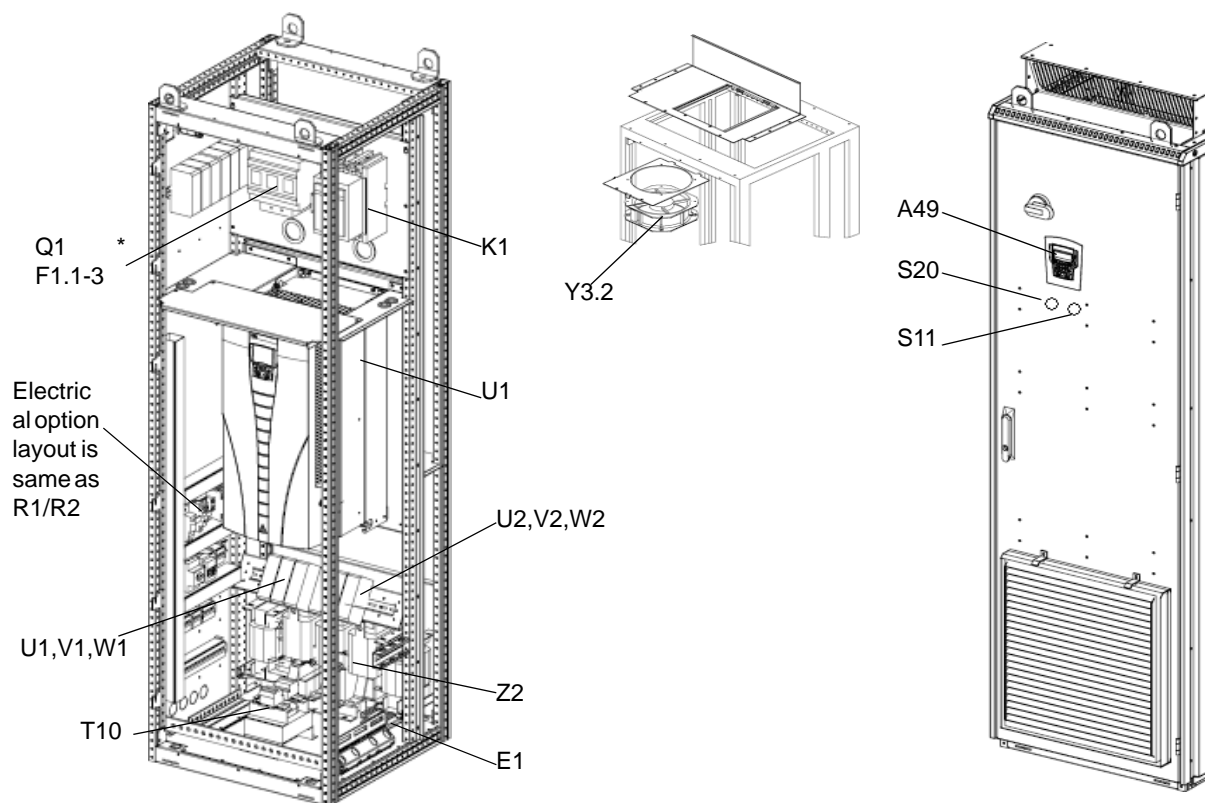
Cabinet layout

2XR1/R2



R3/R4



R5/R6**Replacing the air filters****IP 42****IP 54**

Change the air filter mat of the IP54 unit every year:

- removing the fastener(s) at the top of the grating.
- moving the grating.
- Changing the air filter mat



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 heatsink fins accumulate dust from the cooling air. Since a dusty heatsink is less efficient at cooling the drive, overtemperature faults become more likely. In a “normal” environment (not dusty, not clean) check the heatsink annually, in a dusty environment check more often.

Clean the heatsink as follows:

1. Remove the cooling fan (see section [Fans](#)).
2. 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.
3. Replace the cooling fan.

Fans

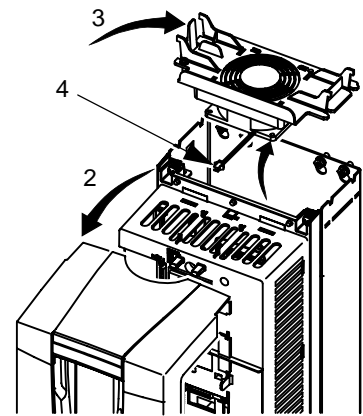
The drive’s main cooling fan has a life span of about 60,000 operating hours at maximum rated operating temperature and drive load. The expected life span doubles for each 10 °C (18 °F) drop in the fan temperature (fan temperature is a function of ambient temperatures and drive loads).

Fan failure can be predicted by the increasing noise from fan bearings and the gradual rise in the heatsink temperature in spite of heatsink cleaning. If the drive is operated in a critical part of a process, fan replacement is recommended once these symptoms start appearing. Replacement fans are available from ABB. Do not use other than ABB specified spare parts.

Frame Sizes R1...R4

To replace the fan:

1. Remove power from drive.
2. Remove drive cover.
3. For Frame Size:
 - R1, R2: Press together the retaining clips on the fan cover sides, and lift.
 - R3, R4: Press in on the lever located on the left side of the fan mount, and rotate the fan up and out.
4. Disconnect the fan cable.
5. Install the fan in reverse order.
6. Restore power.

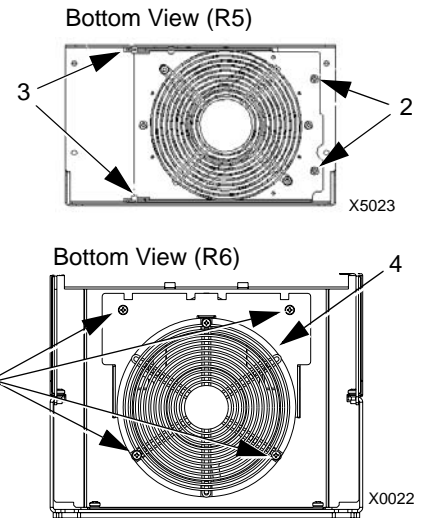


X0021

Frame Sizes R5 and R6

To replace the fan:

1. Remove power from drive.
2. Remove the screws attaching the fan.
3. Remove the fan:
 - R5: Swing the fan out on its hinges.
 - R6: Pull the fan out.
4. Disconnect the fan cable.
5. Install the fan in reverse order.
6. Restore power.
7. Restart the power.



Capacitors

The drive intermediate circuit employs several electrolytic capacitors. Their life span is from 35,000...90,000 hours depending on 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 a input power fuse failure or a fault trip. Contact ABB if capacitor failure is suspected. Do not use other than ABB specified spare parts.

Control Panel

Cleaning

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

Battery

A battery is only used in Assistant control panels that have the clock function available and enabled. The battery keeps the clock operating in memory during power interruptions.

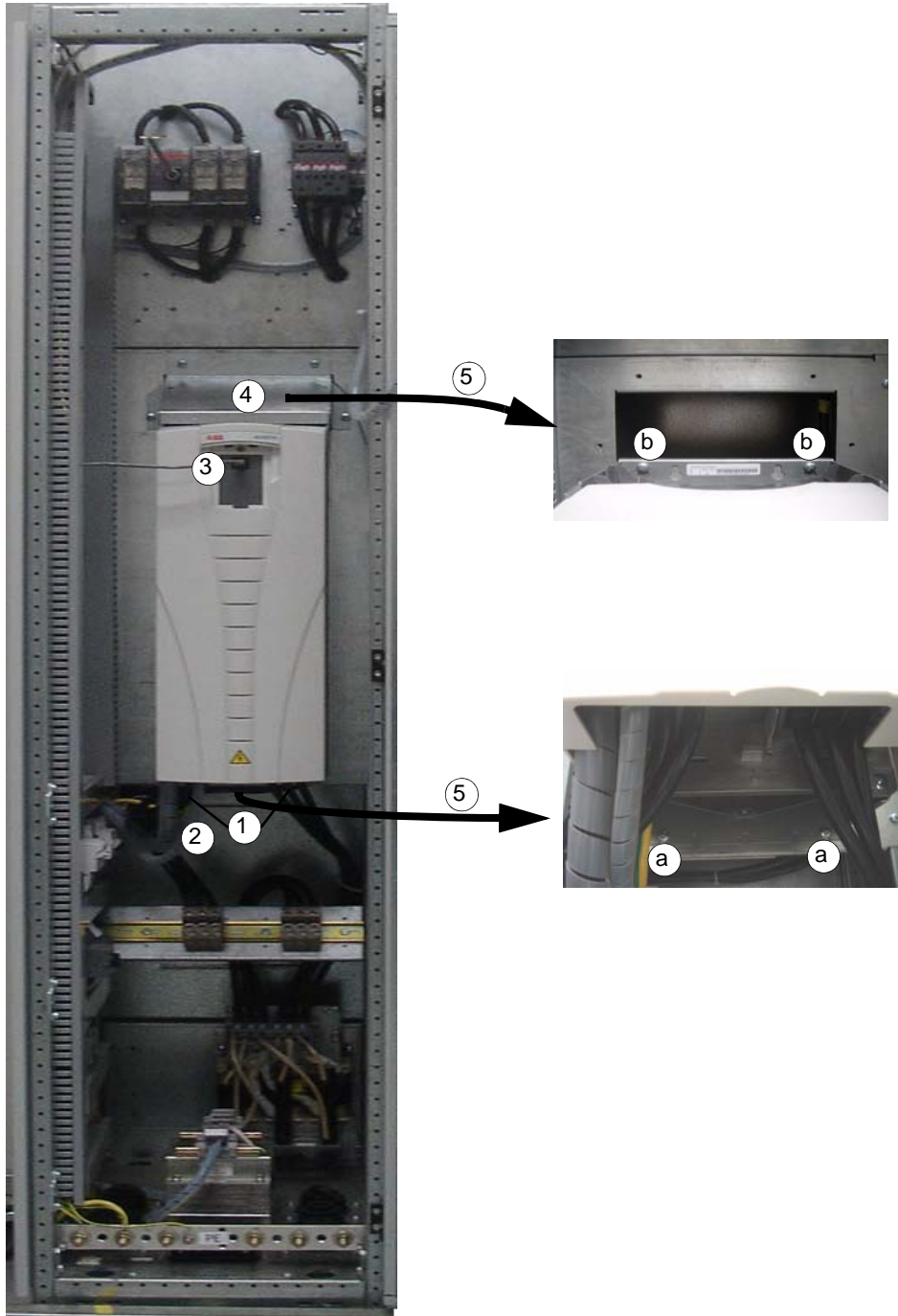
The expected life for the battery is greater than ten years. To remove the battery, use a coin to rotate the battery holder on the back of the control panel. Replace the battery with type CR2032.

Note! The battery is NOT required for any control panel or drive function, except the clock.

Replacing the drive module

1. Disconnect the input power cable and motor wires of the module.
2. Disconnect the control wires of the module.
3. Disconnect the cables of the control panel of the module.
4. Remove the air guide.
5. Undo the fastening bolt (a), loosen the fastening bolt(b)

- 6. Pull the module from the cabinet
- 7. Install the new module in reverse order to the above.



外形规格 R4 的照片

LEDs

This table describes LEDs of the drive.

Where	LED	When the LED is lit
SMIO	Red	Drive in fault state
	Green	The power supply on the board is OK.

Technical data

What this chapter contains

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

Rating capacitance

ACS550/ACS510 drive's rating capacitance, includes:

- IEC ratings
- Frame size

See [technical data](#) of ACS550 User manual or ACS510 User manual.

Fuses

For the fuses restrict drive damage and prevent damage to adjoining equipment in case of a short-circuit inside the drive, see ACS550 User's manual or ACS510 User manual.

Cable types

copper and aluminium cable types please refer to of ACS550 User manual or ACS510 User manual. [Technical data: Input power connection](#).

Cabinet power cabling terminal

Frame size	U1, V1, W1 U2, V2, W2			
	Min. wire size	Max. wire size	Torque	Max. current
	mm ²	mm ²	Nm	A
R1	1.5	16	1.2...2.4(M4)	76
R2	1.5	16	1.2...2.4(M4)	76
R3	1.5	25	2.0...4.0(M5)	101
R4	2.5	50	2.5...5.0(M6)	150
R5 ¹	10	95	6.0...10(M8)	232
R6 ¹	6	150	10...20	309

Note1: For R5/R6 cabling, only can press bond by OT terminal.

Dimensions and weights

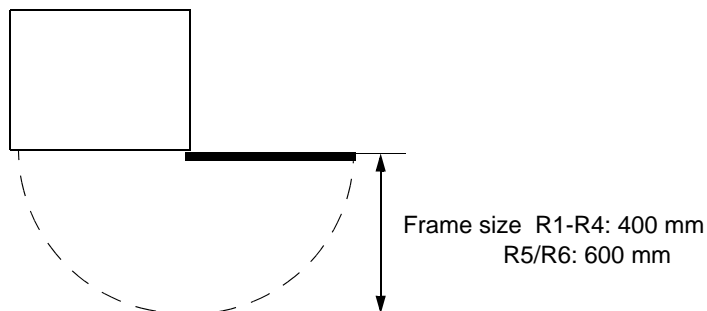
Frame size	Height		Width	Depth	Weight
	IP 21/22/42 mm	IP 54 mm			
R1	2130	2315	430	689	161.5
R2	2130	2315	430	689	164
R3	2130	2315	430	689	171
R4	2130	2315	430	689	179
R5	2130	2315	630	689	224
R6	2130	2315	630	689	259

Free space around the unit

Frame size	Required free space around the unit for cooling					
	Front		Side		Above	
	mm	in.	mm	in.	mm	in.
R1	150	5.91	-	-	600	23.62
R2	150	5.91	-	-	600	23.62
R3	150	5.91	-	-	600	23.62
R4	150	5.91	-	-	600	23.62
R5	150	5.91	-	-	600	23.62
R6	150	5.91	-	-	600	23.62

* Depth depends on the options included in the drive.

Space requirement for the door opening: :



Input power connection

Voltage (U_1)	380 ~ 480 VAC 3-phase + 10 %- 15 % for 400 VAC units
Prospective short-circuit current (IEC 60439-1)	Maximum allowed prospective short circuit current in the supply is 100 kA in a second providing that the mains cable of the drive is protected with appropriate fuses.
Frequency	48 ~ 63 Hz
Imbalance	Max. $\pm 3\%$ 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 U_1 , 3-phase symmetrical, U_{max} at the field weakening point
Voltage (U_2)	0 ~ 500 Hz
Frequency resolution	0.1 Hz
Current	See Rating capacitance
Field weakening point	10 ~ 500 Hz
Switching frequency	Options: 1, 4, 8 or 12 kHz

Maximum recommended motor cable length

Frame size	Max. motor cable length	
	fsw=1 or 4kHz	fsw=8 or 12kHz
R1	100 m	100 m
R2...R4	200 m	100 m
R5...R6	300m	150m

* With longer motor cables may cause the permanent destroy to the units.

Efficiency

Approximately 98% at nominal power level.

Cooling

Method	Internal fan, flow direction from front to top		
Filter material	Inlet (door)	Outlet (roof)	
	IP22 / IP 42 units	318 mm x 540 mm(R1-R4) 518 mm x 540 mm(R5-R6)	-
	IP 54 units	318 mm x 540 mm (R1-R4) 518 mm x 540 mm(R5-R6)	2 pcs: 398 mm x 312 mm

Free space around the unit

See [Free space around the unit](#).

Cooling air flow

See ACS550 User's Manual or ACS510 User's Manual, chapter [Technical data](#).

Degrees of protection

IP 21, IP 22, IP 42 , IP 54

Ambient conditions

	Operation installed for stationary use	Storage in the protective package	Transportation in the protective package
Installation site altitude	<ul style="list-style-type: none"> 0 ~ 1000 m 1000 ~ 2000m ,every rises 100 m the P_N and I_2 Derating 1% . 	-	-
Air temperature	<ul style="list-style-type: none"> min. temp.-15 °C (5 °F) – no frost. max. temp. (fsw = 1 or 4 KHz) 40 °C ;if P_N and I_2 derating to 90% , the allowable temp. is 50 °C. If P_N and I_2 derating to 80%, the allowable max. temp. is (fsw = 8 KHz) is 40 °C. if P_N and I_2 derating to 65%,the allowable max. temp. is (fsw = 12 KHz) is 30 °C. 	-40 ~ +70 °C	-40 ~ +70 °C
Relative humidity	<95%(No condensation allowed.)	<95%(No condensation allowed.)	<95%(No condensation allowed.)
Contamination levels (IEC 60721-3-3)	No conductive dust allowed.		
	<ul style="list-style-type: none"> Chemical gases: Class 3C1 Solid particles: Class 3S2 	<ul style="list-style-type: none"> Chemical gases: Class 1C2 Solid particles: Class 1S3 	<ul style="list-style-type: none"> Chemical gases: Class 2C2 Solid particles: Class 2S2
Sinusoidal vibration	Max.1 mm (0.04 in.) (5 ~ 13.2 Hz), Max. 7 m/s ² (23 ft/s ²) (13.2 ~ 100 Hz) Sinusoidal vibration	Max.1 mm (0.04 in.) (5 ~ 13.2 Hz), Max. 7 m/s ² (23 ft/s ²) (13.2 ~ 100 Hz) Sinusoidal vibration	Max. 3.5 mm (0.14 in.) (2 ~ 9 Hz), Max. 15 m/s ² (49 ft/s ²) (9 ~ 200 Hz) Sinusoidal vibration

Shock (IEC 60068-2-29)	Not allowed	Max. 100 m/s ² (330 ft./s ²), 11 ms	Max. 100 m/s ² (330 ft./s ²), 11 ms
Free fall	Not allowed	100 mm (4 in.) for weight over 100 kg (220 lb)	100 mm (4 in.) for weight over 100 kg (220 lb)

Materials

Drive enclosure	<ul style="list-style-type: none"> • PC/ABS 2.5 mm, colour NCS 1502-Y (RAL 90021 / PMS 420 C and 425 C) • hot-dip zinc coated steel sheet 1.5 to 2 mm, thickness of coating 20 micrometres • cast aluminium AISi • extruded aluminium AISi
Package	Corrugated cardboard, expanded polystyrene, plywood, Wood. (heat up drying) Plastic covering of the package: PE-LD, bands PP or steel.
Disposal	<p>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.</p> <p>If recycling is not feasible, all parts excluding electrolytic capacitors and printed circuit boards can be landfilled. The DC capacitors contain electrolyte and the printed circuit boards contain lead, both of which will be classified as hazardous waste within the EU. They must be removed and handled according to local regulations.</p> <p>For further information on environmental aspects and more detailed recycling instructions, please contact your local ABB distributor.</p>

Applicable standards

Refer to ACS550 User's Manual or ACS510 User's Manual [Technical data: Application standard](#).

CE marking

Refer to ACS550 User's Manual or ACS510 User's Manual [Technical data: Application standard](#).

Equipment warranty and liability

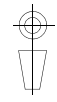
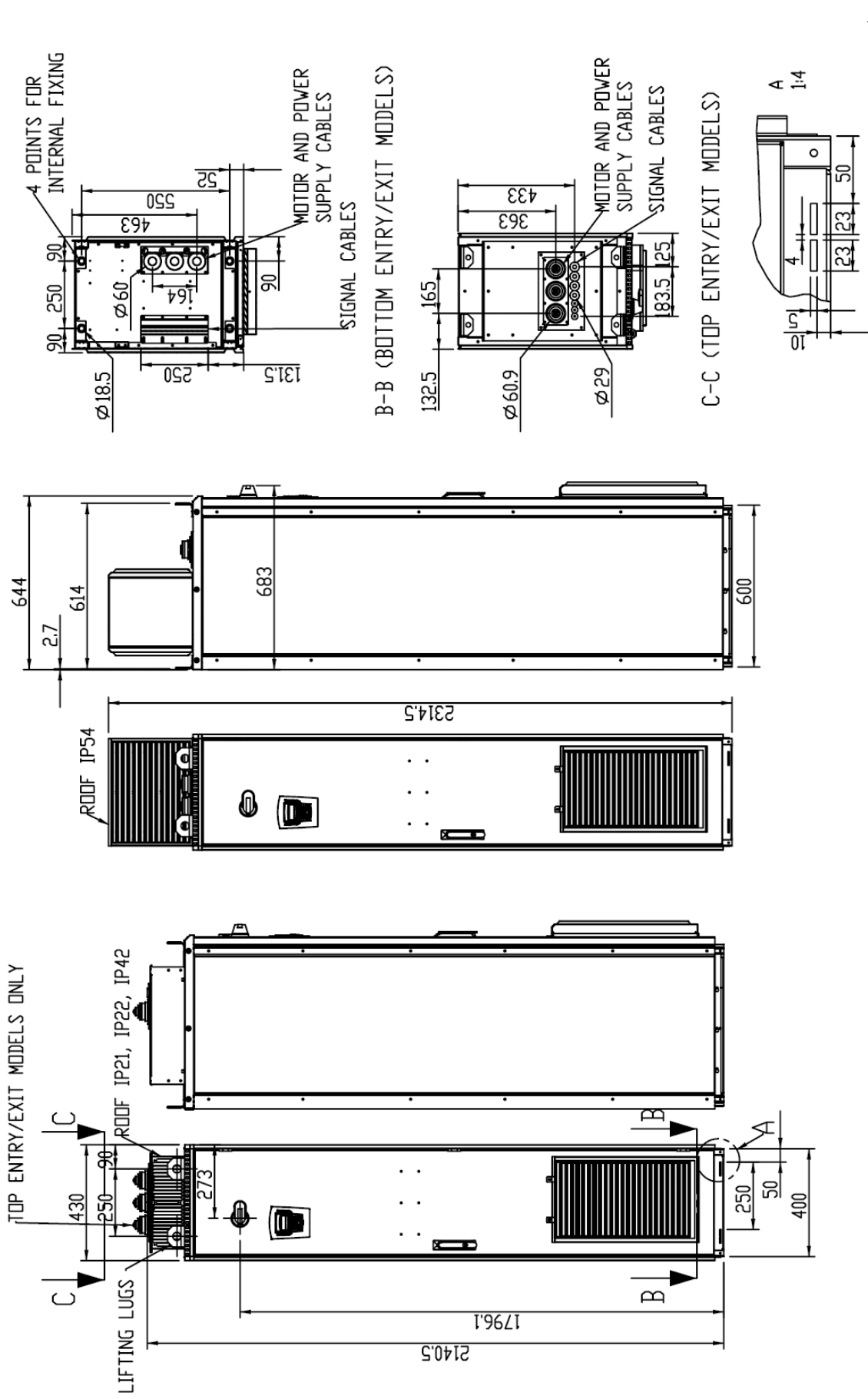
The manufacturer warrants the equipment supplied against defects in design, materials and workmanship for a period of eighteen months after installation. The local ABB office or distributor may grant a warranty period different to the above and refer to local terms of liability as defined in the supply contract.

Dimensional drawings

The dimensions are given in millimetres.

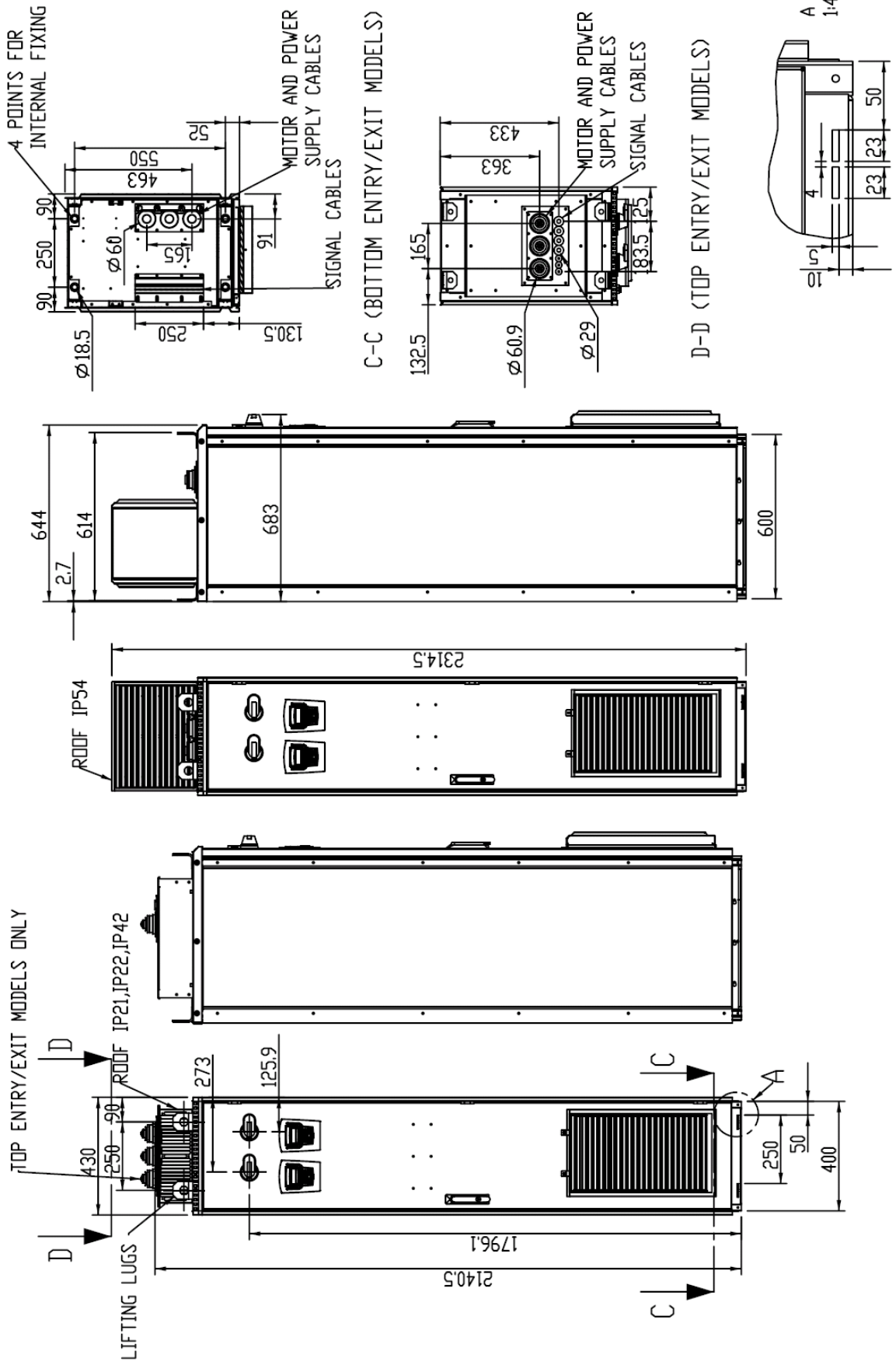
Frame size R1 - R4

First angle projection. Original drawing made with Pro/ENGINEER. Set the correct scale factor when adding dimensions after DWG/DXF conversion.



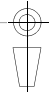
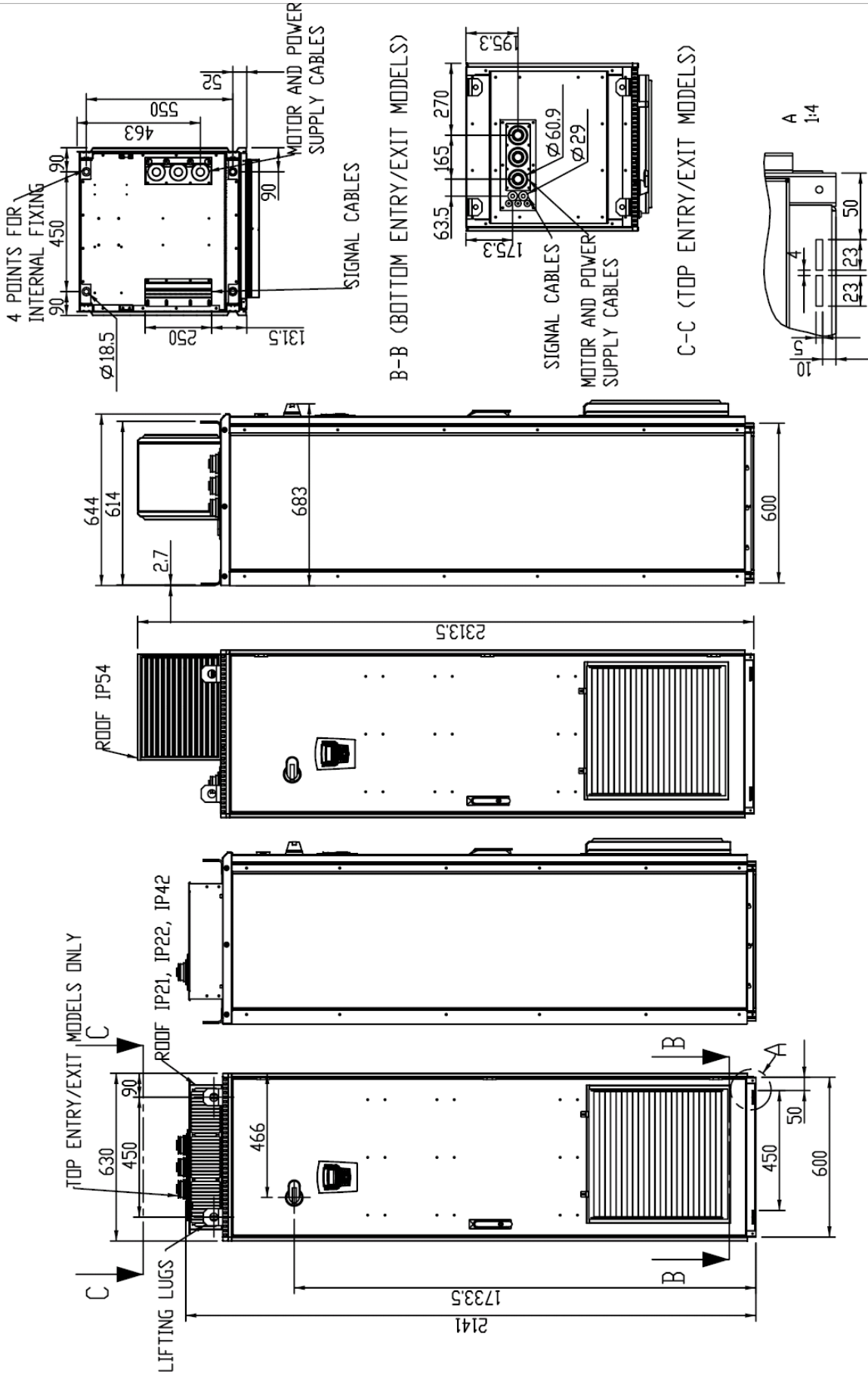
Frame size 2XR1/R2

First angle projection. Original drawing made with Pro/ENGINEER. Set the correct scale factor when adding dimensions after DWG/DXF conversion.



Frame size R5/R6

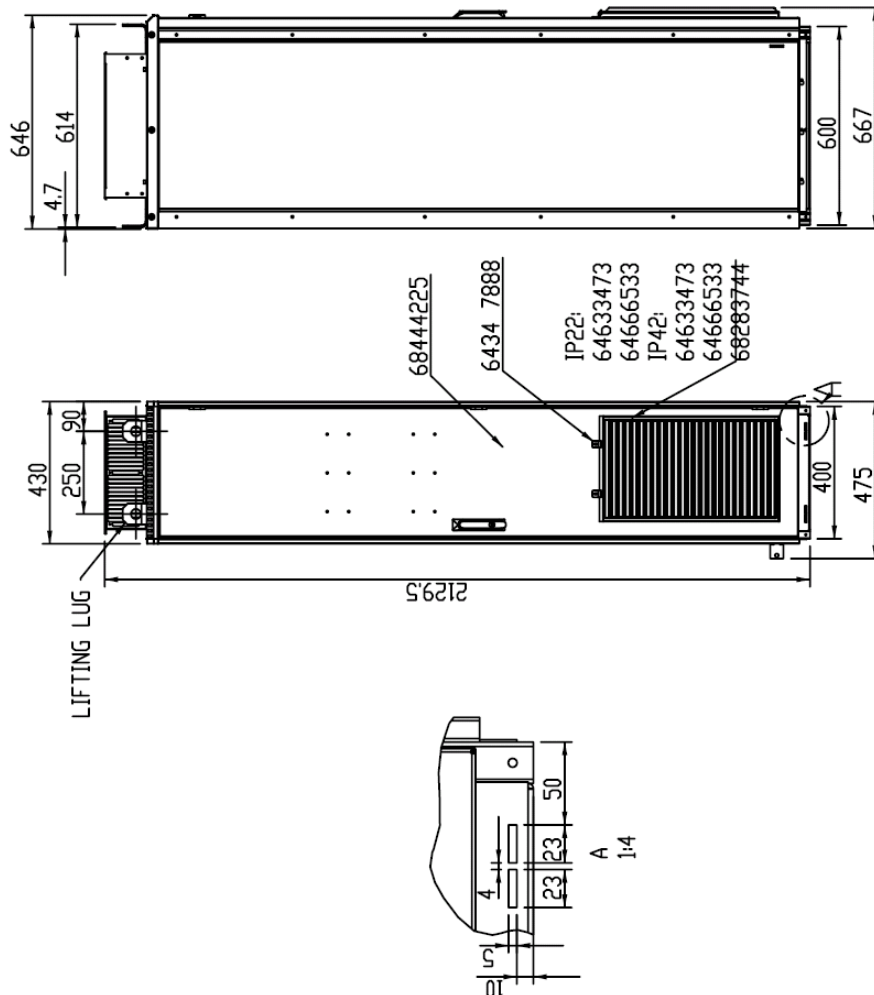
First angle projection. Original drawing made with Pro/ENGINEER. Set the correct scale factor when adding dimensions after DWG/DXF conversion.



Brake chopper + Brake resistor



First angle projection. Original drawing made with Pro/ENGINEER. Set the correct scale factor when adding dimensions after DWG/DXF conversion.



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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 for the ACS 5X0

For the effective brake, brake choppers are selected differently by the frame types of the drive.

- Frame R1 and R2 drives have a built-in brake chopper as standard equipment, matches the suitable resistor.
- R3 ~ R6 drives have no brake choppers are optionally available as built-in units, Connect a brake chopper and resistor or a brake units to the terminal of direct current of the drive.

Select the brake resistor (Frame size R1and R2)

Refer to ACS550 User's Manual or ACS510 User's Manual [Technical data :Brake Components](#)

Optional brake chopper and resistor(s) (Frame size R3~R6)

ACS 550-01 type	Brake chopper type	Brake resistor(s)			
		type	R (ohm)	E _R (kJ)	P _{Rcont} (kW)
3-phase supply voltage 380 ~ 480 V					
-031A-4	BRK-C	Built in	32	–	–
-038A-4	BRK-D	Built in	10.5	–	–
-044A-4	BRK-D	Built in	10.5	–	–
-059A-4	BRK-D	Built in	10.5	–	–
-072A-4	BRK-D	Built in	10.5	–	–
-096A-4	BRK-D	Built in	10.5	–	–
-124A-4	NBRA-656C	SAFUR125F500	4.0	3600	9
-157A-4	NBRA-656C	SAFUR125F500	4.0	3600	9
-180A-4	NBRA-657C	SAFUR125F500	4.0	3600	9
-195A-4	NBRA-657C	SAFUR200F500	2.7	5400	13.5

R Resistance value for the listed 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.

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.

To ensure that the input fuses protect the resistor cable, use resistor cables with the same rating as used for the power input to the drive.

The maximum length of the resistor and brake chopper cable(s) is 10 m (33 ft). See the Power Connection Diagrams on page page 15 for the resistor cable connection points.

ACS5X0-07

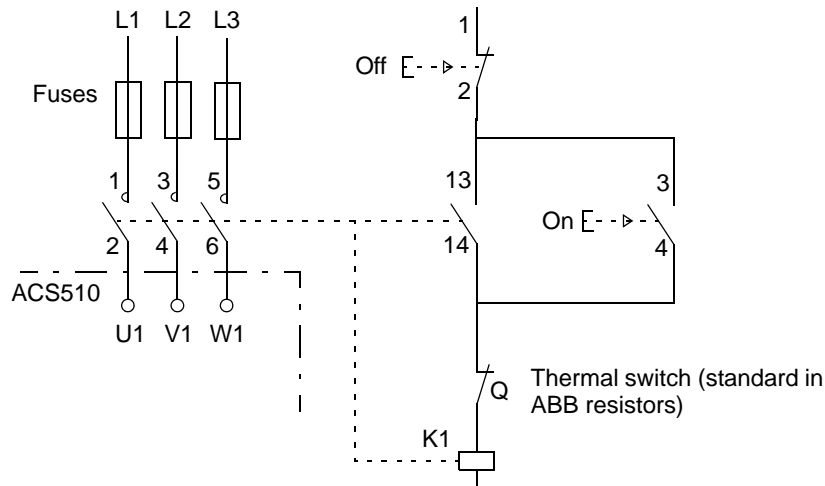
If ordered, the resistors and brake chopper are factory installed in a cubicle(400mm) next to the drive cabinet.

Diagram for resistor connections

The following setup is essential for safety – it interrupts the main supply in fault situations involving chopper shorts:

- Equip the drive with a main contactor.
- Wire the contactor so that it opens if the resistor thermal switch opens (an overheated resistor opens the contactor).

Below is a simple wiring diagram example.



Parameter Set-up

To enable dynamic braking, switch off the drive's overvoltage control (Set parameter 2005 = 0 (DISABLE))



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