

This manual includes

- Safety
- Installation
- Commissioning of the Drive Section
- Maintenance
- Technical Data

ACS/ACC 607/627 Frequency Converters
630 to 3000 kW

ACS/ACC 617 Frequency Converters
75 to 1120 kW

ACS/ACC 677 Frequency Converters
132 to 3000 kW



Manuals for ACx 6x7 Units from 75 kW to 3000 kW

(English Originals)

GENERAL MANUALS (included in the delivery)

ACS/ACC 607/617/627/677 Hardware Manual EN 61329005

- Safety Instructions
- Hardware description of the Drive Section
- Cable selection
- Mechanical and electrical installation
- Hardware commissioning of the Drive Section
- Preventive maintenance
- Technical data

ACS/ACC 607/617/627/677 Dimensional Drawings

EN 64488422

- Dimensional drawings

SUPPLY SECTION MANUALS (depending on the supply type one of these manuals is included in the delivery)

Diode Supply Section (DSU) EN 61451544

- DSU specific Safety Instructions
- DSU hardware and software descriptions
- DSU commissioning
- Earth fault protection options

Thyristor Supply Section (TSU) EN 64170597

- TSU operation basics
- TSU firmware description
- TSU program parameters
- TSU commissioning

IGBT Supply Section Manual (ISU) EN 64013700

- ISU specific Safety Instructions
- Main components of ISU
- ISU ratings
- ISU power losses
- ISU dimensions and weights
- ISU fuses
- ISU program parameters
- Earth fault protection options

FIRMWARE MANUALS FOR DRIVE APPLICATION

PROGRAMS (appropriate manual is included in the delivery)

System EN 63700177

- Commissioning of the System Application Program
- Control Panel use
- Software description
- Parameters of the System Application Program
- Fault tracing
- Terms

Application Program Template EN 63700185

- Commissioning of the Drive Section
- Control Panel use
- Software description
- Parameters
- Fault tracing
- Terms

Standard EN 61201441

- Control Panel use
- Standard application macros with external control connection diagrams
- Parameters of the Standard Application Program
- Fault tracing
- Fieldbus control

Note: a separate Start-up Guide is attached

Crane Drive EN 3BSE 011179

- Commissioning of the Crane Drive Application Program
- Control Panel use
- Crane program description
- Parameters of the Crane Drive Application Program
- Fault tracing

CONTROL SECTION MANUALS (delivered with optional Control Section)

Advant Controller 80 User's Manual EN 64116487

- AC 80 hardware and connections
- AC 80 software
- Programming
- Diagnostics

Advant Controller 80 Reference Manual PC Elements

EN 64021737

- Description of PC and DB elements

Advant Controller 80 Reference Manual TC Elements

EN 64331868

- Description of TC elements

BRAKING SECTION MANUAL (delivered with optional Braking Section)

ACA 621/622 Braking Sections User's Manual EN 64243811

- Installation
- Start-up
- Fault tracing
- Technical data
- Dimensional drawings

MANUALS FOR OPTIONAL EQUIPMENT (delivered with optional equipment)

Fieldbus Adapters, I/O Extension Modules, Braking Choppers etc.

- Installation
- Programming
- Fault tracing
- Technical data

ACS/ACC 607/627 Frequency Converters
630 to 3000 kW
ACS/ACC 617 Frequency Converters
75 to 1120 kW
ACS/ACC 677 Frequency Converters
132 to 3000 kW

Hardware Manual

This manual concerns the ACS 607/617/627/677 and ACC 607/617/627/677 frequency converters constructed of ACS 600 MultiDrive modules. In the text, they are collectively referred to as ACx 6x7 or ACx 600.

3AFY 61329005 REV F
EN
EFFECTIVE: 3.6.2002
SUPERSEDES: 6.6.2001

Safety Instructions

Overview

This chapter states the safety instructions that must be followed when installing, operating and servicing the ACS/ACC 6x7 frequency converters listed in Appendix A. If neglected, physical injury and death may follow, or damage may occur to the frequency converter, the motor and driven equipment. The material in this chapter and the supply unit specific instructions (given in their manuals) must be studied before attempting any work on, or with, the unit.

The following notation is used throughout the manual:

ACx 600 refers to the whole ACS 600 product family.



Dangerous Voltage WARNING! warns of situations in which a high voltage can cause physical injury and/or damage equipment. The text next to this symbol describes ways to avoid the danger.



General WARNING! warns of situations which can cause physical injury and/or damage equipment by means other than electrical. The text next to this symbol describes ways to avoid the danger.



Electrostatic Discharge WARNING! warns of situations in which an electrostatic discharge can damage equipment. The text next to this symbol describes ways to avoid the danger.

CAUTION! Aims to draw special attention to a particular issue.

Note: Gives additional information or points out more information available on the subject.

Installation and Maintenance Safety



These safety instructions are intended for all work on the ACx 6x7. Neglecting these instructions can cause physical injury and death.

WARNING! All electrical installation and maintenance work on the ACx 600 should be carried out by qualified electricians.

Any installation work must be done with the power off, and power is not to be reconnected unless the installation work is complete. Dangerous residual voltages remain in capacitors when the disconnecting device is opened. Wait 5 minutes after switching off the supply before starting work. Always ensure by measuring that the voltage between terminals UDC+ and UDC- and frame is close to 0 V and that the supply has been switched off before performing any work on the equipment or making main circuit connections.

If the main circuit of the inverter unit is live, the motor terminals are also live even if the motor is not running!

When joining shipping splits, check the cable connections at the shipping split joints before switching on the supply voltage.

If the auxiliary voltage circuit of the ACx 600 is powered from an external power supply, opening the disconnecting device does not remove all voltages. Control voltages of 115/230 VAC may be present on the digital inputs or outputs even though the inverter unit is not powered. Before starting work, check which circuits remain live after opening of the disconnecting device by referring to the circuit diagrams for your particular delivery. Ensure by measuring that the part of the cabinet you are working on is not live.

In ACx 600 frequency converters, control boards of the converter unit may be at the main circuit potential. Dangerous voltages may be present between the control boards and the frame of the converter unit, when the main circuit voltage is on. It is critical that the measuring instruments, such as an oscilloscope, are used with caution and safety always as a priority. The fault tracing instructions give special mention of cases in which measurements may be performed on the control boards, also indicating the measuring method to be used.

Live parts on the inside of doors are protected against direct contact. Special safety attention shall be paid when handling shrouds made of sheet metal.

Do not make any voltage withstand tests on any part of the unit while the unit is connected. Disconnect motor cables before making any measurements on motors or motor cables.



WARNING! Do not use the Prevention of Unexpected Start for stopping the drive when the inverter is running. Give a Stop command instead.

CAUTION! Fans may continue to rotate for a while after the disconnection of the electrical supply.

CAUTION! Some parts like heatsinks of power semiconductors and toroidal cores on motor cables inside the cabinet remain hot for a while after the disconnection of the electrical supply.

Permanent Magnet Motor



WARNING!

Installation and maintenance work

When a permanent magnet motor is connected to the drive, ensure that the driven machine cannot rotate the motor during installation and maintenance work. When rotating, the permanent magnet motor feeds power to the intermediate circuit of the drive and also the supply connections become live (even when the inverter is stopped!). Disconnect the motor from the drive with a safety switch, or lock the motor shaft and earth the motor connection terminals temporarily by connecting them together as well as to the PE.

Normal use

Ensure that the permanent magnet motor cannot rotate at too high a speed. Overspeed leads to overvoltage which may explode the capacitors in the intermediate circuit of the drive.

Permanent magnet motor may be used with *ACS 600 Permanent Magnet Synchronous Motor Drive Application Program*, or with other application programs in scalar control mode only.

Starting TSU or DSU



Note the warning below before starting drives equipped with a Thyristor or Diode Supply Section.

WARNING! Before power switch-on, make sure that a sufficient inverter power is connected to the intermediate circuit. Rules of thumb:

1. The sum power of the inverters connected must be at least 30% of the sum power of all inverters.
2. The sum power of the inverters connected must be at least 30% of the rated power of the braking section ($P_{br.max}$) if present.

If the above mentioned rules are not followed, the DC fuses of the connected inverter(s) may blow or the braking chopper (if used) may be damaged.

The phenomena which result in a fuse blow are as follows:

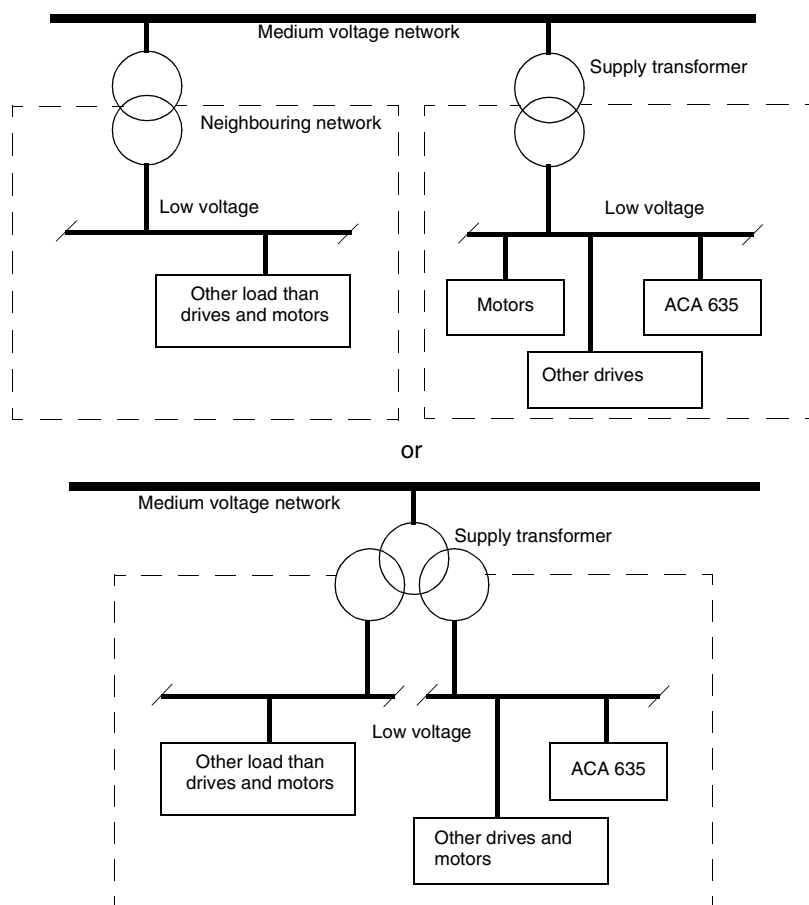
- At start, a charging current high enough for charging all the inverters flows to the connected ones.
- In Thyristor Supply Sections, the DC voltage may overshoot the controller bridge change limit, causing an immediate change to regeneration and a high reverse current.
- The DC voltage may overshoot the braking chopper controller voltage limit, causing an immediate switching into braking mode and a high braking current, which in turn discharges low power inverter capacitors.

The braking chopper may be damaged by repeated on-off switching of the braking due to a high supply and braking section power compared to the inverter power.

ACS/ACC 617 Supply



WARNING! ACS/ACC 617 frame size R11i and above must be supplied with a transformer dedicated to drives and motors or equipment of equal or higher power, or with a transformer equipped with two secondary windings, one of which is dedicated to drives and motors. Resonances might occur if there is capacitive load (e.g. lighting, PC, PLC, small power factor compensation capacitors) in the same network as the ACS/ACC 617. The resonance current may damage a unit in the network.



Supply Connections

The supply section is equipped with a disconnecting device. The electric parts of the whole drive system can be separated by the disconnecting device from the mains network for installation and maintenance work. The supply disconnecting device must be locked to the open position during installation and maintenance work. Both disconnecting devices of 12-pulse units must be locked to the open position during installation and maintenance work.



The supply section can be equipped with an earthing switch as an option. It is used to earth the AC busbars for safety reasons when work is being done on the system. The device is mechanically or electrically interlocked with the main switch.



WARNING! Opening the disconnecting device does not remove all control voltages. Before starting work, check with the circuit diagrams which circuits remain live after opening the disconnecting device.

Note: Voltages from external control circuits may be present.

It is not allowed to install an ACx 6x7 with the EMC Line Filter option to unearthed mains. The mains will be connected to earth potential through the EMC filter of the ACx 600. This may cause danger or damage the unit. The EMC filter capacitors can be disconnected before connecting the ACx 600 to unearthed mains. For detailed instructions on how to do this, please contact your local ABB distributor.

The motor must not be controlled with the supply disconnecting device; instead, the  and  keys of the Control Panel or commands via the digital inputs (NIOC board) or serial communication (NAMC board) of the ACx 600 should be used. The maximum number of charging cycles of the d.c. capacitors of the ACx 600 (i.e. power-ups by applying the mains power) is five in ten minutes.



WARNING! Never connect the mains to the ACx 600 output. If frequent bypassing is required, mechanically connected switches or contactors should be employed. Mains voltage applied to the output can result in permanent damage to the unit.


Operation outside the nominal voltage range should not be attempted, as overvoltages can result in permanent damage to the ACx 600.

Earth Fault Protective Function

The ACx 600 is equipped with an internal earth fault protective function to protect the unit against earth faults in the inverter, the motor and the motor cable. This is not a personal safety or a fire protection feature. The internal earth fault protective function is not applicable in parallel connected inverters. For more information on the earth fault parameter settings, see the appropriate firmware manual.

The supply of the ACx 6x7 can be equipped with an optional earth fault protective device, refer to *Supply Section Manuals*.

Emergency Stop Devices

Emergency stop devices must be installed at each operator control station and at other operating stations where emergency stop may be required. Pressing the  key on the Control Panel of the ACx 600 does not generate an emergency stop of the motor or separate the drive from dangerous potential. Line Contactor, air circuit breaker and Emergency Stop Switch are factory installed as option for ACx 6x7.

An emergency stop function has been provided (optional) in the ACx 600 to stop and switch off the whole drive. The available modes are: Immediate Removal of Power and Controlled Emergency Stop (with thyristor supply only). The emergency stop function must not be used as the normal mode of stopping the drive.

The emergency stop function complies to the principles of the standards listed below.

Table 1 Standards.

EN 292-1: 1991	Safety of machinery - Basic concepts, general principles for design - Part 1: Basic terminology, methodology
EN 292-2: 1991	Safety of machinery - Basic concepts, general principles for design - Part 2: technical principles and specifications
EN 418: 1992	Safety of machinery - Emergency stop equipment, functional aspects - Principles for design
EN 954-1: 1996	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design
EN 60204-1: 1992 + Corr. 1993	Safety of machinery - electrical equipment of machines - Part 1: General principles for design

Immediate Removal of Power (Category 0)

After pressing the emergency stop push-button the power semiconductors of the inverter are blocked (coast stop) and the main contactor (or air circuit-breaker) is opened immediately. No attention is paid to deceleration of the speed of the motor shaft after the emergency stop is activated.

Controlled Emergency Stop (Category 1)

The installer has to make sure that the overriding control fulfils the requirements of EN 60204-1, category 1.

1. Upon receiving the emergency stop signal, each inverter starts braking (by ramp or torque limits) and acknowledges the signal by closing its output contact. (If the emergency stop signal is not acknowledged by all inverters within two seconds, the supply main contactor is opened.)
2. After a delay set with a time relay in the emergency stop circuitry, the supply main contactor is opened. The time delay should be set slightly longer than the inverter stop ramps to ensure controlled braking of all inverters.

Restart

In order to restart the drive system after an emergency stop, the emergency stop push-button has to be released and a reset given before the main contactor (or air circuit-breaker) can be closed and the drive started.

Prevention of Unexpected Start

For personnel safety, it must be possible for the operator to prevent unexpected start of the drive while the production machine is serviced. **Note:** Prevention of Unexpected Start must not to be used for stopping the drive when the inverter is running. A Stop command must be given instead.

The ACx 600 can be equipped with an optional Prevention of Unexpected Start according to the standards: EN 292-1: 1991, EN 292-2: 1991, EN 954-1: 1996, EN 60204-1-1: 1992 + Corr. 1993 (refer to Table 1) and EN 1037: 1995.

The function is achieved by disconnecting the control voltage to the power semiconductors of the inverter. Thus it is not possible for the power semiconductors to switch and generate the AC voltage needed to rotate the motor. In case of faulty main circuit components, the DC voltage from the busbar can be connected to the motor but an AC motor cannot rotate without the field generated by the AC voltage.

The operator activates the Prevention of Unexpected Start with a switch mounted on the control desk. When Prevention of Unexpected Start is activated, the switch is turned to position "0". A signal lamp will be lit on the control desk, indicating that Prevention of Unexpected Start is activated.



WARNING! Prevention of Unexpected Start does not disconnect the voltage of the main and auxiliary circuits. Therefore maintenance work on electrical parts can only be carried out after disconnecting the drive system.

**Frame Sizes R12i,
2 x R12i and 4 x R12i**

Note: This section concerns drive frame sizes R12i, 2 x R12i and 4 x R12i with **ACS 600 Standard Application Program**.

An additional Digital I/O Extension Module (NDIO) is installed in the drives at the factory. The configuration blocks inverter pulses in case of a 230/115 V auxiliary power supply failure, thus preventing incorrect control of the IGBTs.

The node number of this NDIO module is 7. Other optional modules can be chained with it to channel CH1 as usual.

For more information, refer to *ACA 610 Modification Instruction* (EN code 64163671).

Motor Connections



WARNING! Operation is not allowed if the motor nominal voltage is less than 1/2 of the ACS 600 nominal input voltage, or the motor nominal current is less than 1/6 of the ACS 600 nominal output current.

Pulses in the Drive Output

As with all frequency converters employing the most modern IGBT inverter technology, the ACS 600 output comprises – regardless of output frequency – pulses of approximately 1.35 times the mains network voltage with a very short rise time.

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

Modern variable speed drives with their fast rising voltage pulses and high switching frequencies can cause current pulses through the motor bearings which can gradually erode the bearing races.

Protecting the Motor Winding

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

Protecting the Motor Bearings

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

1. optional ACS 600 du/dt filter (protects the motor insulation system and reduces bearing currents)
2. ACS 600 common mode filter (mainly reduces bearing currents)
3. ACS 600 light common mode filter (mainly reduces bearing currents).

The common mode filter is composed of toroidal cores installed onto the motor cable.

Requirements Table

The following table shows how to select the motor insulation system and when optional ACS 600 du/dt filters, insulated N-end (non-driven end) motor bearings and ACS 600 common mode filters are required. Failure of the motor to fulfil the following requirements or improper installation may shorten motor life or damage the motor bearings.

Manufacturer	Motor Type	Nominal Mains Voltage	Requirement for			
			Motor Insulation System	ACS 600 du/dt Filter, Insulated N-end bearing and ACS 600 Common Mode Filter		
				$P_N < 100$ kW and Frame Size < IEC 315	100 kW $\leq P_N < 350$ kW or Frame Size \geq IEC 315	$P_N \geq 350$ kW or Frame Size \geq IEC 400
A B B	Random-wound M2_ and M3_	$U_N \leq 500$ V	Standard	-	+ N	+ N + CMF
		500 V < $U_N \leq 600$ V	Standard	+ du/dt	+ du/dt + N	+ du/dt + N + LCMF
			or	Reinforced	-	+ N + LCMF
	600 V < $U_N \leq 690$ V	Reinforced	+ du/dt	+ du/dt + N	+ du/dt + N + LCMF	
	Form-wound HXR and AM_	380 V < $U_N \leq 690$ V	Standard	n.a.	+ N + CMF	+ N + CMF
	Old* form-wound HX_ and modular	380 V < $U_N \leq 690$ V	Check with the motor manufacturer.	+ du/dt filter with voltages over 500 V + N + CMF		
Random-wound HXR and AM_	380 V < $U_N \leq 690$ V	Check with the motor manufacturer.	+ du/dt filter with voltages over 500 V + N + CMF			
N O N - A B B	Random-wound and form-wound	$U_N \leq 420$ 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	+ du/dt	+ du/dt + N	+ du/dt + N + CMF
			or	+ du/dt + 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	+ du/dt + N + LCMF
			or	+ du/dt + 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	+ du/dt	+ du/dt + N	+ du/dt + N + LCMF	
Form-wound	600 V < $U_N \leq 690$ V	Reinforced: $\hat{U}_{LL} = 2000$ V, 0.3 microsecond rise time	n.a.	+ N + CMF	+ N + CMF	

* manufactured before 1992

Note 1: The abbreviations used in the table are defined below.

Abbreviation	Definition
U_N	nominal mains 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
CMF	common mode filter: 3 toroidal cores per each motor cable
LCMF	light common mode filter: 1 toroidal core per each motor cable
N	N-end bearing: insulated motor non-driven end bearing
n.a.	Motors of this power range are not available as standard units. Consult the motor manufacturer.

Note 2: Explosion-safe (EX) Motors

The motor manufacturer should be consulted regarding the construction of the motor insulation and additional requirements for explosion-safe (EX) motors.

Note 3: High-output Motors and IP 23 Motors

For motors with higher rated output than what is stated for the particular frame size in IEC 50347 (2001) and for IP 23 motors, the requirements of range “100 kW < P_N < 350 kW” apply to motors with P_N < 100 kW. The requirements of range “ P_N > 350 kW” apply to motors with P_N within the range of “100 kW < P_N < 350 kW”.

Note 4: HXR and AMA Motors

All AMA machines (manufactured in Helsinki) to be supplied by a frequency converter have form-wound windings. All HXR machines manufactured in Helsinki since 1997 have form-wound windings.

Note 5: ACA 635 IGBT Supply Sections and the ACS/ACC 611/617

If voltage is raised by the ACA 635 or the ACS/ACC 611/617, select the motor insulation system according to the increased intermediate circuit d.c. voltage level, especially in the 500 V (+10%) supply voltage range.

Note 6: Chopper Resistor Braking

When the drive is in braking mode for a large part of its operation time, the intermediate circuit DC voltage of the drive increases, the effect being similar to increasing the supply voltage by up to 20 percent. This should be taken into consideration when determining the motor insulation requirement.

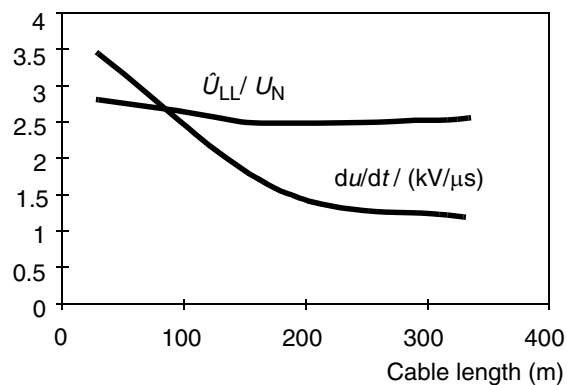
Example: Motor insulation requirement for a 400 V application must be selected as if the drive were supplied with 480 V.

Note 7: The table applies to NEMA motors with the following heading.

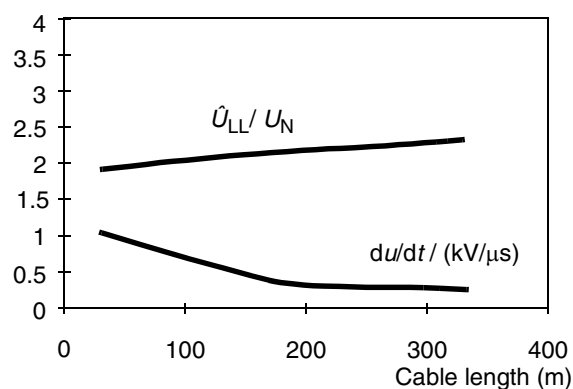
$P_N < 134$ HP and Frame Size < NEMA 500	$134 \text{ HP} \leq P_N < 469$ HP or Frame Size \geq NEMA 500	$P_N \geq 469$ HP
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Note 8: Calculating the Rise Time and the Peak Line-to-line Voltage

The peak line-to-line voltage at the motor terminals generated by the ACS 600 as well as the voltage rise time depend on the cable length. The requirements for the motor insulation system given in the table are “worst case” requirements covering the ACS 600 installations with 30 metre and longer cables. The rise time can be calculated as follows: $\Delta t = 0.8 \cdot \hat{U}_{LL}/(du/dt)$. Read \hat{U}_{LL} and du/dt from the diagrams below.



Without du/dt Filter



With du/dt Filter



WARNING! The ACx 600 introduces electric motors, drive train mechanisms and driven machines to an extended operating range. It should be determined from the outset that all equipment is up to these conditions.



WARNING! There are several automatic reset functions in the ACS 600 (with Standard Application Program). If selected, they reset the unit and resume operation after a fault. These functions should not be selected if other equipment is not compatible with this kind of operation, or dangerous situations can be caused by such action.



WARNING! If an external source for start command is selected and it is ON, the ACS 600 (with Standard Application Program) will start immediately after fault reset or power switch on.

**Power Factor
Compensation
Capacitors**

Power factor compensation capacitors and surge absorbers must not be connected to the motor cables. These devices are not designed to be used with frequency converters, and will degrade motor control accuracy. They can cause permanent damage to the ACx 600 or themselves due to the rapid changes in the ACx 600 output voltage.

If there are power factor compensation capacitors in parallel with the ACx 600 make sure that the capacitors and the ACx 600 are not charged simultaneously to avoid voltage surges which might damage the unit.

Output Contactors

If a contactor is used between the output of the ACx 600 and the motor with DTC control mode selected, the output voltage of the ACx 600 must be controlled to zero before the contactor is opened: ACS 600 units via parameter 21.3, choice COAST. If choice RAMP is selected, the output of the ACS 600 must be controlled to zero via parameter 16.1 by giving zero V DC to the selected digital input. Otherwise the contactor will be damaged. In scalar control the contactor can be opened with ACS/ACC 600 running.

Varistors or RC networks (AC) or diodes (DC) should be used to protect against voltage transients generated by contactor coils. The protective components should be mounted as close as possible to the contactor coils. Protective components should not be installed at the NIOC board terminal block.

Relay Contacts

When used with inductive loads (relays, contactors, motors), the relay contacts of the ACx 600 must be protected with varistors or RC networks (AC) or diodes (DC) against voltage transients. The protective components should not be installed at the NIOC board terminal block.

Components Connected to Digital/ Analogue Inputs



WARNING! IEC 664 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 ACx 600 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 ACx 600
 - are protected against contact, and
 - insulated with basic insulation (the same voltage level as the converter 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 converter main circuit.

EMC

Note: If safety switches, contactors, connection boxes or similar equipment are used in the motor cable, they should be installed in a metal enclosure with 360 degrees earthing for the screens of both the incoming cable and the outgoing cable, or the screens of the cables should otherwise be connected together.



WARNING! The printed circuit boards contain integrated circuits that are extremely sensitive to electrostatic discharge. Exercise appropriate care when working on the unit to avoid permanent damage to the circuits. Do not touch the boards unnecessarily.

Fibre Optic Cables



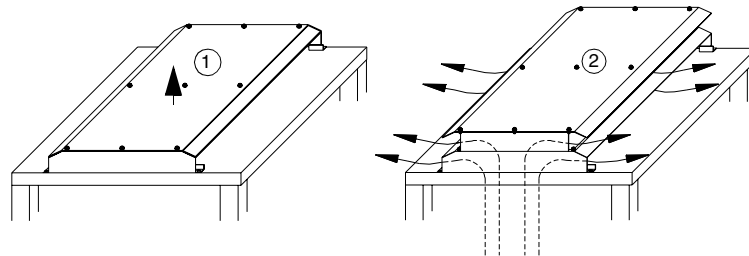
WARNING! Handle the fibre optic cables with care (especially when joining the shipping splits). When unplugging optic cables, always grab the connector, not the cable itself. Do not touch the ends of the fibres with bare hands as the fibre is extremely sensitive to dirt. See *Appendix A – Technical Data / Fibre Optic Cables*.

Cooling



WARNING! The cooling air flow and space requirements must be fulfilled.

If the drive is equipped with a double roof, ensure that the roof is lifted up from the transportation position to enable the cooling air flow before starting the drive.



Air flow from below (from a cable conduit) to the cabinet must be prevented to ensure the degree of protection and fire protection.

Mechanical Installation

CAUTION! Fastening any device to the cabinet frame for lifting purposes is forbidden.

CAUTION! Make sure that dust from drilling does not enter the cabinet when installing. Electrically conductive dust inside the unit may cause damage or lead to malfunction.



WARNING! Welding of the cabinet frame is not recommended. However, if electric welding is the only way to mount the cabinet, connect the return conductor of the welding equipment low to the cabinet frame within 0.5 metres of the welding point. If the welding return wire is connected improperly, the welding circuit may damage electronic circuits located in the cabinets.

Update Notice

This notice concerns	the ACS/ACC 607/617/627/677 Hardware Manual (EN) code 61329005 REV F
Validity	from 3.2.2003 until the release of REV G
Contents	updates
More information	-

Updates in Appendix A – Technical Data

Changed: CE Marking

A CE mark is attached to ACS/ACC 607/617/627/677 drives to verify that the unit follows the provisions of the European Low Voltage and EMC Directives (Directive 73/23/EEC, as amended by 93/68/EEC and Directive 89/336/EEC, as amended by 93/68/EEC).

Definitions

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

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 + Amendment A11 (2000)] covers requirements stated for drives.

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.

Restricted distribution: mode of sales distribution in which the manufacturer restricts the supply of equipment to suppliers, customers or users who separately or jointly have technical competence in the EMC requirements of the application of drives.

Unrestricted distribution: mode of sales distribution in which the supply of equipment is not dependent on the EMC competence of the customer or user for the application of drives.

Compliance with the EMC Directive

The drive complies with the EMC Directive in industrial low-voltage network, and IT networks (unearthed mains) with the following provisions.

First Environment (Restricted Distribution)

1. The drive is of type ACS/ACC 607 equipped with EMC filtering (refer to Table A-1).
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.

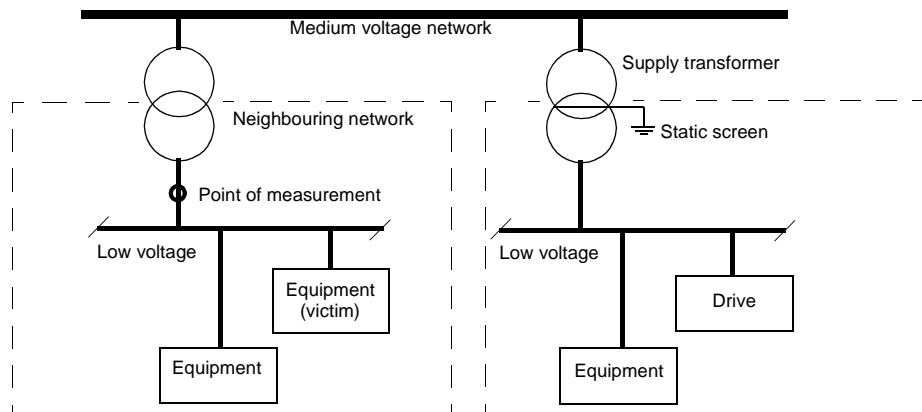
Second Environment (Unrestricted Distribution)

1. The drive is of type ACS/ACC 617, or the drive is equipped with EMC filtering, common mode filter (three toroidal cores per each motor cable), du/dt filter or sine output filter.
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.

Second Environment (Restricted Distribution)

1. The drive is **not** of type ACS/ACC 617, or the drive is **not** equipped with EMC filtering, common mode filter (three toroidal cores per each motor cable), du/dt filter or sine output filter.
2. 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.



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

Notes

Note 1: It is recommended to equip the ACx 607/627 with EMC filtering if equipment sensitive to conducted emission is connected to the same supply transformer as the drive.

Note 2: The ACx 677 must not be equipped with EMC filtering.

Note 3: The drive must not be equipped with EMC filtering (refer to Table A-1) when installed to IT (unearthed) networks. The mains becomes connected to earth potential through the EMC filter capacitors. In IT networks, this may cause danger or damage the unit.

Table A-1 The EMC filtering of the drives is marked in the type code as follows. 1 = EMC cabinet, 2 = EMC cabinet with EMC filters.

ACS 600 Type	Type Code		
	Character no.	EMC Options	No EMC Filter Selection
ACS/ACC 6x7 (75 to 3000 kW)	ACxxxxxxxxxxxxxxxxxxxxxxxxxxx... ↑ 26	1, 2	0

Machinery Directive The drives comply with the European Union Machinery Directive (98/37/EC) requirements for an equipment intended to be incorporated into machinery.

Applicable Standards

- EN 50178 (1997) Electronic equipment for use in power installations
- EN 60204-1 (1997) Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
Provisions for compliance: The final assembler of the machine is responsible for installing
- an emergency-stop device
- EN 60529: 1991 (IEC 60529) Degrees of protection provided by enclosures (IP code)
- IEC 60664-1 (1992) Insulation coordination for equipment within low-voltage systems. Part 1: Principles, requirements and tests.
- EN 61800-3 (1996) + Amendment A11 (2000) EMC product standard including specific test methods
- UL 508C UL Standard for Safety, Power Conversion Equipment, second edition
- CSA C22.2 No. 14-95 Industrial control equipment

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Chapter 1 – Introduction

ACS 600 Product Family

The ACS 600 product family of three phase frequency converters and converter modules for speed control of squirrel cage electric motors includes

- the ACS 600 (for most applications)
- the ACP 600 (for positioning, synchronising and other high-precision control applications)
- the ACC 600 (for crane drive applications)
- the ACS 600 MultiDrive (for multidrive applications)

The application programs are introduced in *Appendix – A*.

Overview of the Manual

Study this manual carefully before installing, commissioning, operating or servicing the frequency converter. We expect that you have a basic knowledge of physical and electrical fundamentals, electrical wiring practices, electrical components and electrical schematic symbols.

ACS/ACC 6x7 frequency converters consist of a Supply Section and a Drive Section. This manual covers:

- System and hardware descriptions of the Drive Section.
- Mechanical and electrical installation of the Supply Section and the Drive Section. Details are given such as: moving of the shipping sections, joining of the shipping sections together, joining of the busbars and fastening of the cabinets to the floor.
- Commissioning of the Drive Section.
Note: For Supply Section commissioning, parameters, fault tracing and product information see *Supply Sections User's Manual (DSU, TSU or ISU)*.
- Preventative maintenance and hardware based fault tracing.
Note: Fault and warning messages given by the software are described in the *ACS 600 Firmware Manual (for System, Standard or Crane Drive Application Program)* or in the *Supply Sections User's Manual (DSU, TSU or ISU)*.

Other Manuals

The use of the Control Panel and the parameter setting of the inverter application program are described in the *ACS 600 Firmware Manual (for System, Standard or Crane Drive Application Program)*. For commissioning of the ACS 600 Standard Application Program there is a *Start-up Guide*.

For dimensional drawings, refer to *ACS/ACC 607/617/627/677 Dimensional Drawings* (EN code 64488422).

For optional equipment, refer to the accompanying manuals.

Delivery Check

Check that there are no signs of damage. Before attempting installation and operation, check the information on the frequency converter nameplate to verify that the unit is of the correct model.

Each ACx 600 is fitted with a nameplate for identification purposes. The nameplate data includes a type code and a serial number, which allow individual recognition of each unit. The type code contains information on the properties and configuration of the 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.

Inquiries

Any inquiries about the product should be addressed to the local ABB representative, quoting the type code and the serial number of the unit. If the local ABB representative cannot be contacted, inquiries should be addressed to ABB Industry, Helsinki, Finland.

ACx 6x7 Type Code

The meaning of the main selections of ACx 6x7 type code characters is explained in the table below. Not all selections are available for all types. More information on selections is in *ACS 600 SingleDrive Ordering Information* guide (code: 58977985, available on request).

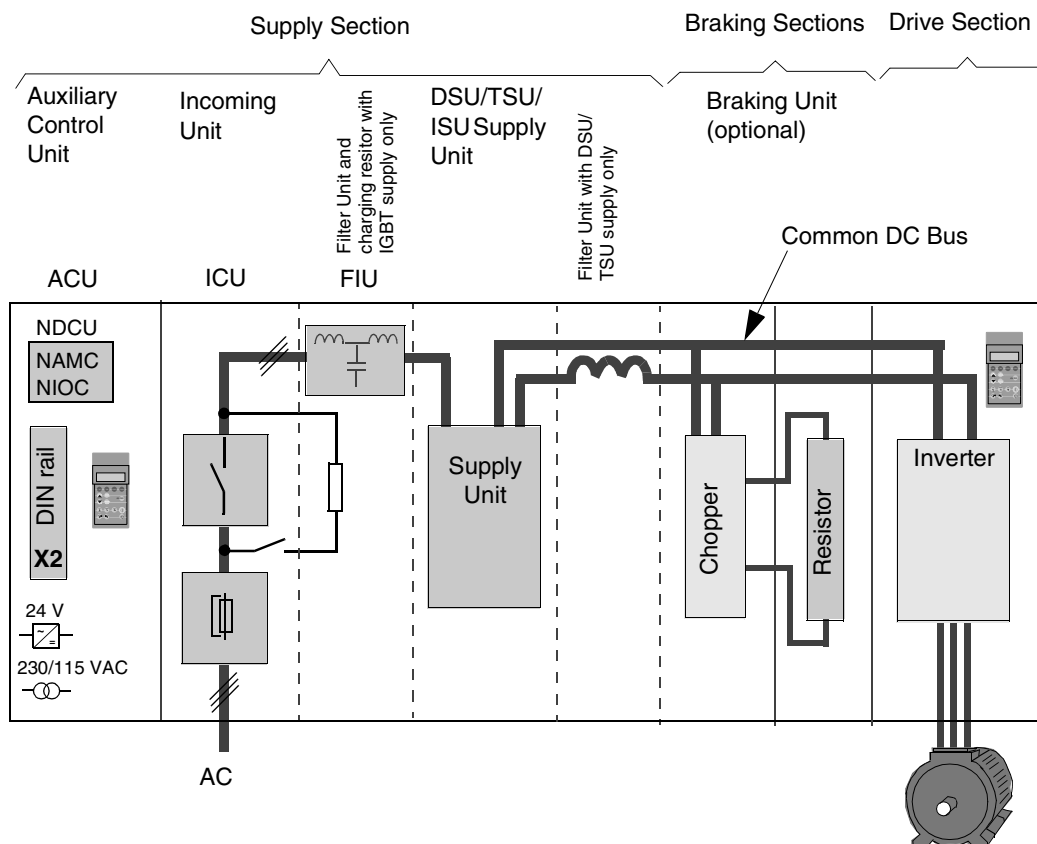
Character no.	Meaning	Refer to
Example: ACS627090062BD0C150200A00100B2100A1A2AX		
1	Product Category A = AC Drive	
2...3	Product Type CS = Standard, CC = Crane Drive	
4	Product Family 6 = ACS 600	
5	Input Bridge 0 = 6-pulse diode rectifier, 1 = IGBT converter, 2 = 12-pulse diode rectifier, 7 = regenerative 4Q thyristor bridge	
6	Construction 7 = cabinet	
7..10	Power Rating (kVA)	<i>Appendix A: Ratings</i>
11	Voltage Rating 3 = 380/400/415 V a.c. 5 = 380/400/415/440/460/480/500 V a.c. 6 = 525/550/575/600/660/690 V a.c.	
12	Supply Frequency 2 = 50 Hz, 3 = 60 Hz	

Character no.	Meaning	Refer to
13	<p>Cabling</p> <p>B = supply and motor cables bottom entry/exit T = supply and motor cables top* entry/exit 1 = supply cables top* entry and motor cables bottom exit 2 = supply cables bottom entry and motor cables top* exit 3 = supply and motor cables bottom entry/exit with common motor output section 4 = supply cables top entry and motor cables bottom exit with common motor output section</p> <p>* extra output section required</p>	
14, 15	I/O Options and Fieldbus Adapter	
16	<p>Application Software</p> <p>x = Languages and Application Macro Options</p>	<i>Appendix A: Application Programs</i>
17	<p>Control Panel</p> <p>0 = none, 1 = Control Panel included</p>	
18	<p>Degree of Protection</p> <p>1 = IP 21, 2 = IP 22, 4 = IP 42, 5 = IP 54, 6 = IP 54R</p>	<i>Appendix A: Enclosures</i>
19	Coated Boards	
20	Emergency Stop	
21	<p>Motor Temperature Protections</p> <p>0 = none, 1 = Pt 100 relay, 2 = thermistor relay</p>	
22	Quantity of Temperature Protections	
23	<p>Cabinet Options</p> <p>0 = none, A = cabinet heater</p>	
24	Auxiliary Motor Fan Supply	
25	Quantity of Auxiliary Motor Fan Supply	
26	<p>EMC</p> <p>1 = EMC cubicle, 2 = EMC cubicle + RFI filters</p>	<i>Appendix A: CE marking</i>
27	<p>du/dt Filter</p> <p>0 = none, 1 = du/dt filters, 2 = common mode filters, 3 = du/dt filters + light common mode filters, 4 = du/dt filters + common mode filters, 5 = light common mode filters</p>	
28	<p>Braking Chopper and Resistors</p> <p>0 = none, 1 = braking chopper, 2 = braking chopper + resistors</p>	
29	<p>Earth Fault Monitoring</p> <p>0 = none, A = selected (unearthed supply network), B = selected (earthed supply network)</p>	
30	<p>Control Voltage for Relays and Fans</p> <p>1 = auxiliary control voltage 230 VAC 2 = auxiliary control voltage 115 VAC 3 = connection for external control 230 VAC supply (UPS) 4 = connection for external control 115 VAC supply (UPS)</p>	
31	<p>Incoming Unit Options</p> <p>0 = switch fuse or load switch 1 = switch fuse or load switch + earthing (grounding) switch 2 = contactor with switch fuse or breaker 3 = contactor with switch fuse or breaker + earthing (grounding) switch</p>	

Character no.	Meaning	Refer to
32	Prevention of Unexpected Start 0 = none, 1 = selected	
33	24 VDC Power Supply 0 = power supply from inverter for NAMC/NIOC 1 = external power supply for NAMC/NIOC	
34	Manual Language	
35	Supply Conductor Type 1 = cable, 2 = busbar	
36	DC Busbar Material A = aluminium, B = tin plated copper	
37	Output for Motor Heaters 0 = none, 2 = 2 pieces, 4 = 4 pieces	
38	Type Code Revision	
39	Special	

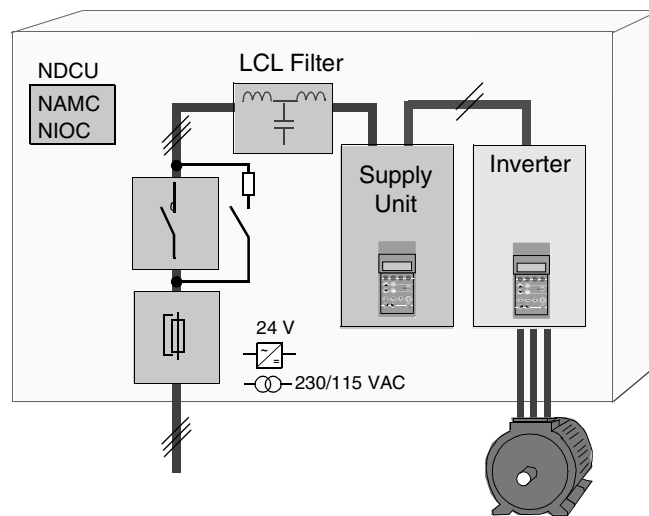
Main Components of the ACx 6x7

The main components of the drive (the ACS/ACC 607/627/677 and 617 frame sizes R11i and up) are shown below. The Supply Unit is equipped with either a Diode, a Thyristor or an IGBT input bridge. Braking Unit is an optional device. The control panels are optional. For a more detailed description of the Supply Unit refer to the Supply Sections User’s Manuals. This chapter describes the Drive Section in more detail.



**ACx 617 Frame Sizes
R6i to R9i**

The main components of ACS/ACC 617 frame sizes R6i to R9i are shown below. The control panels are optional.



Auxiliary Control Unit

The following components are located in the Auxiliary Control Unit of the ACx 6x7:

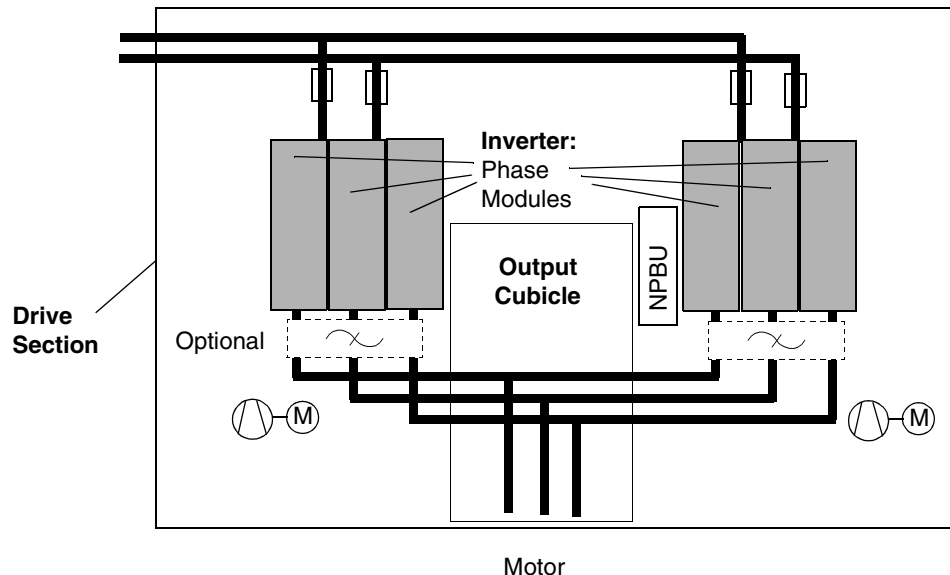
- Drive Control Unit, which includes an Application and Motor Controller (NAMC) Board and a standard I/O (NIOC) Board
- CDP 31x Control Panel
- Control wiring and relays (for e.g. optional prevention of unexpected start-up)
- Optional modules (I/O extension and fieldbus adapter modules, pulse encoder interface module etc.)
- Other options.

Drive Section

The drive section contains parts listed below:

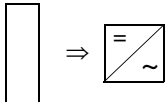
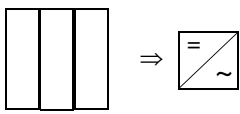
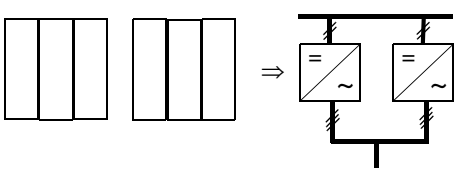
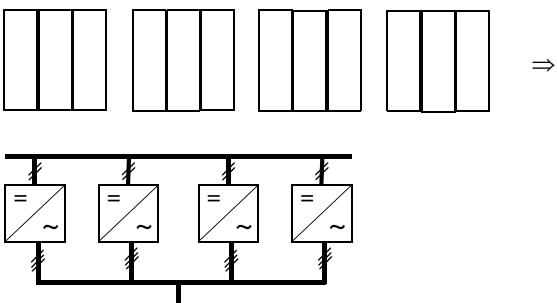
- Inverter
- Inverter Cooling Fans
- Optical Branching Unit (NPBU) with parallel connected units
- du/dt Filters (optional)
- Output Cubicle (with parallel connected inverter units and units with motor cable entry and exit through the top of the cabinet)
- DC Fuses (frames 2 x R11i, 2 x R12i and 4 x R11i only)
- Cabinet mechanics

Example A block diagram of a 2 x R11i drive section is shown below.



Inverter

The inverter includes an IGBT output bridge which forms controlled a.c. voltage from the intermediate circuit d.c. voltage. An inverter controls one motor.

Frame Size	An Inverter Unit (ACN 634 xxxx) includes
R6i to R9i	one inverter module (ACN 634 xxxx) ⇒ one inverter 
R11i, R12i	three phase modules (ACN 634 xxxx) = one inverter 
2 x R11i, 2 x R12i	two times three phase modules (ACN 634 xxxx) = two phase module blocks ⇒ one inverter 
4 x R11i	four times three phase modules (ACN 634 xxxx) = four phase module blocks ⇒ one inverter 

Control Boards

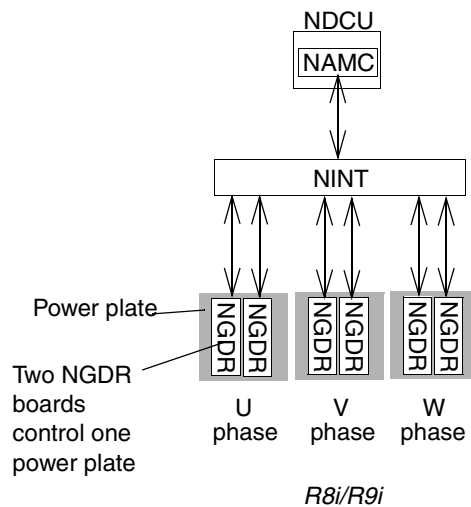
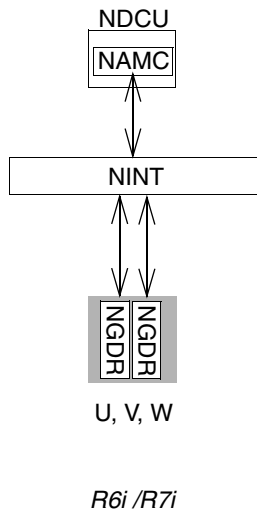
One phase module block includes the following boards:

- main circuit interface board (NINT): This board gives the control commands and sends measurement signals.
- two control distribution boards (NXPP, in frame size R10i and up). These boards distribute the control commands given by the NINT board.
- gate driver boards (NGDR). These boards amplify the control pulses for the insulated gate bipolar transistors (IGBTs).
- branching unit board (NPBU) in parallel-connected units, e.g. 2 x R8i, 4 x R11i
- power supply board for gate drivers (NGPS) in V-phase module
- power supply board (NPOW-62) in V-phase module.

An inverter of frame size 2 x R11i/R12i includes two times the control boards of an R11i/R12i inverter. An inverter of frame size 4 x R11i includes four times the control boards of an R11i inverter.

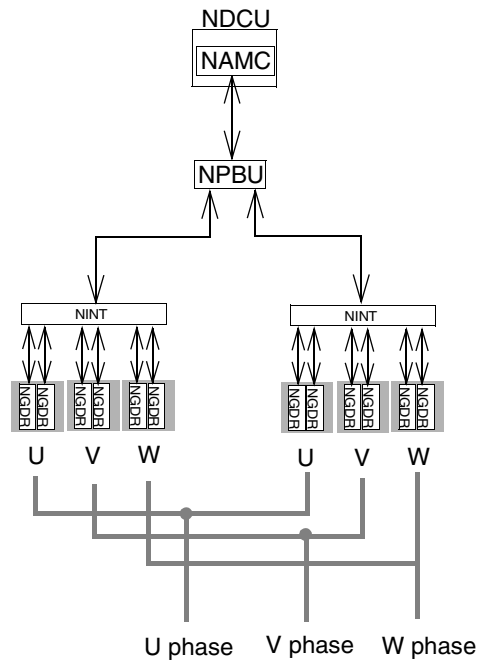
Control Board Diagrams (R6i to R9i)

These diagrams show the control boards that control an inverter of size R6i to R9i.



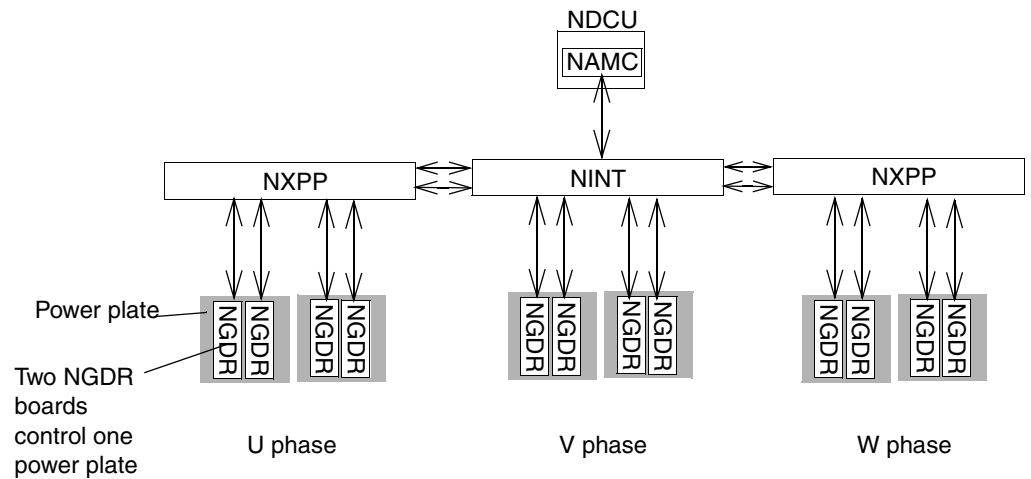
Control Board Diagram
(2 x R8i, 2 x R9i)

This diagram shows the control boards that control an inverter of sizes 2 x R8i and 2 x R9i.

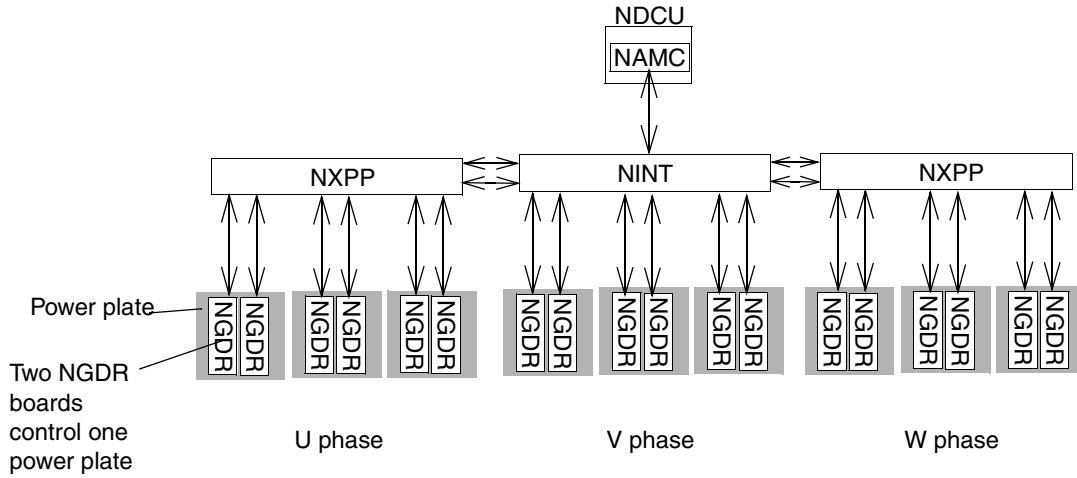


Control Board Diagram
(R10i, R11i)

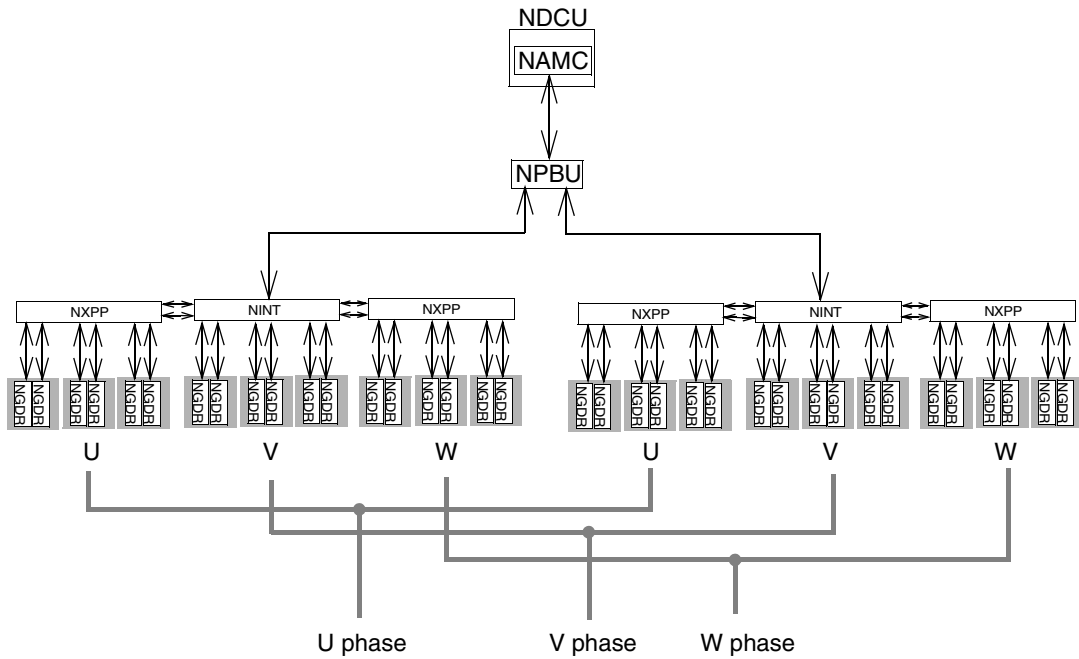
This diagram shows the control boards that control an inverter of sizes R10i and R11i.



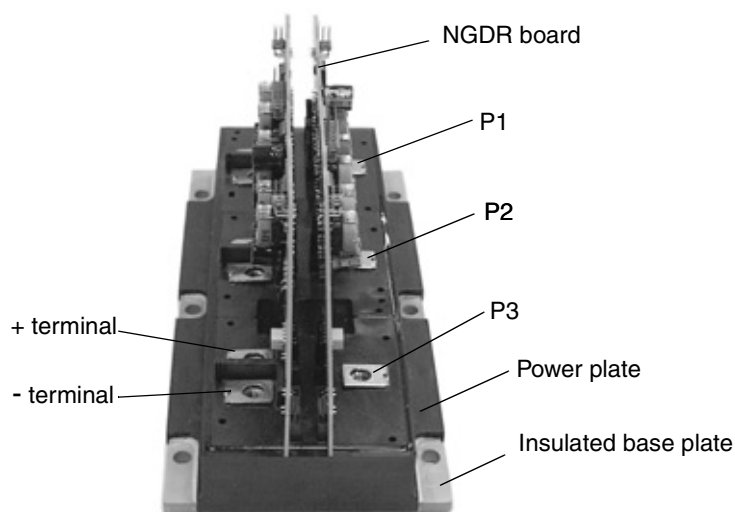
Control Board Diagram (R12i) This diagram shows the control boards that control an inverter of size R12i.



Control Board Diagram (2 x R12i) This diagram shows the control boards that control an inverter of size 2 x R12i.

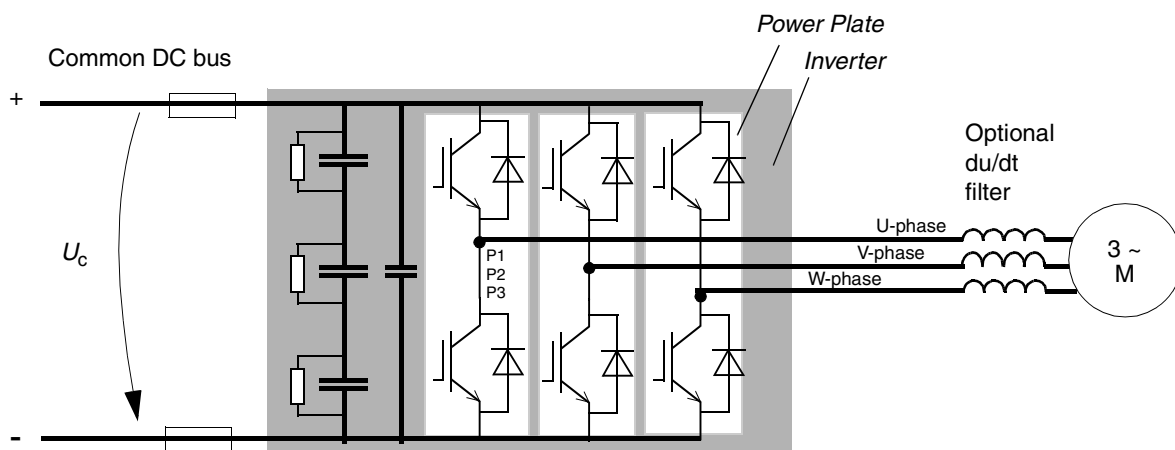


Power Plate This photo shows one power plate with the NGDR boards connected.

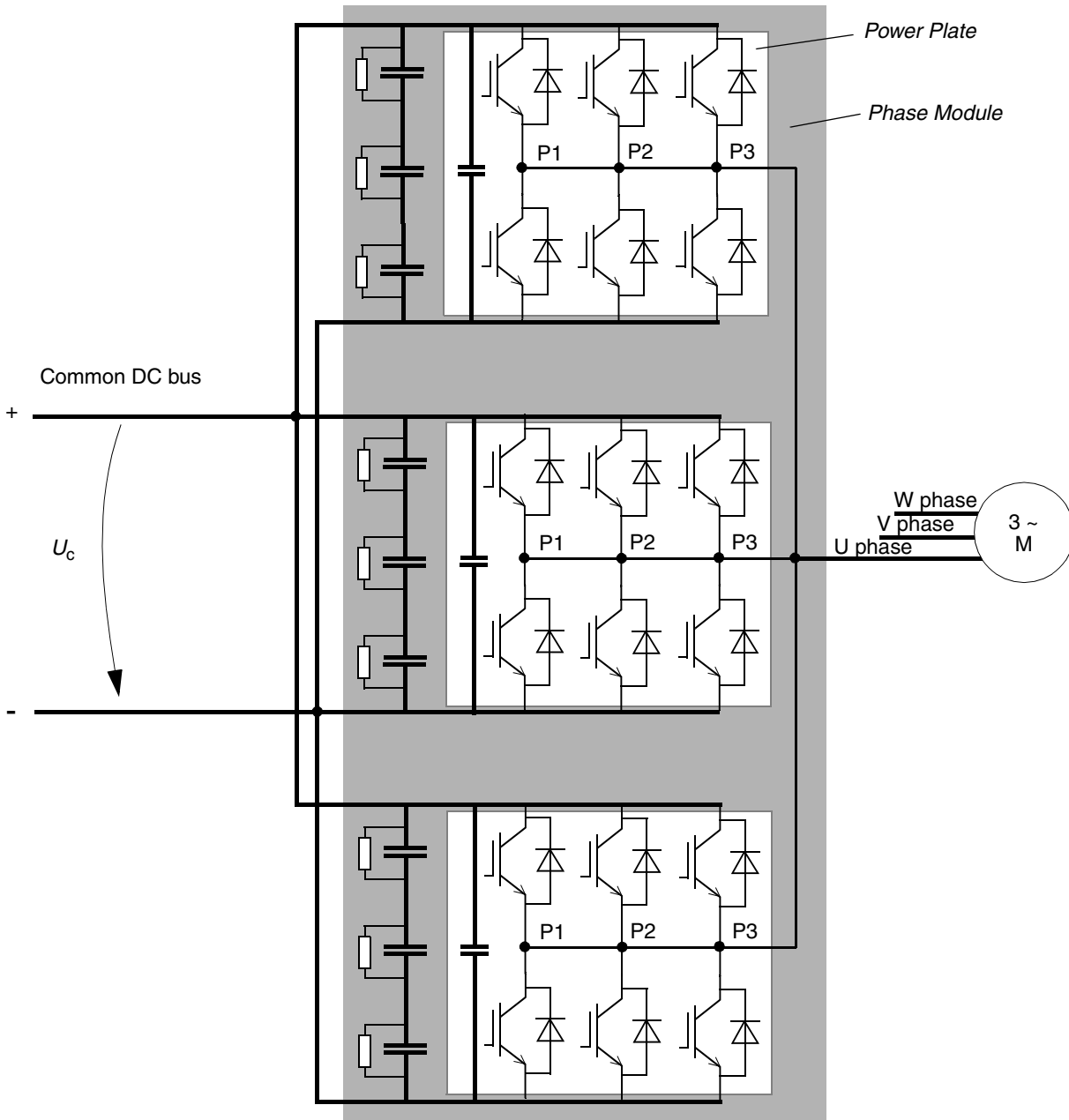


Main Circuit Diagram

Frame Size R8i/R9i Frame R8i/R9i contains three phase modules, each producing one of the three phases driving the motor.



Frame Size R12i Frame R12i contains three phase modules, each producing one of the three phases driving the motor. Each phase module consists of three parallel connected power plates. Six IGBTs with free wheeling diodes are integrated to a single power plate. The figure below shows the connection of one phase.



Note: DC fuses are included in frames 2 x R11i, 2 x R12i and 4 x R11i only

Voltages from the Supply Section

The supply section supplies the inverter via the DC busbar. The inverter also takes energy from the DC busbar to make control voltages for the control boards and auxiliary voltage for I/O board.

Voltage for the inverter cooling fans is taken from a 230/115 V a.c. transformer (in the Auxiliary Control Unit) via thermal protection switch F10, F11 or F12 (depending on the frame size).

The 24 V auxiliary voltage source is powered from the 230/115 V a.c. transformer (in the Auxiliary Control Unit) via F3.

The emergency stop and the optional uninterruptible power supply (UPS) are wired from the Auxiliary Control Unit.

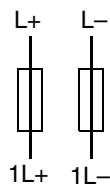
Drive Section Configurations

Drive section configurations are described below.

Drive Section Fuses

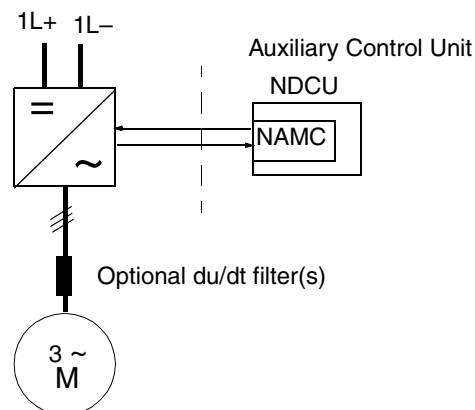
The drive section is equipped with DC fuses with frames 2 x R11i, 2 x R12i and 4 x R11i. Smaller drive sections are protected by the fuses inside the Supply Unit or by a load switch in the Incoming Unit.

DC Fuses



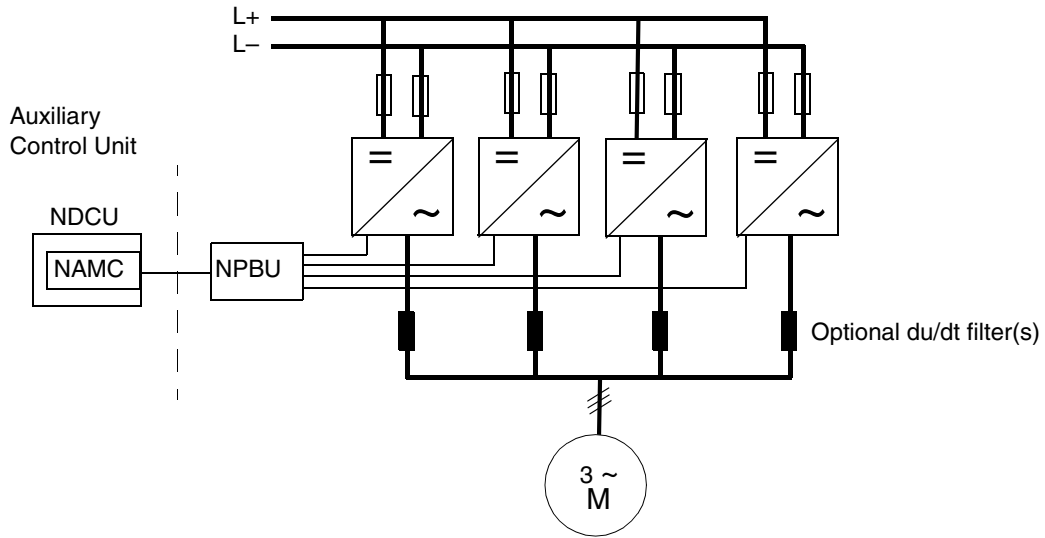
Single Inverter Modules

One NAMC board controls the inverter unit. NAMC board is located on the DIN rail in the Auxiliary Control Unit inside the Drive Control Unit (NDCU) box with the NIOC board.



**Parallel Connected
Phase Module Blocks**

One NAMC board controls all parallel connected phase module blocks via an optical branching unit (NPBU-4x) which forwards commands simultaneously to the interface (NINT) boards of the blocks. Each block is supplied via fuses.



Chapter 2 – Mechanical Installation

General

This chapter provides instructions for moving the shipping splits, fastening them to the floor and joining them together. These instructions apply to the ACS 600 MultiDrive (ACA 6xx) and the ACx 6x7 (75 to 3000 kW). Instructions concerning only some types are marked.

See *Safety and Product Information* (ACS 600 MultiDrive, EN code 63982229) or *Appendix A* (ACx 6x7) for allowed operating conditions of the frequency converter and sufficient room around the unit. Room around the unit is required to enable cooling air flow, service and maintenance. Proper mechanical installation is an important element for a trouble-free installation and should be followed closely.

The frequency converter cabinets should be installed in an upright vertical position.

The floor that the unit is installed on should be of non-flammable material, as smooth as possible, and strong enough to support the weight of the unit. The floor flatness must be checked with a spirit level before the installation of the cabinets into their final position. The maximum allowed deviation from the surface level must be ≤ 5 mm measured every 3 m. The installation site should be levelled, if necessary, as the cabinet is not equipped with adjustable feet.

The wall behind the unit should be of non-flammable material.

Required Tools

The tools required for moving the shipping splits to their final location, fixing them to the floor and tightening the connections are listed below.

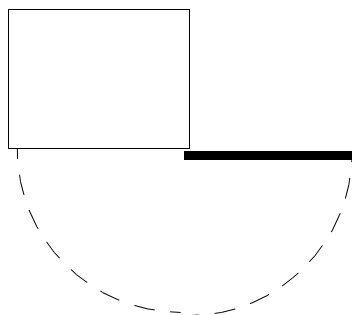
1. Iron bar and roller tubes or similar for moving a shipping split
2. Pozidrive and Torx (2.5–6 mm) screwdrivers for the tightening of the frame screws
3. Torque wrench
4. 19 mm wrench set for tightening the DC horizontal busbars between shipping splits
5. 17 mm wrench set for tightening the PE busbars between shipping splits

Cabinet Construction

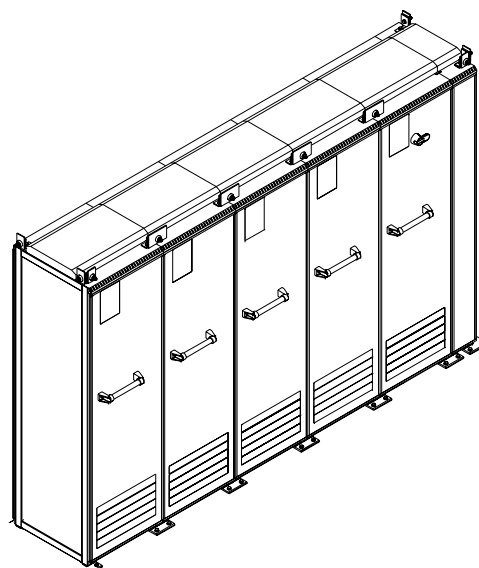
The air-cooled ACS 600 MultiDrive and the ACx 6x7 use the same cabinet construction. In marine versions, the cabinet includes, in addition, vibration dampers and handles on the doors.



ACS 600 MultiDrive and ACx 6x7



Cabinet Door Opening



Marine Applications (ACS 600 MarineDrive)

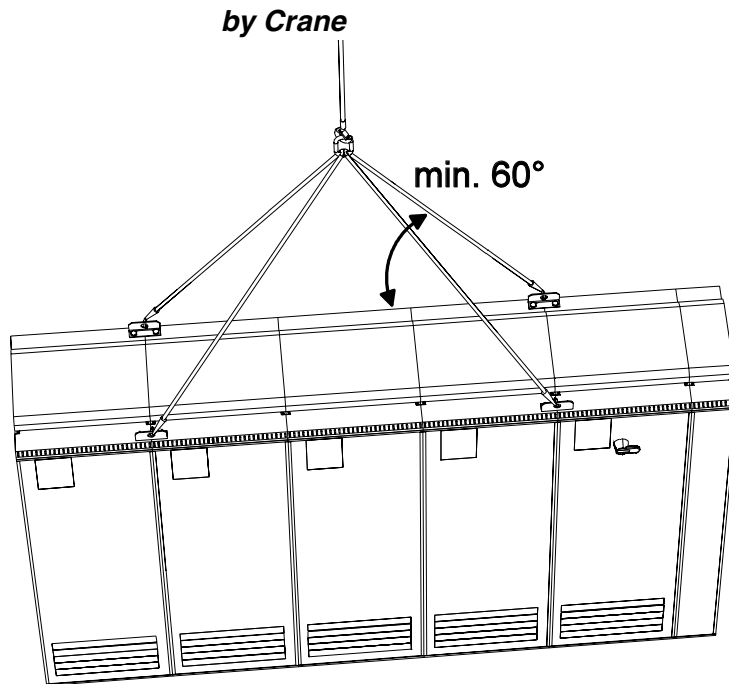


ACx 617
Frame Size R7i



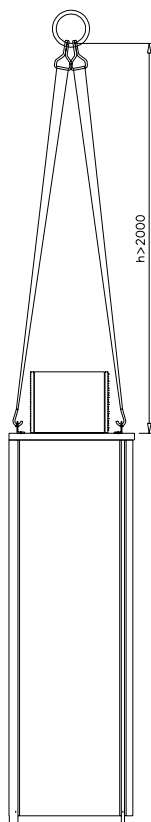
ACx 617 Frame Size R9i

Moving of the Shipping Split



Use the steel lifting lugs attached to the top of the cabinets. Insert the lifting ropes or slings into the holes of the lifting lugs.

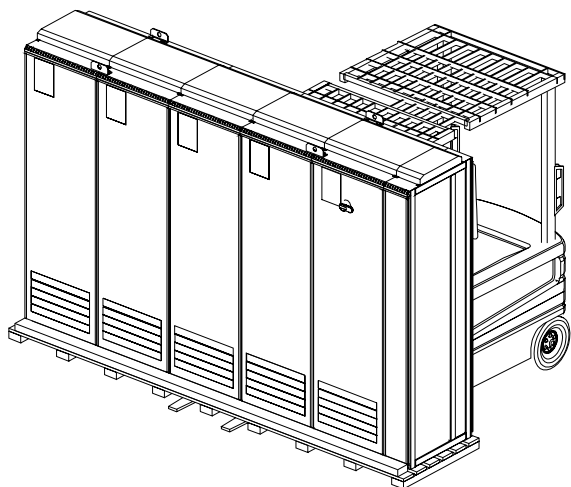
The lifting lugs can be removed (not mandatory) once the cabinets are in their final location. **If the lifting lug is removed, the bolts for each lug must be refastened to maintain the degree of protection of the cabinet.**



ACx 6x7: IP 54

Allowed minimum height of lifting ropes or slings for IP 54 shipping splits is 2 metres.

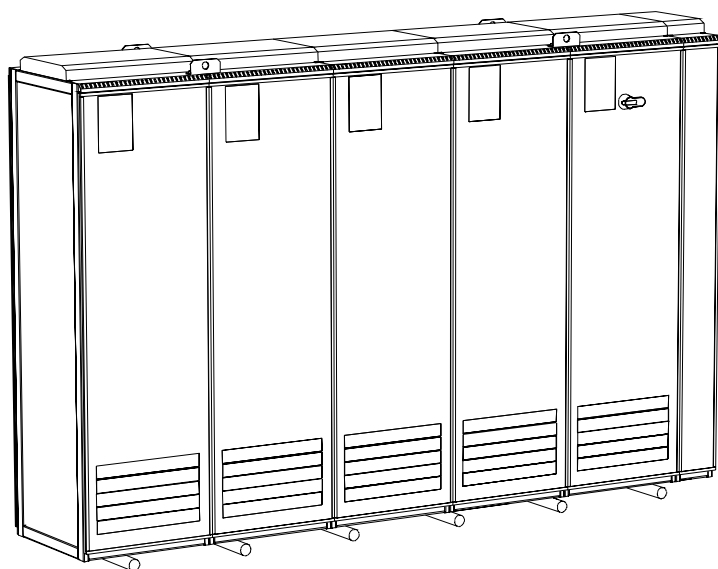
by Fork-lift



The centre of gravity may be quite high. Be therefore careful when transporting the shipping splits. Tilting of the cabinets must be avoided.

Moving of the shipping split is to be done only with the cabinets upright.

by Split Rollers (Not allowed in marine versions)

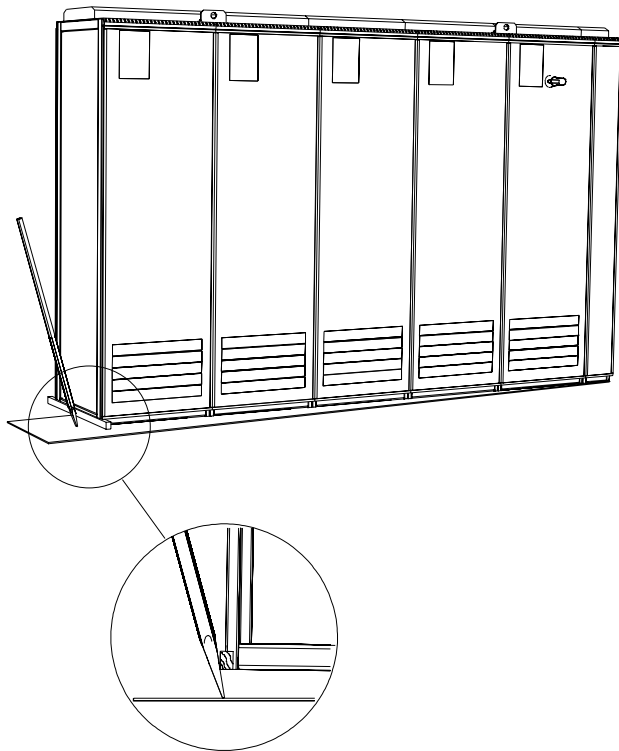


Remove the bottom wooden frame which is part of the shipment.

Lay the shipping split on the rollers and move the unit carefully until it is close to its final location.

Remove the rollers by lifting the shipping split using a crane or fork-lift truck as described above.

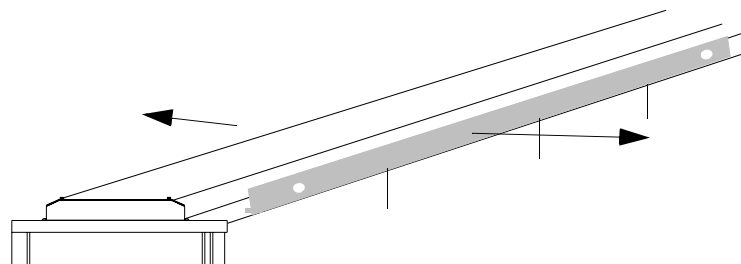
Final Placement of the Shipping Splits (Not allowed in marine versions)



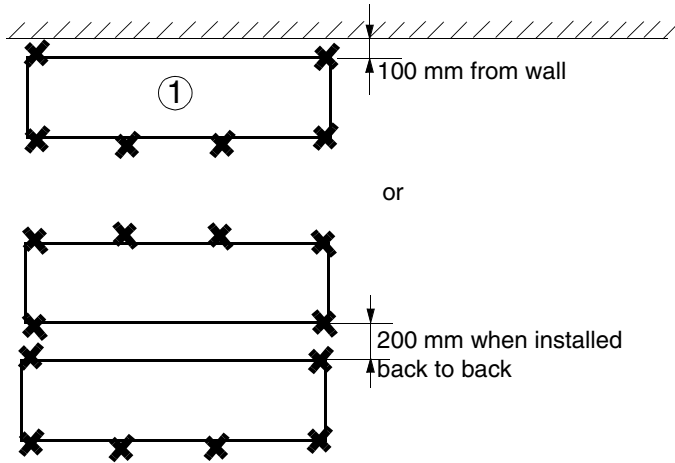
The cabinets can be moved into their final position by using an iron bar and a wooden piece at the bottom edge of the cabinet. Care is to be taken to properly place the wooden piece so as not to damage the cabinet frame.

Removing the Lifting Lugs and Bars

Remove the lifting bars (if used) after lifting, as they disturb the cooling of the unit. Remove the lifting lug of marine versions. **Refasten the original bolts or fasten the upper vibration dampers (if used) in order to maintain the degree of protection of the cabinet.**

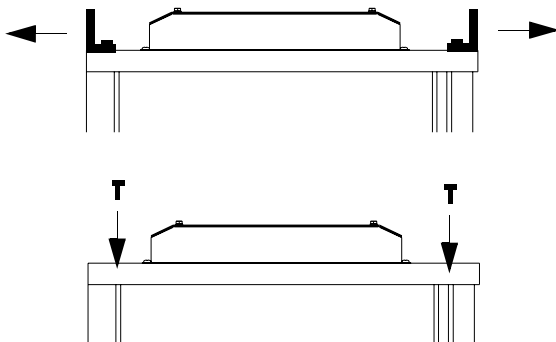


Working Order of the Mechanical Installation



1. Fasten the first shipping split to the floor with fastening clamps or through the holes inside the cabinet. See section *Fastening the Shipping Split to the Floor*. In marine versions, fasten the first shipping split to the floor and roof/wall as described in section *Vibration Dampers on Top and Bottom (Marine Versions)*. **Note:** Any height adjustment of the cabinets must be done before fastening the cabinets together. Height adjustment can be done by using metal shims between the bottom frame and floor.

②



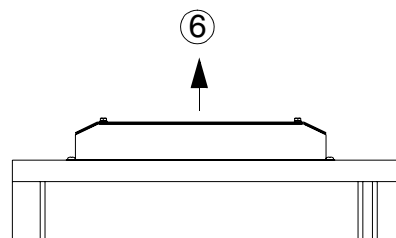
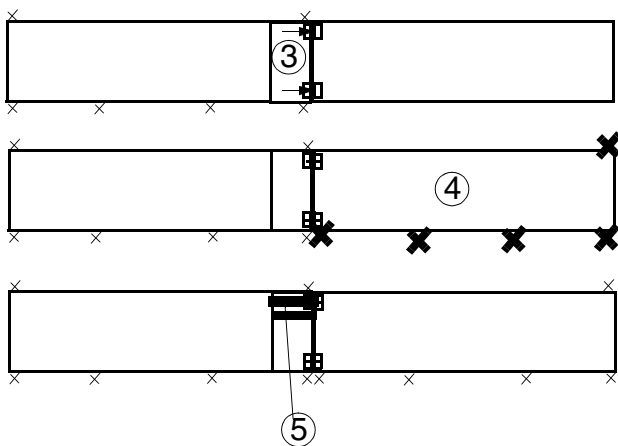
2. Remove the lifting bars (if used) and the lifting lugs in marine applications. Place the original bolts or upper vibration dampers to the holes.

3. Fasten the first shipping split to the next shipping split. Each shipping split includes a 200/600 mm joining cabinet.

4. Fasten the second shipping split to the floor.

5. Connect the DC busbars and the PE busbar.

6. Lift the upper part of the cabinet roof up (if a double roof).

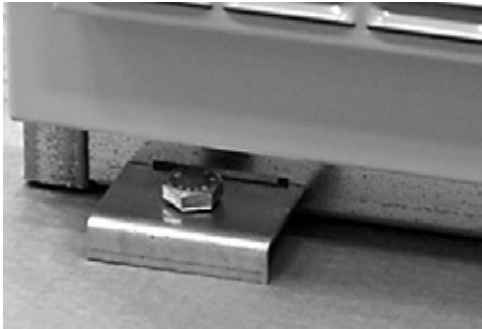


Fastening the Shipping Split to the Floor

Fastening the shipping split to the floor is especially important in installations subjected to vibration or other movement.

Fastening Clamps

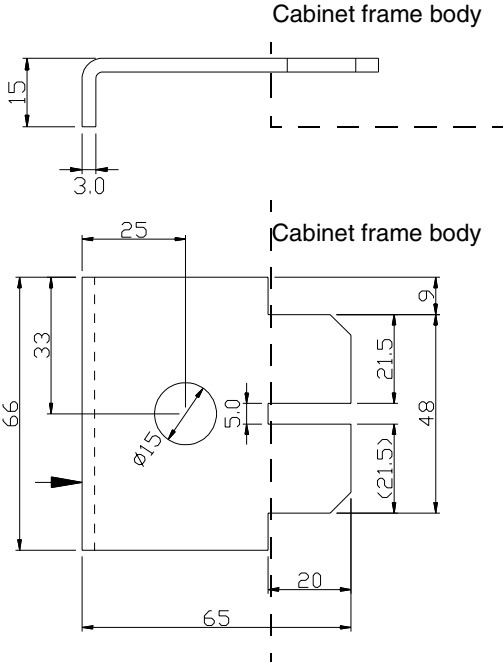
Insert the clamp into the longitudinal hole in the edge of the cabinet frame body and fasten it with a bolt to the floor. Allowed maximum distance between the fastening clamps is 800 mm.



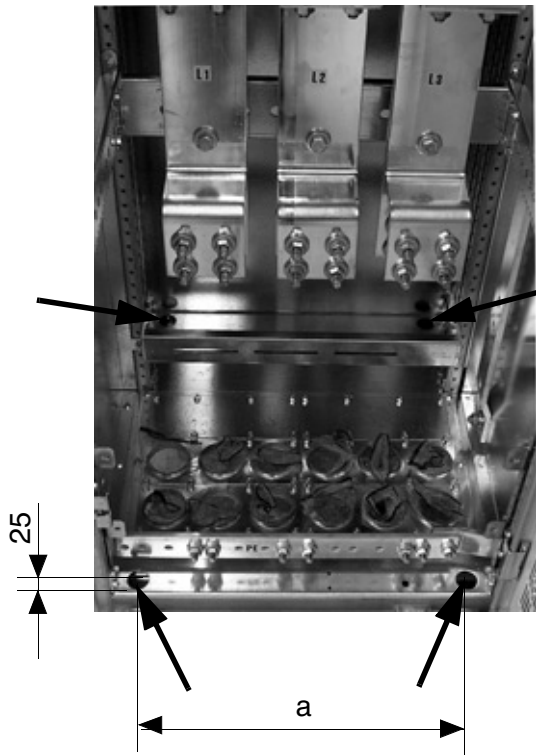
Fastening hole distances for the common cabinet are given below. Fastening bolt: M10 to M12 (3/8" to 1/2").

Cubicle Width	Hole Distance (mm)
200	
400	a: 250
600	a: 450
800	a: 650
1000	a: 350, b: 150, a: 350
1200	a: 450, b: 150, a: 450
1500	a: 350, b: 150, a: 350, b: 150, a: 350

Dimensions of the fastening clamp



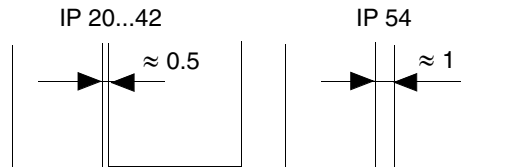
Holes inside the Cabinet The cabinet can be fastened to the floor using the fastening holes inside the cabinet, if they are available and accessible. Allowed maximum distance between the fastening points is 800 mm.



Fastening holes inside the cabinet

Side plates of the cabinet: 15 mm
Back plate of the cabinet: 10 mm

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

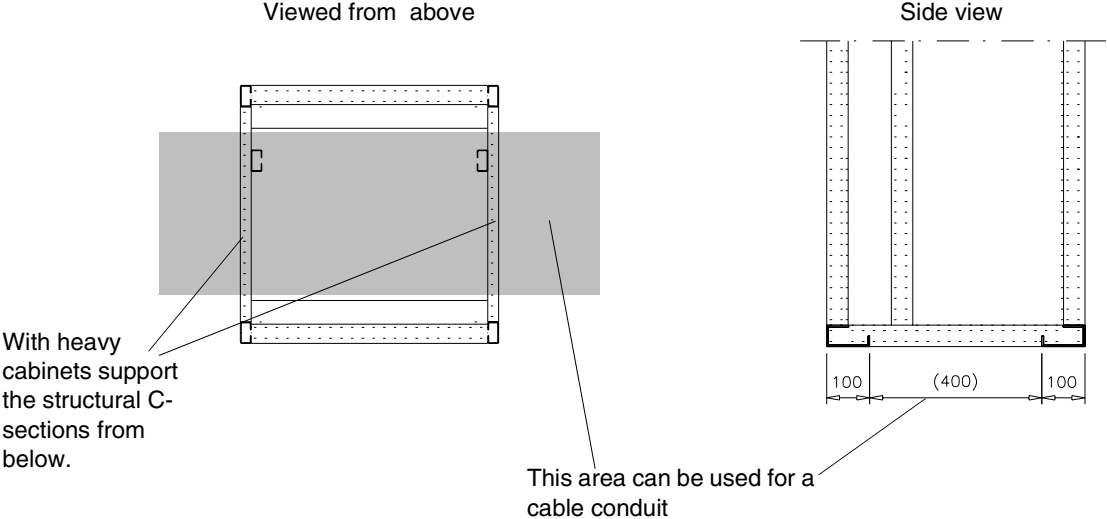


Fastening hole distances for the common cabinet are given below.
Fastening bolt: M10 to M12 (3/8" to 1/2").

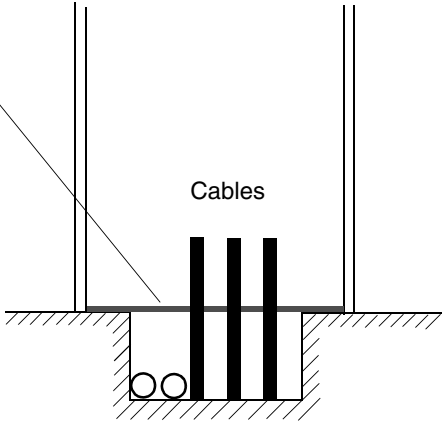
Cubicle Width	Hole Distance (mm)
200	a: 50
400	a: 250
600	a: 450
800	a: 650
1000	a: 350, b: 150, a: 350
1200	a: 450, b: 150, a: 450
1500	a: 350, b: 150, a: 350, b: 150, a: 350

Cable Conduit in the Floor below the Cabinet

A cable conduit 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 conduit 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 and fire protection.



Electric Welding

It is not recommended to fasten the cabinet by welding.

Cabinets without vibration dampers

If the preferred fastening methods (clamps or holes inside the cabinet) can not be used, proceed as follows:

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

Cabinets with vibration dampers

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

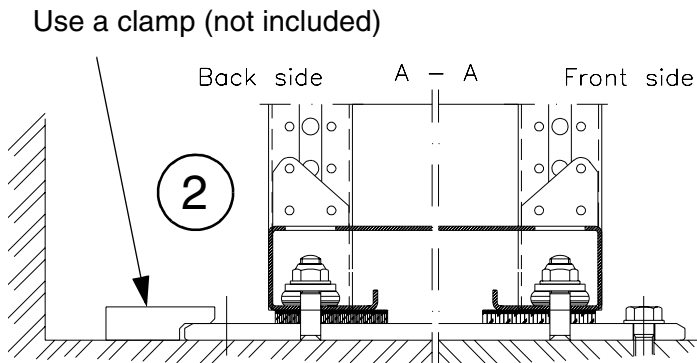
- Weld only the flat bar under the cabinet, never the cabinet frame itself.
- Clamp the welding electrode onto the flat bar about to be welded or onto the floor within 0.5 metres of the welding point. **Do not clamp the electrode on any part of the cabinet frame.**
- Cool the flat bar with a wet cloth so that the heat is not conducted to the vibration dampers.



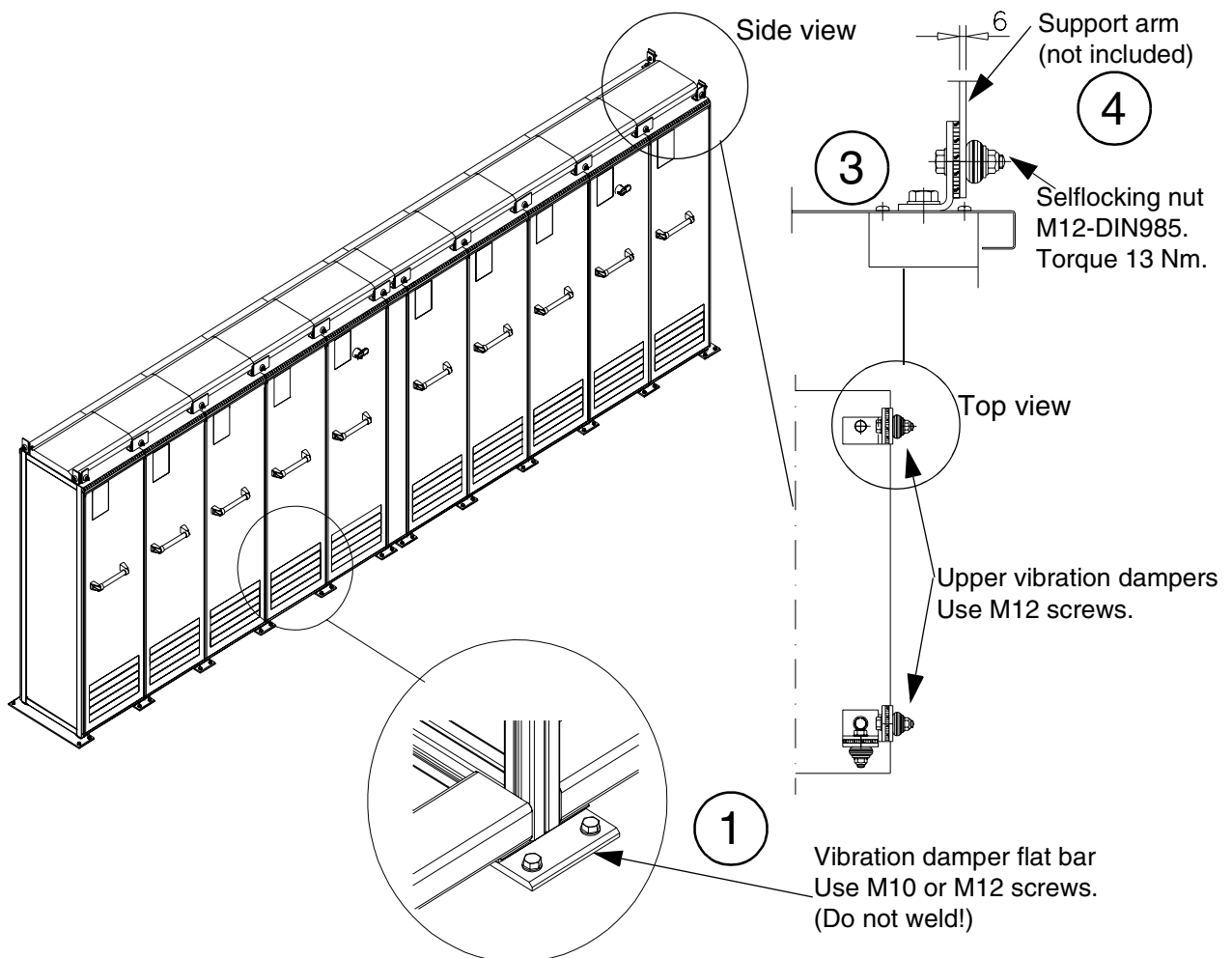
WARNING! If the welding return wire is connected improperly, the welding circuit may damage electronic circuits in the cabinets or the vibration damper bolts may weld to the cabinet frame. The vibration dampers will be damaged if their temperature exceeds 120 degrees Celsius.

Vibration Dampers on Top and Bottom (Marine Versions)

The shipping split must be fastened to the floor and roof (wall) in marine versions as follows.

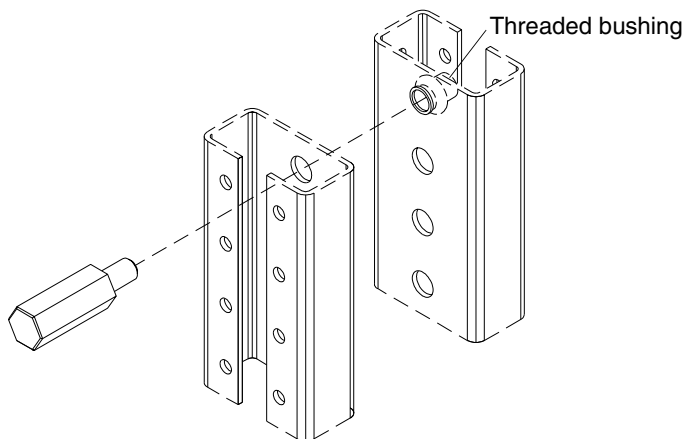


1. Fasten the shipping split to the floor with M10 or M12 bolts through the holes in the vibration damper flat bar.
2. If there is not enough room behind the cabinets for installation, use the fastening method shown in figure (2).
3. Fasten the upper vibration dampers. **For the positions of the upper vibration dampers, see the accompanying dimension drawing of the shipping split!**
4. Fasten the support arms to the upper vibration dampers and roof (wall).

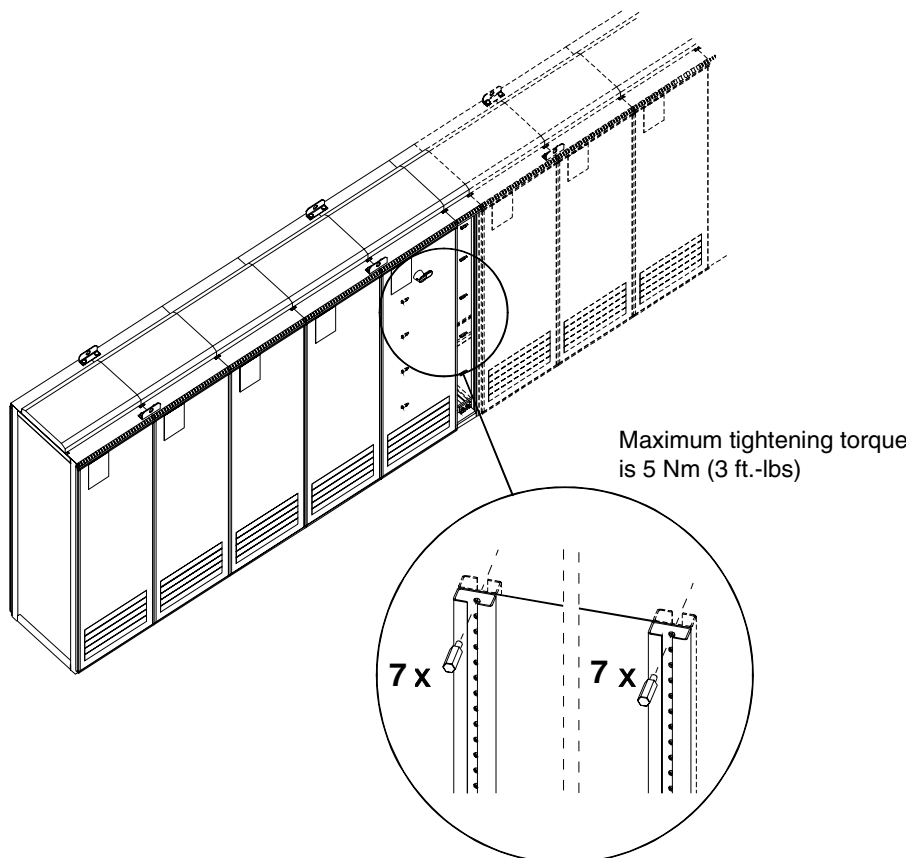


Joining the Shipping Splits

Shipping splits are joined in the busbar joining section. Special screws (M6) for fastening the cabinets together are enclosed in a plastic bag inside the last cabinet of the shipping split. The threaded bushings are already mounted on the post.

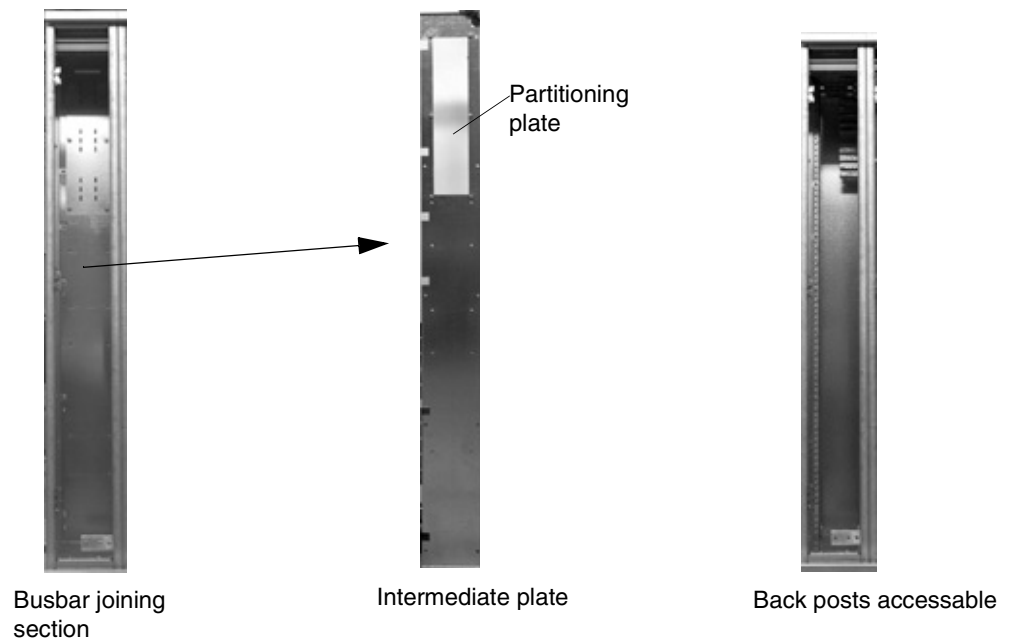


Working Order



1. Fasten the front post of the joining section with seven screws to the front frame post of the next cabinet.

2. 200 mm wide joining section: Remove the intermediate plate hiding the back posts in the joining section. 600 mm wide joining section: Remove the partitioning plates.



3. Fasten the back post of the joining section with seven screws (below the busbar joining part) to the post of the next cabinet.
4. Replace the intermediate plate (and the partitioning plate(s) in the upper part of it after connecting the DC Busbars, see next page).

Connecting the DC Busbar and the PE Busbar

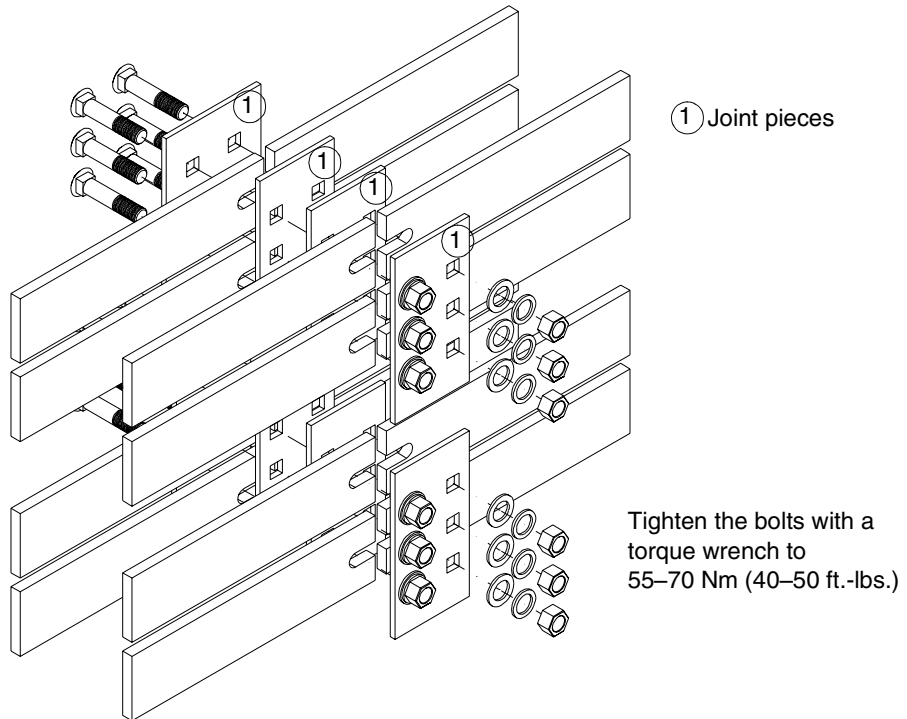


Horizontal main DC busbars and the PE busbar are connected from the front of the 200/600 mm wide busbar joining cabinet. All necessary materials are located in the joining cabinet.

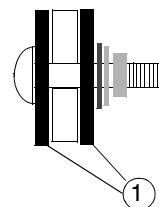
1. Remove the front metal partitioning plate located in the busbar joining cabinet.
2. Unscrew the bolts of the joint pieces.
3. Connect the busbars with the joint pieces (see figure below). For aluminium busbars, joint grease (e.g. TK-Penetrant, made by Framatome Connectors USA Inc. Burndy Electrical) must be used to avoid corrosion and to ensure good electrical connection. The oxide layer must be scrubbed off from the joints before applying the grease.
4. Replace the front metal plate into its original position because of safety of personnel.

DC Busbar

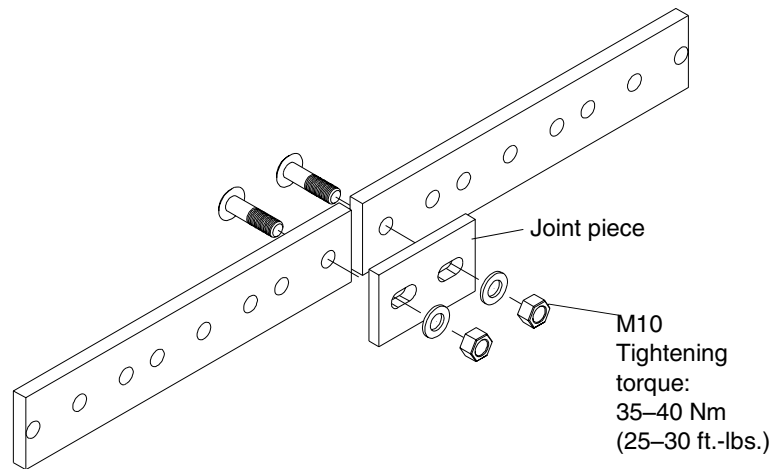
The DC busbar connection is shown below.



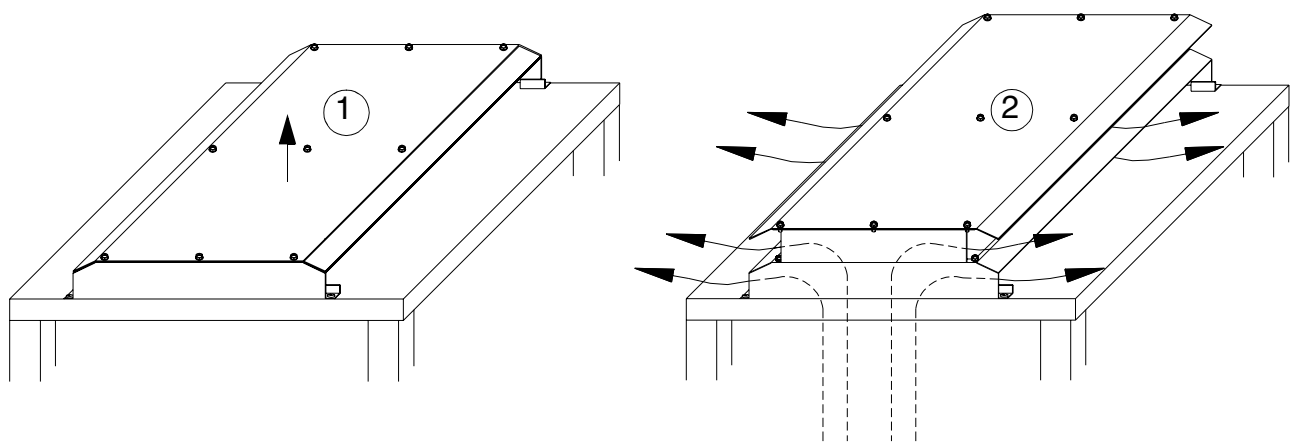
Side view of single busbar connection



PE Busbar The PE busbar connection is shown below.



Lifting a Double Roof When the drive is equipped with a double roof:



1. Lift the upper part of the roof plate up from the transportation position.
2. Lock the roof to its final position with the M6 screws.

Chapter 3 – Electrical Installation



WARNING! The electrical installation described in this chapter should only be carried out by a qualified electrician. The **Safety Instructions** on the first pages of this manual must be followed. Negligence of these instructions can cause injury or death.

Power Cable Selection

The mains and motor cables must be dimensioned **according to local regulations**:

1. The cable must be able to carry the ACx 600 load current. See *Safety and Product Information* (or *Appendix A* for ACx 6x7) for cable types for different load currents.
2. The cable terminals of the ACx 600 warm up to 60 °C (140 °F) during operation. The cable must be rated for at least 60 °C (140 °F) maximum operating temperature.
3. The cable must withstand the short-circuit current given in *Mains Connection: Short Circuit Capability* in *Safety and Product Information* (or in *Appendix A* for ACx 6x7).
4. The inductance and impedance of the cable must be rated according to permissible touch voltage appearing under fault conditions (so that the fault point voltage will not rise too high when an earth fault occurs).
5. The inverter module has an electronic overload protection which limits the largest permissible load current.
6. If multiple motors are connected to the inverter module, a separate thermal overload switch or a compact circuit breaker must be used for protecting the cable and the motor. These devices may require a separate fuse to cut off the short circuit current.

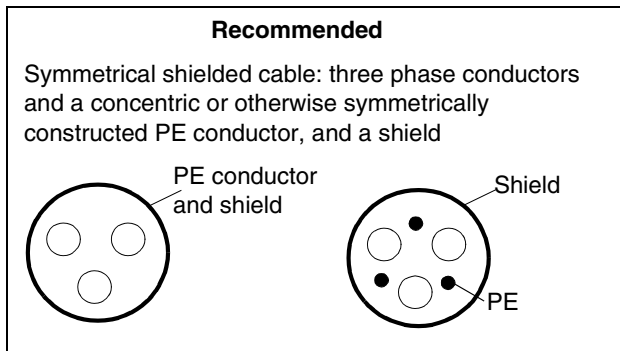
The rated voltage of the mains cables should be $U_0/U = 0.6/1$ kV for 690 VAC rated equipment. (U_0 = rated voltage between the conductor and the earth, U = rated voltage between the conductors.) For the North American market, 600 VAC rated cable is accepted for 600 VAC rated equipment. As a general rule, the rated voltage for the motor cables should be minimum $U_0/U = 0.6/1$ kV.

Symmetrical shielded motor cable must be used (figure below). Four-conductor system is allowed for mains cabling, but shielded symmetrical cable is recommended. To operate as a protective conductor, the shield conductivity must be at least 50 % of the conductivity of the phase lead.

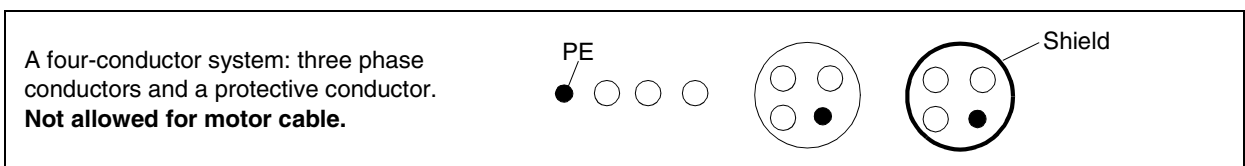
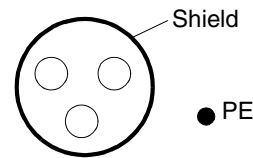
Compared to a four-conductor system, the use of symmetrical shielded cable reduces electromagnetic emission of the whole drive system as well as motor bearing currents and wear.

The motor cable and its PE pigtail should be kept as short as possible in order to reduce electromagnetic emission as well as capacitive current.

Alternatives Power cable types that can be used with ACx 600 are represented below.

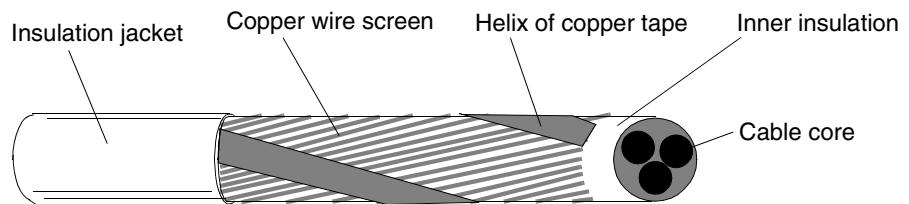


A separate PE conductor is required if the conductivity of the cable shield is < 50 % of the conductivity of the phase conductor.



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 effectiveness of the shield can be evaluated e.g. on the basis of the shield inductance, which must be low and only slightly dependent on the frequency. These requirements are easily met with a copper or aluminium shield/armour. The minimum requirement of the motor cable shield of the ACx 600 is shown below. It consists of a concentric layer of copper wires with an open helix of copper tape. The better and tighter the shield, the lower the emission level and the bearing currents.



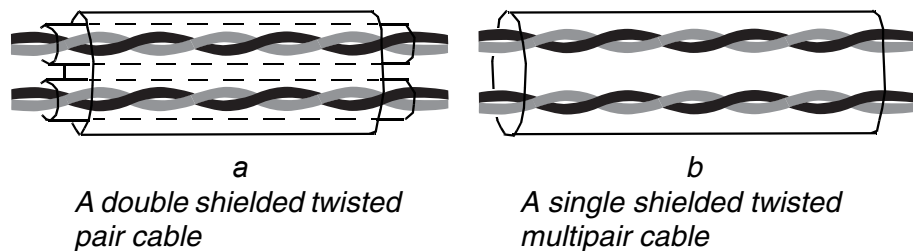
Control Cable Selection

All control cables must be shielded. As a general rule, the control signal cable shield should be earthed directly in the ACx 600. The other end of the shield should be left unconnected or earthed indirectly via some nanofarad high-frequency, high-voltage capacitor (e.g. 3.3 nF / 3000 V). The screen can also be earthed directly at both ends if they are *in the same earth line* with no significant voltage drop between the end points.

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

A double shielded twisted pair cable (Figure a, e.g. JAMAK by NK Cables, Finland) must be used for analogue signals and the pulse encoder signals. 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.



The analogue and digital signals should be run in separate, screened 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.

Co-axial Cable

Recommendations for use with ACS 600 MultiDrive Application Controller:

- 75 Ω type
- RG59 cable with diameter 7 mm or RG11 cable 11 mm
- The maximum cable length is 300 m

Optical Cable When cutting the cable, for example with cutters, the optical cable ends become rough and may cause damping in the cable; the cable ends, therefore, should be ground with fine sand-paper.

Relay Cable The cable type with braided metallic screen (e.g. ÖLFLEX LAPPKABEL, Germany) has been tested and approved by ABB.

Control Panel Cable In remote use, the cable connecting the Control Panel to the ACx 600 must not exceed 3 metres. The cable type tested and approved by ABB is used in Control Panel option kits.

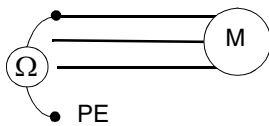
Insulation Checks

Every ACS 600 MultiDrive system and ACx 6x7 unit has been tested for insulation between main circuit and cabinet (2500 V rms 50 Hz for 1 minute) at the factory. Therefore there is no need to check the insulation of the unit again. When checking the insulation of the assembly, proceed in the following manner:



WARNING! Insulation checks must be performed before connecting the ACx 600 to the mains. Before proceeding with the insulation resistance measurements make sure that the ACx 600 is disconnected from the mains.

Motor and Motor Cable

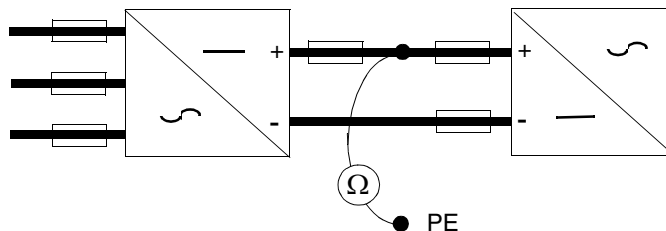


$R \geq 1 \text{ M}\Omega$

1. Check that the motor cable is disconnected from the ACx 600 output terminals U2, V2 and W2.
2. Measure the insulation resistances of motor cable and the motor between each phase and Protective Earth using a measuring voltage of 1 kV d.c. The insulation resistance must be higher than 1 MΩ.

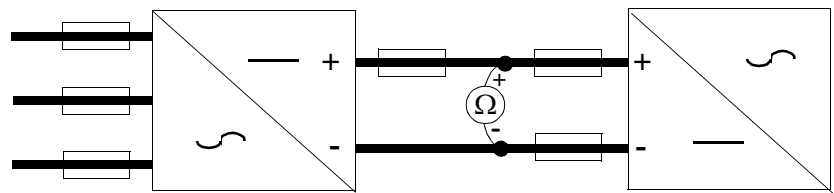
DC Busbars

1. Measure the resistance between each DC busbar and Protective Earth with a multimeter.



$R \geq 100 \text{ k}\Omega$

2. Measure the resistance between the DC busbars with a multimeter.

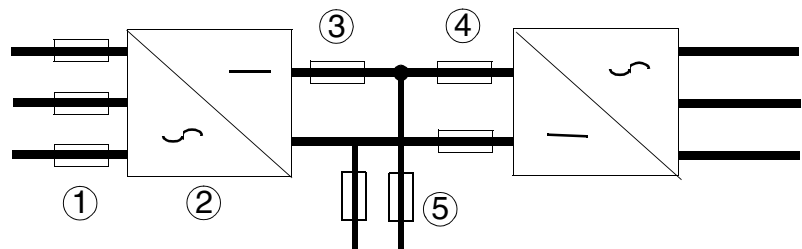


$R = \infty$ or rises gradually depending on the multimeter type

Fuses

Fuses are needed to protect the supply section and the inverter of the ACx 600 in case of an internal short circuit. The ACS 600 MultiDrive and the ACx 6x7 are equipped with internal input fuses introduced in *Appendix A – Technical Data* (located in the *Safety and Product Information* manual for ACS 600 MultiDrive). If a fuse is blown, it must be replaced with a similar ultrarapid fuse.

Internal Fuses



The fuse types used with different supply sections of ACS 600 MultiDrive frequency converters and ACx 6x7 units are listed below.

	Fuse Type	Supply Section
1	Supply AC fuses	B1, B2, B3
2	Branch fuses. Each semiconductor of the rectifier bridge is protected with a fuse.	B4, B5
3	Supply DC fuses	Thyristor Supply: B1, B2, B3
4	Drive unit DC fuses. These fuses are in all ACS 600 MultiDrive units and in parallel connected ACx 6x7 units.	
5	Braking section DC fuses	

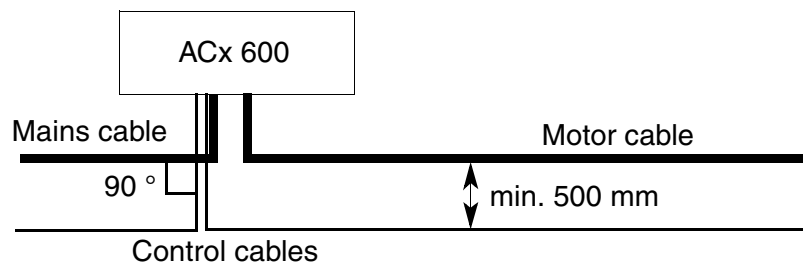
Cable Routing

The motor cable should be installed away from other cable routes. Motor cables of several frequency converters can be run in parallel installed next to each other. It is recommended that the motor cable, mains cable and control cables be installed on separate trays (minimum distance 500 mm). Long parallel runs of motor cable with other cables should be avoided in order to decrease electromagnetic interference caused by the rapid changes in the frequency converter output voltage.

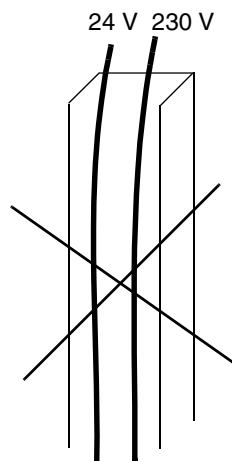
Where control cables must cross power cables make sure they are arranged at an angle as near to 90 degrees as possible. Extra cables should not be run through the ACx 600.

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

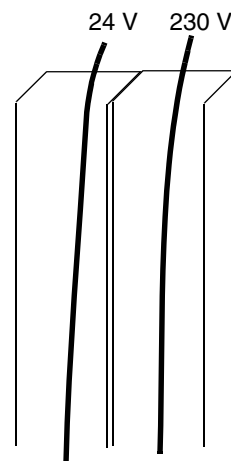
Below is a diagram of cable routing.



Control Cable Ducts



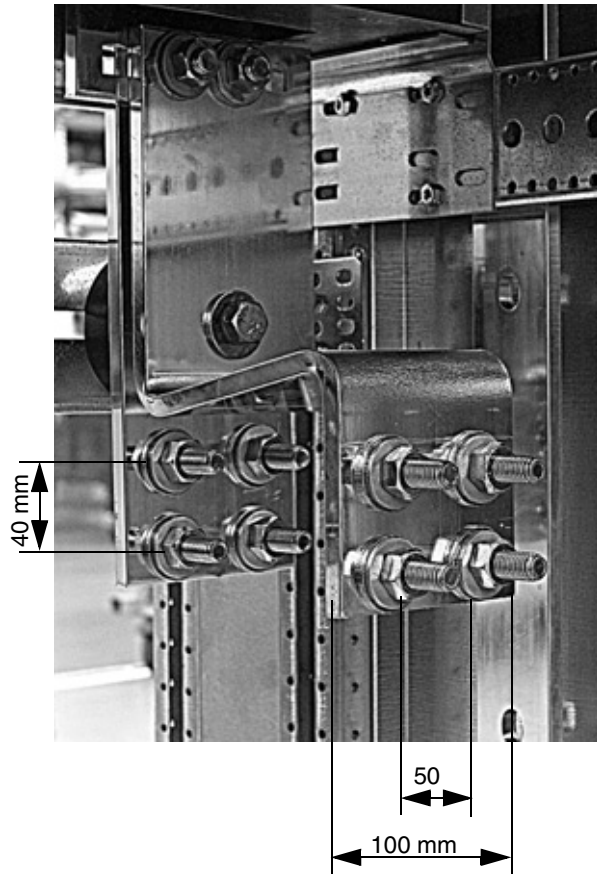
Not allowed unless the 24 V cable is insulated for 230 V or insulated with an insulation sleeving for 230 V.



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

Power Cable Busbars

A view of power cable busbars of large ACx 600 units is shown below. If necessary, the same screw can be used for connecting two cable lugs (on both sides of the busbar). Cable lugs with one or two holes can be used. Always use a torque wrench for tightening the busbar connections. **Note:** In inverter modules R6i and R7i, only one cable lug can be connected to a busbar screw.



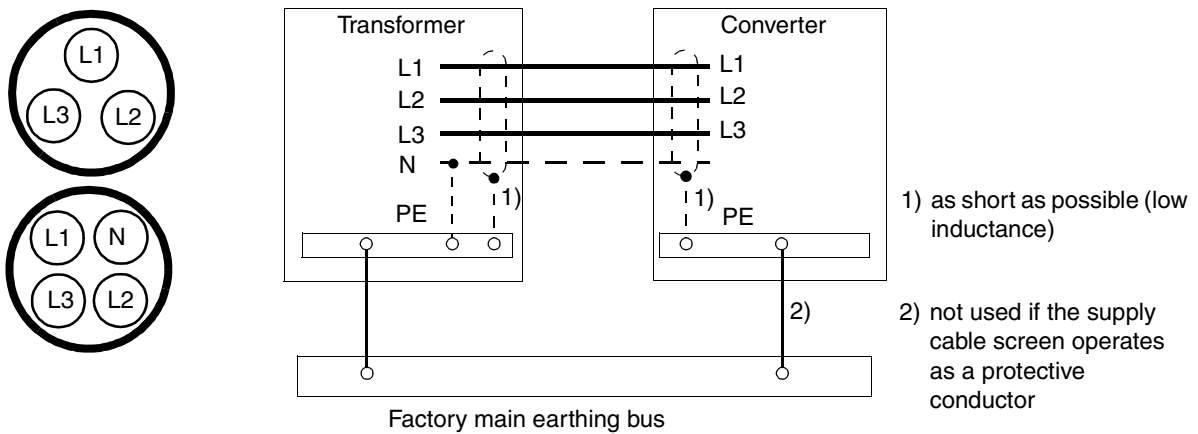
Mains Cable Connection

This section describes the mains cable connections of the ACx 600. The following *Motor Cable Connection* section provides some basic instructions for the routing and mechanical connection of cables. The mechanical cable connections are basically the same, whether for the incoming supply or an inverter; different are the cabinet dimensions and the location of the terminals for the cables. The cabling direction may also vary (top or bottom).

The N conductor is not normally used with ACx 600 frequency converters although it is visible in the following diagrams.

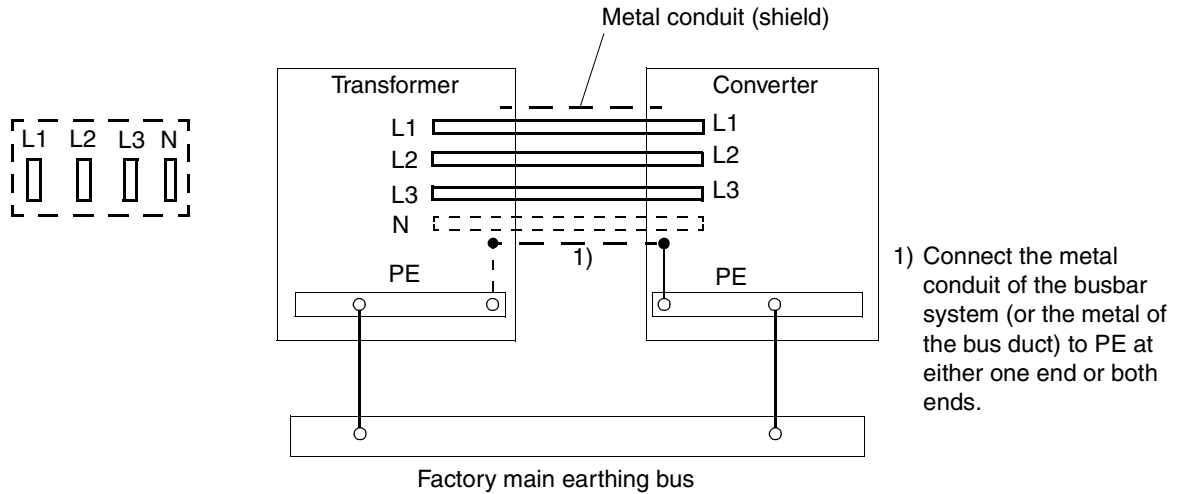
Low Power Supply

A low current (< 300 A) cable connection when one cable is sufficient is represented below.



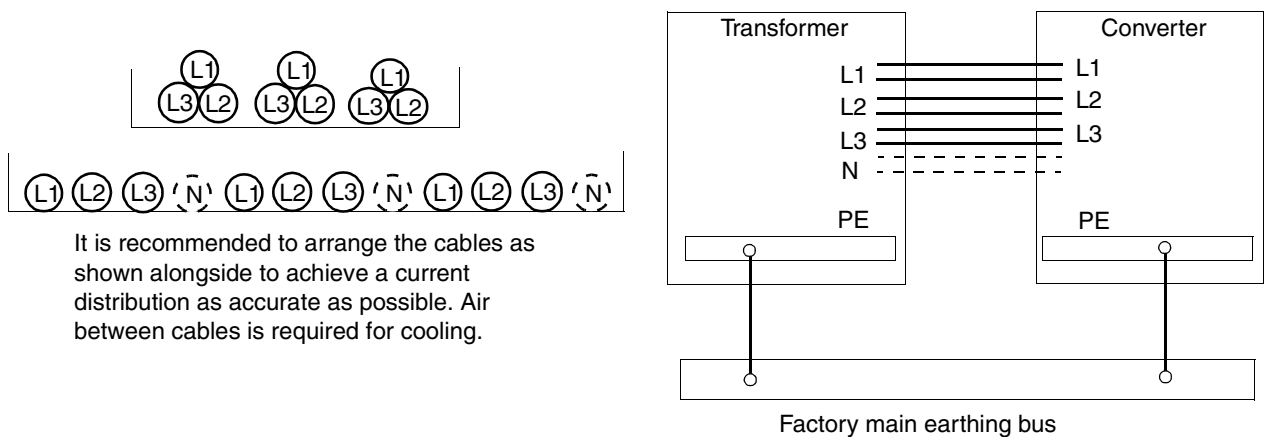
High Power Supply

Busbar connection A high current (> 300 A) busbar connection is represented below.



Note: The paint should be removed to allow a good connection to the cabinet frames throughout the whole perimeter of the metal conduit (or a bus duct). The metal conduit (or the bus duct metal) should be electrically continuous throughout its complete length.

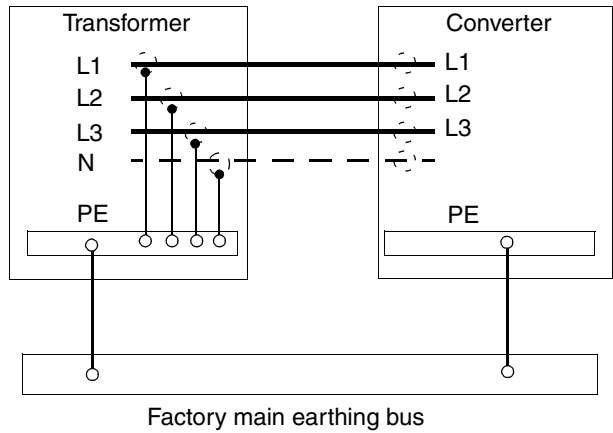
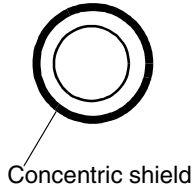
Cable Bus System The connection of a high current (> 300 A) cable bus system that consists of several cables is represented below. In this system, less conductor material is needed due to better cooling of separate conductors.



Note: Current derating of the cables is required when installing the cables in a cable tray. This derating factor must be taken into account as per the local electrical safety codes.

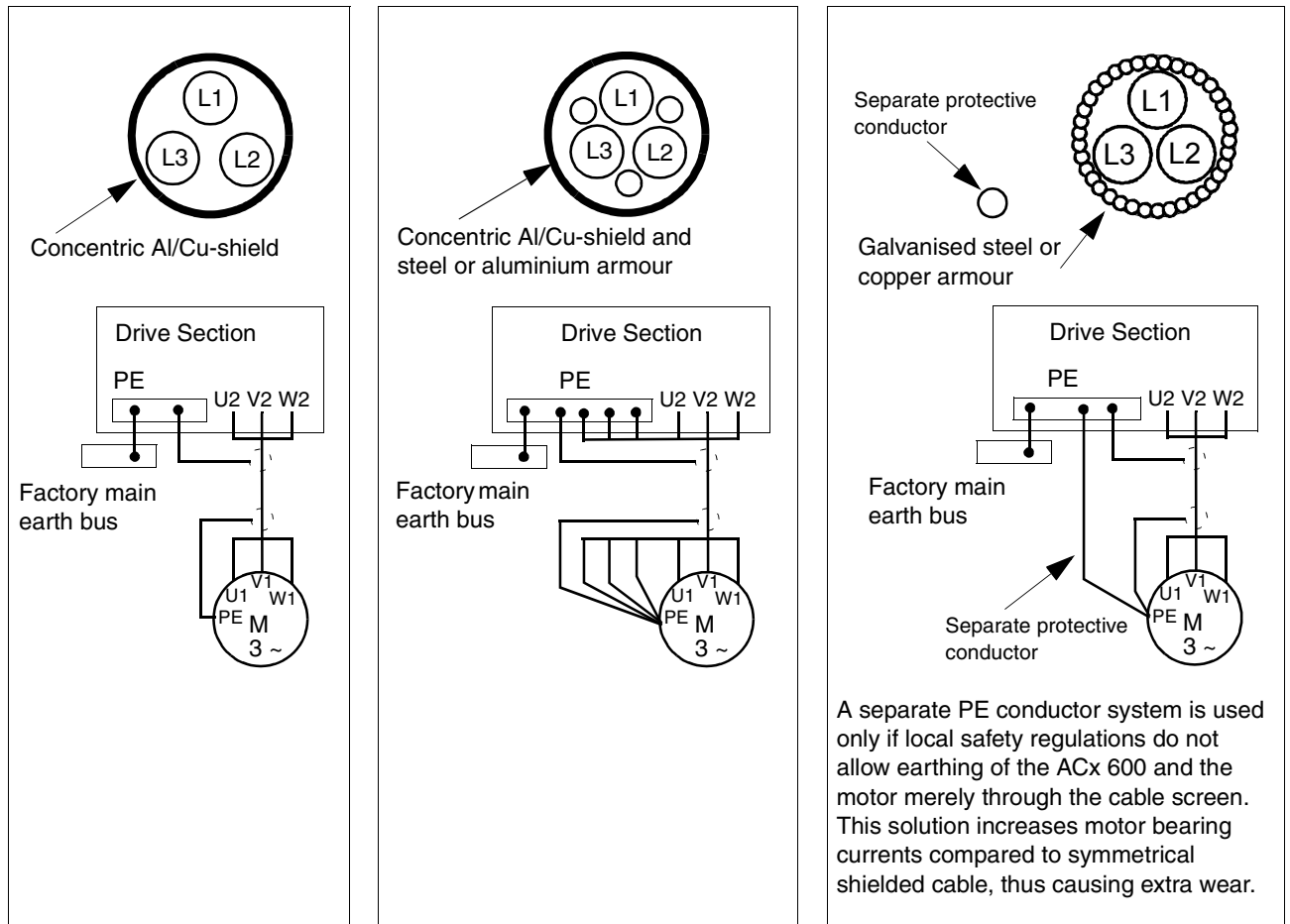
Single-core Cables with Concentric Protective Shields

When single-core cables equipped with concentric protective shields (metal) are used, the phase current will induce voltage to the cable shield. If the shields are connected to each other at both ends of the cable, current will flow in the cable shield. In order to prevent this and to ensure personal safety, the cable shield must be connected only to PE at the transformer side and insulated on the converter side. The connection is represented below.

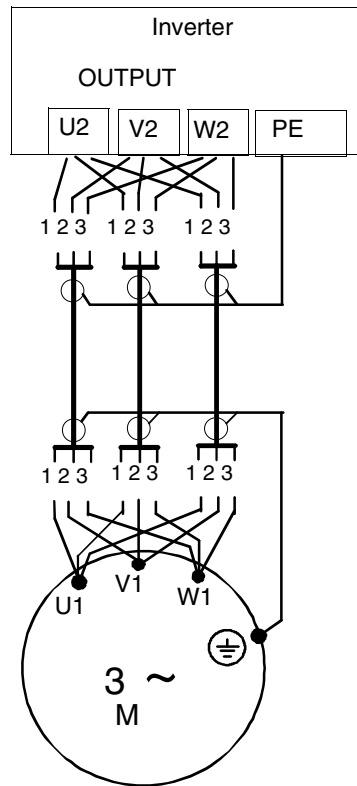


Motor Cable Connection

Motor cable connections for different cable types are represented below. For minimum radio frequency interference (RFI) at the motor end, earth the cable screen 360 degrees at the lead-through or earth the cable by twisting the screen (flattened width $\geq 1/5 \cdot \text{length}$).



High Power Applications Motor cable connections with parallel symmetrical cables are represented below.



Parallel Connected Inverters Motor cable connections with parallel connected inverters are presented below. Parallel connected cables are drawn as single cables to simplify the drawings.

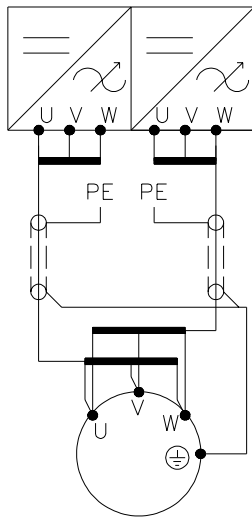
Requirements for parallel connected cables and cables for motors with two separate windings are given as follows:

- The maximum allowed difference in cable length is 5 % i.e. the length of the longest cable divided by that of the shortest cable must be less than or equal to 1.05: $l_{\max}/l_{\min} \leq 1.05$.
- Cables must be of the same type and have equal cross-sectional areas.

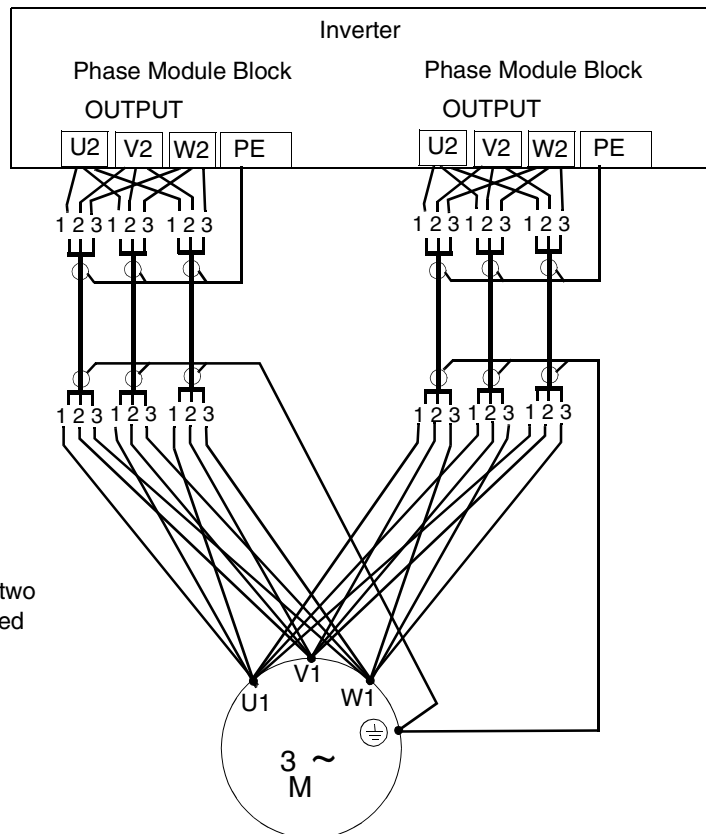
2 x R11i/R12i without Common Motor Connection Terminal

Motor cable connections with parallel symmetrical cables for two phase module blocks with a common motor are represented below.

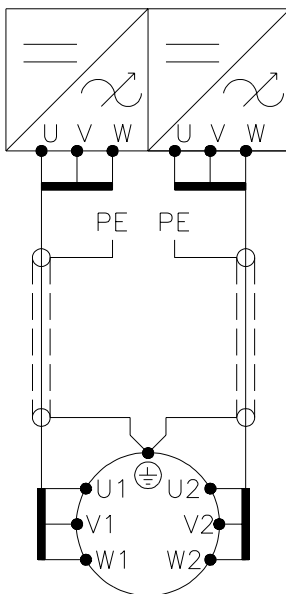
Note: With two parallel phase module blocks, the number of cables must be $n \times 2$, where $n = 1, 2, 3\dots$. With four parallel blocks the number of cables must be $n \times 4$, where $n = 1, 2, 3\dots$. Otherwise the output cabling must be done from a separate output cubicle.



Motor with single connection (or with two separate windings which are connected together in the terminal box)



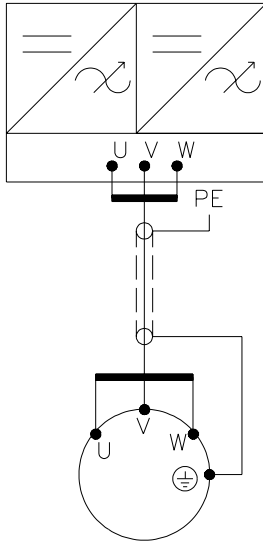
Example: connection with six cables (three parallel connected phase conductors)



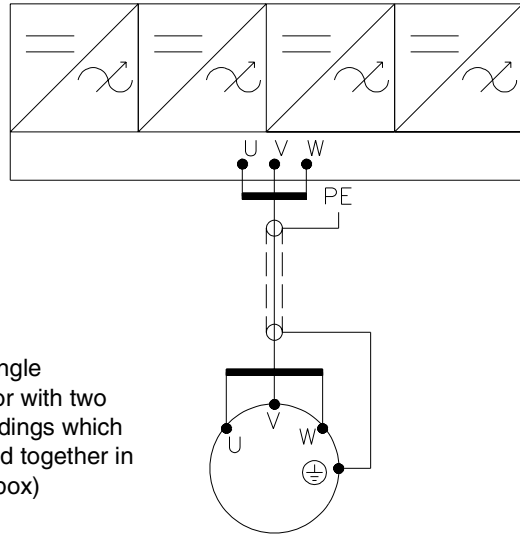
Motor with dual connections (two separate windings)

Inverters with Common Motor Connection Terminal Motor cable connections for parallel connected inverters with a common output cubicle(s) are presented below.

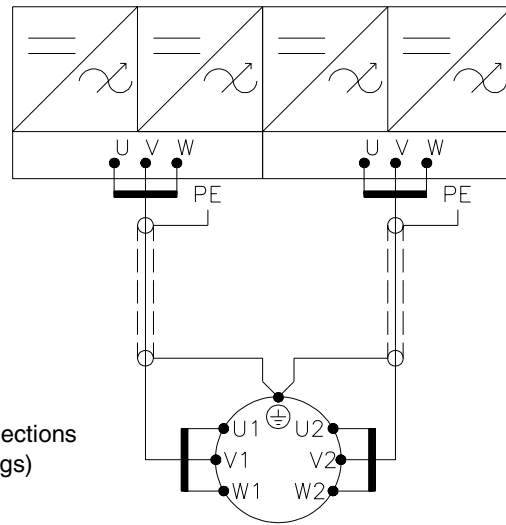
2 x R11i/R12i



4 x R11i/R12i



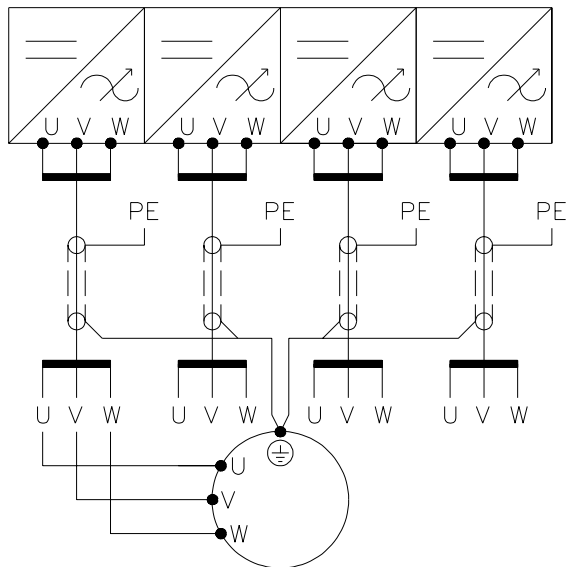
Motor with single connection (or with two separate windings which are connected together in the terminal box)



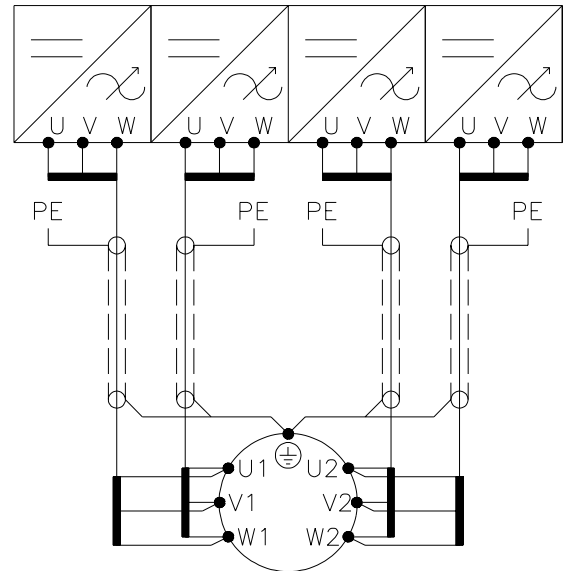
Motor with dual connections (two separate windings)

**4 x R11i/R12i without
Common Motor
Connection Terminal**

Motor cable connections for four parallel connected inverters without a common output cubicle are presented below.



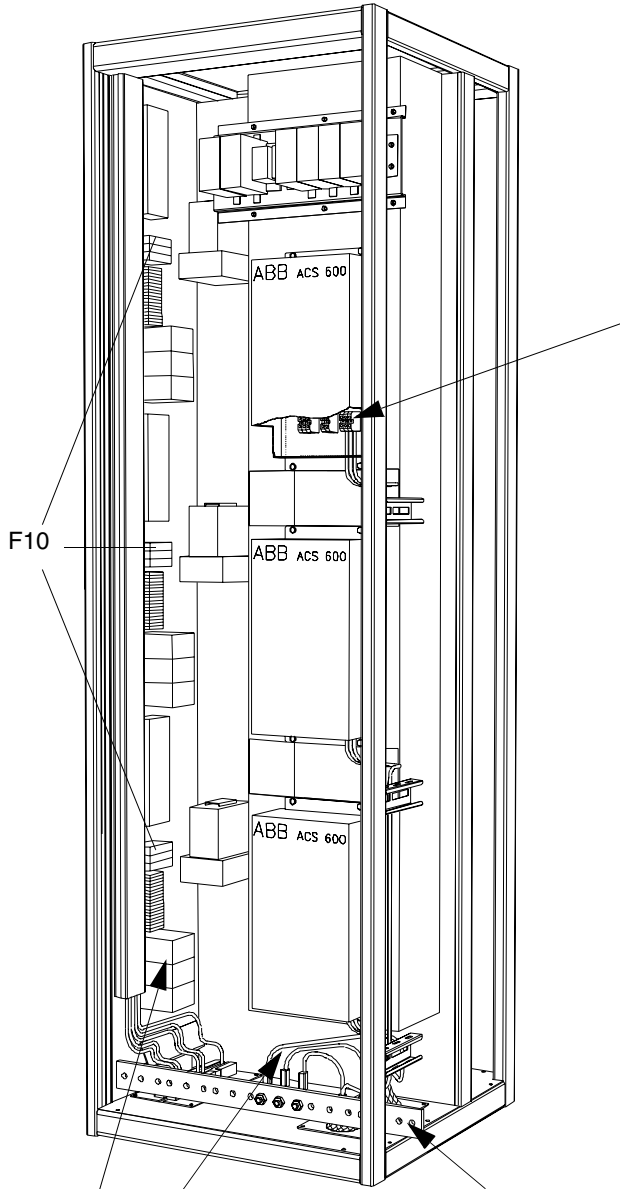
Motor with single connection (or with two separate windings which are connected together in the terminal box)



Motor with dual connections (two separate windings)

Inverter Modules of Frame Sizes R2i to R5i (ACS 600 MultiDrive)

The cable connections of a bottom entry unit are represented below. For top exit, an extra cabinet is required. .



Connect separate PE conductor (if used) to the PE terminal of the cabinet

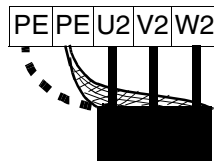
PE terminal of the cabinet

Control cable connection:
Connect the control cables to the appropriate terminal block on the DIN rail.

Motor cable connection

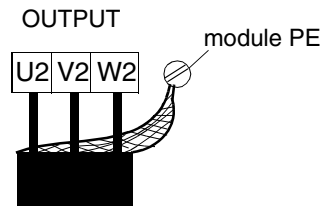
1. Strip the cable for 3 cm at the cabinet entry if EMC sleeves are used.
2. Lead the cable unstripped to the inverter module.

If connection terminals are outside the module, make the connections like this:



Tighten the screw to the torque given in *ACS 600 MultiDrive Safety and Product Information, Appendix A.*

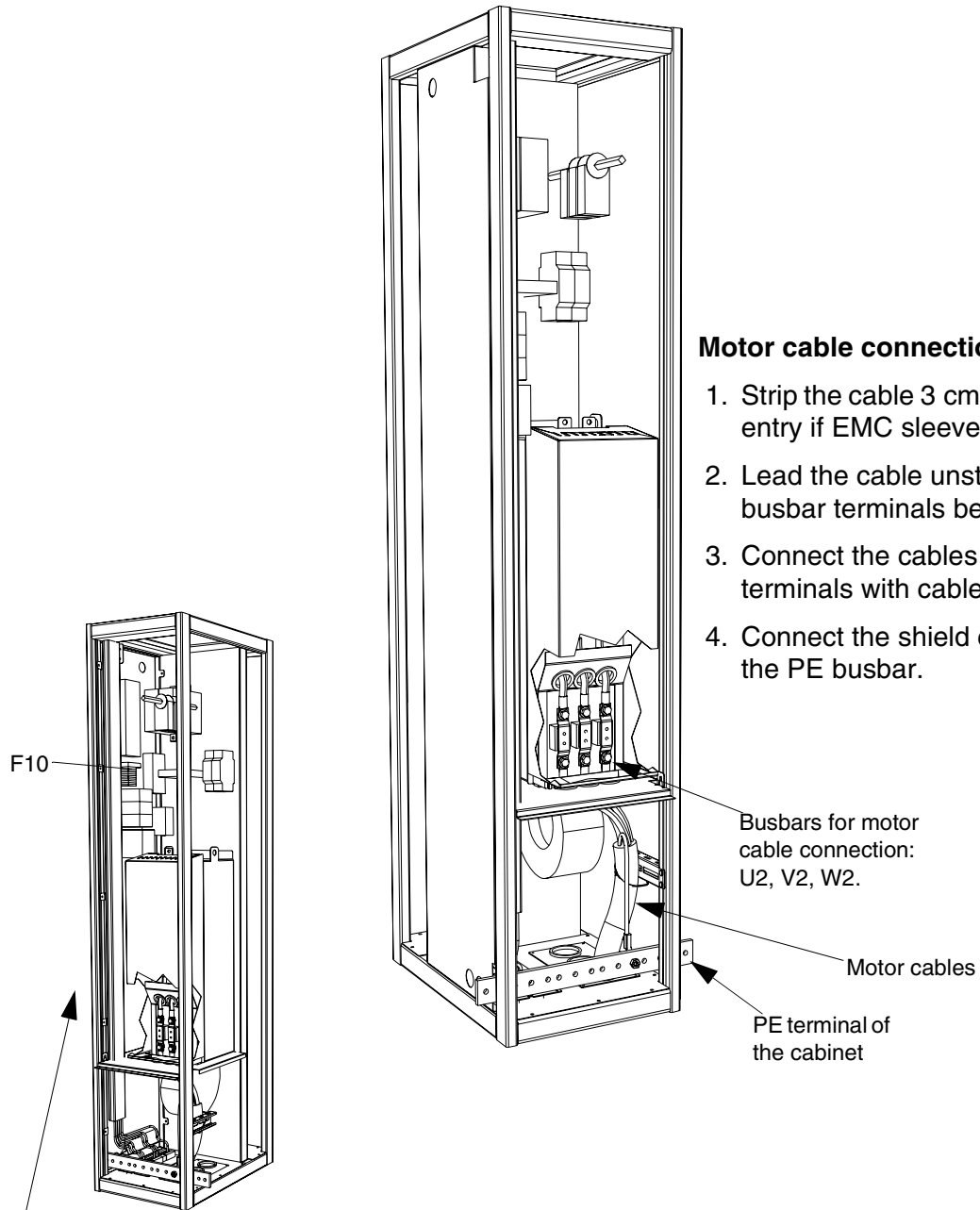
- If connection terminals are inside the module,
1. remove the module cover.
 2. make the connections:



Tighten the screw to the torque given in *ACS 600 MultiDrive Safety and Product Information, Appendix A.*

**Inverter Modules R6i
and R7i (ACS 600
MultiDrive)**

The cable connections of a bottom entry unit are represented below. For top exit, an extra cabinet is required (200 mm to 800 mm, see page 3-21).



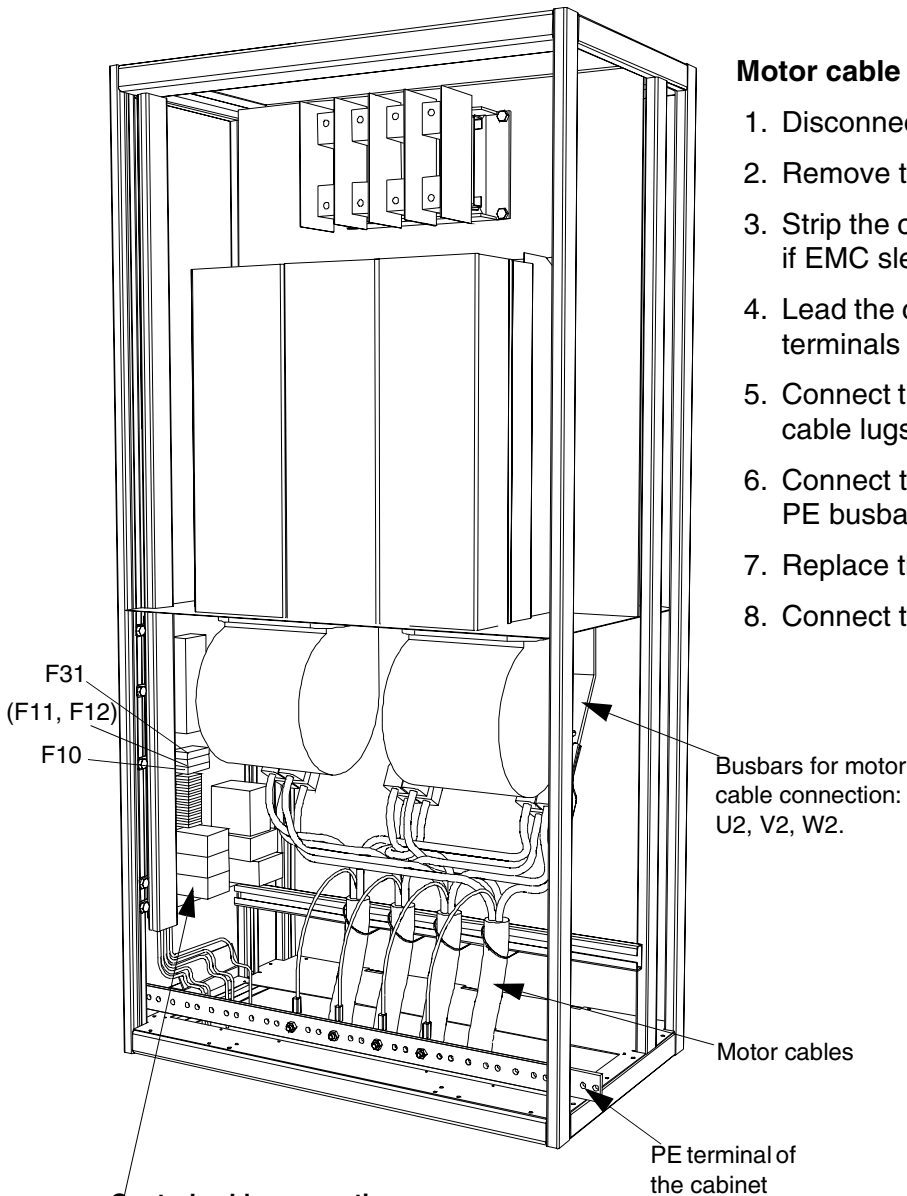
Motor cable connection

1. Strip the cable 3 cm at the cabinet entry if EMC sleeves are used.
2. Lead the cable unstripped to the busbar terminals behind the fan.
3. Connect the cables to the terminals with cable lugs.
4. Connect the shield conductor to the PE busbar.

Control cable connection:
Connect the control cables to the appropriate terminal block on the DIN rail.

**Inverter Modules R8i
and Above**

The cable connections of a bottom entry unit are represented below. For top exit, an extra cabinet is required (200 mm to 800 mm, see next page).



Motor cable connection

1. Disconnect the fan power lead.
2. Remove the fan.
3. Strip the cable 3 cm at the cabinet entry if EMC sleeves are used.
4. Lead the cable unstripped to the busbar terminals behind the fan.
5. Connect the cables to the terminals with cable lugs.
6. Connect the shield conductor to the PE busbar.
7. Replace the fan.
8. Connect the fan power lead.

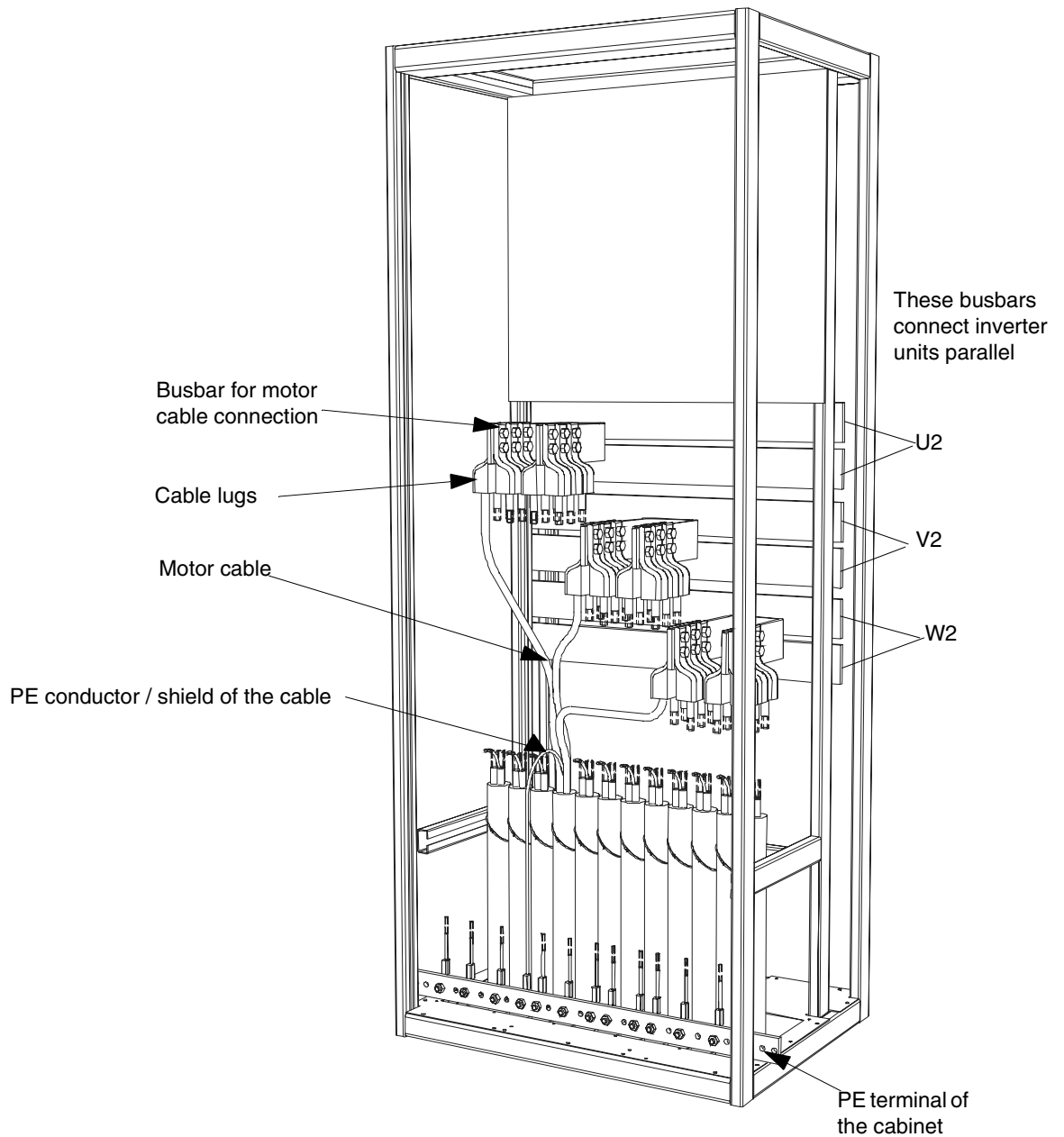
Control cable connection:

Connect the control cables to the appropriate terminal block on the DIN rail. (ACx 607/677 units 630 to 3000 kW: the DIN rail is located in the Auxiliary Control Unit (ACU).)

Output Cubicle This cubicle is used for

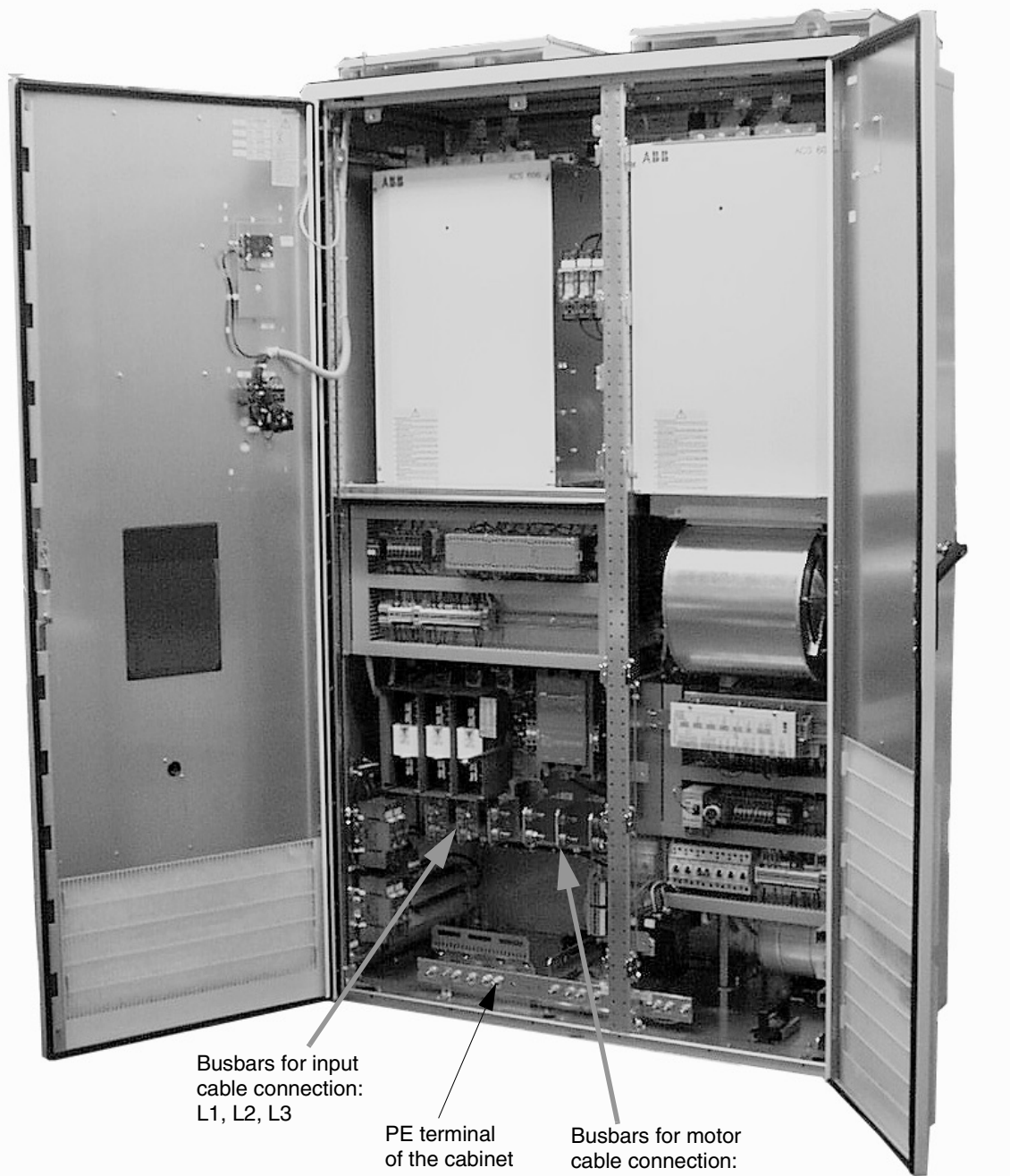
- motor cable entry and exit through the top of the cabinet
- common motor output of parallel connected inverter modules R11i and R12i (optional)
- common motor output of parallel connected inverter modules when the number of cables does not match the rule given on page 3-15 (optional).

Cable entry from the bottom is shown below. The top entry is accomplished in the same way except that cables are entering or exiting the cabinet from the top.



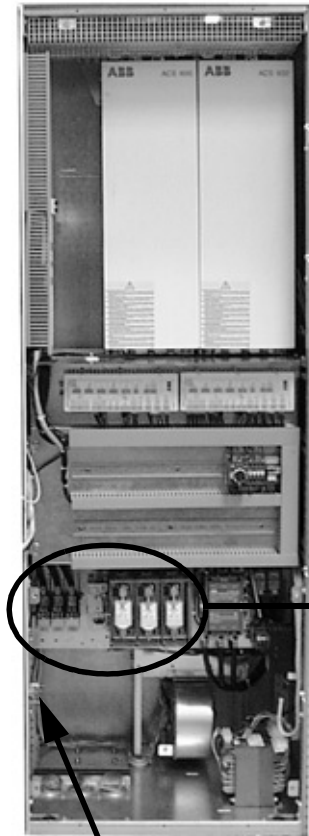
ACx 617 (R8i, R9i)

The cable connections of a bottom entry unit of frame size R9i are represented below. In frame size R8i, the terminals are located similarly.

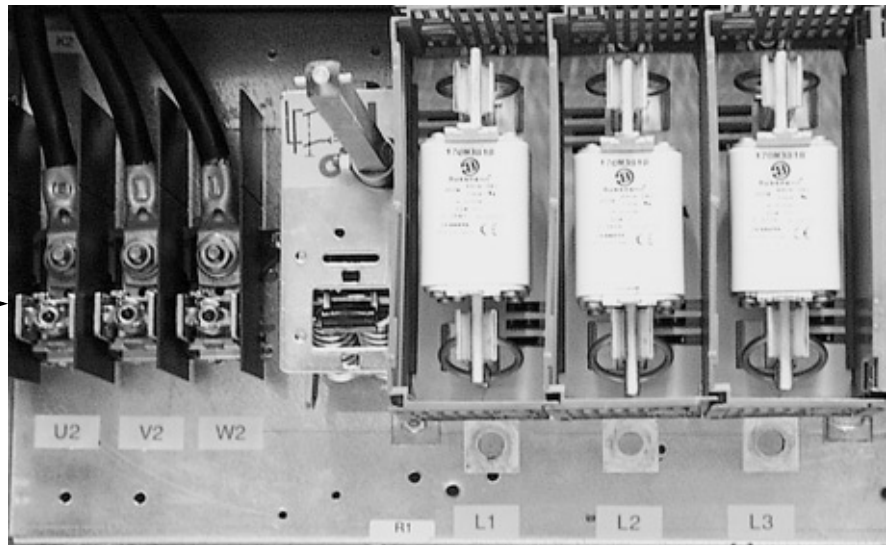


ACx 617 (R6i, R7i)

The cable connections of a bottom entry unit of frame size R7i are represented below. In frame size R6i, the terminals are located similarly.



PE terminal of the cabinet



Isolated stud terminals for motor cable connection: U2, V2, W2.

Busbars for input cable connection: L1, L2, L3.

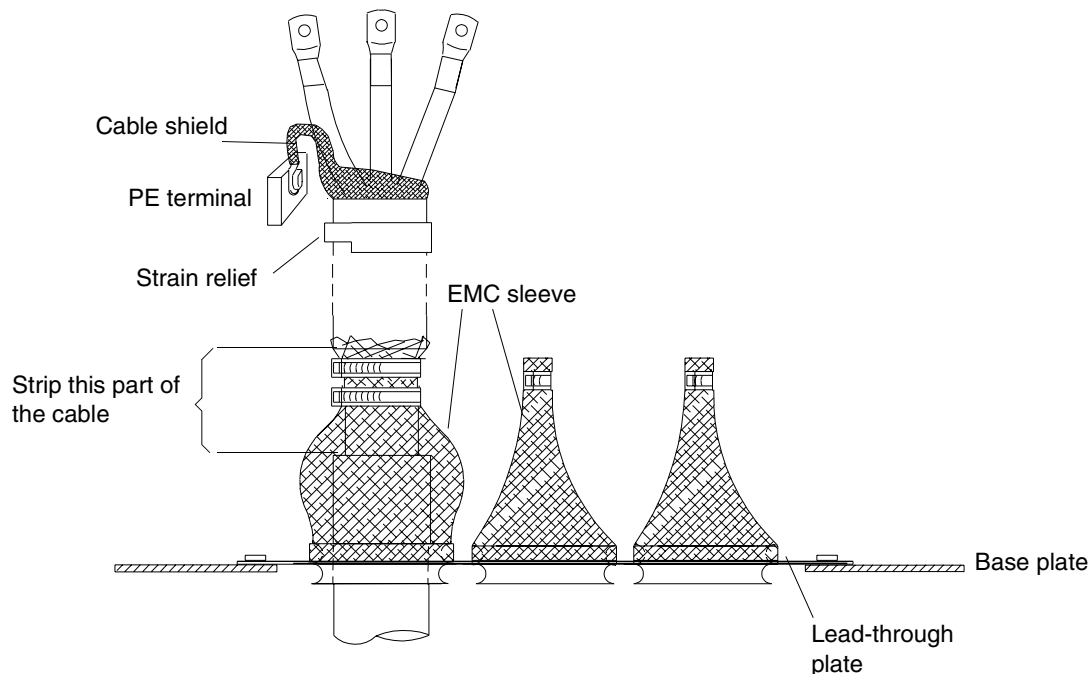
Conductive Sleeves

Conductive sleeves are supplied by ABB as an option to provide 360° high-frequency earthing for motor cables. Follow these instructions:

- If fire insulation is used, make an opening to the mineral wool sheet according to the diameter of the cable.
- Pull the cable into the cabinet through the conductive sleeve.
- If a rubber grommet is used, slide it onto the cable.
- Connect phase conductors to terminals.
- Twist the shield wires of the cable together and connect them to earth terminal or PE busbar.
- Peel off 3 to 5 cm of the outer insulation of the cable above the entry plate for the 360° high-frequency earthing.
- Fasten the conductive sleeve to the cable shield with a cable tie.
- Seal the slot between the cable and mineral wool sheet (if used) with sealing compound (e.g. CSD-F, ABB brand name DXXT-11, code 35080082).
- Tie up the unused conductive sleeves with cable ties.

Cable Entry

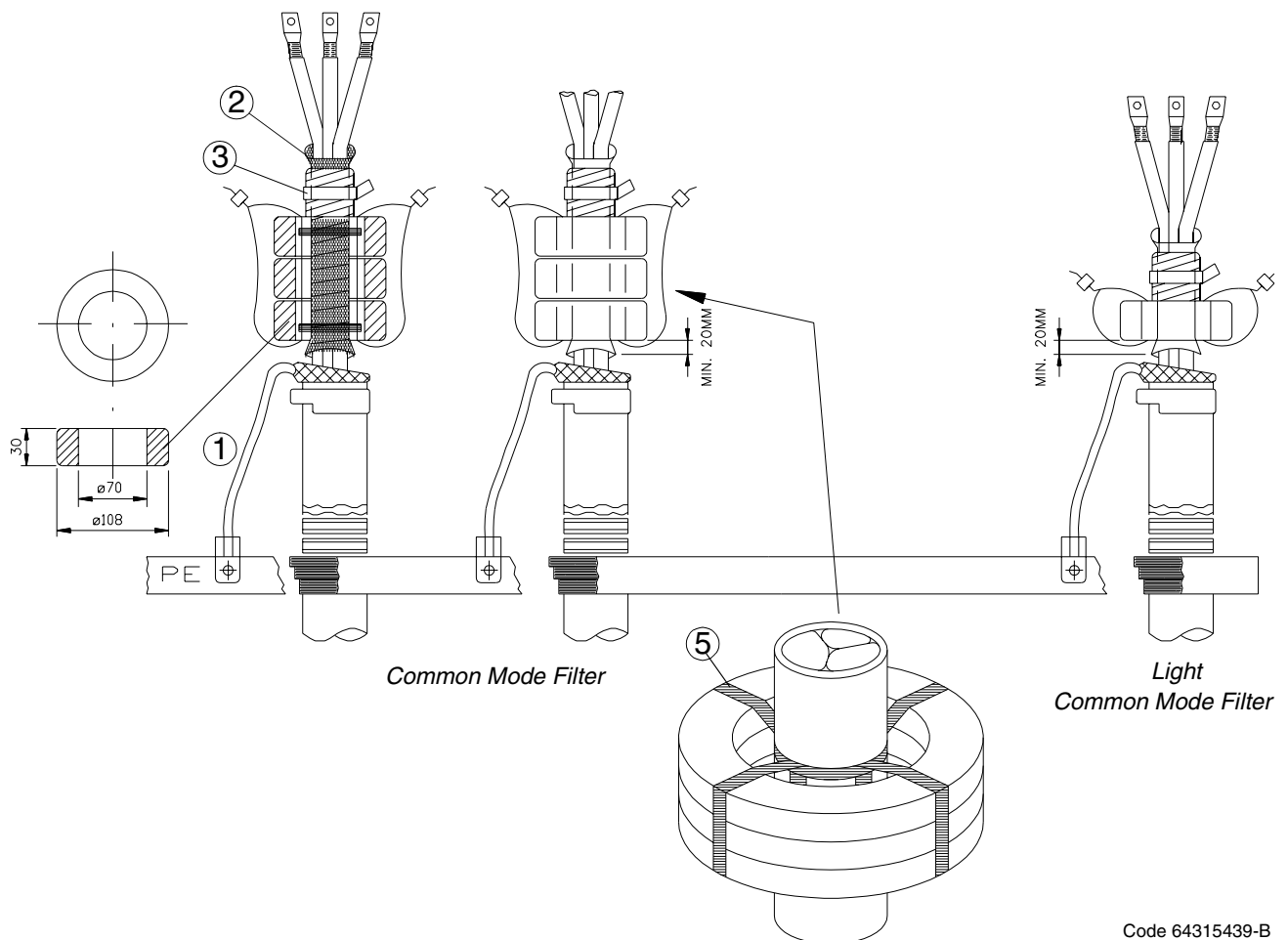
Cable entry from below for power cables of ACx 600 (IP 21 and IP 22) is shown below. Tighten the EMC sleeve on the stripped part of the cable with cable ties. For IP 54 units, add a rubber grommet on the cable under the lead-through plate.



Common Mode Filter

If common mode filter or light common mode filter is required (see *Safety Instructions / Motor Connections / Requirements Table*), lead the motor cable phase conductors through the toroidal cores as follows:

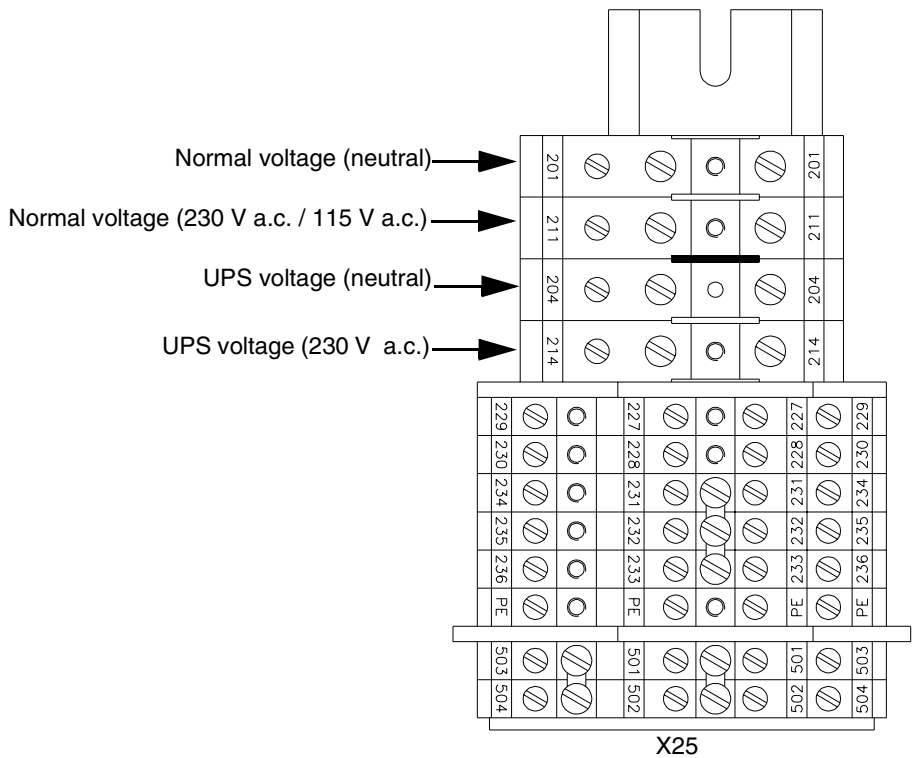
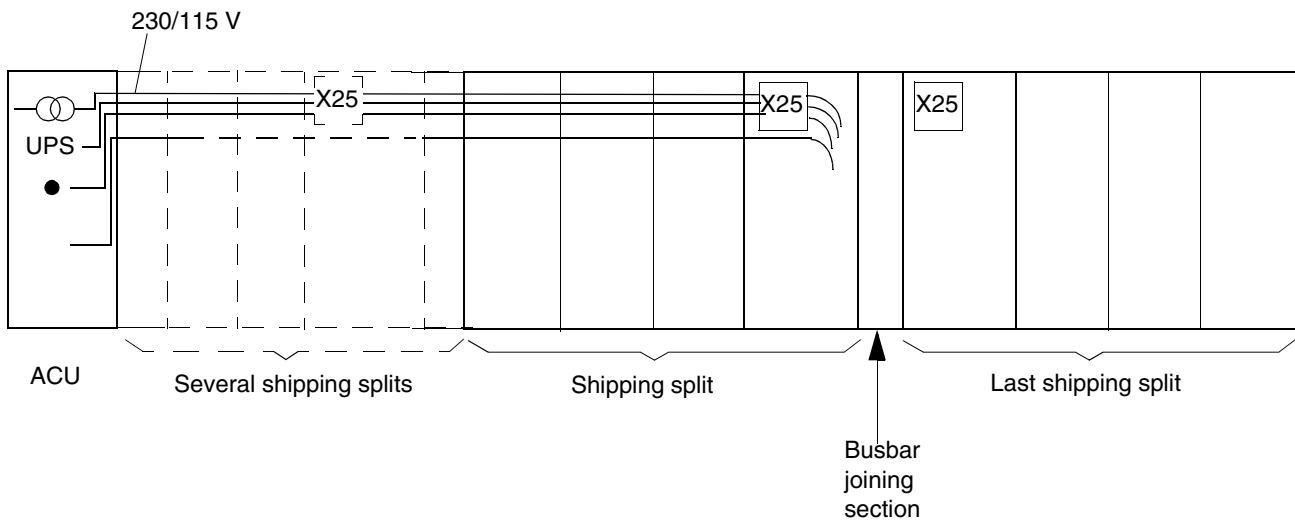
1. Connect the twisted cable screen to the PE terminal.
2. Wrap the phase conductors together with the silicon rubber tape delivered with the toroidal cores to provide thermal insulation for the conductor insulator. Cover the part of the cable which will be left inside the core(s) + 20 mm below. Approximately 1.5 metres of tape is needed per cable. Each turn must overlap the previous turn by half the width of the tape.
3. Bind the conductors tightly with non-conductive electrical tape and a heat-resisting non-metallic cable tie in order to prevent conductor insulation damage caused by the core edges.
4. Slide the core(s) onto the taped part of the phase conductors.
5. Bind the cores together and onto the taped part of the phase conductors with heat-resisting non-metallic cable ties.



Code 64315439-B

Control Cable Connections at Shipping Split Joints

Some control wires are chained through the shipping splits. 230/115 V voltage transformer, uninterruptible power supply (UPS) and emergency stop wires are chained via terminal blocks X25 at the upper left hand corner of the fields next to the busbar joining sections. Connect the loose wires to the next X25 terminal block. Connect the loose wires not coming from X25 to the destinations marked on the wire ends. **Ensure that no unconnected wire ends are left which will be powered when the supply voltage is switched on.**



External Control Cable Connections

Connect the control cables to the appropriate terminals on the NIOC board (or optional terminal block X2, or other options on the DIN rail on the left-hand side of the cabinet). Connect the twisted screen (as short as possible) to the earthing terminal \oplus .

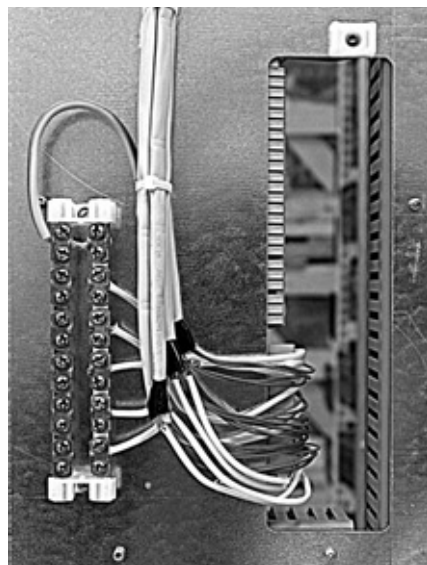
Auxiliary Control Unit of the ACx 607/627/677

External control cables and options are connected in a 400 mm or 600 mm wide Auxiliary Control Unit. NIOC board and X2/2TB terminal block are located on the DIN rail on the left-hand side of the cabinet.

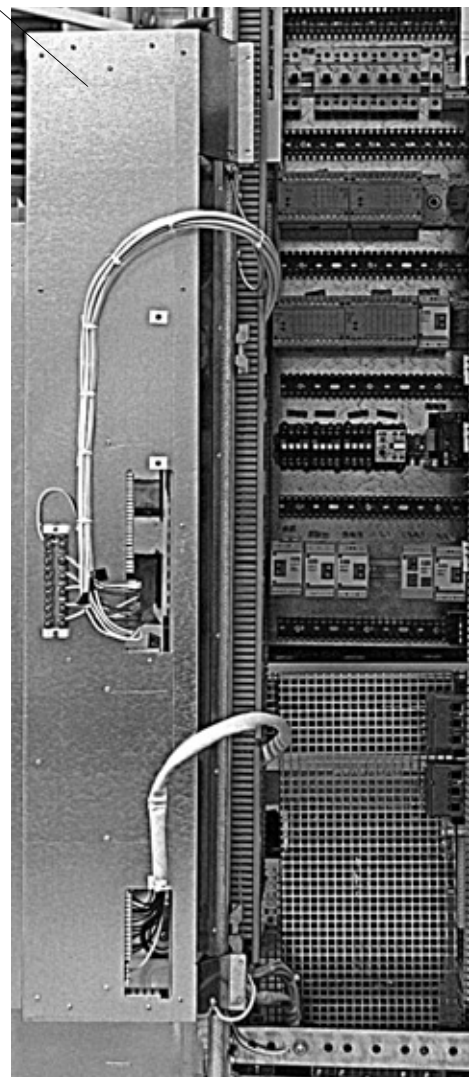
Assembly Door

Wire the door options as shown below.

Assembly door viewed from back



Connect the twisted inner screens (max 2 cm) of double shielded cables to the earthing rail.



Ensure that the cables are long enough for the assembly door to open.

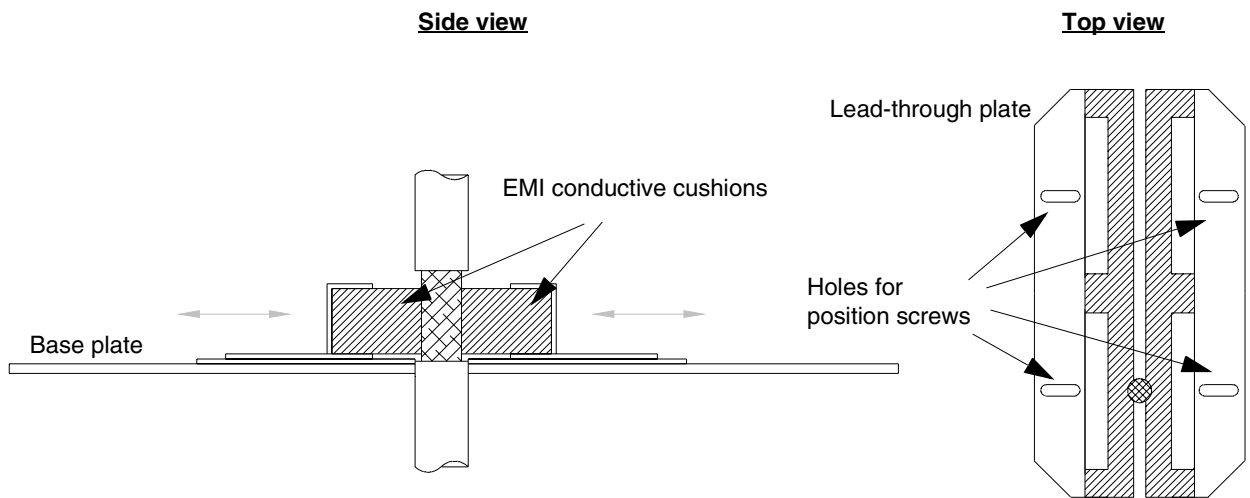
360° Earthing at the

Cable Entry 360° earthing of the control cable screens by EMI conductive cushions at the bottom of the Auxiliary Control Unit is shown below.



EMC Earthing at the Cable Entry

360° high frequency earthing of the control cable screen at the cable entry is available as an option from ABB (figure below).



Special for Top Entry

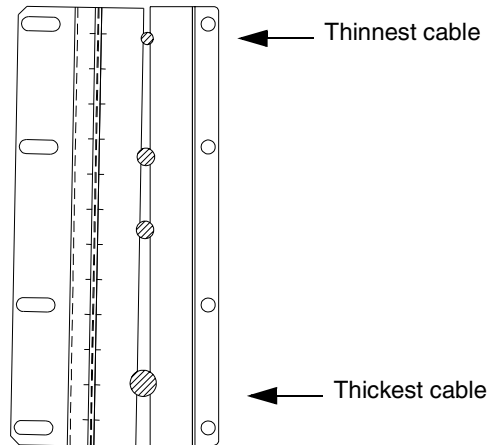
When each cable has its own rubber grommet, sufficient IP and EMC protection can be achieved. However, if very many control cables come to one cabinet, plan the installation beforehand as follows:

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:

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*.

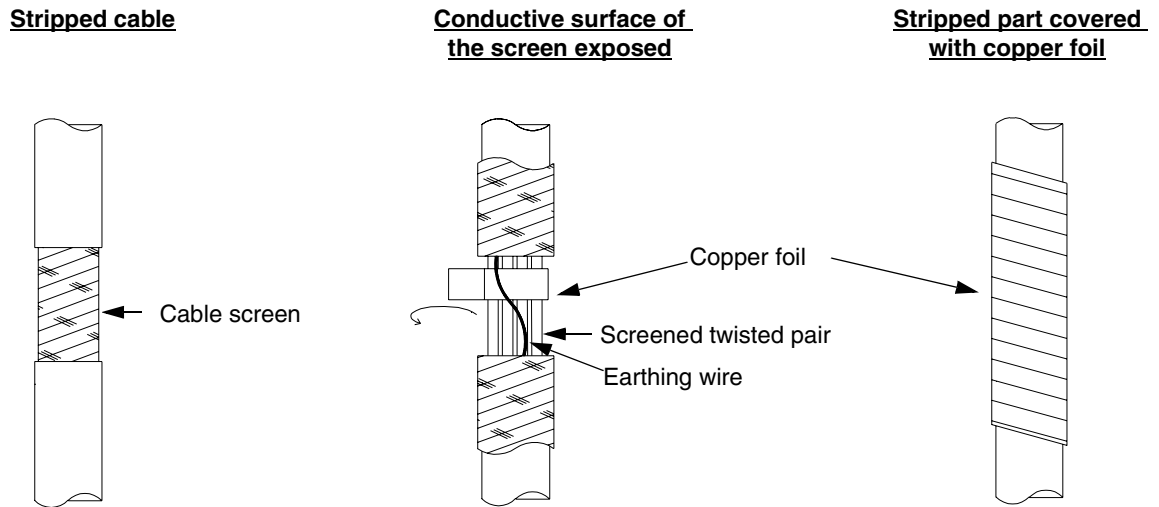
View from below



Bottom and Top Entry Proceed as follows:

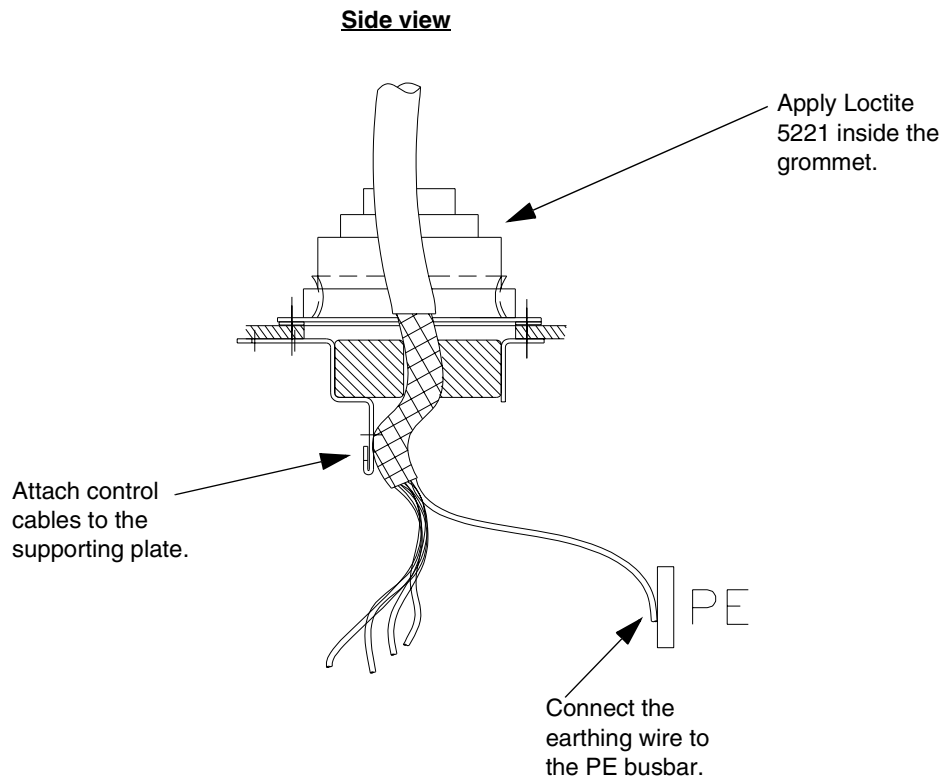
1. Loosen the *lead-through plate position screws*. Pull the two parts apart.
2. **Bottom entry**
Lead the cable inside the cabinet through the *EMI conductive cushions*.
- Top entry**
Lead the cable inside the cabinet through the grommet and the *EMI conductive cushions*. If you have several cables, bunch them together at the grommet, but ensure that each cable has a proper contact to the cushions on both sides.
3. Strip off the cable plastic sheath above the *base plate* (just enough to ensure proper connection of the bare screen and the *EMI conductive cushions*).
4. Earth the screen between the *EMI conductive cushions*:
 - a. If the outer surface of the screen is conductive:
 - Push the two parts of the *lead-through plate* together so that the *EMI conductive cushions* press tightly round the bare screen.

- b. If the outer surface of the screen is covered with non-conductive material:



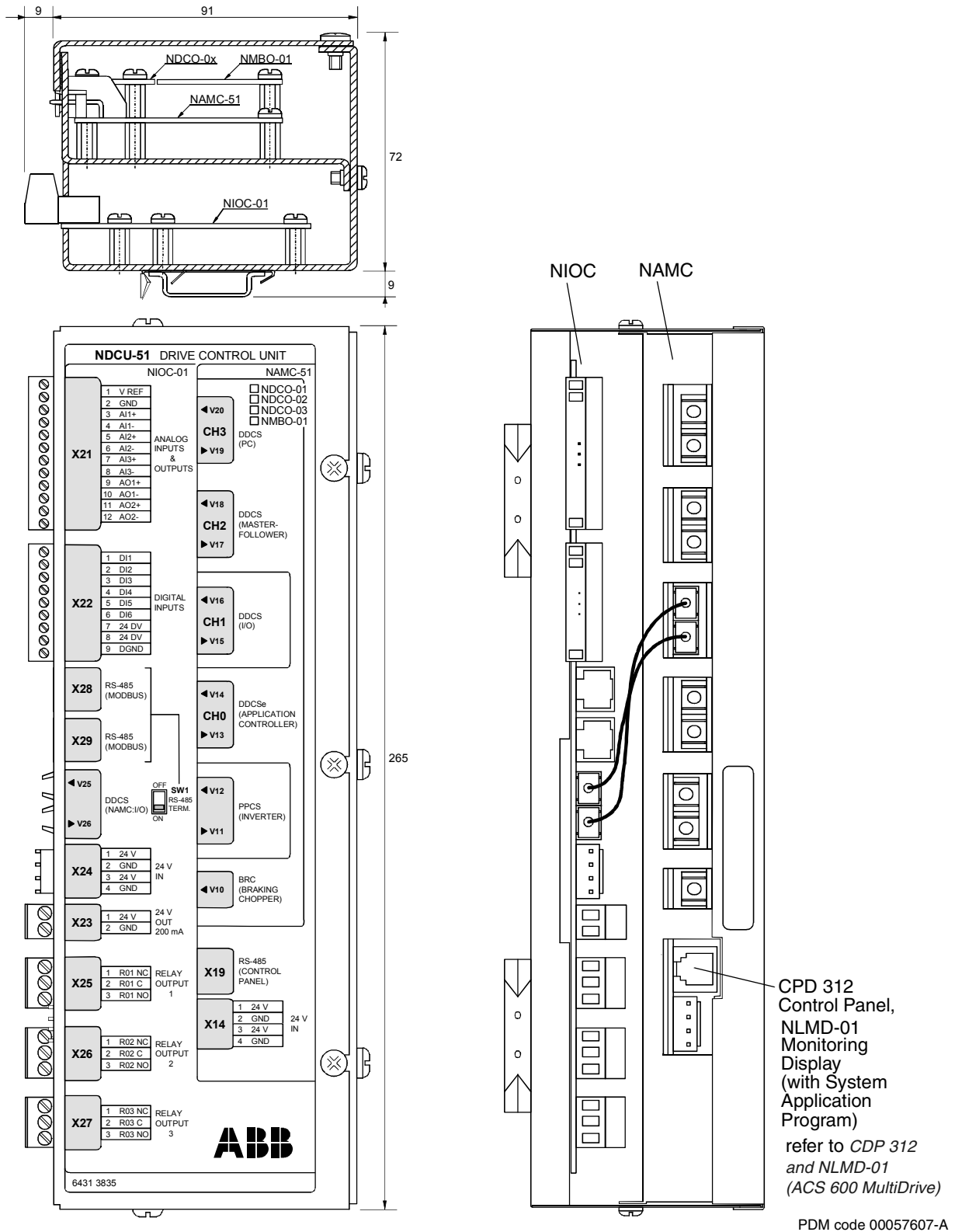
- Cut the screen at the midpoint of the bare part. Be careful not to cut the conductors.
 - Turn the screen inside out to expose its conductive surface.
 - Cover the turned screen and the stripped cable with copper foil to keep the shielding continuous. **Note:** The earthing wire (if present) must not be cut.
 - Push the two parts of the *lead-through plate* together so that the *EMI conductive cushions* press tightly round the foil-covered screen.
5. Lock the two parts of the *lead-through plate* by tightening the *positioning screws*.

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



**Drive Control Unit
NDCU-51**

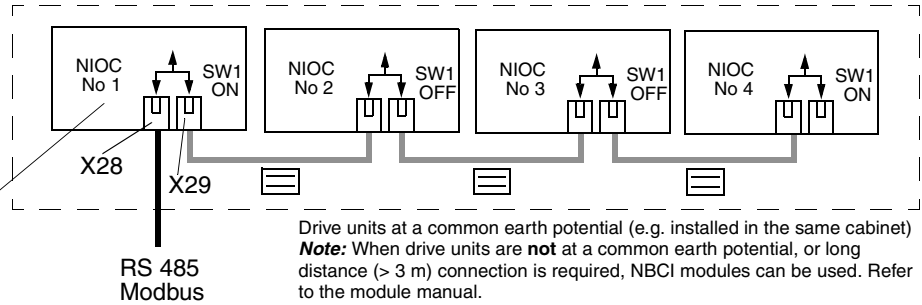
The Drive Control Unit NDCU-51 containing an NAMC-51 board and an NIOC-01 board is shown below. NMBO-01 is an optional Memory Backup board.




NIOC Board Chaining

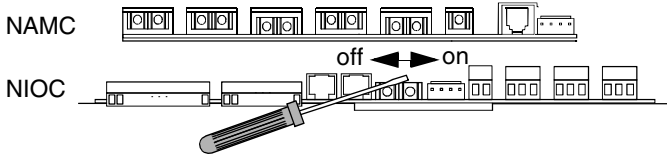
When several NIOC boards are daisy-chained for common control from an external Modbus device the bus termination switch (SW1) must be set on the participating boards as shown below.


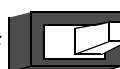
Note: This chaining is not supported by System Application Program.



This board should have SW1 in the OFF position if the external Modbus device has a bus termination circuit. If in doubt, set SW1 to ON here.



 Straight-through cable (Ident.: Grey) (pin 1 to pin 1, pin 2 to pin 2, etc.)



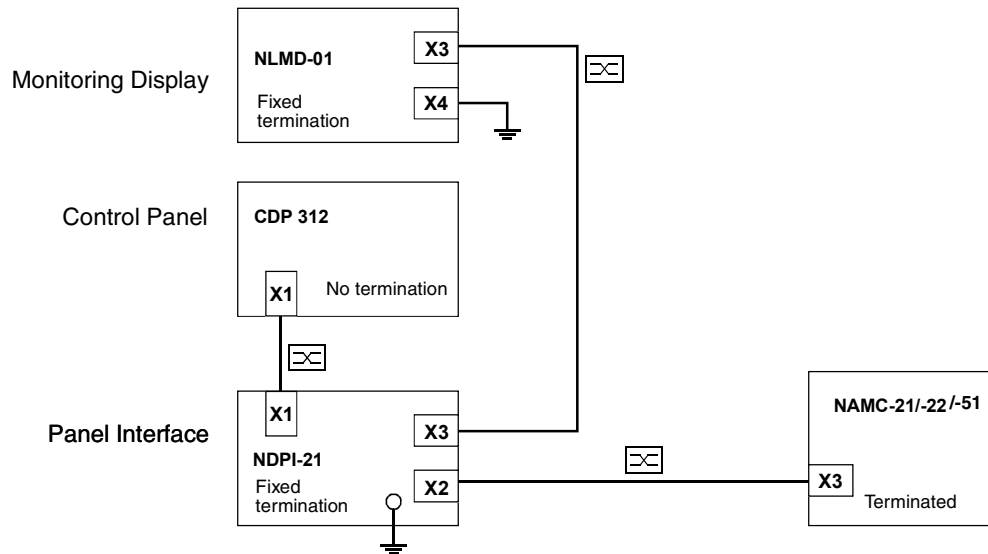
Settings of Switch SW1	Function
OFF 	Termination OFF
OFF  ON	Termination ON (default)

**CDP 312 and NLMD-01
(ACS 600 MultiDrive)**

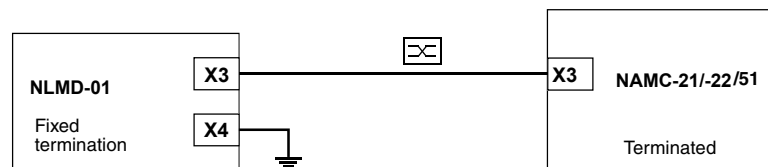
The wiring of the CDP 312 Control Panel and NLMD-01 Monitoring Display in ACS 600 MultiDrive units is shown below:

- Symbols
-  Reversed (crossover) cable (Ident.: Black)
(pin 1 to pin 6, pin 2 to pin 5, etc.)
 -  Straight-through cable (Ident.: Grey)
(pin 1 to pin 1, pin 2 to pin 2, etc.)

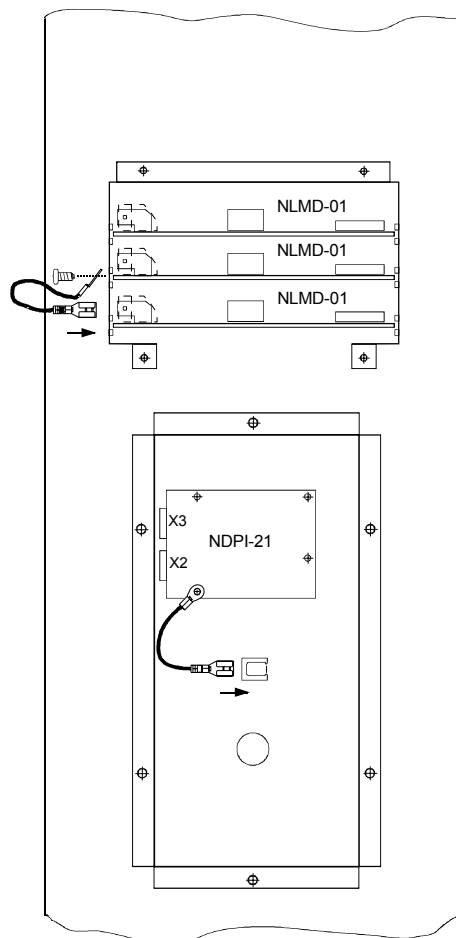
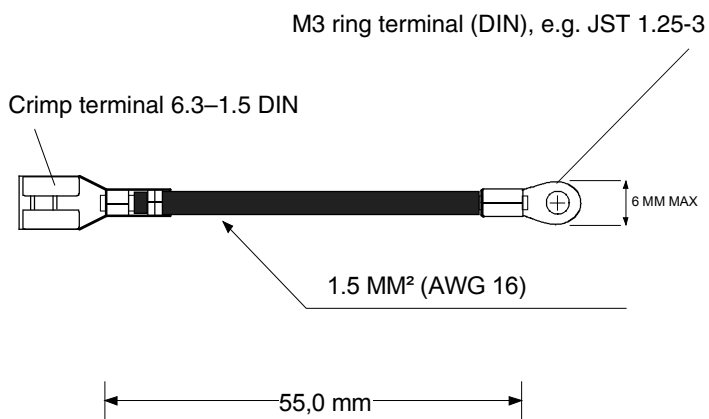
- Control Panel and Monitoring Display



- Monitoring Display only

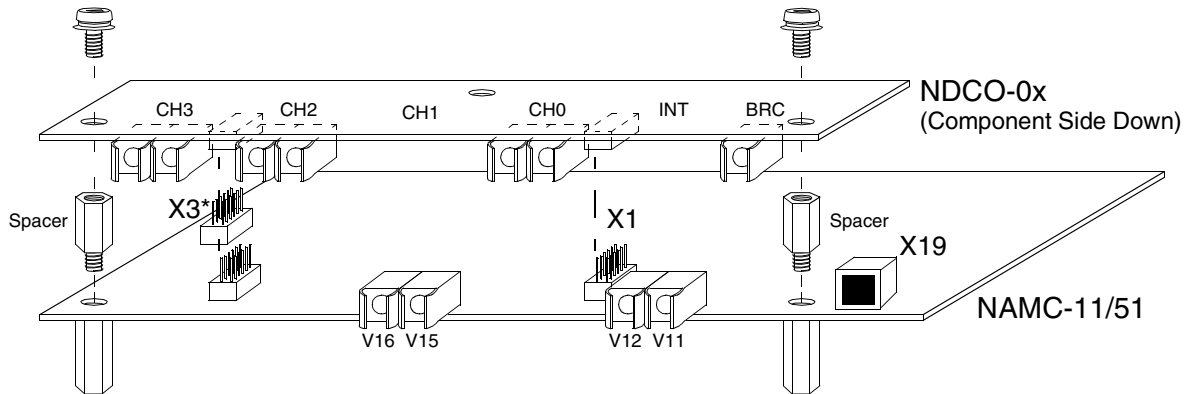


Earthing (Grounding) The boards are earthed to the chassis as shown below (back view of the Control Panel mounting platform.)



Control Panel Connection (ACx 6x7)

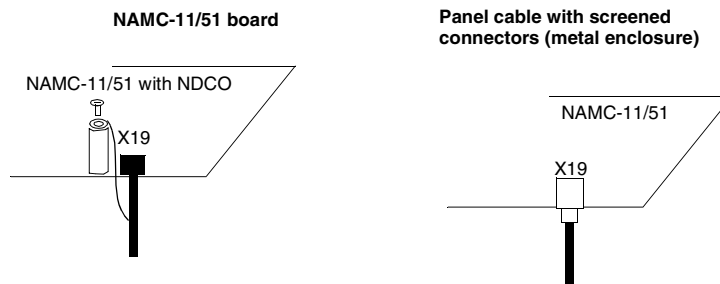
The Control Panel is connected to modular jack X19 on NAMC-11/51 board. The modular jacks on NIOC board are **not** intended for Panel use (they are used by Standard Modbus Link).



* with NAMC-51 for optional Memory Backup board (NMBO)

Control Panel in Remote Use (ACx 6x7)

Connect the Control Panel cable to terminal X19 of the NAMC-11/51.



Pulse Encoder Installation

See *Pulse Encoder Interface Module NTAC-0x Installation and Start-up Guide* (EN code 58919730) for the pulse encoder insulation requirements and connections.

The pulse encoder shall be insulated from the motor stator or rotor in order to prevent currents from finding their way out from the drive shaft through the encoder with resulting damage to the bearings in both the motor and the encoder.

Installation of Optional Modules

This section gives general installation instructions for the DriveWindow PC tool and ACx 600 optional modules, such as fieldbus adapters, I/O extension modules and the pulse encoder interface. Connection examples are given at the end of the section.

Placement The module should be installed on the DIN mounting rail inside the inverter unit cabinet, located on the inside of the left-hand side cabinet wall. The DIN rail of ACx 6x7 units is located in the Auxiliary Control Unit (ACU) or on the assembly door (ACx 617 units of frame size R6i and up). Follow the instructions given in the *Mechanical Installation* chapter of the module manual.

Power Supply for the Module The 24 V d.c. supply for **one** optional module is provided by the NIOC board of the inverter module (terminal X23). The NIOC board is assembled into the NDCU control unit, mounted on a DIN rail inside the inverter unit cabinet or in the Auxiliary Control Unit (ACx 6x7 units).

Fibre Optic Link Optional modules are connected via a DDCS fibre optic link to the NAMC board or NDCO board (both mounted on top of the NIOC board). The terminals to which the cables are connected on the NAMC/ NDCO board are given in the table below. Channel CH1 is on NAMC-11/51 board. Channels CH0, CH2 and CH3 are on the NDCO board.

Module Type	Channel	Terminals
Fieldbus Adapter Modules	CH0*	V13*, V14*
I/O Extension Modules	CH1	V15, V16
Pulse Encoder Interface Module	CH2* with ACS 600 Standard Application Program 5.x	V17*, V18*
	CH1 with ACS 600 System, Crane Master/Follower and Template Application Program	V15, V16
Double Pulse Encoder Interface Module (for ACP 600 only)	CH2*	V17*, V18*
DriveWindow ¹⁾	CH3*	V19*, V20*

* on the NDCO board when the NAMC-11/51 board is used.

¹⁾ DriveWindow Light is connected via an NPCU RS-232/485 converter to the panel connector on the cover (or to modular jack X19 on the NAMC-11/51 board).

Observe colour coding when installing fibre optic cables. Blue connectors should go to blue terminals, and grey connectors to grey terminals.

In case multiple modules are installed on the same channel, they must be connected in a ring.

Optical Components

The optical transmitter and receiver types (5 MBd or 10 Mbd) in DDCS channels CH0 to CH3 on the NAMC boards are given below.

DDCS Channel	Optical Transmitter/Receiver Type			
	NAMC-11/51 Board	DDCS Communication Option		
		NDCO-01	NDCO-02	NDCO-03
CH0	-	10 MBd (DriveBus)	5 MBd	5 MBd
CH1	5 MBd	-	-	-
CH2	-	10 MBd	10 MBd	5 MBd
CH3	-	10 MBd	10 MBd	5 MBd

Note 1: When connecting an NAMC board to another unit make sure, that the optical components are of the same type at both ends of the link. **Do not mix 5 MBd and 10 MBd transmitters and receivers.**

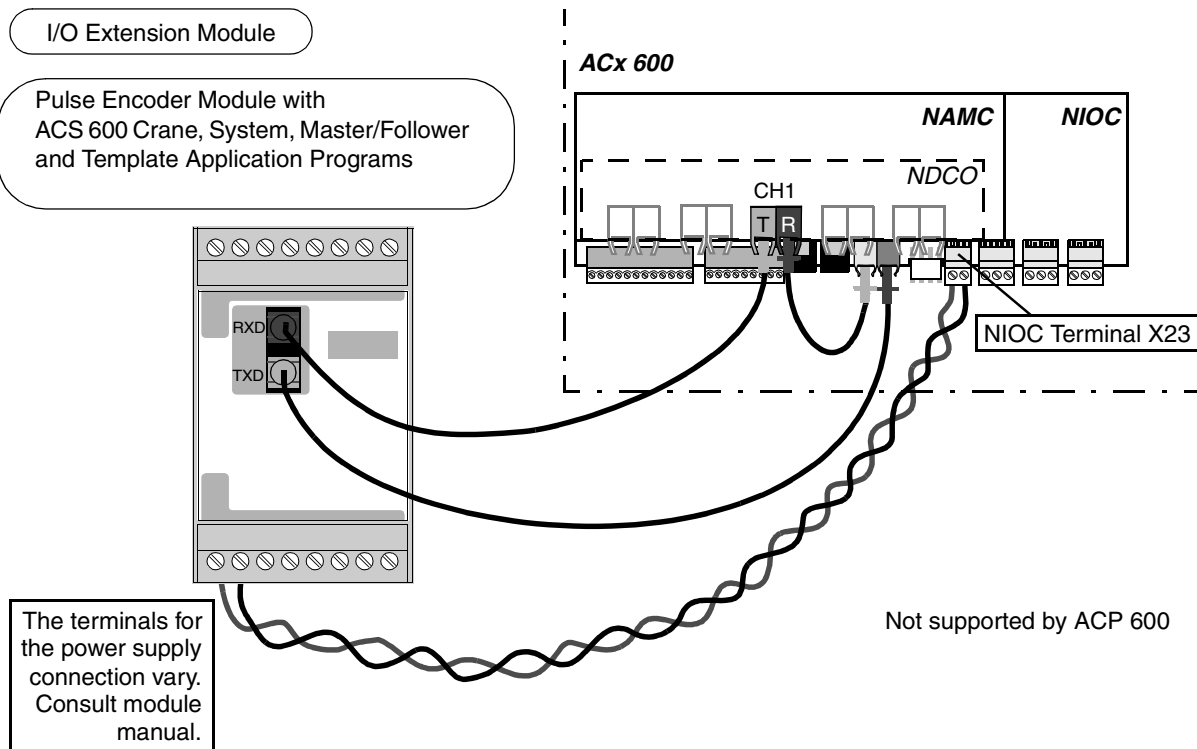
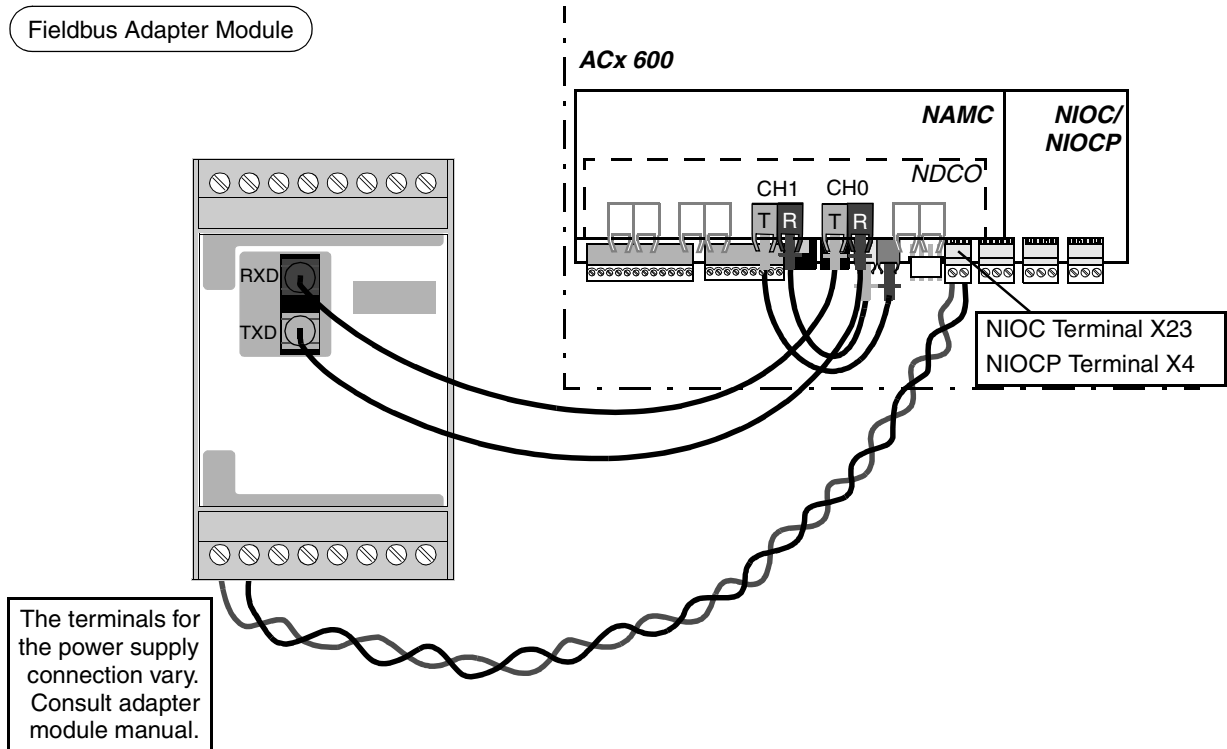
Note 2: With 5 MBd optical components only plastic optical cable (POF) can be used. The maximum cable length is 10 metres. However, when operating at the lower speed of 1 Mbit/s (normally with DriveWindow) the cable length can be extended to 15 metres.

Note 3: With 10 MBd components either plastic (POF) or Hard Clad Silica (HCS) optical cable can be used. When the maximum optical power (transmitter current) is selected by the software, the following cable lengths are applicable:

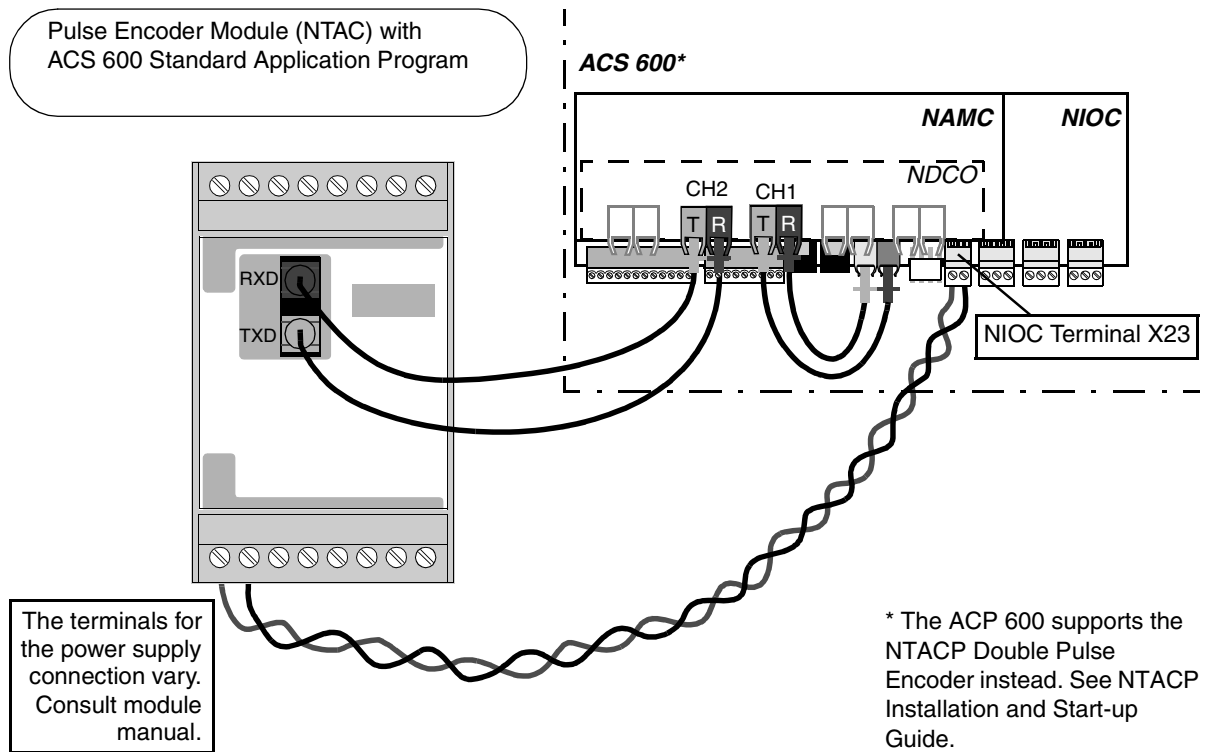
Cable	Cable length (m)
POF	30
HCS	200

When cutting the fibre optic cable, for example with cutters, the optical cable ends become rough and may cause damping in the cable; therefore ground the cable ends with fine sand-paper.

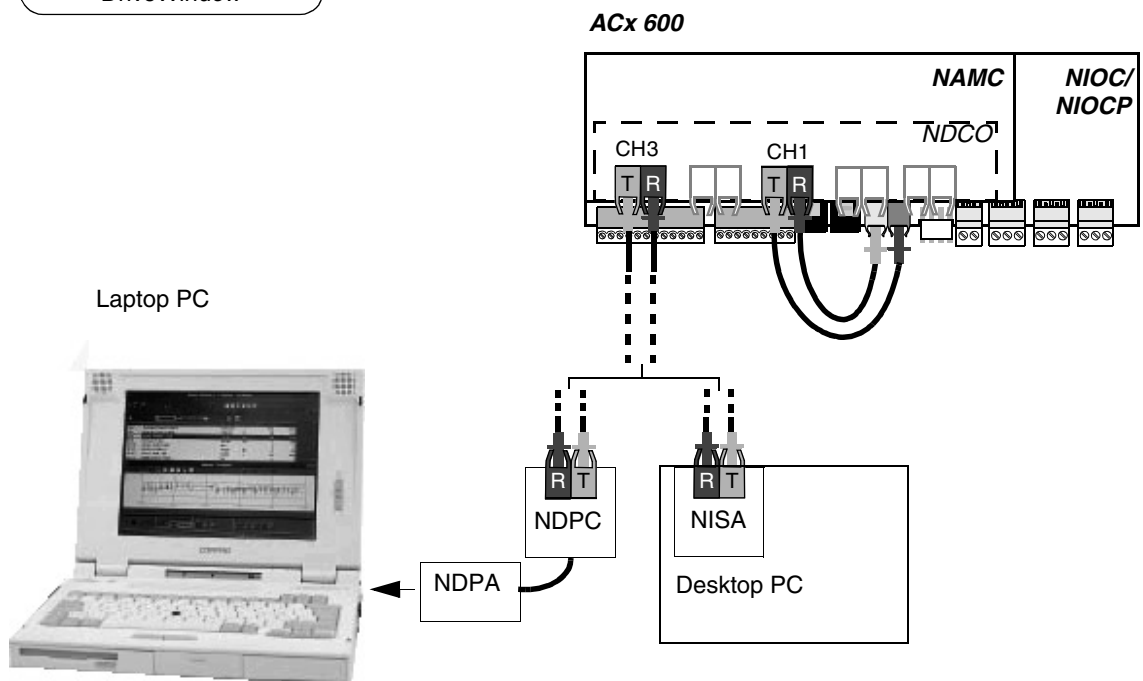
Connection Examples



Connection Examples



DriveWindow



**Installation of Other
Optional Equipment**

Install options such as PTC/PT100 relays, cubicle heater, motor fan starter etc. according to circuit diagrams delivered with the unit.

Installation Checklist

The ACx 600 mechanical and electrical installation must be checked before start-up. It is advisable to go through the checklist below together with another person. Study carefully the *Safety Instructions* on the first pages of this manual before working on the unit.

INSTALLATION CHECKLIST

Check

MECHANICAL INSTALLATION

- The ambient operating conditions are allowable. (See *Appendix A: environmental limits, cooling air flow requirements, free space requirements*)
- The unit is fixed properly. (See *Chapter 2 – Mechanical Installation*)
- The cooling air will flow freely:
 - the lifting bars (if used) are removed. (See *Chapter 2 – Mechanical Installation*)
 - the cabinet roof is lifted up (if a double roof). (See *Chapter 2 – Mechanical Installation*)
- The applicability of the motor and the driven equipment. (See *Safety Instructions / Motor Connections* and *Appendix A: Motor Connection*)

ELECTRICAL INSTALLATION (see *Chapter 3 – Electrical Installation*)

- Joining of the shipping splits:
 - The DC busbars and PE busbars are properly connected (See *Chapter 2 – Mechanical Installation: Connecting the DC Busbar and the PE Busbar*)
 - The control cables are properly connected. (See *Chapter 3 – Electrical Installation: Control Cable Connection at Shipping Split Joints*)
- If the ACx 600 is connected to unearthed mains, the EMC filter capacitors are disconnected.
- The converter unit is earthed properly.
- The mains voltage matches the frequency converter nominal input voltage.
- The setting of the internal 220/115 V transformer corresponds to the supply voltage. The transformer is located in the Auxiliary Control Unit.

INSTALLATION CHECKLIST

- The mains (input power) connections at U1, V1 and W1 are OK.
- The appropriate mains fuses are installed (see *Appendix A*).
- The appropriate DC fuses are installed (see *Appendix A*).
- The motor is of correct voltage.
- The motor star/delta connection at the motor terminal box is correct.
- Motor cable routing.
- Check that the toroidal cores are properly installed on the motor cable when a common mode filter is required.
- The motor connections at U2, V2 and W2 are OK.
- The unused conductive sleeves at cable entries are tied up with cable ties.
- There are no power factor compensation capacitors in the motor cable.
- The control connections inside the frame are OK.
- If a pulse encoder is used, check the encoder cables and correct direction of rotation (see *Chapter 3 – Electrical Installation: Installation of Optional Modules and Pulse Encoder Interface Module NTAC-0x Installation and Start-up Guide* EN code 58919730).
- Thermistor cables. The connections are appropriate for the sensor used in the motor.
- Prevention of Unexpected Start cables.
- Emergency stop cables.
- If other external cables are used, make sure that both ends of the cables are connected and the cables do not cause any damage or danger when power is being switched on.
- Cleanliness of the cabinet and surroundings, e.g.:
 - there are no tools or other foreign objects inside the cabinet or waste left from installation e.g. cable trimmings
 - there is no garbage under the cabinet (the cooling air fan will draw the garbage inside the cabinet)
 - When there is a cable conduit below the cabinet, cooling air flow from below is prevented by bottom plates around the cable entries (See *Chapter 2 – Mechanical Installation: Cable Conduit in the Floor below the Cabinet*.)
- Mains voltage cannot be applied to the output of the ACx 600 (with bypass connection).

Commissioning

This section describes the hardware commissioning of an ACx 6x7 drive section. For the drive control firmware commissioning, refer to the application program *Firmware Manual* (for System, Standard, Crane Drive or other Application). For Standard Application Program there is also a *Start-up Guide*.

Perform the drive section commissioning according to this section. Perform the supply section commissioning according to the instructions given in the *Supply Sections User's Manual* (DSU, TSU or ISU).




WARNING! The work described in this chapter must only be carried out by a qualified electrician. The *Safety Instructions* on the first pages of this manual must be followed. Negligence of the safety instructions can cause injury or death.

Installation Checklist

The installation must be checked before commissioning the Drive Section.

Action	Information
<input type="checkbox"/> Check that the mechanical and electrical installation of the frequency converter is inspected and OK.	See <i>Installation Checklist</i> on page 4-1.
<input type="checkbox"/> Ensure that the insulation resistance of the assembly is checked according to the instructions.	See <i>Insulation Checks</i> in <i>Chapter 3</i> .
<input type="checkbox"/> Ensure that the surroundings and inside of the cabinet are free from dust and loose objects (like cable trimmings and other waste left from the installation).	After the start, the cooling air fans may suck nearby loose objects into the unit. This might cause failure and damage the unit.

Checks with No Voltage Connected The table below is a commissioning checklist for the Drive Section with no voltage connected.

Action	Information
 <p>WARNING! Ensure that the disconnecter of the supply transformer is locked to open position, i.e. no voltage is, or can be connected to the ACx 600 inadvertently. Check also by measuring that no voltage is actually connected.</p> <p>If the motor has a safety switch, make sure that it is open. If the motor has no safety switch, open the circuit Prevention of Unexpected Start (if available).</p>	
1. Drive Data	
<p>Find out the following data for each drive section and note down any differences in the delivery documents:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Motor, pulse encoder and cooling fan rating plate data correspond to the values in the motor list. <input type="checkbox"/> Motor temperature measurement method: Pt 100, PTC or other. <input type="checkbox"/> Cooling of separately ventilated motors <p>Ensure that the fan motor always starts prior to the drive. Check the current drawn by the fan, the overcurrent protection setting, and the functioning of the fan start/stop circuit.</p> <input type="checkbox"/> Direction of motor rotation <input type="checkbox"/> Maximum and minimum speeds, fixed speeds <input type="checkbox"/> Speed scaling factor, gear ratio, roll diameter etc. <input type="checkbox"/> Acceleration and deceleration times <input type="checkbox"/> Inertia compensation <input type="checkbox"/> Means of stopping the machinery <p>Can the free rotation of the driven machine be stopped if necessary, e.g. in power cut? Check the mechanical brakes.</p> <input type="checkbox"/> Operating modes: stop mode etc. <input type="checkbox"/> The number of motors in the section 	<p>See the circuit diagrams of the drive system.</p>

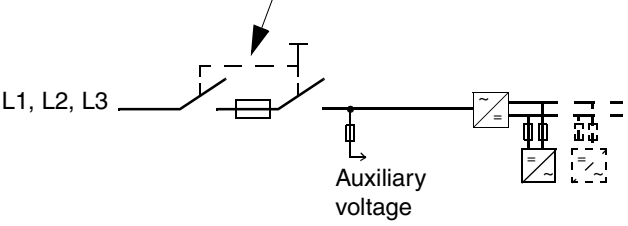
Action	Information
2. Voltage for the Cooling Fans	
The fan motor protection switches (F10.x) and 24 V auxiliary voltage (optional) switch (F13) are on.	See the circuit diagrams delivered with the device. <i>Chapter 1 – Introduction: Voltages from the Supply Section, Chapter 3 – Electrical Installation: Motor Cable Connections.</i>

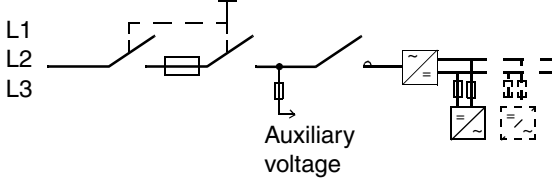
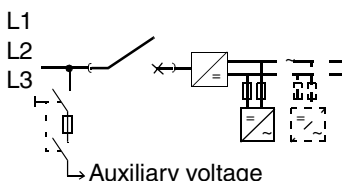

WARNING! When the main disconnecting device of the Supply Section is closed (DC busbar is live), **never remove or insert the fuses of a drive section.**



Note: The drive section must only be energised/de-energised by operating the main disconnecting device in the supply section.


Connecting Voltage The tables below describe how to connect voltage to the Supply Section and to the Auxiliary Control Unit (ACU) for the first time.

Action	Information
<p>TYPES EQUIPPED WITH A SWITCH FUSE OR A LOAD SWITCH (selections 0 and 1 in type code character no. 31)</p>	
 <p>WARNING! When the disconnecting switch of the Supply Section is closed, the voltage will also be connected to the Auxiliary Control Unit and to auxiliary circuits - also to the ones wired to drive sections. The DC busbars will become live, as will all the inverters connected to the DC busbars. The DC busbars will be powered to a voltage of $1.35 \cdot U_1$.</p> <p>Make sure that it is safe to connect voltage to the Supply Section. Ensure that:</p> <ul style="list-style-type: none"> • Nobody is working on the unit or circuits that are wired from outside into the cabinets. • It is safe to start the motor. • All cabinet doors are closed. 	<p>See the circuit diagrams delivered with the unit for the actual connections (customized configurations).</p>
<p>Powering the Auxiliary Control Circuits and the Drive Section</p>	
<ul style="list-style-type: none"> <input type="checkbox"/> Disconnect the 230 VAC cables that lead from the terminal blocks to the outside of the equipment and have not yet been checked, and the connections which may not yet have been completed. <input type="checkbox"/> Disconnect the communication link to the overriding system by removing the fiber optic cables. <input type="checkbox"/> Be ready to trip the main breaker of the supply transformer in case something abnormal occurs. <input type="checkbox"/> Ensure that all cabinet doors are closed. <input type="checkbox"/> Close the main breaker of the supply transformer. <input type="checkbox"/> Power the Drive Section by closing the main disconnecting device in the Supply Section. 	<p>See the circuit diagrams delivered with the device.</p> <p>The auxiliary control circuits and the Drive Section are powered.</p>

Action	Information
TYPES EQUIPPED WITH A CONTACTOR & A SWITCH FUSE OR A BREAKER (selections 2 and 3 in type code character no. 31)	
<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Auxiliary voltage</p> </div> <div style="text-align: center;">  <p>Auxiliary voltage</p> </div> </div> <p>Note: See the circuit diagrams delivered with the unit for the actual connections (customized configurations).</p> <div style="display: flex; align-items: center; margin-top: 20px;"> <div style="text-align: center; margin-right: 20px;">  </div> <div> <p>WARNING! When voltage is connected to the input terminals of the Supply Section and the switch fuse is closed, the voltage will also be connected to the Auxiliary Control Unit and to auxiliary circuits - also to the ones wired to drive sections.</p> <p>Make sure that it is safe to connect voltage to the Supply Section. Ensure that:</p> <ul style="list-style-type: none"> • Nobody is working on the unit or circuits that are wired from outside into the cabinets. • All cabinet doors are closed. </div> </div>	
Connecting Voltage to the Auxiliary Control Circuits	
<ul style="list-style-type: none"> <input type="checkbox"/> Disconnect the 230 VAC cables that lead from the terminal blocks to the outside of the equipment and have not yet been checked, and the connections which may not yet have been completed. <input type="checkbox"/> Disconnect the communication link to the overriding system by removing the fiber optic cables. <input type="checkbox"/> Make sure that the main contactor/air circuit breaker cannot be closed inadvertently by remote control, e.g. by temporarily opening a connection in its control circuit. <input type="checkbox"/> Be ready to trip the main breaker of the supply transformer in case something abnormal occurs. <input type="checkbox"/> Ensure that all cabinet doors are closed. <input type="checkbox"/> Close the main breaker of the supply transformer. <input type="checkbox"/> Close the main disconnecting switch of the auxiliary circuit (if present). <input type="checkbox"/> Close the main disconnecting device of the Supply Section. 	<p>See the circuit diagrams delivered with the device.</p> <p>The auxiliary control circuits are powered.</p>


Checks with Voltage Connected to Auxiliary Circuits

The table below is a commissioning checklist for the Drive Section with voltage connected to the input terminals, and to the Auxiliary Control Unit (ACU).

Action	Information
 <p>WARNING! This section includes instructions for checking/measuring circuits under voltage. Only a qualified person is allowed to do the work. Appropriate and approved meter must be used.</p> <p>IF IN DOUBT, DO NOT PROCEED!</p>	
<input type="checkbox"/> Ensure the actions described in section <i>Connecting Voltage</i> are completed.	
1. Cooling Fans	
<input type="checkbox"/> Check that the cooling air fans rotate freely in the right direction, and the air flows upwards.	A paper sheet set on the lower gratings stays. The fan runs noiselessly.
2. Parameters	
<input type="checkbox"/> Set the drive parameters according to the application <i>Firmware Manual (System, Standard, Crane Drive or other)</i> . With Standard Application Program, use the <i>Start-up Guide</i> .	

Connecting Voltage to Drive Section

The table below describes how to connect voltage to the Drive Section when the Supply Section is equipped with a contactor & a switch fuse or a breaker (selections 2 and 3 in the type code character 31).

Action	Information
 <p>WARNING! When connecting voltage to the Supply Unit, the DC busbars will become live, as will all the inverters connected to the DC busbars. The DC busbars will be powered to a voltage of $1.35 \cdot U_1$.</p> <p>Make sure that it is safe to connect voltage to the Supply Unit. Ensure that:</p> <ul style="list-style-type: none"> • Nobody is working on the unit or circuits that are wired from outside into the cabinets. • It is safe to start the motor. • All cabinet doors are closed. 	
POWERING THE DRIVE SECTION	
<p>Power the Drive Section by closing the main contactor/ breaker of the Supply Unit.</p>	

Checks with Voltage Connected to Drive Section

Basic checks for the Drive Section when voltage is connected to the Supply Section and DC busbars.

Action	Information
1. Basic Checks	
<p><input type="checkbox"/> Check that the Prevention of Unexpected Start (if available) is working.</p> <ol style="list-style-type: none"> 1. Stop the drive by a Stop command and wait until the drive has stopped. 2. Open the Prevention of Unexpected Start switch by opening the switch on the control desk: the circuit will open. The lamp (if fitted) on the desk should be lit. 3. Give a Start command. The drive should not start. 4. Reset the drive. 	<p>See the circuit diagrams delivered with the device.</p>

On-load Checks The table below is a commissioning checklist for the loaded Drive Section.

Action	Information
<ul style="list-style-type: none"> <input type="checkbox"/> Check the rotation direction of the motor. <input type="checkbox"/> Check the pulse encoder functioning (if present) <input type="checkbox"/> Check the emergency stop function of the system from each operating place. 	<p>See <i>Pulse Encoder Interface Module NTAC-0x Installation and Start-up Guide</i> (EN code 58919730).</p>

Control from Overriding System After the drive has been commissioned and tested locally, check that the overriding system works. A checklist is presented below.

Action	Information
<ol style="list-style-type: none"> 1. Disconnect all voltages: open the main contactor/breaker (if present), open the main disconnecting device. 2. Connect the communication link to the overriding system by connecting the fibre optic cables. 3. Power the unit up. 4. Check <ul style="list-style-type: none"> <input type="checkbox"/> the start/stop functions <input type="checkbox"/> speed/torque references <input type="checkbox"/> alarm/fault words <input type="checkbox"/> function in case of a communication break <input type="checkbox"/> updating interval of the drive software <input type="checkbox"/> other items essential to the application 	<p>See the circuit diagrams delivered with the device.</p>

Chapter 5 – Preventive Maintenance



WARNING! The *Safety Instructions* on the first pages of this manual must be followed. Negligence of these instructions can cause injury or death.

If installed in an appropriate environment, the ACx 600 requires very little maintenance.

An annual check-up for dust and corrosion accumulation on the surfaces inside the cabinet is recommended.

Air Filters

When having filtering for cooling air, check and clean or replace filter mats if dirty. Wash dirty filter mats with water (60 °C) and detergent.

Heatsink

The ACx 600 can run into overtemperature faults if the heatsink is not clean. In normal environment, the heatsink should be checked and cleaned annually.

Use compressed air to remove dust from the heatsink. (The airflow direction must be from bottom to top.) Also, use a vacuum cleaner at the air outlet to trap the dust. Fan rotation must be prevented in order to prevent bearing damage.

Relays

Relays should be checked for function and all connections should be inspected and checked for tightness. Any signs of corrosion, especially in ground components, shall be cleaned off.

Fan

The cooling fan lifespan is approximately 40 000 hours. The actual lifespan depends on the frequency converter usage and ambient temperature.

Fan failure can be predicted by increasing noise from fan bearings and gradual rise in the heatsink temperature in spite of heatsink cleaning. If the frequency converter is used in a critical part of a process, fan replacement is recommended once these symptoms appear.

Spare Modules

If spare modules are available, it is recommended to replace the cabinet modules with their spare modules once a year in order to avoid capacitor reforming and to equalize wear and tear on the modules. See section *Capacitors* below.

Capacitors

The ACx 600 intermediate circuit employs several electrolytic capacitors. The lifespan of the capacitors is approximately 100 000 hours, depending on the frequency converter loading and the ambient temperature.

Capacitor life can be prolonged by lowering the ambient temperature. It is not possible to predict capacitor failure.

Capacitor failure is usually followed by a mains fuse failure or a fault trip. Contact ABB if capacitor failure is suspected. Replacements are available from ABB. Do not attempt operation with other than ABB specified spare parts.

Reforming

Converter DC link capacitors need to be reformed (re-aged) if the converter has been non-operational for more than one year. Without reforming capacitors may be damaged when the converter starts to operate. The reforming methods introduced here require that the converter has been stocked clean and dry. It is recommended to reform the capacitors once a year.

How to check the converter age

Converter serial number defines the week, when the converter has been built:

- 8 digit: e.g. 18250125, 1 denotes manufacturing country (1 = Finland), 8 manufacturing year (1998), 25 manufacturing week and 0125 running manufacturing number.
- 10 digit: e.g. 1983200725, 1 denotes manufacturing country, 98 manufacturing year, 32 manufacturing week and 00725 running manufacturing number.

Reforming time

The intermediate circuit of the converter is kept at its nominal voltage for the reforming time to “wake up” the capacitors. The reforming time required depends on how long the converter has been stocked (non-operational).



Figure 5-1 Capacitor reforming time for Method 1 and Method 2.

Converters Stocked (Non-operational) for Less Than 2 years

Switch the power on to the converter for a time given in Figure 5-1 (Method 1). The converter “wakes up” its capacitors by itself. Power the converters up once a year to keep the capacitors in operational condition.

Converters Stocked (Non-operational) for 2 Years and Over

Use Method 2 A or Method 2 B (both explained below) for capacitor reforming if the converter has been stocked or non-operational for two or more years.

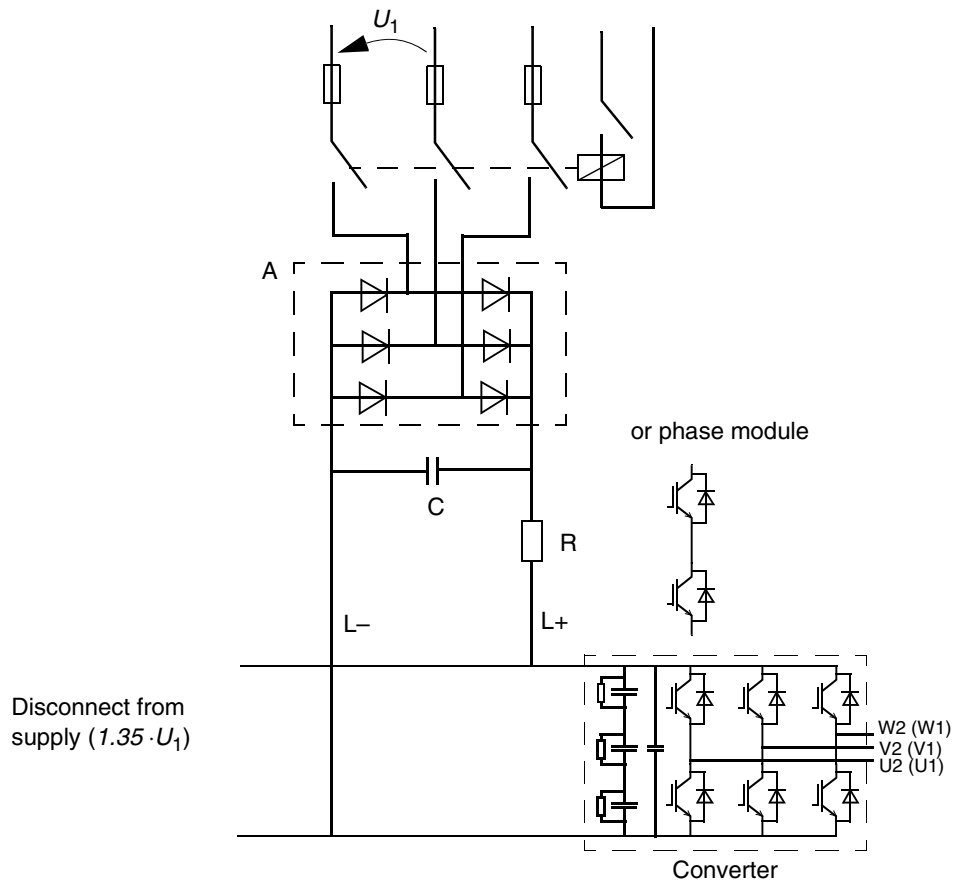


WARNING! The ACS 600 MultiDrive converters (IGBT Supply Units and Drive Units) must be reformed outside the cabinet. Reform the phase modules separately outside the cabinet.

Method 2 A Capacitor reforming is realised by connecting a rectifier and a resistor circuit to the converter DC link. The reforming circuit and component values for different voltages are given below. See Figure 5-1 for reforming time.



WARNING! The converter supply must be disconnected while the reforming circuit is connected.



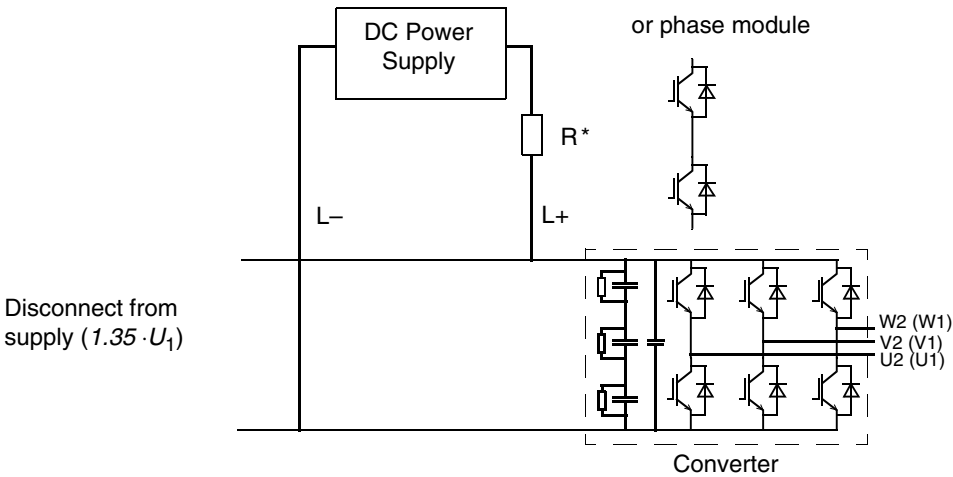
Supply Voltage	Recommended Components		
	A*	R	C
$380\text{ V} < U_1 < 415\text{ V}$	SKD 82/16	220 Ohm / 700 W	22 nF / 2000 V
$380\text{ V} < U_1 < 500\text{ V}$	SKD 82/16	470 Ohm / 1200 W	22 nF / 2000 V
$525\text{ V} < U_1 < 690\text{ V}$	SKD 82/16	680 Ohm / 1700 W	22 nF / 2000 V

* rectifier bridge by Semikron (82 A, 1600 V) or equivalent

Method 2 B Capacitor reforming is based on a DC power supply connected to the converter DC link. Power supply current charges the converter capacitors. If power supply cannot limit the current, voltage is increased gradually (with e.g. 100 V steps). Maximum recommended reforming current is 500 mA. An appropriate reforming voltage is $(1.35 \dots \sqrt{2}) \cdot U_1$. The reforming circuit is shown below. See Figure 5-1 for reforming time.



WARNING! The converter supply must be disconnected while the reforming circuit is connected.



* R = 100 Ohm / 500 W

Appendix A – Technical Data

Ratings

The ratings for the ACx 607/617/627/677 with 50 Hz and 60 Hz supplies are given below. ACx = ACS/ACC.

Frequency Converter Type	Drive Frame Size	Normal Use			Duty Cycle 1/5min		Duty Cycle 10/60s	
		I_{2N} [A]	S_N [kVA]	P_N [kW]	I_{2hd} 4/5min [A]	I_{2hd} 1/5min [A]	I_{2hd} 50/60s [A]	I_{2hd} 10/60s [A]
Supply voltage range 380, 400 or 415 V								
ACx 617-0120-3	R7i	178	120	90	147	221	147	294
ACx 617/677-0185-3	R8i	259	185	132	194	291	178	356
ACx 617/677-0225-3	R8i	312	225	160	234	351	216	432
ACx 617/677-0265-3	R8i	379	265	200	284	426	260	520
ACx 617/677-0335-3	R9i	474	335	250	356	533	316	632
ACx 617/677-0405-3	R9i	576	405	315	432	648	395	790
ACx 617/677-0500-3	R10i	720	500	400	540	810	494	988
ACx 617/677-0630-3	R11i	907	630	500	680	1020	600	1200
ACx 607/617/627/677-0760/0765-3	R11i	1094	760/765	630	821	1231	751	1502
ACx 607/617/627/677-0930/0935-3	R12i	1336	930/935	710	1002	1503	901	1802
ACx 607/617/627/677-1120/1125-3	R12i	1624	1120/1125	900	1218	1827	1126	2252
ACx 607/627/677-1440-3	2xR11i	2079	1440	1120	1559	2339	1501	3002
ACx 607/627/677-1770-3	2xR12i	2558	1770	1400	1919	2878	1801	3602
ACx 607/627/677-2140-3	2xR12i	3085	2140	1750	2314	3471	2252	4504
ACx 627-2340-3	4xR11i	3374	2340	1900	2531	3796	2402	4804
ACx 627-2820-3	4xR11i	4070	2820	2300	3053	4579	3002	6004
Supply voltage range 380, 400, 415, 440, 460, 480 or 500 V								
ACx 617-0100-5	R6i	112	100	75	84	126	84	168
ACx 617-0140-5	R7i	164	140	110	135	203	135	270
ACx 617/677-0215-5	R8i	246	215	160	185	277	164	328
ACx 617/677-0255-5	R8i	295	255	200	221	332	200	400
ACx 617/677-0325-5	R8i	368	325	250	276	414	240	480
ACx 617/677-0395-5	R9i	448	395	315	336	504	300	600
ACx 617/677-0495-5	R9i	565	495	400	424	636	365	730
ACx 617/677-0610-5	R10i	700	610	500	525	788	456	912
ACx 617/677-0770-5	R11i	887	770	630	665	998	570	1140
ACx 607/617/627/677-0930/0935-5	R11i	1073	930/935	710	805	1208	694	1388
ACx 607/617/627/677-1090/1095-5	R12i	1263	1090/1095	900	947	1421	855	1710
ACx 607/617/627/677-1380/1385-5	R12i	1593	1380/1385	1120	1195	1793	1040	2080
ACx 607/627/677-1760-5	2xR11i	2039	1760	1400	1529	2294	1387	2774
ACx 607/627/677-2160-5	2xR12i	2501	2160	1800	1876	2814	1710	3420
ACx 607/627/677-2620-5	2xR12i	3026	2620	2200	2270	3405	2081	4162
ACx 627-2850-5	4xR11i	3300	2850	2400	2475	3713	2280	4560
ACx 627-3450-5	4xR11i	3992	3450	2900	2994	4491	2774	5548

-0765-3, -0935-3, 1125-3, 0935-5, 1095-5 and 1385-5 are ACx 617 types

Continues on the next page

Appendix A – Technical Data

Frequency Converter Type	Drive Frame Size	Normal Use			Duty Cycle 1/5min		Duty Cycle 10/60s	
		I_{2N}	S_N	P_N	I_{2hd} 4/5min	I_{2hd} 1/5min	I_{2hd} 50/60s	I_{2hd} 10/60s
		[A]	[kVA]	[kW]	[A]	[A]	[A]	[A]
Supply voltage range 525, 550, 575, 600, 660 or 690 V								
ACx 617-0120-6	R7i	105	120	90	88	132	88	176
ACx 617/677-0205-6	R8i	176	205	160	132	198	127	254
ACx 617/677-0255-6	R8i	210	255	200	158	236	150	300
ACx 617/677-0315-6	R8i	264	315	250	198	297	179	358
ACx 617/677-0375-6	R9i	310	375	315	233	349	225	450
ACx 617/677-0485-6	R9i	410	485	400	308	461	265	530
ACx 617/677-0600-6	R10i	502	600	500	377	565	340	680
ACx 617/677-0750-6	R11i	630	750	630	473	709	428	856
ACx 607/617/627/677-0900-6	R11i	755	900	710	566	849	504	1008
ACx 607/617/627/677-1040/1045-6	R12i	874	1040/1045	800	656	983	641	1282
ACx 607/617/627/677-1380/1385-6	R12i	1156	1380/1385	1120	867	1301	755	1510
ACx 607/627/677-1710-6	2xR11i	1435	1710	1400	1076	1614	1007	2014
ACx 607/627/677-2120-6	2xR12i	1777	2120	1800	1333	1999	1283	2566
ACx 607/627/677-2540-6	2xR12i	2129	2540	2000	1597	2395	1511	3022
ACx 607/627/677-2800-6	4xR11i	2344	2800	2300	1758	2637	1710	3420
ACx 607/627/677-3350-6	4xR11i	2809	3350	2800	2107	3160	2014	4028

-1045-6 and -1385-6 are ACx 617 types

Normal Use

- I_{2N} Rated rms output current (= maximum continuous output current)
- S_N Rated apparent output power
- P_N Typical motor power. The power ratings in kW apply to most IEC 34 motors.

Duty Cycle

- I_{2hd} Rated rms output current

The current ratings are the same regardless of the supply voltage within one voltage range. The rated current of the ACx 600 must be higher than or equal to the rated motor current to achieve the rated motor power given in the table.

Note 1: The load capacity (current and power) decreases if the installation site altitude exceeds 1000 metres, or if the ambient temperature exceeds 40 °C (units with degree of protection IP 21/22/42/54).

Note 2: Usually du/dt filters are needed at the output of 525 V to 690 V units with random wound motors. No du/dt filters are usually required with form wound motors.

Note 3: For the ACx 677, the P_N ratings are 90 percent of the values given in the table.

Output Current Temperature Derating

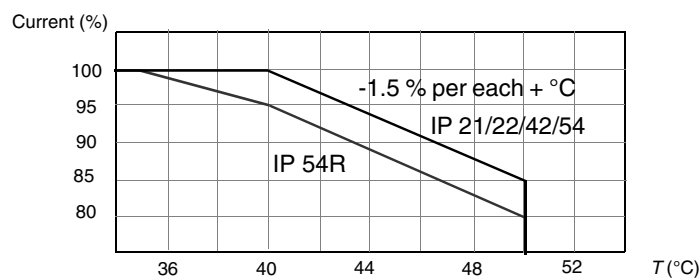
The output current is calculated by multiplying the current given in the rating table by the derating factor.

Temperature derating factor for degree of protection IP 21/22/42/54:

- *General rule:* Above +40 °C, the rated output current is decreased 1.5 % for every additional 1 °C (up to +50 °C).
- *Example 1:* If the ambient temperature is 50 °C the derating factor is

$$100 \% - 1.5 \frac{\%}{^{\circ}\text{C}} \cdot 10 \text{ }^{\circ}\text{C} = 85 \% \text{ or } 0.85. \text{ The output current is then}$$

$$0.85 \cdot I_{2N} \text{ or } I_{2hd}.$$



Derating Diagram: the effect of ambient temperature on the ACx 6x7 continuous load capacity.

Input Power Connection

Voltage (U_1):

380/400/415 VAC 3-phase $\pm 10\%$ for 400 VAC units
 380/400/415/440/460/480/500 VAC 3-phase $\pm 10\%$ for 500 VAC units
 525/550/575/600/660/690 VAC 3-phase $\pm 10\%$ for 690 VAC units

Short Circuit Capability IEC 439-1: The rated short time withstand current of ACx 6x7 is given below

Frame Size	$I_{cw} / 1\text{ s}$ kA	I_{pk} kA
ACS/ACC 627/677: B3	37	78
ACS/ACC 607/627/677: B4, B5	50	105
ACS/ACC 607/627/677: B4, B5 without optional earthing switch	65	143
ACS/ACC 617: R8i, R9i	38	78
ACS/ACC 617: R11i, R12i	50	105

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

Input Voltage Unbalance: $\pm 3\%$ (EN 60204-1)

Power Factor:

Diode and Thyristor Supply Units

($\cos \varphi_1$): 0.97 (fundamental at nominal load)

($\cos \varphi$): 0.93...0.95 (total)

IGBT Supply Units

$\cos \varphi_1 = 1.00$ (fundamental at nominal load)

$\lambda = I_1 / I_{rms} \cdot \cos \varphi_1 > 0.98$ (total), where

λ is power factor,

I_1 is fundamental input current rms value,

I_{rms} is total input current rms value.

Motor Connection

Voltage (U_2): 0 to U_1 , 3-phase symmetrical

Frequency: DTC mode: 0 to $3.2 \cdot f_{FWP}$. 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} : Rated motor voltage; f_{Nmotor} : Rated motor frequency

Scalar Control mode (not for ACP 600): 0 to 300 Hz

With du/dt Filter (DTC and Scalar Control modes): 0 to 120 Hz

Frequency Resolution: 0.01 Hz

Continuous Current: $1.0 \cdot I_{2N}$ (normal use)

Short Term Overload Capacity: according to rating tables on pages A-1 and A-2.

Field Weakening Point: 8 to 300 Hz

Switching Frequency: 2 kHz (average), 3 kHz (ACS/ACC 617).

Maximum Recommended Motor Cable Length: For cables longer than 500 metres / 1640 ft (cumulative length in case of parallel connected motors), an ABB representative must be consulted. With pulse encoder speed measurement, the maximum cable length is 300 m. With du/dt filters, refer to *du/dt Installation Guide* (EN code: 58933368). For additional EMC requirements on cable length, refer to section *CE Marking* below.

Motor Bearings: Insulated bearing at the non-driven end is recommended.

Cable Types: The tables below give the copper and aluminium cable types for different load currents (I_{Lmax}). A correction factor of $K = 0.70$ has been used (max. 9 cables laid on a cable ladder side by side, three ladders on top of each other, ambient temperature 30 °C (86 °F), EN 60204-1 and IEC 364-5-523)

COPPER CABLES WITH A CONCENTRIC COPPER SCREEN		
I_{Lmax} [A]	Cable Type	Diameter [mm]
255	3×185 + 95	50
274	2 × (3×70 + 35)	2 × 32
301	3×240 + 120	55
334	2 × (3×95 + 50)	2 × 38
386	2 × (3×120 + 70)	2 × 41
446	2 × (3×150 + 70)	2 × 44
510	2 × (3×185 + 95)	2 × 50
579	3 × (3×120 + 70)	3 × 41
602	2 × (3×240 + 120)	2 × 55
669	3 × (3×150 + 70)	3 × 44
765	3 × (3×185 + 95)	3 × 50
772	4 × (3×120 + 70)	4 × 41
892	4 × (3×150 + 70)	4 × 44
903	3 × (3×240 + 120)	3 × 55
1020	4 × (3×185+ 95)	4 × 50

ALUMINIUM CABLES WITH A CONCENTRIC COPPER SCREEN		
I_{Lmax} [A]	Cable Type	Diameter [mm]
260	2 × (3×95Al + 29Cu)	2 × 38
302	2 × (3×120Al + 41Cu)	2 × 41
348	2 × (3×150Al + 41Cu)	2 × 44
398	2 × (3×185Al + 57Cu)	2 × 49
470	2 × (3×240Al + 72Cu)	2 × 54
522	3 × (3×150Al + 41Cu)	3 × 44
597	3 × (3×185Al + 57Cu)	3 × 49
696	4 × (3×150Al + 41Cu)	4 × 44
705	3 × (3×240Al + 72Cu)	3 × 54
796	4 × (3×185Al + 57Cu)	4 × 49
940	4 × (3×240Al + 72Cu)	4 × 54
995	5 × (3×185Al + 57Cu)	5 × 49
1175	5 × (3×240Al + 72Cu)	5 × 54

Efficiency and Cooling Method

Efficiency: Approximately 98 % at nominal power level. For units equipped with IGBT supply unit approximately 96 %.

Cooling Method: Internal fan, flow direction from the bottom to the top

Ambient Conditions

Environmental limits of the ACx 6x7 frequency converters are given below. The frequency converters are to be used in a heated, indoor, controlled environment.

ACS/ACC/ACP 600	Operation installed for stationary use	Storage in the protective package	Transportation in the protective package
Installation Site Altitude	Nominal output power at 0 to 1000 m (3300 ft) above sea level ¹⁾	-	-
Air Temperature	0 to +40 °C (32 to 104 °F) ²⁾ (IP 21/22/42/54) 0 to +35 °C (32 to 95 °F) ²⁾ (IP 54R)	-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 721-3-3)	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 68-2-6)	Max. 0.3 mm (0.01 in.) (2 to 9 Hz), max. 1 m/s ² (3.3 ft./s ²) (9 to 200 Hz) sinusoidal	Max. 1.5 mm (0.06 in.) (2 to 9 Hz), max. 5 m/s ² (16.4 ft./s ²) (9 to 200 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 68-2-29)	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	250 mm (10 in.) for weight under 100 kg (220 lbs.) 100 mm (4 in.) for weight over 100 kg (220 lbs.)	250 mm (10 in.) for weight under 100 kg (220 lbs.) 100 mm (4 in.) for weight over 100 kg (220 lbs.)

¹⁾ At sites over 1000 m (3300 ft.) above sea level, the maximum output current is derated as follows. If the installation site is higher than 2000 m (6600 ft.) above sea level, please contact your local ABB distributor or office for further information.

$$I_{max} = I_{N40C} \cdot (100 \% - 1 \% \cdot (h - 1000 \text{ m}) / (100 \text{ m}) + 1.5 \% \cdot (40 \text{ °C} - T_{amb}))$$

where

h altitude above sea level

I_{N40C} ACS 600 nominal current at 40 °C

T_{amb} maximum ambient temperature.

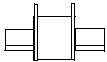
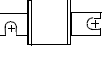
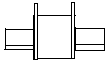
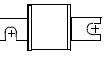
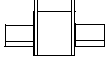
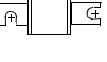
Note: $I_{max} < I_{N40C}$ and $T_{amb} < 40 \text{ °C}$. At 2000...4000 m optional “varistors” are needed.

²⁾ See subsection *Output Current Temperature Derating*.

Fuses

Only ultra rapid fuses guarantee proper protection for the rectifier semiconductors.

AC Fuses (ACx 617) The a.c. fuses (Bussmann) used in the ACx 617 supply sections are listed below.

Frequency Converter Type	Frame Size	Supply Section Type	Fuse					
			U_N V	I_N A	Pre-arching Integral A^2s	Type	Size	
Supply voltage 400V IGBT Supply								
ACx 617-0120-3	R7i	-	690	350	10000	170M3818		DIN1*
ACx 617-0185-3	R8i	-	660	630	31000	170M6810		DIN3
ACx 617-0225-3	R8i	-	660	630	31000	170M6810		DIN3
ACx 617-0265-3	R8i	-	660	630	31000	170M6810		DIN3
ACx 617-0335-3	R9i	-	660	1000	140000	170M6814		DIN3
ACx 617-0405-3	R9i	-	660	1000	140000	170M6814		DIN3
ACx 617-0630-3	R11i	ACA 635-0765-3	690	700	60500	170M5874		2
ACx 617-0765-3	R11i	ACA 635-0765-3	690	700	60500	170M5874		2
ACx 617-0935-3	R12i	ACA 635-1125-3	690	900	125000	170M5876		2
ACx 617-1125-3	R12i	ACA 635-1125-3	690	900	125000	170M5876		2
Supply voltage 500V IGBT Supply								
ACx 617-0100-5	R6i	-	660	200	2200	170M3815		DIN1*
ACx 617-0140-5	R7i	-	690	350	10000	170M3818		DIN1*
ACx 617-0215-5	R8i	-	660	630	31000	170M6810		DIN1*
ACx 617-0255-5	R8i	-	660	630	31000	170M6810		DIN1*
ACx 617-0325-5	R8i	-	660	630	31000	170M6810		DIN1*
ACx 617-0395-5	R9i	-	660	1000	140000	170M6814		DIN3
ACx 617-0495-5	R9i	-	660	1000	140000	170M6814	DIN3	
ACx 617-0770-5	R11i	ACA 635-0935-5	690	700	60500	170M5874		2
ACx 617-0935-5	R11i	ACA 635-0935-5	690	700	60500	170M5874		2
ACx 617-1095-5	R12i	ACA 635-1385-5	690	900	125000	170M5876		2
ACx 617-1385-5	R12i	ACA 635-1385-5	690	900	125000	170M5876		2
Supply voltage 690V IGBT Supply								
ACx 617-0120-6	R7i	-	660	200	2200	170M3815		DIN1
ACx 617-0205-6	R8i	-	1250	400	19500	170M6303		3SHT
ACx 617-0255-6	R8i	-	1250	400	19500	170M6303		3SHT
ACx 617-0315-6	R8i	-	1250	400	19500	170M6303		3SHT
ACx 617-0375-6	R9i	-	1250	630	83500	170M6205		3SHT
ACx 617-0485-6	R9i	-	1250	630	83500	170M6205		3SHT
ACx 617-0750-6	R11i	ACA 635-0900-6	690	900	125000	170M5876		2
ACx 617-0900-6	R11i	ACA 635-0900-6	690	900	125000	170M5876		2
ACx 617-1095-6	R12i	ACA 635-1385-6	690	700	60500	170M5874		2
ACx 617-1385-6	R12i	ACA 635-1385-6	690	700	60500	170M5874		2

AC Fuses (ACx 607/627/677) The a.c. fuses (Bussmann) used in the supply section of the ACx 607/627/677 are listed below.

12-pulse and 6-pulse Diode Supply ACx 6x7 Type	Fuse					Thyristor Supply ACx 6x7 Type	Fuse				
	U_N V	I_N A	Pre-arcing Integral A^2s	Type	Size		U_N V	I_N A	Pre-arcing Integral A^2s	Type	Size
ACx 627-0760-3 ACx 627-0930-5 ACx 627-1090-5	660	900	100000	170M6207	3SHT	ACx 677-0185-3 ACx 677-0215-5 ACx 677-0255-5	660	450	15500	170M5371	2SHT
ACx 607-0900-6 ACx 627-1380-6 ACx 627-1710-6	660	900	100000	170M6207	3SHT	ACx 677-0225-3 ACx 677-0265-3 ACx 677-0325-5	660	700	44500	170M6206	3SHT
ACx 627-0900-6 ACx 627-1040-6	690	800	69500	170M6812	DIN3	ACx 677-0335-3 ACx 677-0405-3 ACx 677-0395-5 ACx 677-0495-5	660	900	100000	170M6207	3SHT
						ACx 677-0205-6 ACx 677-0255-6	1250	315	130000	170M5403	2SHT
						ACx 677-0315-6 ACx 677-0375-6	1250	400	23000	170M5404	2SHT
						ACx 677-0485-6	1250	630	83500	170M6205	3SHT
						ACx 677-0900-6	660	900	100000	170M6207	3SHT

Branch Fuses (ACx 607/627/677) The branch fuses (Bussmann) used in the supply section of the ACx 607/627/677 are listed below.

ACx 6x7 Type	Fuse					ACx 6x7 Type	Fuse				
	U_N V	I_N A	Pre-arcing Integral A^2s	Type	Size		U_N V	I_N A	Pre-arcing Integral A^2s	Type	Size
400 V and 500 V Supply						690 V Supply					
ACx 677-0500-3 ACx 677-0630-3 ACx 677-0610-5 ACx 677-0770-5 ACx 627-0930-3 ACx 627-1120-3 ACx 627-1380-5 ACx 627-1760-5	660	900	1000000	170M6163	3/110	ACx 677-0600-6 ACx 677-0750-6 ACx 607-0900-6 ACx 627-1380-6 ACx 627-1710-6 ACx 677-0600-6 ACx 677-0750-6 ACx 677-0900-6	1250	630	83500	170M6144	3/110
ACx 607-0760-3 ACx 607-0930-3 ACx 607-1120-3 ACx 627-1440-3 ACx 627-1770-3 ACx 627-2140-3 ACx 607-0930-5 ACx 607-1090-5 ACx 607-1380-5 ACx 627-2160-5 ACx 627-2620-5 ACx 627-2850-5	660	1500	460000	170M6168	3/110	ACx 607-1040-6 ACx 607-1380-6 ACx 627-2120-6 ACx 627-2540-6 ACx 627-2800-6	1250	1100	575000	170M6149	3/110
ACx 607-1440-3 ACx 607-1770-3 ACx 627-2340-3 ACx 627-2820-3 ACx 607-1760-5 ACx 607-2160-5 ACx 627-3450-5 ACx 677-0760-3 ... ACx 677-1170-3 ACx 677-0930-5 ... ACx 677-2160-5	660	1500	460000	170M6168	3/110	ACx 607-1710-6 ACx 607-2120-6 ACx 607-2540-6 ACx 627-3350-6 ACx 677-1040-6 ... ACx 677-2540-6	1250	1100	575000	170M6149	3/110
ACx 607-2140-3 ACx 607-2620-5 ACx 677-2140-3 ACx 677-2620-5	1100	1400	1250000	170M6151	3/110	ACx 607-2800-6 ACx 607-3350-6 ACx 677-2800-6 ACx 677-3350-6	1100	1400	1250000	170M6151	3/110

Drive Section DC Fuses The Bussmann fuses used in the inverters of the ACx 6x7 are listed below. U_N and I_N are nominal voltage and current of the fuse.

415 V and 500 V Drive Sections						690 V Drive Sections					
Drive Section Frame Size	U_N [V]	I_N [A]	Pre-arcing Integral A^2s	Type	Size	Drive Section Frame Size	U_N [V]	I_N [A]	Pre-arcing Integral A^2s	Type	Size
2xR11i 4xR11i 2xR12i	660	1000	140000	170M6814	3	2xR11i 4xR11i 2xR12i	1250	630	83500	170M6205	3SHT

Braking Section DC Fuses The d.c. fuses (Bussmann) for the braking sections are listed below.

ACx 6x7 Type	Dynamic Braking Section	Fuse				
		U_N (V)	I_N (A)	Pre-arcing Integral (A^2s)	Type	Size
400 V Range						
ACx 6x7-0760-3...-2820-3	ACA 622-0320-3...-1920-3	1000–1250	630	115000	170M 5146	2/110
500 V Range						
ACx 6x7-0930-5...-3450-5	ACA 622-0400-5...-2400-5	1000–1250	630	115000	170M 5146	2/110
690 V Range						
ACx 6x7-0900-6...3350-6	ACA 622-0400-6...-2400-6	1000–1250	630	115000	170M 5146	2/110

PDM code 00025310-A

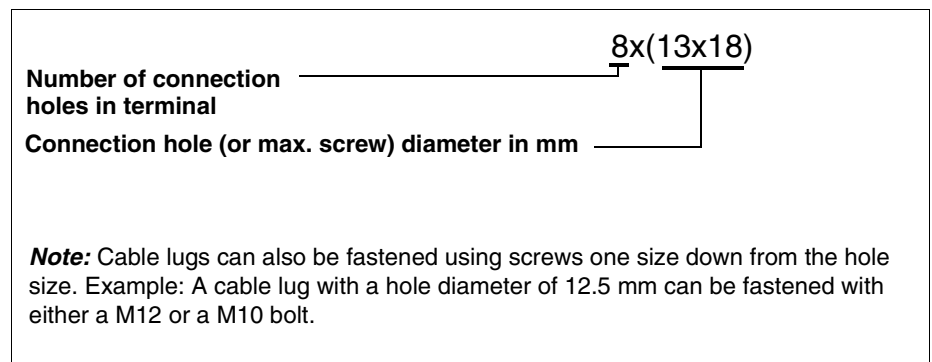
Cable Entries

Tightening Torque The tightening torques for screw connections, applicable to zinc and chrome platings and screw strength class 8.8 are listed below.

Screw	Torque (Nm) *	
	Soft aluminium	Alloyed aluminium and copper
M5	3.5	3.5
M6	6	9
M8	17	20
M10	35	40
M12	55	70
M16	130	180

* valid also for greased screws

Marking Cable connections are marked in the following tables as explained below. The terminals accept cable lugs according to DIN 46234 for copper cables and DIN 46329 for aluminium cables.



Diode Supply Sections The connection holes for cable lugs and bus ducts are presented below. For a view of the terminals, see section *Power Cable Busbars*.

Type	Frame size	Holes for cable lugs per phase	Number of cable entries at bottom (diameter 60 mm)	Bottom plate opening dimensions (mm)	Number of cable entries at top (diameter 60 mm)	Holes for bus duct connection per phase
$U_N = 400V (380V...415V)$						
ACx 627-0760-3	2xB3	2x4x14	2x6	502x280 (2 pcs)	2x6	-
ACx 607-0760-3	B4	8x(13x18)	12	502x280	12	4x(13x24)
ACx 627-0930-3	2xB4	2x8x(13x18)	2x12	502x280 (2 pcs)	2x12	2x4x(13x24)
ACx 607-0930-3	B4	8x(13x18)	12	502x280	12	4x(13x24)
ACx 627-1120-3	2xB4	2x8x(13x18)	2x12	502x280 (2 pcs)	2x12	2x4x(13x24)
ACx 607-1120-3	B4	8x(13x18)	12	502x280	12	4x(13x24)
ACx 627-1440-3	2xB4	2x8x(13x18)	2x12	502x280 (2 pcs)	2x12	2x4x(13x24)
ACx 607-1440-3	B5	12x(13x18)	18	502x280	18	4x(13x24)
ACx 627-1770-3	2xB4	2x8x(13x18)	2x12	502x280 (2 pcs)	2x12	2x4x(13x24)
ACx 607-1770-3	B5	12x(13x18)	18	502x280	18	4x(13x24)
ACx 627-2140-3	2xB4	2x8x(13x18)	2x12	502x280 (2 pcs)	2x12	2x4x(13x24)
ACx 607-2140-3	B5	12x(13x18)	18	502x280	18	4x(13x24)
ACx 627-2340-3	2xB5	2x12x(13x18)	2x18	502x280 (2 pcs)	2x18	2x4x(13x24)
ACx 627-2820-3	2xB5	2x12x(13x18)	2x18	502x280 (2 pcs)	2x18	2x4x(13x24)
$U_N = 500V (380V...500V)$						
ACx 627-930-5	2xB3	2x4x14	2x6	502x280 (2 pcs)	2x6	-
ACx 607-0930-5	B4	8x(13x18)	12	502x280	12	4x(13x24)
ACx 627-1090-5	2xB3	2x4x14	2x6	502x280 (2 pcs)	2x6	-
ACx 607-1090-5	B4	8x(13x18)	12	502x280	12	4x(13x24)
ACx 627-1380-5	2xB4	2x8x(13x18)	2x12	502x280 (2 pcs)	2x12	2x4x(13x24)
ACx 607-1380-5	B4	8x(13x18)	12	502x280	12	4x(13x24)
ACx 627-1760-5	2xB4	2x8x(13x18)	2x12	502x280 (2 pcs)	2x12	2x4x(13x24)
ACx 607-1760-5	B5	12x(13x18)	18	502x280	18	4x(13x24)
ACx 627-2160-5	2xB4	2x8x(13x18)	2x12	502x280 (2 pcs)	2x12	2x4x(13x24)
ACx 607-2160-5	B5	12x(13x18)	18	502x280	18	4x(13x24)
ACx 627-2620-5	2xB4	2x8x(13x18)	2x12	502x280 (2 pcs)	2x12	2x4x(13x24)
ACx 607-2620-5	B5	12x(13x18)	18	502x280	18	4x(13x24)
ACx 627-2850-5	2xB4	2x12x(13x18)	2x18	502x280 (2 pcs)	2x18	2x4x(13x24)
ACx 627-3450-5	2xB5	2x12x(13x18)	2x18	502x280 (2 pcs)	2x18	2x4x(13x24)
$U_N = 690V (525V...690V)$						
ACx 627-0900-6	2xB3	2x4x14	2x6	502x280 (2 pcs)	2x6	-
ACx 607-0900-6	B4	4x(13x18)	12	502x280	12	4x(13x24)
ACx 627-1040-6	2xB3	2x4x14	2x6	502x280 (2 pcs)	2x6	-
ACx 607-1040-6	B4	8x(13x18)	12	502x280	12	4x(13x24)
ACx 627-1380-6	2xB4	2x8x(13x18)	2x12	502x280 (2 pcs)	2x12	2x4x(13x24)
ACx 607-1380-6	B4	8x(13x18)	12	502x280	12	4x(13x24)
ACx 627-1710-6	2xB4	2x8x(13x18)	2x12	502x280 (2 pcs)	2x12	4x(13x24)
ACx 607-1710-6	B5	12x(13x18)	18	502x280	18	4x(13x24)
ACx 627-2120-6	2xB4	2x8x(13x18)	12	502x280	2x12	2x4x(13x24)
ACx 607-2120-6	B5	12x(13x18)	18	502x280	18	4x(13x24)
ACx 627-2540-6	2xB4	2x8x(13x18)	2x12	502x280 (2 pcs)	2x12	2x4x(13x24)
ACx 607-2540-6	B5	12x(13x18)	18	502x280	18	4x(13x24)
ACx 627-2800-6	2xB4	2x12x(13x18)	2x18	502x280 (2 pcs)	2x18	2x4x(13x24)
ACx 607-2800-6	B5	12x(13x18)	18	502x280	18	4x(13x24)
ACx 627-3350-6	2xB5	2x12x(13x18)	2x18	502x280 (2 pcs)	2x18	2x4x(13x24)
ACx 607-3350-6	2xB5	12x(13x18)	18	502x280	18	4x(13x24)

**Thyristor Supply
Section**

The connection holes for cable lugs and bus ducts are presented below.

Type	Holes for cable lugs per phase	Number of cable entries at bottom (diameter 60 mm)	Bottom plate opening dimensions (mm)	Number of cable entries at top (diameter 60 mm)	Holes for bus duct connection
U_N = 400V (380V...415V)					
ACx 677-0185-3	2x14	3	310x240	3	-
ACx 677-0225-3	4x14	6	502x280	6	-
ACx 677-0265-3					
ACx 677-0335-3					
ACx 677-0405-3					
ACx 677-0500-3	4x(13x18)	12	502x280	12	4x(13x24)
ACx 677-0630-3					
ACx 677-0760-3	8x(13x18)	12	502x280	12	4x(13x24)
ACx 677-0930-3					
ACx 677-1120-3					
ACx 677-1440-3	12x(13x18)	18	502x280	18	4x(13x24)
ACx 677-1770-3					
ACx 677-2140-3	12x(13x18)	18	502x280	18	4x(13x24)
U_N = 500V (380V...500V)					
ACx 677-0215-5	2x14	3	310x240	3	-
ACx 677-0255-5					
ACx 677-0325-5	4x14	6	502x280	6	-
ACx 677-0395-5					
ACx 677-0495-5					
ACx 677-0610-5	4x(13x18)	12	502x280	12	4x(13x24)
ACx 677-0770-5					
ACx 677-0930-5	8x(13x18)	12	502x280	12	4x(13x24)
ACx 677-1040-5					
ACx 677-1380-5					
ACx 677-1760-5	12x(13x18)	18	502x280	18	4x(13x24)
ACx 677-2160-5					
ACx 677-2620-5	12x(13x18)	18	502x280	18	4x(13x24)
U_N = 690V (525V...690V)					
ACx 677-0205-6	2x14	3	310x240	3	-
ACx 677-0255-6					
ACx 677-0315-6	4x14	6	502x280	6	-
ACx 677-0375-6					
ACx 677-0485-6					
ACx 677-0600-6	4x(13x18)	12	502x280	12	4x(13x24)
ACx 677-0750-6					
ACx 677-0900-6	4x(13x18)	12	502x280	12	4x(13x24)
ACx 677-1040-6	8x(13x18)	12	502x280	12	4x(13x24)
ACx 677-1380-6					
ACx 677-1710-6	12x(13x18)	18	502x280	18	4x(13x24)
ACx 677-2120-6					
ACx 677-2540-6					
ACx 677-2800-6	12x(13x18)	18	502x280	18	4x(13x24)
ACx 677-3350-6					

ACx 617 The connection holes for mains and motor cable lugs are given below.

Frequency Converter Type	Frame Size	Supply Section Type	Holes for cable lugs per phase 1)	Number of cable entries at bottom (diameter 60 mm) mains/motor	Bottom plate opening dimensions (mm)	Number of cable entries at top (diameter 60 mm)
Supply voltage 400V IGBT Supply						
ACx 617-0120-3	R7i	-	*	3	75x239	3
ACx 617-0185-3	R8i	-	4x(13x18)	6	75x239	6
ACx 617-0225-3	R8i	-	4x(13x18)	6	75x239	6
ACx 617-0265-3	R8i	-	4x(13x18)	6	75x239	6
ACx 617-0335-3	R9i	-	4x(13x18)	6	75x239	6
ACx 617-0405-3	R9i	-	4x(13x18)	6	75x239	6
ACx 617-0630-3	R11i	ACA 635-0765-3	6x(13x18)	6/9	270x911	6
ACx 617-0765-3	R11i	ACA 635-0765-3	6x(13x18)	6/9	270x911	6
ACx 617-0935-3	R12i	ACA 635-1125-3	8x(13x18)	12	195x501	12
ACx 617-1125-3	R12i	ACA 635-1125-3	8x(13x18)	12	195x501	12
Supply voltage 500V IGBT Supply						
ACx 617-0100-5	R6i	-	*	3	75x239	3
ACx 617-0140-5	R7i	-	*	3	75x239	3
ACx 617-0215-5	R8i	-	4x(13x18)	6	75x239	6
ACx 617-0255-5	R8i	-	4x(13x18)	6	75x239	6
ACx 617-0325-5	R8i	-	4x(13x18)	6	75x239	6
ACx 617-0395-5	R9i	-	4x(13x18)	6	75x239	6
ACx 617-0495-5	R9i	-	4x(13x18)	6	75x239	6
ACx 617-0770-5	R11i	ACA 635-0935-5	6x(13x18)	6/9	270x911	6
ACx 617-0935-5	R11i	ACA 635-0935-5	6x(13x18)	6/9	270x911	6
ACx 617-1095-5	R12i	ACA 635-1385-5	8x(13x18)	6/12	270x911	6
ACx 617-1385-5	R12i	ACA 635-1385-5	8x(13x18)	6/12	270x911	6
Supply voltage 690V IGBT Supply						
ACx 617-0120-6	R7i	-	*	3	75x239	3
ACx 617-0205-6	R8i	-	4x(13x18)	6	75x239	6
ACx 617-0255-6	R8i	-	4x(13x18)	6	75x239	6
ACx 617-0315-6	R8i	-	4x(13x18)	6	75x239	6
ACx 617-0375-6	R9i	-	4x(13x18)	6	75x239	6
ACx 617-0485-6	R9i	-	4x(13x18)	6	75x239	6
ACx 617-0750-6	R11i	ACA 635-0900-6	6x(13x18)	6/9	270x911	6
ACx 617-0900-6	R11i	ACA 635-0900-6	6x(13x18)	6/9	270x911	6
ACx 617-1095-6	R12i	ACA 635-1385-6	8x(13x18)	12	195x501	12
ACx 617-1385-6	R12i	ACA 635-1385-6	8x(13x18)	12	195x501	12

* Isolated stud terminals for the motor cable:

- maximum number of cable connections per phase: 1
- cable cross section: 25...120 mm² (3...250 MCM)
- tightening torque: 30 Nm (265 lb-in.).

Mains cable terminal: M10 bolt.

Drive Sections The connection holes for motor cable lugs (terminals U2, V2 and W2) are presented below.

Type	Frame size	Holes for cable lugs per phase 1)	Number of cable entries at bottom (diameter 60 mm)	Bottom plate opening dimensions (mm)	Number of cable entries at top (diameter 60 mm)
380V, 400V, 415V					
ACx 6x7-0760-3	R11i	6x(13x18)	9	270x911	9
ACx 6x7-0930-3	R12i	8x(13x18)	12	195x501	12
ACx 6x7-1120-3	R12i	8x(13x18)	12	195x501	12
ACx 6x7-1440-3	2xR11i	2x6x(13x18)	2x9	270x711	9
ACx 6x7-1770-3	2xR12i	2x8x(13x18)	2x12	270x711	18
ACx 6x7-2140-3	2xR12i	2x8x(13x18)	2x12	270x711	18
ACx 6x7-2340-3	4xR11i	4x6x(13x18)	4x9	270x711	18
ACx 6x7-2820-3	4xR11i	4x6x(13x18)	4x9	270x711	18
440V, 460V, 500V					
ACx 6x7-0930-5	R11i	6x(13x18)	9	270x911	9
ACx 6x7-1090-5	R12i	8x(13x18)	12	195x501	12
ACx 6x7-1380-5	R12i	8x(13x18)	12	195x501	12
ACx 6x7-1760-5	2xR11i	2x6x(13x18)	2x9	270x711	9
ACx 6x7-2160-5	2xR12i	2x8x(13x18)	2x12	270x711	18
ACx 6x7-2620-5	2xR12i	2x8x(13x18)	2x12	270x711	18
ACx 6x7-2850-5	4xR11i	4x6x(13x18)	4x9	270x711	18
ACx 6x7-3450-5	4xR11i	4x6x(13x18)	4x9	270x711	18
575V, 660V, 690V					
ACx 6x7-0900-6	R11i	6x(13x18)	9	270x911	6
ACx 6x7-1040-6	R12i	8x(13x18)	12	195x501	12
ACx 6x7-1380-6	R12i	8x(13x18)	12	195x501	12
ACx 6x7-1710-6	2xR11i	2x6x(13x18)	2x9	270x711	9
ACx 6x7-2120-6	2xR12i	2x8x(13x18)	2x12	270x711	18
ACx 6x7-2540-6	2xR12i	2x8x(13x18)	2x12	270x711	18
ACx 6x7-2800-6	4xR11i	4x6x(13x18)	4x9	270x711	18
ACx 6x7-3350-6	4xR11i	4x6x(13x18)	4x9	270x711	18

1) The number of holes when common output cubicle is used for common motor cable connection or top exit is as follows:

Frame size	Number of holes per phase
R11i, R12i	8
2xR11i, 2xR12i	10
4xR11i	2x8

**External Control
Connection Diagrams**

External control connections of ACS 6x7 equipped with Standard Application Program (Factory Macro) are shown below. External control connections are different with other application macros and programs (see *Firmware Manual*). For external control connections of Supply Section, see *Supply Sections User's Manual* (DSU, TSU or ISU).

External control wiring is connected to terminals on the NIOC board through a terminal block X2 (IEC standard designation) or an optional terminal block 2TB (ANSI standard designation, for US manufactured units only).

When making the external control connections be sure to carefully compare the terminal configuration found in the drive with diagrams below to be sure that the correct diagram is used.

Terminal Block X2, NIOC Board

External connections to terminal block X2 for ACS 600 Standard Application Program (Factory Macro) are shown below. External control connections are different with other application macros and programs (see *Firmware Manual*).

Terminal Block Size

X21, X22: cables 0.5 to 1.5 mm² (#20 to #16 AWG)
 X2, X23, X25, X26, X27: cables 0.5 to 2.5 mm² (#20 to #14 AWG)

Control Cable Lead-through Size:

Ø: 2 x 3x2...11 mm (0.08 to 0.43")

Factory settings of application software selection B (type code):

DI1: Start, DI2: Stop, DI3: Reverse, DI4: Acc/Dec 2, DI5,6: Constant speed 1 to 3 select.

1) Parameter 10.3 must be set to REQUEST.

2) Operation: 0 = Open, 1 = Closed

DI 5	DI 6	Output
0	0	Set speed through AI 1
1	0	Constant Speed 1
0	1	Constant Speed 2
1	1	Constant Speed 3

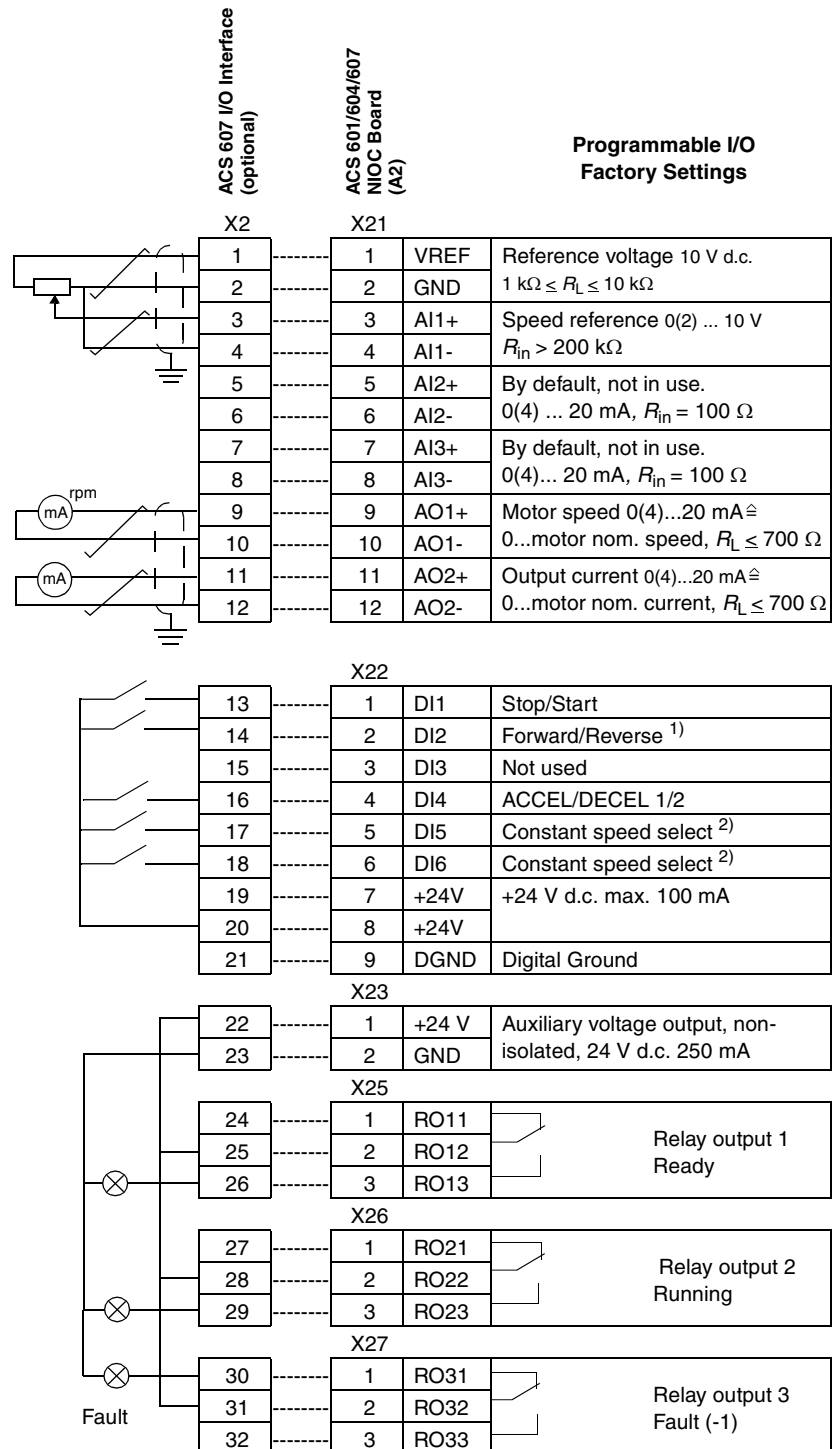
Connector X28 for RS 485 connection*

1	TRANS	Standard Modbus Link
2	GND	
3	B-	
4	A+	
5	GND	
6	+24V	

Connector X29 for RS 485 connection*

1	TRANS	Standard Modbus Link
2	FAULT	
3	B-	
4	A+	
5	GND	
6	+ 24V	

* Connector shield is connected via an RC filter to the frame.



Optional Terminal Block 2TB

External connections to optional terminal block 2TB. This option is available only with ACS 600 Standard Application Program. External control connections with Factory Macro are shown below. Connections are different with other application macros (see *Firmware Manual*).

Terminal Block Size

X21, X22: cables 0.5 to 1.5 mm² (#20 to #16 AWG)
 2TB, X23, X25, X26, X27: cables 0.5 to 2.5 mm² (#20 to #14 AWG)

Control Cable Lead-through Size:

Ø: 2 x 3x2...11 mm (0.08 to 0.43")

Factory settings of application software selection B (type code):

DI1: Start, DI2: Stop, DI3: Reverse, DI4: Acc/Dec 2, DI5,6: Constant speed 1 to 3 select.

1) Parameter 10.3 must be set to REQUEST.

2) Operation: 0 = Open, 1 = Closed

DI 5	DI 6	Output
0	0	Set speed through AI 1
1	0	Constant Speed 1
0	1	Constant Speed 2
1	1	Constant Speed 3

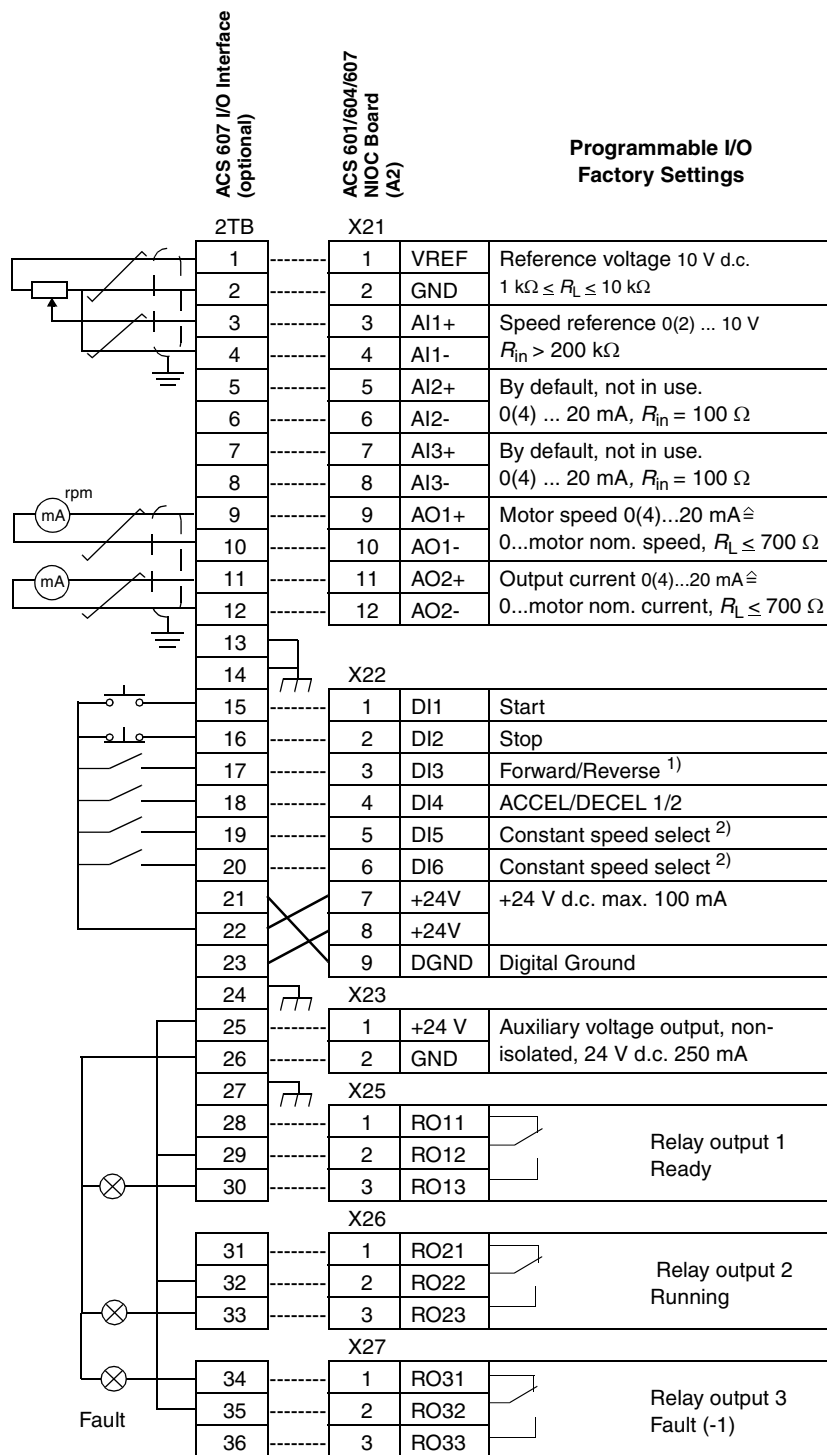
Connector X28 for RS 485 connection*

Pin	Label	Link
1	TRANS	Standard Modbus Link
2	GND	
3	B-	
4	A+	
5	GND	
6	+24V	

Connector X29 for RS 485 connection*

Pin	Label	Link
1	TRANS	Standard Modbus Link
2	FAULT	
3	B-	
4	A+	
5	GND	
6	+24V	

* Connector shield is connected via an RC filter to the frame.



NIOC Board Specifications

Data of the external control connection board of the drive section are given below. For external control connections of the supply section, refer to the appropriate *Supply Sections User's Manual*. For external control connections of the control section, refer to Common Drive Control Manuals.

NIOC Board												
Analogue Inputs	<table border="1"> <thead> <tr> <th>Application Program</th> <th>Input Updating Time</th> <th>Inputs</th> </tr> </thead> <tbody> <tr> <td>System</td> <td>10 ms</td> <td rowspan="2">Two Programmable Differential Current Inputs: 0 (4) to 20 mA, $R_{in} = 100 \Omega$; One Programmable Differential Voltage Input: 0 (2) to 10 V, $R_{in} > 200 k\Omega$;</td> </tr> <tr> <td>Standard 6.x</td> <td>AI1: 12 ms, AI2 and AI3: 6 ms *</td> </tr> <tr> <td>Crane</td> <td>44 ms</td> <td>Two Differential Current Inputs: 0 to 20 mA, $R_{in} = 100 \Omega$; One Differential Voltage Input: 0 to 10 V, $R_{in} > 200 k\Omega$</td> </tr> </tbody> </table>	Application Program	Input Updating Time	Inputs	System	10 ms	Two Programmable Differential Current Inputs: 0 (4) to 20 mA, $R_{in} = 100 \Omega$; One Programmable Differential Voltage Input: 0 (2) to 10 V, $R_{in} > 200 k\Omega$;	Standard 6.x	AI1: 12 ms, AI2 and AI3: 6 ms *	Crane	44 ms	Two Differential Current Inputs: 0 to 20 mA, $R_{in} = 100 \Omega$; One Differential Voltage Input: 0 to 10 V, $R_{in} > 200 k\Omega$
	Application Program	Input Updating Time	Inputs									
	System	10 ms	Two Programmable Differential Current Inputs: 0 (4) to 20 mA, $R_{in} = 100 \Omega$; One Programmable Differential Voltage Input: 0 (2) to 10 V, $R_{in} > 200 k\Omega$;									
	Standard 6.x	AI1: 12 ms, AI2 and AI3: 6 ms *										
Crane	44 ms	Two Differential Current Inputs: 0 to 20 mA, $R_{in} = 100 \Omega$; One Differential Voltage Input: 0 to 10 V, $R_{in} > 200 k\Omega$										
* 12 ms with NAIO extension module												
<p>Common Mode Voltage: ± 15 VDC, max.</p> <p>Common Mode Rejection Ratio: ≥ 60 dB at 50 Hz</p> <p>Resolution: 0.1 % (10 bit)</p> <p>Inaccuracy: ± 0.5 % (Full Scale Range) at 25 °C. Temperature Coefficient: ± 100 ppm/°C, max.</p> <p>The advantage of the differential analogue input is that the earth potential of the device or transmitter sending an analogue signal can differ up to ± 15 V from the earth potential of the ACx 600 chassis without disturbing the signal. Differential input also efficiently attenuates common mode disturbances coupled to control cables.</p>												
Constant Voltage Output	<p>Voltage: 10 VDC ± 0.5 % (Full Scale Range) at 25 °C. Temperature Coefficient: ± 100 ppm/°C, max.</p> <p>Maximum Load: 10 mA</p> <p>Applicable Potentiometer: 1 kΩ to 10 kΩ</p>											
Auxiliary Power Output	<p>Voltage: 24 VDC ± 10 %, Short circuit proof</p> <p>Maximum Current: 250 mA or 130 mA with NLMD-01 option</p>											
Analogue Outputs	Two Programmable Current Outputs: 0 (4) to 20 mA, $R_L \leq 700 \Omega$											
	<table border="1"> <thead> <tr> <th>Application Program</th> <th>Updating Time</th> </tr> </thead> <tbody> <tr> <td>System</td> <td>10 ms</td> </tr> <tr> <td>Standard 6.x</td> <td>24 ms</td> </tr> <tr> <td>Crane</td> <td>44 ms</td> </tr> </tbody> </table>	Application Program	Updating Time	System	10 ms	Standard 6.x	24 ms	Crane	44 ms			
	Application Program	Updating Time										
	System	10 ms										
Standard 6.x	24 ms											
Crane	44 ms											
Resolution: 0.1 % (10 bit)												
Inaccuracy: ± 1 % (Full Scale Range) at 25 °C. Temperature Coefficient: ± 200 ppm/°C, max.												
Digital Inputs	<table border="1"> <thead> <tr> <th>Application Program</th> <th>Input Updating Time</th> <th>Inputs</th> </tr> </thead> <tbody> <tr> <td>System</td> <td>10 ms</td> <td rowspan="2">Six Programmable Digital Inputs (Common Ground): 24 VDC, -15 to +20 %</td> </tr> <tr> <td>Standard 6.x</td> <td>6 ms</td> </tr> <tr> <td>Crane</td> <td>44 ms</td> <td>Six Digital Inputs (Common Ground): 24 VDC, -15 to +20 %</td> </tr> </tbody> </table>	Application Program	Input Updating Time	Inputs	System	10 ms	Six Programmable Digital Inputs (Common Ground): 24 VDC, -15 to +20 %	Standard 6.x	6 ms	Crane	44 ms	Six Digital Inputs (Common Ground): 24 VDC, -15 to +20 %
	Application Program	Input Updating Time	Inputs									
	System	10 ms	Six Programmable Digital Inputs (Common Ground): 24 VDC, -15 to +20 %									
	Standard 6.x	6 ms										
	Crane	44 ms	Six Digital Inputs (Common Ground): 24 VDC, -15 to +20 %									
	Logical Thresholds: < 8 VDC $\hat{=}$ "0", > 12 VDC $\hat{=}$ "1"											
Input Current: DI1 to DI 5: 10 mA, DI6: 5 mA												
Filtering Time Constant: 1 ms												
Thermistor Input: 5 mA, $< 1.5 k\Omega$ $\hat{=}$ "1" (normal temperature), $> 4 k\Omega$ $\hat{=}$ "0" (high temperature), Open Circuit $\hat{=}$ "0" (high temperature)												
Internal Supply For Digital Inputs (+24 VDC): Short-circuit proof, group isolated. An external 24 VDC supply can be used instead of the internal supply.												
Isolation Test Voltage: 500 VAC, 1 minute												

Appendix A – Technical Data

NIOC Board	
Relay Outputs	Three Programmable Relay Outputs Switching Capacity: 8 A at 24 VDC or 250 VAC, 0.4 A at 120 VDC Maximum Continuous Current: 2 A rms Contact Material: Silver Cadmium Oxide (AgCdO) Isolation Test Voltage: 4 kVAC, 1 minute Output Updating Time: 100 ms (Standard), 44 ms (Crane), 10 ms (System)
DDCS Fibre Optic Link	Protocol: DDCS (ABB Distributed Drives Communication System)
Modbus Communication Link	RS 485 Transmission Rate: Max. 9600 bit/s Parity: Selectable Connectors: Shielded modular telecommunication socket

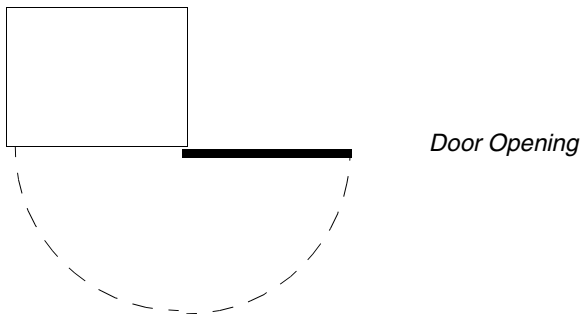
Cabinet

Below are the cabinets, degrees of protection and free space requirements of ACx 6x7 types.

<i>ACx 600 Type</i>	<i>Enclosure</i>	<i>Degree of Protection</i>	<i>Space above mm</i>	<i>Space below mm</i>	<i>Space on left/right mm</i>	<i>Space in front/back mm</i>
ACx 6x7	Cabinet	IP 21, IP 22, IP 42, IP 54, IP 54 R 1)	500	0	0	200/100 2)

1) IP 21 = standard, R = air outlet duct

2) 200 between cabinets when installed back to back



Drive Section Hardware

The frequency converter types contain inverters given below.

Frequency Converter Type	Inverter	Drive Frame Size
Supply voltage 380, 400 or 415V		
ACx 617-0100-3	ACN 634 0100 3	R7i
ACx 617-0120-3	ACN 634 0120 3	R7i
ACx 617/677-0185-3	ACN 634-0185-3	R8i
ACx 617/677-0225-3	ACN 634-0225-3	R8i
ACx 617/677-0265-3	ACN 634-0265-3	R8i
ACx 617/677-0335-3	ACN 634-0335-3	R9i
ACx 617/677-0405-3	ACN 634-0405-3	R9i
ACx 617/677-0500-3	ACN 634-0505-3	R10i
ACx 617/677-0630-3	ACN 634-0635-3	R11i
ACx 607/617/627/677-0760/0765-3	ACN 634-0755-3	R11i
ACx 607/617/627/677-0930/0935-3	ACN 634-0935-3	R12i
ACx 607/617/627/677-1120/1125-3	ACN 634-1125-3	R12i
ACx 607/627/677-1440-3	ACN 634-1445-3	2xR11i
ACx 607/627/677-1770-3	ACN 634-1775-3	2xR12i
ACx 607/627/677-2140-3	ACN 634-2145-3	2xR12i
ACx 627-2340-3	ACN 634-2345-3	4xR11i
ACx 627-2820-3	ACN 634-2825-3	4xR11i
Supply voltage 380, 400, 415, 440, 460, 480 or 500V		
ACx 617-0120-5	ACN 634 0120 5	R7i
ACx 617-0140-5	ACN 634 0140 5	R7i
ACx 617/677-0215-5	ACN 634-0215-5	R8i
ACx 617/677-0255-5	ACN 634-0255-5	R8i
ACx 617/677-0325-5	ACN 634-0325-5	R8i
ACx 617/677-0395-5	ACN 634-0395-5	R9i
ACx 617/677-0495-5	ACN 634-0495-5	R9i
ACx 617/677-0610-5	ACN 634-0615-5	R10i
ACx 617/677-0770-5	ACN 634-0775-5	R11i
ACx 6x7-0930/0935-5	ACN 634-0925-5	R11i
ACx 6x7-1090/1095-5	ACN 634-1095-5	R12i
ACx 6x7-1380/1385-5	ACN 634-1385-5	R12i
ACx 607/627/677-1760-5	ACN 634-1765-5	2xR11i
ACx 607/627/677-2160-5	ACN 634-2165-5	2xR12i
ACx 607/627/677-2620-5	ACN 634-2625-5	2xR12i
ACx 627-2850-5	ACN 634-2855-5	4xR11i
ACx 627-3450-5	ACN 634-3455-5	4xR11i
Supply voltage 525, 550, 575, 600, 660 or 690V		
ACx 617-0100-6	ACN 634 0100 6	R7i
ACx 617-0120-6	ACN 634 0120 6	R7i
ACx 617/677-0205-6	ACN 634-0205-6	R8i
ACx 617/677-0255-6	ACN 634-0255-6	R8i
ACx 617/677-0315-6	ACN 634-0315-6	R8i
ACx 617/677-0375-6	ACN 634-0375-6	R9i
ACx 617/677-0485-6	ACN 634-0485-6	R9i
ACx 617/677-0600-6	ACN 634-0605-6	R10i
ACx 617/677-0750-6	ACN 634-0755-6	R11i
ACx 6x7-0900-6	ACN 634-0905-6	R11i
ACx 607/617/627/677-1040/1045-6	ACN 634-1045-6	R12i
ACx 607/617/627/677-1380/1385-6	ACN 634-1385-6	R12i
ACx 607/627/677-1710-6	ACN 634-1715-6	2xR11i
ACx 607/627/677-2120-6	ACN 634-2125-6	2xR12i
ACx 607/627/677-2540-6	ACN 634-2545-6	2xR12i
ACx 607/627/677-2800-6	ACN 634-2805-6	4xR11i
ACx 607/627/677-3350-6	ACN 634-3355-6	4xR11i

PDM code 00001161-C

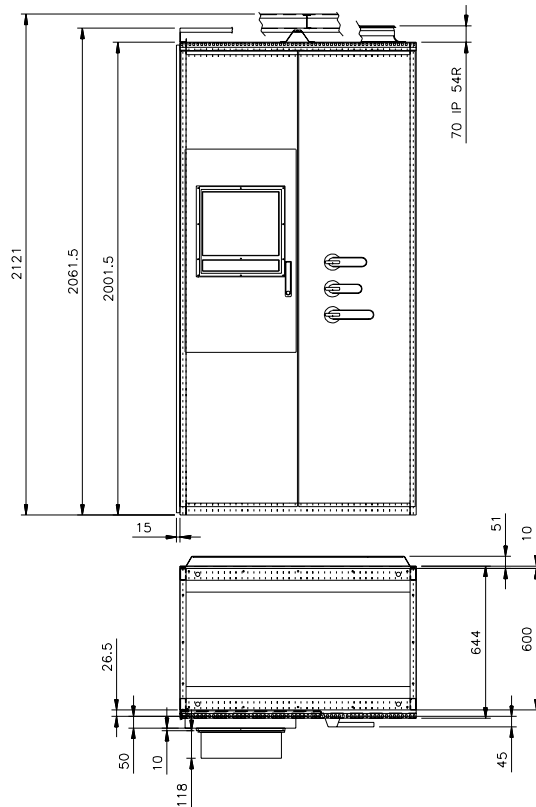
Cooling Air, Dimensions

This table gives the depth of the cabinet. The height of the switch fuse handle is 45 mm from the cabinet door.

Depth	mm
Depth of the frame	600
Depth of the roof	644
Depth including the door, the frame and the back plate	637
Depth including the door, the frame, the back plate and the flash barrier	678
Added depth including air circuit breaker spacer frame and door frame (measured from door)	60
Added depth of air circuit breaker spacer frame, door frame and transparent cover (measured from door)	178
Added depth of switch fuse (measured from door)	45

This table gives the height of the cabinet.

Height	mm
Height of the cabinet with a flat roof	2002
Height of the cabinet with a lifted roof	2062
Height of the cabinet with a double lifted roof	2121
Height of the ACx 617 cabinet (IP 21)	2130
Height of the IP 54 cabinet	2317
Height of the IP 54R cabinet	2072



ACx 607 Below are cooling air flow requirements, heat losses, dimensions and weights of ACx 607.

Frequency Converter Type	Supply Frame Size	Drive Frame Size	Air Flow [m ³ /h]	Heat Loss [kW]	Width [mm]	Weight [kg]
Supply voltage 400V Six-pulse Diode Supply						
ACx 607-0760-3	B4	R11i	5090	20 est.	400+600+400+600+1000+30=3030 (1 (5	1780
ACx 607-0930-3	B4	R12i	6930	24 est.	400+600+400+600+1500+30=3530 (2	2250
ACx 607-1120-3	B4	R12i	6930	29 est.	400+600+400+600+1500+30=3530 (2	2250
ACx 607-1440-3	B5	2xR11i	9790	39 est.	400+600+400+600+1000+1000+30=4030 (2 (B	2800
ACx 607-1770-3	B5	2xR12i	13470	47 est.	400+600+400+600+200+1500+1500+30=5230 (3	3500
ACx 607-2140-3	B5	2xR12i	13470	55 est.	400+600+400+600+200+1500+1500+30=5230 (3	3500
Supply voltage 500V Six-pulse Diode Supply						
ACx 607-0930-5	B4	R11i	5090	22 est.	400+600+400+600+1000+30=3030 (1 (5	1780
ACx 607-1090-5	B4	R12i	6930	26 est.	400+600+400+600+1500+30=3530 (2	2250
ACx 607-1380-5	B4	R12i	6930	33 est.	400+600+400+600+1500+30=3530 (2	2250
ACx 607-1760-5	B5	2xR11i	9790	43 est.	400+600+400+600+1000+1000+30=4030 (2 (B	2800
ACx 607-2160-5	B5	2xR12i	13470	53 est.	400+600+400+600+200+1500+1500+30=5230 (3	3500
ACx 607-2620-5	B5	2xR12i	13470	63 est.	400+600+400+600+200+1500+1500+30=5230 (3	3500
Supply voltage 690V Six-pulse Diode Supply						
ACx 607-0900-6	B4	R11i	5090	22 est.	400+600+400+600+1000+30=3030 (1 (5	1780
ACx 607-1040-6	B4	R12i	6930	25 est.	400+600+400+600+1500+30=3530 (2 (5	2250
ACx 607-1380-6	B4	R12i	6930	33 est.	400+600+400+600+1500+30=3530 (2	2250
ACx 607-1710-6	B5	2xR11	9790	39 est.	400+600+400+600+1000+1000+30=4030 (2 (B	2800
ACx 607-2120-6	B5	2xR12i	13470	49 est.	400+600+400+600+200+1500+1500+30=5230 (3	3500
ACx 607-2540-6	B5	2xR12i	13470	52 est.	400+600+400+600+200+1500+1500+30=5230 (3	3500
ACx 607-2800-6	B5	4xR11i	17150	60 est.	400+600+400+600+200+1000+1000+1000+30=6230 (3	4000
ACx 607-3350-6	B5	4xR11i	17150	72 est.	400+600+400+600+200+1000+1000+1000+30=6230 (3	4000

- 1) With cable top exit an additional 400 mm wide cubicle
- 2), B) With cable top exit (and/or common motor connection terminal units (B)) an additional 600 mm wide cubicle
- 3) With cable top exit and/or common motor connection terminal units an additional 800 mm wide cubicle
- 4) With cable top entry an additional 1200 mm wide cubicle
- 5) With EMC filter an additional 600 mm wide cubicle

ACx 617 Below are cooling air flow requirements, heat losses, dimensions and weights of ACx 617.

Frequency Converter Type	IGBT Supply			Drive Section		Air Flow [m ³ /h]	Heat Loss [kW]	Width ¹⁾ [mm]	Weight [kg]
	Frame Size	Section Type	Module Type	Frame Size	Module Type				
Supply voltage 400V IGBT Supply									
ACx 617-0120-3	R7i	-	ACN634-0120-3	R7i	ACN634-0120-3	1920	4.1	730	305
ACx 617-0185-3	R8i	-	ACN634-0185-3	R8i	ACN634-0265-3	3650	6.0	1200	625
ACx 617-0225-3	R8i	-	ACN634-0225-3	R8i	ACN634-0265-3	3650	7.3	1200	625
ACx 617-0265-3	R8i	-	ACN634-0265-3	R8i	ACN634-0265-3	3650	8.9	1200	625
ACx 617-0335-3	R9i	-	ACN634-0335-3	R9i	ACN634-0405-3	3650	11.2	1200	655
ACx 617-0405-3	R9i	-	ACN634-0405-3	R9i	ACN634-0405-3	3650	13.9	1200	655
ACx 617-0630-3	R11i	ACA 635-0765-3	ACN634-0635-3	R11i	ACN634-0765-3	7280	22.0	3600	1490
ACx 617-0765-3	R11i	ACA 635-0755-3	ACN634-0755-3	R11i	ACN634-0755-3	7280	27.2	3600	1490
ACx 617-0935-3	R12i	ACA 635-1125-3	ACN634-0935-3	R12i	ACN634-1125-3	10330	31.7	4600	2530
ACx 617-1125-3	R12i	ACA 635-1125-3	ACN634-1125-3	R12i	ACN634-1125-3	10330	39.3	4600	2530
Supply voltage 500V IGBT Supply									
ACx 617-0100-5	R6i	-	ACN 634-0140-5	R6i	ACN634-0100-5	1920	3.4	730	305
ACx 617-0140-5	R7i	-	ACN 634-0140-5	R7i	ACN634-0140-5	1920	4.9	730	305
ACx 617-0215-5	R8i	-	ACN 634-0325-5	R8i	ACN634-0325-5	3650	7.2	1200	625
ACx 617-0255-5	R8i	-	ACN 634-0325-5	R8i	ACN634-0325-5	3650	8.8	1200	625
ACx 617-0325-5	R8i	-	ACN 634-0325-5	R8i	ACN634-0325-5	3650	11.1	1200	625
ACx 617-0395-5	R9i	-	ACN 634-0495-5	R9i	ACN634-0495-5	3650	13.7	1200	655
ACx 617-0495-5	R9i	-	ACN 634-0495-5	R9i	ACN634-0495-5	3650	17.4	1200	655
ACx 617-0770-5	R11i	ACA 635-0935-5	ACN 634-0925-5	R11i	ACN634-0775-5	7280	27.3	3600	1490
ACx 617-0935-5	R11i	ACA 635-0935-5	ACN 634-0925-5	R11i	ACN634-0775-5	7280	31.7	3600	1490
ACx 617-1090-5	R12i	ACA 635-1385-5	ACN 634-1385-5	R12i	ACN634-1385-5	10330	38.9	4600	2530
ACx 617-1385-5	R12i	ACA 635-1385-5	ACN 634-1385-5	R12i	ACN634-1385-5	10330	48.7	4600	2530
Supply voltage 690V IGBT Supply									
ACx 617-0120-6	R7i	-	ACN 634-0120-6	R7i	ACN634-0120-6	1920	4.1	730	305
ACx 617-0205-6	R8i	-	ACN 634-0315-6	R8i	ACN634-0315-6	3650	7.2	1200	625
ACx 617-0255-6	R8i	-	ACN 634-0315-6	R8i	ACN634-0315-6	3650	8.8	1200	625
ACx 617-0315-6	R8i	-	ACN 634-0315-6	R8i	ACN634-0315-6	3650	10.9	1200	625
ACx 617-0375-6	R9i	-	ACN 634-0485-6	R9i	ACN634-0485-6	3650	13.4	1200	655
ACx 617-0485-6	R9i	-	ACN 634-0485-6	R9i	ACN634-0485-6	3650	17.2	1200	655
ACx 617-0750-6	R11i	ACA 635-0900-6	ACN 634-0905-6	R11i	ACN634-0905-6	7280	27.0	3600	1730
ACx 617-0900-6	R11i	ACA 635-0900-6	ACN 634-0905-6	R11i	ACN634-0905-6	7280	31.3	3600	1730
ACx 617-1045-6	R12i	ACA 635-1385-6	ACN 634-1385-6	R12i	ACN634-1385-6	10330	38.1	4600	2530
ACx 617-1385-6	R12i	ACA 635-1385-6	ACN 634-1385-6	R12i	ACN634-1385-6	10330	48.7	4600	2530

PDM code 00145936 F

1) With cable top entry/exit additional 200 mm is required in frame sizes R11i and R12i.

ACx 627 Below are cooling air flow requirements, heat losses, dimensions and weights of ACx 627.

Frequency Converter Type	Frame Type Supply	Frame Type Drive	Air Flow [m ³ /h]	Heat Loss [kW]	Width [mm]	Weight [kg]
Supply voltage 400V Twelve-pulse Diode Supply						
ACx 627-0760-3	2xB3	R11i	5880	19 est.	400+2x(600)+1000+30=2630 (1 (4	1120
ACx 627-0930-3	2xB4	R12i	8340	28 est.	400+2x(600+400+600)+200+1500+30=5330 (2	3350
ACx 627-1120-3	2xB4	R12i	8340	34 est.	400+2x(600+400+600)+200+1500+30=5330 (2	3350
ACx 627-1440-3	2xB4	2xR11i	10180	38 est.	400+2x(600+400+600)+200+1000+1000+30=5830 (2 (B	3600
ACx 627-1770-3	2xB4	2xR12i	13860	46 est.	400+2x(600+400+600)+200+1500+1500+30=6830 (3	4300
ACx 627-2140-3	2xB4	2xR12i	13860	56 est.	400+2x(600+400+600)+200+1500+1500+30=6830 (3	4300
ACx 627-2340-3	2xB5	4xR11i	19580	63 est.	400+2x(600+400+600)+200+1000+1000+1000+1000+30=7830 (3	5400
ACx 627-2820-3	2xB5	4xR11i	19580	76 est.	400+2x(600+400+600)+200+1000+1000+1000+1000+30=7830 (3	5400
Supply voltage 500V Twelve-pulse Diode Supply						
ACx 627-0930-5	2xB3	R11i	5880	22 est.	400+2x(600)+1000+30=2630 (1 (4	1120
ACx 627-1090-5	2xB3	R12i	7720	25 est.	400+2x(600)+1500+30=3130 (2 (4	3350
ACx 627-1380-5	2xB4	R12i	8340	38 est.	400+2x(600+400+600)+200+1500+30=5330 (2	3350
ACx 627-1760-5	2xB4	2xR11i	10180	47 est.	400+2x(600+400+600)+200+1000+1000+30=5830 (2 (B	3600
ACx 627-2160-5	2xB4	2xR12i	13860	52 est.	400+2x(600+400+600)+200+1500+1500+30=6830 (3	4300
ACx 627-2620-5	2xB4	2xR12i	13860	63 est.	400+2x(600+400+600)+200+1500+1500+30=6830 (3	4300
ACx 627-2850-5	2xB4	4xR11i	17540	68 est.	400+2x(600+400+600)+200+1000+1000+1000+1000+30=7830 (3	5400
ACx 627-3450-5	2xB5	4xR11i	19580	85 est.	400+2x(600+400+600)+200+1000+1000+1000+1000+30=7830 (3	5400
Supply voltage 690V Twelve-pulse Diode Supply						
ACx 627-0900-6	2xB3	R11i	5880	21 est.	400+2x(600)+1000+30=2630 (1 (4	1120
ACx 627-1040-6	2xB3	R12i	7720	24 est.	400+2x(600)+1500+30=3130 (2 (4	3350
ACx 627-1380-6	2xB4	R12i	8340	38 est.	400+2x(600+400+600)+200+1500+30=5330 (2	3350
ACx 627-1710-6	2xB4	2xR11i	10180	47 est.	400+2x(600+400+600)+200+1000+1000+30=5830 (2 (B	3600
ACx 627-2120-6	2xB4	2xR12i	13860	51 est.	400+2x(600+400+600)+200+1500+1500+30=6830 (3	4300
ACx 627-2540-6	2xB4	2xR12i	13860	61 est.	400+2x(600+400+600)+200+1500+1500+30=6830 (3	4300
ACx 627-2800-6	2xB4	4xR11i	17540	67 est.	400+2x(600+400+600)+200+1000+1000+1000+1000+30=7830 (3	5400
ACx 627-3350-6	2xB5	4xR11i	19580	77 est.	400+2x(600+400+600)+200+1000+1000+1000+1000+30=7830 (3	5400

- 1) With cable top exit an additional 400 mm wide cubicle
- 2), B) With cable top exit (and/or common motor connection terminal units (B)) an additional 600 mm wide cubicle
- 3) With cable top exit and/or common motor connection terminal units an additional 800 mm wide cubicle
- 4) With cable top entry an additional 1200 mm wide cubicle
- 5) With EMC filter an additional 600 mm wide cubicle

ACx 677 Below are cooling air flow requirements, heat losses, dimensions and weights of ACx 677.

Frequency Converter Type	Supply Section		Drive Frame Size	Air Flow [m ³ /h]	Heat Loss [kW]	Width [mm]	Weight [kg]
	Frame Size	6-pulse Supply Type					
Supply voltage 400V Four-quadrant Thyristor Supply							
ACx 677-0185-3	B2	ACA 632-0200-3	R8i	1920	4.6	1430	550
ACx 677-0225-3	B3	ACA 632-0300-3	R8i	2320	5.6	1430	630
ACx 677-0265-3	B3	ACA 632-0300-3	R8i	2320	6.6	1630	630
ACx 677-0335-3	B3	ACA 632-0420-3	R9i	2320	8.4	1630	630
ACx 677-0405-3	B3	ACA 632-0420-3	R9i	2320	10	1630	630
ACx 677-0500-3	B4	ACA 632-0680-3	R10i	5600	12	3630	1950
ACx 677-0630-3	B4	ACA 632-0680-3	R11i	5600	16	3630 (1)	1980
ACx 677-0760-3	B4	ACA 632-1120-3	R11i	5600	20	400+600+400+2x600+1000+30=3630 (1)	1980
ACx 677-0930-3	B4	ACA 632-1120-3	R12i	7150	24	400+600+400+2x600+1500+30=4130 (2)	2450
ACx 677-1120-3	B4	ACA 632-1120-3	R12i	7150	30	400+600+400+2x600+1500+30=4130 (2)	2450
ACx 677-1440-3	B5	ACA 632-1700-3	2xR11i	10700	39	400+600+400+2x600+200+1000+1000+30=4830 (2 (B	3100
ACx 677-1770-3	B5	ACA 632-1700-3	2xR12i	13800	48	400+600+400+2x600+200+1500+1500+30=5830 (3)	3800
ACx 677-2140-3	B5	ACA 632-2100-3	2xR12i	13800	55	400+600+400+2x600+200+1500+1500+30=5830 (3)	3800
Supply voltage 500V Four-quadrant Thyristor Supply							
ACx 677-0215-5	B2	ACA 632-0250-5	R8i	1920	5.1	1430	550
ACx 677-0255-5	B3	ACA 632-0250-5	R8i	2320	6.0	1430	630
ACx 677-0325-5	B3	ACA 632-0375-5	R8i	2320	7.7	1630	630
ACx 677-0395-5	B3	ACA 632-0525-5	R9i	2320	9.4	1630	630
ACx 677-0495-5	B3	ACA 632-0525-5	R9i	2320	12	1630	630
ACx 677-0610-5	B4	ACA 632-0850-5	R10i	5600	14	3630	1950
ACx 677-0770-5	B4	ACA 632-0850-5	R11i	5600	18	3630 (1)	1980
ACx 677-0930-5	B4	ACA 632-1400-5	R11i	5600	22	400+600+400+2x600+1000+30=3630 (1)	1980
ACx 677-1090-5	B4	ACA 632-1400-5	R12i	7150	26	400+600+400+2x600+1500+30=4130 (2)	2450
ACx 677-1380-5	B4	ACA 632-1400-5	R12i	7150	34	400+600+400+2x600+1500+30=4130 (2)	2450
ACx 677-1760-5	B5	ACA 632-2120-5	2xR11i	10700	43	400+600+400+2x600+200+1000+1000+30=4830 (2 (B	3100
ACx 677-2160-5	B5	ACA 632-2120-5	2xR12i	13800	53	400+600+400+2x600+200+1500+1500+30=5830 (3)	3800
ACx 677-2620-5	B5	ACA 632-2600-5	2xR12i	13800	62	400+600+400+2x600+200+1500+1500+30=5830 (3)	3800
Supply voltage 690V Four-quadrant Thyristor Supply							
ACx 677-0205-6	B2	ACA 632-0250-6	R8i	1920	4.9	1430	550
ACx 677-0255-6	B3	ACA 632-0250-6	R8i	2320	5.8	1430	630
ACx 677-0315-6	B3	ACA 632-0375-6	R8i	2320	7.5	1630	630
ACx 677-0375-6	B3	ACA 632-0375-6	R9i	2320	9	1630	630
ACx 677-0485-6	B3	ACA 632-0525-6	R9i	2320	12	1630	630
ACx 677-0600-6	B4	ACA 632-0850-6	R10i	5600	14	3630	1950
ACx 677-0750-6	B4	ACA 632-0850-6	R11i	5600	18	3630 (1)	1980
ACx 677-0900-6	B4	ACA 632-0850-6	R11i	5600	19	400+600+400+2x600+1000+30=3630 (1)	1980
ACx 677-1040-6	B4	ACA 632-1400-6	R12i	7150	25	400+600+400+2x600+1500+30=4130 (2)	2450
ACx 677-1380-6	B4	ACA 632-1400-6	R12i	7150	33	400+600+400+2x600+1500+30=4130 (2)	2450
ACx 677-1710-6	B5	ACA 632-2600-6	2xR11	10700	39	400+600+400+2x600+200+1000+1000+30=4830 (2 (B	3100
ACx 677-2120-6	B5	ACA 632-2600-6	2xR12i	13800	49	400+600+400+2x600+200+1500+1500+30=5830 (3)	3800
ACx 677-2540-6	B5	ACA 632-2600-6	2xR12i	13800	58	400+600+400+2x600+200+1500+1500+30=5830 (3)	3800
ACx 677-2800-6	B5	ACA 632-3600-6	4xR11i	16900	60	400+600+400+2x600+200+1000+1000+1000+30=6830 (3)	4300
ACx 677-3350-6	B5	ACA 632-3600-6	4xR11i	16900	73	400+600+400+2x600+200+1000+1000+1000+30=6830 (3)	4300

- 1) With cable top exit an additional 400 mm wide cubicle
- 2), B) With cable top exit (and/or common motor connection terminal units (B)) an additional 600 mm wide cubicle
- 3) With cable top exit and/or common motor connection terminal units an additional 800 mm wide cubicle
- 4) With cable top entry an additional 1200 mm wide cubicle
- 5) With EMC filter an additional 600 mm wide cubicle

Noise

The noise values of the ACx 6x7 units are given below.

Type	Noise (dB)	Type	Noise (dB)	Type	Noise (dB)
ACx 617-0120-3	63	ACx 617-0100-5	63	ACx 617-0120-6	63
ACx 617-0185-3	63	ACx 617-0140-5	63	ACx 617-0205-6	63
ACx 617-0225-3	63	ACx 617-0215-5	63	ACx 617-0255-6	63
ACx 617-0265-3	63	ACx 617-0255-5	63	ACx 617-0315-6	63
ACx 617-0335-3	63	ACx 617-0325-5	63	ACx 617-0375-6	63
ACx 617-0405-3	63	ACx 617-0395-5	63	ACx 617-0485-6	63
ACx 617-0630-3	68	ACx 617-0495-5	63	ACx 617-0750-6	68
ACx 617-0765-3	68	ACx 617-0770-5	68	ACx 617-0900-6	68
ACx 617-0935-3	71	ACx 617-0935-5	68	ACx 617-1045-6	71
ACx 617-1125-3	71	ACx 617-1090-5	71	ACx 617-1385-6	71
		ACx 617-1385-5	71		
ACx 677-0185-3	63	ACx 677-0215-5	63	ACx 677-0205-6	63
ACx 677-0225-3	66	ACx 677-0255-5	66	ACx 677-0255-6	66
ACx 677-0265-3	66	ACx 677-0325-5	66	ACx 677-0315-6	66
ACx 677-0335-3	66	ACx 677-0395-5	66	ACx 677-0375-6	66
ACx 677-0405-3	66	ACx 677-0495-5	66	ACx 677-0485-6	66
ACx 677-0500-3	73	ACx 677-0610-5	73	ACx 677-0600-6	73
ACx 677-0630-3	73	ACx 677-0770-5	73	ACx 677-0750-6	73
ACx 607-0760-3	71	ACx 607-0930-5	71	ACx 607-0900-6	71
ACx 627-0760-3	68	ACx 627-0930-5	68	ACx 627-0900-6	68
ACx 677-0760-3	73	ACx 677-0930-5	73	ACx 677-0900-6	73
ACx 607-0930-3	73	ACx 607-1090-5	73	ACx 607-1040-6	73
ACx 627-0930-3	74	ACx 627-1090-5	70	ACx 627-1040-6	70
ACx 677-0930-3	74	ACx 677-1090-5	74	ACx 677-1040-6	74
ACx 607-1120-3	73	ACx 607-1380-5	73	ACx 607-1380-6	73
ACx 627-1120-3	74	ACx 627-1380-5	74	ACx 627-1380-6	74
ACx 677-1120-3	74	ACx 677-1380-5	74	ACx 677-1380-6	74
ACx 607-1440-3	75	ACx 607-1760-5	75	ACx 607-1710-6	75
ACx 627-1440-3	74	ACx 627-1760-5	74	ACx 627-1710-6	74
ACx 677-1440-3	76	ACx 677-1760-5	76	ACx 677-1710-6	76
ACx 607-1770-3	76	ACx 607-2160-5	76	ACx 607-2120-6	76
ACx 627-1770-3	75	ACx 627-2160-5	75	ACx 627-2120-6	75
ACx 677-1770-3	76	ACx 677-2160-5	76	ACx 677-2120-6	76
ACx 607-2140-3	76	ACx 607-2620-5	76	ACx 607-2540-6	76
ACx 627-2140-3	75	ACx 627-2620-5	75	ACx 627-2540-6	75
ACx 677-2140-3	76	ACx 677-2620-5	76	ACx 677-2540-6	76
ACx 627-2340-3	76	ACx 627-2850-5	75	ACx 607-2800-6	76
			71	ACx 627-2800-6	75
			72	ACx 677-2800-6	76
ACx 627-2820-3	76	ACx 627-3450-5	76	ACx 607-3350-6	76
				ACx 627-3350-6	76
				ACx 677-3350-6	76

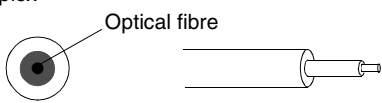
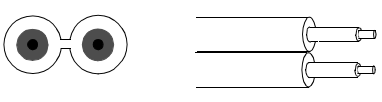

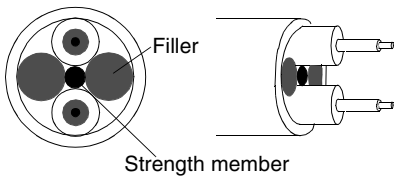
Dynamic Braking

Below are Dynamic Braking Sections for the ACx 6x7.

Frequency Converter Type	Dynamic Braking Section Type	Section Width (mm)	Chopper Type	Resistor			
				Type	R _{min} (ohm)	E _r (kJ)	P _{br,max} (kW)
Supply voltage 400V							
ACx 6x7-0760-3	ACA 622-0960-3	3x(400+800)	3xNBRA-659	3x(2xSAFUR180F460)	3x(1.20)	36000	1060
ACx 6x7-0930-3	ACA 622-0960-3	3x(400+800)	3xNBRA-659	3x(2xSAFUR180F460)	3x(1.20)	36000	1060
ACx 6x7-1120-3	ACA 622-1280-3	4x(400+800)	4xNBRA-659	4x(2xSAFUR180F460)	4x(1.20)	48000	1411
ACx 6x7-1440-3	ACA 622-1600-3	5x(400+800)	5xNBRA-659	5x(2xSAFUR180F460)	5x(1.20)	60000	1764
ACx 6x7-1770-3	ACA 622-1600-3	5x(400+800)	5xNBRA-659	5x(2xSAFUR180F460)	5x(1.20)	60000	1764
ACx 6x7-2140-3	ACA 622-1920-3	6x(400+800)	6xNBRA-659	6x(2xSAFUR180F460)	6x(1.20)	72000	2117
ACx 6x7-2340-3	ACA 622-1920-3	6x(400+800)	6xNBRA-659	6x(2xSAFUR180F460)	6x(1.20)	72000	2117
ACx 6x7-2820-3	ACA 622-1920-3	6x(400+800)	6xNBRA659	6x(2xSAFUR180F460)	6x(1.20)	72000	2117
Supply voltage 500V							
ACx 6x7-0930-5	ACA 622-1200-5	3x(400+800)	3xNBRA-659	3x(2xSAFUR200F500)	3x(1.35)	32400	1208
ACx 6x7-1090-5	ACA 622-1200-5	3x(400+800)	3xNBRA-659	3x(2xSAFUR200F500)	3x(1.35)	32400	1208
ACx 6x7-1380-5	ACA 622-1200-5	3x(400+800)	3xNBRA-659	3x(2xSAFUR200F500)	3x(1.35)	32400	1208
ACx 6x7-1760-5	ACA 622-1600-5	4x(400+800)	4xNBRA-659	4x(2xSAFUR200F500)	4x(1.35)	43200	1611
ACx 6x7-2160-5	ACA 622-2000-5	5x(400+800)	5xNBRA-659	5x(2xSAFUR200F500)	5x(1.35)	54000	2014
ACx 6x7-2620-5	ACA 622-2400-5	6x(400+800)	6xNBRA-659	6x(2xSAFUR200F500)	6x(1.35)	64800	2417
ACx 6x7-2850-5	ACA 622-2400-5	6x(400+800)	6xNBRA-659	6x(2xSAFUR200F500)	6x(1.35)	64800	2417
ACx 6x7-3450-5	ACA 622-2400-5	6x(400+800)	6xNBRA-659	6x(2xSAFUR200F500)	6x(1.35)	64800	2417
Supply voltage 690V							
ACx 6x7-0900-6	ACA 622-1200-6	3x(400+800)	3xNBRA-669	3x(2xSAFUR200F500)	3x(1.35)	32400	1211
ACx 6x7-1040-6	ACA 622-1200-6	3x(400+800)	3xNBRA-669	3x(2xSAFUR200F500)	3x(1.35)	32400	1211
ACx 6x7-1380-6	ACA 622-1200-6	3x(400+800)	3xNBRA-669	3x(2xSAFUR200F500)	3x(1.35)	32400	1211
ACx 6x7-1710-6	ACA 622-1600-6	4x(400+800)	4xNBRA-669	4x(2xSAFUR200F500)	4x(1.35)	43200	1615
ACx 6x7-2120-6	ACA 622-2000-6	5x(400+800)	5xNBRA-669	5x(2xSAFUR200F500)	5x(1.35)	54000	2019
ACx 6x7-2540-6	ACA 622-2400-6	6x(400+800)	6xNBRA-669	6x(2xSAFUR200F500)	6x(1.35)	64800	2422
ACx 6x7-2800-6	ACA 622-2400-6	6x(400+800)	6xNBRA-669	6x(2xSAFUR200F500)	6x(1.35)	64800	2422
ACx 6x7-3350-6	ACA 622-2400-6	6x(400+800)	6xNBRA-669	6x(2xSAFUR200F500)	6x(1.35)	64800	2422

Fibre Optic Cables

Recommendations for fibre optic cables are given below. Plastic optical cables are normally used at short distances (≤ 10 m). Hard clad silica cables are recommended for distances from 10 to 50 metres with maximum optical power (transmitter current) up to 30 mA and for distances from 10 to 200 metres with maximum optical power of 50 mA. The 2-channel type is suitable for installations in harsh environments and when cables may be subjected to mechanical stress.

Cable Type	Parameter	Minimum	Maximum	Unit
Plastic Optical Cable (POF, fibre core diameter 1 mm): Simplex  Duplex (zipcord) 	Storage and Operating Temperature	-55	+85	°C
	Recommended Operating Temperature	-40	+85	°C
	Installation Temperature	-20	+70	°C
	Short Term Tensile Force		Simplex: 50 Duplex: 100	N
	Short Term Bend Radius	25		mm
	Long Term Bend Radius	35		mm
	Long Term Tensile Load		1	N
	Flexing		1000	cycles
Hard Clad Silica Oval Shape Duplex Cable (HCS[®], SpecTran, fibre core diameter 200 µm, outer dimensions 3.2 x 5.4 mm) 	Storage Temperature	-40	+80	°C
	Operating Temperature	-20	+80	°C
	Short Term Tensile Force		46/205	lbs./N
	Long Term Tensile Force		10/44	lbs./N
	Bend Radius	25		mm
Hard Clad Silica 2-channel (Duplex) Cable (HCS[®], SpecTran, fibre core diameter 200 µm, outer diameter 7.5 mm): 	Storage and Operating Temperature	-40	+85	°C
	Short Term Tensile Force		46/205	lbs./N
	Long Term Tensile Force		10/44	lbs./N
	Bend Radius	75		mm

Application Programs

Various application programs are available for the ACS 600 frequency converters. Not all selections are available for all types. One application program at a time can be loaded in the memory of the frequency converter.

ACS 600 Application Programs	
Standard	Decanter Centrifuge
Pump and Fan Control (PFC)	Extruder
Master/Follower (M/F)	Centrifuge
Spinning Control	
Motion Control	
Crane	
System	

Application Macros

The macros of the application programs are introduced below.

Application Program	Macros	For...
Standard	Factory	basic industrial applications
	Hand/Auto	applications that require frequent switching between two external control locations
	PID Control	closed loop processes
	Torque Control	processes that require torque control
	Sequential Control	operation at preset constant speeds
	User macro 1 & 2	user's own customised parameter settings
Pump and Fan Control	Pump and Fan Control	pump or fan station control
	Hand/Auto	applications that require frequent switching between two external control locations and/or speed control of a pump or a fan
Master/Follower	Master/Follower + macros included in Standard Application program	drives which are coupled to each other
Spinning Control	Spinning control	running motor rotating bobbins in ring-frame machines
Motion Control	Torque Control	processes that require torque control
	Speed Control	closed loop speed control
	Positioning	point-to-point positioning
	Synchronising	positioning to moving target
	User macro 1 & 2	user's own customised parameter settings
Crane	Crane	normal crane drive
	Master/Follower Control	two crane drive applications with Master/Follower operation
	User macro 1 & 2	user's own customised parameter settings
Decanter Centrifuge	Decanter	separating solid particles from liquids
Extruder	Extruder, Hand/Auto, PID Control, Torque Control, Sequential Control, User macro 1 & 2	extruder drives
Centrifuge	Centrifuge	centrifuge drives
Traverse Control	Traverse	textile machines

**Macro/Language
Combinations**

Languages and application macros included in each ACx 600 application program are shown below. Not all selections are available for all types.

Application Program	Type code character no. 16	Application Macros	Languages
Standard	B*, **	Factory, Hand/Auto, PID Control, Torque Control, Sequential Control	English (UK & Am), French, Spanish, Portuguese
	C**	Factory, Hand/Auto, PID Control, Torque Control, Sequential Control	English (UK & Am), German, Italian, Dutch
	D	Factory, Hand/Auto, PID Control, Torque Control, Sequential Control	English (UK & Am), Danish, Swedish, Finnish
	E	Factory, Hand/Auto, PID Control, Torque Control, Sequential Control	English (UK & Am), French, Spanish, Portuguese
Pump and Fan Control	F***	PFC (Pump and Fan Control)	English (UK & Am), German, Italian, Dutch
	G	Pump and Fan Control, Hand/Auto	English (UK & Am), Danish, Swedish, Finnish
	H	Pump and Fan Control, Hand/Auto	English (UK & Am), French, Spanish, Portuguese
Master/Follower	J**	Master/Follower + Macros included in selection C	English (UK & Am), German, Italian, Dutch
	K	Master/Follower + Macros included in selection D	English (UK & Am), Danish, Swedish, Finnish
	L	Master/Follower + Macros included in selection E	English (UK & Am), French, Spanish, Portuguese
	M*, **	Master/Follower + Macros included in selection B	English (UK & Am), French, Spanish, Portuguese
System	N	System application (ACS 600 MultiDrive)	English, German
Motion Control	P	ACP 600: Torque Control, Speed Control, Positioning, Synchronising	English, German
	Q	ACP 600: Torque Control, Speed Control	English, German
Crane	S	Crane, Master/Follower Control	English
Spinning Control	V	Spinning control	English
Custom	T	Application program template (FCB Programmable)	English
	Y	Special application program	Custom specified
Decanter Centrifuge	Q	Decanter	English, German
Extruder	P	Extruder, Hand/Auto, PID Control, Torque Control, Sequential Control, User macro 1 & 2	English, German
Centrifuge	2	Centrifuge	English
Traverse Control	1	Traverse	English

* This selection is for the North American market. The default parameter settings in the standard application macros include minor changes to fulfil the local regulations, such as 3-wire start/stop.

** Standard Application Program version 6.x includes MASTER/FOLLOWER Parameter Group and the following languages: Czech, Danish, Dutch, English (UK & Am), Finnish, French, German, Italian, Polish, Portuguese, Spanish, Swedish.

*** PFC Application Program version 6.x includes the following languages: Czech, Danish, Dutch, English (UK & Am), Finnish, French, German, Italian, Polish, Portuguese, Spanish, Swedish.

Protection Features Application program dependent features of the ACx 600 are listed below. ● available as standard, ○ optional. Not all selections are available for all types. For more information, refer to the appropriate application program *Firmware Manual*.

Preprogrammed Faults	Standard PFC, M/F	Crane	Motion Control	System	Programmable Fault Functions	Standard PFC, M/F	Crane	MotionControl	System	Programm. Supervision Functions	Standard PFC, M/F	Crane	Motion Control	System
ACx 600 temperature	●	●	●	●	Analogue input below minimum value	●				Speed	2		2	2
Overcurrent	●	●	●	●	Loss of Control Panel	●	●		●	Motor current	●			●
Short circuit	●	●	●	●	External fault	●	●	●	●	Motor torque	2		●	2
DC overvoltage	●	●	●	●	Motor overtemperature	●	●	●	●	Motor speed	●			●
Supply phase	●	●	●	●	Thermistor/Pt 100	●	●	●	●	Reference 1	●			
DC undervoltage	●	●	●	●	Motor stalled	●		●	●	Reference 2	●			
Overfrequency	●	●		●	Motor underload	●		●	●	Actual value 1	●			
Loss of Control Panel			●		Loss of motor phase	●	●	●	●	Position error			●	
Internal fault	●	●	●	●	Earth fault	●	●	●	●	Synchron error			●	
Internal fault on the I/O control board	●	●	●	●	Speed measurement			●		Position threshold			4	
Ambient temperature	●	●	●	●	Motor overspeed		●			Joystick		●		
User Macro	●	●	●	●	Torque		●			Brake long falling time		●		
Braking chopper (in fieldbus mode)		●			Torque proving		●							
Inverter overload		●			Master/Follower communication	●	●							
No motor data	●	●		●	Brake		●							
ID Run fail	●	●		●	Communication test			●						
Motor fan control and diagnostics				●	Following error			●						
					Position limits	○	○	●	○					
					Communication error									
					Encoder interface module	○	○	●	○					
					Overspeed			●						

Preprogrammed Warnings: ACS 600 temperature, Motor Identification Run, Drive Identification Number change, User Macro, Target position (ACP 600).

Programmable Automatic Reset Functions (ACS 600 Standard Application Program only): after overcurrent, overvoltage, undervoltage and analogue input below minimum value

Information Functions: ACx 600 control firmware package version, ACx 600 application program version, ACx 600 test date.

Applicable Standards

The ACS 600 complies with the following standards:

- EN 60204-1: 1992 + Corr. 1993 (IEC 60204-1). Safety of machinery. Electrical equipment of machines. Part 1: General requirements. *Provisions for compliance:* The final assembler of the machine is responsible for installing
- an emergency-stop device.
- EN 60529: 1991 (IEC 60529), IEC 60664-1: 1992. Degrees of protection provided by enclosures (IP code).
- EN 50178: 1986. Electronic equipment for use in power installations.
- EN 61800-3:1996 (IEC 61800-3): EMC product standard including specific test methods.

Materials

Enclosure	Coating Thickness	Color
hot-dip zinc coated steel sheet 1.0 to 2.5 mm with polyester thermosetting powder coating in visible surfaces	60 µm	RAL 7035 light beige semigloss
Flat Busbars		
aluminium (standard), copper (optional), tin plated copper (optional)		
Package		
wood or plywood (seaworthy package). Plastic covering of the package: PE-LD, bands PP or steel.		

Transportation

Length: max. 4 metres, weight max. 2400 kg

Position: upright

Max. crate dimensions:

length shipping length + 100 mm

depth shipping split depth + 150 mm

height height + 80 mm

Max. seaworthy dimensions:

length shipping length + 200 mm

depth shipping split depth + 185 mm

height 2200 mm

Disposal

ACx 600 contains raw materials that should be recycled to preserve energy and natural resources. The packing materials of ACx 600 units and options 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. If recycling is not feasible, all parts excluding electrolytic capacitors can be landfilled. The DC capacitors of the unit contain electrolyte which is classified as hazardous waste. They must be removed and handled according to local regulations.

For further information on environmental aspects, please contact your local ABB distributor.

CE Marking

A CE mark is attached to ACS/ACC 607/617/627/677 drives to verify that the unit follows the provisions of the European Low Voltage and EMC Directives (Directive 73/23/EEC, as amended by 93/68/EEC and Directive 89/336/EEC, as amended by 93/68/EEC).

Definitions

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

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 covers requirements stated for drives.

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.

Restricted distribution: mode of sales distribution in which the manufacturer restricts the supply of equipment to suppliers, customers or users who separately or jointly have technical competence in the EMC requirements of the application of drives.

Unrestricted distribution: mode of sales distribution in which the supply of equipment is not dependent on the EMC competence of the customer or user for the application of drives.

Compliance with the EMC Directive

Second Environment (Unrestricted Distribution)

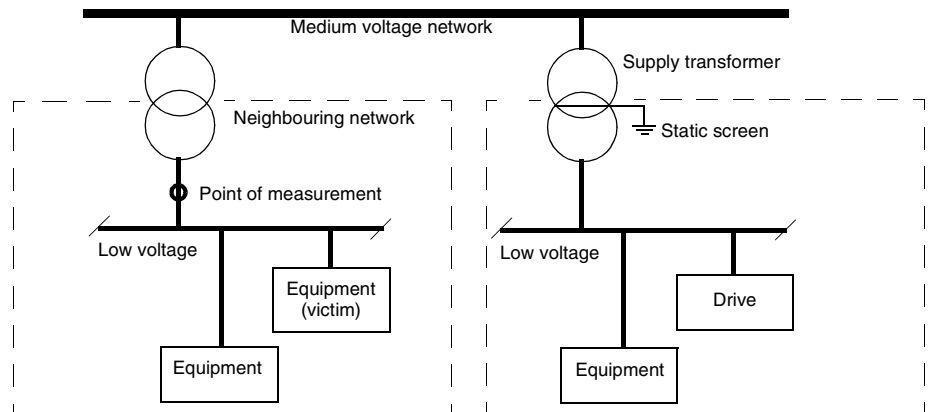
The drive complies with the EMC Directive in industrial low-voltage network, and IT networks (unearthed mains) with the following provisions.

1. The drive is of type ACS/ACC 617, or the drive is equipped with EMC filtering, common mode filter (three toroidal cores per each motor cable), du/dt filter or sine output filter.
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.

*Second Environment
(Restricted Distribution)*

1. The drive is **not** of type ACS/ACC 617, or the drive is **not** equipped with EMC filtering, common mode filter (three toroidal cores per each motor cable), du/dt filter or sine output filter.
2. 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.



3. The installation is described in an EMC plan. (A template is available from the local ABB representative.)
4. The motor and control cables are selected as specified in the *Hardware Manual*
5. The drive is installed according to the instructions given in the *Hardware Manual*.

Note 1: It is recommended to equip the ACx 607/627 with EMC filtering if equipment sensitive to conducted emission is connected to the same supply transformer as the drive.

Note 2: The ACx 617 and ACx 677 must not be equipped with EMC filtering.

Note 3: The drive must not be equipped with EMC filtering (refer to Table A-1) when installed to IT (unearthed) networks. The mains becomes connected to earth potential through the EMC filter capacitors. In IT networks, this may cause danger or damage the unit.

Table A-1 The EMC filtering of the drives is marked in the type code as follows. 1 = EMC cabinet, 2 = EMC cabinet with EMC filters.

ACS 600 Type	Type Code		
	Character no.	EMC Options	No EMC Filter Selection
ACS/ACC 6x7 (75 to 3000 kW)	ACxxxxxxxxxxxxxxxxxxxxxxxxxxxx... ↑ 26	1, 2	0
ACS 600 MultiDrive Supply Section	ACA63xxxxxxxxxxxxxxxx... ↑ 16	1, 2	0
Drive Section	ACA610xxxxxxxxxxxxx... ↑ 16	1	0

Machinery Directive

The drives comply with the European Union Machinery Directive (98/392/EEC) requirements for an equipment intended to be incorporated into machinery.

CSA Marking

The CSA marking is often required in North America. CSA marked ACS/ACC 607/617/627/677 drives are available on request up to 600 V.

The drive is suitable for use in a circuit capable of delivering not more than 65 kA rms symmetrical amperes at 600 V maximum.

The drive provides overload protection in accordance with the CSA standard C22.2 No 14 and the National Electrical Code (US). See *ACS 600 Firmware Manual* for the parameter setting. The setting is OFF by default; it must be activated at start-up.

The drive is to be used in a heated indoor controlled environment. See subsection *Ambient Conditions* for specific limits.

“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 (IEC 61800-3 (1996) – Adjustable speed electrical power drive systems – Part 3: EMC product standard including specific test methods), mandated by the Trans-Tasman Electromagnetic Compatibility Scheme.

Definitions

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

The Trans-Tasman Electromagnetic Compatibility Scheme (EMCS) was introduced by the Australian Communication Authority (ACA) and the Radio Spectrum Management Group (RSM) of the New Zealand Ministry of Economic Development (NZMED) in November 2001. The aim of the scheme is to protect the radiofrequency spectrum by introducing technical limits for emission from electrical/electronic products.

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

Restricted distribution: mode of sales distribution in which the manufacturer restricts the supply of equipment to suppliers, customers or users who separately or jointly have technical competence in the EMC requirements of the application of drives.

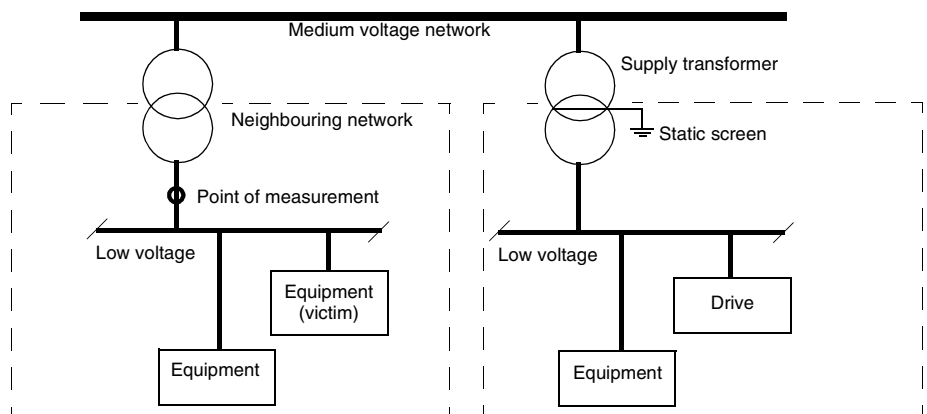
Unrestricted distribution: mode of sales distribution in which the supply of equipment is not dependent on the EMC competence of the customer or user for the application of drives.

Compliance with IEC 61800-3

Second Environment

ACS/ACC 607/617/627/677 drives comply with the limits of IEC 61800-3 with the following provisions:

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 use of EMC filters (if available) or any type of the output filters (du/dt, sine or common mode filter) and/or supply transformers with static screening between the primary and secondary windings is strongly recommended.



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*.

Notes:

- The drive must not be equipped with EMC filtering (refer to Table A-1) when installed to IT (unearthed) networks. The mains becomes connected to earth potential through the EMC filter capacitors. In IT networks this may cause danger or damage the unit.
- The ACS/ACC 617 and the ACS/ACC 677 must not be equipped with EMC filtering independent on network earthing.
- EMC filters are not available for 690 V units.

Equipment Warranty and Liability

General: ABB warrants the Equipment supplied by ABB against defects in material and workmanship for a period of twelve (12) months after installation or twenty four (24) months from date of shipment from factory, whichever first occurs.

Should any failure to conform with the applicable warranties appear during the specified periods under normal and proper use and provided the Equipment has been properly stored, installed, operated and maintained, and if given prompt notice by Purchaser, ABB shall correct such nonconformity, at its option; by (1) repair or replacement of the nonconforming equipment or parts thereof. Repairs or replacements pursuant to warranty shall not renew or extend the applicable original equipment warranty period, provided however, that any such repairs or replacement of equipment or parts thereof shall be warranted for the time remaining of the original warranty period or 30 days, whichever is longer.

ABB shall not be responsible for providing working access to the defect, including disassembly and reassembly of equipment or for providing transportation to and from repair or factory facility, all of which shall be at Purchaser's risk and expense.

These warranties shall not apply to any Equipment or parts thereof which (1) have been improperly repaired or altered; (2) have been subjected to misuse, negligence or accident; (3) have been used in a manner contrary to ABB's instructions; (4) are comprised of materials provided or designed stipulated by Purchaser; or (5) are used equipment.

The foregoing warranties are exclusive and in lieu of all other warranties of quality and performance, written, oral or implied, and all other warranties including any implied warranties of merchantability or fitness for a particular purpose are hereby disclaimed by ABB and all equipment manufacturers.

Correction of nonconformities in the manner and for the period of time provided above shall be the Purchaser's exclusive remedy and shall constitute fulfillment of all liabilities of ABB and any Equipment manufacturer (including any liability for direct, indirect, special, incidental or consequential damages) whether in warranty, contract, negligence, tort, strict liability, or otherwise with respect to any nonconformance of or defect or deficiency in the equipment supplied or services furnished hereunder.

Limitation of Liability

IN NO EVENT SHALL ABB, ITS SUPPLIERS OR SUBCONTRACTORS BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, WARRANTY, TORT, NEGLIGENCE, STRICT LIABILITY OR OTHERWISE, including, but not limited to loss of profits or revenue, loss of use of the Equipment or any associated equipment, cost of capital, cost of substitute equipment, facilities or services, downtime costs, delays, or claims of customers of the Purchaser or other third parties for such or other damages. ABB's liability on any claim whether in contract, warranty, negligence, tort, strict liability, or otherwise for any loss or damage arising out of, connected with, or resulting from the contract or the performance or breach thereof, or from the design, manufacture, sale, delivery, resale, repair, replacement, installation, technical direction of installation, inspection, operation or use of any equipment covered by or in connection therewith, shall in no case exceed the purchase price of the Equipment or part thereof or services which give rise to the Claim.

All clauses of action against ABB arising out of or relating to the contract or the performance or breach hereof shall expire unless brought within one year of the time of accrual thereof.

In no event, regardless of cause, shall ABB assume responsibility for or be liable for penalties or penalty clauses of any description or for indemnification of customer or others for costs, damages, or expenses each arising out of or related to the goods or services of the order.

Appendix A – Technical Data

Your local distributor or ABB office may hold different guarantee details, which are specified in the sales terms, conditions, or guarantee terms. These terms are available on request.

If you have any questions concerning your ABB frequency converter, please contact the local distributor or ABB office. The technical data, information and specifications are valid at the time of printing. The manufacturer reserves the right to modifications without prior notice.



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