ABB GENERAL PURPOSE DRIVES

ACS580-07

Hardware manual

ACS580-07

Hardware manual

Table of contents 

1. Safety instructions 

4. Mechanical installation 

5. Guidelines for planning the electrical installation 

9. Start-up 

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Table of contents

1 Safety instructions

Contents of this chapter 15
Use of warnings and notes 15
General safety in installation, start-up and maintenance 16
General safety in operation 19
Electrical safety in installation, start-up and maintenance 20
Electrical safety precautions 20
Additional instructions and notes 22
Optical components 23
Printed circuit boards 23
Grounding 23
Additional instructions for permanent magnet motor drives 25
Safety in installation, start-up, maintenance 25
Safety in operation 25

2 Introduction to the manual

Contents of this chapter 27
Target audience 27
Related manuals 27
Categorization by frame size and option code 28
Quick installation, start-up and operating flowchart 28
Terms and abbreviations 29

3 Operation principle and hardware description

Contents of this chapter 31
Product overview 31
Single-line circuit diagram of the drive 32
General information on the cabinet layout 33
Cabinet layout – R6 and R7 (bottom entry and exit of cables) 33
Cabinet layout – R8 and R9 (bottom entry and exit of cables) 34
Mounting plate – R6 to R9 36
Cabinet layout – R10 and R11 (bottom entry and exit of cables) 38
Mounting plate 39
Cooling air flow 41
Overview of power and control connections 42
Door switches and lights 43
Main switch-disconnector Q1 43
Control panel 43
Control by PC tools 44
Common mode filter 44
Descriptions of cabinet options 44
Degree of protection 44
Definitions 44
IP21 45
IP42 (option +B054) 45

IP54 (option +B055) 45
UL listed (option +C129) 45
Plinth height (options +C164 and +C179) 45
Empty cubicles (options +C196 to +C201) 45
du/dt filter (option +E205) 45
Molded case circuit breaker (MCCB, option +F289) 46
Cabinet heater with external supply (option +G300) 46
Top cable entry/exit (options +H351 and +H353) 46
Cable conduit entry (option +H358) 46
Additional terminal block X504 (option +L504) 46
Type designation label 47
Type designation key 47

4 Mechanical installation

Contents of this chapter 51
Examining the installation site 51
Necessary tools 52
Moving and unpacking the drive 53
Unpacking the transport package 55
Checking the delivery 55
Lifting the cabinet 56
Moving the cabinet after unpacking 57
Moving on rollers 57
Final placement 58
Attaching the cabinet to the floor and wall or roof 58
General rules 58
Attaching methods 59
Alternative 1 – Clamping 59
Alternative 2 – Using the holes inside the cabinet 60
Miscellaneous 60
Cable duct in the floor below the cabinet 60
Arc welding 60

5 Guidelines for planning the electrical installation

Contents of this chapter 63
Limitation of liability 63
Selecting the supply disconnecting device 63
Selecting the main contactor 63
Examining the compatibility of the motor and drive 64
Protecting the motor insulation and bearings 64
Requirements table 64
Availability of d*u*/d*t* filter and common mode filter by drive or inverter type 67
Additional requirements for explosion-safe (EX) motors 67
Additional requirements for ABB motors of types other than M2_, M3_, M4_, HX_ and AM_ 67
Additional requirements for braking applications 67
Additional requirements for the regenerative and low harmonics drives 67
Additional requirements for ABB high-output and IP23 motors 67
Additional requirements for non-ABB high-output and IP23 motors 67
Additional data for calculating the rise time and the peak line-to-line voltage 68
Additional note for common mode filters 69

Selecting the power cables 69
General guidelines 69
Typical power cable sizes 70
Power cable types 71
Preferred power cable types 71
Alternate power cable types 71
Not allowed power cable types 72
Additional guidelines, North America 72
Metal conduit 73
Power cable shield 73
Selecting the control cables 73
Shielding 73
Signals in separate cables 74
Signals that can be run in the same cable 74
Relay cable type 74
Control panel to drive connection 74
Routing the cables 75
General guidelines – IEC 75
General guidelines – North America 76
Continuous motor cable shield/conduit or enclosure for equipment on the motor cable 77
Separate control cable ducts 77
Implementing thermal overload and short-circuit protection 77
Protecting the input cabling and the drive upon a short-circuit 77
Protecting the motor and motor cable in short-circuits 77
Protecting the drive and the power cables against thermal overload 77
Protecting the motor against thermal overload 78
Protecting the drive against ground faults 78
Residual current device compatibility 78
Implementing the emergency stop function 78
Implementing the Safe Torque Off function 78
Implementing the Power loss ride-through function 78
Using power factor compensation capacitors with the drive 79
Implementing a safety switch between the drive and the motor 79
Using a contactor between the drive and the motor 79
Implementing a bypass connection 80
Implementing the ATEX-certified Safe motor disconnection function (option +Q971) . 80
Protecting the contacts of relay outputs 80
Connecting motor temperature sensor to the drive via an option module 81
Protecting the drive against ground faults 82
Residual current device compatibility 82
Implementing the emergency stop function 82
Implementing ATEX-certified thermistor protection 82
Implementing the Safe torque off function 82
Implementing the ATEX-certified Safe motor disconnection function (option +Q971) ... 82
Implementing the Power-loss ride-through function 83
Units with line contactor (option +F250) 83
Supplying power for the auxiliary circuits 83
Using power factor compensation capacitors with the drive 83
Implementing a safety switch between the drive and the motor 83
Using a contactor between the drive and the motor 84
Implementing a bypass connection 84

Protecting the contacts of relay outputs 84
Implementing a motor temperature sensor connection 85

6 Electrical installation

Contents of this chapter 87
Warnings 87
Attaching the device stickers on the cabinet door 87
Layout of the cable entries (frames R6 to R9) 88
Layout of the cable entries (frames R10 and R11) 89
Connecting the power cables 90
Connection diagram 90
Checking the insulation of the drive system 91
Checking the insulation of the input cable 91
Checking the compatibility with IT (ungrounded), corner-grounded delta, midpoint-grounded delta, and TT systems 91
Ground-to-phase varistor 91
When to disconnect the ground-to-phase varistor: TN-S, IT, corner-grounded delta and midpoint-grounded delta systems 91
Guidelines for installing the drive to a TT system 92
Identifying different types of electrical power systems 93
Disconnecting the EMC filter and ground-to-phase varistor (R6 to R9) 94
Disconnecting the ground-to-phase varistor (R10 and R11) 94
Connecting the motor cable at the motor end 96
Checking the insulation of the motor and motor cable 96
Connection procedure (IEC, frames R6 to R9) 96
Connection procedure (IEC, frames R10 and R11) 100
Connecting the control cables 104
Overview of control cable connection procedure 104
Grounding the outer shields of the control cables at the cabinet entry 105
Routing the control cables inside the cabinet 107
Connecting external wiring to the control unit or optional I/O terminal block 108
Connecting the emergency stop push buttons (options +Q951 and +Q963) 109
Connecting the Safe torque off circuit 109
Connecting external power supply wires for the cabinet heater (option +G300) 110
Setting the voltage range of the auxiliary control voltage transformer (T21) 111
Connecting a PC 111
Installing option modules 112
Option slot 2 (I/O extension modules) 112
Option slot 1 (fieldbus adapter modules) 113
Wiring the optional modules 113

7 Control unit

Contents of this chapter 115
Layout 115
Default I/O connection diagram 117
Option +E205 in frames R10 and R11: DI6 internal overtemperature supervision 118
Power supply connections for PNP with option +L504 118
Power supply connections for NPN with option +L504 119
Power supply connections for PNP without option +L504 119
Power supply connections for NPN without option +L504 119
Changing internal overtemperature supervision from DI6 to another digital input 120

Switches 120
PNP configuration for digital inputs (X2 & X3) 120
NPN configuration for digital inputs (X2 & X3) 121
Connection for obtaining 0…10 V from analog output 2 (AO2) 121
Connection examples of two-wire and three-wire sensors to analog input (AI2) 122
DI6 as frequency input 122
DI6 as PTC input 122
AI1 and AI2 as Pt100, Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) 123
Safe torque off (X4) 123
Technical data 125

8 Installation checklist of the drive

Contents of this chapter 129
Checklist 129

9 Start-up

Contents of this chapter 131
Start-up procedure 131

10 Fault tracing

Contents of this chapter 133
Warning and fault messages 133

11 Maintenance

Contents of this chapter 135
Maintenance intervals 135
Descriptions of symbols 135
Recommended annual maintenance actions by the user. 136
Recommended maintenance intervals after start-up 136
Cleaning the interior of the cabinet 136
Cleaning the air inlet (door) meshes (IP42 / UL Type 1 Filtered) 137
Replacing the air filters (IP54 / UL Type 12) 137
Inlet (door) filters (IP54 / UL Type 12) 137
Outlet (roof) filters (IP54 / UL Type 12) 138
Heatsink 138
Fans 139
Replacing the door fan (frames R6 to R9) 139
Replacing the cabinet fan (frames R6 to R9) 140
Replacing the door fan (frames R10 and R11) 141
Replacing the cabinet fan (frames R10 and R11, IP54) 143
Replacing the drive module main fans (frames R6 to R8) 144
Replacing the drive module main fans (frame R9) 145
Replacing the drive module main fans (frames R10 and R11) 146
Replacing the auxiliary cooling fan of the drive module (frames R6 to R9) 147
Replacing the circuit board compartment cooling fans (frames R10 and R11) 147
Replacing the drive module (frames R6 to R9) 148
Replacing the drive module (frames R10 and R11) 154
Replacing the drive module (frames R10 and R11, IP54) 160
Capacitors 166
Reforming the capacitors 166

Fuses 166
Replacing AC fuses (frames R6 and R7) 166
Replacing AC fuses 167
Control panel 168
Cleaning the control panel 168
Replacing the battery in the assistant control panel 168

12 Technical data

Contents of this chapter 171
Ratings 171
NEC ratings 172
Definitions 173
Output derating 173
Ambient temperature derating 173
Drive types other than ACS580-0414A-4 and ACS580-0430A-4 173
Drive types ACS580-0414A-4 and ACS580-0430A-4 174
Altitude derating 174
Deratings for special settings in the drive control program 175
Fuses (IEC) 176
Fuses (UL) 177
Fuses for branch circuit protection 178
Dimensions and weights 179
Free space requirements 179
Maximum allowed plinth height for the extraction/installation ramp 180
Typical power cable sizes 180
Losses, cooling data and noise 181
Terminal and entry data for the power cables 182
IEC – Standard configuration 182
IEC – With option +E205 182
US – Standard configuration 182
US – With option +E205 183
Connection drawings 184
Terminal and connection data for auxiliary control circuits 210
Electrical power network specification 211
Motor connection data 211
Control unit connection data 211
Efficiency 211
Protection classes 212
Ambient conditions 213
Auxiliary circuit power consumption 213
Materials 214
Applicable standards 215
Markings 216
CE marking 216
Compliance with the European Low Voltage Directive 216
Compliance with the European EMC Directive 216
Compliance with the European Machinery Directive 216
Declaration of Conformity 217
Compliance with the EN 61800-3:2004 219
Definitions 219
Category C2 219
Category C3 219

Category C4 219
UL marking 220
Disclaimers 222
Generic disclaimer 222
Cybersecurity disclaimer 222

13 Dimension drawings

Frames R6 and R7 (IP21, UL Type 1) 224
Frames R6 and R7 (+B054: IP42, UL Type 1) 225
Frames R6 and R7 (+B055: IP54, UL Type 12) 226
Frames R6 and R7 (+H351 and +H353: top entry and exit) 227
Frames R6 and R7 (+F289) 228
Frames R6 and R7 (+F289, +H351, +H353) 229
Frames R8 and R9 (IP21) 230
Frames R8 and R9 (+B054: IP42, UL Type 1) 231
Frames R8 and R9 (+B055: IP54, UL Type 12) 232
Frames R8 and R9 (+H351 and +H353: top entry and exit) 233
Frames R8 and R9 (+F289) 234
Frames R8 and R9 (+F289, +H351, +H353) 235
Frames R10 and R11 (IP21) 236
Frames R10 and R11 (+B054: IP42, UL Type 1) 237
Frames R10 and R11 (+B055: IP54, UL Type 12) 238
Frames R10 and R11 (+F289) 239
Frames R10 and R11 (+H351, +H353) 240
Frames R10 and R11 (+B054: IP42, UL type 1, +H351, +H353) 241
Frames R10 and R11 (+B055: IP54, UL type 12, +H351, +H353) 242

14 The Safe torque off function

Contents of this chapter 243
Description 243
Compliance with the European Machinery Directive 244
Wiring 245
Connection principle 245
Connection with internal power supply 245
Connection with external power supply 246
Wiring examples 246
Wiring with internal power supply 246
Wiring with external power supply 247
Activation switch 247
Cable types and lengths 247
Grounding of protective shields 248
Operation principle 249
Start-up including acceptance test 250
Competence 250
Acceptance test reports 250
Acceptance test procedure 250
Use 252
Maintenance 253
Competence 253
Fault tracing 254

Safety data 255
Abbreviations 255
Declaration of conformity 257
TÜV certificate 258

15 Optional I/O extension modules

Contents of this chapter 259
CBAI-01 bipolar analog IO extension module 259
Hardware description 259
Product overview 259
Layout 260
Mechanical installation 260
Necessary tools and instructions 260
Unpacking and checking the delivery 260
Installing the module 260
Electrical installation 261
Necessary tools and instructions 261
Terminal designations 261
General cabling instructions 261
Wiring 261
Start-up 263
Setting the parameters 263
Diagnostics 263
LEDs 263
Technical data 264
Dimension drawing 264
CHDI-01 115/230 V digital input extension module 266
Hardware description 266
Product overview 266
Layout 266
Mechanical installation 266
Necessary tools and instructions 266
Unpacking and checking the delivery 266
Installing the module 267
Electrical installation 267
Necessary tools and instructions 267
Terminal designations 267
General cabling instructions 268
Wiring 268
Start-up 268
Setting the parameters 268
Diagnostics 270
Faults and warning messages 270
LEDs 270
Technical data 270
CMOD-01 multifunction extension module (external 24 V AC/DC and digital I/O) 272
Hardware description 272
Product overview 272
Layout 272
Mechanical installation 273
Necessary tools and instructions 273
Unpacking and checking the delivery 273

Installing the module 273
Electrical installation 273
Necessary tools and instructions 273
Terminal designations 273
General cabling instructions 274
Wiring 274
Start-up 275
Setting the parameters 275
Diagnostics 277
Faults and warning messages 277
LEDs 277
Technical data 278
CMOD-02 multifunction extension module (external 24 V AC/DC and isolated PTC interface) 280
Hardware description 280
Product overview 280
Layout 281
Mechanical installation 281
Necessary tools and instructions 281
Unpacking and checking the delivery 281
Installing the module 282
Electrical installation 282
Necessary tools and instructions 282
Terminal designations 282
General cabling instructions 282
Wiring 283
Start-up 284
Setting the parameters 284
Diagnostics 284
Faults and warning messages 284
LEDs 284
Technical data 284
CPTC-02 ATEX-certified thermistor protection module (external 24 V AC/DC and isolated PTC interface) 286

Further information

1

Safety instructions

Contents of this chapter

This chapter contains the safety instructions which you must obey when you install, start up, operate and do maintenance work on the drive. If you ignore the safety instructions, injury, death or damage can occur.

Use of warnings and notes

Warnings tell you about conditions which can cause injury or death, or damage to the equipment. They also tell you how to prevent the danger. Notes draw attention to a particular condition or fact, or give information on a subject.

The manual uses these warning symbols:

WARNING!
Electricity warning tells about hazards from electricity which can cause injury or death, or damage to the equipment.

WARNING!
General warning tells about conditions, other than those caused by electricity, which can cause injury or death, or damage to the equipment.

WARNING!
Electrostatic sensitive devices warning tells you about the risk of electrostatic discharge which can cause damage to the equipment.

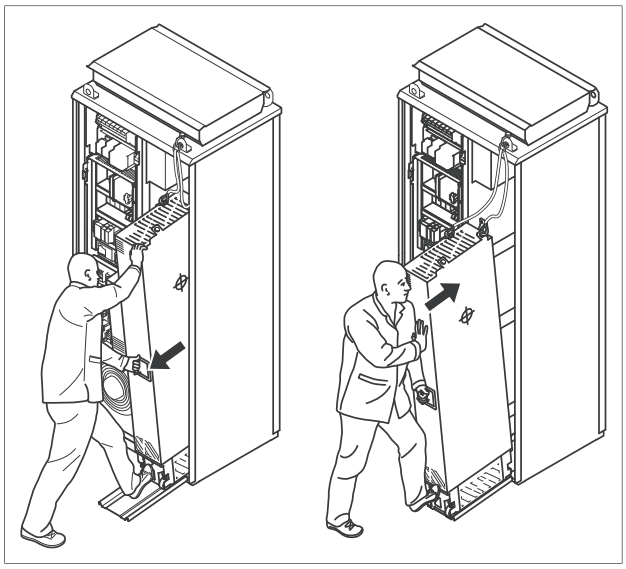
General safety in installation, start-up and maintenance

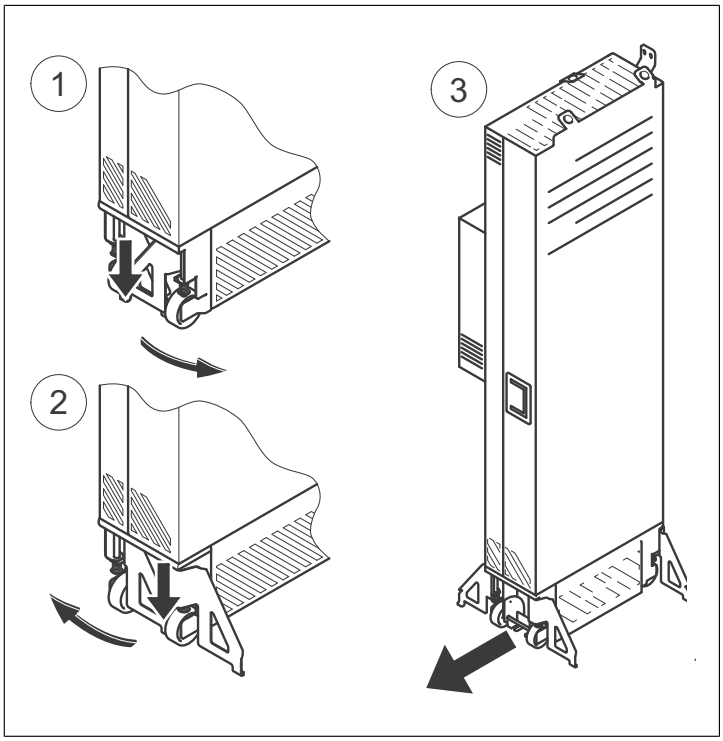
These instructions are for all personnel who do work on the drive.

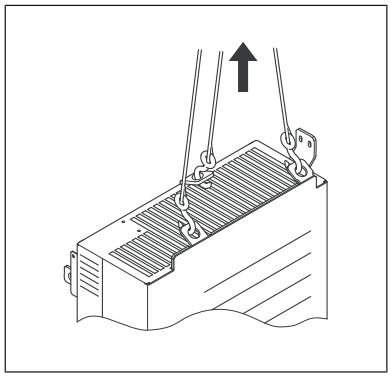
WARNING!
Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

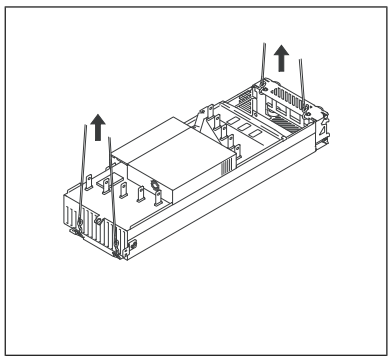
- Keep the drive in its package until you install it. After unpacking, protect the drive from dust, debris and moisture.
- Use the required personal protective equipment: safety shoes with metal toe cap, safety glasses, protective gloves, etc.
- Lift a heavy drive with a lifting device. Use the designated lifting points. See the dimension drawings.
- Secure the drive cabinet to the floor to prevent it from toppling over. The cabinet has a high center of gravity. When you pull out heavy components or power modules, there is a risk of overturning. Secure the cabinet also to the wall when necessary.

- Do not stand or walk on the cabinet roof. Make sure that nothing presses against the roof, side or back plates or door. Do not store anything on the roof while the drive is in operation.
- Frames R10 and R11: Do not use the module installation ramp with plinth heights which exceeds the maximum allowed height. See the technical data.
- Frames R10 and R11: Secure the module extraction/installation ramp carefully.
- Frames R10 and R11: To prevent the drive module from falling, attach its top lifting lugs with chains to the cabinet lifting lug before you push the module into the cabinet and pull it from the cabinet. Push the module into the cabinet and pull it from the cabinet carefully preferably with help from another person. Keep a constant pressure with one foot on the base of the module to prevent the module from falling on its back. Make sure that the module does not topple over when you move it on the floor. To extend the support legs, press each leg a little down (1, 2) and turn it aside. Whenever possible secure the module also with chains. The module overturns from a sideways tilt of 5 degrees.









- Beware of hot surfaces. Some parts, such as heatsinks of power semiconductors, and brake resistors, remain hot for a while after disconnection of the electrical supply.
- Vacuum clean the area around the drive before the start-up to prevent the drive cooling fan from drawing the dust inside the drive.
- Make sure that debris from drilling, cutting and grinding does not enter the drive during the installation. Electrically conductive debris inside the drive may cause damage or malfunction.
- Make sure that there is sufficient cooling. See the technical data.
- Keep the cabinet doors closed when the drive is powered. With the doors open, a risk of a potentially fatal electric shock, arc flash or high-energy arc blast exists. If you cannot avoid working on a powered drive, obey the local laws and regulations on live working (including – but not limited to – electric shock and arc protection).
- Before you adjust the drive operation limits, make sure that the motor and all driven equipment can operate throughout the set operation limits.

- Before you activate the automatic fault reset or automatic restart functions of the drive control program, make sure that no dangerous situations can occur. These functions reset the drive automatically and continue operation after a fault or supply break. If these functions are activated, the installation must be clearly marked as defined in IEC/EN 61800-5-1, subclause 6.5.3, for example, "THIS MACHINE STARTS AUTOMATICALLY".
- The maximum drive power cycles is five times in ten minutes. Power cycling the drive too often can damage the charging circuit of the DC capacitors.
- Validate any safety circuits (for example, Safe torque off or emergency stop) in start-up. See separate instructions for the safety circuits.
- Beware of hot air exiting from the air outlets.
- Do not cover the air inlet or outlet when the drive is running.

Note:

- If you select an external source for the start command and it is on, the drive will start immediately after fault reset unless you configure the drive for pulse start. See the firmware manual.
- Depending on the wiring and parametrization of the drive, the stop key on the control panel may not stop the drive.
- Only authorized persons are allowed to repair a malfunctioning drive.

General safety in operation

These instructions are for all personnel that operate the drive.

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

- Do not power up the drive more than five times in ten minutes. Too frequent power-ups can damage the charging circuit of the DC capacitors. If you need to start or stop the drive, use the control panel start and stop keys or commands through the I/O terminals of the drive.
- Give a stop command to the drive before you reset a fault. If you have an external source for the start command and the start is on, the drive will start immediately after the fault reset, unless you configure the drive for pulse start. See the firmware manual.
- Before you activate automatic fault reset functions of the drive control program, make sure that no dangerous situations can occur. These functions reset the drive automatically and continue operation after a fault.

Note:
When the control location is not set to Local, the stop key on the control panel will not stop the drive.

Electrical safety in installation, start-up and maintenance

Electrical safety precautions

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

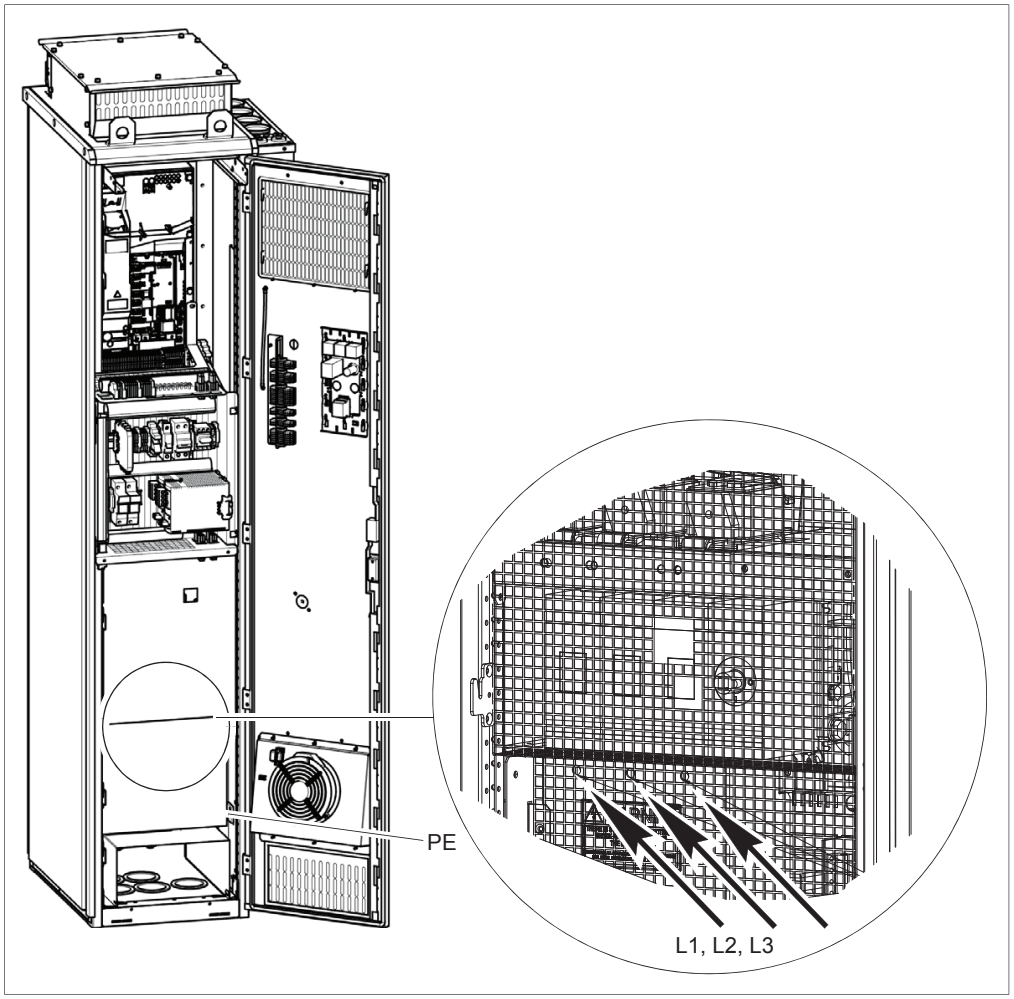
WARNING!
Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

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

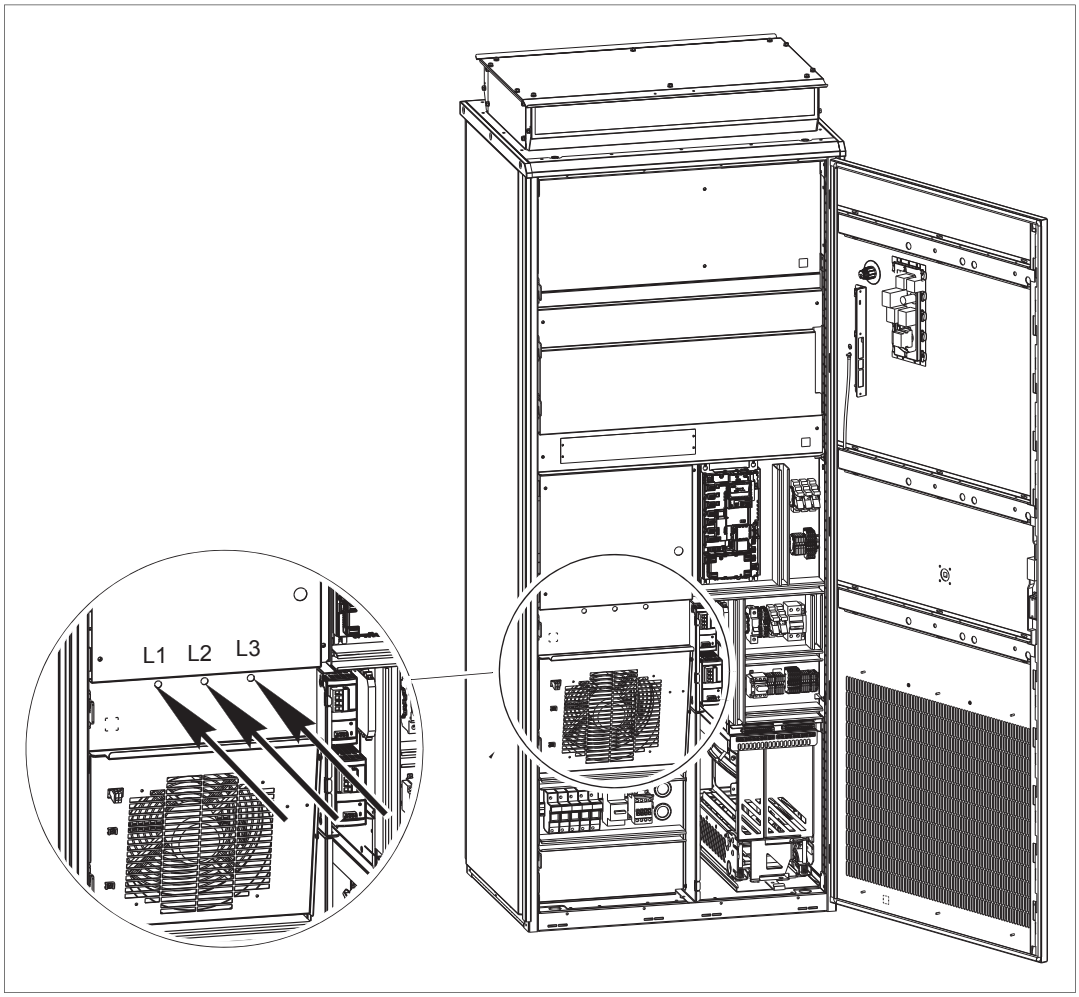
Go through these steps before you begin any installation or maintenance work.

1. Keep the cabinet doors closed when the drive is powered. With the doors open, a risk of a potentially fatal electric shock, arc flash or high-energy arc blast exists.
2. Clearly identify the work location and equipment.
3. Disconnect all possible voltage sources. Make sure that re-connection is not possible. Lock out and tag out.
   - Open the main disconnecting device of the drive.
   - Open the charging switch if present.
   - Open the disconnector of the supply transformer. (The main disconnecting device in the drive cabinet does not disconnect the voltage from the AC input power busbars of the drive cabinet.)
   - Open the auxiliary voltage switch-disconnector (if present), and all other possible disconnecting devices that isolate the drive from dangerous voltage sources.
   - If you have a permanent magnet motor connected to the drive, disconnect the motor from the drive with a safety switch or by other means.
   - Disconnect any dangerous external voltages from the control circuits.
   - After you disconnect power from the drive, always wait 5 minutes to let the intermediate circuit capacitors discharge before you continue.
4. Protect any other energized parts in the work location against contact.
5. Take special precautions when close to bare conductors.
6. Measure that the installation is de-energized. If the measurement requires removal or disassembly of shrouding or other cabinet structures, obey the local laws and regulations applicable to live working (including – but not limited to – electric shock and arc protection).
   - Use a multimeter with an impedance greater than 1 Mohm.
   - Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is close to 0 V.
   - Make sure that the voltage between the drive DC busbars (+ and -) and the grounding (PE) busbar is close to 0 V.
   - If you have a permanent magnet motor connected to the drive, make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is close to 0 V.

Measuring points of frames R6 to R9 are shown below.



Measuring points of frames R10 and R11 are shown below. You can also remove the metallic shield and measure through the holes in the clear plastic shroud behind it.



7. Install temporary grounding as required by the local regulations.
8. Ask the person in control of the electrical installation work for a permit to work.

Additional instructions and notes

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

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

- Make sure that the electrical power network, motor/generator, and environmental conditions agree with the drive data.
- Do not do insulation or voltage withstand tests on the drive.
- ABB recommends not to secure the cabinet by arc welding. If you have to, obey the welding instructions in the drive manuals.

Note:

- The motor cable terminals of the drive are at a dangerous voltage when the input power is on, regardless of whether the motor is running or not.
- When the input power is on, the drive DC bus is at a dangerous voltage.

- External wiring can supply dangerous voltages to the relay outputs of the control units of the drive.
- The Safe torque off function does not remove the voltage from the main and auxiliary circuits. The function is not effective against deliberate sabotage or misuse.

Optical components

WARNING!
Obey these instructions. If you ignore them, damage to the equipment can occur.

- Handle the fiber optic cables with care.
- When you unplug the fiber optic cables, always hold the connector, not the cable itself.
- Do not touch the ends of the fibers with bare hands as the ends are extremely sensitive to dirt.
- Do not bend the fiber optic cables too tightly. The minimum allowed bend radius is 35 mm (1.4”).

Printed circuit boards

WARNING!
Use a grounding wrist band when you handle printed circuit boards. Do not touch the boards unnecessarily. The boards contain components sensitive to electrostatic discharge.

Grounding

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

WARNING!
Obey these instructions. If you ignore them, injury or death, or equipment malfunction can occur, and electromagnetic interference can increase.

If you are not a qualified electrician, do not do grounding work.

- Always ground the drive, the motor and adjoining equipment. This is necessary for the personnel safety. Proper grounding also reduces electromagnetic emission and interference.
- Make sure that the conductivity of the protective earth (PE) conductors is sufficient. See the electrical planning instructions of the drive. Obey the local regulations.
- Connect the power cable shields to protective earth (PE) terminals of the drive to make sure of personnel safety.
- Make a 360° grounding of the power and control cable shields at the cable entries to suppress electromagnetic disturbances.
- In a multiple-drive installation, connect each drive separately to the protective earth (PE) busbar of the power supply.

Note:

- You can use power cable shields as grounding conductors only when their conductivity is sufficient.
- As the normal touch current of the drive is higher than 3.5 mA AC or 10 mA DC, you must use a fixed protective earth (PE) connection. The minimum size of the protective earth conductor must comply with the local safety regulations for high protective earth

conductor current equipment. See standard IEC/EN 61800-5-1, 4.3.5.5.2., and the electrical planning instructions of the drive.

Additional instructions for permanent magnet motor drives

Safety in installation, start-up, maintenance

These are additional warnings concerning permanent magnet motor drives. The other safety instructions in this chapter are also valid.

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

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

- Do not do work on the drive when a rotating permanent magnet motor is connected to it. A rotating permanent magnet motor energizes the drive including its input and output power terminals.

Before installation, start-up and maintenance work on the drive:

- Stop the drive.
- Disconnect the motor from the drive with a safety switch or by other means.
- If you cannot disconnect the motor, make sure that the motor cannot rotate during work. Make sure that no other system, like hydraulic crawling drives, can rotate the motor directly or through any mechanical connection like felt, nip, rope, etc.
- Do the steps in section *Electrical safety precautions (page 20)*
- Measure that the installation is de-energized.
  - Use a multimeter with an impedance greater than 1 Mohm.
  - Make sure that the voltage between the drive output terminals (T1/U, T2/V, T3/W) and the grounding (PE) busbar is close to 0 V.
  - Make sure that the voltage between the drive input power terminals (L1, L2, L3) and the grounding (PE) busbar is close to 0 V.
  - Make sure that the voltage between the drive DC busbars (+ and -) and the grounding (PE) busbar is close to 0 V.
- Install temporary grounding to the drive output terminals (U2, V2, W2). Connect the output terminals together as well as to the PE.

During the start up:

- Make sure that the motor cannot be run into overspeed, eg, driven by the load. Motor overspeed causes overvoltage that can damage or destroy the capacitors in the intermediate circuit of the drive.

Safety in operation

WARNING!
Make sure that the motor cannot be run into overspeed, e.g. driven by the load. Motor overspeed causes overvoltage that can damage or destroy the capacitors in the intermediate circuit of the drive.

2

Introduction to the manual

Contents of this chapter

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

Target audience

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

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

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

Related manuals

Name	Code
Drive hardware manuals and guides	
Drive/converter/inverter safety instructions	Multilingual code: 3AXD50000037978
ACS580-07 drives /75 to 500 kW) hardware manual	3AXD50000045815
Converter module lifting device for drive cabinets hardware manual	3AXD50000210268
ACX-AP-x Assistant control panels user's manual	3AUA0000085685
Drive firmware manuals and guides	
ACS580 standard control program firmware manual	3AXD50000016097
Quick start-up guide for ACS580 drives with ACS580 standard control program	3AXD50000048035

Name	Code
Option manuals and guides	
Emergency stop, stop category 0 (option +Q951) for ACS580-07, ACH580-07 and ACQ580-07 drives user's manual	3AXD50000171828
Emergency stop, stop category 0 (option +Q963) without opening main contactor with safety relay for ACS580-07, ACH580-07 and ACQ580-07 drives user's manual	3AXD50000171835
CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (+L537+Q971) user's manual	3AXD50000030058
FCAN-01 CANopen adapter module user's manual	3AFE68615500
FCNA-01 ControlNet adapter module user's manual	3AUA0000141650
FDNA-01 DeviceNet™ adapter module user's manual	3AFE68573360
FECA-01 EtherCAT adapter module user's manual	3AUA0000068940
FENA-01/-11/-21 Ethernet adapter module user's manual	3AUA0000093568
FEPL-02 Ethernet POWERLINK adapter module user's manual	3AUA0000123527
FPBA-01 PROFIBUS DP adapter module user's manual	3AFE68573271
FSCA-01 RS-485 adapter module user's manual	3AUA0000109533
Tool and maintenance manuals and guides	
Drive composer start-up and maintenance PC tool user's manual	3AUA0000094606
Converter module capacitor reforming instructions	3BFE64059629

Categorization by frame size and option code

Some instructions, technical data and dimension drawings which concern only certain frame sizes are marked with the symbol of the frame size, for example, R7. The frame size is marked on the type designation label, see *Type designation label (page 47)*.

The instructions, technical data and dimension drawings which concern only certain optional selections are marked with option codes (such as +L504). The options included in the drive can be identified from the option codes visible on the type designation label. The option selections are listed in section *Type designation key (page 47)*.

Quick installation, start-up and operating flowchart

Task	See
Plan the electrical installation and acquire the accessories needed (cables, fuses, etc.). Check the ratings, required cooling air flow, input power connection, compatibility of the motor, motor connection, and other technical data.	*Guidelines for planning the electrical installation (page 63)* *Technical data (page 171)*
⬇	
Check the installation site.	*Ambient conditions (page 213)*
⬇	
Unpack and check the units (only intact units may be started up). Examine that all necessary option modules and equipment are present and correct. Mount the drive.	*Mechanical installation (page 51)* If the drive has been non-operational for more than one year, the converter DC link capacitors need to be reformed (*Reforming the capacitors (page 166)*)

Task	See
Route the cables.	*Routing the cables (page 75)*
Check the insulation of the supply cable, the motor and the motor cable.	*Checking the insulation of the motor and motor cable (page 96)*
Connect the power cables. Connect the control cables.	*Connecting the power cables (page 90)*, *Connecting the control cables (page 104)*
Check the installation.	*Installation checklist of the drive (page 129)*
Start the drive up.	*Start-up (page 131)*
Operate the drive: start, stop, speed control etc.	*Start-up (page 131)* and firmware manual

Terms and abbreviations

Term/ Abbreviation	Description
CBAI-01	Bipolar analog IO extension module
CCU-24	Type of control unit
CHDI-01	115/230 V digital input extension module
CMOD-01	Multifunction extension module (external 24 V AC/DC and digital I/O extension)
CMOD-02	Multifunction extension module (external 24 V AC/DC and isolated PTC interface)
CPTC-02	Multifunction extension module (external 24 V and ATEX-certified PTC interface)
EMC	Electromagnetic compatibility
FBIP-21	BACnet/IP adapter module
FCAN	Optional CANopen® adapter module
FCNA-01	Optional ControlNet™ adapter module
FDCO-01	DDCS communication module with two pairs of 10 Mbit/s DDCS channels
FDNA-01	Optional DeviceNet™ adapter module
FECA-01	Optional EtherCAT® adapter module
FENA-11	Optional Ethernet adapter module for EtherNet/IP™, Modbus TCP® and PROFINET IO® protocols
FENA-21	Optional Ethernet adapter module for EtherNet/IP™, Modbus TCP® and PROFINET IO® protocols, 2-port
FEPL-01	Optional Ethernet POWERLINK adapter module
FPBA-01	Optional PROFIBUS DP® adapter module
Frame, frame size	Physical size of the drive or power module
IGBT	Insulated gate bipolar transistor
STO	Safe torque off (IEC/EN 61800-5-2)

3

Operation principle and hardware description

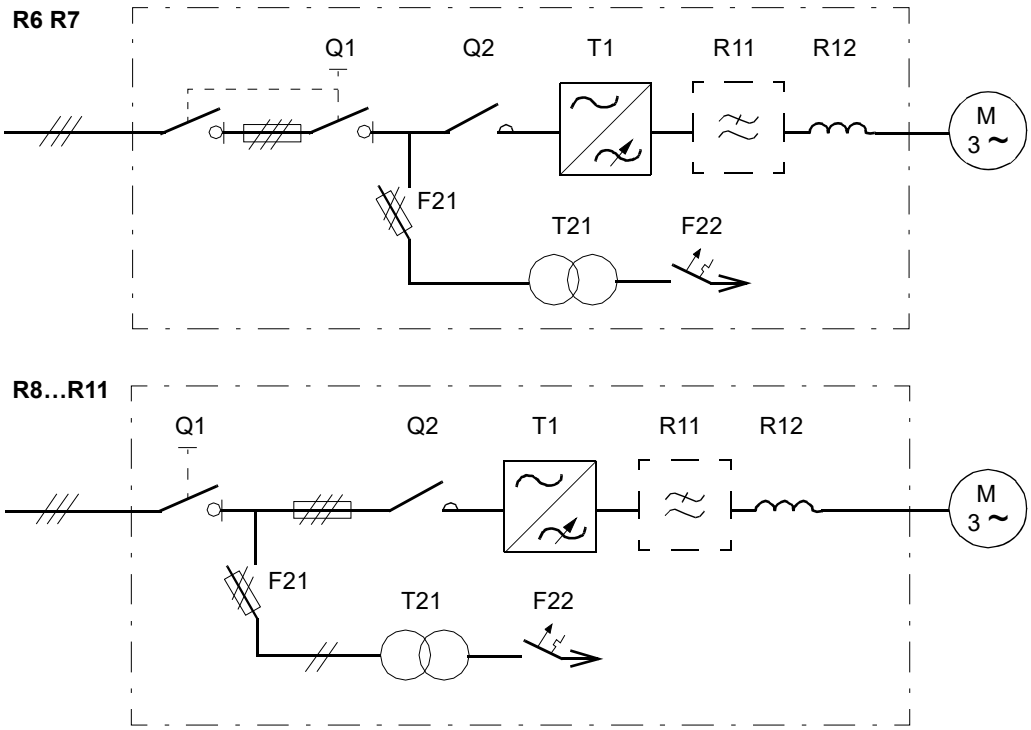
Contents of this chapter

This chapter briefly describes the operation principle and construction of the drive.

Product overview

The ACS580-07 is an air-cooled cabinet-installed drive for controlling asynchronous AC induction motors and permanent magnet motors.

Single-line circuit diagram of the drive



Q1	In frames R6 and R7: Switch fuse or molded case circuit breaker (option +F289). In frames R8 to R11: Switch-disconnector or molded case circuit breaker (option +F289).
Q2	Line contactor (option +F250)
T21	Auxiliary voltage transformer supplying 24 V and 230/115 V control voltage for, eg, cabinet fan(s), control devices and I/O extension adapter module.
F21	Auxiliary voltage supply fuses
F22	Auxiliary circuit protection switch
T1	Drive module
R11	Common mode filter (option +E208 for frames R6 to R10). Standard for frame R11.
R12	du/dt filter (option +E205)

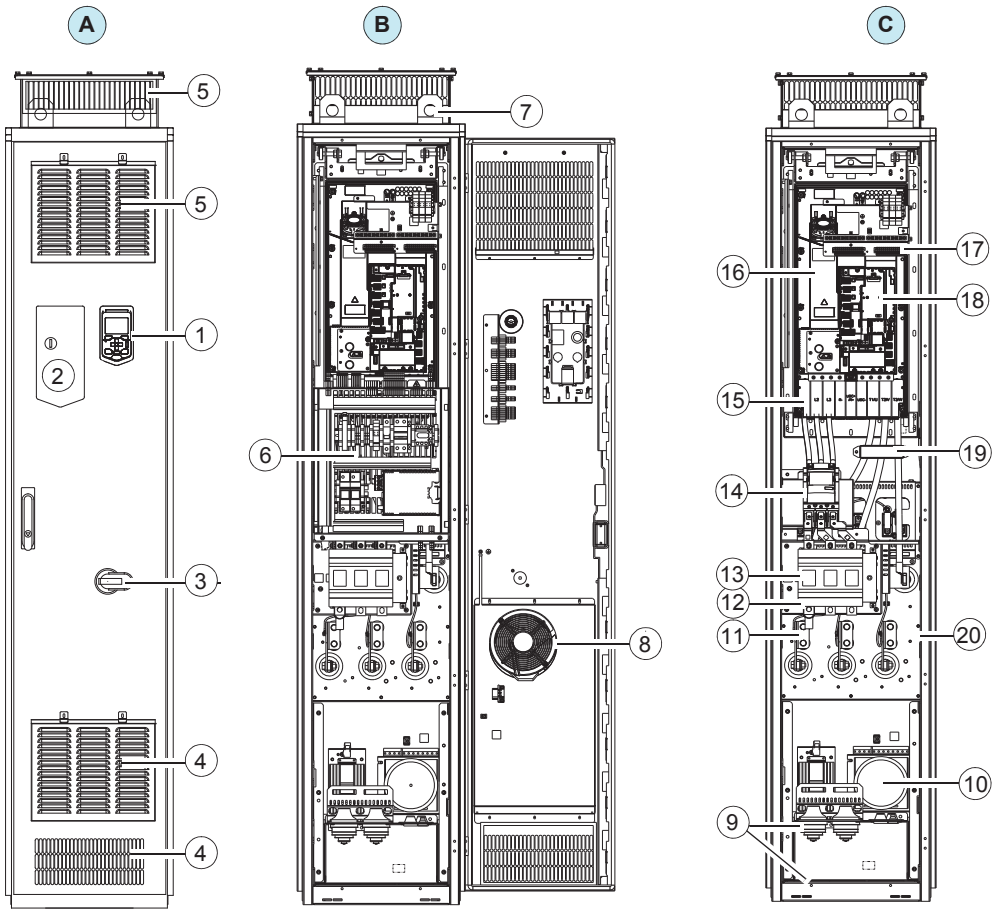
General information on the cabinet layout

IP21
UL Type 1

IP42
UL Type 1
(option +B054)

Cabinet layout – R6 and R7 (bottom entry and exit of cables)

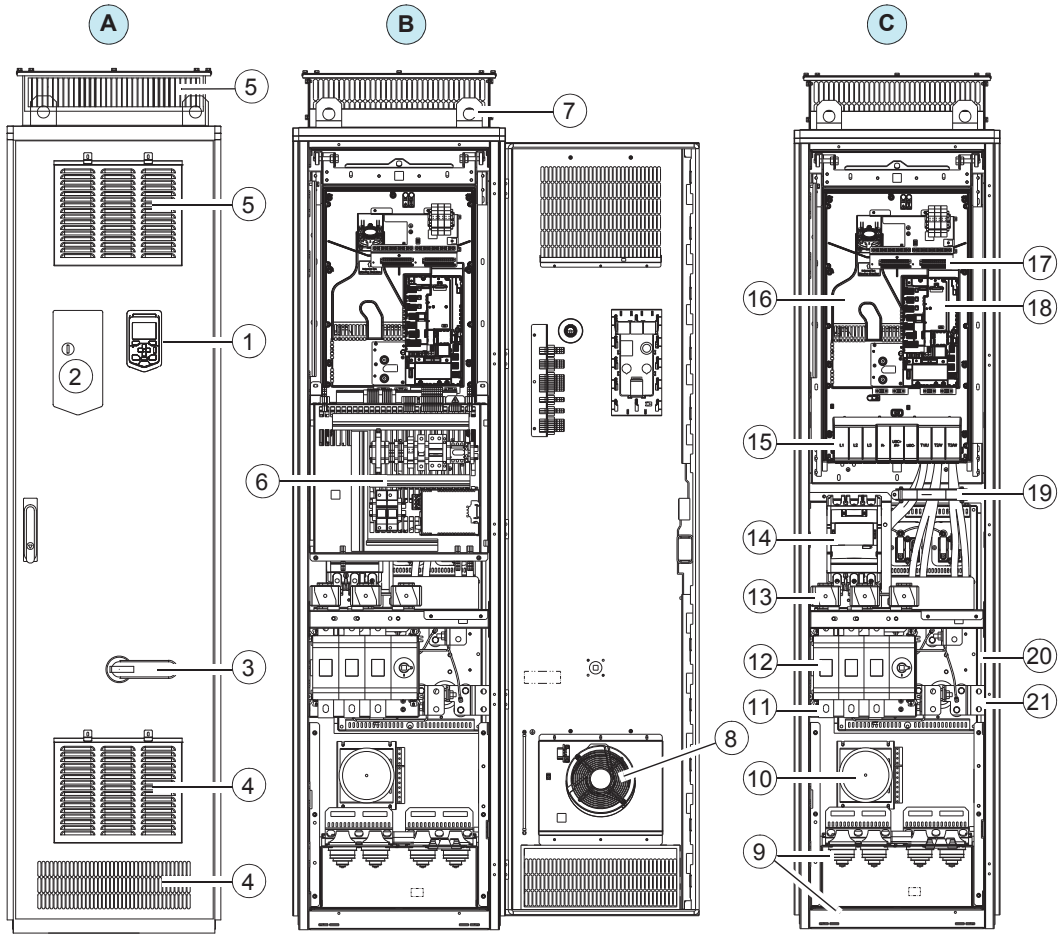
The cabinet layout of frame R7 with dut/dt filter (option +E205) is shown below. Degree of protection IP42 (option +B054). Frame R6 looks similar.



A	Cabinet door closed	10	Auxiliary voltage transformer T21
B	Cabinet door open	11	Motor cable connection terminals **Note:** For drives with no du/dt filter (option +E205), the motor cables are connected to the drive module terminals.
C	Cabinet door open, mounting plate and cabinet shrouds removed	12	Input cable connection terminals
1	Drive control panel	13	Main switch with AC fuses (Q1)
2	Operating switch	14	Main contactor (Q2, option +F250)
3	Main switch handle	15	Power cable connection terminals of the drive module behind the shroud
4	Gratings for cooling air in	16	Drive module
5	Gratings for cooling air out	17	Additional I/O terminal block (option +L504)
6	Mounting plate, see section *Mounting plate – R6 to R9 (page 36)*	18	Drive control unit
7	Lifting lugs	19	Common mode filter (option +E208)
8	Cabinet door fan	20	du/dt filter (option +E205)
9	Power and control cable entries	-	

Cabinet layout – R8 and R9 (bottom entry and exit of cables)

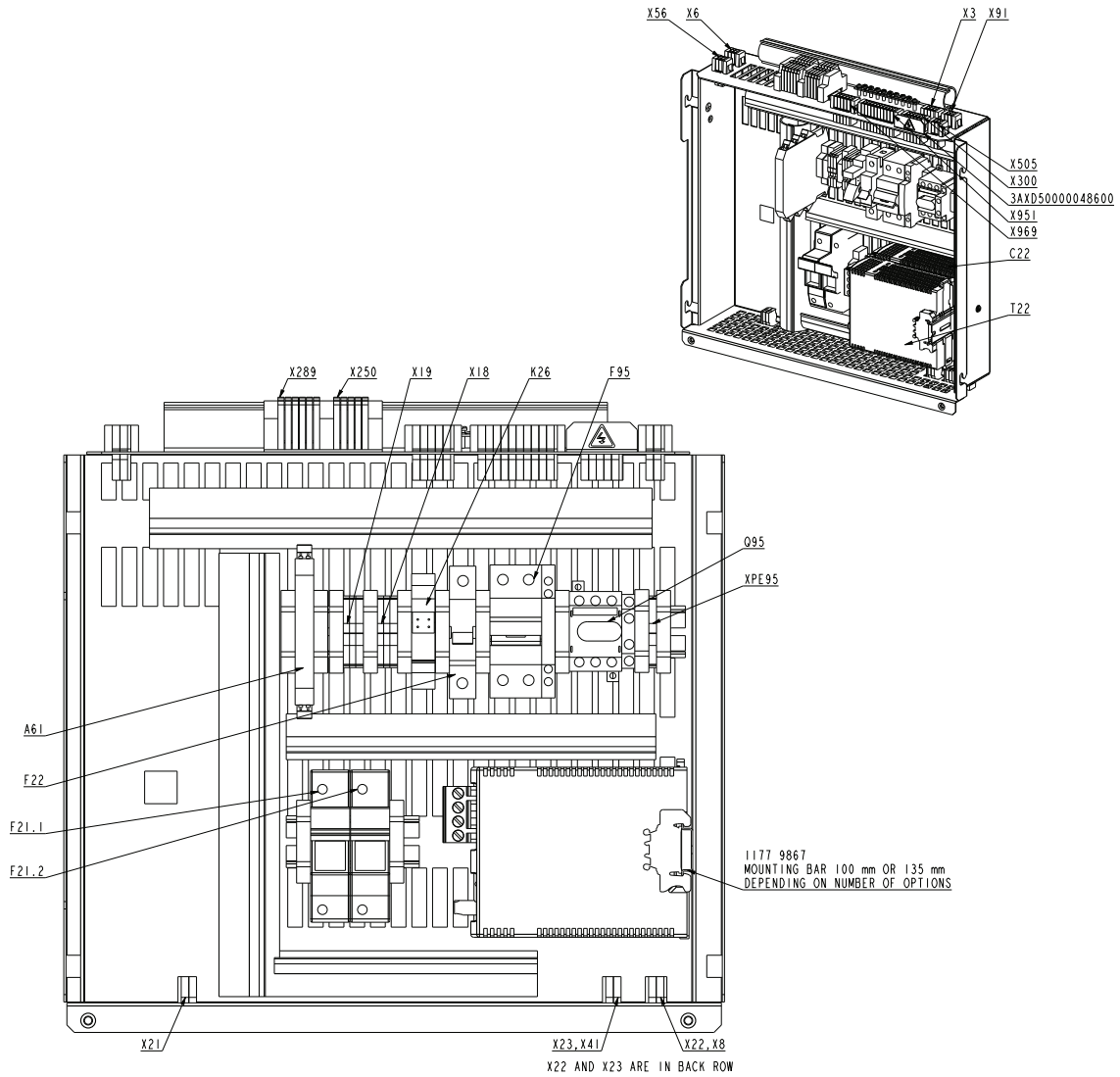
The cabinet layout of frame R9 with du/dt filter (option +E205) is shown below. Degree of protection IP42 (option +B054). Frame R8 looks similar.



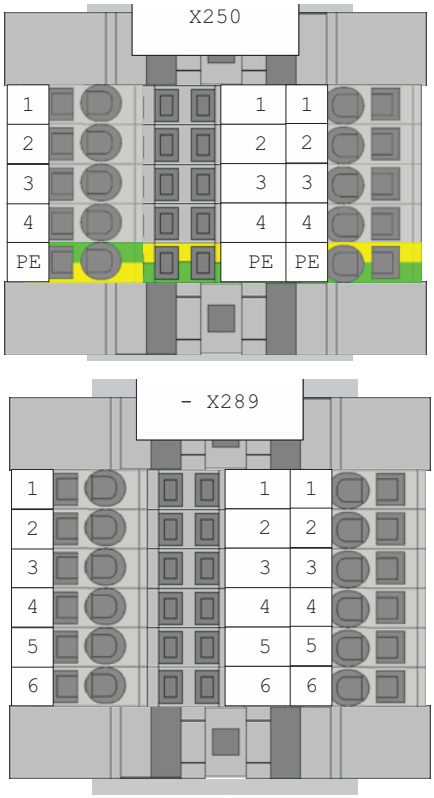
A	Cabinet door closed	10	Auxiliary voltage transformer T21
B	Cabinet door open	11	Input cable connection terminals
C	Cabinet door open, mounting plates and cabinet shrouds removed	12	Main switch-disconnector (Q1)
1	Drive control panel	13	AC fuses
2	Operating switch	14	Main contactor (Q2, option +F250)
3	Main switch handle	15	Power cable connection terminals of the drive module behind the shroud
4	Gratings for cooling air in	16	Drive module
5	Gratings for cooling air out	17	Additional I/O terminal block (option +L504)
6	Mounting plate, see section *Mounting plate – R6 to R9 (page 36)*	18	Drive control unit
7	Lifting lugs	19	Common mode filter (option +E208)
8	Cabinet door fan	20	du/dt filter (option +E205)
9	Power and control cable entries	21	Motor cable connection terminals **Note:** For drives with no du/dt filter (option +E205), the motor cables are connected to the drive module terminals.

Mounting plate – R6 to R9

The components and terminals on the mounting plate of frames R6 to R9 are shown below. The layout of frames R6 and R7 is similar.

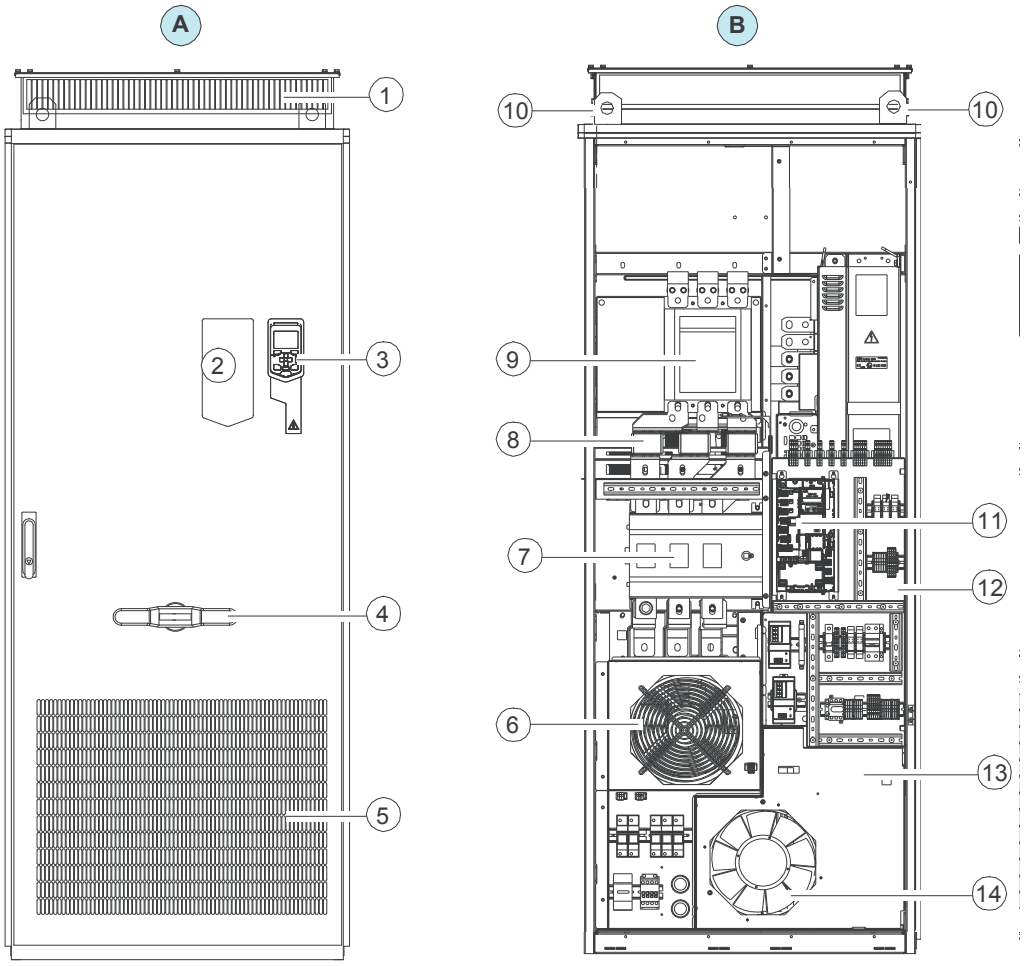


+G300	switch-disconnector and miniature circuit breaker for cabinet heater (option +G300)	X3	External main contactor control
A61	Emergency stop relay for options +Q951 and +Q963	X250	Indication of main contactor status5
Q95, F95	Switch-disconnector and miniature circuit breaker for cabinet heater (option +G300)	X289	Indication of the status of the molded case circuit breaker (option +F289)
F21	Auxiliary transformer fuses	X300	Connection terminals for cabinet heater (option +G300)
F22	Auxiliary transformer's secondary side miniature circuit breaker	X951	Connection of external emergency stop button (options +Q951 and Q963)
T22, C22	24VDC power supply and buffer with emergency stop options (+Q951 and +Q963), also with line contactor option (+F250).	X969	Connection of external Safe torque off button
X251, X4, X6, X56, X53, X51, X55, X18 and X19: for internal use.			

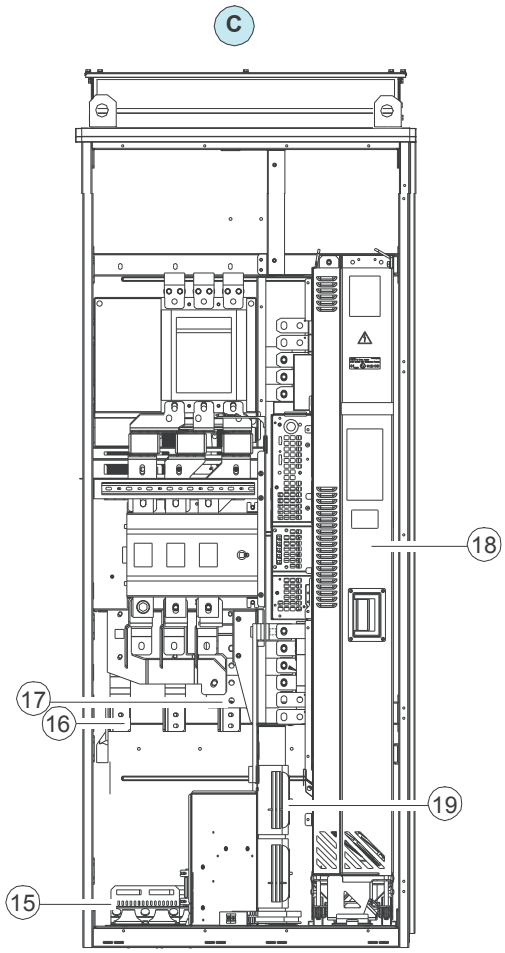


Terminals for	
X250	Auxiliary contacts of line contactor (option +F250)
X289	Auxiliary contacts of molded case circuit breaker (option +F289)
X951	Push buttons for emergency stop option +Q951 or +Q963. See section *Connecting the emergency stop push buttons (options +Q951 and +Q963) (page 109)*.
X969	External STO customer connection for safety option +Q951 or +Q963. See section *Connecting the Safe torque off circuit (page 109)*.

Cabinet layout – R10 and R11 (bottom entry and exit of cables)



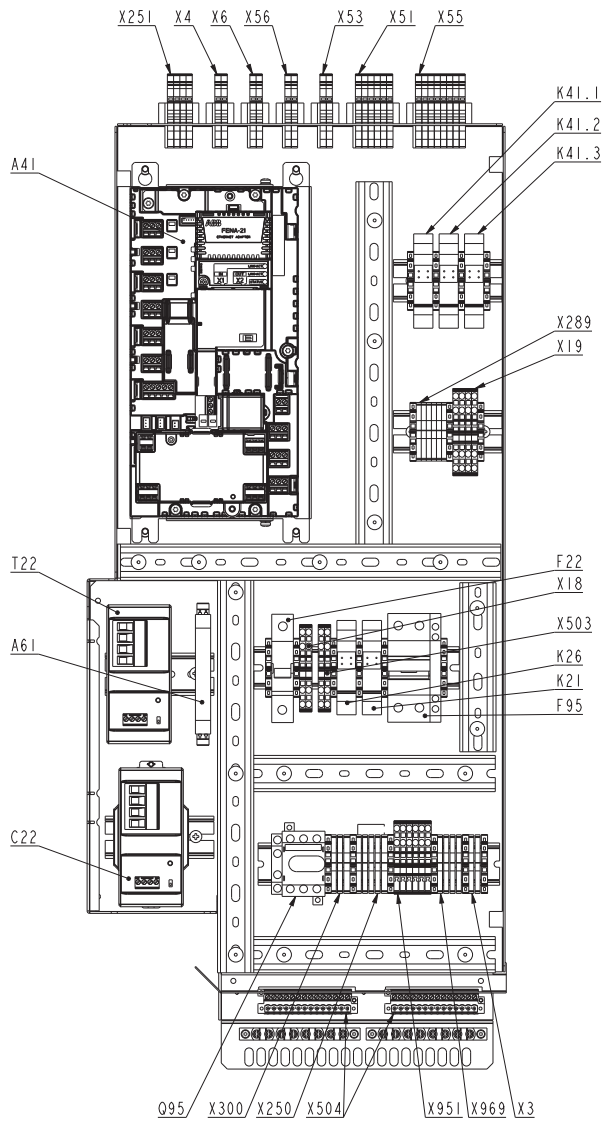
A	Cabinet door closed	7	Main switch-disconnector
B	Cabinet door open	8	AC fuses
1	Gratings for cooling air out	9	Line contactor (option +F250)
2	Operating switch	10	Lifting lugs
3	Drive control panel	11	Drive control unit
4	Main switch handle	12	Mounting plate, see section *Mounting plate (page 39)*
5	Gratings for cooling air in	13	Behind the shroud: Additional I/O terminal block (option +L504)
6	"Door" fan at the back of the mounting plate.	14	Additional fan in IP54 cabinets (option +B055)

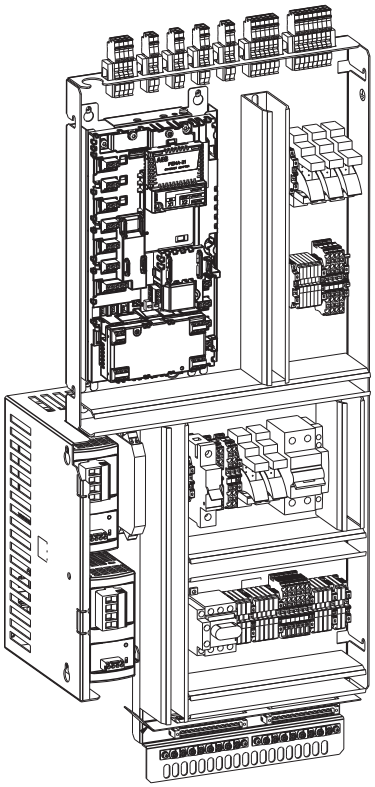


C	Cabinet door open, mounting plates and cabinet shrouds removed	17	Input cable connection terminals
15	Power and control cable entries	18	Drive module
16	Motor cable connection terminals	19	Auxiliary voltage transformer T21

Mounting plate

The components and terminals on the mounting plate of frames R10 and R11 are shown below.

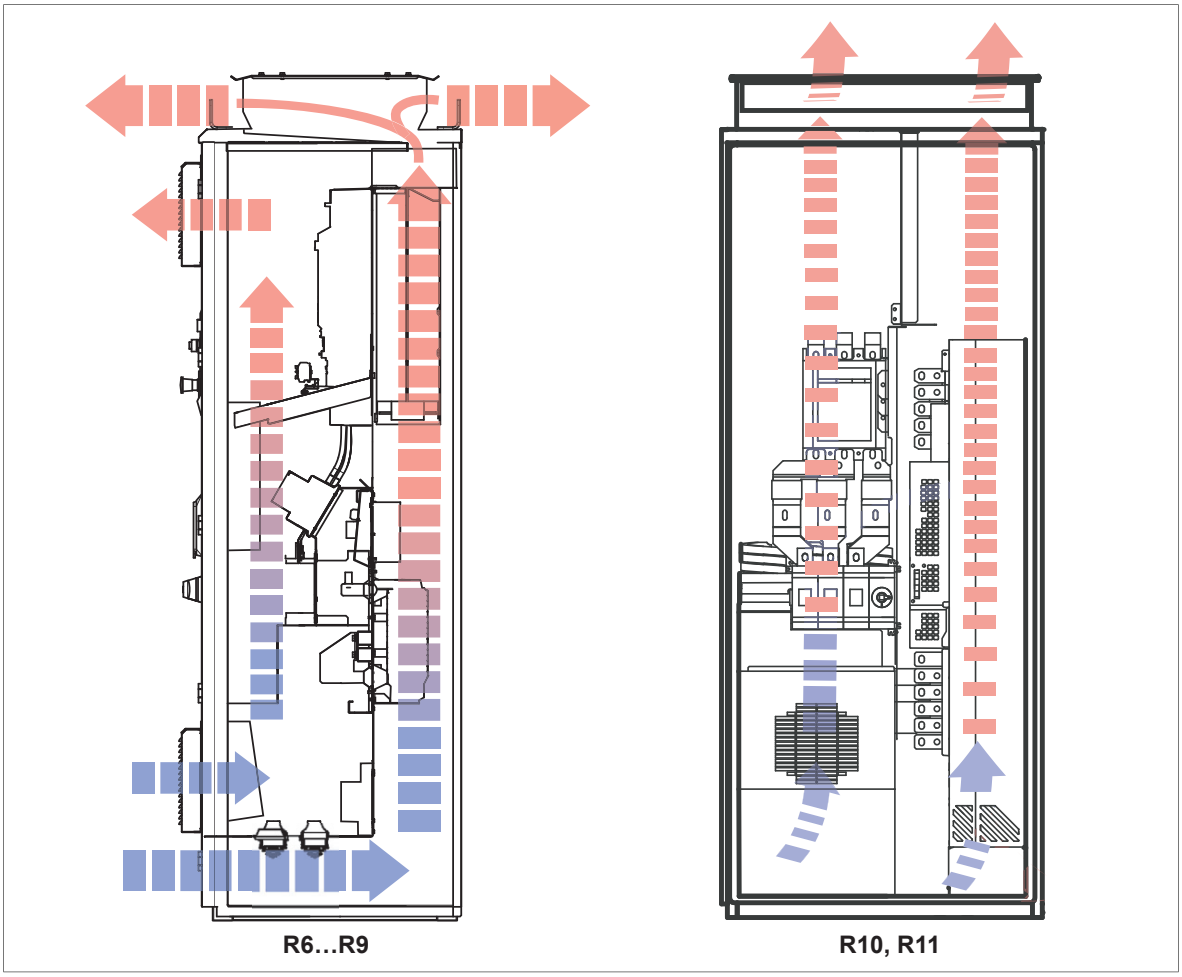




A41	Drive control unit	X289	Indication of the status of the molded case circuit breaker (option +F289)
A61	Emergency stop relay for options +Q951 and +Q963	X300	Connection terminals for cabinet heater (option +G300)
Q95, F95	Switch-disconnector and miniature circuit breaker for cabinet heater (option +G300)	X951	Connection of external emergency stop button (options +Q951 and Q963)
K26	Cabinet fan control relay	X969	Connection of external Safe torque off button
F22	Auxiliary transformer's secondary side miniature circuit breaker	X504	Additional I/O terminal block (option +L504)
T22, C22	24VDC power supply and buffer with emergency stop options (+Q951 and +Q963), also with line contactor option (+F250).	K41.1	Ready pilot light control relay (option +G327)
X3	External main contactor control	K41.2	Run pilot light control relay (option+G328)
X250	Indication of main contactor status	K41.3	Fault pilot light control relay (option +G329)
X251, X4, X6, X56, X53, X51, X55, X18 and X19: for internal use.			

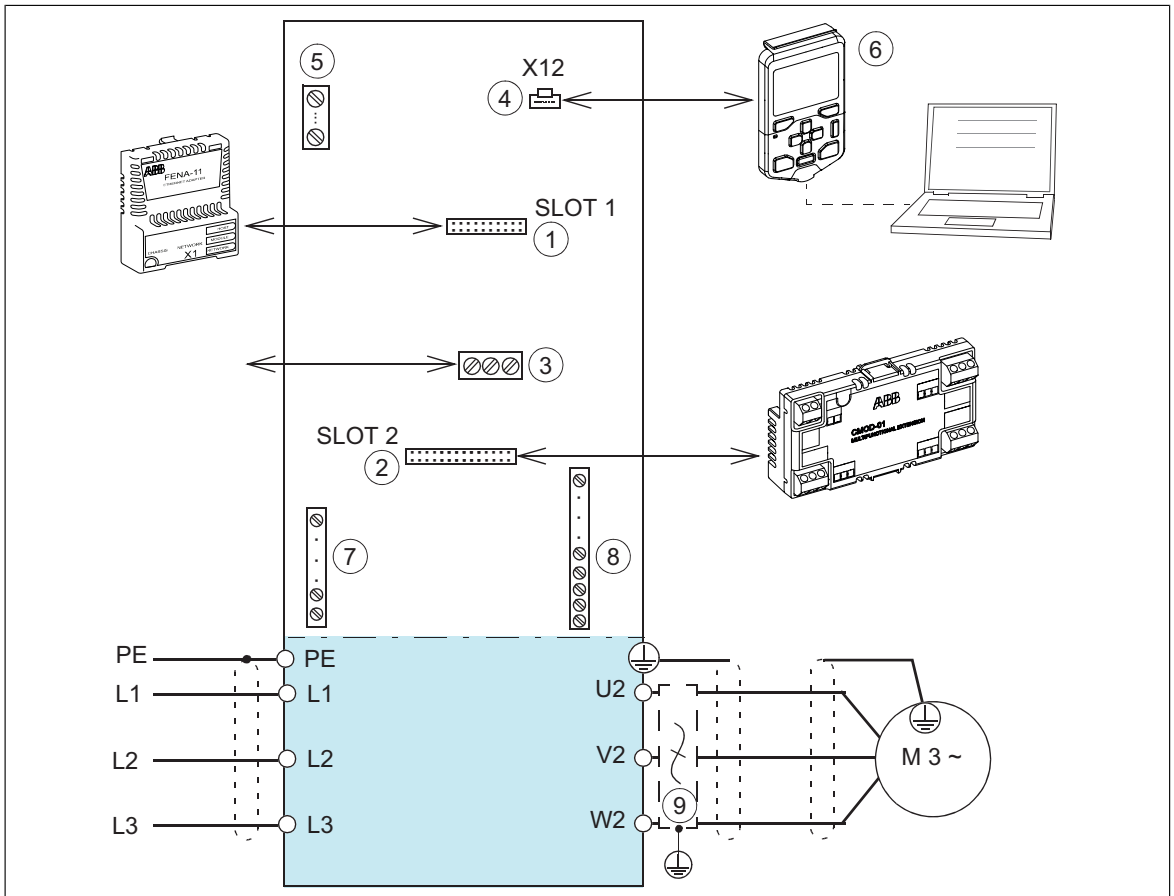
Cooling air flow

The figure below shows cooling air flow in frames R6 to R9 (side view) and in frames R10 and R11 (front view).



Overview of power and control connections

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



1	Option slot 1 for optional fieldbus adapter modules
2	Option slot 2 for optional I/O extension modules
3	Embedded fieldbus connector
4	Panel port
5	I/O terminal blocks. See section *Layout (page 115)* and section *Default I/O connection diagram (page 117)*.
6	*Control panel (page 43)*.
7	Connection terminals for options, see sections *Mounting plate – R6 to R9 (page 36)* and *Mounting plate (page 39)*.
8	*Additional terminal block X504 (option +L504) (page 46)*.
9	*du/dt filter (option +E205) (page 45)*.

Door switches and lights

	Label in English	Label in local language	Description
1	READY	-	Ready pilot light (option +G327)
2	RUN	-	Run pilot light (option+G328)
3	FAULT	-	Fault pilot light (option +G329)
4	MAIN CONT. OFF ON 	-	Operating switch with option +F250 0 Opens the main contactor (Q2) and disables starting of the drive 1 Closes the main contactor (Q2)
5	EMERGENCY STOP RESET	-	Emergency stop indication light and reset push button with options +Q951 and +Q963
6	EMERGENCY STOP	-	Emergency stop push button with options +Q951 and +Q963

Main switch-disconnector Q1

The switch-disconnector handle switches the main voltage to the drive on and off.

Control panel

The control panel is the user interface of the drive. It provides the essential controls such as Start/Stop/Direction/Reset/Reference, and the parameter settings for the control program.

One control panel can be used to control several drives through a panel link.

The control panel can be removed by pulling it forward from the top edge and disconnecting the panel cable. The panel is reinstalled in reverse order. For the use of the control panel, see the firmware manual or *ACX-AP-x Assistant control panel user's manual* (3AUA0000085685 [English]).

Control by PC tools

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

Common mode filter

The drive of frames R6 to R9 can be optionally equipped with a common mode filter. Frames R10 and R11 are equipped with a common mode filter as standard. The filter contains ferrite rings mounted around the drive AC conductors. The filter protects the motor bearings by reducing the bearing currents.

More information on when the option is required: See section *Examining the compatibility of the motor and drive (page 64)*.

Descriptions of cabinet options

Note:
All options are not available for all drive types or do not coexist with certain other options. Check actual availability with ABB.

Degree of protection

Definitions

According to IEC/EN 60529, the degree of protection is indicated by an IP code where the first numeral means protection against ingress of solid foreign objects, and the second numeral protection against ingress of water. The IP codes of the standard cabinet and options covered in this manual are defined below.

IP code	The equipment is protected …	
	First numeral	Second numeral
IP21	against ingress of solid foreign objects > 12.5 mm	against dripping (vertically falling drops)
IP42	against ingress of solid foreign objects > 1 mm	against dripping (15° tilting) water
IP54	dust-protected	against splashing water

IP21

The degree of protection of the standard drive cabinet is IP21 (UL type 1). With doors open, the degree of protection of the standard cabinet and all cabinet options is IP20. The live parts inside the cabinet are protected against contact with clear plastic shrouds or metallic gratings.

IP42 (option +B054)

This option provides the degree of protection of IP42 (UL type 1 Filtered). The air inlet gratings are covered with a metallic mesh between the inner metallic grating and the outer plastic grating.

IP54 (option +B055)

This option provides the degree of protection of IP54 (UL type 12). It provides the cabinet air inlets with filter housings containing folded board air filter mats between the inner metallic grating and the outer plastic grating. An additional fan on the cabinet roof is included.

UL listed (option +C129)

The option includes factory inspection of the cabinet according to UL 508C and the following accessories and features:

- US type main switch fuse
- US cable conduit entry (plain plate without ready-made holes)
- all components UL Listed/Recognized
- maximum supply voltage 480 V.

Related options: +H351 (top entry of cables), +H353 (top exit of cables) and +H358 (cable conduit entry)

Plinth height (options +C164 and +C179)

The standard height of the cabinet plinth is 50 mm. These options specify a plinth height of 100 mm (+C164) or 200 mm (+C179).

Empty cubicles (options +C196 to +C201)

Note:
This option is available for US only.

These options add an empty cubicle to the drive cabinet: The cubicle is equipped with blank power cable entries both at the top and the bottom.

- on the right-hand side of the converter cubicle (400 mm wide with option +C196, 600 mm wide with option +C197 and 800 mm wide with option +C198)
- on the left-hand side of the converter cubicle (400 mm wide with option +C199, 600 mm wide with option +C200 and 800 mm wide with option +C201).

du/dt filter (option +E205)

The du/dt filter protects the motor insulating system by reducing the voltage rise speed at the motor terminals. The filter also protects the motor bearings by reducing the bearing currents.

More information on when the option is required: See section *Examining the compatibility of the motor and drive (page 64)*.

Molded case circuit breaker (MCCB, option +F289)

This option replaces the standard main switch with a molded case circuit breaker. The breaker has inbuilt protection functions against overload and short-circuit. It is operated with a direct rotary handle on the cabinet door.

For US market only.

Cabinet heater with external supply (option +G300)

The option contains:

- 50 W heating elements in the cubicles where needed
- load switch for providing electrical isolation during service
- miniature circuit breaker for overcurrent protection
- terminal block for external power supply.

The heater prevents humidity condensation inside the cabinet when the drive is not running. The power output of the semiconductor-type heating elements depends on the environmental temperature. The customer must switch the heating off when it is not needed by cutting the supply voltage off.

The customer must supply the heater from an external 110…240 V AC power source.

See also

- *Connecting external power supply wires for the cabinet heater (option +G300) (page 110)*
- *Auxiliary circuit power consumption (page 213)*
- circuit diagrams delivered with drive for the actual wiring.

Top cable entry/exit (options +H351 and +H353)

The default input and output cabling direction is through the bottom of the cabinet. The top entry (+H351) and top exit (+H353) options provide power and control cable entries at the roof of the cabinet. The entries are equipped with grommets and 360° grounding hardware. The options add an additional 125 mm (4.92 in) wide cable channel to the cabinet width.

Cable conduit entry (option +H358)

The option provides US/UK conduit plates (plain 3 mm [0.12"] thick steel plates without any ready-made holes). US/UK conduit plates are provided as standard with option +C129 instead of the normal cable entries.

Additional terminal block X504 (option +L504)

The standard terminal blocks of the drive control unit are wired to the additional terminal block at the factory for customer control wiring. The terminals are spring loaded.

Cables accepted by the terminals:

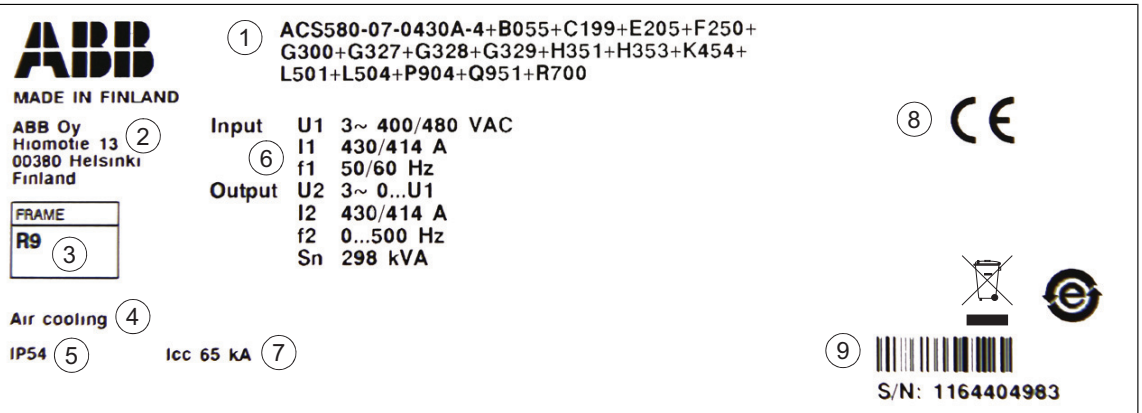
- solid wire 0.2 to 2.5 mm^2 (24 to 12 AWG)
- stranded wire with ferrule 0.25 to 2.5 mm^2 (24 to 12 AWG)
- stranded wire without ferrule 0.2 to 2.5 mm^2 (24 to 12 AWG).

Stripping length: 10 mm (0.5 in).

Note:
The option modules inserted in the slots of the control unit are not wired to the additional terminal block. The customer must connect the option module control wires directly to the modules.

Type designation label

The type designation label includes an IEC rating, appropriate markings, a type designation and a serial number, which allow identification of each unit. The type designation label is located on the front cover. An example label is shown below.



1	Type designation, see section *Type designation key* below.
2	Manufacturing address
3	Frame size
4	Cooling method
5	Degree of protection
6	Ratings, see section *Ratings (page 171)*, *Electrical power network specification (page 211)* and *Motor connection data (page 211)*.
7	Short-circuit withstand strength, see section *Electrical power network specification (page 211)*.
8	Valid markings
9	Serial number. The first digit of the serial number refers to the manufacturing plant. The next four digits refer to the unit's manufacturing year and week, respectively. The remaining digits complete the serial number so that there are no two units with the same number.

Type designation key

The type designation contains information on the specifications and configuration of the drive. The first digits from left express the basic configuration (eg, ACS580-07-0640A-4). The optional selections are given thereafter, separated by plus signs, eg, +B055. The main selections are described below. Not all selections are available for all types or with all options. For more information, refer to *ACX580-07 Ordering Information* (3AXD10000485076 available on request).

Code	Description
Basic codes	
ACS580	Product series
07	When no options are selected: cabinet-installed drive, IP21, main switch, AC fuses, ACS-AP-S assistant control panel, for frames R6 to R9 EMC filtering for first environment TN grounded systems (category C2), for frames R10 and R11 EMC filtering for second environment TN grounded systems (category C3), input choke, common mode filter in frames R10 and R11, coated boards, ACS580 standard control program, EIA/RS-485 fieldbus connector, Safe torque off function, bottom entry and exit of cables, multilingual device label sticker, USB memory stick containing all manuals.
Size	
xxxx	Refer to the rating tables, *Ratings (page 171)*

Code	Description
Voltage range	
4	380…480 V. This is indicated in the type designation label as typical input voltage level 3~400/480 V AC.
Option codes (plus codes)	
Degree of protection	
B054	IP42 (UL Type 1)
B055	IP54 (UL Type 12)
Construction	
C129	*UL listed (option +C129) (page 45)*
C164	Plinth 100 mm (3.94 in). Separate delivery.
C179	Plinth 200 mm (7.87 in). Separate delivery.
C196	Empty cabinet 400 mm on the right-hand side. For US market only. Not available for +H351 and +H353. Not available with +C164 and +C179.
C197	Empty cabinet 600 mm on the right-hand side. For US market only. Not available for +H351 and +H353. Not available with +C164 and +C179.
C198	Empty cabinet 800 mm on the right-hand side. For US market only. Not available with +C164 and +C179. Not available with +C164 and +C179.
C199	Empty cabinet 400 mm on the left-hand side. For US market only. Not available with +C164 and +C179. Not available with +C164 and +C179.
C200	Empty cabinet 600 mm on the left-hand side. For US market only. Not available with +C164 and +C179. Not available with +C164 and +C179.
C201	Empty cabinet 800 mm on the left-hand side. For US market only. Not available with +C164 and +C179. Not available with +C164 and +C179.
Filters	
E205	*du/dt filter (option +E205) (page 45)*
E208	*Common mode filter (page 44)*
Line options	
F250	Line contactor
F289	Molded case circuit breaker (MCCB) for US market only
Cabinet options	
G300	Cabinet heater (external supply). See *Cabinet heater with external supply (option +G300) (page 46)*.
G327	Ready pilot light, white
G328	Run pilot light, green
G329	Fault pilot light, red
Cabling	
H351	Top entry of cables. Additional channel: 125 mm (4.92 in) in cabinet width.
H353	Top exit of cables, Additional channel: 125 mm (4.92 in) in cabinet width.
H358	Cable conduit entry (included with +C129). See *Cable conduit entry (option +H358) (page 46)*.
Control panel	
J429	ACS-AP-W Assistant control panel with Bluetooth interface
Fieldbus adapters	
K451	FDNA-01 DeviceNet™ adapter module
K454	FPBA-01 PROFIBUS DP adapter module
K457	FCAN-01 CANopen adapter module

Code	Description
K458	FSCA-01 RS-485 adapter module
K462	FCNA-01 ControlNet™ adapter module
K469	FECA EtherCat adapter module
K470	FEPL EtherPOWERLINK adapter module
K473	FENA-11 Ethernet adapter module for EtherNet/IP™, Modbus TCP and PROFINET IO protocols
K490	Ethernet/IP adapter module
K491	Modbus/TCP adapter module
K492	PROFINET IO adapter module
I/O extensions and feedback interfaces	
L501	CMOD-01 external 24 V DC/AC and digital I/O extension module (two relay outputs and one digital output)
L504	Additional I/O terminal block (*Additional terminal block X504 (option +L504) (page 46)*)
L512	CHDI-01 115/230 V digital input extension module (six digital inputs and two relay outputs)
L523	CMOD-02 external 24 V and isolated PTC interface
L537	CPTC-02 ATEX-certified thermistor protection module
Specialties	
P931	Extended warranty for 36 month from delivery
P932	Extended warranty for 60 month from delivery
P912	Seaworthy packing
P929	Container packing
Safety functions	
Q951	Emergency stop of Category 0 with opening the main contactor or breaker
Q963	Emergency Stop, Category 0 without opening main contactor with safety relay
Q971	ATEX-certified Safe disconnection function, EX II (2) GD. Requires +L537
Printed documentation (manuals, dimensional drawings, circuit diagrams and manual language). **Note:** The delivered manual set may include manuals in English if the translation is not available.	
R700	English
R701	German
R702	Italian
R703	Dutch
R704	Danish
R705	Swedish
R706	Finnish
R707	French
R708	Spanish
R709	Portuguese
R711	Russian

4

Mechanical installation

Contents of this chapter

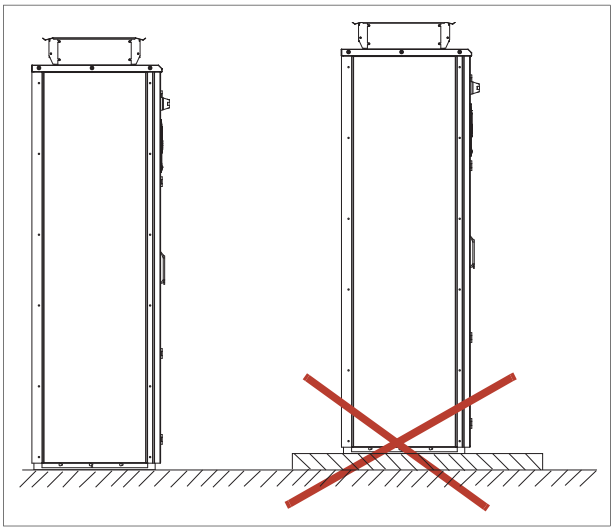
This chapter describes the mechanical installation procedure of the drive.

Examining the installation site

Examine the installation site:

- The installation site is sufficiently ventilated or cooled to remove heat from the drive. See the technical data.
- The ambient conditions of the drive meet the specifications. See the technical data.
- There is enough free space above the drive to enable cooling, maintenance, and operation of the pressure relief (if present).
- The floor that the drive cabinet is installed on is of non-flammable material, as smooth as possible, and strong enough to support the weight of the unit. Check the floor flatness with a spirit level. The maximum allowed deviation from the surface level is 5 mm in every 3 meters. Level the installation site, if necessary, as the cabinet is not equipped with adjustable feet.

Do not install the drive on an elevated platform or a recess. The module extraction/installation ramp included with the drive is only suitable for a height difference of 50 mm maximum (ie. the standard plinth height of the drive).



Necessary tools

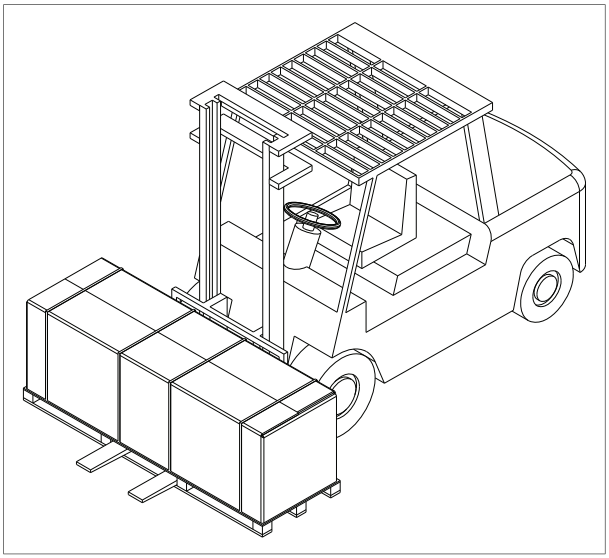
The tools required for moving the unit to its final position, fastening it to the floor and wall and tightening the connections are listed below:

- crane, fork-lift or pallet truck (check load capacity!), slate/spud bar, jack and rollers
- Pozidriv and Torx screwdrivers
- torque wrench
- set of wrenches or sockets.

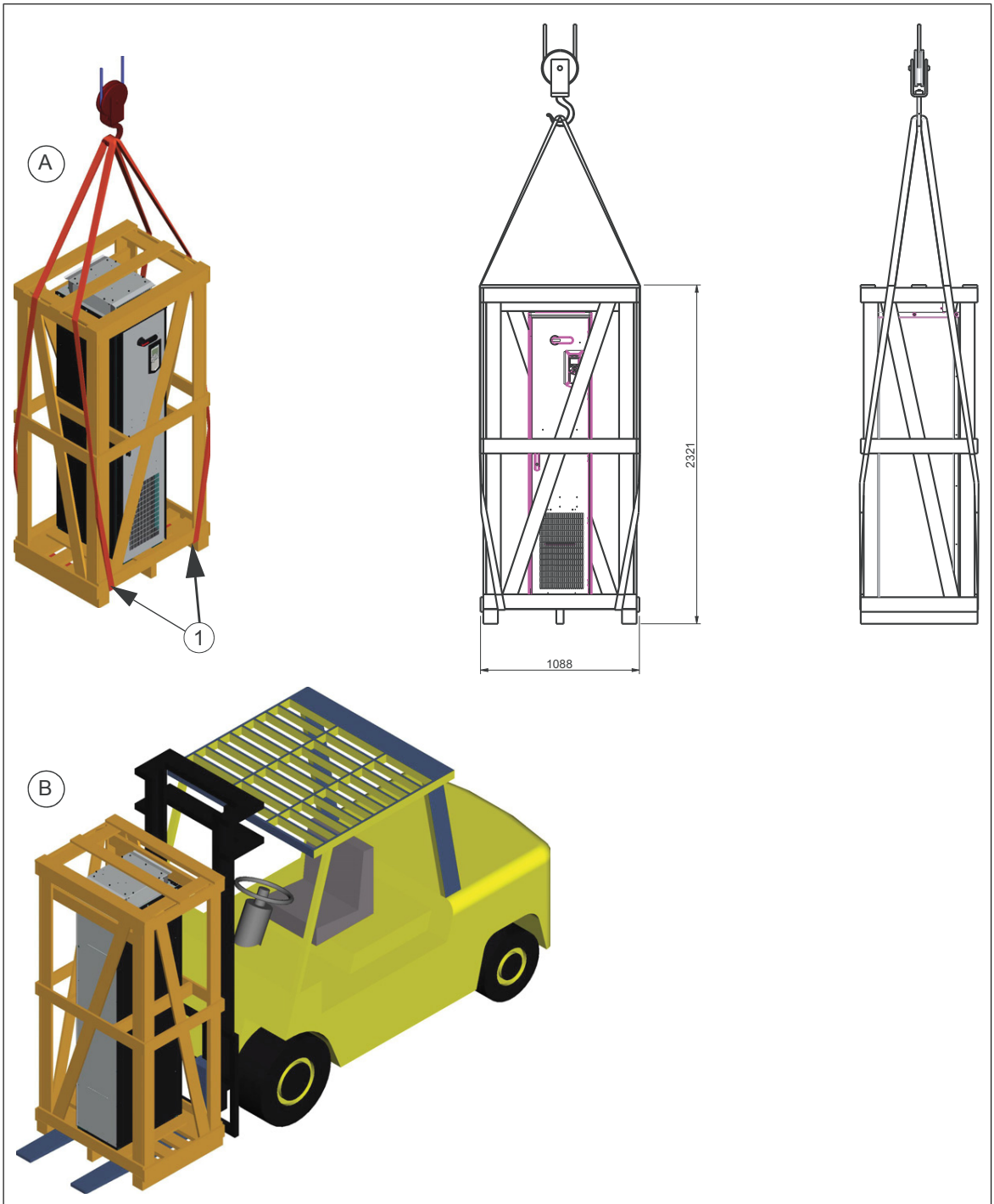
Moving and unpacking the drive

Move the drive in its original pallet in horizontal position, preferably in the original package to installation site as shown below to avoid damaging the cabinet surfaces and door devices. When you use a pallet truck, check its load capacity before you move the drive.

Horizontal package:



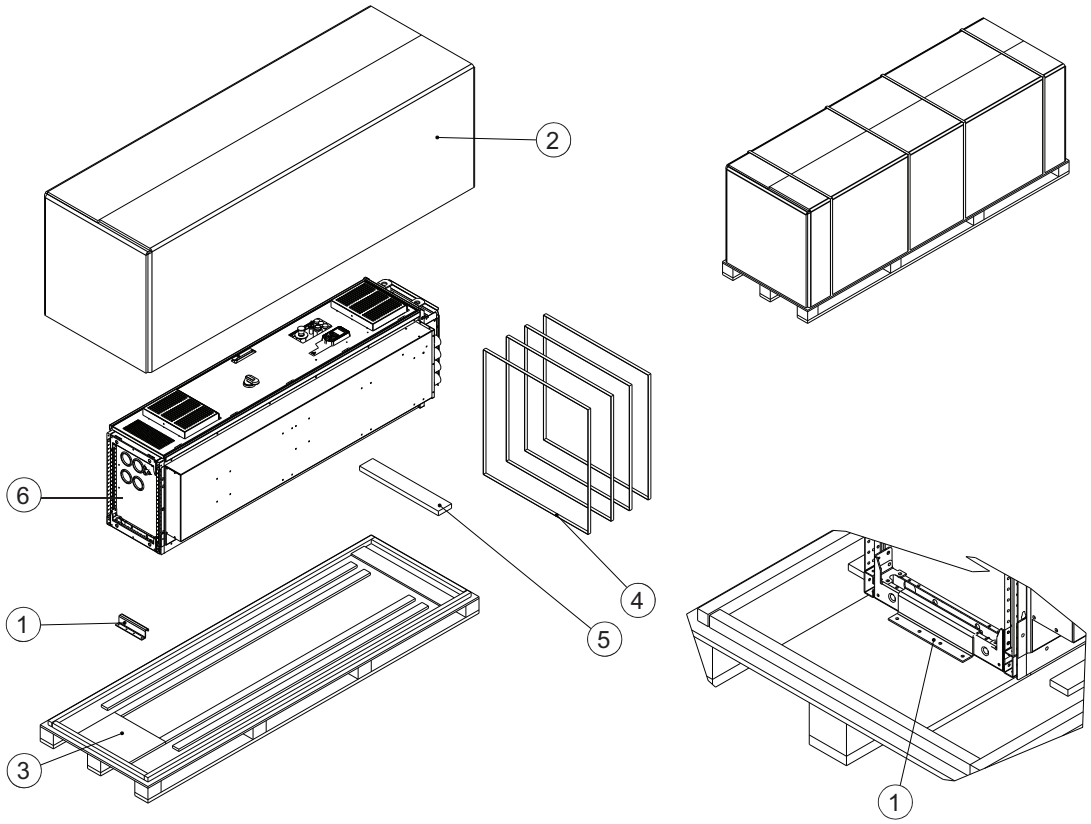
Vertical package:



A	Lifting the transport package with slings.
1	Lifting points
B	Lifting the transport package with forklift

Unpacking the transport package

This drawing shows the layout of the horizontal transport package.



1	Bracket for attaching the drive to the wooden pallet	5	Timber
2	Cardboard packing hood	6	Drive cabinet
3	Wooden pallet	-	-

Unpack the horizontal transport package as follows:

1. Cut the strips (4)
2. Remove the hood (2)
3. Undo the screws that attach the bracket (1) to the wooden pallet.
4. Remove the plastic wrapping.
5. After checking the delivery (see section *Checking the delivery (page 55)*), lift the drive cabinet to its installation place (see section *Lifting the cabinet (page 56)*).

Unpack the vertical transport package as follows:

1. Undo the screws that hold the wooden elements of the transport crate together.
2. Remove the elements.
3. Remove the clamps with which the drive cabinet is mounted onto the transport pallet by undoing the fastening screws.
4. Remove the plastic wrapping.

Checking the delivery

The drive delivery contains:

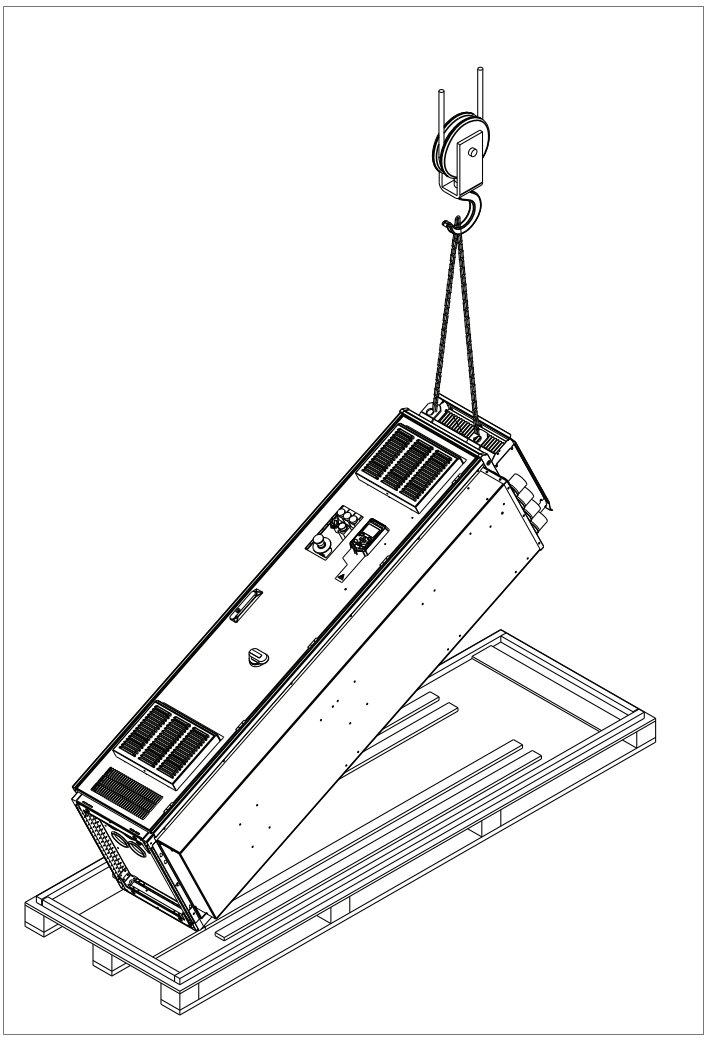
- drive cabinet

- option modules (if ordered) installed onto the control unit at the factory
- appropriate drive and option module manuals
- delivery documents.

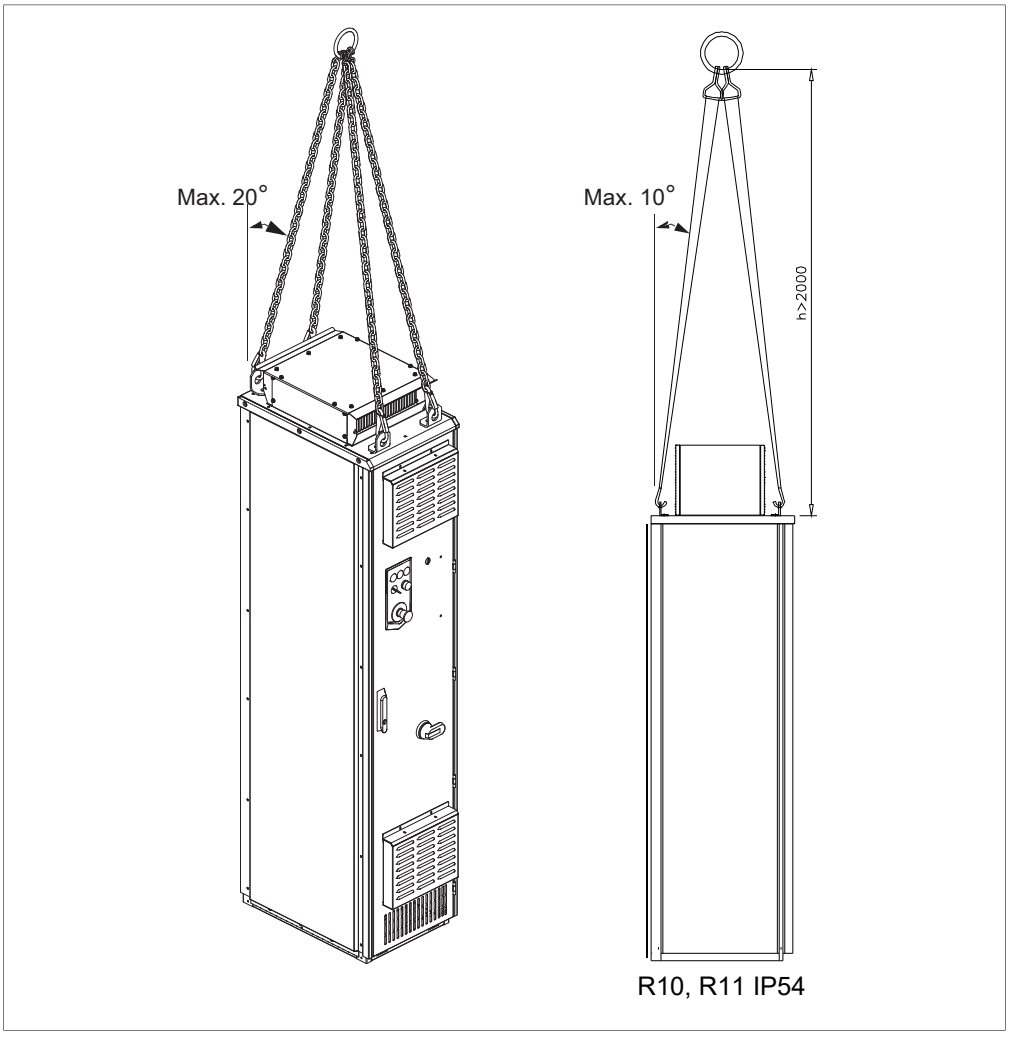
Check that there are no signs of damage. Before attempting installation and operation, check the information on the type designation labels of the drive to verify that the delivery is of the correct type.

Lifting the cabinet

Lift the drive cabinet up using its lifting lugs.



Lift the cabinet to its position. Maximum allowed angle of the lifting slings is 20° (10° for frames R10 and R11, IP54).

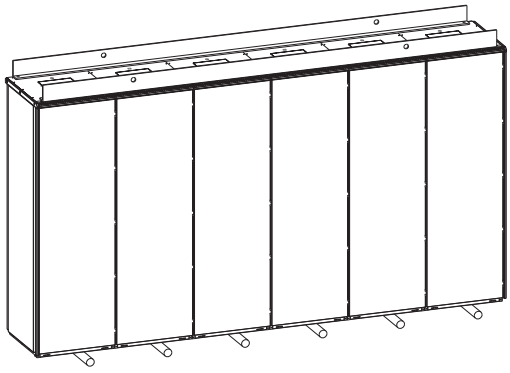


R10, R11 IP54

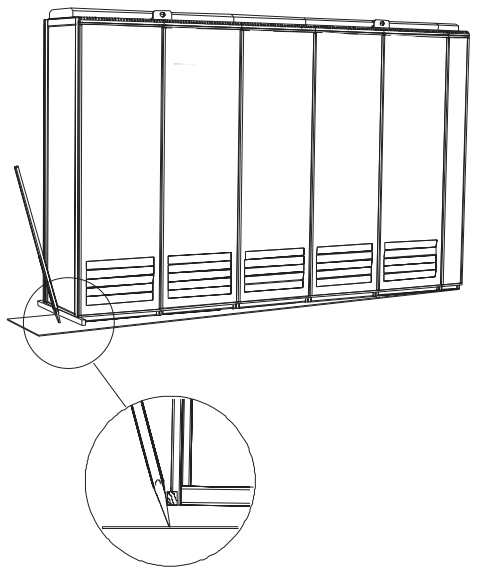
Moving the cabinet after unpacking

Move drive cabinet carefully in the upright position. Avoid tilting. The center of gravity of the cabinet is high.

Moving on rollers

	Lay the cabinet on the rollers and move it carefully until close to its final location. Remove the rollers by lifting the unit with a crane, forklift, pallet truck or jack.

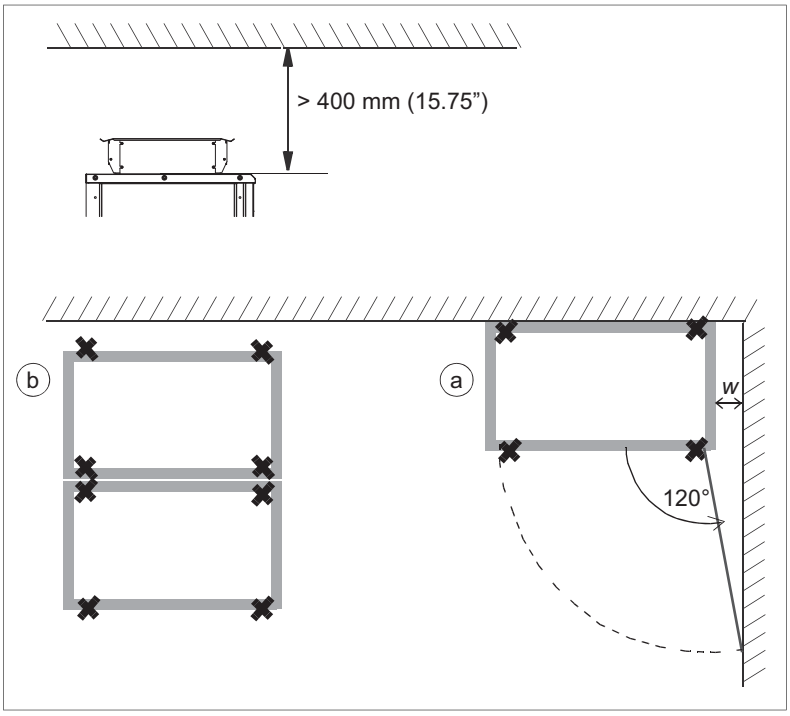
Final placement

	Move the cabinet into its final position with an iron bar. Place a wooden piece at the bottom edge of the cabinet in order not to damage the cabinet frame with the iron bar.

Attaching the cabinet to the floor and wall or roof

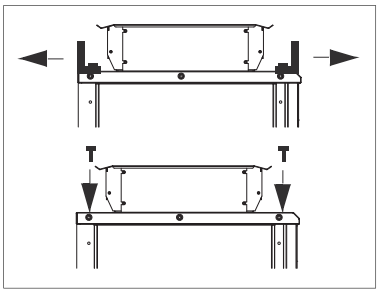
General rules

- Install the drive cabinet in an upright vertical position with its back against a wall (a), or back-to-back with another cabinet (b).
- Leave 400 mm (15.75 in) free space above the basic roof level of the cabinet for cooling. IP54 (UL Type 12) fan replacement requires 320 mm (12.6 in) free space above.
- Leave some space at the side where the cabinet outmost hinges are to allow the doors to open sufficiently (w). The doors must open 120° to allow the drive module replacement.



Note 1: Make height adjustments before attaching the cabinet with metal shims between the cabinet bottom and the floor.

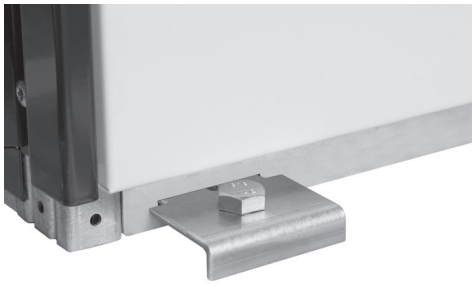
Note 2: If you remove the lifting eyes, attach the bolts back to retain the degree of protection of the cabinet.

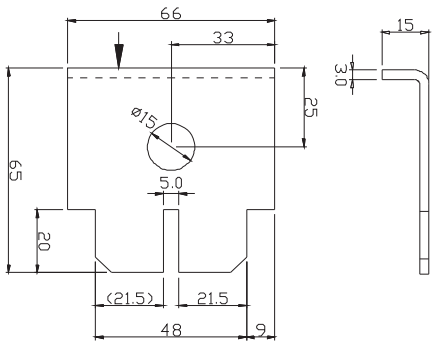


Attaching methods

Attach the cabinet to the floor from the front and rear edge by using clamps delivered with the drive, or bolt the cabinet to the floor through the holes inside if they are accessible.

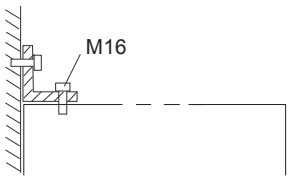
Alternative 1 – Clamping



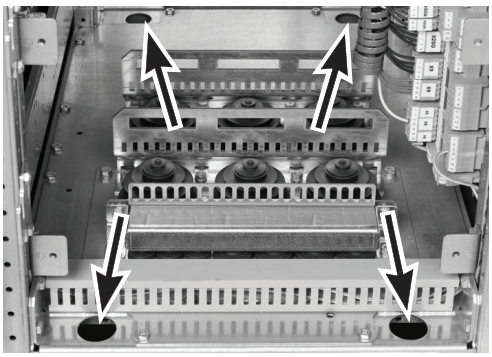


Clamp dimensions

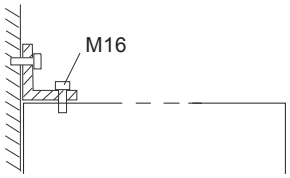
1. Insert the clamps into the twin slots along the front and rear edges of the cabinet frame body and attach them to the floor with a bolt. The recommended maximum distance between the clamps in the front edge is 800mm (31.5").
2. If floor mounting from back is not possible, attach the cabinet at the top to wall with L-brackets (not included in the delivery) using the lifting lug attaching holes.



Alternative 2 – Using the holes inside the cabinet



1. Attach the cabinet to the floor through the bottom attaching holes with M10 to M12 (3/8” to 1/2”) bolts. The recommended maximum distance between the front edge attaching points is 800 mm (31.5”).
2. If the back attaching holes are not accessible, attach the cabinet at the top to wall with L-brackets (not included in the delivery) using the lifting lug attaching holes.

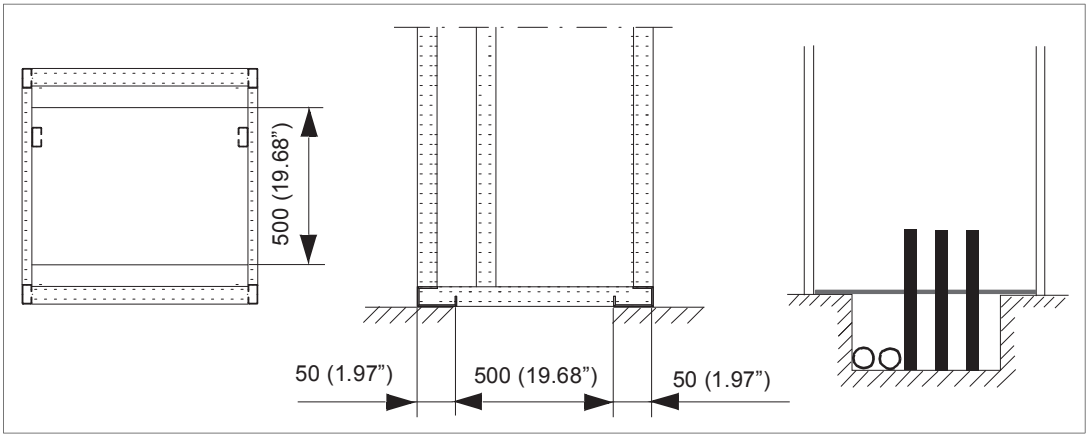


Miscellaneous

Cable duct in the floor below the cabinet

A cable duct can be constructed below the 500 mm wide middle part of the cabinet. The cabinet weight lies on the two 50 mm wide transverse sections which the floor must carry.

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



Arc welding

ABB does not recommend attaching the cabinet by arc welding. However, if arc welding is the only option, connect the return conductor of the welding equipment to the cabinet frame at the bottom within 0.5 meters (1’6”) of the welding point.

Note:
The thickness of the zinc plating of the cabinet frame is 100 to 200 micrometers (4 to 8 mil).

WARNING!
Make sure that the return wire is connected correctly. Welding current must not return via any component or cabling of the drive. If the welding return wire is

connected improperly, the welding circuit can damage electronic circuits in the cabinet.

WARNING!
Do not inhale the welding fumes.

5

Guidelines for planning the electrical installation

Contents of this chapter

This chapter contains instructions for planning the electrical installation of the drive. Some instructions are mandatory to follow in every installation, others provide useful information that only concerns certain applications.

Limitation of liability

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

Selecting the supply disconnecting device

The drive is equipped with a main switch-disconnector as standard. The disconnector can be locked to the open position for installation and maintenance work.

Selecting the main contactor

The drive can be equipped with a line contactor (option +F250).

Examining the compatibility of the motor and drive

Use asynchronous AC induction motors, permanent magnet synchronous motors, AC induction servomotors or ABB synchronous reluctance motors (SynRM motors) with the drive.

Select the motor size and drive type from the rating table on basis of the AC line voltage and motor load. You can find the rating table in the appropriate drive or inverter unit hardware manual. You can also use the DriveSize PC tool.

Make sure that the motor withstands the maximum peak voltage in the motor terminals. See *Requirements table (page 64)*. For basics of protecting the motor insulation and bearings in drive systems, see *Protecting the motor insulation and bearings (page 64)*.

Note:

- Consult the motor manufacturer before using a motor whose nominal voltage differs from the AC line voltage connected to the drive input.
- The voltage peaks at the motor terminals are relative to the supply voltage of the drive, not the drive output voltage.
- If the motor and drive are not of the same size, consider the operation limits of the drive control program for the motor nominal voltage and current. See the appropriate parameters in the firmware manual.

Protecting the motor insulation and bearings

The drive employs modern IGBT inverter technology. Regardless of frequency, the drive output comprises pulses of approximately the drive DC bus voltage with a very short rise time. The pulse voltage can almost double at the motor terminals, depending on the attenuation and reflection properties of the motor cable and the terminals. This can cause additional stress on the motor and motor cable insulation.

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

d*u*/d*t* filters protect motor insulation system and reduce bearing currents. Common mode filters mainly reduce bearing currents. Insulated N-end (non-drive end) bearings protect the motor bearings.

Requirements table

These tables show how to select the motor insulation system and when a drive d*u*/d*t* and common mode filters and insulated N-end (non-drive end) motor bearings are required. Ignoring the requirements or improper installation may shorten motor life or damage the motor bearings and voids the warranty.

This table shows the requirements when an ABB motor is in use.

<table>
<tr><th rowspan="3">Motor type</th><th rowspan="3">Nominal AC supply voltage</th><th colspan="4">Requirement for</th></tr>
<tr><th>Motor insulation system</th><th colspan="3">ABB du/dt and common mode filters, insulated N-end motor bearings</th></tr>
<tr><th>P_N < 100 kW and frame size < IEC 315</th><th>100 kW ≤ P_N < 350 kW or IEC 315 ≤ frame size < IEC 400</th><th>P_N ≥ 350 kW or frame size ≥ IEC 400</th></tr>
<tr><th></th><th></th><th>P_N < 134 hp and frame size < NEMA 500</th><th>134 hp ≤ P_N < 469 hp or NEMA 500 ≤ frame size ≤ NEMA 580</th><th>P_N ≥ 469 hp or frame size > NEMA 580</th></tr>
<tr><td rowspan="5">Random-wound M2_, M3_ and M4_</td><td>U_N ≤ 500 V</td><td>Standard</td><td>-</td><td>+ N</td><td>+ N + CMF</td></tr>
<tr><td rowspan="3">500 V < U_N ≤ 600 V</td><td>Standard</td><td>+ du/dt</td><td>+ N + du/dt</td><td>+ N + du/dt + CMF</td></tr>
<tr><td colspan="4">or</td></tr>
<tr><td>Reinforced</td><td>-</td><td>+ N</td><td>+ N + CMF</td></tr>
<tr><td>600 V < U_N ≤ 690 V (cable length ≤ 150 m)</td><td>Reinforced</td><td>+ du/dt</td><td>+ N + du/dt</td><td>+ N + du/dt + CMF</td></tr>
<tr><td>600 V < U_N ≤ 690 V (cable length > 150 m)</td><td>Reinforced</td><td>-</td><td>+ N</td><td>+ N + CMF</td></tr>
<tr><td rowspan="2">Form-wound HX_ and AM_</td><td rowspan="2">380 V < U_N ≤ 690 V</td><td rowspan="2">Standard</td><td rowspan="2">n.a.</td><td rowspan="2">+ N + CMF</td><td>P_N < 500 kW: +N + CMF</td></tr>
<tr><td>P_N ≥ 500 kW: +N + du/dt + CMF</td></tr>
<tr><td>Old [1] form-wound HX_ and modular</td><td>380 V < U_N ≤ 690 V</td><td>Check with the motor manufacturer.</td><td colspan="3">+ N + du/dt with voltages over 500 V + CMF</td></tr>
<tr><td rowspan="2">Random-wound HX_ and AM_ [2]</td><td>0 V < U_N ≤ 500 V</td><td rowspan="2">Enamelled wire with fiber glass taping</td><td colspan="3">+ N + CMF</td></tr>
<tr><td>500 V < U_N ≤ 690 V</td><td colspan="3">+ N + du/dt + CMF</td></tr>
<tr><td>HDP</td><td colspan="4">Consult the motor manufacturer.</td></tr>
</table>

[1] manufactured before 1.1.1998

[2] For motors manufactured before 1.1.1998, check for additional instructions with the motor manufacturer.

This table shows the requirements when a non-ABB motor is in use.

Motor type	Nominal AC supply voltage	Requirement for			
		Motor insulation system	ABB d*u*/d*t* and common mode filters, insulated N-end motor bearings		
			P_N < 100 kW and frame size < IEC 315	**100 kW ≤ P_N < 350 kW or IEC 315 ≤ frame size < IEC 400**	**P_N ≥ 350 kW or frame size ≥ IEC 400**
			P_N < 134 hp and frame size < NEMA 500	**134 hp ≤ P_N < 469 hp or NEMA 500 ≤ frame size ≤ NEMA 580**	**P_N ≥ 469 hp or frame size > NEMA 580**
Random-wound and form-wound	U_N ≤ 420 V	Standard: $\hat{U}_{LL}$ = 1300 V	-	+ N or CMF	+ N + CMF
	420 V < U_N ≤ 500 V	Standard: $\hat{U}_{LL}$ = 1300 V	+ d*u*/d*t*	+ d*u*/d*t* + (N or CMF)	+ N + d*u*/d*t* + CMF
		or			
		Reinforced: $\hat{U}_{LL}$ = 1600 V, 0.2 micro-second rise time	-	+ N or CMF	+ N + CMF
	500 V < U_N ≤ 600 V	Reinforced: $\hat{U}_{LL}$ = 1600 V	+ d*u*/d*t*	+ d*u*/d*t* + (N or CMF)	+ N + d*u*/d*t* + CMF
		or			
		Reinforced: $\hat{U}_{LL}$ = 1800 V	-	+ N or CMF	+ N + CMF
	600 V < U_N ≤ 690 V	Reinforced: $\hat{U}_{LL}$ = 1800 V	+ d*u*/d*t*	+ d*u*/d*t* + N	+ N + d*u*/d*t* + CMF
		Reinforced: $\hat{U}_{LL}$ = 2000 V, 0.3 micro-second rise time [1)]	-	+ N + CMF	+ N + CMF

1) If the intermediate DC circuit voltage of the drive is increased from the nominal level due to long term resistor braking cycles, check with the motor manufacturer if additional output filters are needed in the applied drive operation range.

The abbreviations used in the tables are defined below.

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

Availability of d*u*/d*t* filter and common mode filter by drive or inverter type

Product type	Availability of du/dt filter	Availability of common mode filter (CMF)
ACS580-07	+E205	+E208

Additional requirements for explosion-safe (EX) motors

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

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

Use the selection criteria given for non-ABB motors.

Additional requirements for braking applications

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

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

Additional requirements for the regenerative and low harmonics drives

It is possible to increase the intermediate circuit DC voltage from the nominal (standard) level with a parameter in the control program. If you choose to do this, select the motor insulation system which withstands the increased DC voltage level.

Additional requirements for ABB high-output and IP23 motors

The rated output power of high output motors is higher than what is stated for the particular frame size in EN 50347 (2001).

This table shows the requirements for protecting the motor insulation and bearings in drive systems for ABB random-wound motor series (for example, M3AA, M3AP and M3BP).

Nominal AC supply voltage	Requirement for			
	Motor insulation system	ABB d*u*/d*t* and common mode filters, insulated N-end motor bearings		
		P_N < 100 kW	100 kW ≤ P_N < 200 kW	P_N ≥ 200 kW
		P_N < 140 hp	140 hp ≤ P_N < 268 hp	P_N ≥ 268 hp
U_N ≤ 500 V	Standard	-	+ N	+ N + CMF
500 V < U_N ≤ 600 V	Standard	+ d*u*/d*t*	+ d*u*/d*t* + N	+ d*u*/d*t* + N + CMF
	or			
	Reinforced	-	+ N	+ N + CMF
600 V < U_N ≤ 690 V	Reinforced	+ d*u*/d*t*	+ d*u*/d*t* + N	+ d*u*/d*t* + N + CMF

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

The rated output power of high-output motors is higher than what is stated for the particular frame size in EN 50347 (2001).

If you plan to use a non-ABB high-output motor or an IP23 motor, consider these additional requirements for protecting the motor insulation and bearings in drive systems:

- If motor power is below 350 kW: Equip the drive and/or motor with the filters and/or bearings according to the table below.
- If motor power is above 350 kW: Consult the motor manufacturer.

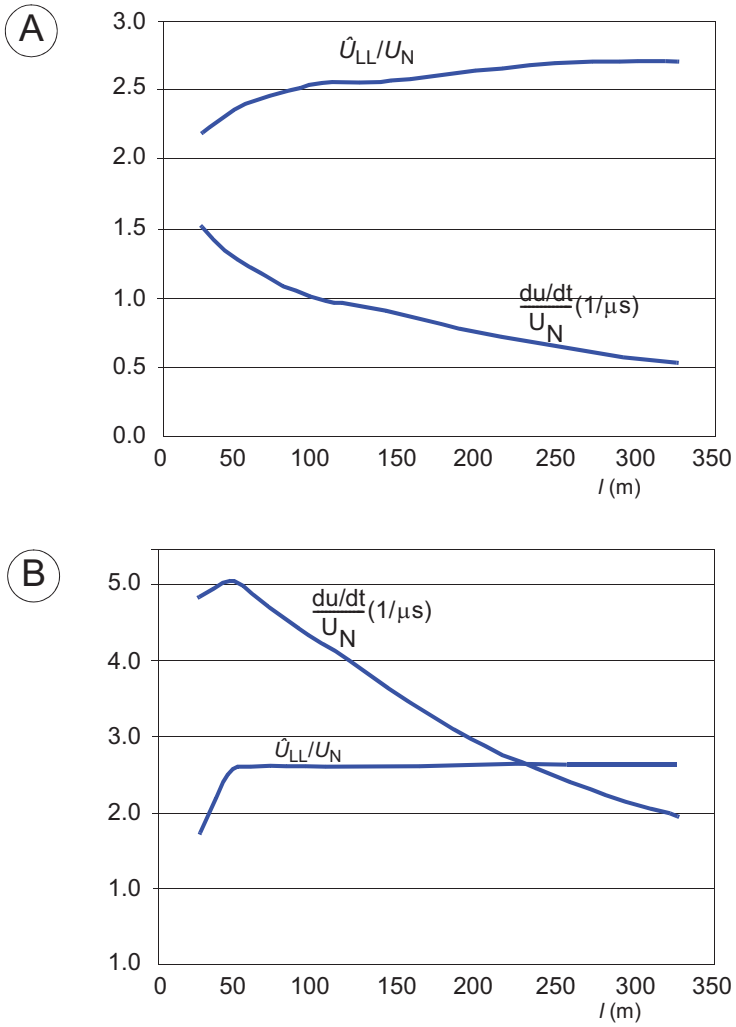
Nominal AC supply voltage	**Requirement for**		
	Motor insulation system	**ABB d*u*/d*t* and common mode filters, insulated N-end motor bearings**	
		P_N < 100 kW or frame size < IEC 315	**100 kW < P_N < 350 kW or IEC 315 < frame size < IEC 400**
		P_N < 134 hp or frame size < NEMA 500	**134 hp < P_N < 469 hp or NEMA 500 < frame size < NEMA 580**
$U_N \leq 500$ V	Standard: $\hat{U}_{LL}$ = 1300 V	+ N or CMF	+ N or CMF
420 V < U_N < 500 V	Standard: $\hat{U}_{LL}$ = 1300 V	+ d*u*/d*t* + (N or CMF)	+ N + d*u*/d*t* + CMF
	or		
	Reinforced: $\hat{U}_{LL}$ = 1600 V, 0.2 microsecond rise time	+ N or CMF	+ N or CMF
500 V < $U_N \leq$ 600 V	Reinforced: $\hat{U}_{LL}$ = 1600 V	+ d*u*/d*t* + (N or CMF)	+ N + d*u*/d*t* + 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	+ N + d*u*/d*t*	+ N + d*u*/d*t* + CMF
	Reinforced: $\hat{U}_{LL}$ = 2000 V, 0.3 microsecond rise time [1)]	+ N + CMF	+ N + CMF

1) If the intermediate DC circuit voltage of the drive is increased from the nominal level due to long term resistor braking cycles, check with the motor manufacturer if additional output filters are needed in the applied drive operation range.

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

The diagrams below show the relative peak line-to-line voltage and rate of change of voltage as a function of the motor cable length. If you need to calculate the actual peak voltage and voltage rise time considering the actual cable length, proceed as follows:

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



A	Drive with du/dt filter
B	Drive without du/dt filter
l	Motor cable length
$\hat{U}_{LL}/U_N$	Relative peak line-to-line voltage
$(du/dt)/U_N$	Relative d*u*/d*t* value

Additional note for common mode filters

Common mode filters are available as plus code option +E208.

Selecting the power cables

General guidelines

Select the input power and motor cables according to local regulations.

- **Current:** Select a cable capable of carrying the drive (or motor) nominal current.
- **Temperature:** For an IEC installation, select a cable rated for at least 70 °C (90 °C for IP55 [UL Type 12]) maximum permissible temperature of conductor in continuous use. For North America, select a cable rated for at least 90 °C (194 °F).
- **Voltage:** 600 V AC cable is accepted for up to 500 V AC. 750 V AC cable is accepted for up to 600 V AC. 1000 V AC cable is accepted for up to 690 V AC.

To comply with the EMC requirements of the CE mark, use one of the preferred cable types. See *Preferred power cable types (page 71)*.

Symmetrical shielded cable reduces electromagnetic emission of the whole drive system as well as the stress on motor insulation, bearing currents and wear.

Metal conduit reduces electromagnetic emission of the whole drive system.

The protective conductor must always have an adequate conductivity.

Unless local wiring regulations state otherwise, the cross-sectional area of the protective conductor must agree with the conditions that require automatic disconnection of the supply required in 411.3.2. of IEC 60364-4-41:2005 and be capable of withstanding the prospective fault current during the disconnection time of the protective device. The cross-sectional area of the protective conductor can either be selected from the table below or calculated according to 543.1 of IEC 60364-5-54.

This table shows the minimum cross-sectional area of the protective conductor related to the phase conductor size according to IEC 61800-5-1 when the phase conductor and the protective conductor are made of the same metal. If this is not so, the cross-sectional area of the protective earthing conductor shall be determined in a manner which produces a conductance equivalent to that which results from the application of this table.

Cross-sectional area of the phase conductors S (mm^2)	**Minimum cross-sectional area of the corresponding protective conductor S_p (mm^2)**
S ≤ 16	S [1), 2)]
16 < S ≤ 35	16
35 < S	S/2

1) Drive safety standard IEC/EN 61800-5-1:
- use a protective earth conductor with a cross-section of at least 10 mm^2 (8 AWG) Cu or 16 mm^2 (6 AWG) Al, or
- use a second protective earth conductor of the same cross-sectional area as the original protective earthing conductor, or
- use a device which automatically disconnects the supply if the protective earth conductor breaks.

2) Drive safety standard IEC/EN 61800-5-1: If the protective earth conductor is separate (ie, it does not form part of the input power cable or the input power cable enclosure), the cross section must be at least:
- 2.5 mm^2 (14 AWG) when the conductor is mechanically protected, or
- 4 mm^2 (12 AWG) when the conductor is not mechanically protected.

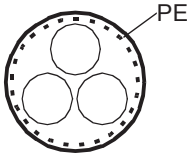
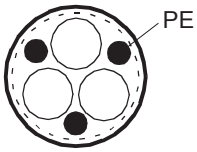
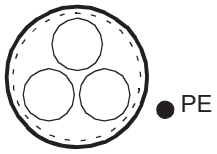
Typical power cable sizes

See the technical data of the drive (or unit).

Power cable types

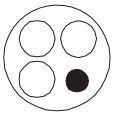
Preferred power cable types

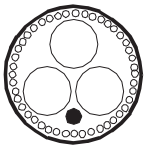
This section presents the preferred cable types. Check with local/state/country electrical codes for allowance.

Cable type	Use as input power cabling	Use as motor cabling
 Symmetrical shielded (or armored) cable with three phase conductors and concentric PE conductor as shield (or armor)	Yes	Yes
 Symmetrical shielded (or armored) cable with three phase conductors and symmetrically constructed PE conductor and a shield (or armor)	Yes	Yes
 Symmetrical shielded (or armored) cable with three phase conductors and a shield (or armor), and separate PE conductor/cable [1)]	Yes	Yes

[1)] A separate PE conductor is required if the conductivity of the shield (or armor) is not sufficient for the PE use.

Alternate power cable types

Cable type	Use as input power cabling	Use as motor cabling
 Four-conductor cabling in PVC conduit or jacket (three phase conductors and PE)	Yes with phase conductor smaller than 10 mm² (8 AWG).	Yes with phase conductor smaller than 10 mm² (8 AWG), or motors up to 30 kW (40 hp). **Note:** Shielded or armored cable, or cabling in metal conduit is always recommended to minimize radio frequency interference.
 Four-conductor cabling in metal conduit (three phase conductors and PE), eg, EMT, or four-conductor armored cable	Yes	Yes with phase conductor smaller than 10 mm² (8 AWG) or motors up to 30 kW (40 hp)

Cable type	Use as input power cabling	Use as motor cabling
 Well-shielded (Al/Cu shield or armor) four-conductor cable (three phase conductors and a PE)	Yes	Yes with motors up to 100 kW (135 hp). A potential equalization between the frames of motor and driven equipment is required.

Not allowed power cable types

Cable type	Use as input power cabling	Use as motor cabling
 Symmetrical shielded cable with individual shields for each phase conductor	No	No

Additional guidelines, North America

ABB recommends the use of conduit for power wiring to the drive and between the drive and the motor(s). Due to the variety of application needs, metallic and non-metallic conduit can be used. ABB prefers the use of metallic conduit.

The following table shows examples of various materials and methods for wiring the drive in the intended application. See NEC 70 along with state and local codes for the appropriate materials for your application.

In all applications, ABB prefers the use of symmetrical shielded VFD cable between drive and motor(s).

Wiring method	Notes
Conduit - Metallic [1) 2)]	
Electrical metallic tubing: Type EMT	• Use separate conduit run for each motor. • Do not run power feed wiring and motor wiring in the same conduit.
Rigid metal conduit: Type RMC	
Liquid-tight flexible metal electrical conduit: Type LFMC	
Conduit - Non-metallic [2) 3)]	
Liquid-tight flexible non-metallic conduit: Type LFNC	• Use separate conduit run for each motor. • Do not run power feed wiring and motor wiring in the same conduit.
Wireways [2)]	
Metallic	• Use output conductors require separation from motor feed and other low voltage conductors. • Do not run outputs of multiple drives in parallel. Bundle each cable together and use separator where possible.

Wiring method	Notes
Free air[2)]	
Enclosures, air handlers, etc.	• Allowed internally in enclosures when in accordance with UL.

1) Metallic conduit may be used as an additional ground path, provided this path is a solid path capable of handling ground currents.
2) See 70 (NEC), UL, and local codes for your application.
3) Non-metallic conduit use underground is allowed; however, these installations inherently have an increased chance for nuisance problems due to the potential for water/moisture in the conduit. Water/moisture in the conduit increases the likelihood of VFD faults or warnings. Proper installation is required to ensure there is no intrusion of water/moisture.

Metal conduit

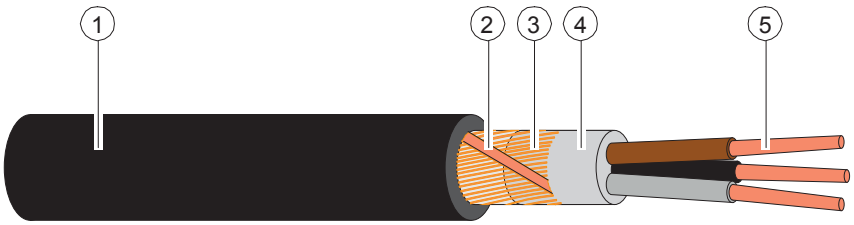
Couple separate parts of a metal conduit together: bridge the joints with a ground conductor bonded to the conduit on each side of the joint. Also bond the conduits to the drive enclosure and motor frame. Use separate conduits for input power, motor, brake resistor, and control wiring.

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

Power cable shield

If the cable shield is used as the sole protective earth (PE) conductor, make sure that its conductivity agrees with the PE conductor requirements.

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



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

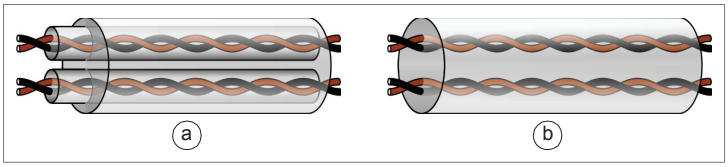
Selecting the control cables

Shielding

Only use shielded control cables.

Use a double-shielded twisted pair cable for analog signals. This type of cable is recommended for the pulse encoder signals also. Employ one individually shielded pair for each signal. Do not use common return for different analog signals.

A double-shielded cable (figure a below) is the best alternative for low-voltage digital signals but single-shielded (b) twisted pair cable is also acceptable.



Signals in separate cables

Run analog and digital signals in separate, shielded cables. Do not mix 24 V DC and 115/230 V AC signals in the same cable.

Signals that can be run in the same cable

If their voltage does not exceed 48 V, relay-controlled signals can be run in the same cables as digital input signals. The relay-controlled signals should be run as twisted pairs.

Relay cable type

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

Control panel to drive connection

Use EIA-485 with male RJ-45 connector, cable type Cat 5e or better. The maximum permitted length of the cable is 100 m (328 ft).

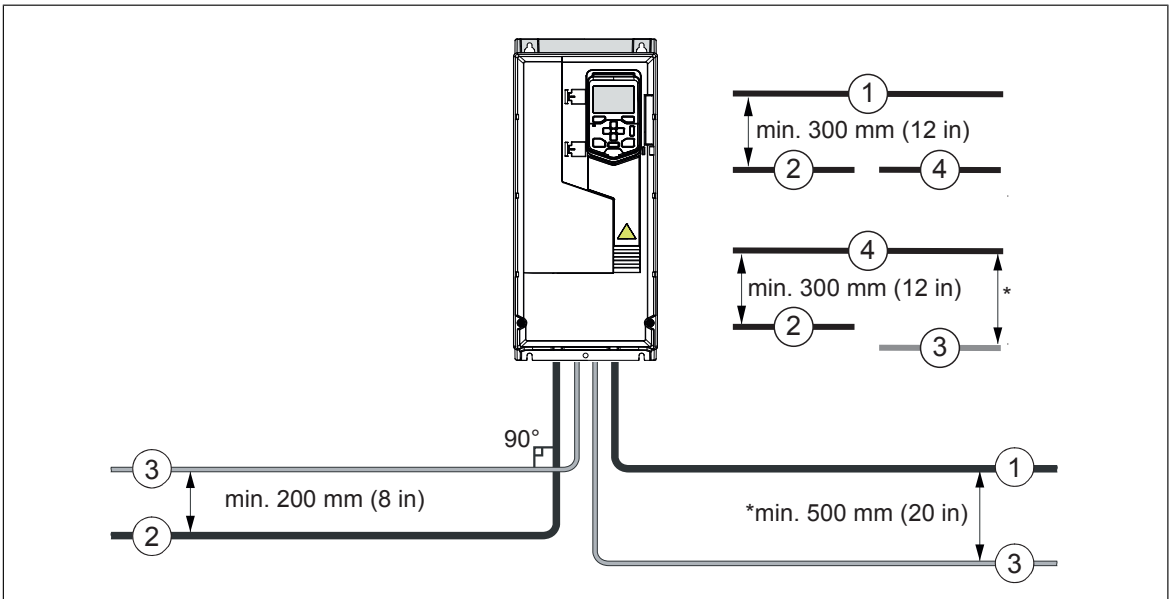
Routing the cables

General guidelines – IEC

- Route the motor cable away from other cables. Motor cables of several drives can be run in parallel installed next to each other.
- Install the motor cable, input power cable and control cables on separate trays.
- Avoid long parallel runs of motor cables with other cables in order to decrease electromagnetic interference caused by the rapid changes in the drive output voltage.
- Where control cables must cross power cables, make sure they are arranged at an angle as near to 90 degrees as possible.
- Do not run extra cables through the drive.
- Make sure that the cable trays have good electrical bonding to each other and to the grounding electrodes. Aluminum tray systems can be used to improve local equalizing of potential.

This figure illustrates the cable routing guidelines with an example drive.

Note:
When motor cable is symmetrical and shielded and it has short parallel runs with other cables (< 1.5 m / 5 ft), distances between the motor cable and other cables can be reduced by half.



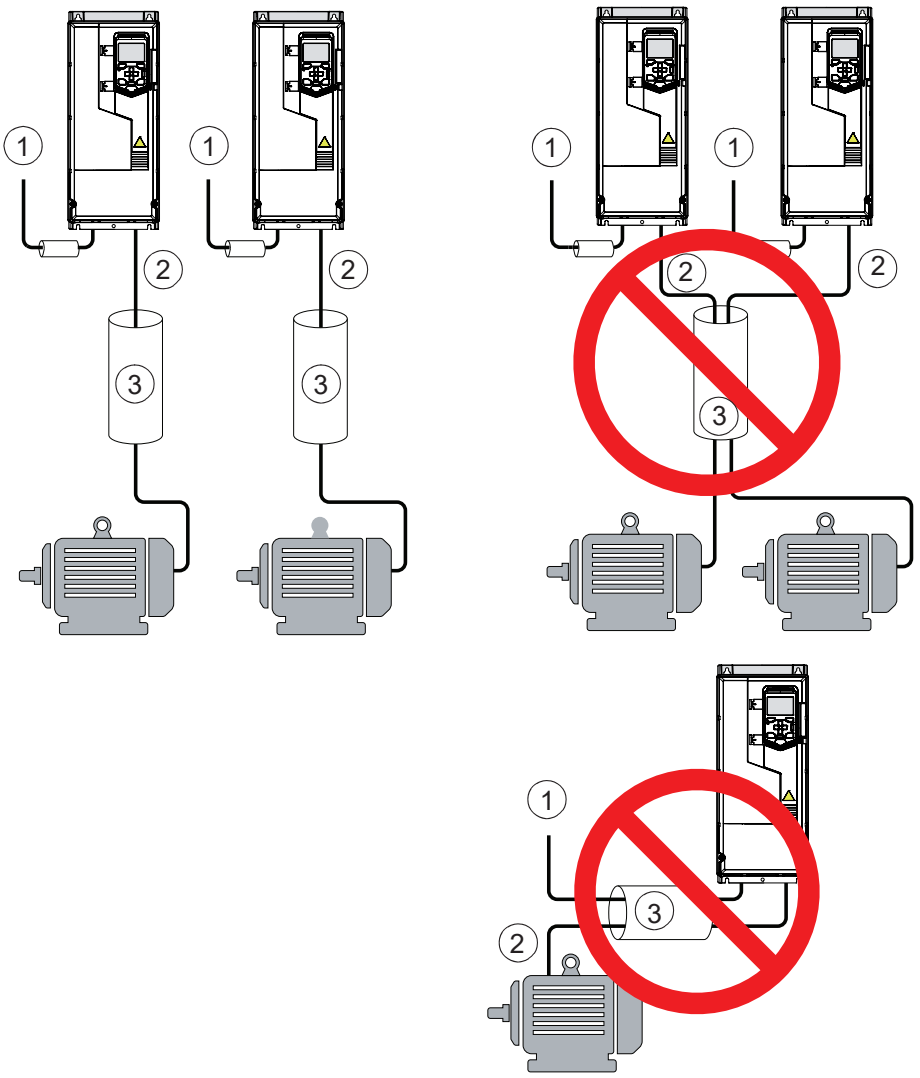
1	Motor cable
2	Input power cable
3	Control cable
4	Brake resistor or chopper cable (if any)

General guidelines – North America

Make sure that the installation is in accordance with national and local codes. Obey these general guidelines:

- Use separate conduits for the input power, motor, brake resistor (optional), and control cabling.
- Use separate conduit for each motor cabling.

The drawing below illustrates general guidelines for routing input power and motor cabling in conduits.



1	Input power cabling
2	Motor cabling
3	Conduit

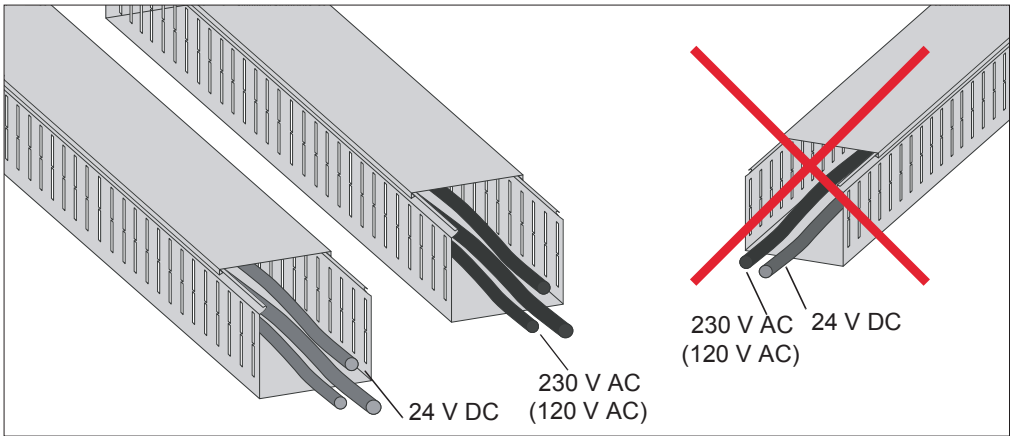
Continuous motor cable shield/conduit or enclosure for equipment on the motor cable

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

- Install the equipment in a metal enclosure.
- Use either a symmetrical shielded cable, or install the cabling in a metal conduit.
- Make sure that there is a good and continuous galvanic connection in the shield/conduit between drive and motor.
- Connect the shield/conduit to the protective ground terminal of the drive and the motor.

Separate control cable ducts

Lead 24 V DC and 230 V AC (120 V AC) control cables in separate ducts unless the 24 V DC cable is insulated for 230 V AC (120 V AC) or insulated with an insulation sleeving for 230 V AC (120 V AC).



Implementing thermal overload and short-circuit protection

Protecting the input cabling and the drive upon a short-circuit

To protect the input cabling in short-circuit situations, install fuses or a suitable circuit breaker at the supply side of the cabling.

The drive is equipped with internal AC fuses as standard. In case of a short-circuit inside the drive, the AC fuses protect the drive, restrict drive damage, and prevent damage to adjoining equipment.

Protecting the motor and motor cable in short-circuits

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

Protecting the drive and the power cables against thermal overload

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

WARNING!
If the drive is connected to multiple motors, use a separate circuit breaker or fuses for protecting each motor cable and motor against overload. The drive overload protection is tuned for the total motor load. It may not trip due to an overload in one motor circuit only.

Protecting the motor against thermal overload

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

The motor thermal protection model supports thermal memory retention and speed sensitivity. The user can tune the thermal model further by feeding in additional motor and load data.

The most common temperature sensors are:

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

See the firmware manual for more information on the motor thermal protection function.

Protecting the drive against ground faults

The drive is equipped with an internal ground fault protective function to protect the unit against ground faults in the motor and motor cable. This function is not a personnel safety or a fire protection feature. See the firmware manual for more information.

Residual current device compatibility

The drive is suitable to be used with residual current devices of Type B.

Note:
As standard, the drive contains capacitors connected between the main circuit and the frame. These capacitors and long motor cables increase the ground leakage current and may cause nuisance faults in residual current devices.

Implementing the emergency stop function

You can order the drive with an emergency stop function.

See the appropriate manual for more information.

Option code	User's manual	Manual code (English)
+Q951	Emergency stop, stop category 0 (using main contactor/breaker)	3AUA0000119895
+Q963	Emergency stop, stop category 0 (using Safe torque off)	3AUA0000119908

Implementing the Safe Torque Off function

See chapter *The Safe torque off function* on page *243*.

Implementing the Power loss ride-through function

Implement the power-loss ride-through function as follows:

- Check that the power-loss ride-through function of the drive is enabled with parameter **30.31**.
- Set parameter **21.01** (in vector mode) or parameter **21.19** (in scalar mode) to make flying start (starting into a rotating motor) possible. If the installation is equipped with a main contactor, prevent its tripping at the input power break. For example, use a time delay relay (hold) in the contactor control circuit.

WARNING!
Make sure that the flying restart of the motor will not cause any danger. If you are in doubt, do not implement the Power-loss ride-through function.

Using power factor compensation capacitors with the drive

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

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

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

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

Implementing a safety switch between the drive and the motor

ABB recommends that you install a safety switch between the permanent magnet motor and the drive output. The switch is needed to isolate the motor during any maintenance work on the drive.

Using a contactor between the drive and the motor

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

- For vector control mode and motor ramp stop, open the contactor as follows:
  1. Give a stop command to the drive.
  2. Wait until the drive decelerates the motor to zero speed.
  3. Open the contactor.
- For vector control mode and motor coast stop, or scalar control mode, open the contactor as follows:
  1. Give a stop command to the drive.
  2. Open the contactor.

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

Implementing a bypass connection

If bypassing is required, employ mechanically or electrically interlocked contactors between the motor and the drive and between the motor and the power line. Make sure with interlocking that the contactors cannot be closed simultaneously. The installation must be clearly marked as defined in IEC/EN 61800-5-1, subclause 6.5.3, for example, “THIS MACHINE STARTS AUTOMATICALLY”.

Bypass connection is available as a factory-installed option for some cabinet-installed drive types. Consult ABB for more information.

WARNING!
Never connect the drive output to the electrical power network. The connection may damage the drive.

Implementing the ATEX-certified Safe motor disconnection function (option +Q971)

With option +Q971, the drive provides ATEX-certified safe motor disconnection without contactor using the drive Safe torque off function. For more information, see

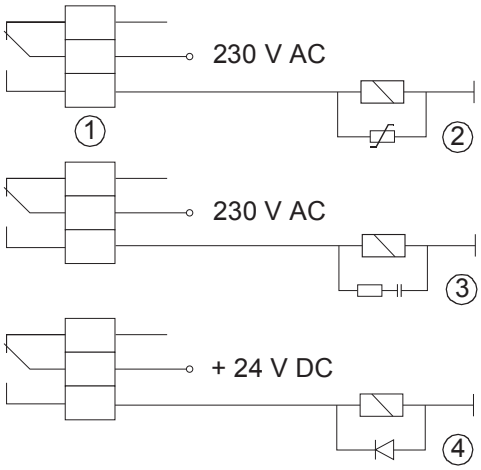
- *ATEX-certified Safe disconnection function, Ex II (2) GD for ACS880 drives (+Q971) Application guide* (3AUA0000132231 [English]).
- *FPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (option +L537+Q971) for ACS880 drives user's manual* (3AXD50000027782 [English]).
- *CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (option +L537+Q971) user's manual* (3AXD50000030058 [English]).

Protecting the contacts of relay outputs

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

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

Install the protective component as close to the inductive load as possible. Do not install protective components at the relay outputs.



1	Relay output
2	Varistor
3	RC filter
4	Diode

Connecting motor temperature sensor to the drive via an option module

This table shows:

- the option module types that you can use for the motor temperature sensor connection
- the insulation or isolation level that each option module forms between its temperature sensor connector and other connectors
- the temperature sensor types that you can connect to each option module
- the temperature sensor insulation requirement in order to form, together with the insulation of the option module, a reinforced insulation between the motor live parts and the drive control unit.

Option module		Temperature sensor type			Temperature sensor insulation requirement
Type	**Insulation/Isolation**	**PTC**	**KTY**	**Pt100, Pt1000**	
FIO-11	Galvanic isolation between sensor connector and other connectors (including drive control unit connector)	-	x	x	Reinforced insulation
FEN-xx	Galvanic isolation between sensor connector and other connectors (including drive control unit connector)	x	x	-	Reinforced insulation
FAIO-01	Basic insulation between sensor connector and drive control unit connector. No insulation between sensor connector and other I/O connectors.	x	x	x	Basic insulation. Connectors of option module other than sensor connector must be left unconnected.
FPTC-xx [1)]	Reinforced insulation between sensor connector and other connectors (including drive control unit connector).	x	-	-	No special requirement

1) Suitable for use in safety functions (SIL2 / PL c rated).

Protecting the drive against ground faults

The drive is equipped with an internal ground fault protective function to protect the unit against ground faults in the motor and motor cable. This function is not a personnel safety or a fire protection feature. See the firmware manual for more information.

Residual current device compatibility

The drive is suitable to be used with residual current devices of Type B.

Note:
As standard, the drive contains capacitors connected between the main circuit and the frame. These capacitors and long motor cables increase the ground leakage current and may cause nuisance faults in residual current devices.

Implementing the emergency stop function

The drive can be equipped with emergency stop function of stop category 0. For safety reasons, install the emergency stop devices at each operator control station and at other operating stations where emergency stop can be needed.

Note:
Pressing the stop key on the control panel of the drive, or turning the operating switch of the drive from position "1" to "0" does not generate an emergency stop of the motor or separate the drive from dangerous potential.

See the user's manual for the wiring, start-up and operation instructions.

Option code	User's manual	Manual code (English)
+Q951	*Emergency stop, stop category 0 (option +Q951) for ACS580-07, ACH580-07 and ACQ580-07 drives user's manual*	3AXD50000171828
+Q963	*Emergency Stop, Category 0 (option +Q963) without opening main contactor with safety relay for ACS580-07, ACH580-07 and ACQ580-07 drives user's manual*	3AXD50000171835

Implementing ATEX-certified thermistor protection

See *CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (+L537+Q971) user's manua*l (3AXD50000030058 [English]).

Implementing the Safe torque off function

See chapter *The Safe torque off function (page 243)*.

Implementing the ATEX-certified Safe motor disconnection function (option +Q971)

With option +Q971, the drive provides ATEX-certified safe motor disconnection without contactor using the drive Safe torque off function. For more information, see

- *ATEX-certified Safe disconnection function, Ex II (2) GD for ACS880 drives (+Q971) Application guide* (3AUA0000132231 [English]).

- *FPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (option +L537+Q971) for ACS880 drives user's manual* (3AXD50000027782 [English]).
- *CPTC-02 ATEX-certified thermistor protection module, Ex II (2) GD (option +L537+Q971) user's manual* (3AXD50000030058 [English]).

Implementing the Power-loss ride-through function

Implement the power-loss ride-through function as follows:

- Check that the power-loss ride-through function of the drive is enabled with parameter **30.31 Undervoltage control**.
- Set parameter **21.01 Vector start mode** to **Automatic** (in vector mode) or parameter **21.19 Scalar start mode** to **Automatic** (in scalar mode) to make flying start (starting into a rotating motor) possible. If the installation is equipped with a main contactor, prevent its tripping at the input power break. For example, use a time delay relay (hold) in the contactor control circuit.

WARNING!
Make sure that the flying restart of the motor will not cause any danger. If you are in doubt, do not implement the Power-loss ride-through function.

Units with line contactor (option +F250)

The main contactor of the drive opens in a power-loss situation. When the power returns, the contactor closes. However, if the power-loss situation lasts so long that the drive trips on undervoltage, it must be reset and started again to continue operation. If the power-loss situation lasts so long that the buffering module (C22) empties, the main contactor remains open and the drive operates only after reset and a new start.

Supplying power for the auxiliary circuits

The drive is equipped with an auxiliary control voltage transformer which supplies control voltage, for example, for the control devices and cabinet fan(s).

Supply this option from an external power source:

- +G300 Cabinet heaters (230 or 115 V AC; external fuse: 16 A gG).

Using power factor compensation capacitors with the drive

Power factor compensation is not needed with AC drives.

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

Implementing a safety switch between the drive and the motor

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

Using a contactor between the drive and the motor

Implementing the control of the output contactor depends on how you select the drive to operate. See also section *Implementing a bypass connection (page 84)*.

When you have selected to use

- vector control mode and motor ramp stop,

open the contactor as follows:

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

When you have selected to use

- vector control mode and motor coast stop; or scalar control mode,

open the contactor as follows:

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

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

Implementing a bypass connection

If bypassing is required, employ mechanically or electrically interlocked contactors between the motor and the drive and between the motor and the power line. Make sure with interlocking that the contactors cannot be closed simultaneously. The installation must be clearly marked as defined in IEC/EN 61800-5-1, subclause 6.5.3, for example, "THIS MACHINE STARTS AUTOMATICALLY".

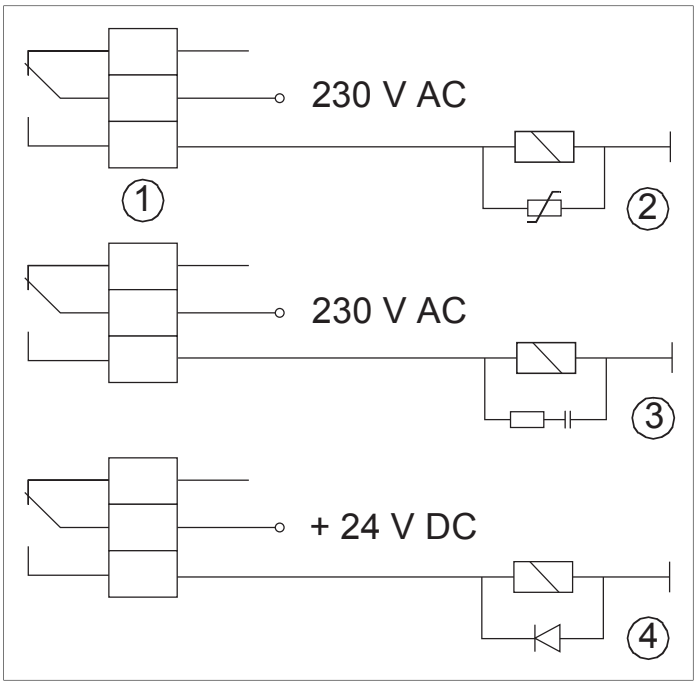
WARNING!
Never connect the drive output to the electrical power network. The connection can damage the drive.

Protecting the contacts of relay outputs

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

ABB highly recommends to equip inductive loads with noise attenuating circuits (varistors, RC filters [AC] or diodes [DC]) in order to minimize the EMC emission at switch-off. If not suppressed, the disturbances can connect capacitively or inductively to other conductors in the control cable and form a risk of malfunction in other parts of the system.

Install the protective component as close to the inductive load as possible. Do not install protective components at the relay outputs.



1) Relay outputs; 2) Varistor; 3) RC filter; 4) diode

Implementing a motor temperature sensor connection

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

To connect a motor temperature sensor and other similar components to the drive, you have four alternatives:

1. If there is double or reinforced insulation between the sensor and the live parts of the motor, you can connect the sensor directly to the inputs of the drive.
2. If there is basic insulation between the sensor and the live parts of the motor, you can connect the sensor to the inputs of the drive if all circuits connected to the drive's digital and analog inputs (typically extra-low voltage circuits) are protected against contact and insulated with basic insulation from other low-voltage circuits. The insulation must be rated for the same voltage level as the drive main circuit. Note that extra-low voltage circuits (such as 24 V DC) typically do not meet these requirements.
3. You can connect the sensor to an extension module with reinforced insulation (eg, CMOD-02) between the sensor connector and the other connectors of the module. See the table below for the sensor insulation requirement. For sensor connection to the extension module, see its manual.
4. You can connect a sensor to an external thermistor relay the insulation of which is rated for the main circuit voltage of the drive.

See sections

- *AI1 and AI2 as Pt100, Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) (page 123)*
- *CMOD-02 multifunction extension module (external 24 V AC/DC and isolated PTC interface*
- *CPTC-02 ATEX-certified thermistor module (external 24 V AC/DC and isolated PTC interface.*

This table shows what temperature sensor types you can connect to the drive I/O extension modules as well as the insulation requirement for the sensor.

Extension module		Temperature sensor type		
Type	**Insulation**	**PTC**	**KTY**	**Pt100, Pt1000**
CMOD-02	Reinforced insulation between the sensor connector and the other connectors of the module (including drive control unit connector). –> No special requirements for the thermistor insulation level. (The drive control unit is PELV compatible also when the module and a thermistor protection circuit are installed.)	X	-	-
CPTC-02		X	-	-

6

Electrical installation

Contents of this chapter

This chapter gives instructions on the wiring the drive.

Warnings

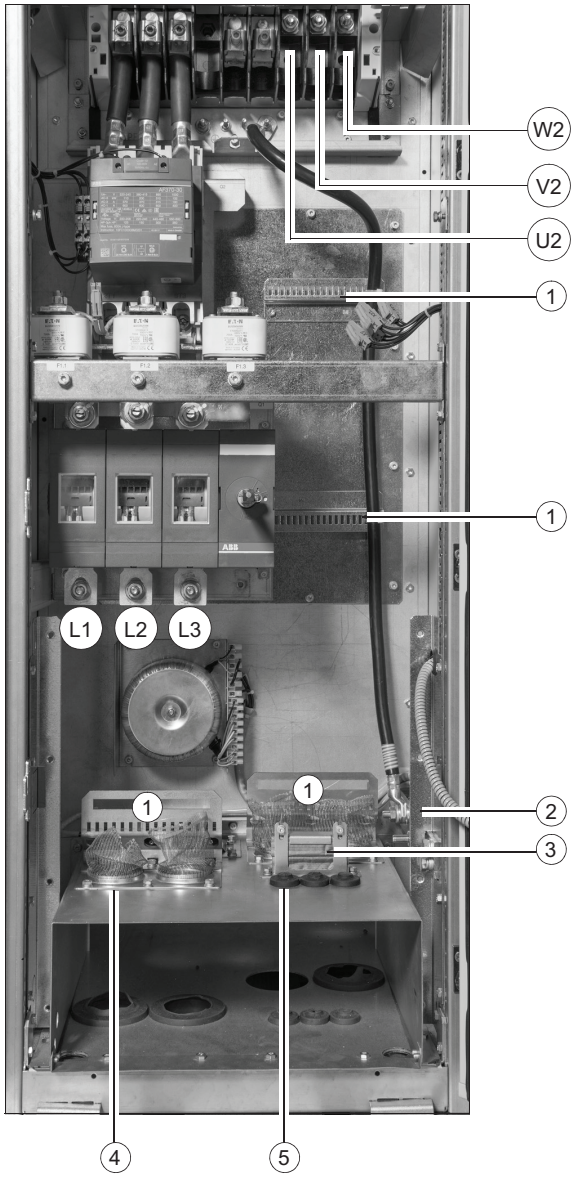
WARNING!
If you are not a qualified electrician do not do the installation work described in this chapter. Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

Attaching the device stickers on the cabinet door

A multilingual device label sticker is delivered with the drive. Attach the stickers in the local language on the English texts, see section *Door switches and lights (page 43)*.

Layout of the cable entries (frames R6 to R9)

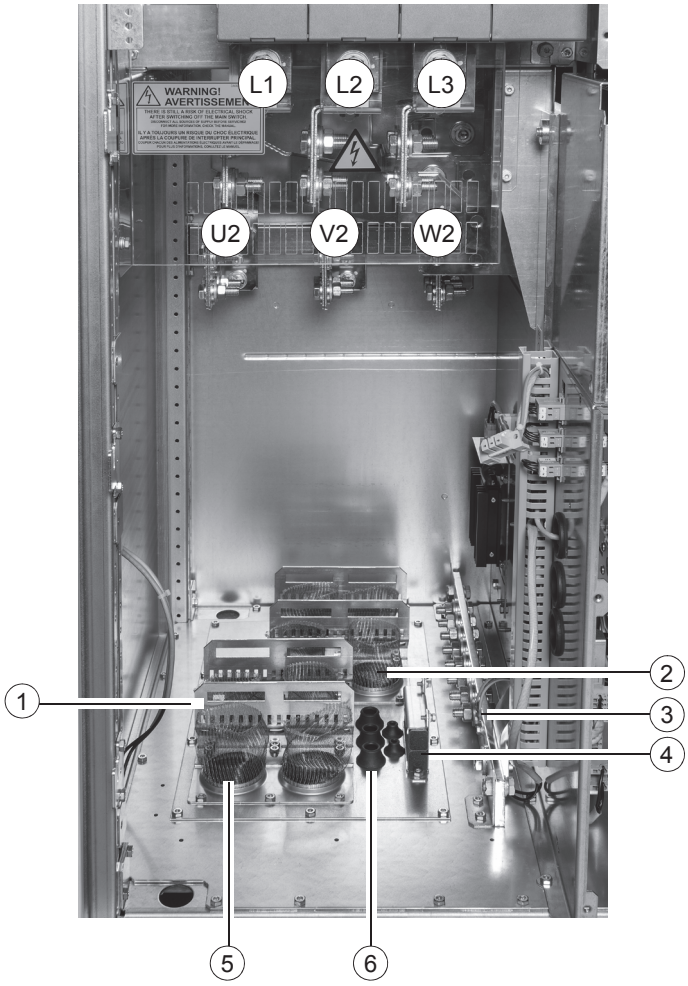
The layout of the input and motor cable connection terminals of frame R9 without du/dt filter (option +E205) is shown below. The shrouds in front of the terminals are removed. The layout is similar for the other frame sizes.



L1, L2, L3	Input power cable terminals
U2, V2, W2	Motor cable terminals
1	Strain relief
2	PE (ground) terminal
3	Emi-conductive cushion for grounding of the outer shields of the control cables
4	Power cable entry
5	Control cable entry

Layout of the cable entries (frames R10 and R11)

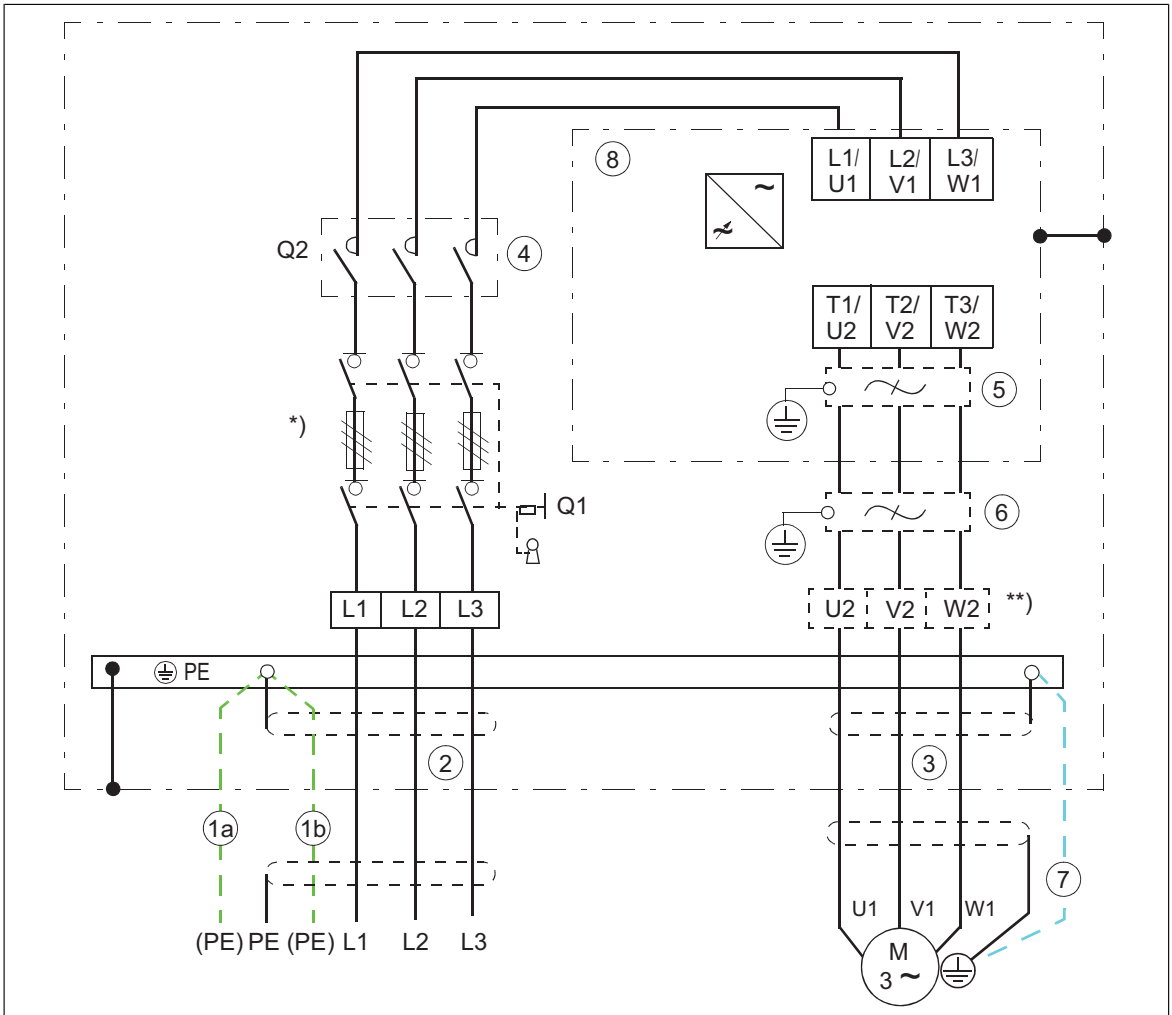
The layout of the input and motor cable connection terminals of frame R10 is shown below. The shrouds in front of the terminals are removed. The layout is similar for frame R11.



L1, L2, L3	Input power cable terminals
U2, V2, W2	Motor cable terminals
1	Strain relief
2	Input power cable entry
3	PE (ground) terminal
4	Emi-conductive cushion for grounding of the outer shields of the control cables
5	Motor cable entry
6	Control cable entry

Connecting the power cables

Connection diagram



1	Use a separate grounding PE cable (1a) or a cable with a separate PE conductor (1b) if the conductivity of the shield does not meet the requirements for the PE conductor.
2	360-degree grounding is recommended if shielded cable is used. Ground the other end of the input cable shield or PE conductor at the distribution board.
3	360-degree grounding is required.
4	Line contactor (option +F250)
5	Common mode filter (option +E208 for frames R6 to R9). Standard in frames R10 and R11.
6	du/dt filter (option +E205)
7	Use a separate grounding cable if the shield does not meet the requirements of IEC 61439-1 and there is no symmetrically constructed grounding conductor in the cable.
8	Drive module

Note:

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

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

*) Switch-disconnector or molded case circuit breaker (option +F289) and separate fuses in frames R8 to R11.

**) Output terminals U2, V2 and W2 are included with option +E205 and in frames R10 and R11.

Checking the insulation of the drive system

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

Checking the insulation of the input cable

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

Checking the compatibility with IT (ungrounded), corner-grounded delta, midpoint-grounded delta, and TT systems

Ground-to-phase varistor

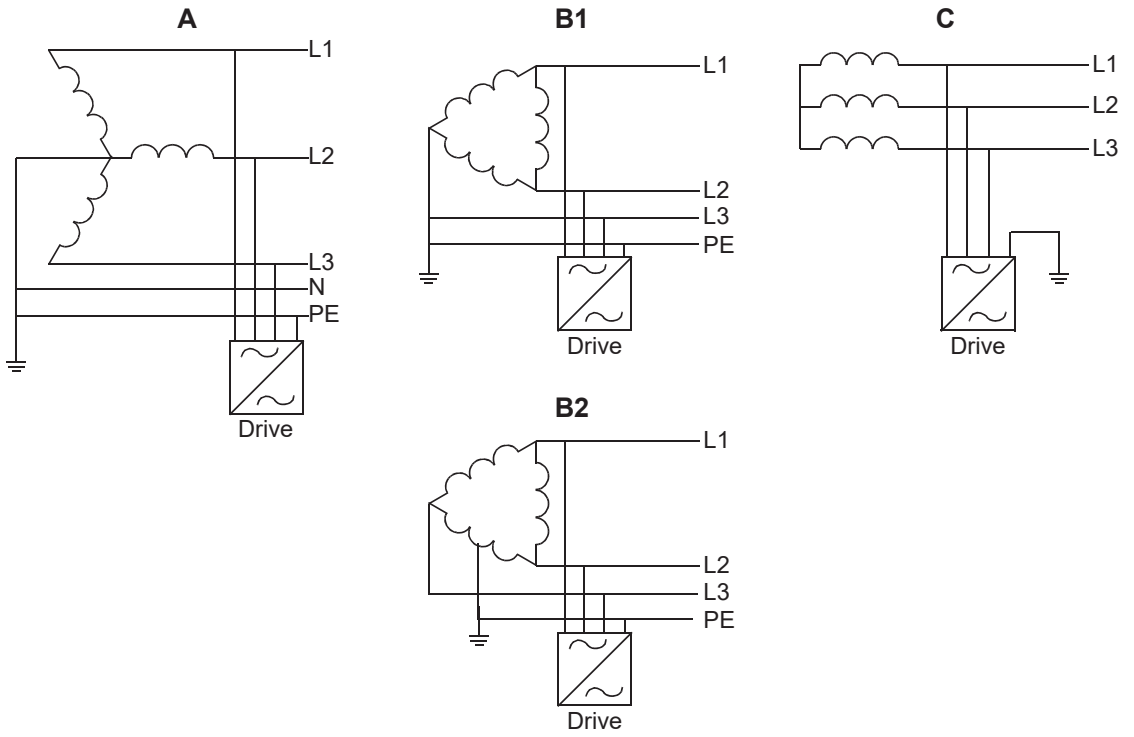
A drive with the ground-to-phase varistor connected can be installed to a symmetrically grounded TN-S system. If you install the drive to another system, you may need to disconnect the varistor.

WARNING!
Do not install the drive with the ground-to-phase varistor connected to a system that the varistor is not suitable for. If you do, the varistor circuit can be damaged.

When to disconnect the ground-to-phase varistor: TN-S, IT, corner-grounded delta and midpoint-grounded delta systems

Frame size	Symmetrically grounded TN systems (TN-S systems), ie. center-grounded wye (A)	Corner-grounded (B1) and midpoint-grounded delta (B2) systems	IT systems (ungrounded or high-resistance grounded [>30 ohms]) (C)
R6...R9	Do not disconnect EMC or VAR screws.	Do not disconnect EMC AC or VAR screws. Disconnect EMC DC screw.	Disconnect EMC screws (2 pcs) and VAR screw.
R10... R11	Do not disconnect VAR wire.	Do not disconnect VAR wire.	Disconnect VAR wire.

Frame size	Symmetrically grounded TN systems (TN-S systems), ie. center-grounded wye (A)	Corner-grounded (B1) and midpoint-grounded delta (B2) systems	IT systems (ungrounded or high-resistance grounded [>30 ohms]) (C)



These are the EMC filter and varistor screws in different drive frame sizes.

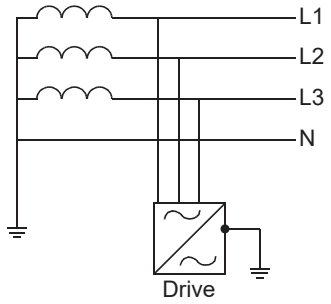
Frame size	EMC filter (+E200) screws	Ground-to-phase varistor screws
R6..R9	Two EMC screws	VAR

Guidelines for installing the drive to a TT system

The drive can be connected to a TT system under these conditions:

1. Residual current device has been installed in the supply system.
2. This wire has been disconnected. Otherwise EMC filter and ground-to-phase varistor capacitor leakage current will cause the residual current device to trip.

Frame size	EMC filter screws	Ground-to-phase varistor screws
R6...R9	Two EMC screws	VAR
R10, R11	-	VAR

Frame size	EMC filter screws	Ground-to-phase varistor screws
		

Note:

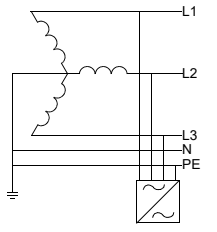
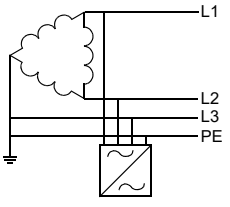
- Because the varistor wire has been disconnected, ABB does not guarantee the EMC category.
- ABB does not guarantee the functioning of the ground leakage detector built inside the drive.
- In large systems the residual current device can trip without a real reason.

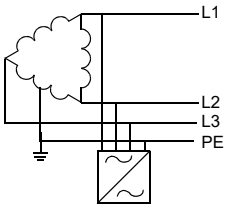
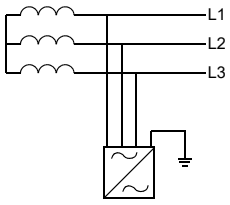
Identifying different types of electrical power systems

To identify the electrical power system type, find out the supply transformer connection. If that is not possible, measure these voltages at the distribution board before you connect power to the drive:

1. input voltage line to line (UL-L)
2. input voltage line 1 to ground (UL1-G)
3. input voltage line 2 to ground (UL2-G)
4. input voltage line 3 to ground (UL3-G).

The line-to-ground voltages in relation to the line-to-line voltage of the electrical power system types are shown below

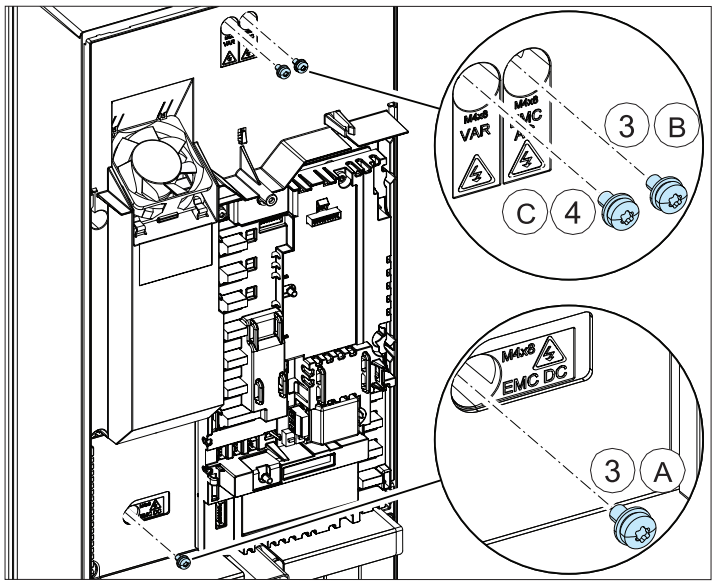
U_{L-L}	U_{L1-G}	U_{L2-G}	U_{L3-G}	Electrical power system type	Connection diagram
X	0.58·X	0.58·X	0.58·X	Symmetrically grounded TN system (TN-S system)	
X	1.0·X	1.0·X	0	Corner-grounded delta system (nonsymmetrical)	

U_{L-L}	U_{L1-G}	U_{L2-G}	U_{L3-G}	Electrical power system type	Connection diagram
X	0.866·X	0.5·X	0.5·X	Midpoint-grounded delta system (nonsymmetrical)	
X	Varying level versus time	Varying level versus time	Varying level versus time	IT systems (ungrounded or high-resistance-grounded [>30 ohms]) nonsymmetrical	

Disconnecting the EMC filter and ground-to-phase varistor (R6 to R9)

To disconnect the internal EMC filter or ground-to-phase varistor, do as follows:

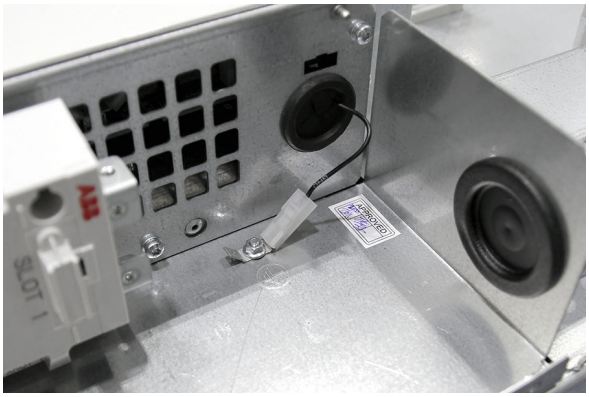
1. Switch off the power from the drive.
2. Open the cover, if not already opened.
3. To disconnect the internal EMC filter, remove the two EMC screws.
4. To disconnect the ground-to-phase varistor, remove the varistor screw.



A	EMC (DC)
B	EMC (AC)
C	VAR

Disconnecting the ground-to-phase varistor (R10 and R11)

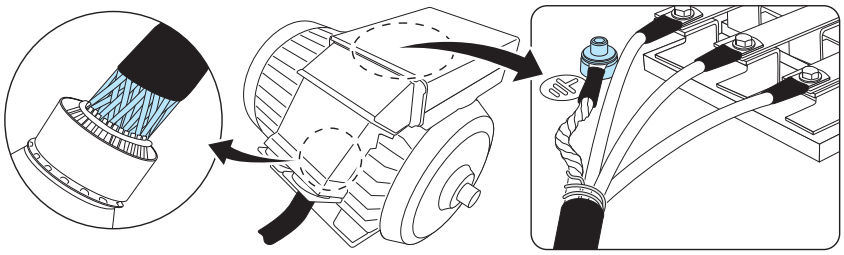
Varistor (VAR) grounding wire is attached next to the control circuit compartment. Disconnect it. Insulate the end and attach it.


SLOT 1

Connecting the motor cable at the motor end

Connect the power cables at the motor end.

For minimum radio-frequency interference, ground the cable shield 360 degrees at the cable entry of the motor terminal box.



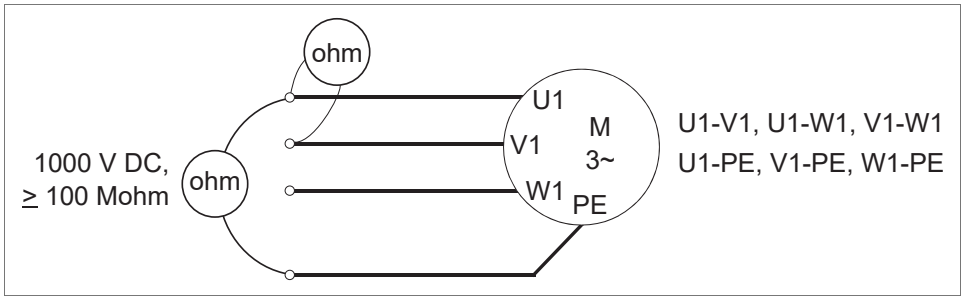
Checking the insulation of the motor and motor cable

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

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

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Check that the motor cable is disconnected from the drive output terminals.
3. Measure the insulation resistance between the phase conductors and then between each phase conductor and the protective earth conductor. Use a measuring voltage of 1000 V DC. The insulation resistance of an ABB motor must exceed 100 Mohm (reference value at 25 °C [77 °F]). For the insulation resistance of other motors, consult the manufacturer's instructions.

   Note:
   Moisture inside the motor casing reduces the insulation resistance. If moisture is suspected, dry the motor and repeat the measurement.

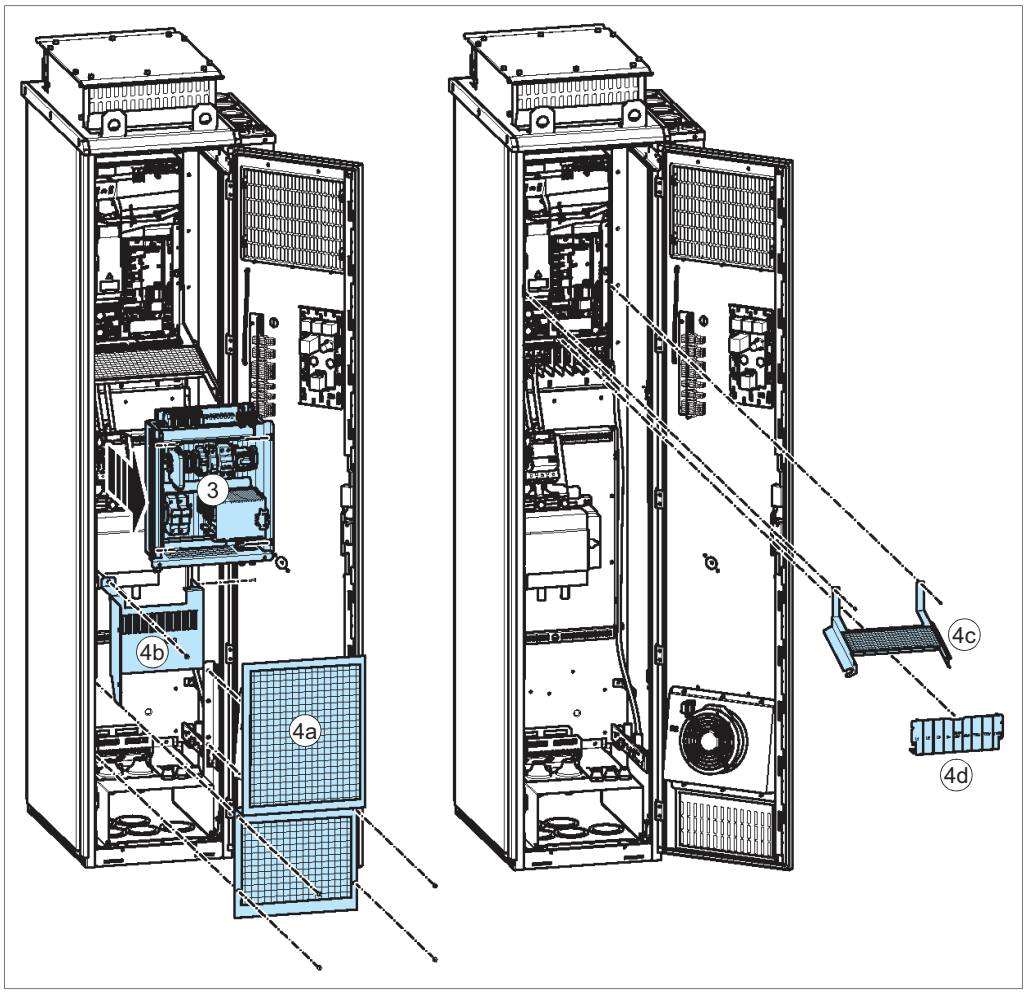


Connection procedure (IEC, frames R6 to R9)

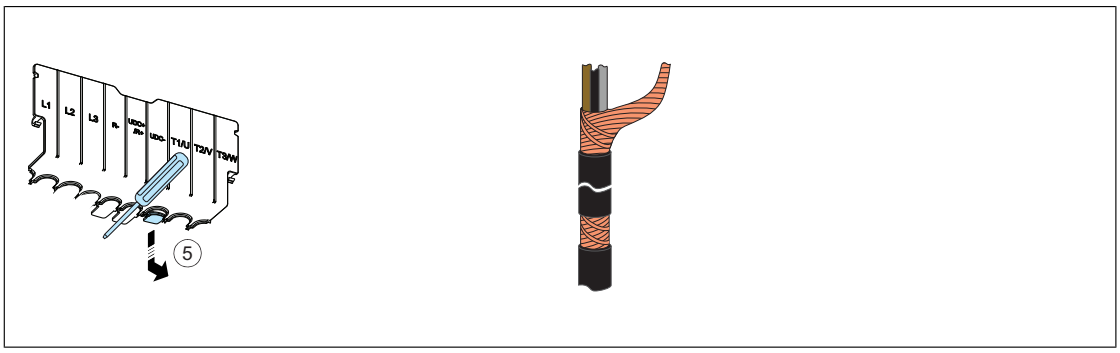
1. Do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. For drives without option +E205: To remove the mounting plate, undo the mounting screws and unplug the connectors on top of it:
   - auxiliary voltage supply connectors X23, X22 and X21
   - Contactor control connectors: X3, X6

- contactor feedback connector X250 with option +F250
- cabinet door fan supply connector X8 and control X505
- cabinet heater connector X300 with option +G300.

4. For drives without option +E205: Remove the shrouds (4a, 4b, 4c and 4d). To remove the shroud on the power cable terminals, release the clips with a screwdriver and pull the shroud out (4d). For drives with option +E205: Remove the shrouds 4a, 4b.

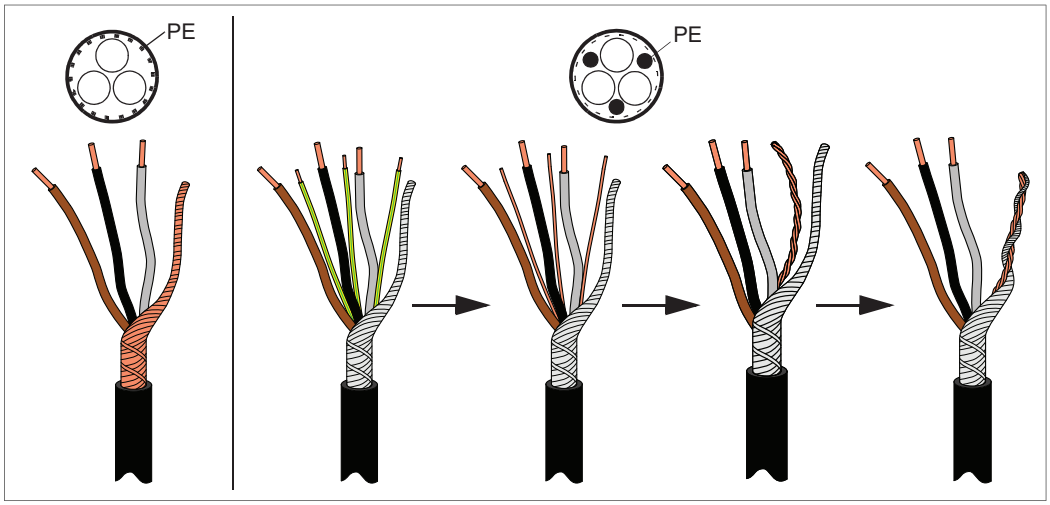


5. For drives without option +E205: Knock out holes in the shroud for the motor cable conductors.
6. Peel off 3 to 5 cm of the outer insulation of the cables above the cable entries with the conductive sleeves for the 360° high-frequency grounding.

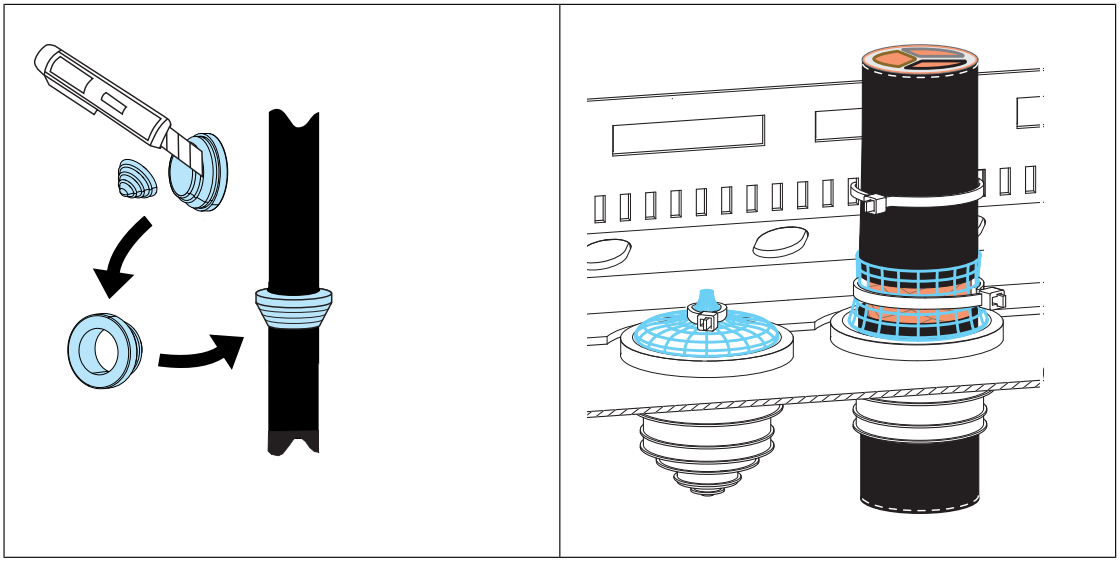


7. Prepare the ends of the cables.

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



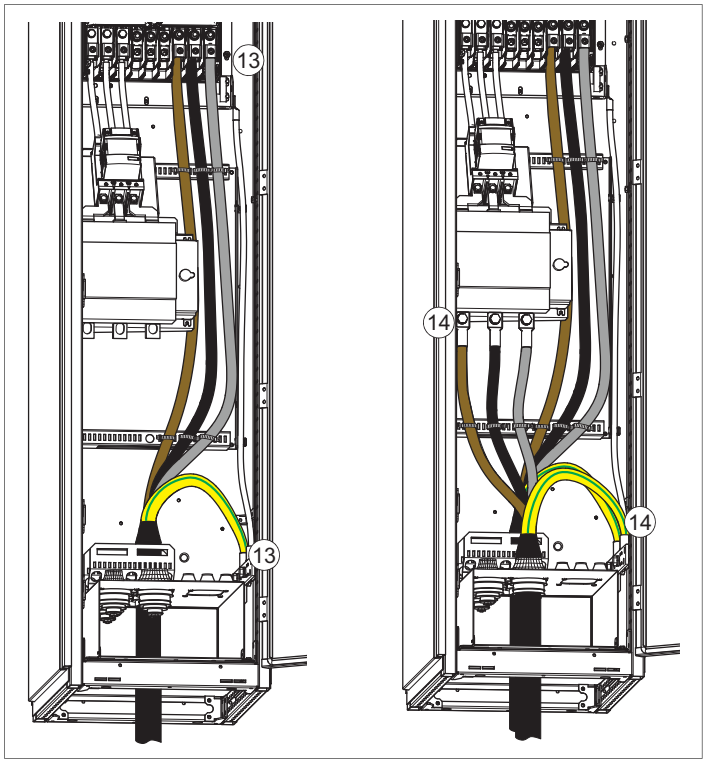
8. If fire insulation is used, make an opening in the mineral wool sheet according to the diameter of the cable.
9. Put the cables through the bottom plate.
10. Remove rubber grommets from the bottom plate for the cables to be connected. Cut adequate holes into the rubber grommets. Slide the grommets onto the cables. Slide the cables through the bottom plate with the conductive sleeves and attach the grommets to the holes.
11. Attach the conductive sleeves to the cable shields with cable ties. Tie up the unused conductive sleeves with cable ties.



12. Seal the slot between the cable and mineral wool sheet (if used) with sealing compound (eg, CSD-F, ABB brand name DXXT-11, code 35080082).
13. Connect the twisted shields of the motor cables to the ground bar and the phase conductors to the U2, V2 and W2 terminals of the drive module. For drives with du/dt

filter (option +E205), connect the phase conductors to the T1/U2, T2/V2 and T3/W2 terminals of the cabinet with cable lugs.

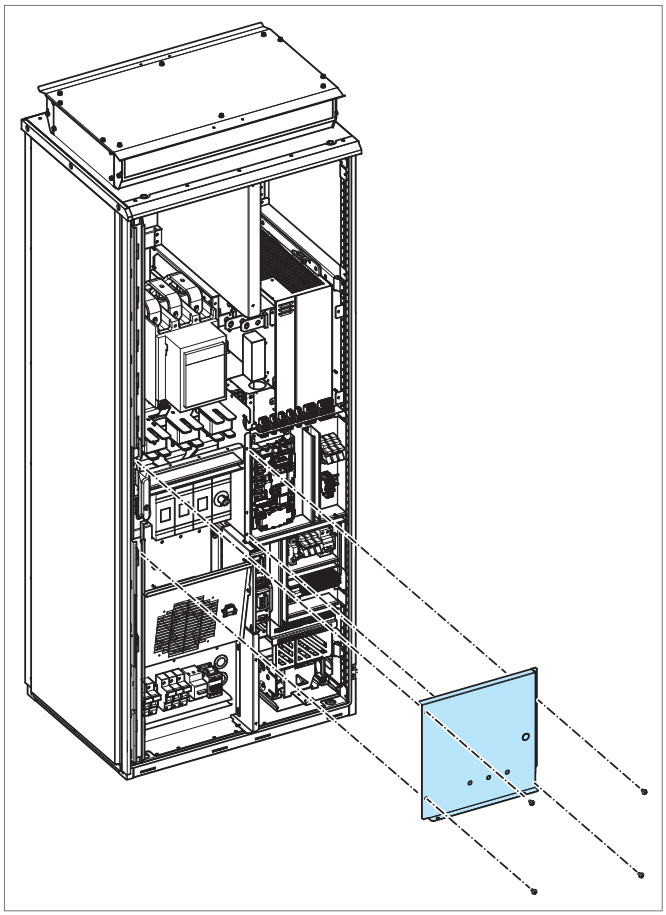
14. Connect the twisted shields of the input cables and separate ground cable (if present) to the PE terminal of the cabinet and the phase conductors to the L1, L2 and L3 terminals.



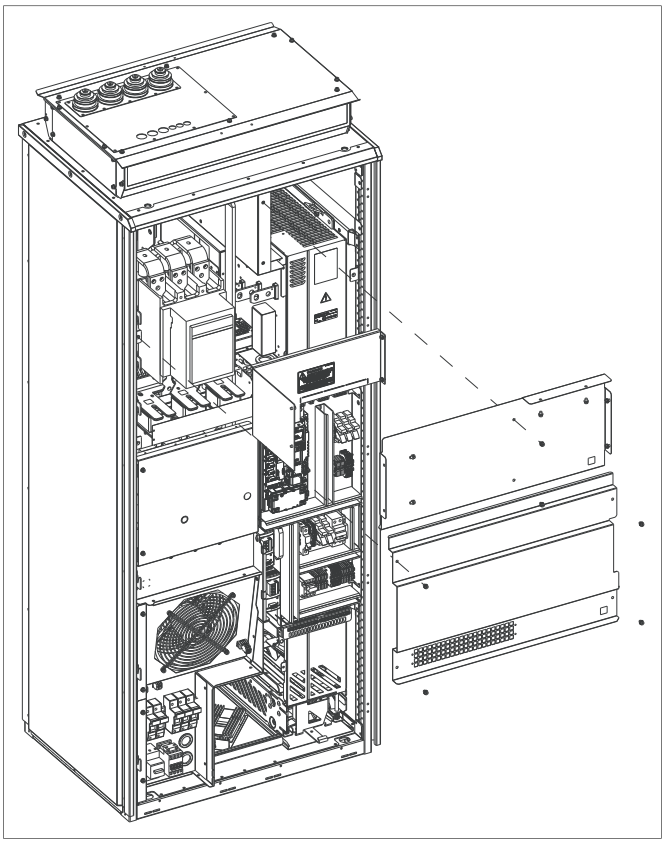
15. Tighten the power cable screws to the torque given in *Terminal and entry data for the power cables (page 182)*.
16. Reinstall the shrouds and mounting plate.

Connection procedure (IEC, frames R10 and R11)

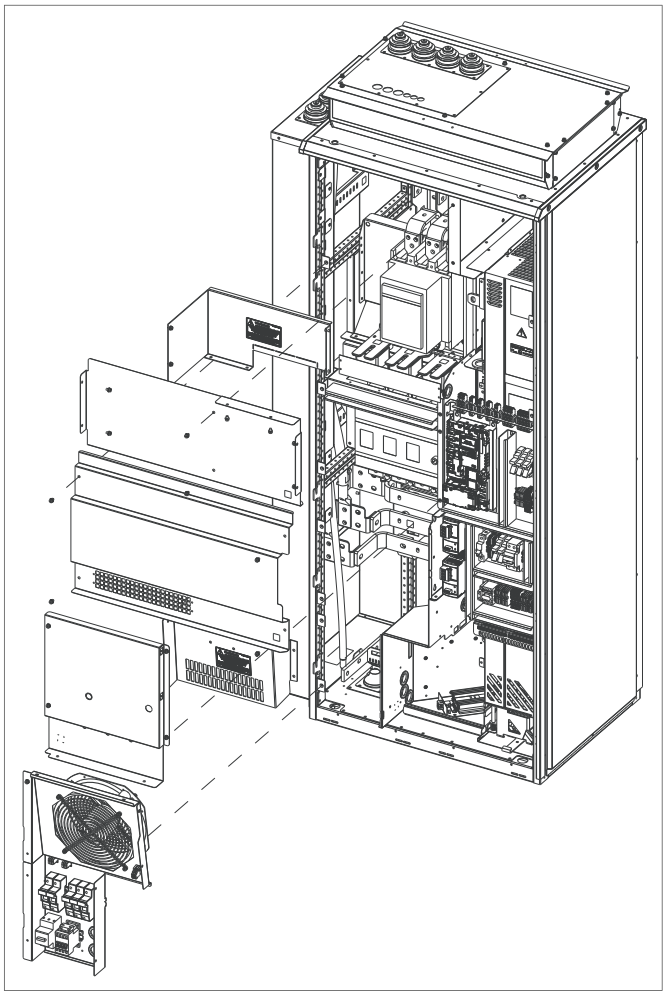
1. Do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Remove the shrouding:
   - With bottom entry and bottom exit: Undo the mounting screws and pull the shroud out.



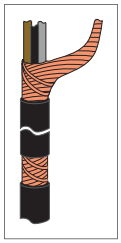
   - With top entry (option +H351) and bottom exit: Undo the mounting screws and pull the shroud out.



- With top entry and top exit (options +H351 and +H353): Remove the shrouds and door fan (see *Replacing the door fan (frames R10 and R11) (page 141)*). Undo the mounting screws and pull the shrouds out.

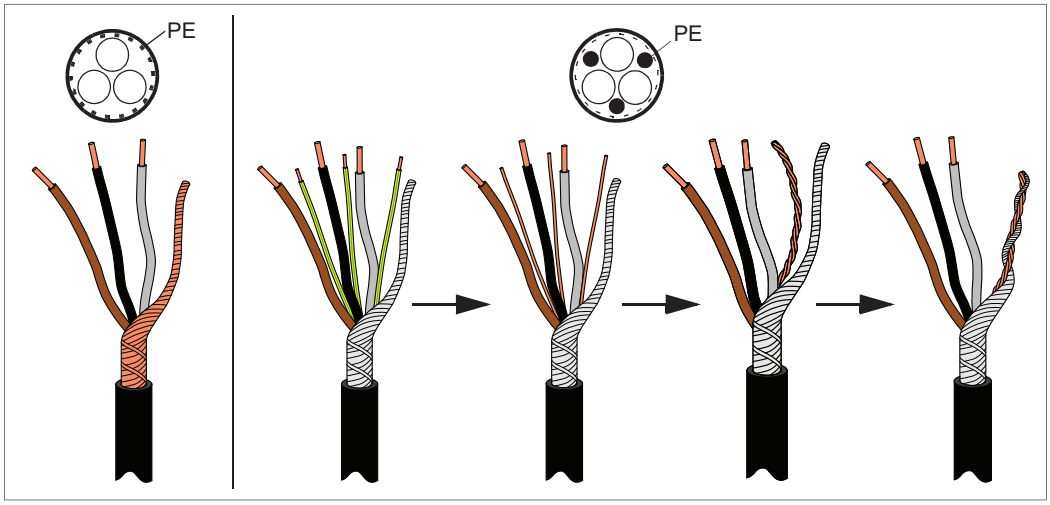


4. Remove the door fan mounting plate. See section *Replacing the door fan (frames R10 and R11) (page 141)*.
5. Peel off 3 to 5 cm of the outer insulation of the cables above the cable entries with the conductive sleeves for the 360° high-frequency grounding.

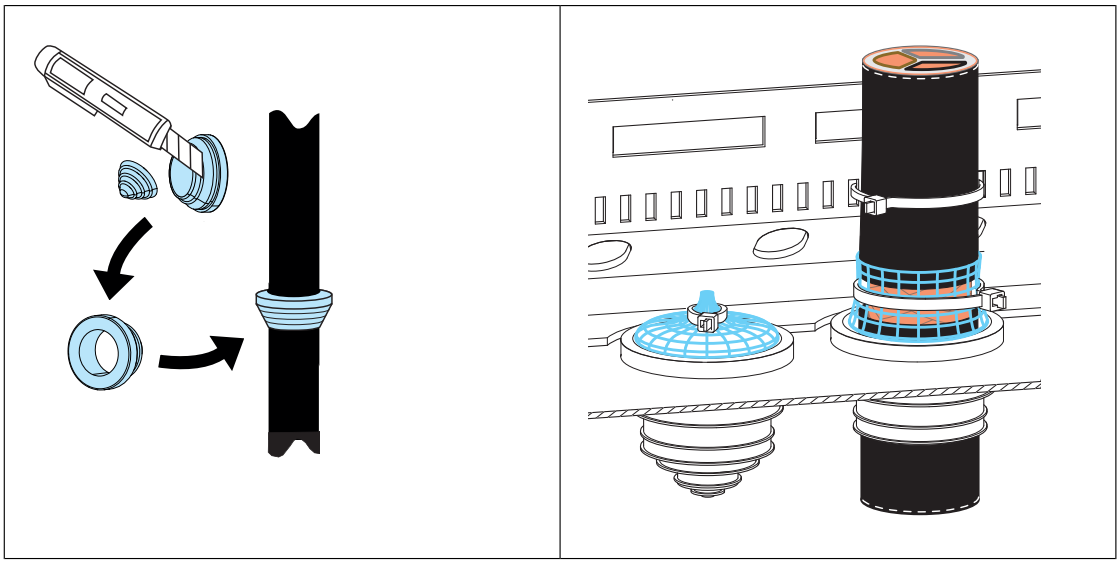


6. Prepare the ends of the cables.

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

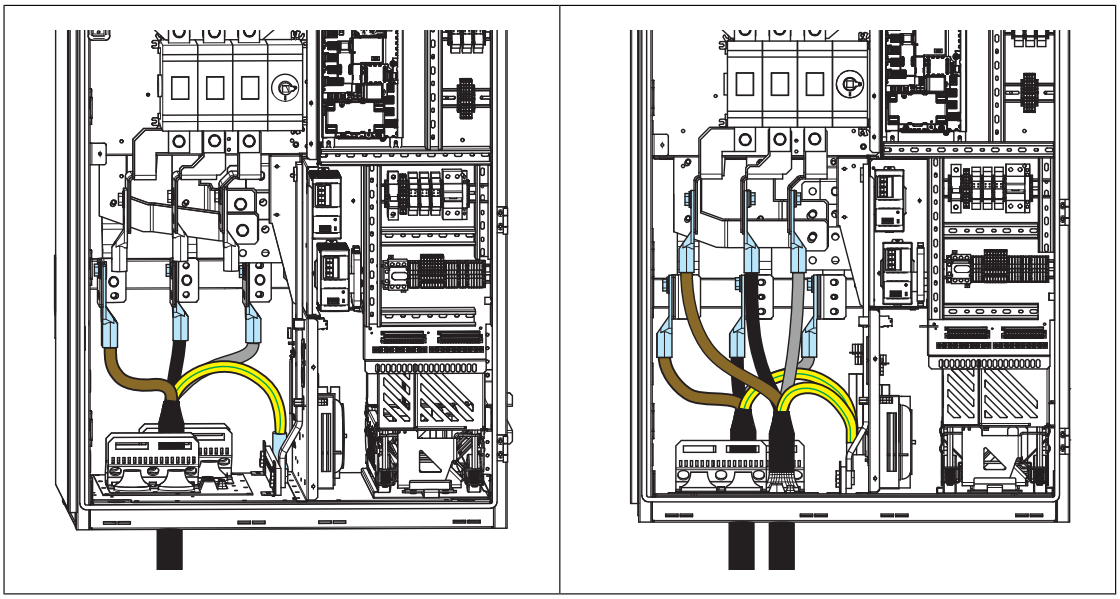


7. If fire insulation is used, make an opening in the mineral wool sheet according to the diameter of the cable.
8. Put the cables through the bottom plate.
9. Remove rubber grommets from the bottom plate for the cables to be connected. Cut adequate holes into the rubber grommets. Slide the grommets onto the cables. Slide the cables through the bottom plate with the conductive sleeves and attach the grommets to the holes.
10. Attach the conductive sleeves to the cable shields with cable ties. Tie up the unused conductive sleeves with cable ties.



11. Seal the slot between the cable and mineral wool sheet (if used) with sealing compound (eg, CSD-F, ABB brand name DXXT-11, code 35080082).

12. Connect the twisted shields of the motor cables to the ground bar and the phase conductors to the U2, V2 and W2 terminals of the drive module.
13. Connect the twisted shields of the input cables and separate ground cable (if present) to the PE terminal of the cabinet and the phase conductors to the L1, L2 and L3 terminals.



14. Tighten the power cable screws to the torque given in *Terminal and entry data for the power cables (page 182)*.
15. Reinstall the shrouds and mounting plate.

Connecting the control cables

See chapter *Control unit (page 115)* for the default I/O connections of the drive control program. The default I/O connections can be different with some hardware options, see the circuit diagrams delivered with the drive for the actual wiring.

Connect the cables as described under *Overview of control cable connection procedure (page 104)*.

Overview of control cable connection procedure

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

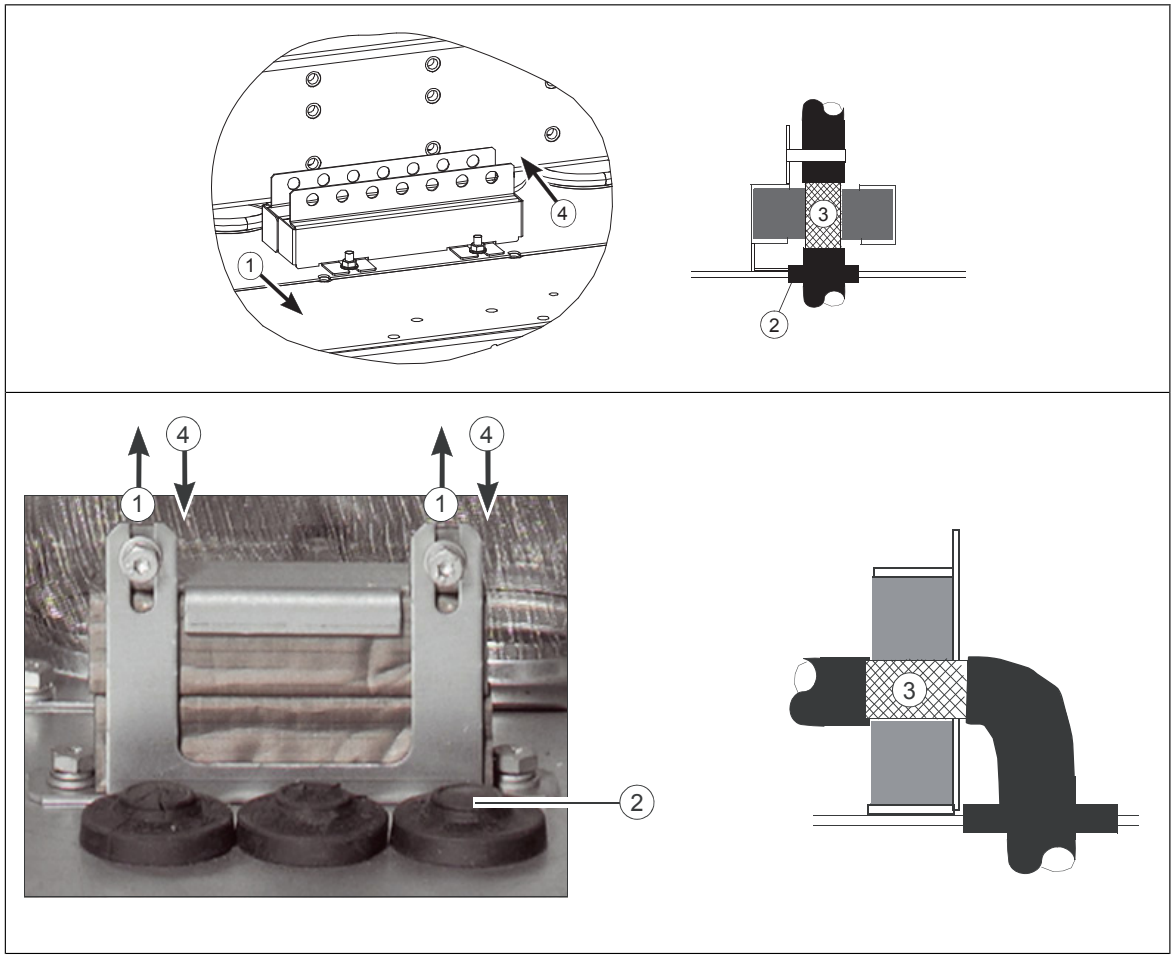
1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Run the control cables to the inside the cabinet as described in section *Grounding the outer shields of the control cables at the cabinet entry (page 105)*.
3. Route the control cables as described in section *Routing the control cables inside the cabinet (page 107)*.
4. Connect the control cables as described in sections
   - *Connecting external wiring to the control unit or optional I/O terminal block (page 108)*
   - *Connecting the emergency stop push buttons (options +Q951 and +Q963) (page 109)*
   - *Connecting the Safe torque off circuit (page 109)*

- *Connecting external power supply wires for the cabinet heater (option +G300) (page 110)*

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

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

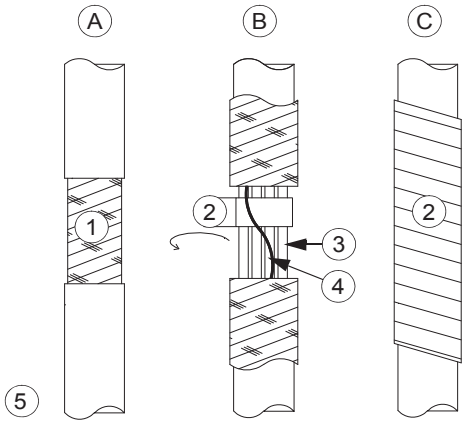
1. Loosen the tightening screws of the EMI conductive cushions and pull the cushions apart.
2. Cut adequate holes to the rubber grommets in the entry plate and put the cables through the grommets and the cushions.
3. Strip off the cable plastic sheath above the entry plate just enough to ensure proper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



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

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

- Cut the shield at the midpoint of the bare part. Be careful not to cut the conductors or the grounding wire (if present).
- Turn the shield inside out to expose its conductive surface.
- Cover the turned shield and the stripped cable with copper foil to keep the shielding continuous.



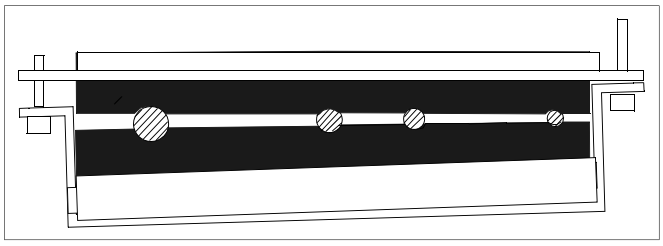
A	Stripped cable
B	Conductive surface of the shield exposed
C	Stripped part covered with copper foil
1	Cable shield
2	Copper foil
3	Shielded twisted pair
4	Grounding wire

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

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

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

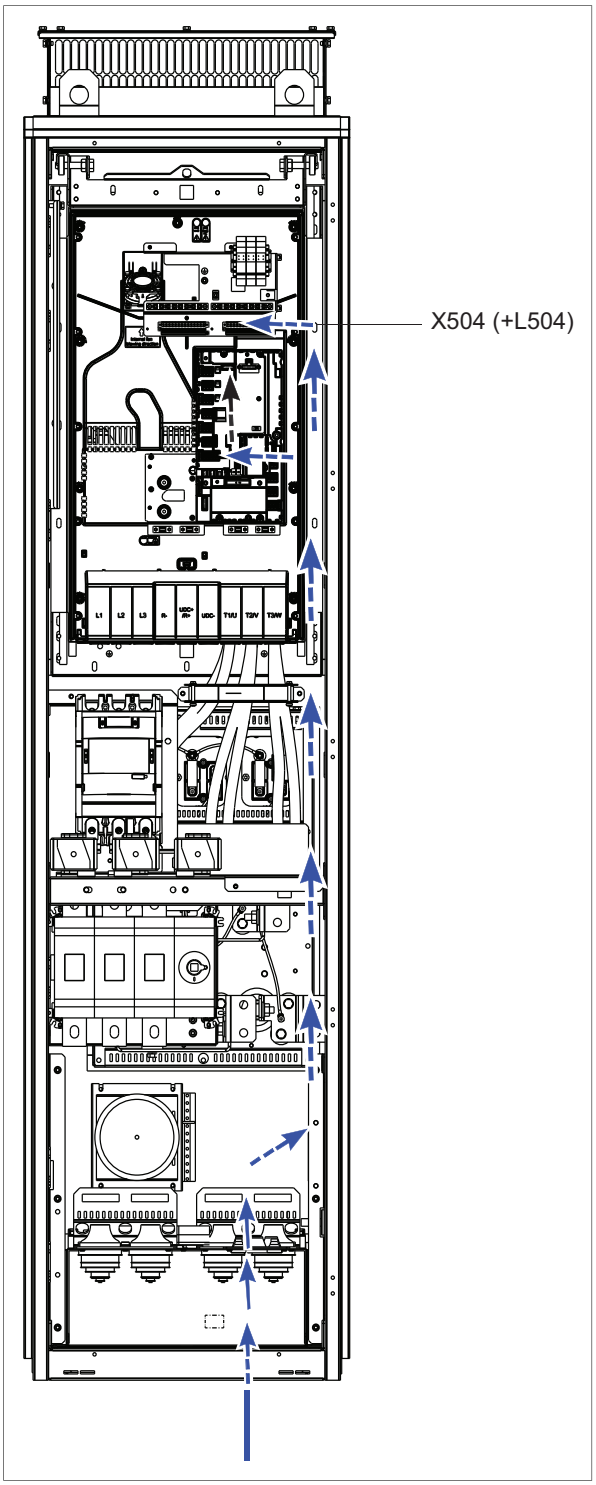
5. Arrange the bunches according to size from thickest to the thinnest between the EMI conductive cushions.



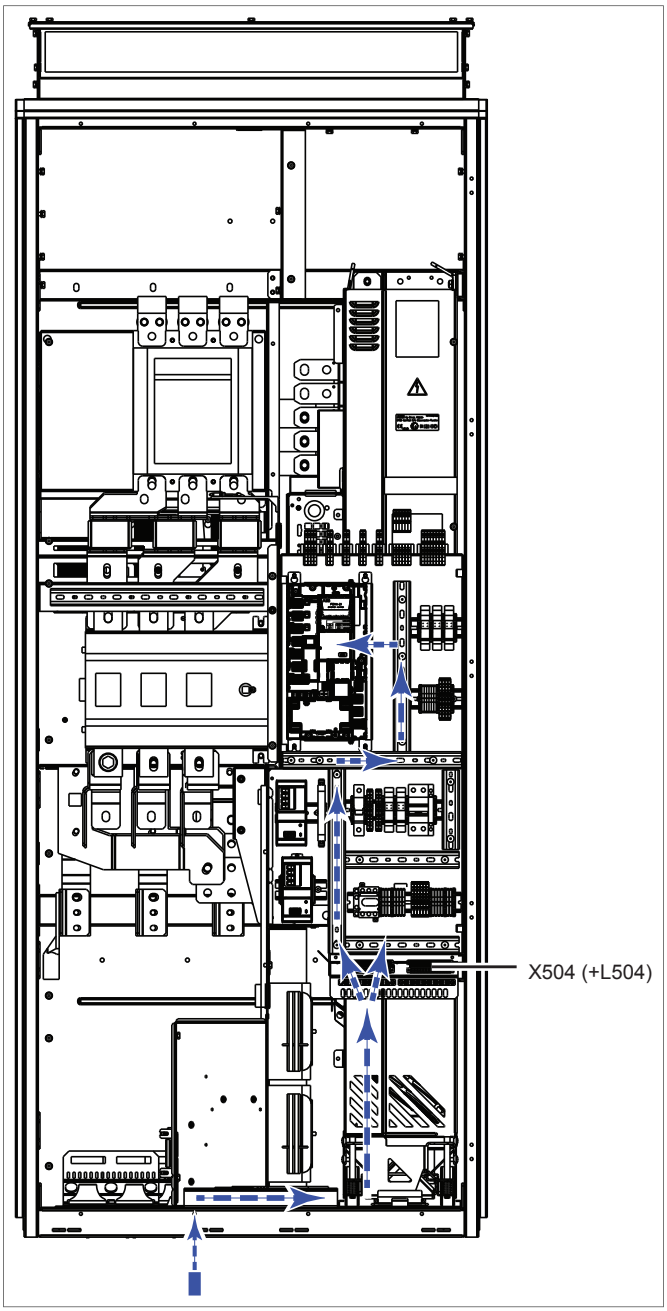
6. If more than one cable go through a grommet, seal the grommet by applying Loctite 5221 (catalogue number 25551) inside the grommet.

Routing the control cables inside the cabinet

The route of the control cables is shown below in frame R9. The route is similar frames R6, R7 and R8.



The route of the control cables for frames R10 and R11 is shown below.

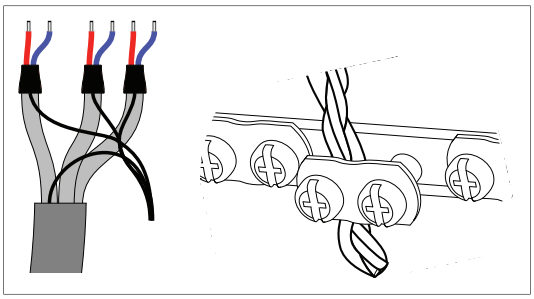


Connecting external wiring to the control unit or optional I/O terminal block

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

Note:
Leave slack to the control wires to make it possible to lift the control unit mounting plate a little when the drive module is replaced.

Ground the pair-cable shields and all grounding wires to the grounding clamp.

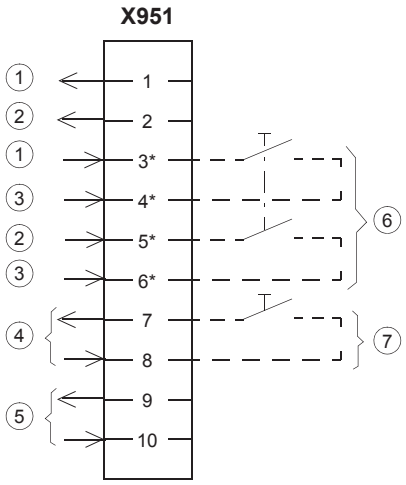


Leave the other ends of the control cable shields unconnected or ground them indirectly via a high-frequency capacitor with a few nanofarads, eg, 3.3 nF / 630 V. The shield can also be grounded directly at both ends if they are in the same ground line with no significant voltage drop between the end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

Connect the conductors to the appropriate terminals (see *Default I/O connection diagram (page 117)*) of the control unit or with option +L504 to the detachable terminal block X504.

Connecting the emergency stop push buttons (options +Q951 and +Q963)

See the circuit diagrams delivered with the drive for connecting the emergency stop circuit and the user manuals of the options.



Internal connections

1 Emergency stop push button on the cabinet door

2 Emergency stop push button on the cabinet door

3 Emergency stop circuit

4 Emergency stop reset button on the cabinet door

5 Emergency stop indication on the cabinet door

Customer connections

6 Customer external emergency stop button

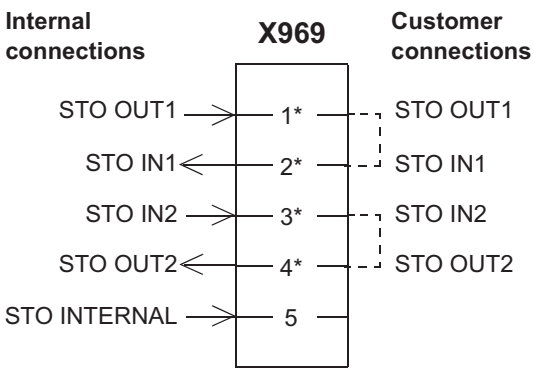
7 Customer external emergency stop reset

* Remove bridges 3–4 and 5–6 if there is an external emergency stop button. When the bridge connections are installed only the cabinet door push button is in use.

Connecting the Safe torque off circuit

Connect the customer Safe torque off circuit as described in chapter .

For drives with options +Q951, +Q963 and +Q971, connect the Safe torque off circuit to terminal block X969 – not to the control unit STO terminals.:

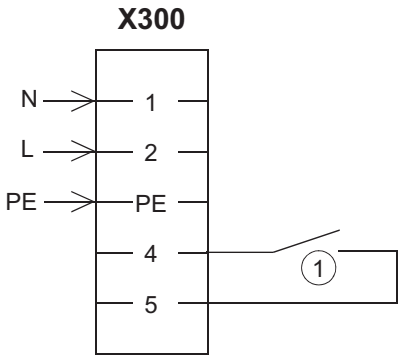


* Remove bridges 1–2 and 3–4 if there is an external Safe torque off function

Connecting external power supply wires for the cabinet heater (option +G300)

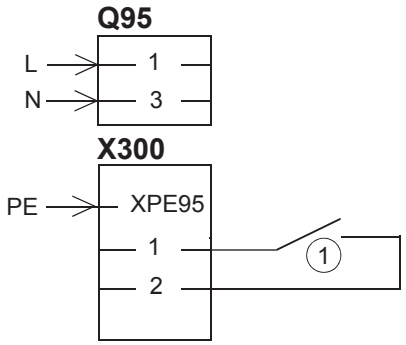
Connect the external power supply wires for the cabinet heater to terminal block X300 at the back of the mounting plate.

Frames R6...R9



1 Internal wiring of the cabinet heater: heater off/fault = contact open.

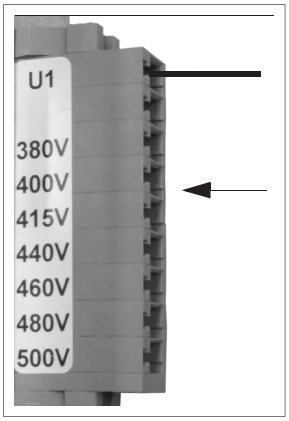
Frames R10...R11



1 Internal wiring of the cabinet heater: heater off/fault = contact open.

Setting the voltage range of the auxiliary control voltage transformer (T21)

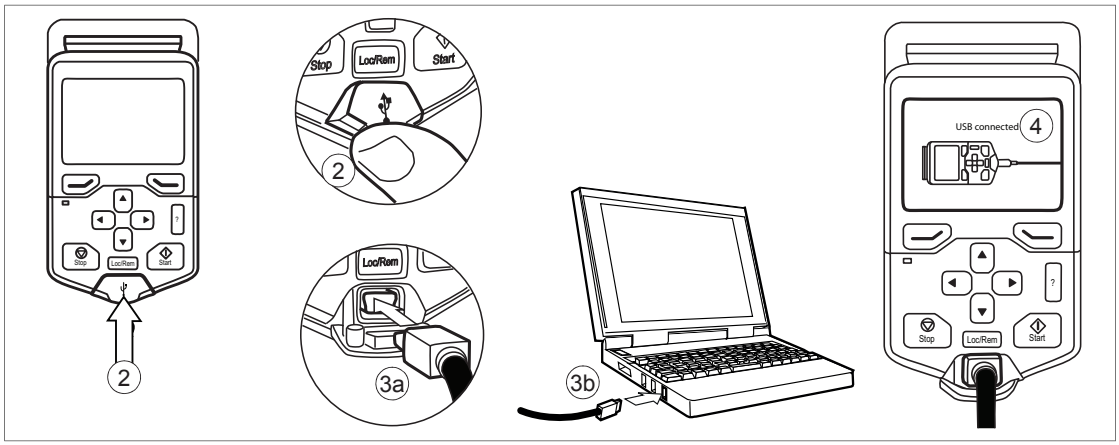
Connect the power supply wires of the auxiliary control voltage transformer according to the power network voltage.



Connecting a PC

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

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



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

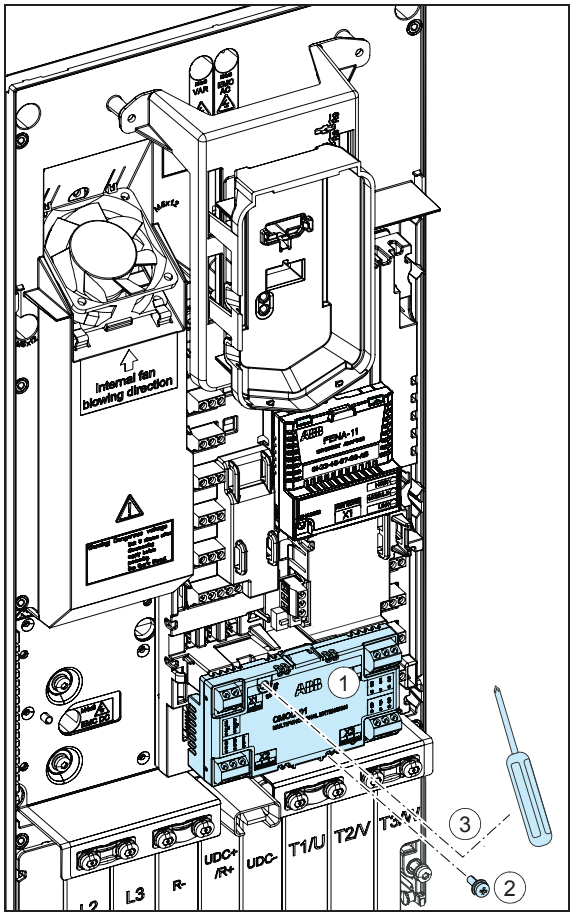
Installing option modules

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

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.

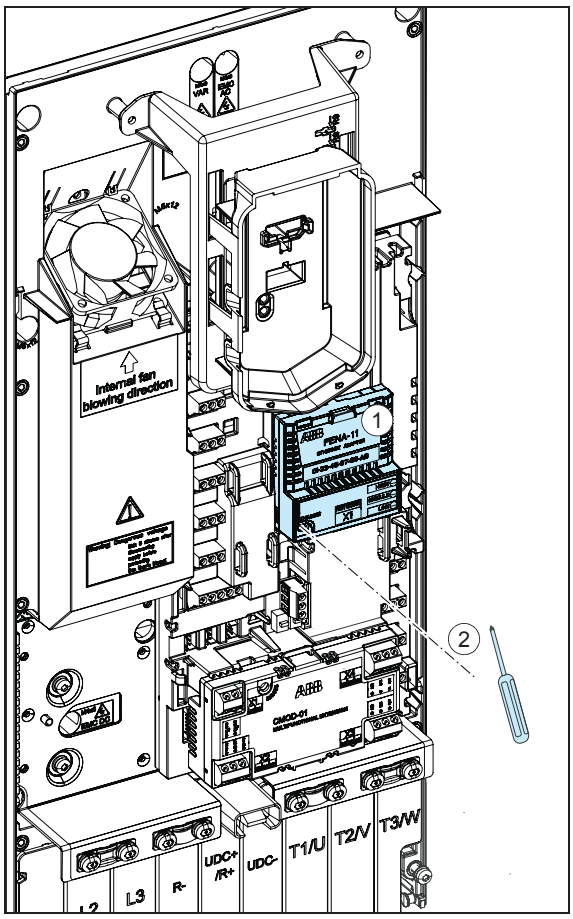
Option slot 2 (I/O extension modules)

1. Put the module carefully into its position on the control unit.
2. Tighten the mounting screw.
3. Tighten the grounding screw (CHASSIS) to **0.8** N·m. The screw grounds the module. It is necessary for fulfilling the EMC requirements and for correct operation of the module.



Option slot 1 (fieldbus adapter modules)

1. Put the module carefully into its position on the control unit.
2. Tighten the mounting screw (CHASSIS) to **0.8** N·m. The screw tightens the connections and grounds the module. It is necessary for fulfilling the EMC requirements and for correct operation of the module.



Wiring the optional modules

See the appropriate optional module manual or for I/O options chapter *Optional I/O extension modules* for specific installation and wiring instructions.

7

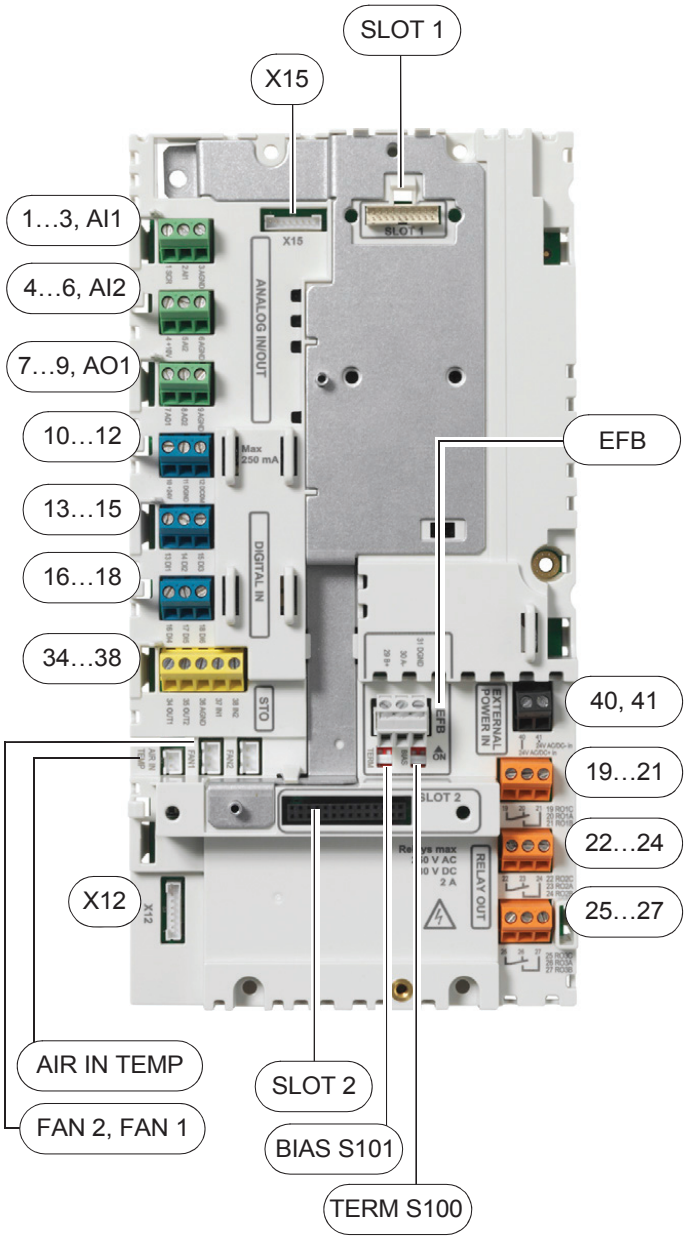
Control unit

Contents of this chapter

This chapter contains the default I/O connection diagram, descriptions of the terminals and technical data for the drive control unit (CCU-24).

Layout

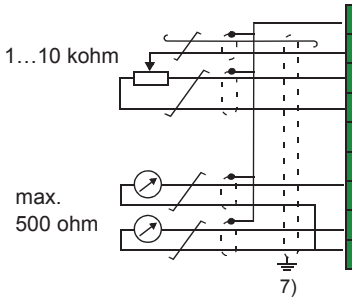
The layout of the external control connection terminals on the drive module control unit is shown below.



SLOT 1	
Option slot 1 (fieldbus adapter modules)	
ANALOG IN/OUT	
1...3	Analog input 1
AI1	Current/Voltage selection switch for analog input 1
4...6	Analog input 2
AI2	Current/Voltage selection switch for analog input 2
7...9	Analog outputs
AO1	Current/Voltage selection switch for analog output 1
10...12	Auxiliary voltage output
DIGITAL IN	
13...18	Digital inputs
STO	
34...38	Safe torque off connection. Reserved for internal use with options +Q951, +Q963 and +Q971.
AIR IN TEMP	Internal air temperature NTC sensor connection
FAN2	Internal fan 2 connection
FAN1	Internal fan 1 connection
X12	Panel port (control panel connection, wired at the factory to the control panel)
X15	Reserved to internal use.
EFB	
EIA/RS-485 fieldbus connector	
BIAS S101	Bias resistor switch
TERM S100	End termination switch
29...31	Connection terminals
SLOT 2	
Option slot 2 (I/O extension modules)	
40, 41	24 V AC/DC external power input
RO1 … RO3	
19...21	Relay output 1 (RO1)
22...24	Relay output 2 (RO2)
25...27	Relay output 3 (RO3)

Default I/O connection diagram

The default I/O connections of the ABB Standard macro are shown below.



XI		Reference voltage and analog inputs and outputs
1	SCR	Signal cable shield (screen)
2	AI1	**Output frequency reference**: 0…10 V [1]
3	AGND	Analog input circuit common
4	+10V	Reference voltage 10 V DC
5	AI2	Not configured
6	AGND	Analog input circuit common
7	AO1	**Output frequency:** 0…20 mA
8	AO2	**Motor current:** 0…20 mA
9	AGND	Analog output circuit common
X2 & X3		Aux. voltage output and programmable digital inputs
10	+24V	Aux. voltage output +24 V DC, max. 250 mA [2]
11	DGND	Auxiliary voltage output common
12	DCOM	Digital input common for all
13	DI1	**Stop (0) / Start (1)**
14	DI2	**Forward (0) / Reverse (1)**
15	DI3	**Constant frequency selection** [3]
16	DI4	**Constant frequency selection** [3]
17	DI5	**Ramp set 1 (0) / Ramp set 2 (1)** [4]
18	DI6	Not configured [7]
X6, X7, X8		Relay outputs
19	RO1C	**Ready run**
20	RO1A	250 V AC / 30 V DC
21	RO1B	2 A
22	RO2C	**Running**
23	RO2A	250 V AC / 30 V DC
24	RO2B	2 A
25	RO3C	**Fault (-1)**
26	RO3A	250 V AC / 30 V DC
27	RO3B	2 A
X5		EIA-485 Modbus RTU
29	B+	Embedded Modbus RTU (EIA-485).
30	A-	
31	DGND	
S4	TERM	Serial data link termination switch
S5	BIAS	Serial data link bias resistors switch
X4		Safe torque off
34	OUT1	Safe torque off. Factory connection. Both circuits must be closed for the drive to start. See chapter *Safe torque off function* and section *Connecting the Safe torque off circuit* on page *84*.
35	OUT2	
36	SGND	
37	IN1	
38	IN2	
X10		24 V AC/DC
40	24 V AC/DC+ i	Ext. 24V AC/DC input to power up the control unit when the main supply is disconnected.
41	24 V AC/DC- in	

See the notes on the next page.

Total load capacity of the Auxiliary voltage output +24V (X2:10) is 6.0 W (250 mA / 24 V DC).

Terminal sizes: 0.14…2.5 mm^2 (all terminals)

Tightening torques: 0.5…0.6 N·m (0.4 lbf·ft)

Notes:

1. Current [0(4)…20 mA, R_{in} = 100 ohm] or voltage [0(2)…10 V, R_{in} >200 kohm]. Change of setting requires changing the corresponding parameter.

2. Total load capacity of the Auxiliary voltage output +24V (X2:10) is 6.0 W (250 mA / 24 V) minus the power taken by the option modules installed on the board.
3. In scalar control (default): See **Menu - Primary settings - Start, stop, reference - Constant frequencies** or parameter group 28 Frequency reference chain.
   In vector control: See **Menu - Primary settings - Start, stop, reference - Constant speeds** or parameter group Speed reference selection

DI3	DI4	Operation/Parameter
0	0	Set frequency through AI1
1	0	28.26 Constant frequency 1
0	1	28.27 Constant frequency 2
1	1	28.28 Constant frequency 3

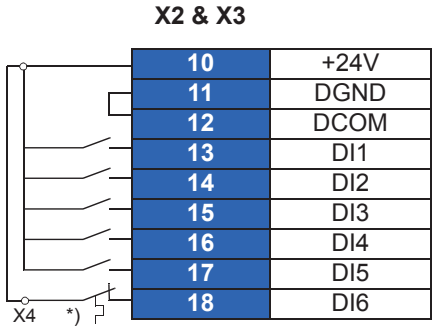
4. See **Menu - Primary settings - Ramps** or parameter group 28 Frequency reference chain.

DI5	Ramp set	Parameters
0	1	28.72 Freq acceleration time 1 28.73 Freq deceleration time 1
1	2	28.74 Freq acceleration time 2 28.75 Freq deceleration time 2

5. Connected with jumpers at the factory.
6. Ground the outer shield of the cable 360 degrees under the grounding clamp on the grounding shelf for the control cables.
7. With option +E202 in frames R10 and R11, digital input DI6 is reserved for internal overtemperature supervison of the cabinet. See section *Option +E205 in frames R10 and R11: DI6 internal overtemperature supervision (page 118)*

Option +E205 in frames R10 and R11: DI6 internal overtemperature supervision

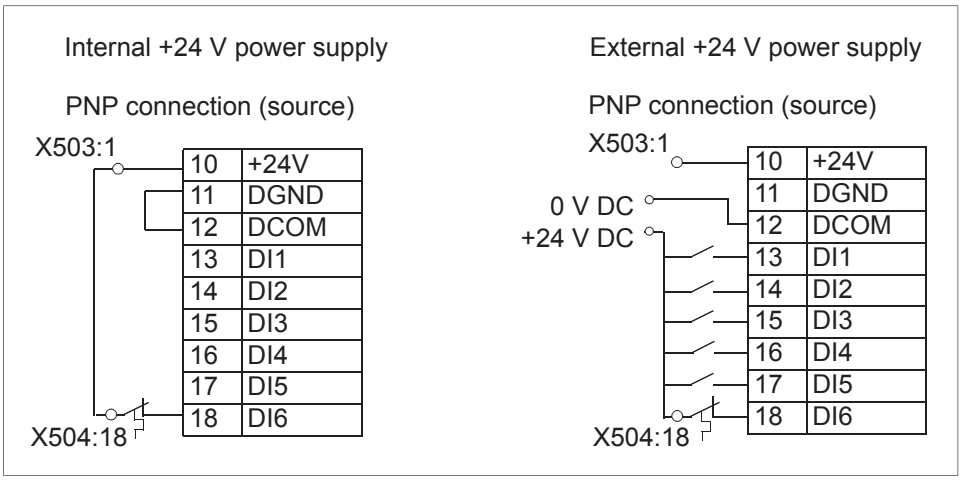
With option +E205, digital input DI6 is used by default for the internal overtemperature supervision of the cabinet in frames R10 and R11. The I/O connection is shown below.



*) Internal overtemperature supervision of the cabinet is connected between DI6 and +24V auxiliary voltage supply. If DI6 is to be used for another purpose, see section *Changing internal overtemperature supervision from DI6 to another digital input (page 120)*

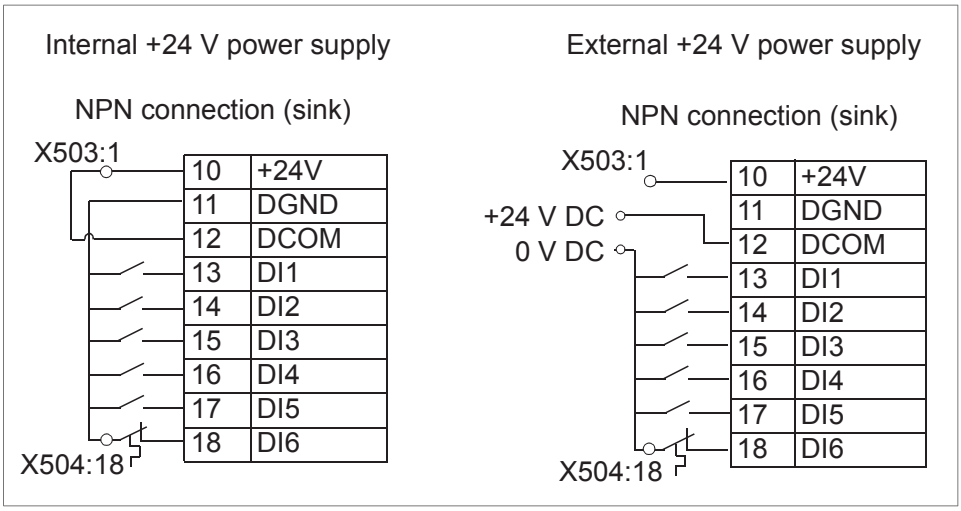
Power supply connections for PNP with option +L504

Internal and external +24 V power supply connections with option +L504 for PNP configuration are shown below.



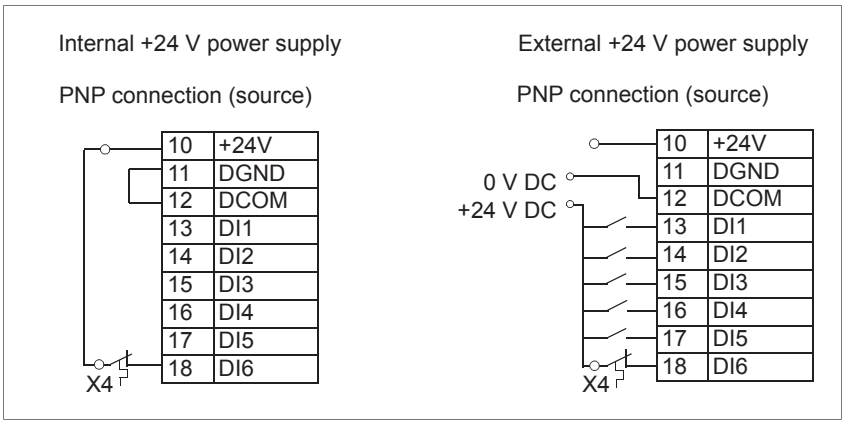
Power supply connections for NPN with option +L504

Internal and external +24 V power supply connections for NPN configuration are shown below.



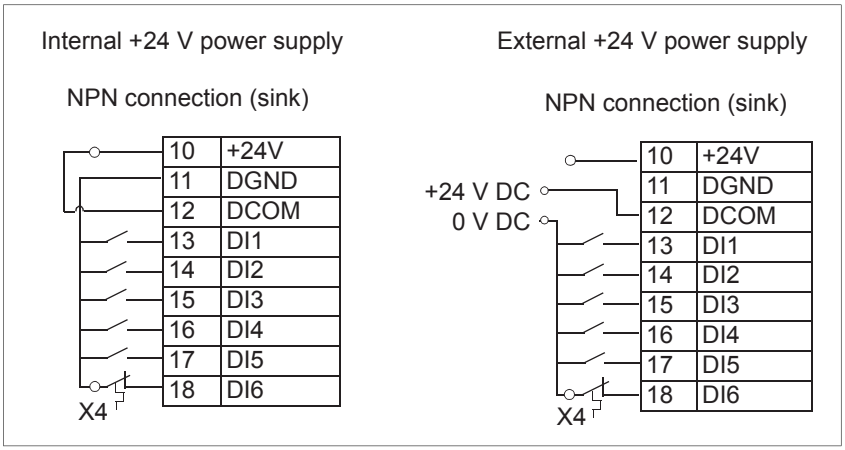
Power supply connections for PNP without option +L504

Internal and external +24 V power supply connections without option +L504 for PNP configuration are shown below.



Power supply connections for NPN without option +L504

Internal and external +24 V power supply connections without option +L504 for NPN configuration are shown below.



Changing internal overtemperature supervision from DI6 to another digital input

With option +E205 in frames R10 and R11, by default, digital input DI6 is used for the internal overtemperature supervision of the drive cabinet. If it is required to use DI6 for an other purpose, change the overtemperature supervision wiring from DI6 to another free digital input either on the control unit or on the CMOD-01 multifunction extension module. Activate the overtemperature supervision in the new digital input with these parameter settings:

1. Select the correct digital input from parameter **31.01 External event 1 source**.
2. Check that parameter **31.02 External event 1 type** is set to Fault = 0.

For more information, see the firmware manual.

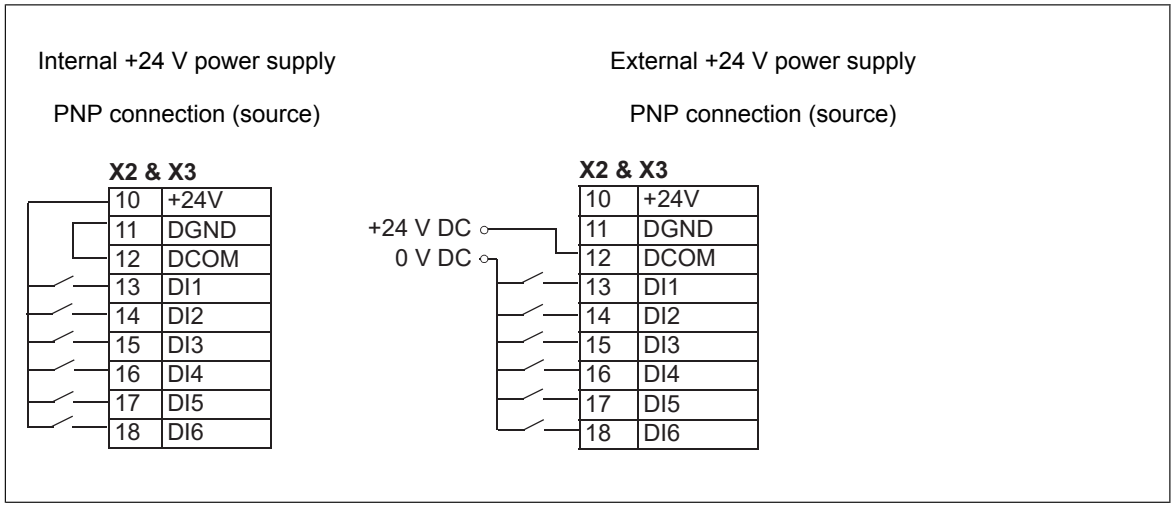
WARNING!
Always connect the internal overtemperature supervision of the drive cabinet to a free digital input or to CMOD-01 multifunction extension module if disconnected from digital input DI6. Activate the change. Disconnection of overtemperature supervision leads to overtemperature and can damage the drive.

Switches

Switch	Description	Position	
TERM	EFB link termination. Must be set to the terminated (ON) position when the drive (or another device) is the first or last unit on the link.	ON TERM	Bus not terminated **(default)**
		ON TERM	Bus terminated
BIAS	Switches on the biasing voltages to the bus. One (and only one) device, preferably at the end of the bus must have the bias on.	ON BIAS	Bias off (**default**)
		ON BIAS	Bias on

PNP configuration for digital inputs (X2 & X3)

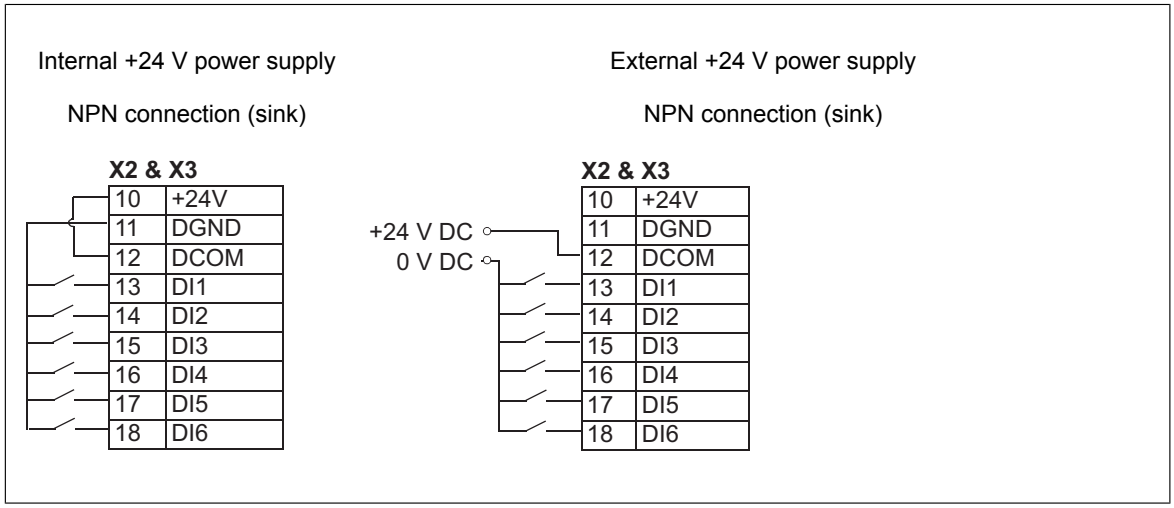
Internal and external +24 V power supply connections for PNP configuration are shown in the figure below.



WARNING!
Do not connect the +24 V AC cable to the control unit ground when the control unit is powered from an external 24 V AC supply.

NPN configuration for digital inputs (X2 & X3)

Internal and external +24 V power supply connections for NPN configuration are shown in the figure below.

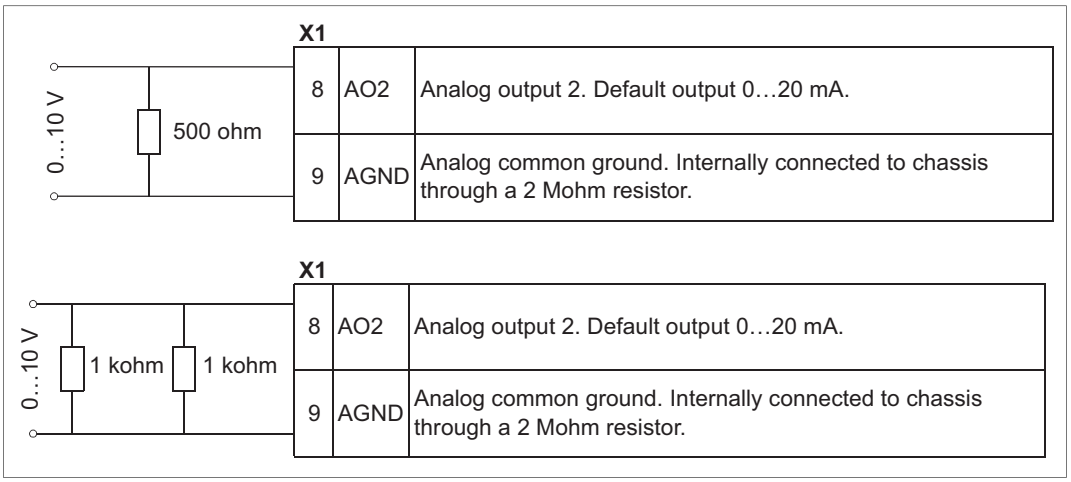


WARNING!
Do not connect the +24 V AC cable to the control unit ground when the control unit is powered from an external 24 V AC supply.

Connection for obtaining 0…10 V from analog output 2 (AO2)

To obtain 0…10 V from analog output AO2, connect a 500 ohm resistor (or two 1 kohm resistors in parallel) between analog output AO2 and analog common ground AGND.

Examples are shown in the figure below.

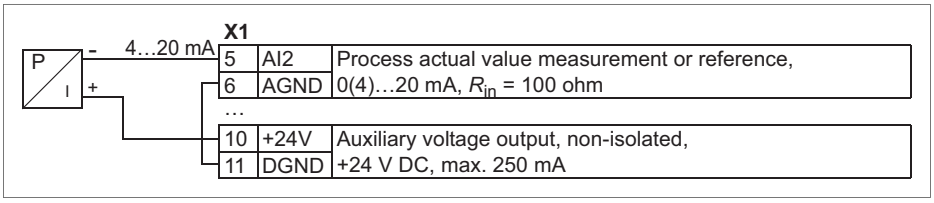


Connection examples of two-wire and three-wire sensors to analog input (AI2)

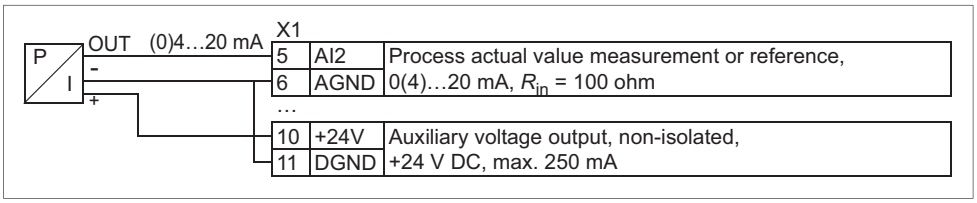
Hand/Auto, Hand/PID, and PID macros use analog input AI2.

Note:
The maximum capability of the auxiliary voltage output (24 V DC [250 mA]) must not be exceeded.

An example of a two-wire sensor/transmitter supplied by the drive auxiliary voltage output is shown below. Set the input signal to 4…20 mA, not 0…20 mA.



An example of a three-wire sensor/transmitter supplied by the drive auxiliary voltage output is shown below.The sensor is supplied through its current output and the drive feeds the supply voltage (+24 V DC). Thus the output signal must be 4…20 mA, not 0…20 mA.

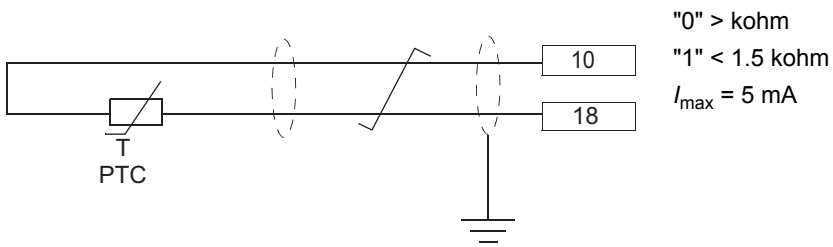


DI6 as frequency input

If DI6 is used as a frequency input, see the firmware manual for how to set parameters accordingly.

DI6 as PTC input

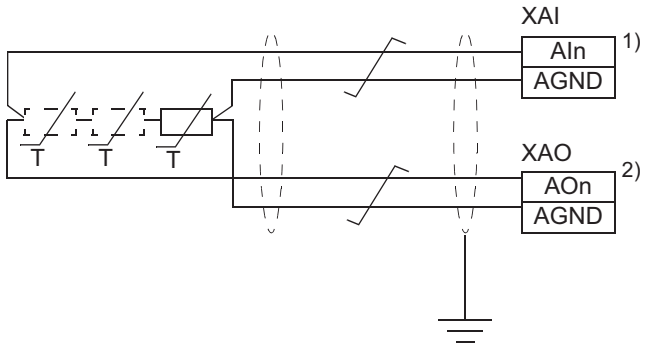
If DI6 is used as a PTC input, see firmware manual for how to set parameters accordingly. The wiring and the PTC sensor need to be double isolated. Otherwise the CMOD-02 I/O extension module must be used.



AI1 and AI2 as Pt100, Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1)

One, two or three Pt100 sensors; one, two or three Pt1000 sensors; or one Ni1000, KTY83 or KTY84 sensor for motor temperature measurement can be connected between an analog input and output as shown below. Leave the other end of the shield unconnected or ground it indirectly via a few nanofarads high-frequency capacitor, for example, 3.3 nF / 630 V. The shield can also be grounded directly at both ends if they are in the same ground line with no significant voltage drop between the end points.

1...3 x (Pt100 or Pt100) or
1 x (Ni1000 or KTY83 or KTY84)



1. Set the input type to voltage with switch S1 for analog input AI1or with S2 for analog input AI2. Set the appropriate analog input unit to V (volt) in parameter group 12 Standard AI.
2. Select the excitation mode in parameter group 13 Standard AO.

WARNING!
As the inputs pictured above are not insulated according to IEC 60664, the connection of the motor temperature sensor requires double or reinforced insulation between motor live parts and the sensor.

If the assembly does not fulfill this requirement, the I/O board terminals must be protected against contact and must not be connected to other equipment or the temperature sensor must be isolated from the I/O terminals.

Safe torque off (X4)

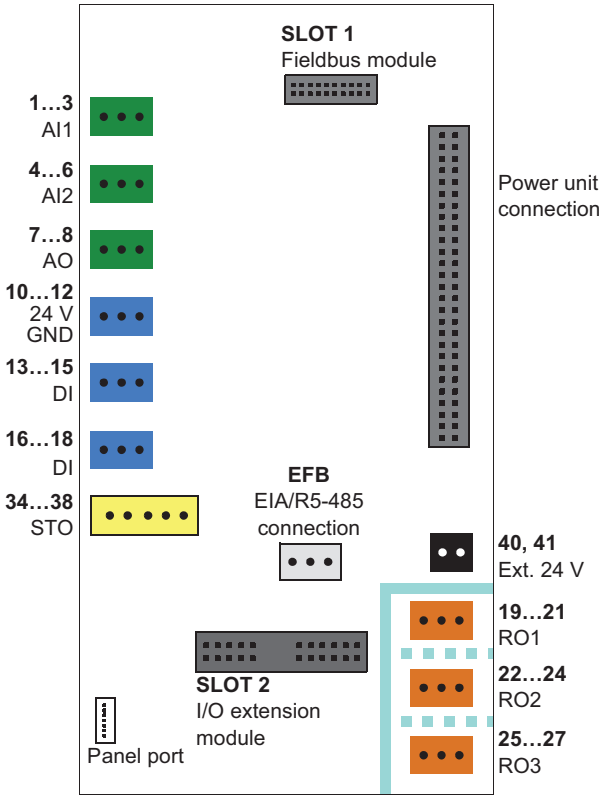
For the drive to start, both connections (+24 V DC to IN1 and +24 V DC to IN2) must be closed. By default, the terminal block has jumpers to close the circuit.

Remove the jumpers before connecting an external Safe torque off circuitry to the drive. See also chapter *The Safe torque off function (page 243)*.

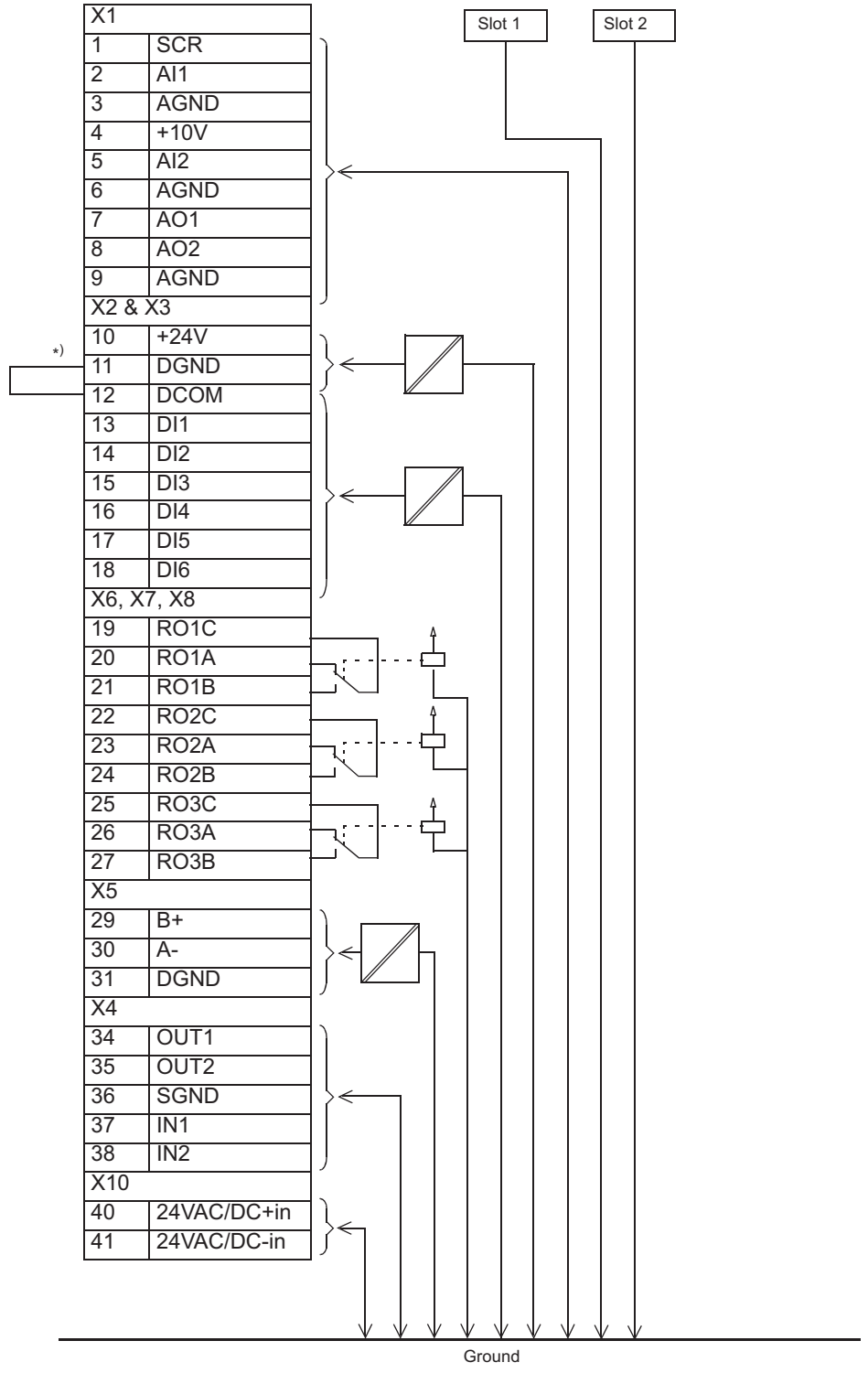
Note:
Only 24 V DC can be used for STO. Only PNP input configuration can be used.

Technical data

External power supply **Term. 40, 41**	Maximum power: 36 W, 1.50 A at 24 V AC/DC ±10% as standard Terminal size: 0.14…2.5 mm^2
+24 V DC output **(Term. 10)**	Total load capacity of this outputs is 6.0 W (250 mA / 24 V) minus the power taken by the option modules installed on board. Terminal size: 0.14…2.5 mm^2
Digital inputs DI1…DI6 **(Term. 13…18)**	Input type: NPN/PNP Terminal size: 0.14…2.5 mm^2 DI1…DI5 (Term.13…17) 12/24 V DC logic levels: "0" < 4 V, "1" > 8 V R_{in}: 3 kohm Hardware filtering: 0.04 ms, digital filtering: 2 ms sampling DI5 (Term.17) Can be used as a digital or frequency input. 12/24 V DC logic levels: "0" < 3 V, "1" > 8 V R_{in}: 3 kohm Max. frequency 16 kHz Symmetrical signal (duty cycle D = 0.50) DI6 (Term.18) Can be used as a digital or frequency input. 12/24 V DC logic levels: "0" < 3 V, "1" > 8 V R_{in}: 3 kohm Max. frequency 16 kHz Symmetrical signal (duty cycle D = 0.50) Hardware filtering: 0.04 ms, digital filtering: 2 ms sampling **Note:** DI6 is not supported in the NPN configuration. PTC mode – PTC thermistor can be connected between DI6 and +24VDC: < 1.5 kohm = ‘1’ (low temperature), > 4 kohm = ‘0’ (high temperature), open circuit = ‘0’ (high temperature). DI6 is not a reinforced/double insulated input. Connecting the motor PTC sensor to this input requires usage of a reinforced/double insulated PTC sensor inside the motor
Relay outputs RO1…RO3 **(Term. 19…27)**	250 V AC / 30 V DC, 2 A Terminal size: 0.14…2.5 mm^2 See section ***Isolation areas*** *(page 126)*.
Analog inputs AI1 and AI2 **(Term. 2 and 5)**	Current/voltage input mode selected with a parameter, see *AI1 and AI2 as Pt100, Pt1000, Ni1000, KTY83 and KTY84 sensor inputs (X1) (page 123)*. Current input: 0(4)…20 mA, R_{in}: 100 ohm Voltage input: 0(2)…10 V, R_{in}: > 200 kohm Terminal size: 0.14…2.5 mm^2 Inaccuracy: typical ±1%, max. ±1.5% of full scale Inaccuracy for Pt100 sensors: 10 °C (50 °F)
Analog outputs AO1 and AO2 **(Term. 7 and 8)**	Current/voltage output mode for AO1 selected with a parameter, see *Connection for obtaining 0…10 V from analog output 2 (AO2) (page 121)*. Current output: 0…20 mA, R_{load}: < 500 ohm Voltage input: 0…10 V, R_{load}: > 100 kohm (AO1 only) Terminal size: 0.14…2.5 mm^2 Inaccuracy: ±1% of full scale (in voltage and current modes)
Reference voltage output for analog inputs +10 V DC (Term. 4)	Max. 20 mA output Inaccuracy: ±1%

Safe torque off (STO) inputs IN1 and IN2 (Term. 37 and 38)	24 V DC logic levels: "0" < 5 V, "1" > 13 V R_{in}: 2.47 kohm Terminal size: 0.14…2.5 mm^2
Embedded fieldbus (X5)	Connector pitch 5 mm, wire size 2.5 mm^2 Physical layer: EIA-485 Cable type: Shielded twisted pair cable with twisted pair for data and a wire or pair for signal ground, nominal impedance 100…165 ohms, for example Belden 9842 Transmission rate: 9.6…115.2 kbit/s Termination by switch
Control panel - drive connection	EIA-485, male RJ-45 connector, max. cable length 100 m (328 ft)
Control panel - PC connection	USB Type Mini-B, max. cable length 2 m (7 ft)
Isolation areas	
	Reinforced insulation (IEC/EN 61800-5-1:2007)
	Functional insulation (IEC/EN 61800-5-1:2007)
	The terminals on the control board fulfill the Protective Extra Low Voltage (PELV) requirements (EN 50178): There is reinforced insulation between the user terminals which only accept ELV voltages and terminals that accept higher voltages (relay outputs). **Note:** There is functional insulation also between the individual relay outputs. **Note:** There is reinforced insulation on the power unit.

Ground isolation diagram



*) Jumper installed at factory

8

Installation checklist of the drive

Contents of this chapter

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

Checklist

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

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

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

WARNING!
Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.

Make sure that …	☑
The ambient operating conditions meet the drive ambient conditions specification, and enclosure rating (IP code or UL enclosure type).	☐
The supply voltage matches the nominal input voltage of the drive. See the type designation label.	☐
The drive cabinet has been attached to floor, and if necessary due to vibration etc, also by its top to the wall or roof.	☐
The cooling air flows freely in and out of the drive.	☐
If the drive is connected to a network other than a symetrically grounded TN-S system: Check the compatibility. See the electrical installation instructions.	☐

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

9

Start-up

Contents of this chapter

This chapter contains the start-up procedure of the drive. The default device designations (if any) are given in brackets after the name, for example "main switch-disconnector (Q1)". The same device designations are also used in the circuit diagrams, typically.

Start-up procedure

Action	☑
Safety	
WARNING! Obey the safety instructions during the start-up procedure. See chapter *Safety instructions (page 15)*.	☐
Checks/Settings with no voltage connected	
Check the mechanical and electrical installation of the drive. See *Installation checklist of the drive (page 129)*.	☐
Powering up the drive	
Close the cabinet doors.	☐
Make sure that it is safe to connect voltage. Ensure that: • cabinet doors are closed • nobody is working on the drive or circuits that have been wired from outside into the drive cabinet • cover of the motor terminal box is on.	☐
Close the main switch-disconnector (Q1).	☐
Setting up the drive parameters, and performing the first start	

Action	☑
Setup the drive control program. See *Quick start-up guide for ACS580 drives with standard control program* (3AXD50000048035 [English])	☐
Drives with main contactor (Q2, option +F250): Close the main contactor by turning the operating switch on the cabinet door from OFF into ON position.	☐
Perform the first start of the drive and motor.	☐
Stop the motor and drive.	☐
Drives with a fieldbus adapter module (optional): Set the fieldbus parameters. Activate the appropriate assistant in the control program, or see the user's manual of the fieldbus adapter module, and the drive firmware manual. Not all control programs include assistants. Check that the communication works between the drive and the PLC.	☐
On-load checks	
Check that the cooling fans rotate freely in the right direction, and the air flows upwards. A paper sheet set on the intake (door) gratings stays. The fans run noiselessly.	☐
Check that the motor starts. stops and follows the speed reference in right direction when controlled with the control panel.	☐
Check that the motor starts. stops and follows the speed reference in right direction when controlled through the customer-specific I/O or fieldbus.	☐
Drives in which the Safe torque off control circuit is connected: Test and validate the operation of the Safe torque off function. See chapter *The Safe torque off function (page 243)*.	☐
Drives with an emergency stop circuit (options +Q951 and +Q963): Test and validate the operation of the emergency-stop circuit. *Implementing the emergency stop function (page 82)*.	☐

10

Fault tracing

Contents of this chapter

This chapter describes the fault tracing possibilities of the drive.

Warning and fault messages

See the firmware manual for the descriptions, causes and remedies of the drive control program warning and fault messages.

11

Maintenance

Contents of this chapter

This chapter contains preventive maintenance instructions.

Maintenance intervals

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

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

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

Descriptions of symbols

Action	Description
I	Visual inspection and maintenance action if needed
P	Performance of on/off-site work (commissioning, tests, measurements or other work)
R	Replacement of component

Recommended annual maintenance actions by the user.

Action	Target
I	IP42 air inlet and outlet meshes on the cabinet doors
R	IP54 air filters on the cabinet doors
P	Quality of supply voltage
I	Spare parts
P	Capacitor reforming, spare modules and spare capacitors
I	Tightness of terminals
I	Dustiness, corrosion or temperature
I	Heat sink cleaning

Recommended maintenance intervals after start-up

Component	Years from start-up					
	3	6	9	12	15	18
Cooling						
Main cooling fans						
Main cooling fans (frames R6 to R11)			R			R
Auxiliary cooling fans						
Auxiliary cooling fan for circuit boards (frames R6 to R9)			R			R
Second auxiliary cooling fan (frames R8 to R9)			R			R
Circuit board compartment cooling fans (frames R10 and R11)			R			R
Cabinet cooling fans						
Cabinet cooling fan, door (frames R6 to R9)			R			R
Cabinet cooling fan, 50 Hz, internal/door/IP54 (frames R10 to R11)			R			R
Cabinet cooling fan, 60 Hz, internal/IP54 (frames R10 to R11)		R		R		R
Cabinet cooling fan, 60 Hz, door (frames R10 to R11)			R			R
Aging						
Control panel battery (real-time clock)			R			R

4FPS10000309652

Cleaning the interior of the cabinet

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

WARNING!
Use a vacuum cleaner with an antistatic hose and nozzle. Using a normal vacuum cleaner creates static discharges which can damage circuit boards.

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. When necessary, clean the interior of the cabinet with a soft brush and a vacuum cleaner.

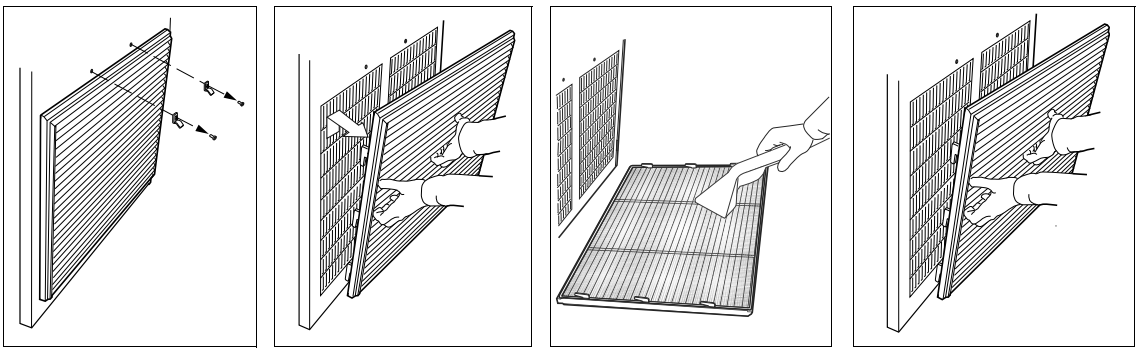
3. Check the air inlet and outlet meshes/filters of the cabinet. Clean when necessary.
   For IP42 (UL Type 1 Filtered) drives: see section *Cleaning the air inlet (door) meshes (IP42 / UL Type 1 Filtered)* below.
   For IP54 (UL Type 12) drives: see section *Cleaning the air inlet (door) meshes (IP42 / UL Type 1 Filtered)*.

Cleaning the air inlet (door) meshes (IP42 / UL Type 1 Filtered)

WARNING!
Use a vacuum cleaner with an antistatic hose and nozzle. Using a normal vacuum cleaner creates static discharges which can damage circuit boards.

Check the dustiness of the air inlet meshes. If the dust cannot be removed by vacuum cleaning from outside through the grating holes with a small nozzle, proceed as follows:

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Remove the fasteners at the top of the grating.
3. Lift the grating and pull it away from the door.
4. Vacuum clean the mesh.
5. Reinstall the mesh and grating in reverse order.

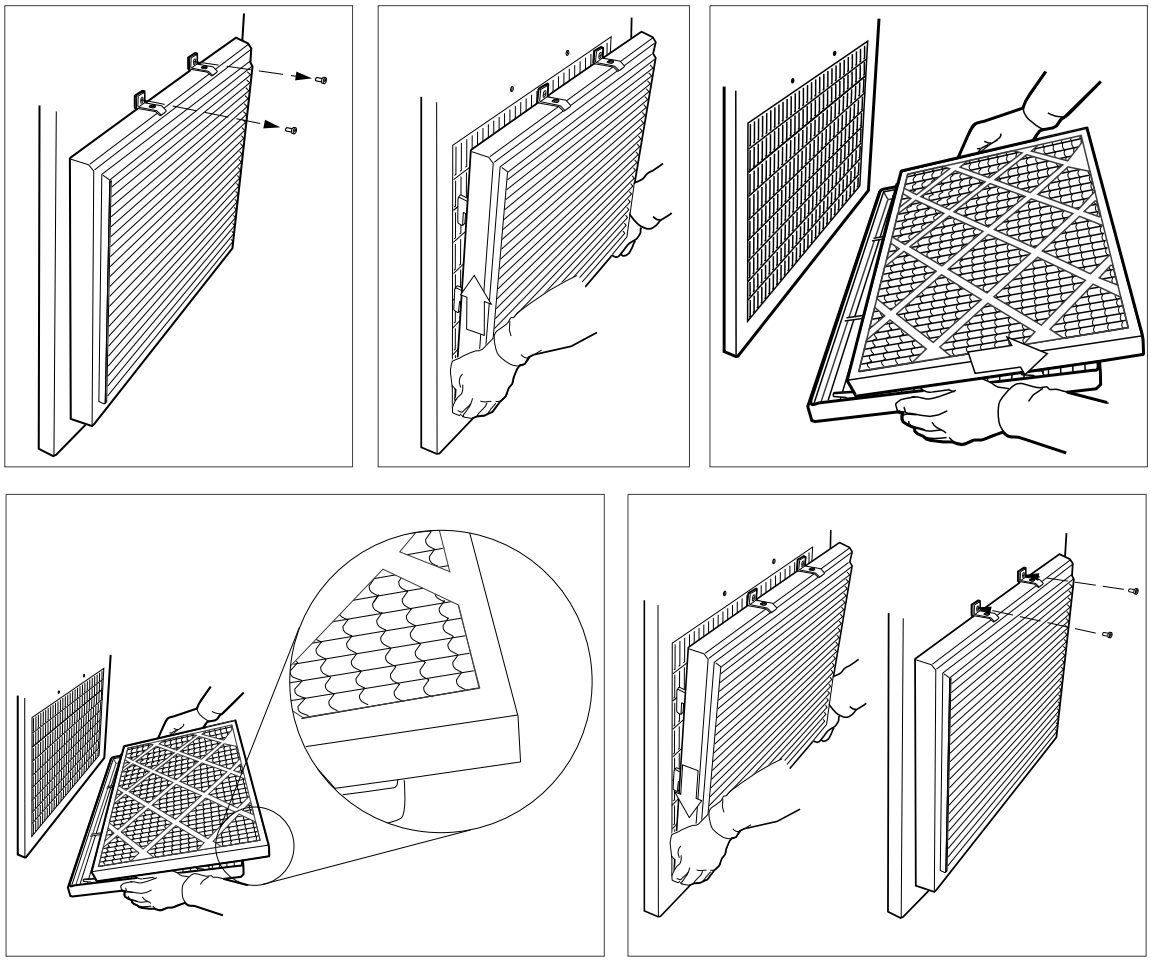


Replacing the air filters (IP54 / UL Type 12)

Check the air filters and replace if necessary (see *Materials (page 214)* for the correct filter types).

Inlet (door) filters (IP54 / UL Type 12)

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Remove the fasteners at the top of the grating.
3. Lift the grating and pull it away from the door.
4. Remove the air filter mat.
5. Place the new filter mat in the grating the metal wire side facing the door.
6. Reinstall the grating in reverse order.



Outlet (roof) filters (IP54 / UL Type 12)

1. Remove the front and back gratings of the fan cubicle by lifting them upwards
2. Remove the air filter mat.
3. Place the new filter mat in the grating.
4. Reinstall the grating in reverse order.

Heatsink

The drive module heatsink fins pick up dust from the cooling air. The drive runs into overtemperature warnings and faults if the heatsink is not clean. When necessary, clean the heatsink as follows.

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

WARNING!
Use a vacuum cleaner with antistatic hose and nozzle. Using a normal vacuum cleaner creates static discharges which can damage circuit boards.

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.

2. Remove the drive module from the cabinet. See section *Replacing the drive module (frames R6 to R9) (page 148)*
3. Undo the attaching screws of the handle plate of the drive module.
4. Remove the handle plate.
5. Vacuum the interior of the heatsink from the opening.
6. Blow clean compressed air (not humid or oily) upwards from the opening and, at the same time, vacuum from the top of the drive module.
7. Reinstall the handle plate.
8. Install the drive module back into the cabinet.

Fans

The lifespan of the cooling fans of the drive depends on the running time, ambient temperature and dust concentration. See the firmware manual for the actual signal which indicates the running time of the cooling fan. Reset the running time signal after fan replacement.

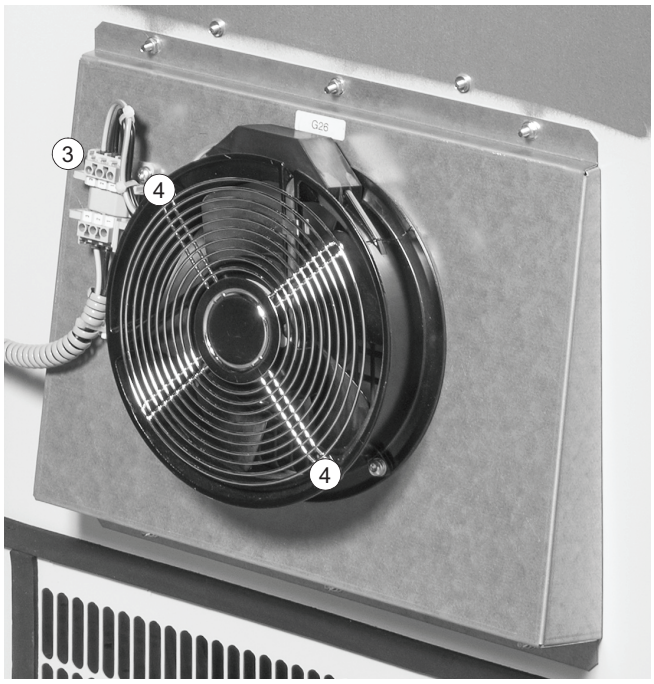
Replacement fans are available from ABB. Do not use other than ABB specified spare parts.

Replacing the door fan (frames R6 to R9)

Applicability: For drives with option +F250, +L537, +B055, +Q951, +Q963, Q971 or +G300.

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

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Unplug the power supply wires.
4. Undo the two mounting screws of the fan.
5. Install the new fan in reverse order.

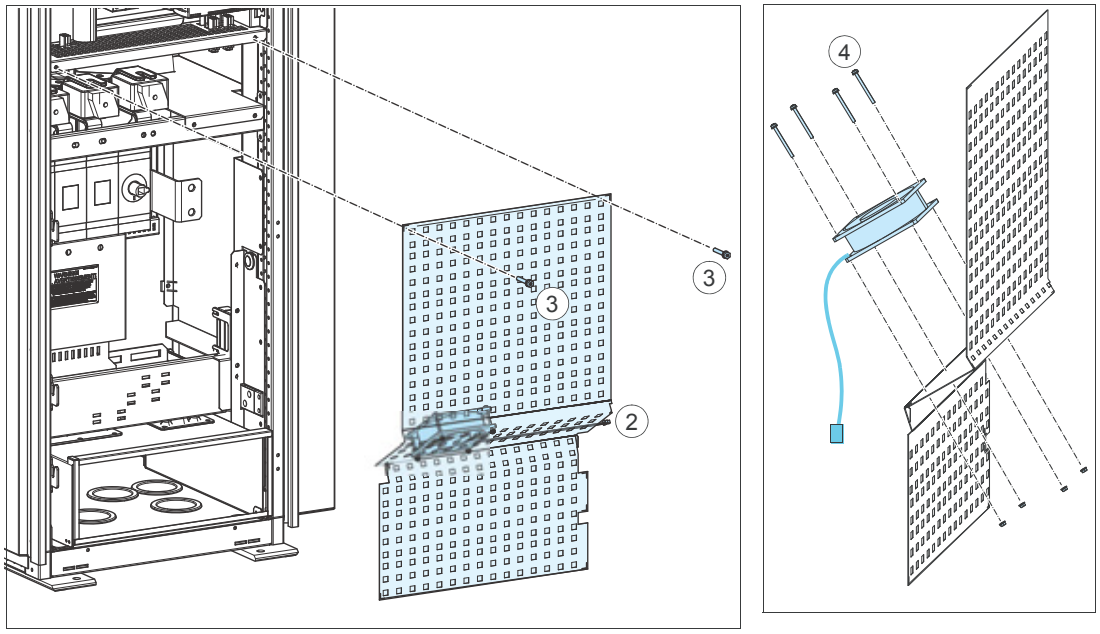


Replacing the cabinet fan (frames R6 to R9)

Applicability: For drives without any of these options +F250, +L537, +B055, +Q951, +Q963, +Q971 and +G300

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

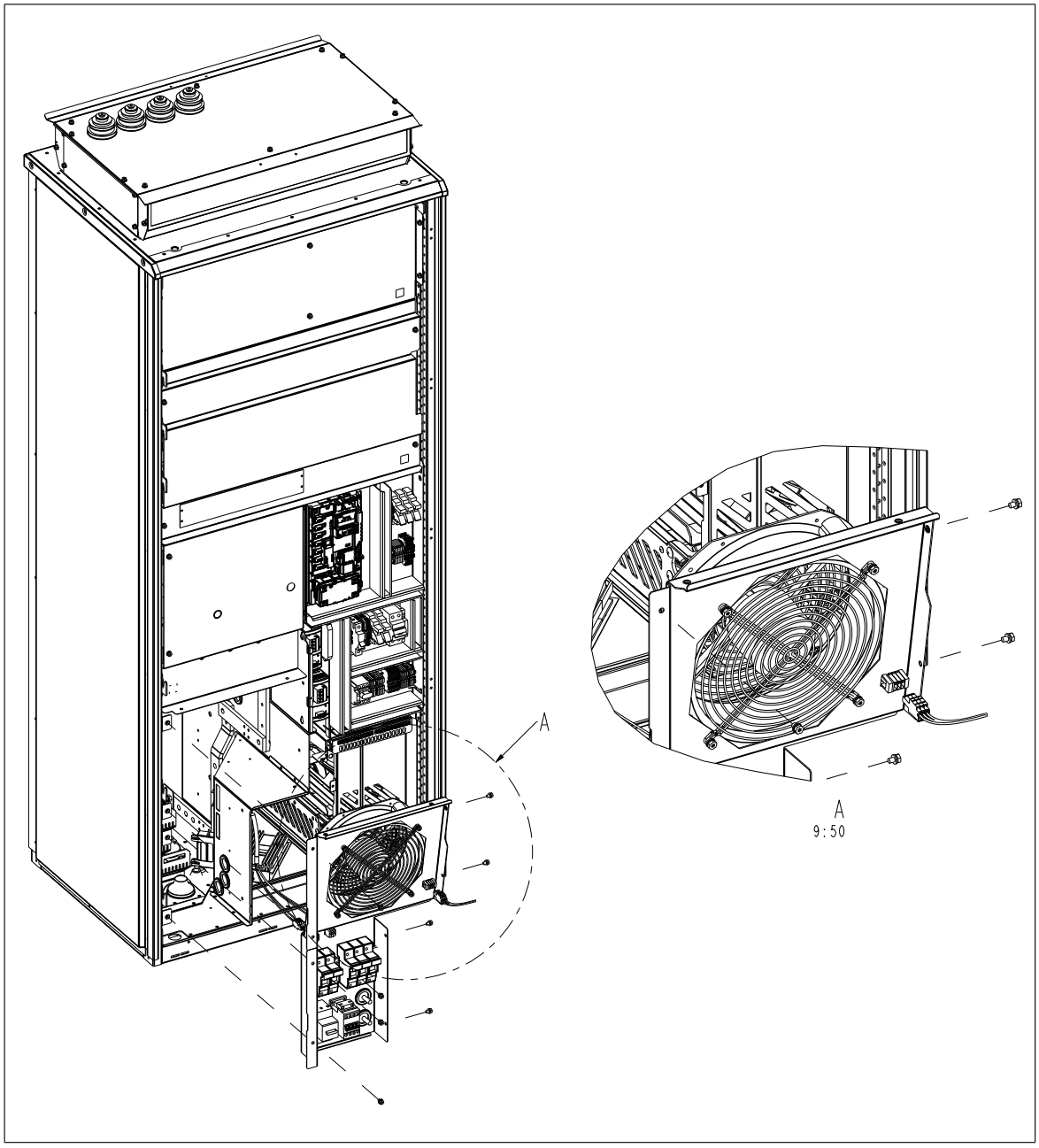
1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Unplug the power supply wires.
4. Remove the shroud.
5. Undo the mounting screws and nuts of the fan.
6. Install the new fan in reverse order.



Replacing the door fan (frames R10 and R11)

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

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Unplug the connector of the fan power supply at the front of the mounting plate.
4. Pull the mounting plate outwards somewhat and unplug the connectors at the back of the mounting plate.
5. Remove the mounting plate.
6. Undo the fan assembly mounting screws.
7. Remove the fan and the fan grating from the mounting plate.
8. Install the new fan in reverse order.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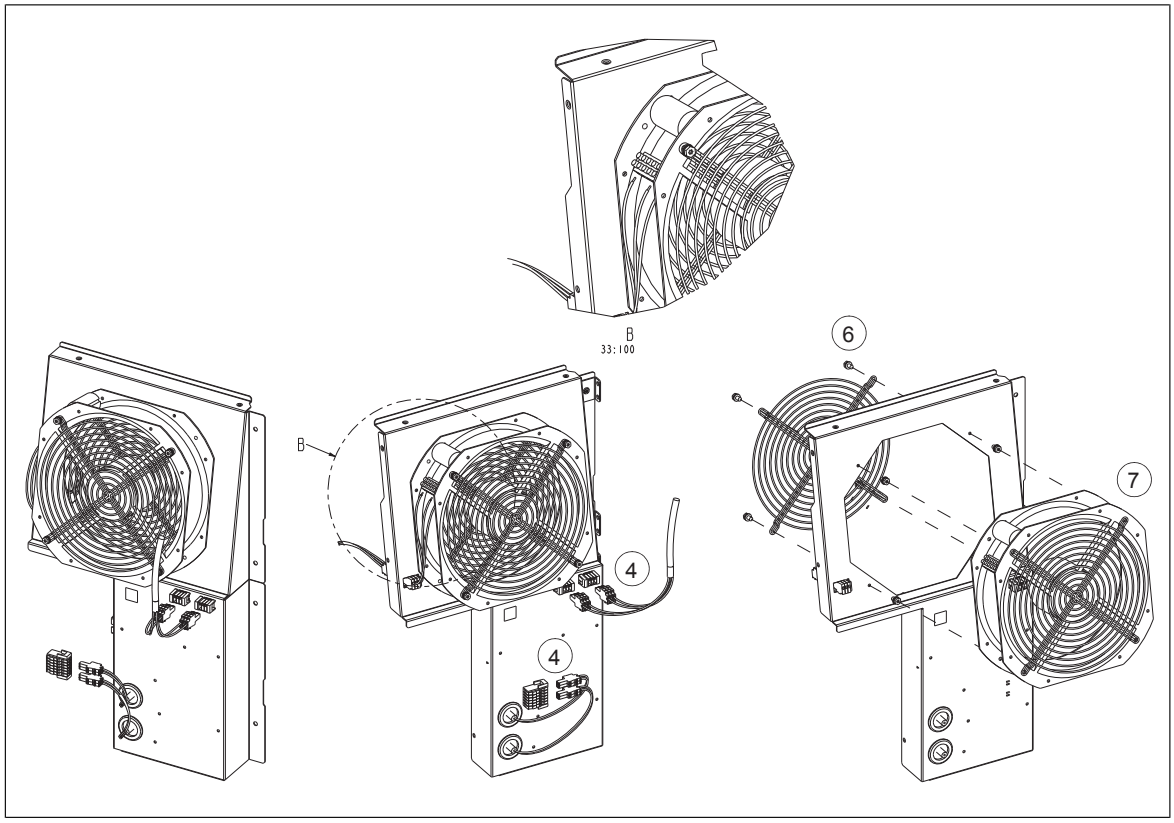
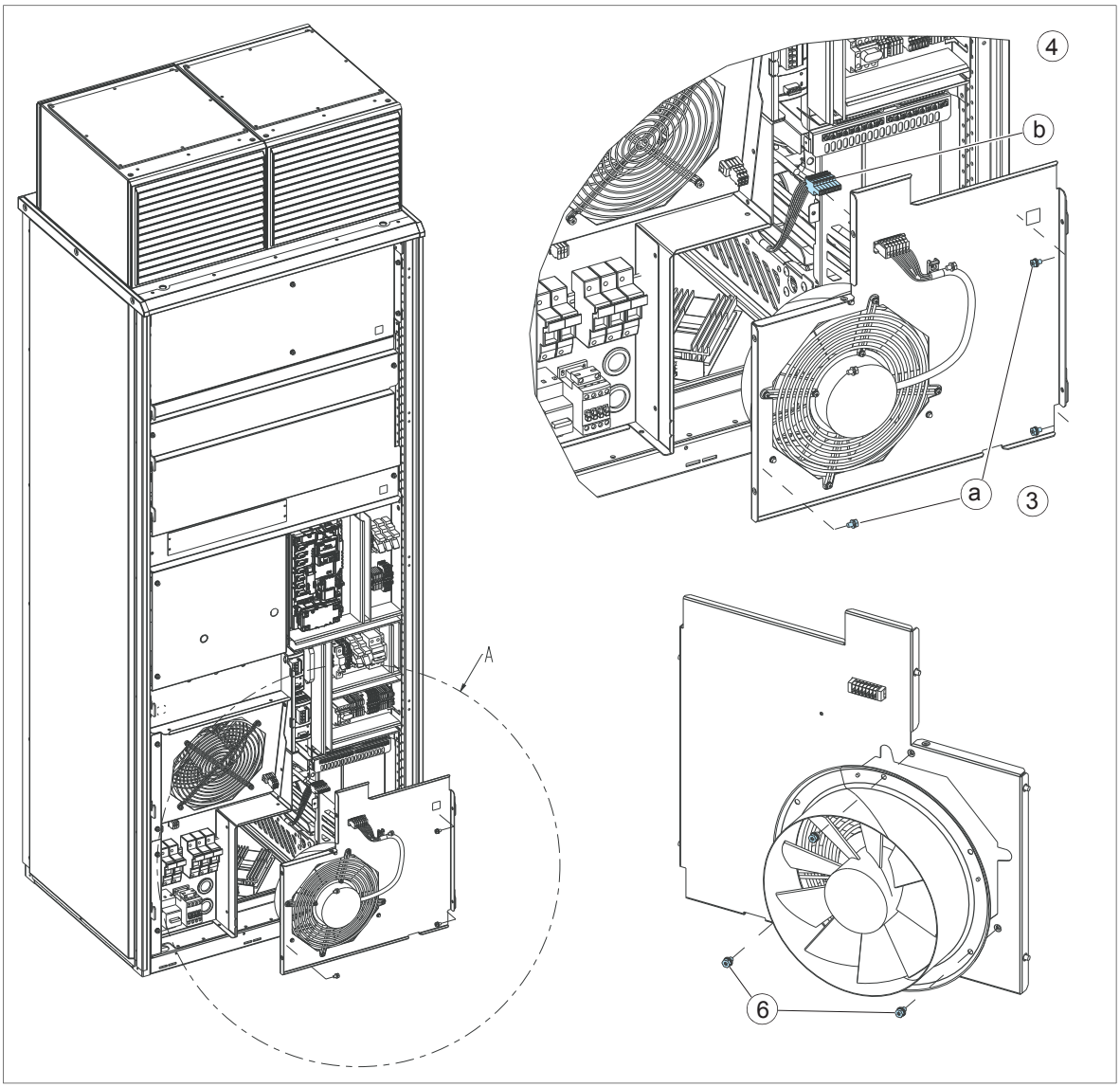


Replacing the cabinet fan (frames R10 and R11, IP54)

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

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Undo the fastening screws (a) of the fan mounting plate.
4. Pull the mounting plate outwards and unplug the power supply cable (b) of the fan behind the mounting plate.
5. Remove the fan mounting plate.
6. Undo the mounting screws and nuts of the fan, and take it out of the mounting plate.
7. Install the new fan in reverse order.

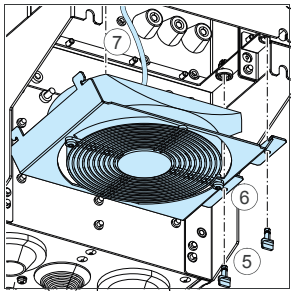


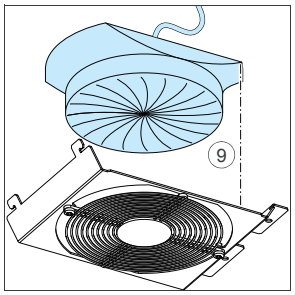
Replacing the drive module main fans (frames R6 to R8)

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

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Remove the drive module from the cabinet as described in section *Replacing the drive module (frames R6 to R9) (page 148)*.
4. Remove the two mounting screws of the fan mounting plate at the bottom of the drive module.
5. Unplug the fan power supply wires from the drive.
6. Pull the fan mounting plate down from the side edge.
7. Unplug the fan power supply wires from the drive.
8. Lift the fan mounting plate off.
9. Remove the fan from the mounting plate.

10. Install the new fan in reverse order.
11. Reset the fan on-time counter in parameter group 5 of the drive control program.

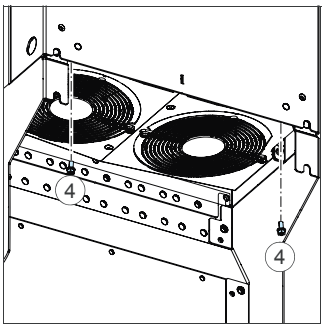


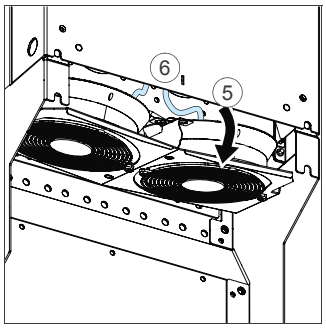


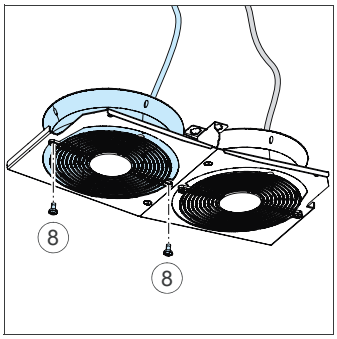
Replacing the drive module main fans (frame R9)

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

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Remove the drive module from the cabinet as described in section *Replacing the drive module (frames R6 to R9) (page 148)*.
4. Undo the two mounting screws of the fan mounting plate at the bottom of the drive module.
5. Turn the mounting plate downwards.
6. Unplug the fan power supply wires from the drive.
7. Remove the fan mounting plate.
8. Remove the fans by removing the two mounting screws.
9. Install the new fans in reverse order.
10. Reset the fan on-time counter in parameter group 5 of the drive control program.



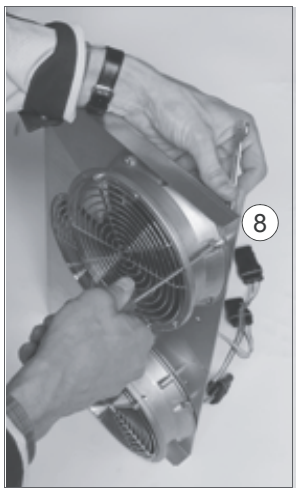




Replacing the drive module main fans (frames R10 and R11)

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

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Remove the drive module out of the cabinet as described in section *Replacing the drive module (frames R10 and R11) (page 154)*.
4. Open the support legs of the pedestal.
5. Undo the two screws that fasten the fan assembly plate.
6. Tilt the fan assembly plate down.
7. Disconnect the power supply wires of the fans.
8. Remove the fan assembly from the drive module.
9. Undo the fastening screws of the fan(s) and remove the fan(s) from the assembly plate.
10. Install the new fan(s) in reverse order.
11. Reset the fan on-time counter in parameter group 5 of the drive control program.

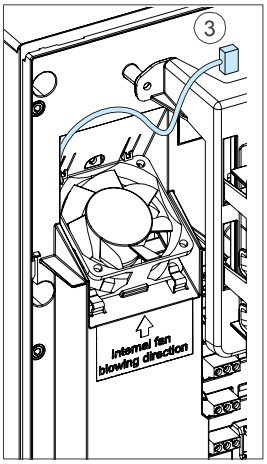


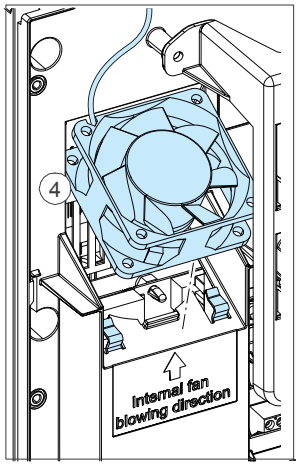
Replacing the auxiliary cooling fan of the drive module (frames R6 to R9)

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

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Unplug fan power supply wires from the drive.
4. Release the retaining clips.
5. Lift the fan off.
6. Install the new fan in reverse order.

   Note:
   Make sure that the arrow on the fan points up.

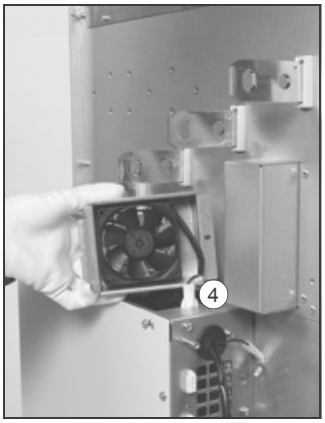




Replacing the circuit board compartment cooling fans (frames R10 and R11)

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

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Remove the drive module out of the cabinet as described in section *Replacing the drive module (frames R10 and R11) (page 154)*.
4. Undo the fastening screw of the fan enclosure.
5. Unplug the power supply cable of the fan.
6. Install the new fan in reverse order.



Replacing the drive module (frames R6 to R9)

This replacing procedure requires: preferably two persons, a set of screw drivers with extension bar and a torque wrench, chains for securing the module during the installation. The drawings below show a cabinet of frame size R7. The procedure is the same for the other frame sizes.

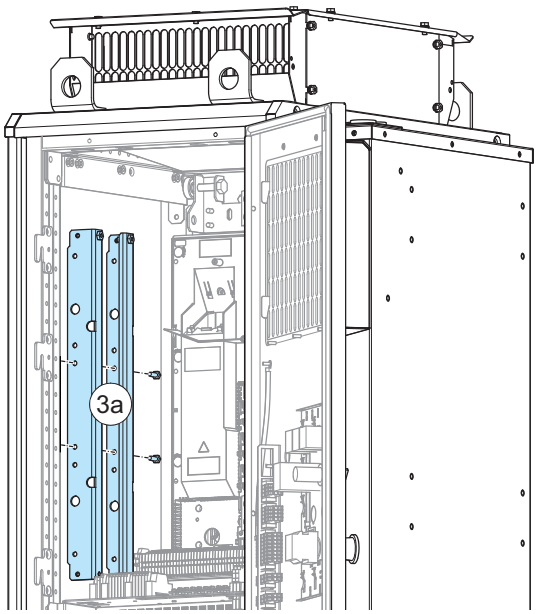
WARNING!
Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

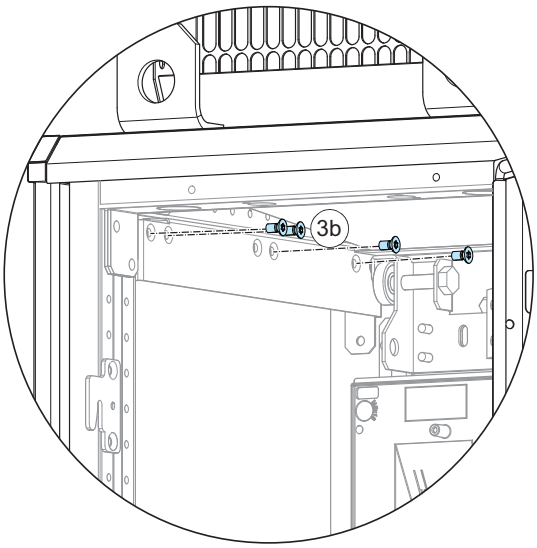
Handle the drive module carefully:

- Use safety shoes with a metal toe cap to avoid foot injury.
- Lift the drive module only by the lifting lugs.

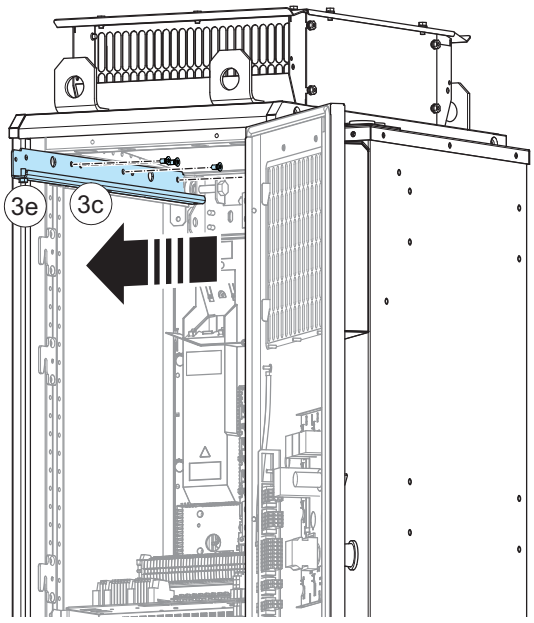
1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. To attach the sliding rails:
   3 a) Remove the sliding rails (2 pcs) from the left-hand side cabinet frame.
   3 b) Undo the four screws from the top horizontal studs.
   3 c) Attach the left-hand side sliding rail to the horizontal stud with the removed screws
   3 d) Attach the right-hand side sliding rail to the horizontal stud with the removed screws.

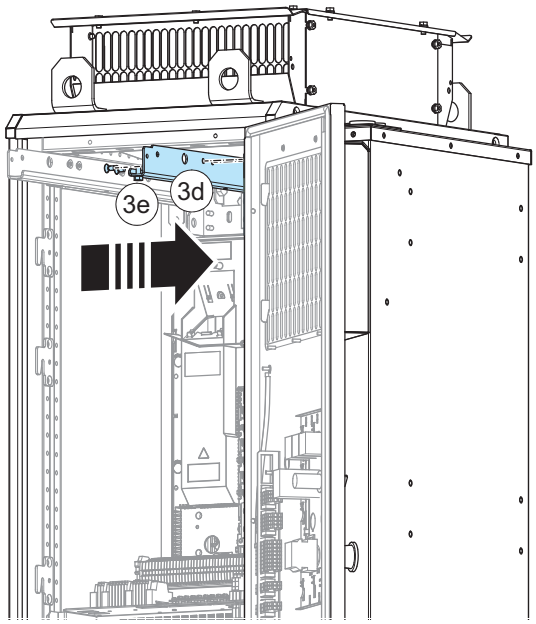
WARNING!
Check that the stopping screws (3e) at the ends of the studs are in place, so that the drive module cannot slide off the rail.





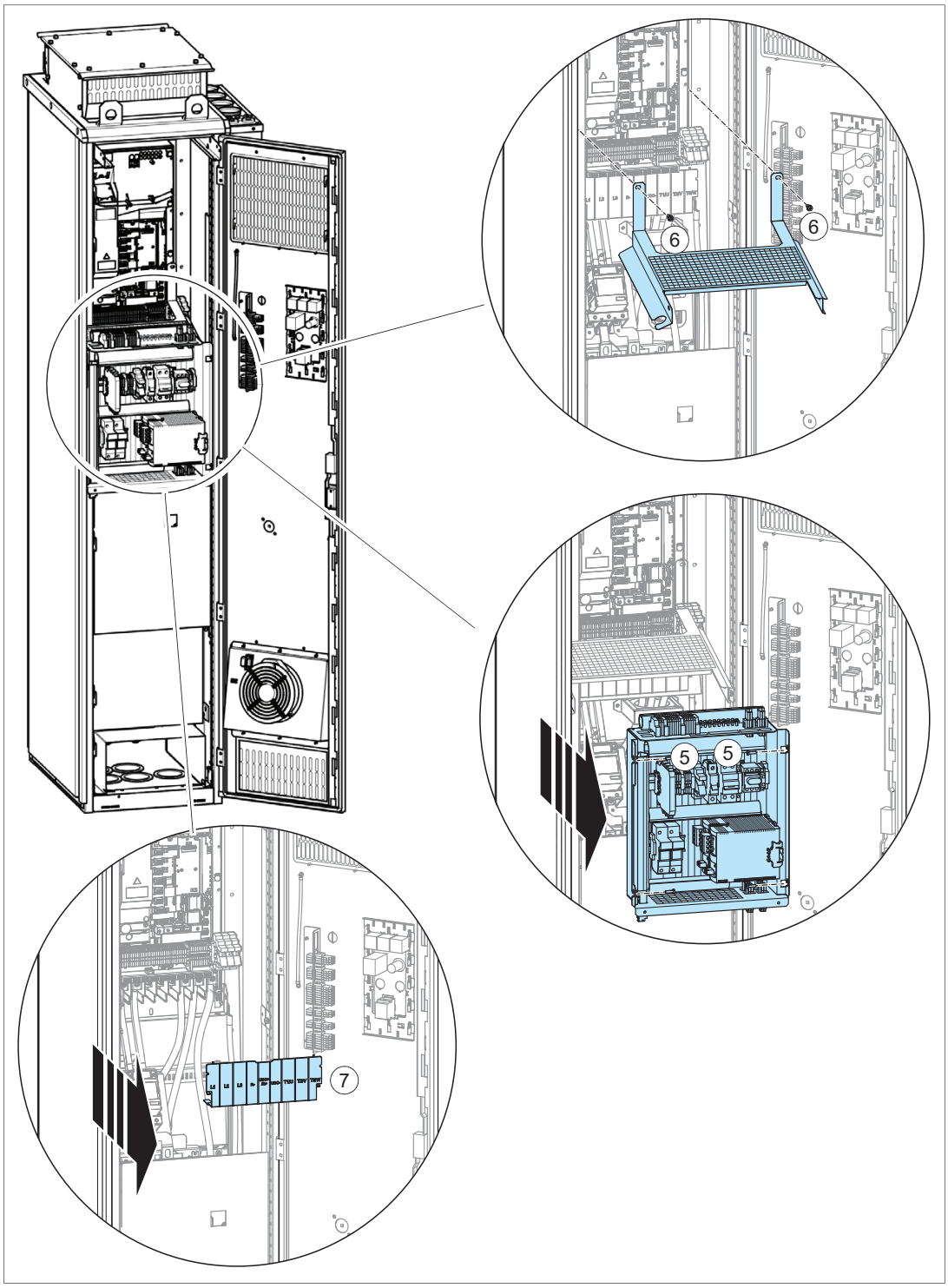
Tap screw M6x16 T30 (hex)	Torx M6x16



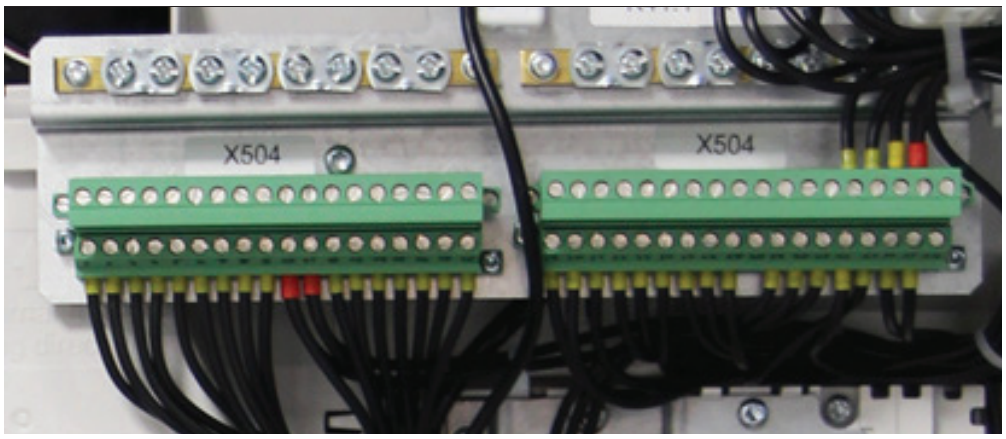


Torx M6x16	Torx M6x16

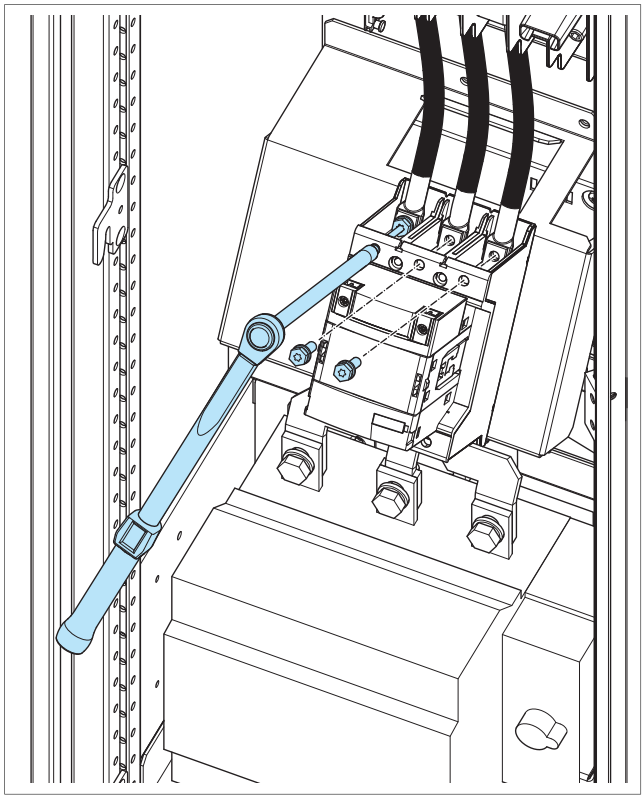
4. Unplug the wires connected to the mounting plate connectors (if present).
5. Remove the mounting plate (four screws).
6. Remove the shroud (two screws).
7. Remove the shroud on the power cable connection terminals.



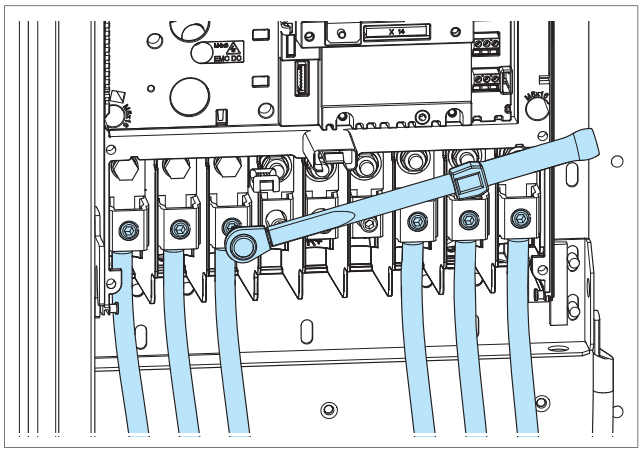
8. Disconnect the option modules from the control unit.
9. For drives with additional I/O terminal block (option +L504), disconnect the upper terminals and remove any fastening. Move the wires aside before you lift the module out. **Note:** Mark the wires for reconnection!



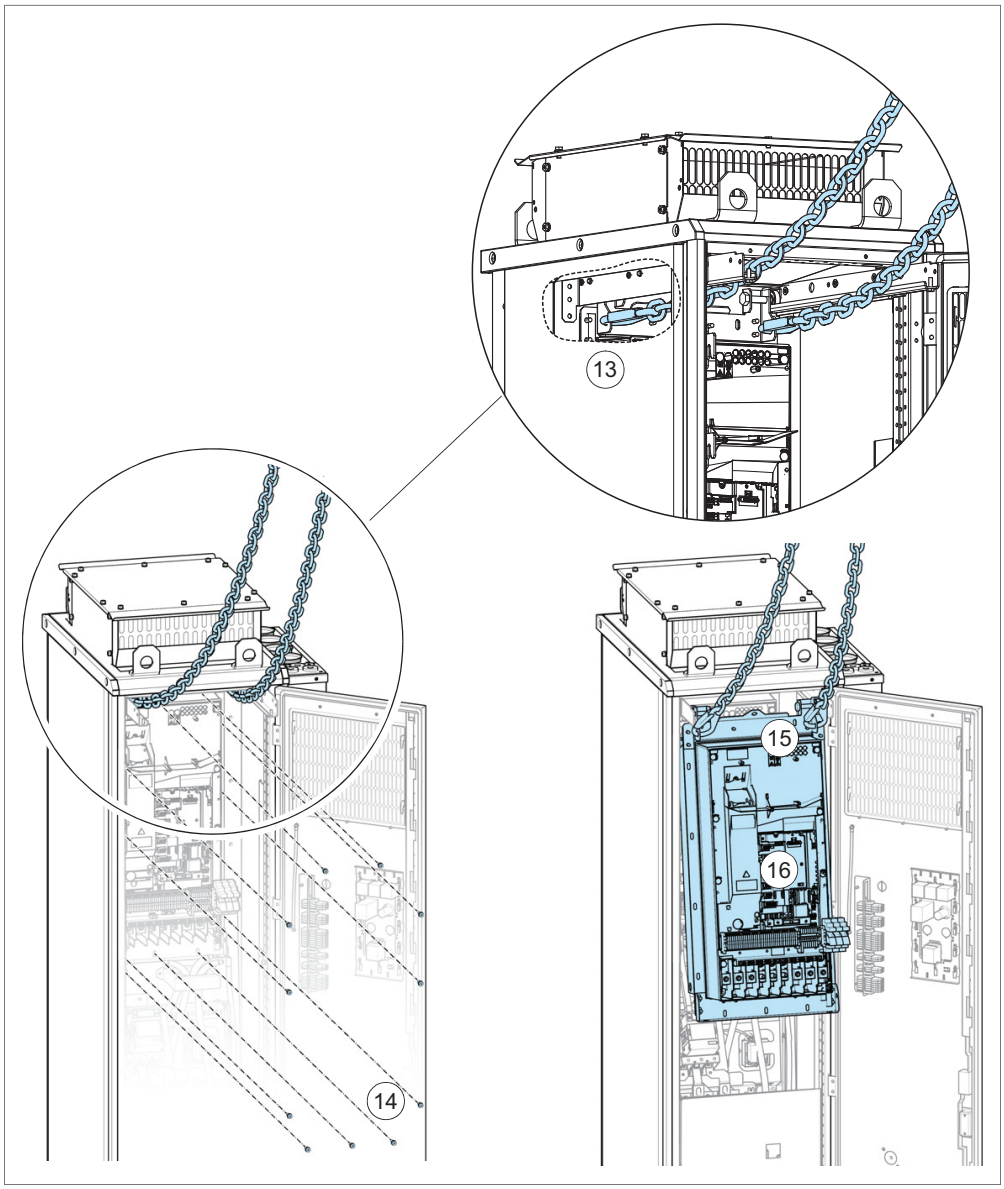
10. For drives without additional I/O terminal block (option +L504), disconnect the customer-installed wires from the control unit. **Note:** Mark the wires for reconnection!
11. For drives with line contactor (option +F250), disconnect the input power cables from the output of the contactor.



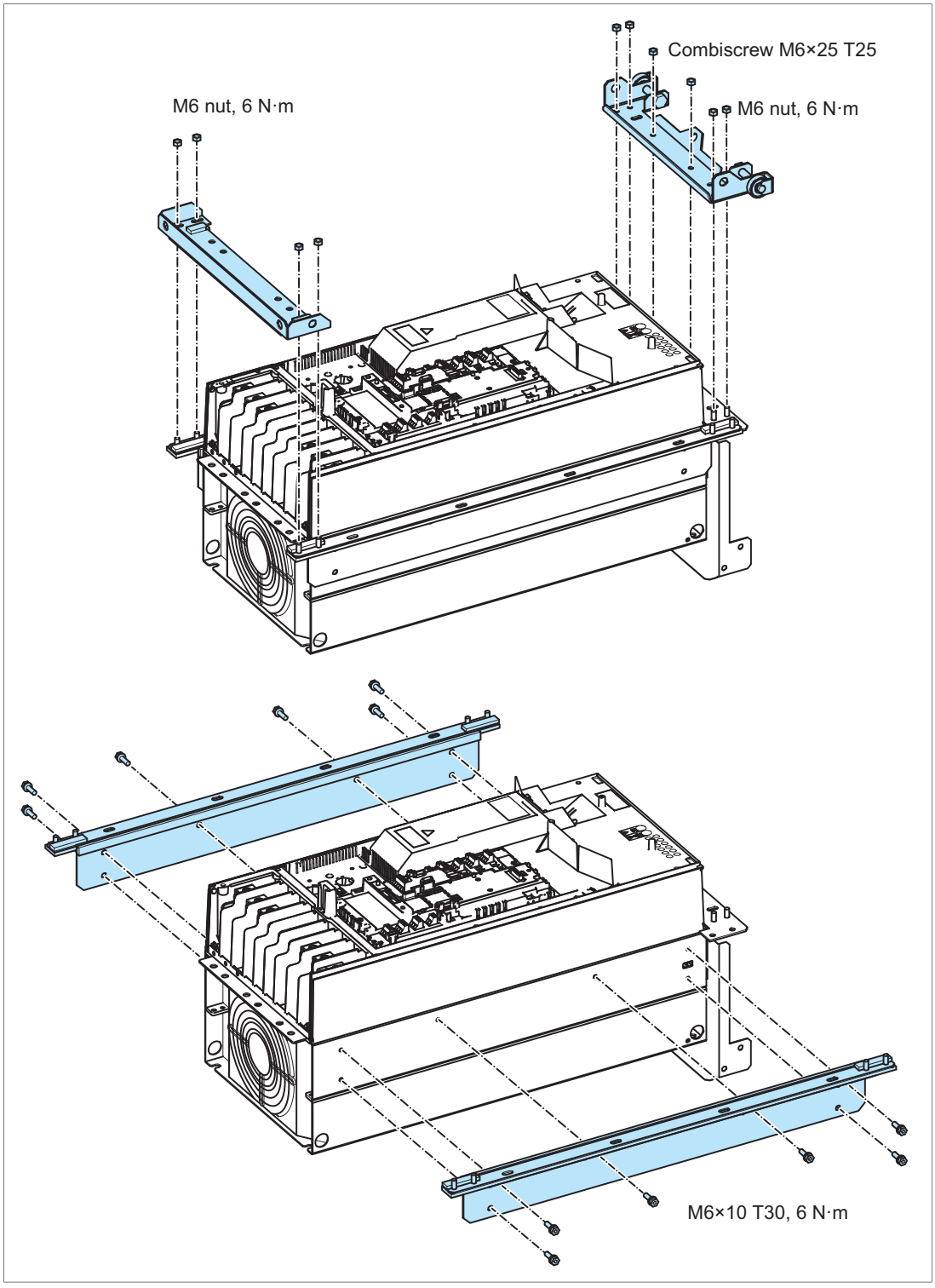
12. Disconnect the input power cable conductors and motor cable conductors from the drive module terminals.



13. Secure the drive module with chains from the lifting eyes.
14. Undo the mounting screws of the flange.
15. Slide the drive module forwards along the sliding bars.
16. Lift the module out of the cabinet with a lifting device.



17. Remove the flange.



18. Install the new module in reverse order.

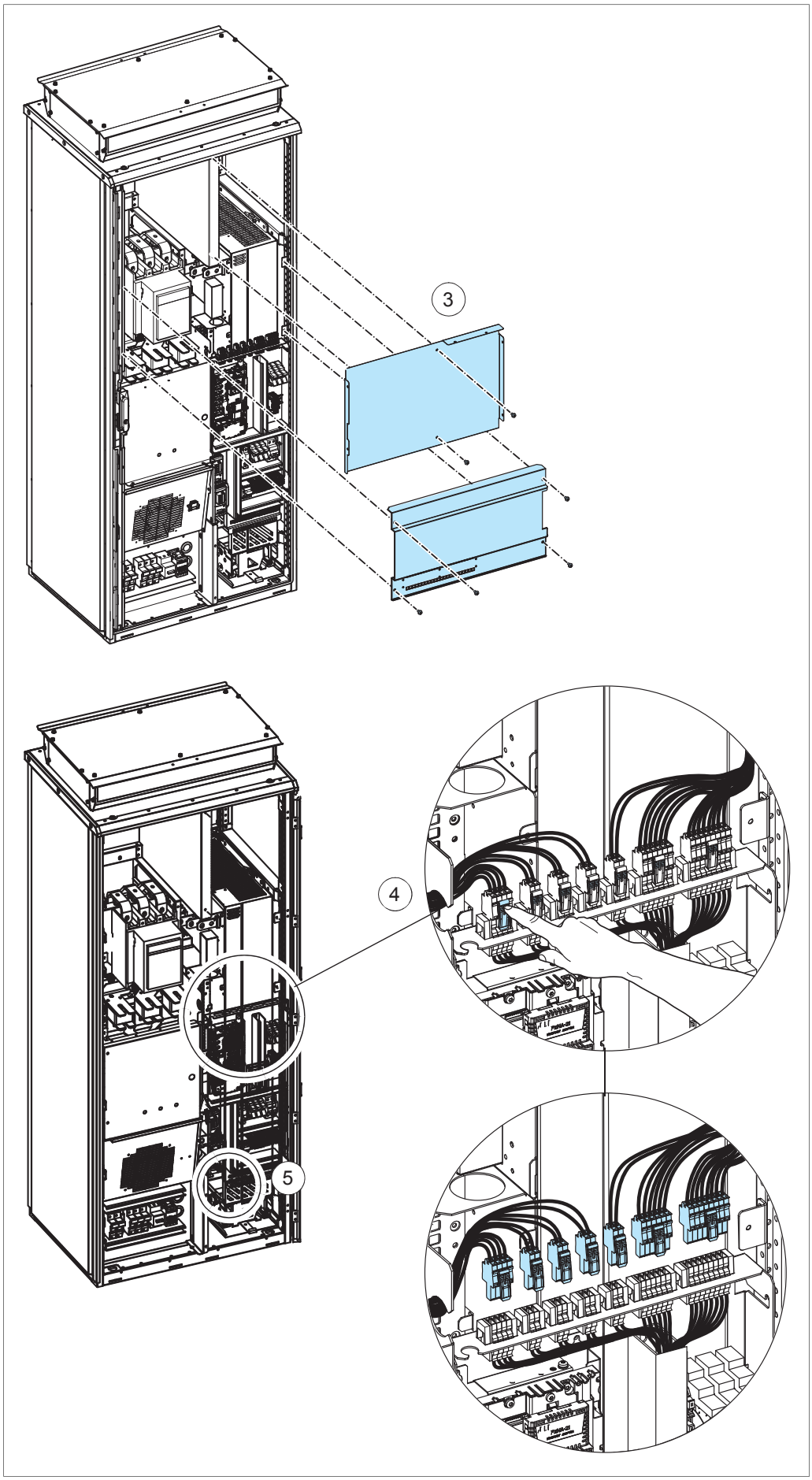
Replacing the drive module (frames R10 and R11)

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

This replacing procedure requires: preferably two persons, installation ramp, a set of screw drivers and a torque wrench with an extension bar of 500 mm (20 in), chains for securing the module during the installation.

The drawings show frame R10. The details in frame R11 are slightly different.

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Remove the shrouds.
4. Unplug the quick connectors at the top and bottom of the control unit mounting plate.
5. Disconnect the PE conductor of the auxiliary control voltage transformer.
6. Remove the mounting plate.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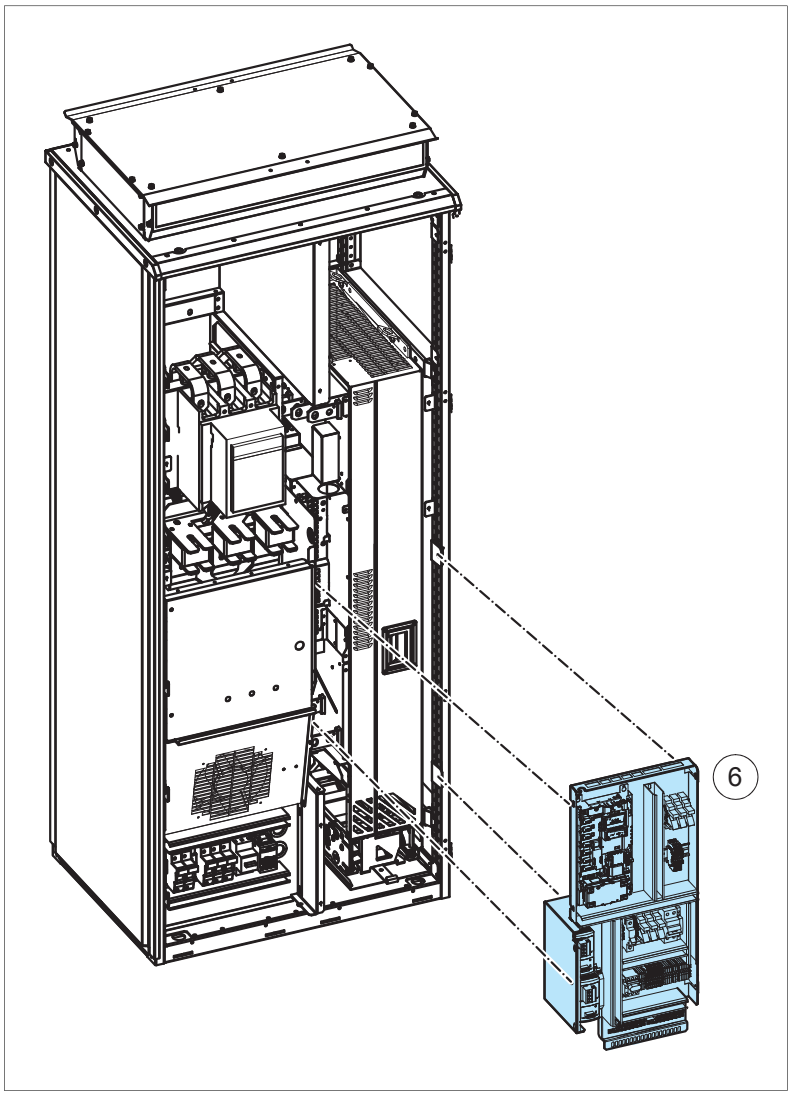
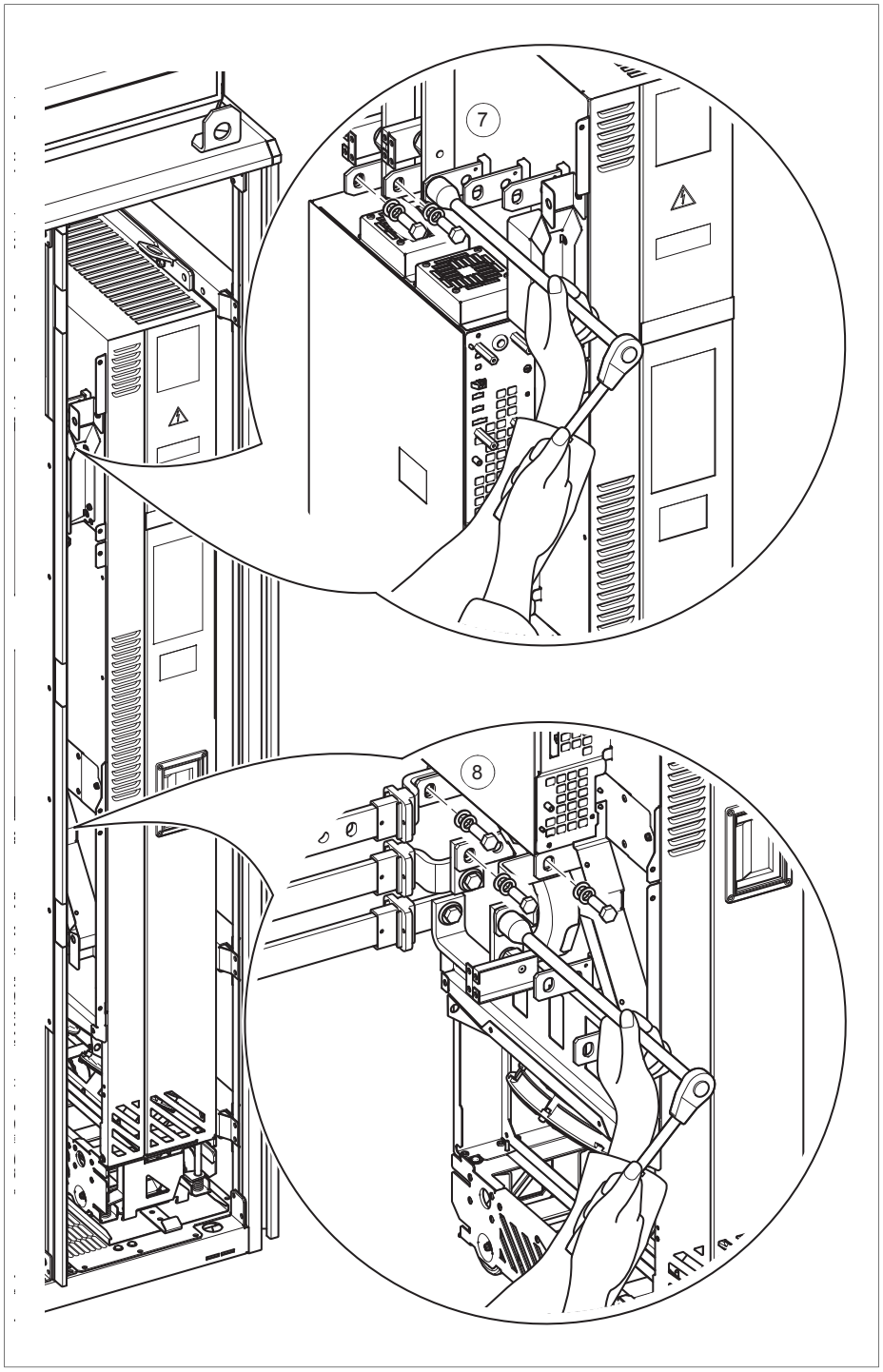
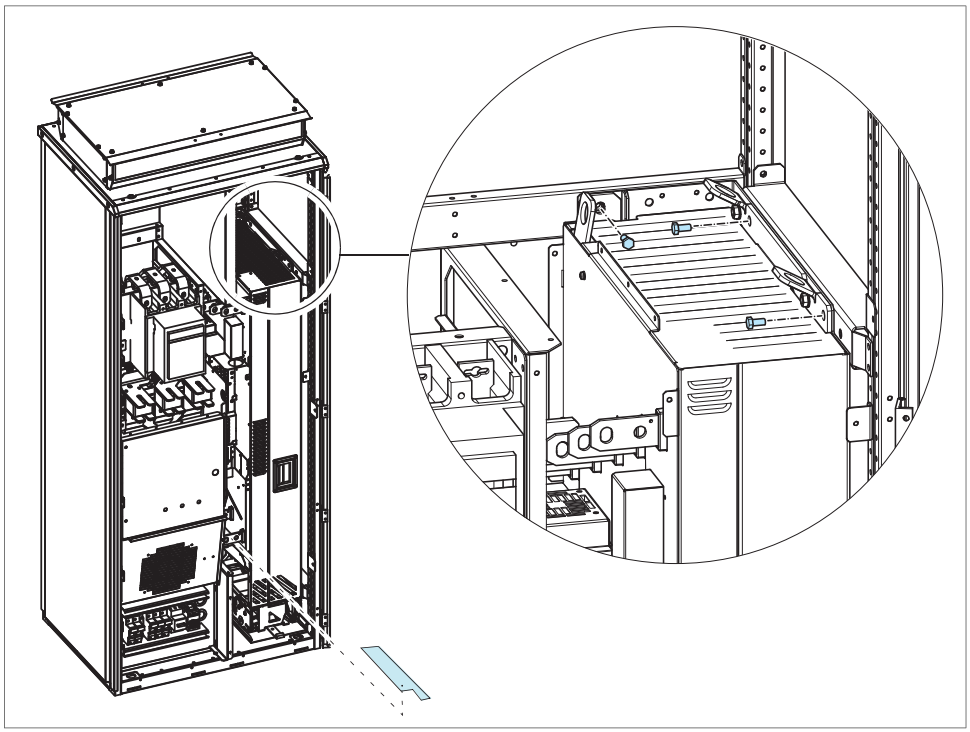


7. Disconnect the drive module input busbars with a torque wrench withn an extension bar of 500 mm (20 in). Combi screw M12, 70 N·m (52 lbf·ft).

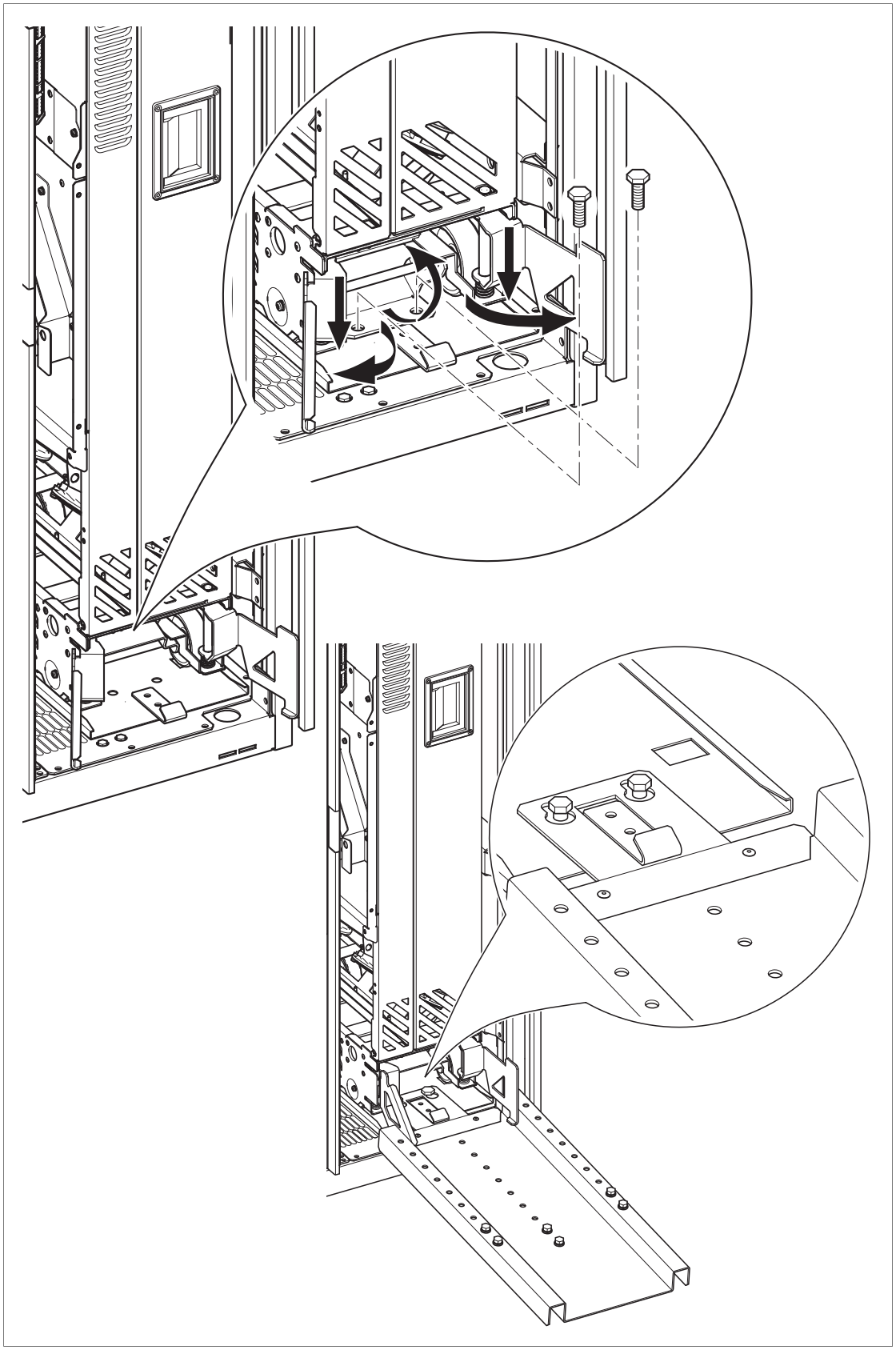
8. Disconnect the drive module output busbars. M12, 70 N·m (52 lbf·ft).



9. Remove the shroud. Undo the screws that attach the drive module to the cabinet at the top and behind the front support legs.

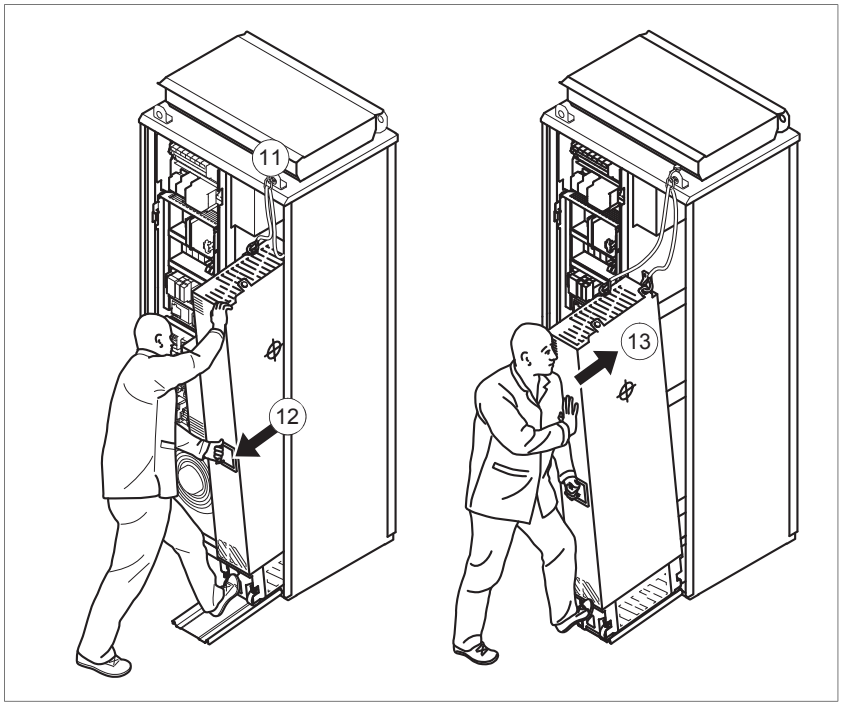


10. Attach the extraction ramp to the cabinet base with two screws.



11. Attach the drive module lifting lugs to the cabinet lifting lug with chains.
12. Pull the drive module carefully out of the cabinet preferably with help from another person.

13. Install the new module in reverse order.



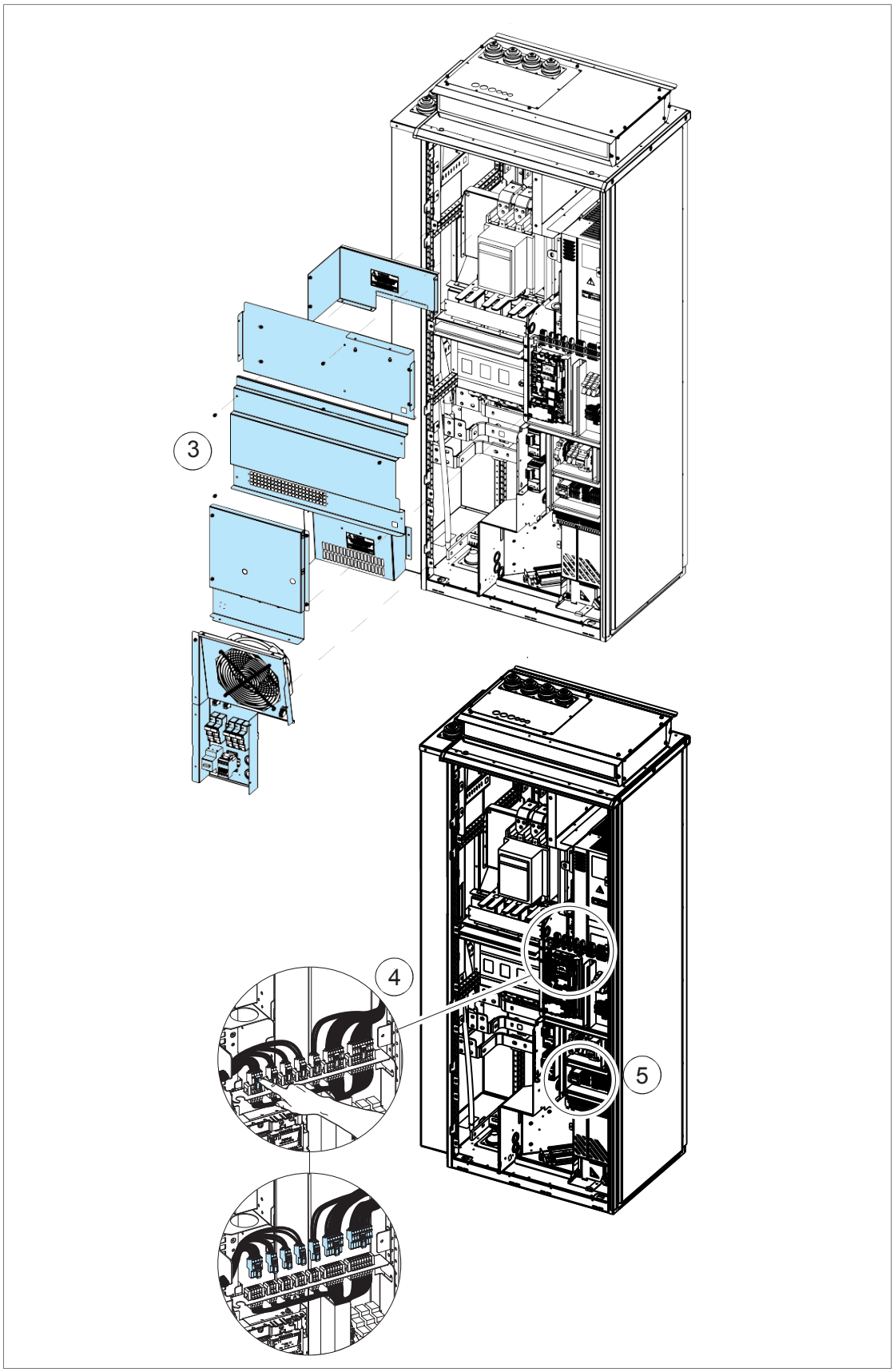
Replacing the drive module (frames R10 and R11, IP54)

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

This replacing procedure requires: preferably two persons, installation ramp, a set of screw drivers and a torque wrench with an extension bar of 500 mm (20 in), chains for securing the module during the installation.

The drawings show frame R10. The details in frame R11 are slightly different.

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Remove the shrouds and the additional IP54 fan.
4. Unplug the quick connectors at the top and bottom of the control unit mounting plate.
5. Disconnect the PE conductor of the auxiliary control voltage transformer.
6. Remove the mounting plate.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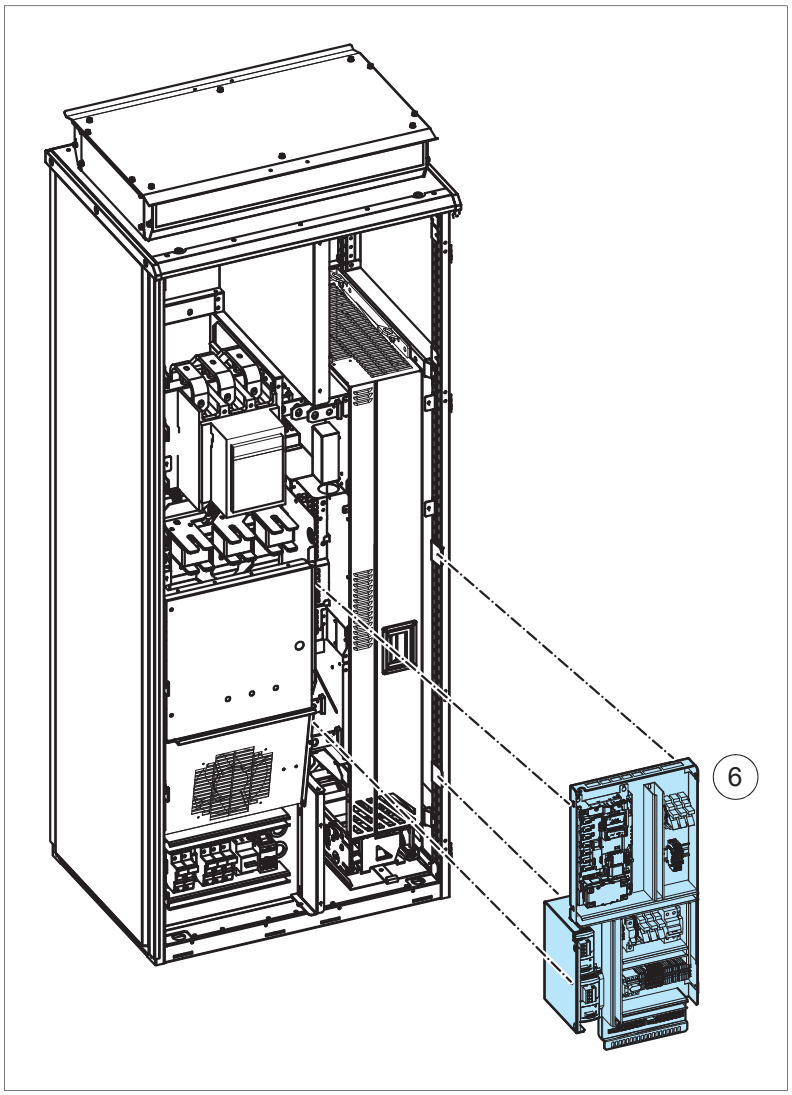
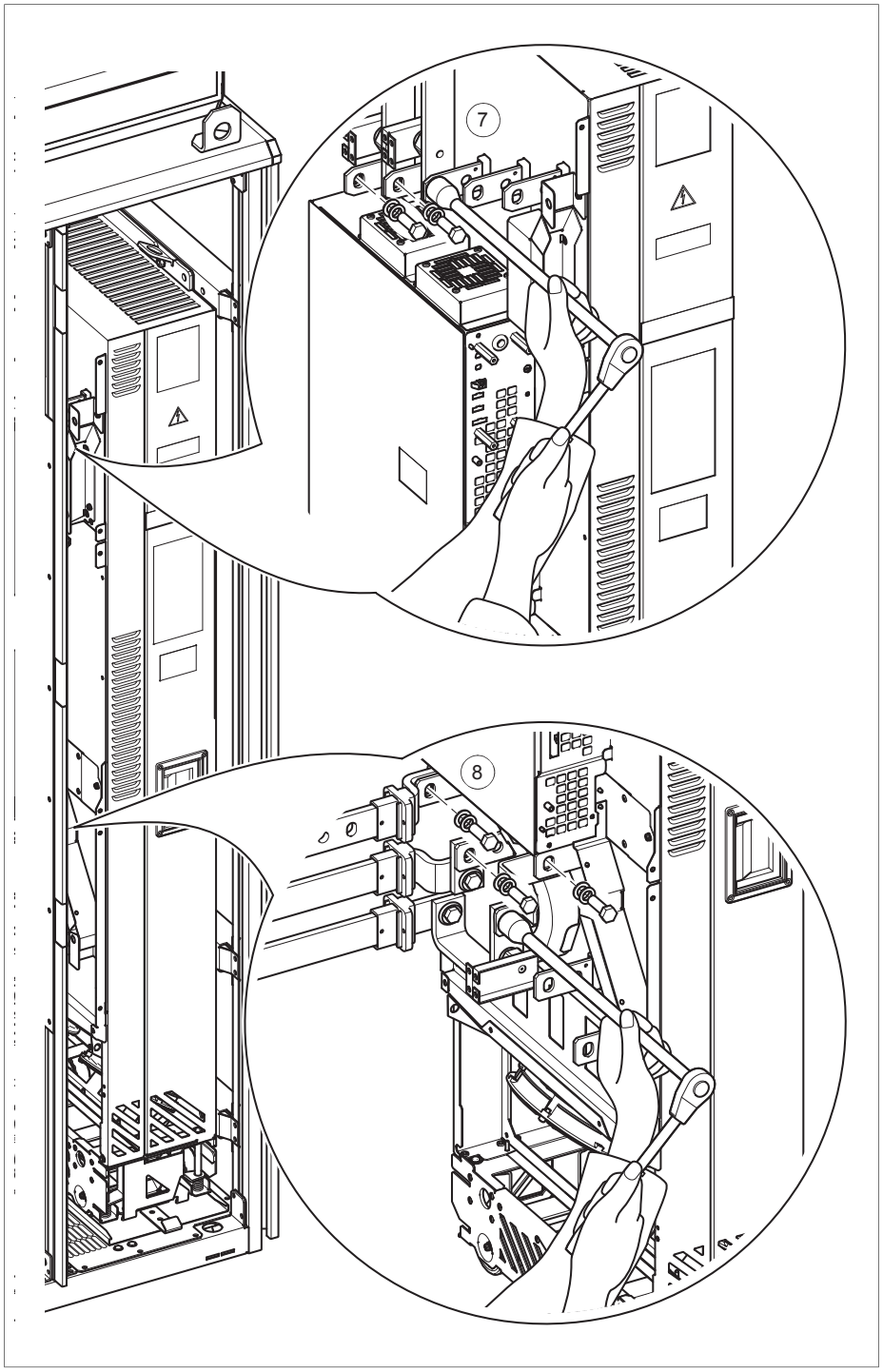
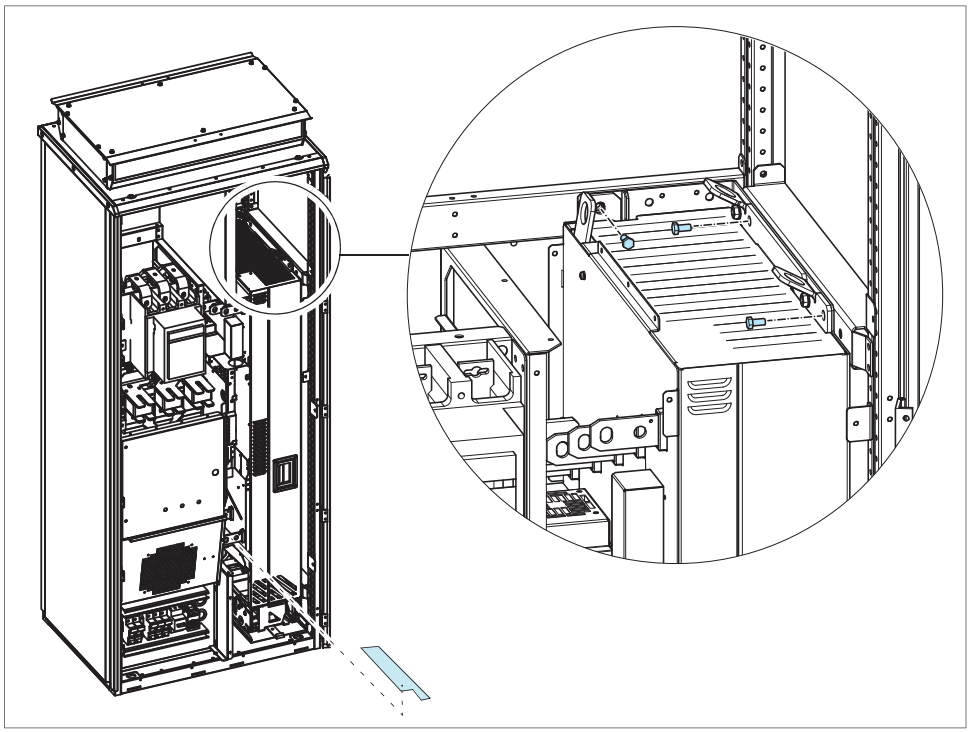


7. Disconnect the drive module input busbars with a torque wrench withn an extension bar of 500 mm (20 in). Combi screw M12, 70 N·m (52 lbf·ft).

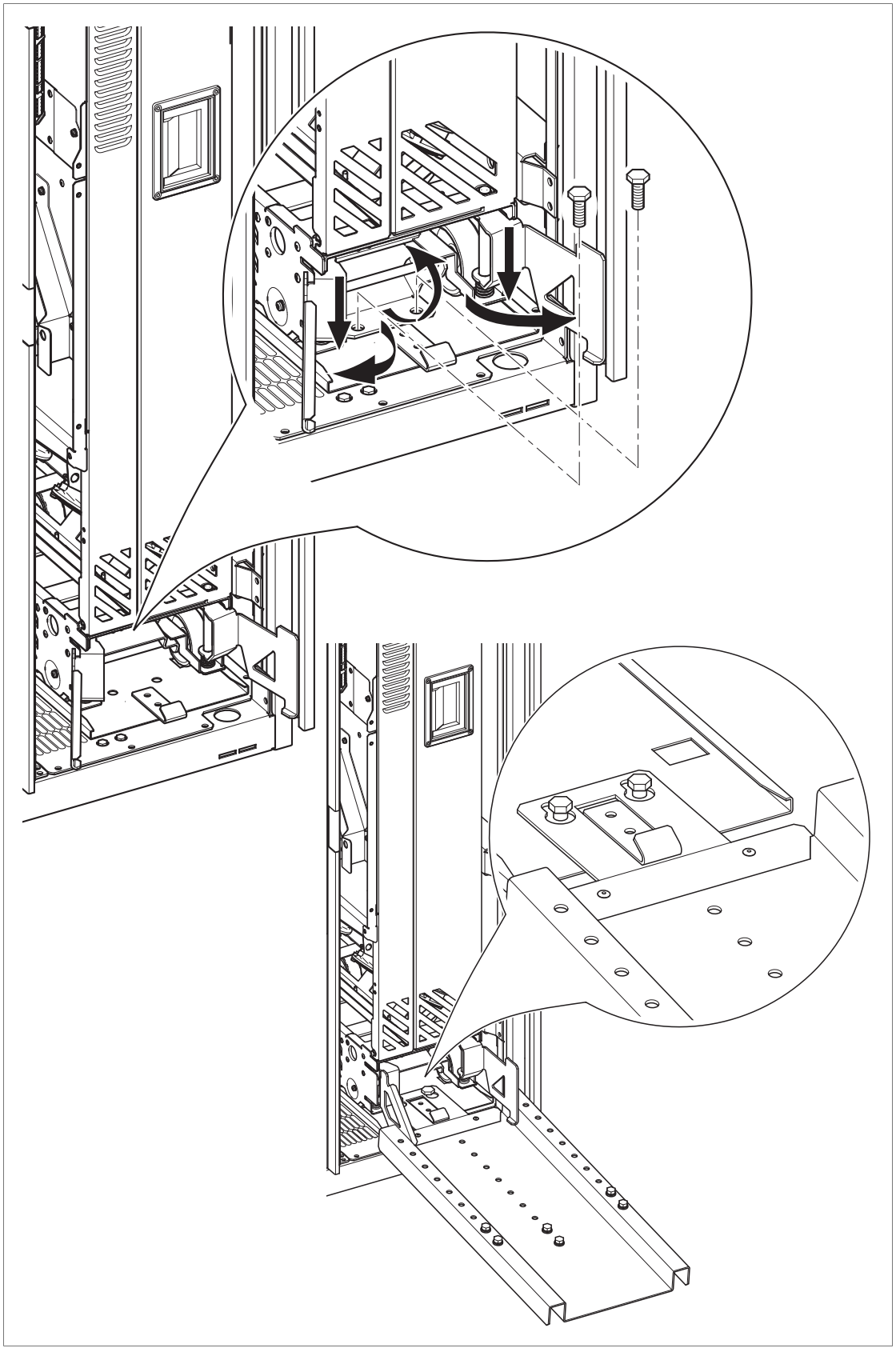
8. Disconnect the drive module output busbars. M12, 70 N·m (52 lbf·ft).



9. Remove the shroud. Undo the screws that attach the drive module to the cabinet at the top and behind the front support legs.

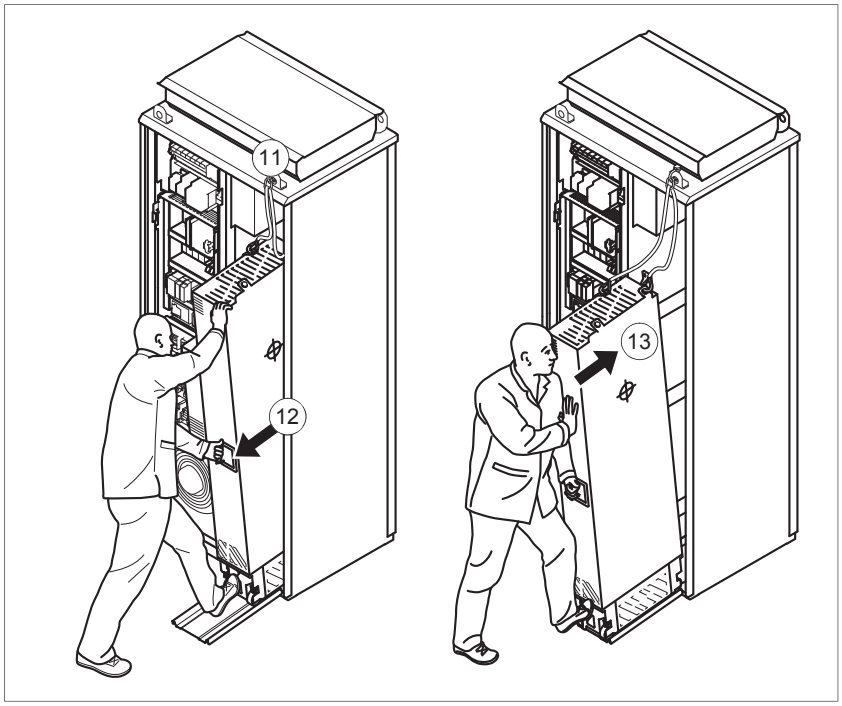


10. Attach the extraction ramp to the cabinet base with two screws.



11. Attach the drive module lifting lugs to the cabinet lifting lug with chains.
12. Pull the drive module carefully out of the cabinet preferably with help from another person.

13. Install the new module in reverse order.



Capacitors

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

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

Reforming the capacitors

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

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

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

Fuses

Replacing AC fuses (frames R6 and R7)

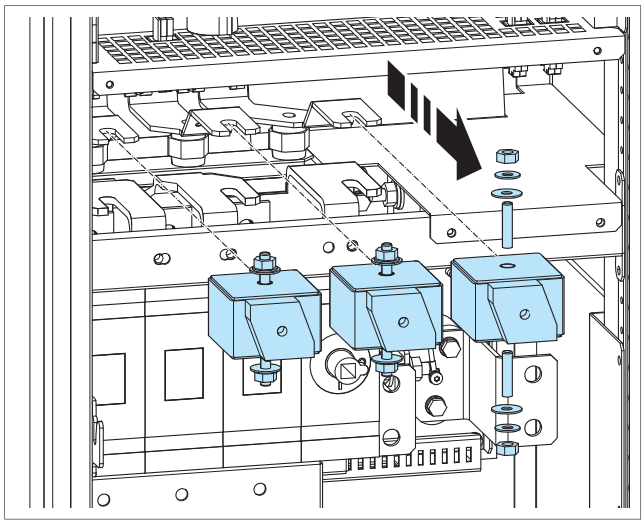
WARNING!
Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur.

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Remove the shrouding from in front of the switch fuse.
4. Replace the fuses with the fuse handle which is in the cabinet.
5. Reinstall the shrouding removed earlier and close the cabinet door.

Replacing AC fuses

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

1. Stop the drive and do the steps in section *Electrical safety precautions (page 20)* before you start the work.
2. Open the cabinet door.
3. Remove the shrouding from in front of the fuses.
4. Slacken the nuts of the headless screws of the fuses so that you can slide out the fuse blocks. Make a note of the order of the washers on the screws.
5. Remove the screws, nuts and washers from the old fuses and attach them to the new fuses. Make sure to keep the washers in the original order.



6. Insert the new fuses into their slots in the cabinet.
7. Tighten the screws to torque 5 N·m (3 lbf·ft) maximum.
8. Tighten the nuts to torque as follows:
   - Cooper-Bussmann fuses: 50 N·m (37 lbf·ft) if size 3; 40 N·m (30 lbf·ft) if size 2
   - Mersen (Ferraz-Shawmut): 46 N·m (34 lbf·ft) if size 33; 26 N·m (19 lbf·ft) if size 32
   - Other fuses: Refer to the fuse manufacturer's instructions.
9. Reinstall the shrouding removed earlier and close the cabinet door.

Control panel

Cleaning the control panel

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

Replacing the battery in the assistant control panel

A battery is only used in assistant control panels that have the clock function. The battery keeps the clock operating during power interruptions.

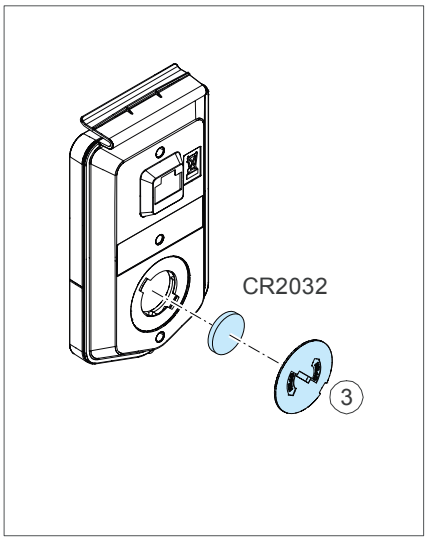
The expected life for the battery is greater than ten years.

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

1. To remove the control panel from the drive, press the retaining clip at the top and pull it forward from the top edge.
2. Disconnect the panel cable.
3. To remove the battery, use a coin to rotate the battery cover on the back of the control panel.
4. Replace the battery with type CR2032. Dispose the old battery according to local disposal rules or applicable laws.
5. To reinstall the control panel, press the retaining clip at the top (5a) and push the control panel in at the top edge (5b)


1


2


CR2032
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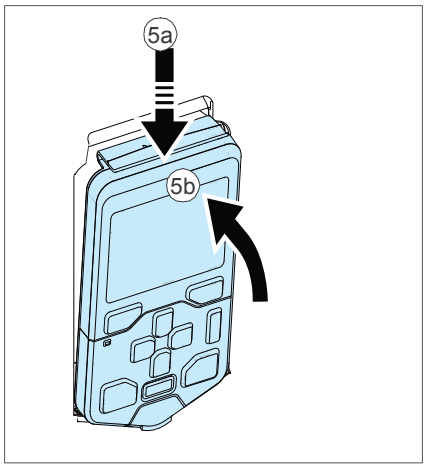
5a
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12

Technical data

Contents of this chapter

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

Ratings

The nominal ratings for the drives with 50 Hz and 60 Hz supply are given below. The symbols are described in section *Definitions (page 173)*.

IEC RATINGS										
Drive type ACS580-07-	**Frame size**	**Input rating**	**Output ratings**							
			No-overload use				**Light-overload use**		**Heavy-overload use**	
		I_1	I_{max}	I_2	S_N	P_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
		A	**A**	**A**	**kVA**	**kW**	**A**	**kW**	**A**	**kW**
U_N = 400 V										
0145A-4	R6	145	178	145	100	75	138	75	105	55
0169A-4	R7	169	247	169	117	90	161	90	145	75
0206A-4	R7	206	287	206	143	110	196	110	169	90
0246A-4	R8	246	350	246	170	132	234	132	206	110
0293A-4	R8	293	418	293	203	160	278	160	246*	132
0363A-4	R9	363	498	363	251	200	345	200	293	160
0430A-4	R9	430	542	430	298	250	400	200	363**	200
0505A-4	R10	505	560	505	350	250	485	250	361	200
0585A-4	R10	585	730	585	405	315	575	315	429	250

IEC RATINGS										
Drive type ACS580-07-	Frame size	Input rating	Output ratings							
			No-overload use				Light-overload use		Heavy-overload use	
		I_1	I_{max}	I_2	S_N	P_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
		A	A	A	kVA	kW	A	kW	A	kW
0650A-4	R10	650	730	650	450	355	634	355	477	250
0725A-4	R11	725	1020	725	502	400	715	400	566	315
0820A-4	R11	820	1020	820	568	450	810	450	625	355
0880A-4	R11	880	1100	880	610	500	865	500	725***	400

3AXD10000451709

NEMA RATINGS								
Drive type ACS580-07-	Frame size	Input rating	Max. current	App. power	Output ratings			
					Light-overload use		Heavy-overload use	
		I_1	I_{max}	S_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
		A	A	kVA	A	hp	A	hp
U_N = 480 V								
0145A-4	R6	124	178	123	124	100	96	75
0169A-4	R7	156	247	171	156	125	124	100
0206A-4	R7	180	287	199	180	150	156	125
0246A-4	R8	240	350	242	240	200	180	150
0293A-4	R8	260	418	290	260	200	240*	150
0363A-4	R9	361	498	345	361	300	302	250
0430A-4	R9	414	542	376	414	350	361**	300
0505A-4	R10	483	560	388	483	400	361	300
0585A-4	R10	573	730	506	573	450	414	350
0650A-4	R10	623	730	506	623	500	477	400
0725A-4	R11	705	850	589	705	600	566	450
0820A-4	R11	807	1020	707	807	700	625	500
0880A-4	R11	807	1020	707	807	700	625	500

NEC ratings

NEC RATINGS								
Drive type ACS580-07-	Frame size	Input rating	Max. current	App. power	Output ratings			
					Light-overload use		Heavy-overload use	
		I_1	I_{max}	S_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
		A	A	kVA	A	hp	A	hp
U_N = 480 V								
0124A-4	R6	124	178	100	124	100	96	75
0156A-4	R7	156	247	117	156	125	124	100
0180A-4	R7	180	287	143	180	150	156	125

NEC RATINGS								
Drive type ACS580-07-	Frame size	Input rating	Max. current	App. power	Output ratings			
					Light-overload use		Heavy-overload use	
		I_1	I_{max}	S_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}
		A	A	kVA	A	hp	A	hp
0240A-4	R8	240	350	170	240	200	180	150
0260A-4	R8	260	418	203	260	200	240*	150
0361A-4	R9	361	542	251	361	300	302	250
0414A-4	R9	414	542	298	414	350	361**	300

Definitions

U_N	Nominal voltage of the drive. For the input voltage range, see section *Electrical power network specification (page 211)*.
I_1	Nominal rms input current
I_2	Nominal output current (available continuously with no over-loading)
S	Apparent power (no overload)
P_N	Typical motor power in no-overload use
I_{Ld}	Continuous rms output current allowing 10% overload for 1 minute every 5 minutes.
P_{Ld}	Typical motor power in light-overload use
I_{max}	Maximum output current. Available for two seconds at start, then as long as allowed by drive temperature.
I_{Hd}	Continuous rms output current allowing 50% overload for 1 minute every 10 minutes. * Continuous rms output current allowing 30% overload for 1 minute every 10 minutes. ** Continuous rms output current allowing 25% overload for 1 minute every 10 minutes.
P_{Hd}	Typical motor power in heavy-duty use

Note 1: The ratings apply at an ambient temperature of 40 °C (104 °F).

Note 2: To achieve the rated motor power given in the table, the rated current of the drive must be higher than or equal to the rated motor current.

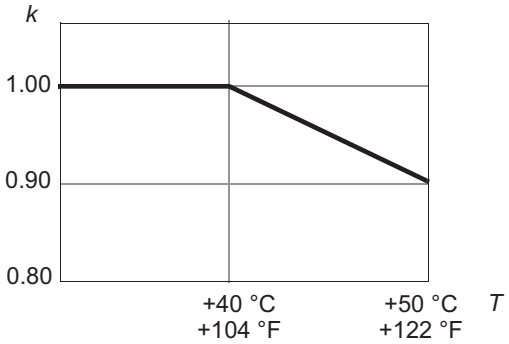
The DriveSize dimensioning tool available from ABB is recommended for selecting the drive, motor and gear combination.

Output derating

Ambient temperature derating

Drive types other than ACS580-0414A-4 and ACS580-0430A-4

In the temperature range +40…50 °C (+104…122 °F), the rated output current is derated by 1% for every added 1 °C (1.8 °F). The output current can be calculated by multiplying the current given in the rating table by the derating factor (k):

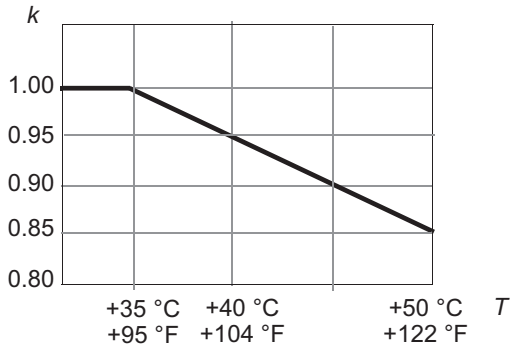


For example:

Temperature	Derated current	
40 ºC (104 ºF)	I_{Ld}	I_{Hd}
45 ºC (113 ºF)	0.95 · I_{Ld}	0.95 · I_d
50 ºC (122 ºF)	0.90 · I_{Ld}	0.90 · I_{Hd}

Drive types ACS580-0414A-4 and ACS580-0430A-4

In the temperature range +35…50 °C (+95…122 °F), the rated output current is derated by 1% for every added 1 °C (1.8 °F). The output current can be calculated by multiplying the current given in the rating table by the derating factor (*k*):



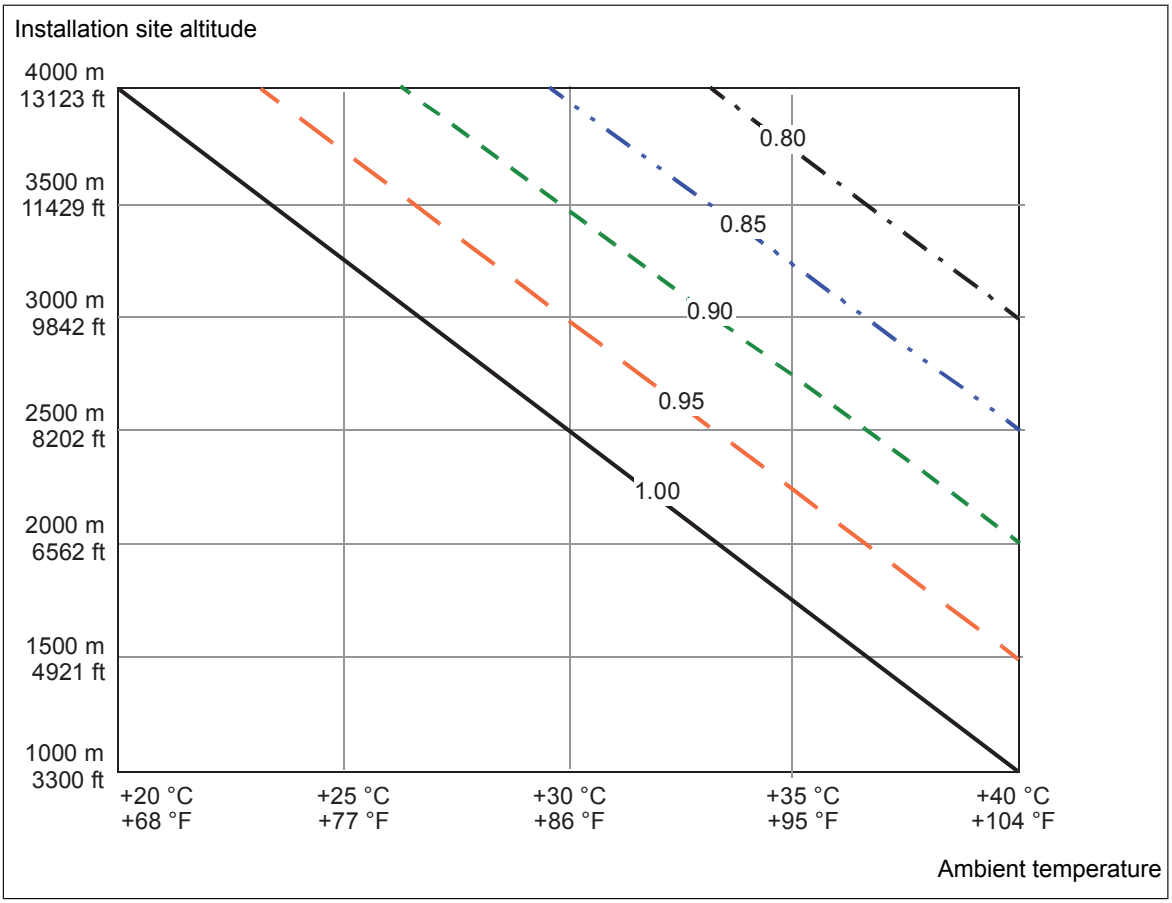
Altitude derating

At altitudes from 1000 to 2000 m (3300 to 6561 ft) above sea level, the derating is 1% for every 100 m (328 ft). Multiply the output current given in *Ratings (page 171)* by the coefficient value given in this table.

Frame	Coeffficient			
	1000 m 3281 ft	**2000 m 6562**	**3000 m 9842 ft**	**4000 m 13123 ft**
R6	1.00	0.90	0.80	0.70
R7	1.00	0.90	0.80	0.70
R8	1.00	0.90	0.80	0.70
R9	1.00	0.90	0.80	0.70
R10	1.00	0.90	0.80	0.70

Frame	Coeffficient			
	1000 m 3281 ft	**2000 m 6562**	**3000 m 9842 ft**	**4000 m 13123 ft**
R11	1.00	0.90	0.80	0.70

If ambient temperature is below +40 °C (+104 .°F), the derating can be reduced by 1.5% for every 1 °C reduction in temperature. Curves with derating factors from 1.00 to 0.80 are shown below. For a more accurate derating, use the DriveSize PC tool. A few altitude derating curves are shown below.



Deratings for special settings in the drive control program

If you change the minimum switching frequency with parameter **97.02 Minimum switching frequency**, multiply the output current given in *Ratings (page 171)* by the coefficient value given in this table.

Frame size	1.5 kHz	2 kHz	4kHz	8 kHz
R6	1.00	0.97	0.84	0.66
R7	1.00	0.98	0.89	0.71
R8	1.00	0.96	0.82	0.61
R9	1.00*	0.95*	0.79*	0.58*
R10	1.00	0.92	0.78	0.58
R11	1.00	0.92	0.78	0.58

Frame size	1.5 kHz	2 kHz	4kHz	8 kHz
R11	1.00	0.92	0.78	0.58
R11	1.00	0.92	0.78	0.58

* current derating for -0414A-4 and -0430A-4 at 35 C

Note:
Changing the value of parameter **97.01 Switching frequency reference** does not require derating.

Fuses (IEC)

The standard drive is equipped with aR fuses listed below.

Drive type ACS580-07-	Input current (A)	Ultrarapid (aR) fuses (one fuse per phase)					
		(A)	A^2s	V	Type (Bussmann)	Type (Mersen)	Size
U_N = 400 V							
0145A-4	145	250	31000	690	170M3816D	J320375C	1
0169A-4	169	250	31000	690	170M3816D	J320375C	1
0206A-4	206	315	52000	690	170M3817D	N320379C	1
0246A-4	246	400	79000	690	170M5408	H300065A	2
0293A-4	293	500	155000	690	170M5410	S1046930K	2
0363A-4	363	630	210000	690	170M6410	X300078C	3
0430A-4	430	700	300000	690	170M6411	Y300079C	3
0505A-4	505	800	465000	690	170M6412	W1046956F	3
0585A-4	585	900	670000	690	170M6413	X1046957F	3
0650A-4	650	1000	945000	690	170M6414	Y1046958F	3
0725A-4	725	1250	1950000	690	170M6416	A1046960F	3
0820A-4	820	1250	1950000	690	170M6416	A1046960F	3
0880A-4	880	1400	2450000	690	170M6417	B1046961F	3

Note 1: See also *Implementing the emergency stop function (page 82)*.

Note 2: Fuses with higher current rating than the recommended ones must not be used. Fuses with lower current rating can be used.

Note 3: Fuses from other manufacturers can be used if they meet the ratings and the melting curve of the fuse does not exceed the melting curve of the fuse mentioned in the table.

Fuses (UL)

The drive with option +C129 and option +F289 is equipped with standard fuses listed below for internal circuit protection. The fuses restrict drive damage and prevent damage to adjoining equipment in case of a short-circuit inside the drive. The drive also requires external fuses for branch circuit protection per NEC, see section *Fuses for branch circuit protection (page 178)*.

Drive type ACS580-07-	Input current A	Fuse (one fuse per phase)						
		A	V	Type (Bussmann)	Type (Mersen)	UL class / Size	Type with option +F289	Size (option +F289)
U_N = 480 V - NEMA types								
0145A-4	124	250	600	DFJ-250	B235889A (HSJ 250)	J	170M3416	1
0169A-4	156	300	600	DFJ-300	C235890A (HSJ 300)	J	170M3416	1
0206A-4	180	300	600	DFJ-300	C235890A (HSJ 300)	J	170M4410	1
0246A-4	240	400	690	170M5408	H300065A	2	170M5408	2
0293A-4	260	500	690	170M5410	S1046930K	2	170M5410	2
0363A-4	361	630	690	170M6410	X300078C	3	170M6410	3
0430A-4	414	700	690	170M6411	Y300079C	3	170M6411	3
0505A-4	483	800	690	170M6412	W1046956F	3	170M6412	3
0585A-4	573	900	690	170M6413	X1046957F	3	170M6413	3
0650A-4	623	1000	690	170M6414	Y1046958F	3	170M6414	3
0725A-4	705	1250	690	170M6416	A1046960F	3	170M6416	3
0820A-4	807	1250	690	170M6416	A1046960F	3	170M6416	3
0880A-4	807	1400	690	170M6417	B1046961F	3	170M6417	3
U_N = 480 V - NEC types								
0124A-4	124	250	600	DFJ-250	B235889A (HSJ 250)			J
0156A-4	156	300	600	DFJ-300	C235890A (HSJ 300)			J
0180A-4	180	300	600	DFJ-300	C235890A (HSJ 300)			J
0240A-4	240	400	690	170M5408	H300065A			2
0260A-4	260	500	690	170M5410	S1046930K			2
0361A-4	361	630	690	170M6410	X300078C			3
0414A-4	414	700	690	170M6411	Y300079C			3

The drive with option +F289 is equipped with standard fuses listed below for internal circuit protection. The fuses restrict drive damage and prevent damage to adjoining equipment in case of a short-circuit inside the drive. The drive also requires external fuses for branch circuit protection per NEC, see section *Fuses for branch circuit protection (page 178)*.

Drive type ACS580-07-	Input current A	Fuse (one fuse per phase) with option +F289			
		A	Manufacturer	Type	Size
U_N = 480 V					
0145A-4	124	250	Bussmann	170M3416	1
0169A-4	156	250	Bussmann	170M3416	1
0206A-4	180	315	Bussmann	170M4410	1
0246A-4	240	400	Bussmann	170M5408	2
0293A-4	260	500	Bussmann	170M5410	2
0363A-4	361	630	Bussmann	170M6410	3
0430A-4	414	700	Bussmann	170M6411	3

Note 1: See also *Implementing the emergency stop function (page 82)*.

Note 2: Fuses with higher current rating than the recommended ones must not be used. Fuses with lower current rating can be used.

Note 3: Fuses from other manufacturers can be used if they meet the ratings and the melting curve of the fuse does not exceed the melting curve of the fuse mentioned in the table.

Note 4: Circuit breakers must not be used without fuses.

Fuses for branch circuit protection

The drive is suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes at 480 V maximum when the input cable is protected with UL class T or L fuses. The fuses for branch circuit protection per NEC must be selected according to the table below. Fast acting class T and L or faster are recommended in the USA. Obey local regulations.

Drive type ACS580-07-	Input current A	Fuse (one fuse per phase)					NEC type
		A	V	Manufacturer	Type	UL class	
U_N = 460 V							
0145A-4	124	200	600	Bussmann	JJS-200	T	0124A-4
0169A-4	156	225	600	Bussmann	JJS-225	T	0156A-4
0206A-4	180	300	600	Bussmann	JJS-300	T	0180A-4
0246A-4	240	350	600	Bussmann	JJS-350	T	0240A-4
0293A-4	260	400	600	Bussmann	JJS-400	T	0260A-4
0363A-4	361	500	600	Bussmann	JJS-500	T	0361A-4
0430A-4	414	600	600	Bussmann	JJS-600	T	0414A-4

Drive type ACS580-07-	Input current A	Fuse (one fuse per phase)					NEC type
		A	V	Manufacturer	Type	UL class	
0505A-4	483	600	600	Bussmann	JJS-600	T	
0585A-4	573	800	600	Ferraz	A4BY800	L	
0650A-4	623	800	600	Ferraz	A4BY800	L	
0725A-4	705	800	600	Ferraz	A4BY800	L	
0820A-4	807	900	600	Ferraz	A4BY900	L	
0880A-4	807	1000	600	Ferraz	A4BY1000	L	

Note 1: See also *Implementing the emergency stop function (page 82)*.

Note 2: Fuses with higher current rating than the recommended ones must not be used. Fuses with lower current rating can be used.

Note 3: Fuses from other manufacturers can be used if they meet the ratings and the melting curve of the fuse does not exceed the melting curve of the fuse mentioned in the table.

Dimensions and weights

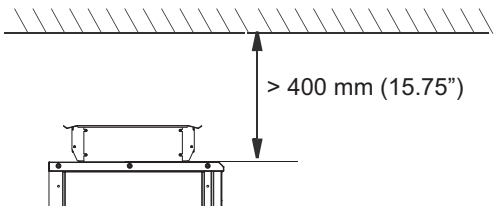
Drive type ACS580-07-	Height		Width		Depth		Weight	
	mm	in.	mm	in.	mm	in.	kg	lb
R6	2145	84.43	430	16.93	673	26.50	210	463
R7	2145	84.43	430	16.93	673	26.50	220	485
R8	2145	84.43	530	20.87	673	26.50	255	562
R9	2145	84.43	530	20.87	673	26.50	275	606
R10 IP21/IP42	2145	84.43	830	32.68	698	27.48	410	904
R10 IP54	2315	91.14	830	32.68	698	27.48	410	904
R11 IP21/IP42	2145	84.43	830	32.68	698	27.48	440	970
R11 IP54	2315	91.14	830	32.68	698	27.48	440	970

Free space requirements

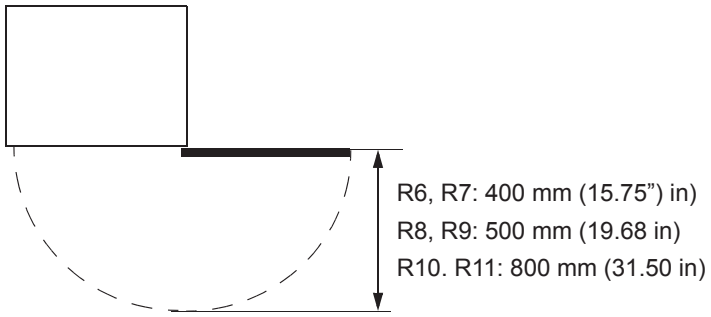
Free space requirements for cooling are given below.

Front		Side		Above *	
mm	in.	mm	in.	mm	in.
150	5.91	-	-	400	15.75

* measured from the base plate of the cabinet top.



Free space for door opening:



Maximum allowed plinth height for the extraction/installation ramp

The maximum plinth height for the extraction/installation ramp delivered with the drive is 50 mm (1.97 in).

Typical power cable sizes

The table below gives typical copper and aluminum cable types with concentric copper shield for the drives with nominal current. For the cable sizes accepted by the drive cabinet cable entries and connection terminals, see *Terminal and entry data for the power cables (page 182)*.

Drive type ACS580-07-	Frame size	IEC [1]		US [2]
		Cu cable type	Al cable type	Cu cable type
		mm²	mm²	AWG/kcmil per phase
U_N = 400 V				
0145A-4	R6	3×95	3×120	3/0
0169A-4	R7	3×120	3×150	250 MCM
0206A-4	R7	3×150	3×240	300 MCM
0246A-4	R8	2×(3×70)	2×(3×95)	2×2/0
0293A-4	R8	2×(3×95)	2×(3×120)	2×3/0
0363A-4	R9	2×(3×120)	2×(3×185)	2×250 MCM
0430A-4	R9	2×(3×150)	2×(3×240)	2×300 MCM
0505A-4	R10	3x(3x95)	3x(3x150)	2×500 MCM or 3×250 MCM
0585A-4	R10	3x(3x120)	4×(3x150)	3x300 MCM
0650A-4	R10	3x(3x150)	4×(3x150)	3x300 MCM
0725A-4	R11	3x(3x185)	4x(3x185)	3×500 MCM or 4×300 MCM
0820A-4	R11	3x(3x240)	4x(3x240)	3×600 MCM or 4×400 MCM
0880A-4	R11	3x(3x240)	4x(3x240)	3×600 MCM or 4×400 MCM
U_N = 480 V				
0124A-4	R6	3x95	3x120	3/0

Drive type ACS580-07-	Frame size	IEC [1]		US [2]
		Cu cable type	Al cable type	Cu cable type
		mm²	mm²	AWG/kcmil per phase
0156A-4	R7	3x120	3x150	250 MCM
0180A-4	R7	3x150	3x240	300 MCM
0240A-4	R8	2x(3x70)	2x(3x95)	2x2/0
0260A-4	R8	2x(3x95)	2x(3x120)	2x3/0
0361A-4	R9	2x(3x120)	2x(3x185)	2x250 MCM
0414A-4	R9	2x(3x150)	2x(3x240)	2x300 MCM

1. The cable sizing is based on max. 9 cables laid on a cable ladder side by side, three ladder type trays one on top of the other, ambient temperature 30 °C, PVC insulation, surface temperature 70 °C (EN 60204-1and IEC 60364-5-52/2001). For other conditions, size the cables according to local safety regulations, appropriate input voltage and the load current of the drive.
2. The cable sizing is based on NEC Table 310-16 for copper wires, 75 °C (167 °F) wire insulation at 40 °C (104 °F) ambient temperature.Not more than three current-carrying conductors in raceway or cable or earth (directly buried). For other conditions, size the cables according to local safety regulations, appropriate input voltage and the load current of the drive.

Losses, cooling data and noise

Drive type ACS580-07-	Air flow				Heat dissipation	Noise
	IP21, IP42 (UL Type 1)		IP54 (UL Type 12)			
	m³/h	ft³/min	m³/h	ft³/min	W	dB(A)
U_N = 480 V						
0145A-4	685	403	585	344	2487	67
0169A-4	700	412	600	353	2497	67
0206A-4	700	412	600	353	3314	67
0246A-4	800	471	700	412	3806	65
0293A-4	800	471	700	412	4942	65
0363A-4	1400	824	1300	765	5868	68
0430A-4	1400	824	1300	765	7600	68
0505A-4	1900	1118	1900	1118	8353	72
0585A-4	1900	1118	1900	1118	9471	72
0650A-4	1900	1118	1900	1118	11200	72
0725A-4	2400	1413	2400	1413	11386	72
0820A-4	2400	1413	2400	1413	13725	72
0880A-4	2620	1542	2620	1542	15300	71
U_N = 480 V - NEC types						
0124A-4	685	403	585	344	2487	67
0156A-4	700	412	600	353	2497	67
0180A-4	700	412	600	353	3314	67
0240A-4	800	471	700	412	3806	65
0260A-4	800	471	700	412	4942	65
0361A-4	1400	824	1300	765	5868	68
0414A-4	1400	824	1300	765	7600	68

Terminal and entry data for the power cables

There are two (in frames R6 to R9) or four (in frames R10 and R11) 60 mm (2.36 in) diameter holes in the entry plate for the input power cables and two (in frames R6 to R9) or four (in frames R10 and R11) 60 mm (2.36 in) diameter holes for the motor cables.

IEC – Standard configuration

Input and motor cable terminal bolt sizes, accepted wire sizes (per three phases) and tightening torques are given below.

Frame size	Input and motor cable connection terminals						PE (grounding) terminals	
	L1, L2, L3			T1/U2, T2/V2, T3/W2				
	Max. wire size mm²	Bolt size	Tightening torque N·m	Min. wire size [1] mm²	Max. wire size mm²	Tightening torque N·m	Bolt size mm²	Tightening torque N·m
R6	3×150	M10	20…40	3×25	3×150	30	M10	30…44
R7	2×(3×240)	M10	20…40	2×(3×95)	2×(3×240)	40	M10	30…44
R8	2×(3×150)	M10	20…40	2×(3×50)	2×(3×150)	40	M10	30…44
R9	2×(3×240)	M12	50…75	2×(3×95)	2×(3×240)	70	M10	30…44
R10	4×(3×150)	M12	50…75	-	4×(3×150)	50…75	M10	30…44
R11	4×(3×240)	M12	50…75	-	4×(3×240)	50…75	M10	30…44

[1] **Note:** Minimum wire size does not necessarily have enough current capability for full load. Make sure the installation complies with local laws and regulations.

IEC – With option +E205

Input and motor cable terminal bolt sizes, maximum accepted wire sizes (per three phases) and tightening torques are given below.

Frame size	L1, L2, L3, U2, V2, W2			PE (grounding)	
	Max. wire size mm²	Bolt size	Tightening torque N·m	Bolt size mm²	Tightening torque N·m
R6	3×120	M10	20…40	M10	30…44
R7	3×240	M10	20…40	M10	30…44
R8	2×(3×120)	M10	20…40	M10	30…44
R9	2×(3×240)	M12	50…75	M10	30…44
R10	4×(3×150)	M12	50…75	M10	30…44
R11	4×(3×240)	M12	50…75	M10	30…44

US – Standard configuration

Input and motor cable terminal bolt sizes, accepted wire sizes (per three phases) and tightening torques are given below.

Frame size	L1, L2, L3			T1/U2, T2/V2, T3/W2			PE (grounding)	
	Max. wire size AWG	Bolt size	Tightening torque lbf·ft	Min. wire size [1] AWG	Max. wire size AWG	Tightening torque lbf·ft	Bolt size	Tightening torque lbf·ft
R6	3×300 MCM	M10 (3/8")	22.1	3	3×300 MCM	22.1	M10 (3/8")	29.5
R7	3×500 MCM	M10 (3/8")	22.1	3/0	3×500 MCM	22.1	M10 (3/8")	29.5
R8	2×(3×300 MCM)	M10 (3/8")	22.1	2×1/0 / 2×3/0 [2]	2×(3×300 MCM)	22.1	M10 (3/8")	29.5
R9	2×(3×500 MCM)	M12 (7/16")	51.6	2×3/0	2×(3×500 MCM)	51.6	M10 (3/8")	29.5
R10	4×(3×300 MCM)	M12 (7/16")	51.6	-	4×(3×300 MCM)	51.6	M10 (3/8")	29.5
R11	4×(3×500 MCM)	M12 (7/16")	51.6	-	4×(3×500 MCM)	51.6	M10 (3/8")	29.5

[1] **Note:** Minimum wire size does not necessarily have enough current capability for full load. Make sure the installation complies with local laws and regulations.

[2] -01-246A-4: 2×1/0, -01-293A-4: 2×3/0

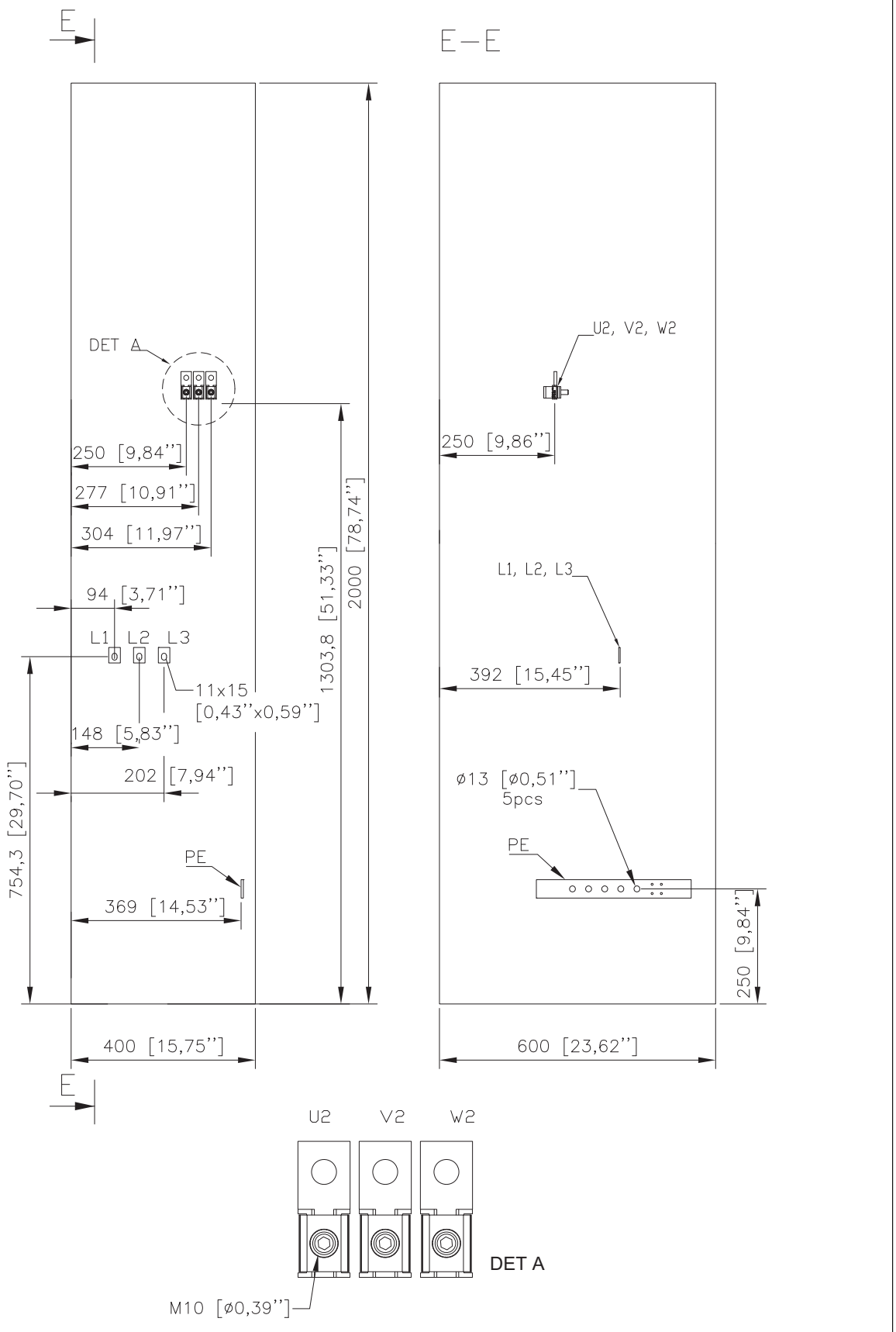
US – With option +E205

Input and motor cable terminal bolt sizes, maximum accepted wire sizes (per three phases) and tightening torques are given below.

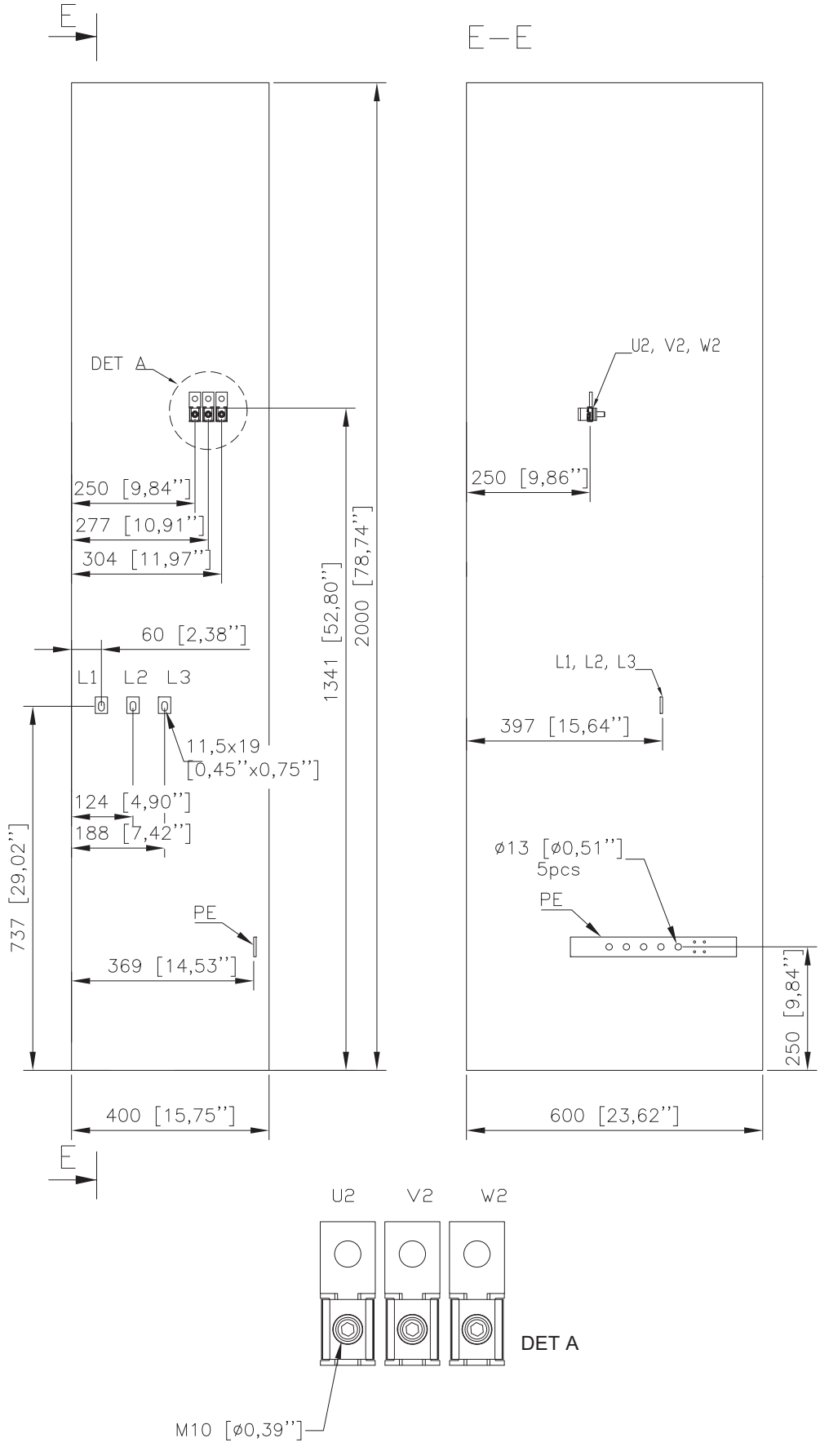
Frame size	L1, L2, L3, U2, V2, W2			PE (grounding)	
	Max. wire size mm^2	Bolt size	Tightening torque N·m	Bolt size mm^2	Tightening torque N·m
R6	3×300 MCM	M10 (3/8")	22.1	M10	30…44
R7	3×500 MCM	M10 (3/8")	22.1	M10	30…44
R8	2×(3×300 MCM)	M12 (7/16")	51.6	M10	30…44
R9	2×(3×500 MCM)	M12 (7/16")	51.6	M10	30…44
R10	4×(3×300 MCM)	M12 (7/16")	51.6	M10	30…44
R11	4×(3×500 MCM)	M12 (7/16")	51.6	M10	30…44

Connection drawings

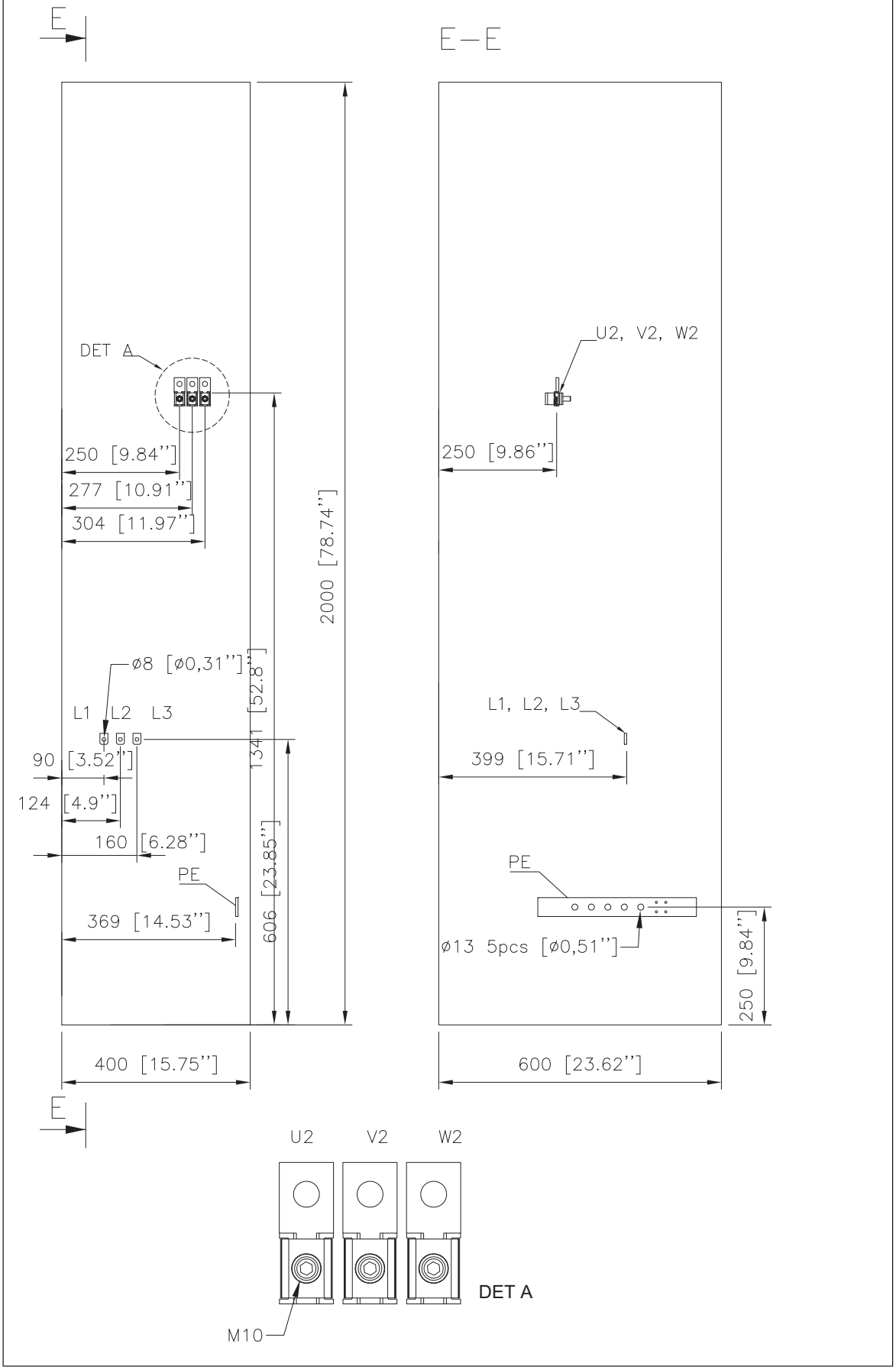
Frame R6: Input and motor cable terminal dimensions (bottom entry and exit, switch fuse OS250)



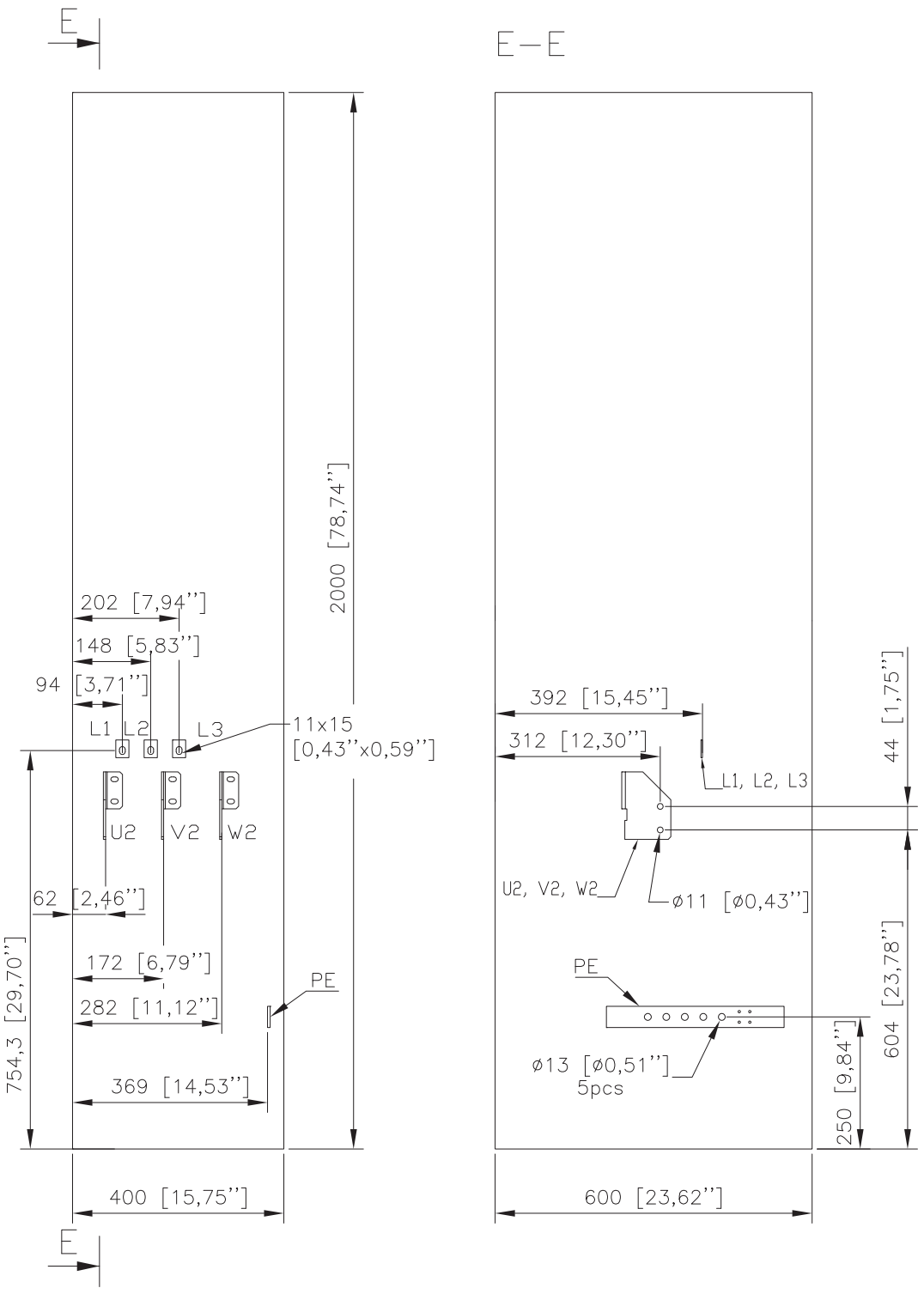
Frame R6: Input and motor cable terminal dimensions (bottom entry and exit, switch fuse OS400)



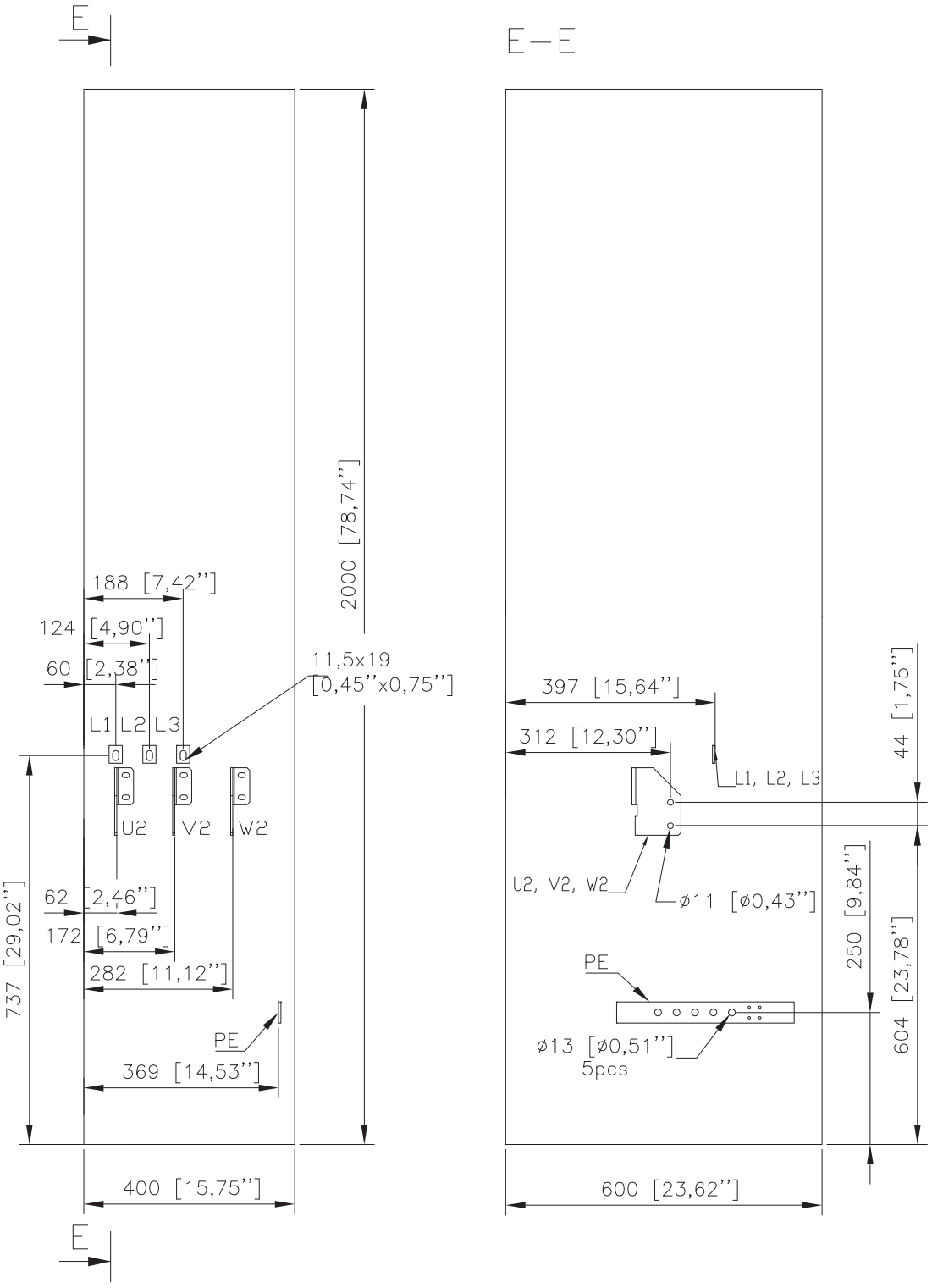
Frame R6: Input and motor cable terminal dimensions (option +F289)



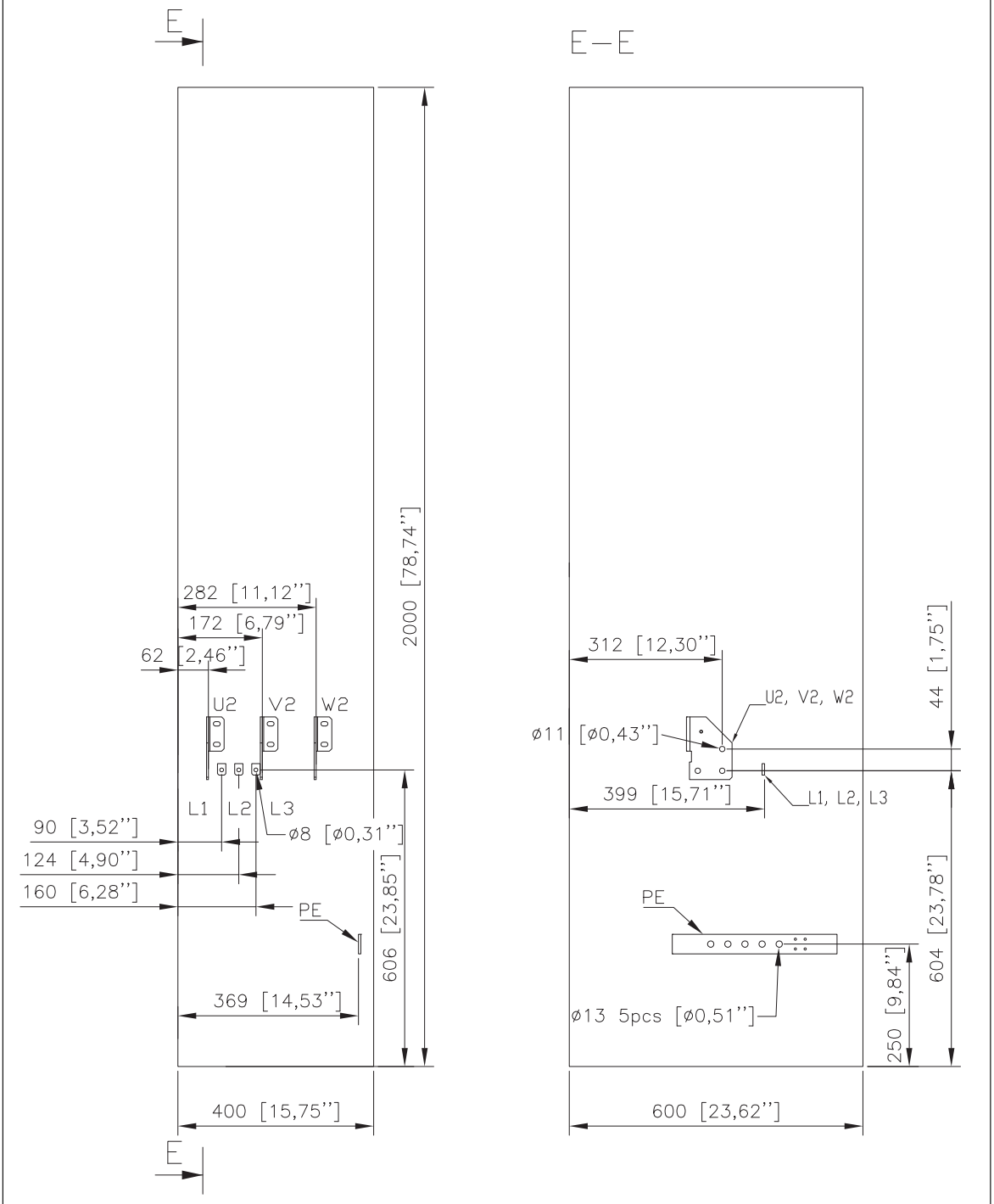
Frames R6 and R7: Input and motor cable terminal dimensions (bottom entry and exit, switch fuse OS250, du/dt filter [option +E205])



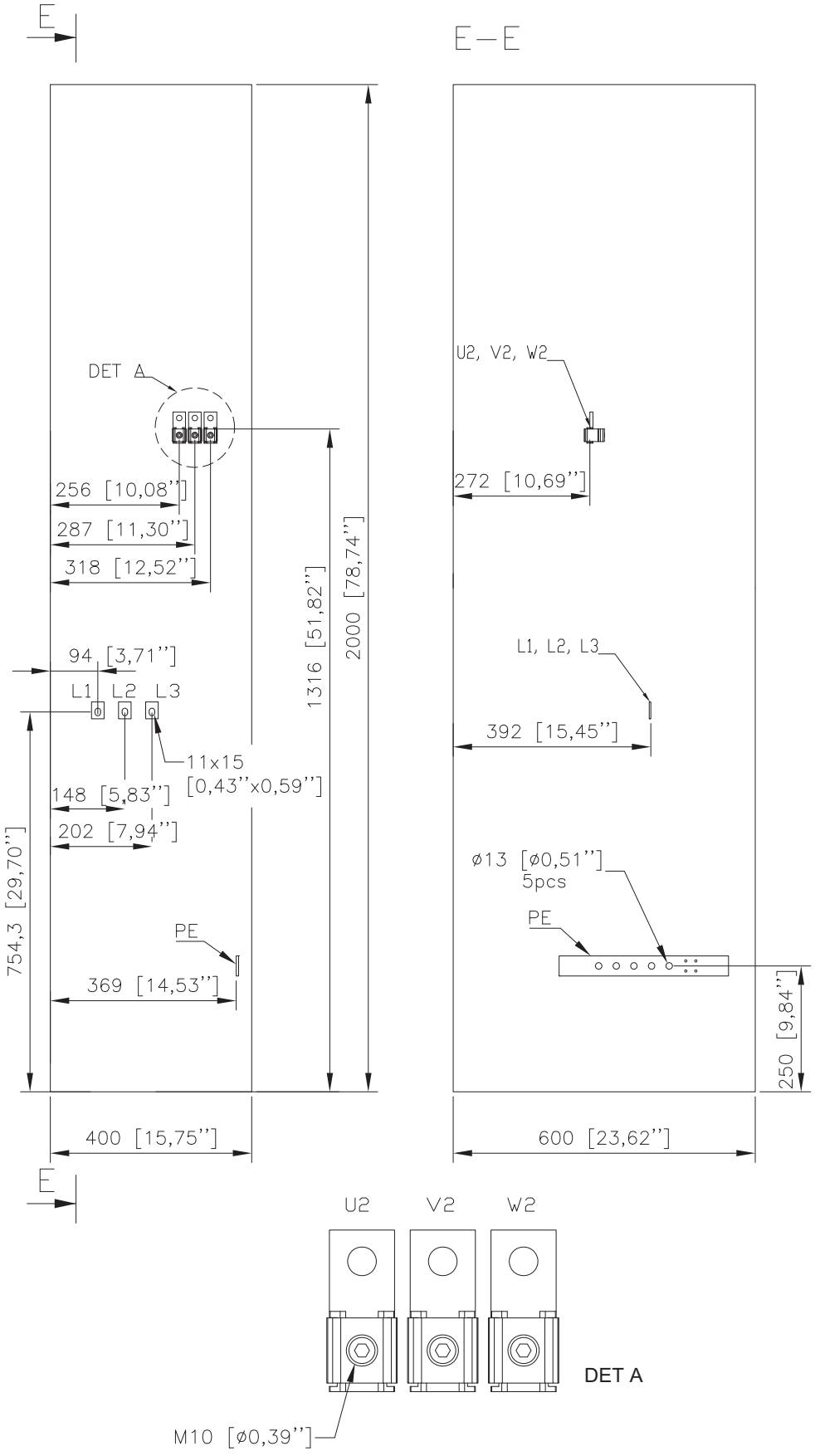
Frames R6 and R7: Input and motor cable terminal dimensions (bottom entry and exit, switch fuse OS400, du/dt filter [option +E205])



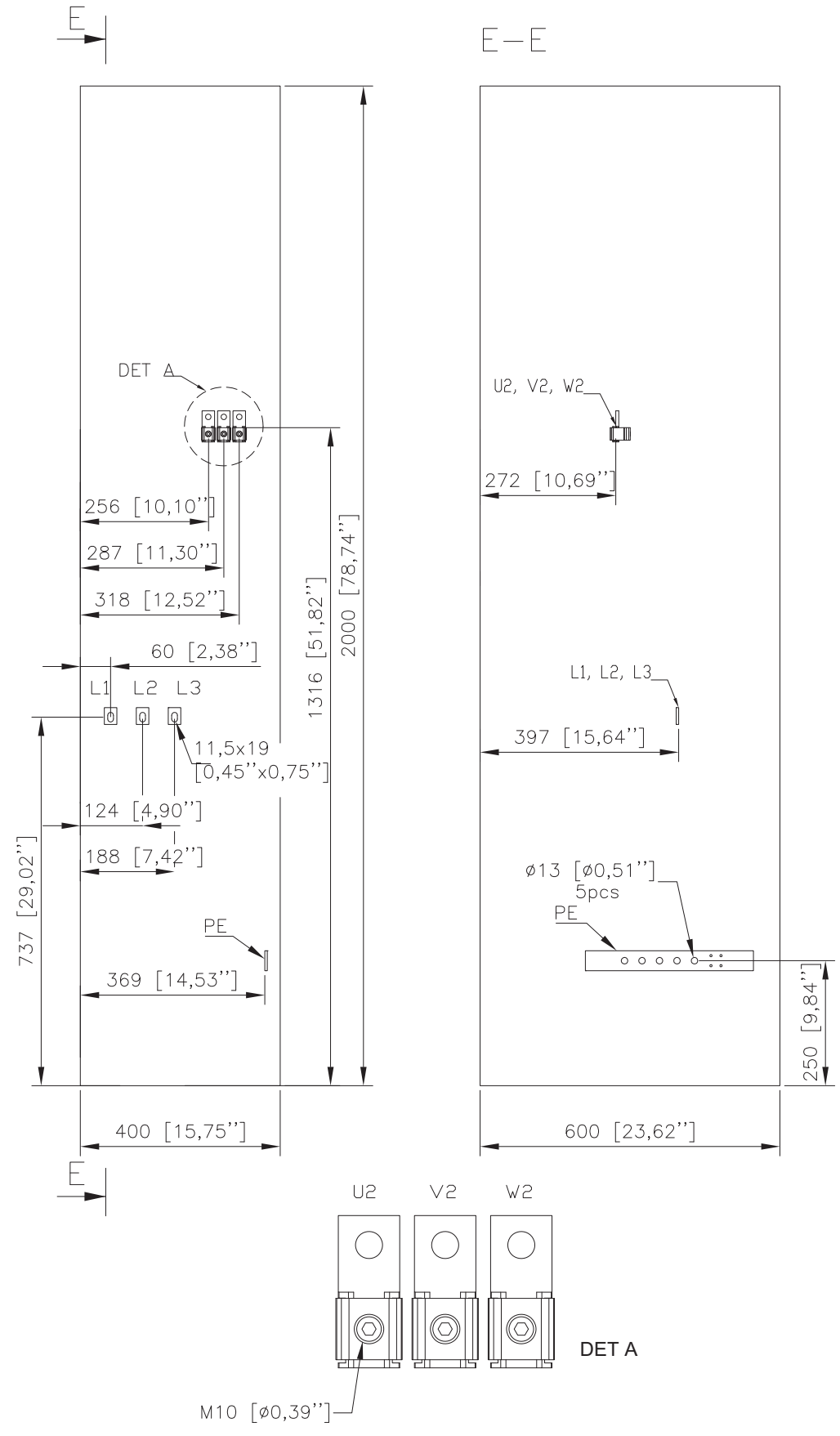
Frames R6 and R7: Input and motor cable terminal dimensions (bottom entry and exit, options +F289 and +E205)



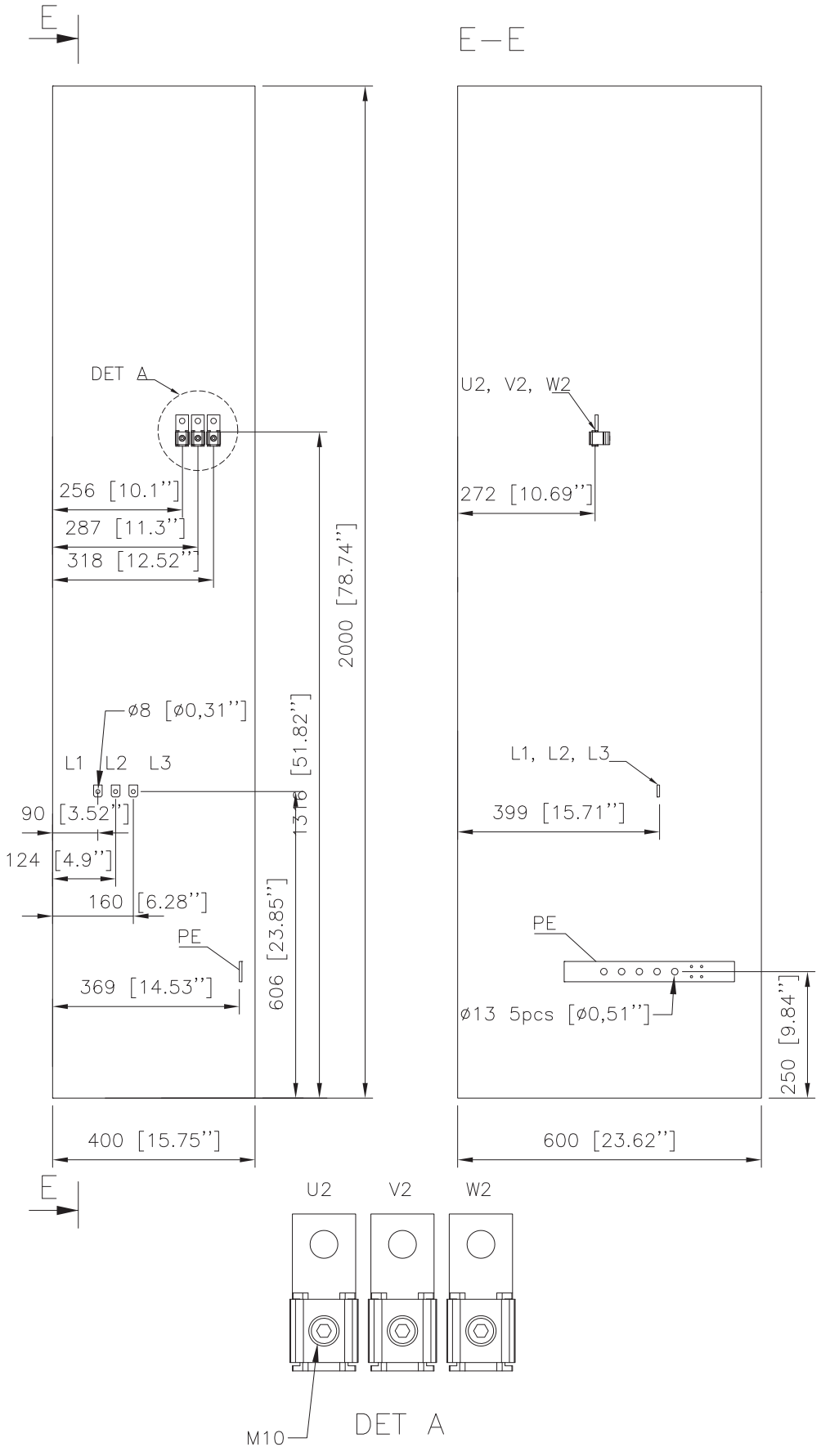
Frame R7: Input and motor cable terminal dimensions (bottom entry and exit, switch fuse OS250)



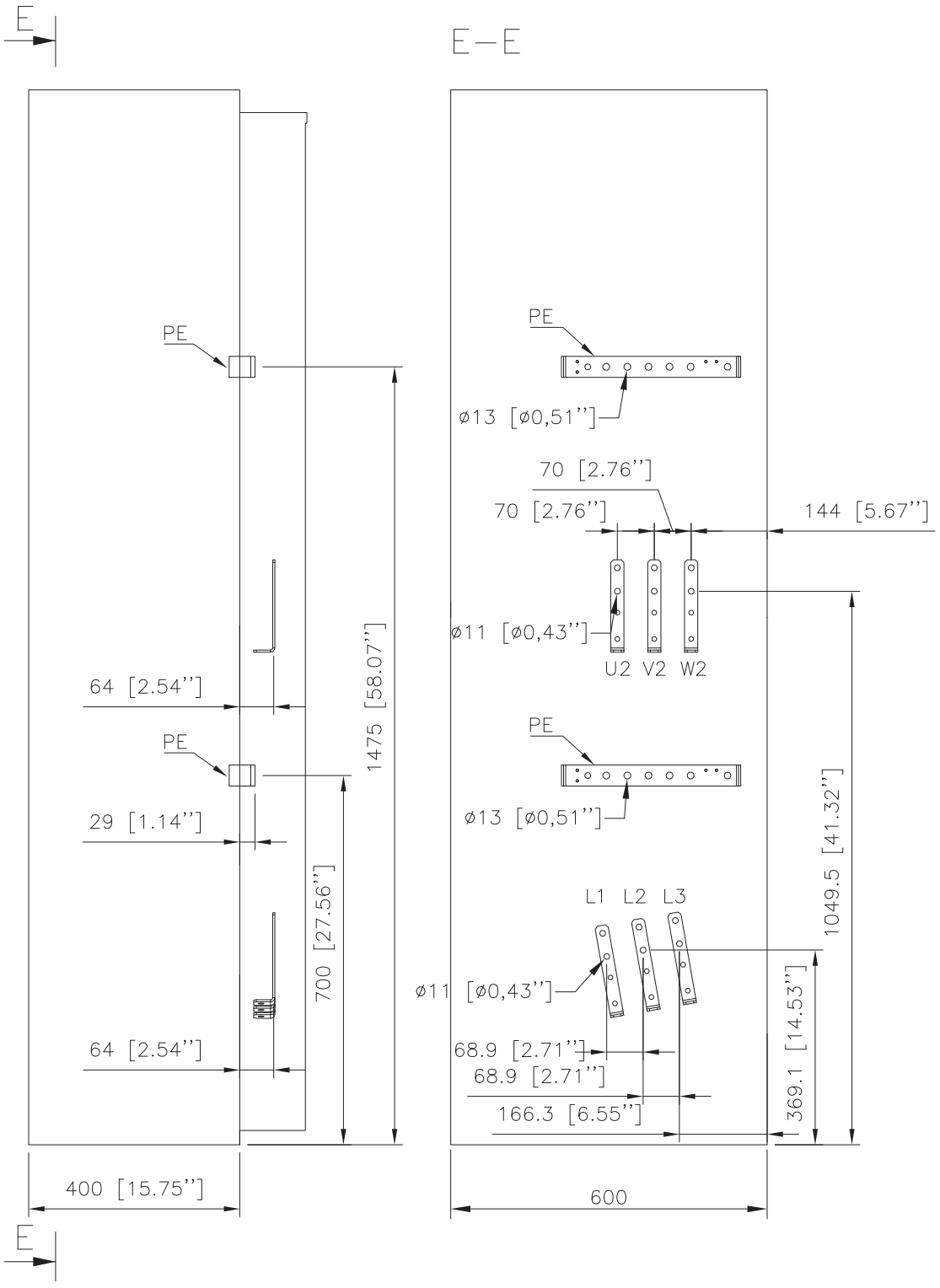
Frame R7: Input and motor cable terminal dimensions (bottom entry and exit, switch fuse OS400)



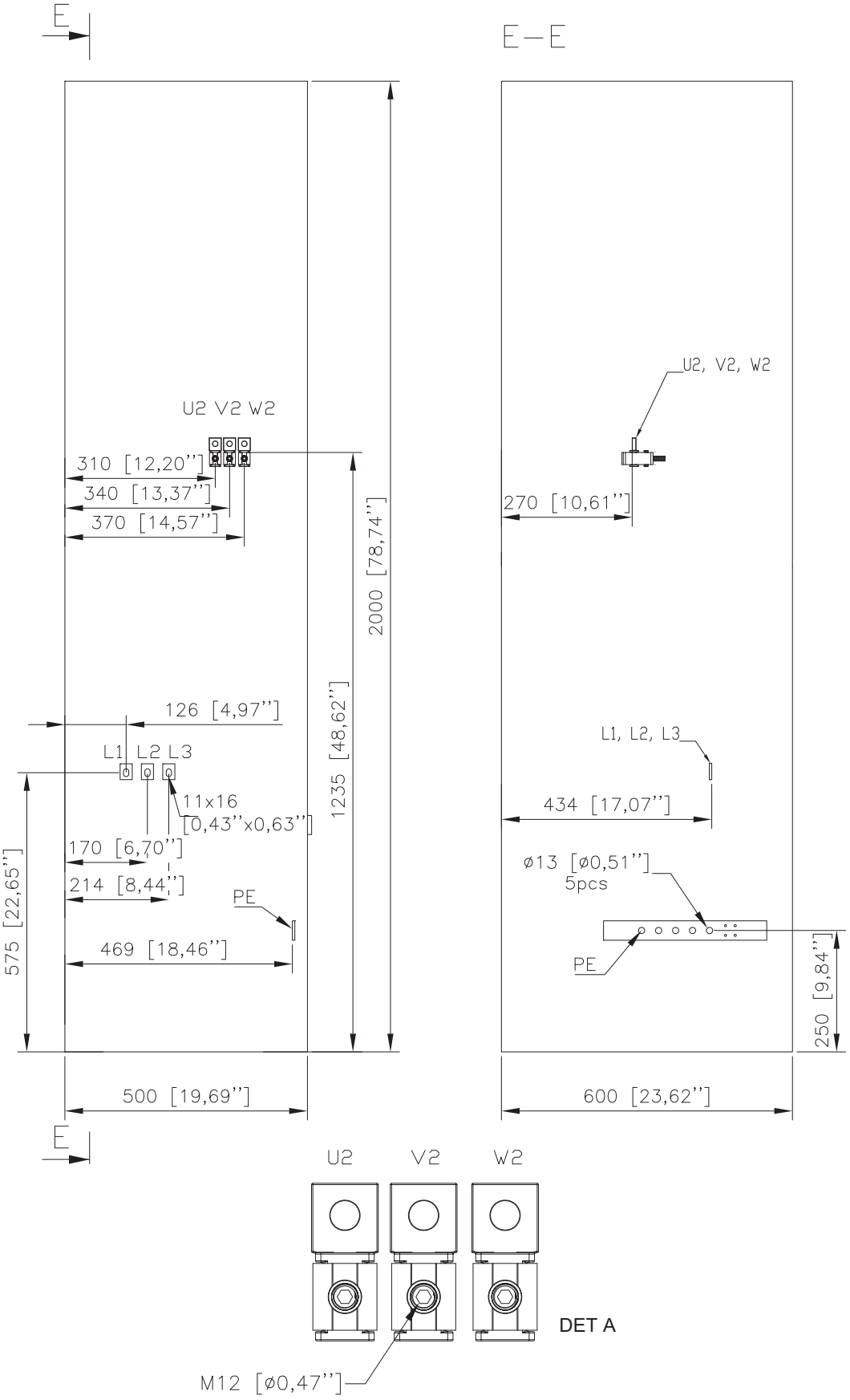
Frame R7: Input and motor cable terminal dimensions (bottom entry and exit, option +F289)



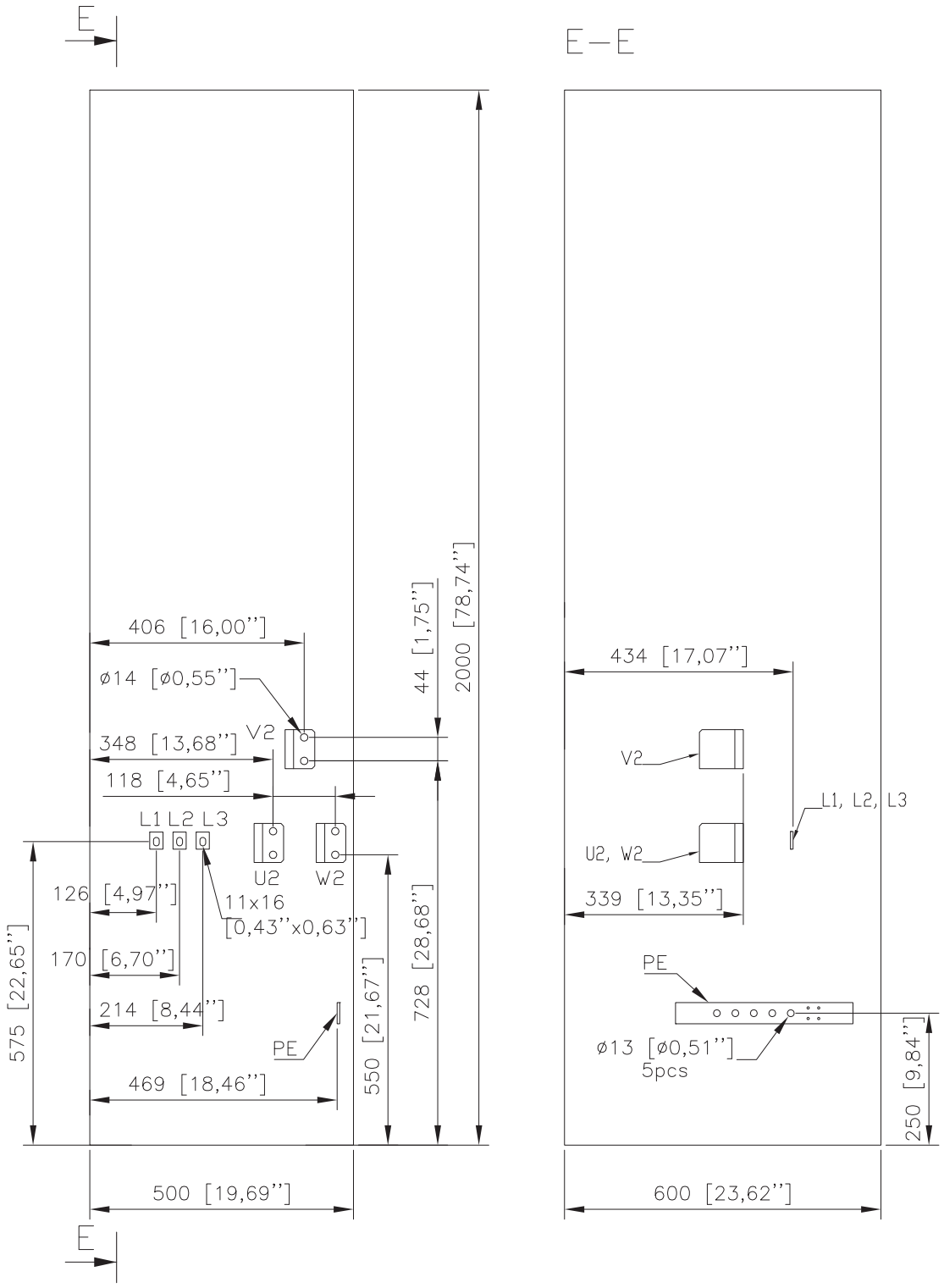
Frames R6 and R7: Input and motor cable terminal dimensions (top entry and exit, options +H351 and +H353)



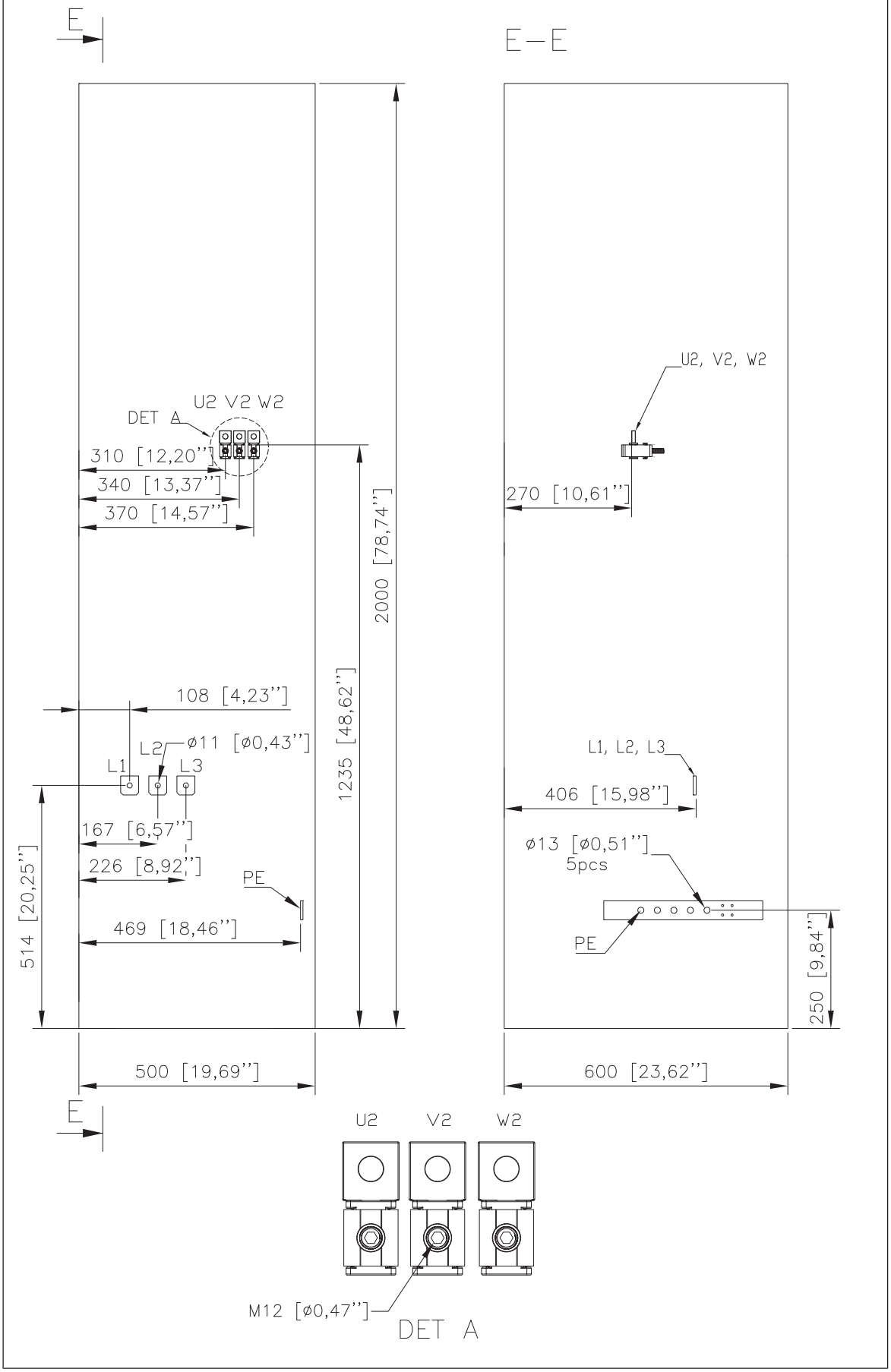
Frame R8: Input and motor cable terminal dimensions (bottom entry and exit, switch-disconnector OT400)



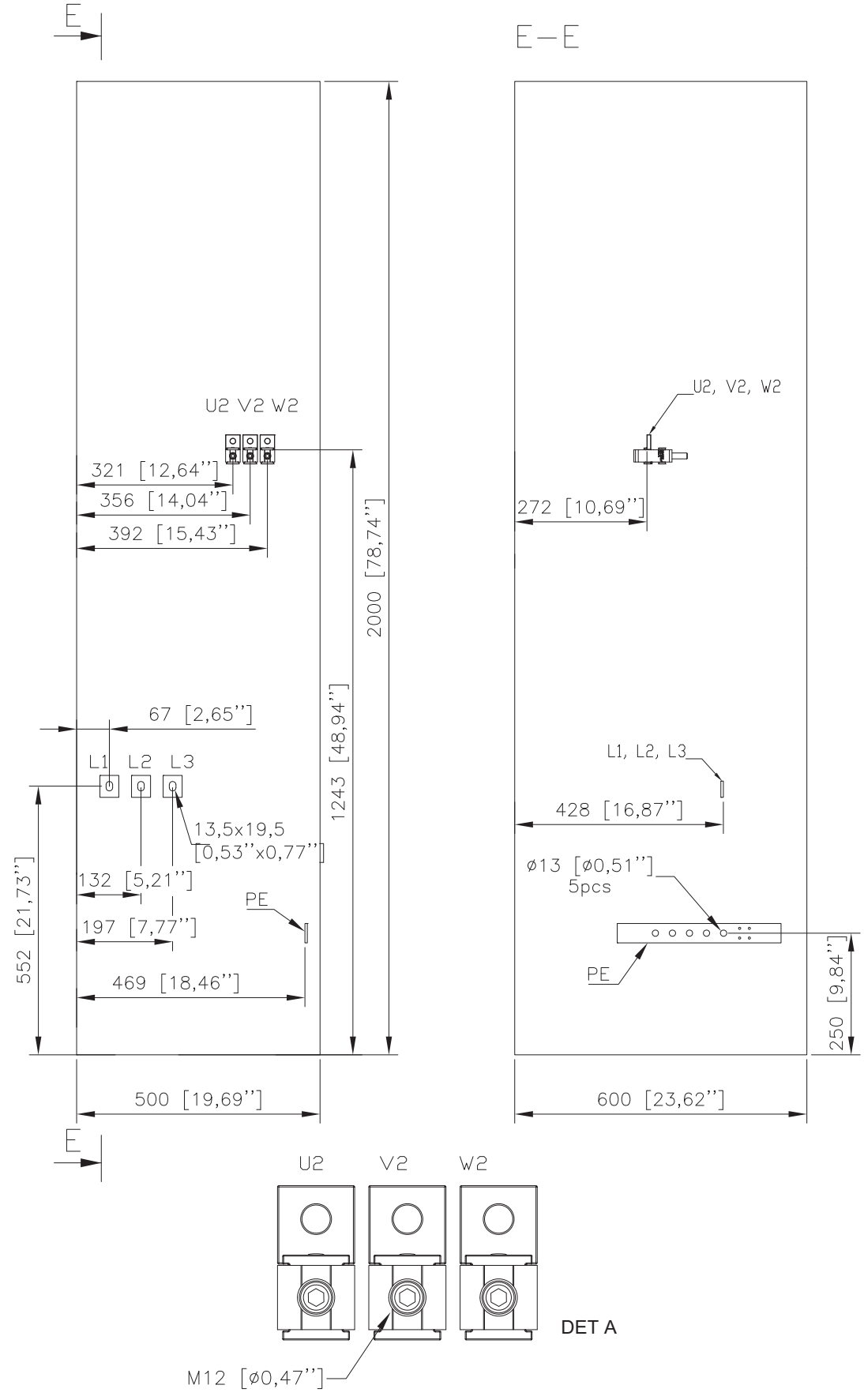
Frame R8: Input and motor cable terminal dimensions (bottom entry and exit, switch-disconnector OT400, du/dt filter [option +E205])



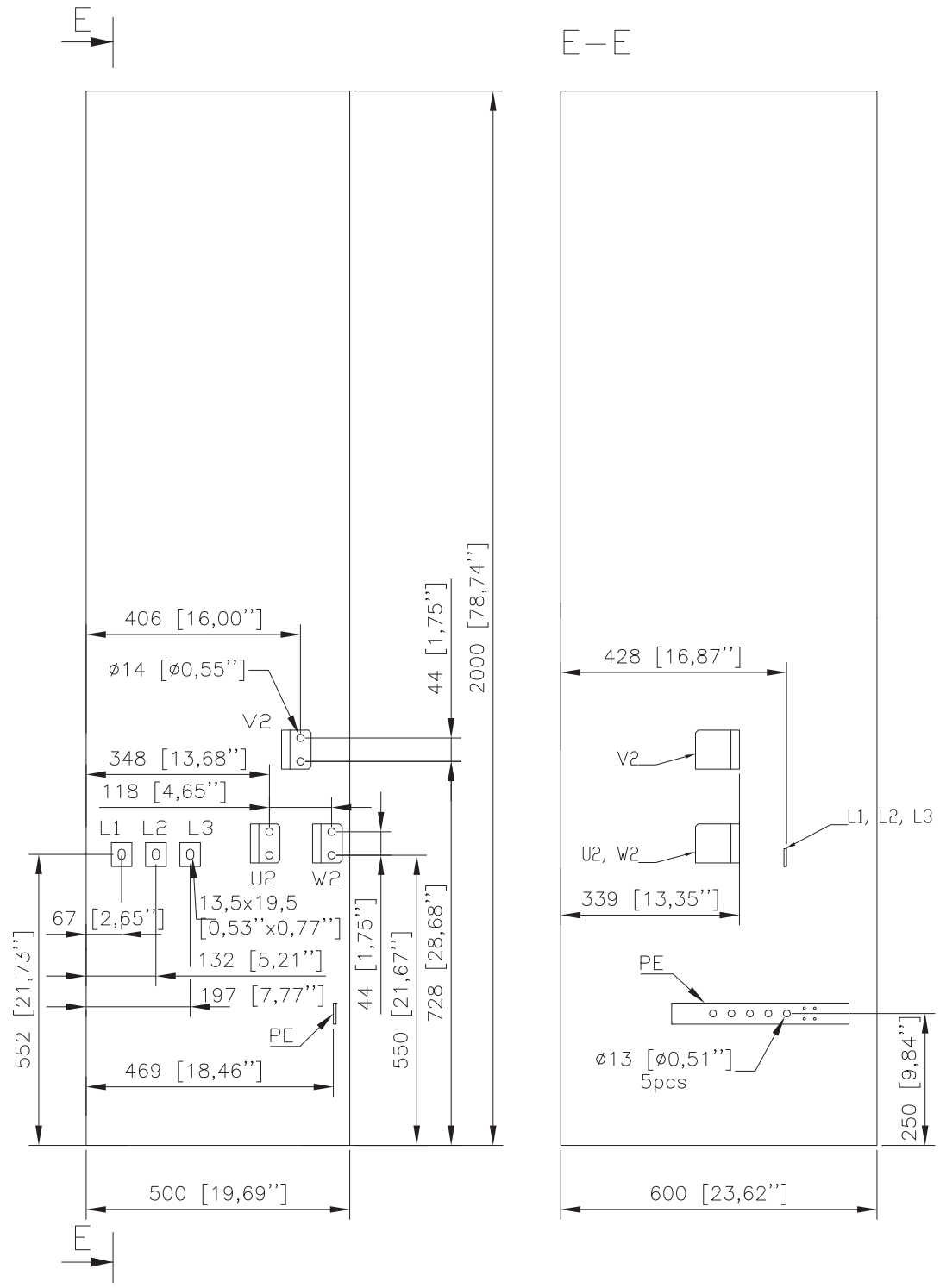
Frame R8: Input and motor cable terminal dimensions (bottom entry and exit, option +F289)



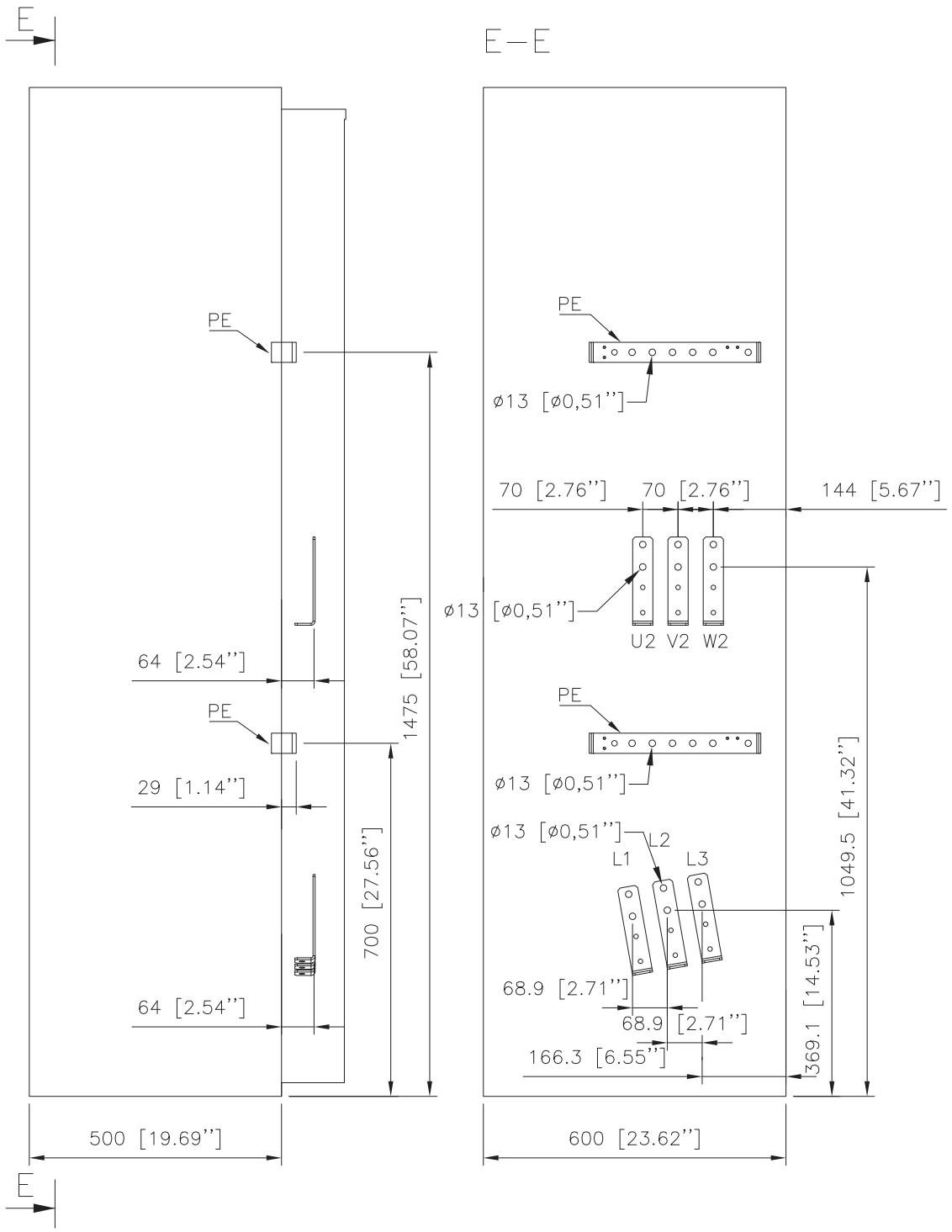
Frame R9: Input and motor cable terminal dimensions (bottom entry and exit, switch-disconnector OT630)



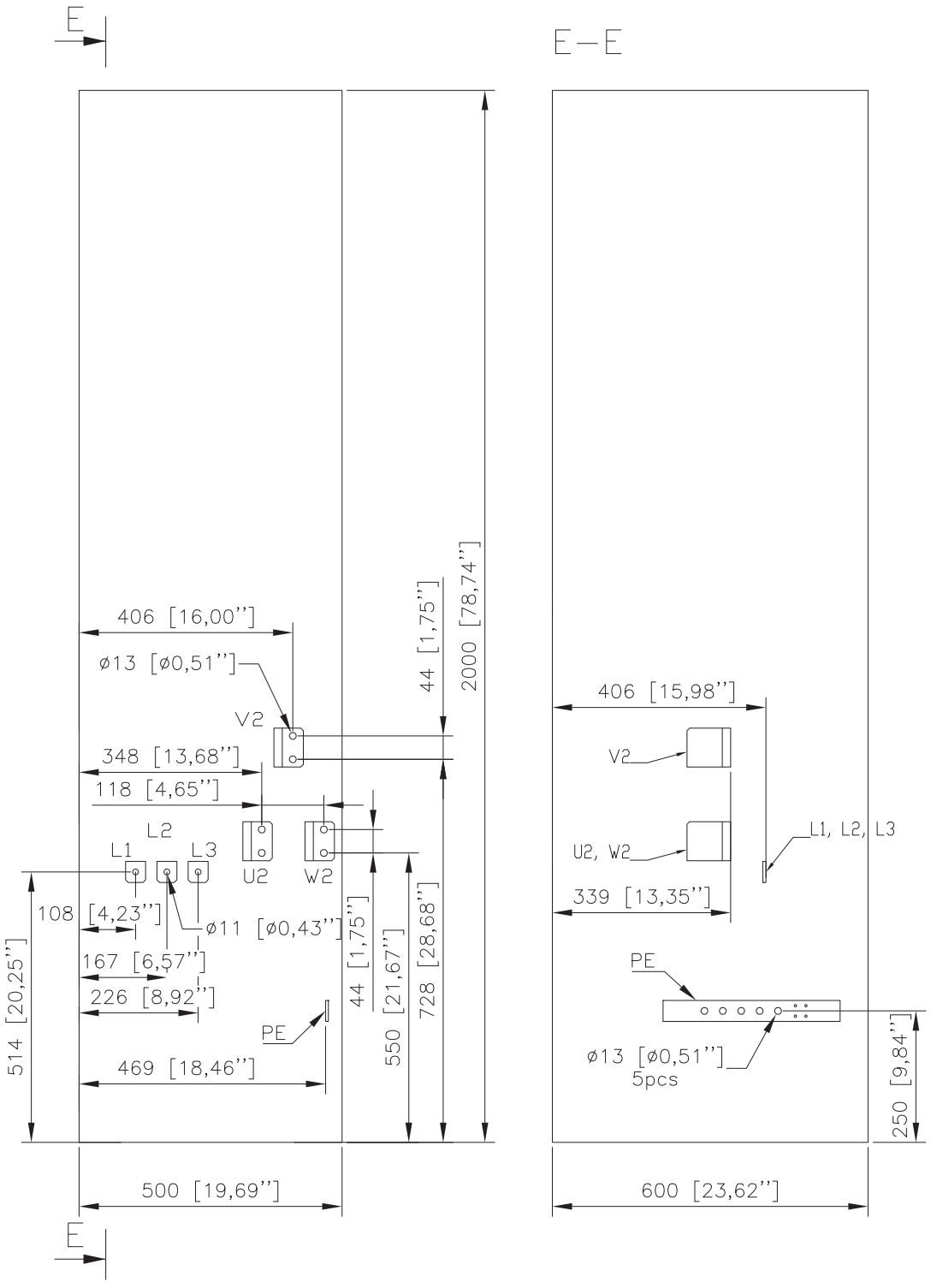
Frame R9: Input and motor cable terminal dimensions (bottom entry and exit, switch-disconnector OT630, du/dt filter [option +E205])



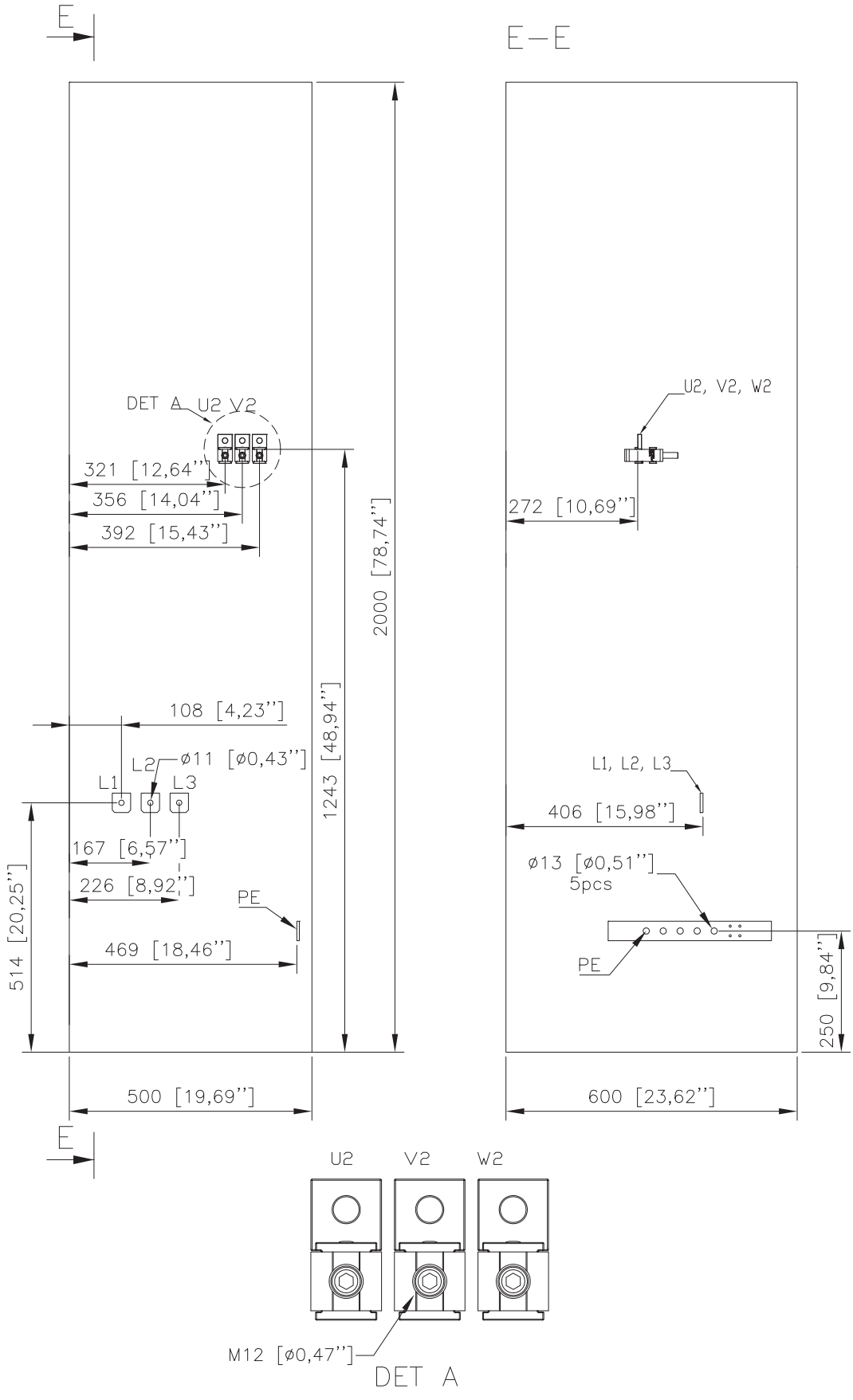
Frames R8 and R9: Input and motor cable terminal dimensions (top entry and exit, options +H351 and +H353)



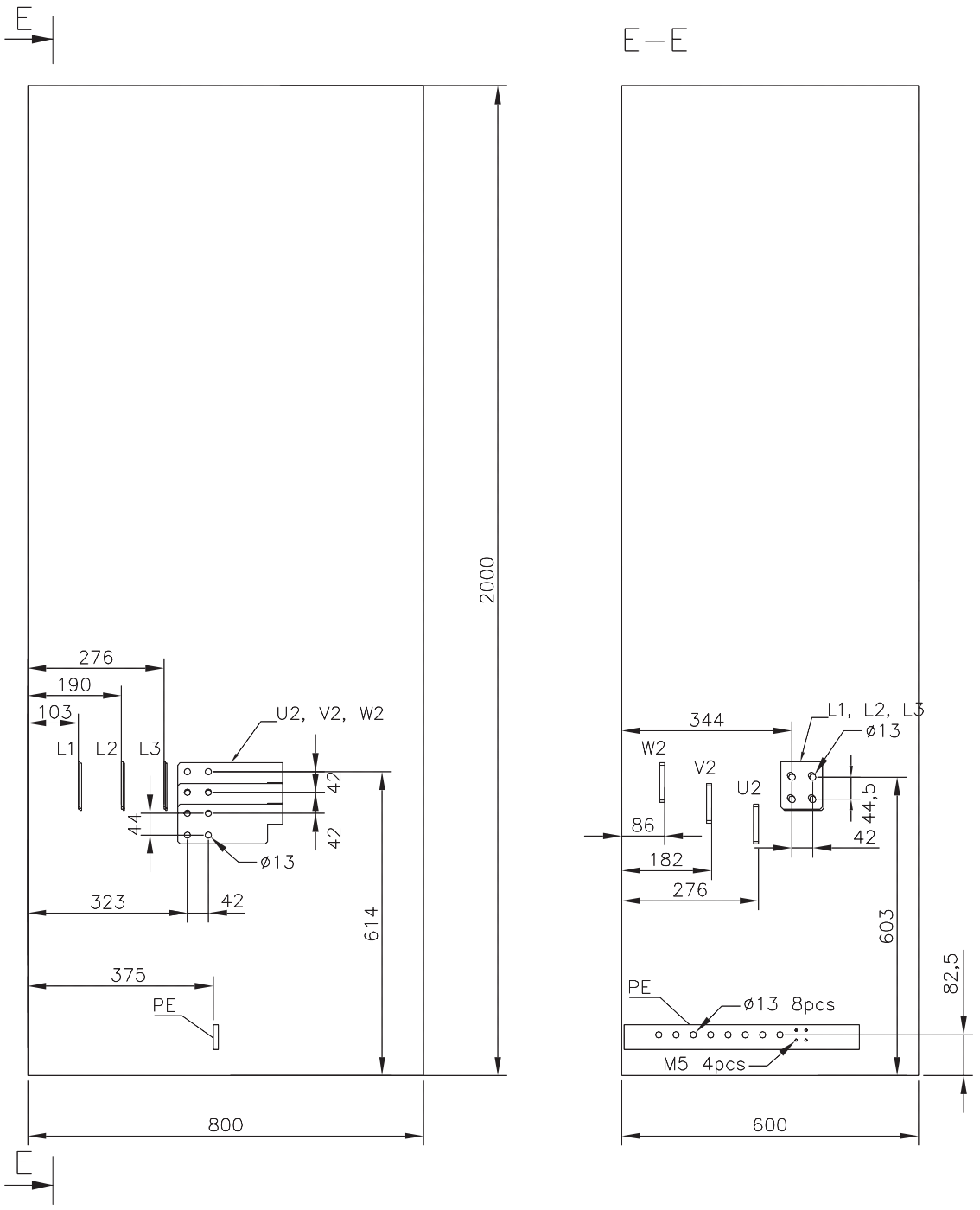
Frames R8 and R9: Input and motor cable terminal dimensions (bottom entry and exit, options +F289 and +E205)



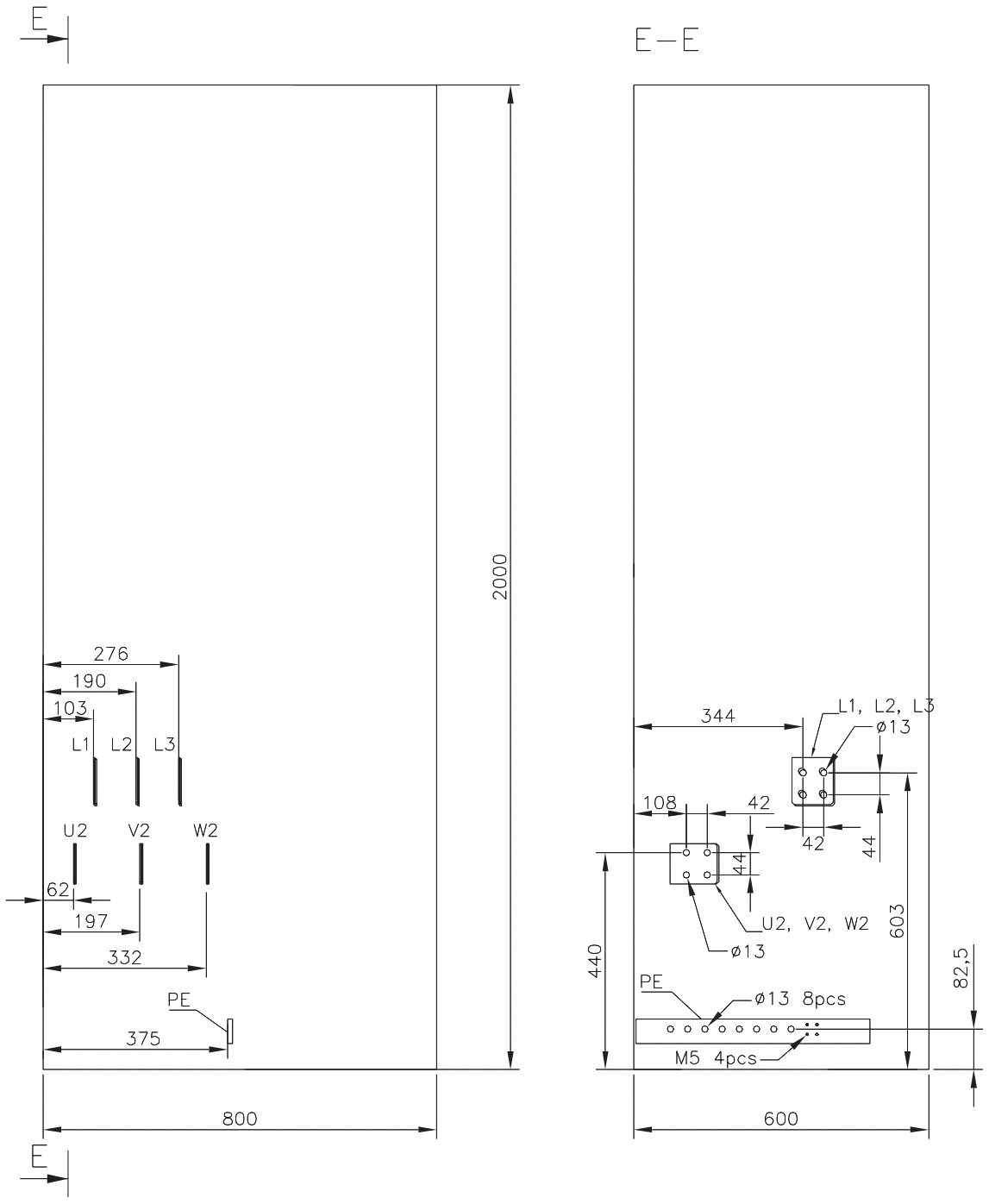
Frame R9: Input and motor cable terminal dimensions (option +F289)



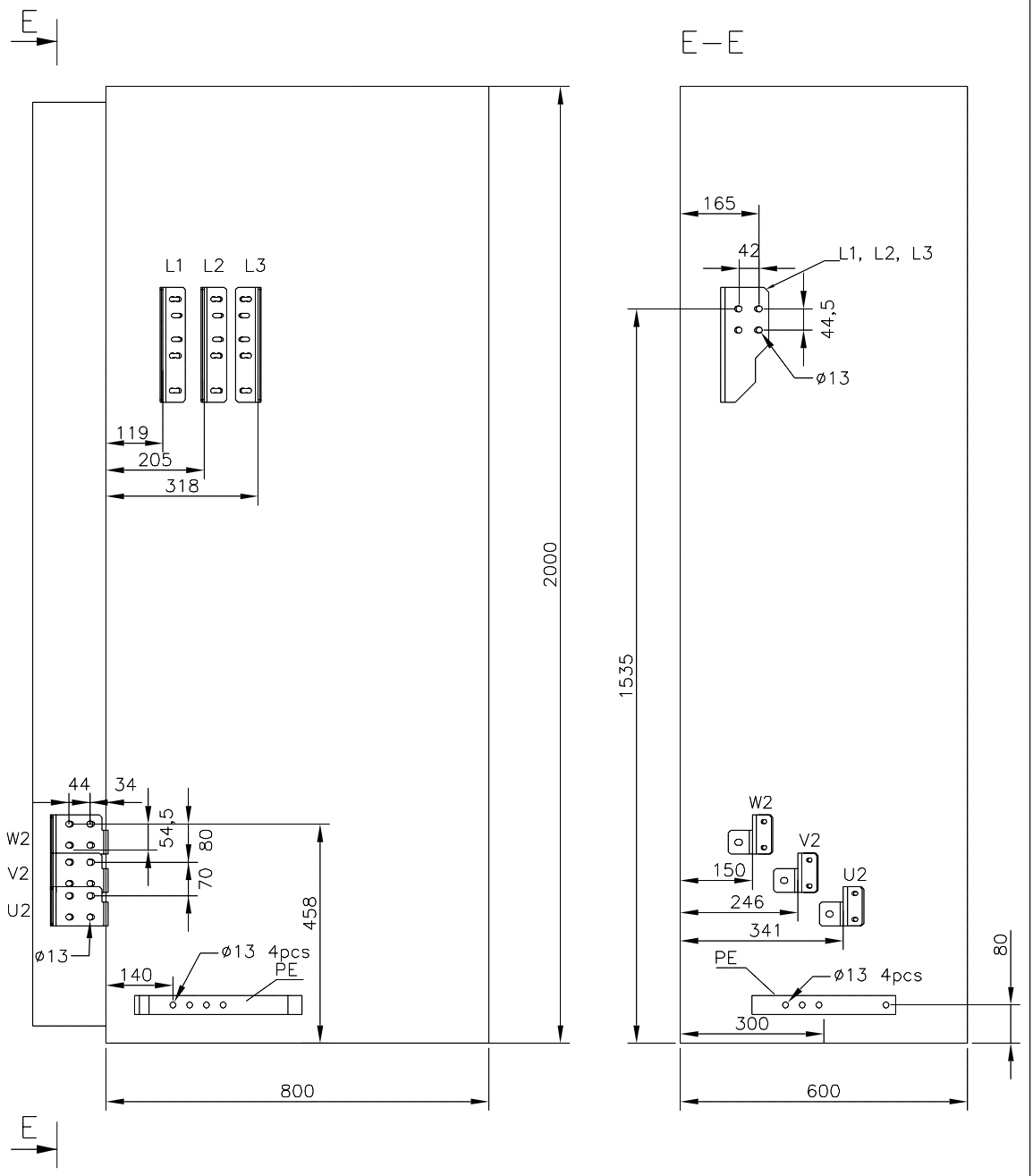
Frame R10: Input and motor cable terminal dimensions (bottom entry and exit)



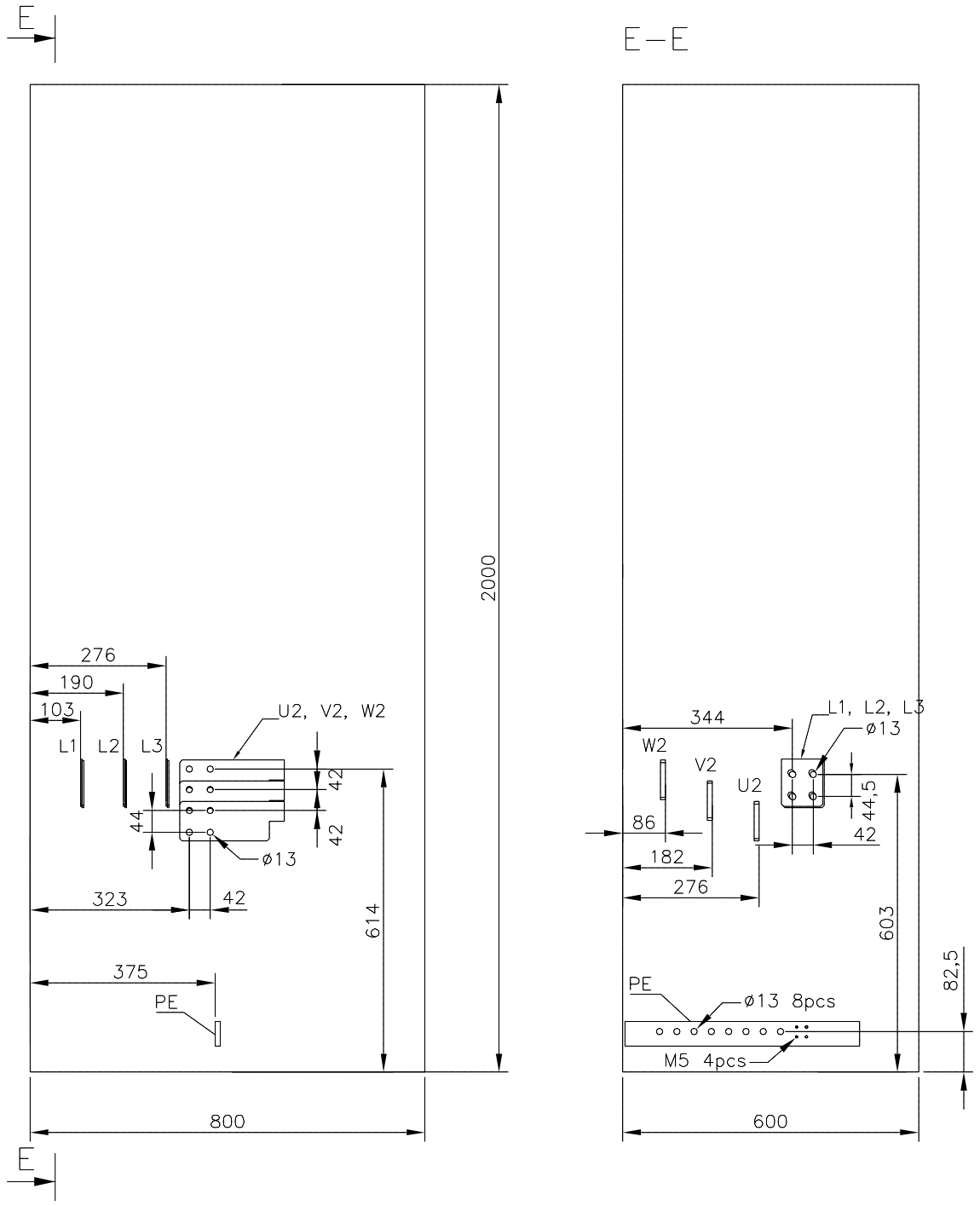
Frame R10: Input and motor cable terminal dimensions (bottom entry and exit, option +E205)



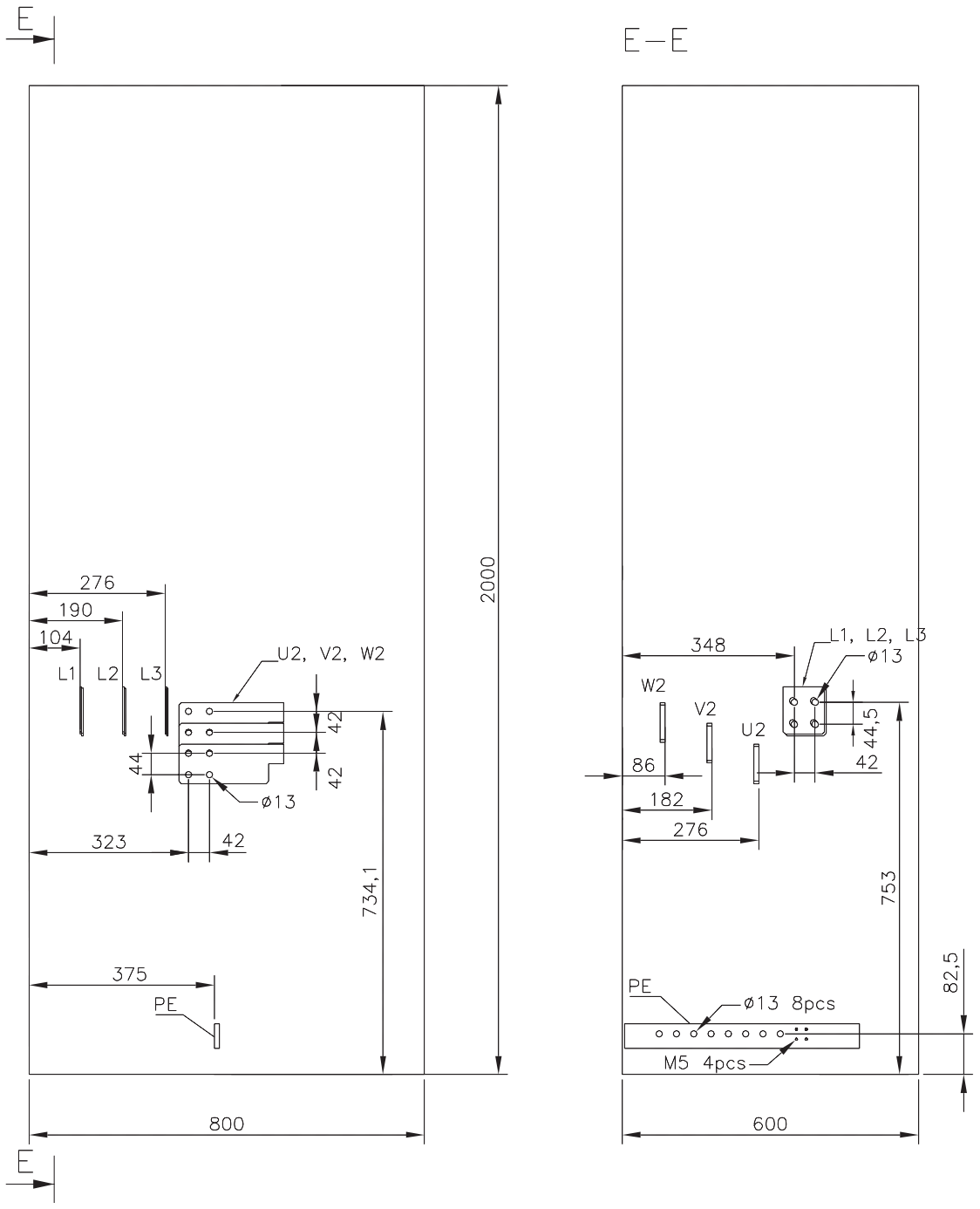
Frame R10: Input and motor cable terminal dimensions (top entry and exit)



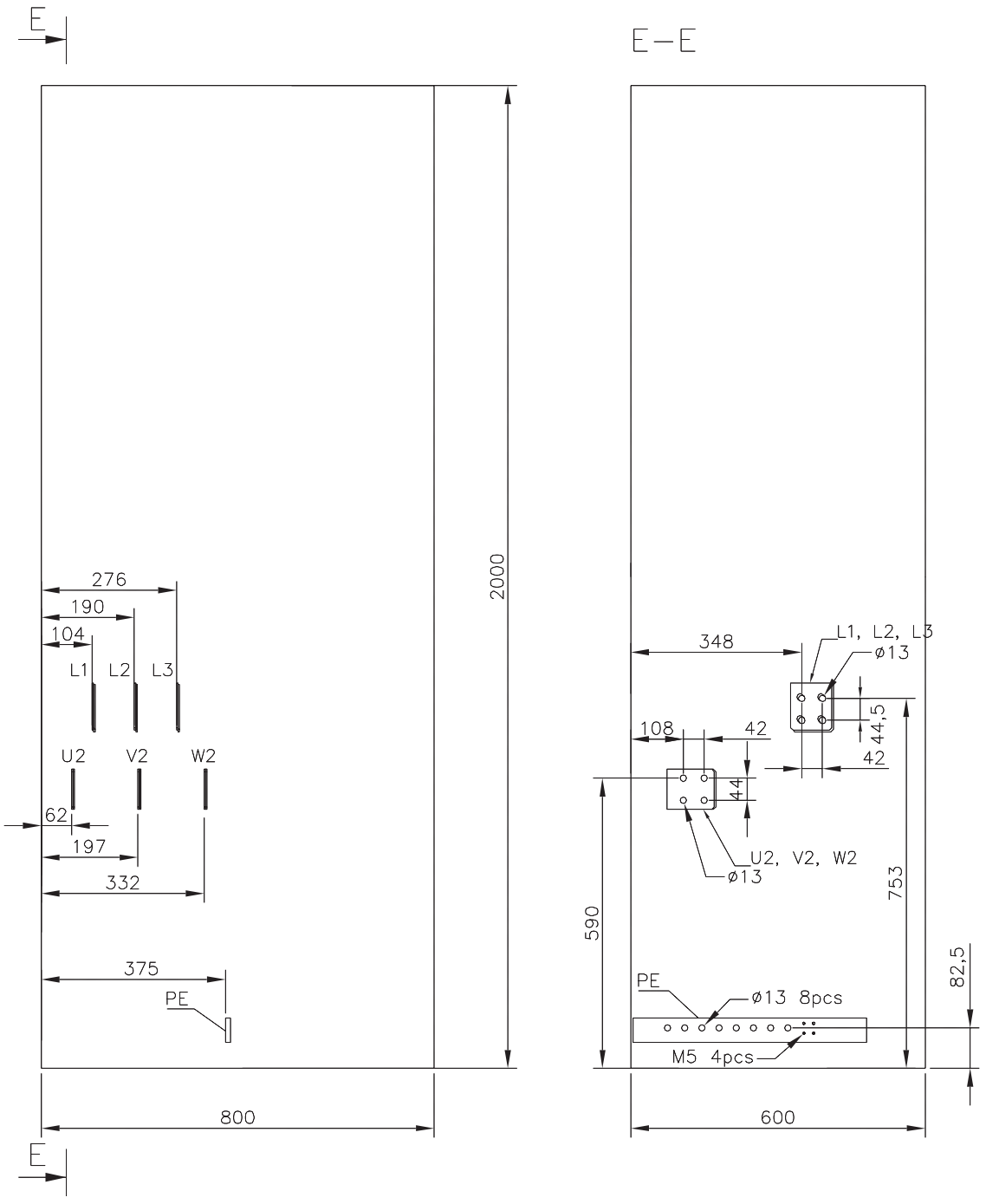
Frame R10: Input and motor cable terminal dimensions (top entry and exit, option +F289)



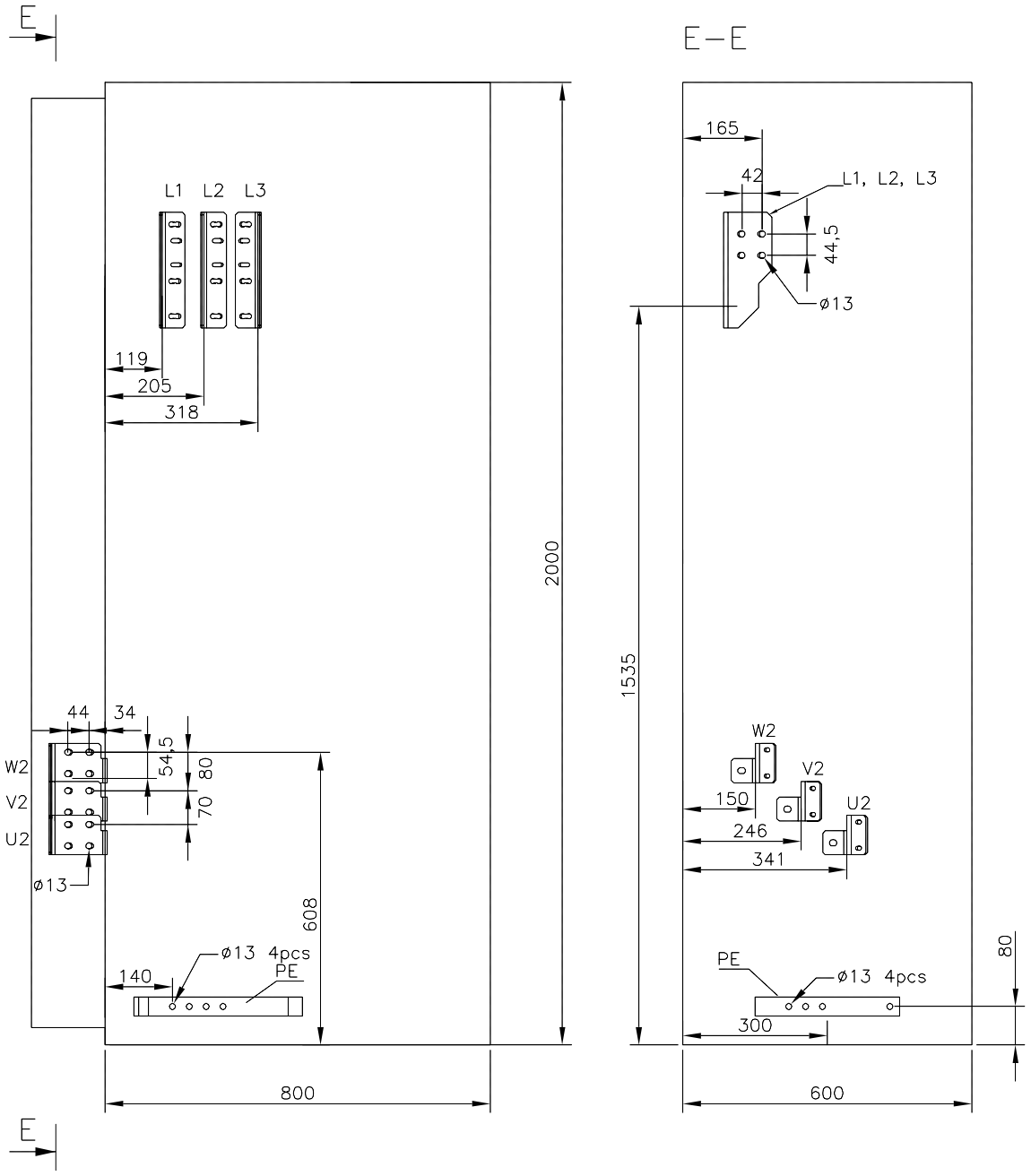
Frame R11: Input and motor cable terminal dimensions (bottom entry and exit)



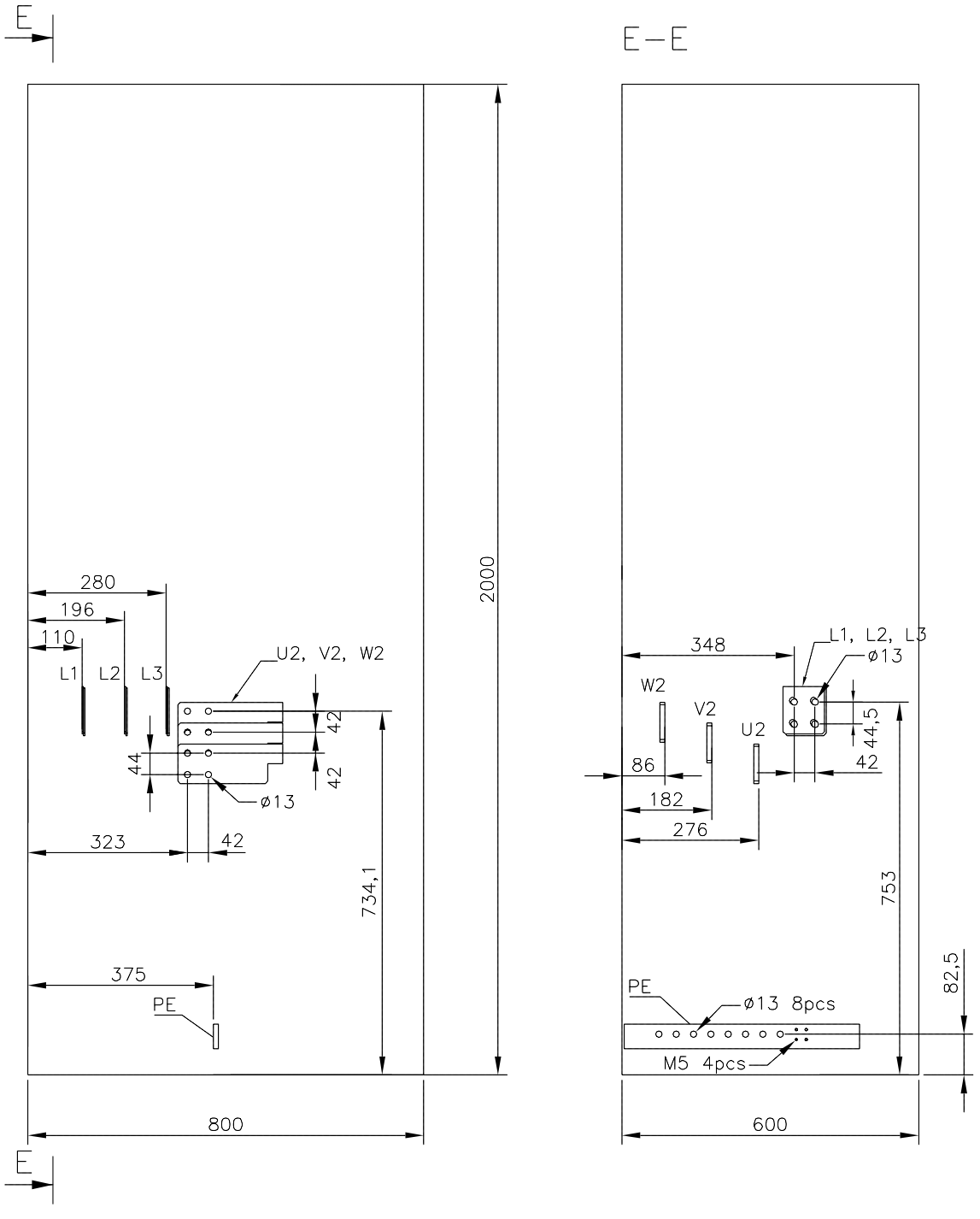
Frame R11: Input and motor cable terminal dimensions (bottom entry and exit, option +E205)



Frame R11: Input and motor cable terminal dimensions (top entry and exit)



Frame R11: Input and motor cable terminal dimensions (top entry and exit, option +F289)



Terminal and connection data for auxiliary control circuits

Maximum acceptable voltage and current values and wire sizes in terminal blocks are given below.

Terminal block	Maximum acceptable voltage and current values and wire sizes
X250	230V AC / 24V DC, 2A • Solid wire 0,14...4 mm2 (28...12 AWG) • Stranded wire 0,08...2,5 mm2 (28...14 AWG)
X289	230V AC / 24V DC, 2A • Solid wire 0,14...4 mm2 (28...12 AWG) • Stranded wire 0,08...2,5 mm2 (28...14 AWG)
X290	230V AC / 24V DC, 2A • Solid wire 0,14...4 mm2 (28...12 AWG) • Stranded wire 0,08...2,5 mm2 (28...14 AWG)
X300	230V AC, 4A • Solid wire 0,14...4 mm2 (28...12 AWG) • Stranded wire 0,08...2,5 mm2 (28...14 AWG)
X951	24V DC • Solid wire 0,14...4 mm2 (28...12 AWG) • Stranded wire 0,08...2,5 mm2 (28...14 AWG)
X969	24V DC • Solid wire 0,14...4 mm2 (28...12 AWG) • Stranded wire 0,08...2,5 mm2 (28...14 AWG)
X3	24V DC • Solid wire 0,14...4 mm2 (28...12 AWG) • Stranded wire 0,08...2,5 mm2 (28...14 AWG)
X504	230V AC / 24V DC, 2A • Solid wire 0,25...2,5mm2 (24...12 AWG) • Stranded wire 0,25...2,5 mm2 (24...14 AWG)
X601.1	480V AC, 20A • Solid wire 0,75...16 mm2 (18...6 AWG) • Stranded wire 0,75...16 mm2 (18...6 AWG)
X601.1	230V AC / 24V DC, 2A • Solid wire 0,2...2,5 mm2 (24...14 AWG) • Stranded wire 0,2...2,5 mm2 (24...14 AWG)

Electrical power network specification

Voltage (U_1)	ACS580-07-xxxxx-4 drives: 380…480 VAC 3-phase ±10%. This is indicated in the type designation label as typical input voltage levels 3~400/480 V AC.
Network type	TN (grounded) and IT (ungrounded) systems
Short-circuit withstand strength (IEC 61439-1)	Maximum allowable prospective short-circuit current is 65 kA when the input cable is protected with gG type fuses (IEC 60269) having maximum operating time of 0.1 seconds and maximum current rating: • 400 A for frames R6 to R8 • 630 A for frame R9 • 1000 A for R10 • 1250 A for R11
Short-circuit current protection (UL 508C)	The drive is suitable for use on a circuit capable of delivering not more than 100,000 rms symmetrical amperes at 480 V maximum when the input cable is protected with UL class T or L fuses. For selection of fuses for branch circuit protection, see section *Fuses for branch circuit protection (page 178)*. Fast acting class T and L or faster are recommended in the USA. Obey local regulations.
Frequency (f_1)	50/60 Hz. Variation ±5% of nominal frequency.
Imbalance	Max. ± 3% of nominal phase to phase input voltage
Fundamental power factor (cos phi$_1$)	0.98 (at nominal load)

Motor connection data

Motor types	Asynchronous AC induction motors, permanent magnet synchronous motors
Voltage (U_2)	0 to U_1, 3-phase symmetrical. This is indicated in the type designation label as typical output voltage level 3 ~ 0...U_1. U_{max} at the field weakening point.
Frequency (f_2)	0…500 Hz For drives with du/dt filter: 500 Hz
Current	See section *Ratings (page 171)*.
Switching frequency	3 kHz (typically)
Maximum recommended motor cable length	300 m (984 ft). Longer cables cause a motor voltage decrease which limits the available motor power. The decrease depends on the motor cable length and characteristics. Note that a sine filter (optional) at the drive output also causes a voltage decrease. Contact ABB for more information. **Note:** With motor cables longer than 100 m (328 ft), the EMC Directive requirements may not be fulfilled.

Control unit connection data

See chapter *Control unit (page 115)*.

Efficiency

Approximately 98% at nominal power level

Protection classes

Degrees of protection (IEC/EN 60529)	IP21 (standard), IP42 (option +B054), IP54 (option +B055) , IP54 (option +B055)
Enclosure types (UL50)	UL Type 1 (standard), UL Type 1 (option +B054), UL Type 12 (option +B055). For indoor use only.
Overvoltage category (IEC/EN 60664-1)	III, except for auxiliary power connections (fan, control, heating, lighting, cooling unit pump etc) which are category II.
Protective class (IEC/EN 61800-5-1)	I

Ambient conditions

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

	Operation installed for stationary use	**Storage** in the protective package	**Transportation** in the protective package
Installation site altitude	0 to 2000 m (6561 ft) above sea level. For altitudes over 2000 m, contact ABB. Output derated above 1000 m (3281 ft). See section *Output derating*	-	-
Air temperature	-0 to +50 °C (32 to 122 °F). No condensation allowed. Output derated in the range +40 … +50 °C (+104 … +122 °F). See section *Output derating*	-40 to +70 °C (-40 to +158 °F)	-40 to +70 °C (-40 to +158 °F)
Relative humidity	5 to 95%	Max. 95%	Max. 95%
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination (IEC 60721-3-x)	IEC/EN 60721-3-3:2002	IEC 60721-3-1:1997	IEC 60721-3-2:1997
Chemical gases	Class 3C2	Class 1C2	Class 2C2
Solid particles	Class 3S2. No conductive dust allowed.	Class 1S3. (packing must support this, otherwise 1S2)	Class 2S2
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 61800-5-1 IEC 60068-2-6:2007, EN 60068-2-6:2008 Environmental testing Part 2: Tests –Test Fc: Vibration (sinusoidal)	IEC/EN 60721-3-3:2002 10…57 Hz: max. 0.075 mm amplitude 57…150 Hz: 1 g	IEC/EN 60721-3-1:1997 10…57 Hz: max. 0.075 mm amplitude 57…150 Hz: 1 g	IEC/EN 60721-3-2:1997 2…9 Hz: max. 3.5 mm amplitude 9…20 Hz: 10 m/s2 (32.8 ft/s2)
Shock IEC 60068-2-27:2008, EN 60068-2-27:2009 Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock	Not allowed	With packing max. 100 m/s2 (330 ft./s2), 11 ms	With packing max. 100 m/s2 (330 ft./s2), 11 ms

Auxiliary circuit power consumption

Cabinet heater (option +G300)	100 W

Materials

Cabinet	Hot-dip zinc coated 1.5 mm thick steel sheet (thickness of coating approximately 20 micrometers). Polyester thermosetting powder coating (thickness approximately 80 micrometers) on visible surfaces, color RAL 7035 and RAL 9017.
Busbars	Tin-plated copper
Air filters of IP54 drives	Inlet (door): airComp 300-50 240 mm x 286 mm (ABB code 3AXD50000037880)
Fire safety of materials (IEC 60332-1)	Insulating materials and non-metallic items mostly self-extinctive
Package	Standard package: • plywood, wet strength heavy duty cardboard, polyethylene sheet (thickness0.15 mm), stretch film (thickness 0.023 mm), PP tape, PET strap,sheet metal (steel) • for land and air transport when planned storage time is less than 2 months or when storage can be arranged in clean and dry conditionsless than 6 months Seaworthy package: • plywood, wet strength heavy duty cardboard (or plywood with specialrequest), VCI sheet film (PE, thickness 0.10 mm), VCI stretch film(PE, thickness 0.04 mm), VCI emitter bags, PP tape, PET strap, sheetmetal (steel) • for sea transport in containers • recommended for land and air transport when storage time prior to installation exceeds 6 months or storage is arranged in partially weather-protected conditions Plywood package on special request Cabinets are attached to the pallet with screws and braced from the bottom end to prevents swaying inside the package. Transportation packaging: • R6...R9 cabinets can be stacked (2 pieces) and transported horizontally. • R10...R11 cabinets are transported vertically. For drives with empty cabinet (options +C196 to +C201) Standard package: • timber, polyethylene sheet (thickness 0.15 mm), stretch film (thickness 0.023 mm),PP tape, PET strap, sheet metal (steel) • for land and air transport when planned storage time is less than 2 months or when storage can be arranged in clean and dry conditions less than 6 months • can be used when products will not be exposed to corrosive atmosphere during transport or storage Seaworthy package: • timber, plywood, VCI sheet film (PE, thickness 0.10 mm), VCI stretchfilm (PE, thickness 0.04 mm), VCI emitter bags, PP tape, PET strap,sheet metal (steel) • for sea transport with or without containerization • for long storage periods in environments where roofed and humidity-controlled storagecannot be arranged For handling the packages, see section *Moving and unpacking the drive (page 53)*.
Disposal	The main parts of the drive can be recycled to preserve natural resources and energy. Product parts and materials should be dismantled and separated. Generally all metals, such as steel, aluminum, copper and its alloys, and precious metals can be recycled as material. Plastics, rubber, cardboard and other packaging material can be used in energy recovery. Printed circuit boards and large electrolytic capacitors need selective treatment according to IEC 62635 guidelines. To aid recycling, plastic parts are marked with an appropriate identification code. Contact your local ABB distributor for further information on environmental aspects and recycling instructions for professional recyclers. End of life treatment must follow international and local regulations.

Applicable standards

The drive complies with the standards below. The compliance with the European Low Voltage Directive is verified according to standard EN 61800-5-1.

European electrical safety requirements product standards	
EN 61800-5-1:2007	*Adjustable speed electrical power drive systems. Part 5-1: Safety requirements – electrical, thermal and energy*
IEC 60146-1-1:2009 **EN 60146-1-1:2010**	*Semiconductor converters – General requirements and line commutated converters – Part 1-1: Specification of basic requirements*
IEC 60204-1:2005 +A1:2008 **EN 60204-1:2006 +AC:2010**	*Safety of machinery. Electrical equipment of machines. Part 1: General requirements.* Provisions for compliance: The final assembler of the machine is responsible for installing emergency-stop device.
IEC 60529:1989 **EN 60529:1991**	*Degrees of protection provided by enclosures (IP code)*
IEC/EN 60664-1:2007	*Insulation coordination for equipment within low-voltage systems. Part 1: Principles, requirements and tests*
IEC/EN 61439-1:2011	*Low-voltage switchgear and control gear assemblies -- Part 1: General rules*
UL 50:2015	*Enclosures for Electrical Equipment, Non-Environmental Considerations, 13th edition*
UL 508C: 2016	*UL Standard for Safety, Power Conversion Equipment, fourth edition*
CSA C22.2 No. 14-13: 2013	*Industrial control equipment*
CSA 22.2 No. 274-13: 2013	*Adjustable Speed Drives*
EMC performance	
IEC 61800-3:2004/A1:2011 **EN 61800-3/A1:2012**	*Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods*

Markings

CE	CE mark Product complies with the applicable European Union legislation. For fulfilling the EMC requirements, see the additional information concerning the drive EMC compliance (IEC/EN 61800-3).
c UL us LISTED	UL listed mark for USA and Canada Product has been tested and evaluated against the relevant North American standards by the Underwriters Laboratories.
	RCM mark Product complies with Australian and New Zealand requirements specific to EMC, telecommunications and electrical safety. For fulfilling the EMC requirements, see the additional information concerning the drive EMC compliance (IEC/EN 61800-3).
EAC	EAC (Eurasian Conformity) mark Product complies with the technical regulations of the Eurasian Customs Union. EAC mark is required in Russia, Belarus and Kazakhstan.
	Electronic Information Products (EIP) green mark The product complies with *the People's Republic of China Electronic Industry Standard* (SJ/T 11364-2014). The product does not contain toxic and hazardous substances or elements above the maximum concentration values, and it is an environmentally-friendly product which can be recycled.

CE marking

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

Compliance with the European Low Voltage Directive

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

Compliance with the European EMC Directive

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

Compliance with the European Machinery Directive

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

Declaration of Conformity

EU Declaration of Conformity

Machinery Directive 2006/42/EC

We

Manufacturer: ABB Oy
Address: Hiomotie 13, 00380 Helsinki, Finland.
Phone: +358 10 22 11

declare under our sole responsibility that the following product:

Frequency converter

ACS580-07

with regard to the safety functions

Safe torque off

Emergency stop (option codes +Q951, +Q963)

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

The following harmonized standards have been applied:

EN 61800-5-2:2007	*Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional*
EN 62061:2005 + AC:2010 + A1:2013 + A2:2015	*Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*
EN ISO 13849-1:2015	*Safety of machinery – Safety-related parts of control systems. Part 1: General requirements*
EN ISO 13849-2:2012	*Safety of machinery – Safety-related parts of the contr ol systems. Part 2: Validation*
EN 60204-1: 2006 + A1:2009 + AC:2010	*Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

The following other standards have been applied:

IEC 61508:2010, parts 1-3	Functional safety of electrical / electronic / programmable electronic safety-related systems
IEC 61800-5-2:2016	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional

Union Directives which are notified in Single EU Declaration of conformity 3AXD10000497690.

Person authorized to compile the technical file:

Name and address: Timo Pasanen, Hiomotie 13, 00380 Helsinki, Finland.

Helsinki, 28 Feb 2018

Manufacturer representative:

Vesa Kandell
Vice President, ABB Oy

Compliance with the EN 61800-3:2004

Definitions

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

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

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

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

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

Category C2

The drive frames R6 to R9 comply with the standard with the following provisions:

1. The motor and control cables are selected as specified in the hardware manual.
2. The drive is installed according to the instructions given in the hardware manual.
3. Maximum motor cable length is 150 meters.

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

Note:
Do not install a drive equipped with EMC filter on IT (ungrounded) systems. The supply network becomes connected to ground potential through the EMC filter capacitors which may cause danger or damage the unit.

Category C3

The drive complies with the standard with the following provisions:

1. The motor and control cables are selected as specified in the hardware manual.
2. The drive is installed according to the instructions given in the hardware manual.
3. Maximum motor cable length is 100 meters.

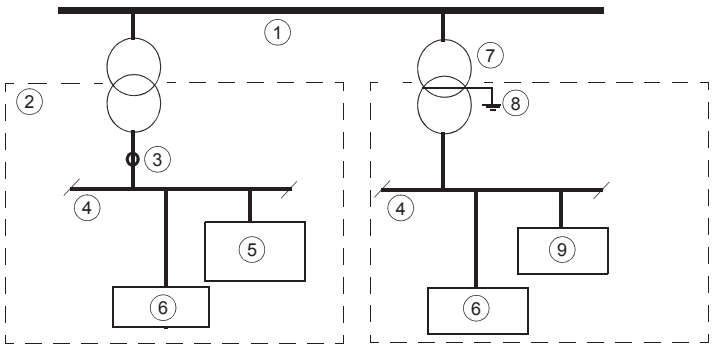
WARNING!
A drive of category C3 is not intended to be used on a low-voltage public network which supplies domestic premises. Radio frequency interference is expected if the drive is used on such a network.

Category C4

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

1. It is ensured that no excessive emission is propagated to neighboring low-voltage networks. In some cases, the 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.



1	Medium voltage network	6	Equipment
2	Neighboring network	7	Supply transformer
3	Point of measurement	8	Static screen
4	Low voltage	9	Drive
5	Equipment (victim)		

2. An EMC plan for preventing disturbances is drawn up for the installation. A template is available in Technical guide No. 3 EMC compliant installation and configuration for a power drive system (3AFE61348280 (English)).
3. The motor and control cables are selected as specified in the hardware manual.
4. The drive is installed according to the instructions given in the hardware manual.

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

UL marking

The drive is cULus listed with option +C129. The approval is valid with rated voltages up to 480 V.

UL checklist

WARNING!
Operation of this drive requires detailed installation and operation instructions provided in the hardware and software manuals. The manuals are provided in electric format in the drive package or on the Internet. Retain the manuals with the drive at all times. Hard copies of the manuals can be ordered through the manufacturer.

- Make sure that the drive type designation label includes the cULus Listed marking.
- **DANGER - Risk of electric shock.** After disconnecting the input power, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you start working on the drive, motor or motor cable.

- The drive is to be used in a heated, indoor controlled environment. The drive must be installed in clean air according to the enclosure classification. Cooling air must be clean, free from corrosive materials and electrically conductive dust.
- The maximum ambient air temperature is 40 °C (104 °F) at rated current. The current is derated for 40 to 50 °C (104 to 122 °F).
- The drive is suitable for use in a circuit capable of delivering not more than 100,000 rms symmetrical amperes, 480 V maximum when protected by the UL fuses given elsewhere in this chapter. The ampere rating is based on tests done according to the appropriate UL standard.
- The cables located within the motor circuit must be rated for at least 75 °C (167 °F) in UL-compliant installations.
- The input cable must be protected with fuses. The fuses must provide branch circuit protection in accordance with the national regulations (National Electrical Code (NEC) or Canadian Electrical Code). Obey also any other applicable local or provincial codes.

  Note:
  Circuit breakers must not be used without fuses in the USA. For suitable circuit breakers, contact your local ABB representative.

WARNING!
The opening of the branch-circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electric shock, current-carrying parts and other components of the device should be examined and replaced if damaged.

- The drive is equipped with UL classified fuses which provide branch circuit protection in accordance with the National Electrical Code (NEC) and Canadian Electrical Code. The fuses are listed elsewhere in this chapter.
- The drive provides motor overload protection. For adjustments, see the firmware manual.
- The drive overvoltage category according to IEC 60664-1 is III, except for auxiliary power connections (fan, control, heating, lighting, cooling unit pump etc) which are of category II.

Disclaimers

Generic disclaimer

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

Cybersecurity disclaimer

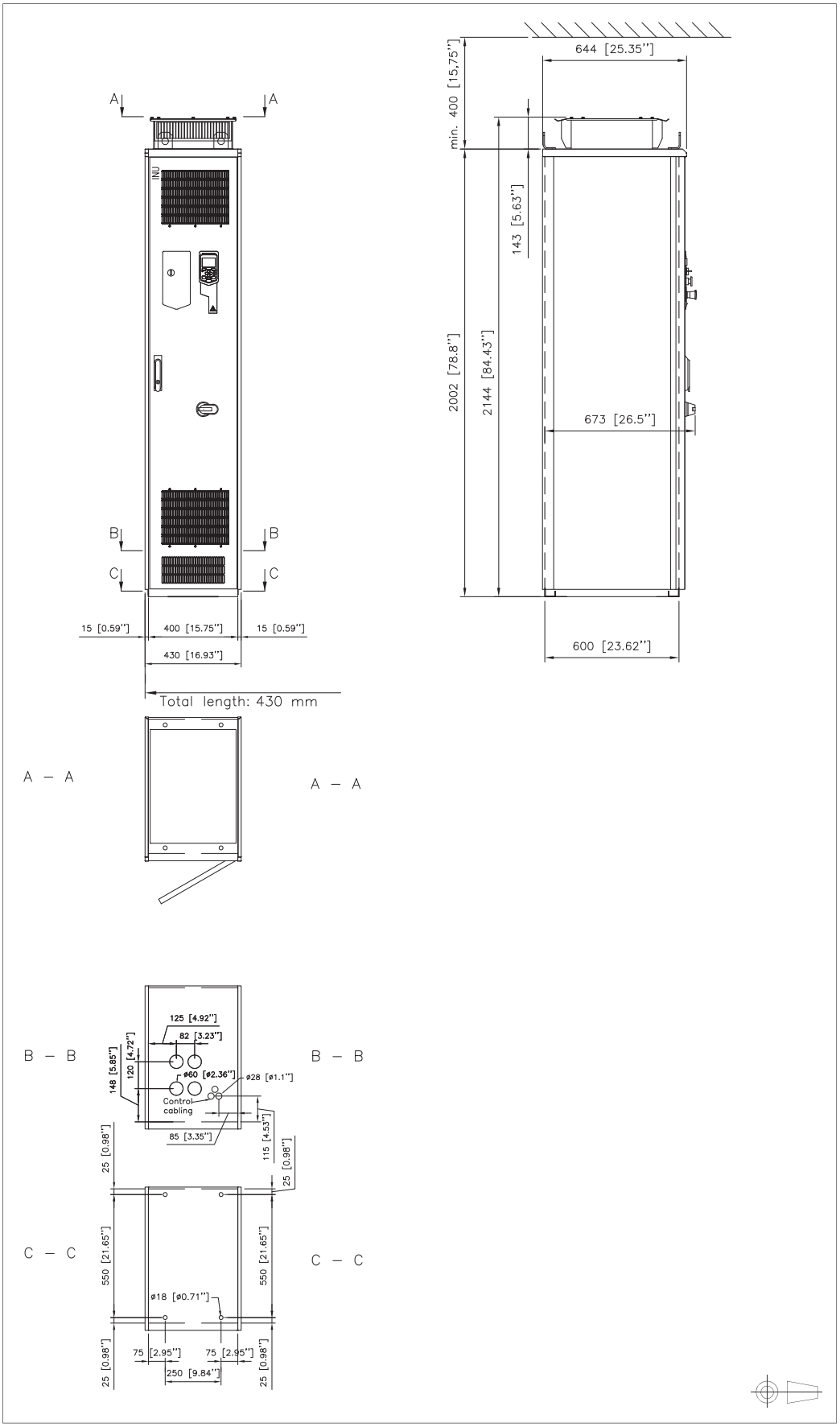
This product is designed to be connected to and to communicate information and data via a network interface. It is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network (as the case may be). Customer shall establish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

13

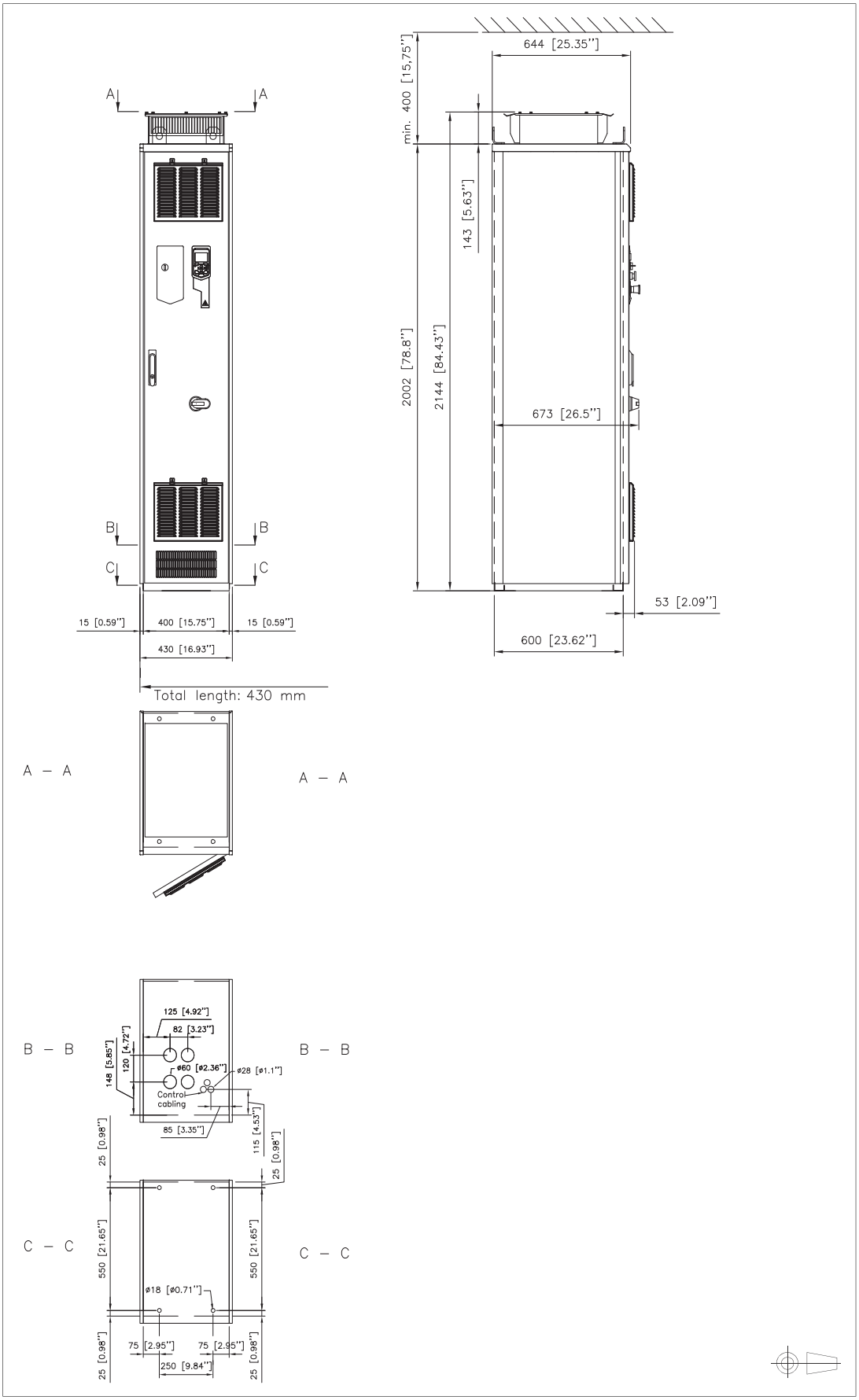
Dimension drawings

Example dimension drawings are shown below.

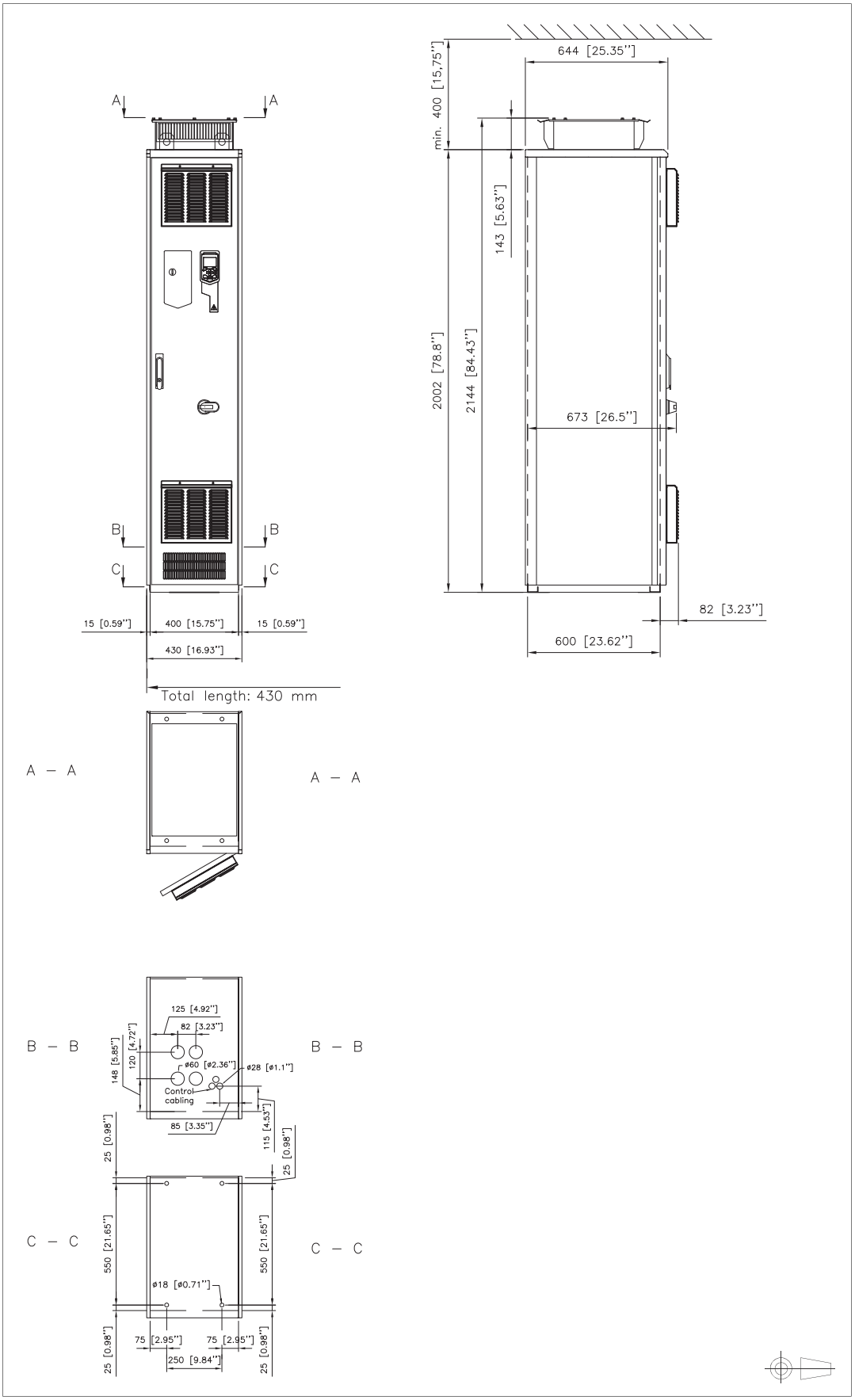
Frames R6 and R7 (IP21, UL Type 1)



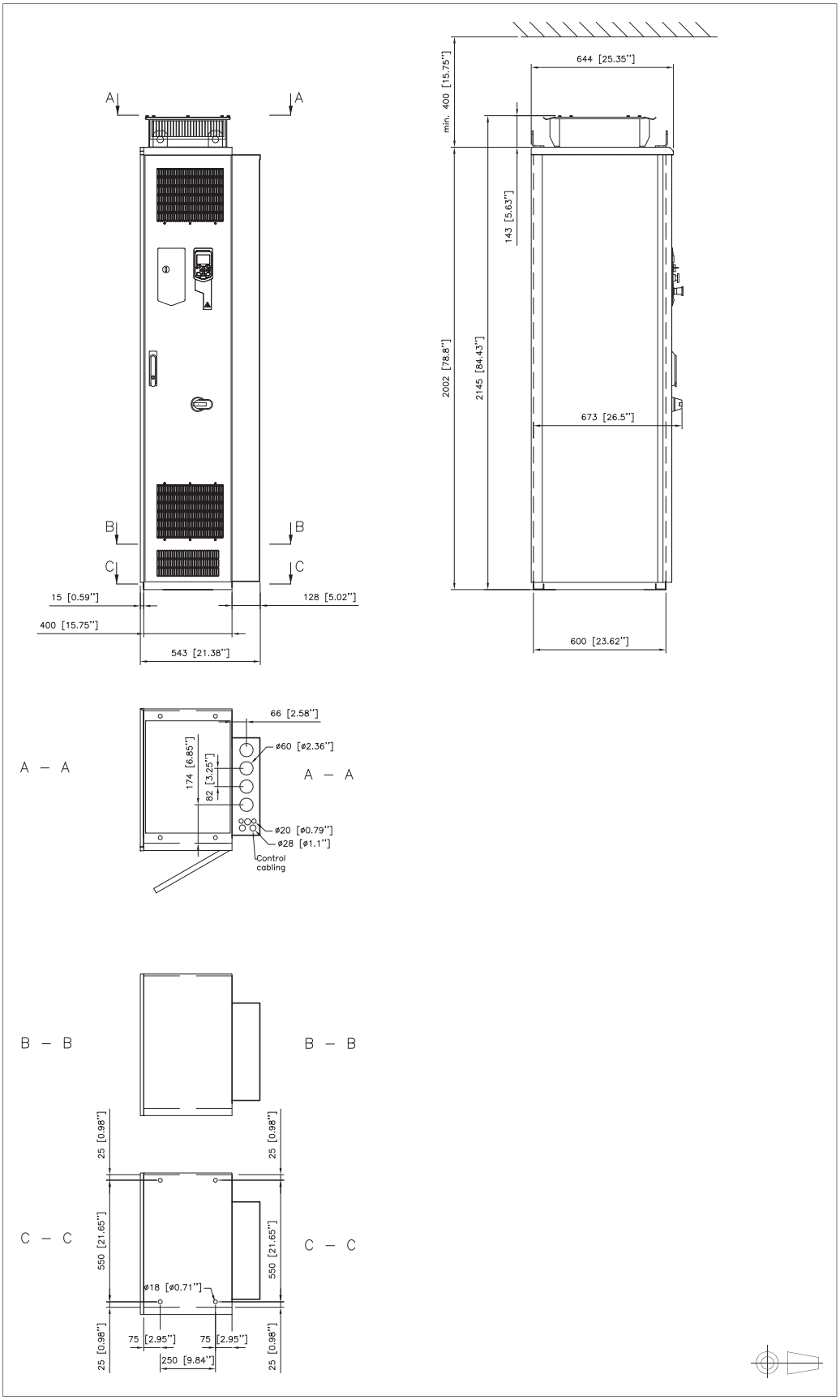
Frames R6 and R7 (+B054: IP42, UL Type 1)



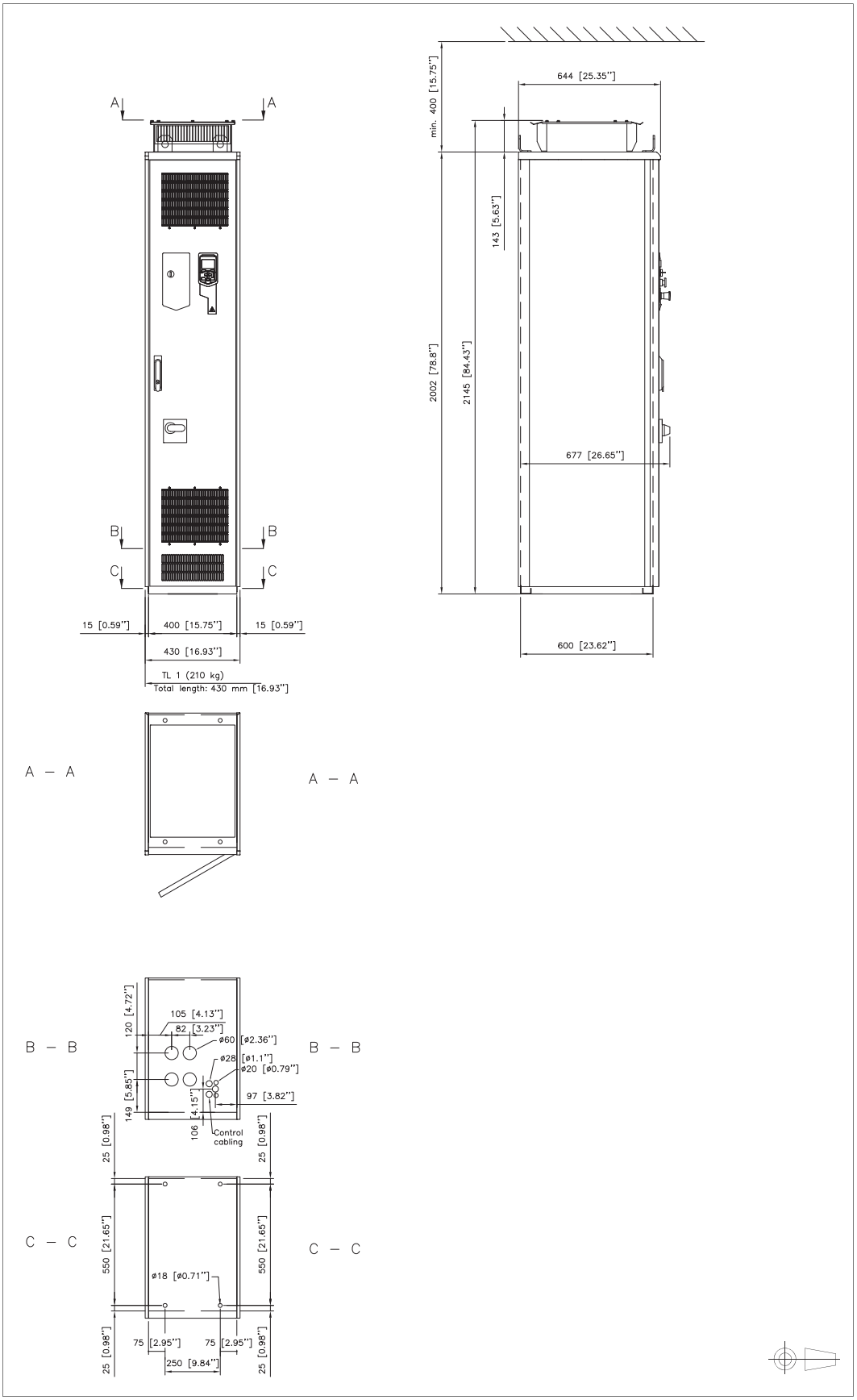
Frames R6 and R7 (+B055: IP54, UL Type 12)



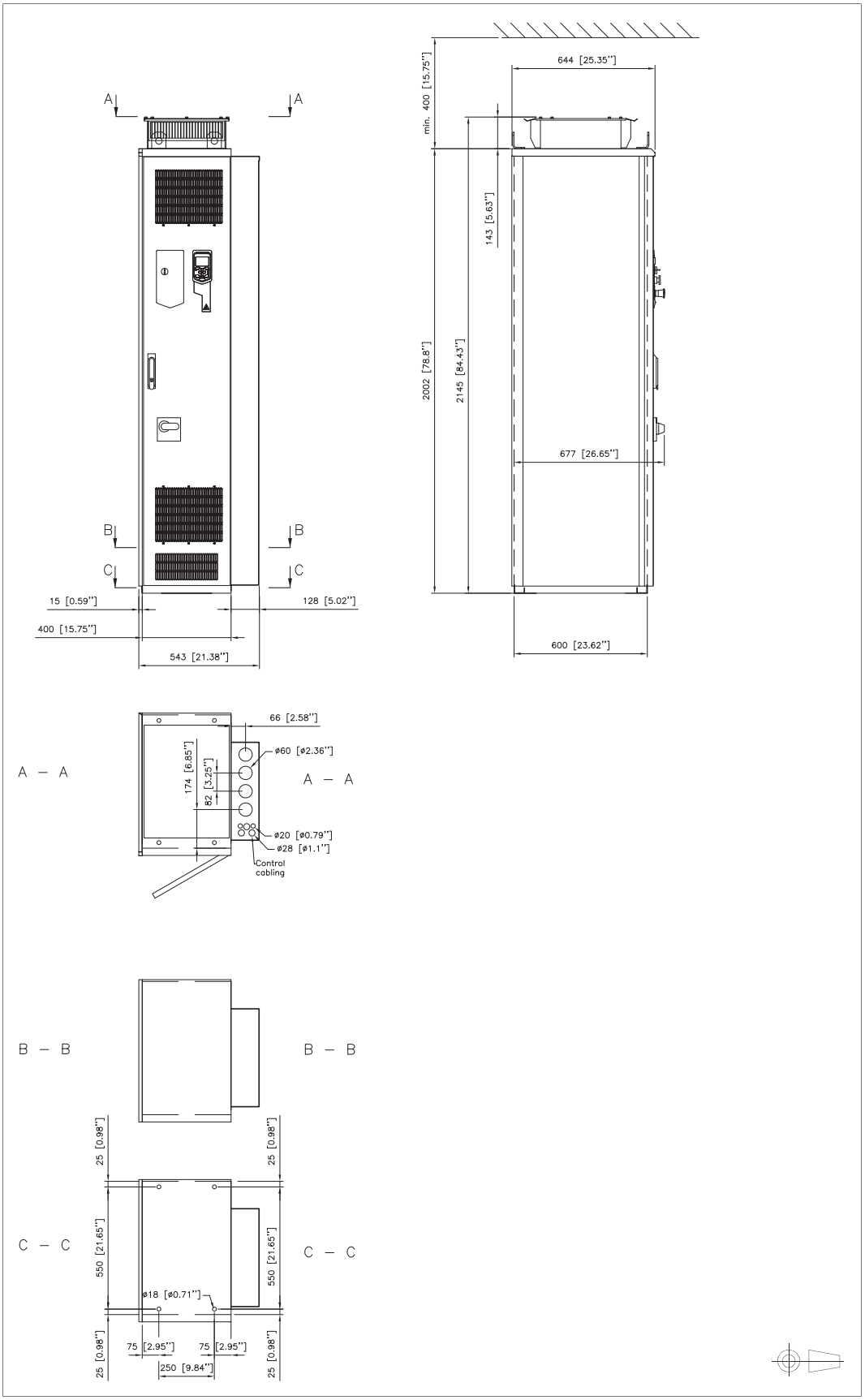
Frames R6 and R7 (+H351 and +H353: top entry and exit)



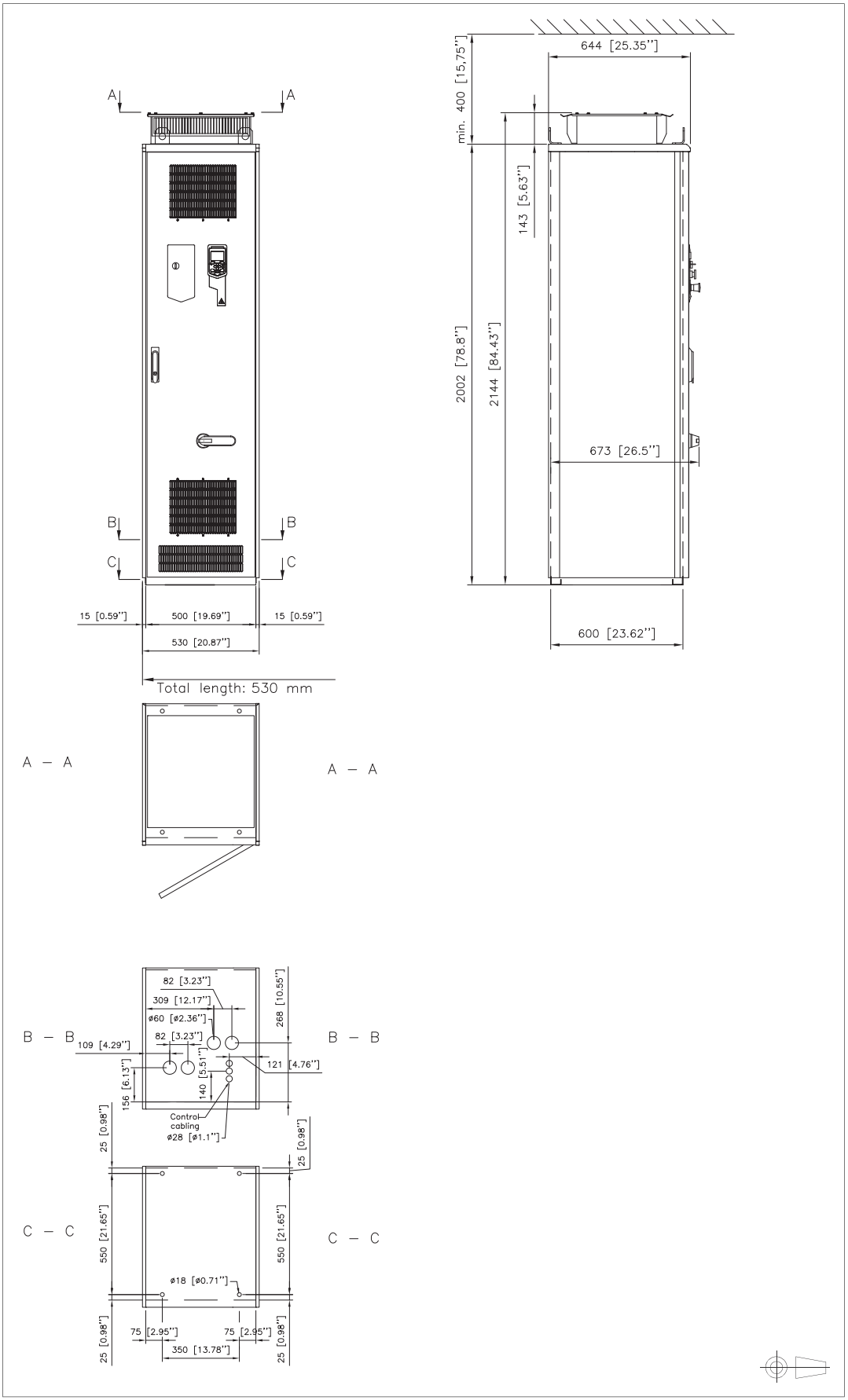
Frames R6 and R7 (+F289)



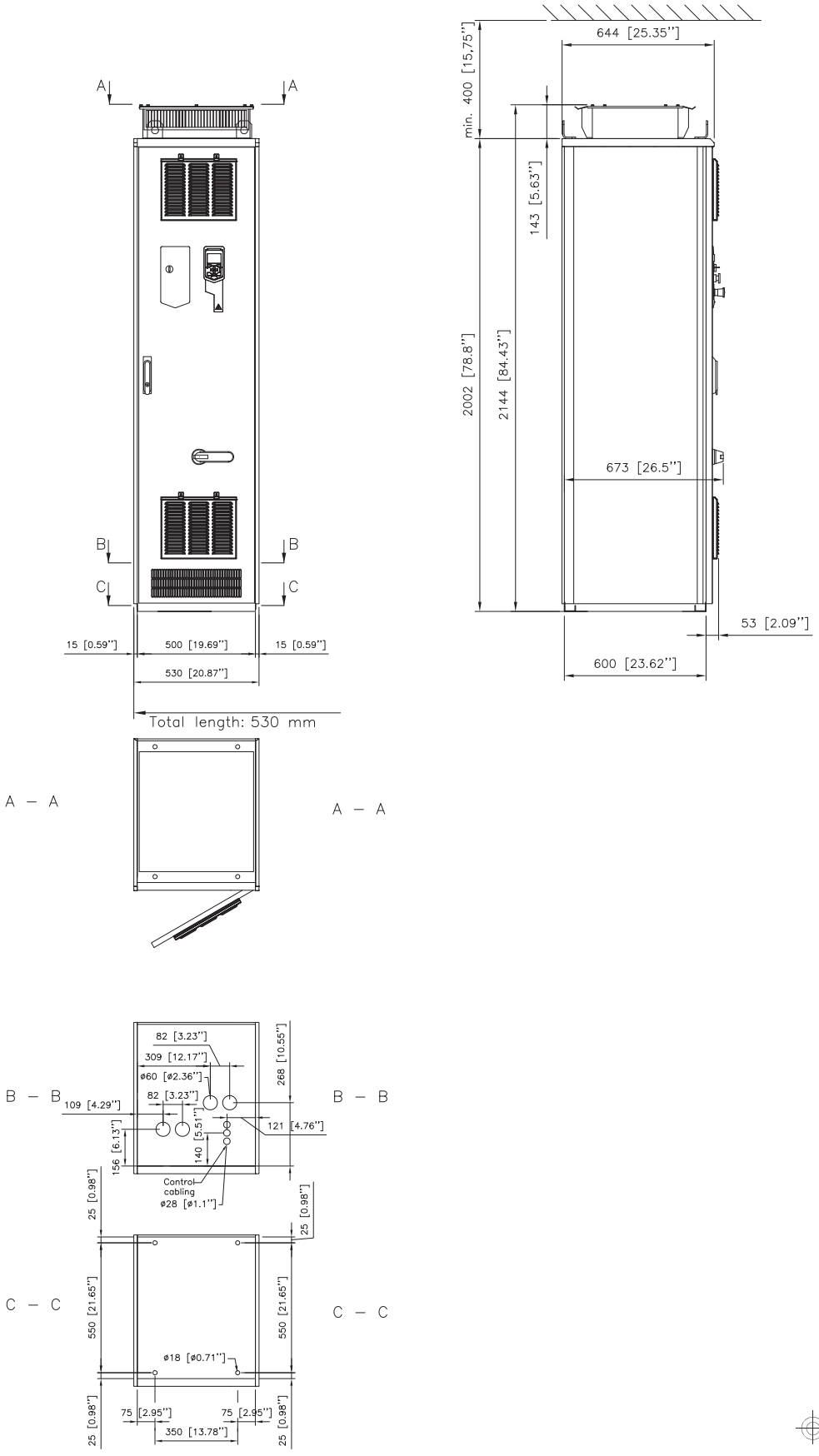
Frames R6 and R7 (+F289, +H351, +H353)



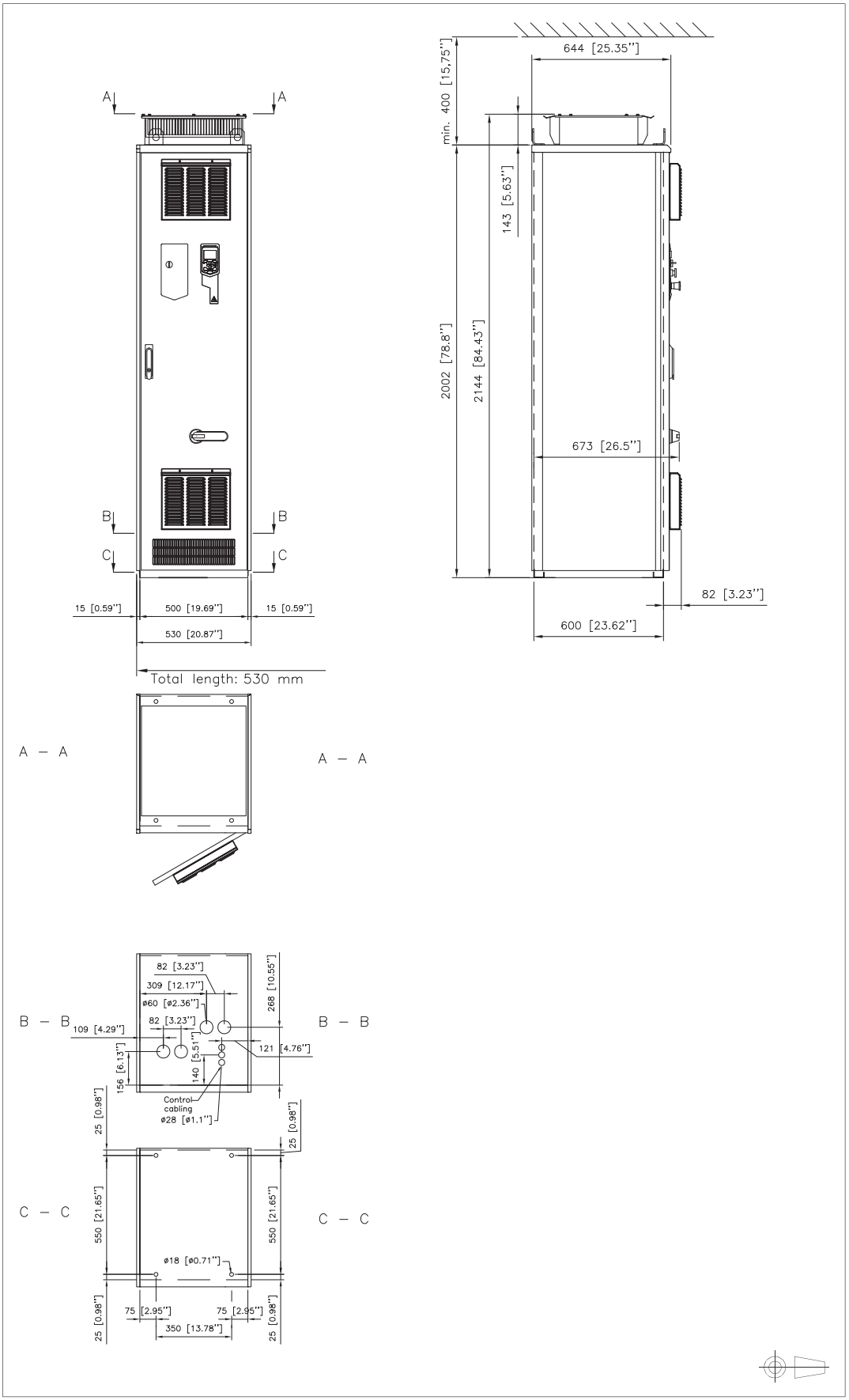
Frames R8 and R9 (IP21)



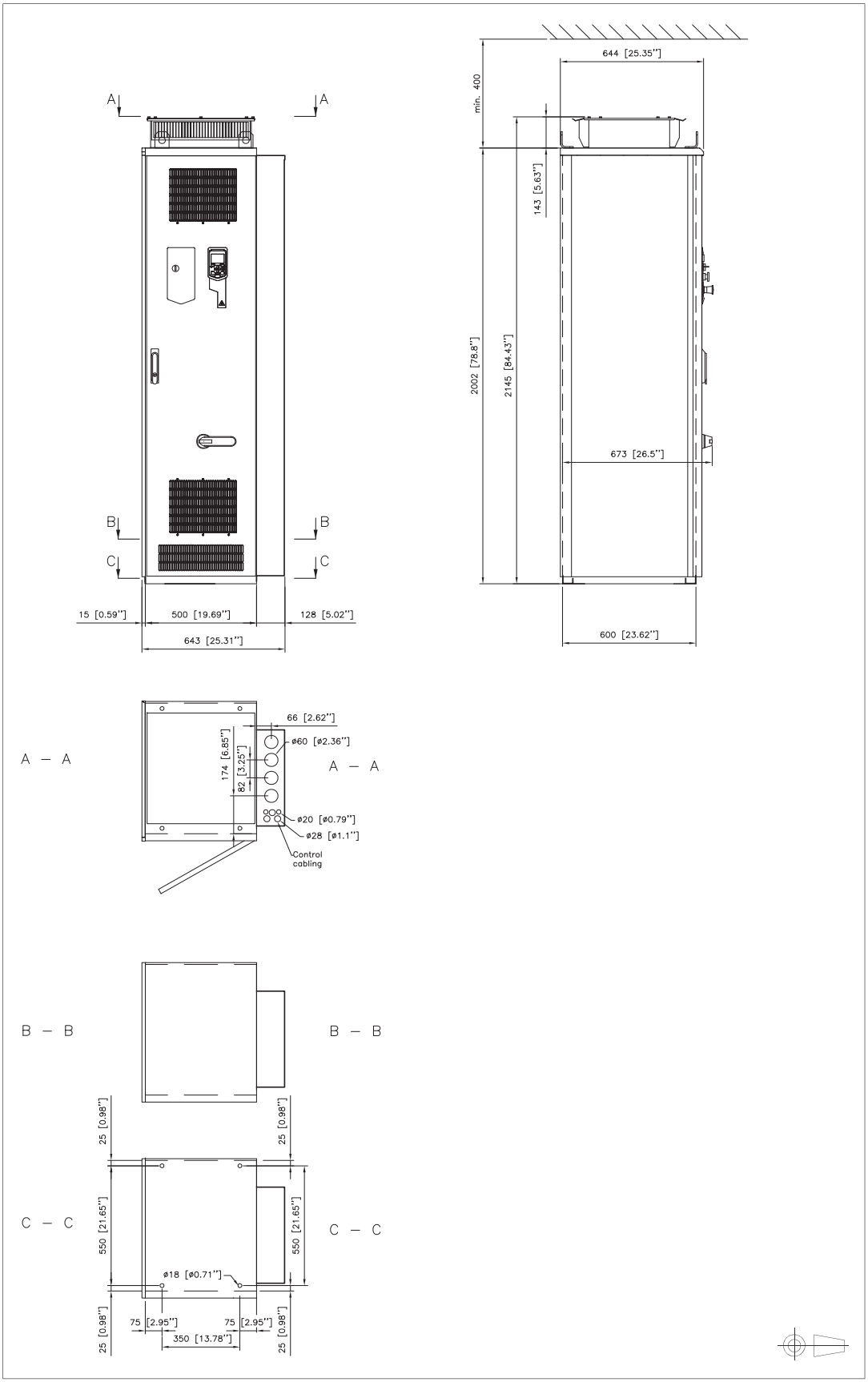
Frames R8 and R9 (+B054: IP42, UL Type 1)



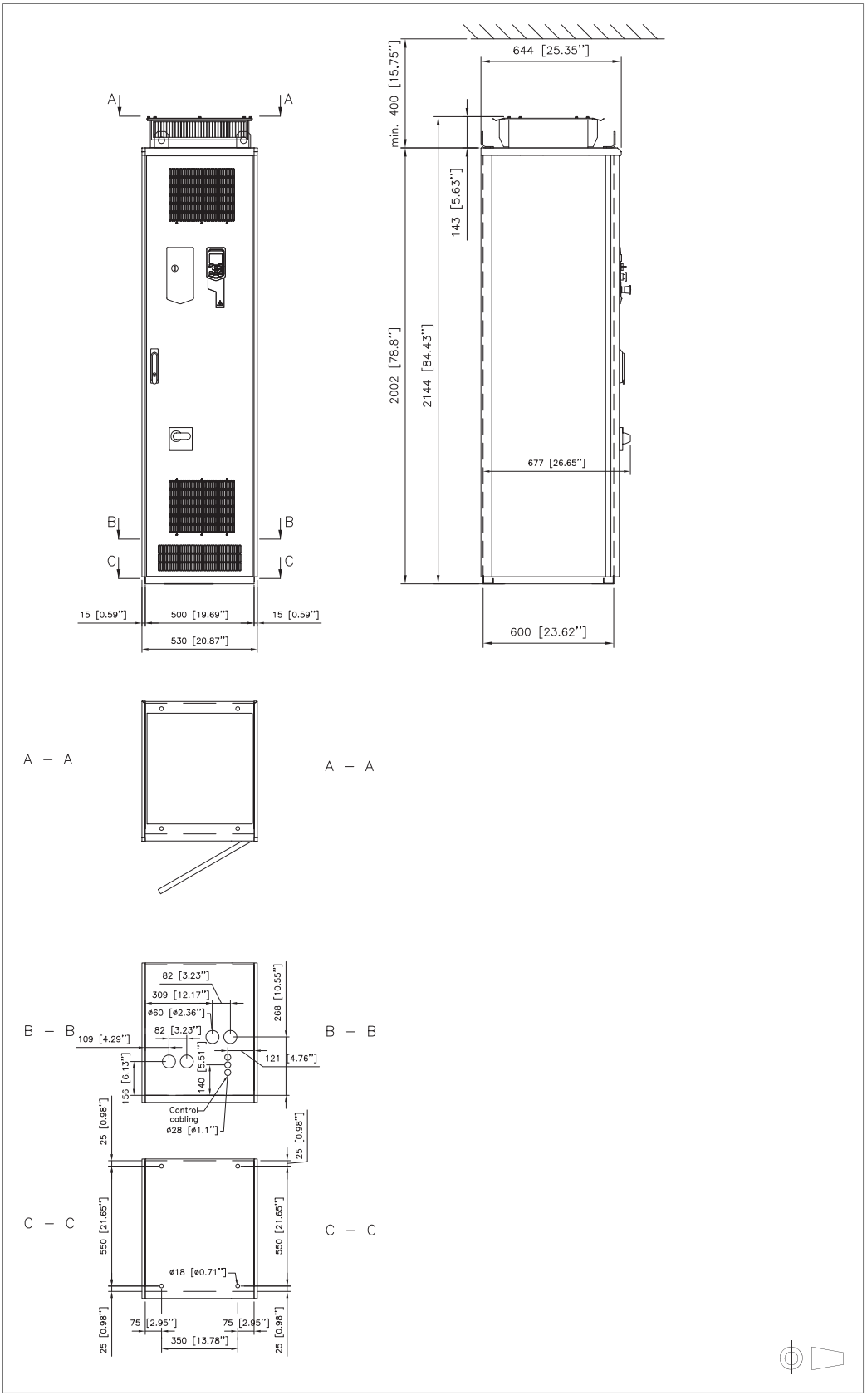
Frames R8 and R9 (+B055: IP54, UL Type 12)



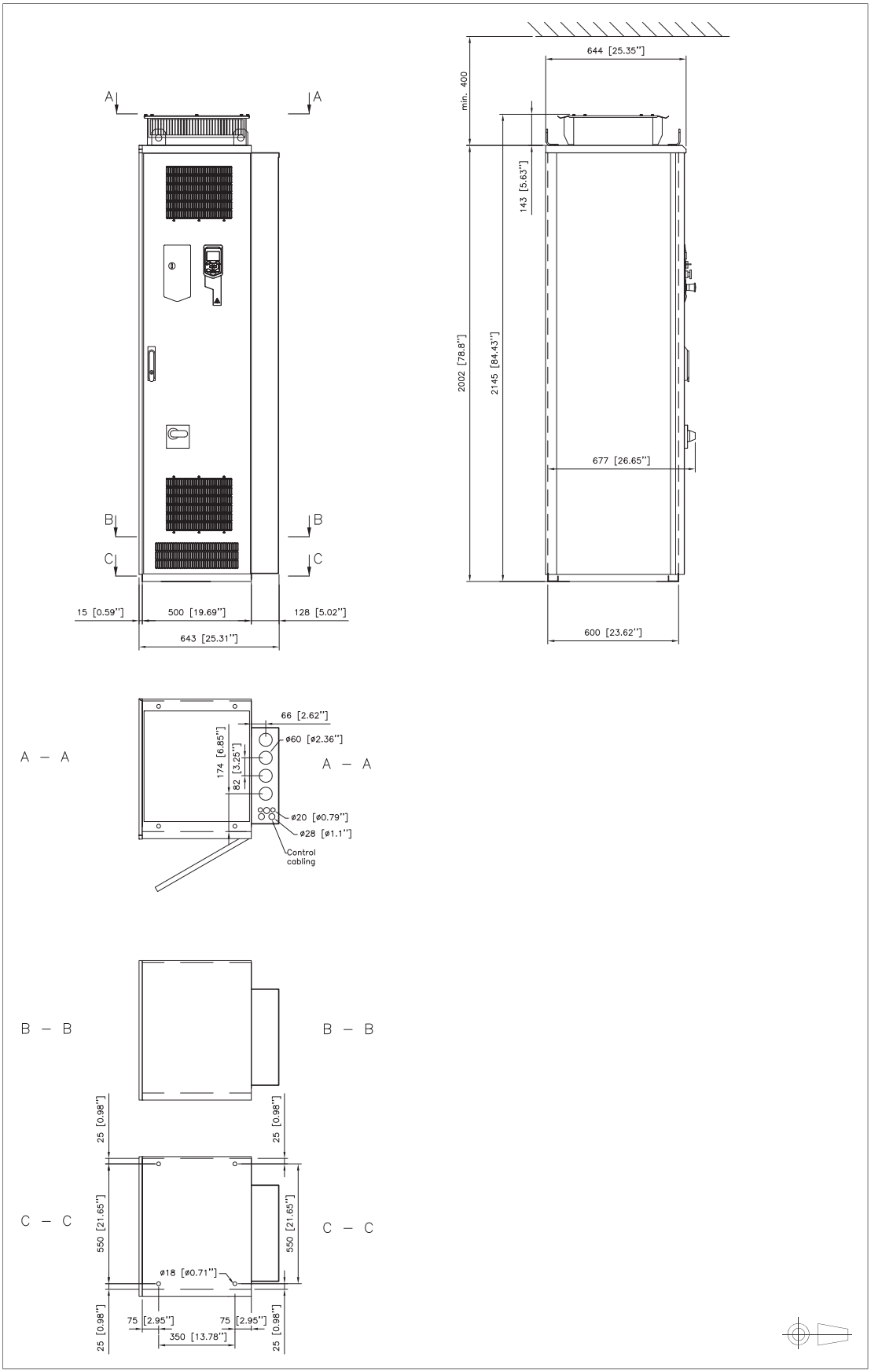
Frames R8 and R9 (+H351 and +H353: top entry and exit)



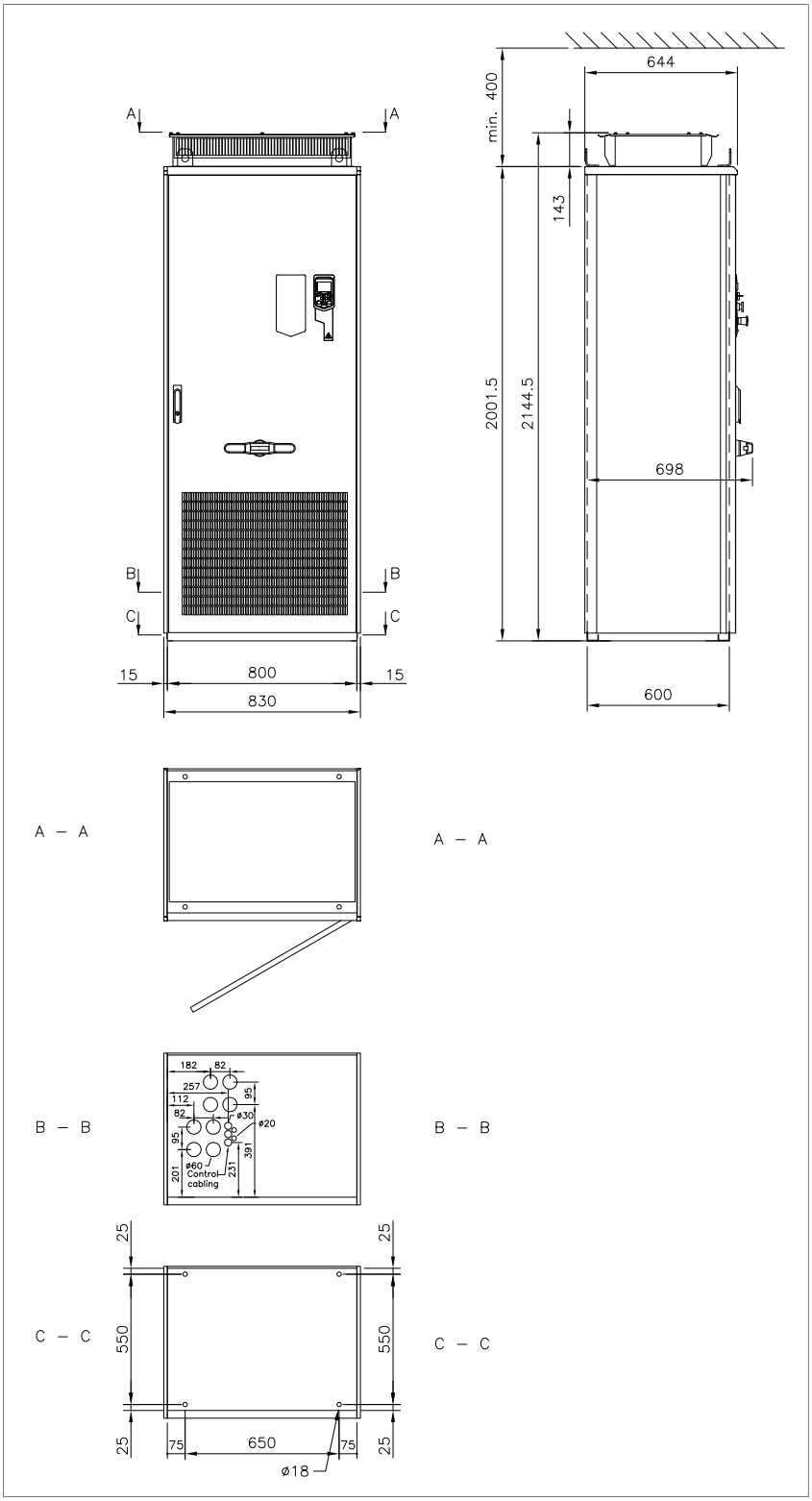
Frames R8 and R9 (+F289)



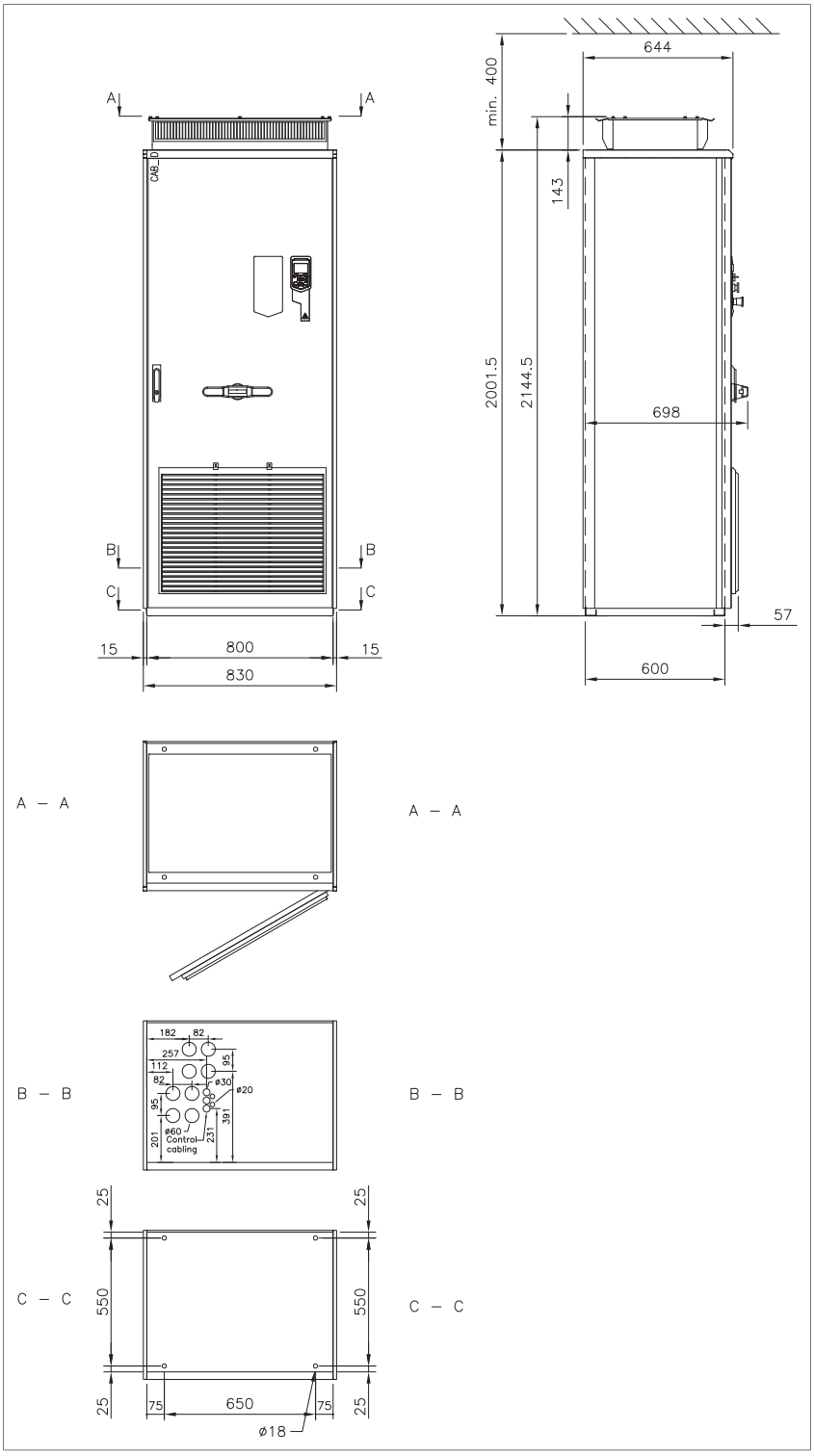
Frames R8 and R9 (+F289, +H351, +H353)



Frames R10 and R11 (IP21)



Frames R10 and R11 (+B054: IP42, UL Type 1)



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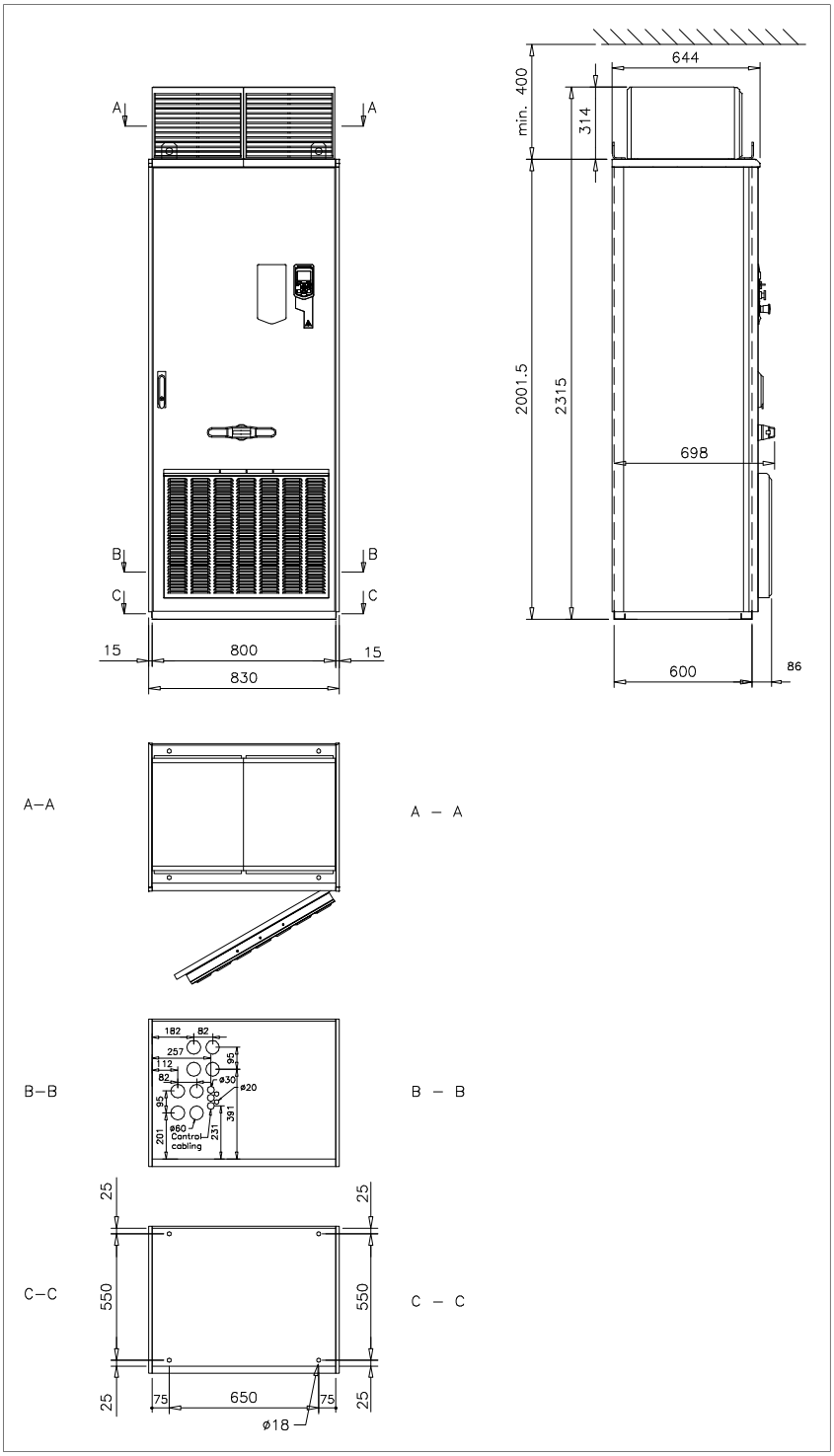
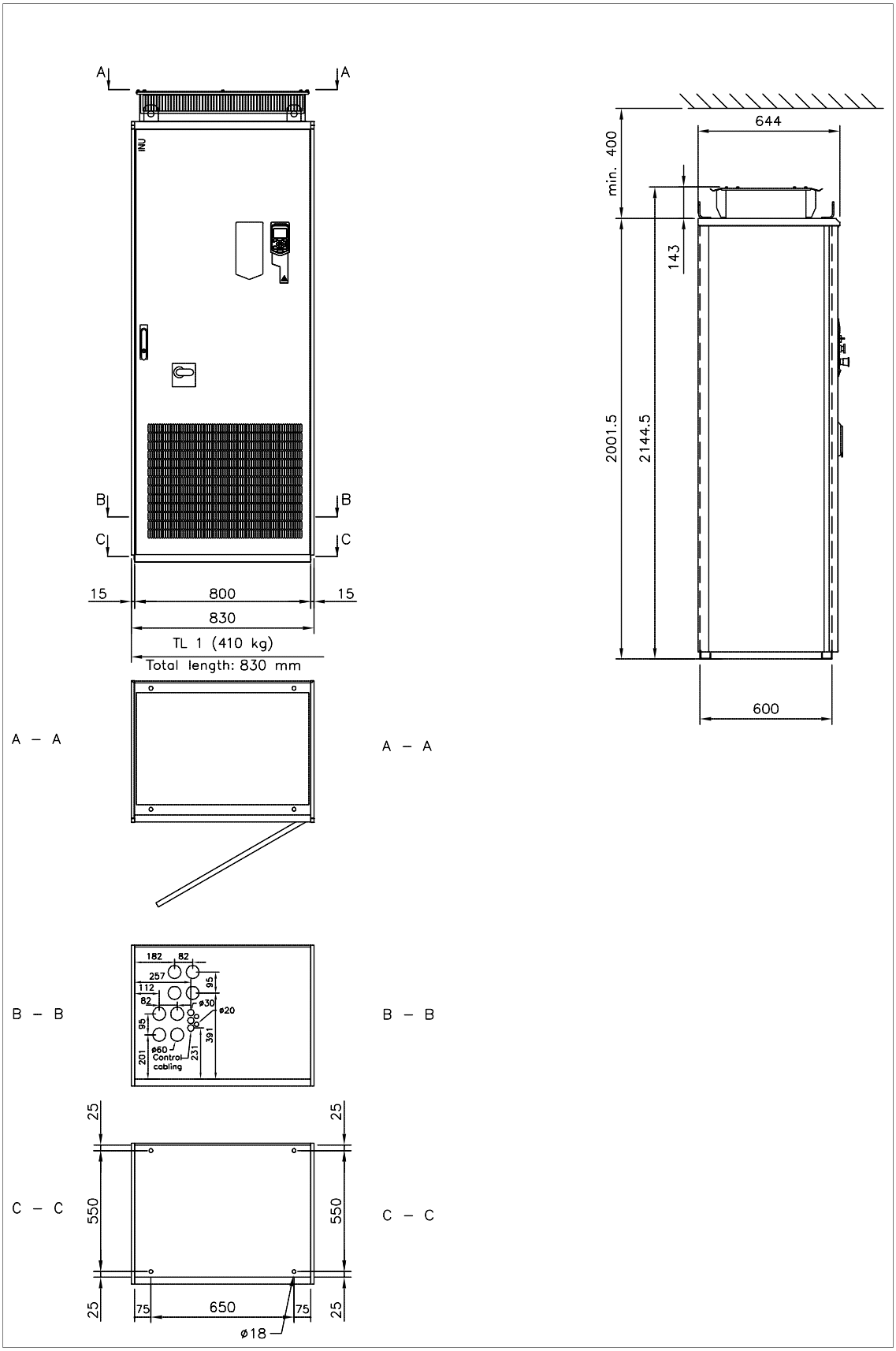
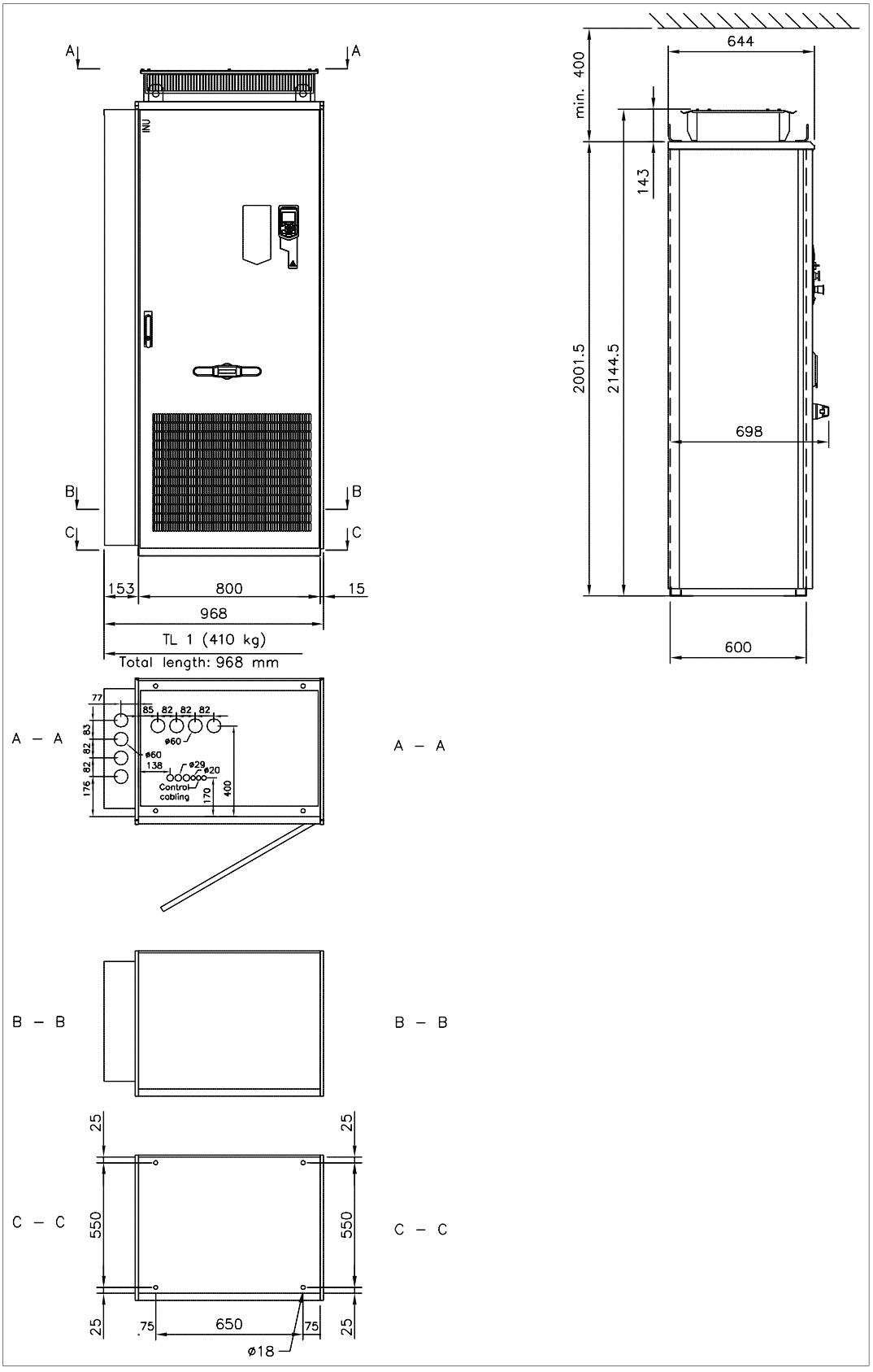


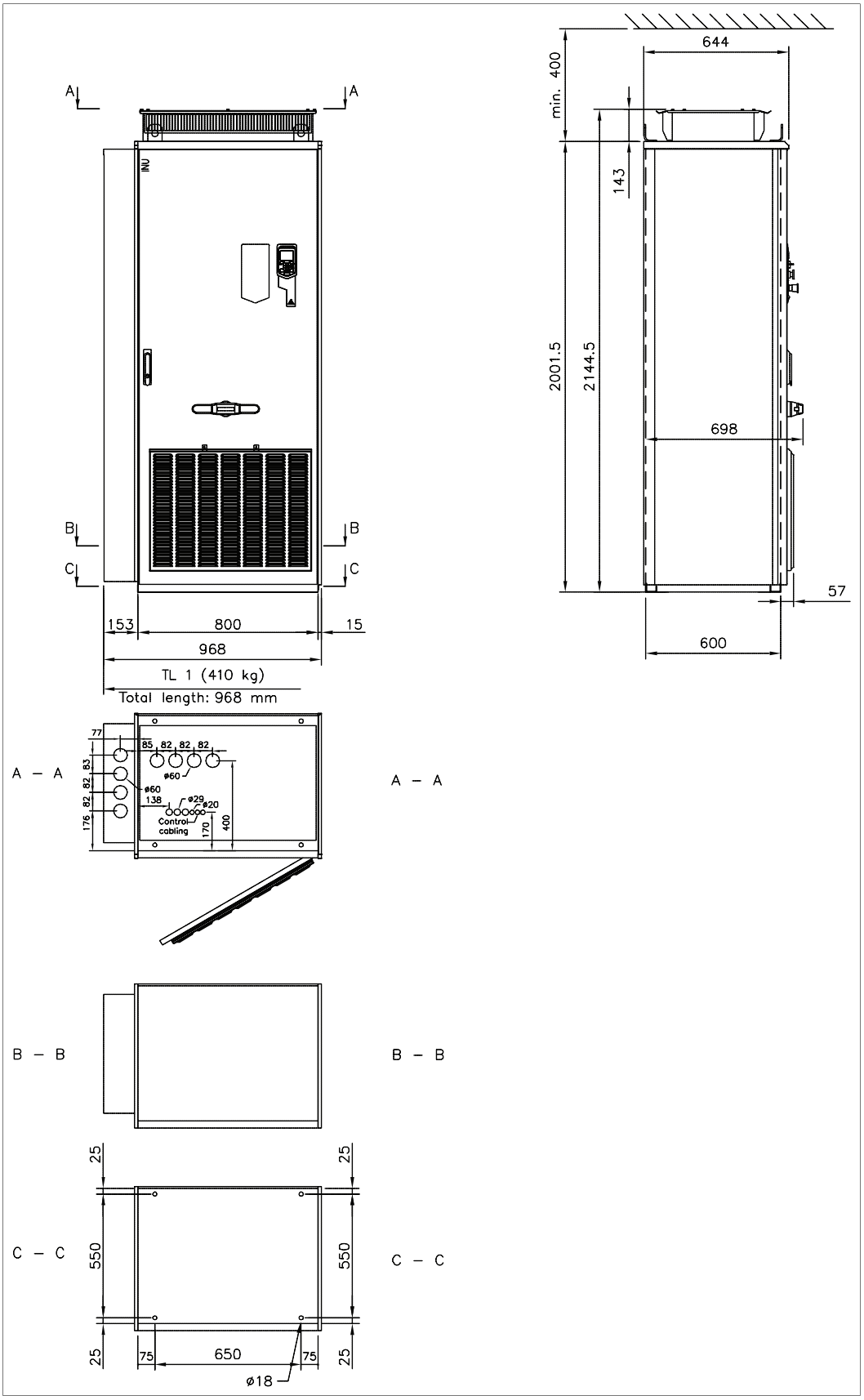
Frames R10 and R11 (+F289)



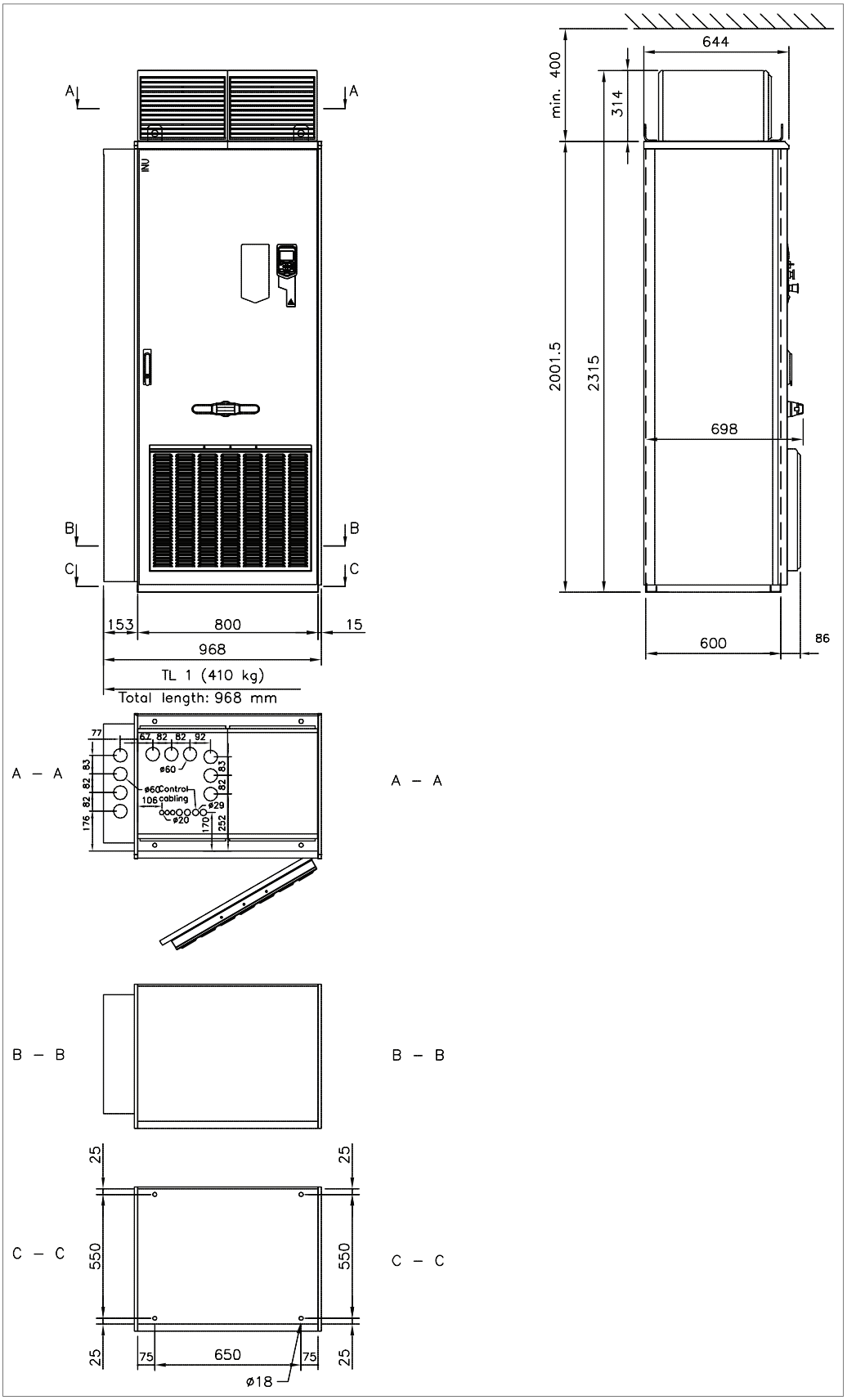
Frames R10 and R11 (+H351, +H353)



Frames R10 and R11 (+B054: IP42, UL type 1, +H351, +H353)



Frames R10 and R11 (+B055: IP54, UL type 12, +H351, +H353)



14

The Safe torque off function

Contents of this chapter

This chapter describes the Safe torque off (STO) function of the drive and gives instructions for its use.

Description

The Safe torque off function can be used, for example, to as the final actuator device of safety circuits that stop the drive in case of danger (such as an emergency stop circuit). Another typical application is a prevention of unexpected start-up function that enables short-time maintenance operations like cleaning or work on non-electrical parts of the machinery without switching off the power supply to the drive.

When activated, the Safe torque off function disables the control voltage of the power semiconductors of the drive output stage (A, see the diagrams below), thus preventing the drive from generating the torque required to rotate the motor. If the motor is running when Safe torque off is activated, it coasts to a stop.

The Safe torque off function has a redundant architecture, that is, both channels must be used in the safety function implementation. The safety data given in this manual is calculated for redundant use, and does not apply if both channels are not used.

The Safe torque off function complies with these standards:

Standard	**Name**
IEC 60204-1:2016 EN 60204-1:2006 + A1:2009 + AC:2010	*Safety of machinery – Electrical equipment of machines – Part 1: General requirements*
IEC 61000-6-7:2014	*Electromagnetic compatibility (EMC) – Part 6-7: Generic standards – Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations*

Standard	Name
IEC 61326-3-1:2017	*Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 3-1: Immunity requirements for safety-related systems and for equipment intended to perform safety-related functions (functional safety) – General industrial applications*
IEC 61508-1:2010	*Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 1: General requirements*
IEC 61508-2:2010	*Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems*
IEC 61511-1:2016	*Functional safety – Safety instrumented systems for the process industry sector*
IEC 61800-5-2:2016 EN 61800-5-2:2007	*Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional*
IEC 62061:2005 + A1:2012 + A2:2015 EN 62061:2005 + AC:2010 + A1:2013 + A2:2015	*Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*
EN ISO 13849-1:2015	*Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*
EN ISO 13849-2:2012	*Safety of machinery – Safety-related parts of control systems – Part 2: Validation*

The function also corresponds to Prevention of unexpected start-up as specified by EN ISO 14118:2018 (ISO 14118:2017), and Uncontrolled stop (stop category 0) as specified in EN/IEC 60204-1.

Compliance with the European Machinery Directive

See the technical data.

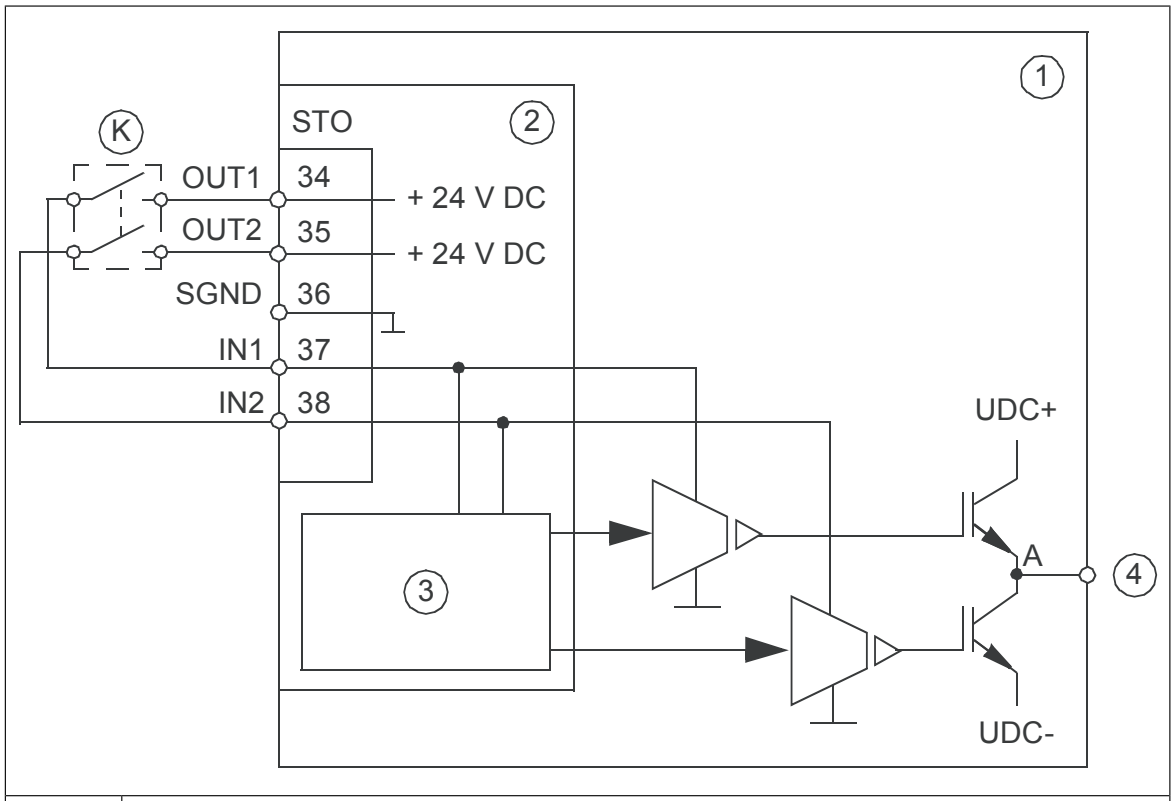
The Declaration of conformity is shown at the end of this chapter.

Wiring

For the electrical specifications of the STO connection, see the technical data of the control unit.

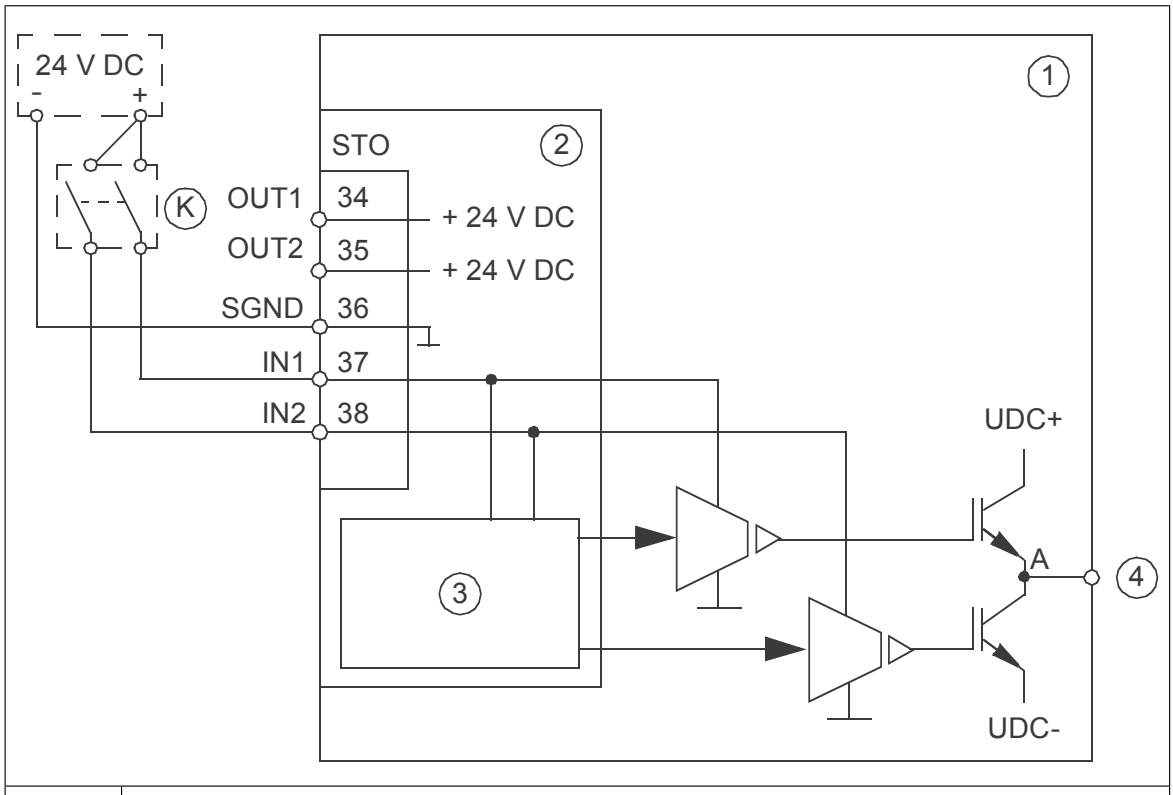
Connection principle

Connection with internal power supply



1	Drive
2	Control unit
3	Control logic
4	To motor
K	Activation switch

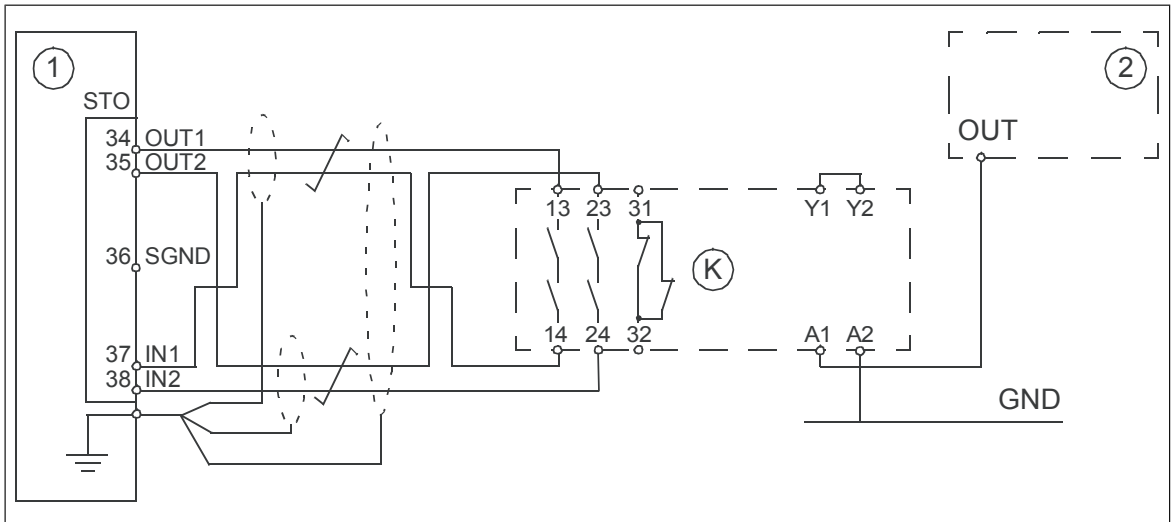
Connection with external power supply



1	Drive
2	Control unit
3	Control logic
4	To motor
K	Activation switch

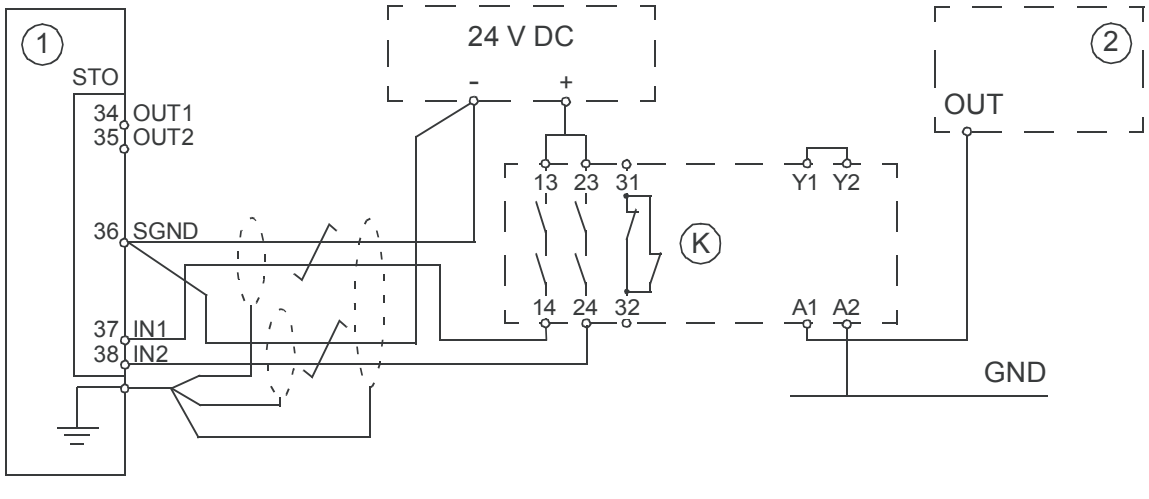
Wiring examples

Wiring with internal power supply



1	Drive
2	Safety PLC
K	Safety relay

Wiring with external power supply



1	Drive
2	Safety PLC
K	Safety relay

Activation switch

In the wiring diagrams, the activation switch has the designation [K]. This represents a component such as a manually operated switch, an emergency stop push button switch, or the contacts of a safety relay or safety PLC.

- In case a manually operated activation switch is used, the switch must be of a type that can be locked out to the open position.
- The contacts of the switch or relay must open/close within 200 ms of each other.
- A CPTC-02 thermistor protection module can also be used. For more information, see the module documentation.

Cable types and lengths

- Double-shielded twisted-pair cable is recommended.
- Maximum cable lengths:
  - 300 m (1000 ft) between activation switch [K] and drive control unit
  - 60 m (200 ft) between multiple drives or inverter units
  - 60 m (200 ft) between external power supply and first control unit

Note:
A short-circuit in the wiring between the switch and an STO terminal causes a dangerous fault. Therefore, it is recommended to use a safety relay (including wiring diagnostics) or a wiring method (shield grounding, channel separation) which reduces or eliminates the risk caused by the short-circuit.

Note:
The voltage at the STO input terminals of the drive must be at least 13 V DC to be interpreted as “1”.
The pulse tolerance of the input channels is 1 ms.

Grounding of protective shields

- Ground the shield in the cabling between the activation switch and the control unit at the control unit only.
- Ground the shield in the cabling between two control units at one control unit only.

Operation principle

1. The Safe torque off activates (the activation switch is opened, or safety relay contacts open).
2. The STO inputs of the drive control unit de-energize.
3. The control unit cuts off the control voltage from the output IGBTs.
4. The control program generates an indication as defined by parameter *31.22* (see the firmware manual of the drive).
   The parameter selects which indications are given when one or both STO signals are switched off or lost. The indications also depend on whether the drive is running or stopped when this occurs.

   Note:
   This parameter does not affect the operation of the STO function itself. The STO function will operate regardless of the setting of this parameter: a running drive will stop upon removal of one or both STO signals, and will not start until both STO signals are restored and all faults reset.

   Note:
   The loss of only one STO signal always generates a fault as it is interpreted as a malfunction of STO hardware or wiring.

5. The motor coasts to a stop (if running). The drive cannot restart while the activation switch or safety relay contacts are open. After the contacts close, a reset may be needed (depending on the setting of parameter *31.22*). A new start command is required to start the drive.

Start-up including acceptance test

To ensure the safe operation of a safety function, validation is required. The final assembler of the machine must validate the function by performing an acceptance test. The acceptance test must be performed

- at initial start-up of the safety function
- after any changes related to the safety function (circuit boards, wiring, components, settings, etc.)
- after any maintenance work related to the safety function.

Competence

The acceptance test of the safety function must be carried out by a competent person with adequate expertise and knowledge of the safety function as well as functional safety, as required by IEC 61508-1 clause 6. The test procedures and report must be documented and signed by this person.

Acceptance test reports

Signed acceptance test reports must be stored in the logbook of the machine. The report shall include documentation of start-up activities and test results, references to failure reports and resolution of failures. Any new acceptance tests performed due to changes or maintenance shall be logged into the logbook.

Acceptance test procedure

After wiring the Safe torque off function, validate its operation as follows.

Note:
If the drive is equipped with safety option +Q951 or +Q953, do the procedure shown in the documentation of the option.

Note:
If a CPTC-02 module is installed, refer to its documentation.

Action	☑
WARNING! Follow the safety instructions. If you ignore them, injury or death, or damage to the equipment can occur.	☐
Ensure that the drive can be run and stopped freely during start-up.	☐
Stop the drive (if running), switch the input power off and isolate the drive from the power line using a disconnector.	☐
Check the STO circuit connections against the wiring diagram.	☐
Close the disconnector and switch the power on.	☐

Action	☑
Test the operation of the STO function when the motor is stopped. • Give a stop command for the drive (if running) and wait until the motor shaft is at a standstill. Ensure that the drive operates as follows: • Open the STO circuit. The drive generates an indication if one is defined for the 'stopped' state in parameter *31.22* (see the firmware manual). • Give a start command to verify that the STO function blocks the drive's operation. The drive generates a warning. The motor should not start. • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Test the operation of the STO function when the motor is running. • Start the drive and ensure the motor is running. • Open the STO circuit. The motor should stop. The drive generates an indication if one is defined for the 'running' state in parameter *31.22* (see the firmware manual). • Reset any active faults and try to start the drive. • Ensure that the motor stays at a standstill and the drive operates as described above in testing the operation when the motor is stopped. • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Test the operation of the failure detection of the drive. The motor can be stopped or running. • Open the 1st channel of the STO circuit (wire coming to IN1). If the motor was running, it should coast to a stop. The drive generates a *FA81 Safe Torque Off 1 loss* fault indication (see the firmware manual). • Give a start command to verify that the STO function blocks the drive's operation. The motor should not start. • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally. • Open the 2nd channel of the STO circuit (wire coming to IN2). If the motor was running, it should coast to a stop. The drive generates a *FA82 Safe Torque Off 2 loss* fault indication (see the firmware manual). • Give a start command to verify that the STO function blocks the drive's operation. The motor should not start. • Close the STO circuit. • Reset any active faults. Restart the drive and check that the motor runs normally.	☐
Document and sign the acceptance test report which verifies that the safety function is safe and accepted for operation.	☐

Use

1. Open the activation switch, or activate the safety functionality that is wired to the STO connection.
2. The STO inputs on the drive control unit de-energize, and the control unit cuts off the control voltage from the output IGBTs.
3. The control program generates an indication as defined by parameter *31.22* (see the firmware manual of the drive).
4. The motor coasts to a stop (if running). The drive will not restart while the activation switch or safety relay contacts are open.
5. Deactivate the STO by closing the activation switch, or reseting the safety functionality that is wired to the STO connection.
6. Reset any faults before restarting.

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

WARNING!
(With permanent magnet or synchronous reluctance [SynRM] motors only)

In case of a multiple IGBT power semiconductor failure, the drive can produce an alignment torque which maximally rotates the motor shaft by 180/*p* degrees (with permanent magnet motors) or 180/2*p* degrees (with synchronous reluctance [SynRM] motors) regardless of the activation of the Safe torque off function. *p* denotes the number of pole pairs.

Notes:

- If a running drive is stopped by using the Safe torque off function, the drive will cut off the motor supply voltage and the motor will coast to a stop. If this causes danger or is not otherwise acceptable, stop the drive and machinery using the appropriate stop mode before activating the Safe torque off function.
- The Safe torque off function overrides all other functions of the drive.
- The Safe torque off function is ineffective against deliberate sabotage or misuse.
- The Safe torque off function has been designed to reduce the recognized hazardous conditions. In spite of this, it is not always possible to eliminate all potential hazards. The assembler of the machine must inform the final user about the residual risks.
- The Safe torque off diagnostics are not available during power outages, or when the drive is only powered by a CMOD-xx multifunction extension module.

Maintenance

After the operation of the circuit is validated at start-up, the STO function shall be maintained by periodic proof testing. In high demand mode of operation, the maximum proof test interval is 20 years. In low demand mode of operation, the maximum proof test interval is 5 or 2 years; see section *Safety data (page 255)*. It is assumed that all dangerous failures of the STO circuit are detected by the proof test. To perform the proof test, do the *Acceptance test procedure (page 250)*.

Note:

See also the Recommendation of Use CNB/M/11.050 (published by the European co-ordination of Notified Bodies) concerning dual-channel safety-related systems with electromechanical outputs:

- When the safety integrity requirement for the safety function is SIL 3 or PL e (cat. 3 or 4), the proof test for the function must be performed at least every month.
- When the safety integrity requirement for the safety function is SIL 2 (HFT = 1) or PL d (cat. 3), the proof test for the function must be performed at least every 12 months.

The STO function of the drive does not contain any electromechanical components.

In addition to proof testing, it is a good practice to check the operation of the function when other maintenance procedures are carried out on the machinery.

Include the Safe torque off operation test described above in the routine maintenance program of the machinery that the drive runs.

If any wiring or component change is needed after start up, or the parameters are restored, follow the test given in section *Acceptance test procedure (page 250)*.

Use only spare parts approved by ABB.

Record all maintenance and proof test activities in the machine logbook.

Competence

The maintenance and proof test activities of the safety function must be carried out by a competent person with adequate expertise and knowledge of the safety function as well as functional safety, as required by IEC 61508-1 clause 6.

Fault tracing

The indications given during the normal operation of the Safe torque off function are selected by drive control program parameter *31.22*.

The diagnostics of the Safe torque off function cross-compare the status of the two STO channels. In case the channels are not in the same state, a fault reaction function is performed and the drive trips on an “STO hardware failure” fault. An attempt to use the STO in a non-redundant manner, for example activating only one channel, will trigger the same reaction.

See the firmware manual of the drive control program for the indications generated by the drive, and for details on directing fault and warning indications to an output on the control unit for external diagnostics.

Any failures of the Safe torque off function must be reported to ABB.

Safety data

The safety data for the Safe torque off function is given below.

Note:
The safety data is calculated for redundant use, and does not apply if both STO channels are not used.

Frame size	SIL/ SILCL	PL	SFF (%)	PFH (T_1 = 20 a) (1/h)	PFD_{avg} (T_1 = 2 a)	PFD_{avg} (T_1 = 5 a)	$MTTF_D$ (a)	DC (%)	Cat.	SC	HFT	CCF	T_M (a)
R6 R7	3	e	>99	3.92E-09	3.44E-05	8.58E-05	9380	≥90	3	3	1	80	20
R8 R9	3	e	>99	4.22E-09	3.69E-05	8.84E-05	8792	≥90	3	3	1	80	20
R10 R11	3	e	99.60	4.15E-09	3.63E-05	9.08E-05	17544	≥90	3	3	1	80	20
3AXD10000015777 K, 3AXD10000410558 D													

- The following temperature profile is used in safety value calculations:
  - 670 on/off cycles per year with ΔT = 71.66 °C
  - 1340 on/off cycles per year with ΔT = 61.66 °C
  - 30 on/off cycles per year with ΔT = 10.0 °C
  - 32 °C board temperature at 2.0% of time
  - 60 °C board temperature at 1.5% of time
  - 85 °C board temperature at 2.3% of time.
- Relevant failure modes:
  - The STO trips spuriously (safe failure)
  - The STO does not activate when requested
  - A fault exclusion on the failure mode “short circuit on printed circuit board” has been made (EN 13849-2, table D.5). The analysis is based on an assumption that one failure occurs at one time. No accumulated failures have been analyzed.
- STO response times:
  - STO reaction time (shortest detectable break): 1 ms
  - STO response time: 2 ms (typical), 5 ms (maximum)
  - Fault detection time: Channels in different states for longer than 200 ms
  - Fault reaction time: Fault detection time + 10 ms
- Indication delays:
  - STO fault indication (parameter *31.22*) delay: < 500 ms
  - STO warning indication (parameter *31.22*) delay: < 1000 ms

Abbreviations

Abbr.	Reference	Description
Cat.	EN ISO 13849-1	Classification of the safety-related parts of a control system in respect of their resistance to faults and their subsequent behavior in the fault condition, and which is achieved by the structural arrangement of the parts, fault detection and/or by their reliability. The categories are: B, 1, 2, 3 and 4.
CCF	EN ISO 13849-1	Common cause failure (%)

Abbr.	Reference	Description
DC	EN ISO 13849-1	Diagnostic coverage
HFT	IEC 61508	Hardware fault tolerance
$MTTF_D$	EN ISO 13849-1	Mean time to dangerous failure: (Total number of life units) / (Number of dangerous, undetected failures) during a particular measurement interval under stated conditions
PFD_{avg}	IEC 61508	Average probability of dangerous failure on demand, that is, mean unavailability of a safety-related system to perform the specified safety function when a demand occurs
PFH	IEC 61508	Average frequency of dangerous failures per hour, that is, average frequency of a dangerous failure of a safety related system to perform the specified safety function over a given period of time
PL	EN ISO 13849-1	Performance level. Levels a…e correspond to SIL
SC	IEC 61508	Systematic capability
SFF	IEC 61508	Safe failure fraction (%)
SIL	IEC 61508	Safety integrity level (1…3)
SILCL	IEC/EN 62061	Maximum SIL (level 1…3) that can be claimed for a safety function or subsystem
STO	IEC/EN 61800-5-2	Safe torque off
T_1	IEC 61508-6	Proof test interval. T_1 is a parameter used to define the probabilistic failure rate (PFH or PFD) for the safety function or subsystem. Performing a proof test at a maximum interval of T_1 is required to keep the SIL capability valid. The same interval must be followed to keep the PL capability (EN ISO 13849) valid. See also section Maintenance.
T_M	EN ISO 13849-1	Mission time: the period of time covering the intended use of the safety function/device. After the mission time elapses, the safety device must be replaced. Note that any T_M values given cannot be regarded as a guarantee or warranty.

Declaration of conformity

EU Declaration of Conformity

Machinery Directive 2006/42/EC

We

Manufacturer: ABB Oy
Address: Hiomotie 13, 00380 Helsinki, Finland.
Phone: +358 10 22 11

declare under our sole responsibility that the following product:

Frequency converter

ACS580-07

with regard to the safety functions

Safe torque off

Emergency stop (option codes +Q951, +Q963)

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

The following harmonized standards have been applied:

EN 61800-5-2:2007	*Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional*
EN 62061:2005 + AC:2010 + A1:2013 + A2:2015	*Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems*
EN ISO 13849-1:2015	*Safety of machinery – Safety-related parts of control systems. Part 1: General requirements*
EN ISO 13849-2:2012	*Safety of machinery – Safety-related parts of the contr ol systems. Part 2: Validation*
EN 60204-1: 2006 + A1:2009 + AC:2010	*Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

The following other standards have been applied:

IEC 61508:2010, parts 1-3	Functional safety of electrical / electronic / programmable electronic safety-related systems
IEC 61800-5-2:2016	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements - Functional

Union Directives which are notified in Single EU Declaration of conformity 3AXD10000497690.

Person authorized to compile the technical file:

Name and address: Timo Pasanen, Hiomotie 13, 00380 Helsinki, Finland.

Helsinki, 28 Feb 2018

Manufacturer representative:

Vesa Kandell
Vice President, ABB Oy

TÜV certificate

The TÜV certificate is available on the Internet at www.abb.com/drives/documents.

15

Optional I/O extension modules

Contents of this chapter

This chapter describes how to install and start up the following optional modules:

- CBAI-01 bipolar analog IO extension module
- CHDI-01 115/230 V digital input extension module
- CMOD-01 multifunction extension module
- CMOD-02 multifunction extension module
- CPTC-02 ATEX-certified thermistor protection module

This chapter also contains diagnostics and technical data of these modules.

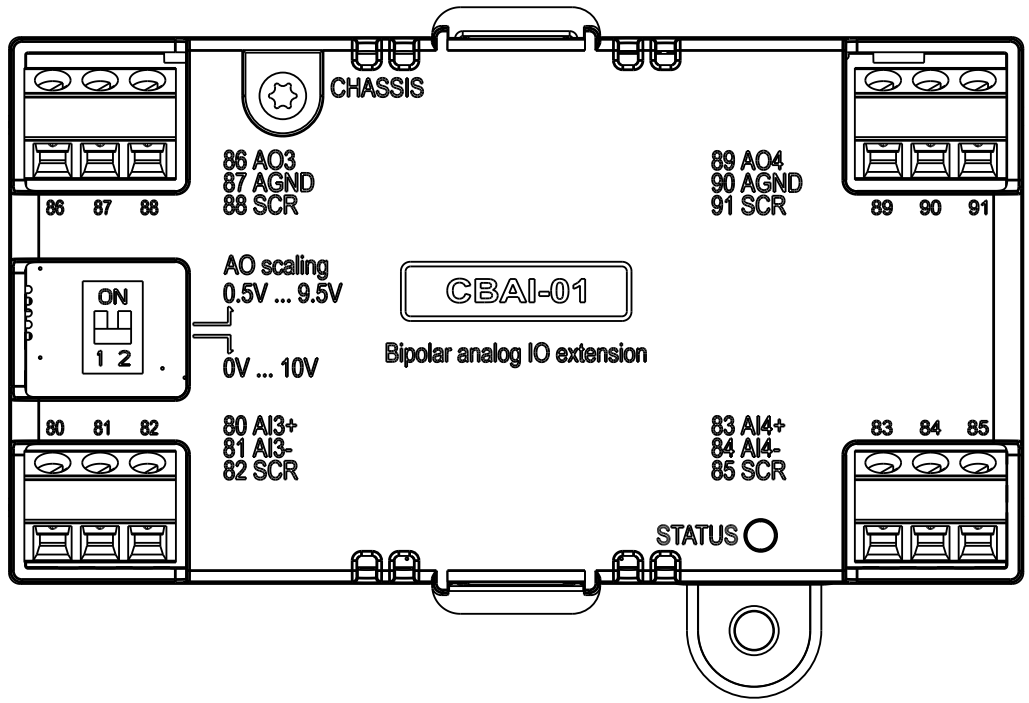
CBAI-01 bipolar analog IO extension module

Hardware description

Product overview

The CBAI-01 bipolar analog IO extension module includes two bipolar analog inputs, two unipolar analog outputs, and a switch which can be used to select scaling of the analog output level.

Layout



1	Analog output 3	*Terminal designations (page 261)*
2	Analog input 3	*Terminal designations (page 261)*
3	Analog output scale switch	***Analog output scale switch:*** *(page 265)*
4	Grounding hole	-
5	Control unit interface (slot 2)	-
6	Diagnostic LED	*Diagnostics (page 263)*
7	Analog output 4	*Terminal designations (page 261)*
8	Analog input 4	*Terminal designations (page 261)*

Mechanical installation

Necessary tools and instructions

- Screwdriver and a set of suitable bits.

Unpacking and checking the delivery

1. Open the option package. Make sure that the package contains:
   - CBAI-01 bipolar analog IO extension module
   - a mounting screw.
2. Make sure that there are no signs of damage.

Installing the module

Note:
Frame R1: Do not install this module before you have installed the power cables as it would cover the power terminals.

See section *Installing optional modules* in chapter *Electrical installation*.

Electrical installation

WARNING!
Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrician, do not do electrical work.

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

Necessary tools and instructions

- Screwdriver and a set of suitable bits
- Cabling tools

Terminal designations

For more detailed information on the connectors, see section *Technical data (page 264)*.

Analog inputs

Marking		Description
80	AI3+	Analog input positive signal
81	AI3-	Analog input negative signal
82	SCR	Cable shield connection (routed directly to output SCR)
83	AI4+	Analog input positive signal
84	AI4-	Analog input negative signal
85	SCR	Cable shield connection (routed directly to output SCR)

Analog outputs

Marking		Description
86	AO3	Analog output signal
87	AGND	Analog ground potential
88	SCR	Cable shield connection (routed directly to output SCR)
89	AO3	Analog output signal
90	AGND	Analog ground potential
91	SCR	Cable shield connection (routed directly to output SCR)

General cabling instructions

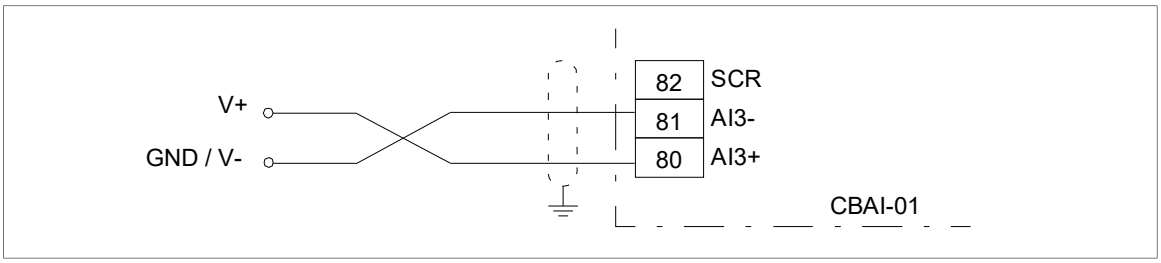
Obey the instructions given in chapter *Planning the electrical installation*.

Wiring

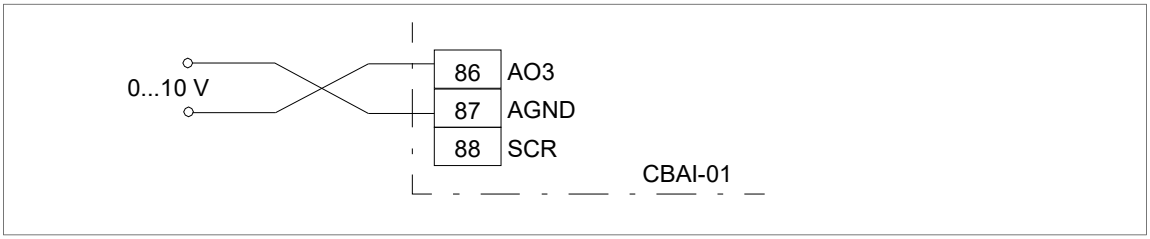
Connect the external control cables to the applicable module terminals. Ground the outer shield of the cables 360 degrees under a grounding clamp on the grounding shelf of the control cables.

Note:
Do not connect both ends of the cable shields directly to ground.

Analog input connection example

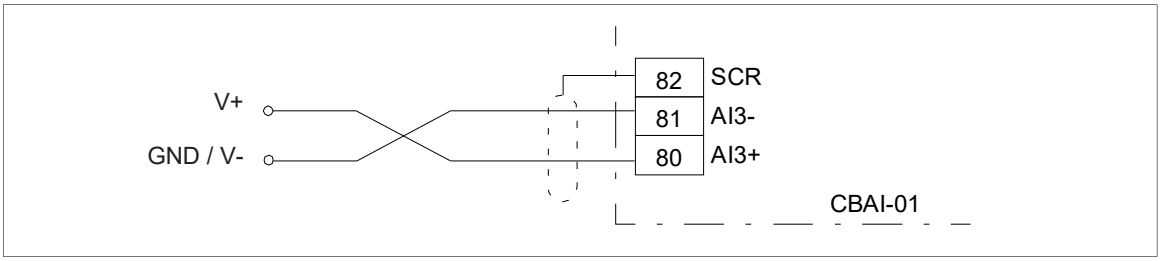


Analog output connection example

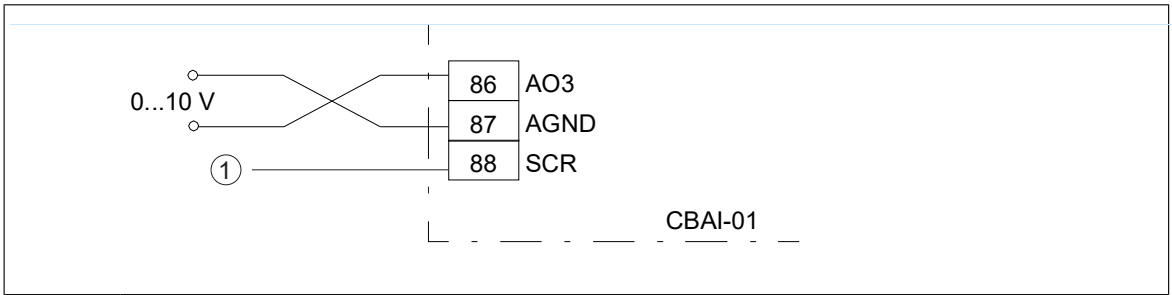


An alternative way to make the connection is to connect the cable shield to the SCR terminal of the control board.

Analog input connection example 2

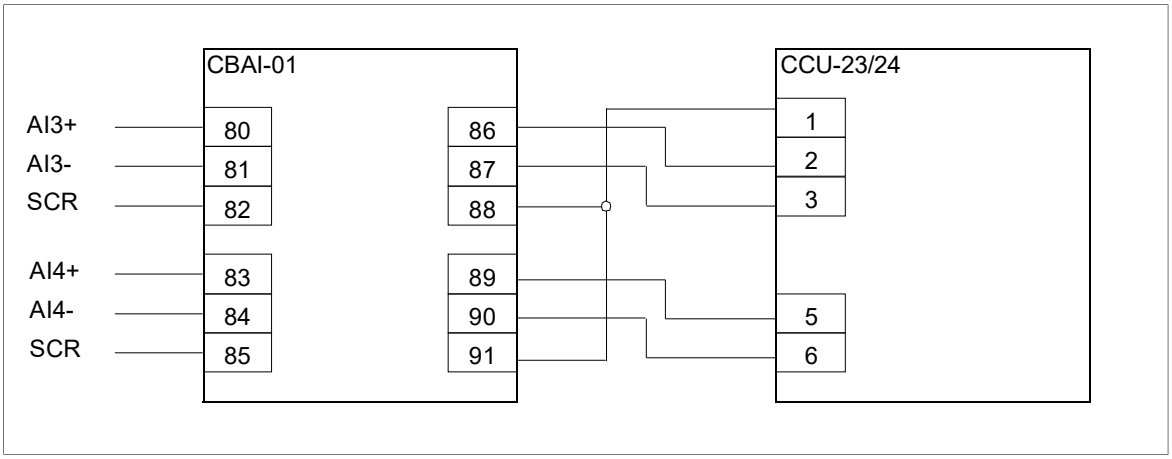


Analog output connection example 2



1	Cable shield connected to control board SCR terminal

Wiring example, extension module and control board



Start-up

Setting the parameters

1. Power up the drive.
2. Verify that the diagnostic LED is on.

Parameter setting example for AI1 (control board)

This example shows how to set the control board parameters for a bipolar speed reference ranging from -50 Hz to 50 Hz, with detection of a wire break between the extension module and the control board of the drive.

Parameter	Setting	Default
12.17 AI1 min	0.5 V	4.000 mA or 0.000 V
12.18 AI1 max	9.5 V	20.000 mA or 10.000 V
12.19 AI1 scaled at AI1 min	-50	0.000
12.20 AI1 scaled at AI1 max	50	50
32.05 Supervision 1 function	Low	Disabled
32.06 Supervision 1 action	Fault	No action
32.07 Supervision 1 signal	AI1	Frequency
32.09 Supervision 1 low	0.4	0.00

Diagnostics

LEDs

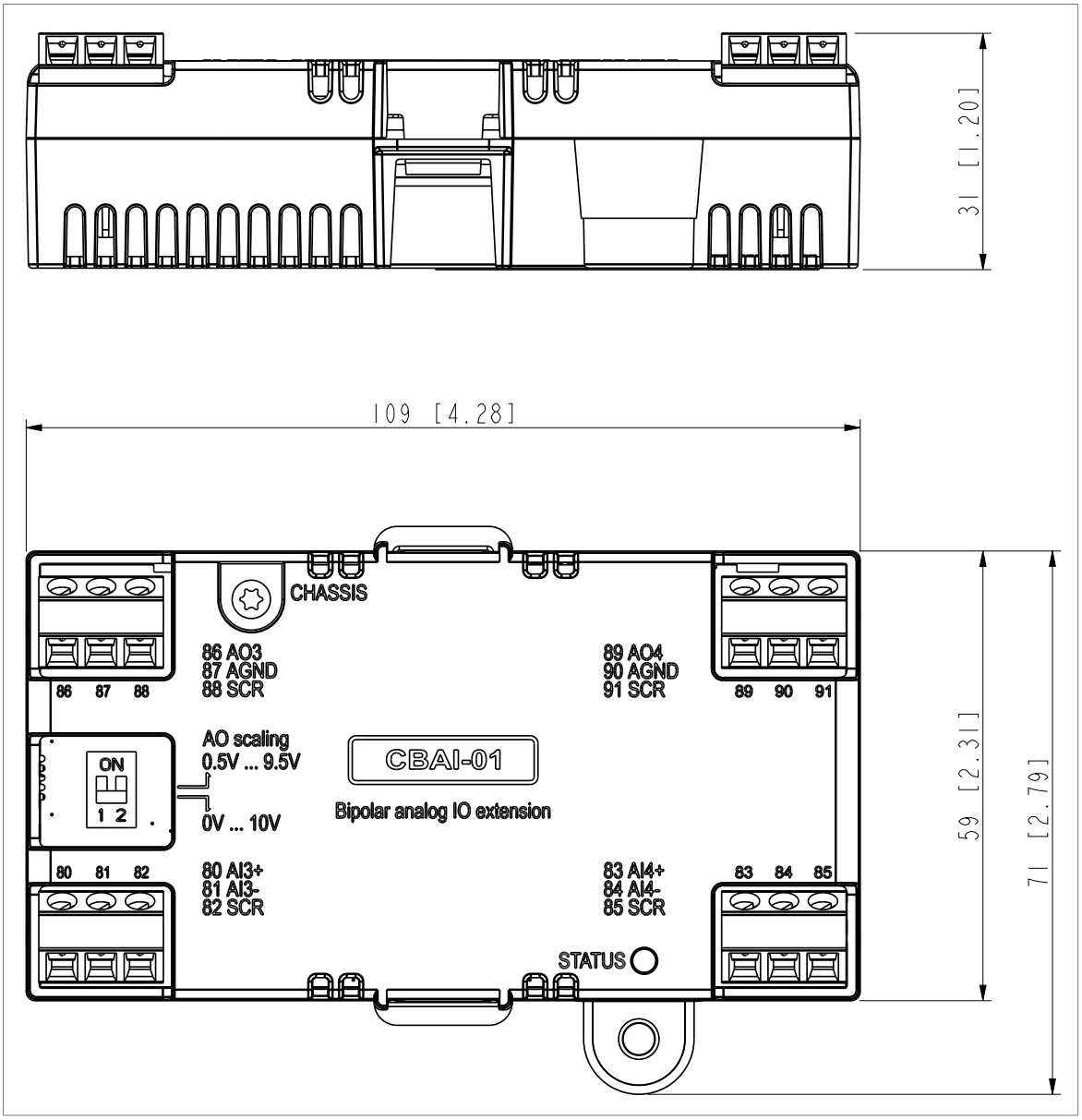
The extension module has one diagnostic LED.

Color	Description
Green	The extension module is powered up.

Technical data

Dimension drawing

The dimensions are in millimeters and [inches].



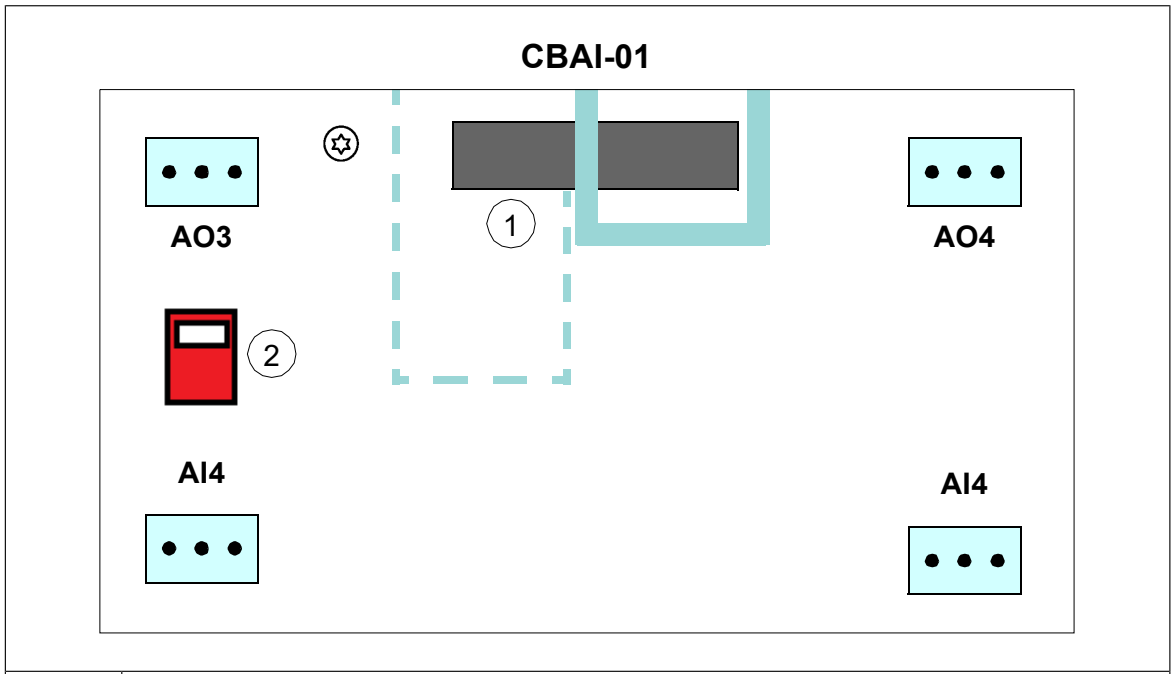
Installation: Into an option slot on the drive control board

Degree of protection: IP20

Ambient conditions: See the drive technical data.

Package: Cardboard

Isolation areas:



Symbol	Description
1	Plugged to drive **SLOT2**
2	**SWITCH**
	Reinforced insulation (IEC 61800-5-1:2007)
	Functional insulation (IEC 61800-5-1:2007)

Analog inputs (80...82, 83...85):

- Wire size max. 1.5 mm^2
- Input voltage (AI+ and AI-): -10 V ... +10 V
- Input resistance: > 200 kohm
- Optional cable shield connection

Analog outputs (86...88, 89...91):

- Wire size max. 1.5 mm^2
- Output voltage (AO and AGND): 0 V ... 10 V
- Output resistance: < 20 ohm
- Recommended load: > 10 kohm
- Inaccuracy: typical ± 1%, max. ± 1.5% of full scale
- Optional cable shield connection

Analog output scale switch:

- ON state: 0.5 V ... 9.5 V range in use
- OFF state: 0 V ... 10 V range in use

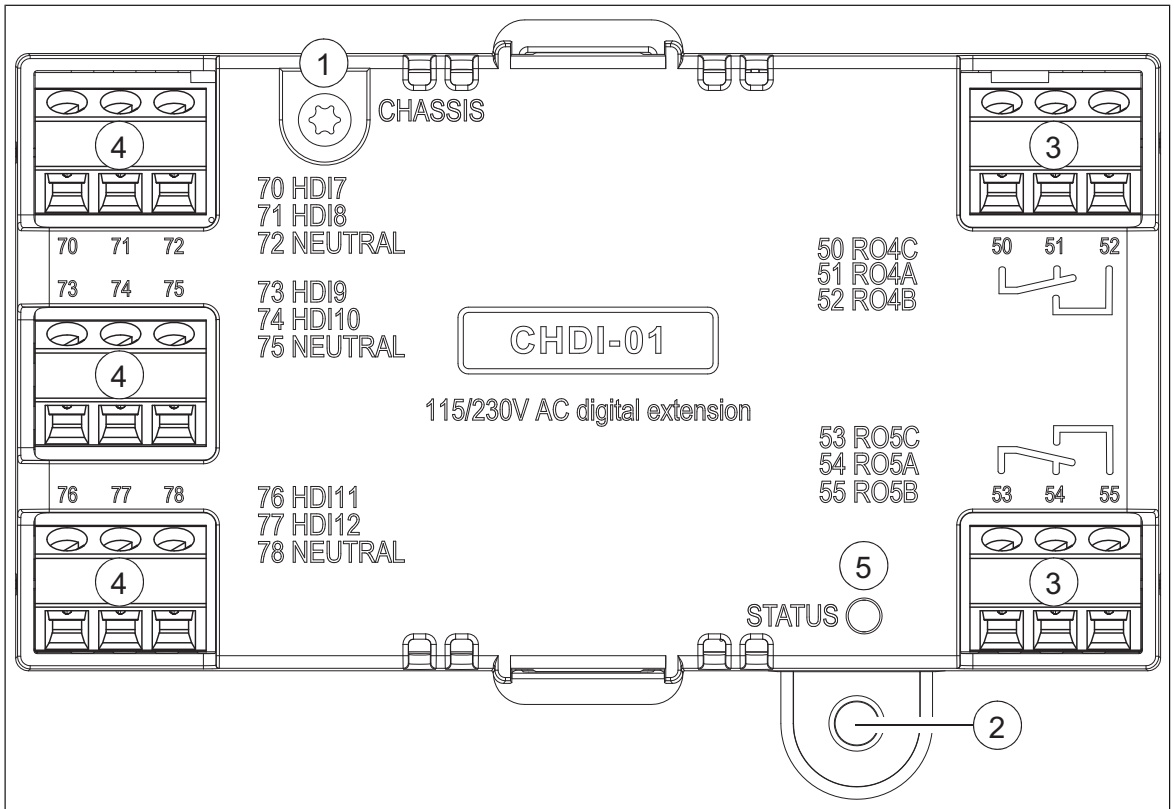
CHDI-01 115/230 V digital input extension module

Hardware description

Product overview

The CHDI-01 115/230 V digital input extension module expands the inputs of the drive control unit. It has six high voltage inputs and two relay outputs.

Layout



1	Grounding screw	-
2	Hole for mounting screw	-
3	3-pin terminal blocks for relay outputs	*Terminal designations (page 267)*
4	3-pin terminal block for 115/230 V inputs	*Terminal designations (page 267)*
5	Diagnostic LED	*LEDs (page 270)*

Mechanical installation

Necessary tools and instructions

- Screwdriver and a set of suitable bits.

Unpacking and checking the delivery

1. Open the option package.
2. Make sure that the package contains:
   - CHDI-01 high voltage digital extension module
   - a mounting screw
   - support part

Note:
The support part is needed for the following frame R1 drive types -02A7, -03A4, -04A1, -05A7, -08A5 and -12A7.

3. Make sure that there are no signs of damage.

Installing the module

See section *Installing optional modules* in chapter *Electrical installation*.

Electrical installation

WARNING!
Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrician, do not do electrical work.

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

Necessary tools and instructions

- Screwdriver and a set of suitable bits
- Cabling tools

Terminal designations

For more detailed information on the connectors, see section *Technical data (page 270)*.

Relay outputs

Marking		Description
50	RO4C	Common, C
51	RO4A	Normally closed, NC
52	RO4B	Normally open, NO
53	RO5C	Common, C
54	RO5A	Normally closed, NC
55	RO5B	Normally open, NO

115/230 V inputs

Marking		Description
70	HDI7	115/230 V input 1
71	HDI8	115/230 V input 2
72	NEUTRAL [1)]	Neutral point
73	HDI9	115/230 V input 3
74	HDI10	115/230 V input 4
75	NEUTRAL[1)]	Neutral point
76	HDI11	115/230 V input 5
77	HDI12	115/230 V input 6

Marking		Description
78	NEUTRAL[1)]	Neutral point

[1)] Neutral points 72, 75 and 78 are connected.

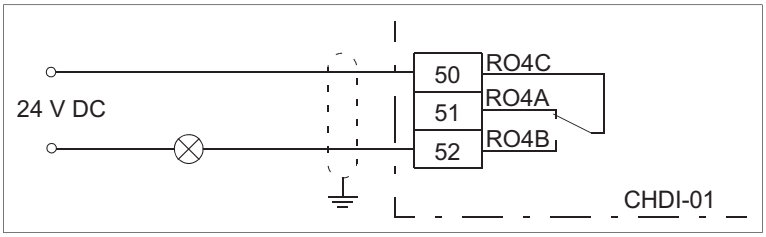
General cabling instructions

Obey the instructions given in chapter *Guidelines for planning the electrical installation*.

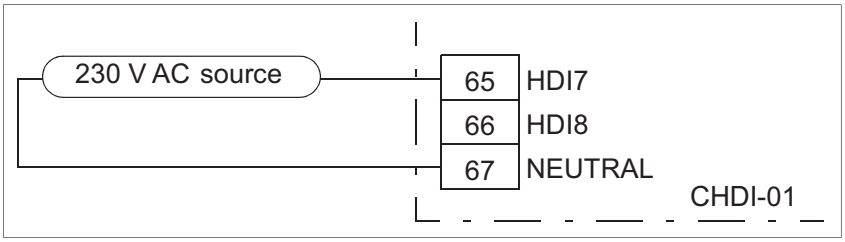
Wiring

Connect the external control cables to the applicable module terminals. Ground the outer shield of the cables 360 degrees under a grounding clamp on the grounding shelf of the control cables.

Relay output connection example



Digital input connection example



Start-up

Setting the parameters

1. Power up the drive.
2. If no warning is shown,
   - make sure that the value of both parameters 15.02 and 15.01 is CHDI-01.

   If warning A7AB *Extension I/O configuration failure* is shown,
   - make sure that the value of parameter 15.02 is CHDI-01.
   - set parameter 15.01 value to CHDI-01.

   You can now see the parameters of the extension module in parameter group 15 I/O extension module.
3. Set the parameters of the extension module to applicable values.

Parameter setting example for relay output

This example shows how make relay output RO4 of the extension module indicate the reverse direction of rotation of the motor with a one-second delay.

Parameter	Setting
15.07 RO4 source	Reverse
15.08 RO4 ON delay	1 s

Parameter	Setting
15.09 RO4 OFF delay	1 s

Diagnostics

Faults and warning messages

Warning A7AB *Extension I/O configuration failure*.

LEDs

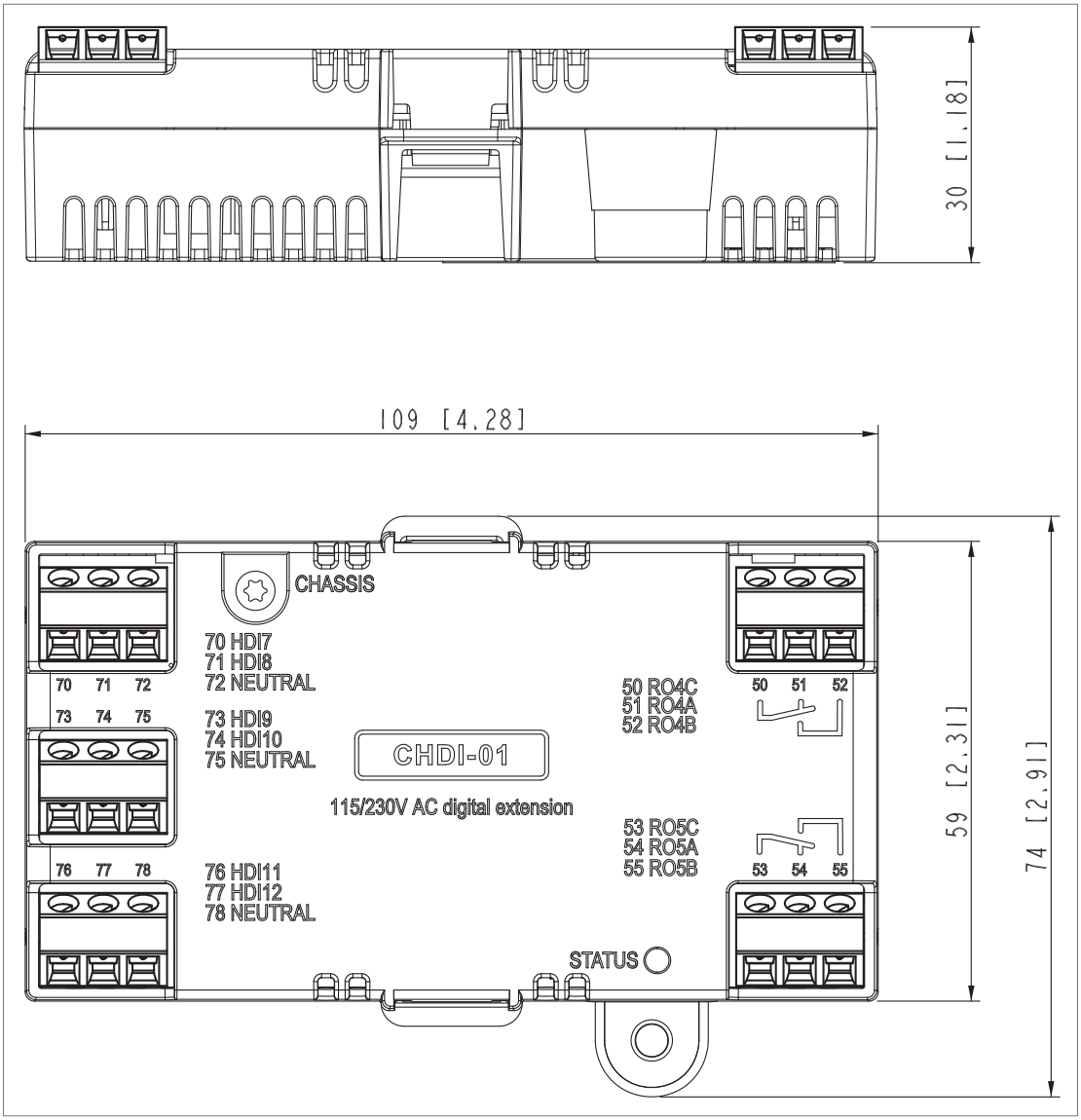
The extension module has one diagnostic LED.

Color	Description
Green	The extension module is powered up.

Technical data

Dimension drawing:

The dimensions are in millimeters and [inches].



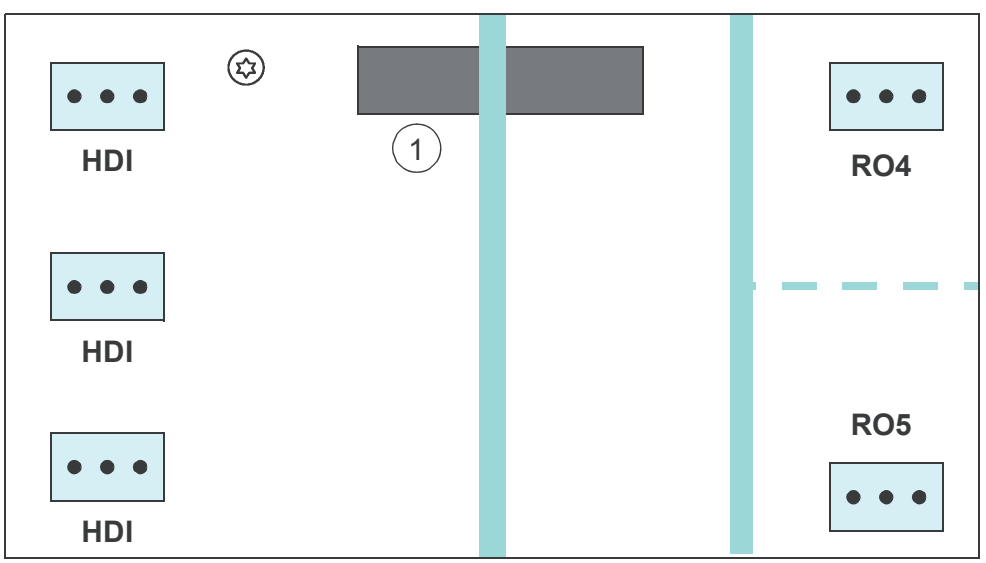
Installation: Into an option slot on the drive control unit

Degree of protection: IP20

Ambient conditions: See the drive technical data.

Package: Cardboard

Isolation areas:



1	Plugged to drive **SLOT2**
	Reinforced insulation (IEC 61800-5-1:2007)
	Functional insulation (IEC 61800-5-1:2007)

Relay outputs (50…52, 53…55):

- Wire size max. 1.5 mm^2
- Minimum contact rating: 12 V / 10 mA
- Maximum contact rating: 250 V AC / 30 V DC / 2 A
- Maximum breaking capacity: 1500 VA

115/230 V inputs (70…78):

- Wire size max. 1.5 mm^2
- Input voltage: 115 to 230 V AC ±10%
- Maximum current leakage in digital off state: 2 mA

CMOD-01 multifunction extension module (external 24 V AC/DC and digital I/O)

Hardware description

Product overview

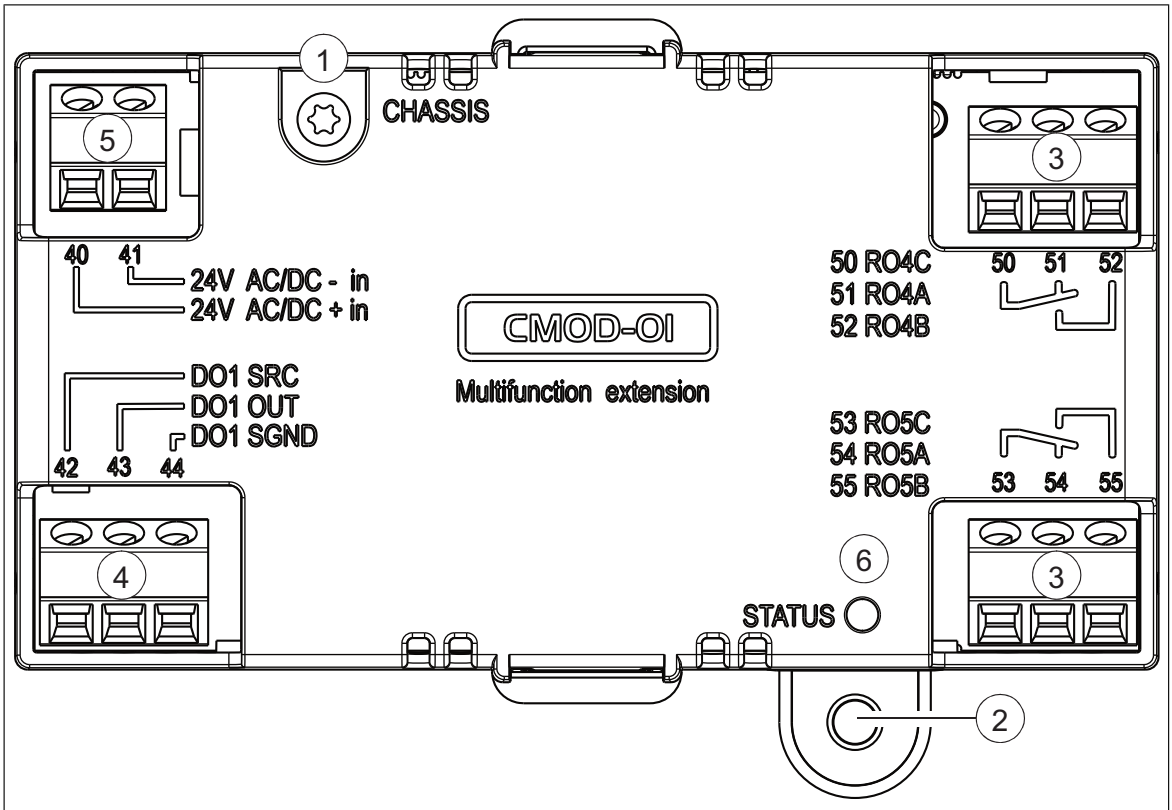
The CMOD-01 multifunction extension module (external 24 V AC/DC and digital I/O) expands the outputs of the drive control unit. It has two relay outputs and one transistor output, which can function as a digital or frequency output.

In addition, the extension module has an external power supply interface, which can be used to power up the drive control unit in case the drive power supply is not on. If you do not need the back-up power supply, you do not have to connect it because the module is powered from the drive control unit by default.

Note:
In frames R6…R9, you do not need a CMOD-01 module to use external 24 V AC/DC supply. The external supply is connected directly to terminals 40 and 41 on the control unit.

WARNING!
Do not connect the +24 V AC cable to the control unit ground when the control unit is powered using an external 24 V AC supply.

Layout



1	Grounding screw	*Mechanical installation (page 273)*
2	Hole for mounting screw	*Mechanical installation (page 273)*
3	3-pin terminal blocks for relay outputs	*Terminal designations (page 273)*

4	3-pin terminal block for transistor output	*Terminal designations (page 273)*
5	2-pin terminal block for external power supply	*Terminal designations (page 273)*
6	Diagnostic LED	*LEDs (page 277)*

Mechanical installation

Necessary tools and instructions

- Screwdriver and a set of suitable bits.

Unpacking and checking the delivery

1. Open the option package.
2. Make sure that the package contains:
   - CMOD-01 multifunction extension module
   - a mounting screw
   - support part

   Note:
   The support part is needed for the following frame R1 drive types -02A7, -03A4, -04A1, -05A7, -08A5 and -12A7.
3. Make sure that there are no signs of damage.

Installing the module

See section *Installing optional modules* in chapter *Electrical installation*.

Electrical installation

WARNING!
Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrician, do not do electrical work.

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

Necessary tools and instructions

- Screwdriver and a set of suitable bits
- Cabling tools

Terminal designations

For more detailed information on the connectors, see section *Technical data (page 278)*.

Relay outputs

Marking		Description
50	RO4C	Common, C
51	RO4A	Normally closed, NC
52	RO4B	Normally open, NO
53	RO5C	Common, C

Marking		Description
54	RO5A	Normally closed, NC
55	RO5B	Normally open, NO

Transistor output

Marking		Description
42	DO1 SRC	Source input
43	DO1 OUT	Digital or frequency output
44	DO1 SGND	Ground (earth) potential

External power supply

The external power supply is needed only if you want to connect an external back-up power supply for the drive control unit.

Note:
CMOD +24V external power supply terminals are not in use with CCU-24 control unit. External power supply to CCU-24 is connected to terminals 40 and 41 on the control unit.

Marking		Description
40	24 V AC/DC + in	External 24 V (AC/DC) input
41	24 V AC/DC - in	External 24 V (AC/DC) input

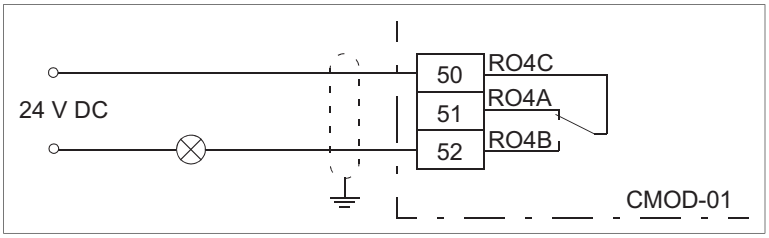
General cabling instructions

Obey the instructions given in chapter *Guidelines for planning the electrical installation*.

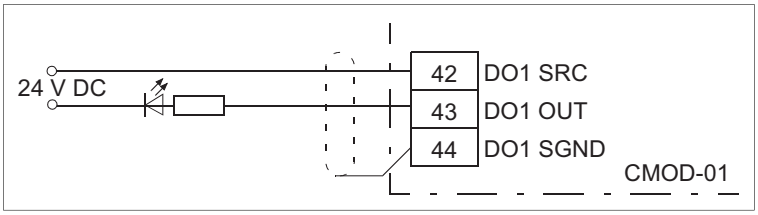
Wiring

Connect the external control cables to the applicable module terminals. Ground the outer shield of the cables 360 degrees under a grounding clamp on the grounding shelf of the control cables.

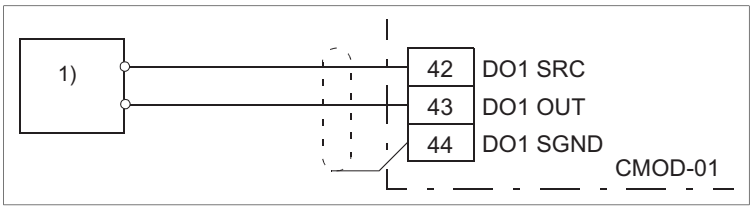
Relay output connection example



Digital output connection example

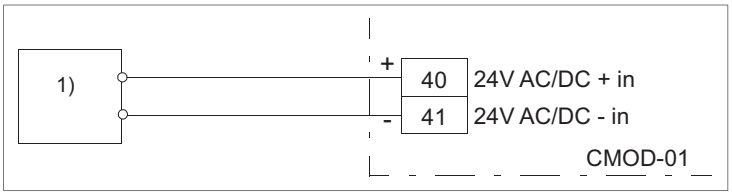


Frequency output connection example



1)	An externally supplied frequency indicator which provides, for example: • a 40 mA / 12 V DC power supply for the sensor circuit (CMOD frequency output) • suitable voltage pulse input (10 Hz … 16 kHz).

External power supply connection example



1)	External power supply, 24 V AC/DC

WARNING!
Do not connect the +24 V AC cable to the control unit ground when the control unit is powered using an external 24 V AC supply.

Start-up

Setting the parameters

1. Power up the drive.
2. If no warning is shown,
   - make sure that the value of both parameters 15.02 and 15.01 is CMOD-01.

   If warning A7AB *Extension I/O configuration failure* is shown,
   - make sure that the value of parameter 15.02 is CMOD-01.
   - set the parameter 15.01 value to CMOD-01.

   You can now see the parameters of the extension module in parameter group 15 I/O extension module.
3. Set the parameters of the extension module to applicable values.

Examples are given below.

Parameter setting example for relay output

This example shows how make relay output RO4 of the extension module indicate the reverse direction of rotation of the motor with a one-second delay.

Parameter	Setting
15.07 RO4 source	Reverse
15.08 RO4 ON delay	1 s
15.09 RO4 OFF delay	1 s

Parameter setting example for digital output

This example shows how to make digital output DO1 of the extension module indicate the reverse direction of rotation of the motor with a one-second delay.

Parameter	**Setting**
15.22 DO1 configuration	Digital output
15.23 DO1 source	Reverse
15.24 DO1 ON delay	1 s
15.25 DO1 OFF delay	1 s

Parameter setting example for frequency output

This example shows how to make digital output DO1 of the extension module indicate the motor speed 0... 1500 rpm with a frequency range of 0...10000 Hz.

Parameter	Setting
15.22 DO1 configuration	Frequency output
15.33 Freq out 1 source	01.01 Motor speed used
15.34 Freq out 1 src min	0
15.35 Freq out 1 src max	1500.00
15.36 Freq out 1 at src min	1000 Hz
15.37 Freq out 1 at src max	10000 Hz

Diagnostics

Faults and warning messages

Warning A7AB Extension I/O configuration failure.

LEDs

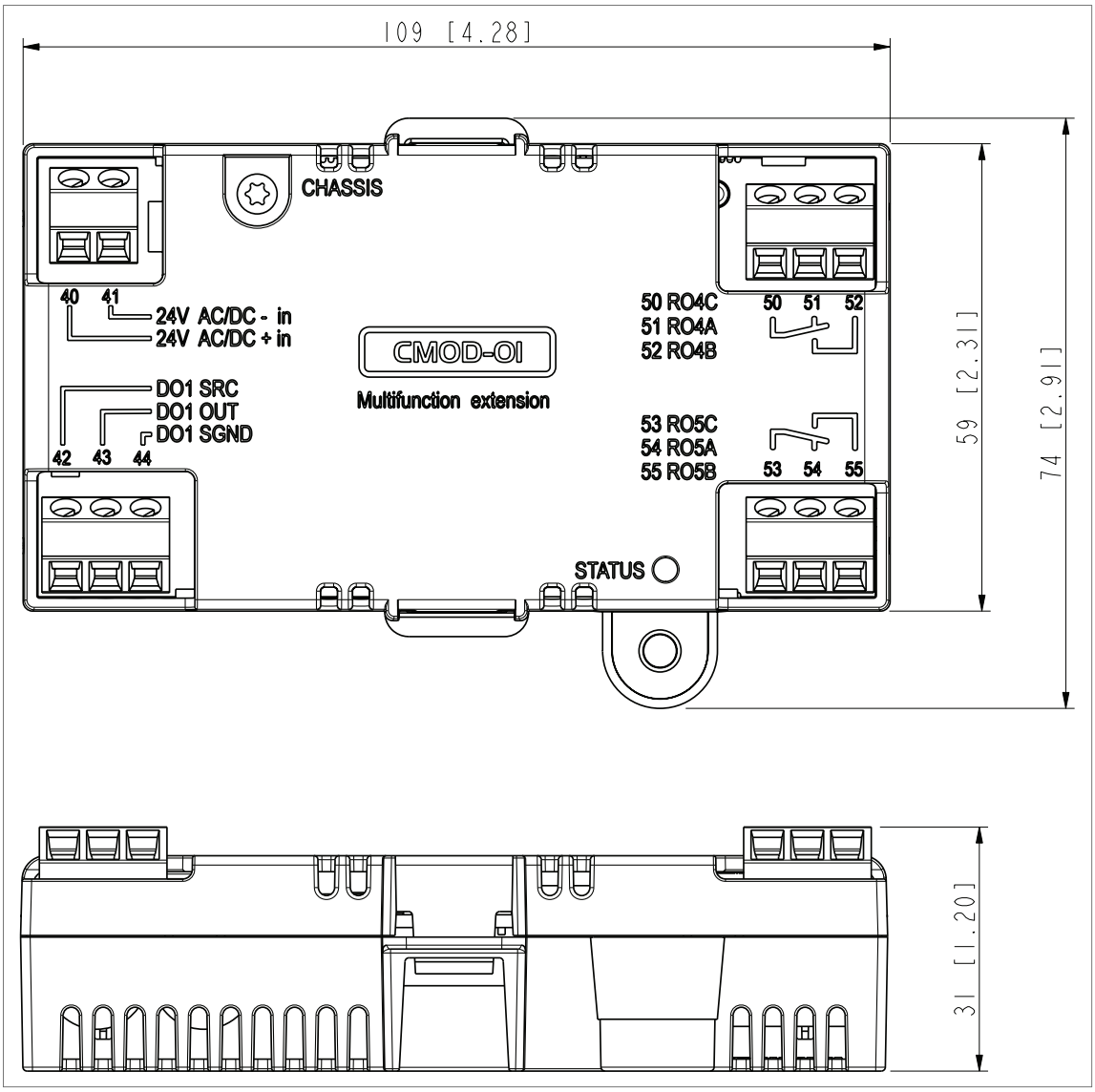
The extension module has one diagnostic LED.

Color	Description
Green	The extension module is powered up.

Technical data

Dimension drawing:

The dimensions are in millimeters and [inches].



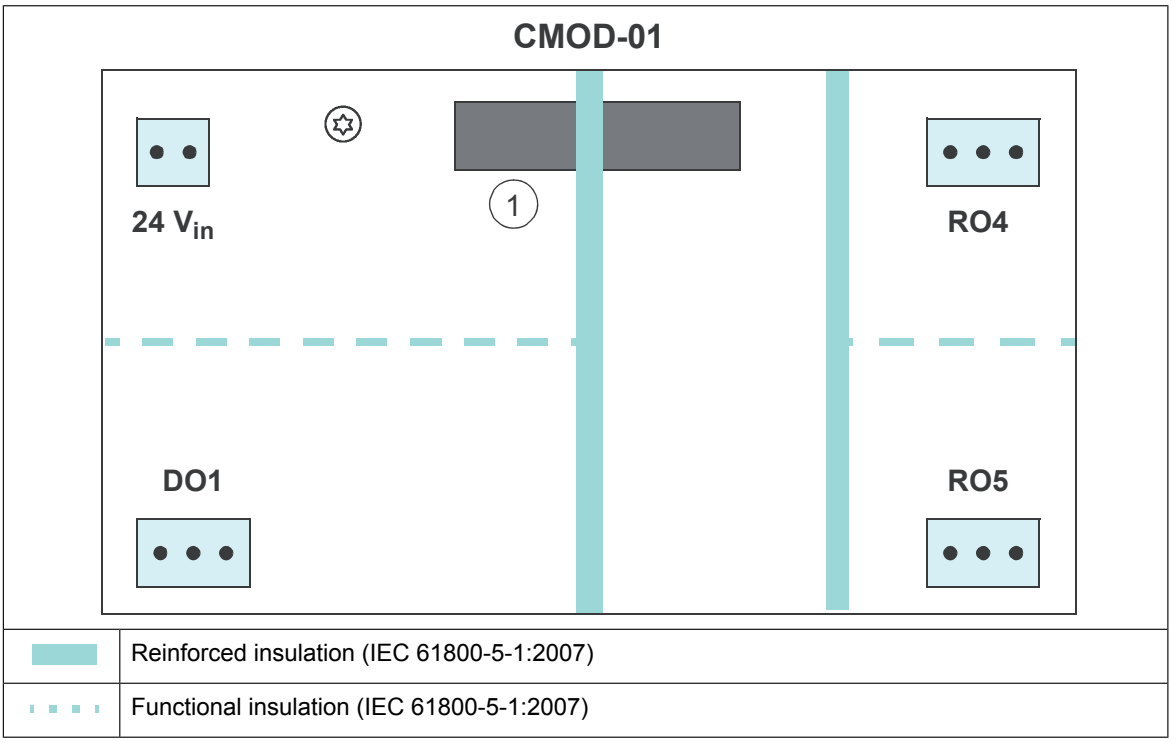
Installation: Into an option slot on the drive control unit

Degree of protection: IP20

Ambient conditions: See the drive technical data.

Package: Cardboard

Isolation areas:



Relay outputs (50…52, 53…55):

- Wire size max. 1.5 mm^2
- Minimum contact rating: 12 V / 10 mA
- Maximum contact rating: 250 V AC / 30 V DC / 2 A
- Maximum breaking capacity: 1500 VA

Transistor output (42…44):

- Wire size max. 1.5 mm^2
- Type: Transistor output PNP
- Maximum load: 4 kohm
- Maximum switching voltage: 30 V DC
- Maximum switching current: 100 mA / 30 V DC, short-circuit protected
- Frequency: 10 Hz … 16 kHz
- Resolution: 1 Hz
- Inaccuracy: 0.2%

External power supply (40…41):

- Wire size max. 1.5 mm^2
- 24 V AC / V DC ±10% (GND, user potential)
- Maximum power consumption: 25 W, 1.04 A at 24 V DC

CMOD-02 multifunction extension module (external 24 V AC/DC and isolated PTC interface)

Hardware description

Product overview

The CMOD-02 multifunction extension module (external 24 V AC/DC and isolated PTC interface) has a motor thermistor connection for supervising the motor temperature and one relay output, which indicates the thermistor status. In case the thermistor overheats, the drive trips on motor overtemperature. If Safe torque off tripping is required, the user must wire the overtemperature indication relay to the certified Safe torque off input of the drive.

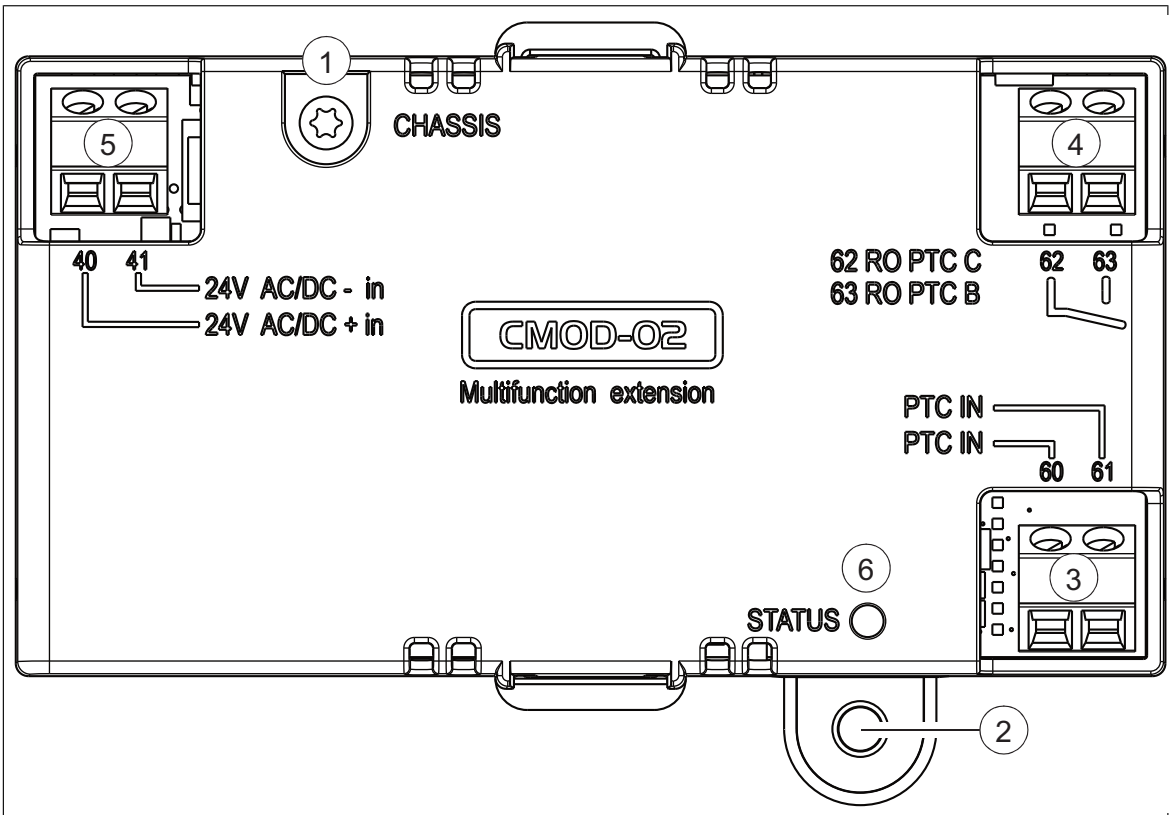
In addition, the extension module has an external power supply interface, which can be used to power up the drive control unit in case the drive power supply is not on. If you do not need the back-up power supply, you do not have to connect it because the module is powered from the drive control unit by default.

There is reinforced insulation between the motor thermistor connection, the relay output and the drive control unit interface. Thus, you can connect a motor thermistor to the drive through the extension module.

Note:
In frames R6…R9, you do not need a CMOD-02 module to use external 24 V AC/DC supply. The external supply is connected directly to terminals 40 and 41 on the control unit.

WARNING!
Do not connect the +24 V AC cable to the control unit ground when the control unit is powered using an external 24 V AC supply.

Layout



1	Grounding screw	*Mechanical installation (page 281)*
2	Hole for mounting screw	*Mechanical installation (page 281)*
3	2-pin terminal block for motor thermistor connection	*Terminal designations (page 282)*
4	2-pin terminal block for relay output	*Terminal designations (page 282)*
5	2-pin terminal block for external power supply	*Terminal designations (page 282)*
6	Diagnostic LED	*LEDs (page 284)*

Mechanical installation

Necessary tools and instructions

- Screwdriver and a set of suitable bits

Unpacking and checking the delivery

1. Open the option package.
2. Make sure that the package contains:
   - CMOD-02 multifunction extension module
   - a mounting screw
   - support part

   Note:

   The support part is needed for the following frame R1 drive types -02A7, -03A4, -04A1, -05A7, -08A5 and -12A7.
3. Make sure that there are no signs of damage.

Installing the module

See section *Installing optional modules* in chapter *Electrical installation*.

Electrical installation

WARNING!
Obey the instructions in chapter *Safety instructions*. If you ignore them, injury or death, or damage to the equipment can occur. If you are not a qualified electrician, do not do electrical work.

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

Necessary tools and instructions

- Screwdriver and a set of suitable bits
- Cabling tools

Terminal designations

For more detailed information on the connectors, see section *Technical data (page 284)*.

Motor thermistor connection

Marking		Description
60	PTC IN	PTC connection
61	PTC IN	Ground (earth) potential

Relay output

Marking		Description
62	RO PTC C	Common, C
63	RO PTC B	Normally open, NO

External power supply

The external power supply is needed only if you want to connect an external back-up power supply for the drive control unit.

Note:
CMOD +24V external power supply terminals are not in use with CCU-24 control unit. External power supply to CCU-24 is connected to terminals 40 and 41 on the control unit.

Marking		Description
40	24 V AC/DC + in	External 24 V (AC/DC) input
41	24 V AC/DC - in	External 24 V (AC/DC) input

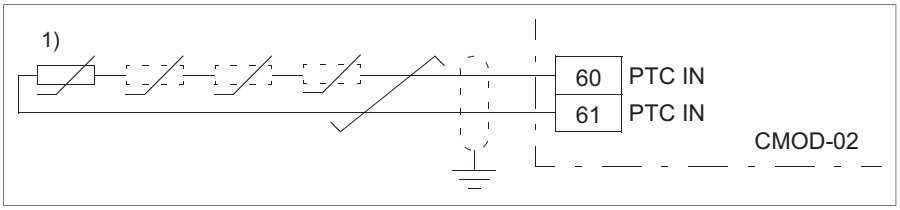
General cabling instructions

Obey the instructions given in chapter *Guidelines for planning the electrical installation*.

Wiring

Connect the external control cables to the applicable module terminals. Ground the outer shield of the cables 360 degrees under a grounding clamp on the grounding shelf of the control cables.

Motor thermistor connection example

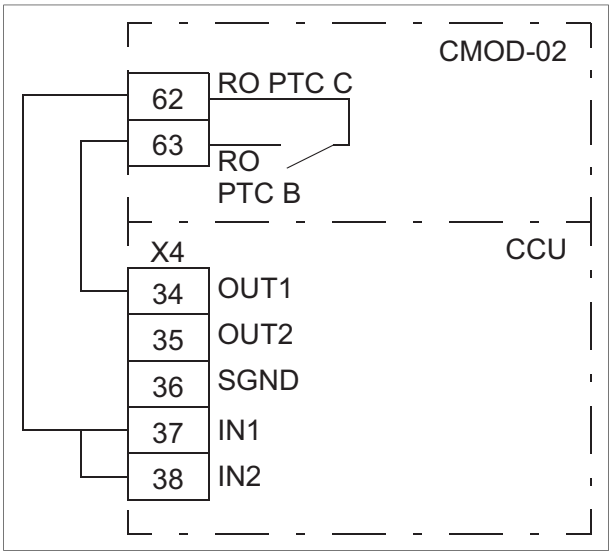


1)	One or 3…6 PTC thermistors connected in series.

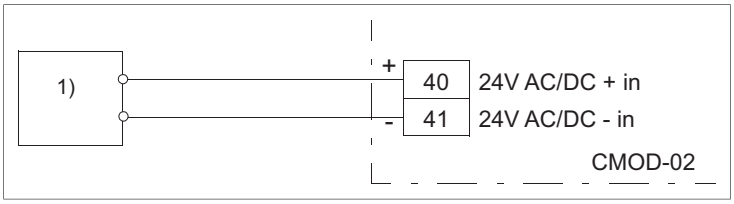
The PTC input is reinforced/double insulated. If the motor part of the PTC sensor and wiring are reinforced/double insulated, voltages on the PTC wiring are within SELV limits.

If the motor PTC circuit is not reinforced/double insulated (ie, it is basic insulated), it is mandatory to use reinforced/double insulated wiring between the motor PTC and CMOD-02 PTC terminal.

Relay output connection example



Power supply connection example



1)	External power supply, 24 V AC/DC

WARNING!
Do not connect the +24 V AC cable to the control unit ground when the control unit is powered using an external 24 V AC supply.

Start-up

Setting the parameters

1. Power up the drive.
2. If no warning is shown,
   - make sure that the values of both parameters 15.02 and 15.01 are CMOD-02.

   If warning A7AB *Extension I/O configuration failure* is shown,
   - make sure that the value of parameter 15.02 is CMOD-02.
   - set the parameter 15.01 value to CMOD-02.

   You can now see the parameters of the extension module in parameter group 15 I/O extension module.

Diagnostics

Faults and warning messages

Warning A7AB Extension I/O configuration failure.

LEDs

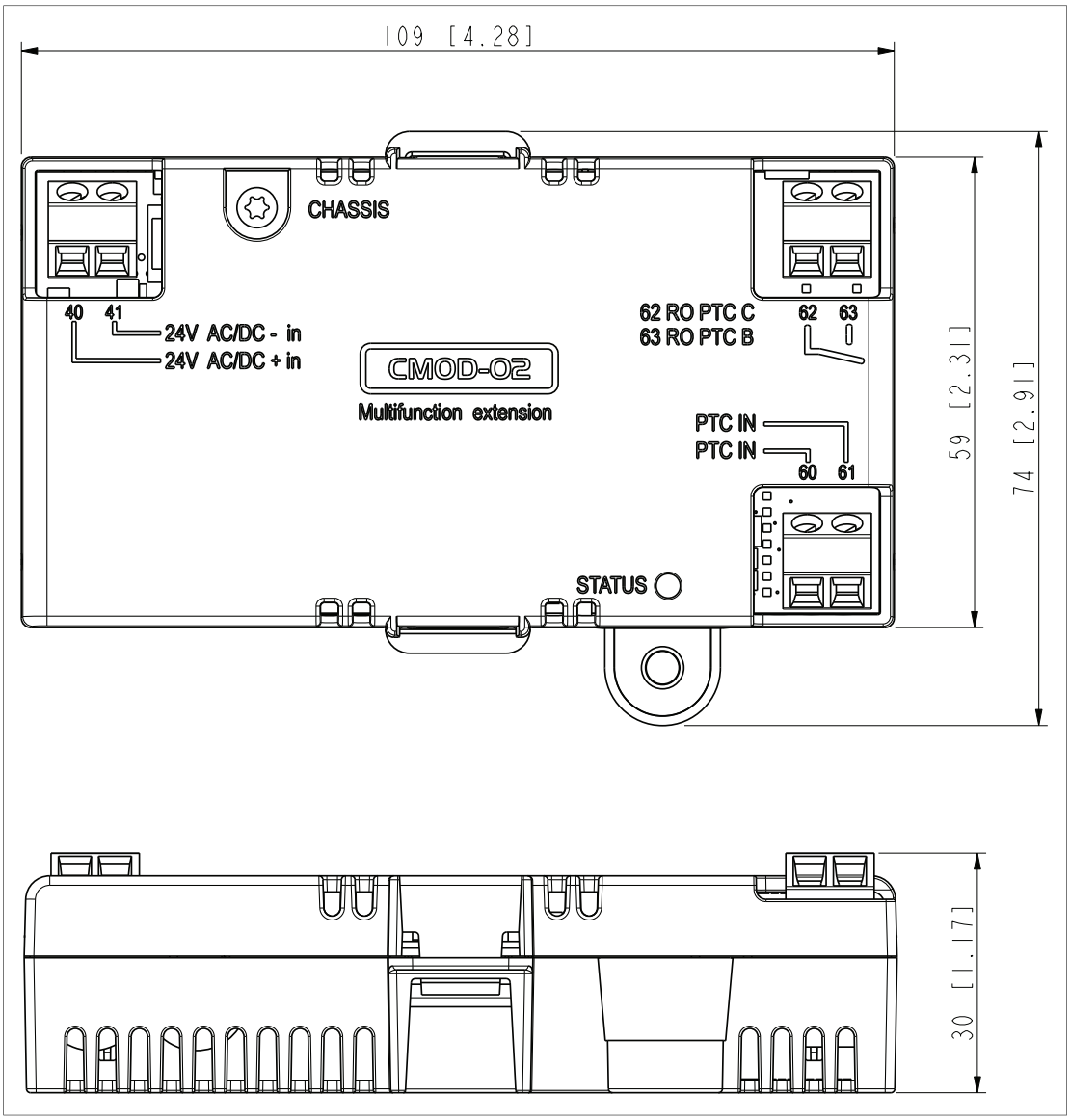
The extension module has one diagnostic LED.

Color	Description
Green	The extension module is powered up.

Technical data

Dimension drawing:

The dimensions are in millimeters and [inches].



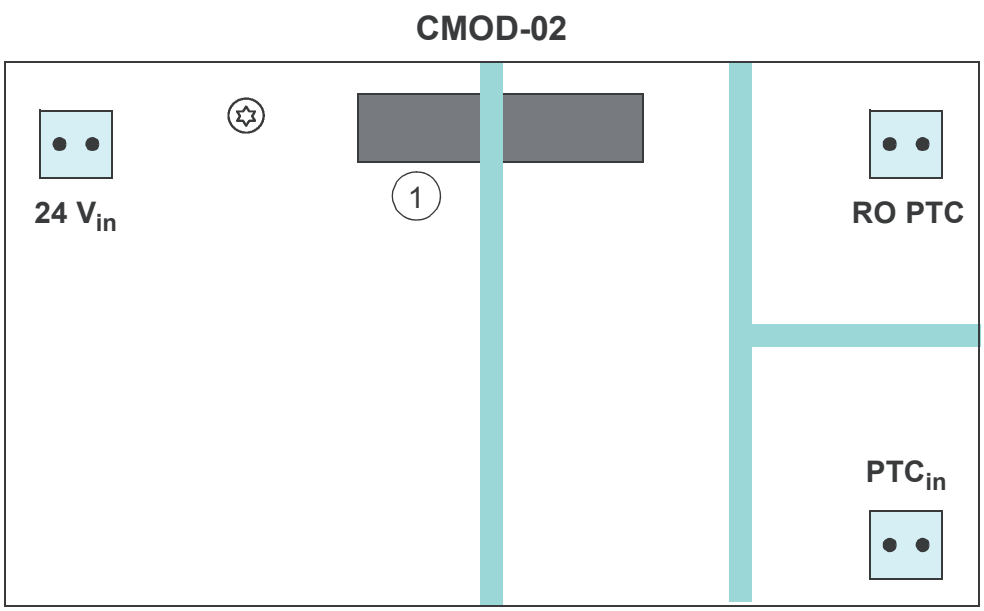
Installation: Into an option slot on the drive control unit

Degree of protection: IP20

Ambient conditions: See the drive technical data.

Package: Cardboard

Isolation areas:



	Reinforced insulation (IEC 61800-5-1:2007)
	Functional insulation (IEC 61800-5-1:2007)
1	Plugged to drive **SLOT2**.

Motor thermistor connection (60…61):

- Wire size max. 1.5 mm^2
- Supported standards: DIN 44081 and DIN 44082
- Number of PTC thermistor relays: 1 or 3…6 in series
- Triggering threshold: 3.6 kohm ±10%
- Recovery threshold: 1.6 kohm ±10%
- PTC terminal voltage: < 5.0 V
- PTC terminal current: < 1 mA
- Short-circuit detection: < 50 ohm ±10%

Relay output (62…63):

- Wire size max. 1.5 mm^2
- Maximum contact rating: 250 V AC / 30 V DC / 5 A
- Maximum breaking capacity: 1000 VA

External power supply (40…41):

- Wire size max. 1.5 mm^2
- 24 V AC / V DC ±10% (GND, user potential)
- Maximum power consumption: 25 W, 1.04 A at 24 V DC

CPTC-02 ATEX-certified thermistor protection module (external 24 V AC/DC and isolated PTC interface)

See *CPTC-02 ATEX-certified thermistor protection module, EX II (2) GD (+L537+Q971) user's manual* (3AXD50000030058 [English]).

Further information

Product and service inquiries

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

Product training

For information on ABB product training, navigate to new.abb.com/service/training.

Providing feedback on ABB manuals

Your comments on our manuals are welcome. Navigate to new.abb.com/drives/manuals-feedback-form.

Document library on the Internet

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