



# iC7-Automation Air-cooled Enclosed Drives

206/385-1710 A





# Contents

## 1 Overview

1.1 Safety and Installation Awareness	5
1.2 Checking the Delivery and the Contents	5
1.3 Unpacking the Product	5
1.4 Lifting the Enclosed Drive	6

## 2 Mechanical Installation

2.1 Installation Requirements	9
2.2 Installing the Enclosed Drive	9
2.3 Installing the Enclosed Drives Back to Back	10
2.4 Installing the IP21 Top Cover	10
2.5 Attaching the Output Cabinet Section	11
2.6 Installing the Back-channel Cooling Option, +OABC	19
2.7 Installing the Marine Construction Option, +AFMC	21

## 3 Electrical Installation

3.1 Grounding Principles	23
3.2 Prerequisites for Cable Installation	23
3.3 Installing Power Cables	25
3.3.1 Installing the Power Cables through the Bottom	25
3.3.2 Installing the Power Cables through the Top (+KCIT or +KDOT)	27
3.3.3 Installing the Power Cables through the Bottom, Gland Plate +KFCP	29
3.3.4 Installing the Power Cables through the Top, Gland Plate +KFCP	32
3.3.5 Installing the Power Cables in the Inverter Module Cabinet, Gland Plate +KFCP	35
3.4 Installing the Brake Cables, FE9, FE10	35
3.5 Power Cabling Floor Components, UL	36
3.6 Checking the Settings for the Auxiliary AC Voltage Transformer (+IHAT)	36
3.7 Parameter Settings for IT Mains	37

## 4 Control and Option Installation

4.1 Control Compartment Connections	38
4.2 I/O and Relay Option Connections	39
4.3 Control Cable Routing	42

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4.4	Installing Boards to the Control Compartment	45
4.5	Wiring of the I/O and Relay Options	46
4.6	Installing the Control Cables	46
4.7	Installing the microSD Card	49
<b>5 Commissioning</b>		
5.1	Commissioning the Enclosed Drive	50
5.2	Preparing for a PC Connection	50
5.3	Pre-charging the Drive	51
5.4	Measuring the Insulation Resistance	52
5.4.1	Measuring the Insulation Resistance of the Motor Cable	52
5.4.2	Measuring the Insulation Resistance of the Mains Cable	52
5.4.3	Measuring the Insulation Resistance of the Motor	52
<b>6 Specifications</b>		
6.1	Tightening Torques	53
6.2	Cable Sizes	53
6.2.1	List of Cable Size Information	53
6.2.2	Mains Cable Size Recommendations, 380–500 V	54
6.2.3	Motor Cable Size Recommendations, 380–500 V	55
6.2.4	Mains Cable Size Recommendations, UL, 480 V	57
6.2.5	Motor Cable Size Recommendations, UL 480 V	58
6.2.6	Brake Cable Size Recommendations	60
6.2.7	Brake Cable Size Recommendations, UL	60
6.3	Fuses	60
6.3.1	Fuse Size Tables	60
6.3.2	AC Fuses, 380–500 V AC	61
6.3.3	DC Fuses, 465–800 V DC	61
6.3.4	External Fuses on External Supply for Input Devices	62

# 1 Overview

## 1.1 Safety and Installation Awareness

Before starting installation, read all safety guidelines and precautions related to installing the products. For more information, see the product-specific design guide. Supplemental information and other guides can be downloaded from [www.danfoss.com/en/service-and-support/documentation/](http://www.danfoss.com/en/service-and-support/documentation/).

## 1.2 Checking the Delivery and the Contents

Make sure that the items supplied and the information on the product label correspond to the order confirmation.

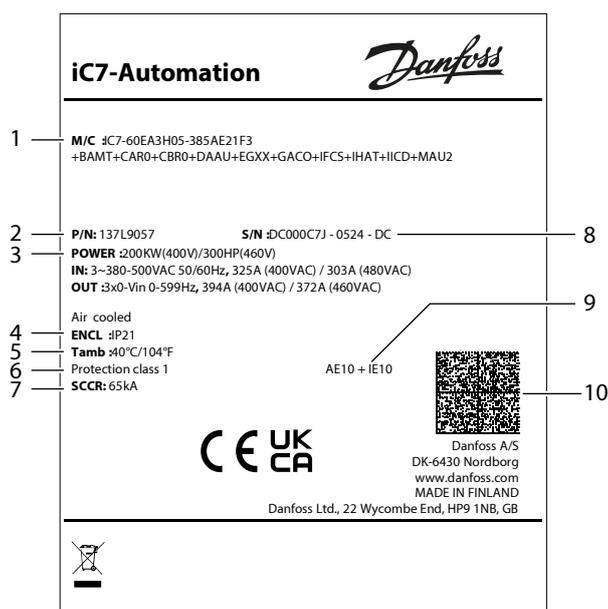


Figure 1: Product Label for iC7 Series Air-cooled Enclosed Drives

1	Model code of the product	2	Code number
3	Power, input, and output ratings	4	Protection rating
5	Temperature rating for ambient air	6	Protection class
7	Short-circuit current rating	8	Serial number
9	Frame designation	10	2D code accessible with a Datamatrix ECC 200 compatible barcode reader

## 1.3 Unpacking the Product

The products are packed in cardboard on a wooden pallet.

1. Open the package only when installing the product.
2. See the center of gravity in the relevant dimensional drawing in the design guide.
3. See the weight in the design guide.
4. Remove the product from the pallet where it was connected to.
5. If the optional sea container package (+TASE) was ordered, remove the yellow VCI capsule from the product.

There are 2 VCI capsules in each cabinet section, 1 in the top part and 1 in the bottom part of the cabinet section.

Locations of the VCI capsules:

- behind the touch protection
- behind the service table
- on the inner surface of the cabinet door

- a. Remove the touch protection to remove the VCI capsule from behind it.
- b. Lift the service table to remove the VCI capsule from behind it.
- c. Reattach the touch protections.

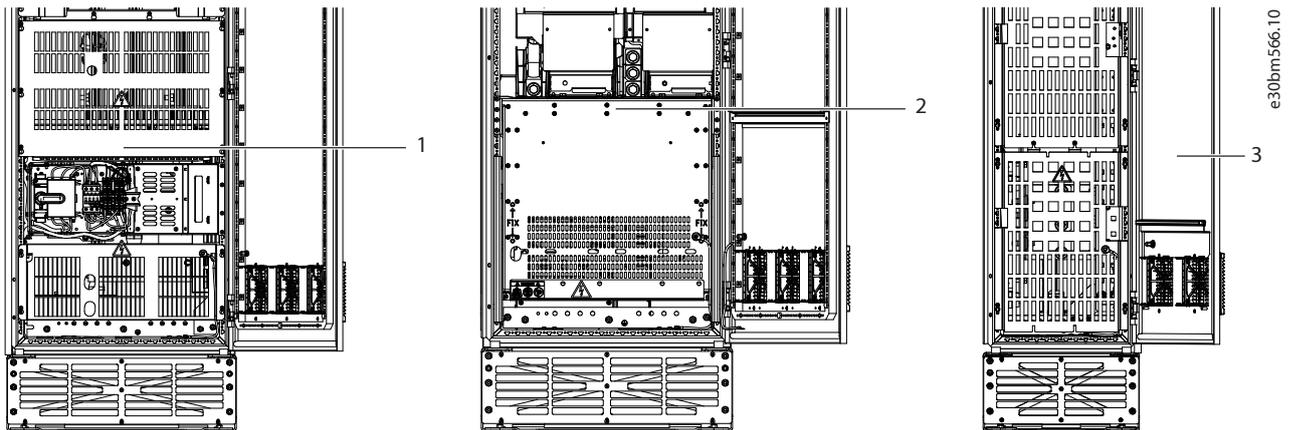


Figure 2: Example Locations of the VCI Capsules

- |   |  |   |                          |
|---|--|---|--------------------------|
| 1 | behind the touch protection              | 2 | behind the service table |
| 3 | on the inner surface of the cabinet door |   |                          |

6. After unpacking the product, wait 24 h before the first power on.

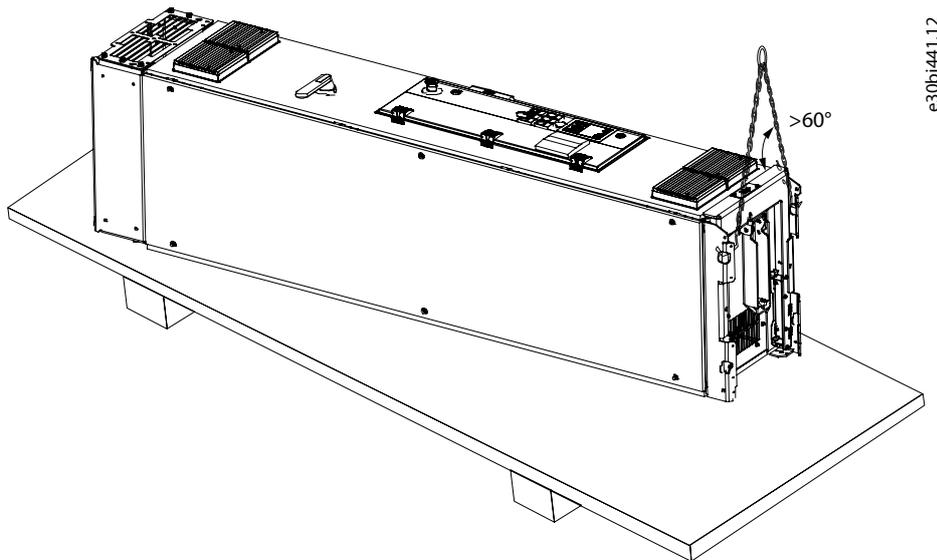
## 1.4 Lifting the Enclosed Drive

A delivery containing 1 cabinet is delivered horizontally, but a delivery containing many cabinets is delivered vertically.

1. If the drive is delivered horizontally, lift it to an upright position.
  - a. Put the lifting hooks in the 2 front lifting loops on the top of the cabinet.

The minimum lifting angle is 60°.

- b. Lift the drive to an upright position.

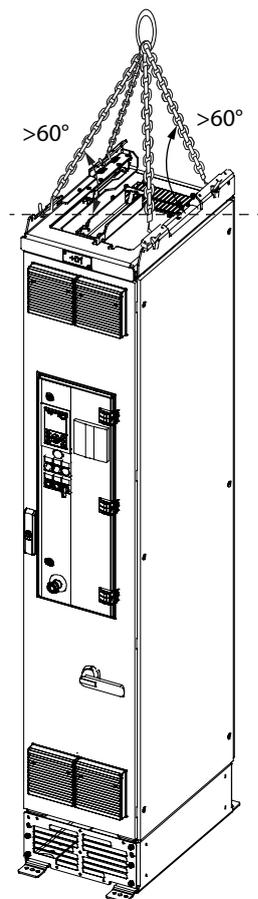


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Figure 3: Lifting the Enclosed Drive to an Upright Position

- Put the lifting hooks in 4 lifting loops on the top of the cabinet.

The minimum lifting angle is 60°.



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Figure 4: Lifting the Enclosed Drive

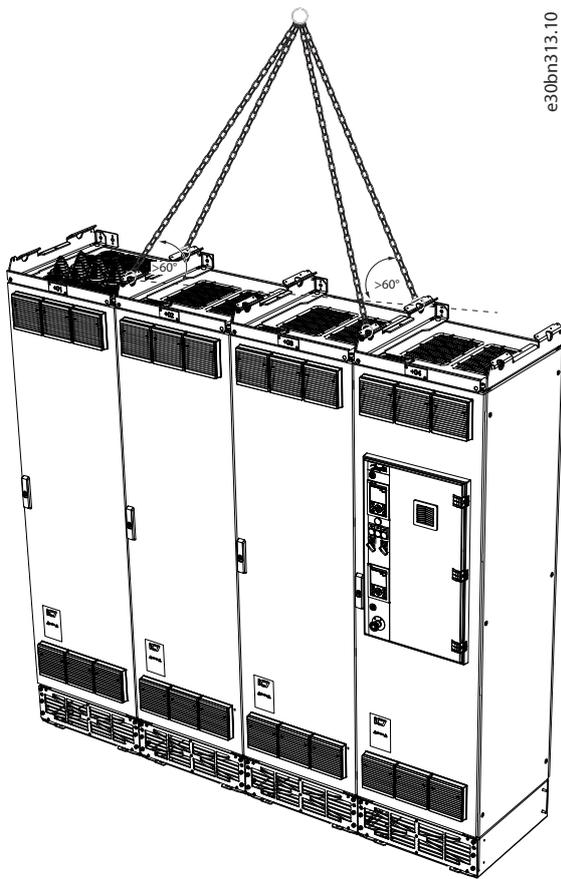


Figure 5: Lifting the Enclosed Drive with Several Cabinet Sections

3. Lift the drive to the required position.

## 2 Mechanical Installation

### 2.1 Installation Requirements

- Make sure that the ambient conditions at the installation location comply with these:
  - Installation temperature:  $-10\text{ }^{\circ}\text{C} \dots +70\text{ }^{\circ}\text{C}$  ( $14\text{ }^{\circ}\text{F} \dots 158\text{ }^{\circ}\text{F}$ )
  - Relative humidity: 5...95% RH, no condensation, no dripping water
- Install the drive on a solid and level surface.
- Make sure that the mounting surface can support the weight of the drive. See the weight in the design guide.
- Make sure that the mounting surface is non-combustible and that there is no combustible material in the mounting area.

### 2.2 Installing the Enclosed Drive

1. Secure the enclosed drive to the floor and to the wall using all the mounting holes.

There are 2 mounting holes at the rear top, 6 mounting holes at the front bottom, and 6 mounting holes at the rear bottom.

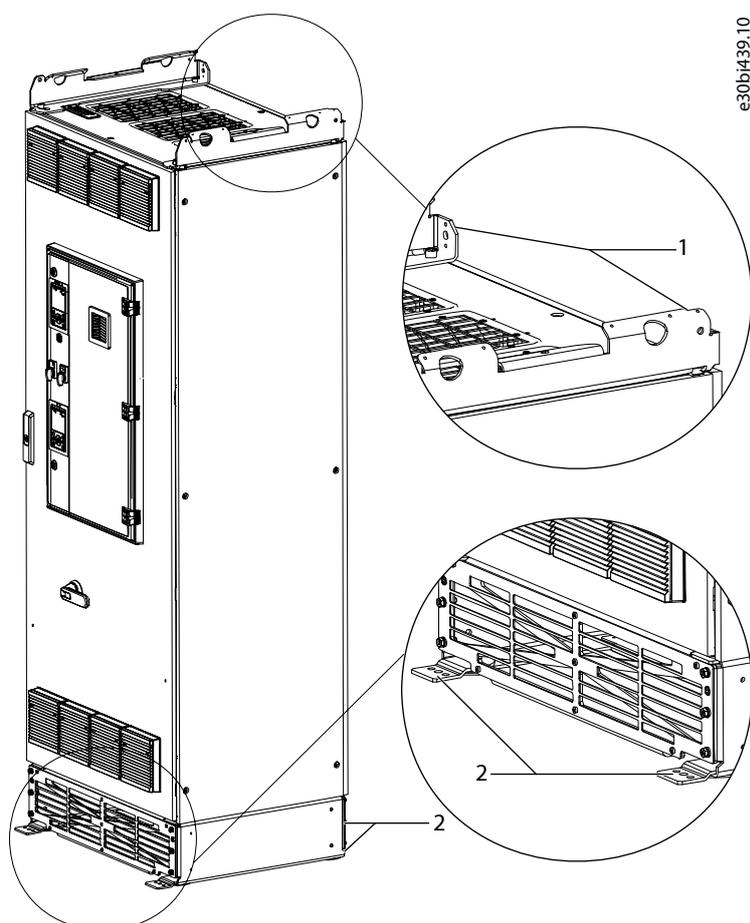


Figure 6: Installing the Enclosed Drive, FE9, FE10

1 Mounting holes at the top

2 Mounting holes at the bottom

## 2.3 Installing the Enclosed Drives Back to Back

The enclosed drives can be installed back to back with other enclosed drives.

1. When installing enclosed drives back to back, leave a minimum of 100 mm (3.94 in) space between them.

Use a spacer between the enclosed drives, for example a steel tube.

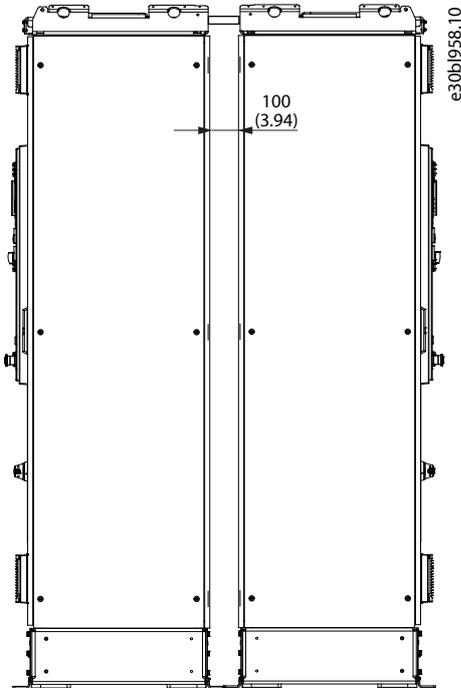


Figure 7: Installation of Cabinets Back to Back, mm (in)

2. Secure the enclosed drive to the floor and to the wall using all the mounting holes.

There are 2 mounting holes at the rear top, 6 mounting holes at the front bottom, and 6 mounting holes at the rear bottom.

## 2.4 Installing the IP21 Top Cover

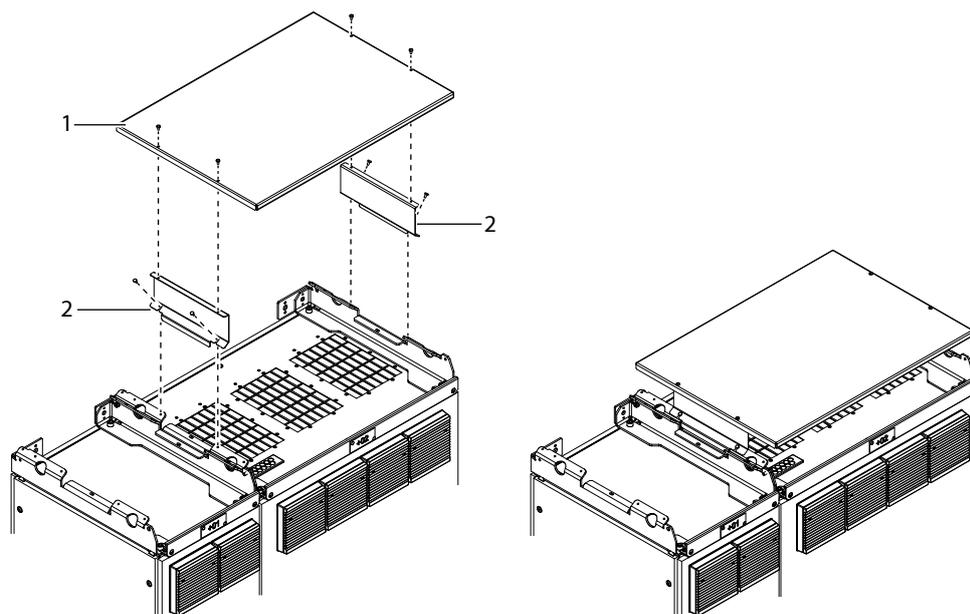
The IP21 top cover is included in the IP21 configuration of the product. The IP21 top cover protects the enclosed drive from dripping water. Install the IP21 top cover on top of the cabinet.

1. Attach the 2 top cover brackets to the lifting bars on top of the cabinet.

Use 4 size M5x10 thread-forming screws.

2. Attach the top cover to the top cover brackets.

Use 4 size M5x10 thread-forming screws.



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Figure 8: Installing the IP21 Top Cover

1 Top cover

2 Top cover brackets

## 2.5 Attaching the Output Cabinet Section

The output cabinet section is delivered separately and must be attached to the other cabinet sections before use.

These instructions apply to frames 2 x AE11 + 2 x IE11 (1260 A, 400 V) and larger.

1. Unpack the packages and unscrew the products from the pallets where they are delivered.
2. Identify the cabinet sections and their order based on the number plates at the top of the cabinet sections.

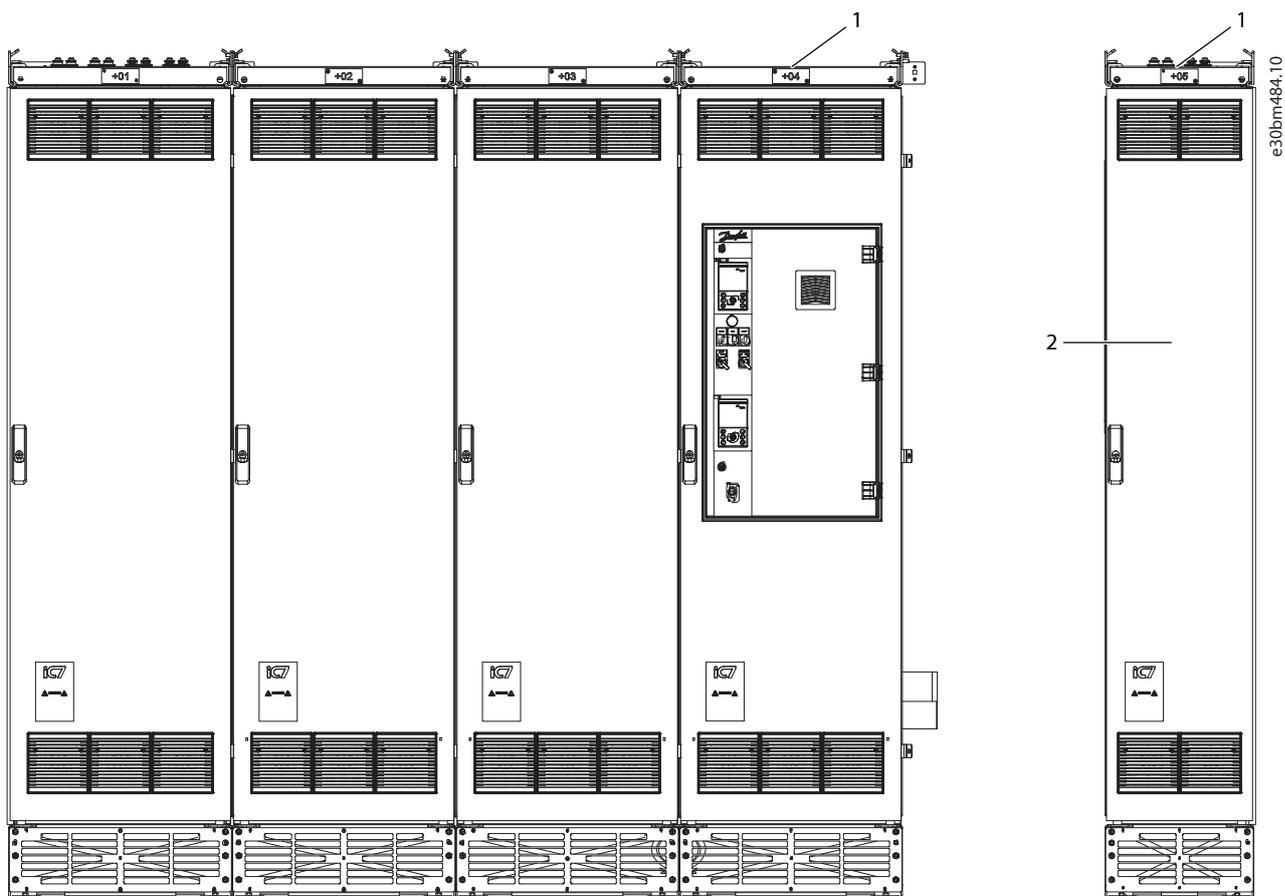


Figure 9: Attaching the Output Cabinet Section to the Other Cabinet Sections (Example)

- |   |               |   |                        |
|---|---------------|---|------------------------|
| 1 | Number plates | 2 | Output cabinet section |
|---|---------------|---|------------------------|

3. Lift the cabinet sections next to each other in numerical order from the smallest to the largest. Leave enough space behind the cabinet sections for working.

See [1.4 Lifting the Enclosed Drive](#).

4. Open the output cabinet section door. Remove the front grill and the touch protection.

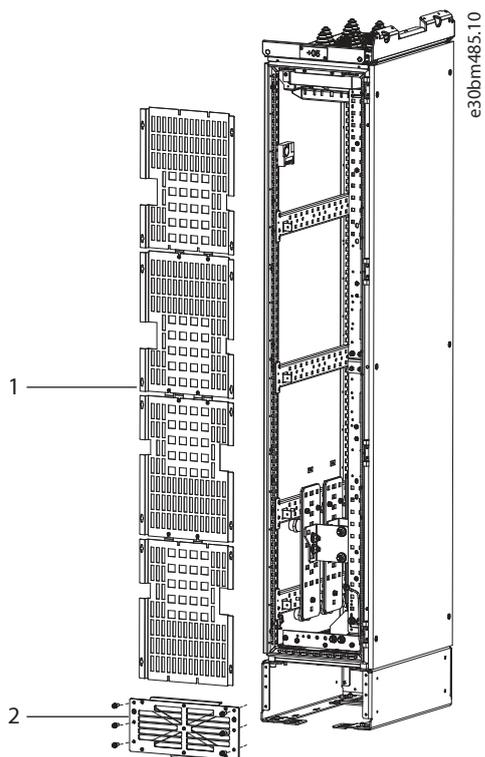


Figure 10: Removing the Front Grill and the Touch Protection

1	Touch protection	2	Front grill
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5. Remove the back wall of the output cabinet section and the back plate of the plinth of the inverter cabinet section.

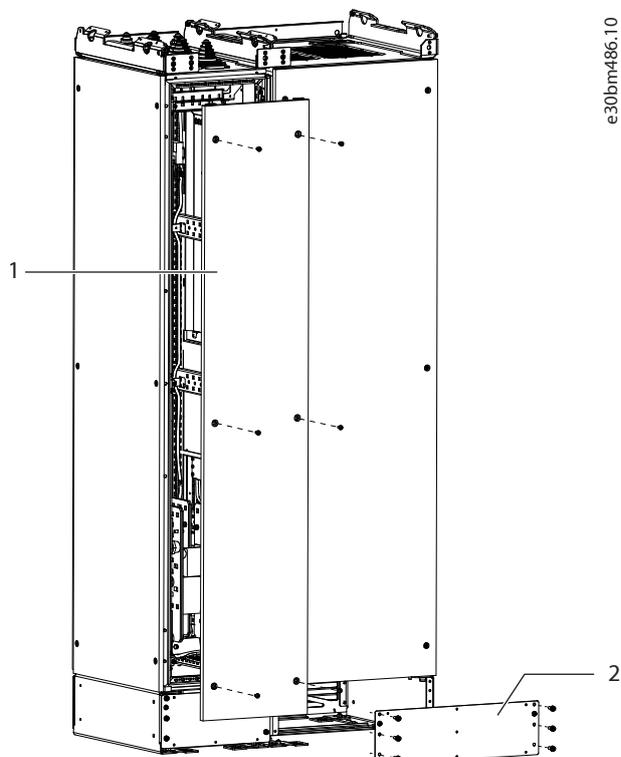


Figure 11: Removing the Back Wall and the Back Plate

1	Back wall	2	Backplate
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6. Install the Rittal seal to the inverter cabinet section. The ends of the seal must meet at the bottom of the cabinet section.

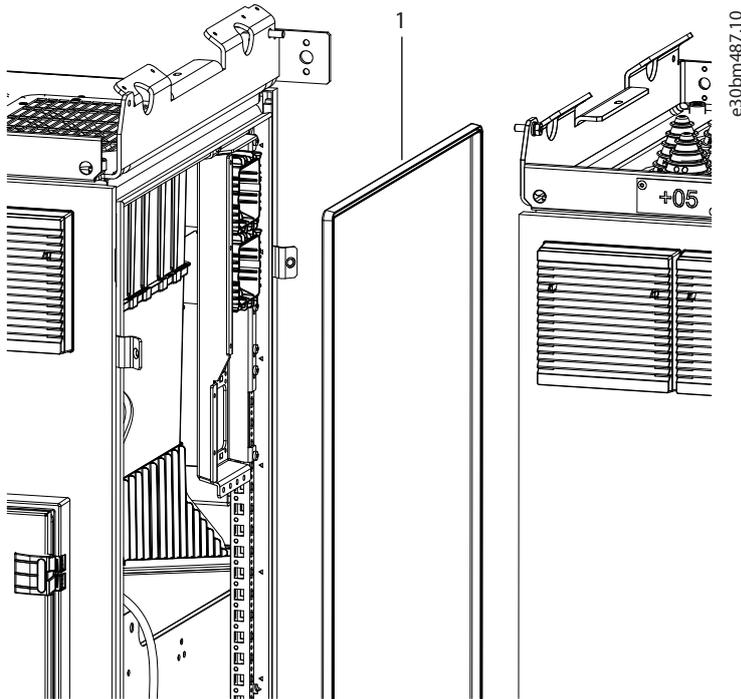


Figure 12: Installing the Seal to the Inverter Cabinet Section

1 Seal

7. Lift the output cabinet section next to the inverter cabinet section.
8. The connection pieces are preinstalled in the inverter cabinet section. Attach them to the output cabinet section.
  - o Use 6 size M6x14 CS screws.
  - o Use the tightening torque of 4 Nm (35 in-lb).

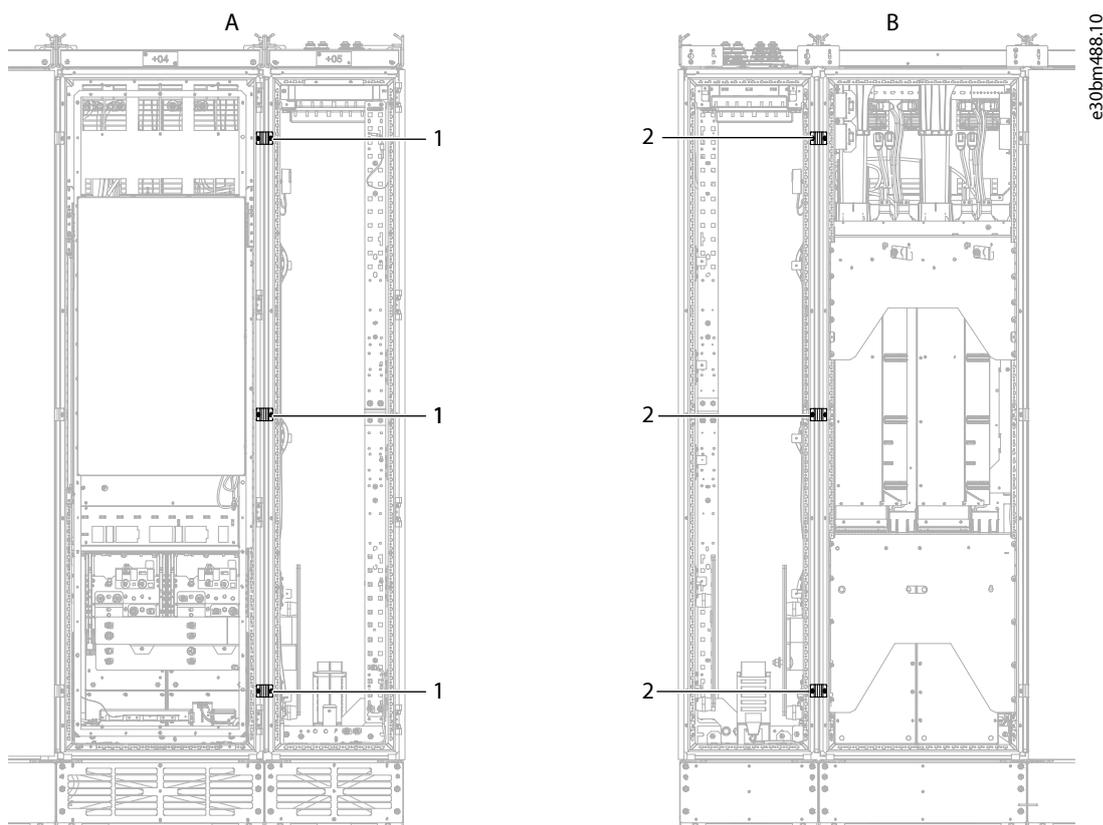


Figure 13: Attach the Connection Pieces to the Output Cabinet Section

A	View from the front	B	View from the back
1	Connection pieces in the front of the cabinet section	2	Connection pieces at the back of the cabinet section

9. Attach the cabinet sections from the plinths.

- o The screws can be found in the accessory bag.
- o Use 4 size M8x25 KOMBI TX screws.
- o Use the tightening torque 20 Nm (180 in-lb).

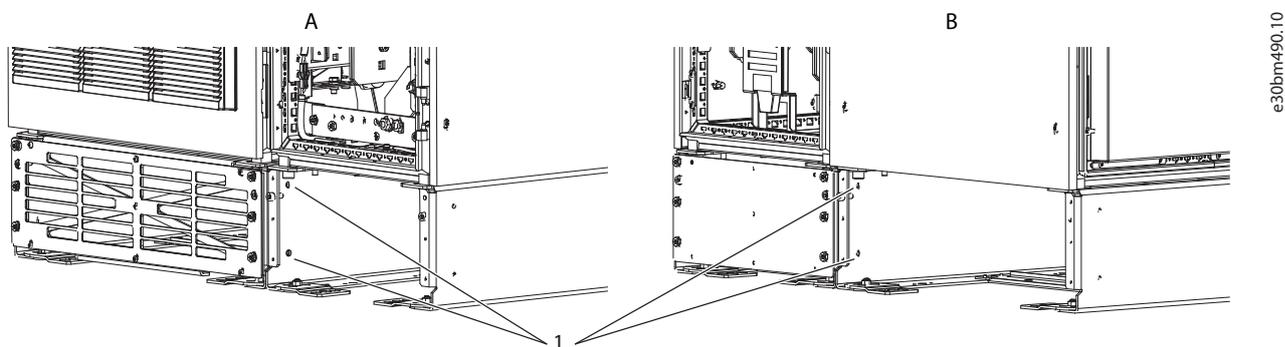


Figure 14: Attaching the Cabinet Sections from the Plinths

A	View from the front	B	View from the back
1	Screw holes		

10. Reattach the front grill and the back plate of the plinths.

Use the tightening torque 20 Nm (180 in-lb).

11. Attach the inverter and output cabinet sections at the top.
  - a. Attach the lifting bars of the inverter and output cabinet sections.

- Use 2 size M8x25 combi screws.
- Use the tightening torque 20 Nm (177 in-lb).

- b. Install the lifting bar connection plate between the inverter and output cabinet sections at the back side.

- Use 4 size M5x10 CS TF screws.
- Use the tightening torque 3 Nm (27 in-lb).

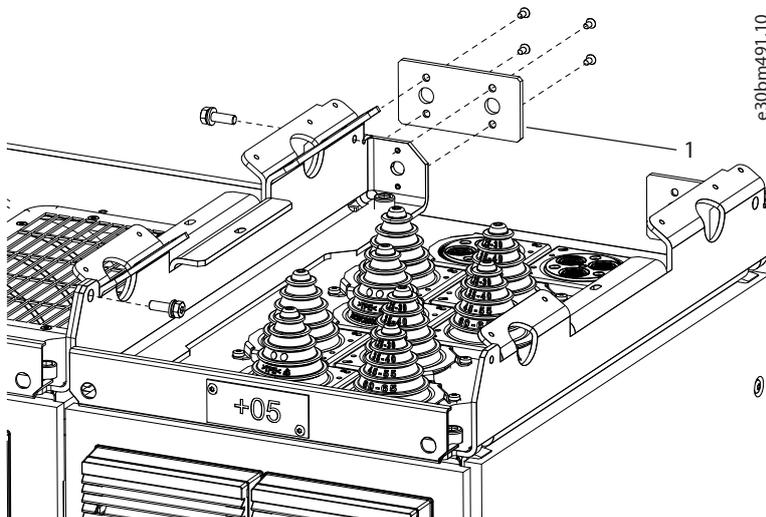


Figure 15: Lifting Bar Connection Plate

1 Lifting bar connection plate

12. If the cabinet heater option +IBCH was ordered, locate the cabinet heater.

The cabinet heater is delivered inside the inverter cabinet section with the wiring connected.

13. Route the cabinet heater under the busbars to the output cabinet section.
14. Install the cabinet heater.

- Use 4 size M5x10 TF screws.
- Use the tightening torque 3 Nm (27 in-lb).

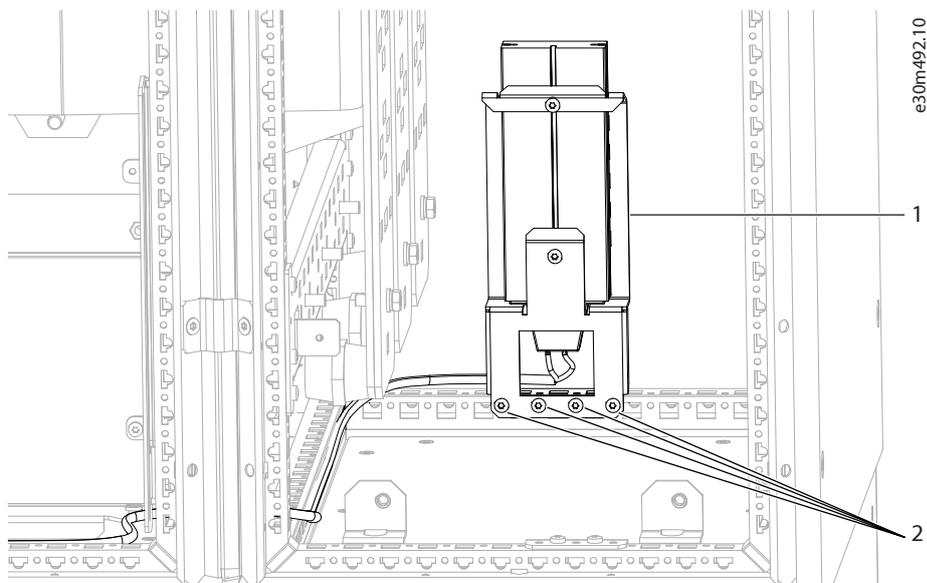


Figure 16: Installing the Cabinet Heater

1	Cabinet heater	2	Screws
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15. Install the PE connection busbar.

- o Use 2 size M8x25 KOMBI TX screws.
- o Use the tightening torque 20 Nm (180 in-lb).

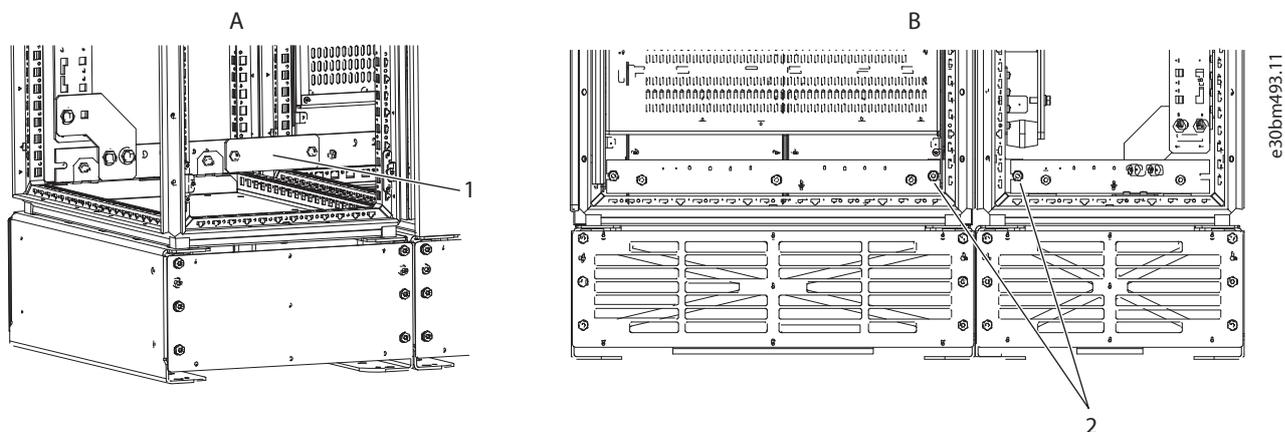


Figure 17: Installing the PE Connection Busbar

A	View from the back	B	View from the front
1	PE connection busbar	2	Screws

16. Connect the inverter busbars to the busbars of the output cabinet section.

- o Use 6 size M12x45 carriage bolts, M12 plain washers, M12 spring washers, and M12 nuts.
- o Use the tightening torque 70 Nm (620 in-lb).

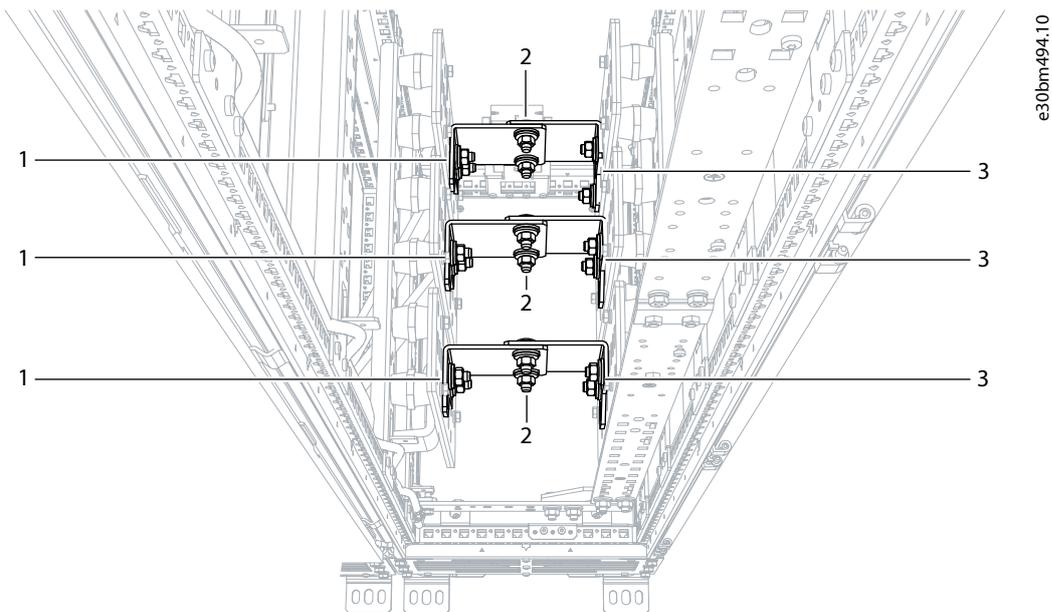


Figure 18: Busbar Connection

- |   |                                       |   |                       |
|---|---------------------------------------|---|-----------------------|
| 1 | Inverter busbars                      | 2 | Connection with bolts |
| 3 | Busbars of the output cabinet section |   |                       |

17. If there are top fans, connect their wiring inside the output cabinet section.

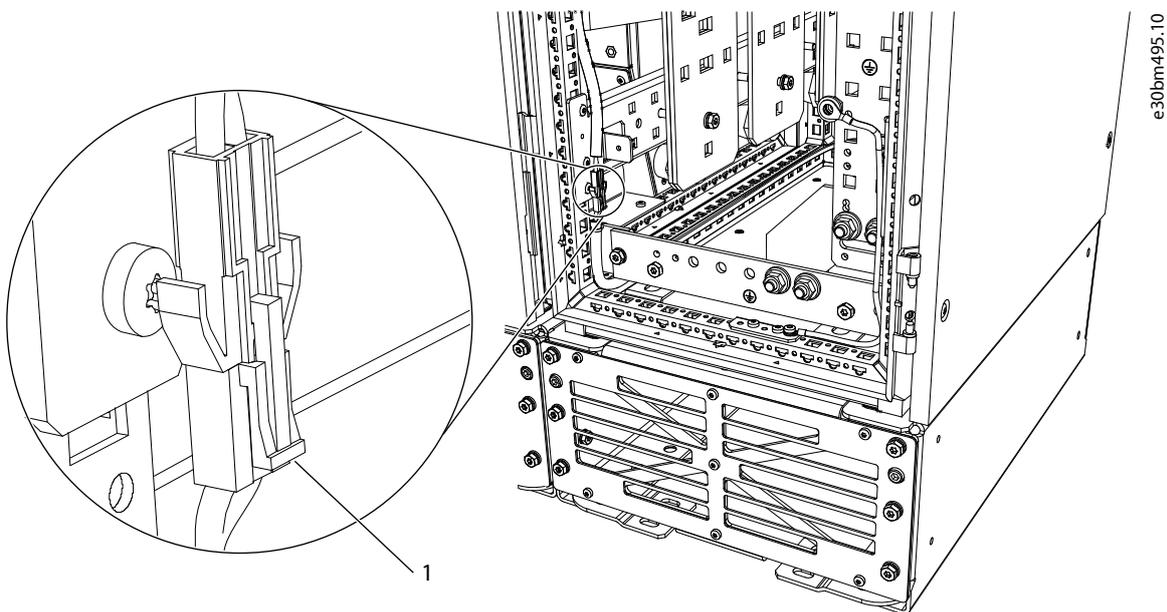


Figure 19: Wiring of the Top Fans

- |   |                  |
|---|------------------|
| 1 | Connection point |
|---|------------------|

18. Reattach the back wall to the output cabinet section with 6 screws.

Use the tightening torque 3 Nm (27 in-lb).

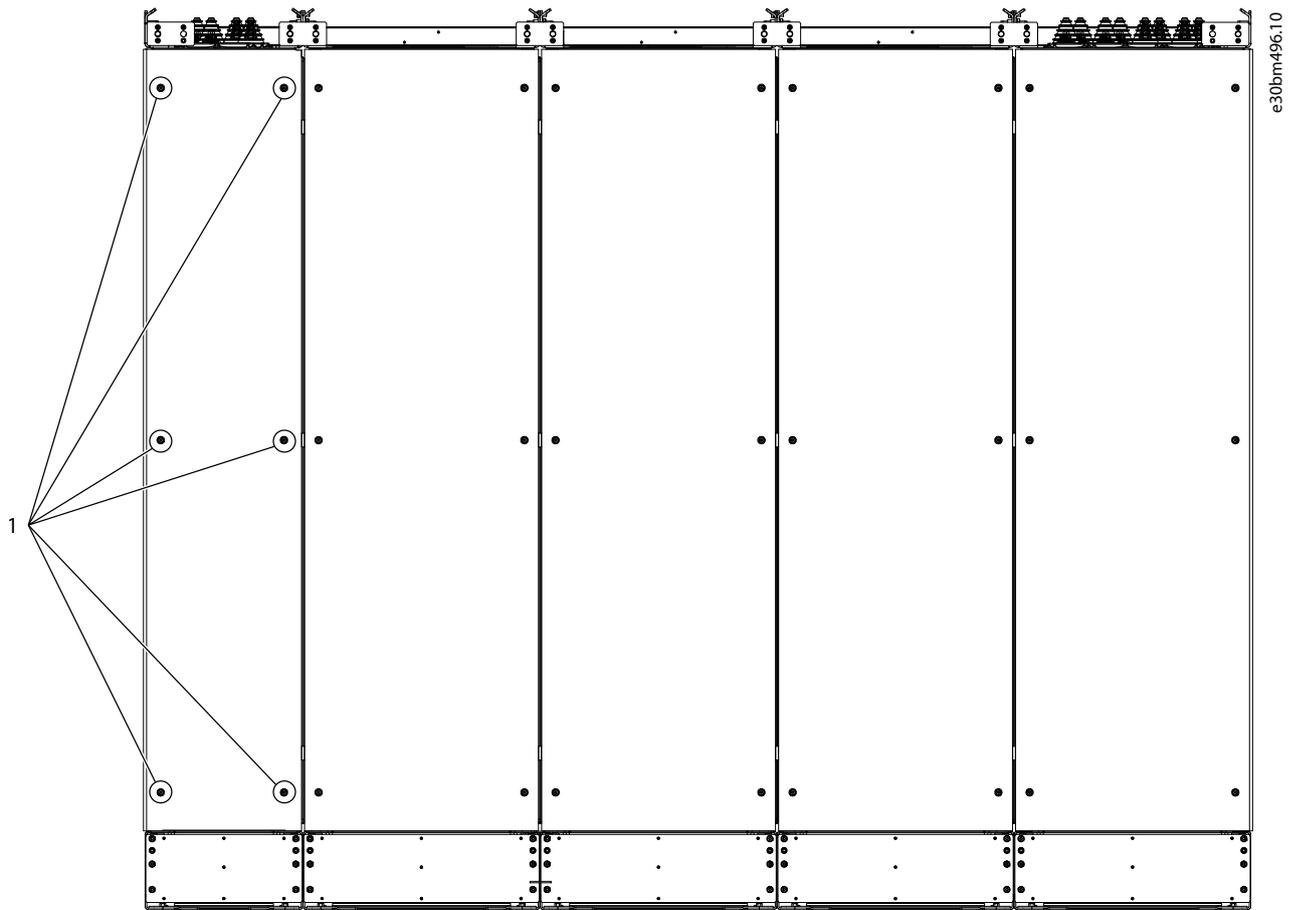


Figure 20: Attaching the Back Wall to the Cabinet Section

1 Screws

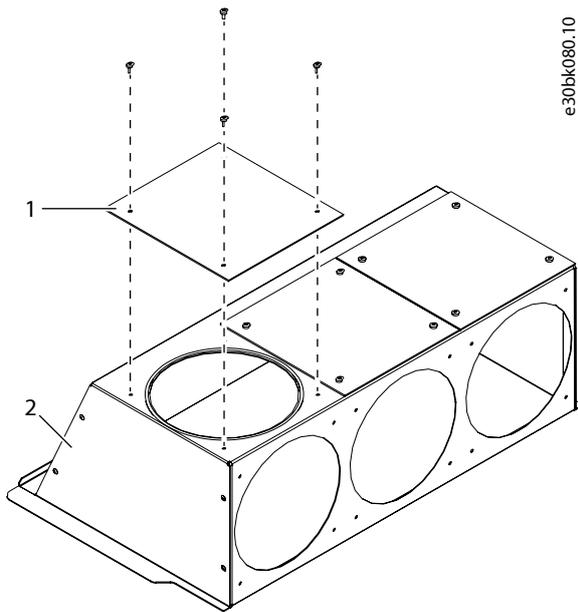
19. Reattach the touch protection.

To comply with the EMC class, attach all the screws that link the 2 touch protections together.

20. Close the cabinet section door.

## 2.6 Installing the Back-channel Cooling Option, +OABC

1. Attach the cover plate of the top hood with 4 screws.



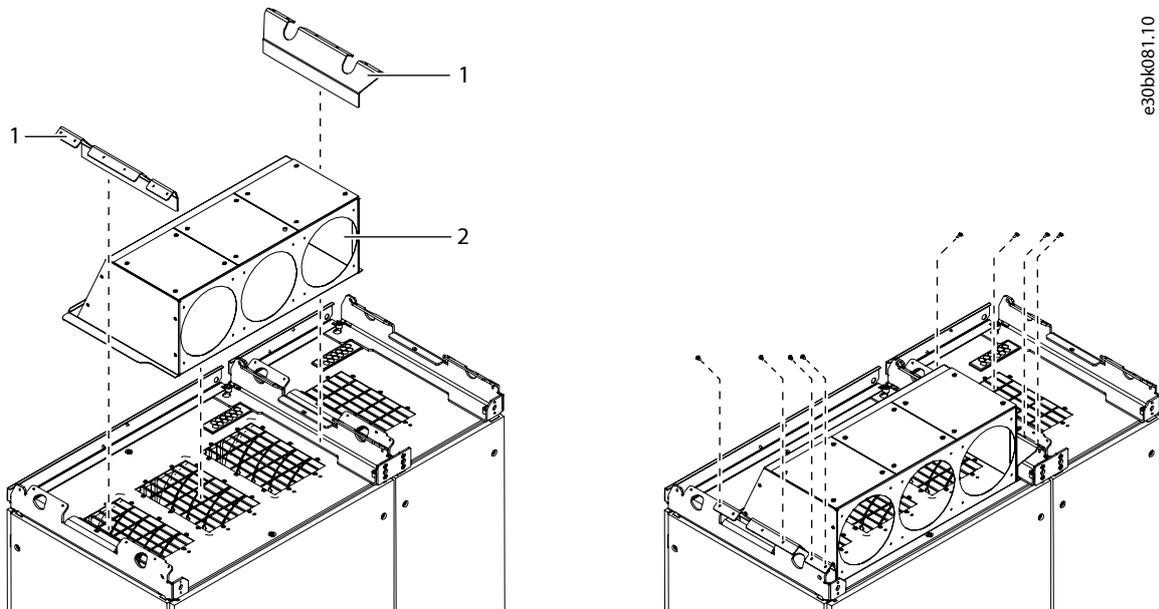
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Figure 21: Installing the Back-channel Cooling Option Cover Plate

1	The cover plate	2	The top hood
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2. Place the top hood on top of the cabinet.
3. Place the brackets so that they press the sides of the top hood down.
  - a. Attach each bracket with 4 screws.

The brackets are identical, each with 6 mounting holes.



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Figure 22: Installing the Back-channel Cooling Option Brackets

1	The brackets	2	The top hood
---	--------------	---	--------------

4. Attach a duct against the top hood to direct the airflow.
5. Adjust the air guide at the bottom.

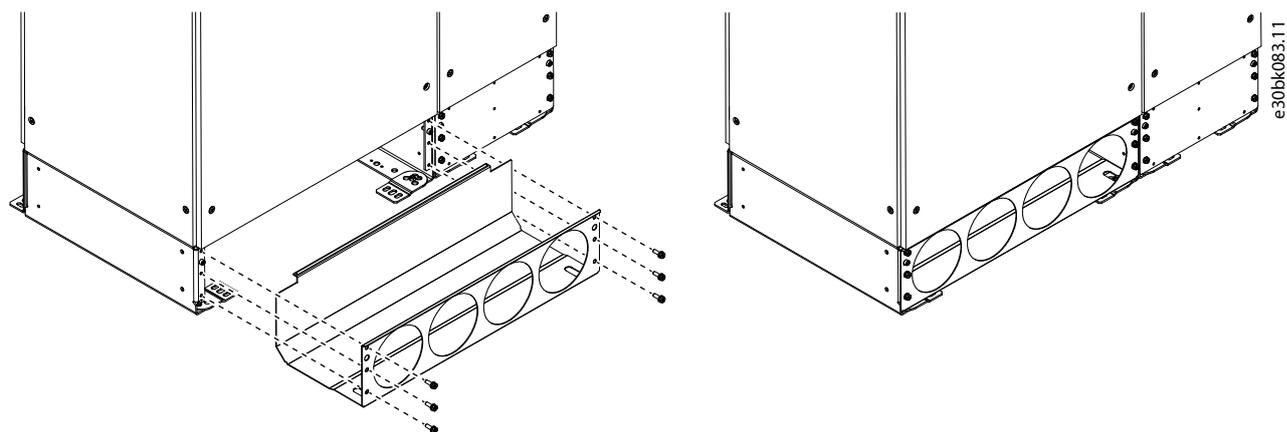


Figure 23: Back-channel Cooling Option Air Guide at the Bottom

## 2.7 Installing the Marine Construction Option, +AFMC

These components of the marine construction option have been pre-installed:

- plinth
- door handle
- door stay.

The spring loops must be installed at the site.

1. Install the spring loops at the back top of the cabinet section before attaching the cabinet section to the wall.

Use an M12x50 bolt, 2 washers, and an M12 nut per spring loop.

Use a tightening torque of minimum 40 Nm (354 in-lb).

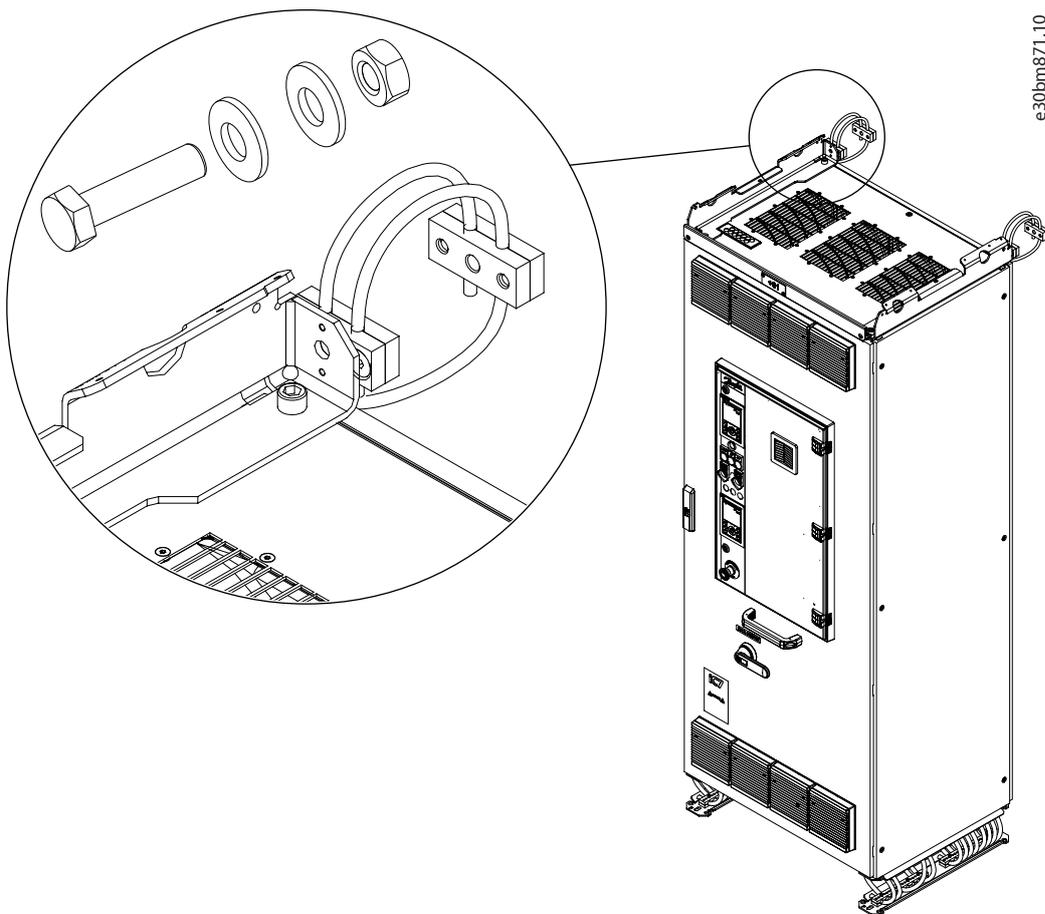


Figure 24: Installing the Spring Loops

## 3 Electrical Installation

### 3.1 Grounding Principles

Ground the product in accordance with applicable standards and directives.

According to IEC 60364-5-54; 543.1, unless local wiring regulations state otherwise, the cross-sectional area of the protective grounding conductor must be at least ½ times of the phase conductor and made of the same material when the phase conductor cross-section is above 35 mm<sup>2</sup> (AWG 2).

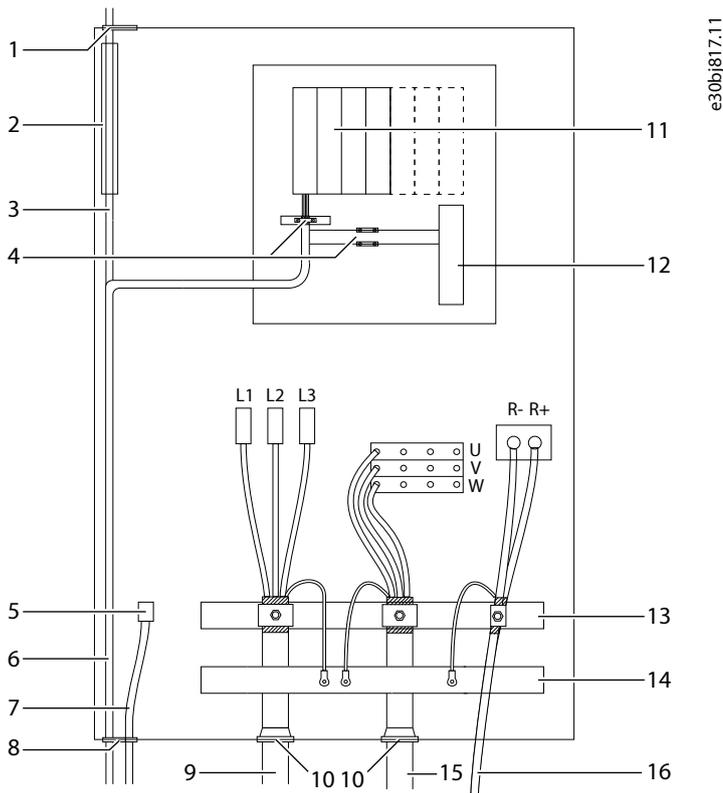
The connection must be fixed.

### 3.2 Prerequisites for Cable Installation

- Before starting, make sure that none of the components of the drive are live. Read all safety precautions in this guide and other documents available for this product.
- Make sure that the motor cables are sufficiently far from other cables.
- The motor cables must cross other cables at an angle of 90°.
- If possible, do not route the motor cables in long parallel lines with other cables.
- If the motor cables are in parallel with other cables, obey the minimum distances (see [Table 1](#)).
- The distances are also valid between the motor cables and the signal cables of other systems.
- The maximum length of shielded motor cables is 150 m (492 ft). If the used motor cables are longer, contact the vendor for more information.
- Check the maximum cable length of the filters.
- Only use symmetrical and shielded motor cables.
- Check the insulation resistance of cables if necessary.

**Table 1: Minimum Distances from Motor Cables to Other Cables**

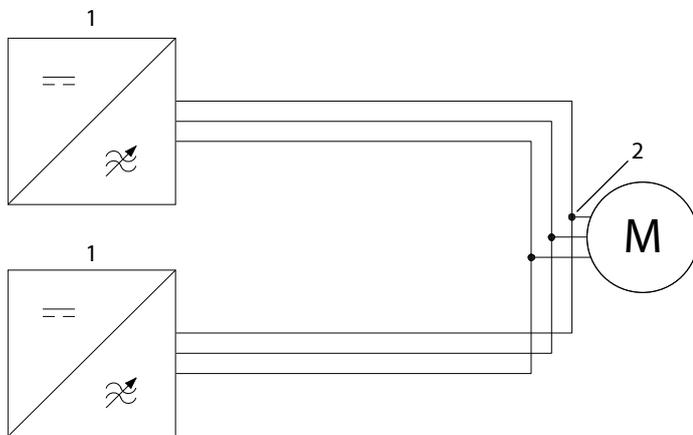
Distance to other cables [m (ft)]	Length of the shielded cable [m (ft)]
0.3 (1.0)	≤ 50 (164)
1.0 (3.3)	≤ 150 (492)



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Figure 25: Cabling Principle

1	Control cable grommet	2	Cable installation tubes, 2 pcs, diameter 32 mm (1.3 in)
3	Control cables from the top	4	Strain relief and cable grounding
5	Auxiliary power terminals	6	Control cables from the bottom
7	Auxiliary power cable	8	Control cable grommet
9	Mains cable	10	Grommets
11	Control board and option boards	12	Terminal blocks
13	Strain relief and 360° grounding	14	PE busbar
15	Motor cable	16	Brake cable



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Figure 26: Recommended Installation

1	Inverter module	2	Common coupling point at the motor terminals
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If the drives are connected in parallel without output filters or only with a common-mode filter, the recommended common coupling point of motor cables is at the motor terminals.

## 3.3 Installing Power Cables

### 3.3.1 Installing the Power Cables through the Bottom

#### DANGER



#### ELECTRIC SHOCK

There are live components behind the touch protections. Lack of touch protections can cause death or serious injury.

- After power cabling, reinstall all touch protections at their original places.

 **IMPORTANT:** This instruction applies for IEC installations.

1. Lift the service table all the way up until it is locked.
2. Strip the mains and motor cables.
3. Make openings for the cables on the bottom of the cabinet.

To keep the protection rating IP54:

- Do not cut too many openings.
- Do not cut too large openings.
- Install a grommet in every opening.
- The grommets must be suited to the output diameter of the cable. The cable diameter is 25–65 mm (1–2.6 in).

4. Lead the power cables through the grommet holders.
5. Peel the cable shield and attach the end to the PE busbar.
6. Use cable clamps to fix the cables.
7. To make a 360° connection, expose the shield of the cables. Use a cable tie to attach the knitted metal mesh tube.

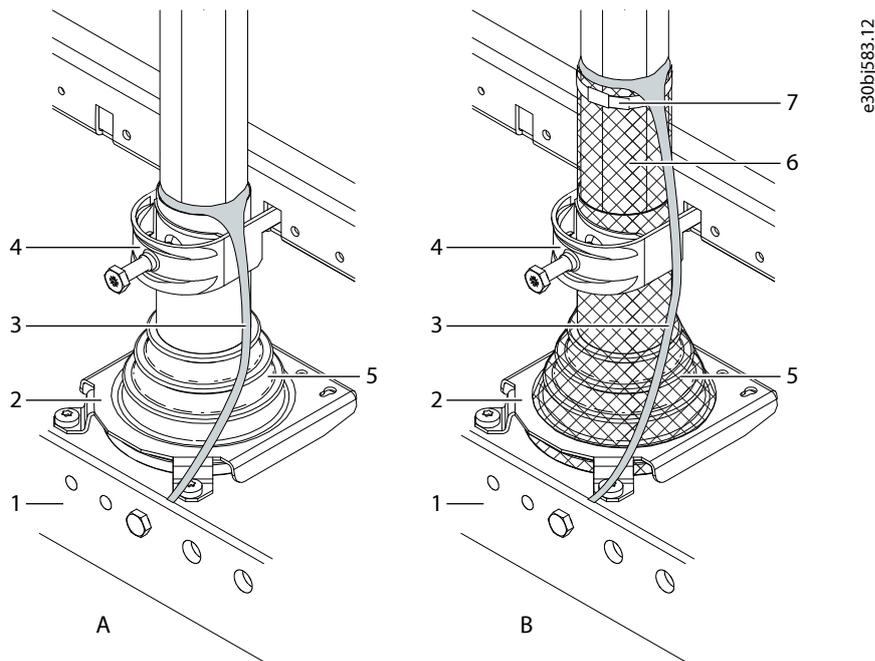


Figure 27: Cabling Methods (IEC)

1	PE busbar	2	Grommet holder
3	Cable shield	4	Cable clamp
5	Grommet	6	Knitted metal mesh tube
7	Cable tie	A	IP54
B	EMC 360° (IP54 and knitted metal mesh tube)		

8. Connect the mains cables to the terminals L1, L2, and L3, and the motor cables to the terminals U, V, and W.

- o The accessories for the mains cables: accessories bag 1 (172F8358)
- o The accessories for the motor cables: accessories bag 2 (172K5228)

See the correct tightening torques in [6.1 Tightening Torques](#).

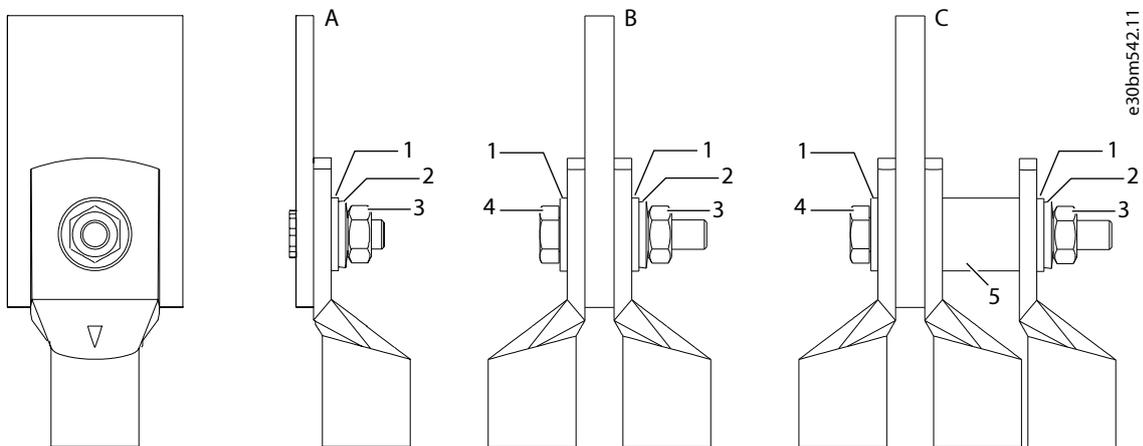


Figure 28: Connecting the Power Cables to the Terminals

A	One power cable: inverter power terminals	B	Two power cables: other power terminals
C	Three power cables	1	Plain washer
2	Spring washer	3	Nut
4	Bolt		

9. Connect the grounding conductors to the PE busbar.

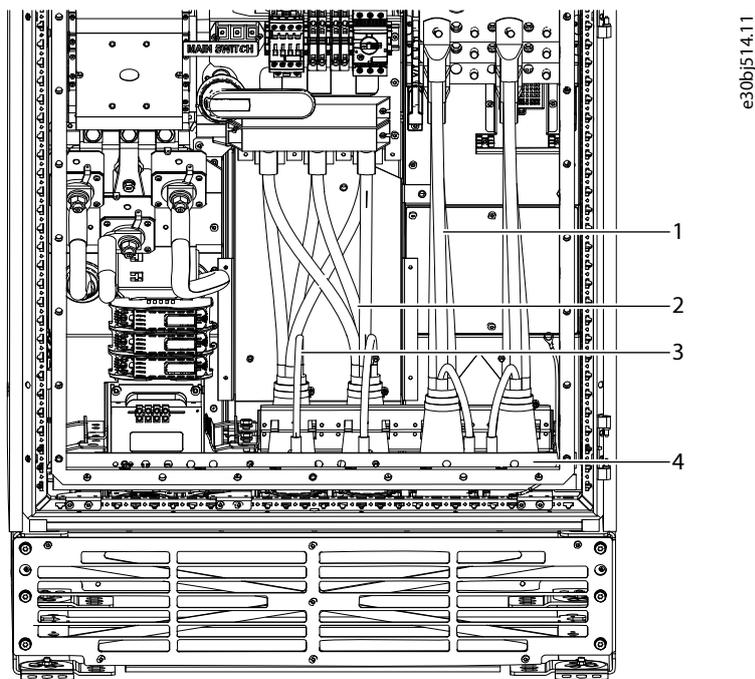


Figure 29: Cabling of the Enclosed Drive

1	Motor cables	2	Mains cables
3	Grounding conductor	4	PE busbar

10. Release and lower the service table.

### 3.3.2 Installing the Power Cables through the Top (+KCIT or +KDOT)

Use these instructions with the options Top-entry +KCIT and +KDOT.

**DANGER**

**ELECTRIC SHOCK**

There are live components behind the touch protections. Lack of touch protections can cause death or serious injury.

- After power cabling, reinstall all touch protections at their original places.

**!** IMPORTANT: This instruction applies for IEC installations.

1. Strip the mains and motor cables.
2. Make openings for the cables in the grommets at the top of the cabinet.

To keep the protection rating IP54:

- Do not cut too many openings.
- Do not cut too large openings.
- Install a grommet in every opening.
- The grommets must be suited to the output diameter of the cable. The cable diameter is 25–65 mm (1–2.6 in).

3. Lead the power cables through the grommet holders.
4. Peel the cable shield and attach the end to the PE busbar.
5. Use cable clamps to fix the cables.
6. To make a 360° connection, expose the shield of the cables. Use a cable tie to attach the knitted metal mesh tube.

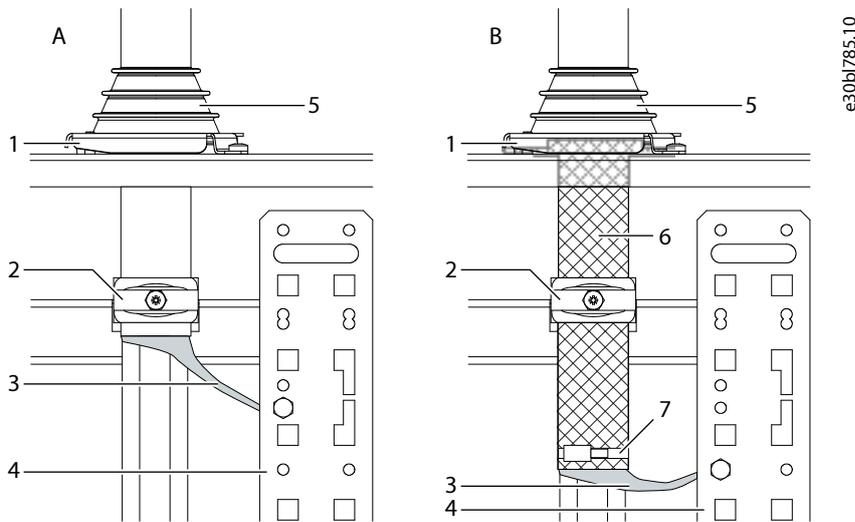


Figure 30: Cabling Methods (IEC)

1	Grommet holder	2	Cable clamp
3	Cable shield	4	PE busbar
5	Grommet	6	Knitted metal mesh tube
7	Cable tie	A	IP54
B	EMC 360° (IP54 and knitted metal mesh tube)		

7. Connect the mains cables to the terminals L1, L2, and L3, and the motor cables to the terminals U, V, and W.

See the correct tightening torques in [6.1 Tightening Torques](#).

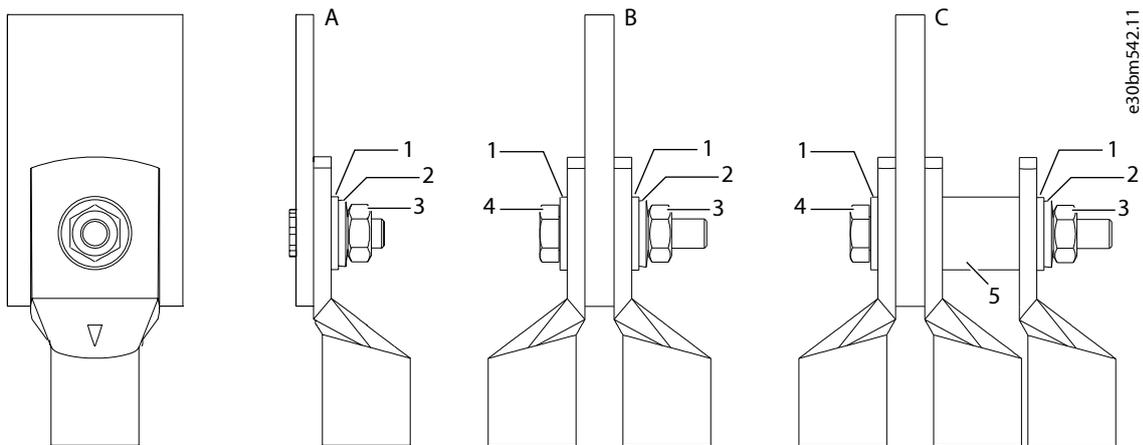


Figure 31: Connecting the Power Cables to the Terminals

A	Inverter power terminals	B	Other power terminals
C	Terminals with 3 power cables	1	Plain washer
		2	Spring washer
		3	Nut
		4	Bolt
		5	Copper cable lug spacer

8. Connect the grounding conductors to the PE busbar.

### 3.3.3 Installing the Power Cables through the Bottom, Gland Plate +KFCP

**DANGER**



**ELECTRIC SHOCK**

There are live components behind the touch protections. Lack of touch protections can cause death or serious injury.

- After power cabling, reinstall all touch protections at their original places.

**IMPORTANT:** This instruction applies for UL installations. The UL variant of the enclosed drive includes a gland plate (+KFCP) for free cutting of the cable entry holes.

1. Lift the service table all the way up until it is locked.
2. Strip the mains and motor cables.
3. Remove the M8 screws of the cable supports. Remove the cable supports.

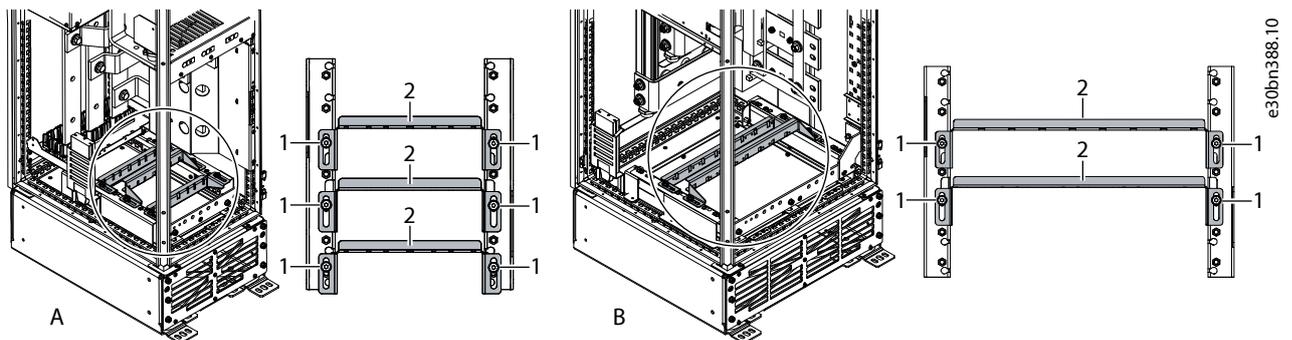


Figure 32: Removing the Cable Supports

1	Screws	2	Cable supports
A	400 mm wide module cabinet section	B	600 mm wide module cabinet section

4. Remove the M5 screws and then the gland plate from the bottom of the cabinet section.

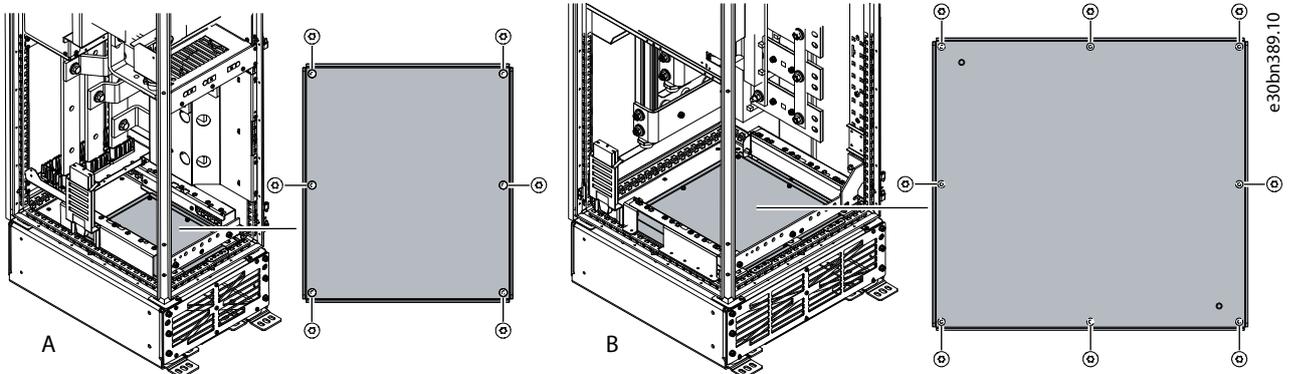


Figure 33: Removing the Gland Plate from the Bottom of the Module Cabinet Section

A	400 mm wide module cabinet section	B	600 mm wide module cabinet section
---	------------------------------------	---	------------------------------------

5. Make openings for the cables on the gland plate.

To keep the protection rating IP54:

- Do not cut too many openings.
- Do not cut too large openings.
- Install a grommet in every opening.
- The grommets must be suited to the output diameter of the cable. The cable diameter is 25–65 mm (1–2.6 in).

6. Reinstall the gland plate.
7. Reinstall the cable supports.
8. Lead the power cables through the grommet holders.
9. Peel the cable shield and attach the end to the PE busbar.
10. Use cable clamps to fix the cables.
11. To make a 360° connection, expose the shield of the cables. Use a cable tie to attach the knitted metal mesh tube.

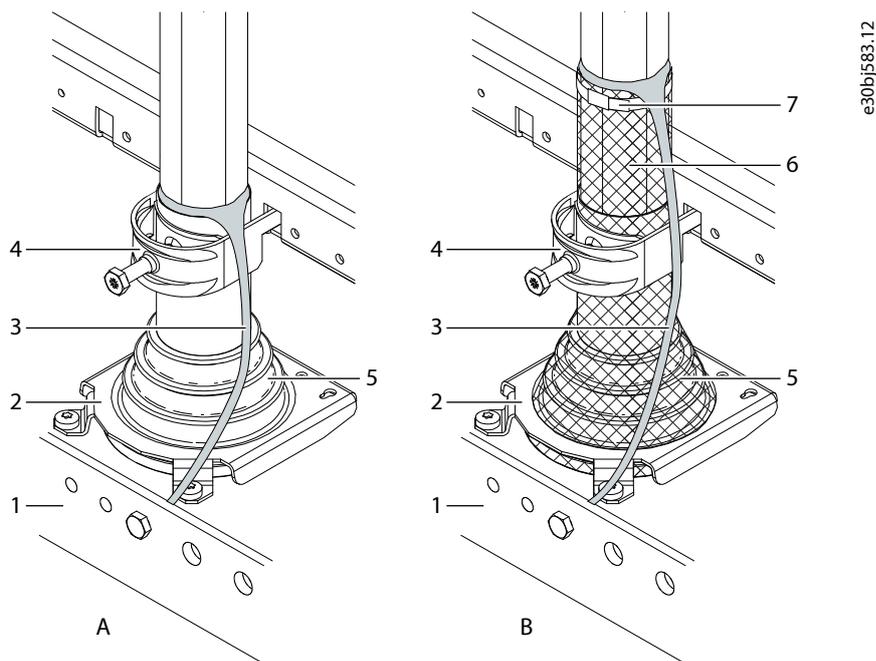


Figure 34: Cabling Methods (IEC)

1	PE busbar	2	Grommet holder
3	Cable shield	4	Cable clamp
5	Grommet	6	Knitted metal mesh tube
7	Cable tie	A	IP54
B	EMC 360° (IP54 and knitted metal mesh tube)		

12. Connect the mains cables to the terminals L1, L2, and L3, and the motor cables to the terminals U, V, and W.

- o The accessories for the mains cables: accessories bag 1 (172F8358)
- o The accessories for the motor cables: accessories bag 2 (172K5228)

See the correct tightening torques in [6.1 Tightening Torques](#).

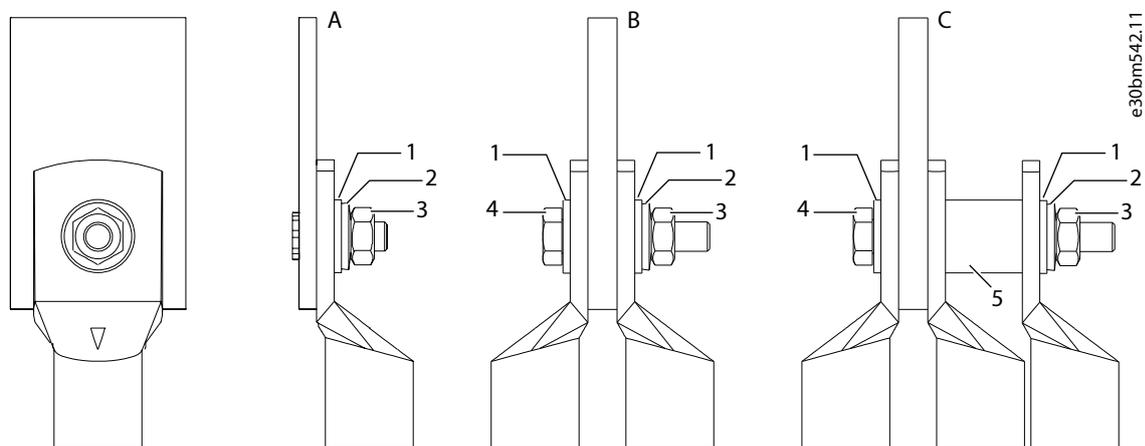


Figure 35: Connecting the Power Cables to the Terminals

A	One power cable: inverter power terminals	B	Two power cables: other power terminals
C	Three power cables	1	Plain washer
2	Spring washer	3	Nut
4	Bolt		

13. Connect the grounding conductors to the PE busbar.

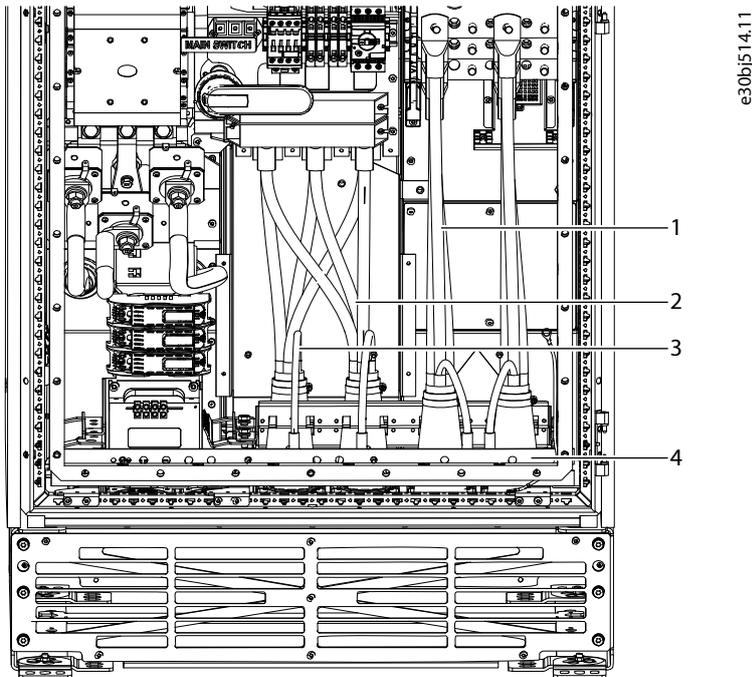


Figure 36: Cabling of the Enclosed Drive

1	Motor cables	2	Mains cables
3	Grounding conductor	4	PE busbar

14. Release and lower the service table.

### 3.3.4 Installing the Power Cables through the Top, Gland Plate +KFCP

Use these instructions with the options Top-entry +KCIT and +KDOT.

#### ⚠ DANGER



#### ELECTRIC SHOCK

There are live components behind the touch protections. Lack of touch protections can cause death or serious injury.

- After power cabling, reinstall all touch protections at their original places.

**!** IMPORTANT: This instruction applies for UL installations. The UL variant of the enclosed drive includes a gland plate (+KFCP) for free cutting of the cable entry holes.

1. Strip the mains and motor cables.
2. Remove the M5 screws of the gland plate.

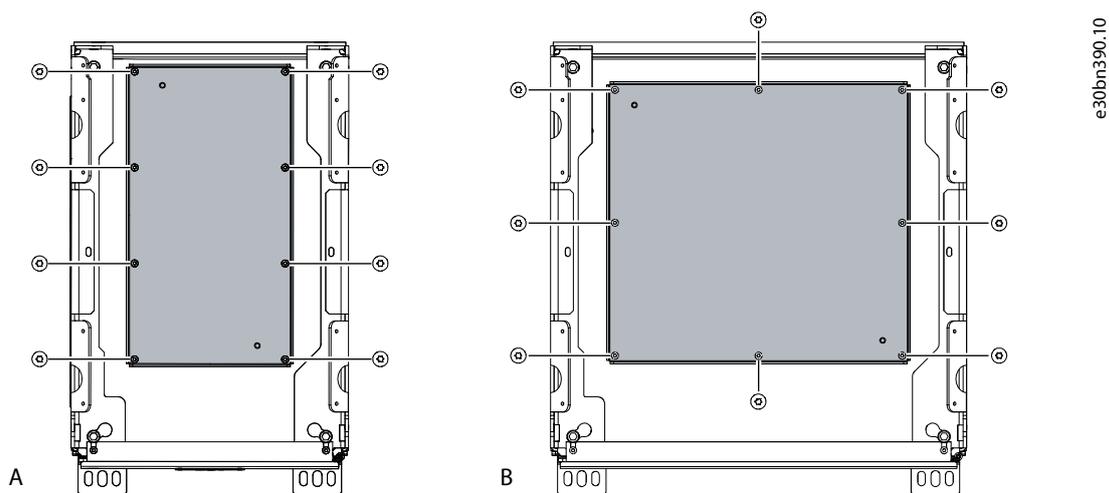


Figure 37: Releasing the Gland Plate from the Roof of the Module Cabinet Section

A    400 mm wide module cabinet section	B    600 mm wide module cabinet section
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- Open the gland plate. Remove the M6 nut to release the grounding wire.

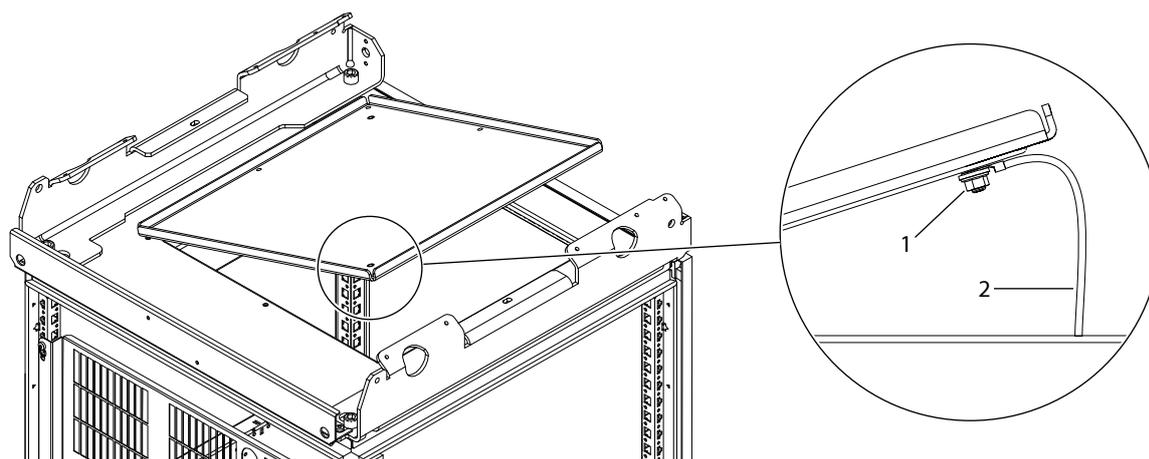


Figure 38: Opening the Gland Plate and Releasing the Grounding Wire

1    Nut	2    Grounding wire
----------	---------------------

- Remove the gland plate.
- Make openings for the cables on the gland plate.

To keep the protection rating IP54:

- Do not cut too many openings.
- Do not cut too large openings.
- Install a grommet in every opening.
- The grommets must be suited to the output diameter of the cable. The cable diameter is 25–65 mm (1–2.6 in).

- Reattach the grounding wire.
- Reinstall the gland plate.
- Lead the power cables through the grommet holders.

9. Peel the cable shield and attach the end to the PE busbar.
10. Use cable clamps to fix the cables.
11. To make a 360° connection, expose the shield of the cables. Use a cable tie to attach the knitted metal mesh tube.

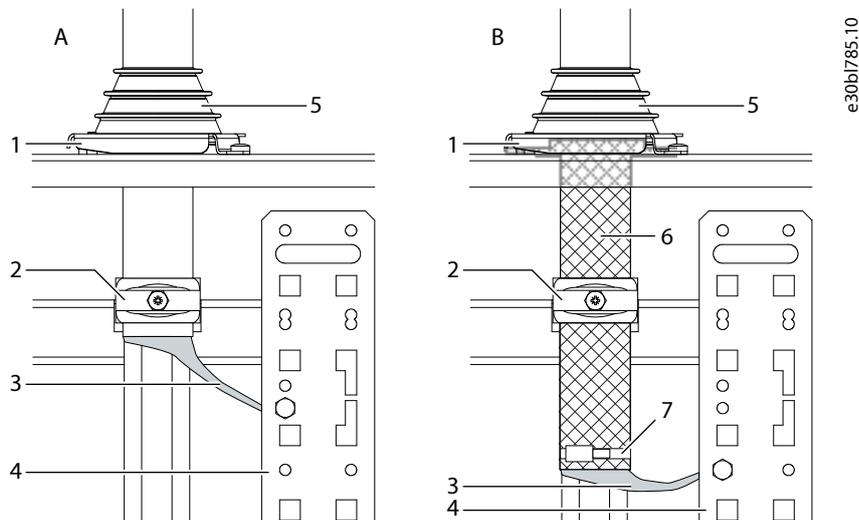


Figure 39: Cabling Methods (IEC)

1	Grommet holder	2	Cable clamp
3	Cable shield	4	PE busbar
5	Grommet	6	Knitted metal mesh tube
7	Cable tie	A	IP54
B	EMC 360° (IP54 and knitted metal mesh tube)		

12. Connect the mains cables to the terminals L1, L2, and L3, and the motor cables to the terminals U, V, and W.

See the correct tightening torques in [6.1 Tightening Torques](#).

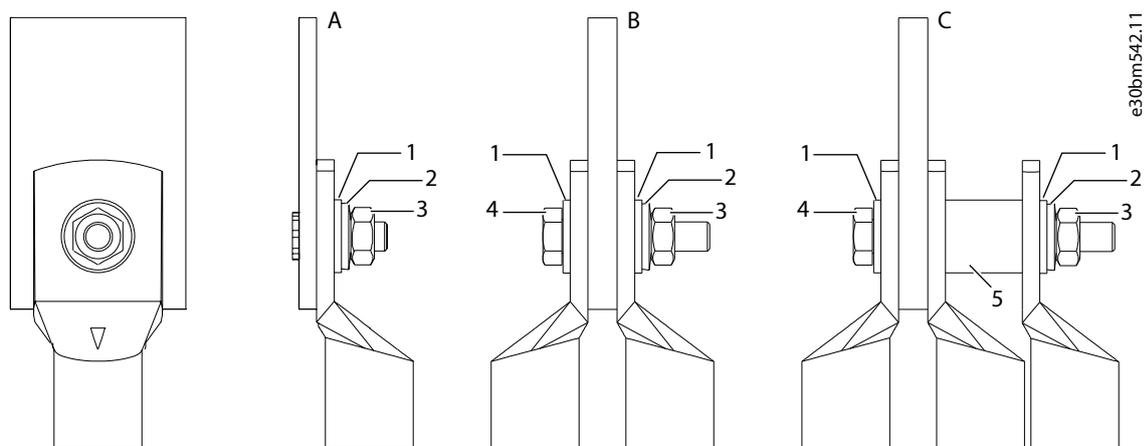


Figure 40: Connecting the Power Cables to the Terminals

A	Inverter power terminals	B	Other power terminals
C	Terminals with 3 power cables	1	Plain washer

2	Spring washer	3	Nut
4	Bolt	5	Copper cable lug spacer

13. Connect the grounding conductors to the PE busbar.

### 3.3.5 Installing the Power Cables in the Inverter Module Cabinet, Gland Plate +KFCP

The UL variant of the enclosed drive includes a gland plate (+KFCP) for free cutting of the cable entry holes.

Some grounding wires are connected to the PE busbar. Reconnect these grounding wires after installation.

1. Remove the PE busbar.

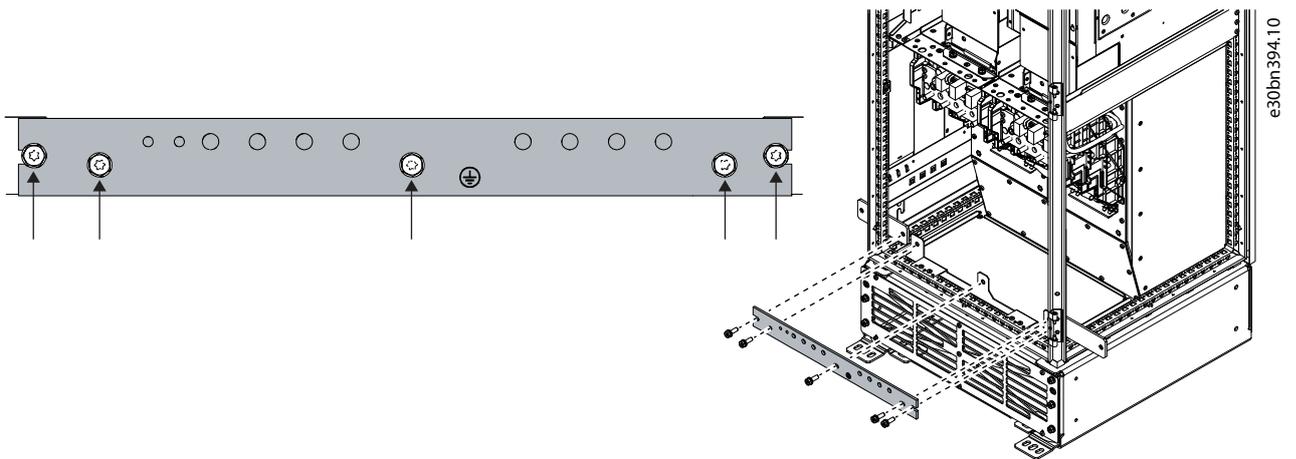


Figure 41: Removing the PE Busbar

2. Remove the gland plate from the bottom of the cabinet.

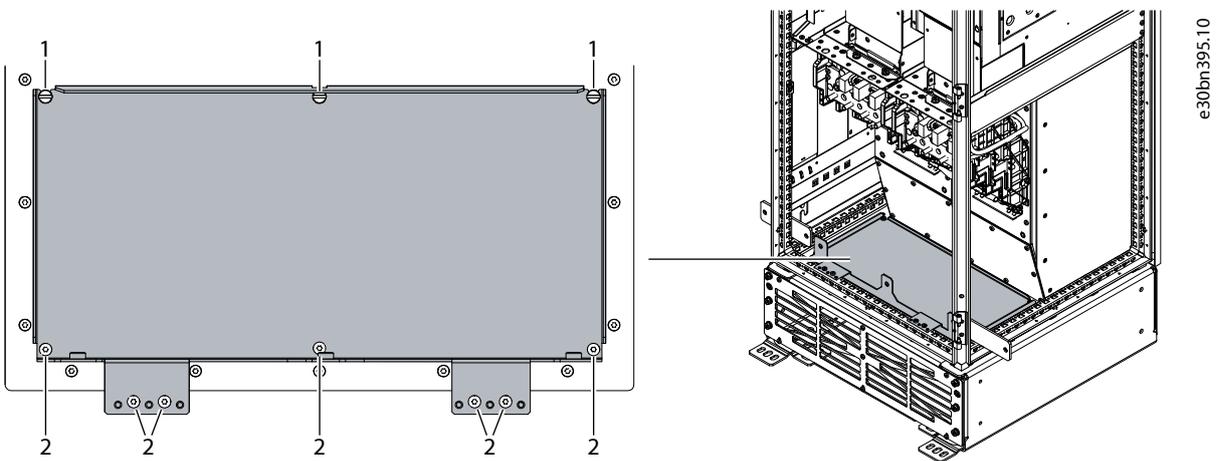


Figure 42: Removing the Gland Plate from the Bottom of the Inverter Cabinet

1	Screws to be loosened	2	Screws to be removed
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3. Continue cabling as in [3.3.3 Installing the Power Cables through the Bottom, Gland Plate +KFCP](#).

### 3.4 Installing the Brake Cables, FE9, FE10

1. Strip the brake cables.
2. To make a 360° connection, expose the shield of the cables.
3. Peel the cable shield and attach the end to the PE busbar.

4. Use cable clamps to fix the cables.
5. Find the brake terminals in the system module inside the cabinet. Connect the brake cables to the brake terminals.

Use M10 bolts.

Use the tightening torque 19 Nm (168 in-lb).

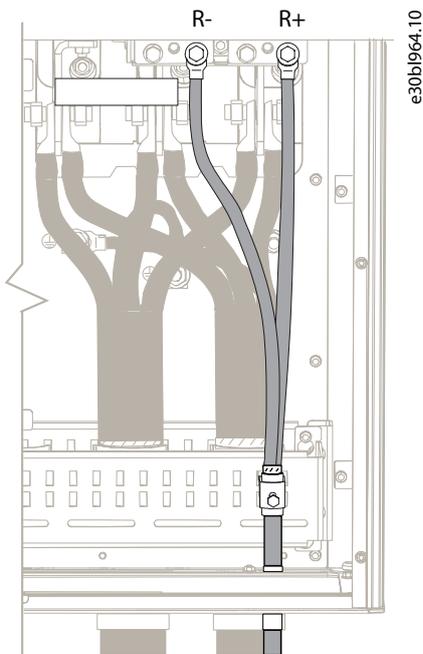


Figure 43: Installing the Brake Cables in the Enclosed Drive, FE9, FE10

### 3.5 Power Cabling Floor Components, UL

The UL variant of the enclosed drive includes a sealed bottom plate for free cutting of the cable entry holes. Some grounding wires are connected to the PE busbar. Reconnect these grounding wires after installation.

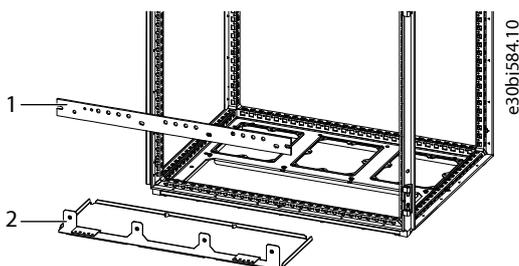


Figure 44: UL Floor Components

- |             |  |
|-------------|--|
| 1 PE busbar | 2 Plate for cutting of the cable entry holes |
|-------------|--|

### 3.6 Checking the Settings for the Auxiliary AC Voltage Transformer (+IHAT)

By default, the auxiliary AC voltage transformer (+IHAT) is connected by the terminal 500.

1. If the mains voltage is other than 500 V, move the wire to another primary terminal.

Select the correct primary terminal based on the mains voltage: 380, 400, 440, 460, or 480.

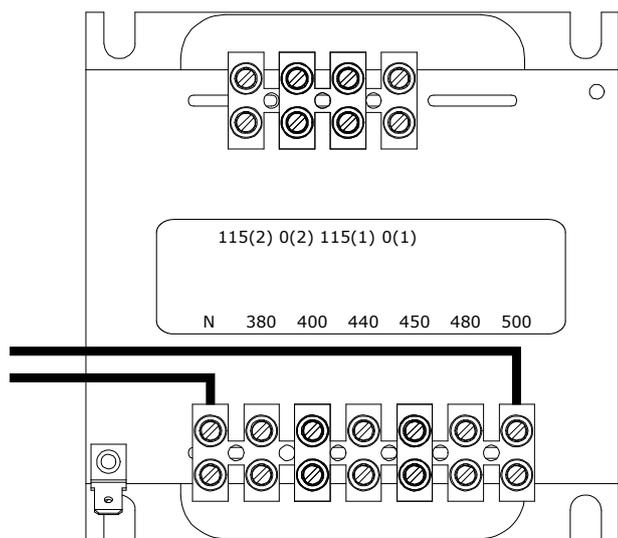


Figure 45: Default Settings for Auxiliary AC Voltage Transformer (+IHAT)

### 3.7 Parameter Settings for IT Mains

If the drive is supplied from an isolated mains (IT mains, floating delta, or grounded delta) or TT/TN-S mains with grounded leg, it is recommended to check the parameter settings of the grid type and RFI. The filter capacitors between the chassis and the DC link should be cut off via the parameters to avoid damage to the DC link and to reduce the ground capacity currents.

See more information in the *iC7 Series Industry Application Guide*.

Keep the filter capacitors between the chassis and the DC link in these cases:

- When optimal EMC performance is needed.
- When parallel motors are used.
- When the motor cable is longer than 25 m (82 ft).

It is important to use isolation monitors that are rated for use together with power electronics.

## 4 Control and Option Installation

### 4.1 Control Compartment Connections

Table 2: Control Compartment Connections

Terminal	Function	Connector type
X1	Ethernet port	RJ45
X2	Ethernet port	RJ45
X0	Ethernet port (used for the PC tool)	RJ45 (Cabled to the door -XD3.1 Ethernet terminal)
Micro SD	MicroSD card	Micro SD
X62	24 V DC supply	2 x 3 spring force connector 0.2–1.5 mm <sup>2</sup>
X33	STO terminal	1 x 10 spring force connector 0.2–1.5 mm <sup>2</sup>
OptionBus	OptionBus (internal connection)	Custom
X80	Fiber optic link to power unit or star coupler board	LC-duplex
X9	Control panel terminal	iX Industrial
RTC battery	RTC battery	BR1632 (battery type)

Table 3: STO Terminal Signals (X33, XD2.2)

Terminal on the control board	Function	Terminal block	Description
41A <sup>(1)</sup>	24 V	-XD2.2:41	+ 24 V DC Output
41B <sup>(1)</sup>	24 V	-XD2.2:41	+ 24 V DC Output
42	S.INA+	-XD2.2:42	+ Safe Input Channel A
43	S.INB+	-XD2.2:43	+ Safe Input Channel B
44	S.FB+	-XD2.2:44	+ STO Feedback
45A <sup>(1)</sup>	GND	-XD2.2:45	0 V/GND
45B <sup>(1)</sup>	GND	-XD2.2:45	0 V/GND
46	S.INA-	-XD2.2:46	- Safe Input Channel A
47	S.INB-	-XD2.2:47	- Safe Input Channel B
48	S.FB-	-XD2.2:48	- STO Feedback

1) Terminals 41A, 41B, 45A, and 45B have double pins to make connections easier.

For more information on the STO safety function, see the *iC7 Series Functional Safety Operating Guide, Air-cooled and Liquid-cooled System Modules* (AE10, AE11, IE10, and IE11) or the *iC7-Automation Functional Safety Operating Guide, Frequency Converters* (FE9 and FE10).

Table 4: 24 V DC Supply Signals (X62, XD2.3)

Terminal on the control board	Function	Terminal block	Description
101	+24 V input	-XD2.3:101	Internal +24 V DC, 60 W control supply
102	GND	-XD2.3:102	Power supply ground

Table 4: 24 V DC Supply Signals (X62, XD2.3) - (continued)

Terminal on the control board	Function	Terminal block	Description
61	+24 V external input	-XD2.3:61	External +24 V DC control supply, maximum 10 A. Must be fuse-protected. Possible to daisy chain for multiple controllers.
62	GND	-XD2.3:62	Power supply ground
63	+24 V output	-XD2.3:63	+24 V DC output for daisy chain, only available when the +24 V DC external input control supply is used.
64	GND	-XD2.3:64	Power supply ground

## 4.2 I/O and Relay Option Connections

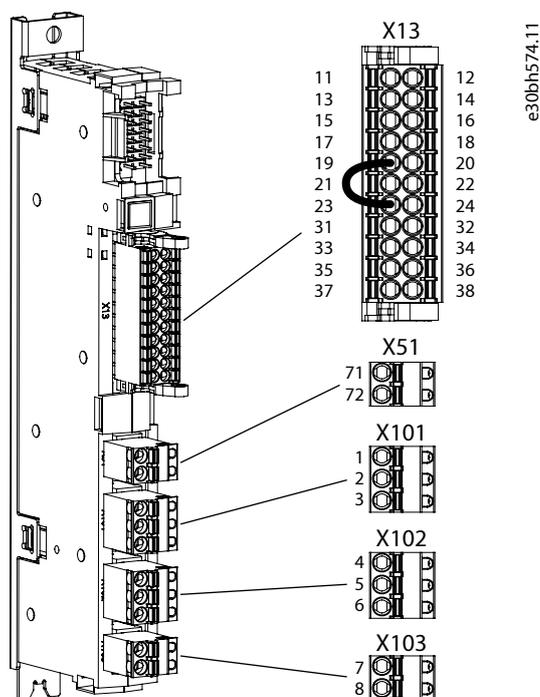


Figure 46: I/O and Relay Option Terminal Block and Terminal Numbering

Table 5: I/O and Relay Option Signals

Terminal	Function	Connector type
X13	I/O terminal	2 x 11 spring force connector 0.2–1.5 mm <sup>2</sup>
X51	Thermistor input	1 x 2 spring force connector 0.25–2.5 mm <sup>2</sup>
X101	Relay 1	1 x 3 spring force connector 0.25–2.5 mm <sup>2</sup>
X102	Relay 2	1 x 3 spring force connector 0.25–2.5 mm <sup>2</sup>
X103	Relay 3	1 x 2 spring force connector 0.25–2.5 mm <sup>2</sup>

Table 6: I/O Terminal Signals (X13)

Terminal	Function	Terminal block	Description
11	+24 V <sub>out</sub>	XD2.1:11	Control voltage output.
12	+24 V <sub>out</sub>	XD2.1:12	24 V DC (-15...+20%) Maximum current 200 mA Short-circuit protected
13	DI 1	XD2.1:13	Configurable digital input, galvanically isolated. 24 V DC, 0 < 5 V, 1 > 15 V. Input load 7.5 mA constant current + 10 kΩ resistive load, maximum pulse frequency 100 kHz.
14	DI 2	XD2.1:14	
15	DI 3	XD2.1:15	
16	DI 4	XD2.1:16	
17	DI 5	XD2.1:17	
18	DI 6	XD2.1:18	
19	DGND	XD2.1:19	Digital input ground, not isolated by default.
20	DGND	XD2.1:20	When using the internal +24 V <sub>out</sub> supply, connect the external jump wire between DGND and GND. When using the external +24 V DC supply, remove the external jump wire between DGND and GND.
21	DO 1	XD2.1:21	Configurable digital output. <sup>(1)</sup> Push-pull 24 V/50 mA Open collector (NPN/PNP) 48 V/50 mA Short-circuit protected
22	DO 2	XD2.1:22	
23	GND	XD2.1:23	I/O ground.
24	GND	XD2.1:24	Ground for digital outputs, +10 V Ref, +24 V <sub>out</sub> , analog inputs, and analog outputs.
31	AO 1	XD2.1:31	Configurable analog output. Voltage mode: <ul style="list-style-type: none"> <li>• 0...10 V</li> <li>• <math>R_L \geq 1 \text{ k}\Omega</math></li> <li>• accuracy <math>\leq \pm 0.5\%</math> of full scale</li> <li>• short-circuit protected</li> </ul> Current mode: <ul style="list-style-type: none"> <li>• 0...20 mA</li> <li>• <math>R_L \leq 600 \Omega</math></li> <li>• accuracy <math>\leq \pm 0.5\%</math> of full scale</li> <li>• short-circuit protected</li> </ul>
32	+10 V ref.	XD2.1:32	10 V (0...+3%), maximum current 10 mA

**Table 6: I/O Terminal Signals (X13) - (continued)**

Terminal	Function	Terminal block	Description
33	AI 1	XD2.1:33	Configurable analog input.
34	AI 2	XD2.1:34	Voltage mode: <ul style="list-style-type: none"> <li>• <math>0 \pm 10</math> V</li> <li>• single-ended</li> <li>• <math>R_i \sim 10</math> k<math>\Omega</math></li> <li>• accuracy <math>\pm 0.5\%</math> of full scale</li> </ul> Current mode: <ul style="list-style-type: none"> <li>• <math>0 \pm 20</math> mA</li> <li>• differential</li> <li>• <math>R_i \sim 200</math> <math>\Omega</math></li> <li>• accuracy <math>\pm 0.5\%</math> of full scale</li> </ul>
35	GND	XD2.1:35	I/O ground.
36	GND	XD2.1:36	Ground for digital outputs, +10 V Ref, +24 V <sub>out</sub> , analog inputs, and analog outputs.
37	GND	XD2.1:37	
38	GND	XD2.1:38	

1) Digital outputs are not recommended for main circuit breaker control, use relay outputs instead.

**Table 7: Thermistor Input Signals (X51)**

Terminal	Function	Terminal block	Description
71	TI+	XD2.1:71	Thermistor input, galvanically isolated. $R_{trip} = 4$ k $\Omega$
72	TI-	XD2.1:72	

**Table 8: Relay 1 Signals (X101)**

Terminal	Function	Terminal block	Description
1	COM	XD2.1:1	Configurable relay output.
2	NO	XD2.1:2	Switching capacity: <ul style="list-style-type: none"> <li>• 24 V DC/8 A</li> <li>• 250 V AC/8 A</li> <li>• 125 V DC/0.4 A</li> </ul> Minimum switching load: 5 V/10 mA
3	NC	XD2.1:3	

**Table 9: Relay 2 Signals (X102)**

Terminal	Function	Terminal block	Description
4	COM	XD2.1:4	Configurable relay output.
5	NO	XD2.1:5	Switching capacity: <ul style="list-style-type: none"> <li>• 24 V DC/8 A</li> <li>• 250 V AC/8 A</li> <li>• 125 V DC/0.4 A</li> </ul> Minimum switching load: 5 V/10 mA
6	NC	XD2.1:6	

Table 10: Relay 3 Signals (X103)

Terminal	Function	Terminal block	Description
7	COM	XD2.1:7	Configurable relay output.
8	NO	XD2.1:8	Switching capacity: <ul style="list-style-type: none"> <li>• 24 V DC/8 A</li> <li>• 250 V AC/8 A</li> <li>• 125 V DC/0.4 A</li> </ul> Minimum switching load: 5 V/10 mA

### 4.3 Control Cable Routing

Use the control cable grommets and tubes to route the control cables into the control compartment. There are control cable grommets at the top and at the bottom of the cabinet. After installation, make sure that the grommet is tight.

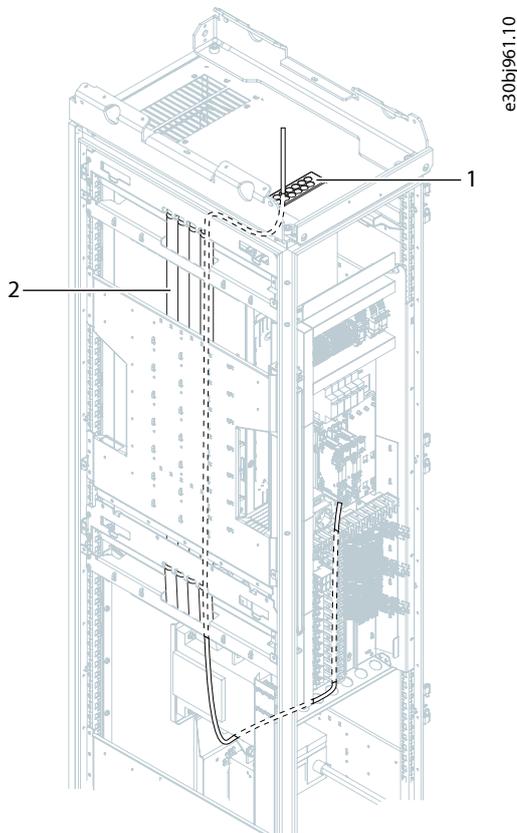


Figure 47: Routing of Control Cables from the Top, FE9, FE10

1	Control cable grommets	2	Tubes
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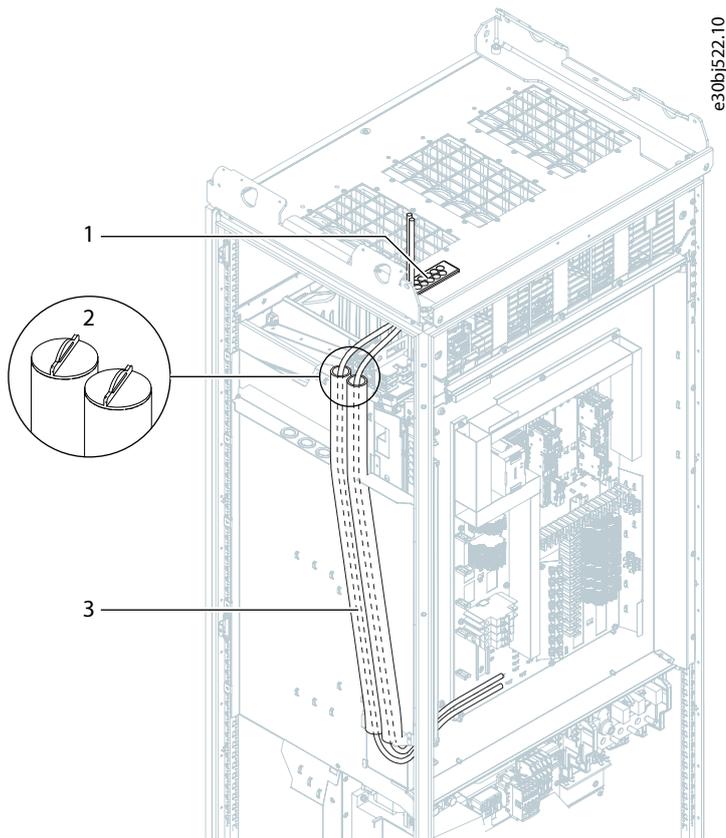


Figure 48: Routing of Control Cables from the Top, AE10/11, IE10/11

1	Control cable grommets	2	Two corks, to be removed when routing control cables from the top
3	Tubes, internal diameter 32 mm (1.3 in)		

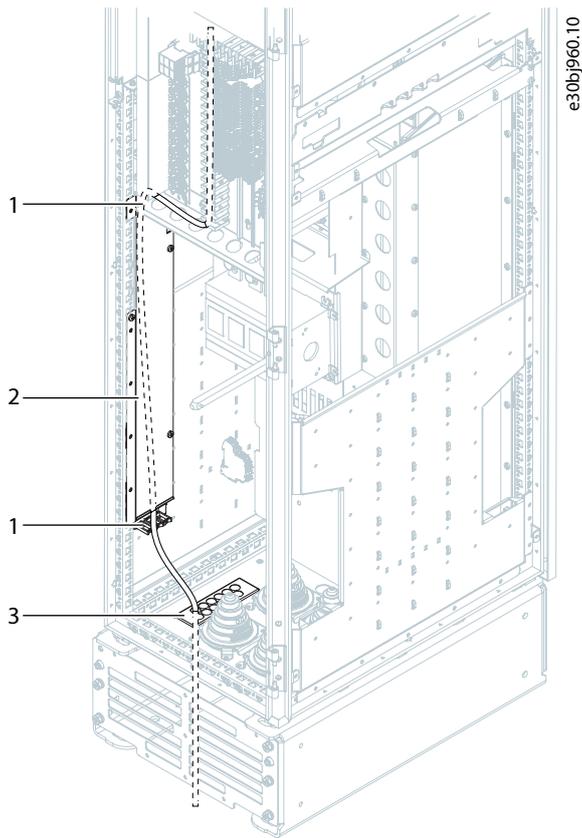


Figure 49: Routing of Control Cables from the Bottom, FE9, FE10

1	Cable clamps	2	Protection plate
3	Control cable grommets		

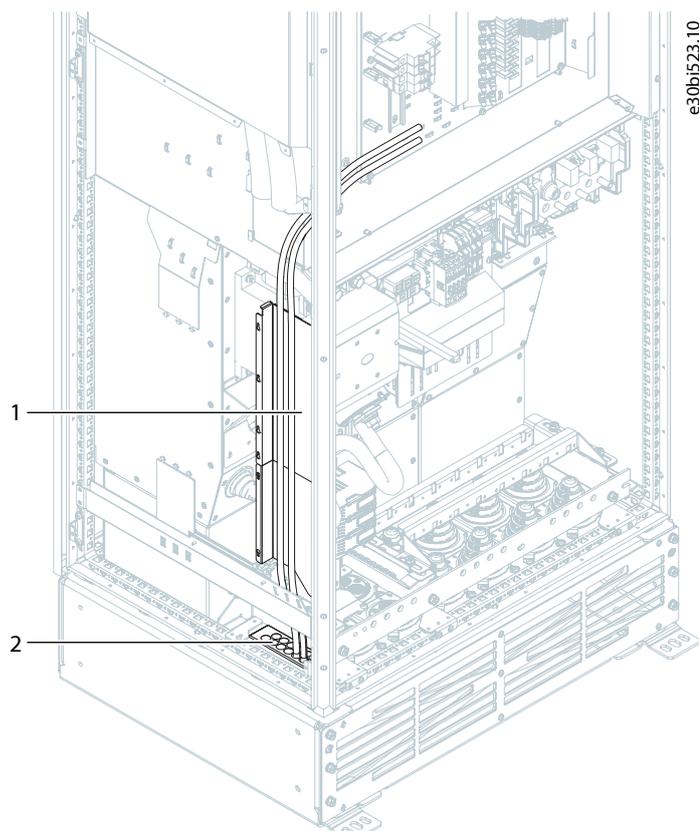


Figure 50: Routing of Control Cables from the Bottom, AE10/11, IE10/11

1	2
Protection plate	Control cable grommets

## 4.4 Installing Boards to the Control Compartment

Use these instructions to install a board, for example an option board, to the mounting plate on the control compartment.

### NOTICE

#### DAMAGE TO OPTION BOARDS

Do not install, remove, or replace option boards on the drive when the power is on. Doing this can cause damage to the boards.

- Switch off the drive before installing, removing, or replacing option boards on the drive.

1. Remove the screw that is pre-attached to the fixing point at the top of the mounting plate and keep it.
2. Slide the lower edge of the board to the mounting plate fixing point.

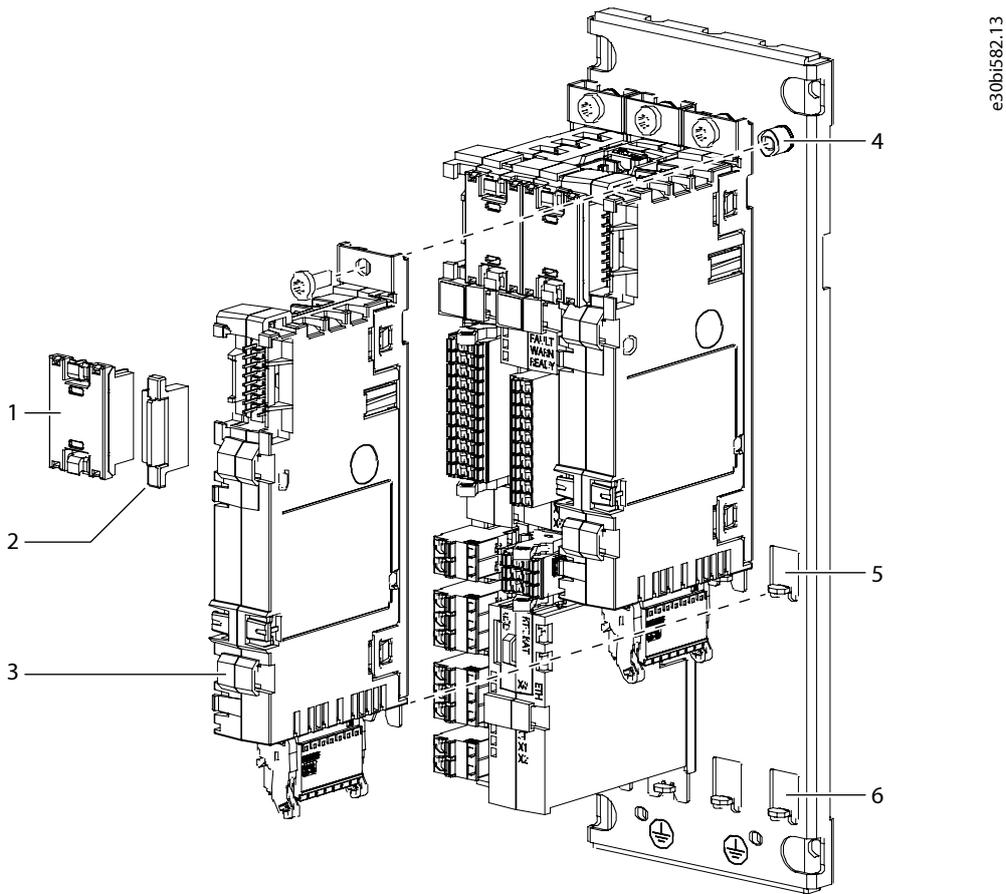


Figure 51: Installing a Board to the Control Compartment Mounting Plate

1	Option connector	2	Option terminal cover
3	Option board	4	Fixing point at the top
5	Fixing point at the middle	6	Fixing point at the bottom

3. Use the screw to attach the board to the fixing point at the top.
4. Attach an option connector to the newly installed board and the board next to it.
5. Attach option terminal covers to the empty terminals.

## 4.5 Wiring of the I/O and Relay Options

The 2 first I/O option boards are wired into the terminal blocks on the control compartment, and the next ones directly into the option board terminals. The wiring of the boards:

- I/O and Relay Option OC7C1 as standard I/O: on the terminal block on the control compartment
- Relay Option OC7R0: on the terminal block on the control compartment
- General Purpose I/O OC7C0: on the terminal block on the control compartment
- I/O and Relay Option OC7C1 as an option: on the option board

## 4.6 Installing the Control Cables

1. Install the control cables into the option board or the terminal block.

See the pin numbering of the I/O and Relay Option in [4.2 I/O and Relay Option Connections](#) and the pin numbering of the terminal blocks in [4.1 Control Compartment Connections](#).

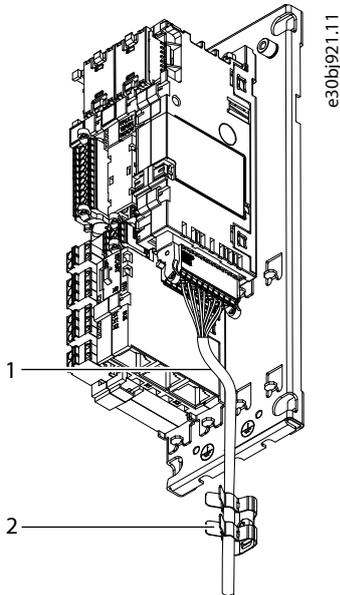


Figure 52: Example of Installing the Control Cables on the Option Board

1	Control cable	2	Cable clamp
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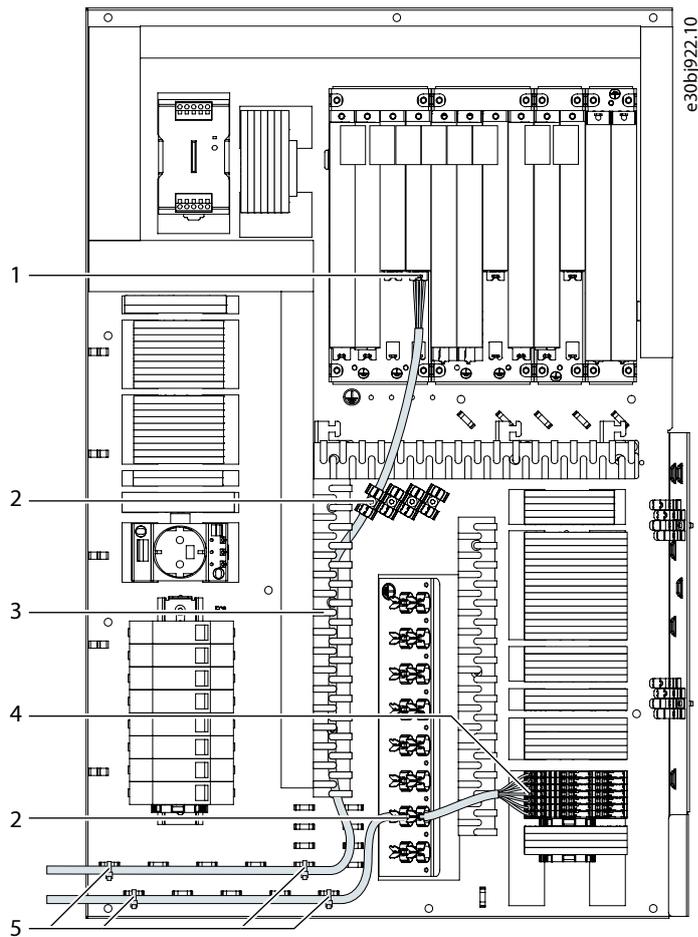


Figure 53: Example of Installing the Control Cables on Terminal Blocks

1	Option board	2	Cable clamp
3	Cable duct	4	Terminal block
5	Guidance for the control cable		

- Strip the control cables. Attach the control cables to the cable clamps on the control compartment.

The lower part of the cable clamp fixes the cable to the plate and provides strain relief. The upper part provides ~360° grounding for the cable shield.

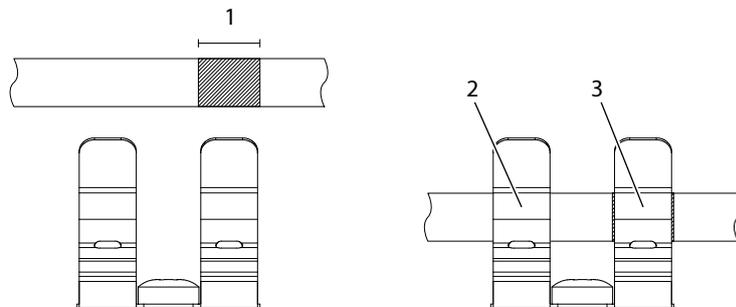


Figure 54: Stripping the Cable and Using the Grounding Plates

- |   |                                  |   |               |
|---|----------------------------------|---|---------------|
| 1 | Stripping length, 10 mm (0.4 in) | 2 | Strain relief |
| 3 | Grounding                        |   |               |

## 4.7 Installing the microSD Card

Supported microSD card types:

- SD
- SDHC
- SDXC

The microSD card must be formatted for the file system FAT32. It is recommended to use SDHC type cards as they are preformatted to FAT32.

1. Locate the microSD card hole on the control board of the control unit.

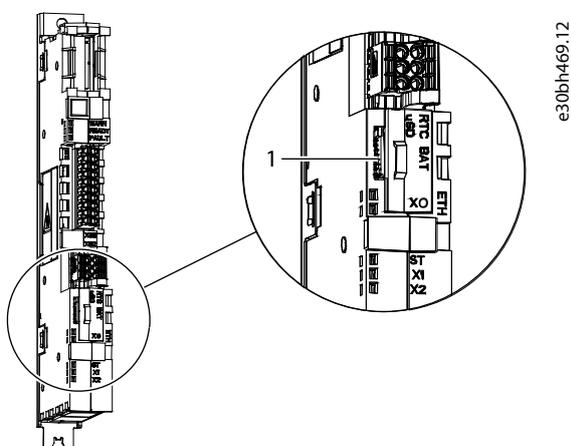


Figure 55: Location of the microSD Card

- 1 The microSD card

2. Push the new microSD card into the hole.

The contact area must face the text  $\mu$ SD on the right.

To remove the microSD card, push it. The microSD card pops out.

## 5 Commissioning

### 5.1 Commissioning the Enclosed Drive

Follow these instructions to commission the enclosed drive.

Read the safety instructions in the Safety Guide and obey them.

1. Make sure that the motor is installed correctly.
2. Make sure that the motor is not connected to mains.
3. Make sure that the drive and the motor are grounded.
4. Make sure to select the mains cable and the motor cable correctly.

For information on cable selections, see [6.2.1 List of Cable Size Information](#).

5. Make sure that drive is protected with external fuses on the supply side.
6. Make sure that the control cables are as far as possible from the power cables.
7. Make sure that the shields of the shielded cables are connected to a grounding terminal that is identified with the grounding symbol.
8. Check the tightening torques of all the terminals.
9. Make sure that the cables do not touch the electrical components of the drive.
10. Make sure that the common input +24 V is connected to an external power source and the ground of the digital input is connected to the ground of the control terminal.
11. Check the quantity of cooling air.
12. Make sure that there is no condensation on the surfaces of the drive.
13. Make sure that there are no unwanted objects in the installation space.
14. Before connecting the drive to mains, check the installation and the condition of all the fuses and other protective devices.

For information on fuse selections, see [6.3.1 Fuse Size Tables](#).

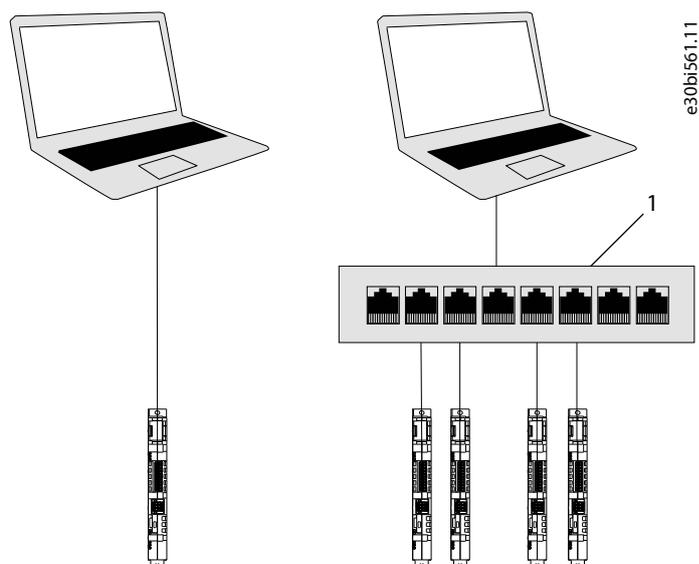
15. Check that all Start/Stop switches connected to the I/O terminals are in the Stop position.
16. Perform the cable and motor insulation checks.
17. For information on setting the parameters, see the relevant application guide.

### 5.2 Preparing for a PC Connection

Use these instructions to connect the drive or several drives to a PC with an RJ45 cable.

1. Connect the RJ45 cable to the PC.

To connect several drives at the same time, use an Ethernet switch between the PC and the control unit.



1 Ethernet switch

Figure 56: Connecting the Drive to a PC

2. Connect the cable coming from the PC or from the Ethernet switch to the RJ45 terminal on the door of the control compartment.

In enclosed drives with 2 control units (for example, AFE and INU), the Ethernet connection is by default to the INU control unit.

- To connect to the AFE control unit, open the door of the control compartment, locate the AFE control unit, and connect the PC to Ethernet terminal X0.

3. See the application guide for information on the next steps.

## 5.3 Pre-charging the Drive

### NOTICE

Before starting the drive, the drive must be pre-charged.

1. Check that the pre-charging fuse switch (-QB6) is closed. It is located inside the cabinet.
2. Select automatic or manual pre-charging with the switch -SF12.
3. Enable mains with the switch -SF11.
4. Connect the power supply.
5. For frames 2 x AE10 + 2 x IE10 and smaller, close the drive main switch -QB0.

➡ In the automatic mode, the drive starts pre-charging immediately when the power is connected.

6. In the manual mode, start the pre-charging by pushing the Run button on the AFE control panel or by giving a start command from remote PLC or fieldbus.

➡ When the pre-charging is complete, the drive automatically closes the main contactor or circuit breaker.

## 5.4 Measuring the Insulation Resistance

### 5.4.1 Measuring the Insulation Resistance of the Motor Cable

Use these instructions to check the insulation of the motor cable.

The drive is already measured at the factory.

1. Disconnect the motor cable from the terminals U, V, and W, and from the motor.
2. Measure the insulation resistance of the motor cable between phase conductors 1 and 2, between phase conductors 1 and 3, and between phase conductors 2 and 3.
3. Measure the insulation resistance between each phase conductor and the grounding conductor.
4. The insulation resistance must be  $>1\text{ M}\Omega$  at the ambient temperature of  $20\text{ }^{\circ}\text{C}$  ( $68\text{ }^{\circ}\text{F}$ ).

### 5.4.2 Measuring the Insulation Resistance of the Mains Cable

Use these instructions to check the insulation of the mains cable.

The drive is already measured at the factory.

1. Disconnect the mains cable from the terminals L1, L2, and L3, and from mains.
2. Measure the insulation resistance of the mains cable between phase conductors 1 and 2, between phase conductors 1 and 3, and between phase conductors 2 and 3.
3. Measure the insulation resistance between each phase conductor and the grounding conductor.
4. The insulation resistance must be  $>1\text{ M}\Omega$  at the ambient temperature of  $20\text{ }^{\circ}\text{C}$  ( $68\text{ }^{\circ}\text{F}$ ).

### 5.4.3 Measuring the Insulation Resistance of the Motor

Use these instructions to check the insulation of the motor.

The drive is already measured at the factory.

#### NOTICE

Obey the instructions of the motor manufacturer.

1. Disconnect the motor cable from the motor.
2. Open the bridging connections in the motor connection box.
3. Measure the insulation resistance of each motor winding. The voltage must be the same or higher than the motor nominal voltage, but at least  $1000\text{ V}$ .
4. The insulation resistance must be  $>1\text{ M}\Omega$  at the ambient temperature of  $20\text{ }^{\circ}\text{C}$  ( $68\text{ }^{\circ}\text{F}$ ).
5. Connect the motor cables to the motor.
6. Do the final insulation check on the drive side. Put all phases together and measure to the ground.
7. Connect the motor cables to the drive.

## 6 Specifications

### 6.1 Tightening Torques

Table 11: Tightening Torques

Frame	Bolt	Tightening torque	
		Nm	In-lb
FE9, FE10	M4	1.8	16
	M5	2.7	24
	M6	6	53
FE9, FE10, AE10, AE11, IE10, IE11	M8	20	180
	M10	40	350
FE9, FE10, AE10, AE11, IE10, IE11	M12	70	620
	Grounding bolt (M8)	13.5	120

### 6.2 Cable Sizes

#### 6.2.1 List of Cable Size Information

#### NOTICE

Use symmetrical cabling with system modules connected in parallel. Each module must have the same number of cables with an equal cross-section.

The cable size tables for the enclosed drives can be found with these links.

- [6.2.2 Mains Cable Size Recommendations, 380–500 V](#)
- [6.2.3 Motor Cable Size Recommendations, 380–500 V](#)
- [6.2.4 Mains Cable Size Recommendations, UL, 480 V](#)
- [6.2.5 Motor Cable Size Recommendations, UL 480 V](#)
- [6.2.6 Brake Cable Size Recommendations](#)
- [6.2.7 Brake Cable Size Recommendations, UL](#)

## 6.2.2 Mains Cable Size Recommendations, 380–500 V

Table 12: Mains Cable Size Recommendations, 380–500 V

Model code	Frame	$I_N$ [A]	Cable [mm <sup>2</sup> ]	Maximum cable size [mm <sup>2</sup> ]	Maximum number of mains cables <sup>(1)</sup>	Hole size of the mains terminal [mm]	Number of grounding holes on PE busbar	Hole size of the grounding terminal [mm]
iC7-60EA3N0 5-206A	FE9 <sup>(2)</sup>	206	Cu 1 x (3x70+35) Al 1 x (3x120+41 Cu)	95 Cu/Al	2	Ø10.5	2	Ø10.5
iC7-60EA3N0 5-245A		245	Cu 1 x (3x95+50) Al 1 x (3x150+41 Cu)	95 Cu/Al	2	Ø10.5	2	Ø10.5
iC7-60EA3N0 5-302A		302	Cu 1 x (3x120+70) Al 2 x (3x95+29 Cu)	95 Cu/Al	2	Ø10.5	2	Ø10.5
iC7-60EA3N0 5-385A		385	Cu 2 x (3x95+50) Al 2 x (3x120+41 Cu)	95 Cu/Al	2	Ø10.5	2	Ø10.5
iC7-60EA3N0 5-480A	FE10 <sup>(2)</sup>	480	Cu 2 x (3x120+70) Al 2 x (2x185+57 Cu)	150 Cu/120 Al	3	Ø13.5	4	Ø10.5
iC7-60EA3N0 5-588A		588	Cu 2 x (3x150+70) Al 2 x (3x240+41 Cu)	150 Cu/120 Al	3	Ø13.5	4	Ø10.5
iC7-60EA3A0 5-385A	AE10 + IE10 <sup>(3)</sup>	325	Cu 1 x (3x150+70) Al 2 x (3x95+29 Cu)	240 Cu/Al	2 <sup>(4)</sup>	Ø13.5 <sup>(5)</sup>	4	Ø10.5
iC7-60EA3A0 5-480A		403	Cu 2 x (3x95+ 50) Al 2 x (3x120+41 Cu)	240 Cu/Al	2 <sup>(4)</sup>	Ø13.5 <sup>(5)</sup>	4	Ø10.5
iC7-60EA3A0 5-590A		508	Cu 2 x (3x120+70) Al 2 x (3x150+41 Cu)	240 Cu/Al	2 <sup>(4)</sup>	Ø13.5 <sup>(5)</sup>	4	Ø10.5
iC7-60EA3A0 5-658A	AE11 + IE11	571	Cu 2 x (3x150+70) Al 3 x (3x120+41 Cu)	240 Cu/Al	4	Ø13	5	Ø10.5
iC7-60EA3A0 5-730A		647	Cu 3 x (3x120+70) Al 3 x (3x150+70 Cu)	240 Cu/Al	4	Ø13	5	Ø10.5
iC7-60EA3A0 5-820A		728	Cu 3 x (3x120+70) Al 4 x (3x120+41 Cu)	240 Cu/Al	4	Ø13	5	Ø10.5
iC7-60EA3A0 5-880A		809	Cu 3 x (3x150+70) Al 4 x (3x120+41 Cu)	240 Cu/Al	4	Ø13	5	Ø10.5
iC7-60EA3A0 5-1000	2 x AE10 + 2 x IE10	905	Cu 4 x (3x120+70) Al 4 x (3x185+57 Cu)	240 Cu/Al	6	Ø13	5	Ø10.5
iC7-60EA3A0 5-1100		1018	Cu 4 x (3x150+70) Al 6x (3 x 150 + 41 Cu)	240 Cu/Al	6	Ø13	5	Ø10.5

**Table 12: Mains Cable Size Recommendations, 380–500 V - (continued)**

Model code	Frame	$I_N$ [A]	Cable [mm <sup>2</sup> ]	Maximum cable size [mm <sup>2</sup> ]	Maximum number of mains cables <sup>(1)</sup>	Hole size of the mains terminal [mm]	Number of grounding holes on PE busbar	Hole size of the grounding terminal [mm]
iC7-60EA3A0 5-1260	2 x AE11 + 2 x IE11	1148	Cu 6 x (3x95+50) Al 6 x (3x120+41 Cu)	240 Cu/Al	8	Ø13	8	Ø10.5
iC7-60EA3A0 5-1450		1293	Cu 6 x (3x120+70) Al 6 x (3x150+70 Cu)	240 Cu/Al	8	Ø13	8	Ø10.5
iC7-60EA3A0 5-1710		1453	Cu 6 x (3x150+70) Al 6 x (3x185+57 Cu)	240 Cu/Al	8	Ø13	8	Ø10.5
iC7-60SA3A0 5-1960	3 x AE11 + 3 x IE11	1777	Cu 6 x (3 x 185 + 95) Al 9 x (3 x 185 + 41 Cu)	240 Cu/Al	12	Ø13	8	Ø10.5
iC7-60SA3A0 5-2150		1938	Cu 9 x (3 x 120 + 70) Al 9 x (3 x 185 + 41 Cu)	240 Cu/Al	12	Ø13	8	Ø10.5
iC7-60SA3A0 5-2510		2261	Cu 9 x (3 x 185 + 95) Al 9 x (3 x 240 + 72 Cu)	240 Cu/Al	12	Ø13	8	Ø10.5

1) Cable lugs installed on both sides of the fixing hole

2) With copper cables, use copper lugs. With aluminum cables, use bimetallic lugs.

3) Use bimetallic lugs. No direct aluminum contact to the mains terminals.

4) If the option Top-entry +KCIT is used, the maximum number of mains cables is 4.

5) If the option Top-entry +KCIT is used, the hole size is 13 mm.

### 6.2.3 Motor Cable Size Recommendations, 380–500 V

**Table 13: Motor Cable Size Recommendations, 380–500 V**

Model code	Frame	$I_N$ [A]	Cable [mm <sup>2</sup> ]	Maximum cable size [mm <sup>2</sup> ] <sup>(1)</sup>	Maximum number of motor cables	Bolt size <sup>(2)</sup>	Number of grounding holes on PE busbar	Hole size of the grounding terminal [mm]
iC7-60EA3N0 5-206A	FE9	206	Cu 1 x (3x70+35) Al 1 x (3x120+41 Cu)	95 Cu/Al <sup>(3)</sup>	2 <sup>(4)</sup>	M10	2	Ø10.5
iC7-60EA3N0 5-245A		245	Cu 1 x (3x95+50) Al 1 x (3x150+41 Cu)	95 Cu/Al <sup>(3)</sup>	2 <sup>(4)</sup>	M10	2	Ø10.5
iC7-60EA3N0 5-302A		302	Cu 1 x (3x120+70) Al 2 x (3x95+29 Cu)	95 Cu/Al <sup>(3)</sup>	2 <sup>(4)</sup>	M10	2	Ø10.5
iC7-60EA3N0 5-385A		385	Cu 2 x (3x95+50) Al 2 x (3x120+41 Cu)	95 Cu/Al <sup>(3)</sup>	2 <sup>(4)</sup>	M10	2	Ø10.5
iC7-60EA3N0 5-480A	FE10	480	Cu 2 x (3x120+70) Al 2 x (2x185+57 Cu)	150 Cu/120 Al <sup>(3)</sup>	3 <sup>(4)</sup>	M10	4	Ø10.5
iC7-60EA3N0 5-588A		588	Cu 2 x (3x150+70) Al 2 x (3x240+41 Cu)	150 Cu/120 Al <sup>(3)</sup>	3 <sup>(4)</sup>	M10	4	Ø10.5

Table 13: Motor Cable Size Recommendations, 380–500 V - (continued)

Model code	Frame	$I_N$ [A]	Cable [mm <sup>2</sup> ]	Maximum cable size [mm <sup>2</sup> ] <sup>(1)</sup>	Maximum number of motor cables	Bolt size <sup>(2)</sup>	Number of grounding holes on PE busbar	Hole size of the grounding terminal [mm]
iC7-60EA3A0 5-385A	AE10 + IE10	394	Cu 1 x (3x185+95) Al 2 x (3x120+41 Cu)	240 Cu/Al <sup>(3)</sup>	4 <sup>(4)</sup>	M10	4	Ø10.5
iC7-60EA3A0 5-480A		490	Cu 2 x (3x120+70) Al 2 x (3x150+70 Cu)	240 Cu/Al <sup>(3)</sup>	4 <sup>(4)</sup>	M10	4	Ø10.5
iC7-60EA3A0 5-590A		601	Cu 2 x (3x150+70) Al 2 x (3x185+57 Cu)	240 Cu/Al <sup>(3)</sup>	4 <sup>(4)</sup>	M10	4	Ø10.5
iC7-60EA3A0 5-658A	AE11 + IE11	672	Cu 2 x (3x185+95) Al 3 x (3x150+70 Cu)	240 Cu/Al	4	M10	4	Ø10.5
iC7-60EA3A0 5-730A		746	Cu 3 x (3x150+70) Al 4 x (3x120+41 Cu)	240 Cu/Al	4	M10	4	Ø10.5
iC7-60EA3A0 5-820A		838	Cu 3 x (3x150+70) Al 4 x (3x150+70 Cu)	240 Cu/Al	4	M10	4	Ø10.5
iC7-60EA3A0 5-880A		899	Cu 4 x (3x120+70) Al 4 x (3x150+70 Cu)	240 Cu/Al	4	M10	4	Ø10.5
iC7-60EA3A0 5-1000	2 x AE10 + 2 x IE10	1021	Cu 4 x (3x150+70) Al 6 x (3x120+41 Cu)	240 Cu/Al	8	M10	8	Ø10.5
iC7-60EA3A0 5-1100		1123	Cu 4 x (3x185+95) Al 6 x (3x120+41 Cu)	240 Cu/Al	8	M10	8	Ø10.5
iC7-60EA3A0 5-1260	2 x AE11 + 2 x IE11	1287	Cu 6 x (3x120+70) Al 6 x (3x150+70 Cu)	240 Cu/Al	8	M10	8	Ø10.5
iC7-60EA3A0 5-1450		1481	Cu 6 x (3x150+70) Al 6 x (3x185+57 Cu)	240 Cu/Al	8	M10	8	Ø10.5
iC7-60EA3A0 5-1710		1746	Cu 6 x (3x185+95) Al 8 x (3x150+70 Cu)	240 Cu/Al	8	M10	8	Ø10.5
iC7-60SA3A0 5-1960	3 x AE11 + 3 x IE11	2001	Cu 9 x (3 x 150 + 70) Al 12 x (3 x 150 + 41 Cu)	240 Cu/Al	12	M10	8	Ø10.5
iC7-60SA3A0 5-2150		2195	Cu 9 x (3 x 150 + 70) Al 12 x (3 x 150 + 41 Cu)	240 Cu/Al	12	M10	8	Ø10.5
iC7-60SA3A0 5-2510		2563	Cu 9 x (3 x 185 + 95) Al 12 x (3 x 185 + 57 Cu)	240 Cu/Al	12	M10	8	Ø10.5

1) With the vertical PE busbar extension installed: 20 x Ø6.5 mm or 16 x Ø6.5 mm + 4 x Ø10.5 mm

2) If the option Top-entry +KDOT is used, the bolt size is M13.

 3) If the option Top-entry +KDOT is used, the maximum cable size is 240 mm<sup>2</sup>.

4) If the option Top-entry +KDOT is used, the maximum number of motor cables is 4.

## 6.2.4 Mains Cable Size Recommendations, UL, 480 V

**Table 14: Mains Cable Size Recommendations, UL, 480 V**

Model code	Frame	I <sub>N</sub> [A]	Mains cable [AWG]	Cable termination, Panduit terminal part number	Maximum cable size	Maximum number of mains cables <sup>(1)</sup> (hole size of the mains terminal [mm])	Number of grounding holes on PE busbar (hole size [mm])
iC7-60EA3N05-2 06A	FE9	206	2 x 1/0	LCAX1/0-12-X	300 MCM	2 (Ø10.5)	2 (Ø10.5)
iC7-60EA3N05-2 45A		245	2 x 2/0	LCAX2/0-12-X	300 MCM	2 (Ø10.5)	2 (Ø10.5)
iC7-60EA3N05-3 02A		302	2 x 4/0	LCAX4/0-12-X	300 MCM	2 (Ø10.5)	2 (Ø10.5)
iC7-60EA3N05-3 85A		385	2 x 300 MCM	LCAX300-12-6	300 MCM	2 (Ø10.5)	2 (Ø10.5)
iC7-60EA3N05-4 80A	FE10	480	3 x 4/0	LCAX4/0-12-X	300 MCM	3 (Ø13.5)	4 (Ø10.5)
iC7-60EA3N05-5 88A		588	3 x 300 MCM	LCAX300-12-6	300 MCM	3 (Ø13.5)	4 (Ø10.5)
iC7-60EA3A05-3 85A	AE10 + IE10	303	2 x 4/0	LCAX4/0-12-X	500 MCM	- (Ø13.5)	4 (Ø10.5)
iC7-60EA3A05-4 80A		352	2 x 250 MCM	LCAX250-12-X	500 MCM	- (Ø13.5)	4 (Ø10.5)
iC7-60EA3A05-5 90A		451	3 x 4/0	LCAX4/0-12-X	500 MCM	- (Ø13.5)	4 (Ø10.5)
iC7-60EA3A05-6 58A	AE11 + IE11	500	3 x 250 MCM	LCAX250-12-X	500 MCM	4 (Ø10.5)	5 (Ø10.5)
iC7-60EA3A05-7 30A		554	3 x 300 MCM	LCAX300-12-6	500 MCM	4 (Ø10.5)	5 (Ø10.5)
iC7-60EA3A05-8 20A		604	3 x 350 MCM	LCAX350-12-6	500 MCM	4 (Ø10.5)	5 (Ø10.5)
iC7-60EA3A05-8 80A		704	4 x 250 MCM	LCAX250-12-X	500 MCM	4 (Ø10.5)	5 (Ø10.5)
iC7-60EA3A05-1 000	2 x AE10 + 2 x IE10	755	4 x 300 MCM	LCAX300-12-6	500 MCM	4 (Ø10.5)	5 (Ø10.5)
iC7-60EA3A05-1 100		855	4 x 350 MCM	LCAX350-12-6	500 MCM	4 (Ø10.5)	5 (Ø10.5)
iC7-60EA3A05-1 260	2 x AE11 + 2 x IE11	955	6 x 4/0	LCAX4/0-12-X	500 MCM	8 (Ø10.5)	8 (Ø10.5)
iC7-60EA3A05-1 450		1106	6 x 300 MCM	LCAX300-12-6	500 MCM	8 (Ø10.5)	8 (Ø10.5)
iC7-60EA3A05-1 710		1306	6 x 350 MCM	LCAX350-12-6	500 MCM	8 (Ø10.5)	8 (Ø10.5)

Table 14: Mains Cable Size Recommendations, UL, 480 V - (continued)

Model code	Frame	I <sub>N</sub> [A]	Mains cable [AWG]	Cable termination, Panduit terminal part number	Maximum cable size	Maximum number of mains cables <sup>(1)</sup> (hole size of the mains terminal [mm])	Number of grounding holes on PE busbar (hole size [mm])
iC7-60SA3A05-1960	3 x AE11 + 3 x IE11	1777	9 x 300MCM	LCAX300-12-6	500 MCM	12 (Ø10.5)	8 (Ø10.5)
iC7-60SA3A05-2150		1938	9 x 350MCM	LCAX350-12-6	500 MCM	12 (Ø10.5)	8 (Ø10.5)
iC7-60SA3A05-2510		2261	12 x 300MCM	LCAX300-12-6	500 MCM	12 (Ø10.5)	8 (Ø10.5)

1) Cable lugs installed on both sides of the fixing hole

## 6.2.5 Motor Cable Size Recommendations, UL 480 V

Table 15: Motor Cable Size Recommendations, UL 480 V

Model code	Frame	I <sub>N</sub> [A]	Motor cable [AWG]	Cable termination, Panduit terminal part number	Maximum cable size	Maximum number of motor cables (bolt size)	Number of grounding holes on PE busbar (hole size [mm]) <sup>(1)</sup>
iC7-60EA3N05-206A	FE9	206	2 x 1/0	LCAX300-12-6	300 MCM	2 (M10)	2 (Ø10.5)
iC7-60EA3N05-245A		245	2 x 2/0	LCAX300-12-6	300 MCM	2 (M10)	2 (Ø10.5)
iC7-60EA3N05-302A		302	2 x 4/0	LCAX300-12-6	300 MCM	2 (M10)	2 (Ø10.5)
iC7-60EA3N05-385A		385	2 x 300 MCM	LCAX300-12-6	300 MCM	2 (M10)	2 (Ø10.5)
iC7-60EA3N05-480A	FE10	480	3 x 4/0	LCAX300-12-6	300 MCM	3 (M10)	4 (Ø10.5)
iC7-60EA3N05-588A		588	3 x 300 MCM	LCAX300-12-6	300 MCM	3 (M10)	4 (Ø10.5)
iC7-60EA3A05-385A	AE10 + IE10	372	2 x 300 MCM	LCAX300-12-6	500 MCM	4 (M10)	4 (Ø10.5)
iC7-60EA3A05-480A		466	3 x 4/0	LCAX4/0-12-X	500 MCM	4 (M10)	4 (Ø10.5)
iC7-60EA3A05-590A		531	3 x 250 MCM	LCAX250-12-X	500 MCM	4 (M10)	4 (Ø10.5)

**Table 15: Motor Cable Size Recommendations, UL 480 V - (continued)**

Model code	Frame	I <sub>N</sub> [A]	Motor cable [AWG]	Cable termination, Panduit terminal part number	Maximum cable size	Maximum number of motor cables (bolt size)	Number of grounding holes on PE busbar (hole size [mm]) <sup>(1)</sup>
iC7-60EA3A05-6 58A	AE11 + IE11	603	3 x 350 MCM	LCAX350-12-6	500 MCM	4 (M10)	4 (Ø10.5)
iC7-60EA3A05-7 30A		672	4 x 250 MCM	LCAX250-12-X	500 MCM	4 (M10)	4 (Ø10.5)
iC7-60EA3A05-8 20A		746	4 x 300 MCM	LCAX300-12-6	500 MCM	4 (M10)	4 (Ø10.5)
iC7-60EA3A05-8 80A		838	4 x 350 MCM	LCAX350-12-6	500 MCM	4 (M10)	4 (Ø10.5)
iC7-60EA3A05-1 000	2 x AE10 + 2 x IE10	940	6 x 4/0	LCAX4/0-12-X	500 MCM	8 (M10)	8 (Ø10.5)
iC7-60EA3A05-1 100		1052	6 x 250 MCM	LCAX250-12-X	500 MCM	8 (M10)	8 (Ø10.5)
iC7-60EA3A05-1 260	2 x AE11 + 2 x IE11	1174	6 x 300 MCM	LCAX300-12-6	500 MCM	8 (M10)	8 (Ø10.5)
iC7-60EA3A05-1 450		1328	8 x 250 MCM	LCAX250-12-X	500 MCM	8 (M10)	8 (Ø10.5)
iC7-60EA3A05-1 710		1603	8 x 300 MCM	LCAX300-12-6	500 MCM	8 (M10)	8 (Ø10.5)
iC7-60SA3A05-1 960	3 x AE11 + 3 x IE11	1940	9 x 350 MCM	LCAX350-12-6	500 MCM	12 (M10)	8 (Ø10.5)
iC7-60SA3A05-2 150		2083	12 x 250 MCM	LCAX250-12-X	500 MCM	12 (M10)	8 (Ø10.5)
iC7-60SA3A05-2 340		2195	12 x 300 MCM	LCAX300-12-6	500 MCM	12 (M10)	8 (Ø10.5)
iC7-60SA3A05-2 510		2389	12 x 300 MCM	LCAX300-12-6	500 MCM	12 (M10)	8 (Ø10.5)

1) With the vertical PE busbar extension installed: 20 x Ø6.5 mm or 16 x Ø6.5 mm + 4 x Ø10.5 mm

## 6.2.6 Brake Cable Size Recommendations

Table 16: Brake Cable Size Recommendations, 380–500 V

Model code	Frame	$I_N$ [A]	Cable [mm <sup>2</sup> ]	Maximum cable size [mm <sup>2</sup> ]	Maximum number of brake cables	Bolt size
iC7-60EA3N05-206A	FE9	206	Cu 70 Al 120	120	2 per polarity	M10
iC7-60EA3N05-245A		245	Cu 95 Al 150	120	2 per polarity	M10
iC7-60EA3N05-302A		302	Cu 120 Al 2 x 95	120	2 per polarity	M10
iC7-60EA3N05-385A		385	Cu 2 x 95 Al 2 x 120	120	2 per polarity	M10
iC7-60EA3N05-480A	FE10	480	Cu 2 x (3x120+70) Al 2 x (2x185+57 Cu)	240	2	M10
iC7-60EA3N05-588A		588	Cu 2 x (3x150+70) Al 2 x (3x240+41 Cu)	240	2	M10

## 6.2.7 Brake Cable Size Recommendations, UL

Model code	Frame	$I_N$ [A]	Cable AWG	Maximum cable size [mm <sup>2</sup> ]	Maximum number of brake cables	Bolt size
iC7-60EA3N05-206A	FE9	206	2 x 4/0	4/0	2 per polarity	M10
iC7-60EA3N05-245A		245	2 x 4/0	4/0	2 per polarity	M10
iC7-60EA3N05-302A		302	2 x 4/0	4/0	2 per polarity	M10
iC7-60EA3N05-385A		385	2 x 4/0	4/0	2 per polarity	M10
iC7-60EA3N05-480A	FE10	480	2 x 400 MCM	400 MCM	2	M10
iC7-60EA3N05-588A		588	2 x 400 MCM	400 MCM	2	M10

## 6.3 Fuses

### 6.3.1 Fuse Size Tables

The fuse size tables for the air-cooled enclosed drives can be found with these links.

- [6.3.2 AC Fuses, 380–500 V AC](#)
- [6.3.3 DC Fuses, 465–800 V DC](#)
- [6.3.4 External Fuses on External Supply for Input Devices](#)

### 6.3.2 AC Fuses, 380–500 V AC

Table 17: AC Fuses, 380–500 V AC

Model code	Frame	Rated current $I_L$ [A]	Number of fuses	Fuse size	Part number	Fuse $U_n$ [V]	Fuse $I_n$ [A]	$I_{cp,mr}$ [A] <sup>(1)</sup>
iC7-60EA3N05-206A	FE9	206	3	00	170M2619 <sup>(2)</sup>	700	315	2000
iC7-60EA3N05-245A		245	3	00	170M2620 <sup>(2)</sup>	700	350	2400
iC7-60EA3N05-302A		302	3	00	170M2621 <sup>(2)</sup>	700	400	2800
iC7-60EA3N05-385A		385	3	00	170M9007 <sup>(2)</sup>	550	475	3700
iC7-60EA3N05-480A	FE10	480	3	1	170M4016 <sup>(2)</sup>	700	630	4500
iC7-60EA3N05-588A		588	3	1	170M4017 <sup>(2)</sup>	700	700	5400
iC7-60EA3A05-385A	AE10 + IE10	385	3	33	PC33UD69V550TF <sup>(3)</sup>	690	550	3288
iC7-60EA3A05-480A		480	3	33	PC33UD69V700TF <sup>(3)</sup>	690	700	4822
iC7-60EA3A05-590A		590	3	33	PC33UD69V700TF <sup>(3)</sup>	690	700	4822
iC7-60EA3A05-658A	AE11 + IE11	658	6 <sup>(4)</sup>	33	PC33UD69V550TF <sup>(3)</sup>	690	550	6576
iC7-60EA3A05-730A		730	6 <sup>(4)</sup>	33	PC33UD69V550TF <sup>(3)</sup>	690	550	6576
iC7-60EA3A05-820A		820	6 <sup>(4)</sup>	33	PC33UD69V550TF <sup>(3)</sup>	690	550	6576
iC7-60EA3A05-880A		880	6 <sup>(4)</sup>	33	PC33UD69V550TF <sup>(3)</sup>	690	550	6576
iC7-60EA3A05-1000	2 x AE10 + 2 x IE10	1000	6	33	PC33UD69V700TF <sup>(3)</sup>	690	700	–
iC7-60EA3A05-1100		1100	6	33	PC33UD69V700TF <sup>(3)</sup>	690	700	–
iC7-60EA3A05-1260	2 x AE11 + 2 x IE11	1260	12 <sup>(4)</sup>	33	PC33UD69V550TF <sup>(3)</sup>	690	550	–
iC7-60EA3A05-1450		1450	12 <sup>(4)</sup>	33	PC33UD69V550TF <sup>(3)</sup>	690	550	–
iC7-60EA3A05-1710		1710	12 <sup>(4)</sup>	33	PC33UD69V550TF <sup>(3)</sup>	690	550	–
iC7-60SA3A05-1960	3 x AE11 + 3 x IE11	1960	18 <sup>(4)</sup>	33	PC33UD69V550TF <sup>(3)</sup>	690	550	–
iC7-60SA3A05-2150		2150	18 <sup>(4)</sup>	33	PC33UD69V550TF <sup>(3)</sup>	690	550	–
iC7-60SA3A05-2510		2510	18 <sup>(4)</sup>	33	PC33UD69V550TF <sup>(3)</sup>	690	550	–

1) Current, prospective, minimum rating

2) Bussmann

3) Mersen

4) Double fuse per phase

### 6.3.3 DC Fuses, 465–800 V DC

Table 18: DC Fuses, 465–800 V DC

Model code	Frame	Rated current $I_L$ [A]	Number of fuses	Fuse size	Part number	Fuse $U_n$ [V]	Fuse $I_n$ [A]
iC7-60EA3A05-385A	AE10 + IE10	385	2	73	PC73UD13C630TF	1250	630
iC7-60EA3A05-480A		480	2	73	PC73UD13C800TF	1250	800
iC7-60EA3A05-590A		590	2	73	PC73UD10C1000TF	1000	1000

Table 18: DC Fuses, 465–800 V DC - (continued)

Model code	Frame	Rated current $I_L$ [A]	Number of fuses	Fuse size	Part number	Fuse $U_n$ [V]	Fuse $I_n$ [A]
iC7-60EA3A05-658A	AE11 + IE11	658	2	73	PC73UD90V13CTF	900	1250
iC7-60EA3A05-730A		730	2	73	PC73UD90V13CTF	900	1250
iC7-60EA3A05-820A		820	2	73	PC73UD85V14CTF	850	1400
iC7-60EA3A05-880A		880	2	73	PC73UD85V14CTF	850	1400
iC7-60EA3A05-1000	2 x AE10 + 2 x IE10	1000	8	73	PC73UD13C800TF	1250	800
iC7-60EA3A05-1100		1100	8	73	PC73UD10C1000TF	1000	1000
iC7-60EA3A05-1260	2 x AE11 + 2 x IE11	1260	8	73	PC73UD90V13CTF	900	1250
iC7-60EA3A05-1450		1450	8	73	PC73UD90V13CTF	900	1250
iC7-60EA3A05-1710		1710	8	73	PC73UD85V14CTF	850	1400
iC7-60SA3A05-1960	3 x AE11 + 3 x IE11	1960	12	73	PC73UD90V13CTF	900	1250
iC7-60SA3A05-2150		2150	12	73	PC73UD90V13CTF	900	1250
iC7-60SA3A05-2510		2510	12	73	PC73UD85V14CTF	850	1400

### 6.3.4 External Fuses on External Supply for Input Devices

The enclosed drives with a mains contactor or a main switch must be protected with external fuses. The fuses in the table meet the IEC type 1 coordination for contactor short-circuit current performance and are required for main switch protection.

Table 19: External Fuses of the Enclosed Drives

Model code	Frame	IEC fuse	Maximum UL fuse
iC7-60EA3N05-206A	FE9, FE10	gG 315 A <sup>(1)</sup> or gG 355 A	Class J, 600 A
iC7-60EA3N05-245A		gG 315 A	Class J, 600 A
iC7-60EA3N05-302A		gG 400 A	Class J, 600 A
iC7-60EA3N05-385A		gG 500 A	Class J, 600 A
iC7-60EA3N05-480A		gG 630 A	Class J, 800 A
iC7-60EA3N05-588A			Class J, 800 A
iC7-60EA3A05-385A	AE10 + IE10	gG 630 A	–
iC7-60EA3A05-480A			–
iC7-60EA3A05-590A			–
iC7-60EA3A05-658A	AE11 + IE11	gG 1000 A	–
iC7-60EA3A05-730A			–
iC7-60EA3A05-820A			–
iC7-60EA3A05-880A			–
iC7-60EA3A05-1000	2xAE10 + 2xIE10	gG 1250 A	–
iC7-60EA3A05-1100			–

1) with the mains contactor option





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