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MD520 Series General-Purpose AC Drive

Installation Guide

Industrial Automation | Intelligent Elevator | New Energy Vehicle | Industrial Robot | Rail Transit

Data code 19011714A05

Preface

Introduction

The MD520 series AC drive is a general-purpose high-performance current vector control AC drive. It is designed to control and regulate the speed and torque of three-phase AC asynchronous motors and permanent magnet synchronous motors. It can be used to drive textile machines, paper making machines, wire drawing machines, machine tools, packaging machines, food machines, fans, water pumps, and other automated production equipment.

This guide describes the installation dimensions, space design, specific installation steps, wiring requirements, routing requirements, option installation requirements, and common EMC troubleshooting suggestions.

More documents

Document Name	Document Code	Description
MD520 Series General-Purpose AC Drive User Guide	PS00012134	This guide describes product selection, mechanical design, electrical design, installation, communication, commissioning, function application, faults, parameters, certifications, and standards.
MD520 Series General-Purpose AC Drive Quick Installation and Commissioning Guide	19011712	This guide describes the installation, wiring, commissioning, troubleshooting, parameters, and fault codes of the AC drive.
MD520 Series General-Purpose AC Drive Hardware Guide	19011713	This guide describes the system composition, technical specifications, components, dimensions, options (including installation accessories, cables, and peripheral electrical components), expansion cards, routine inspection and maintenance, certifications, and standards of the AC drive.
MD520 Series General-Purpose AC Drive Installation Guide	19011714	This guide describes the installation dimensions, space design, specific installation steps, wiring requirements, routing requirements, option installation requirements, and common EMC troubleshooting suggestions.
MD520 Series General-Purpose AC Drive Commissioning Guide	19011715	This guide describes the commissioning tools, commissioning flows, and specific commissioning steps, as well as troubleshooting, fault codes, and parameters related to the AC drive.
MD520 Series General-Purpose AC Drive Communication Guide	19011716	This guide describes the communication mode, communication networking, and communication configuration of the AC drive.

Document Name	Document Code	Description
MD520 Series General-Purpose AC Drive Function Guide	19011717	This guide describes the installation, wiring, commissioning, troubleshooting, parameters, and fault codes of the AC drive.
MD520 Series General-Purpose AC Drive Safety Function Guide	19011795	This guide describes the safety information, instructions for mechanical and electrical installation, commissioning and maintenance guidance, and safety-related parameters of the AC drive.

Revision history

Date	Version	Description
November 2023	A05	Corrected some minor errors.
June 2023	A04	Updated section 8.4.2 Wiring Descriptions of Control Circuit Terminals.
May 2023	A03	• Added T13 models to the product model list. • Added the installation flow of T13 models in section 1.1 Installation Flowchart. • Added the clearance requirements on T13 models in section 1.2.3 Clearance. • Added the mechanical installation tools and wiring tools for T13 models in section 1.3 Tools. • Added T13 model descriptions and updated MD38IO1 terminal descriptions in section 1.4.1 Option List. • Added section 6 Mechanical Installation (T13 Models). • Added T13 model dimensions in section 8.3.2 Dimensions and Cable Selection for Main Circuit Terminals. • Added descriptions of STO terminals in section 8.4.1 Main Circuit Terminal Descriptions. • Added descriptions of STO wiring and modified descriptions of DI1 to DI5 in section 8.4.2 Wiring Descriptions of Main Circuit Terminals. • Made minor corrections.
December 2022	A02	• Updated the preface. • Updated the fundamental safety instructions. • Updated the product model list. • Added the air director cover in section 1.2.3 Clearance. • Updated section 7.4.2 Wiring Descriptions of Control Circuit Terminals. • Added descriptions of installation bases for MDKE-10 and SOP-20-810. • Made minor corrections. • Updated the document style.

Date	Version	Description
June 2022	A01	• Updated the contents. • Updated section 1.2 Site Inspection. • Updated the mounting bracket dimensions of T1 and T2 models in section 1.4.1 Through-Hole Mounting Bracket. • Updated the electrical wiring diagram, descriptions of main circuit terminals, and post-wiring check in section 7 Electrical Installation. • Updated section 8.4 EMC Filter. • Made minor corrections.
January 2022	A00	First release

Access to the Guide

This guide is not delivered with the product. You can obtain the PDF version in the following ways:

- Visit *http://www.inovance.com*, go to Support > Download, search by keyword, and then download the PDF file.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install the app, where you can search for and download manuals.

Warranty

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is caused by proper operation of the user. You will be charged for any repair work after the warranty period expires.

Within the warranty period,maintenance fee will be charged for the following damage:

- Damage caused by operations not following the instructions in the user guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

The maintenance fee is charged according to the latest Price List of Inovance. If otherwise agreed upon, the terms and conditions in the agreement shall prevail.

For details, see the Product Warranty Card.

Table of Contents

Product Model List

The following table lists the mapping between product models and structures.

Table –1 Mapping between product models and structures

Structure	Product Model		
	Three-Phase 380 V to 480 V	Three-Phase 200 V to 240 V	Single-Phase 200 V to 240 V
T1	MD520-4T0.4B(S) MD520-4T0.7B(S) MD520-4T1.1B(S) MD520-4T1.5B(S) MD520-4T2.2B(S) MD520-4T3.0B(S)	MD520-2T0.4B(S) MD520-2T0.7B(S) MD520-2T1.1B(S) MD520-2T1.5B(S)	-
T2	MD520-4T3.7B(S) MD520-4T5.5B(S)	MD520-2T2.2B(S) MD520-2T3.7B(S)	MD520-2S0.4B(S) MD520-2S0.7B(S) MD520-2S1.5B(S) MD520-2S2.2B(S)
T3	MD520-4T7.5B(S) MD520-4T11B(S)	MD520-2T5.5B(S)	-
T4	MD520-4T15B(S)	MD520-2T7.5B(S)	-
T5	MD520-4T18.5(B)(S)(-T) MD520-4T22(B)(S)(-T)	MD520-2T11(B)(S)	-
T6	MD520-4T30(B)(S) MD520-4T37(B)(S)	MD520-2T15(B)(S) MD520-2T18.5(B)(S)	-
T7	MD520-4T45(B)(S) MD520-4T55(B)(S)	MD520-2T22(B)(S) MD520-2T30(B)(S)	-
T8	MD520-4T75(B)(S) MD520-4T90(S) MD520-4T110(S)	MD520-2T37(B)(S) MD520-2T45(S) MD520-2T55(S)	-
T9	MD520-4T132(S) MD520-4T160(S)	MD520-2T75(S)	-
T10	MD520-4T200(S)(-L) MD520-4T220(S)(-L)	MD520-2T90(S) MD520-2T110(S)	-
T11	MD520-4T250(S)(-L) MD520-4T280(S)(-L)	MD520-2T132(S)	-
T12	MD520-4T315(S)(-L) MD520-4T355(S)(-L) MD520-4T400(S)(-L)	MD520-2T160(S) MD520-2T200(S)	-
T13 (without the auxiliary power distribution cabinet)	MD520-4T500 MD520-4T500(S) MD520-4T560 MD520-4T560(S) MD520-4T630 MD520-4T630(S)	-	-

Structure	Product Model		
	Three-Phase 380 V to 480 V	Three-Phase 200 V to 240 V	Single-Phase 200 V to 240 V
T13 (with the auxiliary power distribution cabinet)	MD520-4T500-A MD520-4T500(S)-A MD520-4T560-A MD520-4T560(S)-A MD520-4T630-A MD520-4T630(S)-A	-	-

Note:

- (B): with the braking unit
- (S): with the safe torque off (STO) function
- (-T): with the DC reactor
- (-L): with the AC output reactor

Fundamental Safety Instructions

Safety Precautions

- This chapter presents essential safety instructions for a proper use of the equipment. Before using this product, read the user guide thoroughly and correctly understand the related safety precautions. Failure to comply with the safety instructions may result in death, severe personal injuries, or equipment damage.
- "CAUTION", "WARNING", and "DANGER" items in the guide only indicate some of the precautions that need to be followed; they just supplement the safety precautions.
- Use this equipment according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper use.

Safety Levels and Definitions

Indicates that failure to comply with the notice will result in death or severe personal injuries.

Indicates that failure to comply with the notice may result in death or severe personal injuries.

Indicates that failure to comply with the notice may result in minor or moderate personal injuries or equipment damage.

General Safety Instructions

- Drawings in the guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.
- Users must take mechanical precautions to protect personal safety and wear protective equipment, such as anti-smashing shoes, safety clothing, safety glasses, protective gloves, and protective sleeves.

Unpacking

- Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking.
- Do not install the equipment if you find water seepage or missing or damaged components upon unpacking.
- Do not install the equipment if you find the packing list does not conform to the equipment you received.

- Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking.
- Unpack the package by following the unpacking sequence. Do not strike the package violently.
- Check whether there is damage, rust, or injuries on the surface of the equipment and equipment accessories before unpacking.
- Check whether the package contents are consistent with the packing list before unpacking.

Storage and Transportation

- Large-scale or heavy equipment must be transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage.
- Before hoisting the equipment, ensure the equipment components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in personal injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is being hoisted by the hoisting equipment.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage.

- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Avoid storing or transporting the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing the equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport the equipment with other equipment or materials that may harm or have negative impacts on this equipment.

Installation

- The equipment must be operated only by professionals with electrical knowledge. Non-professionals are not allowed.

- Read through the guide and safety instructions before installation.
- Do not install this equipment in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in an electric shock.
- When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or a fire.
- Do not retrofit the equipment.
- Do not fiddle with the bolts used to fix equipment components or the bolts marked in red.
- When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations.
- Before installing equipments with strong electromagnetic interference, such as a transformer, install a shielding equipment for the equipment to prevent malfunction.
- Install the equipment onto an incombustible object such as a metal. Keep the equipment away from combustible objects. Failure to comply will result in a fire.

CAUTION

- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on the top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes.
- Resonance may occur when the equipment operating at a constant speed executes variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Before wiring, cut off all the power supplies of the equipment. and wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply will result in an electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with power ON. Failure to comply will result in an electric shock.
- Check that the equipment is grounded properly. Failure to comply can result in electric shock.

WARNING

- Do not connect the input power supply to the output end of the equipment. Failure to comply can result in equipment damage or even a fire.
- When connecting a drive to the motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Cables used for wiring must meet cross sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end.
- Fix the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may overheat or damage the connecting part, resulting in a fire.
- After wiring is done, check that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply may result in an electric shock or equipment damage.

CAUTION

- Follow the proper electrostatic discharge (ESD) procedure and wear an anti-static wrist strap to perform wiring. Failure to comply may result in damage to the equipment or to the internal circuit of the product.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will result in equipment malfunction.

Power-on

- Before power-on, check that the equipment is installed and wired properly and the motor can be restarted.
- Check that the power supply meets equipment requirements before power-on to prevent equipment damage or a fire.
- After power-on, do not open the cabinet door or protective cover of the equipment, touch any terminal, or disassemble any unit or component of the equipment. Failure to comply will result in an electric shock.

- Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in personal injuries or equipment damage.
- Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in a fire.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in death or personal injuries.

Operation

- The equipment must be operated only by professionals. Failure to comply will result in death or personal injuries.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply will result in an electric shock.

- Do not touch the equipment casing, fan, or resistor with bare hands to feel the temperature. Failure to comply may result in personal injuries.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

Maintenance

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment with power ON. Failure to comply will result in an electric shock.
- Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- In case of a permanent magnet motor, do not touch the motor terminals immediately after power-off because the motor terminals will generate induced voltage during rotation even after the equipment power supply is off. Failure to comply will result in an electric shock.

- Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.

Repair

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not repair the equipment with power ON. Failure to comply will result in an electric shock.
- Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.

- Submit the repair request according to the warranty agreement.
- When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal injuries or equipment damage.
- When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the equipment according to the replacement instructions.
- Do not use damaged equipment. Failure to comply may result in death, personal injuries, or severe equipment damage.
- After the equipment is replaced, check the wiring and set parameters again.

Disposal

- Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injuries, or even death.
- Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

Safety label

For safe equipment operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. The following table describes the meaning of the safety labels.

Safety Label		Description
T12 Models and Below	T13 Models	
		• Read through the safety instructions before operating the equipment. Failure to comply may result in death, personal injuries, or equipment damage. • Do not touch the terminals or remove the cover with power ON or within 10 min (for T12 models and below) or 15 min (for T13 models) after power-off. Failure to comply will result in an electric shock.

1 Preparations for Installation

1.1 Installation Flowchart

T1 to T9 models

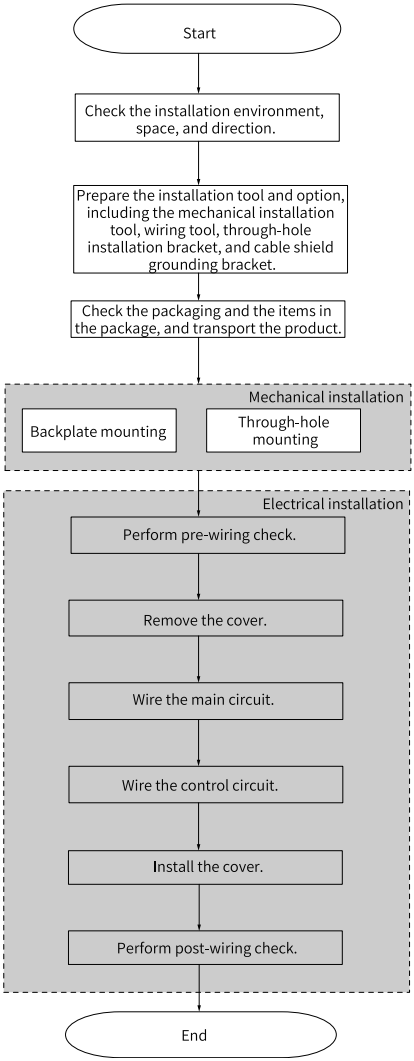


Figure 1-1 General installation process (T1 to T9 models)

T10 to T12 models

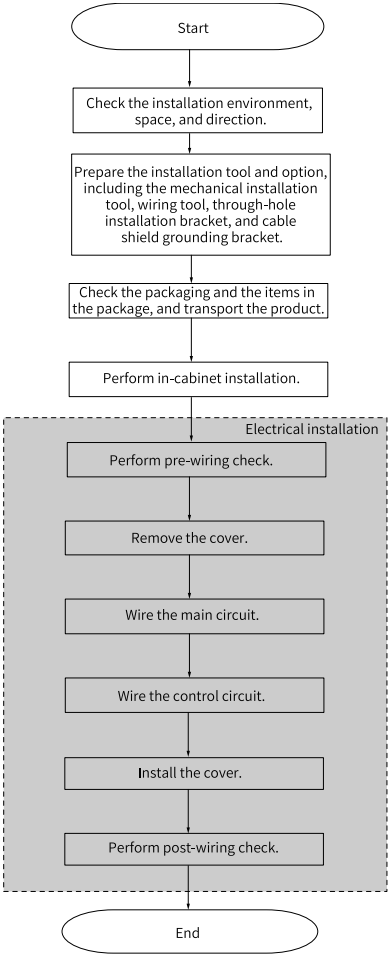


Figure 1-2 General installation process (T10 to T12 models)

T13 models

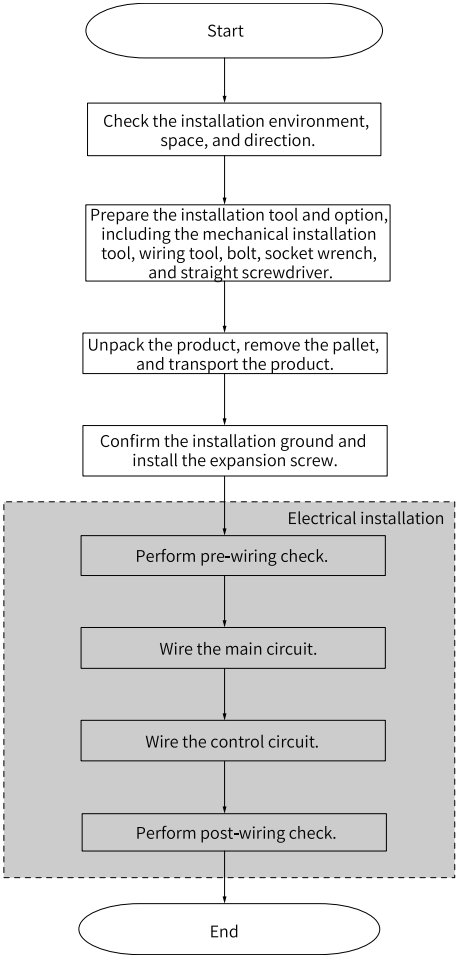


Figure 1-3 General installation process (T13 models)

1.2 Installation Site Inspection

1.2.1 Installation Environment

To maximize performance and ensure long service life of the drive, install the drive in an environment specified as follows.

Table 1–1 Environment requirements

Item	Condition
Installation location	Indoor
Grid overvoltage	OVC III
Temperature	• Installation/Ambient temperature: –10°C to +50°C. When the temperature ranges from –10°C to +40°C, no derating is required. For temperature above 40°C, derate 1.5% for every additional 1°C. • Storage/Transportation temperature: -20°C to +60°C. • For better reliability, use the AC drive in places without sharp temperature changes. • When installing the drive in an enclosed cabinet, use a cooling fan or air conditioner to keep the incoming air temperature below 50°C. Failure to comply will result in overheat or fire. • Install the drive on the surface of an incombustible object and leave sufficient surrounding space for heat dissipation. • Take measures to prevent the drive from being frozen.
Humidity	< 95% RH, without condensation
Environment	Pollution degree: 2 or below Install the drive in a place that meets the following requirements: • Free from direct sunlight, dust, corrosive gas, explosive and inflammable gas, oil mist, vapor, water drop, and salty element • Insusceptible to vibration (away from equipment that may generate strong vibration, such as a punch press) • Free from unwanted objects such as metal powder, oil, and water that may enter the drive • Free from radioactive substances, combustible materials, harmful gases and liquids, and salt corrosion • Away from combustible materials such as wood • Meeting Class 3C3 requirements in IEC 60721-3-3 in terms of chemically active substances.
Altitude	• ⩽ 1000 m: derating is not required • > 1000 m: derate 1% for every additional 100 m For 0.4 kW to 3 kW models, the maximum altitude is 2000 m; for altitudes above 2000 m, contact Inovance. For models with the power higher than 3 kW, the maximum altitude is 3000 m; for altitudes above 3000 m, contact Inovance.
Vibration resistance	• For transportation in the package: compliant with class 2M3 in EN 60721-3-2 • For installation with the package removed: compliant with ISTA 1H

1.2.2 Requirements on Installation Personnel

The equipment must be operated only by professionals with electrical knowledge.

1.2.3 Installation Clearance

Reserve sufficient clearance according to the power rating of the AC drive.

T1 to T9 models

- Installing one drive

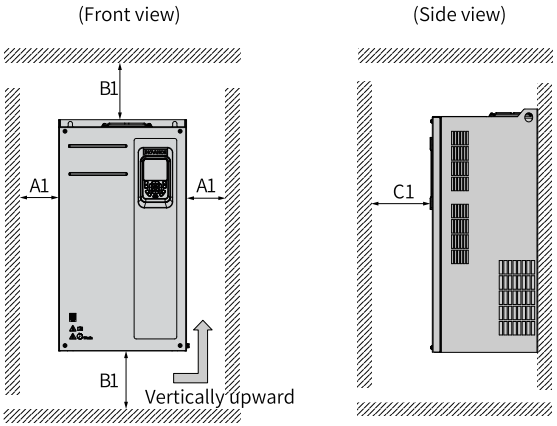


Figure 1-4 Clearance for installing one AC drive (T1 to T9 models)

Table 1–2 Installation clearance

Power Rating	Clearance (mm)		
0.4 kW to 15 kW	A1 ⩾ 10	B1 ⩾ 100	C1 ⩾ 40
18.5 kW to 22 kW	A1 ⩾ 10	B1 ⩾ 200	C1 ⩾ 40
30 kW to 37 kW	A1 ⩾ 50	B1 ⩾ 200	C1 ⩾ 40
45 kW to 160 kW	A1 ⩾ 50	B1 ⩾ 300	C1 ⩾ 40

- Installing multiple drives side by side
  The AC drive dissipates heat upward. When multiple AC drives are required to work together, install them side by side. Keep their tops level with each other, especially for those of different sizes.

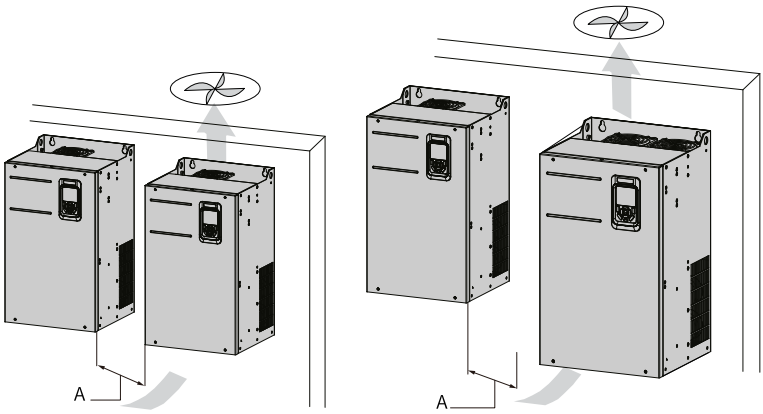


Figure 1-5 Installing multiple AC drives (T1 to T9 models) side by side

Table 1–3 Installation clearance

Power Rating	Clearance (mm)
0.4 kW to 15 kW	A ⩾ 10
18.5 kW to 22 kW	A ⩾ 10
30 kW to 37 kW	A ⩾ 50
45 kW to 160 kW	A ⩾ 50

- Dual-row installation
  If one drive needs to be installed above another one, install an air guide plate, as shown in *"Figure 1–6 Dual-row installation" on page 23*. This can prevent the drive in the lower row from heating that in the upper row, causing overheat or overload faults.

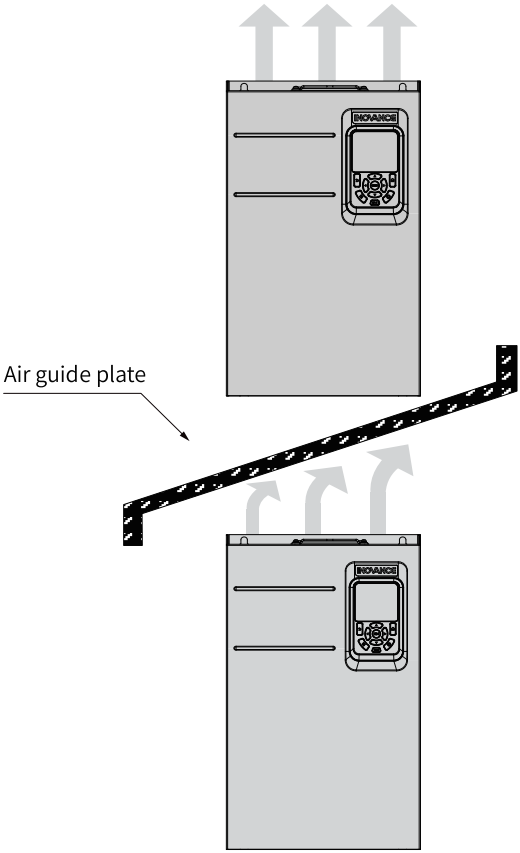


Figure 1-6 Dual-row installation

Air director design

The following figure shows the air director.

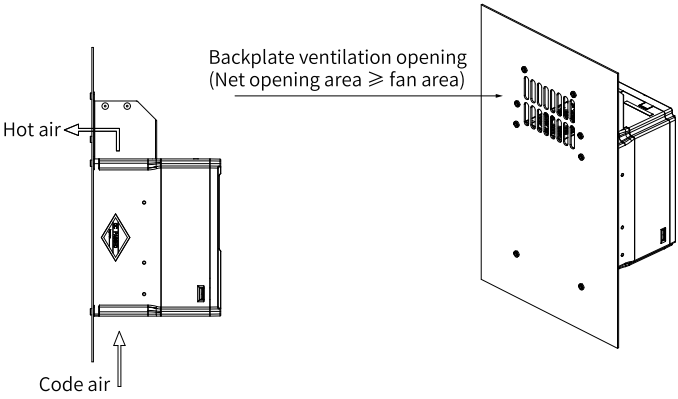


Figure 1-7 Air director

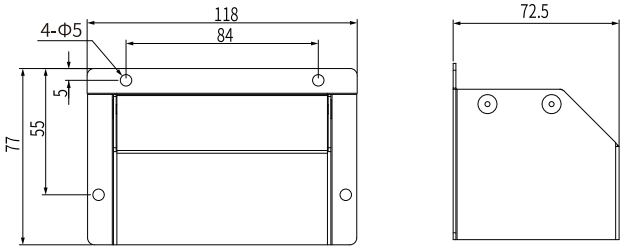


Figure 1-8 Air director dimensions (mm) of T1 models

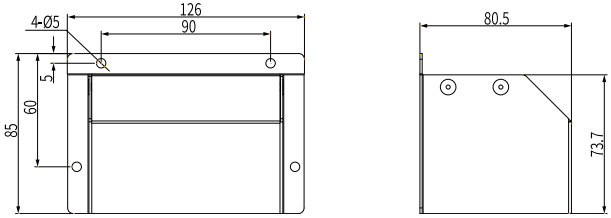


Figure 1-9 Air director dimensions (mm) of T2 models

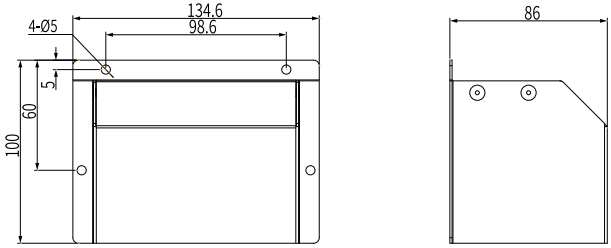


Figure 1-10 Air director dimensions (mm) of T3 models

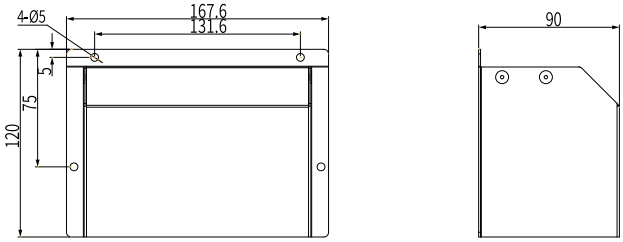


Figure 1-11 Air director dimensions (mm) of T4 models

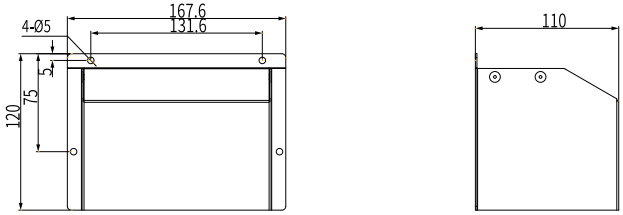


Figure 1-12 Air director dimensions (mm) of T5 models

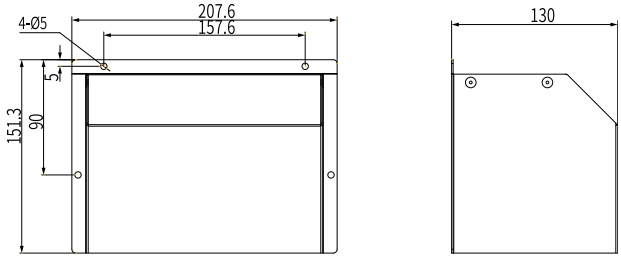


Figure 1-13 Air director dimensions (mm) of T6 models

Caution

Where multiple AC drives are installed in one cabinet, if the fan blows air into the air inlet from the outside, air distribution for the drives in the cabinet will be affected, resulting in poor cooling performance. Therefore, do not install a fan at the air inlet of the cabinet to blow air into the cabinet.

The following table describes the minimum effective ventilation area of the cabinet air inlet after the drive is installed in the cabinet.

Table 1–4 Minimum effective ventilation area of the cabinet air inlet

AC Drive	Minimum Effective Ventilation Area of the Cabinet Air Inlet (cm^2)
T1	20
T2	25
T3 (7.5 kW)	
T3 (11 kW)	50
T4	
T5	60
T6 and T7	102
T8	204
T9	318

The preceding table applies to situations where only one AC drive is mounted in the cabinet. For a cabinet containing multiple AC drives, calculate the total ventilation area by adding the ventilation area of each drive according to the table. For example, if eight T3 models (7.5 kW), two T5 models, and one T9 drives are placed inside the cabinet, the minimum effective ventilation area of the cabinet air inlet is 8 x 25 + 2 x 60 + 1 x 318 = 638 cm^2.

If an air filter is installed at the air inlet, the air inlet resistance will rise significantly. Therefore, the ventilation area of the air inlet must be increased to 1.2 to 1.5 times the value indicated in the table.

The effective ventilation area in *"Table 1–4 Minimum effective ventilation area of the cabinet air inlet" on page 26* refers to the actual through-hole area in the opening area, which means the effective ventilation area = opening area x opening rate.

T10 to T12 models

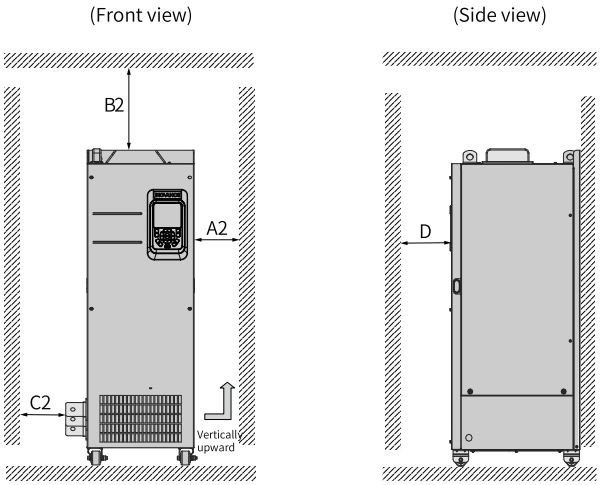


Figure 1-14 Installation clearance

Table 1–5 Installation clearance

Power Rating	Clearance (mm)			
200 kW to 400 kW	A2 ⩾ 10	B2 ⩾ 250	C2 ⩾ 20	D ⩾ 20

Note

T10 to T12 models can only be installed in cabinets individually. They cannot be installed in a side-by-side or up-down way. If side-by-side or up-down installation is required, contact Inovance.

T13 models

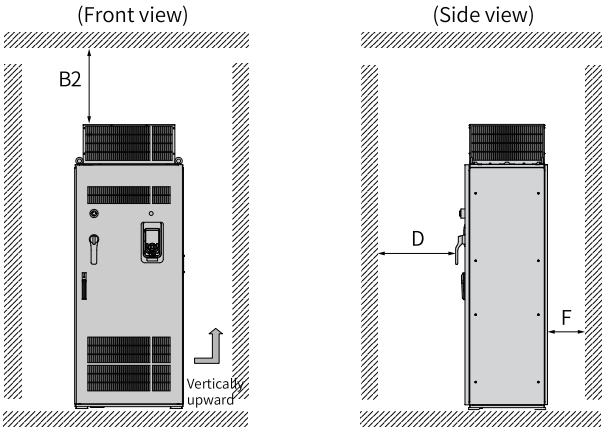


Figure 1-15 Installation clearance

Table 1–6 Installation clearance

Power Rating	Clearance (mm)		
500 kW to 630 kW	B2 ⩾ 250	D ⩾ 800	F ⩾ 100

1.2.4 Installation Direction

Install the AC drive vertically upright only, as shown in *"Figure 1–17 " on page 29* . Do not lie down the AC drive horizontally or by its side, or install it in the upside-down direction.

Do not stress on any side of the AC drive or place it on an inclined surface. The AC drive is large and heavy (close to 200 kg). If the inclination exceeds 5°, it may topple over.

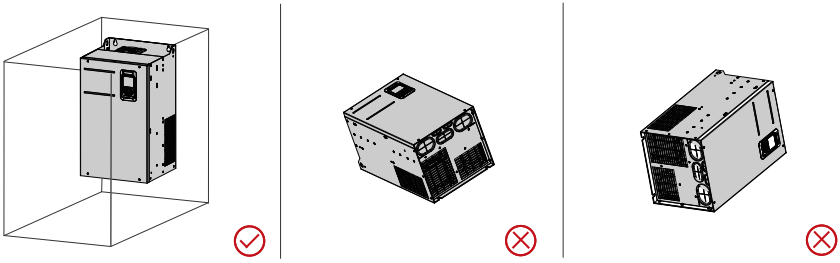


Figure 1-16 Installation direction (T1 to T9 models)

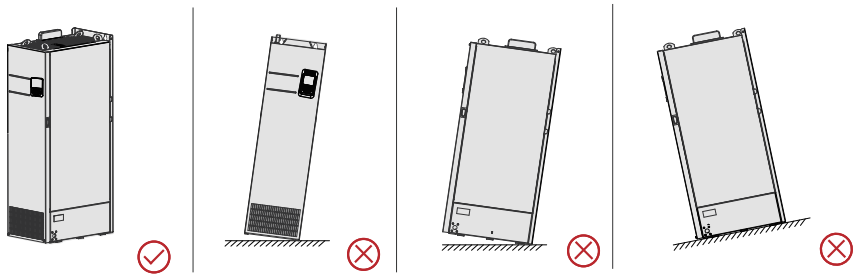


Figure 1-17 Installation direction (T10 to T12 models)

1.3 Installation Tools

1.3.1 Mechanical Installation Tools

T1 to T9 models

"Table 1–7 Tools for mechanical installation" on page 29 lists the tools for mechanical installation.

Table 1–7 Tools for mechanical installation

Tool	Description
Electric drill with appropriate drilling bits	It is used to drill mounting holes on the mounting surface.
Nut wrench or socket wrench	It is used to tighten or loosen screws. The following specifications are required: #13, #16, and #18.
Phillips screwdriver and straight screwdriver (2.5 mm to 6 mm)	It is used to tighten or loosen screws.
Torque wrench	It is used to tighten or loosen screws.
Crowbar	It is used to pry off the upper cover or cover to facilitate installation.
Crane	It is used to lift the drive.
Tape measure	It is used to measure the installation dimensions of the device.
Gloves	They are used to prevent static electricity during mechanical installation.
Bottom mounting bracket (standard)	It is used to fix the AC drive in the cabinet.

Tool	Description
Guide rails (optional)	They are connected to the bottom mounting bracket, enabling you to gently push the AC drive into the cabinet along the guide rails.
Screw	It is used to fix the equipment to the mounting surface.

"Table 1–8 Specifications and quantity of screws" on page 30 lists the specifications and quantity of screws required for mechanical installation.

Table 1–8 Specifications and quantity of screws

Installation Mode	Screw Specification	Quantity (PCS)	Description
Backplate mounting	Users purchase the screw according to the mounting hole diameter.	4	It is used to fix the drive onto the wall.
Through-hole mounting	Users purchase the screw according to the mounting hole diameter.	4	It is used to fix the drive onto the backplate of the control cabinet.

T10 to T12 models

"Table 1–7 Tools for mechanical installation" on page 29 lists the tools for mechanical installation.

"Table 1–9 Specifications and quantity of screws" on page 30 lists the specifications and quantity of screws required for mechanical installation.

Table 1–9 Specifications and quantity of screws

Installation Mode	Screw Specification	Quantity (PCS)	Description
Installation within the cabinet	M5 self-tapping screw	6	It is used to fix the bottom mounting bracket to the bottom of the cabinet.
	M5 x 12 SEMS screw	8	It us used to assemble the guide rails.
	M6 nut	2	It is used to connect the guide rail assembly to the bottom mounting bracket.

T13 models

See mechanical installation tools in *"Table 1–10 Tools for mechanical installation" on page 31*.

Table 1–10 Tools for mechanical installation

Tool	Description
Wrench or socket wrench (18 mm)	It is used to tighten or loosen screws.
Phillips screwdriver and straight screwdriver (2.5 mm to 6 mm)	It is used to tighten or loosen screws.
Torque wrench (torque above 100 N•m)	It is used to tighten or loosen screws.
Electric drill with an appropriate drilling bit	It is used to drill holes on the floor or steel plates for fastening the cabinet.
Crowbar	It is used to pry off the upper cover or cover to facilitate installation.
Crane	It is used to lift the drive.
Tape measure	It is used to measure the installation dimensions of the device.
Gloves	They are used to prevent static electricity during mechanical installation.

Select the screw with correct specifications; otherwise, improper installation may occur.

1.3.2 Tools for Wiring

When wiring the main circuit terminal, select an appropriate installation tool based on the terminal size. *"Table 1–11 Tools for wiring the main circuit terminal" on page 31* lists the tools for wiring the main circuit terminal.

Table 1–11 Tools for wiring the main circuit terminal

AC Drive Model	Recommended Fastener	Tool
T1 to T2	M4 SEMS screw	Phillips screwdriver (#3 slot)
T3 to T4	M5 SEMS screw	Phillips screwdriver (#3 slot)
T5 to T6	M6 SEMS screw	Phillips screwdriver (#3 slot)
T7	M8 nut, spring washer, and flat washer	Socket wrench (#13 socket)

AC Drive Model	Recommended Fastener	Tool
T8 to T9	M12 nut, spring washer, and flat washer	Socket wrench (#19 socket) and socket wrench extension bar (150 mm)
T10 to T11	M12 bolt, spring washer, and flat washer	Socket wrench (#19 socket) and socket wrench extension bar (250 mm)
T12	M16 bolt, spring washer, and flat washer	Socket wrench (#24 socket) and socket wrench extension bar (250 mm)
T13	M12 bolt, spring washer, and flat washer	Socket wrench (#24 socket) and socket wrench extension bar (250 mm)

1.4 Accessories

1.4.1 Option List

Optional peripherals include braking units, function expansion cards, and external operating panels. For use of each option, see its user guide. If any option is required, specify it in your order.

Table 1–12 Option list

Name		Model	Order No.	Supported AC Drive Model	Description
Braking components	External braking unit [1]	MDBUN-60-T	01013133	All models	60 A, 380 VAC series
		MDBUN-60-5T	0101AR57	All models	60 A, 480 VAC series
		MDBUN-90-T	01013126	All models	90 A, 380 VAC series
		MDBUN-90-5T	0101AR58	All models	90 A, 480 VAC series
		MDBUN-200-T	01040104	All models	200 A, 380 VAC series
		MDBUN-200-5T	01040160	All models	200 A, 480 VAC series
	Built-in braking unit	Models with the name containing letter "B"	/	T1 to T8 (75 kW)	Three phase 380-480 V models. For T1 to T4 models, the built-in braking unit is standard. For T5 to T8 (75 kW), the braking unit is optional.

Name		Model	Order No.	Supported AC Drive Model	Description
Expansion card	I/O expansion card 1	MD38IO1	01013098	T4 and above	Five DIs, one DO, one RO, one AO, one AI (PT100/PT1000), one RS485 or CAN communication signal isolation input terminal
	I/O expansion card 2	MD38IO2	01013103	All models	Three DIs
	I/O expansion card 3	MD38IO3	01040051	All models	Three DIs, one RO, one RS485 communication signal isolation input terminal
	I/O expansion card 4	MD520IO1	01040250	All models	Three DIs, one RS485 communication signal isolation input terminal, one normally open relay output terminal, one AO
	RS-485 communication card	MD38TX1	01013112	All models	Modbus communication adaption card with the isolation feature
	CANopen/ CANlink communication card	MD38CAN1	01013100	All models	CANopen/CANlink communication adaption card
	PROFIBUS DP communication card	MD-SI-DP2	01040249	All models	PROFIBUS DP communication card
		MD38DP2	01013144	T4 and above	PROFIBUS DP communication card
	PROFINET communication card	MD500-PN1	01040098	All models	PROFINET communication card
		MD500-PN2	01040198	All models	PROFINET communication card
	EtherCAT communication card	MD500-ECAT	01040113	All models	EtherCAT communication adaption card
	Ethernet/IP communication card	MD500-EN1	01040167	All models	Ethernet/IP communication adaption card
	Modbus TCP communication card	MD500-EM1	01040201	All models	Modbus TCP communication adaption card

Name		Model	Order No.	Supported AC Drive Model	Description
Expansion card	Positioning expansion card	MD38DW1	01013096	T4 and above	Multi-function pulse input expansion card Five DIs, one DO, one RO, one AO, one AI, one RS485 or CAN communication signal isolation input terminal, one differential ABZ terminal
	Positioning expansion card	MD38DW2	01013097	All models	Mini pulse input expansion card One RS485 communication terminal, one differential ABZ terminal (positioning)
	User programmable card	MD38PC1	01013104	T4 and above	Five DIs, two ROs, one CAN communication terminal
	Resolver frequency division encoder card	MD38PG4D	01040008	T4, T7 models and above	The MD38PG4D card is a PG card specially developed for resolvers. Featuring differential frequency division, it is suitable for various applications such as machine tool electric master axis, master-slave control, and synchronous control.
	Resolver interface card	MD38PG4	01013081	All models	It is applicable to the resolver with the excitation frequency of 10 kHz and with the DB9 interface To meet the MD38PG4 requirements, the excitation input DC resistance of the resolver must be greater than 17 Ω. Failure to comply will result in MD38PG4 malfunction. Select a resolver with a maximum of four pole pairs. Otherwise, the MD38PG4 card will be overloaded.

Name		Model	Order No.	Supported AC Drive Model	Description
Expansion card	Multi-function encoder card	MD38PGMD	01013147	All models	The card is an encoder interface card with the optional multiplied frequency division output function and supports 5 V or 15 V power supply. The card supports differential input, collector input, and push-pull input, as well as differential output and collector output; therefore, it can be used to connect to different encoders and supports A/B phase input of the host controller.
	23-bit PG card	ES510-PG-CT1	01320007	All models	Applicable to 23-bit encoders of Inovance; with a DB9 interface
	Sin-cos encoder	MD520-PG-S1	01040237	All models	The MD520-PG-S1 is a PG card that decodes sin-cos encoders. Working with the AC drive, it can measure the motor speed, and realize speed and position closed loop control and encoder frequency division output.

Name		Model	Order No.	Supported AC Drive Model	Description
Mounting accessory	Through-hole mounting bracket	MD500-AZJ-A1T1	01040072	T1	The bracket is used for through-hole mounting. It applies only to T1 to T9 models.
		MD500-AZJ-A1T2	01040073	T2	
		MD500-AZJ-A1T3	01040074	T3	
		MD500-AZJ-A1T4	01040075	T4	
		MD500-AZJ-A1T5	01040001	T5	
		MD500-AZJ-A1T6	01040002	T6	
		MD500-AZJ-A1T7	01040003	T7	
		MD500-AZJ-A1T8	01040004	T8	
		MD500-AZJ-A1T9	01040005	T9	
	Grounding bracket of cable shield	MD500-AZJ-A2T1	01040085	T1	The accessory is used for re-fixing the power cable and stable grounding of the shield in 360°. It applies only to T1 to T9 models.
		MD500-AZJ-A2T2	01040088	T2	
		MD500-AZJ-A2T3	01040083	T3	
		MD500-AZJ-A2T4	01040082	T4	
		MD500-AZJ-A2T5	01040081	T5	
		MD500-AZJ-A2T6	01040086	T6	
		MD500-AZJ-A2T7	01040087	T7	
		MD500-AZJ-A2T8	01040084	T8	
		MD500-AZJ-A2T9	01040089	T9	
	Mounting guide rail	MD500-AZJ-A3T10	01040009	T10 and T12	The option is used for installing the AC drive in a cabinet. For T10 models and models above T10, it is recommended that a guide rail be used to push the AC drive into the cabinet.
	U/V/W output copper busbar	MD500-TP-T10	01040125	T10	MD520 models excluding that with the base (-L) are delivered with the U/V/W output copper busbar.
		MD500-TP-T11	01040126	T11	
		MD500-TP-T12	01040127	T12	

Name		Model	Order No.	Supported AC Drive Model	Description
Cables	Main circuit cable	Lugs manufactured by Suzhou Yuanli are recommended. For details of recommended lugs, see *"8.3.3 Main Circuit Cables" on page 138*.			It is recommended that the input and output main circuit cables use symmetrical shielded cables. Compared with four-conductor cables, symmetrical shielded cables can reduce electromagnetic radiation in the whole transmission system. It is recommended that power cables also use symmetrical shielded cables.
	Control circuit cables	All control circuit cables must be shielded cables. Use a separate shielded cable for each type of analog signal. It is recommended that digital signal cables use shielded twisted pair (STP) cables.			
	External LED operating panel	MDKE-10	01040182	All models	It supports parameter display and modification.
	External LCD operating panel	SOP-20-810	01040028	All models	It supports parameter copy and download, and supports English and Chinese.
	SOP-20-810 mounting base	CP600–BASE1	01040022	All models	It is used to install the SOP-20-810 to the cabinet door.
	MDKE-10 mounting base	MD580-AZJ1	01040202	All models	It is used to install the MDKE-10 to the cabinet door.
	Extension cable	MDCAB	01013008	All models	It is a standard eight-conductor, three-meter network cable that can be used to connect the LED operating panel MDKE-10 and LCD operating panel SOP-20-810.
		MDCAB-1.5	15048471	All models	1.5-Meter cable for connecting the external operating panel

Note

For details on models and specifications of other peripheral electrical components, such as input reactors, EMC filters, output reactors, and fuses, see the section of peripheral electrical components.

1.4.2 Through-Hole Mounting Bracket

The through-hole mounting bracket is an option. Purchase a proper model based on actual needs.

Applicable model

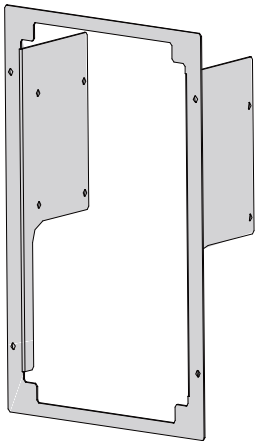


Figure 1-18 Through-hole mounting bracket

Table 1–13 Models of through-hole mounting brackets

Through-hole Mounting Bracket Model	AC Drive Structure
MD500-AZJ-A1T1	T1
MD500-AZJ-A1T2	T2
MD500-AZJ-A1T3	T3
MD500-AZJ-A1T4	T4
MD500-AZJ-A1T5	T5
MD500-AZJ-A1T6	T6
MD500-AZJ-A1T7	T7
MD500-AZJ-A1T8	T8
MD500-AZJ-A1T9	T9

Mounting hole dimensions

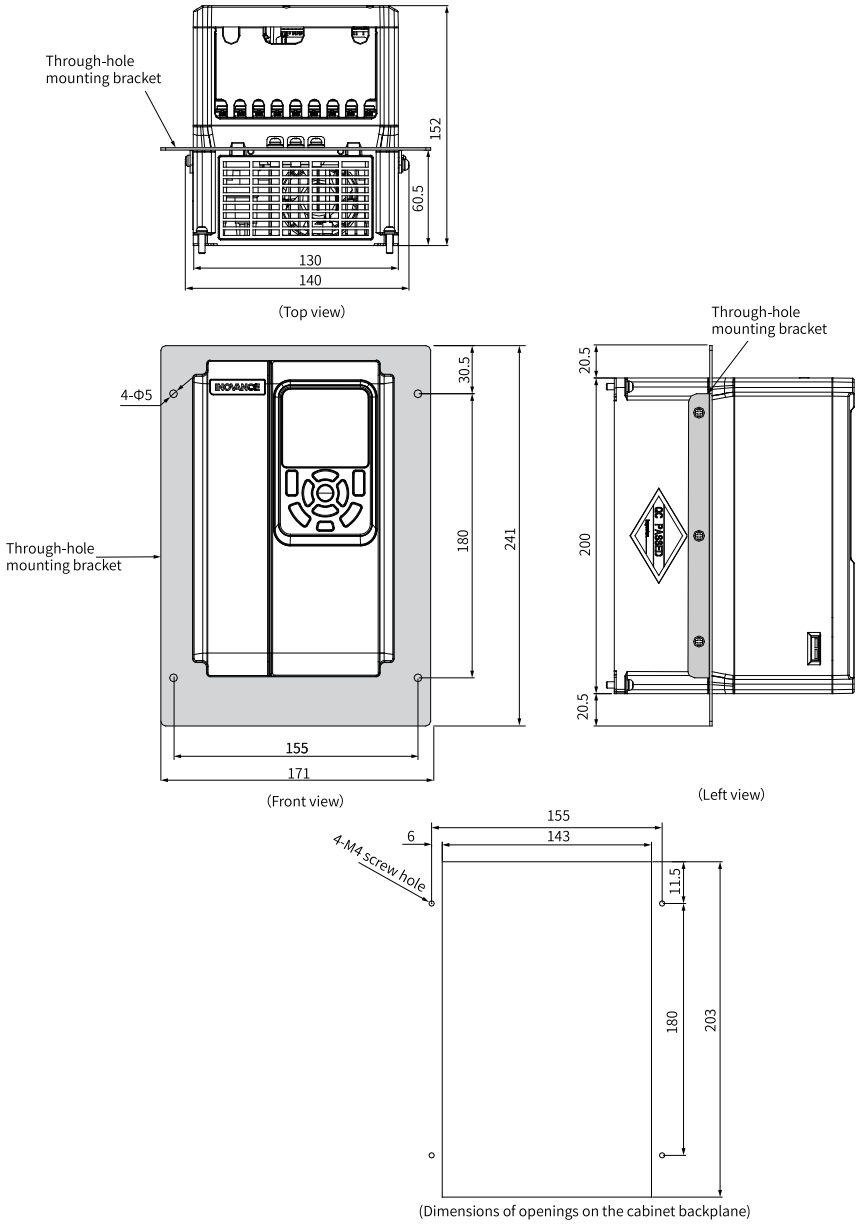


Figure 1-19 MD500-AZJ-A1T1 through-hole mounting bracket and hole dimensions (mm)

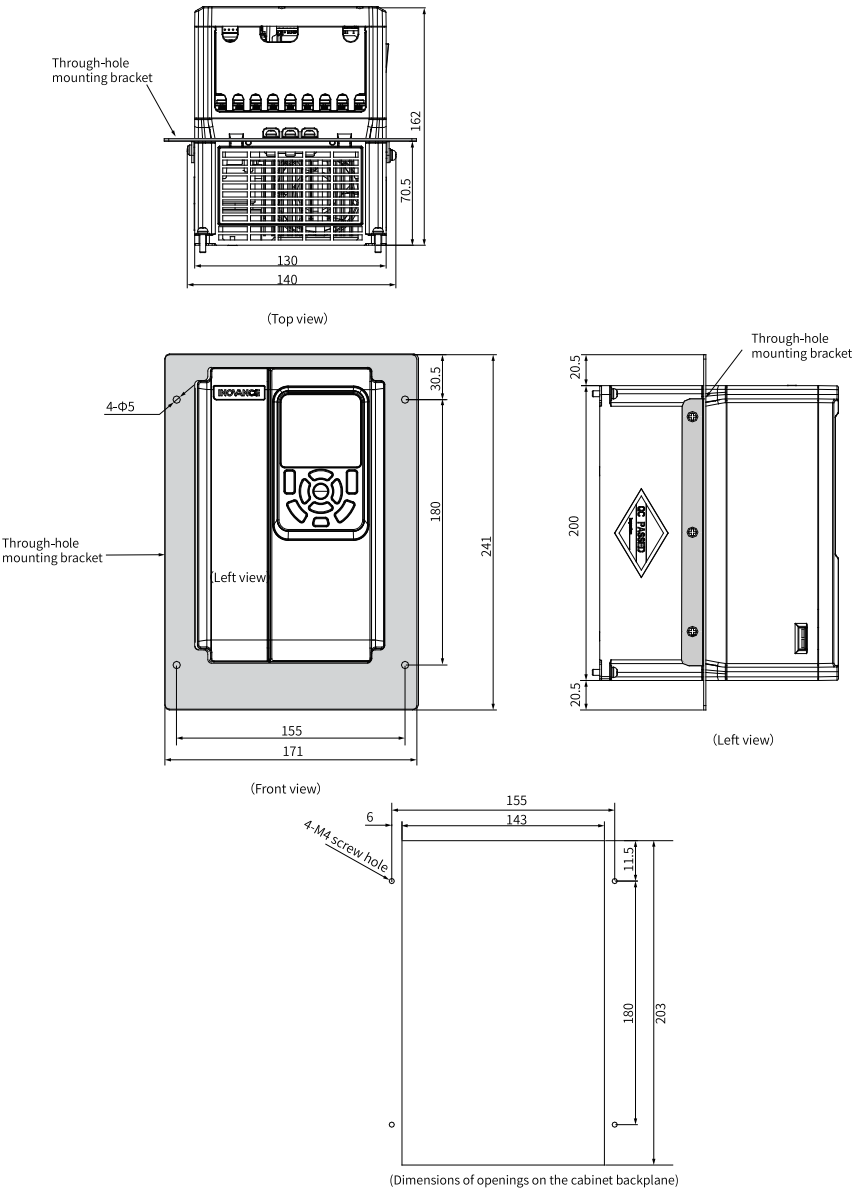


Figure 1-20 MD500-AZJ-A1T2 through-hole mounting bracket and hole dimensions (mm)

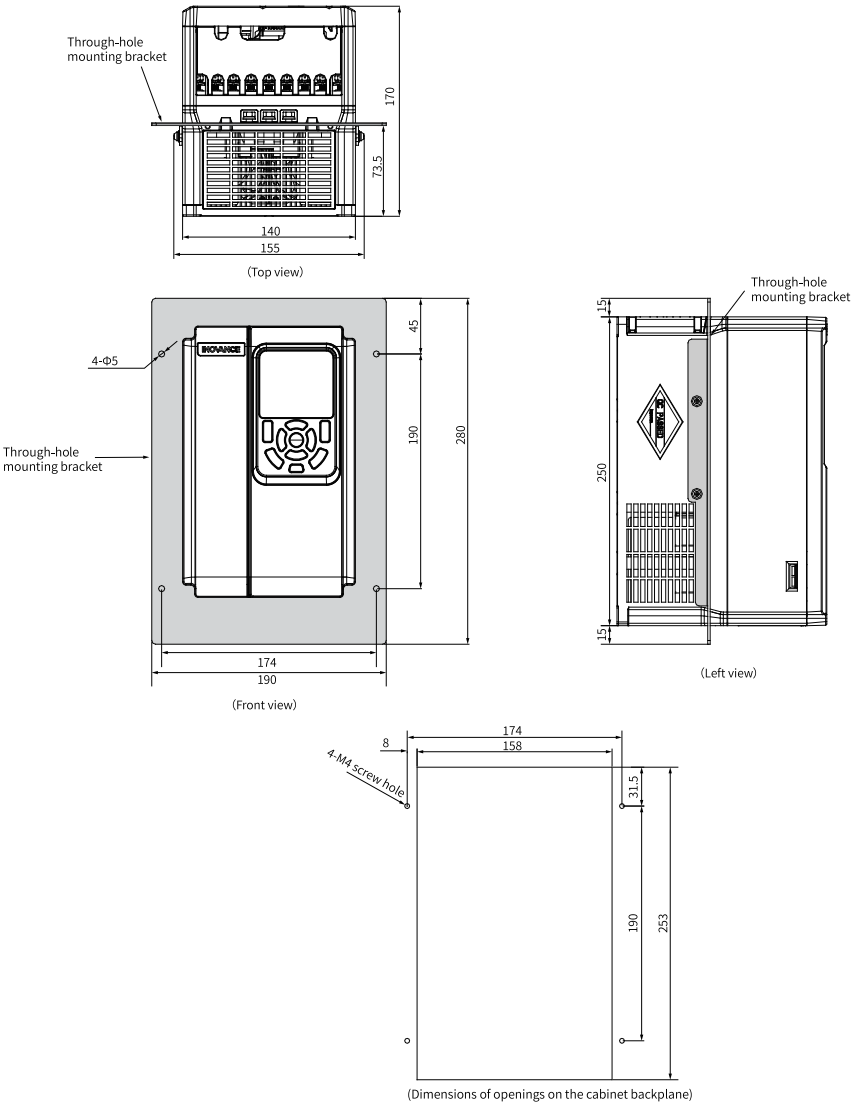


Figure 1-21 MD500-AZJ-A1T3 through-hole mounting bracket and hole dimensions (mm)

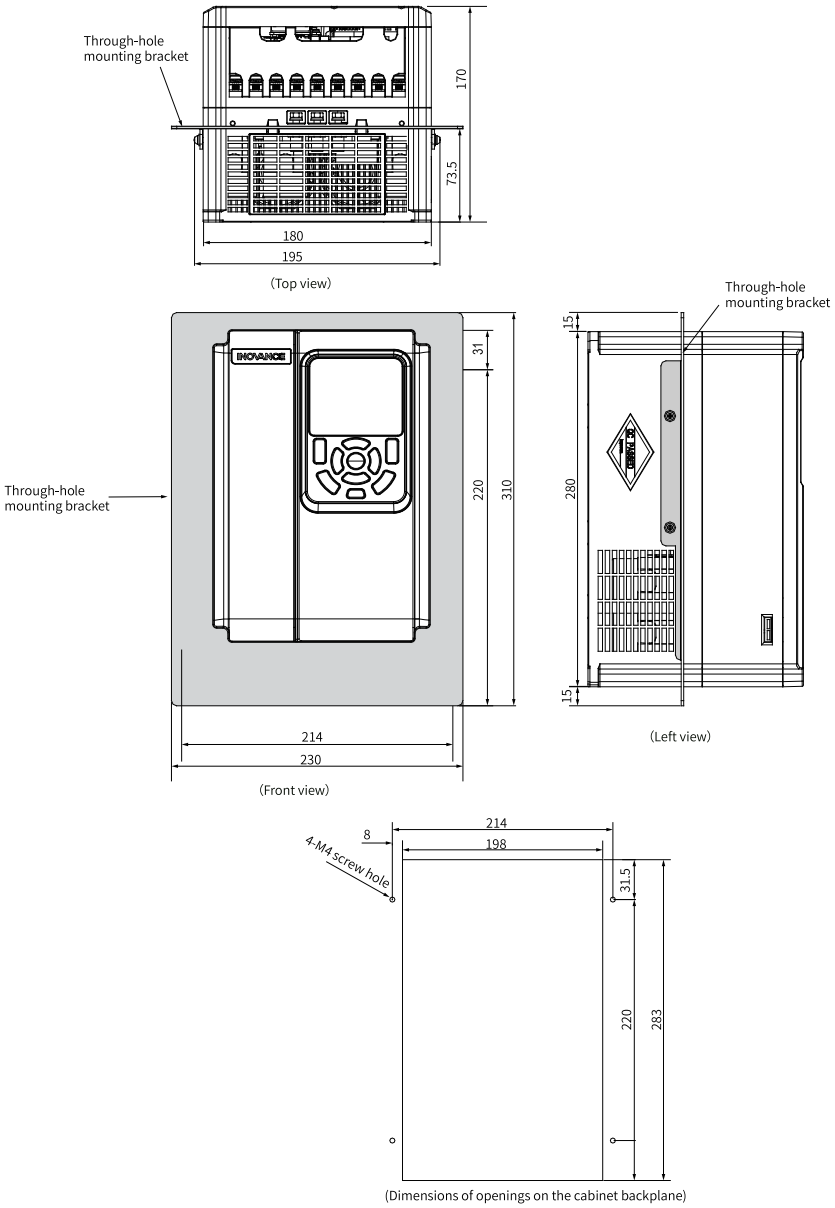


Figure 1-22 MD500-AZJ-A1T4 through-hole mounting bracket and hole dimensions (mm)

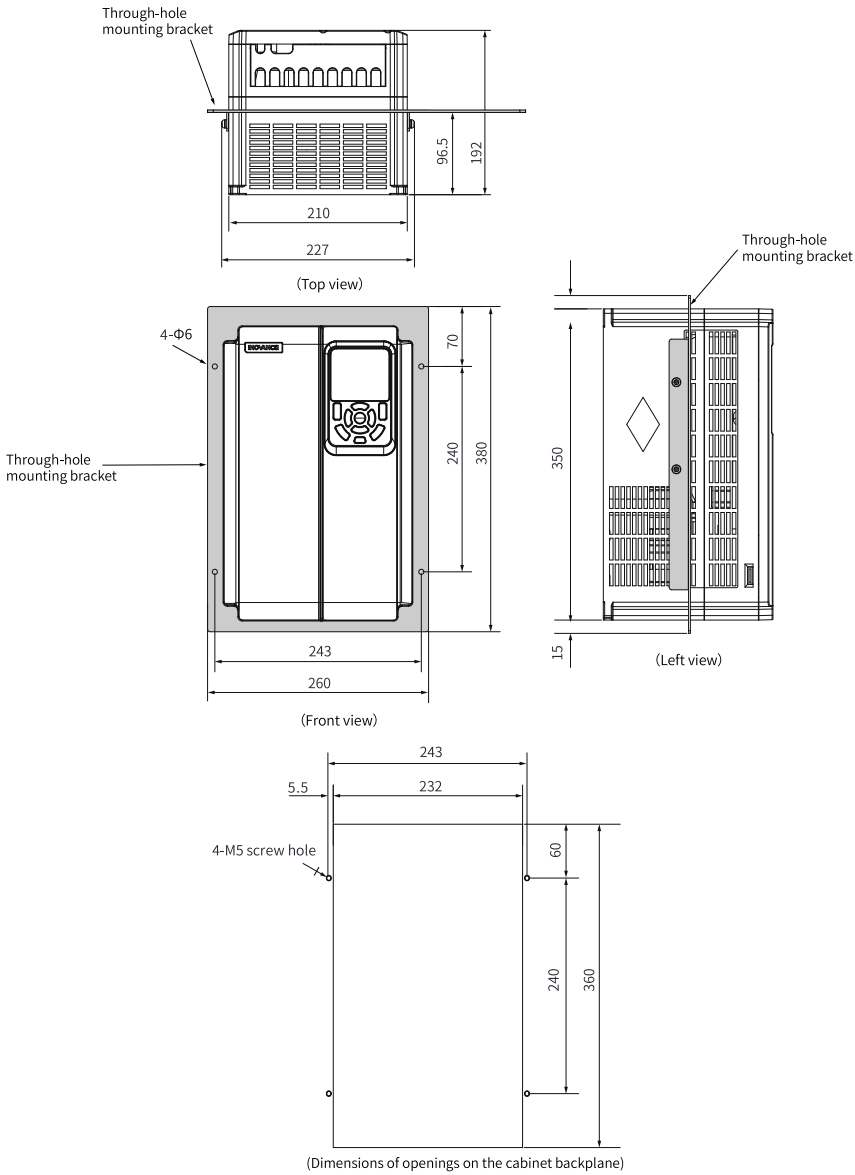


Figure 1-23 MD500-AZJ-A1T5 through-hole mounting bracket and cut-out dimensions (mm)

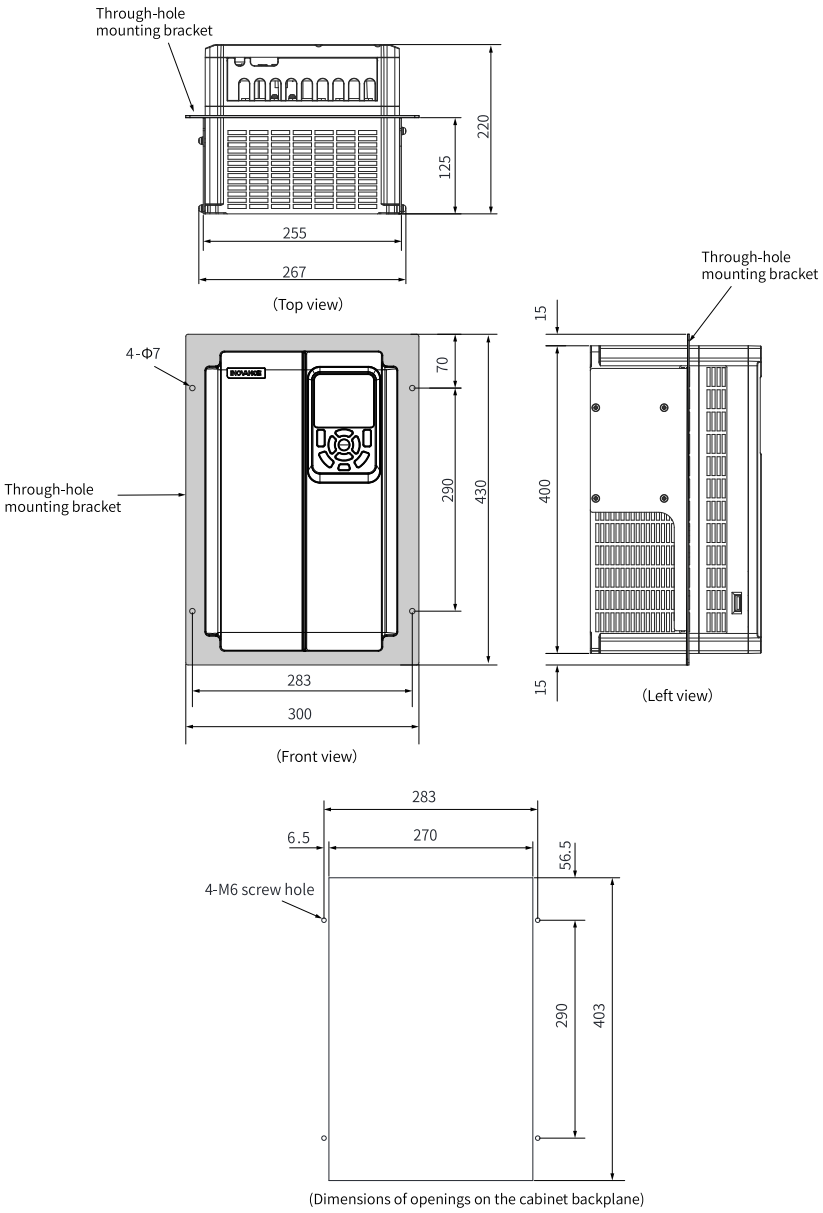


Figure 1-24 MD500-AZJ-A1T6 through-hole mounting bracket and cut-out dimensions (mm)

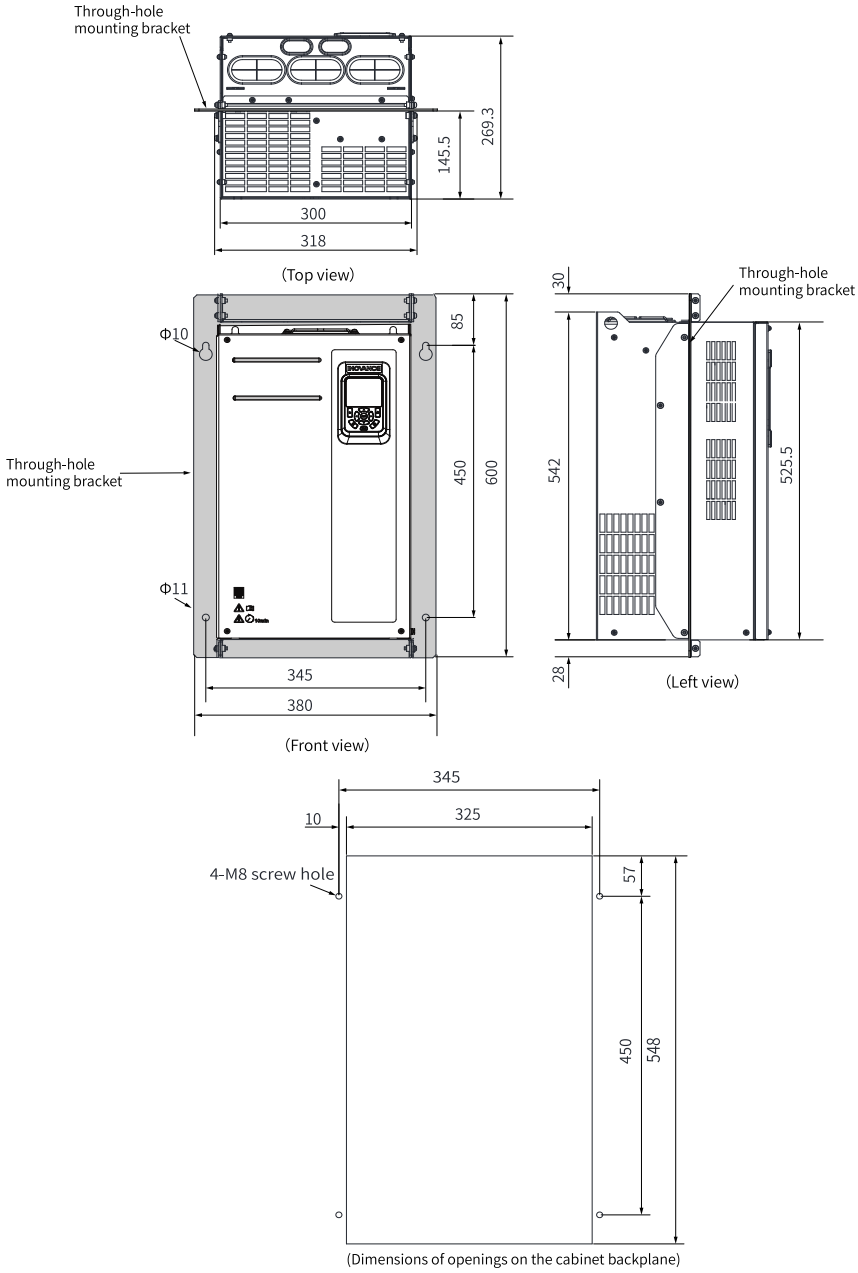


Figure 1-25 MD500-AZJ-A1T7 through-hole mounting bracket and cut-out dimensions (mm)

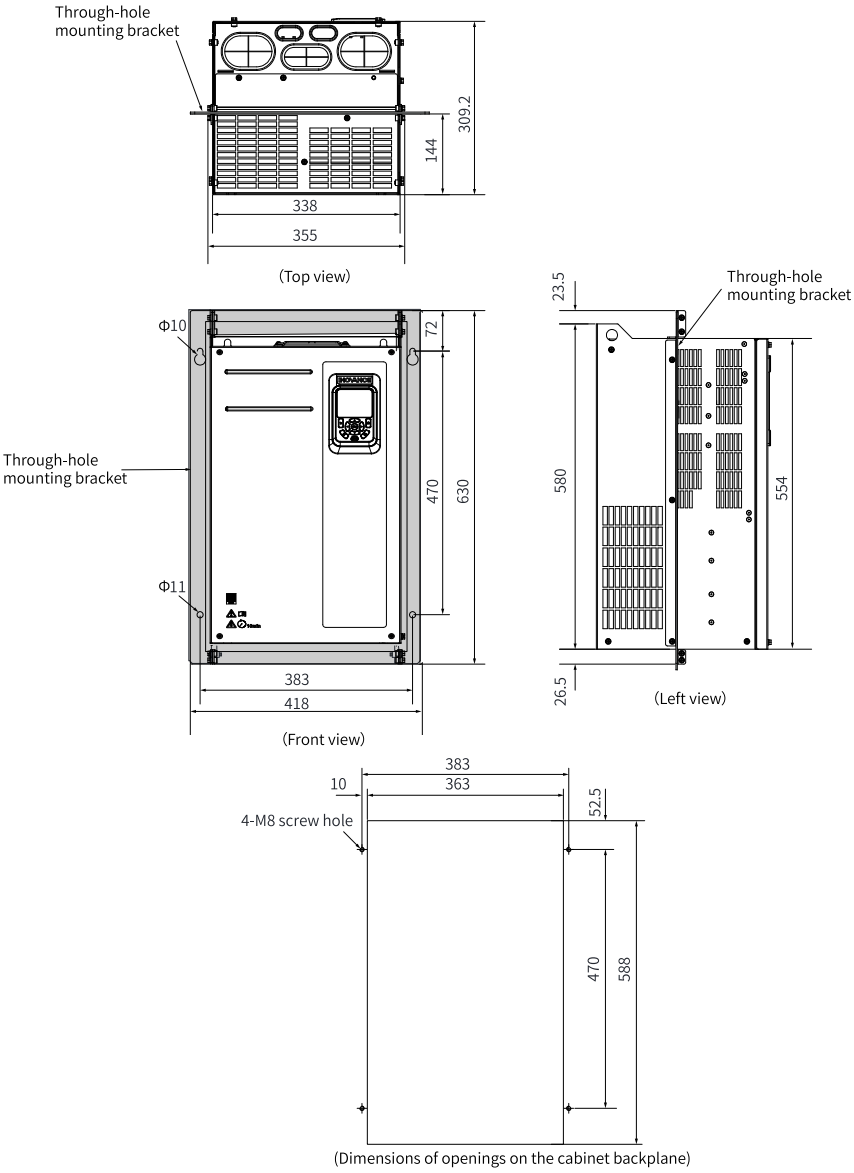


Figure 1-26 MD500-AZJ-A1T8 through-hole mounting bracket and cut-out dimensions (mm)

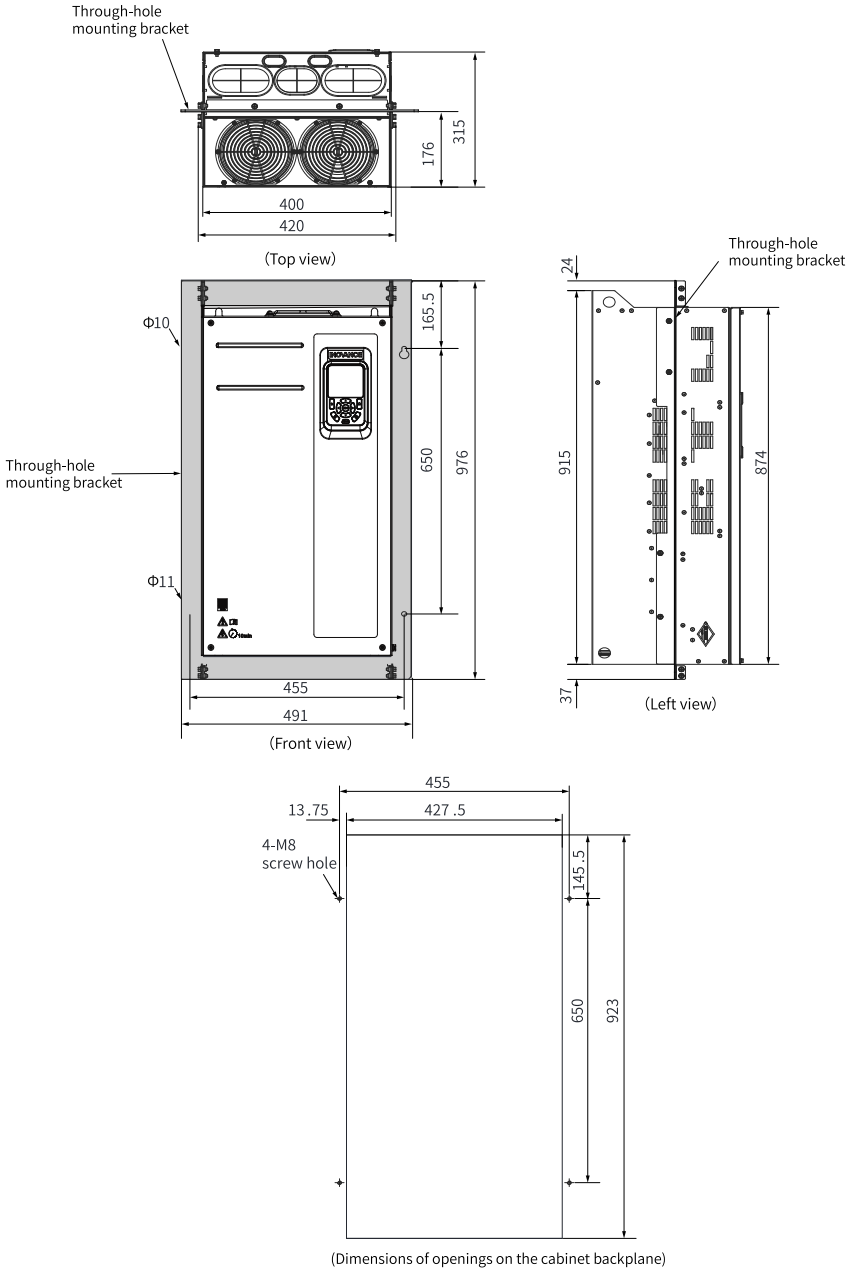


Figure 1-27 MD500-AZJ-A1T9 through-hole mounting bracket and cut-out dimensions (mm)

1.4.3 Grounding Bracket of Cable Shield

The grounding bracket of cable shield is optional and can be purchased separately as required (applicable to T9 models and below).

1.4.4 Bottom Mounting Bracket

T10 to T12 models come with a bottom mounting bracket. When the AC drive is installed in a cabinet, a bottom mounting bracket is required for fixing the AC drive to the cabinet rack base. The dimensions of bottom mounting brackets vary with the power rating, weight, and size of the AC drive, as shown in the following figures.

The bottom mounting bracket provided with the AC drive is applicable to the cabinet with a depth of 600 mm.

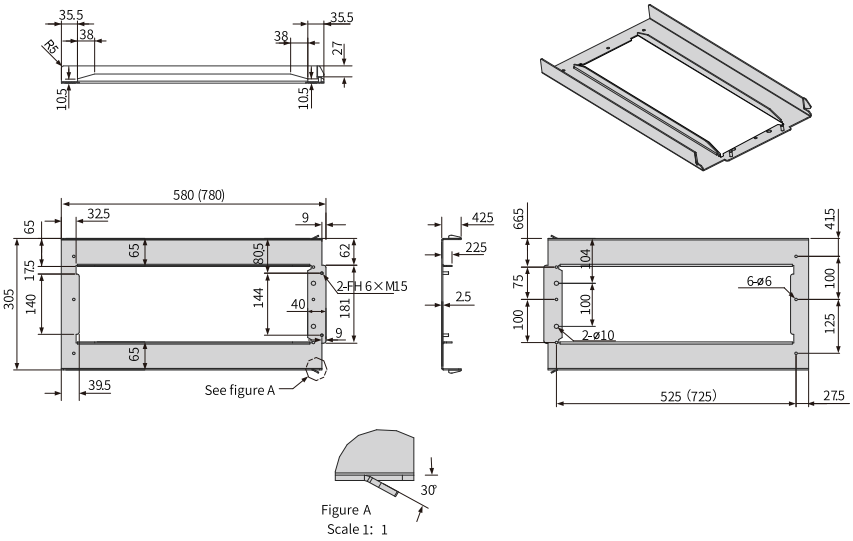


Figure 1-28 Dimensions of the bottom mounting bracket for T10 models

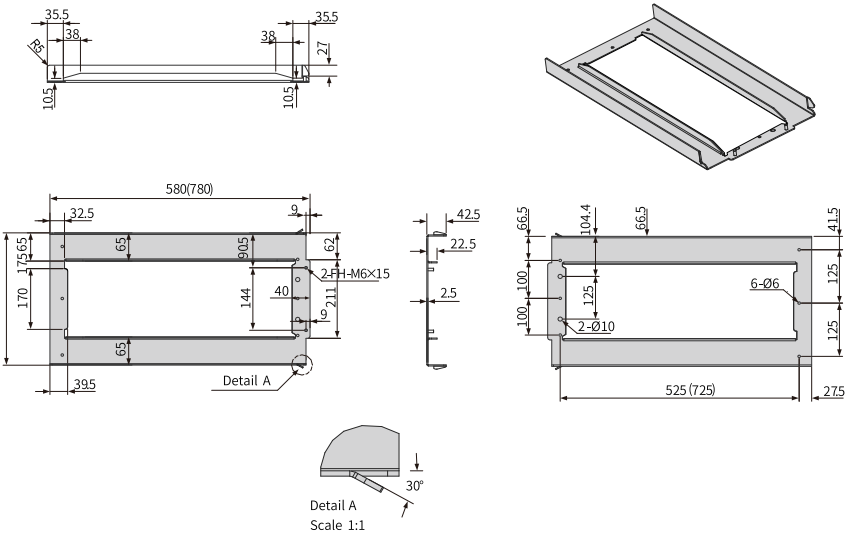


Figure 1-29 Dimensions of the bottom mounting bracket for T11 models

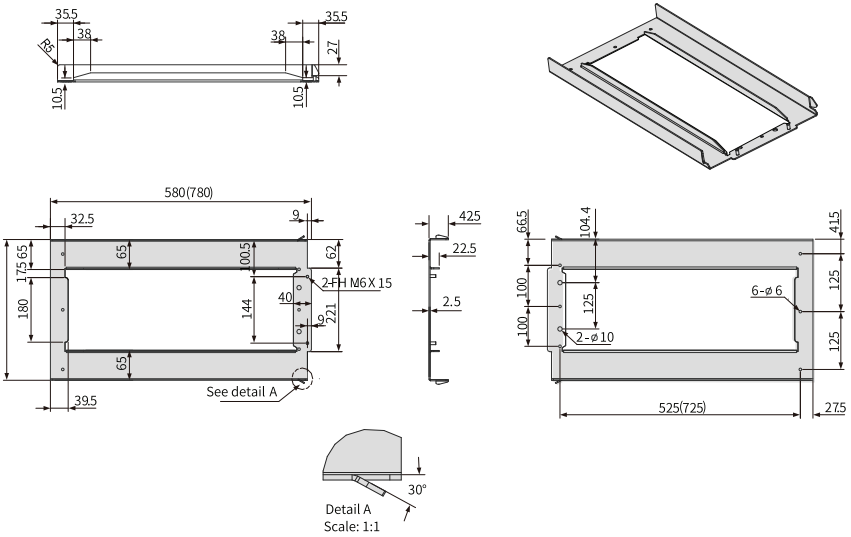


Figure 1-30 Dimensions of the bottom mounting bracket for T12 models

Note

- The bottom mounting brackets shown in the preceding figures are applicable to PS standard cabinets, sized either Width 800 mm x Depth 600 mm or Width 800 mm x Depth 800 mm. Dimensions in parentheses are applicable to PS standard cabinets sized Width 800 mm x Depth 800 mm.
- The bottom mounting brackets that come standard with T10 to T12 models are only applicable to PS standard cabinets sized Width 800 mm x Depth 600 mm.

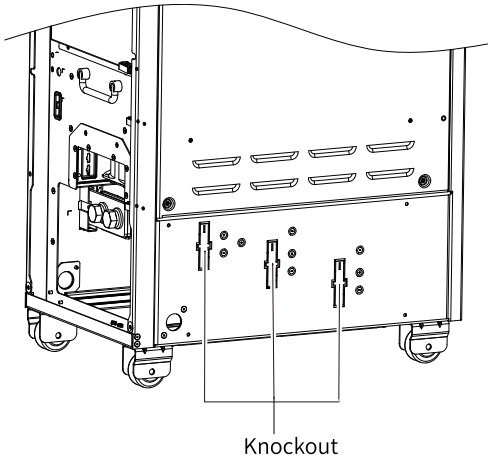
1.4.5 Guide Rail

For details of the guide rail, see *Operation Instructions for MD500-AZJ-A3T10 Guide Rail*.

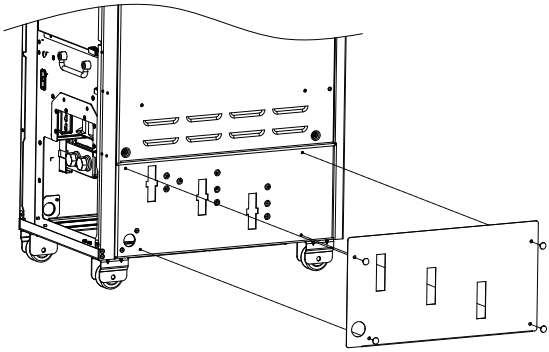
1.4.6 Installing the U/V/W Copper Busbar

All MD520 models excluding those with the base (-L) are delivered with U/V/W output side copper busbars. To install the U/V/W output copper busbars, follow the steps below:

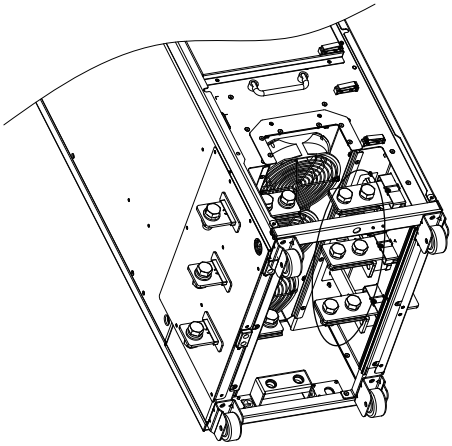
1. Use the screwdriver or cutting pliers to remove the three knockouts.

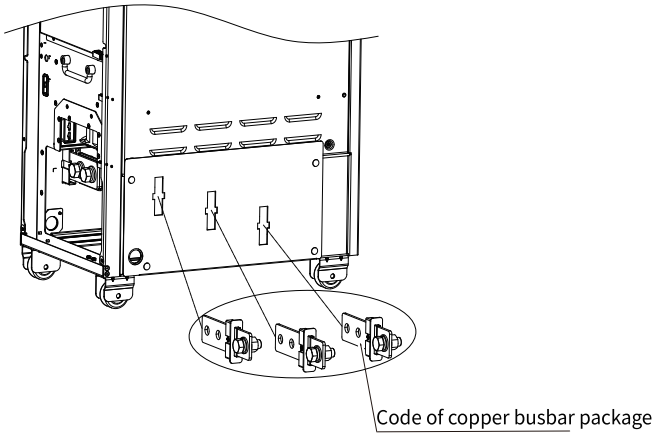


2. Use the four plastic snap-fit joints in the packing box to fasten the insulating paper to the chassis through the four holes on the paper.

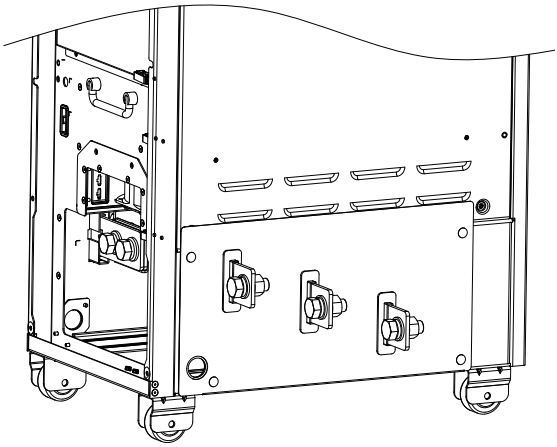


3. Remove the six screws on the drive, install the copper busbars, and then fasten the six screws.





The following figures shows the installed copper busbar.



Note

For selection of the U/V/W output copper busbar, see *"1.4.1 Option List " on page 32*.

2 AC Drive Dimensions

2.1 Dimensions of T1 and T9 Models

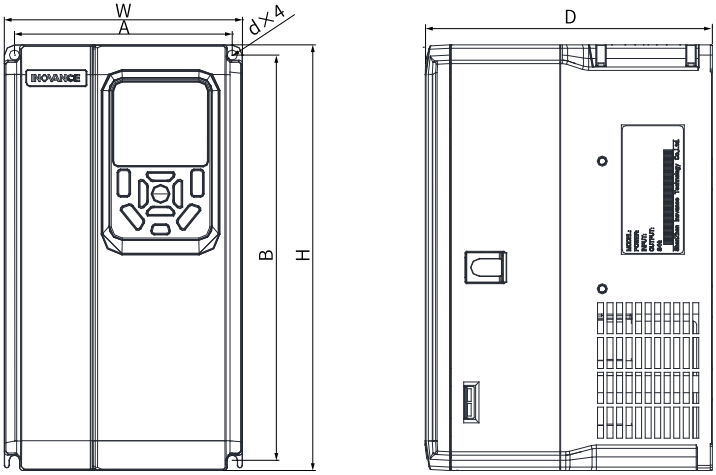


Figure 2-1 Outline dimensions and mounting dimensions of T1 to T4 models

Table 2–1 Outline dimensions and mounting dimensions of T1 to T4 models

Structure	Mounting Hole mm (in.)		Outline Dimension mm (in.)			Mounting Hole Diameter mm (in.)	Weight kg (lb)
	A	B	H	W	D	d x 4	
T1	119 (4.7)	189 (7.5)	200 (7.9)	130 (5.1)	150 (6.0)	Ø5 (0.2)	1.6 (3.5)
T2	119 (4.7)	189 (7.5)	200 (7.9)	130 (5.1)	160 (6.4)	Ø5 (0.2)	2.0 (4.4)
T3	128 (5.0)	238 (9.4)	250 (9.9)	140 (5.5)	168.3 (6.7)	Ø6 (0.2)	3.3 (7.3)
T4	166 (6.5)	266 (10.5)	280 (11.0)	180 (7.1)	169 (6.7)	Ø6 (0.2)	4.3 (9.5)

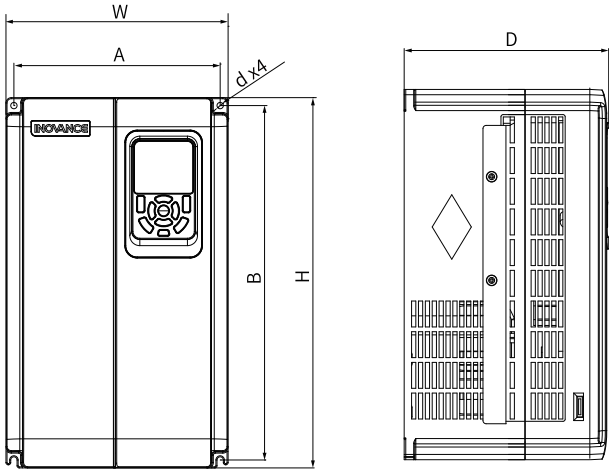


Figure 2-2 Outline dimensions and mounting dimensions of T5 to T6 models

Table 2–2 Outline dimensions and mounting dimensions of T5 to T6 models

Structure	Mounting Hole mm (in.)		Outline Dimension mm (in.)				Mounting Hole Diameter mm (in.)	Weight kg (lb)
	A	B	H	H1	W	D	d x 4	
T5 (without the DC reactor)	195 (7.7)	335 (13.2)	350 (13.8)	-	210 (8.3)	193.4 (7.6)	Ø6 (0.2)	7.6 (16.8)
T5 (-T models come with the DC reactor)	195 (7.7)	335 (13.2)	350 (13.8)	-	210 (8.3)	193.4 (7.6)	Ø6 (0.2)	10.0 (22.0)
T6	230 (9.1)	380 (15.0)	400 (15.8)	-	250 (9.9)	220.8 (8.7)	Ø7 (0.3)	17.5 (38.6)

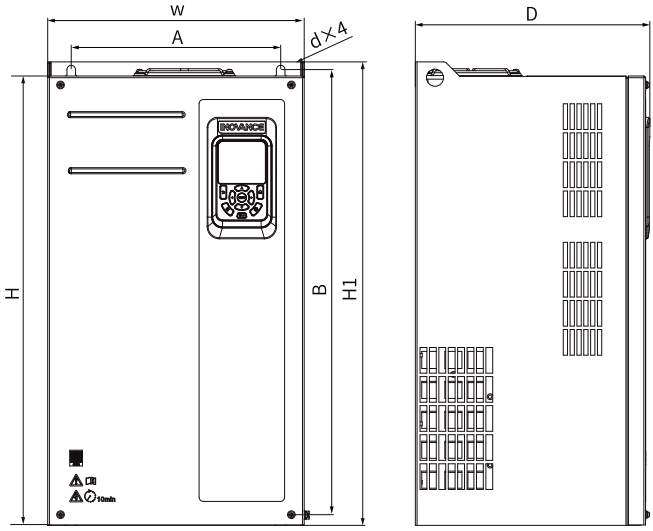


Figure 2-3 Outline dimensions and mounting dimensions of T7 to T9 models

Table 2–3 Outline dimensions and mounting dimensions of T7 to T9 models

Structure	Mounting Hole mm (in.)		Outline Dimension mm (in.)				Mounting Hole Diameter mm (in.)	Weight kg (lb)
	A	B	H	H1	W	D	d x 4	
T7	245 (9.7)	523 (20.6)	525 (20.7)	542 (21.4)	300 (11.8)	275 (10.8)	Ø10 (0.4)	35 (77.2)
T8	270 (10.6)	560 (22.1)	554 (21.8)	580 (22.9)	338 (13.3)	315 (12.4)	Ø10 (0.4)	51.5 (113.5)
T9	320 (12.6)	890 (35.1)	874 (34.4)	915 (36.1)	400 (15.8)	320 (12.6)	Ø10 (0.4)	85 (187.4)

2.2 Dimensions of T10 to T12 Models (Without AC Output Reactor)

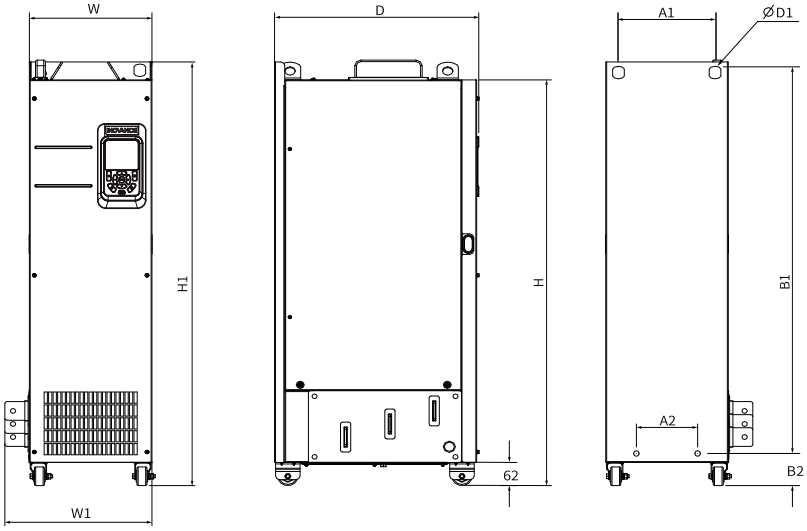


Figure 2-4 Outline dimensions and mounting dimensions of T10 to T12 models (without AC output reactor)

Table 2–4 Outline dimensions and mounting dimensions of T10 to T12 models (without AC output reactor)

Structure	Mounting Hole mm (in.)				Overall Dimension mm (in.)					Mounting Hole Diameter mm (in.)	Weight kg (lb)
	A1	A2	B1	B2	H	H1	W	W1	D	D1	
T10	240 (9.5)	150 (5.9)	1035 (40.8)	86 (3.4)	1086 (42.8)	1134 (44.7)	300 (11.8)	360 (14.2)	500 (19.7)	ϕ13 (0.5)	110 (242.5)
T11	225 (8.9)	185 (7.3)	1175 (46.3)	97 (3.8)	1248 (49.2)	1284 (50.6)	330 (13)	390 (15.4)	545 (21.5)	ϕ13 (0.5)	155 (341.7)
T12	240 (9.5)	200 (7.9)	1280 (50.4)	101 (4)	1355 (53.4)	1405 (55.4)	340 (13.4)	400 (15.8)	545 (21.5)	ϕ16 (0.6)	185 (407.9)

2.3 Dimensions of T10 to T12 Models (with AC Output Reactor)

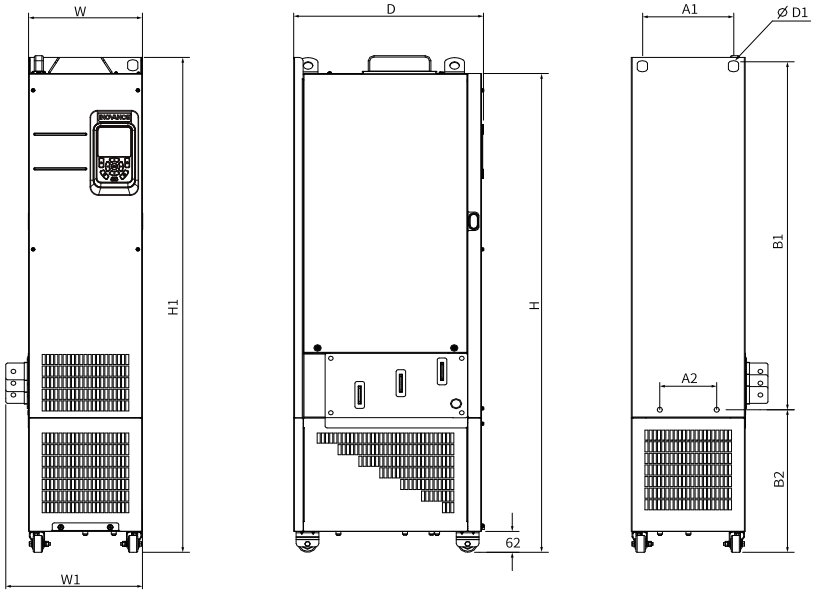


Figure 2-5 Outline dimensions and mounting dimensions of T10 to T12 models (with AC output reactor)

Table 2–5 Outline dimensions and mounting dimensions of T10 to T12 models (with AC output reactor)

Structure	Mounting Hole mm (in.)				Overall Dimension mm (in.)					Mounting Hole Diameter mm (in.)	Weight kg (lb)
	A1	A2	B1	B2	H	H1	W	W1	D	D1	
T10	240 (9.5)	150 (5.9)	1035 (40.8)	424 (16.7)	1424 (56.1)	1472 (58.0)	300 (11.8)	360 (14.2)	500 (19.7)	ϕ13 (0.5)	160 (352.7)
T11	225 -8.9	185 (7.3)	1175 (46.3)	435 (17.1)	1586 (62.5)	1622 (63.9)	330 (13.0)	390 (15.4)	545 (21.5)	ϕ13 (0.5)	215 (474.0)
T12	240 -9.5	200 (7.9)	1280 (50.4)	432 (17.0)	1683 (66.3)	1733 (68.3)	340 (13.4)	400 (15.8)	545 (21.5)	ϕ16 (0.6)	245 (540.1)

2.4 Dimensions of T13 Models (Without Auxiliary Power Distribution Cabinet)

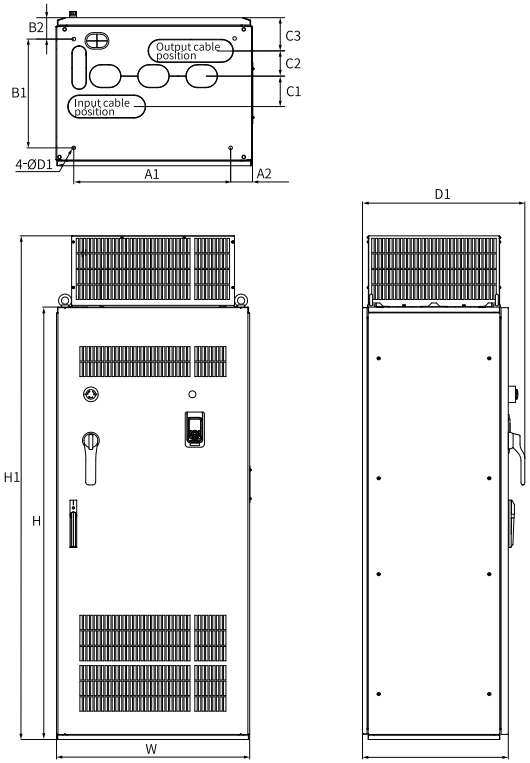


Figure 2-6 Outline dimensions and mounting dimensions of T13 models (without auxiliary power distribution cabinet)

Table 2–6 Outline dimensions and mounting dimensions of T13 models (without auxiliary power distribution cabinet)

Structure	Mounting Hole mm (in.)						
	A1	A2	B1	B2	C1	C2	C3
T13	660 (26.0)	73.5 (2.9)	450 (17.7)	85 (3.3)	125 (4.9)	104 (4.1)	136 (5.4)

Structure	Overall Dimension mm (in.)					Mounting Hole Diameter mm (in.)	Weight kg (lb)
	H	H1	W	D	D1	D2	
T13	1800 (70.9)	2100 (82.7)	805 (31.7)	610 (24.0)	680 (26.8)	15 (0.6)	530 (1168.4)

2.5 Dimensions of T13 Models (with Auxiliary Power Distribution Cabinet)

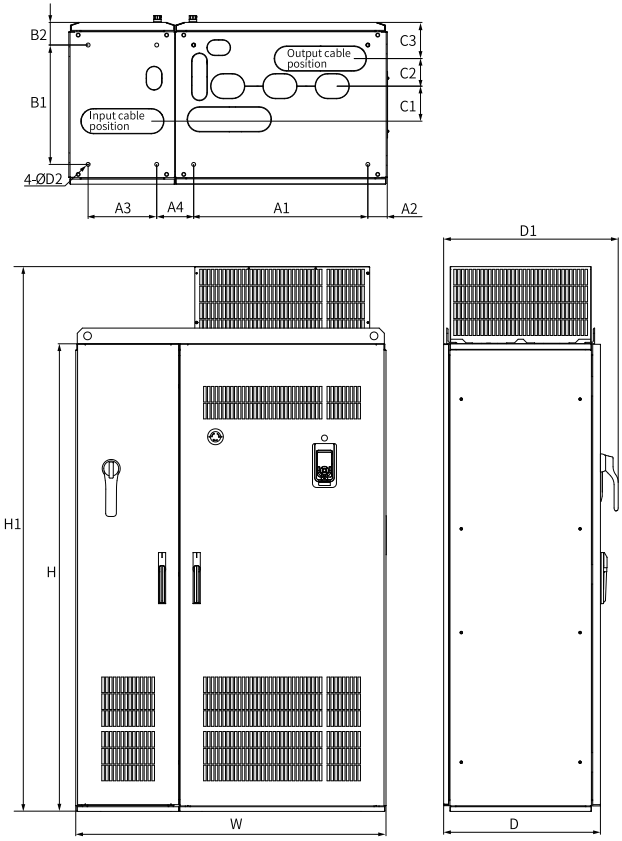


Figure 2-7 Outline dimensions and mounting dimensions of T13 models (with auxiliary power distribution cabinet)

Table 2–7 Outline dimensions and mounting dimensions of T13 models (with auxiliary power distribution cabinet)

Structure	Mounting Hole mm (in.)								
	A1	A2	A3	A4	B1	B2	C1	C2	C3
T13	660 (26.0)	73.5 (2.9)	260 (10.2)	140 (5.5)	450 (17.7)	85 (3.3)	132 (5.2)	104 (4.1)	136 (5.4)

Structure	Overall Dimension mm (in.)					Mounting Hole Diameter mm (in.)	Weight kg (lb)
	H	H1	W	D	D1	D2	
T13	1800 (70.9)	2100 (82.7)	1205 (47.5)	610 (24.0)	680 (26.8)	15 (0.6)	730 (1609.4)

3 Unpacking Inspection

3.1 Storage

- Store the drive in a clean and dry space, with an ambient temperature ranging from –20°C to +60°C and a temperature change rate less than 1°C/min.
- For long time storage, cover the drive or take other appropriate measures to keep it from contamination and environmental influences.
- For storage, pack the drive with the original packing box provided by Inovance.
- Do not expose the drive to moisture, high temperature, or outdoor direct sunlight for an extended period.
- To avoid degradation of electrolytic capacitor during long-term storage, energize the drive once every six months, each time lasting at least 5 hours. Use a regulator to increase the input voltage gradually to the rated value. For any doubt, contact Inovance.

3.2 Transportation Before Unpacking

T1 to T12 models

Precautions for transportation of T1 to T12 models:

- T1 to T6 models are small and light and therefore can be handled manually. T7 to T12 models, however, must be transported with an appropriate lifting tool.
- Fix the drive to a wooden pallet when handling with a forklift. When handing with a crane, fix the drive to the pallet, as shown below.

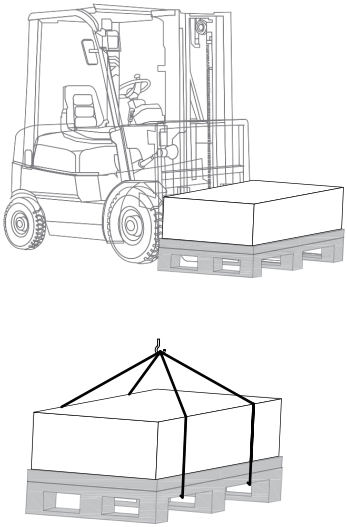


Figure 3-1 Lifting the drive

- T9 to T12 models are heavy with a high center of gravity. Therefore, avoid placing them on an inclined surface with an angle greater than 5 degrees. The AC drive must be placed on a flat and firm ground that can bear its weight.
- Transport the AC drive only when it is upright as indicated on the packaging box, as shown in the following figure. Never turn it upside down or place it on its side.

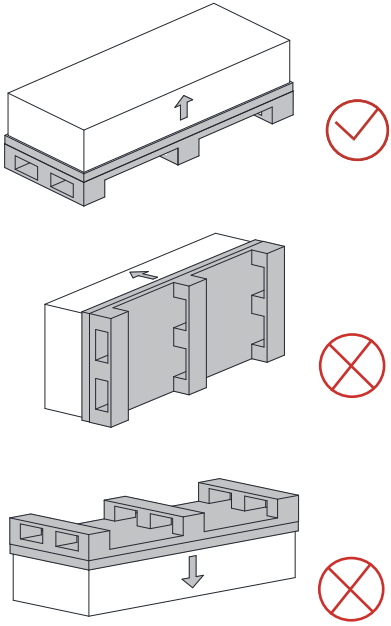


Figure 3-2 Placing the drive

T13 models

Precautions for transportation of T13 models:

- The AC drive is heavy with a high center of gravity. Therefore, avoid placing it on an inclined surface with an angle greater than 5 degrees. The AC drive must be placed on a flat and firm ground that can bear its weight.
- The cabinet must always be transported in the upright position as indicated on the packaging box. Never turn it upside down or place it on its side.

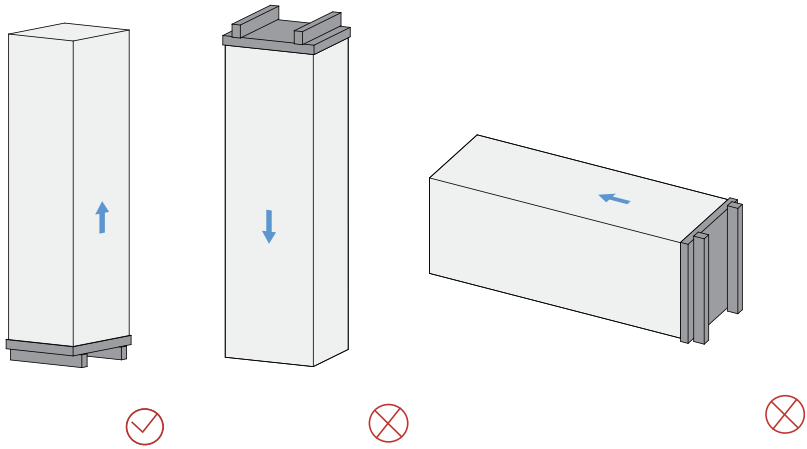


Figure 3-3 Upright position of the cabinet

- Suitable hoisting gear operated by trained personnel is required due to the heavy weight of the cabinet.
- Where applicable, use a forklift and a crane that have a carrying capacity greater than the cabinet weight to transport the cabinet.
- The cabinet must be carried on a wooden pallet when transported with the forklift. Do not remove the cabinet from the pallet during transport. Adjust the spacing between the forks to a distance greater than half the length of the cabinet.
- Considering the weight and length of the cabinet, use the lifting beam (or lifting lug) fixed at the top of the cabinet and the wooden pallet at the bottom of the cabinet to help lift the cabinet. The lifting strap of the crane must pass through the pallet under the cabinet, with the relief height less than or equal to 0.3 m.
- A hydraulic vehicle cannot move for a long distance or move on a slope.
- The cabinet must be held by hands on the left and right sides during movement.

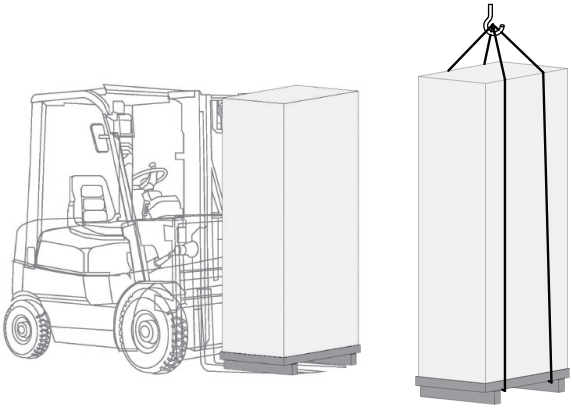


Figure 3-4 Transportation before unpacking

3.3 Package Check

When receiving goods from the shipping company, check that you have received all the items specified on the delivery note. Notify the shipping company immediately of any missing components or damage. If necessary, seek support from the Inovance office or your local agent.

Packing methods and components vary with models due to difference in structural dimensions and weight.

Caution

If the equipment is damaged during transportation, its electrical safety can no longer be ensured. Do not connect the equipment before a professional high-voltage test is performed.

Packing list of T1 to T9 models

- T1 and T6 models are packed using cartons.
- T7 to T9 models are packed using cartons and plywood pallets.

The following figure shows the packing list.

- Packing list of T1 to T6 models

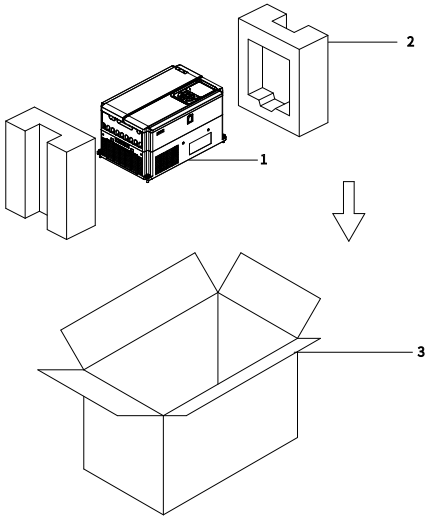


Figure 3-5 Packing list of T1 to T6 models

Table 3–1 Packing list of T1 to T6 models

No.	Name
1	AC drive
2	Cushion
3	Carton

- Packing list of T7 to T9 models

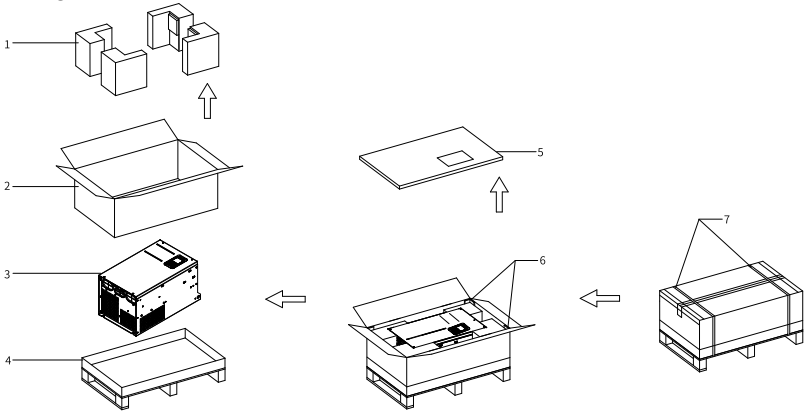


Figure 3-6 Packing list of T7 to T9 models

Table 3–2 Packing list of T7 to T9 models

No.	Name
1	Cushion
2	Carton
3	AC drive
4	Plywood pallet
5	Honeycomb cardboard
6	Paper corner protector
7	Packing strap

Packing list of T10 to T12 models

- T10 to T11 models are packed using cartons and plywood pallets.
- T12 models are packed using wooden crates.

The following figure shows the packing list.

- Packing list of T10 models

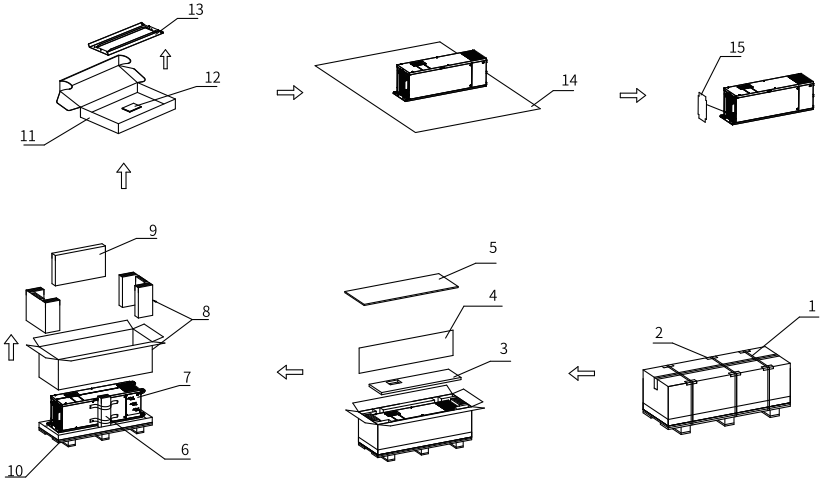


Figure 3-7 Packing list of T10 models

Table 3–3 Packing list of T10 models

No.	Name
1	Packing strap
2	Paper corner protector
3	Honeycomb cardboard
4	Corrugated cardboard
5	9 mm wooden board
6	Paper column

No.	Name
7	AC drive
8	Carton
9	Bracket box
10	Wooden pallet
11	Carton
12	User guide
13	Bracket
14	Plastic bag
15	Corrugated cardboard

- Packing list of T11 models

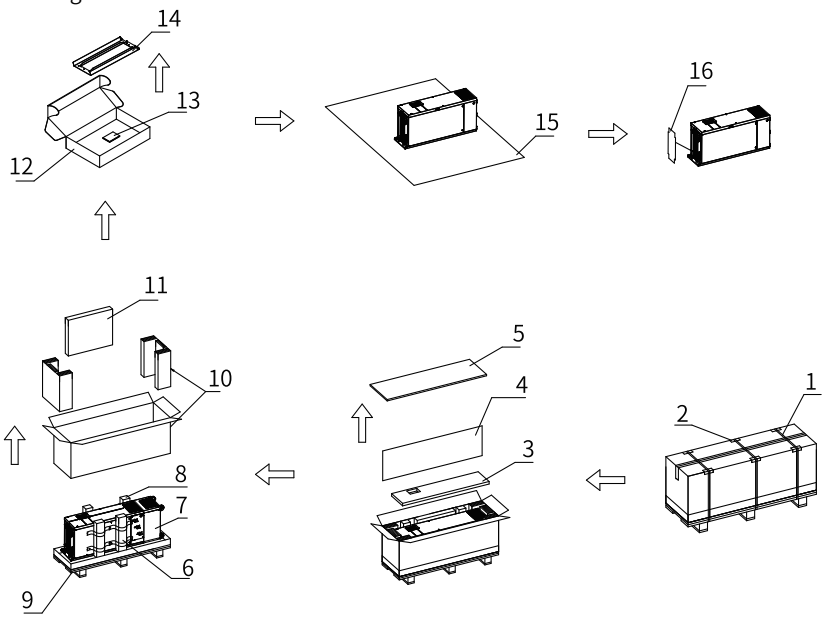


Figure 3-8 Packing list of T11 models

Table 3–4 Packing list of T11 models

No.	Name
1	Packing strap
2	Paper corner protector
3	Honeycomb cardboard
4	Corrugated cardboard
5	9 mm wooden board
6	Paper column
7	AC drive

No.	Name
8	Paper column
9	Wooden pallet
10	Carton
11	Bracket box
12	Carton
13	User guide
14	Bracket
15	Plastic bag
16	Corrugated cardboard

- Packing list of T12 models

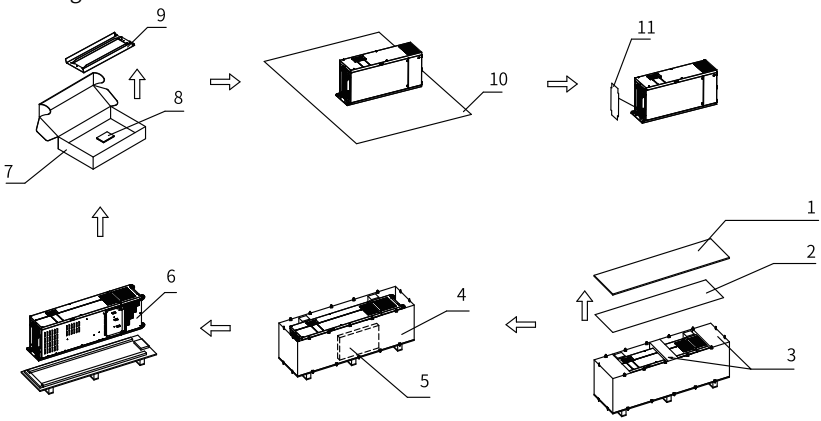


Figure 3-9 Packing list of T12 models

Table 3–5 Packing list of T12 models

No.	Name
1	Cover
2	Corrugated cardboard
3	Expanded polyethylene foam
4	Wooden crate
5	Bracket box
6	AC drive
7	Carton
8	User guide
9	Bracket
10	Plastic bag
11	Corrugated cardboard

Note

The T12 model without the reactor is packed in the same as the T11 model.

Packing list of T13 models

T13 models are provided with a standard cabinet or a cabinet with an auxiliary power distribution cabinet. For the two types of cabinets, the following components are packed.

- Packing list of a T13 model provided with a standard cabinet

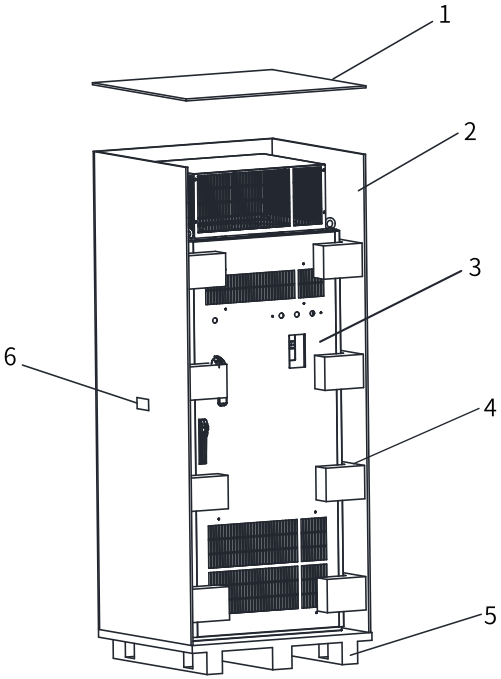


Figure 3-10 Packing list of a T13 model provided with a standard cabinet

No.	Name
1	Top cover
2	Wooden crate
3	MD520AC drive
4	Expanded polyethylene foam

No.	Name
5	Base
6	Anti-inclination label

- Packing list of a T13 model provided with a cabinet with an auxiliary power distribution cabinet

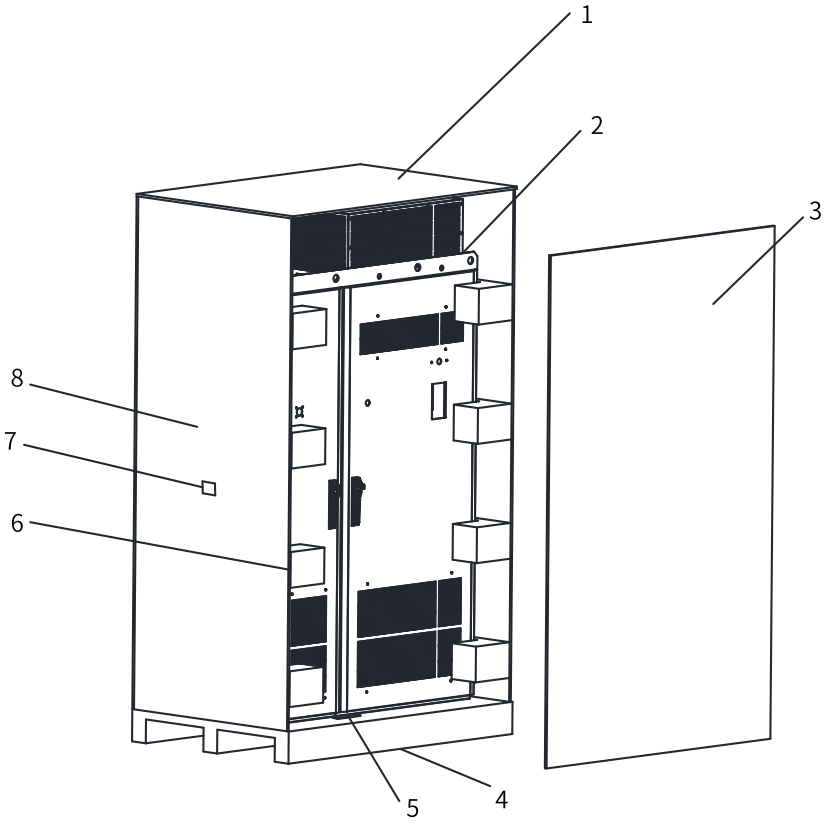


Figure 3-11 Packing list of a T13 model provided with a cabinet with an auxiliary power distribution cabinet

No.	Name
1	Top cover
2	MD520AC drive
3	Front panel
4	Base
5	Plywood

No.	Name
6	Expanded polyethylene foam
7	Anti-inclination label
8	Side panel

3.4 Handling and Hoisting After Unpacking

T1 to T6 models are small and light and therefore can be handled manually. T7 to T13 models, however, must be transported with an appropriate lifting tool.

AC Drive Weight	Personnel Required for Handling
< 15 kg	1
⩾ 15 kg	2, with proper lifting device

Precautions for handling and hoisting:

- Handle the equipment in accordance with local laws and regulations.
- Avoid handling the AC drive by directly holding its upper cover or enclosure. Before handling, check that all screws have been tightened. Failure to comply may result in AC drive fall-off, causing personal injury.
- For T10 to T12 models, when fastening the AC drive, ensure that the four mounting holes on the back of the AC drive are securely connected to the fixing beam.
- Straighten the flat-lying equipment before further handling.
- Ensure that the load capacity of the crane for transportation is larger than the weight of the equipment.
- Ensure that the upper cover, terminals, and other components of the AC drive are secured firmly with screws before vertical lifting. Failure to comply can lead to personal injury.
- When lifting the AC drive with the lifting rope, avoid subjecting the AC drive to excessive vibration or impact. Failure to comply can lead to personal injury.
- When lifting the AC drive with the lifting rope, do not turn the AC drive over or leave it suspended for long time. Failure to comply can lead to personal injury.

T1 to T9 models

To lift T1 to T9 models, do as follows:

1. Hook the lifting rope to the two auxiliary lifting lugs at the top of the drive.
   It is recommended that the lifting angle be greater than 45 degrees and the height fluctuation be no greater than 0.3 m.

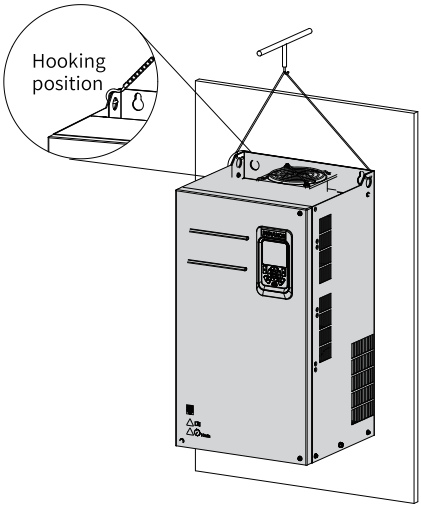


Figure 3-12 Lifting the AC drive

2. Roll up the lifting rope slowly with a crane. After the lifting rope is fully stressed, lift the drive up.
3. Lower the drive down slowly, with a pause at a certain height midway, then continue until the drive reaches the ground or mounting surface. Finally, install the drive to the control cabinet.

T10 to T12 Models

To lift T10 to T12 models, do as follows:

1. Hook the lifting lugs at the top of the drive and the lifting holes at the bottom of the drive, take out the AC drive from the packing box, and lay it flat on the floor. Ensure that there is no stress on the positive and negative bus terminals.

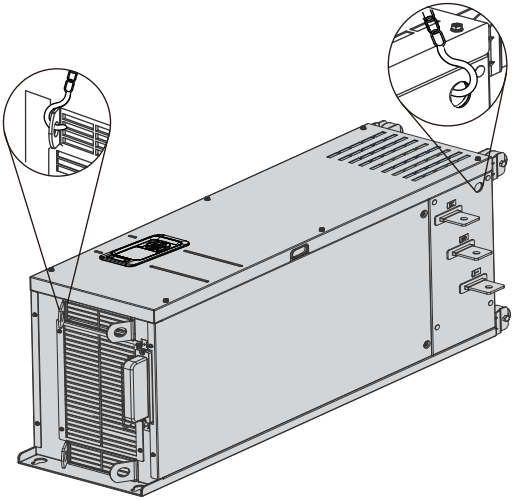


Figure 3-13 Lifting the AC drive

2. Hook the lifting rope to the lifting lugs diagonally placed at the top of the AC drive, slowly place the AC drive upright, and install it to the cabinet.

Caution

Avoid applying stress on any side of the AC drive or placing it on an inclined surface. The AC drive is large and heavy (close to 200 kg). If the inclination angle exceeds 5°, it may topple.

T13 models

1. Before installation, remove the fixing screws from the four corners of the transportation pallet and the cabinet, and remove the pallet.

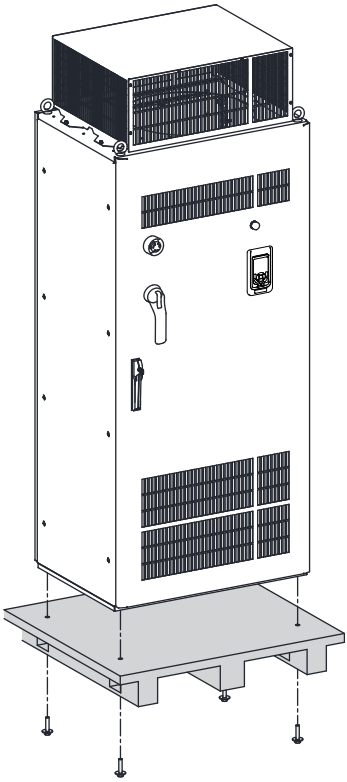
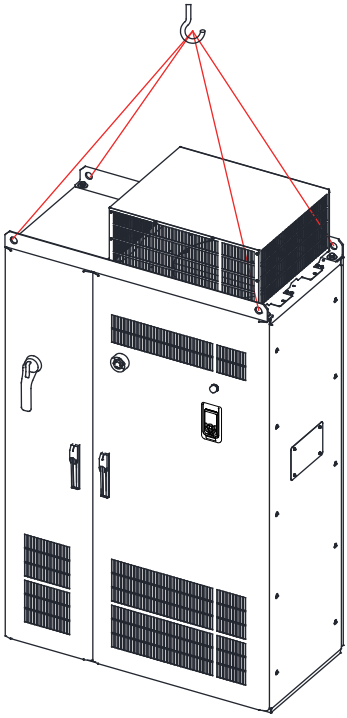
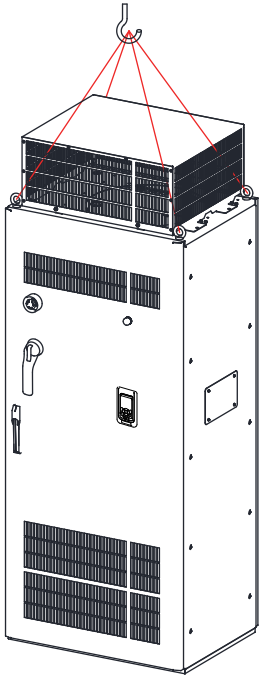


Figure 3-14 Unloading the cabinet from the pallet

2. Transport the cabinet with a crane whose carrying capacity is greater than the cabinet weight.
3. Lift the cabinet through the auxiliary lifting holes or lifting lugs at the top of the cabinet, with the relief height lower than or equal to 0.3 m.
4. Ensure that the cabinet has been locked before moving.
5. The cabinet must be held by hands on the left and right sides during movement.





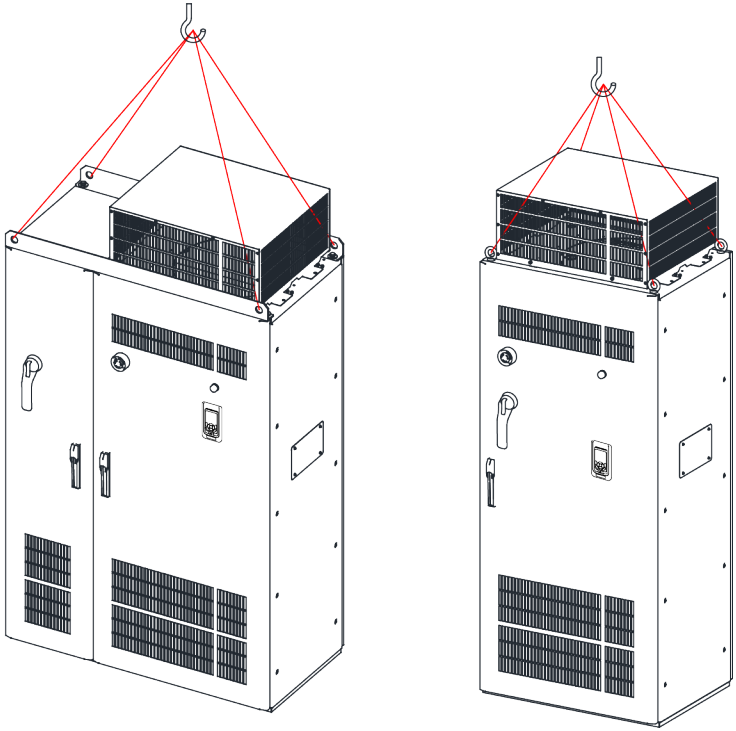


Figure 3-15 Transportation after unpacking

3.5 Unpacking

T1 to T12 models

Related documents and accessories are placed in different partitions in the carton. To unpack the carton, follow these steps:

1. Remove all the ties and open the cover of the carton.
2. Remove all filler materials.
3. Take out the AC drive.
4. Cut and remove the plastic wrap around the AC drive.
5. Ensure there is no sign of damage.
6. Dispose of or recycle the packaging material according to local regulations.

T13 models

1. During unpacking, put the crowbar into the crate as short as possible to prevent damaging the equipment. Exercise caution to avoid injury by iron nails.

2. When removing the packing materials such as plastic film, do not use sharp tool to avoid scratching the equipment.
3. Place a well-packaged product in an open and flat workshop and use an iron crowbar to pry off the wooden crate carefully. Then, remove the cover and the side and end plates.

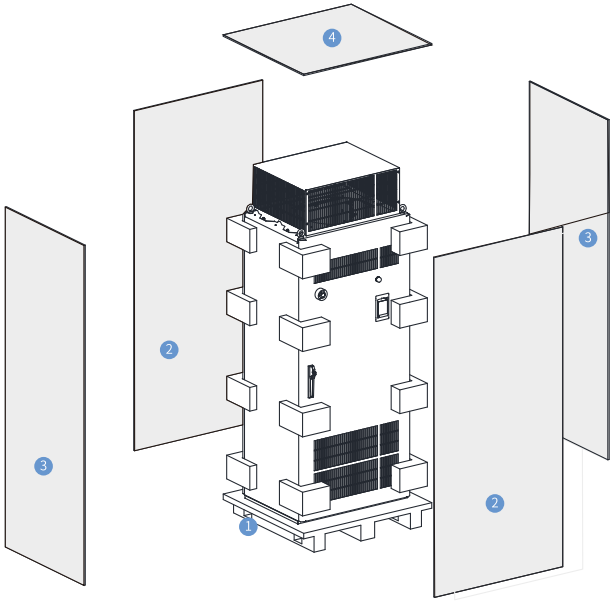


Figure 3-16 Unpacking the AC drive

Note

Dispose of the packing materials according to local laws and regulations.

4 Mechanical Installation (T1 to T9 Models)

4.1 Installation Method

T1 to T9 models support backplate mounting and through-hole mounting.

4.2 Cabinet Design

4.2.1 Overview

Before installing the AC drive in the cabinet, design the cabinet to ensure sufficient clearances for installation and heat dissipation. Take the following factors into consideration:

- Cabinet clearances
- Mounting backplate
- Cabinet heat dissipation

4.2.2 Cabinet Clearance Requirement

For T1 to T9 models, multi-layer installation is recommended. That is, install one AC drive above another. The following table lists the minimum clearance between the upper and lower AC drives. Install an air guide plate above each AC drive except the top one.

Table 4–1 Minimum clearance (mm) for multi-layer installation

Item	T1 to T4	T5	T6	T7 to T9
S1	⩾ 100	⩾ 200	⩾ 200	⩾ 300
S2	⩾ 100	⩾ 200	⩾ 200	⩾ 300
...	⩾ 100	⩾ 200	⩾ 200	⩾ 300
Sn	⩾ 100	⩾ 200	⩾ 200	⩾ 300

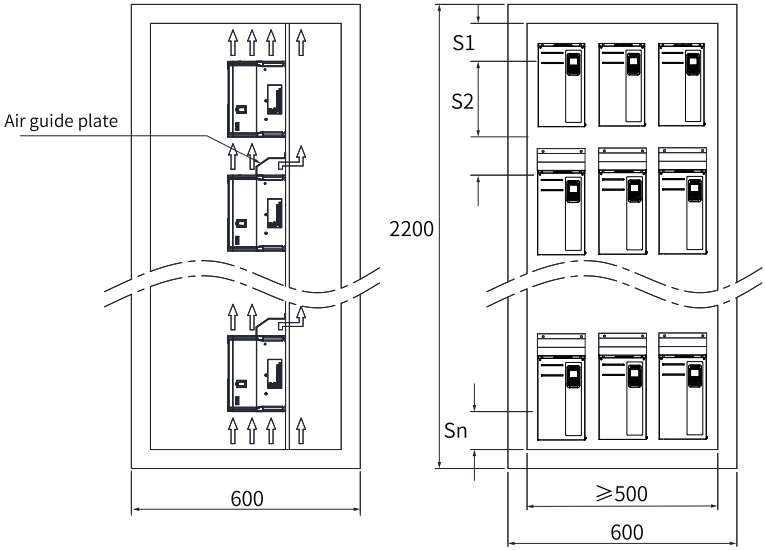


Figure 4-1 Minimum clearance (mm) for multi-layer installation

Note

Observe the ventilation direction when installing the fan to ensure smooth discharge of hot air. Failure to comply may cause failure in hot air exhaust, and over-temperature or damage to the AC drive. Ensure a distance of at least 200 mm between the air exhaust top cover and the fan outlet to avoid adverse effect on the cooling performance of the fan.

4.2.3 Mounting Backplate Requirements

Requirements on backplate thickness, dimensions, and stiffness

To avoid damage to the AC drive during transportation and ensure proper operation of the AC drive, use a mounting plate with excellent stiffness and strength performance, and a thickness of at least 2 mm. Reinforce the backplate where appropriate. For example, weld a lateral reinforcing beam on the back of the backplate, as shown in the following figure.

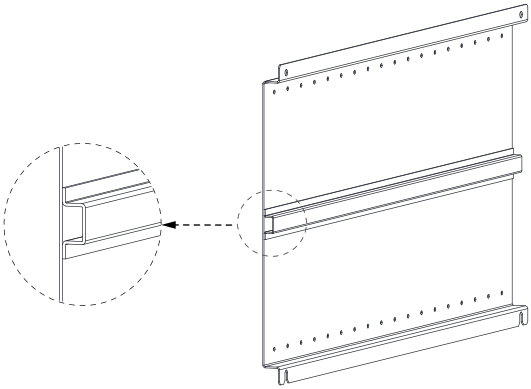


Figure 4-2 Welding a lateral reinforcing beam on the back of the backplate

Requirement on the mounting holes

- You can drill mounting holes on the backplate in advance. For detailed mounting hole dimensions, see *"2.1 Dimensions of T1 and T9 Models" on page 54*.
- To avoid damage to the AC drive during transportation, fix the drive to the mounting backplate by using screws. In addition, use self-clinching nuts or independent nuts on the back of the backplate to enhance screw-thread fitting and fastening effect.

4.2.4 Cabinet Heat Dissipation

Heat dissipation design of the cabinet door

The cabinet is forcibly cooled by a built-in fan. Therefore, to ensure that enough cooling air enters the cabinet, open an air inlet with an appropriate size on the cabinet door.

The air flows from bottom to top after being heated. Therefore, the cabinet air inlet must be at least 50 mm lower than the air inlet of the drive, as shown below.

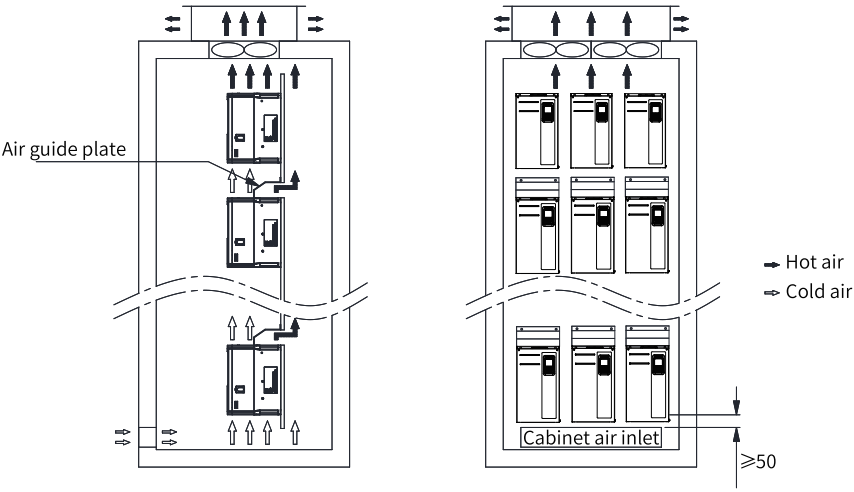


Figure 4-3 Position of the cabinet air inlet

Caution

Where multiple AC drives are installed in one cabinet, if the fan blows air into the air inlet from the outside, air distribution for the drives in the cabinet will be affected, resulting in poor cooling performance. Therefore, do not install a fan at the air inlet of the cabinet to blow air into the cabinet.

The following table describes the minimum effective ventilation area of the cabinet air inlet after the drive is installed in the cabinet.

Table 4–2 Minimum effective ventilation area of the cabinet air inlet

AC Drive	Minimum Effective Ventilation Area of the Cabinet Air Inlet (cm^2)
T1	20
T2	25
T3 (7.5 kW)	
T3 (11 kW)	50
T4	
T5	60
T6 to T7	102
T8	204
T9	318

The preceding table applies to situations where only one AC drive is mounted in the cabinet. For a cabinet containing multiple AC drives, calculate the total ventilation area by adding the ventilation area of each drive according to the table. For example, if eight T3 models (7.5 kW), two T5 models, and one T9 drives are placed inside the cabinet, the minimum effective ventilation area of the cabinet air inlet is 8 x 25 + 2 x 60 + 1 x 318 = 638 cm^2.

If an air filter is installed at the air inlet, the air inlet resistance will rise significantly. Therefore, the ventilation area of the air inlet must be increased to 1.2 to 1.5 times the value indicated in the table.

The ventilation area in *"Table 4–2 Minimum effective ventilation area of the cabinet air inlet" on page 83* refers to the actual through-hole area of an opening. The ventilation area is calculated opening area x opening rate.

Design of top ventilation

To ensure sufficient heat dissipation of the drive, hot air in the cabinet must be exhausted to the outside. The passive or active air ventilation mode can be adopted.

- Passive air ventilation (self-ventilated)
  The air flows from bottom to top after being heated. In this mode, the hot air discharged by the drive is exhausted to outside from the air outlet at the top of the cabinet.

  This might cause accumulated hot air at the top of the cabinet, rising the air pressure. The air pressure at the cabinet air inlet is low due to suction of the fan for the drive. Therefore, there is an air pressure difference between the air outlet and air inlet of the cabinet to form an air flow in the cabinet. The air flow forces hot air at the air outlet to flow towards the air inlet so that it is absorbed into the drive again, causing a great temperature rise and an adverse effect on the performance of the drive.

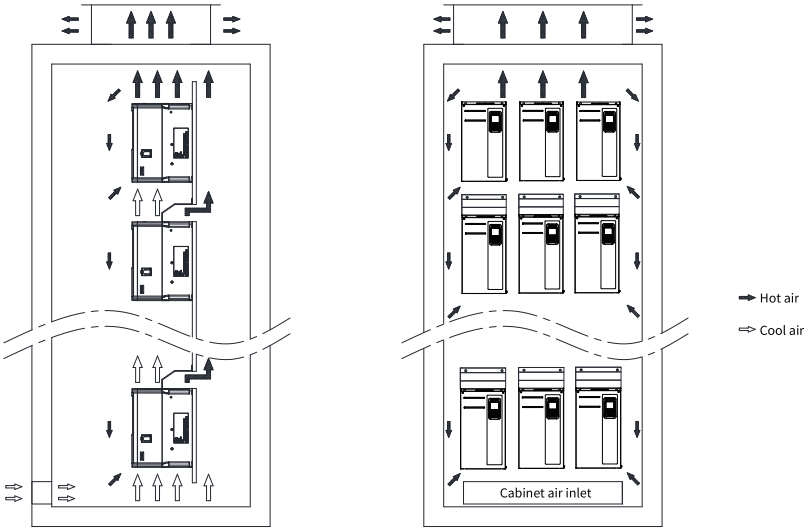


Figure 4-4 Hot air backflow in the passive air ventilation mode (without isolation devices)

For cabinets that adopt the passive air ventilation mode, use an isolation device to prevent hot air backflow, as shown below. The isolation device can be a plate or exhaust duct.

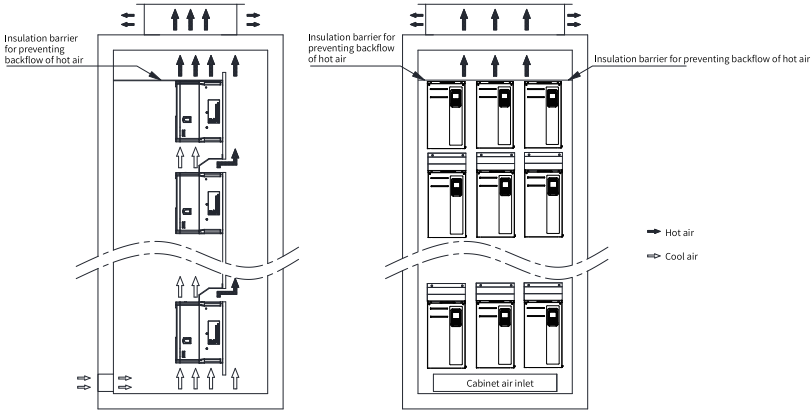


Figure 4-5 Hot air backflow in the passive air ventilation mode (with isolation device)

The temperature at the air outlet of the drive is higher than that at the air inlet and the density at the air outlet is lower than that at the air inlet. To ensure that hot air in the cabinet can be exhausted to outside, the minimum effective ventilation areas of the cabinet air outlet must meet the requirements in *"Table 4-3 Minimum*

effective area of air outlet on a self-ventilated cabinet" on page 86 when passive air ventilation is used.

Table 4–3 Minimum effective area of air outlet on a self-ventilated cabinet

AC Drive	Minimum effective area of the cabinet air outlet in the passive air ventilation mode (cm^2)
T1	32
T2	40
T3 (7.5 kW)	
T3 (11 kW)	80
T4	
T5	96
T6 to T7	163
T8	326
T9	509

"Table 4–3 Minimum effective area of air outlet on a self-ventilated cabinet" on page 86 applies to situations where only one AC drive is mounted in the cabinet. For a cabinet containing multiple AC drives, calculate the total ventilation outlet area by adding the ventilation area of each drive according to the table.

If an air filter is installed at the outlet, the air outlet resistance will rise significantly. Therefore, the ventilation area must be increased to 1.2 to 1.5 times the value indicated in the table.

The effective area in *"Table 4–3 Minimum effective area of air outlet on a self-ventilated cabinet" on page 86* refers to the actual through-hole area in the opening area, which means the effective area = opening area x opening rate.

- Active air ventilation
  In the active air ventilation mode, a fan is installed at the top of the cabinet to draw hot air out of the cabinet. This is a commonly used ventilation mode.

  To ensure that the hot air can be exhausted to the outside, the total air volume of the fan cannot be smaller than that of all drives in the cabinet. *"Table 4–4 AC drive cooling air volume" on page 86* lists the cooling air flow required by the drive.

Table 4–4 AC drive cooling air volume

AC Drive Power	Cooling Air Flow (CFM)
0.4 kW to 1.1 kW	/
1.5 kW to 3.0 kW	11
3.7 kW	20
5.5 kW	24
7.5 kW	29
11 kW to 15 kW	50
18.5 kW	52

AC Drive Power	Cooling Air Flow (CFM)
22 kW	58
30 kW	130
37 kW	102
45 kW to 55 kW	125
75 kW to 90 kW	225
110 kW	350
132 kW	541
160 kW	620
Note: 1 CFM = 0.02832 m^3/min	

Design of the cabinet fan

To select the fan for the cabinet, do as follows:

1. Calculate the sum of the cooling air volume required by all AC drives based on *"Table 4–4 AC drive cooling air volume" on page 86*.
2. Determine the maximum air volume (Qmax) of the cabinet fan.
3. Determine the specification and quantity of the fan based on the maximum air volume (Qmax).

Where:

- Maximum air volume of the cabinet = 1.3 to 1.5 times the total cooling air volume
- Maximum air volume of the cabinet = 1.6 to 2.2 times the total cooling air volume if mesh filters, shutters, or other components are installed at the cabinet air outlet.

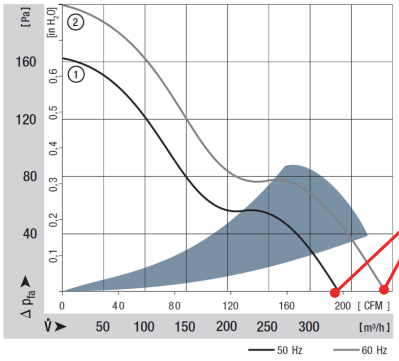
Note

Select a fan whose air volume is not smaller than the maximum air volume Qmax. Install multiple fans in parallel if one fan alone cannot meet the requirements.

The common specifications of the fan air volume is shown below.

Air flow	Air flow	Nominal voltage	Frequency	Sound pressure level	Sound power level	Sintec sleeve bearings / Ball bearings	Power input	Nominal speed	Temperature range	Service life L_{10} at 40 °C	at T max	Curve
m^3/h	CFM	V	Hz	dB(A)	Bel(A)	□/■	Watts	RPM	°C	Hours	Hours	
320	188,3	**230**	**50**	51	6,4	■	27,0	2 800	-25...+55	60 000 / 32 000		1
380	223,6	**115**	**60**	56	6,8	■	28,0	3 350	-25...+65	55 000 / 18 000		2

Maximum fan air volume (Qmax)



Maximum fan air volume (Qmax)

Figure 4-6 Q_{max} of a system fan

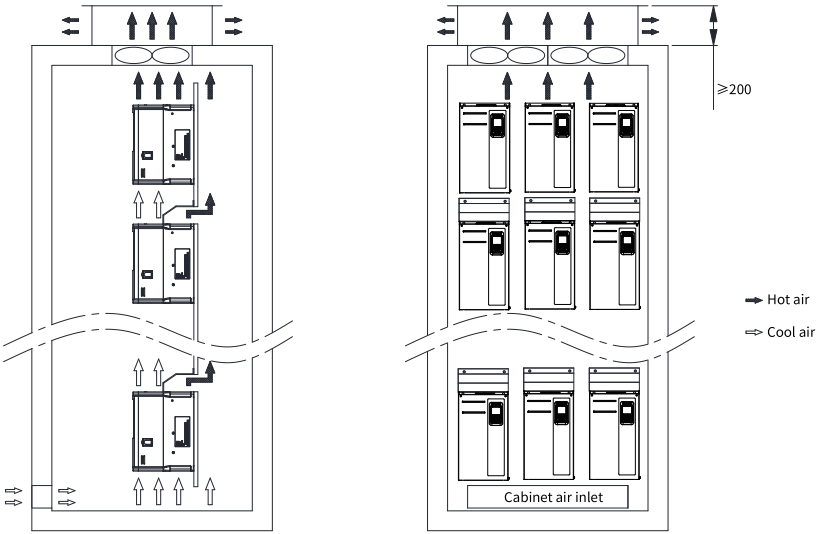


Figure 4-7 Cabinet ventilation system

Note

- When installing the fan, ensure a proper direction and smooth flow of hot air. Failure to comply may cause accumulation of hot air, leading to over-temperature or damage to the AC drive.
- Ensure a distance of at least 200 mm between the top vent and the fan outlet to avoid adverse effect on the cooling performance of the fan.

4.3 Pre-installation Precautions

- Before installation, ensure that the place of installation is mechanically strong enough to bear the AC drive.
- Cover the top of the AC drive with cloth or paper during installation to prevent foreign objects, such as metal chippings, oil, and water, from entering the AC drive. Foreign objects may cause malfunction of the AC drive. Remove the cloth or paper after installation is completed. Failure to comply may degrade ventilation and result in over-temperature of the AC drive.
- Reserve sufficient clearance for heat dissipation, including heat dissipation of other equipment in the cabinet. For details, see "Installing one alone" in *"1.2.3 Installation Clearance" on page 21*.
- Keep the AC drive upright to facilitate upward heat dissipation. To install multiple AC drives in one cabinet, arrange them side by side. Where up and down arrangement is required, install a heat insulation baffle in between. For details, see "Installing one above another" in *"1.2.3 Installation Clearance" on page 21*.
- Use a mounting bracket that is flame retardant, where appropriate.
- In environments with metal dust, use an enclosed cabinet that can completely isolate the AC drive from the metal dust. In this case, ensure the maximum possible space in the cabinet and install cooling devices outside the cabinet.
- Tighten all screws using the specified torque. Failure to comply may result in electric shock or fire.
- Keep combustible and explosive materials away from the AC drive.

4.4 Backplate Mounting

Fix the AC drive with all nuts. Do not fasten only the upper two nuts on the drive. Otherwise, the drive may fall off due to uneven force during long-time running.

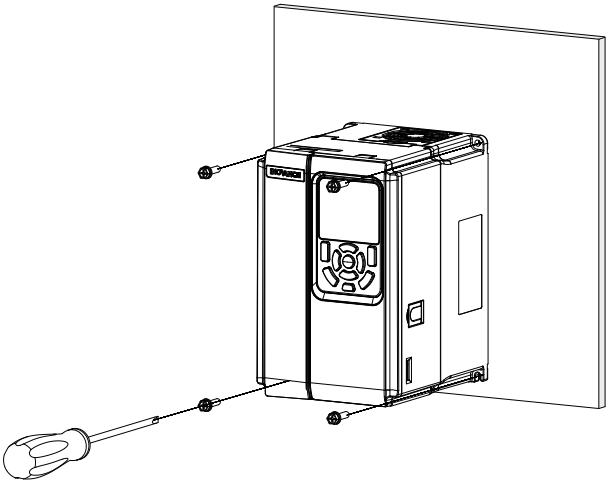


Figure 4-8 Backplate mounting of T1 to T6 models

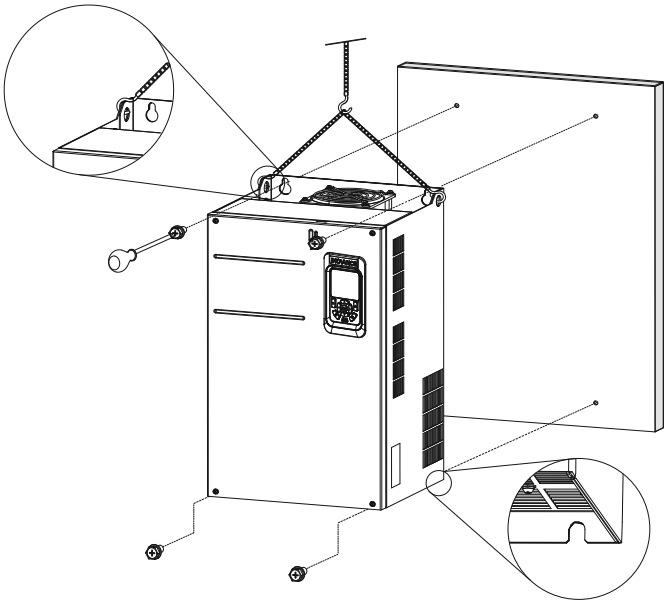
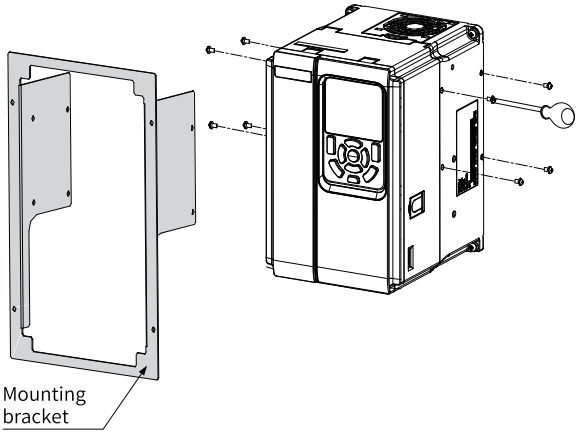


Figure 4-9 Backplate mounting of T7 to T9 models

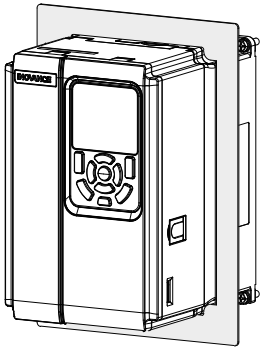
4.5 Through-Hole Mounting

T1 to T6 models

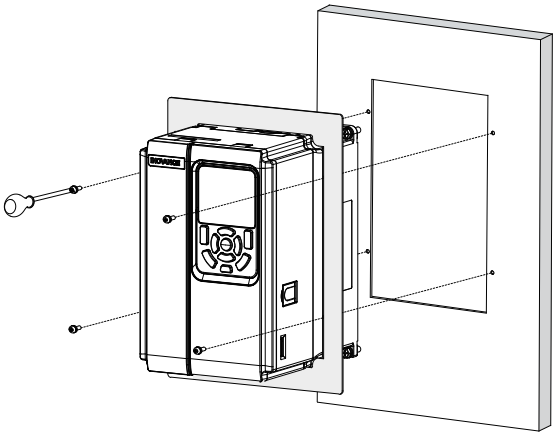
1. Install the AC drive into the mounting bracket, and then fix the screws at both sides of the bracket.



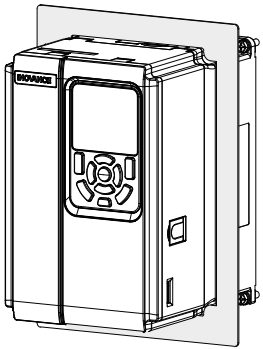
The following figure shows the AC drive with the bracket installed.



2. Fix the AC drive with the bracket to the back of the control cabinet.

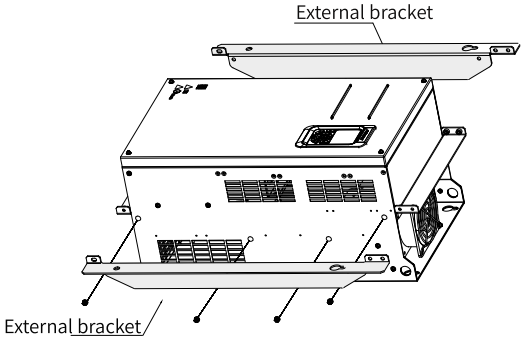


The following figure shows the AC drive installed in the cabinet.

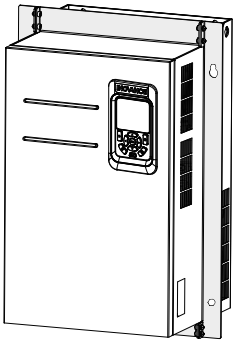


T7 to T9 models

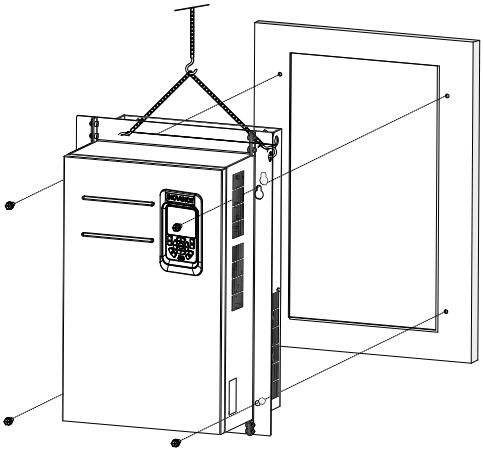
1. Fix the mounting brackets to both sides of the drive.



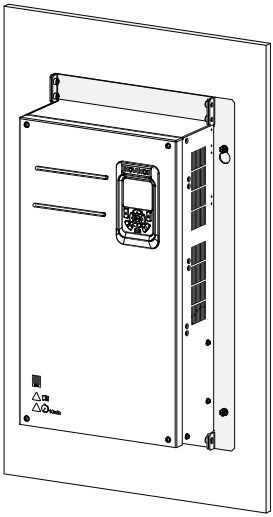
The following figure shows an AC drive with brackets mounted.



2. Fix the drive with brackets to the backplate of the control cabinet.



The following figure shows the drive installed by through-hole mounting.



4.6 Cover Removal and Installation

4.6.1 Removing the Cover

Before wiring the control circuit, for example, connecting the jumper, PG card, or functional expansion card, remove the cover of the AC drive. When removing the cover, hold the cover with your hands and carefully lift the lower part of the cover to prevent it from falling off. Failure to comply will result in equipment damage or personal injury.

Prerequisites

Before removing the cover, ensure that the machine has been powered off for over 10 minutes.

Context

The following figure shows the positions of the control board, jumper, and expansion card after the cover is removed.

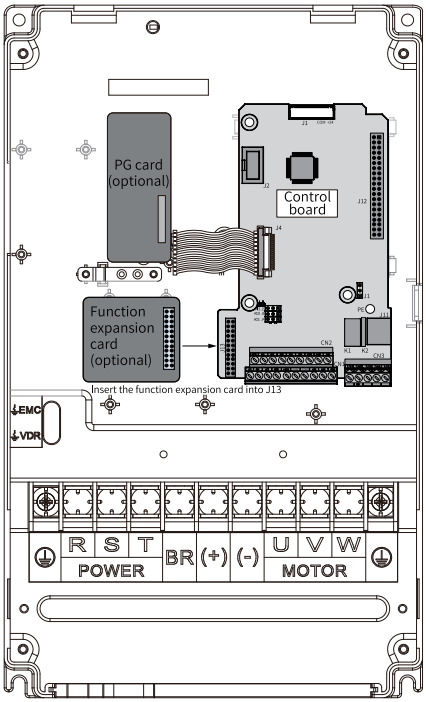
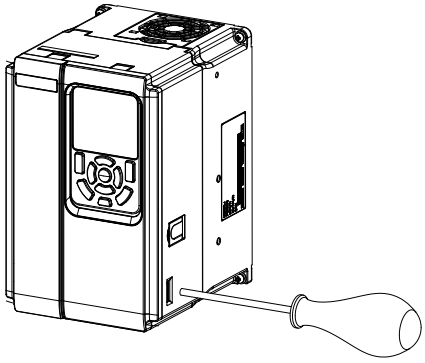
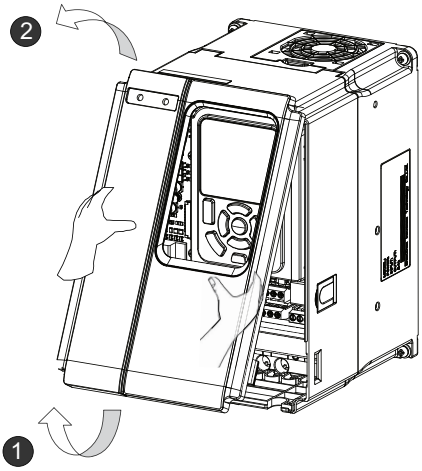


Figure 4-10 Control board position

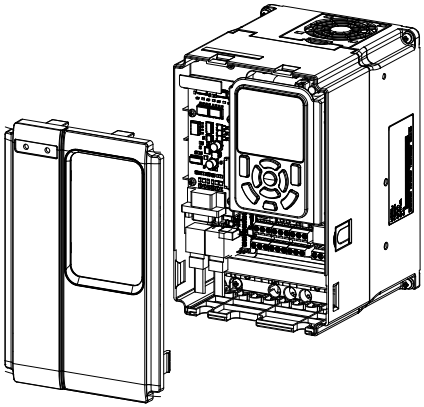
1. Remove the cover for T4 to T6 models.
   a. Use a tool to push the snap-fit joints inwards at both sides of the drive to release the cover.



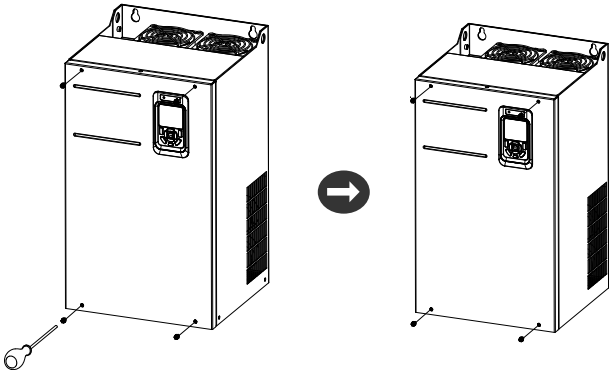
   b. Hold the cover with your hands, lift the lower part of the cover (as shown in ①), push the cover upward, and lift the upper part of the cover (as shown in ②).



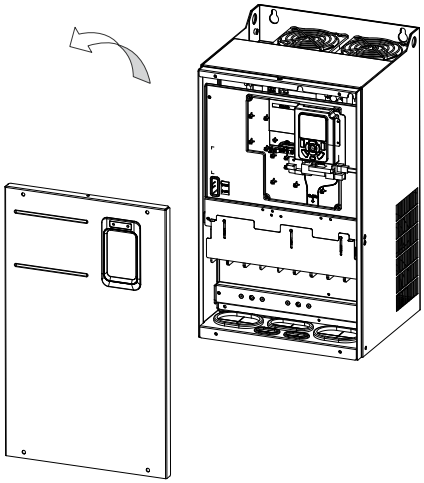
The following figure shows the drive without the cover.



2. Remove the cover for T7 to T9 models.
   a. Use a screwdriver to remove the four fixing screws of the cover.



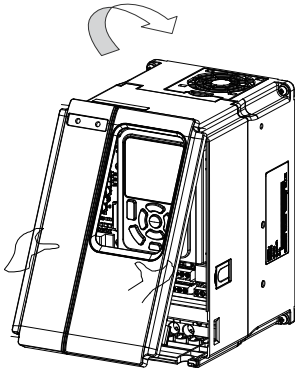
b. Hold the cover with both hands and lift it up in the direction indicated by the arrow.



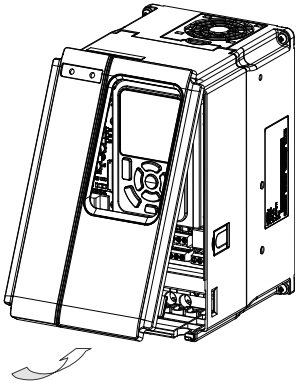
4.6.2 Installing the Cover

The cover of the AC drive must be removed before wiring the main circuit and control circuit. After wiring is done, re-install the cover.

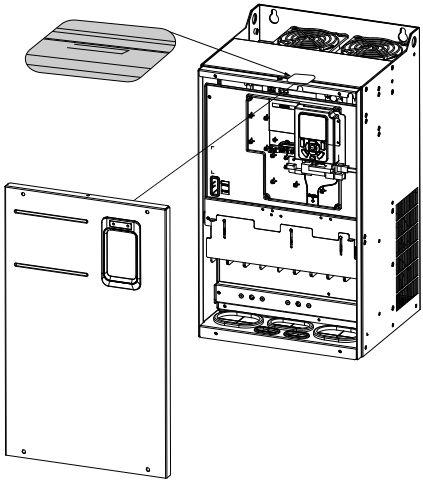
1. Install the cover for T1 to T6 models.
   a. Hold the cover with both hands and insert the upper edge snap-fit joint of the cover into the hole on the drive.



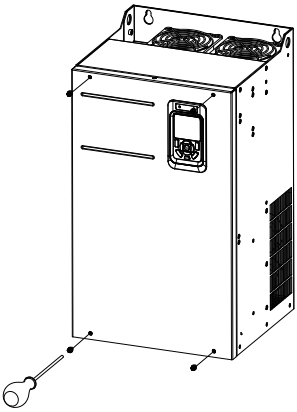
b. Align the cover and push down the lower part of the cover by the arrow direction.



2. Install the cover for T7 to T9 models.
   a. Hold the cover with both hands, align the cover with the upper edge snap-fit joint on the chassis and push it in place as shown in the following figure.



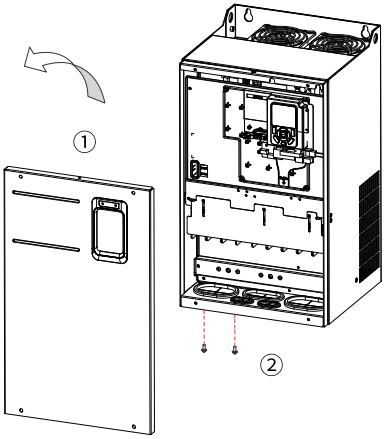
b. Install and fix the four fixing screws with a screwdriver.



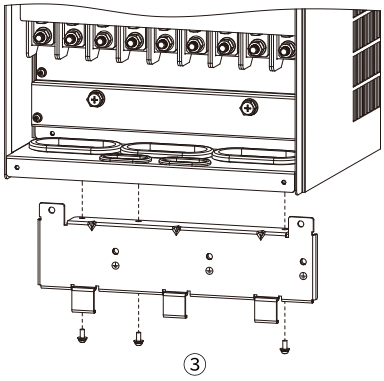
4.7 Installation of Cable Shield Ground Bracket

Procedure

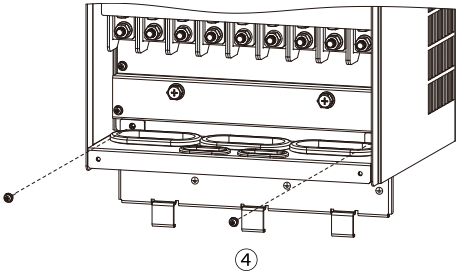
1. Remove the cover, as shown in ①. Remove the two M4x12 SEMS screws from the air inlet plate, as shown in ②.



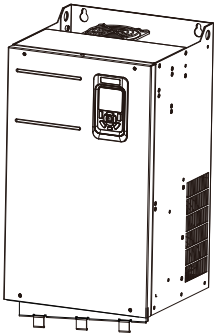
2. Place the ground bracket of the cable shield on the chassis, and fasten the bracket with three M4 x 12 SEMS screws at the positions shown in ③.



3. Tighten two M4x12 SEMS screws at the positions shown in ④.



4. Install the cover.



⑤

Note

For selection of the cable shield ground bracket, see *"1.4.1 Option List " on page 32*.

5 Mechanical Installation (T10 to T12 Models)

5.1 Installation Method

T10 to T12 models can be installed in a cabinet.

5.2 Pre-installation Precautions

- Before installing the AC drive, install the bottom mounting bracket and guide rails on the cabinet, and prepare fixing beams with mounting holes for retaining the AC drive. Reserve sufficient clearance in the cabinet for connecting side copper busbars.
- The guide rails in the cabinet and the four casters of the AC drive cooperate to help the AC drive move in or out of the cabinet. Align the casters with the guide rails before a push or pull. For safety, arrange two persons to pull or push the AC drive together.
- Reserve sufficient clearance for heat dissipation, including heat dissipation of other equipment in the cabinet.
- To push the AC drive into or pull it out of the cabinet, arrange two persons to work together. After pushing the AC drive into the cabinet, remove the baffle from the air outlet of the cabinet to avoid over-temperature caused by failure to exhaust hot air.
- Install an insulation barrier at the top of the cabinet to prevent the exhaust air from flowing back into the cabinet. Provide an air intake vent on the lower part of the cabinet door.
- The cabinet is 2200 mm x 800 mm x 600 mm (including a 200 mm cabinet ventilation top cover). The cabinet needs to be installed on a base that is 100 mm in height.
- When installing the AC drive in an enclosed environment, such as a cabinet or casing box, use a cooling fan or air conditioner to keep the inlet temperature below 50°C. Failure to comply may result in over-temperature or fire.
- Cover the top of the AC drive with cloth or paper during installation to prevent foreign objects, such as metal chippings, oil, and water, from entering the AC drive. Foreign objects may cause malfunction of the AC drive. Remove the cloth or paper after installation is completed. Failure to comply may degrade ventilation and result in over-temperature of the AC drive.
- Use a mounting bracket that is flame retardant, where appropriate.
- In environments with metal dust, use an enclosed cabinet that can completely isolate the AC drive from the metal dust. In this case, ensure the maximum possible space in the cabinet and install cooling devices outside the cabinet.
- Tighten all screws using the specified torque. Failure to comply may result in electric shock or fire.

- Keep combustible and explosive materials away from the AC drive.

5.3 Heat Dissipation Design

When installing T10 to T12 models in a cabinet, reserve sufficient space for heat dissipation. A passive-ventilated cabinet has no fan on the top.

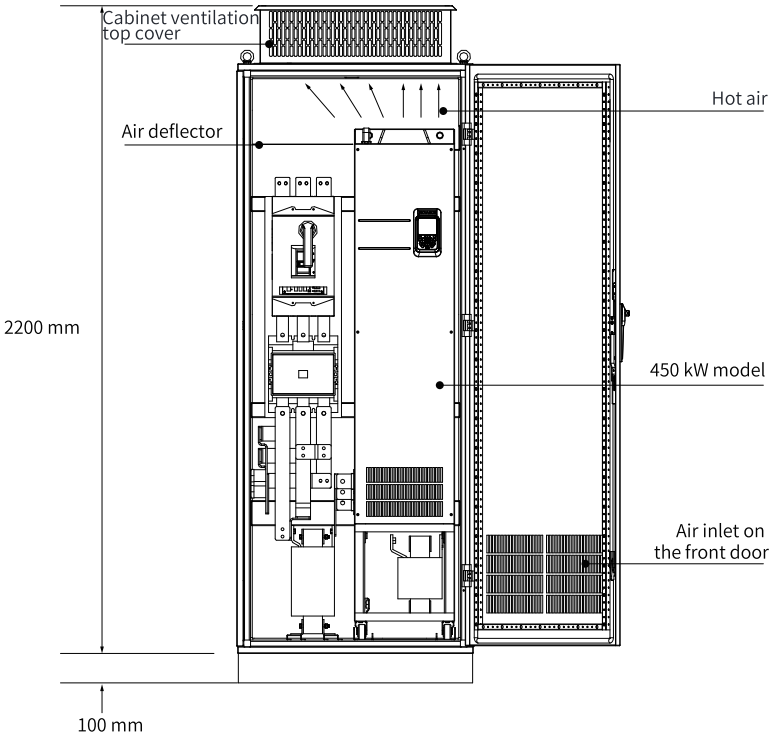


Figure 5-1 Passive-ventilated cabinet

Table 5–1 Parameters of a passive-ventilated cabinet

Model	Quantity of Fans	Total Air Volume (CFM)	Effective Area of the Cabinet Air Inlet (mm^2)	Effective Area of the Cabinet Outlet (mm^2)
T9 (132 kW)	2	541	31809	50894
T9 (160 kW)	2	620	31809	50894
T10 (200 kW)	2	586	31809	50894
T10 (220 kW)	2	722	31809	50894
T11 (250 kW)	3	789	47713	76341

Model	Quantity of Fans	Total Air Volume (CFM)	Effective Area of the Cabinet Air Inlet (mm^2)	Effective Area of the Cabinet Outlet (mm^2)
T11 (280 kW)	3	882	47713	76341
T12 (315 kW)	3	644	47713	76341
T12 (355 kW)	3	796	47713	76341
T12 (400 kW)	3	796	47713	76341

Note

- CFM = 0.0283 m^3/min
- "Actual Effective Area" indicates through-hole area.

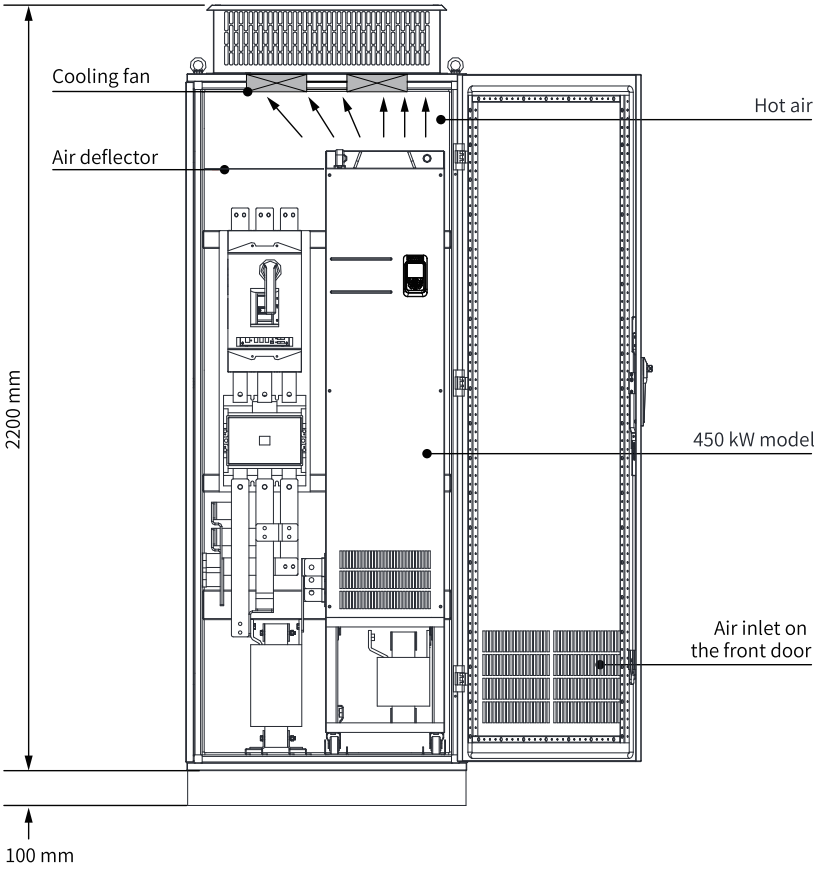


Figure 5-2 Cabinet with top-mounted fans

Table 5–2 Parameters of a cabinet with top-mounted fans

AC Drive Model	Quantity of Fans	Total Air Volume (CFM)	Effective Area of Cabinet Top Air Inlet (mm^2)	Max. Air Volume Required by Fan (CFM)	Effective Area of Cabinet Top Air Outlet (mm^2)
T9 (132 kW)	2	541	31809	649	$S = 0.942 \times N \times (Dout^2 - DHUB^2)$ In the preceding formula, N indicates the quantity of top-mounted fans, Dout indicates the diameter of the fan, and DHUB indicates the diameter of the fan hub.
T9 (160 kW)	2	620	31809	744	
T10 (200 kW)	2	586	31809	703	
T10 (220 kW)	2	722	31809	866	
T11 (250 kW)	3	789	47713	947	
T11 (280 kW)	3	882	47713	1058	
T12 (315 kW)	3	644	47713	773	
T12 (355 kW)	3	796	47713	955	
T12 (400 kW)	3	796	47713	955	

Note

- CFM = 0.0283 m^3/min
- "Actual Effective Area" indicates through-hole area.

As shown in the following figure, the heat dissipation duct of the drive must be isolated in the cabinet to prevent the hot air from circulating in the cabinet. Use an air deflector for isolation to ensure that the hot air of the drive can be exhausted from the heat dissipation hole on the top of the cabinet.

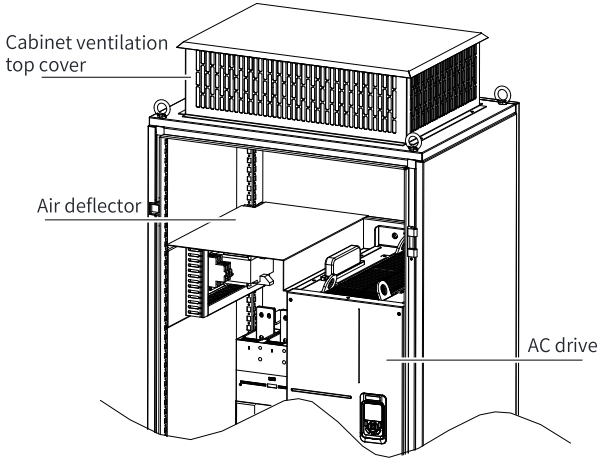


Figure 5-3 Air deflector in the cabinet

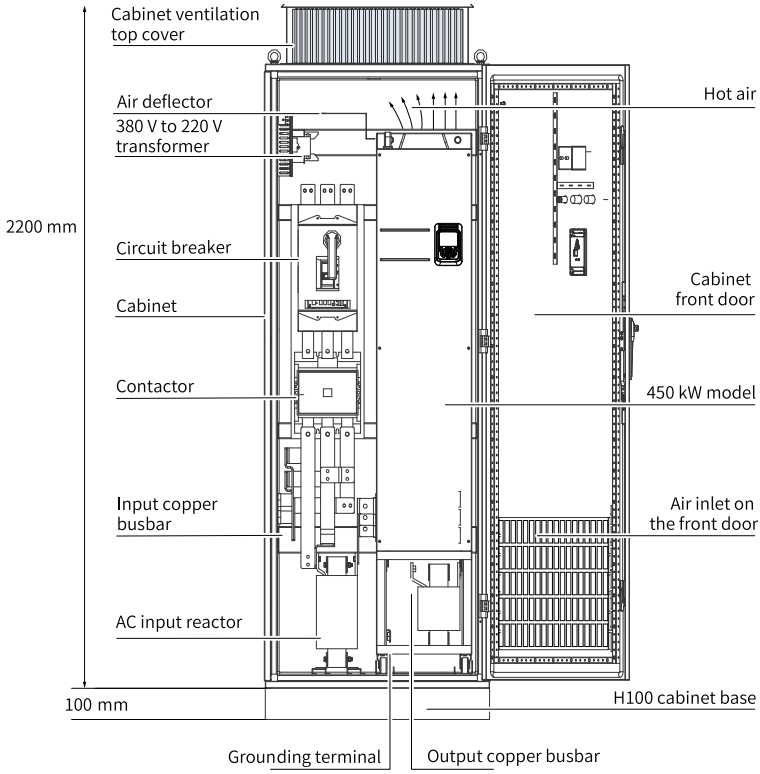


Figure 5-4 Recommended cabinet layout for T12 models

5.4 Installation Within the Cabinet

Context

The nine-fold profile cabinet (PS cabinet) is recommended. This kind of cabinet is in an assembled structure, which is cost effective. The openings on the main column of the cabinet meet the general standards, facilitating the design of mounting beams and structure strengthening. In summary, the nine-fold profile cabinet is a kind of industrial standard cabinet with high reliability. *"Figure 5–5 " on page 107* shows the cross section of the nine-fold profile cabinet.

Procedure

1. In the nine-fold profile cabinet (PS cabinet), install the mounting beam for fixing the AC drive and reserve fixed holes.

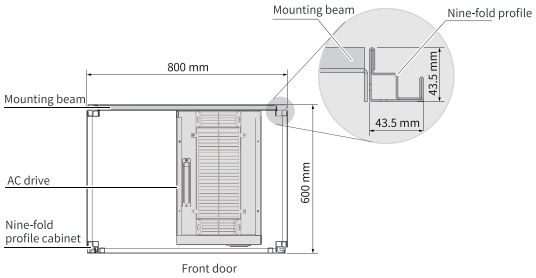


Figure 5-5 Top view of the cabinet for T11 and T12 models

To install T11 to T12 models into the nine-fold profile cabinet with the depth of 600 mm, bend the back mounting board inwards (not required for the cabinet with the depth of 800 mm), as shown in *"Figure 5–6 " on page 107* . However, if the cabinet with the depth of 600 mm has both front and back doors, the AC drive cannot be installed in this kind of cabinet. Instead, install the AC drive into the cabinet with the depth of 800 mm.

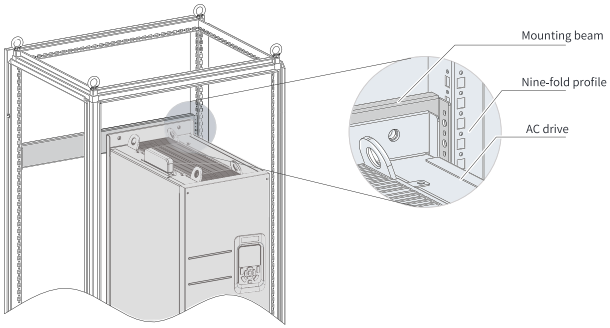


Figure 5-6 3D of the cabinet for T11 and T12 models

2. Fix the bottom mounting bracket in the nine-fold profile cabinet.
   Fix the mounting bracket to the base of the nine-fold profile cabinet by using six M5 self-tapping screws, as shown in *"Figure 5–7 " on page 107* .

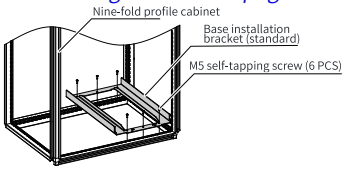


Figure 5-7 Installing the bottom mounting bracket

Drill holes for the mounting bracket and assemble the bracket on site if the cabinet is not a nine-fold profile one.

3. Assemble the guide rails (model: MD500-AZJ-A3T10) and mount the guide rail assembly to the cabinet.
   a. Assemble the guide rail, as shown in *"Figure 5–8 " on page 108* .

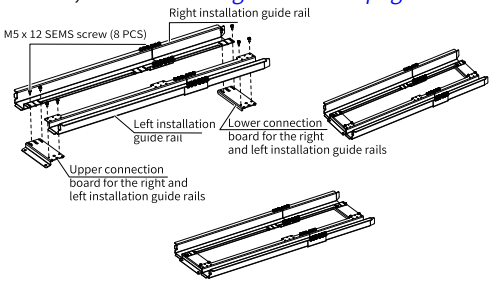


Figure 5-8 Assembling guide rails

   b. Align the two round holes at the front end of the mounting rail with the screws of the mounting bracket, and then lock the guide rail to the cabinet with two M6 nuts, as shown in *"Figure 5–9 " on page 108* .

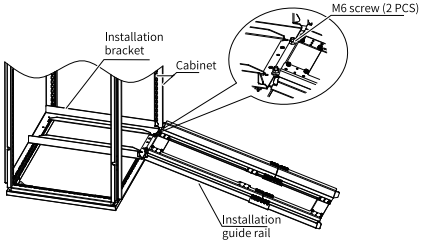


Figure 5-9 Mounting the guide rails to the cabinet

4. Remove the cover from the AC drive.
   For details, see *"5.5.1 Removing the Cover" on page 111*. After the cover is removed, the auxiliary handle will be exposed.
5. Align the casters of the AC drive with the guide rails and gently push the AC drive into the cabinet.
   During the push-in or pull-out process, use the auxiliary strap to prevent the drive from toppling over. It is recommended that two people work together.

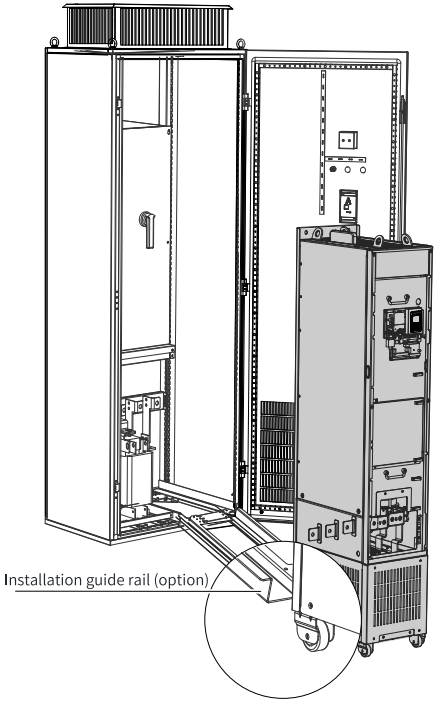


Figure 5-10 Aligning the casters with the guide rails

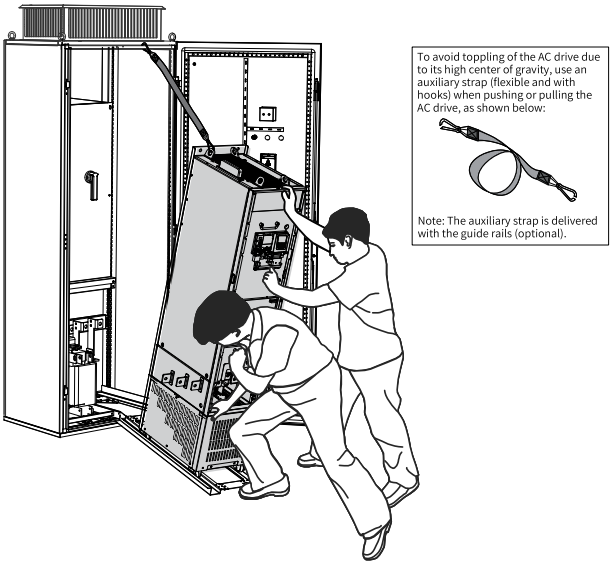


Figure 5-11 Pushing the AC drive into the cabinet

6. Remove the auxiliary strap, install the four screws on the back of the AC drive to fix it to the beam in the cabinet.

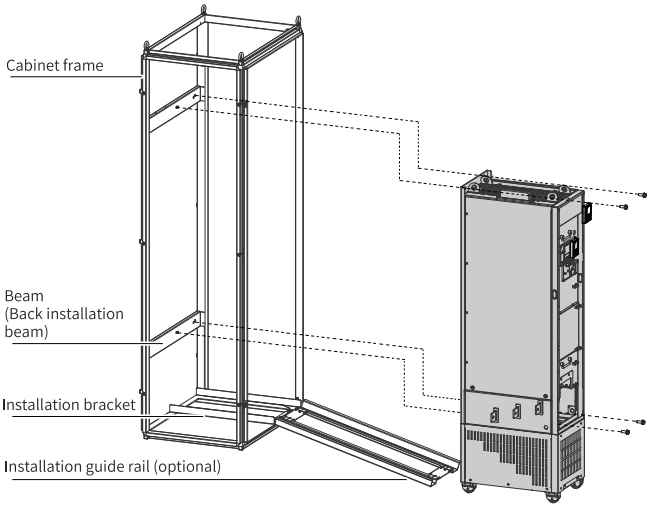


Figure 5-12 Installing the AC drive to the beam

7. After installation is done, remove the guide rail.
8. Remove the air filter paper board at the top of the AC drive. The air filter paper board is used to prevent foreign objects such as screws from falling into the air filter during installation of the AC drive into the cabinet.

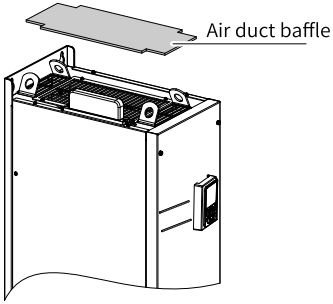


Figure 5-13 Removing the air filter paper board

5.5 Cover Removal and Installation

5.5.1 Removing the Cover

Before wiring the control circuit, such as operating jumpers or connecting PG cards or expansion cards, remove the cover from the AC drive. When removing the cover, hold the cover with your hands and carefully lift the lower part of the cover to prevent it from falling off. Failure to comply will result in equipment damage or personal injury.

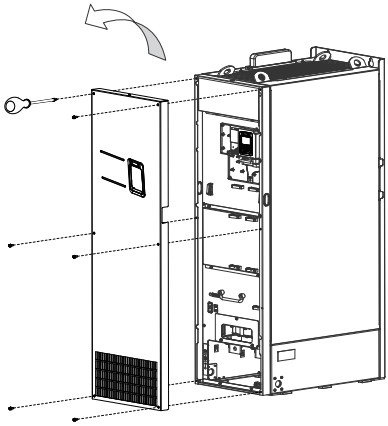
Prerequisites

Before removing the cover, ensure that the machine has been powered off for over 10 minutes.

Procedure

1. Use a screwdriver to remove the six fixing screws of the cover.

2. Hold the cover with both hands, and lift it up in the arrow direction to remove it.

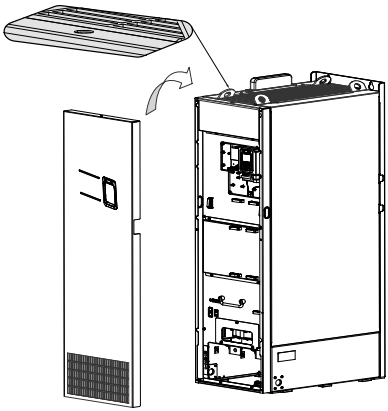


5.5.2 Installing the Cover

The cover of the AC drive must be removed before wiring the main circuit and control circuit. After wiring is done, re-install the cover.

Procedure

1. Hold the cover with both hands, align its upper edge with the upper edge snap-fit joint on the chassis, and snap them together, as shown in the following figure. Then, align the six screw mounting holes on the cover with the cover mounting holes on the chassis and press them tightly against each other.



2. Install six fixing screws into the holes with a screwdriver to fasten the cover.

6 Mechanical Installation (T13 Models)

6.1 Installation Method

T13 models are cabinet-type AC drives that should be vertically mounted on the floor. Multiple cabinets can be installed in parallel.

6.2 Installation Precautions

- Reserve sufficient clearance for heat dissipation, including the heat dissipation of other devices around the AC drive.
- Cover the top of the AC drive with cloth or paper during installation to prevent metal shavings, oil, and water from entering during drilling. Foreign objects entering may cause malfunction of the AC drive. Remove the cloth or paper after the installation is completed. Failure to comply may degrade ventilation and result in unexpected heat.
- Tighten all screws using the specified torque. Failure to comply may result in electric shock or fire.
- Keep combustible and explosive materials away from the AC drive.

6.3 Ground levelness

- The installation base must be level and firm enough to bear the weight of the cabinet.
- Use the door lock in a proper way to open and close the cabinet unit.
- Ensure there is no gap between the cabinet and the ground when cabinets are connected side by side. For any inevitable gap (as shown by ① in the following figure), use a pad (as shown by ② in the following figure) to level the cabinet, and use proper fillings (for example, fireproof mud) to fill the gap.

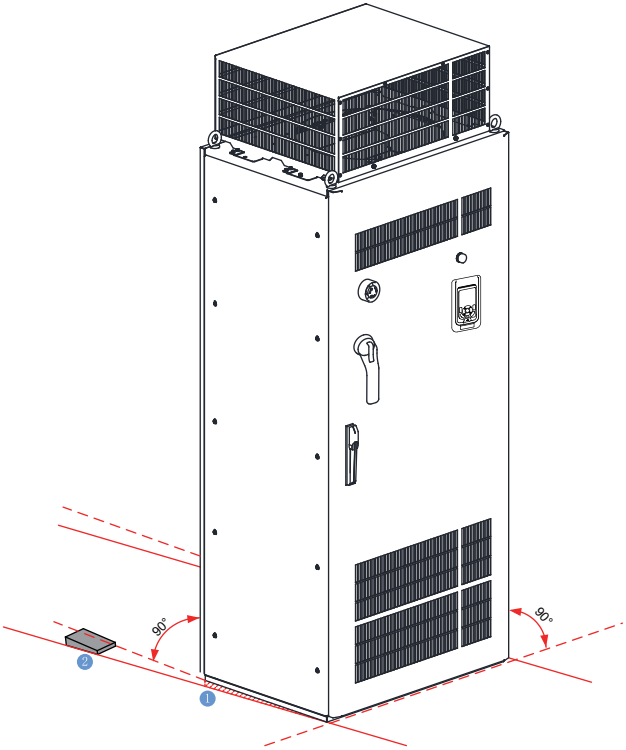


Figure 6-1 Ground requirements

6.4 Installing Expansion Screws

To install the cabinet on a cement floor, embed expansion nuts in advance in the floor at positions corresponding to the fixing holes of the cabinet for fixing the cabinet.

The following figure shows the steps of installing expansion screws, where ❶ indicates an expansion screw, ❷ indicates the cabinet, and ❸ indicates an M12 bolt.

1. Drill a hole for the expansion screw. The hole diameter shall be slightly smaller than the maximum outer diameter of the screw, and the hole depth shall be greater than the expansion screw length. The expansion screw must be vertical to the ground, as shown by "Step 1" in the following figure.
2. The expansion screw consists of a bolt spring enclosure and a screw part. Use a hammer to knock the expansion screw into the hole and ensure that the screw head is below the ground surface, as shown by "Step 2" in the following figure.

3. Place the cabinet and tighten the M12 screw. The screw part of the expansion screw will be pulled upward, so that the spring enclosure will be deformed outward for fixing, as shown by "Step 3" in the following figure.

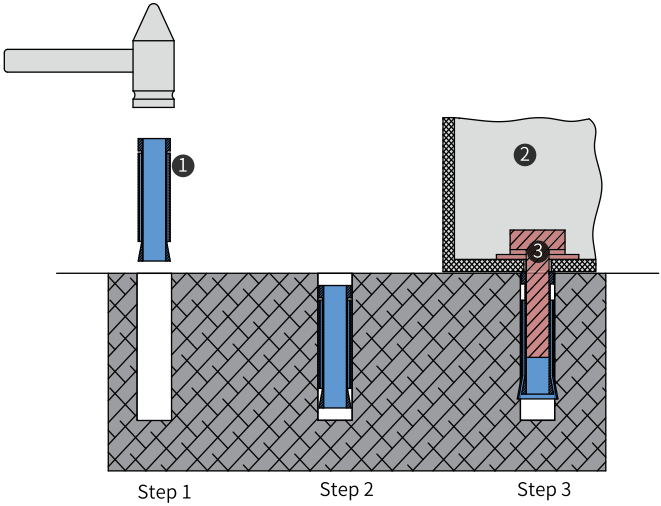


Figure 6-2 Installing an expansion screw

6.5 Requirements on Foundation

- Separate high-voltage cables from low-voltage cables by placing them on different brackets. For failures to do so due to any restrictions, place the low-voltage cables in completely enclosed metal pipes.
- The cable trench must be: a) made of incombustible materials; b) smooth, moisture-proof, and dust-proof; and c) able to prevent intrusion of animals.
- During foundation design, take the following factors into consideration: sufficient space in front of the cabinet for inspection, and wiring and cabling of power supply cables, actuating motor cables, and system control cables. The cabinet comes with a cable trench or cable guide. Separate power cables from signal cables. Failure to comply will affect the operation of the AC drive. The following figure shows the routing and related requirements.

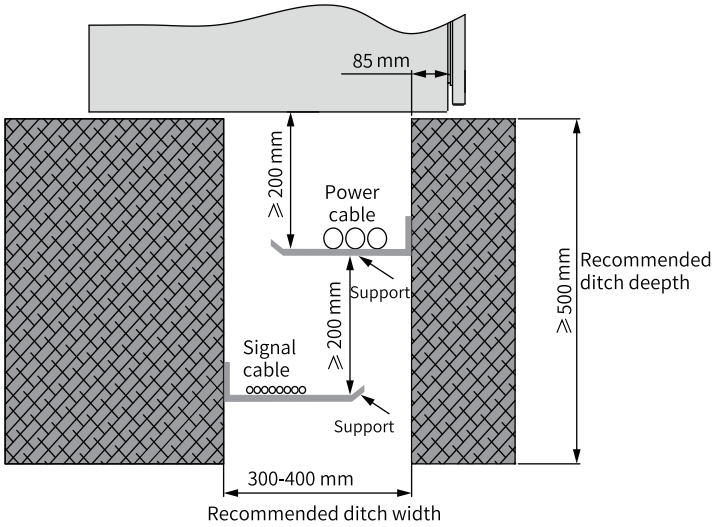
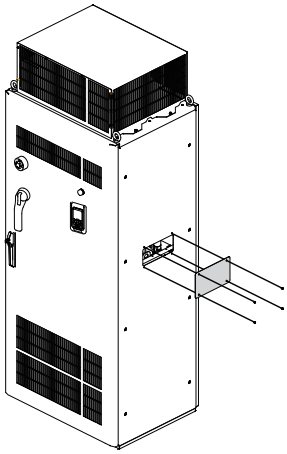


Figure 6-3 Foundation layout

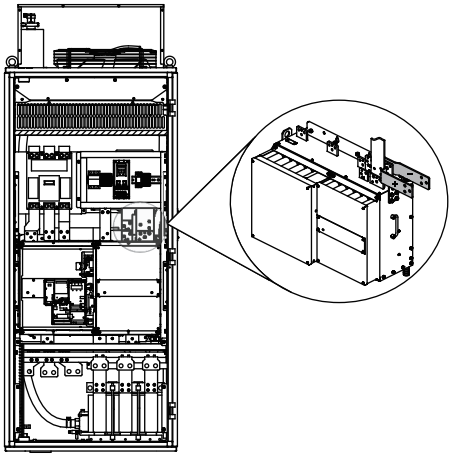
6.6 Installing the External Braking Unit

Procedure

1. Remove the lateral closure plate of the cabinet.



2. Open the cabinet door and mount the adapter busbar for the external braking unit, as shown in the following figure.



3. Connect the AC drive to the external braking unit.

Note

The number of required braking units is subject to actual conditions. When multiple braking units are required, connect them in parallel. The following figure takes one braking unit as an example.

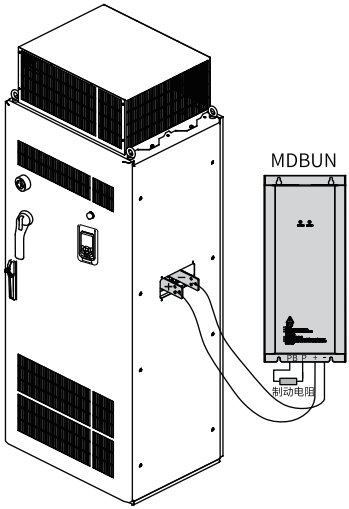


Figure 6-4 Connecting the AC drive to the external braking unit

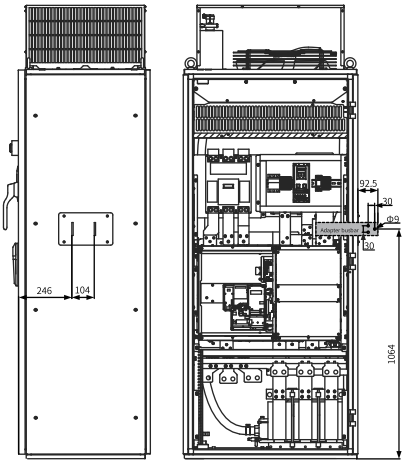


Figure 6-5 Dimensions of the position for installing the adapter busbar (unit: mm)

7 Mechanical Installation Checklist

If the option in the following table is included in the delivery, check the box in the right column. After mechanical installation is done, check each item step by step again.

Table 7–1 Checklist for mechanical installation

Item	Operation	Passed	Completed
1	Check the anti-inclination label.		
2	The packing box is intact and free of deficiency, damage, and dampness.		
3	Check that the load-bearing capacity of the floor and the environment meet the installation requirements. For details, see *"6.3 Ground levelness" on page 114* and *"1.2.1 Installation Environment" on page 19*.		
4	Check that the ceiling height meets the minimum requirements (for smooth ventilation). There is sufficient space for air inlet and outlet without obstruction. Reserve sufficient space to leave a safe passage after the cabinet unit door is opened. For details, see *"1.2.3 Installation Clearance" on page 21*.		
5	The cabinet enclosure is free of deformation, paint peeling, cracks, and other defects. The inside of the cabinet is free of water stains and other defects.		
6	Check that the accessories (user guide and options) in the cabinet are complete.		
7	The wooden pallet is removed before the cabinet is placed at the final installation site. For details, see *"3.5 Unpacking" on page 78*.		
8	The cabinet is installed on the pre-designed anchor point as required.		
9	Install all contact protective devices (protection plates) inside and outside the cabinet before commissioning.		

8 Electrical Installation

8.1 Electrical Wiring Diagram

T1-T12 models

"Figure 8–1 " on page 121 shows a typical wiring method of T1 to T12 models.

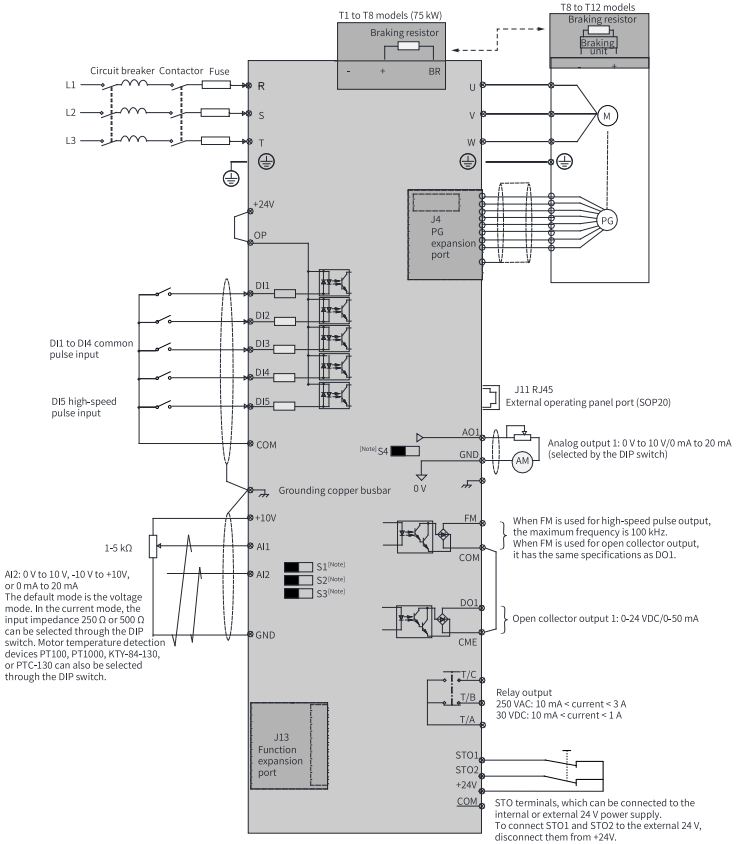


Figure 8-1 Standard wiring diagram (T1 to T12)

Note

- For details on S1 to S4 DIP switches, see *"Table 8–14 Function description of control circuit terminals " on page 157*.
- For three-phase 380–480 V AC drives, a 0.4–75 kW model differs from a 90–450 kW model in the wiring detail marked by the double arrows in the figure.
- For three-phase 200–240 V AC drives, a 0.4–37 kW model differs from a 45–200 kW model in the wiring detail marked by the double arrows in the figure.

T13 models

"Figure 8–2 " on page 122 shows the electrical connection in the cabinet.

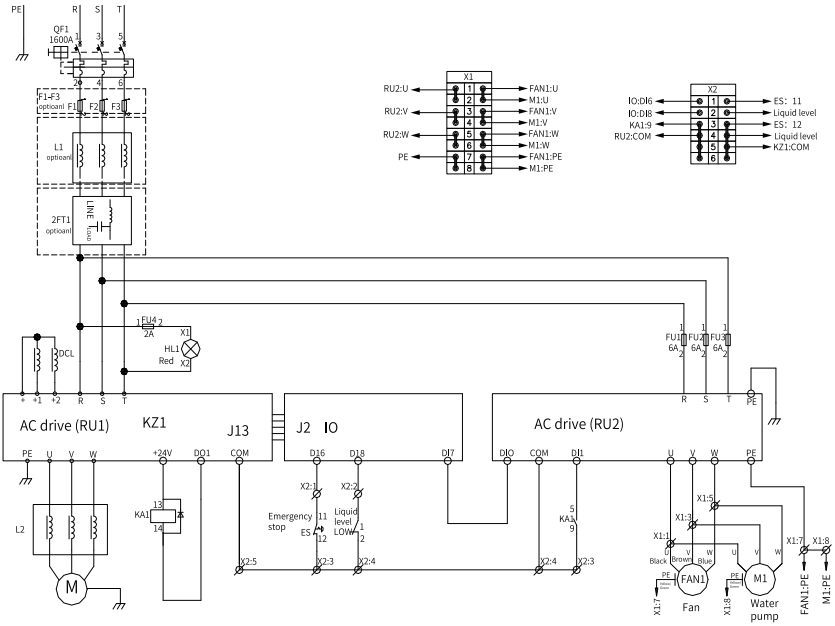


Figure 8-2 Electrical connection in the cabinet (T13)

T13

- The cabinet-housed devices operate under high voltage. Do not attempt to connect any wires while the voltage is live.
- The cabinet can be operated only by qualified professionals.
- Take caution when operating the cabinet disconnected from the power supply as external supply voltage may still be present. The main circuit and control circuit terminals may be live even when the motor is in the stop state.

- Do cut off input and output power, and wait at least 15 minutes until the power indicator is off before further operation.
- Ensure that the motors, cabinets, and other components are installed and connected in accordance with the national technical rules and other applicable regional regulations. Pay special attention to regulations on cable dimensions, fuses, grounding, open circuits, isolation, and overcurrent protection.
- If the safety device trips in a branch circuit, the fault current may have been disconnected. To reduce the risk of fire and electric shocks, check the conductive parts and other components of the cabinet and replace the damaged ones. Find the cause of the tripped fuse and make sure the problem is solved.

8.2 Inspection Before Wiring

Complete the following inspection items before wiring.

No.	Item
1	The diameter and shield of the cables used meet corresponding requirements.
2	The device and the drive are grounded properly.
3	Follow the proper electrostatic discharge (ESD) procedures and wear an antistatic wrist strap.
4	Wiring-related options, including cable shield brackets (applicable to T1 to T9 models), are available.

8.3 Main Circuit Connection

8.3.1 Main Circuit Terminals

T1 to T9 models

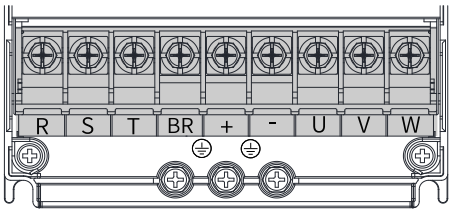


Figure 8-3 Layout of main circuit terminals for T1 to T4 models (three phase)

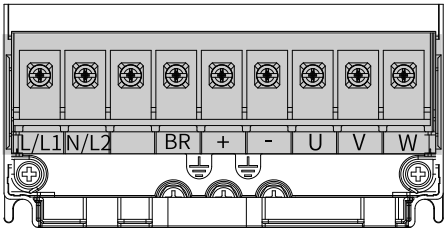


Figure 8-4 Layout of main circuit terminals for T2 models (single phase)

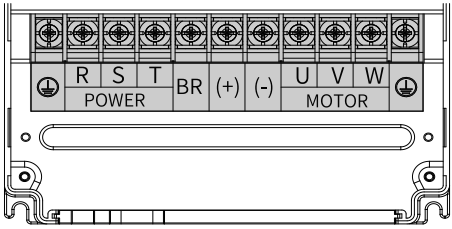


Figure 8-5 Layout of main circuit terminals for T5 to T8 models

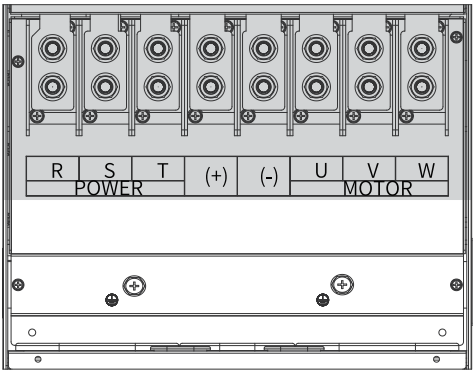


Figure 8-6 Layout of main circuit terminals for T9 models

Table 8–1 Descriptions of main Circuit terminals

Terminal Identification	Terminal Name	Function
R, S, T	Three-phase power supply input terminals	Connected to a three-phase AC input power supply
(+), (-)	Positive and negative terminals of the DC bus	Common DC busbar input; connected to the external braking unit of T9 models and above.

Terminal Identification	Terminal Name	Function
(+), BR	Braking resistor connection terminals	Used to connect to the braking resistor of T8 models and below Note: Only models with the name containing "B" are equipped with brake resistance terminals. For models with the name excluding "B", external brake units are required.
U, V, W	Output terminals	Connected to a three-phase motor
⏚	Grounding terminal (PE)	Used for protective grounding

T10 to T12 models

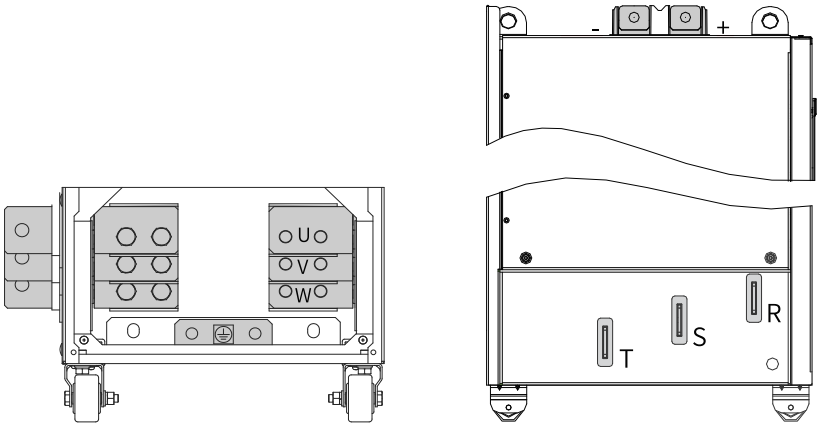


Figure 8-7 Layout of main circuit terminals for T10 to T12 models

Table 8–2 Descriptions of main circuit terminals

Terminal Identification	Terminal Name	Function
R, S, T	Three-phase power supply input terminals	Connected to a three-phase AC input power supply
+, -	Positive and negative terminals of the DC bus	Common DC busbar input; connected to an external braking unit

Terminal Identification	Terminal Name	Function
U, V, W	AC drive output terminals	Connected to a three-phase motor
⏚	Grounding terminal (PE)	Used for protective grounding

T13 models

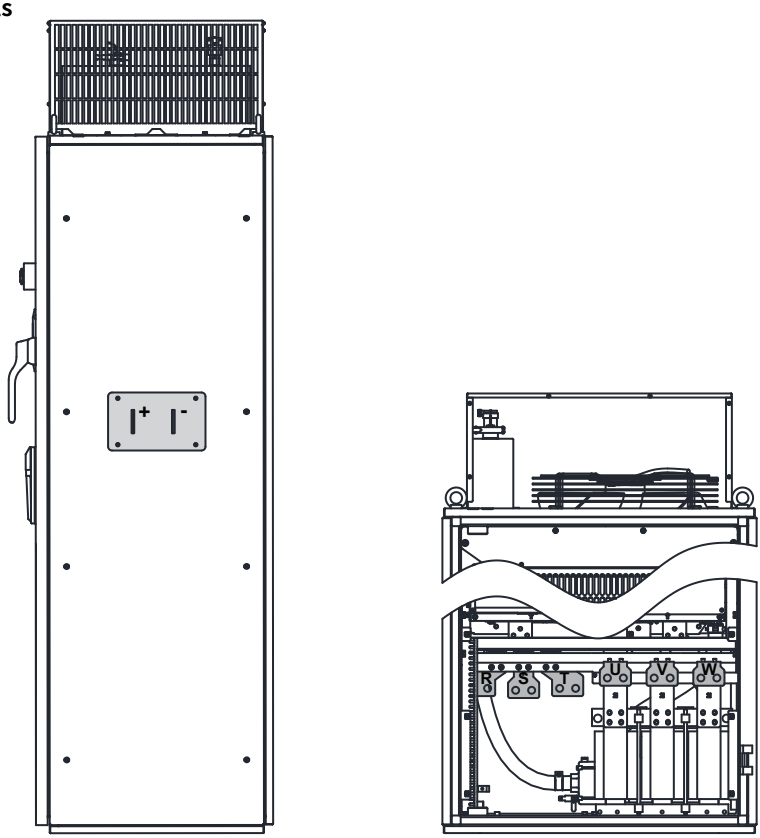


Figure 8-8 Layout of main circuit terminals for T13 models

Table 8–3 Descriptions of main circuit terminals

Terminal Identification	Terminal Name	Function
R, S, T	Three-phase power supply input terminals	Connected to a three-phase AC input power supply
+, -	Positive and negative terminals of the DC bus	Common DC busbar input; connected to an external braking unit
U, V, W	AC drive output terminals	Connected to a three-phase motor
⏚	Grounding terminal (PE)	Used for protective grounding

8.3.2 Dimensions of Main Circuit Terminals

T1 to T2 models

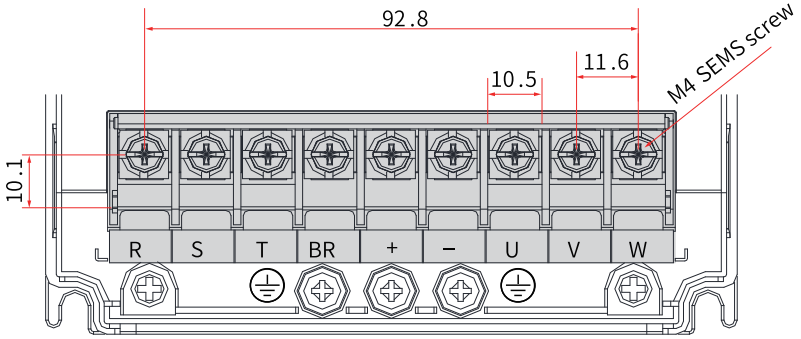


Figure 8-9 Main circuit terminal dimensions (mm) of T1 and T2 models

T3 models

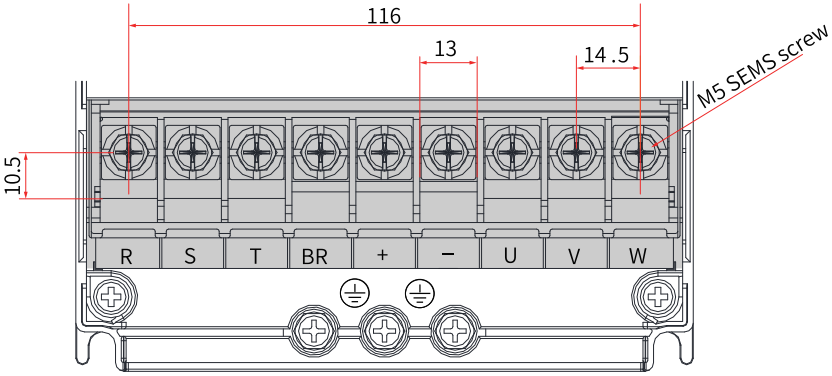


Figure 8-10 Main circuit terminal dimensions (mm) of T3 models

T4 models

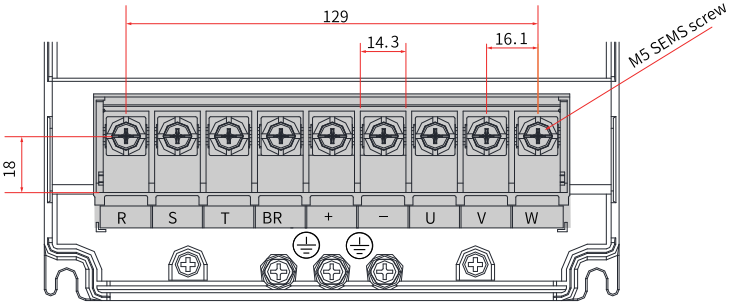


Figure 8-11 Main circuit terminal dimensions (mm) of T4 models

T5 models

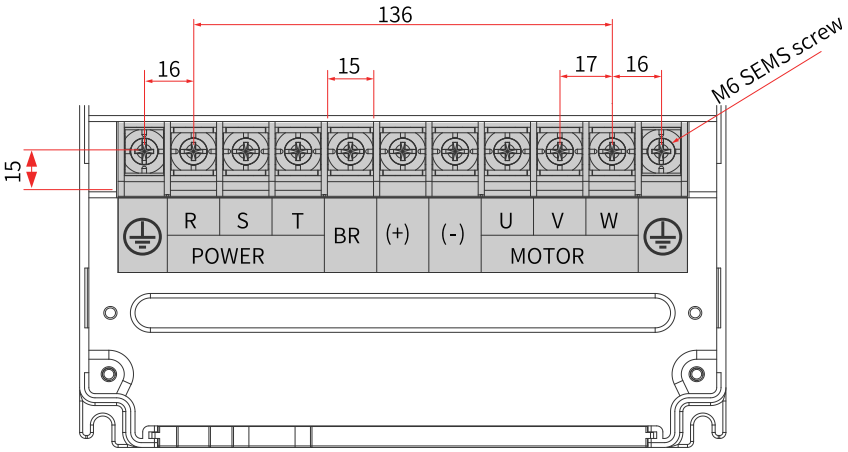


Figure 8-12 Main circuit terminal dimensions (mm) of T5 models

T6 models

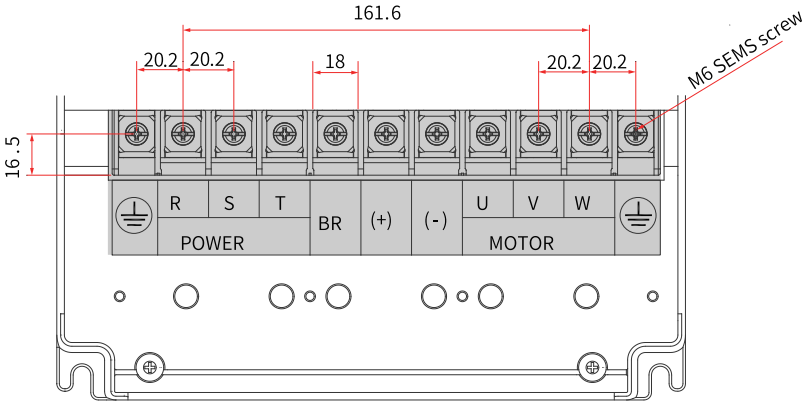


Figure 8-13 Main circuit terminal dimensions (mm) of T6 models

T7 models

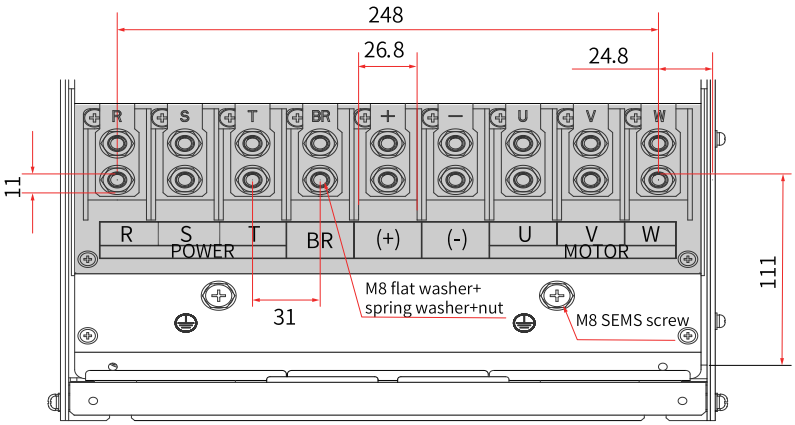


Figure 8-14 Main circuit terminal dimensions (mm) of T7 models

T8 models

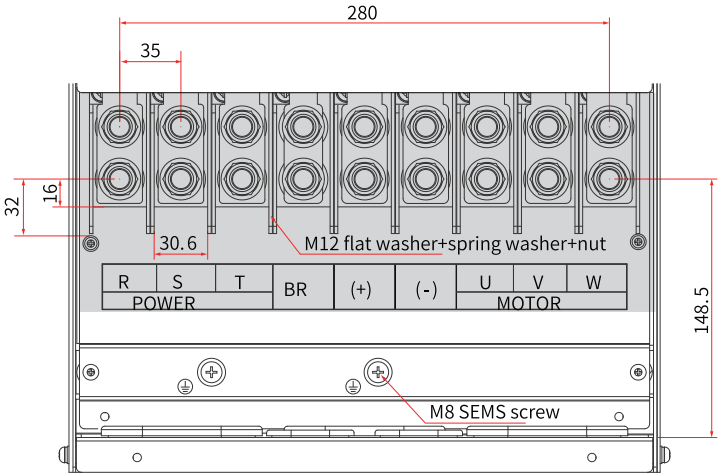


Figure 8-15 Main circuit terminal dimensions (mm) of T8 models

T9 models

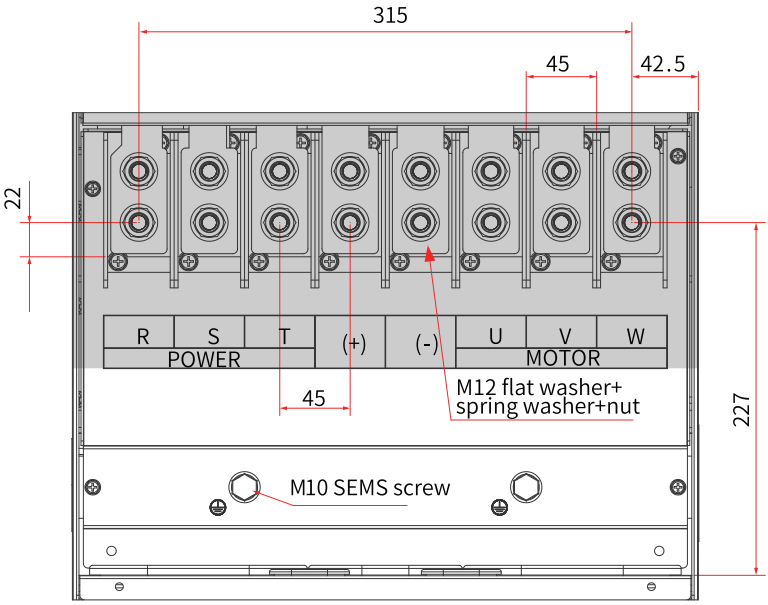


Figure 8-16 Main circuit terminal dimensions (mm) of T9 models

T10 models

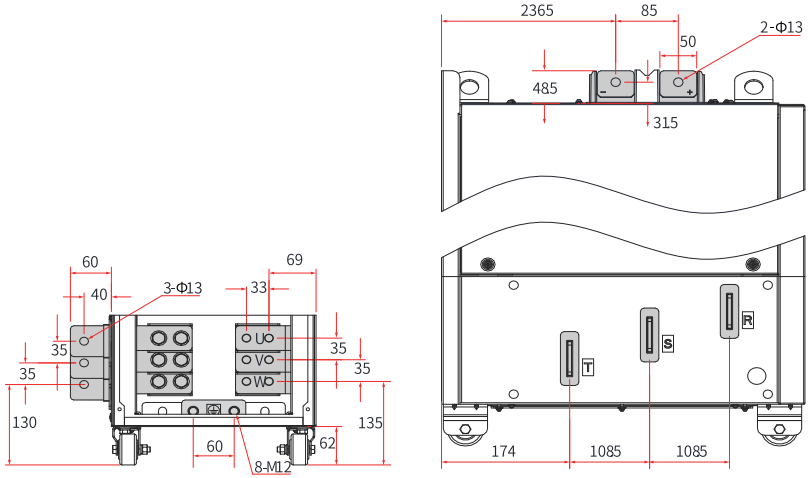


Figure 8-17 Main circuit terminal dimensions (mm) of T10 models (without output reactors)

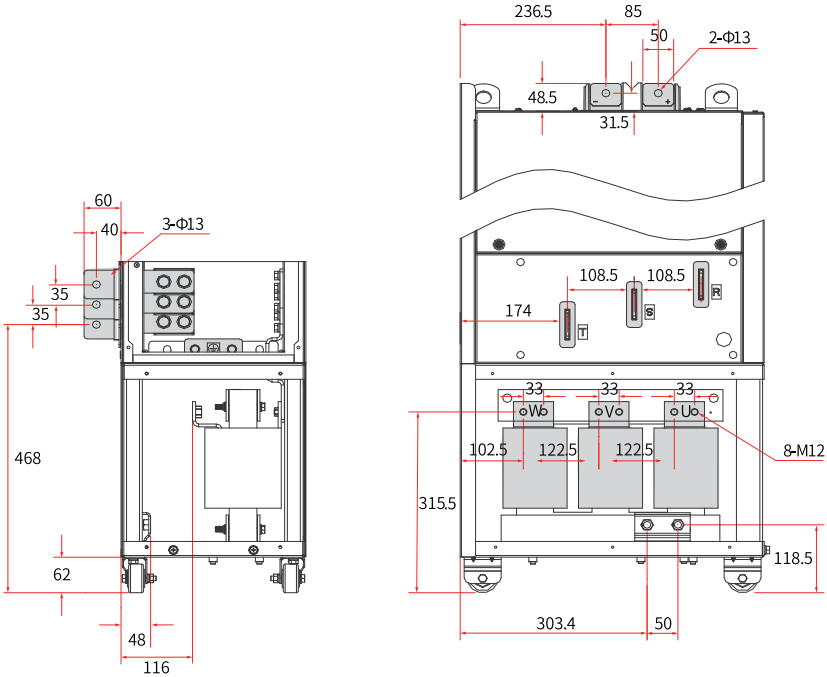


Figure 8-18 Main circuit terminal dimensions (mm) of T10 models (with output reactors)

The copper busbars in the preceding figures can be removed as required. The following figure shows the dimensions of the main circuit terminals without copper busbars.

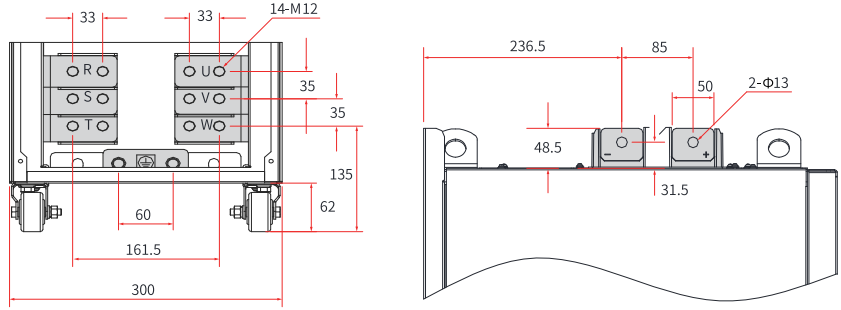


Figure 8-19 Main circuit terminal dimensions (mm) of T10 models (without copper busbar or output reactor)

T11 models

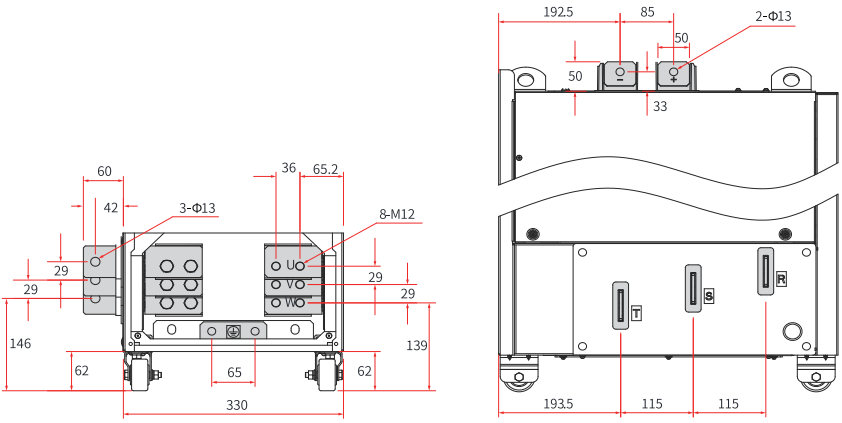


Figure 8-20 Main circuit terminal dimensions (mm) of T11 models without the output reactor

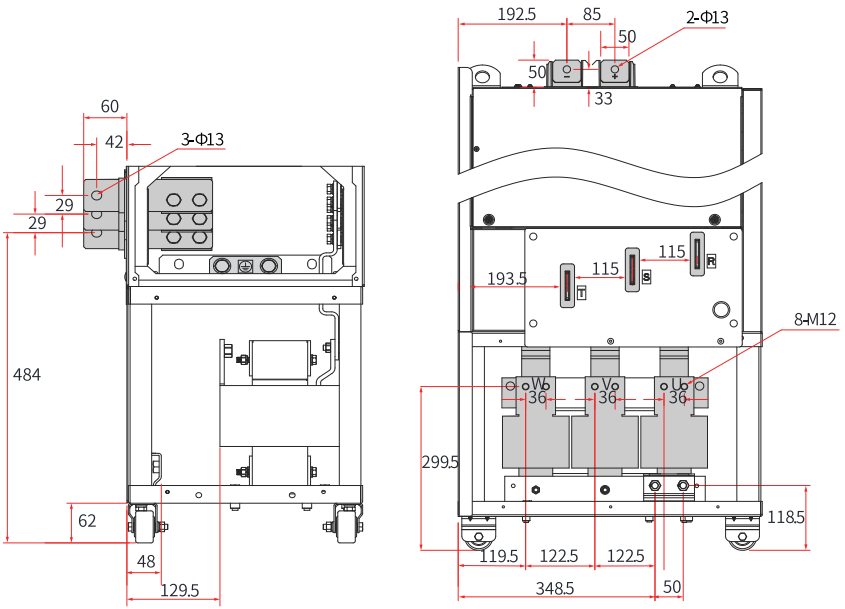


Figure 8-21 Main circuit terminal dimensions (mm) of T11 models with the output reactor

The copper busbars in the preceding figures can be removed as required. The following figure shows the dimensions of the main circuit terminals without copper busbars.

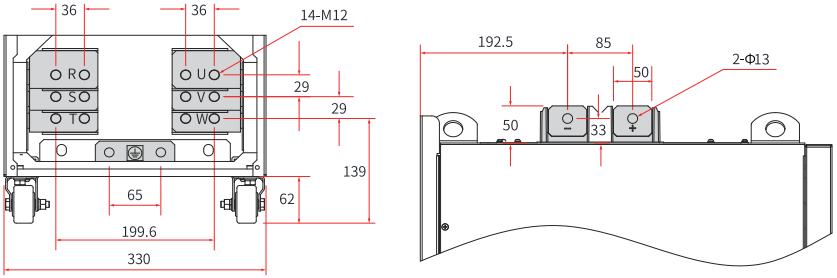


Figure 8-22 Main circuit terminal dimensions (mm) of T11 models (without copper busbar or output reactor)

T12 models

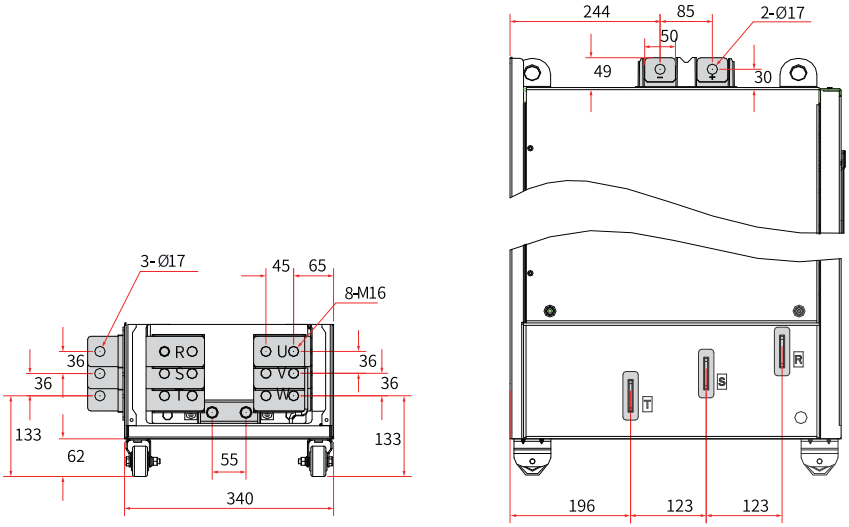


Figure 8-23 Main circuit terminal dimensions (mm) of T12 models without the output reactor

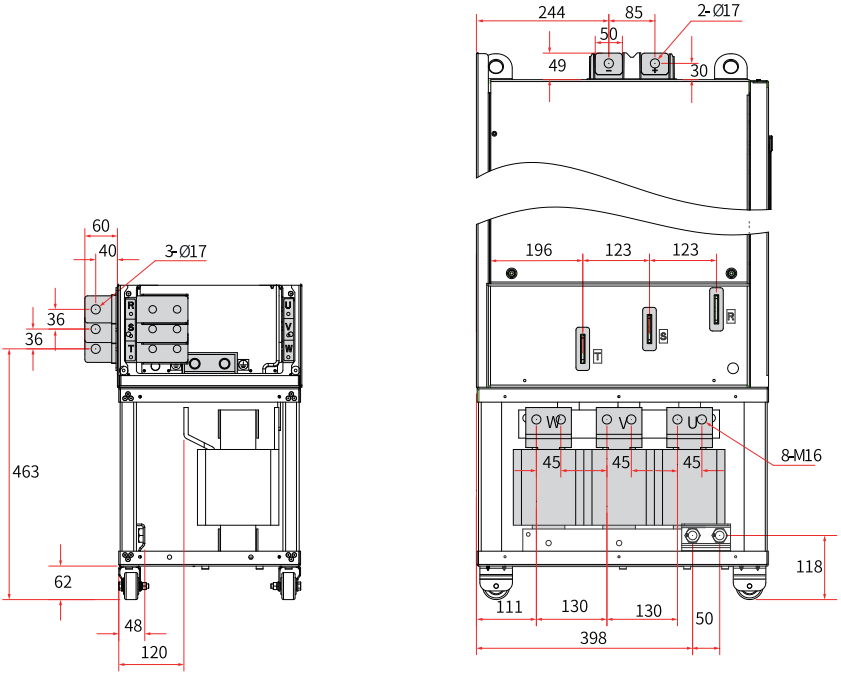


Figure 8-24 Main circuit terminal dimensions (mm) of T12 models with the output reactor

The copper busbars in the preceding figures can be removed as required. The following figure shows the dimensions of the main circuit terminals without copper busbars.

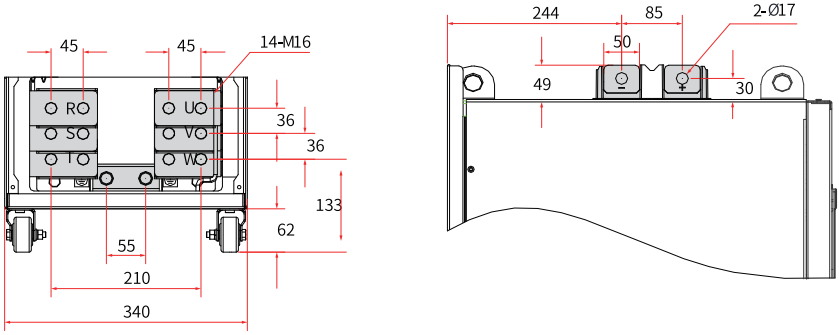


Figure 8-25 Main circuit terminal dimensions (mm) of T12 models (without copper busbar or output reactor)

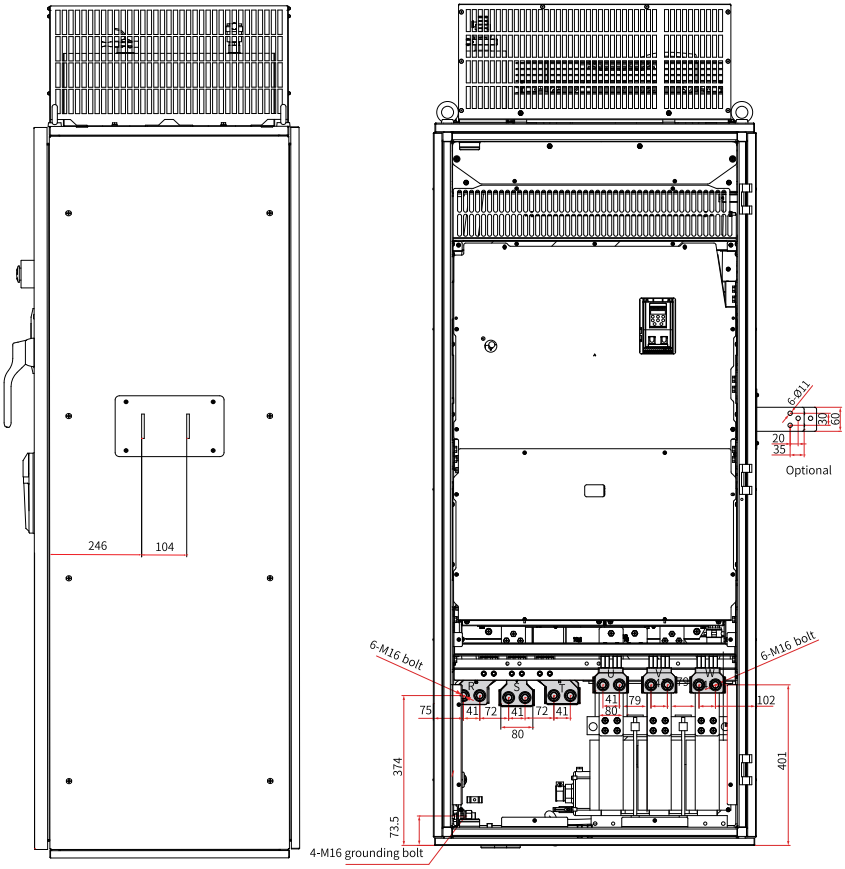


Figure 8-26 Main circuit terminal dimensions (mm) of T13 models (without auxiliary power distribution cabinets, three-phase 380 V to 480 V)

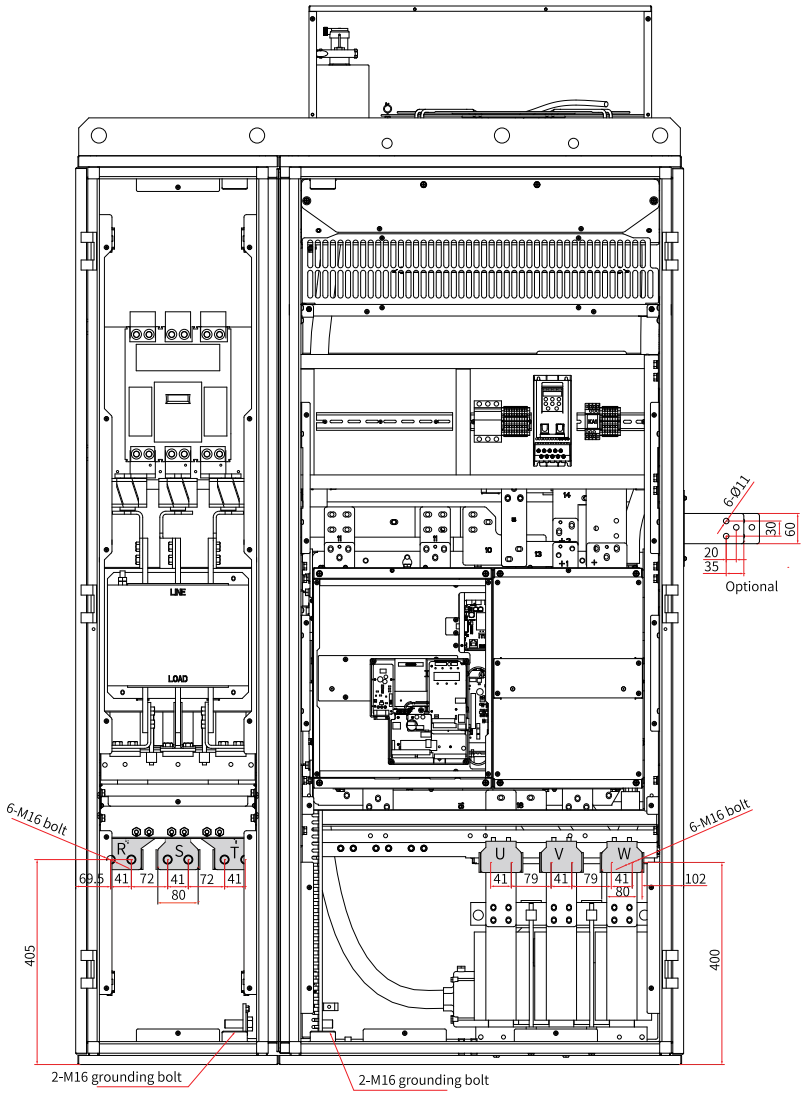


Figure 8-27 Main circuit terminal dimensions (mm) of T13 models (with auxiliary power distribution cabinets, three-phase 380 V to 480 V)

8.3.3 Main Circuit Cables

Power cable selection requirements

For the selection of power cables, follow national or regional regulations. Select IEC cables based on the following requirements:

- Compliant with IEC 60204-1 and IEC 60364-5-52 standards
- PVC insulated cables with copper conductors
- Heat resistance: ambient temperature of 40°C and cable surface temperature of 70°C (Note: When the ambient temperature exceeds 40°C, contact Inovance.)
- Symmetrical cable with copper mesh shield

If specifications of recommended cables for peripheral devices or options are outside the specification range of the cables applicable to the product, contact Inovance.

To meet the EMC requirements, the cable with the shield must be used. The shielded cables are divided into three-conductor cables and four-conductor cables, as shown below. If the conductivity of the three-conductor cable shield cannot meet requirements, add an independent PE cable. Alternatively, use a four-conductor cable with one conductor as the PE wire. The shield of the shielded cable is comprised of coaxial cooper braids to suppress radio frequency interference. To enhance the shielding performance and conductivity, the braided density of the shield must be greater than 90%.

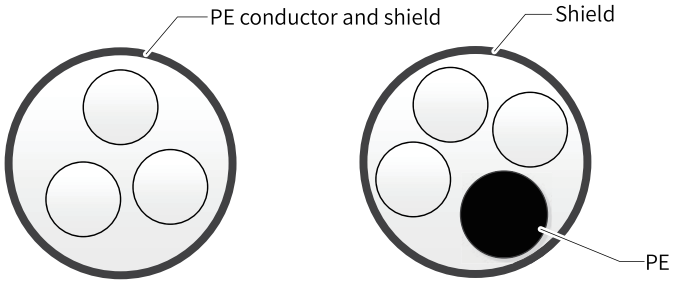


Figure 8-28 Recommended power cable

Recommended cable

Table 8–4 Cable selection (three-phase 380 V to 480 V)

Structure	Drive Model	Rated Input Current (A)	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T1	MD520-4T0.4B(S)	1.8	3 x 0.75	TNR0.75-4	0.75	TNR0.75‑4	M4	1.2 (10.6)
	MD520-4T0.7B(S)	2.4	3 x 0.75	TNR0.75-4	0.75	TNR0.75‑4	M4	1.2 (10.6)
	MD520-4T1.1B(S)	3.7	3 x 0.75	TNR0.75-4	0.75	TNR0.75‑4	M4	1.2 (10.6)
	MD520-4T1.5B(S)	4.6	3 x 0.75	TNR0.75-4	0.75	TNR0.75‑4	M4	1.2 (10.6)
	MD520-4T2.2B(S)	6.3	3 x 0.75	TNR0.75-4	0.75	TNR0.75‑4	M4	1.2 (10.6)
	MD520-4T3.0B(S)	9.0	3 x 1	TNR1.25‑4	1	TNR1.25‑4	M4	1.2 (10.6)
T2	MD520-4T3.7B(S)	11.4	3 x 1.5	TNR1.25‑4	1.5	TNR1.25‑4	M4	1.2 (10.6)
	MD520-4T5.5B(S)	16.7	3 x 2.5	TNR2-4	2.5	TNR2-4	M4	1.2 (10.6)
T3	MD520-4T7.5B(S)	21.9	3 x 4	TNR3.5‑5	4	TNR3.5‑5	M5	2.8 (24.8)
	MD520-4T11B(S)	32.2	3 x 6	TNR5.5‑5	6	TNR5.5‑5	M5	2.8 (24.8)
T4	MD520-4T15B(S)	41.3	3 x 10	GTNR8-5	10	GTNR8-5	M5	2.8 (24.8)
T5	MD520-4T18.5(B) (S)-T	49.5	3 x 10	GTNR10-6	10	GTNR10-6	M6	4.8 (42.5)
	MD520-4T18.5(B)(S)	49.5	3 x 10	GTNR10-6	10	GTNR10-6	M6	4.8 (42.5)
	MD520-4T22(B)(S)-T	59.0	3 x 16	GTNR16-6	16	GTNR16-6	M6	4.8 (42.5)
	MD520-4T22(B)(S)	59.0	3 x 16	GTNR16-6	16	GTNR16-6	M6	4.8 (42.5)
T6	MD520-4T30(B)(S)	57.0	3 x 16	GTNR16-6	16	GTNR16-6	M6	4.8 (42.5)
	MD520-4T37(B)(S)	69.0	3 x 25	GTNR25-6	16	GTNR16-6	M6	4.8 (42.5)
T7	MD520-4T45(B)(S)	89.0	3 x 35	GTNR35-8	16	GTNR16-6	M8	13.0 (115.2)
	MD520-4T55(B)(S)	106.0	3 x 50	GTNR50-8	25	GTNR25-8	M8	13.0 (115.2)

Structure	Drive Model	Rated Input Current (A)	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T8	MD520-4T75(B)(S)	139.0	3 x 70	GTNR70-12	35	GTNR35-8	M12 (main power)	35.0 (310.1)
							M8 (grounding)	13.0 (115.2)
	MD520-4T90(S)	164.0	3 x 95	GTNR95-12	50	GTNR50-8	M12 (main power)	35.0 (310.1)
							M8 (grounding)	13.0 (115.2)
	MD520-4T110(S)	196.0	3 x 120	GTNR120-12	70	GTNR70-8	M12 (main power)	35.0 (310.1)
							M8 (grounding)	13.0 (115.2)
T9	MD520-4T132(S)	240.0	3 x 150	BC150-12	95	BC95-10	M12 (main power)	35.0 (310.1)
							M10 (grounding)	20 (117)
	MD520-4T160(S)	287.0	3 x 185	BC185-12	95	BC95-10	M12 (main power)	35.0 (310.1)
							M10 (grounding)	20 (117)
T10	MD520-4T200(S) (-L)	365.0	2 x (3 x 120)	BC120-12	120	BC120-12	M12	35.0 (310.1)
	MD520-4T220(S) (-L)	410.0	2 x (3 x 150)	BC150-12	150	BC150-12	M12	35.0 (310.1)
T11	MD520-4T250(S) (-L)	441.0	2 x (3 x 150)	BC150-12	150	BC150-12	M12	35.0 (310.1)
	MD520-4T280(S) (-L)	495.0	2 x (3 x 150)	BC150-12	150	BC150-12	M12	35.0 (310.1)
T12	MD520-4T315(S) (-L)	565.0	2 x (3 x 185)	BC185-16	185	BC185-16	M16	85.0 (753.1)
	MD520-4T355(S) (-L)	617.0	2 x (3 x 185)	BC185-16	185	BC185-16	M16	85.0 (753.1)
	MD520-4T400(S) (-L)	687.0	2 x (3 x 240)	BC240-16	240	BC240-16	M16	85.0 (753.1)
T13	MD520-4T500(S)-(A)	838.1	4 x (3 x 150)	GTNR150-16	2 x 150	GTNR150-16	M16	85.0 (753.1)
	MD520-4T560(S)-(A)	949.6	4 x (3 x 185)	GTNR185-16	2 x 185	GTNR185-16	M16	85.0 (753.1)
	MD520-4T630(S)-(A)	1043.5	4 x (3 x 240)	GTNR240-16	2 x 240	GTNR240-16	M16	85.0 (753.1)

Table 8–5 Cable selection (three-phase 380 V to 480 V) (with UL certification)

Structure	Drive Model	Rated Input Current (A)	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
			Recommended Cable (AWG/mil)<2>	Recommended Cable Lug	Recommended Cable (AWG/mil)<2>	Recommended Cable Lug		
T1	MD520-4T0.4B(S)	1.8	16	TLK1.25-4	18	TLK1.25-4	M4	1.2 (10.6)
	MD520-4T0.7B(S)	2.4	16	TLK1.25-4	18	TLK1.25-4	M4	1.2 (10.6)
	MD520-4T1.1B(S)	3.7	16	TLK1.25-4	18	TLK1.25-4	M4	1.2 (10.6)
	MD520-4T1.5B(S)	4.6	16	TLK1.25-4	18	TLK1.25-4	M4	1.2 (10.6)
	MD520-4T2.2B(S)	6.3	16	TLK1.25-4	18	TLK1.25-4	M4	1.2 (10.6)
	MD520-4T3.0B(S)	9.0	16	TLK1.25-4	18	TLK1.25-4	M4	1.2 (10.6)
T2	MD520-4T3.7B(S)	11.4	16	TLK1.25–4	16	TLK1.25–4	M4	1.2 (10.6)
	MD520-4T5.5B(S)	16.7	14	TLK2-4	14	TLK2-4	M4	1.2 (10.6)
T3	MD520-4T7.5B(S)	21.9	12	TLK3.5–5	12	TLK3.5–5	M5	2.8 (24.8)
	MD520-4T11B(S)	32.2	8	TLK10-5	8	TLK10-5	M5	2.8 (24.8)
T4	MD520-4T15B(S)	41.3	6	TLK16-5	6	TLK16-5	M5	2.8 (24.8)
T5	MD520-4T18.5(B) (S)-T	49.5	6	TLK16-6	6	TLK16-6	M6	4.8 (42.5)
	MD520-4T18.5(B)(S)	49.5	6	TLK16-6	6	TLK16-6	M6	4.8 (42.5)
	MD520-4T22(B)(S)-T	59.0	4	TLK25-6	6	TLK16-6	M6	4.8 (42.5)
	MD520-4T22(B)(S)	59.0	4	TLK25-6	6	TLK16-6	M6	4.8 (42.5)
T6	MD520-4T30(B)(S)	57.0	4	TLK25-6	6	TLK16-6	M6	4.8 (42.5)
	MD520-4T37(B)(S)	69.0	2	TLK35-6	6	TLK16-6	M6	4.8 (42.5)
T7	MD520-4T45(B)(S)	89.0	2	TLK35-8	6	TLK16-8	M8	13.0 (115.2)
	MD520-4T55(B)(S)	106.0	1/0	TLK50-8	4	TLK25-8	M8	13.0 (115.2)

Structure	Drive Model	Rated Input Current (A)	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
			Recommended Cable (AWG/mil)<2>	Recommended Cable Lug	Recommended Cable (AWG/mil)<2>	Recommended Cable Lug		
T8	MD520-4T75(B)(S)	139.0	3/0	TLK95-12	1/0	TLK50-8	M12 (main power)	35.0 (310.1)
							M8 (grounding)	13.0 (115.2)
	MD520-4T90(S)	164.0	3/0	TLK95-12	1/0	TLK50-8	M12 (main power)	35.0 (310.1)
							M8 (grounding)	13.0 (115.2)
	MD520-4T110(S)	196.0	300	TLK150-12	3/0	TLK95-8	M12 (main power)	35.0 (310.1)
							M8 (grounding)	13.0 (115.2)
T9	MD520-4T132(S)	240.0	350	TLK185-12	3/0	TLK95-10	M12 (main power)	35.0 (310.1)
							M10 (grounding)	20 (117)
	MD520-4T160(S)	287.0	450	TLK240-12	250	TLK120-10	M12 (main power)	35.0 (310.1)
							M10 (grounding)	20 (117)
T10	MD520-4T200(S) (-L)	365.0	4x1/0	TLK50-12	2x1/0	TLK50-12	M12	35.0 (310.1)
	MD520-4T220(S) (-L)	410.0	4x1/0	TLK50-12	2x1/0	TLK50-12	M12	35.0 (310.1)
T11	MD520-4T250(S) (-L)	441.0	4x1/0	TLK50-12	2x1/0	TLK50-12	M12	35.0 (310.1)
	MD520-4T280(S) (-L)	495.0	4x2/0	TLK70-12	2x2/0	TLK70-12	M12	35.0 (310.1)
T12	MD520-4T315(S) (-L)	565.0	4x3/0	TLK95-16	2x3/0	TLK95-16	M16	85.0 (753.1)
	MD520-4T355(S) (-L)	617.0	4 x 250	TLK120-16	2 x 250	TLK120-16	M16	85.0 (753.1)
	MD520-4T400(S) (-L)	687.0	4 x 250	TLK120-16	2 x 250	TLK120-16	M16	85.0 (753.1)
T13	MD520-4T500(S)-(A)	838.1	4x300kcmil	TLK150-16	2x300kcmil	TLK150-16	M16	85.0 (753.1)
	MD520-4T560(S)-(A)	949.6	4x350kcmil	TLK185-16	2x350kcmil	TLK185-16	M16	85.0 (753.1)
	MD520-4T630(S)-(A)	1043.5	4x400kcmil	TLK240-16	2x400kcmil	TLK240-16	M16	85.0 (753.1)

Table 8–6 Cable selection (three-phase 200 V to 240 V)

Structure	Drive Model	Rated Input Current (A)	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T1	MD520-2T0.4B(S)	2.4	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	M4	1.2 (10.6)
	MD520-2T0.7B(S)	4.6	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	M4	1.2 (10.6)
	MD520-2T1.1B(S)	6.3	3 x 0.75	TNR0.75-4	0.75	TNR0.75-4	M4	1.2 (10.6)
	MD520-2T1.5B(S)	9.0	3 x 1	TNR1.25-4	1	TNR1.25-4	M4	1.2 (10.6)
T2	MD520-2T2.2B(S)	11.4	3 x 1.5	TNR1.25-4	1.5	TNR1.25-4	M4	1.2 (10.6)
	MD520-2T3.7B(S)	16.7	3 x 2.5	TNR2-4	2.5	TNR2-4	M4	1.2 (10.6)
T3	MD520-2T5.5B(S)	32.2	3 x 6	TNR5.5-5	6	TNR5.5-5	M5	2.8 (24.8)
T4	MD520-2T7.5B(S)	41.3	3 x 10	TNR8-5	10	TNR8-5	M5	2.8 (24.8)
T5	MD520-2T11(B) (S)	59.0	3 x 16	GTNR16-6	16	GTNR16-6	M6	4.8 (42.5)
T6	MD520-2T15(B) (S)	57.0	3 x 16	GTNR16-6	16	GTNR16-6	M6	4.8 (42.5)
	MD520-2T18.5(B)(S)	69.0	3 x 25	GTNR25-6	16	GTNR16-6	M6	4.8 (42.5)
T7	MD520-2T22(B) (S)	89.0	3 x 35	GTNR35-8	16	GTNR16-8	M8	4.8 (42.5)
	MD520-2T30(B)(S)	106.0	3 x 50	GTNR50-8	25	GTNR25-8	M8	4.8 (42.5)
T8	MD520-2T37(B) (S)	139.0	3 x 70	GTNR70-12	35	GTNR35-8	M12 (main power)	35.0 (310.1)
							M8 (grounding)	13.0 (115.2)
	MD520-2T45(S)	164.0	3 x 95	GTNR95-12	50	GTNR50-8	M12 (main power)	35.0 (310.1)
							M8 (grounding)	13.0 (115.2)
	MD520-2T55(S)	196.0	3 x 120	GTNR120-12	70	GTNR70-8	M12 (main power)	35.0 (310.1)
							M8 (grounding)	13.0 (115.2)

Structure	Drive Model	Rated Input Current (A)	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
			Recommended Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T9	MD520-2T75(S)	287.0	3x 185	GTNR185-12	95	GTNR95-10	M12 (main power)	35.0 (310.1)
							M10 (grounding)	20 (117)
T10	MD520-2T90(S)	365.0	2 x (3 x 120)	GTNR120-12	120	GTNR120-12	M12	35.0 (310.1)
	MD520-2T110(S)	410.0	2 x (3 x 150)	GTNR150-12	150	GTNR150-12	M12	35.0 (310.1)
T11	MD520-2T132(S)	441.0	2 x (3 x 150)	GTNR150-12	150	GTNR150-12	M12	35.0 (310.1)
T12	MD520-2T160(S)	565.0	2 x (3 x 185)	GTNR185-16	185	GTNR185-16	M16	85.0 (753.1)
	MD520-2T200(S)	687.0	2 x (3 x 240)	GTNR240-16	240	GTNR240-16	M16	85.0 (753.1)

Table 8–7 Cable selection (single-phase 200 V to 240 V)

Structure	Drive Model	Rated Input Current (A)	R/S/T, U/V/W			Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
			Recommended Input Cable (mm^2)<1>	Recommended Output Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug		
T2	MD520-2S0.4B(S)	5.4	0.75	3 x 0.75	TNR0.75‑4	0.75	TNR0.75‑4	M4	1.2 (10.6)
	MD520-2S0.7B(S)	8.2	1	3 x 1	TNR1.25‑4	0.75	TNR1.25‑4		
	MD520-2S1.5B(S)	14	1.5	3 x 1.5	TNR1.25‑4	1.5	TNR1.25‑4		
	MD520-2S2.2B(S)	23	4	3 x 4	TNR3.5‑4	2.5	TNR3.5‑4		

Table 8–8 Cable selection (single-phase 200 V to 240 V) (with UL certification)

Structure	Drive Model	Rated Input Current (A)	R/S/T, U/V/W			Grounding Cable		Screw
			Recommended Input Cable (mm^2)<1>	Recommended Output Cable (mm^2)<1>	Recommended Cable Lug	Recommended Cable (mm^2)<1>	Recommended Cable Lug	
T2	MD520-2S0.4B(S)	5.4	18	18	TLK0.75 - 4	18	TLK0.75 - 4	M4
	MD520-2S0.7B(S)	8.2	18	18	TLK1.25 - 4	18	TLK1.25 - 4	
	MD520-2S1.5B(S)	14	16	16	TLK1.25 - 4	16	TLK1.25 - 4	
	MD520-2S2.2B(S)	23	12	12	TLK3.5 - 4	12	TLK3.5 - 4	

Note

<1>: Chinese standards applicable; 3 x 10: one three-conductor cable; 2 x (3 x 95): two three-conductor cables; <2>: American standards applicable; 5: 5AWG; 1/0: 0AWG; 2/0: 00AWG; 3/0: 000AWG; 4/0: 0000AWG; 2 x 250: two 250 kcmil cables

Recommended cable lug

The following table describes recommended lugs, namely, the TNR, GTNR, and BC series lugs of Suzhou Yuanli. The lugs with UL certifications are TLK and SQNBS series lugs of KST.

Table 8–9 Appearances, models, and dimensions of TNR series lugs (unit: mm)

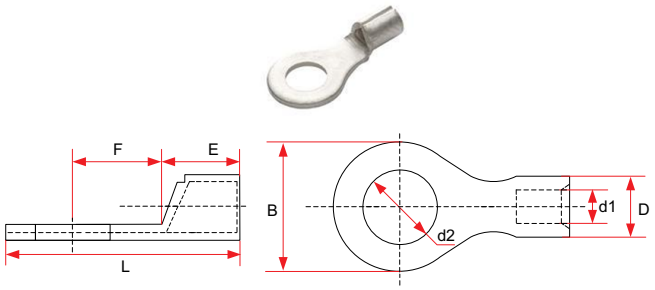
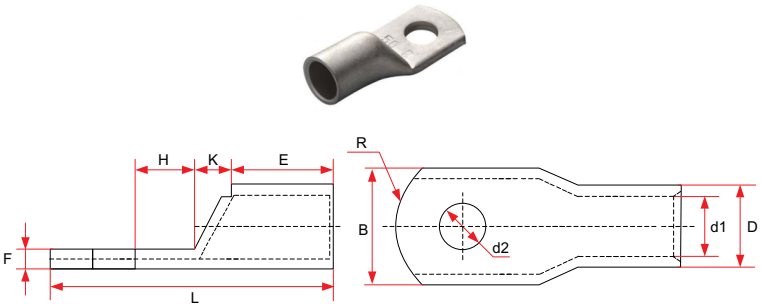
Model	Specification		D	d1	E	F	B	d2	L	Current (A)	Crimping Tool
	AWG/ MCM	mm^2									
											
TNR0.75-4	22–16	0.25–1.0	2.8	1.3	4.5	6.6	8.0	4.3	15.0	10	RYO-8 AK-1M
TNR1.25-4	22–16	0.25–1.65	3.4	1.7	4.5	7.3	8	5.3	15.8	19	

Table 8–10 Appearances, models, and dimensions of GTNR series cable lug (unit: mm)

Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool
											
GTNR1.5-5	4.0	2.2	5.0	5.0	2.0	8.0	5.3	1.0	16.0	5	RYO-8 YYT-8 RYO-14
GTNR2.5-4	4.5	2.9	7.0	5.0	2.0	8.0	4.3	1.0	18.0	5	
GTNR2.5-5	4.5	2.9	7.0	6.0	2.0	8.0	5.3	1.0	20.0	7	
GTNR2.5-6	4.5	2.9	7.0	6.0	2.0	10.2	6.4	0.8	20.0	7	
GTNR4-5	5.2	3.6	7.0	6.0	2.0	10.0	5.3	1.0	20.0	7	
GTNR4-6	5.2	3.6	7.0	6.0	2.0	10.0	6.4	1.0	20.0	7	
GTNR6-5	6.0	4.2	9.0	6.0	3.0	10.0	5.3	1.2	23.0	7	
GTNR6-6	6.0	4.2	9.0	7.5	3.0	10.0	6.4	1.2	26.0	7	
GTNR6-8	6.0	4.2	9.0	7.5	3.0	12.0	8.4	1.0	26.0	7	
GTNR10-6	7.0	5.0	9.0	8.0	3.5	12.4	6.4	1.3	26.5	7	
GTNR10-8	7.0	5.0	9.0	8.0	3.5	12.4	8.4	1.3	27.5	7	
GTNR16-6	7.8	5.8	12.0	8.0	4.0	12.4	6.4	1.3	31.0	7	CT-38 CT-100
GTNR16-8	7.8	5.8	12.0	8.0	4.0	12.4	8.4	1.3	31.0	7	
GTNR25-6	9.5	7.5	12.0	8.0	4.5	14.0	6.4	2.0	32.0	10	
GTNR25-8	9.5	7.5	12.0	9.0	4.5	15.5	8.4	1.6	34.0	10	
GTNR25-10	9.5	7.5	12.0	10.5	4.5	17.5	10.5	1.4	37.0	10	
GTNR35-6	11.4	8.6	15.0	9.0	5.0	15.5	6.4	2.8	38.0	10	
GTNR35-8	11.4	8.6	15.0	9.0	5.0	15.5	8.4	2.8	38.0	10	
GTNR35-10	11.4	8.6	15.0	10.5	5.0	17.5	10.5	2.5	40.5	10	
GTNR50-8	12.6	9.6	16.0	11.0	6.0	18.0	8.4	2.8	43.5	10	CT-100
GTNR50-10	12.6	9.6	16.0	11.0	6.0	18.0	10.5	2.8	43.5	10	
GTNR70-8	15.0	12.0	18.0	13.0	7.0	21.0	8.4	2.8	50.0	14	
GTNR70-10	15.0	12.0	18.0	13.0	7.0	21.0	10.5	2.8	50.0	14	
GTNR70-12	15.0	12.0	18.0	13.0	7.0	21.0	13.0	2.8	50.0	14	
GTNR95-10	17.4	13.5	20.0	13.0	9.0	25.0	10.5	3.9	55.0	14	
GTNR95-12	17.4	13.5	20.0	13.0	9.0	25.0	13.0	3.9	55.0	14	

Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Tool
GTNR120-12	19.8	15.0	22.0	14.0	10.0	28.0	13.0	4.7	60.0	16	RYC-150
GTNR120-16	19.8	15.0	22.0	16.0	10.0	28.0	17.0	4.7	64.0	16	
GTNR150-12	21.2	16.5	26.0	16.0	11.0	30.0	13.0	4.7	69.0	24	
GTNR150-16	21.2	16.5	26.0	16.0	11.0	30.0	17.0	4.7	69.0	24	
GTNR185-16	23.5	18.5	32.0	17.0	12.0	34.0	17.0	5.0	78.0	24	
GTNR240-16	26.5	21.5	38.0	20.0	14.0	38.0	17.0	5.5	92.0	24	
GTNR240-20	26.5	21.5	38.0	20.0	14.0	38.0	21.0	5.5	92.0	24	

Table 8–11 Appearance, models, and dimensions of BC series cable lugs (unit: mm)

Model	A	B	W	E	D	L	T	C	F
120-8	19.0	15.0	27.2	16.5	27.0	73.0	4.0	8.5	16.5
120-10								10.5	
120-12								12.8	
120-14								14.7	
120-16								16.7	
120-20				18.8				20.7	14.3
150-8	21.0	16.5	30.0	16.5	27.0	78.0	4.5	8.5	16.5
150-10								10.5	
150-12								12.8	
150-14								14.7	
150-16								16.7	
150-20				18.8				20.7	14.3

Model	A	B	W	E	D	L	T	C	F
185-10	23	18.5	33.5	16.5	30	82	4.5	10.5	16.5
185-12								12.8	
185-14								14.7	
185-16								16.7	
185-20				18.8				20.7	14.3
240-10	26	21	37.7	18.0	32.0	88.0	5.0	10.5	17.0
240-12								12.8	
240-14								14.7	
240-16								16.7	
240-20								20.7	
300-10	28.0	23.0	41.0	18.0	37.0	97.0	5.0	10.5	17.0
300-12								12.8	
300-14								14.7	
300-16								16.7	
300-20								20.7	

8.3.4 Wiring Descriptions of Main Circuit Terminals

This section specifies requirements on wiring of main circuit terminals. For requirements on selection, routing, and wiring of main circuit cables, see *"8.3.5 Main Circuit Wiring Requirements" on page 150*.

To prevent accidents caused by short circuit, install a fuse on the input side of the drive. For requirements and selection of fuses at the input side, see "Conditions for Compliance with the LVD" in the *MD520 Series General-Purpose AC Drive Hardware Guide*.

R, S, and T terminals of the input power supply

- The cable connection on the input side of the drive has no requirements on the phase sequence.
- The specification and installation method of external main circuit cables must comply with the local regulations and related IEC standards.
- Use copper lead cables with appropriate dimensions for main circuit cables according to the recommended values for main circuit cables.

DC bus terminals (+) and (-)

- After the drive is switched off, DC bus terminals (+) and (-) have residual voltage. After the CHARGE indicator goes off, wait at least 10 minutes before operating the drive. Failure to comply will result in electric shock.
- When wiring an external braking component for a model with the power of 90 kW or above, ensure correct polarity (+)/(-). Failure to comply will result in damage to the AC drive and braking components or even fire.
- The cable length of the braking unit must not exceed 10 m. Use the twisted pair cables or closely-paired cables for parallel connection.

- Avoid connecting the braking resistor directly to the DC bus. Failure to comply will result in damage to the AC drive or even fire.

U, V, and W terminals on the output side

- The specification and installation method of external main circuit cables must comply with the local regulations and related IEC standards.
- Use copper lead cables with appropriate dimensions for main circuit cables.
- Do not connect any capacitor or surge protection device at the output side. Failure to comply will result in frequent triggering of the protection mechanism or even damage to the AC drive.
- An excessively long motor cable may result in electrical resonance due to the distributed capacitance. The generated electrical resonance may cause damage to motor insulation or high leakage current, triggering the overcurrent protection mechanism of the AC drive. When using a motor cable longer than 100 m, install an AC output reactor close to the AC drive.

Grounding terminal (PE)

For grounding requirements, see *"8.5.1 Grounding Requirements" on page 177*.

8.3.5 Main Circuit Wiring Requirements

Main circuit wiring requirements

- Terminals BR, (-), and (+) are used to connect options. Do not connect these terminals to an AC power supply.
- To protect the main circuit, separate and cover the surface that may come into contact with the main circuit.
- The control circuit is the internal safety extra-low voltage (SELV) circuit, which must be insulated and isolated from other circuits. Make sure that the control circuit is connected to the external SELV circuit.
- Prevent foreign matters from entering the wiring part of the terminal block.
- Do not solder the twisted conductors.
- The tightening torque may vary with terminals. Tighten terminal screws with the specified tightening torque. You can use the torque screwdriver, ratchet, or wrench.
- When using an electric screwdriver to tighten terminal screws, set a low speed to prevent damage to the terminal screws.
- Tighten the terminal screws at an angle within 5 degrees. Failure to comply may result in screw damage.

Power cable selection requirements

For the selection of power cables, follow national or regional regulations. Select IEC cables based on the following requirements:

- Compliant with IEC 60204-1 and IEC 60364-5-52 standards
- PVC insulated cables with copper conductors
- Heat resistance: ambient temperature of 40°C and cable surface temperature of 70°C (Remark: When the ambient temperature exceeds 40°C, contact Inovance.)
- Sysmetric cable with copper-braided shield

Note

If the recommended cables for peripheral equipment or options are not suitable for the product, contact Inovance.

To meet the EMC requirements, the cable with the shield must be used. The shielded cables are divided into three-conductor cables and four-conductor cables, as shown below. If the conductivity of the three-conductor cable shield cannot meet requirements, add an independent PE cable. Alternatively, use a four-conductor cable with one conductor as the PE wire. The shield of the shielded cable is comprised of coaxial cooper braids to suppress radio frequency interference. To enhance the shielding performance and conductivity, the braided density of the shield must be greater than 90%.

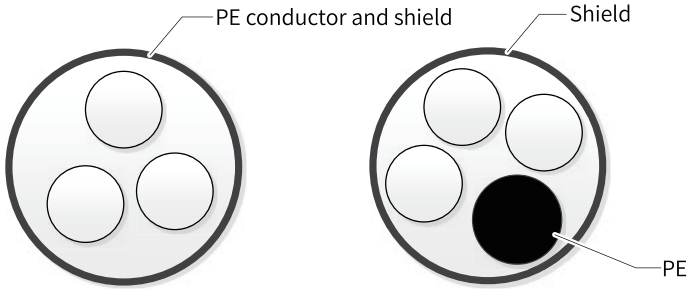


Figure 8-29 Recommended power cable

Main circuit routing requirements

The power supply input cable of the AC drive and motor cable can generate strong electromagnetic interference. To avoid electromagnetic interference caused by long-distance parallel coupling between the strong disturbing cable and control circuit cable, ensure a distance longer than 30 cm between main circuit cables and signal cables when cabling. Common main circuit cables include input R/S/T cables, output U/V/W cables, DC bus, and brake cables. Signal cables include I/O signal cables, communication cables, and encoder cables.

Cable ducts must be in good connection and well grounded. Use aluminum cable ducts to ensure equipotentiality of the drive. Connect the filter, AC drive, and motor

to the system (machines or devices) properly. Protect all connections with spray coating and ensure good contact of conductive metal.

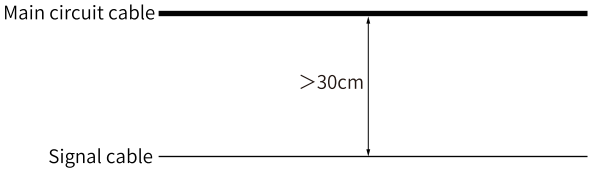


Figure 8-30 Cable layout

Wiring in an IT or delta grid system

Before wiring in an IT or angular grid system, disconnect the optional EMC grounding screw. Failure to comply will result in damage to the AC drive or even personal injury.

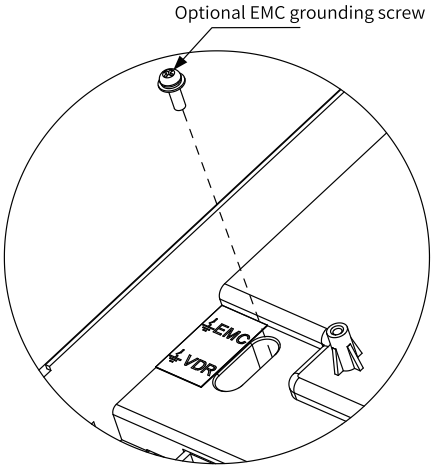


Figure 8-31 Disconnecting the optional EMC grounding screw

Shield of motor cables

Use shielded cables for motor output cables. Strip the cable to expose the shield, crimp the shield to the wire ferrule slot of the bracket with the wire ferrule, and crimp the lead wire of the shield to the PE terminal, as shown below. The following figure shows wiring of the shield.

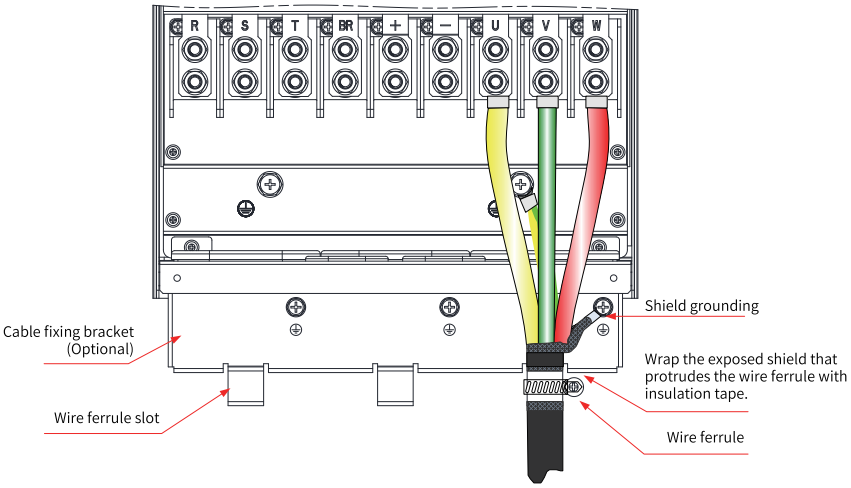


Figure 8-32 Wiring of the shield

Keep the lead wire of the motor cable shield as short as possible, with its width (b in the following figure) no shorter than 1/5 of its length (a in the following figure).

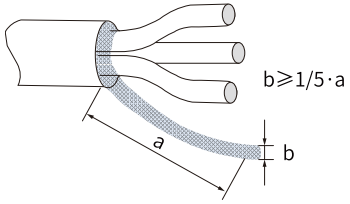


Figure 8-33 ""Lead wire of the motor cable shield

Length of motor cables

When the AC drive is working, the quick on-off of its power switch triode can lead to excessively large dU/dt at the output side. If the motor cable is too long, the motor winding will experience excessive voltage stress that may cause insulation breakdown. Use motors that comply with technical specifications in IEC 60034-25 IVIC B or motors with excellent insulation performance and high voltage resistance. In addition, when the cable length increases, the distributed capacitance of the cable increases linearly, resulting in high harmonic current.

When the length of the motor cable is longer than the maximum length recommended in the following table, install an output reactor on the output side of the AC drive, or use a motor conforming to technical specifications in IEC 60034-25 IVIC B. The output reactor can reduce the voltage stress on the motor winding.

Table 8–12 Requirement for output reactor based on cable length and motor types

AC Drive Rated Power (kW)	Maximum Cable Length of the Common Asynchronous Motor (Without Output Reactor)	Output Reactor Required (Motor Complying with IEC 60034-25 IVIC B)	Output Reactor Required (Common Asynchronous Induction Motor)
0.4–3.7	50 m	Not required	Required
5.5	70 m	Not required	Required
7.5	100 m	Not required	Required
11	110 m	Not required	Required
15	125 m	Not required	Required
18.5	135 m	Not required	Required
22	150 m	Not required	Required
⩾ 30	150 m	Not required	Required

Recommended cable lugs

The following table describes the appearances of the GTNR and BC series cable lugs of Suzhou Yuanli.

Table 8–13 Appearance of cable lugs

Series	Appearance
GTNR series	
TNR series	
BC series	

8.3.6 Protection Requirements

Main circuit cable protection requirements

Apply heat-shrink tubing to the copper lug and conductors of the cable, and ensure all conducting parts of the cable are properly wrapped, as shown in *"Figure 8–34 Applying heat-shrink tubing to conducting parts of the main circuit cable" on page 155*.

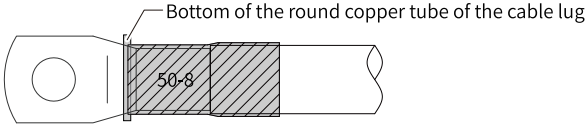


Figure 8-34 Applying heat-shrink tubing to conducting parts of the main circuit cable

Requirements for upstream protective devices

- Install appropriate protective devices on the power input side to provide overcurrent, short-circuit, and isolation protections.
- When selecting protective devices, take the following factors into consideration: current capacity of the main circuit cable, required system overload capacity, and short-circuit capacity of the upstream power input. Generally, select those recommended in the selection guide for peripheral electrical components.

8.4 Control Circuit Connection

8.4.1 Descriptions of Control Circuit Terminals

"Table 8–16 " on page 159 shows the layout of control circuit terminals.

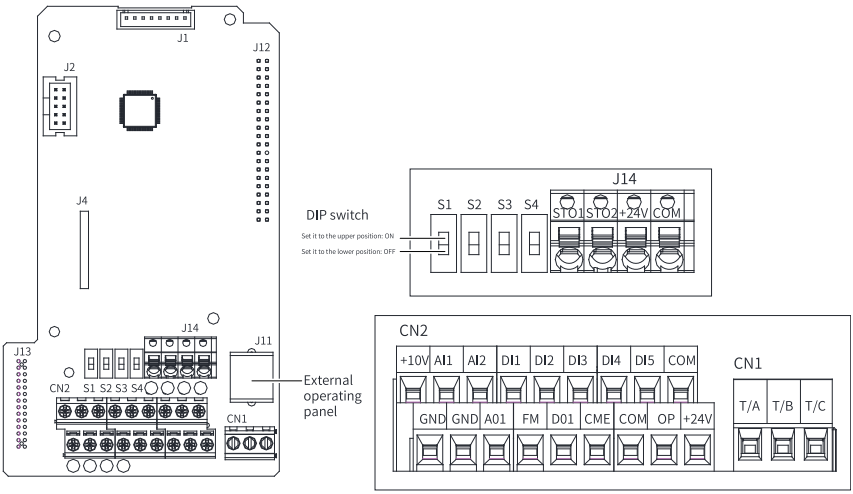


Figure 8-35 Layout of control circuit terminals

Table 8–14 Function description of control circuit terminals

Type	Terminal Symbol	Terminal Name	Function
Power supply	+10V-GND	External +10 V power supply	The terminal is used to provide +10 V power supply to an external unit with the maximum output current 10 mA. Generally, it is used to power an external potentiometer with resistance ranging from 1 kΩ to 5 kΩ.
	+24V-COM	External +24 V power supply	The terminal is used to provide +24 V power supply to external devices. Generally, it is used to power the DI/DO and external sensor. The maximum output current is 200 mA[Note 1].
	OP	Input terminal for external power supply	It is connected to +24V by default. When DI1 to DI5 are driven by external signals, OP must be disconnected from +24 V and connected to the external power supply.
Analog input	AI1-GND	AI1	Input voltage range: -10 VDC to + 10 VDC Input impedance: 22 kΩ
	AI2-GND	AI2	The terminal supports voltage input (default), current input, and temperature input. When used as voltage/current input, the terminal supports 0 V to 10 V, -10 V to +10 V, or 0 mA to 20 mA, and supports 12-bit resolution and the correction accuracy of 0.3%. The input impedance is 22 kΩ for voltage input and 500 Ω or 250 Ω for current input, which is set by S2 and S3 DIP switches[Note 2].
Digital input	DI1-OP	DI1	Photocoupler isolation and bipolar input Input impedance: 1.72 kΩ Voltage range for effective level input: 9 V to 30 V
	DI2- OP	DI2	
	DI3- OP	DI3	
	DI4- OP	DI4	
	DI5- OP	DI5	Besides features of DI1 to DI4, DI5 can also be used for high-speed pulse input. • Input impedance: 1.16 kΩ • Maximum input frequency: 100 kHz • Operating voltage range: 15 V to 30 V
Analog output	AO1-GND	AO1	The DIP switch on the control board is used to determine voltage output (default) or current output. • Operating voltage range: 0 V to 10 V • Output current range: 0 mA to 20mA

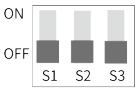
Type	Terminal Symbol	Terminal Name	Function
Digital output	DO1-CME	DO1	Photocoupler isolation and bipolar open collector output • Operating voltage range: 0 V to 24 V • Output current range: 0 mA to 50mA Note that digital output ground CME and digital input ground COM are internally insulated, but are shorted externally by jumper as the factory settings. In this case, DO1 is driven by +24V by default. To drive DO1 by external power supply, remove the jumper between CME and COM.
	FM-COM	High-speed pulse output	The terminal is set by F5-00 (FM terminal output selection). When the terminal is used for high-speed pulse output, the maximum frequency is 100 kHz. When the terminal is used for collector open output, it has the same specifications as DO1.
Relay output	T/A	Common terminal	Driving capacity of the contact: • 250 VAC, 3 A, COSØ=0.4 • 30 VDC, 1 A
	T/B	Normally closed (NC) terminal	
	T/C	Normally open terminal	
Auxiliary interface	J4	Local PG card interface	It is used to connect the resolver, differential, and 23-bit encoders.
	J11	External operating panel interface	It is used to connect the external LCD operating panel (SOP-20-810) or the LED operating panel (MDKE-10).
	J13	Expansion card interface	28-core terminal for connection with expansion cards, including I/O cards, communication cards, and PG card
	J14	STO terminal	For details, see *"Table 8–15 STO terminal descriptions" on page 159*.
DIP switch	S1 S2 S3		For details, see *"Table 8–16 DIP switch descriptions " on page 159*.
	S4		Current/Voltage mode selection for AO1 • On: Current output mode • Off: Voltage output mode

Table 8–15 STO terminal descriptions

No.	Terminal Symbol	Terminal Name	Performance Requirements
1	STO1	STO channel 1	Internal connection: By default, STO1 and STO2 are connected to +24V by using a jumper upon factory delivery. External connection: STO1, STO2, and +24V can be connected to an external 24 V power supply. See the STO function for the detailed wiring.
2	STO2	STO channel 2	
3	+24V	STO1 and STO2 power supply+	
4	COM	STO1 and STO2 power supply ground	

Table 8–16 DIP switch descriptions

DIP Switch Status			Function
S1	S2	S3	
OFF	OFF	OFF	Voltage mode with the range of 0 VDC to 10 VDC for AI2
ON	OFF	OFF	Temperature mode for AI2 Set the temperature sensor type through F9-75. 0: No temperature sensor (AI used for analog input) 1: PT100, -25°C to +200°C 2: PT1000, -25°C to +200°C 3: KTY84-130, -40°C to +260°C 4: PTC130, -20°C to +180°C
OFF	ON	OFF	Current mode for AI2; current range: 0 mA to 20 mA; input impedance: 500 Ω
OFF	ON	ON	Current mode for AI2; current range: 0 mA to 40 mA; input impedance: 250 Ω

Note

- [Note 1] If the ambient temperature exceeds 23°C, the output current must be derated by 1.8 mA for every additional 1°C. The maximum output current is 170 mA at 40°C. When OP and 24V are shorted, the maximum output current is calculated by the following formula: 170 mA minus current over the DI.
- [Note 2] Based on the maximum output voltage of the signal source, select 500 Ω or 250 Ω impedance. For example, if 500 Ω is selected, the maximum output voltage cannot be lower than 10 V so that AI2 can measure 20 mA current.
- S1, S2, and S3 are combined DIP switches for the AI. S4 is the DIP switch for the AO.

8.4.2 Wiring Descriptions of Control Circuit Terminals

Wiring AI1

Weak analog voltage signals are prone to suffer external interference. Therefore, a shielded cable is required, and the wiring distance must be as short as possible (no longer than 20 m), as shown in *"Figure 8–36 AI wiring" on page 160*. In scenarios where analog signals experience severe external interference, install a filter capacitor or a ferrite core on the analog signal source side, as shown in *"Figure 8–37 Grounding the shield of analog input cable" on page 161*. Connect the drain wire of the shield of the analog input cable to the PE terminal of the AC drive.

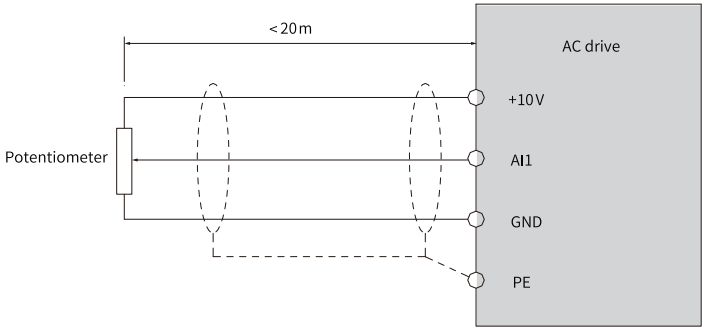


Figure 8-36 AI wiring

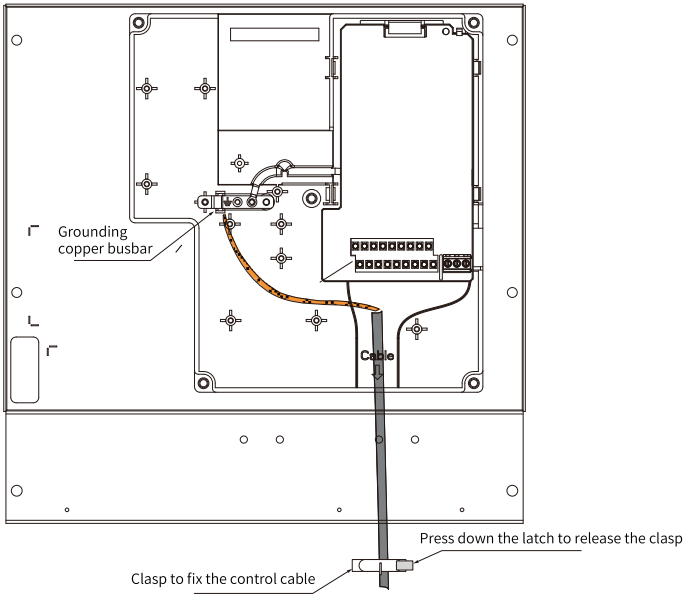


Figure 8-37 Grounding the shield of analog input cable

Wiring AI2

- AI2 is wired in the same way as AI1 when AI2 adopts voltage signal input.
- If AI2 is to be used for current signal input, the current flows from GND to AI2. Toggle S2 (or S2 and S3) to ON. If only S2 is toggled to ON, the impedance is 500 Ω. If both S2 and S3 are toggled to ON, the impedance is 250 Ω.

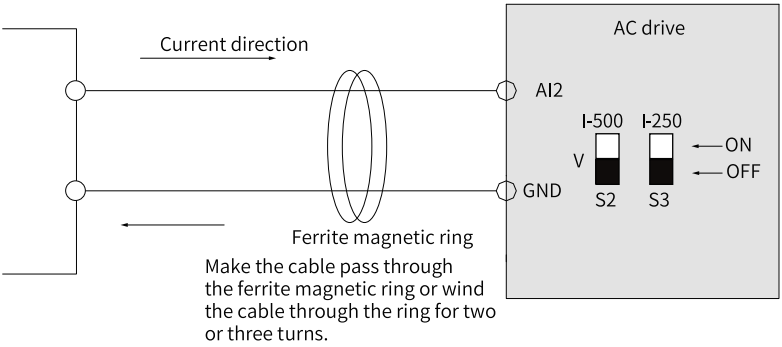


Figure 8-38 Wiring AI2

Wiring DI1 to DI5

- Sink wiring mode

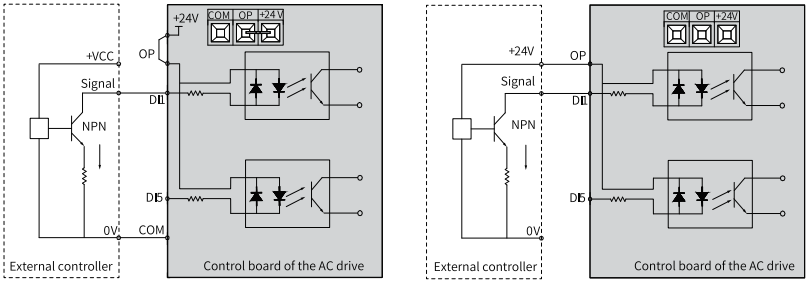


Figure 8-39 Sink wiring mode

The internal 24 V power supply of the drive is the most commonly wiring method. In the sink wiring mode, short the OP and 24V terminals of the drive, and connect the COM terminal of the drive to the 0V terminal of the external controller, as shown in the following figure.

If an external 24 V power supply is used, remove the jumper between +24V and OP. In addition, connect the 24 V positive electrode of the external power supply to the OP terminal. The current flows out of the DI and flows back to 0V of the external power supply via the external controller contact.

In the mode, the DIs of different AC drives cannot be connected in parallel. Otherwise, the DI may malfunction. If DIs of different AC drives must be connected in parallel, connect the anode of a diode to the DI in series and the diode needs to satisfy the following requirement: IF > 40 mA and VR > 40 V, as shown in *"Figure 8-40 Parallel connection of DIs of multiple AC drives in the sink mode" on page 163*.

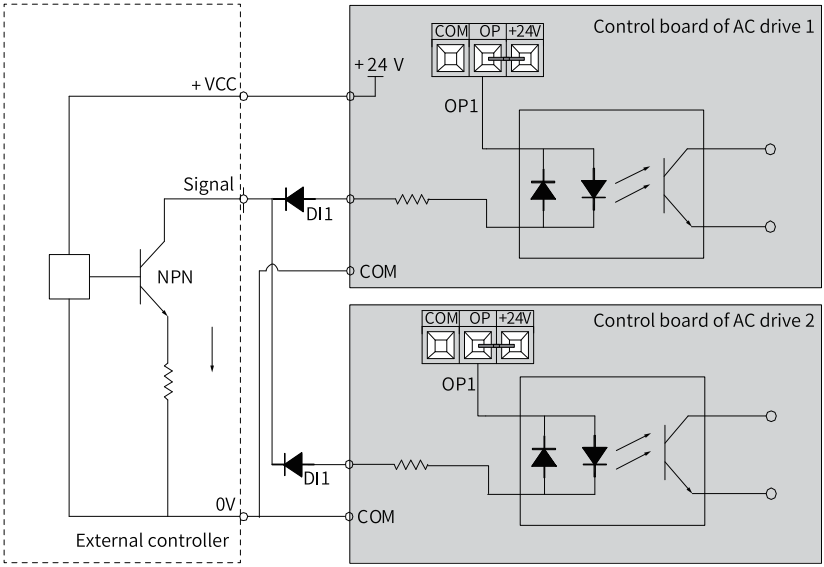


Figure 8-40 Parallel connection of DIs of multiple AC drives in the sink mode

- Source wiring mode

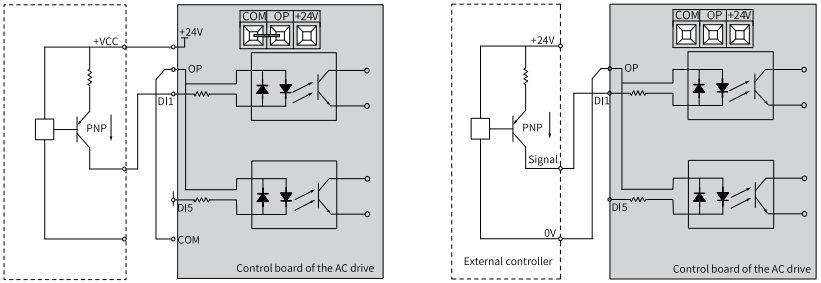


Figure 8-41 Source wiring mode

- To use the internal 24 V power supply of the drive, remove the jumper between the +24V and OP terminals, connect the OP terminal to the COM terminal, and connect the +24V terminal of the drive to the common terminal of the external controller, as shown in the following figure.
- To use an external power supply, remove the jumper between the +24V and the OP terminals, connect the OP terminal of the drive to the 0V terminal of the external power supply, and connect the 24 V positive electrode of the external power supply to the corresponding DI through the external controller contact.

Wiring DO1

When the DO needs to drive a relay, connect a snubber diode on both sides of the relay coil. Otherwise, the 24 VDC power supply may be damaged. Ensure that the driving capacity does not exceed 50 mA.

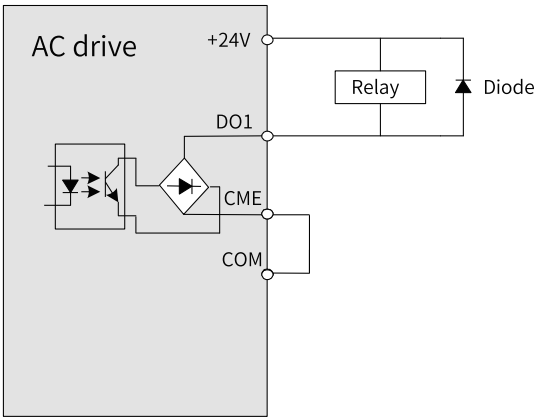


Figure 8-42 Wiring for the DO to connect to the relay

Note

- Connect the snubber diode with the polarity placed correctly. Otherwise, the 24 VDC power supply will be damaged upon the DO output.
- The digital output ground CME and digital input ground COM are internally insulated, but are shorted externally by jumper as the factory settings. In this case, DO1 is driven by +24V by default. To drive DO1 by external power supply, remove the jumper between CME and COM.

DO1: Photocoupler isolation and bipolar open collector output

Output voltage range: 0 V to 24 V

Output current range: 0 mA to 50mA

DO1 supports bipolar output. The following wiring methods are available.

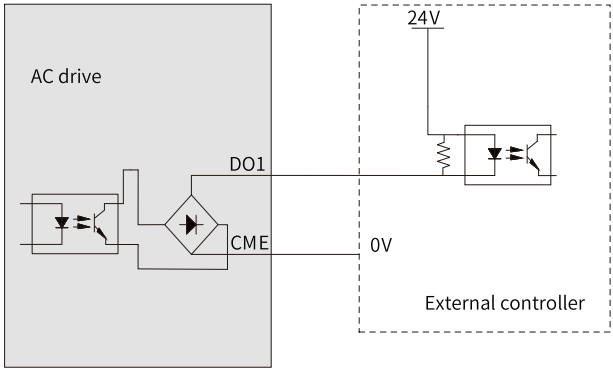


Figure 8-43 DO connecting to external controller 1

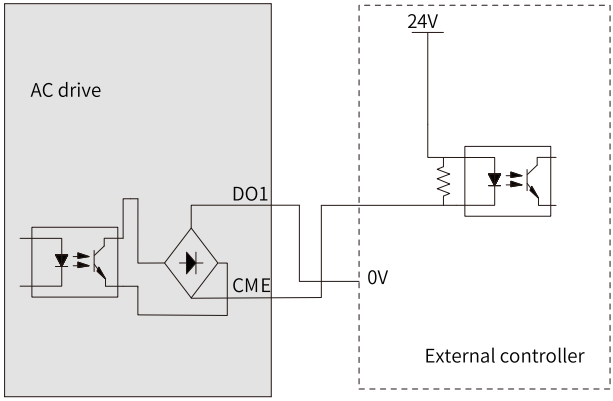


Figure 8-44 DO connecting to external controller 2

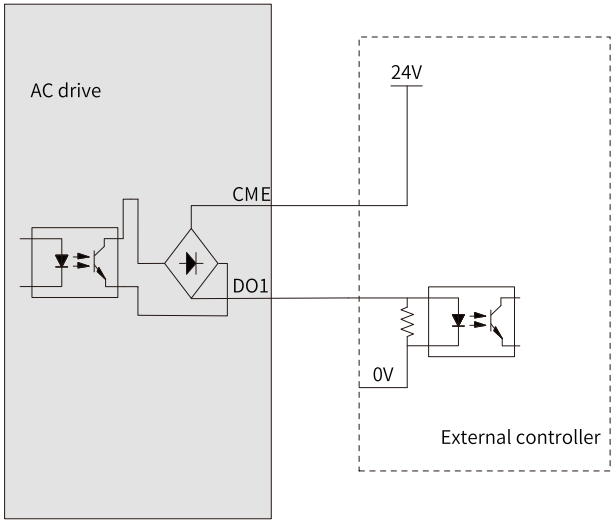


Figure 8-45 DO connecting to external controller 3

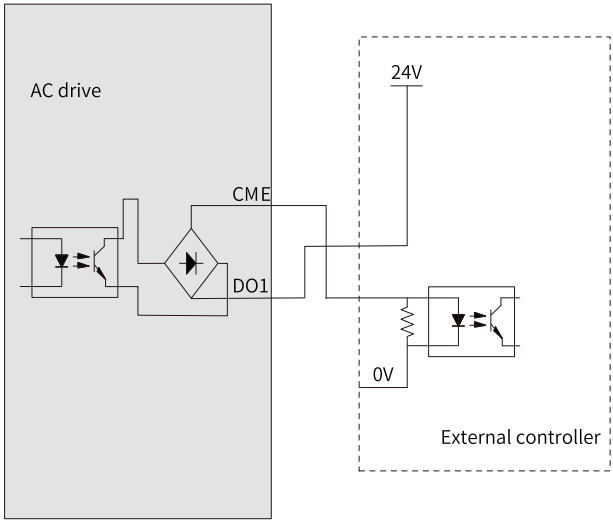


Figure 8-46 DO connecting to external controller 2

Wiring the high-speed digital output terminal FM

When the FM terminal is used for FMP continuous pulse output, the allowed maximum frequency is 100 kHz.

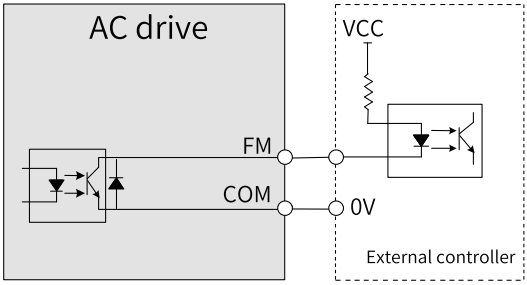


Figure 8-47 Wiring of the high-speed digital output terminal

Wiring the relay output terminal

The inductive load (relay, contactor, and motor) causes voltage peak after the current is disconnected. To minimize the interference at the cutoff, use a voltage dependent resistor (VDR) at the relay contact for protection and install absorption circuits such as VDRs, RC absorption circuits, and diodes on the inductive load, as shown in *"Figure 8–48 Anti-interference processing of relay output terminals" on page 167*.

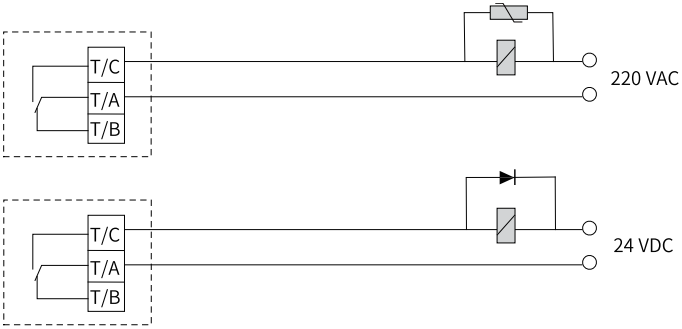


Figure 8-48 Anti-interference processing of relay output terminals

Note

The power supply connected with the control circuit must use class 2 power supply; otherwise, the operation performance of the AC drive will be degraded.

Requirements on tubular terminals

Use tubular terminals with insulation sheath. Keep the exposed conductor of a single or twisted cable no longer than 6 mm, as shown in *"Figure 8–49 Requirements on tubular terminals of the control circuit cable" on page 168*.

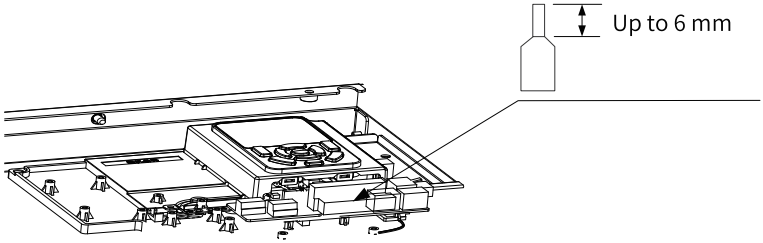


Figure 8-49 Requirements on tubular terminals of the control circuit cable

Table 8–17 Control circuit cable specifications

Single Cable mm² (AWG)	Twisted Cable mm² (AWG)	Tightening Torque (N · m)
0.2 to 0.75 (24AWG to 18AWG)	0.75 mm	0.565

Wiring for connecting an external operating panel

To use an external operating panel, connect one end of the connecting cable to the RJ45 port of the AC drive, and lead the other end of the cable from either side of the AC drive, as shown in *"Figure 8–50 Wiring for connecting an external operating panel" on page 168*.

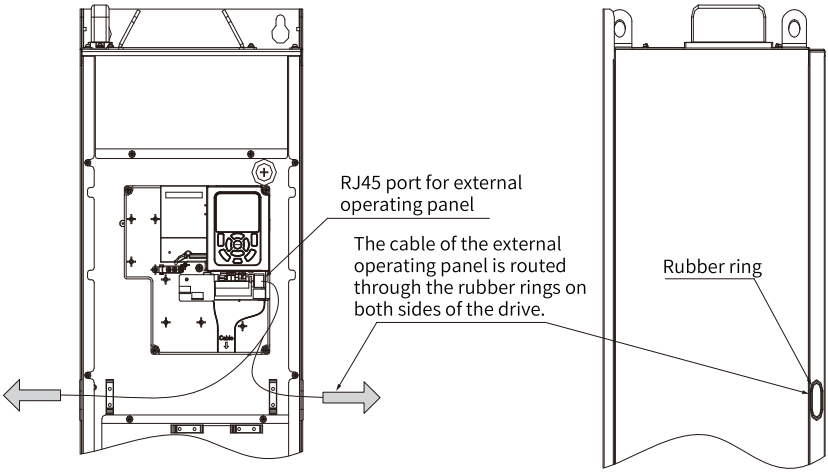
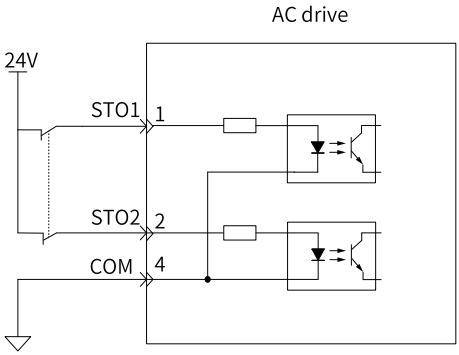


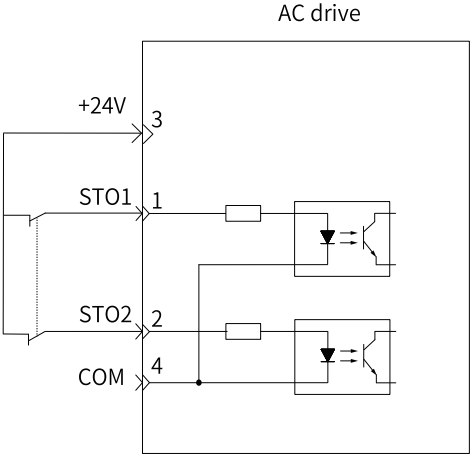
Figure 8-50 Wiring for connecting an external operating panel

STO wiring example

- Wiring example when the external 24 V is used



- Wiring example when the internal 24 V is used



Note

EMC Requirements

- To avoid short circuit between adjacent conductors, use shielded cables and connect the shield to the protective ground. Alternatively, use flat cables and connect a ground cable between adjacent signal conductors.
- Use cables that contain twisted pairs with dual shield layers or single shield layer.
- Fix and ground the cable protective cover using a piece of conductive metal.
- The maximum cable length allowed between the drive and safety switch is 30 m.

8.4.3 Control Circuit Wiring Requirements

Note

Wire the control circuit cable according to EN 60204-1.

Selection requirements

To ensure that the control circuit will not be interfered by peripheries, use shielded cables with the shield for signal cables, and connect both ends of the shield to the drive 360 degrees with the shield bracket. Use separate shielded cables for different analog signals. It is recommended to use shielded twisted pair (STP) cables for digital signals.

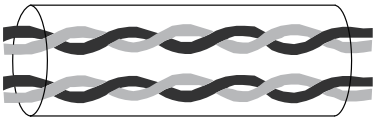


Figure 8-51 Shielded twisted pair cable

Requirements on shield grounding for analog terminals

Weak analog voltage signals are prone to suffer external interference. Therefore, a shielded cable is required, and the wiring distance must be as short as possible (no longer than 20 m). In applications where severe interference exists and impacts certain analog signals, install a filter capacitor or ferrite core at the analog signal source.

- It is recommended to use the grounding bracket (optional) together with the shielded cable, so that the cable shield can be grounded 360 degrees.
- Minimize the length of the lead wire of the shield. Fasten the lead wire to the standard grounding copper busbar of the AC drive by using screws. The following figure shows the grounding.

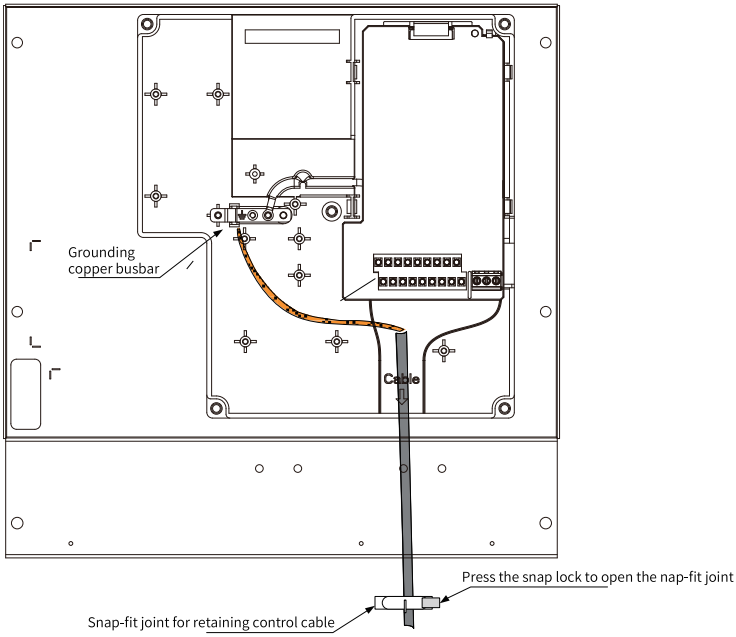


Figure 8-52 Grounding the shield of the analog input cable

Requirements on wiring of encoder signal cables

Before inserting a PG card, remove the screws shown in the enlarged area in the following figure, align the PG card with the three fixing pillars (left part of the enlarged area), and fix the PG card with M3 x 8 screws.

The entire AC drive is grounded in structure. When wiring the encoder after PG card installation, connect the drain wire of the shield of the encoder signal cable to the PE terminal of the PG card to complete shield grounding of the signal cable.
Requirements for connecting the encoder cable:

- During on-site installation and commissioning, route the encoder cables and power cables through different routes. Never bundle the encoder cables and power cables together to prevent interference to the encoder.
- It is recommended to use shielded twisted pair cables. For differential encoders, connect the twisted pair cables based on the differential pairs, and connect the shield to the ground terminal (PE terminal) of the AC drive.
- For some large-scale equipment, the length of the motor cable between the drive and the motor is long (>10 m). The grounding resistor of the encoder cable shield will increase due to the effect of cable parasitic inductance. In this case, the encoder shield does not need to be connected to the ground terminal (PE) of the drive.

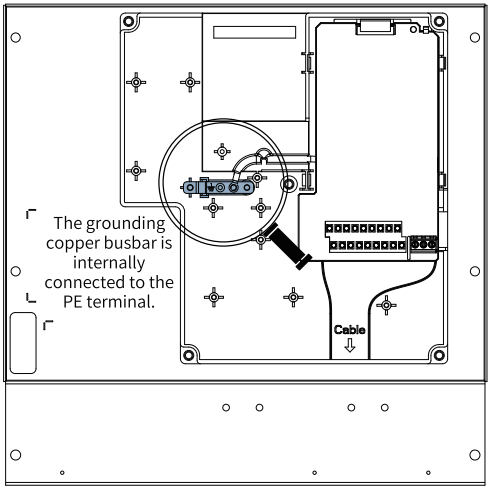


Figure 8-53 PG card installation screws

Requirements on wiring of I/O signal cables

- I/O signals include analog input (AI) signals, analog output (AO) signals, digital input (DI) signals, digital output (DO) signals, and relay output signals. Before wiring the I/O terminal, disconnect the main power supply and ensure that the danger indicator on the AC drive is off.
- To avoid interference to the I/O signals, separate the I/O signal cables at least 30 cm from the main circuit cables (R, S, and T cables and U, V, and W cables) and other power cables (or power supply cables).
- Route relay output cables and other I/O signal cables through different routes with a clearance of at least 30 cm. Failure to comply will result in malfunction of the drive and the machine.

8.4.4 Cable Routing Requirements

- Routing signal cables and power cables through different routes
  When analog signals are used for remote control on the AC drive cabinet, separate signal cables from high-voltage circuits (power supply input, drive unit output, and braking resistor cables) by a distance of above 50 cm. This is used to reduce interference from the AC drive and other equipment to analog signals. Comply with the preceding wiring requirements even in the control cabinet.

- Analog control signal cables
  Use shielded twisted pair cables for the analog control signal cables. Minimize the length of the stripped part of the cable (about 5–7 mm) and wrap the shield with the insulation tape to prevent the shield from coming into contact with other equipment and incurring interference.

- Motor cable
  Use shielded cables for motor cables. Minimize the distance between the cabinet module and the motor, and route the motor cables separately from other cables. Also, avoid long-distance parallel routing of the motor cables and other cables to reduce electromagnetic interference caused by rapid changes in the output voltage of the AC drive.
- Power cable
  Use shielded cables, or shield all the cables from the cabinet module to the motor by using conduits.
- Control cables and power supply cables
  If the power supply cables and control cables must be intersected, make the intersection angle 90 degrees.

8.4.5 Routing Recommendations

Routing disturbing cables and sensitive cables

Route cables that transmit different types of signals through different routes. Separate the disturbing cables from sensitive cables by a distance of at least 30 cm. When two types of cables must be intersected, the intersection angle must be 90 degrees to avoid interference, as shown in the following figure.

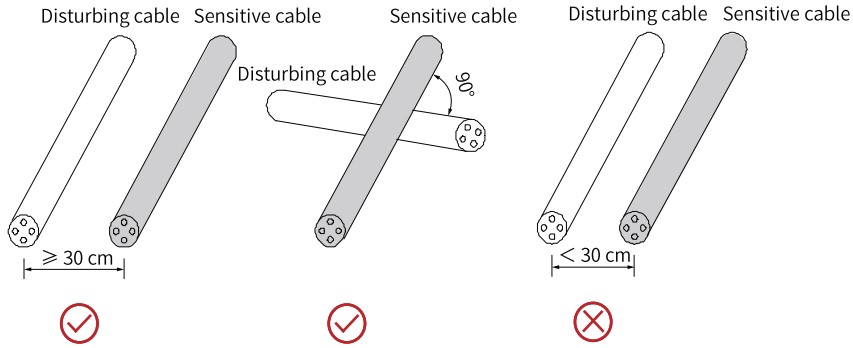


Figure 8-54 Routing disturbing cables and sensitive cables

Routing cables that transmit different types of signals

Route cables that transmit different types of signals through different routes and separate different types of signals with equipotential signals. When routing cables that transmit the same type of signals, lay equipotential signal cables at the outer layers and lay equipotential bondings as many as possible in the middle if possible, as shown in the following figure.

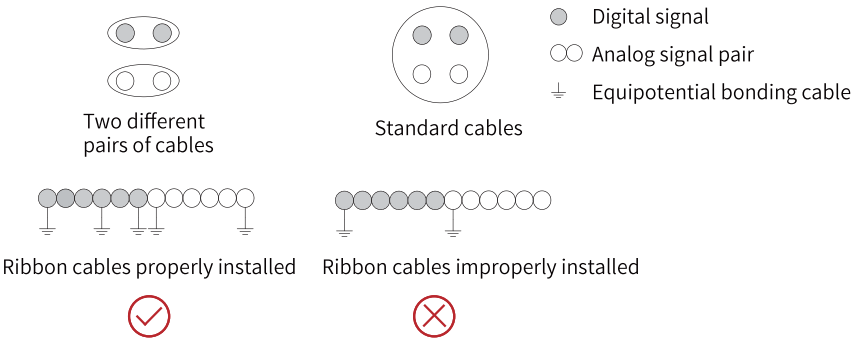


Figure 8-55 Routing cables that transmit different types of signals

Routing multi-conductor cables

For multi-conductor cables, use one cable to transmit one type of signals. To use one cable to transmit multiple types of signals, use a cable with internal conductor shields, as shown in the following figure.

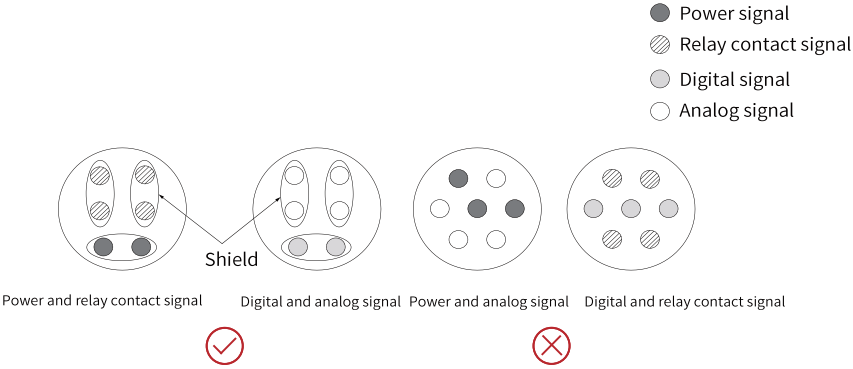


Figure 8-56 Routing multi-conductor cables

If certain conductors in a multi-conductor cable are reserved or unused, connect these conductors to the equipotential bondings, as shown below.

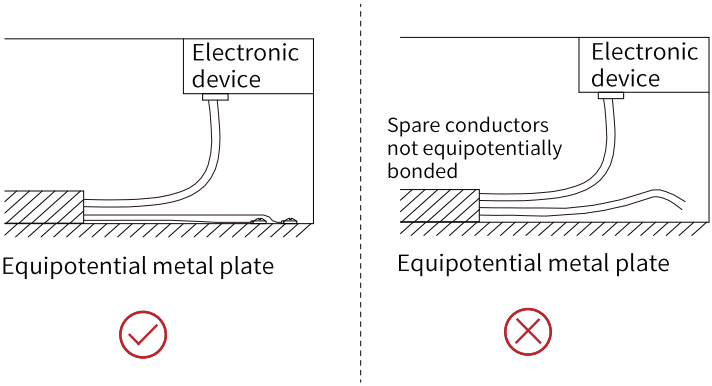


Figure 8-57 Handling reserved or unused conductors of multi-conductor cables

Requirements on the wiring loop area

For cables that transmit low-level sensor signals and shared cables that transmit relay signals, lay them close to each other to avoid large loop area. Use twisted pair cables for analog signals. Lay digital signal cables close to each other.

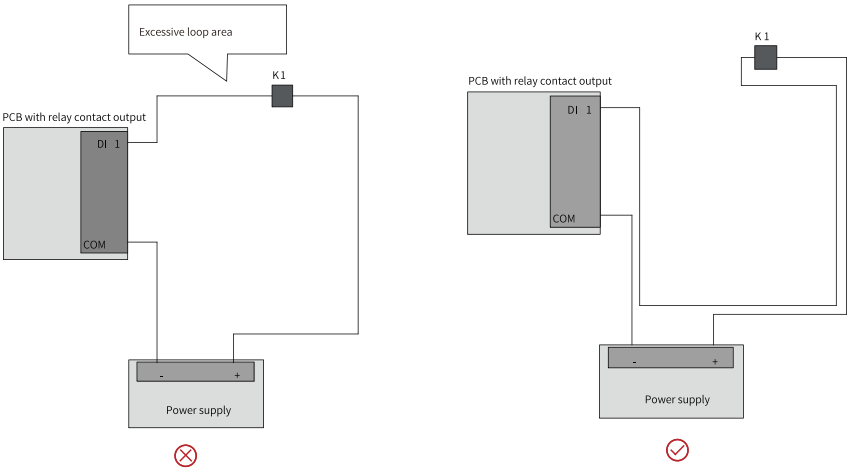


Figure 8-58 Recommended wiring loop area

Laying multiple types of cables

For cables of different types, route the cables along the equipotential metal plate. To enhance the internal EMC performance, separate different types of cables or separate cables with metal separators (recommended) in the same metal (zinc-iron or stainless steel) duct.

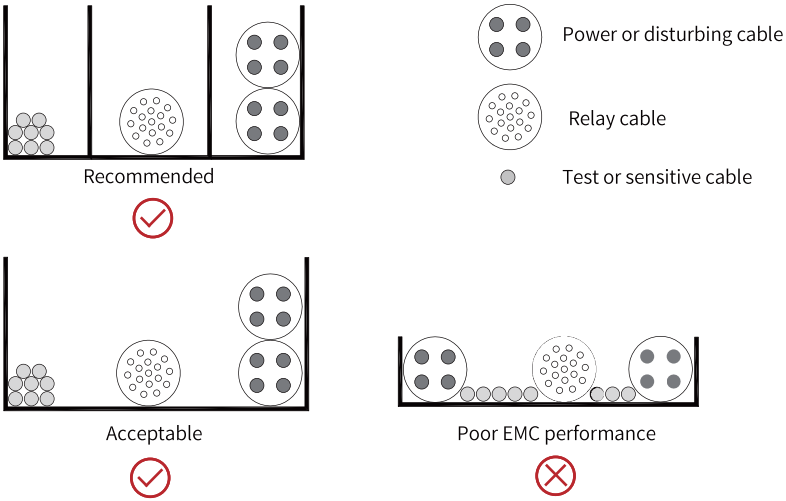


Figure 8-59 Laying multiple types of cables

Requirements on handing of shielded cables

Minimize the unshielded part of the shielded cable, and connect the shield to the nearest PE terminal. If the unshielded part is too long, the conductor may be prone to signal interference, especially the encoder signals.

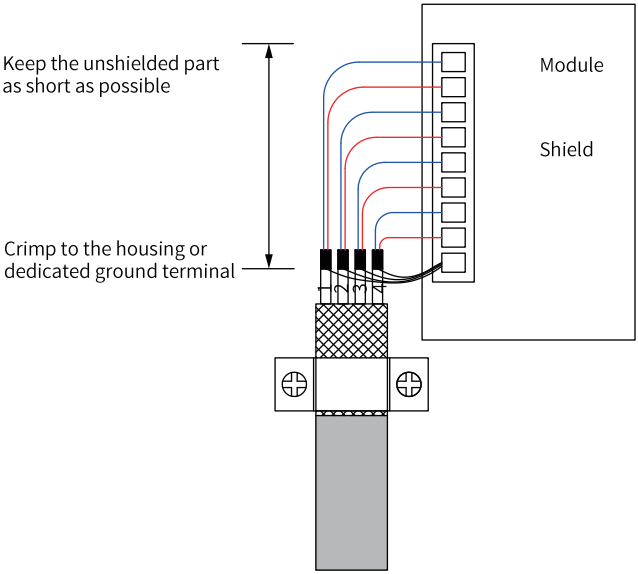


Figure 8-60 Requirements on handing of shielded cables

8.5 Grounding

8.5.1 Grounding Requirements

Observe the following requirements to ensure proper grounding of the drive.

8.5.2 Grounding a Single Drive

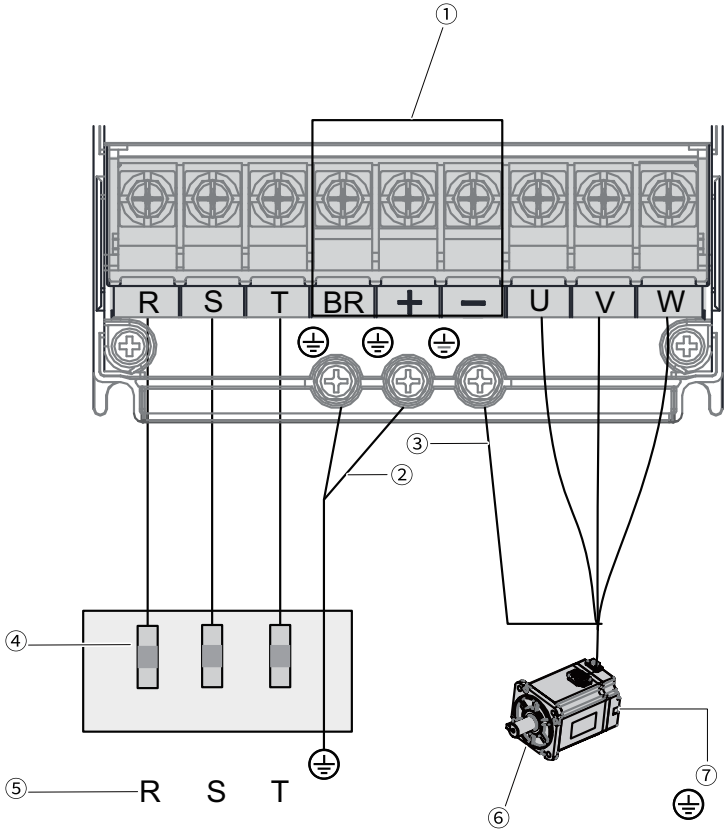


Figure 8-61 Grounding of the main circuit

Table 8–18 Description of the grounding of the main circuit

No.	Wiring Description
1	Do not ground the DC bus terminal or the braking resistor terminal.
2	Connect the PE cable on the power supply side to the PE terminal on the input side of the AC drive.

No.	Wiring Description
3	Connect the PE cable on the output side of the AC drive to the motor output cable shield.
4	Input protection (fuse, connect the lower end of the fuse to the filter)
5	Input power supply
6	Three-phase motor
7	Ground the motor enclosure.

Note

Arrangement of the main circuit terminals varies with models.

8.5.3 Grounding Multiple Drives

When multiple drives are installed in the cabinet in parallel, the grounding wiring of the drives is shown below.

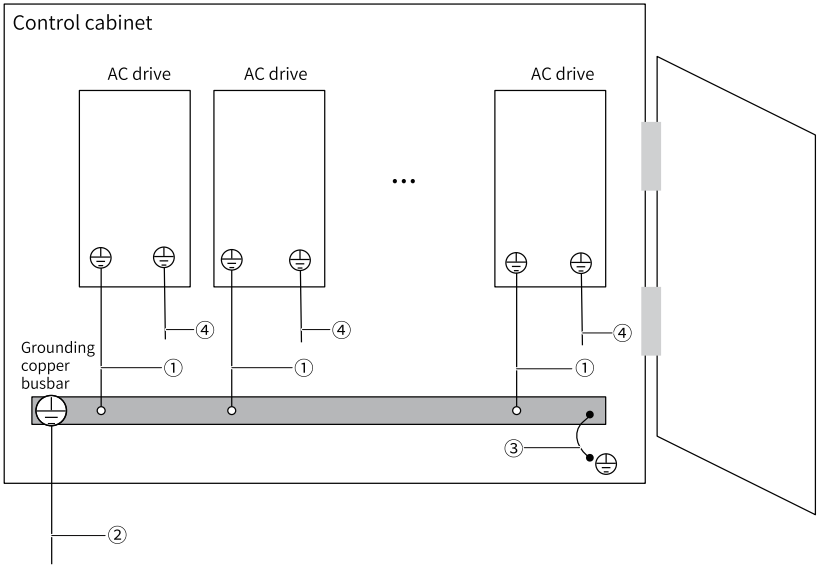


Figure 8-62 Grounding in parallel connection

Table 8–19 Grounding description for parallel connection

No.	Wiring Description
①	Connect the main circuit input PE terminal to the grounding copper busbar of the control cabinet through the protective grounding conductor.
②	Connect the PE cable on the input power supply end to the grounding copper busbar of the control cabinet.
③	Connect the grounding copper busbar of the control cabinet to the metal enclosure of the control cabinet through the protective grounding conductor.
④	Connect the motor output cable shield to the output PE terminal of the drive.

8.5.4 Cabinet System Grounding

The most cost-effective measure to suppress interference in the cabinet is to ensure that the interference source is isolated from the equipment that may be disturbed during installation. Divide the control cabinet into several EMC areas or use several cabinets based on the intensity of the disturbance source, and install devices into corresponding areas based on the requirements listed in the following table.

Table 8–20 Wiring requirements

No.	Wiring Requirement
1	Place the control device and the drive device in two separate cabinets.
2	Use grounding cables with a cross-sectional area of at least 16 mm_2 to connect different cabinets, therefore realizing equipotential between the cabinets.
3	In a cabinet, install devices into different areas according to signal intensity.
4	Devices in different areas of the cabinet should be equipotentially connected.
5	All communication cables (such as RS-485 cables) and signal cables from the cabinet should be shielded.
6	Place the power supply input filter close to the input interface of the cabinet.
7	Spray all grounding points in the cabinet for protection.

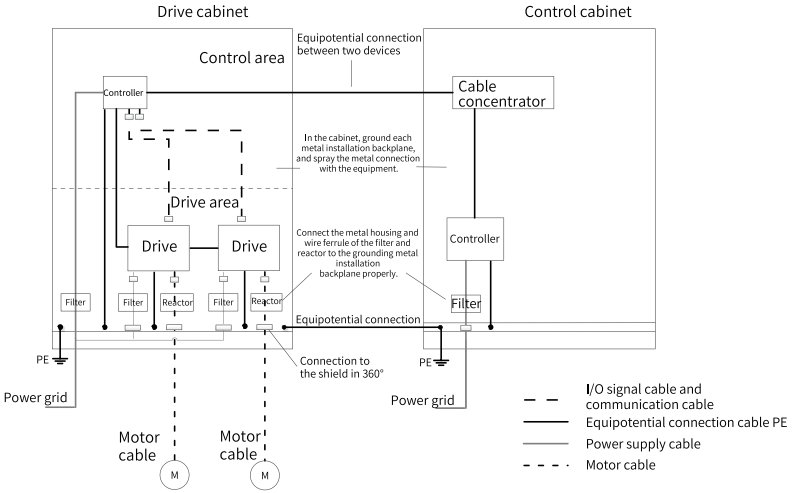


Figure 8-63 Recommended wiring of the cabinet system

8.6 Communication Connection

8.6.1 RS485 Communication Wiring

RS485 communication connection with PLC

Use a three-conductor shielded cable for the RS485 bus to connect to the 485+, 485-, and CGND terminals of the AC drive. Use the twisted pair cable to connect to the 485+ and 485- terminals and use the other cable to connect to the RS485 reference ground CGND. Connect the shield to the equipment ground. Connect a 120 Ω termination resistor at each end of the bus to prevent RS-485 signal reflection. The following table specifies the cable pin for the communication between the AC drive and PLC.

Table 8–21 Cable pin for communication between the AC drive and PLC

AC Drive			PLC		
Communication Type	Signal Name	Function	Communication Type	Signal Name	Function
RS485	RS485+	RS485 signal (positive)	RS485	RS485+	RS485 signal (positive)
	RS485-	RS485 signal (negative)		RS485-	RS485 signal (negative)
	CGND	Signal reference ground		CGND	Signal reference ground
-	GND (CGND)	Enclosure	-	GND (CGND)	Enclosure

RS485 communication for connections of multiple AC drives in parallel

The following table specifies the cable pin for connections of multiple AC drives in parallel in RS485 communication networking.

Table 8–22 Cable pin for parallel communication of multiple AC drives

AC Drive (Side A)			AC Drive (Side B)		
Communication Type	Signal Name	Function	Communication Type	Signal Name	Function
RS485	RS485+	RS485 signal (positive)	RS485	RS485+	RS485 signal (positive)
	RS485-	RS485 signal (negative)		RS485-	RS485 signal (negative)
	CGND	Signal reference ground		CGND	Signal reference ground
-	GND (CGND)	Enclosure	-	GND (CGND)	Enclosure

Networking

Use the daisy chain connection for the RS485 bus in the case of a large number of nodes, as shown in the following figure. Connect the RS485 signal reference ground of all nodes (up to 128 nodes) together.

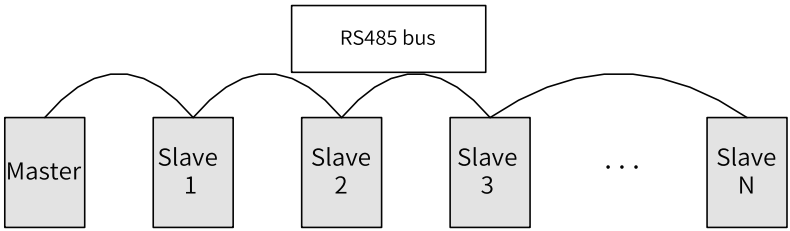


Figure 8-64 Daisy chain connection

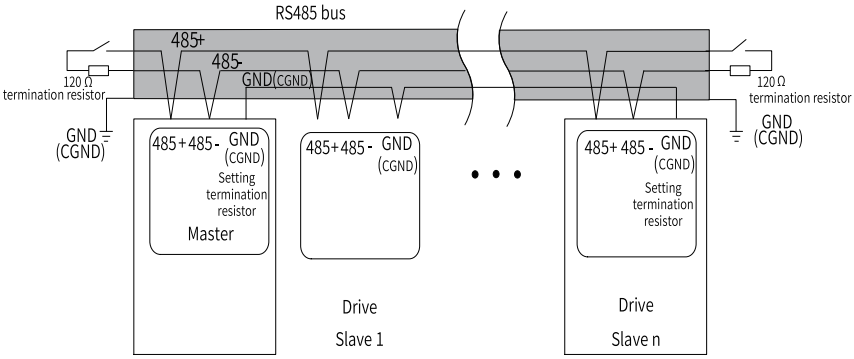


Figure 8-65 RS485 bus topology

The following table lists the maximum number of nodes and transmission distance supported by the standard RS485 circuit at different transmission rates.

Table 8–23 Transmission distance and number of nodes

Transmission Distance (m)	Rate (kbps)	Number of Nodes	Cable Specification
100	115.2	128	26AWG
1000	19.2	128	26AWG

8.6.2 CAN Communication Connection

CAN communication with the PLC

Use a three-conductor shielded cable for the CAN bus to connect to the CANH, CANL, and CGND terminals of the AC drive. Use the twisted pair cable to connect to the CANH and CANL terminals and use the other cable to connect to the CAN reference ground CGND. Connect the shield to the equipment ground. Connect a 120 Ω termination resistor at each end of the bus to prevent CAN signal reflection.

The following table specifies the cable pin for the CAN communication between the AC drive and PLC.

Table 8–24 Cable pin for the CAN communication between the AC drive and PLC

AC Drive			PLC		
Communication Type	Signal Name	Function	Communication Type	Signal Name	Function
CAN	CANH	CAN signal (positive)	CAN	CANH	CAN signal (positive)
	CANL	CAN signal (negative)		CANL	CAN signal (negative)
	CGND	Signal reference ground		CGND	Signal reference ground
-	GND (CGND)	Enclosure	-	GND (CGND)	Enclosure

CAN communication for connections of multiple AC drives in parallel

The following table specifies the cable pin for connections of multiple AC drives in parallel in CAN communication networking.

Table 8–25 Cable pin for connections of multiple AC drives in parallel

AC Drive (Side A)			AC Drive (Side B)		
Communication Type	Signal Name	Function	Communication Type	Signal Name	Function
CAN	CANH	CAN signal (positive)	CAN	CANH	CAN signal (positive)
	CANL	CAN signal (negative)		CANL	CAN signal (negative)
	CGND	Signal reference ground		CGND	Signal reference ground
-	GND (CGND)	Enclosure	-	GND (CGND)	Enclosure

Networking

Use the daisy chain mode for the CAN bus, as shown in the following figure. Use shielded twisted pair cables for the CAN bus, and use twisted pair cables for CANH and CANL signal cables. Connect a 120 Ω termination resistor at each end of the bus to prevent signal reflection. Connect the CAN signal reference ground of all the nodes (up to 64 nodes) together.

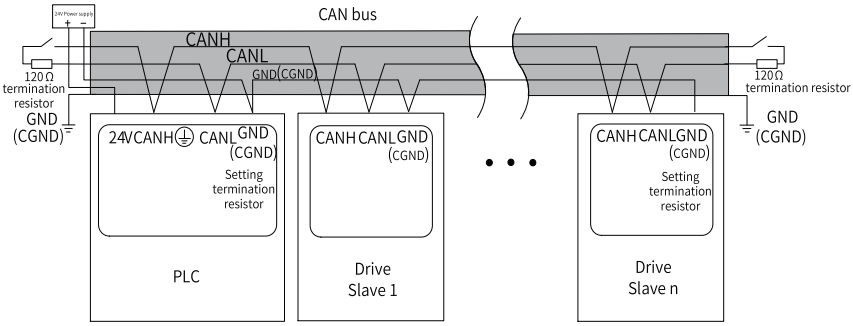


Figure 8-66 CAN bus topology

The transmission distance of the CAN bus is directly related to the baud rate and the communication cable. The following table describes the relationship between the maximum bus length and the baud rate.

Table 8–26 Transmission distance and baud rate

Transmission Distance (m)	Rate (kbps)	Number of Nodes	Cable Diameter
25	1024	64	0.205 mm^2
95	500	64	0.34 mm^2
560	100	64	0.5 mm^2
1100	50	64	0.75 mm^2

8.6.3 EtherCAT Wiring

Use standard RJ45 network ports and standard registered jacks for the EtherCAT bus. Use Cat 5e shielded twisted pair cables and injection molding wires with iron shells. As verified by FastEthernet technology, when the EtherCAT bus is used, the cable between equipment shall not exceed 100 m. Failure to comply may result in signal attenuation, affecting normal communication.

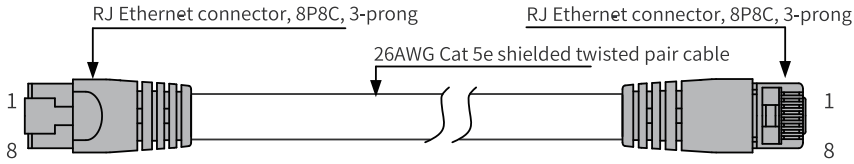


Figure 8-67 Requirements on fabrication of EtherCAT network cables

Use shielded cables for network data transmission for the EtherCAT bus. Network cables of the specifications specified in the following table are recommended.

Table 8–27 EtherCAT cable specifications

Item	Specifications
Cable type	Elastic crossover cable, S-FTP, Cat 5e
Standard compliance	EIA/TIA568A, EN50173, ISO/IEC11801 EIA/TI Abulletin TSB, EIA/TIA SB40-A&TSB36
Lead wire cross section	AWG 26
Lead wire type	Twisted pair cable
Pair	4

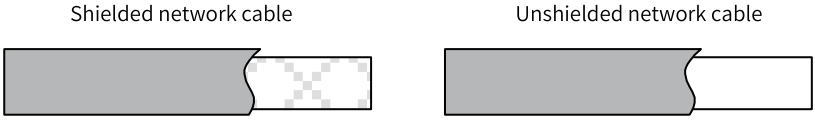


Figure 8-68 Shielded network cables

During wiring, hold the registered jack of the RJ45 network cable and insert it in the RJ45 port of the communication module until you hear a click sound. To remove the RJ45 network cable, press and hold the tail of the registered jack, and pull it out along the direction parallel with the module.

To avoid the influence of other stress on the communication cable and ensure the stability of communication, fasten the cable near the equipment before starting EtherCAT communication.

8.6.4 PROFINET Communication Wiring

After communication between the MD500-PN1/MD500-PN2 card and the AC drive is implemented, connect the AC drive to the PROFINET master station and configure related parameters. This can implement communication between the MD500-PN1/ MD500-PN2 card and the PROFINET master station, thereby implementing AC drive networking.

PROFINET supports multiple types of topologies including the bus type, star type, and tree type. Multiple types of networking can be achieved through the switch.

A ring or linear topology can be implemented by using two ports on the AC drive. Connect the cable to only one of the two ports. The cable between two nodes is no longer than 100 m in length.

8.7 Inspection After Wiring

After wiring is completed, inspect the items in the following table and tick compliant items.

Table 8–28 Post-wiring inspection checklist

No.	Item	Checked
1	The power supply input cables are connected to the R, S, and T terminals.	
2	The motor input cables are connected to the U, V, and W terminals.	
3	The dimensions of the main circuit cables meet the requirements.	
4	Heat-shrink tubes are applied to cable lug copper pipes and conductors of main circuit cables, and completely cover the cable conductors.	
5	The motor output cable does not exceed 50 m. Otherwise, the carrier frequency needs to be reduced through F0-15.	
6	The ground cables are connected correctly.	
7	The output terminals and control signal terminals are securely fastened.	
8	The braking resistor and braking unit (if used) are connected correctly and have proper resistance.	
9	The control circuit signal cables are shielded twisted pair cables.	
10	Optional cards are connected correctly.	
11	The control circuit cables and main circuit power cables are routed separately.	
12	There are no screws, gaskets, or exposed cables left inside the equipment.	

9 Installation Requirements on Options

9.1 AC Input Reactor

An AC input reactor is used to suppress harmonic waves in the input current. Install an AC reactor for applications with strict requirements on harmonic suppression to meet the requirements in IEC/EN 61000-3-2/12.

To install an AC input reactor, ensure sufficient space in the cabinet.

9.2 Output Reactor

With an output reactor installed at the output side of the AC drive, the excessive dV/dt can be reduced, lowering the voltage stress on the motor winding. This protects the motor winding, lowers the motor temperature, and prolongs the service life of the motor.

9.3 Fuses, Contactors, and Circuit Breakers

If the fuse is blown or the circuit breaker trips, wait for at least a period of time specified on the equipment warning label before energizing the AC drive or operating any peripheral equipment. Failure to comply may result in equipment damage, personal injury, or even death.

To meet the requirements in IEC/EN 61800-5-1 and UL61800-5-1, install a fuse or circuit breaker on the input side to prevent accidents caused by internal short circuits.

9.4 EMC Filter

The optional EMC filter can meet the EN IEC 618003 C2 emission requirements. For details about models and dimensions, see the *MD520 Series General-Purpose AC Drive Hardware Guide*. Install the EMC filter according to the following requirements:

- Install the EMC filter close to the input terminals, and keep the connection cable shorter than 30 cm.
- Connect the grounding terminal of the EMC filter to that of the AC drive, and install the EMC filter and the AC drive on the same conductive installation surface, which is connected to the main ground of the cabinet.
- Connect the LINE terminal of the EMC filter to the power grid, and the LOAD terminal to the AC drive.

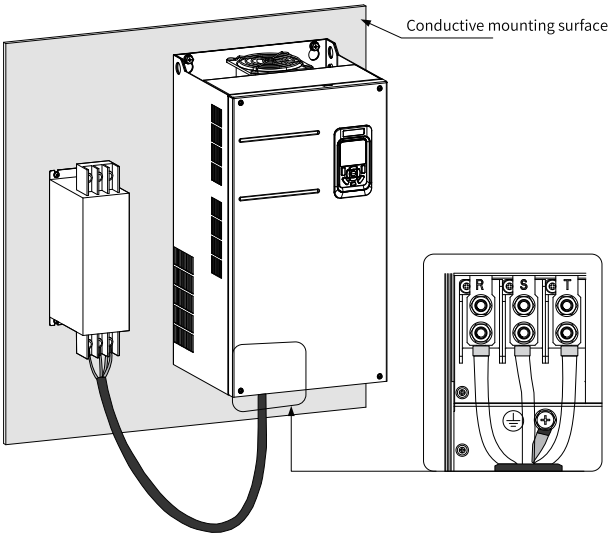


Figure 9-1 Installing an EMC filter

9.5 Magnetic Ring and Buckle

The magnetic ring can be used on the input or output side of the AC drive. Install it as close to the AC drive as possible. When installed on the input side, the magnetic ring can suppress the noise in the input power supply system of the drive. When installed on the output side, the magnetic ring can suppress interference generated by the AC drive to external devices and reduce the bearing current.

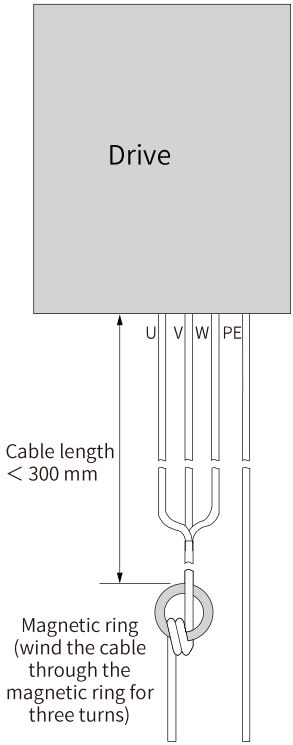


Figure 9-2 Magnetic ring installation

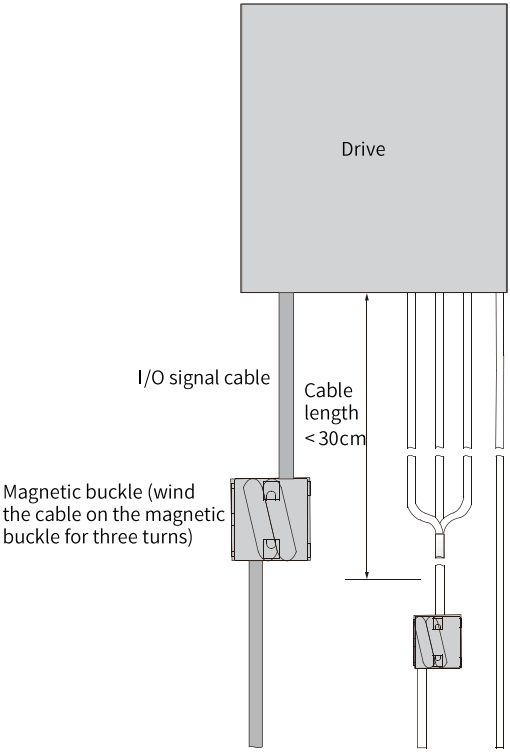
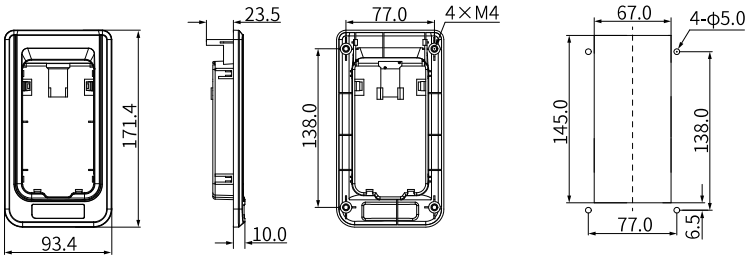


Figure 9-3 Magnetic buckle installation

Note

The R/S/T or U/V/W cables must pass through the same ferrite core to suppress the common mode noise.

9.6 MDKE-10 Mounting Base



Dimensions for the mounting bracket

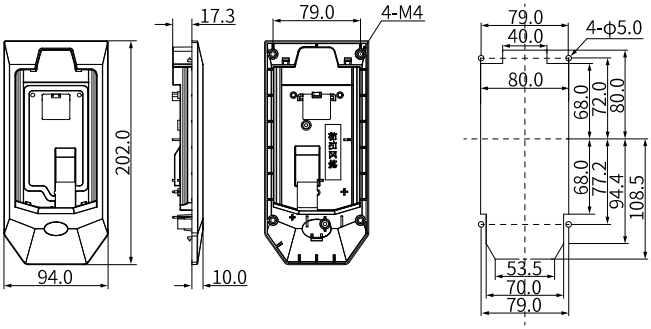
Hole dimensions

Figure 9-4 Dimensions and opening sizes (mm) of the MDKE-10 mounting base

Note

If the thickness of the door is 1.5 mm, no bolts are required.

9.7 SOP-20-810 Mounting Base



Dimensions of the mounting bracket

Hole dimensions

Figure 9-5 Dimensions and opening sizes (mm) of the SOP-20-810 mounting base

10 Solutions To Common EMC Problems

10.1 Residual Current Device Malfunction

When the residual current device (RCD) malfunctions, perform troubleshooting according to the following table.

Table 10–1 Troubleshooting for leakage current

Trip	Possible Cause	Solution
Trip upon power-on	The anti-interference performance of the RCD is poor.	1. Use a RCD from a recommended manufacturer. 2. Replace with a RCD with a higher rated tripping current. 3. Move the unbalanced load to the front end of the RCD. 4. Remove the EMC screw or disconnect the grounding terminal of the external EMC filter to reduce the capacitance of the input end to the ground.
	The action current of the RCD is too low.	
	Unbalanced load is connected to the back end of the RCD.	
	The capacitance to the ground at the front end of the AC drive is large.	
Trip during operation	The anti-interference performance of the RCD is poor.	1. Use a RCD from a recommended manufacturer. 2. For an individual AC drive, tighten the EMC screw. For multiple AC drives, disconnect the optional EMC grounding screw, as shown in *"Figure 10–1 Disconnecting the optional EMC grounding screw" on page 193*. 3. Install a simple filter on the input side of the drive, and wind the LN/RST cables through a magnetic ring near the RCD, as shown in *"Figure 10–2 Installing simple filter and magnetic ring on the input side" on page 193*. 4. Replace with a RCD with a higher rated tripping current. 5. Reduce the carrier frequency while ensuring performance. 6. Use shorter motor cables.
	The action current of the RCD is too low.	
	Unbalanced load is connected to the back end of the RCD.	
	For motor cables and the motor, the distributed capacitance to ground is too high.	

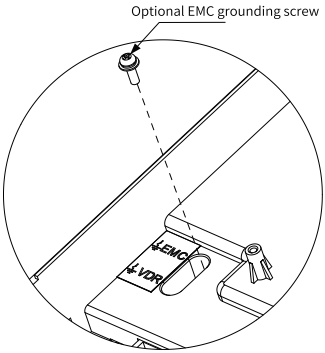


Figure 10-1 Disconnecting the optional EMC grounding screw

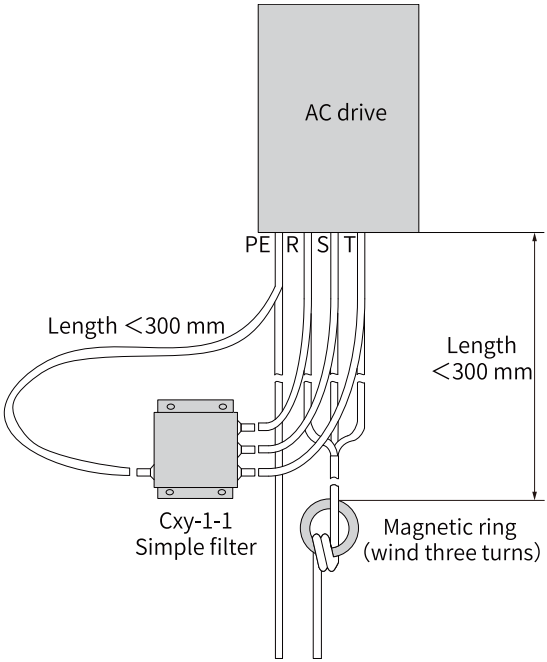


Figure 10-2 Installing simple filter and magnetic ring on the input side

10.2 Harmonic Suppression

To suppress harmonics of the AC drive and improve the power factor, install an AC input reactor on the input side of the AC drive to meet standard requirements.

10.3 I/O Signal Interference

10.3.1High-speed Pulse Interference

Take the following measures to eliminate interference.

Step	Measure
1	Used shielded twisted pairs and ground both ends.
2	Connect the motor enclosure to the PE terminal of the drive.
3	Connect the PE terminal of the drive to that of the power grid.
4	Add equipotential bonding grounding cables between the host controller and drive.
5	Route signal cables and power cables through different routes at a distance of at least 30 cm.
6	Install the magnetic buckle to the signal cable or wind the signal cable around the magnetic ring for one or two turns.
7	Install the magnetic ring to the U, V, and W cables of the drive, and wind the cables around the magnetic ring for two to four turns.
8	Use shielded power cables with the shield grounded properly.

10.3.2Common I/O Signal Interference

The drive generates strong interference during operation, which may interfere with other devices due to improper wiring or grounding. When the drive interferes with or is interfered by other devices, adopt the following measures.

No.	Solution
1	Use shielded I/O signal cables with the shield connected to the PE terminal.
2	Connect the PE terminal of the motor to that of the drive, and connect the PE terminal of the drive to that of the power grid.
3	Add an equipotential bonding grounding cable between the host controller and the AC drive.
4	Install a magnetic ring to the U, V, and W output cables at the drive side and wind the cables through the magnetic ring for two to four turns.
5	Increase the capacitance at the low-speed DI. A maximum of 0.1 uF capacitance is recommended.
6	Increase the capacitance at the AI. A maximum of 0.22 uF is recommended.
7	Install a ferrite clamp or a magnetic ring to the signal cable and wind the signal cable for one to two turns.
8	Use a shielded power cable and ground the shield securely.

10.4 Communication Interference

10.4.1RS485 and CAN Communication Interference

Obverse the following steps for troubleshooting.

No.	Step
1	Install a 120 Ω termination resistor at both ends of the bus.
2	Replace with multi-conductor shielded twisted pair cables and ground both ends of the shield.
3	Separate communication cables from power cables with a distance of at least 30 cm.
4	Adopt the daisy chain mode for multi-node communication cabling.
5	For multi-node communication, add an equipotential bonding grounding cable between nodes.
6	Add a ferrite clamp at both ends of the communication cable or add a magnetic ring at both ends of the communication cable and wind the communication cable through the magnetic ring for one to two turns.
7	Install a magnetic ring to the U, V, and W output cables at the drive side and wind the cables through the magnetic ring for two to four turns.
8	Use shielded power cables and ground the shield properly.

10.4.2EtherCAT and PROFINET Communication Interference

Take the measures listed in the following table.

No.	Description
1	Check that the communication network cables meet the specification requirements for shielded Cat 5e cables.
2	Check that the communication port cable is connected properly.
3	Separate the communication cable from the power cable by a distance of at least 30 cm.
4	For multi-node communication, add an equipotential bonding grounding cable between nodes.
5	Check that the cable between two nodes is no longer than 100 m in length.
6	Install the ferrite clamp on both sides of the communication cable and wind the cable around the ferrite clamp by one or two turns.
7	Install a magnetic ring to the U, V, and W output cables at the drive side and wind the cables through the magnetic ring for two to four turns.
8	Use a shielded power cable and ground the shield securely.

10.5 Encoder Feedback Signal Error

Take the measures listed in the following table.

No.	Step
1	Route encoder cables and power cables through different routes.
2	When the AC drive is far away from the motor (the motor cable is 10 m), disconnect the grounding terminal (PE) of the encoder shield on the AC drive side.
3	Install a magnetic ring or ferrite clamp to the encoder signal cable near the AC drive.
4	Install a magnetic ring to the U, V, and W output cables at the drive side and wind the cables through the magnetic ring for two to four turns.
5	Use shielded power cables and ground the shield properly.

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