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MD520 Series General-Purpose AC Drive

Safety Function Guide

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

Data code 19011795A01

Preface

Introduction

The MD520 series AC drive is a general-purpose high-performance current vector AC drive. It is designed to control and regulate the speed and torque of three-phase AC asynchronous 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.

The MD520 provides the safe torque off (STO) function, which can be controlled through external terminals (hereinafter referred to as local trigger). This guide presents the safety information, instructions for mechanical and electrical installation, commissioning and maintenance guidance, and safety-related parameters of the AC drive.

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.

Document Name	Document Code	Description
MD520 Series General-Purpose AC Drive Communication Guide	19011716	This guide describes the communication mode, communication networking, and communication configuration of the AC drive.
MD520 Series General-Purpose AC Drive Safety Function Guide	19011717	This guide describes function applications, communication, fault codes, and parameters 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	A01	**Modified the following sections:** • Updated *"4.1 LED Operating Panel" on page 43*. • Updated *" Mechanical Installation" on page 77*. • Updated *"5.8.3 Descriptions of Control Circuit Terminals" on page 106*. • Made minor corrections.
June 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 not caused by improper 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

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.

- 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

- 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.

- 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.

- 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 Safety Overview

1.1 List of Safety Functions

Function list

- Safe torque off (STO)
  The STO function immediately blocks the motor torque or power output in electronic mode according to input signals from external devices. This function complies with stop category 0 of EN 60204-1. If the motor is running when the STO function is activated, it coasts to stop.

1.2 Terms and Abbreviations

Term/Abbr.	Description
Cat.	Category of safety components in the control system. The categories are B, 1, 2, 3, and 4.
DCavg	Average diagnostic coverage (%)
DTI	Diagnostic test interval
SFF	Safe failure fraction
PFHd	Probability of dangerous failure on demand per hour
PL	Performance level
SC	System capability
SIL	Safety integrity level
T_1	Proof test interval
DI	Digital input
DO	Digital output
MTTFd	Mean time to dangerous failure

1.3 Safety Standards and Specifications

Standards compliance

- North American standards (UL)
  UL 61800-5-1

  CSA C22.2 No. 274

- EU directives and standards
  Low Voltage Directive 2014/35/EU, EN 61800-5-1

  EMC Directive 2014/30/ EU, EN 61800-3

Machinery Directive 2006/42/EC (Function Safety), IEC 61800-5-2

- Safety standard

Model	Safety standard	Reference
MD520****	Function safety	IEC 61508: 2010 ISO 13849-1: 2015 ISO 13849-2: 2012 IEC 62061: 2021 IEC 61800-3: 2017 EN 61508: 2010 EN ISO 13849-1: 2015 EN ISO 13849-2: 2012 EN IEC 62061: 2021 EN IEC 61800-3: 2018
	EMC	IEC 61000-6-7: 2014 IEC 61326-3-1: 2017 IEC 61800-5-2: 2016 IEC 61800-3: 2017 EN 61000-6-7: 2015 EN 61326-3-1: 2017 EN 61800-5-2: 2017 EN IEC 61800-3: 2018
	LVD	IEC 61800-5-1:2007/AMD1: 2016 EN 61800-5-1:2007/A1: 2017

- Safety specifications

Item	Specification
SIL	SIL3, IEC61508
PFHd	3.13E-09, 3.1% of SIL3, IEC 61508
Cat.	3, EN ISO 13849-1
PL	e, EN ISO 13849-1
MTTFd	326 years (high)
DCavg	⩾ 90% (medium)
T_1	20 years
HFT	1
SC	SC3
Application mode	High demand or continuous mode
Response time (under nominal voltage)	⩽ 20 ms

1.4 Precautions for Use

Safety precautions

This section describes warning symbols used for safety functions and provides safety instructions to be observed during installation and maintenance of safety modules for the drive or inverter. Failure to comply with the safety precautions may result in damage to equipment, physical injuries, or even death. Read this section before starting installation.

The figures, pictures, and examples in this guide are for reference only, and may not be applicable to all products covered by this guide.

As products and documentation upgrade, the specifications described in the safety function section may be modified without advanced notice.

Table 1–1 Warning symbols

Symbol	Text	Description	Consequence
Example:  DANGER  Hazardous voltage Electric shock	DANGER	Critical risk	Ignoring the warning will lead to severe injuries or even death.
	WARNING	Major risk	Ignoring the warning may lead to severe injuries or even death.
	CAUTION	Minor risk	Ignoring the warning may lead to minor injuries.
	STOP!	Damage to equipment or environment	Ignoring the warning may lead to damage to equipment or environment.

Note

- Users must incorporate safety measures in system design and electrical installation for both normal operation and troubleshooting.
- The design, installation, commissioning, and maintenance of the system must be implemented by trained and experienced professionals. They should read the operation guide and related safety information.

Anyone using the safety function must observe current mechanical criteria. Before putting a machine onto the market, the manufacturer or its licensor is obliged to carry out hazard analysis (in accordance with applicable mechanical criteria), take

appropriate measures to reduce or eliminate relevant hazards, and select compliant elements based on the hazard analysis result.

The following describes the information required before starting operation.

- Before operation, read the following safety precautions, risk assessment information, and restriction information.
- Before using the safety function, properly understand all the related information.

Note

If the safety function is used incorrectly or the safety function does not meet safety requirements at the site, physical injuries may arise.

Safety measures

Carefully read and observe the following important precautions when using the safety function:

- The STO function is not a substitute for the emergency stop (E-stop) function. If only the STO function is triggered, with no extra measures taken, and the power supply cannot be cut off in emergency, high-voltage parts of the motor and drive are still energized. This may incur the risk of electric shock or other electricity-related risks. Therefore, carry out maintenance of electrical parts of the drive or motor only after isolating the drive system from the main power supply.
- Depending on standards and requirements for particular applications, STO may be used as part of an E-stop system. However, different from the E-stop function, STO is designed for use in a dedicated safety control arrangement whose purpose is to prevent hazards from occurring.
- The E-stop function is typically provided in a machine to allow operators to notice unexpected situations and take actions to prevent accidents.
- The design requirements for E-stop are different from safety interlock. Generally, E-stop shall be independent from any complex or intelligent control. It may use purely electromechanical devices to disconnect the power supply or initiate a controlled rapid stop using other means such as dynamic or regenerative braking.

- The design of safety-related systems requires specialist knowledge. To ensure the safety of the entire control system, it is necessary to design the entire system according to recognized safety rules. An individual subsystem with the STO function, although intentionally designed for safety-related applications, cannot ensure the safety of the entire system.
- In emergency stop situations, the STO function can be used to stop the drive.
- In processes without personnel protection, do not to use the STO function to stop the drive. If the STO function is used to stop a running drive, the drive will coast to stop. If this is unacceptable, stop the system using a proper mode instead of the STO function.
- This publication provides a guide on the application of Inovance STO function and also on the design of safety-related systems for machinery control.
- It is the responsibility of the designer of the end product or application to ensure safety and compliance with relevant regulations.

Risk assessment

- Before using the safety function, perform risk assessment on the drive system in advance to ensure compliance with the standard safety integrity level.
- The following residual risks can be present even when the safety function is operating. Therefore, safety must always be considered during risk assessment.
- If external forces (such as gravity on the vertical axis) are applied when the safety function is operating, the motor will rotate due to these external forces. In this case, provide a separate mechanical brake to secure the motor.

Note

- When multiple faults occur on the IGBT power transistor, the drive will produce an aligning torque regardless of whether the STO function is used. This torque may drive the motor shaft to rotate to a maximum angle of (180 ÷ p).
- p indicates the number of motor pole pairs.

To guarantee safety, users must determine all the assessed risks and residual risks of the integrated equipment. Companies and individuals that establish safety-related systems must be solely responsible for system installation and commissioning. In addition, relevant sub-systems subject to the European Machinery Directive must be certified against safety standards, and risks and safety levels must be assessed for the machine or the entire system.

The following describes the residual risks related to the safety function of this equipment.

Common residual risks

- Before shipping the equipment to end users, check the settings of safety-related parts using the programming tool and the display. Record and save the settings related to the safety monitoring function and the programming tool that you use. Use a checklist during this process.
- Safety rests with proper installation, wiring, and tuning. Follow instructions in the safety guide during installation, wiring, and commissioning.
- Installation, trial run, repair, and commissioning must be carried out by skilled personnel only. Only relevant safety engineers are allowed to install and operate the equipment.
- Separate the wiring for the safety function from other signal wiring.
- Protect cables using proper methods (such as using cable guards when routing in a cabinet).
- Use switches, relays, and sensors that comply with safety standards. If switches, relays, or sensors that do not comply with safety standards are used, verify the safety.
- Reserve adequate clearances or creepage distances based on the voltage used.
- The time error in safety monitoring depends on parameter settings.
- **STO**
  This function cuts off only the motor torque but not the drive power supply. Before drive maintenance, cut off the power supply to the drive and confirm that the drive is de-energized.

Note

Trigger the STO function for the AC drive at least once every three months.

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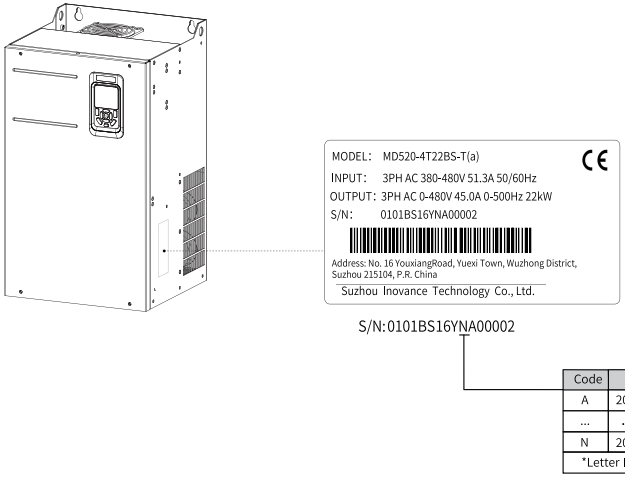
2 Product Information

2.1 Nameplate and Model



MD520 - 4T 22 B S -T (a)

① ② ③ ④ ⑤ ⑥ ⑦

① **Product name** MD520 series AC drive	⑤ **Safety function** Null: without the STO function S: with the STO function
② **Voltage class** 4T: three-phase 380 V to 480 V 2T: three-phase 200 V to 240 V 2S: single-phase 200 V to 240 V	⑥ **Reactor** Null: See the note below. -T: with the DC reactor; applicable to the T5 models -L: with the AC output reactor; applicable to the T10 to T12 models -A: with the auxiliary power distribution box; applicable to the T13 models

③ **Power rating (kW)** 0.4: 0.4 ... 630: 630	⑦ **Customer mark** Null: without the customer mark (A): with the customer mark, suffixed by "XXXXXXXXXX". The suffix can be null or contains digits, letters, or customer marks.
④ **Braking unit** Null: without the braking unit B: with the braking unit	- -

Note

- For three-phase 380 V to 480 V AC drives, reactors are not available for T1 to T4 models, whereas DC reactors are optional for T5 models and standard for T6 models.
- For three-phase 380 V to 480 V AC drives, braking units are standard for T1 to T4 models and optional for T5 to T8 models.

2.2 Cable Models

2.2.1 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%.

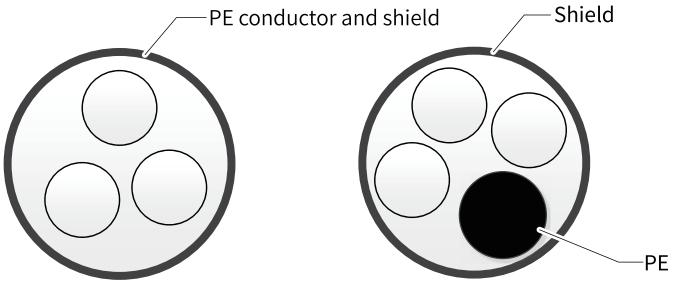


Figure 2-1 Recommended power cable

Recommended cable

Table 2–1 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)

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		
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)
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)

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		
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 2–2 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)

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		
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)
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)

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		
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 2–3 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 2–4 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 2–5 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 2–6 Appearances, models, and dimensions of TNR series lugs (unit: mm)

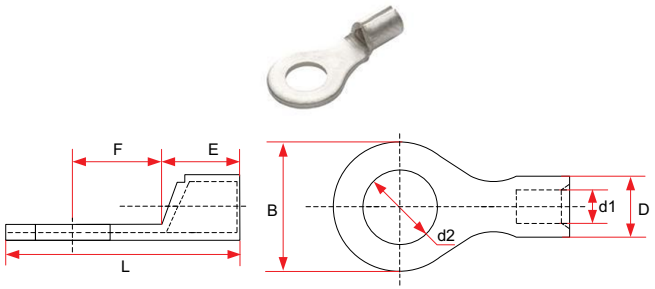
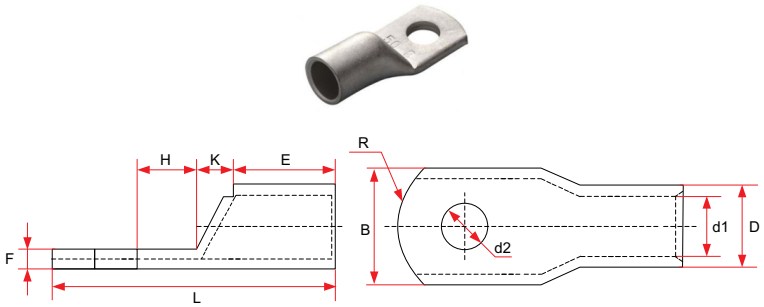
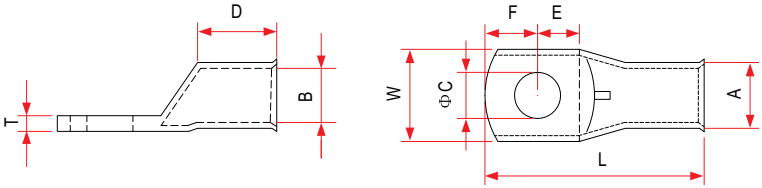
Model	Specification		D	d1	E	F	B	d2	L	Current (A)	Crimping Tool
	AWG/ MCM	mm^2									
											
TNR0.75-4	22–16	0.25–1.0	2.8	1.3	4.5	6.6	8.0	4.3	15.0	10	RYO-8 AK-1M
TNR1.25-4	22–16	0.25–1.65	3.4	1.7	4.5	7.3	8	5.3	15.8	19	

Table 2–7 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 2–8 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	

2.2.2 Selection of Control Circuit Cables

Note

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

To prevent peripheral interference and noise, shielded cables are recommended for I/O signal cables. Connect both ends of the shield to the equipment 360 degrees using signal shield support. Separate shielded cables should be used for different analog signals, and shielded twisted pair cables are recommended for digital signal cables.

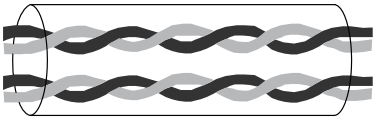


Figure 2-2 Shielded twisted pair cable

3 Components

3.1 Overview

The AC drive is structured in either of the following types:

- Plastic structure for T1 to T6 models
- Sheet metal structure for T7 to T12 models

3.2 Components of T1 to T6 Models

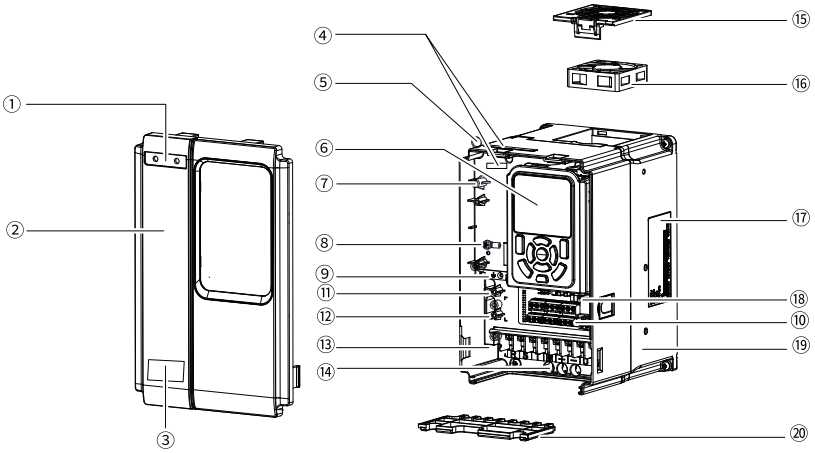


Figure 3-1 Components of T1 to T4 models

No.	Name	No.	Name	No.	Name
①	Logo	②	Front cover	③	Mark Symbol / Description Note: Read through the user guide before installation and operation. Danger: Do not remove the upper cover with power ON or within 10 min after power-off. (10min)
④	Equipment bar code It allows you to check the product code and model. The actual position may vary with models.	⑤	Main circuit power supply indicator Do not disassemble the machine or perform wiring when this indicator is ON.	⑥	Operating panel

No.	Name	No.	Name	No.	Name
⑦	Encoder expansion card fixing base	⑧	Cable tray and fixing base for the control board ground cable Note: Connect the control board ground cable to the grounding bar only when the system is reliably grounded; otherwise, connect the ground cable to the fixing hole.	⑨	Grounding copper busbar It is used to ground the PG card and control board.
⑩	Control circuit terminal	⑪	Base for fixing the expansion card	⑫	Grounding screws for safety capacitor and voltage dependent resistor
⑬	Main circuit terminal	⑭	Grounding terminal	⑮	Fan cover
⑯	Fan	⑰	Nameplate	⑱	External operating panel interface
⑲	Enclosure	⑳	Comb-type wiring cover	-	-

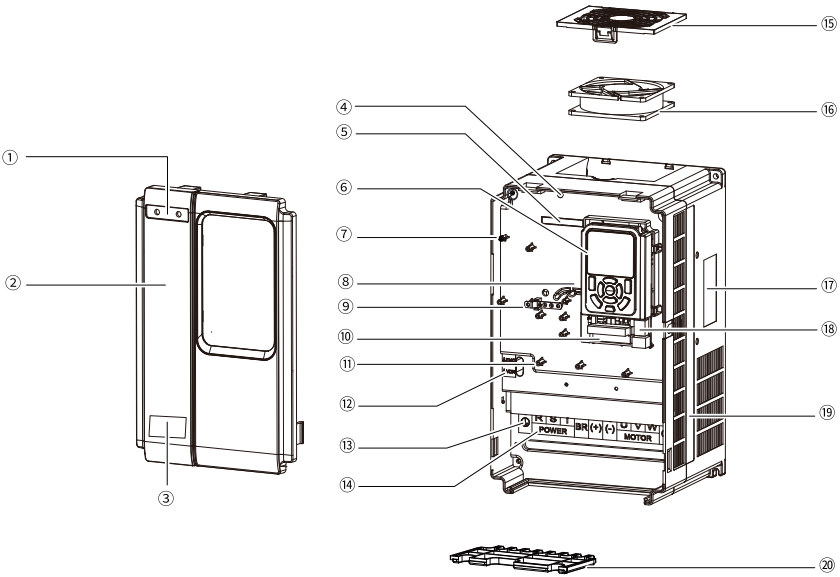


Figure 3-2 Components of T5 and T6 models

No.	Name	No.	Name	No.	Name
①	Logo	②	Front cover	③	Mark Symbol / Description Note: Read through the user guide before installation and operation. Danger: Do not remove the upper cover with power ON or within 10 min after power-off.
④	Main circuit power supply indicator Do not disassemble the machine or perform wiring when this indicator is ON.	⑤	Equipment bar code It allows you to check the product code and model. The actual position may vary with models.	⑥	Operating panel

No.	Name	No.	Name	No.	Name
⑦	Encoder expansion card fixing base	⑧	Cable tray and fixing base for the control board ground cable Note: Connect the control board ground cable to the grounding bar only when the system is reliably grounded; otherwise, connect the ground cable to the fixing hole.	⑨	Grounding copper busbar It is used to ground the PG card and control board.
⑩	Control circuit terminal	⑪	Base for fixing the expansion card	⑫	Grounding screws for safety capacitor and voltage dependent resistor
⑬	Grounding terminal	⑭	Main circuit terminal	⑮	Fan cover
⑯	Fan	⑰	Nameplate	⑱	External operating panel interface
⑲	Enclosure	⑳	Comb-type wiring cover	-	-

3.3 Components of T7 to T9 Models

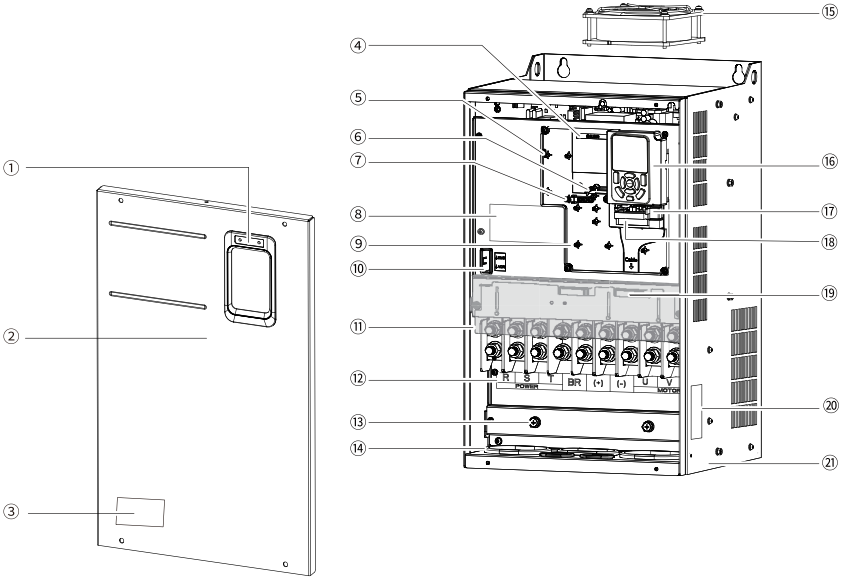


Figure 3-3 Components of T7 to T9 models

No.	Name	No.	Name	No.	Name
①	Logo	②	Front cover	③	Mark Symbol / Description Note: Read through the user guide before installation and operation. Danger: Do not remove the upper cover with power ON or within 10 min after power-off.
④	Equipment bar code It allows you to check the product code and model. The actual position may vary with models.	⑤	Encoder expansion card fixing base	⑥	Cable tray and fixing base for the control board ground cable Note: Connect the control board ground cable to the grounding bar only when the system is reliably grounded; otherwise, connect the ground cable to the fixing hole.
⑦	Grounding copper busbar It is used to ground the PG card and control board.	⑧	Wiring description	⑨	Base for fixing the expansion card

No.	Name	No.	Name	No.	Name
⑩	Grounding screws for safety capacitor and voltage dependent resistor	⑪	Protective cover of the main circuit terminal	⑫	Main circuit terminal
⑬	Grounding terminal	⑭	Grommet	⑮	Fan
⑯	Operating panel	⑰	External operating panel interface	⑱	Control circuit terminal
⑲	Cable tie It is used to fix the signal cable.	⑳	Nameplate	㉑	Enclosure

Note

The quantity and positions of cooling fans vary with AC drive models.

- T7 models have one cooling fan at the top.
- T8 models have two cooling fans at the top.
- The T9 models have two cooling fans at the bottom.

3.4 Components of T10 to T12 Models

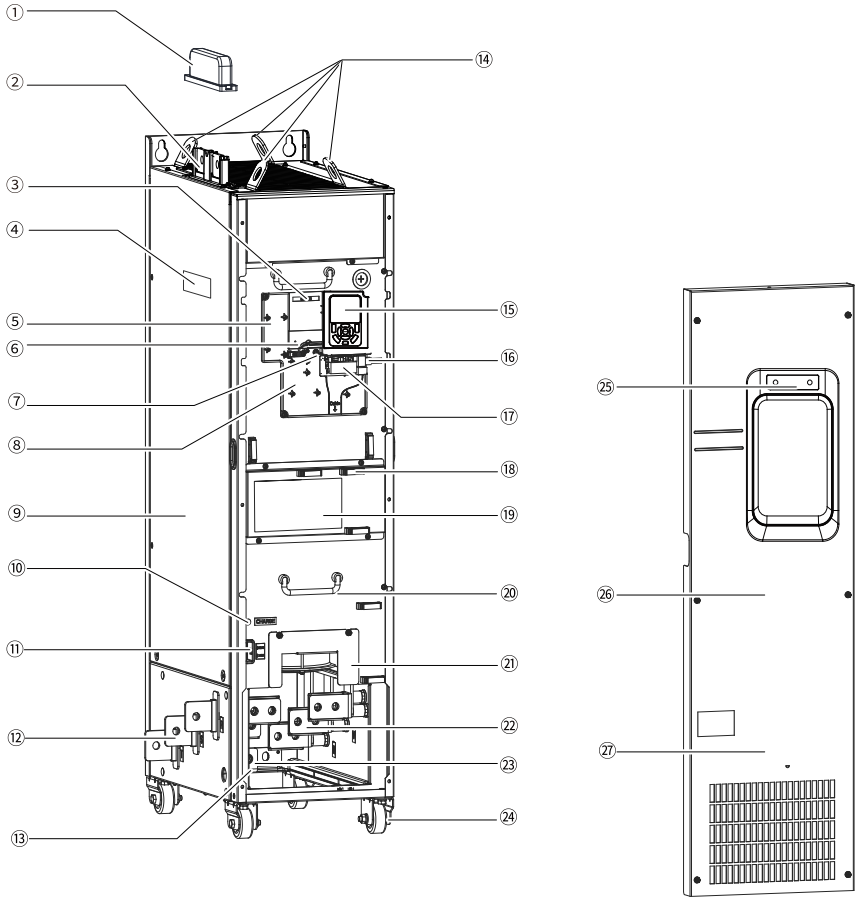


Figure 3-4 Components of T10 to T12 models (without an output AC reactor)

No.	Name	No.	Name	No.	Name
①	Protective cover for positive and negative terminals	②	Positive and negative terminals of the DC bus	③	Equipment bar code It allows you to check the product code and model.
④	Nameplate	⑤	Encoder expansion card fixing base	⑥	Cable tray and fixing base for the control board ground cable Note: Connect the control board ground cable to the ground copper bar only when the system is reliably grounded; otherwise, connect it to the fixing base.
⑦	Grounding copper busbar It is used to ground the PG card and control board.	⑧	Base for fixing the expansion card	⑨	Enclosure
⑩	Main circuit power supply indicator Do not disassemble the machine or perform wiring when this indicator is ON.	⑪	Grounding screws for safety capacitor and voltage dependent resistor	⑫	Main circuit input terminals
⑬	Bottom hoisting position	⑭	Top hoisting position (lifting lug)	⑮	Operating panel
⑯	External operating panel interface	⑰	Control circuit terminal	⑱	Cable tie
⑲	Wiring description	⑳	Handle	㉑	Fan box
㉒	Main circuit output terminal	㉓	Grounding terminal	㉔	Caster
㉕	Logo	㉖	Upper front cover	㉗	Mark Symbol / Description Note: Read through the user guide before installation and operation. Danger: Do not remove the upper cover with power ON or within 10 min after power-off.

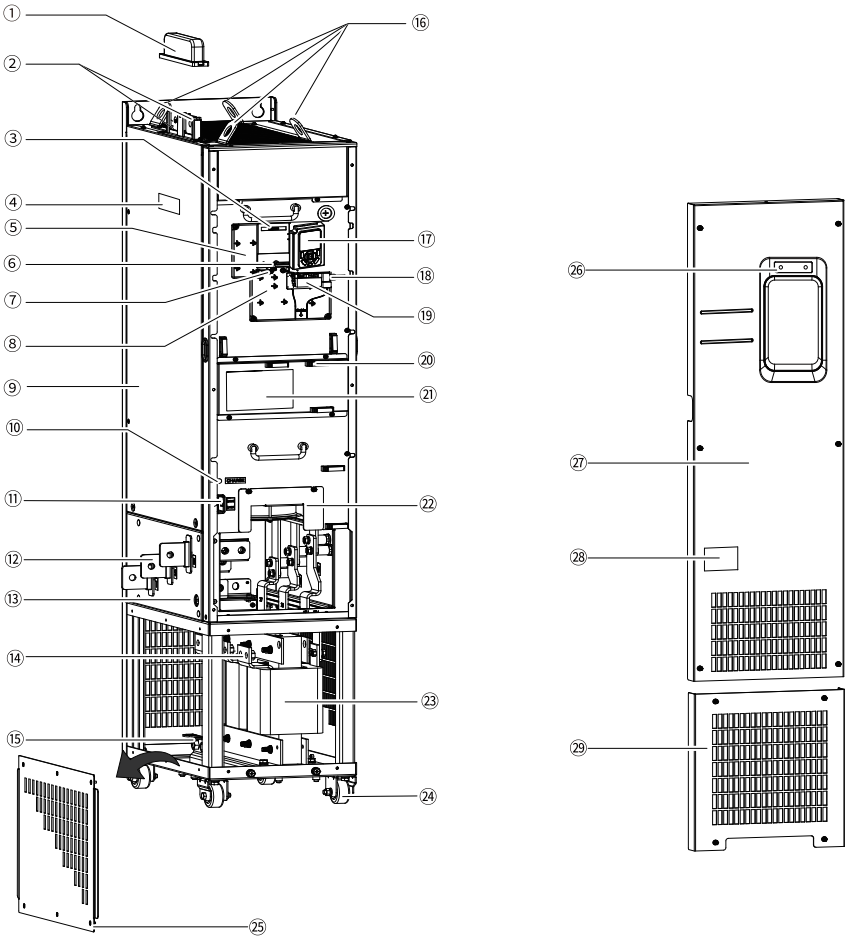
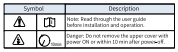


Figure 3-5 Components of T10 to T12 models (with an output AC reactor)

No.	Name	No.	Name	No.	Name
①	Protective cover for positive and negative terminals	②	Positive and negative terminals of the DC bus	③	Equipment bar code It allows you to check the product code and model.
④	Nameplate	⑤	Encoder expansion card fixing base	⑥	Cable tray and fixing base for the control board ground cable Note: Connect the control board ground cable to the ground copper bar only when the system is reliably grounded; otherwise, connect it to the fixing base.
⑦	Grounding copper busbar It is used to ground the PG card and control board.	⑧	Base for fixing the expansion card	⑨	Enclosure
⑩	Main circuit power supply indicator Do not disassemble the machine or perform wiring when this indicator is ON.	⑪	Grounding screws for safety capacitor and voltage dependent resistor	⑫	Main circuit input terminal
⑬	Bottom hoisting position	⑭	Main circuit output terminal	⑮	Grounding terminal
⑯	Top hoisting position (lifting lug)	⑰	Operating panel	⑱	External operating panel interface
⑲	Control circuit terminal	⑳	Cable tie	㉑	Wiring description
㉒	Fan box	㉓	AC output reactor	㉔	Casters
㉕	Left cover of the base	㉖	Logo	㉗	Upper front cover
㉘	Mark  	㉙	Front lower cover	-	-

4 Operating Panel

4.1 LED Operating Panel

Dimensions

The following figures show the outline and installation dimensions of the LED operating panel.

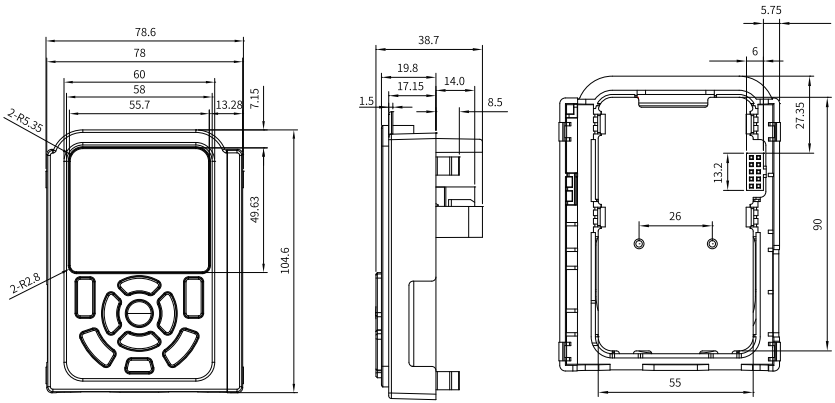


Figure 4-1 Outline and installation dimensions of LED operating panel for T1 to T4 models (mm)

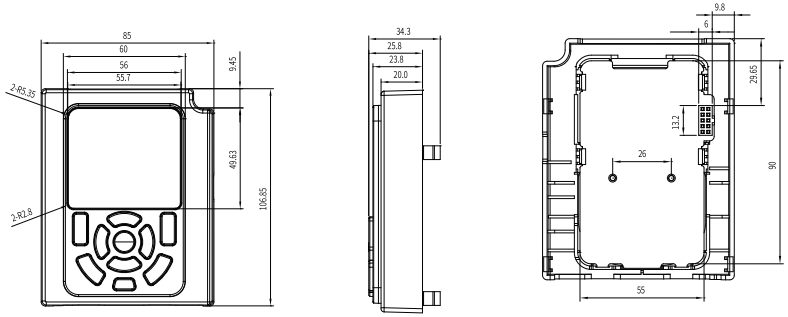


Figure 4-2 Outline and installation dimensions of LED operating panel for T5 to T12 models (mm)

Components

The LED operating panel can be used to view the operating status and fault information, set parameters, and so on. The following figure shows the operating panel.

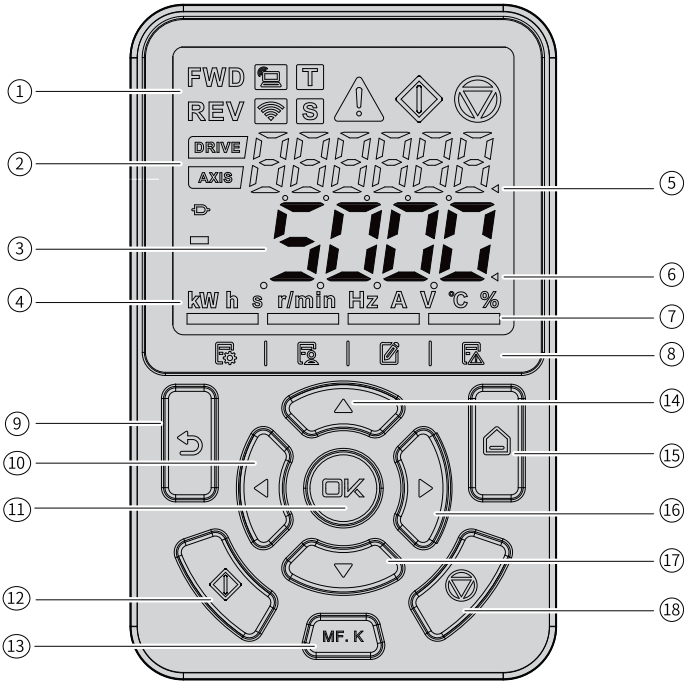


Figure 4-3 Components

Table 4–1 Description of the operating panel

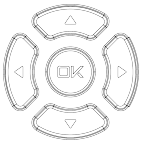
No.	Name	Description
①	Status Indicator	-
②	Secondary display area	It displays the following information: • Key test and auto-tuning • Fault and system status monitoring • Station number, motoring status, and STO status
③	Primary display area	It displays parameter information.
④	Unit indicator	-
⑤	Cursor in the secondary display area	-
⑥	Cursor in the primary display area	-
⑦	Menu indicator	It indicates the current menu and can be switched via the menu key. Only one indicator can become on simultaneously.

No.	Name	Description
⑧	Menu identification	From left to right, the icons indicate the basic menu, user-defined parameter, modified parameter (with default values changed), and fault list.
⑨	Program/Back key	-
⑩	Left shift key	-
⑪	OK key	-
⑫	RUN key	-
⑬	Multi-function key	-
⑭	Increment key	-
⑮	Menu key	-
⑯	Right shift key	-
⑰	Decrement key	-
⑱	Stop key	-

Key descriptions

Table 4–2 Key descriptions

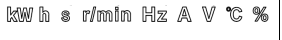
Key	Name	Description
	Menu key	Long press the key to switch between the primary display area and the secondary display area. In the primary display area, press the key to switch among different menus, including the basic menu, user-defined parameter, modified parameter (with default values changed), and fault list.
	Program/Back key	Press the key to return to the previous page and enter level-I menu.
	OK key	Press the key to enter the settings interface or confirm settings.

Key	Name	Description
	Navigation key	In the secondary display area, press the right or left navigation key to switch the display status. Primary display area: • Basic menu, user menu, and calibration menu: On the monitoring interface, the down key is used as the potentiometer and the left and right keys are used to switch between monitored variables. On the parameter interface, the up and down keys are used to adjust the setpoint, the left and right keys are used to select the bit to set, and the OK key is used to confirm the setpoint. • Fault list: Press the left or right key to switch the fault history records.
	Multi-function key	You can allocate different functions, such as command source switch, forward run and reverse run switch, or jog to this key.
	RUN key	Press the key to start the drive in the operating panel control mode.
	Stop/Fault reset key	When the drive is running, press this key to stop the drive. When the drive is in the faulty state, press this key to perform a reset operation.

Status indicator

Table 4–3 Status indicator

Status Indicator		Description
FWD REV	FWD indicator steady on	The AC drive is running in the forward direction, or the reference direction is forward.
	REV indicator steady on	The AC drive is running in the reverse direction, or the reference direction is reverse.
	FWD and REV indicators blinking	The AC drive is switching between forward running and reverse running.
	Local/Remote indicator off	Local control
	Local/Remote indicator on	Terminal control
	Local/Remote indicator blinking slowly	Communication control
	Local/Remote indicator blinking quickly	User-defined control mode
	Torque control indicator steady on	Torque control
	Speed control indicator steady on	Speed control
	Fault indicator steady on	A fault occurs on the AC drive.
	Fault indicator off	No fault
	RUN indicator steady on	Running
	Stop indicator steady on	Stop

Status Indicator		Description
	DRIVE indicator steady on	The station No. is displayed in the auxiliary display area.
	DRIVE indicator off	The value displayed in the auxiliary display area is not the station No.
	AXIS indicator steady on	The axis No. is displayed in the auxiliary display area.
	AXIS indicator off	The value display in the auxiliary display area is not the axis No.
	Connector indicator steady on	The connector variable is displayed in the main display area.
	Connector indicator off	The variable displayed in the main display area is not the connector variable.
	Minus sign indicator steady on	The value displayed in the primary display area is negative.
	Minus sign No. indicator off	The value displayed in the primary display area is positive.
	Cursor indicator in the primary display area steady on	The operating area is the primary display area.
	Cursor indicator in the secondary display area steady on	The operating area is the secondary display area.
	Unit indicator steady on	The unit applying to the data displayed in the main display area is the unit with indicator ON.

Status Indicator		Description
	Indicator steady on	The primary display area displays the basic menu.
	Indicator steady on	The primary display area displays the user-defined parameter menu.
	Indicator steady on	The primary display area displays the modified parameter (with the default value changed) menu.
	Indicator steady on	The primary display area displays the fault menu.

Data display

The operating panel provides two data display areas: the 6-digit LED secondary display area and the 5-digit LED primary display area.

The auxiliary display area displays the station No., axis No., current state, warning/ fault, etc.

The primary display area displays the frequency reference, output frequency, and various monitoring data.

Table 4–4 Mapping between LED display and actual data

LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data
0	0	9	9	h	h	r	r
1	1	A	A	c	c	t	t
2	2	b	B	J	J	U	U
3	3	C	C	L	L	y	y

LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data
	4		D		n		T
	5		E		N		u
	6		F		o		-
	7		H		P	-	-
	8		G		q	-	-

5 Installation

5.1 Requirements on Installation Personnel

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

5.2 Environment

For optimized performance and a long service life of the AC drive, install the AC drive in an environment that meets the following requirements.

Table 5–1 Environment requirements

Environment	Requirement
Installation location	Indoors
Grid overvoltage	Overvoltage Class III (OVC III)
Temperature	Installation/Operation: –10°C to +50°C (–10°C to +40°C: no derating; over +40°C: Derate 1.5% for every additional 1°C.) Storage/Transportation: –20°C to +60°C • For better reliability, use the AC drive in places without sharp temperature changes. • For use in an enclosed space such as a control cabinet, use a cooling fan or air conditioner to keep the temperature of air taken into the AC drive below 50°C. Failure to comply will result in overheat or fire. • Install the AC drive on a flame-retardant surface, with sufficient clearance reserved for heat dissipation. • Take measures to prevent the AC drive from being frozen.
Humidity	Below 95% RH, non-condensing
Environment	Pollution degree: 2 or below Install the AC 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 elements • 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 AC drive • Free from radioactive substances, combustible materials, harmful gas and liquid, and salt corrosion • Away from combustible materials such as wood

Environment	Requirement
Altitude	• 1000 m and below: no derating • Above 1000 m: Derate 1% for every additional 100 m. Above 2000 m for 0.4 kW to 3 kW models: Consult Inovance. Above 3000 m for 3 kW and above models. Consult Inovance.
Vibration resistance	• Transportation with packages: compliant with Class 2M3 requirements in EN 60721-3-2 • Installation without packages: compliant with ISTA 1H

5.3 Installation Clearance

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

T1 to T9 models

- Installing one drive

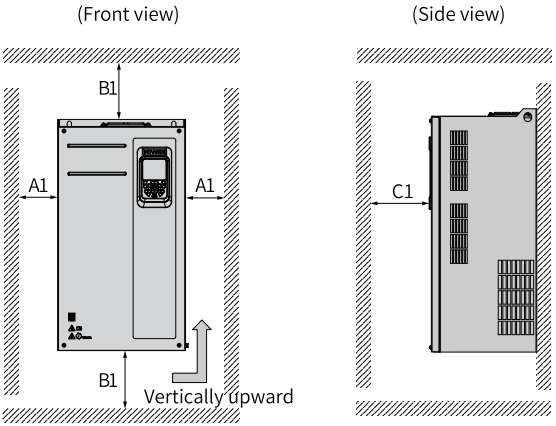


Figure 5-1 Clearance for installing one AC drive (T1 to T9 models)

Table 5–2 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.

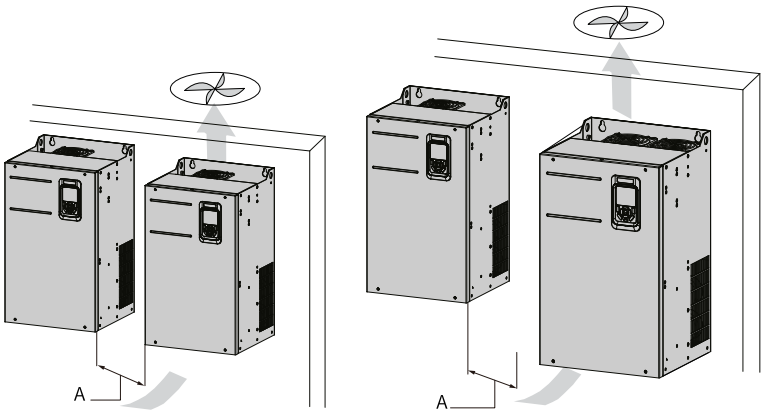


Figure 5-2 Installing multiple AC drives (T1 to T9 models) side by side

Table 5–3 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 5–3 Dual-row installation" on page 54*. This can prevent the drive in the lower row from heating that in the upper row, causing overheat or overload faults.

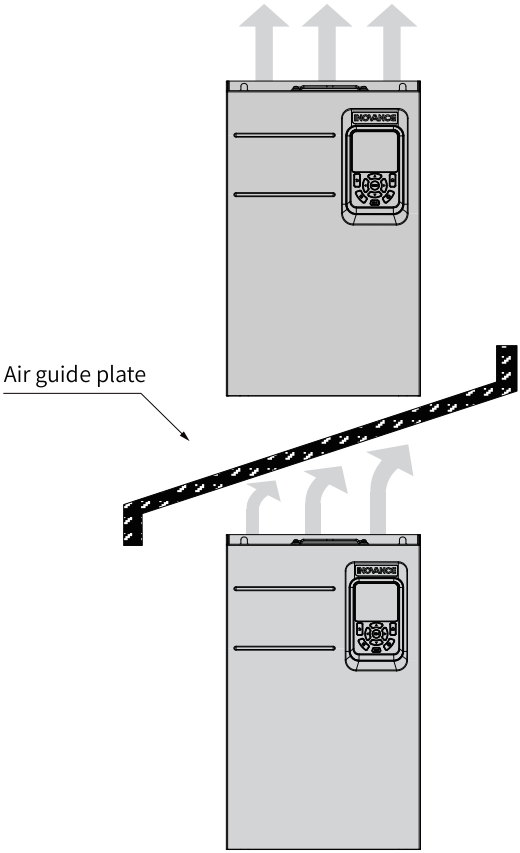


Figure 5-3 Dual-row installation

Air director design

The following figure shows the air director.

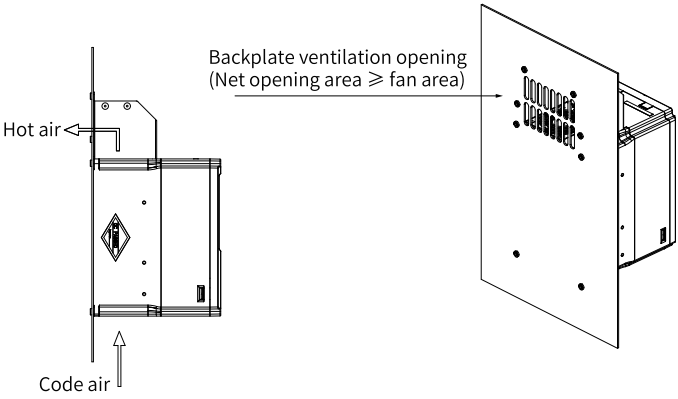


Figure 5-4 Air director

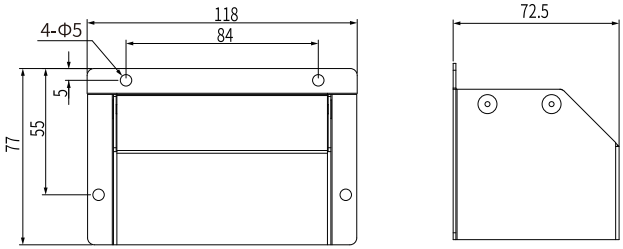


Figure 5-5 Air director dimensions (mm) of T1 models

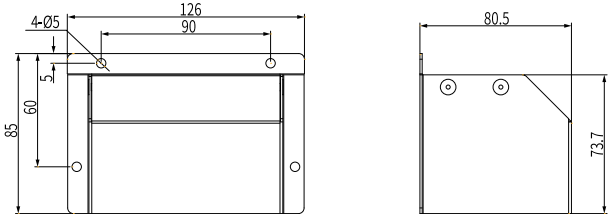


Figure 5-6 Air director dimensions (mm) of T2 models

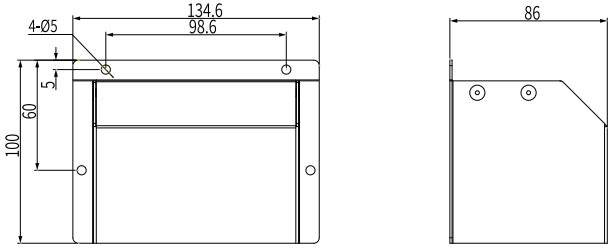


Figure 5-7 Air director dimensions (mm) of T3 models

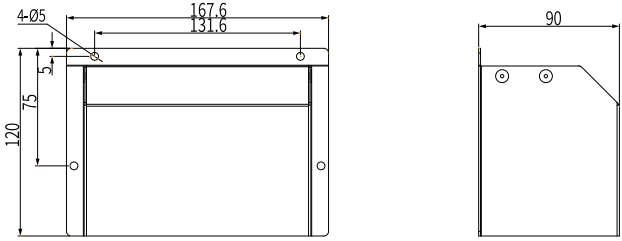


Figure 5-8 Air director dimensions (mm) of T4 models

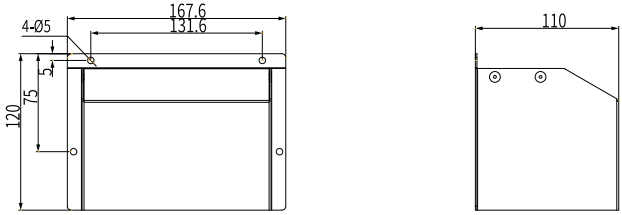


Figure 5-9 Air director dimensions (mm) of T5 models

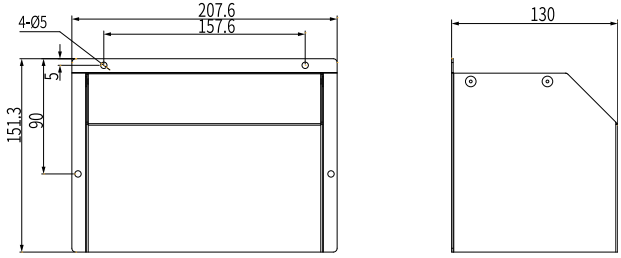


Figure 5-10 Air director dimensions (mm) of T6 models

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 5–4 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 5–4 Minimum effective ventilation area of the cabinet air inlet" on page 57* 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

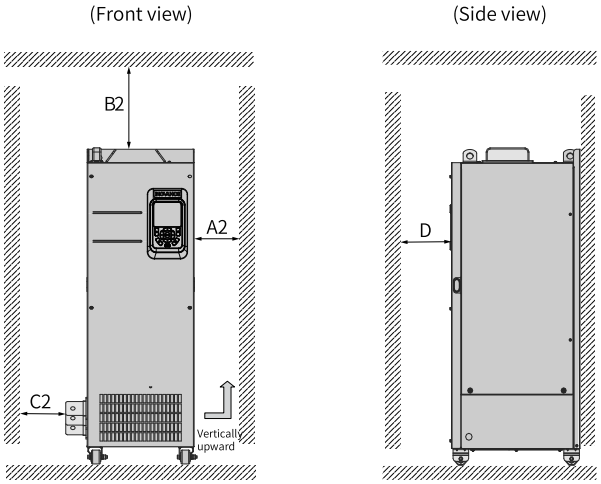


Figure 5-11 Installation clearance

Table 5–5 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

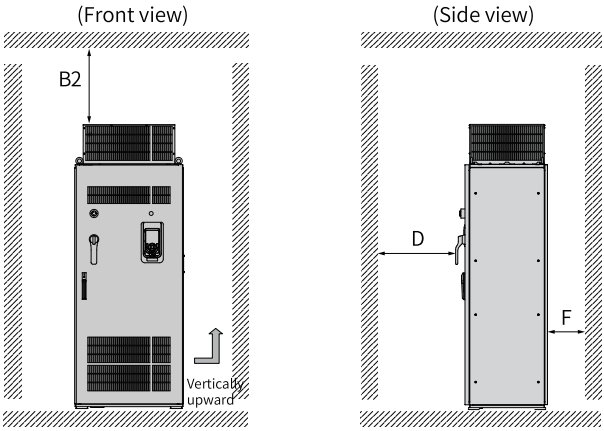


Figure 5-12 Installation clearance

Table 5–6 Installation clearance

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

5.4 Tools

Tools for mechanical installation

Table 5–7 Tools for mechanical installation (T1 to T12 models)

Tool	Description
Electric drill with an appropriate drilling bit	Used to drill mounting holes on the mounting surface
Wrench or socket wrench	Used to tighten or loosen screws Wrench sizes: 13, 16, and 18
Phillips and straight screwdrivers (2.5 mm to 6 mm)	Used to tighten or loosen screws
Torque wrench	Used to tighten or loosen screws
Crowbar	Used to pry off the upper access cover or cover to facilitate installation
Crane	Used to lift the AC drive
Tape measure	Used to measure the installation dimensions of the AC drive
Gloves	Used to prevent static electricity during mechanical installation

Tool	Description
Bottom mounting bracket (standard)	Used to fix the AC drive in the cabinet
Guide rails (optional)	Connected to the bottom mounting bracket to gently push the AC drive into the cabinet along the guide rails
Screws	Used to fix the AC drive onto the mounting surface

Screws

Table 5–8 Specifications and quantities of screws (T1 to T9 models)

Installation Method	Specification	Quantity (PCS)	Description
Backplate mounting	Dependent on the mounting hole diameter (provided by the user)	4	Used to fix the AC drive onto the wall
Through-hole mounting	Dependent on the mounting hole diameter (provided by the user)	4	Used to fix the AC drive onto the backplate of the control cabinet

Table 5–9 Specifications and quantities of screws (T10 to T12 models)

Installation Method	Specification	Quantity (PCS)	Description
Installation in a cabinet	M5 self-tapping screw	6	Used to fix the bottom mounting bracket to the bottom of the cabinet
	M5x12 SEMS screw	8	Used to assemble the guide rails
	M6 nut	2	Used to connect the guide rail assembly to the bottom mounting bracket

Tools for wiring

For wiring of main circuit terminals, use installation tools appropriate to terminal dimensions and secure the joints well.

Table 5–10 Wiring tools for main circuit terminals

Model	Recommended Fastener	Tool
T1 and T2	M4 SEMS screw	Phillips screwdriver (#3 slot)
T3 and T4	M5 SEMS screw	Phillips screwdriver (#3 slot)
T5 and T6	M6 SEMS screw	Phillips screwdriver (#3 slot)

Model	Recommended Fastener	Tool
T7	M8 nut, spring washer, and flat washer	Socket wrench (#13 socket)
T8 and T9	M12 nut, spring washer, and flat washer	Socket wrench (#19 socket) and socket wrench extension bar (150 mm)
T10 and 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)

5.5 Unpacking and Handling

5.5.1 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.

AC drives of different structural dimensions are different in size and weight, and hence are packed in different methods with different components incorporated.

The electrical safety performance of the drive may be affected if it is damaged during transportation. Perform professional high-voltage test on the drive before connection.

Packing list of T1 to T9 models

- T1 and T6 models are packed in 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

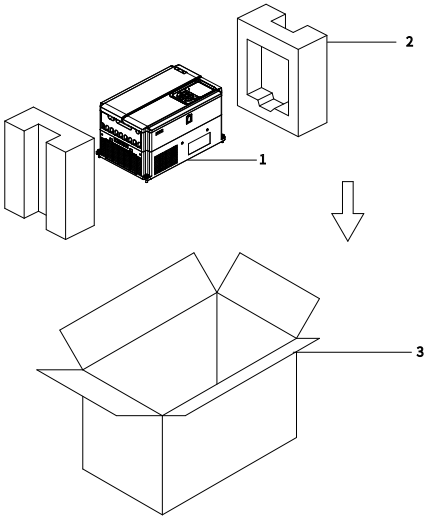


Figure 5-13 Packing list of T1 to T6 models

Table 5–11 Packing list of T1 to T6 models

No.	Name
1	AC Drive
2	Cushion
3	Carton

- Packing list of T7 to T9 models

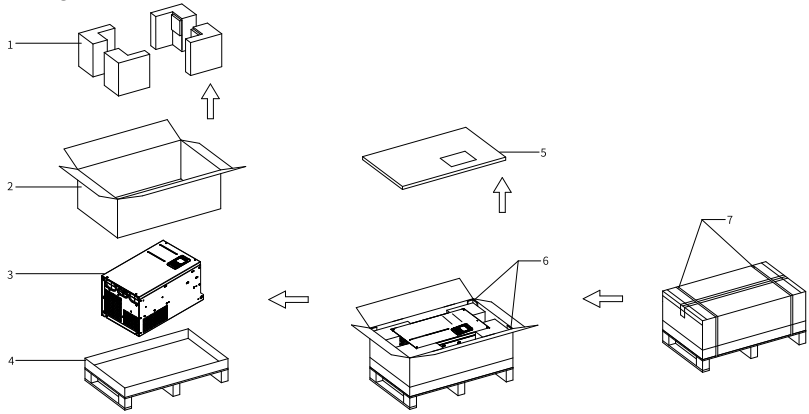


Figure 5-14 Packing list of T7 to T9 models

Table 5–12 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

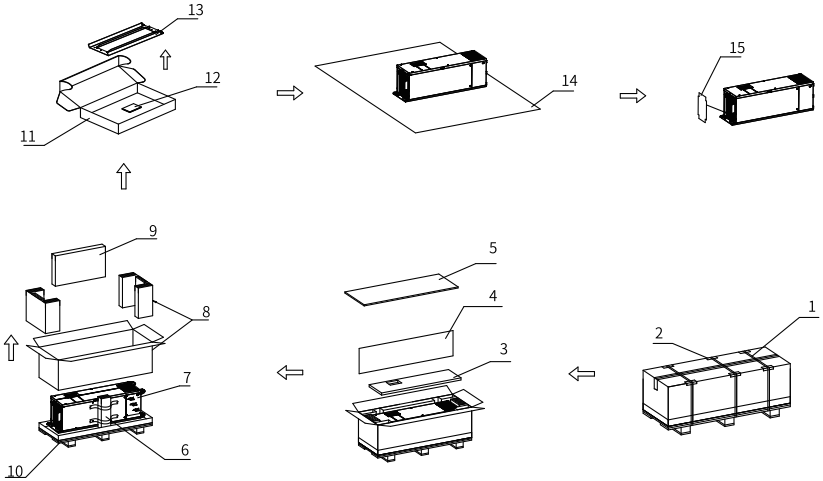


Figure 5-15 Packing list of T10 models

Table 5–13 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

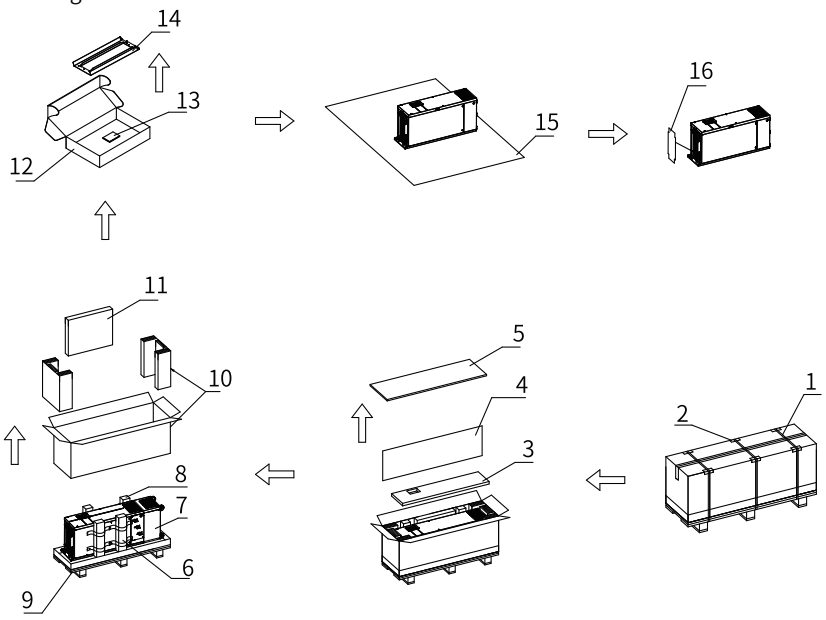


Figure 5-16 Packing list of T11 models

Table 5–14 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

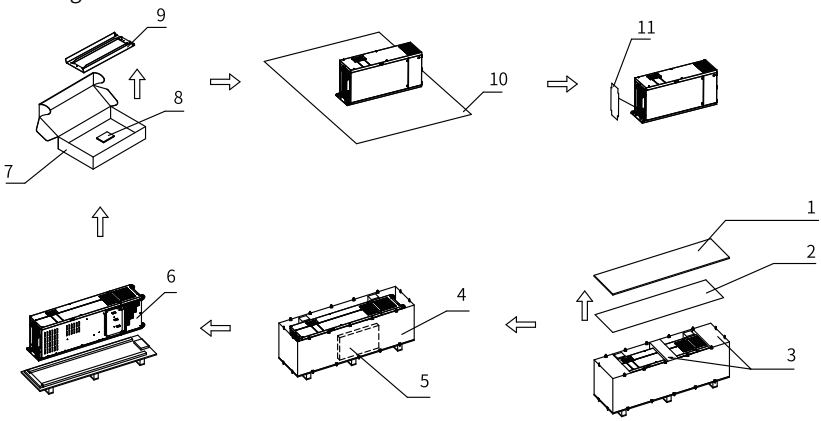


Figure 5-17 Packing list of T12 models

Table 5–15 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

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

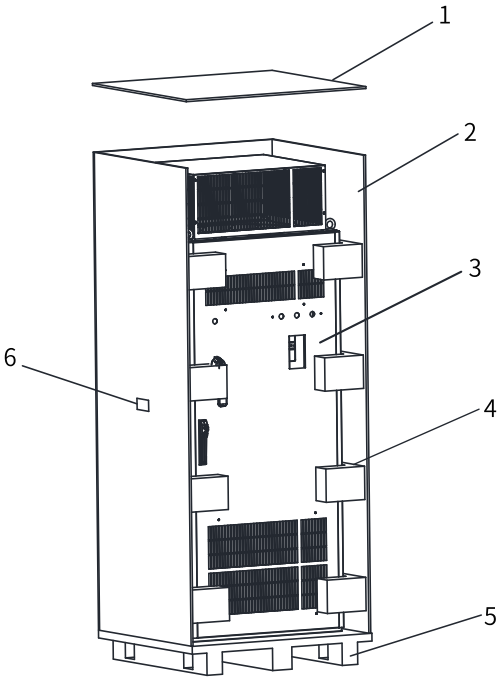


Figure 5-18 Packing list of a T13 model provided with a standard cabinet

No.	Name
1	Cover
2	Wooden crate
3	MD520AC drive
4	Expanded polyethylene foam
5	Base
6	Anti-inclination label

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

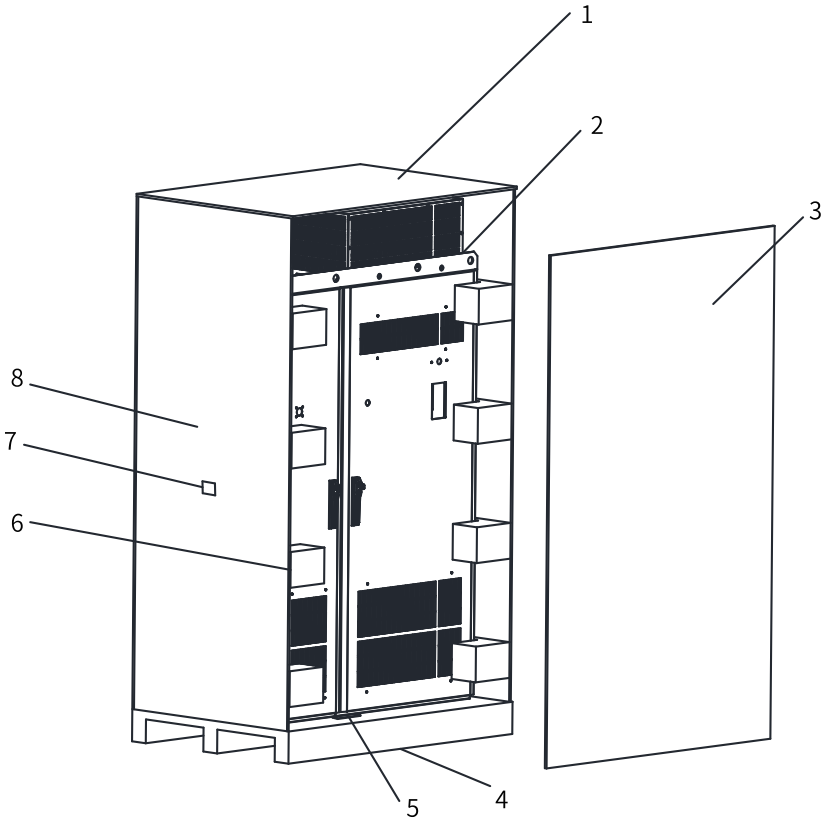


Figure 5-19 Packing list of a T13 model provided with a cabinet with an auxiliary power distribution cabinet

No.	Name
1	Top cover
2	MD520AC drive
3	Front panel
4	Base
5	Plywood
6	Expanded polyethylene foam
7	Anti-inclination label
8	Side panel

5.5.2 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.

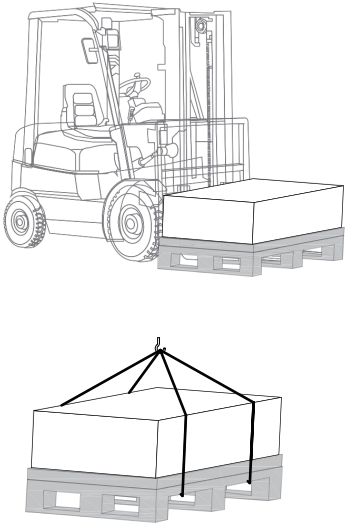


Figure 5-20 Lifting the drive

- 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.

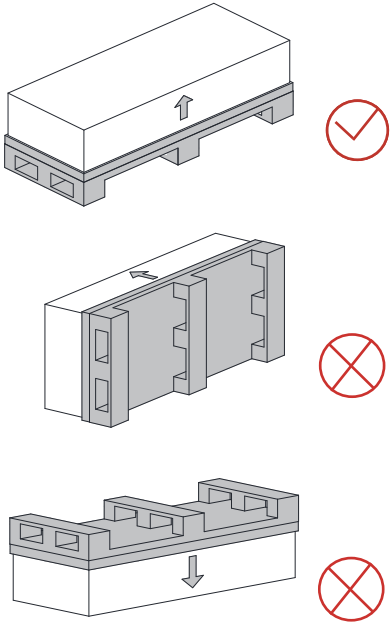


Figure 5-21 Placing the drive

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.

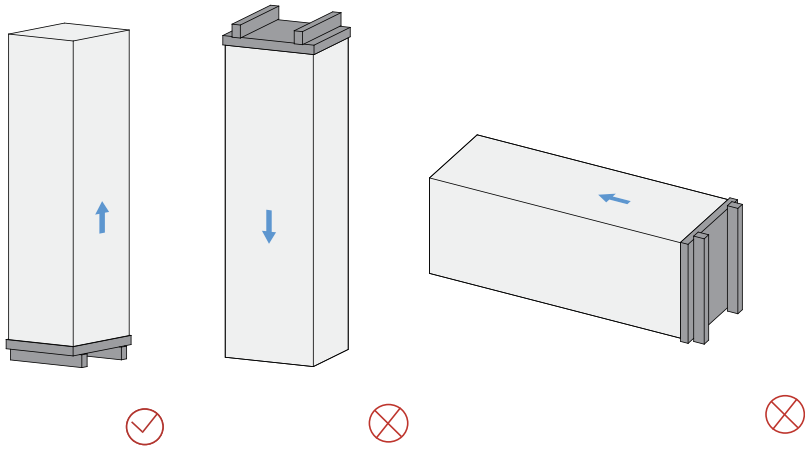


Figure 5-22 Upright position of the cabinet

- 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.

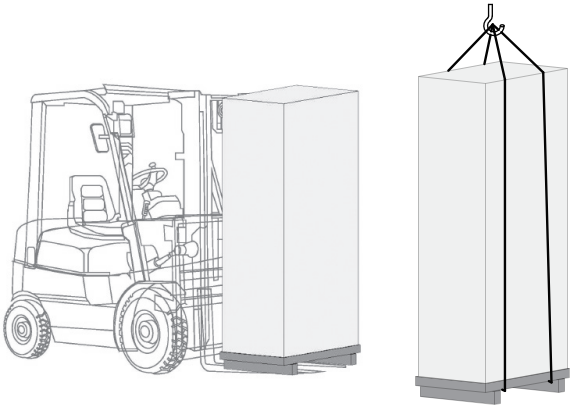


Figure 5-23 Transportation before unpacking

5.5.3 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.

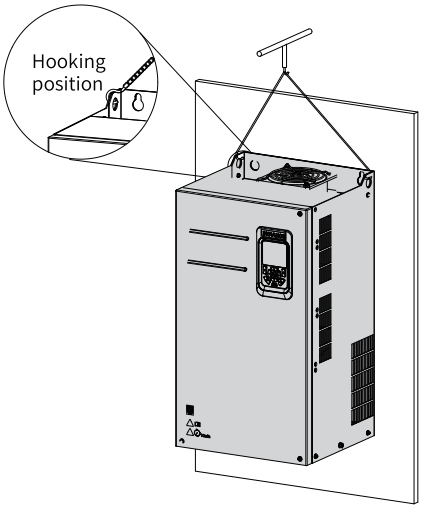


Figure 5-24 Lifting the AC drive

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.

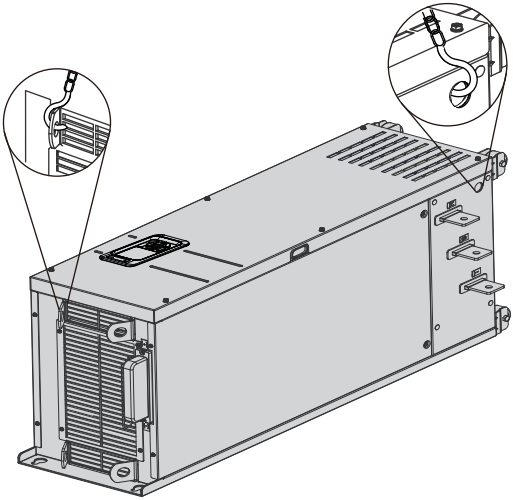


Figure 5-25 Lifting the AC drive

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.

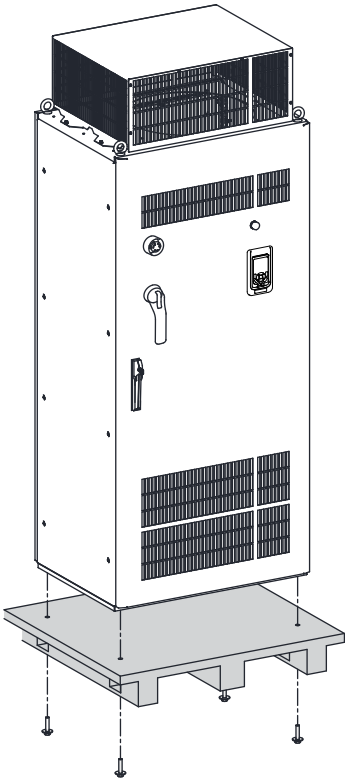
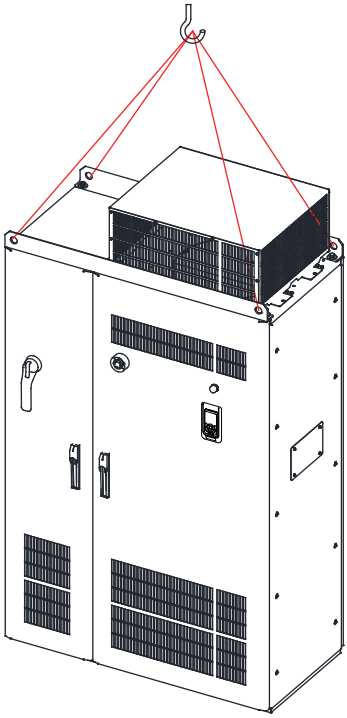
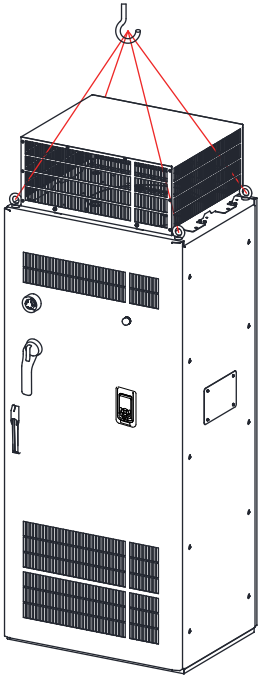


Figure 5-26 Unloading the cabinet from the pallet

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.





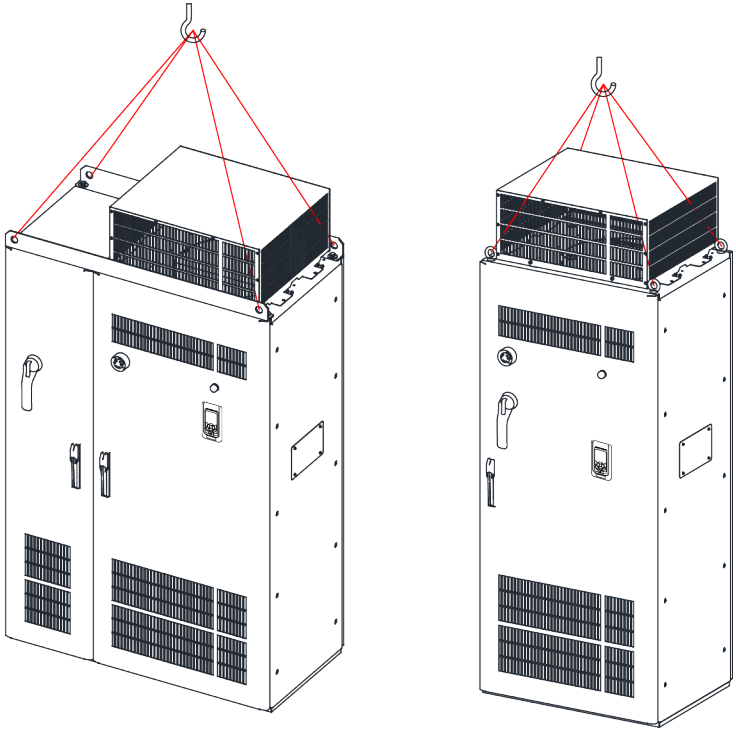


Figure 5-27 Transportation after unpacking

5.5.4 Unpacking

T1 to T12 models

The documentation suite and accessories are placed in different partitions in the package. To unpack, follow these steps:

1. Remove all the strapping band and the cover of the package.
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 according to local regulations.

5.5.5 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.

5.6 Cable Preparation

Table 5–16 Cables

Cable Type	Cable Name	Diagram	Cable Type	Cable Name	Diagram
Main circuit cable	Power cable		Control circuit cable	Signal cable	
	Ground cable			Network cable	

5.7 Mechanical Installation

5.7.1 Inspection Before Installation

Complete the following inspection items before installation.

Table 5–17 Pre-installation inspection checklist

No.	Item
1	The installation position is mechanically strong enough to bear the weight of the AC drive.
2	The load-bearing capacity of the ground and the environment meet the installation requirements.
3	Sufficient clearance is reserved for heat dissipation, including heat dissipation of other devices in the cabinet.
4	The mounting bracket (if needed) is made of flame-retardant material.
5	If the application site is exposed to metal powder, install the AC drive in a completely enclosed cabinet that has enough space to isolate the AC drive from metal powder.
6	Before installing the AC drive, install the bottom mounting bracket and guide rails in the cabinet, and prepare fixing beams with fixing holes for retaining the AC drive. Reserve sufficient clearance in the cabinet for connecting side copper busbars.
7	Keep combustible and explosive materials away from the AC drive.

5.7.2 T1 to T9 Model Installation

5.7.2.1 Dimensions of T1 and T9 Models

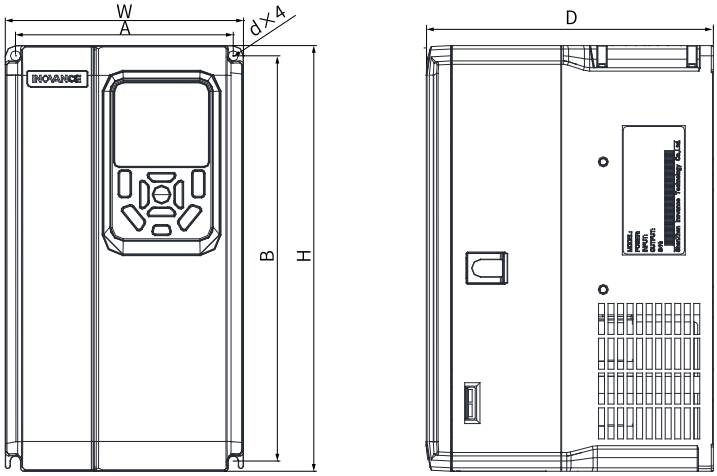


Figure 5-28 Outline dimensions and mounting dimensions of T1 to T4 models

Table 5–18 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)

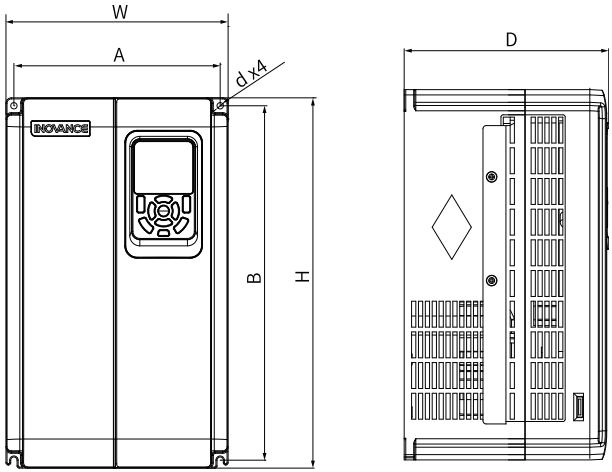


Figure 5-29 Outline dimensions and mounting dimensions of T5 to T6 models

Table 5–19 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)

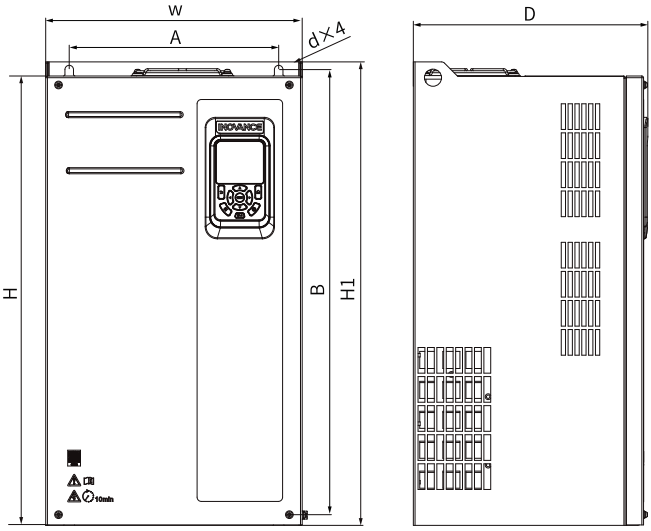


Figure 5-30 Outline dimensions and mounting dimensions of T7 to T9 models

Table 5–20 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)

5.7.2.2 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.

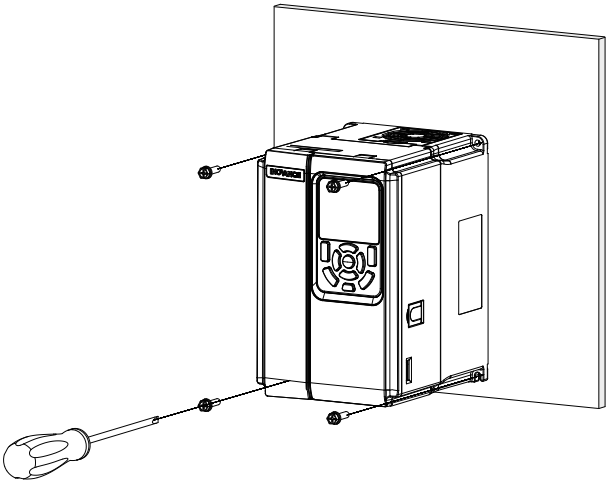


Figure 5-31 Backplate mounting of T1 to T6 models

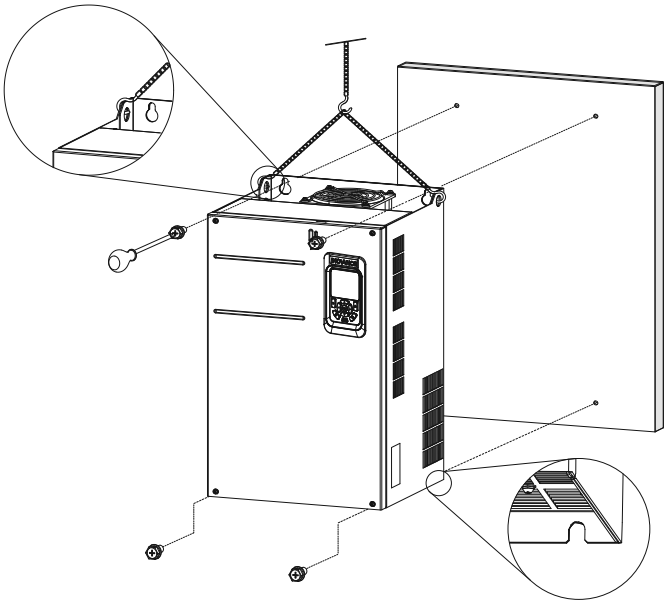
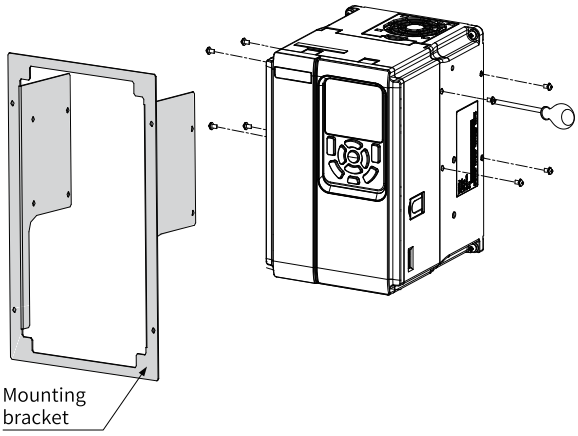


Figure 5-32 Backplate mounting of T7 to T9 models

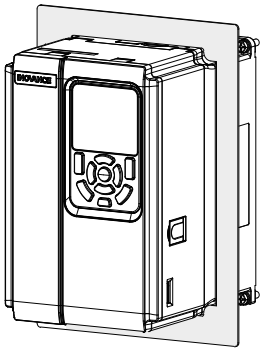
5.7.2.3 Through-Hole Mounting

T1 to T6 models

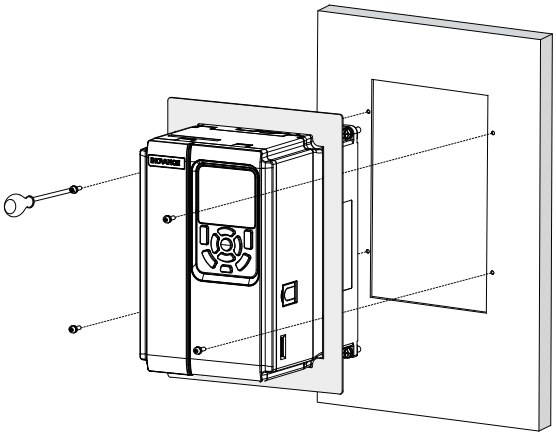
1. Install the AC drive into the mounting bracket, and then fix the screws at both sides of the bracket.



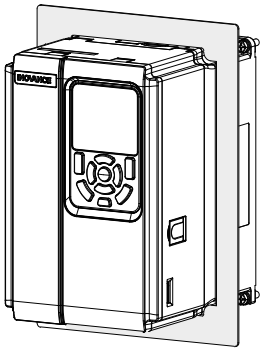
The following figure shows the AC drive with the bracket installed.



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

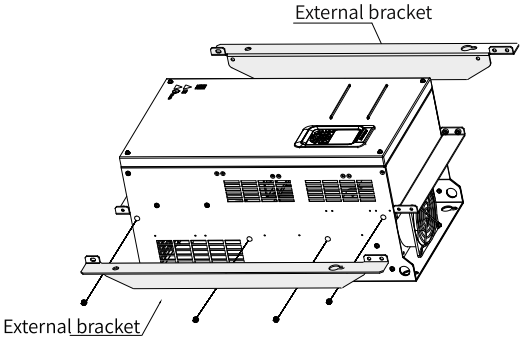


The following figure shows the AC drive installed in the cabinet.

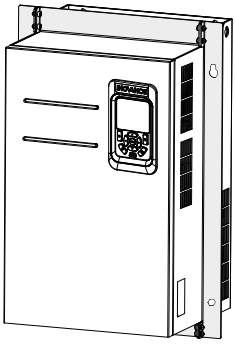


T7 to T9 models

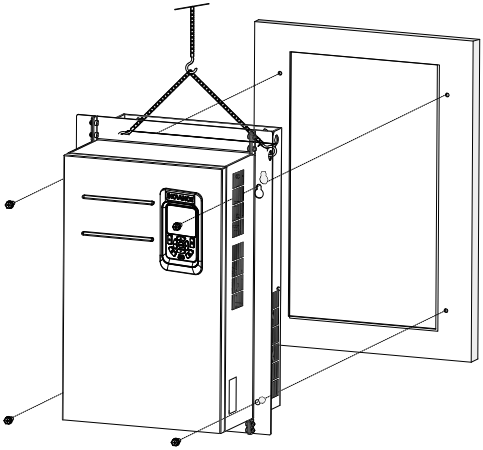
1. Fix the mounting brackets to both sides of the drive.



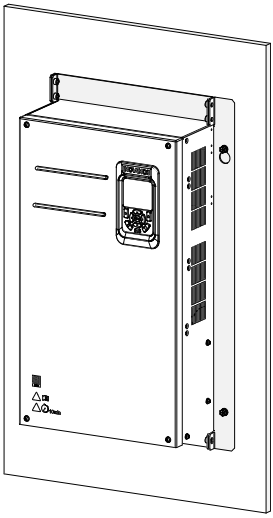
The following figure shows an AC drive with brackets mounted.



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



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



5.7.3 T10 to T12 Model Installation

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

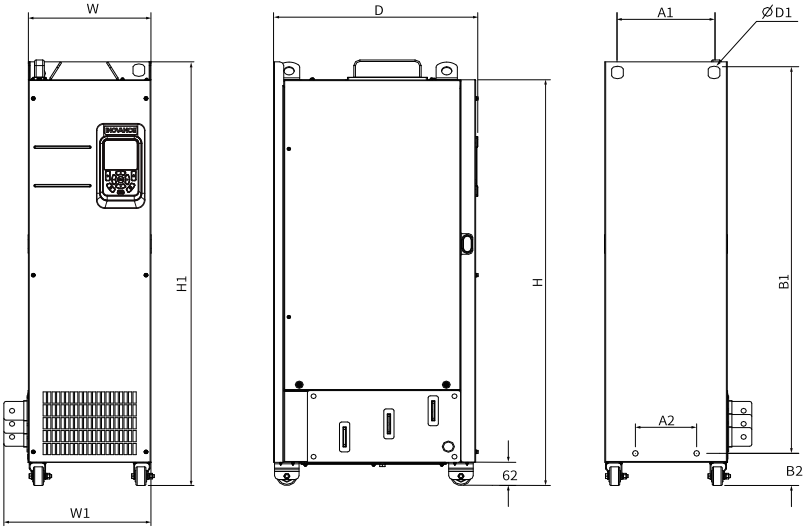


Figure 5-33 Outline dimensions and mounting dimensions of T10 to T12 models (without AC output reactor)

Table 5–21 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)

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

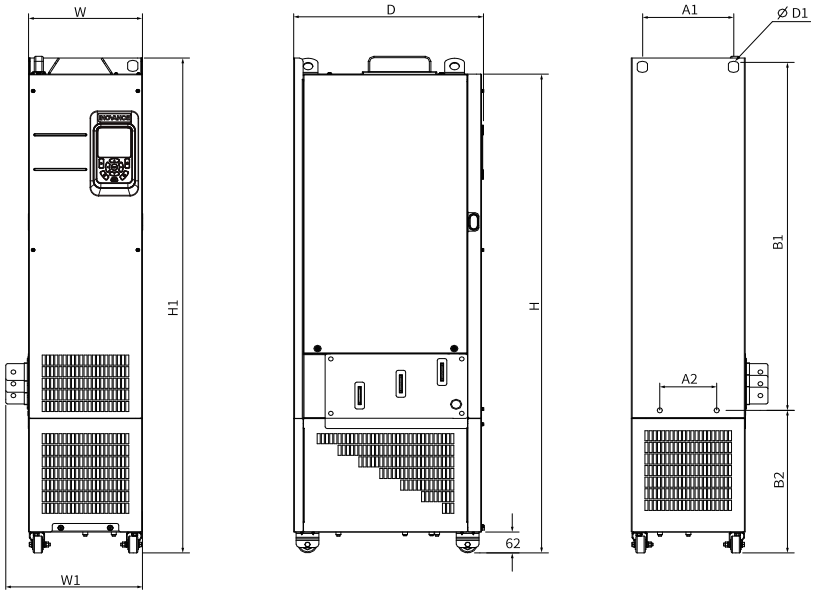


Figure 5-34 Outline dimensions and mounting dimensions of T10 to T12 models (with AC output reactor)

Table 5–22 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)

5.7.3.3 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 5–35 " on page 87* 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.

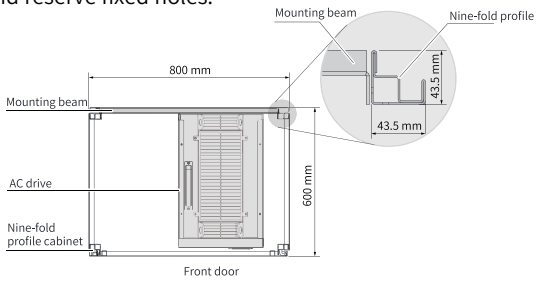


Figure 5-35 Top view of the cabinet for T11 and T12 models

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 5–36 " on page 88* . 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.

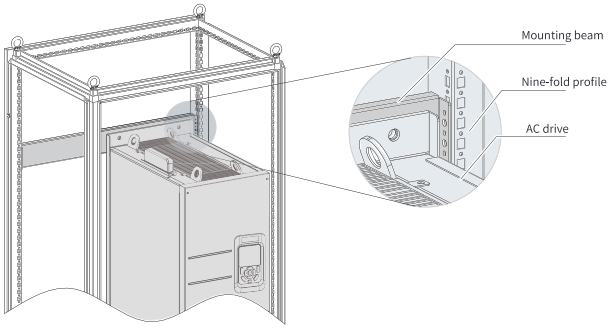


Figure 5-36 3D of the cabinet for T11 and T12 models

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 5–37 " on page 88* .

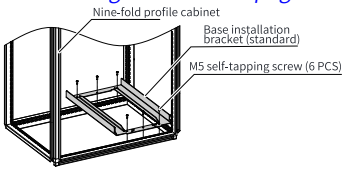


Figure 5-37 Installing the bottom mounting bracket

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 5–38 " on page 88* .

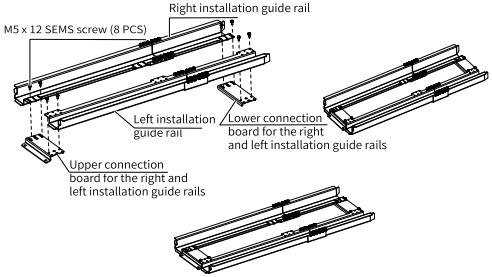


Figure 5-38 Assembling guide rails

   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 5–39 " on page 89* .

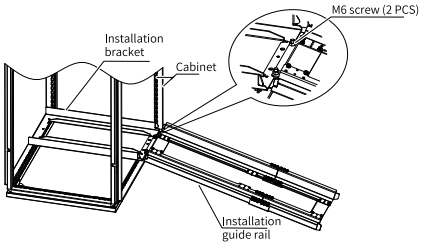


Figure 5-39 Mounting the guide rails to the cabinet

4. Remove the cover from the AC drive.
   For details, see *"5.7.3.4.1 Removing the Cover" on page 91*. 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.

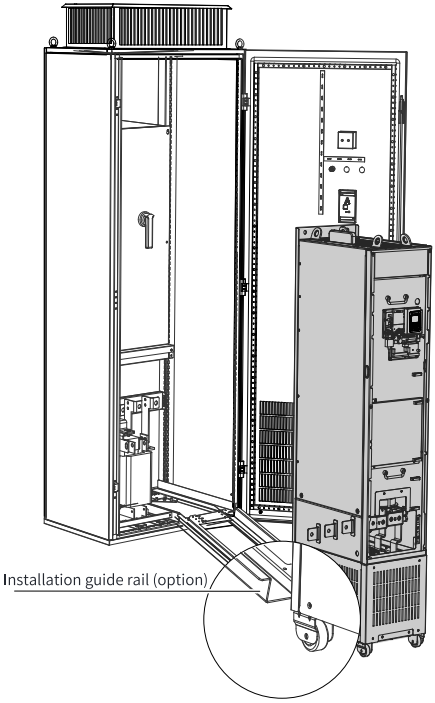


Figure 5-40 Aligning the casters with the guide rails

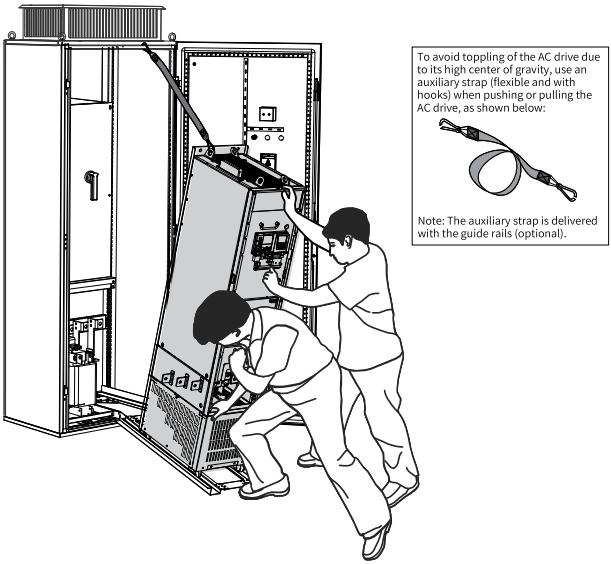


Figure 5-41 Pushing the AC drive into the cabinet

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.

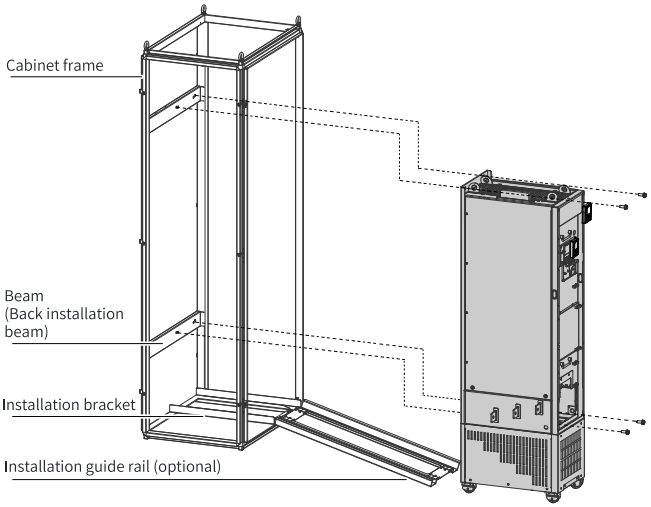


Figure 5-42 Installing the AC drive to the beam

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.

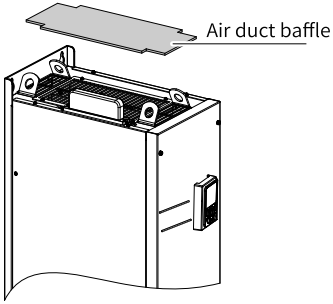


Figure 5-43 Removing the air filter paper board

5.7.3.4 Cover Removal and Installation

5.7.3.4.1 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.

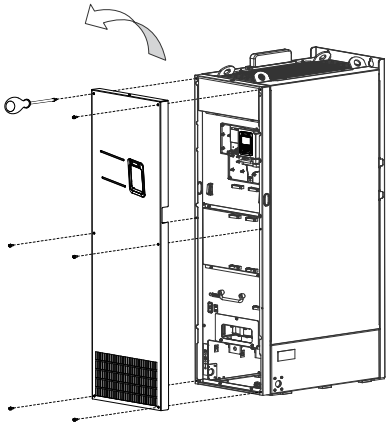
Prerequisites

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.

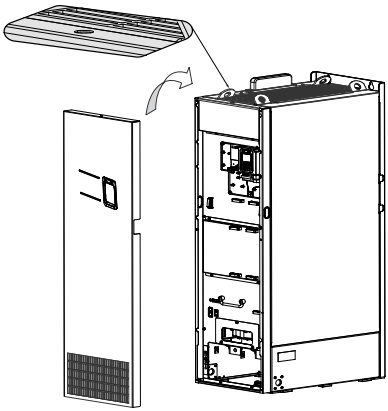


5.7.3.4.2 Installing the Cover

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.

5.7.4 T13 Installation

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

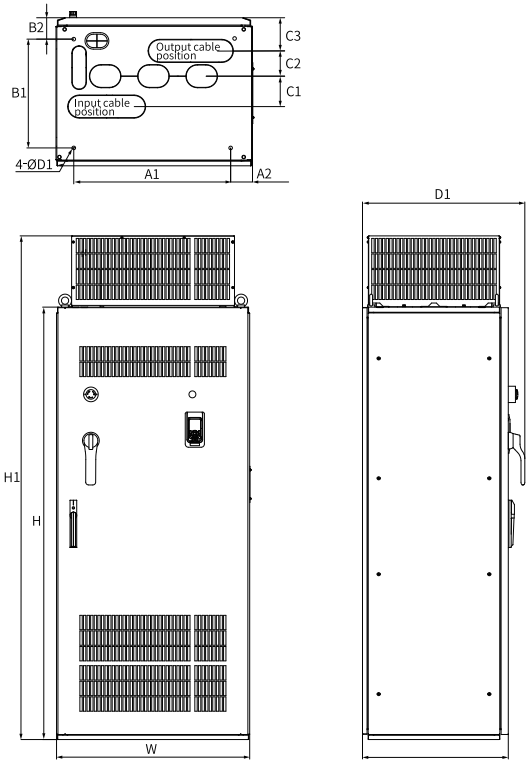


Figure 5-44 Outline dimensions and mounting dimensions of T13 models (without auxiliary power distribution cabinet)

Table 5–23 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)

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

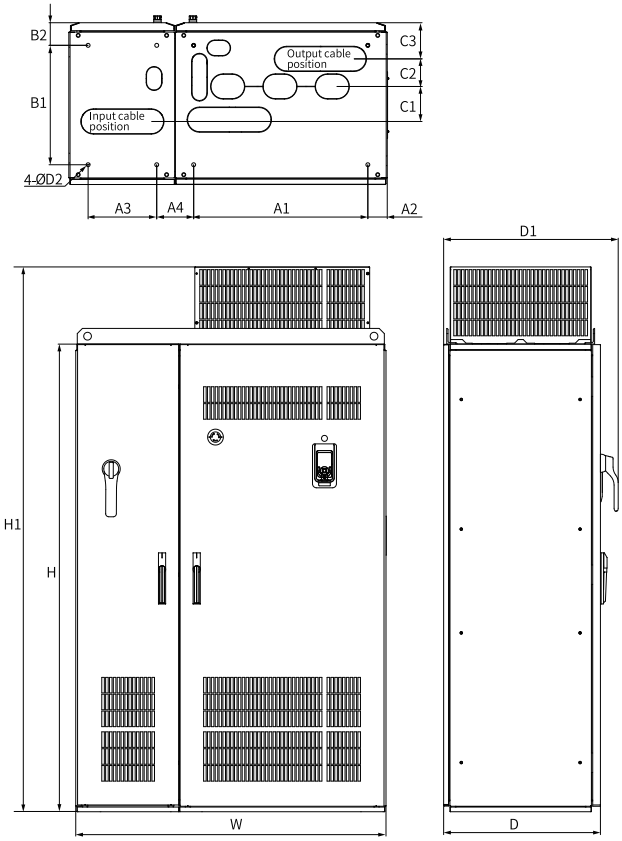


Figure 5-45 Outline dimensions and mounting dimensions of T13 models (with auxiliary power distribution cabinet)

Table 5–24 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)

5.7.4.3 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.

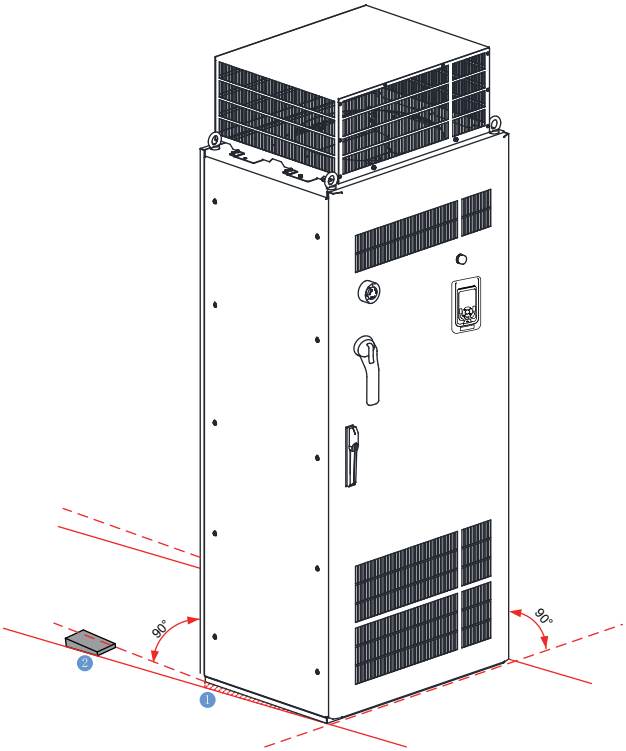


Figure 5-46 Ground requirements

5.7.4.4 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.

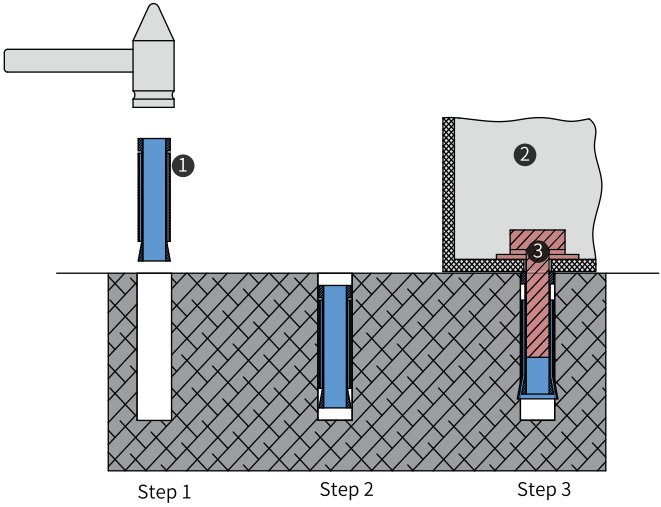


Figure 5-47 Installing an expansion screw

5.7.4.5 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.

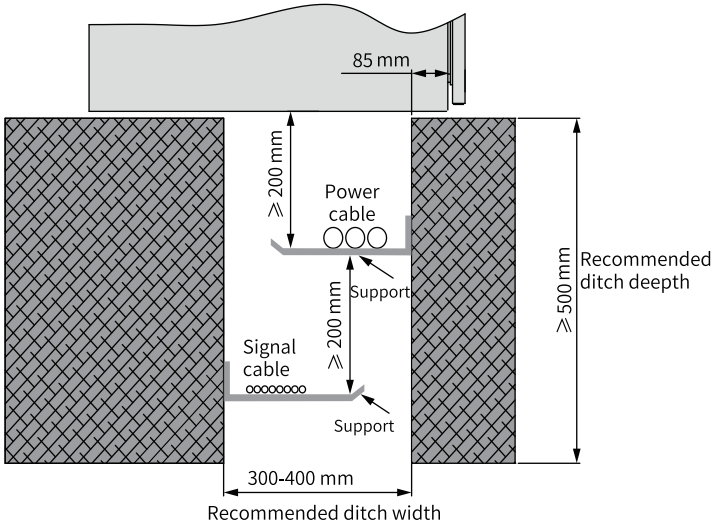
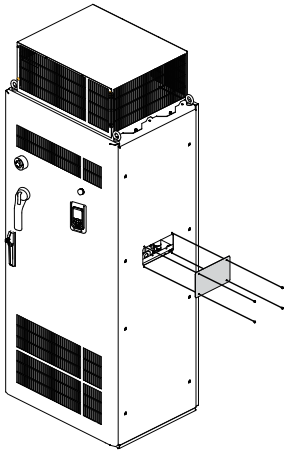


Figure 5-48 Foundation layout

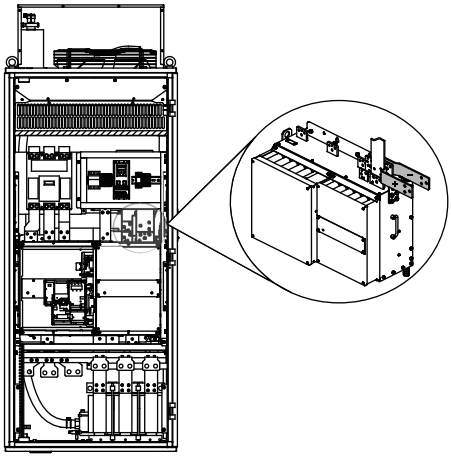
5.7.4.6 Installing the External Braking Unit

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.

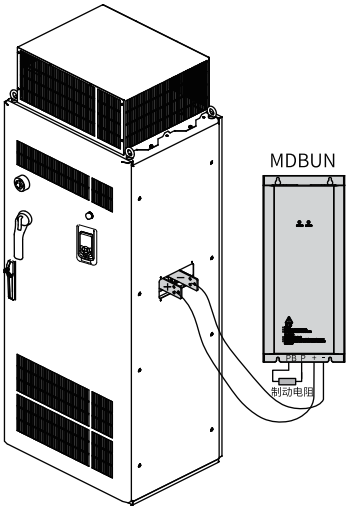


Figure 5-49 Connecting the AC drive to the external braking unit

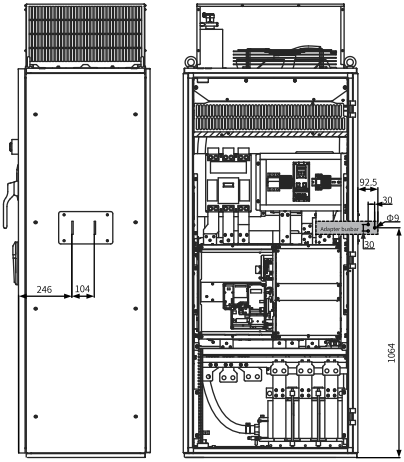


Figure 5-50 Dimensions of the position for installing the adapter busbar (unit: mm)

5.7.5 Inspection After Installation

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

Table 5–25 Post-installation inspection checklist

No.	Item	Compliance
1	The anti-tilt label is contact.	
2	The ceiling height meets the minimum requirements (for smooth ventilation). The air inlet and air outlet are clear of obstruction and have sufficient space. Sufficient space is reserved for safe passing with the cabinet door open.	
3	The wooden pallets for transportation are removed after the AC drive is delivered to the installation location.	
4	The cabinet is firmly attached to the fixing points provided.	
5	All contact protection devices (such as the guard) inside and outside the cabinet are installed.	

5.8 Electrical Installation

5.8.1 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.

5.8.2 Main Circuit Terminals

T1 to T9 models

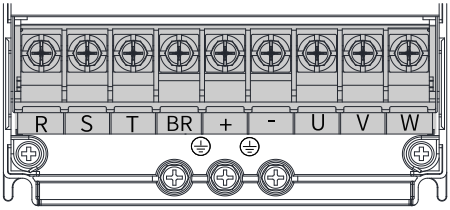


Figure 5-51 Layout of main circuit terminals for T1 to T4 models (three phase)

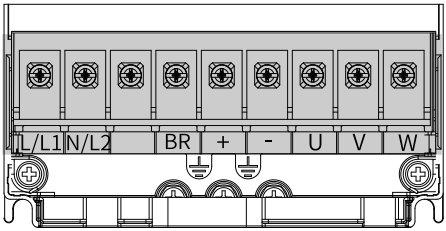


Figure 5-52 Layout of main circuit terminals for T2 models (single phase)

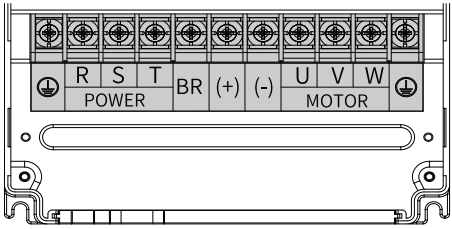


Figure 5-53 Layout of main circuit terminals for T5 to T8 models

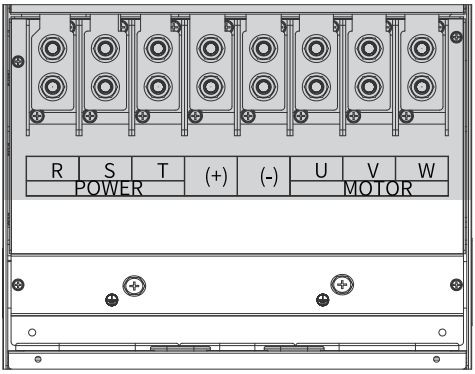


Figure 5-54 Layout of main circuit terminals for T9 models

Table 5–26 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

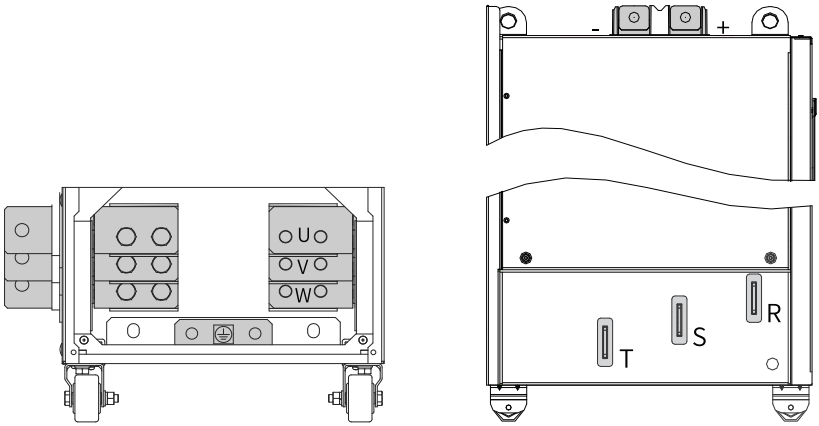


Figure 5-55 Layout of main circuit terminals for T10 to T12 models

Table 5–27 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

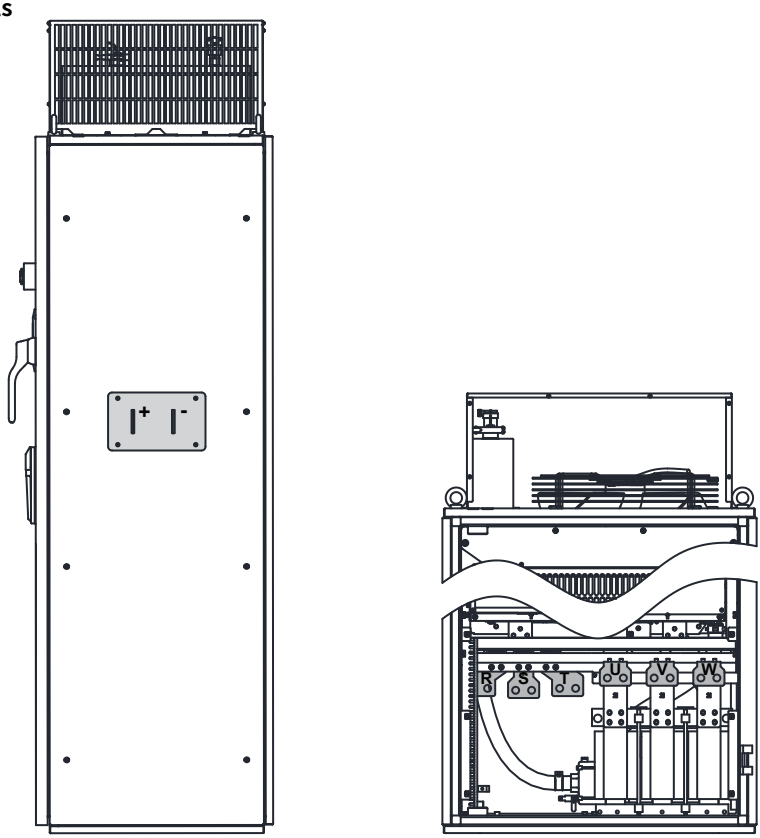


Figure 5-56 Layout of main circuit terminals for T13 models

Table 5–28 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

5.8.3 Descriptions of Control Circuit Terminals

"Table 5–31 " on page 109 shows the layout of control circuit terminals.

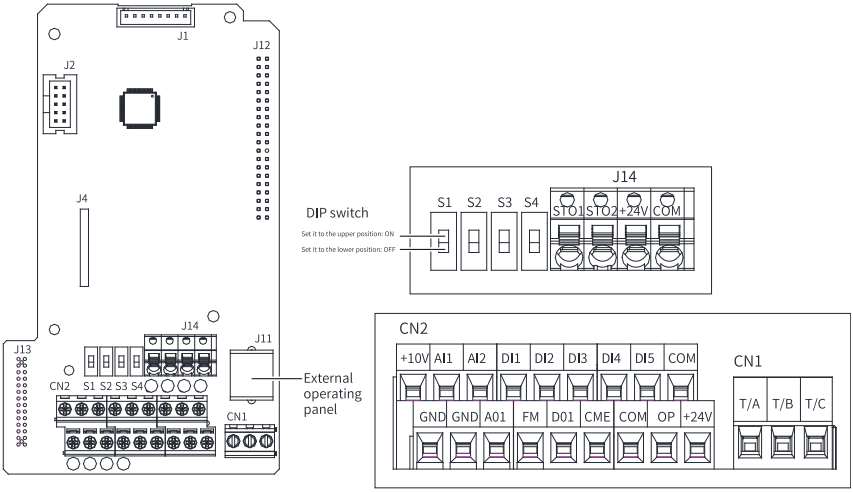


Figure 5-57 Layout of control circuit terminals

Table 5–29 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

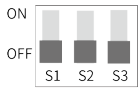
Type	Terminal Symbol	Terminal Name	Function
Digital output	DO1-CME	DO1	Photocoupler isolation and bipolar open collector output • Operating voltage range: 0 V to 24 V • Output current range: 0 mA to 50mA Note that digital output ground CME and digital input ground COM are internally insulated, but are 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 5–30 STO terminal descriptions" on page 109*.
DIP switch	S1		For details, see *"Table 5–31 DIP switch descriptions " on page 109*.
	S2		
	S3		
	S4		Current/Voltage mode selection for AO1 • On: Current output mode • Off: Voltage output mode

Table 5–30 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 5–31 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.

5.8.4 Inspection After Wiring

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

Table 5–32 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.	

5.8.5 Electrical Wiring Diagram

T1-T12 models

"Figure 5–58 " on page 111 shows a typical wiring method of T1 to T12 models.

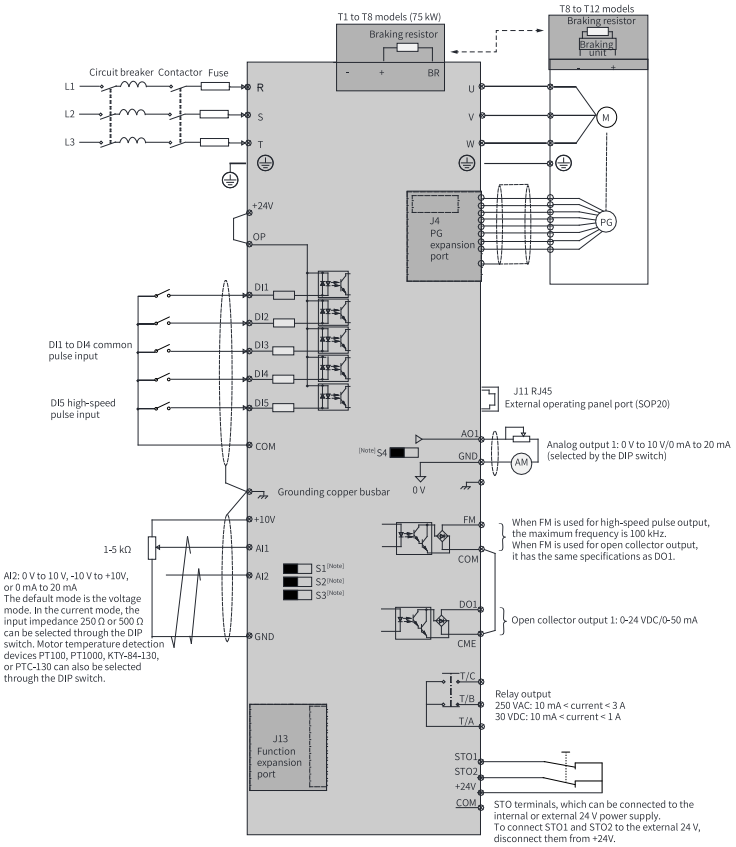


Figure 5-58 Standard wiring diagram (T1 to T12)

Note

- For details on S1 to S4 DIP switches, see *"Table 5–29 Function description of control circuit terminals " on page 107*.
- 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 5–59 " on page 112 shows the electrical connection in the cabinet.

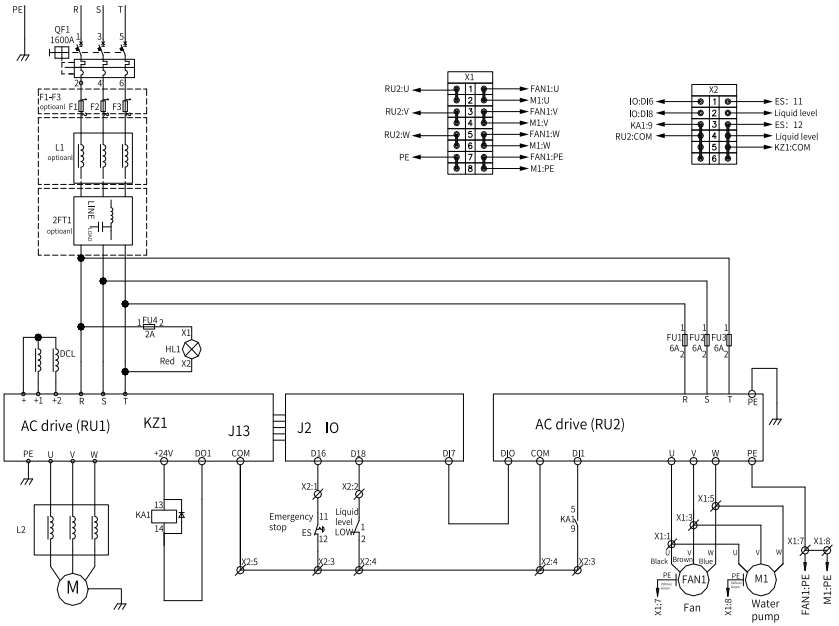


Figure 5-59 Electrical connection in the cabinet (T13)

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.

6 Wiring

6.1 Safety Cautions

Failure to comply with the following safety cautions for wiring may lead to equipment damage, physical injuries, severe accidents, or even death. Strictly follow the following safety cautions.

- Wiring must be carried out by professionals who have received necessary electrical training. Operations by non-professionals are strictly prohibited.
- Before wiring, cut off all equipment power supplies. Wait for at least the time specified on the equipment warning label after power-off so that residual voltage can discharge safely. Measure the DC voltage on the main circuit to ensure that it is within the safe voltage range. Failure to comply may result in electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board when power is on. Failure to comply will result in electric shock.
- Make sure that the AC drive and related equipment are properly grounded. Failure to comply may result in electric shock.
- Tighten terminal screws with tightening torque specified in this guide. Failure to comply may result in overheat and damage to the connection parts or even fire.
- Never connect the input power cable to output terminals of the product or other equipment. Failure to comply may result in equipment damage or even fire.
- After wiring, ensure that all cables are connected properly and no screws, washers, or exposed cables are left inside the equipment. Failure to comply may result in electric shock or equipment damage.

- When connecting a drive to a motor, ensure consistency of terminal phase sequences between the drive and the motor to prevent reverse motor rotation.
- Use cables with required diameter and shield. Properly ground one end of the shield if a shielded cable is used.
- During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an antistatic wrist strap. Failure to comply will result in damage to internal equipment circuits.
- Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment. Failure to comply will result in equipment malfunction.

6.2 STO Terminals (J14) and Wiring

Terminal arrangement and definitions

The STO function is integrated in the control module, and its terminal arrangement and definitions are as follows.

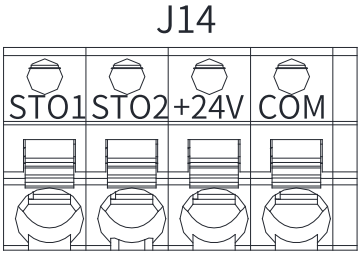


Figure 6-1 STO terminal arrangement

Table 6–1 STO terminals

No.	Mark	Name	Performance Requirements
1	STO1	STO channel 1	Internal connection: By default, STO1 and STO2 are connected to +24V by using a jumper bar 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	Positive power terminal for STO channels 1 and 2	
4	COM	Power ground terminal of STO channels 1 and 2	

Electrical specifications and connections of input circuit

- Specifications

Table 6–2 Specifications

Signal	Input State	Description
STO1	"1" or "H"	The input signal is normal.
	"0" or "L"	The STO function is enabled.
STO2	"1" or "H"	The input signal is normal.
	"0" or "L"	The STO function is enabled.

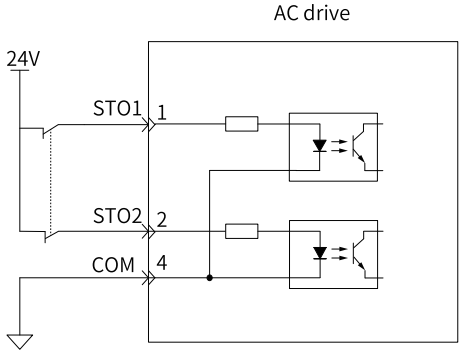
- Electrical characteristics

Table 6–3 Electrical characteristics of safety input signals

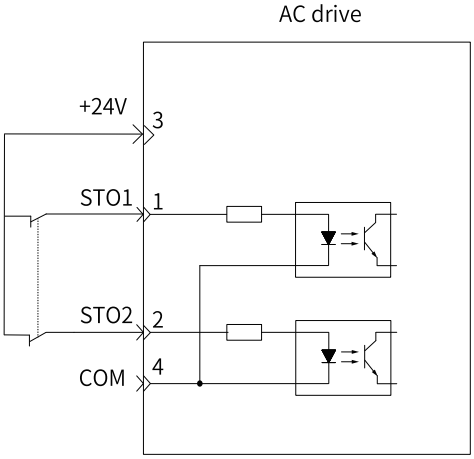
Item	Characteristics	Description
Voltage range	24 VDC (±15%)	-
Input current	4 mA (Typ.)	This is the value per channel.
Standards of logic levels	"0" < 3 V, "1" > 15 V	-
Digital input impedance	5.63 kΩ	-

- Connection example

  1. Example connection of external 24 V



  2. Example connection of internal 24 V



EMC requirements

1. To avoid short circuit between adjacent conductors, use shielded cables and connect the shield to the protective bonding circuit. Alternatively, use flat cables and connect a grounding wire between adjacent signal conductors.
2. Double-shielded or single-shielded twisted multi-pair cable is recommended.
3. Fix and ground the cable shield using a piece of conductive metal.

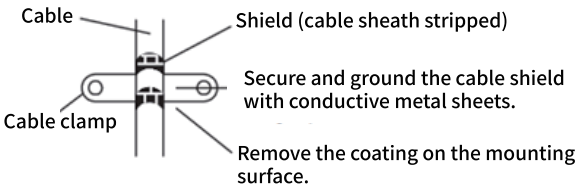


Figure 6-2 Cable clamp

4. The maximum allowable cable length between the AC drive and the activation switch is 30 m.

7 Safety Function

7.1 Safe Torque Off

7.1.1 Overview

Safe Torque Off (STO) is a safety function that complies with IEC 61800-5-2:2016. This AC drive is integrated with the STO function. After the STO function is enabled, the AC drive switches off the servo ready (RDY) signal and enters the safe state. At the same time, the drive control signal of the power semiconductor is blocked and the input motor current is cut off to prevent the AC drive from generating the torque at the motor shaft end to make the motor stop operating.

The STO function blocks the output of PWM signals to the power layer of the AC drive through external redundant hardware terminals STO1 and STO2, preventing the movement of the motor. The two +24 VDC signals must be active (high level) to enable normal operation of the AC drive. If either or both of them are at low level simultaneously, the PWM signal will be blocked.

7.1.2 Related Parameters

Parameters related to the safety function module are shown as follows.

Parameter Code	Parameter Name	Value Range	Default	Description
F9-79	Restoration mode of STO activation state	0: Manual reset 1: Automatic reset	1: Automatic reset	When both STO1 and STO2 are disconnected, the system enters the STO activation state. When STO1 and STO2 are restored, the parameter determines how the system enters the normal preparation state.
U0–96	STO status word	0 to 65535	0	It displays the monitored STO status word. Bit 0: STO1 disconnection flag. 1: STO1 disconnected; 0: STO1 connected Bit 1: STO2 disconnection flag. 1: STO2 disconnected; 0: STO2 connected Bit 2: DO flag 1: DO output; 0: DO not output Bit 3 STO state display 1: STO activated; 0: STO deactivated Bit 4 to Bit 15: Reserved

7.1.3 Function Triggering

To correctly use the input signals of the safety module, ensure that the system is correctly connected. If either the STO1 or STO2 signal is disconnected, the system enters the safe state.

Table 7–1 STO function

STO2 Input	STO1 Input	PWM State	System State	Reset
H	H	Normal	Normal	-
H	L	Blocked	Err47.2; inconsistent inputs	Manual reset
L	H	Blocked	Err47.2; inconsistent inputs	Manual reset
L	L	Blocked	STO activated	Reset automatically or manually as defined by F9-79.

Note

- H (1): The corresponding input is connected to the 24 V voltage.
- L (0): The corresponding input is disconnected from the 24 V voltage.

7.1.4 Time Sequence Diagram

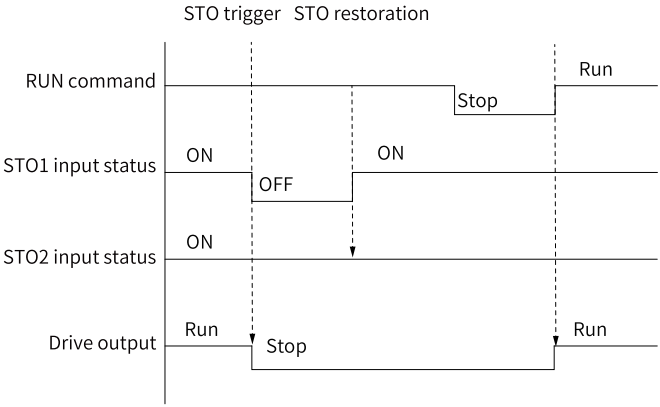


Figure 7-1 Safety function (STO1 trigger changed to OFF)

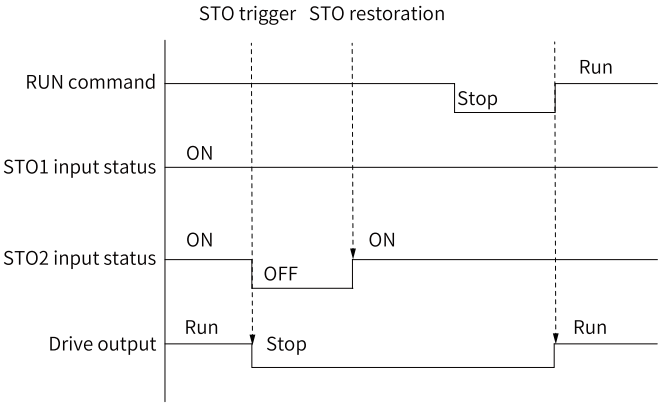


Figure 7-2 Safety function (STO2 trigger changed to OFF)

8 Commissioning, Operation, and Maintenance

8.1 Commissioning, Operation, and Maintenance

Basic requirements

- Technical staff must be trained to understand the requirements and principles of designing and operating safety-related systems.
- Execution and maintenance personnel must be trained on the requirements and principles of designing and operating safety-related systems.
- Operators must be trained to understand the requirements and principles of designing and operating safety-related systems.
- The safety-related circuit on the control board that fails to operate must be replaced with a new one as it is not repairable.

Commissioning checklist

IEC 61508, EN IEC 62061, and EN ISO 13849 require the equipment to pass acceptance tests to verify the operation of safety functions. Acceptance testing must be performed at the following stages:

- Initial startup of the safety functions
- After any changes related to safety functions (wiring, assembly, settings, or other related operations)
- After any maintenance work related to safety functions is completed

Acceptance testing of safety functions must be performed by personnel with safety function expertise and must be documented and signed by the testers. Technical staff and operation, maintenance, and repair personnel must be trained to understand the requirements and principles of designing and operating safety-related systems.

The signed acceptance test report must be kept in the log of the equipment. The report shall include documentation of start-up activities and test results, fault reports, and troubleshooting records. Any new acceptance tests due to changes or maintenance shall be recorded in the log.

Verification and confirmation

- **Content**
  The following describes how to verify and confirm implemented safety functions.

  Document proofs will be available for verification and confirmation to verify that the implementation meets specified safety requirements.

- **SIL/PL level compliance**
  Verification of the functional safety system proves and confirms that the implemented safety system meets the requirements defined for each stage.

The required SIL/PL level of an implemented system is verified by using the specific safety calculator software.

- **Verification program**
  Inovance ensures that all the required safety functions are properly verified and confirmed.

- Never assume that the system is safe before verifying all the safety functions.
- Perform acceptance test for every safety function.

The acceptance test must be performed by using the following startup checklist at the following stages:

- Initial startup of the safety functions
- After any changes related to safety functions (wiring, assembly, settings, or other related operations)
- After any maintenance work related to safety functions is completed
  Acceptance testing must include the following steps at least:

  1. Develop an acceptance test plan.
  2. Test whether all the entrusted functions can operate properly.
  3. Test whether all the inputs in use can operate properly.
  4. Test whether all the outputs in use can operate properly.
  5. Record all the executed acceptance tests.
  6. Ask the testers to sign and archive the acceptance test report for further reference.

- **Acceptance test report**
  You must store the signed acceptance test report in the log of the equipment. According to relevant standards, the report must contain the following items:
  - Safety program description (including one diagram)
  - Description and revision of safety components used in the safety program
  - List of all the safety functions used in the safety program
  - List of all safety-related parameters and their values (list of all parameters not related to safety functions if STO is enabled on the drive)
  - Documentation of startup activities, fault reports, and fault solutions
  - Confirmation of the test result, checksum, test date, and tester for each safety function
- **Safety function verification**

Once complete configuration and cabling are completed for the safety functions and the startup safety check is completed, execute the following functional testing program for each safety function:

- Set the system to the operational state when a safety function is requested.
- Ensure that the confirmation method is set to a proper program (such as manual or automatic confirmation).
- Request to activate a safety function using the specified triggering device.
- Verify that all the required functions are implemented.
- Record the test results in the acceptance test report.
- Sign and archive the acceptance test report.

- **Acceptance test checklist**

Table 8–1 Acceptance test checklist

Step	Action	Result
1	Ensure that the AC drive runs and stops freely during commissioning.	
2	Stop the AC drive (if under operation), switch the input power supply off, and isolate the drive from the power cable through a disconnector.	
3	Check the STO circuit connections (inputs of STO1 and STO2 and 24 V terminals) based on the circuit diagram.	
4	Check whether the shield of the STO input cable is grounded to the drive frame.	

Step	Action	Result
5	Switch the disconnector off and then switch the input power supply on.	
	Test the STO1 or STO2 signal when the system stops: 1. Awake the STO function by disconnecting both the STO1 and STO2 signals. Check whether the AC drive enters the STO activated state and displays STO. 2. Send a start command to the AC drive. Ensure that the AC drive does not respond and the motor stays standstill. 3. The STO1 and STO2 channel signals are restored and the system is restored to the normal state according to the setting of F9-79. Run the ON/RUN command on the AC drive, and check whether the motor operates properly.	
	Test the STO1 channel signal when the system stops: 1. Awake the STO function by disconnecting the STO1 channel input signal (low state or open-circuit). Check whether the AC drive displays the fault code "E047.2". 2. Send a start command to the AC drive. Ensure that the AC drive does not respond and the motor stays standstill.	
	The STO1 channel signal is restored and the fault is cleared. Run the ON/RUN command on the AC drive, and check whether the motor operates properly.	
	Test the STO2 channel signal when the system stops: 1. Awake the STO function by disconnecting the STO2 channel input signal (low state or open-circuit). Check whether the AC drive displays the fault code "E047.2". 2. Send a start command to the AC drive. Ensure that the AC drive does not respond and the motor stays standstill.	
	The STO2 channel signal is restored and the fault is cleared. Run the ON/RUN command on the AC drive, and check whether the motor operates properly.	

Step	Action	Result
6	Test the STO1 or STO2 signal when the system is under operation: 1. Awake the STO function by disconnecting both the STO1 and STO2 signals. Check whether the AC drive enters the STO activated state and displays STO. In this case, the AC drive immediately stops output. The motor then coasts to stop based on the mechanical inertia. 2. Send a start command to the AC drive. Ensure that the AC drive does not respond and the motor stays standstill. 3. The STO1 and STO2 channel signals are restored and the system is restored to the normal state according to the setting of F9-79. Run the ON/RUN command on the AC drive, and check whether the motor operates properly.	
	Test the STO1 channel signal when the system is under operation: 1. Start the AC drive and ensure that the motor operates properly. 2. Awake the STO function by disconnecting the STO1 channel signal. Check whether the AC drive displays the fault code "E047.2". In this case, the AC drive immediately stops output. The motor then coasts to stop based on the mechanical inertia.	
	The STO1 channel signal is restored and the fault is cleared. Run the ON/RUN command on the AC drive, and check whether the motor operates properly.	
	Test the STO2 channel signal when the system is under operation: 1. Start the AC drive and ensure that the motor operates properly. 2. Awake the STO function by disconnecting the STO2 channel signal. Check whether the AC drive displays the fault code "E047.2". In this case, the AC drive immediately stops output. The motor then coasts to stop based on the mechanical inertia.	
	The STO2 channel signal is restored and the fault is cleared. Run the ON/RUN command on the AC drive, and check whether the motor operates properly.	
7	Record and sign the acceptance test report to prove that the safety function is safe and the equipment can be put into operation.	

9 Maintenance and Inspection

9.1 Routine Inspection Items

9.1.1 Daily Inspection Items

The influence of the ambient temperature, humidity, dust, and vibration will cause aging of components inside the AC drive, which will result in potential faults or shorter service life of the AC drive. Therefore, routine maintenance on the device is required. The maintenance interval must be shortened when the drive is used in environments suffering from high ambient temperature, frequent startup and stop, violent fluctuation in the AC power supply and the load, strong vibration or shock, and intrusive and corrosive substances such as dust, metal dust, and hydrochloric acid.

Check the following items daily to ensure a proper operation of the device. It is recommended to make a copy of this checklist and sign the "Checked" column after each inspection.

Item	Content	Solution	Checked
Motor	Check for unusual vibration or noise.	• Check whether the mechanical connection is normal. • Check whether motor phase loss occurs. • Check whether fixing screws of the motor are tightened.	
Fan	Check whether the fan operates normally.	• Check whether the fan on the device side is operating. • Check whether the fan on the motor side operates properly. • Check whether the ventilation duct is blocked. • Check whether ambient temperature is within the specified range.	
Installation environment	Check the cabinet and cable trays.	• Check for insulation damage of input and output cables. • Check whether the mounting bracket is shaking. • Check whether the copper bar and cable terminals are loose or corroded.	

Item	Content	Solution	Checked
Load	Check whether the operating current of the drive exceeds the rated current of the drive and motor.	• Check for settings of motor parameters. • Check whether the motor is overloaded. • Check whether the mechanical vibration is too strong (< 0.6 g under normal conditions).	
Input voltage	Check whether the power supply voltage between the main circuit and control circuit is normal.	• Check whether the input voltage is within the permissible range. • Check whether a heavy load is being started around the drive.	

9.1.2 Regular Checklist

Check the items listed in the following table every one or two years. Determine the actual inspection cycle based on actual application and operating environment. Regular maintenance helps detect product function deterioration and damage.

Make a copy of the following checklist and sign the "Checked" column after each inspection.

Do not perform inspection or connection work with power on. Failure to do so may result in an electric shock. Cut off the power supplies of all equipment before wiring or repair. 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 safety voltage range. Failure to do so may result in an electric shock.

Item	Content	Solution	Checked
AC drive	Check for wastes, dirt and dust on the surface of the AC drive.	• Check whether the controller cabinet has been powered off. • Use a vacuum cleaner to suck up waste and dust to prevent direct contact with the components. • For stubborn surface dirt, wipe up the dirt with a piece of soft cloth immersed in alcohol.	
Cables	• Check whether power cables and the connectors are discolored. • Check whether the insulation is aged or cracked.	• Replace the cracked cable. • Replace the aged or cracked terminal.	

Item	Content	Solution	Checked
Peripherals of the electromagnetic contactor	• Check whether the contactor closes tightly or generates unusual noise during closing. • Check whether short circuit, water seepage, swelling, or cracking occurs on any peripheral device.	Replace the abnormal components.	
Air duct	• Check whether the air duct and heatsink are clogged. • Check whether the fan is damaged.	• Clean the air duct. • Replace the fan.	
Control circuit	• Check whether control components are in poor contact. • Check whether terminal screws are loose. • Check whether the insulation of the control cable is cracked.	• Clean up the surface of control circuit cables and terminals. • Replace the damaged or corroded control cables.	

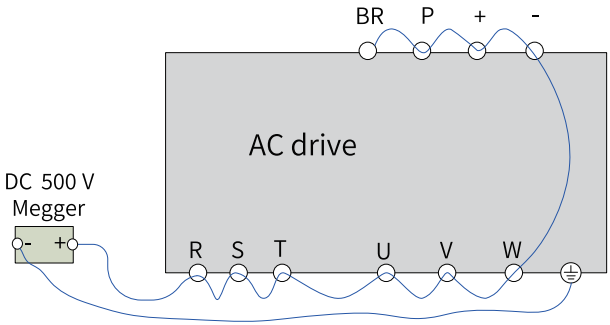
9.2 Main Circuit Insulation Test

Danger

The high voltage (> 500 V) test need not be performed again because it has been completed before delivery.

Before testing, remove the VDR screw and disconnect the VDR.

Before measuring insulation resistance with a megameter (500 VDC megameter recommended), disconnect the main circuit from the AC drive first. Do not measure the control circuit insulation resistance with an insulation resistance meter.



The insulation resistance measured must be greater than 5 MΩ.

Caution

Disconnect the optional grounding screw of VDR before performing a voltage resistance test. Otherwise, the test may fail.

9.3 Replacing Quick-Wear Parts

9.3.1 Service Life of Quick-Wear Parts

The quick-wear parts of the AC drive include the cooling fan and filter electrolytic capacitor. Their service life is closely related to the ambient environment and maintenance condition. Generally, the service life is as follows.

Name	Service Life Time[Note]
Fan	⩾ 5 years
Electrolytic capacitor	⩾ 5 years
Note: The service life indicates the time when the part is used in the following conditions. You can determine when to replace the part according to the actual operating time. Ambient temperature: 40°C Load rate: 80% Operating rate: 24 hours per day	

9.3.2 Replacing the Fan

Cooling fans

- The fan may be damaged due to worn-out bearing or aging blades.
- Criteria for determining fan damage: cracks on the blade, unusual vibration noise upon start, and improper operation of fan blades
- Replacement of the fan: Press the snap-fit joint on the fan plastic cover and pull the fan outward. After replacing the fan, ensure the fan blows the air upwards.

Table 9–1 Number of cooling fans

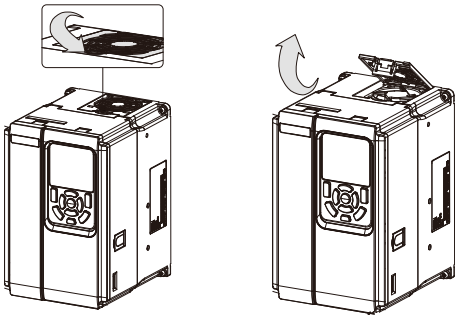
Structure	Fan Quantity
T1 (0.4 kW to 1.1 kW)	/
T1 (1.5 kW to 3.0 kW) T2 T3 (7.5 kW) T5 and T7	1

Structure	Fan Quantity
T3 (11 kW) T4 T8 and T10	2
T11 and T12	3
T13	2

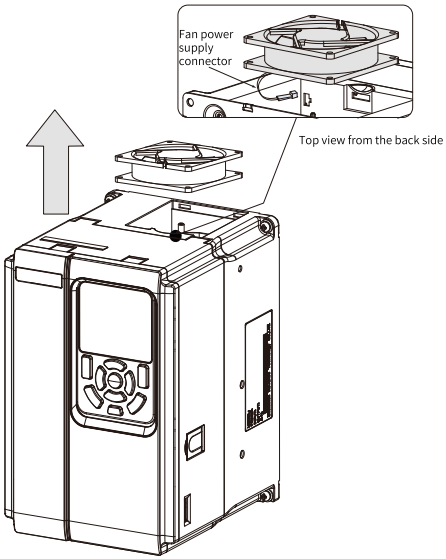
Removing and installing fans of T1 to T6 models

Removing the fan

1. Press the snap-fit joint on the fan cover and remove the cover.



2. Pull the fan upwards and unplug the power cable connector from the socket.

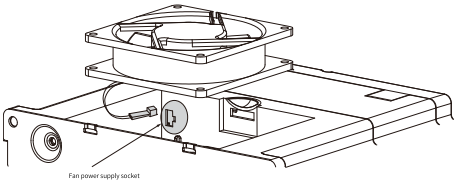


Installing the fan

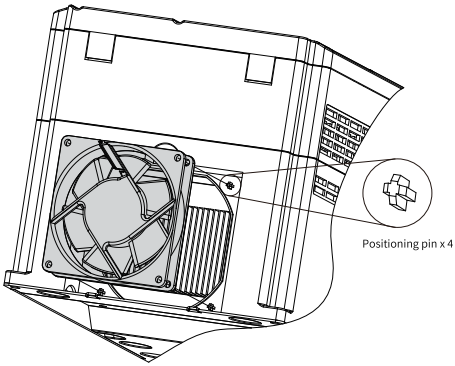
Note

- Install the fan in the reverse order of removal and ensure the correct direction of the fan.
- The fan should rotate clockwise to blow air into the motor air duct when viewed from the rear cover of the fan.

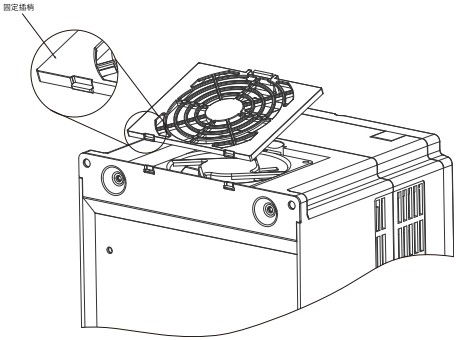
1. Plug the fan power cable connector to the socket.



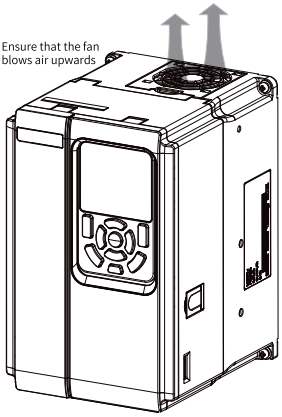
2. Install the fan into the drive, with the four fixing holes at the bottom of the fan aligned with the positioning pins.



3. Insert the two small snap-fit joints on the fan cover into the slot and then press down to fix the snap-fit joints.



4. After replacing the fan, ensure the fan blows the air upwards.



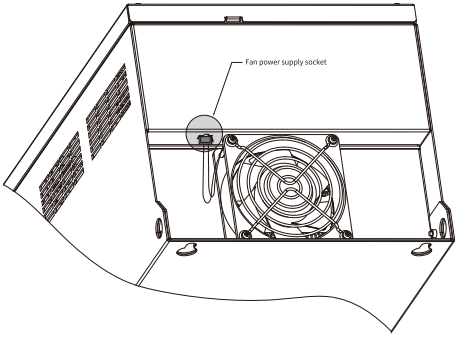
Removing and installing cooling fans of T7 to T9 Models

Note

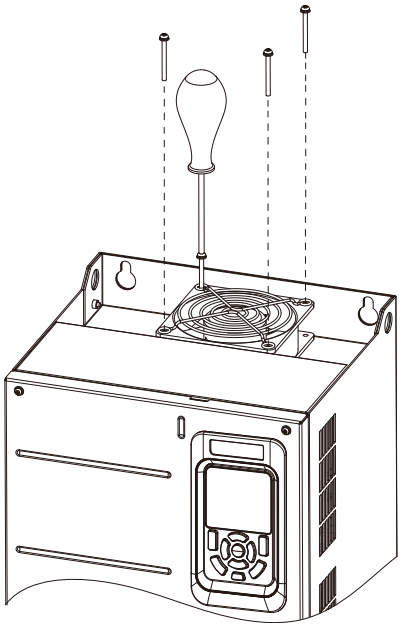
The number and location of cooling fans vary with product models, but the fans are removed and installed in the same way.

Removing the fan

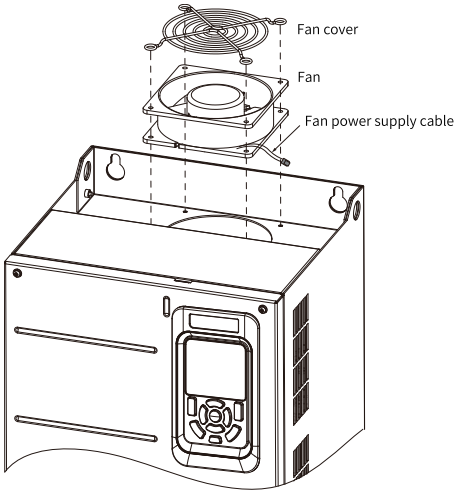
1. Disconnect the power cable connector of the fan (top view).



2. Remove the four fixing screws on the fan cover with a screwdriver.



3. Remove the fan and fan cover from the drive.

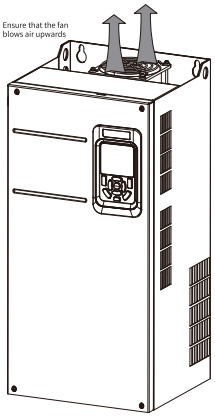


Installing the fan

1. Install the fan in the reverse order of removal and ensure the correct direction of the fan.

2. Align the fixing holes of the fan cover and the fan with those on the drive during installation.

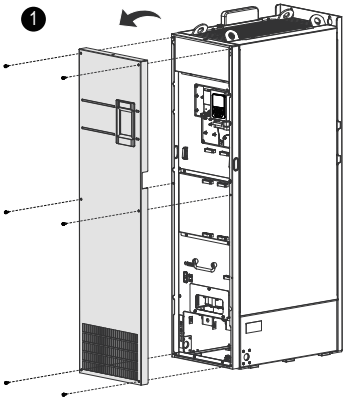
3. After replacing the fan, ensure the fan blows the air upwards.



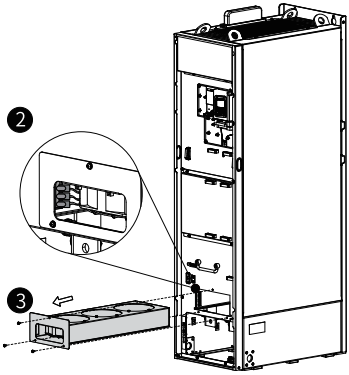
Removing and installing cooling fans of T10 to T12 models

Removing the fan

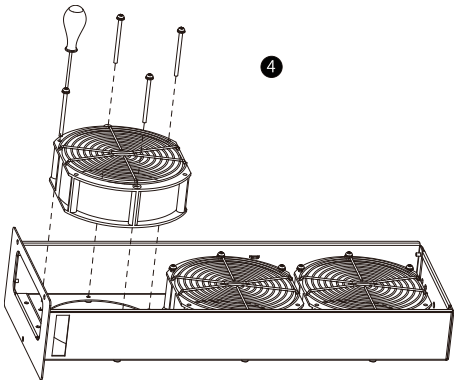
1. Remove the six fixing screws on the cover. Then, hold the cover with both hands and lift it up in the direction indicated by the arrow to remove the cover.



2. Disconnect the power cable connectors of all fans. Remove the three fixing screws from the fan box and pull out the fan box in the direction indicated by the arrow.



3. Remove the four fixing screws from each fan cover and remove the fan.

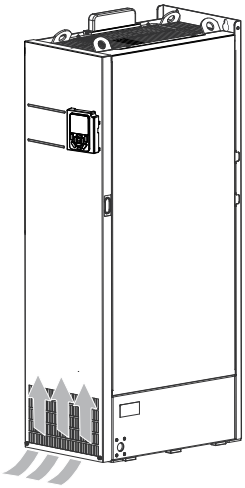


Installing the fan

1. Install the fan in the reverse order of removal and ensure the correct direction of the fan.

2. Align the fan box with the rail and push it into the drive.

3. Connect the power cable connector of the fan and fasten the fan box. After replacing the fan, ensure the fan blows the air upwards.



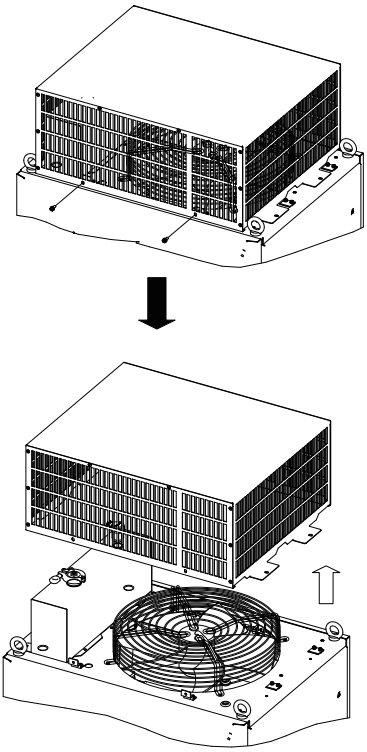
Removing and installing the fan of T3 models

Note

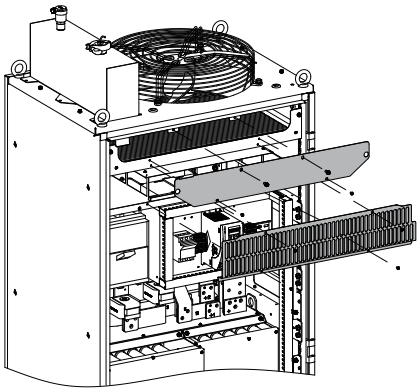
T13 models have a top-mounted fan and a cabinet-mounted AC drive fan. Their removal and installation are described below.

Removing the fan on the top

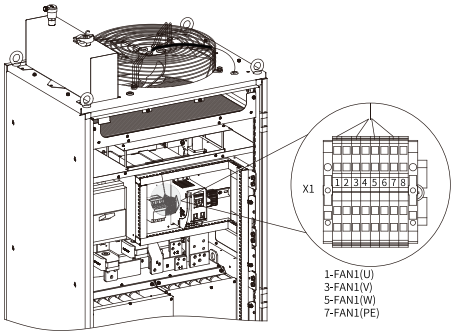
1. Remove the two fixing screws from the top cover at the front, slide forward the protective cover with two hands along the guide for about 20 mm, and lift it up to remove the protective cover.



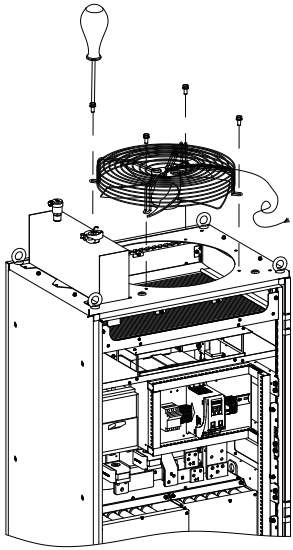
2. Remove the baffle plate as shown in the figure.



3. Disconnect the cables connecting the X1 terminal block to the top-mounted fan and pull out the cables from the wiring tray. Remove cables of terminals 1, 3, 5, and 7 only.



4. Remove the four fixing screws from the top-mounted fan and take out the fan from the AC drive.



Installing the fan on the top

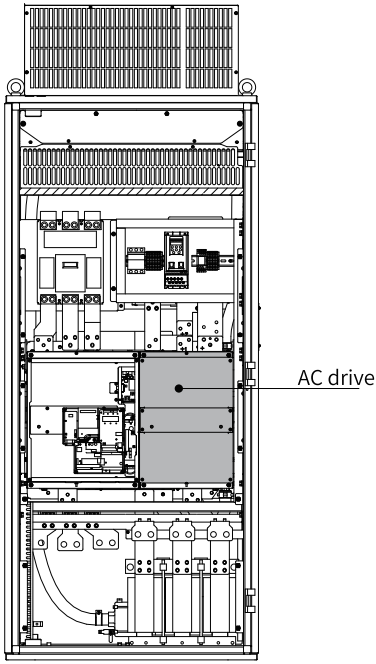
1. Install the fan in the reverse order of removal.

2. Wire fan cables according to the wiring diagram.

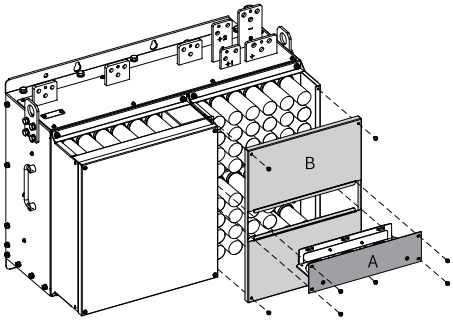
3. Connect the cables to terminals 1, 3, 5, and 7 of the X1 terminal block.

Removing the AC drive fan in the cabinet

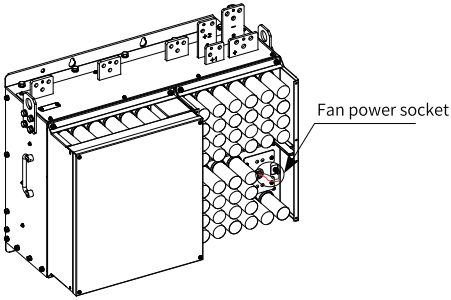
1. Open the cabinet door to find the AC drive position, which is shown in the following figure.



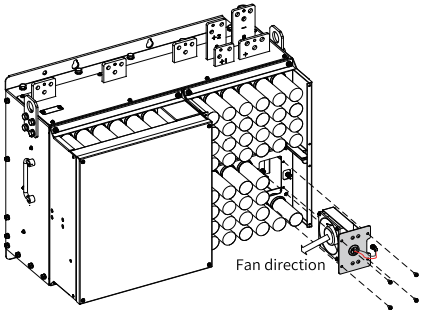
2. Remove baffle plates A and B in sequence from the AC drive.



3. Unplug the fan power cable connector from the socket.



4. Remove the four fixing screws from the fan and take out the fan from the AC drive. Note that the fan direction is from right to left.



Installing the AC drive fan in the cabinet

1. Install the fan in the reverse order of removal and ensure the correct direction of the fan.

2. When installing the fan to the AC drive, align the mounting holes as indicated by the dotted lines in removal step 4.

3. After replacement, check the air flow direction.

9.3.3 Replacing the Filter Electrolytic Capacitor

- Possible damage causes: input power supply in poor quality, high ambient temperature, frequent load jumping, and electrolytic aging

- How to determine whether the capacitor needs to be replaced: 1) Check whether there is liquid leakage. 2) Check whether the safety valve has protruded. 3) Measure the static capacitance and the insulation resistance.
- Replacement: As the capacitor involves the internal parts, never replace the capacitor by yourself. Contact Inovance for replacement.

9.4 Storage and Warranty

Storage

To store the AC drive properly, observe the following:

- To store the drive, pack the drive with the original packing box provided by Inovance.
- Do not expose the product to moisture, high temperature, or direct sunlight for a long time.
- The electrolytic capacitor will deteriorate after long-term storage. Therefore, the AC drive must be switched on once for at least 5 hours every 6 months. The input voltage must be increased slowly to the rated value by using a voltage regulator. Contact Inovance for technical support if necessary.

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.

10 Troubleshooting

See the following table for the causes and solutions of failures. If the problem cannot be solved through the solutions in the following table, contact the agent or Inovance for technical support.

Table 10–1 Fault causes and solutions

Fault Code	Cause	Solution
STO	STO1/STO2 is not connected to 24 V input voltage.	Ensure that both STO1 and STO2 are connected to the 24 V input voltage signal.
E47.02	The input states of STO1 and STO2 are inconsistent.	1. Ensure that STO1 and STO2 voltage disconnection requests are triggered at the same time. 2. The input circuit is abnormal. After disconnecting the 24 V signal, an STO input signal is still in "High" state. In this case, contact Inovance for technical support.
E47.03	The OV/UV of the 5 V power supply or UV of the 1.2 V power supply is detected.	Recover the power supply to normal state. Contact Inovance for technical support.
E47.04	The STO input circuit is abnormal.	To fix the input circuit fault, contact Inovance for technical support.
E47.05	The STO pre-charge circuit is abnormal.	To fix the pre-charge circuit fault, contact Inovance for technical support.
E47.07	The flash is abnormal.	Contact Inovance for technical support.
E47.08	The RAM detection is abnormal.	Contact Inovance for technical support.

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