



MD520 Series

General-Purpose AC Drive

Safety Function Guide



Industrial
Automation



Intelligent
Elevator



New Energy
Vehicle



Industrial
Robot



Rail
Transit



Data code 19011795A03

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 asynchronous AC induction motors (IM), permanent magnet synchronous motors (PMSM), and synchronous reluctance motors (SynRM). The MD520 provides the safe torque off (STO) function, limp mode, position control, and tension control functions. The STO function can be controlled through external terminals (hereinafter referred to as local trigger).

This guide describes the safety information, mechanical and electrical installation, commissioning and maintenance guidance, and safety-related parameters of the MD520 series AC drive.

Note

T1 to T12 models of the MD520 series AC drive support the STO function while T13 models do not.

More Information

Name	Date 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, fault codes, and others.
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.

Name	Date Code	Description
MD520 Series General-Purpose AC Drive Commissioning Guide	19011715	This guide describes the commissioning tools, commissioning flows, and specific commissioning steps, as well as troubleshooting, fault codes, and parameters related to the AC drive.
MD520 Series General-Purpose AC Drive Communication Guide	19011716	This guide describes the communication mode, communication networking, and communication configuration of the product.
MD520 Series General-Purpose AC Drive Function Guide	19011717	This guide presents function application, 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
September 2024	A03	Modified the following content: • Correct minor errors.
August 2024	A02	Modified the following content: • Updated "2.2.1 Main Circuit Cables" on page 19. • Updated "4.1 LED Operating Panel" on page 45. • Updated "5.3 Installation Clearance" on page 53. • Updated "5.8.3 Descriptions of Control Circuit Terminals" on page 100. • Updated "5.8.3 Descriptions of Control Circuit Terminals" on page 100. • Correct minor errors.
November 2023	A01	Modified the following content: • Updated "4.1 LED Operating Panel" on page 45. • Updated " Mechanical Installation" on page 77. • Updated "5.8.3 Descriptions of Control Circuit Terminals" on page 100. • Correct minor errors.
June 2022	A00	Initial release

Access to the Guide

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

- Visit www.inovance.com, click Download under Support and enter a keyword to search.
- 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 Disclaimer

If your product becomes defective under normal use conditions, we will offer guaranteed repair services within the warranty period. You need to pay charges beyond the warranty listed in the purchase order.

The warranty does not cover any defect caused by:

- Damage caused by operations not following the instructions in the user guide
- Events beyond our reasonable control, such as fire, flood and 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 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 Product Warranty Card.

Table of Contents

Preface	1
Fundamental Safety Instructions	6
1 Safety Overview	12
1.1 List of Safety Functions	12
1.2 Terms and Abbreviations	12
1.3 Safety Standards and Specifications	12
1.4 Precautions for Use	14
2 Product Information	18
2.1 Nameplate and Model	18
2.2 Cable Models	19
2.2.1 Main Circuit Cables	19
2.2.2 Selection of Control Circuit Cables	35
3 Components	36
3.1 Overview	36
3.2 Components of T1 to T6 Models	36
3.3 Components of T7 to T9 Models	39
3.4 Components of T10 to T12 Models	41
4 Operating Panel	45
4.1 LED Operating Panel	45
5 Installation	52
5.1 Installation Personnel	52
5.2 Installation Environment	52
5.3 Installation Clearance	53
5.4 Installation Tool Preparations	60
5.5 Unpacking, Storage, and Transportation	62
5.5.1 Package Confirmation	62
5.5.2 Transportation Before Unpacking	69
5.5.3 Handling and Hoisting After Unpacking	72
5.5.4 Unpacking	76
5.5.5 Storage	76
5.6 Cable Preparation	77
5.7 Mechanical Installation	77
5.7.1 Inspection Before Installation	77
5.7.2 T1 to T9 Model Installation	78
5.7.2.1 Dimensions of T1 to T9 Models	78

5.7.2.2 Backplate Mounting	80
5.7.2.3 Through-Hole Mounting	82
5.7.3 T10 to T12 Model Installation	85
5.7.3.1 Dimensions of T10 to T12 Models (Without AC Output Reactor)	85
5.7.3.2 Dimensions of T10 to T12 Models (with AC Output Reactor)	86
5.7.3.3 Installation Within the Cabinet	87
5.7.3.4 Cover Removal and Installation	92
5.7.4 Inspection After Installation	95
5.8 Electrical Installation	95
5.8.1 Pre-wiring Check	95
5.8.2 Descriptions of Main Circuit Terminals	96
5.8.3 Descriptions of Control Circuit Terminals	100
5.8.4 Post-wiring Check	104
5.8.5 Electrical Connection	105
6 Wiring	108
6.1 Safety Cautions	108
6.2 STO Terminals (J14) and Wiring	109
7 Safety Function	112
7.1 Safe Torque Off	112
7.1.1 Function Overview	112
7.1.2 Parameters	112
7.1.3 Function Triggering	113
7.1.4 Sequence Diagrams	113
8 Commissioning, Operation, and Maintenance	115
8.1 Commissioning, Operation, and Maintenance	115
9 Daily Maintenance and Inspection	120
9.1 Routine Inspection Items	120
9.1.1 Daily Checklist	120
9.1.2 Regular Checklist	121
9.2 Main Circuit Insulation Test	122
9.3 Quick-Wear Parts Replacement	123
9.3.1 Service Life of Quick-Wear Parts	123
9.3.2 Replacing the Cooling Fan	123
9.3.3 Replacing the Filter Electrolytic Capacitor	134
9.4 Storage and Warranty	135
10 Troubleshooting	136

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 observe the safety precautions may result in serious injuries or death of personnel or device damage.
- "Danger", "Warning", and "Caution" items in this guide do not indicate all safety precautions that need to be followed; instead, 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 usage.

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 injury.



Indicates that failure to comply with the notice may result in minor or moderate personal injury 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.
- Operators 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 **WARNING**

- 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.

 CAUTION

- 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 **WARNING**

- 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 components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in personal injury 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.



CAUTION

- 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 product 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 drive with other equipment or materials that may harm or have negative impacts on the drive.

Installation



DANGER

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



WARNING

- 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 devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the product on an incombustible object such as metal and do not contact or attach the product with combustible objects. Failure to comply will cause fires.

 CAUTION

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

Wiring
 DANGER

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

 WARNING

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

 CAUTION

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

Power-on

 DANGER

- Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted.
- Check that the power supply meets equipment requirements before power-on to prevent equipment damage or a fire.
- Do not open the cabinet door or protective cover of the product, contact any wiring terminal of the product, or remove any part of the product at power-on. Failure to comply will result in an electric shock.

 WARNING

- 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 accident.
- Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in death or personal injury.

Operation

 DANGER

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

 WARNING

- 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

 DANGER

- 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 can 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.

 WARNING

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

Repair	
 DANGER	• 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 can 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.
 WARNING	• Submit the repair request according to the warranty agreement. • When the fuse is blown or the circuit breaker or residual current device (RCD) 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 injury 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 operate on damaged equipment. Failure to comply may result in death, personal injury, or severe equipment damage. • After the equipment is replaced, check the wiring and set parameters again.
Disposal	
 WARNING	• Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injury, or even death. • Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

Safety Labels

For safe operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. See the following table for descriptions 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

List of Safety Functions

- Safe torque off (STO)
The STO function immediately shuts off the torque or force output of the motor based on an input signal from an external device. 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

Terms and Abbreviations	Description
Cat.	Safety category. It includes B, 1, 2, 3, and 4.
DCavg	Average diagnostic coverage (%)
DTI	Diagnostic test interval time
SFF	Safe failure fraction
PFHd	Probability of dangerous Failure per Hour
PL	Performance level
SC	Systematic 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

Option Model	Safety standards	Reference standards
MD520	Functional 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

Items	Safety parameters
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 Instructions

The chapter contains the warning symbols used in this guide and the safety precautions that you must obey when you install or service the safe option module of the drive. Failure to comply with the safety instructions may lead to injury, death or damage. Please read this chapter before installation.

Illustrations, pictures, or figures used in this manual are intended as examples only and may not cover all products to which this manual applies.

The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual.

Table 1–1 Description for warning symbols

Key	Indication	Description	Consequences in case of disregard
Example:  General hazards  Special hazards Electric shock	DANGER	Major risk	Ignoring the warning can result in severe physical injury or even death.
	WARNINGS	General risk	Ignoring the warning may result in severe physical injury or even death.
	CAUTION	Minor risk	Ignoring the warning may result in minor physical injury.
	STOP!	Damage to equipment or environment	Ignoring the warning may result in 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.

It is the responsibility of the machine builder/OEM/system integrator to make sure that the essential health and safety function requirements specified in the Machinery Directive are

met. Risk analysis and risk assessment is needed before using a product. Make sure that adequate measures are taken to eliminate/reduce the relating risks and components chosen must meet the safety requirements.

This section describes the information that is required before starting operation.

- Read the following safety precautions, risk assessment information, and limitations before starting operation.
- Use of the safety function: Use the safety function after properly understanding all of these 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 Precautions

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

- STO function is not intended as a replacement for the emergency stop function (E-stop). If no other measures are taken and the power supply cannot be cut off in case of emergency, the high voltage parts of motors and AC drives are still charged, which may bring the risk of electric shock or other risks caused by electricity. Therefore, the maintenance of electrical parts of the AC drives or motors can only be implemented after the AC drive system is isolated from the main power supply.
- Depending on the standards and requirements for a particular application, it may be possible to use STO as an integral part of an E-stop system. However, its main purpose is for use in a dedicated safety control arrangement whose purpose is to prevent any hazard from occurring, without the use of an E-stop.
- An E-stop is often provided in a machine to allow for unexpected situations where an operator sees a hazard and can take action to prevent an accident.
- The design requirement for an E-stop differs from that of a safety interlock. Generally, the E-stop is required to be independent from any complex or "intelligent" control. It may use purely electromechanical devices to either disconnect the power or initiate a controlled rapid stop using other means such as dynamic or regenerative braking.



Caution

- The design of safety-related systems requires specialist knowledge. To ensure that a complete control system is safe, it is necessary for the whole system to be designed according to recognized safety principles. The use of individual sub-systems such as drives with STO function, which are intended for safety-related applications, does not in itself ensure that the complete system is safe.
 - The STO function can be used to stop the AC drive in emergency stop situations.
 - In processes without personnel protection, it is recommended not to stop the AC drive by using the STO function. If the STO function is used to stop a running AC drive, the AC drive will gradually stop. If this is not acceptable, the system should be stopped using the correct mode instead of the STO function.
 - This publication is a guide to the application of Inovance STO function, and also on the design of safety-related systems for machinery control.
 - It is the responsibility of designer of the end product or application to ensure that it is safe and in compliance with the relevant regulations.
-

Risk Assessment

- Before using the safety function, perform risk assessment on AC drive system in advance. Make sure that the safety integrity level of the standards is met.
 - The following residual risks can be present even when the safety functions operate. Therefore, safety must always be given consideration during risk assessment.
 - If external forces (such as gravitational force with a vertical axis) are applied when the safety functions are operating, the motor will rotate due to the action of these external forces. Therefore, you must use a separate mechanical brake to secure the motor.
-

Note

- When multiple IGBT power transistors are faulty, the AC drive generates an alignment torque no matter whether STO function is triggered, which may maximally rotate the motor shaft by $180/p$ degrees.
 - p: Number of motor pole pairs.
-

To ensure safety, users should decide all the risk assessments and residual risks in the entire machine equipment. A company and individual who constructed the safety related system must take full responsibility for installation and commissioning of the system. Additionally, when complying with a European machinery directive, the related sub system must acquire safety standards certification, and the whole equipment or system is subject to all risk assessments and safety class certification.

The following shows residual risks concerning the safety function of this product.

Common residual risks

- At the shipment to end-users, check the settings of safety related components with programming tools and monitored/displayed contents on display and record and save the setting data concerning the safety observation function and the programming tools you used. Perform them using a check sheet, etc.
- The safety will not be ensured such as in assembling machine until installing, wiring, and adjustment are completed properly. Install, wire, and adjust your system referring to installation guide for each unit.
- Only qualified personnel are authorized to install, start-up, repair or adjust the machines in which these components are installed. Only trained engineers should install and operate the equipment.
- Separate the wiring for safety observation function from other signal wiring.
- Protect the cables with appropriate ways (routing them in a cabinet, using a cable guard, etc.).
- We recommend using a switch, relay, sensor, etc. which comply with safety standards. When using a switch, relay, sensor, etc. which do not comply with safety standards, perform a safety confirmation.
- Keep the required clearance/creepage distance depending on voltage you use.
- The time to a safety observation error depends on parameter settings.
- **Safe torque off (STO)**
This function only cuts off the torque of the motor, and does not cut off the power supply of the AC drive. Cut off the power supply of the AC drive to make sure the AC drive is powered off before maintenance.

Note

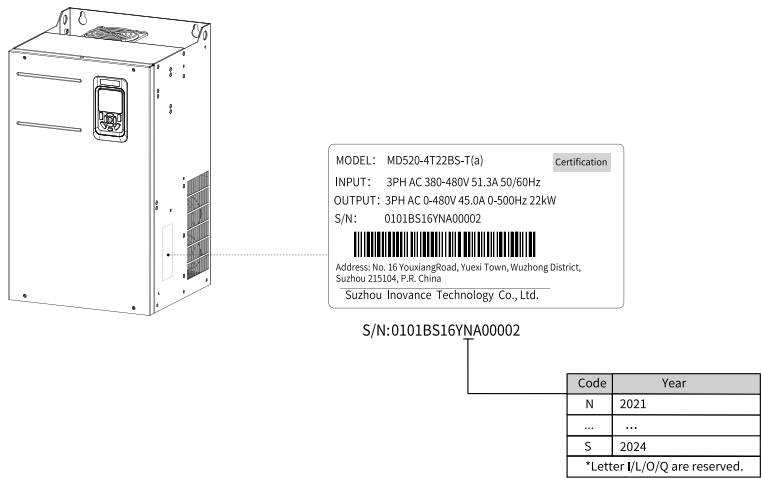
Trigger the STO function for the AC drive at least once every three months.

2 Product Information

2.1 Nameplate and Model

Note

The following nameplate is used as an example. The actual nameplate is subject to the product.



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

① ② ③ ④ ⑤ ⑥ ⑦

① Product name MD520: AC drive series	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 0.4: 0.4 kW ... 630: 630 kW	⑦ Model configuration Null: no configuration
④ Braking Unit Null: without the braking unit B: with the braking unit	- -

Note

- For three-phase 380 V to 480 V 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 drives, braking units are standard for T1 to T4 models and optional for T5 to T8 models; external braking units MDBUN are optional for T9 to T13 models.

2.2 Cable Models

2.2.1 Main Circuit Cables

Power cable selection requirements

For 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
- 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-braided shield

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

Use shielded cables to comply with the EMC requirements. 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 cable. The shield of the shielded cable is comprised of coaxial copper braids to suppress radio frequency interference. To enhance the shielding performance and conductivity, the braided density of the shield must be greater than 90%.

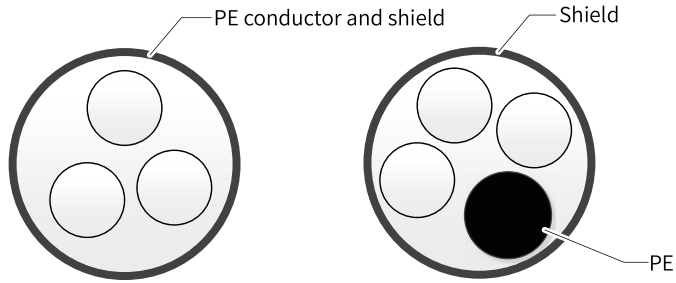


Figure 2-1 Recommended power cable

Recommended cable

Table 2-1 Cable selection (three-phase 380 V to 480 V, compliant with CE certification)

Structure	Drive Model	Rated Input Current (A)	Rated Output 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	1.5	3 × 0.75	TN R0.75 - 4	0.75	TN R0.75 - 4	M4	1.2 (10.6)
	MD520-4T0.7B(S)	2.4	2.1	3 × 0.75	TN R0.75 - 4	0.75	TN R0.75 - 4	M4	1.2 (10.6)
	MD520-4T1.1B(S)	3.7	3.1	3 × 0.75	TN R0.75 - 4	0.75	TN R0.75 - 4	M4	1.2 (10.6)
	MD520-4T1.5B(S)	4.6	3.8	3 × 0.75	TN R0.75 - 4	0.75	TN R0.75 - 4	M4	1.2 (10.6)
	MD520-4T2.2B(S)	6.3	5.1	3 × 1	TN R1.25 - 4	1	TN R1.25 - 4	M4	1.2 (10.6)
	MD520-4T3.0B(S)	9.0	7.2	3 × 1.5	TN R1.25 - 4	1.5	TN R1.25 - 4	M4	1.2 (10.6)
T2	MD520-4T3.7B(S)	11.4	9.0	3 × 2.5	TNR2-4	2.5	TNR2-4	M4	1.2 (10.6)
	MD520-4T5.5B(S)	16.7	13.0	3 × 4	TN R3.5 - 4	4	TN R3.5 - 4	M4	1.2 (10.6)
T3	MD520-4T7.5B(S)	21.9	17.0	3 × 6	TN R5.5 - 5	6	TN R5.5 - 5	M5	2.8 (24.8)
	MD520-4T11B(S)	32.2	25.0	3 × 10	TNR8-5	10	TNR8-5	M5	2.8 (24.8)
T4	MD520-4T15B(S)	41.3	32.0	3 × 10	TNR8-5	10	TNR8-5	M5	2.8 (24.8)

Structure	Drive Model	Rated Input Current (A)	Rated Output 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	37.2	37.0	3 x 16	GTNR16-6	16	GTN R16-6	M6	4.8 (42.5)
	MD520-4T18.5(B)(S)	49.5	37.0	3 x 16	GTNR16-6	16	GTN R16-6	M6	4.8 (42.5)
	MD520-4T22(B)(S)-T	43.4	45.0	3 x 25	GTNR25-6	16	GTN R16-6	M6	4.8 (42.5)
	MD520-4T22(B)(S)	59.0	45.0	3 x 25	GTNR25-6	16	GTN R16-6	M6	4.8 (42.5)
T6	MD520-4T30(B)(S)	57.0	60.0	3 x 25	GTNR25-6	16	GTN R16-6	M6	4.8 (42.5)
	MD520-4T37(B)(S)	69.0	75.0	3 x 35	GTNR35-6	16	GTN R16-6	M6	4.8 (42.5)
T7	MD520-4T45(B)(S)	89.0	91.0	3 x 50	GTNR50-8	25	GTN R25-8	M8	13.0 (115.2)
	MD520-4T55(B)(S)	106.0	112.0	3 x 70	GTNR70-8	35	GTN R35-8	M8	13.0 (115.2)
T8	MD520-4T75(B)(S)	139.0	150.0	3 x 95	GTN R95-12	50	GTN R50-8	M12 (main power)	35.0 (310.1)
								M8 (grounding)	13.0 (115.2)
	MD520-4T90(S)	164.0	176.0	3 x 120	GTNR120-12	70	GTNR70-8	M12 (main power)	35.0 (310.1)
								M8 (grounding)	13.0 (115.2)
	MD520-4T110(S)	196.0	210.0	3 x 150	BC150-12	95	GTNR95-8	M12 (main power)	35.0 (310.1)
								M8 (grounding)	13.0 (115.2)

Structure	Drive Model	Rated Input Current (A)	Rated Output 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	MD520-4T132(S)	240.0	253.0	3 x 185	BC185-12	95	BC95-10	M12 (main power)	35.0 (310.1)
								M10 (grounding)	20 (117)
	MD520-4T160(S)*	287.0	304.0	2 x (3 x 120)	BC120-12	120	BC120-10	M12 (main power)	35.0 (310.1)
								M10 (grounding)	20 (117)
T10	MD520-4T200(S)-(L)	365.0	377.0	2 x (3 x 150)	BC150-12	150	BC150-12	M12	35.0 (310.1)
	MD520-4T220(S)-(L)	410.0	426.0	2 x (3 x 150)	BC150-12	150	BC150-12	M12	35.0 (310.1)
T11	MD520-4T250(S)-(L)*	441.0	465.0	3 x (3 x 120)	BC120-12	185	BC185-12	M12	35.0 (310.1)
	MD520-4T280(S)-(L)*	495.0	520.0	3 x (3 x 150)	BC150-12	2 x 120	BC120-12	M12	35.0 (310.1)
T12	MD520-4T315(S)-(L)*	565.0	585.0	3 x (3 x 185)	BC185-16	2 x 150	BC150-16	M16	85.0 (753.1)
	MD520-4T355(S)-(L)*	617.0	650.0	3 x (3 x 240)	BC240-16	2 x 185	BC185-16	M16	85.0 (753.1)
	MD520-4T400(S)-(L)*	687.0	725.0	3 x (3 x 240)	BC240-16	2 x 185	BC185-16	M16	85.0 (753.1)
T13	MD520-4T500(S)-(A)*	838.1	900.0	4 x (3 x 240)	BC240-16	2 x 240	BC240-16	M16	85.0 (753.1)
	MD520-4T560(S)-(A)*	949.6	1020.0	4 x (3 x 240)	BC240-16	2 x 240	BC240-16	M16	85.0 (753.1)
	MD520-4T630(S)-(A)*	1043.5	1120.0	4 x (3 x 300)	BC300-16	2 x 300	BC300-16	M16	85.0 (753.1)

Note

<1>: Applicable to GB standards. For example, 3 x 10 indicates one 3-conductor 10 mm² cable; 2 x (3 x 120) indicates two 3-conductor 120 mm² cables. The preceding recommended lugs are the TNR, GTNR, and BC series lugs from Suzhou Yuanli.

Note:

1. Observe national or regional regulations during selection. The cables recommended in the preceding table meet the following conditions: PVC insulation and copper conductor; Ambient temperature of 40°C and cable surface temperature of 70°C (When the ambient temperature exceeds 40°C, contact Inovance); Cable layout type E is adopted (see IEC 60204-1).

2. The cables with the asterisk mark (*) must be connected through the copper busbar.

3. If the conditions are different, you need to select the model according to actual conditions.

Table 2-2 Cable selection (three-phase 380 V to 480 V, compliant with UL certification)

Structure	Drive Model	Rated Input Current (A)	Rated Output Current (A)	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
				Recommended Cable (AWG/kcmil) ^{<2>}	Recommended Cable Lug	Recommended Cable (AWG/kcmil) ^{<2>}	Recommended Cable Lug		
T1	MD520-4T0.4B(S)	1.8	1.5	14	TLK2.5-4	14	TLK2.5-4	M4	1.2 (10.6)
	MD520-4T0.7B(S)	2.4	2.1	14	TLK2.5-4	14	TLK2.5-4	M4	1.2 (10.6)
	MD520-4T1.1B(S)	3.7	3.1	14	TLK2.5-4	14	TLK2.5-4	M4	1.2 (10.6)
	MD520-4T1.5B(S)	4.6	3.8	14	TLK2.5-4	14	TLK2.5-4	M4	1.2 (10.6)
	MD520-4T2.2B(S)	6.3	5.1	14	TLK2.5-4	14	TLK2.5-4	M4	1.2 (10.6)
	MD520-4T3.0B(S)	9.0	7.2	14	TLK2.5-4	14	TLK2.5-4	M4	1.2 (10.6)
T2	MD520-4T3.7B(S)	11.4	9.0	12	TLK4-4	12	TLK6-4	M4	1.2 (10.6)
	MD520-4T5.5B(S)	16.7	13.0	10	TLK6-4	10	TLK6-4	M4	1.2 (10.6)
T3	MD520-4T7.5B(S)	21.9	17.0	8	TLK10-5	8	TLK10-5	M5	2.8 (24.8)
	MD520-4T11B(S)	32.2	25.0	8	TLK10-5	8	TLK10-5	M5	2.8 (24.8)
T4	MD520-4T15B(S)	41.3	32.0	6	TLK16-5	6	TLK16-5	M5	2.8 (24.8)

Structure	Drive Model	Rated Input Current (A)	Rated Output Current (A)	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
				Recommended Cable (AWG/kcmil) ^{<2>}	Recommended Cable Lug	Recommended Cable (AWG/kcmil) ^{<2>}	Recommended Cable Lug		
T5	MD520-4T18.5(B)(S)-T	37.2	37.0	4	TLK25-6	6	TLK16-6	M6	4.8 (42.5)
	MD520-4T18.5(B)(S)	49.5	37.0	4	TLK25-6	6	TLK16-6	M6	4.8 (42.5)
	MD520-4T22(B)(S)-T	43.4	45.0	4	TLK25-6	6	TLK16-6	M6	4.8 (42.5)
	MD520-4T22(B)(S)	59.0	45.0	4	TLK25-6	6	TLK16-6	M6	4.8 (42.5)
T6	MD520-4T30(B)(S)	57.0	60.0	2	TLK35-6	4	TLK25-6	M6	4.8 (42.5)
	MD520-4T37(B)(S)	69.0	75.0	2	TLK35-6	4	TLK25-6	M6	4.8 (42.5)
T7	MD520-4T45(B)(S)	89.0	91.0	1/0	TLK50-8	2	TLK35-8	M8	13.0 (115.2)
	MD520-4T55(B)(S)	106.0	112.0	3/0	TLK95-8	1/0	TLK50-8	M8	13.0 (115.2)
T8	MD520-4T75(B)(S)	139.0	150.0	4/0	TLK120-12	2/0	TLK70-8	M12 (main power)	35.0 (310.1)
								M8 (grounding)	13.0 (115.2)
	MD520-4T90(S)	164.0	176.0	300 kcmil	SQNB S150-12	3/0	TLK95-8	M12 (main power)	35.0 (310.1)
								M8 (grounding)	13.0 (115.2)
	MD520-4T110(S)	196.0	210.0	2x3/0	TLK95-12	4/0	TLK120-8	M12 (main power)	35.0 (310.1)
								M8 (grounding)	13.0 (115.2)

Structure	Drive Model	Rated Input Current (A)	Rated Output Current (A)	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
				Recommended Cable (AWG/kcmil) ^{<2>}	Recommended Cable Lug	Recommended Cable (AWG/kcmil) ^{<2>}	Recommended Cable Lug		
T9	MD520-4T132(S)	240.0	253.0	500 kcmil	SQNB S250-12	300 kcmil	SQNB S150-10	M12 (main power)	35.0 (310.1)
								M10 (grounding)	20 (117)
	MD520-4T160(S)	287.0	304.0	2 x 300 kcmil	SQNB S150-12	300 kcmil	SQNB S150-10	M12 (main power)	35.0 (310.1)
								M10 (grounding)	20 (117)
T10	MD520-4T200(S)-(L)	365.0	377.0	2 x 350 kcmil	SQNB S180-12	350 kcmil	SQNB S180-12	M12	35.0 (310.1)
	MD520-4T220(S)-(L)*	410.0	426.0	2 x 400 kcmil	SQNB S250-12	400 kcmil	SQNB S250-12	M12	35.0 (310.1)
T11	MD520-4T250(S)-(L)*	441.0	465.0	2 x 500 kcmil	SQNB S250-12	500 kcmil	SQNB S250-12	M12	35.0 (310.1)
	MD520-4T280(S)-(L)*	495.0	520.0					M12	35.0 (310.1)
T12	MD520-4T315(S)-(L)*	565.0	585.0	4 x 300 kcmil	SQNB S150-12	2 x 300 kcmil	SQNB S150-12	M16	85.0 (753.1)
	MD520-4T355(S)-(L)*	617.0	650.0	4 x 350 kcmil	TLK185-16	2 x 350 kcmil	TLK185-16	M16	85.0 (753.1)
	MD520-4T400(S)-(L)*	687.0	725.0	4 x 400 kcmil	TLK240-16	2 x 400 kcmil	TLK240-16	M16	85.0 (753.1)
T13	MD520-4T500(S)-(A)*	838.1	900.0	4 x 500 kcmil	SQNB S325-16	2 x 500 kcmil	SQNB S325-16	M16	85.0 (753.1)
	MD520-4T560(S)-(A)*	949.6	1020.0	4 x 500 kcmil	SQNB S325-16	2 x 500 kcmil	SQNB S325-16	M16	85.0 (753.1)
	MD520-4T630(S)-(A)*	1043.5	1120.0	4 x 500 kcmil	SQNB S325-16	2 x 500 kcmil	SQNB S325-16	M16	85.0 (753.1)

Note

<2>: Applicable to AWG standards, in which 8 represents 8AWG, 1/0 represents 0AWG, 3/0 represents 000AWG, and 4/0 represents 0000AWG; 2 x 300 kcmil represents two 300 kcmil cables. The preceding recommended cable lugs are TLK and SQNBS series lugs from KST.

Note:

1. Observe national or regional regulations during selection. The cables recommended in the preceding table meet the following conditions: PVC insulation and copper conductor; Ambient temperature of 40°C and cable surface temperature of 75°C (When the ambient temperature exceeds 40°C, contact Inovance); Cable layout type E is adopted (see IEC 60204-1).
2. The recommended cables must meet requirements for 125% overload.
3. The cables with the asterisk mark (*) must be connected through the copper busbar.
4. If the conditions are different, you need to select the model according to actual conditions.

Table 2-3 Cable selection (three-phase 200 V to 240 V, compliant with CE certification)

Structure	Drive Model	Rated Input Current (A)	Rated Output 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	2.1	3 x 0.75	TN R0.75 - 4	0.75	TN R0.75 - 4	M4	1.2 (10.6)
	MD520-2T0.7B(S)	4.6	3.8	3 x 0.75	TN R0.75 - 4	0.75	TN R0.75 - 4	M4	1.2 (10.6)
	MD520-2T1.1B(S)	6.3	5.1	3 x 0.75	TN R0.75 - 4	0.75	TN R0.75 - 4	M4	1.2 (10.6)
	MD520-2T1.5B(S)	9.0	7.2	3 x 1.5	TN R1.25 - 4	1.5	TN R1.25 - 4	M4	1.2 (10.6)
T2	MD520-2T2.2B(S)	11.4	9.0	3 x 2.5	TNR2-4	2.5	TNR2-4	M4	1.2 (10.6)
	MD520-2T3.7B(S)	16.7	13.0	3 x 4	TNR3.5 - 4	4	TN R3.5 - 5	M4	1.2 (10.6)
T3	MD520-2T5.5B(S)	32.2	25.0	3 x 10	TNR8-5	10	TNR8-5	M5	2.8 (24.8)
T4	MD520-2T7.5B(S)	41.3	32.0	3 x 10	TNR8-5	10	TNR8-5	M5	2.8 (24.8)
T5	MD520-2T11(B)(S)	59.0	45.0	3 x 16	GTNR16-6	16	GTN R16-6	M6	4.8 (42.5)
T6	MD520-2T15(B)(S)	57.0	60.0	3 x 25	GTNR25-6	16	GTN R16-6	M6	4.8 (42.5)
	MD520-2T18.5(B)(S)	69.0	75.0	3 x 35	GTNR35-6	16	GTNR16-6	M6	4.8 (42.5)

Structure	Drive Model	Rated Input Current (A)	Rated Output 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		
T7	MD520-2T22(B)(S)	89.0	91.0	3 x 50	GTNR50-8	25	GTNR25-8	M8	4.8 (42.5)
	MD520-2T30(B)(S)	106.0	112.0	3 x 70	GTNR70-8	35	GTNR35-8	M8	4.8 (42.5)
T8	MD520-2T37(B)(S)	139.0	150.0	3 x 95	GTNR95-12	50	GTNR35-8	M12 (main power)	35.0 (310.1)
								M8 (grounding)	13.0 (115.2)
	MD520-2T45(S)	164.0	176.0	3 x 120	GTNR120-12	70	GTNR50-8	M12 (main power)	35.0 (310.1)
								M8 (grounding)	13.0 (115.2)
	MD520-2T55(S)	196.0	210.0	3 x 150	BC150-12	95	GTNR70-8	M12 (main power)	35.0 (310.1)
								M8 (grounding)	13.0 (115.2)
T9	MD520-2T75(S)	287.0	304.0	3 x 240	BC240-12	120	BC120-12	M12 (main power)	35.0 (310.1)
								M10 (grounding)	20 (117)
T10	MD520-2T90(S)	365.0	377.0	2 x (3 x 150)	BC150-12	150	BC150-12	M12	35.0 (310.1)
	MD520-2T110(S)*	410.0	426.0	2 x (3 x 185)	BC185-12	185	BC150-12	M12	35.0 (310.1)
T11	MD520-2T132(S)*	441.0	465.0	2 x (3 x 240)	BC240-12	240	BC240-12	M12	35.0 (310.1)
T12	MD520-2T160(S)	565.0	585.0	2 x (3 x 300)	BC300-16	300	BC300-16	M16	85.0 (753.1)
	MD520-2T200(S)*	687.0	725.0	4 x (3 x 185)	BC185-16	2 x 185	BC185-16	M16	85.0 (753.1)

Note

<1>: Applicable to GB standards. For example, 3 x 10 indicates one 3-conductor 10 mm² cable; 2 x (3 x 120) indicates two 3-conductor 120 mm² cables. The preceding recommended lugs are the TNR, GTNR, and BC series lugs from Suzhou Yuanli.

Note:

- 1. Observe national or regional regulations during selection. The cables recommended in the preceding table meet the following conditions: PVC insulation and copper conductor; Ambient temperature of 40°C and cable surface temperature of 70°C (When the ambient temperature exceeds 40°C, contact Inovance); Cable layout type E is adopted (see IEC 60204-1).
- 2. The cables with the asterisk mark (*) must be connected through the copper busbar.
- 3. If the conditions are different, you need to select the model according to actual conditions.

Table 2-4 Cable selection (three-phase 200 V to 240 V, compliant with UL certification)

Structure	Drive Model	Rated Input Current (A)	Rated Output Current (A)	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
				Recommended Cable (AWG/kcmil) ^{<2>}	Recommended Cable Lug	Recommended Cable (AWG/kcmil) ^{<2>}	Recommended Cable Lug		
T1	MD520-2T0.4B(S)	2.4	2.1	14	TLK2.5-4	14	TLK2.5-4	M4	1.2 (10.6)
	MD520-2T0.7B(S)	4.6	3.8	14	TLK2.5-4	14	TLK2.5-4	M4	1.2 (10.6)
	MD520-2T1.1B(S)	6.3	5.1	14	TLK2.5-4	14	TLK2.5-4	M4	1.2 (10.6)
	MD520-2T1.5B(S)	9.0	7.2	14	TLK2.5-4	14	TLK2.5-4	M4	1.2 (10.6)
T2	MD520-2T2.2B(S)	11.4	9.0	12	TLK4-4	12	TLK4-4	M4	1.2 (10.6)
	MD520-2T3.7B(S)	16.7	13.0	10	TLK6-4	10	TLK6-4	M4	1.2 (10.6)
T3	MD520-2T5.5B(S)	32.2	25.0	8	TLK10-5	8	TLK10-5	M5	2.8 (24.8)
T4	MD520-2T7.5B(S)	41.3	32.0	6	TLK16-5	6	TLK16-5	M5	2.8 (24.8)
T5	MD520-2T11(B)(S)	59.0	45.0	4	TLK25-6	4	TLK25-6	M6	4.8 (42.5)
T6	MD520-2T15(B)(S)	57.0	60.0	2	TLK35-6	4	TLK25-6	M6	4.8 (42.5)
	MD520-2T18.5(B)(S)	69.0	75.0	2	TLK35-6	4	TLK25-6	M6	4.8 (42.5)

Structure	Drive Model	Rated Input Current (A)	Rated Output Current (A)	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
				Recommended Cable (AWG/kcmil) ^{<2>}	Recommended Cable Lug	Recommended Cable (AWG/kcmil) ^{<2>}	Recommended Cable Lug		
T7	MD520-2T22(B)(S)	89.0	91.0	1/0	TLK50-8	2	TLK35-8	M8	4.8 (42.5)
	MD520-2T30(B)(S)	106.0	112.0	3/0	TLK95-8	1/0	TLK50-8	M8	4.8 (42.5)
T8	MD520-2T37(B)(S)	139.0	150.0	4/0	TLK120-12	3/0	TLK95-8	M12 (main power)	35.0 (310.1)
								M8 (grounding)	13.0 (115.2)
	MD520-2T45(S)	164.0	176.0	300 kcmil	SQNB S150-12	3/0	TLK95-8	M12 (main power)	35.0 (310.1)
								M8 (grounding)	13.0 (115.2)
	MD520-2T55(S)*	196.0	210.0	2x3/0	TLK95-12	3/0	TLK95-8	M12 (main power)	35.0 (310.1)
								M8 (grounding)	13.0 (115.2)
T9	MD520-2T75(S)*	287.0	304.0	2 x 300 kcmil	SQNB S150-12	300 kcmil	SQNB S150-10	M12 (main power)	35.0 (310.1)
								M10 (grounding)	20 (117)
T10	MD520-2T90(S)	365.0	377.0	2 x 350 kcmil	SQNB S180-12	350 kcmil	SQNB S180-12	M12	35.0 (310.1)
	MD520-2T110(S)*	410.0	426.0	2 x 400 kcmil	SQNB S250-12	400 kcmil	SQNB S250-12	M12	35.0 (310.1)
T11	MD520-2T132(S)*	441.0	465.0	2 x 500 kcmil	SQNB S250-12	500 kcmil	SQNB S250-12	M12	35.0 (310.1)
T12	MD520-2T160(S)*	565.0	585.0	4 x 300 kcmil	SQNB S150-12	2 x 300 kcmil	SQNB S150-12	M16	85.0 (753.1)
	MD520-2T200(S)*	687.0	725.0	4 x 400 kcmil	TLK240-16	2 x 400 kcmil	TL K240-16	M16	85.0 (753.1)

Note

<2>: Applicable to AWG standards, in which 8 represents 8AWG, 1/0 represents 0AWG, 3/0 represents 000AWG, and 4/0 represents 0000AWG; 2 x 300 kcmil represents two 300 kcmil cables. The preceding recommended cable lugs are TLK and SQNBS series lugs from KST.

Note:

1. Observe national or regional regulations during selection. The cables recommended in the preceding table meet the following conditions: PVC insulation and copper conductor; ambient temperature of 40°C and cable surface temperature of 75°C (When the ambient temperature exceeds 40°C, contact Inovance); Cable layout type E is adopted (see IEC 60204-1).
2. The recommended cables must meet requirements for 125% overload.
3. The cables with the asterisk mark (*) must be connected through the copper busbar.
4. If the conditions are different, you need to select the model according to actual conditions.

Table 2-5 Cable selection (single-phase 200 V to 240 V) (with CE certification)

Structure	Drive Model	Rated Input Current (A)	Rated Output 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		
T2	MD520-2S0.4B(S)	5.4	2.3	3 x 0.75	TNR1.25-4	0.75	TNR1.25-4	M4	1.2 (10.6)
	MD520-2S0.7B(S)	8.2	4.0	3 x 1.5	TNR1.25-4	1.5	TNR1.25-4		
	MD520-2S1.5B(S)	14.0	7.0	3 x 2.5	TNR2-4	2.5	TNR2-4		
	MD520-2S2.2B(S)	20.0	9.6	3 x 4	TNR3.5-4	4	TNR3.5-4		

Note

<1>: Applicable to GB standards. For example, 3 x 4 indicates one 3-conductor 4 mm² cable; 3 x 150 indicates one 3-conductor 150 mm² cables. The preceding recommended cable lugs are the TNR series lugs of Suzhou Yuanli.

Note:

1. Observe national or regional regulations during selection. The cables recommended in the preceding table meet the following conditions: PVC insulation and copper conductor; ambient temperature of 40°C and cable surface temperature of 70°C (When the ambient temperature exceeds 40°C, contact Inovance); Cable layout type E is adopted (see IEC 60204-1).
2. If the conditions are different, you need to select the model according to actual conditions.

Table 2-6 Cable selection (single-phase 200 V to 240 V) (with UL certification)

Structure	Drive Model	Rated Input Current (A)	Rated Output Current (A)	R/S/T, U/V/W		Grounding Cable		Screw	Tightening Torque (N·m) (lb.in)
				Recommended Cable (AWG) ^{<2>}	Recommended Cable Lug	Recommended Cable (AWG) ^{<2>}	Recommended Cable Lug		
T2	MD520-2S0.4B(S)	5.4	2.3	14	TLK2.5-4	14	TLK2.5-4	M4	1.2 (10.6)
	MD520-2S0.7B(S)	8.2	4.0	14	TLK2.5-4	14	TLK2.5-4		
	MD520-2S1.5B(S)	14.0	7.0	12	TLK4-4	12	TLK4-4		
	MD520-2S2.2B(S)	23.0	9.6	10	RNBL5-4	10	RNBL5-4		

Note

<2>: Applicable to AWG standards; 14 represents 14AWG and 12 represents 12AWG. The preceding recommended cable lugs are TLK and RNB series lugs from KST.

Note:

1. Observe national or regional regulations during selection. The cables recommended in the preceding table meet the following conditions: PVC insulation and copper conductor; ambient temperature of 40°C and cable surface temperature of 75°C (When the ambient temperature exceeds 40°C, contact Inovance); Cable layout type E is adopted (see IEC 60204-1).
2. The recommended cables must meet requirements for 125% overload.
3. If the conditions are different, you need to select the model according to actual conditions.

Recommended 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 2-7 Appearances, models, and dimensions of TNR series lugs (unit: mm)

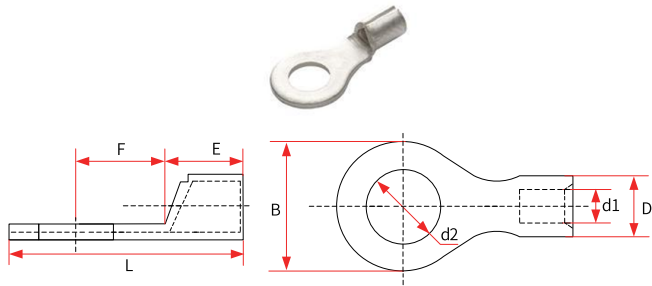
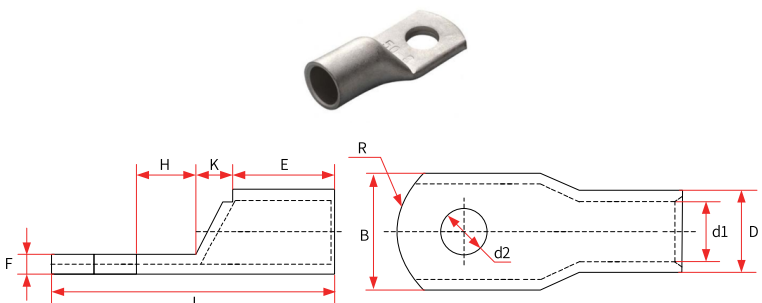
Model	Cable Specification		D	d1	E	F	B	d2	L	Current (A)	Crimping Pliers
	AWG/MCM	mm ²									
											
TNR0.75-4	22-16	0.25-1.0	2.8	1.3	4.5	6.6	8.0	4.3	15.0	10	RYO-8
TNR1.25-4	22-16	0.25-1.65	3.4	1.7	4.5	7.3	8	5.3	15.8	19	AK-1M

Table 2-8 Appearances, models, and dimensions of GTNR series lugs (unit: mm)

Model	D	d1	E	H	K	B	d2	F	L	R	Crimping Pliers
											
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 Pliers
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 2-9 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	
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 ensure that I/O signal cables are not affected by peripheral interference and noise, use shielded cables with the shield for signal cables. Install the signal shield bracket at each end of the shield to reliably connect the shield to the AC drive in 360°. Use separate shielded cables for different analog signals. It is recommended to use shielded twisted pair (STP) cables for digital signals.

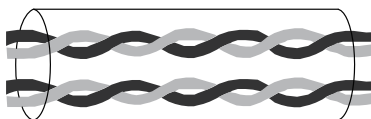


Figure 2-2 STP cable

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

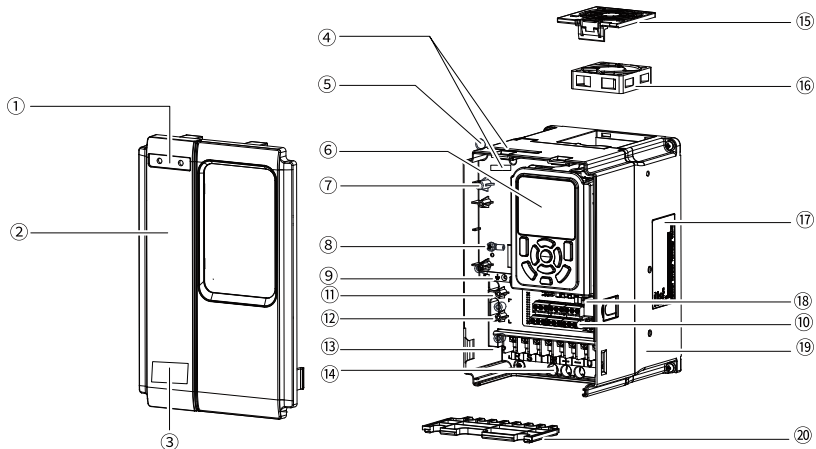


Figure 3-1 Components of T1 to T4 models

No.	Name	No.	Name	No.	Name						
①	Logo	②	Cover	③	Mark						
					<table><tr><th>Symbol</th><th>Description</th></tr><tr><td></td><td>Note: Read through the user guide before installation and operation.</td></tr><tr><td></td><td>10minDanger: Do not remove the upper cover with power ON or within 10 min after power-off.</td></tr></table>	Symbol	Description		 Note: Read through the user guide before installation and operation.		 10minDanger: Do not remove the upper cover with power ON or within 10 min after power-off.
Symbol	Description										
	 Note: Read through the user guide before installation and operation.										
	 10minDanger: Do not remove the upper cover with power ON or within 10 min after power-off.										
④	Equipment bar code You can view the SN and model of the equipment.	⑤	Main circuit power supply indicator	⑥	Operating panel						
⑦	Fixing base of the encoder expansion card	⑧	Trough and fixing base of the control board ground cable	⑨	Grounding sheet metal It is used to ground the PG card and control board.						

No.	Name	No.	Name	No.	Name
⑩	Control circuit terminal	⑪	Fixing base of the expansion card	⑫	Grounding screws for safety capacitor and voltage dependent resistor
⑬	Main circuit terminal	⑭	Grounding terminal	⑮	Fan cover
⑯	Cooling fan	⑰	Nameplate	⑱	External operating panel interface
⑲	Enclosure	⑳	Comb-type wiring cover	-	-

Note

- The actual position of the equipment bar code may vary with models.
- Connect the control board ground cable to the grounding sheet metal only when the system is reliably grounded; otherwise, connect the control board ground cable to the fixing hole.
- Do not disassemble the machine or perform wiring when the main circuit power supply indicator is ON.

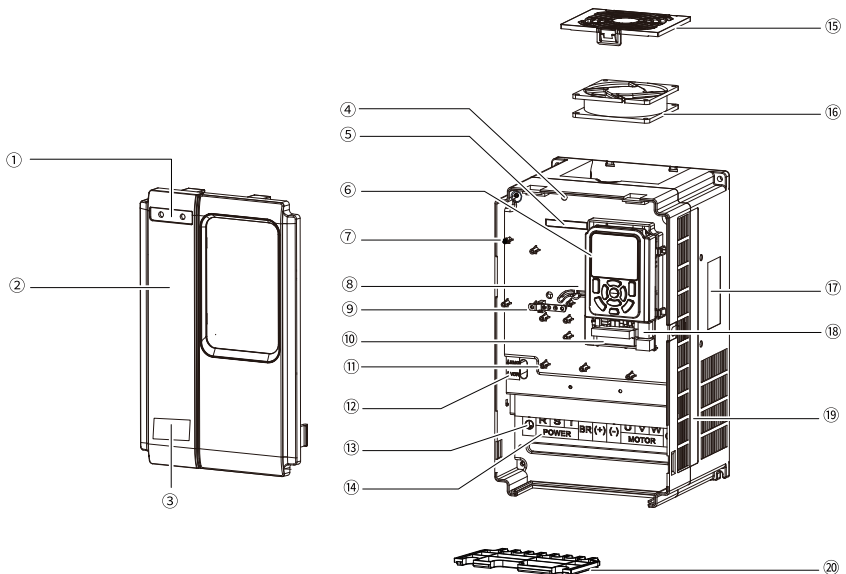


Figure 3-2 Components of T5 to T6 models

No.	Name	No.	Name	No.	Name									
①	Logo	②	Cover	③	Mark <table border="1"><thead><tr><th colspan="2">Symbol</th><th>Description</th></tr></thead><tbody><tr><td></td><td></td><td>Note: Read through the user guide before installation and operation.</td></tr><tr><td></td><td></td><td>Danger: Do not remove the upper cover with power ON or within 10 min after power-off.</td></tr></tbody></table>	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.
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	⑤	Equipment bar code You can view the SN and model of the equipment.	⑥	Operating panel									
⑦	Fixing base of encoder expansion card	⑧	Trough and fixing base of the control board ground cable	⑨	Grounding sheet metal It is used to ground the PG card and control board.									
⑩	Control circuit terminal	⑪	Fixing base of the expansion card	⑫	Grounding screws for safety capacitor and voltage dependent resistor									
⑬	Grounding terminal	⑭	Main circuit terminal	⑮	Fan cover									
⑯	Cooling fan	⑰	Nameplate	⑱	External operating panel interface									
⑲	Enclosure	⑳	Comb-type wiring cover	-	-									

Note

- The actual position of the equipment bar code may vary with models.
- Connect the control board ground cable to the grounding sheet metal only when the system is reliably grounded; otherwise, connect the control board ground cable to the fixing hole.
- Do not disassemble the machine or perform wiring when the main circuit power supply indicator is ON.

3.3 Components of T7 to T9 Models

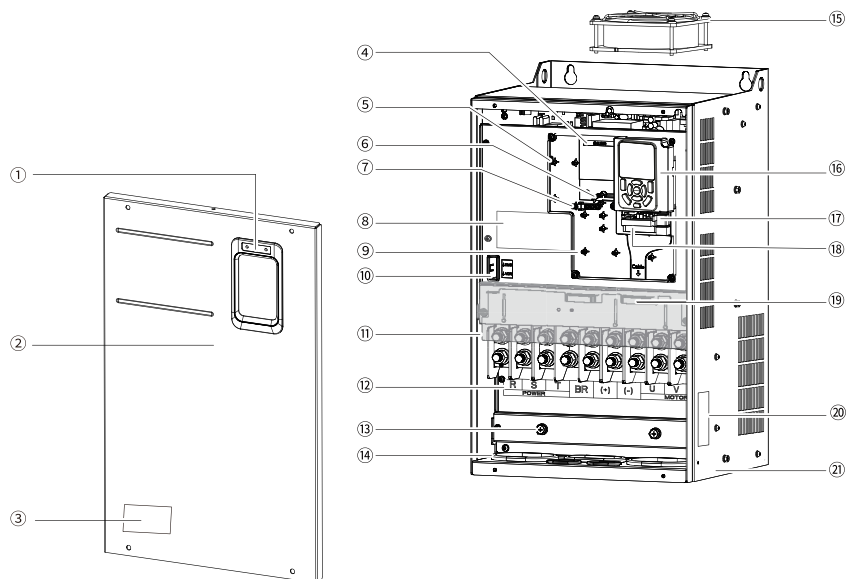


Figure 3-3 Components of T7 to T9 models

No.	Name	No.	Name	No.	Name									
①	Logo	②	Cover	③	Mark <table><tr><th colspan="2">Symbol</th><th>Description</th></tr><tr><td></td><td></td><td>Note: Read through the user guide before installation and operation.</td></tr><tr><td></td><td></td><td>Danger: Do not remove the upper cover with power ON or within 10 min after power-off.</td></tr></table>	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.
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 You can view the SN and model of the equipment.	⑤	Fixing base of the encoder expansion card	⑥	Trough and fixing base of the control board ground cable									
⑦	Grounding sheet metal It is used to ground the PG card and control board.	⑧	Wiring description	⑨	Fixing base of 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	Cooling 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 actual position of the equipment bar code may vary with models.
 - Connect the control board ground cable to the grounding sheet metal only when the system is reliably grounded; otherwise, connect the control board ground cable to the fixing hole.
 - 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.
 - T9 models have two cooling fans at the bottom.
-

3.4 Components of T10 to T12 Models

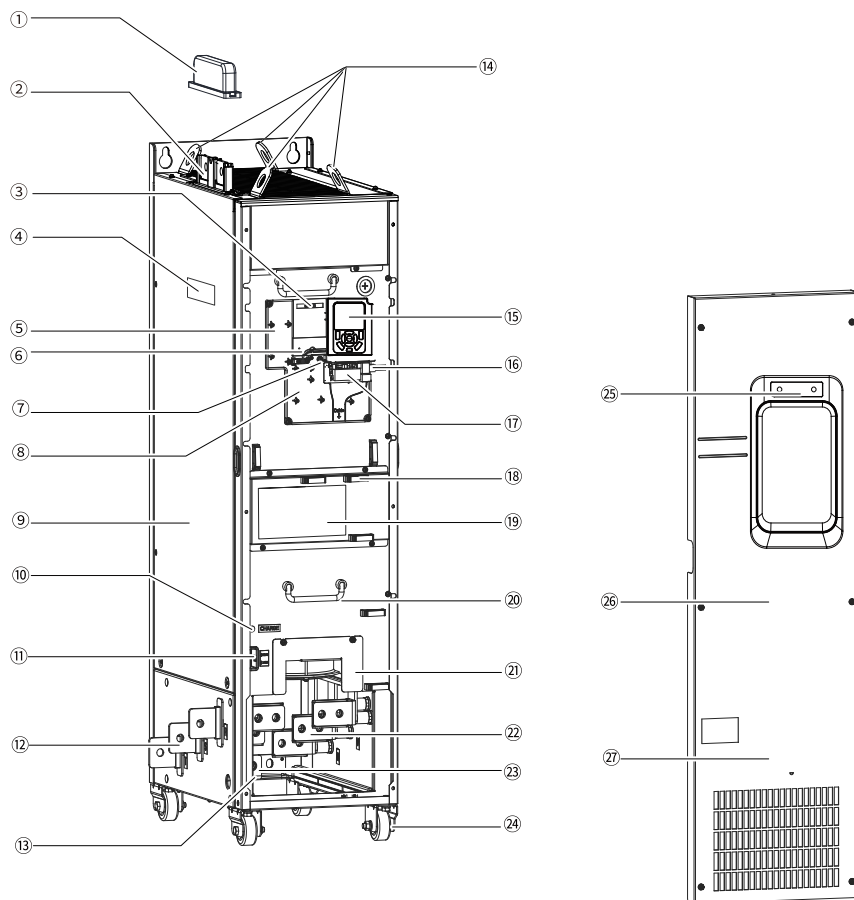


Figure 3-4 Components of T10 to T12 models (without AC output reactors)

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 You can view the SN and model of the equipment.								
④	Nameplate	⑤	Fixing base of the encoder expansion card	⑥	Trough and fixing base of 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 sheet metal It is used to ground the PG card and control board.	⑧	Fixing base for 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	Top hoisting position	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	Cover	㉗	Mark								
					<table><tr><th>Symbol</th><th>Description</th></tr><tr><td></td><td rowspan="2">Note: Read through the user guide before installation and operation.</td></tr><tr><td></td></tr><tr><td></td><td rowspan="2">Danger: Do not remove the upper cover with power ON or within 10 min after power-off.</td></tr><tr><td></td></tr></table>	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.	
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.												
													

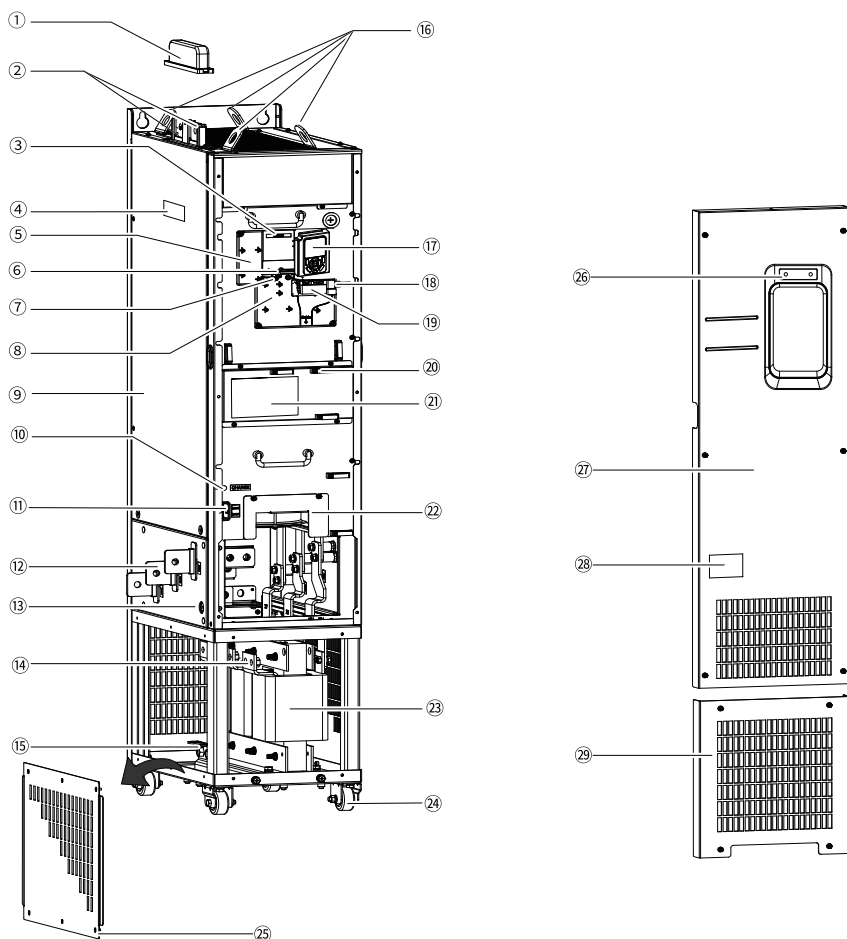


Figure 3-5 Components of T10 to T12 models (with AC output reactors)

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 You can view the SN and model of the equipment.										
④	Nameplate	⑤	Fixing base of encoder expansion card	⑥	Trough and fixing base of 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 sheet metal It is used to ground the PG card and control board.	⑧	Fixing base for 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	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	Caster										
㉕	Left cover of the base	㉖	Logo	㉗	Cover										
㉘	Mark <table border="1"><thead><tr><th>Symbol</th><th>Description</th></tr></thead><tbody><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td colspan="2">Note: Read through the user guide before installation and operation.</td></tr><tr><td colspan="2">Danger: Do not remove the upper cover with power ON or within 10 min after power-off.</td></tr></tbody></table>	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.		㉙	Bottom cover	-	-
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.															

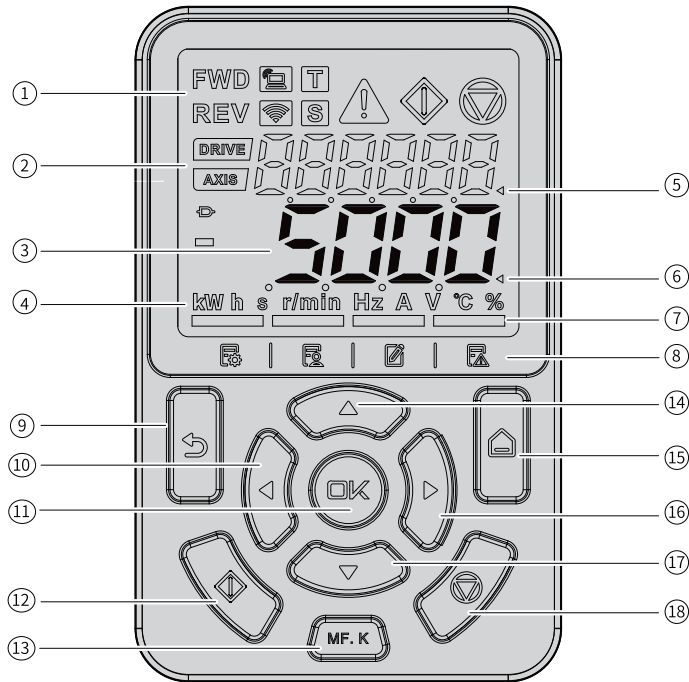


Figure 4-3 Components

Table 4-1 Description of the operating panel

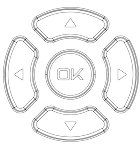
No.	Name	Description
①	Status indicators	/
②	Secondary display area	It displays the following information: • Information on key test and motor parameter auto-tuning • Fault and system status monitoring • Station number, motoring status, and STO status.
③	Primary display area	It displays parameter information.
④	Unit indicators	/
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	UP key	/
⑮	Menu key	/
⑯	Right shift key	/
⑰	DOWN key	/
⑱	Stop key	/

Key Descriptions

Table 4-2 Key descriptions

Key	Name	Function
	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	Return to the previous interface; Enter level 1 menu
	OK key	Press the key to enter the settings interface or confirm settings.

Key	Name	Function
	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 history menu: 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.
	RUNkey	In the operating panel control mode, press the key to operate the drive.
	Stop/Fault reset key	When the drive is running, press the key to stop the drive. When the drive is in the faulty state, press the key to perform a reset operation.

Status Indicator

Table 4-3 Status indicator

Status indicator	Status
	FWD indicator steady on Forward run/Positive direction
	REV indicator steady on Reverse run/Negative direction
	FWD/REV indicator 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

Status indicator		Status
	Torque control indicator steady on	Torque control
	Speed control indicator steady on	Speed control
	Fault indicator steady on	Fault occurred
	Fault indicator off	No fault
	RUN indicator steady on	Running
	Stop indicator steady on	Stop
	Station number indicator steady on	The station number is displayed in the auxiliary display area.
	Station number indicator off	The value displayed in the auxiliary display area is not the station number.
	AXIS indicator steady on	The axis number is displayed in the auxiliary display area.
	AXIS indicator off	The value display in the auxiliary display area is not the axis number.
	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 main display area is negative.
	Minus sign indicator off	The value displayed in the primary display area is positive.

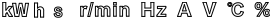
Status indicator		Status
	Cursor indicator in the primary display area steady on	The operating area is the primary display area.
	Cursor indicator in the secondary display area steady on	The operating area is the secondary display area.
	Unit indicator steady on	The unit corresponding to the data displayed in the main display area is the unit with the indicator on. "Table 4-4 " on page 50
	 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.

Table 4-4 Unit description

Unit	Description
kW	Power unit
h	Time unit
kWh	Energy unit
s	Time unit
rpm	Rotational speed unit
Hz	Frequency unit
A	Current unit
V	Voltage unit
°C	Temperature unit
%	Percentage

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 4-5 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
4	4	d	D	n	n	r	T
5	5	E	E	N	N	u	u
6	6	F	F	o	o	-	/
7	7	H	H	P	P	/	/
8	8	G	G	q	q	/	/

5 Installation

5.1 Installation Personnel

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

5.2 Installation Environment

To maximum the product performance and ensure long-term use, install the drive in an environment meeting the following requirements.

Table 5-1 Environmental requirements

Environment	Requirement
Installation location	Indoor
Grid overvoltage	OVC III
Temperature	• Installation/Ambient temperature: -10°C to $+50^{\circ}\text{C}$. When the temperature ranges from -10°C to $+40^{\circ}\text{C}$, no derating is required. For temperature above 40°C, derate 1.5% for every additional 1°C. • Storage/Transportation temperature: -20°C to $+60^{\circ}\text{C}$. • For better reliability, use the AC drive in places without drastic temperature changes. • When installing the drive into an enclosed environment such as a control cabinet, use a cooling fan or air conditioner to keep the temperature of the inlet air below 50°C. Failure to comply will result in overheat or fire. • Install the drive on a flame-retardant surface, with sufficient clearance reserved for heat dissipation. • Take measures to prevent the drive from being frozen.
Humidity	Storage/Ambient humidity: $\leq 95\%$ RH, non-condensing
Environment	Pollution degree: 2 or below Install the drive in a location that meets the following descriptions: • Free from direct sunlight, dust, corrosive gas, combustible or explosive gas, oil mist, water vapor, drip, or salt • Insusceptible to vibration (away from equipment that may generate strong vibration, such as a punch press) • Free from unwanted objects such as metallic dust, oil, and water that may enter the AC drive • Free from radioactive substances, combustible materials, harmful gases and liquids, and salt corrosion • Away from combustible materials such as wood • Meeting Class 3C3 requirements in IEC 60721-3-3 in terms of chemically active substances.

Environment	Requirement
Altitude	• 1000 m and below: derating is not required. • > 1000 m: derate 1% for every additional 100 m For 0.4 kW to 3 kW models, the maximum altitude is 2000 m; for altitudes above 2000 m, contact Inovance. For models with the power higher than 3 kW, the maximum altitude is 3000 m; for altitudes above 3000 m, contact Inovance.
Vibration resistance	• For transportation in the package: compliant with class 2M3 in EN 60721-3-2 • For installation with the package removed: compliant with ISTA 1H

5.3 Installation Clearance

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

T1 to T9 models

- Installing one drive

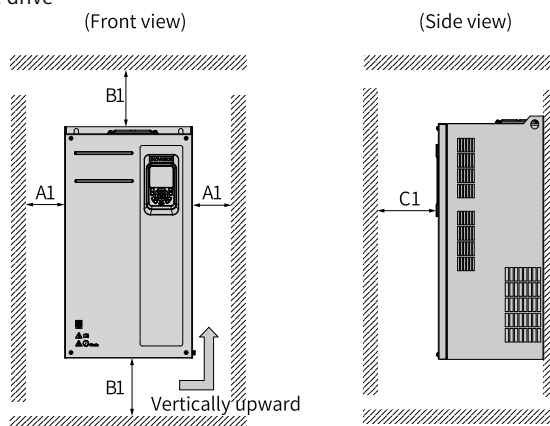


Figure 5-1 Clearance for installing one AC drive (T1 to T9 models)

Table 5-2 Installation clearance

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

说明

The clearance for the air inlet and outlet of the AC drive is given based on extreme work conditions. If the clearance for customers is smaller than the recommended clearance, contact Inovance engineers.

- 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.

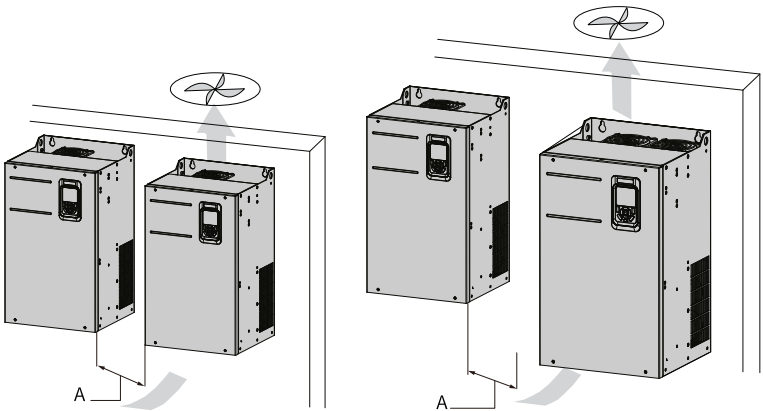


Figure 5-2 Installing multiple AC drives (T1 to T9 models) side by side

Table 5-3 Installation clearance

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

说明

The clearance for the air inlet and outlet of the AC drive is given based on extreme work conditions. If the clearance for customers is smaller than the recommended clearance, contact Inovance engineers.

- 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 55](#). This can prevent the drive in the lower row from heating that in the upper row, causing overheat or overload faults.

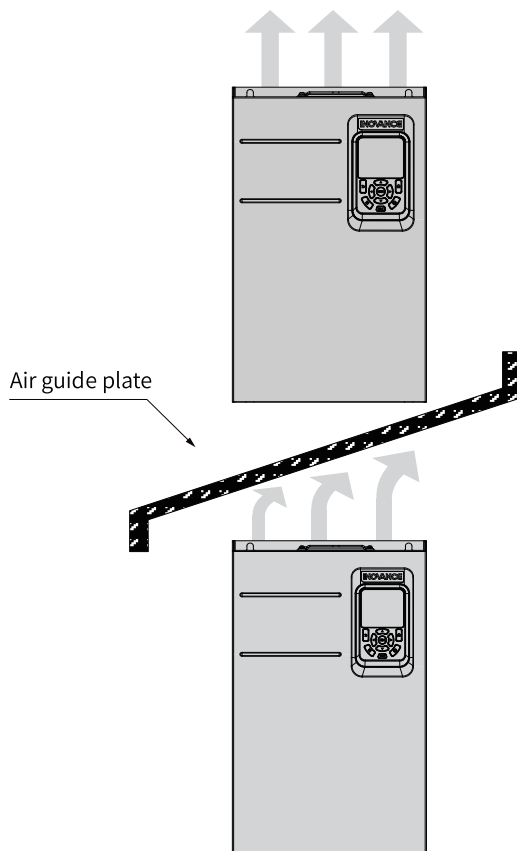


Figure 5-3 Dual-row installation

Air director design

The following figure shows the air director.

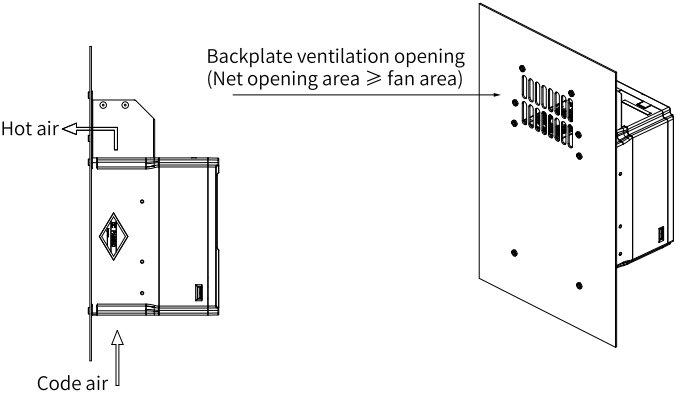


Figure 5-4 Air director

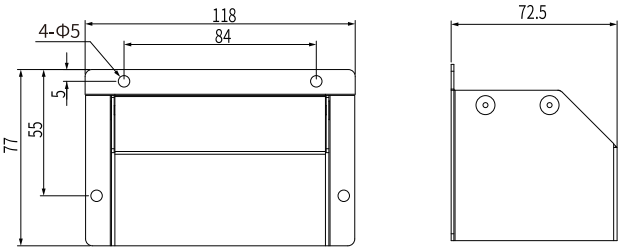


Figure 5-5 Air director dimensions (mm) of T1 models

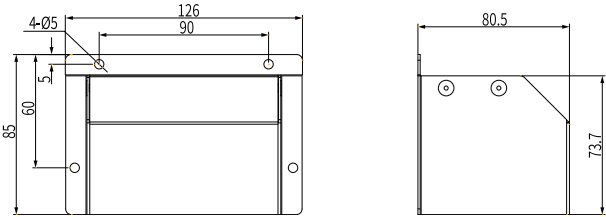


Figure 5-6 Air director dimensions (mm) of T2 models

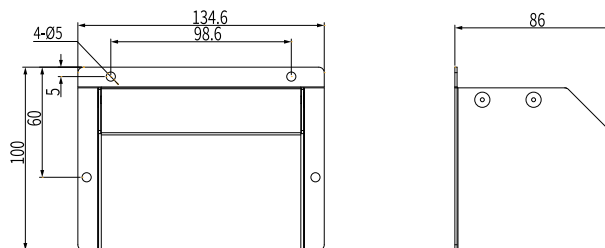


Figure 5-7 Air director dimensions (mm) of T3 models

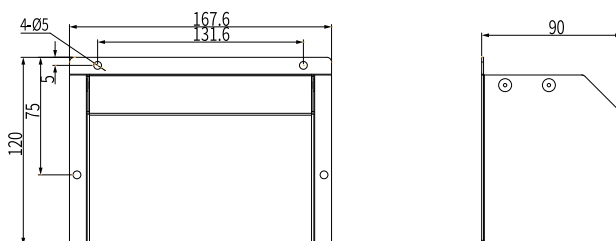


Figure 5-8 Air director dimensions (mm) of T4 models

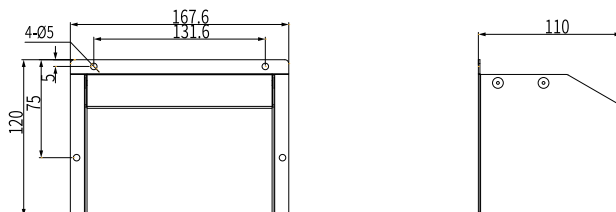


Figure 5-9 Air director dimensions (mm) of T5 models

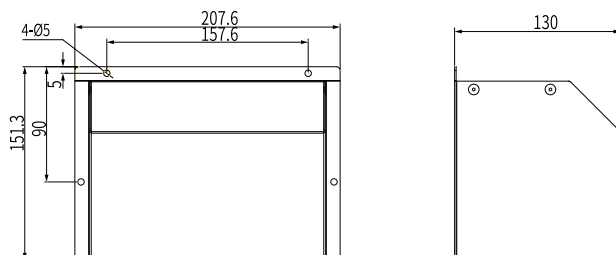


Figure 5-10 Air director dimensions (mm) of T6 models



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)	50
T3 (11 kW)	
T4	
T5	60
T6 to T7	102
T8	204
T9	318

The preceding table applies to situations where only one AC drive is mounted in the cabinet. For a cabinet containing multiple AC drives, calculate the total ventilation area by adding the ventilation area of each drive according to the table. For example, if eight T3 models (7.5 kW), two T5 models, and one T9 drives are placed inside the cabinet, the minimum effective ventilation area of the cabinet air inlet is $8 \times 25 + 2 \times 60 + 1 \times 318 = 638$ cm².

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

The ventilation area in ["Table 5-4 Minimum effective ventilation area of the cabinet air inlet" on page 58](#) refers to the actual through-hole area of an opening. The ventilation area is calculated by the following: opening area x opening rate.

T10 to T12 models

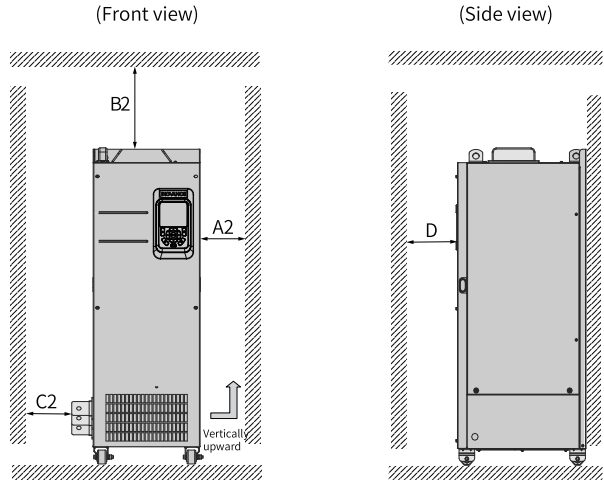


Figure 5-11 Requirements on installation clearance

Table 5-5 Installation clearance

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

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

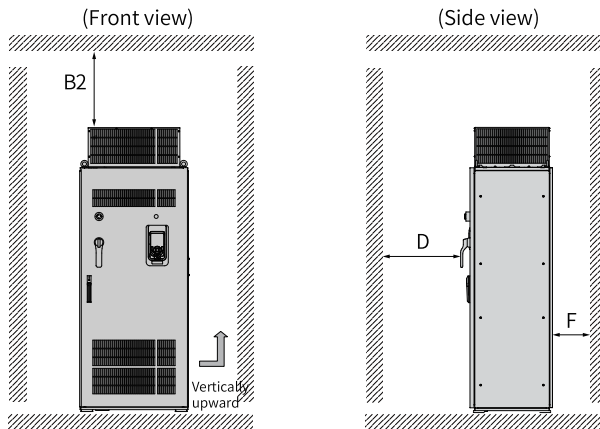


Figure 5-12 Requirements on installation clearance

Table 5-6 Installation clearance

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

5.4 Installation Tool Preparations

Mechanical Installation Tools

Table 5-7 Mechanical Installation (T1 to T12 Models)

Tool	Description
Electric drill with appropriate drilling bits	Used to drill mounting holes on the mounting surface.
Nut wrench or socket wrench	Used to tighten or loosen screws. The following specifications are required: #13, #16, and #18.
Phillips and straight (2.5 mm to 6 mm) screwdrivers	Used to tighten or loosen screws.
Torque wrench	Used to tighten or loosen screws.
Crowbar	Used to pry off the upper cover or cover to facilitate installation.
Hoisting machine	Used to lift the drive.
Tape measure	Used to measure the installation dimensions of the device.

Tool	Description
Gloves	Used to prevent static electricity during mechanical installation.
Bottom mounting bracket (standard)	It is used to fix the AC drive in the cabinet.
Guide rails (optional)	They are connected to the bottom mounting bracket, enabling you to gently push the AC drive into the cabinet along the guide rails.
Screw	Used to fix the equipment to the mounting surface.

Screw

Table 5-8 Specifications and quantity of screws (T1 to T9 models)

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

Table 5-9 Specifications and quantity of screws (T10 to T12 models)

Installation	Screw Specification	Quantity (PCS)	Description
Installation within the cabinet	M5 self-tapping screw	6	Used to fix the bottom mounting bracket to the bottom of the cabinet.
	M5 x 12 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

When wiring the main circuit terminal, select an appropriate installation tool based on the terminal size.

Table 5-10 Main circuit wiring tools

Products	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)
T7	M8 nut, spring washer, and flat washer	Socket wrench (#13 socket wrench)
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, Storage, and Transportation

5.5.1 Package Confirmation

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. Seek support from the Inovance office or your local agent if necessary.

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



Caution

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

The following figure shows the packing list.

- Packing list for T1 to T6 models

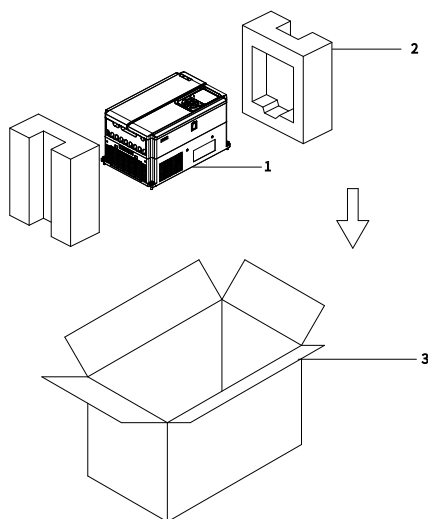


Figure 5-13 Packing list for T1 to T6 models

Table 5-11 Packing list for T1 to T6 models

No.	Name
1	AC Drive
2	Cushion
3	Carton box

- Packing list of T7 to T9 models

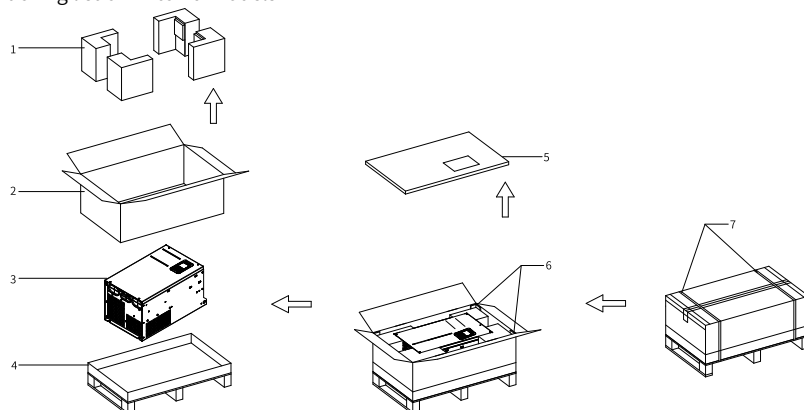


Figure 5-14 Packing list of T7 to T9 models

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

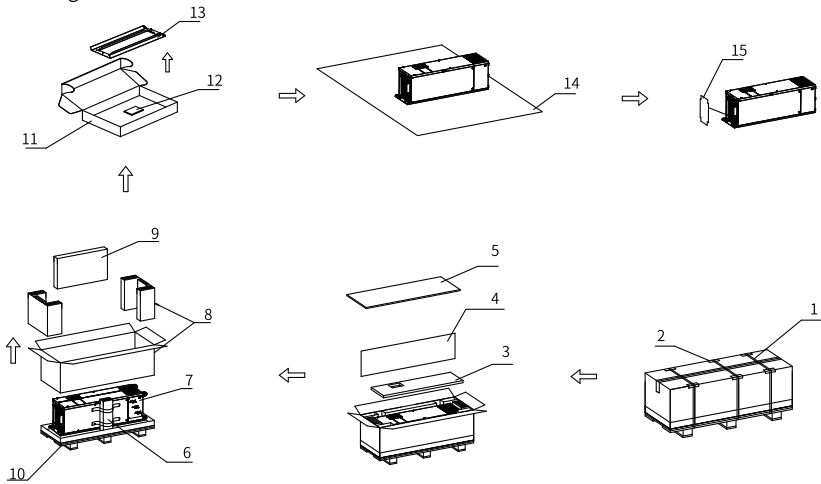


Figure 5-15 Packing list of T10 models

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 box
9	Bracket box
10	Wooden pallet
11	Carton
12	User guide
13	Bracket
14	Plastic bag
15	Corrugated cardboard

● Packing list of T11 model

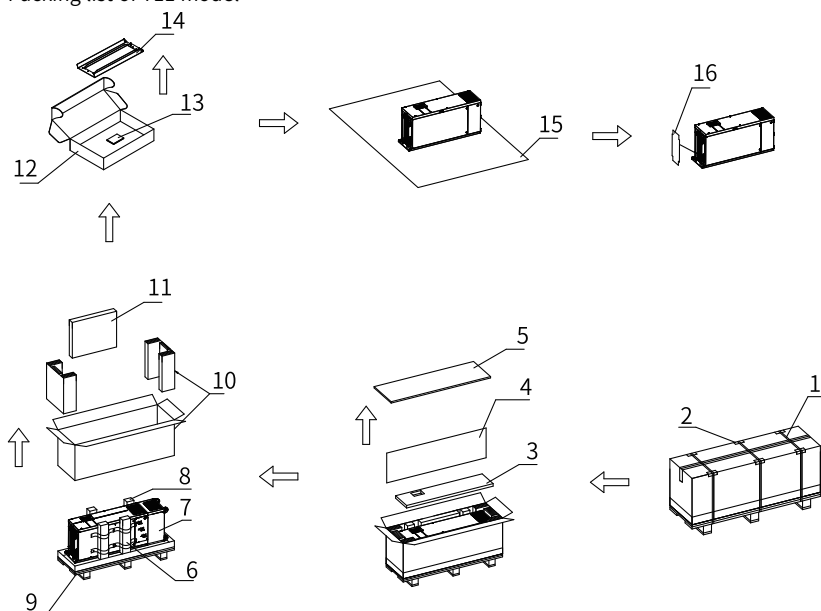


Figure 5-16 Packing list of T11 model

Table 5-14 Packing list of T11 model

No.	Name
1	Packing strap
2	Paper corner protector
3	Honeycomb cardboard
4	Corrugated cardboard
5	Wooden board
6	Paper column
7	AC Drive

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

● Packing list of T12 model

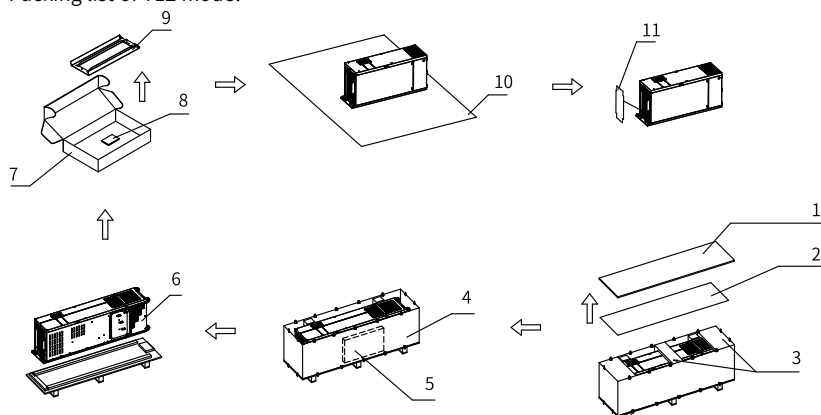


Figure 5-17 Packing list of T12 model

Table 5-15 Packing list of T12 model

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

Packing List of T13 Model

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

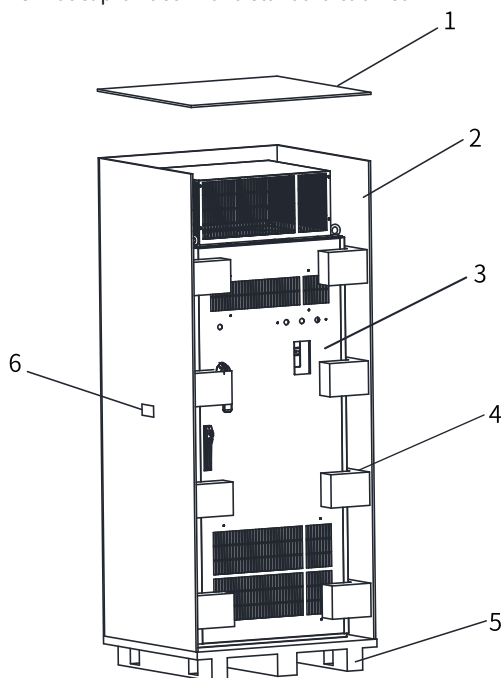


Figure 5-18 Packing list of a T13 model provided with a standard cabinet

No.	Name
1	Top 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

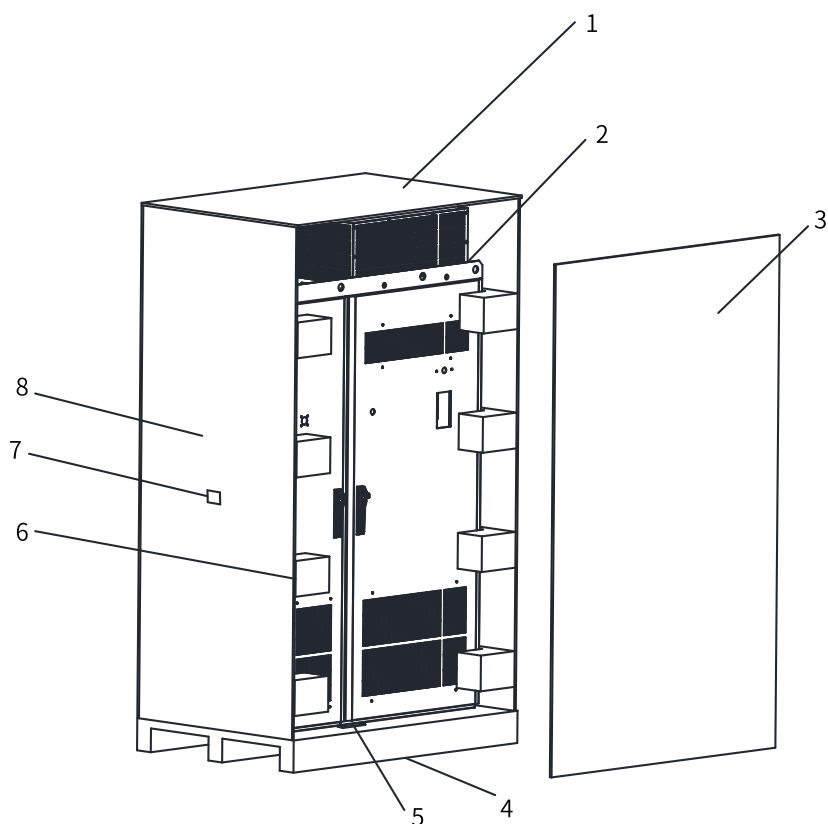


Figure 5-19 Packing list of a T13 model provided with a cabinet with an auxiliary power distribution cabinet

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.
- When handling the drive with a forklift, fix the drive to a wooden pallet. When handling the drive with a crane, fix the drive to the pallet and lift them together, as shown below.

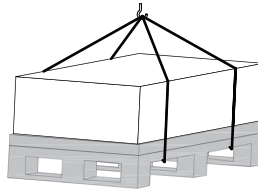
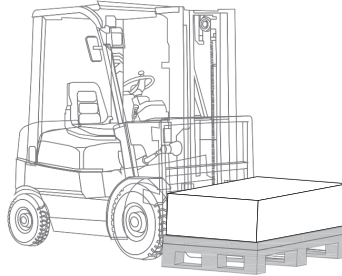


Figure 5-20 Lifting the drive

- 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. Place the AC drive 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.

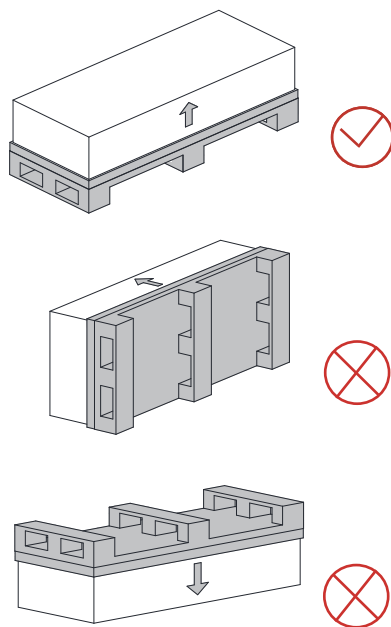


Figure 5-21 Placing the drive

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. Place the AC drive on a flat and firm ground that can bear its weight.
- The equipment must be transported in the upright position as indicated on the packaging box. Never turn it upside down or place it on its side.

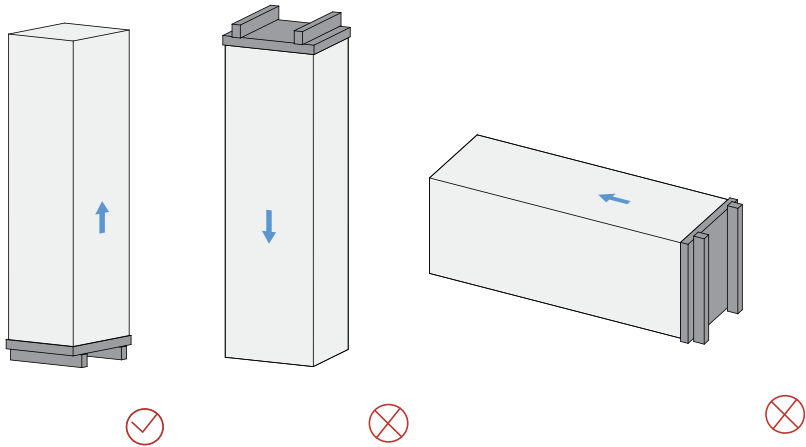


Figure 5-22 Upright position of the cabinet

- 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 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 hoist must pass through the pallet under the cabinet, with the relief height less than or equal to 0.3 m.
- The hydraulic vehicle must not move for a long distance or on the slop road.
- When being moved, the equipment must be held by persons from the left and right.

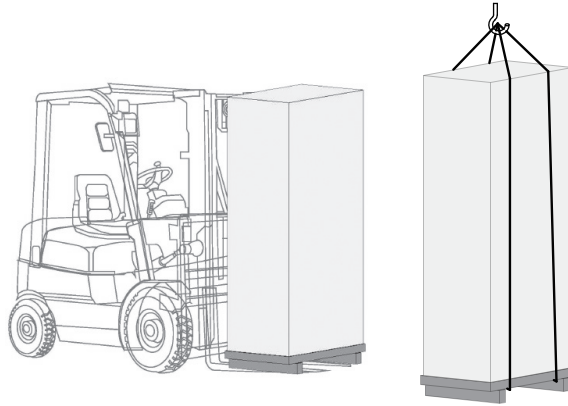


Figure 5-23 Transportation before unpacking

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:

- Comply with local regulations when handling the AC drive.
- 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 drive.
- Ensure that the upper cover, terminals, and other components of the AC drive are secured firmly with screws before vertical lifting. Failure to comply may result in physical injuries due to fall-off of the drive.
- When lifting the AC drive with the lifting rope, avoid subjecting the AC drive to excessive vibration or impact. Failure to comply may result in physical injuries due to fall-off of the drive.
- 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 may result in physical injuries due to fall-off of the drive.

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.

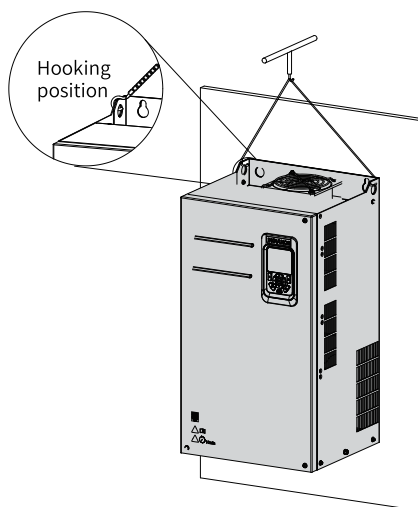


Figure 5-24 Lifting the AC drive

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.

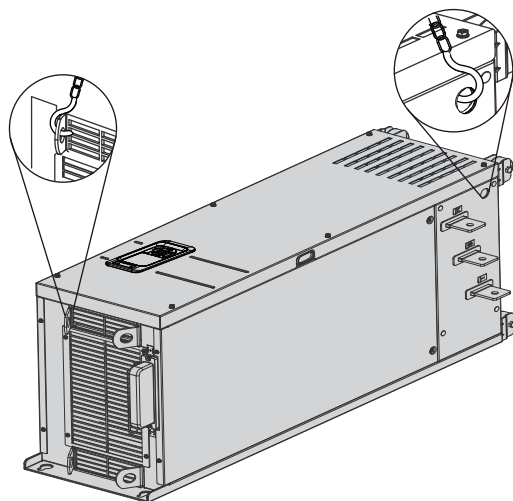


Figure 5-25 Lifting the AC drive

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

If the AC drive needs to be placed in an upright position, ensure the tilt angle of the place that holds the drive does not exceed 5°. Failure to comply may lead to rollover of the drive due to its heavy weight (nearly 200 kg) and large size.

T13 models

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

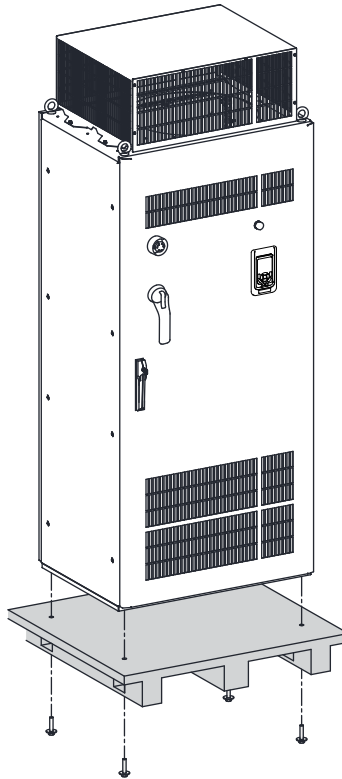


Figure 5-26 Unloading the cabinet from the pallet

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.

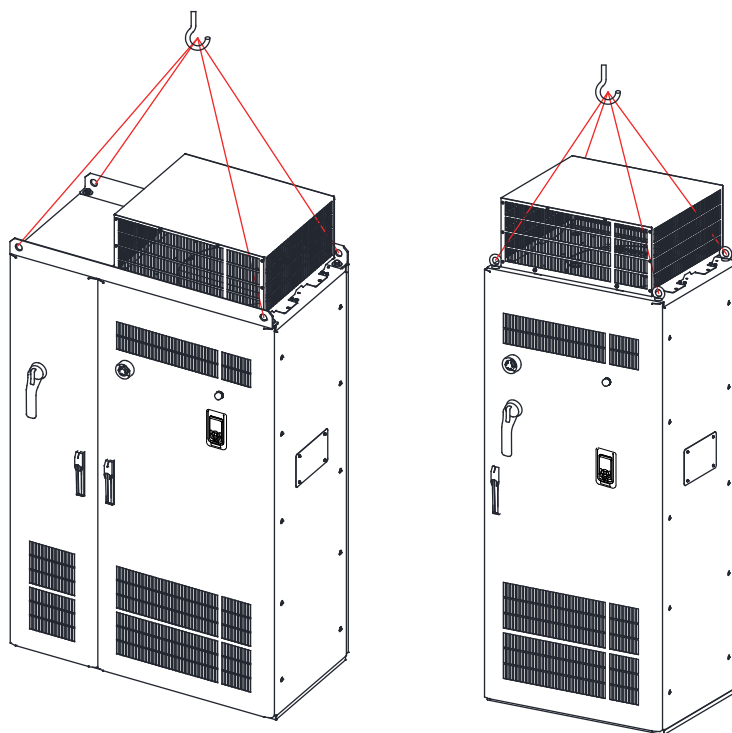


Figure 5-27 Transportation after unpacking

5.5.4 Unpacking

T1 to T12 models

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

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

5.5.5 Storage

- The drive must be stored in a clean and dry room, where the temperature ranges from -20°C and +60°C and temperature change rate is smaller than 1°C/min.

- If the drive needs to be stored for a long period of time, cover it or take other appropriate measures to keep it from contamination and environmental influences.
- Try to store the system with the original packing carton of the company.
- Do not expose the AC drive to environments with moisture, high temperatures, or direct sunlight for a long time.
- The electrolytic capacitor will deteriorate after long-term storage. Therefore, switch on the AC drive once for at least 5 hours every 6 months. Increase the input voltage slowly to the rated value by using a voltage regulator. Contact Inovance for technical support if necessary.

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 to T9 Models

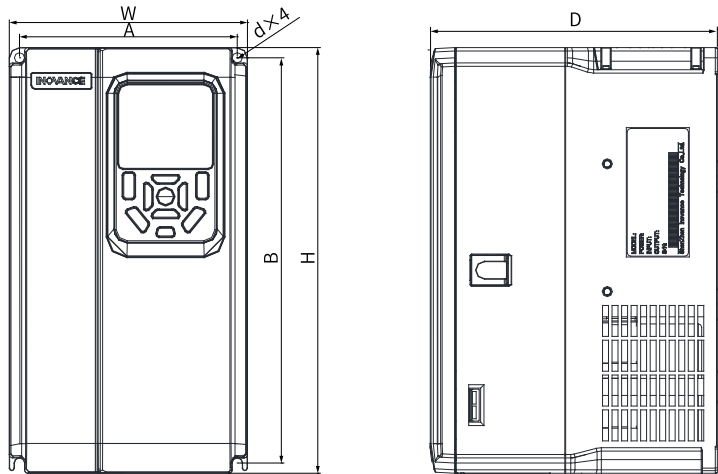


Figure 5-28 Outline dimensions and mounting dimensions of T1 to T4 models

Table 5-18 Outline dimensions and mounting dimensions of T1 to T4 models

Structure	Mounting Hole Dimension mm (in.)		Overall 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)	Φ5 (0.2)	1.6 (3.5)
T2	119 (4.7)	189 (7.5)	200 (7.9)	130 (5.1)	160 (6.4)	Φ5 (0.2)	2.0 (4.4)
T3	128 (5.0)	238 (9.4)	250 (9.9)	140 (5.5)	168.3 (6.7)	Φ6 (0.2)	3.3 (7.3)
T4	166 (6.5)	266 (10.5)	280 (11.0)	180 (7.1)	169 (6.7)	Φ6 (0.2)	4.3 (9.5)

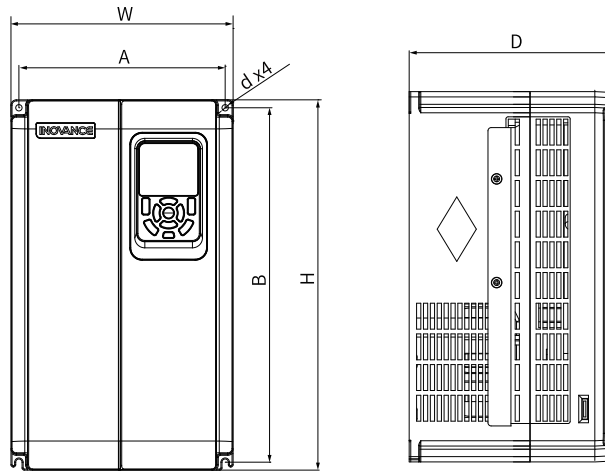


Figure 5-29 Outline dimensions and mounting dimensions of T5 and T6 models

Table 5-19 Outline dimensions and mounting dimensions of T5 to T6 models

Structure	Mounting Hole Dimension mm (in.)		Overall 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)	Φ6 (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)	Φ6 (0.2)	10.0 (22.0)
T6	230 (9.1)	380 (15.0)	400 (15.8)	-	250 (9.9)	220.8 (8.7)	Φ7 (0.3)	17.5 (38.6)

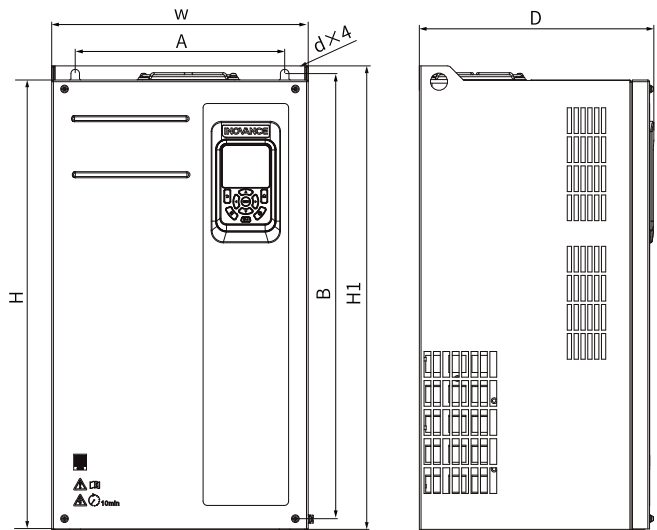


Figure 5-30 Outline dimensions and mounting dimensions of T7 and T9 models

Table 5-20 Outline dimensions and mounting dimensions of T7 to T9 models

Structure	Mounting Hole Dimension mm (in.)		Overall Dimension mm (in.)				Mounting Hole Dimension 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)	Φ10 (0.4)	35 (77.2)
T8	270 (10.6)	560 (22.1)	554 (21.8)	580 (22.9)	338 (13.3)	315 (12.4)	Φ10 (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)	Φ10 (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.

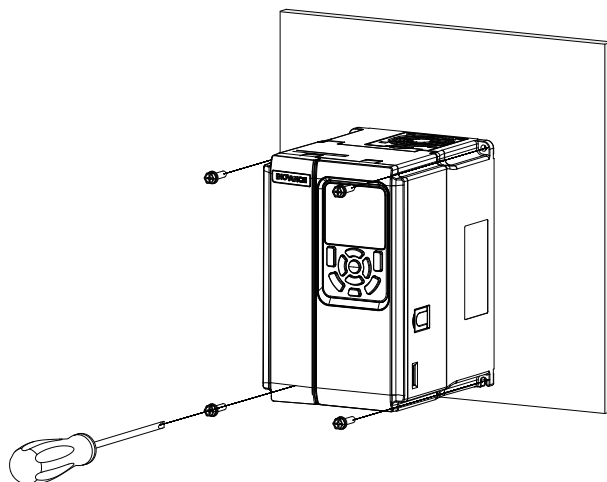


Figure 5-31 Backplate mounting of T1 and T6 models

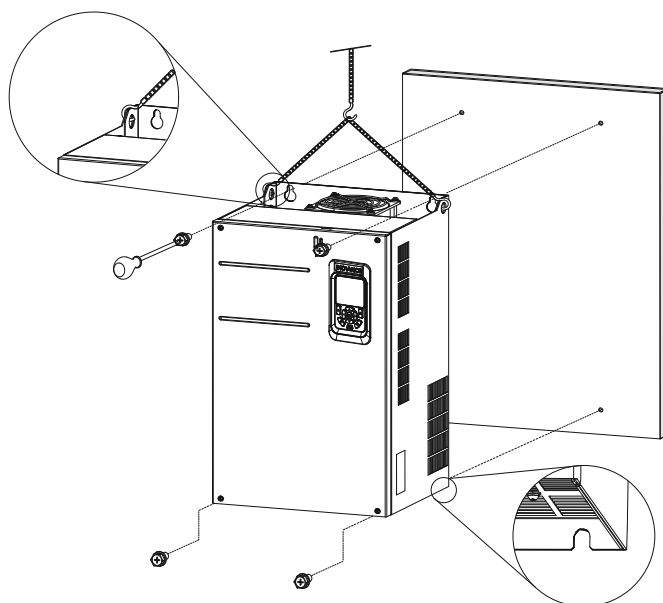
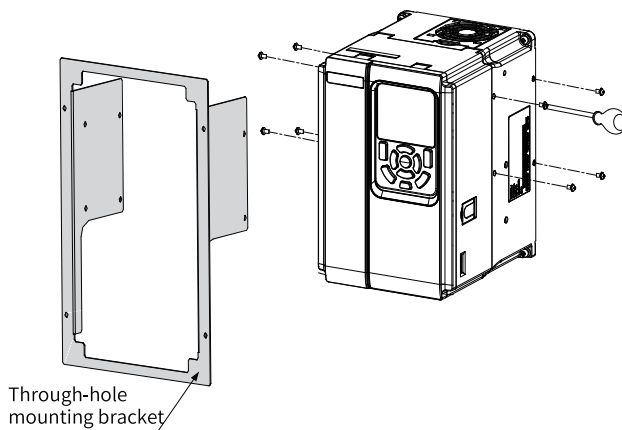


Figure 5-32 Backplate mounting of T7 and T9 models

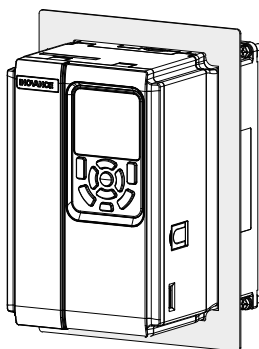
5.7.2.3 Through-Hole Mounting

T1 to T6 models

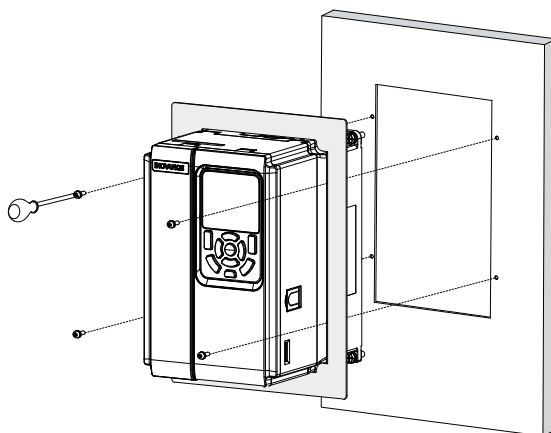
1. Install the AC drive through the mounting bracket, and then fix the screws at both sides of the bracket.



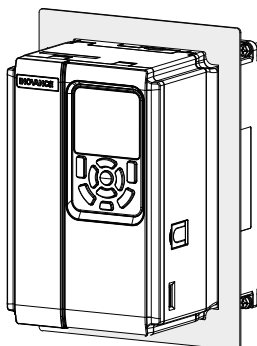
The following figure shows an AC drive with a bracket mounted.



2. Fix the AC drive with the bracket on the backplate of the control cabinet.

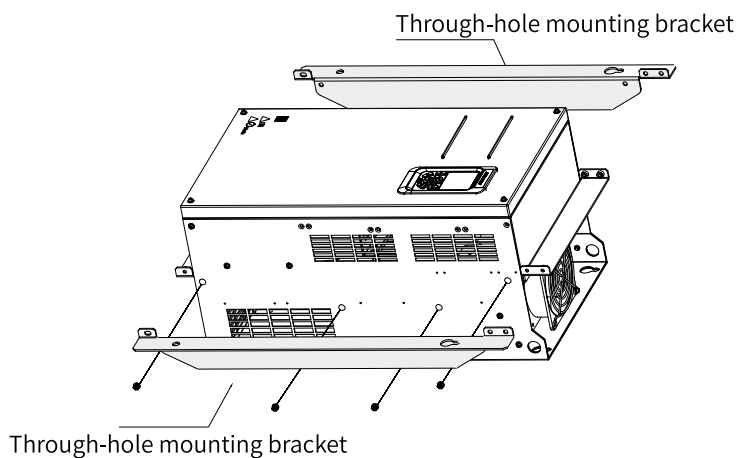


The following figure shows an AC drive with the bracket mounted in the cabinet.

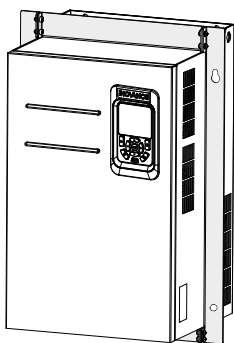


T7 to T9 models

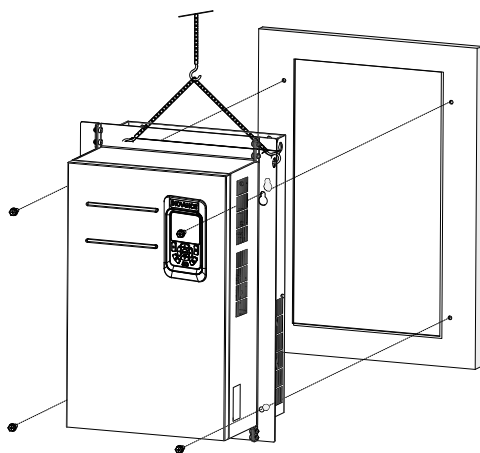
1. Fix the through-hole mounting bracket from both sides of the enclosure.



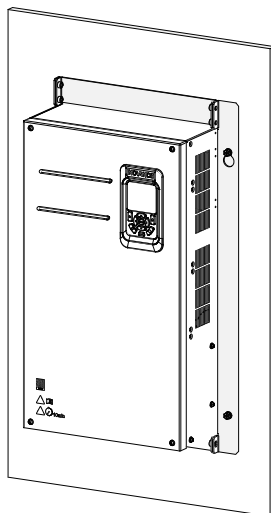
The following figure shows an AC drive with brackets mounted.



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



The following figure shows an AC drive with the bracket mounted in the cabinet.



5.7.3 T10 to T12 Model Installation

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

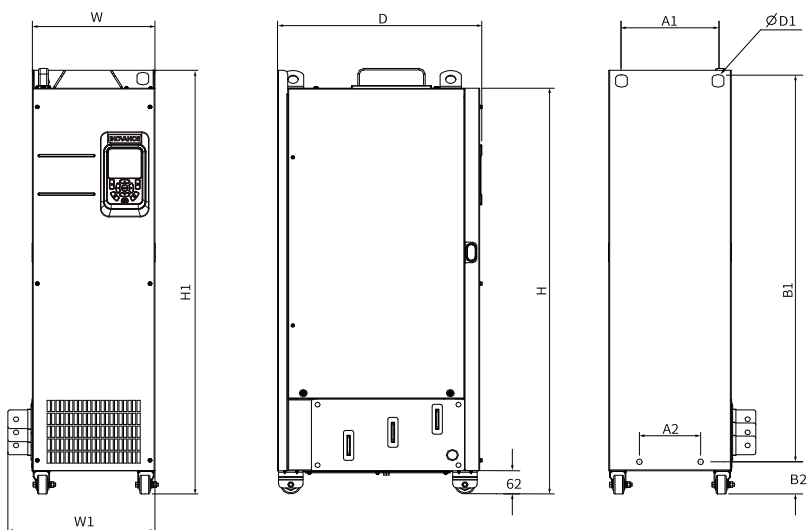


Figure 5-33 Outline dimensions and mounting dimensions of T10 to T12 models (without AC output reactors)

Table 5-21 Outline dimensions and mounting dimensions of T10 to T12 models (without AC output reactors)

Structure	Mounting Hole Dimension mm (in.)				Overall Dimension mm (in.)					Mount ing 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)

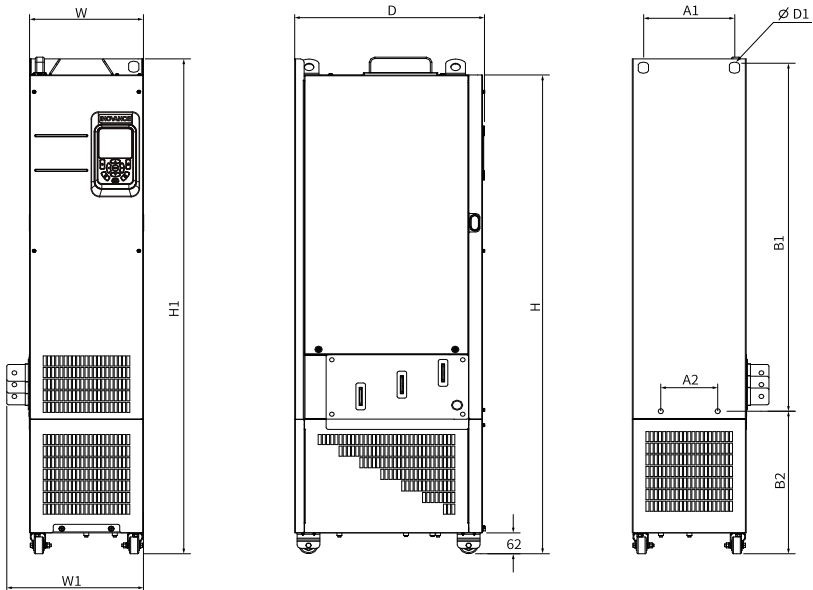


Figure 5-34 Outline dimensions and mounting dimensions of T10 to T12 models (with AC output reactors)

Table 5-22 Outline dimensions and mounting dimensions of T10 to T12 models (with AC output reactor)

Structure	Mounting Hole Diameter 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.

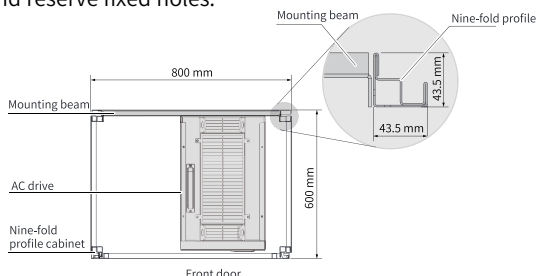


Figure 5-35 Top view of the cabinet for T11 and T12 models

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.

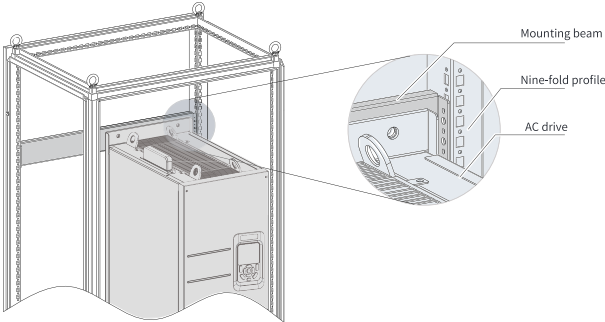


Figure 5-36 3D of the cabinet for T11 and T12 models

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](#) .

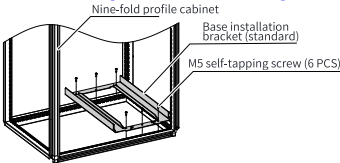


Figure 5-37 Installing the bottom mounting bracket

说明

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](#) .

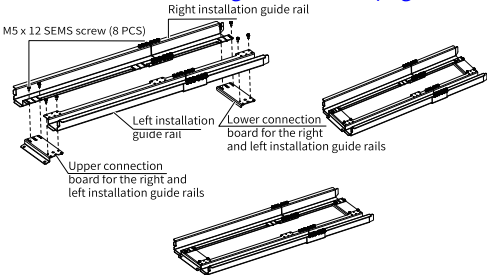


Figure 5-38 Assembling guide rails

- 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 .

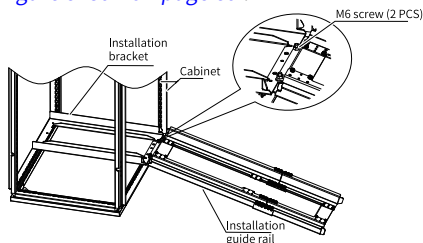


Figure 5-39 Mounting the guide rails to the cabinet

4. Remove the cover from the AC drive.
For details, see "[5.7.3.4.1 Removing the Cover](#)" on page 92. 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.

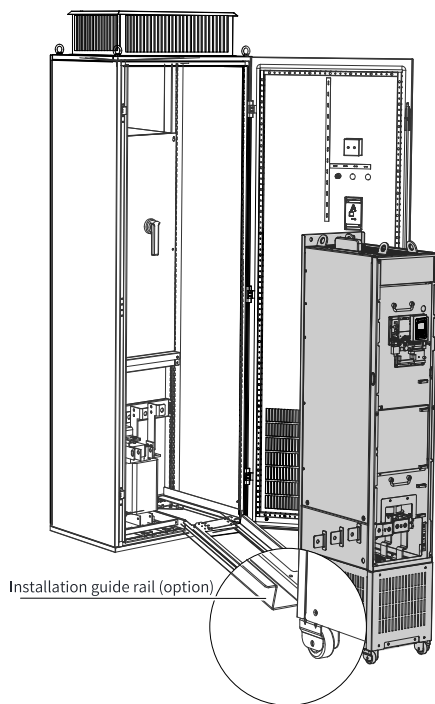


Figure 5-40 Aligning the AC drive caster with the guide rail

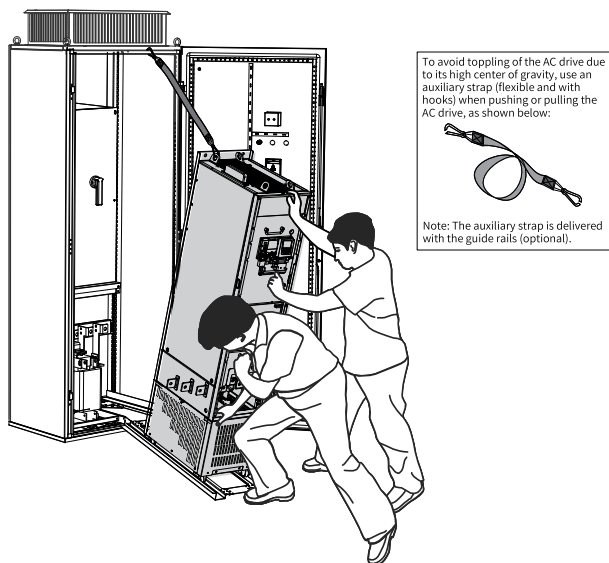


Figure 5-41 Pushing the AC drive into the cabinet

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.

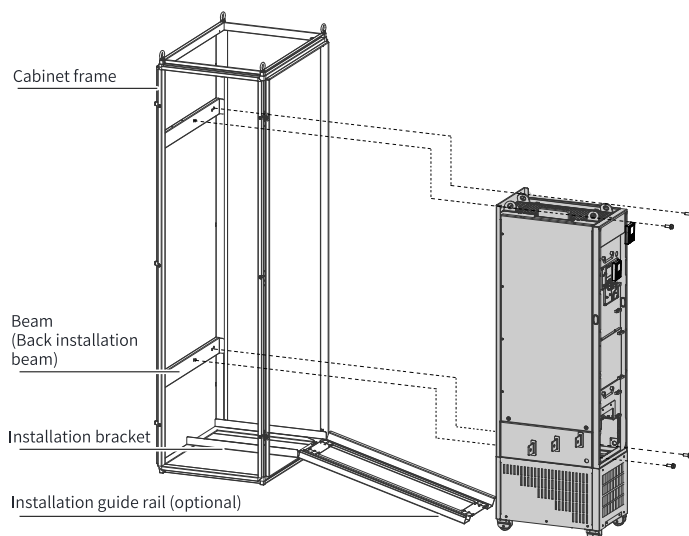


Figure 5-42 Installing the AC drive to the beam

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.

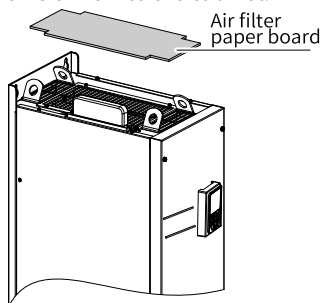


Figure 5-43 Removing the air filter paper board

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

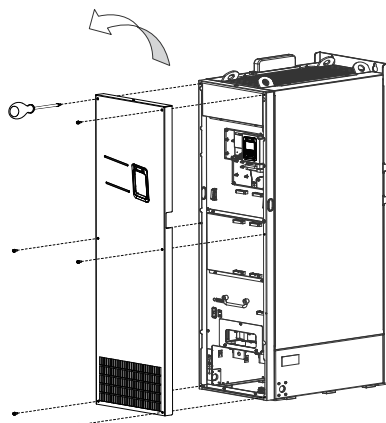
Before removing the cover, ensure that the machine has been powered off for over 10 minutes.

Procedure

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



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

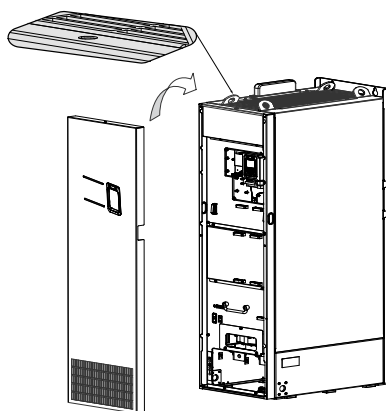


5.7.3.4.2 Installing the Cover

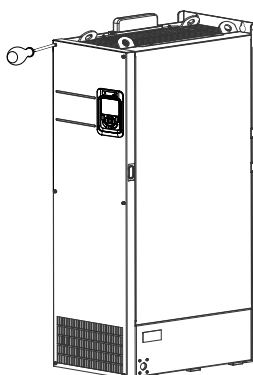
The cover of the AC drive must be removed before wiring the main circuit and control circuit. After wiring is done, re-install the cover.

Procedure

1. Hold the cover with both hands, align the upper edge of the cover 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 in the cover with the cover fixing holes in 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 Inspection After Installation

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

Table 5-23 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 Pre-wiring Check

Check the following items before wiring.

No.	Item
1	Cables used during wiring comply with the requirements on the cross sectional area and the shield.
2	The device and the drive are grounded properly.

No.	Item
3	Proper electrostatic discharge (ESD) procedures are followed and antistatic wrist straps are worn.
4	Wiring-related options, including cable shield brackets (applicable to T1 to T9 models), are available.

5.8.2 Descriptions of Main Circuit Terminals

T1 to T9 models

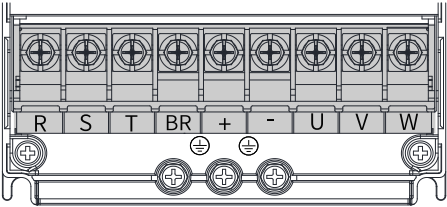


Figure 5-44 Layout of main circuit terminals for T1 to T4 models (three phase)

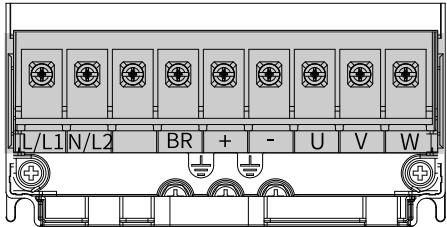


Figure 5-45 Layout of main circuit terminals for T2 models (single phase)

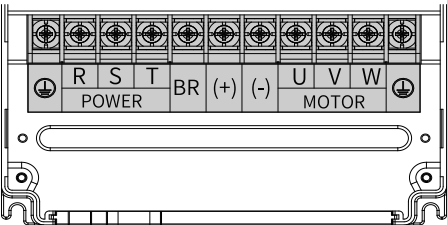


Figure 5-46 Layout of main circuit terminals for T5 to T8 models

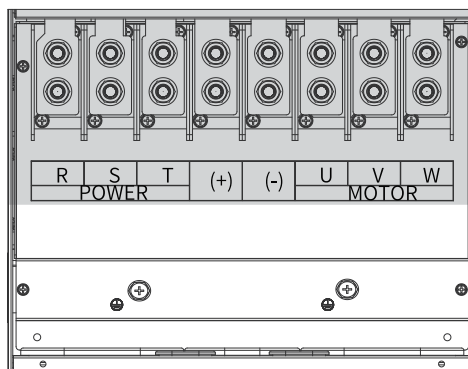


Figure 5-47 Layout of main circuit terminals for T9 models

Table 5-24 Descriptions of main circuit terminals

Terminal Mark	Terminal Name	Function Description
R, S, T	Input terminals of three-phase power supply	Used to connect the 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.
(+), 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 resistor terminals. For models with the name excluding "B", external brake units are required.
U, V, W	Output terminals	Used to connect the three-phase motor.
	Grounding terminal (PE)	Used for protective grounding.

T10 to T12 models

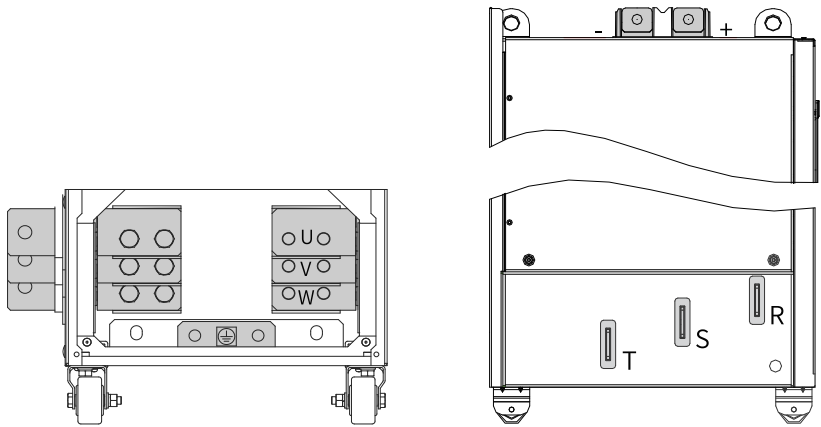


Figure 5-48 Layout of main circuit terminals for T10 to T12 models

Table 5-25 Descriptions of main circuit terminals

Terminal Mark	Terminal Name	Function Description
R, S, T	Input terminals of three-phase power supply	Used to connect the 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	Used to connect the three-phase motor.
	Grounding terminal (PE)	Used for protective grounding.

T13 models

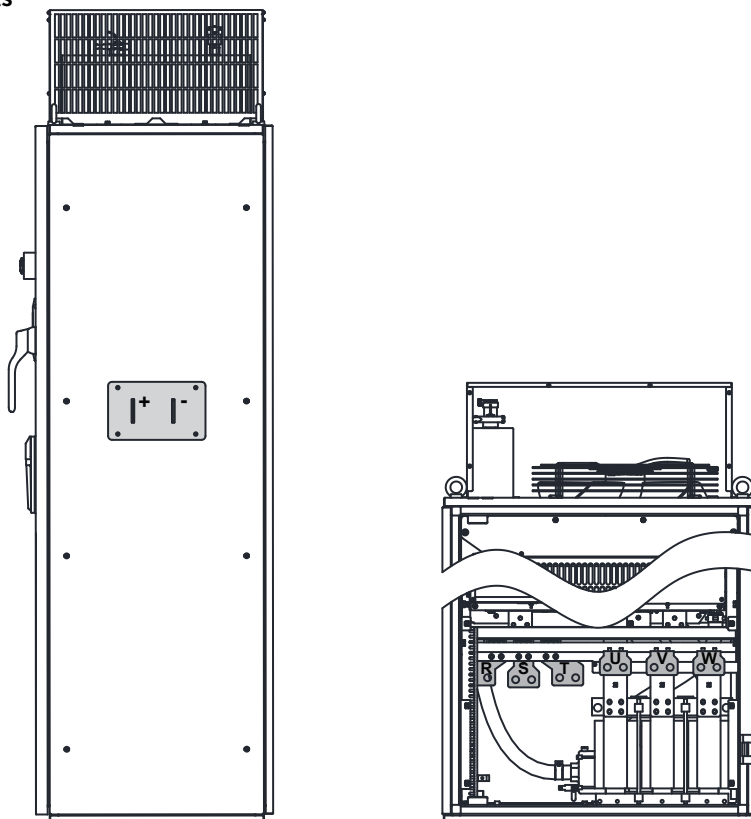


Figure 5-49 Layout of main circuit terminals for T13 models

Table 5-26 Descriptions of main circuit terminals

Terminal Mark	Terminal Name	Function Description
R, S, T	Input terminals of three-phase power supply	Used to connect the 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	Used to connect the three-phase motor.
	Grounding terminal (PE)	Used for protective grounding.

5.8.3 Descriptions of Control Circuit Terminals

"Table 5-29 " on page 103 shows the layout of control circuit terminals.

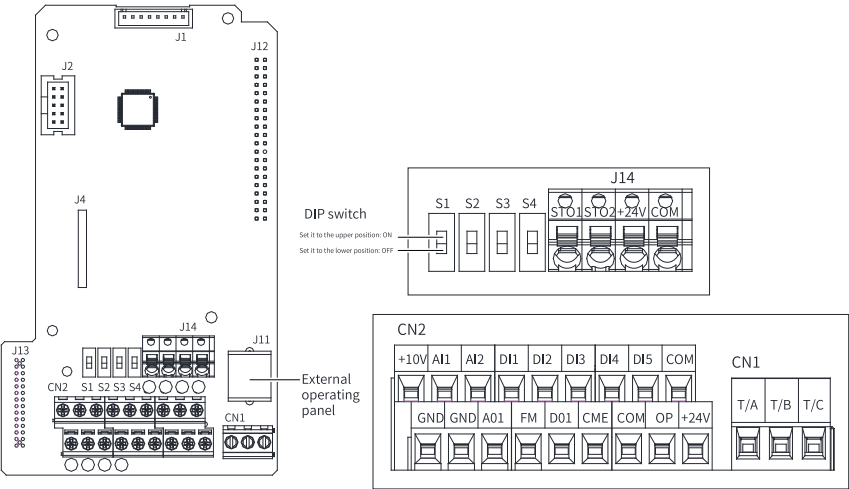


Figure 5-50 Layout of control circuit terminals

Table 5-27 Function description of control circuit terminals

Type	Terminal Mark	Terminal Name	Function Description
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 of 10 mA. Generally, it is used to power an external potentiometer with resistance ranging from 1 k Ω to 5 k Ω .
	+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 DIs/DOs 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 k Ω
	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 1%. The input impedance is 22 k Ω 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, compatible with dual-polarity input. Input impedance: 1.72 k Ω Operating voltage range: 9 V to 30 V
	DI2-OP	DI2	
	DI3-OP	DI3	
	DI4-OP	DI4	Besides features of DI1 to DI4, DI5 can also be used for high-speed pulse input. Input impedance: 1.16 k Ω Maximum input frequency: 100 kHz Operating voltage range: 15 V to 30 V
	DI5-OP	DI5	
Analog output	AO1-GND	Analog output 1	The DIP switch on the control board is used to determine voltage output (default) or current output. Output voltage range: 0 V to 10 V Output current range: 0 mA to 20 mA

Type	Terminal Mark	Terminal Name	Function Description
Digital output	DO1-CME	Digital output 1	Optocoupler isolation; dual-polarity open collector output Output voltage range: 0 V to 24 V Output current range: 0 mA to 50 mA 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, COS ϕ = 0.4 30 VDC, 1 A
	T/B	Normally closed (NC) terminal	
	T/C	Normally open (NO) terminal	
Auxiliary interface	J4	Local PG card interface	It is used to connect the resolver, ABZ incremental encoder, 23-bit encoder, and sin-cos encoder.
	J11	External operating panel interface	It is used to connect the external LCD operating panel (SOP-20) or the LED operating panel (MDKE-10).
	J13	Expansion card interface	28-core terminal used to connect to expansion cards, including I/O cards, communication cards, and PG card
	J14	Safety function terminal	For details, see "Table 5-28 STO terminal description" on page 103 .
DIP switch	S1 S2 S3		For details, see "Table 5-29 DIP switch descriptions" on page 103 .
	S4		

Table 5-28 STO terminal description

No.	Terminal Mark	Terminal Name	Performance Requirement
1	STO1	STO channel 1	Internal: STO1 and STO2 are connected to +24V by jumpers by default. External: You can connect STO1 and STO2 to the COM terminal. For detailed wiring methods, see the STO function.
2	STO2	STO channel 2	
3	+24V	STO channel 1 and STO channel 2 power supply+	
4	COM	Power supply ground of STO channel 1 and STO channel 2	

Table 5-29 DIP switch descriptions

DIP Switch Status			Description
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 temperature detection input signal, -25°C to 200°C, accuracy: $\pm 8^{\circ}\text{C}$ 2: PT1000 temperature detection input signal, -25°C to 200°C, accuracy: $\pm 8^{\circ}\text{C}$ 3: KTY84-130 temperature detection input signal, -40°C to 260°C, accuracy: $\pm 15^{\circ}\text{C}$ 4: PTC130 temperature detection input signal, -20°C to 180°C, accuracy: $\pm 15^{\circ}\text{C}$
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 impedance of 500 Ω or 250 Ω . 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 DIP switches used together for the AI. S4 is the DIP switch for the AO.

5.8.4 Post-wiring Check

After wiring is completed, check the following items and tick compliant items.

Table 5-30 Post-wiring checklist

No.	Item	Compliance
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-shrinkable tubes are applied to copper tubes of the main circuit cable and conductors, and heat-shrinkable tubes are completely cover the 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.	☐

No.	Item	Compliance
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 product.	☐

5.8.5 Electrical Connection

T1 to T12 models

"Figure 5-51 " on page 105 shows a typical wiring method of T1 to T12 models.

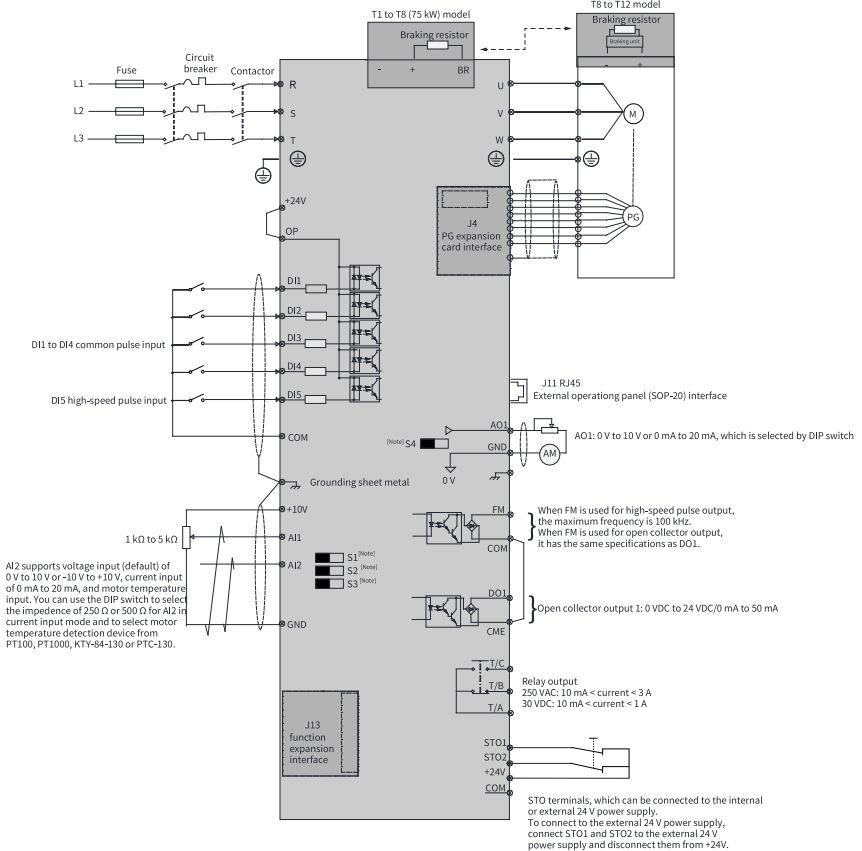


Figure 5-51 Standard wiring (T1 to T12)

Note

- For details on S1 to S4 DIP switches, see ["Table 5-27 Function description of control circuit terminals" on page 101](#).
- 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 5-52 " on page 106](#) shows the electrical connection in the cabinet.

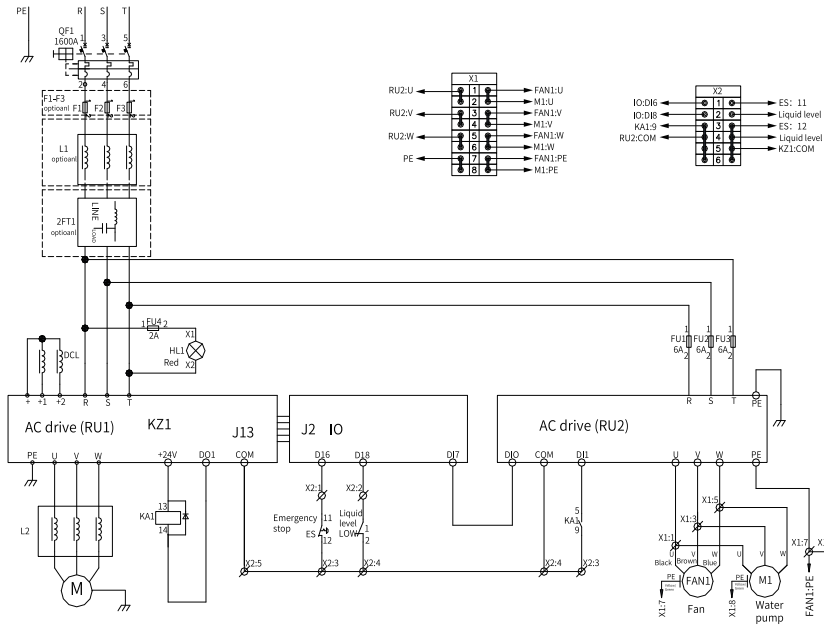


Figure 5-52 Electrical connection in the cabinet (T13)

T13 models

- The cabinet operates under high voltages. 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 equipment 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.

- After disconnecting the input and output power supplies, wait for at least 15 minutes until the bus voltage is lower than 36 V and the power indicator is off before further operation.
- Ensure that the motors, cabinets, and other components are installed and connected in accordance with the recognized technical rules of the country and the region. Pay special attention to regulations on cable dimensions, fuses, grounding, open circuits, isolation, and overcurrent protection.
- If the fuse in a branch circuit trips, 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. After a fuse trips, identify and rectify the cause of the tripping.

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.



Danger

- 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.
-



Caution

- 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.

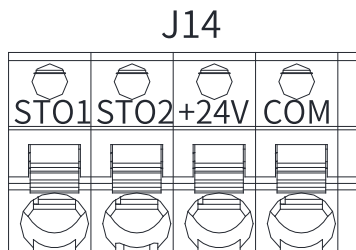


Figure 6-1 STO terminal arrangement

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.

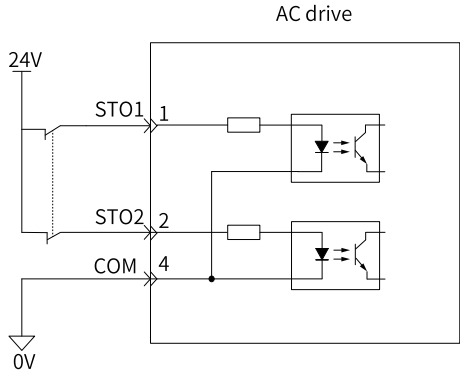
- Electrical characteristics

Table 6-3 Electrical characteristics of safety input signals

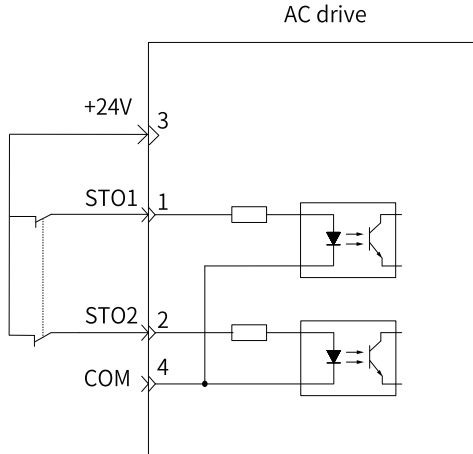
Item	Characteristics	Description
Voltage range	24 VDC ($\pm 15\%$)	-
Input current	4 mA (Typ.)	This is the value per channel.
Standards of logic levels	"0" < 3 V, "1" > 15 V	-
Digital input impedance	5.63 k Ω	-

- 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.

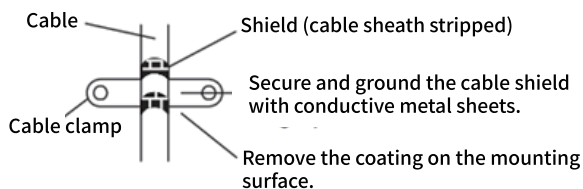


Figure 6-2 Cable clamp

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 Function Overview

Safety torque off (Safe Torque Off) is a safety function that complies with IEC 61800- 5-2:2016. The AC drive is optionally integrated with the STO function. When the STO function is triggered, the drive turns off the RDY signal and enters the safety state, in which the drive control signal of the power semiconductor is blocked and the motor input current is cut off, preventing the drive from generating torque on the motor shaft end and stopping the motor.

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, thus preventing the movement of the motor. These two +24 VDC signals must be at high level to enable normal operation of the drive. If either one or both signals are set to "low" level, the PWM signals will be blocked.

7.1.2 Parameters

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

Item	Parameter	Range	Default	Description
F9-79	STO status reset	0: Manual reset 1: Automatic reset	1	Used to enable STO fault reset mode. If this function is enabled, STO is reset automatically when STO1 and STO2 are recovered.
U0-96	STO status word monitoring	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 output flag (active when the DO is assigned with function 42). 1: DO output; 0: DO not output Bit 3: STO status flag. (If the STO function is activated, the panel displays STO status.) 1: STO activated; 0: STO deactivated

7.1.3 Function Triggering

To use the input signal function of the safety module, connect cables correctly. If either the STO1 or STO2 signal is disconnected, the system enters the safety state.

Table 7-1 STO function

STO2 input	STO1 input	PWM state	System State	Reset
H	H	Normal	Normal	/
H	L	Blocked	E047.2; inconsistent inputs	Manual reset
L	H	Blocked	E047.2; 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 Sequence Diagrams

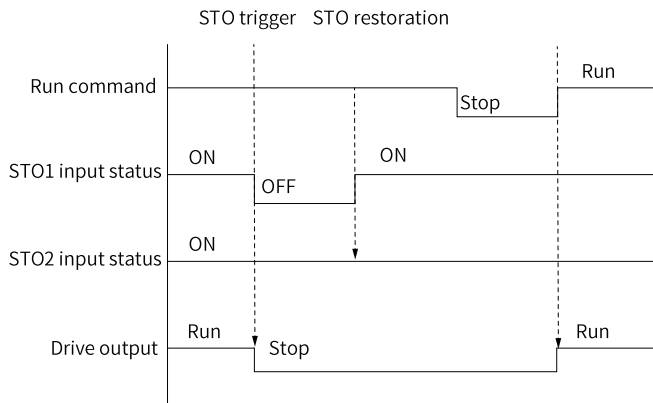


Figure 7-1 Safety function (turned off when triggered by STO1)

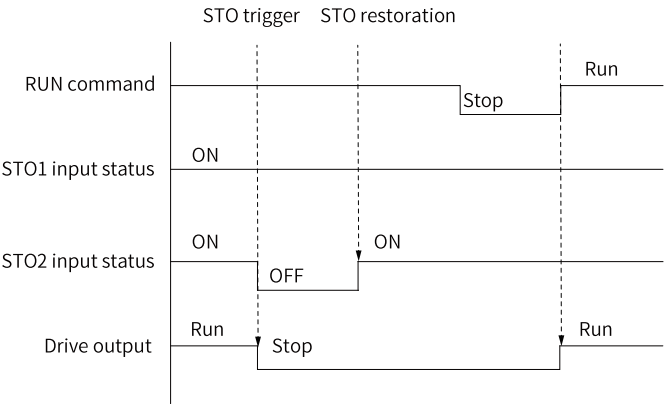


Figure 7-2 Safety function (turned off when triggered by STO2)

8 Commissioning, Operation, and Maintenance

8.1 Commissioning, Operation, and Maintenance

Basic Requirements

- Technicians must be trained to understand the requirements and principles of safety-related system design and commissioning.
- Execution and maintenance personnel must be trained on the requirements and principles for the design and operation of safety-related systems.
- Operation personnel must be trained to understand the requirements and principles for the design and operation of safety-related systems.
- If any safety-related circuit on the control board does not work, which is irreparable, the control board must be replaced.

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:

- Safety functions are initially started.
- After any changes related to safety functions (wiring, assembly, settings, or other related operations)
- after any maintenance work related to the safety function.

Acceptance testing of safety functions must be performed by personnel with safety function expertise and must be documented and signed by the testers. Technicians and operation/maintenance/repair personnel must be trained to understand the requirements and principles for the design and operation of safety-related systems.

The signed copy of the acceptance test report must be kept on record. The report shall include documentations of start-up activities and test results, fault report reference and troubleshooting. Any new acceptance tests that are performed due to changes or maintenance shall be recorded.

Verification and Validation

- **Overview**

This chapter describes verification and validation of the implemented safety functionality.

Verification and validation produce documented proof of the compliance of the implementation with specified safety requirements.

- **Verifying the achieved SIL/PL level**

Verification of the functional safety system demonstrates and ensures that the implemented safety system meets the requirements specified for the system in the safety requirements specification phase.

The most convenient way to verify the required SIL/PL level reached with the implemented system is to use a specific safety calculator software.

- **Validation procedure**

Inovance ensures that the functionality of all the required safety functions has been appropriately verified and validated.



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

The acceptance test using the start-up checklists described below must be performed:

- at initial start-up of the safety function
- after any changes related to the safety function (wiring, components, settings, and so on.)
- after any maintenance work related to the safety function. The acceptance test must include at least the following steps:
 1. having an acceptance test plan
 2. testing all commissioned functions for proper operation
 3. testing all used inputs for proper operation
 4. testing all used outputs for proper operation
 5. documenting all acceptance tests performed
 6. testing person signing and archiving the acceptance test report for further reference.

- **Acceptance test reports**

You must store the signed acceptance test reports in the logbook of the machine. The report must include, as required by the referred standards:

- description of the safety application (including a figure)
- a description and revisions of safety components that are used in the safety application
- a list of all safety functions that are used in the safety application
- a list of all safety related parameters and their values (the AC drive STO has no safety-related parameters, but listing the non-safety related parameter and its setting is recommended)

- documentation of start-up activities, references to failure reports and resolution of failures
 - the test results for each safety function, checksums, date of the tests and confirmation by the test personnel.
- **Validation of safety functions**
Once the system is fully configured and wired for the safety functions, and the startup safety check has been done, you must do the following functional test procedure for each safety function:
 - Have the system at the Operational state when the safety function is requested.
 - Make sure that the acknowledgment method has been configured as suitable for the application (for example, manual or automatic acknowledgment).
 - Activate the safety function by requesting it with the designated trigger device.
 - Verify that the desired functionality takes place.
 - Document the test results to the acceptance test report.
 - Sign and file the acceptance test report.
 - **Acceptance test checklist**

Table 8–1 Acceptance test checklist

Method	Action	Result
1	Ensure that the AC drive can run and stop freely during commissioning.	☐
2	Stop the AC drive (if running), disconnect the input power, and isolate the AC drive from the power cable through a disconnect.	☐
3	Check the STO circuit connections based on the circuit diagram: STO1 and STO2 input connected to 24 V terminal.	☐
4	Check that the shield of the STO input cable is grounded to the drive frame.	☐

Method	Action	Result
5	Switch off the disconnecter and switch on the input power supply.	☐
	Test STO1/ STO2 signals when the system stops: 1. Disconnect STO1 and STO2 signals simultaneously to wake up the STO function. Test whether the AC drive enters the STO state and displays STO status. 2. Send a start command to the AC drive. In this case, the AC drive should not respond to the start command, while the motor should stay at a 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. Activate the ON/RUN command of the AC drive, and check whether the motor operates normally.	☐
	Test STO1 signals when the system stops: 1. Disconnect (low state or open circuit) STO1 input signal to wake up STO function. Check whether the AC drive displays the fault code "E047.2". 2. Send a start command to the AC drive. In this case, the AC drive should not respond to the start command, while the motor should stay at a standstill.	☐
	The STO1 channel signal is restored and the fault is cleared. Use the ON/ RUN command of the AC drive, and check that the motor works normally.	☐
	Test STO2 signals when the system stops: 1. Disconnect (low state or open circuit) STO2 input signal to wake up STO function. Check whether the AC drive displays the fault code "E047.2". 2. Send a start command to the AC drive. In this case, the AC drive should not respond to the start command, while the motor should stay at a standstill.	☐
	The STO2 channel signal is restored and the fault is cleared. Use the ON/ RUN command of the AC drive, and check that the motor works normally.	☐

Method	Action	Result
6	Test STO1/ STO2 signals when the system is under operation: 1. Disconnect STO1 and STO2 signals simultaneously to wake up the STO function. Check whether the AC drive enters the STO activated state and displays STO. In this case, the AC drive immediately stops output. 2. Send a start command to the AC drive. In this case, the AC drive should not respond to the start command, while the motor should stay at a 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. Activate the ON/RUN command of the AC drive, and check whether the motor operates normally.	☐
	Test STO1 signals when the system is under operation: 1. Start the AC drive and check that the motor runs normally. 2. Disconnect (low state or open circuit) STO1 input signal to wake up the STO function. 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.	☐
	The STO1 channel signal is restored and the fault is cleared. Use the ON/ RUN command of the AC drive, and check that the motor works normally.	☐
	Test the STO2 channel signal when the system is under operation: 1. Start the AC drive and check that the motor runs normally. 2. Disconnect (low state or open circuit) STO2 input signal to wake up the STO function. 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.	☐
	The STO2 channel signal is restored and the fault is cleared. Use the ON/ RUN command of the AC drive, and check that the motor works normally.	☐
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 Daily Maintenance and Inspection

9.1 Routine Inspection Items

9.1.1 Daily Checklist

The ambient temperature, humidity, dust, and vibration will cause aging of components inside the drive, which leads to potential faults and shortens the service life of the 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 phase loss occurs on the motor. ● Check whether motor screws are tightened.	
Fan	Check whether the fan of the AC drive and motor operates normally.	● Check whether the fan of the AC drive operates properly. ● Check whether the fan of the motor operates properly. ● Check whether the air duct is blocked. ● Check whether the ambient temperature is within the permissible range.	
Installation environment	Check whether the control cabinet and cable ducts are normal.	● Check for insulation damage of input and output cables. ● Check the mounting bracket for vibration. ● Check whether copper bars and terminals become loose or get corroded.	
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 severe (normal condition: < 0.6 g).	
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 heavy load starts around.	

9.1.2 Regular Checklist

The following shows items to be checked 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 waste, dirt and dust on the surface of the 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. ● Wipe the surface dirt that is difficult to clean with alcohol and wait until the surface becomes dry.	
Cable	● Check power cables and connections for discoloration. ● Check whether the insulation is aged or cracked.	● Replace the cracked cable. ● Replace the damaged terminals.	
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.	

Item	Content	Solution	Checked
Air duct	● Check whether the air duct and heatsink are blocked. ● 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.	● Remove foreign objects on the surface of control cables and terminals. ● Replace the damaged or corroded control cables.	

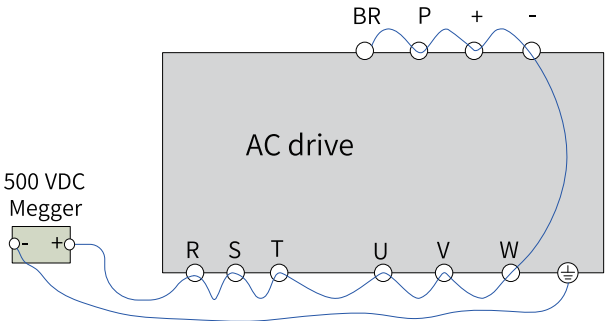
9.2 Main Circuit Insulation Test



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

Remove the voltage dependent resistor screw before test and disconnect the voltage dependent resistor.

Before measuring insulation resistance with a megameter (500 VDC megameter recommended), disconnect the main circuit from the AC drive. Do not use the insulation resistance meter to test the insulation of the control circuit. See the following figure.



The measured insulation resistance 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 Quick-Wear Parts Replacement

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. The service life of such devices is closely related to the operating environment and maintenance conditions. Generally, the service life is as follows.

Name	Service Life ^[Note]
Fan	≥ 5 years
Filter 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 Cooling Fan

Cooling fans

- Possible causes of damage: bearing wear or blade aging
- Criteria for determining the 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

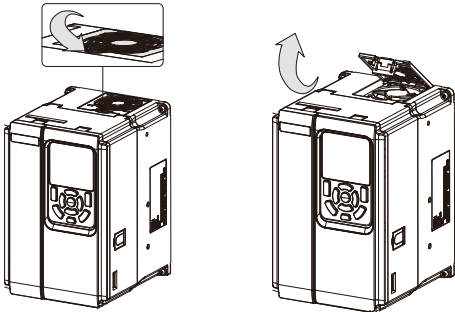
Structure	Number of Cooling Fans
T1 (0.4 kW to 1.1 kW)	-
T1 (1.5 kW to 3.0 kW) T2 T3 (7.5 kW) T5 to T7	1

Structure	Number of Cooling Fans
T3 (11 kW) T4 T8 to T10	2
T11 to T12	3
T13	2

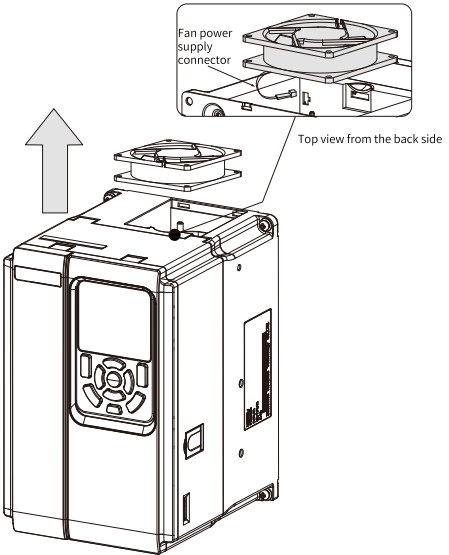
Removing and installing the fan of T1 to T6 models

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.

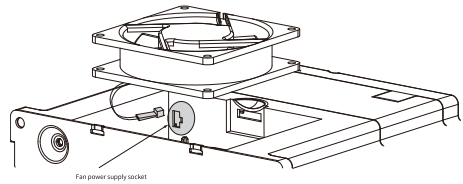


Installing the fan

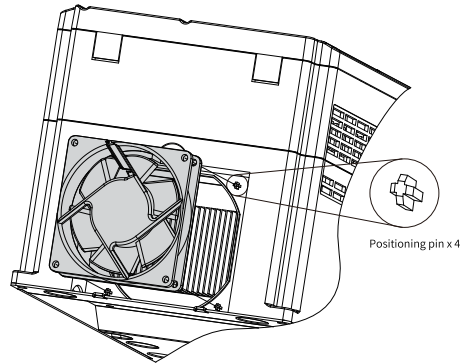
Note

- 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.
-

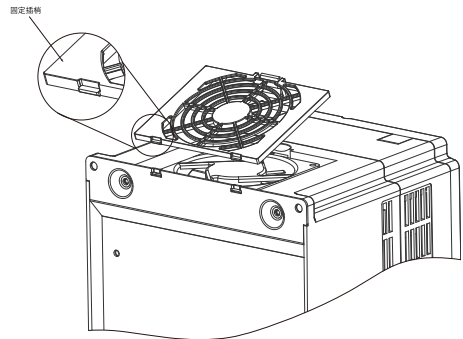
1. Plug the fan power cable connector to the socket.
-



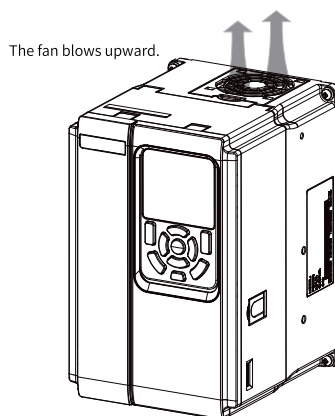
2. Install the fan into the drive, with the four fixing holes at the bottom of the fan aligned with the positioning pins.
-



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.
-



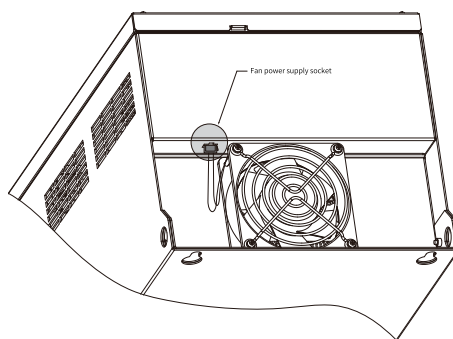
Removing and installing the fan of T7 to T9 models

Note

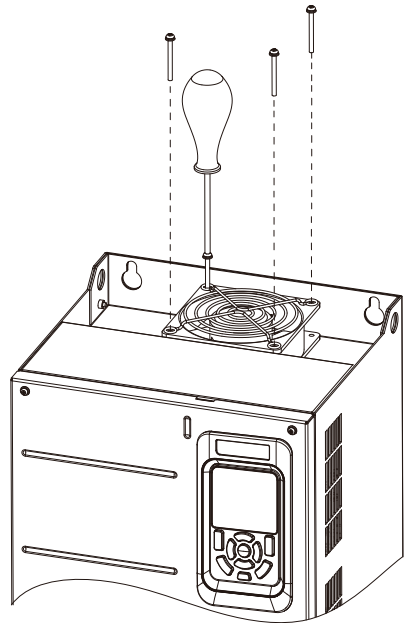
The number and location of cooling fans vary with product models, but the fans are removed and installed in the same way.

Removing the fan

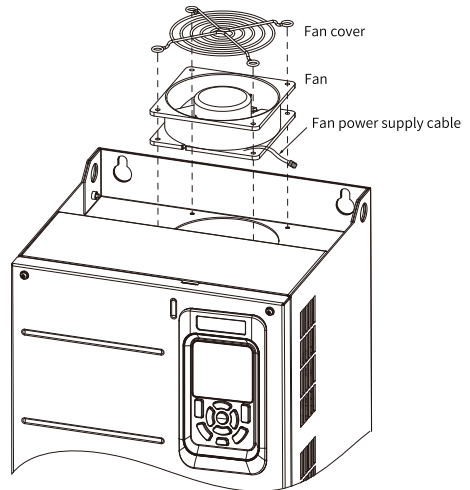
1. Disconnect the power cable connector of the fan (top view).
-



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



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

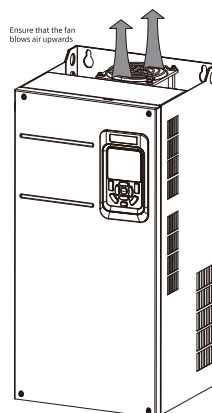


Installing the fan

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.
-

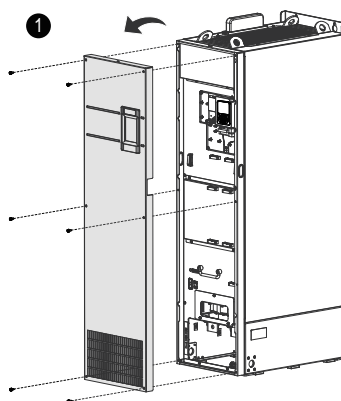
3. After replacing the fan, ensure the fan blows the air upwards.
-



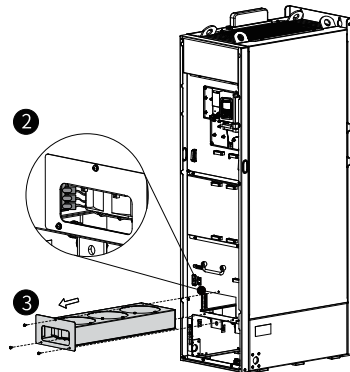
Removing and installing the fan of T10 to T12 models

Removing the fan

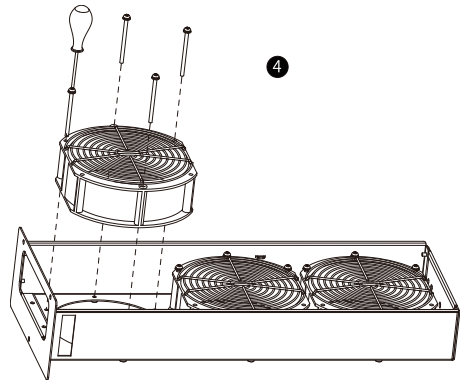
1. Remove the six fixing screws on the cover. Then, hold the cover with both hands and lift it up in the direction indicated by the arrow to remove the cover.
-



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.
-



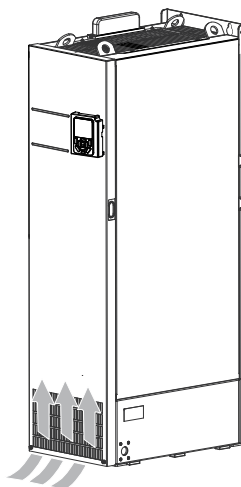
3. Remove the four fixing screws from each fan cover and remove the fan.
-



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 fan power cable connector first and then fix the fan box. After replacing the fan, ensure the fan blows the air upwards.
-



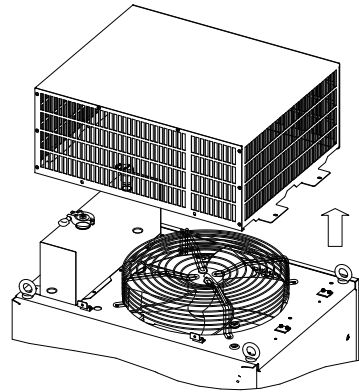
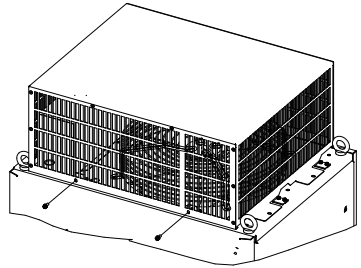
Removing and installing the fan of T13 models

Note

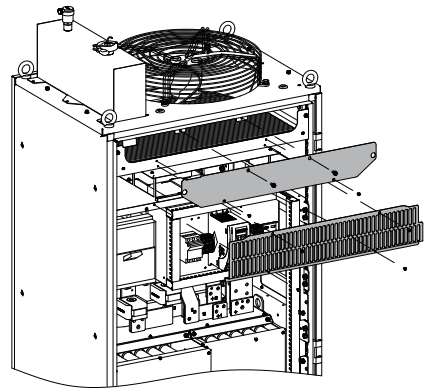
T13 models have a top-mounted fan and a cabinet-mounted AC drive fan. Their removal and installation are described below.

Removing the fan on the top

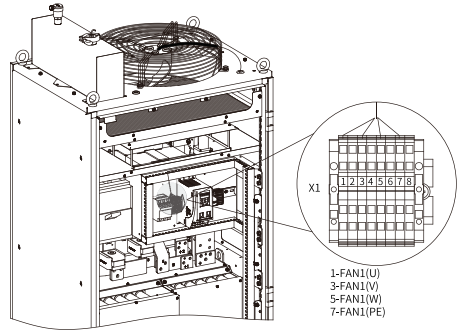
1. Remove the two fixing screws from the top cover at the front, slide forward the protective cover with two hands along the guide for about 20 mm, and lift it up to remove the protective cover.



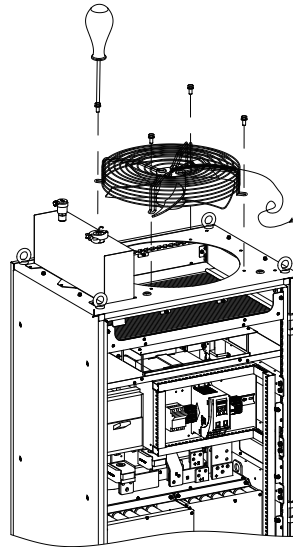
2. Remove the baffle plate as shown in the figure.



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.
-

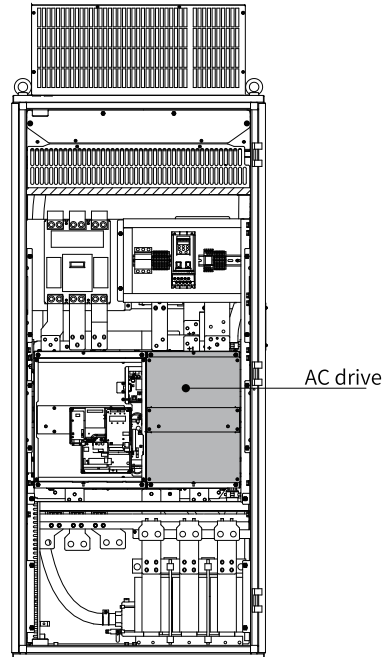


Installing the fan on the top

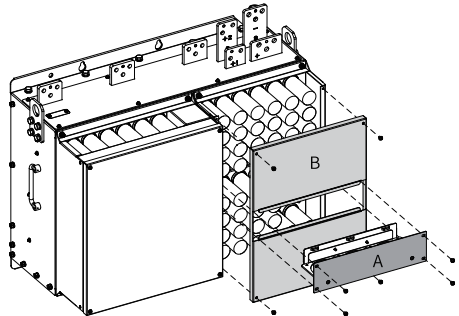
1. Reinstall the fan in the reverse order of removal.
-
2. Route fan cables according to the wiring diagram.
-
3. Connect the cables to terminals 1, 3, 5, and 7 of the X1 terminal block.
-

Removing the AC drive fan in the cabinet

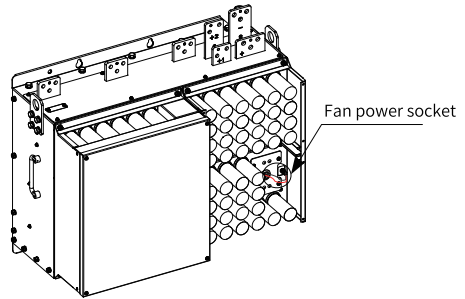
1. Open the cabinet door to locate the AC drive, which is shown in the following figure.



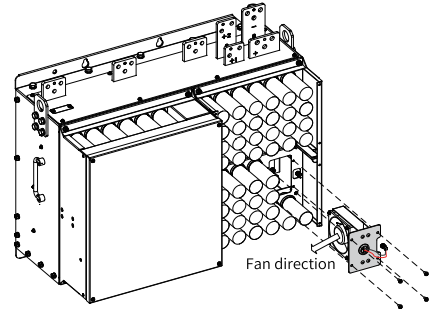
2. Remove baffle plates A and B in sequence from the AC drive.



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. Pay attention to the 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

- Condition 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:

- Store the AC drive with the original packing carton provided by Inovance.
- Do not expose the AC drive to environments with moisture, high temperatures, or direct sunlight for a long time.
- The electrolytic capacitor will deteriorate after long-term storage. Therefore, switch on the AC drive once for at least 5 hours every 6 months. Increase the input voltage 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. Maintenance will be charged after the warranty 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 unusual 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 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 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.



19011795A03

Copyright © Shenzhen Inovance Technology Co., Ltd.



Scan the QR code
to download My Inovance app.

Shenzhen Inovance Technology Co., Ltd.

www.inovance.com

Suzhou Inovance Technology Co., Ltd.

www.inovance.com

Add.: Inovance Headquarters Tower, High-tech Industrial Park,
Guanlan Street, Longhua New District,
Shenzhen 518000, P.R. China

Tel: (0755) 2979 9595

Fax: (0755) 2961 9897

Add.: No. 52, Tian E Dang Road, Wuzhong District, 215104,
Suzhou City, Jiangsu Province, P.R. China

Tel: (0512) 6637 6666

Fax: (0512) 6285 6720