Goodrive880 Series Water-cooled Drive

Hardware Manual

SHENZHEN INVT ELECTRIC CO., LTD.

No.	Change description	Version	Release date
1	First release.	V1.0	December 2022
2	● Added A9LC inverter unit related content. ● Added water-cooled cabinet related content. ● Added water-cooling system related content. ● Optimized water-cooled diode rectifier related content.	V1.1	October 2025

Preface

Thank you for choosing INVT Goodrive880 series engineering variable-frequency drive (VFD).

For ease of use, read the manual carefully before using Goodrive880 series product.

As an upgrade product of Goodrive800 series engineering VFD, Goodrive880 series engineering VFD inherits the high reliability feature of Goodrive800 platform but optimizes the upgrade, structure, and components, achieving unit modularization, flexible cabinet configuration, more compact structure, easier installation and maintenance, and optimum protection. Product overview:

- Rated voltage class: 690V AC
- Excellent speed and torque control performance
- Modular design, as flexible as building blocks, which makes the project integration simple and efficient
- Long-life component selection and fast fault recovery design to ensure efficient process control
- Ergonomic design to make installation and maintenance easier
- Enriched expansion capability to support various protection options

Goodrive880 series engineering VFD can be widely used in:

Petroleum: Offshore drilling rig platform

Marine: main and auxiliary thrust drives for ships

Others: 690V AC water-cooled test platform

This manual is Goodrive880 series water-cooled drive hardware manual, presenting safety precautions, product information, mechanical and electrical installation, and precautions related to daily maintenance. Read through this manual carefully before installation to ensure the product is installed and operated in a proper manner to give full play to its excellent performance and powerful functions. If you have any question about the function and performance of the product, please consult our technical support.

If the product is ultimately used for military affairs or weapon manufacture, comply with the export control regulations in the Foreign Trade Law of the People's Republic of China and complete related formalities.

To continuously improve the performance of the product to meet higher application requirements, we reserve the right to continuously improve the product and accordingly the product manual, which may be made without prior notice. We have the final interpretation of the manual content.

Contents

1 Safety precautions

1.1 Safety declaration

Read this manual carefully and follow all safety precautions before moving, installing, operating and servicing the product. Otherwise, equipment damage or physical injury or death may be caused.

We shall not be liable or responsible for any equipment damage or physical injury or death caused due to your or your customers' failure to follow the safety precautions.

1.2 Safety definition

Danger: Severe personal injury or even death can result if related requirements are not followed.

Warning: Personal injury or equipment damage can result if related requirements are not followed.

Note: Actions taken to ensure proper running.

Trained and qualified professionals: People operating the equipment must have received professional electrical and safety training and obtained the certificates, and must be familiar with all steps and requirements of equipment installing, commissioning, running and maintaining and capable to prevent any emergencies.

1.3 Warning symbols

Warnings caution you about conditions that can result in severe injury or death and/or equipment damage and advice on how to prevent dangers. The following table lists the warning symbols in this manual.

Symbol	Name	Description
	Danger	Severe personal injury or even death can result if related requirements are not followed.
	Warning	Personal injury or equipment damage can result if related requirements are not followed.
	Electrostatic discharge	The PCBA may be damaged if related requirements are not followed.
	Hot sides	Do not touch. The power unit base may become hot.
	Electric shock	High voltage may remain on the bus capacitors after power-off. To prevent electric shock, wait at least 25 minutes before any operation; see the warning symbols on the power unit for the specific wait time.
Note	Note	Actions taken to ensure proper running.

1.4 Safety guidelines

	• Only trained and qualified professionals are allowed to carry out related operations. • Do not perform wiring, inspection or component replacement when power supply is applied. Ensure all the input power supplies have been disconnected before wiring or inspection, and wait for at least the time designated on the power unit or until the DC bus voltage is less than 36V. The minimum waiting time is listed in the following.

<table>
<tr><td></td><td>
<table>
<tr><th colspan="2">Power unit model</th><th>Minimum waiting time</th></tr>
<tr><td>690V</td><td>315kW and higher</td><td>25 minutes</td></tr>
</table>
</td></tr>
<tr><td>  </td><td>● Do not refit the power unit unless authorized; otherwise fire, electric shock or other injury may result.</td></tr>
<tr><td>  </td><td>● The base may become hot when the power unit is running. Do not touch. Otherwise, you may get burnt.</td></tr>
<tr><td>  </td><td>● The electrical parts and components inside the power unit are electrostatic sensitive. Take measurements to prevent electrostatic discharge when performing related operations.</td></tr>
</table>

1.4.1 Delivery and installation

<table>
<tr><td>  </td><td>● Do not install the power unit on inflammables. In addition, prevent the power unit from contacting or adhering to inflammables.
● Do not run the power unit if it is damaged or incomplete.
● Do not contact the power unit with damp objects or body parts. Otherwise, electric shock may result.</td></tr>
<tr><td>Note</td><td>● Select appropriate tools for power unit delivery and installation to ensure the safe and proper running and avoid physical injury or death. To ensure personal safety, take mechanical protective measures like wearing safety shoes and working uniforms.
● Protect the power unit against physical shock or vibration during the delivery and installation.
● Do not carry the product only by its front cover as the cover may fall off.
● The installation site must be away from children and other public places.
● Prevent the screws, cables and other conductive parts from falling into the power unit.
● As power unit leakage current caused during running may exceed 3.5mA, ground properly and ensure the grounding resistance is less than 10Ω. The conductivity of PE grounding conductor must meet the following requirements:
<table>
<tr><th>Power cable conductor cross-sectional area S (mm²)</th><th>Grounding conductor cross-sectional area (mm²)</th></tr>
<tr><td>S≤16</td><td>S</td></tr>
<tr><td>16＜S≤35</td><td>16</td></tr>
<tr><td>35＜S</td><td>S/2</td></tr>
</table>
● (+) and (-) are the DC bus input terminals, while U, V, and W are the output terminals. Connect the input power and motor cables properly; otherwise, the power unit may be damaged.</td></tr>
</table>

1.4.2 Commissioning and running

<table>
<tr><td>  </td><td>● Cut off all power supplies connected to the power unit before terminal wiring, and wait for at least the time designated on the power unit after disconnecting the power supplies.
● High voltage presents inside the power unit during running. Do not carry out any operation on the power unit during running except for keypad setup. The control terminals of the –4 and –6 models are ELV (extra-low voltage) circuits. Without</td></tr>
</table>

	protective isolation, direct connection between these control terminals and accessible terminals of other equipment should be avoided. ● Before turning on the power supply, check the cable connection status. ● Prevent anyone from directly touching the energized part of the cabinet door. Pay special attention to safety when handling shields that are made of metal sheets. ● Do not do any withstand voltage testing during unit connection. Disconnect the motor cable before performing any insulation and voltage withstand tests for the motor or motor cable. ● Do not open the cabinet door since high voltage presents inside the power unit during running.
Note	● Do not switch on or switch off the input power supplies of the power unit frequently. ● If the power unit has been stored for a long time without use, perform checking and carry out pilot run for the power unit before using it again. ● Close the power unit front cover before running; otherwise, electric shock may occur.

1.4.3 Maintenance and component replacement

	● Only trained and qualified professionals are allowed to perform maintenance, inspection, and component replacement for the power unit. ● Cut off all power supplies connected to the power unit before terminal wiring, and wait for at least the time designated on the power unit after disconnecting the power supplies. ● During maintenance and component replacement, take measures to prevent screws, cables and other conductive matters from falling into the internal of the power unit.
Note	● Use proper torque to tighten screws. ● During maintenance and component replacement, keep the power unit and its parts and components away from combustible materials and ensure they have no combustible materials adhered. ● Do not carry out insulation voltage-endurance test on the power unit, or measure the control circuits of the power unit with a megohmmeter. ● During maintenance and component replacement, take proper anti-static measures on the power unit and its internal parts.

1.4.4 Disposal

	● The power unit contains heavy metals. Dispose of a scrap power unit as industrial waste.
	● Dispose of a scrap product separately at an appropriate collection point but not place it in the normal waste stream.

2 Product overview

GD880-51 (LC) series are Goodrive880 series 690V AC water-cooled inverter unit products (hereinafter referred to as water-cooled inverter units) with a single unit rated power of 400kW–630kW. The water-cooled inverter unit consists of precharge component, bus capacitor, IGBT, and other components. It is compact in structure and easy to integrate and maintain.

GD880-61 (LC) series are Goodrive880 series 690V AC water-cooled basic rectifier unit products (hereinafter referred to as water-cooled rectifier units) with a single unit rated power of 2283kW. The water-cooled rectifier unit consists of rectifier bridge, snubber capacitor, RC absorber plate, and other components. It is compact in structure and easy to integrate and maintain.

GD880-11 (LC) series are Goodrive880 series 690V AC water-cooled VFD unit products (hereinafter referred to as water-cooled VFD units) with a single unit rated power of 315kW–500kW. The water-cooled VFD unit consists of rectifier bridge, IGBT, bus capacitor, and other components. It is compact in structure and easy to integrate and maintain.

2.1 Product specifications

Table 2-1 GD880-51 (LC) product specifications

Item		Specifications
Power input	Input voltage (V)	690V system: 735–976VDC
	Input current (A)	See section 2.3 Product ratings.
Power output	Output voltage (V)	0–0.7*Vin
	Output current (A)	See section 2.3 Product ratings.
	Output power (kW)	See section 2.3 Product ratings.
	Output frequency (Hz)	0–400Hz
	Working efficiency	⩾ 98.5% (@ rated current)
Protection functions	Overheating protection	Triggered by IGBT module overheating
	Overcurrent protection	150% of rated current: 60s; 180% of rated current: 10s; 200% of rated current: 1s
	Overvoltage protection	520–690V: Bus 1200V triggers overvoltage, software can be reset in special cases.
	Undervoltage protection	520–690V: Bus 570V triggers undervoltage, software can be reset in special cases.
Water cooling system	Cooling liquid component	Pure water, or a mixture of pure water and glycol with a corrosion inhibitor. Add antifreeze if the temperature may drop below +5 °C.
	Max. pressure	6bar
	Flow rate requirement	100% of water: ⩾16L/min Water/glycol solution in a ratio of 80:20: ⩾18L/min Water/glycol solution in a ratio of 60:40: ⩾21L/min

Item		Specifications
Environment requirements	Cooling method	Water cooling
	Ambient temperature	0°C–55°C; Derating is required if the ambient temperature exceeds 45°C. Derate 0.5% for each increase of 1°C.
	Cooling water temperature	0°C–40°C; Derating is required if the ambient temperature exceeds 40°C. Derate 2% for each increase of 1°C.
	Storage temperature	-40–+70°C (drain all water from the cavity below 0°C)
	Humidity	<95%RH, no condensation
Water quality requirements	PH value	6–8
	Hardness	<10.dH
	Conductivity	<300μS/cm
	Chlorides	<50mg/l
	Fluorides	<50mg/l
	Sulphates	<100mg/l
	Total dissolved solids	<200mg/l
	Corrosion inhibitor	0.5% Cortec VCI-649 (replace every 2 years)
Other	Installation method	Unit installation
	IP rating	IP00

Table 2-2 GD880-61 (LC) product specifications

Item		Specifications
Power input	Input voltage (V)	690V system: 520–690V AC 3PH, ±10% (-15%, < 1min)
	Input current (A)	See section 2.3 Product ratings.
Power output	Output voltage (V)	690V system: 735–976VDC
	Output current (A)	See section 2.3 Product ratings.
	Output power (kW)	See section 2.3 Product ratings.
	Working efficiency	⩾99% (@ rated current)
Protection functions	Overheating protection	Rectifier bridge module overheating will trigger overheating protection.
Water cooling system	Cooling liquid component	Pure water, or a mixture of pure water and glycol with a corrosion inhibitor. Add antifreeze if the temperature may drop below +5 °C.
	Max. pressure	6bar
	Flow rate requirement	100% of water: ⩾16L/min Water/glycol solution in a ratio of 80:20: ⩾18L/min Water/glycol solution in a ratio of 60:40: ⩾21L/min
Environment requirements	Cooling method	Water cooling
	Ambient temperature	0°C–55°C; Derating is required if the ambient temperature exceeds 45°C. Derate 0.5% for each increase of 1°C.
	Cooling water temperature	0°C–40°C; Derating is required if the ambient temperature exceeds 40°C. Derate 2% for each increase of 1°C.

Item		Specifications
Environment requirements	Storage temperature	-40–+70°C (drain all water from the cavity below 0°C)
	Humidity	<95%RH, no condensation
Water quality requirements	PH value	6–8
	Hardness	<10.dH
	Conductivity	<300μS/cm
	Chlorides	<50mg/l
	Fluorides	<50mg/l
	Sulphates	<100mg/l
	Total dissolved solids	<200mg/l
	Corrosion inhibitor	0.5%Cortec VCI-649 (replace every 2 years)
Other	Installation method	Unit installation
	IP rating	IP00

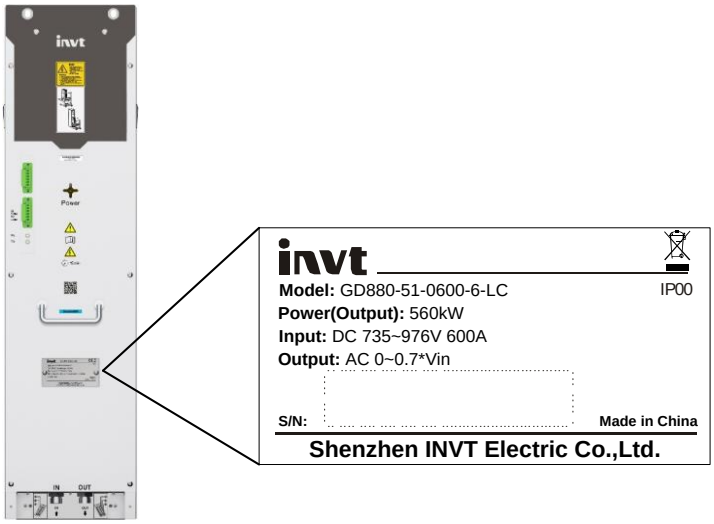
Table 2-3 GD880-11 (LC) product specifications

Item		Specifications
Power input	Input voltage (V)	690V system: 520–690V AC 3PH, ±10% (-15%, < 1min)
	Input current (A)	See section 2.3 Product ratings.
Power output	Output voltage (V)	690V system: 0–Vin
	Output current (A)	See section 2.3 Product ratings.
	Output power (kW)	See section 2.3 Product ratings.
	Output frequency (Hz)	0–400Hz
	Working efficiency	⩾98% (@ rated current)
Protection functions	Overheating protection	Triggered by IGBT module overheating
	Overcurrent protection	150% of rated current: 60s; 180% of rated current: 10s; 200% of rated current: 1s
	Overvoltage protection	520–690V: Bus overvoltage threshold: 1200V, software-adjustable under special conditions.
	Undervoltage protection	520–690V: Bus undervoltage threshold: 570V, software-adjustable under special conditions.
Water cooling system	Cooling liquid component	Pure water, or a mixture of pure water and glycol with a corrosion inhibitor. Add antifreeze if the temperature may drop below +5 °C.
	Max. pressure	6bar
	Flow rate requirement	100% of water: ⩾16L/min Water/glycol solution in a ratio of 80:20: ⩾18L/min Water/glycol solution in a ratio of 60:40: ⩾21L/min
Environment requirements	Cooling method	Water cooling
	Ambient temperature	0°C–55°C; Derating is required if the ambient temperature exceeds 45°C. Derate 0.5% for each increase of 1°C.

Item		Specifications
Environment requirements	Cooling water temperature	0°C–40°C; Derating is required if the ambient temperature exceeds 40°C. Derate 2% for each increase of 1°C.
	Storage temperature	-40–+70°C (drain all water from the cavity below 0°C)
	Humidity	<95%RH, no condensation
Water quality requirements	PH value	6–8
	Hardness	<10.dH
	Conductivity	<300μS/cm
	Chlorides	<50mg/l
	Fluorides	<50mg/l
	Sulphates	<100mg/l
	Total dissolved solids	<200mg/l
	Corrosion inhibitor	0.5%Cortec VCI-649 (replace every 2 years)
Other	Installation method	Unit installation
	IP rating	IP00

2.2 Product nameplate and model

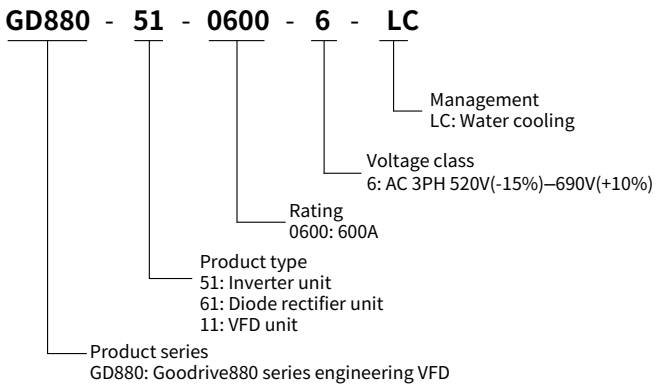
Figure 2-1 Product nameplate



Note: The preceding nameplate is a GD880-51 product nameplate example. Markings may vary slightly by specification.

The model designation code contains basic product information such as rated current and rated voltage. You can find the model designation code on the product nameplate.

Figure 2-2 Product model



2.3 Product ratings

Table 2-4 GD880-51 (LC) specifications

735–976V DC										
Model	Rating			Light overload application		Heavy overload application		Frame size	Heat dissipation c/a/T	Rated water flow rate
	I_N	I_{max}	P_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}			
	A (AC)	A (AC)	kW	A (AC)	kW	A (AC)	kW		kW	L/min
GD880-51-0410-6-LC	410	492	400	394	355	308	315	A8LC	6.8/0.4/7.2	16
GD880-51-0530-6-LC	530	636	500	509	450	398	355		8.8/0.5/9.3	
GD880-51-0600-6-LC	600	720	560	576	560	450	400		9.9/0.7/10.6	
GD880-51-0650-6-LC	650	780	630	624	560	488	450		10.7/0.7/11.4	
GD880-51-0900-6-LC	900	1080	900	864	800	675	630	A9LC	13.2/0.9/14.1	

Table 2-5 GD880-61 (LC) specifications

520–690V AC										
Model	Rating			Light overload application		Heavy overload application		Frame size	Heat dissipation c/a/T	Rated water flow rate
	I_N	I_{max}	P_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}			
	A(AC)	A(DC)	kW	A(DC)	kW	A(DC)	kW		kW	L/min
GD880-61-2000-6-LC	2000	2450	2283	2352	2192	1833	1708	D3DLC	11	16

Table 2-6 GD880-11 (LC) specifications

520–690V AC										
Model	Rating			Light overload application		Heavy overload application		Frame size	Heat dissipation c/a/T	Rated water flow rate
	I_N	I_{max}	P_N	I_{Ld}	P_{Ld}	I_{Hd}	P_{Hd}			
	A (AC)	A (AC)	kW	A (AC)	kW	A (AC)	kW		kW	L/min
GD880-11-0340-6-LC	340	408	315	326	315	255	250	A8LC	5.8/0.4/6.2	16
GD880-11-0410-6-LC	410	492	400	394	355	308	315		7.0/0.4/7.4	
GD880-11-0530-6-LC	530	636	500	509	450	398	355		9.0/0.5/9.5	

Remarks:

- I_{max} indicates the maximum output current for a start-up duration of 10s (every 300s).
- Typical capacity for light overload applications (110% overload capacity): P_{Ld} indicates the typical values of adapted motor power; I_{Ld} indicates the continuous output effective current; Overload is allowed for 1 minute every 5 minutes and the overload current is 110%*I_L.
- Typical capacity for heavy overload applications (150% overload capacity): P_{Hd} indicates the typical values of adapted motor power; I_{Hd} indicates the continuous output effective current; Overload is allowed for 1 minute every 5 minutes and the overload current is 150%*I_{Hd}.
- c = power loss dissipated in the coolant.
  a = power loss dissipated in the air.
  T = total power loss.
  The above losses are unit losses only and do not include reactor losses.

Note:

- The continuous output effective current is affected by the supply voltage.
- The continuous output effective current and overload current are defined a coolant temperature of 40°C and an ambient temperature of 45°C.

2.4 Frame size and weight

Frame size	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
A8LC	910	230	538	85
A9LC	1080	210	496	115
D3DLC	427	599	204	45

2.5 Derated application

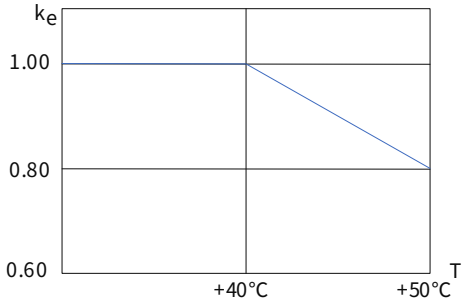
2.5.1 Derating due to coolant and ambient temperature

Coolant temperature:

With pure water as the coolant, the product can deliver 100% of the rated output current over 5–40°C (coolant temperature). From 40–50°C, the maximum output current is linearly derated to 80%.

With a mixture of water and antifreeze as the coolant, the product can deliver 100% of the rated output current over a coolant temperature range of 0–40°C. From 40–50°C, the maximum output current is linearly derated to 80%. The curve of derating coefficient is shown as follows:

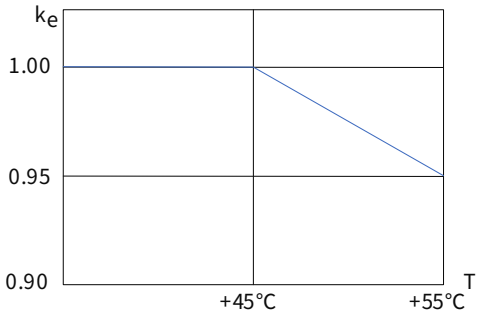
Figure 2-3 Derating due to coolant temperature



Ambient temperature:

When the product works under the ambient temperature of 45–55°C, the rated current must be derated by 0.5% for each increase of 1°C. The curve of derating coefficient is shown as follows:

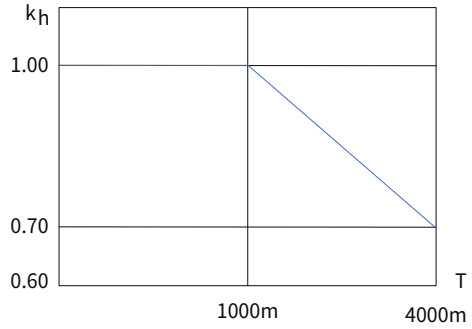
Figure 2-4 Derating due to ambient temperature



2.5.2 Derating due to altitude

The power unit needs to be derated by 1% for each increase of 100m when the altitude exceeds exceeded 1000m. Contact our local technical support for model selection when the altitude exceeds 2000m.

Figure 2-5 Derating due to altitude



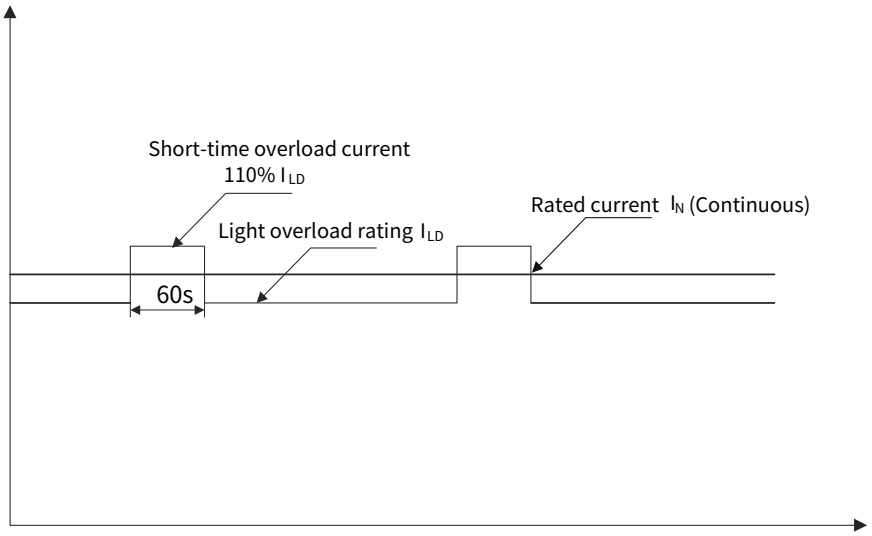
2.5.3 Derating due to carrier frequency

Model	Rated power	Carrier frequency (kHz)							Frame size
	(kW)	2.5	3.2	4	5	6	7	8	
GD880-51-0410-6-LC	400	100%	88%	76%	62%	53%	46%	40%	A8LC
GD880-51-0530-6-LC	500	100%	88%	76%	62%	53%	46%	40%	
GD880-51-0600-6-LC	560	100%	86%	73%	61%	52%	45%	40%	
GD880-51-0650-6-LC	630	100%	86%	73%	61%	52%	45%	40%	
GD880-11-0340-6-LC	315	100%	88%	76%	62%	53%	46%	40%	
GD880-11-0530-6-LC	500	100%	88%	76%	62%	53%	46%	40%	
GD880-51-0900-6-LC	900	100%	84%	71%	60%	51%	44%	40%	A9LC

2.6 Overload capability

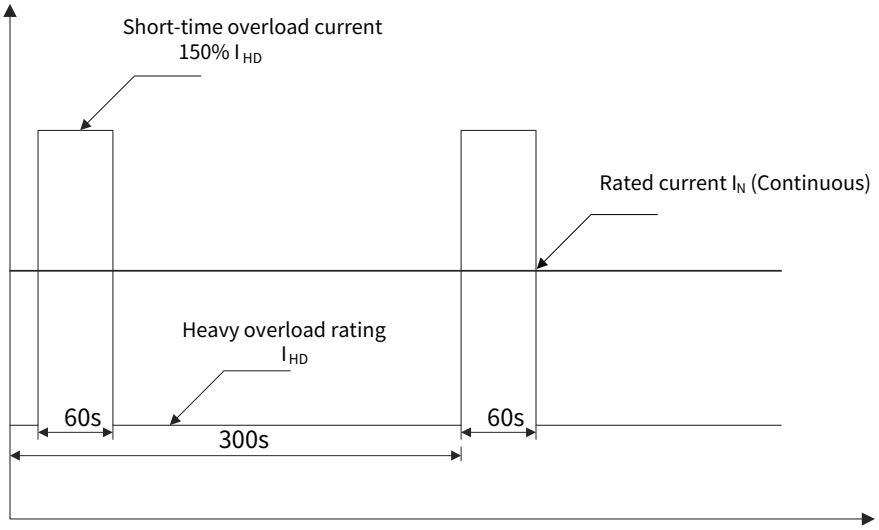
Based on the light overload continuous run current (I_{Ld}), the power unit can keep running for 60s at 110% of the rated current. See Figure 2-6.

Figure 2-6 Light overload application



Based on the heavy overload continuous run current (I_{Ld}), the power unit can keep running for 60s at 150% of the rated current. See Figure 2-7.

Figure 2-7 Heavy overload application



2.7 Hardware principles

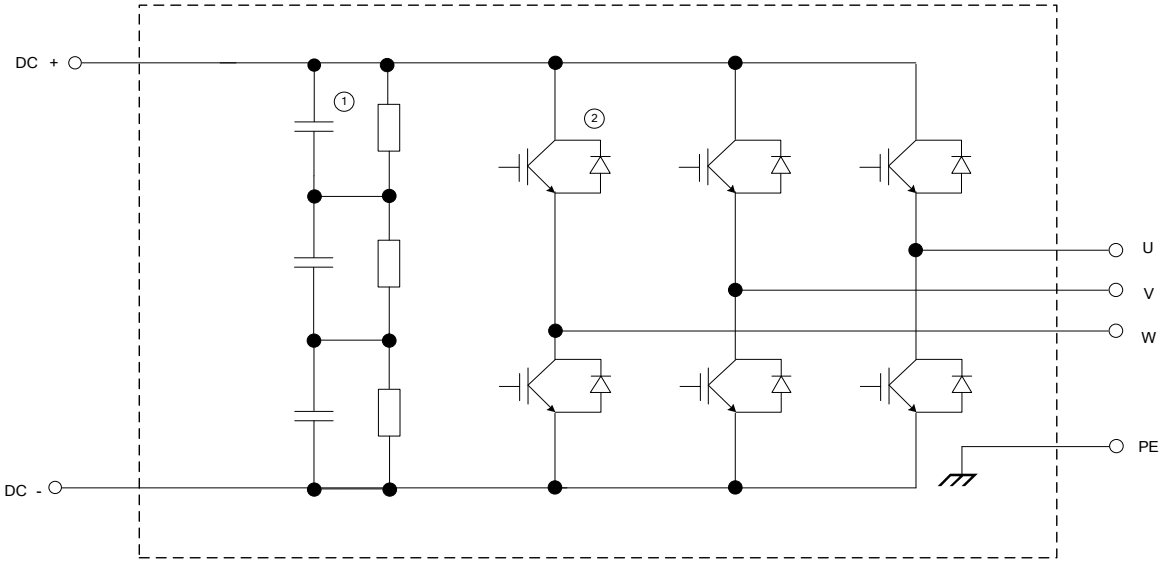
2.7.1 Basic principles

2.7.1.1 Water-cooled inverter unit

The inverter unit converts DC voltage into AC frequency-variable voltage and supports driving asynchronous and synchronous motors. The voltage class is 690V.

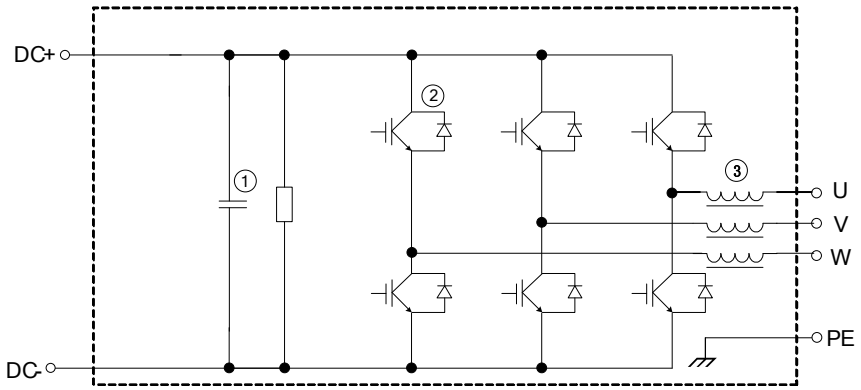
The water-cooled inverter unit consists of DC precharge, bus capacitor, IGBT, and other components. Figure 2-8 shows the simplified main circuit.

Figure 2-8 Simplified main circuit diagram of A8LC water-cooled inverter unit



No.	Name	Description
1	Bus capacitor	To make the voltage stable by filtering out the AC part from the bus voltage.
2	Inverter module	To convert DC current to AC current.

Figure 2-9 Simplified main circuit diagram of A9LC water-cooled inverter unit



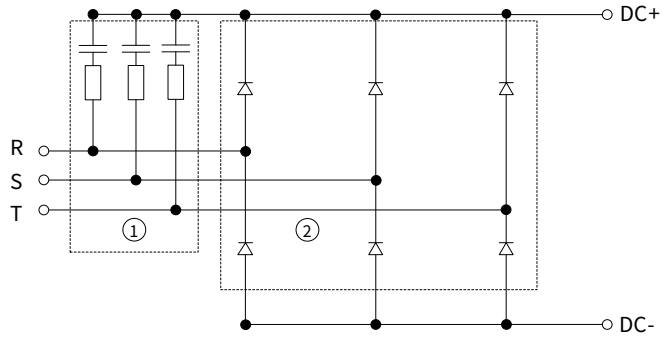
No.	Name	Description
1	Bus capacitor	To make the voltage stable by filtering out the AC part from the bus voltage.
2	Inverter module	To convert DC current to AC current.
3	Output reactor	To filter higher-order harmonics and balance current sharing in parallel connection configuration.

2.7.1.2 Rectifier unit

The rectifier unit converts three-phase AC voltage to DC voltage and provides power for the subsequent inverter module to drive the motor. One or more inverter modules can be installed.

The D3DLC rectifier unit mainly consists of RC filter board and rectifier bridge. Figure 2-10 shows the simplified main circuit.

Figure 2-10 Simplified main circuit diagram of rectifier unit



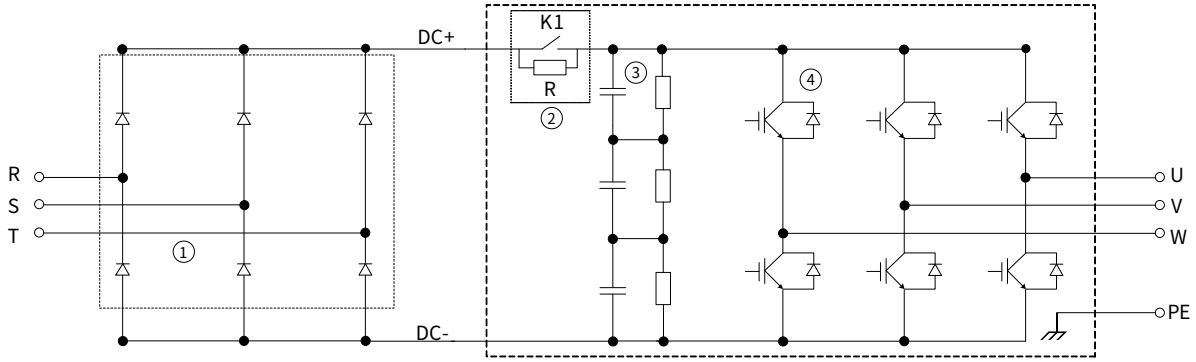
No.	Name	Description
1	RC filter board	To absorb the surge current.
2	Rectifier bridge	To convert AC current to DC current.

2.7.1.3 VFD unit

The VFD unit converts three-phase AC voltage to DC voltage through the rectifier module, and then converts the DC voltage to the AC voltage with adjustable frequency and voltage through the inverter module, and finally drives the motor.

The A8LC VFD unit mainly consists of rectifier bridge, DC precharge, bus capacitor, and inverter bridge. Figure 2-11 shows the simplified main circuit.

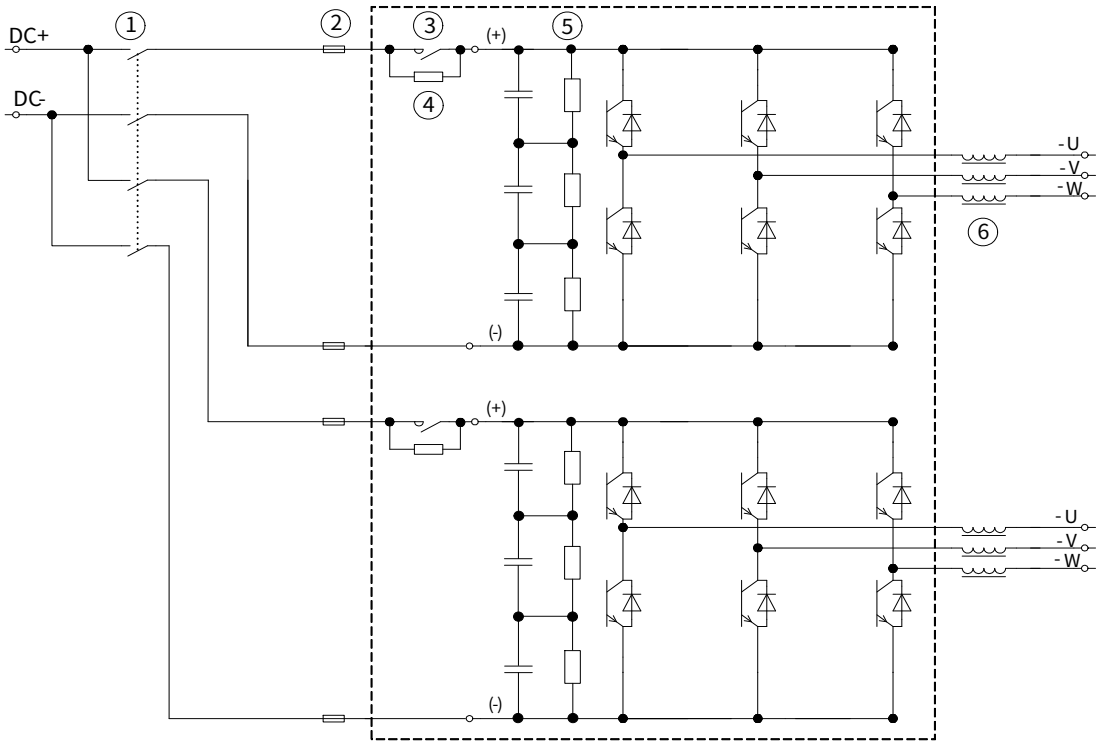
Figure 2-11 Simplified main circuit diagram of the VFD unit



No.	Name	Description
1	Rectifier bridge	To convert AC current to DC current.
2	DC precharge	To limit inrush on power-up by precharging bus capacitors.
3	Bus capacitor	To make the voltage stable by filtering out the AC part from the bus voltage.
4	Inverter module	To convert DC current to AC current.

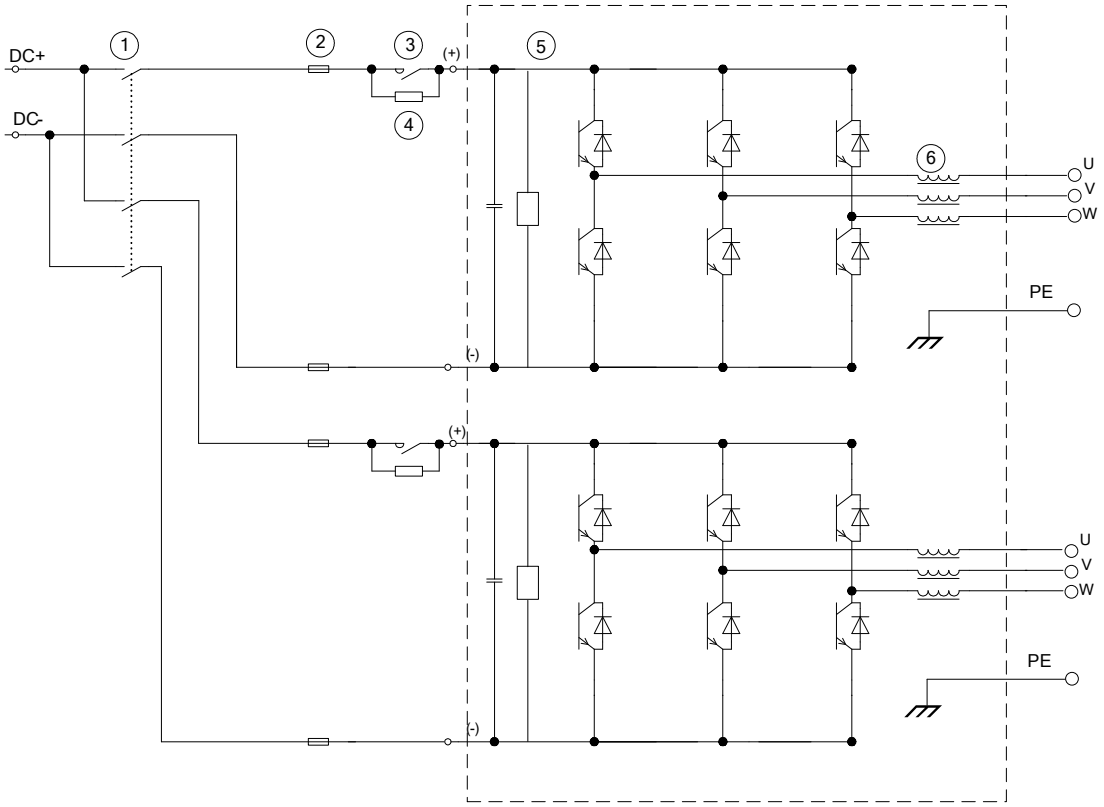
2.7.2 Paralleling principle

Figure 2-12 Simplified main circuit diagram of A8LC water-cooled inverter units in parallel



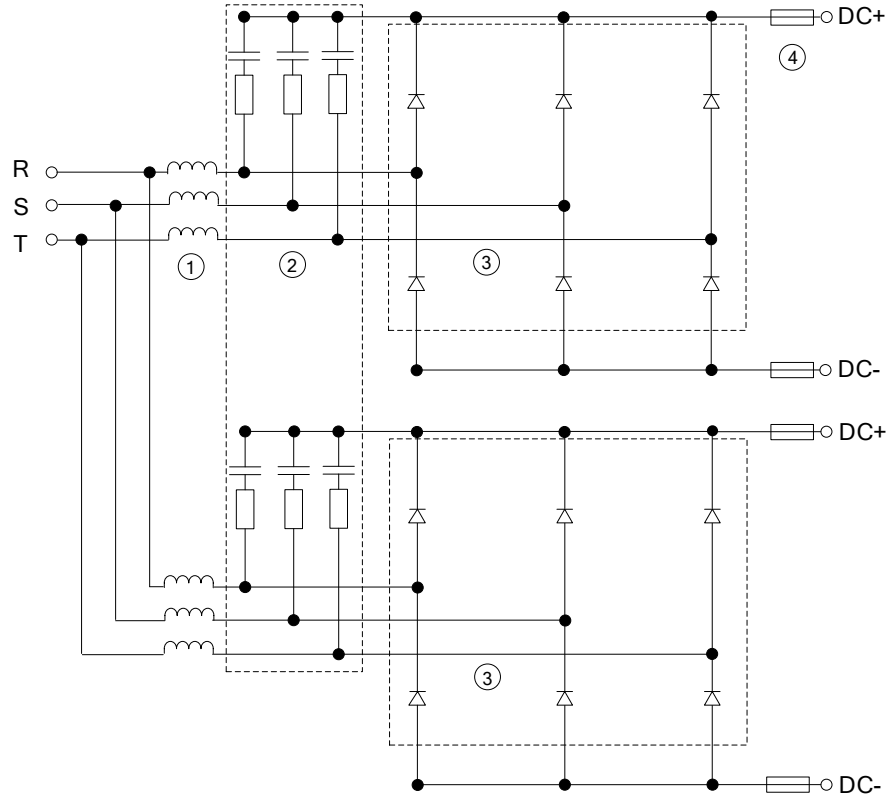
No.	Name
1	(Optional) Isolation switch
2	DC fuse
3	(Optional) DC contactor
4	(Optional) Precharge resistor
5	Inverter unit
6	Reactor

Figure 2-13 Simplified main circuit diagram of A9LC water-cooled inverter units in parallel



No.	Name
1	(Optional) Isolation switch
2	DC fuse
3	(Optional) DC contactor
4	(Optional) Precharge resistor
5	Inverter unit
6	Current sharing reactor built in the power unit

Figure 2-14 Simplified main circuit diagram of water-cooled rectifier unit

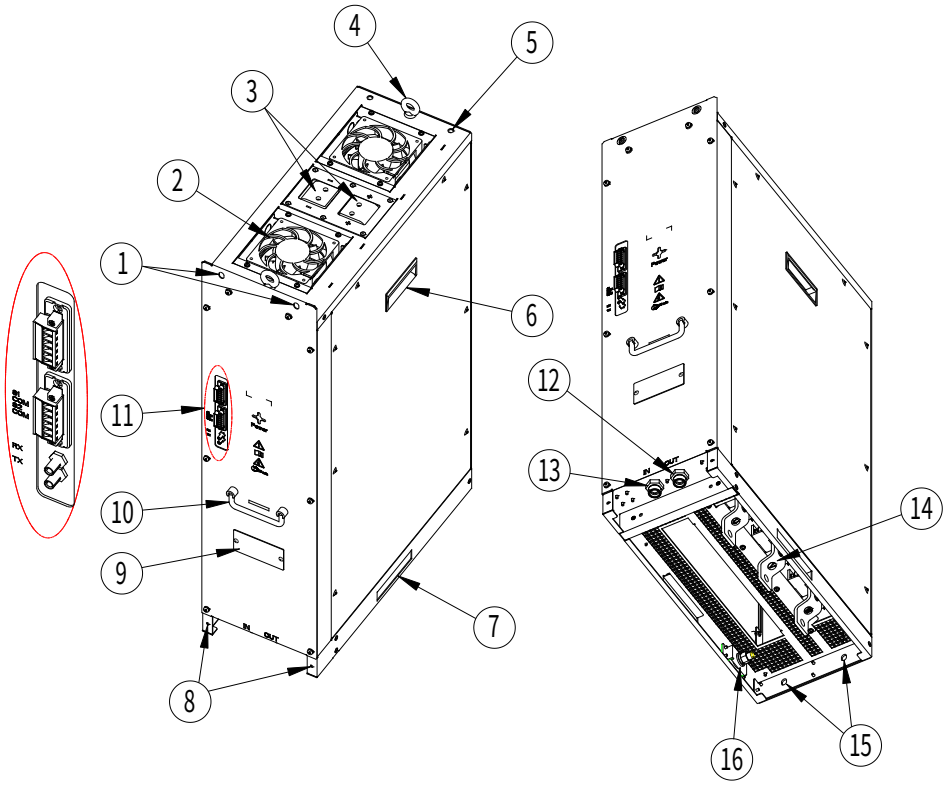


No.	Name
1	AC input reactor
2	RC filter board
3	Rectifier bridge
4	DC fuse

2.8 Product structure

2.8.1 A8LC water-cooled inverter unit

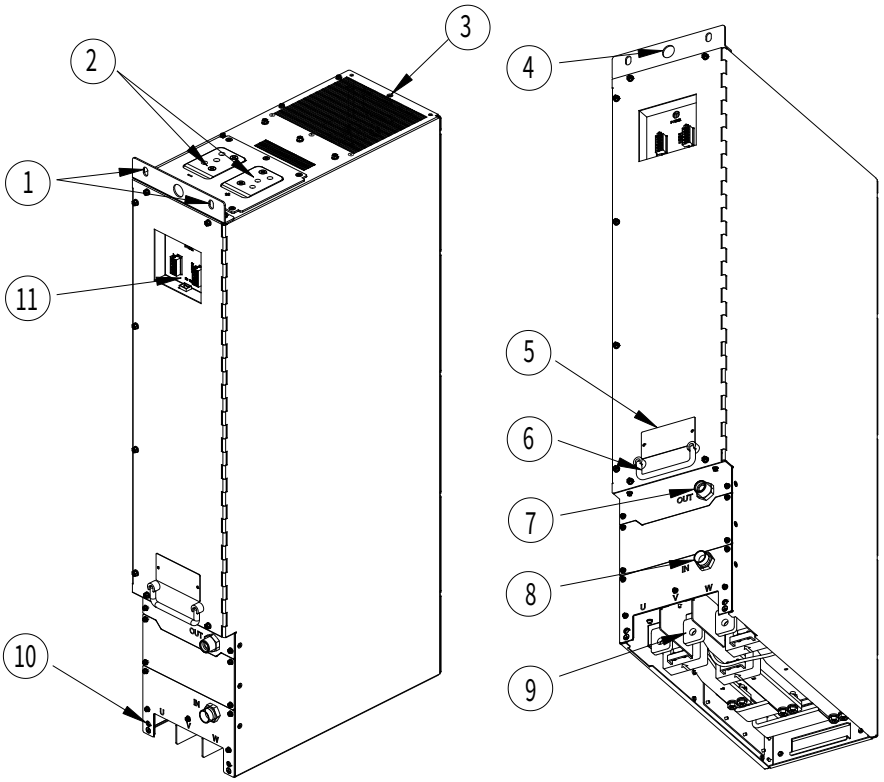
Figure 2-15 A8LC water-cooled inverter unit structure



No.	Description
1	Front-top mounting hole
2	Auxiliary cooling fan
3	Positive/negative input copper bar
4	Rings
5	Rear-top fixing hole (for wall mounting)
6	Embedded side handle
7	Bottom handle
8	Front-bottom fixing hole
9	Nameplate
10	Front handle
11	User terminals on the optical fiber and control boards
12	Water outlet connector
13	Water inlet connector
14	UVW AC output copper bar
15	Fixing hole at the bottom rear end of the unit (for wall mounting)
16	Ground (PE) terminal

2.8.2 A9LC water-cooled inverter unit

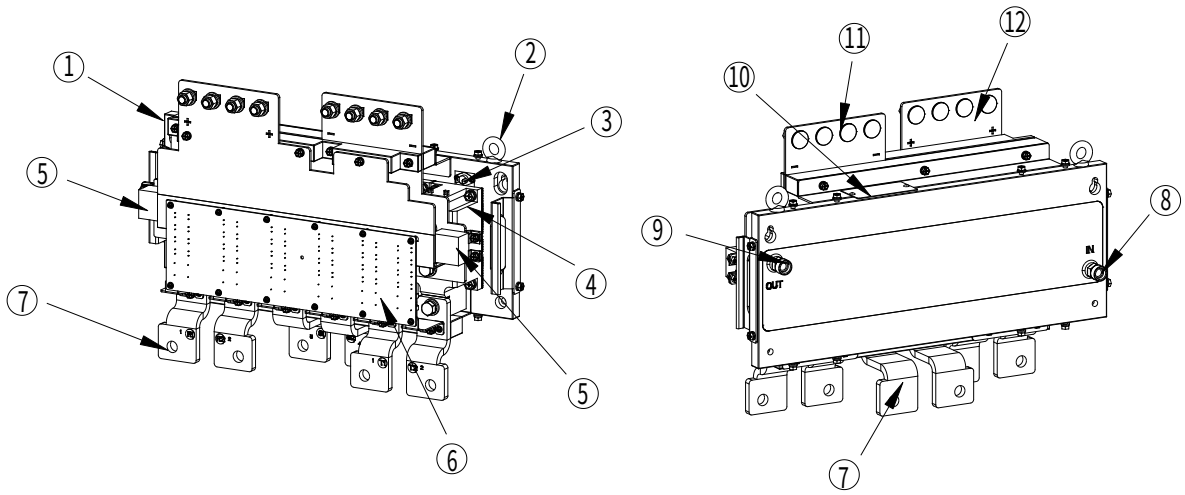
Figure 2-16 A9LC water-cooled inverter unit structure



No.	Description
1	Front-top mounting hole
2	Positive/negative input copper bar
3	Lifting-ring mounting hole
4	Lifting hole
5	Metal nameplate
6	Handle
7	Water outlet connector
8	Water inlet connector
9	UVW AC output copper bar
10	Front-bottom mounting hole and PE grounding hole
11	User terminals on the optical fiber and control boards

2.8.3 Water-cooled rectifier unit

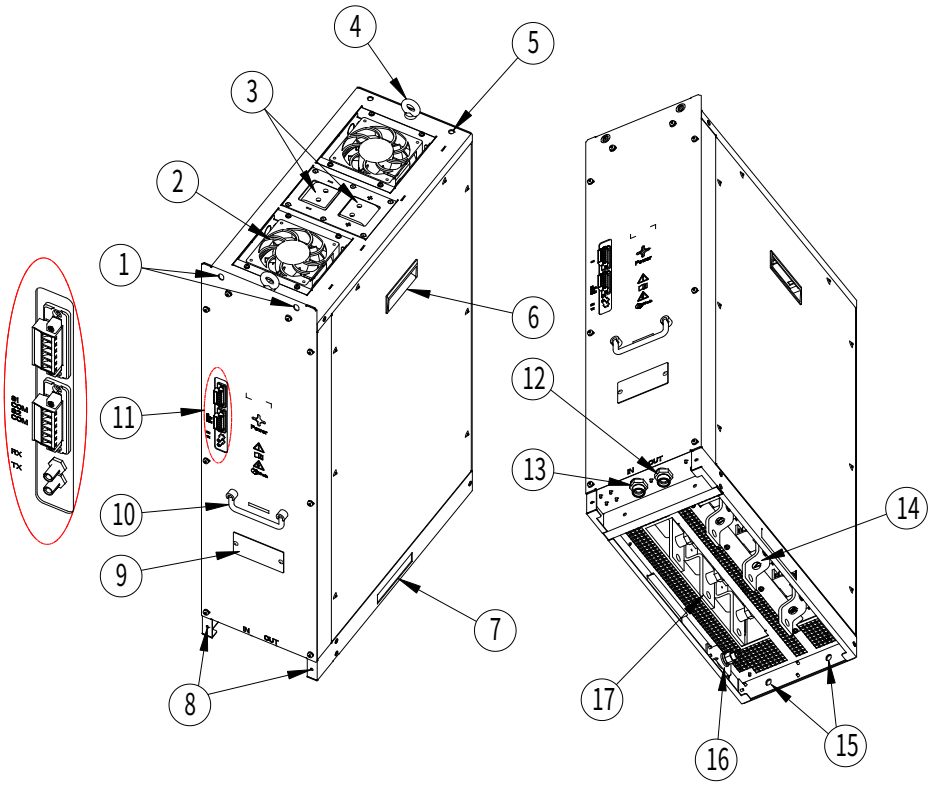
Figure 2-17 Water-cooled rectifier unit structure



No.	Description
1	Water-cooled heat-dissipating plate
2	Rings
3	Temperature switch
4	Module
5	Snubber capacitor
6	RC absorber plate
7	3PH input copper bar terminal
8	Water inlet connector
9	Water outlet connector
10	Nameplate
11	Negative output copper bar
12	Positive output copper bar

2.8.4 Water-cooled VFD unit

Figure 2-18 Water-cooled VFD unit structure



No.	Description
1	Front-top mounting hole
2	Auxiliary cooling fan
3	Positive/negative input copper bar
4	Rings
5	Rear-top fixing hole (for wall mounting)
6	Embedded side handle
7	Bottom handle
8	Front-bottom fixing hole
9	Nameplate
10	Front handle
11	User terminals on the optical fiber and control boards
12	Water outlet connector
13	Water inlet connector
14	UVW AC output copper bars
15	Fixing hole at the bottom rear end of the unit (for wall mounting)
16	Ground (PE) terminal
17	RST AC input terminals

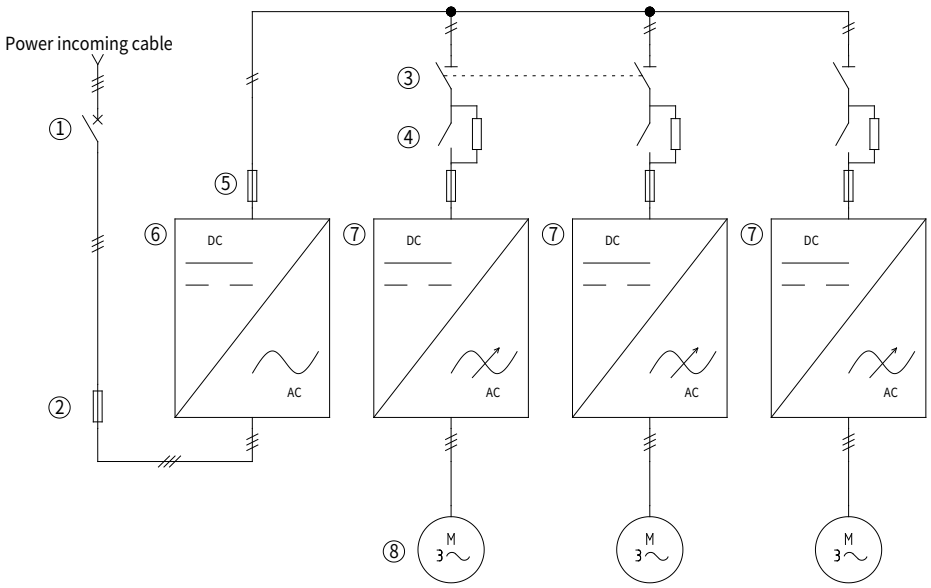
2.9 System configuration

Figure 2-19 shows a typical water-cooled common DC bus drive system.

The water-cooled rectifier module converts AC voltage to DC voltage, and the DC voltage is distributed to all inverter modules through the DC bus, then the water-cooled inverter modules convert the DC voltage to AC

voltage to drive the motor to rotate. An external DC fuse is required for the connection between each inverter module and DC bus.

Figure 2-19 System configuration



No.	Description
1	Power supply incoming circuit breaker (customer supplied)
2	(Optional) AC fuse
3	(Optional) Isolation switch
4	AC side snubber assembly
5	(Optional) DC fuse
6	Water-cooled rectifier unit
7	Water-cooled inverter unit (built-in precharge is optional for A8LC)
8	Motor

2.10 Electrical model selection

2.10.1 AC fuse

An AC fuse protects the rectifier unit in case of short circuit, avoiding thermal overload. The same brand replacement principle should be followed. See the following table for selection.

Unit model	Frame size	Model	Current (A)	Quantity
GD880-61-2000-6-LC	D3DLC	170M6468	1500	6
GD880-11-0340-6-LC	A8LC	170M6410	630	3
GD880-11-0530-6-LC	A8LC	170M6413	900	3

2.10.2 DC fuse

A DC fuse protects the rectifier unit and DC bus in case of short circuit, avoiding thermal overload. The same brand replacement principle should be followed. See the following table for selection.

Unit model	Frame size	Model	Current (A)	Quantity
GD880-51-0410-6-LC	A8LC	170M6546	800	2
GD880-51-0530-6-LC	A8LC	170M6547	900	2
GD880-51-0600-6-LC	A8LC	170M6548	1000	2

Unit model	Frame size	Model	Current (A)	Quantity
GD880-51-0650-6-LC	A8LC	170M6549	1100	2
GD880-51-0900-6-LC	A9LC	170M6547	900	4
GD880-61-2000-6-LC	D3DLC	170M7595	2500	4

2.10.3 Isolation switch

An isolation switch acts as an isolator for the circuit, causing an obvious break in the circuit and ensuring work safety during inspection or maintenance. The same brand replacement principle should be followed. See the following table for selection.

Unit model	Frame size	Current (A)	Model	Quantity
GD880-51-0410-6-LC	A8LC	1000	OT1000E11P	1
GD880-51-0530-6-LC	A8LC	1000	OT1000E11P	1
GD880-51-0600-6-LC	A8LC	1000	OT1000E11P	1
GD880-51-0650-6-LC	A8LC	1000	OT1000E11P	1
GD880-51-0410-6-LC*2	A8LC*2	1000	OT1000E22P	1
GD880-51-0530-6-LC*2	A8LC*2	1000	OT1000E22P	1
GD880-51-0600-6-LC*2	A8LC*2	1000	OT1000E22P	1
GD880-51-0650-6-LC*2	A8LC*2	1000	OT1000E22P	1
GD880-51-0900-6-LC	A9LC	1600	OT1600E02P	1
GD880-51-0900-6-LC*2	A9LC*2	1600	OT1600E22P	1

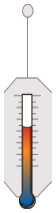
3 Mechanical installation

3.1 Safety notes

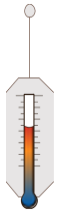
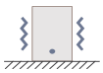
⚠	Equipment can tip over if transported incorrectly or with disallowed means of transport. Serious injury, property damage, or even death may result. ● Only trained and qualified professionals are allowed to carry out the operations mentioned in this chapter. Please carry out operations according to instructions presented in section 1.4.1 Delivery and installation. Ignoring these safety precautions may lead to physical injury or death, or device damage. ● Ensure the unit power has been disconnected before installation. If the unit has been powered on, disconnect the unit power and wait for at least the time specified on the unit, and ensure the POWER indicator is off. You are recommended to use a multimeter to check and ensure the unit DC bus voltage is below 36V. ● The equipment installation must be designed and done according to applicable local laws and regulations. We do not assume any liability whatsoever for any equipment installation which breaches local laws or regulations. If recommendations given by us are not followed, the unit may experience problems that the warranty does not cover. ● Only trained and qualified professionals are allowed to carry out related operations. ● Do not perform wiring, inspection or component replacement when power supply is applied. Ensure all the input power supplies have been disconnected before wiring or inspection, and wait for at least the time designated on Goodrive880 series product or until the DC bus voltage is less than 36V.

3.2 Installation environment

3.2.1 Storage environment

Environment	Condition	
Ambient temperature		● -40–+70°C (drain all water from the unit cavity below 0°C) ● There is no sudden temperature change.
Humidity		● The relative humidity (RH) of the air is less than 90%, and there is no condensation. ● The max. RH cannot exceed 60% in the environment with corrosive gases.

3.2.2 Running environment requirements

Environment	Condition	
Ambient temperature		● 0–55°C (Add antifreeze if the temperature may drop below 5 °C.) ● When the ambient temperature exceeds 45°C, derate 1% for every increase of 1°C. ● It is not recommended to use the power unit when the ambient temperature exceeds 55°C. ● To improve reliability, do not use the power unit in the places where the temperature changes rapidly. ● When the VFD is used in a closed space, such as control cabinet, use a cooling fan or air conditioner for cooling, preventing the internal temperature from exceeding the temperature required. ● When the temperature is too low, if you want to use the VFD that has been idled for a long time, install an external heating device before the use to eliminate the freeze inside the VFD. Otherwise, the VFD may be damaged.
Humidity		● The relative humidity (RH) of the air is less than 90%, and there is no condensation. ● The max. RH cannot exceed 60% in the environment with corrosive gases. ● There is a correlation between humidity and temperature. Refer to section 6.4 Protection against condensation for the anti-condensation settings.
Running environment	Install the power unit in a place:	
		Without electromagnetic radiation sources and direct sunlight. **Note:** The unit must be installed in a clean and well-ventilated environment based on the housing IP rating.
		Without foreign objects such as oil mist, metal powder, conductive dust, and water.
		Without radioactive, corrosive, hazard, and combustible and explosive substances. **Note:** Do not install the unit onto combustible objects.
Altitude		● Lower than 1000m ● When the altitude exceeds 1000m, derate by 1% for every increase of 100m. ● When the altitude exceeds 3000m, consult our local dealer or office for details.
Vibration		Max. ACC: 5.8m/s² (0.6g)

3.3 Installation procedure

The power unit installation procedure is as follows:

Step 1 Perform unpacking inspection. For details, see section 3.3.1.

Step 2 Transport before unpacking. For details, see section 3.3.2.

Step 3 Unpack. For details, see section 3.3.3.

Step 4 Lift the modules. For details, see section 3.3.4.

Step 5 Install the modules. For details, see section 3.3.5.

3.3.1 Unpacking inspection

After receiving the product, perform the following steps to ensure the product use safety.

Step 1 Before unpacking, check whether the product package is intact–whether the package is damaged, dampened, soaked, or deformed.

Step 2 Check whether the nameplate and label on the product body are consistent with the model ordered.

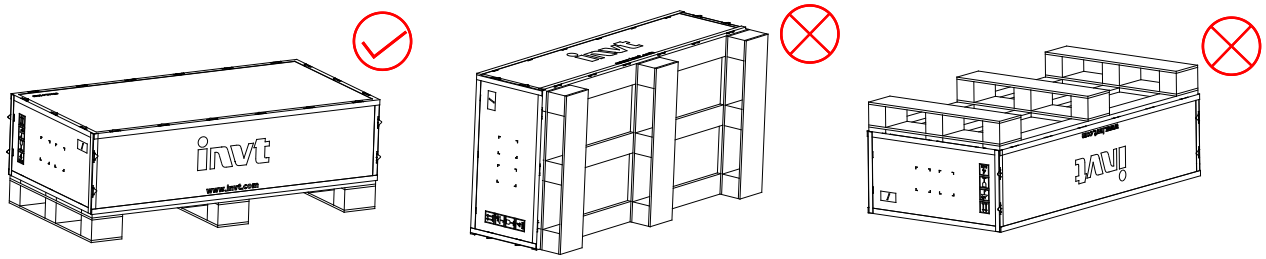
Step 3 After unpacking, check whether the interior surface of the packing box is abnormal, for example, in wet condition, and whether the equipment enclosure is damaged or cracked.

Step 4 Check whether the parts (including the complete equipment of unit, keypad, and manual) inside the packing box are complete.

3.3.2 Transportation

The power unit is shipped in a wooden box with pallets, which are heavy as a whole and must be carried with a lifting tool, such as a forklift and crane; operators must be professionally trained; the unit must be transported in strict accordance with the allowed ways marked on the box, and not allowed to be transported upside down or on the sides.

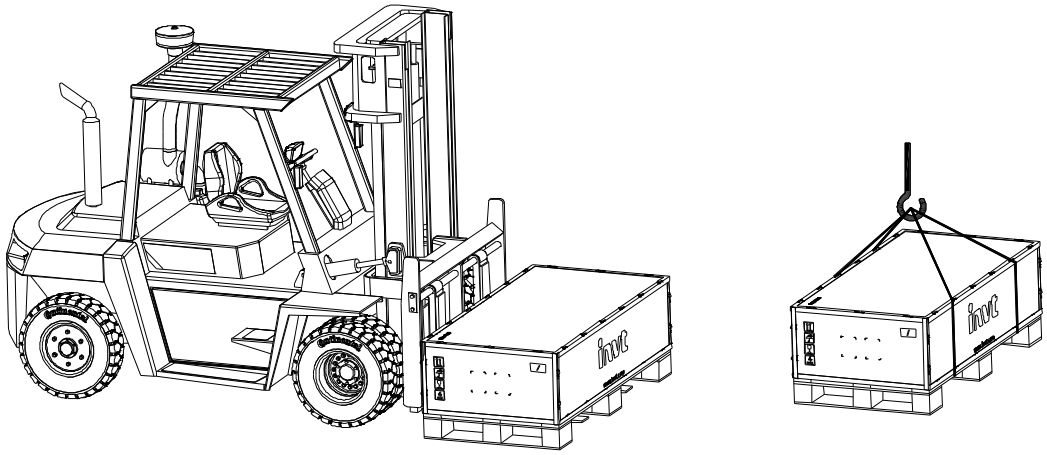
Figure 3-1 Transportation requirements



When transported with a forklift, the power unit must be fixed to the pallets and transported together, which means you are not allowed to remove the pallets to transport the unit. If the forklift's fork tines are too short, it may cause the unit/cabinet to tip over, resulting in serious injury, property damage or even death.

When transported with a crane, the unit must be fixed to the pallets and lifted together.

Figure 3-2 Transportation means



3.3.3 Unpacking

The unit is delivered in the wooden box padded with EPE.

To remove the packing, do as follows:

Step 1 Place the well-packed unit in an empty and flat place.

Step 2 Use tools such as a pry bar or large one-piece screwdriver to remove the wooden box cover and the steel tongue nails of the surrounding boards.

Step 3 Remove the surrounding boards and EPE filling materials from the wooden box.

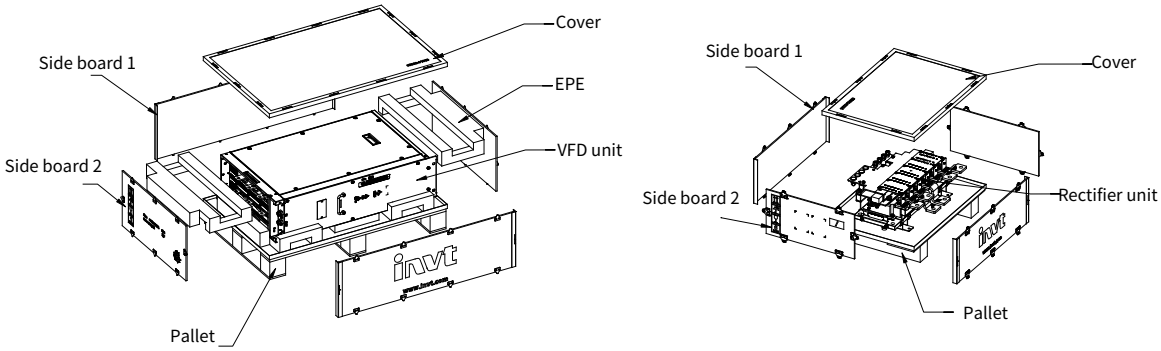
Step 4 Cut off the plastic windings and remove the fixing bolts between the unit and the pallet.

Step 5 Take out of the unit.

Step 6 Ensure that the unit is intact without any damage.

Step 7 Dispose of or recycle packaging in accordance with local regulations.

Figure 3-3 Unpacking



3.3.4 Lifting

Attach the required lifting ring to the locations shown in the figure, use the sling to slowly lift the unit end, move the unit until it is completely lifted, place it vertically in an empty and flat place, and then unfold the anti-tipping stand at the lower front of the unit. The following figure shows the anti-tipping stand location.

Figure 3-4 VFD unit lifting

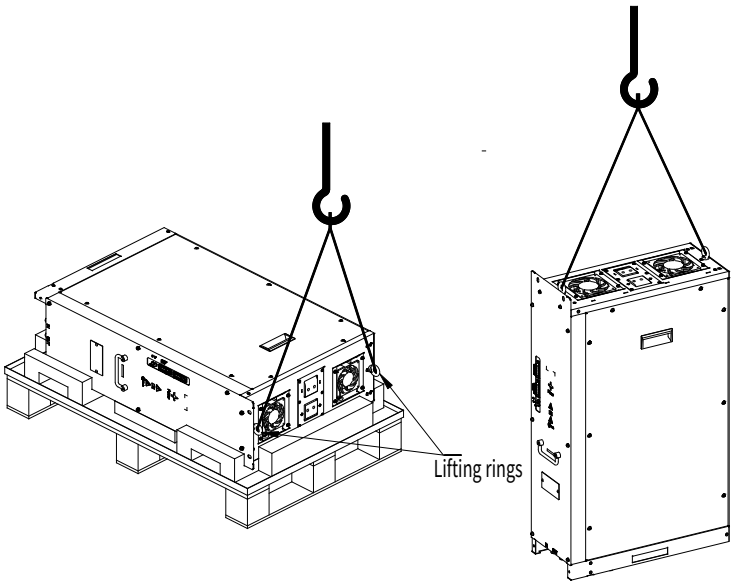
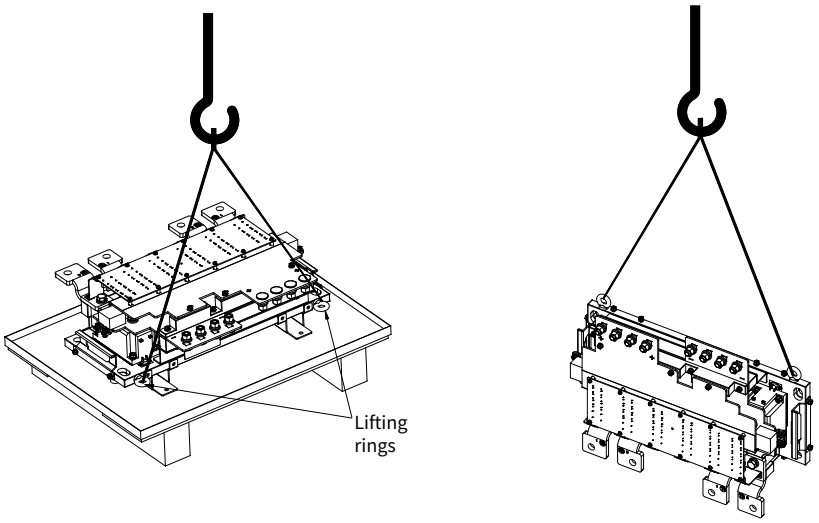
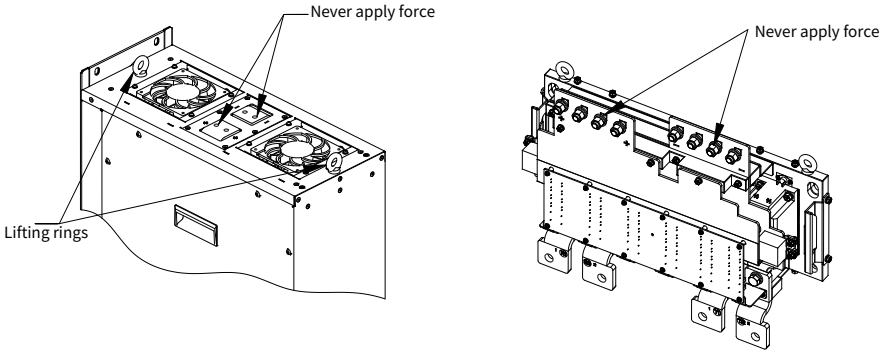


Figure 3-5 Rectifier unit lifting



Note: Use the lifting ring on the top of unit for lifting and moving. Never apply force to the positive or negative bus terminals.

Figure 3-6 Unit top structure



3.3.5 Installation

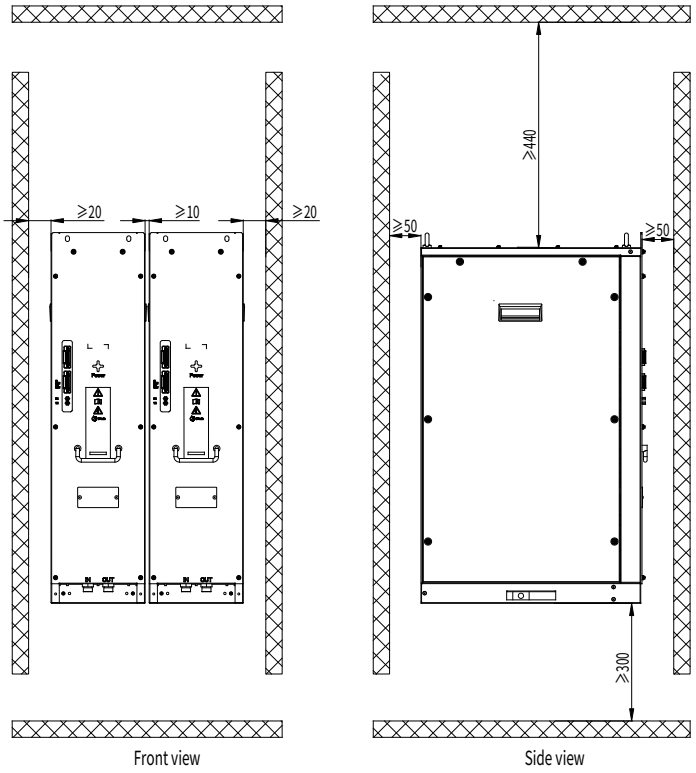
3.3.5.1 Installation space and heat dissipation

Installation space requirements for water-cooled VFD and inverter units

To ensure reliable installation and effective heat dissipation for A8LC VFD/inverter units, observe the following requirements:

- The unit must be installed and used in a cabinet.
- A minimum ventilation clearance must be kept at the top, bottom, and both sides of the unit to ensure good heat dissipation. See Figure 3-7.
- Both sides of the unit are designed with air baffle and sealing sponge for isolation to prevent the hot air at the unit top outlet from circulating inside the cabinet and ensure that the heat of the unit is discharged from the heat dissipation holes at the cabinet top outlet cover. See Figure 3-7.

Figure 3-7 Installation space requirements for water-cooled VFD and inverter units

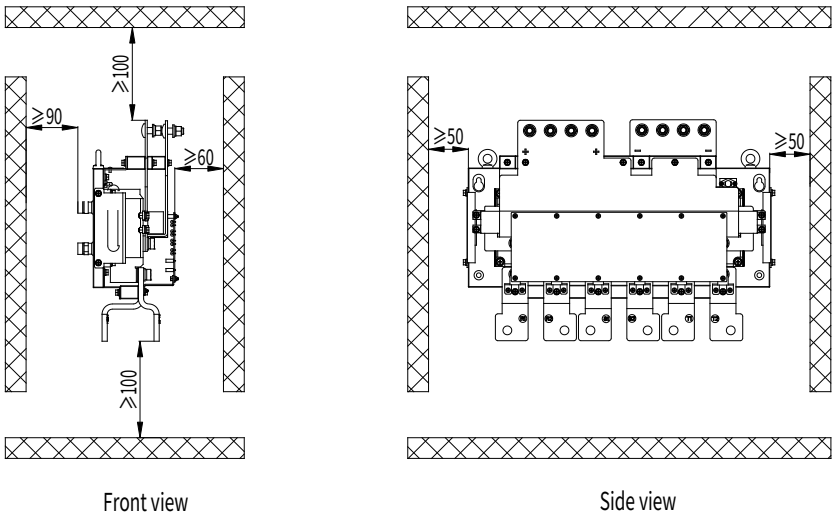


Installation space requirements for water-cooled rectifier units

To ensure that the water-cooled rectifier unit is installed reliably and in good heat dissipation, pay attention to the following:

- The unit must be installed and used in a cabinet.
- A minimum ventilation clearance must be kept at the top, bottom, and both sides of the rectifier unit to ensure good heat dissipation. See Figure 3-8.

Figure 3-8 Installation space requirements for water-cooled rectifier units



Cabinet inlet and outlet area

To ensure good unit heat dissipation, design the air inlet and outlet as follows:

Air inlet area formula: S_{in}= (1.5~2.0) x ($S_{module1}$ + $S_{module2}$ + $S_{module3}$+⋯+ $S_{module\ N}$);

S_{in} indicates the system ventilation area, in cm^2.

S_{module} indicates the each module ventilation area, in cm^2.

Air outlet area formula: S_{out}= (1.2~1.5) x $S_{in,}$ in cm^2.

For details about the air volumes required by the units, see Table 3-1.

Table 3-1 Ventilation areas and actual air volumes of units

No.	Frame size	Ventilation area S_{in} (cm^2)	Actual air volume (CFM)
1	D3DLC	416	460
2	2*A8LC	832	920
3	2*A9LC	832	920

	● Violation of the requirements in section 3.3.5.1 Installation space and heat will shorten the unit life and may result in unit failure or malfunction.

3.3.5.2 Cabinet requirements

- The cabinet frame must be strong enough to withstand the weight of components, control circuits and other equipment installed in it.
- The cabinet must provide contact-proof shields for the powered circuits, and meet the requirements in terms of dust and humidity.
- To facilitate installation, it is recommended to leave sufficient space around the device: space for cooling air flow, necessary clearance, and space required by the cable and cable support structure. Do not install the control board near the main circuit or high-temperature components.
- Ensure that any straddle components or racks with components installed are properly grounded and that the connection surface is not painted.
- Ensure that the module is properly grounded through the fixing point on its mounting base.
- It is recommended to use nickel-plated copper for the internal conductive parts of the cabinet. Besides, aluminum can also be used.
- If there is a risk of condensation in the cabinet, use a cabinet heater. Though the heater is mainly used to keep the air dry in this case, it can also be used for heating in low temperature environments. When placing the heater, follow the instructions provided by its manufacturer.
- When placing coolant pipes, be careful to ensure that the pipes are installed properly and check for leaks.

3.3.5.3 Recommended cabinet layout and installation

Recommended layout of 1*A8LC inverter unit cabinet

Figure 3-9 Layout of 1*A8LC water-cooled inverter unit cabinet with isolation switch

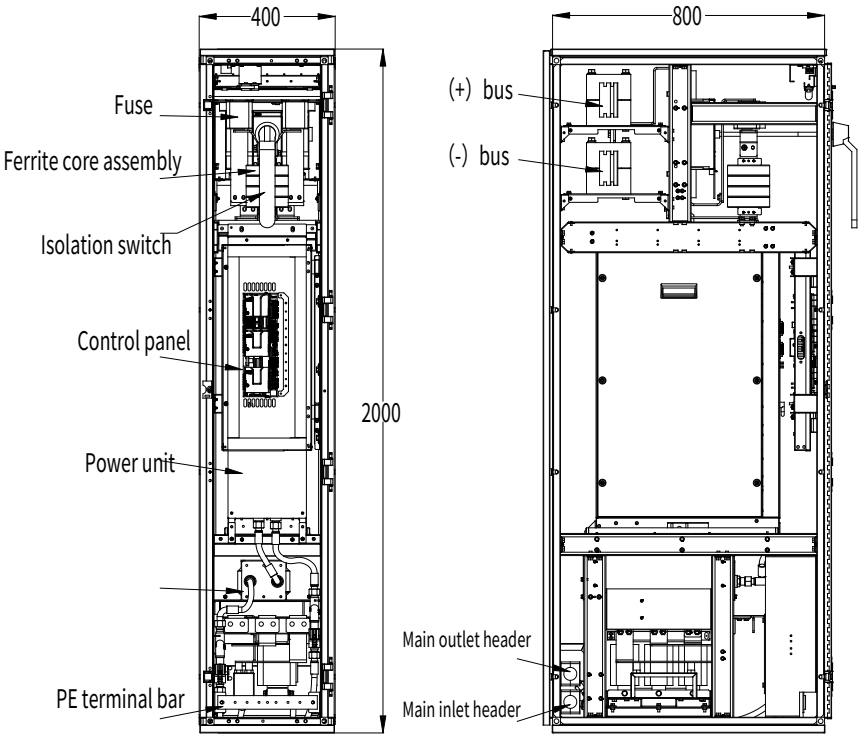
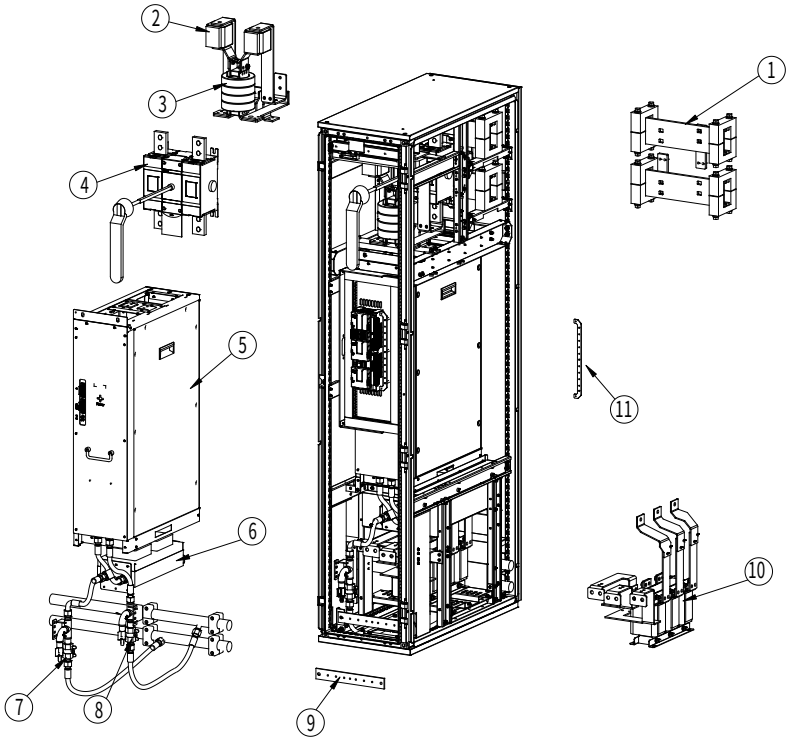


Figure 3-10 Installation of 1*A8LC water-cooled inverter unit cabinet with isolation switch



No.	Description
1	(+)/(-) bus
2	Fuse

No.	Description
3	Ferrite core assembly
4	(Optional) Isolation switch
5	Power unit
6	Water-to-air heat exchanger
7	Inlet water valve assembly (with drain valve)
8	Outlet water valve assembly (with drain valve)
9	PE bar
10	Current sharing reactor and output copper bar
11	Control unit grounding bar

Recommended layout of 2*A8LC inverter unit cabinet

Figure 3-11 Layout of 2*A8LC water-cooled inverter unit cabinet with isolation switch

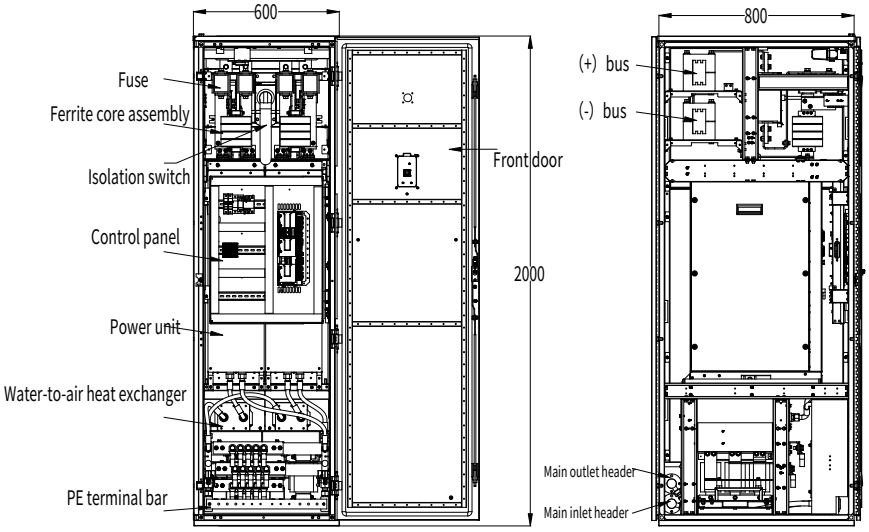
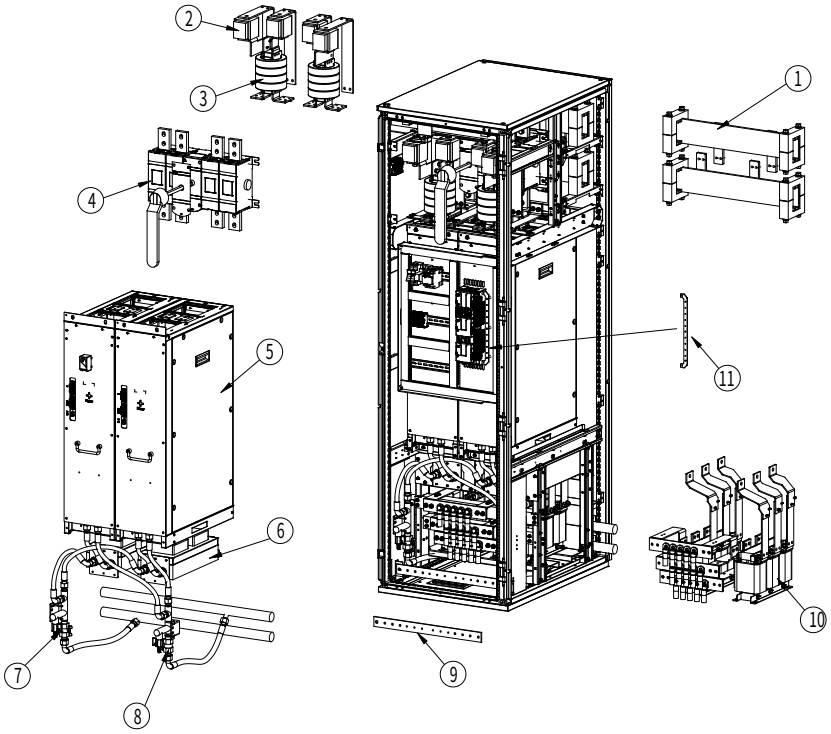


Figure 3-12 Installation of 2*A8LC water-cooled inverter unit cabinet with isolation switch



No.	Description
1	(+)/(-) bus
2	Fuse
3	Ferrite core assembly
4	(Optional) Isolation switch
5	Power unit
6	Water-to-air heat exchanger
7	Inlet water valve assembly (with drain valve)
8	Outlet water valve assembly (with drain valve)
9	PE bar
10	Current sharing reactor and output copper bar
11	Control unit grounding bar

Figure 3-13 Layout for 2*A8LC water-cooled inverter unit cabinet without isolation switch

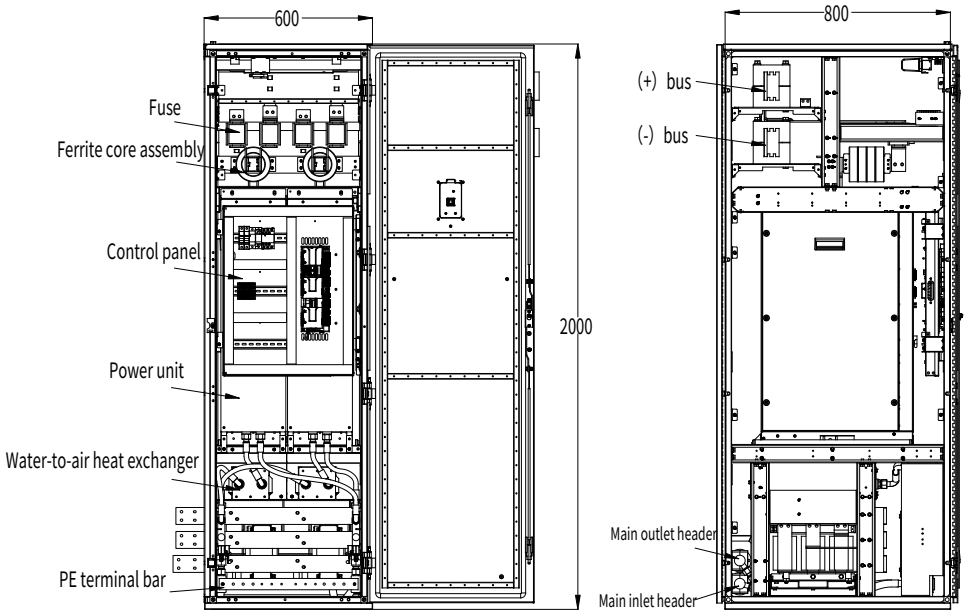
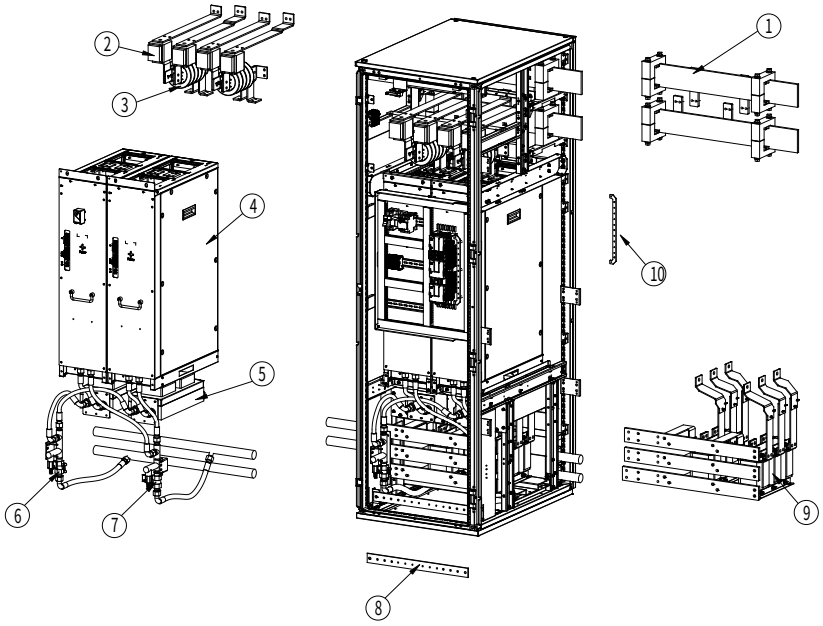


Figure 3-14 Installation of 2*A8LC water-cooled inverter unit cabinet without isolation switch



No.	Description
1	(+)/(-) bus
2	Fuse
3	Ferrite core assembly
4	Power unit
5	Water-to-air heat exchanger
6	Inlet water valve assembly (with drain valve)
7	Outlet water valve assembly (with drain valve)
8	PE bar
9	Current sharing reactor and output copper bar
10	Control unit grounding bar

Recommended layout of 3*A8LC inverter unit cabinet

Figure 3-15 Layout of 3*A8LC water-cooled inverter unit cabinet

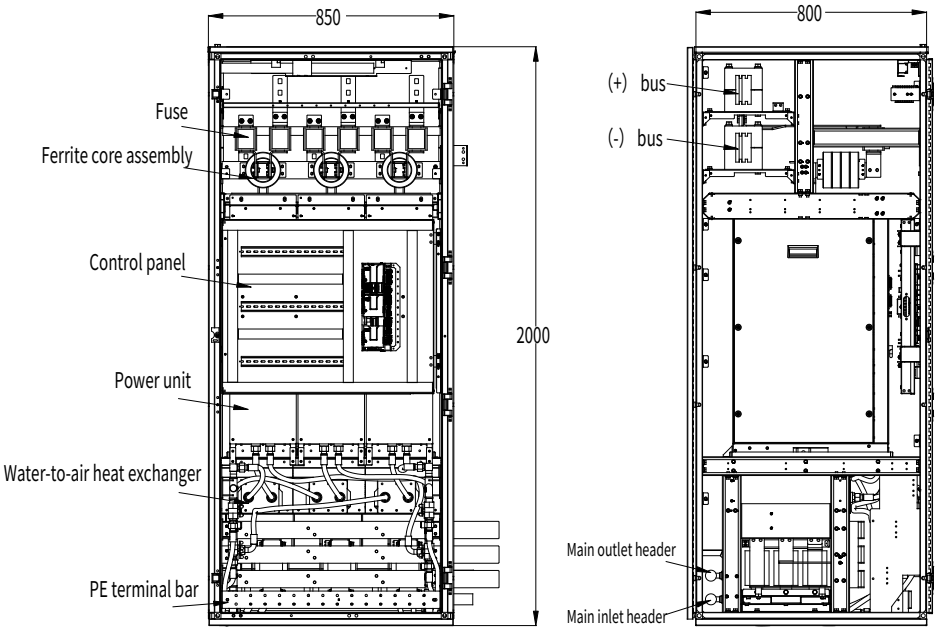
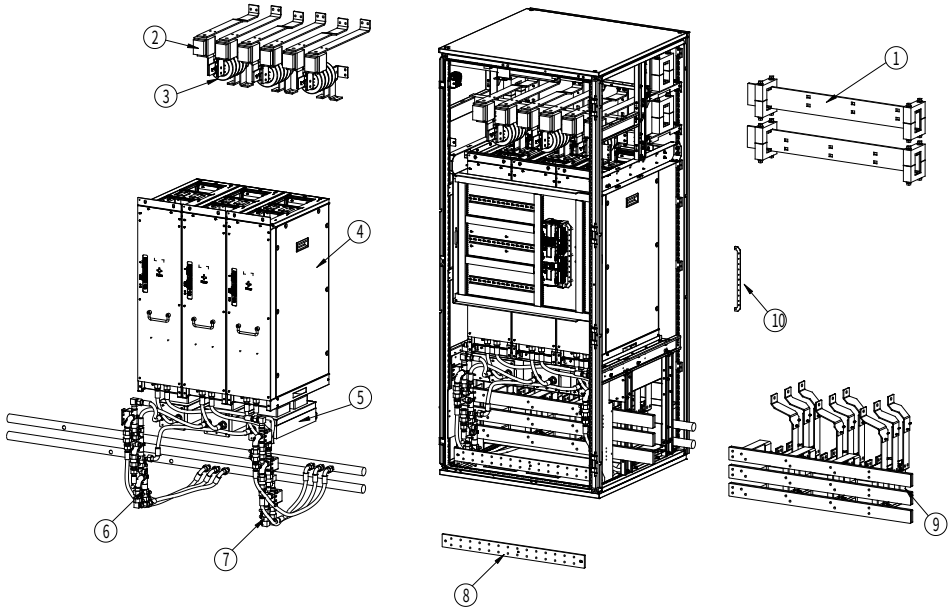


Figure 3-16 Installation of 3*A8LC water-cooled inverter unit cabinet



No.	Description
1	(+)/(-) bus
2	Fuse
3	Ferrite core assembly
4	Power unit
5	Water-to-air heat exchanger
6	Inlet water valve assembly (with drain valve)
7	Outlet water valve assembly (with drain valve)
8	PE bar
9	Current sharing reactor and output copper bar
10	Control unit grounding bar

3.3.5.4 Layout and installation of water-cooled rectifier unit cabinet

Figure 3-17 Layout of D3DLC water-cooled rectifier unit cabinet

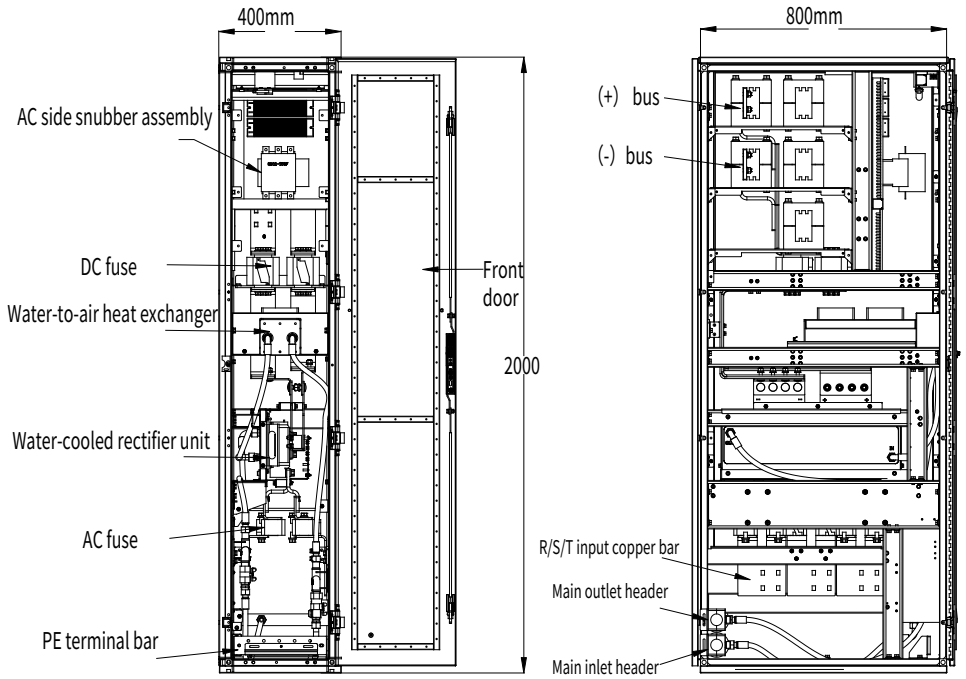
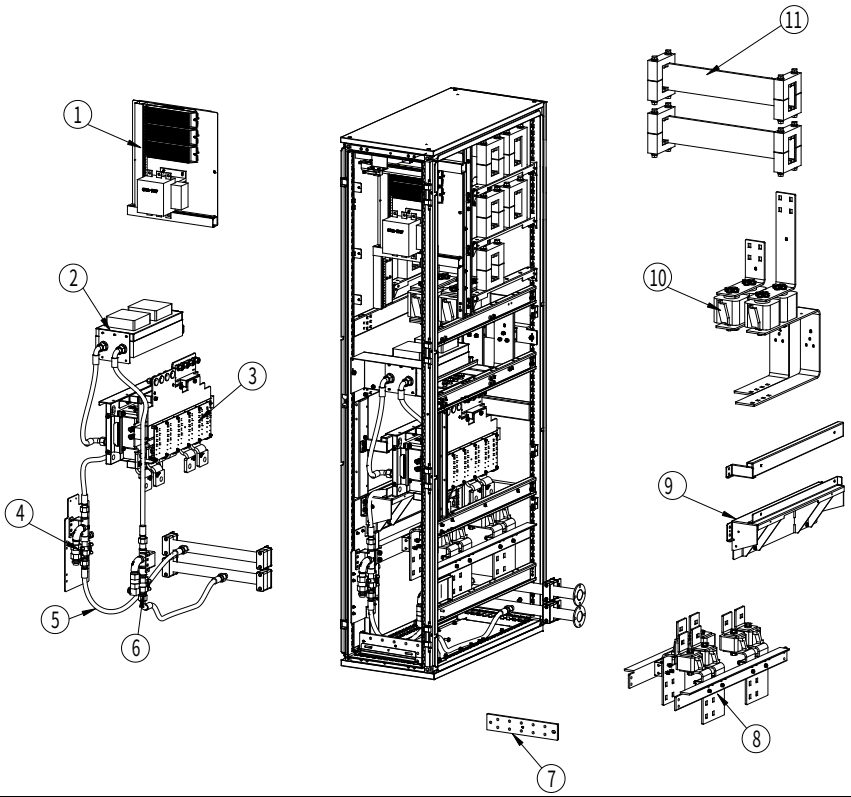


Figure 3-18 Installation of D3DLC water-cooled rectifier unit cabinet



No.	Description
1	AC side snubber assembly
2	Water-to-air heat exchanger
3	Rectifier water-cooled unit
4	Inlet water valve assembly (with drain valve)
5	Flexible hose
6	Outlet water valve assembly (with drain valve)
7	PE bar
8	Input copper bar
9	Unit installation bracket
10	Fuse
11	(+)/(-) bus

Figure 3-19 Layout of a 400-mm-wide cabinet for A8LC water-cooled active rectifier units

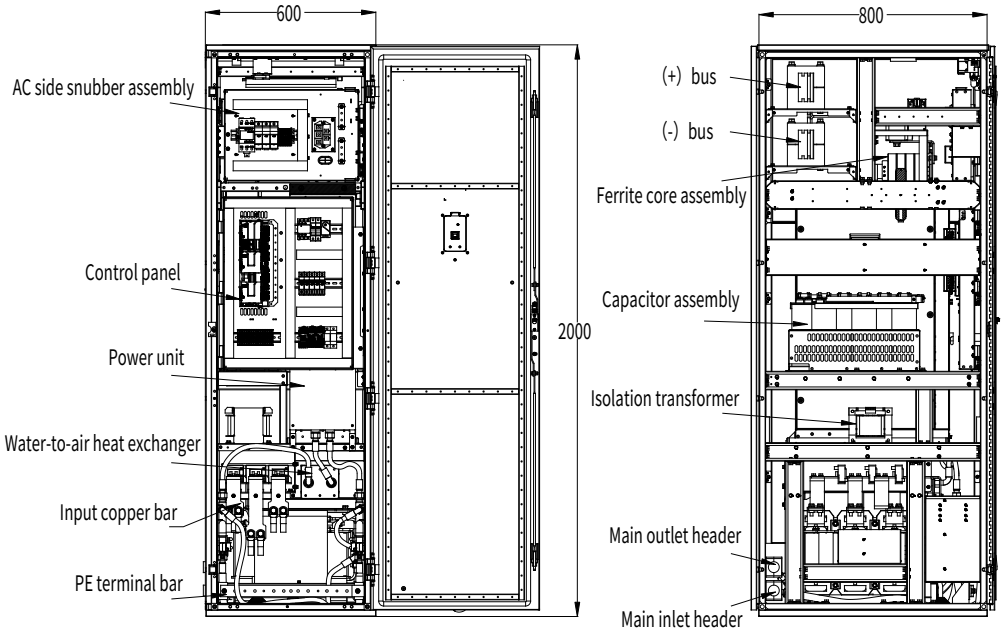
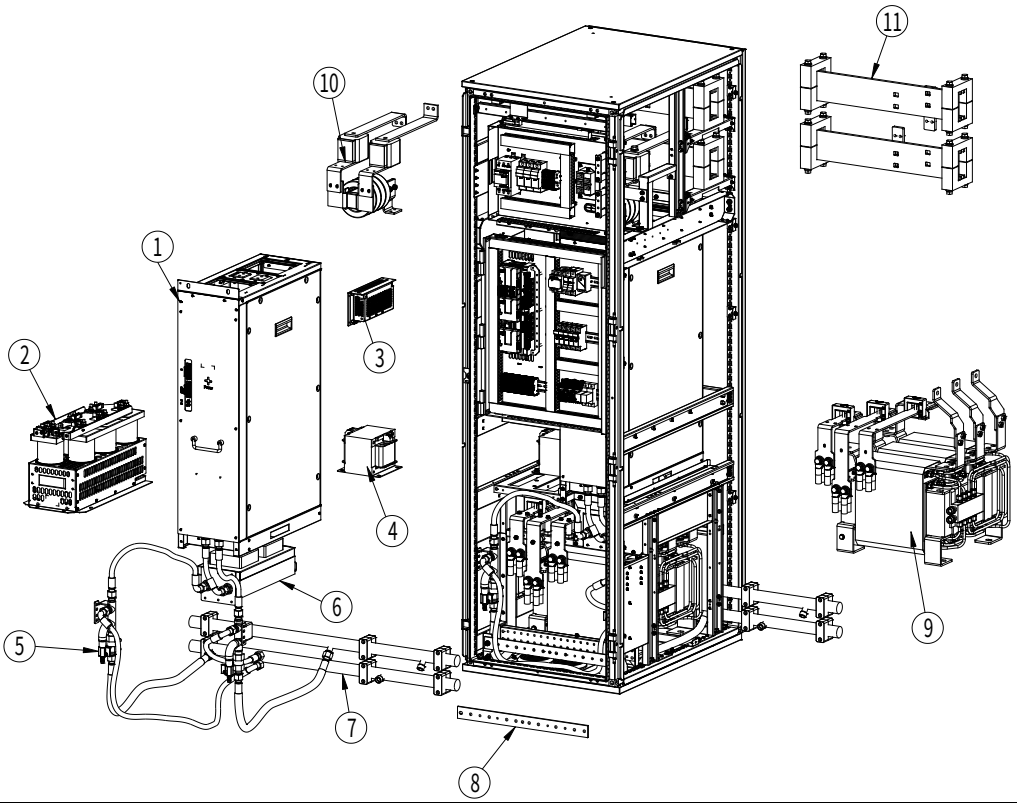


Figure 3-20 Installation of a 400-mm-wide cabinet for A8LC water-cooled active rectifier units



No.	Description
1	Active rectifier unit
2	Capacitor module
3	Filter board
4	Isolation transformer
5	Inlet water valve assembly (with drain valve)
6	Water-to-air heat exchanger
7	Outlet water valve assembly (with drain valve)

No.	Description
8	PE terminal bar
9	Water-cooled reactor
10	Fuse
11	(+)/(-) bus

Figure 3-21 Recommended layout of a 600-mm-wide LC filter cabinet

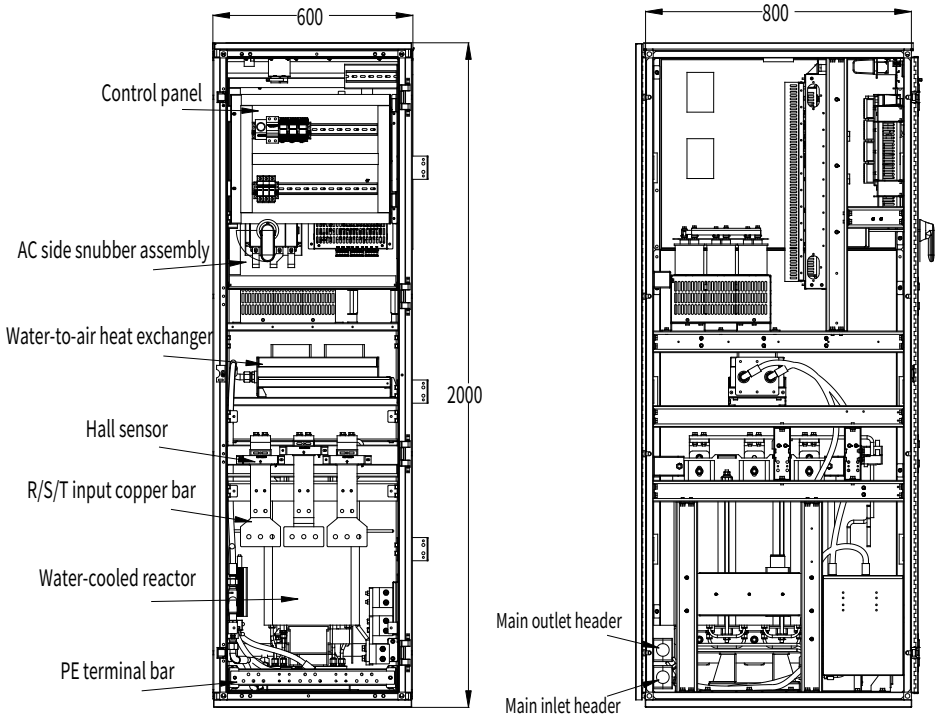
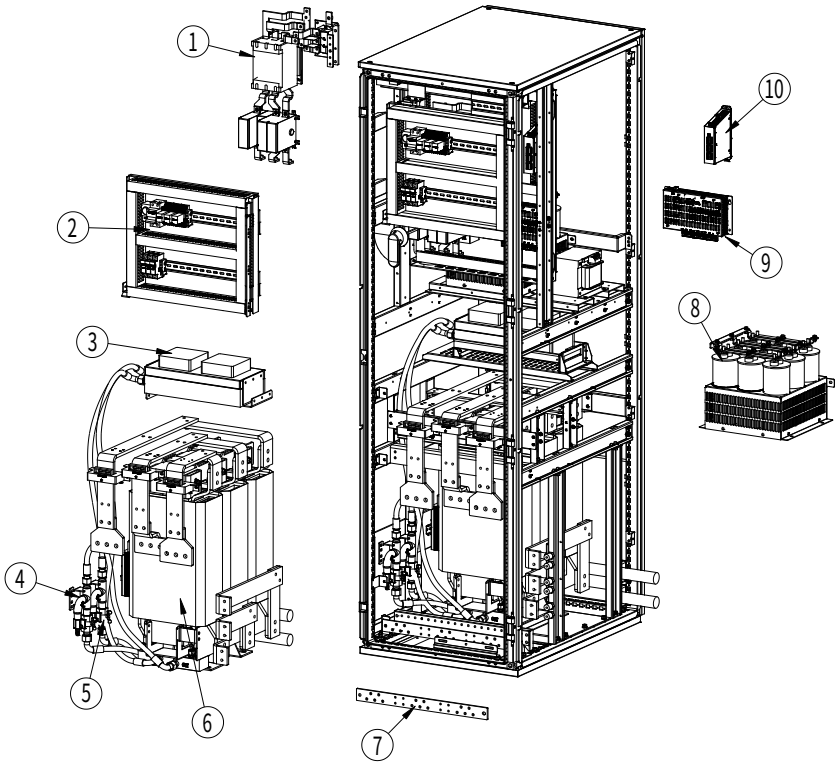


Figure 3-22 Installation of a 600-mm-wide LC filter cabinet



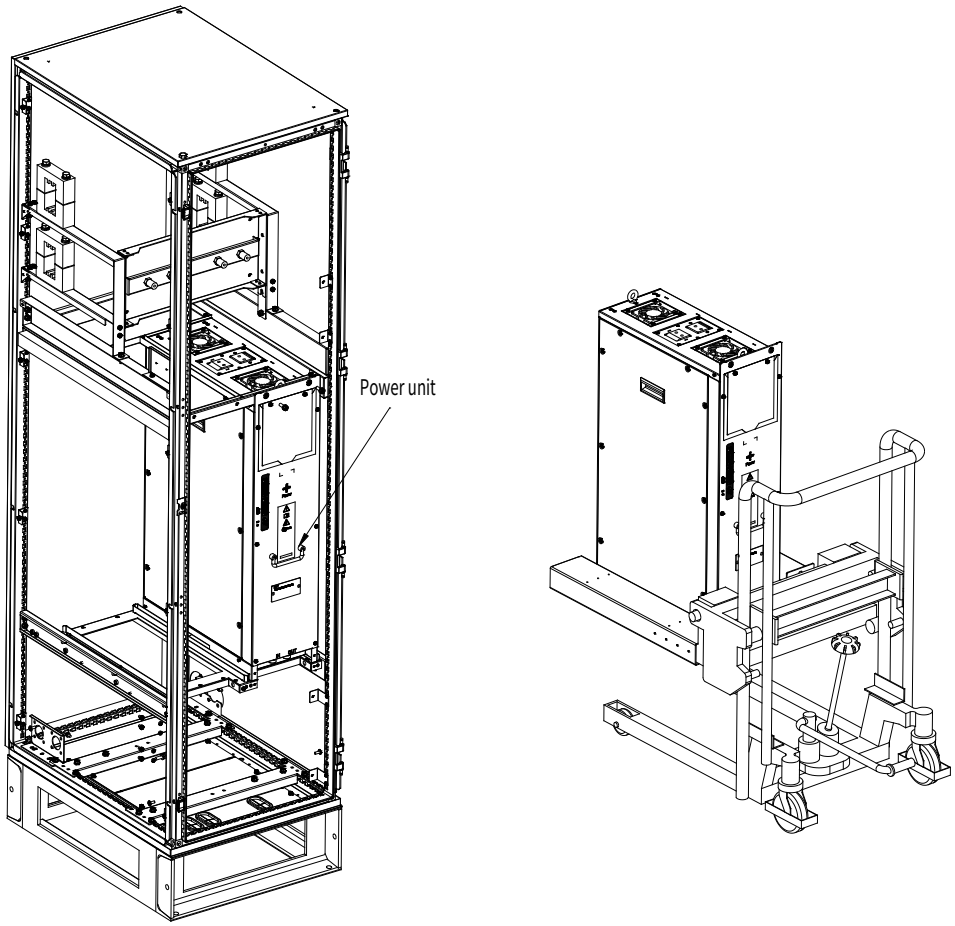
No.	Description
1	AC side snubber assembly
2	Control part
3	Water-to-air heat exchanger
4	Inlet water valve assembly (with drain valve)
5	Outlet water valve assembly (with drain valve)
6	Reactor
7	PE terminal bar
8	Capacitor module
9	3PH voltage detection module
10	3PH AC detection module

3.3.5.5 Unit installation (including rectifier, inverter and VFD units)

Recommended installation method of water-cooled inverter and VFD units

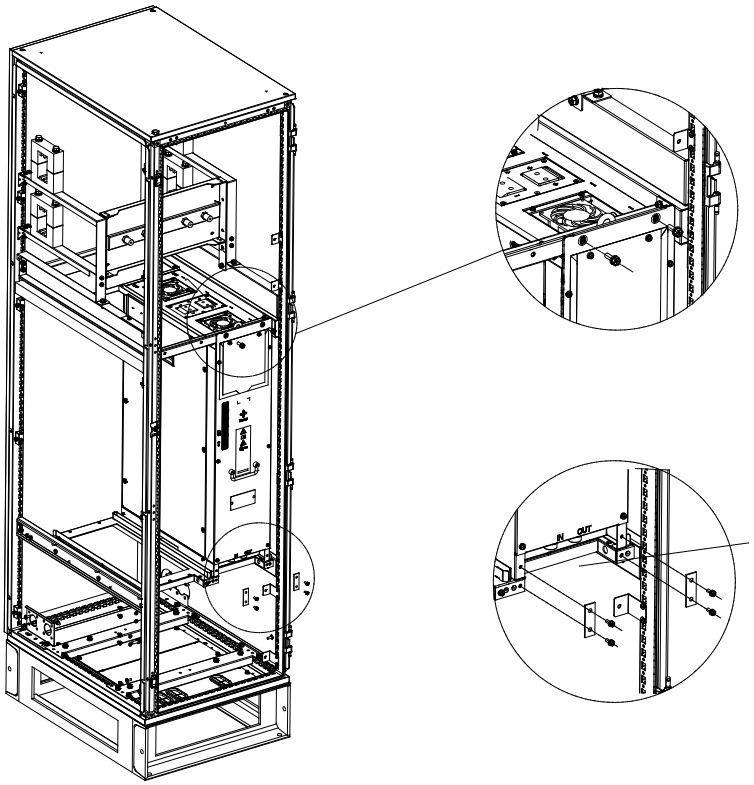
Step 1 Push the power unit into the cabinet with a lifting device along the mounting limit slot, as shown in Figure 3-23.

Figure 3-23 Unit entry to the cabinet



Step 2 After pushing the power unit into the cabinet slowly, lock the two fixing bolts (M8 × 20) at the top of the unit, and then secure the bottom with the fixing plate, as shown in Figure 3-24.

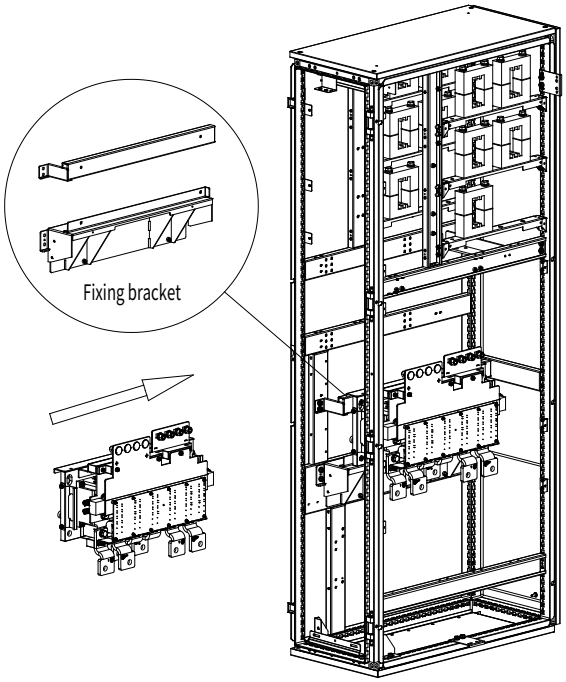
Figure 3-24 Unit entry to the cabinet



Recommended installation method of water-cooled rectifier units

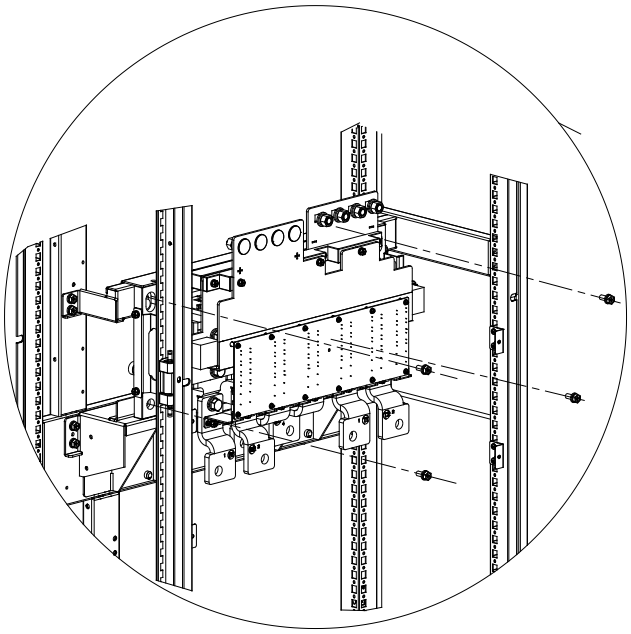
Step 1 Hang the water-cooled rectifier unit on the sheet metal fixed bracket and push it along the sheet metal to the right position (the unit mounting hole position), as shown in Figure 3-25.

Figure 3-25 Unit entry to the cabinet



Step 2 When the water-cooled unit mounting holes reach the fixed holes on the sheet metal, lock the four fixing screws (M8 × 30) on the water-cooling plate of the water-cooled rectifier unit to fix the unit in the cabinet, as shown in Figure 3-26.

Figure 3-26 Unit entry to the cabinet



Note: When installing or replacing the unit, wear gloves and safety shoes to prevent against scratching or smashing.

3.3.6 Control unit size and installation description

3.3.6.1 Preparing

Before installation, the following preparations shall be done.

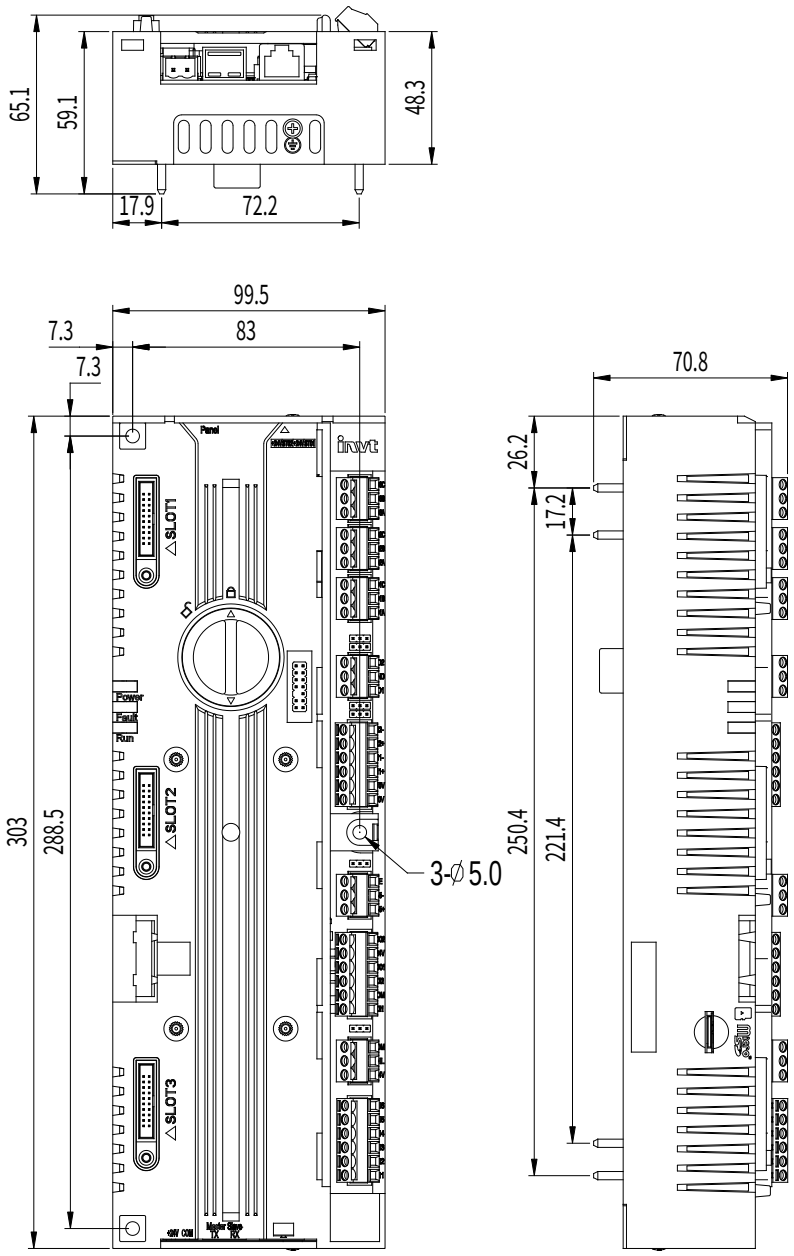
- Before installation, ensure the cabinet has been powered off (including external power) for at least 25 minutes.
- Prevent the control unit from falling or shock to avoid damage.
- Do not disassemble the control unit, as this may cause damage to the unit.
- Do not fasten with excessive torque; otherwise, terminals may be damaged.
- 1# Phillips screwdriver may be required during installation.

The screws used for the control unit installation require the following tightening torque.

Screw	Fastening torque
M4	1.5N・m

3.3.6.2 Control unit size

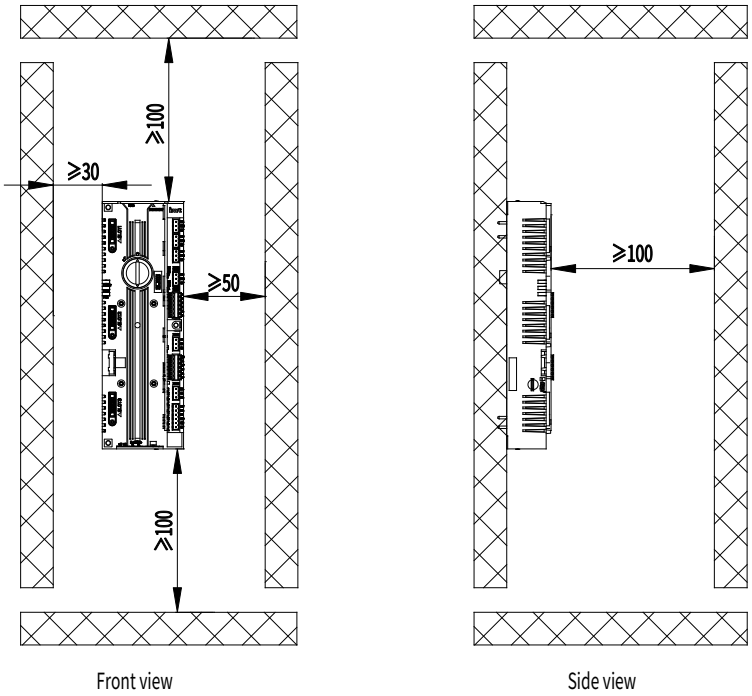
Figure 3-27 Control unit dimensions (unit: mm)



3.3.6.3 Control unit installation space

To make the control unit installation smooth, the distance between the upper and lower parts of the control unit and the building and its components should be left as shown in the following figure, and the control unit must be installed on a conductive metal plate, the entire conductive bottom of the control unit must properly work with the installation surface.

Figure 3-28 Requirements on control unit installation space (unit: mm)

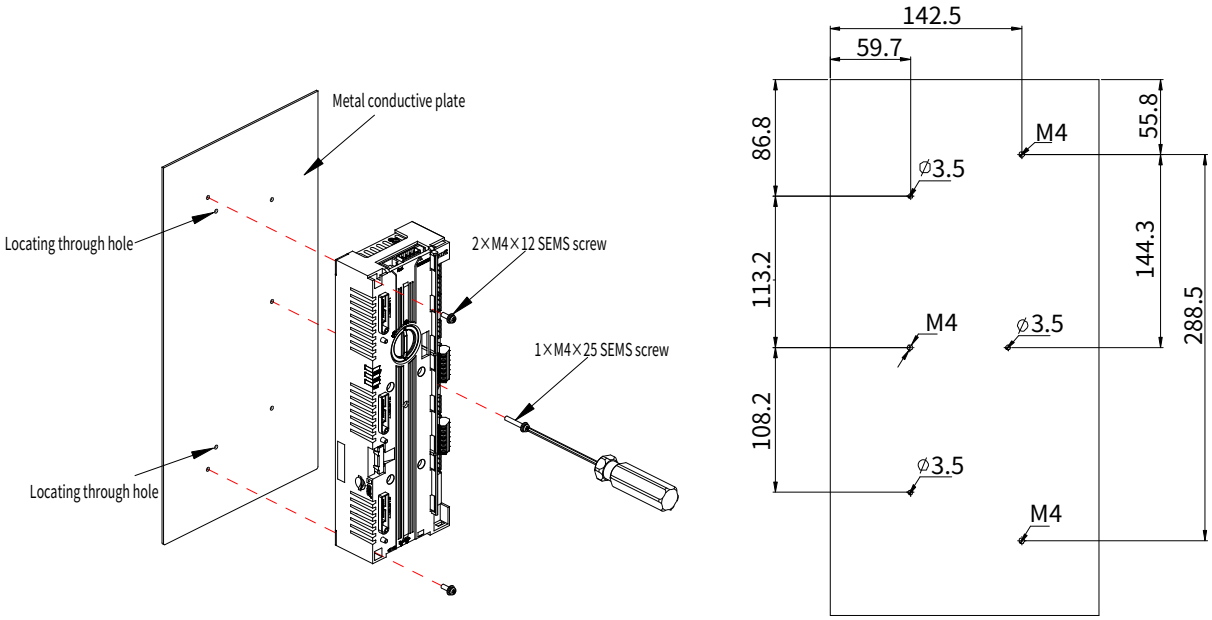


3.3.6.4 Control unit installation procedure

Step 1 Place the control unit as shown in the figure.

Step 2 Use 1# Phillips screwdriver to tighten the four M4 screws to fix the control unit to the metal plate as shown in Figure 3-29.

Figure 3-29 Control unit installation diagram



Note:

- The control unit assembly plate must be an exposed metal plate and ensure that the metal plate can be reliably grounded.
- The control unit housing will be connected to the cabinet housing via a grounding plate.

3.3.7 Keypad installation

The GD880-51 inverter unit is equipped with an externally mounted keypad (as shown in Figure 3-30), which is used with a keypad bracket that can be fixed to the cabinet door or external support sheet metal, and the keypad bracket mounting structure is shown in Figure 3-31.

Figure 3-30 LCD keypad structure (unit: mm)

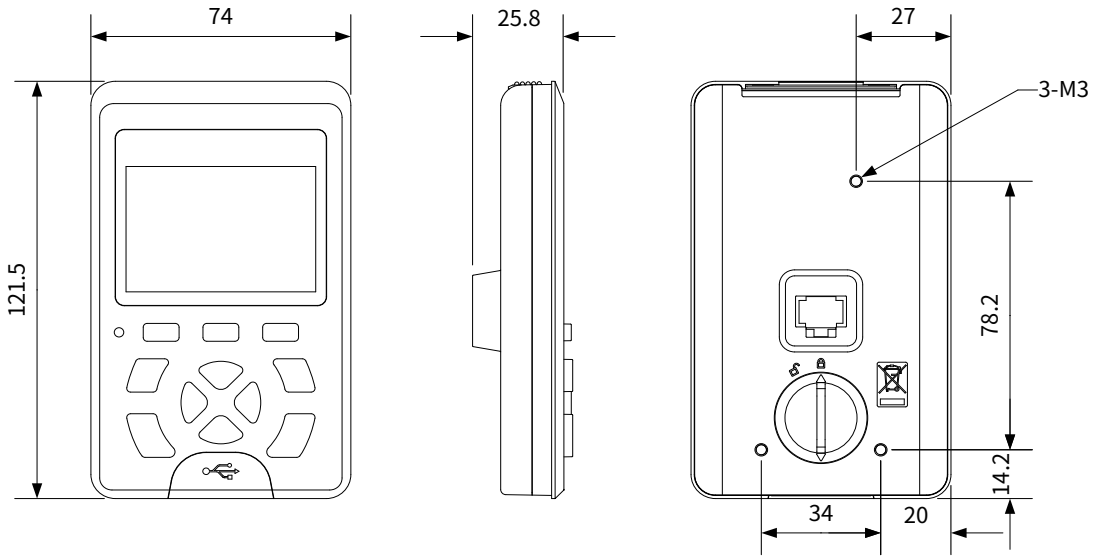


Figure 3-31 Mounting the keypad bracket

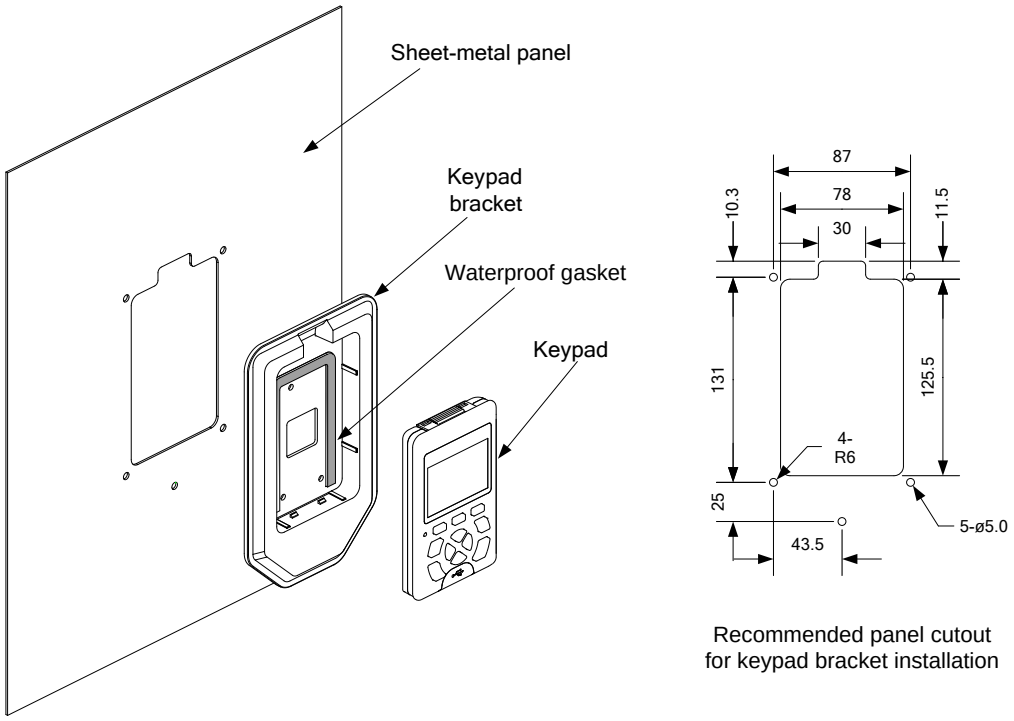
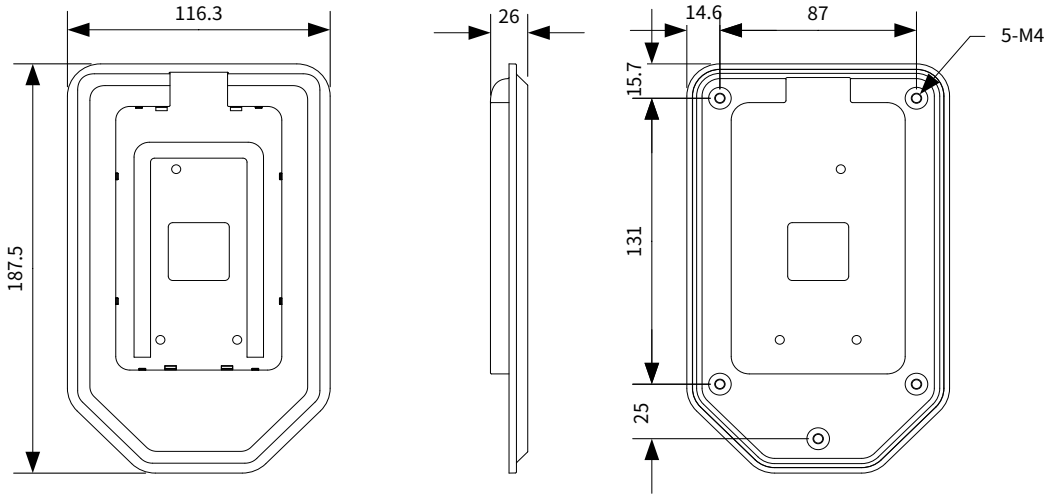


Figure 3-32 Keypad bracket dimensions (unit: mm)



3.3.8 Fastening torque

You need the following tools to install the power unit:

- Standard toolbox, including screwdrivers, nut wrenches, socket wrenches
- Torque wrench, 1.5N・m to 100N・m
- Socket wrench extension bars, 400mm long

The power unit installation involves conductive components (AC input connectors, DC bus connectors, and cable terminals) and other component connections (grounding terminals, protective ground terminals, and fixing screws), and the screw tightening torques must meet the requirements in the following table.

Table 3-2 Recommended values of screw thread tightening torque

Screw/Bolt	Strength grade	Recommended torque (N・m)
M4	4.8	1.5
M5	5.8	3
M6	5.8	5
M8	5.8	11
M10	4.8	22
M12	4.8	39

3.3.9 Checklist

No.	Operation	Compliant	Completed
1	Installed the beam for power unit fixing in the nine-fold profile cabinet.	☐	☐
2	Installed the bottom tray for power unit fixing in the nine-fold profile cabinet.	☐	☐
3	Installed the copper bars of the cabinet.	☐	☐
4	Assembled the installation guide rail (optional part) and installed it in the cabinet.	☐	☐
5	In the cooperation of two people, pushed the power unit to the cabinet. (The auxiliary rope for mounting has been used to prevent the unit from side tipping during the push-in or push-out.)	☐	☐

No.	Operation	Compliant	Completed
6	Removed the auxiliary rope for mounting, and ensured that the unit was pushed into place.	☐	☐
7	Inserted screws into the fixing holes at the unit front top and bottom to fix the unit to the cabinet.	☐	☐
8	Checked the screw tightening state.	☐	☐

4 Control unit

4.1 Control unit composition

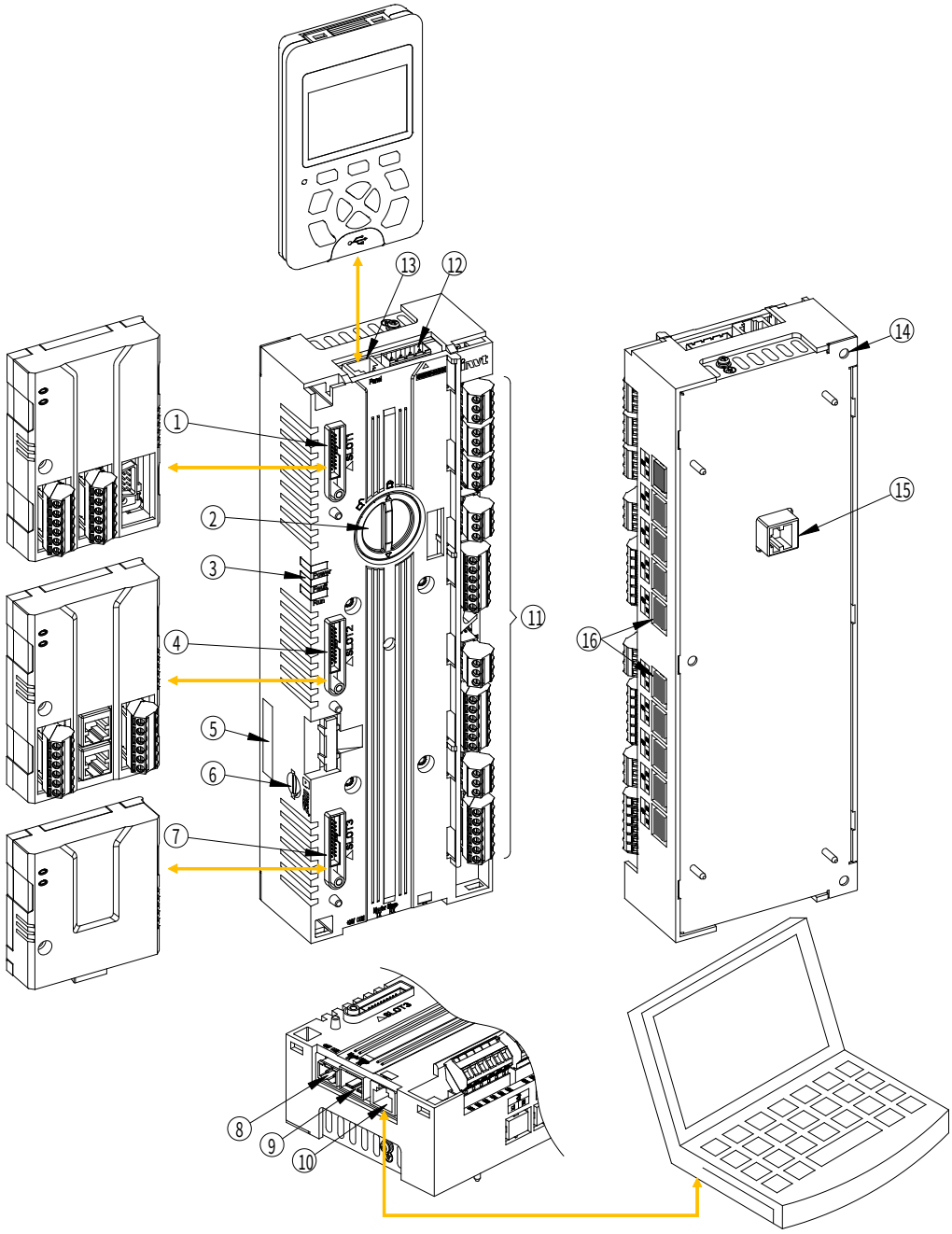


Table 4-1 Function description

No.	Component	Function description
1	Slot 1	Applied to 73.5 × 103 × 23.5 (mm) function expansion modules and communication expansion cards
2	Battery cover plate	Button battery replacement cover. The internal button battery is a non rechargeable lithium battery that needs to be replaced regularly.
3	Indicators	Power supply, fault, running indicator

No.	Component	Function description
4	Slot 2	Applied to 73.5 × 103 × 23.5 (mm) function expansion modules, communication expansion cards, and optical fiber expansion cards
5	Nameplate	Nameplate information
6	SD card	Standard microSD memory card, flexible to plug and unplug, capacity: 32GB
7	Slot 3	Applied to 73.5 × 74 × 23.5 (mm) function expansion modules, communication expansion cards, and optical fiber expansion cards
8	Power interface	24V power input
9	Optical fiber interface	Master/slave optical fiber interface
10	RJ45 terminal	Upper computer interface, connecting to a PC for status monitoring
11	User terminal	Standard input and output terminals for users
12	STO terminal	Safe Torque Off input
13	RJ45 terminal	HMI, connecting to the SOP-880 keypad
14	Fixing hole	ICU fixing holes (three holes)
15	RJ45 terminal	Communication interface with power units (A1i–A4i, A6i, and A7i inverter units)
16	Optical fiber interface	Optical fiber communication interface with power units (A8 inverter unit)

4.2 Status indication

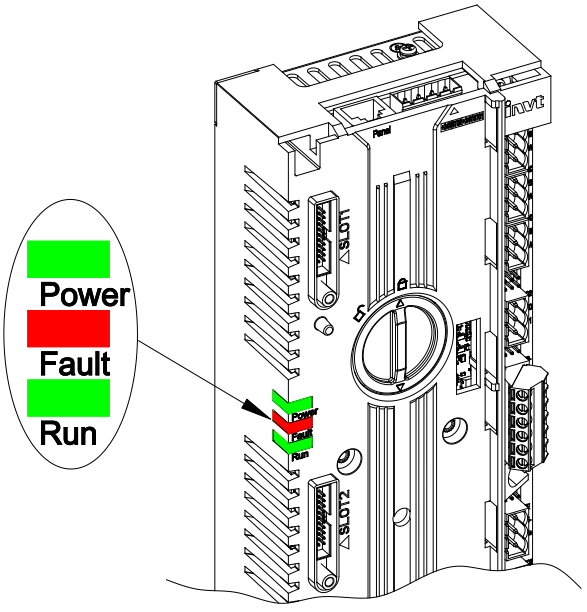
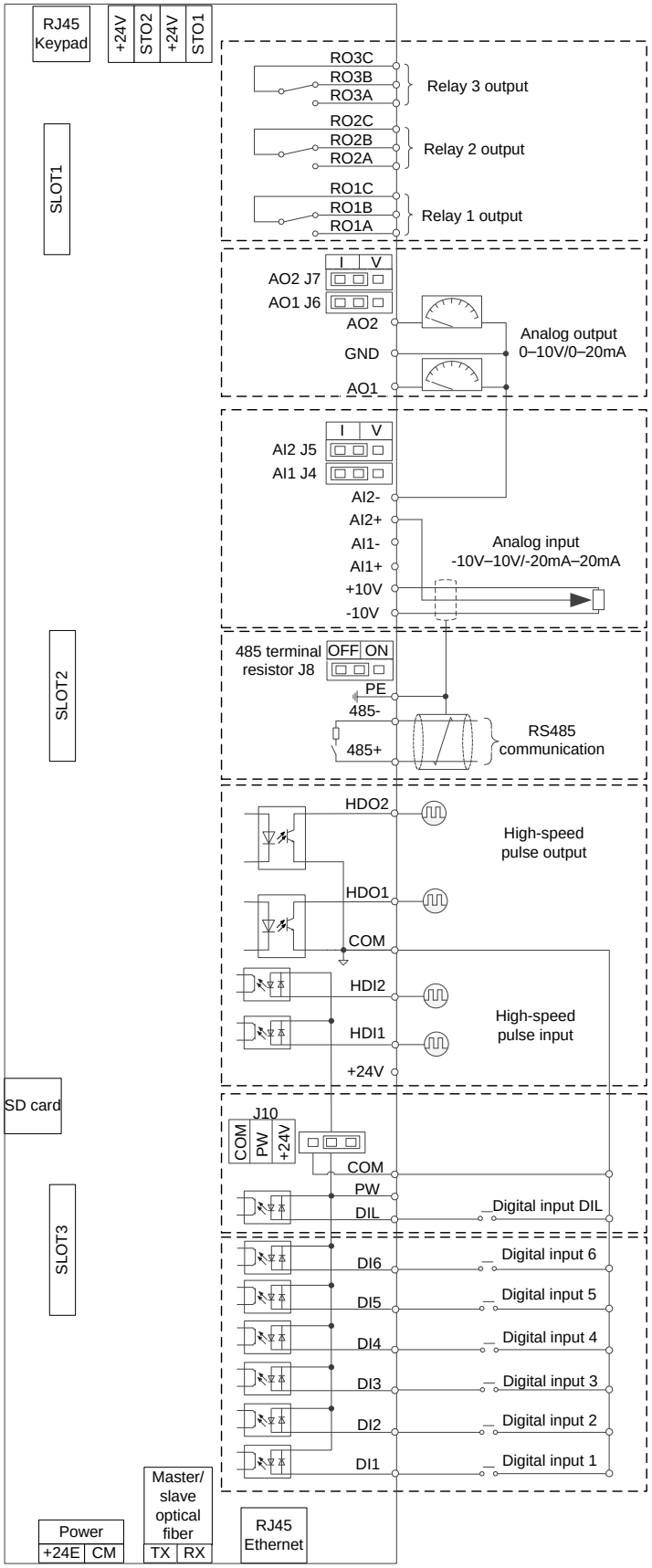


Table 4-2 Indicator description

No.	Name	Status	Description
1	POWER	Steady on	The control unit is properly powered.
		Steady off	The control unit is not powered or power failure occurs.
2	Fault	Steady on	The system is faulty.
		Steady off	The system is normal.
3	RUN	Steady on	The inverter unit is in the running state.
		Steady off	The inverter unit is in the stopped state.

4.3 Control unit interface description

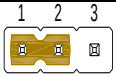
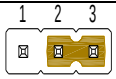
Figure 4-1 Control unit circuit wiring

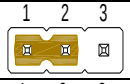


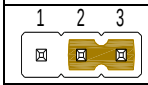
4.4 External interface

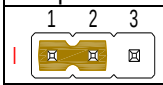
Terminal symbol	Terminal name	Description
Input power	+24E, CM	Power supply for the control unit
Digital input	DI1–DI6, DIL	Input type: relay contact, NPN or PNP
Digital power output	+24V, COM	Digital power, isolated from power input 24V
High-speed digital input	HDI1, HDI2	Input type: NPN or PNP
High-speed digital output	HDO1, HDO2	Output type: Open collector
Analog input	AI1, AI2	Input type: current or voltage, selected through the jumper
Analog output	AO1, AO2	Output type: current or voltage, selected through the jumper
Relay output	RO1, RO2, RO3	Contacts: NO, NC, common point
RS485 communication	485+, 485-	RS485 communication. The terminal resistor is selected through the jumper.
RJ45 terminal	RJ45 keypad	Communication interface with keypad
RJ45 terminal	RJ45 Ethernet	Ethernet communication with a PC

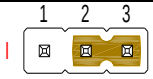
4.5 Detailed introduction to external interfaces

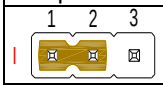
Terminal	Symbol	Function description	Cable specifications
Input power			
1	+24E	24Vdc±10% 2A	The two-core twisted-pair cable is recommended. Cross-sectional area: 0.5–2.5mm²
2	CM		
DI input terminal			
1	DI1	Input impedance: 3.3kΩ Voltage input range: 12–30V Supports NPN and PNP bi-direction input, relay contact input Max. input frequency: 1kHz	Single-core wire Cross-sectional area: 0.5–2.5mm²
2	DI2		
3	DI3		
4	DI4		
5	DI5		
6	DI6		
DIL input terminal			
1	DIL	Digital interlock. When its input is high, all other input terminals are forced to be invalid.	The two-core twisted-pair cable is recommended. Cross-sectional area: 0.5–2.5mm²
2	PW	Provides power supply for DIL, DI1–DI6, HDI, and HDO.	
3	COM	Digital common ground	
Jumper J10: power supply selection			
 1 is short connected to 2, PW is short connected to internal COM, and DI uses the internal power ground. If external power is required, you need to remove the shorting cap.			
 2 is short connected to 3, PW is short connected to internal +24V, and DI uses the internal			

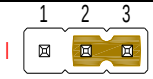
<table>
<tr><th>Terminal</th><th>Symbol</th><th>Function description</th><th>Cable specifications</th></tr>
<tr><td colspan="4">power. If external power is required, you need to remove the shorting cap.</td></tr>
<tr><td colspan="4">HDIO terminal</td></tr>
<tr><td>1</td><td>+24V</td><td rowspan="3">1. Input type: PNP, NPN
2. Input frequency range: 0–50kHz
3. Input voltage range: 12–30V
4. Duty ratio: 30%–70%</td><td rowspan="4">The two-core twisted-pair cable is recommended.
Cross-sectional area: 0.5–2.5mm²
HDI and COM, HDO and COM use twisted-pair cables.
Note: An external pull-up resistor must be added to the HDO output.</td></tr>
<tr><td>2</td><td>HDI1</td></tr>
<tr><td>3</td><td>HDI2</td></tr>
<tr><td>4</td><td>COM</td><td rowspan="3">1. Output type: OC
2. Output frequency range: 0–50kHz
3. Max. output load: 20mA/30V
4. Duty ratio: 50%</td></tr>
<tr><td>5</td><td>HDO1</td></tr>
<tr><td>6</td><td>HDO2</td></tr>
<tr><td colspan="4">RS485 communication terminals</td></tr>
<tr><td>1</td><td>485+</td><td rowspan="3">RS485 bus, standard 5V electrical level
Terminal resistor: 120Ω
Max. baud rate: 115200
Max. number of nodes: 32 (without relay)</td><td rowspan="3">The two-core twisted-pair cable is recommended.
Cross-sectional area: 0.5–2.5mm²</td></tr>
<tr><td>2</td><td>485-</td></tr>
<tr><td>3</td><td>PE</td></tr>
<tr><td colspan="4">Jumper J8: terminal resistor selection</td></tr>
<tr><td colspan="4"> 

When 1 and 2 are short-circuited, the terminal resistor is disconnected.</td></tr>
<tr><td colspan="4"> 

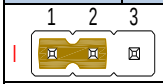
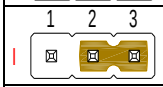
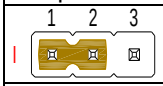
When 2 and 3 are short-circuited, the terminal resistor is connected.</td></tr>
<tr><td colspan="4">Analog input terminal</td></tr>
<tr><td>1</td><td>+10V</td><td rowspan="2">Positive and negative 10V power supply
Max. output current: 10mA</td><td rowspan="6">Cross-sectional area: 0.5–2.5mm²
When two AIs are used, use two two-core shielded twisted-pair cables.
When reference voltage is used, use one four-core shielded twisted-pair cable for one AI.</td></tr>
<tr><td>2</td><td>-10V</td></tr>
<tr><td>3</td><td>AI1+</td><td rowspan="4">Current input: -20mA–20mA, Rin: 500Ω
Voltage input: -10V–10V, Rin: 30kΩ
Differential input range: ±30V
Sampling interval: 0.1ms
Resolution: 11 bits + sign bit</td></tr>
<tr><td>4</td><td>AI1-</td></tr>
<tr><td>5</td><td>AI2+</td></tr>
<tr><td>6</td><td>AI2-</td></tr>
<tr><td colspan="4">Jumper J4: Selection between AI1 voltage and current signal inputs</td></tr>
<tr><td colspan="4"> 

When 1 and 2 are short-circuited, AI1 current input is used.</td></tr>
<tr><td colspan="4"> 

When 2 and 3 are short-circuited, AI1 voltage input is used.</td></tr>
<tr><td colspan="4">Jumper J5: Selection between AI2 voltage and current signal inputs</td></tr>
<tr><td colspan="4"> 

When 1 and 2 are short-circuited, AI2 current input is used.</td></tr>
<tr><td colspan="4"> 

When 2 and 3 are short-circuited, AI2 voltage input is used.</td></tr>
<tr><td colspan="4">Analog output terminal</td></tr>
<tr><td rowspan="3">Analog output</td><td>AO1</td><td rowspan="3">AO output range:
0–20mA, Rload≤500Ω
0–10V, Rload≥10kΩ
Resolution: 11 bits + sign bit
Accuracy: 2% of full scale range</td><td rowspan="3">The two-core twisted-pair cable is recommended.
Cross-sectional area: 0.5–2.5mm²
AO1 and GND, AO2 and GND use twisted-pair cables.</td></tr>
<tr><td>GND</td></tr>
<tr><td>AO2</td></tr>
<tr><td colspan="4">Jumper J6: Selection between AO1 voltage and current signal outputs</td></tr>
</table>

Terminal	Symbol	Function description	Cable specifications
		When 1 and 2 are short-circuited, AO1 current output is used.	
		When 2 and 3 are short-circuited, AO1 voltage output is used.	
Jumper J7: Selection between AO2 voltage and current signal inputs			
		When 1 and 2 are short-circuited, AO2 current output is used.	
		When 2 and 3 are short-circuited, AO2 voltage output is used.	
Relay 1 output terminal			
1	RO1A	Output type: passive NO and NC contacts Contact parameters: 250Vac/30Vdc, 3A	Single-core wire Cross-sectional area: 0.5–2.5mm²
2	RO1B		
3	RO1C		
Relay 2 output terminal			
1	RO2A	Output type: passive NO and NC contacts Contact parameters: 250Vac/30Vdc, 3A	Single-core wire Cross-sectional area: 0.5–2.5mm²
2	RO2B		
3	RO2C		
Relay 3 output terminal			
1	RO3A	Output type: passive NO and NC contacts Contact parameters: 250Vac/30Vdc, 3A	Single-core wire Cross-sectional area: 0.5–2.5mm²
2	RO3B		
3	RO3C		
Master/slave optical fiber			
1	TX	Transmitting optical fiber communication	Dedicated optical fiber cable
2	RX	Receiving optical fiber communication	
Safe torque off terminal			
1	STO1	Inverter module STO input They has been short connected before delivery by default.	Four-core shielded twisted-pair cable Cross-sectional area: 0.5–2.5mm²
2	+24V		
3	STO2		
4	+24V		
RJ45 keypad			
1	RJ45	Connect the SOP-880-01 keypad	Standard shielded network cable
RJ45 Ethernet			
1	RJ45	Ethernet communication with a PC	Standard shielded network cable

4.6 Control unit function application

4.6.1 Expansion modules

The control unit can be used with expansion modules to achieve corresponding functions. The details are as follows.

No.	Name	Model	Function description	Connection method	Dimensions (W×H×D) (unit: mm)
1	Encoder detection module	EC-PG805-05	TTL incremental encoder signal detection	SLOT	73.5×103×23.5
		EC-PG805-24	HTL incremental encoder signal detection	SLOT	73.5×103×23.5
		EC-PG804	Resolver encoders signal	SLOT	73.5×103×23.5

No.	Name	Model	Function description	Connection method	Dimensions (W×H×D) (unit: mm)
			detection		
2	Input/output module	EC-IO801	Two AIs Two AOs Three DIs One relay output	SLOT	73.5×103×23.5
3	PROFINET IO module	EC-TX809	PROFINET IO industrial Ethernet	SLOT	73.5×74×23.5
4	Industrial Ethernet communication module	EC-TX809-U5	Support for PROFINET I/O, EtherCAT, EtherNet IP, Modbus TCP, and PowerLink communication protocols	SLOT	73.5×74×23.5
5	PROFIBUSDP module	EC-TX803	PROFIBUS-DP bus adapter	SLOT	73.5×74×23.5
6	CAN bus module	EC-TX805	CANopen bus adapter	SLOT	73.5×74×23.5
7	Optical fiber expansion module	EC-TX821	One 50m expansion optical fiber port	SLOT	73.5×74×23.5
		EC-TX823	Three 50m expansion optical fiber ports	SLOT	73.5×74×23.5
8	SLOT expansion module	I-ESM-30	SLOT expansion module	Optical fiber	99.5×303×65
9	Voltage detection module	IVDM-10	AC voltage detection module	Optical fiber	37.4×180×113
		IVDM-20	DC voltage detection module	Optical fiber	37.4×180×113
		IVDM-13-4	3-channel line voltage detection module (380V)	Optical fiber	254×154×41
		IVDM-13-6	3-channel line voltage detection module (660V)	Optical fiber	254×154×41
10	Current detection module	ICDM-10	3PH current detection module	Optical fiber	37.4×180×113
11	Intelligent operation keypad	SOP-880-01	Human-machine interface keypad	RS422	74×121.5×26

Note: EC-TX823 and EC-TX821 are only supported in SLOT1 or SLOT3. EC-PG805 is recommended for installation in SLOT1. EC-TX803 is recommended for installation in SLOT3.

4.6.2 SLOT expansion application

The control unit can cooperate with different expansion modules, which are directly installed in the SLOT of the control unit, as shown in the following figure.

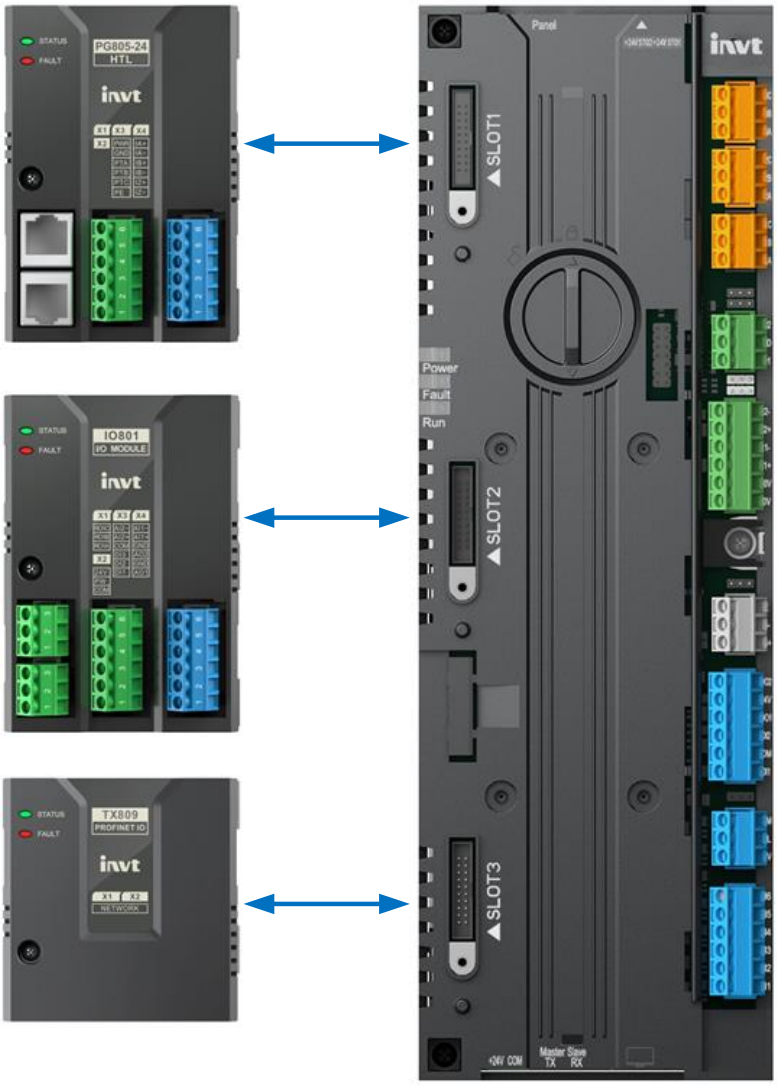


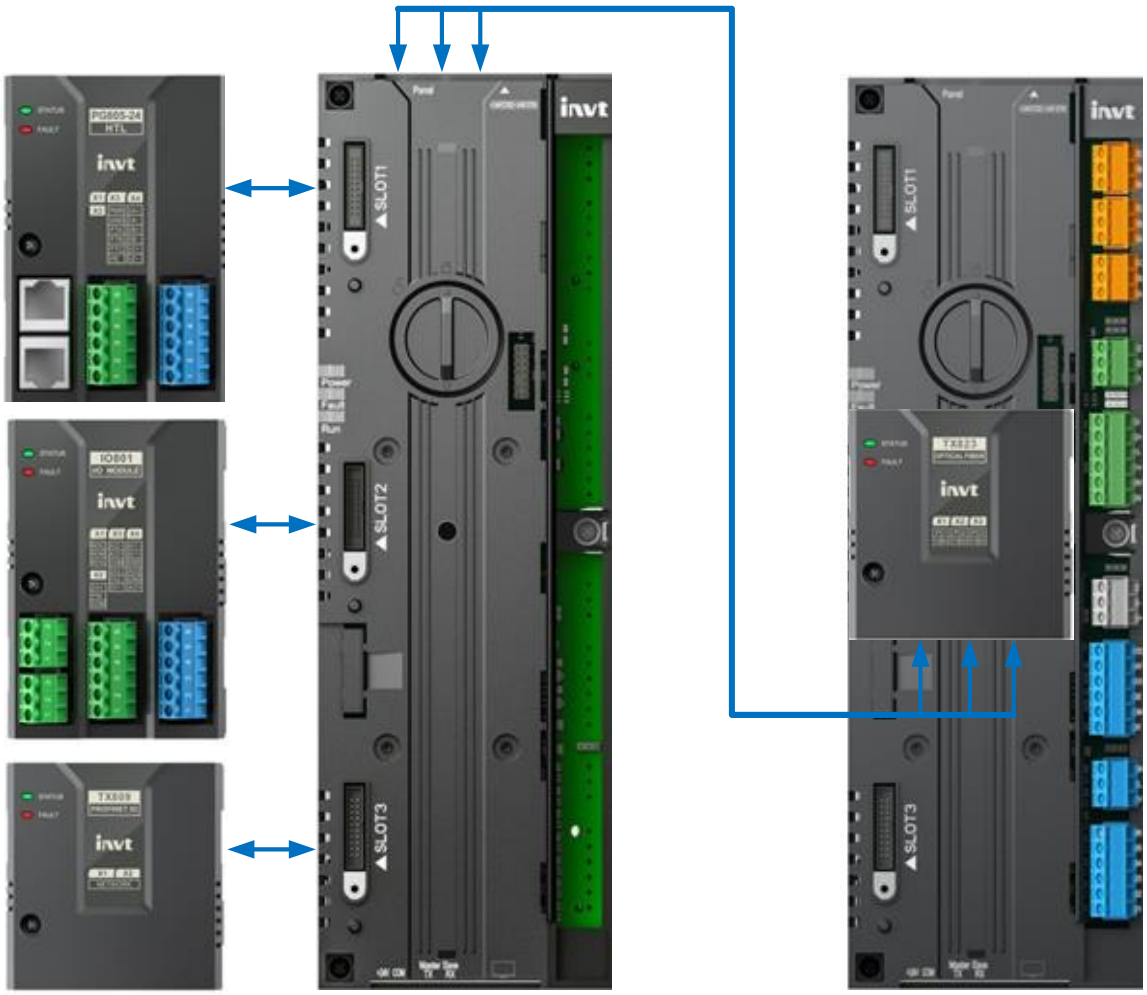
Table 4-3 Expansion card installation description

Expansion card	SLOT1	SLOT2	SLOT3	Expansion card type
EC-TX803	✓	-	✓	PROFIBUS-DP
EC-TX805	✓	✓	✓	CANopen
EC-TX809	✓	-	✓	PROFINET IO
EC-TX809-U5	✓	-	✓	PROFINET I/O, EtherCAT, EtherNet IP, Modbus TCP, PowerLink
EC-TX821	✓	-	✓	Expansion module with one optical fiber port
EC-TX823	✓	-	✓	Expansion module with three optical fiber ports
EC-PG805-05	✓	✓	-	TTL PG card
EC-PG805-24	✓	✓	-	HTL PG card
EC-PG804	✓	✓	-	Resolver PG card
EC-IO801	✓	✓	-	IO expansion card

Note: When SLOT2 is unpopulated, EC-TX803 and EC-TX809 are installable in SLOT1; EC-TX821 and

EC-TX823 are supported only in SLOT1 or SLOT3.

The control unit has three SLOT card slots. When more modules are needed, install the optical-fiber expansion module EC-TX823 and SLOT expansion module I-ESM-30. Each SLOT expansion module can expand three functional modules, as shown in the following figure.



Note:

- SLOT1, SLOT2, and SLOT3 can hold function modules, with addresses for expansion card slots 1, 2, and 3, respectively.
- SLOT2 and SLOT3 can be expanded by using the optical-fiber expansion module EC-TX823 together with the slot expansion module I-ESM-30, enabling up to six expansion modules in total. The addresses are SLOT2-1, SLOT2-2, SLOT2-3 and SLOT3-1, SLOT3-2, SLOT3-3.
- SLOT1 has no expansion function, which means it does not support the EC-TX823 module.
- The SLOT expansion module I-ESM-30 does not support the installation of the optical-fiber expansion module EC-TX823.

5 Electrical installation

5.1 Safety notes

- All safety precautions in this manual must be read and followed. Only trained and qualified professionals are allowed to carry out the operations mentioned in this chapter.
- All work on electrical equipment must comply with the following:
  - ✓ Ensure that the power is off.
  - ✓ Re-power on must not occur.
  - ✓ Wait for at least the time designated on the machine.
  - ✓ Ensure the voltage between (+) and (-) is lower than 36V through measurement.
  - ✓ The equipment is well grounded.
  - ✓ Live parts have been shielded or isolated.
- All installation work can be performed only in power-off (no voltage) state since high voltage is present in the power unit internal during the running.
- Do not perform wiring, inspection or component replacement when power supply is applied. Before wiring or inspection, ensure all the input power supplies have been disconnected, and wait for at least 15 minutes or until the DC bus voltage is lower than 36V.
- If the auxiliary control power of the power unit is supplied externally, the disconnecting the circuit break device cannot disconnect the entire power supply. The power unit control system may be live even if not started. Please refer to the electrical schematic diagram for inspection to avoid personal injury caused by contacting the live part of the power unit.
- If the safety device on a current branch trips, check the power unit for the fault cause, rectify the fault, and replace the damaged parts.

5.2 Insulation inspection

Power unit

Before delivery, each power unit has been tested for insulation of the main circuit to the housing. Moreover, there is voltage limiting circuit inside the unit, and the circuit will automatically cut off the test voltage of the withstand voltage test. Do not carry out insulation withstand test on the unit, or measure the control circuit of the unit with a megohmmeter.

Input power cable

Check the insulation conditions of the input power cable of the power unit according to the local regulations before connecting it.

Motor and motor cable

Check the motor and motor cable insulation status as follows:

Step 1 Ensure that the motor cable has been connected to the motor.

Step 2 Remove the motor cable from the U, V, and W output terminals of the power unit.

Step 3 Measure the insulation resistance between the motor cable and each phase of the motor and the protective ground with a 1kVDC megohmmeter. Insulation resistance must be greater than 1MΩ.

5.3 EMC regulations

General knowledge of electromagnetic compatibility

EMC is short for electromagnetic compatibility, which refers to the ability of a device or system to function properly in its electromagnetic environment and not constitute an unbearable electromagnetic disturbance to anything in that environment. EMC includes two aspects: electromagnetic interference and electromagnetic immunity.

Electromagnetic interference can be divided into two categories according to the transmission paths: conducted interference and radiation interference.

Conducted interference propagates along any conductor. Therefore, any conductor, such as wire, transmission line, inductor, and capacitor, is a transmission channel for conducted interference.

Radiated interference is in the form of electromagnetic waves that propagate with energy that is inversely proportional to the square of the distance.

Electromagnetic interference must have three conditions or three elements at the same time: interference source, transmission channel, and sensitive receiver, each of which is indispensable. The solution of EMC problem mainly focuses the three elements. For users, the solution of EMC problem is mainly in transmission channels because the equipment as interference source or receiver cannot be changed.

Different electric and electronic devices have different EMC capacities because of adopting different EMC standards or classes.

General EMC guidelines on variable-frequency regulation system wiring

The following introduces general EMC guidelines on variable-frequency regulation system wiring in several aspects including noise control, site wiring and grounding for reference in site installation, with consideration of ECM characteristics of VFDs where the input current and output voltage harmonics are relatively small but the voltage is high and the current is large.

- Noise control

All the connections to the system control terminals must use shielded wires. The shield layer of wire must be grounded near the system entrance. The ground mode is 360° loop connection formed by cable clips. Do not twist a shield layer in the braid shape before grounding it. Otherwise, the shield effect may be significantly reduced and even lost.

- Site wiring

Power supply wiring: The shield layer of power supply incoming cables of the system shall be grounded reliably. It is not allowed to route the power cables and control cables in parallel.

Device categorization: There are different electric devices in the same distribution system, which have different ability of emitting and withstanding electromagnetic noise. Therefore, it needs to categorize these devices into strong noise device and noise sensitive device. The same kind of devices needs to be placed in the same area, and the distance between devices in different categories needs to be more than 20cm.

Wiring in the control cabinet: During wiring, signal cables and power cables need to be arranged in different areas. It is not allowed to arrange them in parallel or in interlaced state at a close distance (less than 20cm) or tie them together. If the signal cables have to cross the power cables, they need to be arranged in 90° angle.

- Grounding

The variable-frequency speed regulation system must be safely and reliably grounded during operation. Grounding has the priority in all EMC methods because it does not only ensure the safety of equipment and persons, but also it is the simplest, most effective and lowest-cost solution for EMC problems.

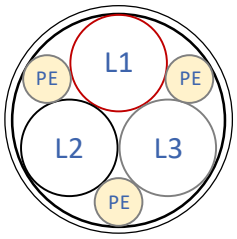
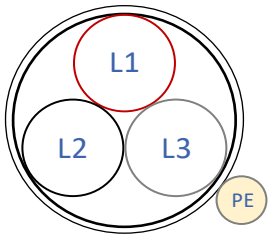
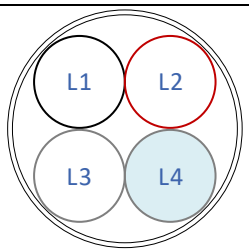
Three categories of grounding: special pole grounding, common pole grounding and series-wound

grounding. Different control system needs to use special pole grounding, different devices in the same control system needs to use common pole grounding, and different devices connected by the same power cables needs to use series-wound grounding.

5.3.1 Power cable

To meet the EMC requirements stipulated in the CE standards, it is recommended to use symmetrical shielded cables for motor connection.

Four-core cables can be used as input cables, but symmetrical shielded cables are recommended. Compared with four-core cables, symmetrical shielded cables can reduce electromagnetic radiation as well as the current and loss of the motor cables.

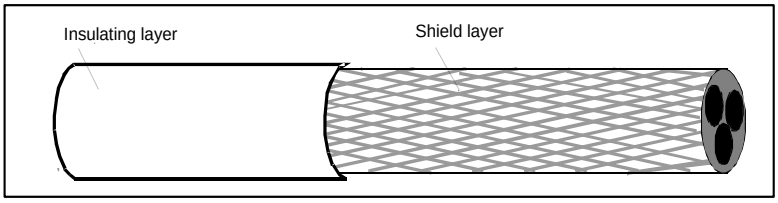
		
Symmetrical shielded cable, PEs in symmetrical manner	Symmetrical shielded cable, PE in separated manner	Asymmetrical four-core cable

Power cables must meet the following requirements:

- The sizes of the input power cables and motor cables must comply with local regulations.
- The input power cables and motor cables must be able to carry the corresponding load currents.
- The maximum temperature margin of the motor cables in continuous operation cannot be lower than 70°C.
- PE grounding conductor conductivity must be as good as possible to reduce the grounding resistance to achieve better impedance continuity. If the electrical conductivity of the motor cable shield layer does not meet the requirements, a separate PE conductor must be used.

To effectively restrict the emission and conduction of radio frequency (RF) interference, the conductivity of the shielded cable must be at least 1/10 of the conductivity of the phase conductor. This requirement can be well met by a copper or aluminum shield layer. The following figure shows the minimum requirement on motor cables. The cable must consist of a layer of spiral-shaped copper strips. The denser the shield layer is, the more effectively the electromagnetic interference is restricted.

Figure 5-1 Cable cross section



Note: Check the insulation conditions of the input power cable according to the local regulations before connecting it.

5.3.2 Control cable

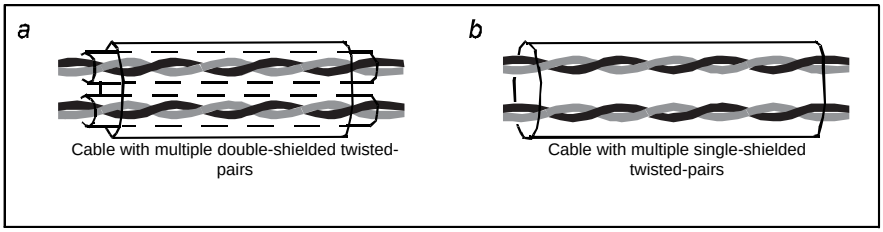
All analog signal cables, communication cables, and encoder cables must be shielded cables.

Analog signal cables need to be double-shielded twisted-pair cables (as shown in figure a). Use one separate shielded twisted pair for each signal. Do not use the same ground wire for different analog signals.

Communication cables and encoder cables need to be single-shielded twisted-pair cables (as shown in figure b). The shield layer of cable is connected to the system PE by means of a 360° connection or twisting into a single bundle, and the exposed shield layer is wrapped with insulating tape to prevent interference introduced by the shield layer in contact with other equipment and structural components.

The keypad needs to be connected by using a network cable. In complicated electromagnetic environments, a shielded network cable is recommended.

Figure 5-2 Control cable



Note: Analog signals and digital signals cannot share a same cable, and their cables must be routed separately.

5.3.3 Wiring suggestions

Motor cables and input cables in a drive system are interference cables, while communication cables, encoder cables, analog signals, and high-speed signal cables are sensitive cables. It is recommended that you arrange the motor cables, input power cables, and control cables separately in different trays, reducing electromagnetic interference caused by the du/dt of the inverter output to other cables. The general cable arrangement rules are shown in Figure 5-3. The recommended values for the spacing between sensitive and interference cables are shown in the following table.

Figure 5-3 General cable arrangement rules

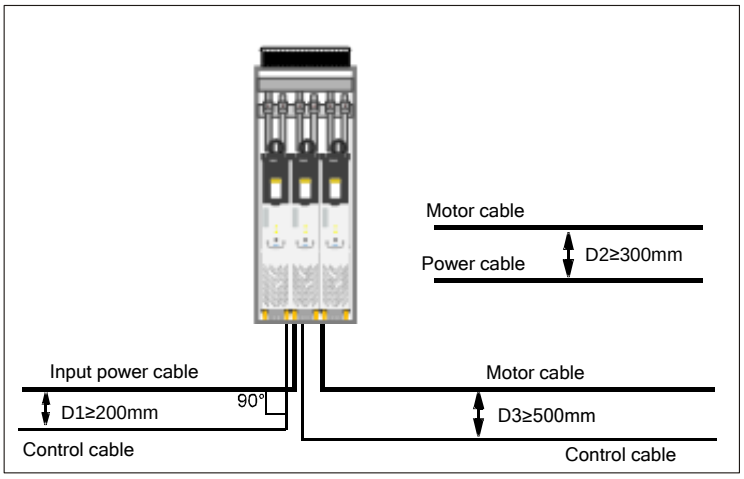


Table 5-1 Recommended values for the spacing between sensitive and interference cables

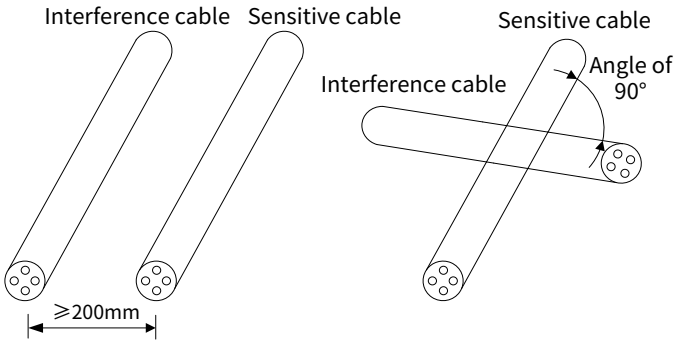
D1	D2	D3
⩾200mm	⩾300mm	⩾500mm

Note:

- The motor cables of different VFDs/inverters can be arranged in parallel, but motor cables must be arranged far away from sensitive cables.
- Analog signals and digital signals cannot share a same cable, and their cables must be routed separately.
- If a control cable and power cable must cross each other, ensure that the crossing angle between them is

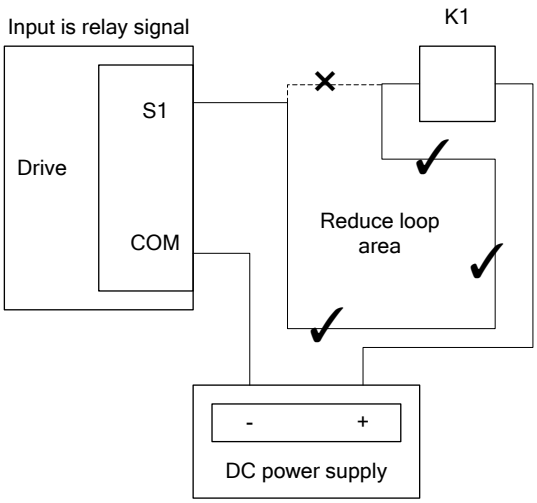
90°.

Table 5-4 Routing sensitive and interference cables



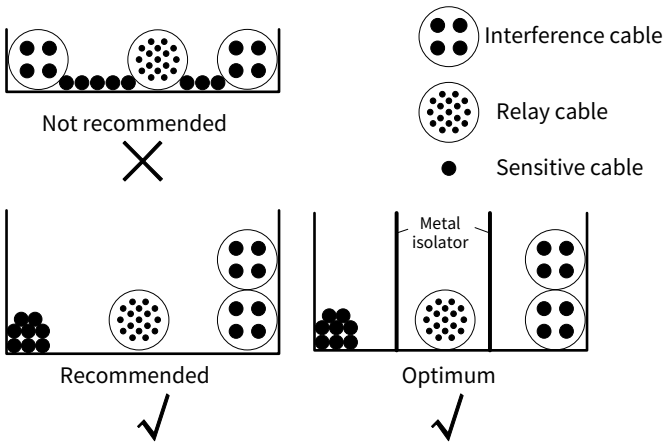
The cable trays must be connected properly and well grounded. Aluminum trays can implement local equipotential. For inputs of such as relay signals and other non-differential signals, non-twisted pair cables can be used, and the wiring should minimize the loop area and a pair of signal lines should be routed as close as possible.

Figure 5-5 Non-differential signal wiring loop



When laying multiple types of cables, the cables should always be routed along the alignment grooves or metal pipes in equipotential connection, with different types of cables separated as much as possible. You can better improve electromagnetic compatibility by using metal spacers to isolate different types of cables in the same metal groove or metal pipe.

Figure 5-6 Routing multiple types of cable

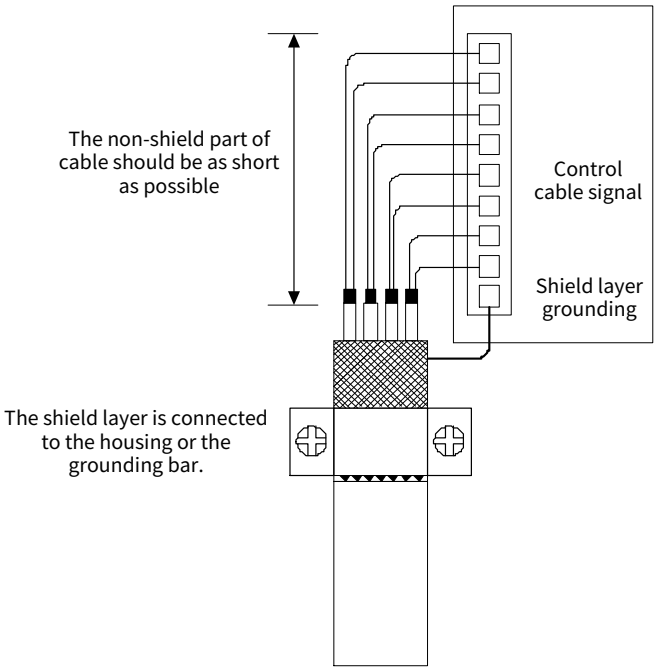


5.3.4 Shielded cable connection

The shield layer of signal cable is grounded at both ends, of which the grounding points must be the same. That is, if the shield layer at the upper computer side is connected to PE, the shield layer at the drive side is also connected to PE; if the shield layer at the upper computer side is connected to GND, the shield layer at the drive side is also connected to GND. It is recommended to connect the both ends of the shield layer to PE, which is the housing.

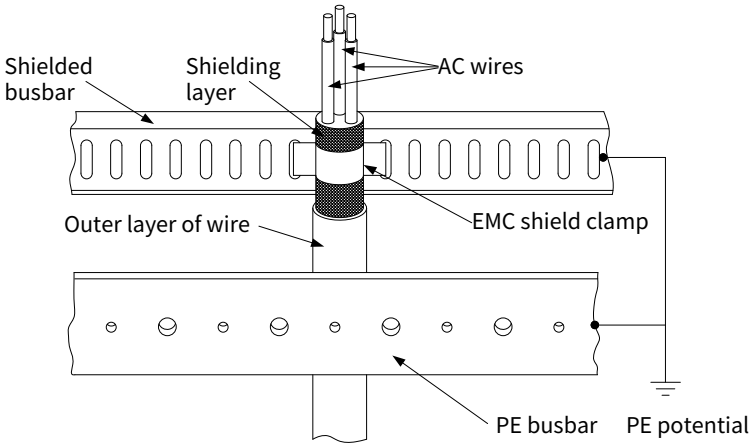
The unshielded part of the control cable that is shielded should be as short as possible, and the shield layer is connected to the nearest PE end. If the cable is stripped too long, the core is susceptible to interference of signals, especially analog, communication, and encoder signals.

Figure 5-7 Control cable shield connection



The shield layers of the input power and output motor cables should have large contact with the shield board inside the installation cabinet to achieve good EMC shield effect. The specific installation and fixing method can be referred to the following diagram.

Figure 5-8 Power cable shield connection



5.3.5 Cable specifications and recommendations

Table 5-2 Water-cooled inverter unit output cable recommendation

Model	Number of single-phase cables * Conductor size (mm^2) (Marine cable)	Connection terminal	Remarks
GD880-51-0410-6-LC	2*120	OT/120-12	
GD880-51-0530-6-LC	3*95	OT/95-12	Connect the recommended cable via an adapter copper bar.
GD880-51-0600-6-LC	3*95	OT/95-12	Connect the recommended cable via an adapter copper bar.
GD880-51-0650-6-LC	3*120	OT/120-12	Connect the recommended cable via an adapter copper bar.
GD880-51-0900-6-LC	4*120	OT/120-12	Connect the recommended cable via an adapter copper bar.

Table 5-3 Water-cooled rectifier unit input cable recommendation

Model	Number of single-phase cables * Conductor size (mm^2) (Marine cable)	Connection terminal	Remarks
GD880-61-2000-6-LC	9*120	OT/120-12	Connect the recommended cable via an adapter copper bar.

Table 5-4 Water-cooled VFD unit input and output cable recommendation

Model	Number of single-phase cables * Conductor size (mm^2) (Marine cable)	Connection terminal	Remarks
GD880-11-0340-6-LC	2*95	OT/95-12	
GD880-11-0410-6-LC	2*120	OT/120-12	
GD880-11-0530-6-LC	3*95	OT/95-12	Connect the recommended cable via an adapter copper bar.

Note: In the **Connection terminal** column, OT/185-12 indicates that the cable is connected to an OT-type terminal, the matching cable diameter is $185mm^2$, and the screw hole size is M12.

5.4 Electrical wiring

5.4.1 Main circuit wiring diagrams

Figure 5-9 A8LC inverter unit wiring

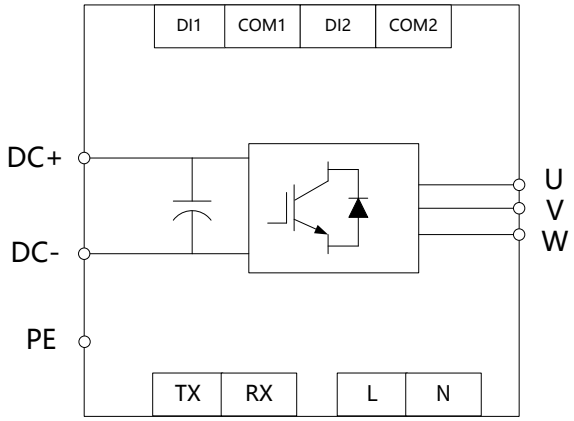


Figure 5-10 A8LC VFD unit wiring

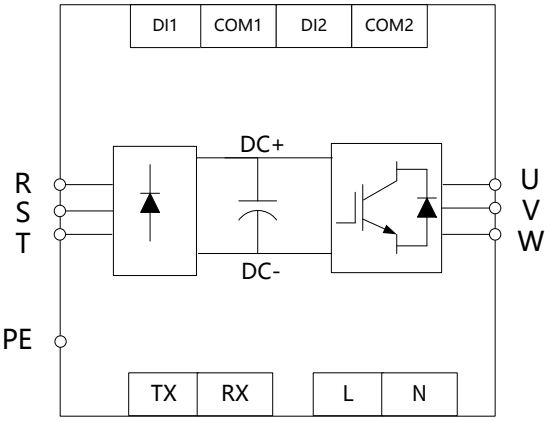
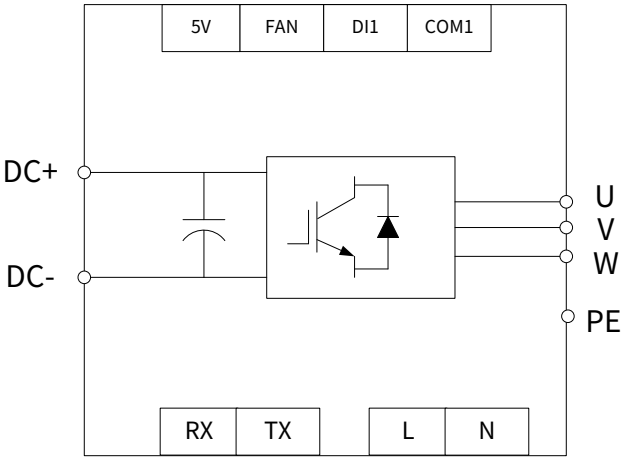
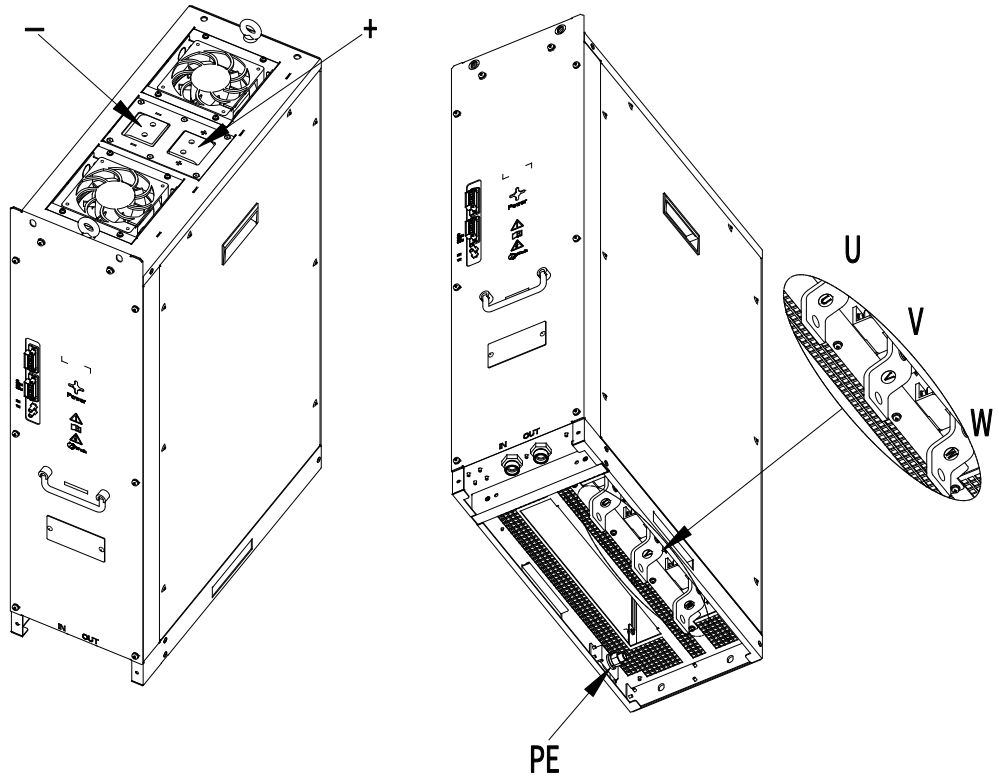


Figure 5-11 A9LC inverter unit wiring



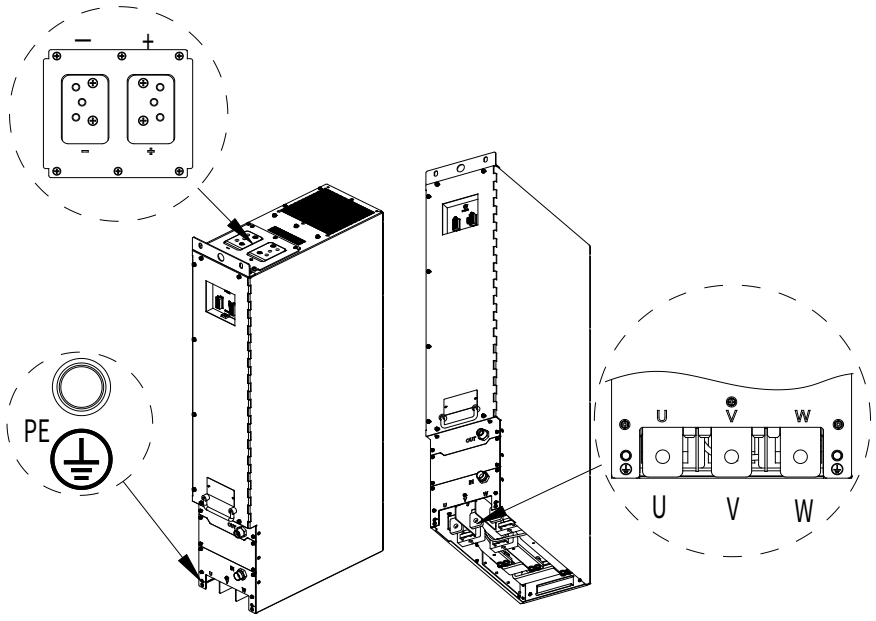
5.4.2 Main circuit wiring terminals

Figure 5-12 Water-cooled A8LC inverter unit terminal diagram



Name	Description
(+), (-)	DC bus voltage input terminals
U, V, W	3PH AC output terminals
PE	Grounding terminal

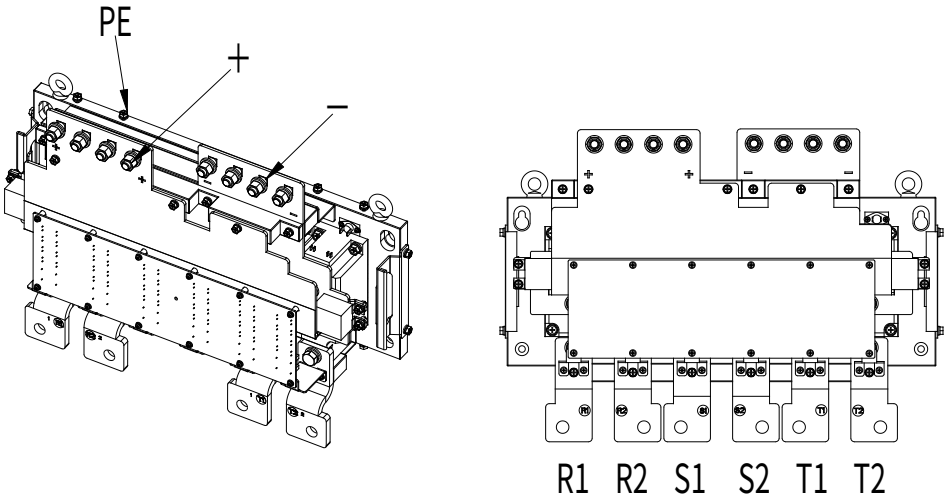
Figure 5-13 Water-cooled A9LC inverter unit terminal diagram



Name	Description
(+), (-)	DC bus voltage input terminals

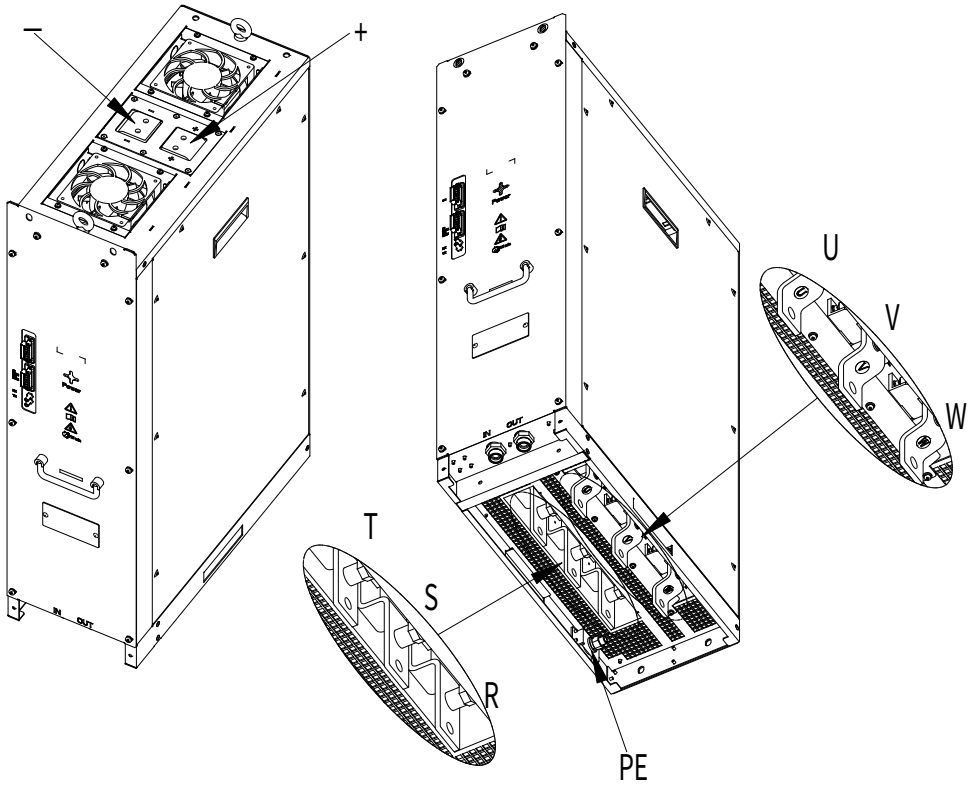
Name	Description
U, V, W	3PH AC output terminals
PE	Grounding terminal

Figure 5-14 Water-cooled rectifier unit terminal diagram



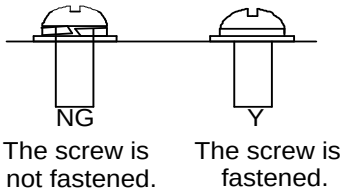
Name	Description
(+), (-)	DC bus voltage input terminals
R1, R2, S1, S2, T1, T2	3PH AC input terminals
PE	Grounding terminal

Figure 5-15 Water-cooled VFD unit terminal diagram



5.4.3 Screw tightening

Figure 5-16 Screw installation requirements

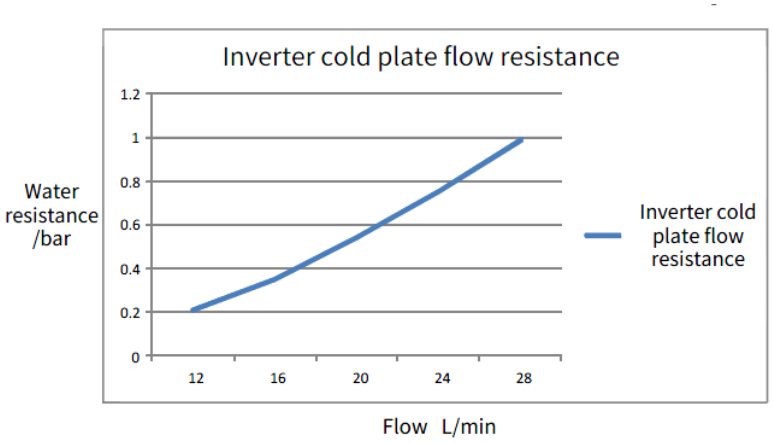


5.4.4 Electrical installation checklist

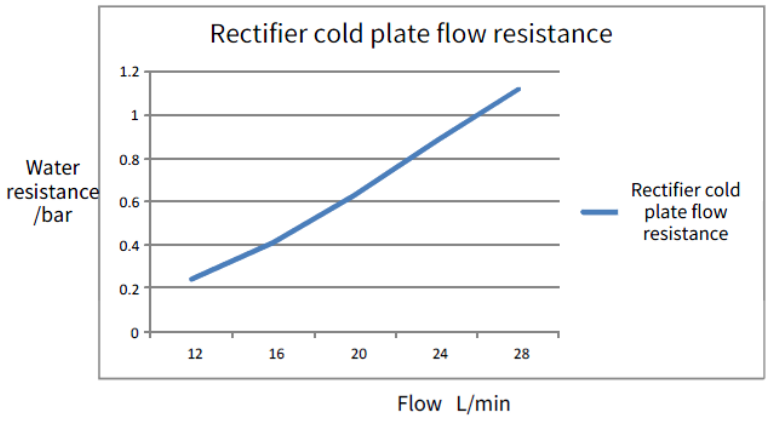
No.	Operation	Compliant	Completed
1	Checked the input and output power wiring and ensured the wiring positions and voltages were correct.	☐	☐
2	Ensured that the input and output power wiring was correct and fastened.	☐	☐
3	Ensured that the input and output power cable carrying capacity selection was correct.	☐	☐
4	Ensured that routing the input and output power cables that were shielded complied with EMC regulations.	☐	☐
5	Checked the external auxiliary power wiring and ensured the wiring positions and voltages are correct.	☐	☐
6	The date of manufacture can be known from the power unit nameplate. If the interval to the first commissioning time or the power module downtime is less than 2 years, precharge for the DC bus capacitors is not needed; if the downtime is more than 2 years, precharge for the DC bus capacitors is needed. For details about precharge, see 7.2.1 Capacitor.	☐	☐
7	Routed the control power cables and power cables separately, complying with EMC regulations.	☐	☐

6 Cooling loop

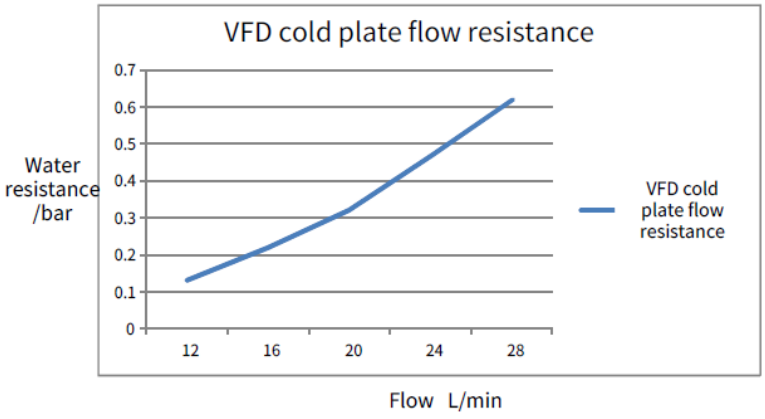
6.1 Flow resistance curve of water-cooled inverter cold plate



6.2 Flow resistance curve of water-cooled rectifier cold plate



6.3 Flow resistance curve of water-cooled VFD cold plate



6.4 Protection against condensation

You should take your own measures to prevent condensation from appearing on the equipment. Once condensation appears, the power must be cut off and the equipment must be dried before it is powered on.

Condensation occurs preferentially on the inlet pipe of the device when the inflow temperature of coolant is significantly lower than the ambient temperature. The temperature at which air condenses into water is called the dew point.

The following table shows the dew point for different relative humidity and room temperature at 1 bar atmospheric pressure. If the coolant temperature is lower than the dew point, condensation will occur, so the coolant temperature needs to be higher than the dew point temperature. Control the coolant temperature according to the following table.

Table 6-1 Minimum coolant temperature at ambient temperature and relative humidity

Ambient temperature (°C)	Min. coolant temperature (°C)											
	RH=95%	RH=90%	RH=85%	RH=80%	RH=75%	RH=70%	RH=65%	RH=60%	RH=55%	RH=50%	RH=45%	RH=40%
5	4	3	2	1	0	-1	-2	-3	-4	-5	-6	-7
10	9	8	7	6	5	4	3	2	1	0	-1	-2
15	14	13	12	11	10	9	8	7	6	5	4	3
20	19	18	17	16	15	14	13	12	11	10	9	8
25	24	23	22	21	20	19	18	17	16	15	14	13
30	29	28	27	26	25	24	23	22	21	20	19	18
35	34	33	32	31	30	29	28	27	26	25	24	23
40	39	38	37	36	35	34	33	32	31	30	29	28
45	44	43	42	41	40	39	38	37	36	35	34	33
50	49	48	47	46	45	44	43	42	41	40	39	38
55	54	53	52	51	50	49	48	47	46	45	44	43

The dew point is also related to the absolute pressure, i.e. to the installation height. When the air pressure drops down (for example altitude escalates), the dew point changes accordingly. Therefore, in the actual application, keeping the coolant inlet temperature above the values given in the table (at 1 bar standard atmospheric pressure) is sufficient to prevent condensation.

6.5 Coolant temperature control

To ensure proper operation of the internal cooling circuit, the coolant temperature must be maintained within the specified range. Select the coolant mixture according to ambient temperature: a 20% ethylene-glycol solution is suitable for storage down to −10 °C, while a 40% solution is suitable down to −25 °C. System operation below 0 °C is strictly prohibited, regardless of the coolant's freezing point. If the operating temperature is between 0 °C and 5 °C, increase the ethylene-glycol concentration to prevent freezing. The minimum allowable coolant temperature is also influenced by ambient relative humidity and should be assessed accordingly.

6.6 Temperature limits

To prevent freezing, the coolant's freezing point depends on the heat-transfer fluid concentration. A higher concentration lowers the freezing point but increases system pressure drop (see 6.7 Pressure limits for details).

Requirements for drive output current vs. inlet coolant temperature:

- 0 °C to 40 °C: No derating required.
- 40 °C to 45 °C: Derate the drive output current by 2% for every 1°C rise.
- 45 °C to 50 °C: If any components with a 55 °C maximum operating temperature are installed in the same space as the drive module, derate the drive output current by 6% for every 1°C rise. If no such 55 °C components are installed in the same space, derate the drive output current by 2% for every 1°C rise.

6.7 Pressure limits

Flow resistance between main inlet and outlet at rated flow:

- Pure water: 0.3 MPa @ 16 L/min
- 20% (by volume) ethylene-glycol/water: 0.4 MPa @ 18 L/min
- 40% (by mass) ethylene-glycol/water: 0.5 MPa @ 21 L/min

Rated water supply pressure: 0.6 MPa

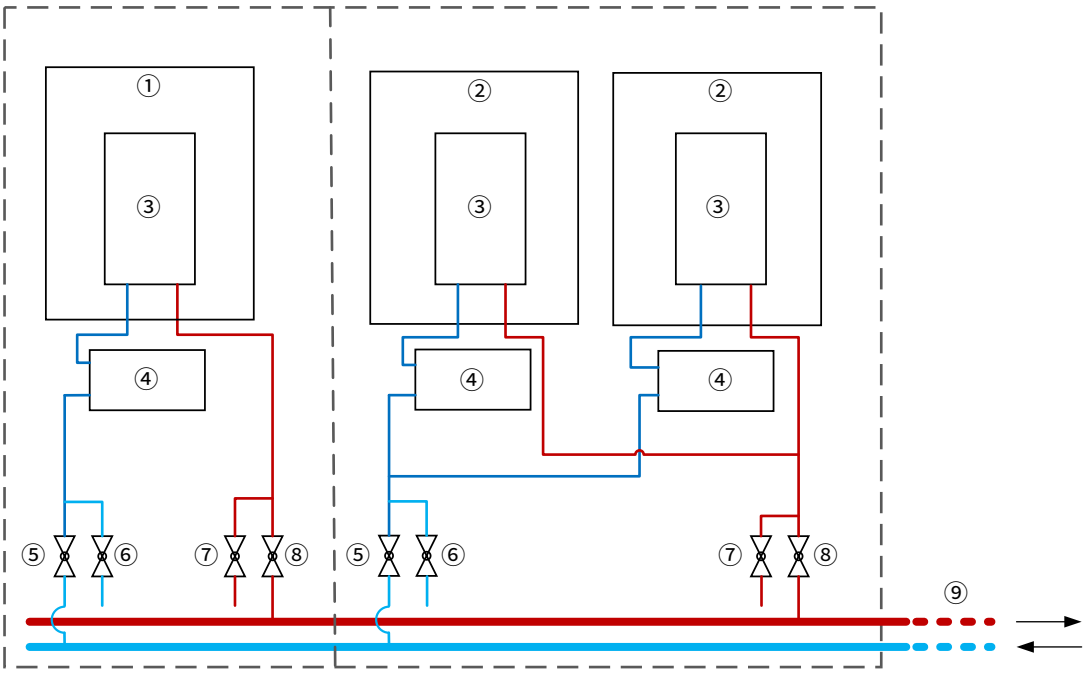
Max. short-term withstand water supply pressure: 0.9 MPa

When sizing the liquid-cooling circuit piping, the rated differential pressure must be taken into account.

6.8 Recommended cabinet water-cooling system design

Each cabinet has one inlet header and one outlet header, equipped with a water-inlet valve and a drain valve. By closing the inlet valve, all modules inside the cabinet can be isolated from the main cooling circuit. The coolant piping connections in a drive system consisting of active rectifier and inverter modules are shown in the following.

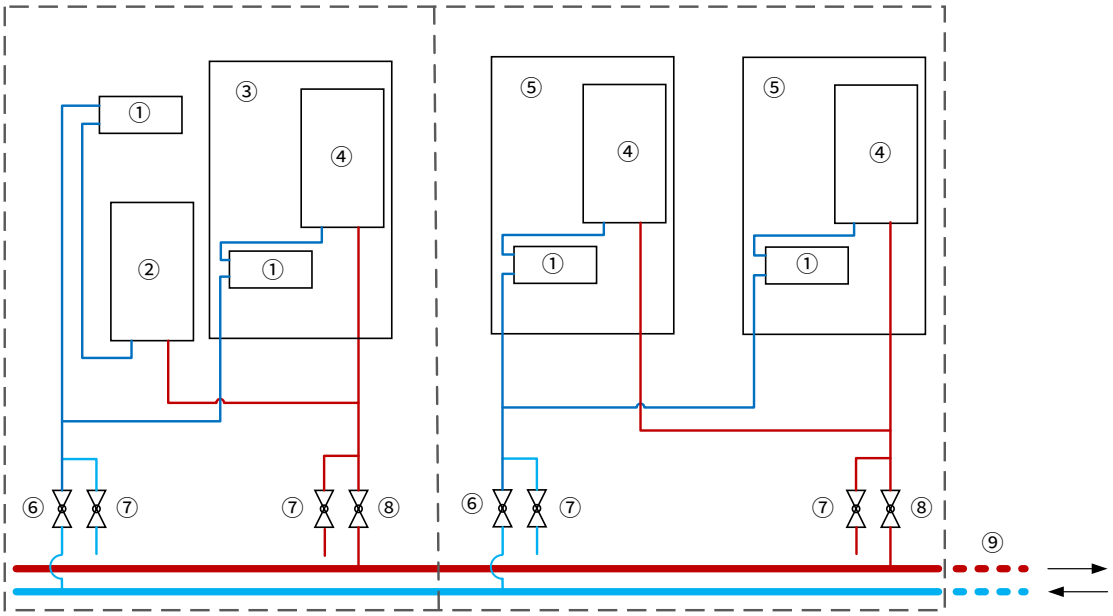
Figure 6-1 Internal water-cooling system of an A8LC multi-module cabinet



No.	Description
1	Rectifier module
2	Inverter module
3	Module cold plate (water-cooled)
4	Water-to-air heat exchanger

No.	Description
5	Inlet valve
6	Inlet-side drain valve
7	Outlet-side drain valve
8	Outlet valve
9	Main inlet/outlet header

Figure 6-2 Internal water-cooling system of an A9LC multi-module cabinet



No.	Description
1	Water-to-air heat exchanger
2	Water-cooled reactor
3	Rectifier module
4	Module cold plate (water-cooled)
5	Inverter module
6	Inlet valve
7	Drain valve
8	Outlet valve
9	Main inlet/outlet header

6.9 Cooling loop materials

Piping and fittings for both the internal and external cooling loops must use the following compatible materials: 304 stainless steel, aluminum alloy, and ethylene-propylene diene rubber (EPDM).

The following materials are strictly prohibited:

Copper, brass, bronze, and other copper alloys: Even trace copper dissolution can cause copper ions to plate out on aluminum surfaces, triggering severe galvanic corrosion and rapid failure of aluminum components.

Any zinc-containing materials (e.g., galvanized pipe): No zinc is permitted anywhere in the liquid-cooling system.

6.10 Filling and venting the internal cooling loop

Preparation and safety warnings

Temperature requirement: Before starting, ensure the drive equipment and the coolant to be filled are both at room temperature.

Pressure monitoring: Throughout the filling process, pressure must be closely monitored and must not exceed the system's maximum allowable operating pressure. If the pressure becomes excessive, immediately relieve it by draining a portion of the coolant via the drain valve.

Importance of venting

Thorough venting of the cooling loop is critical. Residual air can reduce—or even block—coolant flow, leading to localized overheating and equipment damage. The venting procedure must be rigorously carried out after the initial fill, whenever coolant is topped up, and after any power-module replacement.

Vent valve functions and locations

On-cabinet drain valves: Located on the equipment inside the cabinet. They are used only at the initial filling stage to expel air (liquid–air displacement).

Main vent valve: Final, thorough venting must be performed via an external vent valve installed at the highest point of the system (typically on or near the cooling unit). The active rectifier and similar modules have no built-in vent valves; venting relies on the valve mounted at the top of the cooling cabinet system.

Filling and venting procedure for the internal cooling loop:

Step 1 Open the cooling cabinet system's vent valve.

Step 2 Connect a hose to the outlet-side drain valve and route it to a suitable container.

Step 3 On that cabinet, open the inlet valve and the outlet-side drain valve. Keep the other cabinets' outlet valves and inlet-side drain valves closed.

Step 4 Connect a hose to the outlet-side drain valve and route it to a suitable container.

Step 5 Fill the cooling circuit with coolant.

Step 6 When the cabinet's internal circuit and modules are full, coolant will begin to flow from the hose. Discharge a small amount of coolant, then close the drain valve.

Step 7 Close the inlet valve for that cabinet.

Step 8 Repeat steps 2–8 for each remaining cabinet.

Step 9 After all cabinets have been processed, open the inlet and outlet valves on all cabinets. Vent all remaining air through the cooling cabinet system's main vent valve.

Step 10 Close the cabinet system's main vent valve.

Step 11 Open the pump's vent valve and vent all air from the pump.

Step 12 If necessary, re-check pressure and top up coolant.

Step 13 Start the coolant pump. Vent all remaining air through the cooling cabinet system's main vent valve.

6.11 Draining the internal cooling loop

Before you start, verify that the system is shut down. Hot, pressurized coolant may be present in the cooling loop. Stop the pump and depressurize the system to atmospheric pressure before any operation.

Procedure:

Step 1 Connect one end of a drain hose to the cabinet's drain valve and route the other end to a suitable coolant collection container. Ensure the hose outlet remains above the liquid surface in the container so that air can enter the system to displace the coolant and maintain a smooth flow path.

Step 2 Fully open the drain valve and wait until the coolant is completely discharged and no liquid flows out.

Step 3 Perform freeze protection (perform only if the storage temperature is below 0 °C):

(1) Thoroughly dry the loop using clean compressed air or ambient air.

(2) Fill the circuit with a 20% or 40% ethylene-glycol solution as an antifreeze protection fluid.

(3) Repeat steps 1–2 to completely drain the protection fluid.

7 Maintenance and inspection

7.1 Periodical inspection

7.1.1 Overview

Only personnel who are specially trained and certified as competent are permitted to perform maintenance on the equipment.

Before operating the interior of the equipment:

- Isolate the equipment from the power supply (switches or circuit breakers installed inside the cabinet are not reliable isolation points; disconnect the supply at the upstream main source).
- After power-off, wait at least 25 minutes to allow the capacitors in the internal DC circuit to discharge fully.
- Before performing any work, use a reliable instrument (e.g., a multimeter) to verify that the DC bus voltage is below 36V.

7.1.2 Required tools

These tools are used to remove and install devices, screws, and other components during maintenance and repair.

- A set of torque wrench or sleeve
- A set of open end wrench or sleeve
- A set of hexagonal wrench
- A medium-sized straight screwdriver and a small-sized straight screwdriver
- A medium-sized cross screwdriver
- Cart

Table 7-1 Tightening torque for threaded fasteners (property class 4.8, unit: N・cm)

Screw thread specification	Copper bar connection	Metal sheet connection	Remarks
M5	30	20	-
M6	45	30	-
M8	110	85	-
M10	220	164	-
M12	390	285	-
M16	980	710	-

7.1.3 Maintenance cycle

Little maintenance is required when the drive equipment is installed in an environment that meets requirements. The following table describes the routine maintenance periods recommended by us.

Maintenance cycle	Maintenance work description
Once per 6–12 months (based on the site installation environment)	Check according to the following table
Once per 6–12 months (based on the site	Heat sink inspection and cleaning

Maintenance cycle	Maintenance work description
installation environment)	
Once per year (stored without use)	Capacitor aging
Once per year	Air filter check. Replace it when necessary.
Every 6 years	Replace the fans for the filter and power units
Every 10 years	Capacitor replacement

The following table describes the routine check items recommended by INVT.

Check scope		Item	Method	Expected result
Ambient environment		Check the temperature, and humidity, and whether there is vibration, dust, gas, oil spray, and water droplets in the environment.	Visual inspection and instrument measurement	The requirements stated in this manual are met.
		Check whether there are foreign matters, such as tools, or dangerous substances placed nearby.	Visual inspection	There are no tools or dangerous substances placed nearby.
Voltage		Check the voltage of the main circuit and control circuit.	Use multimeters or other instruments for measurement.	Comply with the requirements stated in this manual. (Do not use a multimeter to measure the bus voltage.)
Keypad		Check the display of information.	Visual inspection	The characters are displayed properly.
		Check whether characters are not completely displayed.	Visual inspection	The requirements stated in this manual are met.
Main circuit	Common	Check whether bolts are loose or fall off.	Screw them up.	No exception occurs.
		Check whether the machine is deformed, cracked, or damaged, or their color changes due to overheating and aging.	Visual inspection	No exception occurs.
		Check whether there are stains and dust attached.	Visual inspection	No exception occurs. **Note:** Discoloration of copper bars does not mean that they cannot work properly.
	Conductor and wire	Check whether conductors are deformed or color change for overheat.	Visual inspection	No exception occurs.
		Check whether the wire sheaths are cracked or their color changes.	Visual inspection	No exception occurs.
	Terminal block	Check whether there is damage.	Visual inspection	No exception occurs.
	Reactor	Check whether there is unusual vibration sounds or smells.	Auditory, olfactory, and visual inspection	No exception occurs.

Check scope		Item	Method	Expected result
Control circuit	Control PCB and connector	Check whether the screws and connectors are loose.	Screw them up.	No exception occurs.
		Check whether there is unusual smell or discoloration.	Olfactory and visual inspection	No exception occurs.
		Check whether there are cracks, damage, deformation, or rust.	Visual inspection	No exception occurs.
		Check whether there is electrolyte leakage or deformation.	Visual inspection, and determine the service life based on the maintenance information.	No exception occurs.
Cooling system	Cooling fan	Check whether there are unusual sounds or vibration.	Auditory and visual inspection, and turn the fan blades with your hand.	The rotation is smooth.
		Check whether the bolts loose.	Screw them up.	No exception occurs.
		Check whether there is discoloration caused due to overheat. Check whether there is dust.	Visual inspection, and determine the service life based on the maintenance information.	No exception occurs.
	Ventilation duct	Check whether there are foreign matters blocking or attached to the cooling fan, air inlets, or air outlets. Check whether there are foreign objects attached.	Visual inspection	No exception occurs.

For more details about maintenance, contact the local INVT office, or visit our website www.invt.com, and click the online chat button.

7.2 Replacement of wearing parts

7.2.1 Capacitor

7.2.1.1 Capacitor reforming

If the power unit has been left unused for a long time, you need to follow the instructions to reform the DC bus capacitor before using it. The storage time is calculated from the date the product is delivered.

Storage time	Operation principle
Less than 1 year	No charging operation is required.
1 to 2 years	The power unit needs to be powered on for 1 hour before the first running command.

Storage time	Operation principle
2 to 3 years	Use a variable-voltage power supply to charge it: Charge the power unit at 25% of the rated voltage for 30 minutes, and then charge it at 50% of the rated voltage for 30 minutes, at 75% for another 30 minutes, and finally charge it at 100% of the rated voltage for 30 minutes.
More than 3 years	Use a variable-voltage power supply to charge it: Charge the power unit at 25% of the rated voltage for 2 hours, and then charge it at 50% of the rated voltage for 2 hours, at 75% for another 2 hours, and finally charge it at 100% of the rated voltage for 2 hours.

The method for using a variable-voltage power supply to charge a power unit is described as follows:

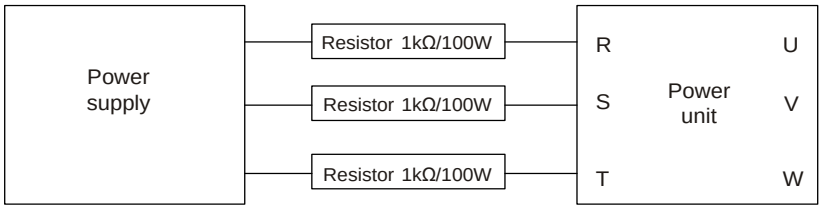
For the power unit of a high voltage class, ensure that the voltage requirement (for example, 380V) is met during charging. Capacitor changing requires little current, and therefore you can use a small-capacity power supply (2A is sufficient).

The method for using a resistor (incandescent lamp) to charge a power unit is described as follows:

If you directly connect the power unit to a power supply to charge the DC bus capacitor, it needs to be charged for a minimum of 60 minutes. The charging operation must be performed at a normal indoor temperature without load, and you must connect a resistor in series mode in the 3PH circuit of the power supply.

For a 380V power unit, use a resistor of 1 kΩ/100W. If the voltage of the power supply is no higher than 380 V, you can also use an incandescent lamp of 100W. If an incandescent lamp is used, it may go off or the light may become very weak.

Figure 7-1 380V power unit charging circuit example



7.2.1.2 Electrolytic capacitor replacement

⚠	Read chapter 1 Safety precautions carefully and follow the instructions to perform operations. Ignoring these safety precautions may lead to physical injury or death, or device damage.

The electrolytic capacitor of a power unit must be replaced if it has been used for more than 35,000 hours. For details about the replacement, contact the local INVT office.

7.2.2 Cooling fan

The service life of a power unit cooling fan is more than 35000 hours. The actual service life of the cooling fan is related to the use of the equipment and the ambient environment.

You can view the running duration of the equipment through P07.14 (Accumulated running time).

The increase of the bearing noise indicates a fan fault. If the equipment is applied in a key position, replace the fan once the fan starts to generate unusual noise. You can purchase spares of fans from INVT.

Cooling fan replacement for an A8LC module:

⚠	Read chapter 1 Safety precautions carefully and follow the instructions to perform operations. Ignoring these safety precautions may lead to physical injury or death, or device damage.

Step 1 Stop the equipment, disconnect the AC power supply, and wait for a time no shorter than the waiting time designated on the equipment.

Step 2 Remove the fan module front cover from the unit housing.

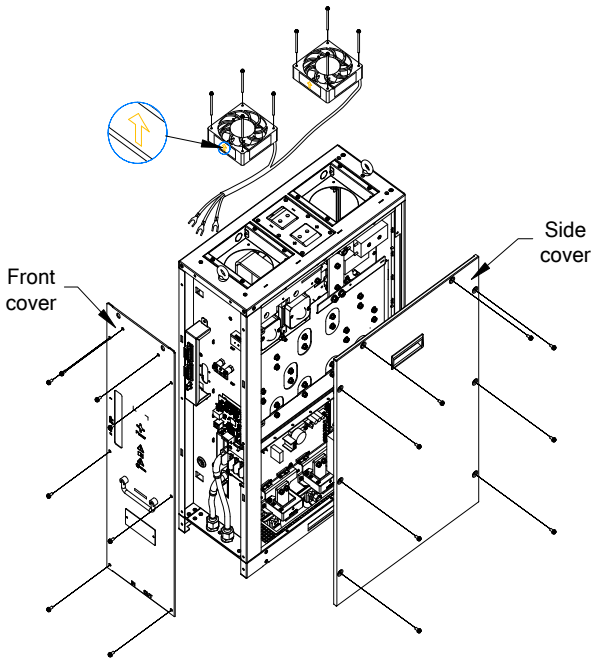
Step 3 Remove the fan module connection cable.

Step 4 Pull out the fan tray and remove the fan with a screwdriver.

Step 5 Install a new fan in the fan tray. Insert the fan module connection cable to the connector in reverse sequence. Install the front plate. Ensure that the air direction of the fan is consistent with that of the unit, as shown in Figure 7-2.

Step 6 Connect to the power supply.

Figure 7-2 A8LC water-cooled power unit fan maintenance



Cooling fan replacement for an A9LC power unit:

⚠	Read chapter 1 Safety precautions carefully and follow the instructions to perform operations. Ignoring these safety precautions may lead to physical injury or death, or device damage.

Step 1 Stop the unit, disconnect the AC power supply, and wait for a time no shorter than the waiting time designated on the unit.

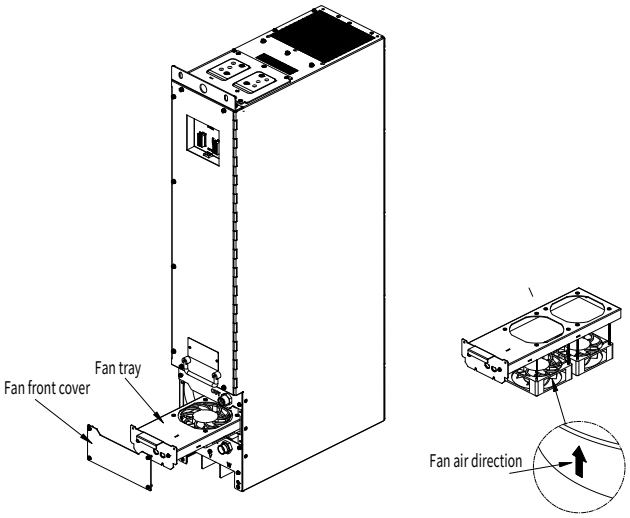
Step 2 Remove the fan module front cover from the unit housing.

Step 3 Remove the fan module connection cable.

Step 4 After removing the screws securing the fan tray, pull out the tray and use a screwdriver to remove the fan.

Step 5 Install the new cooling fan into the fan tray. Reconnect the fan cable to the corresponding connector in the reverse order, then reinstall the front cover. Ensure the fan's airflow direction is aligned with the unit's airflow, as shown in Figure 7-2.

Step 6 Connect to the power supply.



7.2.3 DC fuse

To check and replace a DC fuse, do as follows:

⚠	Only qualified electricians can perform this task. Read all the safety precautions. Ignoring these safety precautions may lead to physical injury or death, or device damage.

Step 1 Stop the power unit, disconnect the AC power supply, and wait for a time no shorter than the waiting time designated on the unit.

Step 2 Remove the screws from the DC fuse protective cover and remove the cover plate.

Step 3 Remove the copper bar fixing screws of the DC fuse assembly and remove the DC fuse assembly.

Step 4 Check the condition of the fuse and replace it as needed. When replacing it, install the new fuse and copper bar as an assembly and tighten the screws according to the tightening torque table.

Step 5 Install the protective cover and close the cabinet door.

Step 6 Connect to the power supply.

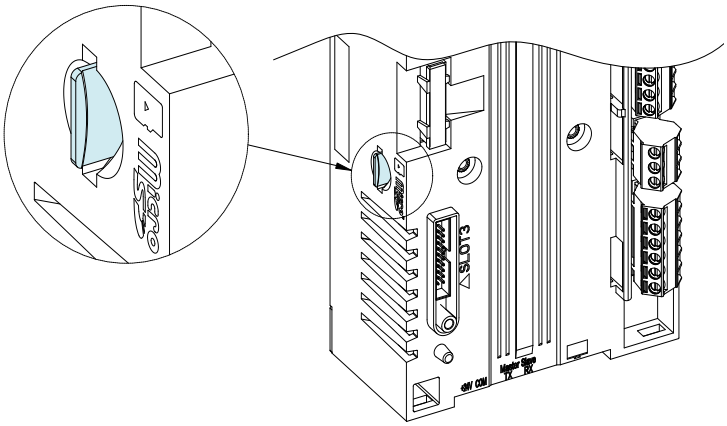
7.2.4 Control unit and keypad

7.2.4.1 Replace the storage card

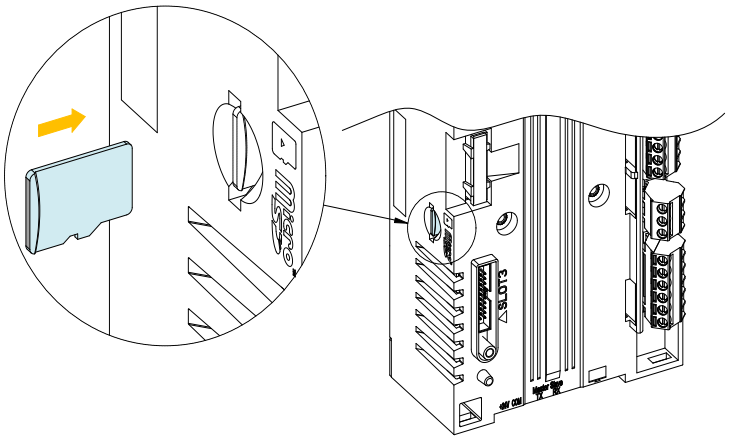
After the control unit is replaced, the existing parameter settings can be preserved by transferring the storage card from the faulty control unit to a new control unit.

The procedure is as follows:

Step 1 Press the SD storage card once, and pull the SD storage card out from the faulty module after the SD card is ejected.



Step 2 Insert and push the SD card into the card holder of the new control unit in the direction shown in the figure.



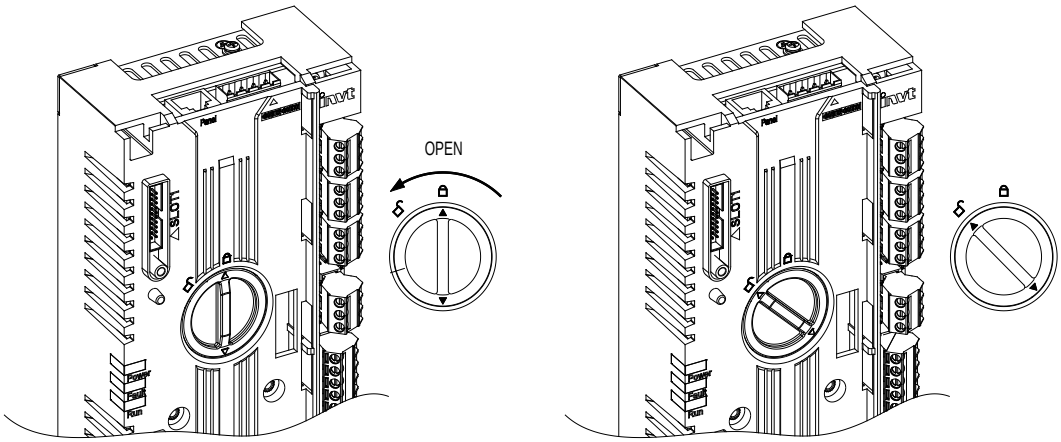
Step 3 Ensure that the SD storage card is pushed into place. Otherwise, abnormalities may occur due to poor contact.

7.2.4.2 Replace the control unit battery

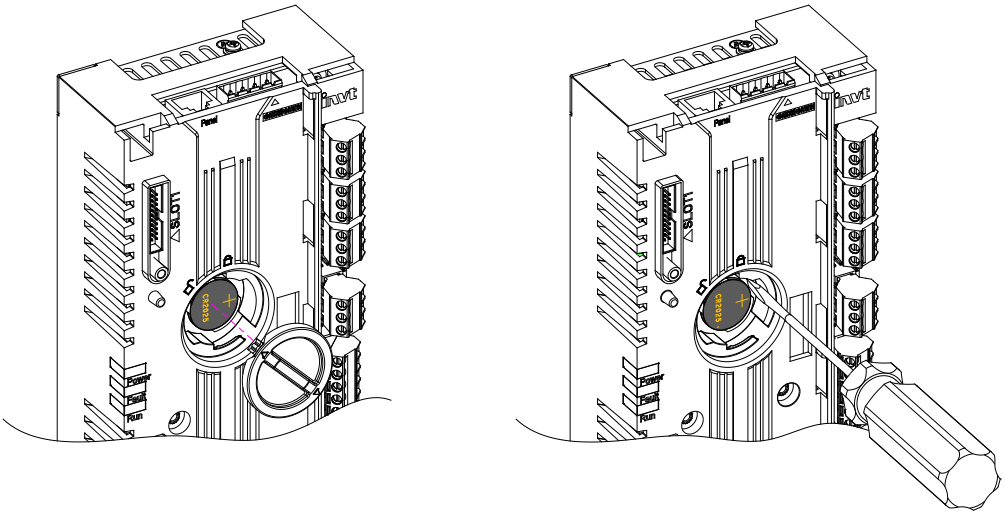
Note: The battery model of the control unit is CR2032 (MAXELL).

The procedure is as follows:

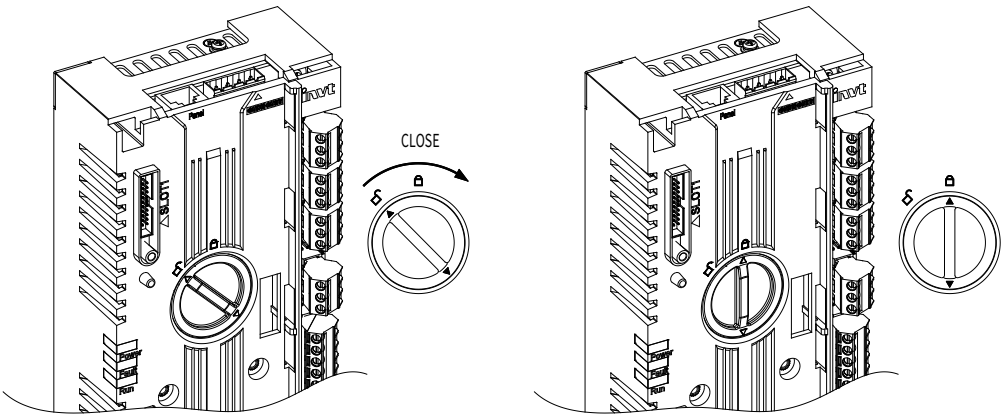
Step 1 Hold the battery cover by hand and rotate it counterclockwise by 45° until the cover opens.



Step 2 Remove the cover, press one side of the battery with a screwdriver, remove and replace the control unit battery with a new one.



Step 3 Close the cover and rotate it clockwise by 45° to tighten it.



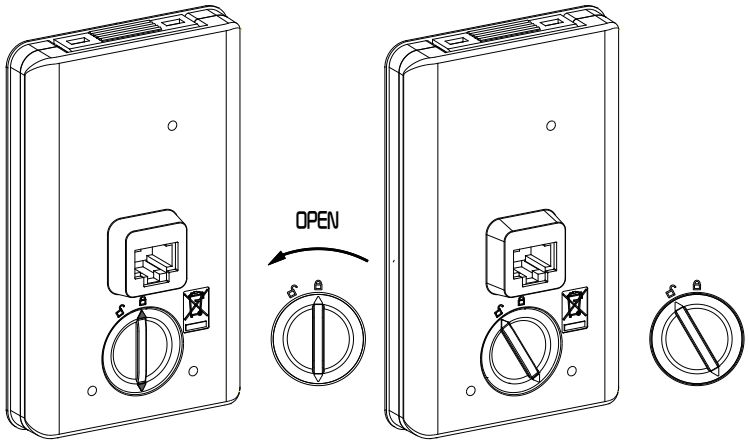
Step 4 Dispose of waste batteries in accordance with local disposal rules or applicable laws.

7.2.4.3 Replace the keypad battery

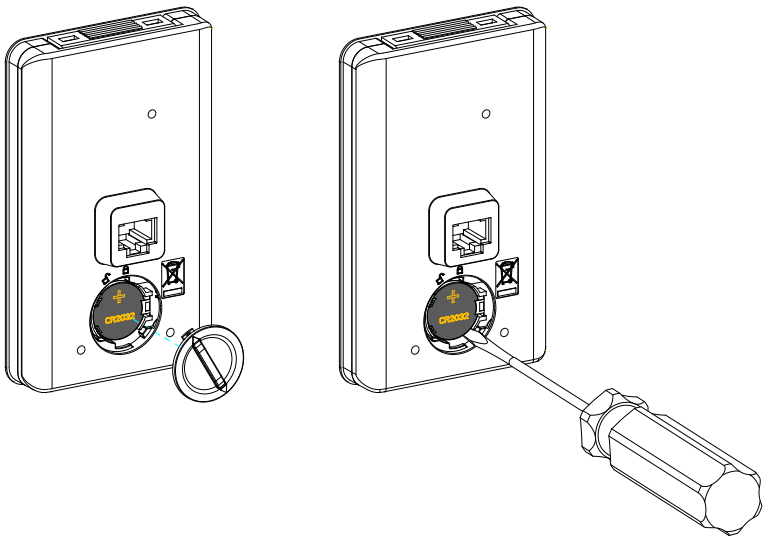
Note: The battery model of the keypad is CR2032 (MAXELL).

The procedure is as follows:

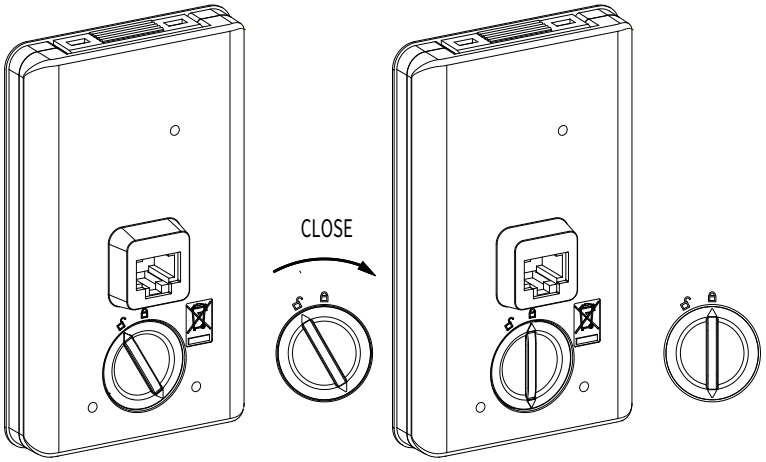
Step 1 Rotate the battery cover counterclockwise by 30° by hand until the cover opens.



Step 2 Remove the cover, press one side of the battery with a screwdriver, remove and replace the battery with a new one.



Step 3 Close the cover and rotate it clockwise by 30° to tighten it.



Step 4 Dispose of waste batteries in accordance with local disposal rules or applicable laws.

7.2.5 Water-cooled units (including rectifier, inverter, and VFD units)

To replace the water-cooled inverter unit and VFD unit, do as follows:

Step 1 Stop the machine and disconnect the AC power.

Step 2 Open the cabinet door and check to ensure there is no voltage in the equipment.

Step 3 Disconnect the external connection cables of the inverter unit and remove the optical fiber.

Step 4 Drain all coolant from the inverter module. Remove the cooling duct, as shown in Figure 7-3.

Step 5 Remove the main circuit incoming and outgoing copper strips (or cable).

Step 6 Remove the (six M8) fixing screws from the top and bottom fixed plates of the inverter unit, as shown in Figure 7-4.

Step 7 Pull out the unit with a lifting device, as shown in Figure 7-5.

Step 8 Install the new water-cooled inverter unit by referring the reverse order of the procedure.

Figure 7-3 Removing the cooling duct

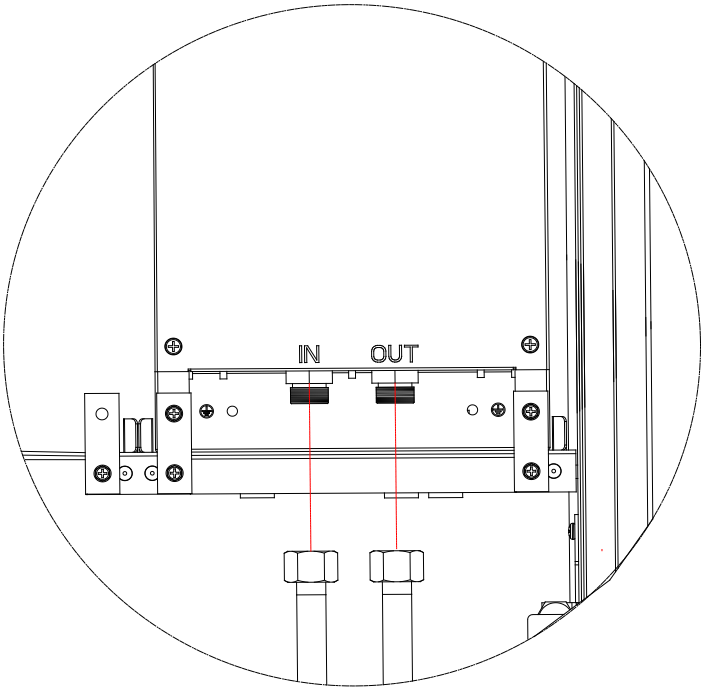


Figure 7-4 Removing the fixing screws at the top and bottom of the unit

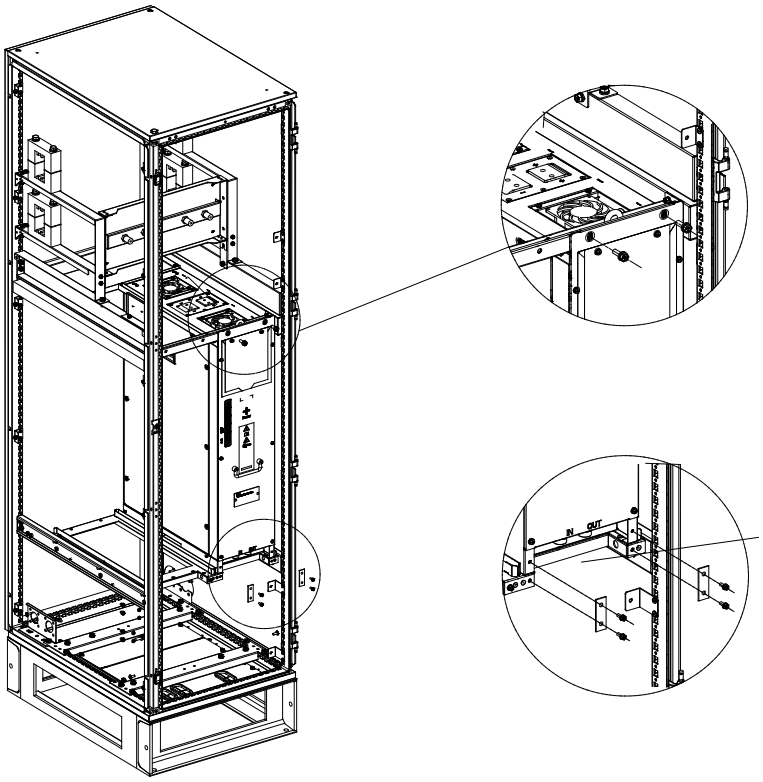
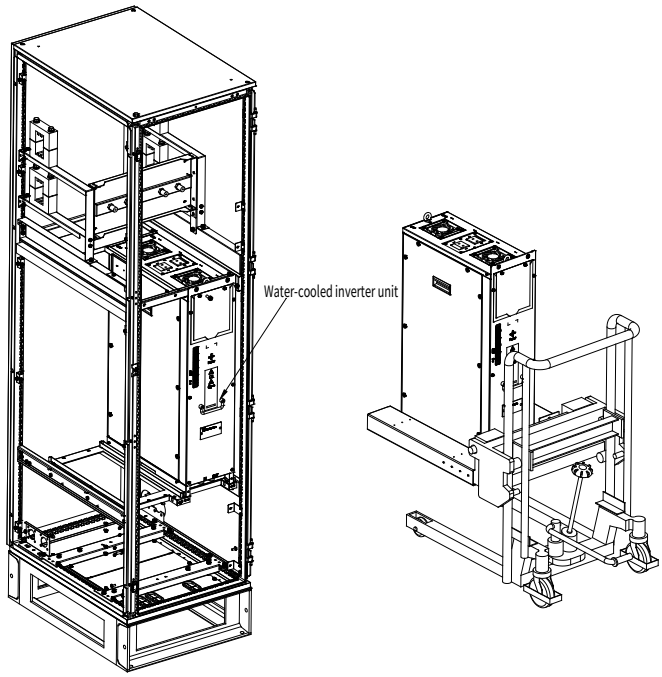


Figure 7-5 Pulling out the water-cooled inverter unit



To replace the water-cooled rectifier unit, do as follows:

Step 1 Stop the unit and disconnect the AC power.

Step 2 Open the cabinet door and check to ensure there is no voltage in the equipment.

Step 3 Disconnect the external connection cables from the rectifier unit.

Step 4 Drain all coolant from the rectifier module. Remove the cooling duct, as shown in Figure 7-6.

Step 5 Remove the (four M8) fixing screws from the water-cooled unit cold plate, as shown in Figure 7-7.

Step 6 Remove the water-cooled rectifier unit, as shown in Figure 7-8.

Step 7 Install the new water-cooled rectifier unit by referring the reverse order of the procedure.

Figure 7-6 Removing the cooling duct

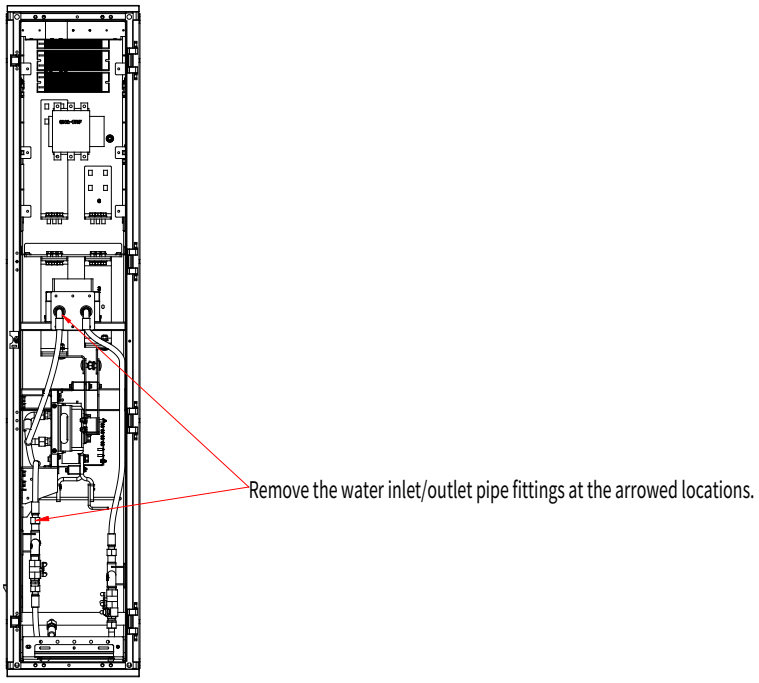


Figure 7-7 Removing four fixing screws from the unit water-cooled plate

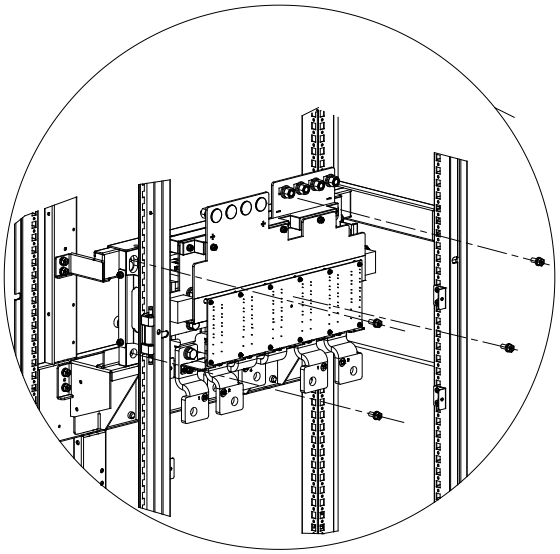
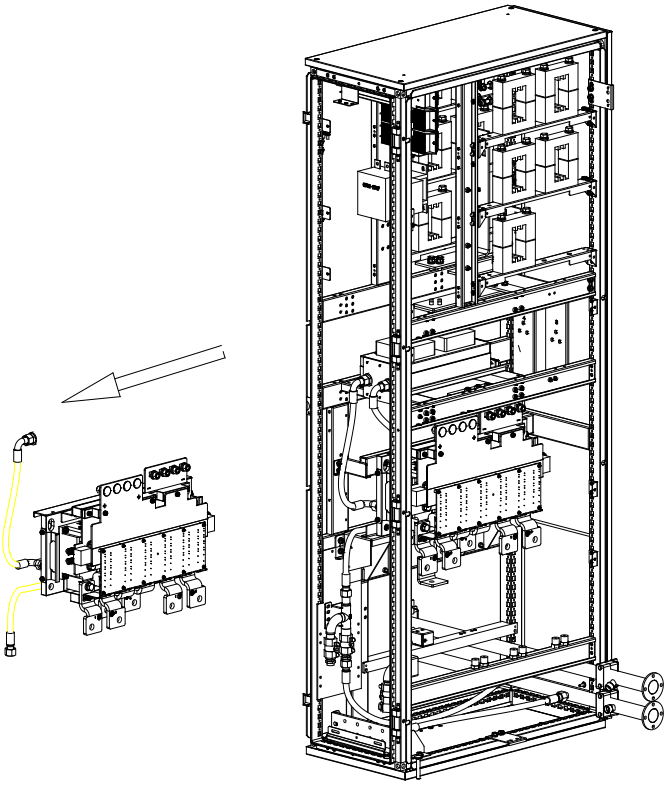


Figure 7-8 Removing water-cooled rectifier unit



7.3 Warranty description

The warranty period for GD880 series product shall be as stipulated in the contract.

Appendix A Technical data

A.1 Capacity

Choose a VFD model based on the rated current and power of the motor. To endure the rated power of the motor, the rated output current of the VFD must be larger or equal to the rated current of the motor. The rated power of the VFD must be higher or equal to that of the motor.

Note:

- The maximum allowable shaft power of the motor is limited to 1.5 times the rated power of the motor. If the limit is exceeded, the VFD automatically restricts the torque and current of the motor. This function effectively protects the input shaft against overload.
- The rated capacity is the capacity at the ambient temperature of 45°C.
- You need to check and ensure that the power flowing through the common DC connection in the common DC system does not exceed the rated power of the motor.

A.2 Grid specifications

Grid voltage	AC 3PH 380V(-15%) – 440V(+10%) AC 3PH 520V(-15%) – 690V(+10%)
Short-circuit capacity	According to IEC 61439-1, the rated short-time withstand current at the incoming terminals of the switchgear assembly is up to 100 kA. The VFD is suitable for applications where the prospective short-circuit current does not exceed the breaking capacity (for example, 100 kA) of its protective devices, and its rated operational current is significantly lower than this value—typically ⩽ 1 kA.
Frequency	50/60Hz±5%, with a maximum change rate of 20%/s

A.3 Application standards

The following table describes the standards that our inverters comply with.

EN/ISO 13849-1	Safety of machinery—Safety-related parts of control systems—Part 1: General principles for design
IEC/EN 60204-1	Safety of machinery. Electrical equipment of machines. Part 1: General requirements
IEC/EN 62061	Safety of machinery—Safety-related functional safety of electrical, electronic, and programmable electronic control systems
IEC/EN 61800-3	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods
IEC/EN 61800-5-1	Adjustable speed electrical power drive systems—Part 5-1: Safety requirements—Electrical, thermal and energy
IEC/EN 61800-5-2	Adjustable speed electrical power drive systems—Part 5-2: Safety requirements—Function
GB/T 30844.1-2014	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 1: Technical conditions
GB/T 30844.2-2014	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 2: Test methods

GB/T 30844.3-2017	General-purpose variable-frequency adjustable-speed equipment of 1 kV and lower—Part 3: Safety requirements

A.3.1 CE marking

The CE marking on the VFD nameplate indicates that the VFD is CE-compliant, meeting the regulations of the European low-voltage directive (2014/35/EU) and EMC directive (2014/30/EU).

A.3.2 EMC compliance declaration

European union (EU) stipulates that the electric and electrical devices sold in Europe cannot generate electromagnetic disturbance that exceeds the limits stipulated in related standards, and can work properly in environments with certain electromagnetic interference. The EMC product standard (EN 618003) describes the EMC standards and specific test methods for adjustable speed electrical power drive systems. Our products have been compliant with these regulations.

A.4 EMC regulations

The EMC product standard (EN 61800-3) describes the EMC requirements on VFDs.

Application environment categories:

First environment: Civilian environments, including application scenarios where VFDs are directly connected to the civil power supply low-voltage grids without intermediate transformers.

Second environment: All environments except those in the first environment.

VFD categories:

C1: VFD of rated voltage lower than 1000V, applied to the first environment.

C2: VFD of rated voltage lower than 1000V, which is neither a non-plug, socket, nor mobile devices and must be installed and commissioned by a professional person when used in the first environment.

Note: The EMC standard IEC/EN 61800-3 no longer restricts the power distribution of the VFD, but defines the use, installation, and commissioning of the VFD. Specialized personnel or organizations must have the necessary skills (including the EMC-related knowledge) for installing and/or performing commissioning on the electrical drive systems.

C3: VFD of rated voltage lower than 1000V, applied to the second environment. They cannot be applied to the first environment.

C4: VFD of rated voltage higher than 1000 V, or rated current higher or equal to 400 A, applied to complex systems in the second environment.

A.4.1 Category C2

The induction disturbance limit shall meet the following stipulations:

- Select the motor and control cables according to the description in the manual.
- Install the VFD according to the description in the manual.

	The product may generate radio interference in some environments, and you need to take measures to reduce the interference.

A.4.2 Category C3

The anti-interference performance of the VFD meets the requirements of the second environment in the IEC/EN 61800-3 standard.

The induction disturbance limit shall meet the following stipulations:

- Select the motor and control cables according to the description in the manual.
- Install the VFD according to the description in the manual.

	VFDs of category C3 cannot be applied to civilian low-voltage common grids. When applied to such grids, the VFD may generate radio frequency electromagnetic interference.

Appendix B Product dimensions

Figure B-1 Installation dimensions of A8LC water-cooled inverter unit

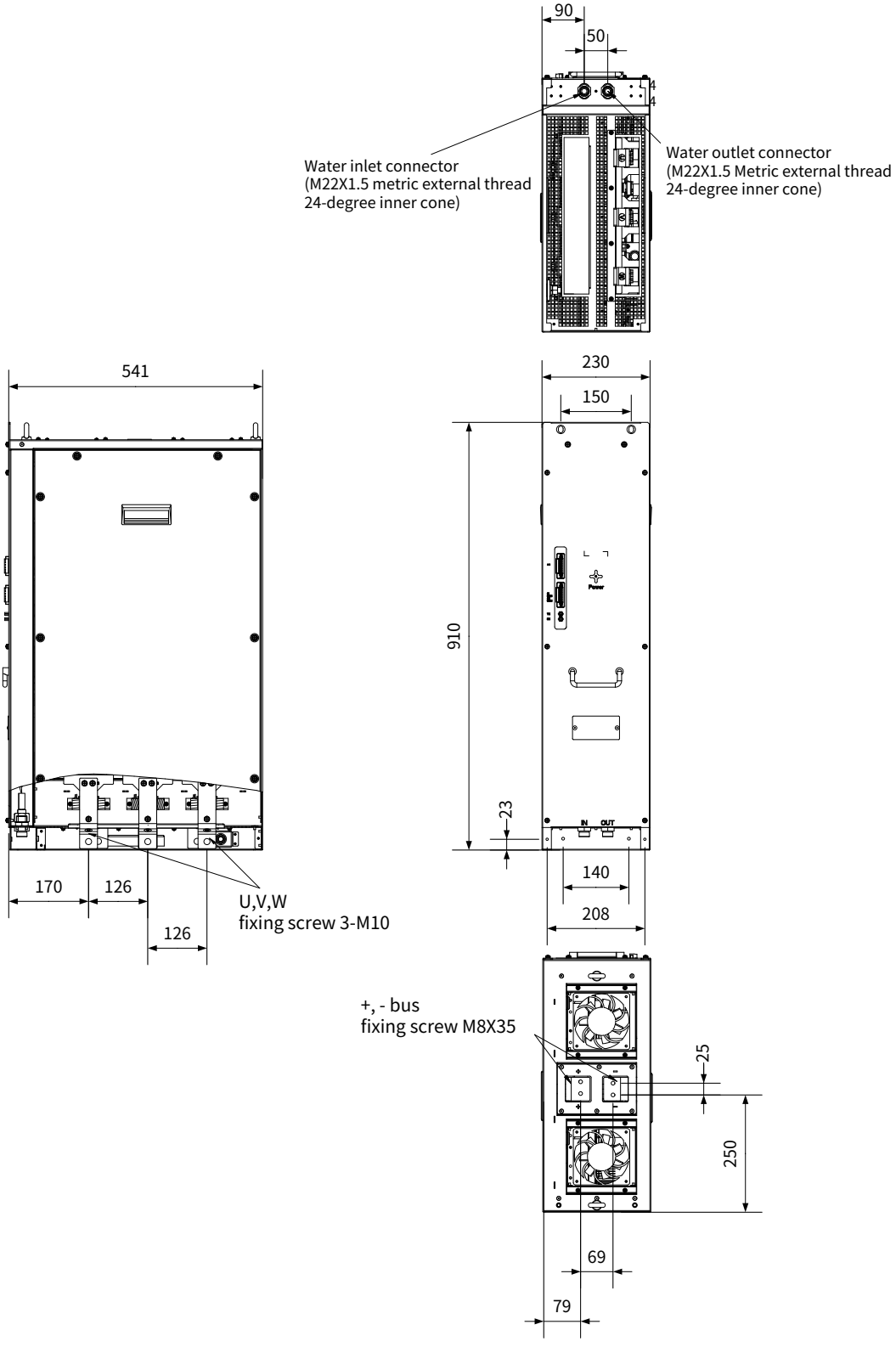


Figure B-2 Installation dimensions of D3DLC water-cooled rectifier unit

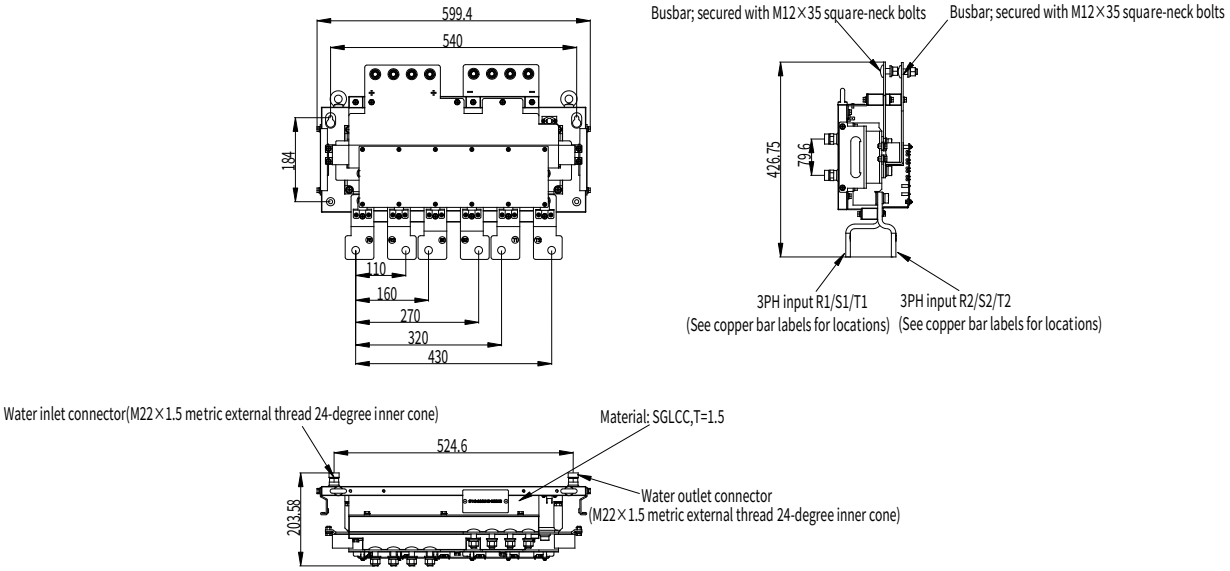


Figure B-3 Installation dimensions of A8LC water-cooled VFD unit

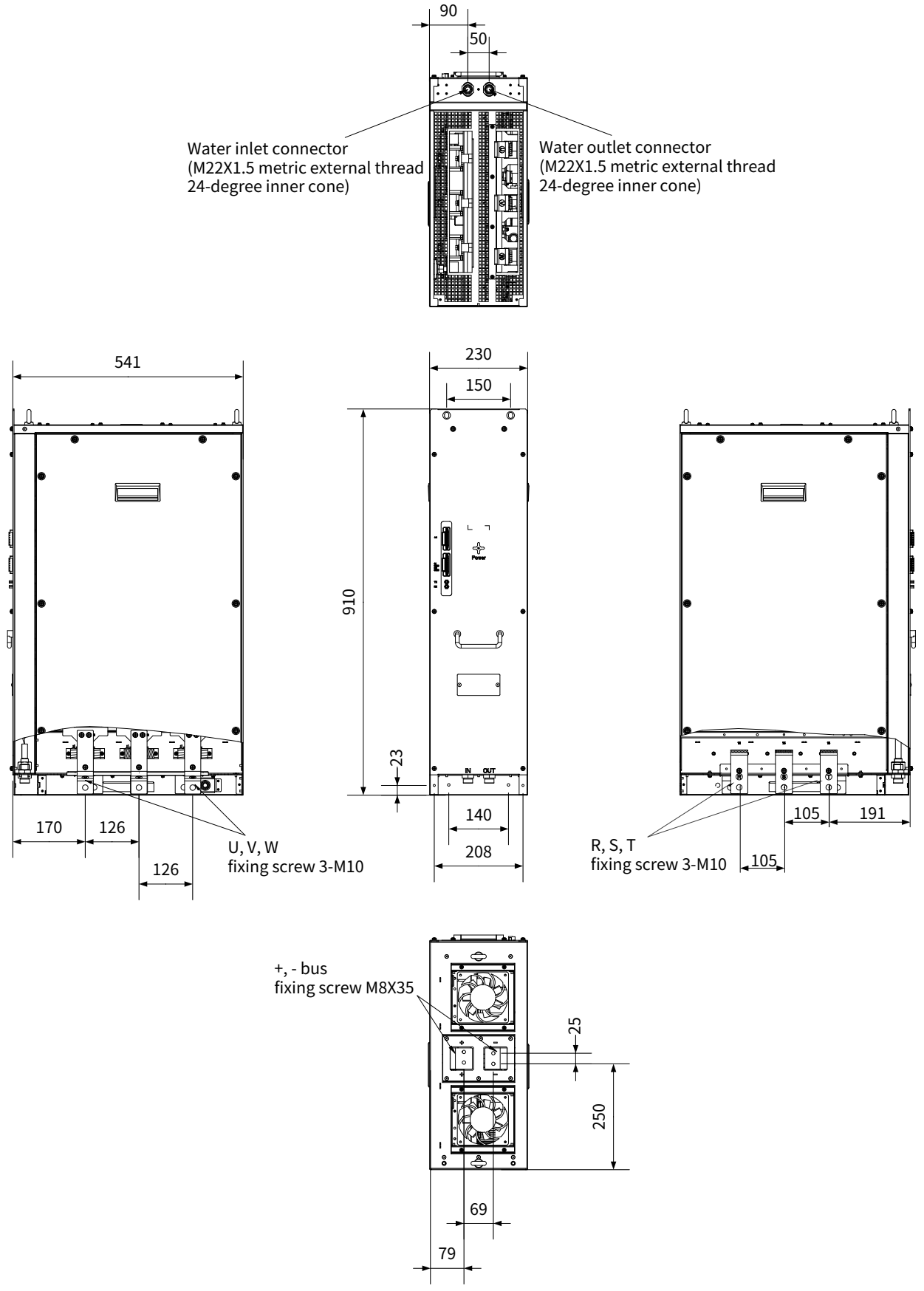
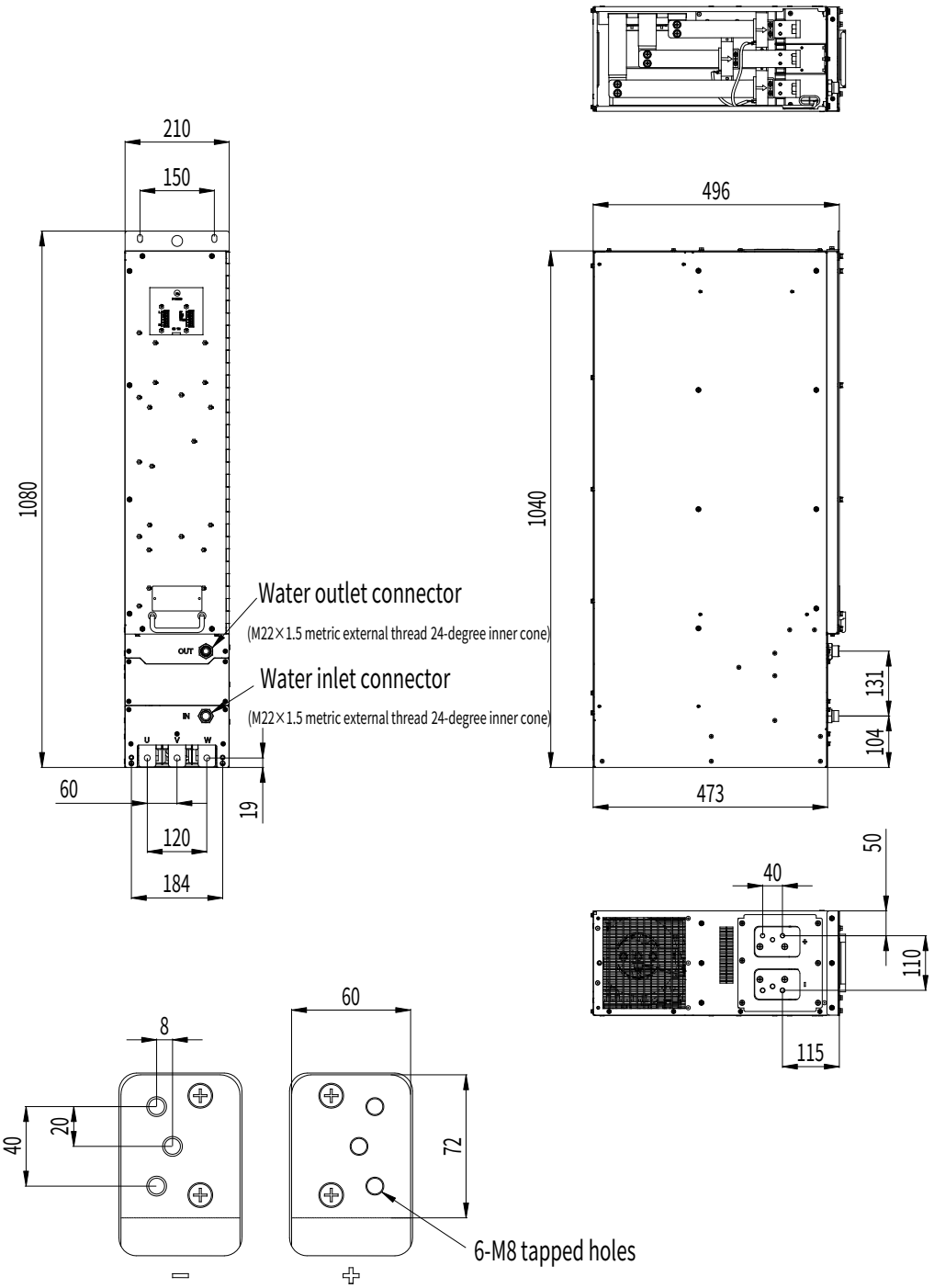


Figure B-4 Installation dimensions of A9LC water-cooled inverter unit



Top copper busbar lap joint area and hole pattern (4:1)

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