

ECM3 Series Outdoor Power System

User Manual

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Safety Precautions

To reduce the chance of accident, please read the safety precautions carefully before operation. The 'Caution, Notice, Warning, Danger' in this book do not represent all the safety points to be observed, and are only supplement to various safety points. Therefore, the installation and operation personnel must be strictly trained and master the correct operations and all the safety points before operation.

When operating Vertiv products, you must strictly observe the safety rules in the industry, the general safety points and special safety instructions specified in this book.

Electrical Safety

I. Hazardous voltage



Some components of the outdoor power system carry hazardous voltage in operation. Direct contact or indirect contact through moist objects with these components will result in fatal injury.

Observe safety rules in the industry when installing the AC power system. The installation personnel must be licensed to operate high voltage and AC power.

In operation, the installation personnel are not allowed to wear conductive objects such as watches, bracelets, bangles, rings.

When water or moisture is found in the cabinet, just turn off the power immediately. In moist environment, precautions must be taken to keep moisture out of the power system.

Attach 'Prohibit' warning label to the switches and buttons that are not permitted to operate during installation.



High voltage operation may cause a fire or electric shock. The connection and wiring of AC cables must be in compliance with the local rules and regulations. Only those who are licensed to operate high voltage and AC power can perform high voltage operations.



To avoid electric shock hazard of outdoor environment and outdoor equipment, the non-professionals are prohibited to operate or maintain the outdoor power system.

II. Tools



In high voltage and AC operation, special tools must be used. No common or self-carried tools should be used.

III. Thunderstorm



Never operate on high voltage, AC, iron tower or mast in the thunderstorm.

In thunderstorms, a strong electromagnetic field will be generated in the air. Therefore the equipment should be well earthed in time to avoid damage by lightning strikes.

IV. ESD



The static electricity generated by the human body will damage the static sensitive elements on PCBs, such as large-scale ICs. Before touching any plug-in board, PCB or IC chip, wear ESD wrist strap to prevent body static from damaging the sensitive components. The other end of the ESD wrist strap must be well earthed.

V. Short circuit



During operation, never short the positive and negative poles of the DC distribution unit of the system or the non-grounding pole and the earth. The power system is constant voltage DC power equipment, and short circuit will result in equipment burning and endanger human safety.

VI. Reverse connection



Never connect reversely live line and neutral line of the AC input cables, or else the system will be damaged.

Check carefully the polarity of the cable and connection terminal when performing DC live operations.

As the operation space in the DC distribution unit is tight, please carefully select the operation space.

Never wear a watch, bracelet, bangle, ring, or other conductive objects during operation.

Use insulated tools.

In live operation, keep the arm, wrist and hand tense, so that when the tool in operation slips, the movement of the human body and tool is reduced to a minimum.

Others

I. Sharp object



When moving equipment by hand, wear protective gloves to avoid injury by sharp object.

II. Cable connection



Please verify the compliance of the cable and cable label with the actual installation prior to cable connection.

III. Binding the signal lines



The signal lines should be bound separately from heavy current and high voltage lines, with binding interval of at least 150mm.

Contents

Chapter 1 Overview	1
1.2 Composition & Configuration	1
1.2.1 Power subrack	8
1.2.2 AC Distribution Unit (Optional)	10
1.2.3 DC Distribution Unit (Optional)	11
1.2.4 Environment Monitoring System (Optional)	11
1.2.5 Heating Unit (Optional)	14
1.3 Technical Parameters	14
1.4 Operating Principles	15
1.4.1 Heat Exchanger	15
1.4.2 Air Conditioner	16
1.5 Main Features	17
1.6 Typical Configurations	18
Chapter 2 Installation	20
2.1 Safety Regulations	20
2.2 Preparation	20
2.3 Mechanical Installation	22
2.3.1 Disassembling On Site	25
2.3.2 Opening And Closing Cabinet Door	28
2.4 Electrical Installation	29
2.4.1 Installing Power Subrack	29
2.4.2 Installing Rectifier	29
2.4.3 Installing Battery	30
2.4.4 Connecting Cables	31
2.4.5 Sealing Cable Entry Holes	34
2.4.6 Installing Base Cover Plate (Optional)	35
2.5 Installation Check	36
Chapter 3 Testing	37
3.1 Power-on	37
3.2 System Operation Status Check	37
3.3 Final Steps	38
Chapter 4 Maintenance	39
4.1 Routine Maintenance	39
4.2 Replacing Parts	40
4.2.1 Replacing Fan	40
4.2.2 Replacing Heater	41
4.2.3 Replacing Heat Exchanger	42

4.2.4 Replacing Air Conditioner	42
4.2.5 Replacing LED Lamp.....	43
4.2.6 Replacing Micro Switch	44
Appendix 1 Spare Part List.....	45
Appendix 2 Schematic diagram.....	46
Appendix 3 Wiring diagram	50
Appendix 4 Glossary	54

Chapter 1 Overview

ECM3 series integrated outdoor power system ('power system' for short) has 11 models, see Table 1-1 for details.. The power system is specially used in outdoor to provide outdoor protection and operating environment for power supplies and communication equipment. The power system is configured with thermal control unit, power subrack and AC socket for user.

This chapter introduces the composition & configuration, technical parameters, operating principles and main features of the power system.

Table 1-1 shows the cabinet type and dimensions.

Table 1-1 Cabinet type and dimensions

Cabinet model	Thermal control type	Dimensions (W × D × H)
ECM3-E18H-2/1	Heat exchanger	800mm × 800mm × 1800mm
ECM3-E18A-4/1	Air conditioner	800mm × 800mm × 1800mm
ECM3-E18A-4/2		650mm × 650mm × 1800mm
ECM3-P18M-1/1	Heat exchanger + air conditioner	800mm × 800mm × 1800mm
ECM3-B18A-1/1	Air conditioner type battery cabinet	800mm × 800mm × 1800mm
ECM3-B18A-8/2		650mm × 650mm × 1800mm
ECM3-E14H-1/1	Heat exchanger	800mm × 800mm × 1400mm
ECM3-E14A-4/1	Air conditioner	800mm × 800mm × 1400mm
ECM3-E14A-4/2		650mm × 650mm × 1400mm
ECM3-B14A-1/1	Air conditioner type battery cabinet	800mm × 800mm × 1400mm
ECM3-B14A-8/2		650mm × 650mm × 1400mm

1.2 Composition & Configuration

Composition

The power system consists of thermal control unit, power subrack, distribution unit and relevant mechanical parts. There are three types of thermal control units for use to select: heat exchanger, air conditioner, and heat exchanger + air conditioner.

Configuration of 1.8m cabinet

1. See Table 1-2 for the configuration of ECM3-E18H-2/1 power system.

Table 1-2 Configuration of ECM3-E18H-2/1 power system

Component		Configuration
Thermal control unit	Heat exchanger	1 set, standard configuration (max. heat exchanging capacity: 190W/K)
Lighting Unit	LED lamp	1 set, standard configuration
	Micro switch	
Power subrack	NetSure 731 power subrack	1 set, standard configuration
AC socket (for user)		One 10A single-phase AC socket (standard configuration)
Environment monitoring	FSU	1 set, optional
	Temperature & humidity sensor	
	Smoke sensor	
	Water-logging sensor	
AC distribution unit		1 set, optional
DC distribution unit		1 ~ 2 sets, optional
Heating unit		2 set, optional, power: 1260W

The structure of ECM3-E18H-2/1 power system is shown in Figure 1-1.

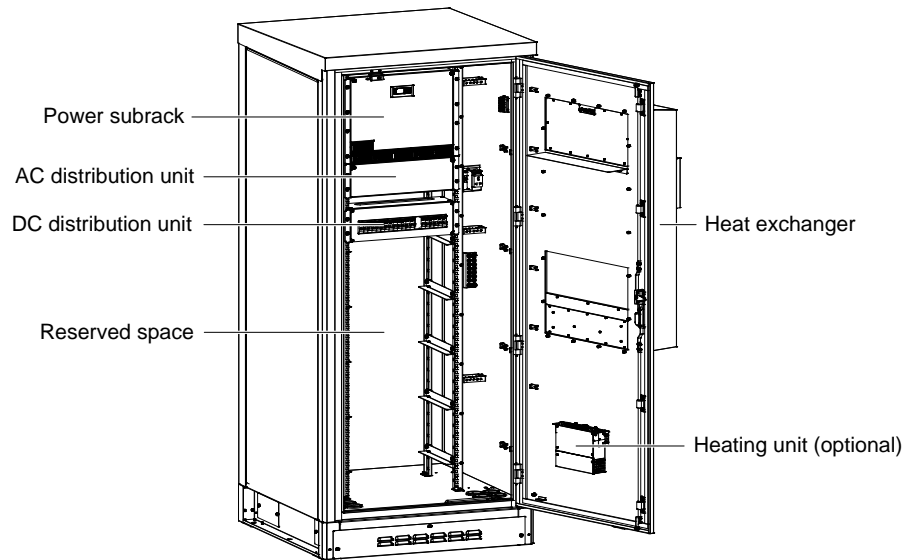


Figure 1-1 Structure of ECM3-E18H-2/1 power system

2. The configuration of ECM3-E18A-4/1 is same as that of ECM3-E18A-4/2, see Table 1-3 for details.

Table 1-3 Configuration of ECM3-E18A-4/1 and ECM3-E18A-4/2 power system

Component		Configuration
Thermal control unit	Intelligent outdoor air conditioner	1 set, cooling capacity: 1500W, no heating function
	Emergency ventilation unit	1 set, max. heat exchanging capacity: 1000W (temperature difference between indoor and outdoor cabinet is 10°C)
Lighting Unit	LED lamp	1 set, standard configuration
	Micro switch	
Power subrack	NetSure 731 power subrack	1 set, optional
AC socket (for user)	One 10A single-phase AC socket	1 set, standard configuration
Environment monitoring	FSU	1 set, optional
	Temperature & humidity sensor	
	Smoke sensor	
	Water-logging sensor	
AC distribution unit		1 set, optional
DC distribution unit		1 ~ 2 sets, optional

The structure of ECM3-E18A-4/1 power system is same as that of ECM3-E18A-4/2 power system, as shown in Figure 1-2.

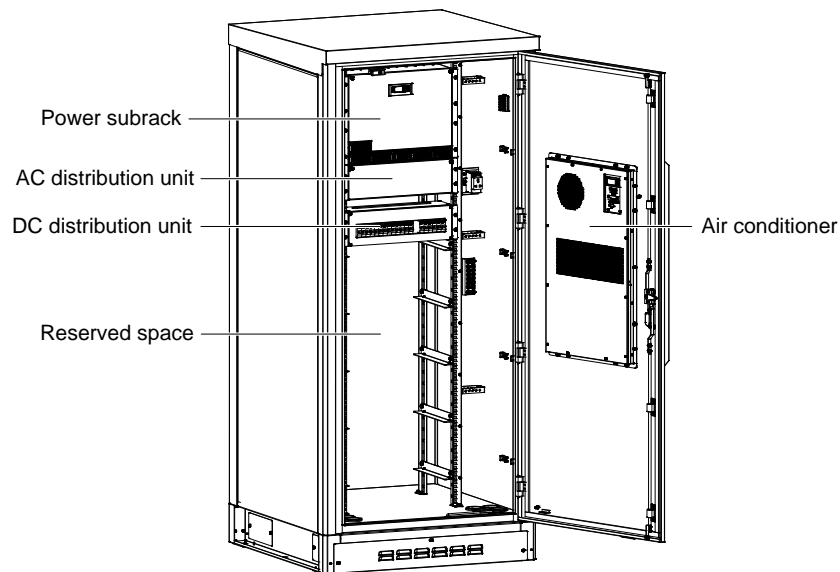


Figure 1-2 Structure of ECM3-E18A-4/1 and ECM3-E18A-4/2 power system

3. See Table 1-4 for the configuration of ECM3-P18M-1/1 power system.

Table 1-4 Configuration of ECM3-P18M-1/1 power system

Component		Configuration
Thermal control unit (equipment compartment)	Heat exchanger	1 set, max. heat exchanging capacity: 80W/K
Thermal control unit (battery compartment)	Intelligent outdoor air conditioner	1set, cooling capacity: 300W; no heating function
Lighting Unit	LED lamp	1 set, standard configuration
	Micro switch	
Power subrack	NetSure 731 power subrack	1 set, optional
AC socket (for user)	One 10A single-phase AC socket	1 set, standard configuration
Environment monitoring	FSU	1 set, optional
	Temperature & humidity sensor	
	Smoke sensor	
	Water-logging sensor	
AC distribution unit		1 set, optional
DC distribution unit		1 set, optional
Heating unit in equipment compartment		1 set, optional, power: 600W
Note: The battery compartment space is reserved, standardly configured with two groups of battery		

The structure of ECM3-P18M-1/1 power system is shown in Figure 1-3.

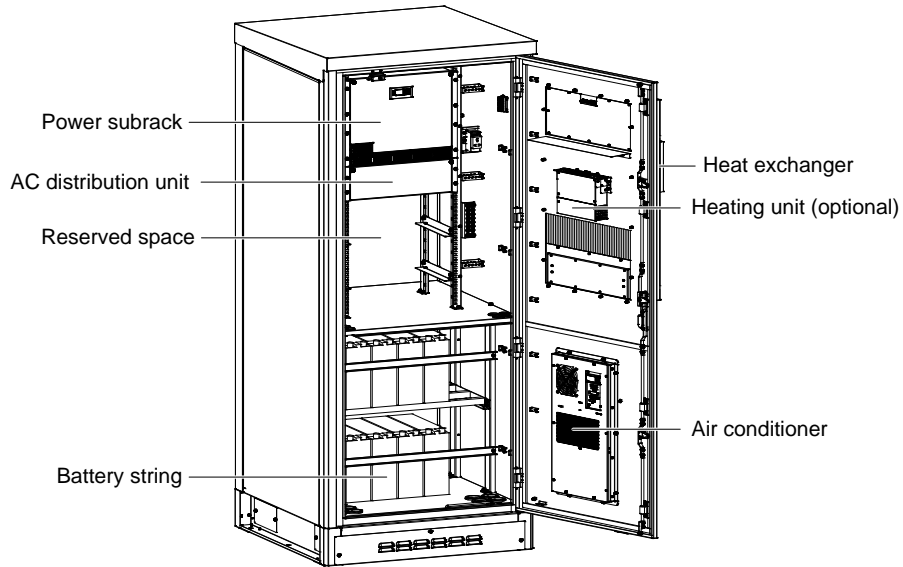


Figure 1-3 Structure of ECM3-P18M-1/1 power system

4. The configuration of ECM3-B18A-1/1 is same as that of ECM3-B18A-8/2, see Table 1-5 for details.

Table 1-5 Configuration of ECM3-B18A-1/1 and ECM3-B18A-8/2 power system

Component name		Configuration
Thermal control unit in battery compartment	Intelligent outdoor air conditioner	1 set, 300W cooling capacity, no heating function
Lighting unit	LED lamp	1 set, standard configuration
	Micro switch	
Environment monitoring	Infrared sensor	1 set, optional
	Temperature & humidity sensor	
	Smoke sensor	
	Water-logging sensor	
Note: The battery compartment space is reserved, standardly configured with four groups of battery		

The structure of ECM3-B18A-1/1 power system is same as that of ECM3-B18A-8/2 power system, as shown in Figure 1-4.

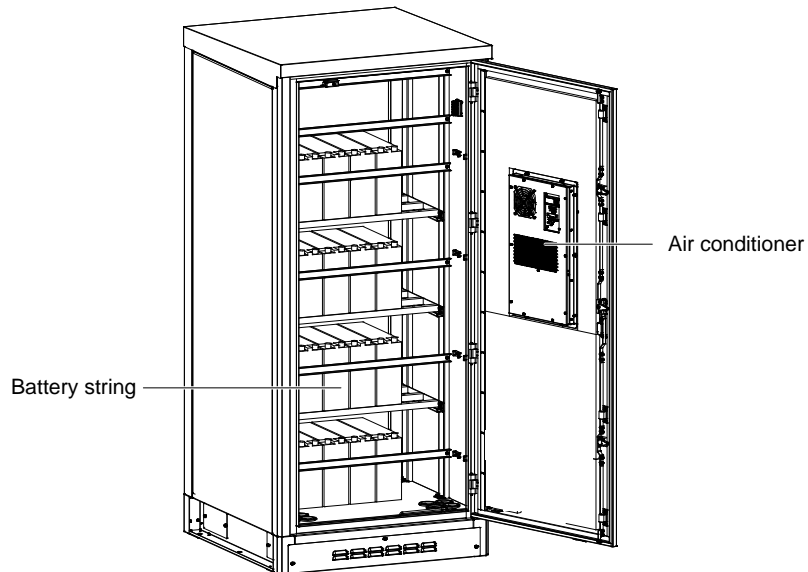


Figure 1-4 ECM3-B18A-1/1 and ECM3-B18A-8/2 power system

Configuration of 1.4m cabinet

5. See Table 1-6 for the configuration of ECM3-E14H-1/1 power system.

Table 1-6 Configuration of ECM3-E14H-1/1 power system

Component name		Configuration
Thermal control unit	Heat exchanger	1 set, standard configuration (max. heat exchanging capacity: 80W/K)
Lighting unit	LED lamp	1 set, standard configuration
	Micro switch	
Power subrack	NetSure 731 power subrack	1 set, optional
AC socket (for user)	One 10A single-phase AC socket	1 set, standard configuration
Environment monitoring	FSU	1 set, optional
	Temperature & humidity sensor	
	Smoke sensor	
	Water-logging sensor	
AC distribution unit		1 set, optional
DC distribution unit		1 set, optional
Heating unit		1 set, optional, power: 600W

The structure of ECM3-E14H-1/1 power system is shown in Figure 1-5.

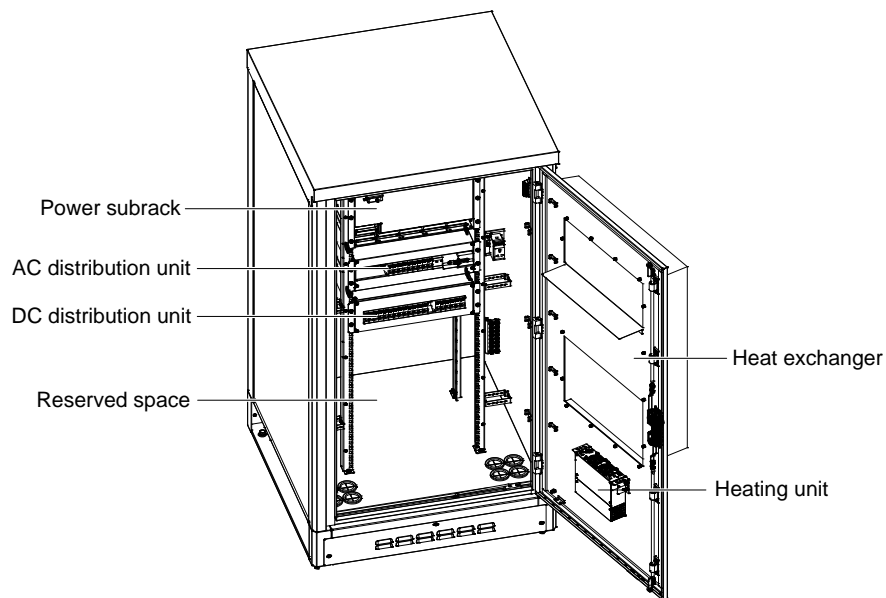


Figure 1-5 ECM3-E14H-1/1 power system

6. The configuration of ECM3-E14A-4/1 power system is same as that of ECM3-E14A-4/2 power system, see Table 1-7 for details.

Table 1-7 Configuration of ECM3-E14A-4/1 and ECM3-E14A-4/2 power system

Component name		Configuration
Thermal control unit	Intelligent outdoor air conditioner	1 set, cooling capacity: 1500W, no heating function
Lighting unit	LED lamp	1 set, standard configuration
	Micro switch	
Power subrack	NetSure 731 power subrack	1 set, optional
AC socket (for user)	One 10A single-phase AC socket	1 set, standard configuration
Environment monitoring	FSU	1 set, optional
	Temperature & humidity sensor	
	Smoke sensor	
	Water-logging sensor	
AC distribution unit		1 set, optional
DC distribution unit		1 set, optional

The structure of ECM3-E14A-4/1 power system is same as that of ECM3-E14A-4/2 power system, as shown in Figure 1-6.

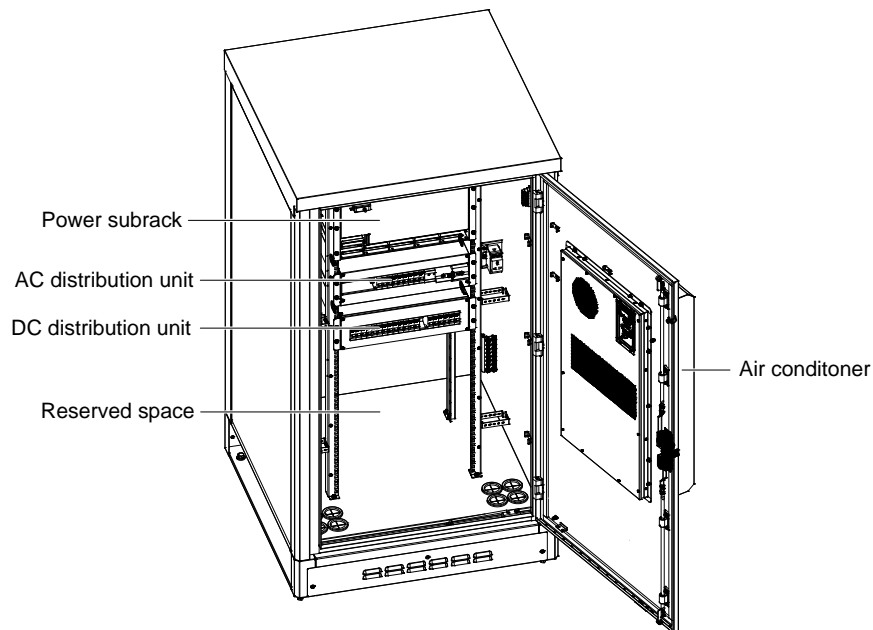


Figure 1-6 ECM3-E14A-4/1 and ECM3-E14A-4/2 power system

7. The configuration of ECM3-B14A-1/1 power system is same as that of ECM3-B14A-8/2 power system, see Table 1-8 for details.

Table 1-8 Configuration of ECM3-B14A-1/1 and ECM3-B14A-8/2 power system

Component name		Configuration
Thermal control unit	Intelligent outdoor air conditioner	1 set, cooling capacity: 300W, no heating function
Lighting unit	LED lamp	1 set, standard configuration
	Micro switch	
Environment monitoring	Infrared sensor	1 set, optional
	Temperature & humidity sensor	
	Smoke sensor	
	Water-logging sensor	
Note: The battery compartment space is reserved, standardly configured with two groups of battery		

The structure of ECM3-B14A-1/1 power system is same as that of ECM3-B14A-8/2 power system, as shown in Figure 1-7.

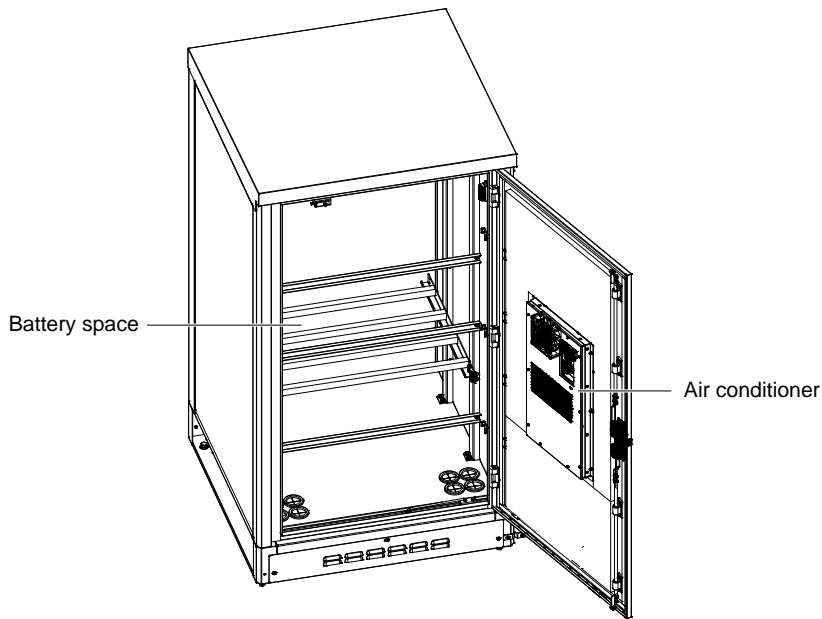


Figure 1-7 ECM3-B14A-1/1 and ECM3-B14A-8/2 power system

8. Internal space configuration of power system.

Take 1.8m tri-cabinet three-user power system (configured with 300A power subrack) as an example, the internal layout of the power system is shown in Figure 1-8.

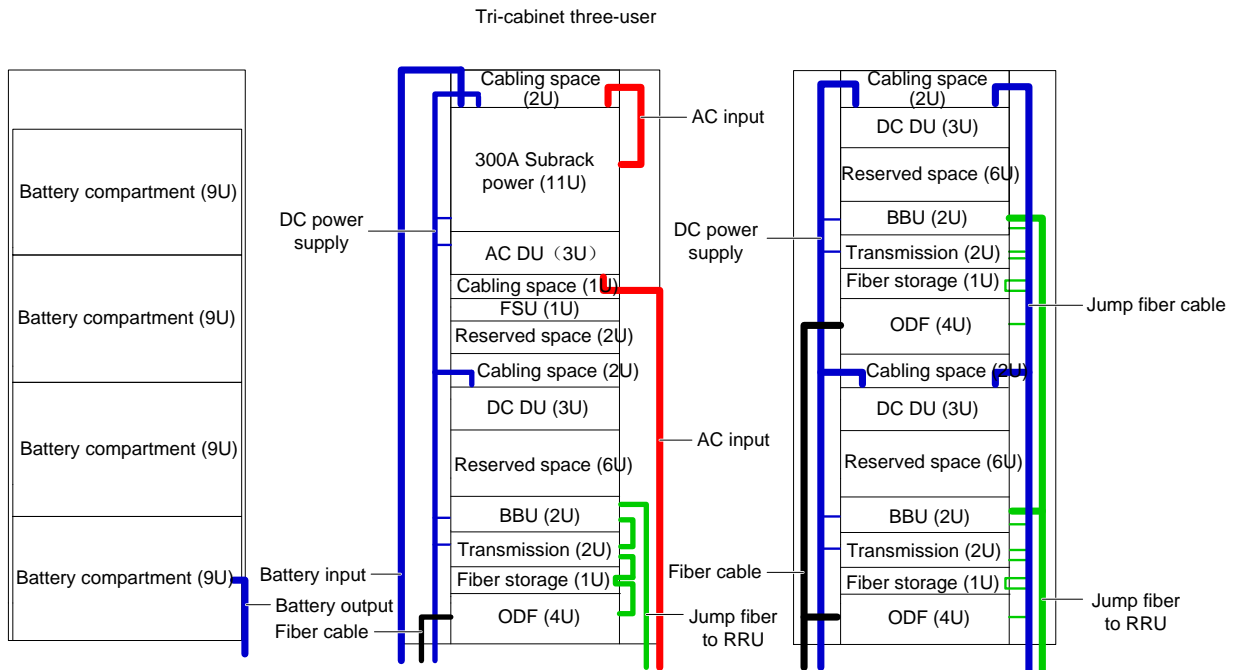


Figure 1-8 Internal space layout of 1.8m cabinet power system

The 1.8m battery cabinet can be configured with four battery strings at most. For integrated cabinet, max. two battery strings can be configured in the battery compartment, and the equipment compartment can be configured with AC distribution unit (AC DU for short) and DC distribution unit (DC DU for short) according to your need. For different configuration, the user equipment space is different, respectively shown in Table 1-9 and Table 1-10.

Table 1-9 Internal space configuration list of 1.8m cabinet

Configuration of battery layers, AC DU and DC DU		User equipment space
Two layers of battery compartment	With AC DU and DC DU	3U ~ 6U
	Without AC DU and DC DU	10U ~ 13U

Table 1-10 Internal space configuration list of 1.8m equipment cabinet

Configuration of power subrack, AC DU and DC DU		User equipment space
With power subrack	With AC DU and DC DU	20U ~ 23U
	Without AC DU and DC DU	27U ~ 30U
Without power subrack	With DC DU	30U ~ 35U
	Without DC DU	40U

Take 1.4m tri-cabinet three-user power system (configured with 300A power subrack) as an example, the internal layout of the power system is shown in Figure 1-9.

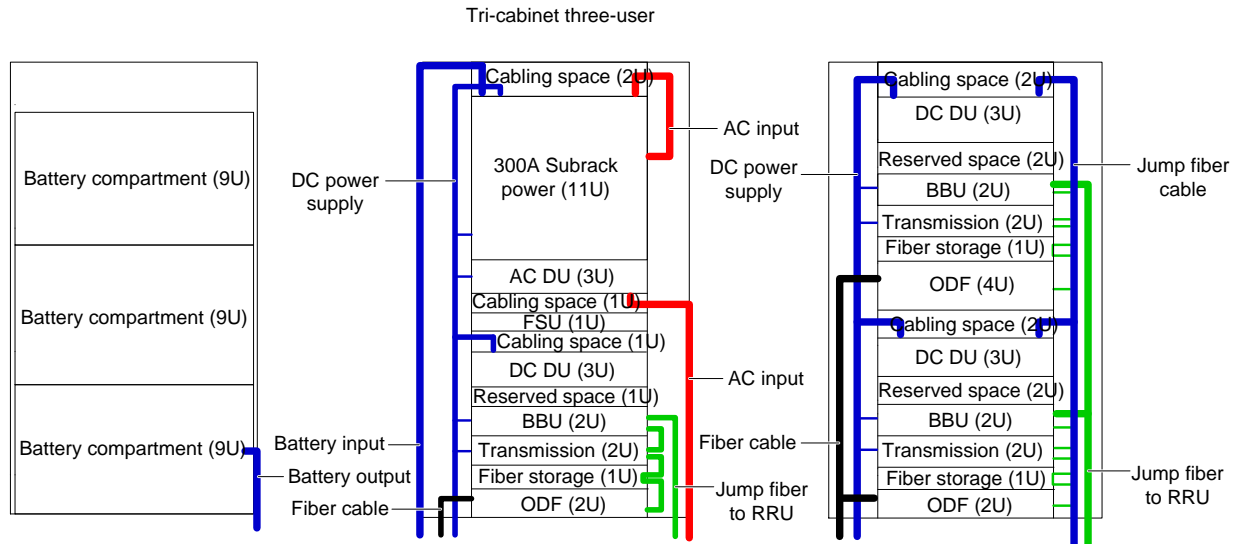


Figure 1-9 Internal space layout of 1.4m cabinet power system

The 1.4m battery cabinet can be configured with three battery strings at most. For equipment cabinet, the power subrack, AC distribution unit (AC DU for short) and DC distribution unit (DC DU for short) can be configured according to your need. For different configuration, the user equipment space is different, as shown in Table 1-11.

Table 1-11 Internal space configuration list of 1.4m equipment cabinet

Configuration of power subrack, AC DU and DC DU		User equipment space
With power subrack	With AC DU and DC DU	10U ~ 13U
	Without AC DU and DC DU	17U ~ 20U
Without power subrack	With DC DU	20U ~ 25U
	Without DC DU	30U

1.2.1 Power subrack

NetSure 731 A41-S7, Netsure 731 A61-S2 and NetSure 731 A61-S3 subrack power supplies are optional for the power system. You can choose either one according to the actual power distribution requirement.

The layout of Netsure 731 A61-S2 and NetSure 731 A61-S3 power subrack are generally the same, an B-level SPD is added to S2 based on the S3 structure, therefore, take Netsure 731 A61-S2 for example, the internal structure of

the power subrack is shown in Figure 1-10. The structure of NetSure 731 A41-S7 power subrack is shown in Figure 1-11.

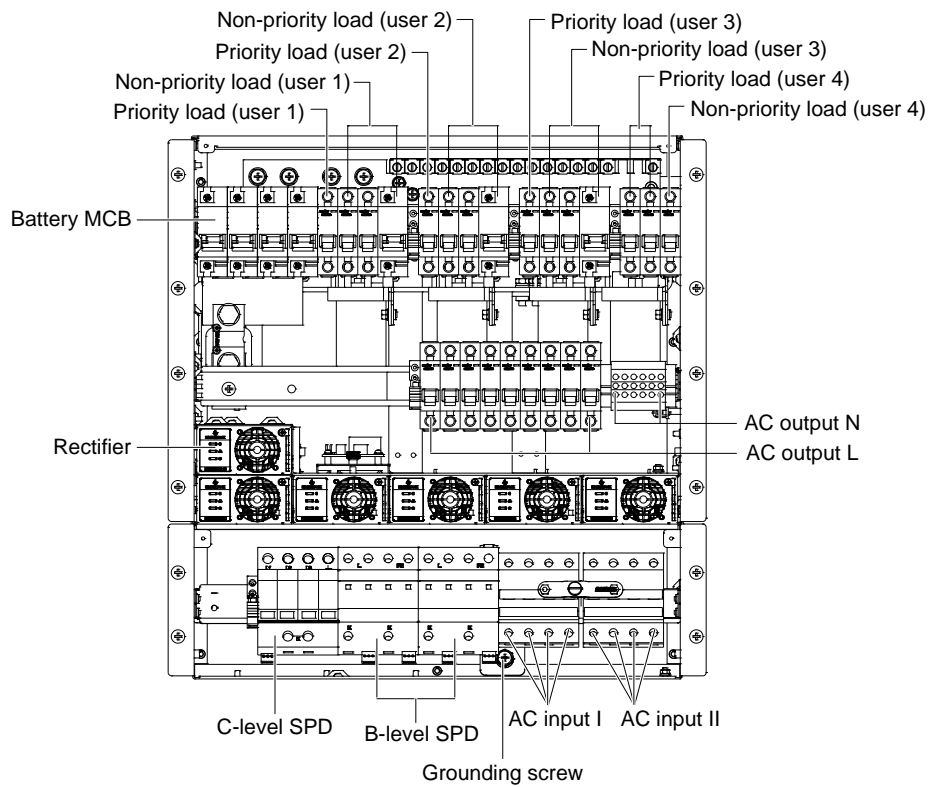


Figure 1-10 NetSure 731 A61-S2 power subrack

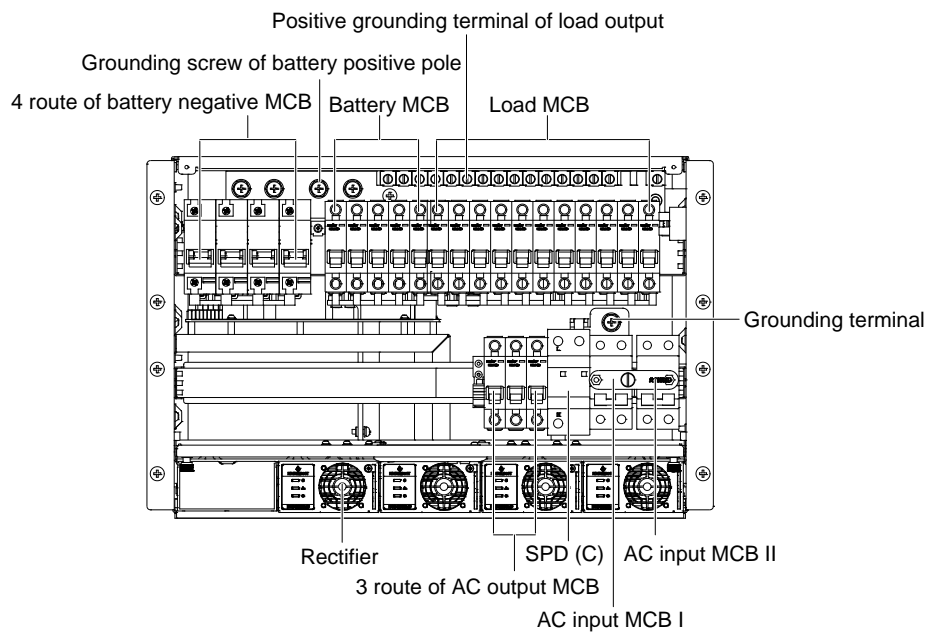


Figure 1-11 NetSure 731 A41-S7 power subrack

The technical parameters of the power subrack are described in Table 1-12.

Table 1-12 Technical parameters of power subrack

Parameter	Configuration	Parameter	Configuration
Controller	Model: M530S	AC distribution	3-phase input
Rectifier	Model: R48-3000e3 Netsure 731 A61-S2 max. configuration: 6; Netsure 731 A61-S3 max. configuration: 6 Netsure 731 A41-S7 max. configuration: 4	DC distribution	Netsure 731 A61-S2, S3: Priority load (PL): User 1 ~ 3: MCB: 25A/1P × 1 User 4: MCB: 10A/1P × 2 Non-priority load (NPL): User 1 ~ 3 MCB: 125A/1P × 1+16A/1P × 1+6A/1P × 1 User 4: MCB: 63A/1P × 1 Netsure 731 A41-S7: Priority load (PL): MCB: 25A/1P × 3+10A/1P × 2 Non-priority load (NPL): MCB: 32A/1P × 8 + 16A/1P × 2 + 6A/1P × 1
AC input MCB	Netsure 731 A61-S2,S3: 63A/4P × 2; Netsure 731 A41-S7: 63A/2P × 2	AC output MCB	Netsure 731 A61-S2,S3: 5 × 16A/1P, 4 × 10A/1P Netsure 731 A41-S7: 2 × 16A/1P, 1 × 10A/1P
Battery MCB	4 × 125A/1P		
AC SPD	1 piece (Netsure 731 A61-S2: B + C SPD)	DC SPD	1 piece
Controller mode after BLVD	Netsure 731 A61-S2,S3: Controller power on mode; Netsure 731 A41-S7: Controller power off mode		

Refer to *NetSure 731 A61 Subrack Power System User Manual* and *NetSure 731 A41 Subrack Power System User Manual* for the detailed technical parameters and configurations of the power subrack.

1.2.2 AC Distribution Unit (Optional)

The power system supports a three-phase or single-phase AC distribution unit (respectively see Figure 1-12 and Figure 1-13), and can work with the power subrack. You may choose to configure as required.

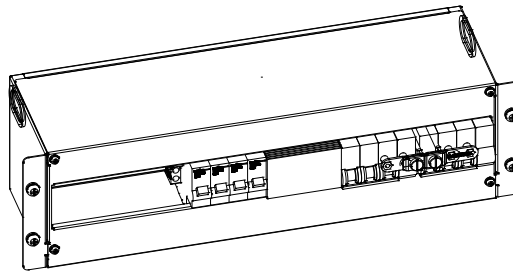


Figure 1-12 Three-phase AC distribution unit

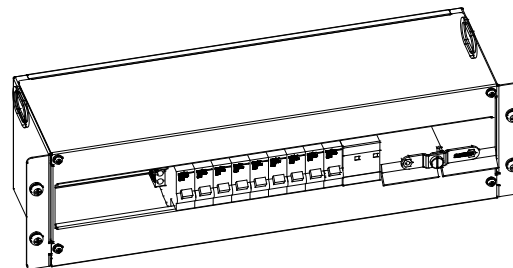


Figure 1-13 Single-phase AC distribution unit

AC distribution parameters and configurations are respectively given in Table 1-13 and Table 1-14.

Table 1-13 Three-phase AC distribution parameters and configurations

Category	Parameter name		Technical parameter
AC distribution	Three-phase	Input system	TN or TT system, double-route three-phase five wire
		Rated input voltage	Without an air conditioner: 346Vac ~ 433Vac With an air conditioner: 380Vac ~ 398Vac ($\pm 10\%$)
		Rated input current	50A (Max.)
		Input MCB	2 × 63A/4P (manually switch, with mechanical mutual interlock)
		AC SPD	60kA (Max.)
		AC output	2 × 16A/1P, 2 × 10A/1P

Table 1-14 Single-phase AC distribution parameters and configurations

Category	Parameter name		Technical parameter
AC distribution	Single-phase	Input system	TN or TT system, double-route single-phase three wire
		Rated input voltage	Without an air conditioner: 200Vac ~ 250Vac With an air conditioner: 220Vac ~ 230Vac ($\pm 10\%$)
		Rated input current	95A (Max.)
		Input MCB	2 × 125A/2P (manually switch, with mechanical mutual interlock)
		AC SPD	60kA (Max.)
		AC output	5 × 16A/1P, 4 × 10A/1P

1.2.3 DC Distribution Unit (Optional)

The power system supports a DC distribution unit (see Figure 1-14), and can work with the power subrack. You may choose to configure as required.

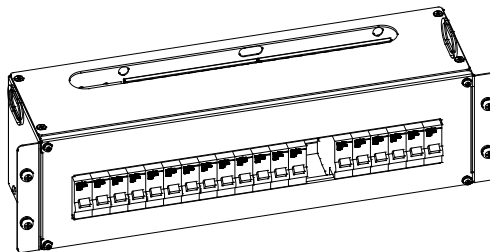


Figure 1-14 DC distribution unit

DC distribution parameters and configurations are given in Table 1-15.


Table 1-15 DC distribution parameters and configurations

Category	Parameter name	Technical parameter
DC distribution	Rated input voltage	53.5V
	Priority load	Total current $\leq 50A$
		16A/1P × 4, 10A/1P × 2
	Non-priority load	Total current $\leq 100A$
32A/1P × 12, 6A/1P × 1		

1.2.4 Environment Monitoring System (Optional)

The power system provides the FSU intelligent monitoring equipment, which controls environment parameter acquisition such as micro switch (optional), temperature and humidity (optional), smoke (optional), water-logging (optional), infrared (optional). In addition, it provides multiple routes of dry contact alarm port for user monitoring. Table 1-16 describes the definition of relevant ports.

Table 1-16 Ports silkprint and description

Silkprint	Description
	PE terminal
POWER 36-60VDC	Power input port, power input range: 36Vdc ~ 60Vdc
CONSOLE	Console port
12V	Output terminal of 12Vdc auxiliary power
AGND	Ground terminal of 12Vdc auxiliary power
V1+, V1M, V1- V2+, V2M, V2-	Total battery string voltage port. V1+, V2+: positive battery terminal; V1M, V2M: battery middle points; V1-, V2-: negative battery terminal
CH1 ~ CH8	AI1 ~ AI8, can be set to voltage, DC current or digital signal input channel
REL1 ~ REL4	Output common terminal of relays 1, 2, 3, 4
NO1 ~ NO4	Normally open node of relays 1, 2, 3, 4, can be set to normally closed node through internal jumpers
DI1 ~ DI12	DI port, can be voltage or digital signal input channel
DI13 ~ DI16	Water detection input
COM1 ~ COM9	Serial ports 1 ~ 9, supporting RS485 communication mode
COM10	Serial ports 10, supporting RS232 communication mode
CONSOLE	Port standard: RS232; baud rate:115200bps, N, 8, 1; non-isolation
Micro SD	Micro SD card slot, max. 32G Micro SD card can be inserted into the slot to expand the storage space of the monitoring equipment
USB	USB port, for connecting modem
LAN1/2/3/4	10M/100M self-adaptive Ethernet port

The FSU acquires power monitoring information through RS485 port, and uploads information of components such as heat exchanger and air conditioner through internal RS485 port. The FSU universally processes and transmits the information to user monitoring system through Ethernet remote communication port. The appearance and port position of the FSU are shown in Figure 1-15.

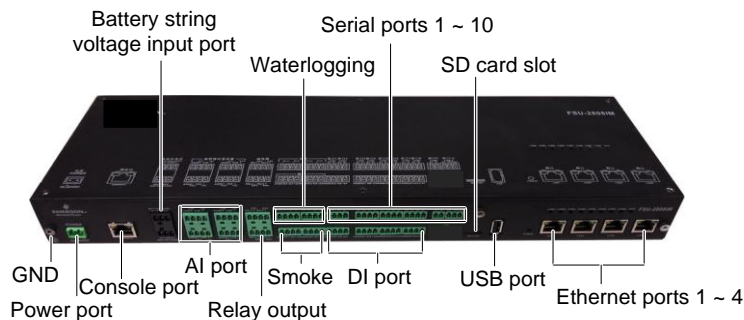


Figure 1-15 ECCUP appearance and port positions

For detailed technical parameters and configuration of FSU, please refer to *FSU-2808IM Monitoring Equipment Installation And Commissioning Manual*.

Sensor Introduction

- Micro switch

Each cabinet door can be configured with a micro switch. When the door is open, the system will generate a door open alarm. The appearance of the micro switch is shown in Figure 1-16.

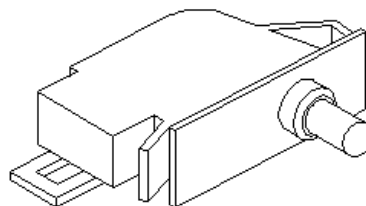


Figure 1-16 Appearance of micro switch

- Temperature & humidity sensor

A temperature & humidity sensor can be configured to each cabinet for detecting the temperature and humidity of internal cabinet, and providing temperature basis for the system running control. The appearance of the temperature & humidity sensor is shown in Figure 1-17.



Figure 1-17 Appearance of temperature & humidity sensor

- Smoke sensor

A smoke sensor can be selected for each cabinet. When an unexpected failure occurred in the system cabinet and producing smoke whose concentration reaches the sensor setting, the system will generate a smoke alarm. The appearance of the smoke sensor is shown in Figure 1-18.

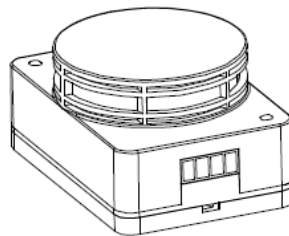


Figure 1-18 Appearance of smoke sensor

- Water-logging sensor

The system provides a water-logging sensor as an option, which can only be configured in the main cabinet. When the cabinet water level reaches the submerged position of that sensor, an water-logging alarm will be generated. The appearance of the water-logging sensor is shown in Figure 1-19.

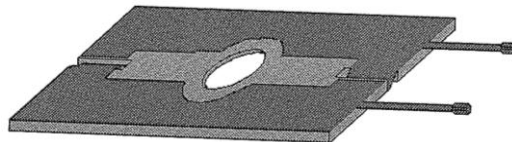


Figure 1-19 Appearance of water-logging sensor

- Infrared sensor

The system provides an infrared sensor as an option, which can only be configured in the battery cabinet. The appearance of the infrared sensor is shown in Figure 1-20.



Figure 1-20 Appearance of infrared sensor

1.2.5 Heating Unit (Optional)

The power system can be configured with a heating unit; its appearance is shown in Figure 1-21.

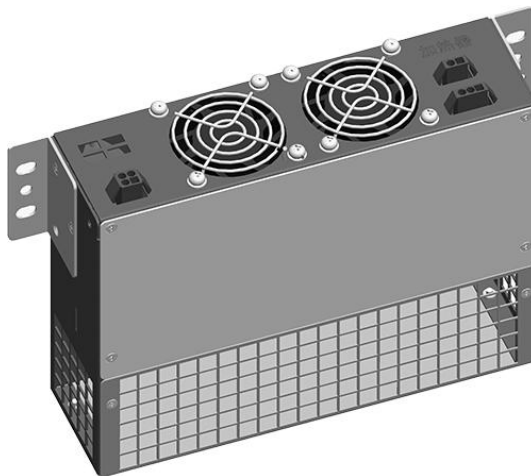


Figure 1-21 Appearance of heating unit

The heating unit consists of the Positive Temperature Coefficient (PTC) heater, fan, temperature relay, fuse and installation cover. It uses a built-in fan to release the heat produced by the heater to the cabinet, while the heater starts or stops automatically according to the cabinet temperature.

1.3 Technical Parameters

The technical parameters of the power system are listed in Table 1-17.

Table 1-17 Technical parameters of the power system

Parameter			Specifications	
Environment parameter	Temperature	Operating temperature	Without heating:-10°C ~ +45°C With heating: -40°C ~ +45°C	
		Storage temperature	-40°C ~ +70°C	
	Relative humidity	Operating relative humidity	5%RH ~ 95%RH (40°C ± 2°C)	
		Storage relative humidity	≤ 95%RH (40°C no condensation)	
	Altitude		≤ 2000m (derating is necessary above 2,000m; The maximum working temperature decreases 1°C when the altitude increases every 200m)	
	Solar radiation		1120W/m ²	
	Application environment		Over-voltage level: II; pollution level: 2	
	Noise		≤ 60dB (at a distance of 1.5m)	
Protection level		IP45		
Mechanical parameter	Dimensions (H x W x D)	Single cabinet	ECM3-18	1800mm x 800mm x 800mm 1800mm x 650mm x 650mm
			ECM3-14	1400mm x 800mm x 800mm 1400mm x 650mm x 650mm
Mechanical parameter	Dimensions (H x W x D)	Battery compartment	ECM3-18	Independent battery compart: Four layers in total: 355mm x 780mm x 580mm/layer (1800mm x 800mm x 800mm); 355mm x 630mm x 560mm/layer (1800mm x 650mm x 650mm) Battery compartment (equipment + battery): Two layers in total: 330mm x 780mm x 580mm/layer (1800mm x 800mm x 800mm)

Parameter				Specifications
Mechanical parameter	Dimensions (H × W × D)	Battery compartment	ECM3-14	Independent battery compart: Two layers in total: 542mm × 780mm × 580mm/layer (1400mm × 800mm × 800mm) 542mm × 630mm × 560mm/layer (1400mm × 650mm × 650mm)
Mechanical parameter	Dimensions (H × W × D)	User equipment space	ECM3-18	Independent equipment compartment: 40U Equipment compartment (equipment + battery): 23U
			ECM3-14	Independent equipment compartment: 31U
	Weight	Single cabinet		ECM3-18: ≤ 280kg (including base and top cover, excluding power subrack and batteries) ECM3-14: ≤ 250kg (including base and top cover, excluding power subrack and batteries)

1.4 Operating Principles

There are multiple thermal control modes available in the system, such as heat exchanger, air conditioner and emergent ventilation.

Each cabinet has been configured with its own thermal control unit, which reports the relevant information through RS485 bus to FSU. To equalize the temperature of the cabinet, it is recommended to distribute the loads evenly from top to bottom, and reserve 2 ~ 3U at the top to maintain the smooth flow of air duct, for better heat dissipation.

1.4.1 Heat Exchanger

The power system with the heat exchanger dissipates heat through a door-mounted heat exchanger. The internal circulation is as follows: Hot air produced by the equipment goes in from the top, passes the heat exchanger, cools down, goes out from the bottom, and blows towards the equipment to cool the equipment. The external circulation is as follows: Cold air goes in from the bottom and goes out from the top, carrying away heat of the internal circulation and cooling down the user equipment. When at low temperature, the external circulation fan of the heat exchanger stops running, the heater in the heat exchanger generates heating power. Driven by the internal fan, the hot air circulates in the heat exchanger core, internal circulation outlet, user equipment and internal circulation air inlet. Figure 1-22 shows the wind direction.

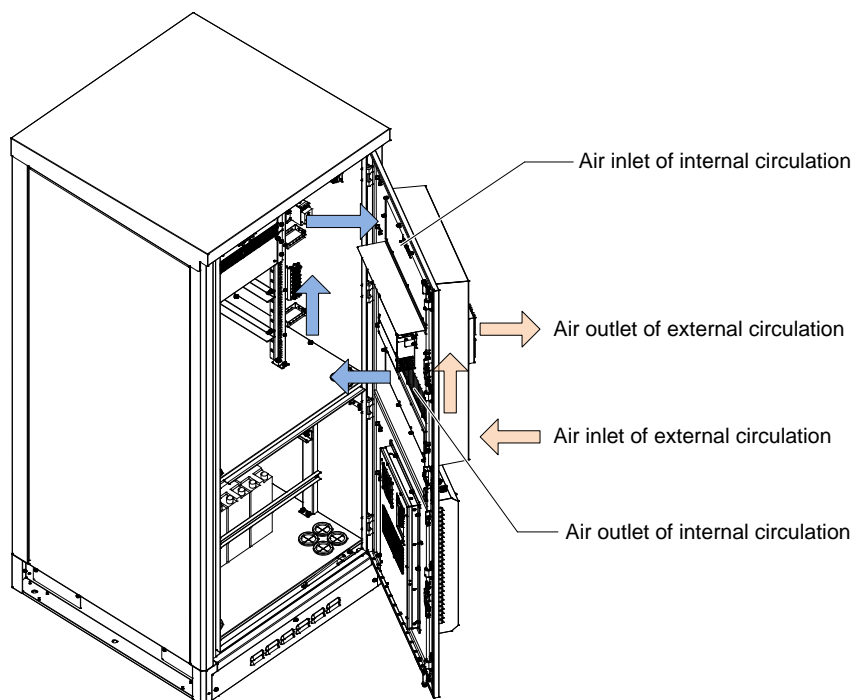


Figure 1-22 Heat dissipation theory of ECM3-P18M-1/1

The internal circulation fan keeps running and adjusts the speed according to the ambient temperature of inside cabinet. The external circulation fan starts and stops at preset temperature spots (the default start temperature is 35°C and the default stop temperature is 25°C). When running, the external circulation fan adjusts its speed according to the ambient temperature of inside cabinet. The heater starts at the preset temperature point (0°C by

default), and stops at the preset temperature point (10°C by default). The system provides two thermal control units for user to select, see Table 1-18 for specific parameters.

Table 1-18 Heating performance of heat exchanger

Type	Heating performance	
	Heat dissipation	Heating
80W/K heat exchanger	Meet 800W load, 10°C temperature difference between inside and outside cabinet	When selecting one group of heaters, the inside temperature of the 80W/K heat exchanger type cabinet can be heated from -40°C to 0°C within three hours; When selecting two group of heaters, the inside temperature of the 190W/K heat exchanger type cabinet can be heated from -40°C to 0°C within three hours
190W/K heat exchanger	Meet 1200W load, 10°C temperature difference between inside and outside cabinet	

1.4.2 Air Conditioner

The power system with an air conditioner refrigerates through a door-mounted air conditioner. The air conditioner internal circulation is as follows: Hot air is inhaled from the top, and cold air is expelled out from the bottom. The external circulation is as follows: External cold air is inhaled from the bottom, after heat exchanging, hot air is eliminated out from the top. The wind direction is shown in Figure 1-23.

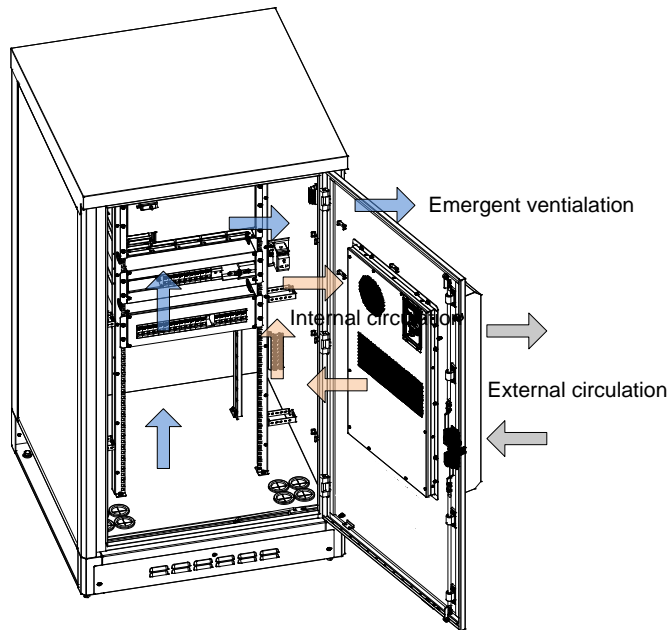


Figure 1-23 Heat dissipation theory of ECM3-E14A-4/1

Refrigeration and heating functions

The air conditioner starts refrigeration when inside cabinet temperature exceeds the refrigeration startup temperature point (35°C by default). The air conditioner stops refrigeration when the inside cabinet temperature is lower than the refrigeration stop temperature point (25°C by default). If the selected air conditioner with heating function, then the air conditioner starts heating when the inside cabinet temperature is lower than the heating startup temperature point (0°C by default), and stops heating when the inside cabinet temperature is higher than the heating stop temperature point (10°C by default).

Emergent ventilation function

Upon air conditioner failure or the inside temperature exceed the start temperature point of the emergent fan (45°C by default) and the outside temperature is lower than the inside temperature (3°C by default), the power system can automatically start the emergent fan for heat dissipation. The cold air is inhaled in at the bottom of cabinet door, after filtering by the filter; the cold air goes to user equipment, and the generated hot air is drawn out by the fan, so as to cool the user equipment under emergent circumstance.

Hydrogen exhausting function

For 300W air conditioner cabinet, its emergent fan functions as a hydrogen exhausting fan for a period (5 minutes by default) at a preset hydrogen exhausting interval (24 hours by default) to dilute concentration of hydrogen in the cabinet.

Performance parameter

The system provides two types of air conditioner for user selection, see Table 1-19 for specific parameters.

Table 1-19 Parameters of air conditioner

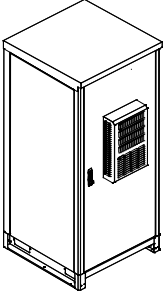
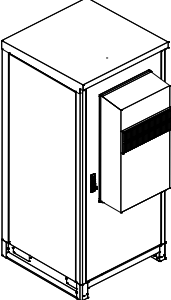
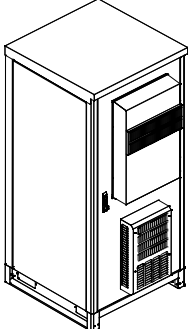
Type	Heating performance	
	Cooling	Heating
300W air conditioner	Under L35/L45 conditioner, meets 600Ah battery heating power	In the battery compartment of general cabinet, if the selected air conditioner with heating function, then the inside temperature can be heated from -40°C to -0°C within two hours; In single battery cabinet, if the selected air conditioner with heating function, then the inside temperature can be heated from -20°C to -5°C within two hours; If it needs to meet -40°C ambient temperature, another group of heater (630W) should be selected
1.5kW air conditioner + emergent ventilation (optional)	Under L35/L45 conditioner, meets 1000W load	If the selected air conditioner with heating function, then the inside temperature can be heated from -40°C to -5°C within two hours

1.5 Main Features

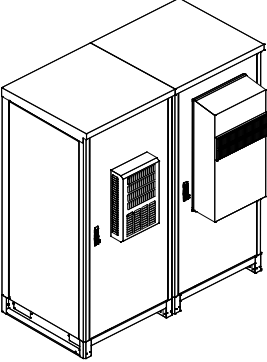
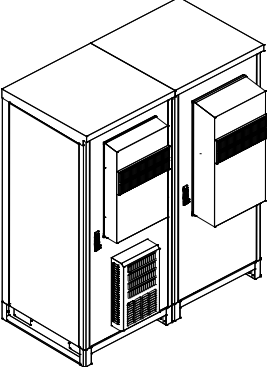
- Flexible configuration, applicable to various thermal control modes and user equipment.
- Easy to disassemble and install onsite, meeting various installation site requirements.
- Protection index: meet the requirement of IP45.
- Lighting: LED lamp configured, easy to maintain.
- Thermal control unit: adjustable according to temperature changes, energy saving.
- Complete environment monitoring system: monitoring the power system, thermal control unit, and environment parameters; uploading alarms.

1.6 Typical Configurations

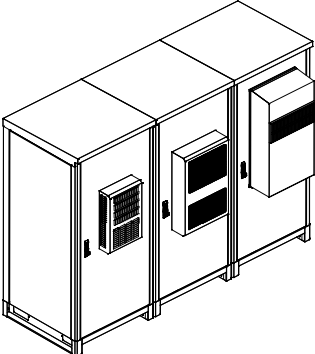
● Single cabinet system

	<ul style="list-style-type: none"> ● Used as independent battery compartment ● Classified into 300W air conditioner according to temperature control modes ● Supports 12V, 2V batteries and max. capacity is 600Ah
	<ul style="list-style-type: none"> ● Used as independent equipment compartment ● Classified into heat exchanger (80W/K, 190W/K), and air conditioner (1.5kW) according to temperature control modes ● Meet the installation requirements of ODF, DDF, BBU and BTS through configuring different racks
	<ul style="list-style-type: none"> ● Used as equipment and battery integrated compartment ● Battery compartment can be of 300W air conditioner; supporting two groups of 12V narrow type batteries and max. capacity is 300Ah ● Equipment compartment is of 80W/K heat exchanger type, can accommodate power supply, ODF, DDF and BBU

● Bi-cabinet system

	<ul style="list-style-type: none"> ● The left unit is used as battery compartment, and can be of 300W air conditioner ● The right unit is used as equipment compartment, and can be of heat exchanger (80W/K, 190W/K), or air conditioner(1.5kW) ● Battery cabinet can maximally support four groups of 12V narrow type batteries; for 1.8m battery cabinet, its max. capacity is 600Ah; for 1.4m battery cabinet, its max. capacity is 300Ah ● Equipment cabinet can accommodate power supply, ODF, DDF and BBU
	<ul style="list-style-type: none"> ● The left unit is used as battery and equipment integrated power compartment. The upper part is 80W/K heat exchanger, and can accommodate power supply and a few ODF, DDF, and BBU; the lower part is 300W air conditioner, and can accommodate battery. It supports 12V narrow type battery and max. capacity is 300Ah ● The right unit is used as equipment compartment, and can be of heat exchanger (190W/K) or air conditioner (1.5kW) type, and can meet the installation requirements of ODF, DDF, BBU, and BTS through configuring different racks

● Tri-cabinet system

	<ul style="list-style-type: none"> ● The left unit is used as battery compartment, and can be of 300W air conditioner type, and can accommodate battery. It supports 12V, 2V batteries and max. capacity is 600Ah ● The middle unit is usually 190W/K heat exchanger or 1.5kW air conditioner, which can meet the installation requirements of ODF, DDF, BBU and BTS through configuring different racks ● The right unit is used as equipment compartment, and can be of heat exchanger (190W/K), or air conditioner (1.5kW) type, and can meet the installation requirements of ODF, DDF, BBU, and BTS through configuring different racks
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Chapter 2 Installation

This chapter introduces installation and cable connection. Read the safety rules carefully before installation, and strictly follow the instructions provided in this chapter to carry out the installation and cable connection.

2.1 Safety Regulations

Certain components in this power system have hazardous voltage and current. To ensure personnel safety, always follow the instructions below:

1. Only trained personnel with adequate knowledge of the power system is allowed to carry out the installation. The *Safety Precautions* listed before the *Contents* of this manual and local safety rules in force have to be adhered to during installation.
2. All external circuits below -48V connected to the power system must comply with the SELV requirements defined in IEC 60950.
3. Do not operate or maintain the power system under thunderstorm or humid weather!
4. Make sure that the power system is powered off before any operation carried out within the system.
5. The power cables should be routed and protected properly, so that the cables are kept away from the operation and maintenance personnel.
6. Connect the field cable and tighten the screw according to the screwing torque shown in Table 2-1, to avoid torque too large or too small when tightening the cable.

Table 2-1 Screwing torque

Spec.	Screwing torque (unit:kg f · cm) (torque range: ±10%) (connection rating 4.8)
M5	30
M6	45
M8	110
M10	220
M12	390

2.2 Preparation

Unpacking inspection

The equipment should be unpacked and inspected after it arrives at the installation site. The inspection shall be done by representatives of both the user and Vertiv Tech Co., Ltd. To inspect the equipment, you should open the packing case, take out the packing list and check against the packing list. Then check the quantity and sequence number in the packing label, check if the equipment packing is correct, and check if the accessory quantity and model are correct, and check if the equipment is intact.

Preparing cables

The cable selection should meet relevant industry standards. It is recommended to use the RVVZ cables as AC cables. The cable should reach at least +70°C temperature durability. When the cable length is shorter than 30m, the CSA calculation should be based on the current density of 2.5A/mm². The suggested CSA value is not smaller than 16mm².

The CSA of DC cable depends on the current flowing through the cable and the allowable voltage drop. Select the battery cable CSA according to Table 2-2. Select the load cable CSA according to Table 2-3.

Table 2-2 Battery cable CSA selection

Battery MCB rated current	Max. battery current	Min. cable CSA	Max. cable length (allowable voltage drop: 0.5V)
125A	85A	25mm ²	14m
100A	70A	25mm ²	11m
63A	40A	16mm ²	7m

Note:

- The specifications are applicable at ambient temperature of 25°C. If the temperature is too high, the CSA of the cable should be increased.
- The battery cable should reach at least +90°C heat durability. It is recommended to use double-insulated copper-core flame retardant cable as battery cable

Table 2-3 Load cable CSA selection

Load route rated current	Max. output current	Min. cable CSA	Max. cable length (volt drop: 0.5V, with min. CSA)	Max. cable CSA	Max. cable length (volt drop: 0.5V, with max. CSA)
63A	32A	16mm ²	7m	25mm ²	11m
32A	16A	16mm ²	14m	25mm ²	22m
10A	5A	6mm ²	17m	25mm ²	71m

Note: The specifications are applicable at ambient temperature of 25°C. If the temperature is too high, the CSA of the cable should be increased

To prevent the MCB stop working upon over-load, the recommended MCB capacity is 1.5 to 2 times of load peak capacity.

The CSA of the system earth cable should be consistent with that of the max. power distribution cable and not less than 35mm².

Preparing tools

The installation tools are given in Table 2-4. The tools must be insulated and ESD-proof processed before they are used.

Table 2-4 Installation tools

Tool	Specification	Tool	Specification
Combination wrench (hatch, club)	Wrench set (10#, 13#, 16#, 18#, 21#)	Box wrench	16mm
Adjustable wrench	200mm	Cross screwdriver	100mm, 200mm
Electrician diagonal pliers	150mm	Slotted screwdriver	100mm, 200mm
Electrician sharp nose pliers	150mm	Wire cutters	Max. 300mm ²
Steel tape	5m	Hydraulic-pressure compaction pincher	Max. 300mm ²
Electric knife	Normal type	Digital multimeter	Three and a half bit digital display
Gradienter	Normal type	Impact electric drill	With Φ14 impact aiguille
Eye goggles	To prevent splash	Power socket	With 5m cable
Fireproof mud	Configured in the accessories	Safety shoes	To prevent puncture and for insulation
Hammer			

2.3 Mechanical Installation

Reserved space

Reserve the installation space according to Table 2-5.

Table 2-5 Reserved space

	Front	Top	Left	Right	Rear
Reserved space	≥1500mm	≥800mm	≥800mm	≥800mm	≥800mm

Installation procedures

1. Determine and mark the central point of each installation hole on the ground by referring to dimensions shown in Table 2-5, Figure 2-1 to Figure 2-4. Drill installation holes (depth: 70mm) at the marked positions by using a Φ16 drill. Clean the dust off the holes, and insert an expansion pipe into each installation hole. Note: The cement base should be at least 200mm higher than the ground and the horizontal error should be equal to or less than 5mm. The recommended concrete type is C25. See for parallel connector installation.

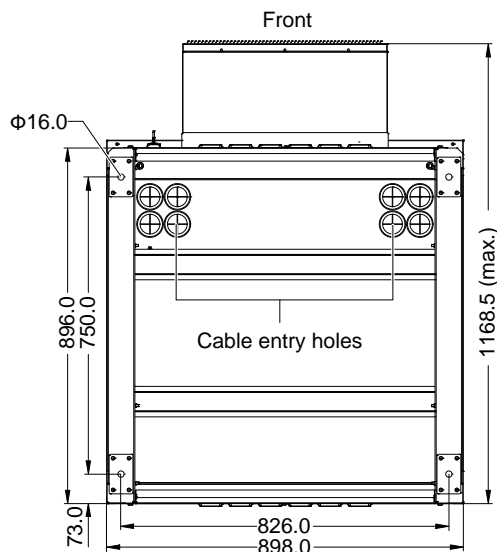


Figure 2-1 Installation dimensions (800mm x 800mm) of single cabinet base (Unit: mm)

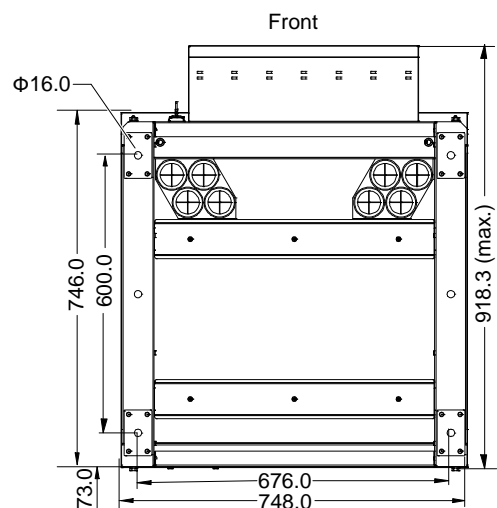


Figure 2-2 Installation dimensions (650mm x 650mm) of single cabinet base (Unit: mm)

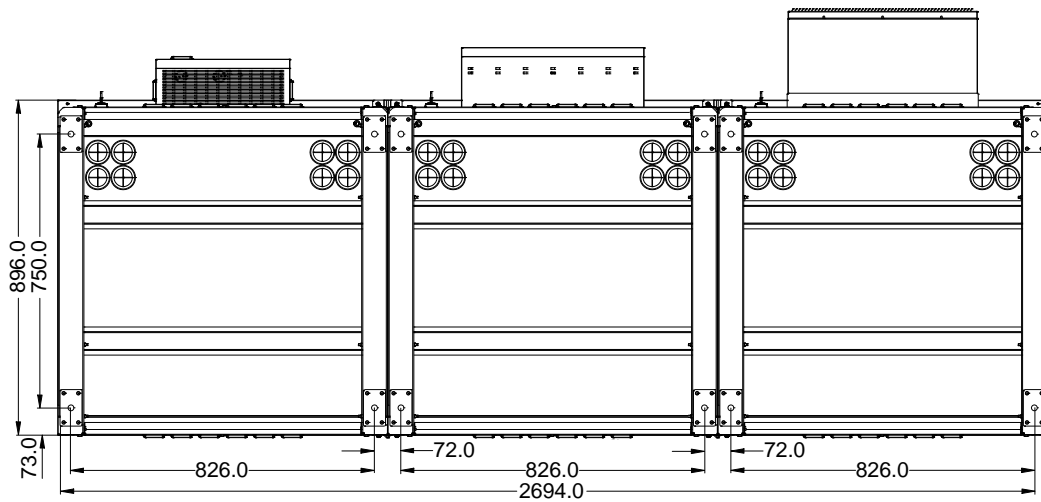


Figure 2-3 Installation dimensions (800mm x 800mm) of multi-cabinet base (Unit: mm)

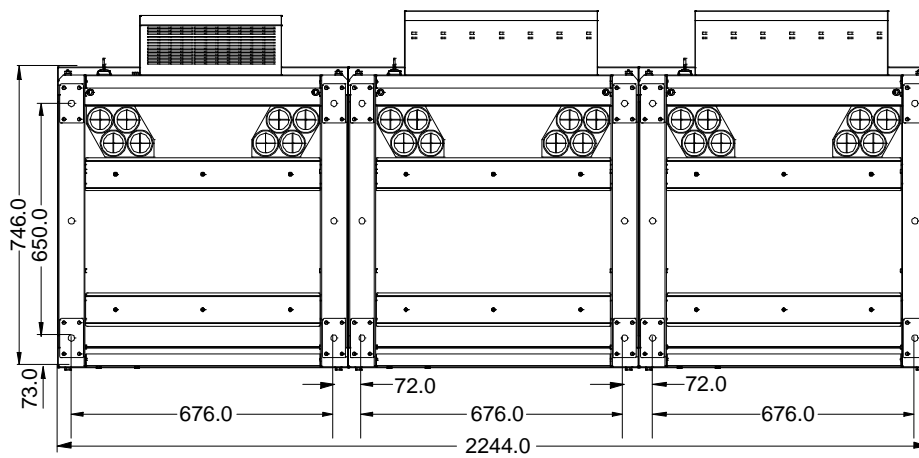


Figure 2-4 Installation dimensions (650mm x 650mm) of multi-cabinet base (Unit: mm)

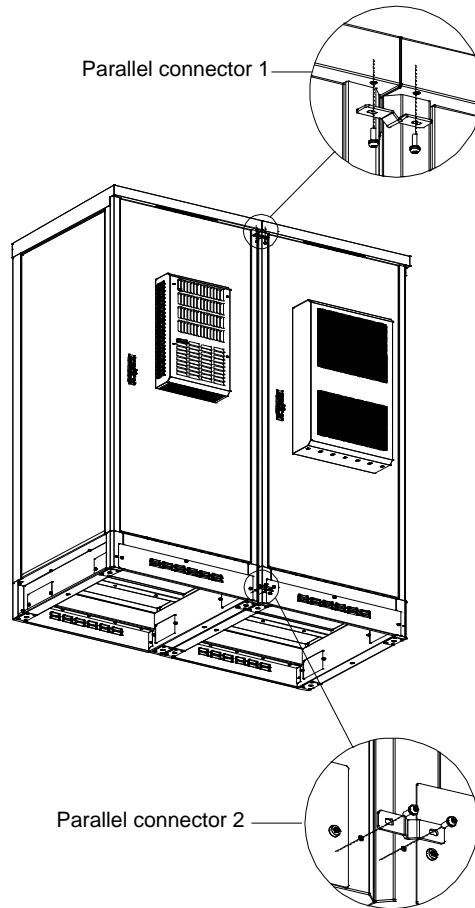


Figure 2-5 Installation of parallel connector

Move the cabinet to the installation position. Make the installation holes on the base coincide with those holes dug on the ground. Screw the M12 × 60 anchor bolts down into the expansion pipe in the floor, as shown in Figure 2-6.

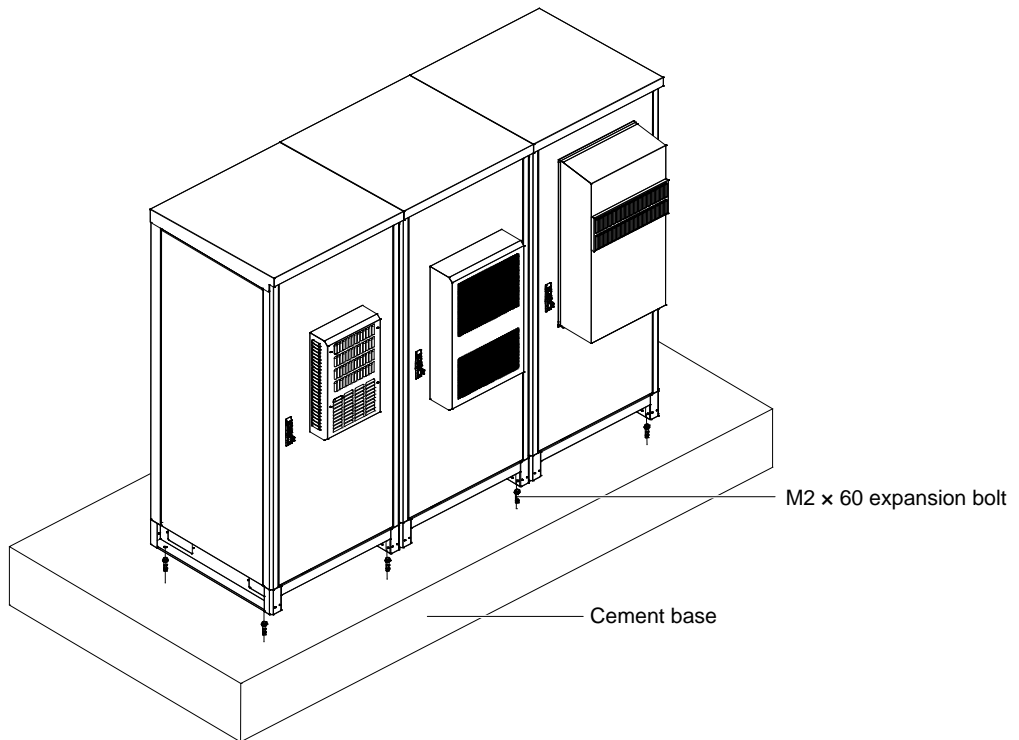


Figure 2-6 Fixing the cabinet

2.3.1 Disassembling On Site

After the cabinet arrives at the installation location, user needs to judge if the field condition is suitable for transporting and installing the power system, if yes, skip this section, if not, perform disassembling of the power system according to 2.3.1 *Disassembling On Site*.

This manual describes the disassembling processes with single cabinet as an example.

Note

1. Lay the packing paper on smooth ground, so that you can put disassembled parts on the paper.
2. When disassembling the power system, pay attention to avoid damaging the paint coat of parts. If the coat is damaged, you need to re-paint the parts.
3. During disassembling, store the screws safe. Do not use wrong screws in installation, and counter-sunk screws can only be used at the positions with counter-sunk holes. If any screw is missing, find a replacement of the same size.
4. Prepare ratchet wrench and 16# socket wrench to remove the M10 screws used to fix the main cabinet frame, the disassembling tools are shown in Figure 2-7.



Ratchet wrench



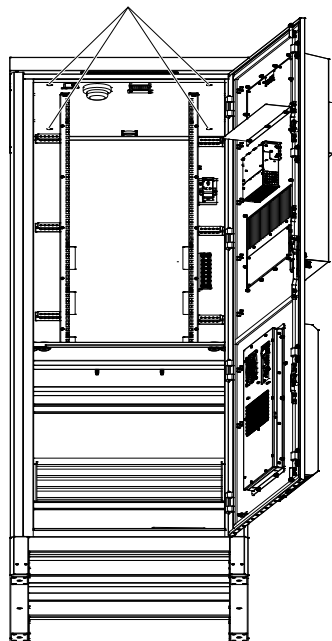
16# socket wrench

Figure 2-7 Disassembling tools

The procedures for disassembling the cabinet are as follows:

1. Lay the packing box on smooth ground, so that you can put disassembled parts on the box.
2. Disconnect all the connections between cabinets, including AC/DC power cables, RS485 communication cable and smoke sensor cable (if configured).
3. Disconnect all the cable connections between cabinet and cabinet door.
4. Disassemble top cover according to Figure 2-8.

1. Remove the four screws fixing the top cover from internal of the cabinet



2. Take off the top cover upward

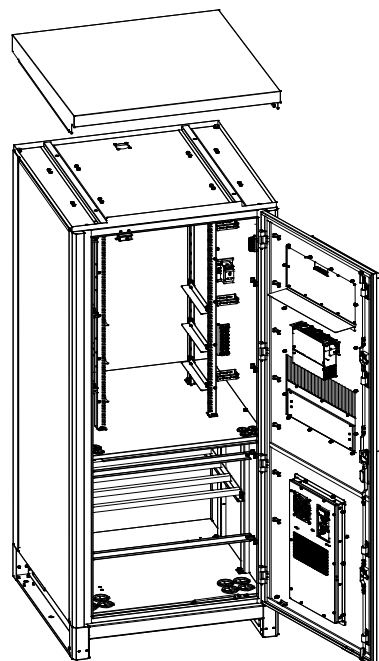


Figure 2-8 Disassembling top cover

5. Disassemble top frame kit.

- 1) Disassemble the two M12 screws used to fix the front part of the top frame kit and eight M6 screws used to connect the rack and top frame from internal cabinet.
- 2) Remove the two M12 screws used to fix the rear part of the top frame kit from the top of the cabinet, and then remove the top frame kit, as shown in Figure 2-9.

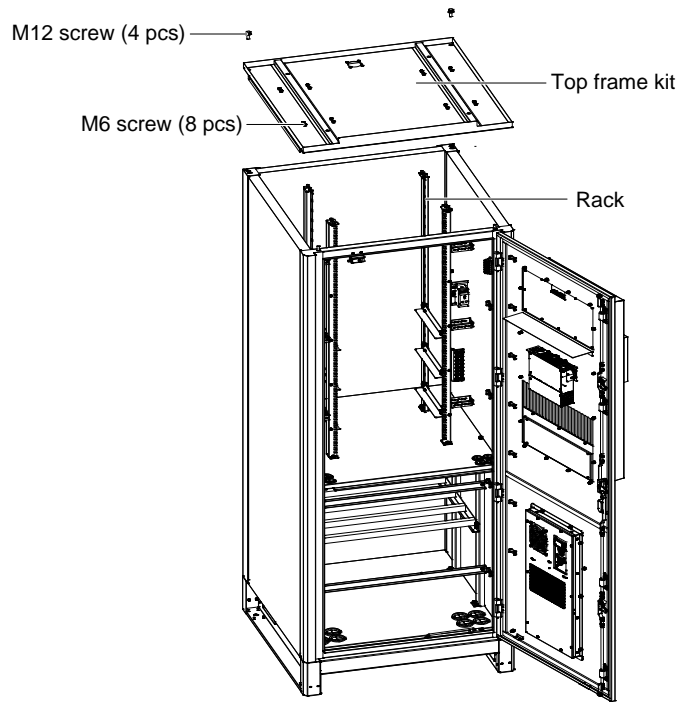


Figure 2-9 Disassembling top frame kit

6. Disassemble front frame and front door kit, as shown in Figure 2-10.

- 1) Remove the two M12 screws used to fix the bottom of the front frame from the internal of the cabinet.
- 2) Close and lock the front door, then disassemble the front frame and front door kit together.

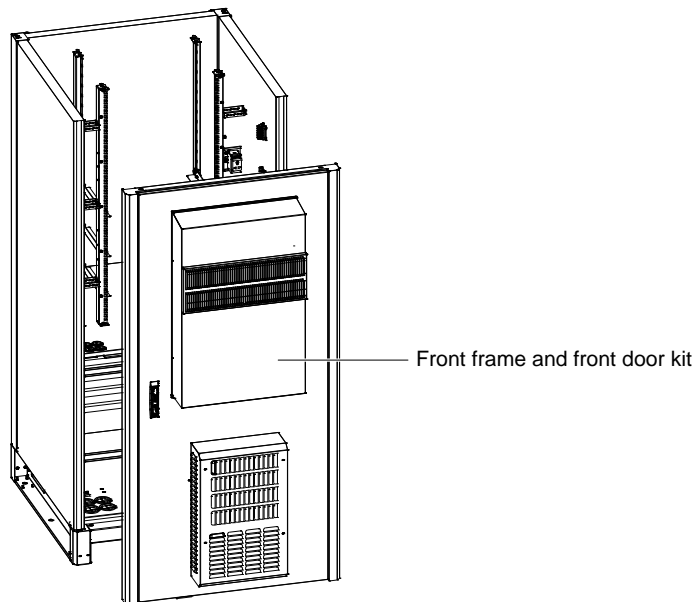


Figure 2-10 Disassembling front frame and front door kit

7. Disassemble the left and right side plates and remove them toward front, as shown in Figure 2-11.

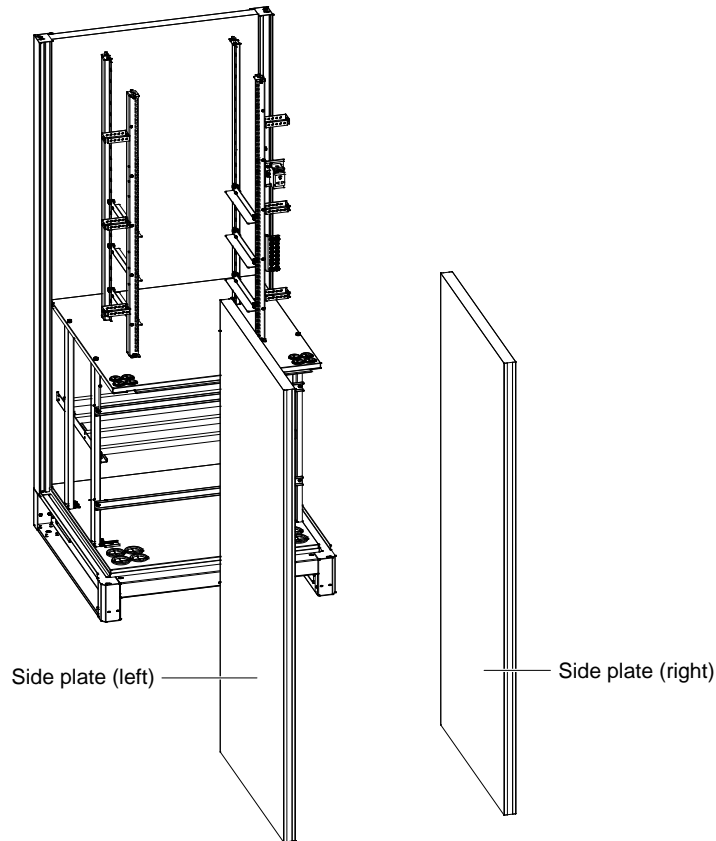


Figure 2-11 Disassembling side plates

8. Disassemble the rear frame kit and internal rack kit, as shown in Figure 2-12.

- 1) Remove the two M10 screws used to fix the rear frame from the rear bottom part of the bottom frame, then take off the rear frame kit upward.
- 2) Unscrew eight M6 screws used to fix the bottom of the internal rack kit, and then remove the internal rack.

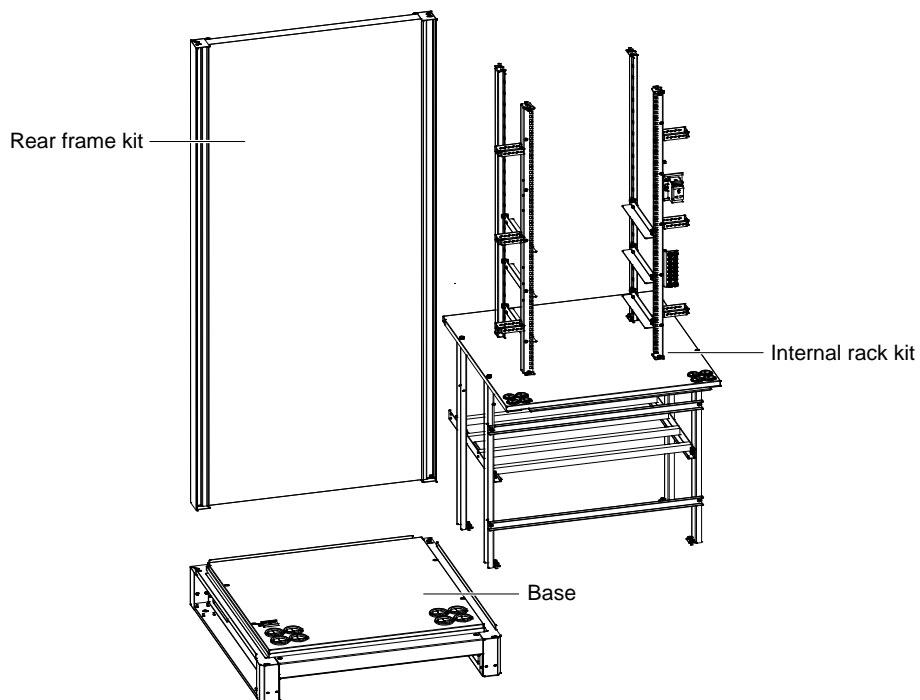


Figure 2-12 Disassembling rear frame and internal rack kit

2.3.2 Opening And Closing Cabinet Door

Procedures for opening and closing the cabinet door are as follows:

1. Loosen the movable baffle plate of the key hole by using a miniature angle wrench attached to a key string (see Figure 2-13), and remove the baffle plate to expose the key hole.

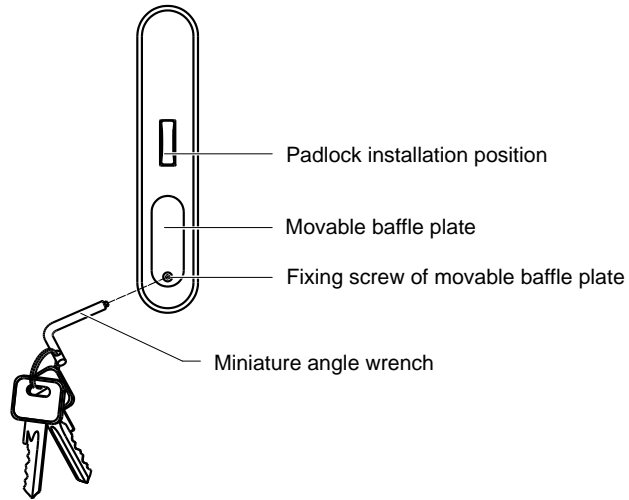


Figure 2-13 Position of movable baffle plate

2. Insert the key into the keyhole, and rotate the key clockwise until a handle pops out.
3. Turn the handle 120° counterclockwise, as shown in Figure 2-14. And then pull the handle out until the door is open.

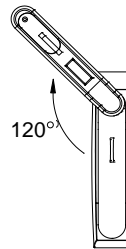


Figure 2-14 Rotating the handle

4. After the door is open, the door stay bar will restrain the door manually. You can adjust the angle twice, first time 90° and the second time 110°. The door stay bar is shown in Figure 2-15.

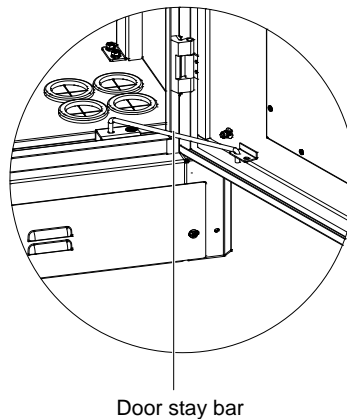


Figure 2-15 Position of door stay bar

5. Before closing the door, manually restore the door stay bar to its original position, and then close the door and put the handle to the original place.
6. Rotate the movable baffle plate upward and cover it over the keyhole after the cabinet door is closed, as shown in Figure 2-13.

7. Tighten the fixing screw of the movable baffle plate to lock the door. Then the door is locked. If necessary, you can install a padlock at the padlock installation position (see Figure 2-13).

2.4 Electrical Installation

2.4.1 Installing Power Subrack

If other manufacturer's power subrack is configured, it should be installed at the top of equipment rack, in addition, a 2U to 3U space should be reserved between the power subrack and the top for the convenience of heat dissipation and cabling. If Vertiv power subrack is selected, then it should have been installed before delivery and user does not need to install it again. The position of the power subrack is shown in Figure 2-16.

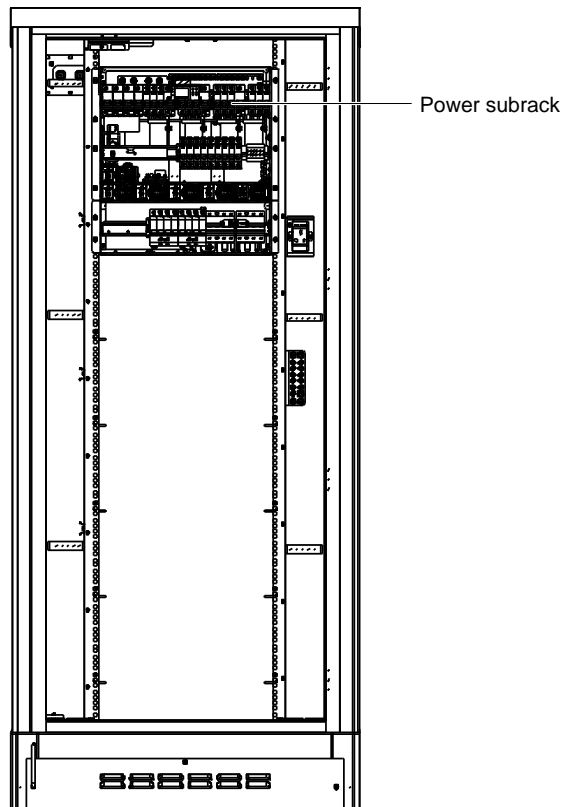


Figure 2-16 Position of power subrack

2.4.2 Installing Rectifier

Note

1. If there are vacancies among module slots, install the rectifiers from left to right.
2. When installing the rectifier, you must hold the handle of the rectifier and push it into the installation slot gently; otherwise, the positioning slot of the rectifier may be damaged.
3. Apply the rectifier according to its rated power, if the rectifier is faulty, please return it to manufacturer for repair.
4. After taking out of the rectifier, you should replace with a new one or install a dummy plate.

This manual takes an R48-3000e3 rectifier as an example to describe the installation procedures of the rectifier.

1. Loosen the fixing screw (see Figure 2-17) of rectifier handle, and pull the handle outside.

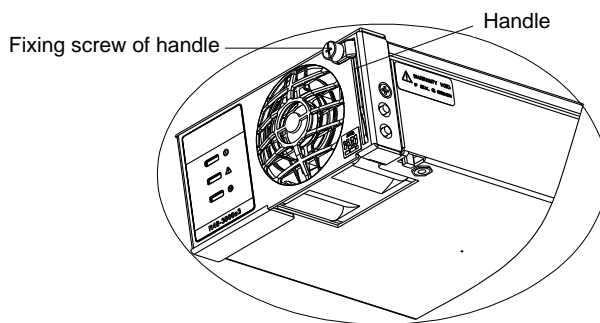


Figure 2-17 Position of rectifier handle

2. Put the rectifier into installation slot, and push the rectifier completely into the cabinet.
3. Close the handle and tighten the fixing screw to lock the rectifier onto the cabinet.

2.4.3 Installing Battery

Note

1. Large current may occur when operating batteries. Before connecting battery cables, make sure that all battery MCBs are off. Before the power system is connected to battery string cables, you must switched off all related battery MCBs or the cell connection straps of the battery string to avoid that the power system is with live power after installation.
2. Check that the polarity of battery and power system connection terminal are consistent on both ends of the battery cable; otherwise, the battery and power system will be damaged.
3. When replacing or installing batteries in a battery compartment, install batteries from bottom to top, uninstall batteries from top to bottom, and maintain the center of gravity of the battery compartment.
4. When installing the batteries, check that every screw is tightened on a pole according to the required torque. After a battery compartment is delivered and used for 1 ~ 2 months, recheck that every screw is tightened on a pole according to the required torque. Otherwise, fire hazard may occur.
5. Lead-acid batteries may cause chemical hazards.
6. When changing a battery, make sure that the replacement is of the same type and capacity as the replaced battery. Otherwise, explosions may occur.
7. Scrap used batteries according to related local laws.
8. The system supports maintenance-free valve-regulated lead-acid batteries. When you connect 24 cells of 2V battery or 4 cells of 12V battery in a series, make sure that the maximum battery capacity is equal to or less than 600Ah.
9. When using one battery string, make sure that the load output current is equal to or less than the MCB capacity of the battery string. Otherwise, a battery MCB trip may occur.

The maximum dimensions of single battery:

2V 500Ah: 395mm (H) × 185mm (W) × 215mm (D)

2V 300Ah: 395mm (H) × 185mm (W) × 144mm (D)

12V 200Ah: 238mm (H) × 259mm (W) × 497mm (D)

12V 150Ah: 318mm (H) × 125mm (W) × 558mm (D)

Installation procedures of battery are as follows:

1. Switch off the AC input MCB and battery MCB in the power subrack of the power cabinet.
2. Loosen the two fixing screws of the battery baffle plate, and remove the baffle plate.
3. Push the batteries into the battery compartment from right to left. Ensure that every two batteries are 10mm distant from each other.
4. Remove the protection cover on the battery connection terminal, and connect battery lead plates between batteries in turn.
5. Connect one end of the negative battery cable to the battery MCB of the power subrack, and then connect the other end of the negative terminal of the battery string. Connect one end of the positive battery cable to the DC output busbar, and connect the other end to the positive terminal of the battery string.
6. Attach the temperature sensor of temperature compensation cable onto the surface of the battery case.

7. Measure the battery string voltage. If the voltage is correct, resume the battery baffle plate to its original place, and tighten the fixing screws to baffle the battery string.
8. Put the battery protection cover back.

2.4.4 Connecting Cables



Note

1. Use sheathed cables for AC cables, DC cables, and communication cables in and out of each cabinet. Besides, separate these cables.
 2. Open all switches and fuses before electrical connection.
 3. Only qualified personnel are permitted to connect the mains power cables.
 4. Stay away and do not bridge a system that has hazardous energy over 240VA.
 5. Connect the power system with other equipment only if the 60950-1 relevant standard is met.
 6. The AC thermal control MCB and DC thermal control MCB in the power cabinet supply power to the thermal control device and socket in each cabinet, when the system is running, make sure that the thermal control MCBs are closed.
 7. Distribute cables by referring to the wiring diagram. Make sure that the cable connection is correct before powering on the system.
-

Parallel Cable Connection

Relevant cables have been connected and the cabinet has been tested before delivery. If the cabinets need to be paralleled for use, then you should connect the cable between cabinets onsite. This manual takes three single cabinets parallelizing for example to describe the cable connection between cabinets. There is a white 6 Pin terminal installed on the right side wall of each cabinet, which feeds power to the socket and thermal control device of the cabinet, as shown in Figure 2-18. Take the typical configuration (battery cabinet + power cabinet + equipment cabinet) for example, when paralleling the cabinets, you should connect the power cable of the thermal control device from battery cabinet to the power cabinet, and the cables of each sensor to FSU in the power cabinet. Moreover, the power cables of the thermal control device from the equipment cabinet to the power cabinet, the AC socket power cable, and the cables of each sensor to FSU in the power cabinet need to be connected (such as the micro switch, temperature & humidity sensor, infrared sensor are optional parts, if selected, you should connect the corresponding cables).

Among which, the cross-cabinet cable used by thermal control device is optional, if selected, you should connect one end of the tube terminal of the cross-cabinet cable for DC power use to the 6 Pin terminal, and the other end to the 3 Pin terminal led out from the DC output MCB on the power subrack in the power cabinet according to the cable marks and the wiring diagram. In the same way, connect one end of the cross-cabinet cable for AC power use to the 6 Pin terminal, and the other end to the AC output MCB used by thermal control device and AC socket on the power subrack in the power cabinet according to cable marks and the wiring diagram (Note: make sure that the L is connected to the AC output MCB, and N to the neutral line terminal). If the cross-cabinet cable of Vertiv is not selected, then you should connect the cross-cabinet cable by yourself according to above method. All the sensors are optional, and the corresponding cables are not connected for standard cabinet, the onsite engineering personnel shall carry out the cable connection according to actual requirement.

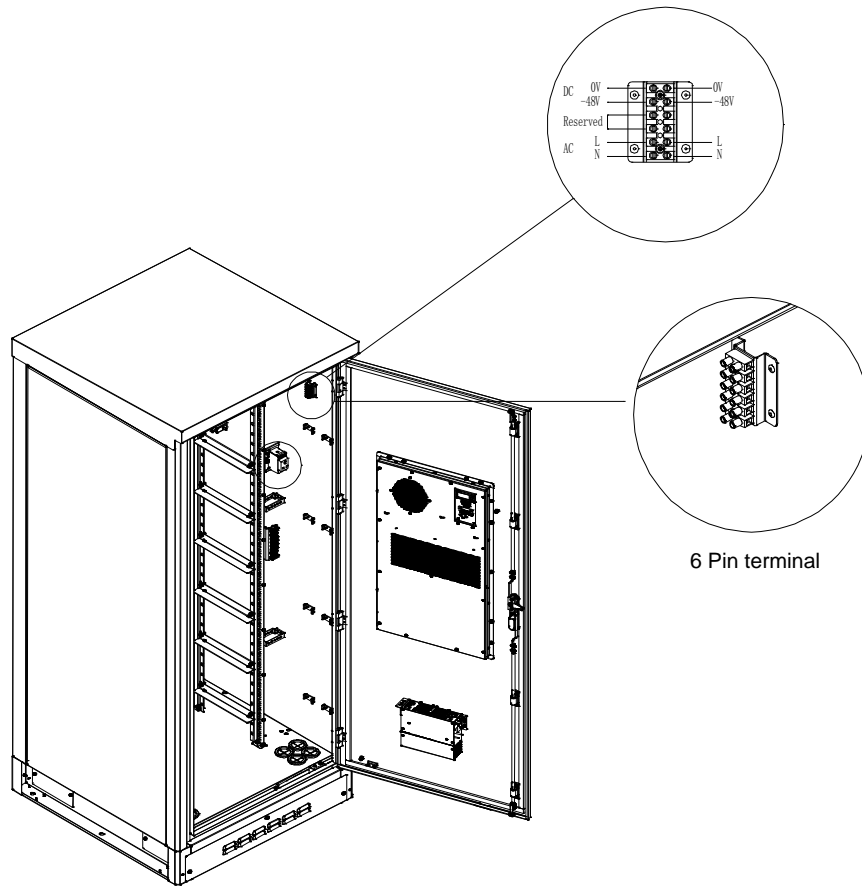


Figure 2-18 Position of 6 Pin terminal

All the AC and DC cables, and communication cables must be put through metal pipes for protection. The metal pipe should be connected to the PE bar reliably. Plastic coated metal hoses are recommended.

Position Of Cable Entry Holes

There are 16 cable entry holes at the bottom plate of each cabinet for cabling. The position is shown in Figure 2-19. During connection, use an electrician knife to cut the cable bushing, and then lead the cables through the cable entry hoses. After connection, use fire-proof mud to seal the cable entry holes.

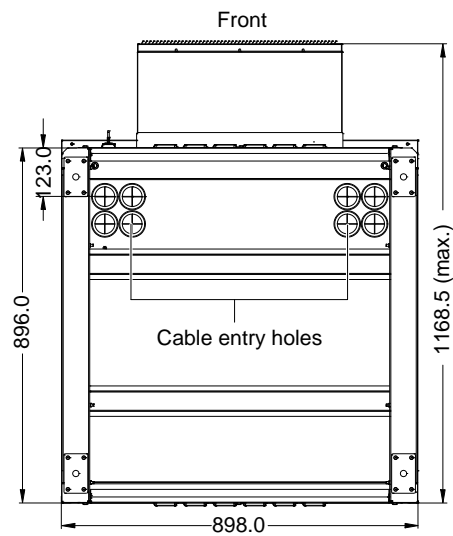


Figure 2-19 Position of cable entry holes

Connecting earth cable



Note

1. The grounding bar of each cabinet is located on the bottom of the cabinet or on the equipment rack, which should be respectively connected to the earth metal base reliably.
2. The grounding bar in the equipment cabinet has two M8 screws and ten M6 screws, and that of the battery cabinet has two M8 screws and one M6 screw.

The connecting procedures of earth cable are as follows:

1. Led the earth cable through the cable entry holes and route the cable along the cable holder.
2. Connect one end of the earth cable to the grounding bar (see Figure 2-20) in the cabinet, and solder the other end to the earth metal base reliably.
3. Use nylon cable ties to tie the earth cable to the cable holders.

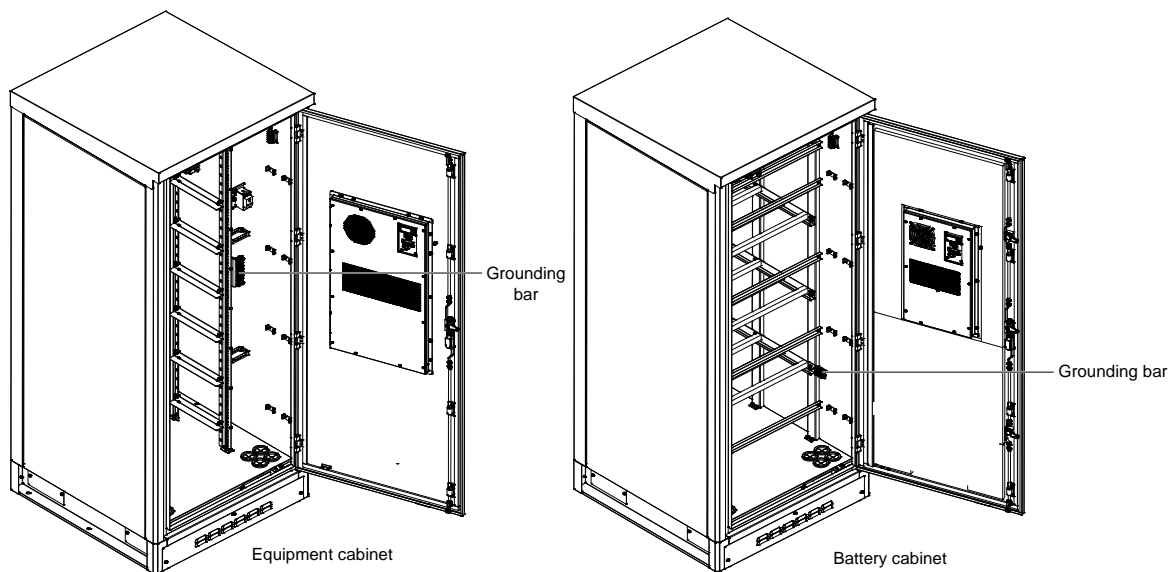


Figure 2-20 Position of grounding bar

Connecting AC input cable



Note

1. Reverse connection of the AC input live line (L) and neutral line (N) is strictly prohibited. Or else, an equipment fault will be caused.
2. Use sheathed cable. Ensure that the protective earth (PE) cable must be longer than the live line and neutral line. This can avoid hazards as the PE cable is disconnected before the live line and neutral line when you pull cables.
3. For the thermal control system configured with an air conditioner, the AC input range: 220Vac to 230Vac/50Hz must be ensured.

The routing of the AC input cables is the same as that of the earth cable.

After the outdoor cabinet is delivered to customer site, you need to connect the AC input cable to the lower part of the input MCBs of AC distribution, if Vertiv Network Power (shorted as ‘Emerson’ hereafter) AC distribution unit has been installed for the outdoor cabinet, as shown in Figure 2-21.

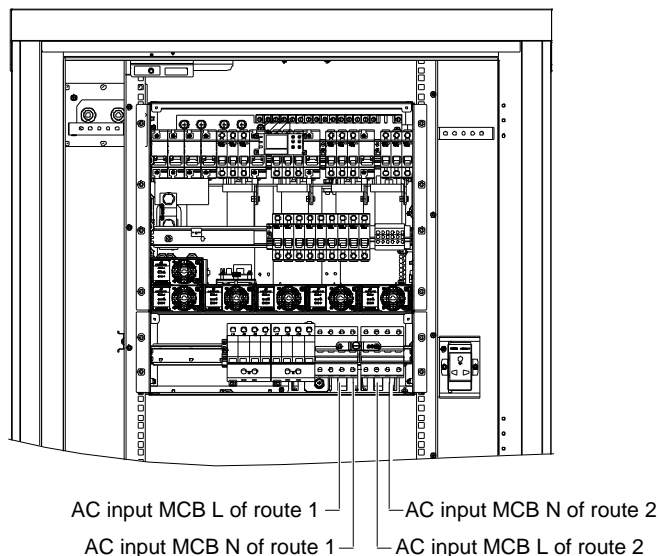


Figure 2-21 Position of AC input MCB

After the outdoor cabinet is delivered to customer site, you only need to connect the AC input cables based on the user manual of the power subrack if no AC distribution unit but Vertiv power subrack has been configured for the outdoor cabinet.

Connecting DC cables

If the outdoor cabinet has been installed an Vertiv matched power subrack before delivery, the DC cable connection between power subrack and cabinet should have been done by Emerson. Users only need to connect load cables according to the power subrack user manual.

If the system has been configured with DC distribution unit, then the user of DC distribution unit in power cabinet can connect the load from output port. The DC distribution unit in equipment cabinet should be connected to power subrack through power cable by referring to the wiring diagram, and lead the cable through the cable entry holes on the bottom of the cabinet.

Connecting RS485 communication cable

The thermal control device, subrack power and sensors can be connected to FSU in the power cabinet through RS485 port.

2.4.5 Sealing Cable Entry Holes

After cable connection, use fireproof mud to seal the cable entry holes of the cabinet (as shown in Figure 2-22).



Note

The cable entry holes on the separation board between the equipment compartment and battery compartment of the integrated cabinet should be sealed with fire-proof mud after cable connection.

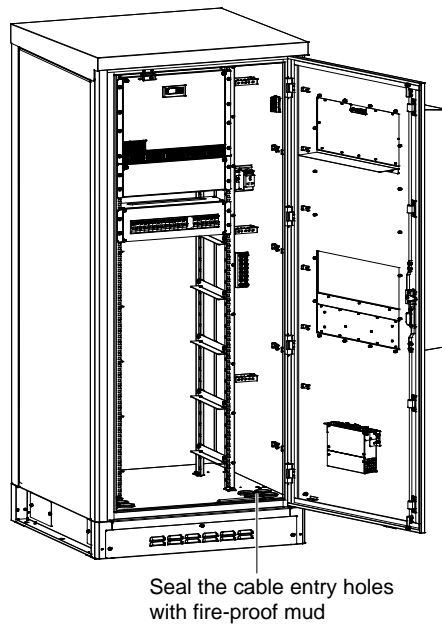


Figure 2-22 Sealing the cable entry holes

2.4.6 Installing Base Cover Plate (Optional)

The power system provides base cover plate as an option. You can install the base cover plate according to actual requirements after connecting cables.

The installation procedures are as follows:

1. Insert the square nut (see Figure 2-23) into the square hole at the cabinet base, and drive it from inside to outside.
2. Tighten theft-proof screws by using a theft-proof wrench, so that the baffle plate is fixed on the cabinet base, as shown in Figure 2-23.

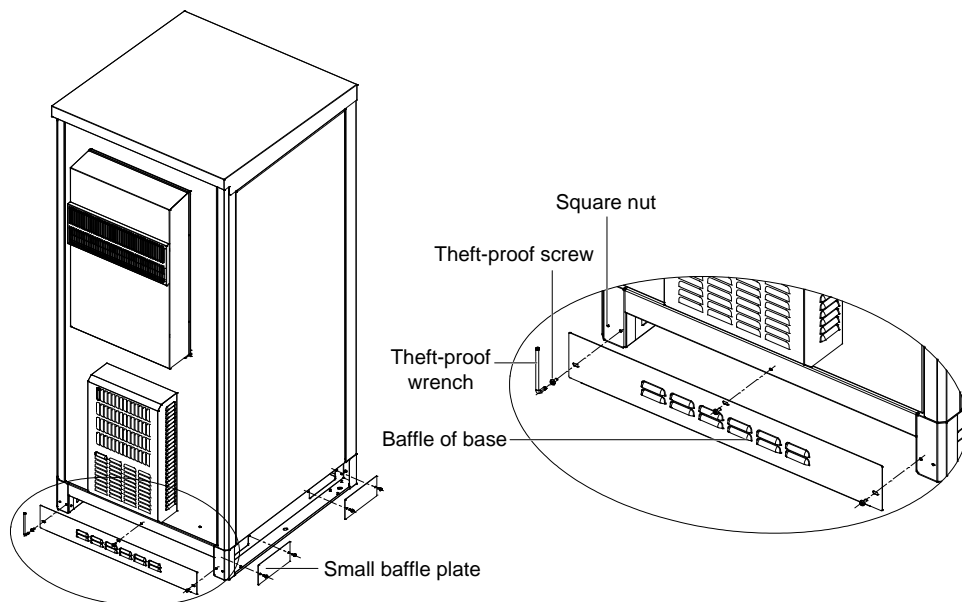


Figure 2-23 Installing base cover plate

2.5 Installation Check

After installation, check the installation against the list given in Table 2-6.

Table 2-6 Installation check list

Check item	No.	Description
Cabinet installation	1	Check that the cabinet is steadily fixed and stands upright on a horizontal level.
	2	Check that all bolts are tightened, especially those in electrical connections, that all bolts have plain washers and spring washers, and that the washers are not reversed
	3	Check that there are no irrelevant materials in the cabinet, and clear them away if any
	4	Check that the cabinet paint is intact. If there are scratches, paint them immediately with antirust paint to prevent corrosion.
	5	Clean up the cabinet
	6	Check that the door can move freely, the locks are in good condition and the door stay bar is fixed
	7	Check whether the reserved space where user equipment is not installed has been installed with a dummy plate
Electrical connection	1	Verify the specifications of all MCBs and cables
	2	Check the correctness of busbar connections, input and output cable connection, and the system earthing
	3	Check the correctness of the battery cell number and connection, and battery strings polarities
	4	Make sure all the cable connections are firm and reliable
	5	Check the connection point, line sequence and polarities between DC output cables and batteries. Check the connection polarities of the batteries. Check that the connection points are fixed and the cable connections are correct and reliable
	6	Measure the resistance value between the DC loop positive terminal and negative terminal, and phase-to-phase resistance value in the AC loop, making sure there is no shortcircuit
	7	Check the AC wiring and power distribution, make sure that the colors of the AC cables are normative, the original wiring are fixed, and the safety labels of the AC power distribution are complete
	8	Check that the SPD PE cable and earthing cable are correctly connected and the contacts are reliable
	9	Check the communication cables of controller and check that the rectifiers are properly fixed
	10	Check that all MCBs are open
	11	Check that the cables are tidy, and the cable binding is normative

Chapter 3 Testing

This chapter introduces the testing after installation. The corresponding safety rules shall be adhered to in the testing.

3.1 Power-on

Note





1. Test the power subrack (if configured) in the cabinet at the very beginning.
2. Before test, inform the manufacturer representative. Only trained electrical engineers shall conduct the test.
3. Remove any metal objects that may cause short-circuit, including finger rings, watches, and so on.

During operation, Watch out for hazardous voltage and avoid personnel injury and property loss. The power system must be properly earthed before power-on. Installation check (see Table 2-6) must be conducted before test.




If a power subrack is configured in the cabinet, you must connect cables according to the user manual of the power subrack, and set battery capacity and charge/discharge management parameters according to actual situation.

Modify the default charge/discharge parameters if they are against battery manufacturer regulations. After the power subrack is tested, you can start to test the cabinet system.





Startup preparation

Check item	OK	Comments
Ensure that the system AC input and DC input are normal, all AC input MCBs, battery MCBs and load MCBs are switched off, and all devices are properly installed		
Measure the AC input voltage. Make sure that the input voltage is within the rated input range. For the system configured with an air conditioner, you need to confirm the AC input range: 220Vac ~ 230Vac/50Hz		Umin= V
If batteries are connected, measure with a voltmeter across the connection points of each battery and make sure that the polarity is right. For a lead-acid battery with 24 cells, the voltmeter should read 2.0 ~ 2.1V/cell or 48V ~ 51V/battery string. If the voltage of certain cell is lower than 2.0V, that cell must be replaced		Umin= V
Check with an ohmmeter that there is no short circuit between the positive & negative DC terminals (Note: Pull out all modules before the check and restore them after the check)		

Startup

Check item	OK	Comments
Switch on the system AC input MCB. The run indicator on the rectifier will be on and the fan will start running after a certain delay. The controller will show that the output voltage is 54.0V		
Check the system voltage and busbar polarity with a voltmeter. The voltage difference between the measured value and displayed value should be less than $\pm 0.3V$		
Close the MCB of thermal control unit		

3.2 System Operation Status Check

Check item	OK	Comments
Make sure that the temperature of internal cabinet is the same as that of the actual value. Hold the probe of the temperature sensor with hands, which should display the change of the temperature		
For thermal control unit of heat exchanger type, check if the internal fan runs normally and if the external fan runs or stops normally according to thermal control logics		
For thermal control unit of air conditioner type, check if the air conditioner runs or stops normally according to thermal control logics		
When the door is open, the light will be illuminated and there should be no other alarms except door open alarm (if the micro switch is selected)		

3.3 Final Steps

Check item	OK	Comments
Disconnect all test equipment from the system and make sure that materials irrelevant to the equipment have been all removed	<input type="checkbox"/>	
Restore the power system to its original condition and close the cabinet door	<input type="checkbox"/>	
Check and handover the equipment that the user has purchased	<input type="checkbox"/>	
Note down all the operations taken, including time of the operation and name of the operator	<input type="checkbox"/>	

If any defects are found in this power system, inform the personnel responsible for the contract.

If repairing is needed, please fill in the FAILURE REPORT and send the report together with the defective unit to the service center for fault analysis.

Chapter 4 Maintenance

This chapter describes routine maintenance, alarm and fault handling, and method of replacing parts of the power system.

Note

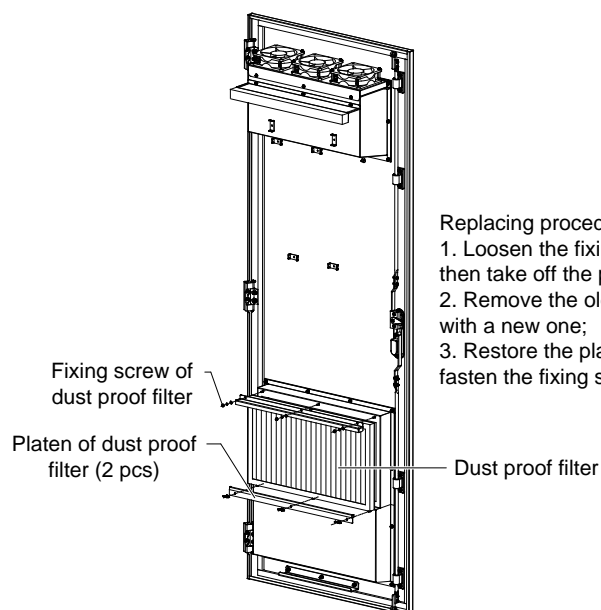
1. The maintenance must be conducted under the guidance of the related safety regulations.
2. Only trained personnel with adequate knowledge about the power system shall operate the inner part of the cabinet.

4.1 Routine Maintenance

Inspect the power system periodically and shoot the trouble in time. The routine maintenance items are given in Table 4-1.

Table 4-1 Routine maintenance items

Inspection item	Frequency	Inspecting method	Guide
Whether thermal control unit runs normally	Once half a year	Visual inspection	Check alarms and operation status. If the thermal control unit is running abnormally, see the relevant section about how to replace parts described in this chapter
No peels and scratches in paint and galvanization layer	Once half a year	Visual inspection	If there are scratches and peelings, paint them immediately
Dust proof filter	Once half a year	Visual inspection	The dust-proof filter of heat exchanger type cabinet is slightly different from that of air conditioner type cabinet, but their replacement methods are the same. If the dust-proof filter is dusty, loosen the screws used to fix the dust-proof filter cover plate, remove the dust-proof filter cover, and then brush the dust-proof filter. If the dust-proof filter is damaged, replace it. After the replacement, re-install the dust-proof filter cover. The replacing procedures are shown in Figure 4-1



Replacing procedures:

1. Loosen the fixing screws of dust proof filter, then take off the platen of dust proof filter;
2. Remove the old dust proof filter and replace with a new one;
3. Restore the platen of dust proof filter and fasten the fixing screws.

Figure 4-1 Replacing dust-proof filter

4.2 Replacing Parts

4.2.1 Replacing Fan

Replacing Heating Unit Fan

The replacing procedures are as follows:

1. Turn off the AC distribution MCBs and DC power supply in thermal control unit.
2. Unplug the power input terminals of the heating unit, and loosen the four fixing screws of the heating unit to remove the heating unit from the cabinet door, as shown in Figure 4-2.

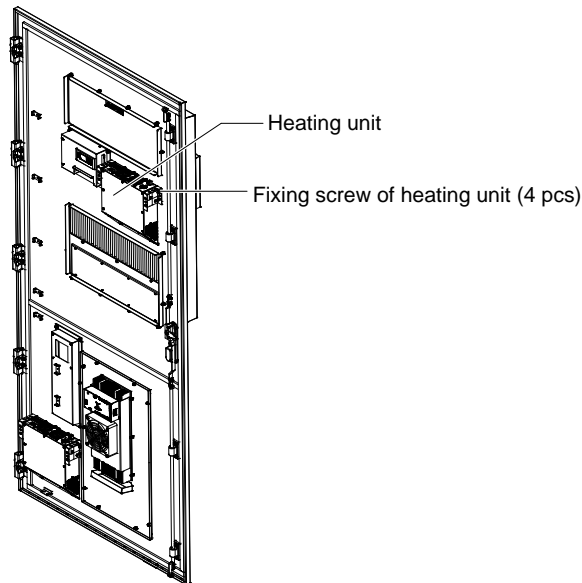


Figure 4-2 Position of heating unit

3. Use a cross screwdriver to loosen the nine fixing screws of the heating unit cover, and remove the heating unit cover, as shown in Figure 4-3.

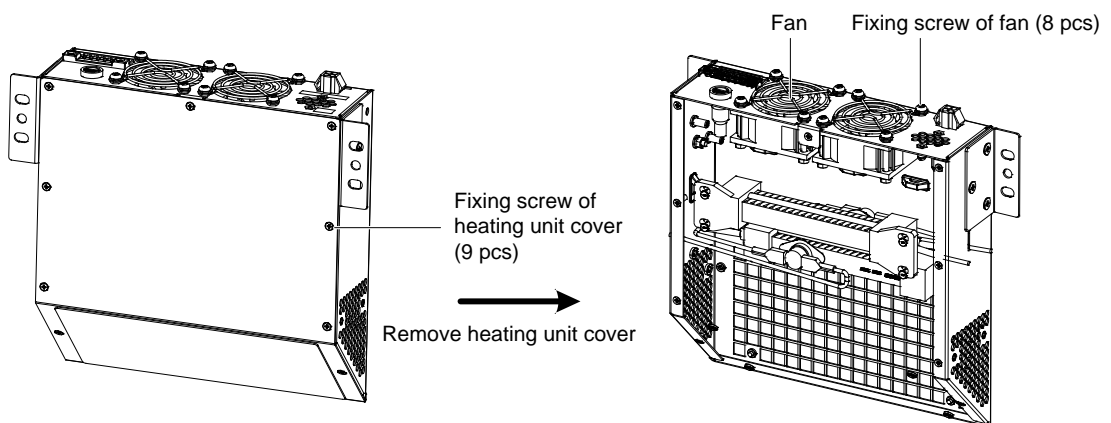


Figure 4-3 Position of fixing screws of fan

4. Loosen the fixing screws (8pcs) of the fan (see Figure 4-3), and remove the faulty fan.
5. Replace with a new fan and fix it with screws, reinstall the heating unit cover, and restore the heating unit to the cabinet door.
6. Plug the connection terminals, and then restore the AC distribution MCBs and DC power supply in thermal control unit.
7. Make sure that the fan can work normally, and check that the fan fault alarm signal should disappear.

Replacing emergent fan

The replacing procedures are as follows:

1. Turn off the AC output MCB of power subrack, and the position is shown in Figure 4-4.

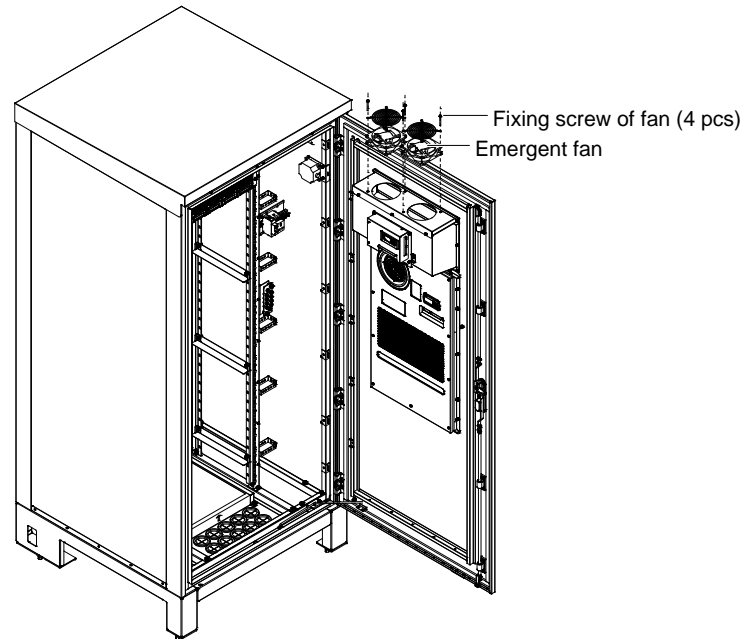


Figure 4-4 Position of emergent fan

2. Unplug the fan terminal and loosen the fixing screws of the fan, as shown in Figure 4-4.
3. Remove the faulty fan and replace with a new fan, and fix the fan with screws.
4. Restore the connection terminals of the fan.
5. Switch on the AC output MCB of the power subrack.

4.2.2 Replacing Heater

The procedures for replacing the heater of heating unit are as follows:

1. Turn off the AC distribution MCBs and DC power supply in thermal control unit, and unplug the power input terminals of the heater.
2. Disconnect the power input terminals of the heating unit and loosen the four fixing screws of the heating unit, to remove the entire heating unit from the cabinet door, as shown in Figure 4-2.
3. Use a cross screwdriver to loosen the nine fixing screws of the heating unit cover, and remove the heating unit cover, as shown in Figure 4-3.
4. Loosen the eight groups of M4 nuts, flat washers, spring washers (see Figure 4-5) used to fix the heater, and remove the heater.

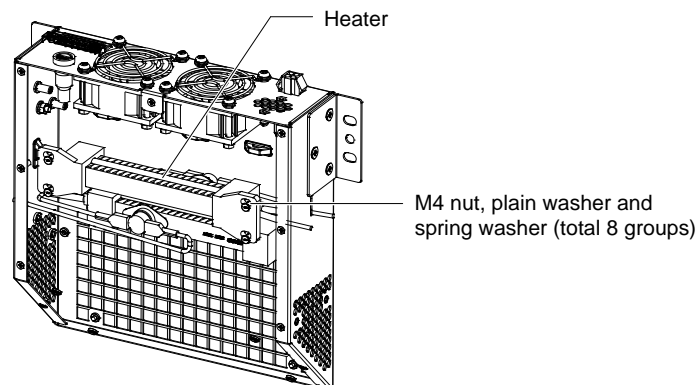


Figure 4-5 Position of heater

5. Reverse the preceding steps to install a new heater.
6. Plug the connection terminals, and restore the AC distribution MCBs and DC power supply in thermal control unit.

4.2.3 Replacing Heat Exchanger

Note

As the heat exchanger is heavy, at least two persons are need to cooperate when disassembling or installing the heat exchanger.

The procedures of replacing 190W/K heat exchanger are the same with those of 80W/K heat exchanger. Take the 80W/K heat exchanger as an example; the replacing procedures are as follows:

1. Disconnect all cable connections with the heat exchanger.
2. Use a socket wrench to loosen the combination of 16 nuts (M5), spring washers, flat washers used to fix the heat exchanger from the inside cabinet door, as shown in Figure 4-6.

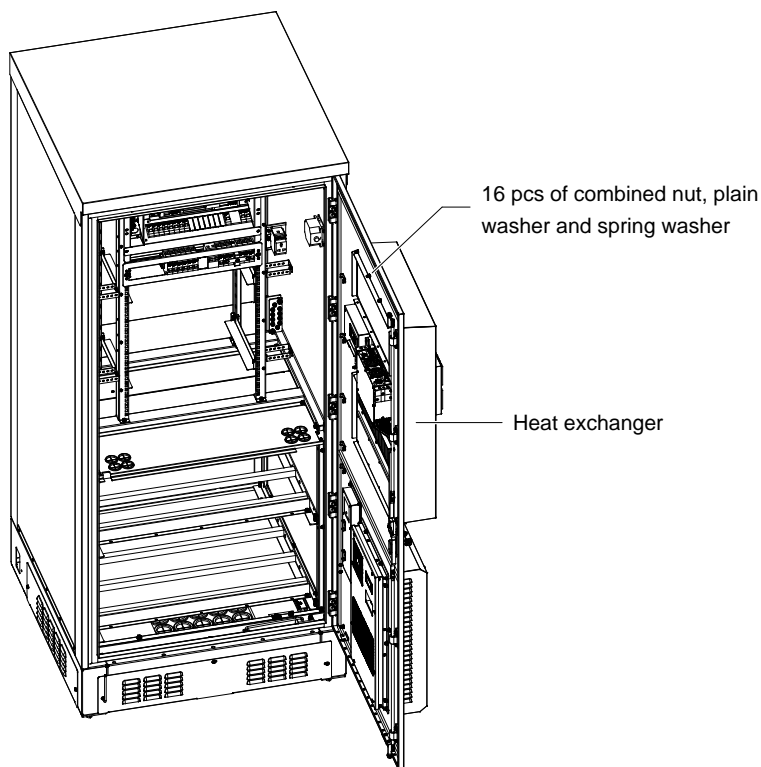


Figure 4-6 Position of heat exchanger

3. Take out the heat exchanger from the outside of cabinet door.
4. Install a new heat exchanger and fix it with screws.
5. Reconnect all cables to the new heat exchanger, and the system should have no other alarms except door open alarm.

4.2.4 Replacing Air Conditioner

Note

As the air conditioner is heavy, at least two persons are need to cooperate when disassembling or installing the air conditioner.

Procedures for replacing the 1500W air conditioner and 300W air conditioner are the same, this manual takes 1500W air conditioner for example, and the replacing procedures are as follows:

1. Turn off the AC distribution MCBs and DC power supply in thermal control unit, and disconnect all the cable connections with the air conditioner.

2. Use a cross screwdriver to loosen all fixing screws of the air conditioner from the inside cabinet door, as shown in Figure 4-7.

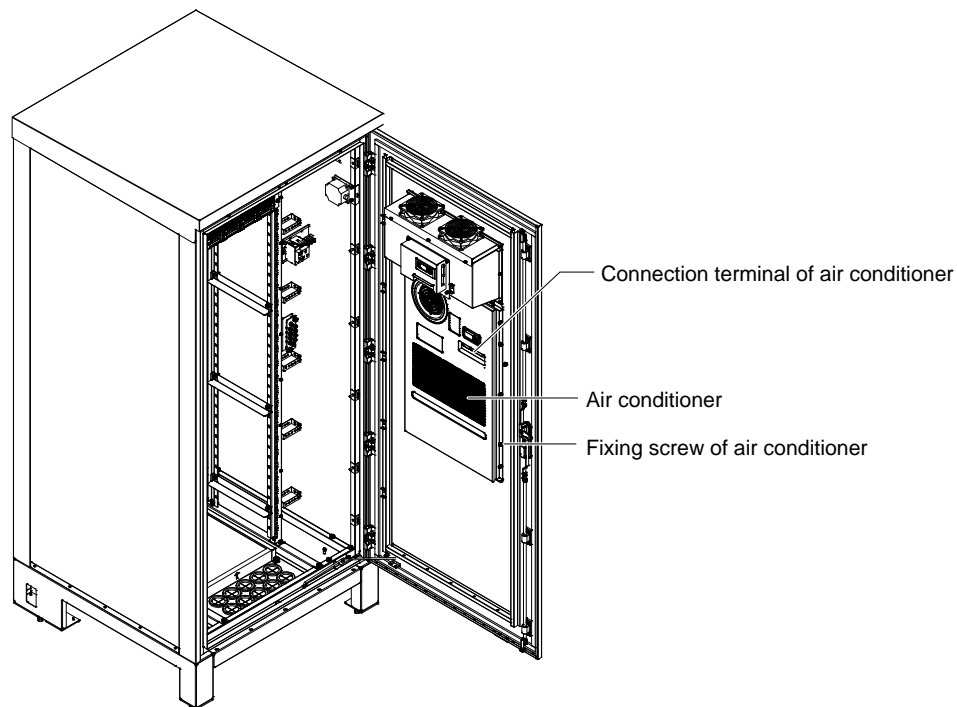


Figure 4-7 Replacement of 1500W air conditioner

3. Remove the air conditioner cover from the outside of cabinet door, and then take off the air conditioner from the inside of cabinet door.
4. Install a new air conditioner and fix it with screws.
5. Restore all cable connections of the air conditioner, and switch on the thermal control AC output MCB of power subrack.

4.2.5 Replacing LED Lamp

The LED lamp is at the top inner side of the cabinet, as shown in Figure 4-8. The LED lamp needs no extra maintenance; just replace it if it is damaged. After you open the cabinet door, if the DC 48V power supply is normal but the LED lamp is off, the LED lamp may have been damaged and should be replaced. The replacement is simple: Loosen the two fixing screws of the LED lamp, remove the mechanical part that fix the LED and then change the damaged LED with new one.

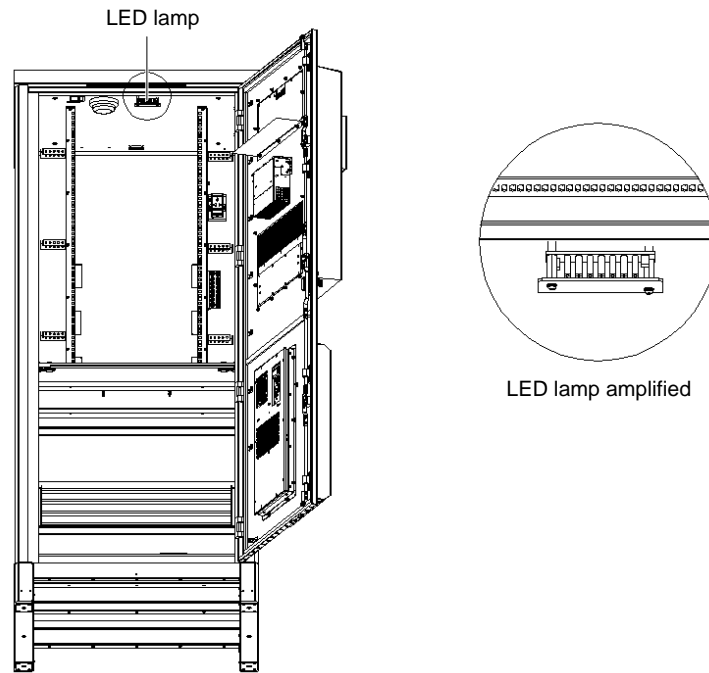


Figure 4-8 Position of LED lamp

4.2.6 Replacing Micro Switch

There is a micro switch (optional) installed in the power system for monitoring the close or open status of the cabinet door and controlling the LED lamp.

The micro switch requires no particular maintenance, just replace it when it is damaged. If the door is closed, but the door open alarm occurs or the LED lamp is illuminated, the micro switch may have been damaged and needs to be replaced. The position of the micro switch is shown in Figure 4-9. The replacing procedures are simple: Remove the cover of the micro switch, loosen the two fixing screws of the micro switch, and finally you can replace the damaged micro switch with a new one. When installing the new micro switch, remember to reconnect the signal cable and tightly fix the cable on the screws.

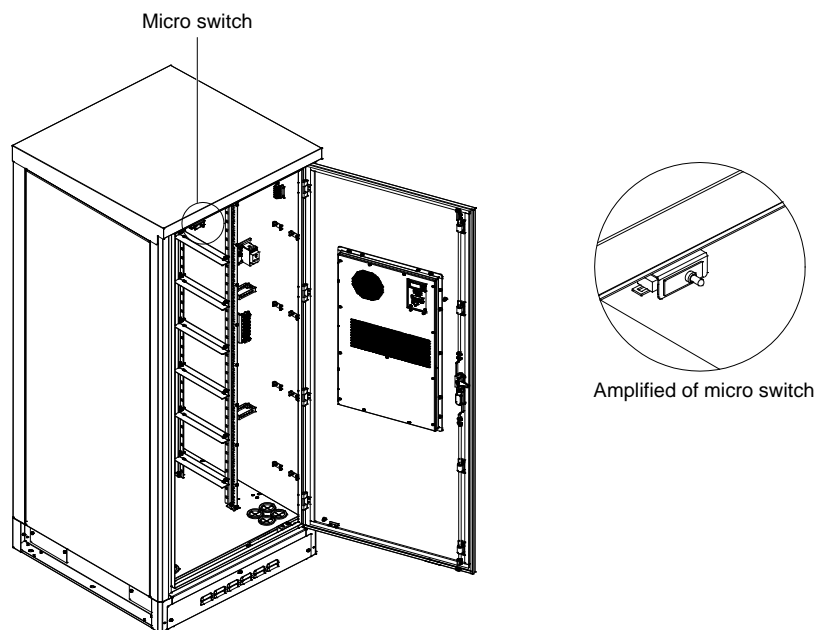


Figure 4-9 Position of micro switch

Appendix 1 Spare Part List

Table 1 Spare part list

Name	Description	BOM code
Micro switch	Micro switch	16010051
Hydrogen exhausting fan	60mm axial flow fan	32010478
Forced ventiation fan	120mm axial flow fan	32010500
PCBA-LED lamp board	PCBA--ECM250001X1	03029134
Heating unit (02357627)	Heater	02510041
	60mm axial flow fan	32010478
	Temperature relay	11010118
	10A fuse	19040022
Air conditioner	300W DC air conditioner	01303759
	1500W AC air conditioner	01303761
Heat exchanger	190W/K heat exchanger unit	02357636
	80W/K heat exchanger unit	02357635

Appendix 2 Schematic diagram

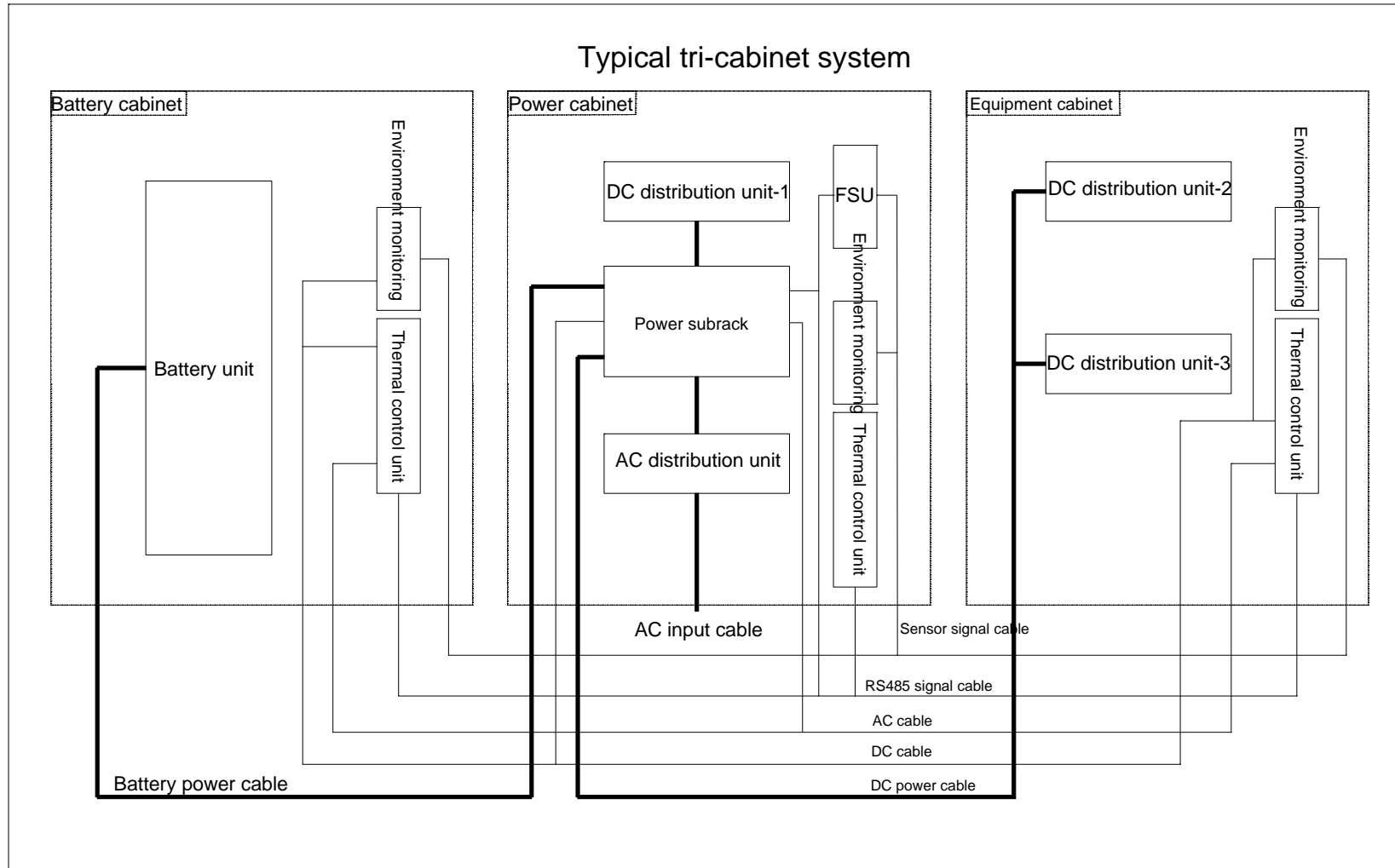


Figure 1 Schematic diagram of typical tri-cabinet power system

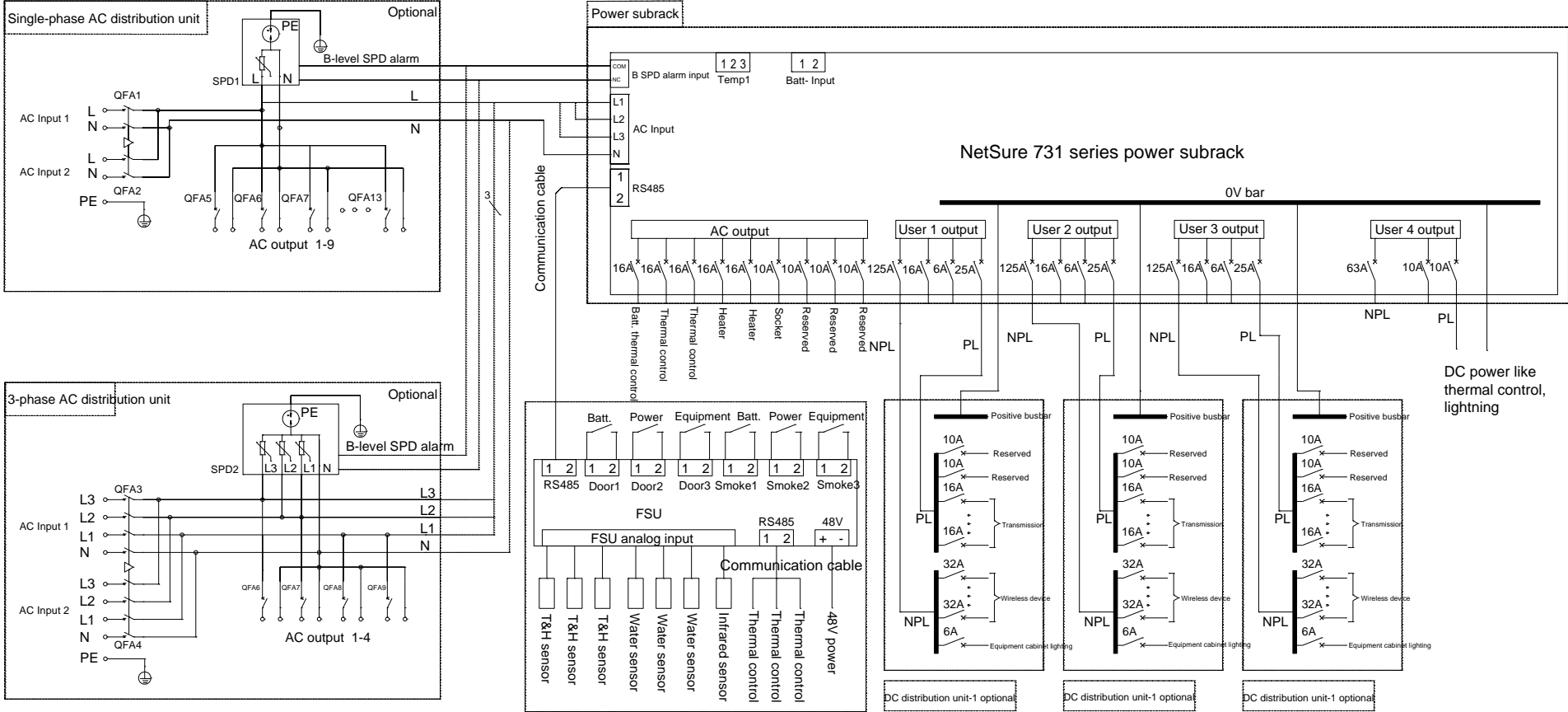


Figure 2 Schematic diagram of typical power cabinet (without thermal control)

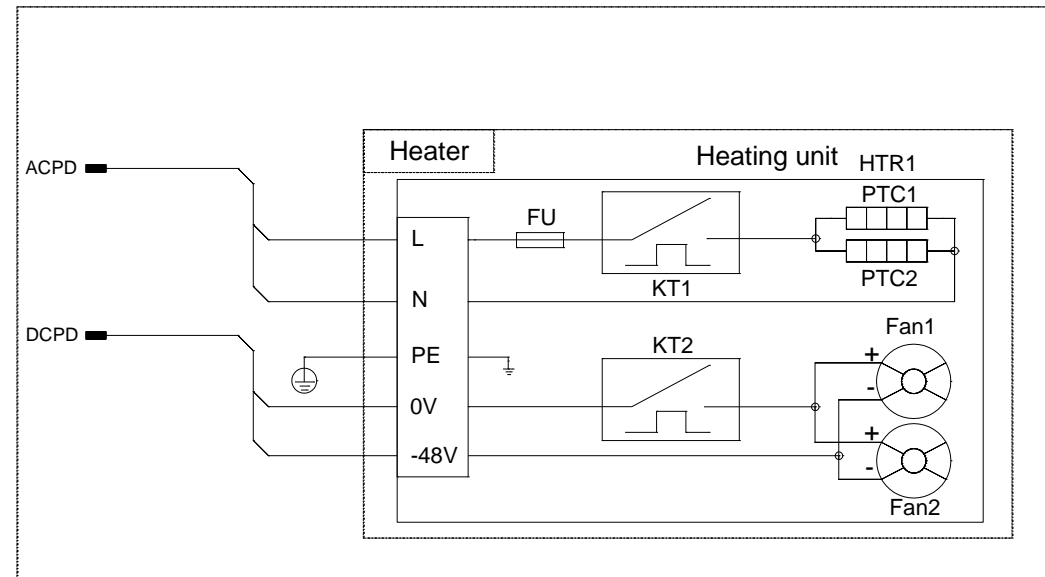
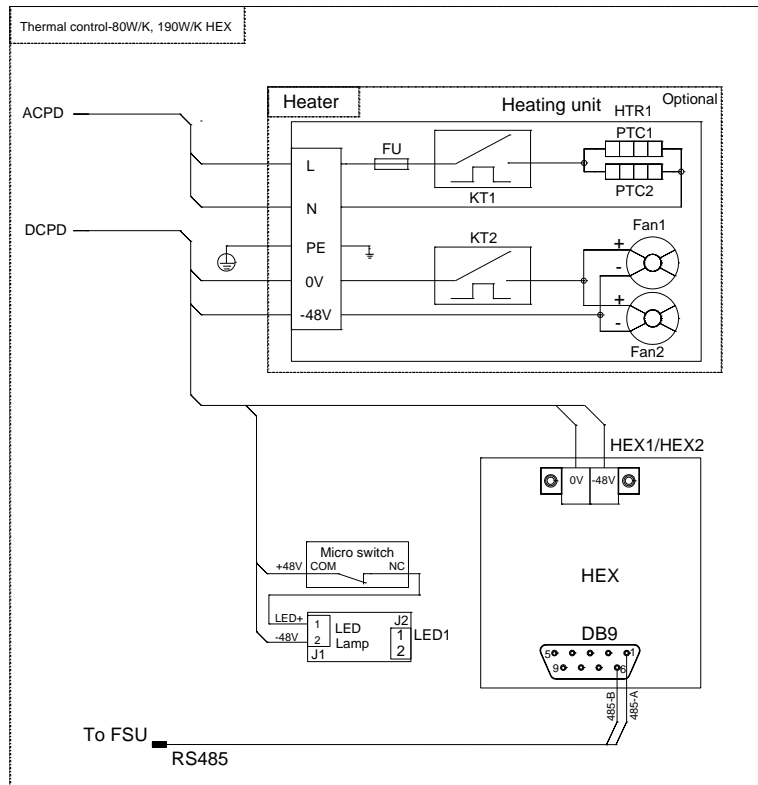


Figure 3 Schematic diagram of typical power cabinet/equipment cabinet (with thermal control)

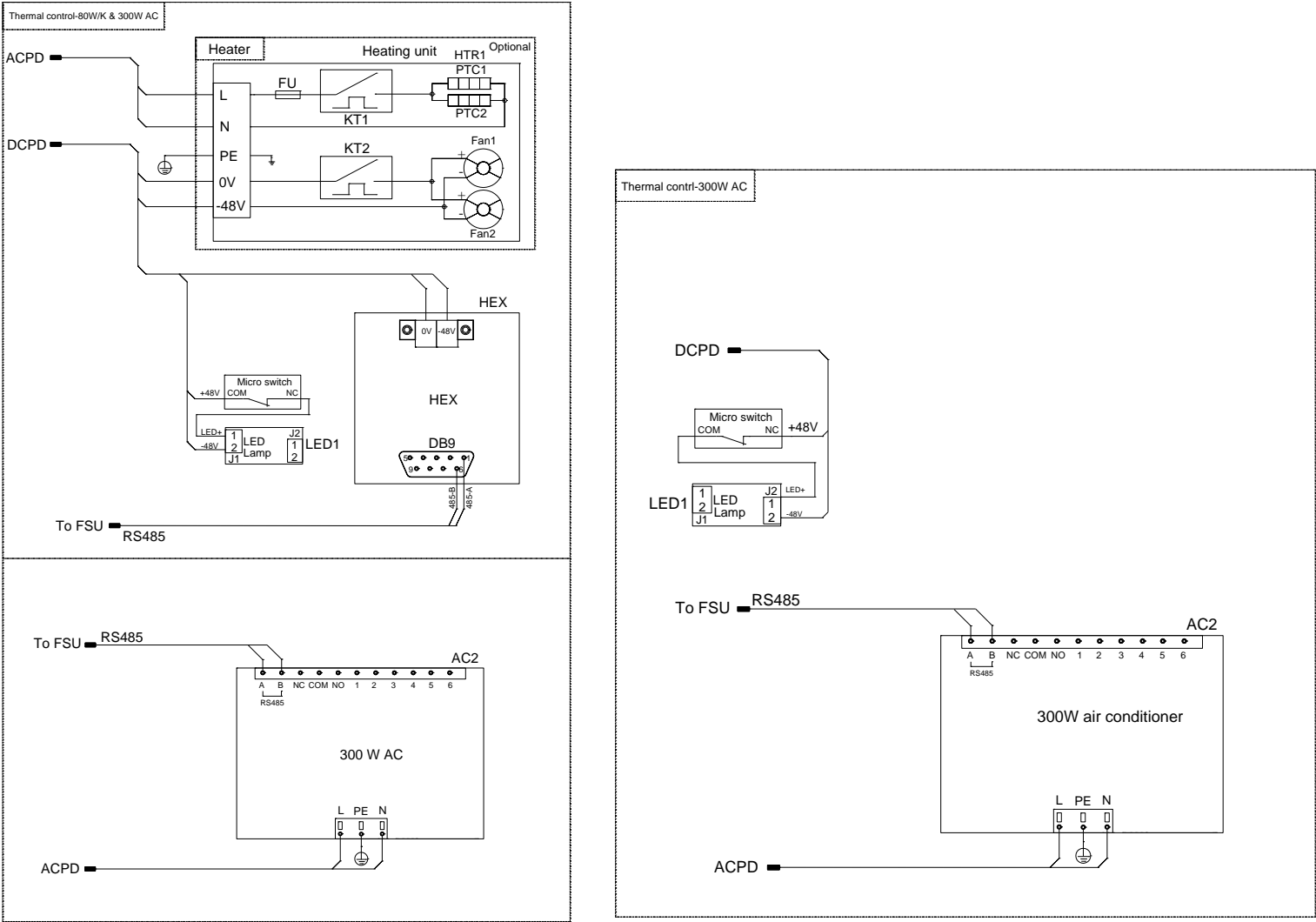


Figure 4 Schematic diagram of power cabinet + typical air conditioner type battery cabinet

Appendix 3 Wiring diagram

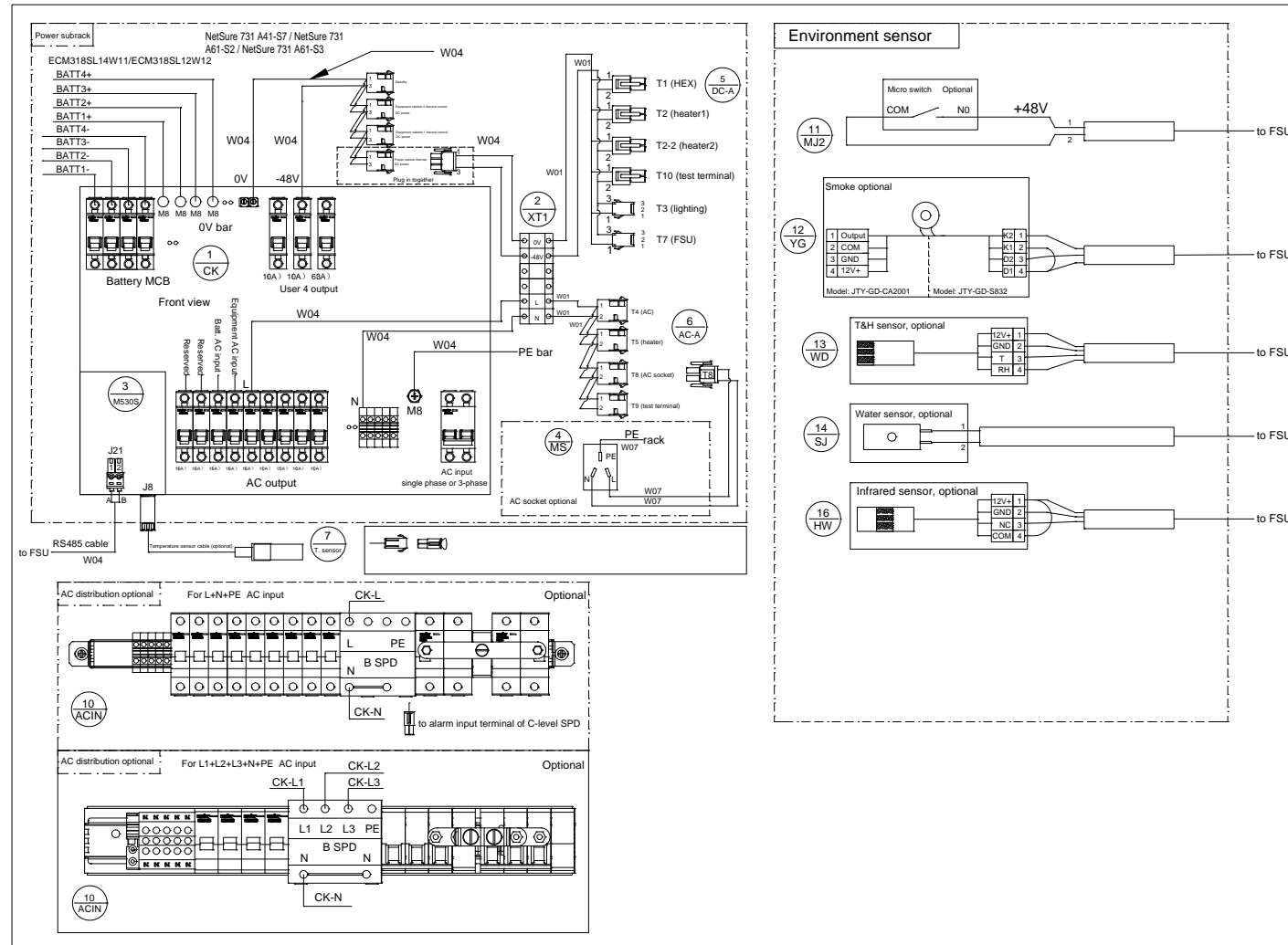


Figure 5 Wiring diagram (a)

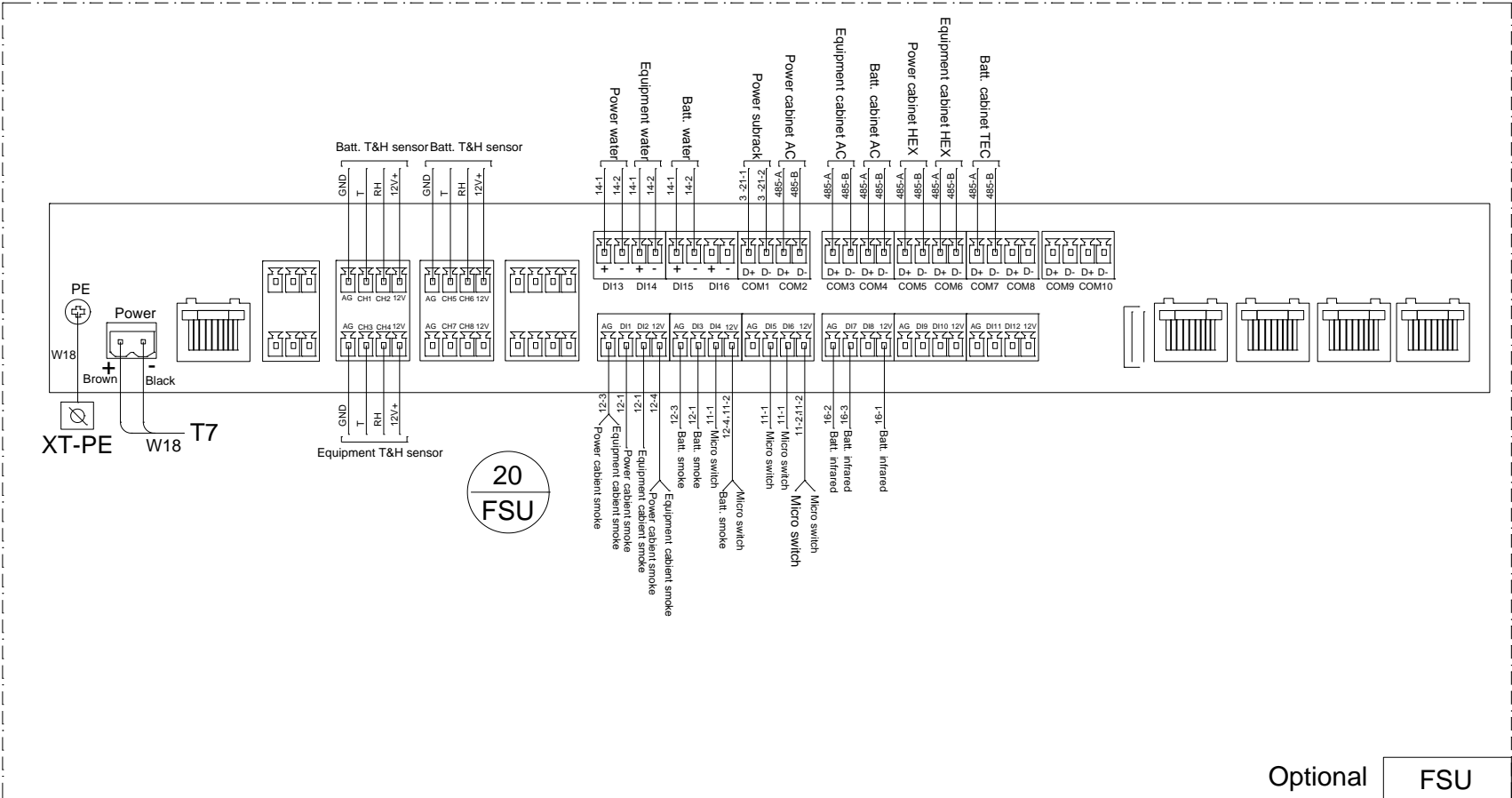


Figure 6 Wiring diagram (b)

Typical power cabinet/equipment cabinet wiring diagram (thermal control)

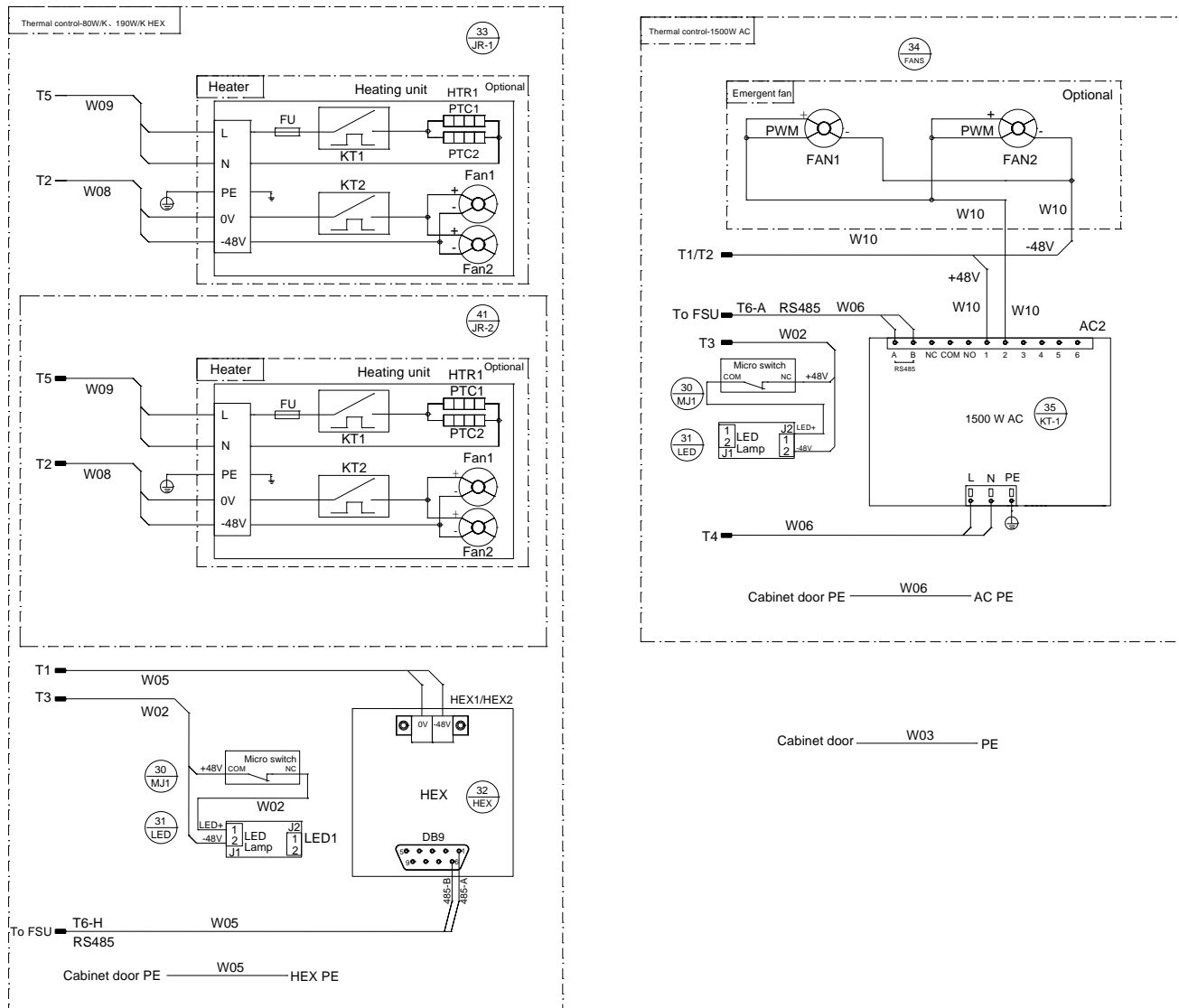
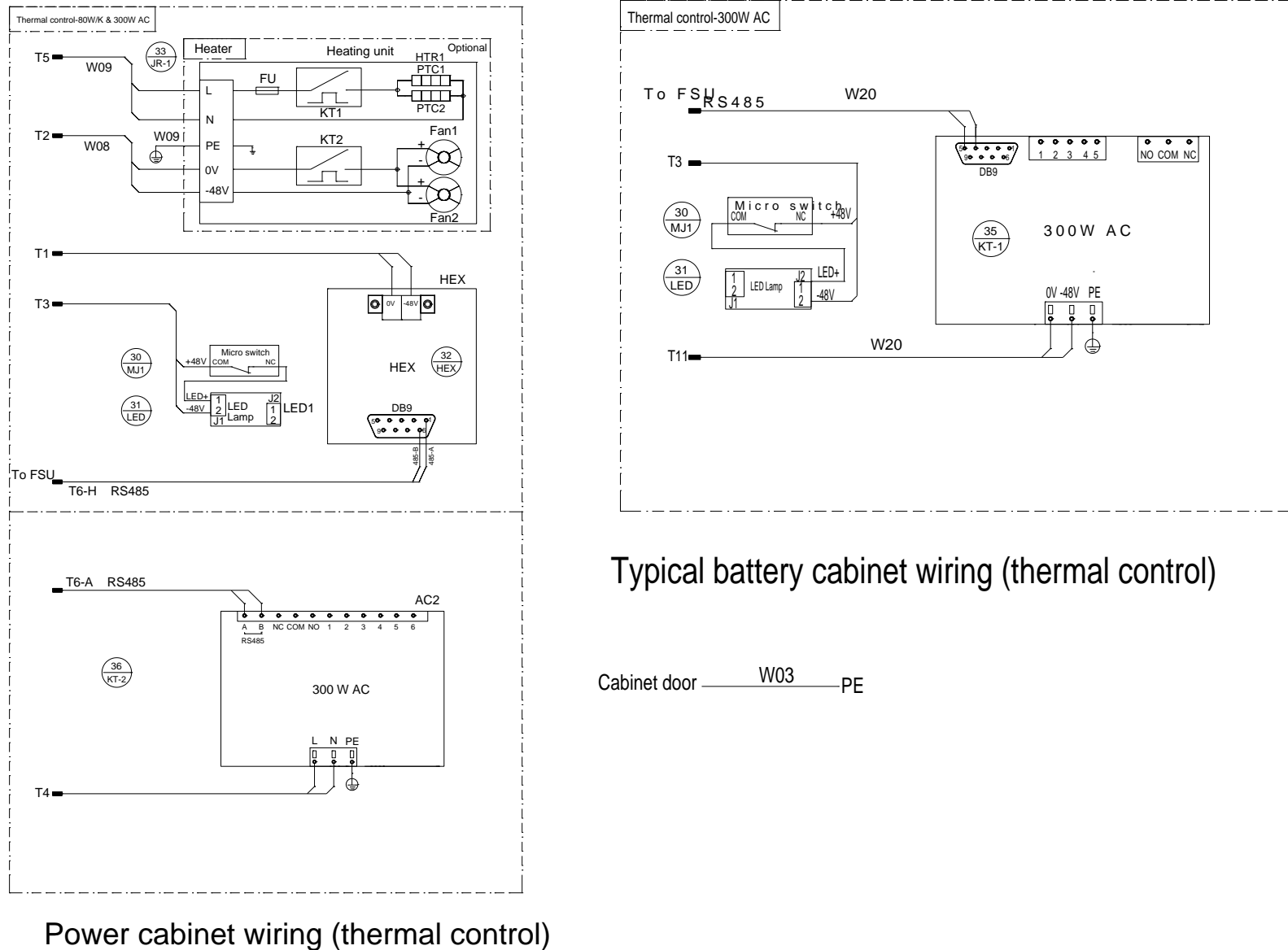


Figure 7 Wiring diagram (c)



Typical battery cabinet wiring (thermal control)

Cabinet door — W03 — PE

Figure 8 Wiring diagram (d)

Appendix 4 Glossary

AC	Alternating current
Batt	Battery
CSA	Cross sectional area
DC	Direct current
EMC	Electromagnetic compatibility
FC	Float charge
BLVD	Battery lower voltage disconnection
LCD	Liquid crystal display
PE	Protective earth
LLVD	Load low voltage disconnection
LVD	Low voltage disconnection
MCB	Miniature circuit breaker
PWD	Password
SPD	Surge protection device
SW Version	Software version
HEX	Heat exchanger
PL	Priority load
NPL	Non-priority load
DCDU	DC distribution unit
ACDU	AC distribution unit
PTC	Positive temperature coefficient