261KWh Outdoor Cabinet Energy Storage System

Product: 261KWh Outdoor Cabinet Energy Storage System

Model: ESS-BN-QB261-N1

Specification: 125kW/261kWh

Revision

No.	Revision Date	Version	Description	Prepare	Review	Approval
1	2024.6.27		First edition released			

CONTENT

Abbreviations

ESS	Energy Storage System
BESS	Battery Energy Storage System
PCS	Power Conversion System
EMS	Energy Management System
BMS	Battery Management System
SOC	State Of Charge
SOH	State Of Health
MSD	Manual Service Disconnect
DOD	Depth Of Discharge

1. Product Overview

1.1 Product Overview

This product is a 125kW/261kWh industrial and commercial energy storage liquid cooling product. The DC side battery system capacity is 261kWh, and the AC side rated output power is 261kWh. The power is 125kW and the AC side grid voltage is 400V.

It can work in both grid-connected and off-grid states; it can flexibly match various industrial and commercial scenarios to achieve peak load shifting, off-peak power consumption, and buffering. It can relieve the pressure of the power grid and can also be used in micro-grid scenarios and emergency power supply. The battery cell adopts large-capacity energy-type lithium iron phosphate battery cell, and the battery pack

It adopts advanced liquid cooling technology solutions and PACK-level fire protection technology to ensure the life and safety of the product.

The product adopts the design of energy storage battery cabinet and AC combiner cabinet. The AC combiner cabinet reserves the busbar position, which can support multiple cabinet parallel expansion.

1.2 Working Environment

1) Use environment: outdoor on the ground

2) Maximum temperature: 40℃

3) Minimum temperature: -20℃

4) Ambient relative humidity: 95%

5) Altitude: ⩽2000m

The use place must not contain explosive media, and the surrounding media must not contain harmful gases and conductive media that corrode metals and damage insulation, water vapor and severe mold are not allowed to exist.

2. Design reference standards

This document complies with the technical specifications of relevant countries and industries, including but not limited to the following standards.

The latest version shall apply to this technical specification.

1) GB50052–2009 "Design Specifications for Power Supply and Distribution Systems"

2) GB 50054–2011 "Low Voltage Power Distribution Design Code"

3) DL/T621–1997 "Grounding of AC Electrical Installations"

4) GB4208–2008 "Degrees of Protection Provided by Enclosures (IP Code)"

5) GB51048–2014 "Design Specifications for Electrochemical Energy Storage Power Stations"

6) GB/T 36276–2018 "Lithium–ion Batteries for Power Energy Storage"

7) GB/T36547–2018 Technical Regulations for the Connection of Electrochemical Energy Storage Systems to the Grid

8) GB/T36548–2018 "Test Specifications for Electrochemical Energy Storage System Connection to the Grid"

9) GB/T34131–2017 Technical Specification for Lithium–ion Battery Management Systems for Electrochemical Energy Storage Power Stations

10) GB/T 34120–2017 Technical Specification for Energy Storage Converters for Electrochemical Energy Storage Systems

11) GB/T 228–2022 Safety Regulations for Electrochemical Energy Storage Power Stations

12) DL/T620–1997 "Over voltage Protection and Insulation Coordination for AC Electrical Installations"

13) DL/T621–1997 "Grounding of AC Electrical Installations"

14) GB14048.1 "Low–voltage switch gear and control gear Part 1: General provisions"

15) GB21966–2008 "Safety Requirements for Lithium Primary Cells and Batteries in Transport"

16) GB7947 "Basic and safety rules for marking and identifying human–machine interfaces – Color or numerical marking of conductors"

3 . Product Features

The use of lithium iron phosphate batteries with mature technology, safety, economy, environmental protection and long life can meet the needs of MW–level power output.

energy storage capacity.

- ✧ The design and testing of lithium iron phosphate batteries comply with relevant national standards;
- ✧ Large battery storage capacity, ALL–in–ONE design concept, higher integration;
- ✧ By adopting comprehensive control strategies, the system conversion efficiency has been significantly improved, reaching the industry–leading level;
- ✧ The battery management system adopts multi–level management, which is flexible and reliable and easy to expand and upgrade.
- ✧ Real–time monitoring of single cell voltage and temperature, with configurable sampling time;
- ✧ Adopting LCD touch screen design, monitoring is more intuitive and operation is more convenient;
- ✧ Unique system power supply design ensures safe and reliable operation of the energy storage system;
- ✧ Adopt comprehensive, multi–level battery protection strategies and fault isolation measures to ensure the safe application of energy storage systems;
- ✧ Outdoor cabinet installation has high modularity, simple structure, small footprint, and is easy to transport, install, and maintain;
- ✧ Equipped with automatic fire alarm and automatic fire extinguishing system, PACK–level fire protection technology, safe and reliable;
- ✧ New liquid cooling technology reduces battery temperature rise;
- ✧ Can support multiple machines in one cabinet, flexible application;

4 . Energy Storage System Architecture, Principles, and Key Component Properties

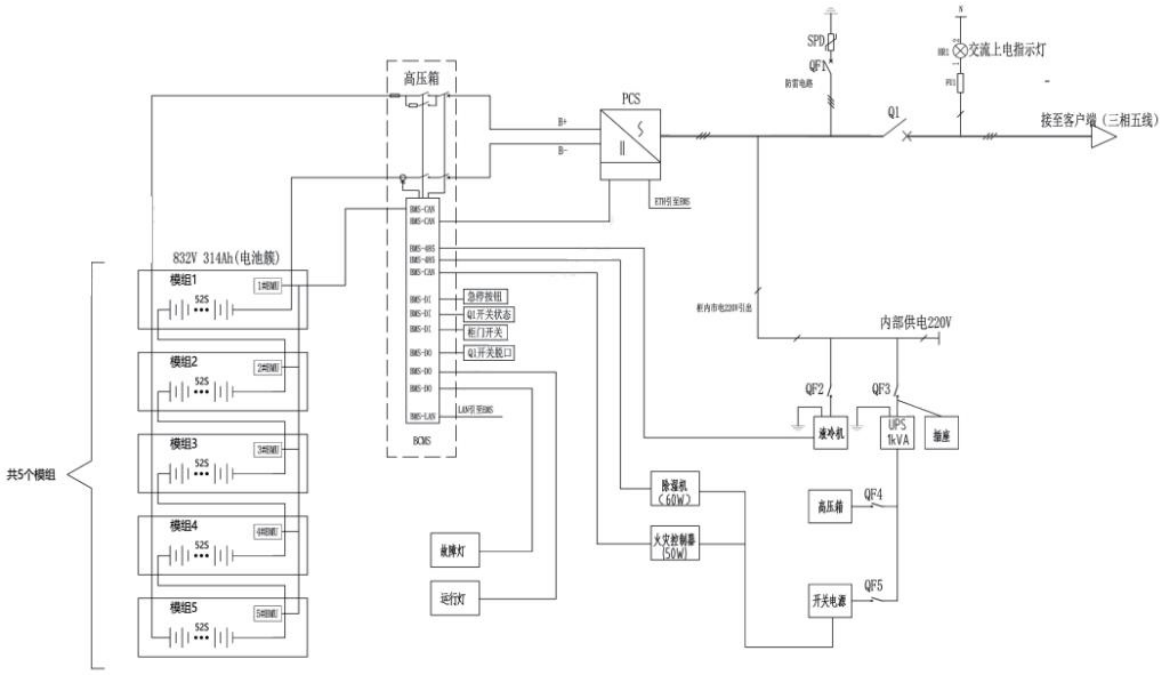
4.1 Energy Storage System Composition

This product consists of: outdoor energy storage battery cabinet.

Composition table of outdoor energy storage battery cabinet

No.	Components	QTY	Remark
1	Cabinet	1	Dimensions (W*D*H):1000mm*1300mm*2450mm
2	Battery box	5	1P52S liquid-cooled battery box, 314Ah, including BMU
3	Energy Storage Converter	1	DC voltage 650-950V, AC 400V, rated power 125kW, Three-phase four-wire
4	Liquid cooling system	1	5kW liquid cooling unit and liquid cooling pipes
5	Fire protection system	1	PACK-level fire detection + PACK-level fire suppression
6	EMS display and control	1	Industrial and commercial energy storage EMS display and control (configured in combiner cabinet)
7	High-voltage box	1	Includes secondary battery management system
8	Molded case circuit breakers	1	AC400V, 250A/4P switch 1
9	The primary and secondary loops connect the components	1	Including cables, connectors, copper busbars

4.2 Energy Storage System Topology



4.3 Energy Storage System Technical Parameters

Energy storage battery cabinet technical parameter table

Item	Parameter	Remark
Cell Capacity(Ah)	314	
Configuration	1P260S	
DC rated voltage(V)	832	
DC voltage range(V)	728~936	
Installed capacity (kWh)	261.248	
DC Max. Continuous current(A)	170	
Operating temperature range	Charge: 0~55℃ Discharge: −20~60℃	
PCS rated power(kW)	125	
Pack cooling type	Liquid Cooling	5kW cooling capacity, 3kW heating capacity
Firefighting methods	Perfluorohexanone fire extinguishing device	PACK−level fire detection + PACK−level extinguishing Anti−inhibition
Battery cabinet dimensions (W*D*H mm)	1000*1300*2450	
Battery cabinet weight (kg)	About 2600	
Cabinet protection level	IP54	
Cycle life	≥6000cycle	25℃/100%DOD/80%SOH
Allowable altitude	≤2000m	
Allowable relative humidity	5%−95%	
DC connecting cable specifications	EV−DC 1500V−70 square cable	DC side power cable

5. Component parameters

5.1 Battery Cell Technical Parameters

Lithium iron phosphate battery is a commonly used lithium-ion battery for energy storage, which has high rate, good cycle life, large single capacity, high safety, high consistency and other characteristics, which are very suitable for applications in energy storage scenarios.

Cell Parameter Table

Item	parameter	Condition
Rated capacity	314Ah	25℃±2℃，Standard charge/discharge
Rated energy	1004.8Wh	25℃±2℃，Standard charge/discharge
Rated voltage	3.2V	
Operating voltage range	2.5V-3.65V	Temperature T＞0℃
Batter internal resistance(1kHz)	0.18±0.05mΩ	
Operating temperature (charging)	0-60℃	
Operating temperature (discharging)	-30~60℃	
Cycle life	⩾8000cycle	25℃ 0.5P 70%SOH
Weight kg	5.6±0.3	
Dimensions (W*H*D)	173.7*207.2*71.7± 0.5mm	Thickness tested under 300Kgf pressure

Apply Altitude	Below 2000m	
Continuous charging rate	0.5C	15℃~55℃
Continuous discharge rate	0.5C	−20℃~55℃
Self−discharge rate	⩽3% per month	25℃±2℃

5.2 Battery Module Parameters

The battery module (PACK) is mainly composed of battery cells connected in series and has the functions of voltage and temperature collection and balance control of the battery.

It adopts a dedicated battery management chip design, receives control commands through CAN communication, and reports collected data.

Battery module parameter table

Item	Parameter	Condition
Configuration	1P52S	
Rated voltage	166.4V	Cell voltage:3.2V
Operating voltage range	145.6~187.2V DC	Cell voltage range: 2.8−3.6V
Standard charging current	160A	15℃~55℃

Peak charging current	190A	Lasts 60 seconds
Standard discharge current	160A	−20℃~55℃
Peak discharge current	190A	Lasts 60 seconds
Rated capacity	314Ah	
Discharge capacity	52.2496kWh	25℃±2℃，Standard charging&discharge
Battery Pack Size Largest	1134*790*244mm	
Weight	About 350kgs	
Self−discharge	⩽5% 28days	25℃ 100%SOC
Discharge temperature range	−20℃~60℃	
Charging temperature range	0−55℃	
Recharge cycle	Recommend to recharge when the storage period reaches 3 months	
Cooling method	Liquid cooling	
Battery pack directional fire fighting	Have	

5.3 Battery String Parameters

This product consists of a single battery string formed by connecting five battery PACKs in series, with the PACKs connected via power harnesses.

Each battery PACK is equipped with a first−level monitoring unit (BMU) of the battery management system, configured according to the number of cells. The BMU monitors the voltage and temperature of the PACK, and also provides balancing and protection functions.

The BMU is located on the front panel inside the PACK, making installation and maintenance convenient.

The battery string is equipped with one high−voltage box, which contains contactors, fuses, a DC power supply module, and a second−level BMS module, ensuring system safety.

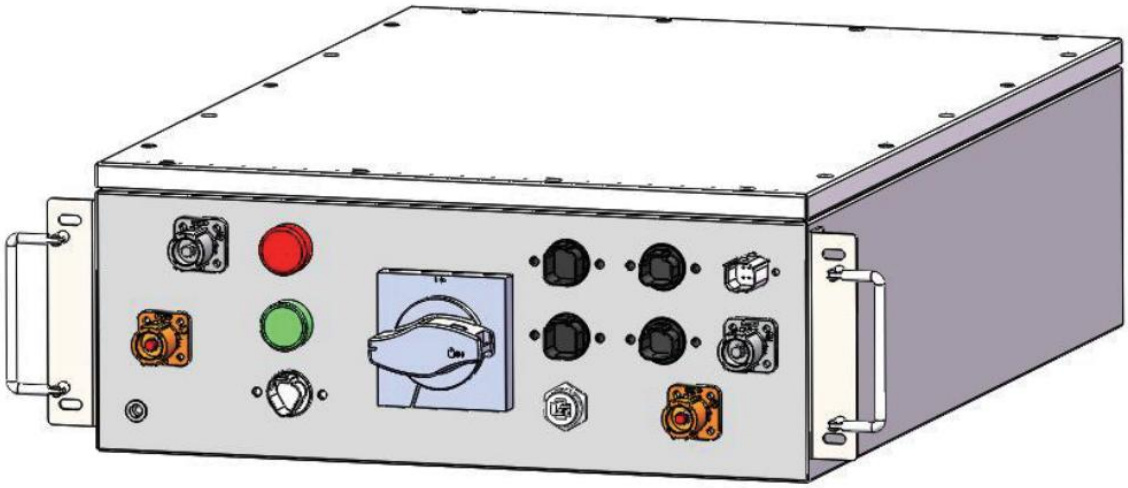
Battery String Parameters Table

Item	Parameter	Condition
Rated voltage	832V	Cell voltage:3.2V
DC side voltage range	728~936V DC	Cell voltage range: 2.8−3.6V

Rated capacity	314Ah	0.5C 25℃
Rated energy	261.248kWh	0.5C 25℃
Configuration	1P260S	
Standard charging current	160A	
Peak charging current	190A	Lasts 60 seconds
Standard discharge current	160A	
Peak discharge current	190A	Lasts 60 seconds
Operating ambient temperature range	Charging: 0–55℃ Discharge: –20℃~60℃	
Storage temperature	–30℃~60℃	
Operating humidity	5%~95% RH	
Application altitude	⩽2000m	
PACK Cooling method	Liquid cooling,50% ethylene glycol aqueous solution	5kW cooling capacity, 3kW heating capacity
IP grade	IP54	
Dimension(W*D*H)	⩽1000*1300*2450	
CAN protocol	Ethernet, RS485, CAN	

5.4 High Voltage Box Parameters

High Voltage Box:Maximum operating voltage and current: DC 1000V / 250A, equipped with a circulating current control circuit, main positive and main negative contactors, and powered by AC 220V. Protection rating: IP54, features aviation plug–type power connections and is suitable for practical applications in user–side, grid–side, and generation–side energy storage systems.



High voltage box interface table

Interface Definition	Function Description	Remark
B+	Battery cluster positive input terminal	
B–	Battery cluster input negative terminal	
P+	High voltage box output positive terminal	
P–	High voltage box output negative terminal	
Power	BMS power switch	

High voltage box parameter

Item	Parameters	Condition
Battery type	LiFePO4 cell	
Rated operating voltage(v)	832	
Max. Continuous discharge current (A)	190	
Max. Continuous charging current(A)	190	
Main positive& negative contactor	1000Vdc 250A	
Fuse specification	1000Vdc 315A	

Circuit breaker specification	1000Vdc 250A	
BMS LV power supply	AC220V/DC24（150W）	
Positive&negative connector	1500Vdc 250A	Adapt to 70mm²
CAN protocol	Ethernet, RS485, CAN	
IP grade	IP54	
Dimension(W*D*H)	⩽1000*1300*2450	
Operating ambient temperature range	–30℃~65℃	

5.5 Switch Definition

No.	switch label	Switch Name	Function	Specification
1	Q1	AC output molded case circuit breaker	PCS 400V output protection switch	250A/4P
2	QF1	AC Surge Protector Switch	Supplies power to the AC surge protector inside the battery cabinet.	C40A/3P
3	QF2	Liquid Cooling Unit Power Switch	Supplies AC 220V power to the liquid cooling unit inside the cabinet	D20A/2P
4	QF3	Cabinet UPS Circuit Breaker	Supplies power to the UPS input circuit inside the cabinet.	C16A/2P
5	QF4	High Voltage Box Power Circuit Breaker	Supplies AC 220V power to the high voltage box circuit	C10/2P
6	QF5	Switching Power Supply Circuit Breaker	Supplies power to the 24V switching power supply circuit inside the cabinet.	C10/2P

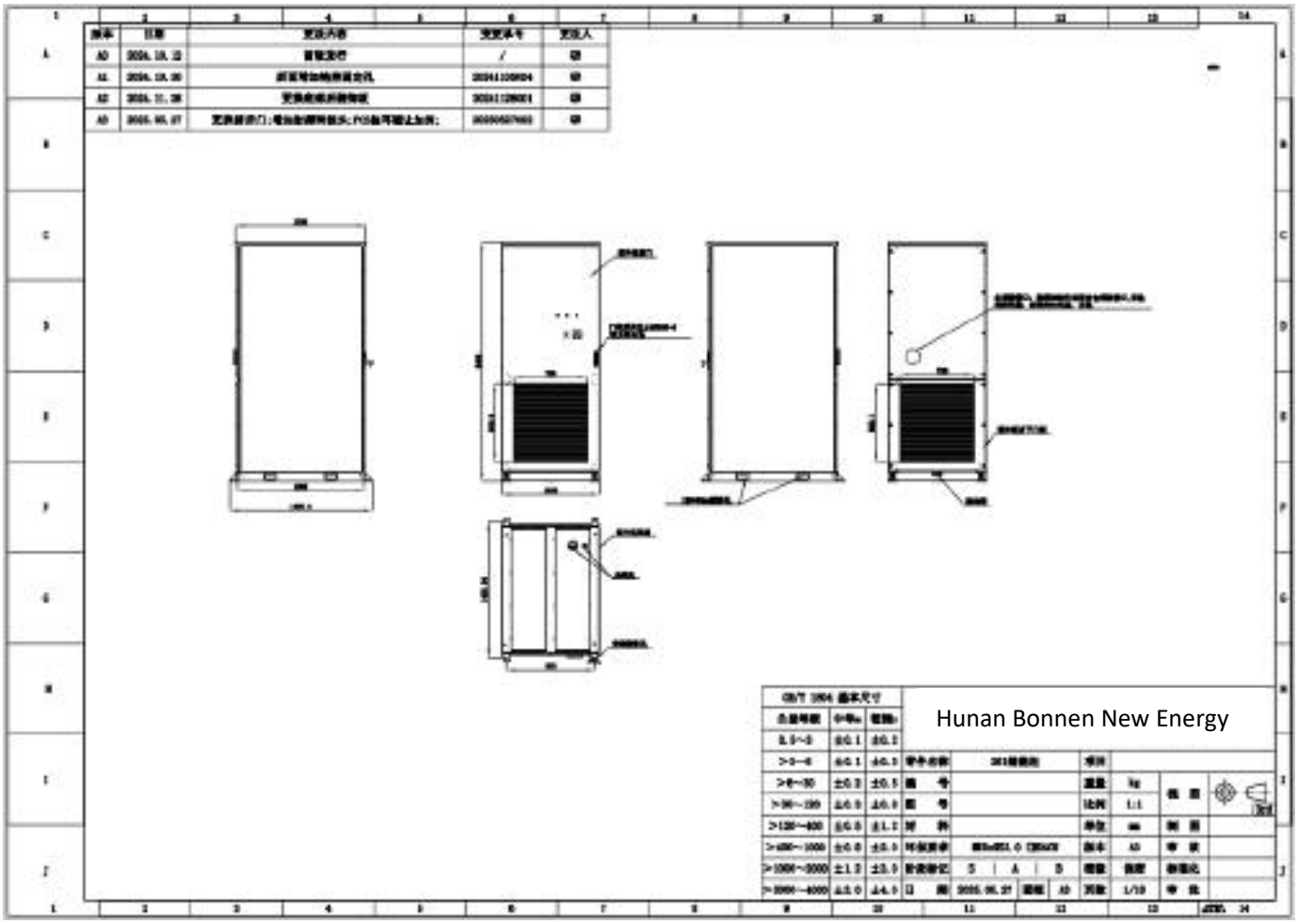
5.6 Indicator Light Definition

Indicator Light Definition Table

No.	Indicator light label	Indicator light name	Indicator light function
1	HR	Power indicator	Primary circuit Q1 switch incoming terminal energized — indicator ON.

2	HG	Running indicator light	Indicator ON when the energy storage system is operating normally.
3	HY	Fault indicator light	The indicator light turns on when the energy storage system fails

5.7 Product dimension drawing



6. Equipment Installation

6.1 Transportation Precautions

✧ The cabinet must be strapped and secured during road transportation to prevent shaking.

✧ During road transportation, do not position the cabinet door facing directly forward or backward relative to the vehicle's direction.

6.2 Installation Precautions

- ✧ During hoisting, the cabinet tilt angle should not exceed 5°.
- ✧ Avoid contact with personnel during hoisting.
- ✧ Establish a dedicated installation isolation area during installation operations.
- ✧ Handle the cabinet gently during hoisting.
- ✧ Only professionally trained electrical installation personnel are allowed to install the cabinet.
- ✧ Do not install the product if there are defects, cracks, or damages.
- ✧ Do not attempt to open, disassemble, repair, tamper with, or modify the cabinet during installation.
- ✧ Do not install the cabinet in rainy, dusty, or other harsh weather conditions.
- ✧ To protect the cabinet and its components from damage during transportation, handle with care.
- ✧ Do not insert foreign objects into any part of the cabinet.
- ✧ Do not expose the cabinet or its components directly to flames.
- ✧ Do not install the cabinet near heating equipment.
- ✧ Handle with care to avoid damage during transport. Do not hit, pull, drag, or step on the cabinet. Avoid applying strong external forces to the cabinet. To prevent damage, keep the cabinet in its packaging until ready for installation.
- ✧ Do not immerse the cabinet or its components in water or other liquids.
- ✧ Do not clean the cabinet with solvents or expose it to flammable or irritating chemicals or vapors.
- ✧ Note: The transport and hoisting illustrations are for reference only; actual operations depend on the tools and equipment used.
- ✧ The gap between cabinets side–by–side should be ⩾10mm; back–to–back gap should be ⩾200mm.
- ✧ During transport, place the battery system on a level surface, ensuring it is stable with no shaking or tilting.
- ✧ Battery system installation should consider the load–bearing capacity of the installation floor or slab.

6.3 Site and Environmental Requirements

Unless otherwise specified, concrete grade is C30, floor thickness is 200mm, with edges extending 300mm beyond the cabinet on each side, reinforced with Grade 3 steel (12@150).

- ✧ Reinforcement steel uses HRB400 grade (Grade 3 steel); after rust removal, apply anti-corrosion treatment per relevant standards. Floor slab cushion thickness is 100mm, concrete strength grade C15.
- ✧ The foundation bearing layer should be natural soil with a bearing capacity characteristic value not less than 100 kPa.
- ✧ Dewatering measures must be taken during foundation construction; water accumulation in the foundation pit is strictly prohibited. Safe and reliable support must be provided during foundation excavation. Floor flatness requirement: within 2 meters, flatness deviation should be less than ± 4mm.

6.4 Chemical Anchor Bolt Fixing Requirements

1) Before chemical rebar anchoring, the surface coating on the anchoring area must be removed and thoroughly cleaned before proceeding.

2)The concrete strength grade is C30; chemical rebar anchoring requires pull-out tests.

3) The required tensile strength of the installed chemical anchor bolts must be at least twice the design bearing capacity.

4) It is recommended to use Hilti HVA chemical anchor bolts; specific design values are shown in the table below.

Table 4-1 Chemical Anchor Bolt Parameters

Chemical Anchor Bolt	Tensile Design Load (kN)	Shear Design Load (kN)	d	hef	tfix
R-M12	23.8	18.3	14	110	28

5) Chemical anchor bolt installation should comply with JGJ145–2013 "Technical Code for Post–installed Reinforcement in Concrete Structures".

6) When welding is involved, measures must be taken to avoid overheating the anchoring area which may cause the anchoring adhesive to fail.

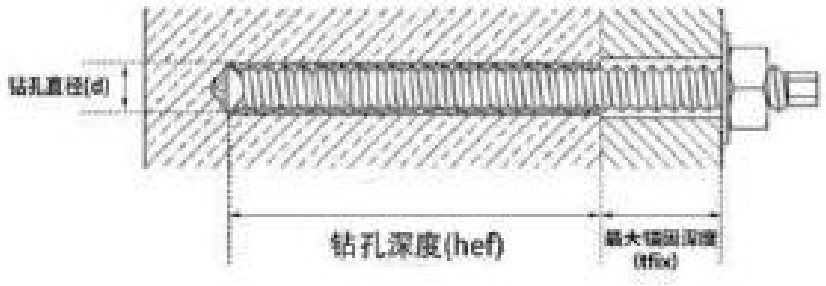


Figure 6–4 Chemical Anchor Fixing Requirements

6.5 Electrical Wiring

The AC side wiring uses a three–phase five–wire system (phases A, B, C recommend using 50mm² AC cables; neutral (N) and protective earth (PE) lines recommend using 35mm² AC cables). The cables pass through five M25 waterproof cable glands located at the bottom of the outdoor cabinet. The gland fixing plate is removable to facilitate cable installation. If the actual cables do not match the cable glands, fireproof sealant may be used to seal and protect instead of the cable glands.

7. Product Application

7.1 System Power On/Off Operations

7.1.1 Power On Procedure

1) Before formal power–on, inspect all system connection cables to ensure reliable connections, no aging or breakage, and no insulation damage.

2）Verify that all cables are connected correctly before powering on.

3）After verification, close the transformer-side circuit breaker.

4）Secondary power-on: close the four miniature circuit breakers inside the high-voltage box's breaker panel. The high-voltage box panel 220Vac power and Control power indicator lights turn on. The switch, dehumidifier, and EMS inside the electrical box are powered on, completing the system power-on.

5）Primary power-on: close the main circuit breakers QF4 and QF5.

6）Lock the waterproof cover of the high-voltage box breaker panel, close the electrical box door and outdoor cabinet door, then send the system run command. The cabinet RUN indicator light turns on.

7.1.2 Power Off Procedure

EMS issues a power-off command to the primary circuit for PCS and BMS; the system powers off the primary circuit and returns to the state when the system was first started. At this time, the cabinet main circuit is disconnected, no high voltage exists at the positive and negative output terminals, and the cabinet RUN indicator light turns off.

7.2 System External Communication

7.2.1 EMS Introduction

The cabinet is equipped with an EMS controller, as shown in the figure, located inside the electrical box within the cabinet. It coordinates and controls the components inside the cabinet. The EMS controller supports single-cabinet and multi-cabinet management and features 4G communication capability. It can connect in real time to the Cloud Data Platform for data and control command exchange.

8. Cloud Platform Introduction

8.1 Cloud Platform Overview

The distributed energy storage operation platform is a web–based cloud monitoring platform suitable for distributed energy storage power stations. Once connected to the station equipment, it can monitor basic station information and the operating status of each device in real time. Through monitoring, control, maintenance, operation, and demand response services of on–site equipment, the platform quickly reaches operation personnel to realize efficient station operation and maintenance.

At the same time, through peak shaving and valley filling operational analysis, it helps reduce users' electricity costs. Its value is reflected in three main aspects:

Functionality:

Charging and discharging times and power of the storage system are controlled by strategies that adapt to different application scenarios.

In photovoltaic–storage integration scenarios, due to the inherent volatility of PV generation and local weather effects, charging and discharging control is adjusted accordingly.

In charging station scenarios, sudden impacts from large power charging and discharging may occur, requiring flexible adjustment of storage system operation to smooth fluctuations.

Safety:

Control strategies can promptly and effectively protect equipment during faults. Cloud–based algorithms can predict safety risks and issue early warnings.

Economy:

Lithium battery life is affected by temperature and charge/discharge rate. Improper operations accelerate cycle life reduction and affect overall equipment lifespan.

Precise control strategies make charge/discharge decisions based on battery state, choosing optimal paths to reduce battery performance and life loss, supporting distributed storage systems in gaining additional revenue through virtual power plants and extending earning periods.

8.2 Cloud Platform Functions

The distributed energy storage smart operation platform meets the following needs:

1) User authentication via username and password login protects station data from unauthorized access and various network attacks, ensuring multiple levels of data security.

2) The operation dashboard is mainly used for customer data analysis, safe operation and maintenance, revenue accounting, and multidimensional statistical ranking of invested stations. It provides a "single-page" overview of storage station analysis, operation, and revenue for efficient daily work.

3) At the corporate group level, it provides project statistics, distribution, and installed capacity visualization. Utilization rates, charge/discharge, and revenue data are displayed.

4) Enhances decision support by visually presenting business data for faster understanding and planning.

8.3 Main Features

The distributed energy storage smart operation platform has the following features:

✧ Intelligent and Flexible

- Layered, graphical display of device operating status with smooth, high-performance visualization.

✧ Simple and Efficient

- Real-time data refresh at second-level intervals.
- Real-time device alarm display and precise fault localization support efficient troubleshooting.

✧ Safe and Reliable

- Supports primary and backup redundancy configurations for reliable operation.
- Control processes strictly comply with power system safety regulations.
- Real-time data backup.

8.4 Interface Display (Partial)

9. Others

Other matters not covered herein shall be governed by the terms of the business contract.