Product Guide

IEC+UL

DC Energy Storage System

Model Name: CESS4000

Nominal Energy:4073kWh

REV: V5.0_2026.07.02

Table Of Contents

1 Document Version History

Data	Version	Changes in document
2025.08.25	**V1.0**	First version.
2025.12.30	**V2.0**	1.Update the technical parameters; 2.Adjust the structure of this document.
2026.03.01	**V3.0**	Adjust the some description about product configuration.
2026.04.20	**V4.0**	1.Update the introduction about product. 2.Add the introduction about installation
2026.07.02	**V5.0**	Update some parameters of datasheet (C rate), and we have two options for C rate,0.25C or 0.5C.

2 Purpose Of This Guide

This product guide describes **CESS4000 DC energy storage system**.

3 Safety Instructions

3.1 Intended Use

Intended use of product

- Any use of the product other than that described in this section does not qualify as the intended use.CESS4000 is a non-walk-in battery system for energy storage system (ESS) projects. CESS4000 enclosures come fully assembled, certified, and tested with internal subsystems and equipment including battery racks, DCC, ACC, FSS and safety systems.
- This product is intended to be used, monitored and controlled by the EMS power plant controller.
- This product can be set to be controlled remotely. For any inspection or maintenance work, follow the local safe work practices and the correct shutdown and LOTO procedures.
- The electrical and communication cabling must be prepared on site for power exchange.
- All power electronic devices (that is, battery inverter) required to perform power exchange with the batteries are located external to CESS4000.
- The product is designed for outdoor use only.
- Operation of CESS4000 is permitted only if the requirements concerning the maximum permissible DC input voltage, the maximum permissible auxiliary power AC input voltage and the ambient conditions are met. These parameters depend on the respective configuration of CESS4000.

3.2 Safety Precautions

The following safety precautions must be observed at all times when working on or with the product. To prevent personal injury and property damage and to ensure long-term operation of the product, read the safety precautions carefully. Also read the safety data sheet provided with the product.

 DANGER	**Risk of death or serious injury due to hazardous voltages.** ■ Only personnel possessing all of the skills required for the target group as defined in this manual are permitted to work on or with the product. ■ All persons working on or with the product shall use suitable personal protective equipment (PPE). ■ Unauthorized persons must not operate the product and shall keep a safe distance. ■ All work on the product shall be performed only using appropriate tools and in compliance with the electrostatic discharge (ESD) protection regulations.

DANGER

Danger to life due to applied voltages.

High voltages are present in the live components of the product. Touching live components results in death or serious injury due to electric shock.

- Always safely shut down the power exchange between the battery system and the external equipment before working on the product (see the shutdown instructions)
- After switching off the inverter, wait at least 15 minutes before opening the DCC, to allow the capacitors of the power electronics to discharge completely.
- Before performing any work on CESS4000, ensure that the DCCs are open (handle turned to the “OFF” position) and isolated from the external equipment.
- Wear suitable personal protective equipment of the corresponding hazard risk category for all work performed on CESS4000. The hazard risk categories of the various areas of the product are different.
- Risk assessment for selecting suitable personal protective equipment shall be made by qualified personnel before working on or with the product.
- Always perform all work in accordance with the locally applicable standards, directives and laws.
- Do not touch any live components.
- Observe all warning messages on the product and in the documentation.
- Observe all safety information on components associated with the product.
- CESS4000 cannot be operated with the doors open under any circumstances.

DANGER

Danger to life from electric shock due to live DC cables.

The DC cables connected in the DCC may be live in the event of a battery switch gear failure. Touching live cables results in death or serious injury due to electric shock.

- Wear suitable personal protective equipment of the corresponding hazard risk category for all work performed on CESS4000. The hazard risk categories of the various areas of the product are different.
- Always perform all work in accordance with the locally applicable standards, directives and laws.
- Before starting any work on CESS4000, ensure that there is no voltage on any side of the DC busbars in the DCC.

DANGER

Danger to life from electric shock due to ground fault.

- If a ground fault has occurred, the container and exposed metal equipment may in fact be live. Touching incorrectly grounded parts of CESS4000 may result in death or serious injuries from electric shock.
- Before working on CESS4000, ensure that there is no ground fault.
- Wear suitable personal protective equipment for all work on the device.

DANGER

Danger to life from electric shock from auxiliary power connections inside ACC.

The auxiliary power inside CESS4000 remains live when accessing internal equipment. Although the main auxiliary AC breaker can be turned off to isolate the auxiliary power distribution inside CESS4000, care must be taken to ensure the protection because the feeder coming into CESS4000 could still be live. Refer to the project-specific engineering documentation for information on how to isolate the site-level auxiliary power cables and the feed into CESS4000.

- Any work on CESS4000 shall be performed only by qualified service personnel.
- Wear suitable protective equipment for all work.
- The single-phase AC power socket is rated at 10A maximum. Do not connect power tools to this socket.

DANGER

Danger to life from electric shock due to damaged product.

Operating a damaged product can lead to hazardous situations resulting in death or serious injuries due to electric shock.

- Only operate the product when it is in a flawless technical condition and safe to operate.
- Check the product regularly for visible damage.
- Make sure that all external safety equipment is freely accessible at all times.
- Make sure that all safety equipment is in good working order.
- Wear suitable personal protective equipment of the corresponding hazard risk category for all work performed on CESS4000. The hazard risk categories of the various areas of the product are different.
- Always perform all work in accordance with the locally applicable standards, directives and laws.

DANGER

Danger to life from electric shock if the product is not locked.

If the product is not locked, unauthorized persons will have access to live components carrying lethal voltages. Touching live components can result in death or serious injury due to electric shock.

- Always close and lock the product.
- Remove the keys.
- Store the keys in a safe place.
- Ensure that no unauthorized persons have access to the closed electrical operating area.

DANGER

Danger to life due to electric shock or arc flash fault in the event of faults within CESS4000.

Energized high voltage DC equipment is present. Arc flash faults may occur during maintenance or operation of CESS4000 product. Arc flash faults may be caused due to equipment failure or due to accidental short circuit of conductors or busbars to equipment, container, or other conductors. If arc flash faults occur in CESS4000, spontaneous pressurization or electrical shock may cause serious injury or death.

- Wear personal protective equipment (PPE) when working on or near CESS4000 enclosure.

DANGER

Danger to life due to electric arc if there are tools inside the product.

When reconnecting or during operation, an electric arc can occur if there are tools in the product creating a conductive connection between the live components. This can result in death or serious injury.

- Before commissioning or reconnection, verify that no tools are inside the product.

WARNING

Risk of fire due to failure to observe torque specifications on live bolted connections.

Failure to follow the specified torques reduces the ampacity of live bolted connections so that the contact resistances increase. This can cause components to overheat and catch fire.

- Ensure that live bolted connections, especially on batteries, are always tightened with the exact torque specified in the battery installation manual.
- When working on the device, use suitable electrically insulated tools only.

CAUTION

Risk of hearing impairment due to high-frequency noise of the product.

The HVAC unit may generate high-frequency noise during operation. This can result in hearing impairment.

- Wear personal protective equipment for all work on the product.
- Wear hearing protection.

CAUTION

Risk of burns due to hot components.

Some components of the product can get very hot during operation. Touching these components can cause burns.

- Observe the warnings on all components.
- During operation, do not touch any components marked with such warnings.
- After switching off the product, wait until any hot components have cooled down sufficiently.
- Wear suitable personal protective equipment for all work on the product.

CAUTION

Risk of falling from battery service platforms.

In cases where CESS4000 is installed with service platforms, icy, moist or sand-covered service platforms may be slippery. The service personnel can be injured by slipping or falling from the service platforms.

- Wear suitable personal protective equipment for all work on the product.
- Before stepping onto the service platform, ensure that there is no layer of snow, ice, sand or moisture on the platform.
- Do not keep any objects near or on the service platforms.

CAUTION

Risk of injury when using unsuitable tools.

Using unsuitable tools can result in injuries.

- Ensure that the tools are suitable for the work to be carried out.
- Wear personal protective equipment for all work on the product.

CAUTION

Risk of crushing and collision when carelessly working on the product.

Carelessly working on the product may result in crushing injuries or collisions with edges.

- Wear personal protective equipment for all work on the product.
- Use caution when opening and closing the doors that pose a risk of pinch point injuries.

CAUTION

Danger of slipping due to wet conditions.

Wet conditions can lead to slippery surfaces. This can result in minor injuries.

- Wear personal protective equipment for all work on the product.

 CAUTION	**Risk of damage to electronic components due to electrostatic discharge.** Electrostatic discharge can damage or destroy electronic components. ■ Observe the ESD safety regulations when working on the product. ■ Wear suitable personal protective equipment for all work on the product. ■ Discharge electrostatic charge by touching grounded enclosure parts or other grounded elements. Only then is it safe to touch electronic components.

 NOTICE	**Risk of damage to the devices due to sand, dust or moisture penetration.** Sand, dust or moisture penetration can damage the batteries and other internal equipment inside CESS4000 or impair their functionality. Caution must be used if a product door needs to be opened when it is raining or when the humidity exceeds 95%, as such conditions can lead to condensation inside CESS4000. ■ Do not open any devices during a sandstorm or heavy precipitation. ■ It is highly recommended to perform maintenance work only when the environment is dry and free of dust. ■ If the installation, maintenance or commissioning process is interrupted, close all doors.

NOTICE

Risk of damage to property due to environmental disturbances.

The product can be damaged by environmental disturbances, such as earthquakes, storms or flooding. With a damaged product, a safe and trouble-free operation is not guaranteed.

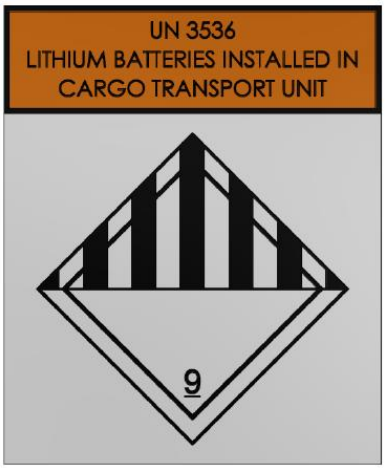
Considerable damage to the product and yield losses can result.

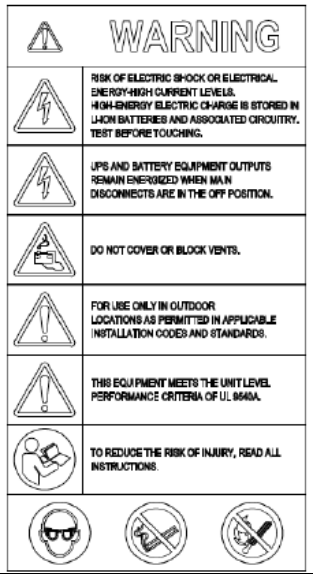
- Always disconnect the product from the voltage sources as quickly as possible after large-scale environmental disturbances.
- Once the product is disconnected from the voltage sources, perform a thorough inspection and do any required maintenance to repair the damage.
- After a dust or snow storm, ensure that air inlets and outlets are not blocked, for instance by snow or sand.
- Recommission the product only once any damage has been repaired.

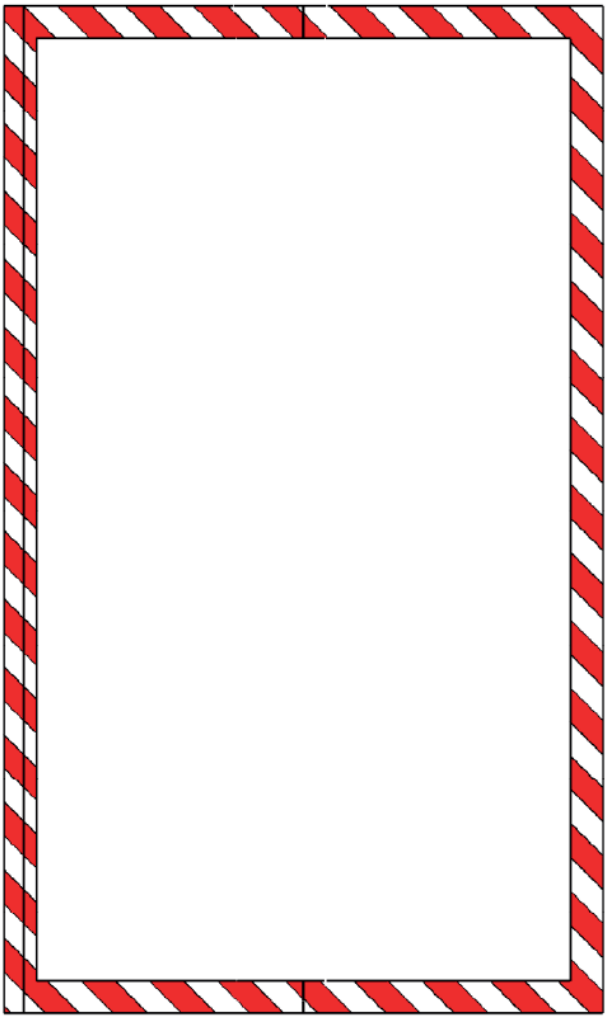
3.3 Product Safety Labels

Safety labelling contains essential safety information and draws attention to hazards associated with working with CESS4000.

WARNING	Product safety labels give important safety information about the product. Ensure that all the safety labels remain permanently attached to the product. If any of the safety labels become illegible or peel off, replace the label with a new one.For ordering new safety labels, contact RCT Power.

Labels	Descriptions
	**Center of gravity**
	**UN 3536**
	**Arc flash danger**

	**Voltage Caution**
	**Battery container warning**
	**Explosive gas**
	**Voltage**

	**Red and white boundary tape**
	**Do not step**

3.4 Personal protective equipment (PPE) selection

 DANGER	**ARC flash hazard!** ■ **NEVER OPERATE** the Main DC disconnect switch under load! (if supplied) ■ If load status is unknown, operate **PROCESS STOP** on the door of the DCC chamber door prior to pressing the DC disconnect switch. ■ Always perform disconnection in specified order. ■ **NEVER OPERATE** the rack DC disconnect switch under load! ■ If load status is unknown turn off rack AC auxiliary power downstream of UPS device (see site specific drawings), prior to operating rack DC disconnect switch. Following this if rack maintenance is required, also disconnect one battery rack cable. ■ Continue to apply electrical safety practices when working with AC and DC auxiliary voltage within the enclosure.

Under normal site conditions the main DC disconnect (if supplied) and rack DC disconnect switches can be opened to allow for safe working with **minimum PPE (Personal Protective Equipment)**, when the DC main disconnect (if supplied) and DC switch on the rack switch gear are in a non-loaded status.

Following PPE is the recommended minimum:

- Fitted work clothes made of 100% cotton
  - Wear long-sleeve shirt and long pants
- Proper head protection
- Proper hearing protection
- Safety gloves
- Safety shoes
  - In a dry environment, wear safety shoes of category S3 with perforation-proof soles and steel toe caps
  - During precipitation or on moist ground, wear safety boots of category S5 with perforation-proof soles and steel toe caps

- Any other prescribed protective equipment that is determined as necessary by a specific job analysis.

3.5 Lock Out/Tag Out (LOTO)

3.5.1 Locking Out Equipment

When maintenance or service is required, the equipment shall be properly locked out as a safety precaution.

 WARNING	**Main DCC Disconnect switch Damage** ■ If Equipped with a DCC switch, Improper operation of the Main DC disconnect switch inside the DCC compartment, will result in switch damage. When changing the switch from the “ON” position to the “OFF” position the handle should only be turned counterclockwise. Turning the switch clockwise from the “ON” position will result in switch damage. Likewise, operating the main DC Disconnect switch in the counterclockwise direction when in the off position will result in switch damage, from the “OFF” position the switch should only be turned clockwise. Furthermore the switch should always be in the “OFF’ position when opening and closing the DCC compartment door failure to ensure the switch is in the correct position when opening and closing the door will result in switch damage.

Procedure

- **Notify all affected employees about the lockout.**

Inform what machine/equipment will be shut down and locked out.

- **Review the procedures.**

Ensure that each person performing LOTO (authorized employee) understands the type and magnitude of the energy present, the associated hazards and the proper methods of control.

- **De-energize the inverters.**

Use the EMS interface or site plant control system to de-energize the inverters connected to the battery enclosures that needs to be shut down.

- **De-energize the battery contactors.**

Use the EMS interface or site plant control system to de-energize the battery racks.

- **Shut down the equipment.**

Press the PROCESS STOP button on the front panel of the DCC compartment.

- **De-energize the DCC disconnect switch (if equipped) by turning the manual non-load switch handle inside the cabinet door to OFF position, otherwise open the DC bus and isolate DC voltage from the battery container from the inverter according to site specific inverter.**
- **Open all battery cabinet doors and isolate the battery strings.**

Turn the manual switch to OFF position for every battery switchgear on every battery row connected to inverter (system under maintenance).

- **De-energize AC Aux power (when required).**

Open Aux main breaker. To disable the 400 Y / 230 V AC (IEC)/480 Y / 277 V AC (UL) UPS the 24 Vdc fuses must be removed from battery pack.

- **Apply all locks and follow locally established lock out tag out procedures as required.**

3.5.2 Putting equipment back into service after a lockout

The lockout can be released when the maintenance is completed and the equipment is again ready for use.

Procedure

- **Inspect the equipment.**

Make sure that all components are operational.

- **Check the immediate area.**

Make sure that all employees have been safely positioned, and that tools and non-essential items have been removed.

- **Re-energize the equipment.**

Remove the lockout devices and activate the energy isolating devices to restore auxiliary power inside the ACC.

- **Turn the manual switch to ON position for every battery switchgear on every battery row connected to inverter.**
- **Close all the doors.**
- **Energize the DCC by turning the DCC manual non-load switch to position ON(if equipped), otherwise restore DC bus from inverter LOTO point.**
- **Reset the shutdown.**

Press the RESET button on the front panel of the DCC cabinet, and send a reset command on the EMS or site plant control system interface.

- **Notify all affected employees about the end of the lockout.**

Inform that the service or maintenance has been completed and that the equipment is ready for use.

- **Close the battery contactors.**

Energize the ESS units in that CESS4000 via the EMS or site plant control system interface.

- **Energize the inverters connected to CESS4000.**

Use the EMS or site plant control system interface to energize the ESS units connected to that CESS4000.

4 System Descriptions

CESS4000 is a modular and compact energy storage system. It consists of **10 battery racks** for DC energy storage, and electrical cabinets for power distribution and control.

Multiple CESS4000 enclosures can be installed in a row and networked to achieve the desired energy storage capacity.

CESS4000 comprises the following main units and subsystems:

- Battery racks and cooling units
- ACC cabinet
- DCC cabinet
- CESS4000 Controller (industrial controller)
- Process stop system.

The automation system components are installed in CESS4000 enclosure, together with equipment for internal power distribution and various other auxiliaries and instrumentation.

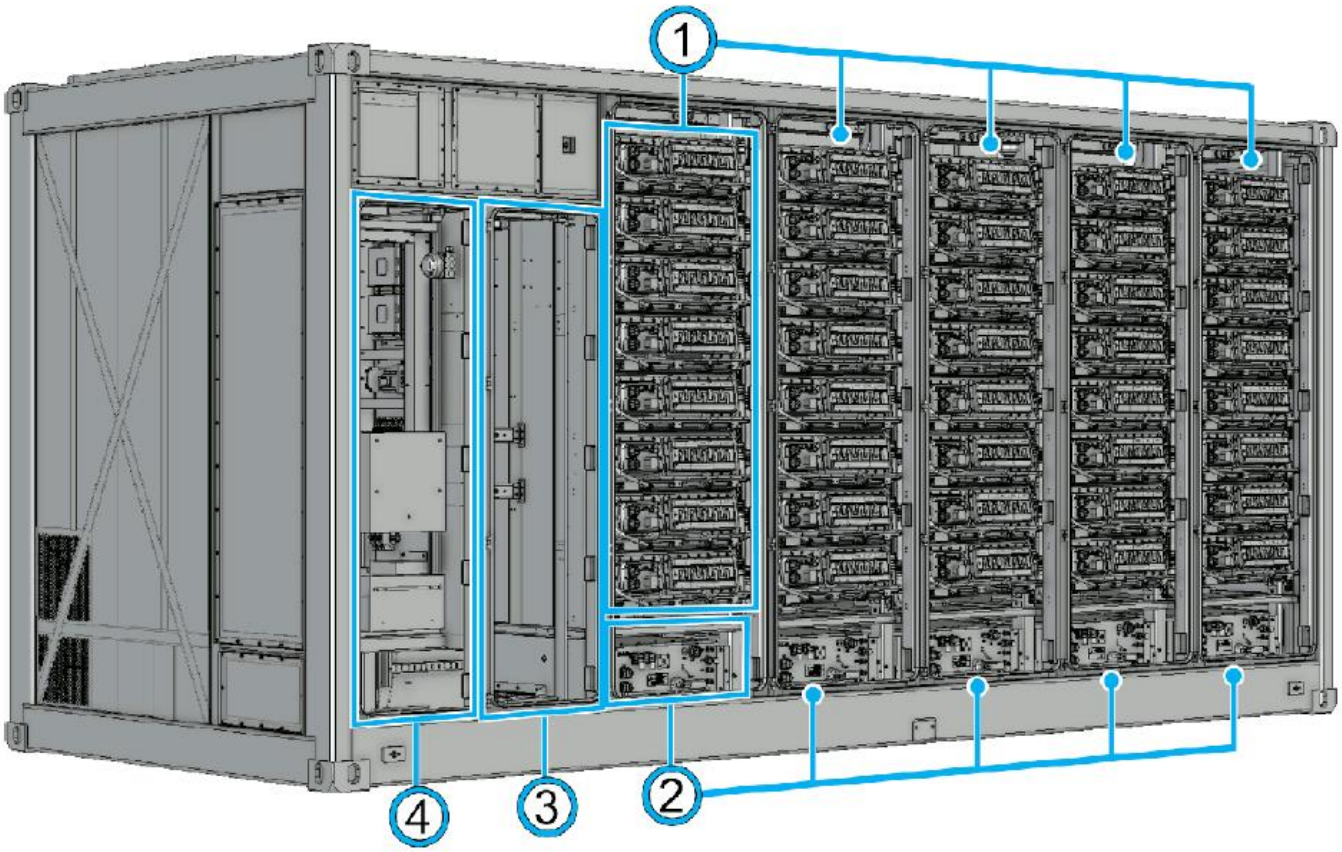
CESS4000 is connected to the external systems through the ACC and DCC.

The ACC and DCC cabinets are integrated into CESS4000 enclosure and adjacent to the battery chiller. The smoke detectors of each CESS4000 enclosure are wired to a fire alarm control panel inside the ACC door.

Cables from the external systems are brought into the cabinets through the floor or side panel, which is provided with gland plates.

4.1 Left Front View Of Product (All Doors Removed)

Batteries are glycol liquid coolant thermal-controlled LiFePO 4 (lithium ferro-phosphate). CESS4000, when fully equipped, can contain **10 battery racks** of **8 battery packs** each for around 4 MW of storage capacity. Each battery rack chamber is secured behind a battery chamber door. Each battery chamber door can be optionally fitted with deflagration burst panels as part of CESS4000 Explosion Protection System. Below each battery rack is a power distribution unit switchgear.



No.	Description
1	Battery rack, fully populated with 8 battery packs (Battery rack chamber doors removed in image)
2	Power distribution switchgear (1 for each battery rack)
3	DC combiner cabinet (DCC) interior (Door removed in image)
4	Auxiliary control cabinet (ACC) interior (Door removed in image)

4.2 Left Rear View Of Product (All Doors Removed)

The ACC cabinet accommodates AC and DC auxiliary power entry and data connection through cable lead-through plates at CESS4000 underside and left side.

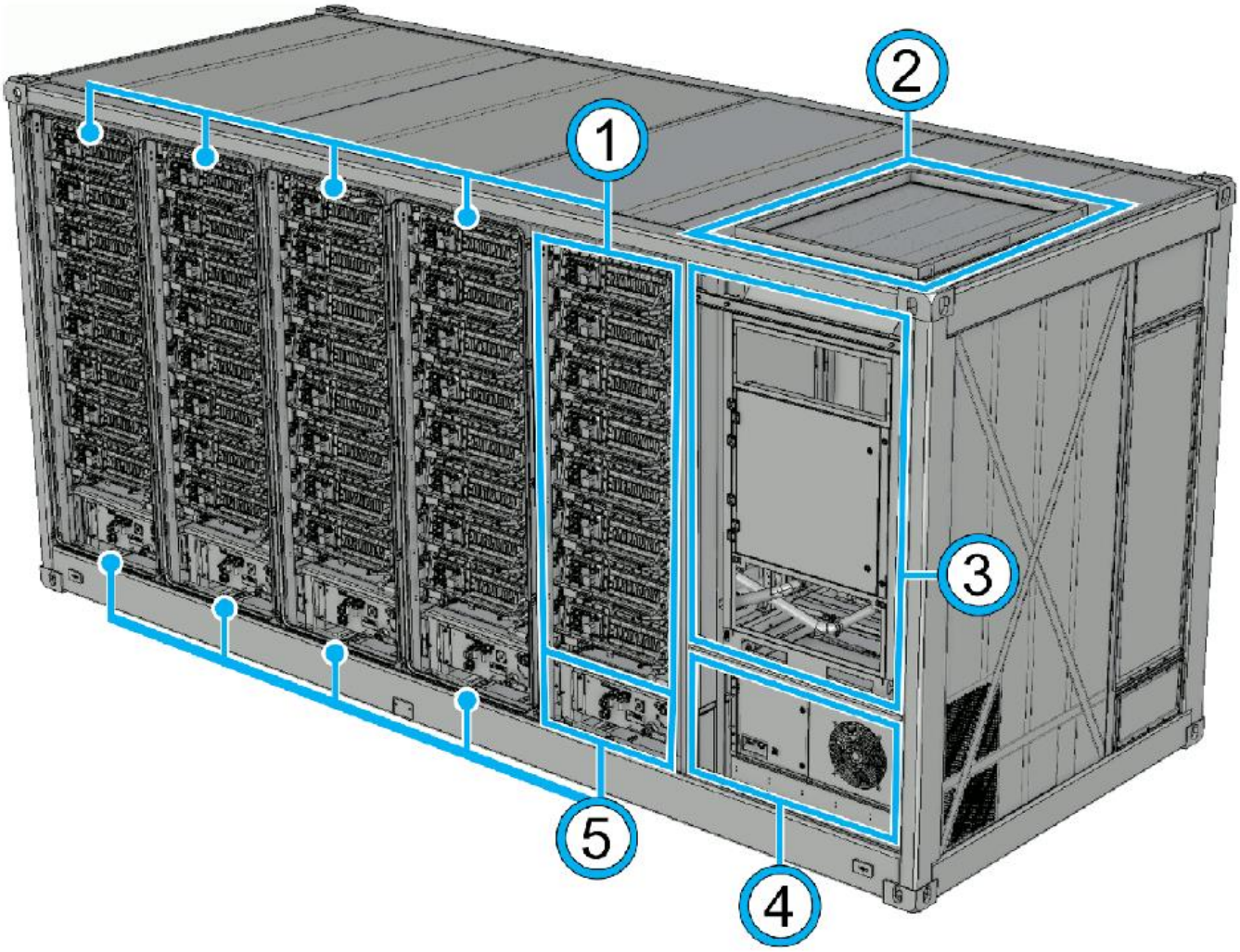
The ACC contains the door-mounted fire alarm control panel (FACP) and FACP battery back-up housing. The standard dehumidifier mounts to the ACC door.

Fiber optic data connection to the EMS or site PPC system is in the ACC cabinet. Within and between CESS4000 containers in a row, are internal data connections for safety, detection, and operating condition systems.

A smoke detector, CESS4000 industrial PC computer controller, PLC assembly, networking equipment, battery management system (BMS), patch panels, power supplies with battery back-up, optional AC auxiliary power meter, the battery management unit (BMU), and other market-specific equipment are mounted in the ACC cabinet.

Inside the DCC cabinet, connection to the external inverter PCS conductor is made. A main DC power fuse protects CESS4000 battery equipment inside the container and the external inverter. Surge arresting equipment is fitted here, connected to site earthing / ground network to protect risk associated with AC mains power surges and lightning strike. DC battery power is made through conduit connection at CESS4000 underside.

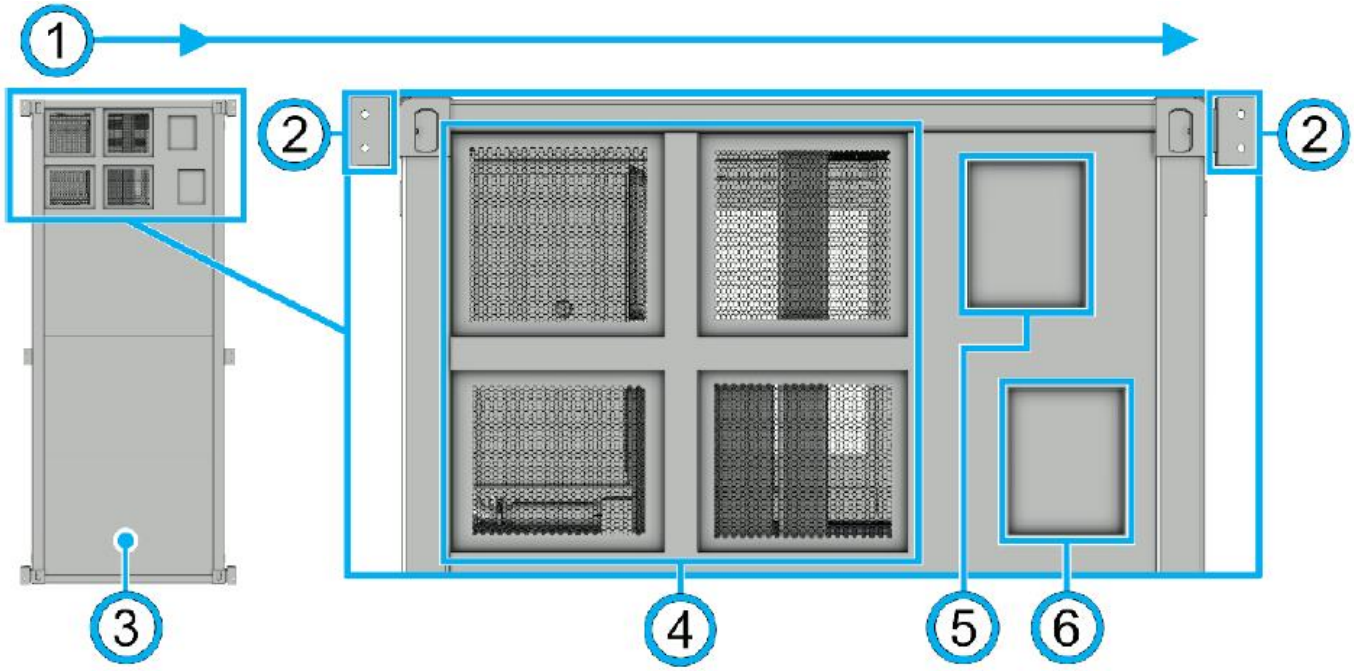
Two hydrogen gas detector mounts at the ceiling of the center battery chamber at the front and rear of CESS4000 container.



No	Description
1	Battery rack fully populated with 8 battery packs per rack (Battery rack chamber doors removed in image.)
2	Battery chiller coolant thermal exhaust
3	Battery chiller (ventilated door removed) access service door
4	HVAC (**optional**)
5	Power distribution switch gear (One under each battery rack)

4.3 Underside View Of Product

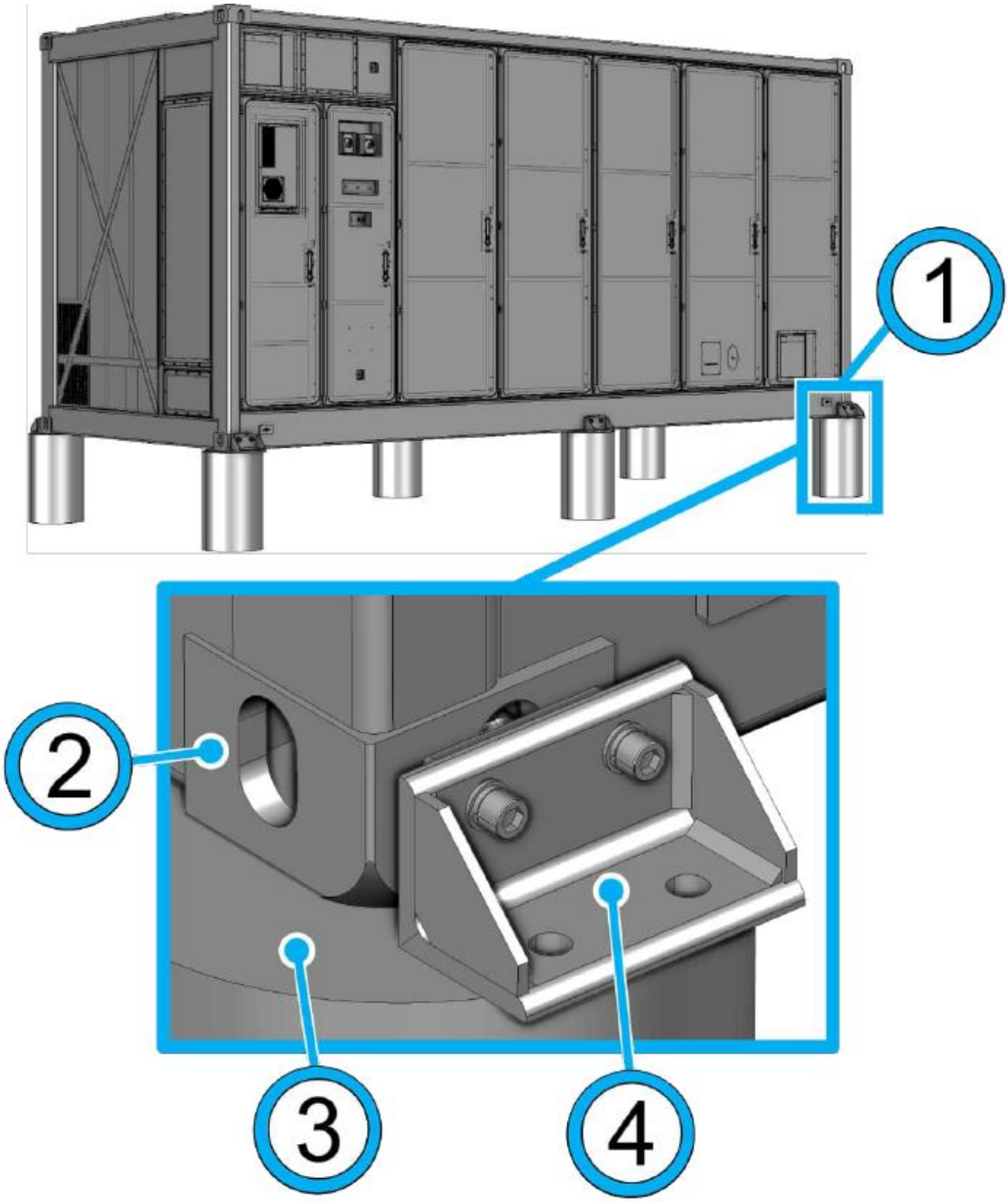
The ACC and DCC cabinets are fitted with conduit lead-through plates for AC auxiliary control power, **DC battery power conduit for connection to an external inverter PCS system and MV transformer**. Fiber optic data lines may be routed through conduit to connect the EMS or site power plant controller (PPC) server hardware to CESS4000 row deployment. CESS4000 can connect to a variety of inverter and MV transformer makes and models to exchange energy for charge and discharge.



No	Description
1	To product front (Left side when viewed from front of product)
2	Container tie down (6 total – mounting platform options vary)
3	Product underside
4	Underside thermal management ventilation
5	DCC cabinet conduit lead-through plate
6	ACC cabinet conduit lead-through plate

4.4 Container Mount

CESS4000 can secure to different mounting solution methods to accommodate the ESS site size, shape, and conduit entry into the container ACC and DCC cabinets. The mounting option is flexible to achieve the desire C-rate for the row and deployment.



No	Description
1	Concrete pier or footing assembly (An example CESS4000 mount method)
2	ISO block (Integral to CESS4000 container for lift and securing to mounting platform method)
3	Example mounting platform material or method (Pier or footing)
4	Container tie down (6 total – Mounting platform options vary)

4.5 Enclosure Of Product

CESS4000 battery enclosure houses the battery racks, chiller, Auxiliary Control Cabinet (ACC) and DC Combiner Cabinet (DCC), and provides the interface between the Energy Storage System (ESS) and the external AC power system.

The DCC connects the battery banks to inverters and communicates with EMS for overall plant control. AC auxiliary power for components in CESS4000 is fed through the ACC.

No	Description
1	ACC (Auxiliary Control Cabinet)
2	DCC (DC Combiner Cabinet)
3	Battery Racks
4	Chiller

The control system components of CESS4000 enclosures are located in the ACC. The sensors in the ACC/DCC cabinet are connected to a local CESS4000 Controller for monitoring and process control. A combined strobe and siren unit for the fire safety system is mounted on to the DCC door exterior.

The ACC/DCC cabinet has an HVAC unit for temperature control. In addition, ventilation fans are installed in the roof of the ACC and DCC enclosures for air circulation within CESS4000.

The battery enclosure contains the following equipment:

- Liquid-cooled battery racks with string-level switchgear protection and control units
- Chiller and piping for battery cooling
- CESS4000 Controller
- AC UPS and AC/DC power supply
- Temperature and humidity sensors
- Smoke detectors
- Hydrogen gas detectors
- Ventilation fan exhaust (over DCC / ACC doors) and passive front air intake, on furthest battery rack door, with ingress protection automatic motorized louvres
- Interior lighting
- Access doors with position switches
- Fire alarm intelligent addressable devices

The sensors in the battery enclosure are used for monitoring and for various alarm and process control functions. The sensors are connected to the local CESS4000 Controller, that communicates with the external EMS for overall plant control.

The battery enclosure is connected to adjacent enclosures through an interconnection bus with connections at the top of the enclosure on both sides. This includes connections for the DC busbars, the auxiliary power supply and the communication cables.

4.5.1 ACC (Auxiliary Control Cabinet)

The auxiliary control cabinet (ACC) houses automation equipment for CESS4000 installation. This equipment includes the battery management system, the fire alarm system, and the process stop system. The ACC also provides an interface to external AC power, for the auxiliary AC and DC power supply to CESS4000 enclosures and handles the communication with external systems.

The auxiliary control cabinet contains the following equipment:

- Main auxiliary power breaker and power meter
- UPS
- CESS4000 Controller
- Network Communication Devices
- Battery management units and communication adapters
- HVAC unit (**Optional**)
- Interior lighting
- Smoke detector
- Conventional (zonal) fire alarm control panel with (IEC) power supply, connected devices (smoke detectors, gas sensors, and alarm annunciation through the enclosure-mounted strobe and siren.
- Safety relay
- AC power socket (single-phase). Mounted to the right wall of the ACC cabinet, The single-phase AC power socket is rated at 10A maximum. Socket form factor and AC Hz varies by installation market. Do not connect power tools to this socket!
- Access door with position switch

The process stop button and the reset button are mounted on the door of the DCC cabinet, and can thus be accessed without opening the DCC cabinet door. Addressable modules arrive pre-installed for connection to approved site level master panels.

4.5.2 DCC (DC Combiner Cabinet)

The DCC takes care of the power exchange between the battery racks and the external power conversion system. It provides a connection between the DC busbar and the associated inverter.

The DCC contains the following equipment:

- Main DCC Non-load disconnector (optional equipment)
- aR class fuses for mains protection

- Surge arrestors
- Access door with position switch
- Process stop button and reset button

The positive and negative power conductors of the batteries are connected to the inverter through a four-pole manual non-load disconnector inside the DCC. The Non-load disconnector is operated from inside the cabinet and so requires the use of proper PPE when accessing CESS4000 cabinet interior.

Main DCC non-load disconnector is optional.

If your CESS4000 system is not equipped with a Main DCC non-load disconnector, use proper PPE and:

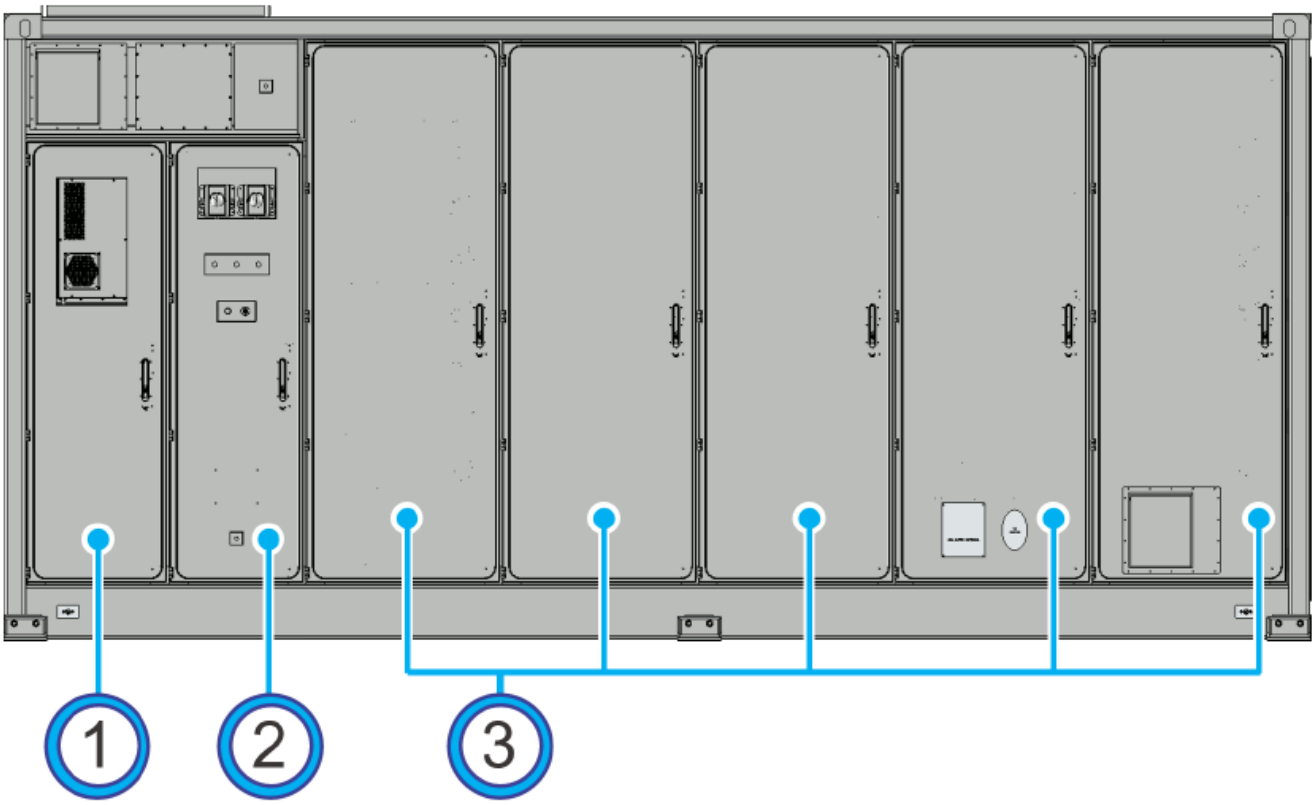
- Use EMS or the site power plant control to issue a shutdown of CESS4000 enclosure.
- Apply lock out / tag out (LOTO) to CESS4000 you will disconnect from the related power conversion system (PCS).
- Disable the connection on the power conversion system (PCS). **Please refer to the PCS system documentation**.
- While wearing proper PPE, unlock each battery chamber door and use the battery rack disconnector / breaker to disconnect each battery rack from the DC bus.
- Update LOTO logs as to system status.
- Operation restoration starts with re-enabling system connection in reverse order.
- Remove the LOTO and update LOTO logs that the system will be returned to operation.

4.5.3 Access Doors

CESS4000 battery enclosure can be accessed for maintenance through 12 access doors on the sides of the enclosure.

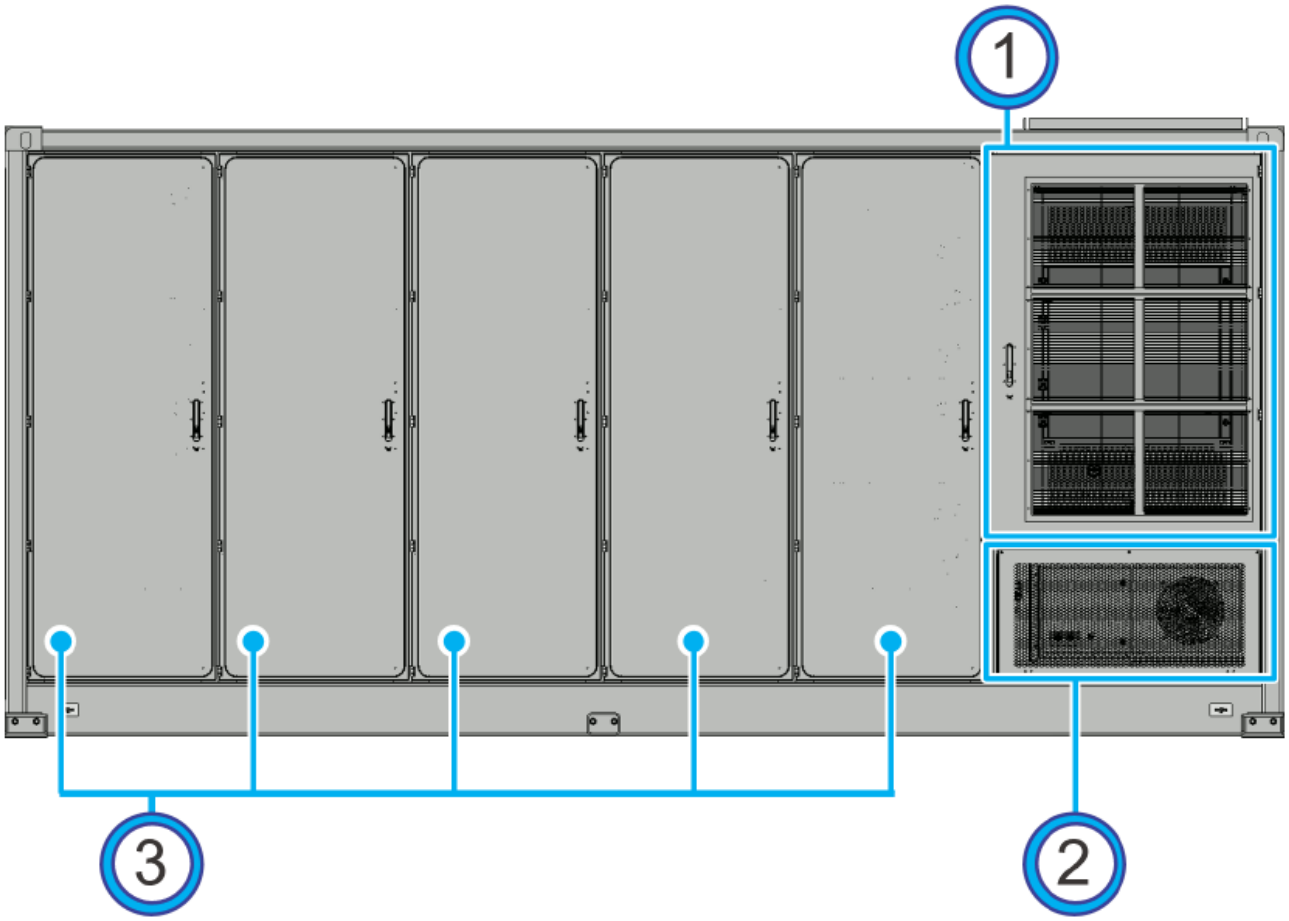
IMPORTANT! Ensure all doors are secured closed during normal operation. The doors are equipped with switches for position monitoring and warning indications.

Front Access Doors



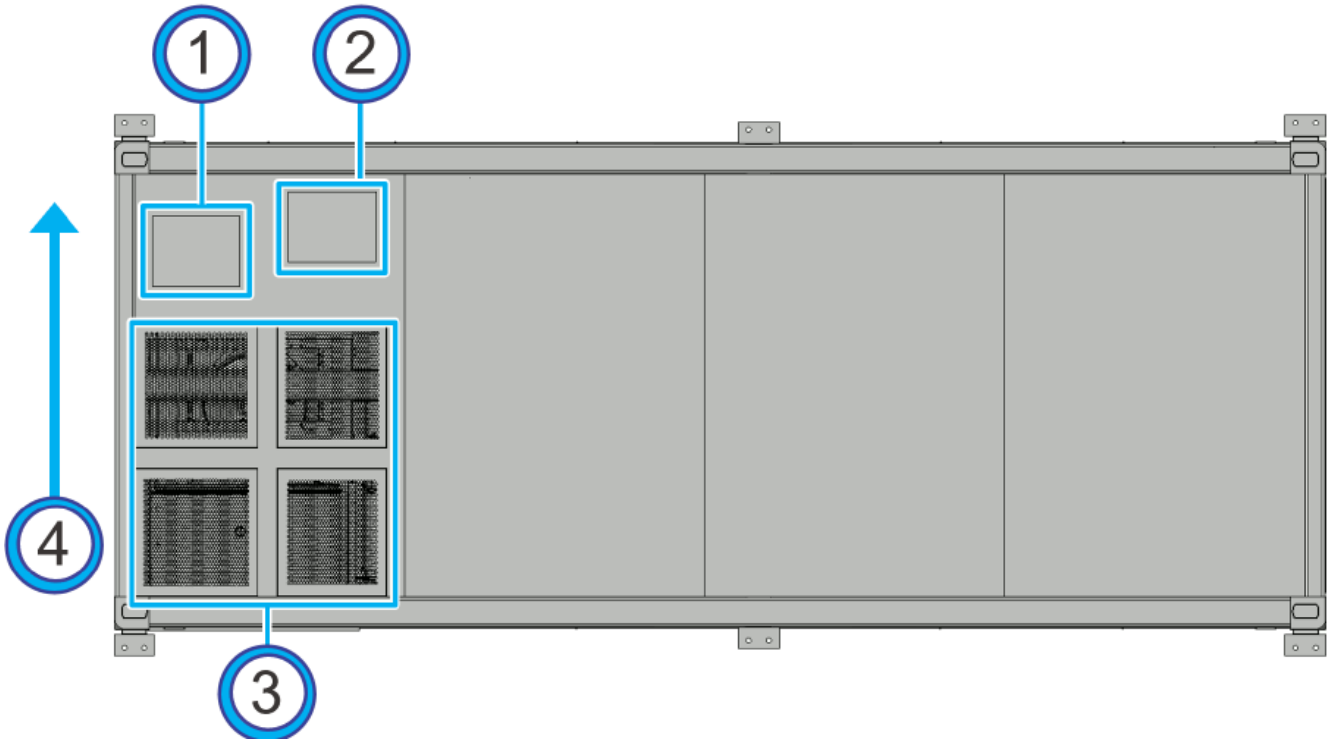
No	Description
1	AC Combiner (ACC) Chamber Door
2	DC Chamber (DCC) Chamber Door
3	Battery Rack Chamber Doors (5)

Rear Access Doors



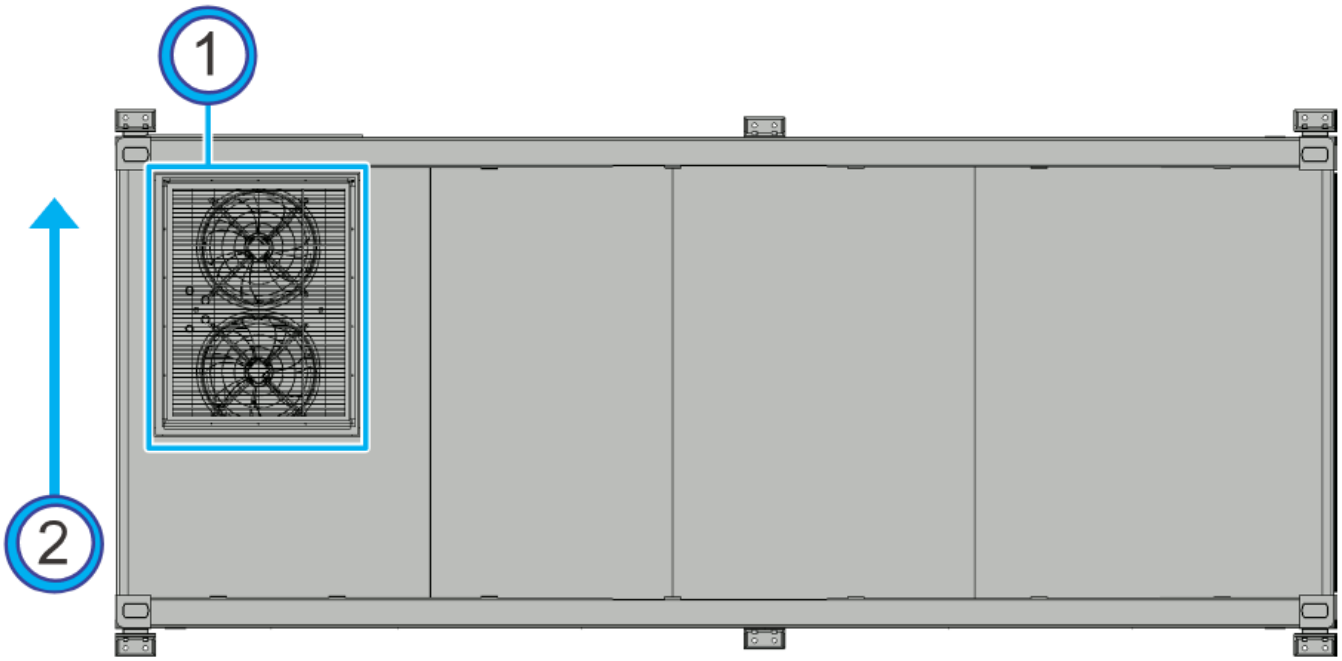
No	Description
1	Chiller Air Vent Intake Grille and Service Door
2	HVAC Air Vent Intake Grille and Access Plate
3	Battery Rack Chamber Doors (5)

Underside Access Doors



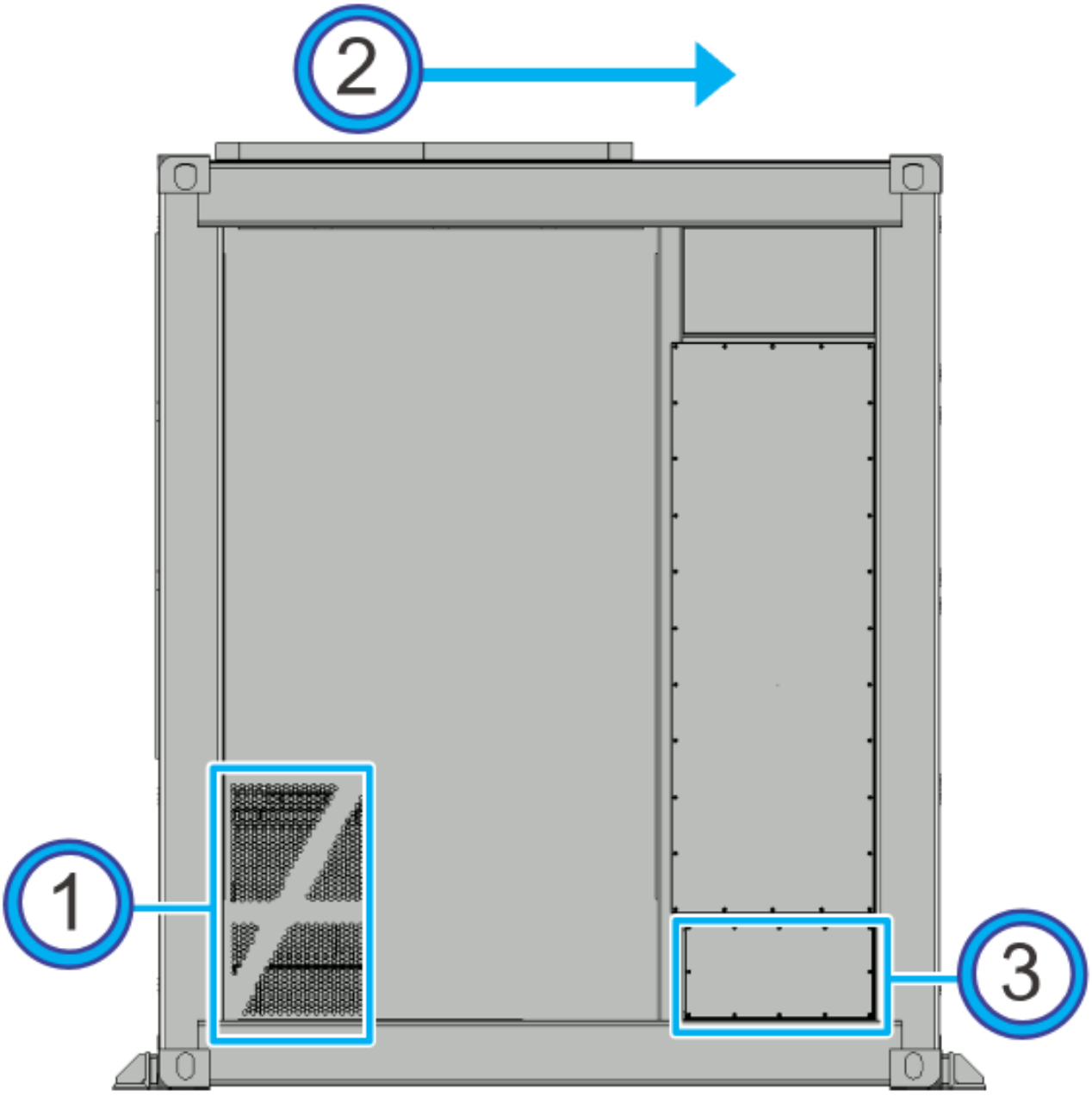
No	Description
1	ACC cabinet conduit lead in plate
2	DCC cabinet conduit lead in plate
3	Thermal Management System Ventilation Port
4	To CESS4000 Front

Top Access Doors



No	Description
1	Thermal Control System Ventilation Exhaust
2	To CESS4000 Rear

Bottom Left Side Access Doors



No	Description
1	Ventilation Management System Port (primarily used by optional HVAC)
2	To CESS4000 Front
3	ACC cabinet conduit (side) lead in plate

4.6 Thermal Management System

Thermal Management system of this product contains a Chiller, and Dehumidifier or optional HVAC. Each component handles thermal load to climate control the batteries and electronics in optimal conditions for operation and overall life.

4.6.1 Chiller

CESS4000 battery thermal management is primarily handled by the liquid cooling using an air-cooled Chiller unit that circulates coolant through the system to maintain optimal conditions for battery operation. CESS4000 system is also designed and operated to achieve low noise level and the noise generating components in the unit faces up at the roof to further lower the full installation noise level at site. The chiller keeps the temperature within the optimal range for efficient function and overall life of the batteries.

The battery enclosure contains piping for distribution of coolant to the liquid-cooled battery racks. The pump in the chiller unit circulates coolant which is a mixture of water and glycol through the battery racks.

The air-cooled chiller uses a refrigeration cycle with R32 refrigerant. The refrigerant circuit comprises a compressor, a condenser, an expansion valve and a plate heat exchanger. Heat is released from the refrigerant to the outside air in the condenser, which is equipped with an air fan. In the plate heat exchanger, heat is transferred from the battery cooling liquid to the refrigerant circuit, causing evaporation of the refrigerant.

The chiller operates based on the temperature of the batteries and coolant.

The chiller is electrically powered by auxiliary 3 phase AC power, and connected to CESS4000 Controller (industrial controller) through modbus communication. The chiller also has a local controller in the event of communications loss.

No	Description
1	Warm air outlet
2	HVAC (**optional**)
3	Inlet
4	Outlet
5	Fill valve
6	Drain valve

4.6.2 Dehumidifier

CESS4000 comes standard equipped with a dehumidifier unit, if a dehumidifier option is selected when ordering, CESS4000 will not have an HVAC unit. CESS4000 uses a refrigerant based dehumidifier located in the ACC to regulate the entire CESS4000 container's humidity. Along with this the dehumidifier also regulates enclosure temperature. This dehumidifier uses a low Global Warming Potential (GWP) refrigerant (R513a) to achieve a lower carbon footprint.

CESS4000 ACC cabinet has two fans to assist with air circulation internally in the container.

The dehumidifier is powered by auxiliary AC power. CESS4000 controller determines operation mode of the dehumidifier based on the measured temperature and humidity inside CESS4000 container. The dehumidifier controls humidity by removing excess moisture as condensate. The condensate drains out of the enclosure through a drainpipe.

4.6.3 HVAC (Optional)

CESS4000 has the option of an HVAC unit for hybrid thermal management . If equipped with HVAC option, the unit will not have a dehumidifier. The HVAC unit is recommended for installations that have extreme climate conditions.

The the HVAC works in conjunction with the chiller to accomplish Hybrid cooling by combining air and liquid cooling from the HVAC and the chiller unit respectively and is part of the overall thermal management of CESS4000. The HVAC uses a low Global Warming Potential (GWP) refrigerant (R513a) to achieve a lower carbon footprint.

The HVAC primarily controls battery temperatures during the commissioning stage, and optimizes overall power consumption.

The HVAC System uses an air-cooled unit to regulate the interior enclosure temperature and humidity. The HVAC unit is powered by 3 phase AC power. CESS4000 controller determines

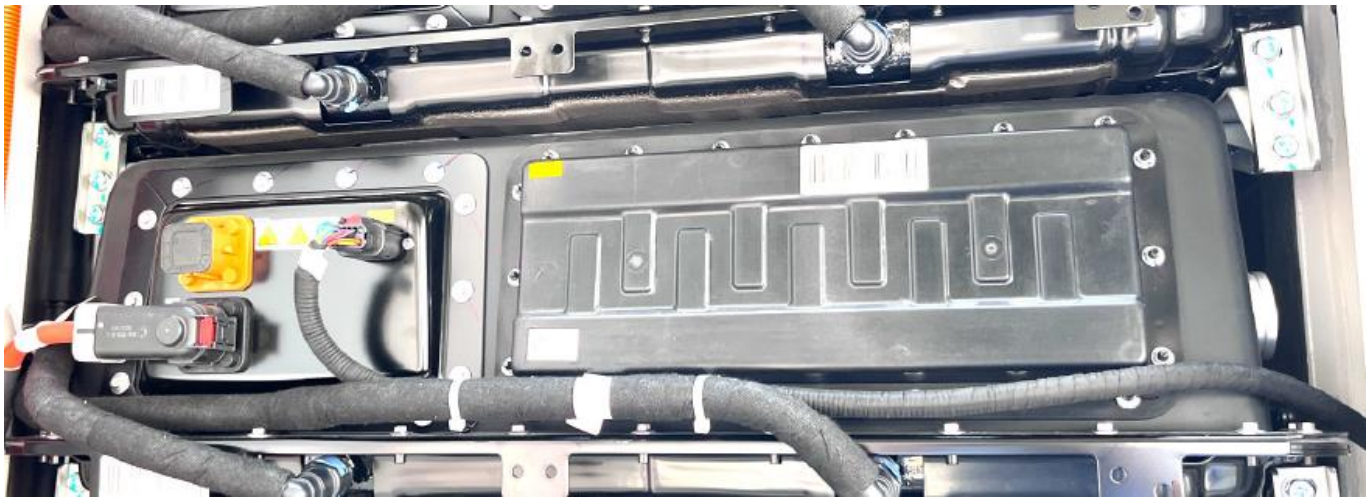
operation mode of the HVAC based on the measured temperature and humidity inside CESS4000 container.

4.7 Battery System

4.7.1 Battery Rack

CESS4000 uses Li-ion batteries. The batteries are installed in racks inside the battery enclosure. A battery rack comprises eight liquid-cooled battery modules which are installed in series and connected to the DC bus through a switchgear module.

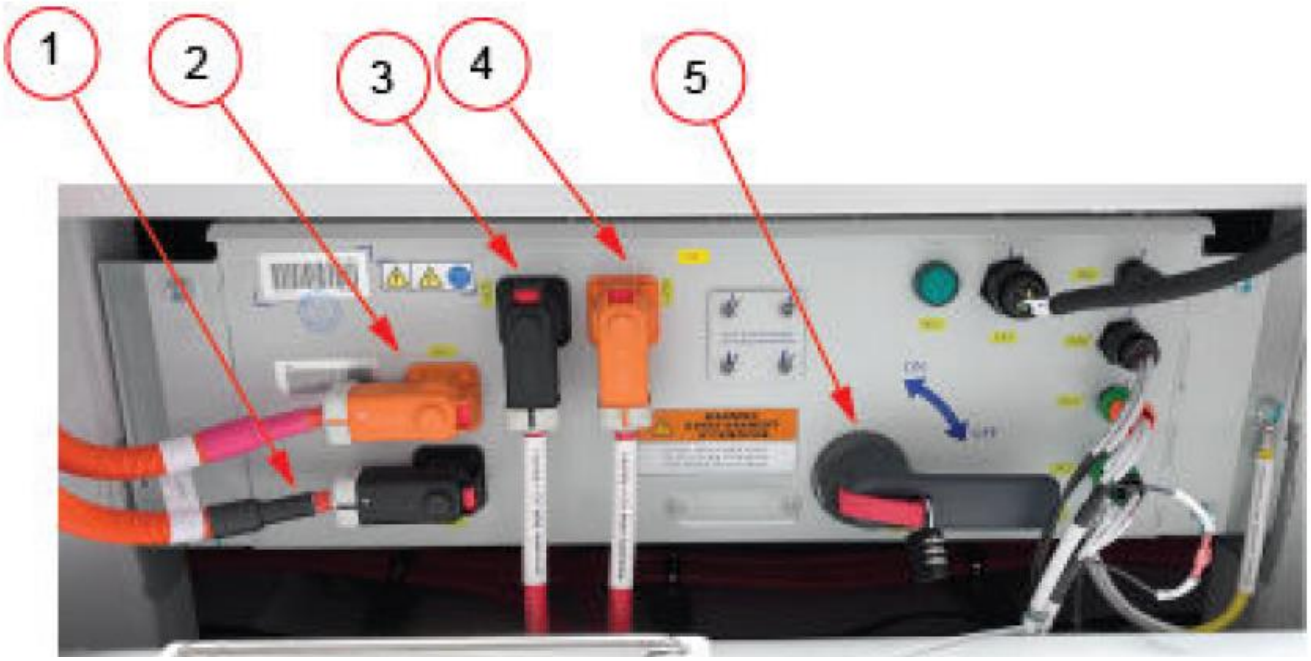
The battery enclosure contains up to **10 battery racks**.



4.7.2 Power Distribution Switchgear

Each battery rack is connected to the DC bus through a power distribution switchgear module. The power distribution switchgear module is used for rack-level switch gear protection and control.

The power distribution switchgear module includes a rack-level battery management system, a manual load disconnection switch, string-level fuse protection, and a DC contactor. The DC contactor is controlled by the battery management system.



No	Description
1	Battery (-) connection
2	Battery (+) connection
3	Mini bank (-) connection
4	Mini bank (+) connection
5	Manual load disconnection switch

4.7.3 Battery Management System (BMS)

The batteries in CESS4000 are managed by an electronic Battery Management System (BMS).

The BMS consists of three layers:

- **Battery Management Unit (BMU):** Monitoring each battery pack
- **Battery Control Unit (BCU):** Monitoring all the battery packs in a battery rack
- **Battery Array Unit (BAU):** Monitoring all the battery racks in a mini bank. There are by default **two BAUs** per CESS4000 Container.

The **BMU** monitors various parameters related to the operation and condition of the batteries. This includes the voltage, the current, the battery module temperature, the state of charge and the state of health.

The **BCU** is responsible for the protection of the batteries, for instance by activating alarms or limiting the current if abnormal conditions are detected.

The **BAU**s communicate with the overall energy management system.

4.8 Controller And Automation System

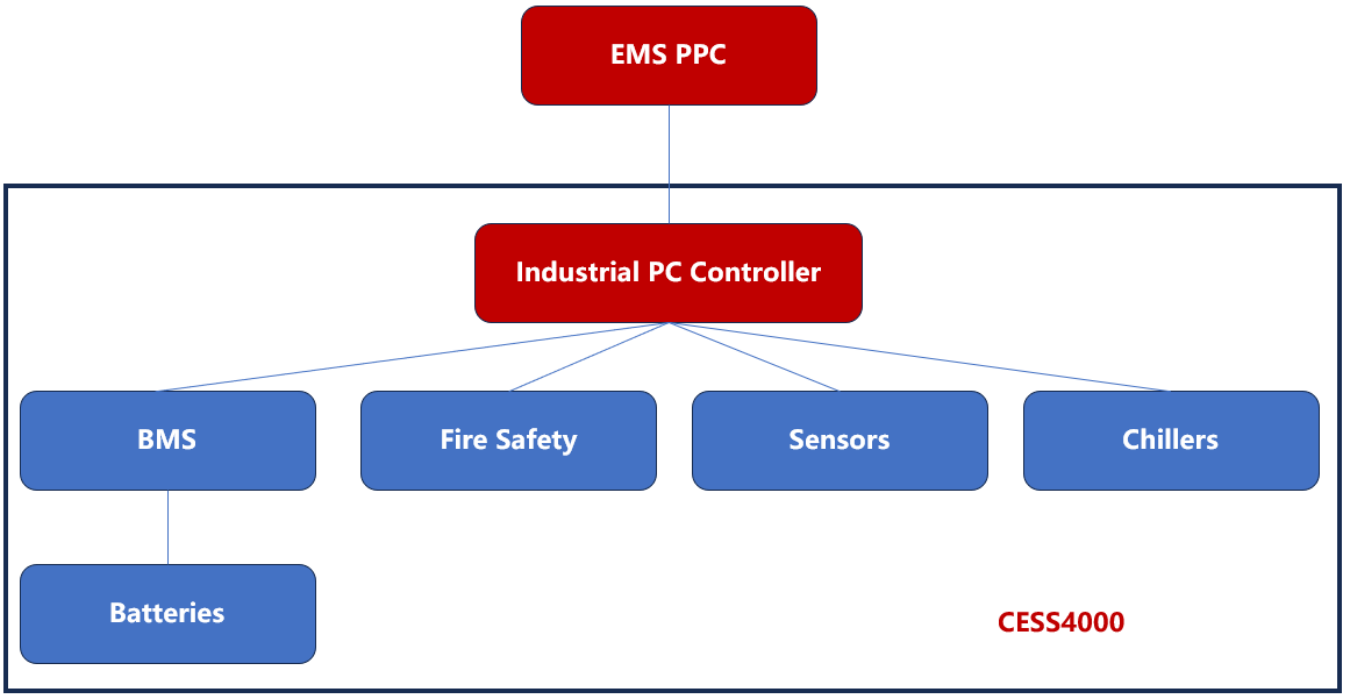
The automatic control and monitoring of CESS4000 installation is handled by an industrial controller. The industrial controller is interfaced with the local sensors, relays and other equipment for status indication, and control.

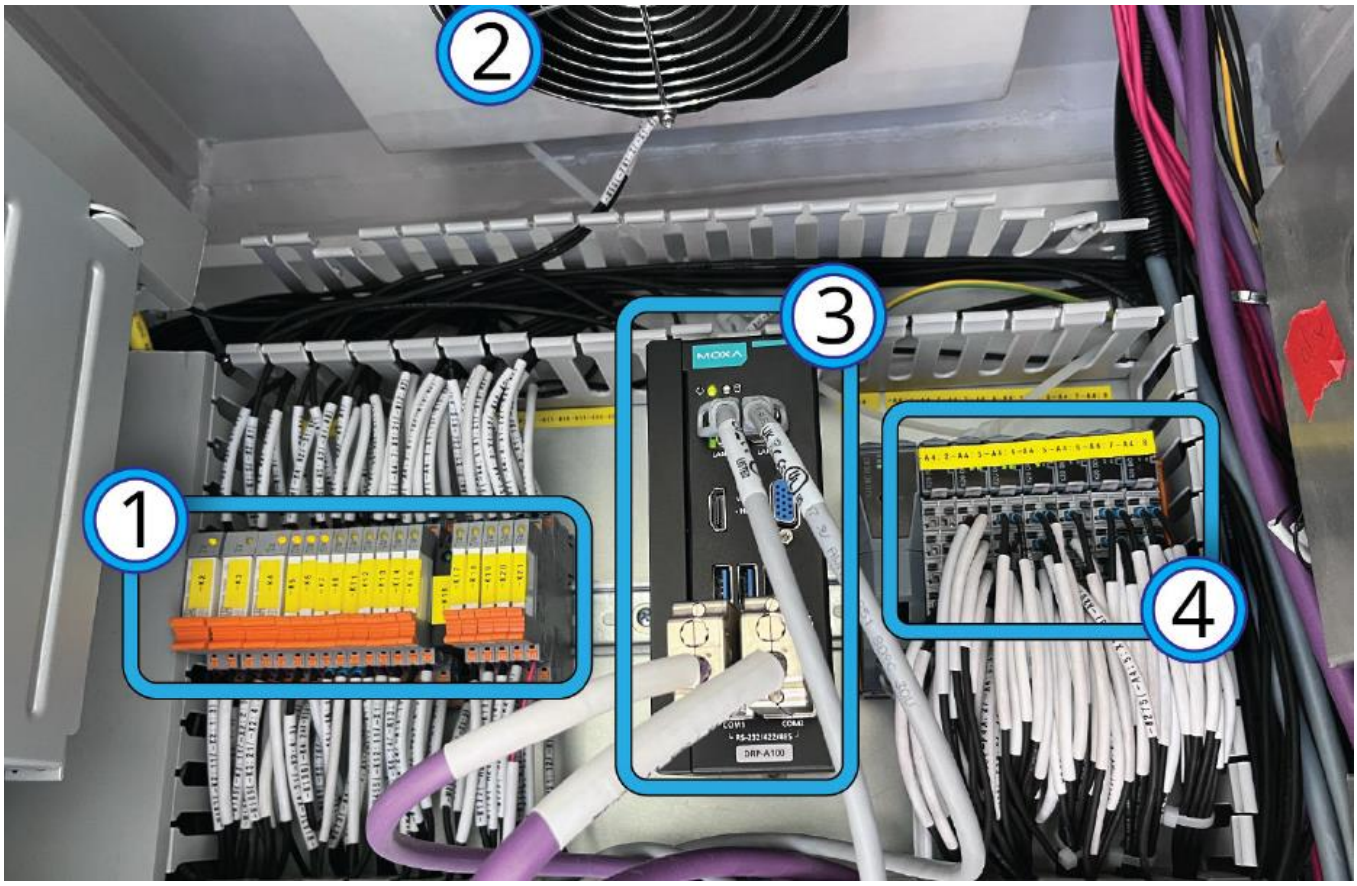
The industrial controller is not responsible for any protection.

The industrial controller and other automation system units are interconnected by means of network devices. The network devices also enable communication between CESS4000 system and the external power plant controller.

4.8.1 Industrial PC Controller

CESS4000 industrial PC controller is an computer in CESS4000 enclosure that monitors, controls, and interacts with all component systems: batteries and battery racks, fire safety, environmental sensors, chiller, and system specific meters. It can communicate and act on direction from an external power plant controller (PPC) such as **RCT's EMS** or other industry standard control software, from an operator using a PC as a terminal and from routines saved in the controller.





No	Description
1	Control relays
2	ACC cabinet ventilation fan
3	Controller
4	Remote I/O cards

The main component of CESS4000 industrial controller is the Industrial PC (IPC) which handles the actual control functions. The industrial controller assembly also includes remote I/O cards for collecting and transmitting data.

The industrial controller receives input signals from the sensors and status indicators in the respective enclosure. This includes control relays from temperature and humidity sensors, and digital inputs from door position switches, circuit breakers, fuses, and so forth. The industrial controller also has connections for serial communication with the chillers and the gas detectors.

The industrial controller monitors the enclosure conditions and the status of the equipment. If abnormal conditions are detected, it alerts the operators by means of warning or fault messages.

The readings, status information and alerts are communicated to EMS or site PPC for overall plant control.

The industrial controller has digital outputs for normal control of the equipment in the enclosure and for shutdown signals. The digital outputs are activated based on control commands from either EMS power plant controller or a site PPC.

Additional overcurrent protection device (OCPD) is required for power conversion systems whose short-circuit withstand performance is less than 10.85 MI²t. When selecting an OCPD, the OCPD must have a maximum breaking capacity of 250kA.

4.8.2 Network Communication

Network communications in CESS4000 consist of internal and external communications.

- **External communication**

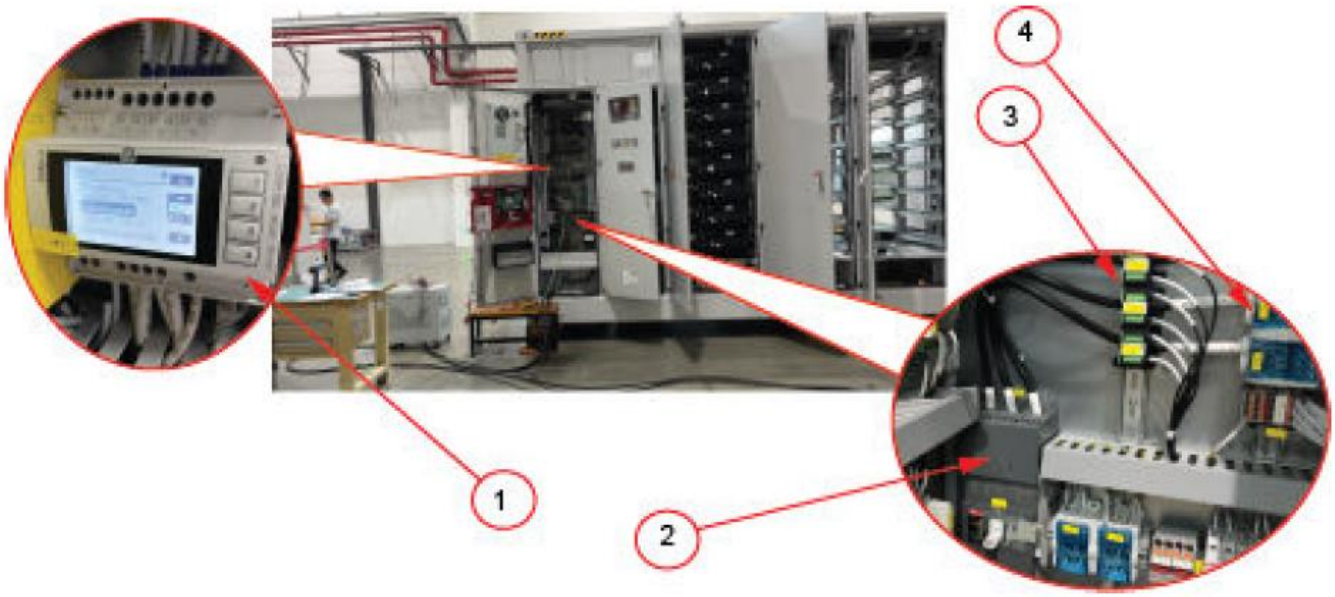
  CESS4000 provides an Ethernet RJ45 port to connect site level network. The external ethernet port is ETH1 port in CESS4000 controller. CESS4000 network design meets the requirement of IEC 62443-3. All the external traffic go through a layer 3 firewall which is implemented by the controller. The external network communication or site level network communication is not the scope of the product. The purchaser can add external network equipment in CESS4000 ACC if needed for site specific configurations.

- **Internal communication**

  Devices on the internal network include the ACC auxiliary power meter(optional), Remote IO, BMS, PCS, and UPS all of which are connected to copper ethernet ports on the layer 2 unmanaged switch. Only the PCS connection is connected through a surge protector in the ACC. CESS4000 controller ETH2 port also connects to this switch.

4.9 Auxiliary AC Power

Some equipment in CESS4000 enclosure requires auxiliary AC power for operation. Auxiliary AC power is used for various automation and safety system components, chillers, ventilation units, lighting, sensors, and so forth.



No	Description
1	Power meter (optional equipment)
2	Main breaker
3	Current transformers
4	Power distribution blocks

Auxiliary AC power for CESS4000 enclosures is supplied from the external AC commercial mains power system through a site transformer, and into the auxiliary control cabinet (electrical cabinet). The incoming AC mains feeder includes a main AC breaker. An AC power meter displays system power status. A surge arrester connected between the incoming AC power feeder. The connection to site protective earth / ground protects the equipment in the event of an AC voltage surge or lightning strike.

■ DC Power

DC power is provided by means of a DC power supply in the respective enclosures. Uninterruptible power supplies (UPS) provide DC power for the PLCs, the battery switcher fire alarm control, and other critical safety equipment, if auxiliary AC power is temporarily lost.

■ Uninterruptible power supply

The power supply to critical equipment uses battery backup to ensure uninterrupted operation even in the event of an external power failure. The battery enclosure is equipped with two uninterruptible power supply (UPS) battery modules.

The UPS modules are installed in the ACC. The UPS modules provide battery-backed DC power for the local CESS4000 Controller , the network devices, the battery management units, the temperature and humidity sensors, and the safety shutdown system. The UPS modules also provide battery-backed DC power for the switch gear modules of the battery racks.

4.10 Fire Safety System

Each CESS4000 fire safety system comes equipped with listed fire alarm equipment. CESS4000 fire safety system includes equipment for automatic fire detection, explosive gas detection/ventilation and.reporting of related hazards through SCADA, EMS (or customer PPC), as well as, enclosure-mounted alarms for fire and gas alarm annunciation for site personnel.

Conventional fire alarming uses series connected (zonal) detectors that are connected to the conventional Fire Alarm Control Panel (FACP).

An authorized contracted fire systems safety consultant service can perform all CESS4000 fire safety system, verification, testing, and validation; so the site can demonstrate compliance to the applicable Authority Having Jurisdiction (AHJ).

4.10.1 Enclosure Fire Resistance

The battery enclosure design helps to prevent the propagation of fire flames and heat to external surroundings for a certain time without losing the integrity of the structure. This is achieved using insulation panels of suitable material and thickness. The fire rating is expressed in an E or EI rating followed by a numerical number, see product data sheets for your specific equipment.

- “E” represents the integrity of the structure and the ability of the structure to prevent flames and hot gases from passing through to the outside for the specified time.
- “EI” represents the insulation rating of the construction material, which will not allow the outside temperature to rise severely due to a fire inside the enclosure for the specified time.
- “As an example E60” and “EI15” would denote an integrity rating of 60 minutes and an insulation rating of 15 minutes respectively.

The electrical cabinet and battery enclosure doors are not fire rated but are constructed of fire resistant material.

4.10.2 Conventional Fire Alarm Control Panel (FACP)

A central conventional Fire Alarm Control Panel (FACP) comes installed in the ACC.

This conventional FACP monitors the status of connected smoke detectors and hydrogen gas sensors.

The FACP initiates an alarm or other trouble or supervisory signal. The panel is set up with detection zones for the detectors in CESS4000 battery enclosures.

The FACP is connected to local strobe and siren units, mounted on the DCC door, for fire and gas alarm annunciation. General alarm and fault signals are reported through EMS (or customer PPC) and connected SCADA systems.

The conventional fire alarm control panel can be networked to a site-level master panel with the provided addressable modules. The following are Site level FACP’s compatible with the system, selection, procurement, design and installation or a site FACP is the responsibility of the customer if desired.

UL/AUS- Honeywell Notifier Onyx and Inspire

IEC- Kentec Takis, Hochiki Latitude, Hochiki HFP AP, or Kentec Syncro AS

The FACP in all markets is powered by an auxiliary AC power feed, specific source of feed may vary refer to site specific drawings.

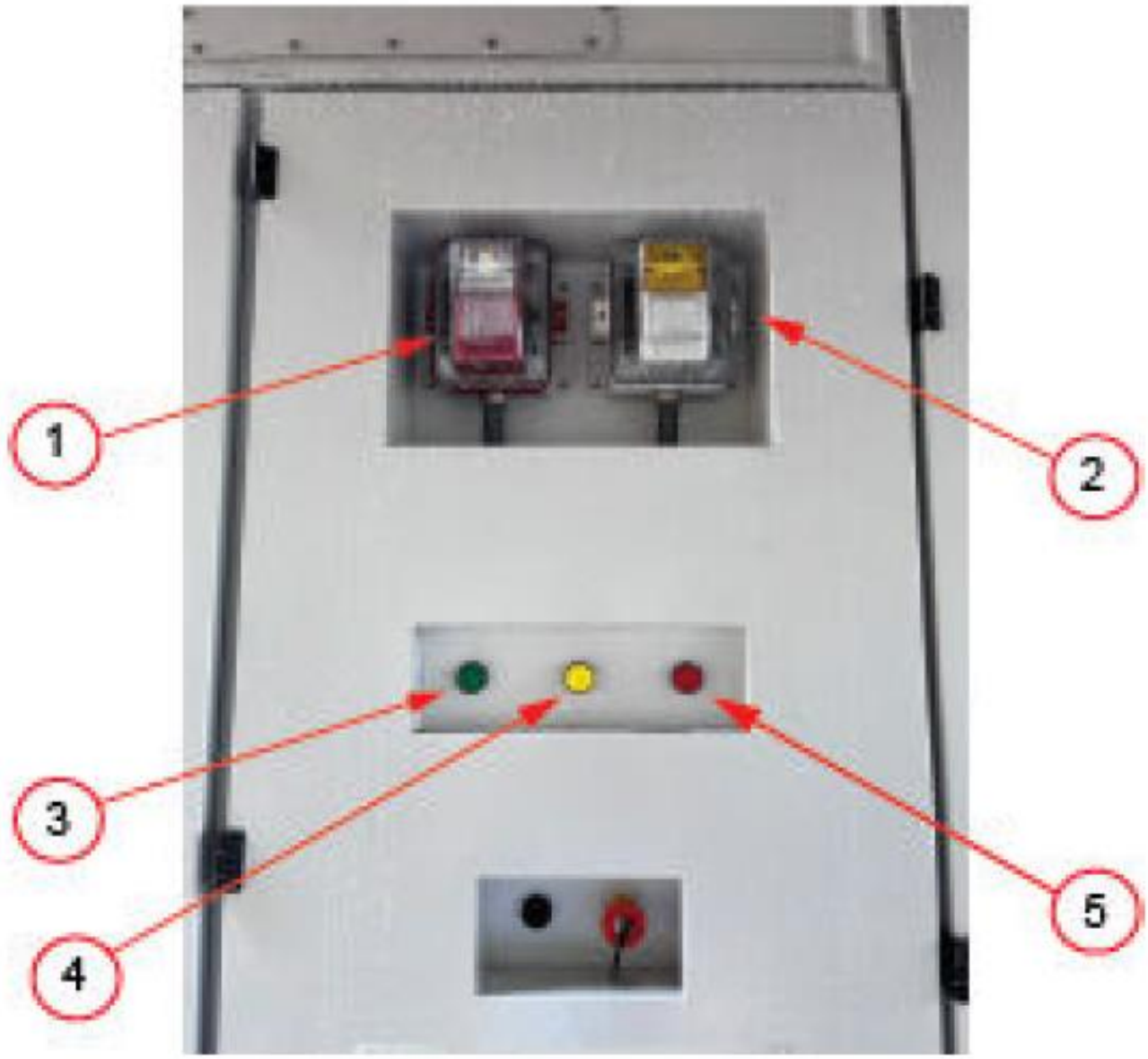
Back up batteries (UL) or UPS batteries (IEC/AUS) in the ACC provide backup power if the AC commercial mains power is temporarily lost (varies according to market).

In UL markets, the gas sensors, local strobe and sirens are powered by the FACP, and under normal operating conditions the FACP charges an external battery box which provides backup 24Vdc power if the main power supply is temporarily lost.

In (IEC/AUS) markets the gas sensors, local strobe and sirens are powered by the FACP. In the event of a power outage the FACP powers the local strobe sirens and itself, using its own internal UPS batteries, and a UPS located in the ACC powers the gas sensors.

4.10.3 Fire And Gas Alarms And Indicators

The fire and gas alarms and indicators are mounted in the DCC cabinet door. The fire alarm light flashes white when the alarm is tripped. The gas alarm light flashes yellow.



No	Description
1	Fire alarm
2	Gas alarm
3	System normal indicator
4	System alarm indicator
5	System dangerous indicator

The indicators below the fire and gas alarm lights indicate the current system condition:

- If the green indicator (3) is lit, the system status is normal. Neither of the alarm lights is lit and the system is running as designed.
- Yellow indicates there is an alarm condition. Either or both of the alarm lights is lit.

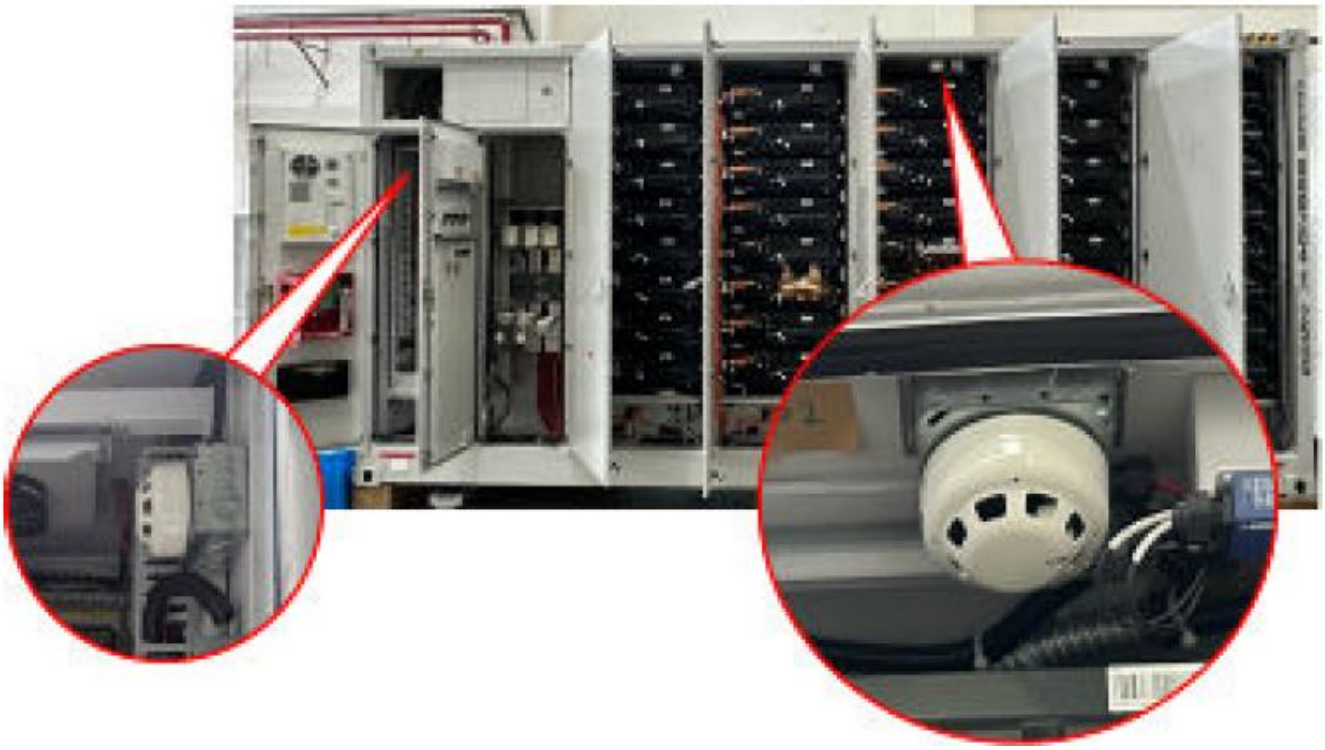
- Red indicates the condition is dangerous. Personnel should follow emergency protocols when addressing the alarm.

4.10.4 Smoke Detectors

CESS4000 battery enclosure is equipped with photoelectric smoke detectors installed as follows:

- One smoke detector in the center battery door on the front (ACC) side of the enclosure
- One smoke detector in the ACC cabinet

These smoke detectors are wired to the conventional fire alarm control panel in a single zone.



4.10.5 Hydrogen Detectors

The battery enclosure is equipped with two hydrogen detectors installed inside the center battery door on each side of the enclosure. The detectors use 24 VDC power, and are connected to CESS4000 industrial controller and FACP.

When the hydrogen gas sensor encounters a hydrogen gas concentration at or above a preset limit of 10% LEL (Default alarm is set through EMS or site PPC); the FACP activates the explosion protection fan system. The explosion protection fan system consists of an intake louver located

on the front right of the enclosure and outlet fan assembly with louver located above the ACC cabinet.

The control system also triggers a safety shutdown if the hydrogen concentration in the battery enclosure exceeds the set limit.

4.10.6 Explosion Protection Ventilation Fan System

The explosion protection ventilation fan system removes detected hazardous gas like hydrogen and combustion products like smoke. The system provides protection from deflagration using fan assemblies that consist of:

- A passive (no fan) air intake port with an ingress protection louver located on the front right of the enclosure at the bottom and on the latch side of the battery module rack cabinet door.
- An exhaust fan assembly with ingress protection louver is located above the ACC door.

The explosion protection system is **NFPA 69 compliant** requiring connection to AC power. The ventilation system and fans are powered through a dedicated circuit breaker located in the ACC.

When local requirements dictate, an optional external AC UPS backed-up supply can be connected, (if specified by the customer as requirement when ordering the product). This optional AC feed is solely for the purposes of powering the ventilation system and fans and in some instances also provides the FACP with an AC UPD backup feed to continuously power the ventilation system and FACP when AC commercial mains power fails.. Refer to site specific Drawings for detailed information.

No	Description

1	Explosion protection ventilation fan exhaust port over the ACC door with fan and open ingress protection louver (detail) when powered on.
2	Gas / combustion particulate sampling port over the DCC door to test CESS4000 interior air.
3	Explosion protection system (passive-no fan) air intake port louver.

The ventilation system air intake and exhaust do not include a filter. The louvers, when closed and the system off, are protection against ingress of dust and moisture.

CESS4000 receives as safety shut down when the gas / smoke material is detected and the ventilation system powers on.

The ventilation protection fans are activated by the hydrogen sensor and smoke detectors when a minimum threshold for gas or smoke is detected.

When activated the fan in the exhaust port powers on to withdraw and eject interior air from inside CESS4000 and air intake and exhaust louvers open simultaneously.

On detection of hazardous gas / smoke inside CESS4000, an alarm is set. The DCC door mounted strobe and sirens activate. Through the FACP / CESS4000 Controller, one or more alarms are set and notification sent to EMS or the ESS site plant controller, including ventilation system activation, providing multiple notification methods for site personnel.

4.11 Rapid System Shutdown

CESS4000 is equipped with a safety system for rapid shutdown in emergency situations. The shutdown system contributes to the protection of the site personnel and the equipment.

The shutdown can be triggered automatically if a critical failure is detected, and it can also be initiated manually by the operator. The shutdown system includes a safety relay and an input circuit.

4.11.1 Safety Relay

The safety relay triggers a shutdown of the inverters and the battery switch gear in hazardous situations. **The process stop circuit is wired directly to the safety relay, which is located inside the ACC**.

The shutdown circuits for the inverters and the battery switchgear use additional relays. When the safety relay is activated, the inverters are tripped and the batteries are isolated from the DC bus. These shutdown signals are delayed.

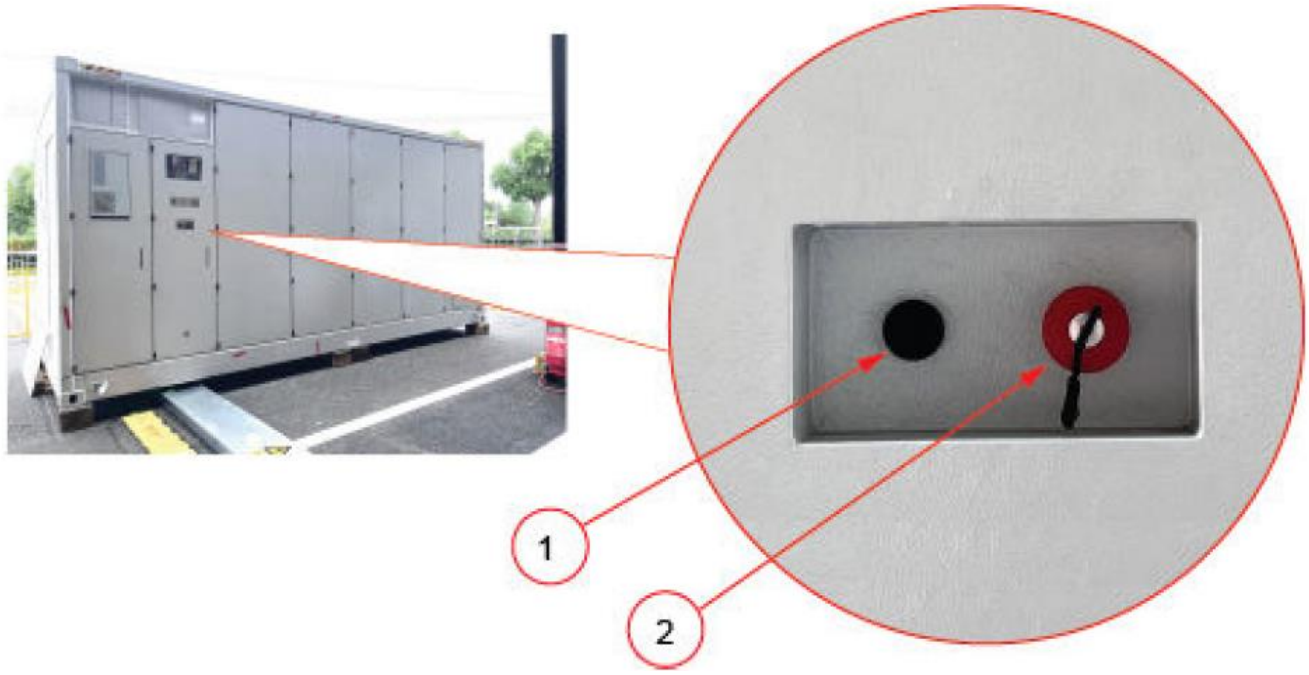
- The inverter shutdown is initiated with a delay of approximately two seconds after the safety relay is activated.

- The batteries are isolated by the DC contactors in the battery switchgear with an additional delay of approximately one second after the inverter trip signal.

The safety relay status is communicated to CESS4000 industrial controller which performs additional safety-related actions.

4.11.2 Process Stop Buttons

The input circuit for the safety relay comprises a process stop button and a reset button, which are located on the door of the DCC cabinet for easy access. The buttons are wired directly to the safety relay.



No	Description
1	Reset button
2	Process stop button

A controlled stop of the energy storage system can be initiated manually by pushing the process stop button. The safety relay trips the inverters and the battery switchgear to stop the power exchange between the batteries and the external power electronics. The process stop does not cut off the control power to the internal CESS4000 components.

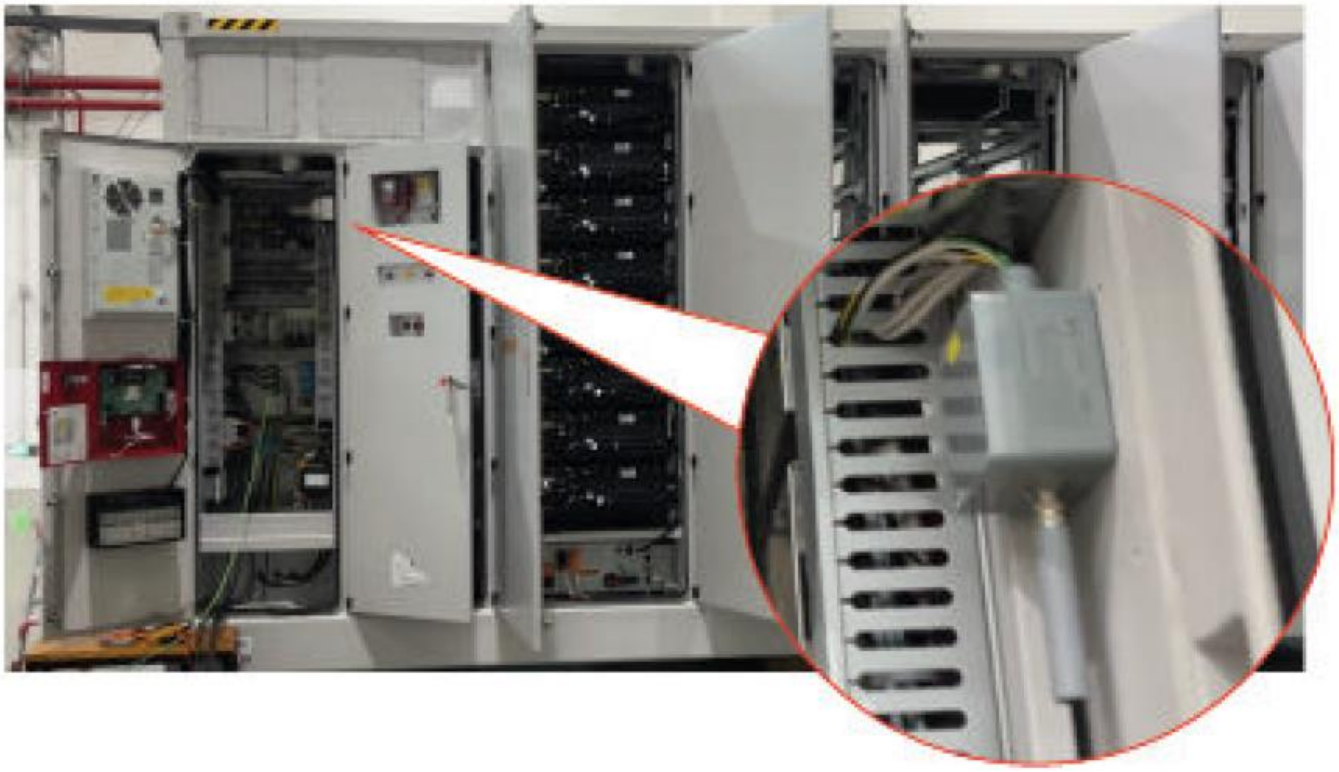
Before the operation can be restored after a process stop, the process stop needs to be reset. This can be done either with the reset button on the DCC or by a reset command from EMS.

4.12 Auxiliary Equipment And Instrumentation

4.12.1 Temperature And Humidity Sensor

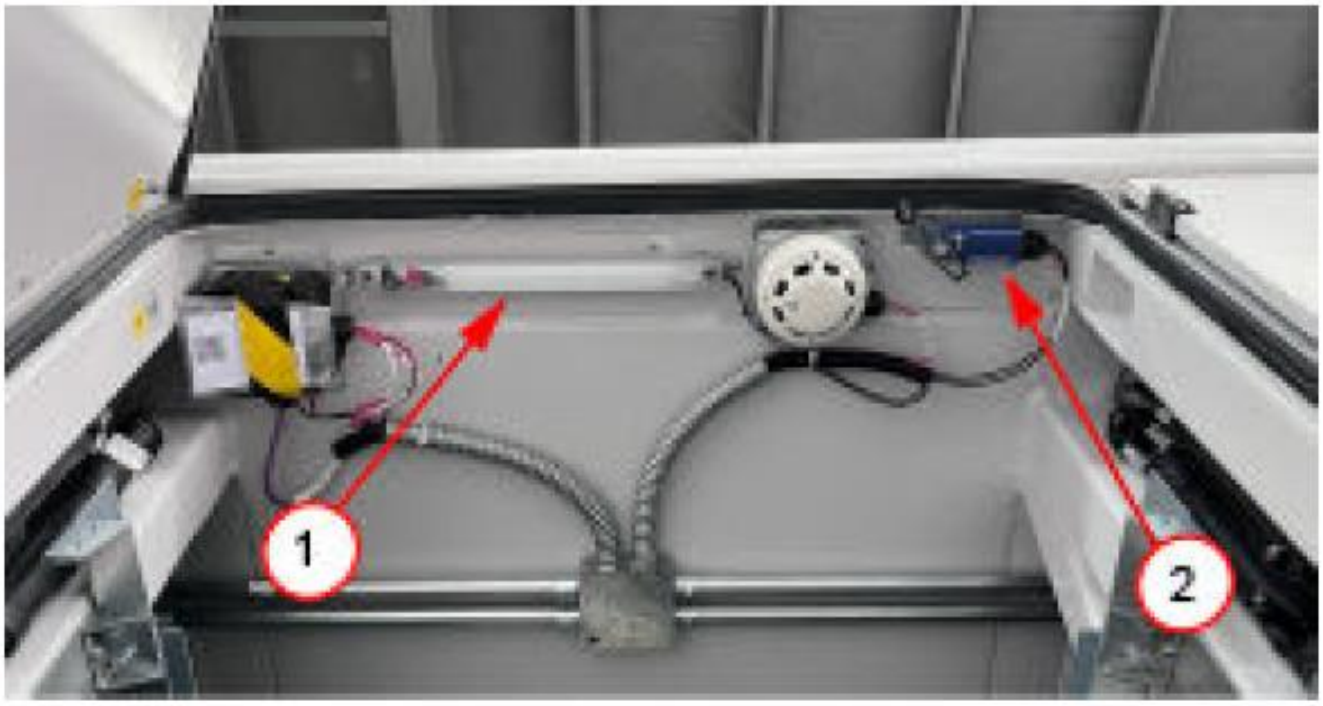
Each CESS4000 is equipped with three combined temperature and humidity sensors for monitoring the internal temperature and humidity conditions. The sensors use 24 VDC power. One sensor is located in the ACC compartment and two are located within the battery enclosures.

The temperature and humidity signals are transmitted to the CESS4000 industrial controller which activates a warning if the temperature/humidity goes outside the set limits. The humidity reading for the battery enclosure is also used for automatic control of the dehumidifier or HVAC dehumidifier in the enclosure.



4.12.2 Interior Lighting

CESS4000 battery enclosures are equipped with interior lighting for inspection and maintenance situations. Lighting is powered using auxiliary AC power.



No	Description
1	Light fixture
2	Door position switch

The position switches for the enclosure doors control the automatic lighting. The lighting is switched on when a door is opened, and switched off again when all the doors are closed.

4.12.3 Door Position Switches

The access doors are equipped with switches for monitoring the door position. This includes the doors of the battery enclosure, the auxiliary control cabinet and the DC combiner cabinet.

The status (open/closed) of each door is communicated to the PLC in the corresponding enclosure. A warning is activated in the control system if all doors are not closed. The door position signals are also used for automatic control of the interior lighting.

5 Site Preparation For Installation

5.1 Dimensions And Clearance Requirements

Observe the specified minimum clearances of aisles between groups of CESS4000 cabinets.

- The overall dimensions of the CESS4000 installation depend on the number of battery enclosures. Sufficient space for the installation workers and the used installation equipment must also be available in the installation phase.
- In addition to the dimensions of the enclosures themselves, the installation location must consider the additional space required for inspection and maintenance of the product without compromising the safety.

CESS4000 has 10 doors on the sides of the enclosure. You use the doors to access the CESS4000 interior. There is also a door for the ACC cabinet and one for the DCC cabinet. Once you complete the physical installation of your deployment, ensure there is enough space so you can open doors fully to access the CESS4000 enclosure for inspection, maintenance, and replacement of components.

Ensure the required clearance for the HVAC on the ACC and chiller units in the CESS4000 enclosure.

The equipment dimensions are specified in ***Dimensions Table***.

The clearance requirements are specified in ***Clearance Requirements Table***.

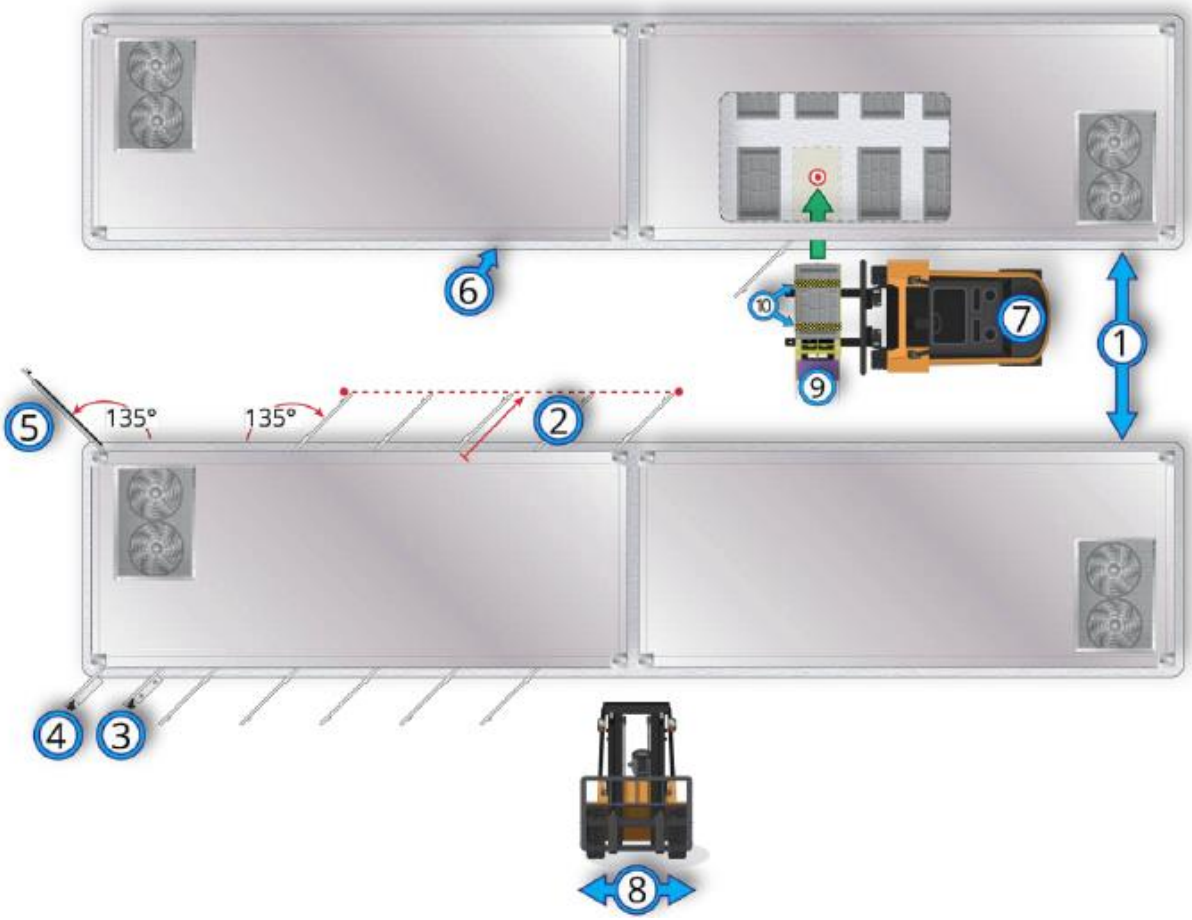
Dimensions Table			
Equipment	**Width**	**Depth**	**Height**
CESS4000	2.44m (8ft)	6.06m (19ft 10.5in)	2.90m (12ft 10in)

Clearance Requirements Table	
Equipment	**Width**

Between corner fitting aperture centerlines	203 mm (8 in)
Battery enclosure doors	910 mm (3 ft)
ACC compartment door	645 mm (26 in)
DCC compartment door	619 mm (25 in)
Chiller compartment door	1288 mm (51 in)
Free space for opening CESS4000 doors	150°
CESS4000 row to CESS4000 row aisle width [1]	3.05 m (10 ft) [2]

[1] Clearance shall be measured from the face of closed enclosure door to the face of the adjacent closed enclosure door across the aisle.

[2] Minimum 2.5m (8.2 ft). Recommended 3.05m (10 ft)–3.96m (13 ft), for safer forklift truck access to replace battery modules and perform other maintenance.



No	Description
1	Aisle between CESS4000 rows or protruding foundation widths: ● Minimum 2.5 m (8.2 ft) ● Recommended minimum 3.05 m (10 ft) ● Optimum 3.96 m (13 ft)

2	643.3 mm battery module chamber door swing out
3	472.4 mm DCC module chamber door swing out
4	494.3 mm ACC module chamber door swing out
5	918.1 mm air-cooled chiller chamber door swing out
6	Protruding foundation, proud of CESS4000 perimeter (dotted line)
7	Forklift minimum rated 1500 to 1800 kg (1.5 to 1.8 SAE / imperial ton) lift with up to 3 m (10 ft) lift, safely accommodating lift height
8	Forklift axle wheel width that fits aisle or protruding mount aisle width
9	CESS4000 Battery Module Replacement Tool (BMRT) secured to forklift tines
10	Two SAE / imperial ton ratchet straps secure a single CESS4000 battery module forklift transport battery module (330 kg / 730 lbs.)
11	Not to scale

5.2 Foundation Requirements

CESS4000 enclosures shall be installed on an adequately dimensioned foundation. The required size of the foundation depends on the number of battery enclosures.

- The foundation shall be designed to support the weight of the enclosures.
- Each enclosure needs to be supported in all four corners.
- The maximum allowable height difference between adjacent enclosures is **6 mm**.

Clearance of site-specific civil work and foundations, shall be designed to permit access of a fork truck, or other vehicle with a boom, for servicing of battery modules while maintaining proper CESS4000 row clearance, see ***Clearance Requirements Table***.

Anchor bolt holes for securing the enclosure to the foundation are located inside the enclosure in each corner. Interior mounting anchors must be installed in the foundation prior to placement of the enclosures.

The enclosure can also be anchored to the foundation by means of toe clamps on the outside. It is advisable to drill the holes for the anchor bolts in the foundation when the enclosures are in place and the toe clamp positions can be verified.

Mounting hole areas should be sealed with a suitable material that is weather-tight and will prevent vermin (e.g. rodents, snakes, insects, etc.) from entering the CESS4000 enclosure.

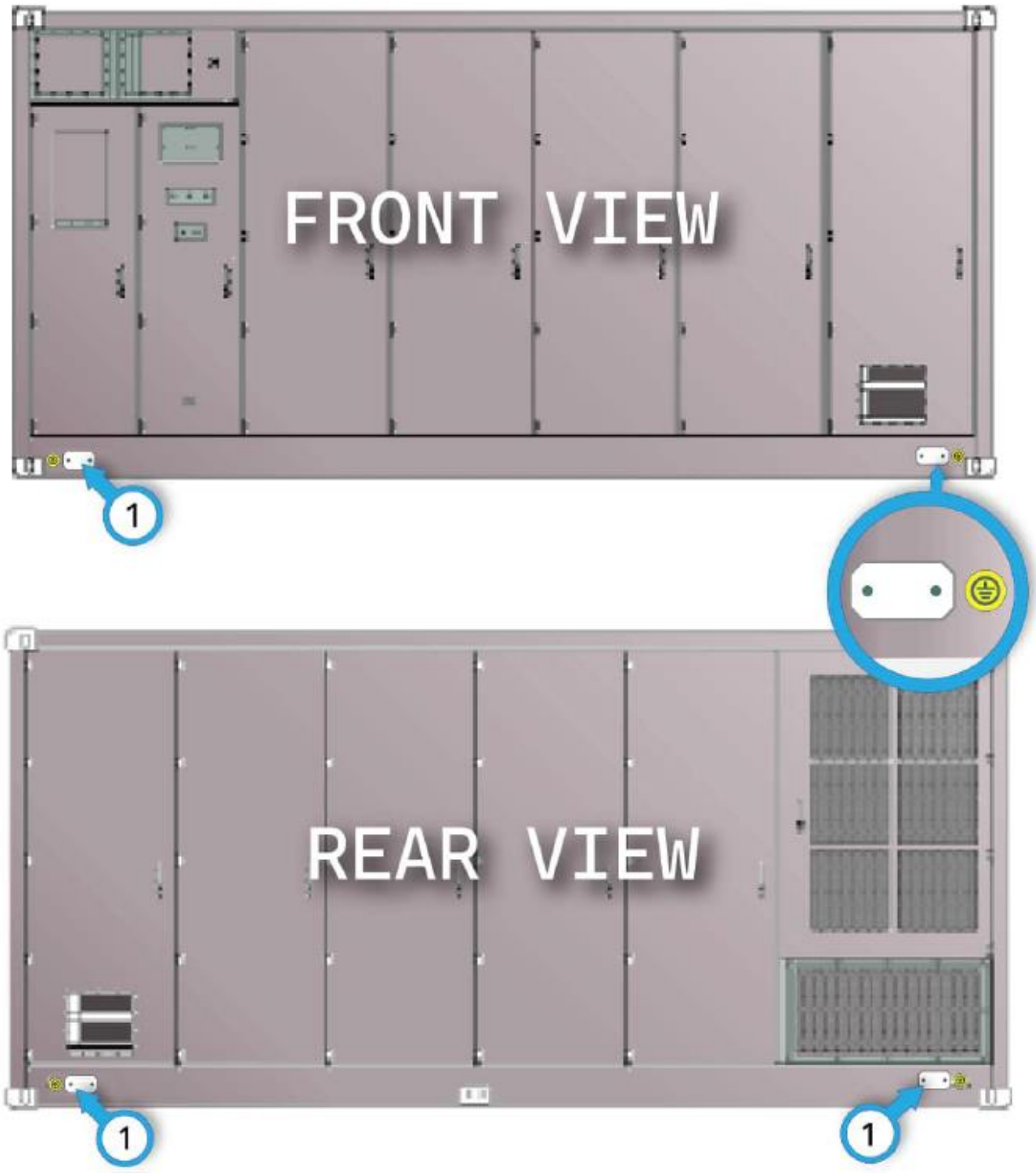
5.3 Electrical Wiring Preparations

5.3.1 Earth / ground site connection

CESS4000 must be securely grounded prior to energizing or operation. CESS4000 battery enclosure has four dedicated grounding points for the connection to the grounding design.

Exterior Earthing / Grounding Plates on Enclosures

- The Site grounding design should be configured for the CESS4000 to be independently grounded to the earth grounding grid/system to insure proper operation of equipment when installed in a BESS system. Specifically, the CESS4000 ground system must not be directly connected to the PCS ground system. Failure to provide independent grounding for the CESS4000 can result in mis-operation of the battery system when the grounding is not separated from other system equipment such as an inverter. It is the responsibility of Site EPC grounding design to ensure this requirement to avoid issues associated with improper grounding of equipment.
- Located on the CESS4000 battery enclosure at the bottom of the enclosure, on the base, at each corner at the front and back of CESS4000.
- Plates may come coated with anticorrosive protection that, after installation and prior to connection, must be removed using abrasive (sandpaper, emery cloth, wire brush), then apply a fine polish to the plate, then clean with clean cloth and residue free cleaner.



No	Description
1	Ground plates

Parts and materials

- Use **AWG 2 / 35mm²** to **AWG 3/0 / 90mm²** cabling sized for the system.
- Connect site earth / ground to four ground plates on each enclosure base.
- Cable lugs

- The ground plates are bare carbon-steel and can rust. A rusting ground plate can increase resistance to protective earth / ground. .
- M12 hardware shipped as loose parts inside the same cabinet or as part of the shipment to your site marked as loose parts.

5.3.2 DC Power Conductors

DC power conductors are required to connect the battery racks of CESS4000 to nearby battery inverters on the site. There are two DC combiner cabinets for each battery enclosure row. The DCCs shall be connected to the associated inverters in accordance with the project engineering documentation.

The positive and negative power conductors shall be connected to the busbars in the DC combiner cabinet using M12 terminal lugs. The DCC enables four to eight connections per DC polarity See ***General Specifications For The DC Cables***. The cable size is site-specific and shall be determined based on the local and project-specific engineering requirements. Consider the general specifications for the DC cables.

General Specifications For The DC Cable	
Maximum cable cross section per DC input	Two options for DC bus configuration: ● Split bus ○ two independent DC mini-banks ○ four per polarity per mini-bank ● Combined bus ○ both DC mini-banks connected in parallel ○ eight per polarity (total, not per minibank)
DC voltage rating (UL markets)	2.0 kV
DC voltage rating (IEC markets)	1.8 / 3.0 kV

The external DC cables shall be installed inside an underground conduit or duct and brought into the DC combiner cabinet through the bottom plate.

Connecting UPS batteries

CESS4000 ships with all of the battery connections to all of the ups batteries disconnected.

5.3.3 Auxiliary AC Power Conductors

CESS4000 requires a connection to an auxiliary power source for operation. The auxiliary power source shall be of three-phase type with a frequency of 50/60 Hz. The power connection uses five wires (L1, L2, L3, N, PE).

The auxiliary power feeder is connected to the terminals in the ACC for further distribution. The external cables shall be installed inside an underground conduit or duct and brought into the ACC through the bottom plate. As a preparation for the CESS4000 installation, the cables need to be routed to the installation location of the ACC.

Size the auxiliary AC power cables according to the project-specific maximum auxiliary load and soil conditions.

Consider the general specifications for the power connection and the cables.

General Specifications For The Power Connection And The Cables	
Recommended cable type	Cu or Al, XLPE, 600 V, 90 °C (194 °F)
Wire size	35–95 mm2
Nominal voltage	IEC: 400 Y / 230 Vac UL: 480 Y / 277 Vac
Short-circuit current rating	10 kA

6 Mechanical Installation

The mechanical installation of CESS4000 at the site mainly comprises lifting the prefabricated enclosures in position and anchoring them to the foundation. The enclosures in a row shall be accurately aligned.

Certain additional components may be added to the exterior of the enclosures, if ordered.

The foundation must be completed as a preparation for the installation of the CESS4000 enclosures.

CESS4000 enclosure is anchored using ISO blocks at each corner. It is the customer's responsibility to procure and install foundation anchoring according to site-specific requirements.

CESS4000 secures to the foundation or platform using ISO blocks. ISO blocks are installed at each corner of the base. The mounting anchors that embed into the mounting platform or surface that ISO block securing hardware threads into may be installed in the foundation after final placement and alignment of the enclosure.

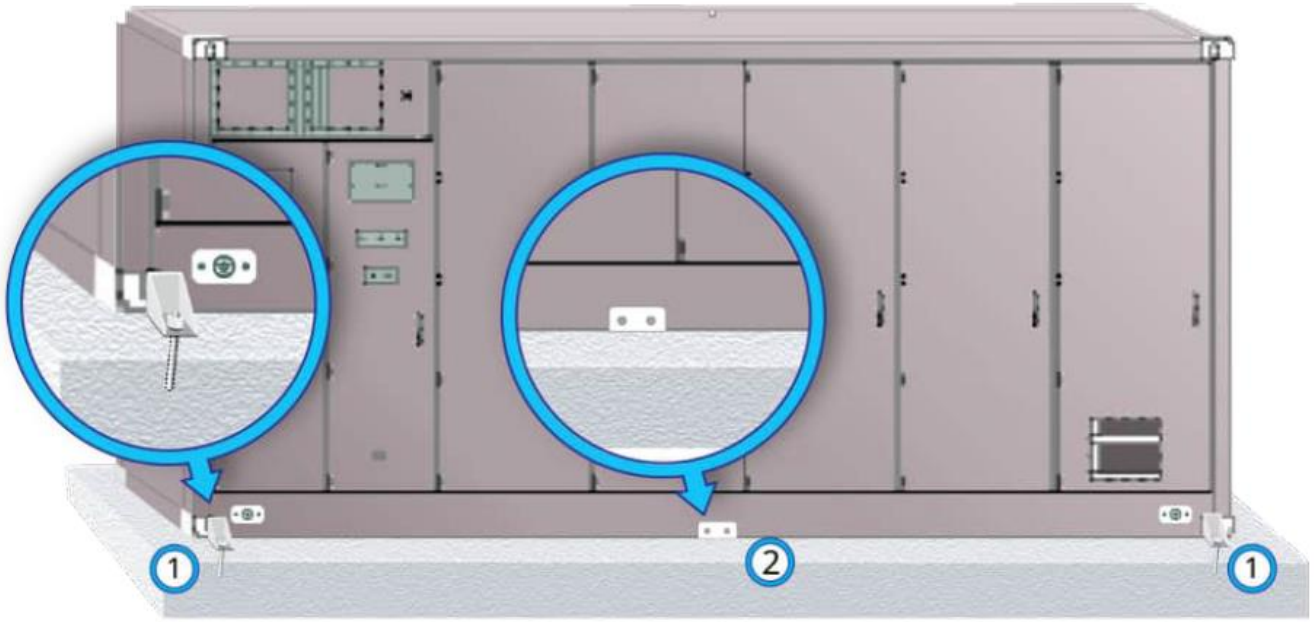
Measure, space, position, and place the CESS4000 enclosure on the mounting surface. Use the picture below to secure to the mounting platform outside the enclosure on opposite sides. Drill the holes for the ISO anchor hardware after the enclosure is in place and the ISO anchor locations can be verified.

Procedure

1.Lift the CESS4000 enclosure and carefully land on the foundation.

2.Secure the battery enclosure to the foundation.

The mounting base should be slightly proud of the mounting platform. When using ISO anchors, the gap between the ISO anchor and the foundation surface can be reduced using washers as needed as ISO anchor hardware is tightened.



No	Description
1	ISO anchor installation locations
2	Middle Anchor[1]

[1] The middle anchor requirements must be determined by the site EPC contractor according to site specific needs and seismic requirements. The location and dimension of the hardware required to attach the middle anchor is provided to allow the EPC to procure materials acceptable to the site requirements as needed.

3.As each CESS4000's installation is competed ISO block can be anchored as follows:

a.Inset customer supplied twist to lock anchor of choice into standard ISO block on each corner of the CESS4000, twist and slide mounting surface flush to the foundation. See these pictures below

b.Mark mounting holes drilling locations.

c.Lift up twist and remove anchor.

d.Drill anchor mounting holes according to manufacturer required hole sizes.

e.Reinsert customer supplied twist to lock anchor of choice into standard ISO block on each corner of the CESS4000, twist and slide mounting surface flush to the foundation.

f.Install anchor hardware according to manufacturer instructions for customer supplied mounting hardware selection, on all four anchors for each CESS4000.

4.The middle anchor should be installed using 2 design and procurement of the middle anchors is the responsibility of the EPC contractor in order to comply with site specific requirements.

7 Electrical Installation

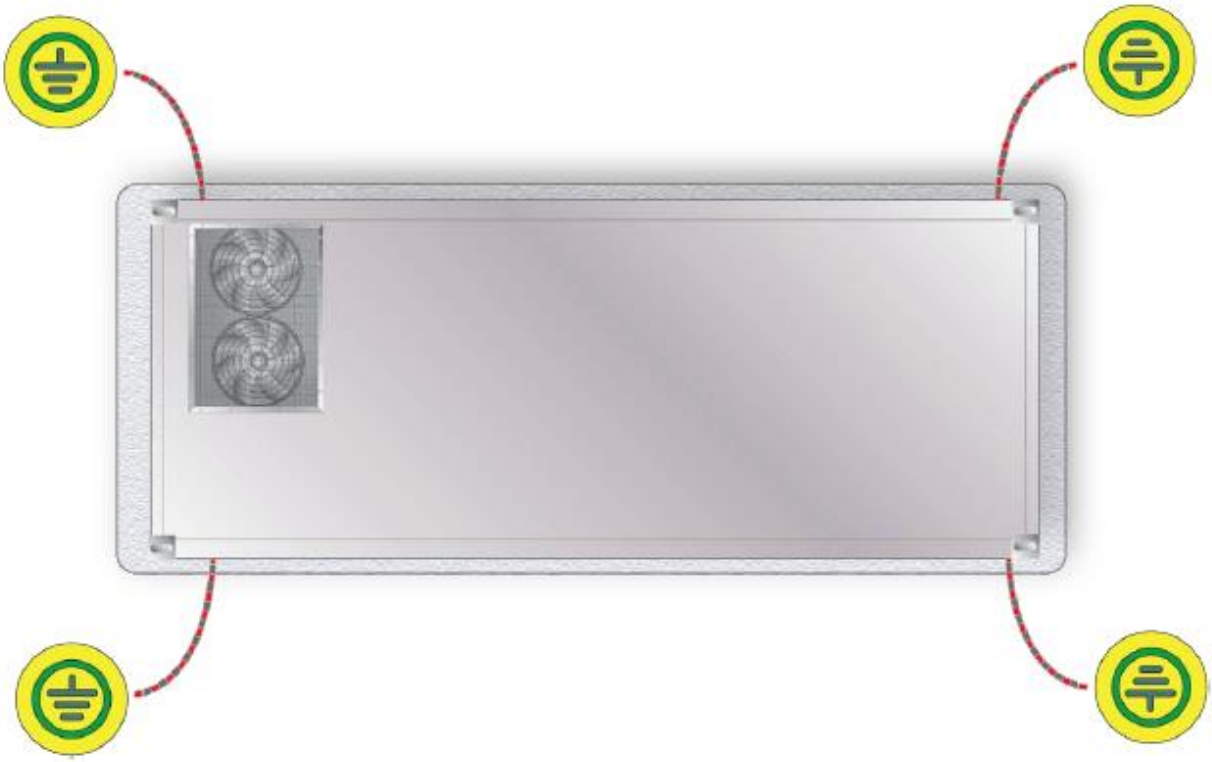
The electrical installation of CESS4000 at the site includes the electrical interconnection of adjacent enclosures as well as installing the connections to external systems.

CESS4000 requires external cabling for grounding and various communication. Preparations for these external connections shall be made before the installation of the CESS4000 enclosures.

7.1 Connecting enclosures to site earth / ground

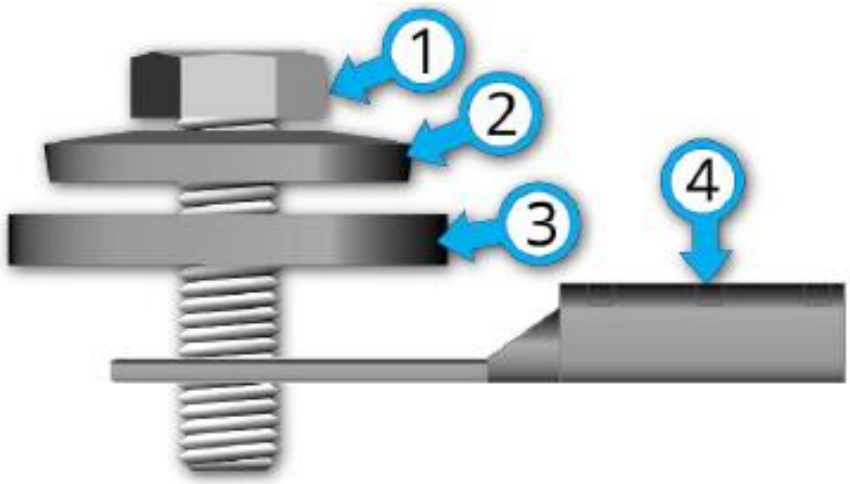
You'll route cabling between the site ground to the enclosures using exterior enclosure earthing / grounding plates on the enclosure base. Ground all four corners of the container at the grounding pads..

The exterior earthing / grounding plates can arrive with a corrosion resistant temporarily covered mild steel alloy. During transit, however, the exterior grounding plates can rust during global delivery transit and, after installation, are a maintenance inspection item.



For bonded connections, make dry, clean connections between exterior grounding plate and the ground cable lug. Do not use any treatments or anti-corrosion preparation. When connection is

complete, seal the rest all exterior ground plates using UV resistant all weather paint. Recommend using the method to achieve at least a **C4 or C5** coating if near marine and polluted environments using a two-part epoxy paint.



No	Description
1	M12 hex head bolt
2	M12 Belleville washer
3	M12 flat washer
4	Lug at ground cable end

Connecting the CESS4000 enclosure to the site earth/ground

1.Use sand paper, wire brush, or like tools to remove the anti-corrosive sealant.

2.If the exterior ground bars have rust, use sand paper, wire brush, or like tools to remove the anti-corrosive sealant.

3.Use a tool with polishing stone or wheel to remove remaining coatings and rust to achieve and bright and polished surface on the exterior ground plate.

4.Use a clean cloth and solvent free cleaner to remove all grease and particulates.

5.Size the ground cable for your CESS4000 deployment.

6.Choose the enclosure exterior ground plate connection and grounding configuration.

7.Produce site planning documentation that includes any conduit and trenching for site connection to earth / ground useful for the CESS4000 system you are installing and commissioning.

8.Crimp lugs properly sized conductor diameter and insulation.

9.If not already, gather the M12 hardware shipped inside the current enclosure or shipped as loose parts.

10.Measure and strip cable ends.

11.Secure properly sized lugs to the ground cable ends.

12.Use a clean cloth and solvent free cleaner to remove all grease and particulates from the ground lug plate.

13.Position and secure the grounding conductors using M12×40 hex head flange bolt, flat washers, and Belleville washers. **Do not overtighten!**

14.Apply a UV resistant all-weather pain such as a two-part epoxy coating and seal all exterior earth / ground plate include ground cable lug hardware. Recommend using the method to achieve at least a C4 or, if near marine and polluted environments or in areas of heavy ice, snow, and rain, achieve a C5 coating.

15.Use UV resistant plastic zip ties or other method to dress and secure the ground wire jumpers to ensure compliance with national and local code slip and fall hazards as fall protection and powered systems that require connection to earth / ground.

16.When finished, clean the area of tools and materials. Update site documentation with revised earth / ground connection for the CESS4000 enclosures.

7.2 Connecting The DC Power Conductors

The DC power conductors from the battery inverter are connected to CESS4000 through the DC combiner cabinet (DCC), which has two busbars for the positive and negative conductors respectively. The conductors enter the DCC through the floor, which is provided with a lead-through plate. The positive and negative DC power busbars can each accommodate up to eight

two-hole lug connectors. The ACC cabinet contains a strain relief bar inside to support the cables as needed.

No	Description
1	DC busbars
2	DC main switch
3	Lead-through plate

Procedure

1.Make sure that no voltage is present and the system will remain fully de-energized throughout the installation work.

2.Unbolt and remove the lead-through plate at the DCC floor.

3.Punch openings of the correct size for the DC cables in the lead-through plate, and install cable fittings to ensure liquid-tight penetrations.

4.Pass the DC cables through the cable fittings in the lead-through plate.

5.Bolt the lead-through plate back in place.

6.Strip the cable insulation and fit the cables with terminal lugs.

To procure the correct lugs the size of cable that the lug need to accept will be determined by site specific EPC design. For size and spacing refer to . The bus bar is designed to accept M12 hardware.

No	Description
×	44.5 mm (1.75 in)
1	Ø 13 mm (0.51 in)

7.Clean the contact surfaces of the terminal lugs and the DCC busbars.

Use a clean cloth and ethanol cleaning agent. Take care not to touch the contact surface after the cleaning.

8.Land the terminal lugs on the DCC busbars, the bus bars are designed to accept M12 bolts, the EPC contractor should procure lugs which accommodate the DC conductor size and the hole spacing outlined in this section.

There are three mounting locations on the busbar. Lugs can be mounted on the front and back for a total of six connections. Tighten to 78 Nm. Once tightened, mark the surface of the tightened fastener and continue that mark onto the surface that is being clamped.

9.Apply fire rated caulking or foam to the openings around the cables, to make the leadthrough plate fire-resistant and weather-tight.

7.3 Connecting The Auxiliary Power Conductors

The auxiliary power conductors are connected to CESS4000 through the ACC. The cable enters the ACC through the floor, which is provided with a lead-through plate.

The same lead-through plate is used also for the communication cables, which for practical reasons are brought into the cabinet at the same time as the auxiliary power cable.

No	Description
1	Lead-through plate

Procedure

1.Unbolt and remove the lead-through plate at the ACC floor.

2.Punch openings of the correct size for all auxiliary power and communication cables in the lead-through plate and install cable fittings to ensure liquid-tight penetrations.

The openings shall be located so that the power cable and the communication cables are properly separated from each other.

3.Pass the auxiliary power cable and the communication cables through their respective cable fittings in the lead-through plate.

4.Bolt the lead-through plate back in place.

5.Terminate the wires of the auxiliary power cable.

- Connect the L1, L2 and L3 wires to the bottom terminals of the main circuit breaker Q1 and tighten to 9 Nm for Model XT2S and 18 Nm for Model XT4S. Once tightened, mark the surface of the tightened fastener and continue that mark onto the surface that is being clamped.
- Connect the N wire to the bottom terminal of power distribution block XD4 and tighten to 13.6 Nm. Once tightened, mark the surface of the tightened fastener and continue that mark onto the surface that is being clamped.
- Connect the PE wire to the bottom terminal of power distribution block XD5 and tighten to 13.6 Nm. Once tightened, mark the surface of the tightened fastener and continue that mark onto the surface that is being clamped.

No	Description
1	Main circuit breaker in the ACC

6.For explosion protection Fans and the FACP there are two options for auxiliary power. Option 1 (standard) the Aux feed into the ACC supplies the 230 VAC and will come prewired or Option

2: a customer wires in their UPS backed up supply if using a site supplied UPS backed up power source. When applicable terminate the customer supplied UPS backed up AC feed for the explosion protection fans and FACP as follows, refer to site specific electrical schematics for further details:

- Connect Site “IN” power to Terminal Blocks X100:1 and X100:3. (Ventilation fan intake at CESS4000 front, small active door bottom).
- Connect Site “OUT” power to Terminal Blocks X100:2 and X100:4. (Ventilation fan exhaust at CESS4000 rear, small active door bottom)

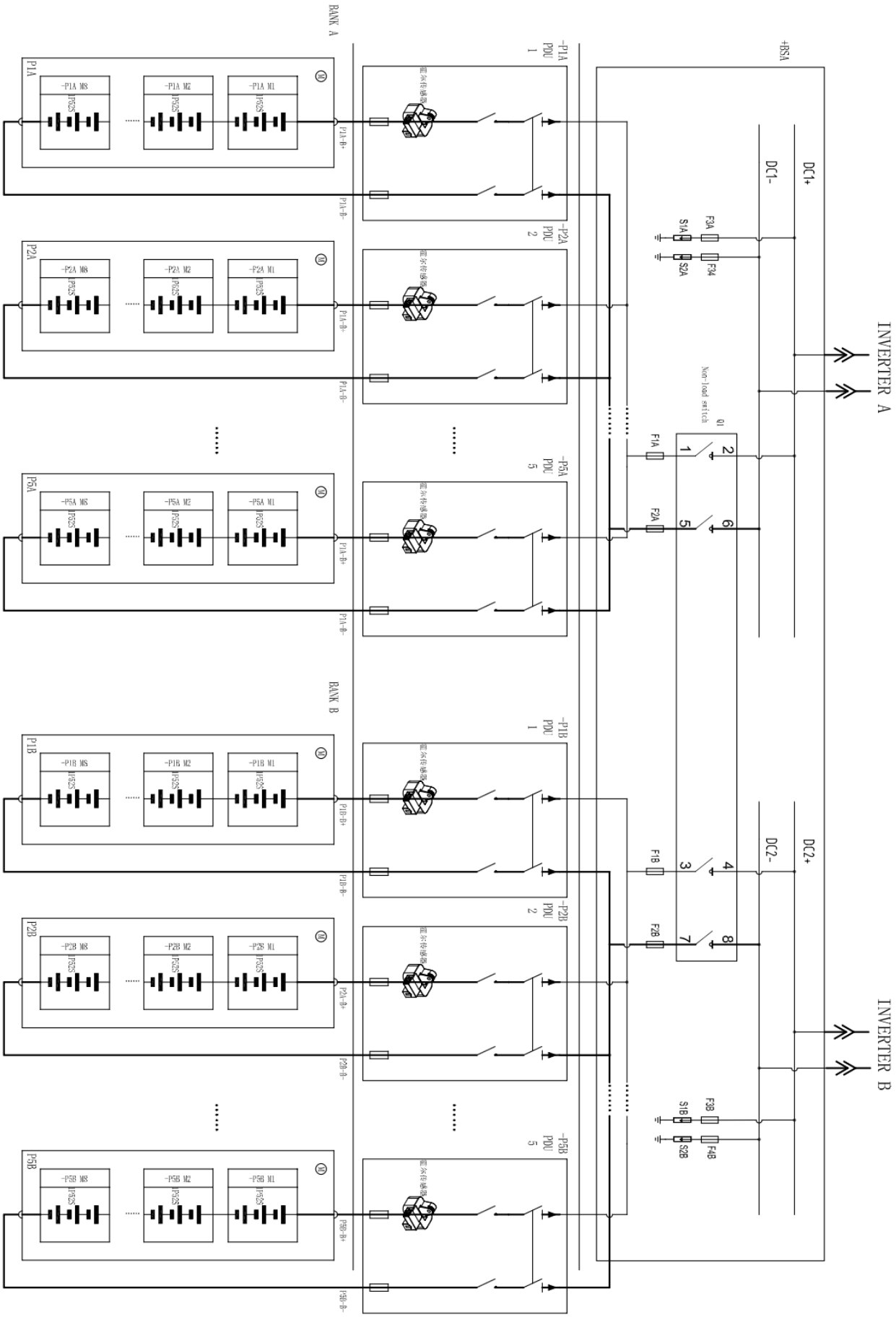
7.Apply fire rated caulking or foam to the opening around the auxiliary power cable, to make the lead-through plate fire-resistant and weather-tight.

8 Technical Data

Technical Data	DC Energy Storage System
Model Name	**CESS4000**
GENERAL	
Nominal Capacity	4073 kWh
Nominal Charge/Discharge Rate	0.25 C or 0.5 C
Ambient And Operating Temperature Range	-30℃~+50℃ / -22°F~+122 °F
Dimensions (mm)	W 6058 x H 2896 x D 2438
Footprint	20’ high – cube IOS container
Weight	Approximately 83775 lbs / 38ton
Corrosion-proof Grade of Cabinet	C4 (C5 Optional)
IP Rating	IP55 (**Outdoor Use**)
Noise Level	84 dB(A) 50 Hz power source 86 dB(A) 60 Hz power source
BMS	Integrated
EMS	Integrated
Auxiliary Load Voltage	480V 60Hz or 380 ~ 415V 50~60Hz, 3P4W
Cycle Lifetime Of Battery Cell	⩾8000 cycles (70%SOH, 25±2℃)
DC Side	
Battery Rack Quantity	10
Battery Pack Quantity per Rack	8
Battery Pack Structure	1P52S
Battery Cell Capacity	306 Ah
Battery Energy per Pack	50.918 kWh
Battery Type	LiFePO4
DC-side Rated Voltage	1331.2 Vdc
Output DC Voltage Range	1164~1500 Vdc

Cooling Method	Liquid-cooling

9 Single Electrical Diagram



10 Contact

China

Jiangsu RCT Power Energy Technology Co., Ltd

No. 18, Ruipu Road, Suzhou Industrial Park,

Suzhou Area, China (Jiangsu)

Pilot Free Trade Zone

Phone: +86 512 6683 0096

E-mail: info@rct-power.com.cn

Website: www.rct-power.com.cn

US

RCT Power Energy Technology Corporation

One Walnut Creek Center,100 Pringle Ave., Suite 780,

Walnut Creek, CA 94596

Phone: +1 (888) 99 RCTUS / (888-99-72887)

E-mail: info@rct-power.us

Website: www.rct-power.us

GER

RCT Power GmbH

Line Eid Str. 1

78467 Konstanz, Germany

Phone: +49 (0)7531 996 77-0

Mail: info@rct-power.com

Website: www.rct-power.com

REV 5.0

Date:2026/07/02