POWIN

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POM-017 POWIN POD OPERATIONS AND MAINTENANCE MANUAL

Powin Pod

CONFIDENTIAL

POM-017 Rev 0

Disclaimer and Contact Information

About Powin

Powin is advancing the next frontier of energy by delivering end-to-end, fully integrated battery storage solutions, cutting-edge software, and comprehensive services designed to optimize today's power grid and facilitate the transition to renewable energy. Our modular, configurable, and scalable systems empower our customers to reliably deploy cost-effective utility-scale energy storage systems with ease. With over a decade of energy storage experience and expertise, Powin has nearly 15GWh of projects installed or under construction worldwide.

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1.0 Introduction

Powin is advancing the next frontier of energy by ensuring access to clean, resilient, and affordable power. Today's dynamic energy landscape is shifting toward decentralization and more options for sourcing and managing energy. A key component of this new energy landscape is energy storage. Battery energy storage is a rapidly maturing energy storage solution, with Powin at the forefront in the development of commercialized Energy Storage Systems (ESS).

The Powin Pod 5.015 MWh ESS features upgraded Lithium Iron Phosphate (Lithium Ferrous Phosphate, or LFP) cells, utilization of cell-to-pack technology, and optimized internal space. The design maximizes energy density and results in significant land savings for projects. This solution and density improvement is available at 2-hour or greater system applications. See Powin Pod.

Liquid cooling provides stable internal battery system temperatures, ensuring enhanced system safety and longevity.

This manual provides required inspection criteria for the Pod Energy Storage System (ESS) and the intervals in which they are required to be conducted. It also provides common troubleshooting and maintenance procedures for a variety of systems and components within the Pod.

Field-service personnel must receive task-specific training for authorization to perform these tasks. Only certified individuals shall be authorized to perform repairs on Pod systems. To ensure proper maintenance and repair procedures are executed on Powin systems, all technicians must successfully complete the Powin Centipede Field Service Training program.

It is mandatory to document all repair and maintenance activities, including replacement parts and names of technicians doing the work. A daily report must be submitted to Powin management by the technician responsible for the work.

Original parts may not be available. If original parts are not available, Powin may authorize the use of compatible parts. Before using compatible parts, contact Powin to confirm their safety. Compatible parts must be safe to use in the system and must not compromise the system's ability to monitor its condition.

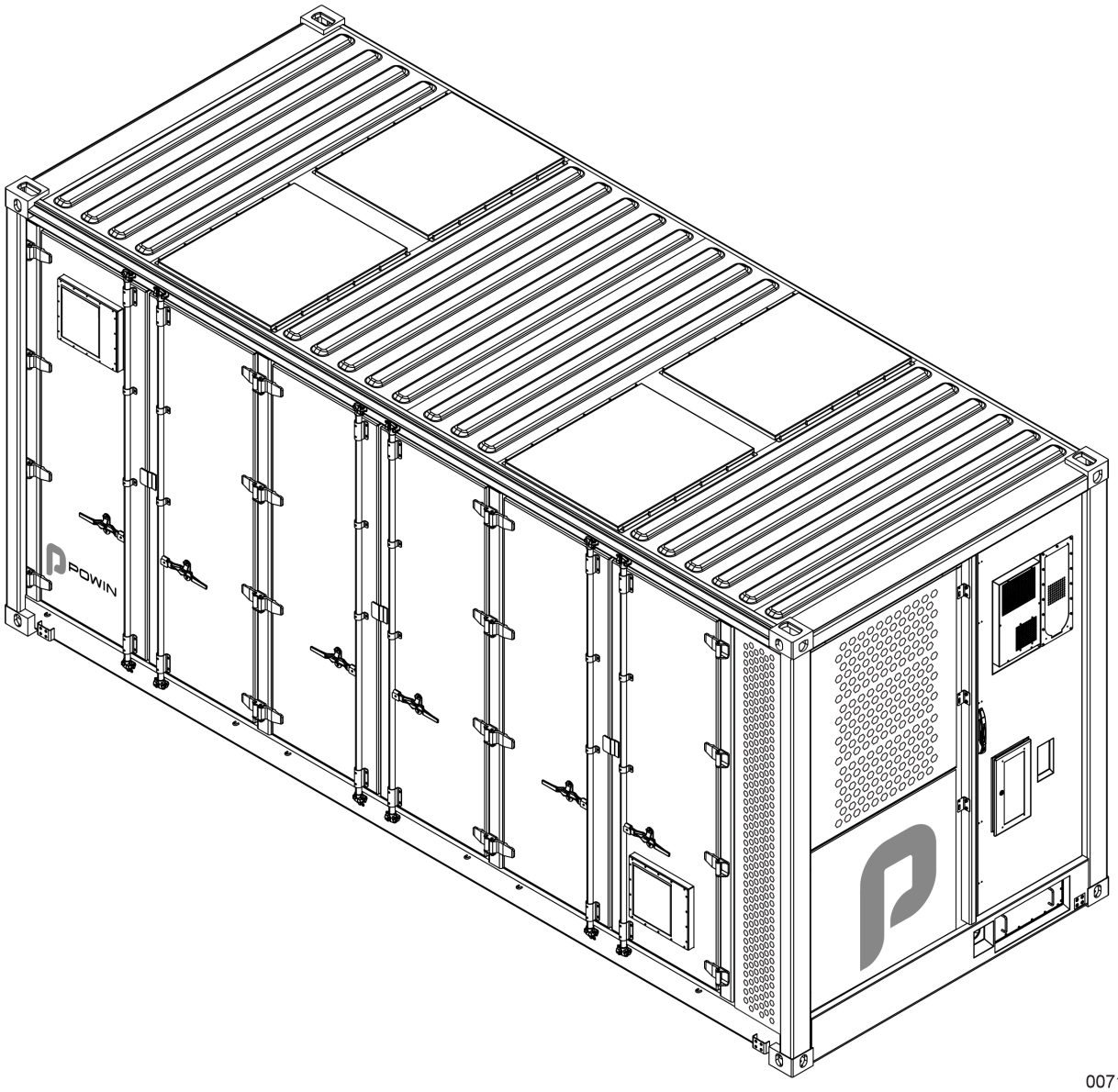

Figure 1. Powin Pod

2.0 External Applicable Environment

Table 1. External Applicable Environment

Storage Ambient Temperature	• -40°C to -30°C (-40°F to -22°F) or 50°C to 60°C (122°F to 140°F) for no longer than one month. • -20°C to 50°C (-4°F to 122°F) is acceptable for no more than three (3) cumulative months. • Storage greater than three (3) cumulative months requires verification of cell SOC >40% and may require balancing.
Operating Ambient Temperature[1]	-30°C to 50°C (-22°F to 122°F)

Altitude[1]	≤3000 m (≤9842.5 ft)
Environment Humidity	10% - 90% RH
IP Level of Enclosure	Battery cabinet IP55 Electric cabinet IP55 Chiller controller IP55 Battery Pack IP67
[1] StackOS may automatically derate power at high/low ambient temperatures, at high elevations, and/or after extended operation to maintain proper cell temperatures.	

3.0 Operating Conditions and Warranty Limitations

Powin does not assume any warranty, property damage, or safety responsibility for battery performance degradation, life attenuation, damage, or accidents caused by improper use of lithium-iron batteries in violation of the terms of this document.

Do not install or operate the battery system in the followings environments without first consulting Powin:

- Discharge temperature: <-30°C or >50°C (<22°F or >122°F)
- Charging temperature: <0°C or >50°C (<32°F or >122°F)
- Operating humidity: <10% RH or >95% RH
- Working altitude: >3000 m (>9843 ft)
- Working Environment: areas with high salt spray (e.g. coastal areas); Highly contaminated areas (areas with pollution level 3 and above specified in IEC60664-1).

Do not disassemble or modify the BMS or battery box without authorization from Powin.

Do not install or operate the battery system in areas close to heat or ignition.

Powin does not assume relevant responsibilities for improper operation by on-site personnel (non-Powin personnel) where the battery system suffers mechanical damage, such as deformation, puncture, heavy pressure, fall, etc.

Do not use the battery beyond the following conditions:

- Do not overcharge: the upper limit of charging voltage shall not be higher than 3.65 V.
- Do not over-discharge: the lower limit of discharge voltage shall not be lower than 2.5 V.
- Overcurrent is prohibited: the continuous, pulse charge and discharge rate shall not exceed the requirements of the charge and discharge current limit table in the specification.
- Prohibition of overtemperature: when the battery temperature is lower or higher than the requirements of the charge and discharge current limit table in the specification, the power should be limited or the charge and discharge should be stopped.

Powin does not assume relevant responsibilities due to excessive electromagnetic interference of the working environment of the battery system.

Do not mix lithium-iron batteries of different types, manufacturers and different chemical systems (such as lead-acid batteries) in the same module, electrical box, or other level of system integration products.

The ESS integration unit (such as a container) developed by the integrator using the battery box or battery cluster described herein must meet the relevant regulations, standards, and specifications of the corresponding application field.

Powin does not assume any warranty, property damage, or accidents caused by battery performance nor life attenuation, damage, or accidents caused by non-battery box or battery cluster factors such as integrated design, thermal design, assembly process, operating environment, abnormal charge, and discharge and control.

4.0 Personal Protective Equipment

The following Personal Protective Equipment (PPE) shall be worn during installation and maintenance of this equipment:

- Safety helmet
- Insulated gloves
- Protective glasses
- Safety/protective boots
- High visibility clothes and/or safety vests

Please be aware that a battery can pose risk of electrical shock including high short circuit current. Follow all safety precautions while operating the batteries. During the installation or maintenance of the battery system, a worker shall wear proper personal protective equipment such as eye protection, high visibility clothing, protective gloves, and protective footwear. Insulation gloves with over 1500 Vdc ratings are needed when connecting the busbars and jumpers between modules and racks.

Table 2. Danger, Warnings, and Cautions for Tasks

	Please be aware that the batteries have a risk of electrical shock with extremely high short circuit current.
	Please be aware that batteries may cause fire in fault condition.

	Wear personal protective equipment and do not wear any metal object such as watches, rings, metal necklace, etc. While performing any operation related to ESS.
	Use tools with insulated handling to avoid accidental short circuit. Do not put any tool or metal parts on the top cover of the battery.
	Do not open or damage the battery module.
	Sharp points and pinch points are present on most system components. Be aware of the serious risk of injury while working around battery equipment.
	Components in the battery system can be damaged by electrostatic discharge. Ensure that you wear a grounded anti-static wrist strap and discharge static electricity by touching a grounded surface near the equipment before you touch any system components.

5.0 Safe Use Instructions

Make sure the working environment of the Powin Pod battery system meets the requirements in the product specification. Do not install or use this product in abnormal conditions (such as high altitude ≥3000 m [≥9842 feet]), high salt spray (coastal areas), high pollution (areas with pollution level 3 and above specified in IEC60664-1), high humidity (Relative Humidity [RH] ≥95%). Environment for operation is -30°C to 55°C (-22°F to 131°F). Environment for storage is -40°C to 60°C (-40°F to 140°F) for no longer than one month.

- If the Powin Pod is intended to be installed in areas where the above-mentioned conditions apply, Powin must be consulted in advance. Technical personnel will respond after evaluation.
- The battery system should be kept away from heat and fire sources and avoid direct sunlight for extended periods of time.
- Do not decompose, puncture, crush, roll, or incinerate the batteries. Do not expose the batteries to or submerge them under water.
- Do not hit, throw, or otherwise cause the battery to be subjected to mechanical vibration or falls to avoid mechanical damage to the outside of the battery box or damage the anti-corrosion layer of the battery shell.
- If the battery emits peculiar odor, heat, deformation, discoloration or any other abnormal behavior, stop using it immediately and remove the battery from use.

- Do not connect the positive and negative poles of the battery box or battery system directly with metal or other conductors to avoid ignition or short circuit.
- Do not contact or expose the battery module to items that can cause a short circuit.
- Ensure that the positive terminal is connected to the positive connection point and the negative terminal to the negative connection point. Reversing these connections can cause damage.
- Be sure to charge or discharge according to the requirements of the product specification and use charging equipment approved by both parties.
- Make sure the energy storage converter or charge-discharge equipment used can limit the charging and discharging power according to the allowable power boundary of the battery system and take corresponding protective measures when the battery charge and discharge reaches the cut-off voltage. Do not overcharge or over-discharge the battery.
- Make sure the Battery Management System (BMS) is properly connected and working normally during charging or discharging. Make sure communications in the BMS is normal. Avoid abnormal communication of the BMS due to external line failure or electromagnetic interference.
- When working in a low temperature environment, the capacity and output power capacity of the battery system will be reduced, which is normal.

NOTE

Cell performance gradually recovers after the ambient temperature approaches 25ºC (77ºF).

- Non-professionals are prohibited from disassembling or modifying the BMS or battery box.
- The installation and fixation of the battery box and battery cluster should be carried out in accordance with the methods given in this manual. Do not deviate from these instructions during installation.
- Do not mix the battery system with other types of batteries or batteries from other manufacturers.
- If the battery catches fire, it is necessary to use professional firefighting equipment to extinguish the fire. Non-fire-fighting professionals should not approach any equipment that is on fire.

6.0 Danger, Warning, and Caution

Table 3. Danger, Warning and Caution Symbols

	During the lifting process, the container operation safety regulations of the project location country / region must be observed. The container and any machines or tools used during operation shall be maintained. All personnel engaged in loading and unloading and bolt-fixing should receive corresponding training, especially on safety aspects. Crane safety operartions must be strictly followed during lifting of the energy storage container. No persons shall stand within 5m~10m of the operation area. To avoid severe injuries or casualties, no persons shall stand under the lifting arm or under any part of the moving machinery. No lifting operations shall be done during bad weather conditions, such as heavy rain, heavy fog, strong wind, etc
	Failure to follow the instructions with this symbol may result in a serious accident or severe injury.
	Failure to follow the instructions with this symbol may result in a minor accident or moderate injury.

7.0 Tools and Materials

The following tables provide a list of tools and materials that are required for this procedure.

All chemical products must be delivered to site with the Safety Data Sheet (SDS). SDS must be retained on-site while this work instruction is completed. Prior to performing work using a chemical product, the SDS must be reviewed to ensure work will be performed safely.

WARNING

All tools should meet standards given in IEC60900 and ASTM F1505-16 (insulated for use with 1500 Vdc as appropriate).

WARNING

Tous les outils doivent répondre aux exigences des normes IEC60900 et ASTM F1505-16 (isolé pour une utilisation avec 1500 Vdc).

Table 4. Tools Required

TOOL	DESCRIPTION	QUANTITY	REFERENCE
TBD	TBD	TBD	TBD

TOOL	DESCRIPTION	QUANTITY	REFERENCE
TBD	TBD	TBD	TBD

Table 5. Materials Required

MATERIAL	PART NUMBER	UNIT DRIVER	QUANTITY PER UNIT	REFERENCE
TBD	TBD	TBD	TBD	TBD
TBD	TBD	TBD	TBD	TBD

8.0 Inspections

The following sections give inspection criteria for the Pod. When performing scheduled inspection and maintenance procedures, also check the following:

1. Make sure all wiring harnesses are properly secured.
2. Check for any Battery Management System (BMS) failure reports from the Environmental Controller client.

8.1 Inspection - Battery Systems in Operation

Table 6 outlines the daily maintenance procedures required for Pod battery systems in operation, including steps and frequency.

Table 6. Daily Inspection - Battery Systems in Operation

Inspection Type	Procedure	Passing Criteria	Frequency
Voltage	Check for consistent voltage.	No voltage difference alarm.	Daily
Temperature	Verify that the temperature is within operating range.	No temperature difference alarm.	Daily
System Fault	Use BMS data to identify any system faults.	No system faults detected.	Daily

Table 7 outlines the semiannual maintenance procedures required for Pod battery systems in operation.

Table 7. Semiannual Inspection - Battery Systems In Operation

Inspection Type	Procedure	Passing Criteria	Frequency
Visual	Check for exposed copper wire. Make sure the wire sheaths are in good condition and all connectors are properly plugged/seated, and any other damage or deformation.	All wires and plugs are in good condition and properly connected.	6 months

Inspection Type	Procedure	Passing Criteria	Frequency
Charge/Discharge Operation	Fully charge and discharge once and calibrate State of Charge (SOC) and State of Health (SOH) per standard processes.	Capacity requirements are met.	6 months
Voltage	Check for consistent voltage.	No voltage difference alarms present.	6 months
Temperature	Check that temperature is within operating range.	No temperature difference alarms present.	6 months
System Fault	Use BMS data to identify any system faults.	No system faults detected.	6 months

8.2 Inspection - Chiller Faults

If any faults are detected with the chiller, refer to Chiller Faults to determine the cause of the fault and potential solutions:

Table 8. Chiller Faults

Symptom	Possible Cause	Solution
Compressor won't start	Power supply is off or in standby mode	Check the main power switch and ensure the startup screen is displayed.
	Loose electrical connection	Tighten the electrical connectors.
	Compressor motor failure	Inspect the motor and replace it if any defects are found.
Compressor won't run	No demand for cooling	Check the temperature inside the cabinet and verify the compressor's status on the control panel.
	Shutdown delay in progress	The compressor has a short shutdown period. If the temperature rises during this time, it won't restart until the delay ends.
High discharge pressure	Condenser is dirty or clogged	Clean the condenser thoroughly.
	Condenser fan not working	Refer to Heating/Cooling Set Point Parameters for more information.
Evaporator freezes up	Internal circulation fan isn't working	Refer to Heating/Cooling Set Point Parameters for more information.
	Fault capillary temperature sensor	Check the sensor connection. If faulty, replace the sensor.

The heating startup point is determined by subtracting the heating sensitivity from the heating stop point. When the temperature inside the cabinet falls below the heating startup point, the heating system activates. Conversely, when the temperature exceeds the heating stop point, the heating system deactivates.

Heating/Cooling Set Point Parameters outlines the key parameters for setting heating and cooling points in the battery cabinets:

Table 9. Heating/Cooling Set Point Parameters

Parameter	Default Value	Setting Range	Units	Set Point Description
CoolSP	23	[15 ~ 55]	°C	Temperature at which cooling stops
CoolΔT	3	[1 ~ 10]		Sensitivity of the temperature control
INHT	40	[30 ~ 70]		Internal high temperature alarm threshold
HeatSP	10	[5 ~ 25]		Temperature at which heating starts
HeatΔT	15	[1 ~ 10]		Sensitivity of the heating control

8.3 Inspection - Environmental Control System (Chiller)

Table 10 outlines the maintenance procedures required for the Pod thermal management system, including steps and frequency.

See Figure 2 for the locations of parts to be inspected.

Table 10. Environmental Control System Inspections

Component/ Element	Inspection Type	Procedure	Preventative Maintenance	Frequency
Chiller	Visual - Chiller unit	Make sure the chiller is clean and free of debris.	Clean any dust/debris from the chiller with a clean cotton cloth or similar.	6 months
	Visual - Power cables/ connections and wiring panel	Check that all power cables and connections are connected and secure.	Tighten any loose connections.	6 months
		Check cables and connections for damage, deterioration or any other abnormalities.	Replace any damaged/ deteriorated cables/ connectors.	6 months
		Check for dust and debris at the wiring panel.	Clean any dust/debris from the wiring panel with a brush.	6 months
	Visual - Chiller fans	Check for dust/ debris on the fans. Make sure the fan intakes are free of obstructions.	Ensure power is off for a minimum of 1 minute. Clean any dust/ debris from the fans/fan intakes with a brush.	6 months

Component/ Element	Inspection Type	Procedure	Preventative Maintenance	Frequency
		Fan blades operate smoothly. No damage or deformation present.	Ensure power is off for a minimum of 1 minute. Tighten any loose hardware or remove any obstructions that interfere with smooth operation of the fans. Replace damaged fans as required.	6 months
	Visual - Condenser	Check for dust/ debris on the condenser.	Ensure power is off for a minimum of 1 minute. Use compressed air or a vacuum cleaner with a brush head to clean the condenser.	6 months
		Check condenser fins for damage.	Ensure power is off for a minimum of 1 minute. Straighten any damaged/bent condenser fins with a fin comb.	6 months
	Visual - Expansion Tank	Check that coolant levels are appropriate if a low level water alarm is present.	Add coolant as necessary. The tank should be at least 2/3 full.	6 months
Coolant	Visual/ Operational	Coolant concentration is within prescribed range.	Ensure power is off for a minimum of 1 minute. Replace the coolant.	6 months
		The pH concentration of the electrolyte is within the prescribed range.		6 months
		No debris or foreign matter such as algae is present.		6 months
Coolant Line	Operational - Exhaust Valve	Operational inspection required if the system is shut down for more than 3 months.	If the exhaust valve leaks, tighten the cap clockwise. If the leak persists, replace the valve.	After 3 months of system downtime

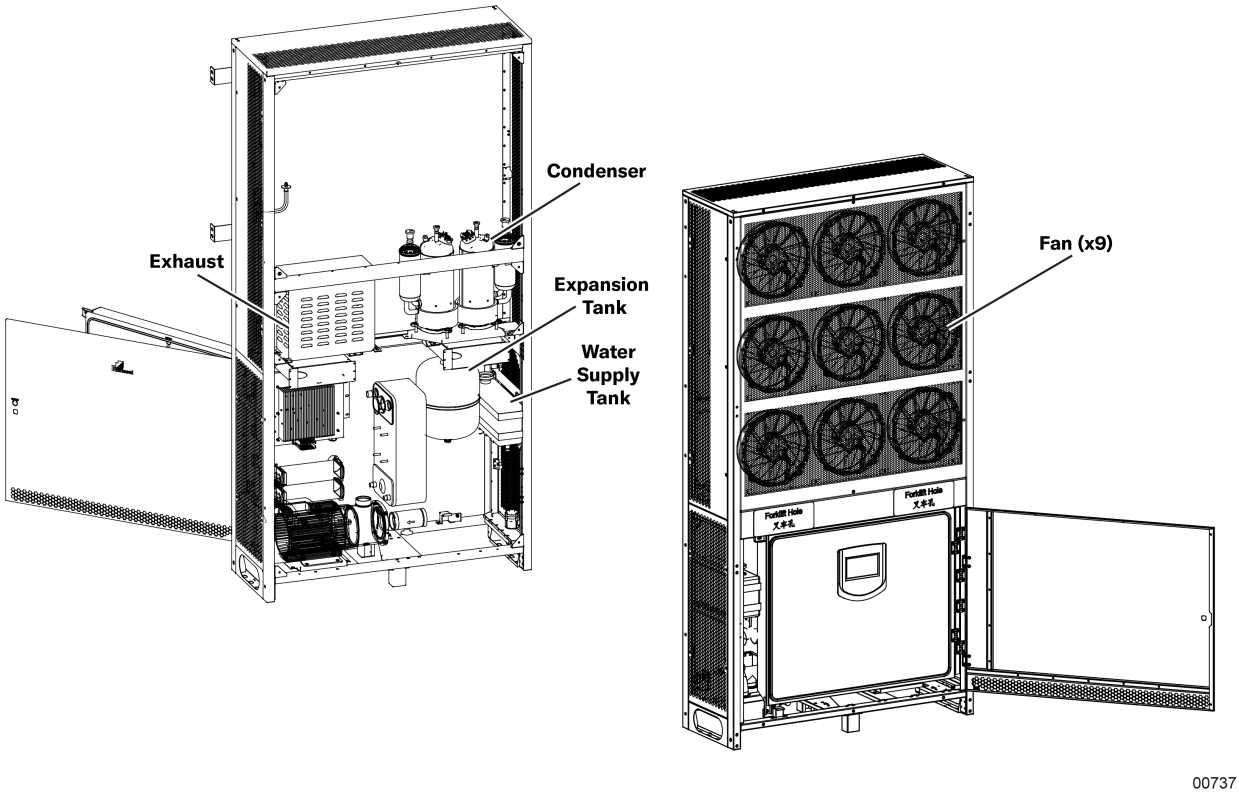

Figure 2. Chiller Components

8.4 Environmental Controls System Replacement Criteria

Environmental Controls System Replacement gives criteria and procedures for replacing components of the chiller.

Table 11. Environmental Controls System Replacement

Component	Replacement Criteria	Action Required
Water Chilling Unit	Severe or irreparable damage	Replace the entire unit.
Liquid Cooling Pipeline	Significant damage to primary pipes or thermal insulation	Replace the damaged pipes and insulation.
	Severe damage to multi-layered pipes or thermal insulation	Replace affected pipes and insulation.

8.5 Troubleshooting - Electrical Cabinet HVAC Fan Faults

If any faults are detected in the HVAC fan, refer to HVAC Fan Faults to determine the cause of the fault and potential solutions:

Table 12. HVAC Fan Faults

Symptom	Cause	Solution
Internal cycling fan isn't operating.	The air conditioner is in standby.	This is normal. Wait for 30 seconds after turning on the unit; it will start automatically.
	The fan blade is stuck.	Check for any objects blocking the fan blades.
	Loose electrical connection.	Ensure all electrical connections to the fan are secure.
External cycling fan isn't operating.	Compressor hasn't started.	The fan will start once the compressor begins running.
	The fan blade is stuck.	Check for any objects blocking the fan blades.
	Loose electrical connection.	Ensure all electrical connections to the fan are secure.
Fan is making an unusual/ unexpected noise.	Worn bearings.	Replace the fan.
	The fan blades are hitting something.	Check to see if the fan blades are hitting any cables or other objects.
External hydrogen discharge fan isn't operating.	Incorrect settings or operating conditions.	Make sure the settings and operating conditions are correct.
	No power.	Check the external power supply to the fan.
	Fan is faulty.	Replace the fan.
	Default settings not configured.	Ensure the fan's settings are properly configured for operation.

8.6 Troubleshooting - Electrical Cabinet HVAC Cooling System Faults

If any faults are detected with the HVAC cooling system, refer to Table 13 to determine the cause of the fault and potential solutions.

Figure 3 gives an image of the HVAC unit for reference.

Table 13. Cooling System Faults

Symptom	Cause	Solution
Compressor won't start	Power isn't on (in standby mode).	Ensure the main power switch is on and the startup screen is visible.
	Loose wiring or circuit connection.	Tighten all electrical connections.
	Compressor motor is burnt out or damaged.	Check the motor for damage and replace it if necessary.
Compressor not operating	No demand for cooling.	Verify the cabinet's temperature and compressor status on the control panel.
	The compressor is in delay mode after shutdown.	Wait for the safety delay period to end. The compressor won't restart immediately after shutting down.
High discharge pressure	Condenser is dirty.	Check the condenser for any clogs. Clean the condenser thoroughly.
	Condenser fan isn't working.	Check and fix issues with the condenser fan. Refer to Heating/Cooling Set Point Parameters for more information..

Symptom	Cause	Solution
Evaporator is freezing	The internal fan isn't working.	Check and fix issues with the internal fan.
	Faulty capillary temperature sensor.	Ensure the temperature sensor is connected properly and replace it if it's defective.

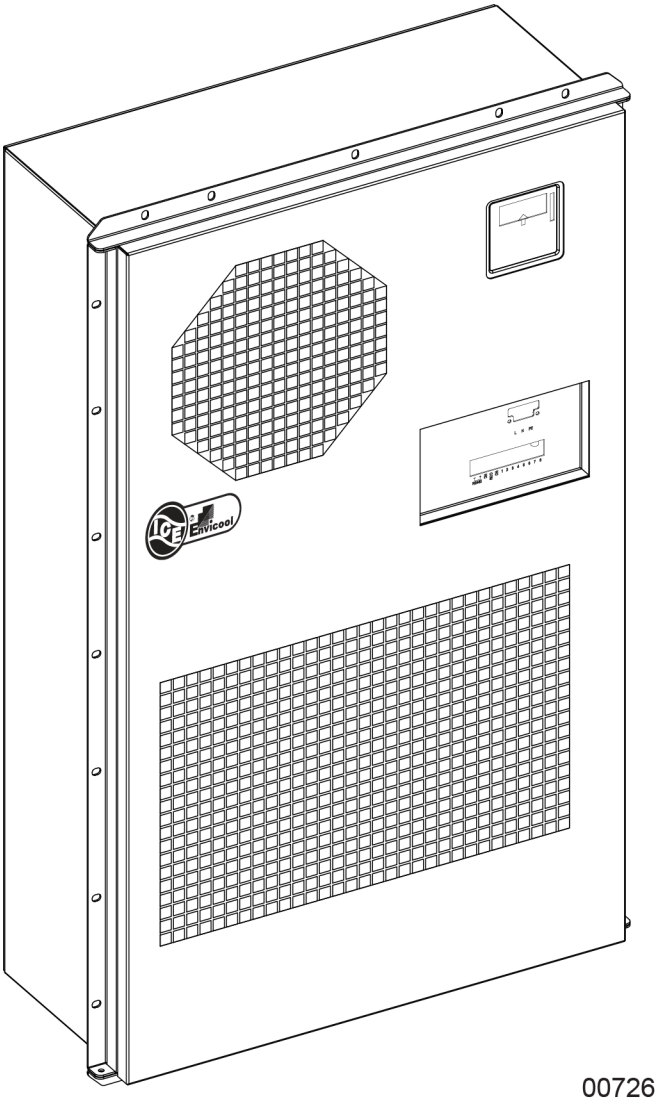

Figure 3. Electrical Cabinet HVAC Cooling Unit

8.7 Inspection - Fire Suppression System

Semiannual Visual Inspection - Fire Suppression System gives the maintenance procedures required for Pod battery systems in operation, including steps and frequency.

Table 14. Semiannual Visual Inspection - Fire Suppression System

Component	Procedure	Frequency
All equipment	Check for changes affecting performance, like occupancy changes, environmental conditions, device location, physical obstructions, device orientation, physical damage, and cleanliness.	6 months
Fire suppression control panel	Verify normal operation by checking fuses, interfaced equipment, LED indicators, main supply, and trouble signals.	
Battery	Ensure manufacture date is marked. Inspect for tight connections, corrosion, container/cover distortion, cracks, or electrolyte leakage. Replace if necessary.	
Pull station	Inspect for distortion, rust, aging, and correct system installation.	
Smoke detector	Verify normal operation and inspect for distortion, rust, aging, and correct system installation.	
Heat detector	Verify normal operation and inspect for distortion, rust, aging, and correct system installation.	
Gas detector	Verify normal operation and inspect for distortion, rust, aging, and correct system installation.	6 months
Alarm bell	Inspect for distortion, rust, aging, and correct system installation.	
Horn & strobe	Inspect for distortion, rust, aging, and correct system installation.	
Abort switch	Inspect for distortion, rust, aging, and correct system installation.	
Disable switch	Inspect for distortion, rust, aging, and correct system installation.	
Aerosol generator	Check mounting bracket for looseness, inspect for damage, and check expiration date. Replace if necessary. Inspect structure for changes that could affect agent leakage.	
Exhaust fan, electric ventilation louver, and emergency start/stop switch	Inspect for distortion, rust, aging, and system installation.	
Nozzle	Inspect visible areas for distortion, rust, aging, and system installation. Check sprinkler piping system, flange component, and nozzle in non-visible areas when removing batteries.	

Functional Testing Schedule - Fire Suppression System outlines the daily maintenance procedures required for Pod battery systems in operation, including steps and frequency.

Table 15. Functional Testing Schedule - Fire Suppression System

Parent Component	Component	Procedure	Cause	Solution	Frequency
Fire suppression control panel	Primary functions	Verify correct receipt of alarm, supervisory, and trouble signals.	Short circuit or open circuit in the control panel.	Contact Powin if issue persists.	6 months

Parent Component	Component	Procedure	Cause	Solution	Frequency
		Check operation of auxiliary functions and circuit supervision, including detection of open circuits and grounding faults.			
		Verify power supply supervision for loss of AC power and disconnection of standby batteries..			
	Fuses	Verify rating and supervision of fuses.			
	Interfaced equipment	Verify the integrity of circuits interfacing two or more control units			
		Test interfaced equipment connections by operating or simulating the operation			
		Verify that required signals are transmitted at the control panel.			
	Main supply	Disconnect standby supply and test under maximum load, including all alarm appliances.			
		Restore all standby supplies at end of test			
Trouble signals	Alarm sound and LED indicator	Verify operation of all trouble signals at the control panel	Short circuit or open circuit in the control panel.	Contact Powin if issue persists.	6 months

Parent Component	Component	Procedure	Cause	Solution	Frequency
		Press the Silence Buzzer button, and the alarm should stop. If the issue occurs again, the alarm should sound			
	Wiring	Verify correct receipt of trouble signals when any component is disconnected (smoke, heat, and gas detectors, or aerosol generator). When the component is reconnected, the trouble signal should disappear.			
	Grounding fault monitoring circuit	Verify that the earth-trouble indicator occurs when any installation conductor is earthed.			
	Standby supply	Disconnect main supply to verify that the main loss trouble indication appears.			

Parent Component	Component	Procedure	Cause	Solution	Frequency
		Ensure the battery's rated capacity is greater than the system's power demand, including a safety margin. Disconnect the main power supply to the fire suppression control panel and activate the full-load alarm and linkage output. Verify that the batteries can power the system for at least 2 hours. After the test, reconnect the main power supply	Unable to meet power supply requirements.	Powin recommends complete replacement.	
Battery	Temperature	Open the cabinet door and, using an infrared thermometer, record the temperature of each battery at the negative terminal.	Unable to meet power supply requirements.	Powin recommends complete replacement.	6 months
	Charger	With the battery fully charged and connected to the charger, use a voltmeter to measure voltage. Verify that the voltage falls within the battery/alarm equipment manufacturer's recommendation.	Voltage falls outside of specified limits.	Adjust the charger so that it falls within recommended limits	
	Voltage	Charge batteries continuously for 48 hours, then connect them to the charger.	Problem occurs only if the Battery Fail indicator appears on the fire suppression control panel.	Replace batteries.	

Parent Component	Component	Procedure	Cause	Solution	Frequency
	Ohmic test	With the battery fully charged, measure the internal ohmic value of each battery. Record the test date and ohmic value on the battery.		Replace the battery if its ohmic value deviates by 30% or more from the baseline for conductance, or by 40% or more for resistance or impedance. If using the manufacturer's baseline values, replace any battery with an internal ohmic value outside the acceptable range	
	Circuit integrity	Check each initiating device circuit, notification appliance circuit, and signaling line circuit to ensure they provide the correct indications at the fire suppression control panel.	Short circuit or open circuit in the control panel.	Inspect the circuit.	
Gas detector	Alarm bell	Verify that the alarm sounds as intended.	No alarm sound, or the sound is lower than expected.	Replace the alarm.	6 months
	Alarm flash	Verify that horn and strobe flashes function as designed.	Strobe doesn't flash at all or doesn't flash at the required intensity.	Replace the alarm flash.	
	Relay	Verify that the relay transmits alarm signals to the BMS.	The BMS doesn't receive or recognize alarms, or the relay cannot output an alarm signal.	Replace the relay.	

8.8 Battery Management System Faults

Any time a Battery Management System (BMS) fault is present, save the local fault information and contact Powin.

If any of the following conditions occur, turn power off immediately and operate the manual disconnection switch:

- Battery Rack thermal runaway alarm
- Over-discharge fault of battery rack cell
- Overcharge fault of battery rack cell

8.9 Dielectric Withstand Testing

A dielectric withstand test (Hipot test) must be performed using a calibrated Hipot testing device per Table 16. Disconnect the surge protector prior to any tests. This will measures the Pod's insulation effectiveness at the given locations.

NOTE

Dielectric withstand testing only needs to be done after major rework of the Pod that includes replacement of the cables or system components list in Table 16. This testing does not need to be performed as part of regular maintenance or inspections.

Table 16. Dielectric Withstand Testing Criteria

Test Location	Withstand Voltage	Passing Criteria
Battery system HV(+) to Ground	4414 Vdc	Test duration of 60 seconds: current leakage is less than 10mA
Battery system HV(-) to Ground	4414 Vdc	Test duration of 60 seconds: current leakage is less than 10mA
Battery system HV(+) to the communication circuit	4700 Vdc	Test duration of 60 seconds: current leakage is less than 10mA
Battery system HV(-) to communication circuit	4700 Vdc	Test duration of 60 seconds: current leakage is less than 10mA
A/C input to Ground	2120 Vdc	Test duration of 60 seconds: current leakage is less than 10mA
A/C input to the communication circuit	4240 Vdc	Test duration of 60 seconds: current leakage is less than 10mA

9.0 Parts Replacement Procedures

The following sections give procedures for replacing parts of the Pod.

9.1 Battery Module Replacement

Contact Powin if the batteries are damaged, need replacement, or have reached the end of their service life

9.2 Periodic Battery Maintenance Requirements

To ensure optimal battery performance and longevity, follow the periodic maintenance tasks outlined in the following table:

Table 17. Battery Maintenance Schedule

Maintenance Task	Frequency	Notes
State of Charge (SOC) correction	Every two weeks	Perform a charge to 0.25P (charging at 25% of the battery's maximum capacity)
Battery equalization	Automatic by BMS	No manual action required.
Small current charge and discharge	Once a month	Power level depends on current usage.

Log all maintenance tasks and report any irregularities to Powin.

9.3 Self-Sealing Joints and Fasteners

Document and notify Powin of any damaged parts.

9.4 Surge Protector and Fuse Damage Assessment

Before replacing the surge protector or fuse, carry out the following damage assessment:

1. Check the surge protector fault display light. Refer to Surge Protector Components to identify the display light location.
    a. If the light is green, the surge protector is operating normally.
    b. If the light is red, the surge protector is damaged.
2. Measure the fuse resistance.
    a. If the resistance is 100mΩ, the fuse is functioning correctly.
    b. If the resistance is greater than 100mΩ or the circuit is open, the fuse is damaged.
3. Check for any additional signs of damage to the surge protector of fuse.

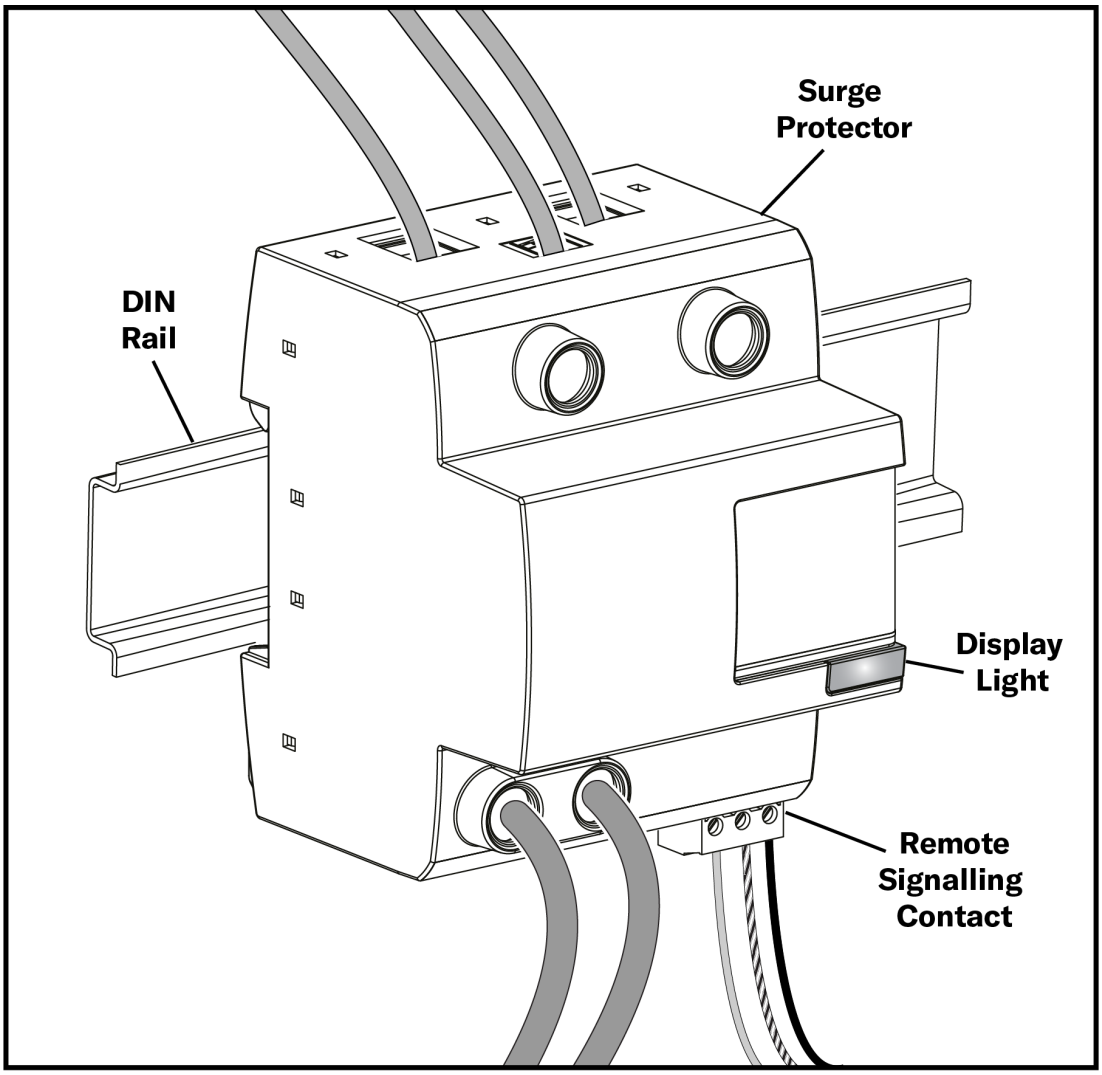

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Figure 4. Surge Protector Components

9.5 Surge Protector and Fuse Replacement

⚠	**CAUTION**
	Wear insulated gloves rated for above 10 kV DC during replacement procedures.

⚠	**CAUTION**
	Portez des gants isolants conçus pour supporter des tensions supérieures à 10 kV DC pendant les procédures de remplacement.

Follow these steps to replace the surge protector and fuse:

1. Prepare the PCD DC side:
    a. Ensure the PCS (Power Conversion System) is in standby or shutdown mode.
    b. Confirm that the PCS DC switch (QS) is in the OFF position. If not:
        i. Switch the QS from ON to OFF.
        ii. At the DC junction cabinet, turn any QS switches from ON to OFF.
        iii. Repeat for all switchgear, ensuring all QS switches are OFF.
2. Measure voltage in the junction cabinet:
    a. Measure the voltage between each positive bus bar and its corresponding negative bus bar.
    b. Measure the voltage of all positive bus bars.
    c. Measure the voltage of all negative bus bars.
3. Assess voltage readings:
    a. If the voltage between any positive and negative bus bar in Step 2a exceeds 48 VDC, there is a fault in the circuit that requires inspection.
    b. If the voltage of any individual bus bar from Steps 2b or 2c exceeds 48 VFC:
        i. Use a 16 mm² or thicker cable to connect the bus bar to a grounding point until the voltage drops below 48 VDC.
        ii. Repeat this grounding process for all bus bars until their voltages are below 48 VDC.
4. Before removing the surge protector, take clear photos or mark the positions of all cables, including auxiliary contacts.
5. Safely remove cables:
    a. Use an insulated screwdriver to disconnect the cables from the device.
    b. Ensure all disconnected cables are properly insulated to prevent any accidental contact.
6. Remove the surge protector:
    a. Insert a flathead screwdriver into the hole under the surge protector. See Removing Surge Protector and Wires for a visual reference.
    b. Press down vertically while pulling back at an angle of about 15° to release the surge protector.
7. Install the new surge protector:
    a. Reconnect the cables to the new surge protector according to your markings or photos.
    b. Secure the cables with the attachment bolt, making sure to apply the correct torque. Refer to the figure.
        i. Main wiring holes: tighten to 2.95 lb·ft (4 Nm).

ii. Auxiliary contact wiring holes: tighten to 0.14 lb·ft (0.2 Nm).

c. After securing the cables, gentle pull each cable to verify that they're properly locked.

8. Replace the surge protector fuse:
   a. Open the fuse shell. Use a downward angle of approximately 15° and pull to release.
   b. Remove the old fuse by pulling it out as shown by "unbuckle indicator" in Replacing the Surge Protector Fuse.
   c. Install the new fuse with the red point facing up, ensuring that it's properly oriented.
   d. Secure the fuse in place and close the fuse shell.
9. Post-replacement checks:
   a. Verify that all wiring is reconnected and secure.
   b. Confirm that you applied the correct torque to all connections.
   c. Verify that the fuse shell is correctly installed and secure.
10. Once all checks in Step 9 are complete, power the unit on.

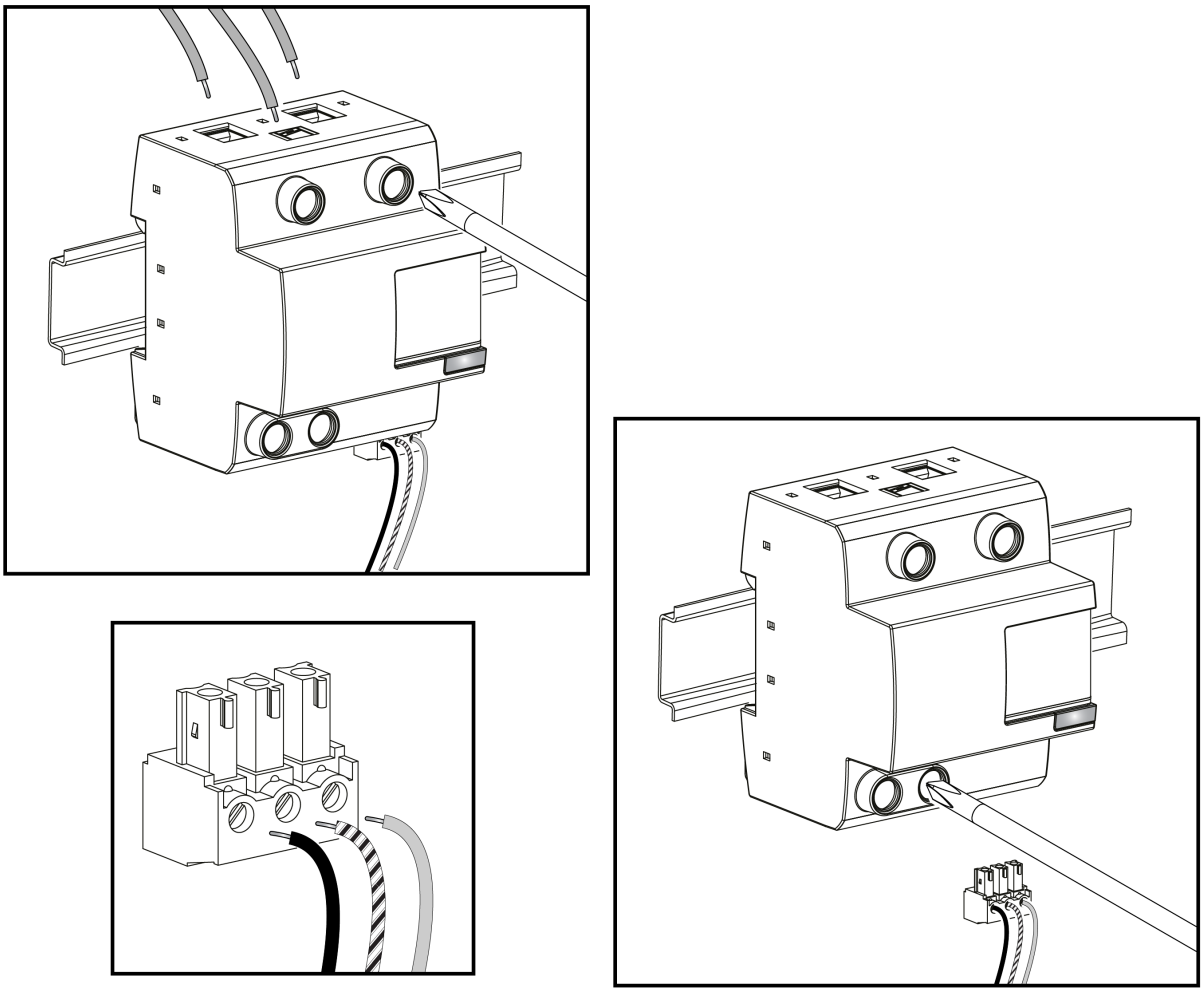

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Figure 5. Removing Surge Protector and Wires

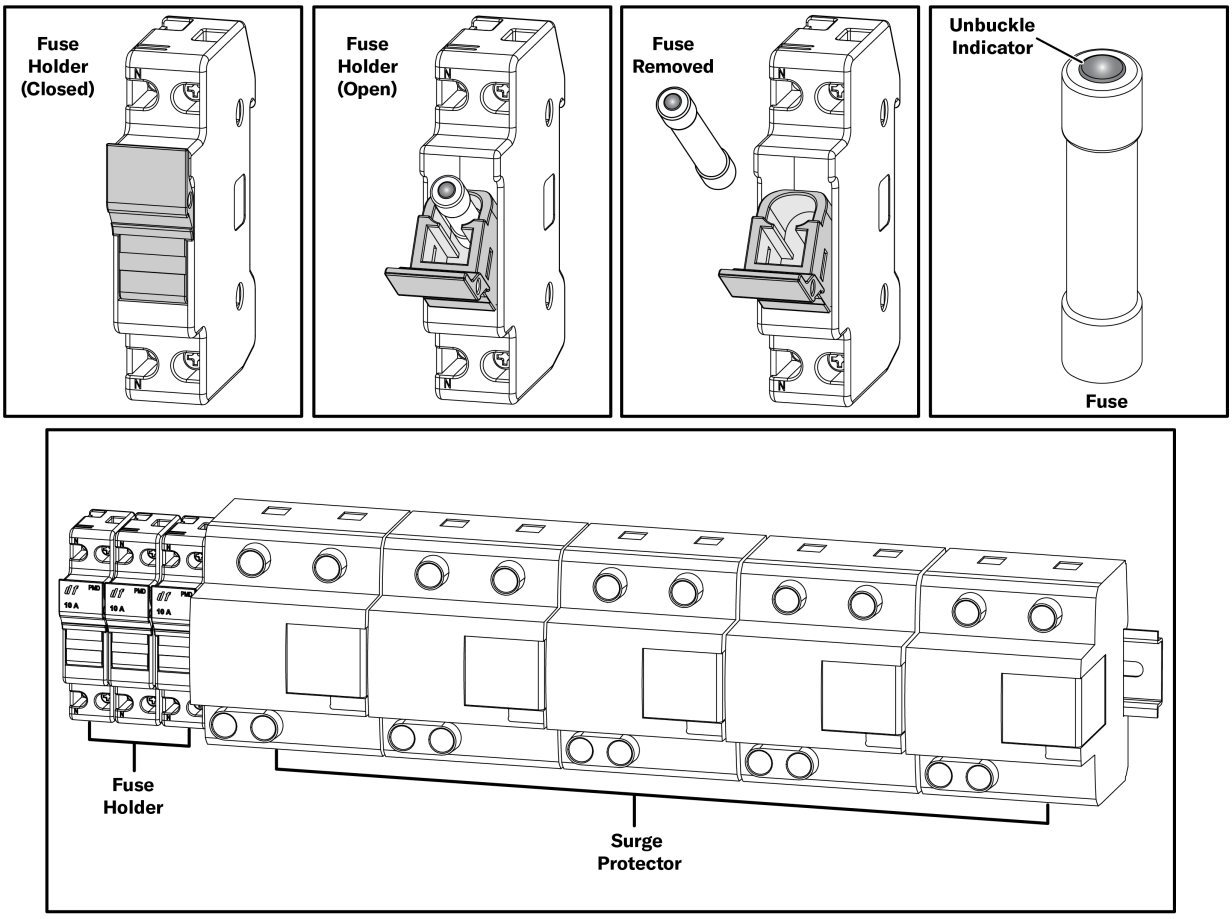

Figure 6. Replacing the Surge Protector Fuse

10.0 References

10.1 Powin Product References

The following documents are relevant to this manual and are integral to the proper installation, maintenance, and use of this product. Be sure to read them carefully to ensure the safety of anyone working with this product.

- Product Manual (MP-POD-001)
- Installation Manual (PI-POD-001)

10.2 Regulatory References

- NFPA 70 National Electric Code (NEC), Current Edition
- CSA C22.1 Canadian Electric Code (CEC), Current Edition

10.3 Reference to Acronyms and Definitions

For a complete list of acronyms and definitions used in Powin documentation, refer to the separate document:

- *Powin Acronyms and Definitions* (GP-ACDF)

11.0 Revision History

Table 18. Revision History

Author/SME/Safety Reviewer	Date	Reason for Changes	Version
P. Wooley / M. French / A. Silva	2024.23.08	Initial Release	0