

**SUPPLEMENTAL SOLAR
DOCUMENTATION**

*At
0 Murdock Avenue
Winchendon, Massachusetts*

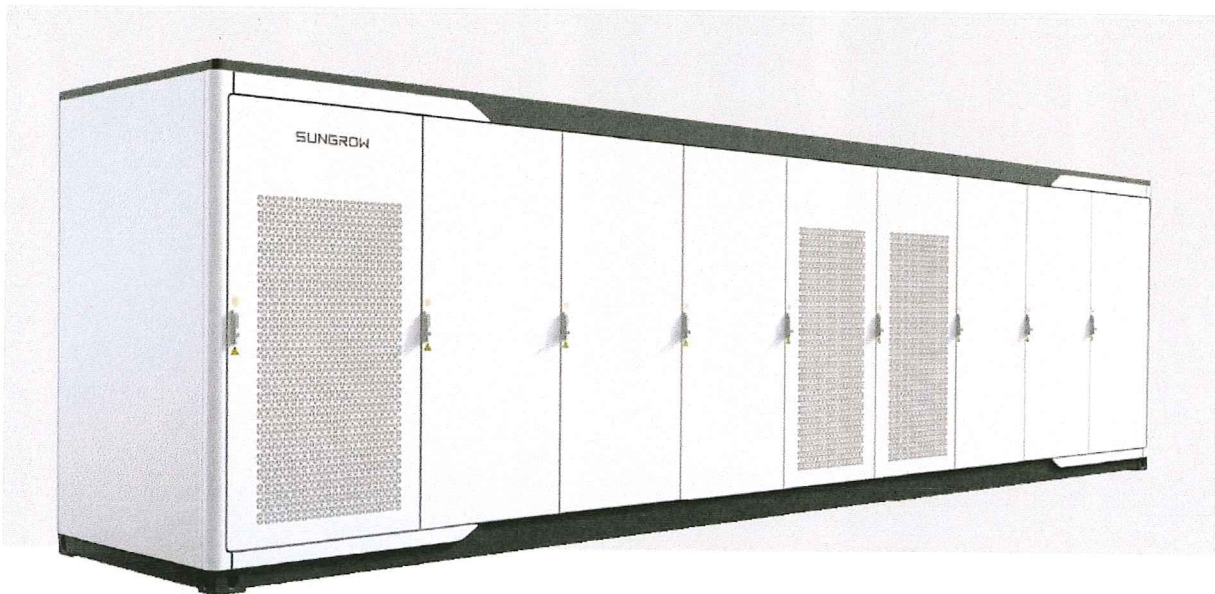
March 27, 2023

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SYSTEM OPERATIONS & COMPONENTS

Energy Storage System (ESS)



1.0 ESS SYSTEM OPERATION

An Energy Storage System is comprised of many components to successfully store energy from a distribution line and discharge that energy back into the distribution line during times of high load. Interconnection to the distribution line is done by the local power company who owns the distribution line. The interconnection to a specific distribution line is done with intricate detail to assure the system charges and discharges at appropriate times and does not cause unwanted load on the grid. In addition, the Grid Synergy (GS) Controller is a hardware interface between ESS equipment on site and the Network Operations Center. The GS controller is typically mounted by the main electrical panel within the facility. The GS controller communicates to the ESS via an ethernet connection. The GS Controller is responsible for monitoring all components of the ESS and delivers charge and discharge commands to the ESS.

The ESS will charge from existing photovoltaic systems interconnected to the same distribution line as the ESS. PV arrays generate electricity during the day while the sun shines, known as the charging window. While PV is a clean, renewable energy source it only distributes energy to the grid during the day. Energy storage systems stores that power produced by the PV arrays during daylight hours. ESS's then discharge the stored PV power during times of peak demand creating an efficiency within the power structure.

2.0 INTERCONNECTION

Interconnection is the energized connection of the ESS to the distribution line. The local power company designs the interconnection and what equipment is required to make that connection to the grid. The power company is also the one who performs the interconnection work from the distribution line to the required project equipment on site.

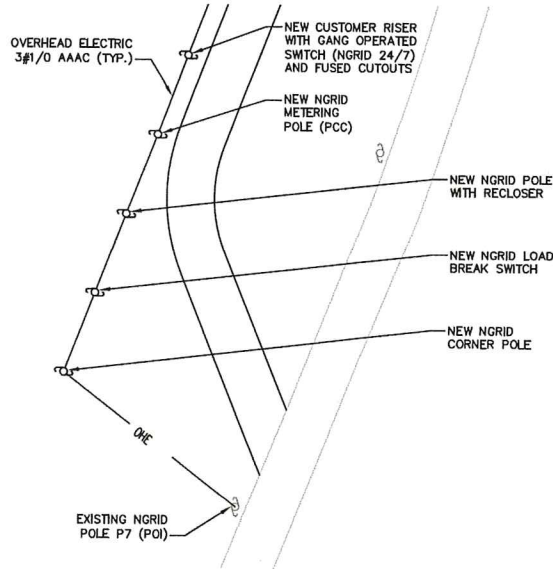
A typical interconnection requires multiple pieces of equipment. That equipment can be pole mounted or pad mounted equipment. Whether the equipment is pole or pad mounted, it needs to meet the specifications and requirements of the utility company. Each connection to the distribution line goes through an interconnection service process with the utility company to assure proper relay settings and metering of the ESS.

2.1 POLE MOUNTED INTERCONNECTION

A pole mounted interconnection starts at a pre-determined utility pole in the public way. From the existing pole, the connection will go to a utility owned Gang Operated Air Break (GOAB) and Recloser, allowing the utility company to sever the connection to the site if they need to perform maintenance on equipment. A separate line will go to the utility owned meter for the auxiliary service. From there, the line will go to a utility owned primary meter tracking the amount of power produced by the ESS.

Following the utility owned equipment there will be a project owned GOAB which allows the project owner to cut the power from the distribution line in case of

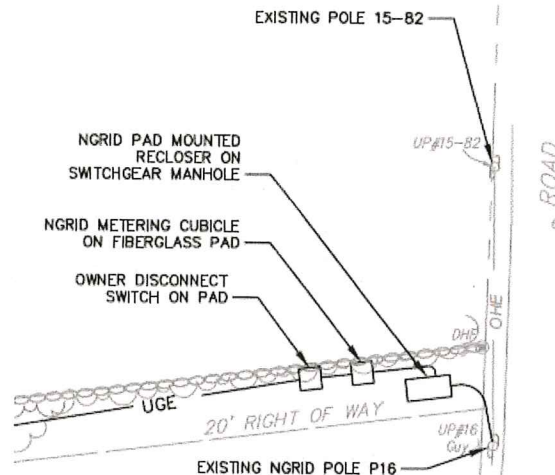
emergency and/or maintenance of the facility. After the investor owned GOAB the line will go underground via conduit to the project location and connect to the site via the onsite recloser.



2.2 PAD MOUNTED INTERCONNECTION

A pad mounted interconnection starts the same way a pole mounted interconnection does, with a GOAB/Recloser which will typically be mounted on the pre-determined interconnection pole or a new pole on the property that will get tied into the distribution line. From the Recloser, the line will go to a pad mounted, utility owned meter via underground conduit. A separate line will go to a pad mounted, utility owned meter via underground conduit from the interconnection pole for the auxiliary service.

Following the utility owned equipment meter, the line will continue to a project-owned, pad mounted disconnect switch via underground conduit. The line will then continue to a Recloser and meter within the ESS site.



3.0 INTERCONNECTION COMPONENTS

3.1 GANG OPERATED AIR BREAK (GOAB)

A Gang Operated Air Break is a commonly used disconnect switch that utility companies use to break an electrical connection for isolation. It is referred to as “gang operated” because there are three separate switches, one for each phase, that are operated as a group from a single control. “Air Break” refers to it being operated in the air rather than in another medium, such as soil.



The purpose of this switch is to disconnect the project site from the incoming distribution line, not to disconnect the transformer from the load. It acts as a large safety switch that has no load breaking capability.

On the top side of the GOAB there are 300 Amp fuses that stop the flow of current in the event of an internal fault or a short circuit in the transformer.

3.2 TRANSFORMER

A transformer is a device that provides the final voltage transformation in the electric power system. In normal operation, electricity flows into the transformer on the high-voltage side where it goes into a coil of wire, usually wound around an iron core. As the electricity flows through this coil, it creates a magnetic field that “induces” a voltage in the other coil.

The transformers on site will step down the voltage that comes into the site from the distribution line for it to be stored into the battery modules. When the batteries are discharged the voltage will then be stepped up to match the voltage in the distribution line where it will be fed into.



3.3 RECLOSER

A Recloser is an automatic, high-voltage electric switch. It operates like a circuit breaker on household electrical lines, it shuts off electric power when trouble occurs. A Recloser will automatically test the electrical lines to determine whether the trouble has been removed. If the problem was only temporary, the Recloser will automatically reset and restore power.



3.4 METER

A meter will read the amount of electricity that is used and taken off the distribution line. The meter reflects the total percentage of the load placed on the generating capacity of the electrical accessories and battery.



4.0 ENERGY STORAGE SYSTEM COMPONENTS

There are components of the ESS that are similar or the same as the components of interconnection, the reason for this is so that the project owner and utility company can simultaneously monitor the site. Components that make up the ESS system allow the user to create relay and time settings that provide further security and assurances that the system will be discharging and charging appropriately.

4.2 INVERTER

An inverter is an electronic device that can turn Direct Current (DC) to Alternating Current (AC). The inverters that will be used in the ESS are Sungrow model SC1375UD-US and SC2750UD. The SC2750UD model is a double cabinet of two SC1375UD's. This Sungrow model has bidirectional power conversion system so that energy can be brought in off the distribution line as AC current and turned into DC current to be stored in the batteries then be discharged from the batteries as DC current and turned into AC current to go back into the distribution line. The inverter has a forced-air cooling system built in.



The Inverter has a sound rating of 80 Decibels (dB) at a distance of 1 meter. In a free field setting, where the sound is not bouncing off obstructions back towards the sound source, the sound level will decrease by 6 dB every time the distance from the sound source doubles. If the sound level at 1 meter is 80 dB then the at 2 meters the sound level would be 74 dB, at 4 meters the sound level would be 68 dB and so on. At a distance of 16 meters (about 53 feet) the sound level would be around 55 decibels.

Common outdoor sound pressure levels can vary significantly. It is common that day to night sound levels may vary a range of 50 dB in different areas. Outdoors in a wilderness sound levels may occur as low as 35-40 dB where in urban areas it could be 85-90 dB. In most cases urban dwellers live in areas with sound pressure levels more than 48 dB.

Night-time	Rural, no nearby traffic of concern	42
	Suburban, no nearby traffic of concern	47
	Urban, no nearby traffic of concern	52
Daytime	Business or commercial area	57
	Business or commercial area	62
	Industrial or manufacturing area	67
	Within 300 ft (91 m) of continuous heavy traffic	72

On an ESS site the inverters will not be in a free field setting, the inverters will be behind a fence, next to other equipment and will be screened with a natural buffer and/or plantings. Each of these obstructions will reduce the decibel level that is present at the distances stated above from the sound source.

System Type	SC1200UD-US	SC1375UD-US	SC1575UD-US	SC1725UD-US
DC side				
Max. DC voltage			1500 V	
Min. DC voltage	700 V	800 V	915 V	1000 V
DC voltage range	700 - 1500 V	800 - 1500 V	915 - 1500 V	1000 - 1500 V
Max. DC current			815 A	
No. of DC inputs	1			
AC side (Grid)				
AC output power	1000kVA @ 45°C (83°F) / 1500kVA @ 30°C (86°F)	1275kVA @ 45°C (83°F) / 1500kVA @ 30°C (86°F)	1575kVA @ 45°C (83°F) / 1725kVA @ 30°C (86°F)	1725kVA @ 45°C (83°F) / 1875kVA @ 30°C (86°F)
Max. AC output current		1443 A @ 45°C (83°F) / 1587 A @ 30°C (86°F)		
Nominal AC voltage	480 V	550 V	630 V	690 V
AC voltage range	472 - 578 V	484 - 605 V	554 - 693 V	607 - 759 V
Nominal grid frequency / Grid frequency range	60 Hz / 50 - 65 Hz			
Harmonic (THD)	≤ 1.1% (at nominal power)			
Power factor at nominal power / Adjustable power factor	≥ 0.99 / 1 leading - 1 lagging			
Adjustable reactive power range	100% - 100%			
Feed-in phases / AC connection	3 / 3			
AC side (Off-Grid)				
Nominal AC voltage	480 V	550 V	630 V	690 V
AC voltage range	472 - 578 V	484 - 605 V	554 - 693 V	607 - 759 V
AC voltage distortion	≤ 1.1% (linear load)			
DC voltage component	≤ 0.5% (at linear balance load)			
Unbalance load capacity	100%			
Nominal Voltage frequency / Voltage frequency range	60 Hz / 50 - 65 Hz			
Efficiency				
Max. efficiency / CEC efficiency	99% / 98.5%			
Protection				
DC input protection	Load break switch + fuse			
AC output protection	Circuit breaker			
Surge protection	DC type II / AC type II			
Grid monitoring / Ground fault monitoring	Yes / Yes			
Insulation monitoring	Yes			
Overheat protection	Yes			
General Data				
Dimensions (W*H*D)	1680*2400*1400 mm; 425" * 94.5" * 55.1"			
Weight	1500 kg; 3307 lbs			
Topology	Transformerless			
Degree of protection	NEMA 4X (Electronic) / NEMA 3R (Others)			
Operating ambient temperature range	-35 to 60°C (-31 to 140°F) (-13.3 V derating)			
Allowable relative humidity range	0 - 100%			
Cooling method	Temperature controlled forced air cooling			
Max. operating altitude	4000 m (+2000 m derating); 13123 ft (+6561 ft derating)			
Display	LED, WEB, HMI			
Noise emission	≤ 80 dB @ 1m			
Communication	RS485, CAN, Ethernet			
Compliance	UL1741, UL1741 SA, IEEE 1547, Rule 2L, HECO 14H, CSA C22.7 No.1071-01			
Grid support	LVRT, LHFRT, active & reactive power control and power ramp rate control, Volt-var, Volt-watt, Frequency-watt			

CERTIFICATE OF COMPLIANCE

Certificate Number: **SGSNA20G200180**

Contract Number: **800504**
 Certificate Project Number: **GZ-CERT201207412**

Certified Product: Energy Storage Converter
Trademarks: SUNGROW
Model(s): SC1725UD-US, SC1575UD-US, SC1375UD-US, SC1200UD-US
Software Version: MDSF_AMBER_B_V11_V1_A; SDSP_AMBER_B_V11_V1_A; SDCP_AMBER_B_V11_V1_A; -35°C to 60°C (H45C derating), Type 3R, transformerless.
Technical Data:
SC1725UD-US: AC side (On-Grid and Off-Grid); 690V(607-759V), 1443A(1725kVA @ 45°C, 3-, 60Hz (50.8Hz-60.5Hz), PF>0.99 (1-1 adjustable), Battery side: 1000Vdc-1500Vdc, 1760Amax @ 45°C.
SC1575UD-US: AC side (On-Grid and Off-Grid); 630V(554V-693V), 1443A(1575kVA @ 45°C, 3-, 60Hz (50.8Hz-60.5Hz), PF>0.99 (1-1 adjustable), Battery side: 915Vdc-1500Vdc, 1760Amax @ 45°C.
SC1375UD-US: AC side (On-Grid and Off-Grid); 554V(484V-605V), 1443A(1375kVA @ 45°C, 3-, 60Hz (50.8Hz-60.5Hz), PF>0.99 (1-1 adjustable), Battery side: 800Vdc-1500Vdc, 1760Amax @ 45°C.
SC1200UD-US: AC side (On-Grid and Off-Grid); 480V(422V-528V), 1443A(1200kVA @ 45°C, 3-, 60Hz (50.8Hz-60.5Hz), PF>0.99 (1-1 adjustable), Battery side: 700Vdc-1500Vdc, 1760Amax @ 45°C.

Certificate Holder: Sungrow Power Supply Co., Ltd.
 1699 Xiyou Road, New & High Technology Industrial Development Zone, Hefei, 230008, Anhui, China

This certificate supersedes previous certificates issued with the same certificate number. Declaration is made when products are indicated on the DCS directory of certified products at www.sgscert.com or using the QR code below. The product is certified according to IEC/UL/CSA/GB standards and applicable requirements of product standards, CE, RoHS, and in accordance with:

- UL 1741, 2nd Ed., Rev. February 15th, 2018
- CSA C22.2 NO. 107.1-10
- UL 1741 Supplement SA, 2010 Ed 2 Rev Feb. 15, 2018
- Compliance with UL1741, includes applicable requirements of IEEE 1547-2003 (R2008), CPUC Rule 21 (Effective on Jul 30, 2017).
- SRD-UL-1741-SA-V1.1 (Issued on September 26, 2017)

Authorized by: *Jason Wei* Effective date: 30 December 2020

Jason Wei
 Certifier

Page 1 of 1



This certificate is issued by the company under its General Conditions for Certification. General conditions of certification are available at www.sgscert.com. Attention is drawn to the existence of the CE mark. The CE mark is a declaration of conformity with the applicable standards. The CE mark is not a guarantee of the quality of the product. The CE mark is not a guarantee of the safety of the product. The CE mark is not a guarantee of the performance of the product. The CE mark is not a guarantee of the reliability of the product. The CE mark is not a guarantee of the durability of the product. The CE mark is not a guarantee of the environmental friendliness of the product. The CE mark is not a guarantee of the energy efficiency of the product. The CE mark is not a guarantee of the safety of the product. The CE mark is not a guarantee of the performance of the product. The CE mark is not a guarantee of the reliability of the product. The CE mark is not a guarantee of the durability of the product. The CE mark is not a guarantee of the environmental friendliness of the product. The CE mark is not a guarantee of the energy efficiency of the product.

Certification Body

SGS Certification Services, a division of SGS North America Inc.
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4.3 TRANSFORMER (XFMR)

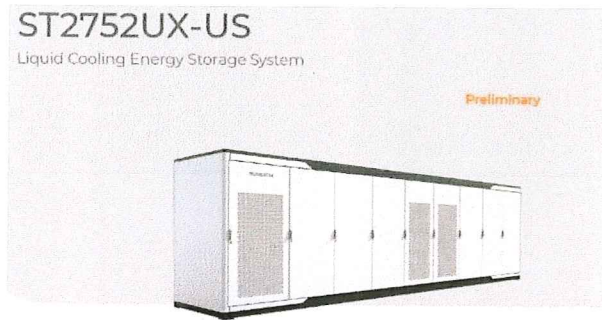
A transformer is designed to convert alternating current from one voltage to another. It can “step up” or “step down” voltages. The transformer consists of two magnetically coupled coils. Alternating current in one coil creates a changing magnetic field which induces a current in the second coil. When taking energy from the distribution line, the energy from the line will come into the transformer as medium voltage and be stepped down to a lower voltage that is acceptable for the inverters to operate. When discharging energy back into the distribution line the energy will go through the transformer as a lower voltage and be stepped up to match the voltage on the distribution line.



4.4 BATTERY CONTAINER

The ESS container is where the storage of energy takes place. Bringing energy from the distribution line through the necessary relay settings, clock settings, Recloser settings, inverters and transformers gets us to charging the batteries.

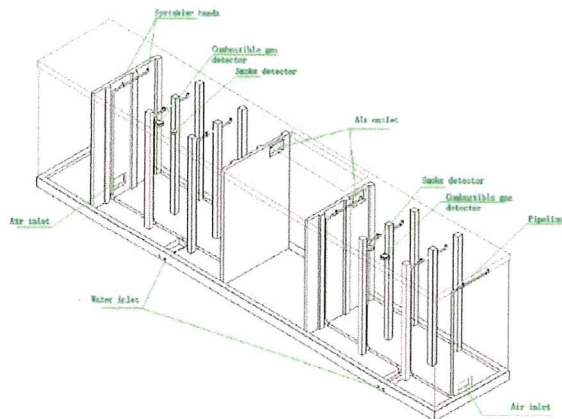
The ESS containers are white in color and placed on concrete slabs that extend a minimum of 6 inches past the edges of the container. The dimensions of the ESS container are 30.6ft x 8.27ft x 5.67ft (LxHxW). The ESS container weighs approximately 57,320 lbs. and comes as a fully assembled unit with the battery cells installed from the manufacturer.



Type designation	ST2752UX-US
Battery Data	
Cell type	LFP
Battery capacity (BOL)	2752 kWh
Battery voltage range	1500 - 1550 V
General Data	
Dimensions of battery unit (W*H*D)	3140*2520*1730mm
Weight of battery unit	26,000kg
Degree of protection	IP 23/NEMA 2R
Operating temperature range	-30 to 50 °C (+45 °C derating)
Relative humidity	0 - 95 % (non-condensing)
Max. working altitude	3000m
Cooling concept of battery chamber	Liquid cooling
Fire safety standard/Optional	Deluge sprinkler heads (standard), Fused sprinkler heads (optional), NFPA63 explosion protection and ventilation (CJH gases/optional)
Communication interfaces	RS485, Ethernet
Communication protocols	Modbus RTU, Modbus TCP
Compliance	UL9540, UL9540A, NFPA 855
2-HOUSE APPLICATION ST2752UX-US-5000UD-MV-US	
BOL kWh(DC/AC LV Side)	11,008kWh DC/0,379kWh AC
ST2752UX Quantity	4
PCS Model	SC3000UD-MV-US
4-HOUSE APPLICATION ST2752UX-US-5000UD-MV-US	
BOL kWh(DC/AC LV Side)	22,016kWh DC/0,748kWh AC
ST2752UX Quantity	8
PCS Model	SC3000UD-MV-US
Grid Characteristics Data	
Max THD of current	< 1 % (at nominal power)
DC component	< 0.5 % (at nominal power)
Power factor	> 0.99 (at nominal power)
Adjustable power factor	1.0 leading - 1.0 lagging
Nominal grid frequency	60 Hz
Cold frequency range	58 - 65 Hz
Transformer	
Transformer rated power	5,000 kVA
LV/MV voltage	0.9 kv / 34.5 kv
Transformer cooling type	ONAN (ON Natural Air Natural)
Oil type	Mineral oil (PCB free) or degradable oil on request

4.5 FIRE PROTECTION SYSTEM

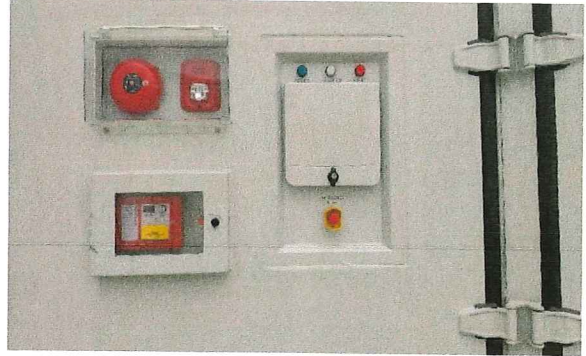
The ESS container has a standard equipped fire protection system, please refer to the Emergency Response Plan provided in this submission package for more detailed information regarding fire protection and response. Within the container are smoke and heat sensors that are part of the fire protection system.



There is a fire protection system installed on all ESS sites includes dry pipes plumbed to the ESS container. These dry pipes get individually plumbed from each ESS container and continue underground to outside of the project fence line where they will be labeled, correlating

them to each individual container. The pipes outside the fence will have a pipe connection that the fire department can attach a water line to that will supply water to the deluge sprinkler system.

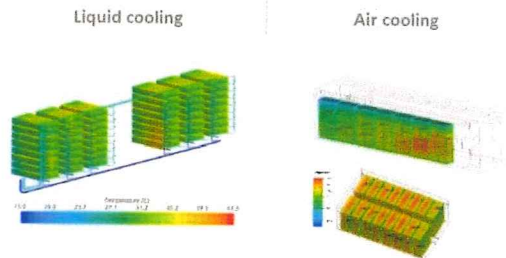
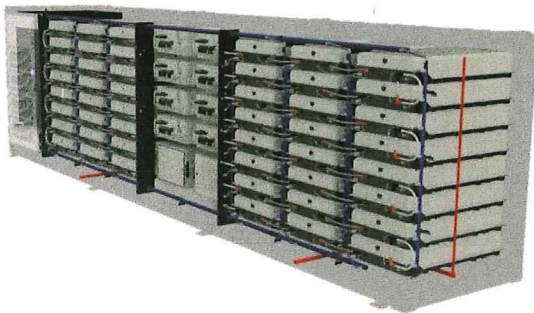
There are both visual and audible alarms on each ESS container. There is a control panel on the outside of the ESS container that has status lights for the system.



4.6 Liquid Cooling

The ESS container and battery modules is liquid cooled. The container is plumbed with piping to each battery module. The liquid that is being used as a coolant/ heat transfer medium is a Sinopec coolant . The liquid is made up of Water, Ethylene Glycol and an additive. The fluid will go through a compressor that brings the coolant back down to an operating temperature to then cycle back through the modules. Each battery module is equipped with a solenoid that will determine if the battery module needs cooling or not. This increases the efficiency of the system and keeps a more consistent operating temperature.

3 REDUCE CELL MISMATCH AND EXTEND LIFE SPAN



Items	Liquid cooled	Air cooled
Cell temperature delta	<3°C	<10°C


4.7 BATTERY RACKING

The batteries are held within the ESS container on a racking system. Through the racking system the batteries are hooked up to a monitoring system that monitors each battery module and each battery rack with heat sensors that monitor battery temperature. Each rack holds 8 battery modules.



4.8 LITHIUM-ION BATTERY

A Lithium-Ion Battery is a type of rechargeable battery most commonly used for portable electronics, tools and electric vehicles. Li-ion batteries do not require scheduled cycling to maintain their battery life. The Lithium-ion batteries being used in the ESS is a Sungrow E3L-M618 battery module. The battery is a Lithium iron phosphate (LFP) cell battery which have excellent safety and a long lifecycle.

NO.	Classification	Specification
1	Image (reference)	
2	Model	E3L-M618
3	Charging & discharging rate	$\leq 0.5C$
4	Cell type	LFP 302Ah
5	Configuration	1P64S
6	Capacity	302Ah
7	Nominal energy	61.849kWh
8	Charging & discharging power	$\leq 30.924kWh$
9	Nominal voltage	204.8V
10	Operating voltage range	172.8V~233.6V
11	Dimensions (W*H*D)	$(810\pm 3) * (243\pm 2) * (1405\pm 5)mm$
12	Weight	$388\pm 10kg$



Liquid Cooling System Preliminary Maintenance Guidelines

SUNGROW

1 Introduction

This document introduces the maintenance functions of Sungrow’s liquid cooling system and gives some advice on maintenance.

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2 Intelligent O&M

Sungrow’s energy storage system integrates a local controller. It integrates fault and alarm management functions. As showed in the following picture, the local controller collects and uploads the real-time information of PCSs, battery system and other equipment in the energy storage system through an Ethernet connection. The local controller can upload fault information to EMS and SCADA for remote monitoring and management.

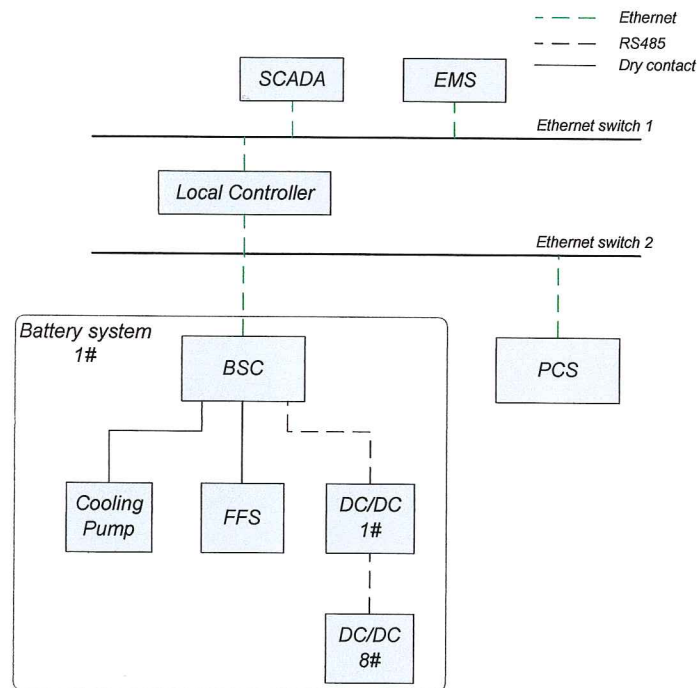


Fig.2-1: Communication Diagram of Liquid Cooling System

Sungrow’s energy storage system has a three-level failure handling mechanism of alarm, derating and shutdown. The system has set up detection nodes in PCS, batteries and other equipment. When a fault is detected, the system will quickly locate the fault point and take corresponding measures. At the same time, the fault information will be uploaded to the EMS and SCADA through the local controller.

Table 2-1: System Failure Types

Devices	Failure types
Battery	Over/under voltage, over/under temperature, sampling fault, etc.
PCS	Over/under frequency, IGBT/ reactor over temperature, SPD fault, etc.

Other Devices(Cooling pump, FSS, etc.)	Liquid leak, liquid over temperature, cooling pump failure, etc.
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3 Routine Maintenance

During the course of life of the product, various parts age and wear as a function of vibration, corrosion, temperature, humidity and dust. To maintain the efficiency of the BESS, it is necessary to carry out routine and periodic maintenance on the liquid cooling system.

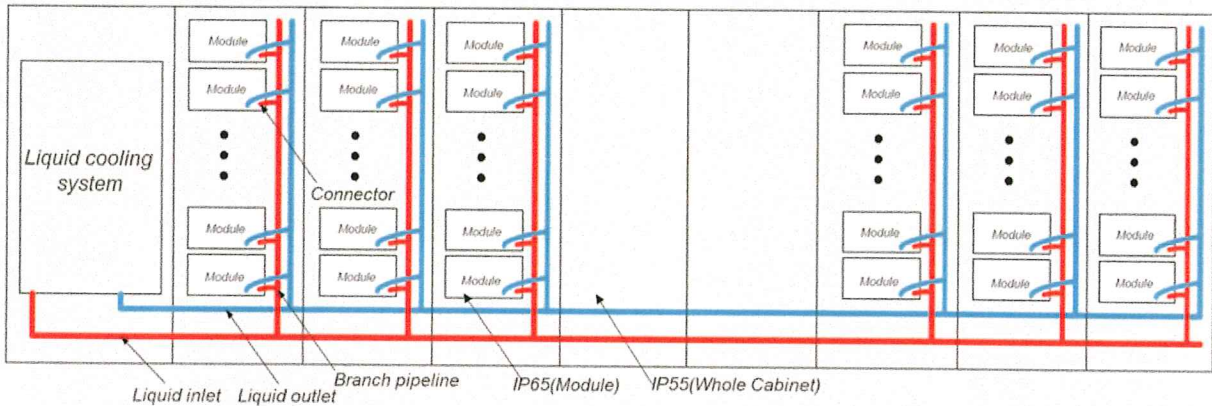


Fig.3-1: Liquid Cooling Fluid Circuit Overview

3.1 Safety Rules

Respect the following two rules during maintenance or service on the BESS to ensure the safety of the maintainer.

- Power off
- Follow the grounding procedure for servicing of the liquid cooling system pump bay.

3.2 General Maintenance

The following maintenance is recommended every year. The frequency of maintenance could be increased according to the use environment, especially when the environment is poor.

Table 3-1: General Maintenance Items

Maintenance Part	Content	Standard.	Tool	Professionals Required	Maintenance time (min.)
Air Filter Net	1. When the area of the filter net at the bottom of the air-conditioning warehouse is more than 10% dirty, a high-pressure air gun needs to be used for cleaning; 2. When the dirt and blocked area of the filter on the top of the air	Dirty gap ratio <10%	High pressure air gun, steel brush	No	30

	conditioner reaches more than 10%, use a steel brush to clean it.				
Fan ¹	Checking whether the fan blades rotate normally and whether the fan blades are damaged. If the fan cannot be rotated or the fan blades are damaged, replace the fan.	1. The fan blades rotate smoothly and there is no abnormal noise; 2. The fan blades are not damaged.	Long handle screwdriver	No	30
Pump ¹	1. Check whether the dirty blockage area of the cooling air inlet of the water pump is more than 5%, if it exceeds, it needs to be cleaned with a brush; 2. Visually inspect the pump body (non-pipeline connection) for obvious dripping (except for condensed water). If there is obvious dripping, replace the pump sealing ring.	1. The pump runs smoothly without abnormal noise; 2. The pump body has no obvious dripping phenomenon (except for condensed water)	Brush	No	30
Electronic Control System ¹	1. Do an appearance inspection every six months to check whether the circuit connection is replaced and whether the circuit is corroded. 2. Check whether the pull-in of each contactor is flexible, and whether there are arcing and burn marks in the connection pull-in. 3. Use a brush or dry compressed air to remove dust from electrical and control components. 4. Fasten each electrical conductor.	1. The circuit connection shall not fall off or rust; 2. No dust on the surface of electrical components; 3. The electrical contactor has no arc and burn marks;	Brush, flat-blade screwdriver	No	30
Water System	Check the high and low pressure values of the water system through HMI, high pressure <2.5bar; low pressure>0.2bar. 1. If the high pressure is higher than 2.5bar, check whether the water system filter is dirty or blocked; 2. If the low pressure is lower than 0.2bar, the water system needs to be refilled.	High pressure<2.5bar low pressure>0.2bar	Slotted screwdriver, Phillips screwdriver, water pump, water pipe, clamp.	No	90
Cooling System ²	1. Check whether the refrigeration pipeline is worn or not, and whether the fixed structure is loose; 2. Check the compressor suction and discharge pressure values: Inhalation: 700kPa~1350kPa; Exhaust: 2300kPa~4000kPa.	/	Brush	Yes	60

	3. Check whether there is obvious dirty blockage on the inlet side of the condenser. When the dirty blockage area is more than 10%.				
¹ Estimated time to replace: 10 years ² Estimated time to replace: 15 years					

3.3 Device Replacement

The corresponding equipment is recommended to be replaced if the following situations occur.

Table 3-2: Device Replacement

Change Object	Replacement standard	Period	Tool	Professionals are needed
Cooling Liquid	1. The antifreeze contains impurities above the recommended level. 2. The color of antifreeze changes from pink to deep red.	5-6 years	Water pump, hose, hose clamp, flat screwdriver	No

ESS OPERATION AND MAINTENANCE GENERAL OVERVIEW

VERSION: 4.0

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1.0 PROTOCOL

1.1 Operations and Maintenance Dispatch Contact

The main point of contact for any operations and maintenance related issues will be Duk Lee. He can be reached at the headquarters:

Duk Lee
Technical Services Manager
(408) 638-0072
duk.lee@engie.com

2.0 SAFETY

2.1 Safety Notice

Prior to opening, inspecting, using, or servicing an ESS system this manual must be read in its entirety. All instructions must be followed with diligent care. If there are any questions regarding the operation or troubleshooting of the ESS system, please contact Engie Storage



at:

ENGIE STORAGE

engiestorage-remote@engie.com

1-800-426-5010 x9

Caution needs to be taken throughout this document whenever the symbol below is evident.

SYMBOL	DESCRIPTION
	NOTE: Special instructions to be considered
	CAUTION: Risk of electrical shock

2.2 Safety Rules

All rules contained here within must be complied with in their entirety to reduce risk of injury to personnel.

- 1) The ESS contains high voltage AC and DC components and wiring and should not be opened or worked on except by trained personnel.
- 2) Before servicing any high voltage components, the system should be shut down and all safety disconnects and breakers should be opened to de-energize the system as completely as possible.
- 3) Adhere to all safety recommendations of the manufacture of all components contained within the ESS.
- 4) Do not short circuit terminals or components. This includes the battery modules.
- 5) Do not reverse the polarity of any connection. This includes the battery modules.
- 6) Do not disassemble any component within the ESS. This includes the inverter, transformer, battery modules, and battery management modules.
- 7) Do not subject connections or components to excessive mechanical stresses.
- 8) Do not expose internal components to water.
- 9) Use high voltage safety equipment and procedures when working on the high voltage components. These include use of safety glasses, insulated tools and high voltage gloves.

2.3 Required Equipment and Guidelines

Equipment

- ESS enclosure door key
- Engie Storage (ES) controller lock key
- Safety glasses
- High voltage safety gloves (Class 00 or greater)
- Digital multi meter (DMM)
- Ohm meter
- Insulated tools (500V or greater)
- Torque wrench
- Label maker
- Tamper proof stickers
- CO2 fire extinguisher
- Body rescue hook

Spare Parts

- Misc. fuses i.e. for inverter and sub-components
- Door handle and keys
- Battery communication cables
- Warning labels/stickers

Safety Guidelines

- Remove conductive rings, jewelry, necklaces, belt buckles, etc...
- Always wear safety glasses
- Always work with a partner
- Always verify voltage potential with a DMM before making or breaking an electrical connection

3.0 ESS OVERVIEW

The ESS is an energy storage and management device operated directly by end-users such as grocery and convenience stores, fast-food chains, hotels, college, cities, and municipalities. While the majority of energy management companies force changes in energy usage patterns, ESS locally stores energy during periods of low use and augments grid power during peak demand with stored energy. It effectively balances electric loads across a facility and time. ESS provides demand response on previously fixed, uncurtailable loads. This avoids usage peaks that cause expensive demand charges, providing significant savings on the electricity bill each month. ESS also avoids last-mile grid infrastructure upgrade costs and can store energy from renewable generation such as solar and wind.

To accomplish these functions, the facilities loads are monitored via the Grid Synergy (GS) Controller. The GS controller is typically mounted by a main electrical panel in the facility. It is tied into the building's electrical system with current transducers and voltage measurement probes. It communicates to the ESS via an ethernet connection.

The ESS consists of a control tower and multiple battery towers. Each tower is NEMA 3R. Each tower should always be locked and each contains high voltage.

The ESS is tied into the building's 480VAC power system directly via a AC disconnect typically mounted on a building wall near the ESS. The ESS is also tied into the building's 110VAC supply to power ancillary units in the ESS. The ESS interfaces to the building via an isolation transformer (which may or may not step up the voltage, the output is always 480VAC), passing current through an EMI filter, then to a bi-directional inverter, through an additional EMI filter and finally the battery system. The ESS contains ancillary support equipment to protect, manage, cool, and heat the main components. Additional details will follow.

4.0 MAINTENANCE OVERVIEW



Before undertaking any service or maintenance procedure, be sure to execute shutdown procedure to ensure system is completely de-energized!

General proper maintenance, both preventive and remedial, is the key to optimal operation of the energy storage system and will ensure a long and useful life of the equipment. Preventive maintenance includes regularly performed procedures designed to prevent system malfunction and obtain maximum operational efficiency. Remedial maintenance consists of troubleshooting the system in order to affect repairs. Troubleshooting the energy storage system involves following a logical sequence of steps which will determine the cause of an alarm and/or malfunction within the shortest time frame safely possible so as to expedite the repair and return of the equipment to normal service. ES recommends that the energy storage system be inspected annually to ensure that equipment is operation within normal tolerances. Any faults or alarms should be checked at time of discovery and not wait until annual maintenance. ES will monitor the system 24 hours a day, 7 days week, 365 days a year to ensure that the system is delivering power as guaranteed.

SAFETY PRECAUTIONS

In order to safely and successfully perform maintenance on the system, certain basic safety precautions must be observed, necessary tools and test equipment must be available, and properly trained maintenance personnel must be involved. The following basic safety practices should always be observed:

1. Always be aware that hazardous voltages are present within the storage system even when the system is not operating.
2. Ensure that storage system operating and maintenance personnel are thoroughly familiar with the equipment and with the contents of this manual.
3. Never wear metal jewelry such as rings or wrist watches when working on any equipment.
4. Keep cabinet doors closed and secured during normal operation.
5. Never guess about safety procedures. If any doubt exists, ask someone who understands the equipment and safety protocols.
6. Always be aware of the presence of high voltage within the equipment. Check with a voltmeter to make sure power is off and conditions are safe before attempting to make repairs, adjustments, etc. within the unit.
7. Above all, always use common sense

5.0 PREVENTATIVE MAINTENANCE

The following describes the preventive maintenance procedures which, when followed, will increase the reliability and efficiency of the energy storage system operations.



Follow shutdown procedure to shutdown, lockout, and tag out energy storage system from the electrical system before performing any maintenance.



Before servicing, do not power down controller unless service work needs to be done. Shutdown will also need to be done during serviceable window provided by ES.

Grid Synergy Controller System

1. Visually inspect exterior of Controller for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
2. Inspect proper operation of door and seal is intact and not damaged.
3. Visually inspect interior for signs of damage, discoloration, deterioration, disfiguration and water and/or dust ingress.
4. Verify all current carrying conductor connections are tight and solidly connected.
5. Confirm all network cables are tight and solidly connected as well as indicate activity on both connection and data transfer lights.
6. Repeat steps 1-3 for the all Gridsynergy controller equipment which can include Metering hub, Power hub, Lan hub, extended range metering boxes and 3rd party metering boxes.
7. Confirm mini master lock is placed on lock hole for all Gridsynergy controller equipment hubs and boxes.
8. If applicable, verify voltage of battery backup.
9. Verify connectivity back to Network Operations Center (NOC) with Engie remote support team member.



Before servicing, ensure only ESS system is turned off within the serviceable window provided by ES. (For multiple systems, perform O&M service one at a time.)

ESS Enclosure

1. Visually inspect exterior of ESS enclosure for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
2. Visually inspect all louvers for any signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
3. Verify all ESS's are labeled with their designated number and that it matches the breaker inside the subpanel.
4. Verify all anchor bolts are securely fastened and check for any signs of damage, discoloration, deterioration, disfiguration and vandalism.
5. If applicable, verify combo of lockbox and verify appropriate keys are inside.
6. Verify door, hinges, seals and locking mechanisms are in good working order.
7. Verify all doors close securely and tightly when handle is locked.
8. Visually inspect DC disconnect knob for damage and ensure knob/handle functionality.
9. Visually inspect interior of cabinet for any signs of damage, discoloration, deterioration, disfiguration and water, dust and rodent ingress. Also inspect for possible failure points.
10. Visually inspect internal components for any signs of damage, discoloration, deterioration, disfiguration and water, dust and rodent ingress. Also inspect for possible failure points.
11. Verify all current carrying conductor connections are tight and solidly connected.
12. Confirm all network cables are tight and solidly connected.

ESS Batteries

1. Visually inspect batteries and battery management systems for signs of damage, discoloration, deterioration, disfiguration and water ingress. Also inspect for possible failure points
2. Visually inspect battery power and data termination points for signs of damage, discoloration, deterioration, disfiguration and water damage. Also inspect for possible failure points
3. Visually inspect battery racking system for signs of damage, discoloration, deterioration, disfiguration and water and dust ingress. Also inspect for possible failure points
4. Measure insulation resistance between battery (+) to ground and battery (-) to ground at 1000VDC for 30 seconds

Power Converter

1. Visually inspect power converter for signs of damage, discoloration, deterioration, disfiguration and water, dust and rodent ingress. Also inspect for possible failure points.
2. Visually inspect converter power termination points for signs of damage, discoloration, deterioration, disfiguration and water damage. Also inspect for possible failure points.

Heat and Air Conditioning System

1. Visually inspect HVAC unit for signs of damage, discoloration, deterioration, disfiguration and water and dust ingress. Also inspect for possible failure points.
2. Visually inspect drip tray for signs of pooling or clogging.
3. Inspect bottom of HVAC unit for pooling.
4. Visually inspect exhaust hose for damage and proper operation.
5. Inspect outlet of exhaust hose for signs of pooling.
6. Inspect all filters and clean/change as necessary.
7. Once HVAC unit is on, inspect settings are set per OEM specifications.

Balance of Plant Equipment

1. Visually inspect exterior of AC disconnect(s) for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
2. Verify AC disconnect(s) has "ES Warning" sticker applied on the front of the box and that site ID is visible. Apply/re-apply as necessary.
3. Verify AC disconnect(s) has tamper proof sticker placed on handle. Apply/re-apply as necessary.
4. With all power de-energized, visually inspect interior of AC disconnect(s) for signs of damage, discoloration, deterioration, disfiguration and water ingress.
5. Visually inspect subpanel for any signs of damage, discoloration, deterioration, disfiguration and vandalism.
6. Verify if subpanel has proper labels defining location of feed, voltage, amperage and appropriate placards.
7. Verify key exists inside subpanel.
8. Verify subpanel panel schedule has breakers assigned to appropriate equipment.
9. Verify subpanel schedule has drawing of ESS cabinet layout w/ associated cabinet number for multiple systems.
10. Verify breakers inside subpanel are labeled. Label/re-label as necessary.
11. With all power turned off, visually inspect subpanel condition of breakers and check for operation by toggling off then on (perform only during servicing window).
12. Verify tamper proof sticker is placed on ESS and Controller breakers. Apply/re-apply as necessary.

13. Verify subpanel has "ES Warning" sticker applied visibly inside the panel and that the site ID is visible. Apply/re-apply as necessary.
14. If applicable, visually inspect step-up and/or step-down transformer(s) for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
15. Visually inspect all conduit runs for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
16. Visually inspect all junction and gutter boxes for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
17. Open all junction and gutter boxes and inspect for signs of damage, discoloration, deterioration, disfiguration and water ingress.

BESS Equipment Area

1. Confirm working area and surrounding area is clear of debris, plant overgrowth, water or any other inhibiting factors.
2. If applicable, inspect access locks for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
3. If applicable, inspect access hasps for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
4. If applicable, inspect fence for signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.
5. If applicable, inspect concrete pad and mounting surface for any signs of damage, discoloration, deterioration, disfiguration and vandalism. Also inspect for possible failure points.



CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)
03/22/2021

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Marsh USA Inc. 2929 Allen Parkway, Suite 2500 Houston, TX 77019 CN115354100--GAWU-20-21	CONTACT NAME: PHONE (A/C, No, Ext): E-MAIL ADDRESS:		FAX (A/C, No):
	INSURER(S) AFFORDING COVERAGE		NAIC #
INSURED ENGIE Holdings Inc. And their subsidiaries 1360 Post Oak Blvd, Ste 400 Houston, TX 77056	INSURER A : ACE American Insurance Company		22667
	INSURER B : ACE Property & Casualty Insurance Company		20699
	INSURER C :		
	INSURER D :		
	INSURER E :		
INSURER F :			

COVERAGES **CERTIFICATE NUMBER:** HOU-003768082-01 **REVISION NUMBER:** 5

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	<input checked="" type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS-MADE <input checked="" type="checkbox"/> OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: <input type="checkbox"/> POLICY <input checked="" type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC OTHER:			HDO G71080316	07/01/2020	07/01/2021	EACH OCCURRENCE	\$ 1,000,000
							DAMAGE TO RENTED PREMISES (Ea occurrence)	\$ 300,000
							MED EXP (Any one person)	\$ 10,000
							PERSONAL & ADV INJURY	\$ 1,000,000
							GENERAL AGGREGATE	\$ 2,000,000
							PRODUCTS - COMP/OP AGG	\$ 2,000,000
							EMPLOYEE BENEFITS	\$ 1,000,000
A	<input checked="" type="checkbox"/> AUTOMOBILE LIABILITY <input checked="" type="checkbox"/> ANY AUTO <input type="checkbox"/> OWNED AUTOS ONLY <input type="checkbox"/> SCHEDULED AUTOS <input checked="" type="checkbox"/> HIRED AUTOS ONLY <input checked="" type="checkbox"/> NON-OWNED AUTOS ONLY			ISA H25260090	07/01/2020	07/01/2021	COMBINED SINGLE LIMIT (Ea accident)	\$ 1,000,000
							BODILY INJURY (Per person)	\$
							BODILY INJURY (Per accident)	\$
							PROPERTY DAMAGE (Per accident)	\$
								\$
B	<input checked="" type="checkbox"/> UMBRELLA LIAB <input checked="" type="checkbox"/> OCCUR <input type="checkbox"/> EXCESS LIAB <input type="checkbox"/> CLAIMS-MADE DED RETENTION \$			XOOG27614814 006	07/01/2020	07/01/2021	EACH OCCURRENCE	\$ 10,000,000
							AGGREGATE	\$ 10,000,000
								\$
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	Y/N	N/A	WLR C50803697 (AOS) SCF C50803703 (WI)	07/01/2020 07/01/2020	07/01/2021 07/01/2021	<input checked="" type="checkbox"/> PER STATUTE <input type="checkbox"/> OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	\$ 1,000,000 \$ 1,000,000 \$ 1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

CERTIFICATE HOLDER Evidence of Insurance	CANCELLATION SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.
	AUTHORIZED REPRESENTATIVE of Marsh USA Inc. Freeman M. Wade <i>Freeman M. Wade</i>



ADDITIONAL REMARKS SCHEDULE

AGENCY Marsh USA Inc.		NAMED INSURED ENGIE Holdings Inc. And their subsidiaries 1360 Post Oak Blvd, Ste 400 Houston, TX 77056	
POLICY NUMBER		EFFECTIVE DATE:	
CARRIER	NAIC CODE		

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,
FORM NUMBER: 25 FORM TITLE: Certificate of Liability Insurance

Contractors Professional Protective Indemnity
 Carrier: Berkley Assurance Company
 Policy#: PCAB-5012115-0720
 Effective Date: 07/01/2020 - 07/01/2021
 SIR: \$250,000
 Limits: \$8,000,000

STANDARDS FOR INTERCONNECTION OF DISTRIBUTED GENERATION

Exhibit I—Landowner Consent Agreement

(Note: This Consent is to be signed by the owner of the land where the distributed generation installation and interconnection will be placed, when the owner or operator of the distributed generation installation is not also the owner of the land, and the landowner's electric facilities will not be involved in the interconnection of such distributed generation installation.)

This Consent is executed by Peter Saloom, (the "Landowner"; as used herein the term shall include the Landowner's successors in interest to the Property), as owner of the real property situated in the City/Town of Winchendon, Worcester County, Massachusetts, known as 0 Murdock Ave [street address] (the "Property"), at the request of **ZP Battery DevCo LLC** [name of Interconnecting Customer] (the "Interconnecting Customer"; as used herein the term shall include the Interconnecting Customer's successors and assigns) and for the benefit of **Massachusetts Electric Company (d/b/a National Grid)** a Massachusetts corporation with a principal place of business at **40 Sylvan Road, Waltham, MA 02451** (the "Company"); as used herein the term shall include the Company's successors and assigns).

1. The purpose of this Consent is to provide the Company with assurance that the installation of a distributed generation facility (the "Facility") by the Interconnecting Customer on the Property has been approved by the Landowner.
2. The Landowner hereby acknowledges that it has authorized the Facility to be installed and operated by Interconnecting Customer on the Property pursuant to agreements between the Landowner and the Interconnecting Customer that are in full force and effect as of the date hereof.
3. The Landowner hereby acknowledges that the Landowner shall look solely to the Interconnecting Customer for the performance of and compliance with all of the terms of any agreements between the Landowner and the Interconnecting Customer, and that the Company shall not, by virtue of any agreement between the Company and the Interconnecting Customer, be deemed to have assumed any obligation or liability to the Landowner.
4. The Company hereby acknowledges that the Company shall look solely to the Interconnecting Customer for the performance of and compliance with all of the terms of any agreements between the Company and the Interconnecting Customer, and that the Landowner shall not, by virtue of any agreement between the Landowner and the Interconnecting Customer, be deemed to have assumed any obligation or liability to the Company.


STANDARDS FOR INTERCONNECTION OF DISTRIBUTED GENERATION

5. The Landowner hereby grants the Company access as necessary to the Property for Company personnel, contractors or agents, to perform Company's duties under the agreements with the Interconnecting Customer.

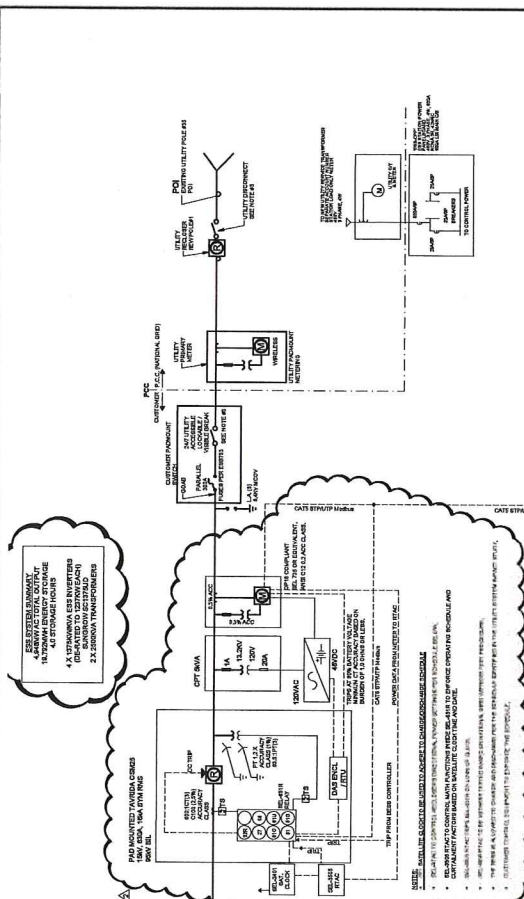
6. Landowner acknowledges and agrees that the Company shall have no liability to the Landowner, whether in tort or contract, or under any other legal theory, and specifically excluding any indirect, incidental, special, consequential, or punitive damages of any kind whatsoever, for any loss, cost, claim, injury, liability, or expense, including court costs and reasonable attorney's fees, relating to or arising from (a) the installation or operation of the Facility on the Property, or (b) any act or omission in the Interconnecting Customer's performance of its agreements with the Landowner or the Company, except to the extent caused solely by the negligence or willful misconduct of the Company, its agents, contractors or employees.

7. This Agreement shall be interpreted, governed, and construed under the laws of the Commonwealth of Massachusetts without giving effect to choice of law provisions that might apply the law of a different jurisdiction.

IN WITNESS WHEREOF, the Landowner and the Company have caused this Consent to be executed under seal by its duly authorized representatives.

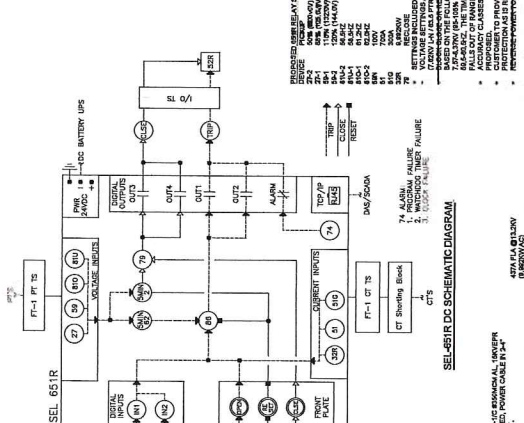
LANDOWNER

By: _____
Name: Peter F. Saloom
Title: President

COMPANY
By: _____
Name: _____
Title: _____



REVISIONS

1. THE INVERTER TO BE CONTROLLED BY THE SEL-651R UNIT.
2. THE INVERTER TO BE CONTROLLED BY THE SEL-651R UNIT.
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SEL-651R DC SCHEMATIC DIAGRAM

1. THE INVERTER TO BE CONTROLLED BY THE SEL-651R UNIT.

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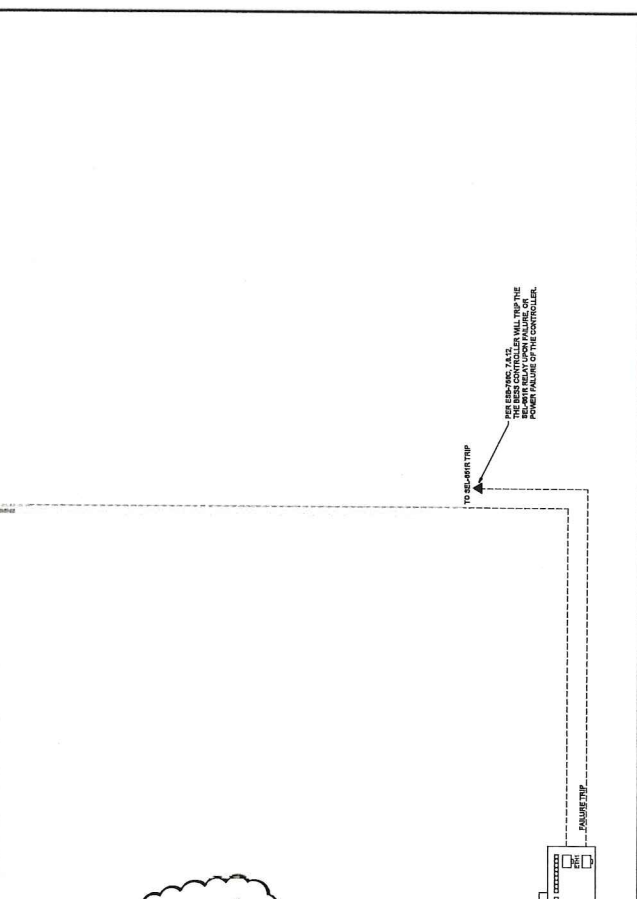
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SEL-651R UNIT

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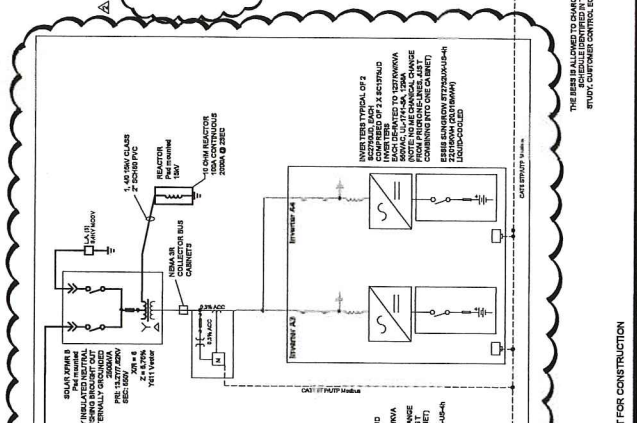
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POWER ENGINEERS, LLC
 Electrical Engineering, Power, Lighting
 Instrumentation, Fire Alarm, Security, Life Safety
 1000 Main Street, Suite 200
 Worcester, MA 01608
 (508) 852-5032
 www.powerengineersllc.com

PROJECT INFORMATION

PROJECT: ZP BATTERY DEVCO, LLC
 ZPB-4460 MURDOCK AVE
 4948KW AC ESS ONE-LINE DIAGRAM

DATE: APRIL 2021

SCALE: HORIZ: NONE
 VERT: 1/8" = 1'-0"

DATE: APRIL 2021

REVISIONS

NO.	DATE	DESCRIPTION
1	11/12/2020	ISSUED FOR REVIEW AND UTILITY APPLICATION
2	3/27/2023	REVISED PER CLIENT COMMENTS

FOR INTERCONNECTION APPLICATION ONLY - NOT FOR CONSTRUCTION

POWER ENGINEERS, LLC
 Electrical Engineering, Power, Lighting
 Instrumentation, Fire Alarm, Security, Life Safety
 1000 Main Street, Suite 200
 Worcester, MA 01608
 (508) 852-5032
 www.powerengineersllc.com

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DATE: APRIL 2021

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FOR INTERCONNECTION APPLICATION ONLY - NOT FOR CONSTRUCTION

