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October 19, 2023

VIA ELECTRONIC MAIL
Melanie Bachman
Executive Director/Staff Attorney
Connecticut Siting Council
10 Franklin Square
New Britain, CT 06051

Re: Petition No. 1579 - KCE CT 9, LLC for a Declaratory Ruling that no Certificate of Environmental Compatibility and Public Need is Required for the Proposed Construction, Operation and Maintenance of a 5.0-megawatt ("MW") Battery Energy Storage System, to be Located at 2 Ella Grasso Turnpike, Windsor Locks, Connecticut

Dear Ms. Bachman:

I am writing on behalf of my client, KCE CT 9, LLC in connection with the above-referenced Petition. With this letter, I am enclosing an electronic file containing the responses and attached exhibits of KCE CT 9, LLC to the Council's Second Set of Interrogatories in this Petition. An original and fifteen hard copies of these responses will follow via U.S. Mail.

Should you have any questions concerning this submittal, please contact me at your convenience.

Sincerely,

Lee D. Hoffman

Lee D. Hoffman
Enclosures

STATE OF CONNECTICUT
CONNECTICUT SITING COUNCIL

KCE CT 9, LLC petition for a declaratory ruling, pursuant to Connecticut General Statutes §4-176 and §16-50k, for the proposed construction, maintenance and operation of a 5.0-megawatt AC battery energy storage facility located at 2 Ella T. Grasso Turnpike, Windsor Locks, Connecticut and associated electrical interconnection.

Petition No. 1579

October 19, 2023

Petitioner KCE CT 9, LLC ("KCE") hereby submits the following responses to the Second Set of Interrogatories that were directed to KCE by the Connecticut Siting Council ("CSC" or "Council") on September 26, 2023.

Project Development

60. Has KCE CT 9, LLC's (KCE) battery energy storage facility (BESF) been procured? Identify the manufacturer of the proposed batteries.

Per the information provided in section 2.4 Project description, and Exhibit B, Equipment Specifications, the proposed BESS is anticipated to utilize the SunGrow SC3150U, manufactured by Sungrow. KCE is in preliminary communication with the manufacturer regarding this project's equipment needs and timeline. However, orders with financial commitments will not be submitted until the project has received a final interconnection agreement and all major permits. Variations in this equipment may apply based on technology changes and availability at the time of order. If changes do occur, KCE is willing to provide the Council with information regarding such changes.

61. Referencing page 4 of the Petition, what is the status of the system impact study with Eversource? Is it anticipated the battery manufacturer/model will change based on the interconnection agreement?

The distribution system impact study is complete The project has just entered the 75 day facility study upon completion of which an interconnection agreement will be tendered. Completion of the full process is expected in the first quarter of 2024.

At this time no equipment modifications are being considered.

62. How frequently would site visits be typically required for maintenance purposes?

Planned maintenance of the BESS is anticipated to be completed twice annually. Reactive maintenance and other site visits will be on an as-needed basis.

Public Safety

63. Referencing Response to Council interrogatory 33, which version of the National Electrical Code (NEC) would the Project be designed for?

Currently, the 2022 Connecticut State Building Code applies to projects with permit applications filed from October 1, 2022 until present. The 2022 Connecticut State Building Code (SBC) is based on the International Code Council's widely-adopted 2021 International Codes and applies to projects with permit applications filed from October 1, 2022. The 2022 SBC adopts the 2020 National Electrical Code (NFPA 70). With that said, the 2023 edition of the NEC was issued by the NFPA Standards Council on August 12, 2022. The effective date of September 1, 2022 is when it officially became available for federal, state, county, and municipal governmental entities to update their electrical installation regulations.

Please also see the table of codes below and UL testing requirements that the proposed BESS will meet.

The Project will conform with all the following electrical codes as standards		
Applicable Code	**Component Part Covered**	**Notes**
2021 International Fire Code (IFC)	Whole System	
2018 International Building Code (IBC) or 2021 pending release	Whole System	
National Fire Protection Association (NFPA) 855	Whole System	Standard for the Installation of Stationary Systems
UL 9540	Whole System	Requirements for installation, providing appropriate instruction manuals
NFPA70	Whole System	Benchmark for safe electrical design, installation, and inspection
NFPA70e	Whole System	Workplace injuries and fatalities due to shock, electrocution, arc flash, and arc blast, and assists in complying with OSHA
UL 9540A	Battery Rack + enclosure	Installation ventilation requirements; fire protection (integral or external); Fire service strategy
UL 1973	Battery Rack	Test ability to withstand fire from the outside and inside of BESS without cascading between modules
UL 1741	Inverter	Inverters capable of managing

		grid reliability functions.
UL 1642	Battery Cell	Reduce the risk of fire or explosion and for the responder when dealing with damaged product
UL 2054	Battery Cell	Type of plastic, wall thickness, amount of non-UL qualified material used, etc.
IEC 62281	Battery Cell Transportation	Safe transport as hazardous material

The project will comply with the most updated code applicable at the time of filing for local building permit, expected in Q2 of 2024. Please also see the following link for more information on applicable building codes: https://portal.ct.gov/DAS/Office-of-State-Building-Inspector/Connecticut-State-Building-Code/Regulations

64. Identify the code/standard and section that addresses the minimum fence height for the BESF.

Per CT Building Code Chapter 52 – 52.1.15 Security of Installations, the ESS shall be secured against unauthorized entry and safeguarded in an approved manner. [NFPA 855:4.3.8.1]

Per the 2020 NFPA 70 portion of the 2022 CT State Building Code, for installations other than equipment as described in 110.31(D), a wall, screen, or fence shall be used to enclose an outdoor electrical installation to deter access by persons who are not qualified. A fence shall not be less than 2.1 m (7 ft) in height or a combination of 1.8 m (6 ft) or more of fence fabric and a 300 mm (1 ft) or more extension utilizing three or more strands of barbed wire or equivalent.

For more information, please see the following: https://up.codes/viewer/connecticut/nfpa-70-2020/chapter/1/general#110.31

65. Referencing Petition Attachment A, Sheet C-5.0, an approximately 2-inch maximum gap is proposed between the bottom of the fence and grade. What animal deterrents are in place for small animals, such as nesting birds, chewing rodents, etc.?

The project design was following examples of recent solar development practices that include a 6 inch gap at the bottom of the fence to allow the passage of small animals. Petitioner prefers to have the fence secured to the ground to deter any pests from entering. Additionally, the BESS containers/enclosures are designed prevent small animals to enter the containers where they may chew or cause damage. NDDB has been consulted for this project and is not requesting such a gap in the perimeter fence. Project plans have been updated accordingly and are included with these interrogatory responses as Exhibit A.

66. Referencing the response to Council interrogatory 35, KCE notes that, "The battery units do come with a dry sprinkler system...activated when the responding fire department connects a tank truck to the system from outside of the container...Current guidance instructs that the sprinkler system should not be used, and any fire event should be allowed to burn out in a controlled manner while nearby resources are monitored and protected using water as a proactive cooling agent on the exterior of the battery containers." Identify the guidance that recommends that the sprinkler system should not be used.

Please refer to the International Association of Fire Chiefs (IAFC), Recommended Fire Department Response to Energy Storage Systems (ESS). KCE follows the guidance from the IAFC for defensive fire firefighting which includes the best practices of containment strategy for any fire until it is exhausted and use water on surrounding structures to prevent any spread of fire. A copy of this document is included with these interrogatory responses as Exhibit B.

Please also refer to the American Clean Energy Power's *First Responders Guide to Lithium-Ion Battery Energy Storage System Incidents* ("the Guide"). A copy of this document is included with these interrogatory responses as Exhibit C. The Guide provides more context related to the current industry guidance for incident response that minimizes life safety and environmental impact issues.

Consistent to the IAFC guidelines, section 4.3 of the Guide notes that "application of water should be limited to cooling and protecting nearby exposures." Per section 4.6, introduction of water within the containers can create potential for problematic run off. Per the discussion in section 5.1, the uncertainties, risks, and complications of introducing water or other fire control substances lead to the same conclusion provided by the IAFC to respond to fire with a defensive containment strategy.

67. Explain why a dry sprinkler system (that requires outside fire department connection) was selected in lieu of an automatic sprinkler system with a dedicated water supply. Cite any codes/standards or guidance if applicable.

The sprinkler system is included as equipment from the manufacturer as listed in the specification sheets that were provided as Exhibit B to KCE's original petition and was not selected as a design option by KCE.

Please see the response to Interrogatory 66 for additional context regarding sprinkler systems and the potential impacts associated with liberal or non-directed use of water. KCE notes that its proposed systems are designed with passive fire suppression, including the sensors noted in response to Interrogatory Number 36. c. and the equipment noted in response to Interrogatory Number 84. Due to these factors, KCE concludes the best practice is a containment strategy for any fire until it is exhausted and to use water on surrounding structures to prevent any spread of fire.

68. Would there be any water quality issues resulting from emergency response, e.g. use of foam?

Water used in response to a fire following the prescribed method for use of water on surrounding structures in a containment strategy reduces the chance of contamination. Any hazardous materials that are not in gaseous form will remain contained in the affected container. The use of foam in response to fire is not recommended. KCE will hold training sessions with local emergency responders with this and other necessary information to ensure any response is conducted with a priority for the safety of human life and best protection surrounding environment. KCE will provide multiple trainings to local emergency responders during initial construction and commissioning of the BESS. Such training will be updated and repeated annually per NFPA 855 code.

69. Would the proposed facility have any on-site lighting? If yes, identify the type, location and potential visual impacts.

Emergency lighting is required at the facility egress as required per NFPA 855:4.3.10.2. It is anticipated that visual impacts will be mitigated with the existing vegetative buffer surrounding the project area and the recessed nature of the location as shown in Exhibit H of KCE's original Petition.

70. Referencing page 29 of the Emergency Operations Plan, a battery fire would be self-extinguishing. What is the typical duration of a battery fire before it self-extinguishes? If one battery caught fire, can it easily spread to adjacent batteries? Explain.

The system equipment proposed by KCE passes UL 9540A. In order to pass that standard, no propagation may occur between a cell that has been ignited and the other system unit cells. The typical duration of BESS fire should be no more than 2 days, assuming the containment strategy is applied as prescribed.

71. Would firewater or other runoff from a battery fire be considered hazardous and require cleanup by a hazardous materials response contractor?

Water used in response to a fire following the prescribed method for use of water on surrounding structures in a containment strategy reduces the chance of contamination. Any hazardous materials that are not in gaseous form will remain contained in the affected container, and therefore are not anticipated to require cleanup by a hazardous materials response contractor. KCE will hold training sessions with local emergency responders with this and other necessary information to ensure any response is conducted with a priority for the safety of human life and best protection surrounding environment. KCE will provide multiple trainings to local emergency responders during initial construction and commissioning of the BESS. Such training will be updated and repeated annually per NFPA 855 code.

72. Referencing page 3 of the Petition, please respond to the following:

a. Could a battery potentially burst and release hazardous decomposition products when exposed to a fire situation?

Given sufficient heat (such as direct exposure to a flame or an electrical short leading to massive heating on conductors or wires), a lithium-ion cell may undergo thermal runaway that results in gas generation and release. Based on the product's UL 9540A fire test result and industry understanding, the gases that could potentially be released are similar to "fires involving materials such as sofas, mattresses, or office furniture." See page 4 of American Clean Power's *Battery Energy Storage Safety*, which is attached to these interrogatory responses as Exhibit D for additional information.

b. If a battery burst, would smoke from the fire be considered hazardous and require notification to local authorities?

In any event of fire, the project will notify and cooperate with local emergency responders and fire safety authorities. As noted in the response to Interrogatory 72.a. above, it would be anticipated that a BESS fire incident would involve the release of gases that would be anticipated to be similar to "fires involving materials such as sofas, mattresses, or office furniture.". See page 4 of Exhibit D.

c. If a battery burst, would smoke require area residences to stay in place or evacuate? If yes, who would determine if these actions are necessary?

It is not anticipated that evacuation would be required, however, the fire marshal has the ultimate authority for making decisions for orders to shelter in place or evacuate. Per the guidance from the IAFC, (found in Exhibit B), in the event of a fire, individuals should maintain a safe distance from the unit involved. For a large commercial system, the suggested distance is "at least 300'" according to the IAFC guidance.

73. Provide a detailed standard operating procedure for emergency response and notifications in the event of a battery fire.

Please refer to *Operation and Maintenance Plan – Emergency Response Plan,* which was included as Exhibit J to the original Petition in this matter. Annex H- Fire of Exhibit J begins on page 28 of the project's Emergency Operation Plan (which is page 121 of Exhibit J). Annex H contains the detailed standard operating procedure for emergency response and notifications in the event of a battery fire.

74. Would KCE dispatch personnel to the BESF in the event of a fire? Where would KCE personnel be located that can respond to site emergencies?

In the event of a fire, KCE will mobilize personnel to the site as outlined in the EOP Annex H. Mobilization will be led by a regional operations manager. The location of such manager is to be determined when KCE has approved projects ready for construction in New England. Additionally, personnel from the BESS provider would be mobilized to advise on response, investigate the incident and provide guidance for remediation post event. KCE will provide multiple trainings to local emergency responders during initial construction and commissioning of the BESS. Such training will be updated and repeated annually per NFPA 855 code.

75. Would placards be installed at the facility to alert emergency responders as to how to extinguish a fire, the fire media to be used, and contact numbers to operators of the BESF? If yes, provide detail. If no, explain why such measures are not necessary.

Telephone and emergency contact numbers will be provided on the project fence and gate. A standard UN placard will also be affixed to the containers. The placard will be based on the United Nations Committee on Transportation of Hazardous Goods committee assigned number. The project battery containers will have the placard of UN3536, 9. This is for lithium batteries installed in cargo transport unit.

KCE will provide local emergency responders with training in fires involving lithium ion batteries and their potential generation of hydrogen fluoride gas. Emergency response instruction will be directly provided and documented in a handbook provided to emergency responders. KCE will provide multiple trainings to local emergency responders during initial construction and commissioning of the BESS. Such training and documentation will be updated when appropriate and repeated annually per NFPA 855 code.

76. Referencing the response to Council interrogatory 36a, KCE states an exhaust ventilation system would remove flammable gases during a potential battery failure. Is this ventilation system susceptible to fire and subject to failure? Is it within a fire enclosure?

Our current flammable gas detection limit is in compliance with relevant codes and will detect well below lower flammability limit and trigger the ventilation. It is therefore not anticipated to be susceptible to fire. The system will be activated before an internal flame starts and remain open as long as it is safe to do so without permitting the flame to propagate to neighboring units.

77. What explosion mitigation system is more effective, vent panels or an exhaust system? Explain.

The exhaust system is more effective in preventing the situation from occurring. Vents are effective in release of gases even if a fire state is reached.

78. Has KCE considered an aerosol-based fire suppression system? If yes, what media would be used in such system?

See the response to Interrogatory 66. Based on current guidance available, KCE intends to follow that guidance and allow such fires to burn themselves out, while taking steps to ensure that fires to not spread to other units or materials.

79. Referencing pages 3 and 5 of the Petition, provide a safety data sheet for ethylene glycol, lithium-ion phosphate and other materials, as applicable, that would be associated with the proposed batteries.

The material safety data sheet (MSDS) for the coolant used in the Sungrow system components provided by Sinopec is attached to these interrogatory responses as Exhibit E. The MSDS for the lithium ion cells used in the Sungrow PowerTitan 1.0 is attached to these interrogatory responses as Exhibit F.

80. Referencing Council interrogatories 25 and 27, inverter step-up transformers and an auxiliary power transformer are proposed.

a. Provide a transformer oil safety data sheet.

The MSDS for the dielectric fluid used in these transformers in attached to these interrogatory responses as Exhibit G.

b. How much oil is contained within each transformer?

697.8 gals per transformer in a PT 1.0 KV skid.

c. Are there alarms (such as low-level oil alarms) that can alert personnel of a leak? If not, how would a leak be detected?

Each transformer has a low level alarm after certain amount of leakage and is built into Sungrow's alarm list. The minimum oil volume is 693.5Gal. When oil leakage reaches 4.3 gallons, it will trigger the low oil level alarm.

d. Do the transformers have a leak containment system? If yes, describe.

There is a containment system in the skid at the lower unit.

Site Plans

Issued for	**Application**
Date Issued	**June 2, 2023**
Latest Issue	**October 12, 2023**

BESS Installation CT9

2 Ella Grasso Turnpike
Windsor Locks, Connecticut

vhb.com

vhb

100 Great Meadow Road
Suite 200
Wethersfield, CT 06109
860.807.4300

Applicant

Key Capture Energy
25 Monroe Street
Albany, NY 12210

Map / Block / Lot:
038 / 001 / 002

Owner

Barberino John S
10311 Boca Woods Lane
Boca Raton, FL 33428

Sheet Index

Reference Drawings

No.	Drawing Title	Latest Issue
1 of 1	ALTA/NSPS Land Title Survey	July 18, 2022

VHB Project : BESS Installation
Issued for : Application

Legend

Exist.	Prop.	
		PROPERTY LINE
		PROJECT LIMIT LINE
		RIGHT-OF-WAY/PROPERTY LINE
		EASEMENT
		BUILDING SETBACK
		PARKING SETBACK
10+00	10+00	BASELINE
		CONSTRUCTION LAYOUT
		ZONING LINE
		TOWN LINE
		LIMIT OF DISTURBANCE
		WETLAND LINE WITH FLAG
		FLOODPLAIN
		100-YEAR FLOOD LIMITS
		GRAVEL ROAD
EOP	EOP	EDGE OF PAVEMENT
BB	BB	BITUMINOUS BERM
BC	BC	BITUMINOUS CURB
CC	CC	CONCRETE CURB
CG	CG	CURB AND GUTTER
ECC	ECC	EXTRUDED CONCRETE CURB
MCC	MCC	MONOLITHIC CONCRETE CURB
PCC	PCC	PRECAST CONC. CURB
SGE	SGE	SLOPED GRAN. EDGING
VGC	VGC	VERT. GRAN. CURB
		LIMIT OF CURB TYPE
		SAWCUT
		BUILDING
EN	EN	BUILDING ENTRANCE
LD	LD	LOADING DOCK
		BOLLARD
D	D	DUMPSTER PAD
		SIGN
		DOUBLE SIGN
		STEEL GUARDRAIL
		WOOD GUARDRAIL
		PATH
		TREE LINE
		WIRE FENCE
		FENCE
		STOCKADE FENCE
		STONE WALL
		RETAINING WALL
		STREAM / POND / WATER COURSE
		DETENTION BASIN
		HAY BALES
		SILT FENCE
		SILT SOCK / STRAW WATTLE
4	4	MINOR CONTOUR
20	20	MAJOR CONTOUR
10	10	PARKING COUNT
	C10	COMPACT PARKING STALLS
DYL	DYL	DOUBLE YELLOW LINE
SL	SL	STOP LINE
		CROSSWALK
		ACCESSIBLE CURB RAMP
		ACCESSIBLE PARKING
VAN	VAN	VAN-ACCESSIBLE PARKING

Exist.	Prop.	
		CONCRETE
		HEAVY DUTY PAVEMENT
		BUILDINGS
		RIPRAP
		CONSTRUCTION EXIT
27.35 TC×	27.35 TC×	TOP OF CURB ELEVATION
26.85 BC×	26.85 BC×	BOTTOM OF CURB ELEVATION
132.75 ×	132.75 ×	SPOT ELEVATION
45.0 TW× 36.5 BW×	45.0 TW× 36.5 BW×	TOP & BOTTOM OF WALL ELEVATION
		BORING LOCATION
		TEST PIT LOCATION
MW	MW	MONITORING WELL
UD	UD	UNDERDRAIN
12"D	12"D	DRAIN
6"RD	6"RD	ROOF DRAIN
12"S	12"S	SEWER
FM	FM	FORCE MAIN
OHW	OHW	OVERHEAD WIRE
6"W	6"W	WATER
4"FP	4"FP	FIRE PROTECTION
	2"DW	DOMESTIC WATER
3"G	G	GAS
E	E	ELECTRIC
STM	STM	STEAM
T	T	TELEPHONE
FA	FA	FIRE ALARM
CATV	CATV	CABLE TV
		CATCH BASIN
		DOUBLE CATCH BASIN
		GUTTER INLET
		DRAIN MANHOLE
		TRENCH DRAIN
		PLUG OR CAP
CO	CO	CLEANOUT
		FLARED END SECTION
		HEADWALL
		SEWER MANHOLE
CS	CS	CURB STOP & BOX
WV	WV	WATER VALVE & BOX
TSV	TSV	TAPPING SLEEVE, VALVE & BOX
		SIAMESE CONNECTION
HYD	HYD	FIRE HYDRANT
WM	WM	WATER METER
PIV	PIV	POST INDICATOR VALVE
W	W	WATER WELL
GG	GG	GAS GATE
GM	GM	GAS METER
	EMH	ELECTRIC MANHOLE
EM	EM	ELECTRIC METER
		LIGHT POLE
	TMH	TELEPHONE MANHOLE
T	T	TRANSFORMER PAD
		UTILITY POLE
		GUY POLE
		GUY WIRE & ANCHOR
HH	HH	HAND HOLE
PB	PB	PULL BOX
Matchline	Matchline	MATCHLINE

Abbreviations

General

ABAN	ABANDON
ACR	ACCESSIBLE CURB RAMP
ADJ	ADJUST
APPROX	APPROXIMATE
BIT	BITUMINOUS
BS	BOTTOM OF SLOPE
BWLL	BROKEN WHITE LANE LINE
CONC	CONCRETE
DYCL	DOUBLE YELLOW CENTER LINE
EL	ELEVATION
ELEV	ELEVATION
EX	EXISTING
FDN	FOUNDATION
FFE	FIRST FLOOR ELEVATION
GRAN	GRANITE
GTD	GRADE TO DRAIN
LA	LANDSCAPE AREA
LOD	LIMIT OF DISTURBANCE
MAX	MAXIMUM
MIN	MINIMUM
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
PERF	PERFORATED
PROP	PROPOSED
REM	REMOVE
RET	RETAIN
R&D	REMOVE AND DISPOSE
R&R	REMOVE AND RESET
SWEL	SOLID WHITE EDGE LINE
SWLL	SOLID WHITE LANE LINE
TS	TOP OF SLOPE
TYP	TYPICAL

Utility

CB	CATCH BASIN
CMP	CORRUGATED METAL PIPE
CO	CLEANOUT
DCB	DOUBLE CATCH BASIN
DMH	DRAIN MANHOLE
CIP	CAST IRON PIPE
COND	CONDUIT
DIP	DUCTILE IRON PIPE
FES	FLARED END SECTION
FM	FORCE MAIN
F&G	FRAME AND GRATE
F&C	FRAME AND COVER
GI	GUTTER INLET
GT	GREASE TRAP
HDPE	HIGH DENSITY POLYETHYLENE PIPE
HH	HANDHOLE
HW	HEADWALL
HYD	HYDRANT
INV	INVERT ELEVATION
I=	INVERT ELEVATION
LP	LIGHT POLE
MES	METAL END SECTION
PIV	POST INDICATOR VALVE
PWW	PAVED WATER WAY
PVC	POLYVINYLCHLORIDE PIPE
RCP	REINFORCED CONCRETE PIPE
R=	RIM ELEVATION
SMH	SEWER MANHOLE
TSV	TAPPING SLEEVE, VALVE AND BOX
UG	UNDERGROUND
UP	UTILITY POLE

Notes

General

1. CONTRACTOR SHALL NOTIFY "CALL BEFORE YOU DIG" (811 OR 1-800-922-4455) AT LEAST 72 HOURS BEFORE EXCAVATING.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR SITE SECURITY AND JOB SAFETY. CONSTRUCTION ACTIVITIES SHALL BE IN ACCORDANCE WITH OSHA STANDARDS AND LOCAL REQUIREMENTS.
3. WORK WITHIN THE LOCAL RIGHTS-OF-WAY SHALL CONFORM TO LOCAL MUNICIPAL STANDARDS.
4. UPON AWARD OF CONTRACT, CONTRACTOR SHALL MAKE NECESSARY CONSTRUCTION NOTIFICATIONS AND APPLY FOR AND OBTAIN NECESSARY PERMITS, PAY FEES, AND POST BONDS ASSOCIATED WITH THE WORK INDICATED ON THE DRAWINGS, IN THE SPECIFICATIONS, AND IN THE CONTRACT DOCUMENTS. DO NOT CLOSE OR OBSTRUCT ROADWAYS, SIDEWALKS, AND FIRE HYDRANTS, WITHOUT APPROPRIATE PERMITS.
5. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.
6. IN THE EVENT THAT SUSPECTED CONTAMINATED SOIL, GROUNDWATER, AND OTHER MEDIA ARE ENCOUNTERED DURING EXCAVATION AND CONSTRUCTION ACTIVITIES BASED ON VISUAL, OLFACTORY, OR OTHER EVIDENCE, THE CONTRACTOR SHALL STOP WORK IN THE VICINITY OF THE SUSPECT MATERIAL TO AVOID FURTHER SPREADING OF THE MATERIAL, AND SHALL NOTIFY THE OWNER IMMEDIATELY SO THAT THE APPROPRIATE TESTING AND SUBSEQUENT ACTION CAN BE TAKEN.
7. CONTRACTOR SHALL PREVENT DUST, SEDIMENT, AND DEBRIS FROM EXITING THE SITE AND SHALL BE RESPONSIBLE FOR CLEANUP, REPAIRS AND CORRECTIVE ACTION IF SUCH OCCURS.
8. DAMAGE RESULTING FROM CONSTRUCTION LOADS SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST TO OWNER.
9. CONTRACTOR SHALL CONTROL STORMWATER RUNOFF DURING CONSTRUCTION TO PREVENT ADVERSE IMPACTS TO OFF SITE AREAS, AND SHALL BE RESPONSIBLE TO REPAIR RESULTING DAMAGES, IF ANY, AT NO COST TO OWNER.
10. THIS PROJECT DISTURBS LESS THAN ONE ACRE OF LAND AND IT IS NOT ANTICIPATED THAT A REGISTRATION FOR THE CONNECTICUT DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION GENERAL PERMIT FOR THE DISCHARGE OF STORMWATER AND DEWATERING WASTEWATERS FROM CONSTRUCTION ACTIVITIES, EFFECTIVE DECEMBER 31, 2020, WILL BE NEEDED FOR THE PROJECT.
11. STAGING AND STOCKPILE AREAS SHALL NOT BE LOCATED WITHIN ANY WETLAND AND ABUTTING RESOURCE AREA AND SHALL BE LOCATED WITHIN THE LIMITS OF WORK.

Utilities

1. THE LOCATIONS, SIZES, AND TYPES OF EXISTING UTILITIES ARE SHOWN AS AN APPROXIMATE REPRESENTATION ONLY. THE OWNER OR IT'S REPRESENTATIVE(S) HAVE NOT INDEPENDENTLY VERIFIED THIS INFORMATION AS SHOWN ON THE PLANS. THE UTILITY INFORMATION SHOWN DOES NOT GUARANTEE THE ACTUAL EXISTENCE, SERVICEABILITY, OR OTHER DATA CONCERNING THE UTILITIES, NOR DOES IT GUARANTEE AGAINST THE POSSIBILITY THAT ADDITIONAL UTILITIES MAY BE PRESENT THAT ARE NOT SHOWN ON THE PLANS. PRIOR TO ORDERING MATERIALS AND BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL VERIFY AND DETERMINE THE EXACT LOCATIONS, SIZES, AND ELEVATIONS OF THE POINTS OF CONNECTIONS TO EXISTING UTILITIES AND, SHALL CONFIRM THAT THERE ARE NO INTERFERENCES WITH EXISTING UTILITIES AND THE PROPOSED UTILITY ROUTES, INCLUDING ROUTES WITHIN THE PUBLIC RIGHTS OF WAY.
2. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, OR EXISTING CONDITIONS DIFFER FROM THOSE SHOWN SUCH THAT THE WORK CANNOT BE COMPLETED AS INTENDED, THE LOCATION, ELEVATION, AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR, AND THE INFORMATION FURNISHED IN WRITING TO THE OWNER'S REPRESENTATIVE FOR THE RESOLUTION OF THE CONFLICT AND CONTRACTOR'S FAILURE TO NOTIFY PRIOR TO PERFORMING ADDITIONAL WORK RELEASES OWNER FROM OBLIGATIONS FOR ADDITIONAL PAYMENTS WHICH OTHERWISE MAY BE WARRANTED TO RESOLVE THE CONFLICT.
3. THE LOCATION, SIZE, DEPTH, AND SPECIFICATIONS FOR CONSTRUCTION OF PROPOSED PRIVATE UTILITY SERVICES SHALL BE INSTALLED ACCORDING TO THE REQUIREMENTS PROVIDED BY, AND APPROVED BY, THE RESPECTIVE UTILITY COMPANY (GAS, TELEPHONE, ELECTRIC, FIRE ALARM, ETC.). FINAL DESIGN LOADS AND LOCATIONS TO BE COORDINATED WITH OWNER AND ARCHITECT.
4. CONTRACTOR SHALL MAKE ARRANGEMENTS FOR AND SHALL BE RESPONSIBLE FOR PAYING FEES FOR POLE RELOCATION AND FOR THE ALTERATION AND ADJUSTMENT OF GAS, ELECTRIC, TELEPHONE, FIRE ALARM, AND ANY OTHER PRIVATE UTILITIES, WHETHER WORK IS PERFORMED BY CONTRACTOR OR BY THE UTILITIES COMPANY.
5. CONTRACTOR SHALL COORDINATE WITH ELECTRICAL CONTRACTOR AND SHALL FURNISH EXCAVATION, INSTALLATION, AND BACKFILL OF ELECTRICAL FURNISHED SITEWORK RELATED ITEMS SUCH AS PULL BOXES, CONDUITS, DUCT BANKS, LIGHT POLE BASES, AND CONCRETE PADS. SITE CONTRACTOR SHALL FURNISH CONCRETE ENCASEMENT OF DUCT BANKS IF REQUIRED BY THE UTILITY COMPANY AND AS INDICATED ON THE DRAWINGS.

Layout and Materials

1. PROPOSED BOUNDS AND ANY EXISTING PROPERTY LINE MONUMENTATION DISTURBED DURING CONSTRUCTION SHALL BE SET OR RESET BY A PROFESSIONAL LICENSED SURVEYOR.
2. PRIOR TO START OF CONSTRUCTION, CONTRACTOR SHALL VERIFY EXISTING PAVEMENT ELEVATIONS AT INTERFACE WITH PROPOSED PAVEMENTS, AND EXISTING GROUND ELEVATIONS ADJACENT TO DRAINAGE OUTLETS TO ASSURE PROPER TRANSITIONS BETWEEN EXISTING AND PROPOSED FACILITIES.
3. FINAL LAYOUT SUBJECT TO CONDITIONS ENCOUNTERED IN THE FIELD.

Demolition

1. CONTRACTOR SHALL DISPOSE OF DEMOLITION DEBRIS IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS, ORDINANCES AND STATUTES.
2. THE DEMOLITION LIMITS DEPICTED IN THE PLANS IS INTENDED TO AID THE CONTRACTOR DURING THE BIDDING AND CONSTRUCTION PROCESS AND IS NOT INTENDED TO DEPICT EACH AND EVERY ELEMENT OF DEMOLITION. THE CONTRACTOR IS RESPONSIBLE FOR IDENTIFYING THE DETAILED SCOPE OF DEMOLITION BEFORE SUBMITTING ITS BID/PROPOSAL TO PERFORM THE WORK AND SHALL MAKE NO CLAIMS AND SEEK NO ADDITIONAL COMPENSATION FOR CHANGED CONDITIONS OR UNFORESEEN OR LATENT SITE CONDITIONS RELATED TO ANY CONDITIONS DISCOVERED DURING EXECUTION OF THE WORK.
3. UNLESS OTHERWISE SPECIFICALLY PROVIDED ON THE PLANS OR IN THE SPECIFICATIONS, THE ENGINEER HAS NOT PREPARED DESIGNS FOR AND SHALL HAVE NO RESPONSIBILITY FOR THE PRESENCE, DISCOVERY, REMOVAL, ABATEMENT OR DISPOSAL OF HAZARDOUS MATERIALS, TOXIC WASTES OR POLLUTANTS AT THE PROJECT SITE. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR ANY CLAIMS OF LOSS, DAMAGE, EXPENSE, DELAY, INJURY OR DEATH ARISING FROM THE PRESENCE OF HAZARDOUS MATERIAL AND CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS THE ENGINEER FROM ANY CLAIMS MADE IN CONNECTION THEREWITH. MOREOVER, THE ENGINEER SHALL HAVE NO ADMINISTRATIVE OBLIGATIONS OF ANY TYPE WITH REGARD TO ANY CONTRACTOR AMENDMENT INVOLVING THE ISSUES OF PRESENCE, DISCOVERY, REMOVAL, ABATEMENT OR DISPOSAL OF ASBESTOS OR OTHER HAZARDOUS MATERIALS.

Erosion Control

1. PRIOR TO STARTING ANY OTHER WORK ON THE SITE, THE CONTRACTOR SHALL NOTIFY APPROPRIATE AGENCIES AND SHALL INSTALL EROSION CONTROL MEASURES AS SHOWN ON THE PLANS AND AS IDENTIFIED IN FEDERAL, STATE, AND LOCAL APPROVAL DOCUMENTS PERTAINING TO THIS PROJECT.
2. CONTRACTOR OR QUALIFIED INSPECTOR SHALL INSPECT AND MAINTAIN EROSION CONTROL MEASURES ON A WEEKLY BASIS OR MORE FREQUENTLY AS NEEDED (MINIMUM). THE CONTRACTOR SHALL ADDRESS DEFICIENCIES AND MAINTENANCE ITEMS WITHIN TWENTY-FOUR HOURS OF INSPECTION. CONTRACTOR SHALL PROPERLY DISPOSE OF SEDIMENT SUCH THAT IT DOES NOT ENCUMBER OTHER DRAINAGE STRUCTURES AND PROTECTED AREAS.
3. CONTRACTOR SHALL BE FULLY RESPONSIBLE TO CONTROL CONSTRUCTION SUCH THAT SEDIMENTATION SHALL NOT AFFECT REGULATORY PROTECTED AREAS, WHETHER SUCH SEDIMENTATION IS CAUSED BY WATER, WIND, OR DIRECT DEPOSIT.
4. CONTRACTOR SHALL PERFORM CONSTRUCTION SEQUENCING SUCH THAT EARTH MATERIALS ARE EXPOSED FOR A MINIMUM AMOUNT OF TIME BEFORE THEY ARE COVERED, SEEDED, OR OTHERWISE STABILIZED TO PREVENT EROSION.
5. UPON COMPLETION OF CONSTRUCTION AND ESTABLISHMENT OF PERMANENT GROUND COVER, CONTRACTOR SHALL REMOVE AND DISPOSE OF EROSION CONTROL MEASURES AND CLEAN SEDIMENT AND DEBRIS FROM ENTIRE DRAINAGE AND SEWER SYSTEMS.
6. VEGETATIVE SLOPE STABILIZATION WILL BE IMPLEMENTED WITHIN 14 DAYS AFTER GRADING OR CONSTRUCTION ACTIVITIES HAVE TEMPORARILY OR PERMANENTLY CEASED. VEGETATIVE SLOPE STABILIZATION WILL BE USED TO MINIMIZE EROSION ON SLOPES OF 3:1 OR STEEPER. ESTABLISHMENT OF TEMPORARY AND PERMANENT VEGETATIVE COVER MAY BE ESTABLISHED BY HYDRO-SEEDING OR SODDING. A SUITABLE TOPSOIL, GOOD SEEDBED PREPARATION, AND ADEQUATE LIME, FERTILIZER AND WATER WILL BE PROVIDED FOR EFFECTIVE ESTABLISHMENT OF THESE VEGETATIVE STABILIZATION METHODS. MULCH WILL ALSO BE USED AFTER PERMANENT SEEDING TO PROTECT SOIL FROM THE IMPACT OF FALLING RAIN AND TO INCREASE THE CAPACITY OF THE SOIL TO ABSORB WATER.

Existing Conditions Information

1. BASE PLAN: THE PROPERTY LINES SHOWN WERE DETERMINED BY PLANS AND DEEDS OF RECORD AND MONUMENTS FOUND IN A FIELD SURVEY CONDUCTED BY BARTON & LOGUIDICE ON JULY 18, 2022.
2. TOPOGRAPHY: ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988.
3. WETLANDS, WATERCOURSES, AND INTERMITTENT STREAMS REFERENCED ON THESE SITE PLANS WERE FIELD-DELINEATED BY FLYCATCHER, LLC AND SUMMARIZED IN A REPORT BY FLYCATCHER, LLC, DATED MAY 17, 2023.

Document Use

1. THESE PLANS AND CORRESPONDING CADD DOCUMENTS ARE INSTRUMENTS OF PROFESSIONAL SERVICE, AND SHALL NOT BE USED, IN WHOLE OR IN PART, FOR ANY PURPOSE OTHER THAN FOR WHICH IT WAS CREATED WITHOUT THE EXPRESSED, WRITTEN CONSENT OF VHB. ANY UNAUTHORIZED USE, REUSE, MODIFICATION OR ALTERATION, INCLUDING AUTOMATED CONVERSION OF THIS DOCUMENT SHALL BE AT THE USER'S SOLE RISK WITHOUT LIABILITY OR LEGAL EXPOSURE TO VHB.
2. CONTRACTOR SHALL NOT RELY SOLELY ON ELECTRONIC VERSIONS OF PLANS, SPECIFICATIONS, AND DATA FILES THAT ARE OBTAINED FROM THE DESIGNERS, BUT SHALL VERIFY LOCATION OF PROJECT FEATURES IN ACCORDANCE WITH THE PAPER COPIES OF THE PLANS AND SPECIFICATIONS THAT ARE SUPPLIED AS PART OF THE CONTRACT DOCUMENTS.
3. SYMBOLS AND LEGENDS OF PROJECT FEATURES ARE GRAPHIC REPRESENTATIONS AND ARE NOT NECESSARILY SCALED TO THEIR ACTUAL DIMENSIONS OR LOCATIONS ON THE DRAWINGS. THE CONTRACTOR SHALL REFER TO THE DETAIL SHEET DIMENSIONS, MANUFACTURERS' LITERATURE, SHOP DRAWINGS AND FIELD MEASUREMENTS OF SUPPLIED PRODUCTS FOR LAYOUT OF THE PROJECT FEATURES.

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BESS Installation CT9

2 Ella Grasso Turnpike
Windsor Locks, Connecticut

No.	Revision	Date	Appvd.
1	CSC Set 1 Interrogatories	8/8/2023	SJK
2	CSC Set 2 Interrogatories	10/12/2023	SJK

Designed by AMK | Checked by SJK

Issued for: Application | Date: June 2, 2023

Not Approved for Construction

Drawing Title: Legend, Abbreviations and General Notes

Drawing Number: C-1.0

Sheet 1 of 5

Project Number: 43175.00

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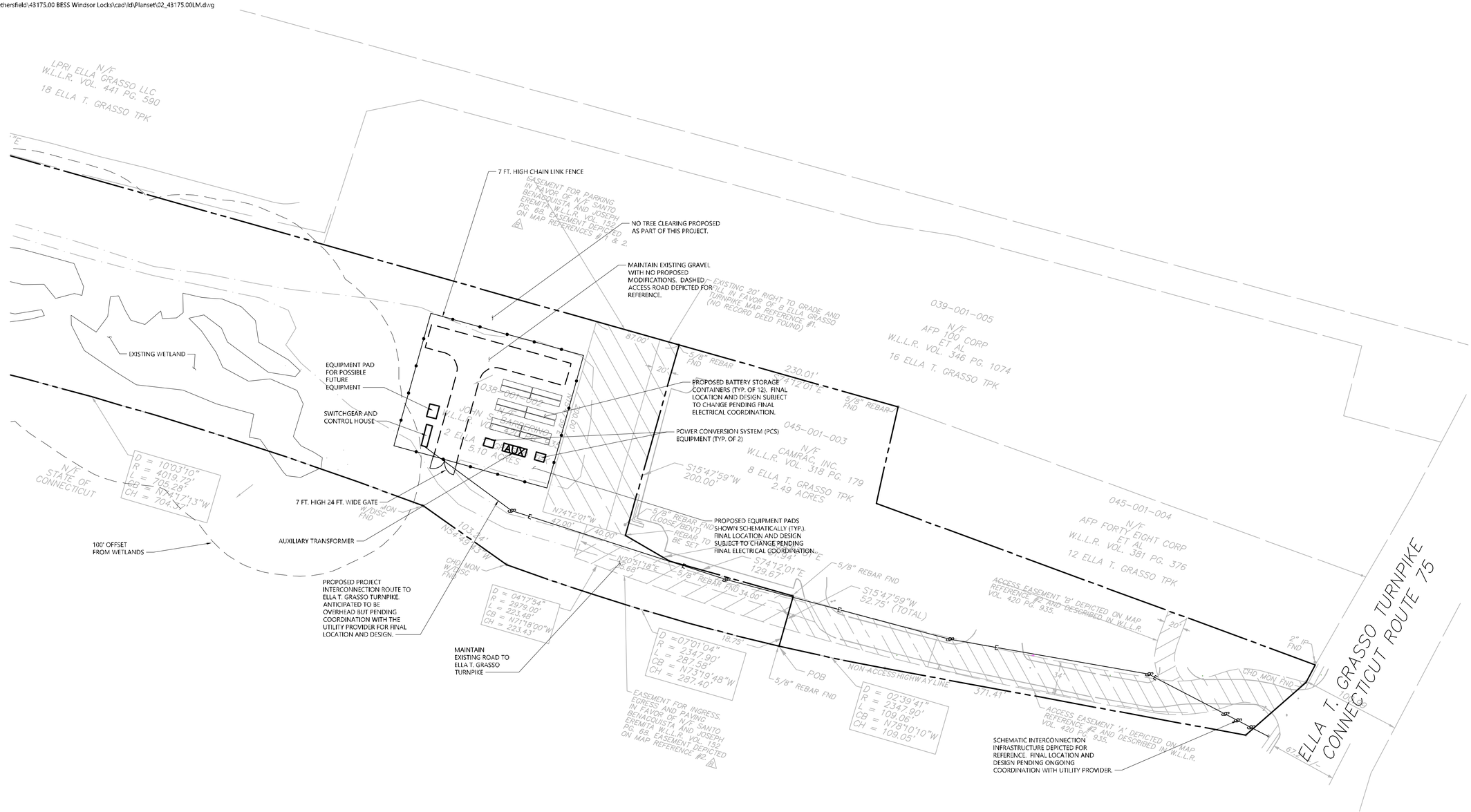

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Designed by: AMK
Checked by: SJK

Issued for: **Application**
Date: **June 2, 2023**

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Drawing Title
Layout & Materials Plan

Drawing Number
C-2.0

Sheet 2 of 5

Project Number
43175.00

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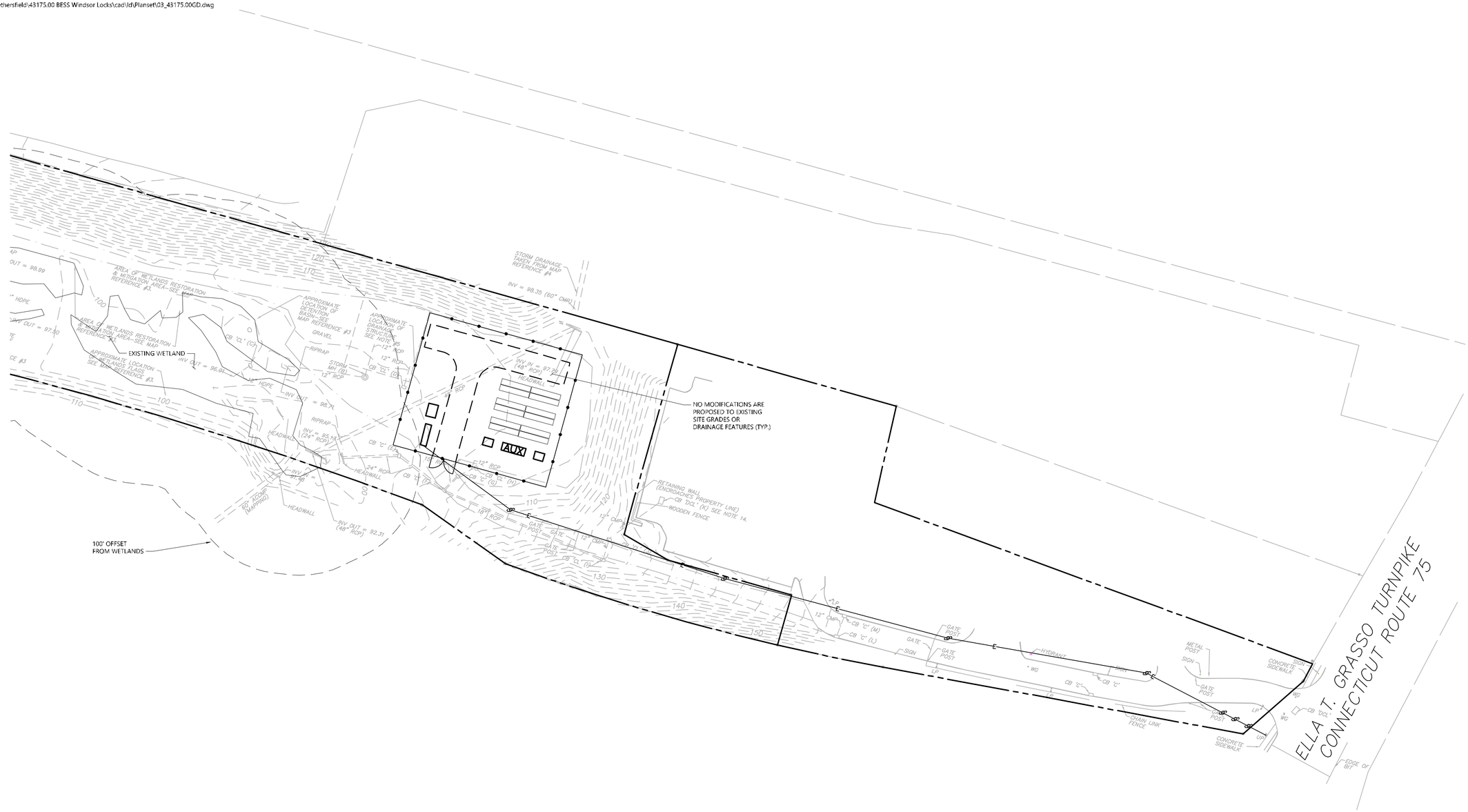

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Designed by AMK | Checked by SJK

Issued for: Application | Date: June 2, 2023

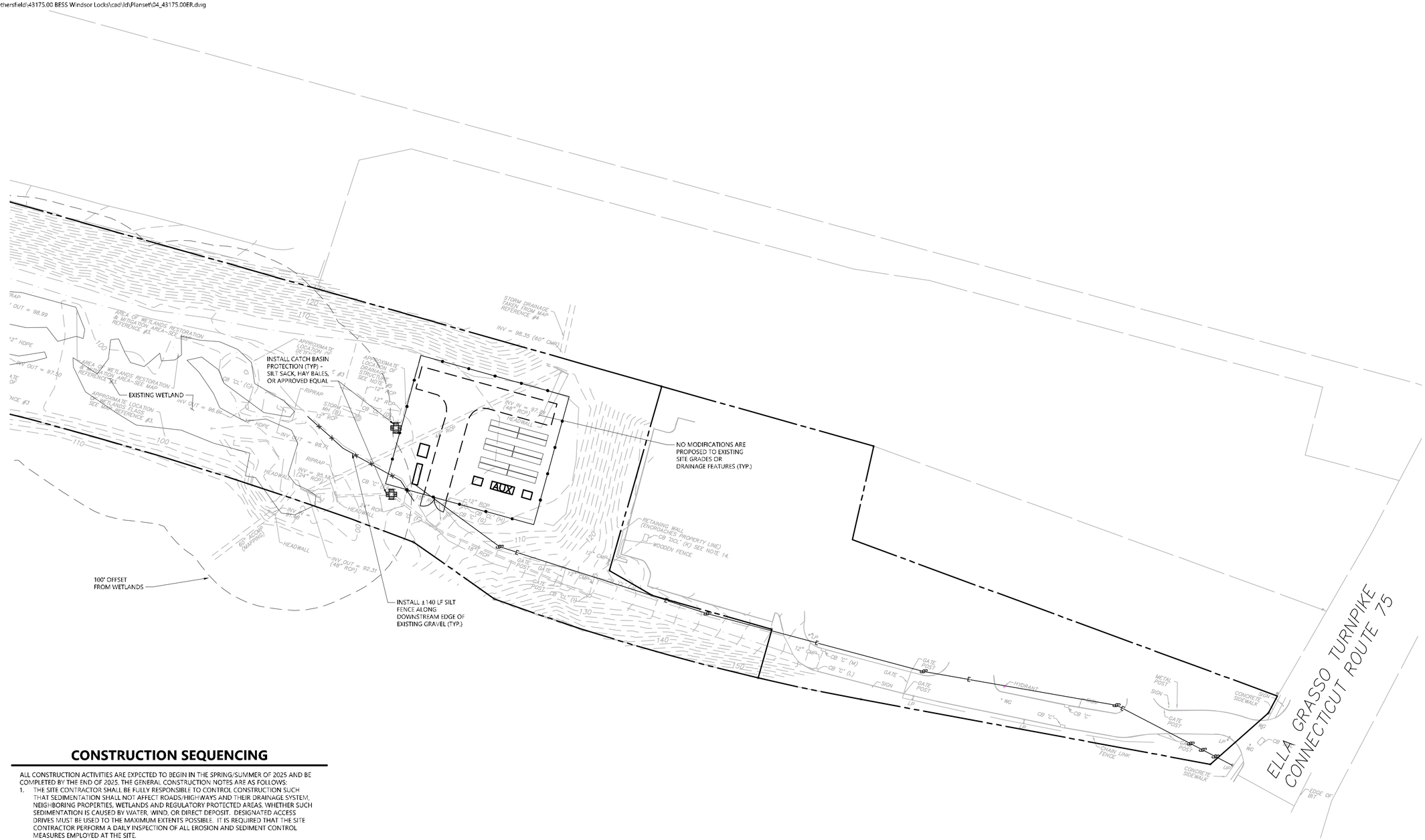
Not Approved for Construction

Drawing Title: **Grading & Drainage Plan**

Drawing Number: **C-3.0**

Sheet 3 of 5

Project Number: 43175.00



CONSTRUCTION SEQUENCING

ALL CONSTRUCTION ACTIVITIES ARE EXPECTED TO BEGIN IN THE SPRING/SUMMER OF 2025 AND BE COMPLETED BY THE END OF 2025. THE GENERAL CONSTRUCTION NOTES ARE AS FOLLOWS:

1. THE SITE CONTRACTOR SHALL BE FULLY RESPONSIBLE TO CONTROL CONSTRUCTION SUCH THAT SEDIMENTATION SHALL NOT AFFECT ROADS/HIGHWAYS AND THEIR DRAINAGE SYSTEM, NEIGHBORING PROPERTIES, WETLANDS AND REGULATORY PROTECTED AREAS. WHETHER SUCH SEDIMENTATION IS CAUSED BY WATER, WIND, OR DIRECT DEPOSIT. DESIGNATED ACCESS DRIVES MUST BE USED TO THE MAXIMUM EXTENTS POSSIBLE. IT IS REQUIRED THAT THE SITE CONTRACTOR PERFORM A DAILY INSPECTION OF ALL EROSION AND SEDIMENT CONTROL MEASURES EMPLOYED AT THE SITE.
2. THROUGHOUT THE COURSE OF THE CONSTRUCTION PROJECT, ADDITIONAL SEDIMENT AND EROSION CONTROL MEASURES MAY BE WARRANTED AT THE DISCRETION OF THE OWNER AND/OR DESIGN ENGINEER. THESE IMPROVEMENTS MUST BE IMPLEMENTED IN A TIMELY FASHION IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONSTRUCTION GENERAL PERMIT.
3. PRIOR TO CONSTRUCTION, THE APPLICANT SHALL PROVIDE THE TOWN OF WINDSOR LOCKS WITH THE NAME OF CONTACT AND 24-HOUR CONTACT INFORMATION.
4. CONTRACTOR SHALL ADHERE TO 2002 CONNECTICUT GUIDELINES FOR EROSION AND SEDIMENT CONTROL, AS AMENDED.
5. THE CONTRACTOR SHALL HOLD PRE-CONSTRUCTION MEETING(S). ATTENDEES SHALL INCLUDE, BUT NOT BE LIMITED TO, REPRESENTATIVES OF THE GENERAL CONTRACTOR, SITE CONTRACTOR, TOWN OF WINDSOR LOCKS, AND ENGINEER OF RECORD.
6. THE CONTRACTOR SHALL CONTACT CALL-BEFORE-YOU-DIG (1-800-922-4455) PRIOR TO ENGAGING IN ANY EXCAVATION ACTIVITIES AT THE SITE.
7. THE CONTRACTOR SHALL NOTIFY THE TOWN OF WINDSOR LOCKS AGENT, ZONING ENFORCEMENT OFFICER, AND ENGINEERING DEPARTMENT, 48 HOURS PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION ACTIVITY.
8. NO CONSTRUCTION OR SITE IMPROVEMENTS MAY BEGIN UNTIL THE PROPER EROSION CONTROL MEASURES SERVING THE AREA TO BE DISTURBED ARE IN PLACE.
9. ANTICIPATED WORK HOURS WILL BE BETWEEN 7:00 AM AND 5:00 PM MONDAY THROUGH FRIDAY. IF ANY VARIATION FROM THIS SCHEDULE IS TEMPORARILY REQUIRED, THE PROJECT TEAM SHALL PROVIDE NOTICE TO CONNECTICUT SITING COUNCIL.

CONSTRUCTION SEQUENCE (SPRING/SUMMER 2025)

1. INSTALL EROSION AND SEDIMENT CONTROLS FOLLOWING THE CT GUIDELINES AND MANUFACTURER'S DIRECTIONS. DURING CONSTRUCTION, THE CONTRACTOR SHALL INSTALL MEASURES AS REQUIRED BY THE ENGINEER OF RECORD OR OWNER, TO PREVENT SEDIMENT-LADEN RUNOFF FROM REACHING WETLANDS OR DISCHARGING OFFSITE.
2. INSTALL ELECTRICAL COMPONENTS AND INTERCONNECTION.
3. INSTALL SITE FENCING.
4. RESEED, REPAVE, AND/OR REPLANT ANY AREAS DISTURBED BY CONSTRUCTION.

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Designed by: AMK
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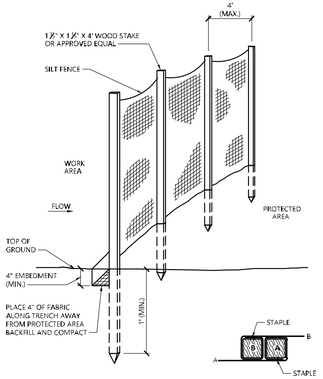
Drawing Title
Erosion and Sediment Control Plan

Drawing Number
C-4.0

Sheet 4 of 5

Project Number
43175.00

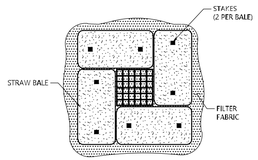


WOOD STAKE JOINT DETAIL

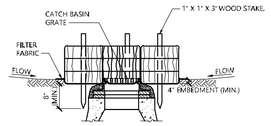
Silt Fence Barrier

1/16

N.T.S. Source: VHB LD_650



PLAN VIEW



SECTION VIEW

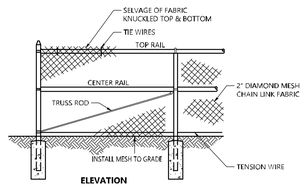
NOTES

1. ENCLOSE STRUCTURE WITH HAYBALES IMMEDIATELY AFTER CATCH BASIN CONSTRUCTION. MAINTAIN UNTIL PAVING BINDER COURSE IS COMPLETE OR A PERMANENT STAND OF GRASS HAS BEEN ESTABLISHED.
2. IF GRATE IS AGAINST EXISTING CURB THEN BALES ARE TO BE PLACED AROUND THREE SIDES OF GRATE ONLY.
3. GRATE TO BE PLACED OVER FILTER FABRIC.
4. BALES SHALL BE INSPECTED PERIODICALLY AND AFTER ALL STORM EVENTS AND REPAIR OR REPLACEMENT SHALL BE PERFORMED PROMPTLY AS NEEDED.

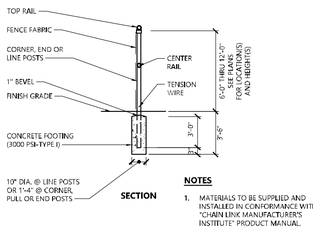
Catch Basin Sediment Trap

1/16

N.T.S. Source: VHB LD_673



ELEVATION



SECTION

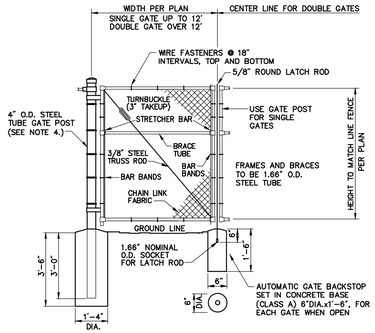
NOTES

1. MATERIALS TO BE SUPPLIED AND INSTALLED IN CONFORMANCE WITH "CHAIN LINK MANUFACTURER'S INSTITUTE" PRODUCT MANUAL.

6' to 12' Chain Link Fence

10/20

N.T.S. Source: VHB LD_480



Notes:

1. CHAIN LINK FABRIC FOR GATES TO BE THE SAME AS REQUIRED FOR FENCE.
2. GATE POST BASE--PORTLAND CEMENT CONCRETE (3000 PSI).
3. FENCE FABRIC, POSTS, FRAMEWORKS, AND HARDWARE SHALL BE GALVANIZED STEEL OR BLACK VINYL (AS INDICATED ON PLANS) PER SPECIFICATIONS.
4. GATE POSTS TO BE USED ON EACH SIDE OF SINGLE AND DOUBLE GATE OPENINGS.

Chain Link Fence Gate

6/08

N.T.S. Source: VHB LD_482

PHOTOVOLTAIC INSTALLATION
Site Location: 2 Ella Grasso Turnpike, Windsor Locks, CT
Owner: Key Capture Energy

IN CASE OF EMERGENCY CALL 911
WINDSOR LOCKS POLICE DEPARTMENT - (860) 627-1461

Notes:

1. THE SITE FACILITY SIGN IS A DRAFT SHOWING THE MINIMUM AMOUNT OF INFORMATION THAT WILL BE PROVIDED. SIGN WILL BE 18" X 24".
2. ALL SIGNS WILL BE MOUNTED ONTO THE CHAIN LINK FENCE.

Danger and Site Facility Signs

1/16

N.T.S. Source: VHB

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1	CSC Set 1 Interrogatories	8/8/2023	SJK
2	CSC Set 2 Interrogatories	10/12/2023	SJK

Designed by: AMK
Checked by: SJK

Issued for: Application
Date: June 2, 2023

Not Approved for Construction

Drawing Title: Site Details

Drawing Number: C-5.0

Sheet 5 of 5

Project Number: 43175.00

MAP REFERENCES:

1. LAYOUT PLAN SITE PLAN PREPARED FOR JOHN BARBARINO 2 ELLA GRASSO TURNPIKE RTE 75 WINDSOR LOCKS, CONNECTICUT, SCALE: 1" 40', DATE: 10/04/12, LAST REVISED: 2/2/13, BY: DENNO LAND SURVEYING & CONSULTING, LLC. W.L.L.R. MAP NUMBER 1659.
2. PREPARED FOR SANTO BENACQUESTA AND ANTONIO SABATINI 8 TURNPIKE ROAD WINDSOR LOCKS, CONN. SCALE: 1" = 40, DATE: JAN. 3, 1985, LAST REVISED: 1/10/85, BY: ALFORD ASSOCIATES, INC. W.L.L.R. MAP NUMBER 619.
3. GRADING AND EROSION CONTROL PLAN SITE PLAN PREPARED FOR JOHN BARBARINO 2 ELLA GRASSO TURNPIKE RTE 75 WINDSOR LOCKS, CONNECTICUT, SCALE: 1" = 40', DATE: 10/04/12, LAST REVISED: 2/2/13, BY: DENNO LAND SURVEYING & CONSULTING, LLC. W.L.L.R. MAP NUMBER 1660.
4. PROPERTY TO BE CONVEYED TO WINDSOR LOCKS HOTEL COMPANY 14-18 ELLA GRASSO TURNPIKE CONN. RTE. 75, WINDSOR LOCKS, CONNECTICUT, SCALE: 1" = 40', DATE: OCT 17, 1983. BY: CLOSE, JENSEN & MILLER. W.L.L.R. MAP NUMBER 558.
5. RIGHT OF WAY MAP TOWN OF WINDSOR LOCKS BRADLEY FIELD CONNECTOR FROM BRADLEY INTERNATIONAL AIRPORT EASTERLY TO THE HARTFORD-SPRINGFIELD EXPRESSWAY. SCALE: 1" = 80'. DATE: SEPTEMBER 4, 1969. BY: CONNECTICUT STATE HIGHWAY DEPARTMENT. MAP NUMBER 165-08 SHEETS 4 & 5 OF 8.

NOTES:

1. BEARINGS, COORDINATES AND ELEVATIONS DEPICTED HEREON ARE BASED UPON THE NORTH AMERICAN DATUM OF 1983 (NAD 83) AND THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88) AND WERE OBTAINED VIA GNSS OBSERVATIONS PROCESSED THROUGH THE SUPERIOR INSTRUMENT RTK GNSS NETWORK.
2. FIELD SURVEY WAS CONDUCTED BY BARTON & LOGUIDICE IN JUNE 2022 & OCTOBER 2022.
3. ABUTTER ADDRESS INFORMATION DEPICTED HEREON TAKEN FROM TOWN OF WINDSOR LOCKS GIS WEBSITE.
4. APPROXIMATE LOCATION OF STORM DRAINAGE DEPICTED HEREON TAKEN FROM MAP REFERENCES #3 & #4. NOT FIELD VERIFIED.
5. SUBJECT PARCEL IS LOCATED IN ZONE X (AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN) AS DEPICTED UPON FIRM FLOOD INSURANCE RATE MAP HARTFORD COUNTY, CONNECTICUT (ALL JURISDICTIONS) PANEL 216 OF 675. MAP NUMBER 09003C0216F EFFECTIVE DATE: SEPTEMBER 26, 2008.
6. 12" CMP FROM CB 'DCL' (K) DEPICTED ON SURVEY FLOWS IN SOUTHWESTERLY DIRECTION ACROSS PROPERTY LINE TO CB 'CL' (J).
7. UNDERGROUND UTILITY, STRUCTURE AND FACILITY LOCATIONS DEPICTED AND NOTED HEREON HAVE BEEN COMPILED, IN PART, FROM RECORD MAPPING SUPPLIED BY, THE RESPECTIVE UTILITY COMPANIES OR GOVERNMENT AGENCIES, FROM PAROL TESTIMONY AND FROM OTHER SOURCES. THESE LOCATIONS MUST BE CONSIDERED APPROXIMATE IN NATURE. ADDITIONALLY, OTHER SUCH FEATURES MAY EXIST ON THE SITE. THE EXISTENCE OF WHICH ARE UNKNOWN TO BARTON & LOGUIDICE. THE SIZE, LOCATION AND EXISTENCE OF ALL SUCH FEATURES MUST BE FIELD DETERMINED AND VERIFIED BY THE APPROPRIATE AUTHORITIES PRIOR TO CONSTRUCTION. CALL BEFORE YOU DIG: 1-(800) 922-4455.

PROPERTY DESCRIPTION (SURVEY):

A CERTAIN PIECE OR PARCEL OF LAND SITUATED IN THE TOWN OF WINDSOR LOCKS, COUNTY OF HARTFORD AND STATE OF CONNECTICUT, AND IS MORE PARTICULARLY BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT IN THE NORTHERLY LINE OF LAND OF THE STATE OF CONNECTICUT, KNOWN AS CONNECTICUT ROUTE 20, ALSO KNOWN AS BRADLEY FIELD CONNECTOR, SAID POINT IS LOCATED A DISTANCE OF 480.47' WESTERLY ALONG THE NORTHERLY LINE OF LAND OF THE STATE OF CONNECTICUT, KNOWN AS CONNECTICUT ROUTE 20, ALSO KNOWN AS BRADLEY FIELD CONNECTOR FROM THE WESTERLY STREETLINE OF ELLA T. GRASSO TURNPIKE, THENCE;

ALONG A CURVE TO THE RIGHT WITH AN ARC LENGTH OF 287.58 FEET AND A RADIUS OF 2347.90 FEET TO A POINT, THENCE;

N54°49'43" W A DISTANCE OF 103.24 FEET TO A POINT, THENCE;

ALONG A CURVE TO THE LEFT WITH AN ARC LENGTH OF 705.28 FEET AND A RADIUS OF 4019.72 FEET, THE LAST THREE COURSES ALONG LAND NOW OR FORMERLY THE STATE OF CONNECTICUT, TO A POINT, THENCE;

N01°14'14" E A DISTANCE OF 235.62 FEET ALONG LAND NOW OR FORMERLY HAMILTON SUNSTRAND TO A POINT, THENCE;

S74°12'01" E A DISTANCE OF 968.38 FEET ALONG LAND NOW OR FORMERLY LPRI ELLA GRASSO LLC TO A POINT, THENCE;

S15°47'59" W A DISTANCE OF 200.00 FEET TO A POINT, THENCE;

S59°53'01" W A DISTANCE OF 51.94 FEET TO A POINT, THENCE;

S74°12'01" E A DISTANCE OF 129.67 FEET TO A POINT, THENCE;

S15°47'59" W A DISTANCE OF 52.75 FEET, THE LAST FOUR COURSES ALONG LAND NOW OR FORMERLY CAMRAC, INC. TO THE POINT AND PLACE OF BEGINNING.

ALTA NOTES:

3. SUBJECT PARCEL IS LOCATED IN ZONE X (AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN) AS DEPICTED UPON FIRM FLOOD INSURANCE RATE MAP HARTFORD COUNTY, CONNECTICUT (ALL JURISDICTIONS) PANEL 216 OF 675. MAP NUMBER 09003C0216F EFFECTIVE DATE: SEPTEMBER 26, 2008.
4. SUBJECT PARCEL AREA: 222,076 SQ. FT. OR 5.10 ACRES.
7. NO BUILDINGS OBSERVED.
8. NO SUBSTANTIAL FEATURES OBSERVED ON SUBJECT PARCEL.
10. NO PARTY WALLS OBSERVED.
16. NO EVIDENCE OF RECENT EARTH MOVING WORK, BUILDING CONSTRUCTION, OR BUILDING ADDITIONS.
17. NO OBSERVED CHANGES IN STREET RIGHT OF WAYS. NO EVIDENCE OF RECENT STREET OR SIDEWALK CONSTRUCTION.
20. NO EXISTING SOLAR LEASES AND EASEMENTS FOUND FOR SUBJECT PARCEL.

PROPERTY DESCRIPTION (RECORD):

A CERTAIN PIECE OR PARCEL OF LAND, TOGETHER WITH OF ALL OF THE BUILDINGS AND IMPROVEMENTS THEREON, SITUATED OFF THE WESTERLY SIDE OF TURNPIKE ROAD, ALSO KNOWN AS ELLA T. GRASSO TURNPIKE, IN THE TOWN OF WINDSOR LOCKS, COUNTY OF HARTFORD AND STATE OF CONNECTICUT, TO THE REAR OF PROPERTY KNOWN AS NO. 8 TURNPIKE ROAD, AND BEING SHOWN AS "PARCEL B 5.10 ACRES (INCLUDING 0.40 +/- ACRE EASEMENT FOR FUTURE PARKING)" ON A MAP OR PLAN ENTITLED: "PREPARED FOR SANTO BENACQUISTA AND ANTONIO SABATINI 8 TURNPIKE ROAD WINDSOR LOCKS, CONN. ALFORD ASSOCIATES CIVIL ENGINEERS WINDSOR, CONNECTICUT WILSON M. ALFORD, SR. P.E. & L.S. WILSON M. ALFORD, JR., P.E. & L.S. ALFORD ASSOCIATES, INC. DATE: JAN. 3, 1985 SCALE: 1 IN = 40 FT. DATE REVISION 1/4/85 ADD. NOTE #15 1/10/85 ADD. EASEMENT "C" ", WHICH MAP OR PLAN IS ON FILE IN THE OFFICE OF THE TOWN CLERK IN SAID TOWN OF WINDSOR LOCKS, TO WHICH REFERENCE IS HEREBY MADE. SAID PREMISES ARE MORE PARTICULARLY BOUNDED AND DESCRIBED AS FOLLOWS:

COMMENCING AT AN IRON PIN SET IN THE NORTHERLY LINE OF LAND OF THE STATE OF CONNECTICUT KNOWN AS CONNECTICUT ROUTE 20 AND ALSO KNOWN AS THE BRADLEY FIELD CONNECTOR, WHICH IRON PIN IS 480.46 FEET WESTERLY, AS MEASURED IN THE NORTHERLY LINE OF SAID CONNECTICUT ROUTE 20 OR BRADLEY FIELD CONNECTOR, FROM A MONUMENT SET IN THE WESTERLY STREET LINE OF TURNPIKE ROAD ALSO KNOWN AS ELLA T. GRASSO TURNPIKE, AND WHICH IRON PIN MARKS THE SOUTHEASTERLY CORNER OF THE WITHIN DESCRIBED PREMISES;

THENCE N 15° 48' 10" E., ALONG PARCEL A, AS SHOWN ON SAID MAP, A DISTANCE OF 52.75 FEET TO A POINT;

THENCE N 74° 11' 50" W., CONTINUING ALONG PARCEL A AS SHOWN ON SAID MAP, A DISTANCE OF 129.67 FEET TO A POINT;

THENCE N 59° 52' 50" W., CONTINUING ALONG SAID PARCEL A AS SHOWN ON SAID MAP, A DISTANCE OF 51.94 FEET TO A POINT;

THENCE N 15° 48' 10" E., CONTINUING ALONG SAID PARCEL A, AS SHOWN ON SAID MAP, A DISTANCE OF 200.00 FEET TO A POINT IN LINE OF LAND NOW OR FORMERLY OF RICHARD A. & PAULINE MINER;

THENCE N 74° 11' 50" W., ALONG LAND NOW OR FORMERLY OF RICHARD A. & PAULINE MINER, A DISTANCE OF 968.38 FEET TO A POINT IN LINE OF LAND NOW OR FORMERLY OF UNITED TECHNOLOGIES CORPORATION HAMILTON STANDARD DIVISION;

THENCE S 1° 14' 25" W., ALONG LAND NOW OR FORMERLY OF UNITED TECHNOLOGIES CORPORATION HAMILTON STANDARD DIVISION, A DISTANCE OF 235.64 FEET TO A POINT IN LINE OF LAND OF THE STATE OF CONNECTICUT KNOWN AS CONNECTICUT ROUTE 20 AND ALSO KNOWN AS THE BRADLEY FIELD CONNECTOR;

THENCE IN A GENERAL EASTERLY DIRECTION ALONG THE ARC OF THE CURVE OF LAND OF THE STATE OF CONNECTICUT KNOWN AS CONNECTICUT ROUTE 20 AND ALSO KNOWN AS THE BRADLEY FIELD CONNECTOR, HAVING A DELTA OF 10°30'10" AND A RADIUS OF 4019.72 FEET, A DISTANCE OF 705.27 FEET TO A POINT;

THENCE S 54° 49' 05" E., CONTINUING ALONG LAND OF THE STATE OF CONNECTICUT KNOWN AS CONNECTICUT ROUTE 20 AND ALSO KNOWN AS THE BRADLEY FIELD CONNECTOR, A DISTANCE OF 103.24 FEET TO A POINT;

THENCE CONTINUING IN A GENERAL EASTERLY DIRECTION ALONG THE ARC OF THE CURVE OF LAND OF THE STATE OF CONNECTICUT KNOWN AS CONNECTICUT ROUTE 20 AND ALSO KNOWN AS THE BRADLEY FIELD CONNECTOR, HAVING A DELTA OF 7° 01' 49", A DISTANCE OF 287.59 FEET TO THE POINT AND PLACE OF BEGINNING.

TOGETHER WITH A PERMANENT EASEMENT TO THE GRANTEE HEREIN AND ITS SUCCESSORS AND ASSIGNS FOREVER FOR VEHICULAR AND PEDESTRIAN TRAFFIC, OVER A PORTION OF PARCEL A AS SHOWN ON SAID MAP AND SHOWN AND DESIGNATED AS

"ACCESS EASEMENT 'A' " AND "ACCESS EASEMENT 'B' " ON THE AFORESAID MAP AND MORE PARTICULARLY DESCRIBED BY THE FOLLOWING COURSES AND DISTANCES: ACCESS EASEMENT "A": STARTING AT AN ANGLE POINT IN THE WEST HIGHWAY LINE OF TURNPIKE ROAD ALSO KNOWN AS ELLA T. GRASSO TURNPIKE, SAID POINT BEING 20.05 FEET SOUTH, AS MEASURED IN SAID HIGHWAY LINE, FROM THE SOUTHEAST CORNER OF PROPERTY NOW OR FORMERLY OF HARRY D. VANDERBILT AS SHOWN ON PLAN IS ON FILE IN THE OFFICE; THENCE S48° 38' 50" W., IN THE WEST STREET LINE OF SAID TURNPIKE ROAD ALSO KNOWN AS ELLA T. GRASSO TURNPIKE, 49.87 FEET TO A POINT; THENCE ALONG A CURVE TO THE LEFT, 39.92 FEET TO A POINT; SAID CURVE HAVING A RADIUS OF 30.00 FEET AND A CENTRAL ANGLE OF 76° 14' 40"; THENCE ALONG A CURVE TO THE RIGHT 82.18 FEET TO A POINT, SAID CURVE HAVING A RADIUS OF 155.00 FEET AND A CENTRAL ANGLE OF 30° 22' 45"; THENCE ALONG A CURVE TO THE RIGHT 383.77 FEET TO A POINT, SAID CURVE HAVING A RADIUS OF 2979.00 FEET AND A CENTRAL ANGLE OF 7° 22' 50". THE THREE PRECEEDING COURSES BEING THROUGH PARCEL A; THENCE N 15° 48' 10" E., ALONG PARCEL B, 34.00 FEET TO A POINT; THENCE ALONG A CURVE TO THE LEFT, 379.83 FEET TO A POINT, SAID CURVE HAVING A RADIUS OF 2945.00 FEET TO A POINT AND A CENTRAL ANGLE OF 7° 23' 25"; THENCE ALONG A CURVE TO THE LEFT 64.16 FEET TO A POINT, SAID CURVE HAVING A RADIUS OF 121.00 FEET AND A CENTRAL ANGLE OF 30° 22'45"; THENCE ALONG A CURVE TO THE RIGHT 39.78 FEET TO A POINT, SAID CURVE HAVING A RADIUS OF 64.00 FEET AND A CENTRAL ANGLE OF 35° 37' 00"; THENCE S 75° 35' 15" E, 47.59 FEET TO THE POINT OF BEGINNING; THE FOUR PRECEEDING COURSES BEING THROUGH PARCEL A: CONTAINING 17,750 SQUARE FEET.

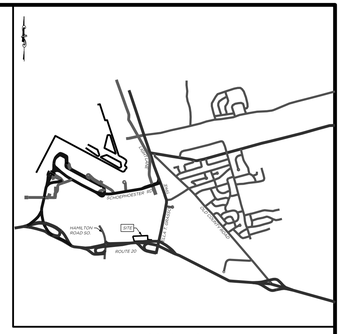
ACCESS EASEMENT "B": STARTING AT A POINT ON THE NORTH LINE OF PARCEL A, SAID POINT BEING 138.00 FEET WESTERLY FROM THE WEST STREET LINE OF TURNPIKE ROAD; THENCE 20° 12' 00" W., 30.33 FEET TO A POINT; THENCE ALONG A CURVE TO THE LEFT, 37.99 FEET TO A POINT, SAID CURVE HAVING A RADIUS OF 35.00 FEET AND A CENTRAL ANGLE OF 62° 11' 15"; THE TWO PRECEEDING COURSES BEING THROUGH PARCEL A; THENCE ALONG A CURVE TO THE RIGHT 24.49 FEET, THROUGH PARCEL A AND ALSO ALONG ACCESS EASEMENT "A", TO A POINT, SAID CURVE HAVING A RADIUS OF 121.00 FEET AND A CENTRAL ANGLE OF 11° 35' 45"; THENCE ALONG A CURVE TO THE RIGHT, 42.00 FEET TO A POINT, SAID CURVE HAVING A RADIUS OF 55.00 FEET AND A CENTRAL ANGLE OF 43° 44' 55"; THENCE N 20° 12' 00" E, 30.33 FEET TO A POINT; THE TWO PRECEEDING COURSES BEING THROUGH PARCEL A; THENCE S 69° 48' 00" E , IN THE NORTH LINE OF PARCEL A, 20.00 FEET TO THE POINT OF BEGINNING: CONTAINING 1410 SQUARE FEET.

SAID EASEMENTS ARE CONVEYED TOGETHER WITH AND SUBJECT TO THE TERMS AND CONDITIONS SET FORTH IN A DEED FROM CLIFFORD L. OSTERLING TO ANTONIO SABATINI, SANTO BENACQUISTA AND JOSEPH A. EREMITA DATED FEBRUARY 5, 1985 AND RECORDED AT VOLUME 152 AT PAGE 68 OF THE WINDSOR LOCKS LAND RECORDS.

TITLE EXCEPTIONS:

STATED TO AFFECT 2 ELLA GRASSO TPKE, AS LISTED IN OLD REPUBLIC NATIONAL TITLE COMPANY COMMITMENT NO. 2202024 DATED MAY 9, 2022.

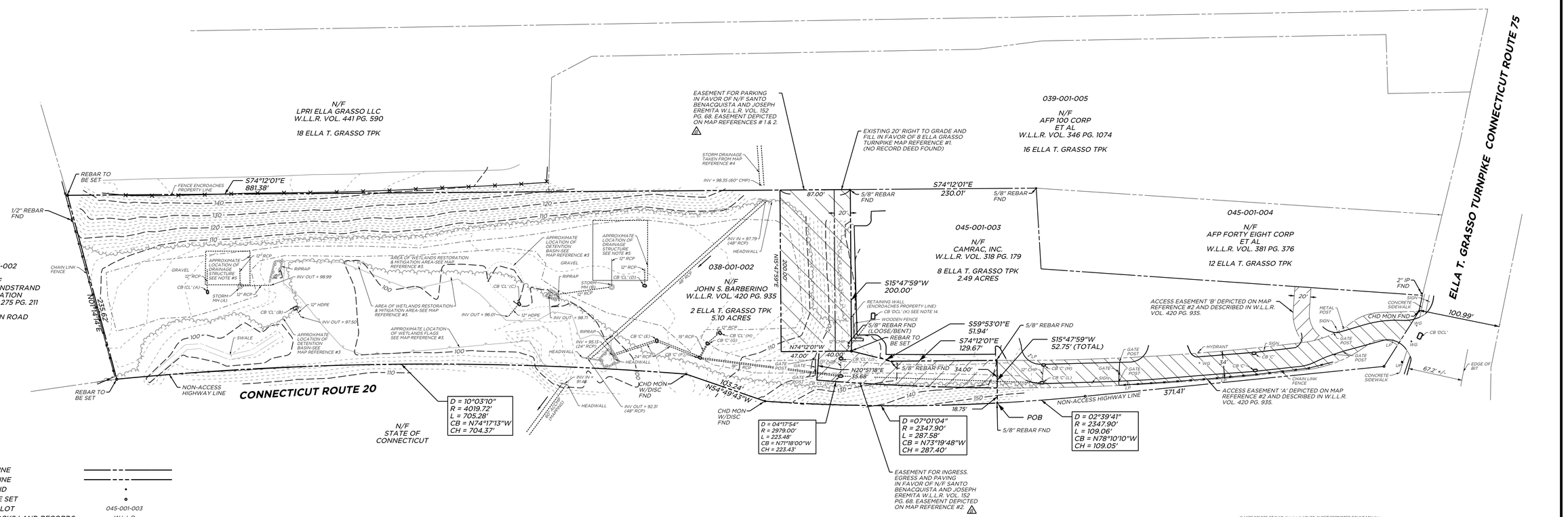
1. NOTES, CONDITIONS AND MATTERS AS MAY APPEAR ON A MAP ENTITLED, "PREPARED FOR SANTO BENACQUISTA AND ANTONIO SABATINI 8 TURNPIKE ROAD WINDSOR LOCKS, CONN: ALFORD ASSOCIATES CIVIL ENGINEERS WINDSOR, CONNECTICUT WILSON M. ALFORD, SR. P.E. & L.S. WILSON M. ALFORD, JR. P.E. & L.S. ALFORD ASSOCIATES, INC. DATE: JAN. 3, 1985 SCALE: 1 IN = 40 FT. DATE REVISION 1/4/85 ADD. NOTE #15 1/10/85 ADD. EASEMENT "C" ", WHICH MAP OR PLAN IS ON FILE IN THE WINDSOR LOCKS TOWN CLERK'S OFFICE. (NOT PLOTTABLE).
2. THE EFFECT, IF ANY, OF A VARIANCE GRANTED BY THE WINDSOR LOCKS PLANNING AND ZONING COMMISSION, DATED DECEMBER 17, 2012 AND RECORDED DECEMBER 22, 2016 IN VOL 463 AT PAGE 57 OF THE WINDSOR LOCKS LAND RECORDS. (NOT PLOTTABLE)
3. RESTRICTIONS AND COVENANTS AS DEFINED IN A DEED RECORDED FEBRUARY 14, 1985 IN VOL 152 AT PAGE 68 OF THE WINDSOR LOCKS LAND RECORDS. (PLOTTABLE).



LOCUS MAP
(NOT TO SCALE)

SCHEDULE OF INVERTS

STRUCTURE NUMBER	TOP OF FRAME	INVERT ELEVATION	PIPE DESCRIPTION	DIRECTION
CB CL 'A'	102.34	98.94 (OUT)	12" RCP	N
CB CL 'B'	100.01	97.91 (OUT)	12" HDPE	SE
CB CL 'C'	100.19	96.89 (OUT)	12" HDPE	SW
CB CL 'D'	101.58	98.98 (OUT)	12" RCP	N
CB C 'E'	100.85	96.85 (IN)	24" RCP	SE
		96.65 (OUT)	24" RCP	SW
CB C 'F'	105.28	101.08 (IN)	15" RCP	NE
		100.98 (IN)	18" RCP	SE
		100.68 (OUT)	24" RCP	SW
CB C 'G'	105.02	101.32 (IN)	12" RCP	NE
		101.22 (OUT)	15" RCP	SW
CB CL 'H'	104.65	101.65 (OUT)	12" RCP	SW
CB CL 'I'	124.09	120.89 (IN)	15" CMP	SE
		120.79 (IN)	12" CMP	NE
		120.69 (OUT)	18" RCP	W
CB CL 'J'	124.23	121.23 (IN)	12" CMP	NE
		120.93 (OUT)	12" CMP	SW
CB DCL 'K'	129.14	125.44 (OUT)	12" CMP	SW
CB C 'L'	144.55	134.45 (IN)	12" CMP	NE
		134.25 (OUT)	15" CMP	NW
CB C 'M'	144.52	136.52 (OUT)	12" CMP	SW
STORM MH 'A'	102.91	98.86 (IN)	12" RCP	NE
		98.81 (OUT)	12" RCP	SE
STORM MH 'B'	101.72	98.92 (IN)	12" RCP	NE
		98.82 (OUT)	12" RCP	SW



LEGEND

PROPERTY LINE	
EASEMENT LINE	
REBAR FOUND	•
REBAR TO BE SET	o
MAP-BLOCK-LOT	045-001-003
WINDSOR LOCKS LAND RECORDS	W.L.L.R.
RIPRAP	
TREELINE	
GRAVEL	
SWALE	
CATCH BASIN	CB 'C'; CB 'CL'
LIGHTPOLE	LP
DOUBLE CATCH BASIN CL	DCL
MINOR CONTOUR	
MAJOR CONTOUR	
CHAIN LINK FENCE	
WETLANDS LINE	
UTILITY POLE	•
WATER GATE	WG

60 0 60 120 180 240
SCALE: 1"=60'

TO: KCE CT 9, LLC AND STEWART TITLE:

THIS IS TO CERTIFY THAT THIS MAP AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2021 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS AND INCLUDES ITEMS 1, 2, 3, 4, 5, 7(a), 8, 10, 16, 17, 18 & 20 OF TABLE A THEREOF. THE FIELD WORK WAS COMPLETED JUNE & OCTOBER 2022.

TO THE BEST OF MY KNOWLEDGE AND BELIEF, THIS MAP IS SUBSTANTIALLY CORRECT AS NOTED HEREON.

KEVIN J. FLOWERS, CT L.S. #70513

STATE OF CONNECTICUT KEVIN J. FLOWERS 70513 REGISTERED LAND SURVEYOR

ANY ORIGINAL OR DUPLICATE OF THIS MAP IS INVALID UNLESS IT BEARS THE EMBOSSED SEAL OF THE SURVEYOR WHOSE REGISTRATION APPEARS ABOVE. NO OTHER CERTIFICATION OR WARRANTY IS EXPRESSED OR IMPLIED.

J:\4428\001\005 CT 9 Windsor Locks\PLOT_SHEET\PERIMETER BOUNDARY.dgn

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PROJ. ENGINEER	ASF
PROJ. MANAGER	WEW
OFFICE REVIEW	WEW
REVISIONS	
SCALE:	1" = 60'

ALTA/NSPS LAND TITLE SURVEY

PREPARED FOR
KEY CAPTURE ENERGY, LLC

KCE CT9 WINDSOR LOCKS

2 ELLA T. GRASSO TPKE — WINDSOR LOCKS, CT

PROJECT	DATE	SHEET NO.	OF
4428-001-005	7/18/22	1	1

Recommended Fire Department Response to Energy Storage Systems (ESS) Part 1

Events involving ESS Systems with Lithium-ion batteries can be extremely dangerous. All fire crews must follow department policy, and train all staff on response to incidents involving ESS. Compromised lithium-ion batteries can produce significant amounts of flammable gases with potential risk of deflagration and fire.

1. If a commercial or utility install, follow pre-plan and do not enter structure.
2. Residential setting response, control power to the unit, ventilate the area, and protect exposures.
3. In all cases contact manufacture technical support as soon as possible.

This guide serves as a resource for emergency responders with regards to safety surrounding lithium ion Energy Storage Systems (ESS). Each manufacturer has specific response guidelines that should be made available to first responders prior to activation.

ESS systems come in many shapes and sizes. They may be affiliated with renewable systems (wind, photovoltaic systems, etc) or used as standby power. ESS Systems can be installed in single family homes too large commercial and utility applications.

Pre-Incident

Modify or establish your department policy or standard response guideline to ESS incidents. Include guidelines for mitigation of the event which may include a defensive operations such as non-intervention and manage fire propagation or protect exposures.

Review installation procedures for systems with the various code officials including Building, Fire, and Electrical

ESS systems must be installed per the adopted fire and building codes in the region.

For the 2015 editions of the International Fire Code and NFPA 1 Fire Code and earlier editions the necessary safety requirements are not present (Consider language in 2021 Fire Codes or NFPA 855).

Ensure pre-incident plans are covering location, type, disconnect, and other contact information

Pre-incident plans should provide rapid response resources for company officers specific to your area and region including OEM emergency contact information

Train on department policy and perform practical scenarios which support the response plan

INCIDENT ACTIONS

The fire crew should allow the battery to burn itself out, during which it is recommended to apply water spray to neighboring battery enclosures and exposures to further mitigate the spread of the hazards rather than directly onto the burning unit.

Applying water directly to the affected enclosure will not stop the thermal runaway event, as the fire will be located behind several layers of steel material, and direct application of water has shown to only delay the eventual combustion of the entire unit.

- Firefighters must wear full personal protective equipment, including SCBA with face-piece.
- If identified in pre-incident plan, shut off the unit/system by operating any visible disconnects or E-stops (shutting off the disconnect does not remove the energy from the battery). To isolate any PV system and ESS in an emergency, multiple disconnects may need to be shut off. This could include circuit breakers, knife-blade disconnects, or other switches.
- Lithium ion batteries that are in thermal runaway or off gasing will create hazardous atmospheres. Firefighters must stay out of the vapor cloud and not rely on gas monitors (without consideration of cross contamination of the gas sensors)
- Due to construction of the unit, thermal imaging cameras may not give true thermal conditions.

Events can occur from damage, exterior fire, or a malfunction. Smoke or suspicious odor from an ESS system can be an indication of a hazardous condition. When batteries or cells enter thermal runaway, there is typically a period of smoke (may be under pressure). The smoke is most likely flammable and may ignite at any time.

Responding to a venting ESS product

- Evacuate the area. **Never open any doors or remove panels to ESS units.**
- Contact vendor-specific technical support for assistance including BMS data.
- Residential units that are located inside a dwelling unit or garage, the space should be properly ventilated with charged hand-lines in place.
- Maintain a safe distance from the ESS and monitor. A remote FDC may be present on larger commercial or utility ESS to support a sprinkler system inside the enclosure.
- Each manufacturer will have a recommended time for a battery pack to cool down. This can be near a full work cycle of 12 hours or more.
- Defensive Firefighting, Water spray is the preferred agent for response to lithium-ion battery fires *(Lithium-ion is not water reactive)*.
    - If a fire has not developed and only smoke is visible, take a defensive stance toward the system and be prepared to apply water spray.
    - If a fire develops, take a defensive stance toward the burning unit and apply water spray to neighboring battery enclosures and exposures.
- Maintaining a safe distance from the unit involved (large commercial systems, at least 300').
- Response crews should allow the battery to burn out. Water should be applied to adjacent battery enclosures and exposures (building).

First Responders Guide to Lithium-Ion Battery Energy Storage System Incidents

1 Introduction

This document provides guidance to first responders for incidents involving energy storage systems (ESS). The guidance is specific to ESS with lithium-ion (Li-ion) batteries, but some elements may apply to other technologies also. Hazards addressed include fire, explosion, arc flash, shock, and toxic chemicals. For the purposes of this guide, a facility is assumed to be subject to the 2023 revision of NFPA 855 [B8][1] and to have a battery housed in a number of outdoor enclosures with total energy exceeding 600 kWh, thus triggering requirements for a hazard mitigation analysis (HMA), fire and explosion testing in accordance with UL 9540A [B14], emergency planning, and annual training. (The 2021 International Fire Code (IFC) [B2] has language that has been largely harmonized with NFPA 855, so the requirements are similar.)

This guide provides recommendations for pre-incident planning and incident response. Additional tutorial content is provided for each of the hazard categories. The Bibliography provides references to applicable codes and standards, and other documents of interest.

2 Abbreviations and acronyms

AHJ	authority having jurisdiction
BMS	battery management system
ERP	emergency response plan (designated in NFPA 855 as 'emergency operations plan')
ESS	energy storage system
HMA	hazard mitigation analysis
IDLH	immediately dangerous to life and health
LEL	lower explosive limit
LFL	lower flammable limit
LFP	lithium iron phosphate battery
Li-ion	lithium-ion
NCA	lithium nickel-cobalt-aluminum oxide
NFPA	National Fire Protection Association
NMC	lithium nickel-manganese-cobalt oxide
PPE	personal protective equipment
SCBA	self-contained breathing apparatus
SDS	safety data sheet
SME	subject-matter expert
UFL	upper flammable limit
UL	Underwriters Laboratories

[1] References in square brackets are to the Bibliography at the end of this guide.

3 Pre-incident planning

3.1 General

The pre-incident plan is used by first responders in effectively managing emergencies. It is required to be available to the incident commander during an event. The plan should be in accordance with the newly released NFPA 1660 [B9]. From the front matter of this new document: “The 2024 edition of NFPA 1660 integrates NFPA 1600, NFPA 1616, and NFPA 1620 into a single standard that establishes a common set of criteria for emergency management and business continuity programs; mass evacuation, sheltering, and re-entry programs; and the development of pre-incident plans for emergency response personnel.” Pre-incident planning, formerly in NFPA 1620, is in Chapters 17 through 23.

Additional ESS-specific guidance is provided in the NFPA Energy Storage Systems Safety Fact Sheet [B10]. NFPA 855 requires several submittals to the authority having jurisdiction (AHJ), all of which should be available to the pre-incident plan developer. These include:

- Results of fire and explosion testing conducted in accordance with UL 9540A
- Hazard mitigation analysis (HMA)
- Emergency response plan (ERP)

While the main document for development of the pre-incident plan is the ERP, the UL 9540A test results and HMA may provide useful additional information for the plan and associated training.

3.2 UL 9540A test results

Testing to UL 9540A provides information at a level of detail that may not be included in the ERP (see 3.4). Cell-level testing provides a breakdown of the composition of vented gas from cells in thermal runaway, including flammable gases and vapors. Potentially significant concentrations of highly toxic hydrogen fluoride may also be produced. Video recordings are made of testing at unit (rack) and installation levels (if the latter is performed). These test results and videos can be used in first-responder training (see 3.6) since they provide insight into system behavior in a thermal runaway event that cannot be gained from outside the enclosure.

3.3 HMA

While testing to UL 9540A is valuable, it involves initiation of thermal runaway in a limited number of cells. This method does not address larger-scale failures that could occur, for example, with a loss of insulation and subsequent arcing, or with mechanical damage potentially caused by vehicle impacts or flying debris. Such failures could result in a fire that consumes the entire enclosure. The HMA should address such an occurrence and should assess, at least by simulation or calculation, the maximum temperature rise of cells in adjacent enclosures. This information is used to justify limited spacing between enclosures and can also be used to determine whether first responders should intervene.

3.4 ERP

The ERP forms the basis for pre-incident planning. Among other information, the ERP should include details on the following:

- Site overview and ESS nameplate information
- Potential hazards
- Fire protection and safety systems
- Emergency response recommendations

- Emergency contacts, including subject-matter expert (SME)
- Safety data sheets (SDS)
- PPE

The firefighting philosophy should be outlined, whether that be to suppress the fire using built-in systems or to let it burn out safely (and in some cases, to make it burn. See 5.1.)

3.5 Availability of battery management system data

Access to battery management system (BMS) data is critical for informed incident response. Depending on the severity of the incident, it may be possible to observe the current conditions within the enclosure where the incident began, such as module temperatures and readings for any gas sensing systems that may be installed. If a fire is in progress, it is important to monitor module temperatures in adjacent enclosures, to determine whether additional actions should be taken.

BMS access may be direct, such as using a first responder's computer to access the local human-machine interface or a remote digital twin, or it may be indirect, such as through a voice connection to a network operations center or SME. Data may also be available on a screen local to each enclosure, but this should not be accessed if there is any danger of fire, explosion, or toxic emissions.

3.6 Training

NFPA 855 mandates initial and annual refresher training for facility staff (see section 4.3.2.2). First responders should be included in such training, either in person or via video recordings of the training sessions. Trainees should be familiar with the site layout, installed equipment, SDS contents, and emergency response recommendations of the ERP.

4 Incident response

4.1 General

An incident command system should be established immediately on arrival, and an appropriate incident command individual should have access to BMS data (see 3.5). Working with facility personnel, the scene should be assessed, and potential hazards should be communicated to all responders.

4.2 Personal protective equipment (PPE)

Full firefighter protective gear should be worn where there is any possibility of fire or explosion, including proper use of self-contained breathing apparatus (SCBA). If there is no risk of fire or explosion per the project incident command, protective clothing for arc-flash and shock hazards should be worn by anyone operating within the arc-flash boundary (see 4.5). Jewelry and other metallic items should be removed.

4.3 Fire

If a fire is in progress, flammable gases will be consumed as they are released, and an explosion is unlikely. The safest approach is to allow the enclosure to burn in a controlled manner, so that all fuel is consumed and the possibility of reignition is minimized. BMS data from adjacent enclosures should be monitored to verify that module temperatures remain at safe levels (typically up to around 80 °C/180 °F). Application of water should be limited to cooling and protecting nearby exposures (and adjacent enclosures if module temperatures are above thresholds identified in the ERP).

Once the fire has self-extinguished, there may be ongoing releases of flammable or toxic gases. Full protective gear and SCBA should continue to be used until releases (such as carbon monoxide) are measured to be at a safe level.

If an earlier fire has been extinguished by the enclosure's fire suppression system, there is a potential for ongoing release of flammable gases, with a corresponding explosion risk (see 4.4). See 5.1 for additional discussion of fire hazards.

4.4 Explosion

If system sensors (temperature, smoke, heat, and/or flammable gas) indicate that a thermal runaway event occurred, but there is no sign of fire, it should be assumed that an explosion risk is present. Personnel should be stationed outside the potential blast radius, at an angle to the doors, and upwind of the enclosure. The enclosure should be inspected from a distance using BMS data to determine the status of the system, including module temperatures, gas sensing, and ventilation systems for gas exhaust. If the BMS is not functioning because of system damage, thermal scanning may provide an indication of ongoing thermal issues. However, responders should be aware that enclosure insulation may make it difficult to make an accurate assessment of internal temperature.

If the enclosure has been vented by automatic door or panel opening and there is no indication of high temperatures, the enclosure may be approached by responders using continuous gas monitoring to warn of any residual atmospheric risk.

If the enclosure appears to be sealed – for example, if gas venting is accomplished through a magnetic flap or if there is no provision for gas venting – BMS data and external visual assessment should be reviewed with the SME before attempting to open the enclosure.

See 5.2 for additional discussion of explosion hazards.

4.5 Arc flash and electric shock

Even when disconnected from external circuits, batteries retain their stored energy and should be considered to be energized. A battery may be partially destroyed by fire yet retain stranded energy at hazardous levels. All batteries, whatever their visual condition, should be treated as fully charged with respect to arc flash and electric shock hazards.

Appropriate PPE should be worn by properly trained individuals when working within the arc flash boundary. See 5.3 for additional discussion of arc flash and shock hazards.

4.6 Toxic chemicals

Toxic chemicals, including hydrogen fluoride, hydrogen chloride, hydrogen cyanide, and carbon monoxide, may be released during an incident. Spraying water on smoke or vapor released from the battery, whether burning or not, may cause skin or lung irritation and contaminated run-off similar to plastic fires [B1]. This is one additional reason for allowing the battery to burn in a controlled manner. The site perimeter should be entered only by trained firefighters wearing full protective gear and using SCBA. See 5.4 for additional discussion of toxic chemical hazards.

5 Discussion of Li-ion hazards

5.1 Fire

There is ongoing debate in the energy storage industry over the merits of fire suppression in outdoor battery enclosures. On one hand, successful deployment of clean-agent fire suppression in response to a limited event (for example, an electrical fire or single-cell thermal runaway with no propagation) can limit damage to the system, which can then be expeditiously returned to service. On the other hand, actuation of the same system in response to a large event, such as a multicell arcing fault, may knock out or prevent a fire but allow ongoing release of flammable gases, thus creating an explosion hazard.

Some ESS designs employ a 'make it burn' strategy, in which a sparker ignites flammable gas when the lower flammable limit (LFL) is exceeded but before the lower explosive limit (LEL) is reached. Such designs do not include fire suppression, on the basis that the loss of an enclosure through controlled burning is preferable to increasing the risk of an explosion. This strategy can be effective for Li-ion technologies based on transition metal oxides, such as lithium nickel-cobalt-aluminum oxide (NCA) and lithium nickel-manganese-cobalt oxide (NMC) materials, which release oxygen during thermal runaway, thus maintaining a flammable gas mixture. The same arrangement would potentially be less effective for batteries using lithium iron phosphate (LFP) material, as discussed in 5.2.

There are pros and cons to each of the common fire-suppression media in use today, including clean agents, inert gases, aerosols, and water.

- Clean agents, such as Novec 1230®, and inert gases, such as nitrogen, will extinguish small fires without causing extensive damage within the enclosure; they also have a cooling effect, which can assist in limiting thermal runaway propagation. In a larger-scale event, such as a multi-cell arcing fault, their effect may be temporary and may result in ongoing propagation with the risk of reignition or explosion. Also, inert gases are oxygen-depleting and cannot be used in structures where personnel may be present.
- Aerosol devices, such as Stat-X®, can be self-actuating, releasing based on elevated temperature without the need for control systems. They are effective on small fires and can help to limit initiation of thermal runaway. The aerosol itself is typically alkaline and may damage BMS and other electronic components in the enclosure. These devices are unlikely to be effective in larger-scale events or when thermal runaway is freely propagating between cells or modules.
- Water is the most efficient medium for cooling cells below the level at which thermal runaway can occur. However, to be effective, the water must be able to reach cells that may be otherwise shielded within closely spaced modules. This means that directed spray across the top of each module is more likely to achieve full extinguishing and arresting of propagation than can be realized with ceiling-mounted sprinklers, and this precise coverage may not always be feasible to achieve. Liberal use of water may also serve as the initiator for electrical arcing that may cause thermal runaway in otherwise unaffected modules. Additionally, the combination of water and highly energized battery systems could electrolytically generate more explosive hydrogen gas. Finally, similar to plastics fires [B1] use of water for directly targeting a fire will also create contaminated run-off [B11], which must be contained and removed for treatment.

5.2 Explosion

Venting of all Li-ion cells results in the release of a gas mixture with high levels of hydrogen, carbon monoxide, and carbon dioxide. Depending on the circumstances, there may also be a fog of unreacted flammable organic compounds, and hydrogen fluoride (normally in trace amounts, but can be higher). The volume of gas released is typically orders of magnitude greater than the cell volume. In the absence of fire, this gas mixture poses an explosion risk.

NFPA 855 requires design provisions for either explosion prevention in compliance with NFPA 69 [B5], or explosion management according to NFPA 68 [B4]. However, systems only complying with NFPA 68 can present explosion hazards to first responders if the following conditions are met: 1) the atmosphere in the enclosure is above the upper flammable limit (UFL), 2) the system has no remote means to ventilate its contents, 3) and a door is opened. Caution and deliberation with the project SME should be taken in situations where gas has accumulated, and automatic ventilation is either not present or not functioning.

The '**make** it burn' strategy for explosion prevention is discussed in 5.1. This approach may be less effective for batteries using LFP technology, from which minimal amounts of oxygen are released during thermal runaway. In a multi-cell arcing fault and in the absence of emergency ventilation with outside air, the available oxygen in the enclosure would be quickly consumed. Further cell venting would drive the gas concentration above the UFL, creating the same hazard described in the previous paragraph.

Ventilation for explosion prevention may be accomplished by the automatic opening of doors or other panels. While this measure is unlikely to meet the requirements of NFPA 69, it addresses the intent of the standard and can be important for protecting first responders. It should be noted that this procedure will reduce the effectiveness of airborne fire suppressants and is more compatible with a 'let it burn' philosophy.

5.3 Arc flash and shock

Battery strings in an enclosure involved in an incident should have been tripped by the BMS, but as detailed in 4.5, they can continue to present arc-flash and shock hazards. Many ESS designs now operate at dc voltages up to 1500 V, representing a significant risk to untrained personnel. At the time of preparing this guide, there is ongoing work on characterization of dc arc-flash hazards, and it is likely that this work will inform future changes to NFPA 70E [B7].

5.4 Toxic chemicals

Recommendations for first responders are detailed in 4.6. Emissions from battery fires vary by battery chemistry and state of charge. Toxicity issues are discussed at length in [B1], where it is stated that hydrogen chloride is the chemical that reaches its IDLH (immediately dangerous to life and health) value fastest. In terms of 30-minute average release rates as a function of IDLH, the greatest concern is with hydrogen fluoride, followed by hydrogen cyanide, hydrogen chloride, and carbon monoxide.

6 Bibliography

The following documents are discussed in this guide:

[B1] DNV-GL, Considerations for ESS Fire Safety, Report for Consolidated Edison and NYSERDA, 2017

[B2] International Fire Code (IFC), 2021, International Code Council, Inc.

[B3] NFPA 1, Fire Code, 2021

[B4] NFPA 68, Standard on Explosion Protection by Deflagration Venting, 2018

[B5] NFPA 69, Standard on Explosion Prevention Systems, 2019

[B6] NFPA 70, National Electrical Code, 2023

[B7] NFPA 70E, Standard for Electrical Safety in the Workplace, 2021

[B8] NFPA 855, Standard for the Installation of Stationary Energy Storage Systems, 2023

[B9] NFPA 1660, Standard for Emergency, Continuity, and Crisis Management: Preparedness, Response, and Recovery, 2024

[B10] NFPA Energy Storage Systems Safety Fact Sheet, available from the NFPA website

[B11] Quant, M., Willstrand, O., Mallin, T., Hynynen, J., Ecotoxicity Evaluation of Fire-Extinguishing Water from Large-Scale Battery and Battery Electric Vehicle Fire Tests. *Environ. Sci. Technol.* https://doi.org/10.1021/acs.est.2c08581

[B12] UL 1973 Ed. 3, ANSI/CAN/UL Batteries for Use in Stationary and Motive Auxiliary Power Applications, 2022

[B13] UL 9540 Ed. 2, Energy Storage Systems and Equipment, 2020

[B14] UL 9540A Ed. 4, ANSI/CAN/UL Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, 2019

Battery Energy Storage Safety

Frequently Asked Questions (FAQs)

Why do we need batteries to support the electricity grid?

Energy storage fundamentally improves the way we generate, deliver, and consume electricity. Battery energy storage systems can perform, among others, the following functions:

1. **Provide the flexibility needed** to increase the level of variable solar and wind energy that can be accommodated on the grid.
2. **Help provide back-up power during emergencies** like blackouts from storms, equipment failures, or accidents.
3. **Lower costs** by storing energy when the price of electricity is low and discharging that energy back onto the grid during peak demand.
4. **Balance power supply and demand instantaneously**, which makes the electrical grid more reliable, resilient, efficient, and cleaner than ever before.

How are batteries arranged in an energy storage system?

Battery energy storage systems vary in size from residential units of a few kilowatt-hours to utility-scale systems of hundreds of megawatt-hours, but they all share a similar architecture. These systems begin with individual battery cells, which are electrically connected and then packaged in a battery module. Battery modules are aggregated with controls and other equipment and housed within racks, which in turn are built into an enclosure, such as a cabinet or ISO shipping container, or a building. One or more of these enclosures or buildings, along with necessary electrical equipment, comprise the battery energy storage facility that discharges to or charges from the electrical grid.

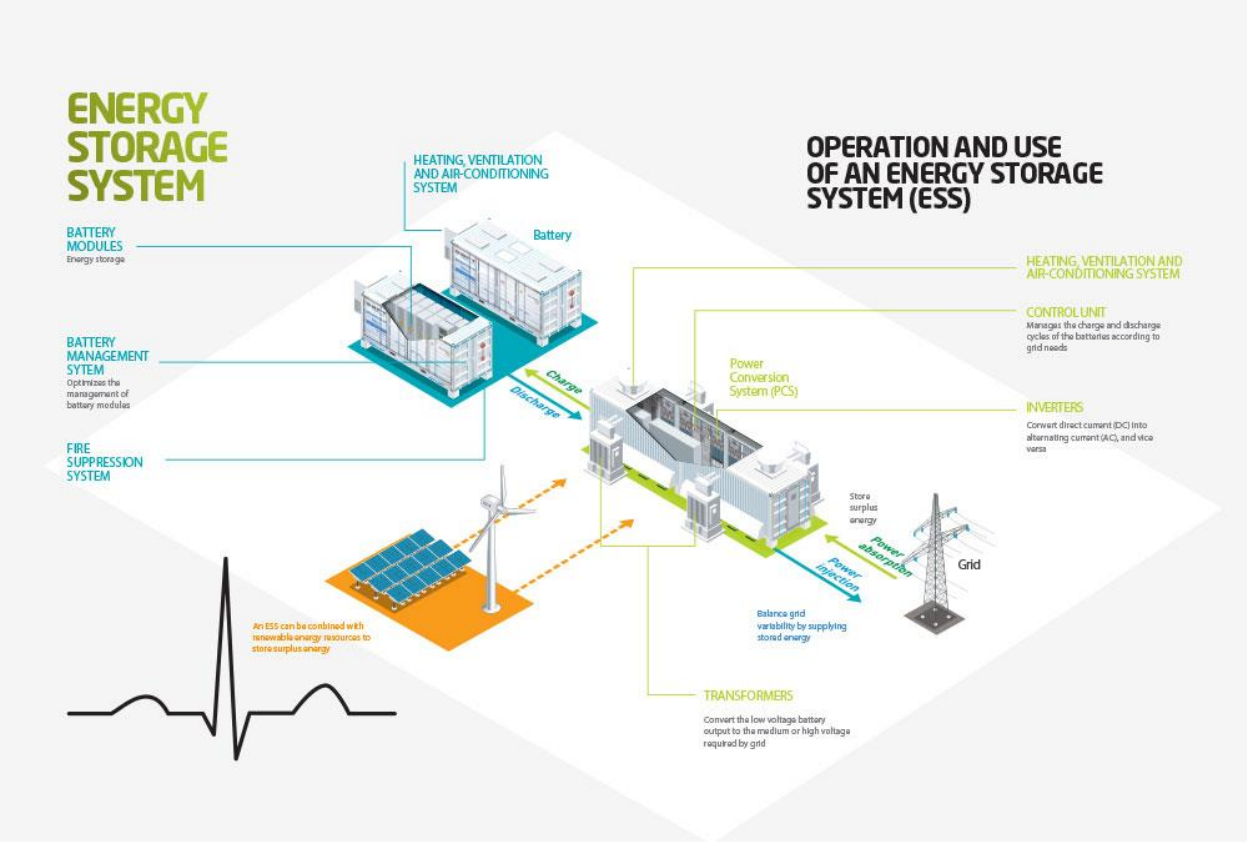


Image Source: Saft

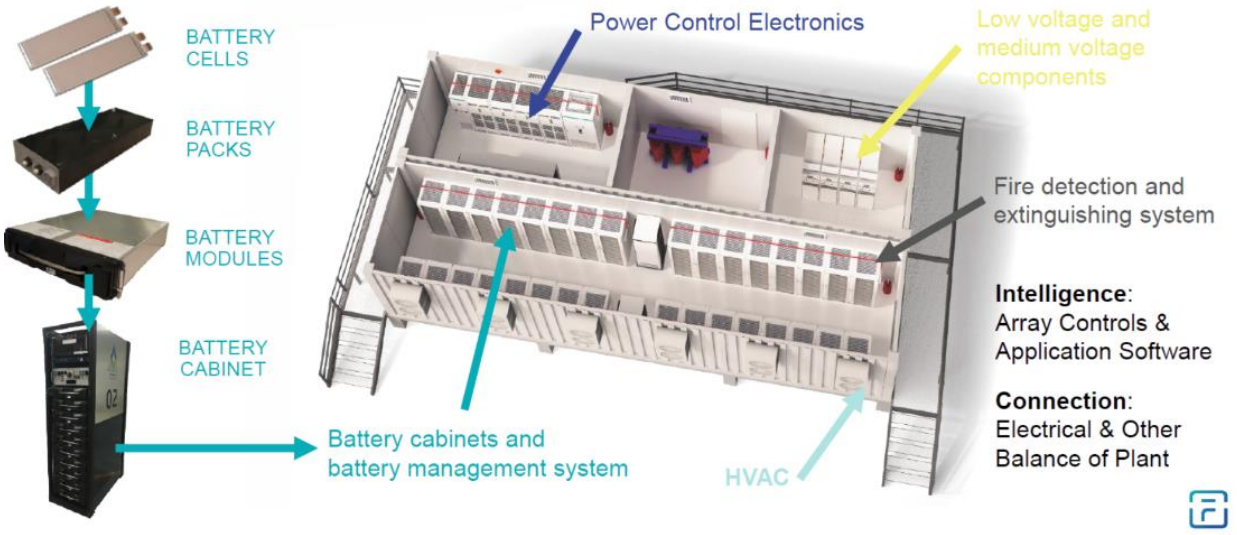


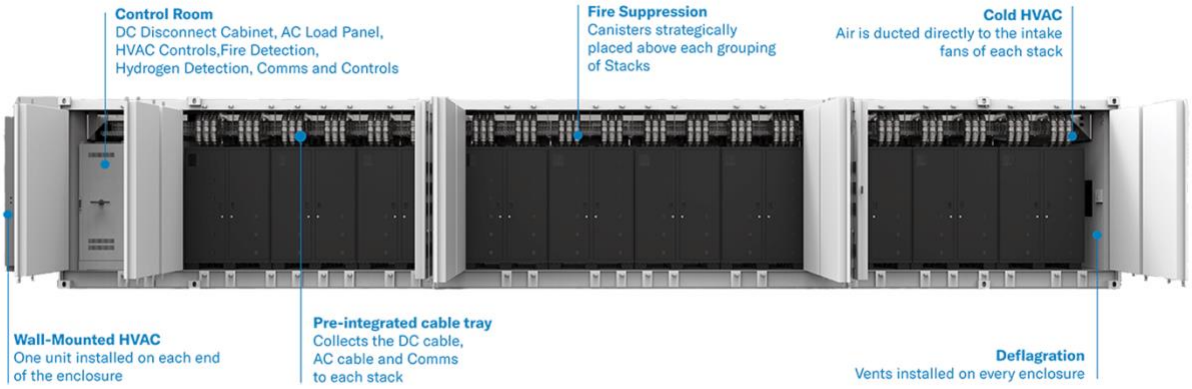
Image Source: Fluence

How are batteries connected to the electrical grid different from batteries in laptops and mobile devices?

Battery energy storage systems operate by converting electricity from the grid or a power generation source (such as from solar or wind) into stored chemical energy. When the chemical energy is discharged, it is converted back into electrical energy. This is the same process used with phones, laptops, and other electronic devices. However, while batteries in consumer electronics have a single function, those connected to the electrical grid -- which are much larger -- serve more complex functions. For instance, electrical grid batteries must be combined with power conversion devices to produce AC (alternating current) power. Batteries connected to the electrical grid can also have a different composition than those found in consumer electronics.

What is the risk of fire or explosion associated with battery storage systems?

Safety events that result in fires or explosions are rare. Explosions constitute a greater risk to personnel, so the US energy storage industry has prioritized the deployment of safety measures such as emergency ventilation to reduce the buildup of flammable gases. Such ventilation can reduce the effectiveness of fire suppression, so an increasing number of manufacturers have adopted a strategy of allowing fires in individual battery enclosures to burn out in a controlled manner, while also preventing the propagation of fire between enclosures. The rationale is that fire consumes any flammable gases as they are produced, thus preventing explosions. Additionally, allowing the battery to burn avoids problems with stranded energy and reignition, both of which have been issues with electric vehicle fires. The monitoring systems of energy storage containers include gas detection and monitoring to indicate potential risks. As the energy storage industry reduces risk and continues to enhance safety, industry members are working with first responders to ensure that fire safety training includes protocols that avoid explosion risk.



Do energy storage systems pose a risk to first responders?

Battery energy storage system operators develop robust emergency response plans based on a standard template of national best practices that are customized for each facility. These best practices include extensive collaboration with first responders and address emergency situations that might be encountered at an energy storage site, including extreme weather, fires, security incidents and more. They also address emergency response roles and highlight the importance of coordinating with first responders—particularly during planning—to ensure there is a complete and detailed shared understanding of potential emergencies and the proper safety responses. Emergency response plans also include contact details for subject-matter experts who can advise first responders on appropriate actions for each situation.

To learn more, read ACP's Energy Storage Emergency Response Plan Template.

Do battery energy storage systems pose a risk to the broader community?

In the rare case where fires do occur, they may be managed without endangering broader communities. A study for the New York State Energy Research & Development Authority states that, while battery fires emit toxic fumes, the average level of toxicity is similar to that of plastics fires involving materials such as sofas, mattresses, or office furniture. Depending on the size of the facility, authorities may close nearby roads and issue shelter-in-place advisories to local residents. The diverse system components that comprise the energy storage facility have chemical and fire smoke data that can be utilized to determine the risks for each facility. The code-required Hazard Mitigation Analysis will summarize how risks beyond the site boundary will be prevented.

A September 2022 fire in California presents a case study where a thermal event was resolved with minimal effect to the local community. Fire broke out in one battery enclosure (out of 256). The fire did not spread to adjacent units, and firefighters had been trained to allow the fire to burn while protecting nearby exposures. After some hours, shifting winds caused a nearby highway to be closed and residents were advised to shelter in place with their windows closed. The fire burned itself out in five hours, leaving no possibility of reignition. Approximately 18 hours after the fire broke out, the highway was reopened and the advisory lifted when air-quality sampling around the facility showed no detectable traces of airborne contaminants.

Are these batteries built to withstand extreme weather events?

Battery energy storage systems are currently deployed and operational in all environments and settings across the United States, from the freezing temperatures of Alaska to the deserts of Arizona. These systems are designed with associated heating and cooling systems to ensure optimal battery operations and life based on the environmental conditions at the installation location. Not only are battery energy storage facilities built to withstand disruptive weather events, but they can also help increase resiliency to extreme weather events, prevent power outages, and provide back-up power.

Do batteries leak or emit pollution?

In normal operation, energy storage facilities do not release pollutants to the air or waterways. Like all energy technologies, batteries can present chemistry-specific hazards under fault conditions. Batteries with free-flowing electrolytes could leak or spill chemicals, so these systems are normally equipped with spill containment. Batteries with aqueous electrolytes may emit small quantities of hydrogen gas in normal operation and larger amounts under fault conditions, but these emissions are handled by ventilation systems and are not considered polluting. As discussed previously, all batteries release toxic substances in a fire, and if water is used for firefighting, it can create contaminated runoff – another reason for manufacturers' recommendations to allow fires to burn themselves out.

Do batteries give off electromagnetic radiation?

Like batteries used in handheld devices, lithium-ion and other types of batteries do not give off electromagnetic radiation. These batteries store electrical energy in chemical form, which can be converted back into electrical energy and discharged back to the grid. This conversion is performed by a bidirectional inverter, which must be tested and certified for electromagnetic compatibility.

Do batteries produce noise?

Batteries alone do not make any noise. Unlike other power infrastructure or generation facilities, energy storage systems have very low noise profiles, with fans, HVAC systems, and transformers producing sounds at similar levels to standard commercial buildings.

What do grid batteries look like? Is there light pollution?

Battery energy storage systems may or may not be visible from a facility's property line. Grid batteries can be housed in a variety of enclosures or buildings, none of which are taller than a house. Energy storage facilities are often unmanned and do not need light to function. Some may have lighting for security purposes, and this would be consistent with normal streetlighting.

Figure 1. Battery storage systems come in a variety of sizes

Source: Clean Energy Group

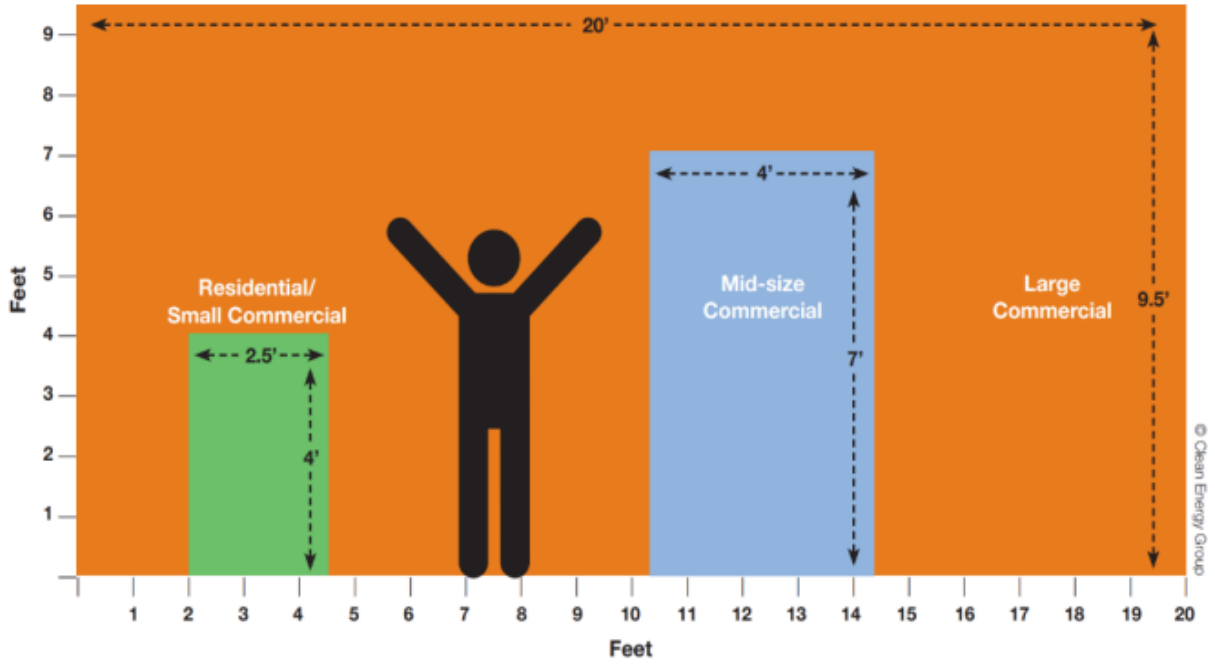


Image Source: AES

How long will grid batteries last?

Grid battery life depends on usage and can last for 20 years or more. One of the earliest deployed grid-scale battery energy storage systems, put into operation in Alaska by the Golden Valley Electric Association, has been in continuous operation since 2003. Batteries will degrade based on numerous factors such as chemical composition, number of charge and discharge cycles, and the temperature of the environment that the batteries are exposed to.

What happens to the batteries when they reach the end of their lifetime?

The U.S. lithium-ion battery recycling industry is growing rapidly to accommodate batteries from both electric vehicles and energy storage systems. Companies are moving beyond simple recovery of raw materials and into direct recycling of electrode materials that can be built sustainably and cost-effectively into new batteries. Indeed, energy storage applications provide the opportunity to repurpose batteries from end-of-life electric vehicles, extracting maximum usage from these units for the benefit of consumers.

How are batteries monitored?

Battery energy storage systems are equipped with sensors that track battery temperatures and enable storage facilities to turn off batteries if they get too hot or too cold. Battery management systems also monitor the performance of each individual cell voltage and other key parameters then aggregate that data in real time to assess the entire system's operation, detect anomalies, and adjust the system to maintain safety. Battery management systems often contain state of the art software designed to safely operate and monitor energy storage systems.

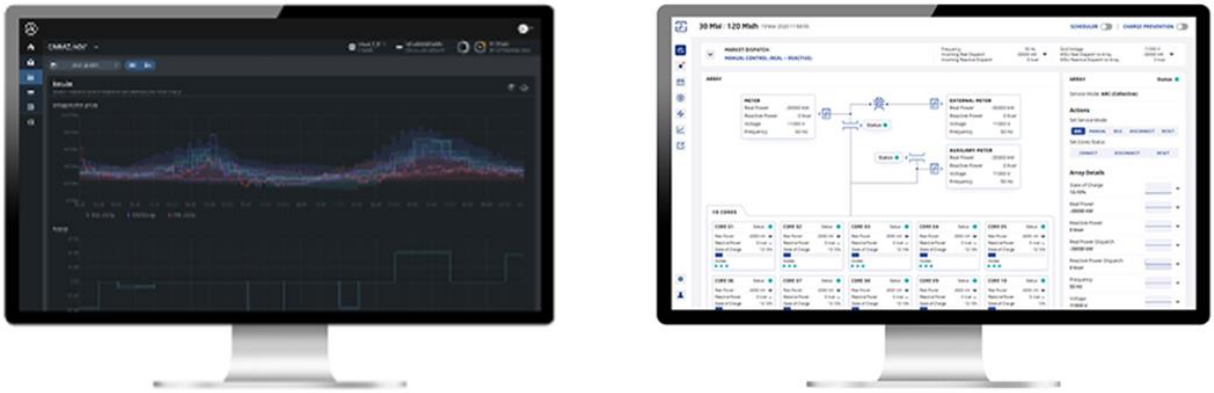


Image Source: Fluence

How are battery energy storage systems regulated?

Battery energy storage systems must comply with electrical and fire codes adopted at the state and local level. Facility owners must submit documentation on system certification, fire safety test results, hazard mitigation, and emergency response to the local Authority Having Jurisdiction (AHJ) for approval. Before operation, facility staff and emergency responders must be trained in safety procedures and are required to be given annual refresher training.

To learn more, refer to ACP's ESS Codes and Standards Overview. The U.S. storage industry has continuously supported the development of codes, standards, and best practices to promote safety.

What are the certification requirements for energy storage systems?

The fire codes require battery energy storage systems to be certified to UL 9540, *Energy Storage Systems and Equipment*. Each major component – battery, power conversion system, and energy storage management system – must be certified to its own UL standard, and UL 9540 validates the proper integration of the complete system. Additionally, non-residential battery systems exceeding 50 kWh must be tested in accordance with UL 9540A, *Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems*. This test evaluates the amount of flammable gas produced by a battery cell in thermal runaway and the extent to which thermal runaway propagates within the battery system.

What are some key parameters for energy storage systems?

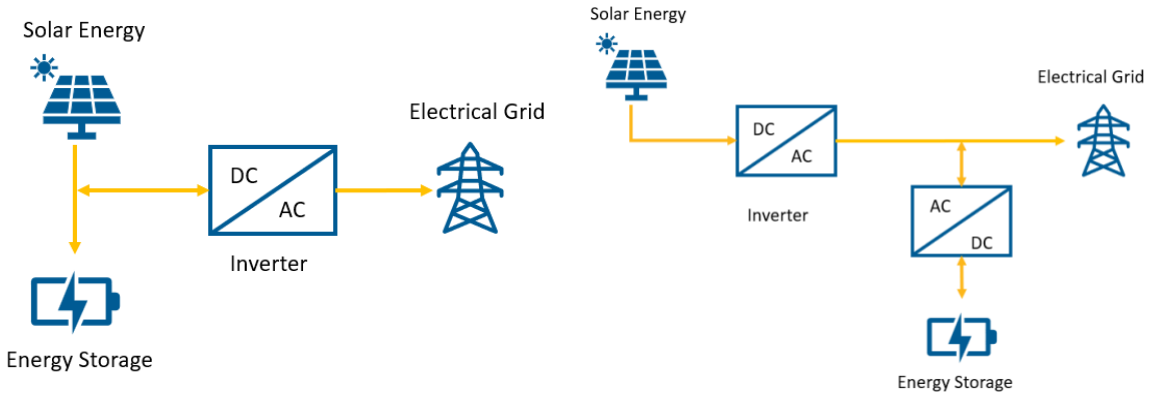
Rated power is the total possible instantaneous discharge capability, usually in kilowatts (kW) or megawatts (MW), of the system. Energy is the maximum amount of stored energy (rate of power over a given time), usually described in kilowatt-hours (kWh) or megawatt-hours MWh. Cycles are the number of times the battery goes from fully (or nearly fully) charged to discharged (or fully discharged). The amount of time or cycles a battery storage system can provide regular charging and discharging before failure or significant degradation is typically the cycle lifetime. State of Charge (SoC) is usually expressed as a percentage and represents the battery's level of charge and ranges from completely discharged to fully charged. The state of charge influences a battery's ability to provide energy or ancillary services to the grid at any given time. State of Health (SoH) is a calculation that will express the estimated remaining capacity including degradation. This can be simplified into the difference between a new battery and the actual battery based on the amount of capacity lost to degradation caused by time, temperature, number of cycles, and several other factors.

What is the difference between AC and DC coupled systems?

Energy storage systems are typically defined as either AC or DC coupled systems. This is simply the point of connection for the energy storage system in relation to the electrical grid or other equipment.

For AC (alternating current) coupled systems, the batteries are connected to the part of the grid that has AC or alternating current.

For energy storage systems that are also connected to solar energy, there is an option to have the energy storage system be DC (direct current) coupled. Since solar generation systems create DC electricity, it is often most efficient to have this go directly to the batteries (via a DC-DC converter) as DC energy. This can be utilized for residential, commercial, or utility applications.



【Material Safety Data Sheet】

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Product Name	Sinopec -40℃ Inverter Engine Coolant
Product Code	60506820
Product Usage:	Used as heat transfer medium in inverter
Company Identification	SINOPEC LUBRICANT CO., LTD.
Address	No. 6 Anning Zhuang West Road，Haidian District，Beijing，P.R.China
Post Code	100085
Emergency Response	Phone 86-800-810-9886
	Fax 86-10-82410856
Website	http://english.sinolube.com
E-mail	csc.lube@sinopec.com
Effective date	2020-03-01

SECTION 2 COMPOSITION/ INFORMATION ON INGREDIENTS

This product is a mixture of additives, water and glycol.

COMPONENTS	CAS NUMBER	AMOUNT
Additive	Mixture	<5%weight
Water	7732-18-5	40-60%weight
Ethylene Glycol	107-21-1	40-60%weight

SECTION 3 HAZARDS IDENTIFICATION

GHS Hazards Type	Non-hazardous
GHS Label Elements	
Sign	No data
Caution Words	No data
Hazard Statement	Physical hazards: According to GHS, it is not classified as hazardous substances. Health hazard: According to GHS, it is not classified as health hazard substances. Environmentally hazard: According to GHS, it is not classified as environmentally hazard substances.
GHS Precautionary Statements	
Precaution	No data
Incident Response	No data
Safe Storage	No data

Disposal	No data
Other Hazards	Not classified as flammable, but will combustible
Main Symptoms and Emergency Overview	Based on animal experiments, found no strong evidence to prove that the product Carcinogenic. Usually this product is no hazardous to health. Might be it stimulate to eyes, skin and respiratory when overexposure.

SECTION 4 FIRST AID MEASURES

General Information	Shouldn't become a health hazard when used under normal condition
The disposal of the Different Contact Manner	
Inhalation	Move exposed person from the contact area to fresh air and provide oxygen, and keep the respiratory tract unobstructed. If breathing is difficult, give oxygen, if breathing stops, carry out artificial respiration immediately and get medical treatment.
Skin	Take off contaminated clothes, wash with a large amount of flowing water, and seek medical advice if necessary.
Eye	Wash eyes with water for 15 minutes. If irritation occurs, get medical attention.
Ingestion	Urge vomiting immediately and receive medical treatment.
Main Symptoms(acute / delayed effect)	No data

SECTION 5 FIRE FIGHTING MEASURES

Special Risk	This product is not hazardous product. It may be to combustion when exposure to high temperature or fire.
Extinguishing Method and media	Foam extinguishers, carbon dioxide extinguishers, dry powder extinguishers, spray extinguishers, etc. Sand is only suitable for small fires.
Combustion Products	Incomplete combustion produces smoke, carbon monoxide, oxides, aldehydes and other decomposition components.
Forbidden Media	Water.
Firefighters Special Protective Equipment	Breathing apparatus must be worn when approaching the ignition point in a confined space.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. Guide to the selection of personal protective equipment, see chapter 8 of the safety data sheet.

Disposal information, see chapter 13 of safety data sheet. Please comply with all applicable local or national regulations.

Emergency Response Procedures	Cut off the fire source, contact the operators immediately, and let the irrelevant personnel evacuate to the safety zone and isolate. Cut off the leakage source as much as possible to prevent entering into the sewer, drainage ditch, water body and other spaces. Observe the relevant firefighting procedures, refer to Chapter 8 of the safety technical instructions.
Protective Measures for Operators	In case of leakage, use protective equipment to protect the human body when removing the leakage liquid.
Environmental Protection Measures	No data Disposal of the waste refer to chapter 13 of the safety data sheet.
Spill Management	FOR LARGE SPILLS: Remove with vacuum truck or pump to storage/salvage vessels.

	FOR SMALL SPILLS: Soak up residue with an absorbent such as clay, sand or other suitable material. Place in non-leaking container and seal tightly for proper disposal

SECTION 7 HANDLING AND STORAGE

Handling	
General Preventive Measures	Avoid contact with skin for a long time or repeatedly, and wash thoroughly after contact. If there is a danger of inhaling steam, spray or smoke, please use partial exhaust ventilation. Handle with care to prevent damage to packaging and containers.
Precautions for safety disposal	Operators must be specially trained and strictly abide by the operation specifications. Avoid contact with oxidants. Equip with corresponding quantity of fire-fighting equipment and leakage emergency treatment equipment. Protective shoes shall be worn when loading and unloading 200L barreled products. Empty containers may contain harmful substances.
Storage	Do not store in open or unlabeled containers. Store in a cool, dry place with adequate ventilation. Keep away from open flames and high temperatures. Suggest do not to be stored in the galvanized container.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Allowable Concentration	No data
Engineering Controls	Provide good natural ventilation conditions.
Personal Protective Equipment	Personal protective equipment shall meet the relevant national standards. Specific content consult the supplier of personal protective equipment.
Respiratory Protection	If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, an approved respirator must be worn.
Hand protection	Use protective gloves which are chemically resistant to this material.
Eye protection	Chemical goggles, or safety glasses with side shields.
Personal Protection	Use protective clothing and shoes which are chemically resistant to this material.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Distinctive
Odor	No odor
pH	7.5～11.0
Melting Point	Not Applicable
Pour Point	No data
Boiling Point	109.5℃(typical data)
Flash Point	No data
Explosion Limit	No data
Vapour Pressure	No data
Vapour Density	No data
Density	1076 kg/ m3(typical data)
Solubility	Soluble in water
Octanol/ Water Partition Coefficient	No data
Decomposition Temperature	No data
Freezing Point	-41.0℃(typical data)

SECTION 10 STABILITY AND REACTIVITY

Chemical Stability	Stable （at room temperature）
Incompatibility With Other Materials	Contact with strong oxidant
Conditions to Avoid	Extreme temperature, sunlight exposure, contact with strong oxidant and fire source
Incompatible Materials	Strong oxidant
Hazardous Decomposition	May react with strong oxidizing agents
Product	Hazardous decomposition will not form under normal storage conditions

SECTION 11 TOXICOLOGICAL INFORMATION

Acute Dermal Toxicity	LD_{50}/Oral/Mouse:>2000mg/kg Primary skin irritation/Rabbit/OECD 404:No irritation Primary mucous membrane irritation/Rabbit eyes/OECD 405:No irritation
Skin irritation or Corrosion	Mild irritation
Eye irritation or Corrosion	Long-term exposure can cause eye irritation
Inhalation Hazards	Mild irritation
Respiratory or Skin Sensitization	No data
Germ Cell Mutagenicity	No data
Reproductive Toxicity	No data
Specific target Organ Toxicity——Disposable Contact	No data
Specific target Organ Toxicity——Disposable Contact——Repeated contact	No data
Additional Information	No data

SECTION 12 ECOLOGICAL INFORMATION

Ecotoxicity	Though long time infiltration, it may produce ecological toxicity
Persistence and Degradability	This product is expected to be inherently biodegradable
Potential Bioaccumulation	This product has the water solubility; but bioavailability and bioaccumulation to aquatic organisms is minimal.
Mobility	When released into the environment, adsorption to sediment and soil will be the predominant behavior.

SECTION 13 DISPOSAL CONSIDERATIONS

Waste Disposal	It should be recycled or recycled as far as possible, or disposed of by an approved recycling facility, or at an appropriate government waste disposal facility.
Disposal of Containers	Uncontaminated container can be recycled.

	Containers that cannot be cleaned must be discarded and disposed of by a waste collector approved by relevant laws and regulations.
Note to Release	Please use personal protective equipment. Keep waste away from soil or into drai ns. Transport means, recycling devices, treatment or storage equipment approved by the authority shall be used for waste turnover or storage.

SECTION 14 TRANSPORT INFORMATION

Land, sea and air transport process, the product is not classified as dangerous goods.

UN Dangerous Goods Code	Not Applicable
UN Shipping Name	Not Applicable
UN Hazard type	Not Applicable
Packing Group	Not Applicable
Marine Pollutant	Not Applicable

SECTION 15 REGULATORY INFORMATION

EPCRA 311/312 CATEGORIES:

1. Immediate (Acute) Health Effects:	NO
2. Delayed (Chronic) Health Effects:	NO
3. Fire Hazard:	NO
4. Sudden Release of Pressure Hazard:	NO
5. Reactivity Hazard:	NO

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1 03=EPCRA 313
01-2A=IARC Group 2A 04=CA Proposition 65
01-2B=IARC Group 2B 05=MA RTK
02=NTP Carcinogen 06=NJ RTK
07=PA RTK

No components of this material were found on the regulatory lists above.

Chemical Inventories	All components comply with the following chemical inventory requirements: AICS (Australia), DSL (Canada), EINECS (European Union), KECI (Korea), PICCS (Philippines), TSCA (United States). One or more components does not comply with the following chemical inventory Requirements: ENCS (Japan). Additional notifications in Canada may be required 90 days prior to use other than as a lubricating oil additive.
NEW JERSEY RTK CLASSIFICATION:	Under the New Jersey Right-to-Know Act L. 1983 Chapter 315 N.J.S.A. 34:5A-1 et. seq., the product is to be identified as follows: PETROLEUM OIL (Motor oil)
WHMIS Classification	This product is not considered a controlled product according to the criteria of the Cana dian Controlled Products Regulations.

SECTION 16 OTHER INFORMATION

Revision Date:	March 01,2020
MSDS Version Number	5
Other Information	Other information and manuals can be obtained through the sales department and technical department.
Amendment Statement	The information provided is based on our understanding of the existing data. Desc

ription of the product solely for the purpose of complying with requirements of the health, safety and environment. We don't provide any guarantee of the specific characteristics of the product.

宁德时代新能源科技股份有限公司
Contemporary Amperex Technology Co. ,Limited
No.2 Xingang Road,Zhangwan Town,Jiaocheng Distric,Ningde City, Fujian Province, P.R of China,352100
中国福建省宁德市蕉城区漳湾镇新港路 2 号 352100

MATERIAL SAFETY DATA SHEET

Issue: 2020-A Doc No.: 2020-A-139 Issue Date: 7/14/2020

1. Product & Company Identification

Product Description	Lithium Ion Cell (Rechargeable type)	**CATL Model Name:**	CB310
Manufacturer	Contemporary Amperex Technology Co. ,Limited	**Approximate Weight:**	5.4Kg
Capacity	280Ah	**Equivalent lithium content**	84g
Nominal voltage	3.2V	**Watt-hour**	896Wh
UN No.	UN3480	**Proper Shipping Name**	Lithium Ion Battery
Address	No.2 Xingang Road,Zhangwan Town,Jiaocheng Distric,Ningde City, Fujian Province, P.R of China		
Telephone:	86-593-2583668	**Fax**	+86-593-2583667

2.Hazardous Overview

2.1 CAS-No/EINECS NO.:N/A

INCI CTFA-Description: Lithium ion polymer rechargeable battery series.

2.2 The product is classified and labeled according to Regulation (EC) No 1272/2008

- Hazard pictograms

GHS05 GHS07 GHS08

Signal word: Danger

· Hazard statements

H314 Causes severe skin burns and eye injuries.

H317 May cause an allergic skin reaction.

· Precautionary statements

P101 If medical advice is needed, have the product container or label at hand.

P102 Keep out of reach of children.

P103 Read label before use.

P260 Do not breathe dust/fume/gas/mist/vapors/spray.

P303+P361+P353 IF ON SKIN (or hair): Take off all contaminated clothing immediately. Rinse skin with water/ take a shower.

P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if contact lenses are worn and can be easily removed. Continue rinsing.

P310 Call a detox center/doctor immediately.

P405 Storage must be locked.

P501 Dispose of contents/container in accordance with local/regional/national/international regulations.

2.3 Other hazards:

Results of PBT and vPvB assessment

PBT: Not applicable.

vPvB: Not applicable

3. Composition /Information on Ingredients

Important note: The battery should not be opened or burned. It is harmful to expose ingredients or combustion products in the battery.

MATERIAL OR INGREDIENT	PEL (OSHA)	TLV (ACGIH)	%/wt.
Graphite	CAS# 7782-42-5 EC#231-955-3	None established	7-25
Lithium iron Phosphate	CAS# 15365-14-7 EC# 476-700-9	None established	15-40
Hexafluoropropylene-vinylidene fluoride Copolymer	CAS# 9011-17-0 EC# 618-470-6	Hazardous，H411	3-15
Lithium Hexafluorophosphate	CAS# 21324-40-3 EC#235-362-0	ıte Tox. 3, H311; Skin Corr. 1B, H314; ute Tox. 4, H302	0-5
Acetylene Black	CAS# 1333-86-4 EC#215-609-9	None established	0-2

Diethyl Carbonate	CAS# 105-58-8 EC#203-311-1	Flam. Liq. 3, H226	0-15
Dimethyl Carbonate	CAS# 616-38-6 EC# 210-478-4	Inflammable，H225	0-15
Ethyl Methyl Carbonate	CAS# 623-53-0 EC# 433-480-9	Inflammable，H225	0-15
Propylene Carbonate	CAS# 108-32-7 EC#203-572-1	Eye Irrit. 2, H319	0-15
Ethylene Carbonate	CAS# 96-49-1 EC#202-510-0	Eye Irrit. 2, H319	0-15

4. First Aid Measures

Use under normal conditions, the battery is hermetically sealed.

Ingestion: Swallowing a battery can be harmful

Contents of an open battery may cause serious chemical burns of mouth, esophagus, and gastrointestinal tract. If battery or open battery is ingested, do not induce vomiting or eat food or drink. Seek medical attention immediately.

Inhalation: Contents of an open battery can cause respiratory irritation. Inhalation of vapors may cause irritation of the upper respiratory tract and lungs. Provide fresh air and seek medical attention.

Skin Absorption: Ethylene carbonate, diethyl carbonate and dimethyl carbonate may be absorbed through the skin causing localized inflammation.

Skin Contact: Contents of an open battery can cause skin irritation and/or chemical burns. Remove contaminated clothing and wash skin with soap and water. If a chemical burn occurs or if irritation persists, seek medical attention.

Eye Contact: Contents of an open battery can cause severe irritation and chemical burns. Immediately flush eyes thoroughly with water for at least 15 minutes, lifting upper and lower lids, until no chemical remains. Seek medical attention.

5. Fire Fighting Measures

5.1 **Hazard Analysis (electrical shock, fire, explode, population)**

There was no electrical shock Hazard for single cell, or battery module with voltage less than 50V DC (the safety voltage). But if the voltage of pack was greater than 50V DC, the electrical shock shall be controlled.

During the shipment or testing process for LIB Pack or Module, there was danger factors like drop, crush, broken, metal short circuit, amd liquid immersion, which would lead to the Hazard like electrical shock, of fire. If pack was in hermetic space, there was a risk of gas exploding Hazard; if the pack was iwell ventilated or in open space, there was no risk of explode Hazard. The released liquid including improperly treated firefighting water was the environment population Hazard.

5.2 **Material preparation & personnel training**

1） **Water based sprayer fire extinguish**: 1 set of 9L or 2 sets of 6L water spray fire extinguishers per each 500KWh LIB pack or Modules. The water based spray fire extinguisher could be used for fire type ABCE = solid (A), flash point >60℃ liquid (B), gas (C), <36Kv electrical (E) fire.

2） **Water protection sets**: raincoat, galoshes, rubber gloves. Plastic rollers.And Rags.

3） **PPE**: breathing mask, safety glass, face mask, gloves for high temperature.

4） **Smoke extraction tools**: one wall exhaust fan every 20 meters or mobile exhaust fan in rooms. Keep gas vent holes in trucks.

5） **Gases explosion-proof tools**: open condition for devices & rooms. Some devices like high or low temperature ovens must be sealed; there was one copper film with the diameter 200mm & thickness 8um as the safety vent. One fan is required every 20 meters on the wall of the room, and the fan flow rate is at least 5000 m3 per hour.

6） **Neutralized material**: prepare 10kg $Ca(OH)_2$ powder per 500KWh LIB pack or modules, and it was used for neutralized for release electrolyte. because the electrolyte will form HF by 8% by weight when it encounters water.

7） **Voltage measure**. Multimeter. Please physical block the current measure function, the mistake would lead instrument exploding.

8） **Personnel training**: (a) turn on fans or portable fans to exhaust smoke. (b) Wear the water protection sets → use water spray fire extinguishers → wipe dry with a cloth or with rubber gloves → insulated by plastic film. (c) Neutralized by $Ca(OH)_2$ or NaOH for released electrolyte. (d) Use multimeter to measure voltage. Pay special attention not to use the wrong gear (to physically close the current block) to prevent instrument explosion.

5.3 **Fire Extinguisher Flow Chart**

1） Alarm if you found the smoking or burning.

2） Wear PPE. (Breath mask, face mask. If using water, PPE should include the raincoat, galoshes, and rubber gloves).

3） Turn Off power supply in devices or power supply.

4） Use any fire extinguishers for solid material fire, the recommended sequence was water or mist water, sand, fire extinguisher blanket, CO_2, powder.

5） Exhaust smoke by turn on fans or open air environment.

6） Dry and neutralize. Drying by fans, Neutralization by $Ca(OH)_2$ powder if water was used.

Figure 1 water based fire extinguisher (Could be used for 36KV electrical fire)

Figure 2 water sprayers to fire extinguisher (Wear PPE to avoid electrical shock)

6. Leak Emergency Measures

On hand: Place material into suitable containers and call local fire/police department.

In water: Low electrical shock hazard when battery or module is in water. Hydrogen is generated when electrolyzing water, and ventilation must be maintained to prevent the accumulation of hydrogen and the explosion of hydrogen in confined spaces. If possible, remove the battery or module from the water and report to the local police.

7. Handling & Storage

One of the major Hazards when transporting batteries and battery-powered equipment is the short-circuit of the battery caused by the battery terminals coming into contact with other batteries, metal objects, or conductive surfaces. Therefore, packed batteries or cells must be separated in a proper way to prevent short circuits and broken electrode. They must be packed in a strong outer packaging or be contained in equipment.

Handling: Do not expose the battery to excessive physical shock or vibration. Short-circuiting should be avoided; although an accidental short-circuiting in a few seconds will not seriously affect the battery. Prolonged short circuits will cause the battery to rapidly lose energy, could generate enough heat to burn the outer casing. Sources of short circuits include jumbled batteries in bulk containers, coins, metal jewelry, metal covered tables, or metal belts used for assembly of batteries in devices. To minimize Hazard of short-circuiting, the protective case supplied with the battery should be used to cover the terminals when transporting or storing the battery. Do not disassemble or deform the battery. Should an individual cell within a battery become ruptured, do not allow contact with water. When operators handle the battery with voltage more than 50v, they must wear the insulation protection PPE.

Storage: The lithium ion battery's charging capacity should be between 25% and 75% of full charge when stored for a long period of time. Stored in a cool, dry, and well ventilated area. Elevated temperatures can result in loss of battery performance, leakage, or rust. Do not expose the battery to open flames.

8. Exposure Control/Personal Protection

Engineering Control: Keep away from heat and open flame. Stored in a cool dry place.

Personal Protection:

Respiratory Protection: Not necessary under normal conditions.

Eye/Face Protection: Not necessary under normal conditions. Wear safety glasses with side shields if handling an open or leaking battery.

Hands Protection: Not necessary under normal conditions. Use neoprene or natural rubber gloves if handling an open or leaking battery.

Foot Protection: Steel toed shoes recommended for large container handling.

9. Physical/Chemical Properties

Physical state	Solid	Solubility in water:	Not Applicable
Color	Withe	Vapor pressure	Not Applicable
Odor	No Odor	Explosion limit	Not Applicable
Flash point	Not Applicable	Auto flammability	Not Applicable
Solubility in ethanol soluble	Not Applicable	Melting Point	Not Applicable
Boiling Point	Not Applicable	Freezing Point	Not Applicable

10. Stability & Reactivity

Stability: Product is stable under conditions described in Section 7.

Conditions to Avoid: Heat above 70°C or incinerate. Deform. Mutilate. Crush. Disassemble. Overcharge. Short circuit. Expose to humid conditions over a long period.

Materials to avoid: Oxidising agents, alkalis, water.

Hazardous Decomposition Products: Toxic Fumes, and may form peroxides.

Hazardous Polymerization: N/A.

If leaked, avoid contacting with strong oxidizers, mineral acids, strong alkalies, and halogenated hydrocarbons.

11. Toxicological information

Signs & symptoms: None, unless battery ruptures.

In the event of exposure to internal contents, vapour fumes may be very irritating to the eyes and skin.

Inhalation: Lung irritant.

Skin contact: Skin irritant.

Eye contact: Eye irritant

Ingestion: Poisoning if swallowed..

Medical conditions generally aggravated by exposure: In the event of exposure to internal contents, moderate to server irritation, burning and dryness of the skin may occur, and target organs nerves, liver and kidneys.

12. Ecological information

Mammalian effects: None known at present.

Eco-toxicity: None known at present.

Bioaccumulation potential: Slowly Bio-degradable.

Environmental fate: None known environmental hazards at present.

13. Disposal considerations

Do not incinerate, or subject cells to temperature in excess of 70°C, Such abuse can result in

loss of seal leakage, and/or cell explosion. Dispose in accordance with appropriate local regulations.

14. Transport Information

14.1 The requirement of air transportation

The lithium battery should accord with the International Air Transport Association (IATA DGR 61edition) requirements for transportation. The battery or cell should be packed and signed as following table.（If the cell's power less than 20Wh or battery's power less than 100Wh and the package according with PI-965 Section Ⅱ， it is not classified as dangerous cargo）.

MATERIAL SAFETY DATA SHEET

Issue: 2020-A Doc No.: 2020-A-139 Issue Date: 7/14/2020

UN NO.	Proper Shipping Name	Power	Package requirements	Label which need to paste
UN3480	lithium ion batteries	Cell＞20Wh Battery＞100Wh	PI965 Section IA **Limit per package:** Pax A/C = Forbidden CAO = 35 kg	Class 9 hazard label 
		Cell≤20Wh Battery≤100Wh	PI965 Section IB **NOTE: Use "IB" if package exceeds Section II Limits or more than 1 package** **Limit per package:** Pax A/C = Forbidden CAO = 10 kg Gross	Class 9 hazard label and lithium battery handling label  
		Cell≤20Wh Battery≤100Wh	PI965 Section Ⅱ **(no more than 1 package)Limit per package:** ≤2.7 Wh = 2.5kg; or cells > 2.7 Wh≤20 Wh = 8 cells; or batteries > 2.7 Wh ≤100 Wh = 2 batteries Pax A/C = Forbidden	lithium battery handling label 
UN3481	lithium ion batteries contained in equipment	Cell＞20Wh Battery＞100Wh	PI967 Section I **Limit per package:** Pax A/C = 5 kg CAO = 35 kg	Class 9 hazard label 
		Cell≤20Wh Battery≤100Wh	PI967 Section Ⅱ **Limit per package:** Pax A/C = 5 kg CAO = 5 kg	lithium battery handling label 
UN3481	lithium ion batteries packed with equipment	Cell＞20Wh Battery＞100Wh	PI966 Section I **Limit per package:** Pax A/C = 5 kg CAO = 35 kg	Class 9 hazard label 
		Cell≤20Wh	PI966 Section Ⅱ	lithium battery handling label

		Battery≤100Wh	**Limit per package:** Pax A/C = 5 kg CAO = 5 kg	

Cells and/or batteries at a SOC of greater than 30% of their rated capacity may only be shipped with the approval of the State of Origin and the State of the Operator under the written conditions established by those authorities.

Packages prepared according to Section Ⅱ of PI965 must be offered to the operator separately from other cargo and must not be loaded into a unit load device before being offered to the operator.

The lithium core and battery goods required by the packaging specification PI965 and PI968 II shall not be packed in the same outer package as other dangerous goods.

Ban lithium ion battery (UN 3480, PI965 Section IA or IB) and Aggregate Lithium Content (3090, UN PI968 Section IA or IB) with category 1 explosive material (except ammunition) 1.4, 2.1 flammable gas, flammable liquid, 4.1 3 flammable solid, 5.1 class antioxidant and other dangerous goods packaging in the same package.

Do not damage or mishandle this package. If package is damaged, batteries must be quarantined, inspected, and repacked. **C**ells and batteries identified by the manufacturer as being defective for safety reasons, or that have been damaged, that have the potential of producing a dangerous evolution of heat, fire or short circuit are forbidden to transport .Waste lithium batteries and lithium batteries being shipped for recycling or disposal are prohibited from air transport unless approved by the appropriate national authority of the State of origin and the State of the operator.

The lithium battery should pass the UN38.3 test. If the battery can not pass the testing, it should be redesigned. If the batteries pass the test, for the lithium battery only,shall follow the UN3480 and the packing requirements for PI965, for the lithium battery which installed in equipment, sheall follow the UN3481 and the packing requirements for PI967.

The lithium battery testing meets all requirements under UN Manual of Tests and Criteria Part III, subsection 38.3.

No	ITEMS	RESULT	REMARKS
1	Altitude simulation	Pass	Test 1 to 5 must be conducted in sequence on the same cell or battery
2	Thermal test	Pass	
3	Vibration	Pass	
4	Shock	Pass	
5	External short circuit	Pass	
6	Impact	Pass	
7	Forced Discharge	Pass	Only for Cell

14.2 The requirement of ocean shipping

According to International Maritime Dangerous Goods Code (IMDG) to transport and according to the requirements of UN NO. 3480/3481 to management the goods, and ther class II packaging is used Firmly installation. Mutual isolation. Avoid short circuits. If the package contain more than 24 lithium batteries or more than 12 lithium battery packs, must provide the special procedures in the event of package damage. A special procedure document shall be provided with the ship.

The clause 188 of IMDG stipulates that the Watt of lithium ion cell less than 20Wh is not classified as dangerous cargo and the Watt of lithium ion battery less than 100Wh is not classified as dangerous cargo but the WHR ratio label needs to be marked. Otherwise, the battery and module should packed in a sturdy outer packaging or be contained in equipment.

The clause 230 of IMDG stipulated that the lithium battery testing should meets all requirements under UN Manual of Tests and Criteria Part III, subsection 38.3.

15. Regulatory Information

See ACGIH exposure limits information as noted in Section3

US: This MSDS meets/exceeds OSHA requirements.

International: This MSDS conforms to European Union (UN), the International Standards Organization (ISO) and the International Labor Organization (ILO) and as documental in ANSI (American National Standards Institute) Standard Z400.1-1993.

Air transportation: Referring to Civil aviation industry standard MH/T1020-2018 Lithium Battery Air Transport Standard and IATA DGR and ICAO. This standard is currently used in the international transport and commodity (IMDG CODE),

Ocean shipping： Referring to International Maritime Dangerous Goods Code to transport and According to the requirements of UN NO 3480/3481 to management the goods.

Land transportation： Referring to List of Dangerous Goods(GB12268).

Avoid electrical shock： Referring to Standard for Electrical Safety in the Workplace, NFPA-70E.

16. Charging and labeling

Charging: This battery is made to be charged many times. Use an Energizer approved battery charger. Never use a modified or damaged battery charger. A backup charge termination based on time is recommended to prevent overcharging. The charging temperature should be between 0° C and 45° C (32° F and 113° F). The battery pack will be normally warm during charging.

Charging Voltages and Currents: Charging voltages are prevented from exceeding the specified limits by an internal battery protection circuit. Never use a battery that shows signs of a damaged protection circuit or broken case. Adhere to all specified charging and discharging voltages and currents. Do not use battery if its voltage drops below the specified minimum voltage.

Labeling: If the CATL label or package warnings are not visible, please contact relevant personnel to provide a package and/or device label stating.

If the lithium-ion battery or cell transported by air, the labeling according to the requirement of IATA 60th, the packages is affixed with the Class 9 hazard label(**Figure 3**) or/and lithium battery handling label(**Figure 4**).

Figure 3 Class 9 hazard label

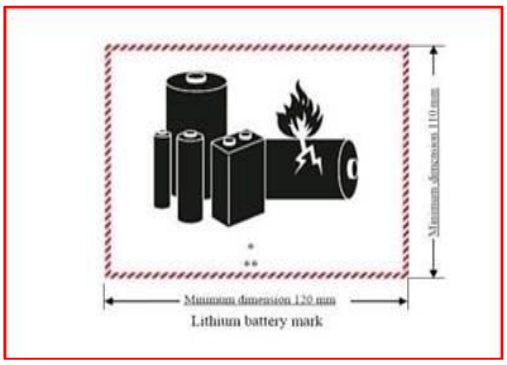


Figure 4 lithium battery handling label

If the lithium-ion battery or cell transported by sea, the labeling according to IMDG, the requirement are as follows,

- Package, do not need any indication.
- Need all the UN Number.
- Subassembly：Do not need any indication.
- Need the *LQ* label.

WARNING: CHARGE ONLY WITH SPECIFIED CHARGERS ACCORDING TO DEVICE MANUFACTURER'S INSTRUCTIONS. DO NOT OPEN BATTERY, DISPOSE IN FIRE, OR SHORT CIRCUIT IT MAY IGNITE, EXPLODE, LEAK, OR GET HOT CAUSING PERSONAL INJURY.

Disposal: Dispose in accordance with all applicable federal, state and local regulations.

The information contained herein is furnished without warranty of any kind. Users should consider this data only as a supplement to other information gathered by them and must make independent determinations of the suitability and completeness of information from all sources to assure proper use and disposal of these materials and the safety and health of employees and customers.

物料安全技术说明书(MSDS)

1. 化学品及企业标识

产品类型	锂离子电芯 (可充电型)	**CATL 产品型号**	CB310
制造商	宁德时代新能源科技股份有限公司	**约计重量**	5.4Kg
容量	280Ah	**当量锂含量**	84g
标称电压	3.2V	**瓦时数**	896Wh
UN 号	UN3480	**运输名称**	锂离子电池
地址	中国福建省宁德市蕉城区漳湾镇新港路 2 号		
电话	+86-593-2583668	**传真**	+86-593-2583667

2. 危险性概述

2.1 美国化学文摘号/欧洲现有化学品目录号：无
国际标准化学名：可充电式锂离子电池

2.2 本产品根据欧盟法规 (EC) No. 1272/2008 进行了分类及标记。

• 图 示

GHS05 GHS07 GHS08

• 信号词: 危险

• 危险字句

H314 引起严重的皮肤灼伤和眼睛损伤

H317 可能引起皮肤过敏性反应

H301 吞咽会中毒

• 防范说明

P101 如需医嘱：请将产品容器或标签备放在手边。

P102 放在儿童伸手不及之处。

P103 使用前请读标签。

P260 不要吸入粉尘/烟/气体/烟雾/蒸气/喷雾。

P303+P361+P353 如皮肤(或头发)沾染：立即脱掉所有沾染的衣服。用水清洗皮肤/淋浴。

P305+P351+P338 如进入眼睛 ： 用水小心冲洗几分钟 。 如戴隐型眼镜并可方便地取出 ，取出隐型眼镜。继续冲洗。

P310 立即呼叫解毒中心/医生

P301+P310 如误吞咽： 立即呼叫解毒中心/医生。

P330 漱口。

P405 存放处须加锁。

P501 按照本地 / 地区 / 国家 / 国际规例处理内含物 / 容器。

2.3 其它危害：

PBT (残留性、生物浓缩性、毒性物质) 及 vPvB (高残留性、高生物浓缩性物质) 评价结果

PBT (残留性、生物浓缩性、毒性物质)：不适用的

vPvB (高残留性、高生物浓缩性物质)：不适用的

3. 成分/组成信息

重要提示：电池不能拆开或燃烧，暴露电池中在成分或燃烧产物是有害的。

原料或配料	CAS No. / EC No.	化学品 GHS 安全标签	重量百分比
石墨	CAS# 7782-42-5 EC#231-955-3	未被归类	7-25
磷酸铁锂	CAS# 15365-14-7 EC# 476-700-9	未被归类	15-40
氟丙烯亚乙烯基氟聚合物	CAS# 9011-17-0 EC# 618-470-6	Hazardous，H411	3-15
六氟磷酸锂	CAS# 21324-40-3 EC#235-362-0	ıte Tox. 3, H311; Skin Corr. 1B, H314; Acute Tox. 4, H302	0-5
乙炔炭黑	CAS# 1333-86-4 EC#215-609-9	未被归类	0-2
碳酸二乙酯	CAS# 105-58-8 EC#203-311-1	Flam. Liq. 3, H226	0-15

碳酸二甲酯	CAS# 616-38-6 EC# 210-478-4	Inflammable，H225	0-15
碳酸甲乙酯	CAS# 623-53-0 EC# 433-480-9	Inflammable，H225	0-15
碳酸丙烯酯	CAS# 108-32-7 EC#203-572-1	Eye Irrit. 2, H319	0-15
碳酸亚乙酯	CAS# 96-49-1 EC#202-510-0	Eye Irrit. 2, H319	0-15

4. 急救措施

在常规条件下使用，电池是密封的

摄取：摄入电池是有害的

电池的成分可以导致嘴、食道、胃肠道严重的化学烧伤，如果摄入电池或拆开的电池，不要诱导呕吐或吃食物或饮料。应立刻就医。

吸入：电池里的成分可能会引起呼吸道过敏，吸入蒸汽可能引起上呼吸道和肺过敏。应马上呼吸新鲜空气并就医。

皮肤吸收：碳酸亚乙酯、碳酸二乙酯、碳酸二甲酯可能会通过皮肤吸收导致局部炎症。

皮肤接触：电池里的成分可能会引起皮肤过敏或化学烧伤。消除污染的衣物并用肥皂和水清洗皮肤，如果发上化学烧伤或持续刺激，立刻就医。

眼睛接触：电池里的成分可能会引起严重的过敏和化学烧伤。立刻翻开上下眼睑，用清水冲洗眼睛 15 分钟以上，直到没有化学物质残留。然后立刻就医。

5. 消防措施

5.1 危险特性：触电、起火、爆炸、污染

单个电芯、电池组的电压也小于 50V（安全电压），没有电击的危险，如果电池组的电压大于 50V，那么就应该控制电击的发生。

在运输和测试工程，可能发生电箱跌落、挤压、刺破、金属短路、液体浸泡等危险因子，可能发生触电、起火危险；如果在密闭空间，可能有气体爆炸危险，通风良好或者敞开空间，不会有气体爆炸；事故泄露的液体，包括消防水处理不当有污染环境的危险。

5.2 物资准备和人员训练

1） 水雾灭火器： 每 500KWH 有 1 个 9 升的水基型水雾灭火器或者 2 个 6 升的水基型水雾灭火器，可扑灭 ABCE 类火灾（固体、非易燃液体、气体、低于 36KV 的电气火灾）。

2） 防水用品：雨衣、雨靴、橡胶手套；保鲜膜；抹布。

3） 个人保护用品（PPE）：口罩、高温手套，安全眼镜，半面罩。

4） 排烟工具： 每 20 米 1 个墙壁排烟风机，或移动排烟风机。车辆有通风孔。

5） 防爆工具： 保持敞开，如开放环境，车辆/设备不密闭。 测试中一定要密闭的设备如高温炉、高低温冲击测试仪器等，设备上要放置直径 200 毫米的厚度 8 微米的铜箔当泄压膜，房间墙壁每 20 米要 1 个风机，风机排量至少每小时 5000 立方米。

6） 中和物资：每 500KWH 准备 10 公斤石灰粉末用于中和流出的电解液，电解液遇到水会按照重量的 8%形成 HF, 要用碱性物资中和。

7） 电压测量：万用表。 物理密封住电流档，避免误操作仪表爆炸。

8） 训练技能：

a） 开启风机或者移动风机排烟；

b） 穿戴防水用具后用水雾灭火器灭火，灭火后晾干或者待手套抹干，测量电压正常，缠绕保鲜膜绝缘，再运输处理；

c） 对泄漏的电解液以重量的 8%比例洒石灰、或者 NaOH 粉末中和液体；

d） 会用万用表测试电压， 特别留意别用错档位（要物理封闭电流挡），防仪表爆炸。

5.3 灭火流程

1） 发现电池冒烟或燃烧时立即报警；

2） 穿着防护用品，包括呼吸器、口罩，如果用水还应包括雨衣、雨鞋、绝缘手套等

3） 切断电源；

4） 使用固体类灭火器材，推荐按以下顺序使用灭火器材：水或水雾沙灭火毯、干粉、二氧化碳灭火器；

5） 通过风扇或空气流通排烟；

6） 干燥、中和。通过风扇干燥，如果使用了水用氢氧化钙中和。

图片 1 水基灭火器
(可使用灭 36KV 下的电气火灾)

图片 2 水雾灭火器
(穿着 PPE 防止触电)

6. 泄露应急处理

现场：将物质置于合适在容器中，然后向当地警方报警。

在水中：当电池组在水中时，有微弱电击的危险；在电解水时会产生氢气，必须保持通风以防止氢气集聚，防止氢气在密闭空间爆炸。如果可以，将电池或模组从水中拿出然后向当地警方报警。

7. 操作处置与储存

电池和电池动力设备运输时，最主要的危险之一就是电池两极接触其他电池、金属物体或其他导电体而引起的电池短路。因此，必须将包装好的电池芯和电池使用适当的方式隔开，以防止发生短路和电极破损。此外，电池和电池芯还必须包装在坚固的外包装内，或者安装在设备中。

操作注意事项：请勿对电池进行过度的物理冲击或振动。应避免短路，虽然几秒钟在短路不会对电池造成严重的影响。长时间的短路会导致电池迅速失去能量，可以产生足够的热量将外壳烧着。短路的来源包括将电池胡乱放在在散装容器中、或在设备上进行电池装配时使用的各种金属物品。为了将电池短路的危险降低到最小，那么在电池运输和存储时，应该提供电池的保护措施。不能将电池拆解或使电池变形。电芯破裂时，不要将其接触到水。操作处理超过 50V 的电池组时，操作人员需要绝缘防护。

储存注意事项：当锂离子电池长时间储存时，其充电容量应在 25% 和 75%之间。应储存在干燥凉爽且通风较好的区域。温度过高会导致电池发生一系列的问题，如泄漏或生锈。请勿将电池置于明火中。

8. 接触控制/个体防护

工程控制：远离热源和明火。存储与干燥凉爽的区域

个人防护：

呼吸系统防护：正常条件下不需要防护

眼睛/脸部防护：正常条件下不需要防护。处理拆卸的或泄漏的电池，要佩戴有护边的安全眼镜。

手的防护：正常条件下不需要防护。处理拆卸的或泄漏的电池，应佩戴氯丁橡胶或天然橡胶手套。

脚的保护：在搬运大容器时，建议穿戴劳保鞋。

9. 理化特性

物理状态	固体	在水中的溶解度	不适用
颜色	白色	蒸气压力	不适用
气味	无	爆炸极限	不适用
闪点	不适用	自燃性	不适用
在乙醇中的溶解度	不适用	熔点	不适用
沸点	不适用	凝固点	不适用

10. 稳定性和反应活性

稳定性：产品在第 7 节所述的条件下稳定。

应避免的条件：加热 70° C 以上或焚烧。变形。毁坏。粉碎。拆卸。过充电。短路。长时间暴露在潮湿的条件下。

应避免的材料：氧化剂，碱，水。

危险分解物：有毒烟雾，并可能形成过氧化物。

聚合危害：不适用

如果发生泄露，避免与强氧化剂，无机酸，强碱，卤代烃接触。

11. 毒理学资料

标志及症状：无，除非电池破裂。

内部物质暴露的情况下，蒸汽烟雾可能对眼睛和皮肤的刺激性。

吸入：对肺有刺激性。

皮肤接触：对皮肤刺激性。

眼睛接触：对眼睛有刺激性。

食入：吞下中毒。

下列情况下会危险人员身体健康：如果与电池内部材料直接接触，皮肤可能会出现干燥、灼烧等轻微或严重的刺激，并且损坏靶器官的神经，肝脏和肾脏。

12. 生态学资料

对哺乳动物的影响：目前未知。

生态毒性：目前未知。

生物累积潜势：慢慢地生物降解。

环境危害：目前没有已知的环境危害。

13. 废弃处置

禁止焚烧电池，或使电池温度超过 70° C，这种滥用可导致泄漏和/或电池爆炸。按照相应的地方性法规处理。

14. 运输信息

14.1 空运要求

锂离子电池或电池芯应根据国际航空运输协会 IATA DGR 第 61 版相关要求进行运输。锂离子电池或电池芯按国际航空运输协会危险物品的规定，应依照下表要求进行包装和装贴标签（如果电芯小于 20Wh，电池小于 100Wh 且包装满足 PI-965 第二部分的要求时，不属于危险物品。）。

UN 号	运输品	功率	包装要求	需粘贴的标签
UN3480	锂离子电池	电池芯＞20WH 电池＞100Wh	PI965 Section IA 每个包装件限量： 客机禁运 全货机=35Kg	第 9 类危化品标识 
		电池芯≤20Wh 电池≤100Wh	PI965 Section IB 包装件超过 SectionII 限制时使用 IB 每个包装件限量： 客机禁运 全货机=10Kg 毛重	第 9 类危化品标识和安全操作标签  

		电池芯≤20Wh 电池≤100Wh	PI965 Section Ⅱ 每个包装件限量： 电池芯、电池≤2.7Wh，限量=2.5Kg 或 ＞2.7Wh 且≤20Wh 限量=8 块电池芯 ＞2.7Wh 且≤100Wh 限量=2 块电池 客机禁运	安全操作标签 
UN3481	锂离子电池安装在设备中	电池芯＞20WH 电池＞100Wh	PI967 Section I 每个包装件限量： 客机= 5Kg 全货机=35Kg	第 9 类危化品标识 
		电池芯≤20Wh 电池≤100Wh	PI967 Section Ⅱ 每个包装件限量： 客机= 5Kg 全货机=5Kg	安全操作标签 
UN3481	锂离子电池与设备包装在一起	电池芯＞20WH 电池＞100Wh	PI966 Section I 每个包装件限量： 客机= 5Kg 全货机=35Kg	第 9 类危化品标识 
		电池芯≤20Wh 电池≤100Wh	PI966 Section Ⅱ 每个包装件限量： 客机= 5Kg 全货机=5Kg	安全操作标签 

如果电芯或电池的电荷载量大于 30%的荷电容量上限，需要获得在原产地和运营商主管当局批准。

符合包装说明 PI965 第 II 节规定的包装件在提供给运营人之前，必须单独封装，而不能与其他货物混装。

符合包装说明 PI965 和 PI968 第 II 章节要求的锂电芯和电池货物不得与其它危险品装入同一个外包装中。

禁止锂离子电池（UN 3480, PI965 Section IA or IB）和锂聚合物电池（UN 3090, PI968 Section IA or IB）与包括第 1 类爆炸物质（除第 1.4 类弹药）、第 2.1 类易燃气体、第 3 类易燃液体、第 4.1 类易燃固体、第 5.1 类氧化剂等危险品货物包装在同一个外包装中。

不能损坏或错误处理电芯，如果电芯损坏，必须隔离、检查和重新包装。禁止运输被厂商确定为出于安全原因的缺陷，或已损坏，有潜在产生发热、着火或短路危险的电芯和电池；废锂电池和锂电池被运往回收或处理，禁止空运除非经起源国相关的国家机关批准。

锂离子电池需经过 UN38.3 测试，如果未通过该测试，则不能运输，需重新设计。若通过测试，则对于锂离子电池：遵循 UN3480，包装要求为 PI965。锂离子电池安装在设备中的：遵循 UN3481，包装要求为 PI967。

电池测试满足联合国手册中第三部分测试标准 38.3 部分的所有要求（如下表）。

编号	项目	结果	备注
1	高度模拟试验	通过	测试 1 到 5 必须用相同的电芯或电池按顺序进行
2	加热危险	通过	
3	振动	通过	
4	冲击	通过	
5	外短路	通过	
6	碰撞	通过	
7	强制放电	通过	只针对电芯

14.2 海运要求

运输参考《国际海运危险货物规则》，按 UN NO 3480/3481 的要求管理，采用第二类包装。安装牢固，互相隔离，防止短路，装有多于 24 个锂电池或 12 个锂电池组的包件：须标记说明破损时遵守的特殊程序；随船备有一份破损时遵守的特殊程序说明文件.

《国际海运危险货物规则》188 条规定：对于锂离子电芯，瓦特-小时的额值不超过 20Wh，不作为危险货物运输。对于锂离子电池（组）瓦特-小时比率不超过 100Wh 的不作为危险货物运输，但需在外壳标明及瓦特-小时值。除装在设备中外，电池和电池组须装在完全将其密封的内包装箱内，电池或电池组须加以防护以免发生短路。

《国际海运危险货物规则》230条规定：电池或电池组的类型应满足联合国《实验和标准手册》第三部分第38.3小节的每项试验要求。

15. 法规信息

法规信息：见 ACGIH 第三部分规定暴露限值信息。

美国：本物质安全数据资料符合 OSHAS 相关要求。

国际：本物质安全数据资料符合欧盟（联合国），国际标准化组织（ISO）和国际劳工组织（ILO）和美国（美国国家标准协会）标准 Z400.1-1993。

空运：参考民航行业规范 MH/T1020-2018 《锂电池航空运输规范》与 IATA DGR、ICAO 的要求是一致的。目前国际运输及商检都是采用的这个标准。

海运：运输参考《国际海运危险货物规则》，按 UN NO 3480/3481 的要求管理。

陆运：参考《危险货物品名表》（GB12268-2012）

防触电：参照工作场所电气安全标准 NFPA-70E

16. 其他信息

充电：本电池可多次重复充电。请使用原装电池充电器。不要使用改装或损坏的电池充电器。当充电超过规定的充电时间可停止充电，来防止电池过充。充电温度应在 0℃-45℃°，电池充电过程中有正常的发热现象。

充电电压和电流：当电压超过规定的值后受到电池内部保护电路限制。如果出现保护电路受损情况，请停止使用。请在规定的电压和电流下充、放电。如果电池的电压下降到低于规定的最低电压时，请停止使用。

标识：如果没有或看不清标签或包装上的警告时，请联系相关人员提供封装和设备标签说明。如果锂电池或电池芯使用空运，包装上根据 IATA 60th 相关要求粘贴第 9 类危险性标签（如图 3）或/和锂电池操作标签（如图 4）。

图 3：第 9 类危险性标签

图 4：锂电池操作标签

如果锂电池或电池芯使用海运，包装上根据 IMDG.相关要求如下

- 包件：不需任何标志；
- 不需正确运输名称；
- 需要所有的联合国编号；
- 组件：不需要标牌和标志；
- 需要标明“限量”字样。

警告：应使用设备制造商提供的充电器并按操作指南使用。禁止将电池打开，靠近火源，以及短路，可能引起着火、爆炸、泄漏造成人身伤害。

处置：依照联合国、国家、地方相应规程进行处置。

说明:这里包含的信息是没有任何授权下完成的。该信息只作为一个参考，使用者应该根据自己实际搜集的完整可靠的信息来定制独立的体系，从而确保能够适当的使用并处理员工和顾客的安全及健康。

Safety Data Sheet

According to OSHA Hazard Communication Standard, 29 CFR 1910.1200

Initial preparation date: 09.22.2016

ENVIROTEMP™ FR3™ FLUID BULK

SECTION 1: Identification

Material name: ENVIROTEMP™ FR3™ FLUID BULK
Product code: 100088941
Recommended use of the product and restriction on use:
Dielectric fluid.

Manufacturer or supplier details

Manufacturer:
Cargill, Incorporated
Cargill Industrial Specialties
13400 15th Avenue North
Plymouth, MN 55441
1-800-842-3631, 1-952-984-9122
CIS_CustomerService@Cargill.com

Emergency telephone number:
ChemTel Inc
North America: 1-800-255-3924
International: 01-813-248-0585

SECTION 2: Hazard(s) identification

GHS classification: Not a hazardous substance or mixture

Label elements

Hazard pictograms: None

Signal word: None

Hazard statements:

Precautionary statements:
None

Hazards not otherwise classified: None

SECTION 3: Composition/information on ingredients

Identification	Name	Wt. %
CAS number: 8001-22-7	Soybean Oil	>99

SECTION 4: First-aid measures

Description of first aid measures

After inhalation:

Get medical advice if you feel unwell.

If inhaled, remove to fresh air.

After skin contact:

Wash with plenty of water / soap and rinse thoroughly.
Get medical advice if skin irritation occurs or you feel unwell.

After eye contact:

Rinse cautiously with water for several minutes.
Remove contact lenses, if present and easy to do. Continue rinsing.
Get medical advice/attention.

After swallowing:

Rinse mouth and do not induce vomiting.
Get medical advice if you feel unwell or concerned.

Most important symptoms and effects, both acute and delayed

Acute symptoms:

No information available.

Delayed symptoms:

No information available.

Immediate medical attention and special treatment:

No information available.

SECTION 5: Fire-fighting measures

Extinguishing media

Suitable extinguishing media:

Use Water (fog only), dry chemical, chemical foam, carbon dioxide, or alcohol-resistant foam.

Unsuitable extinguishing media:

Do not use water as an extinguisher.

Specific hazards during fire-fighting:

Thermal decomposition can lead to release of irritating gases and vapors.

Special protective equipment for firefighters:

Use typical firefighting equipment, self-contained breathing apparatus, special tightly sealed suit.

Additional information:

None

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures:

Wear recommended personal protective equipment.
Ensure adequate ventilation.
Ensure air handling systems are operational.

Environmental precautions:

Should not be released into the environment.
Prevent from reaching drains, sewer or waterway.

Methods and material for containment and cleaning up:

Wear protective eye wear, gloves and clothing.
Absorb with non-combustible liquid-binding material (sand, diatomaceus earth (clay), acid binders, universal binders).
Dispose of contents / container in accordance with local regulations.

Reference to other sections:

None

SECTION 7: Handling and storage

Precautions for safe handling:

Use appropriate personal protective equipment (see Section 8).
Use only with adequate ventilation.
Avoid breathing mist or vapor.
Do not eat, drink, smoke or use personal products when handling chemical substances.
Wash thoroughly after handling.

Conditions for safe storage, including any incompatibilities:

Store in a cool, well-ventilated area.
Protect from freezing and physical damage.
Keep container tightly sealed.

SECTION 8: Exposure controls/personal protection

Components with workplace control parameters:

Appropriate engineering controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and mists below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above.
Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:

Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines.
If there are no applicable exposure limit requirements or guidelines, use a NIOSH-approved respirator.

Eye protection:

Safety goggles or glasses, or appropriate eye protection.

Skin and body protection:

Select glove material impermeable and resistant to the substance.

General hygienic measures:

Wash hands before breaks and at the end of work.
Avoid contact with skin, eyes and clothing.
Wash contaminated clothing before reusing.

SECTION 9: Physical and chemical properties

Appearance (physical state, color):	Light green liquid	**Explosion limit lower:** **Explosion limit upper:**	Not determined or not available. Not determined or not available.
Odor:	Slight	**Vapor pressure:**	< 1.3 Pa (<0.01 mmHg)
Odor threshold:	Not determined or not available.	**Vapor density:**	Not determined or not available.
pH-value:	Not determined or not available.	**Relative density:**	Not determined or not available.
Melting/Freezing point:	Not determined or not available.	**Solubilities:**	Insoluble.
Boiling point/range:	>360°C (>680°F)	**Partition coefficient (n-octanol/water):**	Not determined or not available.
Flash point (closed cup):	>= 310°C (Open Cup); >= 250°C (Closed Cup)	**Auto/Self-ignition temperature:**	401-404°C (ASTM E659)
Evaporation rate:	Not determined or not available.	**Decomposition temperature:**	Not determined or not available.
Flammability (solid, gaseous):	Not determined or not available.	**Dynamic viscosity:**	Not determined or not available.
Density:	0.92 gm/cm³ (7.677 lb/gal)	**Kinematic viscosity:**	33-35 mm²/s

SECTION 10: Stability and reactivity

Reactivity:

Does not react under normal conditions of use and storage.

Chemical stability:

Stable under normal conditions of use and storage.

Possibility of hazardous reactions:

None under normal conditions of use and storage.

Conditions to avoid:

None known.

Incompatible materials:

Strong oxidizing agents.

Hazardous decomposition products:

Carbon monoxide, carbon dioxide.

SECTION 11: Toxicological information

Exposure routes:

No information available.

Acute toxicity:

No information available.

Skin corrosion/irritation:

No information available.

Serious eye damage/irritation:

No information available.

Respiratory or skin sensitization:

No information available.

Carcinogenicity:

IARC (International Agency for Research on Cancer):

None of the ingredients are listed.

NTP (National Toxicology Program):

None of the ingredients are listed.

Germ cell mutagenicity:

No information available.

Reproductive toxicity:

No information available.

STOT-single and repeated exposure:

No information available.

Aspiration toxicity:

No information available.

Additional toxicological information

No information available.

SECTION 12: Ecological information

Ecotoxicity:

No information available.

Persistence and degradability:

No information available.

Bioaccumulative potential:

No information available.

Mobility in soil:

No information available.

Other adverse effects:

No information available.

SECTION 13: Disposal considerations

Disposal methods:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory agencies.

SECTION 14: Transportation information

Land transport:

DOT (49 CFR) transport

UN Number:	Not Regulated
UN Proper shipping name:	Not Regulated
UN Transport hazard classes:	
Packing group: **Danger label:**	Not Regulated
Environmental hazards:	No
Special precautions for user:	None

Air transport:

IATA-DGR

UN Number:	Not Regulated
UN Proper shipping name:	Not Regulated
UN Transport hazard classes:	
Packing group: **Danger label:**	Not Regulated
Environmental hazards:	No
Special precautions for user:	None

Sea transport:

IMDG

UN Number:	Not Regulated
UN Proper shipping name:	Not Regulated

UN Transport hazard classes:	
Packing group:	Not Regulated
Danger label:	
EMS code:	None
Environmental hazards:	No
Special precautions for user:	None
Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable	

SECTION 15: Regulatory information

North American

SARA Section 311/312 (Specific toxic chemical listings):
Not classified.

SARA Section 302 (Extremely hazardous substances):
None of the ingredients are listed.

SARA Section 313 (Specific toxic chemical listings):
None of the ingredients are listed.

TSCA (Toxic Substances Control Act):
All ingredients are listed.

TSCA Rules and Orders:
Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer:
None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females:
None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males:
None of the ingredients are listed.

Chemicals known to cause developmental toxicity:
None of the ingredients are listed.

Canada

DSL (Canadian Domestic Substances List):
All ingredients are listed.

SECTION 16: Other information

Abbreviations and Acronyms: None

This product has been classified in accordance with OSHA HCS 2012 guidelines. The information provided in this SDS is correct, to the best of our knowledge, based on information available. The information given is designed only as a guidance for safe handling, use, storage, transportation and disposal and is not to be

considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials, unless specified in the text. The responsibility to provide a safe workplace remains with the user.

NFPA: 0-1-0

HMIS: 0-1-0

Initial preparation date: 09.22.2016