

AUTORIZZAZIONE UNICA Ex D. LGS. N. 387/2003



PROGETTO DEFINITIVO PARCO EOLICO EMILIA

Titolo elaborato:

RELAZIONE DESCRITTIVA BESS

LT	GD	GD	EMISSIONE	12/09/22	0	0
REDATTO	CONTR.	APPROV.	DESCRIZIONE REVISIONE DOCUMENTO	DATA	REV	

PROPONENTE



EMILIA PRIME S.R.L.

VIA G. GARIBALDI N. 15
74023 GROTTAGLIE (TA)

CONSULENZA



GE.CO.D'OR S.R.L.

VIA G. GARIBALDI N. 15
74023 GROTTAGLIE (TA)

PROGETTISTA

ING. GAETANO D'ORONZIO
VIA GOITO 14 – COLOBRARO (MT)

Codice
MCOE065

Formato
A4

Scala
/

Foglio
1 di 20

1. PREMESSA	3
2. DEFINIZIONI	5
3. CODICI E STANDARD	6
4. DESCRIZIONE GENERALE DEL PROGETTO	7
5. DESCRIZIONE DEI COMPONENTI DEL SISTEMA BESS	12
6. CARATTERISTICHE DEL CONTAINER	13
7. CARATTERISTICHE DELLE BATTERIE	14
8. COLLEGAMENTO DEL SISTEMA DI CONVERSIONE A 36 KV	14
9. FUNZIONALITA' BESS	15
10. SUPERVISIONE E CONTROLLO DEL SISTEMA	15
11. SMALTIMENTO PRESSO L'END OF PLANT LIFE	17
ALL 1 - ENERGY STORAGE COMPONENTS	18
ALL 2 - CATL MSDS- FLUENCE R852280-E-T-I-1	19
ALL. 3 - MSDS_LITHIUM IRON PHOSPHATE FINAL 3OCT2018	20

1. PREMESSA

La **Emilia Prime s.r.l.** è una società costituita per realizzare un impianto eolico in Emilia-Romagna, denominato “**Parco Eolico Emilia**”, nel territorio dei Comuni di Monterenzio, Casalfiumanese e Castel Del Rio (Provincia di Bologna) con punto di connessione a 36 kV in corrispondenza della Stazione Elettrica RTN Terna 132/36 kV di Castel San Pietro Terme di futura realizzazione.

A tale scopo, la Ge.co.D’Or. s.r.l., società italiana impegnata nello sviluppo di impianti per la produzione di energia da fonti rinnovabili con particolare focus nel settore dell’eolico e proprietaria della Emilia Prime s.r.l., si è occupata della progettazione definitiva per la richiesta di Autorizzazione Unica (AU) alla costruzione e l’esercizio del suddetto impianto eolico e della relativa Valutazione d’Impatto Ambientale (VIA).

L’impianto eolico presenta una potenza nominale totale in immissione pari a 79 MWp ed è costituito da 9 aerogeneratori di potenza nominale pari a 6.0 MWp, con altezza torre pari a 135 m e rotore pari a 170 m, e un sistema di accumulo energia elettrica (BESS, Battery Energy Storage System) di potenza pari a 25 MWp.

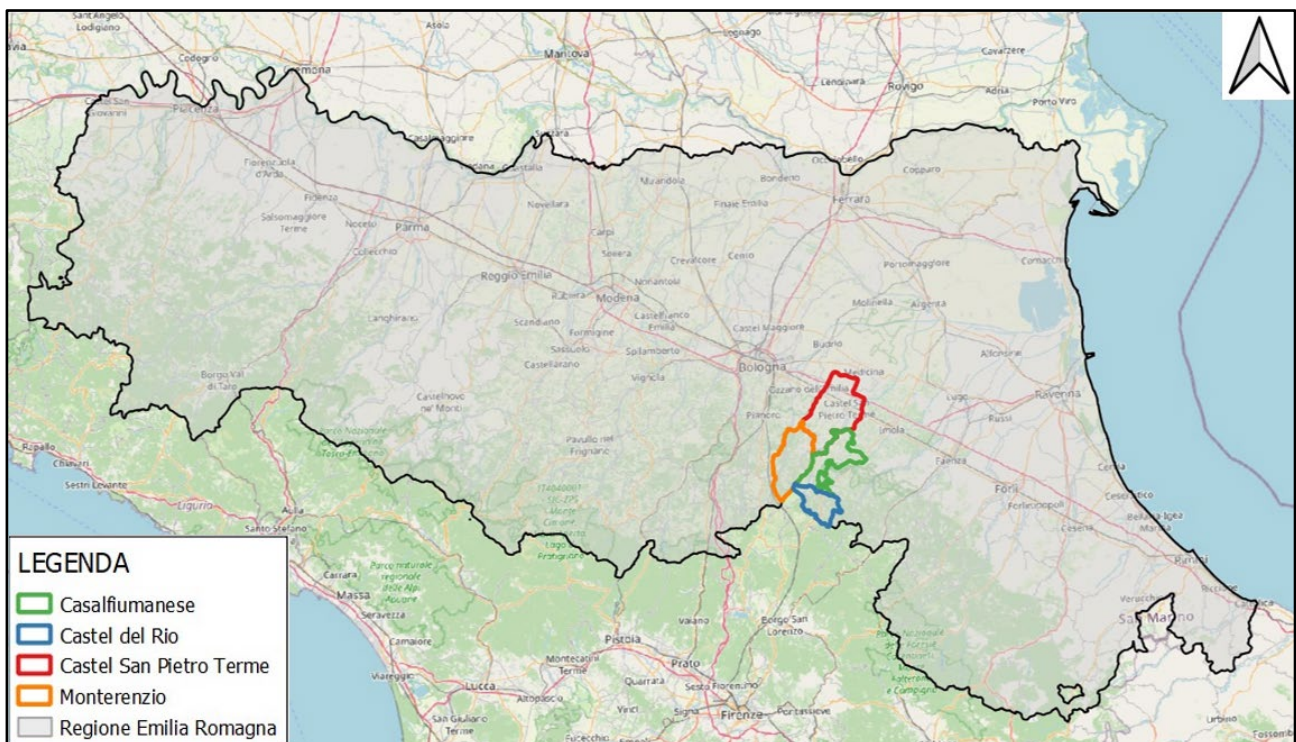


Figura 1.1: Localizzazione Impianto Eolico Emilia

Lo scopo del presente documento è quello di definire le caratteristiche tecniche del Battery Energy Storage System (detto BESS) destinato ad essere installato nelle vicinanze della Stazione Elettrica di trasformazione della RTN Terna 132/36 kV situata nel Comune di Castel San Pietro Terme, Provincia di Bologna, della Regione Emilia-Romagna.

Il trend di crescita del settore delle energie rinnovabili negli ultimi anni ha richiesto l'integrazione con sistemi normativi costituiti da sistemi di stoccaggio dell'energia, tra cui BESS.

L'integrazione di sistemi di stoccaggio con grandi sistemi di produzione di energia da fonti rinnovabili, eolici e solari, permette di garantire un'alta qualità dell'energia immessa in rete, evitando prima di tutto le possibili fluttuazioni naturali di potenza, intrinseche a questi sistemi.

Di conseguenza, il BESS integrato ai sistemi di produzione di energia solare ed eolica contribuisce così ad un sostanziale aumento della diffusione degli impianti di produzione di energia da fonti rinnovabili, migliorandone le prestazioni tecniche ed economiche.

Il sistema di stoccaggio dell'energia da installare fornirà servizi di regolazione della frequenza primaria, servizi di regolazione secondaria e terziaria e riduzione degli squilibri.

Il BESS sarà collegato alla rete attraverso un trasformatore 132/36 kV interno alla SE RTN 132/36 kV di Castel San Pietro Terme, con il quale condividerà anche il framework di distribuzione a 36 kV. Il BESS avrà una potenza di 25 MW e sarà costituito da batterie al litio. La configurazione finale del BESS, in termini di numero di contenitori batteria, numero di sistemi di conversione e numero di moduli batteria, sarà effettuata in base alle scelte progettuali relative alla fornitura che sarà condivisa con il fornitore del sistema.

Allegata è la planimetria (ALL. 1) del progetto preliminare, che rappresenta una possibile soluzione footprint con valori unitari medi di potenza e densità di capacità rappresentativi dei prodotti attualmente sul mercato.

L'altezza dei contenitori, di tipo standard (40'), sarà di circa 3 m e sollevata da terra tra i 10 e i 15 cm.

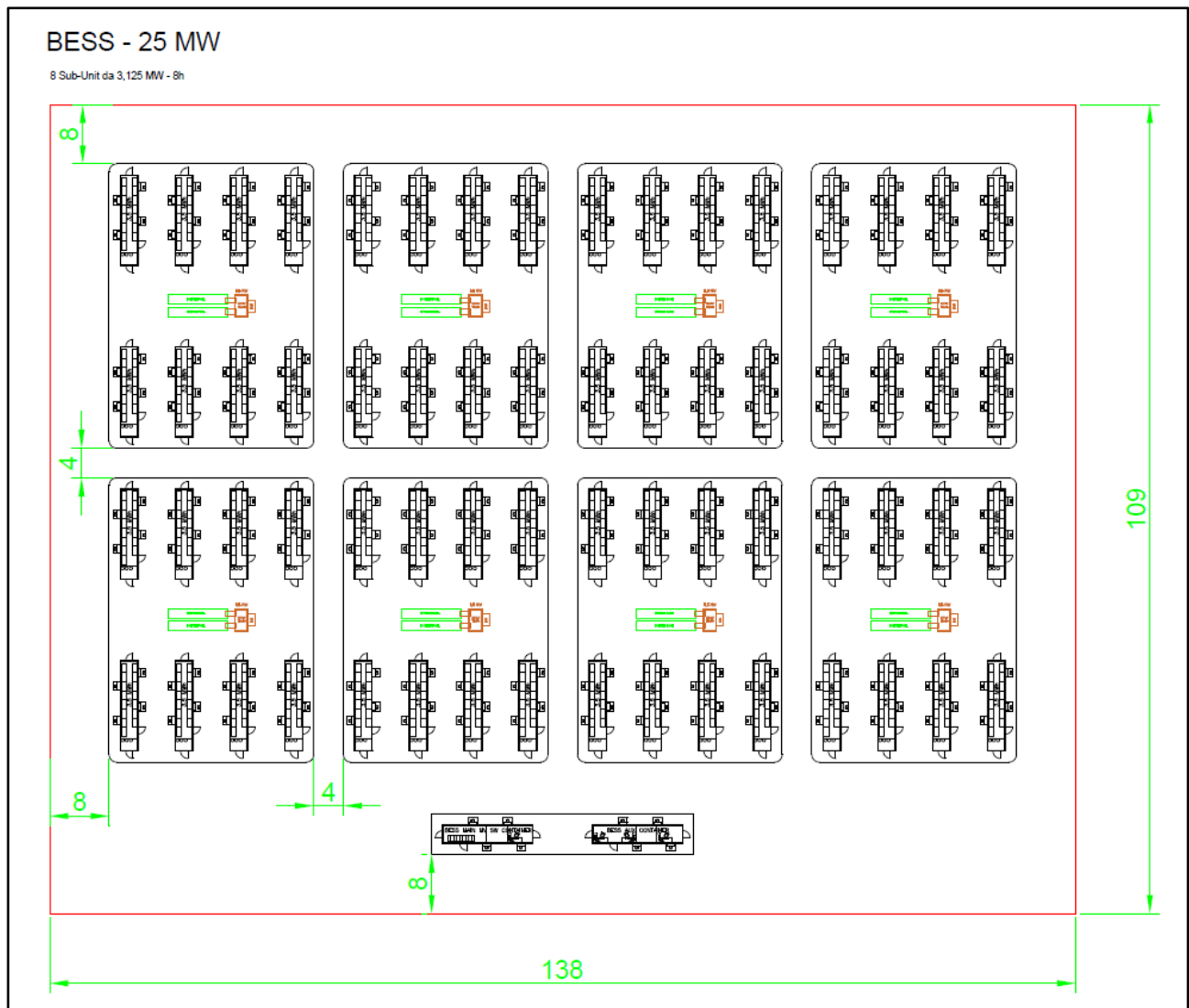


Figura 1.2: Planimetria del progetto preliminare del BESS (ALL 1)

2. DEFINIZIONI

- **BESS:** Battery Energy Storage System – Sistema di accumulo di energia a batterie;
- **MSDS:** Material Safety Data Sheet – Scheda tecnica di sicurezza;
- **MSD:** Mercato dei Servizi di Dispacciamento;
- **PCS:** Power Conversion System – Sistema di conversione della corrente (AC-DC e viceversa);
- **BMS:** Battery Management System – Sistema di controllo batterie;
- **SCI:** Sistema di Controllo Integrato;
- **Plant SCADA** Sistema Centrale di Controllo Integrato;
- **SOC:** Stato di Carica – rappresenta il rapporto tra energia immagazzinata nel sistema e la rispettiva energia nominale;
- **SOH:** State of Health – rappresenta in % le condizioni di una batteria/cella comparate alle condizioni ideali;

- **DOD**: Profondità di Scarica – rappresenta la variazione subita dal SOC 100% durante una fase di scarica;
- **ΔP_e** : Variazione della potenza elettrica [MW];
- **THD**: Total Harmonic Distorsion – Distorsione armonica totale;
- **MT**: Media tensione;
- **BT**: Bassa tensione;
- **AC**: Corrente alternata;
- **DC**: Corrente continua;
- **TSO**: Transmission System Operator (TERNA);
- **LPS**: Lightning Protection System (sistemi protezione da scariche atmosferiche);
- **RUP**: Registro Unità Produttive;
- **SLMM**: Sul Livello Medio Marino.

3. CODICI E STANDARD

- ✓ Nel seguito sono riportate le norme tecniche di riferimento:
- ✓ CEI EN 61936-1: Impianti elettrici con tensione superiore a 1 kV; in c.a. – Parte 1: Prescrizioni comuni;
- ✓ CEI EN 50522: Messa a terra degli impianti elettrici a tensione superiore a 1kV in a.c.;
- ✓ CEI 99-5: Guida per l'esecuzione di sistemi di terra di utenze attive e passive relative a sistemi di distribuzione con tensioni superiori a 1 kV in a.c.;
- ✓ CEI EN 61000-6-2: Compatibilità elettromagnetica (EMC) – Parte 6-2 Standard generali – Immunità per ambienti industriali;
- ✓ CEI EN 61000-6-4: Compatibilità elettromagnetica (EMC) – Parte 6-4 Standard generali – Emissioni per ambienti industriali;
- ✓ CEI EN 62305-1: Protezioni per fulmini - Parte 1: Principi Generali;
- ✓ CEI EN 62305-2: Protezioni per fulmini - Parte 1: Valutazione del rischio di fulmini;
- ✓ CEI EN 62305-3: Protezioni per fulmini - Parte 1: Danneggiare il materiale alle strutture e il pericolo per le persone;
- ✓ CEI EN 62305-4: Protezioni per fulmini - Parte 1: Impianti elettrici ed elettronici nelle strutture;
- ✓ CEI 81-30: Lightning Protection – Location Networks Lightning (LLS) – Linee guida per l'utilizzo dei sistemi LLS per l'individuazione dei valori Ng;
- ✓ UNI 9795: Sistemi fissi di rilevamento automatico.

4. DESCRIZIONE GENERALE DEL PROGETTO

L'impianto eolico presenta una potenza nominale totale pari a 79 MWp ed è costituito da 9 aerogeneratori di potenza pari a 6.0 MWp, altezza torre pari a 135 m e rotore pari a 170 m, collegati tra loro mediante un sistema di cavi interrati a 36 kV, opportunamente dimensionati, che si collega alla Stazione Elettrica di trasformazione (SE) della RTN 132/36 kV di Castel San Pietro Terme prevista in realizzazione, e dal BESS di potenza di 25 MWp.

L'impianto si colloca in Emilia-Romagna, nella provincia di Bologna, all'interno di un'area di circa 2.000 ettari ed interessa prevalentemente il Comune di Monterenzio, ove ricadono 3 aerogeneratori, il Comune di Casalfiumanese, ove ricadono 4 aerogeneratori, il Comune di Castel del Rio, dove ricadono 2 aerogeneratori e il Comune di Castel San Pietro Terme dove ricadono la linea di collegamento elettrico tra il parco eolico e la SE RTN 132/36 kV, tale sottostazione elettrica e il BESS.

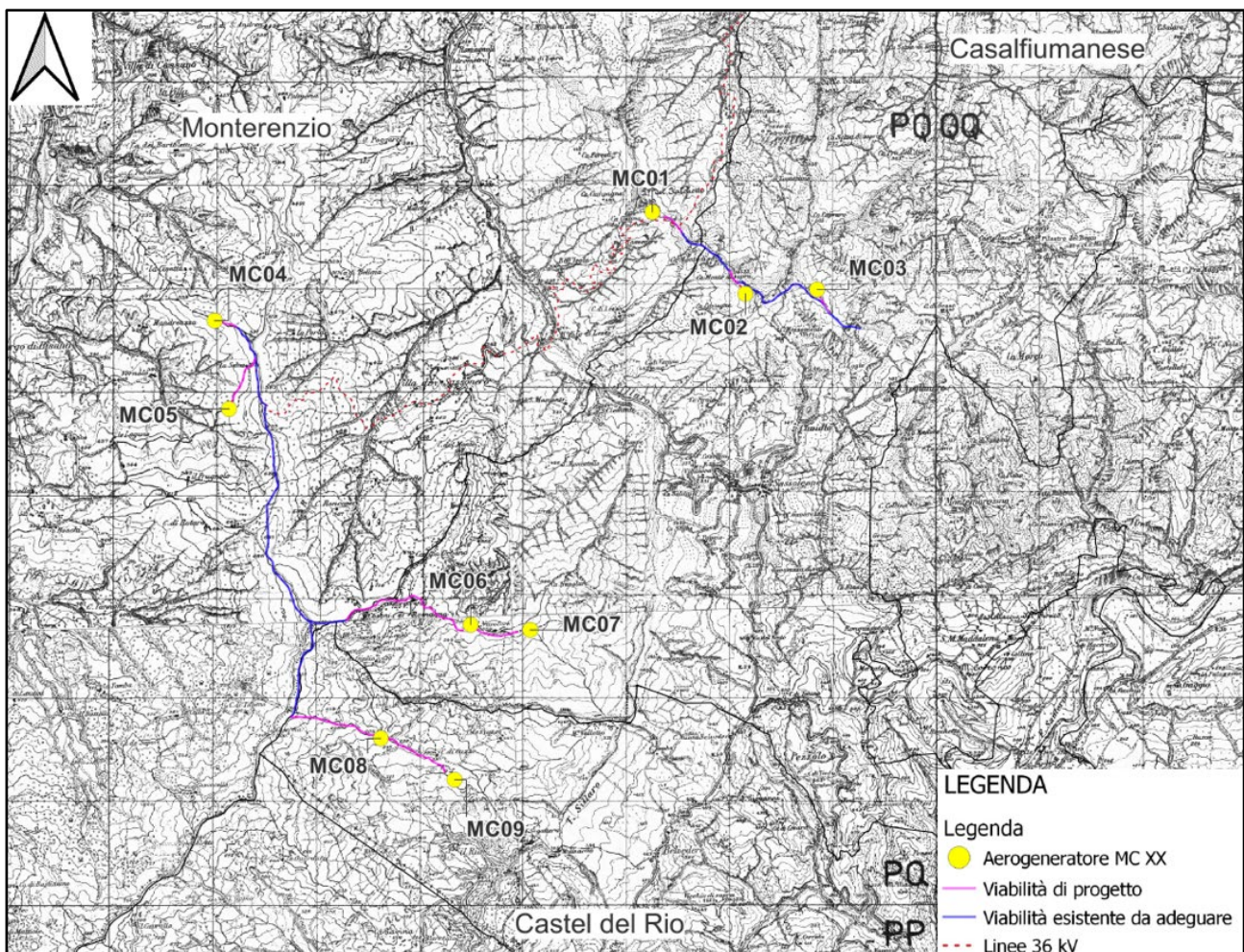


Figura 4.1: Layout d'impianto su carta IGM

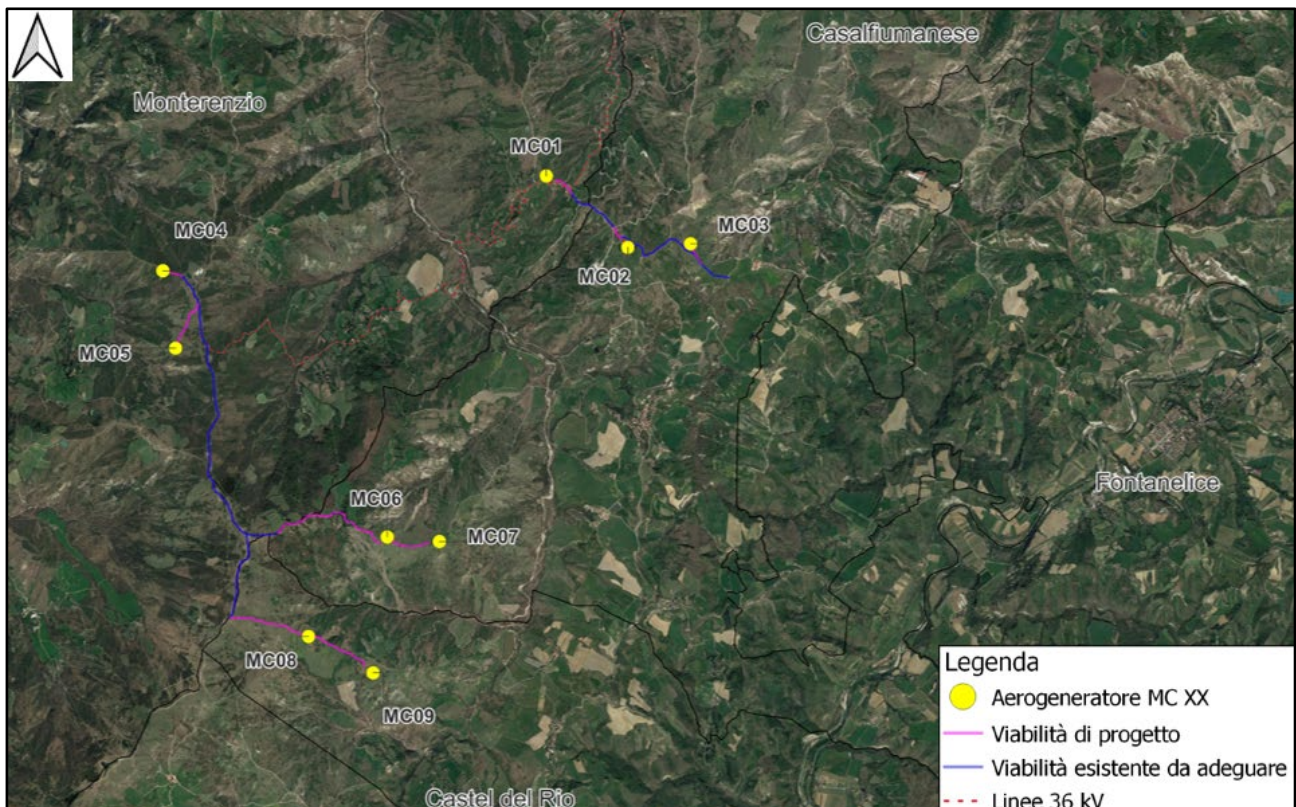
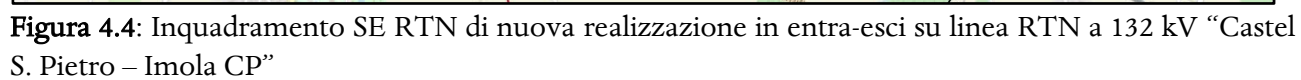
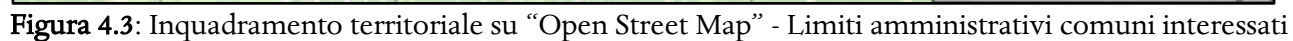


Figura 4.2: Layout d’impianto su ortofoto

Lo schema di allacciamento alla RTN prevede che l’impianto eolico venga collegato in antenna a 36 kV con la futura Stazione Elettrica (SE) della RTN da inserire in entra-esce alla linea RTN a 132 kV “Castel S. Pietro – Imola CP” in accordo con la STMG (Soluzione Tecnica Minima Generale) CP 202102219.

Ai sensi dell’art. 21 dell’allegato A alla deliberazione Arg/elt/99/08 e s.m.i. dell’Autorità di Regolazione per Energia Reti e Ambiente, il nuovo elettrodotto in antenna a 36 kV per il collegamento dell’impianto eolico sulla Stazione Elettrica della RTN costituisce impianto di utenza per la connessione, mentre lo stallo arrivo produttore a 36 kV nella suddetta stazione costituisce impianto di rete per la connessione.

Le turbine eoliche sono collegate alla SE di trasformazione della RTN attraverso un sistema di linee elettriche interrate a 36 kV allocate prevalentemente in corrispondenza del sistema di viabilità interna che servirà per la costruzione e la gestione futura dell’impianto e verrà realizzato prevalentemente adeguando il sistema viario esistente e, nei casi necessari, anche per evitare di interessare aree vincolate, realizzando nuovi tratti di viabilità.



Si riportano di seguito le coordinate delle posizioni scelte per l'installazione degli aerogeneratori con il relativo inquadramento catastale.

Aerogeneratore	Comune	Latitudine	Longitudine	Foglio	Particella	D rotore [m]	H _{hub} [m]	H _{tot} [m]
MC01	Monterenzio	44°17'7.15"N	11°28'14.23"E	70	8	170	135	220
MC02	Casalfiumanese	44°16'40.69"N	11°28'53.76"E	47	155	170	135	220
MC03	Casalfiumanese	44°16'41.30"N	11°29'25.07"E	68	1	170	135	220
MC04	Monterenzio	44°16'37.27"N	11°25'1.86"E	79	14	170	135	220
MC05	Monterenzio	44°16'9.45"N	11°25'6.99"E	79	187	170	135	220
MC06	Casalfiumanese	44°14'59.72"N	11°26'49.64"E	82	20	170	135	220
MC07	Casalfiumanese	44°14'57.51"N	11°27'15.52"E	85	7	170	135	220
MC08	Castel del Rio	44°14'24.94"N	11°26'8.93"E	2	7	170	135	220
MC09	Castel del Rio	44°14'11.27"N	11°26'40.61"E	3	36	170	135	220

Tabella 4.1: Localizzazione planimetrica e catastale degli aerogeneratori di progetto

Il progetto prevede che uno dei possibili aerogeneratori da installare è il modello Siemens Gamesa SG 170 di potenza nominale pari a 6.0 MWp, altezza torre all'hub pari a 135 m e diametro del rotore 170 m.

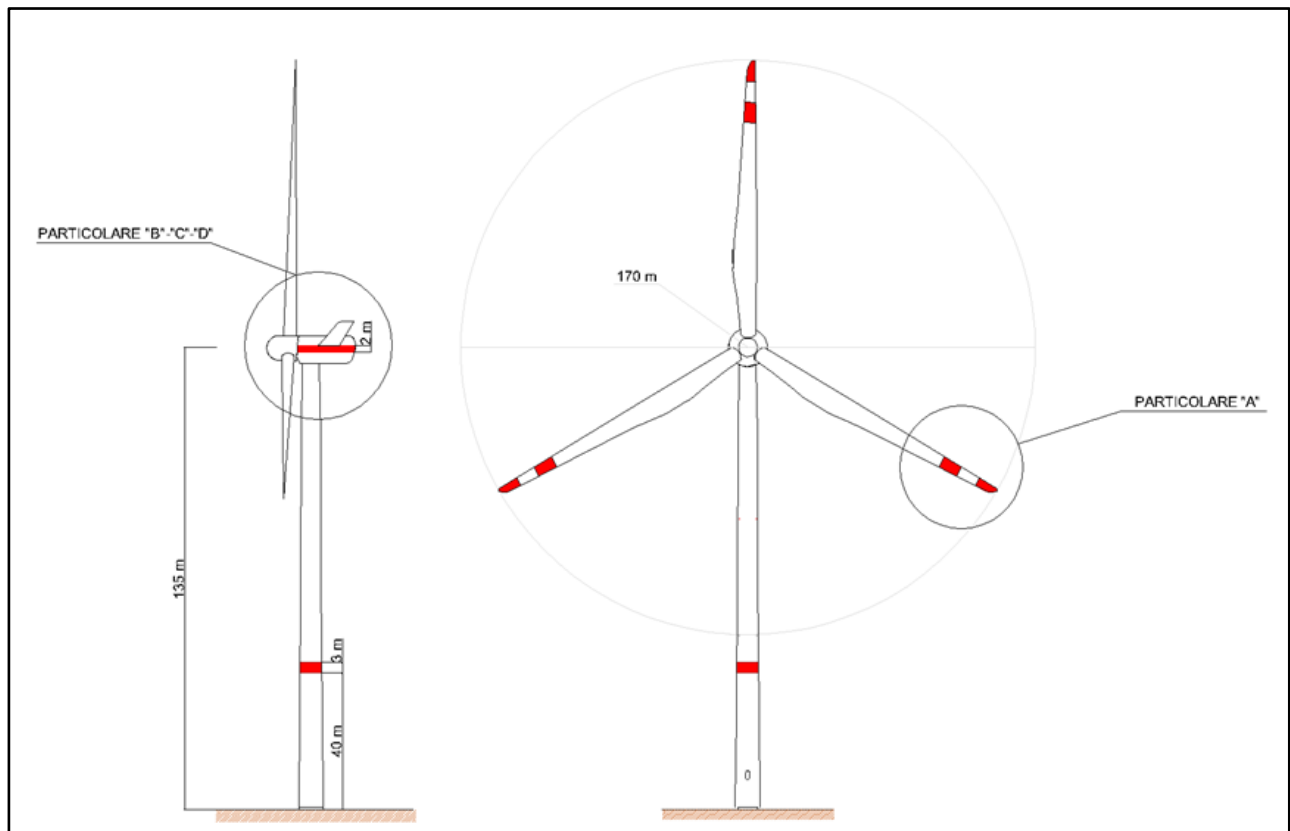


Figura 4.5: Profilo aerogeneratore SG170 – 6.0 MWp

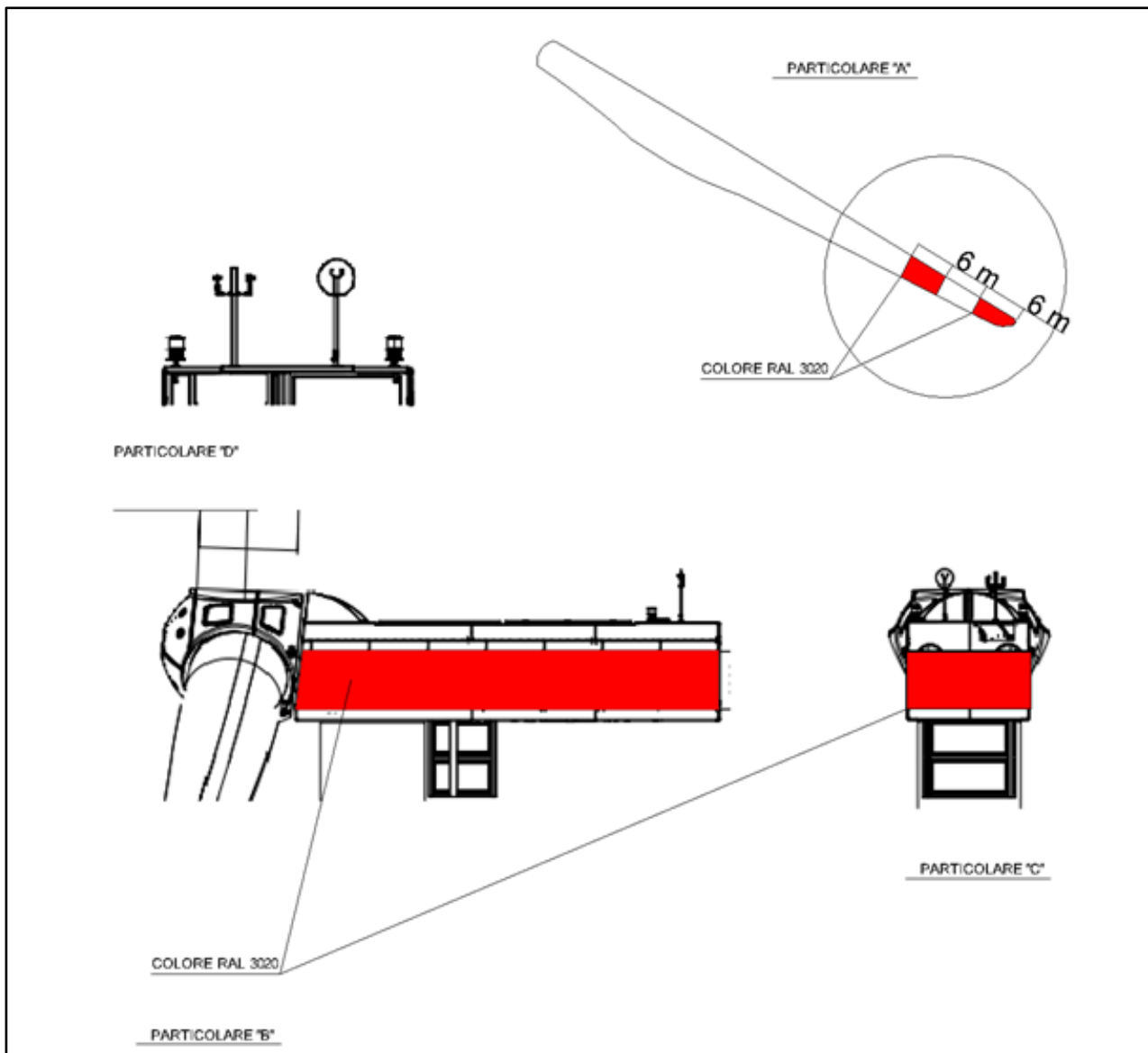


Figura 4.6: Particolari aerogeneratore SG170 – 6.0 MW

Ogni macchina è dotata di un sistema che esegue il controllo della potenza ruotando le pale intorno al proprio asse principale ed il controllo dell'orientamento della navicella, detto controllo dell'imbardata, che permette l'allineamento della macchina rispetto alla direzione del vento.

Il rotore, posto sopravvento al sostegno, viene realizzato in resina epossidica rinforzata con fibra di vetro ed è caratterizzato da un funzionamento a passo variabile. Altre caratteristiche salienti sono riassunte nella **Tabella 4.2**.

Rotor		Grid Terminals (LV)	
Type	3-bladed, horizontal axis	Baseline nominal power	6.0MW/6.2 MW
Position	Upwind	Voltage	690 V
Diameter	170 m	Frequency	50 Hz or 60 Hz
Swept area	22,698 m ²	Yaw System	
Power regulation	Pitch & torque regulation with variable speed	Type	Active
Rotor tilt	6 degrees	Yaw bearing	Externally geared
Blade		Yaw drive	Electric gear motors
Type	Self-supporting	Yaw brake	Active friction brake
Single piece blade length	83,3 m	Controller	
Segmented blade length:		Type	Siemens Integrated Control System (SICS)
Inboard module	68,33 m	SCADA system	Consolidated SCADA (CSSS)
Outboard module	15,04 m	Tower	
Max chord	4.5 m	Type	Tubular steel / Hybrid
Aerodynamic profile	Siemens Gamesa proprietary airfoils	Hub height	100m to 165 m and site- specific
Material	G (Glassfiber) – CRP (Carbon Reinforced Plastic)	Corrosion protection	
Surface gloss	Semi-gloss, < 30 / ISO2813	Surface gloss	Painted
Surface color	Light grey, RAL 7035 or White, RAL 9018	Color	Semi-gloss, <30 / ISO-2813 Light grey, RAL 7035 or White, RAL 9018
Aerodynamic Brake		Operational Data	
Type	Full span pitching	Cut-in wind speed	3 m/s
Activation	Active, hydraulic	Rated wind speed	11.0 m/s (steady wind without turbulence, as defined by IEC61400-1)
Load-Supporting Parts		Cut-out wind speed	25 m/s
Hub	Nodular cast iron	Restart wind speed	22 m/s
Main shaft	Nodular cast iron	Weight	
Nacelle bed frame	Nodular cast iron	Modular approach	Different modules depending on restriction
Mechanical Brake		Generator	
Type	Hydraulic disc brake	Type	Asynchronous, DFIG
Position	Gearbox rear end		
Nacelle Cover			
Type	Totally enclosed		
Surface gloss	Semi-gloss, <30 / ISO2813		
Color	Light Grey, RAL 7035 or White, RAL 9018		

Tabella 4.2: Specifiche tecniche dell'aerogeneratore Siemens Gamesa SG 170 HH 135

Le caratteristiche dell'aerogeneratore sopra riportate sono quelle ritenute idonee in base a quanto disponibile oggi sul mercato; in futuro potrà essere possibile cambiare il modello dell'aerogeneratore senza modificare in maniera sostanziale l'impatto ambientale e i limiti di sicurezza previsti.

5. DESCRIZIONE DEI COMPONENTI DEL SISTEMA BESS

Il BESS è un impianto di accumulo elettrochimico di energia, ovvero un impianto costituito da sottosistemi, apparecchiature e dispositivi necessari all'immagazzinamento dell'energia ed alla conversione bidirezionale della stessa in energia elettrica a 36 kV.

La tecnologia di accumulatori (batterie al litio) è composta da celle elettrochimiche. Le singole celle sono tra loro elettricamente collegate in serie ed in parallelo per formare moduli di batterie. I moduli, a loro volta, vengono elettricamente collegati in serie ed in parallelo tra loro ed assemblati in appositi armadi in modo tale da conseguire i valori richiesti di potenza, tensione e corrente.

Ogni “assemblato batterie” è gestito, controllato e monitorato, in termini di parametri elettrici e termici, dal proprio sistema BMS.

Di seguito è riportato un elenco dei componenti principali del sistema BESS:

- celle elettrochimiche assemblate in moduli e rack (Battery Assembly);
- DC/AC Two-Way Conversion System (PCS);
- trasformatori di potenza 36 kV/BT;
- quadri elettrici di potenza a 36 kV;
- sistema locale di gestione e controllo dell'assemblaggio della batteria (BMS);
- sistema integrato locale di gestione e controllo dell'impianto (SCI) - garantisce il corretto funzionamento di ogni gruppo di batterie gestito da PCS chiamato anche EMS (Energy Management System);
- integrazione del sistema di supervisione dell'impianto SCADA con l'impianto eolico Emilia;
- servizi ausiliari;
- sistemi di protezione elettrica;
- cavi di alimentazione e segnale;
- container o quadri ad uso esterno equipaggiati di sistema di condizionamento ambientale, sistema antincendio e rilevamento fumi.

La configurazione del BESS, in termini di numero di PCS e numero di moduli batteria, sarà effettuata in base alle scelte progettuali che saranno condivise con il fornitore del sistema, nonché al numero di PCS che saranno collegati al framework a 36 kV.

6. CARATTERISTICHE DEL CONTAINER

La struttura dei containers sarà del tipo autoportante metallica, per stazionamento all'aperto, costruita in profilati e pannelli coibentati.

La struttura consentirà il trasporto, nonché la posa in opera in un unico blocco sui supporti, con tutte le apparecchiature già installate a bordo e senza che sia necessario procedere allo smontaggio delle varie

parti costituenti il singolo container. L'unica eccezione riguarderà i moduli batteria, che se necessario, saranno smontati e trasportati a parte.

Nei container sarà previsto dove necessario, un impianto di condizionamento e ventilazione, idoneo a mantenere le condizioni ambientali interne ottimali per il funzionamento dei vari apparati.

Il grado di protezione minimo dei container sarà di IP54.

La verniciatura esterna dovrà essere realizzata secondo particolari procedure e nel rispetto della classe di corrosività atmosferica relativa alle caratteristiche ambientali del sito di installazione.

Sarà previsto un sistema antieffrazione con le relative segnalazioni.

La struttura sarà antisismica, nel rispetto delle norme tecniche per le costruzioni (D.M. 14/01/2008) NTC 2018.

Tutti i container batterie, convertitori, quadri elettrici saranno dotati di rivelatori incendi. I container batterie saranno inoltre equipaggiati con relativo sistema di estinzione automatico specifico per le apparecchiature contenute all'interno.

Estintori portatili e carrellati saranno, inoltre, posizionati in prossimità dei moduli batterie, dei convertitori di frequenza e dei quadri elettrici.

Le segnalazioni provenienti dal sistema antiincendio vengono inviati al sistema di controllo di impianto e alla sala controllo ENEL.

7. CARATTERISTICHE DELLE BATTERIE

Le batterie sono costituite da celle agli ioni di litio (Li-Ion) con fosfato di litio ferro (LFP) o chimica NMC assemblate in serie /parallelo per formare i moduli. Infine, diversi moduli in serie formano il rack.

In allegato sono riportate la tipica scheda tecnica con la scheda di sicurezza (MSDS).

8. COLLEGAMENTO DEL SISTEMA DI CONVERSIONE A 36 KV

In riferimento al paragrafo precedente relativo al sistema di conversione mediante valvole IGBT da corrente continua a corrente alternata in Bassa Tensione, si è menzionata la necessità di elevare, mediante trasformatori, la tensione a 36 kV. Tali trasformatori saranno collegati tra di loro in configurazione entra esci e avranno il compito di distribuire la potenza erogata/assorbita dalle batterie verso i quadri a 36 kV. Da un punto di vista funzionale i quadri avranno quindi il compito di:

- dispacciare la totale potenza erogata/assorbita dal sistema di stoccaggio mediante un pannello dedicato che, in assetto classico, viene identificato come “montante di generazione”;
- alimentare i servizi ausiliari di tutti i container che alloggiano le batterie e i PCS mediante un pannello dedicato che, in assetto classico, viene identificato come “distributore”;

- garantire la funzione di misura e protezioni per il sistema BESS.

9. FUNZIONALITA' BESS

Il sistema BESS potrà fornire servizio per la regolazione primaria di frequenza, secondaria e terziaria di rete ed altri servizi ancillari di rete, oltre a coprire e ridurre gli sbilanciamenti dell'impianto eolico Emilia. Il PCS comprende l'insieme dei dispositivi e delle apparecchiature necessarie alla connessione degli assemblati batterie al punto di connessione AC, installati in apposito container.

Il sistema risulterà equipaggiato con i seguenti componenti principali:

- trasformatori 36 kV/BT isolati;
- ponti bidirezionali di conversione statica dc/ac;
- filtri sinusoidali di rete;
- filtri RFI;
- sistemi di controllo, monitoraggio e diagnostica;
- sistemi di protezione e manovra;
- sistemi ausiliari (condizionamento, ventilazione, etc.);
- sistemi di interfaccia assemblati batterie.

La tensione denominata "BT" sarà determinata in base alla proposta del fornitore del sistema BESS.

I convertitori statici dc/ac saranno di tipologia VSC (Self-Commutated Voltage source Converter) con controllo in corrente, di tipo commutato. Essi saranno composti da ponti trifase di conversione dc/ac bidirezionali reversibili realizzati mediante componenti total-controllati di tipo IGBT (Insulated Gate Bipolar Transistor).

Il PCS sarà dotato di un sistema di supervisione con funzioni di protezione, controllo e monitoraggio, dedicato alla gestione locale dello stesso e degli assemblati batterie da esso azionati.

10. SUPERVISIONE E CONTROLLO DEL SISTEMA

Le principali funzioni del sistema di gestione della batteria (BMS) saranno:

- monitoraggio e gestione di SoC e SoH;
- monitoraggio e gestione del bilanciamento delle celle;
- monitoraggio e diagnostica dei gruppi di batterie;
- gestione dei segnali di allarme/anomalia;
- supervisione e controllo delle protezioni con eventuale azione di scollegamenti/collegamento batterie in caso di necessità;

- gestione dei segnali di sicurezza della batteria con monitoraggio fino a singole celle di valori come tensioni, temperature, correnti disperse;
- invio di segnali soglia per la gestione delle fasi di ricarica e download;
- elaborazione dei parametri per la gestione delle fasi di ricarica e scarico;
- elaborazione dei parametri necessari per identificare la durata residua delle batterie;
- elaborazione dei parametri necessari per stimare lo stato di carica delle batterie.

Le caratteristiche principali del sistema di monitoraggio BMS saranno:

- monitoraggio e gestione di SoC e SoH;
- monitoraggio e gestione del bilanciamento delle celle;
- monitoraggio e diagnostica dei gruppi di batterie;
- gestione dei segnali di allarme/anomalia;
- supervisione e controllo delle protezioni con eventuale azione di scollegamenti/collegamento batterie in caso di necessità;
- gestione dei segnali di sicurezza della batteria con monitoraggio fino a singole celle di valori come tensioni, temperature, correnti disperse;
- invio di segnali soglia per la gestione delle fasi di ricarica e download;
- elaborazione dei parametri per la gestione delle fasi di ricarica e scarico;
- elaborazione dei parametri necessari per identificare la durata residua delle batterie;
- elaborazione dei parametri necessari per stimare lo stato di carica delle batterie.

Le caratteristiche principali del sistema di monitoraggio BMS saranno:

- calcolare e inviare ai sistemi locali (SCI) lo stato di ricarica (SOC);
- fornire ai sistemi locali (SCI) i parametri per valutare i programmi di produzione e di consegna ammissibili;
- fornire ai sistemi locali (SCI) segnali di allarme/anomalia;
- confermare la fattibilità di una richiesta di energia nell'assorbimento o nell'erogazione.

Le principali funzioni del sistema di controllo PCS saranno:

- gestione della carica/scarico delle batterie assemblate;
- gestione di blocchi e interblocchi di gruppi batteria;
- protezione dei gruppi batteria;
- protezione dei convertitori.

Le principali funzioni del sistema SCI integrato saranno:

- consentire ai singoli moduli batteria di funzionare localmente, utilizzando funzioni di protezione, controllo e interblocco;
- azionare il funzionamento remoto del sistema;
- comunicazione con l'impianto SCADA per gestire le funzionalità BESS in interazione con la funzionalità e la produzione di energia dell'impianto eolico Emilia.

11. SMALTIMENTO PRESSO L'END OF PLANT LIFE

Il processo di decommissioning, riciclaggio e smaltimento dei materiali costituenti il sistema BESS verrà attuato in conformità alle leggi nazionali, europee ed internazionali vigenti (tra le quali European Directive on batteries and accumulators 2006/66/EC), assicurandone il rispetto anche nel caso di modifiche e/o integrazioni di quest'ultime dal momento in cui l'impianto verrà messo in esercizio.

Il fornitore del sistema BESS fornirà idonea documentazione nella quale verranno descritte le modalità gestionali e gli aspetti di sicurezza.

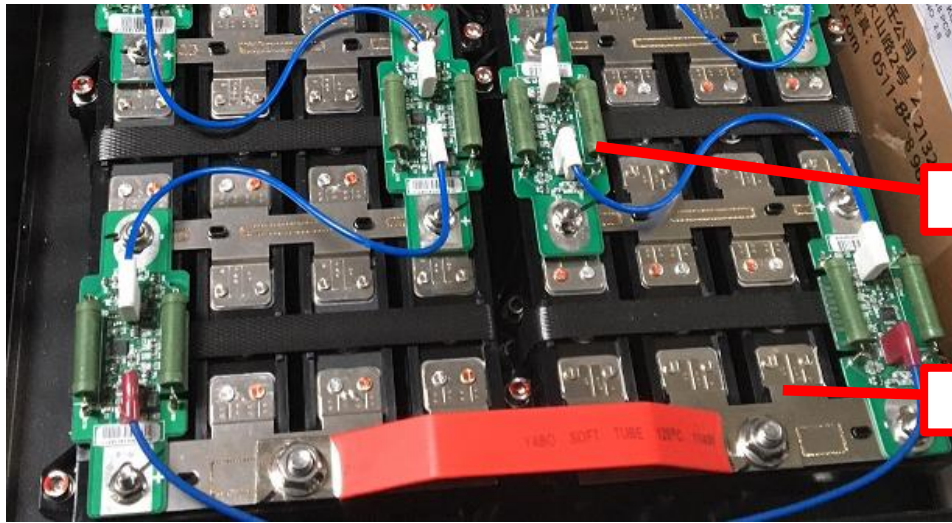
Dal 1° gennaio 2009, in virtù del D.Lgs. 188, datato 20 novembre 2008, è stato esteso in Italia l'obbligo di recupero alle pile e agli accumulatori non basati sull'uso di piombo bensì sull'impiego di altri metalli o composti. Tale decreto recepisce e rende effettiva la direttiva europea 2006/66/CE.

A fine vita il sistema di accumulo sarà disassemblato e, in conformità alle leggi vigenti, trasportato verso un centro autorizzato di raccolta e riciclaggio

ALL 1 - ENERGY STORAGE COMPONENTS

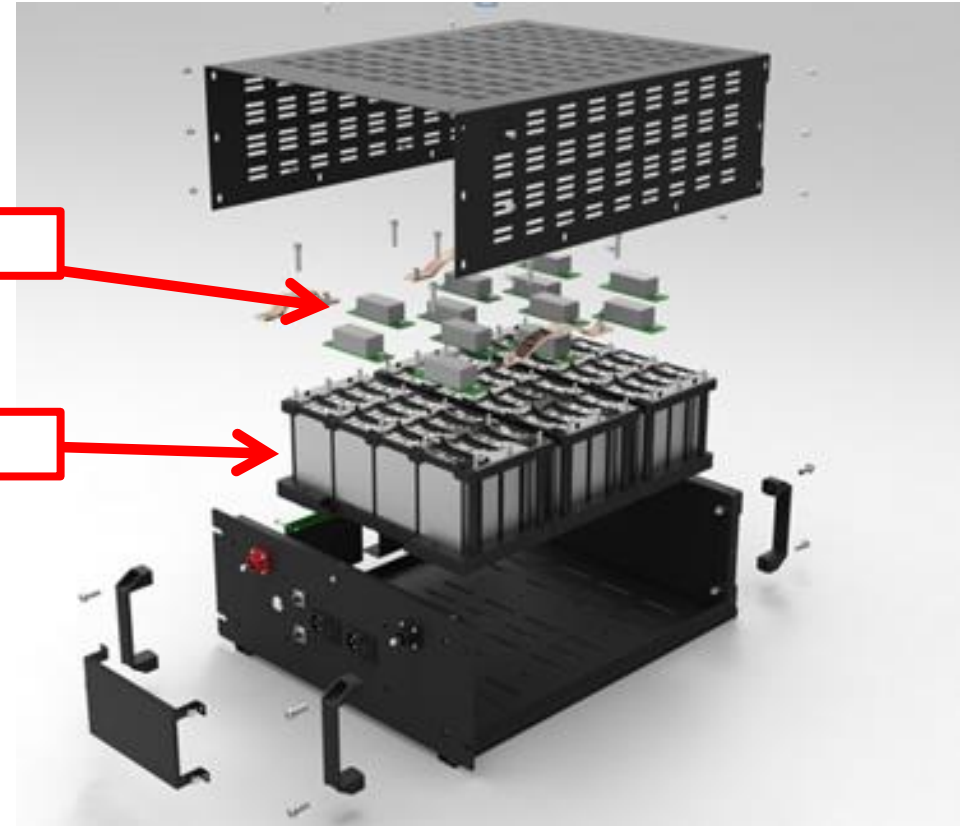
Energy Storage Components

- Cells -> Modules + BMS



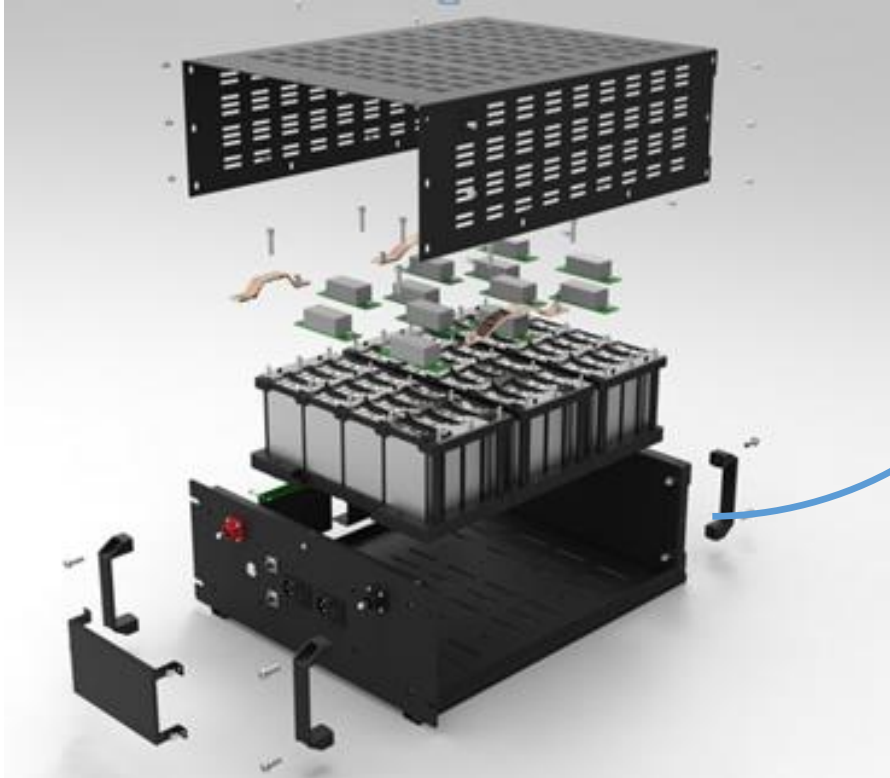
BMS

Cell



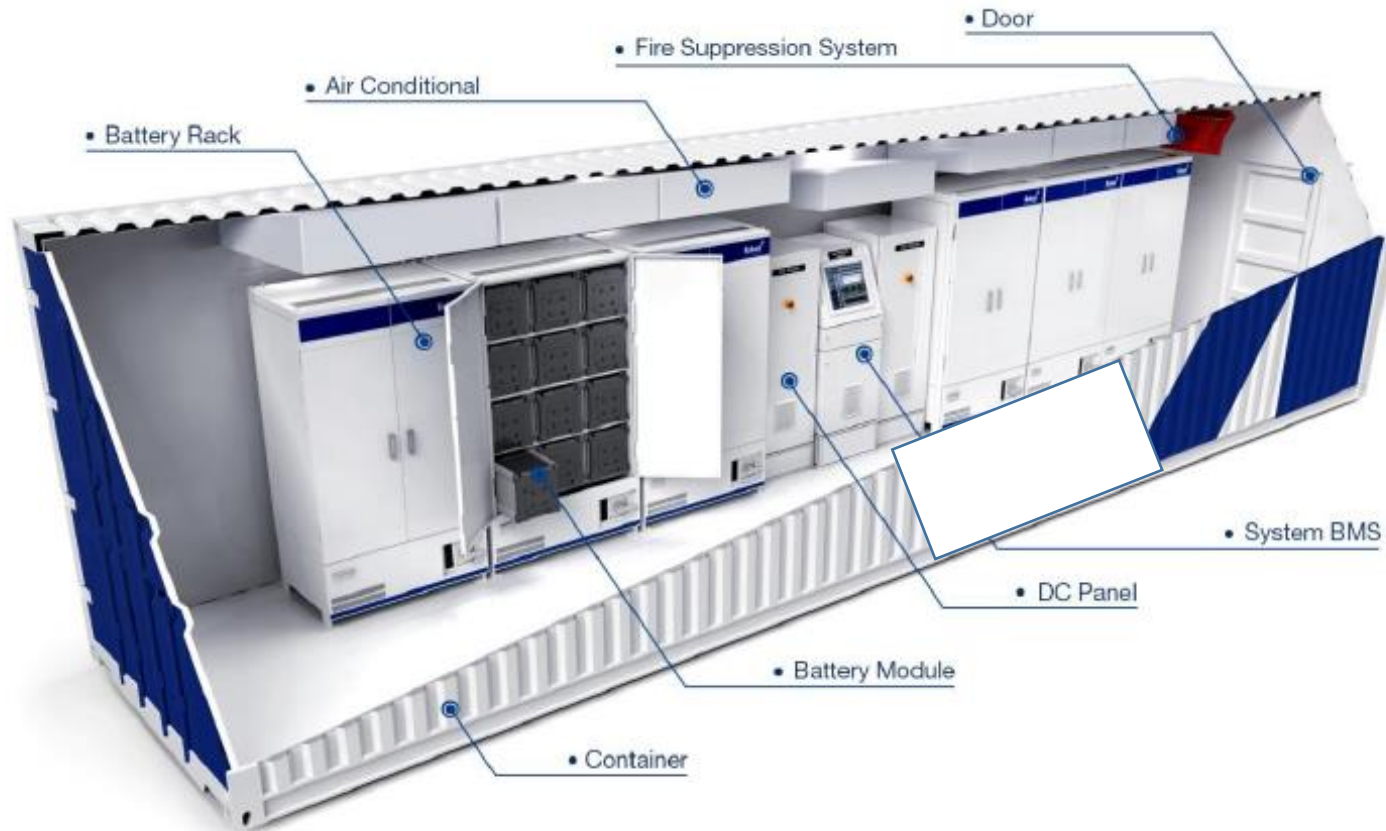
Energy Storage Components

- Modules -> Racks



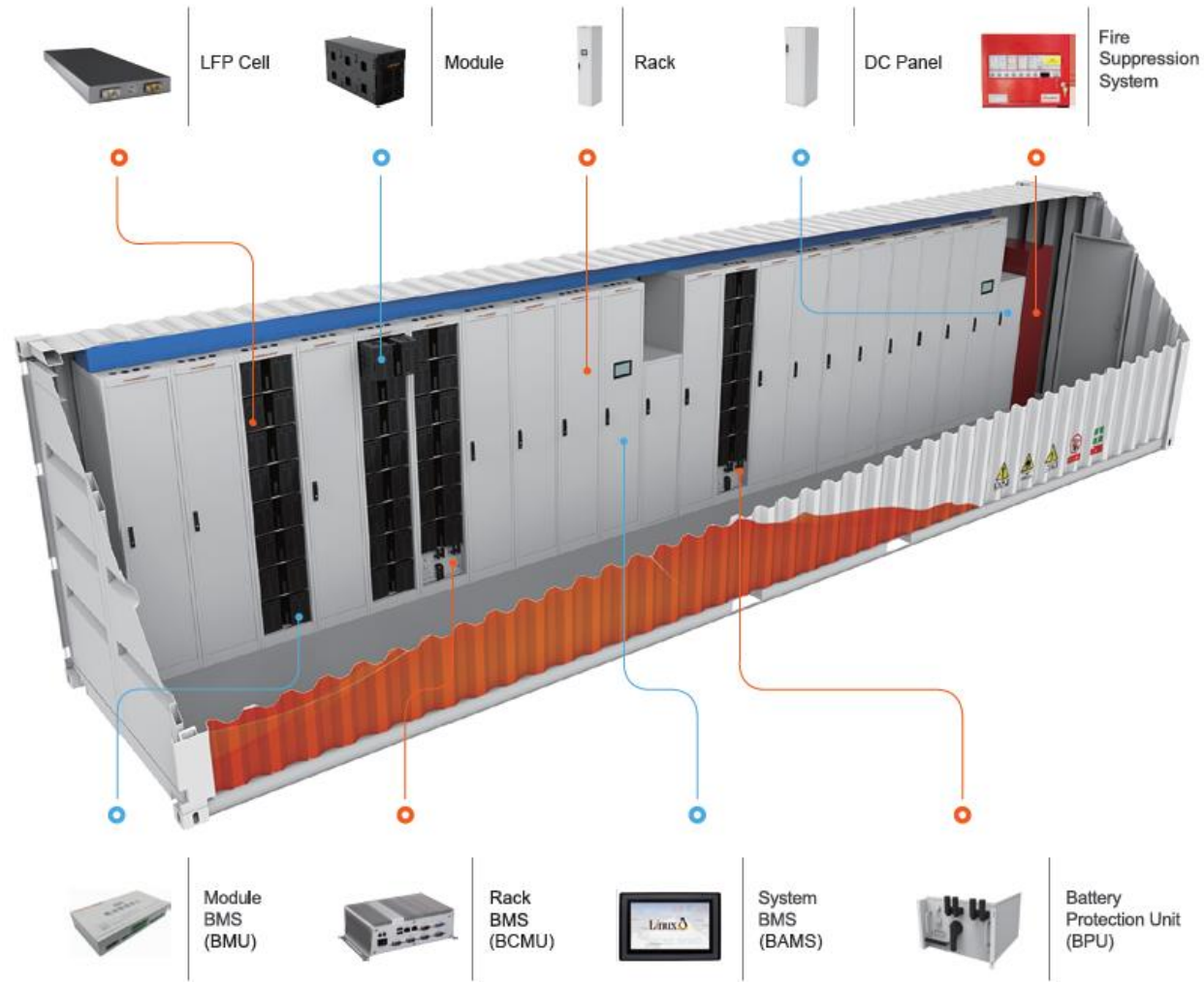
Energy Storage Components

- Container Components



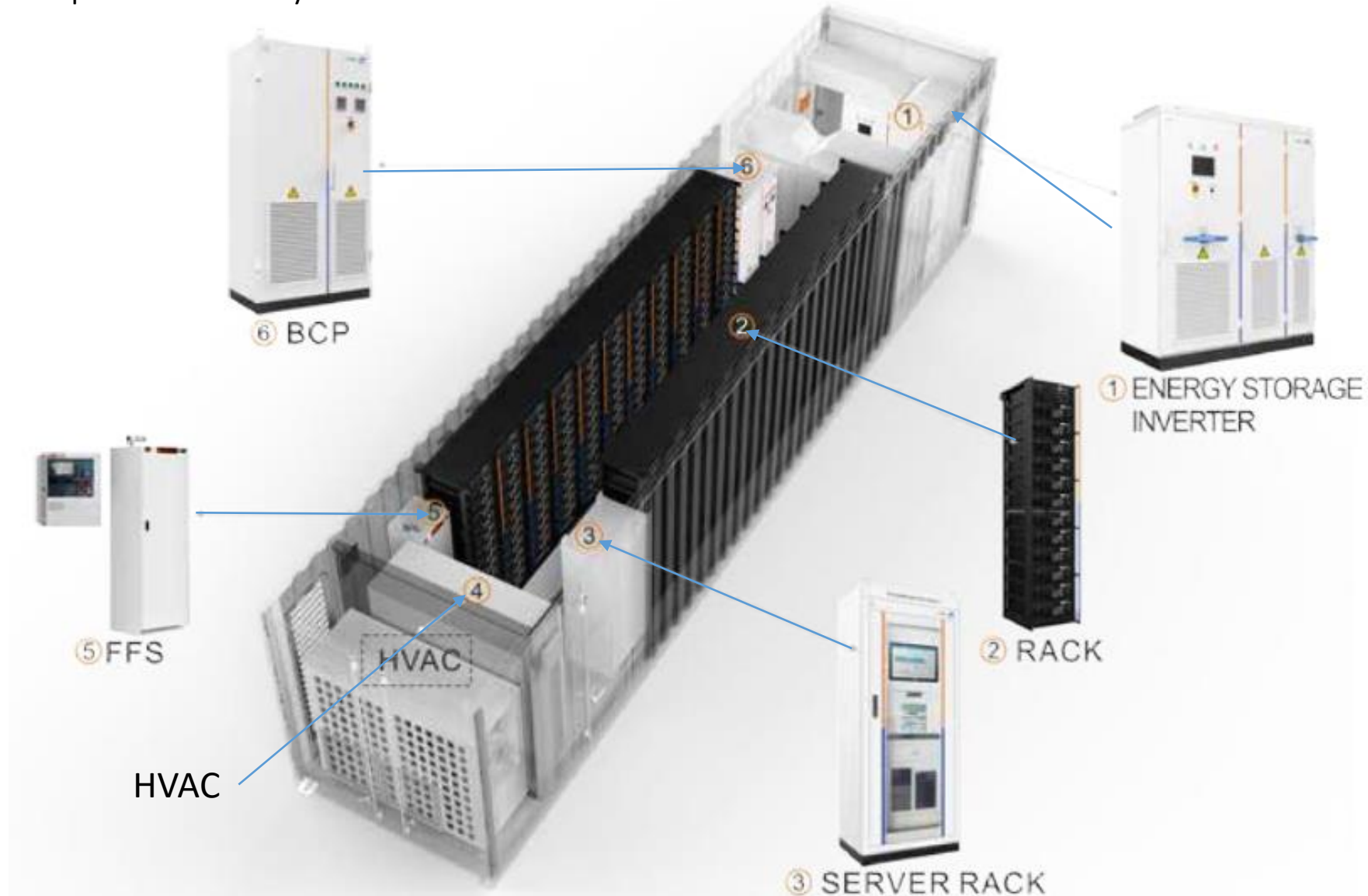
Energy Storage Components

- Typical composition of Battery Container



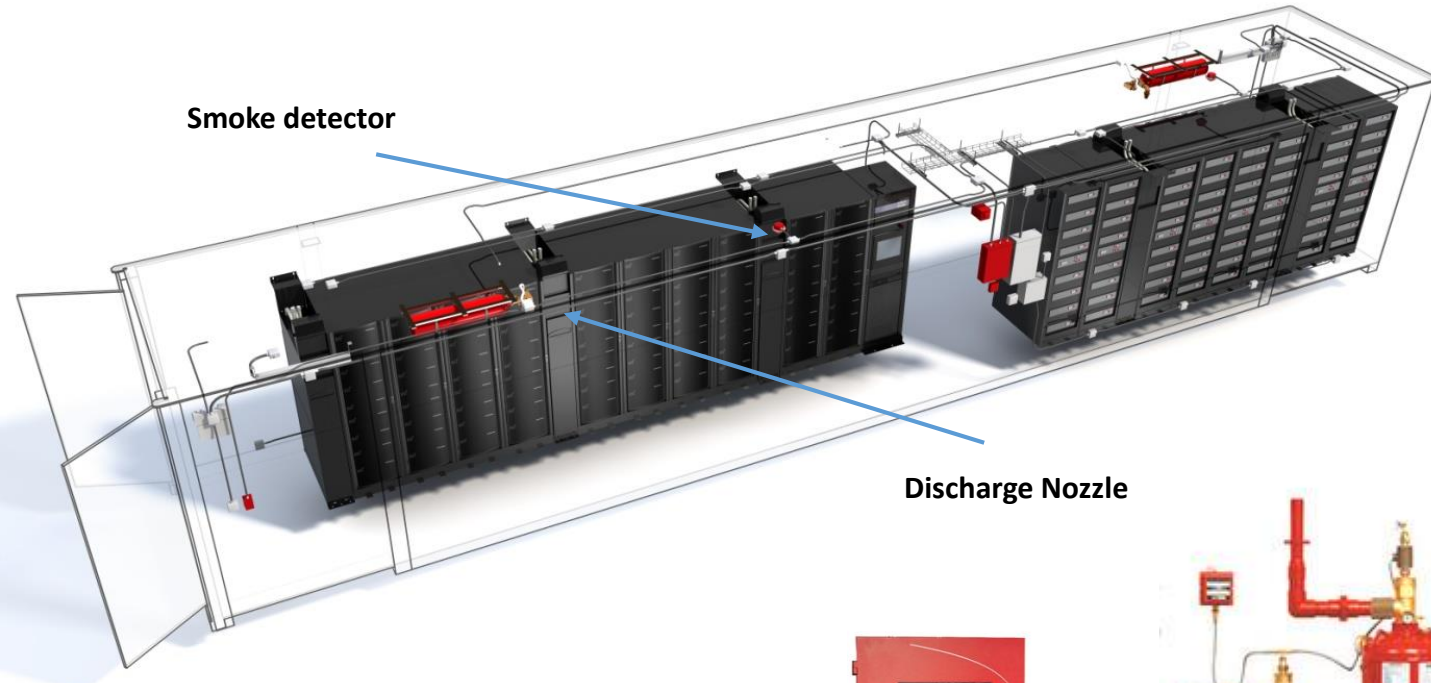
Energy Storage Components

- Typical composition of Battery + PCS Container



Energy Storage Components

- **Fire Detection and Suppression**



- The system uses an inert gas, colorless odorless and electrical non-conductive;
- When discharged, the gas expands throughout the distribution piping system and at the nozzle;
- The gas suppresses fire by reducing the oxygen concentration and breaking the chain reaction of the combustion process.

Main Component list

- ✓ Control panel
- ✓ Firefighting agent cylinders
- ✓ Smoke detectors
- ✓ heat sensor
- ✓ Internal horn and strobe
- ✓ External strobes (3)
- ✓ Battery backup



Fire suppression
control panel



Typical fire suppression clean
agent container
(outdoor installation)

*High pressure suppression agent
(Must be defined by cell manufacturer)*

Nitrogen, Carbon Dioxide

Low pressure suppression agent:

HFC-227ea, FM-200, Novec 1230

ALL 2 - CATL MSDS- FLUENCE R852280-E-T-I-1

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

1. Product & Company Identification

Product Description:	Li-Ion Battery (Rechargeable type)	CATL Model Name:	R852280-E-T-I-1
Manufacturer:	Contemporary Amperex Technology Co., Limited	Approximate Weight:	3100Kg
Capacity	280Ah	Equivalent lithium content	34944g
Nominal voltage	1331.2V	Nominal power	372736Wh
UN No:	3480/3481	Proper Shipping Name	Lithium Ion Battery
Address:	No.2 Xingang Road, Zhangwan Town, Jiaocheng Distric, Ningde City, Fujian Province, P.R of China, 352100		
Telephone:	+86-593-2582114	Fax:	+86-593-2583667

2. Hazardous Identification**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 damage.

H317 May cause an allergic skin reaction.

• Precautionary statements

P101 If medical advice is needed, have 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.

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

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

P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P310 Immediately call a POISON CENTER/doctor.

P405 Store locked up.

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. Exposure to the ingredients contained within or their combustion products could be harmful.

3.1 PACK Composition

MATERIAL OR INGREDIENT	%/wt.
Container, Steel Support and Control System (Note: Non-dangerous chemical)	35-45
Batteries (The composition of the battery reference to the following table 3.2.)	55-65

3.2 Composition of battery (Note: The percent in following table is only for the weight of 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

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

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	Acute Tox. 3, H311;  Skin Corr. 1B, H314;  Acute 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

Under normal conditions of use, the battery is hermetically sealed.

Ingestion: Swallowing a battery can be harmful

Contents of an open battery can cause serious chemical burns of mouth, esophagus, and gastrointestinal tract. If battery or open battery is ingested, do not induce vomiting or give 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.

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

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 evidence of the 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 which voltage was less than 50V DC (the safety voltage). But if the pack had the voltage was bigger than 50V DC, the electrical shock shall be protected.

During the shipment or testing process for LIB Pack or Module, there was danger factors like drop, crush, broken, metal short circuit, liquid immersion, the factors would lead the Hazard like electrical shock, catch fire. If pack was in well sealed box, there was gas exploding Hazard; if the pack was in big room or fans, there was not explode Hazard. The released liquid was the environment population Hazard.

5.2 Material prepare & people 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 $>60^{\circ}\text{C}$ liquid (B), gas (C), $<36\text{Kv}$ electrical (E) fire.
- 2) **Water protection sets**: raincoat, galoshes, and rubber gloves. Plastic rollers. Rags.
- 3) **PPE**: breathing mask, safety glass, face mask, gloves for high temperature.
- 4) **Smoke escape**: fans in wall one per 20m or portable fans in rooms. Keep gas exchange hole in trucks.
- 5) **Gases explode 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. The wall should have one fan per 20m, $\geq 5000\text{m}^3$ per hour for flow rate.
- 6) **Neutralized material**: prepare 10kg $\text{Ca}(\text{OH})_2$ powder per 500KWh LIB pack or modules, it was used for neutralized for release electrolyte. Because electrolyte met with water, 8% HF would be created.

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

- 7) **Voltage measure.** Multimeter. Please physical block the current measure function, the mistake would lead instrument exploding.
- 8) **People training:** (a) turn on fans or portable fans for smoke escape. (b) Wear the water protection sets → use water spray fire extinguishers → dry by cloths with rubber gloves → insulated by plastic film. (c) Neutralized by Ca(OH)_2 or NaOH for released electrolyte. (d) Use multimeter to measure voltage. Take care of the mistake.

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) Smoke Escape 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. Accidental Release Measures

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

In water: Low electrical shock Hazard when EV or battery/pack in water, GM also shared the

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

information. But H₂ gas was released by the electrolyzed water, you should keep good air flow to avoid the H₂ gas accumulated to prevent hydrogen explosion in enclosed space. If possible, remove from water and call local fire/police department.

7. Handling & Storage

One of the major Hazards associated with the transport of batteries and battery-powered equipment is short-circuit of the battery as a result of the battery terminals coming into contact with other batteries, metal objects, or conductive surfaces. Packaged batteries or cells must be separated in a way to prevent short circuits and damage to terminals. 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; however, accidental short-circuiting for 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 skin. 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 which voltage more than 50v, they must wear the insulation protection PPE.

Storage: The lithium ion battery 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.

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

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

Foot Protection: Steel toed shoes recommended for large container handling.**9. Physical/Chemical Properties**

Physical state	Solid	Solubility in water:	Not Applicable
Color	Not Applicable	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 over a long period to humid conditions.**Materials to avoid:** Oxidising agents, alkalis, water.**Hazardous Decomposition Products:** Toxic Fumes, and may form peroxides.**Hazardous Polymerization:** N/A.

If leaked, forbidden to contact with strong oxidizers, mineral acids, strong alkalies, 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, Target organs nerves, liver and kidneys.

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

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 of 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 60edition) 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).

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  

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

		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 Battery ≤ 100Wh	PI966 Section II Limit per package: Pax A/C = 5 kg CAO = 5 kg	lithium battery handling label 

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 lithium batteries (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

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

in the same package.

Do not damage or mishandle this package. If package is damaged, batteries must be quarantined, inspected, and repacked. Cells 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 for 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 can not transport, should redesign. If the batteries through the test, for the lithium battery only, follow the UN3480 and the packing requirements for PI965, for the lithium battery which installed in equipment, 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 38th) to transport and according to the requirements of UN NO. 3480/3481 to management the goods, and require class II packaging. 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 program if package damage.

The clause 188 of IMDG require 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 need marked the WHR ratio label. Otherwise, the battery and module should packed in a strong outer packaging or be contained in equipment.

The clause 230 of IMDG 38th requires the lithium battery testing should meets all requirements under UN Manual of Tests and Criteria Part III, subsection 38.3.

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

15. Regulatory Information

See ACGIH exposure limits information as noted in Section 3

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 documented in ANSI (American National Standards Institute) Standard Z400.1-1993.

Air transportation: According to Civil aviation industry standard MH/T1020-2009 Lithium Battery Air Transport Standard and IATA DGR and ICAO. The international transport and commodity inspection is used this standard at the moment (IMDG CODE),

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

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

Avoid electrical shock: According 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. (Such damage to the protection circuit may be indicated by voltages at the battery terminals outside of their specified ranges.) 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, it is important to provide a package and/or device label stating.

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

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

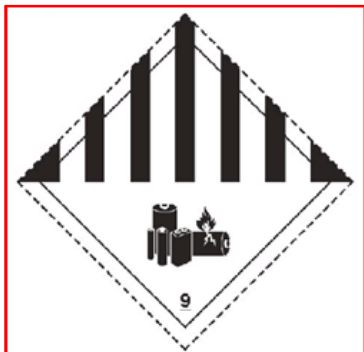


Figure 3 Class 9 hazard label



Figure 4 lithium battery handling label

If the lithium-ion battery or cell transported by sea the labeling according to IMDG 38th, the requirement as follow,

- Package, do not any indication.
- Need all the UN No.
- subassembly: Do not any indication.
- Need the *LQ* label.

WARNING: CHARGE ONLY WITH SPECIFIED CHARGERS ACCORDING TO DEVICE MANUFACTURER'S INSTRUCTIONS. DO NOT OPEN BATTERY, DISPOSE OF IN FIRE, OR SHORT CIRCUIT - 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.

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

物料安全技术说明书(MSDS)

1. 化学品及企业标识

产品类型	锂离子电池(可充电型)	CATL 产品型号	R852280-E-T-I-1
制造商	宁德时代新能源科技股份有限公司	约计重量	/
容量	280Ah	当量锂含量	34944g
标称电压	1331.2V	瓦时数	372736wh
UN 号	3480/3481	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 352100		
电话	+86-593-2582114	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

• 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。

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

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

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，暴露电池中所在成分或燃烧产物是有害的。

3.1 PACK 成分表

成分	重量百分比
集装箱、金属支架及控制系统（非危险化学品）	35-45
电池（电池成分见下表 3.2）	55-65

3.2 电池成分表（注：下表的重量百分比仅针对电池重量）

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	Acute Tox. 3, H311;  Skin Corr. 1B, H314;  Acute Tox. 4, H302	0-5

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

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。

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

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) 个人防护用品（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。

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020



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、或在设备上进行的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。

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

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	不适用	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。

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

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。

下列情况下会危害人员身体健康: 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 60 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
		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 Section II 限制时 使用 IB 每个包装件限量:	第 9 类危化品标识和 安全操作标签

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

UN3480	锂离子电池		客机禁运 全货机=10Kg 毛重	 
		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) 和锂金属电池 (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。

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

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。

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

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

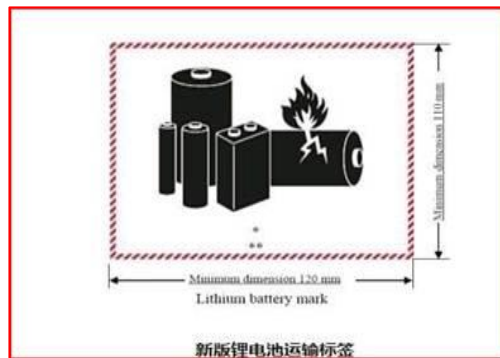


图 4：锂电池操作标签

如果锂电池或电池芯使用海运，包装上根据 IMDG 38th 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。



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

Tel: +86-593-2582114 Fax: +86-593-2583667

MATERIAL SAFETY DATA SHEET

Issue: 2019-A

Doc No.: 2019-A-254

Issue Date: 1/18/2020

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。

ALL. 3 - MSDS LITHIUM IRON PHOSPHATE FINAL 3OCT2018

NARADA LITHIUM ION BATTERY SAFETY DATA SHEET

(LFP CELL)

Section I Identification of Product and Company

- I.1 Product Identification : Lithium ion battery
- I.2 Manufacturer' s Name: Zhejiang Narada Power Source Co., Ltd./www.naradapower.com
- I.3 Manufacturer' s Address :No.72 Jingguan RD,Qingshan Town, Lin'an Economic Development Zoon.Zhejiang pro,China 311305
- I.4 Manufacturer' s Tel/Fax: +86 571 56975980 / +86-571- 56623706
- I.5 Manufacturer' E-mail: info@narada.biz
- I.6 Emergency Telephone Number :+86-571- 56975932
- I.7 National Chemical Emergency Advisory Telephone: +86 -0532-83889090
- I.8 Main Application : ☐ Telecommunication
☐ UPS
☐ Renewable energy system

Section II Hazards Identification

The product described in this material (product) safety data sheet is a lithium-ion rechargeable battery which is a sealed unit non hazardous when used according to the manufacturers recommendations and as long as the product maintains its integrity.

Under normal conditions of use, the active materials and electrolyte contained in the product are not exposed to the outside. Risk of exposure only occurs in case of abuse (mechanical, electrical, thermal). Do not short circuit, puncture, incinerate, crush, immerse in water, force discharge or expose to temperatures exceeding the maximal usage temperature. Abuse could result in fire or explosion.

Section III Composition and Information on Ingredients

A cell is composed of terminal,cover, taps,separators,plates and aluminum case.The cell contains a number of chemicals and other materials. Under normal use there is no potential for exposure to these materials. Nevertheless in case of cell leakage, following exposure to high temperature, mechanical or electrical abuse, the following materials could potentially be hazardous upon release.

Chemical Name	CAS No	Approximate % of total weight
lithium iron phosphate	12057-17-9	13.0 -17.0
Carbon	7782-42-5	10.0 -13.0
PVDF	24937-79-9	0.3- 0.8
LiPF ₆	21324-40-3	6.0-8.5
N-methyl-2-pyrrolidone	872-50-4	12.0 ~15.0
Al Metal	7429-90-5	4.5 ~7.0
Cu Metal	7440-50-8	8.0 ~11.0
Iron	7439-89-6	20.0-30.0
PP	9022-88-4/ 9003-07-0	2.0 -3 .00

Section IV First Aid Measures

In case of accidental exposure to materials contained within the product following a leakage of burst of the battery, the following measures must be taken. Evacuate all employees from the contaminated area and ventilate all rooms exposed to fumes in order to evacuate all corrosive gas, smoke and unpleasant odours.

Inhalation	Not expected under normal use. Remove from exposure, ventilate contaminated area. Rest and keep warm in area with plenty of fresh air. In extreme cases provide oxygen and breathing aid. Consult a physician immediately.
Eye contact	Not expected under normal use. Remove from exposure, ventilate contaminated area. Wash with cold water immediately and maintain running water with eyelids open for 15 to 20 minutes. Consult a physician immediately.
Ingestion	Not expected under normal use. Remove from exposure, ventilate contaminated area. Wash mouth thoroughly with water, and if possible make patient drink abundantly, preferably milk. Consult a physician immediately.
Skin contact	Not expected under normal use. Remove from exposure, ventilate contaminated area. Remove all contaminate clothing and wash skin abundantly with cold water for 10 to 15 minutes. Consult a physician immediately.
Further treatment	If any persistent signs of irritation remain (skin or eye irritation, breathing difficulties...), consult immediately a doctor .

Section V Fire Fighting Measures

Use dry chemical or CO₂ type extinguishers. If not available use copious amounts of water or water based foam to cool down the cells .When apply water care must be taken as burning particles can be ejected from the fire.

It is recommended to wear a self-contained breathing apparatus, and all contact with the irritant fumes must be avoided. Evacuate all non essential personnel from the contaminate area until all fumes and extinguishing agents have been purged.

Section VI Accidental Release Measures

In a case of electrolyte leakages, all direct contact must be avoided, particular attention must be taken to avoid any inhalation of the gas coming from the electrolyte.

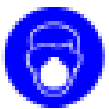
Using protective equipment (glasses and gloves), absorb all leakage material with sand or earth. Dispose of all cleaning material and damaged cell, by sealing it in a plastic bag and dispose of it as Special Waste in accordance with local regulations.

Section VII Handling and storage

Handling	Cells should be handled and stored carefully to avoid short circuits . Never throw out cells in a fire or expose to high temperatures. Do not soak cells in
----------	--

	water and seawater. Do not expose to strong oxidizers. Do not give a strong mechanical shock or throw down. Never disassemble, mutilate or mechanically abuse batteries. Do not connect the positive terminal to the negative terminal with electrically conductive material. In the case of charging, use only dedicated charger. Do not mix cells of different types and/or brands. Do not mix new and old cells.
Storage	Avoid direct sunlight, high temperature, high humidity .Store in cool place and ventilated room , temperature should be lower than 40° C, but more than -5 ° C. The SOC of battery should be kept at around 60% while storing. Keep adequate clearance between batteries packagings . Keep away from moisture, sources of heat and flames. Do not keep in proximity of food and beverages. To avoid any risk of short circuits, keep in original packaging and avoid storing on metal surfaces.
Other	For operating conditions, stick to all manufacturer recommendations contained in the Technical Data Sheet.

Section VIII Exposure Controls and Personal Protection

	Respiratory protection	In case of electrolyte leakage use a protective mask, and in cases of extreme fumes such as seen in cases of fire, use a self-containing breathing apparatus.
	Hand protection	In all cases of battery rupture or leakage, wear protective gloves before touching the battery or any other leaked material.
	Eye protection	If any battery is showing signs of leakage, rupture, over heating, wear protective glasses before approaching the battery.

Section IX Physical and Chemical Properties

Appearance	Solid prismatic shape ,aluminum housing
Odour	Odorless,unless leakage of electrolyte
PH	Not applicable
Flash point	Not applicable
Flammability	Not applicable
Relative density	Not applicable
Solubility (water)	Not applicable
Solubility (other)	Not applicable

Section X Stability and Reactivity

The product is stable under the conditions described in section VII.

Conditions to avoid	Do not expose to temperatures above 70 ° C or incinerate. Do not use in application where generated heat is not adequately extracted. Do not deform, crush, pierce disassembly or short circuit battery. Do not store in high humidity conditions for prolonged periods of time.
---------------------	--

Materials and substances to avoid	Do not expose to strong acids or bases, oxidising agents or organic solvents. Do not use conductive materials in proximity of batteries (tools must be properly insulated).
-----------------------------------	--

Section XI Toxicological Information

Signs and Symptoms	None unless cell leaks or ruptures. If exposed to internal battery contents, skin eyes and mucous membranes could be exposed to high irritating fumes. Over exposure can lead to lung injuries and other several membrane irritations.
Inhalation	Lung irritant
Skin contact	Skin irritant
Eye contact	Eye irritant
Ingestion	Tissue damage
Carcinogenic	None
Other	Exposure to internal content can lead to or aggravate existing conditions such as eczema, skin allergies, asthma, and other respiratory disorders.

Section XII Ecological Information

When properly used and/or disposed of, lithium-ion rechargeable batteries do not present an environmental hazard.

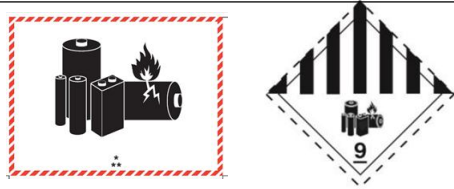
Section XIII Disposal considerations

Do not incinerate. Dispose of or recycle in accordance with local regulations.

Section XIV Transport Information

XIV.1 Sea transportation according to IMDG Code (amendment 38-16) :

The transportation of Lithium Ion Batteries is regulated by the International Maritime Dangerous Goods (IMDG) 4.1.4. These regulations classify these types of batteries as dangerous goods. Refer to IMDG Code Packaging Instructions P903 for more details pertaining to the transportation of Lithium Ion Batteries. Additional requirements, or relief from some requirements, may be found in special provisions 188,230,310,348,376,377 and 384.

Labelling	
UN number	UN3480
UN Shipping name	Lithium ion batteries (including lithium ion polymer batteries)
Hazard classification	Class 9
Packing group	II
Marine pollutant	No
UN certified packing code	4D
EMS NO	F-A,S-I

Packaging instruction	P903 for sea transport
-----------------------	------------------------

XIV.2 Air transportation according to IATA 59th edition 2018:

The transportation of Lithium Ion Batteries is regulated by IATA Dangerous Goods Regulations 59th Edition . Lithium cells and batteries should be manufactured under the quality management programme as described in IATA DGR 59th 3.9 2.6.1(e), not the defective cells or batteries returned to the manufacturer for safety reasons. Lithium cells and batteries should be of the types proven to meet the requirements each applicable test in the UN manual of Tests and Criteria Part III, sub-section 38.3 .Lithium cells and batteries are packed in inner packagings that completely enclose the cell or battery and placed in a strong rigid outer packagings .Lithium cells and batteries should properly to prevent short circuits.Lithium ion cells and batteries must be offered for transport at a state of charge (SoC) not exceeding 30% of their rated design capacity .

Labelling	
UN number	UN3480
UN Shipping name	Lithium ion batteries (including lithium ion polymer batteries)
Hazard classification	Class 9
Section IB PI965 :	The package should comply with the requirements of section IB of Packing Instruction 965 of 59th DGR Manual of IATA .The net quantity of each packages does not exceed 10kg and apply to Cargo Aircraft only.
Section IA PI965	The package should comply with the requirements of section IA of Packing Instruction 965 of 59th DGR Manual of IATA .The net quantity of each packages does not exceed 35kg and apply to Cargo Aircraft only.

Section XV Regulatory Information

The battery is mainly regulated by the following laws, regulations and international conventions.

- Hazardous Chemicals Safety Management Regulations of P.R.C
- IMDG Code (amendment 38-16)
- IATA 59th edition 2018

Section XVI Other Information

The information contained in this document relates to the specific materials and chemicals designated and is valid for the specific combination found within this product. The information is compiled from sources considered to be dependable and is, to the best of our knowledge and belief, accurate and reliable. All information is considered valid at the date of publication. . If this product is to be used in large amounts and /or an unusual manner, the user is obliged to determine what safety measures are appropriate, including the applicable and relevant workplace and environmental regulations pertaining to handling, use and disposal.