



BESS STANDARD

Battery Energy Storage System Standard

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- Ruengrit Ninae
 - Electrical and Electronic Products Testing Center
 - National Science and Technology Development Agency

International Electrotechnical Commission

- Several IEC technical committees (TCs) prepare international standards relevant to EES:

IEC TC 4

- Publishes standards covering storage pumps used in pumped-storage hydro power plants

IEC TC 21

- Issues documents for all secondary cells and batteries, including for renewable, on-grid and off-grid energy storage

IEC TC 40 [O-Member]

- Establishes the specifications for energy storage systems using electrodes and electrolytes (capacitors)

IEC TC 105 [O-Member]

- Develops standards for fuel cell technologies

IEC TC 120

- Covers all types of EES technologies in a systems-based approach

IEC TC 69

- Prepares standards relating to EVs including for the management of charging infrastructure

IECEE

- Is one of the four Conformity Assessment Systems administered by the IEC

Battery Energy Storage System Standard

	Performance	Safety
BESS	Grid code IEC 62933-2-1/2	IEC 6933-5-1/2
BESS Units	IEC 62933-2-1/2	IEC 6933-5-1/2
Conversion subsystem	Grid code IEC 61683	IEC 62109 IEC 62477
Battery system	IEC 61427-1/2	IEC 63056
Battery cell/module/tray	IEC 62620	IEC 62619

Battery Energy Storage System Standard

	Performance	Safety
BESS	Grid code IEC 62933-2-1/2	IEC 6933-5-1/2
BESS Units	IEC 62933-2-1/2	IEC 6933-5-1/2
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Battery system	IEC 61427-1/2	IEC 63056
Battery cell/module/tray	IEC 62620	IEC 62619



Battery cell/module/tray

IEC 62619

- Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary **lithium cells and batteries**, for use in **industrial applications**



Publication type	International Standard
Publication date	2022-05-24
Edition	2.0
TC/SC	TC 21/SC 21A - Secondary cells and batteries containing alkaline or other non-acid electrolytes

 Edition 1.0 Revised IEC 62619:2017	 Edition 2.0 Published IEC 62619:2022
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Battery cell/module/tray

IEC 62619 - Scope



Requirements and tests for the safe operation of **secondary lithium cells and batteries** used in industrial applications including stationary applications.



Stationary applications:

telecom, uninterruptible power supplies (UPS), electrical energy storage system, utility switching, emergency power, and similar applications.



Motive applications:

forklift truck, golf cart, auto guided vehicle (AGV), railway, and marine, excluding road vehicles.

Battery cell/module/tray

IEC 62619 - Potential hazard



fire, (การเกิดไฟ)

burst/explosion, (การระเบิด)

critical electrical short-circuit due to leakage
of cell electrolyte, (การรั่วไหลของอิเล็กโทรไลต์)

venting which continuously vents out
flammable gases,

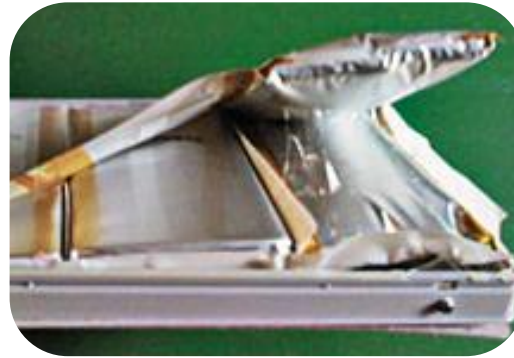
rupture of the casing of cell, module,
battery pack, and battery system with
exposure of internal components.

Hazard Definitions



การระเบิด (explosion)

- ความบกพร่องที่เกิดขึ้นเมื่อ ภาชนะบรรจุของเซลล์หรือ เปลือกหุ้มแบตเตอรี่เปิดออก อย่างรุนแรงและชิ้นส่วนหลัก ถูกขับด้วยแรงให้หลุดออกมา



การแตกร้าว (rupture)

- ความบกพร่องทางกลของ ภาชนะบรรจุเซลล์หรือเปลือก หุ้มแบตเตอรี่ที่เกิดจากสาเหตุ ภายนอกหรือ ภายในเป็นผล ทำให้วัสดุภายในเผยตัว



การรั่วซึม (leakage)

- การรั่วไหลของอิเล็กโทรไลต์ เหลวที่มองเห็นได้

Hazard Definitions



การรั่วซึม (leakage)

- การรั่วไหลของอิเล็กโทรไลต์เหลวที่มองเห็นได้



การระบาย (venting)

- การที่เซลล์หรือแบตเตอรี่ระบายความดันภายในส่วนที่เกินออกมา ในลักษณะที่เป็นไปตามที่ได้ออกแบบไว้ เพื่อป้องกันไม่ให้เกิดการแตกหรือการระเบิด



ไฟ (fire)

- การกระจายออกของเปลวไฟจากเซลล์หรือแบตเตอรี่

Battery cell/module/tray

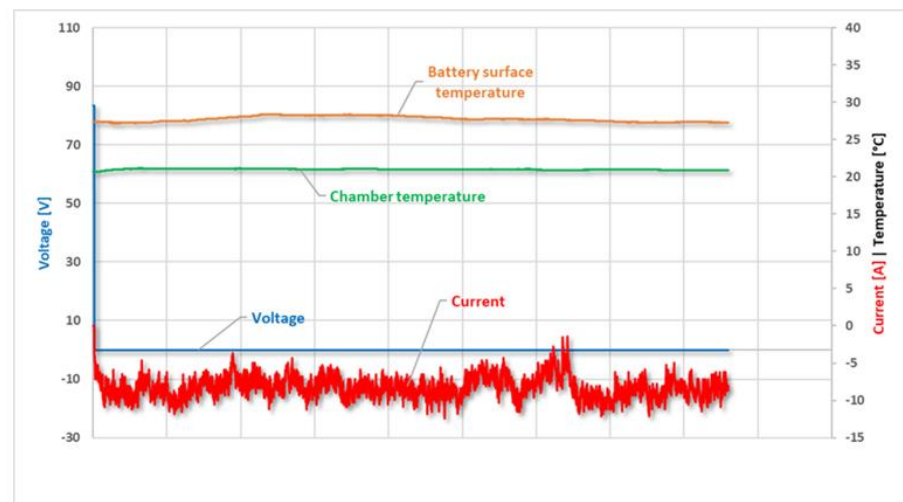
IEC 62619 - Sample size for type tests

Category	Requirements and tests		Cell	Battery
Product safety test (safety of cell and battery system)	External short-circuit test		1	-
	Impact test		1	-
	Drop test		1	1
	Thermal abuse test		1	-
	Overcharge test		1	-
	Forced discharge test		1	-
	Consideration of internal short circuit (select one from the two options)	Internal short circuit test	5	-
Propagation test		-	1	
Functional safety test (safety of battery system)	Overcharge control of voltage		-	1
	Overcharge control of current		-	1
	Overheating control		-	1

Battery cell/module/tray

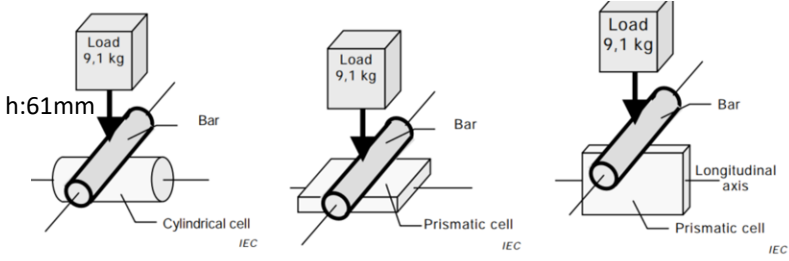
IEC 62619- Specific requirements and tests

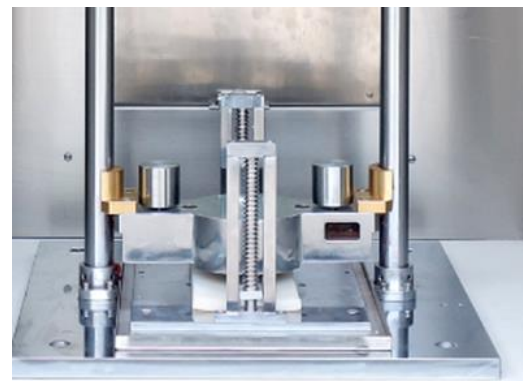
Test Item	Requirements	Criteria
External short-circuit test (cell or cell block)	Fully charged cells are short-circuited with resistance of $30 \pm 10\text{m}\Omega$ The cells remain on test 6 hours elapsed	No fire. No explosion



Battery cell/module/tray

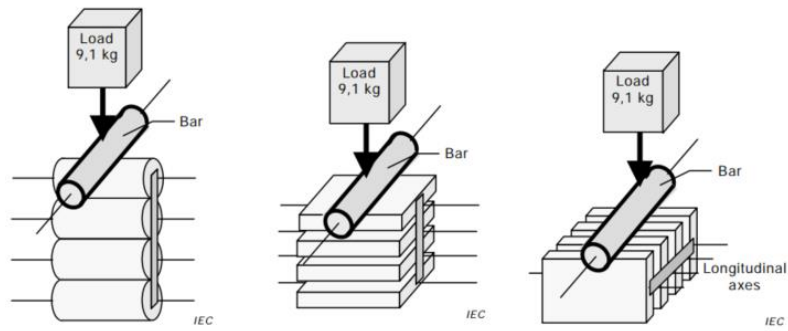
IEC 62619- Specific requirements and tests

Test Item	Requirements	Criteria
Impact test (cell or cell block).	 <p>1a) Cylindrical cell</p> <p>1b) Direction 1 of prismatic cell</p> <p>1c) Direction 2 of prismatic cell</p>	No fire, no explosion.



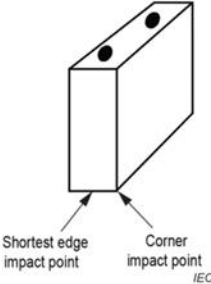
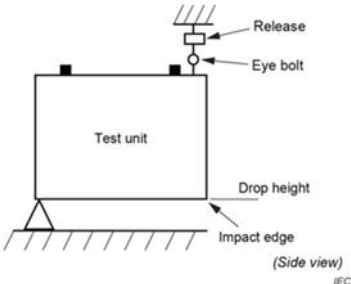
Battery cell/module/tray

IEC 62619- Specific requirements and tests

Test Item	Requirements	Criteria
Impact test (cell or cell block).	 <p>1d) Several cylindrical cells</p> <p>1e) Direction 1 of several prismatic cells</p> <p>1f) Direction 2 of several prismatic cells</p>	No fire, no explosion.

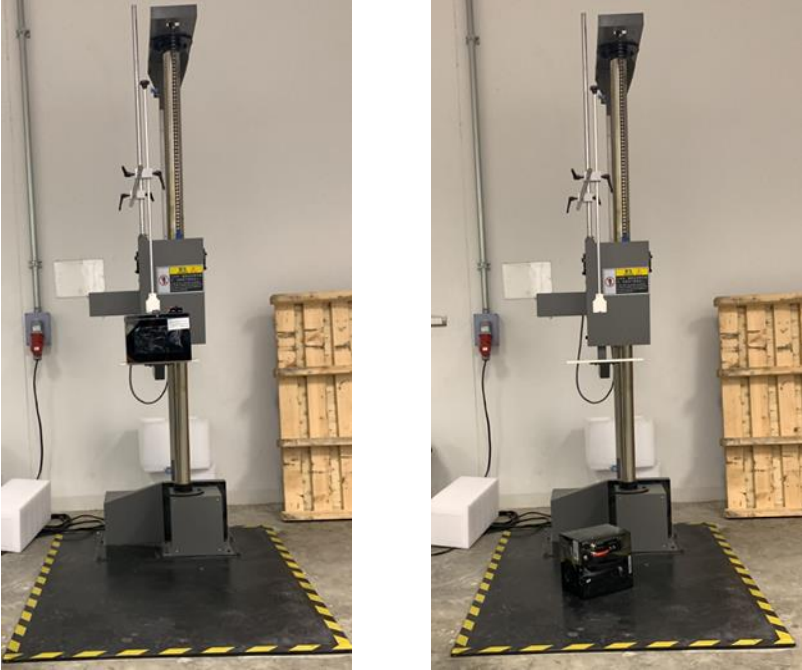
Battery cell/module/tray

IEC 62619- Specific requirements and tests

Test Item	Requirements	Criteria																								
<p>Drop test (cell or cell block, and battery system).</p>	<p style="text-align: center;">Table 2 – Drop test method and condition</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Mass of the DUT, m</th> <th style="text-align: center;">Test method</th> <th style="text-align: center;">Orientation</th> <th style="text-align: center;">Height of drop</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$m < 7$ kg</td> <td style="text-align: center;">Whole</td> <td style="text-align: center;">Random</td> <td style="text-align: center;">100,0 cm</td> </tr> <tr> <td style="text-align: center;">$7 \text{ kg} \leq m < 20$ kg</td> <td style="text-align: center;">Whole</td> <td style="text-align: center;">Bottom down direction ^a</td> <td style="text-align: center;">100,0 cm</td> </tr> <tr> <td style="text-align: center;">$20 \text{ kg} \leq m < 50$ kg</td> <td style="text-align: center;">Whole</td> <td style="text-align: center;">Bottom down direction ^a</td> <td style="text-align: center;">50,0 cm</td> </tr> <tr> <td style="text-align: center;">$50 \text{ kg} \leq m < 100$ kg</td> <td style="text-align: center;">Edge and corner</td> <td style="text-align: center;">-</td> <td style="text-align: center;">5,0 cm</td> </tr> <tr> <td style="text-align: center;">$m \geq 100$ kg</td> <td style="text-align: center;">Edge and corner</td> <td style="text-align: center;">-</td> <td style="text-align: center;">2,5 cm</td> </tr> </tbody> </table> <p>^a The bottom surface of the DUT is specified by the manufacturer</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;">  <p>Figure 3 – Impact location</p> </div> <div style="text-align: center;">  <p>Figure 4 – Configuration for the shortest edge drop test</p> </div> </div>	Mass of the DUT, m	Test method	Orientation	Height of drop	$m < 7$ kg	Whole	Random	100,0 cm	$7 \text{ kg} \leq m < 20$ kg	Whole	Bottom down direction ^a	100,0 cm	$20 \text{ kg} \leq m < 50$ kg	Whole	Bottom down direction ^a	50,0 cm	$50 \text{ kg} \leq m < 100$ kg	Edge and corner	-	5,0 cm	$m \geq 100$ kg	Edge and corner	-	2,5 cm	<p>No fire, no explosion</p>
Mass of the DUT, m	Test method	Orientation	Height of drop																							
$m < 7$ kg	Whole	Random	100,0 cm																							
$7 \text{ kg} \leq m < 20$ kg	Whole	Bottom down direction ^a	100,0 cm																							
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Battery cell/module/tray

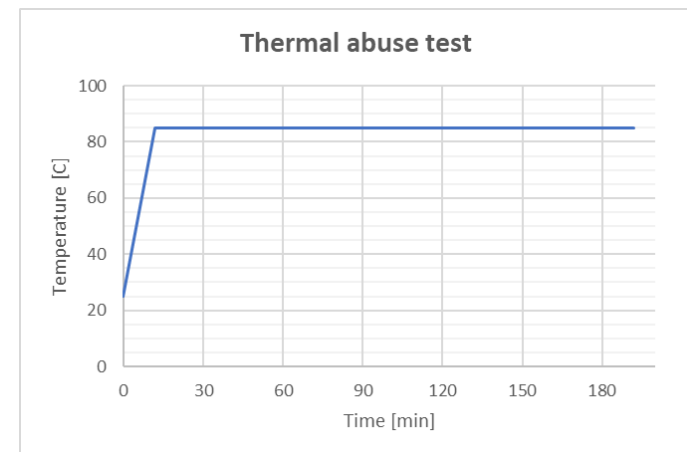
IEC 62619- Specific requirements and tests

Test Item	Requirements	Criteria
<p>Drop test (cell or cell block, and battery system).</p>		<p>No fire, no explosion</p>

Battery cell/module/tray

IEC 62619- Specific requirements and tests

Test Item	Requirements	Criteria
Thermal abuse test (cell or cell block)	Each fully charged cell, ambient temperature of $25\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$, raised at a rate of $5^{\circ}\text{C} / \text{min}$ temperature of $85\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$, 3h	No fire, No explosion



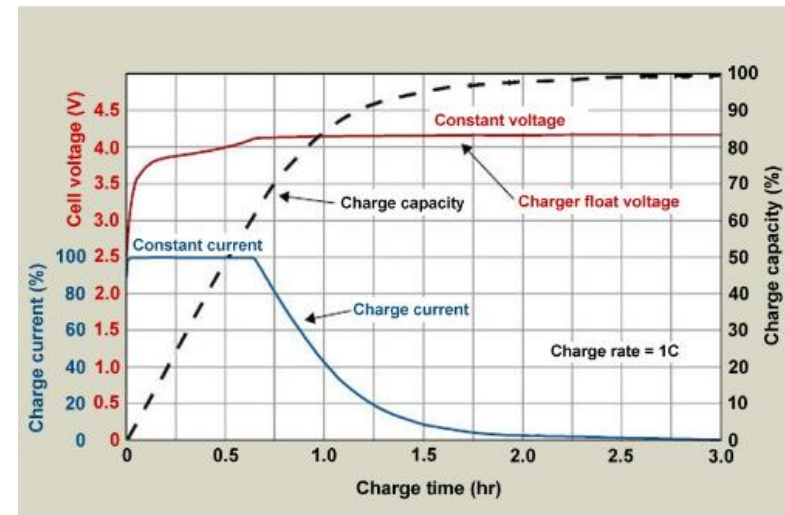
Battery cell/module/tray

IEC 62619- Specific requirements and tests

Test Item	Requirements	Criteria
Overcharge test (cell or cell block)	Charged CC-mode with Maximum charging current <u>battery system</u> until the voltage reaches the maximum voltage	No fire, No explosion

4.1 Cell specification 电芯特性

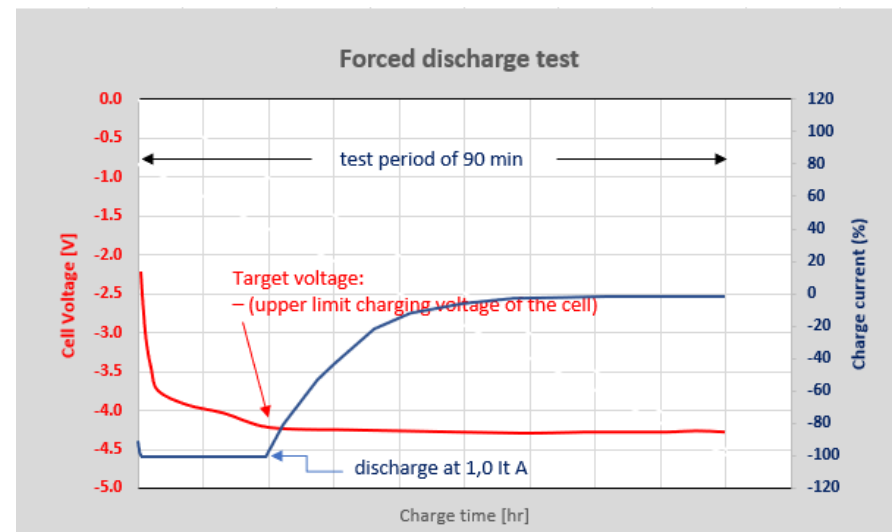
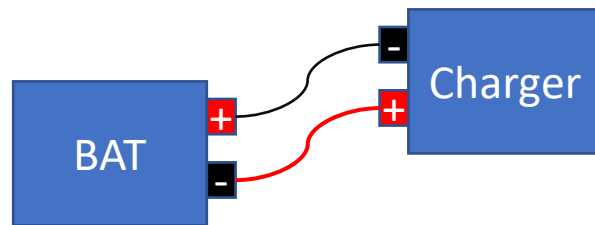
ITEM 项目	SPECIFICATION 特性
Normal capacity 标称容量	2600 mAh@0.5C
Minimum capacity 最小容量	2550 mAh@0.5C
Normal voltage 标称电压	3.6V
Charging voltage 充电电压	4.2 ±0.05 V
Discharge ending voltage 放电终止电压	2.75 ±0.05 V
Standard charging current 标准充电电流	0.5C(1300mA)
Standard discharge current 标准放电电流	5C(13000mA)
Max charge current 最大充电电流	1C (25 ± 3°C) (not for cycle life)
Max discharge current 最大放电电流	7C (25 ± 3°C) (not for cycle life)



Battery cell/module/tray

IEC 62619- Specific requirements and tests

Test Item	Requirements	Criteria
Forced discharge test (cell or cell block).	<p>discharge at 1,0 It A for a test period of 90min.</p> <p>Target voltage = – (upper limit charging voltage of the cell)</p>	No fire, No explosion



Battery cell/module/tray

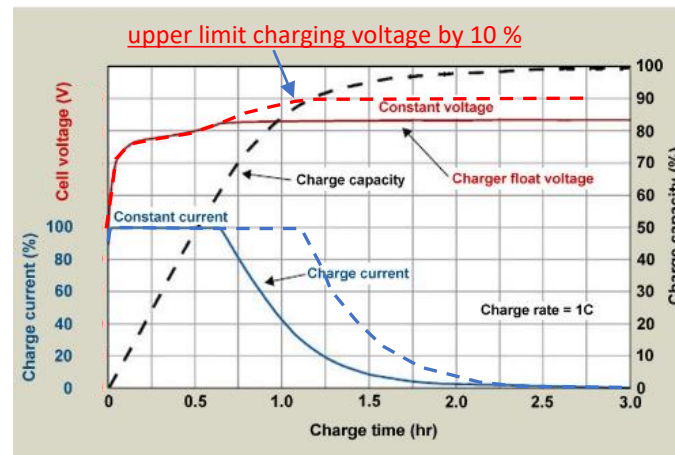
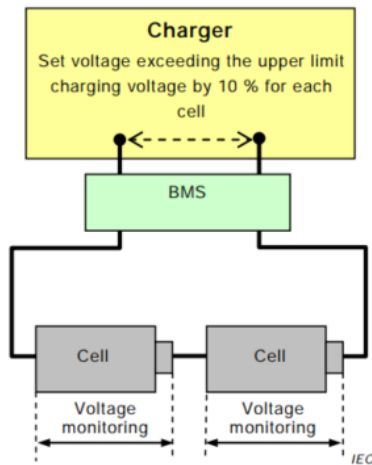
IEC 62619- Specific requirements and tests

Test Item	Requirements	Criteria
Internal short circuit test	Refer to 8.3.9 of IEC 62133:2012	No fire, no explosion.
Battery management system	<ul style="list-style-type: none"> - Overcharge control of voltage (battery system) - Overcharge control of current (battery system) - Overheating control (battery system) 	No fire, no explosion.

Battery cell/module/tray

IEC 62619- Specific requirements and tests

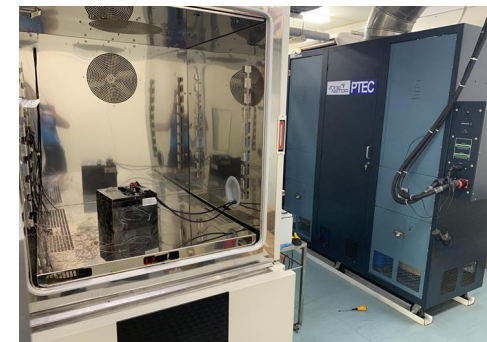
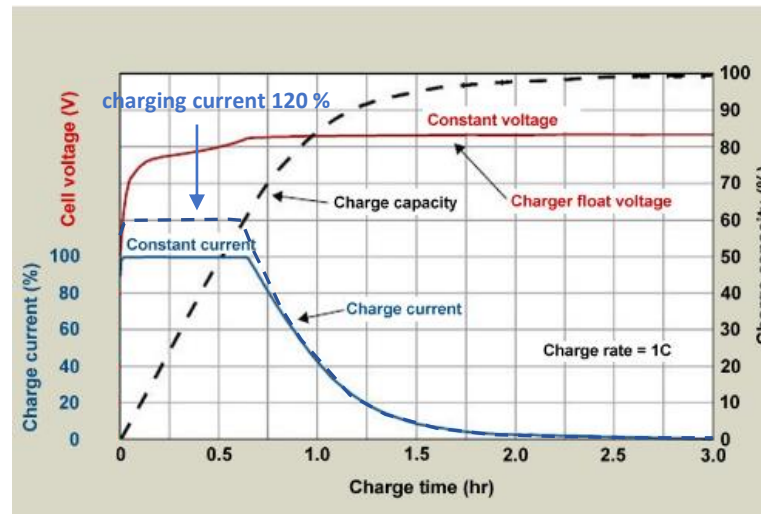
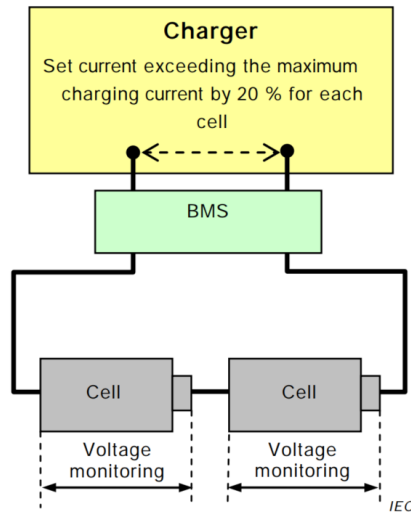
Test Item	Requirements	Criteria
Battery management system	<ul style="list-style-type: none"> - Overcharge control of voltage (battery system) - charged at the <u>maximum current</u> with set voltage exceeding the <u>upper limit charging voltage</u> by 10 %, 1h 	No fire, no explosion.



Battery cell/module/tray

IEC 62619- Specific requirements and tests

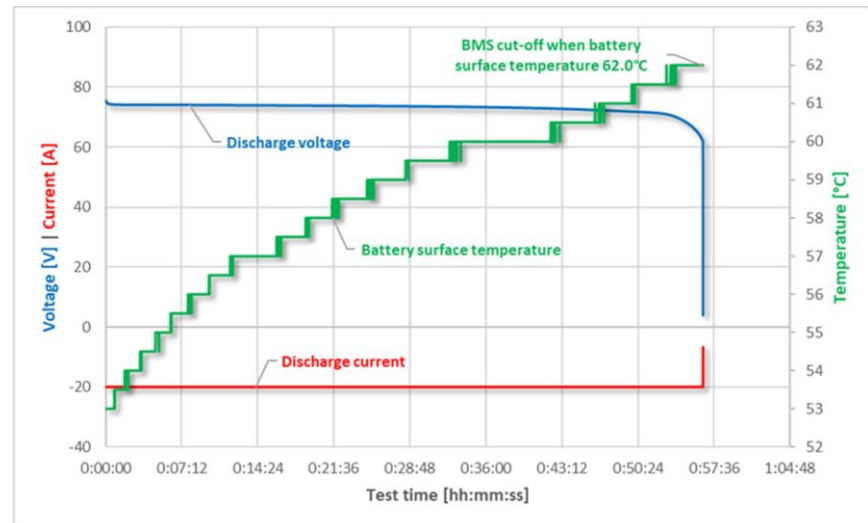
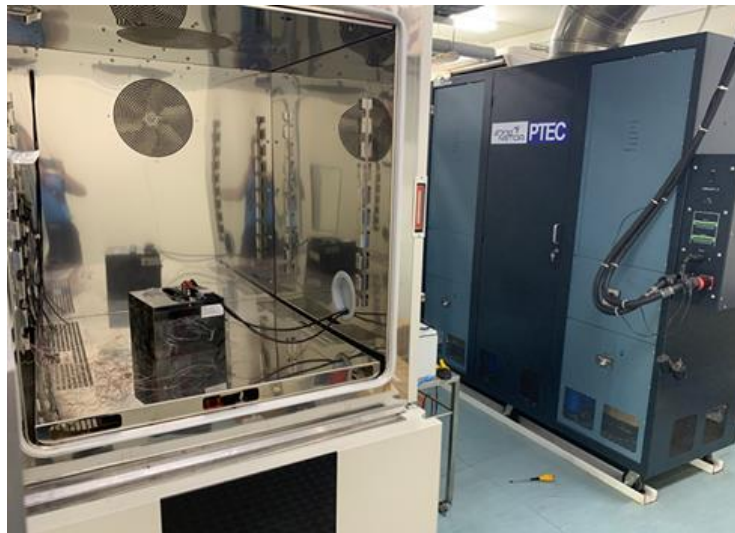
Test Item	Requirements	Criteria
Battery management system	<ul style="list-style-type: none"> - Overcharge control of current (battery system) - charged at a current exceeding the maximum charging current by 20 %. 1h 	No fire, no explosion.



Battery cell/module/tray

IEC 62619- Specific requirements and tests

Test Item	Requirements	Criteria
Battery management system	<ul style="list-style-type: none"> - Overheating control (battery system) - charged at a current 0.5C - The temperature increased to 5 °C above the maximum operating temperature. 	No fire, no explosion.



Battery Energy Storage System Standard

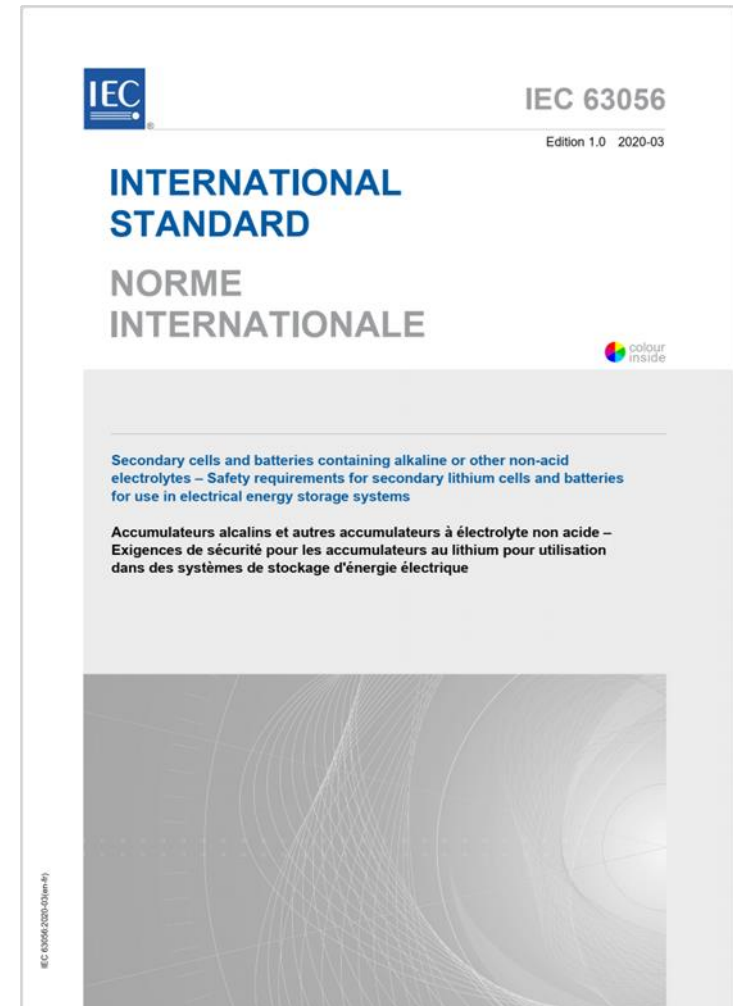
	Performance	Safety
BESS	Grid code IEC 62933-2-1/2	IEC 6933-5-1/2
BESS Units	IEC 62933-2-1/2	IEC 6933-5-1/2
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Battery system

IEC 63056

- Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries for use in **electrical energy storage systems**

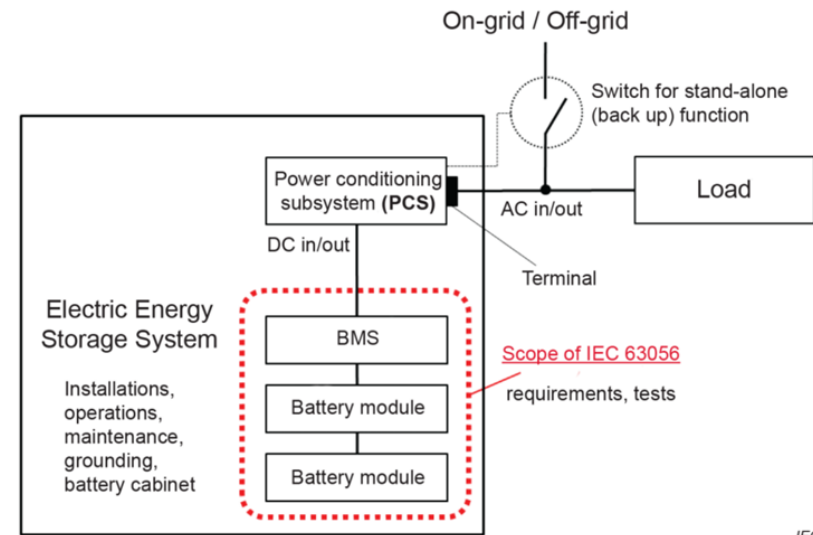
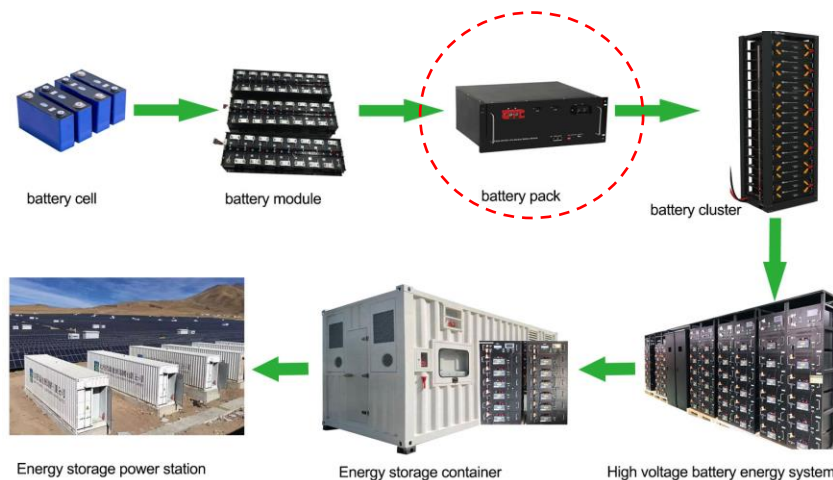
Publication type	International Standard
Publication date	2020-03-27
Edition	1.0
TC/SC	TC 21/SC 21A - Secondary cells and batteries containing alkaline or other non-acid electrolytes



Battery system

IEC 63056 - Scope

- Requirements and tests with a maximum DC voltage of 1 500 V (nominal).
- Basic safety requirements are included in IEC 62619. This document provides additional or specific requirements for EESS.



Battery system

IEC 63056 - Specific requirements and tests

- Resistance to abnormal heat
- Casing material of a battery system that can be transported for installation or maintenance
- Electric insulation check during transport and installation
- Charging procedures for test purposes
- Protection against short circuit during transport and installation
- Protection for reverse connection
- Over-discharge control of voltage (battery system)
- Drop test

Battery system

IEC 63056 - Specific requirements and tests

Table 1 – Type test

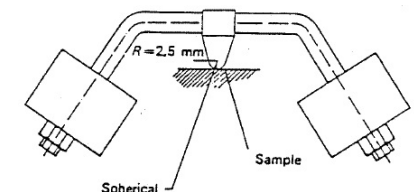
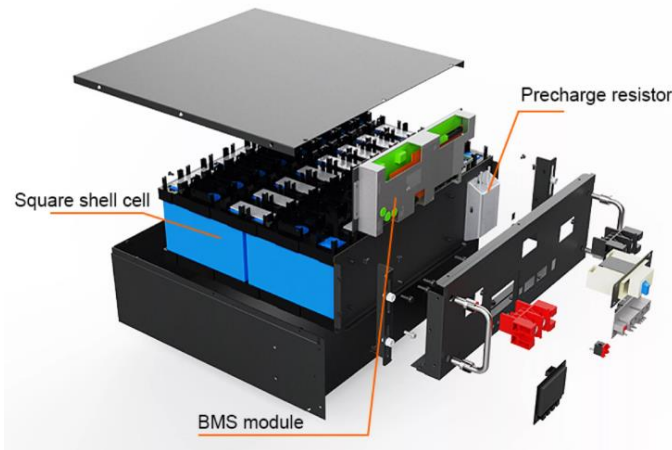
Test items	DUT
7.3 Resistance to abnormal heat	minimum of 1
7.5 Protection for short circuit during transport and installation	minimum of 1
7.6 Electric insulation check during transport and installation	minimum of 1
7.7 Protection for reverse connection	minimum of 1
7.8 Drop test	minimum of 1
7.9 Overdischarge control of voltage (battery system)	minimum of 1

Battery system

IEC 63056 - Specific requirements and tests

Test items	Specific requirements and tests
Resistance to abnormal heat	Non-metallic materials on which parts at HAZARDOUS VOLTAGE subjecting the part to the ball pressure test in IEC 60695-10-2

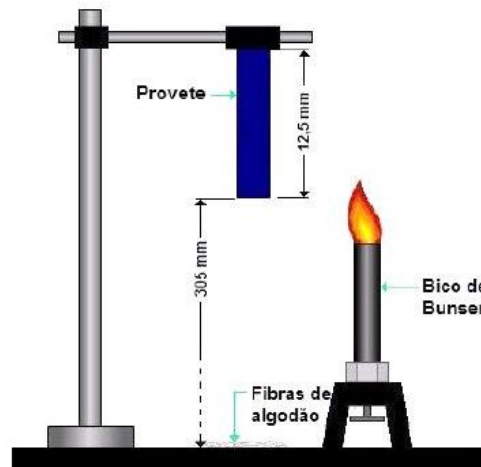
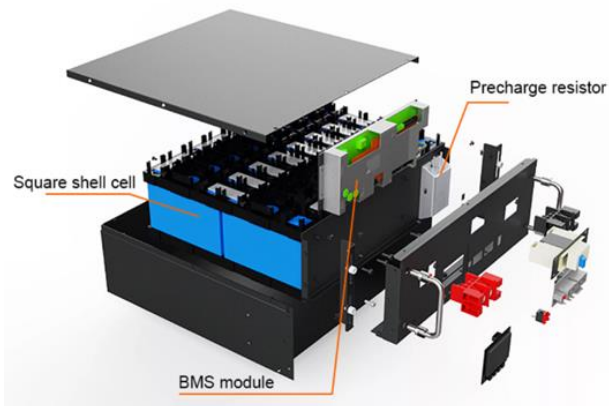
The test is made in a heating cabinet at a temperature of $(\Delta T + T_{max} + 15 \text{ }^{\circ}\text{C}) \pm 2 \text{ }^{\circ}\text{C}$.



Battery system

IEC 63056 - Specific requirements and tests

Test items	Specific requirements and tests
Casing material of a battery system that can be transported for installation or maintenance	Thermoplastic materials used for casing should be of class V-2, V-1 or V-0. classified in accordance with IEC 60695-11-10.



Battery system

IEC 63056 - Specific requirements and tests

Test items	Specific requirements and tests
Electric insulation check during transport and installation	Compliance is checked by an insulation resistance test of IEC 62133:2017 Insulation >5 MΩ at 500 V DC



Battery system

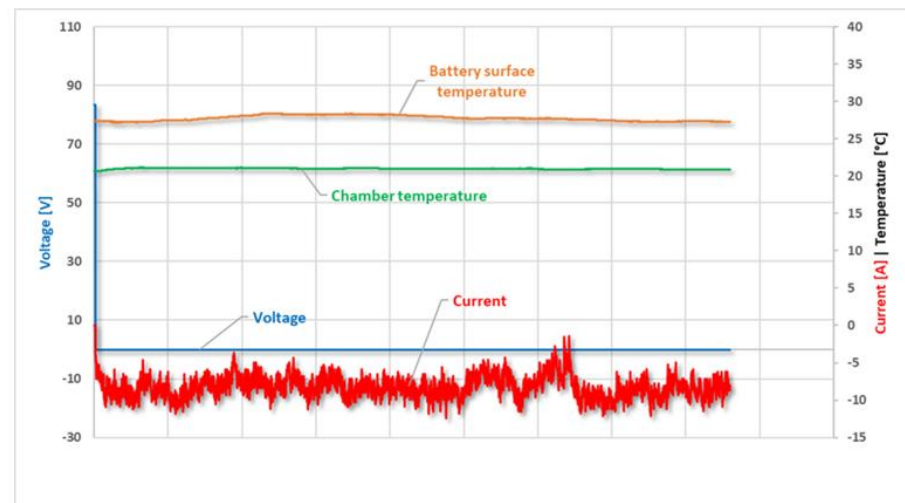
IEC 63056 - Specific requirements and tests

Test items

Specific requirements and tests

Protection for short circuit during transport and installation

- Short-circuited with external resistance <math>< 100 \text{ m}\Omega</math>
- Remain on test for 6 h
- No rupture, no fire, no explosion.



Battery system

IEC 63056 - Specific requirements and tests

Test items	Specific requirements and tests
Protection for reverse connection	<ul style="list-style-type: none">- Connect one of the DUTs of the battery system with opposite polarity.- Connect the remaining other DUTs in the battery system with the correct polarity.- Turn on the main power of the BMS and of the battery system.- Charge/Discharge the battery system with the conditions specified by the manufacturer- until it is fully charged, or charging is stopped by a safety protection.- The battery system shall be put on rest for an hour- No rupture, no fire, no explosion.



Battery system

IEC 63056 - Specific requirements and tests

Test items	Specific requirements and tests
Over discharge control of voltage (battery system)	<p>The BMS shall control the cell voltage during discharging above the lower limit discharging voltage of the cells.</p> <ul style="list-style-type: none">• discharged 0.2C to SOC 30%• discharged at the specified <u>maximum discharging current</u>.• until the BMS terminates the discharging before exceeding the lower limit discharging voltage• continued for 1 h after discharging is stopped <p>Acceptance criteria</p> <ul style="list-style-type: none">• The <u>BMS shall interrupt the over-discharging current by an automatic disconnect</u> of the main contactors in order to protect the battery system against further related severe effects such as fire, explosion or cell voltages below their specified limits.

Battery system

IEC 63056 - Specific requirements and tests

Test items Specific requirements and tests

Drop test

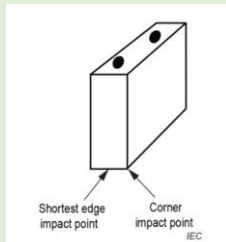


Figure 3 – Impact location

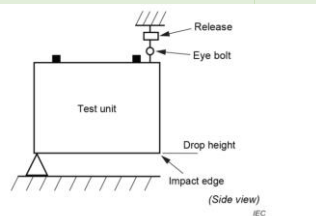


Figure 4 – Configuration for the shortest edge drop test

Table 2 – Drop test method and condition

Mass of the DUT, m	Test method	Orientation	Height of drop
$m < 7$ kg	Whole	Random	100,0 cm
$7 \text{ kg} \leq m < 20$ kg	Whole	Bottom down direction ^a	100,0 cm
$20 \text{ kg} \leq m < 50$ kg	Whole	Bottom down direction ^a	50,0 cm
$50 \text{ kg} \leq m < 100$ kg	Edge and corner	-	5,0 cm
$m \geq 100$ kg	Edge and corner	-	2,5 cm

^a The bottom surface of the DUT is specified by the manufacturer

Battery Energy Storage System Standard

	Performance	Safety
BESS	Grid code IEC 62933-2-1/2	IEC 6933-5-1/2
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Conversion subsystem

IEC 62477-1

- Safety requirements for power electronic converter systems and equipment - Part 1: General
- Scope
 - This part of IEC 62477 applies to Power Electronic Converter Systems (PECS) with rated system voltages not exceeding 1 000 V a.c. or 1 500 V d.c.
 - Provides minimum requirements for safety aspects.

Publication type	International Standard
Publication date	2016-07-28
Edition	1.1
TC/SC	TC 22 - Power electronic systems and equipment



Conversion subsystem

IEC 62477-1 - Specific requirements and tests

- Visual inspection
- Mechanical tests
- Electrical tests
- Abnormal operation tests
- Material tests
- Environmental tests
- Hydrostatic pressure test

Conversion subsystem

IEC 62477-1 Test overview

Table 22 – Test overview

Test	Type	Routine	Sample	Requirement(s)	Specification
Visual inspection	X	X			5.2.1
Mechanical tests					5.2.2
Clearance and creepage distances test	X			4.4.7.1, 4.4.7.5	5.2.2.1
Non-accessibility test	X			4.4.3.3, 4.5.1.1, 4.6.3.3.2	5.2.2.2
Ingress protection test (IP rating)	X			4.12.1	5.2.2.3
Enclosure integrity test	X			4.12.1	5.2.2.4
Deflection test	X			4.12.1	5.2.2.4.2
Steady force test, 30N	X			4.12.1	5.2.2.4.2.2
Steady force test, 250N	X			4.12.1	5.2.2.4.2.3
Impact test	X			4.12.1	5.2.2.4.3
Drop test	X			4.12.1	5.2.2.4.4
Stress relief test	X			4.12.1	5.2.2.4.5
Stability test	X			4.12.1	5.2.2.5
Wall or ceiling mounted equipment test	X			4.12.1	5.2.2.6
Handles and manual control securement test	X			4.12.1	5.2.2.7

Conversion subsystem

IEC 62477-1 Test overview

Table 22 – Test overview

Test	Type	Routine	Sample	Requirement(s)	Specification
Electrical tests				4.4.7.10	5.2.3
Impulse voltage test	X		X	4.4.3.2, 4.4.5.4, 4.4.7.1, 4.4.7.10.1, 4.4.7.10.2, 4.4.7.8.3	5.2.3.2
a.c. or d.c. voltage test	X	X		4.4.3.2, 4.4.5.4, 4.4.7.1, 4.4.7.10.1, 4.4.7.10.2, 4.4.7.8.4.2	5.2.3.4
Partial discharge test	X		X	4.4.7.1, 4.4.7.10.2, 4.4.7.8.3	5.2.3.5
<i>Protective impedance test</i>	X	X		4.4.5.4	5.2.3.6
<i>Touch current measurement test</i>	X			4.4.4.3.3	5.2.3.7
Capacitor discharge test	X			4.4.9	5.2.3.8
Limited power source test	X			4.5.1.2, 4.6.5	5.2.3.9
Temperature rise test	X			4.6.4	5.2.3.10
<i>Protective equipotential bonding test</i>	X	X		4.4.4.2.2	5.2.3.11

Conversion subsystem

IEC 62477-1 Test overview

Table 22 – Test overview

Test	Type	Routine	Sample	Requirement(s)	Specification
Abnormal operation tests				4.2	5.2.4
Short time withstand current (I_{CW}) test	X			4.3.5	5.2.4.10
Output Short circuit test	X			4.3	5.2.4.4
Output overload test	X			4.3	5.2.4.5
Breakdown of components test	X			4.2	5.2.4.6
PWB short circuit test	X			4.4.7.7	5.2.4.7
Loss of phase test	X			4.2	5.2.4.8
Cooling failure tests	X			4.2, 4.7.2.3.6	5.2.4.9
Inoperative blower test	X			4.2	5.2.4.9.2
Clogged filter test	X			4.2	5.2.4.9.3
Loss of coolant test	X			4.7.2.3.6	5.2.4.9.4

Conversion subsystem

IEC 62477-1 Test overview

Table 22 (continued)

Test	Type	Routine	Sample	Requirement(s)	Specification
Material tests					5.2.5
High current arcing ignition test	X			4.4.7.8.2	5.2.5.2
Glow-wire test	X			4.4.7.8.2	5.2.5.3
Hot wire ignition test	X			4.4.7.8.2	5.2.5.4
Flammability test	X			4.6.3	5.2.5.5
Flaming oil test	X			4.6.3.3.3	5.2.5.6
Cemented joints test	X			4.4.7.9	5.2.5.7
Environmental tests	X			4.9	5.2.6
Dry heat test	X			4.9	5.2.6.3.1
Damp heat test	X			4.9	5.2.6.3.2
Vibration test	X			4.9	5.2.6.4
Salt mist test	X			4.9	5.2.6.5
Dust and sand test	X			4.9	5.2.6.6
Hydrostatic pressure test	X	X		4.7.2.3.3	5.2.7

Conversion subsystem

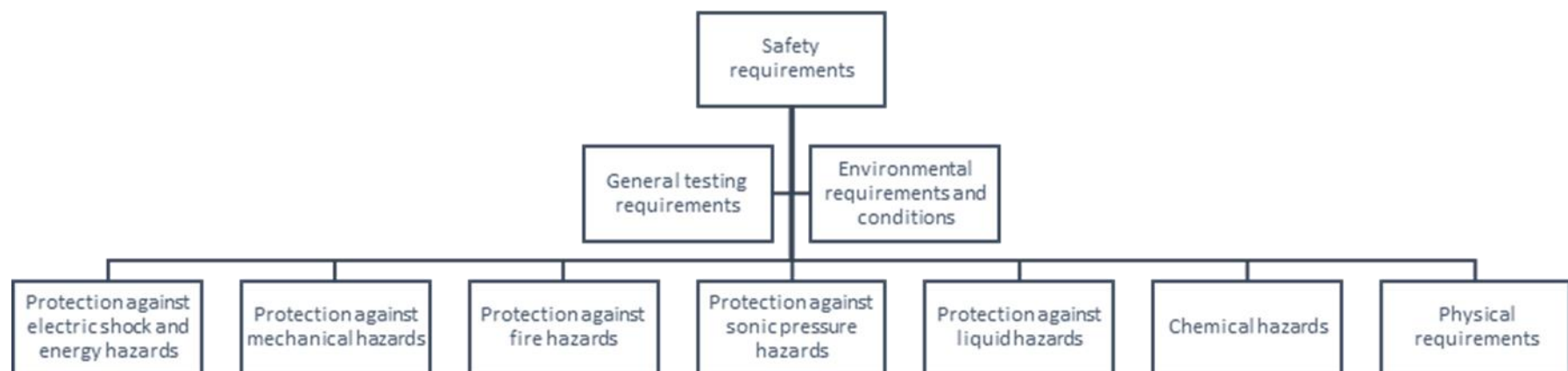
IEC 62109

- **IEC 62109-1:2010** Safety of power converters for use in photovoltaic power systems - Part 1: General requirements
- **IEC 62109-2:2011** Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters
- **IEC 62109-3:2020** Safety of power converters for use in photovoltaic power systems - Part 3: Particular requirements for electronic devices in combination with photovoltaic elements

Conversion subsystem

IEC 62109 - Scope

- IEC 62109-1:2010 applies to the power conversion equipment (PCE) for use in photovoltaic systems where a uniform technical level with respect to safety is necessary. Defines the minimum requirements for the design and manufacture of PCE for protection against electric shock, energy, fire, mechanical and other hazards. Provides general requirements applicable to all types of PV PCE.



Battery Energy Storage System Standard

	Performance	Safety
BESS	Grid code IEC 62933-2-1/2	IEC 6933-5-1/2
BESS Units	IEC 62933-2-1/2	IEC 62933-5-1/2
Conversion subsystem	Grid code IEC 61683	IEC 62109 IEC 62477
Battery system	IEC 61427-1/2	IEC 63056
Battery cell/module/tray	IEC 62620	IEC 62619

BESS Units

IEC 62933 series Electrical energy storage (EES) systems

Standard no.	Title
IEC 62933-1	Part 1: Vocabulary
IEC 62933-2-1	Part 2-1: Unit parameters and testing methods - General specification
IEC TS 62933-3-1	Part 3-1: Planning and performance assessment of electrical energy storage systems - General specification
IEC TS 62933-4-1	Part 4-1: Guidance on environmental issues - General specification
IEC TS 62933-5-1	Part 5-1: Safety considerations for grid-integrated EES systems - General specification
IEC 62933-5-2	Part 5-2: Safety requirements for grid-integrated EES systems - Electrochemical-based systems

BESS Units

IEC 62933 series Electrical energy storage (EES) systems

IEC TS 62933-5-1, Electrical energy storage (EES) systems - Part 5-1: Safety considerations for grid integrated EES systems - General specification

- Scope - specifies safety considerations (e.g. hazards identification, risk assessment, risk mitigation) applicable to EES systems integrated with the electrical grid.

IEC 62933-5-2 Electrical energy storage (EES) systems Part 5-2: Safety requirements for grid integrated EES systems - electrochemical based systems (recently published)

- Scope – safety Standard for electrochemical energy storage systems (BESSs)

BESS Units

IEC 62933-5-2 Safety requirements for grid integrated EES systems - electrochemical based systems

- Scope
 - References IEC TS 62933-5-1
 - Topics covered
 - Hazard consideration for BESS
 - BESS System Risk Assessment
 - System Testing
 - Guidelines and Manuals

- IEC battery safety standards referenced normative in IEC 62933-5-2

Standard No.	Battery
IEC 62619	Lithium ion
IEC 63056	Lithium ion
IEC 62485-5	Lithium ion
IEC 63115-2	Nickel metal hydride
IEC 62585-2	Lead acid
IEC 62932-2-2	Flow battery
IEC 62984-2	Sodium high temp

IEC 62933-5-2 (BESS categories)

Table 1 – BESS categories

Features for categorization	Category denominations	Explanation
“POC voltage” where BESS is connected	V-L	Low: $V \leq 1 \text{ kV AC or } 1,5 \text{ kV DC}$
	V-H	High: $V > 1 \text{ kV AC or } 1,5 \text{ kV DC}$
“Energy capacity” of BESS	E-S	Small: $E \leq 20\text{kWh}$
	E-L	Not small: $E > 20\text{kWh}$
“Site occupancy” in relation to electrochemical accumulation subsystem	S-O	Occupied site (see 3.2)
	S-U	Unoccupied site (see 3.2)
“Chemistry” of electrochemical accumulation subsystem	C-A	BESS using non-aqueous electrolyte battery (e.g. Li-based)
	C-B	BESS using aqueous electrolyte battery (e.g. Lead acid, Ni-based)
	C-C	BESS using high temperature battery (e.g. NaS, NaNiCl)
	C-D	BESS using flow battery
	C-Z	Others
<p>NOTE 1 Denominations of BESS categorization are described as "V-X / E-X / S-X / C-X" in any requirements of this document (e.g. V-H / E-L / S-U / C-C). Some characteristics can be omitted if any limitation of category does not apply.</p> <p>NOTE 2 To apply this document to both BESS and other electrochemical-based EESS including chemical based supercapacitors, the latter EESS are included in category "C-Z".</p> <p>NOTE 3 Combinations of two or more electrochemical accumulation chemistries are included in category "C-Z".</p>		

****3.2**
 occupied site location that is within or adjacent to a building or structure with an overhead cover, where people live or work
 Note 1 to entry: A location that is not an occupied site is called “unoccupied site”.

BESS Units

IEC 62933-5-2 (Overview of validation and testing for BESS)

Test	Subclause no.	Referenced document	Required tests		
			Type Test	FAT Test	SAT Test
Electrical hazards	8.2.1				
Short-circuit protection	8.2.1.1	-	X	-	-
Overcharge, high current charge and earth fault protection	8.2.1.2	-	X	-	X
Impulse withstand voltage protection	8.2.1.3	IEC 60664-1	X	-	-
Dielectric voltage	8.2.1.4	IEC 60664-1	X	X*	X*
Insulation resistance	8.2.1.5	IEC 60364-6	X	X	X
Earthing and bonding system check	8.2.1.6	IEC 62368-1 IEC 61936-1	X*	-	X*
Anti-islanding	8.2.1.7	-	X*	X*	X*

FAT: Factory Acceptance Test

SAT: Site Acceptance Testing

BESS Units

IEC 62933-5-2 (Overview of validation and testing for BESS)

Test	Subclause no.	Referenced document	Required tests		
			Type Test	FAT Test	SAT Test
Mechanical hazards	8.2.2				
Enclosure impact	8.2.2.1	IEC 62477-1	X	-	-
Static force	8.2.2.2	IEC 62477-1	X	-	-
Earthquake impact and vibration	8.2.2.3	-	-	-	X
Explosion	8.2.3				
Specification of flammable gas	8.2.3.1	-	X	-	-
Gas detection / off-gas detection	8.2.3.2	IEC 60079-29 (all parts)	X	X*	X*
Ventilation	8.2.3.3	IEC 60079-7 IEC 60079-13	-	X*	X*

BESS Units

IEC 62933-5-2 (Overview of validation and testing for BESS)

Test	Subclause no.	Referenced document	Required tests		
			Type Test	FAT Test	SAT Test
Hazards arising from electric, magnetic, and electromagnetic fields	8.2.4	IEC 61000-1-2 IEC 61000-6-7 IEC 60364-4-44	X	-	-
Fire hazards (propagations)	8.2.5	IEC 62619	X	X*	X*
Temperature hazards	8.2.6				
Verification of thermal control operation	8.2.6.1	-	X*	-	X
Abnormal operations of subsystems for ventilation	8.2.6.2	-	X	-	X
Temperature under normal operations test	8.2.6.3	-	X	-	X
Chemical effects	8.2.7				
Specification of toxic fluids	8.2.7.1	-	X	-	-
Fluids detection	8.2.7.2	-	X	X*	X*
Protective measures against hazardous fluids	8.2.7.3	-	X	X*	X*

IEC 62933-5-2 (Overview of validation and testing for BESS)

Test	Subclause no.	Referenced document	Required tests		
			Type Test	FAT Test	SAT Test
Hazards arising from auxiliary, control and communication system malfunctions	8.2.8	IEC TS 62933-5-1	X	-	X*
Hazards arising from environments	8.2.9				
Resistance to moisture ingress	8.2.9.2	IEC 60529	X	-	-
Exposure to marine environments (salt fog)	8.2.9.3	IEC 60086-5-52	X	-	-
IP rating of BESS enclosure and protective guards	8.2.10	IEC 60529	X	-	-
NOTE 1 The detailed applicable conditions of "X*" testing items can be found in the individual subclauses.					
NOTE 2 Detailed testing items and procedures of SAT can be decided considering the individual BESS system design.					

BESS STANDARD

Thank you

