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**Safety requirements for electric energy
storage equipment**

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Foreword

This Japanese Industrial Standard has been established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal for establishment of Japanese Industrial Standard submitted by The Japan Electrical Manufacturers' Association (JEMA)/Japanese Standards Association (JSA) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act. This Standard replaces **JIS C 4412-1** : 2014 and **JIS C 4412-2** : 2019, which have been withdrawn.

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Safety requirements for electric energy storage equipment

Introduction

This Japanese Industrial Standard has been prepared based on **IEC 62909-1** : 2017, Edition 1; this Standard derives only the safety requirements of storage systems from the said **IEC** while changing some of the technical contents in consideration of the local condition of power distribution in Japan.

Annex JA and Annex JB are unique to **JIS** and not given in the corresponding International Standard. The vertical lines on both sides and dotted underlines indicate changes from the corresponding International Standard. A list of modifications with the explanations is given in Annex JC.

1 Scope

This Standard specifies the safety requirements for equipment of low voltage energy storage systems provided with an integral or separate storage battery (hereafter referred to as the energy storage system).

This Standard covers the energy storage systems used for supplying backup power to loading apparatuses in equipment in the event of the equipment having a power failure, for peak shaving and peak load shifting (for using charged power at a peak period), for virtual power plant (VPP), for demand response, etc.

This Standard is used together with **JIS C 62477-1** : 2017. In applying the cited parts of **JIS C 62477-1** : 2017 in this Standard, the term “PECS” shall be replaced with “energy storage system”. For Annex A, Annex D, Annex H and Annex N of this Standard, the respective corresponding annexes of **JIS C 62477-1** : 2017 shall apply.

This Standard covers either of the following.

- Stand-alone system of AC input voltage of 600 V or less or DC input voltage of 750 V or less which receives power from a low-voltage distribution system and supplies power from an output terminal or socket outlet.
- Grid connection system of AC output voltage of 600 V or less or DC input/output voltage of 750 V or less which supplies power through the wiring of equipment via a distribution board by connecting a low-voltage distribution system

However, this Standard does not specify requirements concerning grid connection protection function.

This Standard does not cover uninterruptible power supply systems, which fall under the scope of **JIS C 4411** (all parts).

NOTE 1 The discharge time of an energy storage system is not specified as it depends on the capacity and number of loading apparatuses to be connected, as well as on the degree of aged deterioration of the storage

battery. Similarly, the capacity of an energy storage system is not specified because it depends on the loading apparatus to be connected by the manufacturer.

NOTE 2 Some systems of energy storage system require reconnecting of plugs in the event of power failure.

NOTE 3 For the requirements for grid connection protection functions and equipment, it is necessary to apply the criteria and standards concerning grid connection protection functions and/or wiring rules.

NOTE 4 The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

IEC 62909-1 : 2017 *Bi-directional grid-connected power converters — Part 1 : General requirements* (MOD)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21-1**.

2 Normative references

Part or all of the provisions of the following standards, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS C 6950-1 : 2016 *Information technology equipment — Safety — Part 1 : General requirements*

JIS C 8715-2 : 2019 *Secondary lithium cells and batteries for use in industrial applications — Part 2 : Tests and requirements of safety*

JIS C 60695-11-10 : 2015 *Fire hazard testing — Part 11-10 : Test flames — 50 W horizontal and vertical flame test methods*

JIS C 62477-1 : 2017 *Safety requirements for power electronic converter systems and equipment — Part 1 : General*

NOTE Normative reference in the corresponding International Standard : IEC 62477-1 + AMD1 : 2006 *Safety requirements for power electronic converter systems and equipment — Part 1 : General*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions, and those given in **JIS C 62477-1 : 2017** apply.

3.1

low voltage energy storage system

combination of converters, switches and storage batteries constituting a power system for supplying backup power to loading apparatuses in equipment for a few hours in the event of the equipment having a power failure, for peak shaving and peak load shifting

(for using charged power at a peak period), for virtual power plant (VPP), for demand response, etc.

Note 1 to entry Terms such as “backup power supply system” and “portable power supply” may be used according to the use, capacity, etc. of the energy storage system.

Note 2 to entry The equipment may use valve-regulated lead-acid batteries, lithium secondary batteries, etc.

Note 3 to entry The storage battery may be internal to the energy storage system or connected through a DC link as an enclosure separate from the semiconductor power converter.

3.2

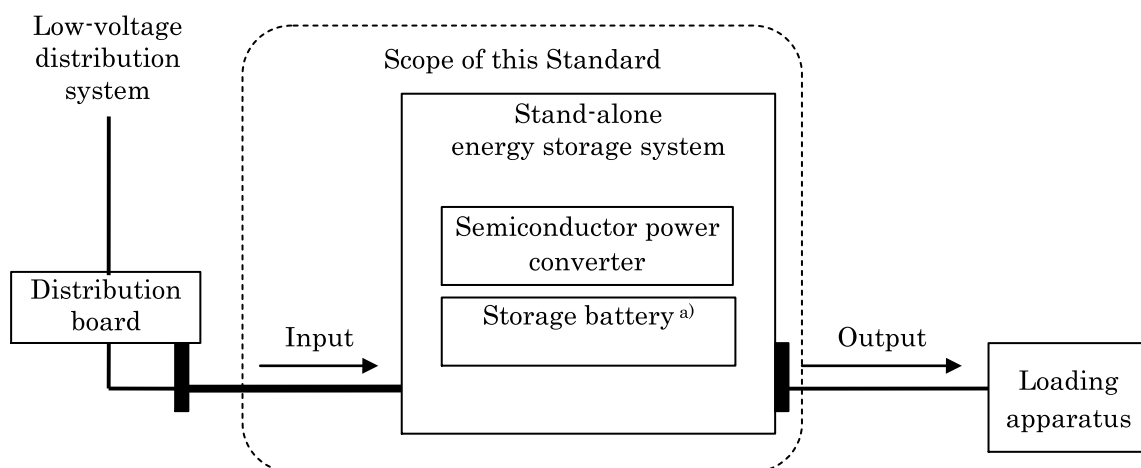
stand-alone system

system which receives power from a low-voltage distribution system and supplies power through an output terminal or socket outlet

Note 1 to entry The schematic diagram of a stand-alone system is shown in Figure 0A.

Note 2 to entry For the input, it may have a power supply plug for connecting to a socket outlet or perform terminal connection.

Note 3 to entry For the output, it may have an output socket outlet, perform output to an exclusive socket outlet through the wiring of equipment, or perform terminal connection.



Note ^{a)} In the case of a lithium secondary battery, it includes a battery-management unit.

Figure 0A Schematic diagram of stand-alone system

3.3

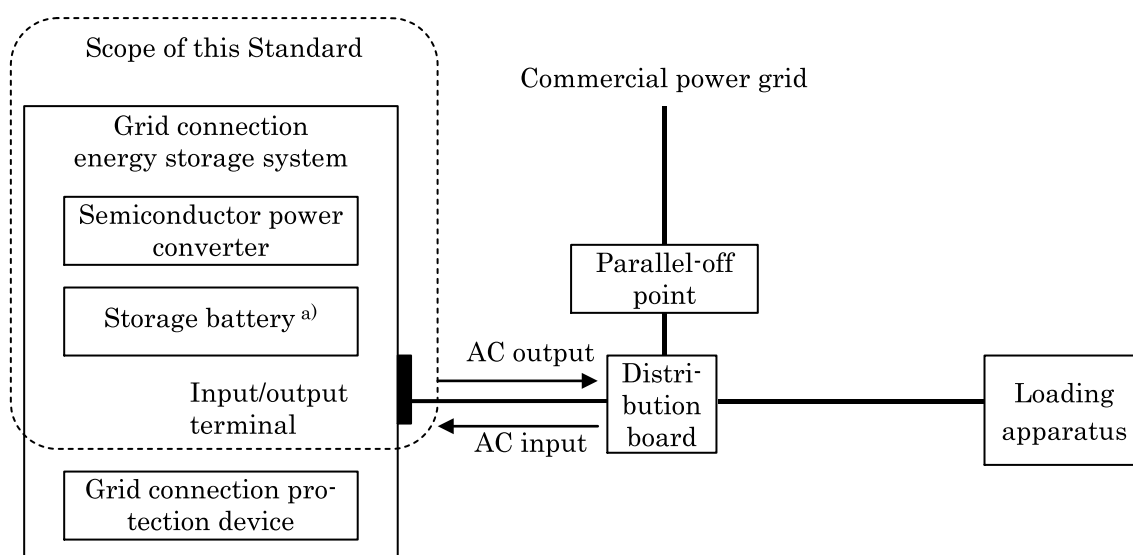
grid connection system

system which is connected to the grid and supplies power through the wiring of the

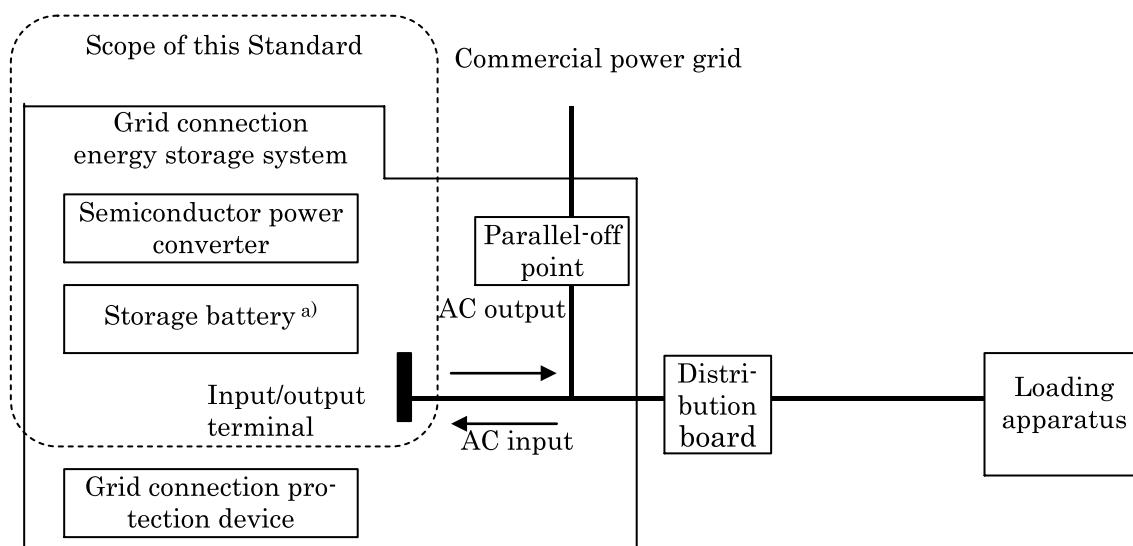
equipment via a distribution board, etc.

Note 1 to entry The schematic diagram of a grid connection system is shown in Figure 0B.

Note 2 to entry The input and output wiring between the energy storage system and the distribution board may be a single grid connection or a multiple grid connection where input and output are divided.



a) Schematic diagram of grid connection system having parallel-off point outside energy storage system (example of AC input/output)



b) Schematic diagram of grid connection system having parallel-off point inside energy storage system (example of AC input/output)

Note ^{a)} In the case of a lithium secondary battery, it includes a battery-management unit.

Figure 0B Schematic diagram of grid connection system

3.4

pluggable equipment

either pluggable type A equipment or pluggable type B equipment.

3.5

direct plug-in equipment

equipment that is intended to be used without a power supply cord; the mains plug forms an integral part of the equipment enclosure

Note 1 to entry Due to this structure, the weight of the equipment is taken by the socket outlet.

3.6

transportable equipment

movable equipment that is intended to be routinely carried by a user

3.7

movable equipment

equipment which is either 18 kg or less in mass and not fixed, or provided with wheels, castors or other means to facilitate movement by the operator as required to perform its intended use

3.8

skilled person

person with relevant education and experience to enable him or her to perceive risks and to avoid hazards which the equipment can create

Note 1 to entry Such person has access to restricted access areas.

3.9

instructed person

person adequately advised or supervised by skilled persons to enable him or her to perceive risks and to avoid hazards which the equipment can create

Note 1 to entry Such person has access to restricted access areas.

3.10

ordinary person

person who is neither a skilled person nor an instructed person

Note 1 to entry Such person is not trained to identify hazards and does not have access to a restricted access area. Such person may otherwise have access to the equipment or may be in the vicinity of the equipment. An ordinary person will not intentionally create hazards nor have access to hazardous parts under normal and single fault conditions.

3.11**hazardous voltage**

voltage exceeding 42.4 V peak, or 60 V DC, existing in a circuit that does not meet the requirements for either a limited current circuit or a TNV-1 circuit

Note 1 to entry A limited current circuit is understood in the context of “protection by means of protective impedance” as described in 4.4.5.4 of JIS C 62477-1 : 2017.

3.12**hazardous energy**

available power level of 240 VA or more, having a duration of 60 s or more, or a stored energy level of 20 J or more (for example, from one or more capacitors), at a potential of 2 V or more

3.13**primary power**

power supplied by an electrical utility company or by a local generator

3.14**bypass**

alternative power path to the energy storage system

3.15**low impedance path**

path containing devices that present negligible impedance, such as cabling, switching devices, protecting devices and filtering devices

Note 1 to entry The devices in a low impedance path generally present current limiting characteristics under short circuit conditions.

Note 2 to entry Examples include current limiting fuses, current limiting circuit-breakers, transformers and inductors.

3.16**backfeed**

condition in which a voltage or energy available within the energy storage system is fed back to any of the input terminals, either directly or by a leakage path while operating in the stored energy mode and with primary power not available

3.17**backfeed protection**

control scheme in stand-alone system that reduces the risk of electric shock due to backfeed

3.18

stored energy mode

stable mode of operation of an energy storage system powered entirely by storage battery

Note 1 to entry The stored energy mode is attained under the following conditions:

- a) AC input power is disconnected or is out of required tolerance;
- b) the load is within the specified rating of the energy storage system.

4 Protection against hazards**4.1 General**

The requirements in 4.1 of JIS C 62477-1 : 2017, along with the following, shall apply.

The requirements in 1.5.1, 1.5.2, 1.5.3, 1.5.4, 1.5.5, 1.5.6, 1.5.7 and 1.5.8 of JIS C 6950-1 : 2016 shall apply. Furthermore, components may conform to the standards, etc. comparable to the requirements of the related component standards.

When a lithium secondary battery is used as a storage battery, it shall conform to the requirements of JIS C 8715-2 : 2019.

4.2 Single fault conditions and abnormal operating conditions

The requirements in 4.2 of JIS C 62477-1 : 2017 shall apply.

4.3 Short circuit and overload protection**4.3.1 General**

The requirements in 4.3.1 of JIS C 62477-1 : 2017, along with the following, shall apply.

Add the following to the second and fifth paragraphs :

However, instead of specifying I_{cc} and/or I_{cw} , the short-circuit protective device and cable diameter based on the national wiring rules in Japan may be marked. In this case, compliance is checked by the marking of “the rated current and rated breaking capacity of the short circuit protective device and the cable diameter based on the national wiring rules in Japan” in 6.2.

Add the following to the list under “However, provision or specification of overcurrent protection is not necessary in the following cases” in the paragraph following NOTE 2 in 4.3.1 of JIS C 62477-1 : 2017 :

— the input circuit from photovoltaic module.

4.3.2 Specification of input short circuit withstand strength and output short circuit current ability**4.3.2.1 General**

The requirements in 4.3.2.1 of JIS C 62477-1 : 2017 shall apply.

4.3.2.2 Conditional short circuit current (I_{cc}) rating on input ports

The requirements in 4.3.2.2 of JIS C 62477-1 : 2017, along with the following, shall apply.

Add the following to the second paragraph :

In the test of 5.2.4.4, replace the term “output port” with “input port”.

4.3.2.3 Output short circuit current ability

The requirements in 4.3.2.3 of JIS C 62477-1 : 2017, along with the following, shall apply.

This subclause shall not apply when the output port is grid-connected.

4.3.2.4 Combined input and output ports

The requirements in 4.3.2.4 of JIS C 62477-1 : 2017 shall apply.

4.3.3 Short circuit coordination (backup protection)

The requirements in 4.3.3 of JIS C 62477-1 : 2017 shall apply.

4.3.4 Protection by several devices

The requirements in 4.3.4 of JIS C 62477-1 : 2017 shall apply.

4.3.5 Short time withstand current of input port, I_{cw}

The requirements in 4.3.5 of JIS C 62477-1 : 2017 shall apply.

4.3.6 Protection of storage battery

The storage battery whether internal (integral) or external to the energy storage system shall be protected against fault current and against overcurrent.

An overcurrent protective device providing the functions of a disconnect device as stated in 4.13 shall be located in close proximity to the storage battery, and the following requirements apply :

- a) for the purpose of interrupting a fault current supplied by the storage battery, the overcurrent protective device shall :
 - not require a current greater than the fault current available,
 - be rated to interrupt the maximum fault current available.
- b) the cables interconnecting the storage battery, the overcurrent protective device and the energy storage system shall be rated to support :
 - the maximum current required by the energy storage system when operating in stored energy mode,
 - the maximum fault current available.

The maximum fault current available shall be determined at the output of the fully charged storage battery.

Compliance with requirements a) and b) above is verified by investigation of the characteristics of the protective device(s) and of the cables as supplied (or as specified for installation) while considering the storage battery (or range of storage batteries) to be supported.

NOTE..... Guidance for current rating of cables is found in IEC 60287-1-1.

4.4 Protection against electric shock

4.4.1 General

The requirements in 4.4.1 of JIS C 62477-1 : 2017 shall apply.

4.4.2 Decisive voltage class

4.4.2.1 General

The requirements in 4.4.2.1 of JIS C 62477-1 : 2017 shall apply.

4.4.2.2 Determination of decisive voltage class

4.4.2.2.1 General

The requirements in 4.4.2.2.1 of JIS C 62477-1 : 2017 shall apply.

4.4.2.2.2 Selection tables for contact area and skin humidity condition

The requirements in 4.4.2.2.2 of JIS C 62477-1 : 2017, along with the following, shall apply.

Add the description, “the appropriate conditions in Table 3 and Table 4 shall be specified by the manufacturer”, after Table 4 of JIS C 62477-1 : 2017.

4.4.2.2.3 Limits of the working voltage for the DVC

The requirements in 4.4.2.2.3 of JIS C 62477-1 : 2017 shall apply.

4.4.2.3 Requirements for protection against electric shock

The requirements in 4.4.2.3 of JIS C 62477-1 : 2017 shall apply.

4.4.3 Means for basic protection

4.4.3.1 General

The requirements in 4.4.3.1 of JIS C 62477-1 : 2017 shall apply.

4.4.3.2 Protection by means of basic insulation of live parts

The requirements in 4.4.3.2 of JIS C 62477-1 : 2017 shall apply.

4.4.3.3 Protection by means of enclosures or barriers

The requirements in 4.4.3.3 of JIS C 62477-1 : 2017, along with the following, shall apply.

Add the following as the third item in the list given in the first paragraph of JIS C 62477-1 : 2017 :

— provided with protection of protective class IP20 as a minimum unless a higher protection level is specified, or of protective class IP23 if it is for outdoor use.

4.4.3.4 Protection by limitation of touch current and electric charge

The requirements in 4.4.3.4 of JIS C 62477-1 : 2017 shall apply.

4.4.3.5 Protection by limitation of voltage

The requirements in 4.4.3.5 of JIS C 62477-1 : 2017 shall apply.

4.4.4 Means for fault protection

4.4.4.1 General

The requirements in 4.4.4.1 of JIS C 62477-1 : 2017 shall apply.

4.4.4.2 Protective equipotential bonding

4.4.4.2.1 General

The requirements in 4.4.4.2.1 of JIS C 62477-1 : 2017, along with the following, shall apply.

For the output circuit of the energy storage system, the protective earthing of equipment required by the power system in which the energy storage system is intended to operate shall be referred.

The protective earthing and the bonding of a neutral conductor shall apply to all the operating states of a unit. The physical bonding point may be located outside the energy storage system.

The AC output circuit of pluggable type A energy storage system or pluggable type B energy storage system in which power is not supplied with the earthing wire separated from the power supply during operation in the normal operating condition does not need bonding in the stored energy mode. For the power distribution system in which power is supplied with the earthing separated from the AC power supply, see Annex V of JIS C 6950-1.

NOTE In Annex V of JIS C 6950-1, the power distribution system is classified into TNS, TNC, TT or IT according to :

- the bonding condition between protective earthing and neutral conductor (phase conductor when there is no neutral conductor);
- separation between neutral conductor and earthing when there is a neutral conductor;
- earthing of the equipment structure.

4.4.4.2.2 Rating of protective equipotential bonding

The requirements in 4.4.4.2.2 of JIS C 62477-1 : 2017 shall apply.

4.4.4.3 Protective earthing conductor

4.4.4.3.1 General

The requirements in 4.4.4.3.1 of JIS C 62477-1 : 2017 shall apply.

4.4.4.3.2 Means of connection for protective earthing conductor

The requirements in 4.4.4.3.2 of JIS C 62477-1 : 2017 shall apply.

4.4.4.3.3 Touch current in case of failure of protective earthing conductor

The requirements in 4.4.4.3.3 of JIS C 62477-1 : 2017 shall apply.

4.4.4.4 Automatic disconnection of supply

The requirements in 4.4.4.4 of JIS C 62477-1 : 2017 shall apply.

4.4.4.5 Supplementary insulation

The requirements in 4.4.4.5 of JIS C 62477-1 : 2017 shall apply.

4.4.4.6 Simple separation between circuits

The requirements in 4.4.4.6 of JIS C 62477-1 : 2017 shall apply.

4.4.4.7 Electrically protective screening

The requirements in 4.4.4.7 of JIS C 62477-1 : 2017 shall apply.

4.4.5 Enhanced protection

4.4.5.1 General

The requirements in 4.4.5.1 of JIS C 62477-1 : 2017 shall apply.

4.4.5.2 Reinforced insulation

The requirements in 4.4.5.2 of JIS C 62477-1 : 2017 shall apply.

4.4.5.3 Protective separation between circuits

The requirements in 4.4.5.3 of JIS C 62477-1 : 2017 shall apply.

4.4.5.4 Protection by means of protective impedance

The requirements in 4.4.5.4 of JIS C 62477-1 : 2017 shall apply.

4.4.6 Protective measures

4.4.6.1 General

The requirements in 4.4.6.1 of JIS C 62477-1 : 2017 shall apply.

4.4.6.2 Protective measures for protective class I equipment

The requirements in 4.4.6.2 of JIS C 62477-1 : 2017 shall apply.

4.4.6.3 Protective measures for protective class II equipment

The requirements in 4.4.6.3 of JIS C 62477-1 : 2017 shall apply.

4.4.6.4 Protective measures for protective class III equipment

4.4.6.4.1 General

The requirements in 4.4.6.4.1 of JIS C 62477-1 : 2017 shall apply.

4.4.6.4.2 Protective measures for protective class III PELV equipment

The requirements in 4.4.6.4.2 of JIS C 62477-1 : 2017 shall apply.

4.4.7 Insulation

4.4.7.1 General

4.4.7.1.1 Influencing factors

The requirements in 4.4.7.1.1 of JIS C 62477-1 : 2017 shall apply.

4.4.7.1.2 Pollution degree

The requirements in 4.4.7.1.2 of JIS C 62477-1 : 2017 shall apply.

4.4.7.1.3 Overvoltage category (OVC)

The requirements in 4.4.7.1.3 of JIS C 62477-1 : 2017, along with the following, shall apply.

As a minimum, the energy storage system shall be suitable for installation in environments presenting OVC listed in Table 0A.

For energy storage systems designed to be part of a parallel configuration, the current to be considered in Table 0A is that provided by the parallel configuration.

Table 0A Overvoltage categories

Rated output current (RMS) A	Overvoltage category ^{a)}
$I \leq 16$	II
$16 < I \leq 75$	II
$75 < I \leq 400$	II
$400 < I \leq 500$	III
$500 < I$	III
NOTE In general, the OVC to which the critical load is subjected is that of the input of the energy storage system. This can be reduced through overvoltage reduction techniques (see Annex I of JIS C 62477-1 : 2017).	
Note ^{a)} The OVCs specified represent those of typical installations in accordance with 4.4.7.1.3. Different OVC can apply under special conditions (see Annex I of JIS C 62477-1 : 2017).	

If measures are provided to reduce impulses of overvoltage category III to values of category II, or values of category II to values of category I, appropriate insulation may be designed to the reduced values, provided that following a single failure, e.g. of the reduction measure, at least the basic insulation requirements for the original overvoltage category shall be fulfilled.

NOTE For guidance on OVC reduction, see Annex I of JIS C 62477-1 : 2017.

4.4.7.1.4 Supply system earthing

The requirements in 4.4.7.1.4 of JIS C 62477-1 : 2017 shall apply.

4.4.7.1.5 Determination of impulse withstand voltage and temporary overvoltage

The requirements in 4.4.7.1.5 of JIS C 62477-1 : 2017 shall apply.

4.4.7.1.6 Determination of the system voltage

4.4.7.1.6.1 For mains supply

The requirements in 4.4.7.1.6.1 of JIS C 62477-1 : 2017 shall apply.

4.4.7.1.6.2 For non-mains supply

The requirements in 4.4.7.1.6.2 of JIS C 62477-1 : 2017 shall apply.

4.4.7.1.7 Components bridging insulation

The requirements in 4.4.7.1.7 of JIS C 62477-1 : 2017 shall apply.

4.4.7.2 Insulation to the surroundings

4.4.7.2.1 General

The requirements in 4.4.7.2.1 of JIS C 62477-1 : 2017 shall apply.

4.4.7.2.2 Circuits connected to mains supply

The requirements in 4.4.7.2.2 of JIS C 62477-1 : 2017 shall apply.

4.4.7.2.3 Circuits connected to non-mains supply

The requirements in 4.4.7.2.3 of JIS C 62477-1 : 2017 shall apply.

4.4.7.2.4 Insulation between circuits

The requirements in 4.4.7.2.4 of JIS C 62477-1 : 2017 shall apply.

4.4.7.3 Functional insulation

The requirements in 4.4.7.3 of JIS C 62477-1 : 2017 shall apply.

4.4.7.4 Clearance distances

4.4.7.4.1 Determination

The requirements in 4.4.7.4.1 of JIS C 62477-1 : 2017 shall apply.

4.4.7.4.2 Electric field homogeneity

The requirements in 4.4.7.4.2 of JIS C 62477-1 : 2017 shall apply.

4.4.7.4.3 Clearance to conductive enclosures

The requirements in 4.4.7.4.3 of JIS C 62477-1 : 2017 shall apply.

4.4.7.5 Creepage distances

4.4.7.5.1 Insulating material groups

The requirements in 4.4.7.5.1 of JIS C 62477-1 : 2017 shall apply.

4.4.7.5.2 Determination

The requirements in 4.4.7.5.2 of JIS C 62477-1 : 2017 shall apply.

4.4.7.6 Coating

The requirements in 4.4.7.6 of JIS C 62477-1 : 2017 shall apply.

4.4.7.7 Printed wiring board spacings for functional insulation

The requirements in 4.4.7.7 of JIS C 62477-1 : 2017, along with the following, shall apply.

Replace the first sentence of the third paragraph by the following :

Decreased spacings for components assembled on printed wiring board and/or decreased spacings on printed wiring board are permitted when all the following are satisfied :

4.4.7.8 Solid insulation

4.4.7.8.1 General

The requirements in 4.4.7.8.1 of JIS C 62477-1 : 2017 shall apply.

4.4.7.8.2 Material requirements

The requirements in 4.4.7.8.2 of JIS C 62477-1 : 2017, along with the following, shall apply.

This test shall be carried out in a thermostat. The temperatures shall be as follows :

$$[(T - T_{\text{amb}} + T_{\text{ma}} + 15) \pm 2]$$

where, T : temperature of the relevant part measured under the specified test conditions

T_{amb} : ambient temperature during the test

T_{ma} : maximum ambient temperature specified by the manufacturer or 25 °C, whichever is higher

However, the thermoplastic components supporting hazardous voltage portions in the primary circuit shall be tested at a temperature of 125 °C or higher.

4.4.7.8.3 Thin sheet or tape material

4.4.7.8.3.1 General

The requirements in 4.4.7.8.3.1 of JIS C 62477-1 : 2017 shall apply.

4.4.7.8.3.2 Material thickness equal to or more than 0.2 mm

The requirements in 4.4.7.8.3.2 of JIS C 62477-1 : 2017 shall apply.

4.4.7.8.3.3 Material thickness less than 0.2 mm

The requirements in 4.4.7.8.3.3 of JIS C 62477-1 : 2017 shall apply.

4.4.7.8.3.4 Compliance

The requirements in 4.4.7.8.3.4 of JIS C 62477-1 : 2017 shall apply.

4.4.7.8.4 Printed wiring boards (PWB)

4.4.7.8.4.1 General

The requirements in 4.4.7.8.4.1 of JIS C 62477-1 : 2017 shall apply.

4.4.7.8.4.2 Use of coating materials

The requirements in 4.4.7.8.4.2 of JIS C 62477-1 : 2017 shall apply.

4.4.7.8.5 Wound components

The requirements in 4.4.7.8.5 of JIS C 62477-1 : 2017 shall apply.

4.4.7.8.6 Potting materials

The requirements in 4.4.7.8.6 of JIS C 62477-1 : 2017 shall apply.

4.4.7.9 Connection of parts of solid insulation (cemented joints)

The requirements in 4.4.7.9 of JIS C 62477-1 : 2017 shall apply.

4.4.7.10 Requirements for electrical withstand capability

4.4.7.10.1 Basic or supplementary insulation

The requirements in 4.4.7.10.1 of JIS C 62477-1 : 2017 shall apply.

4.4.7.10.2 Double or reinforced insulation

The requirements in 4.4.7.10.2 of JIS C 62477-1 : 2017 shall apply.

4.4.7.11 Insulation requirements above 30 kHz

The requirements in 4.4.7.11 of JIS C 62477-1 : 2017 shall apply.

4.4.8 Compatibility with residual current-operated protective devices (RCD)

The requirements in 4.4.8 of JIS C 62477-1 : 2017 shall apply.

4.4.9 Capacitor discharge

The requirements in 4.4.9 of JIS C 62477-1 : 2017 shall apply.

4.5 Protection against electrical energy hazards

4.5.1 Operator access areas

4.5.1.1 General

The requirements in 4.5.1.1 of JIS C 62477-1 : 2017 shall apply.

4.5.1.2 Determination of hazardous electrical energy level

The requirements in 4.5.1.2 of JIS C 62477-1 : 2017 shall apply.

4.5.2 Service access areas

The requirements in 4.5.2 of JIS C 62477-1 : 2017 shall apply.

4.6 Protection against fire and thermal hazards

4.6.1 Circuits representing a fire hazard

The requirements in 4.6.1 of JIS C 62477-1 : 2017 shall apply.

4.6.2 Components representing a fire hazard

4.6.2.1 General

The requirements in 4.6.2.1 of JIS C 62477-1 : 2017 shall apply.