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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 This Standard replaces **JIS C 4412-1** : 2014 and **JIS C 4412-2** : 2019, which have been withdrawn.

Attention is drawn to the possibility that some parts of this Standard may conflict with patent rights, published patent application or utility model rights. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying any of such patent rights, published patent application or utility model rights.

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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

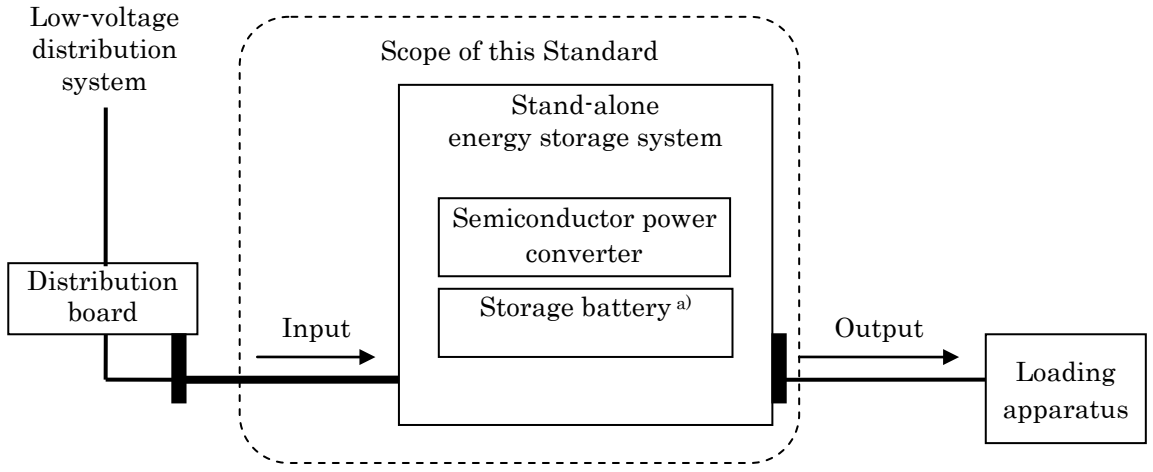
stand-alone system

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

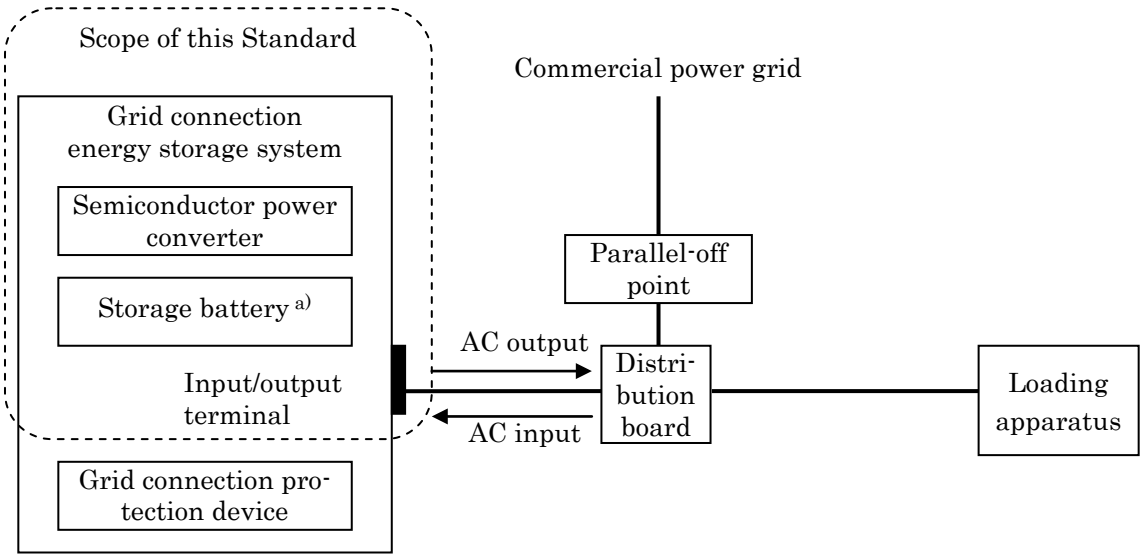
grid connection system

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

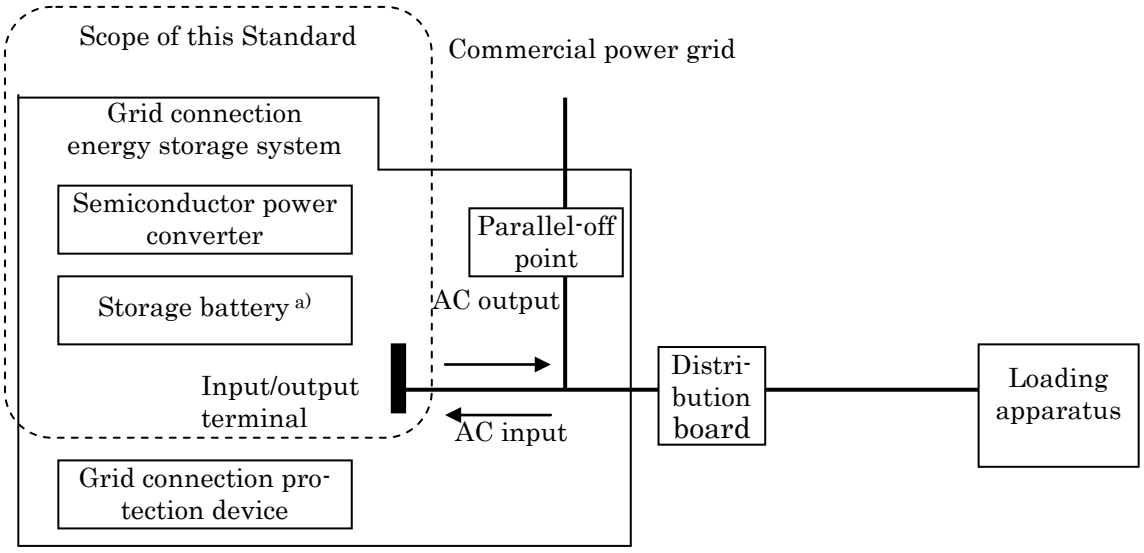
equipment via a distribution board, etc.

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 :

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

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.

4.6.2.2 Components within a circuit representing a fire hazard

The requirements in **4.6.2.2** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Add the following after the first paragraph of **JIS C 62477-1** : 2017 :

The storage battery shall be graded as HB or higher in flammability classification specified in **JIS C 60695-11-10** : 2015.

Replace the last item of the list given in **JIS C 62477-1** : 2017 by the following :

— tubing for air or any fluid systems, containers for powders or liquids and foamed plastic parts that are of flammability class HB and are separated from electrical parts (other than insulated wires and cables) which under fault conditions are likely to produce a temperature that could cause ignition, by at least 13 mm of air or by a solid barrier of material of flammability class V-1 or better;

— other small parts which would contribute negligible fuel to a fire, including, labels, mounting feet, key caps, knobs and the like.

4.6.2.3 Components within a circuit not representing a fire hazard

The requirements in **4.6.2.3** of **JIS C 62477-1** : 2017 shall apply.

4.6.3 Fire enclosures

4.6.3.1 General

The requirements in **4.6.3.1** of **JIS C 62477-1** : 2017 shall apply.

4.6.3.2 Flammability of enclosure materials

The requirements in **4.6.3.2** of **JIS C 62477-1** : 2017 shall apply.

4.6.3.3 Openings in fire enclosures

4.6.3.3.1 General

The requirements in **4.6.3.3.1** of **JIS C 62477-1** : 2017 shall apply.

4.6.3.3.2 Openings in the top and side of fire enclosures

The requirements in **4.6.3.3.2** of **JIS C 62477-1** : 2017 shall apply.

4.6.3.3.3 Openings in the bottom of a fire enclosure

The requirements in **4.6.3.3.3** of **JIS C 62477-1** : 2017 shall apply.

4.6.3.3.4 Doors or covers in fire enclosures

The requirements in **4.6.3.3.4** of **JIS C 62477-1** : 2017 shall apply.

4.6.4 Temperature limits

4.6.4.1 Internal parts

The requirements in **4.6.4.1** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Replace the first paragraph by the following :

The internal materials and components of an energy storage system shall not attain temperatures in excess of those in Table 14 of **JIS C 62477-1** : 2017 when tested in normal operating condition in accordance with the ratings of energy storage system.

Add the following after the first paragraph :

The temperature of the windings shall conform to Table 0B and Table 0C.

Magnetic components inside the energy storage system shall not attain temperatures in excess of those in Table 0D when tested in stored energy mode in accordance with the ratings of the energy storage system.

NOTE Table 0D provides additional temperature limits for infrequent and occasional occurrences.

Table 0B Maximum temperature limits

Heat insulation class (insulation, including that of windings)	Temperature limit °C
Class A material 105	100
Class E material 120	115
Class B material 130	120
Class F material 155	140
Class H material 180	165
Class C material 200	180
Class N material 220	200
Class P material 250	225

Table 0C Maximum temperature limits for windings immediately before the end of stored energy operation

Heat insulation class	Temperature limit by resistance method °C	Temperature limit by thermocouple method °C
105	127	117
120	142	132
130	152	142
155	171	161
180	195	185
200	209	199
220	216	206
250	234	224

Table 0D Maximum temperature limits for magnetic components during stored energy mode of operation

Heat insulation class	Resistance method °C	Thermocouple method °C
105 (A)	127	117
120 (E)	142	132
130 (B)	152	142
155 (F)	171	161
180 (H)	195	185
200 (N)	209	199
220 (R)	216	206
250 (S)	234	224

4.6.4.2 Accessible parts

The requirements in **4.6.4.2** of **JIS C 62477-1** : 2017 shall apply.

4.6.5 Limited power sources

The requirements in **4.6.5** of **JIS C 62477-1** : 2017 shall apply.

4.7 Protection against mechanical hazards

4.7.1 General

The requirements in **4.7.1** of **JIS C 62477-1** : 2017 shall apply.

4.7.2 Specific requirements for liquid cooled energy storage systems

4.7.2.1 General

The requirements in **4.7.2.1** of **JIS C 62477-1** : 2017 shall apply.

4.7.2.2 Coolant

The requirements in **4.7.2.2** of **JIS C 62477-1** : 2017 shall apply.

4.7.2.3 Design requirements

4.7.2.3.1 General

The requirements in **4.7.2.3.1** of **JIS C 62477-1** : 2017 shall apply.

4.7.2.3.2 Corrosion resistance

The requirements in **4.7.2.3.2** of **JIS C 62477-1** : 2017 shall apply.

4.7.2.3.3 Tubing, joints and seals

The requirements in **4.7.2.3.3** of **JIS C 62477-1** : 2017 shall apply.

4.7.2.3.4 Provision for condensation

The requirements in **4.7.2.3.4** of **JIS C 62477-1** : 2017 shall apply.

4.7.2.3.5 Leakage of coolant

The requirements in **4.7.2.3.5** of **JIS C 62477-1** : 2017 shall apply.

4.7.2.3.6 Loss of coolant

The requirements in **4.7.2.3.6** of **JIS C 62477-1** : 2017 shall apply.

4.7.2.3.7 Conductivity of coolant

The requirements in **4.7.2.3.7** of **JIS C 62477-1** : 2017 shall apply.

4.7.2.3.8 Insulation requirements for coolant hoses

The requirements in **4.7.2.3.8** of **JIS C 62477-1** : 2017 shall apply.

4.8 Equipment with multiple sources of supply

Replace the contents of **4.8** of **JIS C 62477-1** : 2017 by the following :

4.8.1 General

If equipment is provided with more than one supply connection (for example, with different voltages or frequencies or as backup power), the design shall be such that all of the following conditions are met :

— separate means of connection are provided for different circuits;

— supply plug connections, if any, are not interchangeable if a hazard could be created by incorrect plugging; and

— hazards, within the meaning of this Standard, shall not be present under normal operating conditions or single fault conditions due to the presence of multiple sources of supply. Actions such as disconnection or de-energizing of a supply are considered a normal operating condition.

Compliance is checked by the evaluation of **4.2** of **JIS C 62477-1** : 2017.

Information shall be provided indicating the presence of multiple sources of supply and disconnection procedures (see **6.5.5** of **JIS C 62477-1** : 2017).

NOTE Examples of the types of hazards that should be considered are :

a) backfeed;

b) unintentional islanding;

c) touch current levels, which may be higher with multiple sources connected simultaneously (if that is a normal operating condition for the energy storage system);

d) hazard resulting from damage to one or more connected sources (for example, a generator) due to energy from another source, for example the mains supply; and

e) damage to wiring due to currents higher than the wiring is designed for flowing from another source.

4.8.2 Backfeed protection

An energy storage system shall prevent hazardous voltage or hazardous energy from being present on the input AC terminals after interruption of the input AC power.

No shock hazard shall exist at AC input terminals when measured 1 s after de-energization of AC input for pluggable energy storage system, or 15 s for permanently connected energy storage system.

For permanently connected energy storage system, backfeed protection may be implemented external to the energy storage system with the use of an AC input line isolation device.

In this case, the backfeed protection requirement applies to the input terminals of the isolation device. The manufacturer shall provide or specify a suitable isolating device which shall include additional labelling and instructions in accordance with **6.4.3.6**.

Compliance is checked by inspection of the equipment and relevant circuit diagram, and by simulating fault conditions in accordance with **5.2.3.12**.

When an air gap is employed for backfeed protection, the provision of **JIS C 62477-1** : 2017, Table 10 and Table 11 for creepage and clearance distances applies in addition to the following :

a) Subject to confirmation from the manufacturer, the output of the energy storage system, in stored energy mode, may be considered a transient free circuit of OVC I (for this purpose identify the OVC I value in **JIS C 62477-1** : 2017, Table 9, by using the appropriate RMS system output voltage of the energy storage system). An impulse voltage withstand test is not required since there is no transient overvoltage present when the AC main input supply is not available. Therefore, the OVC values apply without an impulse test.

b) The creepage and clearance distances shall meet the requirements for pollution degree 2 (see **JIS C 62477-1** : 2017, Table 10 and Table 11).

c) Reinforced or equivalent insulation of the output to input of the energy storage system applies if during stored energy mode of operation not all input poles are isolated by the backfeed protection device. In all other cases, basic insulation is acceptable. Impulse withstand voltage is not required since there is no impulse when the AC main input supply is not available. Therefore, the pollution degree values apply without an impulse test.

NOTE 1 A contactor is an example of an isolation device presenting an air gap.

NOTE 2 One method of obtaining insulation equivalent to reinforced insulation is to combine an air gap meeting the basic insulation requirements and a solid-state power isolation device(s) as described in **5.2.3.12.5**.

Compliance is checked by inspection.

4.9 Protection against environmental stresses

The requirements in **4.9** of **JIS C 62477-1** : 2017 shall apply.

4.10 Protection against sonic pressure hazards

4.10.1 General

The requirements in **4.10.1** of **JIS C 62477-1** : 2017 shall apply.

4.10.2 Sonic pressure and sound level

The requirements in **4.10.2** of **JIS C 62477-1** : 2017 shall apply.

4.11 Wiring and connections

4.11.1 General

The requirements in **4.11.1** of **JIS C 62477-1** : 2017 shall apply.

4.11.2 Routing

The requirements in **4.11.2** of **JIS C 62477-1** : 2017 shall apply.

4.11.3 Colour coding

The requirements in **4.11.3** of **JIS C 62477-1** : 2017 shall apply.

4.11.4 Splices and connections

The requirements in **4.11.4** of **JIS C 62477-1** : 2017, along with the following, shall apply.

A force of 10 N is applied to the conductor near its termination point. The conductor shall not break away or pivot on its terminal to the extent that clearances or creepage distances are reduced below the values specified in this Standard.

For the purpose of assessing compliance it is assumed that :

- two independent fixings will not become loose at the same time; and
- parts fixed by means of screws or nuts provided with self-locking washers or other means of locking are not liable to become loose.

Examples of constructions regarded as meeting the requirements include :

— close-fitting tubing applied over the wire and its termination;

— conductors connected by soldering and held in place near to the termination, independently of the soldered connection;

— conductors connected by soldering and “hooked in” before soldering, provided that the hole through which the conductor is passed is not unduly large;

— conductors connected to screw terminals, with an additional fixing near to the terminal that clamps, in the case of stranded conductors, the insulation and not only the conductors;

— conductors connected to screw terminals and provided with terminators that are unlikely to become free when the screw is loosened. The pivoting of such terminators is considered;

— short rigid conductors that remain in position when the terminal screw is loosened.

4.11.5 Accessible connections

The requirements in **4.11.5** of **JIS C 62477-1** : 2017 shall apply.

4.11.6 Interconnections between parts of the energy storage system

The requirements in **4.11.6** of **JIS C 62477-1** : 2017 shall apply.

4.11.7 Supply connections

The requirements in **4.11.7** of **JIS C 62477-1** : 2017 shall apply.

4.11.8 Terminals

4.11.8.1 Construction requirements

The requirements in **4.11.8.1** of **JIS C 62477-1** : 2017 shall apply.

4.11.8.2 Connecting capacity

The requirements in **4.11.8.2** of **JIS C 62477-1** : 2017, along with the following, shall apply.

The manufacturer shall indicate whether the terminals are suitable for connecting copper or aluminum conductors, or both. The terminals shall be such that the external conductors may be connected by a means (screws, connectors, etc.) which ensures that the necessary contact pressure corresponding to the current rating, the short-circuit strength of the apparatus and the circuit are maintained.

In the absence of a special agreement between the manufacturer and the purchaser, terminals shall be capable of accommodating copper conductors from the smallest to the largest cross-sectional areas corresponding to the appropriate rated current (see Annex JA).

Compliance is checked by inspection, by measurement and by fitting at least the smallest and largest cross-sectional areas of the appropriate range in Annex JA.

4.11.8.3 Connection

The requirements in **4.11.8.3** of **JIS C 62477-1** : 2017 shall apply.

4.11.8.4 Wire bending space for wires 10 mm² and greater

The requirements in **4.11.8.4** of **JIS C 62477-1** : 2017 shall apply.

Add the following subclauses :

4.11.9 Non-detachable cords

4.11.9.1 Cord guard

A cord guard shall be provided at the cord inlet opening of equipment that has a non-detachable cord and is hand-held equipment or intended to be moved while in operation. Alternatively, the inlet or bushing shall be provided with a smoothly rounded bell-mouthed opening having a radius of curvature equal to at least 150 % of the overall diameter of the cord with the largest cross-sectional area to be connected.

Cord guards shall :

- be so designed as to protect the cord against excessive bending where it enters the equipment,
- be of insulating material,
- be fixed in a reliable manner,

- and project outside the equipment beyond the inlet opening for a distance of at least five times the overall diameter or, for flat cords, at least five times the major overall cross-sectional dimension of the cord.

4.11.9.2 Cord anchorages and strain relief

For equipment with a non-detachable cord, a cord anchorage shall be supplied such that :

- the connecting points of the cord conductors are relieved from strain, and
- the outer covering of the cord is protected from abrasion.

It shall not be possible to push the cord back into the equipment to such an extent that the cord or its conductors, or both, could be damaged or internal parts of the equipment could be displaced.

For non-detachable cords containing a protective earthing conductor, the construction shall be such that, if the cord should slip in its anchorage, placing a strain on conductors, the protective earthing conductor shall be the last to take the strain.

The cord anchorage shall either be made of insulating material or have a lining of insulating material complying with the requirements for supplementary insulation. However, where the cord anchorage is a bushing that includes the electrical connection to the screen of a screened cord, this requirement shall not apply.

The construction of the cord anchorage shall be such that :

- cord replacement does not impair the safety of the equipment,
- for normal replacement of cords, it is clear how relief from strain is to be obtained,
- if the cord is clamped by a screw that bears directly on the cord, the cord anchorage, including the screw, is made of insulating material and the screw is of comparable size to the diameter of the cord being clamped,
- methods such as tying the cord into a knot or tying the cord with string are not used, and
- the cord cannot rotate in relation to the body of the equipment to such an extent that mechanical strain is imposed on the electrical connections.

Compliance is checked by inspection and by applying the following tests.

The cord is subjected to a steady pull of the following value, applied in the most unfavourable direction :

a) 30 N for UPS of mass up and to including 1 kg;

b) 60 N for UPS over 1 kg and including 4 kg;

c) 100 N for UPS over 4 kg.

The test is conducted 25 times, each time for duration of 1 s.

During the tests, the cord shall not be damaged. This is checked by visual inspection, and by the withstand voltage test between the cord conductors and accessible conduc-

tive parts, at the test voltage appropriate for reinforced insulation.

After the tests, the cord shall not have been longitudinally displaced by more than 2 mm nor shall there be appreciable strain at the connections, and clearances and creepage distances shall not be reduced below the values specified in **4.4.7.4** and **4.4.7.5**, respectively, of **JIS C 62477-1** : 2017.

4.12 Enclosures

4.12.1 General

The requirements in **4.12.1** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Add the following to the last paragraph :

Enclosures having passed the tests of **5.2.2.4.2** and **5.2.2.4.3** are regarded to be in conformance with the requirements of **4.12.3** and **4.12.4**.

4.12.2 Handles and manual controls

The requirements in **4.12.2** of **JIS C 62477-1** : 2017 shall apply.

4.12.3 Cast metal

The requirements in **4.12.3** of **JIS C 62477-1** : 2017 shall apply.

4.12.4 Sheet metal

The requirements in **4.12.4** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Modify the first paragraph as follows :

The thickness of a sheet-metal enclosure at points to which a wiring system is to be connected shall be not less than 0.8 mm for uncoated steel, 0.9 mm for coated thickness and 0.8 mm for base metal thickness of zinc-coated steel, and 1.2 mm for non-ferrous metal.

4.12.5 Stability test for enclosure

The requirements in **4.12.5** of **JIS C 62477-1** : 2017 shall apply.

4.13 Disconnect devices

Means shall be provided to disconnect the energy storage system from the AC and DC supplies for service and testing.

A switch, connector (in the case of DVC A, A1, A2, or A3), etc. which can disconnect all the unearthed conductors connected to the storage battery shall be provided.

Switch for disconnecting all unearthed conductors connected to the AC supply shall be provided. This does not apply where a power supply plug for AC input is used in a stand-alone system.

NOTE 1 The means of disconnection are generally located external to the energy storage system according to the specification by the manufacturer. They may be located within the energy storage system if applicable for func-

tional use. For further guidance about selection of disconnect devices, see Table 2 of **JIS C 8201-3**.

If operation of a disconnect device alters the output voltage of the earthing with respect to the protective earth potential, then operation of that device shall be alarmed. Alternatively, an appropriate warning label shall be located adjacent to that disconnect device or to its command.

NOTE 2 Such a situation arises upon opening of a 4-pole input isolator for three-phase four-wire systems that provides neutral reference to the energy storage system.

If the operating means of the disconnect device is operated vertically rather than rotationally or horizontally, the “UP” position of the operating means shall be the “ON” position.

Where a permanently connected energy storage system receives power from more than one external source, there shall be a prominent marking at each disconnect device giving adequate instructions for the removal of all power from the unit.

4.14 Storage battery

4.14.1 General

The storage battery shall be installed in consideration of the requirements specified in **4.14**.

Storage batteries can be installed in

- separate battery rooms or buildings from the converter section, or
- separate cabinets or compartments from the converter section, indoor or outdoor, or
- battery bays or compartments within the enclosure of the energy storage system.

For valve-regulated stationary lead-acid batteries and small-sized valve-regulated lead-acid batteries, installation in a separate room, cabinet or compartment is not necessary.

4.14.2 Accessibility and maintainability

When deemed necessary, access to battery poles and battery connectors shall be provided so that their fittings can be tested for correct tightening (torque) and be readjusted if required. Vented storage batteries shall be so located that the battery cell caps are accessible for electrolyte tests and readjustment of electrolyte levels.

Compliance is checked by inspection and application of the tools and measuring equipment supplied or recommended by the battery manufacturer for the prevailing conditions.

4.14.3 Distance between battery cells

Battery cells, blocks or modules (hereafter referred to as single cells, etc.) shall be mounted for the purpose of complying with ventilation, battery temperature and insulation requirements in accordance with the requirements from the battery manufac-

turer.

The batteries shall be so located and mounted that the terminals of cells are prevented from coming into undesirable contact with terminals of adjacent cells, or with metal parts of the battery compartment, as the result of shifting of the battery.

Compliance is checked by inspection and by analysis of the battery manufacturer data-sheet.

4.14.4 Case insulation

Single cells, etc. in conductive casings shall have adequate insulation between each other and to cabinets or compartments. The insulation shall meet the AC or DC voltage test (dielectric strength test) requirements of **5.2.3.4** of **JIS C 62477-1** : 2017.

Compliance is checked by test.

4.14.5 Electrolyte spillage

To prevent effects of electrolyte spillage from the single cell, etc., adequate protection such as an electrolyte-resistive coating on the battery trays and cabinets shall be provided.

This requirement does not apply to valve-regulated lead-acid batteries and lithium secondary batteries.

Compliance is checked by inspection.

4.14.6 Ventilation and hydrogen concentration

The enclosure or compartment of an energy storage system that houses a vented storage battery

— shall comply with the ventilation requirements of Annex JB,

— may contain arc-producing elements such as open fuse links and the contacts of circuit breakers, relays, switches, disconnectors, switch-disconnectors and fuse-combination units, only if any such parts are mounted at least 100 mm below the lowest battery vent, and

— shall not vent into other closed spaces like adjacent enclosures or compartments where arc-producing elements are located.

For the purpose of this subclause, the following components are not considered arc-producing elements: connectors, monitoring sensors (such as thermistors) and sand enclosed fuses. For battery rooms, proper information on the required flow of air shall be provided in the installation instructions where the battery installation is supplied with the energy storage system.

Compliance is checked by inspection, calculation or measurement.

4.14.7 Charging voltages

The energy storage system shall protect the storage batteries against excessive voltages, including under a single fault condition within the charger. Protection may be accomplished by turning off the charger or by interrupting the charging current.

The appropriate charging voltage limit value of the storage battery shall be a value specified by the manufacturer.

Compliance is checked by circuit evaluation or test.

4.14.8 Monitoring and control of storage battery

The energy storage system manufacturer shall design the system in consideration of monitoring and control (number of temperature sensors and level sensors, monitoring of charging current and DC voltage, etc.) of the storage battery in agreement with the storage battery manufacturer.

Compliance is checked by inspection.

4.15 Energy storage system connection to communication line

Terminals in the energy storage system that are intended for connection to telecommunication lines shall comply with the relevant telecommunication network voltage (TNV) classification. Refer to Table A.101 for a TNV classification comparison with decisive voltage classification (DVC).

Compliance is checked by analysis.

5 Test requirements

5.1 General

5.1.1 Test objectives and classification

The requirements in **5.1.1** of **JIS C 62477-1** : 2017 shall apply.

5.1.2 Selection of test samples

The requirements in **5.1.2** of **JIS C 62477-1** : 2017 shall apply.

5.1.3 Sequence of tests

The requirements in **5.1.3** of **JIS C 62477-1** : 2017 shall apply.

5.1.4 Earthing conditions

The requirements in **5.1.4** of **JIS C 62477-1** : 2017 shall apply.

5.1.5 General conditions for tests

5.1.5.1 Application of tests

The requirements in **5.1.5.1** of **JIS C 62477-1** : 2017 shall apply.

5.1.5.2 Test samples

The requirements in **5.1.5.2** of **JIS C 62477-1** : 2017 shall apply.

5.1.5.3 Operating parameters for tests

Replace **5.1.5.3** of **JIS C 62477-1** : 2017 by the following :

Except where specific test conditions are stated elsewhere in this Standard, the tests shall be conducted at the rated voltage and under the most unfavourable combination

within the manufacturer's operating specifications of the following parameters :

— power failure duration of supply voltage;

— supply frequency;

— charging condition of the storage battery;

— physical location of the energy storage system and position of movable parts;

— operating mode.

5.1.6 Compliance

The requirements in **5.1.6** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Replace "a suitable date code or serial number as described in **6.2**" in the fourth paragraph by "a suitable date code, or a serial number or manufacturing number indicating the date of manufacture".

5.1.7 Test overview

Replace **5.1.7** of **JIS C 62477-1** : 2017 by the following.

Table 22 provides an overview of the type, routine and sample testing of electronic components, equipment and energy storage system.

Table 22 Test overview

Test	Type	Routine	Sample	Requirement(s)	Specification
Visual inspection	X	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, 250 N	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**

Table 22 (continued)

Test	Type	Routine	Sample	Requirement(s)	Specification
Electrical tests	—	—	—	**4.4.7.10**	**5.2.3**
Impulse voltage test [a) d)]	X	—	X [b)]	**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**
AC or DC voltage test [d)]	X [c)]	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 [a) d)]	X	—	X [b)]	**4.4.7.1**, **4.4.7.10.2**, **4.4.7.8.3**	**5.2.3.5**
Protective impedance test	X	X	—	**4.4.5.4**	**5.2.3.6**
Touch current measurement test	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**
Protective equipotential bonding test	X	X	—	**4.4.4.2.2**	**5.2.3.11**
Backfeed protection test (type test)	X	—	—	**4.8.2**	**5.2.3.12**
Abnormal operation and simulated faults tests	—	—	—	**4.2**	**5.2.4**
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**
Printed wiring board (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 motor 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**
Short time withstand current (I_{cw}) test	X	—	—	**4.3.5**	**5.2.4.10**
Material tests	—	—	—	—	**5.2.5**
High current arcing ignition test [a)]	X	—	—	**4.4.7.8.2**	**5.2.5.2**
Glow-wire test [a)]	X	—	—	**4.4.7.8.2**	**5.2.5.3**
Hot wire ignition test [a)]	X	—	—	**4.4.7.8.2**	**5.2.5.4**
Flammability test [a)]	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	—	—	—	**4.9**	**5.2.6**

Table 22 (concluded)

Test	Type	Routine	Sample	Requirement(s)	Specification
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**

X : Applicable

Note a) When the manufacturer of a related component performs the type test, the type test of a component shall not apply (see **5.1.5.2** of **JIS C 62477-1** : 2017).

Note b) When specified in the standard of a related component or when the standard of the component does not exist, only the sample test of the component shall apply.

When the manufacturer of a related component performs the sample test, the sample test shall not apply.

Note c) Preconditioning specified in **5.2.3.1** of **JIS C 62477-1** : 2017 is not necessary.

Note d) Two or more tests may be performed after one preconditioning as specified in **5.2.3.1** of **JIS C 62477-1** : 2017.

5.2 Test specifications

5.2.1 Visual inspections (type test, sample test and routine test)

The requirements in **5.2.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.2 Mechanical tests

5.2.2.1 Clearances and creepage distances test (type test)

The requirements in **5.2.2.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.2.2 Non-accessibility test (type test)

The requirements in **5.2.2.2** of **JIS C 62477-1** : 2017 shall apply.

5.2.2.3 Ingress protection test (IP rating) (type test)

The requirements in **5.2.2.3** of **JIS C 62477-1** : 2017 shall apply.

5.2.2.4 Enclosure integrity test (type test)

5.2.2.4.1 General

The requirements in **5.2.2.4.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.2.4.2 Deflection test (type test)

5.2.2.4.2.1 General

The requirements in **5.2.2.4.2.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.2.4.2.2 Steady force test, 30 N

The requirements in **5.2.2.4.2.2** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Replace "a straight unjointed version of the test finger (Figure 2, test probe B of **JIS C 0922** : 2002)" with "a straight unjointed version of the test finger (Figure 7, test probe B of **JIS C 0922** : 2002)".

5.2.2.4.2.3 Steady force test, 250 N

The requirements in **5.2.2.4.2.3** of **JIS C 62477-1** : 2017 shall apply.

5.2.2.4.3 Impact test (type test)

The requirements in **5.2.2.4.3** of **JIS C 62477-1** : 2017 shall apply.

5.2.2.4.4 Drop test

The requirements in **5.2.2.4.4** of **JIS C 62477-1** : 2017 shall apply.

5.2.2.4.5 Stress relief test

The requirements in **5.2.2.4.5** of **JIS C 62477-1** : 2017 shall apply.

5.2.2.5 Stability test

The requirements in **5.2.2.5** of **JIS C 62477-1** : 2017 shall apply.

5.2.2.6 Wall or ceiling mounted equipment test

The requirements in **5.2.2.6** of **JIS C 62477-1** : 2017 shall apply.

5.2.2.7 Handles and manual controls securement test

The requirements in **5.2.2.7** of **JIS C 62477-1** : 2017 shall apply.

5.2.3 Electrical tests

5.2.3.1 General

The requirements in **5.2.3.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.2 Impulse voltage test (type test and sample test)

The requirements in **5.2.3.2** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.3 Alternative to impulse voltage test (type test and sample test)

The requirements in **5.2.3.3** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.4 AC or DC voltage test (type test and routine test)

5.2.3.4.1 Purpose of test

The requirements in **5.2.3.4.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.4.2 Value and type of test voltage

The requirements in **5.2.3.4.2** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Replace the last paragraph of **5.2.3.4.2** of **JIS C 62477-1** : 2017 by the following :

Routine tests are performed to verify that clearances have not been reduced during the manufacturing operations in comparison to the type test values.

Protective devices designed to reduce impulse voltages on the circuits under test (see **4.4.7.2.2** and **4.4.7.2.3**), and circuits belonging to monitoring or protection circuits, not designed to sustain the test overvoltage for the duration of the test, shall be disconnected in order to avoid damage and to ensure that the test voltage can be applied without a false indication of failure.

5.2.3.4.3 Performing the voltage test

The requirements in **5.2.3.4.3** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.4.4 Duration of the AC or DC voltage test

The requirements in **5.2.3.4.4** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.4.5 Verification of the AC or DC voltage test

The requirements in **5.2.3.4.5** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.5 Partial discharge test (type test, sample test)

The requirements in **5.2.3.5** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.6 Protective impedance test (type test and routine test)

The requirements in **5.2.3.6** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.7 Touch current measurement test (type test)

The requirements in **5.2.3.7** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.8 Capacitor discharge test (type test)

The requirements in **5.2.3.8** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Replace the cited subclause "**4.4.3.4**" by "**4.4.9**".

5.2.3.9 Limited power source test (type test)

The requirements in **5.2.3.9** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.10 Temperature rise test (type test)

Replace the ninth paragraph in **5.2.3.10** of **JIS C 62477-1** : 2017 by the following :

The corrected temperature of the material or component shall not exceed the temperature limit given in Table 14 of **JIS C 62477-1** : 2017, or Table 0C.

5.2.3.11 Protective equipotential bonding tests (type tests and routine test)

5.2.3.11.1 General

The requirements in **5.2.3.11.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.11.2 Protective equipotential bonding impedance test

5.2.3.11.2.1 Test conditions

The requirements in **5.2.3.11.2.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.11.2.2 Test current, duration and acceptance criteria

The requirements in **5.2.3.11.2.2** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.11.3 Protective equipotential bonding short-circuit withstand test (type test)

The requirements in **5.2.3.11.3** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.11.4 Protective equipotential bonding continuity test (routine test)

The requirements in **5.2.3.11.4** of **JIS C 62477-1** : 2017 shall apply.

5.2.3.12 Backfeed protection test (type test)

5.2.3.12.1 General

Backfeed protection shall apply to a stand-alone energy storage system.

An energy storage system shall not allow excessive touch currents to be available between any pairs of AC input terminals during its stored energy mode of operation. Where the measured open-circuit voltage between the AC input terminals does not exceed 30 V RMS (42.4 V peak, 60 V DC), the touch current measurement need not be taken.

Compliance is checked by the tests specified in **5.2.3.12.2**, **5.2.3.12.3** and **5.2.3.12.5**. The single-fault condition shall be determined by applying a short-circuit across any components where failure could adversely affect the backfeed protection, or by disconnecting such components.

5.2.3.12.2 Test for pluggable energy storage system

The energy storage system shall initially operate in normal mode. The AC input terminals or plug(s) shall then be disconnected. This shall cause the energy storage system to operate in stored energy mode. If the energy storage system requires manual steps to be in operation, those manual steps shall be taken prior to the test. When tested under no-load, under full-load and under load-induced change of reference potential conditions as described in **5.2.3.12.4**, the following complying performance shall be verified :

a) the current shall not exceed 3.5 mA when measured between any two input terminals or parts accessible by an ordinary person, using the measurement instruments shown in Annex L;

b) the protection shall operate within 1 s for pluggable type A and within 5 s for pluggable type B energy storage system of the disconnection of the input terminals.

A single-fault condition shall then be applied. The test above shall be repeated and the compliance shall again be verified.

5.2.3.12.3 Test for permanently connected energy storage system

The energy storage system shall initially operate in normal mode. The AC input terminals, except for the protective earth conductor, shall then be disconnected from the AC supply. This shall cause the energy storage system to operate in stored energy mode. When tested under no-load and under full-load conditions, the following complying performance shall be verified :

a) the current shall not exceed 3.5 mA when measured between any two input terminals, using the measurement instruments shown in Annex L;

b) the protection shall operate within 15 s of the disconnection of the input terminals.

A single-fault condition shall then be applied. The test above shall be repeated and the compliance shall again be verified.

Where a backfeed protection isolation device is provided externally, compliance shall be determined by relevant circuit diagram inspection and by demonstrating that the means required to operate the external backfeed isolating device is within the manufacturer's specifications for such circuit to operate.

5.2.3.12.4 Method to simulate the load-induced change of reference potential for pluggable energy storage system

The method detailed in this subclause is used to create the change of reference potential required in **5.2.3.12.2**. Change of reference potential can be caused by summation of otherwise complying load-induced earth currents and may arise when an energy storage system operates in stored energy mode. This condition is simulated by applying the test circuits of Figures 0C or 0D. Figure 0D applies for 3-phase systems and simulates also the effect of asymmetrical single-phase loads.

NOTE 1 In some cases the input neutral is required to be opened together with the phases either in the building installation or in the transmission system. In this case, the voltage potential of neutral input of the energy storage system is of concern unless it is clearly stated in the installation guide that the energy storage system is for use with symmetrical 3-phase loads only.

NOTE 2 **5.2.3.12.4** applies to pluggable energy storage systems (see **5.2.3.12.2**).

NOTE 3 *C* simulates the capacitance of concern. The value of *C* is fixed as shown in Figures 0C and 0D.

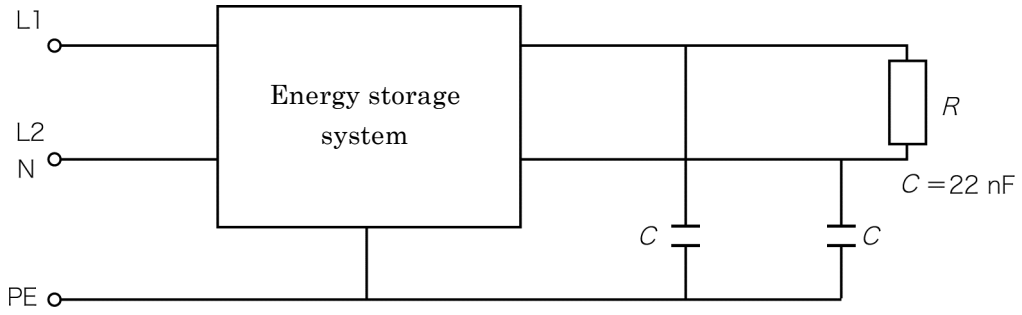


Figure 0C Test circuit for load-induced change of reference potential — Single-phase output

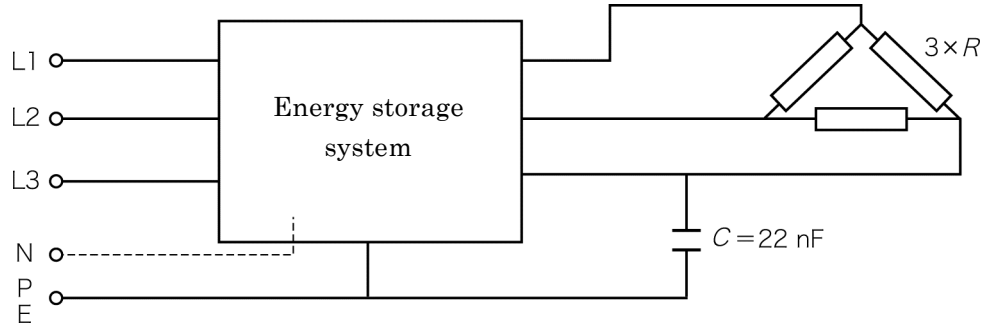


Figure 0D　Test circuit for load-induced change of reference potential — Three-phase output

The value of resistive load *R* shall be equal to that specified as the maximum load at unity power factor by the manufacturer.

5.2.3.12.5　Solid-state backfeed protection

In addition to **5.2.3.12.2** and **5.2.3.12.3** requirements, when backfeed protection relies on solid-state power isolation device(s), and if the isolation devices are not redundant, the components necessary to ensure backfeed protection shall withstand the environmental tests in **5.2.6** of **JIS C 62477-1** : 2017.

5.2.4　Abnormal operation and simulated faults tests

5.2.4.1　General

The requirements in **5.2.4.1** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Replace the ninth paragraph in **5.2.4.1** of **JIS C 62477-1** : 2017 by the following :

The supply shall be capable of delivering the specified prospective short circuit current (see **4.3.1**) at the connection to the energy storage system, unless the circuit analysis of **4.2** demonstrates that a lesser value may be used.

Examples in which the lesser prospective short-circuit current available from the test supply may be used include situations wherein :

— the fault path of concern is not a low impedance path; or

— the resulting let-through current from the supply is equal to or less than 10 kA; or

— the result is independent of the prospective short-circuit current available from the supply.

5.2.4.2　Acceptance criteria

The requirements in **5.2.4.2** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.3　Protective equipotential bonding short-circuit withstand test (type test)

5.2.4.3.1　General

The requirements in **5.2.4.3.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.3.2 Test conditions

The requirements in **5.2.4.3.2** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.3.3 Protective equipotential bonding short-circuit test method

The requirements in **5.2.4.3.3** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.3.4 Acceptance criteria

The requirements in **5.2.4.3.4** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.4 Output short-circuit test (type test)

5.2.4.4.1 Load conditions

The requirements in **5.2.4.4.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.4.2 Short-circuit test method

The requirements in **5.2.4.4.2** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.5 Output overload test (type test)

The requirements in **5.2.4.5** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.6 Breakdown of components test (type test)

5.2.4.6.1 Load conditions

The requirements in **5.2.4.6.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.6.2 Application of short circuit or open-circuit

The requirements in **5.2.4.6.2** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.6.3 Test sequence

The requirements in **5.2.4.6.3** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.7 Printed wiring board (PWB) short-circuit test (type test)

The requirements in **5.2.4.7** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.8 Loss of phase test (type test)

The requirements in **5.2.4.8** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Replace the phrase in the first paragraph “A system shall be operated with each line disconnected” by “The test shall be performed with each line disconnected”.

5.2.4.9 Cooling failure tests (type tests)

5.2.4.9.1 General and acceptance criteria

The requirements in **5.2.4.9.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.9.2 Inoperative blower motor test

The requirements in **5.2.4.9.2** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.9.3 Clogged filter test

The requirements in **5.2.4.9.3** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.9.4 Loss of coolant test

The requirements in **5.2.4.9.4** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.10 Short time withstand current (I_{cw}) test (type test)

5.2.4.10.1 General

The requirements in **5.2.4.10.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.10.2 Short time withstand current test method

The requirements in **5.2.4.10.2** of **JIS C 62477-1** : 2017 shall apply.

5.2.4.10.3 Acceptance criteria

The requirements in **5.2.4.10.3** of **JIS C 62477-1** : 2017 shall apply.

5.2.5 Material tests

5.2.5.1 General

The requirements in **5.2.5.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.5.2 High current arcing ignition test (type test)

The requirements in **5.2.5.2** of **JIS C 62477-1** : 2017 shall apply.

5.2.5.3 Glow-wire test (type test)

The requirements in **5.2.5.3** of **JIS C 62477-1** : 2017 shall apply.

5.2.5.4 Hot wire ignition test (type test – alternative to glow-wire test)

The requirements in **5.2.5.4** of **JIS C 62477-1** : 2017 shall apply.

5.2.5.5 Flammability test (type test)

The requirements in **5.2.5.5** of **JIS C 62477-1** : 2017 shall apply.

5.2.5.6 Flaming oil test (type test)

The requirements in **5.2.5.6** of **JIS C 62477-1** : 2017 shall apply.

5.2.5.7 Cemented joints test (type test)

The requirements in **5.2.5.7** of **JIS C 62477-1** : 2017 shall apply.

5.2.6 Environmental tests (type tests)

5.2.6.1 General

The requirements in **5.2.6.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.6.2 Acceptance criteria

The requirements in **5.2.6.2** of **JIS C 62477-1** : 2017 shall apply.

5.2.6.3 Climatic tests

5.2.6.3.1 Dry heat test (steady state)

The requirements in **5.2.6.3.1** of **JIS C 62477-1** : 2017 shall apply.

5.2.6.3.2 Damp heat test (steady state)

The requirements in **5.2.6.3.2** of **JIS C 62477-1** : 2017 shall apply.

5.2.6.4 Vibration test (type test)

The requirements in **5.2.6.4** of **JIS C 62477-1** : 2017 shall apply.

5.2.6.5 Salt mist test (type test)

The requirements in **5.2.6.5** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Replace "Severity level" in the Subject column of Table 34 by "Test method", and "Severity level" in the Test conditions column by "Test method 2".

5.2.6.6 Dust and sand test (type test)

The requirements in **5.2.6.6** of **JIS C 62477-1** : 2017 shall apply.

5.2.7 Hydrostatic pressure test (type test and routine test)

The requirements in **5.2.7** of **JIS C 62477-1** : 2017 shall apply.

6 Information and marking requirements

6.1 General

The requirements in **6.1** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Any marking required by this Standard shall be durable and legible. In considering the durability of the marking, the effect of normal use shall be taken into account.

Compliance is checked by visual inspection and by rubbing the marking by hand for 15 s with a piece of cloth soaked with water and again for 15 s with a piece of cloth soaked with petroleum spirit. After this test, the marking shall be legible; it shall not be possible to remove marking plates easily and they shall show no curling.

The petroleum spirit to be used for the test is aliphatic solvent hexane having a maximum aromatics content of 0.1 % by volume, a kauri butanol value of 29, an initial boiling point of approximately 65 °C, a dry point of approximately 69 °C and a mass per unit volume of approximately 0.7 kg/L.

As an alternative, it is permitted to use a reagent grade hexane with a minimum of 85 % as n-hexane.

6.2 Information for selection

Replace the contents of **6.2** of **JIS C 62477-1** : 2017 by the following :

Each part of an energy storage system that is supplied as a separate product shall be provided with information relating to its function, electrical characteristics, and intended environment, so that its fitness for purpose and compatibility with other parts of the energy storage system can be determined. This information includes, but is not

limited to :

a) **Nameplate**

— name or trademark of the manufacturer, supplier or importer;

— type of product;

— electrical ratings for each power port :

— maximum nominal input voltage or input voltage range [1)];

— maximum nominal input current or input current range;

— maximum nominal output voltage;

— maximum nominal output current or nominal output power rating;

— number of phases (e.g. 3 AC);

— rated frequenty (in the case of AC output).

Note [1)] In the case of the equipment connected to both phase conductors and a neutral conductor of a single-phase three-wire system power system, a marking of the voltage between the phase conductors and the neutral conductor and the voltage between both phase conductors divided with a slash (/), as well as a marking of "three-wire plus protective earth", "3W + PE" or an equivalent marking shall be given.

b) **Nameplate or user manual**

— type of electrical supply system (e.g. TN, IT, etc.) to which the energy storage system may be connected;

— rated current and rated breaking capacity of the short-circuit protective device and the cable diameter based on the national wiring rules in Japan, or short circuit current rating by either of the following :

— conditional short-circuit current (I_{cc}) specified in **4.3.2.2**, minimum required prospective short-circuit current, $I_{cp,\ mr}$ and short-circuit protective device characteristics,

— short time withstand current (I_{cw}) specified in **4.3.5**, duration and peak withstand voltage (I_{pk});

— maximum nominal input current RMS for dimensioning overload protective elements and wiring;

— output short-circuit current accordance with **4.3.2.3**;

— supply requirements of the load (if applicable);

— liquid coolant type and design pressure for liquid cooled energy storage system;

— protective class (IP rating) for enclosure;

— operating and storage environment;

— reference(s) to relevant standard(s) for manufacture, test, or use;

— reference to instructions for installation, use and maintenance.

The information shall be limited to that which is essential for correct selection to be made, and should relate to specific equipment. If information covers a number of product variants, it shall be readily possible to distinguish between them.

The range shall have a hyphen (-) between the minimum and maximum rated values and when multiple values or ranges are given, they shall be separated by a solidus (/).

Equipment with a rated voltage range shall be marked with either the maximum rated current or with the current range.

Example 1 100 V-240 V : 2.8 A or 100 V-240 V : 2.8 A-1.2 A

For equipment with multiple rated voltages, the corresponding rated currents shall be marked such that the different current ratings are separated by a solidus (/) and the relation between rated voltage and associated rated current appears distinctly.

Example 2 100 V-120 V : 2.8 A/200 V-240 V : 1.4 A or 100 V-120 V : 2.8 A-2.4 A/200 V-240V : 1.4 A-1.2 A

6.3 Information for installation and commissioning

6.3.1 General

The requirements in **6.3.1** of **JIS C 62477-1** : 2017 shall apply.

6.3.2 Mechanical considerations

The requirements in **6.3.2** of **JIS C 62477-1** : 2017 shall apply.

6.3.3 Environment

The requirements in **6.3.3** of **JIS C 62477-1** : 2017 shall apply.

6.3.4 Handling and mounting

The requirements in **6.3.4** of **JIS C 62477-1** : 2017, along with the following, shall apply.

For pluggable type A or pluggable type B energy storage system with storage battery already installed by the supplier, the installation instructions shall be made available, for example in the user manual, that shall intend for the user to perform the installation. When the disconnect device for isolation of mains power is not incorporated in the energy storage system, or when the plug on the cord is intended to serve as the disconnect device, the installation instructions shall state that the mains socket outlet that supplies the energy storage system shall be installed near the energy storage system and shall be easily accessible. When the energy storage system cord shall be connected to an earthed mains socket outlet for safety reasons, the marking on the energy storage system or installation instructions shall so state. The same requirement for marking applies to any special equipotential earth bonding to other connected energy storage system equipment or to class I loads.

NOTE Pluggable cords are normally 2 m in length or less.

6.3.5 Enclosure temperature

The requirements in **6.3.5** of **JIS C 62477-1** : 2017 shall apply.

6.3.6 Connections

6.3.6.1 General

The requirements in **6.3.6.1** of **JIS C 62477-1** : 2017 shall apply.

6.3.6.2 Interconnection and wiring diagrams

The requirements in **6.3.6.2** of **JIS C 62477-1** : 2017 shall apply.

6.3.6.3 Conductor (cable) selection

The requirements in **6.3.6.3** of **JIS C 62477-1** : 2017 shall apply.

6.3.6.4 Terminal capacity and identification

The requirements in **6.3.6.4** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Replace "types (busbar or stranded)" in the first paragraph by "types (solid or stranded)".

6.3.7 Protection requirements

6.3.7.1 Accessible parts and circuits

The requirements in **6.3.7.1** of **JIS C 62477-1** : 2017 shall apply.

6.3.7.2 Type of electrical supply system

The requirements in **6.3.7.2** of **JIS C 62477-1** : 2017 shall apply.

6.3.7.3 Protective class

6.3.7.3.1 General

The requirements in **6.3.7.3.1** of **JIS C 62477-1** : 2017 shall apply.

6.3.7.3.2 Protective class I equipment

The requirements in **6.3.7.3.2** of **JIS C 62477-1** : 2017 shall apply.

6.3.7.3.3 Protective class II equipment

The requirements in **6.3.7.3.3** of **JIS C 62477-1** : 2017 shall apply.

6.3.7.3.4 Protective class III equipment

The requirements in **6.3.7.3.4** of **JIS C 62477-1** : 2017 shall apply.

6.3.7.4 Touch current marking

The requirements in **6.3.7.4** of **JIS C 62477-1** : 2017 shall apply.

6.3.7.5 Compatibility with residual current-operated protective device (RCD) marking

The requirements in **6.3.7.5** of **JIS C 62477-1** : 2017 shall apply.

6.3.7.6 Cable and connection

The requirements in **6.3.7.6** of **JIS C 62477-1** : 2017 shall apply.

6.3.7.7 External protection devices

The requirements in **6.3.7.7** of **JIS C 62477-1** : 2017 shall apply.

6.3.8 Commissioning

The requirements in **6.3.8** of **JIS C 62477-1** : 2017 shall apply.

6.4 Information for use

6.4.1 General

The requirements in **6.4.1** of **JIS C 62477-1** : 2017 shall apply.

6.4.2 Adjustment

The requirements in **6.4.2** of **JIS C 62477-1** : 2017 shall apply.

6.4.3 Labels, signs and signals

6.4.3.1 General

The requirements in **6.4.3.1** of **JIS C 62477-1** : 2017 shall apply.

6.4.3.2 Isolators

The requirements in **6.4.3.2** of **JIS C 62477-1** : 2017 shall apply.

6.4.3.3 Visual and audible signals

The requirements in **6.4.3.3** of **JIS C 62477-1** : 2017 shall apply.

6.4.3.4 Hot surfaces

The requirements in **6.4.3.4** of **JIS C 62477-1** : 2017 shall apply.

6.4.3.5 Control and device marking

The requirements in **6.4.3.5** of **JIS C 62477-1** : 2017 shall apply.

6.4.3.6 Distribution-related backfeed

A label shall be required for the purpose of warning the electrical service person, which shall be a skilled person, against backfeed situations not caused by the energy storage system. A backfeed situation can arise when a particular load fault is present while the energy storage system operates in stored energy mode or while unbalanced loads are supplied through a particular power distribution system, for example an impedance grounded IT system.

The installation instructions for permanently connected energy storage system shall require the placement of a warning label by the energy storage system manufacturer at the input terminals of the energy storage system, and by the installer, that shall be a skilled person, on all primary power isolators installed remote from the energy storage system area and on external access points, if any, between such isolators and the energy storage system.

The installation instructions for permanently connected energy storage system shall give the above-mentioned warning label when :

a) the automatic backfeed isolation (see **4.8.2**) is provided external to the energy storage system,

b) the input of the energy storage system is connected through external isolators that, when opened, isolate the neutral, or

c) the energy storage system is connected to an IT power distribution system (see **4.4.7.1.6.1** of **JIS C 62477-1** : 2017).

The warning label shall carry the wording shown in the following, or equivalent.

Before working on this circuit

- Isolate the energy storage system
- Then check for hazardous voltage between all terminals including the protective earth

Risk of Voltage Backfeed

NOTE Backfeed protection against faults occurring in the energy storage system is described in **4.8.2**.

6.5 Information for maintenance

6.5.1 General

The requirements in **6.5.1** of **JIS C 62477-1** : 2017 shall apply.

6.5.2 Capacitor discharge

The requirements in **6.5.2** of **JIS C 62477-1** : 2017, along with the following, shall apply.

Replace "**4.4.3.4**" in the first paragraph by "**4.4.9**".

6.5.3 Auto restart/bypass connection

The requirements in **6.5.3** of **JIS C 62477-1** : 2017 shall apply.

6.5.4 Other hazards

The requirements in **6.5.4** of **JIS C 62477-1** : 2017 shall apply.

6.5.5 Equipment with multiple sources of supply

The requirements in **6.5.5** of **JIS C 62477-1** : 2017 shall apply.

6.5.6 Storage battery

6.5.6.1 Labelling

External battery cabinets, or storage batteries and battery housings within the energy storage system shall be provided with the following, clearly legible information in such a position as to be immediately seen by a skilled person or an instructed person

when servicing the energy storage system :

a) battery type (valve-regulated lead-acid, nickel cadmium, lithium secondary, etc.) and number of blocks or cells;

b) nominal voltage of total battery;

c) nominal capacity of total battery;

d) warning label denoting an energy or electrical shock and chemical hazard, and reference to the maintenance, handling and disposal requirements detailed in the user manual.

Exception : Pluggable type A energy storage system, supplied with internal batteries or with separate battery cabinets, intended for location either under or over or alongside the energy storage system, connected by plugs and socket outlets for installation by an operator need only be fitted with the warning label on the outside of the unit.

6.5.6.2 Information in instruction manual(s)

Other necessary information as listed below shall be given in the instruction manual(s).

a) **Internally mounted storage battery** For an energy storage system with a replaceable storage battery, the following shall apply :

- if the storage battery can be replaced by an ordinary person, the operation manual shall provide sufficient information to enable the replacement of the battery with a suitable recommended type;
- if the storage battery can be replaced by a skilled person or an instructed person, the installation or maintenance instructions shall provide sufficient information to enable the replacement of the battery with a suitable recommended type;
- the installation or maintenance instructions shall contain safety-related explanations for when a skilled person or an instructed person accesses the system;
- if a skilled person or an instructed person is to install a storage battery, instructions for interconnections including terminal tightening torques shall be provided.

The following explanations shall be given in the instruction manual :

- servicing of storage batteries including maintenance and checks should be performed or supervised by personnel knowledgeable about batteries and required precautions;
- when replacing batteries, replace with the same type and number of batteries or battery packs as specified by the manufacturer.

The following precautions for an internal storage battery shall be given :

- "CAUTION : Do not dispose of batteries as combustible waste, but dispose of them properly by consulting with the manufacturer, etc. The batteries may ex-

plode in fire."

- "CAUTION : Do not open or mutilate storage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic."

b) **Externally mounted storage battery** For an externally-mounted storage battery, the following shall apply :

- where the storage battery is not provided by the energy storage system manufacturer, installation instructions shall state voltage, ampere-hour (Ah) rating, charging regime, method of protection or other information required on installation to coordinate with UPS protective devices;
- where the storage battery is not provided by the energy storage system manufacturer, instructions for the battery cells shall be provided by the battery manufacturer.

c) **External battery cabinet** External battery cabinet(s) supplied with the energy storage system shall have adequate installation instructions to define cable sizes for connection to the energy storage system if the cabling is not supplied by the energy storage system manufacturer. Where the battery cells or blocks are not supplied pre-installed and wired, installation instructions for the battery cells or blocks shall be provided by the battery manufacturer, if not detailed in the installation instructions by the energy storage system manufacturer.

Protection against energy hazards shall conform to **2.1.1.5** of **JIS C 6950-1**.

NOTE 1 Exposed parts associated with risks of energy hazards should be positioned, encased, protected or covered by a skilled person or an instructed person in consideration of unintended bridging by conductive materials.

NOTE 2 Exposed parts operating at hazardous voltage levels should be located or protected so that they do not come into contact with the operation, including other parts of the energy storage system, and so that contact does not occur while another part is in service.

Annexes

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

Annex A (normative)
Additional information for protection against electric shock

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

A.101 Comparison of limits of working voltage

Table A.101 provides a comparison of the steady-state decisive voltage class limits used in this Standard to those defined in other standards.

Table A.101 Comparison of limits of working voltage

Limits of working voltage V			Decisive voltage classification (DVC)	Electrical energy source classification [j] (ES)	Telecommunication network voltage classification [e] (TNV)
AC voltage (RMS)	AC voltage (peak)	DC voltage (mean)			
U_{ACL}	U_{ACPL}	U_{DCL}	(**JIS C 62477-1** : 2017)	(**JIS C 62368-1** : 2018)	(**JIS C 6950-1** : 2016)
8	11,3	22	A1	ES1 [b), h)]	TNV-1 [f)]
12	17	28	A2		
20	28.3	48	A3		
30	42.4	60	A [a)]		
50	71	120	B	ES2 [c), i)]	TNV-2 [g)], TNV-3 [f)]
>50	>71	>120	C	ES3 [d)]	

Note [a)] Decisive voltage class DVC A voltage limits are considered for one circuit only. When more than one DVC A circuit of the energy storage system is accessible and the voltage of the two circuits can, subject to evaluation, add together under single fault condition, the limit is 25 V for AC voltage RMS.

Note [b)] ES1 or class 1 voltage limits for AC voltages at frequencies not exceeding 1 kHz under normal conditions, and abnormal conditions, and single fault conditions of a component, device or insulation not serving as a safeguard. At frequencies greater than 1 kHz, the limits for AC voltage RMS increase linearly as a function of frequency to a maximum of 70 V RMS at frequencies equal to or greater than 100 kHz.

Note [c)] ES2 or class 2 voltage limits for AC voltages at frequencies not exceeding 1 kHz under normal conditions, and abnormal conditions, and single fault conditions. At frequencies greater than 1 kHz, the limits for AC voltage RMS increase linearly as a function of frequency to a maximum of 100 V RMS at frequencies equal to or greater than 100 kHz.

Note [d)] ES3 or class 3 voltage limits exceed ES2 or class 2 voltage limits.

Note [e)] Voltage limits of TNV circuits under normal operating conditions.

Note [f)] Overvoltages from telecommunications networks and cable distribution systems are possible on TNV-1 and TNV-3 circuits under normal operating conditions.

Note [g)] Overvoltages from telecommunications networks are not possible on TNV-2 circuits under normal operating conditions.

Note [h)] ES1 or class 1 voltage limits for a repetitive pulse with an off time of less than 3 s is 42.4 V peak and with an off time of greater than or equal to 3 s is 60 V peak.

Note [i)] ES2 or class 2 voltage limits for a repetitive pulse with an off time of less than 3 s is 70.7 V peak. For an off time of greater than 3 s the ES2 voltage limits depend also on the time period that the pulse is on with a lower limit of 120 V peak for an on time equal to or greater than 200 ms and an upper limit of 196 V peak for an on time equal to or less than 10 ms.

Note [j)] Electrical energy sources derived from a capacitor and single pulses defined in **JIS C 62368-1** : 2018 are not considered here.

Annex D (normative)
Evaluation of clearance and creepage distances

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

Replace the second sentence of the first paragraph of **D.2** by the following.

If the associated permitted clearance is less than 3 mm, the *X* value shall be the value given in Table D.1 or one third of the clearance, whichever is the smaller.

Annex H (informative)
Guidelines for RCD compatibility

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

Replace “Caution necessary” in Figure H.1 by “Caution marking necessary”.

Annex N (informative)
Guidance regarding short circuit current

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

Replace "Figure N.3" in the first line of **N.3.4** with "Figure N.5".

Annex JA (informative)

Minimum and maximum cross-section of copper conductors suitable for connection to terminals for external conductor

Table JA.1 provides guidance on minimum range of cable section that terminals should be designed to support when one copper cable is connected per terminal.

Table JA.1 Conductor cross-section (extract from IEC 61439-1 : 2011)

Rated current	Solid or stranded conductors		Flexible conductors	
	Cross-sections		Cross-sections	
	Minimum	Maximum	Minimum	Maximum
A	mm^2		mm^2	
6	0.75	1.5	0.5	1.5
8	1	2.5	0.75	2.5
10	1	2.5	0.75	2.5
12	1	2.5	0.75	2.5
16	1.5	4	1	4
20	1.5	6	1	4
25	2.5	6	1.5	4
32	2.5	10	1.5	6
40	4	16	2.5	10
63	6	25	6	16
80	10	35	10	25
100	16	50	16	35
125	25	70	25	50
160	35	95	35	70
200	50	120	50	95
250	70	150	70	120
315	95	240	95	185

If the external conductors are connected directly to built-in apparatus, the cross-sections indicated in the relevant specifications are valid.

In cases where it is necessary to provide for conductors other than those specified in the table, special agreement shall be reached between the assembly manufacturer and the purchaser.

Annex JB (normative)
Ventilation of lead-acid battery compartments

JB.1 General

The enclosure or compartment housing a battery where gassing is possible during heavy discharge, overcharging, or similar type of usage shall be vented. The means of venting shall provide airflow throughout the enclosure or compartment in order to reduce the risk of build-up of pressure or accumulation of a gas mixture, such as hydrogen-air, involving a risk of injury to persons.

The requirements in this Annex assume the gas mixture to be hydrogen-air, which is lighter than air. Consequently, for compliance, in addition to air intake openings in the bottom portions of the battery enclosure or compartment, ventilation openings are required in the uppermost portions where such a gas mixture may accumulate.

JB.2 Normal conditions

The lower explosion level of hydrogen in a (hydrogen-air) mixture, under normal conditions of pressure and temperature, is 4 % by volume. With reference to **JB.1**, the venting means shall prevent hydrogen concentration, under normal operating and charging conditions, in excess of 0.8 % by volume which, as a provision for abnormal situations, includes a safety factor of 5.

A lead-acid battery at full charge, when most of the charging energy goes into gas, will generate approximately 0.028 3 m^3 of hydrogen gas per cell for each 63 Ah of input (= 0.45×10^{-3} m^3 /Ah).

If the adequacy of the ventilation required is not obvious, a determination shall be made by measurement of gas concentration under normal and abnormal conditions as specified in this Annex.

Subject to the energy storage system being provided with a regulating circuit preventing an increase in battery charging current and voltage when the AC input voltage is increased within the limits specified for energy storage system operation, the formula listed below may be used to calculate the necessary air flow for a lead-acid battery compartment that complies with the ventilation requirements of this Annex:

$$Q = vqsnI\,(1 - a)$$

where,

- Q : ventilation air flow (m^3/h)
- v : necessary dilution of hydrogen (100 – 4)/4 = 24
- q : 0.45×10^{-3} (m^3/Ah) generated hydrogen
- s : factor of safety (s = 5)
- n : number of battery cells
- I : overcharge current (A) consumed for generation of hydrogen gas, typically 0.1 CnA

Cn is the battery nominal capacity of n hour discharge rate in Ah at the 10 h discharge rate.

a : gas recombinating efficiency

for vented battery : $a = 0$

for valve-regulated battery : $a = 0.2$

NOTE 1 To allow for equalization (boost charging), in the case of valve-regulated batteries operating over a wider range of ambient temperatures, the factors of I correspond to typical 2.4 V/cell figures at 25 °C.

By adopting safety factor $s = 5$, the formula for Q can be simplified by introducing the resultant value of

$vqs = 0.054\ m^3/Ah$

$Q = 0.054\ nIC$

Q air flow (m^3/h)

This amount of ventilation air flow shall preferably be ensured by natural air flow, otherwise by forced ventilation.

Inlet and outlet apertures shall allow for a free access of air flow. The mean speed of air through the apertures shall at least be in the region of 0.1 m/s (= 360 m/h).

With this amount of natural air flow, the battery compartment shall contain air inlet and outlet apertures with a free area of at least

$A \geq Q/360$

where, A: area of inlet or outlet aperture (m^2)

NOTE 2 Natural ventilation is applicable where the electrical power for hydrogen generation keeps below certain limits. Otherwise, the ventilation air outlets would exceed acceptable dimensions. The limits for natural ventilation depend on the battery capacity and the number of cells, and also on the battery technology (vented cells, valve-regulated cells), and the battery charging voltage applied.

The above calculation method will result in a sufficient degree of safety against explosion, assuming hot (>300 °C) or sparking components are kept at adequate distance from battery vent plugs or gas pressure outlets. In battery rooms, a distance of 500 mm may be regarded as ensuring sufficient safety. In battery compartments or cabinets or batteries built-in with the energy storage system, it is permitted to reduce this distance depending on the level of ventilation.

The most severe charging rate referred to above is the maximum charging rate that does not cause a thermal or overcurrent protective device to open.

JB.3 Blocked conditions

The ventilating means for an enclosure or a compartment housing a battery shall comply with the requirements in **JB.1** under test conditions as described in **4.2** of **JIS C 62477-1** : 2017. During, and at the conclusion of the test, the maximum hydrogen gas concentration shall not be more than 2 % by volume in consideration of safety factor 2.

JB.4 Overcharge conditions

If a measurement is needed to determine if a battery compartment complies with **JB.2**, the battery charger shall be connected to an AC input voltage adjusted to 106 % of nominal voltage of the energy storage system and then subjected to 7 h of overcharging using a fully charged battery. Any controls associated with the charger that can be adjusted by a skilled person or an instructed person shall be adjusted for the most severe charging rate.

Exception 1 This requirement does not apply to an energy storage system to be used with a battery charger that is not investigated with the energy storage system.

Exception 2 This requirement does not apply to an energy storage system provided with a regulating circuit preventing an increase in battery charging current when the AC input voltage is increased from rated value to 106 % of rated value.

During, and at the conclusion of the test, the maximum hydrogen gas concentration shall not be more than 2 % by volume. Measurements are to be made by sampling the atmosphere inside the battery compartment at the periods of 2 h, 4 h, 6 h and 7 h during the test. Samples of the atmosphere within the battery compartment shall be taken at the location where the greatest concentration of hydrogen gas is likely, using an aspirator bulb provided with the concentration measurement equipment, or other equivalent means.

Bibliography

JIS C 8201-3 *Low-voltage switchgear and controlgear — Part 3 : Switches, disconnectors, switch-disconnectors and fuse-combination units*

JIS C 62368-1 : 2018 *Audio/video, information and communication technology equipment — Part 1 : Safety requirements*

IEC 60287-1-1 *Electric cables — Calculation of the current rating — Part 1-1 : Current rating equations (100 % load factor) and calculation of losses — General*

IEC 61439-1 : 2011 *Low-voltage switchgear and controlgear assemblies — Part 1 : General rules*

Annex JC (informative)
Comparison table between JIS and corresponding International Standard

JIS C 4412	**IEC 62909-1** : 2017, (MOD)

a) No. of clause (**JIS**)	b) No. of clause (corresponding International Standard)	c) Classification by clause	d) Detail and justification of technical deviation	e) Future measures for the technical deviation
1	1	Alteration	**IEC** covers general requirements for converters with two or more DC ports or converters with one DC port connected to the storage battery, while **JIS** covers safety requirements for energy storage systems.	The scope of coverage is partially different between **JIS** and **IEC**. No revision proposal will be made to **IEC**.
3	3	Addition	Add definitions of terms specific to energy storage systems.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
—	4	Deletion	Delete the requirements in this clause because they are not safety requirements.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
—	5	Deletion	Delete the requirements in this clause because they are not safety requirements.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
4.1	6.1	Addition	Add the provision in **JIS C 6950-1**, "components may conform to the standards, etc. comparable to the requirements of the related component standards." Add the requirement that if a lithium secondary battery is used, it shall conform to **JIS C 8715-2**.	A revision proposal will be considered at the review of **IEC 62477-1**. The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.

a) No. of clause (**JIS**)	b) No. of clause (corresponding International Standard)	c) Classification by clause	d) Detail and justification of technical deviation	e) Future measures for the technical deviation
4.3.1	6.3.1	Addition	Add the following : "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." Add "the input circuit from photovoltaic module" as one of the cases where neither installation nor specification of overcurrent protection is needed.	This is based on the national wiring rules in Japan, and no revision proposal will be made to **IEC**. A revision proposal will be considered at the next review of **IEC**.
4.3.2.2	6.3.2.2	Alteration	Add the following : In the test of **5.2.4.4**, replace the term "output port" with "input port".	A revision proposal will be considered at the review of **IEC 62477-1**.
4.3.2.3	6.3.2.3	Addition	Add the following : "This subclause shall not apply when the output port is grid-connected."	A revision proposal will be considered at the next review of **IEC**.
4.3.5	—	Addition	Add the requirements not included in **IEC 62477-1** : 2012 cited in this Standard, but included in Amendment 1 of the said **IEC**, prior to the incorporation of the said amendment into the said **IEC**.	This change will be incorporated into the next edition of **IEC**.
4.3.6	—	Addition	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
4.4.2.2.2	6.4.2.2.2	Addition	Add the provision that the appropriate conditions of contact area and skin condition shall be specified by the manufacturer.	A revision proposal will be considered at the next review of **IEC**.
4.4.3.3	6.4.3.3	Addition	Add the requirements for protection by means of enclosures.	A revision proposal will be considered at the next review of **IEC**.
4.4.4.2.1	6.4.4.2.1	Addition	Add the requirements of **JIS C 6950-1**.	A revision proposal will be considered at the next review of **IEC**.
4.4.7.1.3	6.4.7.1.3	Addition	Add the requirements of **IEC 62040-1**.	A revision proposal will be considered at the next review of **IEC**.

a) No. of clause (**JIS**)	b) No. of clause (corresponding International Standard)	c) Classification by clause	d) Detail and justification of technical deviation	e) Future measures for the technical deviation
4.4.7.7	6.4.7.7	Alteration	To facilitate precise understanding, replace the provision of **JIS C 62477-1**, "Decreased spacings for components assembled on printed wiring board are permitted when used in :", with "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 :"	A revision proposal will be considered at the next review of **IEC**.
4.4.7.8.2	6.4.7.8.2	Addition	Add the requirements of **JIS C 6950-1**.	A revision proposal will be considered at the next review of **IEC**.
4.6.2.2	6.6.2.2	Alteration	Add the requirements of **IEC 62040-1** (flammability of storage batteries). Remove the condition for exemption of flammability requirements for small parts so that all small parts are exempted from flammability requirements.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**. A revision proposal will be considered at the review of **IEC 62477-1**.
4.6.3.1	6.6.3.1	Addition	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
4.6.4.1	6.6.4.1	Addition	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
4.8	6.8	Alteration	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
4.11.4	6.11.4	Addition	Add the requirements of **JIS C 6950-1**.	A revision proposal will be considered at the review of **IEC 62477-1**.

a) No. of clause (**JIS**)	b) No. of clause (corresponding International Standard)	c) Classification by clause	d) Detail and justification of technical deviation	e) Future measures for the technical deviation
4.11.8.2	6.11.8.2	Addition	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
4.11.9	—	Addition	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
4.12.1	6.12.1	Addition	Add the following: "Enclosures having passed the tests of **5.2.2.4.2** and **5.2.2.4.3** are regarded to be in conformance with the requirements of **4.12.3** and **4.12.4**."	A revision proposal will be considered at the review of **IEC 62477-1**.
4.12.4	6.12.4	Addition	Add the following to the zinc-coated steel thickness requirement : "not less than 0.8 mm for base metal thickness of zinc-coated steel".	A revision proposal will be considered at the review of **IEC 62477-1**.
4.13	—	Addition	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
4.14	—	Addition	Add the requirements of **IEC 62040-1**. Add the sublause "Monitoring and control of storage battery".	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
5.1.6	7.1.6	Alteration	Replace "a serial number described in **6.2**" in **JIS C 62477-1** with a suitable description, since a serial number is not listed in **6.2**.	A revision proposal will be considered at the review of **IEC 62477-1**.
5.1.7	7.1.7	Alteration	Modify the contents of the test overview table according to the additions and changes **JIS** has made.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.

a) No. of clause (**JIS**)	b) No. of clause (corresponding International Standard)	c) Classification by clause	d) Detail and justification of technical deviation	e) Future measures for the technical deviation
5.1.5.3	7.1.5.3	Alteration	Change the test conditions to those specific to energy storage systems.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
5.2.2.4.2.2	7.2.2.4.4.2	Alteration	Correct the citation in **JIS C 62477-1** as follows: Replace "Figure 2 of **JIS C 0922** : 2002" with "Figure 7 of **JIS C 0922** : 2002".	A revision proposal will be considered at the review of **IEC 62477-1**.
5.2.3.4.2	7.2.3.4.2	Alteration	Divide the paragraph into separate sentences to prevent misunderstanding that can otherwise arise.	A revision proposal will be considered at the review of **IEC 62477-1**.
5.2.3.8	7.2.3.8	Alteration	Correct the citation in **JIS C 62477-1** as follows: Replace "**4.4.3.4**" with "**4.4.9**".	A proposal for correction of this error will be considered at the review of **IEC 62477-1**.
5.2.3.10	7.2.3.10	Alteration	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
5.2.3.12	—	Addition	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
5.2.4.1	7.2.4.1	Alteration	Add the requirements of **IEC 62040-1** listing examples where a lesser prospective short-circuit current may be used.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
5.2.4.8	7.2.4.8	Alteration	Correct "A system shall be operated with each line disconnected" to "The test shall be performed with each line disconnected".	A revision proposal will be considered at the review of **JIS C 62477-1**.
5.2.6.5	7.2.6.5	Alteration	Replace "Severity level 2" by "Test method 2".	A revision proposal will be considered at the review of **JIS C 62477-1**.
6.1	8.1	Addition	Add the marking durability requirements of **JIS C 6950-1** because **IEC** does not have these requirements.	A revision proposal will be considered at the review of **IEC 62477-1**.

a) No. of clause (**JIS**)	b) No. of clause (corresponding International Standard)	c) Classification by clause	d) Detail and justification of technical deviation	e) Future measures for the technical deviation
6.2	8.2	Alteration	Add and modify the contents as suitably for energy storage systems. Corresponding to the deviation regarding **4.3.1**, change the provision so that the marking of conditional short-circuit current (I_{cc}) or rated short time withstand current (I_{cw}) based on **JIS C 62477-1** is only given when "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" are not marked.	This change is due to the difference in scope of coverage and also based on the national wiring rules in Japan, and no revision proposal will be made to **IEC**.
6.3.4	8.3.4	Addition	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
6.3.6.4	8.3.6.4	Alteration	Correct the term given in **JIS C 62477-1** as follows: Replace "busbar" with "solid".	A revision proposal will be considered at the review of **JIS C 62477-1**.
6.4.3.6	—	Addition	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
6.5.2	8.5.2	Alteration	Correct the citation in **JIS C 62477-1** as follows: Replace "**4.4.3.4**" with "**4.4.9**".	This correction has already been made in the revision draft of **IEC 62477-1**.
6.5.6	—	Addition	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.
Annex A	Annex A	Addition	Add the comparison of limits of working voltage given in **IEC 62040-1**.	Deletion of this content will be considered at the next revision of this Standard.

a) No. of clause (**JIS**)	b) No. of clause (corresponding International Standard)	c) Classification by clause	d) Detail and justification of technical deviation	e) Future measures for the technical deviation
Annex D	Annex D	Alteration	Replace the sentence "If the associated permitted clearance is less than 3 mm, the *X* value shall be one third of the clearance." given in **JIS C 62477-1** cited in this Standard with "If the associated permitted clearance is less than 3 mm, the *X* value shall be the value given in Table D.1 or one third of the clearance, whichever is the smaller."	A revision proposal will be considered at the review of **JIS C 62477-1**.
Annex JB	—	Addition	Add the requirements of **IEC 62040-1**.	The change is due to the difference in scope of coverage, and no revision proposal will be made to **IEC**.

NOTE 1 Symbols in sub-columns of classification by clause in the above table indicate as follows :
- — Deletion : Delete the specification item(s) or content(s) of International Standard(s).
- — Addition : Add the specification item(s) or content(s) which are not included in International Standard(s).
- — Alteration : Alter the specification content(s) or structure of International Standard(s).

NOTE 2 Symbol of overall degree of correspondence between **JIS** and International Standard(s) in the above table indicates as follows :
- — MOD : Modify International Standard(s).

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Errata for **JIS** (English edition) can be downloaded in PDF format at Webdesk (purchase information page) of our website (https://www.jsa.or.jp/).

For inquiry, please contact:
Publication and Information Unit, Japanese Standards Association Group
E-mail: csd@jsa.or.jp