JAPANESE INDUSTRIAL STANDARD

Safety requirements for electric energy storage equipment— Part 1: General requirements

JIS C 4412-1 : 2014

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table of contents

Preface

Based on the provisions of Article 12, Paragraph 1 of the Industrial Standardization Law, this standard has been proposed by the Japanese Industrial Standards Committee (JEMA) to establish the Japanese Industrial Standards with the draft industrial standard. It is a Japanese Industrial Standard established by the Minister of Economy, Trade, and Industry after deliberation by the Japanese Industrial Standards Committee.

It should be noted that some of these standards may conflict with patent rights, patent applications after publication or utility model rights.
The Minister of Economy, Trade and Industry and the Japanese Industrial Standards Committee are not responsible for confirmation of such patent rights, patent applications after publication of applications, and utility model rights.
The JIS C 4412 standard group has the following sub-organizations.
JIS C 4412-1 Part 1: General requirements
JIS C 4412-2 Part 2: Specific requirements for separate power conditioners

Japanese Industrial Standard JIS
C 4412-1: 2014

Low Voltage Power Storage System Safety Requirements-Part 1: General Requirements
Safety requirements for electric energy storage equipment-Part 1: General requirements

1 Scope

This standard stipulates the safety of a low-voltage power storage system (hereinafter referred to as a power storage system) as a device.
This standard is used in conjunction with JIS C 6950-1: 2012.
When a clause number is cited by the sentence "Applying the definition or provision of a clause number of JIS C 6950-1", it means that the definition or provision of that clause of JIS C 6950-1 is applied. However, there may be provisions that cannot be clearly applied to the power storage system, and such provisions can be excluded. Matters relating to a specific country / region described as reference in the notes of JIS C 6950-1 clause are also referred to in this standard.
The power storage system covered by this standard aims to supply power to the load equipment for several hours when a power outage occurs in the equipment, and to use the charged power in the daytime (peak cut / peak shift).
The purpose is not to ensure the continuity of load power in the event of a power outage.

- Note 1: The discharge time of the power storage system is not specified because it depends on the capacity and number of connected load devices and the degree of aging deterioration of the storage battery. Similarly, the capacity of the power storage system is not specified because it differs depending on the load equipment that the manufacturer assumes to connect.
- Note 2: For the purpose of ensuring the continuity of load power, an uninterruptible power supply (UPS) specified in JIS C 4411-3 is installed separately from the power storage system, or it has the same function as the UPS. It is necessary to use a power storage system.
- Note 3: Depending on the method of the power storage system, it may be necessary to reconnect the plug in the event of a power failure.

This standard applies to the following conditions:
Portable, stationary, fixed, built-in type power storage system that connects to the low-voltage distribution system and is installed in the operator access area (area where access is not restricted) or access restricted area (area where access is restricted).
This standard sets out the requirements for ensuring the safety of operators, the general public, and service personnel who may come into contact with the equipment.
This standard is intended to ensure the safety of power storage systems used on the premise that they will be installed, operated, and maintained in the manner specified by the manufacturer.
This standard does not apply to UPS specified by JIS C 4411-3.
However, this standard applies to UPSs that use lithium secondary batteries.
These standard covers all the following:

- A stand-alone system that receives power from a low-voltage distribution system and supplies power from an output terminal or outlet, with an AC input voltage of 600 V or less or a DC input voltage of 750 V or less.
- A grid interconnection method that connects to a low-voltage distribution system and supplies power to the load through the wiring of the equipment via the distribution board, with an AC output voltage of 600 V or less or a DC input / output voltage of 750 V or less.

However, the requirements for the grid interconnection protection function are not specified in this standard.
Note 4: It is desirable to apply the standards and standards related to the grid interconnection protection function and / or wiring rules for the requirements of the grid interconnection protection function and equipment.
This standard is positioned as a general rule for power storage systems and is applied to power storage systems that do not have individual standards.
For power storage systems that have individual standards, that standard is prioritized.

2. Citation standard

The following standards form part of the provisions of this standard by being cited in this standard.
Of these cited standards, those with the year added are applied to the version of the stated year, and the revised version (including supplements) after that is not applied.
The latest version (including supplements) of the citation standard without the year is applied.

- JIS C 0920: 2003 Protection class (IP code) by the outer shell of electrical machinery and equipment
- JIS C 1302 insulation resistance tester
- JIS C 4411-2 Uninterruptible Power Supply (UPS) -Part 2: Electromagnetic Compatibility (EMC) Requirements
- JIS C 6950-1: 2012 Information Technology Equipment-Safety-Part 1: General Requirements
- JIS C 8715-2 Industrial lithium secondary battery cell and battery system-Part 2: Safety requirements
- IEC 60417 (all parts), Graphical symbols for use on equipment

3. Terms and definitions

The main terms and definitions used in this standard are based on JIS C 6950-1 and the following.

3.1

Low voltage power storage system

A power supply device for the purpose of supplying power to load equipment for several hours when a power failure occurs in the equipment installed by combining a semiconductor power converter, switch, and storage battery, or for peak cut / peak shift using the charged power in the daytime.

- Note 1: Terms such as "backup power supply system" and "portable power supply" may be used depending on the application and capacity of the power storage system.
- Note 2: The storage batteries used include control valve type lead storage batteries and lithium secondary batteries.
- Note 3: The storage battery may be built into the power storage system, or the storage battery may be connected via a DC link as a housing separate from the semiconductor power converter.

3.2

Uninterruptible power supply, UPS

A power supply device that combines a semiconductor power converter, a switch, and an energy storage device (for example, a storage battery) to ensure continuity of load power in the event of an AC input power supply error.

- Note: Load power continuity means when the voltage and frequency including strain and power failure determined by the load are within the rated steady state and transient fluctuation limits. An input power supply error is when the voltage / frequency is out of the rated steady state and transient fluctuation limit range, or the strain or power failure is outside the limit value specified by the UPS.

3.3

Standalone method

A method of receiving power from a low-voltage distribution system and supplying power from an output terminal or outlet (see Fig. 1).

- NOTE 1 The input may have a household plug for connecting to a household outlet or a terminal connection.
- NOTE 2 The output may have an output outlet or may be output to a dedicated outlet through the wiring of the equipment.

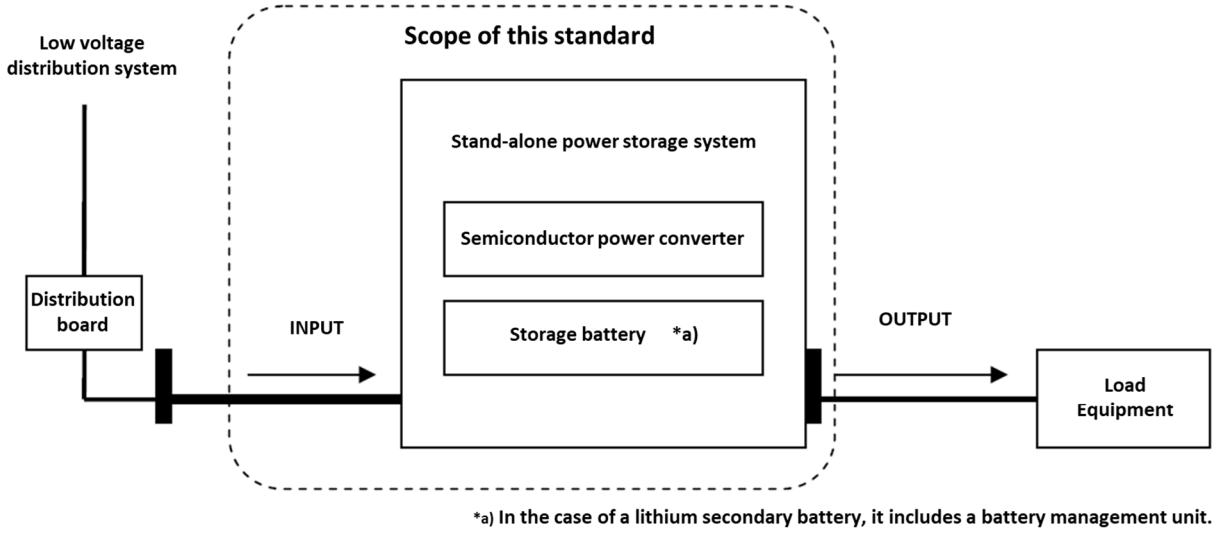


Figure 1-A schematic diagram of the stand-alone method

3.4

Grid interconnection method

A method of connecting to the grid and supplying power to the load through the wiring of the equipment via the distribution board (see Fig. 2).

- Note: The input / output wiring between the power storage system and the distribution board may be a single system or multiple systems with separate inputs and outputs.

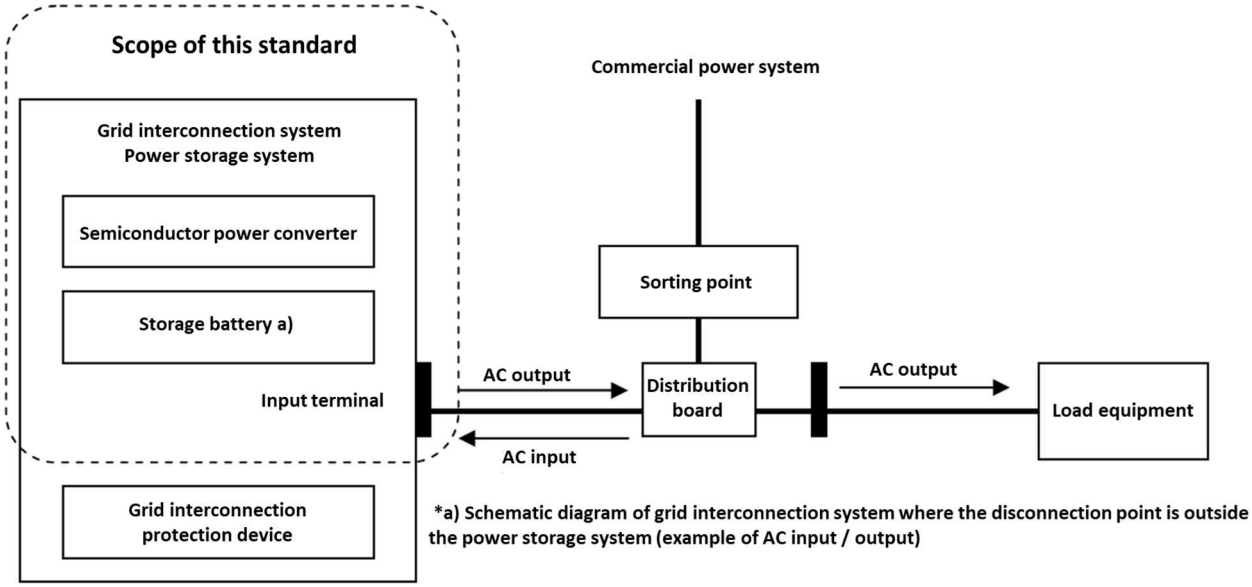


Fig. 2-Schematic diagram of grid interconnection method

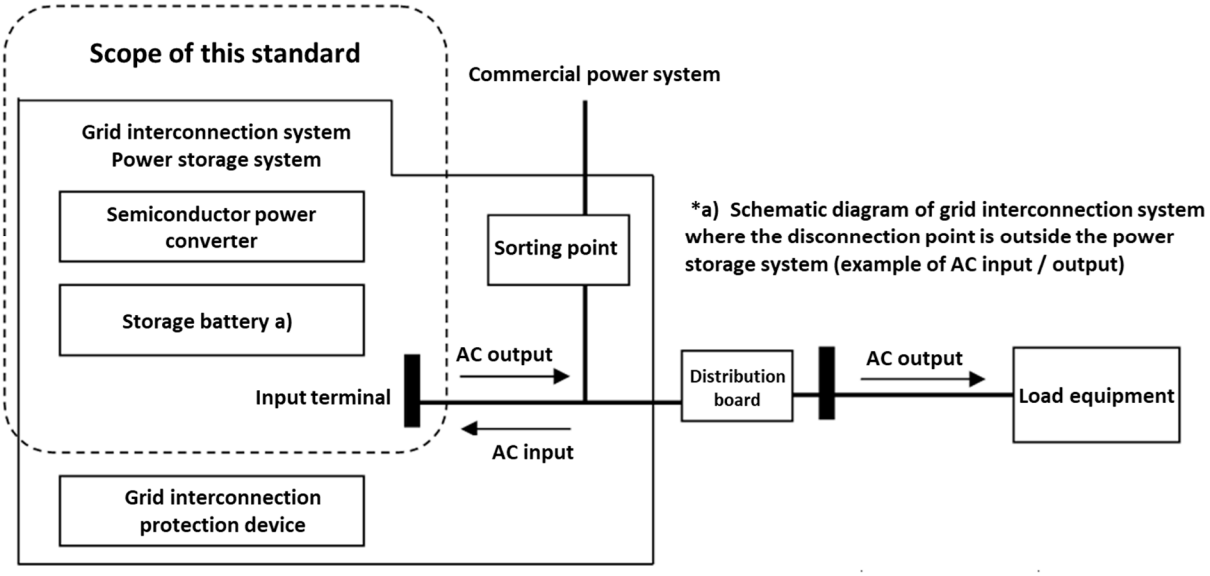


Fig. 2-Schematic diagram of grid interconnection method(continued)

3.5
Indoor power storage system
A power storage system designed to be installed indoors.

3.6
Outdoor power storage system
A power storage system designed to be installed outdoors.

3.7
Indoor / outdoor power storage system
A power storage system designed for indoor and outdoor use.
- Note 1: Normally, it is used indoors, but some power storage systems are supposed to be used outdoors temporarily. Such a power storage system is also considered to be shared indoors and outdoors.
- Note 2: This power storage system must meet the requirements for both indoor and outdoor use.

3.8
Back feed
In a stand-alone energy storage system, a state in which a part of the voltage or energy inside the energy storage system is generated at an input terminal directly or via a leakage current path in a state where the energy storage system is in operation and no regular power is supplied.

3.9
Backfeed protection
Protection to reduce the risk of electric shock from backfeed.

3.10
Stored energy operating state
The operating state of the power storage system when power is supplied under the following conditions.
- The AC input power supply is not input or is out of the specified allowable range.
- All electricity is supplied from the energy storage device.
- The load is within the range specified by the rating of the power storage system.
- The output voltage is within the specified accuracy.

3.11
Regular load
Maximum permissible load when the power storage system is used normally according to the manufacturer's instruction manual.

- Note 1: If the actual operating conditions can be significantly more stringent than the manufacturer's recommended maximum load conditions, a load corresponding to the maximum load that can be applied can be used.
- Note 2: See Annex C for an example of a reference regular load for a power storage system.

4 General conditions for the exam

4.1 Overview

JIS C 6950-1 1.4.1, 1.4.3, 1.4.6, 1.4.7, 1.4.8, 1.4.10, 1.4.11, 1.4.12, 1.4.13 and 1.4.14 along with the following provisions to apply.
The leakage current and heating test are performed by changing the voltage within the allowable input voltage range (see 1.4.5 of JIS C 6950-1).
Other tests are performed at the nominal input voltage.

4.2 Format test

The provisions of JIS C 6950-1 1.4.2 apply along with the following provisions.
If the conformity of a material, part or subassembly is confirmed by this standard by inspection or specific test, confirm conformity by confirming relevant data or prior test results instead of performing the specified formal test.
This condition is beyond the scope of the manufacturer's equipment if there is no commercial test simulation equipment.
It also applies to electrical tests that require dedicated test equipment.
- NOTE For physically larger units and / or units with higher power ratings, there may not be suitable test equipment to perform part of the formal test.

4.3 Test conditions

The test shall be performed with the rated voltage and the strictest combination of the following factors within the range specified by the manufacturer in the specifications.
However, if this standard stipulates specific test conditions, the test shall be conducted under those conditions.
- Power outage time
- Power frequency
- Charging conditions for storage batteries
- Installation location of power storage system and position of moving parts
- Operating condition

The automatic temperature controller and controller in the operator access area and other similar devices, and the adjustment values of the following items, do not apply to the power storage system installed in the access restricted area.
a) Adjustable without the use of tools.
b) Those that can be adjusted using the attached key or tool for the operator.

4.4 Load during test

If changes in the load of the power storage system may affect the test results, consider the following items and set the strictest conditions.
This condition is the expected load.
- Connection with the standard power outlet or terminal of the device below the value specified by the display specified in 4.7.2
- Electric power for charging stored energy devices
- Power consumption of optional equipment built into the power storage system under test or provided by the manufacturer together with the power storage system
- If the manufacturer decides to supply power from the power storage system under test Power consumption by other units
- NOTE 1 Equivalent load may be used in the test to simulate these power consumptions. See also NOTE 2 4.6.

4.5 Parts

When it comes to safety, the part shall comply with the requirements of this standard or the safety aspects of the relevant part standard.
- NOTE 1 If there is any doubt that a part is within the scope of the relevant part standard, that part standard should be considered for reference only.

Furthermore, the provisions of JIS C 6950-1 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 apply.
In addition, it may conform to a standard equivalent to the related component standard.
If some of the parts meet the requirements for parts of this standard or the safety requirements of the parts standard, the other parts also meet the requirements for parts of this standard or the safety requirements of the parts standard.

- NOTE 2 The requirements of this standard include anomaly testing to withstand a component safety anomaly mode (see 8.3).

4.6 Power interface

The provisions of JIS C 6950-1 1.6.1, 1.6.2 and 1.6.4 shall apply along with the following provisions.
NOTE While supplying the rated output under each of the conditions described in a) to d) below, the associated AC or DC steady-state input current should be 110% or less of the rated current.

A) In the discharged state: Even when the storage battery is being charged, the power storage system receives power from an applicable regular power source.
B) In the stored energy operating state: Receives power from an applicable DC current, such as a remote storage battery while simulating a power outage of a regular power source. It is desirable that the inverter, which is a main component of the power storage system, receives power from a fully charged storage battery bank or an external DC power source.
C) Bypass: It is desirable that the changeover switch is located in the normal power supply to the output load that bypasses the rectifier or charger, and in the inverter section of the power storage system, and powers the load directly.
D) In normal operation: It is desirable to connect a fully charged storage battery and receive power from the regular power supply in the power storage system. If there is a neutral wire, the neutral wire must be insulated from the ground and the main body of the power storage system as well as the wires of each phase.

The rated voltage of the component connected between the neutral wire and the ground should be equal to the phase voltage.
If the output neutral wire is isolated from the input neutral wire, the service provider installing the power storage system shall follow the wiring standards and installation instructions for the area in which it is installed when connecting the output neutral wire.
Confirm by inspection whether it conforms.

4.7 Display and instruction manual

4.7.1 General matters

If labeling requirements are specified in 4.7.2 and 4.7.3, display in sentences equivalent to those provisions.
The display should be easily visible from the operator access area or on the outer surface of the power storage system.
When displaying on the outer surface of the stationary power storage system, it should be visible even after the power storage system is installed in the normal use state.
In the case of a power storage system installed by a service worker or intended to be installed in a restricted access area, even if the display cannot be seen from the outside of the power storage system, it is sufficient that the display can be seen immediately when the door or cover is opened.
In this case, a sign must be attached to the main body of the power storage system so that it can be visually recognized, or the place where the sign is displayed must be clearly indicated in the instruction manual or the like.
They may be temporary signs.

4.7.2 Power rating

The following items shall be appropriately displayed on the power storage system.

- Input conditions (specify the type of AC or DC)
- Output rating

For power storage systems with multiple rated voltages, different rated currents are separated by diagonal lines (/) and displayed so that the rated current corresponding to each rated voltage can be clearly seen.
Devices with a rated voltage range display the maximum rated current or current range.
Inputs and outputs are displayed as follows in addition to the contents specified in JIS C 6950-1.

- Output rated voltage (specify the type of AC or DC)
- Output rated power factor (if not 1).

It may be a combination of active power and apparent power, or active power and rated current.

- Number of output phases (single-phase, single-phase three-wire or three-phase) and presence / absence of neutral wire (see 1.7.1 of JIS C 6950-1)
- Rated output active power.

In accordance with Annex L of JIS C 6950-1, the unit is watt (W) or kilowatt (kW).

- Rated output apparent power.

In accordance with Annex L of JIS C 6950-1, the unit is volt-ampere (VA) or kilovolt-ampere (kVA).

- Operating temperature range (other than 0-40 ℃)

Note: For example, indoor offices may be specified by the manufacturer as 10-35 ℃.
For power storage system units with separate automatic switching or maintenance bypasses, additional input AC power supplies, or external batteries, the power supply ratings of those separate devices may be indicated in their accompanying installation instructions.
In this case, write the following words on or near the connection point.
"Be sure to read the installation manual before connecting to the power supply."

4.7.3 Safety instructions

4.7.3.1 General matters

The manufacturer describes in the instruction manual precautions to prevent danger when operating, installing, maintaining, transporting, storing, or disposing of the power storage system.
For example, when installing a plug-type power storage system consisting of separate enclosures, special precautions regarding protective grounding may be required.
Even if the main power plug of the power storage system is disconnected, it is desirable that the power storage system, the storage battery box, and the terminal or outlet for the power storage system output remain protected and grounded.
Such enclosures may be household power electronics, battery strings, bypass switches, terminals and / or outlets.

4.7.3.2 Installation

The manufacturer must indicate the technical level required for installation.
Where appropriate, the installation instructions should include national wiring standards.
A clear explanation will be given as follows.

- Power storage system designed only in restricted access areas

If the power storage system is installed in a location that meets the fire resistance conditions, it does not have to comply with the requirements for the fire protection enclosure specified in 1.2.6.2 of JIS C 6950-1, but the conditions shall be specified.

- A power storage system designed so that cables to power supplies or loads or isolated energy storage devices are permanently connected by fixed wiring.

For example, the storage battery may not be installed when supplying to the user.
The installation instructions are:

- It is stated that only a specific technician (for example, a service worker) can install this power storage system.
- It is stated that if a switch that separates inputs (see JIS C 6950-1 3.4.2) is not installed in the power storage system, an appropriate and easy-to-read separation switch must be built into the fixed wiring.

When the switch that separates the inputs (see 3.4.2 of JIS C 6950-1) is not attached to the power storage system, or when the plug of the power cord is used as the input switch:

- Indicate and state in the installation manual that the power storage system should be installed near the outlet for supplying power to the power storage system and so that the power storage system can be easily accessed.

When connecting the power cord of the power storage system to a grounded outlet for safety reasons, specify it on the display of the power storage system or in the installation manual.
Similar labeling requirements apply to special equipotential ground bonding of equipment or Class I loads connected to power storage systems.

- NOTE The length of the power cord of a plug-type power storage system is usually 2 m or less.

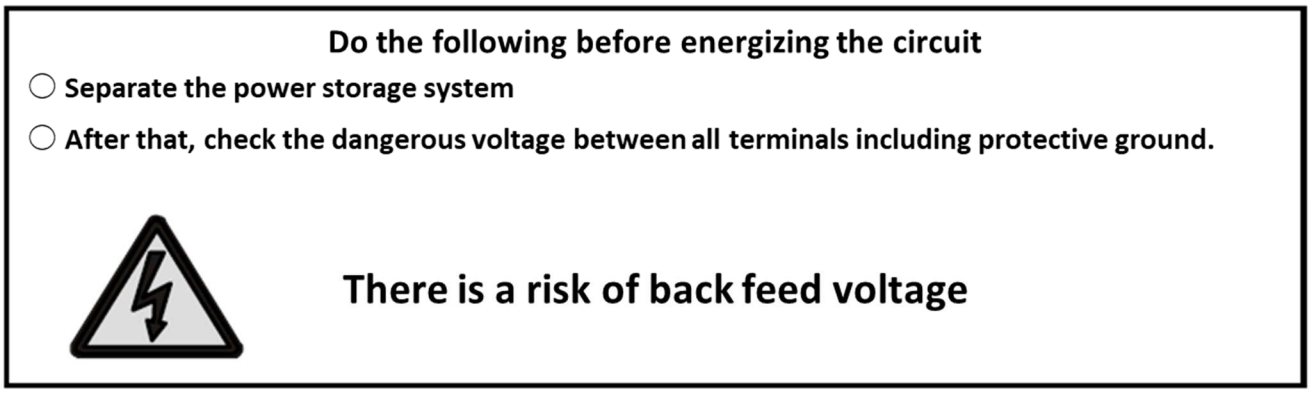
4.7.3.3 Operation

With the exception of power storage systems intended to be operated by the user, the manufacturer provides guidance on the level of qualification for operating the device.
This includes reference documents to train operators or allow them to enter restricted access areas.

4.7.3.4 Maintenance
Except for routine maintenance performed by the operator, the safety manuals used during maintenance of the power storage system can only be used by service personnel.

4.7.3.5 Power distribution related to back feed
It does not occur with some power storage systems, but while the power storage system operates in a stored energy operating state, or while powering an unbalanced load through a specific distribution system, such as an IT system that is grounded through impedance.
In order to warn electrical service personnel about backfeeds that may be caused by certain load anomalies, the installation instructions for a permanent connected power storage system must require a warning label to be affixed to the following parts:
a) Power storage system supplier: Input terminal of the power storage system.
b) User: Separation switch for all regular power supplies installed away from the power storage system, and an external contact point between the separation switch and the power storage system.
- There is an automatic backfeed disconnector outside the power storage system (see 5.1.4).
- Connect via an external separation switch that is separated from the neutral line when the input of the power storage system is open.
- Connect the power storage system to the IT power system (see JIS C 6950-1 1.6.1).

The warning label clearly states the following text or equivalent content.



NOTE Backfeed protection against failures that occur inside the power storage system is specified in 5.1.4.

4.7.4 Power supply voltage adjustment
Apply JIS C 6950-1 1.7.4.

4.7.5 Power supply outlet
Apply JIS C 6950-1 1.7.5.

4.7.6 Fuse
Apply JIS C 6950-1 1.7.6.

4.7.7 Wiring terminal
Apply JIS C 6950-1 1.7.7.

4.7.8 Battery terminal
The terminals connected to the storage battery shall indicate the polarity according to IEC 60417 or shall be structured so that they are not easily misconnected.
The power storage system that may be used by the operator and that uses a connector shall have a structure that cannot be erroneously connected.

4.7.9 Control and display
Apply JIS C 6950-1 1.7.8.

4.7.10 Separation between multiple power supplies
Apply JIS C 6950-1 1.7.9.

4.7.11 IT power system

Apply JIS C 6950-1 1.7.2.4.

4.7.12 Protection inside building equipment

In a type B plug-connected power storage system or fixed power storage system, if the wiring protection inside the power storage system depends on the equipment of the building.
-Indicate that in the installation manual of the power storage system
-State requirements for short circuit protection, overcurrent protection, or both as necessary (see 5.6.1).

The protection against electric shock of the power storage system (see 5.1) depends on the earth leakage protection device installed in the distribution equipment, and the power storage system may flow a ground fault current with a DC component under some operating conditions (normal or abnormal):

- Clearly state in the installation manual for consideration.

NOTE It is advisable to consider the requirements for the protection of public distribution systems, if any, domestic wiring standards.

4.7.13 Large leakage current

The provisions of JIS C 6950-1 5.1 shall apply along with the following provisions.
For Type B plug-connected power storage systems or fixed power storage systems, when the sum of the earth leakage currents flowing through the power storage system and the protective ground conductor on the power storage system power supply side of the connected load exceeds or may exceed the JIS C 6950-1 5.1 limit value under some operating conditions.

- The power storage system displays the warning specified in 5.1 of JIS C 6950-1.
- The instruction manual must describe how to connect to the regular power supply.

4.7.14 Automatic temperature controller and other regulators

Apply JIS C 6950-1 1.7.10.

4.7.15 languages

Safety instructions and device labeling shall be in a language accepted by the country in which the power storage system is installed.
Apply JIS C 6950-1 1.7.2.1 and 1.7.8.1.

4.7.16 Display durability

Apply JIS C 6950-1 1.7.11.

4.7.17 Detachable part

Apply JIS C 6950-1 1.7.12.

4.7.18 Replaceable battery

Apply JIS C 6950-1 1.7.13.

4.7.19 Approach of operator by using tools

Apply 1.7.2.5 of JIS C 6950-1.

4.7.20.2 Instruction manual

Other necessary information, such as the following, should be included in the user's instruction manual.
a) Built-in storage battery for a power storage system with a replaceable storage battery, follow the procedure below.

- Indicate the compatible recommended storage battery type in the instruction manual so that the storage battery can be replaced according to the instruction manual.
- Safety instructions for access by service personnel should be described in the installation manual or maintenance manual.
- When a service worker installs a storage battery, describe the explanation for internal connection including the terminal tightening torque.

The following explanation is described in the instruction manual.

- The maintenance and inspection of the storage battery shall be performed by a person who has knowledge of the storage battery and its handling precautions, or according to the instructions of that person.
- When replacing the storage battery, replace it with a storage battery or battery pack of the same type and number.

The following precautions for the built-in storage battery are described.

- "Caution: Do not dispose of the storage battery as combustible waste. It may explode in a fire."
- "Caution: Do not open or disconnect the storage battery.
  Leaked electrolyte may hurt your skin and eyes.
  In addition, electrolytes can be toxic."

b) Externally mounted storage battery

Externally mounted storage batteries shall be as follows.

- If the storage system manufacturer does not deliver the storage battery, describe the storage battery voltage, amp-hour (Ah) rating, charging method and protection method in the installation manual in order to cooperate with the protection device of the power storage system during installation.
- The instructions for the battery cell are provided by the battery manufacturer.

c) External battery box

If the power storage system manufacturer does not deliver the connection cable to the power storage system, attach the appropriate installation instructions for determining the cable size to the battery box provided with the power storage system.

If the storage battery cell or block is not pre-installed and wired, the storage battery manufacturer will supply the storage battery cell or block installation instructions unless otherwise stated in the battery storage system manufacturer's installation instructions.

Protection against energy hazards shall comply with JIS C 6950-1 2.1.1.5.

- NOTE 1 Exposed area containing energy hazards should be applied by service personnel with placement, encapsulation, protection, or covering, taking into account unintended bridges due to conductive materials.
- NOTE 2 Exposed areas operating at hazardous voltage levels should be placed or protected from contact during service of other components, including other components of the power storage system, as they do not come into contact with operation.

4.7.21 Installation Manual

If it is necessary to connect to a circuit such as a signal, relay, or emergency cutoff, explain the purpose and connection method appropriately in the installation manual.

It is advisable to note that the safety of TNV, SELV or ELV circuits connected to other equipment must be maintained.

In order to show that there is no problem with the distribution system, sufficient information including the basic circuit configuration of the power storage system will be described in the installation manual.

The various rules for wiring and the bypass circuit will be described with particular care.

The potential of the output neutral wire of the power storage system (grid interconnection method) depends on the potential of the input neutral wire, and there is a danger that the potential of the neutral wire will not be fixed due to power separation or power switching outside the power storage system. If there is a risk of this, describe it appropriately in the installation manual so that this neutral line fixed potential is not lost.

Only power storage systems that comply with the indications in 1.7.2.4 of JIS C 6950-1 can be used in the IT power system defined in Annex V of JIS C 6950-1. If additional external parts are required to meet this requirement, those parts shall be listed in the installation manual.

5 Basic design requirements

5.1 Protection against electric shock and energy hazards

5.1.1 Protection of power storage system intended for use in operator access area

The requirements and restrictions of JIS C 6950-1 2.1.1 apply.
The requirements for protection against electric shock to the energized conductive parts are premised on the operator being allowed to approach the following locations:

- Exposed part of SELV circuit
- Exposed part of current limiting circuit
- ELV circuit with specified conditions

➢ NOTE: Although TNV circuits are usually not designed as part of a power storage system, some power storage systems can be connected to an external TNV circuit, for example a power storage system with a communication line to the PSTN. The energy hazard protection requirements assume that there is no risk of injury even at hazardous energy levels.
Built-in and / or rack-mounted, or larger equipment-embedded power storage systems are tested for restricted access to the power storage system according to the installation method specified by the manufacturer.

5.1.2 Protection of power storage systems intended for use in service personnel access areas

The following requirements apply in the service worker access area.
The exposed parts to which the hazardous voltage is applied must be placed or protected from unexpected contact during service operations, including other parts of the equipment.
The exposed area to which the hazardous voltage is applied shall be placed or protected from accidental short circuits to the SELV or TNV circuits (e.g., by tools or test probes used by service personnel).
It does not specify requirements for access to SELV or TNV circuits.
However, exposed parts with hazardous energy levels shall be placed or protected from unexpected bridges due to conductive materials during service operations, including other parts of the equipment.
All protections required to comply with this clause must be easily removable and replaceable if they need to be removed for service.
Whether it conforms or not is confirmed by inspection or measurement.
Determining whether to consider unintended contact to occur considers whether the service worker has had the opportunity to approach in the past or has approached the exposed area to operate the other area.
See 2.1.1.5 c) of JIS C 6950-1 for the determination of the hazardous energy voltage.

5.1.3 Protection of power storage systems intended for use in restricted access locations

For power storage systems installed in restricted access areas, the requirements in the operator access area shall apply except for the following.
-There may be contact with the exposed part of the secondary circuit at a dangerous voltage by the test finger of JIS C 6950-1 Figure 2A (see 2.1.1.1 of JIS C 6950-1).
However, such parts shall be arranged or protected to prevent unintended contact.
• Exposed areas with hazardous energy levels must be placed or protected to prevent unintended bridges due to conductive materials during normal operation.
-Requirements for contact with exposed parts of TNV-1, TNV-2 and TNV-3 circuits are not specified.

5.1.4 Backfeed protection

Backfeed protection applies to stand-alone power storage systems.
The power storage system must prevent dangerous voltage or energy generated at the AC input terminal of the power storage system after a power failure of the AC input.
There should be no risk of electric shock to the AC input terminals when measured 1 second for plug-type power storage systems or 15 seconds for permanent connection power storage systems after disconnecting the input AC power supply.
In the case of a permanently connected power storage system, if any of the following applies, the requirement may be satisfied by using an AC input line separator outside the power storage system.

- Requirements apply to the input terminals of the separator.
- The power storage system supplier provides or specifies the appropriate isolation switch.
- Apply additional warning labels (4.7.3).

Compliance is confirmed by testing and inspecting the equipment and collating it with the relevant circuit drawings, and by simulating the failure state in accordance with Annex B.

When using an air gap for backfeed protection, the clearance shall apply JIS C 6950-1 2.10.3.3 for creepage and clearance, along with the following provisions:

A) With the manufacturer's confirmation, the output of the power storage system in the stored energy operating state may be regarded as the transient voltage of the secondary circuit of overvoltage category I. (Check the overvoltage category I values in Table 2J of JIS C 6950-1 by using the appropriate output voltage effective values of the power storage system for this purpose.)
B) The creepage distance and clearance distance must meet the requirements for basic insulation with a degree of fouling 2 (see Table 2M and Table 2N of JIS C 6950-1).

- NOTE: Reinforced insulation or equivalent insulation may be applied if the storage system contains neutral wires during stored energy operating conditions and either output conductor does not conform to the basic insulation to ground.
  Confirm by inspection whether it conforms.

5.1.5 Emergency opening / closing (disconnecting) device

The power storage system is provided with an emergency switchgear (or a terminal for a remote emergency switchgear) so that the power supply from the power storage system to the load can be stopped in any operating state simply by operating the switchgear.
When opening and closing the output supply of the power storage system by adding a switch or the like to the wiring equipment of the building, it is described in the installation manual to do so.
Where permitted by national wiring standards, this requirement does not apply to power storage systems for devices with output plugs.
NOTE The emergency switchgear is also called "EPO (emergency power off)".
Check for conformity by inspection and associated schematics.

5.2 Requirements for auxiliary circuits

5.2.1 Safety ultra-low voltage circuit-SELV

The provisions of JIS C 6950-1 2.2 are applied to all SELV circuits provided in the power storage system.

5.2.2 Communication network voltage circuit-TNV

The provisions of JIS C 6950-1 2.3 are applied to all TNV circuits supported by the power storage system.

- NOTE: Many power storage systems do not have TNV circuits, but it is advisable to consider applying them to TNV circuits that the power storage system can support, for example connecting to a PSTN.

5.2.3 Current limit circuit

The provisions of JIS C 6950-1 2.4 are applied to all current limiting circuits provided in the power storage system.

5.2.4 External signal circuit

The provisions of JIS C 6950-1 3.5 apply.

5.2.5 Limited power supply

The provisions of JIS C 6950-1 2.5 apply.

5.3 Protective grounding and bonding

5.3.1 General matters

The provisions of JIS C 6950-1 2.6 are applied together with the following provisions.
However, "green" can be used for the portion that requires "a combination of green and yellow" for the color of the insulating material of the protective ground conductor and the protective bonding conductor.

5.3.2 Protective ground

A single insulation failure of a Class I or Class 0I power storage system could impose a dangerous voltage in the event of an accessible conductive part that is securely connected to a protective ground terminal inside the power storage system.
NOTE In areas close to service personnel, it is desirable to connect conductive parts such as the frame of the motor and the chassis of the electrical equipment, where a dangerous voltage is expected to be applied in the event of a single failure, to the protective ground terminal.
If it is impossible or unrealistic, it is desirable to check that the part is not grounded and that no dangerous voltage is applied before touching it. (It is best to indicate to service personnel with an appropriate warning

label).
This requirement does not apply to accessible conductive parts that are separated from the parts to which the hazardous voltage is applied by any of the following:

- Separation by grounded metal parts.
- Separation that meets the requirements for double insulation or reinforced insulation with solid insulation or clearance, or a combination of these.

In this case, the relevant parts shall be securely fixed, and the minimum insulation distance shall be maintained even when the force specified in the tests of JIS C 6950-1 2.10 and 4.2 is applied.
Whether it conforms or not is inspected and confirmed by applying the applicable requirements of JIS C 6950-1 2.6.1 and 5.2.

5.3.3 Protective bonding

The output circuit of the power storage system shall refer to the protective grounding of the equipment required by the power system in which the power storage system is intended to operate.
Protective grounding and neutral conductor bonding apply to all operating conditions of the unit.
The physical bonding point may be outside the power storage system.
The AC output circuit of a type A plug-connected power storage system or a type B plug-connected power storage system in which the ground wire is not distributed separately from the power supply during normal operation does not require bonding in the stored energy operation state.
See Annex V of JIS C 6950-1 for the distribution system where the ground is supplied separately from the AC power supply.

- NOTE: In Annex V of JIS C 6950-1, the power system is classified as TNS, TNC, TT or IT according to the following conditions.
  - Bond conditions between the protective ground and the neutral wire (or phase conductor if there is no neutral conductor)
  - If there is a neutral conductor, separate the neutral conductor from the ground.
  - Grounding of the equipment structure

Class I or Class 0I Type A plug-in power storage systems:
With other Class I or Class 0I equipment, including an external battery box for the power storage system, and the power storage system, regardless of whether the grounding conductor of the power storage system input plug is disconnected from the power supply in the final system configuration. It is provided with a ground terminal, an outlet with a ground electrode, or other means so that the system can make an equal potential connection.
If special wiring connection is required, it will be explained in the instruction manual for the user.
Whether it conforms or not is confirmed by inspection and measurement of ground resistance at each connection point.

5.4 Separation of alternating current and direct current

5.4.1 General matters

The provisions of JIS C 6950-1 3.4 shall apply along with the following provisions.

5.4.2 Disconnector

Means must be provided to disconnect the power storage system from the power system for maintenance and testing by designated personnel.

- NOTE 1 The means for separation may be installed in the service worker access area or outside the equipment unless functionally necessary.
- NOTE 2 Disconnectors for maintenance and testing are usually designed for no-load operation and can be replaced by other means, such as the use of static selector switches, for harsh load conditions. For example, a disconnecting device or separating means from an internal or external DC power source such as a storage battery bank must open all ungrounded conductors connected to the DC power source. If the operation of the isolation switch occurs in connection with the storage system output voltage to protective ground because it differs from the requirements of 5.3.3, An alarm shall be given when the device is in operation, or a warning label shall be affixed near the disconnecting device or near its operating location.
- NOTE 3 This situation can occur when the 4-pole input isolation switch that supplies the neutral conductor to the power storage system is disconnected. When the operating means of the disconnecting device operates in the vertical direction instead of the rotating or horizontal direction, the upper side is set to the "ON" position. When the permanent connection power storage system receives power from multiple power sources, an appropriate display is given to each separation switch so that the power storage system can be disconnected from all power sources.

- NOTE 4 See Annex F for guidelines on disconnecting batteries during transport.

5.5 Overcurrent protection and ground fault protection

5.5.1 General matters

The provisions of JIS C 6950-1 2.7.3, 2.7.4, 2.7.5 and 2.7.6 shall apply along with the following provisions.

5.5.2 Basic requirements

Protects input / output circuits from overcurrent, short circuits, and ground faults as an integral part of the equipment or as part of building equipment.

- NOTE 1 Ground faults in this clause are different from the leakage currents specified in 4.7.12 and 4.7.13.
  Protective devices for building equipment shall provide short circuit and ground fault protection for the components of the power storage system configured in series with the main circuit input.
  Protected components include power cords, equipment couplers, RFI (Radio Frequency Interference) filters, bypass, and isolation switches.
  In addition, the protective device required to meet the requirements for abnormal operation and failure conditions specified in 8.3 shall be installed as an integral part of the power storage system.
  If protection is provided with a building equipment protector, the installation instructions must include 4.7.12 for protection of the building equipment.
  However, in the type A plug-connected power storage system, it is considered that the equipment of the building is protected according to the rating of the outlet, and 4.7.12 is not applied.
  The manufacturer must specify the effective value of the maximum fault current that can flow under the worst conditions so that the neutral wires, protective conductors, and phase wires that are permanently connected to the output circuit can be sized correctly.
  It is not necessary to specify the fault current if the manufacturer protects the output circuit or if the output is a Type A plug-in device.
  When the output current of the inverter is suppressed only by the current limiting circuit, the suppressed short-circuit current or overload current should not cause the danger assumed in this standard.
  Short circuit protection must be activated within 5 seconds.
- NOTE 2 The purpose of the requirements specified here is to prevent electric shock or fire during an output short circuit.
  The installation of an output circuit breaker with the same rating as the output circuit, or limiting the overcurrent with the same rating, is considered sufficient to meet this requirement.
  Whether it conforms or not is confirmed by inspection and functional test.

5.5.3 Battery circuit protection

5.5.3.1 Overcurrent and ground fault protection

The battery circuit shall be equipped with overcurrent protection and ground fault protection and shall comply with the requirements of 5.5.3.2 and 5.5.3.3.

- NOTE: The ground fault in this clause is different from the leakage current specified in 4.7.12 and 4.7.13.

5.5.3.2 Position of protective device

If the storage battery is built into the power storage system, the power supply circuit to the storage battery must be equipped with an overcurrent protection device.

- NOTE If the battery is installed outside the power storage system, it is advisable to install an overcurrent protection device near the battery in accordance with regional grounding regulations.
  Confirm by inspection whether it conforms.

5.5.3.3 Protective device rating

The rating of the overcurrent protection device built into the power storage system shall be able to protect against the conditions specified in 5.3.1 of JIS C 6950-1.
For a power storage system that is used separately from the storage battery:
The rating of the overcurrent protection device shall be specified in the instruction manual and shall be determined in accordance with the requirements specified in 6.2 in consideration of the current rating of the conductor connected between the power storage system and the storage battery.

- NOTE If the battery bank terminals are not directly grounded, the device should protect both terminals.
  Whether it conforms or not is confirmed by inspection.

5.6 Protection for people-safety interlock

5.6.1 Operator protection
The requirements for JIS C 6950-1 2.8 and compliance apply to areas accessible to the op**erator.**

5.6.2 Protection of service workers

5.6.2.1 Overview
If a service worker needs to reach around non-insulated or mechanically moving parts to adjust or measure the energizing system during voltage application:
The provisions of 5.6.2.2 to 5.6.2.8 and the requirements of JIS C 6950-1 2.8 apply.

5.6.2.2 Cover
The dangerous voltage or dangerous energy level part is configured, and the cover is arranged so that electric shock or large current does not flow when the cover is removed or returned.

5.6.2.3 Placement and protection of dangerous parts
When a service worker performs a mechanical operation as shown in the following example
Place, protect, or enclose parts of hazardous voltage or energy levels and dangerous mechanical moving parts.
Examples of mechanical operations include power storage systems such as control adjustment or resetting or similar operations, lubrication to electric motors, adjustment by dial setting (with or without scale), trip reset, manual switch operation, etc. Examples include mechanical operations performed during operation.

5.6.2.4 Part to be attached to the door
Installed on the back of the door and used at hazardous voltage and energy levels, protect, or insulate the voltage-applied components from accidental contact by service personnel.

Compliance with 5.6.1 to 5.6.2.4 is verified by inspection, measurement and use of test fingers (Fig. 2A of JIS C 6950-1).

5.6.2.5 Approaching parts
Parts that require inspection, reset, adjustment, inspection, or maintenance while applying voltage to the power storage system:
Consider the placement of other parts and grounded metal parts so that service personnel can approach without being exposed to dangers such as electric shock / danger due to energy level, danger due to large current energization, and injury due to moving parts in the vicinity. And install it in the proper position.
Access to parts shall not be blocked by other parts or wires.
When adjusting with a screwdriver or similar tool while applying voltage to the power storage system:
In accordance with the requirements of 2.8.3 of JIS C 6950-1, protection shall be provided to prevent inadvertent contact with non-insulated voltage-applied parts that may cause electric shock or energy.
Also consider touching the wrong position with a tool during adjustment.
This protection is provided by one of the following:
- Place the adjustment point away from the non-insulated part to which the dangerous voltage is applied.
- Protect the tool from contact with the voltage-applied part that is not insulated.

Whether it conforms or not is confirmed by inspection and, if necessary, simulation of failure.

5.6.2.6 Moving parts
Moveable parts that may be injured if touched shall be arranged or protected so that they will not come into contact with the parts when the equipment is operated.

5.6.2.7 Capacitor bank
A discharge device is installed in the capacitor bank to protect service personnel.
If the discharge time exceeds 1.0 second, attach a warning label stating the time required for the voltage to drop to a safe level (5 minutes or less) (JIS C 6950-1 1.2.8.5, 1.2. 8.8).

5.6.2.8 Built-in storage battery
The built-in storage battery should be arranged so that there is no risk of inadvertent contact with the terminals and electric shock, and internal wiring should be performed so that there is no short circuit or electric shock

during inspection and replacement.
If possible, include the following instructions or similar warnings in the instruction manual.

Note: Batteries can cause electric shock and large short circuit currents.

We recommend that you pay attention to the following precautions while handling the storage battery.

a) Remove the watch, ring or other metal object.
b) Use a tool whose hand-held part is electrically insulated.
c) Wear leather gloves and shoes.
d) Do not place tools or metal parts on the battery.
e) Before attaching or detaching the terminal of the storage battery, disconnect the power supply for charging the storage battery.
f) Do not ground the battery.
If it is grounded, remove the power supply from the ground.
A grounded storage battery may cause an electric shock no matter where you touch it.
The risk of such electric shock may be reduced if such grounding is removed during installation and maintenance (applicable to devices without grounding circuits and external battery circuits).

Check by inspection whether it conforms to 5.6.2.6 to 5.6.2.8.

5.6.3 Durability
The provisions of JIS C 6950-1 2.8.5 apply.

5.7 Spatial distance, creepage distance and distance through insulation
The provisions of JIS C 6950-1 2.10 apply.

5.8 Battery monitoring / control and power storage system protection
The power storage system manufacturer shall confirm with the storage battery manufacturer what to do when the battery is damaged and provide protective measures accordingly.
The power storage system manufacturer shall design in consideration of the following items in accordance with the agreement with the storage battery manufacturer.
a) Structural specifications for the housing in which the storage battery is inserted
(Distance from the floor, housing material, space distance, isolation of battery unit, etc.)
b) Battery monitoring and control
(Number of temperature sensors / liquid level sensors, charging current / DC voltage monitoring, etc.)
The monitoring and control of the battery system using the lithium secondary battery must comply with JIS C 8715-2.

6 Wiring, connection, and power supply

6.1 General matters

6.1.1 Overview
The provisions of JIS C 6950-1 3.1 are applied together with the following provisions.
The power cords supplied to the equipment and measuring devices inside the cover or door shall be installed so that the conductor is not mechanically damaged when the cover or door operates.
The neutral conductor of the three-phase power storage system is selected in consideration of the total harmonic current generated by the single-phase load.
Normally, only one conductor is connected to one terminal.
Connection of two or more leads to one terminal is only possible if the terminals are so designed.

6.1.2 Area and rating of conductors and insulating conductors
The cross-sectional area of the conductor inside the power storage system is selected by the manufacturer.
In addition to the energizing/flowing current, it is selected according to the mechanical stress assumed in the power storage system, the conductor arrangement method, the type of insulation, and if applicable, the element to be connected (for example, a semiconductor).
Conformity is confirmed by inspection and testing.

6.2 Connection to power supply

6.2.1 General requirements for connecting to a power supply

The provisions of JIS C 6950-1 3.2.2, 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.7, and 3.2.8 shall be applied together with the following provisions.

6.2.2 Connection method

The power storage systems are classified and connected as follows so that a safe and reliable connection to the primary power supply can be made (see 1.2.5.2 of JIS C 6950-1).

- Permanently connected power storage system: Terminal for permanent connection to the power supply
- Type B plug-connected power storage system: Non-detachable power cord or coupler for Type B equipment conforming to JIS C 6950-1 3.2.5
- Type A plug-connected power storage system: A device inlet for connecting a detachable power cord, or a non-detachable power cord that conforms to JIS C 6950-1 3.2.5.

If the power storage system can be connected to more than one power source (e.g., to accommodate power sources of different voltages or frequencies, or as a redundant power source), all the following must be met:

- Provide independent connection means for each different circuit.
- In the case of plug connection, if there is a risk of danger if it is inserted incorrectly, make it incompatible.
- Even when the connector is separated, the operator should not come into contact with exposed parts such as ELV or dangerous voltage plug connections.

Whether it conforms or not is confirmed by inspection.

6.3 Wiring terminal for external primary power supply wire

The provisions of JIS C 6950-1 3.3 apply together with the following provisions.

External cable glands and accessories, such as metal or wire exteriors, shall be equipped to prevent the movement of cables from the installation site.

The manufacturer specifies whether the terminals are compatible with copper conductors, aluminum conductors, or both.

The terminals must be able to fix the outer conductor with screws, connectors, etc. at a contact pressure corresponding to the current rating and short-circuit strength of the equipment and must be able to maintain energization.

Unless otherwise agreed between the manufacturer and the user, the terminals shall be compatible with copper conductors and cables of any cross-sectional area from minimum to maximum corresponding to the rated current (Annex E).

Compliance is checked by inspection, measurement, and installation of conductors with the minimum and maximum cross-sectional areas at the current shown in Annex E.

7 Physical requirements

7.1 Enclosure

The frame or chassis of the unit shall not be energized during the intended operation.

- NOTE Grounded frames or chassis may carry leakage currents or fault currents.
  Parts used as part of the enclosure's functionality, such as the display, controls, and nameplate, must meet the requirements of the enclosure.

Individual modules of modular units may be open if the enclosure of the entire unit when all modules are installed in place meets the requirements specified in 2.1 of JIS C 6950-1. (No enclosure or partial enclosure).

See 6.2.1 and JIS C 6950-1 1.7.7 for module identification methods and electrical connections between modules.

Enclosures allow protection of various parts of the power storage system.

Parts of the enclosure installed where it must meet the requirements for fire, electric shock, harm to the human body, and hazards due to hazardous energy levels shall comply with the applicable requirements for enclosures specified in this standard.

Whether it conforms or not is confirmed by inspection.

7.2 Stability

The provisions of JIS C 6950-1 4.1 are applied together with the following provisions.

The device or unit shall not have an unstable structure that would endanger the operator or service worker during normal handling.

When a means for ensuring stability is used, the means must operate automatically when the operator opens a drawer, a door, or the like.

If it does not work automatically, make an appropriate display to alert the service staff.
Whether it is compliant is confirmed by the applicable test from 7.3 to 7.7.
Each test is done separately.
During the test, the power storage system will be installed under the most severe conditions under normal use.
If it is equipped with casters, it will be the most unstable position.
The power storage system, with or without a built-in storage battery, must not tip over under the strictest conditions stipulated in JIS C 6950-1.

7.3 Mechanical strength
The provisions of 4.2 of JIS C 6950-1 apply.

7.4 Structural details

7.4.1 Overview
The provisions of JIS C 6950-1 4.3.1, 4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.3.7, 4.3.11, 4.4 and 4.5 shall apply along with the following provisions.
When installed according to the manufacturer's instructions, IP20 shall be provided as the minimum protection level unless a higher protection level is specified.
However, for outdoor use, IP23 must be provided.
Compliance is checked by inspection and test fingers unless a higher level of protection is specified, and the test fingers are replaced by the appropriate test method of JIS C 0920 (see Annex A).

7.4.2 Opening
The upper vertical openings of fire and electrical enclosures with exposed areas where hazardous voltage is applied must all have a linear distance of 5 mm or less in all directions.
However, this excludes parts with a structure that prevents falling objects from reaching exposed parts where dangerous voltage is applied by installing a trap or limiting plate (see Fig. 4B of JIS C 6950-1).
This requirement does not apply to top openings larger than 1.8 m in height.
Confirm by inspection whether it conforms.

7.4.3 Gas concentration
Equipment with a built-in storage battery shall take appropriate safety measures to prevent it from being filled with explosive gas and leaking to the inside or outside of the equipment during normal use (see 7.6 and Annex D).
Whether it conforms or not is confirmed by inspection.

7.4.4 Moving equipment
Devices with casters to facilitate movement to the installation site and connected with permanent fixed wiring after installation will be provided with additional fixing means to allow the housing to be fixed after installation.
For a power storage system with a mass of 25 kg or more, apply a force of 20% of the mass (however, up to 250 N) and check that the power storage system does not move.
Compliance is checked by inspection and testing.

7.5 Fire resistance
JIS C 6950-1 4.7 provisions apply along with the following provisions.
In addition, the flame retardancy requirements may conform to JIS C 6950-1, which is equivalent to 4.7.
A power storage system intended for use in an operator access area (see 5.1.1) shall comply with the minimum requirements of JIS C 6950-1 4.7.2.

7.6 Location of storage batteries

7.6.1 Arrangement and installation of storage batteries
The storage battery used in the power storage system should be installed in consideration of the requirements of 7.6.2 to 7.6.8.
Install the storage battery in the following location.

- Separate storage battery room or storage battery building
- Indoor or outdoor, separate battery storage panel or battery compartment

- Battery tray or storage battery compartment inside the power storage system

In the case of control valve type and other sealed type storage batteries, separation or partitioning is not required.

7.6.2 Accessibility and maintainability

Keep the battery terminals and connectors accessible so that they can be tightened and secured with appropriate tools.

A storage battery using an electrolytic solution is brought close to the liquid port plug of the storage battery so that the specific gravity of the electrolytic solution can be measured, and the electrolytic solution can be replenished.

However, this does not apply to storage batteries that do not require measurement of the specific gravity of the electrolytic solution and replenishment of the electrolytic solution.

Compliance is checked by inspection and application of tools and measuring instruments supplied or recommended by the battery manufacturer.

7.6.3 Distance

Battery cells are spaced apart to meet ventilation, battery temperature and insulation requirements.

The storage battery is arranged and installed so that the terminal of the cell prevents undesired contact with a nearby cell or a metal part of the storage battery compartment due to the movement of the storage battery.

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

7.6.4 Case insulation

The cells housed in the conductive case are:

Appropriately insulate between storage batteries and between storage battery storage panels or storage battery compartments.

Insulation for that purpose shall be performed so as to satisfy the requirements of 5.2 of JIS C 6950-1.

Whether it conforms or not is confirmed by a test.

7.6.5 Wiring

Contacts, connections, and wiring shall be protected in accordance with Clause 6 against the effects of ambient temperature, humidity, gas, vapor, and mechanical stress.

Compliance is checked by inspection and testing.

7.6.6 Electrolytic solution outflow

The trays and boxes of the storage batteries are coated with a resistant coating to protect the electrolyte from spillage.

This requirement does not apply to control valve lead-acid batteries and all-solid-state lithium-ion batteries.

Confirm by inspection whether it conforms.

7.6.7 Ventilation

Since a mixed gas of hydrogen and oxygen can explode, proper ventilation should be provided so that the gas concentration does not reach dangerous levels.

For lead-acid batteries, Annex D determines the ventilation required to adequately diffuse the mixed gas concentration in the storage battery compartment (separated from or integrated with the device).

In a device that integrates a storage battery and electrical components:

Be careful not to ignite when the hydrogen and oxygen concentrations are partially high due to the presence of arc-generating components such as contactors or switches near the battery exhaust valve.

To achieve the above, use fully enclosed components, separate battery compartments, or provide adequate ventilation depending on the structure of the storage system and battery.

In the test, the manufacturer must use technical data on the structure of the test storage system to show that the distance between the battery exhaust valve and the open arc generator is sufficient (see D.2 for guidance).).

If the storage battery is supplied with the power storage system, provide an appropriate description of the required ventilation volume in the installation manual for the storage battery compartment.

Compliance is checked by inspection, calculation, and measurement.

However, the above regulations are limited to storage batteries that may generate hydrogen gas:

The ventilation function can be omitted if there is no risk of hydrogen gas being generated due to the properties of the electrolytic solution and the structure of the storage battery.

- Note: There may be provisions regarding ventilation in ordinances.

7.6.8 Charging voltage

The storage battery must be protected from overvoltage due to the shutdown of the charger or interruption of the charging current, for example, in any single failure condition due to charging failure.
Similarly, it must be protected from a voltage drop caused by over-discharging due to an inverter failure.
The appropriate charging voltage limit value of the storage battery shall be the value specified by the manufacturer.
Whether it conforms or not is confirmed by circuit evaluation and performance test.

7.7 Temperature rise

The provisions of JIS C 6950-1 4.5 are applied.
However, Table 1 and Table 2 apply to the winding temperature.

Table 1-Allowable temperature

Insulation class (Insulation including winding insulation)	Maximum temperature ℃
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 2-Allowable winding temperature just before the end of stored energy operation

Temperature index	"Temperature by resistance method ℃"	"Temperature by thermometer method ℃"
105	127	117
120	142	132
130	152	142
155	171	161
180	195	185
200	209	199
220	216	206
250	234	224

8 Simulation of electrical requirements and abnormal conditions

8.1 General requirements for ground leakage current

The provisions of JIS C 6950-1 5.1.1 apply along with the following provisions.
In the case of a circuit configuration in which the sum of the earth leakage current of the electricity storage system and the load flows through the protective ground conductor of the electricity storage system under any operating condition, the electricity storage system must meet the following requirements.
Equipment interconnect systems that connect individually to AC mains test each element of the equipment separately.
The interconnection system of devices that are commonly connected to the AC main power supply is treated as a single device.

See also JIS C6950-1 1.4.10 when optional products are included.

- NOTE: Details of the interconnect system are given in Annex A of IEC 60990.

Devices designed to connect to multiple mains but require only one at a time (for example, for backup), are tested by connecting to only one power source.
Power storage systems that require power from more than one power source at the same time should be tested with all power sources connected.
If the earth leakage current exceeds 3.5 mA, the requirements of JIS C 6950-1 5.1.7 apply.
See 6.2.2 for how to connect the primary power supply.
Compliance is checked by inspection and relevant tests at the harshest input voltages.

8.2 Withstand voltage

The provisions of JIS C 6950-1 5.2 are applied together with the following provisions.

8.2.1 Impulse withstand voltage

Between the terminal (main circuit batch) connected to the commercial power system of the grid interconnection system power storage system and the ground:
A voltage with a crest length of 1.2 μs, a crest length of 50 μs, and a crest value of 5 kV is applied three times each for positive and negative electrodes at a minimum interval of 1 minute.
In this test, dielectric breakdown shall not occur through the flash path or insulation in the insulation gap.

8.2.2 Insulation resistance

If the space between the input / output terminals of the power storage system and the non-charged metal part, and the outer shell is an insulator:
The space between the metal foil that is in close contact with the outer surface is 500 V specified in JIS C 1302 (the rated voltage of the test product is 300 V or less).
Or
Measure with an insulation resistance tester of 1000 V (the rated voltage of the test product exceeds 300 V and 600 V or less), or an insulation resistance tester with equivalent performance.
The insulation resistance shall be 1 MΩ or more after the withstand voltage test of 5.2 of JIS C 6950-1 and the impulse withstand voltage test of 8.2.1.

8.3 Abnormal operation status and failure status

8.3.1 General matters

The provisions of JIS C 6950-1 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.5 and 5.3.9 shall be applied together with the following provisions.

8.3.2 Simulation of failure

For parts and circuits other than those specified in 5.3.2, 5.3.3 and 5.3.5 of JIS C 6950-1, confirm whether they are compatible by simulating the following failures.

- Failure of primary circuit parts
- Failure of parts that may adversely affect additional insulation or reinforced insulation if it fails
- Failure of all parts except equipment that meets the requirements of JIS C 6950-1 4.7.1 and 4.7.2.
- Failure caused by connecting the load impedance, which is the most severe condition, to the terminals and connectors that output power or signals from the power storage system.

However, terminals and connectors that output the input power as it is excluded.
A power storage system with forced ventilation restrains the rotor or fan of the blower motor and operates under normal operating conditions.
Power storage systems with one or more blower motors or fans are tested with each blower motor or fan constrained once.
A power storage system with a filter in the ventilation opening operates with the opening closed to represent a clogged fan.
The test is repeated with the ventilation opening first closed by approximately 50% and then completely closed.
However, one blower or fan with a filter does not need to be tested in a completely closed state.
Further, all blowers or fan motors in a unit having two or more blower or fan motors may be restrained at the same time.
If you have multiple outlets and the internal circuits are the same, you only need to test one outlet.
Parts of the primary circuit connected to the main input / output, such as power cords, equipment couplers, RFI filters, bypasses, switches, and their interconnect wiring, comply with JIS C 6950-1 5.3.4 a). If so, the failure is

not simulated.
Carefully study the specifications of the power storage system, circuit diagram, and component specifications, and simulate failures that may occur.

- NOTE Examples of failures:
  - Shorting and opening transistors, diodes and capacitors (especially electrolytic capacitors),
  - Failure to continuously energize a resistor designed to be energized intermittently,
  - An integrated circuit internal failure that causes excessive loss.

The test operates the power storage system at the rated voltage or the upper limit voltage of the rated voltage range.
The test may be performed as it is in the internal circuit of the power storage system or may be tested using a simulated circuit in which a component or subassembly is separated from the outside of the power storage system.
Transformers that supply power to components shall comply with the conformity criteria specified in 5.3.3 of JIS C 6950-1 and the temperature shall not exceed the values specified in Annex C of JIS C 6950-1.
Consider the exceptions mentioned in this annex.

8.3.3 Test conditions

Test the power storage system under all conditions that are expected when used normally and when misused.
The power storage system operates at the rated voltage or the upper limit voltage in the rated voltage range.

- NOTE: Examples of normal or misuse are shown below.
  - Operations that do not follow the manufacturer's instructions for accessible operating instruments such as knobs, levers, keys, and bars.
  - Sealing a group of vents that can be blocked at the same time.
    For example, it is conceivable to seal a group of ventilation ports on one side of the power storage system or a group of ventilation ports arranged at the top, and the groups of those ventilation ports are sealed in order.
  - Overload operation including load short circuit

In addition, storage systems with protective covers are installed in place and tested until the temperature stabilizes.

9 Connection to telecommunications network

The provisions of Clause 6 and 3.5 of JIS C 6950-1 apply along with the following provisions.
JIS C 6950-1 2.1.3, 2.3.1, 2.3.2, 2.3.3, 2.3.4, 2.3.5, 2.6.5.8, 2.10.3.3, 2.10.3.4, 2.10.4 and Annex M.

- NOTE: Clause 6 of JIS C 6950-1 is cited by the user to consider the provisions of JIS C 6950-1 5.1.8.

Annex A
(reference)

Guidelines for protection of water ingress and foreign solids

For power storage systems where the possibility of water intrusion and foreign solids intrusion is assumed in advance, an appropriate protection class is selected and applied from JIS C 0920.
An excerpt from JIS C 0920 is shown in this annex.
Parts to ensure the required level of protection against water ingress and foreign solids ingress should not be removed without tools.
Tables A.1 and A.2 are excerpts from JIS C 0920.
See JIS C 0920 for test conditions and conformity.

Table A.1-Protection class against invasion of foreign solids indicated by the first characteristic number

First characteristic number	Summary of protection grades	Definition of protection class
0	Unprotected	
1	Protects against foreign solids with a diameter of 50 mm or more.	The entire spherical, solid probe with a diameter of 50 mm must not invade a).
2	Protects against foreign solids with a diameter of 12.5 mm or more.	The entire spherical, solid probe with a diameter of 12.5 mm must not invade a).
3	Protects against foreign solids with a diameter of 2.5 mm or more.	A solid probe with a diameter of 2.5 mm must not enter at all a).
4	Protects against foreign solids with a diameter of 1.0 mm or more.	A solid probe with a diameter of 1.0 mm must not enter at all a).
5	Dustproof shape	Although it is not possible to completely prevent the intrusion of dust, there must be no amount of dust intrusion that interferes with the prescribed operation and safety of electrical equipment.
6	Dust resistant	There should be no intrusion of dust.
Note a) The full diameter portion of the solid probe must not pass through the opening of the enclosure.		

Table A.2-Second characteristic Number of protection against water ingress

Second characteristic number	Summary of protection grades	Definition of protection class
0	Unprotected	
1	Protects against vertically falling water droplets.	Vertically falling water droplets must also have no harmful effect.
2	Protects against water droplets that fall vertically even if tilted within 15 degrees.	When the enclosure is tilted to either side within 15 degrees of the vertical, water droplets that fall vertically shall not have a harmful effect.
3	Protect against spraying water	Water sprayed at an angle of up to 60 degrees from the vertical to both sides should not have any harmful effects.
4	Protect against splashing water.	Splashes of water from all directions must not have a detrimental effect.
5	Protect against water jets.	Nozzle jets from all directions should also have a detrimental effect.
6	Protect against powerful jets	Strong jets from nozzles from all directions must not have any detrimental effects.
7	Protects against water immersion	When the enclosure is temporarily submerged in water at the specified pressure and time, there shall be no ingress of water that would cause harmful effects.
8	Protect against use in diving conditions.	There shall be no ingress of water in an amount that would have a detrimental effect when the enclosure is continuously submerged under conditions more stringent than number 7.

Annex B
(Regulation)

Backfeed protection test

B.1 General matters

A touch current exceeding the limit value must not flow between all input terminals while the power storage system is in the stored energy operating state.
If the voltage measured with the input terminal open does not exceed the effective value of 30 V (peak value 42.4 V) for AC and 60 V for DC, it is not necessary to perform the next measurement.
Conformity is confirmed by testing B.2, B.3 and B.5 where applicable.
A single failure condition is determined in accordance with JIS C 6950-1 5.3.7.

B.2 Plug-type power storage system test

First, the power storage system is operated in the normal operating state.
Next, disconnect the AC input terminal or plug.
As a result, the power storage system operates in the stored energy operating state.
Test under no load, full load, and under conditions that can cause possible changes on the load side as specified in B.4 and confirm that the following performance is met.

A) When measured using the circuit specified in Annex D of JIS C 6950-1:
   The current between any two input terminals that can be touched by the user in normal and single failure conditions does not exceed 3.5 mA.
B) Protection after disconnecting the input AC power supply:
   Type A plug-connected power storage systems operate within 1 second, and Type B plug-connected power storage systems operate within 5 seconds.
   Then apply a single failure condition.

Repeat the above tests to see if they meet again.

B.3 Test of permanent connection type power storage system

First, the power storage system is operated in the normal operating state.
Next, disconnect the AC input terminal or plug except for the protective ground conductor.
As a result, the power storage system operates in the stored energy operating state.
Test with no load and full load to confirm that it conforms to the following performance.

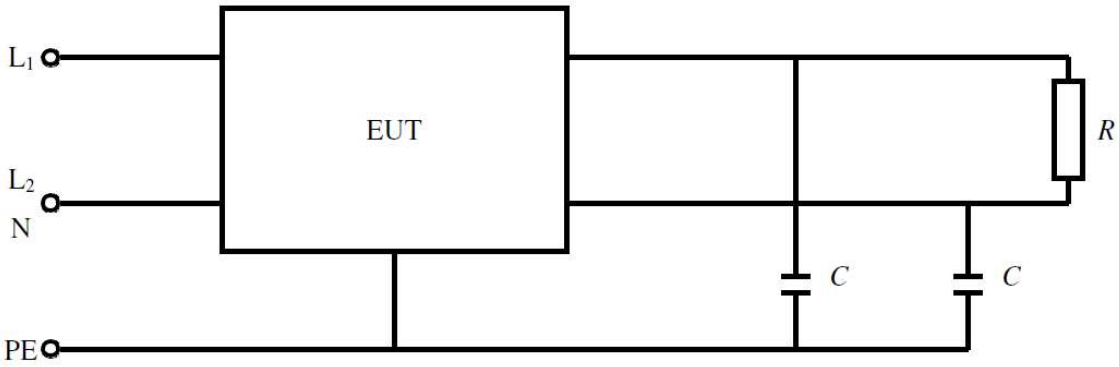
A) When measured using the circuit specified in Annex D of JIS C 6950-1:
   The current between any two input terminals that can be touched by the user in normal and single failure conditions does not exceed 3.5 mA.
B) Protection works within 15 seconds after disconnecting the input AC power.
   Then apply a single failure condition.

Repeat the above tests to see if they meet again.
If the backfeed protector is external:
Compliance is determined by reviewing the appropriate schematic and the operation of the external backfeed protector, which is required to operate within the specifications of the power storage system manufacturer to operate such circuits.

B.4 Possible changes on the load side

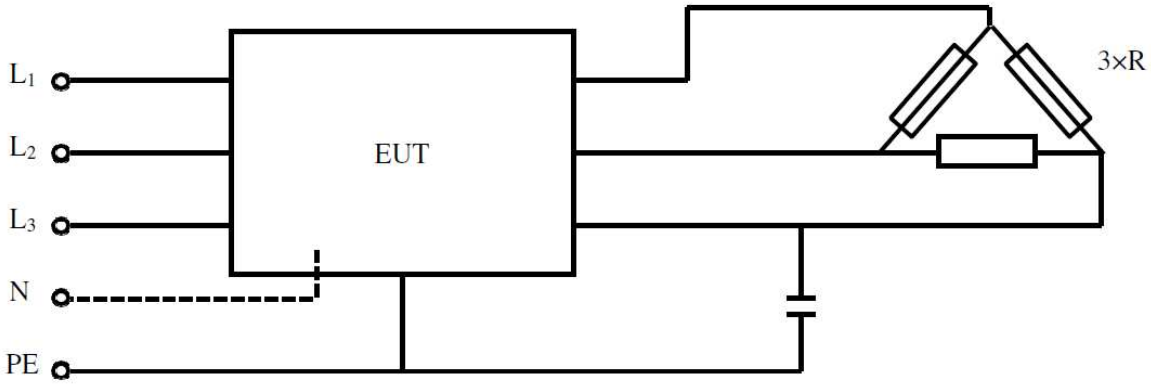
The potential for load changes can be caused by the sum of other methods adapted to the load changes due to ground current and can occur during the stored energy operating state of the energy storage system.
This condition is simulated by applying the test circuit in Figure B.1 or Figure B.2.
Figure B.2 applies to a three-phase system and simulates the asynchronous effects of a single-phase load.

- Note 1: Building equipment or distribution systems may be required to separate input neutral lines.
  In this case, it is necessary to pay attention to the potential of the neutral input unless the installation manual clearly states that the power storage system applies only to the three-phase synchronous circuit.
- Note 2: B.4 applies to plug-type power storage systems (see B.2).
  The purpose of this is to ensure that there are no dangerous conditions that could result in leakage currents or voltages that could occur in the load circuit through capacitance when the AC input terminal or plug is disconnected.
- Note 3: C simulates the expected capacity.
  The value of C is a fixed value as shown in Fig. B.1 and Fig. B.2.



EUT: Test storage system
C: Capacitor 22 nF
R: Value specified by the load resistance manufacturer that provides the maximum output active power at power factor 1.

Figure B.1-Circuit diagram for considering possible failures on the load side: Single-phase output



EUT: Test storage system
C: Capacitor 22 nF
R: Value specified by the load resistance manufacturer that provides the maximum output active power at power factor 1.

Figure B.2-Circuit diagram for considering possible failures on the load side: Three-phase output

B.5 Solid back feed protection

In addition to the requirements of B.2 and B.3, if backfeed protection is provided by a power semiconductor device and the isolation switch is not redundant:
The parts required to ensure backfeed protection must withstand the effects of transient overvoltage, voltage fluctuations, electromagnetic sensitivity and electrostatic discharge specified in JIS C 4411-2 7.1-7.5. See JIS C 4411-3 7.1 and 7.2 for environmental tests.

Annex C

(Regulation)
Reference load

C.1 General matters

Connect a load that meets the manufacturer's specifications to the power storage system according to the instruction manual.
If you do not know the specifications, connect the reference load of C.2 to C.5.
Linear loads and non-linear loads other than those specified here may be connected to the power storage system.
The most common linear loads are shown below.

- Resistive load
- Inductive resistance load
- Capacitive resistance load

Non-linear loads include the following loads.

- Capacitor input type rectifier load
- Load controlled (phase control) by thyristor or magnetic amplifier

Capacitor-input rectifier loads are most common for low power loads less than 3 kVA.
The load can be characterized by the following values.
S: Output apparent power (VA)
P: Output active power (W)
λ: Power factor. $\lambda = P / S$
U: Output voltage (V)
f: Output frequency (Hz)

C.2 Reference resistance load

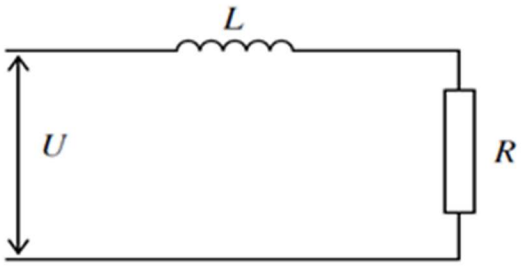
For the reference resistance load, the power storage system loads a resistor below the nominal power.

$$R = \frac{U^2}{P}$$

C.3 Inductive resistance load

For inductive resistance loads, connect the reactor in series or in parallel with the resistor.
The resistance (R) and the inductance (L) of the reactor are calculated by the following equations.

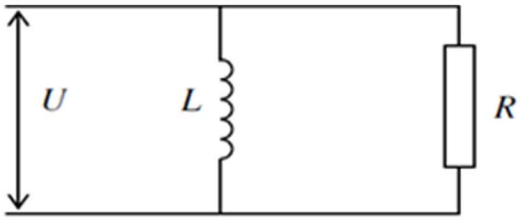
a) Series connection



$$R = \frac{U^2 \lambda}{S}$$

$$L = \frac{U^2 \sqrt{1 - \lambda^2}}{2\pi f S}$$

b) Parallel connection



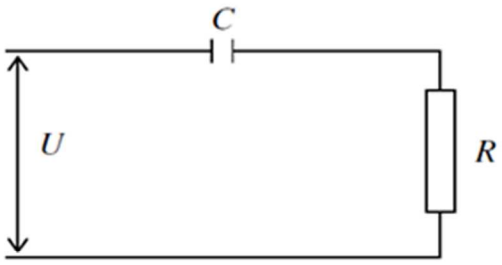
$$R = \frac{U^2}{S\lambda}$$

$$L = \frac{U^2}{2\pi f S \sqrt{1 - \lambda^2}}$$

C.4 Capacitive resistive load

For capacitive resistor loads, connect the capacitor in series or in parallel with the resistor.
The resistance (R) and the capacitance (C) of the capacitor are calculated by the following equations.

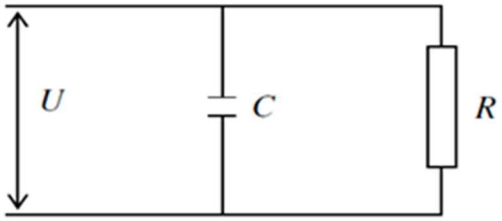
a) Series connection



$$R = \frac{U^2\lambda}{S}$$

$$C = \frac{S^2}{2\pi f S\sqrt{1-\lambda^2}}$$

b) Parallel connection



$$R = \frac{U^2}{S\lambda}$$

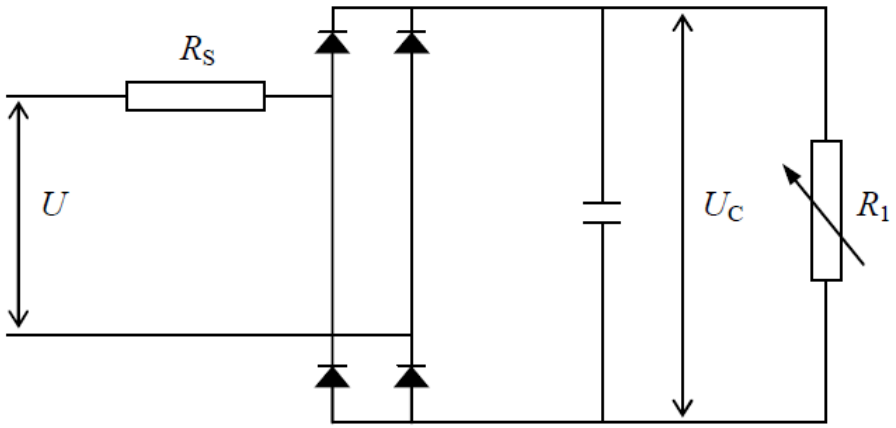
$$C = \frac{S\sqrt{1-\lambda^2}}{2\pi f S}$$

C.5 Reference nonlinear load

C.5.1 General matters

In order to simulate a single-phase capacitor input type rectifier load in a steady state, a bridge-connected diode rectifier in which a capacitor and a resistor are connected in parallel to the output is used as the load of the power storage system.

The load may be composed of a single load or an equivalent load in which a plurality of loads are connected in parallel.



UC: Rectifier DC voltage (V)

R1: Load resistance

- The value at which the active power consumption is 66% of the apparent power output S.

RS: Series power resistance
- Make sure that the active power consumption is 4% of the total output apparent power S.
(4% is the voltage drop of the power line proposed by IEC / TC 64.).

The peak-peak ripple voltage 5% of the rectifier DC voltage U_C corresponds to the time constant of $R_1 \times C = 0.15$ (seconds).
Considering the voltage peak value, voltage distortion rate, cable voltage drop, and ripple of rectifier DC voltage, the average value of rectifier output voltage U_C is given by

$$\boldsymbol{U_c = \sqrt{2} \times (0.92 \times 0.96 \times 0.975) \times U = 1.22 \times U}$$

The values of the resistor's R_S and R_1 and the capacitor C are calculated by the following equations.

$$\boldsymbol{R_s = 0.04 \times U^2/S}$$
$$\boldsymbol{R_1 = (U_c)^2/(0.66 \times S)}$$
$$\boldsymbol{C = 0.15_s/R_1}$$

- NOTE 1: The above describes the case where the frequency is 50 Hz, the output voltage distortion rate is up to 8%, and the power factor is $\lambda = 0.7$ according to IEC 61000-2-2.
  (That is, 70% of the output apparent power S is consumed as active power by the two resistors R_1 and R_S).
- NOTE 2: The resistor R_S may be connected to either the AC or DC side of the rectifier bridge.
- NOTE 3: The actual values of the parts used in the test should be within the following range with respect to the calculated values.
  R_S: ± 10%
  R_1: Adjust by test to reach the rated output apparent power.
  C: 0 to + 25%
- NOTE 4: The value of capacitor C is also applicable at 60 Hz.
- NOTE 5: This standard does not cover electronic ballasts (IEC 61347 and IEC 60929).

C.5.2 Test method

The following test method is applied.

A) Connect the reference nonlinear load to the AC power system with a voltage equal to the rated output voltage of the test power storage system.
B) The impedance of the AC input power supply should be such that the distortion rate of the AC input voltage does not exceed 8% when this test load is connected (as specified in IEC 61000-2-2).
C) Adjust the resistor R1 so that the input apparent power of the reference nonlinear load is equal to the rated output apparent power (S) of the test power storage system.
D) After adjusting the resistor R1, connect the reference nonlinear load as it is to the output of the test storage system without readjustment.
E) Perform the test with the reference nonlinear load according to the relevant clauses and use the test load without further adjustment while collecting data.

C.5.3 Connection to reference nonlinear load

The reference nonlinear load is connected as follows.

A) For single-phase power storage systems, use a reference nonlinear load of apparent power S equal to the rated apparent power of the power storage system up to 33 kVA.
B) For single-phase power storage systems above 33 kVA, connect a reference nonlinear load with an apparent power S of 33 kVA and add a linear load up to the rated apparent power and rated active power of the power storage system.
C) For three-phase power storage systems up to 100 kVA designed for single-phase loads:
   Three single-phase reference nonlinear loads of equal capacitance are connected between each phase and neutral phase or between lines, depending on the design of the power system and power storage system defined by national standards.
D) For a three-phase power storage system with a rating above 100 kVA, connect the load according to c) up to 100 kVA, and add a linear load up to the rated apparent power and rated active power of the power storage system for the amount exceeding 100 kVA.

Annex D

(Regulation)

Ventilation of power storage system using lead-acid battery

D.1 General matters

Since the storage battery may generate gas when it is rapidly discharged, overcharged, or used in the same manner, the storage battery panel, or the storage battery chamber for storing the storage battery must be ventilated.

Ventilation should be done so that the airflow reaches every corner of the battery compartment so that the concentration of the mixed gas, which can be harmful to humans, does not increase or partially accumulates (for example, hydrogen gas).

The requirements of this annex assume that the mixed gas is lighter than air (eg, hydrogen gas).

Therefore, since the mixed gas may accumulate, it may be necessary to provide an additional ventilation port at the top of the battery panel or the battery compartment.

Parts that generate arcs, such as switches, circuit breakers, and relay contacts, are located inside the battery panel or battery compartment that houses the batteries: They must be located below 100 mm of the battery exhaust valve.

However, this does not apply when completely sealed parts are used or when the storage battery compartment is separated.

In addition, an exhaust port from the storage battery portion shall not be provided near these parts.

To meet this requirement, fuses or connectors must have no arcing parts.

A sensor (such as a temperature sensor) that monitors the storage battery or the storage battery panel or the storage battery chamber may be arranged in the storage battery panel or the storage battery chamber.

D.2 Normal use condition

Under normal pressure and temperature, the low explosion level of hydrogen in the mixed gas has a hydrogen concentration of 4% by volume.

The exhaust specified in D.1 must be a ventilation method that prevents the concentration of hydrogen exceeding 0.8% by volume under normal and charged conditions (to ensure a safety factor of 5 assuming an abnormal situation).

Assuming that most of the charging energy is gas, a fully charged lead-acid battery produces about 0.028 3 m3 of hydrogen gas per 63 Ah capacity per cell (0.45 x 10-3 m^3 / Ah).

If the required ventilation volume is not clear, determine by measuring the gas concentration under normal and abnormal conditions as specified in this annex.

If the input voltage increases within the tolerance of the power storage system: In a power storage system equipped with an adjustment circuit that prevents an increase in battery charging current and voltage, the following equation may be used to measure the ventilation required for a lead-acid battery compartment that meets the ventilation requirements of this annex.

$Q = vqs\,nIC$

Here, Q: Ventilation volume (m^3 / h)

v: Required dilution of hydrogen (100-4) / 4 = 24

q: Hydrogen generated per Ah 0.45 × 10-3 (m^3 / Ah)

s: Safety factor

n: Number of storage battery cells

I: 2 A / 100 (Ah) (for vent type storage battery)

I: 1 A / 100 (Ah) (for vent type storage batteries using low antimony alloy)

I: 0.5 A / 100 (Ah) [For sealed storage battery (catalyst plug type)]

I: 0.2 A / 100 (Ah) (for control valve type storage battery)

C: 10-hour rated capacity (Ah)

- Note 1 : The coefficient I corresponds to the typical numerical value of 2.4 volt per cell index at 25 ° C so that it can be charged evenly (boost charge) and can be used in a wider ambient temperature range in the case of control valve batteries.

  By adopting the safety factor s = 5, the formula of Q can be simplified to the following formula.

  $vqs = 0.054$ (m^3 / Ah)

  $Q = 0.054nIC$

  This ventilation volume should be secured by natural ventilation as much as possible, and if not possible, forced ventilation should be performed. The gap between the intake and exhaust ports must allow natural ventilation of the airflow. The average velocity of the airflow passing through the gap shall be about 0.1

m / s (360 m / h) or more.
In order to provide natural ventilation, the intake and exhaust ports of the storage battery compartment must have the following areas or more.

$$A \geqq Q / 360$$

Here, A: Area of intake port and exhaust port (m^2)

- Note 2 : Natural ventilation can only be applied when the power consumed to generate hydrogen is below a certain value. Beyond that, the dimensions of the ventilation openings become unrealistic.
  The range of natural ventilation is determined by the capacity and number of cells of the storage battery, the type of storage battery (vent type, control valve type), and charging voltage.
  If an appropriate distance is secured between a part with a high temperature exceeding 300 ° C or a part that generates sparks and a vent or pressure release valve of the storage battery, sufficient safety against an explosion can be ensured by the above calculation method.
  It is considered safe enough in the battery compartment at a distance of 500 mm.
  The distance may be shortened depending on the degree of ventilation in the storage battery board, the storage battery box, and the storage battery built in the power storage system.
  The "strictest charge rate" in the above description is the maximum charge rate at which the heat protection device or the overcurrent protection device does not operate.

D.3 Closed

The ventilation method of the storage battery panel or the storage battery chamber for accommodating the storage battery must meet the requirements even in an abnormal state such as fan stop and filter clogging.
Under the test conditions specified in 8.3.1, the ventilation method of the battery panel or battery compartment shall comply with the requirements of D.1. The maximum hydrogen gas concentration during and after the test shall not exceed 2% by volume in consideration of the safety factor of 2.

D.4 Overcharge test

If a measurement is needed to determine if the battery panel or battery compartment that houses the battery is D.2 compliant: The charger is connected to the AC input voltage adjusted to 106% of the rated voltage of the power storage system, and overcharges for 7 hours when the storage battery is fully charged. The control setting value of the storage battery charging circuit that can be adjusted by the user is adjusted so as to have the strictest charging rate.

- ✧ Exception 1: This requirement does not apply to power storage systems that use battery charging circuits that have not been tested in combination with power storage systems.
- ✧ Exception 2: This requirement does not apply to power storage systems that have an adjustment function that does not increase the battery charging current even if the AC input voltage rises to 106% of the rated value.

During and after the test, the maximum hydrogen gas concentration shall not exceed 2% by volume.
The measurement is performed by collecting air in the storage battery panel or storage battery chamber at 2, 4, 6 and 7 hours during the test.
The air in the storage battery chamber is sampled at the place where the concentration of hydrogen gas is considered to be the highest, using an aspirator equipped with a concentration measuring device or an equivalent method.

Annex E

(Regulation)

Minimum and maximum cross-sectional areas of copper conductors used for connection (see 6.3)

Table E.1 applies when connecting one copper conductor per terminal.

Table E.1-Cross section of conductor (excerpt from IEC 60439-1)

Unit mm^2

Rated current	Sectional area			
	Solid or stranded hard conductor		Flexible conductor	
(A)	Minimum	Maximum	Minimum	Maximum
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

NOTE

If conductors other than those listed in this table need to be used, the terminals should be sized accordingly.

Annex F

(reference)

Guidelines for disconnecting storage batteries during transportation

This annex is used only as a guide. It may become an annex (regulation) in the future.

F.1 Applicable products

This annex applies to power storage systems or battery panels with built-in lead-acid batteries.
Currently, F.2 to F.5 are used only as guidelines for use.
It may become an annex (regulation) in the future.

- Note: For lithium secondary batteries, it is necessary to follow the recommendations regarding the transportation of dangerous goods.

F.2 Separation of storage battery

It is desirable for the manufacturer to have a means for disconnecting the battery during transportation.
The means should be arranged as close to the storage battery as possible, and should be on the storage battery side from the point where the storage battery is connected to other electric components or circuits including the circuit part of the printed wiring board.

F.3 Label to be attached to the package or display on the package

It is advisable to attach a caution label to the package to give caution as to whether the batteries in the package have been disconnected.
Manufacturers should use Figure F.1 or a similar label for products with batteries removed prior to transport.

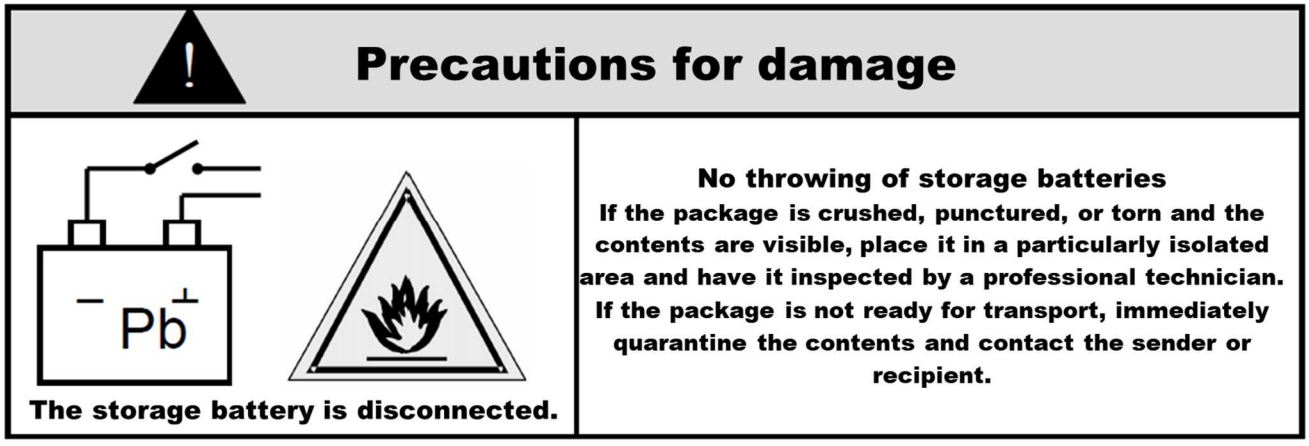


Figure F.1-Caution label for products that are transported with the storage battery separated

Manufacturers use Figure F.2 or similar labels for products that are shipped without disconnecting the battery.

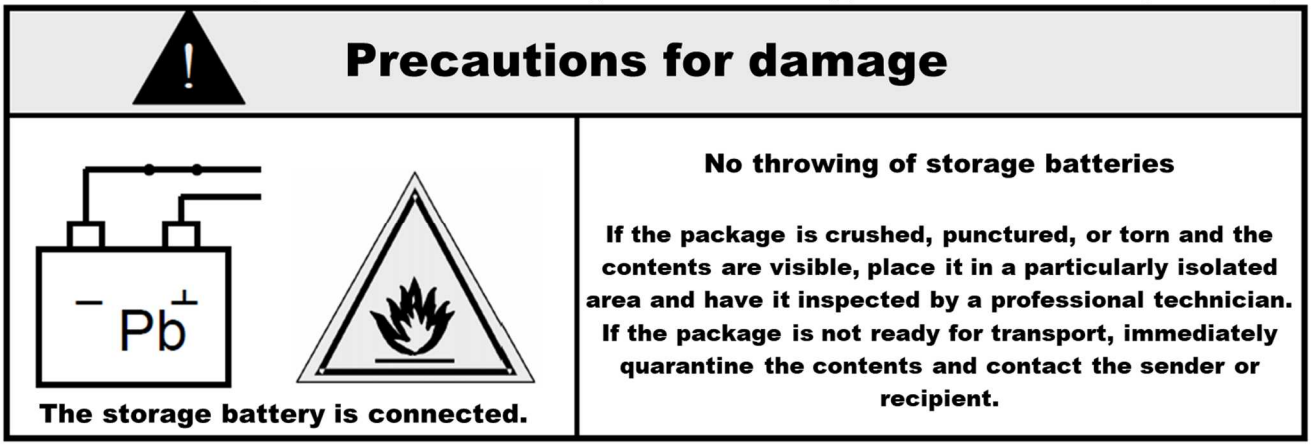


Figure F.2-Caution label for products transported with the storage battery connected

- Note: "Pb" in the graphic symbols of the storage batteries in Fig. F.1 and Fig. F.2 represents lead-acid batteries. For other batteries, write the appropriate chemical symbol.

F.4 Damage inspection

Isolate crushed, perforated, or torn containers (so that the contents are visible) and have a professional technician inspect them.

If the container is determined to be unbearable for shipping, the contents should be collected and quarantined immediately.
Also, contact the sender or recipient.
Manufacturers should explain these guidelines to the carriers and handlers of the applicable products.

F.5 Importance of safe handling

Power storage system manufacturers perform comprehensive testing according to this standard to ensure that the equipment delivered is safe for air transportation.
However, in this case as well, it is important to understand that "damage to a storage system or battery panel with a built-in battery poses fire, smoke or similar hazards."
These products should be handled with care and inspected immediately if damaged.

References

JIS C 4411-3: 2004 Uninterruptible Power Supply (UPS) -Part 3: Performance and Test Requirements
IEC 60439-1: 2004, Low-voltage switchgear and control gear assemblies-Part 1: Type-tested and partially type-tested assemblies
IEC 60929, AC and/or DC-supplied electronic control gear for tubular fluorescent lamps-Performance requirements
IEC 60990: 1999, Methods of measurement of touch current and protective conductor current
IEC 61000-2-2, Electromagnetic compatibility (EMC) -Part 2-2: Environment-Compatibility levels for low-frequency conducted disturbances and signaling in public low-voltage power supply systems-Basic EMC publication
IEC 61347 (all parts), Lamp control gear

JIS C 4412-1: 2014

Low Voltage Power Storage System Safety Requirements-Part 1: General Requirements Explanation

This commentary explains what is specified and described in the standard and is not a part of the standard. This commentary is edited and published by the Japanese Standards Association, and the contact for inquiries regarding this is the Japanese Standards Association.

1 Purpose and background of enactment

In recent years, especially after the Great East Japan Earthquake, power storage systems have been used for the purpose of continuously supplying power to electrical equipment for several hours even during a power outage, or using the charged power in the daytime (peak cut / peak shift), this has accelerate the commercialization and is expected to spread rapidly in the future.

Under these circumstances, the Ministry of Economy, Trade and Industry (METI) stated in the 2011 Third Supplementary Budget, A subsidy project for the introduction of stationary lithium-ion batteries was planned for the purpose of demand-side measures (peak cuts, backup measures in the event of a power outage) based on the power supply and demand situation and promotion of the spread of lithium secondary batteries.

Many power storage systems use lithium secondary batteries as storage batteries, but the safety of lithium secondary batteries alone was already standardized by the Battery Industry Association (BAJ) at the time of the subsidy business plan.

SBA S 1101 [Safety test of industrial lithium secondary battery (cell and battery system)] 1) was established. However, there was no safety standard for a power storage system including a power converter.

For this reason, in October 2011, the Japan Electric Industry Association (JEMA) was informed of the safety standards for power storage systems that could be cited by METI and BAJ as subsidy target standards for subsidy projects (hereinafter referred to as subsidy safety standards). There was a request to prepare the draft, and JEMA decided to prepare the draft.

With this situation, in order to discuss efficiently, JEMA decided to create subsidy safety standard based on the safety standard (IEC 62040-1) of the uninterruptible power supply (UPS), which has a similar circuit configuration, summarizing only the differences from the standard as differences.

As a result, the draft of the subsidy safety standard was completed at the end of January 2012, and the subsidy was targeted at the external review committee held in March of the same year at the General Incorporated Association Environmental Co-creation Initiative, which is the subsidy business execution organization.

Following the decision to be cited as a standard, the public offering of subsidies for the project cost for promoting the introduction of stationary lithium-ion batteries was started on March 30, the same year.

After that, JEMA continued to prepare the draft of the Japanese Industrial Standards (JIS) including the provisions of IEC 62040-1 so that the contents of this subsidy safety standard could be applied more widely and established this standard.

Note 1) JIS C 8715-2: 2012 was established based on SBA S 1101.

2 Matters that became a particular problem during deliberation

The main issues that became a problem in the deliberation on the establishment of this standard are as follows.

A) Positioning of this standard the power storage system, especially the stand-alone power storage system, has almost the same circuit configuration as the UPS. Therefore, we believe that hardware safety can be guaranteed by conforming to the UPS safety standard, and this standard was created based on the UPS safety standard IEC 62040-1. However, there are a wide variety of power storage systems depending on the capacity range, application, and the presence or absence of grid interconnection, and there are also standards and certification systems that are applied to similar devices. Therefore, we decided that it was not appropriate to cover the safety of all power storage systems with one standard.
   Power storage systems for specific applications and methods will be established as individual standards. This standard is generally positioned as applicable to power storage systems that do not have individual standards [see Clause 3c) of the explanation for details].

B) Handling of performance requirements
   In the subsidy safety standards, electromagnetic interference and environmental tests were also stipulated as matters stipulated by the Electrical Appliance and Material Safety Law, the Electrical Appliance and Material Technical Standards (hereinafter referred to as the Electric Safety Law, etc.), and similar standards.
   In addition, in consideration of safety to the load, the power quality to the load was also specified independently.

However, the normal safety standard does not stipulate matters related to these performances, and IEC 62040-1, which is the basis of this standard, also stipulates another standard.
In consideration of this situation, this standard stipulates only safety requirements thus it was decided not to specify the electromagnetic interference, environmental tests, and power quality for loads specified in the subsidy safety standards.

C) Battery monitoring / control and power storage system protection
For lithium secondary batteries, which have become widespread in recent years, SBA S 1101 and JIS C 8715-2 stipulate the monitoring and control of storage batteries as a battery management unit (BMU).
However, in the power storage system, it is necessary not only to monitor and control the state of the storage battery, but also to protect the storage battery as a power storage system even if an abnormality occurs.
IEC62040-1, which is based on this standard, seems to assume a lead-acid battery that is commonly used in UPS as a storage battery.
Assuming the safety of lithium secondary batteries, 5.8 stipulates the protection of the power storage system against storage batteries in addition to the monitoring and control of storage batteries.

3 About the scope of application

As described in Clause 2 of the explanation, there are a wide variety of power storage systems, and there are also standards and certification systems that are applied to similar devices.
The outline is shown below.

A) Relationship with UPS
The stand-alone power storage system has almost the same circuit configuration as the UPS, but the UPS is a device aimed at ensuring the continuity of load power, and the required performance is also different.
Regarding UPS, standards are being developed as IEC 62040 series and corresponding JIS C 4411 series, and JIS, a safety standard, is expected to be established in the future, so UPS is basically excluded from the scope of this standard.
However, some stand-alone power storage systems have a function to ensure the continuity of load power, like UPS, and most of them use lithium secondary batteries.
Since it is an urgent task to ensure the safety of devices equipped with lithium secondary batteries, we have decided to make such a power storage system subject to this standard.

B) Handling of grid interconnection protection function
When connecting to a low-voltage distribution system, it is essential to comply with the technical standards for electrical equipment, JEAC 9701 (system interconnection regulations), etc.
In addition, for distributed power sources that are grid-connected to low-voltage distribution systems, the certification standards of the Institute of Electrical Safety and Environment (JET) have been established, and the grid interconnection protection function is also stipulated.
Therefore, this standard does not specify the grid interconnection protection function, but only the items related to the structure of the power storage system such as mechanical and electrical safety.
In 2012, JET certification standards were established for grid-connected power storage systems of 10 kW or less.

C) Separate power conditioner
Distributed power sources for grid-connected power storage systems, especially photovoltaic power generation systems.
In the case of a system integrated with the system, a power storage system may be configured by combining a "power conditioner" in which a power conversion device unit and a grid interconnection protection device are integrated and a storage battery.
The safety of the power conditioner alone is ensured based on the JET certification standards mentioned above, but the structure is manufactured based on the Electrical Safety Law, etc., and individual requirements do not necessarily meet this standard.
Therefore, such a power conditioner is called a "separate type power conditioner", and individual standards based on the Electrical Safety Law etc. are referred to as Part 2 (JIS C 4412-2) in the standard group of this standard. It was enacted so that any standard can be applied.

D) Industrial, large-capacity power storage system
IEC 62040-1 also covers industrial and large capacity UPS,
It is difficult to adapt each requirement as a device, and there are some that can be satisfied as a facility.

In Japan as well, storage battery equipment, including UPS, is subject to the technical standards for electrical equipment, the certification system of the Battery Industry Association, and the Tokyo Metropolitan Fire Prevention Ordinance, depending on the conditions.
Considering that it is difficult to clearly define the scope of coverage, it is not explicitly exempted, but it may be difficult for such a power storage system to comply with this standard.

E) Batteries to use
Under the subsidy safety standards, the target batteries are limited to lithium secondary batteries.
However, due to economic efficiency and ease of handling, many power storage systems using other storage batteries such as lead batteries are on the market, so this standard does not limit the types of storage batteries.

4 Concerns

As described in Clause 3d) of the explanation, it may be difficult to comply with this standard for industrial and large-capacity power storage systems.
While there is an idea that such a power storage system should conform to existing technical standards as equipment, it is also requested to establish individual JIS.
In the future, we will consider establishing JIS for such power storage systems as an individual standard.

5 Composition table of the drafting committee

The composition table of the drafting committee is shown below.

Power storage system JIS draft draft This committee composition table

	Name	Affiliation
(Chair)	Yoichi Hayashi	Aoyama Gakuin University
(Member)	Yasufumi Akagi	Tokyo Institute of Technology
	Tamotsu Ninomiya	Nagasaki University
	Masaharu Yoshizawa	Institute for Electrical Safety and Environment
	Keiichi Hirose	NTT Facilities, Inc.
	Shigeyuki Totsugi	Federation of Electric Power Companies of Japan
	Hayashiya Hitoshi	East Japan Railway Company
	Babazaki Tadashi	Nippon Telegraph and Telephone Corporation
	Takahiro Baba	General Incorporated Association Electronic Information Industry Technology Association (Japan IBM Japan Ltd.)
	Natsuko Oishi	Japan Consumer Association
	Masashi Satohara	Yaskawa Electric Corporation
	Yoshihiro Yamada	Hitachi, Ltd.
	Takumi Kimura	GS Yuasa Co., Ltd.
	Yukio Takahashi	Sony Corporation
	Kenji Yamaguchi	Panasonic Corporation
	Masato Shirakata	General Incorporated Association Battery Industry Association (NEC Energy Device Co., Ltd.)
	Hideo Nagai	Japanese Standards Association
(Participation)	Satoshi Kawakami	Information and Communication Equipment Division, Ministry of Economy, Trade and Industry
	Ryoji Suruga,	Information and Communication Equipment Division, Ministry of Economy, Trade and Industry
	Tatsuya Tomita	Policy Division, Ministry of Economy, Trade and Industry
	Kunio Iwaya	Ministry of Economy, Trade and Industry New Industry and Social Systems Promotion Office
	Katsuchi Inagaki	Ministry of Economy, Trade and Industry Environmental Life Standardization Promotion Office
(Secretariat)	Kenichi Kaneko	General Incorporated Association Japan Electric Industry Association Home Appliances Department

	Kenichi Hagiwara	New Energy Department, Japan Electric Industry Association
	Kunihiko Egawa	General Incorporated Association Japan Electric Industry Association Engineering Department
	Hiroshi Inoue	Engineering Department, Japan Electrical Manufacturers' Association

Power storage system JIS drafting subcommittee composition table

	Name	Affiliation
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(Member)	Takashi Mashima	IHI Corporation
	Hideki Morioka	Erie Power Co., Ltd.
	Tomohiro Miki	Kyocera Corporation
	Kenji Teraoka	Sanken Electric Co., Ltd.
	Kazuo Yamada	Sharp Corporation
	Hiroshi Ohno	Shin-Kobe Electric Machinery Co., Ltd.
	Ken Fujimoto	Seiko Electric Mfg. Co., Ltd.
	Yukio Takahashi	Sony Corporation
	Kenshin Shimoda	Denso Corporation
	Yojiro Nomura	NEC Corporation
	Yagi Yasuhiro	Panasonic Corporation
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	Kazuo Ishizuka	Japan Quality Assurance Organization
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	Keijiro Edo	Sharp Corporation
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