Handouts

General Rules for Test Methods for Low-Voltage Grid-Interconnection Protection Devices, etc. **JETGR0002-1-16.0 (2023)**

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Electrical Safety and Environment Laboratory

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General rules for testing low-voltage system interconnection protection devices, etc.

Preface This general test method is a test method to be used in conjunction with the individual test methods for the applicable grid-interconnection protection devices for power supply systems, etc. The individual test methods include items that supplement or modify the corresponding items of the general test method.

I. Scope

This test method applies to certification tests conducted by the Electrical Safety and Environment Technology Laboratory (hereinafter referred to as "JET") for grid-connection protection devices for distributed power systems that are connected to low-voltage distribution lines via inverters, etc. and that are manufactured to comply with the "Interpretation of Technical Standards for Electrical Equipment," "Grid-connection Technical Requirements Guideline for Ensuring Power Quality (Agency for Natural Resources and Energy)," and "Grid-connection Regulations" (issued by the Japan Electric Association, JEAC9701).

I.I Islanding prevention and **FRT** requirements for each electrical system

ÿ.ÿ.ÿAbout designations

When distinction is necessary for description, the names are as follows: - "Standard type active system" For single-phase equipment, :

"JEM1498 Standard active islanding detection method for single-phase power conditioners for distributed power sources" Or, for three-phase equipment,

"JEM1505 Standard active islanding detection method for three-phase power conditioners for photovoltaic power generation connected to low-voltage distribution lines" (Both methods use a frequency feedback method with step injection). Note that the grid interconnection regulations state this as a "new active method."

- [Multiple-unit grid-connected FRT compatible type]: Equipped with a "standard active method" and meets FRT requirements

• [FRT compatible type] : Equipment that has a "conventional active method" and complies with FRT requirements.

• [200V connection devices] : Standard single-phase equipment. Equipment that is single-phase two-wire 200V and single-phase three-wire 100V/200V and that is connected to a single-phase three-wire 100V/200V system. When comparing with [100V connected equipment] below, the name will be used as necessary.

• [100V connection devices] : A single-phase two-wire, 100V device that is connected to a single-phase three-wire, 100V/200V system. device.

I.I.II Single-phase equipment ([200V connected equipment] / [100V connected equipment])

•Applicable to solar cell systems, gas engine systems, fuel cell systems, lithium-ion storage battery systems, combined systems of storage batteries and gas engine systems*, combined systems of storage batteries and fuel cells*, combined systems of storage batteries and solar cells, storage batteries (DC connection type) systems installed in electric vehicles, etc., combined systems of storage batteries (DC connection type) installed in electric vehicles, etc. and solar cells, and multi-input systems.

*Currently not accepting applications

- Apply FRT requirements. - For active islanding detection methods, it is desirable to adopt the "standard active method" whenever possible, which does not require confirmation of non-interference of the islanding detection function with other grid-connection protection devices installed at each interconnection location.

- [100V connection devices] apply to fuel cell systems and battery systems.

I.I.III three-phase equipment

- Applicable to solar cell systems, gas engine systems, fuel cell systems, lithium-ion storage battery systems, combined systems of storage batteries and solar cells, storage batteries (DC connection type) systems installed in electric vehicles, combined systems of storage batteries (DC connection type) installed in electric vehicles and solar cells, and multi-input systems.

- Meet FRT requirements.

- Regarding active islanding detection methods, it is desirable to adopt, whenever possible, a "standard active method" that does not require confirmation of non-interference of the islanding detection function with other grid-connection protection devices installed at each interconnection location.

I.II DC energy source-dependent mandatory

requirements • Products that include solar cells in the DC energy source must operate with a constant power factor of 0.95 as the standard power factor. In addition, the Grid Code Study Group of the Organization for Cross-regional Coordination of Transmission Operators (OCCTO) is considering making the installation of a power factor setting function (setting range: 0.80 to 1.00, variable in 0.01 increments) for constant power factor control mandatory at the time of grid interconnection negotiations. For specific details and the timing of mandatory implementation, it is recommended to check the materials and

minutes of the OCCTO Grid Code Study Group. However, this does not apply when a power conditioner that has been certified with a power factor of 1.0 is partially changed to a new test method for some tests for special reasons, such as the "reactive power oscillation suppression function test."

• For products that include a gas engine in the DC energy source, the gas engine part must be certified by a third-party certification body. have been obtained.

- For products that include a fuel cell in the DC energy source, all parts other than the grid-connection protection device shall be certified by a third-party certification body in accordance with the "Technical Standards and Inspection Methods for Small Stationary Fuel Cells" established by the Household Fuel Cell Certification System Review Committee of the Japan Electrical Manufacturers' Association.

• For products that include lithium-ion batteries in the DC energy source, the battery section must be certified for the cell (including the battery module, etc., if safety considerations are required for the battery module, etc.) and the battery system in accordance with a standard equivalent to JIS C 8715-2. The certification certificate must be issued by a certification body (NCB) under the

IECEE-CB scheme. There are two types of power conditioners: "battery separate type" that is separate from the battery, and "battery integrated type" that is integrated with the battery.

- Products that include an on-board battery for electric vehicles, etc. as a DC energy source must have received a certification in accordance with the "Guidelines for Electric Vehicle Charging and Discharging Systems V2H DC Edition" (hereinafter referred to as "V2H Guidelines (DC)") issued by the Electric Vehicle Power Supply System Consortium (EVPOSSA) and the "V2H Certification Standards DC Edition" issued by the CHAdeMO Consortium.

* "Certification" in the above means that in addition to confirming specifications and performance, appropriate production process management is confirmed to ensure that products with the same specifications and performance as the test product are continuously produced, factory inspections are conducted, and regular product confirmation tests are also conducted.

ÿ.ÿGrid -connection protection devices that can be connected to power conditioners for isolated circuits

Grid-connection protection devices that can be connected to a power conditioner for an independent circuit refer to devices that, when connected to the grid, supply power from the grid to the independent circuit, have a single-phase three-wire output during independent operation, and can be connected to a power conditioner for solar cells (hereinafter referred to as "power conditioner connected to an independent circuit"). This applies to storage battery systems, combined systems of storage batteries and solar cells, systems of storage batteries (DC connection type) installed in electric vehicles, combined systems of storage batteries (DC connection type) installed in electric vehicles and solar cells, and multi-input systems.

For details on grid-connection protection devices that can be connected to a power conditioner for an independent circuit, see the definition of terms. Note that "100V connection equipment" is not applicable.

I.IV Capacity range of each system and corresponding individual test method a) Solar cell

systems are

ÿ [Multiple-unit interconnection FRT compatible] and [FRT compatible] equipment with single-phase interconnection output of less than 20kW [Multiple-unit interconnection FRT compatible] and [FRT compatible] equipment with three-phase interconnection output of less than 50kW ÿ For the individual test methods, refer to Single-phase equipment: "Individual test methods for grid-connection protection devices for multi-unit interconnection photovoltaic power generation systems" Three-phase equipment: "Individual test methods for grid-connection protection devices for photovoltaic power generation systems" b) Gas engine systems are

ÿ [Multiple-unit FRT compatible] and [FRT compatible] equipment with single-phase interconnection output of less than 10kW ÿ [Multiple-unit FRT compatible] and [FRT compatible] equipment with three-phase interconnection output of less than 10kW ÿ The individual test method is "Individual test method for grid-connection protection devices for gas engine cogeneration systems, etc."

For more information, see:

c) The fuel cell system is

ÿ The fuel cell will be a small stationary polymer electrolyte fuel cell (PEFC) or a stationary solid oxide fuel cell (SOFC).

- Equipment with single-phase interconnection output of less than 10kW (multiple-unit interconnection FRT compatible type, FRT compatible type)

However, in the case of 100V connection equipment, it must be 2kVA or less.

[Multiple-unit interconnection FRT compatible type] and [FRT compatible type] equipment with a three-phase interconnection output of less than 10kW

The individual test method is "Individual test method for grid-connection protection devices for stationary small fuel cell systems, etc."

For more information, see:

d) For systems using lithium-ion batteries,

- Equipment with single-phase interconnection output of less than 10kW (multiple-unit interconnection FRT compatible type, FRT compatible type)

However, for 100V connected equipment, it must be 2kVA or less. Please note that for [multiple-unit interconnection FRT compatible type] with a three-phase interconnection output of less than 50kW and [FRT compatible type] equipment with an output of 10kW or more, various requirements such as earth resistance and voltage to ground are different from those for equipment less than 10kW. ÿ Forward/reverse conversion switching type (former name in some test methods: "charge/discharge switching type") and seamless type. ÿ For individual test methods, refer to "Individual test methods for grid-connection protection devices for battery storage systems, etc."

e) A combined system of lithium-ion batteries and solar cells is

ÿ [Multiple-unit FRT compatible] and [FRT compatible] equipment with single-phase interconnection output of less than 10kW [Multiple-unit FRT compatible] and [FRT compatible] equipment with three-phase interconnection output of less than 50kW However, since the FRT requirements for multiple DC input systems of three-phase equipment have not yet been defined in the Grid Interconnection Regulations, the provisional criteria will be the same as for photovoltaic power generation systems. If defined in the Grid Interconnection Regulations, that definition will be followed. In addition, please note that products with a storage battery output of 10kW or more have different requirements for earth resistance, voltage to ground, etc. than those with an output of less than 10kW.

ÿ Forward/reverse conversion switching type and seamless type. ÿ The individual test method is "Individual test method for grid-connection protection devices for multiple DC input systems (PV+BS)"

For more information, see:

f) For combined systems of lithium-ion batteries and gas engines,

ÿ [Multiple-unit FRT compatible] and [FRT compatible] equipment with single-phase interconnection output of less than 10kW ÿ Forward/reverse conversion switching type. ÿ The individual test method is "Individual test method for grid-connection protection devices for multiple DC input systems (GE+BS)"

Please refer to the following. Note that this system is currently not accepting applications.

g) For systems combining lithium-ion batteries and fuel cells, the following are applicable: -

[Multiple-unit interconnection FRT compatible] and [FRT compatible] equipment with single-phase interconnection output of less than 10 kW ÿ It is a forward/reverse conversion switching type. ÿ

The individual test method is "Individual test method for grid-connection protection devices for multiple DC input systems (FC+BS)" Please refer to the following. Note that this system is currently not accepting applications.

h) Electric vehicle mounted battery (DC connection type) systems:

- [Multiple-unit FRT compatible] and [FRT compatible] equipment with single-phase interconnection output of less than 10kW - [Multiple-unit FRT compatible] and [FRT compatible] equipment with three-phase interconnection output of less than 10kW

ÿ Forward/reverse conversion switching type and seamless type. ÿ The individual

test method is "Individual test method for grid-connection protection devices for storage batteries (DC connection type) mounted on electric vehicles, etc." For more information, see:

i) For combined systems of on-board storage batteries (DC connection type) for electric vehicles, etc. and solar cells: - [Multiple-unit

interconnection FRT compatible] and [FRT compatible] equipment with single-phase interconnection output of less than 10 kW - [Multiple-unit interconnection FRT compatible] and [FRT compatible] equipment with three-phase interconnection output of less than 50 kW However, the output from on-board storage batteries for electric vehicles, etc. must be less than 10 kW.

ÿ Storage batteries installed in electric vehicles, etc., shall have only one input.

ÿ They shall be forward/reverse conversion switching type and seamless type. ÿ

The individual test method shall be "Individual test method for grid-connection protection devices for multiple DC input systems (PV+EV)" For more information, see:

j) In a multi-input system consisting of an electric vehicle mounted battery (DC connection type), a lithium-ion battery, and a solar cell, the DC energy source that can be connected is either a solar cell, a lithium-ion battery, or an electric vehicle mounted battery. (Hereinafter, lithium-ion batteries and electric vehicle mounted batteries are collectively referred to as "batteries, etc.") ÿ Electric vehicle mounted batteries are limited to one input. ÿ DC energy sources include batteries, etc. ÿ [Multiple-unit

interconnection FRT compatible] and [FRT compatible] devices with single-phase

interconnection output of less than 10kW [Multiple-unit interconnection FRT

compatible] and [FRT compatible] devices with three-phase interconnection output of less than 50kW However, the output from a single electric vehicle mounted battery is less than 10kW. Please note that products with a battery output of 10kW or more are considered business-use electrical facilities.

ÿ It is a forward/reverse conversion switching type and a seamless type.

The shape of the power conditioner must be one of the following: a. Same case

All DC power conversion devices and inverters are housed in the same housing.

b. Some parts are in separate housings

Some of the DC power converters are configured in separate housings from the inverters, etc., and the DC buses connecting the independent DC power converters and the main body are connected by cables. c. Separate housing All of the DC power converters are configured in separate housings from the inverters, etc., and the respective DC buses are connected by cables.

ÿ For individual test methods, refer to "Individual test methods for grid-connection protection devices for multi-input systems, etc."

For all equipment, grid-connection protection devices equipped with standard active methods with a rated output of over 6 kW may be implemented after consultation with the certification applicant regarding the number of power conditioners connected in 3.2.8 Islanding prevention test 2. In addition, if the output voltage of three-phase equipment is different from the low-voltage voltage of the grid, consultation must be held in advance.

system	Interconnection	Solo driving FRT requirement name	output	Active islanding detection method	FRT	Constant power factor control	Remote Output Control	Independent circuit connection PCS	100V connection	Mandatory authentication
Solar Cell System	Single Phase	Multi-unit interconnected FRT compatible type	Less than 20kW	JEM1498	correspondence	Required /No Note 3)	Not applicable	Not applicable		-
		FRT compatible type		Conventional						
	three phase	Multi-unit interconnected FRT compatible type	Less than 50kW	JEM1505						
		FRT compatible type		Conventional						
Gas Engine System	Single Phase	Multi-unit interconnected FRT compatible type	Less than 10kW	JEM1498		Not required	Not required	Not applicable	Not applicable	Gas engine parts are certified by a third-party certification body
		FRT compatible type		Conventional						
	three phase	Multi-unit interconnected FRT compatible type	Less than 10kW	JEM1505						
		FRT compatible type		Conventional						
Gas engine and battery hybrid system Note 1)	Single-phase, multiple-unit interconnection, FRT compatible, less than 10kW , JEM1498					Not supported	Not supported	Not supported	Not supported	
Fuel Cell Systems	Single Phase	Multi-unit interconnected FRT compatible type	Less than 10kW	JEM1498		Not required	Not applicable		Applicable	The product has been certified by a third-party certification body based on the "Technical Standards and Inspection Methods for Small Stationary Fuel Cells" established by the Household Fuel Cell Certification System Review Committee of the Japan Electrical Manufacturers' Association.
		FRT compatible type		Conventional						
	three phase	Multi-unit interconnected FRT compatible type		JEM1505					Not applicable	
		FRT compatible type		Conventional						
Fuel cell and battery hybrid system*1	Single-phase, multiple-unit interconnection, FRT compatible, less than 10kW , JEM1498					Not supported	Not supported	Not supported	Not supported	
Lithium-ion battery system	Single Phase	Multi-unit interconnected FRT compatible type	Less than 10kW	JEM1498		Unnecessary	Unnecessary	Applicable Note 2)	Applicable	The battery unit has been certified by a third-party certification body.
		FRT compatible type		Conventional						
	three phase	Multi-unit interconnected FRT compatible type	Less than 50kW	JEM1505				Not applicable	Not applicable	
		FRT compatible type		Conventional						
Combined battery and solar cell system	Single Phase	Multi-unit interconnected FRT compatible type	Less than 10kW	JEM1498		Required /Not requiredNote 3)		Applicable	Not applicable	
		FRT compatible type		Conventional						
	three phase	Multi-unit interconnected FRT compatible type	Less than 50kW	JEM1505				Not applicable		
		FRT compatible type		Conventional						
Battery storage system for e…ric vehi… (DC connection type)	Single Phase	Multi-unit interconnected FRT compatible type	Less …	JEM1498		Unnecessa…	…nnec…	Applicab…	…pplicable	General incorpora… association Received a c…ication in … with the "V2H Certification Standard DC Edition" issued by the CHAdeMO Association.
		FRT co…ible type		…nventional						
	three phase	Multi-uni…erconnected FR…mpatible ty…		…1505				…t applicable		
		FRT co…ible type		Co…						
A combined system of electric vehicle batteries (DC connection type) and solar cells	Single Phase	Multi-unit interconnected FRT compatible type	Less than 10kW	JEM1498		Required /Not requiredNote 3)		Applicable	Not applicable	
		FRT compatible type		Conventional						
	three phase	Multi-unit interconnected FRT compatible type	Less than 50kW	JEM1505				Not applicable		
		FRT compatible type		Conventional						
Multi-Input System	Single Phase	Multi-unit interconnected FRT compatible type	Less than 10kW	JEM1498		Required Note 3)	Yes/No Note 3)	Applicable	Not applicable	Depending on what is included in the DC energy source, certification of storage batteries etc. may be required.
		FRT compatible type		Conventional						
	three phase	Multi-unit interconnected FRT compatible type	Less than 50kW	JEM1505				Not applicable		
		FRT compatible type		Conventional						

Note 1) Applications are currently not accepted. Note 2) Does not apply to 100V connection devices. Note 3) When the DC energy source includes solar cells.
"Yes/No": Not required if the power company in the installation location is limited

ÿ.ÿOther

• The various protection functions related to grid interconnection are protection functions against various risks, and in principle, masking these functions during grid interconnection operation is not permitted. In the gate block state during FRT permitted by the grid interconnection regulations, minimum masking is permitted.

• Various discussions regarding grid interconnection are being held in committees and study groups of the Organization for Cross-regional Coordination of Transmission Operators (OCCTO). In particular, some specifications being discussed in the Grid Code Study Group may be reflected in the Grid Interconnection Technical Requirements to be applied in actual grid interconnection discussions in the near future, so it is advisable to check the various materials such as Document 5 Comprehensive Evaluation and minutes of the 8th Grid Code Study Group. It is necessary to take measures to ensure that there is no unaddressed inventory remaining in the market.

II. Certification Test

II.ÿ Scope of Certification

a) The photovoltaic power generation system shall consist of a DC power input section provided for connection to a solar cell and an AC power output section provided for connection to a low-voltage distribution line.

b) The gas engine system includes electrical equipment centered on the inverter and equipment that is electrically or functionally closely related to the inverter. Related auxiliary equipment, etc. (excluding gas engine parts)

c) The fuel cell system shall consist of electrical equipment centered around the reverse conversion device and auxiliary equipment that is closely related electrically or functionally to the electrical equipment (excluding the fuel cell portion).

d) Systems using lithium-ion batteries include electrical equipment centered on power conversion devices and auxiliary equipment that is closely related electrically or functionally to these (limited to those related to grid-connection protection devices).

e) A combined system of lithium ion batteries and solar cells consists of electrical equipment centered on a power conversion device and auxiliary equipment, etc. that is closely related electrically or functionally to the electrical equipment (limited to those related to grid connection protection devices). f) A combined system of lithium ion batteries and gas engines consists of electrical equipment centered on a power conversion device and auxiliary equipment, etc. that is closely related electrically or functionally to the electrical equipment (limited to those related to grid connection protection devices).

g) A combined system of lithium-ion batteries and fuel cells consists of electrical equipment centered on a power conversion device and auxiliary equipment, etc. closely related electrically or functionally to the power conversion device (limited to those related to grid-connection protection devices). h) An electric vehicle-mounted battery (DC connection type) consists of electrical equipment centered on a power conversion device and auxiliary equipment, etc. closely related electrically or functionally to the power conversion device (limited to those related to grid-connection protection devices).

i) A combined system of an electric vehicle or other onboard storage battery (DC connection type) and solar cell shall consist of electrical equipment centered on a power conversion device and auxiliary equipment, etc. that is closely related electrically or functionally to the power conversion device (limited to those related to grid interconnection protection devices).

j) Multi-input systems consisting of storage batteries (DC connection type) installed in electric vehicles, etc., lithium-ion storage batteries, and solar cells shall consist of electrical equipment centered on power conversion devices and auxiliary equipment, etc. that is closely related electrically or functionally to these (limited to those related to grid-connection protection devices).

II.II Scope of the Test

The test is a type test performed on the grid-connection protection device and its components. The test scope also includes parts other than the grid-connection protection device, and auxiliary equipment that is electrically or mechanically related to the grid-connection protection device. For grid-connection protection devices for multi-input systems, the test scope includes all combinations of DC energy sources specified in the scope of application.

II.III. Judgment of Conformity

All applicable tests specified in this test method and individual test methods shall be carried out to determine conformity with requirements. However, JET may, at its discretion, omit testing for items related to certification by a third-party certification body for which test data is available, or for items for which conformity with requirements can be determined by inspecting the product.

III. Terminology The

terms used in this general rule are, in principle, based on the "Grid Interconnection Regulations" and "Technical Specifications for PCS with Output Control Function" (Federation of Electric Power Companies of Japan, Japan Electrical Manufacturers' Association (JEMA), Japan Photovoltaic Energy Association). The "Technical Specifications for PCS with Output Control Function" is available on the JEMA website under "New Energy Systems" -> "Distributed Power Systems".

Low voltage

distribution line: A low voltage distribution line that supplies electricity to an unspecified number of low voltage consumers. Generally, there are single phase two-wire: 100V, single phase three-wire: 100V/200V, three phase three-wire: 200V, and three phase four-wire: 100V/200V systems.

Parallel: Connecting a power generating facility, etc. to a commercial power grid (hereinafter referred to as the "grid"). Note that this general rule describes the connection of a power generating facility, etc. to a grid in the AC circuit portion, and does not include the case of connecting via a rectifier to DC.

Electromagnetic

switching device This refers to electromagnetic relays, electromagnetic contactors, and electromagnetic switches that open and close with electrical signals.

Circuit breaker:

An electromagnetic switching device used to disconnect power generation equipment, etc. from the grid.

Disconnection Disconnecting power generation equipment, etc. from the grid. When disconnecting by opening the gate block and circuit breaker, disconnection occurs when both the gate block and circuit breaker are opened.

Disconnection

point A point where power generation equipment, etc. can be disconnected from the grid using a circuit breaker or breaker.

Interconnection The state in which a power generation facility, etc. is connected to the grid from the point at which it is disconnected.

Gate Pulse Signal

A signal sent from the gate circuit in a device to the power semiconductor elements of a power inverter or DC power converter in order to realize power conversion operation through the switching operation of the power semiconductor elements.

Gate block The gate

pulse signal from the gate circuit is set to zero value, current conduction in the power semiconductor element is cut off, and the output power of the inverter or DC power converter is stopped. However, if the target of gate block is also permitted for DC power converter, it will be described separately in the test method.

Gate pulse removal

This is a control operation that stops the gate pulse signal of the gate circuit for about a few milliseconds while continuing to output AC current through the inverse conversion operation in order to prevent operation shutdown due to an overcurrent in an inverter or DC power conversion device.

Standard active method

An active islanding method described in JEM1498 or JEM1505 (Japan Electrical Manufacturers' Association standard). In the grid interconnection regulations, it is described as a "new active method."

Conventional active method:

A conventional active islanding method described in the grid interconnection regulations.

Multi-unit grid-connected FRT compatible type (former name: "Multi-unit grid-connected type 1")

It uses the standard active method and applies FRT requirements.

FRT compatible

type: This type uses the conventional active method and applies FRT requirements.

Forward

flow: A state in which active power flows (current) from the grid to the premises of the installer of the power generation equipment, etc.

Reverse

power flow: A state in which active power flows (current) from the premises of a power generation facility installer to the grid.

Power conversion

device One of the components of a power conditioner, it is a circuit with a power conversion function that converts AC power to DC power when charging a storage battery, etc., and converts DC power back to AC power when discharging.

DC power converter

A component of a power conditioner, this is a circuit that converts DC power into DC power of a different voltage.

Reverse conversion device (inverter)

A device that converts DC power into AC power by using the switching action of power semiconductor elements. Depending on the commutation method, there are self-excited types in which the commutation voltage is provided by the components of the inverter, and separately excited types in which the commutation voltage is provided from outside the inverter.

Inverter, etc. (In this test method, "etc." is underlined to make it easier to understand)

Either an inverter or a power converter.

DC Energy Source

Supplies DC power to the power conditioner.

Examples: "Lithium ion batteries", "solar cells", "fuel cells", "batteries installed in electric vehicles, etc."

"A combination of a DC power conversion device and a storage battery," etc.

Forward

conversion: Converting AC power into DC power through the conversion operation of a power conversion device.

Reverse

conversion: Converting DC power into AC power by the conversion operation of an inverter or similar device.

Grid-connection protection device

A general term for a system that realizes grid protection functions and is composed of protective relays (relays) required for grid connection or equivalent functions, islanding detection functions or reverse charging detection functions, and disconnection breakers.

Power conditioner

This refers to a device that combines an inverter device and a grid-connection protection device.

PCS is

an abbreviation for power conditioner.

Islanding

operation: When a part of a system to which power generating equipment, etc. are connected is cut off from the system power supply due to an accident or other reason, the power generating equipment, etc. present on the line continues to generate power and supply electricity to the line load.

Reverse

charging: A special state of isolated operation in which there is no reverse power flow from the premises of the generator equipment installer (a state in which there are no loads other than the premises of the generator equipment installer in a system isolated from the grid power source), and only voltage is applied from the generator equipment to the point isolated from the grid power source.

Voltage rise suppression function

This is a function used as a measure to adjust voltage using an automatic voltage regulator. There are leading-phase reactive power control function and output control function.

Rated output:

The value of the effective power output indicated by the manufacturer as the rated value, expressed in W or kW. For equipment with a constant power factor control function, the specified output value shall be the power factor at the time of shipment from the factory.

Rated current:

The current value indicated by the manufacturer as the rated value, expressed in A.

Constant power factor control function

This function allows the power conditioner to operate at a constant power factor as a leading phase operation to suppress voltage rises on distribution lines caused by reverse power flow. The power factor is considered to be a leading power factor from the perspective of the power conditioner.

Designated

power factor This refers to the operating power factor value set in the test from within the power factor setting range for power conditioners equipped with a constant power factor control function. It corresponds to ÿ1, ÿ2,

and ÿ3 in Supplementary Figure 1. (Note: For power conditioners

that do not include solar cells in the DC energy source, the designated power factor does not need to be applied.)

Specified output

When the power factor is a specified power factor, the maximum active power at that specified power factor is expressed in W or kW. It corresponds to the active power values p1, p2, and p3 in Supplementary Figure 1.

Specified apparent

power The apparent power value when the power factor is the specified power factor and the output is the specified output, expressed in VA or kVA. It corresponds to the magnitude of the apparent power values s1, s2, and s3 in Supplementary Figure 1.

Specified current

The current value when the power factor is the specified power factor and the output is the specified output, expressed in A. It corresponds to the apparent current values for s1, s2, and s3 in Supplementary Figure 1.

Maximum specified

output The specified output included in the power factor range that has the maximum active power value. This corresponds to the magnitude of [illegible] and [illegible] in Supplementary Figure 1.

Maximum specified apparent power

The maximum apparent power value among the specified apparent powers included in the power factor range.

Maximum specified

current The specified current included in the power factor range that has the maximum current value.

Standalone

operation A state in which a power generation facility, etc. is disconnected from the power grid and supplies power only to the load within the facility's premises.

Auxiliary AC input An

input that allows connection of an external AC power source that does not meet the grid interconnection requirements, such as the independent output of a solar power generation facility or the output of a portable generator, during stand-alone operation.

Auxiliary DC input An

input that allows connection of an external DC power source that does not meet the grid interconnection requirements, such as the DC output of a solar cell or storage battery, during stand-alone operation.

Forward/reverse conversion switching type (former name in some test methods: "charge/discharge switching type")

A method in which, at the input/output terminals on the AC side of the system when connected to the grid, a certain period of time is required for forward/reverse conversion to be held in standby (charging/discharging standby) or for parallel-off between switching between forward and reverse conversion.

Connection

port The terminals for the U phase, V phase, and W phase of a system are collectively referred to as the "connection port."

Grid connection

port A connection port that connects the electrical circuit from the grid side inlet circuit breaker to the power conditioner.

Load connection

port A connection port for connecting a load that normally receives power from the grid connected to the grid connection port, and can receive power from an inverter inside the power conditioner during stand-alone operation.

Connection port

terminals The terminals for the U-phase, V-phase, and W-phase, such as the system connection port and the load connection port, are called "connection port terminals."

Storage

batteries Storage batteries are also called secondary batteries or rechargeable batteries. They are batteries (chemical batteries) that can be repeatedly charged and discharged, and that chemically store electricity by charging so that they can be used as batteries.

Battery installed in electric vehicles, etc. (DC connection type)

This refers to a power conditioner device that uses lithium-ion batteries installed in electric vehicles, etc. as a DC energy source. The DC connection type is defined as "Guidelines for charging

and discharging systems for electric vehicles" issued by the CHAdeMO Association, a general incorporated association.

A system equipped with a connection method based on the "V2H DC version."

Storage batteries, etc. (In this test method, the word "etc." is underlined to make it easier to understand) Either or both of lithium-ion storage batteries and storage batteries installed in electric vehicles, etc.

Charging: Storing electricity in storage batteries, etc. Depending on the type of storage battery, charging may be performed using constant current charging, constant voltage charging, or a combination of these.

Discharge: Outputting electricity from a storage battery, etc.

Maximum DC current limit

The maximum instantaneous value of DC current flowing into the storage battery port of the power conditioner specified by the certification applicant. This includes instantaneous voltage drop and instantaneous current during AC short circuit.

Seamless type: A method that allows continuous switching between forward conversion (charging) and reverse conversion (discharging) at the AC input/output terminals of the system when connected to the grid.

Conversion standby (former name: "charge/discharge standby" in some test methods) A state in which parallel-off is not performed by a circuit breaker, and the power conversion function of the power conversion device is stopped by the gate block.

Integrated battery type (previously called "integrated type")

The power conditioner and the storage battery are housed in a single housing.

Separate storage battery type (former name: “Separate type”)

The power conditioner and storage battery are each housed in an independent housing.

Load following:

The ability of the power conditioner output to follow fluctuations in the load within the home.

Peak shaving:

Supplying power to domestic loads from a storage battery or other system so that the power supplied from the grid does not exceed a certain level even if the load fluctuates.

Dedicated load (surplus power recovery heater)

This refers to a dedicated load provided on equipment, such as a heater, that recovers surplus electricity as heat when the power output of a fuel cell system, etc., exceeds the power supplied to the load on the premises of the power generation facility installer.

DC bus This

refers to the location where a DC power converter and an inverter are connected. However, the DC energy source may also be directly connected to the inverter.

Power factor switching function according to tide

flow A function in which the standard values of power factor during reverse conversion are different from those during forward tide flow, and the power factor changes depending on the tide flow.

Multiple DC Input System

The following combination of DC power is supplied to the power conditioner:

•Solar cells and lithium-ion batteries •Gas engines and lithium-ion batteries •Fuel cells and lithium-ion batteries •Solar cells and batteries installed in electric vehicles, etc.

Multi-Input System

This is included in the multiple DC input system, and consists of an electric vehicle or other on-board storage battery (DC connection type), a lithium-ion storage battery, and a solar cell as the DC energy source for the power conversion device, and the combinations are as follows: - A combination of multiple storage batteries, etc. (electric vehicle or other on-board storage batteries or lithium-ion storage batteries) - A combination of multiple storage batteries, etc. (electric vehicle or other on-board storage batteries or lithium-ion storage batteries) and solar cells *Note that electric vehicle or other on-board storage batteries are only allowed to have one input.

Same

housing: All DC power conversion devices and inverters, etc. are constructed in the same housing.

Partially separate

housing: Some of the DC power conversion equipment is configured in a housing independent of the inverter, etc., and the DC bus connecting the independent DC power conversion equipment and the main body is connected by a cable.

Separate

housing: All DC power conversion equipment is configured in a housing independent of the inverter, etc., and the respective DC buses are connected by cables.

Grid-connection protection devices that can be connected to power conditioners for isolated circuits

This indicates a power conditioner equipped with some or all of the following components

(1) By allowing power from the grid to pass through the power conditioner from the grid connection port to the inside of the power conditioner and then to be supplied to the load from the load connection port, the inverter has the function of supplying power to the load, such as the load side distribution board, using a single-phase three-wire system to supply grid power when connected to the grid and to an independent output when isolated. When connected to the grid, the grid connection port and the load connection port are connected without passing through an electronic circuit such as an inverter.

(2) A connection port (hereinafter referred to as the "power conditioner connection port") is provided for connecting the AC output of another power conditioner ("power conditioner connected to an isolated circuit") so that the power of the other power conditioner can be utilized even during isolated operation. Note that the load connection port and the power conditioner connection port may be shared. This also excludes configurations in which the isolated output of an inverter, etc. and the power conditioner connection port are not electrically connected during isolated operation.

Class A

Class A equipment is equipment suitable for use in all establishments other than domestic establishments and those directly connected to a low-voltage power supply network which supplies buildings intended for domestic use.

Class B

Class B equipment is suitable for use in domestic establishments and in establishments directly connected to a low-voltage power supply network which supplies buildings intended for domestic use.

Frequency deviation
For single-phase equipment, the amount of change in frequency calculated using the method defined in JEM1498. For three-phase equipment, the amount of change in frequency calculated using the method defined in JEM1505.

Frequency Feedback Gain
The ratio of reactive power injection to frequency deviation (e.g. 0.25pu/0.5Hz). The "Standard Specifications for PCS" on the JEMA website recommends that this gain have as small a slope as possible. Furthermore, a setting that allows the slope to be changed is requested.

Active function enabled state (formerly: Active function normal state)
In the JEM standard, it is described as "active function normal state", but the content of the state has changed since the standard was established, and this state is not necessarily maintained steadily. Therefore, in order to prevent misunderstanding, the name has been changed in this test method. A state in which reactive power is injected according to the frequency deviation with the set frequency feedback gain, and reactive power is further injected in a step injection due to a sudden increase in fundamental wave voltage or harmonic voltage.

Active function standby state
A state in which the frequency feedback gain is maintained at 0, reactive power injection is not performed according to the frequency deviation, and reactive power injection is not performed in a stepwise manner even when the fundamental wave voltage suddenly increases, but reactive power injection is performed only in a stepwise manner when the harmonic voltage suddenly increases.

Flicker test standard machine (formerly called "standard machine")
This is a single-phase reference unit for testing used in reactive power oscillation suppression confirmation tests. It was selected from models that represent power conditioners installed in the market. The conditions are set as follows: 1) The maximum output is 3kW or more, JEM1498 is adopted, and the maximum reactive power injection amount is 0.25pu (1kVar). (The maximum reactive power injection amount of 0.25pu (1kVar) of the flicker test reference unit is equivalent to the maximum reactive power injection amount of a 4kW power conditioner.)

ÿThe slope of the frequency feedback gain is 0.25pu(1kVar)/0.5Hz.

Disturbance detection: A function that detects signs of reactive power oscillation when the power conditioner is operating in grid-connected mode.

IV. Test method

• For power conditioners that do not perform constant power factor control, in the following test methods, "specified" and "maximum specified" regarding measurement values shall be read as "rated". Note that this does not apply to items that have rated output and specified apparent power separately. Furthermore, "standard power factor" refers to the power factor at the time of shipment from the factory.

- The function to reset all parameters/mask settings of the power conditioner to the factory default settings at once. It is desirable to have the capability for testing.

It is desirable to have settings that can be shortened for testing purposes for the safety confirmation process at startup, the time to prevent power being turned on for a certain period of time after power is restored, and the voltage rise suppression operation standby time.

• For grid-connection protection devices that can be connected to a power conditioner in an isolated circuit, all or part of the actual load may not be connected between the test power conditioner and the AC power source as shown in the attached test circuit diagrams cited in each test item. However, since the electrical connections are equivalent, tests shall be performed with the circuit connections in the attached diagrams unless otherwise specified in each test item.

• In the case of a power conditioner that can operate in an isolated state by connecting the power conditioner to a separate enclosure that has a disconnection point for isolated operation, the power conditioner itself has a grid connection protection function other than isolation, and the separate enclosure that has a disconnection point for isolated operation does not impede that grid protection function. Furthermore, a product that operates as a standalone power conditioner without connecting the power conditioner to a separate enclosure that has a disconnection point for isolated operation must satisfy the requirements of this test even when used alone.

If auxiliary equipment such as a switch for an independent circuit is included, the switch may not function as a system protection function. Do not hinder the

- It is desirable to have OFR/UFR settings that do not cause the equipment to stop during a frequency variation test (FRT test) even when the allowable error is taken into account. If this is not possible, the test period may become longer.

- When masking a specific function and conducting a test, the masking must not affect the performance or functions other than the masked function. When multiple function masks are to be performed in a single setting, consultations must be held in advance to confirm that the combination allows testing. In addition, the details must be clearly stated in the documentation.

- Products with overvoltage relay (OVR) function, passive islanding prevention function, active islanding prevention function, frequency feedback function, step injection function, voltage rise suppression standby function, reverse power flow prevention function, and load following function must have a function to mask these functions. Products with conventional active islanding prevention function must also be able to mask active operation.

- For seamless type products, as auxiliary test equipment for performing islanding detection test 1 during forward conversion, it is necessary to set the standard type active islanding prevention function to operate the step injection function and frequency feedback function while masking the stop due to active islanding detection.

It is desirable that the undervoltage relay (UVR) function, instantaneous unbalanced overvoltage relay function, over-frequency relay (OFR) function, and under-frequency relay (UFR) function also have a mask function for testing.

• Products with a power factor switching function based on power flow must have a function to fix the power factor by setting. • Products with a power factor switching function based on power flow must start up with a power factor in reverse flow state at start-up. • It is desirable to prepare a method (an external PC for various settings is also acceptable) that can transition the reactive power oscillation suppression function's active function standby state to the active function enabled state. If this function is not available, the test period may be longer.

• Products with functions related to the following states must have the function of outputting the parallel-off relay state, gate block state, active standby state, step injection state, leading-phase reactive power operation state, and power factor change due to power flow (see notes in 4.9 Power factor switching test due to power flow) as an electrical signal. Note that active standby state signals should not be used in conjunction with command signals used in step injection function tests. Products with other relays, such as independent relays and auxiliary input relays, should also be able to output relay signals.

• External output signals that can confirm the output control state for voltage rise suppression, voltage rise state detection, operation/release of the voltage rise suppression function (leading-phase reactive power control function and output control function), and operation standby time limit hold of the voltage rise suppression function

A port should be provided for testing. For the leading

reactive power control signal, a flag should be set up while the power factor is dropping due to leading reactive power control, and for the output control signal, a flag should be set up when the output control is moving in the direction of reducing power, and a flag should be set down when the output control is moving in the direction of releasing the output control even if the specified output has not been returned. Furthermore, this may be used in conjunction with a command signal confirmation port used in step injection function tests, etc.

(For details, see

Note 2 in the voltage rise suppression function test). - During islanding detection tests, it is desirable to be able to output a signal that indicates that the shutdown is due to an active method.

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• For the [Multiple-unit interconnected FRT compatible type], an external output signal port that can confirm the active function enabled state and active function standby state must be provided for testing purposes. Note that this port must not be used in conjunction with the command signal confirmation port used in the step injection function test.

• For the [Multiple-unit-connected FRT compatible type], in order to perform islanding detection test 1 in the active function standby state, it is desirable that the active function standby state be started and maintained for a certain period of time. For example, it is desirable to set the number of standby transitions to three or more times when "disturbance detection" as specified in the JEM standard is detected, so that the active function standby state can be maintained for five minutes. However, the active function must transition to the active function enabled state in accordance with the standard. If the above setting is not possible, it must be possible to mask the function that switches from the active function standby state to the active function enabled state due to continued undetected disturbance detection. If either method is difficult, the active standby state will be maintained in consultation with the certification applicant.

• Must have a forced active function enable setting function that keeps the active function enabled at all times. • When there are multiple

circuit breakers that can be the subject of the circuit breaker opening in the [Judgment Criteria] of each test item, it must be made clear which circuit breaker of the test power conditioner is being referred to (check the circuit diagram, etc.). • Unless otherwise specified, "circuit breaker" refers to the circuit breaker for parallel-off during grid-connection

(hereinafter referred to as "circuit breaker for parallel-off during grid-connected operation"), and if the circuit breaker for parallel-off during isolated operation (hereinafter referred to as "circuit breaker for parallel-off during isolated operation") is different, it must be distinguished.

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Let us assume that.

1.Structural test

[criteria]

[If the system does not include a storage battery, etc.]

A. Structural tests (excluding marking items) shall comply with the technical contents stipulated in the Interpretation of the Ministerial Ordinance Prescribing Technical Standards for Electrical Appliances, Appendix 8, Part 1, "Common Items" (see reference material, "Confirmation Items for Structural Tests").

B. The following statuses shall be clearly indicated and can be confirmed without using tools: - Operation, failure, stop, independent operation (if independent operation is possible) - On/off of switch (switch for turning main power on/off, etc.) if the general user can operate it. Note that the above indications may be displayed in multiple locations and may also be displayed on remote controls, devices connected via a network, etc. When displayed on network devices, etc., they must be able to be confirmed in the same situation as when used by a user.

[If the system includes a storage battery, etc.]

A. Structural tests (excluding marking items) shall be in accordance with JIS C 4412. If older standards are used, the JIS standards selected for the following items shall be the same as the JIS standards selected for this test. All items to which JIS C 4412 applies are the same.

Furthermore, in the case of systems using on-board storage batteries such as electric vehicles, - Insulation distances shall be in accordance with JIS C 60664-1 - The DC circuit on the charge/discharge connector side shall be insulated from the AC circuit and other DC energy sources - The number of charge/discharge connectors shall be limited to one B. The markings shall clearly indicate the following conditions, and shall be able to be confirmed without the use of tools.

- Operation (or charging/discharging), charging/discharging standby, stop, independent operation, failure (abnormality, etc.)

Operation (or charging/discharging) and charge/discharge standby can be collectively substituted with "operation". - If a general user can operate it, it is acceptable to turn on/off the switch (switch for turning the main power on/off, etc.) The above indication may be displayed in multiple locations and may also be displayed on remote controls, devices connected via a network, etc. When displayed on network devices, etc., it must be possible to confirm the indication in the same situation as when the user uses the device.

[When grid power can be supplied to an independent load]

The following indications and status must also be clearly visible. They must be displayed on the unit itself (in a place visible during connection work).

(1) When the electric path from the grid to the load equipment passes through the inside of the power conditioner: - Maximum current or power that can be supplied from the load connection port - Maximum current or power that flows through the grid connection port (including independent loads)

However, if the rated output is the same as the one indicated, the rated output indication may be used instead. - The destination of the connection to the terminal block, etc. that connects the trunk line or its branch circuit (such as "grid side", "load side", etc.) (2) The "power conditioner" for connecting the AC output of the power conditioner connected to the independent circuit

- If the power conditioner has a "connection port" (including cases where it is shared with a load connection port), the type, maximum output, and electrical method of the power conditioner that can be connected to the independent circuit connection. - If the power conditioner connection circuit does not have an overcurrent breaker required for the branch circuit to the grid-connected small-output power generation equipment as required by the internal wiring regulations, a statement to that effect.

(3) The grid-connection protection devices that can be connected to the power conditioner shall not be controlled by signals from the power conditioner connected to the isolated circuit. (4) If the load connection port is not equipped with an overcurrent circuit breaker, a notice to that effect shall be displayed. (5) If the "shutdown device for parallel-off during grid-connected operation" and the "shutdown device for parallel-off during isolated operation" are different, each of the circuit breakers shall be installed in the same housing and shall have a structure that makes it difficult to touch the control signal wires, etc. Note that this does not apply to equipment that meets the requirements of 12.4 Test for signal interruption of isolated parallel-off.

[remarks]

1. In principle, the latest version of JIS C 4412-related standards are used, but other organizations may handle older versions of JIS. The same applies below to the parts of this test method that refer to JIS C 4412.

2. For this test, a CB certificate issued by a certification body (NCB) under the IECEE CB scheme is required. IEC62109-1 test reports are also acceptable, with the following modifications to accommodate Japanese power distribution and earthing methods:

   1) The IEC62109-1 test is not performed on the IT grounded device. 2) During grid connection, the neutral conductor is insulated from the earth and the energy storage system body, just like the power sources of each phase.

2.Insulation performance test

[When the system does not include a storage battery, etc.] The surge absorber can be removed from the circuit in accordance with the explanation in Appendix 3 of Annex 8 of the Ministerial Ordinance on Technical Standards for Electrical Appliances. [When
the system includes a storage battery, etc.] The common test conditions for this test are in accordance with JIS C 4412. In addition, follow 1. [Note] 1 of 1. Structural test.

[Note]

2 of 1. Structural test is also applicable.

2.1 Insulation Resistance

Test [Test

Method] A. The insulation resistance between the input/output terminals of the power conditioner and the non-live metal parts and the casing (if the casing is insulating, a metal foil attached to the surface of the casing) shall be measured using a 500V (1,000V for test items with a rated voltage of more than 300V and not exceeding 600V) insulation resistance tester specified in JIS C 1302:2002 "Insulation Resistance Testers" or an insulation resistance tester with equivalent performance. Note that the disconnection circuit breaker shall be a closed circuit, and if there are dedicated loads or auxiliary equipment, these circuits shall also be closed circuits so that the test voltage can be applied.

B. If the insulation resistance value changes during measurement, the value measured shall be that one minute after the voltage is applied.

C. Details of the test conditions may be determined separately through discussion with the certification applicant. [Judgment

Criteria] The

insulation resistance shall be 1 Mÿ or more.

2.2 Power frequency withstand voltage

test [When the system does not include a storage battery, etc.]

[Test method]

A. Apply an AC voltage of 1,500V (1,000V for those with a rated voltage of 150V or less) continuously for one minute between the input/output terminals of the power conditioner and the non-live metal parts and casing (metal foil attached to the surface of the casing if the casing is made of insulating material). Note that the parallel-off circuit breaker must be a closed circuit, and if there are dedicated loads or auxiliary equipment, these circuits must also be closed circuits so that the test voltage can be applied.

B. For parts that are charged by the secondary voltage of an insulating transformer such as control circuits, an AC voltage of the value specified in Table 2.2-1 shall be applied continuously for one minute between the parts that are charged by the secondary voltage of the transformer and non-charging metal parts and the casing (if the casing is insulating, metal foil attached to the surface of the casing), and between the windings of the transformer. C.

For auxiliary equipment, an AC voltage of the value specified in Table 2.2-1 shall be applied continuously for one minute between the charging parts and the casing.

Table 2.2-1 Test voltage

Voltage Classification(V)	Test voltage (V)
30 or less	500
30 to 150 over 150 to 300 over	1,000
300 to 600	1,500
	Let E be the voltage on the secondary side. 2Eÿ1,000

D. Details of the test conditions may be determined separately through discussion with the certification applicant. [Criteria] The specified

AC voltage

must be withstood continuously for one minute without causing insulation breakdown. [Notes] 1.

Single-

phase three-wire devices are considered to have a rated voltage of 200V. 2.

In the test of the secondary circuit of a transformer, if one side of the secondary side is grounded, the test may be performed with the ground removed.

[When the system includes a storage battery,

etc.] This test shall be in accordance with JIS C 4412 for both the test method and the evaluation criteria. In addition, follow 1. [Note] 1 of 1.

Structural

test. [Note] 2 of 1. Structural test may also be applied.

2.3 Lightning impulse test

[If the system does not include a storage battery, etc.]

[Test method]

A voltage with a crest duration of 1.2ÿS, a tail duration of 50ÿS, and a peak value of 5.0kV is applied between the output terminal (main circuit) and non-charging metal part (earth terminal) of the power conditioner, with a minimum interval of 1 minute, three times each of positive and negative polarity.

[Evaluation

Criteria] a. There shall be no flashover in the insulation gap or insulation breakdown penetrating the insulation.

b. After the test, the insulation resistance test in section 2.1 shall be met.

[Note]

In this test, if the earth leakage circuit breaker used as the main switch malfunctions and it is clear that the cause is leakage current flowing through a surge absorber, noise prevention capacitor, etc., the test may be performed by shorting the input and output terminals of the earth leakage circuit breaker. [If the system includes a storage battery, etc.] This test shall be in accordance

with JIS C 4412 for both the test method and

evaluation criteria. In addition, follow 1. [Note] 1 of 1. Structural test. [Note] 2 of 1. Structural test may also be applied.

3.Protection function test

[When the system includes a storage battery, etc.]

For products that include a storage battery, etc., it is possible to use a DC power supply instead of the storage battery section depending on the test. In that case, the DC power supply specification must be such that it can output more than the maximum DC current specified value for the storage battery input of the power conditioner. The

maximum DC current specified value refers to the maximum instantaneous value of the DC current flowing into the storage battery port of the power conditioner specified by the certification applicant. In this test method, the judgment criteria are described only for tests in which the DC side overcurrent is assumed to be high, but even in tests that are not described in the judgment criteria, it is not permitted to exceed this current specified value. This applies to all subsequent test

methods.

3.1 Mock input test

The tests in this section can be performed under simulated operating conditions.

The method of simulated operation (simulated operating conditions) will be determined in consultation with the certification

applicant.

[Note] The simulated input test is a test to check the operation of protection functions that are difficult to perform under actual operating conditions. For this reason, the power conditioner is placed in a simulated operating state, the protection circuit is operated in the same way as in normal operating conditions, and an equivalent signal is given to the detection unit to perform the test.

3.1.1 AC overcurrent test

[Test conditions]

The operating state of the power conditioner shall be a simulated operating state or a normal operating state in consultation with the certification applicant. [Measurement

method] A. Apply

an AC current of rated frequency that does not activate a protective device to a detection device (AC transformer, etc.) and measure the operating state of the protective device.

The AC overcurrent detection level is measured by gradually increasing the detection voltage until the AC overcurrent detection level is reached.

B. The AC current at the rated frequency is reduced to 110% or less of the set value from the value at which the protective device does not operate and the protective device does not operate.

The voltage is increased stepwise above the threshold value and the operating time of the protective device

is measured.

[Evaluation Criteria] A. AC overcurrent is detected and the gate is blocked. The electromagnetic switch may be opened.

However, this gate block and electromagnetic switchgear opening refers to the opening of the gate block, electromagnetic switchgear or circuit breaker of an inverter device or DC power conversion device.

B. The protection level must be within ±5% of the set value. The set value of the protection level must be 150% of the maximum specified current.

It is less than or equal to.

C. The operating time must be within 0.5 seconds.

3.1.2 DC overvoltage and undervoltage tests

The following tests shall be performed on the input terminals of all types of DC power conversion equipment that have a DC bus or a terminal for connection to external wiring.

[Test conditions]

The operating state of the power conditioner shall be a simulated operating state or a normal operating state in consultation with the certification applicant.

[Measurement

method] a. Connect a DC power source to the DC bus or the input terminal of a specified DC power conversion device. b.

Gradually increase the DC voltage from a voltage at which the protective device does not operate to a level at which the protective device operates, and measure the DC overvoltage detection

level. c. Increase the DC voltage in steps from the rated voltage to below 110% of the set value and above the voltage at which the protective device operates, and measure the operating time of the protective device.

D. The DC voltage shall be gradually decreased from 110% or less of the protection setting value at which the protective device does not operate to a level at which the protective device does operate, and the DC insufficiency detection voltage level shall be measured.

E. The DC voltage shall be stepped down from the rated voltage to 90% or more of the set value and below the voltage at which the protective device operates, and the operating time of the protective device shall be measured.

F. The above measurements shall be carried out for all types of DC energy sources. [Evaluation

Criteria] A. DC

overvoltage and DC undervoltage shall be detected and gates shall be blocked. Electromagnetic switchgear may be opened. However, this gate blocking and opening of the electromagnetic switchgear refers to the gate blocking, electromagnetic switchgear or circuit breaker opening of inverters or DC power converters.

B. The protection level must be within ±5% of the set value. C. The operation

time must be within 0.5 seconds. [Note] DC overvoltage testing

can be

omitted for fuel cell power generation systems, since overvoltage does not occur due to the principles of fuel cells. In addition, this test is not performed for gas engine cogeneration systems, since there is no DC voltage section.

3.1.3 DC detection test

This test applies to power conditioners that do not have a transformer to prevent DC from leaking out of the power conditioner to the grid. [Test conditions] The operating state of the power conditioner shall be a simulated

operating state

or a normal operating state, as determined by consultation with the certification applicant. [Measurement method] A. Apply DC current to the DC leakage detection

circuit, gradually

increase it to the level at which the protection device operates, and measure the protection level.

Measure.

B. The DC current exceeds the specified value of the protection level from the DC current at which the protective device does not operate and is 110%

The current is increased in steps to the following values and the operating time of the protective device is measured:

[Evaluation

Criteria] A. Detects DC current and disconnects the power

supply B. The protection level is 1% or less of the maximum specified output current.

C. The operating time must be within 0.5 seconds.

3.2 Actual driving test

The tests in this section shall be performed under actual operating conditions.

The standard test conditions are shown below. For each test item, only the parts that differ from the standard test conditions are described. Furthermore, the applicable subject of single-phase two-wire 100V equipment testing shall follow the applicable conditions of this test method.

[Standard test conditions for inverse conversion mode]

A. The test circuit shall be the circuit connection shown in Attached Figure I, II, IV or V.

In addition, in the case of a 100V connection mechanism, the circuit connection shall be as shown in Figure ÿ.

B. The AC power source is operated at the rated voltage and rated frequency. C. For

products with conversion mode switching, set the power conditioner to reverse conversion mode and perform constant power factor control.

For power conditioners that do this, set the power factor of the power conditioner to the specified power factor.

D. The DC power supply settings shall be adjusted to adjust the amount of solar radiation so that the power conditioner output is maximum while allowing continuous operation. If there are multiple types of DC energy sources, all of them shall be operated. E. The line impedance shall be short-circuited.

F. In principle, the settings of the protective relays, etc. of the protective devices shall be the factory settings (as stated in the certification application), but they may be changed in accordance with the test only if the change is deemed appropriate. Furthermore, if the test cannot be performed normally due to the protective devices, the minimum protective functions may be masked only if it is deemed appropriate to mask the protective functions after consultation with the certification applicant. (If masked, the protective devices that have been masked shall be recorded.)

G. Turn on the SWLD and set the load so that the power conditioner has the output set in item 2 of the test conditions.

Furthermore,

if a dedicated load is connected to prevent reverse power, that load may be used. However, if it is difficult to reduce the dedicated load or if the output of the power conditioner is to be varied, this shall be done in consultation with the certification applicant. In addition, in the case of a power conditioner with a power factor switching function based on power flow, the load and power source shall be set so as to create a reverse power flow state. Tests

may also be performed with the power factor switching function based on power flow masked and the power factor fixed.

H. When using a DC power source instead of a storage battery, etc., the current limit value of the DC power source shall be set to the value of the storage battery of the power conditioner.

Set the input voltage to a value equal to or higher than the maximum DC current limit for batteries, etc.

If a DC power source is used instead of a storage battery, etc., the output voltage of the DC power source is set to the power conditioner's storage battery.

Set the input to the rated input voltage value of the input, etc.

[When the system includes a storage battery, etc., and is in forward conversion/conversion standby mode]

[Standard test conditions for forward conversion/conversion standby mode]

(The parts that differ from the reverse conversion mode are underlined.) A.

The test circuit shall be the circuit connection shown in Attached Figure I, II, IV or V.

In addition, in the case of a 100V connection mechanism, the circuit connection shall be as shown in Figure ÿ.

B. AC power sources shall be operated at rated voltage and rated frequency.

C. When measuring in forward conversion mode, set the power conditioner to forward conversion mode. When measuring in standby mode, set the power conditioner to standby mode in consultation with the certification applicant.

D. When measuring in forward conversion mode, the DC power supply setting shall be set in consultation with the certification applicant so that the charging power of the storage battery, etc. is rated. When measuring in conversion standby mode, the power conditioner shall be set in conversion standby mode in consultation with the certification applicant.

E. Line impedance shall be short-circuited. F. The settings of protective

relays, etc. of protective devices shall, in principle, be the factory settings (as stated in the certification application form) for detection level and operation time, but may be changed in accordance with testing only if the change is deemed appropriate. Furthermore, if a test cannot be performed normally due to protective devices, a minimum of protective functions may be masked only if it is deemed appropriate to do so after consultation with the certification applicant. (If masking is done, the masked protective devices shall be recorded.)

G. Open the SWLD. In the case of a power conditioner that has a power factor switching function based on the power flow,

The power factor switching function may be masked and the test may be performed with the power factor fixed.

H. When using a DC power source instead of a storage battery, etc., the current limit value of the DC power source shall be set to the power conditioner.

Set the input of the storage battery, etc. to a value equal to or higher than the maximum DC current specification.

i) When using a DC power source instead of a storage battery, etc., set the output voltage of the DC power source to the rated input voltage value of the input of the storage battery, etc. of the power conditioner.

3.2.1 AC overvoltage and undervoltage tests

[When the system includes a storage battery, etc.] •In the case of reverse conversion/forward conversion switching type, it is performed in reverse conversion/forward conversion/conversion standby mode respectively.

•In the case of seamless type, it is performed in reverse conversion/forward conversion mode respectively.

[When converting inversely]

[Test conditions for reverse conversion]

The standard test conditions for the inverse conversion mode shown in 3.2 shall apply. However, items 2 and 6 shall be changed as follows. 4. The DC power supply shall be set to a level where the output harmonic current satisfies the criteria for the output harmonic current test in 4.4 and the power conditioner output is stable. The type of DC energy source is not specified.

F. The settings of the protective relays of the protective devices shall be the detection level and operation time settings. [When the system includes a storage battery, etc., and is in forward conversion/conversion standby mode] [Test conditions for forward conversion/conversion standby]

The standard test conditions for the forward conversion/conversion standby mode shown in Section 3.2 shall apply, except that items 2 and 6 shall be changed as follows: d. When measuring in forward conversion mode, the DC power supply settings shall be set in consultation with the certification applicant to a level at which the charging power of the storage battery, etc. is stable. When measuring in conversion standby mode, the power conditioner shall be set in conversion standby mode in consultation with the certification applicant. f. The settings of the protective relays, etc. of the protective devices shall be the standard values for detection level and operation time.

[Measurement method] A. Gradually increase the AC voltage from 95% of the detection level of the overvoltage relay (OVR) and measure the voltage at which the OVR disconnects the power supply. Measure the pressure detection level.

B. The AC voltage is increased in a stepwise manner from the rated voltage to 105% of the set value, and the behavior is measured until the OVR disconnects the inverter. Measure the operation time.

C. Gradually reduce the AC voltage from 105% of the undervoltage relay (UVR) detection level and measure the voltage detection level at which the UVR disconnects the power supply. D. Reduce the AC voltage in steps from the rated voltage to 95% of the set value and measure the operation until the UVR disconnects the power supply. Measure the time.

E. The above measurements shall be carried out for each phase. F. The above measurements shall be carried out in all operation modes that require them. [Criteria for Judgment] A.

Abnormal voltage shall be detected and parallel-off shall be performed. B. The operation protection level shall be within ±2% of the set value. If the parallel-off includes a gate block, the gate The protection levels of both the gate block and the circuit breaker opening must satisfy this judgment.

C. The operation time must be within ±0.1 seconds of the set value. If the parallel-off includes a gate block, the gate block The operating times of both the lock and the cutoff device opening must satisfy this judgment.

D. Even if the system voltage is restored to normal, re-paralleling must not occur for the time specified in the specifications or the settling time (e.g. 150 seconds). In addition, even if an operation operation signal is input using an operation switch, etc., re-paralleling must not occur during the re-paralleling prevention time.

[Note] In the AC overvoltage test, if the voltage rise suppression function operates during detection level measurement and the detection level cannot be measured accurately, the voltage rise suppression function can be masked when measuring the detection level.

3.2.2 Frequency up and down tests

[When the system includes a storage battery, etc.] •In the case of reverse conversion/forward conversion switching type, it is performed in reverse conversion/forward conversion/conversion standby mode respectively. •In the case of seamless type, it is performed in reverse conversion/forward conversion mode respectively.

[When converting inversely]

[Test conditions for reverse conversion]

The standard test conditions for the inverse conversion mode shown in 3.2 shall apply. However, items 2 and 6 shall be changed as follows. 7. The DC power supply shall be set at a level where the output current harmonics are below the specified value and the power conditioner output is stable.

The type of DC energy source is not specified.

F. The settings of protective relays, etc. of protective devices shall be the respective settings of detection level and operation time.

[When the system includes a storage battery, etc. and is in forward conversion/conversion standby mode] [Test conditions for forward conversion/conversion standby]

The standard test conditions for forward conversion/conversion standby mode given in Section 3.2 shall apply.

However, items 2 and 6 shall be changed as follows: d. When measuring in forward conversion mode, the DC power supply settings shall be set in consultation with the certification applicant to a level at which the charging power of the storage battery, etc. is stable. When measuring in conversion standby mode, the settings shall be set in consultation with the certification applicant so that the power conditioner is in conversion standby mode. f. The settings of the protective relays, etc. of the protective devices shall be the standard values for detection level and operating time.

[Measurement method] B. Gradually increase the frequency from -0.5 Hz, the detection level of the Over Frequency Relay (OFR), and disconnect the power supply by the OFR. The detection level is measured.

B. The frequency is increased in a stepwise manner from the rated frequency to 105% of the set value until parallel-off by OFR. Measure the time.

C. The frequency is gradually decreased from the detection level of the under frequency relay (UFR) +0.5Hz, and the power supply is disconnected by the UFR. The detection level is measured.

D. The frequency is stepped down from the rated frequency to 95% of the set value until parallel-off by UFR. Measure the time.

E. The above measurements shall be carried out in all operation modes that require implementation.

[Judgment Criteria] A. Abnormal frequency shall be detected and parallel-off shall be performed. B. The operation protection level shall be within ±0.1Hz of the set value. If the parallel-off includes a gate block, the protection levels of both the gate block and the circuit breaker open shall satisfy this judgment.

C. The operation time must be within ±0.1 seconds of the set value. If the parallel-off includes a gate block, the gate block The operating times of both the lock and the cutoff device opening must satisfy this judgment.

D. Even if the frequency recovers to normal, re-paralleling shall not occur for the time specified in the specifications or the settling time (e.g. 150 seconds). In addition, even if an operation operation signal is input by an operation switch, etc., re-paralleling shall not occur during the re-paralleling prevention time. E. For FRT-compatible power conditioners, the setting value shall include 47.5Hz for 50Hz and 57.0Hz for 60Hz.

[Note] If the islanding detection function operates during the operating time test, the step size of the frequency change may be changed and the islanding detection function may be masked.

3.2.3 Reverse power prevention test

This test applies to power conditioners with reverse power prevention function. In addition, grid-connection protection devices that can be connected to a power conditioner in an isolated circuit are subject to the application conditions of this test method. In the case of grid-connection

protection devices that can be connected to a power conditioner and have a power conditioner connection port that is separate from the load connection port, and the path of the power supplied to the isolated circuit-connected power conditioner and the load is different , in addition to the following tests in 3.2.3.1, 3.2.3.2, or 3.2.3.3, also perform the tests in 3.2.3.4 or 3.2.3.5 according to the applicable specifications. In addition,

(1) The CT is installed in the distribution board of the customer by the contractor when installing the power conditioner, and since incorrect installation (misdirection, falling off, etc.) is possible, it is stated that "it must comply regardless of the installation state." In addition, if the incorrect installation test is performed and the state transitions to start/stop (misdirection only), power generation stop, etc., it is considered to be in compliance. Furthermore, CTs that are clearly not affected by the installation state of the CT and are not likely to be installed incorrectly are not included in the scope of the standard. (2) For grid-connection protection devices that can be connected to a power conditioner in an isolated circuit, and for

which all CTs related to the reverse power relay (RPR) are installed inside the power conditioner, the CT incorrect installation test may be omitted upon consultation with the certification applicant.

(3) If a dedicated load is connected for the purpose of preventing reverse power, the load may be used. However, if it is difficult to reduce the dedicated load or if the output of the power conditioner is variable, this may be done in consultation with the certification applicant.

(4) If it is not possible to test the reverse power prevention function by changing the output of the power conditioner in response to a decrease in the load or dedicated load, the load following function associated with the load change may be masked.

(5) If the load following function can be disabled independently of the reverse power protection setting, the reverse power protection function shall operate effectively even when the reverse power protection setting is enabled and the load following function is disabled.

(6) Products with reverse power prevention functions other than those specified in 3.2.3.1 shall be treated as devices with reverse current.

(7) For products that allow the reverse power prevention function to be switched on and off, the reverse power prevention function shall be set to enabled at the factory to prevent the reverse power prevention function from being mistakenly connected to a connection point without reverse current with the reverse power prevention function disabled.

(8) This function is a test to confirm that the system operates as a grid-connection protection device and stops when the amount of reverse power exceeds a certain level, but it does not indicate that no reverse power flows at all under normal (quasi-steady-state) conditions.

(9) In this test method, "CT" refers to any module that can measure current, in addition to a current transformer for current detection. This includes rules, etc.

(10) The CT drop test is performed on split CTs that can be removed without using tools, etc. This is performed using CT.

(11) The CT disconnection test should be performed in a place where the user can touch the communication wiring from the CT to the power conditioner. This will be implemented when necessary.

3.2.3.1 If equipped with a reverse power relay (RPR) This test

applies to power conditioners equipped with a reverse power relay (RPR). [Test conditions] The standard test conditions for

the reverse

conversion mode shown in section 3.2 shall apply. However, items 2 and 3 shall be changed as follows. 2. The DC power supply setting shall be such that the power conditioner can reliably detect reverse power when in a no-load state, and

The output harmonic current shall be set to an output level that satisfies the criteria of 4.4 Output Harmonic Current Test and allows stable operation. If multiple types of DC energy sources are used, all of them shall be in operation. In addition, the DC energy source that prevents reverse power shall be in a state of outputting power.

G. Turn on the SWLD and set the load to achieve forward power flow. Furthermore, the description after "Note" in item G does not apply.

[Measurement method] A. Gradually reduce the load or dedicated load, etc., and confirm the reverse power value at which the reverse power prevention function disconnects. B. Change the load or dedicated load in a stepwise manner from a forward power flow state to a reverse power flow state that exceeds the reverse power value measured in A. The reverse power prevention function is activated and the operation time until the reverse power prevention function disconnects the inverter is measured. [Criteria] a. Regardless of the installation status of all current monitoring CTs installed outside the power conditioner housing, the following items shall be met. The equipment must meet the following criteria. In addition, if a CT is removed or broken, item B must be satisfied within 5 minutes. However, the statement "detecting reverse power" does not apply.

B. Detects reverse power and disconnects the power supply

C. The reverse power protection level is 5% or less of the maximum specified output of the power conditioner.

D. The operating time must be within 0.5 seconds.

3.2.3.2 When the device has a function to stop the output of a DC energy source that prevents reverse power when the reverse power detection function is activated (Previous name: Reverse power relay (RPR))

This test applies to power conditioners that have this function and include both DC energy sources that prevent reverse power and DC energy sources that do not prevent reverse power. [Test conditions] The test conditions shown in Section 3.2.3.1 shall apply.

[Measurement method] A. Gradually reduce the load or dedicated load, etc., and verify that the reverse power prevention function stops the output, and that when the output stops Check the reverse power value. The specific details for stopping the output are described in the judgment criteria.

B. The load or dedicated load is changed stepwise from a forward flow state to a reverse flow state that exceeds the reverse power value measured in A. The reverse power protection function is activated and the operating time until the output is stopped is measured.

C. The above measurements shall be performed on the DC energy source, and tests shall be performed on all types of DC energy sources that prevent reverse power in all configurations including both DC energy sources that prevent reverse power and DC energy sources that do not prevent reverse power in the configurations described in the system registered in the certification application, with the DC energy source that does not prevent reverse power in operation. However, the output settings shall be set in consultation with the certification applicant.

D. Stop the input of the DC energy source that does not prevent reverse power and operate only with the DC energy source that prevents reverse power, and then carry out items A and B. [Evaluation Criteria]

(Parts that differ from the judgment criteria in Section 3.2.3.1 are underlined)

A. Regardless of the installation state of all current monitoring CTs installed outside the power conditioner housing, the judgment criteria in the following sections must be met. In addition, if a CT falls off or is broken, the requirement in Section B must be met within 5 minutes. However, the statement "detects reverse power" does not apply. In addition, it is also deemed compliant if the DC energy source that prevents reverse power switches to a charging state.

B. Reverse power is detected and one of the following occurs:

•The electromagnetic switch of the DC energy source that prevents reverse power is open. •The DC power conversion device of the DC energy source that prevents reverse power is gate blocked. •The gate of the inverter or other device is blocked or the cutoff device is open.

C. The reverse power protection level shall be 5% or less of the power conditioner output when only the DC energy source that prevents reverse power is operating at rated capacity.

D. The operating time must be within 0.5 seconds.

E. Even if this function is activated, the DC energy source other than the one that prevents reverse power shall operate according to the specifications. [Note] In a multi-input system, if there is a configuration with only a DC energy source that prevents reverse power, please note that this configuration must comply with the test in 3.2.3.1 for cases with a reverse power relay (RPR).

3.2.3.3 Power generated by a DC energy source that does not prevent reverse power flow

When equipped with a function to prevent reverse power flow from a DC energy source that prevents reverse power

This test applies to power conditioners that include both DC energy sources that prevent reverse power and DC energy sources that do not prevent reverse power, and that stop output from the DC energy source that prevents reverse power when the measured power value of the DC part of the DC energy source that prevents reverse power exceeds the measured power value flowing to the load. [Test conditions] The standard test conditions for the reverse conversion mode shown in Section 3.2 shall apply. However, items 2 and 3 shall be changed as follows. 2. The DC power supply settings shall be set so that the output of the power conditioner adjusts the amount of solar radiation and the output of the power conditioner is maximum while allowing continuous operation. If there are multiple types of DC energy sources, all of the DC energy sources shall be operated. The DC energy source that prevents reverse power shall be in a state of outputting power.

G. Turn on the SWLD and set the load to consume the output of the DC energy source that prevents reverse power.

[Measurement method] (Underline the parts that differ from the measurement method in Section 3.2.3.2) A. Gradually reduce the load or dedicated load, etc., and check that the reverse power prevention function stops the output, and that the output power (DC side) and load power of the DC energy source that prevents reverse power when stopped. The specific details of stopping the output are described in the evaluation criteria.

B. The load or dedicated load is changed in a stepped manner from a value exceeding the load amount measured in A to a value less than the load amount, and the operating time until the output is stopped by the reverse power prevention function is measured. C. The above measurements are performed on the DC energy source, and tests are performed on all types of DC energy sources that prevent reverse power in all configurations described in the system registered in the certification application, including both DC energy sources that prevent reverse power and DC energy sources that do not prevent reverse power, with the DC energy source that does not prevent reverse power in operation. However, the output settings will be set in consultation with the certification applicant.

D. Stop the input of the DC energy source that does not prevent reverse power and operate only with the DC energy source that prevents reverse power, and then carry out items A and B. [Evaluation Criteria] (Parts that differ from the judgment criteria in Section 3.2.3.2 are underlined) A. Regardless of the installation state of all power monitoring CTs installed outside the power conditioner housing, the judgment criteria in the following sections must be met. In addition, if a CT falls off or is broken, the item B must be met within 5 minutes. However, the statement "detects reverse power" does not apply. In addition, it is also compliant if the DC energy source that prevents reverse power switches to a charging state.

B. When the output power of the DC energy source that prevents reverse power is greater than the load power, any of the following occurs: It works.

•The electromagnetic switch of the DC energy source that prevents reverse power is open. •The DC power conversion device of the DC energy source that prevents reverse power is gate blocked. •The gate of the inverter or other device is blocked or the cutoff device is open.

C. The reverse power protection level shall be [output power of the DC energy source that prevents reverse power] - [load power], which is 5% or less of the output of the power conditioner when only the DC energy source that prevents reverse power is operating at rated power.

D. The operating time must be within 0.5 seconds. E.

Even if this function is activated, the DC energy source other than the one that prevents reverse power must operate according to the

specifications. [Notes] 1. The "output power" in this test refers to the DC output power flowing from the storage battery, etc. to the DC power converter.

Measures the power flowing between a storage battery or the like and a power converter.

2. Note that in equipment for multiple input systems, if there is a configuration with only a DC energy source that prevents reverse power, that configuration will be required to comply with the test in 3.2.3.1 for when a reverse power relay (RPR) is present.

3.2.3.4 Power generated by a power conditioner that does not prevent reverse power

If the device has a function to stop output power from the energy source

This test detects reverse power in a grid-connection protection device that can connect a power conditioner to an isolated circuit, and applies to power conditioners that have this function. If the test contents can be confirmed by the test in Section 3.2.3.2 based on the connection position of the CT, this test may be omitted. Furthermore, if the disconnection point during isolation is a device in a separate housing, the power conditioner connection port and the load connection port shall be read as the grid connection port. [Test conditions] The standard

test conditions

for the reverse conversion mode shown in Section 3.2 shall apply. However, items A, B, and C shall be changed as follows. A. The test circuit is as shown in

Figure 1, with an AC power source connected to the grid connection port, an isolated circuit-connected power conditioner connected to the power conditioner connection port, and a load connected to the load connection port. The isolated circuit-connected power conditioner to be connected and the operating power factor shall be determined in consultation with the certification applicant.

D. The DC power supply setting shall be set to an output level that allows the power conditioner to reliably detect reverse power when in a no-load state, and that allows stable operation with the output harmonic current satisfying the criteria for the 4.4 Output Harmonic Current Test. If there are multiple types of DC energy sources, all of them shall be in operation. DC energy sources that prevent reverse power shall be in a state of outputting power. The DC power supply of the power conditioner connected to an independent output interconnection circuit shall also be in a state where it can operate stably at 5% or more of the specified output of the power conditioner to be certified.

G. Turn on SWLD and SWLD2, set the DC energy source that prevents reverse power to the output state, operate the power conditioner connected to the independent circuit, and set the load to achieve forward power flow. If necessary, the output value of the power conditioner can be determined in consultation with the certification applicant. [Measurement method] (Underline

parts that

differ from the judgment criteria shown in Section 3.2.3.2) A.

Gradually reduce the load or dedicated load connected to the load connection port, and check that the reverse power prevention function stops the output and the reverse power value at the time of stopping. The specific details of stopping the output are described in the judgment criteria. B. Stepwise change the load or dedicated load connected to the load connection port from a forward power flow state to a reverse power flow state that exceeds the reverse power value measured in section A, and measure the operating time until the reverse power prevention function stops th

C. The above measurements are performed on all DC energy sources, including both DC energy sources that prevent reverse power and DC energy sources that do not prevent reverse power, in the configuration described in the system registered in the certification application.

In this

configuration, the test shall be performed for all types of DC energy sources that prevent

reverse power, while a DC energy source that does not prevent reverse power is in operation.

However, the output settings shall be set in consultation with the certification applicant. [Criteria]

(Same as the judgment criteria in Section 3.2.3.2. Here again) a.

Regardless of the installation state of all current monitoring CTs installed outside the power conditioner housing, the judgment criteria in the following sections must be met. Also, if a CT falls off or is broken, the requirement in section b must be met within 5 minutes. However, the statement "detects reverse power" does not apply. In addition, it is also deemed compliant if the DC energy source that prevents reverse power switches to a charging state.

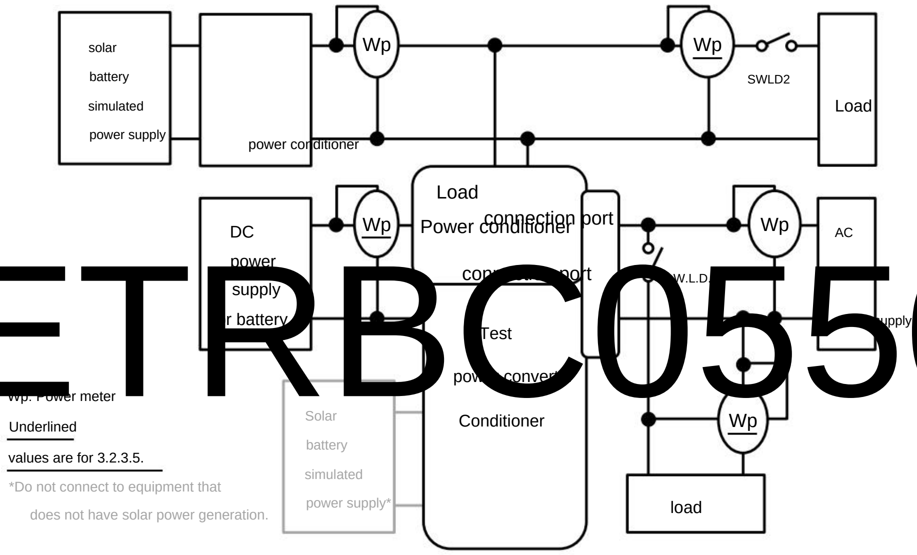
B. Reverse power is detected and one of the following occurs:

•The electromagnetic switch of the DC energy source that prevents reverse power is open. •The DC power conversion device of the DC energy source that prevents reverse power is gate blocked. •The gate of the inverter or other device is blocked or the cutoff device is open.

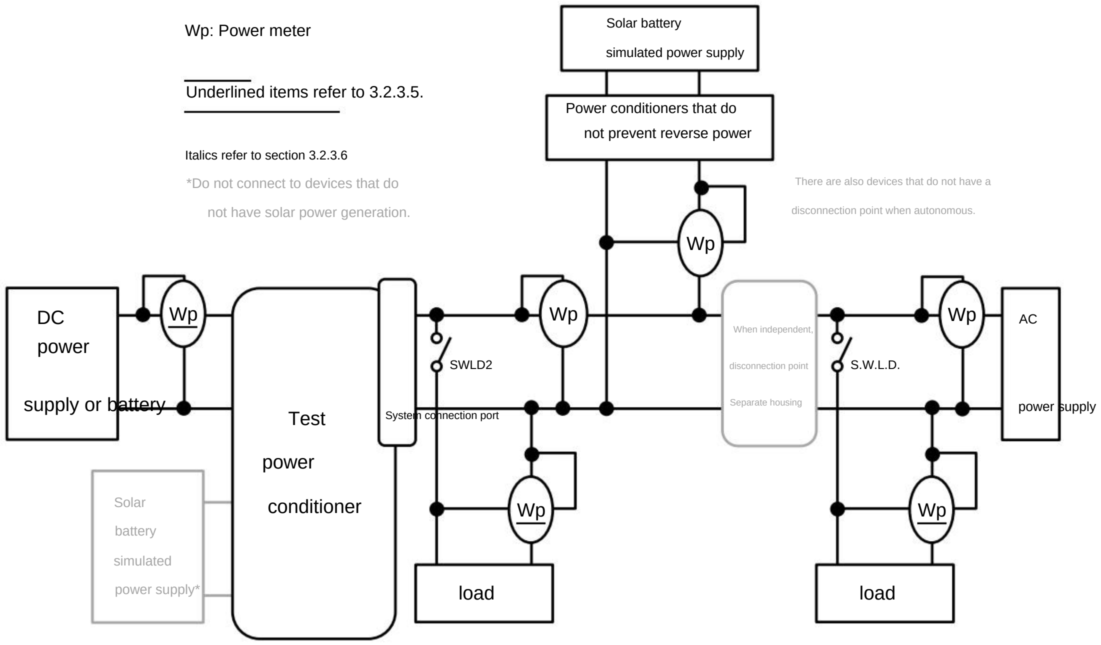
C. The reverse power protection level shall be 5% or less of the power conditioner output when only the DC energy source that prevents reverse power is operating at rated capacity.

D. The operating time must be within 0.5 seconds. E. Even if this

function is activated, all devices other than the DC energy source that prevents reverse power must operate according to the specifications.



(a) When the load connection port and the power conditioner connection port are shared



(b) When the configuration in 3.2.3.6 and the disconnection point in the stand-alone state are in separate housings Figure 1: Example of measurement circuit when carrying out tests in 3.2.3.4, 3.2.3.5 and 3.2.3.6

[Note]

In equipment for a multiple-input system, if there is a configuration with only a DC energy source that prevents reverse power, note that the configuration must comply with the test in 3.2.3.1 for equipment with a reverse power relay (RPR).

3.2.3.5 Power generated by a power conditioner that does not prevent reverse power flow

When the power conditioner has a function to prevent reverse power flow from a DC energy source that prevents reverse power 1 This test applies to power conditioners that can be connected to an isolated circuit, such as a grid-connection protection device, and that stop the output of the DC energy source that prevents reverse power when the measured power value of the DC part of the DC energy source that prevents reverse power exceeds the measured power value flowing to the load. This test may be omitted if the test contents can be confirmed by the test in Section 3.2.3.3 based on the CT connection position, etc. Furthermore, if the disconnection point during isolation is a device in a separate housing, the power conditioner connection port and load connection port shall be read as the grid connection port.

[Test conditions] The standard test conditions for the reverse conversion mode shown in Section 3.2 shall apply.

However, items A, D, and G shall be changed to the following (underlined parts different from Section 3.2.3.4). A. The test circuit is connected to an AC power source at the grid connection port, an independent circuit connection power conditioner at the power conditioner connection port, and a load at the load connection port, as shown in Figure 1. The independent circuit connection power conditioner to be connected and the operating power factor will be determined in consultation with the certification applicant.

D. The DC power supply settings shall be set so that the power conditioner output adjusts the amount of solar radiation and is at its maximum while allowing continuous operation. If there are multiple types of DC energy sources, all DC energy sources shall be operated. DC energy sources that prevent reverse power shall be in a state of outputting power. The DC power supply of the independent circuit connected power conditioner shall be in a state where it can operate stably at 5% or more of the designated output of the power conditioner to be certified.

G. Turn on SWLD and SWLD2, put the DC energy source that prevents reverse power into the output state, set the load to consume the output of the DC energy source that prevents reverse power, and set the power conditioner connected to the independent circuit to

The inverter is operated to generate a reverse current flow to the AC power source. If necessary, the output value of the power conditioner can be determined in consultation with the certification applicant.

[Measurement method] (Underlining the parts that differ from the measurement method in Section 3.2.3.4) A. Gradually reduce the load or dedicated load connected to the load connection port, and check that the reverse power prevention function stops the output, and that the output power (DC side) and load power of the DC energy source that prevents reverse power when stopped. The specific details of how to stop the output are described in the evaluation criteria.

B. The load or dedicated load connected to the load connection port shall be stepped from a value exceeding the load amount measured in A to a value less than the load amount, and the operating time until the output is stopped by the reverse power prevention function shall be measured.

C. The above measurements shall be performed on all types of DC energy sources that prevent reverse power in all configurations described in the system registered in the certification application, including both DC energy sources that prevent reverse power and DC energy sources that do not prevent reverse power, with the DC energy sources that do not prevent reverse power in operation. However, the output settings shall be set in consultation with the certification applicant. [Judgment Criteria] (Underline the parts that differ from the measurement method shown in Section 3.2.3.3) A.

Regardless of the installation state of all power monitoring CTs installed outside the power conditioner case, the system shall meet the judgment criteria in the following sections. In addition, if a CT falls off or is broken, the system shall meet Section B within 5 minutes. However, the phrase "detects reverse power" does not apply. In addition, it is also considered compliant if the DC energy source that prevents reverse power switches to the charging state.

B. When the output power of a DC energy source that prevents reverse power becomes greater than the load power, one of the following operations shall occur. However, products that perform grid-connection without reverse power flow shall be disconnected. - The electromagnetic switch of the DC energy source that prevents reverse power is opened. - The DC power conversion device of the DC energy source that prevents reverse power is gate blocked. - The inverter or other device is gate blocked or the circuit breaker is opened.

C. The reverse power protection level is [output power of the DC energy source that prevents reverse power] - [load power], which is 5% or less of the power conditioner output when only the DC energy source that prevents reverse power is operating at rated power. D. The operation time is within 0.5 seconds. E. Even if this function is operating, the DC energy source other than the one that prevents reverse power must operate according to the specifications. [Notes] 1. The "output power" in this test refers to the DC output power flowing from the storage battery etc. to the DC power converter,

Measures the power flowing between a storage battery or the like and a power converter.

2. Note that in equipment for multiple input systems, if there is a configuration with only a DC energy source that prevents reverse power, that configuration will be required to comply with the test in 3.2.3.1 for when a reverse power relay (RPR) is present.

3.2.3.6 When reverse power flow occurs due to a power conditioner that does not prevent reverse power

Case 2: Having a function to prevent reverse power flow from a DC energy source

This test applies to a power conditioner that measures the output of an attached power conditioner, and when the measured value exceeds the measured value of the power flowing to the load power, stops the output from the DC energy source that prevents reverse power. Note that the power conditioner does not include a DC energy source that does not prevent reverse power, and does not include an attached reverse power source.

This applies to products that can measure the reverse power value, which is the total power consumption of the test power conditioner and the load, not including the output of the power conditioner that does not prevent reverse power. [Test conditions] The

standard test

conditions for the reverse conversion mode shown in Section 3.2 shall apply. However, items

A, D, and G shall be changed as follows (underlined parts differing from Section 3.2.3.5). A. As shown in Figure 1, the test circuit shall be connected to the grid connection port of the AC power source, the attached power conditioner, and the load. The attached power conditioner to be connected and the operating power factor shall be decided in consultation with the certification applicant. For power conditioners with a load connection port, the load shall be connected to the load connection port. D. The DC power supply settings shall be set so that the output of the power conditioner adjusts the amount of

solar radiation and the output of the power conditioner is maximum while allowing continuous operation. If there are multiple types of DC energy sources, all of the DC energy sources shall be operated. The DC energy source that prevents reverse power shall be in a state of outputting power. The DC power supply of the attached power conditioner shall also be in a stable operating state at 5% or more of the specified output of the power conditioner to be certified.

G. SWLD and SWLD2 are turned on, the DC energy source that prevents reverse power is in the output state, the load is set to consume the output of the DC energy source that prevents reverse power, and the attached power conditioner is also operated to create a reverse power flow to the AC power source. If necessary, the output value of the power conditioner can be determined in consultation with the certification applicant.

[Measurement method]

(The parts that differ from 3.2.3.5 are underlined.)

A. Gradually reduce the load or dedicated load, etc., and confirm the reverse power value at which the reverse power prevention function disconnects. B. Step the load or dedicated load from a value that exceeds the load amount set in test condition item G to a value that is less than the load amount at which the parallel-off occurs. The state is changed to the normal state and the operating time until parallel-off is measured.

C. The above measurements shall be performed on all types of DC energy sources that prevent reverse power in the configuration described in the system registered in the certification application. However, the output settings shall be set in consultation with the certification applicant.

D. Set the power conditioner that does not prevent reverse power to the specified output, have the load consume all the power, and perform the above measurements.

[Judgment

Criteria] The judgment criteria shown in Section 3.2.3.1 shall

apply.

[Notes] 1. The "reverse power value" in this test shall be measured without including the output of a parallel power conditioner that does not prevent reverse power. In the test circuit diagram 1(b), the evaluation shall be performed using "Wp" shown in italics, which is installed between the load directly connected to the power conditioner and the power conditioner that does not prevent reverse power .

2. Note that if a non-reverse power protected inverter is operated without a CT measuring its output, the configuration will be required to comply with the test in 3.2.3.1 If equipped with a reverse power relay (RPR).

3. Please note that at the stage of formulating the test method, it has not been confirmed whether this method can be used in conjunction with FIT equipment.

3.2.4 Reverse charging prevention test

This test applies to power conditioners with reverse charging detection function. If it is not possible to test the reverse charging prevention function by changing the output of the power conditioner with a decrease in the load or dedicated load, the load following function associated with the load fluctuation may be masked upon consultation with the certification applicant. [Test conditions] The standard test conditions for the reverse conversion mode shown in Section 3.2

shall apply.

[Measurement

method] A. Gradually reduce the load or dedicated load, etc., and check that the gate is blocked by the underpower (UP) function. do.

B. Check the protection level operation value C.

Measure the operation time of the gate block.

[Evaluation

Criteria] A. Detects insufficient power and blocks the gate. It is acceptable to open the circuit breaker. B. The

protection level is within ±5% of the specified value (3% of maximum receiving power).

C. The operating time must be within 0.5 seconds.

3.2.5 Frequency feedback function test Applies to [multiple-

unit interconnection FRT compatible type].

Not applicable to [FRT compatible type]. This

test is applied to all power conditioners connected in 3.2.8 Islanding prevention test 2. However, it may be omitted for equipment that JET recognizes as being the same as the test equipment. For seamless type power conditioners that operate the frequency feedback function even during forward conversion, the test during forward conversion is also performed. Furthermore, for power conditioners with a power factor switching function based on power flow, if the power factor error during forward power flow does not meet the criteria for reverse power flow in section 4.3, this test is also performed with the power factor set to forward power flow. Furthermore, if the power factor error during forward power flow meets the criteria for reverse power flow in section 4.3 but the power factor during forward power flow is not included in the specified power factor range for reverse power flow, the specified power factor range is expanded to include the power factor during forward power flow and this test is performed. [Test Objective] Standard active methods require that there is no mutual interference between

the same

methods, and the timing of reactive power injection, which is an active signal, is confirmed to be in accordance with the JEM standard. [Test Conditions] The standard test conditions for the inverse conversion mode shown in Section 3.2 shall apply. However, items 2, 3,

and 4 shall be

changed as follows. A. The DC power supply settings shall be such that all DC energy sources are operating and the power conditioner is operating as set in Section 3.2.8.

Set it so that the output is

F. The active step injection function and forced active function are set to active, and other protective devices such as protective relays are set to active. The settings will be the factory settings (as stated in the certification application form).

G. Turn on the SWLD and set the load so that the power conditioner outputs the voltage set in Section 3.2.8.

[Measurement

method] ÿ When checking single-

stage gain: Fluctuate the frequency of the AC power supply in steps of ±0.01 Hz for one cycle. The phase at which the frequency is changed shall be 0°. ÿ

When checking two-stage

gain: Determine the frequency for one cycle at which the maximum reactive power set in advance through simulation etc. is injected. Fluctuate the frequency

of the AC power supply by the frequency determined through simulation etc. The phase at which the frequency is changed shall be 0°. [Judgment criteria] ÿ When checking

single-stage

gain: When the frequency is

changed, no fluctuation in reactive power exceeding the measurement error range should be observed. ÿ When checking two-

stage gain:

In addition to the reactive power during normal operation, the amount of reactive power injected for frequency feedback is set to the maximum specified

The power must be less than 0.25 pu of phase power.

B. The injected reactive power is inductive when the frequency deviation is positive, and capacitive when it is negative.

There are no particular requirements, but the test in 3.2.7 must be met.

The upper limit of the amount of reactive power injected and the timing of injection shall be in accordance with the attached evaluation procedure manual.

[remarks]

If the amount of reactive power injected is large, it may cause reactive power oscillation. Therefore, the maximum amount of injection and the frequency

It is desirable to make the injection slope as small as possible without affecting islanding detection.

The following slopes are recommended:

It is listed on the JEMA website under "New Energy Systems" ÿ "Distributed Power Systems"

The latest standards information is listed in "PCS Standard Specifications," so please comply with the information therein.

3.2.6 Step injection function test

Applies to [Multiple-unit interconnection FRT compatible type].

Does not apply to [FRT compatible type].

This test is applied to all power conditioners connected in 3.2.8 Islanding prevention test 2.

However, equipment that JET recognizes as being identical to the test equipment may be omitted.

Regarding seamless type power conditioners that operate the step injection function even during forward conversion,

In some cases, tests are also performed during forward conversion.

Furthermore, in power conditioners that have a power factor switching function based on the power flow, the power factor error during forward power flow is

If the reverse power flow criteria in section 4.3 are not met, this test shall be performed with the power factor set to forward power flow.

In addition, the error of the power factor during forward power flow satisfies the judgment criteria for reverse power flow in Section 4.3, but the power factor during forward power flow is

If the specified power factor range is not included in the power factor range during forward flow, the specified power factor range is expanded to include the power factor during forward flow.

Conduct an experiment.

[Test Purpose]

Same [illegible]quen[illegible]tes[illegible]

[Test condition

Fo[illegible]w the [illegible]est c[illegible]ditions given in Sec[illegible]n 3.2.5.

However, paragraph (h) shall be changed to the following:

F. Only the active frequency feedback function is masked, and the settings of other protective devices such as protective relays are

At the time of shipment from the factory (as stated in the certification application form).

[Measurement method]

1) When harmonic voltage suddenly increases

A. While maintaining the AC power supply at the rated frequency, the 2nd to 7th order total harmonic voltage components are suddenly increased by more than 2.0V.

To make.

The test involves suddenly increasing the harmonic voltage components* for each of the 2nd to 7th orders. However, for three-phase equipment,

Tertiary and sixth grades are excluded.

In addition, any combination of 2nd to 7th harmonic voltages (the voltage of each harmonic voltage component is less than 2.0V)

At this time, the total harmonic voltage component* is set so that the increase exceeds 2.0V.

* The applied voltage of the harmonic voltage component shall be in accordance with the attached evaluation procedure manual.

$$Harm[THD] = \sqrt{Harm[2]^2 + Harm[3]^2 + Harm[4]^2 + Harm[5]^2 + Harm[6]^2 + Harm[7]^2}$$

B. Check the operation of the step injection function using a command signal, etc.

C. Measure the output current and output voltage to calculate the amount of reactive power injected.

ÿ When the fundamental wave voltage suddenly increases A. The active function is put into standby mode. Note that the active function standby mode may be implemented upon consultation with the certification applicant. B. While maintaining the AC power supply at the rated frequency, the fundamental wave voltage is suddenly increased by an amount exceeding 2.5V*. * The applied voltage of the fundamental wave voltage shall be in accordance with the attached evaluation procedure manual.

c) Check the operation of the step injection function using command signals, etc. d) Measure the output current and output voltage to calculate the amount of reactive power injected. e) Set the active function to the enabled state and carry out items b) to d). [Criteria] 1) When harmonic voltage suddenly increases a) In addition to the reactive power during normal operation, the amount of reactive power (capacitive) injected for step injection must be 0.1 pu or less of the maximum specified apparent power, and the injection period must be 3 cycles or less. b) There are no particular regulations regarding the minimum value of reactive power injection and the minimum injection cycle, but it must comply with the test in Section 3.2.7. To do so.

The upper limit of the reactive power injection amount and the timing of injection shall be in accordance with the attached evaluation procedure manual. ÿ When the fundamental wave voltage suddenly increases A. Under the test conditions in the active function standby state, the active function is not transitioned to the active function enabled state and reactive power is injected. Not having it.

B. (Active function) Under test conditions in the enabled state, in addition to the reactive power during normal operation, the step injection The amount of reactive power (capacitive) injected for this purpose shall be less than 0.1 pu of the maximum specified apparent power and the duration of the injection shall be less than or equal to 3 cycles.

C. The minimum value of reactive power injection and the minimum value of the injection cycle are not specified, but they shall comply with the test in 3.2.7. To do so.

The upper limit of the reactive power injection amount and the timing of injection shall be in accordance with the attached evaluation procedure.

[Notes]

1. Example of application of any 2nd to 7th order total harmonic voltage: When the total harmonic voltage is 2% (3rd order: 1.2%, 5th order: 1.2%, 7th order: 1.2%).
2. "Injecting reactive power for 3 cycles or less" during a sudden increase in harmonic voltage means that the step injection function operates due to a sudden increase in the total harmonic voltage components of 2nd to 7th orders. (The use of harmonic voltages of 8th order or higher is not permitted.)

3.2.7 Anti-islanding test 1 [Test purpose]

To verify that the passive and active methods meet the requirements set forth in the grid interconnection regulations under various load conditions and operating states.

3.2.7.1 Islanding prevention load range test Apply the applicable items according to the respective scope of application.

[Common items]

A. This test applies to power conditioners with islanding prevention function (passive and active types). The test shall be conducted using the following test method that is appropriate for the operating conditions of the power conditioner:

a. With reverse current b. Without reverse current Note that in the case of products with small output (2.6 kW or less), multiple units may be tested, so the test method, including the battery configuration, may be discussed with the certification applicant.

B. For products without reverse power flow, the anti-islanding function test shall be conducted taking into consideration the following conditions.

This may be implemented upon consultation with the certification applicant. a. Load following type products may mask the load following function.

The masking of this function may be implemented upon consultation with the certification applicant. b. Even if there is a dedicated load for the purpose of preventing reverse power flow, etc., the dedicated load shall not be used.

In addition, if it is necessary to use a dedicated load, etc., this may be done in consultation with the certification applicant.

C. If the DC energy source includes a storage battery or the like and is a reverse/forward conversion switching type, the following operation checks must be performed.

a. The anti-islanding function operates in reverse conversion mode. b. The protection functions operate as specified in forward conversion mode/conversion standby mode.

D. In the case of a seamless type that includes a storage battery as a DC energy source, in both reverse conversion mode and forward conversion mode Check the operation of the anti-islanding function.

E. For power conditioners with a power factor switching function based on power flow, the function may be masked and the power factor may be fixed for testing. F. For power conditioners with a power factor switching function based on

power flow, if the power factor error during forward flow does not meet the criteria for reverse flow in Section 4.3, this test shall also be performed with the power factor set to forward flow. In addition, if the power factor error during forward flow meets the criteria for reverse flow in Section 4.3 but the power factor during forward flow is not included in the specified power factor range for reverse flow, this test shall be performed by expanding the specified power factor range to include the power factor during forward flow.

G. In the case of a [multiple-unit interconnection FRT compatible type], set the active function to standby.

It is desirable to detect "disturbance detection 1" as specified in the JEM standard, set the number of standby transitions to 3 or more, and maintain the active function standby state for 5 minutes. However, if the harmonic voltage rises above the specified level, the active function must transition to the active state as specified in the standard. If the above settings are not possible, the

function that switches from the active function standby state to the active function active state due to continued undetected disturbance detection can be masked. (If masked, the masked operating function must be recorded.)

H. If protective devices other than the islanding prevention function are activated during the test, the function may be masked.

Conduct the test. (If masked, record the masked operation function.)

The common load conditions are as follows.

[Common load conditions]

1) Turn on the

resistive load SWLD and set the R load so that the active power flow between the AC power source satisfies the conditions in Table 3.2.7-2.

ÿBalanced load (rotating machine load)

A. The SWLD is turned on, a rotating machine load with a moment of inertia of 0.014 kgÿm2 or more is connected, and the rotating machine is operated at no load. In the case of the [Multiple-unit Interconnection FRT Compatible Type], the number of rotating machine loads shall be as shown in Table 3.2.7-1.

B. After setting the power conditioner to the operating power factor, turn on the SWLD and set the R, L and C loads so that the active power flow and reactive power flow between the AC power source and the load satisfy the conditions in Table 3.2.7-2.

ÿ Unbalanced load

After setting the power conditioner to the operating power factor, turn on the SWLD and set the R, L and C loads so that the active power flow and reactive power flow with the AC power source are as shown in Table 3.2.7-2.

i) Measurement method for inverse conversion mode

[Test conditions for reverse conversion]

The standard test conditions for the reverse conversion mode shown in Section 3.2 shall apply, except that items A and G shall be changed as follows.

A. The test circuit shall be the circuit connection shown in Attached Figure I, II, IV or V.

In addition, in the case of a single-phase device with a 100V connection mechanism, the circuit connection shall be as shown in Figure ÿ. In addition, a device that generates harmonics (such as a transformer, the power flowing must be stable) may be connected to the test circuit. In the case of a three-phase device, a device that generates harmonics may be connected to each phase at the end of the system.

G. The load conditions shall be ÿ to ÿ as described in the [Common Load Conditions] section. In addition, item J shall be added. J. The number of power conditioners shown in Table 3.2.7-1 shall be connected.

If there are multiple numbers of devices to be connected, the number will be determined in consultation with the certification applicant.

[Measurement method] Tests are performed using all combinations of the following methods: 1) Passive method a) The SWCB is opened and the time until it is disconnected is measured.

B. The above measurements are performed for a balanced load (rotating machine load). ÿ Active method

Products that are [compatible with multi-unit interconnected FRT] are not tested using this method.

A. Open the SWCB and measure the time it takes to disconnect.

B. The above measurements are carried out for each of the three "common load conditions." ÿ Passive method + active method

a. Open the SWCB and measure the time it takes to disconnect. b. Perform the above measurements for each of the three "common load conditions." c. If the test is not performed using only the active method and the power is stopped using the passive method, perform the same measurements under that load condition.

The passive method is masked and the time until disconnection by the active method is measured.

[Judgment criteria]

[Multiple-unit interconnected FRT compatible type]

In case where two or more power conditioners are connected, each power conditioner must meet the following criteria. 1) Passive method a. Detects islanding and disconnects within 0.5 seconds.

In this case, the existence of dead zones (areas where islanding is not detected) is permitted due to the characteristics of the passive detection method, but dead zones should be avoided as much as possible.

B. Even if the system voltage is restored, the re-paralleling will not be performed for the time specified in the specifications or the settling time (e.g. 150 seconds). ÿ Active method

A. The SWCB must be opened and the parallel-off must occur within 0.2 seconds.

In addition, even under conditions other than those listed in Table 3.2.7-2, the disconnection must occur within 0.2 seconds.

B. Even if the system voltage is restored, re-paralleling must be performed for the time specified in the specifications or the settling time (e.g. 150 seconds). ÿ Passive method + active method A. The SWCB must be opened and the parallel-off must occur within 0.2 seconds. B. Even if the system voltage is restored, the parallel-off must not occur again for the time specified in the specifications or the settling time (e.g. 150 seconds).

That is.

[FRT compatible

type] 1) Passive

method a) Disconnection within 0.5 seconds by the islanding prevention function. In this case, a dead zone (part where islanding is not detected) is allowed due to the characteristics of the passive detection method, but the dead zone should be avoided as much as possible.

B. Even if the system voltage is restored, re-paralleling must be performed for the time specified in the specifications or the settling time (e.g. 150 seconds). ÿ Active

method A. The system must disconnect from the grid within 0.5 to 1 second due to the islanding prevention function. B. Even if the grid voltage is restored, the system must not re-parallel for the time specified in the specifications or the settling time (e.g. 150 seconds). That is.

3) Passive method + active method

A. The anti-islanding function must disconnect the inverter within one second. However, if detection and stopping is performed using an active method, the period must be between 0.5 seconds and 1 second.

B. Even if the system voltage is restored, re-paralleling must be performed for the time specified in the specifications or the settling time (e.g. 150 seconds). That is.

[When the system includes a storage battery, etc., and is in forward conversion/conversion standby mode]

ii) Measurement method for forward conversion/conversion standby mode of reverse conversion/forward conversion switching type [Test conditions] The standard test conditions for forward conversion/conversion standby mode shown in Section 3.2 shall apply, except that items A and G shall be changed as follows: A. The test circuit shall be the circuit connection shown in Attached Figure I, II, IV or V.

In addition, in the case of a 100V connection mechanism, the circuit connection shall be as shown in Figure ÿ. Also, equipment that generates harmonics (such as a transformer. The power flow must be stable) may be connected to the test circuit.

In the case of devices that generate harmonics, one device may be connected to each phase at the end of the system.

G) The load conditions shall be no load and rated load.

[Measurement method] 1) Passive

method a. Open the SWCB and measure the time until it is disconnected.

B. Conduct the above tests at no load and at rated load.

[Evaluation Criteria] Each power conditioner, including cases where two or more power conditioners are connected, must meet the following evaluation criteria: A. Detect a power outage and block the gates of the inverter, etc. It is acceptable to open the circuit breaker. In addition, reverse conversion must not be performed without transitioning to an isolated operation state.

B. If the passive method works, it must satisfy criterion 1 for the inverse conversion mode.

iii) Measurement method for seamless type forward conversion mode This test applies only to seamless types. [Test conditions] a.

The test circuit shall be connected as shown in Attached Figure VII or VIII.

For single-phase equipment with a 100V connection mechanism, the circuit shall be connected as shown in Attached Figure XI.

Equipment that generates harmonics (such as a transformer; the power flow must be stable) may also be connected to the test circuit.

For three-phase equipment, equipment that generates harmonics may be connected to each phase at the end of the system.

B. The AC power source will be operated at the rated voltage and rated frequency.

C. The line impedance will be short-circuited. D. The settings of protective relays and other protective devices will be the factory default values (as stated in the certification application form). E.

The input and output power of the power conditioner on the reverse conversion side and the power conditioner on the forward conversion side will be rated. Set it up.

F. Adjust the active power and reactive power at the interconnection point to (0,0) by R, L and C loads and rotating machine loads. do.

G. The frequency feedback function and step injection function on the inverse conversion side are operated, but the active detection method Mask only the

[Measurement method] 1. Passive method : Open the SWCB and measure the time it takes to disconnect.

2. Active method:

Open the SWCB in the active function standby state and measure the time it takes to disconnect.

[Evaluation Criteria] Each power conditioner, including cases where two or more power conditioners are connected, must meet the following evaluation criteria. 1) Passive method: Detects islanding and disconnects within 0.5 seconds. Note that power conditioners without an independent operation function must not switch to reverse conversion mode. In this case, due to the characteristics of the passive detection method, a dead zone (part where islanding is not detected) is permitted, but the dead zone should be avoided as much as possible. 2) Active method: A. The SWCB is opened and the power conditioner on the forward conversion side disconnects within 0.2 seconds using the active method. thing.

B. Even if the system voltage is restored, do not re-parallel for the time specified in the specifications or the settling time (e.g. 150 seconds). and.

[Notes]

1. Table 3.2.7-2 shows the points selected for conducting the test. The active method is advantageous in that it has, in principle, no dead zone. Therefore, the above criteria must also be satisfied under test conditions other than those in Table 3.2.7-2.

2. For the [Multiple-unit FRT compatible type], an external output signal port that can confirm the active function enabled state and active function standby state must be provided for testing purposes. Note that this port must not be used in conjunction with the command signal confirmation port used in the step injection function test.

3. [Test conditions] The equipment generating the harmonics required in item (a) is intended to achieve the sudden increase in harmonic voltage required for the power conditioner to activate the islanding detection function when the SWCB is opened.

Table 3.2.7-1 Number of power conditioners and rotating loads used during testing

Specified output	Number of connected PCS units	Number of connected rotating machine load units
(kW) 0.70 to less than	1-6	1
0.73 0.73 to less than	1–5	1
0.89 0.89 to less	1-4	1
than 1.2 1.2 to less	1-3	1
than 1.6 1.6 to less	1-2	1
than 2.7 2.7 to less	1	1
than 6.0 6.0 to less	1	2
than 10.0 10.0 to less	1	3
than 14.0 14.0 to less	1	4
than 18.0 18.0 to less	1	5
than 22.0 22.0 to less	1	6
than 26.0 26.0 to less	1	7
than 30.0 30.0 to less	1	8
than 34.0 34.0 to less	1	9
than 38.0 38.0 to less	1	10
than 42.0 42.0 to less	1	11
than 46.0 46.0 to less than 50.0	1	12

Note: Any power conditioner connection that matches the specified output of the power conditioner can be used.

You can select the number of connected units and the number of rotating machine loads.

Table 3.2.7-2 Test conditions (active power, reactive power)

[illegible]10, +10	[illegible], +10	0, +10 +5, [illegible]	0, +5 [illegible],	[illegible]10, [illegible]
-10, +5	[illegible], +5	+[illegible] 0, [illegible]+5, 0	0, -5 [illegible], -5	+10, [illegible]
-10, 0	[illegible], 0 -5[illegible]	0, [illegible]10 [illegible]5, -10	Note: The	+[illegible]0, 0
-10, -5	-5 -5,	ratio (%) of active power		+10, -5
-10, -10	-10	and reactive	power to the	+10,-10

maximum specified output of the power conditioner.

do.

4. The definition of "disconnection" is as follows: When this is achieved by opening the gate block and the interrupter,

The point at which the lock and the opening of the circuit breaker are both established. All subsequent sections are the same unless otherwise specified.

3.2.7.2 Islanding prevention test after detection of momentary voltage drop

[Test Purpose]

Even if a momentary voltage drop is detected, operation will not continue if the system is in an islanding state, and it is confirmed that islanding detection is possible.

I acknowledge.

[Test conditions]

The standard test conditions for the inverse conversion mode given in Section 3.2 shall apply.

However, items (i), (v), and (vi) shall be changed to the following:

A. The test circuit shall be the circuit connection shown in Attached Figure I, II, IV or V.

In addition, in the case of a single-phase device with a 100V connection mechanism, the circuit connection shall be as shown in Figure ÿ.

A device that is connected to the test circuit (e.g. a transformer, the power flowing through it must be stable) may be connected to the test circuit.

In the case of equipment, one device that generates harmonics may be connected to each phase at the end of the system.

E. The line impedance shall be short-circuited. However, if the voltage rise suppression function is activated, the voltage rise suppression function shall be activated. Mask the feature.

G. The load conditions are set to an impedance that allows islanding detection. No rotating load is connected. The undervoltage relay (UVR) setting may be changed to a setting that does not interfere with the FRT test. [Measurement method] B. The phase closing angle for instantaneous voltage drop is set to 0°.

B. An instantaneous voltage drop (without a sudden phase change) of 52% of the rated residual voltage on the AC power source side is generated. C. Voltage drop of 1.0 second or less (however, 0.3 seconds or less if the DC energy source includes a fuel cell or gas engine) The SWCB is opened within this time (should be within 1000 s) and the time until it is disconnected is measured.

D. The above test shall be carried out with the load in a no-load state.

[Judgment Criteria] A. In tests using impedance capable of detecting islanding, islanding shall be detected and disconnected. The disconnection time after opening the SWCB shall follow the judgment criteria for passive method + active method in section 3.2.7.1, ÿ. However, while it is desirable to follow the judgment criteria above, as a temporary measure, for [multiple-unit interconnection FRT compatible type], gate blocking within 0.2 seconds and circuit breaker opening within 0.3 seconds shall also be deemed compliant. Note that this temporary measure will be considered for removal when the test method is revised in 2026.

B. In a no-load test after detecting a momentary voltage drop, the gate is blocked within 0.2 seconds. Furthermore, regardless of the detection element, the circuit breaker must open within the operating time of the UVR factory settings. However, if the detection element for opening the circuit breaker is the UFR, the circuit breaker is permitted to open within the operating time of the UFR.

[Notes]

1. The gate block time and the circuit breaker opening time described in the criteria are both based on the SWCB opening. The time was measured by

2. In Section 3.2.8.1, tests were conducted to confirm that compliance with FRT requirements would not affect the islanding prevention function. However, concerns were expressed by stakeholders that the tests were insufficient. Therefore, in addition to confirming that compliance with FRT requirements would not affect the islanding prevention function, it was decided to also conduct a confirmation of shutdown under no-load conditions, which is close to the high-voltage cut-off conditions under light load that will be observed in actual construction work.

3. The impedance used in the test that enables islanding detection is the impedance specified by the certification applicant. The islanding detection performance has already been confirmed in Section 3.2.7.1, and this test is a test to confirm that the islanding detection function is not masked when the inverter enters an islanding state, even if the inverter judges that the inverter is in an instantaneous voltage drop state. Therefore, it is considered that the judgment result will not change depending on the impedance value. In addition to the impedance range used in the test in Section 3.2.7.1, the applicable impedance range is limited to a resistance value of 67 to 3.3 ÿ (600 W to 12 kW at a power supply voltage of 200 V). If the impedance range deviates from this range, it will be decided through prior consultation. In this test, rotating machines are not connected because the voltage changes. Furthermore, when a load that adjusts the amount of reactive power is added, the voltage change situation may differ from that in the instantaneous voltage drop (FRT) test due to the capacitor or coil discharging current, so the instantaneous voltage drop (FRT) test may be performed under those conditions.

4. The criteria for testing at impedance that allows islanding detection are that it may detect frequency fluctuations due to voltage drops, and it is expected that the detection time will be longer than normal islanding detection. Therefore, although the system will start stopping within the 0.2 seconds required for islanding detection, a provisional relaxation time of 0.1 seconds has been added, which is the operation delay of the mechanical parallel-off circuit breaker.

5. The criteria for the no-load test after the detection of a momentary voltage drop are not necessarily the same as the simple load dump test in Section 6.5, and there is a possibility that the test may stop due to other equipment protection functions. Since a certain level of safety is ensured by blocking the gate within 0.2 seconds, the time for opening the breaker is set to the longest time, regardless of the detection element, in consideration of the fact that it is difficult to confirm the protective functions that are operating.

However, if it is confirmed that the detection element for opening the circuit breaker is the UFR, the factory settling time is set to "2 seconds" as determined by the "Electricity Resilience Working Group" and other organizations, and in that case, the operation time of the UFR is permitted.

3.2.8 Islanding prevention test 2 This test

applies to the [multiple-unit interconnected FRT compatible type] and performs "3.2.8.1 Islanding prevention test with multiple units interconnected" and "3.2.8.2 Islanding prevention test with active function standby state".

Not applicable to [FRT compatible type]. For

power conditioners with a power factor switching function based on tidal flow, the power factor switching function based on tidal flow may be masked and the power factor may be fixed for testing.

3.2.8.1 Islanding prevention test for multiple connected units

(former name: Islanding prevention test with active function enabled) [Test

purpose]

Standard active methods require that there is no mutual interference between the same methods, and this test is to confirm that the specified detection performance is maintained even if the number of power conditioners connected to the same distribution line increases. To allow for unlimited number of connected units, this test is to confirm that the detection time does not increase even if the number of connected units increases. For this reason, testing under the same detection conditions is required, so the active function state is fixed to the same state during testing. [Test conditions] The

standard test

conditions for the inverse conversion mode shown in Section 3.2 shall apply. However,

items A, B, C, and D shall be changed to the following.

A. The test circuit shall be connected as shown in Attached Figure III. Note that the connection phases of even-numbered units shall be reversed. Also, equipment that generates harmonics (such as a transformer; the power flowing must be stable) may be connected to the test circuit. In the case of three-phase equipment, one unit of equipment that generates harmonics may be connected to each phase at the end of the system. D.

For the DC power supply settings, all DC energy sources shall be operational. The output of each power conditioner shall be set to the value given in the attached document "Explanation of Test 2 to Prevent Islanding When Multiple Units are Connected".

F. The settings of protective relays, etc. of protective devices shall be the factory default values (as stated in the certification application form). Only active types of anti-islanding functions shall be applied, and if protective devices other than the anti-islanding function are activated during testing, the activated protective devices shall be masked. (If masked, the masked activated protective devices shall be recorded.)

G. Turn on the SWLD and set it to the following load conditions. In addition, add items

J to K. J. This test may connect up to 9

combinations of power conditioners.

If the certification applicant wishes to test only the power conditioner section using a DC power source with the characteristics specified by the certification applicant, this can be done in consultation with the certification applicant.

Set the state to "forced active enabled" or "active standby". However, the initial state of the active state must not be changed during the test.

[Power conditioner settings]

When adjusting the output under the above test condition D, all of the following conditions must be met: A. The reactive power injection amount must be set to a percentage of the adjusted designated output.

B. Measure the output current distortion rate at the adjusted output and verify that the total harmonic current distortion rate is 5% or less and that each harmonic

The wave current distortion rate must be 3% or less.

[Load conditions: Balanced load (rotating machine load)]

A. Set the load conditions to those of the active power flow and reactive power flow that resulted in the longest islanding duration in anti-islanding test 1. However, for the load conditions in which the step injection function was activated in 3.2.7 Anti-islanding test 1, set the longest load conditions using the results of retesting with this function masked.

B. The total output value for each test unit is adjusted to be a multiple of 4kW. The number of rotating machine loads is as follows: The value shall be the total output value divided by

4. [Measurement method] a. Adjust the output of the power conditioner according to the attached sheet and connect it.

b. Open the SWCB and measure the time it takes for each connected power conditioner to disconnect for each number of connected units, and measure the longest disconnection time of all power conditioners. Measure 15 times and calculate the average value. This measurement shall be performed for each number of connected units. Note that the test combination with an increased number of connected power conditioners shall be limited to 9 times.

C. Open the SWCB and measure the time to disconnection and the current waveform 15 times.

[Judgment Criteria] a. The maximum minus the minimum of the group of average values obtained for each number of connected units must be within 20 ms. b. As per the formula below, there must be two or more cases where the difference between the "average value of 15 data measured with n+1 power conditioners connected" and the "average value of 15 data measured with n power conditioners connected" decreases or remains the same. However, the number of times does not matter consecutively.

"Average value of 15 data measurements taken with n units connected" ÿ "Average value of 15 data measurements taken with n+1 units connected"

C. The maximum time for any of the connected power conditioners to detect islanding and disconnect is: The judgment value in anti-islanding test 1 must not be exceeded.

3.2.8.2 Anti-islanding test in active function standby state

This test is performed for the [Multiple-unit FRT compatible type]. Note that this test is not performed if the test in 3.2.8.1 is performed in the "active function standby state". [Test purpose] The standard active method has a mode called "active function standby state" that suppresses the active function to suppress reactive power oscillation. In the active function standby state, the active function is suppressed and there is a possibility that the islanding detection time will be extended, so it is confirmed that the inverter stops within the specified time even in the "active function standby state". [Test conditions] The standard test conditions for the inverse conversion mode shown in 3.2 are applied. However, items A, B, C, and D are changed as follows. A. The test circuit shall be the circuit connection shown in Attached Figure III. Note that the connection phase of the even-numbered units shall be reversed. The number of power conditioners shall be the maximum number of units connected in the test in 3.2.8.1. Also, equipment that generates harmonics (such as a transformer. The power flow must be stable) may be connected to the test circuit. In the case of three-phase equipment, one device that generates harmonics may be connected to each phase at the end of the system. D. The DC power supply settings shall be set so that the power conditioner output is the value given in the attached "Explanation of Islanding Prevention Test 2".

F. The settings of protective relays and other protective devices shall be the factory default values (as stated in the certification application form). Only active types of anti-islanding functions shall be applied, and if protective devices other than the anti-islanding function are activated during testing, the activated protective devices shall be masked. (If masked, the masked activated protective devices shall be recorded.)

G. Turn on the SWLD and set the load to consume the output of the power conditioner connected in Section 3.2.8.

do.

Add another item J. J. Set to "active

function standby state." [Measurement method] A. Adjust the

output of the

power conditioner according to the attached sheet and connect it. B. Open the SWCB in the active function

standby state, and measure the time until the maximum number of connected units in test 1 is disconnected.

The time is measured 15 times. The

setting to put the power conditioner into the active function standby state may be implemented upon consultation with the certification applicant. [Evaluation Criteria]

The SWCB is opened and all connected inverters are disconnected within 0.2 seconds.

[Notes]

1. An external output signal port that can confirm the active function enabled state and active function standby state must be provided for testing purposes. Note that this port must not be used in conjunction with the command signal confirmation port used in the step injection function test.

2. [Test conditions] The equipment generating harmonics required in item (a) is intended to achieve a sudden increase in harmonic voltage required for the power conditioner to activate the islanding prevention function when the SWCB is opened.

3.2.9 Test to prevent power supply for a certain period after power restoration

3.2.9.1 Test 1: Preventing power supply for a certain period after power restoration

[When the system includes a storage battery, etc.] •In the case of reverse conversion/forward conversion switching type, it is performed in reverse conversion/forward conversion/conversion standby mode respectively. •In the case of seamless type, it is performed in reverse conversion/forward conversion mode respectively.

[Reverse conversion

mode] [Test

conditions] The standard test conditions for the reverse conversion mode shown in section 3.2 shall apply. However, items 2 and 6 shall be changed as follows. 7. The DC

power supply setting shall be set to a level where the output harmonic current satisfies the criteria for the 4.4 Output Harmonic Current Test and the power conditioner output is stable. The type of DC energy source is not specified. 8. The settings of protective relays, etc. of the protective devices shall be the

factory default values (as stated in the certification application form) and shall be prevented from being turned on for a certain period of time.

The time limit setting is performed for each setting value.

[Measurement

method] A. Open the SWCB to cause a power outage in the system voltage and maintain the power outage for 10 seconds.

B. Close the SWCB and restore the grid voltage. C. If the power conditioner

automatically connects in parallel after power is restored, set the time from power restoration until re-paralleling.

In addition,

when paralleling using the main unit or a remote controller, re-paralleling operation is to be performed within a certain period of time after power is restored.

D. Set the frequency to a frequency higher than the parallel allowable frequency setting value + 0.1 Hz.

E. Open the SWCB to cause a power outage of the grid voltage and maintain this for 10 seconds. F. Close the

SWCB to restore the grid voltage. G. Check the operation status of the

power conditioner until the time required for re-paralleling has elapsed after power restoration.

Measurements from item 2 onwards are carried out using only a single setting for the time-limit blocking time, but the re-parallel allowable frequency adjustment is also carried out. Tests are performed at each set point.

[Evaluation

Criteria] A. After the power conditioner detects a power outage and disconnects, it must not re-parallel for the time specified in the specifications or the set time (e.g. 150 seconds) even if the grid voltage is restored. If the set value is "manual", it must not automatically re-parallel except by manual operation.

B. Products that detect a power outage and automatically switch to independent operation must not be used in parallel for a certain period of time after power is restored, even if they switch to grid-connected operation when power is restored.

C. Even if an operation signal is input from an operation switch, etc., the device will not operate during the re-parallel prevention time. thing.

D. In the case of a power conditioner that has a power factor switching function based on the power flow, reverse power flow is not permitted for 10 minutes or more after startup. The inverter operates at the specified power factor at the time of power supply failure and does not switch power factor.

E) Do not reconnect the equipment when the frequency is high.

[When the system includes a storage battery, etc. and is in forward conversion/conversion standby mode]

[Forward conversion/conversion standby mode]

[Test conditions]

The standard test conditions for the forward conversion/conversion standby mode shown in section 3.2 shall apply.

However, items 2 and 6 shall be changed as follows. 7. When measuring the

forward conversion mode, the DC power supply setting shall be set to a level at which the charging power of the storage battery, etc. is stable, in consultation with the certification applicant. When measuring the conversion standby mode, the power conditioner shall be set to conversion standby mode, in consultation with the certification applicant.

F. The settings of protective relays, etc. of protective devices shall be the factory default values (as stated in the certification application form) and shall be set to the values that are not applied for a certain period of time. The stop time limit setting is performed for each setting value.

[Measurement method] and [Assessment criteria] follow the inverse

conversion

mode. [No[illegible]s] 1. [illegible]easurement method [illegible]ems N to [illegible] and [Asse[illegible]ment [illegible]iteria] i[illegible]m E w[illegible] be mandatory fr[illegible] April 20[illegible]4. 2[illegible]

devices wi[illegible] a re[illegible]allel allowable frequ[illegible]cy setting [illegible]nction, [illegible]e functi[illegible] will be en[illegible]bled [illegible] the time of shipm[illegible]nt from [illegible]e factory fro[illegible] April 2023 on[illegible]ard[illegible]

[illegible]o do so.

3. The criteria can be found on the JEMA website under "New Energy Systems" ÿ "Distributed Power Systems". The settings were made according to the published "Standard PCS Specifications."

4. The "Standard Specifications for PCS" states that "Do not connect in parallel at a frequency that exceeds the setting value by 0.1 Hz." This means that reconnecting at a frequency higher than the setting value + 0.1 Hz, which exceeds the measurement instrument error, is not permitted.

5. As this specification may be reflected early in the "grid interconnection technical requirements" that will be applied in actual grid interconnection negotiations, it is advisable to check the materials 5 (Comprehensive Evaluation) and minutes of the 8th Grid Code Study Group of the Organization for Cross-regional Coordination of Transmission Operators (OCCTO). It is necessary to take measures so that there is no remaining uncompliant distribution inventory.

3.2.9.2 Test 2: Preventing power supply for a certain period after power restoration

[Test purpose] In

order to prevent power supply for a certain period of time after power is restored, it is necessary to measure the time from power restoration to reconnection. The control circuit that measures the time requires a power supply, and the power supply source varies depending on the product, such as DC and AC. Confirm that the requirement to prevent power supply for a certain period of time after power is restored can be observed even if the power of each power supply source is interrupted.

The following test is performed to confirm operation when a system abnormality or DC input abnormality occurs during the re-parallel inhibition time in reverse conversion mode.

For models that use DC output power for the control power supply, (1), (3) and (4) shall be performed, and for models that use commercial power for the control power supply, (2), (3) and (4) shall be performed. However, for models that use DC output power from a lithium-ion battery for the control power supply, (2) shall be performed. (1) DC input interruption test (2) Second power outage test (3) Power outage test after DC input interruption (4) DC input interruption test after second power outage [Common test conditions] The standard test conditions for the inverse conversion mode shown in Section 3.2 shall apply. However, items 2 and 6 shall be changed as follows. 2. The DC power supply setting shall be set to a level where the output harmonic current satisfies the criteria for 4.4 Output harmonic current test and the power conditioner output is stable. If there are multiple types of DC energy sources, each DC energy source shall be operated individually.

F. The settings of protective relays, etc. of protective devices shall be the factory default values (as stated in the certification application form) and shall be prevented from being turned on for a certain period of time. The time limit setting is performed for each setting value.

[Measurement method]

(1) DC input interruption test A. Open the SWCB to cause a power outage of the grid voltage and maintain it for 10 seconds. B. Close the SWCB to restore the grid voltage.

C. During the re-parallel prevention time of the power conditioner, the DC input is cut off and the control power is completely cut off. D. Maintain the inverter so that it stops operating. E. Reconnect the DC input.

F. If the inverter automatically connects in parallel after power is restored, the time from power restoration until reconnecting in parallel In addition, when paralleling using the main unit or a remote controller, etc., check that re-paralleling does not occur within a certain period of time after power is restored.

(2) Re-interruption test A. Open the SWCB to cause a power outage in the grid voltage and maintain it for 10 seconds.

B. Close the SWCB to restore system voltage.

C. During the re-paralleling prevention time of the power conditioner, open the SWCB to cause a power outage of the grid voltage, and maintain the system so that the control power is completely cut off and operation stops. D. Close the SWCB to restore the grid voltage. E. If the power conditioner automatically parallels after power is restored, re-paralleling will start after power is restored as described in item B. In addition, when paralleling using the main unit or a remote control, etc., check that re-paralleling does not occur within a certain period of time after power is restored.

(3) Power outage test after DC input interruption A. Open the SWCB to cause a power outage of the grid voltage and maintain it for 10 seconds. B. Close the SWCB to restore the grid voltage.

C. During the re-paralleling prevention time of the power conditioner, the DC input is cut off. D. The SWCB is opened to cause a power outage of the grid voltage, and the control power is completely cut off and operation is stopped. E. The SWCB is closed to restore the grid voltage.

F. Reapply DC input.

G. If the power conditioner automatically parallels after power is restored, re-parallel the inverters after power is restored as described in item B. Measure the time until

In addition, when paralleling using the main unit or a remote control, etc., make sure that re-paralleling is not performed within a certain period of time after power is restored.

(4) DC input interruption test after re-power failure

A. Open the SWCB, cause a power outage of the grid voltage, and maintain the interruption for 10 seconds. B. Close the SWCB and restore the grid voltage. C. Open the SWCB during the re-paralleling prevention time of the power conditioner.

D. Shut off the DC input, completely cut off the control power supply, and stop the operation. E. Close the SWCB and restore the system voltage.

F. Reapply DC input.

G. If the power conditioner automatically connects in parallel after power is restored, re-connect the inverters in parallel after power is restored as described in E. In addition, when paralleling using the main unit or a remote control, etc., check that re-paralleling does not occur within a certain period of time after power is restored.

[Common Judgment Criteria]

The judgment criteria shown in Section 3.2.9.1 must be satisfied.

"After power restoration" is defined as the time from the second power outage to the restoration of power if a second power outage occurs during power restoration.

[Note] In the case of models using storage batteries mounted on electric vehicles, etc., the DC input is cut off by performing the normal stopping operation of the connection with the electric vehicle to cut off the DC.

3.2.10 Instantaneous (unbalanced) overvoltage test

This test applies to power conditioners whose electrical system is single-phase three-wire and single-phase two-wire, and which have an unbalanced overvoltage protection function for connection to a single-phase three-wire distribution line. [Structure] The terminal for connecting the neutral wire (for overvoltage detection) shall be marked in a conspicuous place nearby to indicate that it is for use as a neutral wire. [Test conditions] The standard test conditions for the reverse conversion mode shown in Section 3.2 shall apply. In addition, Section [illegible] shall be added. If it is necessary to mask AC overvoltage detection, this may be done in consultation with the certification applicant. [Measurement method] A. The AC voltage shall be gradually increased from 90% of the detection level of the instantaneous (unbalanced) overvoltage relay, and the voltage detection level at which the instantaneous (unbalanced) overvoltage relay detects a voltage abnormality and parallel-off the power conditioner shall be measured. B. The AC voltage is stepped up from the rated voltage to 110% of the set value, and the operation time until the instantaneous (unbalanced) overvoltage relay detects the voltage abnormality and disconnects the power conditioner is measured.

[Judgment Criteria] A. Abnormal voltage must be detected and disconnected. B. The operation protection level must be within ±5% of the set value and must be 135V or less. If the disconnection includes a gate block, the operation protection levels of both the gate block and the circuit breaker release must satisfy this judgment.

C. The operating time must be within 1 second.

D. Even if the system voltage is restored to normal, re-paralleling must not occur for the time specified in the specifications or the settling time (e.g. 150 seconds). In addition, even if an operation operation signal is input using an operation switch, etc., re-paralleling must not occur during the re-paralleling prevention time.

[remarks]

In the instantaneous (unbalanced) overvoltage test, the voltage rise suppression function and AC overvoltage are activated during the detection level measurement. If the detection level cannot be measured accurately, the voltage rise suppression function and AC overvoltage relay are turned on when measuring the detection level. can be performed in a masked manner.

3.2.11 Active function state transition confirmation test

This test will be conducted in the case of the [multiple-unit grid-connected FRT compatible type].

[Test Purpose]

In the standard active method, the transition between the standby state and the active state of the active function to suppress the occurrence of voltage flicker is Verify that the detection function is performed in accordance with JEM standards.

3.2.11.1 State transition confirmation test from active function standby state to active function enabled state

[Test conditions]

The standard test conditions for the inverse conversion mode given in Section 3.2 shall apply.

[Measurement method]

B. Set active function to standby state

The active function standby state may be implemented upon consultation with the authentication applicant.

B. While maintaining the AC power supply at the rated frequency, apply (rapidly increase) the total 2nd to 7th harmonic voltage components to 2.2V.

In addition, the test applies (suddenly increases) a harmonic voltage component of 2.2V for each of the 2nd to 7th orders.

In addition, any combination of 2nd to 7th harmonic voltages (the voltage of each harmonic voltage component is less than 2.0V) can be applied.

At this time, the total harmonic voltage component is set to 2.2V.

$$Harm[THD] = \sqrt{Harm[2]^2 + Harm[3]^2 + Harm[4]^2 + Harm[5]^2 + Harm[6]^2 + Harm[7]^2}$$

C. Check the state transition of active functions using external output signals, etc.

D. The above test shall be carried out with an applied voltage of 1.8V (sudden increase).

[Judgment criteria]

A. When performing [illegible] measurement method the device shall transition from the active function standby state to the active function enabled state.

B. When performing measurement method 2, the device must not switch from the active function standby state to the active function enabled state.

[remarks]

Example of harmonic voltage application: Superimposed so that the total harmonic voltage is 2% (3rd: 1.2%, 5th: 1.2%, 7th: 1.2%) do.

3.2.11.2 State transition confirmation test from active function enabled state to active function standby state

[Test conditions]

The standard test conditions for the inverse conversion mode given in Section 3.2 shall apply.

[Measurement method]

A. Start the power conditioner with the active function enabled. If the power conditioner is started with the active function in standby mode,

Transition to active function enabled state.

B. Increase the frequency by +0.02 Hz.

C. Measure changes in active state

[Judgment criteria]

After the frequency change, the active function standby state shall be entered within 0.55 ± 0.1 seconds.

[Notes]

1. The method of transitioning to the active function enabled state includes application of harmonic voltage (e.g. superimposing so that the total harmonic voltage exceeds 2%). If harmonic voltage is applied, the operation to increase the frequency should be performed after waiting for at least 1 second after the harmonic voltage application is released, and the active function enabled state should be confirmed before conducting the test.

2. This test will be mandatory for applications made after January 1, 2024. However, since it is expected that this requirement may become mandatory at the time of grid connection negotiations depending on the grid connection location, it is desirable to respond as soon as possible.
For products that do not support this function, the expiration date will be the end of September 2027, and if this function is added through partial changes, the expiration date will be changed to five years from the date of certification. If the expiration date has been shortened due to individual circumstances, the expiration date will be set taking those circumstances into consideration.
3. The frequency deviation calculation in the JEM standard is delayed by 0.05 seconds from the actual frequency change, so this value is added to the standard time of 0.5 seconds to get 0.55 seconds.

3.2.12 Reactive power oscillation suppression confirmation test

This test is performed for [Multiple-unit FRT compatible type]. [Test conditions] A.

The test circuit

shall be connected as shown in Attached Figure ÿ-1. However, for 100V connected equipment, the circuit connection shall be as shown in Attached Figure ÿ-2. The neutral wire shall be connected to the terminal marked as neutral wire. For three-phase equipment, the circuit connection shown in Attached Figure ÿ-3 shall be used.

B. AC power sources shall be operated at rated voltage and rated frequency.

C. The output of the flicker test reference device (*1) power conditioner shall be set to 3.0 kW, and the output of the test device (*2) power conditioner shall be adjusted so that the total output value of the test device and the flicker test reference device power conditioner is 6.0 kW. In the case of three-phase equipment, a single-phase 3.0 kW flicker test reference device power conditioner shall be inserted into each phase for a total of 9.0 kW, and the output of the test device power conditioner shall be adjusted so that the total output value with the test device (*2) power conditioner is 18.0 kW. In addition, the frequency feedback function of the test device and the flicker test reference device power conditioner shall be enabled.

2. Open the SW[illegible]N and connect the maximum limit line impedance. (ÿ3)

E. The settings of protective relays and other protective devices shall be the factory default settings (as stated in the certification application form).
In addition, if protective devices such as anti-islanding functions operate during testing, the operating function can be masked.

F. Turn on the SWLD and load the test equipment and the flicker test reference equipment power conditioner to consume their output.
In addition, if the
power conditioner has a power factor switching function based on the tidal current, the test may be performed with the power factor fixed by masking the power factor switching function based on the tidal current.

[Measurement

method] A. Operate the flicker test standard power conditioner with a power factor of 1.0. B. Operate it with a

specified power factor, and adjust the output of the test power conditioner so that the total output value becomes the specified output.
For products that
generate reactive power oscillation and enter active function standby before the total output value reaches the specified output, the product shall be consulted with the certification applicant and the active function shall be activated by injecting harmonic voltage when the total output value is at the specified output.

The voltage phase is suddenly changed from 0° to 10°.

D. Confirm that the power conditioner switches from the active function enabled state to the active function standby state by using the external output

signal (ÿ 4).

[Judgment Criteria] A. The power conditioner under test switches from the active function enabled state to the active function standby state.

B. The test equipment and the flicker test reference power conditioner suppress the oscillation of reactive power while continuing to operate. The control state must last for one minute.

[Notes]

1. Do not shut down the EUT before it switches to the active function standby state during the test. 2. The EUT power conditioner should be handled as follows.

ÿÿThe test power conditioner can be set to inject reactive power at the adjusted ratio using the function of the power conditioner. ÿÿIf the output of the test power conditioner is small, the test power conditioner can be set to the circuit connection shown in Figure IX.

Two or more power conditioners shall be connected in parallel.

However, for 100V connection equipment, the test power conditioners shall be as follows: a. The total number of units shall be an even number. b. The same number shall be connected to each phase.

c. The output power of each test power conditioner shall be determined in consultation with the certification applicant so that the output power is the same.

ÿÿIf the output of the test power conditioner is large and the test power conditioner does not start due to the influence of the test line impedance, the line impedance can be reduced in the circuit connection of Attached Figure ÿ, and two or more sets of flicker test reference power conditioners can be connected in parallel.

3. Maximum limiting line impedance This is shown as ZLN in the reactive power oscillation suppression confirmation test circuit in Figure IX. For single-phase equipment, reactive power oscillation occurs when two flicker test reference devices are connected in parallel and a phase jump is performed, but the maximum value of the line impedance at which reactive power oscillation does not occur when the frequency feedback gain of one of the two devices is set to 0. Or, when one single-phase flicker test reference device is connected to each phase in the case of three-phase, reactive power oscillation occurs when the EUT is phase-jumped with the forced active function enabled, but the maximum value of the line impedance at which reactive power oscillation does not occur when the forced active function is in standby state. Example of maximum limiting line impedance: Single phase: R phase (U phase) and T phase (W phase): (DC resistance 0.8ÿ) + (inductance 0.8ÿ) Three-phase: Each phase: (DC resistance 0.5ÿ) + (inductance 0.5ÿ)

4. An external output signal port that can confirm the active function enabled state and active function standby state must be provided for testing purposes. Note that this port must not be used in conjunction with the command signal confirmation port used in the step injection function test.

4. Steady-state characteristic test

The tests in this section shall be performed under actual operating conditions. The "standard line impedance" used in the tests shall be as follows: When the EUT is a single-phase two-wire type a. For 100V equipment:

(DC resistance 0.40 ÿ±8%) + (inductance 0.37 mH±8%) b. For 200V equipment: (DC resistance 0.38 ÿ±8%) + (inductance 0.46 mH±8%) When the EUT is a single-phase three-wire type a. R phase (U phase) and T phase (W phase): (DC resistance 0.19 ÿ±8%) +

(inductance 0.23 mH±8%) b. N phase (O phase): (DC resistance 0.21 ÿ±8%) + (inductance 0.14 mH±8%)

When the test equipment is a three-phase, three-wire system

aÿSpecified output at standard power factor of 10 kW or less, each phase: (DC resistance 0.19 ÿ ±8%) + (inductance 0.23 mH ±8%) bÿSpecified output at standard power factor of 10 kW or more and 15 kW or less, each phase: (DC resistance 0.126 ÿ ±8%) + (inductance 0.153 mH ±8%) cÿSpecified output at standard power factor of 15 kW or more and 20 kW or less, each phase: (DC resistance 0.095 ÿ ±8%) + (inductance 0.115 mH ±8%) dÿSpecified output at standard power factor of 20 kW or more and 25 kW or less, each phase: (DC resistance 0.076 ÿ ±8%) + (inductance 0.092 mH ±8%) eÿ Specified output at standard power factor exceeding 25 kW and not exceeding 30 kW, each phase: (DC resistance 0.063 ÿ±8%) + (inductance 0.077 mH±8%) f. Specified output at standard power factor exceeding 30 kW and not exceeding 35 kW, each phase: (DC resistance 0.054 ÿ±8%) + (inductance 0.066 mH±8%) g. Specified output at standard power factor exceeding 35 kW and not exceeding 40 kW, each phase: (DC resistance 0.0475 ÿ±8%) + (inductance 0.057 mH±8%) h. Specified output at standard power factor exceeding 40 kW and not exceeding 45 kW, each phase: (DC resistance 0.042 ÿ±8%) + (inductance 0.051 mH±8%) i. Specified output at standard power factor exceeding 45 kW and less than 50 kW, each phase: (DC resistance 0.038 ÿ±8%) + (inductance 0.046 mH±8%)

However, if measurement is possible with the current impedance ((DC resistance 0.19 ÿ±8%) + (inductance 0.23 mH±8%)), the above values do not apply.

4.1 AC voltage tracking test

For power conditioners with power factor switching function according to power flow, if the error in the power factor during forward power flow does not meet the criteria for reverse power flow in section 4.3, the test shall be performed with the power factor set to forward power flow. If the error in the power factor during forward power flow meets the criteria for reverse power flow in section 4.3 but the power factor during forward power flow is not included in the specified power factor range for reverse power flow, the test shall be performed by expanding the specified power factor range to include the power factor during forward power flow.

[Test conditions]

The standard test conditions for the inverse conversion mode shown in Section 3.2 shall apply, except that Section E shall be changed as follows: E. Open the SWLN and set the line impedance to the "standard line impedance" described in Section 4. [Measurement method] A. Change the system voltage within the range of +10% to -15% of the rated value, and measure the AC output power and AC output

Measures current (harmonic content) and power factor.

B. Harmonics shall be measured up to the 40th order.

[Evaluation Criteria] A. The power conditioner output follows the voltage changes of the grid and maintains normal operation.

B. The output current distortion factor must be a total harmonic current distortion factor of 5% or less, and each harmonic current distortion factor must be 3% or less. The total harmonic current distortion factor DF is calculated using the following formula.

$$= \frac{\sqrt{ÿÿ(\ )^{2}}}{\ } \times 100\ (\%)$$

Here : Effective value of n-th harmonic current component of the power conditioner output current (A) : Effective value of the power conditioner's specified AC current (A) : Harmonic order 2 to 40.

C. The upper and lower limits of the system voltage must satisfy the criteria in Section 4.3.

[Note]

If the voltage rise suppression function operates when the grid voltage is changed within a range of +10%, the voltage rise suppression function It can be performed masked.

4.2 Frequency tracking test

For power conditioners with a power factor switching function based on power flow, if the error in the power factor during forward power flow does not meet the criteria for reverse power flow in section 4.3, this test is also performed with the power factor set to forward power flow. Also, if the error in the power factor during forward power flow meets the criteria for reverse power flow in section 4.3, but the power factor during forward power flow is not included in the specified power factor range for reverse power flow, this test is performed by expanding the specified power factor range to include the power factor during forward power flow.

[Test conditions]

The test conditions are the same as those in section 4.1.

[Measurement method] a. The frequency is changed within a range of ±1% of the rated value, and the AC output power, AC output current (harmonic components), and power factor are measured at the upper and lower limits. b. Harmonics are measured up to the 40th order. [Judgment criteria]

(Parts that differ from the criteria shown in Section 4.1 are underlined) A. The power conditioner output follows the frequency changes of the grid and maintains normal operation. B. The output current distortion rate is a total harmonic current distortion rate of 5% or less, and each harmonic current distortion rate is 3% or less. (See Section 4.1 for the calculation formula.)

C. The upper and lower limits of the system frequency must satisfy the criteria in Section 4.3.

4.3 Operation power factor test

[Test conditions]

The test conditions shall be the same as those in section 4.1.

[Measurement method] a. If the power conditioner is a self-excited type, set the power conditioner output to the output set in Section 3.2, measure the AC output power, and determine the operating power factor. When testing the operating power factor of a three-phase device, also measure 50% output of the specified output at the standard power factor. b. If the power conditioner is a separate-excited type, set the power conditioner output to the output set in Section 3.2, 50% and 12.5% of the specified output at the standard power factor, and measure the AC output power to determine the operating power factor.

C. In the case of a power conditioner that has a power factor switching function based on power flow, the power factor switching function based on power flow shall be masked and the power factor set to reverse power flow before testing.Then, the power factor shall be set to forward power flow before performing the above test.

[Judgment criteria]

[Power conditioner with solar cell as DC energy source]

When operated at the specified power factor, the error in the reactive power value shall be as follows, or the power factor error shall be within ±0.005. Note that the apparent power and active power shall be the values actually measured. Furthermore, for power conditioners with a power factor switching function according to the power flow, if the criterion for the power factor during forward power flow complies with the reactive power error and power factor error when operated at the specified power factor mentioned above, it shall include a power factor value of 0.95 or more. If not, the operating power factor shall be 0.95 or more. Note that the allowable error in the case of the specified power factor shall be accepted in the same manner.

ÿ When the power conditioner output changes depending on the operating power factor

$$\left| \frac{\sqrt{\text{Apparent power}^2 - \text{Effective power}^2}}{\text{Maximum specified output}} - \frac{\text{Apparent power} \times \sqrt{1 - \text{Set power factor}^2}}{\text{Maximum specified output}} \right| \leq 0.03$$

ÿ When the power conditioner has a specified output regardless of the operating power factor

$$\left| \frac{\sqrt{\text{Apparent power}^2 - \text{Effective power}^2}}{\text{Maximum specified output}} - \frac{\text{Apparent power} \times \sqrt{1 - \text{Set power factor}^2}}{\text{Maximum specified output}} \right| \leq 0.05$$

In addition, for power conditioners with a power factor switching function according to the power flow, if the operating power factor during forward flow is not within the reactive power error and power factor error range when operating at the specified power factor and is 0.95 or more, it is determined that the error in the power factor during forward flow does not satisfy the judgment criteria in Section 4.3 for the power factor range

at the specified power factor. [Note] For combined power conditioners in which the active power output is constant regardless of the operating power factor up to a certain operating power factor and the active power output changes depending on the operating power factor above a certain operating power factor, judgment criteria ÿ or ÿ are used depending on the operating mode to which the operating power factor corresponds. [For power conditioners that do not include solar cells in the DC energy source] The operating power factor must be 0.95 or more. The error that is permissible when operating at the specified power factor is also recognized.

4.4 Output harmonic current test

For power conditioners with a power factor switching function based on power flow, if the error in the power factor during forward power flow does not meet the criteria for reverse power flow in 4.3, the test is also performed with the power factor set to forward power flow. If the error in the power factor during forward power flow meets the criteria for reverse power flow in 4.3, but the power factor during forward power flow is not included in the specified power factor range for reverse power flow, the specified power factor range is expanded to include the power factor during forward

power flow

and the test is performed. [Test conditions]

The test

conditions are the same as those in 4.1. [Measurement method] A. If the power conditioner is a self-excited type, set the output of the power conditioner to the output set in 3.2, measure the AC output power, and obtain the output harmonic current. For three-phase equipment, also measure 50% of the specified output at the standard power factor.

B. If the power conditioner is a separately excited type, set the power conditioner output to the output set in Section 3.2, and to 50% and 12.5% of the specified output at the standard power factor, measure the AC output power, and calculate the output harmonic current.

C. Harmonics are measured up to the 40th order. [Judgment

Criteria] The

output current distortion rate must be 5% or less for the total harmonic current distortion rate, and 3% or less for each order harmonic current distortion rate. (See Section 4.1 for the calculation formula.)

4.5 Contact current test

(Formerly called leakage current test)

[Test

conditions] Since this test is a system characteristic evaluation test, in the case of a system including a storage battery, a DC power source cannot be used instead of the storage battery. The standard

test conditions for the reverse conversion mode shown in Section 3.2 shall apply.

However, Section A shall be changed to the following:

A. The test circuit shall be the circuit connection shown in Attached Figure I, II, IV or V.

In addition, in the case of a 100V connection mechanism, the circuit connection shall be as shown in Figure ÿ. In addition, an isolation transformer shall be connected between the power conditioner and the AC power source. An isolation transformer may be used for the power source of the measuring instrument.

For devices connected to a 100V power grid, the measurement method described in "When connected to a single-phase three-wire system" applies.

[Measurement method]

[When connecting to a single-phase two-

wire system] A. Connect a filter circuit containing a 1kÿ resistor between the charging part that is grounded on the AC side of the power conditioner and the exposed metal part of the unit. In addition, for products with a DC input terminal, connect a DC power supply in the same way as the AC side, and further, if the DC circuit is grounded outside the power conditioner, connect it to the charging part that is grounded on the AC side.

B. Measure the terminal voltage of the filter circuit as follows:

- If the DC circuit is earthed outside the power conditioner, connect the DC side changeover switch to the grounded circuit (either E or F). If the DC circuit is not earthed outside the power conditioner, switch the DC side changeover switch to position D. - For the AC side, change the changeover switch to A or B for measurement. This applies to ports that may have cables connected. Also, change the settings of the equipment to obtain the maximum measured value.

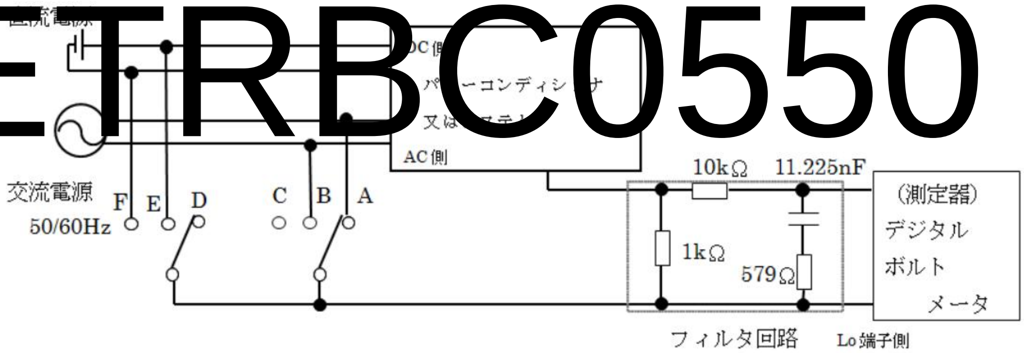


Figure 1 Measurement circuit when connecting to a single-phase

two-wire system [When connecting to a

single-phase three-wire system] A. Connect a filter circuit including a 1kÿ resistor between the charging part that is grounded on the AC side of the power conditioner and the exposed metal part of the device and the ground. In addition, for products with a DC input terminal, connect a DC power supply in the same way as the AC side, and further, if the DC circuit is grounded outside the power conditioner, connect it to the charging part that is grounded on the AC side.

B. Measure the terminal voltage of the filter circuit as follows:

- If the DC circuit is earthed outside the power conditioner, connect the DC side changeover switch to the earthed circuit (either D or E). If the DC circuit is not earthed outside the power conditioner, switch the DC side changeover switch to position C. - For the AC side, switch the changeover switch to position A and perform measurements.

This also applies to ports to which cables may be connected.

Also, the settings of the equipment are changed so as to obtain the maximum measurement value.

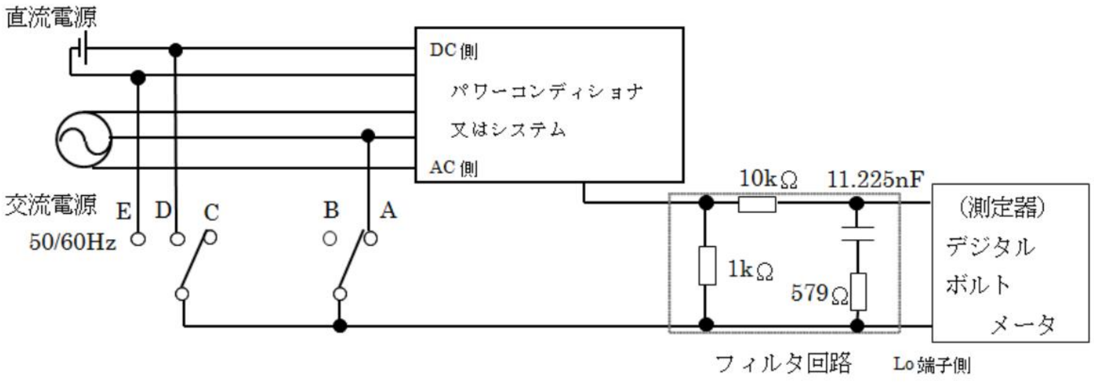


Figure 2 Measurement circuit when connecting to a single-

phase three-wire system [When

connecting to a three-phase three-wire system] A. Connect a filter circuit containing a 1kÿ resistor between the charging part that is grounded on the AC side of the power conditioner and the exposed metal part of the device. In addition, for products with a DC input terminal, connect a DC power supply in the same way as the AC side, and further, if the DC circuit is grounded outside the power conditioner, connect it to the charging part that is grounded on the AC side.

B. Measure the terminal voltage of the filter circuit as follows:

- If the DC circuit is earthed outside the power conditioner, connect the DC side changeover switch to the grounded circuit (either F or G). If the DC circuit is not earthed outside the power conditioner, switch the DC side changeover switch to position E. - For the AC side, change the changeover switch to A, B, or C for measurement. This applies to ports that may have cables connected. Also, change the settings of the equipment to obtain the maximum measured value.

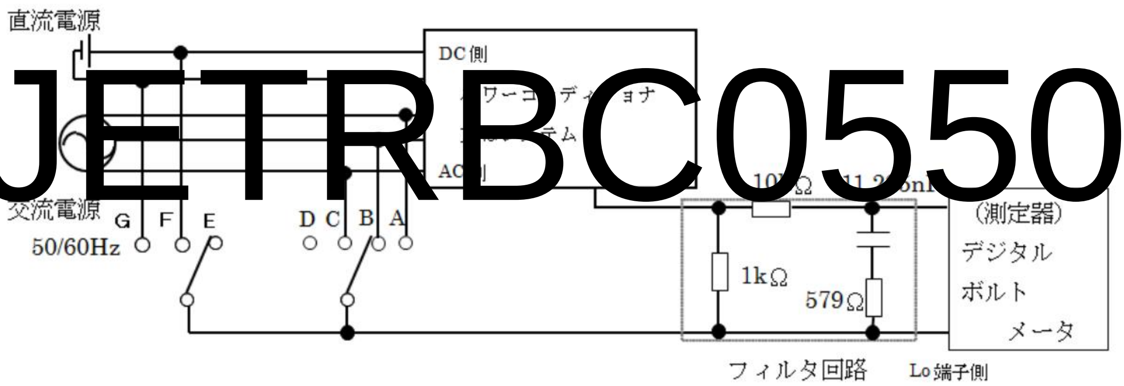


Figure 3 Measurement circuit for connecting to a three-phase three-wire system

[Evaluation

Criteria] The terminal voltage of the filter circuit is 5V or less.

[Notes]

The purpose of this test is to measure the leakage current flowing to the ground when the power conditioner is touched with the grounding wiring disconnected. However, since the test is performed with the power supply floating, the current flowing between the pole of the AC power supply that is originally grounded and the case of the power conditioner is measured. Furthermore, if the DC power supply is grounded, the pole that is originally grounded for the DC power supply and the pole that is grounded for the AC power supply are also connected for the test.

The above port refers to the case where the port is exposed on the exterior of the power conditioner, or the case where the port is inside the power conditioner and can be touched by the test finger. In addition, if the power

conditioner includes a lithium-ion storage battery and is not insulated, there is a possibility that leakage current will increase on the storage battery side through the circuit, so a system including a storage unit is essential, and the use of a DC power supply is prohibited.

If the power conditioner is an isolated type, the leakage current is blocked by an isolation transformer, so testing can be done with a DC power supply.

4.6 Voltage rise suppression function test

This test applies to products with reverse power flow. For products with multiple suppression limit value settings for the output control function, the standard value (factory default value) shall be "0%."

[Common test conditions]

The standard test conditions for the reverse conversion mode shown in Section 3.2 shall apply. However, items 2, 5, and 6 shall be changed as follows. 2. The DC power supply settings shall be set so that only DC energy sources that do not prevent reverse power are in operation and the power conditioner output is set to maximum output. 6. Open the SWLN and set the line impedance to the "standard line impedance" described in Section 4. For 100V connected equipment, the line impedance shall be "for single-phase three-wire system".

7. Turn on the SWLD and adjust the load as necessary so that the reverse power flow state can be maintained during the test. In addition, item 8 shall be added. 9. The operating time shall be measured using the signal from the external output signal port.

4.6.1 Voltage rise suppression function test (without standby operation)

Applies to products that can be set not to standby for voltage rise suppression operation.

[Measurement method] A. By adjusting the AC power supply voltage, gradually deviate from the normal voltage, and check the voltage at which the output control function and the leading-phase reactive power control function (if available) start to operate, and the suppression effect (voltage).

If the power supply has a reactive power control function, measure the power factor while the leading-phase reactive power control function is operating.

B. Further increase the voltage of the AC power supply and check the suppression limit value (0%) of the output control function (active power). C. By adjusting the AC power supply voltage, gradually increase the voltage from -1.0% to +1.0% of the set value and confirm the voltage rise suppression limit value (0%) of the output control function (active power).

Check the voltage at which the function operates.

2. Adjust the AC power supply voltage to gradually reduce the voltage from the voltage rise suppression operating state, and check the voltage at which the output control function is released.

E. Adjust the AC power supply voltage to suddenly change the voltage from the voltage rise suppression operating state to -5.0% of the set value, and check the operating time until the output control function is released.

F. Carry out the above measurements for each phase.

When measuring time, use the signal from the external output signal port.

[Criteria for judgment] A. The output voltage of the power conditioner is maintained at +0.5% or less of the set value by the output control function or the leading-phase reactive power control function. In addition, the lower limit of the power factor controlled by the leading-phase reactive power control function is 0.85 or more. However, the judgment is made after the voltage rise suppression function starts operating and the voltage stabilizes.

B. The suppression limit value of the output control function (effective power) is 0%. Note that the output power change at 0% output The control error is within 5% of the maximum specified output.

C. The voltage at which the output control function and the leading-phase reactive power control function (if provided) start to operate shall be adjusted. Within ±0.5% of the specified value.

D. The voltage at which the output control function is released must not have a hysteresis characteristic with respect to the voltage at which the output control function starts to operate. However, due to control constraints, it is permitted for the voltage at which the output control function is released to be higher than the voltage at which the function starts to operate, within the range specified in A.

E) The time required for the output control function to be released must be within 6 seconds.

4.6.2 Voltage rise suppression function test (if equipped with standby function) Applies to products

equipped with a voltage rise suppression standby function.

[Measurement

method] (Differences from Section 4.6.1 are underlined.) a.

The AC power supply voltage is adjusted to gradually deviate from the set voltage, and the voltage at which the output control function and leading-phase reactive power control function (if available) begin to operate (standby) and the suppression effect (voltage) are confirmed. If the leading-phase reactive power control function is available, the power factor is measured while the leading-phase reactive power control function is operating. b. The voltage of the AC power supply is further increased, and the suppression limit value (0%) of the output control function (active power) is confirmed. c. The AC power supply voltage is adjusted to gradually increase the voltage from -1.0% to +1.0% of the set value, and the voltage increase suppression effect is confirmed.

Check the voltage at which the function starts to standby.

D. After the voltage rise suppression function starts standby, the voltage is suddenly changed to -1.0% of the set value 60 seconds later, and the voltage rise suppression function

Check the operation time at which the inhibition function standby is initialized.

E. By adjusting the AC power supply voltage, gradually increase the voltage from -1.0% of the set value, and after the voltage rise suppression function starts to wait for operation, stop the voltage rise and check the operating time until the voltage rise suppression function starts operating. F. Further increase the AC power supply voltage, and check the operating time until the output control function (effective power) starts after the voltage rise suppression function starts operating.

Check the time it takes to reach the suppression limit (0%).

G. By adjusting the AC power supply voltage, gradually reduce the voltage from the voltage rise suppression operating state, and check the voltage at which the output control function is released.

H. By adjusting the AC power supply voltage, suddenly change the voltage from the voltage rise suppression operating state to -5.0% of the set value, and check the operating time until the output control function is released. (It is acceptable to perform the test by setting a shorter operating time limit.) In addition, check that the operating standby time limit of the voltage rise suppression function is initialized by the external output signal port.

i) Carry out the above measurements for each phase.

When measuring the time, use the signal from the external output signal port. [Judgment Criteria]

(Differences from 4.6.1 are underlined.) A. The output control function or leading-phase reactive power control function maintains the output terminal voltage of the power conditioner at +0.5% or less of the set value. In addition, the lower limit of the power factor controlled by the leading-phase reactive power control function is 0.85 or more.

The voltage at which the output control function and the leading-phase reactive power control function (if available) start to operate (standby) must be within ±0.5% of the set value. However, the judgment is made after the voltage rise suppression function starts to operate and the voltage stabilizes.

B. The suppression limit value of the output control function (effective power) is 0%.

In addition, a control error of output power fluctuation of 5% or less of the maximum specified output at 0% output is permitted.

C. The voltage at which the voltage rise suppression function starts to standby must be within ±0.5% of the set value.

D. The voltage rise suppression operation standby time shall be initialized within 6 seconds. E. The voltage rise suppression function operation standby time shall be 200 seconds (tolerance -0/+15 seconds). F. The time it takes for the voltage rise suppression function to reach the suppression limit value (0%) after operation shall be within 100 seconds. G. There shall be no hysteresis between the voltage at which the output control function is released and the voltage at which the output control function begins to operate. However, due to control constraints, it is permitted for the voltage at which the output control function is released to be higher than the voltage at which the function begins to operate, within the range specified in A.

H. Output control function only:

The time for the output control function to be released must be within 6 seconds. Furthermore, when the output suppression state is released, In the case of leading-phase reactive power control function and output control function:

The time for the output control function to be released must be within 6 seconds.

Furthermore, the voltage rise suppression operation standby time must be initialized when the output suppression state is released, leading-phase reactive power control is released, and the power factor returns to a steady operation state.

[Notes]

1. Concept of setting operation time limit

- Based on the idea of setting an operating time limit that is in harmony with the voltage regulator of the power distribution system as specified by the grid interconnection regulations, standard values were established as the certification test method.

- The maximum operating time limit of the SVR (Step Voltage Regulator), which has the longest operating time limit among the voltage adjustment devices in the power distribution system, was determined as the operating time limit of the power conditioner's voltage suppression function.

- According to a survey by the Federation of Electric Power Companies, the maximum operating time of the SVR is 200 seconds. The inverter's voltage rise suppression function has a time limit of 200 seconds.

2. Setting the cancellation deadline

•The power conditioner detects that the power grid voltage has returned to the upper limit reference value and then performs the release operation. This is the time until the start of the cancellation process, and the following requirements are required for the cancellation process.

- First, to return to normal operation as quickly as possible and reduce loss of power generation opportunities. Second, to resolve output control functions. The object of the present invention is to perform the removal process reliably and to avoid repeating operation and waiting.

•As a method to realize these requirements, JEMA investigated product specifications and developed output control function (active power control). The proposed release time limit of 6 seconds has been set as the standard value for the certification test method. As for the release of the leading reactive power control function, no release time limit has been set because it has little impact on power generation opportunity loss.

3. Check the operation of the voltage rise suppression function External output port settings

- An external output signal port that can check the operation/release of the voltage rise suppression function (leading phase reactive power control function and output control function) and the operating standby time limit of the voltage rise suppression function must be provided for testing. This port may be used in conjunction with the command signal confirmation port used for step injection function testing, etc.

•The leading reactive power control function is released when the power factor reaches a steady operating state. In addition, releasing the output control function means that "when the voltage rise suppression function is activated and the voltage at the power conditioner terminal returns to below the set voltage, the power conditioner is returning from the output suppression state to the designated output."

4. Explanation of "hysteresis" in the judgment criteria

- In the criteria, "no hysteresis characteristics are observed" means that the reference voltage for operating and releasing the output control function is the same. When the AC power supply voltage is maintained at a voltage at which the output control operates in a device without hysteresis characteristics, the output control function operation confirmation signal operates in a direction that reduces the output, and as the output is reduced, the voltage at the power conditioner end falls below a specified voltage. When the voltage falls below the specified voltage, the output control is released, the output increases, and the voltage at the power conditioner end rises above the specified voltage again. This operation is repeated, causing the confirmation signal to hunt.

4.7 Temperature Rise Test The

test is conducted under the conditions that cause the greatest temperature rise in each part. The conditions will be decided in consultation with the certification applicant. However, for battery-integrated types, the test should be conducted on a system basis, taking into account the temperature rise in the storage unit. For grid-connection protection devices that can be connected to a power conditioner in an independent circuit, the test is conducted under the conditions that cause the greatest temperature rise. The conditions will be decided in consultation with the certification applicant.

[If the system does not include a storage battery, etc.]

[Test conditions]

The standard test conditions for the inverse conversion mode shown in Section 3.2 shall apply, except that items J through W shall be added. J. If there are dedicated loads or auxiliary equipment, these shall be in normal operation. K. For equipment used inside an enclosure, testing shall be performed using the designated enclosure. L. The reference ambient temperature shall be 30°C for indoor use, 40°C for outdoor use, and 65°C for microinverters for AC modules in photovoltaic power generation systems.

[Measurement method] A. Adjust the load so that the power conditioner output is at its maximum, and continue operation at the rated power factor until the temperature rise of each part reaches saturation. If a dedicated load is set, use that load.

B. Operate the unit until the temperature rise in each part becomes almost constant, and measure the temperature of each part.

If the temperature continues to rise after the analyzer is stopped, continue measuring the temperature.

[Criteria for judgment] A. The temperature of each part must be below the specified temperature.

(The specified value is based on Appendix 4 of Annex 8 of the Interpretation of the Ministerial Ordinance Prescribing Technical Standards for Electrical Appliances and Materials) B. After leaving it, it must pass the insulation resistance test in Section 2.1.

C. After leaving it, it must pass the power frequency withstand voltage test in section 2.2.

[If the system includes a storage battery, etc.]

This test is based on JIS C 4412 for both the test method and the evaluation criteria. It also follows 1. [Note] 1. of 1. Structural test. However, for integrated battery types, the test is carried out as a system, taking into account the temperature rise of the storage unit. In addition, the test should be carried out under the most severe conditions.

[Note] 1.

[Note] 2. of the structural test may also be applied. However, the test must be performed under the conditions that cause the greatest temperature rise in each part. If the operating conditions under which the test was [illegible] are insufficient, the test must be performed and the judgment criteria must be in accordance with IEC 62109-1.

4.8 Soft start function test [Test conditions] The

standard test

conditions for the reverse conversion mode shown in Section 3.2 shall apply.

[Measurement

method] B. After disconnecting the power conditioner by the external switch (operation switch) of the power conditioner,

B. Measure the AC output

current when the power conditioner is restarted.

[Evaluation

Criteria] When the power conditioner is started, the maximum value of the AC output current must be 150% or less of the maximum specified current, and the time during which it exceeds 105% must be 0.5 seconds or less.

4.9 Power factor switching test due to power flow

This test applies to power conditioners that have a power factor switching function based on tidal current.

[Test conditions]

The standard test conditions for the inverse conversion mode shown in Section 3.2 shall apply.

However, if 5% of the maximum specified output is less than 150W, 95% of the specified output during reverse flow (reverse flow state) and 105% of the specified output during forward flow (forward flow state) shall be read as the specified output during reverse flow - 150W (reverse flow state) and the specified output during forward flow + 150W (forward flow state).

[Measurement

method] a. The load is stepped up from 95% of the power conditioner's designated output during reverse flow (reverse flow state) to 105% of the designated output during forward flow (forward flow state) to achieve a forward flow state. This is maintained for at least the maximum time for detection of switching to forward flow power factor specified by the applicant for certification (but must be less than 10 minutes). b. The load is changed to 95% of the designated output during reverse

flow (reverse flow state) and maintained for 220 seconds. c. The load is again changed to 105% of the designated output during forward flow

(forward flow state) and this state is maintained.

D. The time from when the reverse power flow is switched to the forward power flow in item C until the power factor of the forward power flow starts to be switched is defined as the power factor switching time.
The measurement is performed using an external port that indicates the inside.

E. Measure the power factor switching time and the change in reactive power during the switching period.

F. After the power factor has been switched to the forward flow state, measure the power factor.

G. Change the load to 95% of the specified output during reverse flow (reverse flow state). C. After switching

from forward flow to reverse flow in item G, the time until the power factor of reverse flow is changed over is
Measured using an external port that indicates power factor switching.

i. Measure the power factor switching time and the change in reactive power during the switching period. j.

Measure the power factor after switching to the power factor in the reverse flow state is complete. [Judgment Criteria] a. The

time measured in

measurement method item 2 must be greater than or equal to 10 minutes plus the maximum time required for power flow detection. The maximum time required for power flow detection must take into account factors such as the frequency of communication and must conform to the specifications presented by the certification

applicant. b. The time required for power factor switching measured in measurement method items 5 and 9 must be greater than or equal to 80 seconds and less than or equal to 100 seconds.
thing.

C. The change in reactive power during power factor switching measured in items C and D of the measurement method shall be a ramp shape. D. The power factor

in the forward flow state shall be the forward flow power factor specified by the certification applicant.

The time measured in item H of the measurement method shall be the minimum time possible on the system and shall be within 5 minutes. The minimum time possible on the system shall be confirmed in the specifications provided by the certification applicant.

F. The power factor during reverse power flow is the specified power factor. G. The

voltage rise suppression function takes precedence over this function. The priority is provided by the certification applicant.
Please check the specifications provided.

[Notes] 1.

Confirmation that the voltage rise suppression function has priority will be made based on a comprehensive judgment taking into account the information below and other information.

•Switching to the forward flow power factor must not start during voltage rise suppression (including standby time). •Change characteristics of reactive

power and active power when the voltage rise suppression function operates while operating at a forward flow power factor. •Reactive power and active power

when voltage rise suppression starts during switching from a power factor in a reverse flow state to a power factor in a forward flow state.
Changes in active power

•Reactive power when voltage rise suppression starts during switching from a power factor in a forward flow state to a power factor in a reverse flow state,
Change characteristics of active

power 2. When measuring the time when the power factor of the power conditioner starts or ends, it must be possible to confirm the switching period using a signal from an external output signal port that clearly indicates the switching period. This may be used in conjunction with the command signal confirmation port used in step injection function tests, etc.

3. The time required for power factor switching is set to 80 to 100 seconds, so as to be equal to or less than the time it takes for the output control function (effective power) to reach its suppression limit value after the voltage rise suppression function is activated, and so as to ensure a sufficiently gradual change so as not to affect the islanding prevention function.

4. The time required for the power factor to change from forward flow to reverse flow after the reverse flow condition is reached is called the broad-sense power factor.

The time was set to 5 minutes, which is the same as the time it takes for the conditioner to detect reverse power flow.

5. The time required for reverse power flow detection is the time required for power factor switching described in Note 3 minus the time described in Note 4.

The minimum time between the two tests was subtracted to 220 seconds.

6. The waiting time from when forward flow is detected until the switchover to forward flow power factor begins is set to twice the waiting time (200 seconds) to ensure that the voltage rise suppression function is completed, even if the voltage rise suppression function is activated immediately before the switchover to forward flow, plus the voltage rise suppression function operation time (100 seconds).

5. Transient response characteristic test

The tests in this section shall be carried out under actual operating conditions.

5.1 Sudden input power change test and sudden load change test

In this test method, a sudden input power change test and a sudden load change test are applied as necessary.

5.1.1 Sudden input power change test For

configurations that include solar cells as a DC energy source, the following test is performed. [Test conditions]

The standard

test conditions for the inverse conversion mode shown in section 3.2 shall apply, except that

item (g) shall be changed as follows: g. Turn on the SWLD

and set the load so that it consumes 50% of the specified output at the standard power factor of the power conditioner. [Measurement method] a. Change the DC

input for the solar

cell of the power

conditioner, and suddenly change the AC output of the power conditioner from 50% to approximately 75%, and maintain this for 10 seconds, after which change the DC input of the power conditioner, suddenly change the AC output of the power conditioner to 50%, and measure the AC output current.

B. Change the DC input to the solar cell of the power conditioner, suddenly change the AC output of the power conditioner from 50% to about 25%, and maintain this for 10 seconds. Then, change the DC input to the power conditioner, suddenly change the AC output of the power conditioner to 50%, and measure the AC output current.

C. Observe the stability of the AC output current, and if oscillation occurs in the AC output current, measure the duration of the oscillation.

[Evaluation

Criteria] A. The power conditioner smoothly follows a sudden change in DC input power and outputs a voltage equivalent to the DC input power after the sudden change. To output AC output power stably.

B. The AC output current of the power conditioner after the sudden change is 150% or less of the maximum specified current and does not exceed 105%.

The time it takes to reach the target should be less than 0.5 seconds.

C. The power conditioner must not operate unintentionally when there is a sudden change in DC input power.

5.1.2 Sudden load change test

The following tests are carried out for load following type products: [Test

conditions] The

standard test conditions for the inverse conversion mode shown in Section 3.2 shall be applied.

However, change item G to the following: G. Turn on the

SWLD and set the load so that the output of the operating state combined in item D can be consumed.

[Measurement

method] A. Operate the power conditioner so that its output is 50% of the specified output at the standard power factor.

If there is a dedicated load installed in the system to prevent reverse power flow, etc., set it to a state where the power conditioner output can be consumed.

B. Rapidly change the load connected to the power conditioner

output from 50% to approximately 75%, and after the power conditioner output has stabilized, suddenly change it back to 50% and measure the AC output current.

C. The load connected to the output of the power conditioner is suddenly changed from 50% to about 25%.

After the output of the inverter has stabilized, suddenly change it to 50% and measure the AC output current.

D. Operate the power conditioner so that its output is at its maximum. If there is a dedicated load installed in the

system to prevent reverse power flow, etc., set the power conditioner output so that it can be consumed.

E. The load connected to the output of the power conditioner is suddenly changed from 100% to 0%.

After the output of the inverter has stabilized, suddenly change it to 100% and measure the AC output current.

[Evaluation

Criteria] A. The power conditioner smoothly follows a sudden change in load and stably maintains the AC output power equivalent to the load after the sudden change.

In addition, in the case of a device without reverse current, reverse current must not be provided.

B. The maximum value of the AC output current of the power conditioner after the sudden change is 150% or less of the maximum specified current and 105%

The time for which the

C. The power conditioner must not operate unintentionally when the load changes suddenly.

The following tests are conducted on peak-cut type products.

[Test

conditions] Apply the test conditions shown for the load following

type.

[Measurement method] A. Set the maximum peak cut amount to 0% or the minimum value and perform the load following type test.

B. Set the maximum peak cut amount to 50% of the specified output of the power conditioner. C. Rapidly change the load

connected to the output of the power conditioner from 100% to 0% and measure the AC output current. D. Rapidly change the load connected to

the output of the power conditioner from 0% to approximately 100% and measure the AC output current.

[Evaluation

Criteria] A. The power conditioner smoothly follows sudden changes in the load and stably outputs AC power according to the specifications.

Also, if there is no reverse current, do not reverse current.

B. The maximum value of the AC output current of the power conditioner after the sudden change is 150% or less of the maximum specified current and 105%

The time for which the

C. The power conditioner must not operate unintentionally when the load changes suddenly.

5.2 System voltage sudden change test

[Test conditions]

The standard test conditions for the inverse conversion mode shown in Section [illegible].2 shall apply.

[Measurement

method] A. Operate the grid voltage at the rated voltage of each phase of the power conditioner.

B. Suddenly change the grid voltage from the rated value of each phase of the power conditioner to 105% and maintain it for 10 seconds, then

The voltage is suddenly changed to the rated value for each phase and the AC output current is measured.

C. Operate the system voltage at the rated voltage of each phase of the power conditioner. D.

Suddenly change the system voltage from the rated value of each phase of the power conditioner to 95% and maintain it for 10 seconds, then

The AC output current is measured while suddenly changing each phase to its rated value.

[Evaluation

Criteria] A. The power conditioner must smoothly follow sudden changes in the grid voltage and stably output AC output power equivalent to the grid voltage after the sudden change.

B. The maximum value of the AC output current of the power conditioner after the sudden change is 150% or less of the maximum specified current and 105%

The time for which the

5.3 System voltage phase change test

5.3.1 Sudden change in system voltage phase (phase difference 10°)

As all devices are now FRT-compatible, this test, which applies only to devices that are not FRT-compatible, will no longer be conducted. For the previous test method, see "ÿAppendixÿAbout test methods that are no longer being conducted."

5.3.2 Sudden change in system voltage phase (phase difference **120°)**

[Test conditions]

The standard test conditions for the inverse conversion mode shown in section 3.2 shall apply.

However, section F shall be changed to the following: F. The

settings of the protective relays etc. of the protective devices shall be the factory default values (as stated in the certification application form), and the islanding prevention function

(passive and active methods) shall be masked. [Measurement method] A.

Operate the

power conditioner with the output voltage phase set as the reference (0°).

B. The phase of the system voltage is suddenly changed from 0° to +120° and the AC output current is measured.

C. Check the power conditioner's operating status and whether each part is damaged. D. If the power conditioner is disconnected,

restart it automatically or manually. E. Operate the power conditioner with the output voltage phase set as the reference (0°).

F. The phase of the system voltage is suddenly changed from 0° to -120° and the AC output current is measured.

G. Implement items C and D. [Criteria] A. The power

conditioner

continues to operate or is safely disconnected, and there is no damage to any part.

B. If the power conditioner is disconnected, operation can be resumed automatically or manually.

5.4 System voltage unbalance sudden change test

This test applies to power conditioners whose electrical system is single-phase three-wire and three-phase three-wire. [Test conditions] The standard

test conditions

for the inverse conversion mode shown in Section 3.2 are applied. [Measurement method] [For single-

phase three-wire]

A. After operating the system

voltage at the rated voltage of each phase of the power conditioner, simultaneously carry out the following conditions and measure the AC output current.

- The system voltage is suddenly changed from the power conditioner's single-phase (UN) rated value to [illegible]% and maintained for 10 seconds, after which the system voltage is suddenly changed to the rated value of each phase.

- The system voltage is suddenly changed from the rated value of one phase (VN) of the power conditioner to 95% and maintained for 10 seconds, after which the system voltage is suddenly changed to the rated value of each phase.

B. After operating the system voltage at the rated voltage of each phase of the power conditioner, simultaneously carry out the following conditions and measure the AC output current.

- The system voltage is suddenly changed from the power conditioner's single-phase (UN) rated value to 95% and maintained for 10 seconds, after which the system voltage is suddenly changed to the rated value of each phase.

•The system voltage is suddenly changed from the rated value of one phase (VN) of the power conditioner to 105% and maintained for 10 seconds,

The system voltage is suddenly changed to the rated value of each phase.

[For three-phase, three-wire systems]

A. After operating the power conditioner at the rated voltage for each phase of the system, perform the following conditions simultaneously and measure the AC output current.

- The grid voltage is suddenly changed from the power conditioner's single-phase (UV) rated value to 105% and maintained for 10 seconds, after which the grid voltage is suddenly changed to the rated value of each phase.

- The system voltage is suddenly changed from the rated value of one phase (VW) of the power conditioner to 95% and maintained for 10 seconds, after which the system voltage is suddenly changed to the rated value of each phase.

B. After operating the system voltage at the rated voltage of each phase of the power conditioner, simultaneously carry out the following conditions and measure the AC output current.

- The grid voltage is suddenly changed from the power conditioner's single-phase (UV) rated value to 95% and maintained for 10 seconds, after which the grid voltage is suddenly changed to the rated value of each phase.
- The system voltage is suddenly changed from the power conditioner's single-phase (VW) rated value to 105% and maintained for 10 seconds, after which the system voltage is suddenly changed to the rated value of each phase. C. After

operating the system voltage at the rated voltage of each phase of the power conditioner, the following conditions are simultaneously performed and the AC output current is measured.

•The system voltage was suddenly changed from the power conditioner's single-phase (VW) rated value to 105% and maintained for 10 seconds. After that, the system voltage is suddenly changed to the rated value of each phase.

- The system voltage is suddenly changed from the power conditioner's single-phase (WU) rated value to 95% and maintained for 10 seconds, after which the system voltage is suddenly changed to the rated value of each phase.

D. After operating the system voltage at the rated voltage of each phase of the power conditioner, simultaneously carry out the following conditions and measure the AC output current.

- The system voltage is suddenly changed from the rated value of one phase (VW) of the power conditioner to 95% and maintained for 10 seconds, after which the system voltage is suddenly changed to the rated value of each phase.
- The system voltage is suddenly changed from the power conditioner's single-phase (WU) rated value to 105% and maintained for 10 seconds, after which the system voltage is suddenly changed to the rated value of each phase. E. After

operating the system voltage at the rated voltage of each phase of the power conditioner, the following conditions are simultaneously performed and the AC output current is measured.

- The system voltage is suddenly changed from the power conditioner's single-phase (WU) rated value to 105% and maintained for 10 seconds, after which the system voltage is suddenly changed to the rated value of each phase.
- The grid voltage is suddenly changed from the power conditioner's single-phase (UV) rated value to 95% and maintained for 10 seconds, after which the grid voltage is suddenly changed to the rated value of each phase.

F. After operating the power conditioner at the rated voltage for each phase, perform the following operations simultaneously and measure the AC output current.

- The system voltage is suddenly changed from the power conditioner's single-phase (WU) rated value to 95% and maintained for 10 seconds, after which the system voltage is suddenly changed to the rated value of each phase.

• The system voltage is suddenly changed from the power conditioner's single-phase (UV) rated value to 105% and maintained for 10 seconds, The system voltage is suddenly changed to the rated value of each phase.

[Evaluation Criteria] A. The power conditioner smoothly follows the sudden change in the line unbalanced voltage and stably outputs the AC output power equivalent to the line voltage unbalanced after the sudden change. B. The maximum value of the AC

output current of the power conditioner after the sudden change is 150% or less of the maximum specified current and 105% or less.

The time for which the

6.External Accident Test

The tests in this section shall be carried out under actual operating conditions.

6.1 AC short circuit test

[Test conditions]

The standard test conditions for the inverse conversion mode shown in Section 3.2 shall apply.

However, paragraph (b) shall be changed to the following:

B. The AC power supply shall be operated at the rated voltage and rated frequency. In addition, it shall be set so that it detects a short circuit current and opens the circuit within 0.1 seconds after an accident occurs. In addition, clauses J and L shall be added.

J. Set the short-circuit resistor RSC to a value equivalent to a load that is 10 times or more the maximum specified current of the power conditioner. Determine.

l. Wrap the power conditioner with unbleached kana cloth (unpasted plain weave cotton cloth with a density of 72 ± 4 warp threads and 69 ± 4 weft threads per 25.4 mm, using 30 count warp threads and 36 count weft threads). [Measurement method] a. Close the switch SWSC to create an AC short circuit, and measure the AC

current and disconnection time on the power conditioner output side. If a DC power source is used, also measure the DC input current. b. Check the condition of the unbleached kana cloth. c. Check

the operating state of the power conditioner and whether or not there is any damage to each part.

[Evaluation

Criteria] A. The outer casing is not damaged and the wrapped cloth or wire is not burned. B. The power conditioner

is safely disconnected and there is no damage to any part.

C. The time during which the AC output current during a short circuit exceeds 150% of the maximum specified current is 1/2 cycle or less.

D. When using a DC power source instead of a storage battery, etc., or when using a storage battery installed in an electric vehicle, etc., the peak current of the DC input current is equal to or less than the maximum DC current regulation value.

6.2 Instantaneous voltage drop test

As all devices are now FRT-compatible, this test, which applies only to devices that are not FRT-compatible, will not be conducted. For information on the previous test method, see "(Appendix) Test Methods that are no longer being conducted."

6.3 Instantaneous voltage drop test (FRT test)

In grid-connection protection devices that can connect power conditioners to an isolated circuit, all electromagnetic switchgears between the inverter and grid connection port, between the inverter connection port and grid connection port, and between the load connection port and grid connection port shall not be opened during the instantaneous voltage drop test (FRT test). (Confirm with the specifications of the electromagnetic switchgear, etc.) Furthermore, in the case of a power conditioner that has a power

factor switching function based on power flow, if the error in the power factor during forward power flow does not meet the criteria for reverse power flow in section 4.3, this test shall also be performed with the power factor set to forward power flow. In addition, if the error in the power factor during forward power flow meets the criteria for reverse power flow in section 4.3, but the power factor during forward power flow is not included in the specified power factor range for reverse power flow, this test shall be performed by expanding the specified power factor range to include the power factor during forward power flow. [Test conditions] The standard test conditions for the reverse conversion

mode shown in

section 3.2 shall apply. However, section e shall be changed to the following. e. The line

impedance is short-circuited. However, if the voltage rise

suppression function is activated, the voltage rise suppression function is activated. Mask the feature.

The undervoltage relay (UVR) setting may be changed to a setting that does not interfere with the FRT test. [Measurement method]

[For single-

phase equipment] A.

Steady-state voltage shall be 107V, 101V, and 95V for a 100V system.
The phase angle for instantaneous voltage drop is set to three values: 0°, 45°, and 90°. The output setting will be determined in consultation with the certification applicant.

B. Generate an instantaneous voltage drop lasting 1.0 second or less on the AC power supply side (residual voltage is 20% or more of the rated voltage and less than the UVR operating voltage). However, if the DC energy source includes a fuel cell or gas engine, the duration of the instantaneous voltage drop shall be 0.3 seconds or less. Furthermore, regardless of the steady-state voltage, the minimum residual voltage shall be 20V in all cases. If a DC power source is used instead of a storage battery, etc., the DC input current shall also be measured. C. Generate an instantaneous power outage lasting

1.0 second or less on the AC power supply side (residual voltage is 0% or more and less than 20% of the rated voltage). However, if the DC energy source includes a fuel cell or gas engine, the duration of the momentary voltage drop shall be 0.3 seconds or less. If a DC power source is used instead of a storage battery, etc., the DC input current shall also be measured.

D. Measure the gate block signal and current waveform during the voltage drop test. E. Operate a single type of

DC energy source and perform the above test for all types and combinations of each DC energy source at all combinations of the above power supply voltages and phase insertion angles. If the specified output cannot be achieved with a single type of DC energy source, it may be performed after consultation with the certification applicant.

F. Equipped with a power factor switching function based on power flow, the time required to switch from a forward flow power factor to a reverse flow power factor is 1 second.
For power conditioners falling under the following criteria, the load shall be set so as to consume 110% of the specified output of the power conditioner, and the above test shall be carried out.

[For three-phase equipment]

A. The steady-state voltage shall be three times for a 200V system: 222V, 202V, and 182V. For equipment whose power supply voltage differs from the system voltage, tests shall be conducted at the rated voltage and at that voltage ±10%. The phase insertion angle for momentary voltage dips shall be three times: 0°, 45°, and 90°. The following tests shall be conducted for all of the above combinations.

B. An instantaneous voltage drop (residual voltage is 20% or more of the rated voltage and less than the UVR operating voltage) is generated on the AC power supply side, lasting for 0.3 seconds or less. However, regardless of the steady-state voltage, the minimum residual voltage shall be 40V in all cases. For equipment whose power supply voltage is different from the system voltage, the voltage shall be 20% of the rated voltage.

C. An instantaneous power outage lasting 0.3 seconds or less occurs on the AC power supply side (residual voltage is 0% or more and less than 20% of the rated voltage). To give birth.

D. Measure the gate block signal and current waveform during the voltage drop test. E. Operate a single type of

DC energy source and perform the above test for all types and combinations of each DC energy source at all combinations of the above power supply voltages and phase insertion angles. If the specified output cannot be achieved with a single type of DC energy source, it may be performed after consultation with the certification applicant.

F. In the case of a power conditioner that has a power factor switching function based on power flow and that takes 1 second or less to switch from a forward flow power factor to a reverse flow power factor, the above test shall be performed by setting the load so that 110% of the specified output of the power conditioner is consumed.

[Criteria] 1)

Instantaneous voltage drop (less than the UVR operating voltage when the residual voltage is 20% or more) a) Parallel operation (continuation of current) without gate blocking for instantaneous voltage drop. (Note 1)

B. The time required for the effective power output to recover to 80% of the level before the momentary voltage drop occurs is within 0.1 seconds after the voltage recovery. However, in the case of single-phase and three-phase systems in which the DC energy source is only a storage battery, or in the case of a combined system of a single-phase storage battery and a solar cell, and recovery is performed by load following power control, the recovery time to 80% may be within 0.4 seconds. This does not apply to combined systems of a three-phase storage battery and a solar cell. Furthermore, if the DC energy source includes a fuel cell or a gas engine, the recovery time to 80% may be within 1 second.

C. When the grid voltage is restored, the maximum value of the AC output current of the power conditioner must be 150% or less of the maximum specified current, and the time during which it exceeds 105% must be 0.5 seconds or less. Furthermore, the inverter must be operated in parallel (continuation of current) without gate blocking. (Note 1)

D. When using a DC power source instead of a storage battery, etc., or when using a storage battery installed in an electric vehicle, etc., the peak current of the DC input current must be equal to or less than the maximum DC current regulation value.

ÿ Momentary power outage (when the residual voltage is 0% or more and less than 20%) a. For a momentary voltage drop, either continue parallel operation or block the gate. Opening the circuit breaker is not permitted. Not done.

B. The time required for the effective power output to recover to 80% of the level before the momentary voltage drop occurs is within 1.0 second after the voltage recovery. However, if the DC energy source is only a solar cell, the recovery time to 80% must be within 0.2 seconds.

C. When the grid voltage is restored, the maximum value of the AC output current of the power conditioner must be 150% or less of the maximum specified current, and the time during which it exceeds 105% must be 0.5 seconds or less. Furthermore, the inverter must be operated in parallel (continuation of current) without gate blocking. (Note 1)

D. Products that automatically switch to isolated operation shall not switch to isolated operation during a momentary voltage drop of 0% residual voltage.

E. When using a DC power source instead of a storage battery, etc., or when using a storage battery installed in an electric vehicle, etc., the peak current of the DC input current must be equal to or less than the maximum DC current regulation value.

[Voltage drop with phase change]

[Test conditions]

The standard test conditions for the inverse conversion mode shown in Section 3.2 shall apply, except that items E and G shall be changed as follows: E. The line impedance shall be short-circuited. However, if the voltage rise suppression function is activated, the voltage rise suppression function shall be activated. Mask the feature.

G. The settings of protective relays and other protective devices shall be the factory default values (as stated in the certification application form). In addition, for products that monitor frequency changes as a condition for returning from the active function standby state (which can be implemented upon consultation with the certification applicant) to the active function enabled state, the test shall also be performed in the active function standby state. In addition, the setting of the undervoltage relay (UVR) may be changed to a setting value that does not interfere with the FRT test. [Measurement method] [For single-phase

equipment] A. Steady-state voltage shall be 107V, 101V, and 95V for the 100V system. Furthermore, for products that monitor frequency changes as a condition for returning from the active function standby state to the active function enabled state, the test shall be performed at 101V in the active function standby state. There shall be three phase angles for instantaneous voltage dips: 0°, 45°, and 90°. The output settings shall be determined in consultation with the certification applicant.

B. An instantaneous voltage drop lasting 1.0 second or less is generated on the AC power supply side (three-phase high-voltage Y-connection side two-phase short circuit state, residual voltage 20% or more, less than the UVR operating voltage, and a phase change (lead/lag) on the delta connection side). When the high-voltage side two-phase short circuit residual voltage is 20%, the low-voltage side residual voltage will be 52% of the rated voltage and there will be a

phase change (lead/lag) of 41°. However, if the DC energy source includes a fuel cell or gas engine, the duration of the instantaneous voltage drop shall be 0.3 seconds or less.

Furthermore, regardless of the steady-state voltage, the minimum residual voltage shall be 52V in all cases. If a DC power source is used instead of a storage battery, etc., the DC input current shall also be measured.

C. Measure the gate block signal and current waveform during the voltage drop test. D. Operate a single type of

DC energy source and conduct the above test for all types and combinations of each DC energy source at all combinations of the above power supply voltage and phase insertion angle. If the specified output cannot be obtained with a single type of DC energy source, it may be possible to conduct the test after consultation with the certification applicant.

E. In the case of a power conditioner that has a power factor switching function based on power flow and that takes 1 second or less to switch from a forward flow power factor to a reverse flow power factor, the above test shall be performed with the load set to consume 110% of the specified output of the power conditioner.

[For three-phase equipment]

a. The steady-state voltage shall be three times for a 200V system: 222V, 202V, and 182V. For equipment whose power supply voltage differs from the system voltage, tests shall be conducted at the rated voltage and at that voltage ±10%. a. The steady-state voltage shall be three times for a 200V system: 222V, 202V, and 182V. Furthermore, for products that monitor frequency changes as a condition for returning from an active function standby state to an active function enabled state, tests shall be conducted at 202V in the active function standby state. The phase closing angle for momentary voltage dips shall be three times: 0°, 45°, and 90°. The following tests shall be conducted for all of the above combinations.

B. When a two-phase short circuit on the three-phase high voltage Y-connection side continues for 0.3 seconds or less on the AC power supply side, and the residual voltage is 20% or more, An instantaneous voltage drop below the UVR operating voltage is generated. Each of the three phases is used as the reference phase. Tables 6.3-1 and 6.3-2 show examples of voltage and phase when the residual voltage is 20%.

C. Measure the gate block signal and current waveform during the voltage drop test. D. Operate a single type of

DC energy source and conduct the above test for all types and combinations of each DC energy source at all combinations of the above power supply voltage and phase insertion angle. If the specified output cannot be obtained with a single type of DC energy source, it may be possible to conduct the test after consultation with the certification applicant.

E. In the case of a power conditioner that has a power factor switching function based on power flow and that takes 1 second or less to switch from a forward flow power factor to a reverse flow power factor, the above test shall be performed with the load set to consume 110% of the specified output of the power conditioner.

Table 6.3-1 Test conditions for Y-connection side (calculation example when two-phase short circuit residual

Steady-state voltage	voltage is 20%) L1 Upper row: Minimum voltage (V)	L2 Upper row: Minimum voltage (V) Lower row: Phase	L3 Upper row: Minimum voltage (V) Lower row: Phase
202V	Lower row:	(°) 40.00 0.00	(°) 176.08 23.48
222V	Phase (°) 176.08	40.00 0.00	193.30 24.06
182V	23.48 193.30 24.06 158.88 22.77	40.00 0.00	158.88 22.77

Table 6.3-2 Test conditions for ÿ connection side (calculation example when two-phase short circuit residual voltage is 20%)

	Steady-state voltage	L1 Top row: Minimum voltage (V) Bottom row: Phase	L2 Upper row: Minimum voltage (V) Lower row:	L3 Top row: Minimum voltage (V) Bottom row: Phase	
	202V	(°) 106.78 41.07	Phase (°) 202.00	(°) 106.78 41.07	
	222V	116.28 42.67	0.00 222.00	116.28 42.67	
	182V	97.37 39.16	0.00 182.00 0.00	97.37 39.16	

[Criteria for

judgment] A. Parallel operation (continuation of current) without gate blocking for momentary voltage drop. (ÿ) B. After voltage recovery,

the time for the effective power output to return to 80% of the level before the momentary voltage drop occurs is within 0.1 seconds .

However, if

the recovery operation is performed by load following power control, the recovery time to 80% may be within 0.4 seconds. However, this does not include a composite system of a three-phase storage battery and solar cell, and a photovoltaic power generation system. Furthermore, if the DC energy source includes a fuel cell or a gas engine, the recovery time to 80% may be within 1 second.

C. When the grid voltage is restored, the maximum value of the AC output current of the power conditioner must be 150% or less of the maximum specified current, and the time during which it exceeds 105% must be 0.5 seconds or less. Furthermore, the power conditioner must be operated in parallel (continuation of current) without gate blocking.

D. When using a DC power source instead of a storage battery, etc., or when using a storage battery installed in an electric vehicle, etc., the peak current of the DC input current must be equal to or less than the maximum DC current regulation value.

[remarks]

1. Gate pulses are permitted to be removed when the system voltage drops and recovers. 2. For three-

phase equipment, Tables 6.3-1 and 6.3-2 are calculated values of voltage drops and phase changes (rounded off to the third decimal place) assuming a two-phase short circuit accident from 202V, 222V, and 182V to 40V. Depending on the accuracy of the power source, it may not be possible to test with the values in the table. In this case, the test can be performed within the settable range. 3. The amount of phase change in the case of a voltage drop accompanied by a phase change

reflects the phase change on the delta connection side due to the three-phase high voltage Y connection side being in a two-phase short circuit state. Therefore, the phase at the time of recovery returns to the original state as the three-phase high voltage Y connection side two-phase short circuit state is restored, and the phase returns to the phase before the voltage drop.

6.4 Frequency variation test (FRT test)

In grid-connection protection devices that can connect power conditioners to an isolated circuit, all electromagnetic switching devices between the inverter and the grid connection port, between the inverter connection port and the grid connection port, and between the load connection port and the grid connection port shall not be opened during the frequency fluctuation test (FRT test). (Confirm with the specifications of the electromagnetic switching devices, etc.) Furthermore, in the

case of a power conditioner with a power factor switching function based on the power flow, if the error of the power factor during forward power flow does not meet the judgment criteria for reverse power flow in section 4.3, this test shall also be performed with the power factor set to forward power flow. In addition, if the error of the power factor during forward power flow meets the judgment criteria for reverse power flow in section 4.3, but the power factor during forward power flow is not included in the specified power factor range for reverse power flow, the specified power factor range shall be expanded to include the power factor during forward power

flow and this

test shall be performed. [Test conditions] The standard test conditions for the reverse conversion mode shown in section 3.2 shall apply. In addition, the OFR and UFR settings may be changed so that this test can be performed normally.

[Measurement

method] A. The AC power supply is stepped up to +0.8Hz or less (for 50Hz), +1.0Hz or less (for 60Hz), up to a maximum of 3 steps.
A. Apply a continuous cycle fluctuation and check the operation of the power conditioner. B. Apply a

ramp fluctuation in the range of ±2Hz/s and check the operation of the power conditioner. •The upper frequency limit is 51.5Hz or
less for 50Hz and 61.8Hz or less for 60Hz. •The lower frequency limit is 47.5Hz or more for 50Hz and
57.0Hz or more for 60Hz.

C. Measure the gate block signal and current waveform.

[Evaluation

Criteria] A. Parallel operation (continuation of current) without blocking the gate during frequency fluctuation. B.

Parallel operation (continuation of current) without blocking the gate even after frequency fluctuation.

6.5 Load dump test [Test

conditions] The

standard test conditions for the inverse conversion mode shown in Section 3.2 shall apply.

However, item T shall be changed to the following:

G. Turn on the SWLD and set the load so that it consumes the maximum output of the power conditioner.
Furthermore, if a dedicated load is connected to prevent reverse power, the load may be used. However, if it is difficult to reduce the dedicated load or if the output of the power conditioner is to be varied, this must be done in consultation with the certification applicant. However, the load must be connected to the grid side of the switch SWCB to be opened.

[Measurement

method] A. Open the switch SWCB and confirm that the power conditioner is disconnected. B. Measure the disconnection

time. C. Measure the voltage and AC

current after the switch SWCB is opened.

[Evaluation

Criteria] a. Disconnection b.

Disconnection time is within 0.5 seconds c. The maximum voltage after

opening is 150% or less of the rated voltage, and the time it exceeds 105% is 0.5 seconds or less
and.

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7.Environmental compatibility test

Products with a specified output of 20 kW or less at the standard power factor are classified as Class B. In addition, products with a specified output of more than 20 kW and less than 50 kW at the standard power factor are also accepted as Class A. However, for Class A, the user documentation must include a statement calling attention to the fact that there may be potential difficulties in ensuring compatibility of the electromagnetic environment in other environments due to conducted and radiated interference.

7.1 Emissions testing

7.1.1 Conducted interference test

For grid-connection protection devices that can be connected to a power conditioner in an isolated circuit, the load connection terminals and power conditioner connection terminals are also subject to measurement, and the measurement method and judgment criteria shall be the same as those for the isolated load terminals.

For products with a separate enclosure that disconnects when in an independent state, the power conditioner and the separate enclosure disconnection point are treated as a single device, the power conditioner and the separate enclosure disconnection point are connected with the shortest cable, and the AC connection terminal to the grid and the independent load terminal of the separate enclosure disconnection point are the subject of measurement. The connection point between the power conditioner and the separate enclosure disconnection point is

not measured. [If the system includes a storage battery, etc.] •Perform measurement in both reverse conversion and forward conversion modes.

[Reverse conversion mode] [Test conditions] Since this test is a system characteristic evaluation test, in the case of a system including a storage battery, a DC power source cannot be used instead of the storage battery. The standard test conditions for reverse conversion mode shown in Section 3.2 shall apply. However, items A and D shall be changed as follows. A. The test circuit shall be the circuit connection shown in Attached Figure I, II, IV or V. In the case of a 100V connection mechanism, the circuit connection shall be that shown in Attached Figure XI. However, for products with DC terminals, insert a DC-AN as specified in CISPR11 (Edition 6.2) and terminate with a 50ÿ resistor. The measurement arrangement shall be as shown in Attached Figure VI.

D. Set the DC power supply so that the power conditioner output is at its maximum.

In addition, when there are multiple types of DC energy sources, the DC energy sources shall be operated in the operating condition that produces the maximum interference waves.

In addition, item J is added. J.

Conducted disturbances at DC terminals are measured for all DC power conversion equipment in a configuration where the equipment is connected to an external device. do.

The DC power source may be a storage battery capable of supplying a rated input.

[When the system includes a storage battery, etc., and is in forward conversion mode] The standard test conditions for forward conversion/conversion standby mode shown in section 3.2 shall apply, except that items A and D shall be changed as follows: A. The test circuit shall be connected as shown in Attached Figure I, II, IV, or V. In the case of a 100V connection mechanism, the circuit connection shall be as shown in Attached Figure XI. However, for products with DC terminals, insert a DC-AN as specified in CISPR11 (Edition 6.2) and terminate with a 50ÿ resistor. The measurement arrangement shall be as shown in Attached Figure VI.

D. When measuring in the forward conversion mode, the DC power supply setting should be certified so that the charging power of the storage battery, etc. is rated. This shall be set in consultation with the applicant. If there are multiple types of DC energy sources, the DC energy sources shall be operated under the operating conditions that maximize the disturbance waves. The DC power source may be a storage battery capable of supplying the rated input. In addition, item J shall be added.

J. Conducted interference from DC terminals is measured for all DC power conversion equipment in a configuration where it is connected to an external device. Let us assume that.

[Measurement method]

A. AC terminals and DC terminals of the power conditioner (only if it has an external DC terminal)

Conducted interference is measured at this point.

B. Products that can supply power to loads for isolated operation even when not in isolated operation are in grid-connected operation.

The independent load terminal is also included in the measurement. Conducted disturbance is measured using a high impedance probe.

Applications from July 2022 onwards will be accepted for products that permanently connect wiring for power supply to the independent load terminal.

This test will be conducted on the following:

C. When the system includes a storage battery, etc., the test for the case when the system includes a storage battery, etc. and is in forward conversion mode is also performed.

The above test is carried out under the test conditions.

[Judgment criteria]

Conducted interference waves at AC terminals must be below the following values.

Table 7.1.1-1 Conducted interference limits

Frequency range (MHz)	Conducted interference dB(ÿV) Quasi-peak	
	Class A 100	Class B
0.15 or more and 0.5 or less 0.5 or		66ÿ56
more and 5 or less 5 or more and	86	56
30 or less	90ÿ73	60

Conducted interference at the DC terminal must be below the following values.

However, connection ports for electric vehicles, etc., including testing methods, shall follow the V2H Guidelines (DC).

Table 7.1.1-2 Conducted interference limits

Frequency range (MHz)	Conducted interference dB(ÿV) Quasi-peak
	Class A
0.15 or more and 5 or less	116ÿ106
Over 5 and 30 or less	106ÿ89

Frequency range (MHz)	Conducted interference dB(ÿV) Quasi-peak
	Class B
0.15 or more 0.5 or less Over	84ÿ74
0.5 and 30 or less	74

However, the measurement frequency shall be in accordance with the table below.

Table 7.1.1-3 Measurement frequency range

DC connection cable length (L)	Measurement frequency
L < 3 m	No measurement required
3 m ÿ L < 30m	Lower frequency limit f (MHz) = 60/L according to Table 7.1.1-2
L ÿ 30 m	According to Table 7.1.1-2

L: The maximum length of the cable connected to the DC terminal as specified by the product or manufacturer.

If no maximum length is specified, the test will be performed with a length of at least 30m.

- Conducted interference waves at the independent load terminal must be below the following values.

Table 7.1.1-4 Conducted Disturbance Limits

Frequency range (MHz)	Conducted interference dB(ÿV) Quasi-peak
0.15 or more and 0.5 or less 0.5 or	80
more and 30 or less	74

Note 1) In Tables 7.1.1-1 to 4, the lower limit applies at the boundary of frequencies. 2) In Tables 7.1.1-1 to 4, when the limit includes "ÿ", the value of each frequency is expressed as the logarithmic value of the frequency. The decrease is linear.

[remarks]

For products with a specified output of 20 kW or less at the standard power factor, the system does not include a storage battery, or the system includes a storage battery, and JIS C 4412-1 or

For models that use JIS C 4412-2, the test methods described below may be applied. However, the expiration date is February 22, 2026. The above handling also applies to products that have been applied for renewal.

[Test conditions]

Since this test is a system characteristic evaluation test, in the case of a system including a storage battery, a DC power source cannot be used instead of the battery. The standard test conditions

for the reverse conversion mode shown in section 3.2 shall apply, except that items

A and D shall be changed as follows: A. The test circuit shall be

the circuit connection shown in attached Figure I, II, IV or V. In the case of a 100V connection mechanism, the circuit connection shall be that shown in attached Figure XI. However, for products with an external DC input, a

Insert a CDN as specified in JIS C 61000-4-6 and terminate with a 50ÿ resistor. If inserting a CDN causes the device to not function properly, it is not necessary to insert a CDN. The arrangement during measurement shall

be as shown in Figure VI. D. Set the DC power supply so that

the power conditioner output is at its maximum. If there are multiple types of DC energy sources, operate the device under conditions that maximize the DC energy source interference.

In addition, item J is added. J. The

noise terminal voltage of the DC terminal is to be measured for all DC power conversion equipment in a configuration connected to an external device.

The DC power source may be a storage battery capable of supplying the rated input.

[When the system includes a storage battery, etc., and the forward conversion mode is in progress] The standard test conditions for the forward conversion/conversion standby mode shown in Section 3.2 shall apply. However, items

A and D shall be changed as follows. A. The test circuit shall be the circuit connection shown in Attached Figure I, II, IV, or V. In addition, in the case of a 100V connection mechanism, the circuit connection shall be that shown in Attached Figure XI. However, for products with an external DC input, a CDN as specified in JIS C 61000-4-6 shall be inserted between the power conditioner and the DC power source, and terminated with a 50ÿ resistor. If inserting a CDN causes the product to not operate normally, it

is not necessary to insert the CDN. The arrangement during

measurement shall be as shown in Attached Figure VI. In addition, the DC power source may be a storage battery

capable of supplying the rated input. D. The DC power source settings shall be set in consultation with the certification applicant so that the charging power of the storage battery, etc., is rated when measuring the forward conversion mode. In addition, when measuring in conversion standby mode, the power conditioner shall be set to conversion standby mode in

consultation with the certification applicant. In addition, if there are multiple types of DC energy sources, they shall be operated under the operating conditions

that maximize the DC energy source

interference. In addition, item J shall be added. J. Conducted interference at DC terminals shall be measured for all DC power conversion devices in a configuration connected to an external device.

[Measurement

method] A. Measure the noise terminal voltage at the AC output terminal of the power conditioner.

B. At the DC input terminal of the power conditioner (only if it has an external DC input)

Then, use a high impedance probe to measure the noise terminal voltage.

C. For products that can supply power to an isolated load even when not in isolated operation, the isolated load terminals are also subject to measurement.

The measurement method and criteria shall be the same as for the DC input terminal.

D. If the system includes a storage battery, etc., the above test shall be conducted under the test conditions for the system including a storage battery, etc., in forward conversion mode.

[Evaluation

Criteria] The noise terminal voltage of the AC output terminal must be less than the following value.

Table 7.1.1-5 Terminal voltage tolerance

Frequency range (MHz)	Noise terminal voltage dB(ÿV) Quasi-peak
0.15 or more 0.5 or less	66ÿ56
Over 0.5 and 5 or less	56
More than 5 and less than 30	60

The noise terminal voltage of the DC output terminal and the independent load terminal must be less than the following values.

Table 7.1.1-6 Terminal voltage tolerance

Frequency range (MHz)	Noise terminal voltage dB(ÿV) Quasi-peak
0.15 or more and 0.5 or less	80
0.5 or more and 5 or less or more	74
and 30 or less	74

Note 1) In Tables 7.1.1-5 to 7.1.1-6, when the tolerance includes "ÿ", the value of each frequency decreases linearly with the logarithm of the frequency.

7.1.2 Radiated Emissions Test

[If the system includes a storage battery, etc.] -

Perform in both reverse conversion and forward conversion modes.

[Test

conditions] Since this test is a system characteristic evaluation test, in the case of a system including a storage battery, a DC power source cannot be used instead of the storage battery. The standard

test conditions for the reverse conversion mode shown in Section 3.2 shall apply.

However, items A and D shall be changed as follows. A. The test

circuit shall be the circuit connection shown in Attached Figure I, II, IV or V. In the case of a 100V connection mechanism, the circuit connection shall be that shown in Attached Figure XI. For the test arrangement, refer to CISPR11 (Edition 6.2). CMAD shall be used for the power line and the cable coming out of the test site. An example of the arrangement during measurement is shown in Attached Figure VI. In addition, the DC power source may be a storage battery capable of supplying the rated input.

D. Set the DC power supply so that the power conditioner output is at its maximum.

In addition, when multiple types of DC energy sources are used, they should be operated under the operating conditions that maximize the DC energy source interference.

[When the system includes a storage battery, etc., and the forward conversion mode is used] The standard test conditions for forward conversion/conversion standby mode shown in Section 3.2 shall apply. However, items A and D shall be changed as follows. A. The test circuit shall be the circuit connection shown in Attached Figure I, II, IV, or V. For the 100V connection mechanism, the circuit connection shall be that shown in Attached Figure XI. For the test layout, refer to CISPR11 (Edition 6.2). CMAD shall be used for the power line and the cable that comes out of the test site. An example of the layout during measurement is shown in Attached Figure VI. The DC power source may be a storage battery that can supply the rated input. D. When measuring the forward conversion mode, the DC power source settings shall be set in consultation with the certification applicant so that the charging power of the storage battery, etc. is rated. When measuring the conversion standby mode, the power conditioner shall be set in conversion standby mode in consultation with the certification applicant. In addition, if there are multiple types of DC energy sources, they should be operated under the operating conditions that maximize the DC energy source interference.

[Measurement method] A. Measure the electric field strength with an antenna installed 10 m from the edge of the test volume. However, For small devices defined in CISPR11 (edition 6.2), the measurement distance can be set to 3m. For details, refer to CISPR11 (edition 6.2).

B. If the system includes a storage battery, etc., the above test shall be performed under the test conditions for the system including a storage battery, etc., and in forward conversion mode. [Judgment Criteria]

- Radiated interference must be below the following values.

Table 7.1.2-1 Radiated interference limits

Frequency range (MHz)	Radiated interference d (ÿV/ m) Quasi-peak value			
	Class A		Class B	
	10m	3m	10m	3m
Over 30 and up to 230 Over 230 and	method 50	method 60	method 30	method 40
up to 1,000	50	60	37	47

[Note]

This test is not mandatory for systems that do not include storage batteries, or for systems that include storage batteries and use JIS C 4412-1 or JIS C 4412-2 as the standards for structural requirements, but products certified without applying this test will expire on February 22, 2026. The above treatment will also apply to products that have been applied for renewal.

7.2 Conduction Disturbance Test

[If the system includes a storage battery, etc.] -
Perform in both reverse conversion and forward conversion modes.

[Test conditions]

The standard test conditions for the inverse conversion mode shown in Section 3.2 shall apply, except that items 2 and 5 shall be changed as follows: 2. The DC power supply shall be set so that the power conditioner output is at its maximum. If there are multiple types of DC energy sources, the DC energy sources shall be operated under the operating conditions that maximize the interference waves.

The output (effective power) of the power conditioner shall be set to 100%, 50%, and 12.5% of the maximum output. If the output cannot be varied as described above, the test shall be performed at the maximum and minimum of the output range.

E. Open the SWLN and set the line impedance to the "standard line impedance" described in Section 4. In addition, add Section J. J. When implementing on a system, auxiliary equipment other than the power conditioner shall be in normal operation.

[When the system includes a storage battery, etc. and is in forward conversion mode] The standard test conditions for forward conversion/conversion standby mode shown in Section 3.2 shall apply. However, items 2 and 5 shall be changed as follows. 2.

The DC power supply settings shall be set in consultation with the certification applicant so that the charging power of the storage battery, etc. is rated when measuring in forward conversion mode. In addition, in consultation with the certification applicant, the power conditioner shall be set to conversion standby mode when measuring in conversion standby mode. In addition, in consultation with the certification applicant, if there are multiple types of DC energy sources, the DC energy sources shall be operated under operating conditions that maximize the interference waves. In consultation with the certification applicant, the charging power of the storage battery, etc. shall be set to 100%, 50%, and 12.5%, respectively, of the rating specified by the certification applicant.
In addition, for devices that cannot be adjusted in the above output, measurements shall be performed at the maximum and minimum of the output range.

E. Open the SWLN and set the line impedance to the "standard line impedance" described in Section 4. In addition, add Section J. J. When implementing on a system, auxiliary equipment other than the power conditioner shall be in normal operation.

[Measurement method] Operate the power conditioner so that its output (active power) is 50% and 12.5% (minimum of the output range) of the specified output at the output and standard power factor set in Section 3.2, and measure the AC output voltage (harmonic components) of the power conditioner at that time.

[Judgment criteria] Harmonic components in the 5kHz to 10kHz band must be 89dB (ÿV) or less.

8.Electric environment resistance test

The tests in this section shall be carried out under actual operating conditions.

8.1 System voltage distortion tolerance test

For power conditioners with a power factor switching function based on power flow, if the error in the power factor during forward power flow does not meet the criteria for reverse power flow in section 4.3, this test will also be performed with the power factor set to forward power flow. Also, if the error in the power factor during forward power flow meets the criteria for reverse power flow in section 4.3, but the power factor during forward power flow is not included in the specified power factor range for reverse power flow, this test will be performed by expanding the specified power factor range to include the power factor during forward power flow.

[Test conditions]

The standard test conditions for the inverse conversion mode shown in section 3.2 shall

apply, except that items B, D, and E shall be changed as follows. B. The AC

power source shall be operated at the rated voltage and rated frequency, and the total harmonic voltage distortion of the voltage shall not exceed 5%.

(e.g. 3rd: 2.9%, 5th: 2.9%, 7th: 2.9%; in the case of three-phase equipment, use 4th instead of 3rd, etc.) Voltage distortion is superimposed so that the voltage distortion is as follows:

D. The DC power supply settings shall be set so that the power conditioner output is the output set in Section 3.2. If there are multiple types of DC energy sources, all DC energy sources shall be operated. The power conditioner output (active power) shall be set to the output set in Section 3.2, 50% of the specified output at the standard power

factor. E. Open the SWLN and set the line impedance to the "standard line impedance" described in Section 4.

In addition, item J is added. J.

When performing this test on a system, all auxiliary equipment other than the power conditioner shall be in normal operation.

[Measurement

method] Measure the AC output power and power factor of the power conditioner output section with a 5% voltage distortion superimposed on the system voltage. At the same time, measure the AC output current (harmonic components) as a

reference

value. [Judgment criteria] The judgment criteria shown in Section 4.3 shall apply. Furthermore, stable operation shall be possible at each output. Reprint of

the "Judgment criteria" from Section 4.3 [For power conditioners that include solar cells in their DC energy source]

When operated at the specified power factor, the error in the reactive power value shall be as follows, or the power factor error shall be within ±0.005. Note that the apparent power and active power shall be the values actually measured. Furthermore, for power conditioners with a power factor switching function according to the power flow, if the criterion for the power factor during forward power flow complies with the reactive power error and power factor error when operated at the specified power factor mentioned above, it shall include a power factor value of 0.95 or more. If not, the operating power factor shall be 0.95 or more. Note that the allowable error in the case of the specified power factor shall be accepted in the same manner.

ÿ When the power conditioner output changes depending on the operating power factor

ÿApparent power2 ÿ Effective power2 Apparent power × ÿ1 ÿ Set power factor 2

Maximum specified output

| Maximum specified output | ÿ 0.03

ÿ When the power conditioner has a specified output regardless of the operating power factor

ÿApparent power2 ÿ Effective power2 Apparent power × ÿ1 ÿ Set power factor 2

Maximum specified output

| Maximum specified output | ÿ 0.05

In addition, for power conditioners with a power factor switching function according to power flow, if the operating power factor during forward flow is not within the reactive power error and power factor error range when operating at a specified power factor and is 0.95 or more, it is determined that the error in the power factor during forward flow does not satisfy the criteria in Section 4.3 for the power factor range at the specified power factor.

[remarks] In the case of a composite power conditioner in which the active power output is constant regardless of the operating power factor up to a certain operating power factor and the active power output changes according to the operating power factor above that operating power factor, either judgment criterion ÿ or ÿ is used depending on the operation mode to which the operating power factor corresponds. [For power conditioners that do
not include solar cells in the DC energy source] The operating power factor must be 0.95 or more. The allowable error when operating at the specified power factor is also accepted.

8.2 System voltage unbalance test

This test applies to equipment with a single-phase three-wire and three-phase three-wire electrical system. Furthermore, for power conditioners with a power factor switching function based on power flow, if the error in the power factor during forward power flow does not meet the criteria for reverse power flow in section 4.3, this test is also performed with the power factor set to forward power flow. Furthermore, if the error in the power factor during forward power flow meets the criteria for reverse power flow in section 4.3, but the power factor during forward power flow is not included in the specified power factor range for reverse power flow, this test is performed by expanding the specified power factor range to include the power factor during forward power flow. [Test conditions] The standard test conditions for the inverse conversion mode shown in section

3.2 are applied.

However, section e is changed to the following. e. Open the SWLN and set the line impedance to the "standard line impedance" described in section 4. [Measurement method]

[Single-phase three-wire system] A. After operating the system voltage at the rated voltage value of each phase of the power conditioner, the following conditions are simultaneously performed: Measure the AC output power, AC output current (harmonic components) and power factor for each phase. - Change the system voltage from the power conditioner's single-phase (UN) rated value to 107V. - Change the system voltage from the power conditioner's single-phase (VN) rated value to 95V. B. After operating the system voltage at the power conditioner's rated voltage for each phase, simultaneously carry out the following conditions: Measure the AC output power, AC output current (harmonic components) and power factor for each phase. Change the system voltage from the power conditioner's single-phase (UN) rated value to 95V. Change the system voltage from the power conditioner's single-phase (VN) rated value to 107V. C. Harmonics shall be measured up to the 40th order.
[For three-phase, three-wire systems] A. After operating the system voltage at the rated voltage value of each phase of the power conditioner, the following conditions are carried out simultaneously. Measure the AC output power, AC output current (harmonic components) and power factor for each phase. - Change the system voltage from the power conditioner's single-phase (UV) rated value to 222V. - Change the system voltage from the power conditioner's single-phase (VW) rated value to 182V. B. After operating the system voltage at the power conditioner's rated voltage for each phase, simultaneously carry out the following conditions: Measure the AC output power, AC output current (harmonic components) and power factor for each phase. - Change the system voltage from the power conditioner's single-phase (UV) rated value to 182V. - Change the system voltage from the power conditioner's single-phase (VW) rated value to 222V. C. After operating the system voltage at the power conditioner's rated voltage for each phase, simultaneously carry out the following conditions: Measure the AC output power, AC output current (harmonic components) and power factor for each phase. - Change the system voltage from the power conditioner's single-phase (VW) rated value to 222V. - Change the system voltage from the power conditioner's single-phase (WU) rated value to 182V. D. After operating the system voltage at the power conditioner's rated voltage for each phase, simultaneously carry out the following conditions: Measure the AC output power, AC output current (harmonic components) and power factor for each phase. Change the system voltage from the power conditioner's single-phase (VW) rated value to 182V. Change the system voltage from the power conditioner's single-phase (WU) rated value to 222V.

E. After operating the system voltage at the rated voltage value of each phase of the power conditioner, the following conditions are performed simultaneously:

Measure the AC output power, AC output current (harmonic components) and power factor for each phase. - Change the system voltage from the power conditioner's single-phase (WU) rated value to 222V. - Change the system voltage from the power conditioner's single-phase (UV) rated value to 182V. F. After operating the system voltage at the power conditioner's rated voltage for each phase, perform the following conditions simultaneously:

Measure the AC output power, AC output current (harmonic components) and power factor for each phase. Change the system voltage from the power conditioner's single-phase (WU) rated value to 182V.

Change the system voltage from the power conditioner's single-phase (UV) rated value to 222V.

G. Harmonics shall be measured up to the 40th order.

For equipment whose power supply voltage differs from the system voltage, tests shall be performed at the rated voltage and at that voltage ±10%.

[Evaluation Criteria] A. The evaluation criteria shown in 4.1 B shall apply. Re-listing of 4.1 B. The output current distortion factor shall be 5% or less for total harmonic current distortion and 3% or less for each harmonic current distortion.

The total harmonic current distortion factor DF shall be calculated using the following formula.

$$DF = \frac{\sqrt{\sum (i_{ACn})^2}}{i_{ACO}} \times 100\ (\%)$$

Here, i_{ACn} : nth harmonic current component effective value of the power conditioner output current (A)

i_{ACO} : Power conditioner's specified AC current effective value (A)

n : Harmonic orders 2 to 40.

B. Stable operation.

[For single-phase equipment]

In addition to the above criteria, the following criteria also apply.

C. The criteria in Section 4.3 shall apply, with the criteria in Section 4.3 being repeated in Section 8.1.

8.3 Surge immunity test [Test conditions] The standard test conditions for the inverse conversion mode shown in Section 3.2 shall be applied. [Measurement method] A. The following 1 kV surge voltage shall be applied between the AC terminals: 3 times each for positive and negative polarities at phase 0°, 3 times for positive polarity at 90°, and 3 times for positive polarity at phase 270°.

Negative polarity is applied three times. Tests at levels lower than the specified level are not required.

Voltage waveform 1.2/50ÿs

Current waveform 8/20ÿs

B. Apply the following 2kV voltage surge between the AC terminal and earth, 3 times each of positive and negative polarity at phase 0°, 3 times of positive polarity at 90°, and 3 times of negative polarity at phase 270°. Tests at levels lower than the specified level are not required. Voltage waveform 1.2/50ÿs Current waveform 8/20ÿs

The application conditions shall conform to JIS C 61000-4-5:2018 "Electromagnetic compatibility - Part 4-5: Testing and measurement techniques - Surge immunity test."

[Judgment criteria]

The performance criteria specified in JIS C 61000-6-1:2019 "Electromagnetic compatibility - Part 6-1: Common standard - Immunity in residential, commercial and light industrial environments" shall be B.

If operation stops, it will be automatically restarted. However, a stop due to the detection of a grid voltage abnormality and/or a grid frequency abnormality will not be considered a malfunction.

8.4 Noise immunity test

Not applicable as this is equivalent to the 8.7 Electrical Fast Transient/Burst Immunity (EFT/B) test.

8.5 Electrostatic discharge immunity test [Test

conditions]

Since this test is a system characteristic evaluation test, in the case of a system including a storage battery, a DC power supply cannot be used instead of the storage battery. The standard test conditions for

the inverse conversion mode shown in Section 3.2 are applied. [Measurement method]

Immunity is applied in accordance with JIS C 61000-4-2:2012 "Electromagnetic compatibility - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test". The test levels are 4kV contact discharge and 8kV air discharge. [Evaluation criteria]

The performance criteria shall be B as specified in JIS C 61000-6-1:2019.

8.6 Radiated radio frequency electromagnetic field immunity testing

[Test conditions]

Since this test is for evaluating system characteristics, in the case of a system including a storage battery, a DC power supply cannot be used instead of the battery. The standard test conditions for the inverse

conversion mode shown in Section 3.2 are applied. [Measurement method] The

application

conditions are in accordance with JIS C 61000-4-3:2012 "Magnetic compatibility - Part 4-3: Testing and measurement techniques - Radiated radio frequency electromagnetic field immunity test". The test level is a frequency of 80HzM to 1000MHz, a field strength of 3V/m,

AM modulation [illegible]. [[illegible]

criteria]

The performance criteria specified in JIS C 61000-6-1:2019 shall be A.

8.7 Electrical Fast Transient/Burst Immunity (EFT/B) Testing

[Test conditions]

Since this test is a system characteristic evaluation test, in the case of a system including a storage battery, a DC power supply cannot be used instead of the storage battery. The standard test conditions for

the reverse conversion mode shown in Section 3.2 are applied. [Measurement method]

The application

conditions are in accordance with JIS C 61000-4-4:2015 "Electromagnetic compatibility - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test". The test level and repetition rate are in accordance with Table 8.7-1. A capacitive coupling clamp is used for application to the DC input terminal and signal/control ports.

Table 8.7-1 EFT/B Test Levels

AC output terminal and protective ground		DC input terminals and signal/control ports Applies only to ports to which cables longer than 3 m may be connected according to the manufacturer's	
Voltage Peak (kV)	Repetition Rate (kHz) 1.0	specifications. Voltage peak (kV)	Repetition rate (kHz)
5.0		0.5 5.0	

[Judgment criteria]

The performance criteria shall be B as specified in JIS C 61000-6-1:2019.

8.8 Immunity tests for conducted disturbances induced by radio frequency electromagnetic fields

[Test conditions] Since this test is for evaluating system characteristics, in the case of a system including a storage battery, a DC power supply cannot be used instead of the storage battery. The standard test conditions for the inverse conversion mode shown in Section 3.2 shall apply.

[Measurement method] The application conditions are in accordance with JIS C 61000-4-6:2017 "Electromagnetic compatibility - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances induced by radio frequency electromagnetic fields". The test levels are 0.15MHz to 80MHz in frequency, 3V in voltage level (emf), and 80% AM modulation (1kHz) for all AC output terminals, DC input terminals (applies only to ports to which cables longer than 3m may be connected according to the manufacturer's specifications), and signal/control ports (applies only to ports to which cables longer than 3m may be connected according to the manufacturer's specifications). [Evaluation criteria]

The performance criteria specified in JIS C 61000-6-1:2019 shall be A.

8.9 Power frequency magnetic field immunity test

This applies to [integrated battery type] systems that include storage batteries. It does not apply to [separate battery type]. [Test conditions]

Since this test is a system characteristic evaluation test, in the case of a system that includes a storage battery, a DC power source cannot be used instead of the battery. The standard test conditions for the reverse conversion mode shown in Section 3.2 apply.

[Measurement method] The application conditions are in accordance with JIS C 61000-4-8:2016 "Electromagnetic compatibility - Part 4: Testing and measurement techniques - Section 8: Power frequency magnetic field immunity test." The test level is 3A/m.

[Judgment criteria]

Performance criteria A as specified in JIS C 61000-6-1: 2019 shall be used. [Note]

For the battery-integrated type, if it is clear that the system itself, including the PCS, is a source of noise, we will consider deeming it "not applicable" as with the battery-separated type (PCS alone).

9. Ambient environment resistance test

9.1 Humidity test

This test applies to products intended for indoor use. [Measurement method] Leave the product in an

environment

with an ambient temperature of 40°C and a relative humidity of 90-95% for 48 hours.

[Evaluation

Criteria] A. After being left as is, it must pass the insulation resistance test in

section 2.1. B. After the test in A, it must pass the power frequency withstand voltage test in section 2.2.

9.2 Temperature and humidity cycle test

This test applies to products intended for outdoor use. [Measurement method]

Conduct five 24-hour cycles (Appended Figure 2a) including the low-temperature subcycle shown in Section 6.3.1 of JIS C 60068-2-38 (JIS C 0028-1988) "Environmental Test Methods (Electricity and Electronics) Temperature and Humidity Combination (Cycle) Test Methods."

For microinverters for AC modules, the upper limit temperature in Figure 2a of JIS C 60068-2-38 (JIS C 0028-1988) shall be 85°C.

[Criteria for

judgment] A. After the cycle is completed, the insulation resistance test in section 2.1 must be passed. If the test result is not passed but the measured insulation resistance is 0.3Mÿ or more, the tester may be allowed to leave the tester at 25ÿ±2ÿ and 65%±5% for 24 hours and then conduct an insulation resistance test.

B. After the test in A, the device shall pass the power frequency withstand voltage test in Section 2.2.

9.3 Water injection test

This test applies to systems intended for outdoor use. [Systems that do not include storage batteries, etc.]

[Measurement

method] Fresh water is poured uniformly at a rate of 3 mm per minute from a 45° inclination direction for 1 hour in a rain-like condition.

[Judgment

criteria] A. The insulation resistance test in section 2.1 must be passed while water is being poured.

B. After the test in A, the power frequency withstand voltage test in Section 2.2 must be passed while pouring water.

[If the system includes a storage battery, etc.]

This test shall be in accordance with JIS C 4412 for both test method and evaluation criteria. In addition, follow 1. [Note] 1. of 1.

Structural test.

10. Durability Test The

following tests shall be conducted for relays, breakers, etc. that have mechanical operation.
However, these tests may be omitted if the following performance is guaranteed by a known standard. [Measurement

method] A.

For devices that detect abnormal conditions inside the system or power conditioner and perform protective operation:

A voltage of 1.1 times the operating voltage of the component is applied and a load equivalent to that of the control load circuit is applied, and 1,000 opening and closing tests are performed.

B. A control operation is performed to maintain certain parameters at a constant level while the power conditioner is operating.

A.

For parts that operate more than once a day: A voltage 1.1 times the operating voltage of the part is applied, and a load equivalent to that of the control load circuit is applied, and 10,000 switching

tests are performed.

Apply a voltage 1.1 times the operating voltage of the part and perform a 10,000-cycle switching test with a load equivalent to that of the control load circuit.

[Criteria] A. After the switching

test, the part

must pass the insulation resistance test in Section 2.1.

B. After the switching test, the power frequency withstand voltage test in 2.2 shall be met. C. After the switching

test, "4.7 Temperature rise test" shall be carried out and the temperature of each part shall be within the limits of the Ministerial Ordinance on Technical Standards for Electrical Appliances.

It must comply with the temperature rise test of Appendix 3 of Annex 4 of the Interpretation.

11. Parts failure testing

[If the system does not include a storage battery, etc.]

[Measurement

method] Open or short circuit the components used in the electronic circuit. [Judgment

criteria] There is

no risk of fire. Details will be determined in

consultation with the certification applicant.

[If the system includes a storage battery, etc.]

The test method and criteria for this test are in accordance with JIS C 4412. In addition, follow 1. [Notes] 1. of 1. Structural test.

12. Self-driving test

12.1 Islanded operation switching test

This test applies to power conditioners with an independent operation function. If independent operation is possible by connecting the power conditioner to a separate enclosure for disconnection during independent operation, the test shall be performed together with the separate enclosure for disconnection during independent operation. [Structure] [Common items] A. When

performing

independent operation, one of the following shall be used to prevent reverse charging to the grid and asynchronous input. In addition, if the disconnection breaker during grid-connected operation and the disconnection breaker during independent operation are different, confirm with the circuit diagram, operation sequence, etc.

a) During isolated operation, disconnection from the grid shall be achieved by two mechanical switching points, or one mechanical switching point and one manually operated switching point (to be confirmed by operation sequences, etc.).

b) Disconnection from the grid during isolated operation is performed using one mechanical switch and disconnection at one point during isolated operation If the power conditioner is in a separate housing, it must have all of the following functions. For products that supply grid power to a load via a parallel-off point, the following conditions also apply to products that do not have a function to prevent a transition to independent operation due to the overcurrent detection history of the parallel-off circuit breaker. Furthermore, the following conditions also apply to bypass electromagnetic switching devices that supply power directly from the grid to an isolated load without passing through a parallel-off circuit breaker. - Must have a locking function that reliably detects a power outage on the grid side and prevents re-paralleling. (Operation system) (Check with sequences, etc.)

- If the disconnection circuit breaker and bypass electromagnetic switchgear do not open due to welding of contacts, etc. (state where only the gate block disconnects from the grid), the device must have a function to prevent a transition to isolated operation. - If the grid is restored during isolated operation, devices with a function to automatically switch to grid-connected operation must disconnect the power conditioner and start operation after a certain period of time has passed. [In cases other than grid-connection protection devices that can connect a power

conditioner to an isolated circuit] B. The isolated operation output must be supplied from a dedicated output terminal or dedicated outlet, and a notice to that effect must be attached. This item does not apply if the point where the parallel-off occurs during isolation is in a separate housing from the power conditioner. C. If ancillary equipment such as a changeover switch is included and supplied from a dedicated output terminal, the output is independent. The electricity is not connected to the grid.
[For grid-connection protection devices that can connect a power conditioner to an isolated circuit] B. Circuit breakers installed in the trunk line through which power flows from the grid to load equipment during grid-connected operation must not cause reverse charging or asynchronous input to the grid during isolated operation, even if they are welded (this can be confirmed by checking the operation sequence, etc.). C. When the power grid is restored during isolated operation, the power supply from the grid to the load connection port is provided by an inverter, etc. This should be done after the inverter is stopped by the gate block. In addition, grid-connected operation should start after a certain period of time has elapsed. In addition, in the case of a power conditioner that includes a solar cell in the DC energy source, the operating power factor should also be the specified power factor according to the specifications. D. If there is a dedicated output terminal or dedicated outlet for stand-alone operation output, a notice to that effect must be affixed.

[Test conditions]

[In the case of a grid-connection protection device other than one that can connect a power conditioner to an isolated circuit] The standard test conditions for the forward conversion/conversion standby mode shown in Section 3.2 shall apply. In addition, Section J shall be added. J. The isolated output shall be unloaded.

[For grid-connection protection devices that can connect a power conditioner to an isolated circuit]

A. The test circuit is connected to the power conditioner's grid connection port and the AC power supply, Connect the load to the dedicated output terminal or dedicated outlet.

B. The AC power source will be operated at the rated voltage and rated frequency. C. Line impedance will be short-circuited. 2. Settings of protective relays, etc. of protective devices will be factory default values (as stated in the certification application form). E. The load will be set so as to obtain the maximum output of the inverter, etc. inside the power conditioner. However, if the rated output during independent operation is smaller than the maximum output during grid-connected operation, the load will be set so as to obtain the rated output during independent operation.

[Measurement method] a. Open the SWCB during grid-connected operation to simulate a power outage and switch to independent operation. b. Close the SWCB during independent operation to restore power and switch to grid-connected operation. If the power conditioner automatically operates in grid-connected operation after power is restored, measure the time from power restoration until grid-connected operation begins. In addition, if grid-connected operation is performed by the main unit, remote control, etc., check the time from power restoration until grid-connected operation begins.

C. If the inverter has a function for connecting to an isolated circuit, measure the voltage at the inverter connection port during the period from when power is restored until when it starts operating on a grid. If the inverter has a load connection port, measure the voltage at the load connection port during the period from when power is restored until when it starts operating on a grid.

D. To check operation when a system abnormality occurs during the period from the restoration of power to grid-connected operation as described in B above.

3.2.9.2 Measurement shall be performed according to the [Measurement method] of Test 2 for preventing power supply for a certain period of time after power restoration.

E. In case of structure A.b), the test of the above item A shall be performed with the contacts of the parallel-off circuit breaker welded (short circuited). conduct.

Details such as the measurement method will be determined in consultation with the certification applicant.

[Judgment Criteria] a. When switching from grid-connected operation to isolated operation, the system must safely switch to isolated operation after disconnection. b. When switching from isolated operation to grid-connected operation, the inverter device, etc. must be stopped by the gate block, and the isolated operation output must stop. The system must safely switch to grid-connected operation after the time specified in the specifications or the setting time has elapsed since power was restored. In the case of a power conditioner that includes solar cells in its DC energy source, the operating power factor must also operate according to the sequence and become the specified power factor. c. The [Judgment Criteria] of 3.2.9.2 Test 2 for preventing power supply for a certain period of time after power restoration must be satisfied. d. If structure a.

b) applies, the system must switch from grid-connected operation to isolated operation when the contacts of the disconnection circuit breaker are in a welded (short-circuited) state. The method of simulating welding will be determined in consultation with the certification applicant.

e) If the equipment has a function for connecting a power conditioner to an isolated circuit, the voltage application to the power conditioner connection port and the load connection port must be stopped for at least 3 seconds after the power conditioner stops isolated operation. In addition, if isolated operation is possible by connecting the power conditioner to the isolated disconnection point of a separate unit during isolated operation, and if another power conditioner can be connected to the isolated circuit, the time required for closing the disconnection point of the separate unit after the isolated output stops must be at least 3 seconds.

[Notes]

1. When connecting the isolated operation output to a distribution board, etc. and using existing indoor wiring, a system is required to certify the power distribution of the house or building in which the power conditioner is installed, rather than certifying the isolated operation performance of the power conditioner. Therefore, although it has been treated as outside the scope of the test method for low-voltage grid-connection protection devices, etc.

Due to the nature of grid-connection protection devices, it is becoming common to use the isolated operation output with existing indoor wiring. For this reason, for changeover switches and other devices shipped from the factory together with the power conditioner, it is possible to simplify the items to be checked on-site during grid-connection discussions by certifying them together with the power conditioner.

2. In the normal state, the current of the disconnection circuit breaker is controlled by the inverter, etc., so that no overcurrent will flow unless the inverter, etc., is shorted. If the inverter, etc., is shorted, a fault state is detected and the system will not switch to stand-alone operation. On the other hand, when power is supplied to a load from the grid, a large overcurrent will flow in the path when the load is shorted. In addition, some load devices generate large inrush currents. If such an overcurrent flows, two circuit breakers may melt at the same time, so welding detection is required. 3. In devices that apply voltage to detect welding before switching to stand-alone operation, if the circuit breaker is welded at that time, the voltage will be applied to the low voltage side of the pole transformer, and the boosted voltage will be output to the high voltage side. During a power outage, workers may be repairing high voltage wiring at high places such as utility poles. Even if there is no direct danger to life when working at high places, the stimuli that make the worker shake may also be dangerous. The mechanism for detecting welding must be sufficiently safe so as not to endanger workers.

12.2 Automatic switching test for isolated operation

This test applies to power conditioners that have an island operation function that satisfies 12.1 Island Operation Switching Test and also have an automatic island operation switching function. Details such as the measurement method will be determined in consultation with the certification applicant. [Structure] For products that have an automatic switching function between grid-connected operation and island operation, the switching operation must not be performed within the time specified in the specifications so that island operation switching operation is not performed in response to a momentary voltage drop or momentary power outage.

[Test conditions]

Comply with the test conditions shown in Section 12.1.

[Measurement method] A. After the SWCB is opened during grid-connected operation, the circuit breaker is opened and the time from the SWCB opening to the independent output is measured. Measure the time.

B. In the isolated operation state, set the power consumption of the isolated load to the rated output of no-load and isolated operation output, and measure the isolated output voltage and frequency. [Judgment Criteria] A. The time from opening the SWCB to switching to isolated operation is greater than or equal to the time specified in the specifications.

B. The output voltage during isolated operation shall be in the range of 101±6V if the isolated output is a single-phase 100V system, or in the range of single-phase 202±12V if the isolated output is a single-phase two-wire 200V system or a three-phase 200V system, taking into consideration the supply of power to a single-phase three-wire 100V system.

C. The frequency in the isolated operation state is equal to the frequency in the grid-connected operation state.

[Note] In the case of automatic switching, it is assumed that the load connection status will not be checked, so voltage and frequency standards will be applied. In particular, the time when the external switch automatically switches to independent operation should not hinder FRT support.

12.3 Auxiliary Input Test This test applies to power conditioners that have an isolated operation function that satisfies 12.1 Isolated operation switching test and fall under ÿ to ÿ below. The auxiliary AC input and auxiliary DC input are collectively called auxiliary input. Details such as the measurement method will be determined in consultation with the certification applicant.

ÿ Auxiliary AC input terminal to which an auxiliary AC input power supply is connected between the AC side of a inverter or the like and a parallel-off circuit breaker (Terminals to which power is supplied from other emergency AC power sources, etc.)

ÿ Those that have an auxiliary DC

input terminal (a terminal to which power is supplied from another emergency DC power source, etc.) to which an auxiliary DC input power source is connected on the DC side of the inverter, etc. (Hereinafter referred to as "auxiliary DC input" in this section.)

3) A power conditioner that has an auxiliary AC input terminal and whose auxiliary AC input power source is connected to the DC side of an inverter, etc. via an AC/DC converter inside the power conditioner. This configuration is treated as having an auxiliary DC input, and tests are conducted with the auxiliary AC input terminal as the auxiliary DC input terminal.

[Structure]

When power is input from the auxiliary AC input, an auxiliary AC input electromagnetic switch that cuts off the current must be provided in the circuit between the auxiliary AC input and the AC side of the inverter, etc., and when power is input from the auxiliary DC input, an auxiliary DC input electromagnetic switch that cuts off the current must be provided in the circuit between the auxiliary DC input and the DC side of the inverter, etc. The auxiliary AC input electromagnetic switch and auxiliary DC input electromagnetic switch are collectively referred to as the auxiliary input electromagnetic switch. In order to prevent the auxiliary input from being connected to the system, the following functions must be provided: A. The electrical system

of the power source input to the auxiliary AC input must be the same as the electrical system of the independent operation output. (Confirm this by referring to the circuit diagram, instruction manual, or specifications, etc.)

However, single-phase two-wire and single-phase three-wire are considered to be the same.

B. The auxiliary input electromagnetic switchgear must have a locking mechanism that will not close when the parallel-off circuit breaker is in the closed state (this can be confirmed by the operation sequence, etc.).

C. The auxiliary input electromagnetic switchgear must have a locking mechanism that prevents the parallel-off circuit breaker from being turned on when the auxiliary input electromagnetic switchgear is closed (this can be confirmed by checking the operation sequence, etc.).

D. If the equipment has an auxiliary DC input, it must have a backflow prevention mechanism to prevent power from flowing back from the auxiliary DC input.

The following test applies to the equipment that has an auxiliary AC input and performs independent output while power is being supplied from the auxiliary AC input. E. If the

indepe[illegible]t out[illegible] lo[illegible]ut[illegible] of the a[illegible]C power s[illegible] the test sh[illegible] perfor[illegible]

Do not deviate from the scope of paragraph (b).

The following items apply to devices that have the function of performing independent operation through reverse conversion using an inverter, etc., while power is being supplied from the auxiliary AC input: F.

When the auxiliary AC input electromagnetic switchgear is closed, the inverter, etc., is gate-blocked. G. When the input from the auxiliary AC power source stops or deviates from the input range, the auxiliary AC input electromagnetic switchgear is closed within one second.

The device opens or the inverter or other device blocks the gate.

H. When releasing the gate block without auxiliary AC input, the auxiliary AC electromagnetic switch is opened. thing.

[Test conditions]

a. The test circuit shall be the circuit connection shown in Attached Figure I, II, IV or V. In the case of a 100V connection mechanism, the circuit connection shall be the circuit connection shown in Attached Figure ÿ.

B. A resistive load that consumes the rated power during independent operation output is connected to the independent operation output. C.

A power source that can supply the specified rated voltage and power specified in the specifications is connected to the auxiliary input. The power source is specified as follows: Generates a voltage as specified above.

D. The AC power source is operated at the rated voltage and rated frequency. E. The

power conditioner is set so that its output when connected to the grid is the output set in Section 3.2. F. The line impedance is short-circuited.

G. The settings of the protective relays and other protective devices shall be the factory default values (as stated in the certification

application form). H. Turn on the SWLD and set the load so that it consumes the designated power when the power conditioner is connected to the grid.

[Measurement

method] A. For products that can be operated in grid-connected mode while the power supply connected to the auxiliary input is in operation, switch from grid-connected mode to stand-alone mode while the power supply connected to the auxiliary input is in operation at the voltage specified in the specifications, and switch to a state where power is supplied from the auxiliary input. For products that cannot be operated in grid-connected mode while the power supply connected to the auxiliary input is in operation, switch from a state where the power supply connected to the auxiliary input is in operation at the voltage specified in the specifications to stand-alone mode, and switch to a state where power is supplied from the auxiliary input.

For equipment with the configuration of 12.1 Structure A b) of the isolated operation switching test, the operation sequence of the above A shall be performed by simulating the welded (short-circuited) state of the contacts of the parallel-off circuit breaker.

C. With the power source connected to the auxiliary input operating at the voltage specified in the specifications, the power input from the auxiliary input during stand-alone operation must be maintained for 10 seconds or more, and then the system must be switched to the grid-connected state.

D. If the auxiliary input electromagnetic switching device does not have two mechanical switching points, the operation sequence described in item C above shall be performed while the auxiliary input electromagnetic switching device is in the closed state during independent operation, simulating a welded (short-circuited) state of the contacts of the auxiliary input electromagnetic switching device.

E. For equipment with auxiliary DC input, the auxiliary DC input is short-circuited and the operation described in A is carried out. In this case, the DC power supply in C of the test conditions is disconnected.

The following tests apply to equipment that has an auxiliary AC input and provides independent output when power is supplied from the auxiliary AC input. F. With the power supply connected to

the auxiliary AC input operating at the voltage specified in the specifications, transition to independent operation. Gradually reduce the voltage to a level lower than the minimum input voltage specified by the certification applicant, and measure the independent output voltage.

G. With the power supply connected to the auxiliary AC input operating at the voltage specified in the specifications, transition to independent operation. Gradually increase the voltage to a level higher than the maximum input voltage specified by the certification applicant and measure the independent output voltage.

The following tests apply to equipment that has an auxiliary AC input and has the function of operating in an independent mode by reverse conversion using a converter or the like when an auxiliary AC power source is input. H. With the power source connected to the

auxiliary AC input stopped, the equipment is shifted to independent operation. Then, when the auxiliary AC input is turned

Operate the power supply connected to the power source.

i) The power supply connected to the auxiliary AC input is operated at the voltage specified in the specifications, and then the system is switched to independent operation.

Then, turn off the power supply connected to the auxiliary AC input for at least 1 second.

The following tests are applied to equipment that has an auxiliary AC input and whose auxiliary AC input electromagnetic switchgear does not open when the auxiliary AC power supply stops. N. After the test in

item 3 is completed, the equipment is transferred to grid-connected operation.

[Criteria] A. When

switching to a state where power is supplied from the auxiliary input, the auxiliary input electromagnetic switch is in a closed state after parallel-off.

This will be the case.

B. For equipment with the configuration in 12.1 Structure of the isolated operation switching test A. b), the auxiliary input electromagnetic switching device shall not transition to the closed state.

C. After the auxiliary input electromagnetic switchgear is opened, the parallel-off circuit breaker is closed and operation is switched to grid-connected operation.

However, products that are not designed to operate in a grid-connected manner while the power supply connected to the auxiliary input is in operation must be stopped (disconnected).

D. The closing of the parallel-off circuit breaker is prevented. E. The operation of the

backflow prevention function from the auxiliary DC input section is confirmed, and there is no damage to any part. F. The independent output voltage does not deviate

from the range of B. in 12.2 Independent operation automatic switching test judgment criteria.

In addition, if a deviation occurs, the independent output must stop within one second.

G. The independent output voltage must not deviate from the range of B. in 12.2 Independent operation automatic switching test criteria.

In the event of deviation, the independent output must stop within one second.

H. When the gate is blocked, the auxiliary AC input electromagnetic switch is closed. I. After the auxiliary AC power supply is stopped, the auxiliary AC input electromagnetic switch is opened or the gate is blocked within one second. To do so.

J. The auxiliary AC input electromagnetic switch must be opened before the gate block is released. [Note]

Items A to J of the [Judgment Criteria] correspond to Items A to J of the [Measurement Method] above.

12.4 Stand-alone disconnection signal

interruption test This test applies when stand-alone operation is possible by connecting the power conditioner to the stand-alone disconnection point in a separate housing.

[Structure] If signal lines other than the main circuit connect the power conditioner and the isolated parallel-off circuit, the structure must be such that incorrect wiring does not occur. [Test conditions] Comply

with the test conditions shown in Section 12.1. [Measurement

method] a. If signal lines other than the main circuit connect the power conditioner and the isolated parallel-off circuit, switch from grid-connected operation to isolated operation with the wiring not connected. b. If signal lines other than the main circuit do not connect the power conditioner and the isolated parallel-off circuit, switch from grid-connected operation to isolated operation with the isolated parallel-off circuit not present. [Evaluation criteria] In either case, there should be no switch to isolated operation.

13. Conversion standby mode confirmation test (former

name: forward conversion/reverse conversion mode switching test)

Not applicable to seamless type. [Test conditions] The

standard test

conditions for the reverse conversion mode shown in Section 3.2 shall apply.

[Measurement

method] A. When switching from forward transformation to reverse transformation, the forward transformation is stopped by the gate block before the reverse transformation actually begins.

Measure the time it takes to start.

B. When switching from inverse transformation to forward transformation, the inverse transformation is stopped by the gate block before the forward transformation actually begins.

[Criteria] a. The time from when forward conversion stops

to when reverse

conversion actually starts is measured within the time specified in the specifications or the time when the conversion is stabilized.

The time must be longer than the time (e.g. 2 seconds).

B. The time from when the reverse conversion stops to when the forward conversion actually starts is the time specified in the specifications or the time when the conversion is settled.

The time must be longer than the time (e.g. 2 seconds).

14. V2H Guideline (DC) Protocol Test (Grid Interconnection)

This test applies to connectable DC energy sources that include on-board storage batteries such as electric vehicles.

14.1 Maximum DC current rated value insufficient vehicle rejection test

[Test conditions]

The test circuit shall be connected as shown in Figure ÿ.

[Measurement

method] The following tests shall be carried out for each operation mode of the power conditioner, including the grid-connected mode (V2H Guideline Category 3 or Category 4): A. Activate the power conditioner discharge start sequence, set the

absolute value of the discharge current upper limit of CAN ID:H'200 of the communication signal from the vehicle simulator or electric vehicle, etc., to a value equal to or greater than the maximum DC current specification, and operate the power conditioner.

B. Activate the power conditioner discharge start sequence, set the absolute value of the upper limit of the discharge current of CAN ID:H'200 of the communication signal from the vehicle simulator or electric vehicle, etc. to less than the maximum DC current regulation value, and operate it. [Judgment Criteria] The following

judgment criteria

must be satisfied according to the above measurement method.

A. In the measurement method, the power conditioner transitions to the discharge sequence normally. B. In the measurement method, the power

conditioner does not output power from the electric vehicle, etc. to the AC side.
and.

14.2 Grid-non-compatible vehicle connection refusal test

[Test conditions]

The test circuit shall be connected as shown in Figure ÿ.

[Measurement

method] The following tests are performed for each operation mode of the power conditioner, including the grid-connected mode (V2H Guideline Category 3 or Category 4): A. With the protocol test tool, set the V2H sequence control number

to 0x00, CHAdeMO sequence control number to 0x01, and vehicle category to 0x00, and perform the grid-connected discharge operation of the power conditioner.

B. Using the protocol test tool, set the V2H sequence management number 0x00, CHAdeMO sequence management number 0x01, vehicle category 0x01, vehicle power supply source operating mode 0x01, and bit 0 of the vehicle power supply source grid connection compatibility information to '0', and perform the grid connection discharge operation using the power conditioner.

C. In the protocol test tool, set the V2H sequence control number to 0x00, the CHAdeMO sequence control number to 0x01, the vehicle category to 0x01, and the vehicle power supply source operating mode to a value other than 0x01 (vehicle power supply source grid connection compatible information is optional), and perform grid connection discharge operation in the power conditioner.

D. Using the protocol test tool, set the V2H sequence management number to 0x00, the CHAdeMO sequence management number to 0x02, and the vehicle category to 0x00, and perform the grid-connected discharge operation using the power conditioner. E. Using the protocol test

tool, set the V2H sequence management number to 0x00, the CHAdeMO sequence management number to 0x02, the vehicle category to 0x01, the vehicle power supply source operating mode to 0x01, and the 0th bit of the vehicle power supply source grid-connected compatibility information to '0', and perform the grid-connected discharge operation using the power conditioner.

F. In the protocol test tool, set the V2H sequence control number to 0x00, the CHAdeMO sequence control number to 0x02, the vehicle category to 0x01, and the vehicle power supply source operating mode to anything other than 0x01 (vehicle power supply source grid connection compatible information is optional), and perform grid connection discharge operation in the power conditioner.

G) In the protocol test tool, set the V2H sequence management number to 0x01, the CHAdeMO sequence management number to 0x01, and the vehicle category to 0x00, and perform grid-connected discharge operation on the power conditioner.

H. Using the protocol test tool, set the V2H sequence management number 0x01, CHAdeMO sequence management number 0x01, vehicle category 0x01, vehicle power supply source operating mode 0x01, and bit 0 of the vehicle power supply source grid connection compatibility information to '0', and perform the grid connection discharge operation using the power conditioner.

i) In the protocol test tool, set the V2H sequence control number to 0x01, the CHAdeMO sequence control number to 0x01, the vehicle category to 0x01, and the vehicle power supply source operating mode to a value other than 0x01 (vehicle power supply source grid connection compatible information is optional), and perform grid connection discharge operation in the power conditioner.

J. Using the protocol test tool, set the V2H sequence management number to 0x02, CHAdeMO sequence management number to 0x02, and vehicle category to 0x00, and perform grid-connected discharge operation on the power conditioner. L. Using the protocol test tool, set the V2H

sequence management number to 0x02, CHAdeMO sequence management number to 0x02, vehicle category to 0x01, vehicle power supply source operating mode to 0x01, and bit 0 of the vehicle power supply source grid-connected compatibility information to '1', and perform grid-connected discharge operation on the power conditioner.

w. Using the protocol test tool, set the V2H sequence management number 0x02, CHAdeMO sequence management number 0x02, vehicle category 0x01, vehicle power supply source operating mode 0x01, and bit 0 of the vehicle power supply source grid connection compatibility information to '0', and perform the grid connection discharge operation using the power conditioner.

M. In the protocol test tool, set the V2H sequence control number to 0x02, CHAdeMO sequence control number to 0x02, vehicle category to 0x01, and vehicle power supply source operating mode to a value other than 0x01 (vehicle power supply source grid connection information is optional), and perform grid-connected discharge operation in the power conditioner. [Judgment criteria] The above measurement

method must

be met and the following judgment criteria must be satisfied.

A. [Measurement method] In items A, B and C, the power conditioner normally transitions to the discharge sequence.
thing.

In addition, for power conditioners that do not support vehicle category information, discharge conversion operation is not required for the above conditions.

B. [Measurement method] In the items B, C, E, F, G, H, I, J, W, and W, the power conditioner shall not output power from the electric vehicle, etc. to the AC side.

14.3 Power Conditioner Operation Category Notification Test

[Test conditions]

The test circuit shall be connected as shown in Figure ÿ.

[Measurement

method] A. Set the operation mode (grid-connected mode, isolated operation mode, etc.) possessed by the power conditioner individually, and perform the connection operation with an electric vehicle, etc. B. If the

operation mode of the power conditioner can be set to a mode that does not include the grid-connected mode, set it to that mode, connect it to the vehicle, start the discharge operation, and perform the operation to set it to the grid-connected mode.

[Criteria for

judgment] A. The power conditioner transmits the operation mode according to the operation mode. B. The power conditioner's

grid connection information is set appropriately.

C. When the operation in B is performed, the system shall not switch to the grid-connected mode.

15. Remote output control confirmation test (specification confirmation of narrowly defined power conditioner)

This test is based on the contents described in Section 1 of the Remote Power Control Function Test Method.

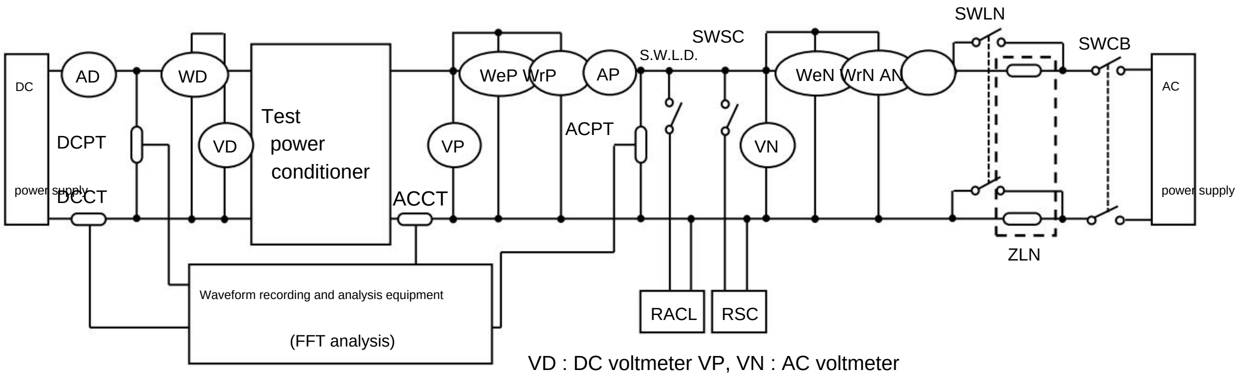
16. Remote output control confirmation test (broad power conditioner specification confirmation)

This test is based on the contents described in Section 2 of the Remote Power Control Function Test Method.

Supplementary Provisions

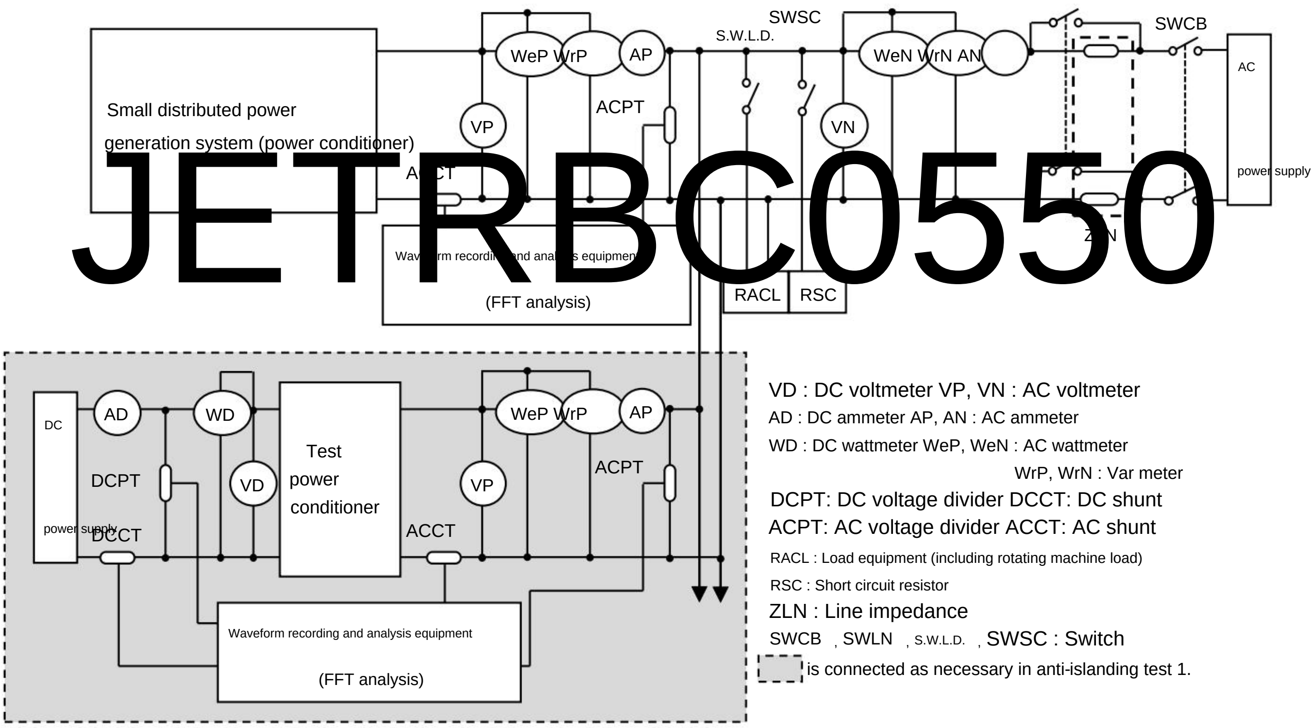
This test method will be effective from the date of issue of the test method cover (the specific effective date will be posted on the "Announcements" page on our website). This applies to products applied for.

However, if there is an application date in the supplementary provisions of each individual test method, that date shall take precedence.



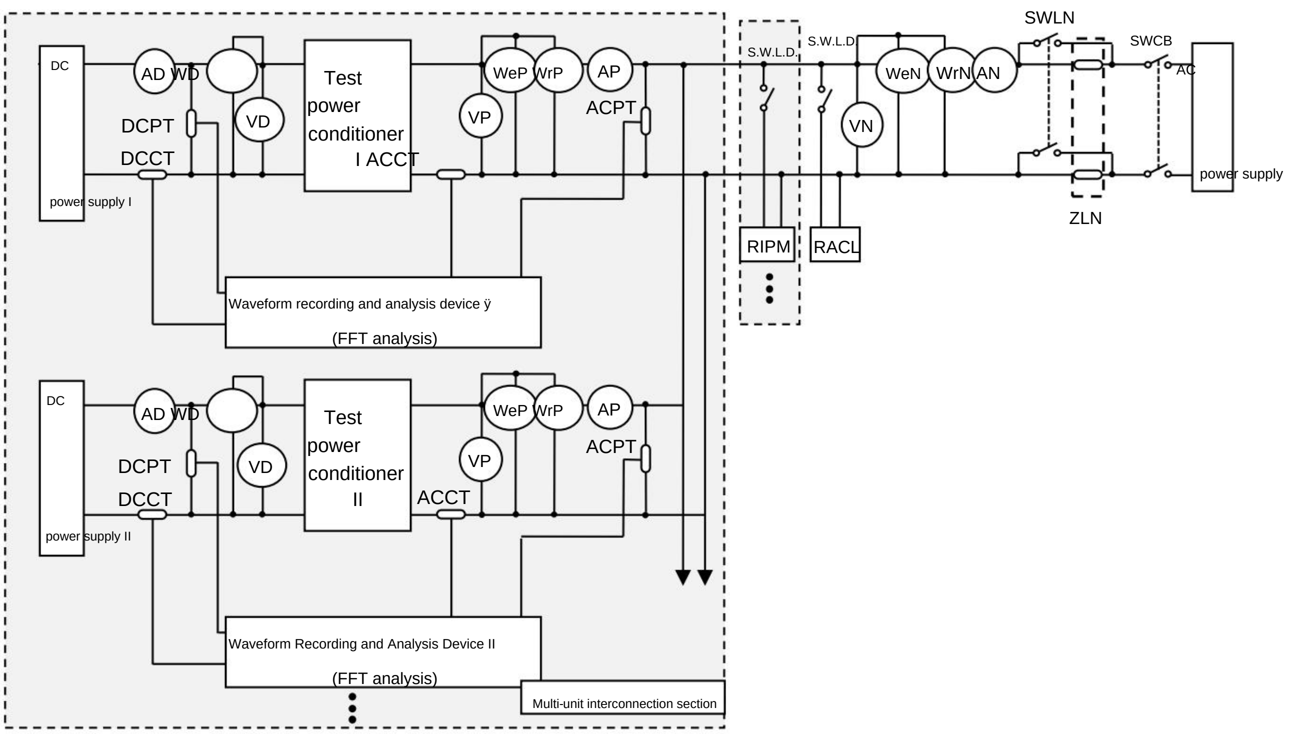
VD : DC voltmeter VP, VN : AC voltmeter
AD : DC ammeter AP, AN : AC ammeter
WD : DC wattmeter WeP, WeN : AC wattmeter
WrP, WrN : Var meter
DCPT: DC voltage divider DCCT: DC shunt
ACPT: AC voltage divider ACCT: AC shunt
RACL : Load equipment (including rotating machine load)
RSC : Short circuit resistor
ZLN : Line impedance
SWCB , SWLN , S.W.L.D. , SWSC : Switch
*Note: This includes cases where a DC power source is used instead of a battery in a battery storage system.

Attached Figure I Test circuit when testing using a DC power supply (example for a solar power generation system *Note)



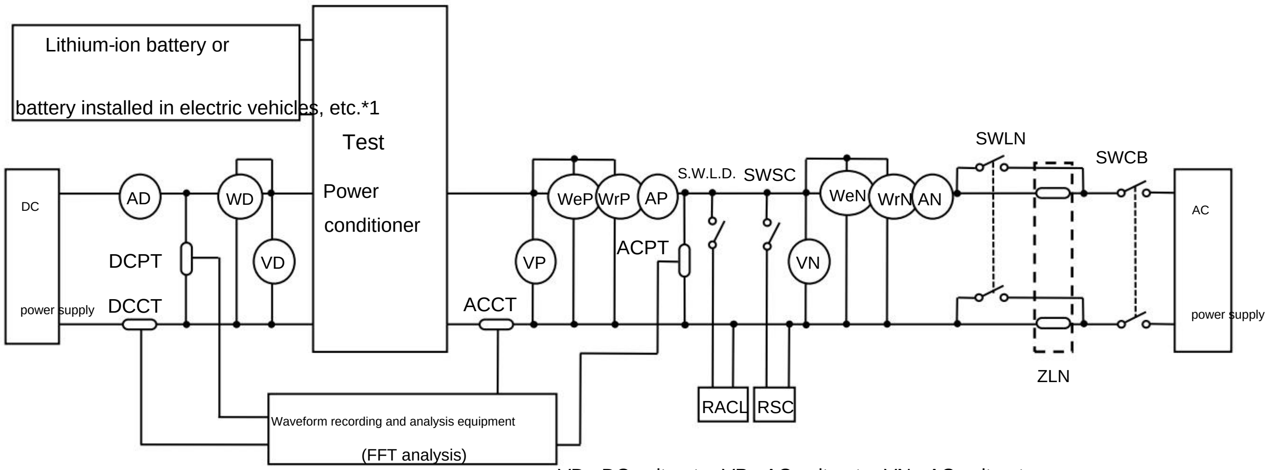
VD : DC voltmeter VP, VN : AC voltmeter
AD : DC ammeter AP, AN : AC ammeter
WD : DC wattmeter WeP, WeN : AC wattmeter
WrP, WrN : Var meter
DCPT: DC voltage divider DCCT: DC shunt
ACPT: AC voltage divider ACCT: AC shunt
RACL : Load equipment (including rotating machine load)
RSC : Short circuit resistor
ZLN : Line impedance
SWCB , SWLN , S.W.L.D. , SWSC : Switch
is connected as necessary in anti-islanding test 1.

Attached Figure II Test circuit for testing in a system (examples for gas engine cogeneration systems, fuel cell systems, storage battery systems, and electric vehicle storage battery (DC connection) systems)



VD : DC voltmeter VP : AC voltmeter VN : AC voltmeter
AD : DC ammeter AP : AC ammeter AN : AC ammeter
WD : DC wattmeter WeP : AC wattmeter WeN : AC wattmeter
WrP : Var wattmeter WrN : Var wattmeter
DCPT: DC voltage divider DCCT: DC shunt
ACPT: AC voltage divider ACCT: AC shunt
RACL : Load device RIPM : Rotating machine load
ZLN : Line impedance
SWCB , SWLN , SWLD : Switch

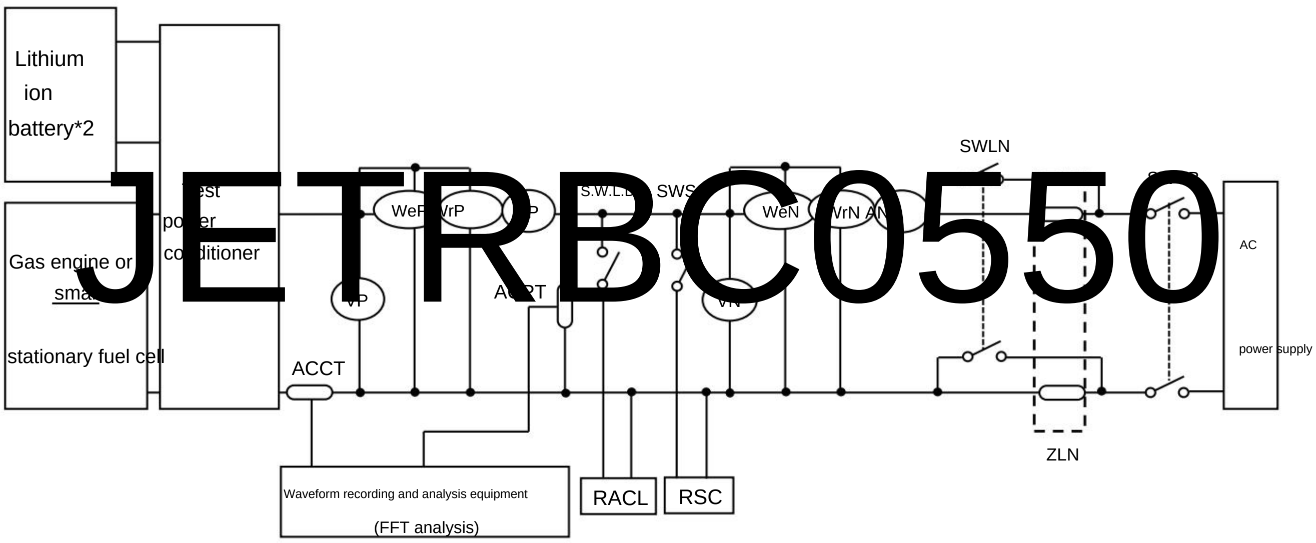
Attached Figure Test circuit for testing multiple units connected to the grid (example for
a multi-unit grid-compatible photovoltaic power generation system)



VD : DC voltmeter VP : AC voltmeter VN : AC voltmeter
AD : DC ammeter AP : AC ammeter AN : AC ammeter
WD : DC wattmeter WeP : AC wattmeter WeN : AC wattmeter
WrP : Var wattmeter WrN : Var wattmeter
DCPT: DC voltage divider DCCT: DC shunt
ACPT: AC voltage divider ACCT: AC shunt
RACL : Load device (including rotating machine load) RSC : Short circuit resistor
ZLN : Line impedance SWCB , SWLN , SWLD , SWSC : Switch

Attached Figure IV Test circuit for testing multiple DC input systems and multi-input systems

(Examples of solar power and lithium-ion batteries, or solar power and batteries installed in electric vehicles, etc.)



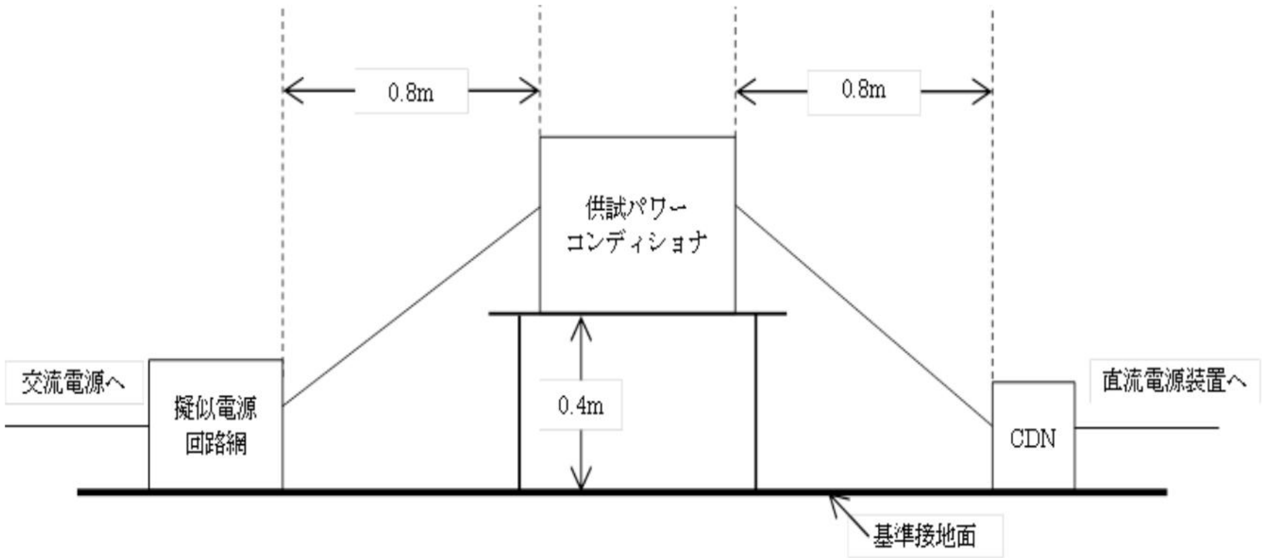
*2: Lithium-ion batteries can be substituted with a DC power source.
However, if a DC power supply is substituted, the voltage, current, etc. must be measured. Also, for items that require system testing, a DC power supply cannot be used instead.

VD : DC voltmeter VP : AC voltmeter VN : AC voltmeter AD : DC ammeter AP : AC ammeter AN : AC ammeter WD : DC wattmeter WeP : AC wattmeter WeN : AC wattmeter WrP : Var wattmeter WrN : Var wattmeter

DCPT: DC voltage divider DCCT: DC shunt
ACPT: AC voltage divider ACCT: AC shunt
RACL : Load equipment (including rotating machine load) RSC : Short circuit resistor
ZLN : Line impedance SWCB , SWLN , SWLD , SWSC : Switch

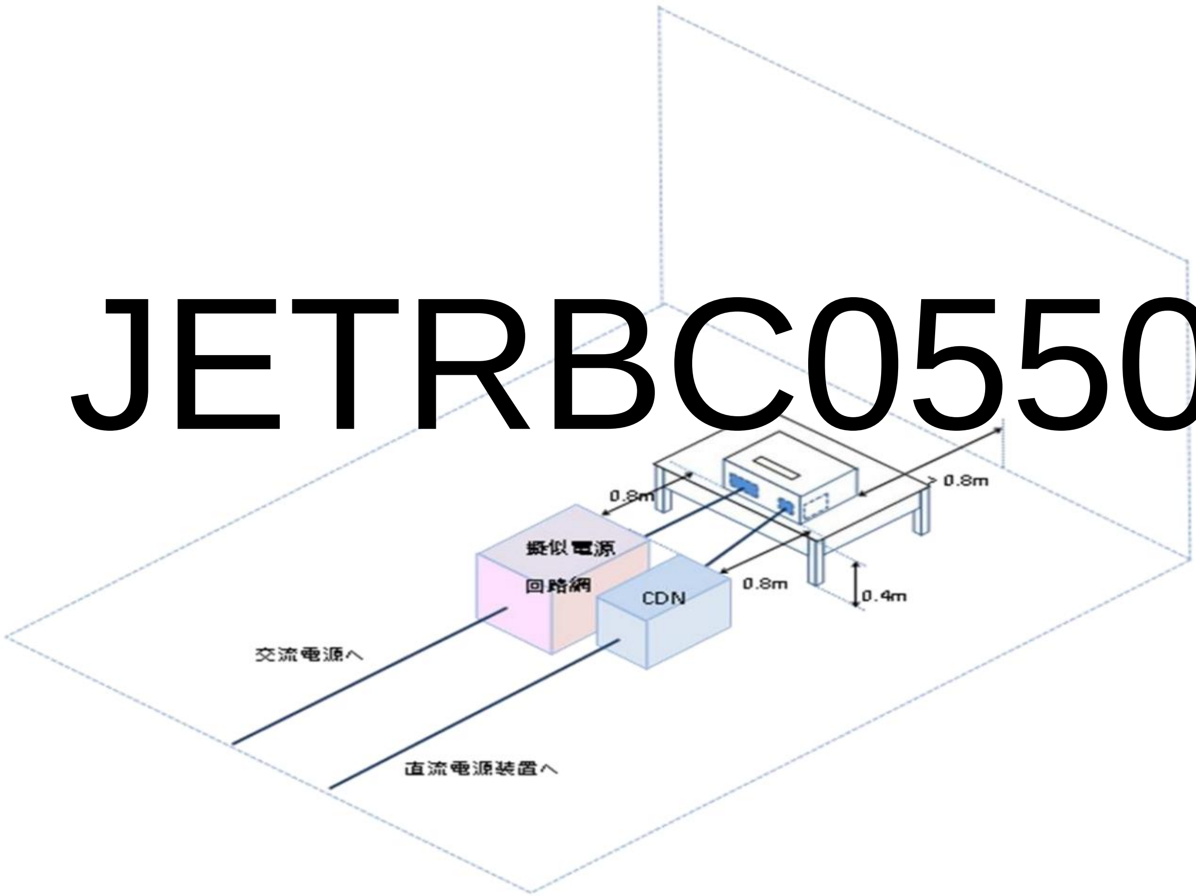
Attached Figure V Test circuit for testing multiple DC input systems

(Examples of gas engines and lithium-ion batteries or fuel cells and lithium-ion batteries)

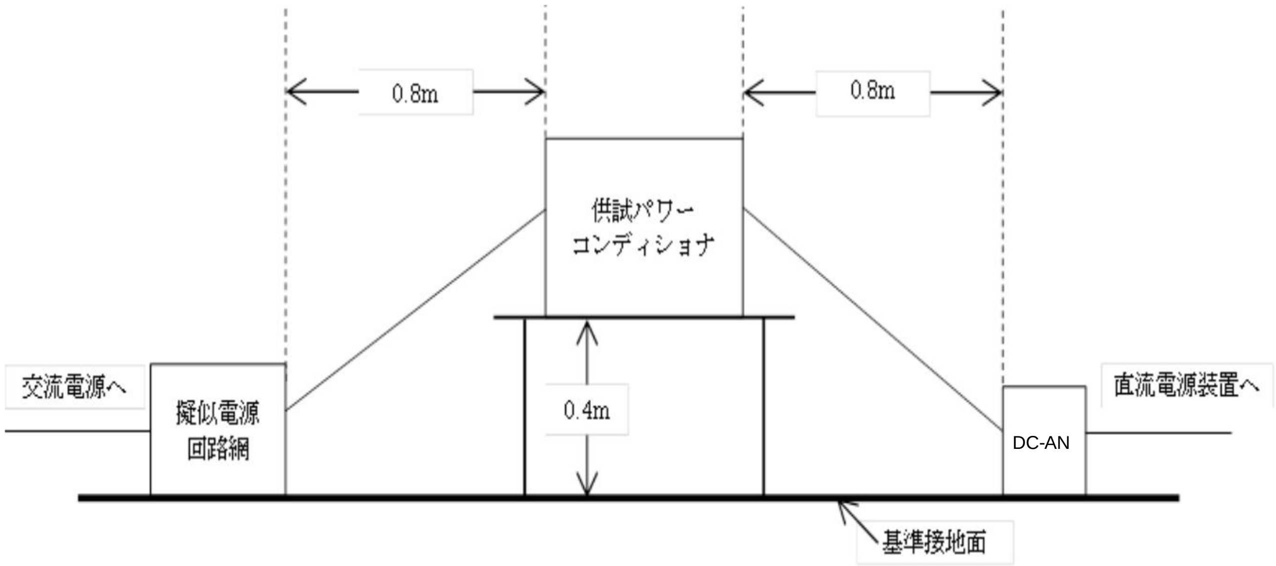


Note: The power conditioner under test must be located at least 0.8 m away from any metal other than the reference ground plane.

Attached Figure VI-1 Layout of test power conditioners for radio interference testing (old standard)

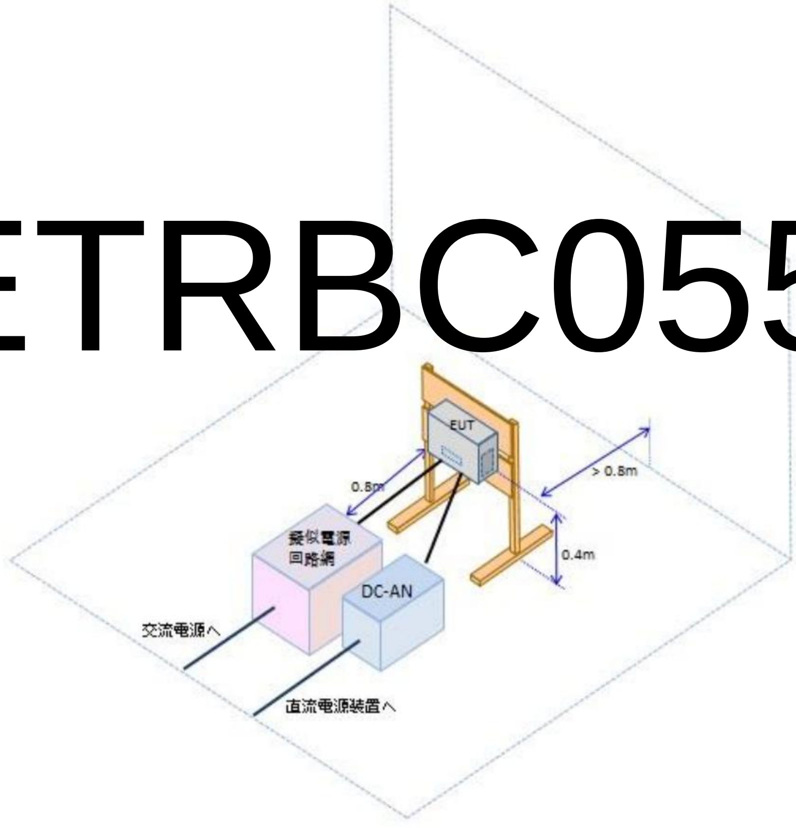


Attached Figure VI-2 Layout of test power conditioners for radio interference testing (old standard)

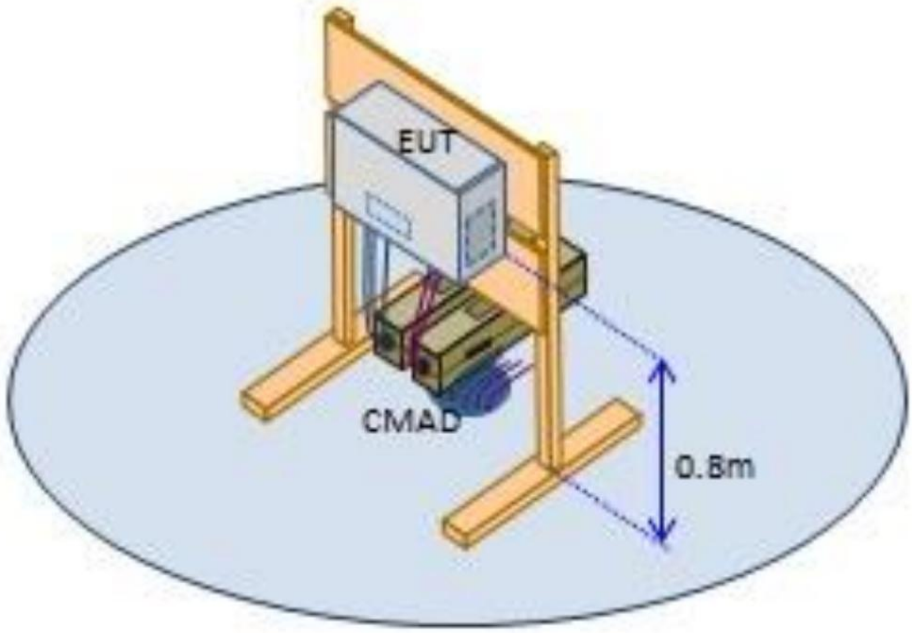


Note: The power conditioner under test must be located at least 0.8 m away from any metal other than the reference ground plane.

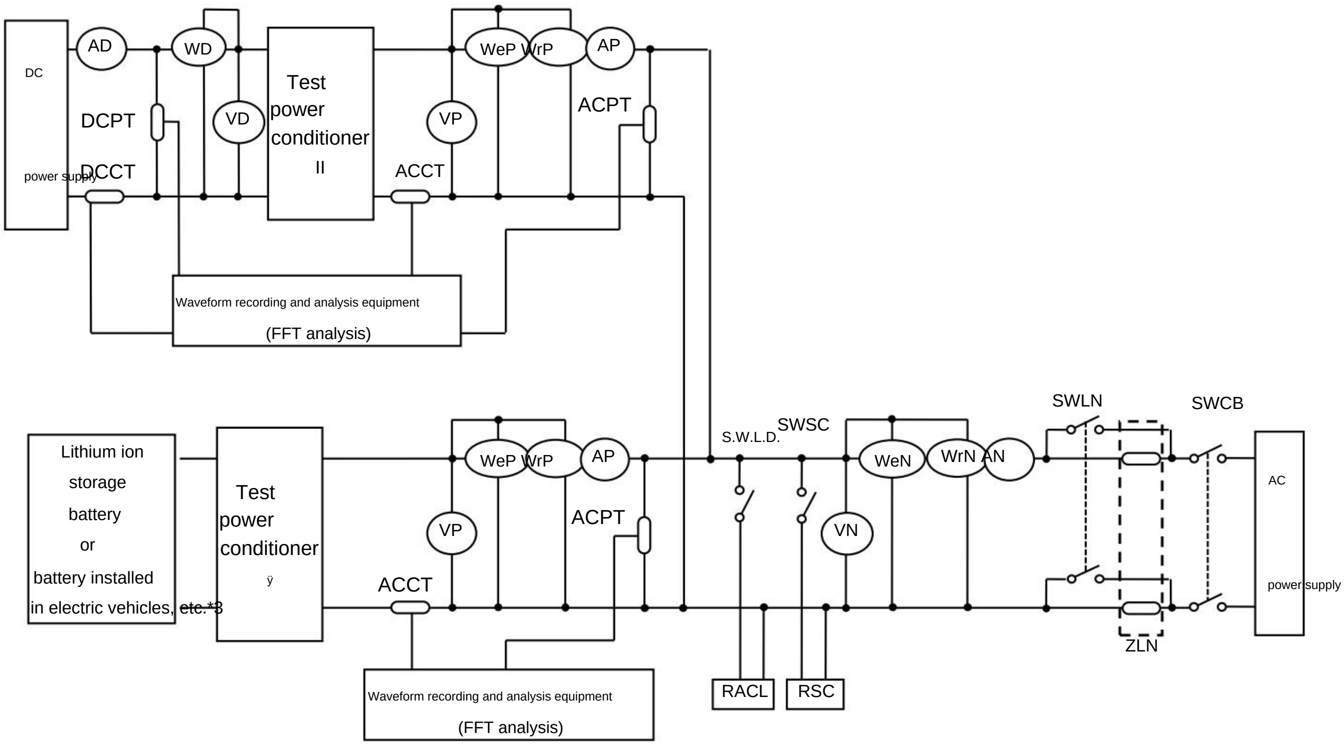
Attached Figure VI-3 Layout of test power conditioners for radio interference testing



Attached Figure VI-4 Layout of test power conditioners for radio interference testing



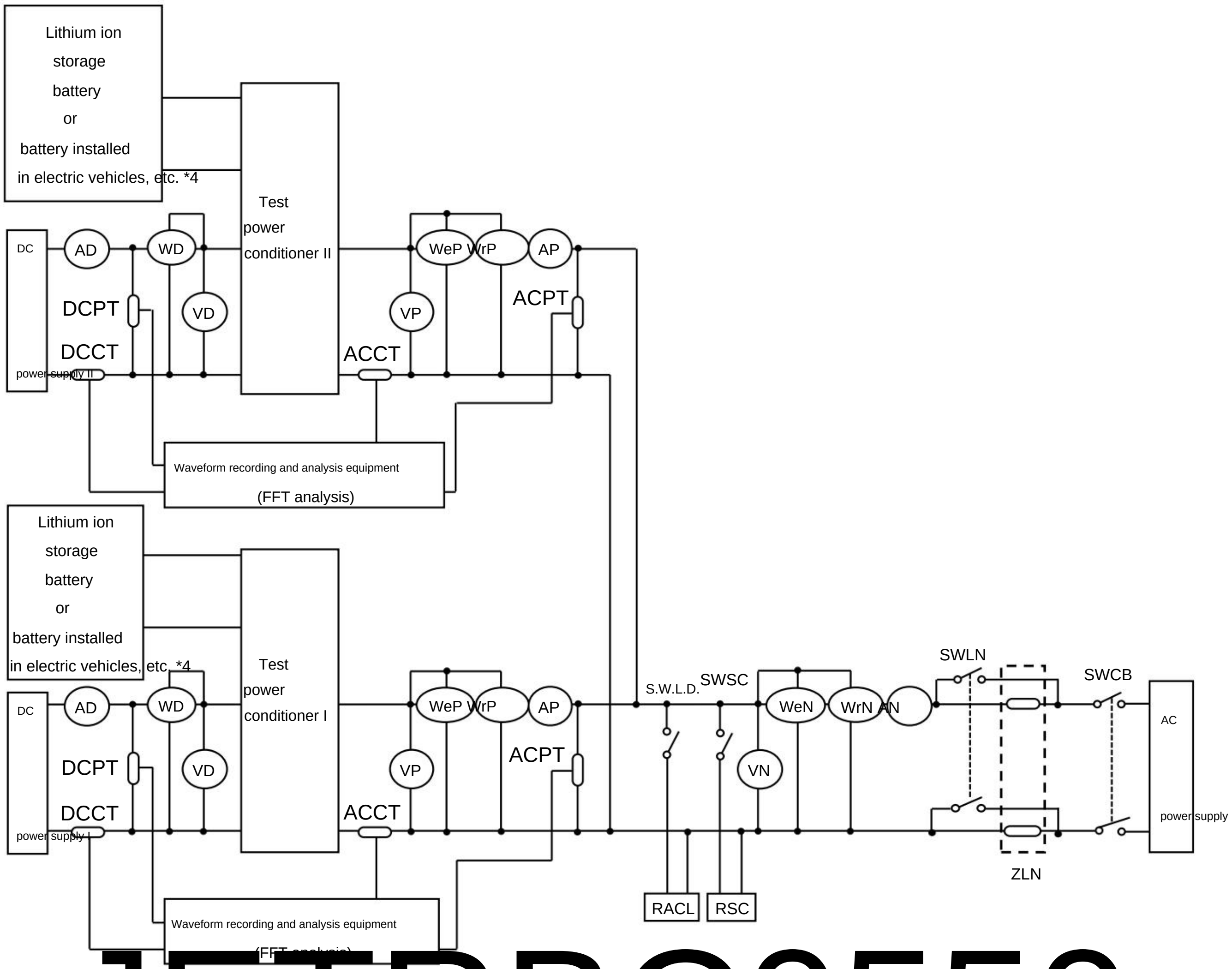
Attached Figure VI-5 Layout of power conditioner under test for radiated interference test



*3: Lithium-ion batteries or batteries installed in electric vehicles, etc. may be substituted with a DC power source. However, when substituted with a DC power source, voltage and current, etc. must be measured. Also, items requiring system testing cannot be substituted with a DC power source. Test power conditioner I shall be in charging mode. Test power conditioner II shall be in discharging mode.

VD : DC voltmeter VP : AC voltmeter VN : AC voltmeter
AD : DC ammeter AP : AC ammeter AN : AC ammeter
WD : DC wattmeter WeP : AC wattmeter WeN : AC wattmeter
WrP : Var wattmeter WrN : Var wattmeter
DCPT: DC voltage divider DCCT: DC shunt
ACPT: AC voltage divider ACCT: AC shunt
RACL : Load equipment (including rotating machine load) RSC : Short circuit resistor
ZLN : Line impedance
SWCB , SWLN , SWLD , SWSC : Switch

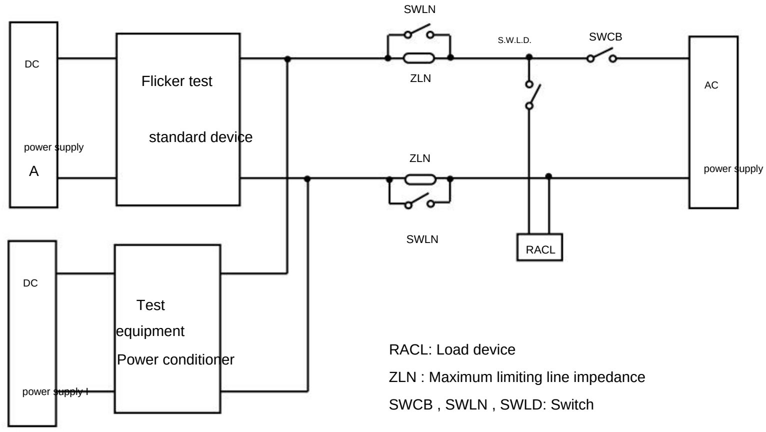
Attached Figure VII Seamless battery system and seamless electric vehicle battery Circuit diagram of anti-islanding test 1 in charging mode for (DC connection type) system



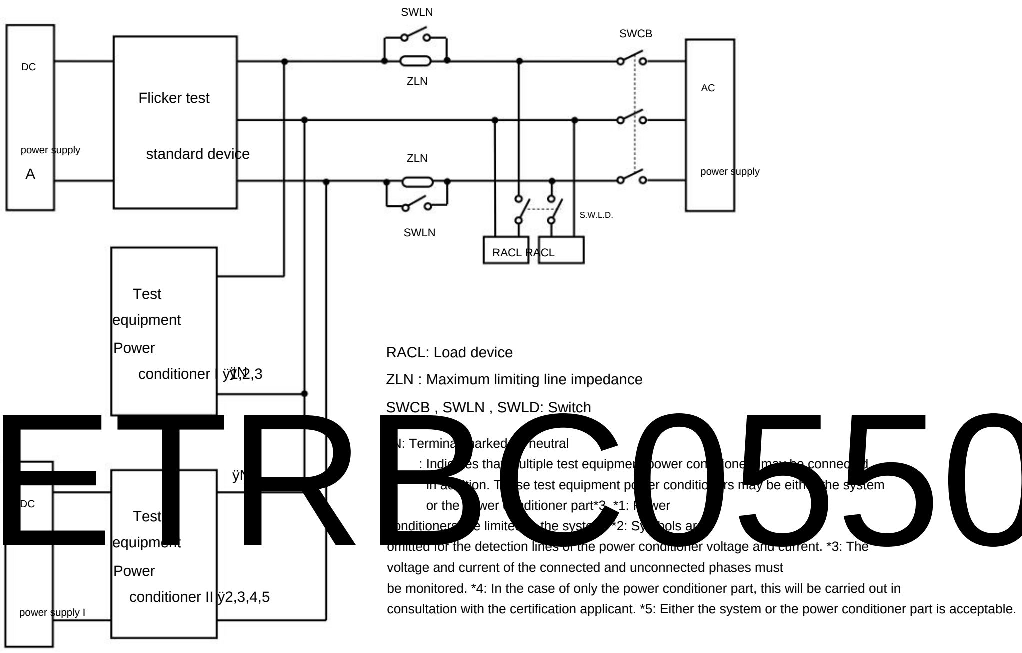
*4: Lithium-ion batteries or batteries installed in electric vehicles, etc. may be substituted with a DC power source. However, when substituted with a DC power source, voltage and current, etc. must be measured. Also, items requiring system testing cannot be substituted with a DC power source. Test power conditioner I shall be in forward conversion mode. Test power conditioner II shall be in reverse conversion mode.

VD : DC voltmeter VP : AC voltmeter VN : AC voltmeter
AD : DC ammeter AP : AC ammeter AN : AC ammeter
WD : DC wattmeter WeP : AC wattmeter WeN : AC wattmeter
WrP : Var wattmeter WrN : Var wattmeter
DCPT: DC voltage divider DCCT: DC shunt
ACPT: AC voltage divider ACCT: AC shunt
RACL : Load device (including rotating machine load) RSC : Short circuit resistor
ZLN : Line impedance
SWCB , SWLN , SWLD , SWSC : Switch

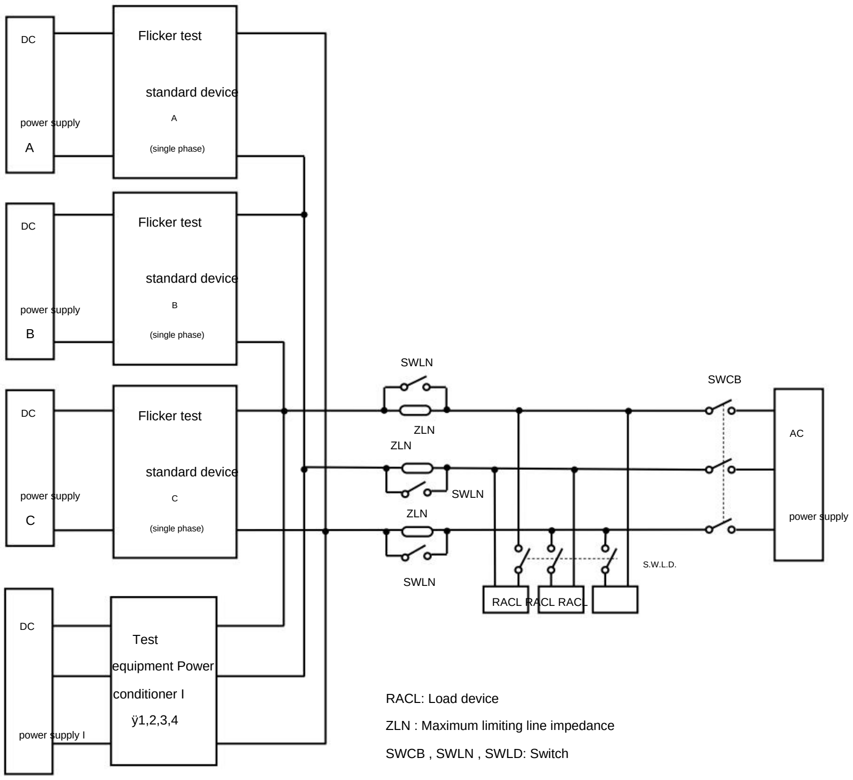
Attached Figure VIII Circuit diagram of anti-islanding test 1 in forward conversion mode for seamless type multiple DC input system and seamless type multi-input system



Attached Figure ÿ-1 Reactive power oscillation suppression confirmation test circuit (for equipment connected to 200V)



Attached Figure ÿ-2 Reactive power oscillation suppression confirmation test circuit (for 100V connection equipment)



RACL: Load device

ZLN : Maximum limiting line impedance

SWCB , SWLN , SWLD: Switch

*N: Terminal marked as neutral
: Indicates that multiple test equipment power conditioners may be connected in addition. These test equipment power conditioners may be either the system or the power conditioner part*3. *1: Either the system or the power conditioner part is acceptable. *2: Symbols are omitted for the detection lines of the voltage and current of the power conditioner. *3: The voltage and current of the connected and unconnected phases must be monitored.
*4: In the case of only the power conditioner part, this will be done in consultation with the certification applicant.

Attached Figure ÿ-3 Reactive power oscillation suppression confirmation test circuit (for three-phase connection equipment)

Information sent from the vehicle to the PCS

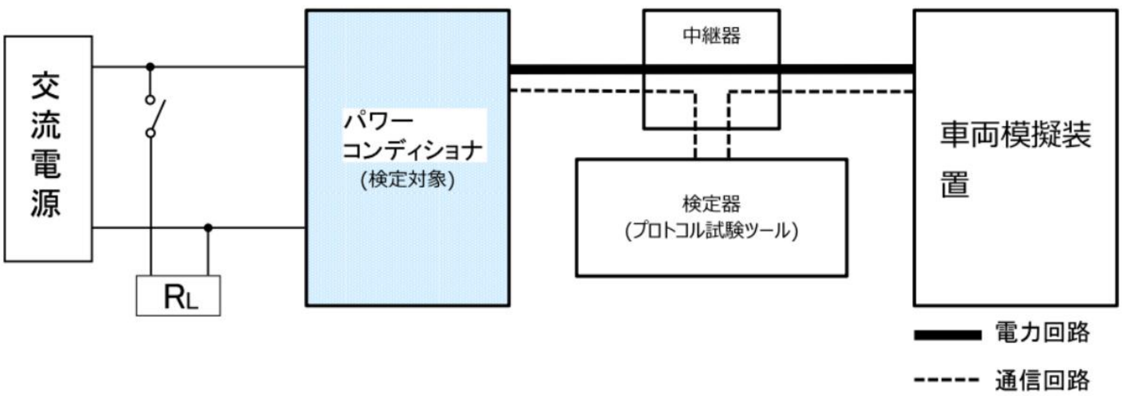
Electric Vehicle CAN Parameters \ symbol	Test items: stomach	A	B	Ha	D	B	H	F
(V2H Guideline Version hmm)	V2H Guidelines 1.x and earlier							
V2H sequence control number	0x00							
CHAdeMO sequence control number issue	0x01				0x02			
Vehicle Category (Information)	0x00 (No information)	0x01 (Power supply information available)			0x00 (No information)	0x01 (Power supply information available)		
Operational Mode	No data 0x01 (battery)			0x01 or later outside (Other than storage batteries)	No data 0x01 (battery)			0x01 or later outside (Other than storage batteries)
Grid connection information	No data (including	bit0:1 storage battery)	bit0:0 (Not including storage battery)	-	No data (including battery)	bit0:1	bit0:0 (Not including storage battery)	-
Possibility of grid connection via PCS	•	•/×	×	×	•	•/×	×	×

Electric Vehicle CAN Parameters \ symbol	Test items: to	C	blood	R	N	R	Wo	W
(V2H Guideline Version hmm)	V2H Guidelines Version 2.x (Annex A)				V2H Guidelines Version 2.x (Annex B)			
V2H sequence control number	0x01				0x02			
CHAdeMO sequence control number issue	0x01				0x02			
Vehicle Category (Information)	0x00 (No information)	0x01 (Power supply information available)			0x00 (No information)	0x01 (Power supply information available)		
Operational Mode	No data 0x01 (battery)			0x01 or later outside (Other than storage batteries)	No data 0x01 (battery)			0x01 or later outside (Other than storage batteries)
Grid connection information	No data (including	bit0:1 storage battery)	bit0:0 (Not including storage battery)	-	No data (including battery)	bit0:1	bit0:0 (Not including storage battery)	-
Possibility of grid connection via PCS	×	•	×	×	×	•	×	[illegible]

Reference: V2H Certification Standards DC Version (CHAdeMO Council)

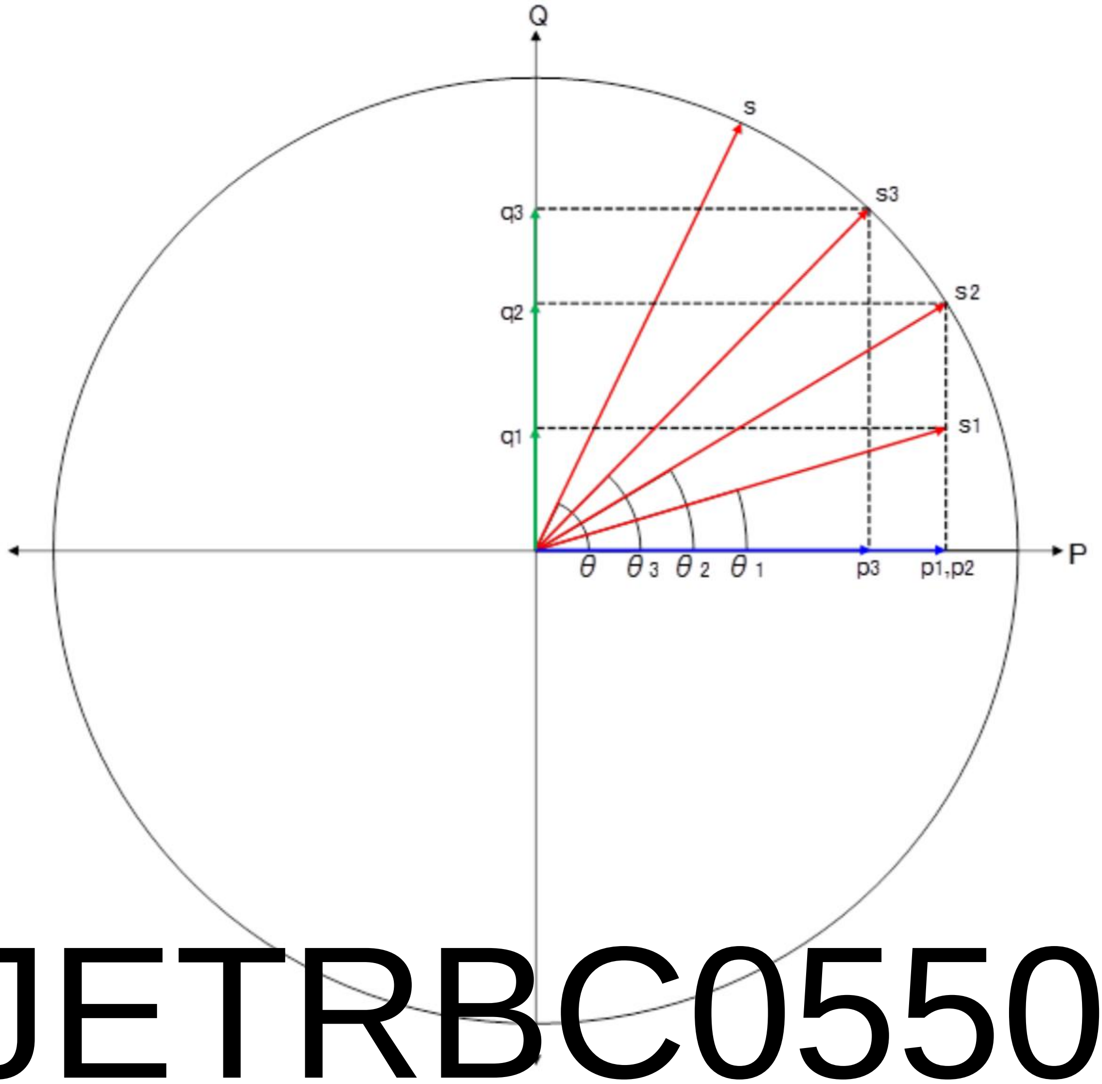
*The vehicle simulator must reproduce the communication functions of a vehicle.

An electric vehicle or the like may also be used.



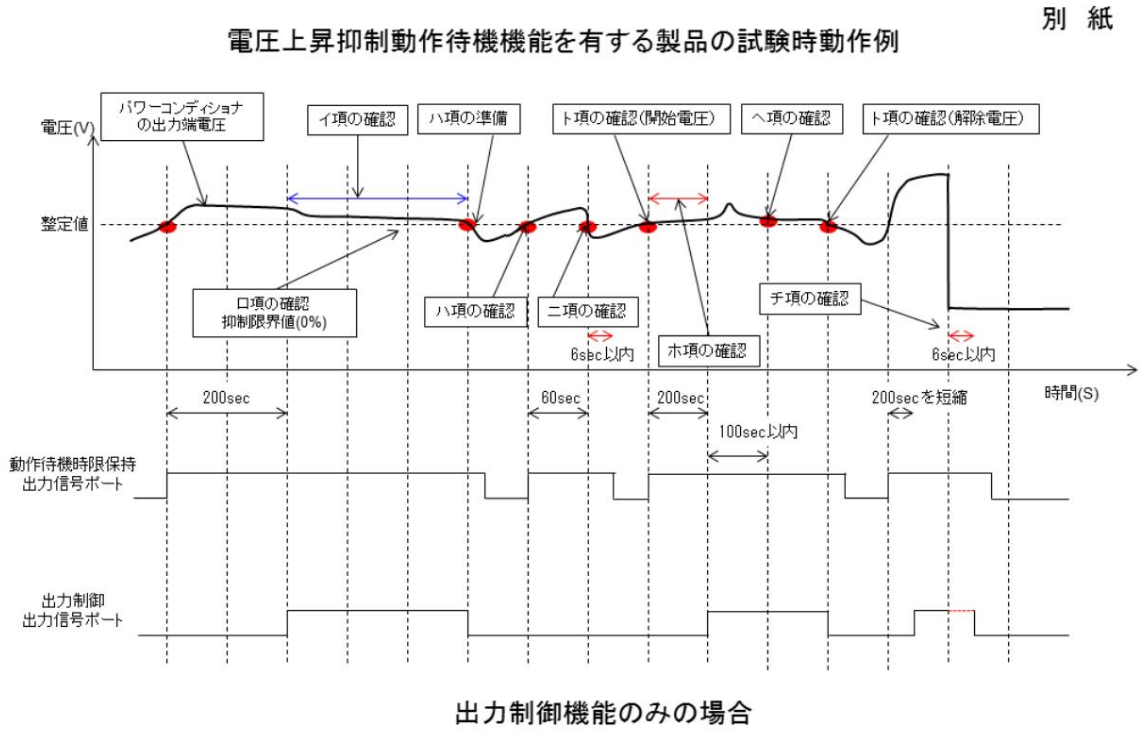
Attached Figure ÿ Circuit diagram of **V2H** Guideline (DC) protocol test

(Example of storage batteries (DC connection type) installed in electric vehicles, etc.)

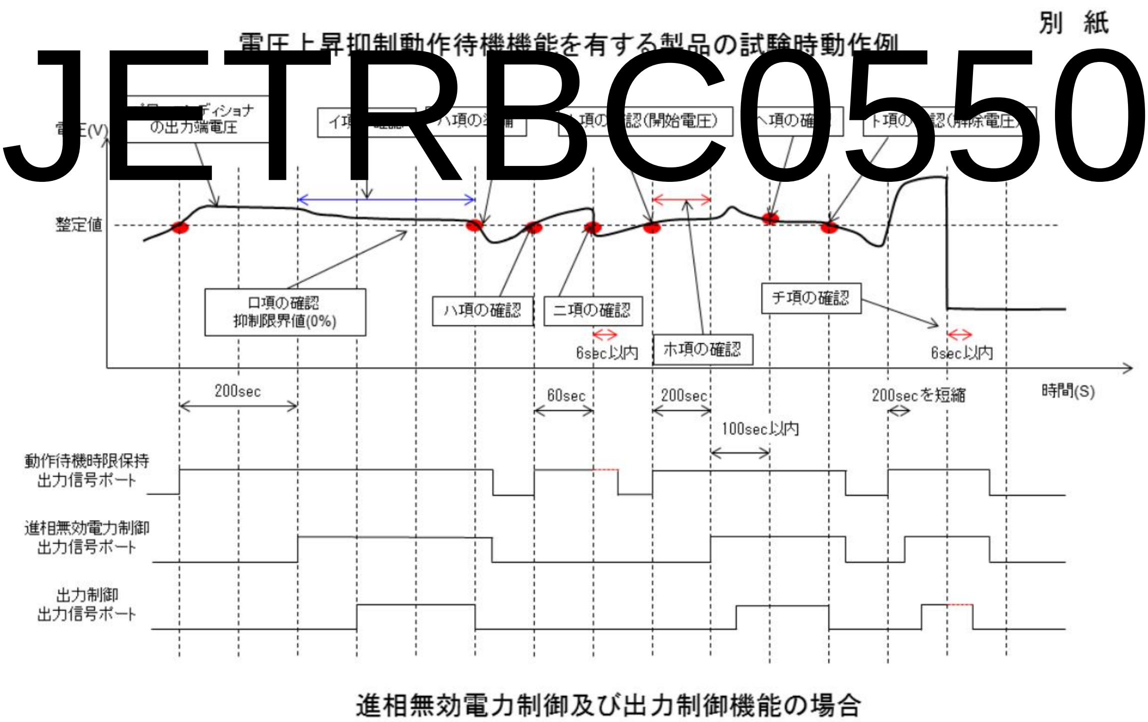


s ： 最大指定皮相電力
s1, s2, s3 ： 指定皮相電力
p1, p2, p3 ： 指定出力
θ1, θ2, θ3 ： 指定力率(相当する位相角)

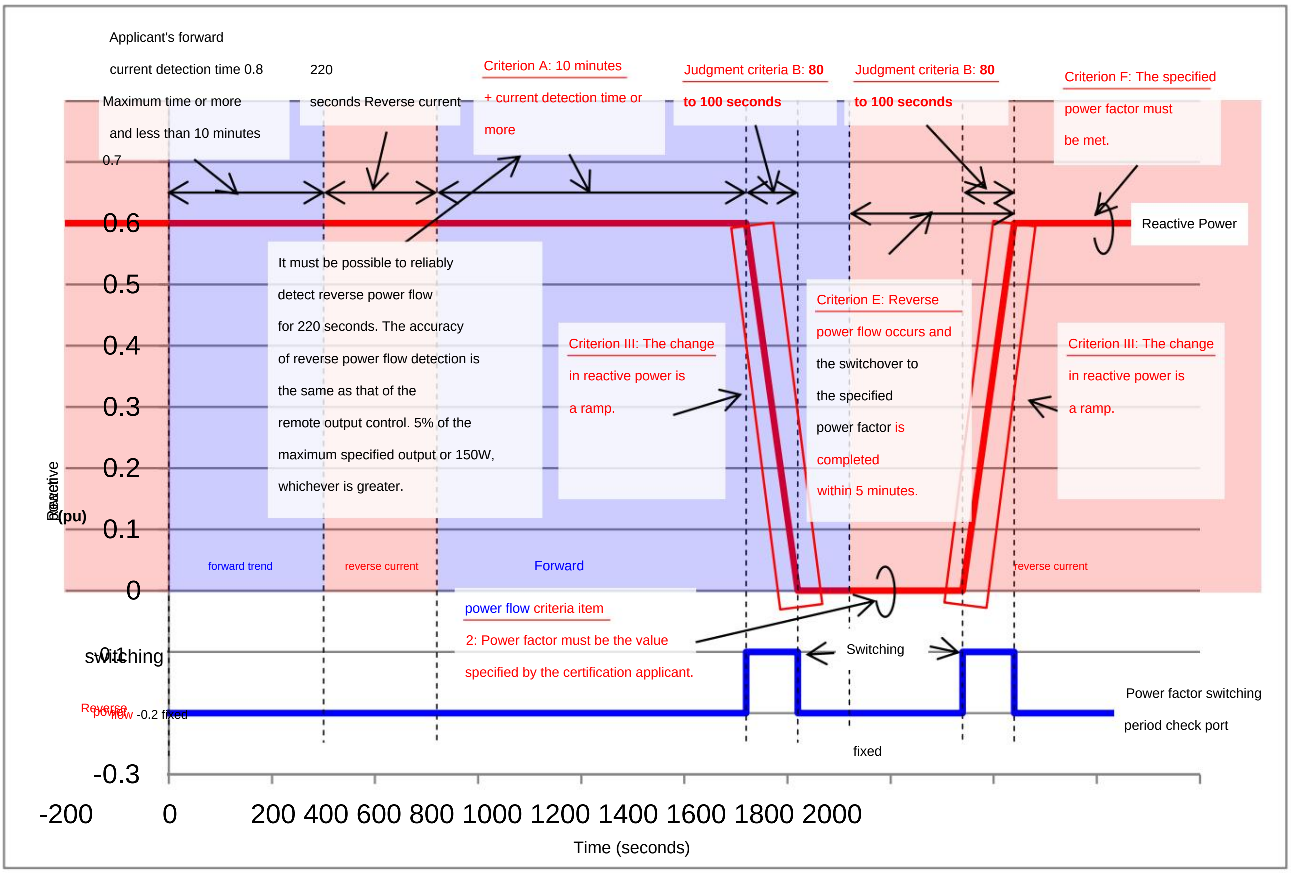
Supplementary Figure **1:** Example of the relationship between terms in the terminology organization



Supplementary Figure **2:** Example of test operation of voltage rise suppression function (output control)



Supplementary Figure **3:** Example of test operation of voltage rise suppression function (leading-phase reactive power control and output control)



Supplementary Figure **4** Example of power factor switching test by power flow

JETRBC0550

Attachment

[Attachment] Evaluation procedure for frequency feedback function verification test and step injection function test

1. Frequency feedback function test evaluation procedure

The frequency feedback function test may use the following method.

(1) Test method: As described in Section 3.2.5, change the frequency and measure the voltage and current of the PCS.

(2) Mask the active method (set so that the frequency feedback function does not operate) and measure the voltage and current of the PCS when changing the same frequency as in (1).

(3) Calculate the frequency from the voltage measured in (1) and calculate the period deviation.

(4) Calculate the amount of reactive current injection from the results of measurements in (1) and (2) and determine whether it exceeds 0.25 pu (taking into account judgment errors). Make sure it is not there.

(5) Calculate the difference between the reactive current injection amount in (1) and the reactive current injection amount in (2). This calculates the reactive current injection amount excluding the control response. A flow rate is obtained.

(6) Compare the reactive current injection amount obtained in (5) with the period deviation obtained in (3) to evaluate the timing of reactive current injection. Worth it.

2. Evaluation procedure for step injection function test (1)

Test method As described in Section 3.2.6, the harmonic voltage and fundamental voltage are suddenly increased to test whether the step injection function works. If the step injection function works, the reactive power is calculated from the PCS voltage and current.

(2) If the step injection function does not work, the harmonic voltage is increased sharply in the range of 2.0V + 10% and the fundamental voltage is increased. In this case, the voltage is suddenly increased within the range of 2.5V + 10% to test whether the step injection function works. If the step injection function works, the reactive power is calculated from the voltage and current of the PCS.

(3) If the step injection function operates in (1), suddenly increase the harmonic voltage in the range of 2.0V-10% to confirm that the step injection function does not operate. Also, suddenly increase the fundamental voltage in the range of 2.5V-10% to confirm that the step injection function does not operate.

(4) From the calculation results of the reactive power, confirm that the reactive power does not exceed the maximum specified apparent power of 0.10 pu (taking into account the judgment error).

(5) Based on the reactive power calculation results, reactive power is injected during the time when the reactive power exceeds the maximum specified apparent power of 0.01 pu. In either case, it is
confirmed that the reactive power has decreased after 3 cycles (50Hz: 60ms, 60Hz: 50ms) from that time.

[Reference] Frequency feedback and step injection amount

The standard for the maximum injection amount required for each test is the "maximum apparent power".

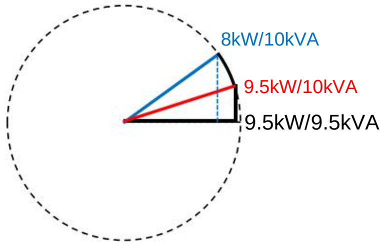
At the design stage, it is important to decide whether to design the maximum injection amount based on the "maximum apparent power" or the "effective power".

The amount of reactive power injected (the ratio to active power) when the power factor is changed varies depending on the type of inverter.

Care must be taken because islanding detection performance is affected by the amount of reactive power injected relative to the amount of active power.

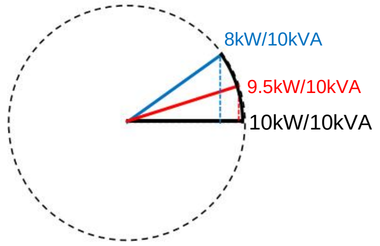
Calculation example

maximum apparent power	10kVA	
Frequency feedback maximum injection amount	2.5 kVA	0.25pu
Step injection maximum injection amount	1 kVA	0.1pu



Constant apparent power with power factor of 0.8 to 0.95

Constant active power with power factor of 0.95 to 1.0



Power factor 0.8 to 1.0, constant apparent power

Power factor	0.8	0.95	1	0.8	0.95	1
maximum apparent power	10kVA			10kVA		
apparent power	10kVA	10kVA	9.5 kVA	10kVA	10kVA	10kVA
Maximum Available Power	9.5 kW			10 kW		
Active Power	8 kW	9.5 kW	9.5 kW	8 kW	9.5 kW	10 kW
Frequency Feedback Injection						
When based on maximum apparent power	2.5 kVA			2.5 kVA		
When apparent power is used as the reference	2.5 kVA	2.5 kVA	2.375 kVA	2.5 kVA	2.5 kVA	2.5 kVA
When based on maximum active power	2.375 kVA			2.5 kVA		
When based on active power	2 kVA	2.375 kVA	2.375 kVA	2 kVA	2.375 kVA	2.5 kVA
Ratio of injection amount to active power						
When based on maximum apparent power: 0.313 pu When		0.263 pu	0.263pu	0.313 pu	0.263 pu	0.250 pu
based on apparent power: 0.313 pu When based on maximum		0.263 pu	0.250pu	0.313 pu	0.263 pu	0.250 pu
active power: 0.297 pu When based on active power: 0.250		0.250 pu	0.250 pu	0.313pu	0.263pu	0.250 pu
puArea where the reactive power injection amount (ratio to active power) is lower than the	0.250 pu	0.250 pu		0.250 pu	0.250 pu	0.250 pu

standard power factor

Step injection is a similar idea

Attachment

[Attachment] Explanation of Islanding Prevention Test 1 for Specified Output Other than **4.0kW**

In the following text, for power conditioners that do not perform constant power factor control, "designated output" shall be replaced with "rated output." Read as "power."

The anti-islanding test for multiple-unit grid-connected systems is based on a power conditioner with a designated output of 4.0 kW. When conducting anti-islanding test 1, the test method involves connecting one rotating machine load to a power conditioner with a designated output of 4.0 kW.

Therefore, when conducting anti-islanding test 1 for power conditioners with a specified output other than 4.0 kW, the number of power conditioners and rotating loads to be connected will be determined based on the following considerations so that the test can be performed with minimal influence from the rotating load.

[Preparing the test specimen] The test specimen shall consist of the PCS (only for solar power) or power generation system to be certified (hereinafter referred to as the master unit) and the same PCS or power generation system as that used for the master unit (hereinafter referred to as the slave unit).

- The combination of master and slave devices in this test shall be as follows: However, if it is difficult to carry out the test with the following combination, it shall be carried out in consultation with the certification applicant.

Combination

1 Master unit: Operates with the system (If for solar power, operates with a simulated DC power supply) Slave unit: Operates with a simulated DC power supply (PCS only) Combination

2 Master

unit: Operates with the system (If for solar power, operates with a simulated DC power supply) Slave unit: Operates with the system (If for solar power, operates with a simulated DC power supply)

[Number of test specimens and rotating loads connected] [How to determine the number of test specimens connected]

•If the designated output is 4kW or more, the designated output will be used, so one test specimen will be used. •If the designated output is less than 4kW, the designated output will be rounded down to two significant digits and calculated in the following manner. However, in consultation with the certification applicant, the number of units to be tested may be set at any number less than the number calculated above.

N = ÿ4/ÿ ...Formula (1)

| × ÿ 4| ...Formula (2)

| × (+ 1) ÿ 4| ...Formula (3)

ÿ ÿSpecified output of PCS (kW) ÿTruncate to whole number ÿ ÿ

M: Number of connected rotating loads: Absolute value

If formula (2) ÿ formula (3), the maximum number of units that can be connected is N. If formula (2) > formula (3), the maximum number of units that can be connected is N+1.

Calculation

example 1 When the PCS specified output is

1.2kW, N = ÿ4/1.2ÿ = 3 ...Formula (1')

|1.2 × 3 ÿ 4| = |3.6 ÿ 4| = 0.4 ...Formula (2')

|1.2 × (3 + 1) ÿ 4| = |4.8 ÿ 4| = 0.8 ...Formula (3')

Since formula (2') ÿ formula (3'), the answer is N. In other words, a maximum of three units can be connected.

Calculation example 2

When the PCS specified output is 1.19kW

N = ÿ4/1.1ÿ = 3 ...Formula (1'')

|1.1 × 3 ÿ 4| = |3.3 ÿ 4| = 0.7 ...Formula (2'')

|1.1 × (3 + 1) ÿ 4| = |4.4 ÿ 4| = 0.4 ...Formula (3'')

Since equation (2'') > equation (3''), the result is N+1. In other words, a maximum of four PCS units can be connected.

[How to calculate the number of connected rotating loads]

The number of rotating loads connected to a PCS of 4.0kW or less is limited to one.

•If it exceeds the specified 4kW, it is calculated using the following method.

M = ÿ/4ÿ ...Formula (4)

| ÿ 4 × | ...Formula (5)

| ÿ 4 × (+ 1)| ...Formula (6)

ÿ ÿSpecified output of PCS (kW) ÿTruncate to whole number ÿ ÿ

M: Number of connected rotating loads: | | Absolute value

If (5) < (6), the number of units will be M, and if (5) ÿ (6), the number of units will be M+1.

Calculation example 3

M = ÿ7/4ÿ = 1 ...Formula (4')

|7 ÿ 4 × 1| = 3 ...Formula (5')

|7 ÿ 4 × (1 + 1)| = 1 ...Formula (6')

Since equation (5') > equation (6'), the number of units is M+1. In other words, two rotating machine loads are connected.

Table 1 Example of the number of power conditioners and rotating loads used during testing

Specified output (kW)	Number of connected PCS units	Number of connected rotating machine load units
0.70 to less than 0.73	1-6	1
0.73 to less than 0.89	1–5	1
0.89 to less than 1.2	1-4	1
1.2 to less than 1.6	1-3	1
1.6 to less than 2.7	1-2	1
2.7 to less than 6.0	1	1
6.0 to less than 10.0	1	2
10.0 to less than 14.0	1	3
14.0 to less than 18.0	1	4
18.0 to less than 22.0	1	5
22.0 to less than 26.0	1	6
26.0 to less than 30.0	1	7
30.0 to less than 34.0	1	8
34.0 to less than 38.0	1	9
38.0 to less than 42.0	1	10
42.0 to less than 46.0	1	11
46.0 to less than 50.0	1	12

Attachment

[Attachment] Explanation of Test 2 to Prevent Islanding Operation When Multiple Units are Connected

In the following text, for power conditioners that do not perform constant power factor control, "designated output" shall be replaced with "rated output." Read as "power."

In the islanding prevention test 2 when multiple units are connected, it is necessary to make the test conditions equal and compare the islanding detection time in order to confirm that the islanding detection time by the active islanding prevention function does not increase with the number of connected units. In this test,

the rotating machine load is connected at a ratio of one unit per 4kW total output of the power conditioner, so if the specified output of the power conditioner is other than 4kW, it is necessary to adjust the output of the power conditioner to eliminate the effect of the rotating machine load.

However, in order to use power conditioners with small designated outputs and make the total designated output a multiple of 4kW, a large number of units are required, and test specimens for other test items are not equipped with an output adjustment function. Therefore, the output of the test specimen in this test and the number of connected units for judgment will be determined based on the following considerations.

[Preparation of test specimen] •The test specimen shall consist of a PCS (hereinafter referred to as the master unit) that has not been modified for the output adjustment (reactive power injection adjustment) that is the subject of certification, and a PCS (hereinafter referred to as the slave unit) that has been modified for the output adjustment (reactive power injection adjustment) required to adjust the total output to the value listed in Table 1. •The combination of the master unit and the slave unit in this test shall be as follows. However, the following combinations shall not apply.

If it is difficult to carry out the inspection in person, the inspection will be carried out in consultation with the certification applicant.

Combination

1 Master unit: Operated with the system (test unit used for single unit testing) Slave unit: Operated with a DC simulated power supply (PCS only)

Combination

2 Master unit: Operated with a PCS removed from the system with a DC simulated power supply

Slave unit: Operated with a DC simulated power supply (PCS only)

[Total output of test specimens]

•The total output value for each test unit is adjusted to be a multiple of 4kW. •The number of test units to be adjusted to (4×m)kW must satisfy the following formula: m×4(kW) ÿ PCS designated output (kW) × number of test units N < (m+1)×4(kW) m: Number of connected rotating load units

- The total output of the number of test units with certified designated outputs is shown in Table 1. - Examples of designated outputs of 1.2kW and 5.5kW are attached as explanatory diagrams.

Table 1 Total output of test units

	PCS specified output (kW)																	
trial experience stand number N	0.7	0.75	1.0	1.2	1.5	2.0	2.7	3.0	3.2	3.3	3.5	4.0	4.5	4.8	5.0	5.5	5.8	10.0
2						4	4	4			8	8	8	8	8	8	8	20
3					4	4	8	8	8	8	8	12	12	12	12	16	16	28
4			4	4	4	8	8	12	12	12	12	16	16	16	20	20	20	40
5			4	4	4	8	12	12	16	16	16	20	20	24	24	24	28	48
6	4	4	4	4	8	12	16	16	16	16	20	24	24	28	28	32	32	60
7	4	4	4	8	8	12	16	20	20	20	24	28	28	32	32	36	40	68
8	4	4	8	8	12	16	20	24	24	24	28	32	36	36	40	44	44	80
9	4	4	8	8	12	16	24	24	28	28	28	36	40	40	44	48	52	88
10	4	4	8	12	12	20	24	28	32	32	32	40	44	48	48	52	56	100
11	4	8	8	12	16				32	36	36							
12	8	8	12	12														
13	8	8																
14	8	8																

[Test unit output adjustment]

- Connect the master and slave units and adjust the PCS output so that the total output is as shown in Table 1.

The PCS used to satisfy the total output in Table 1 is designed so that the output current distortion rate after adjusting the output is less than the total harmonic current Distortion rate must be 5% or less, and each harmonic current distortion rate must be 3% or less.

[Combination of units in the test]

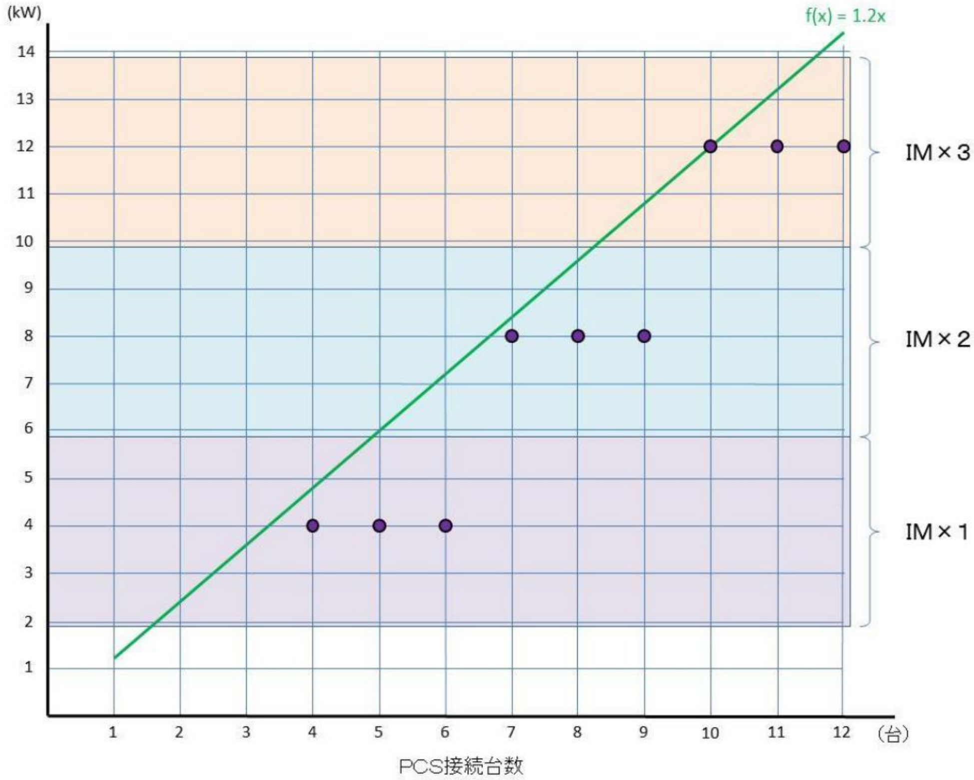
When the PCS that has been adjusted to achieve the total output in Table 1 cannot satisfy the output current distortion rate. The number of connected devices at that time will not be included in the number of tests.

•Appendix 1 to Appendix 17 show examples of combinations of the number of test units at specified outputs.

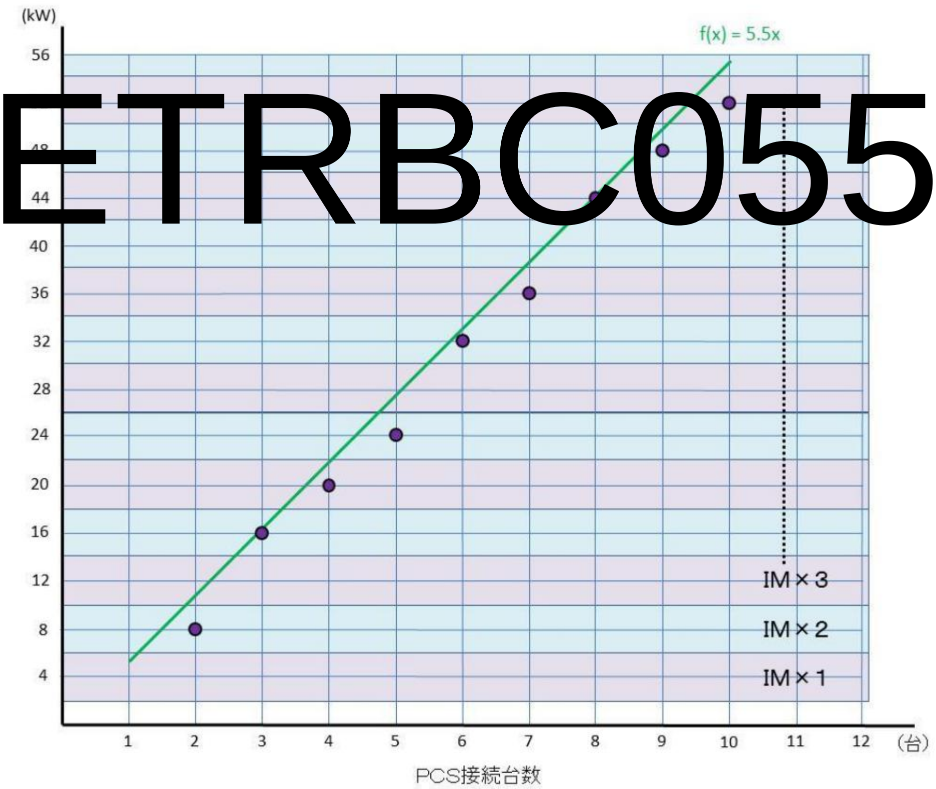
JETRBC0550

That's all

定格出力1．2kW



定格出力5．5kW



Appendix 1 When the specified output is 0.7kW

test Tests	PCS Number of	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
	6 units	4.2	1 unit (4kW)	0.7×5ÿ0.5×1
2	1 7 units 8 units 9 units	4.9	1 unit (4kW)	0.7×4ÿ0.4×3
3	10	5.6	1 unit (4kW)	0.7×2ÿ0.5×2ÿ0.4×4
4	units	6.3	1 unit (4kW)	0.7×1ÿ0.5×1ÿ0.4×7
5	11 units	7.0	1 unit (4kW)	0.7×1ÿ0.4×6ÿ0.3×3
6	12 units	7.7	1 unit (4kW)	0.7×1ÿ0.4×3ÿ0.3×7
7	13 units	8.4	2 units (8kW)	0.7×10ÿ0.5×2
8	14 units	9.1	2 units (8kW)	0.7×8ÿ0.5×4ÿ0.4×1
9		9.8	2 units (8kW)	0.7×8ÿ0.4×6

Appendix 2 When the specified output is 0.75kW

test Number of times	PCS Number of test	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
1	units 6	4.5	1 unit (4kW)	0.75×4ÿ0.5×2
2	units 7	5.25	1 unit (4kW)	0.75×3ÿ0.55×1ÿ0.4×3
3	units 8	6.0	1 unit (4kW)	0.75×2ÿ0.5×1ÿ0.4×5
4	units 9	6.75	1 unit (4kW)	0.75×1ÿ0.45×1ÿ0.4×7
5	units 10	7.5	1 unit (4kW)	0.75×1ÿ0.45×1ÿ0.4×4ÿ0.3×4
6	units 11 units	8.25	2 units (8kW)	0.75×10ÿ0.5×1
7	12 units	9.0	2 units (8kW)	0.75×9ÿ0.55×1ÿ0.35×2 0.75×9ÿ0.45×2ÿ0.35×1
8	13 units	9.75	2 units (8kW)	0.75×8ÿ0.4×5
9	14 units	10.5	2 units (8kW)	0.75×8ÿ0.4×2ÿ0.3×4

Appendix 3 When the specified output is 1.0kW

test Tests	PCS Number of	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
	4 units	4.0	1 unit (4kW)	1.0×4
2	1 5 units 6 units 7 units	5.0	1 unit (4kW)	1.0×3ÿ0.5×2
3	8 units	6.0	1 unit (4kW)	1.0×2ÿ0.5×4
4	9 units	7.0	1 unit (4kW)	1.0×2ÿ0.4×5
5	10	8.0	2 units (8kW)	1.0×8
6	units	9.0	2 units (8kW)	1.0×7ÿ0.5×2
7	11 units	10.0	2 units (8kW)	1.0×6ÿ0.5×4
8	12 units	11.0	2 units (8kW)	1.0×6ÿ0.4×5
9		12.0	3 units (12kW)	1.0×12

Appendix 4 When the specified output is 1.2kW

test Tests	PCS Number of	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
	4 units	4.8	1 unit (4kW)	1.2×2ÿ0.8×2
2	4 5 units 6 units 7 units	6.0	1 unit (4kW)	1.2×1ÿ0.8×2ÿ0.6×2
3	8 units	7.2	1 unit (4kW)	1.2×1ÿ0.6×3ÿ0.5×2
4	9 units	8.4	2 units (8kW)	1.2×6ÿ0.8×1
5	10	9.6	2 units (8kW)	1.2×5ÿ0.8×1ÿ0.6×2
6	units	10.8	2 units (8kW)	1.2×4ÿ0.8×1ÿ0.6×4
7	11 units	12.0	3 units (12kW)	1.2×10
8	12 units	13.2	3 units (12kW)	1.2×9ÿ0.6×2
9		14.4	3 units (12kW)	1.2×8ÿ0.6×4

Appendix 5 When the specified output is 1.5kW

test Tests	PCS Number of	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
	3 units	4.5	1 unit (4kW)	1.5×2ÿ1.0×1
2	4 4 units	6.0	1 unit (4kW)	1.5×1ÿ1.0×1ÿ0.75×2
3	5 units	7.5	1 unit (4kW)	1.5×1ÿ1.0×1ÿ0.5×3 1.5×1ÿ0.75×2ÿ0.5×2
4	6 units	9.0	2 units (8kW)	1.5×4ÿ1.0×2
5	7 units	10.5	2 units (8kW)	1.5×2ÿ1.0×5
6	8 units	12.0	3 units (12kW)	1.5×8
7	9 units	13.5	3 units (12kW)	1.5×6ÿ1.0×3
8	10 units	15.0	3 units (12kW)	1.5×4ÿ1.0×6
9	11 units	16.5	4 units (16kW)	1.5×10ÿ1.0×1

Appendix 6 When the specified output is 2.0kW

test Tests	PCS Number of	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
	2 units	4.0	1 unit (4kW)	2.0×2
2	4 3 units 4 units 5 units	6.0	1 unit (4kW)	2.0×1ÿ1.0×2
3	6 units	8.0	2 units (8kW)	2.0×4
4	7 units	10.0	2 units (8kW)	2.0×3ÿ1.0×2
5	8 units	12.0	3 units (12kW)	2.0×6
6	9 units	14.0	3 units (12kW)	2.0×5ÿ1.0×2
7	10 units	16.0	4 units (16kW)	2.0×8
8		18.0	4 units (16kW)	2.0×7ÿ1.0×2
9		20.0	5 units (20kW)	2.0×10

Appendix 7 When the specified output is 2.7kW

test Tests	PCS Number of	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
	2 units	5.4	1 unit (4kW) 2.7×1ÿ1.3×1	
2	3 units 4 units 5 units	8.1	2 units (8kW) 2.7×2ÿ2.6×1	
3	6 units	10.8	2 units (8kW) 2.7×2ÿ1.3×2	
4	7 units	13.5	3 units (12kW) 2.7×3ÿ2.6×1ÿ1.3×1	
5	8 units	16.2	4 units (16kW) 2.7×4ÿ2.6×2	
6	9 units	18.9	4 units (16kW) 2.7×4ÿ2.6×1ÿ1.3×2	
7	10 units	21.6	5 units (20kW) 2.7×5ÿ2.6×2ÿ1.3×1	
8		24.3	6 units (24kW) 2.7×8ÿ2.4×1	
9		27.0	6 units (24kW) 2.7×6ÿ2.6×2ÿ1.3×2	

Appendix 8 When the specified output is 3.0kW

test Tests	PCS Number of	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
	2 units	6.0	1 unit (4kW) 3.0×1ÿ1.0×1	
2	3 units 4 units 5 units	9.0	2 units (8kW) 3.0×2ÿ2.0×1	
3	6 units	12.0	3 units (12kW) 3.0×4	
4	7 units	15.0	3 units (12kW) 3.0×3ÿ1.5×2	
5	8 units	18.0	4 units (16kW) 3.0×5ÿ1.0×1	
6	9 units	21.0	5 units (20kW) 3.0×6ÿ2.0×1	
7	10 units	24.0	6 units (24kW) 3.0×8	
8		27.0	6 units (24kW) 3.0×7ÿ1.5×2	
9		30.0	7 units (28kW) 3.0×9ÿ1.0×1	

App[illegible]x 9 W[illegible] is 3.2kW

tes[illegible] Te[illegible]ts	PCS Number of	Specification x[illegible]	[illegible]ber of rotati[illegible] machin[illegible] ([illegible]est Ou[illegible]ut)	Test output [illegible]xamples [illegible]r e[illegible] PCS [illegible]st sp[illegible]imen
1	[illegible]ts	[illegible]6	2 units ([illegible]kW) 3.2[illegible]1.6×1	
2	4 units	12.8	3 units (12kW) 3.2×3ÿ2.4×1	
3	5 units	16.0	4 units (16kW) 3.2×5	
4	6 units	19.2	4 units (16kW) 3.2×4ÿ1.6×2	
5	7 units	22.4	5 units (20kW) 3.2×5ÿ2.0×2	
6	8 units	25.6	6 units (24kW) 3.2×7ÿ1.6×1	
7	9 units	28.8	7 units (28kW) 3.2×8ÿ2.4×1	
8	10 units	32.0	8 units (32kW) 3.2×10	
9	11 units	35.2	8 units (32kW) 3.2×9ÿ1.6×2	

Appendix 10 When the specified output is 3.3kW

test Number of times	PCS Number of Test Units	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
1	3 units	9.9	2 units (8kW)	3.3×2ÿ1.4×1 3.3×1ÿ2.6×1ÿ2.1×1
2	4 units	13.2	3 units (12kW)	3.3×3ÿ2.1×1
3	5 units	16.5	4 units (16kW)	3.3×4ÿ2.8×1
4	6 units	19.8	4 units (16kW)	3.3×4ÿ1.4×2 3.3×2ÿ2.6×2ÿ2.1×2
5	7 units	23.1	5 units (20kW)	3.3×5ÿ2.1×1ÿ1.4×1 3.3×4ÿ2.6×1ÿ2.1×2
6	8 units	26.4	6 units (24kW)	3.3×6ÿ2.1×2
7	9 units	29.7	7 units (28kW)	3.3×7ÿ2.8×1ÿ2.1×1
8	10 units	33.0	8 units (32kW)	3.3×8ÿ2.8×2
9	11 units	36.3	9 units (36kW)	3.3×10ÿ3.0×1

Appendix 11 When the specified output is 3.5kW

test Number of times	PCS Number of test	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
1	units 3	10.5	2 units (8kW)	3.5×1ÿ2.5×1ÿ2.0×1
2	units 4	14.0	3 units (12kW)	3.5×2ÿ2.5×2
3	units 5	17.5	4 units (16kW)	3.5×4ÿ2.0×1
4	units 6	21.0	5 units (20kW)	3.5×5ÿ2.5×1
5	units 7	24.5	6 units (24kW)	3.5×6ÿ3.0×1
6	units 8	28.0	7 units (28kW)	3.5×8
7	units 9	31.5	7 units (28kW)	3.5×5ÿ3.0×1ÿ2.5×3
[illegible]	units 10	[illegible]	[illegible] units ([illegible]2kW)	[illegible]×8ÿ[illegible]0×2
[illegible]	units 11 units	[illegible].5	[illegible] units ([illegible]6kW)	3.5×9ÿ2.5×[illegible]2.0×1

App[illegible]dix 12 [illegible] specifie[illegible] output i[illegible]4.5kW

test Number of times	PCS Number of test	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
1	units: 2	9.0	2 units (8kW)	4.5×1ÿ3.5×1
2	3 units	13.5	3 units (12kW)	4.5×1ÿ3.5×1ÿ4.0×1 4.5×2ÿ3.0×1
3	4 units	18.0	4 units (16kW)	4.5×1ÿ3.5×1ÿ4.0×2 4.5×3ÿ2.5×1
4	5 units	22.5	5 units (20kW)	4.5×1ÿ3.5×1ÿ4.0×3 4.5×4ÿ2.0×1
5	6 units	27.0	6 units (24kW)	4.5×1ÿ3.5×1ÿ4.0×4 4.5×4ÿ3.0×2
6	7 units	31.5	7 units (28kW)	4.5×1ÿ3.5×1ÿ4.0×5 4.5×4ÿ4.0×1ÿ3.0×2
7	8 units	36.0	9 units (36kW)	4.5×8
8	9 units	40.5	10 units (40kW)	4.5×8ÿ4.0×1
9	10 units	45.0	11 units (44kW)	4.5×8ÿ4.0×2 4.5×9ÿ3.5×1

Appendix 13 When the specified output is 4.8kW

test Number of times	PCS Number of test	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
1	units: 2	9.6	2 units (8kW)	4.8×1ÿ3.2×1
2	3 units	14.4	3 units (12kW)	4.8×2ÿ2.4×1 4.8×1ÿ3.2×1ÿ4.0×1
3	4 units	19.2	4 units (16kW)	4.8×2ÿ3.2×2 4.8×1ÿ3.2×1ÿ4.0×2
4	5 units	24.0	6 units (24kW)	4.8×5
5	6 units	28.8	7 units (28kW)	4.8×5ÿ4.0×1
6	7 units	33.6	8 units (32kW)	4.8×5ÿ4.0×2
7	8 units	38.4	9 units (36kW)	4.8×6ÿ4.0×1ÿ3.2×1
8	9 units	43.2	10 units (40kW)	4.8×7ÿ3.2×2
9	10 units	48.0	12 units (48kW)	4.8×10

Appendix 14 When the specified output is 5.0kW

test Number of times	PCS Number of test	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
1	units: 2	10.0	2 units (8kW)	5.0×1ÿ3.0×1
2	3 units	15.0	3 units (12kW)	5.0×2ÿ2.0×1 5.0×1ÿ3.0×1ÿ4.0×1
3	4 units	20.0	5 units (20kW)	5.0×4
4	5 units	25.0	6 units (24kW)	5.0×4ÿ4.0×1
5	6 units	30.0	7 units (28kW)	5.0×5ÿ3.0×1 5.0×4ÿ4.0×2
6	7 units	35.0	8 units (32kW)	5.0×6ÿ2.0×1 [illegible]×4ÿ4.0×[illegible]
[illegible]	[illegible]nits	4[illegible]0	10 [illegible] ([illegible]0kW[illegible]	5.0×8
[illegible]	[illegible] units	4[illegible]0	11 [illegible] ([illegible]4kW)	[illegible]×8ÿ[illegible].0×1
9	10 units	50.0	12 units (48kW)	5.0×9ÿ3.0×1 5.0×8ÿ4.0×2

Appendix 15 When the specified output is 5.5kW

test Number of times	PCS Number of test	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
1	units 2	11.0	2 units (8kW)	5.5×1ÿ2.5×1
2	units 3	16.5	4 units (16kW)	5.5×2ÿ5.0×1
3	units 4	22.0	5 units (20kW)	5.5×2ÿ5.0×1ÿ4.0×1
4	units 5	27.5	6 units (24kW)	5.5×2ÿ5.0×1ÿ4.0×2
5	units 6	33.0	8 units (32kW)	5.5×4ÿ5.0×2
6	units 7	38.5	9 units (36kW)	5.5×4ÿ5.0×2ÿ4.0×1
7	units 8	44.0	11 units (44kW)	5.5×8
8	units 9	49.5	12 units (48kW)	5.5×8ÿ4.0×1
9	units 10 units	55.0	13 units (52kW)	5.5×8ÿ4.0×2

Appendix 16 When the specified output is 5.8kW

test Number of times	PCS Number of test	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
1	units: 2	11.6	2 units (8kW)	5.8×1ÿ2.2×1
2	3 units	17.4	4 units (16kW)	5.8×1ÿ5.1×2 5.8×2ÿ4.4×1
3	4 units	23.2	5 units (20kW)	5.8×2ÿ4.4×1ÿ4.0×1
4	5 units	29.0	7 units (28kW)	5.8×4ÿ4.8×1
5	6 units	34.8	8 units (32kW)	5.8×4ÿ4.8×1ÿ4.0×1 5.8×4ÿ4.4×2
6	7 units	40.6	10 units (40kW)	5.8×4ÿ5.6×3 5.8×5ÿ5.5×2 5.8×6ÿ5.2×1
7	8 units	46.4	11 units (44kW)	5.8×6ÿ5.2×1ÿ4.0×1 5.8×6ÿ4.6×2
8	9 units	52.2	13 units (52kW)	5.8×8ÿ5.6×1
9	10 units	58.0	14 units (56kW)	5.8×8ÿ5.6×1ÿ4.0×1 5.8×8ÿ4.8×2

Appendix 17 When the specified output is 10.0kW

test Number of times	PCS Number of test	Specification x number of units	Number of rotating machines (Test Output)	Test output examples for each PCS test specimen
1	units 2	20.0	5 units (20kW)	10.0×2
2	units 3	30.0	7 units (28kW)	10.0×2ÿ8.0×1
3	units 4	40.0	10 units (40kW)	10.0×4
4	units 5	50.0	12 units (48kW)	10.0×4ÿ8.0×1
[illegible]	[illegible] 6	[illegible]	15 [illegible] (60kW)	[illegible]
[illegible]	units 7	7[illegible]0	18 units ([illegible]8kW)	10.0×6ÿ8.0×[illegible]
[illegible]	units 8	8[illegible]0	20 units (8[illegible]kW)	10.0×8
8	[illegible] 9 units	9[illegible]0	22 [illegible] (88kW)	10.[illegible]ÿ8.0×1
9	10 units	100.0	25 units (100kW)	10.0×10

(Reference Material) Structural Test Verification

Items, Appendix 8, **1,** Common Items

(1) Material
A. Material of the body B.
Temperature limit of insulation C.
Prohibition of flammable materials such as celluloid
D. Insulation material used in arc section
E Rust prevention
F. Conductive materials
G. Outer casing of outdoor objects
H. Material of terminal screws for power cables
Material of earth terminal screw. Use of PCB
(polychlorinated biphenyls) is prohibited. Material of parts that
come into contact with drinking water, food, etc.
(2) Structure
Assembly and normal use
~~B. Remote control mechanism (remote control)~~
C. Fall test
D. Construction materials (capable of being firmly attached)
E Arc generating parts (must be provided with arc resistant insulation) F Exposed
live parts (parts where the voltage to ground and line voltage is AC30V or less or DC45V or less, Exposed live parts: 1mA or less. Excluding heating elements that generate heat: 150V or less.)
G Insulation distance
Thickness of insulation
Loosening of connections (mechanical connections and aluminum creep, etc.)
Internal wiring of the device
K: Through holes for power cables, etc.
L: Pulling of power cables (including cables connecting devices) K: Protection
against short circuits and overcurrents in cables connecting devices
Shell pipe (there is no risk of the conductive part coming into contact with the metal part)
Water-resistant and waterproof construction to prevent water from splashing on the live part
Moisture-proofing treatment (impregnation, application of insulating moisture-proofing impregnation agent, etc.)
Restriction test of electric motors and electromagnetic vibrators Other (temperature control device short circuit due to continuous current, etc.)
Earth Obligation
Earth mechanism
Interference with motor rotation
Protection of moving parts (display)
La Installation and removal of parts of the device (sure of installation and
removal) M Protection of interior
lights, etc. U Switch indication
I Charging parts in contact with liquid in the container
Wire attachment part
E. Heating element
Fuse mounting area
Y Residual charge in capacitor (45V or less)
M Fuse marking K Enclosure
strength F Controller drop
test

J Semiconductor control (simulating abnormalities such as
short circuits) D External connection mechanism (display of output or
impedance) T High voltage display (peak voltage exceeding 600V)
A. Wire winding mechanism (cord reel)
Bending the power cable
Prohibition of exposure of live parts due to hardening, etc.
Flame retardancy of synthetic resin outer casing (combustion
test) Short circuit and open circuit of
electronic components Mi Devices using batteries
Dual rating
Steam (immersion test using ammonium chloride solution)
Flame retardancy of heat insulating materials (combustion test)
Connectors used in electric heating appliances
Rapid cooling of glass
window Pressure relief
valve Lead wire directly connected to power source
Parallel connection of rectifiers for electric heating appliances
(3) Parts
Parts or accessories
B. Power supply wires, etc.
Earth wire
Ni Hughes
E Automatic temperature
regulator F Automatic
switch G Motor operation switch
Flasher
Switch
J Connector
Transformers and voltage regulators
Discharge lamp ballast
Wa Electric motor
Ka Capacitor Yo Overload
protection device (excluding fuses) Ta Fuses for
motor overload protection Re Laminates and
flexible boards for printed circuits shall be flame retardant.
~~(4) Tolerances for power consumption, etc.~~
~~(5) Noise intensity: "Due to missing numbers"~~
~~(6) Operational performance due to voltage fluctuations~~
~~(7) Double insulation~~
~~structure (8) Starting characteristics (for those with~~
~~electric motors) (9) Leakage c~~urrent test
~~(10) Cathode ray tubes and their accessories~~
~~(11) Solar cell module~~
~~(12) Display~~

[Attachment] Regarding test methods that are not currently being implemented

For items that will no longer be tested due to the mandatory implementation of FRT and other measures at the time of the revision of the test methods in 2021, the test methods as of the September 2020 version of JETGR0002-1-12.0 (2020) are listed below for reference.

5.3.1 Sudden change in system voltage phase (phase difference 10°)

Applies to [Conventional type] and [Multiple-unit interconnection compatible type]. Does not apply to [Multiple-unit interconnection FRT compatible type] and [FRT compatible type].

[Test conditions]

The standard test conditions for the inverse conversion mode shown in Section 3.2 shall apply.

However, Section F shall be changed to the following. F. The settings of the protective relays of the protective devices shall be the factory default values (as stated in the certification application form), and the islanding prevention function (passive This masks the AC output voltage (static and active methods).

[Measurement method] a. Operate with the power conditioner output voltage phase as the reference (0°).

b. Suddenly change the phase of the grid voltage from 0° to +10°, maintain it for 10 seconds, then suddenly change it back to 0° and measure the AC output current. c. Operate with the power conditioner output voltage phase as the reference (0°). d. Suddenly change the phase of the grid voltage from 0° to -10°, maintain it for 10 seconds, then suddenly change it back to 0° and measure the AC output current.

[Evaluation criteria] a. The power conditioner must smoothly follow the sudden change in the grid voltage phase and measure the AC output current equivalent to the grid voltage phase after the s To output a stable output power.

B. The maximum value of the AC output current of the power conditioner after the sudden change is 150% or less of the rated current, and the time during which it exceeds 105% is 0.5 seconds or less. **6.2**

Instantaneous voltage drop test

Applies to [Conventional type] and [Multiple-unit grid-connected type]. Does not apply to [Multiple-unit grid-connected FRT-compatible type] and [FRT-compatible type].

[Test conditions]

Apply the standard test conditions for the inverse conversion mode shown in Section 3.2.

[Measurement method] a. Operate the power conditioner at rated output. b.

Generate a 0.3 second momentary power outage (residual voltage is 0% of the rated voltage) on the AC power supply side. If a DC power supply is used, also measure the DC input current.

C. The phase angle for momentary power outage is set to 0°, 45°, and 90°, and tests are conducted for each phase angle. The reference phase is the R phase (U phase) or the RS phase (UV phase).

D. Operate the power conditioner at rated output. E. Generate a momentary voltage drop of 0.3 seconds on the AC power supply side (residual voltage is 70% of the rated voltage). If a DC power supply is used, also measure the DC input current.

F. The phase angle for instantaneous voltage drop is set to 0°, 45°, and 90°, and tests are conducted for each phase angle. In this case, the R phase (U phase) or RS phase (UV phase) is used as the reference phase.

[Evaluation Criteria] a. Stable operation must be continued even during momentary power outages and voltage drops. b. In the event of gate blocking, operation must be resumed approximately 10 seconds after power is restored. c. In the event of gate blocking and switch operation, operation must be resumed approximately 10 seconds after power is restored. d. When system voltage is restored, the AC output current must be 150% or less of the rated current, and the time it exceeds 105% must be 0.5 seconds or less. To be.

E. When using a DC power source instead of a storage battery, etc., or when using a storage battery mounted on an electric vehicle, etc., the DC input The peak current of the current is below the maximum DC current specification value.