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**Testing methods of power conditioner
for grid interconnected small fuel cell
power systems**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by the Japan Electrical Manufacturers' Association (JEMA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS C 8826**: 2008 is replaced with this Standard.

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Testing methods of power conditioner for grid interconnected small fuel cell power systems

Introduction

This Japanese Industrial Standard was established in 2008, and revised this time in order to add solid oxide fuel cells to the scope of this Standard.

No International Standard corresponding to this Standard has been established at this point.

1 Scope

This Standard specifies the testing methods of the stationary power conditioner for grid-connected small polymer electrolyte fuel cell power systems and small solid oxide fuel cell power systems relevant to the following **a)** to **g)** (hereafter referred to as the “fuel cell power systems”).

- a) **Type of fuel cell** Polymer electrolyte fuel cell and solid oxide fuel cell
- b) **Output** Rated transmission output of less than 10 kW
- c) **AC output voltage** 220 V or under
- d) **Operating state** Grid-connected operation or grid-independent operation
- e) **Raw fuel** Gaseous fuel (city gas, liquefied petroleum gas, etc.), liquid fuel (kerosene, etc.) or hydrogen
- f) **Operating pressure** Less than 0.1 MPa in maximum working pressure for the portion through which gaseous fuel passes, and less than 1.0 MPa for the portion through which liquid fuel passes
- g) **System configuration** Stationary power generation dedicated system or cogeneration system housed in a package

NOTE : The power conditioner with which an electric storage device is combined shall be tested by detaching the electric storage device.

2 Normative references

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

JIS C 1102 (series) *Direct acting indicating analogue electrical measuring instruments and their accessories*

JIS C 8800 *Glossary of terms for fuel cell power system*

JIS C 8823 *Testing methods for small polymer electrolyte fuel cell power systems*

- JIS C 8824 *Testing methods for environment of small polymer electrolyte fuel cell power systems*
- JIS C 8825 *Testing and measurement techniques of small polymer electrolyte fuel cell power systems*
- JIS C 8827 *Testing procedure of islanding prevention measures for utility-inter-connected small polymer electrolyte fuel cell power system power conditioners*
- JIS C 8841-1 *Small solid oxide fuel cell power systems — Part 1 : General rules*
- JIS C 8841-2 *Small solid oxide fuel cell power systems — Part 2 : General safety codes and safety testing methods*
- JIS C 8841-3 *Small solid oxide fuel cell power systems — Part 3 : Performance testing methods and environment testing methods*
- JIS C 60068-1 *Environmental testing Part 1 : General and guidance*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in **JIS C 8800** and the following apply.

3.1 fuel cell power system

system that converts chemical energy into electrical energy (DC or AC) and thermal energy electrochemically

Usually, it consists of a power generation unit and a hot-water storage unit.

3.2 power generation unit

unit that consists of a cell stack or a module, a power conditioner, a fuel reformer, an air supply device, water treatment equipment, exhaust heat recovery device, a controller, etc.

3.3 hot-water storage unit

unit that stores heat collected from a power generation unit as hot water, and supplies it to outside as necessary

It consists of a hot-water storage tank, a back-up heater, etc. The back-up heater has a heating function by gaseous fuel, liquid fuel, electricity, etc.

3.4 module

group of cell stacks consisting of one or more cell stacks, joints of fuel, air, exhaust gas and electric power, storage containers, etc. in order to obtain the required output

It may include an offgas combustor, a reformer, etc.

3.5 cell stack

stack of single cells

It includes accessories to be the basic constituent of the module.

3.6 power conditioner

apparatus equipped with a part or all of a control and monitor device, a DC converter, a grid-connected converter and an attached device having the function which converts the output from DC power generator into the required electric power and supplies it

3.7 package

container in which main devices constituting a power generation unit such as a cell stack or a module, a fuel reformer, a power conditioner, a controller and auxiliary equipment are housed

The container in which a power conditioner and others are housed may be separated from the package of the power generation unit.

3.8 storage state

state in which although energy is supplied from outside in order to protect the devices in the power generation unit and/or to apply the current to the controller, the power generation unit has been stopped

3.9 fuel cell simulation power supply unit

DC power supply unit capable of simulating the output characteristics (V–I characteristics) of a cell stack

3.10 isolated operation detection function

function detecting the isolated operation even at the isolated operation state in which it cannot be detected by the usual overvoltage relay, undervoltage relay, overfrequency relay or underfrequency relay

There are a passive type method and an active type method according to the detection principle.

3.11 grid-connected system

state in which the power generator is connected to the commercial power system

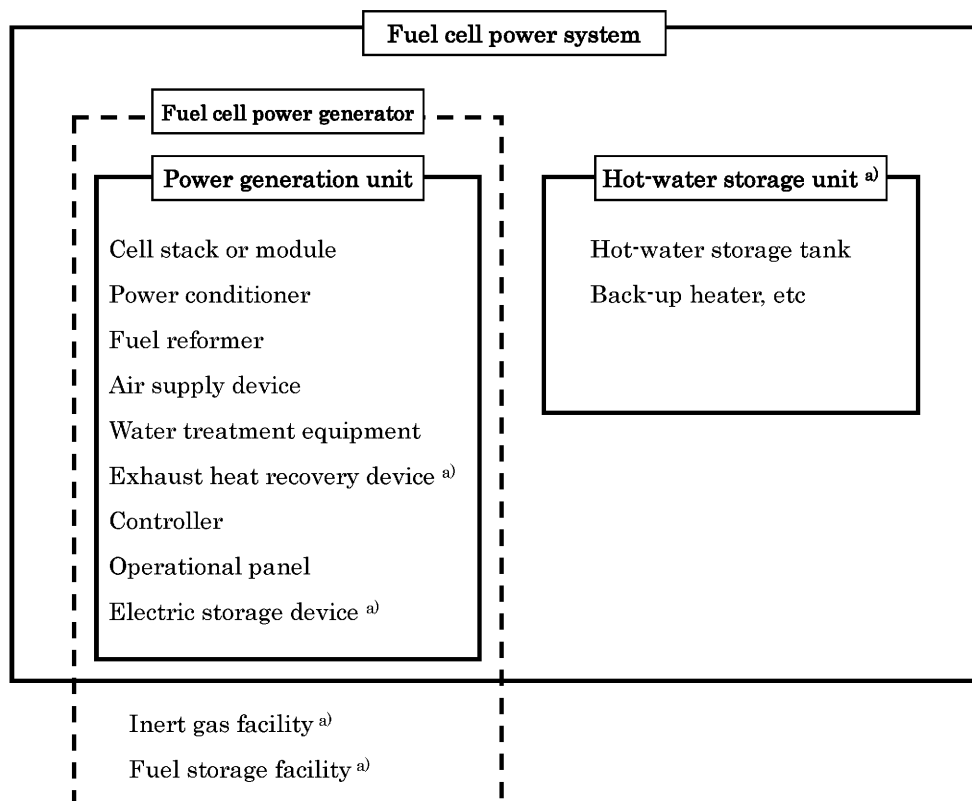
NOTE : Connecting the power generator to the commercial power system is called “parallel”, separating from a commercial power system is called “parallel off” and the part where the power generation can be paralleled off from the commercial power system using a shutdown device or a circuit breaker is called “parallel-off part”.

3.12 reversed charge

state in which an electric power system is separated from the power supply of the system due to an accident etc., and one or more power generators grid-connected to that system continue the operation without the reverse power flow but with the voltage application from the power generator

4 Configuration and scope

The basic configuration of the fuel cell power system in the scope of this Standard shall be as shown in figure 1.



Installation location of device, etc. is not limited to that in one package.

Fuel reformer is not used when raw fuel is hydrogen.

In the case of the power generation dedicated system, the hot-water storage unit and the exhaust heat recovery device are not installed.

Note a) Device or unit installed as necessary.

Figure 1 Basic configuration of fuel cell power system

5 Types of tests

In this Standard, test items applied to the power conditioner for the grid-connected fuel cell power system are shown in table 1. When testing the power conditioner on the test items other than these, they shall be upon the agreement between the parties concerned with delivery.

Table 1 Test items of power conditioner for grid-connected fuel cell power system

No.	Test item	
1	Insulation resistance test	
2	Withstand voltage test (dielectric strength test)	
3	Lightning-impulse withstand voltage test	
4	Leakage current test	
5	Protective function test	a) Input undervoltage protective function test
		b) Input overcurrent protective function test
		c) Output overcurrent protective function test
		d) Output overvoltage and undervoltage protective function test
		e) Input-side ground-fault protective function test (DC ground-fault test)
		f) Output-side ground-fault protective function test
		g) Excessive temperature rise protective function test
		h) Frequency rise and fall protective function test
		i) DC leak protective function test
		j) Unbalanced overvoltage protective function test
		k) System voltage rise suppressive function test
		l) Reverse charge preventive function test
		m) Reverse power preventive function test
		n) Isolated operation detection function test
		o) Fixed time power-on preventive function test after power recovery
6	Steady-state characteristics test	a) Efficiency test
		b) Overload capability test
		c) Startup test
		d) Temperature rise test
		e) DC input current ripple test ^{a)}
		f) Stand-by loss test (storage state loss test)
		g) Stop test
		h) AC output power factor test
		i) Voltage and frequency follow-up range test
		j) AC output current distortion test
		k) System voltage distortion test
		l) System unbalance test
		m) Grid-independent operation function test
		n) Soft start test
7	Transient response characteristics test	a) System voltage sudden change test
		b) System phase sudden change test
		c) Load shutdown test (power interruption test)
		d) System voltage unbalance sudden change test
8	External accident test	a) Input-side short-circuit test
		b) Output-side short-circuit test
		c) System voltage momentary power interruption test and momentary voltage drop test
9	Environmental compatibility test	a) Noise test
		b) High frequency noise test [conducted disturbance (emission)]
10	Ambient environment resistance test	a) Temperature-humidity cycling test
		b) Immunity test
Note ^{a)} Not performed on the power conditioner without an electric storage device.		