Eco Mark Product Category No. 135

Certification Criteria for "Products Using Photovoltaic Cells Version 1.7"

Applicable Scope
A. Residential photovoltaic power generation system
B. Small-scale power generator/ charger
C. Installed products (for residential use, industrial use, or public use)
D: Mobile and vehicle-mounted products
E: Photovoltaic modules
F: Power conditioners for small-output photovoltaic power generation

Established March 15, 2006
Last revised October 1, 2012
Expiration date March 31, 2024

Japan Environment Association
Eco Mark Office

Eco Mark Product Category No. 135

Product Certification Criteria for "Products Using Photovoltaic Cells Version 1.7" Category F: Power conditioners for small-output photovoltaic power generation

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1. Purpose of Establishing Criteria

In order to effectively implement the United Nations Framework Convention on Climate Change (UNFCCC), which came into force in March 1994, its first protocol, the Kyoto Protocol, was adopted at the third session of the Conference of Parties (COP3) to the UNFCCC. This protocol imposed limits on the emissions of greenhouse gases, including carbon dioxide (CO_2), by developed nations. The Kyoto Protocol required Japan to reduce the emissions of greenhouse gases by 6% relative to the emission levels in 1990. Since the Kyoto Protocol entered into force on February 16, 2005, Japan is required to achieve this reduction target according to the UNFCCC. These greenhouse gases consist mostly of CO_2, which originates from energy production and usage, and most of them are emitted through the burning of fossil fuels. The main measures to combat global warming in Japan are therefore related to policies for reductions in energy consumption and policies that promote alternatives to fossil fuels through the development and proliferation of technologies that substitute for fossil fuels. The main alternatives to the use of fossil fuel energy are nuclear power generation and renewable sources of energy. Japan is emphasizing the development and proliferation of photovoltaic power generation as a form of renewable energy.

The first oil crisis in 1973 triggered the development of photovoltaic cells in Japan. The government's Sunshine Project started in 1974, which was a major project for the development of photovoltaic cells. The Sunshine Project was succeeded by the New Sunshine project in 1993, resulting in the rapid proliferation of photovoltaic power generation in the 1990s due to the cost-effectiveness of technological developments and political support, such as a system of subsidies for the installation of photovoltaic power generation facilities. This political support enabled the cumulative capacity of photovoltaic power generation facilities to rise to more than 1,100 MW by 2004. As a result, Japan has the most widespread photovoltaic power generation facilities in the world. The production base that supports the introduction of photovoltaic power has also become well established. As a result, Japan accounts for about 50% of the world's total production, making Japan the largest producer of photovoltaic cells in the world. This cumulative level of production, however, is far below the 4,820 MW goal for fiscal 2010 set by the government. This requires further cost reductions through technological innovation and additional support for technological proliferation.

Compared to general commercial electric power production and primary batteries, the photovoltaic cell has the potential to reduce the environmental burden in relation to the following aspects.

(1) Reduction of the amount of fuel and fossil reserves and rare metals used for commercial electric power generation and primary batteries (silicon, the material used for silicon-based photovoltaic cells, is a ubiquitous resource that is virtually unlimited)

(2) Reduction of the generation of waste (photovoltaic cells have a long life and may

be reused or recycled.)
(3) No gases contributing to global warming are emitted when the cells are in use.
(4) Improvement of maintenance and user-friendliness, including replacement of the primary batteries, refilling fuel, and transportation.
(5) Reduction in the facilities and construction work required in relation to power supply

It has been considered that the Eco Mark should be given in recognition of the potential of photovoltaic cells to reduce the environmental burden and this standard has been established as a result.

On the other hand, it has also been recognized that the production of photovoltaic cells also consumes resources and in their manufacture emit gases that contribute to global warming, use hazardous materials, and any used photovoltaic cells also become waste, thus imposing a burden on the environment just as much as products that do not use solar energy. Of the environmental burdens associated with photovoltaic cell production, manufacturers are required to further reduce the amount of chemical substances used in manufacturing. Concerning the recovery, recycling, or reuse of photovoltaic cells, up to now no recovery system for products using photovoltaic cells has been established. Residential photovoltaic power generation systems, which account for most of the market, are considered to be part of the construction. Thus, quantities of used photovoltaic cells are expected to be generated in the future as buildings are demolished and replaced. Accordingly, it is highly possible that photovoltaic power generation systems could be recovered as a part of construction waste. Thus, photovoltaic cells that come onto the market in future should be required to be designed in consideration of the 3Rs (Reduce, Reuse, and Recycle) for the product. Products using photovoltaic cells can be either incinerated or buried. In order to prevent hazardous materials from entering the environment when photovoltaic cells are disposed of, there should also be investigation of how to reduce the usage of hazardous materials in the production of the cells in the first place.

2. Applicable Scope

This category covers silicon photovoltaic modules and products that use silicon photovoltaic cells as main power sources. In addition, systems using photovoltaic cells as main power sources, together with wind power generation or hydroelectric power generation systems, are also covered. This category does not cover the other photovoltaic cells such as compound semiconductor cells (refer to "3. Terminology") and products using them as sources of power.

Products covered by this category shall be residential photovoltaic power generation systems, traffic signs, streetlights, and other products smaller than these. Large-scale photovoltaic power generation systems or facilities for buildings or public places are excluded.

Scope of applicable products in this category is shown in Table 1.

Table 1 Scope of applicable products

Category F: Power conditioners for small-output photovoltaic power generation	
	Example of applicable product * The number is based on Japan Standard Commodity Classification
Power conditioners for small-output photovoltaic power generation	Power conditioners for small-output photovoltaic power generation that comply with JIS C8980 1997

3. Terminology

Compound semiconductor cell	A photovoltaic cell using compound semiconductors consisting of multiple types of elements. This battery is categorized by its constituent elements: III-V compound, II-IV compound, and I-III-VI2 compound cells. The major types are GaAs, InP, CdS/CdTe, and $CuInSe_2$ photovoltaic cells (cited from JIS C 8960 2004.)
Nominal maximum output	The nominal value of the maximum output in a basic state. The basic state is defined as a state with a module temperature of 25 degrees Celsius, a spectral distribution of AM1.5 global photovoltaic radiation standard sunshine (refer to JIS C 8911 1998,) and an irradiance of 1000 W/m^2.
Renewable energy	Energy sources in which the resource is constantly being regenerated and thus does not become depleted, including wind power and photovoltaic radiation.
Residential photovoltaic power generation system	A photovoltaic power generation system for installing in residences. These systems consist of components such as photovoltaic modules, power conditioners, connecting boxes, distribution boards, voltmeters, and batteries with support frames for installing the various components and wiring. This product category targets photovoltaic power generation systems with an output of less than 20 kW (Article 48, Section 4 of the enforcement regulations of the Electric Utility Law (Ministerial ordinance No. 77 of the Ministry of Economy, Trade and Industry of October 18, 1996.))
Prescription constituent	Components intentionally added with the purpose of providing specific characteristics to the product. Impurities that inevitably enter during the manufacturing process are excluded.
Silicon photovoltaic cell	A photovoltaic cell using silicon as the semiconductor material. Major types of this cells are single-crystal, multi-crystal, amorphous cells, etc.
Photovoltaic power generation system	A general term for systems and accessories that convert solar energy to electricity using photovoltaic effects and that supply power suitable for loading (cited from JIS C 8960 2004.)
Lead-acid battery for photovoltaic power generation	A generic term for lead-acid batteries used in photovoltaic power generation systems. In a narrow sense, this means lead-acid batteries designed to satisfy the required quality for photovoltaic power generation systems (cited from JIS C 8960 2004.)
Photovoltaic array	An assembly in which the photovoltaic modules or panels are mechanically connected using a photovoltaic frame and/or base or other components, and that are electrically connected (cited from JIS C 8960 2004.)
Photovoltaic sub-module	Smallest unit of multiple photovoltaic cells formed on an undividable substrate (cited from JIS C 8960 2004.)
Photovoltaic cell	Smallest constituent unit of a photovoltaic sell for photovoltaic power generation (cited from JIS C 8960 2004)
Photovoltaic module	Smallest power generation unit with a standard output, constituting a photovoltaic cell or photovoltaic sub-modules enclosed in a container to provide them with resistance to environmental conditions (cited from JIS C 8960 2004)
Rated load efficiency	One of the load efficiencies of the power conditioner. The rate between AC output power (effective electric power) and DC input power under the rated load. This efficiency is usually

	shown as a percentage (%) (cited from JIS C 8960 2004.)
Power conditioner	A system for converting the output of photovoltaic arrays to the prescribed power, consisting of or part of the main line controlling/monitoring systems, DC conditioners, inverters, DC/DC interfaces, AC/AC interfaces, and AC line interfaces (cited from JIS C8960 2004.)
Partial load efficiency	One of the load efficiencies of the power conditioner. The rate between AC output power (effective electric power) and DC input power under the designated load. This efficiency is usually shown as a percentage (%) (cited from JIS C 8960 2004.)

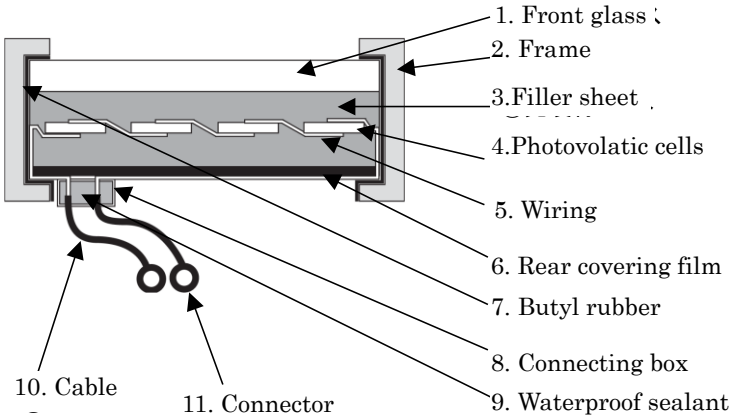

Figure 1 Photovoltaic module illustration

4. Certification Criteria

4-1. Environmental criteria

The applied product shall meet "4-1-1 Environmental Common Criteria and Certification Procedure" and individual criteria "4-1-2 Category F: Power conditioners for small-output photovoltaic power generation".

4-1-1. Environmental Common Criteria and Certification Procedure

(1) In manufacturing the applied product, related environmental laws and regulations and pollution control agreement (hereinafter referred to as the "Environmental Laws, etc.") must be followed with respect to air pollution, water contamination, noise, offensive odor, and emission of hazardous materials in the area where the plant performing the final manufacturing process is located.

In addition, the state of compliance with the Environmental Laws, etc. for the last five years from the date of application (whether there is any violation) must be reported. If there is any violation, it is necessary that proper remedies and preventive measures have been already taken, and the related Environmental Laws, etc. must thereafter be followed appropriately.

[Certification Procedure]
[Issuer of the certificate: the manufacturing plant of the final product]
With respect to the compliance with the Environmental Laws, etc. in the area where the plant performing the final manufacturing process is located, a certificate issued by the representative of the business of manufacturing the applied product or the manager of the relevant plant (entry or attachment of the list of names of the

Environmental Laws, etc.) must be submitted. (Example 6)
In addition, it is necessary to report whether there is any violation during the last five years, including a violation subject to administrative punishment or administrative guidance, and if there is, the following documents in a and b must be submitted:

a. With respect to the fact of violation, guidance documents from administrative agencies (including order of correction and warning) and copies of written answers (including those reporting causes and results of correction) to such documents (making a series of progress clear);
b. Following materials (copies of recording documents, and so on) concerning the management system for compliance with the Environmental Laws, etc. in 1)-5):
   1) List of the Environmental Laws, etc. related to the area where the plant is located;
   2) Implementation system (organizational chart with entry of roles, etc.);
   3) Document stipulating retention of recording documents;
   4) Recurrence prevention measures (future preventive measures);
   5) State of implementation based on recurrence prevention measures (result of checking of the state of compliance, including the result of onsite inspection).

(2) The packaging of the products shall be considered resource saving, easy-to-reuse and recyclable.

[Certification Procedure] [Issuer of the certificate: Applicant]
Compliance with this item shall be indicated in the Attached Certificate. A document shall be submitted describing the product packaging conditions and packaging materials in detail and what was taken into consideration to achieve resource saving, reuse, and recycling (supplemented by figures and photographs.)

(3) Compounds that deplete the ozone layer (Attachment 2), including CFC substitutes, shall not be used in manufacturing the packaging materials

[Certification Procedure]
Compliance with this item shall be indicated in the Attached Certificate.

(4) The plastic materials used for packaging shall not contain polymers containing halogens or organic halogen compounds as recipe constituents.

[Certification Procedure]
Compliance with this item shall be indicated in the Attached Certificate.

(5) Maintenance and repair service systems shall be established, and repairs shall be carried out at the request of the users. As part of the maintenance and repair service system, user-requested information shall be provided regarding the applied items for each product in the items (a)-(c) in Table 2 (coverage and service contents for maintenance or repair, time and costs required for maintenance or repair).

[Certification Procedure] [Issuer of the certificate: Applicant]
Compliance with this item shall be indicated in the Attached Certificate. The contact address for the users, the maintenance and repair service system, and the guarantee system shall be described to explain the developed service system for maintenance/repair(Entry Table 135-2). Figures and tables may be used for this description

(6) The contents of the documents supplied with the product or catalogues of the product shall correspond to the product category items shown in (d)-(m) in Table 3, providing users with information such as usage conditions/performance, information for

consumables or warranty, contact for information of the product, availability of maintenance and repair services, a contact address for obtaining these information, and notes on disposal of the product. The documents supplied with the product referred to here shall include all the documents supplied with the product, such as instruction manuals, as well as descriptions on the packaging and packing materials.

[Certification Procedure]
Compliance with this item shall be indicated in the Attached Certificate. A copy of the corresponding part of the documents attached to the product or catalogues of the product shall also be submitted.

(7) Plastic parts of the product shall not contain PBB (polybromobiphenyl,) PBDE (polybromodiphenyl ether,) or short-chain chlorinated paraffins (containing a chain carbon of 10-13, and a chlorine content of 50% or more) as the prescription constituents.

[Certification Procedure]
Compliance with this item shall be indicated in the Attached Certificate.

(8) None of the constituents of the product shall contain lead, cadmium, hexavalent chromium, or mercury as prescription constituents. Lead-based solder shall not be used. This standard, however, shall not apply to secondary batteries, to which the individual standards for each product category shall apply.

[Certification Procedure]
Compliance with this item shall be indicated in the Attached Certificate.

Table 8 Information supplied, classified by product category

Item	Category A: Residential photovoltaic power generation systems	Category B: Small-scale power generators and chargers	Category C: Installed products	Category D: Mobile and vehicle mounted products	Category E: Photovoltaic modules	Category F: Power conditioners
Information provided to the users that is written in the documents supplied with the product. Related to Certification Criteria (6)						
(a) Coverage and service contents for maintenance	XX	X	XX	X	X	X
(b) Coverage and service contents for repair	XX	XX	XX	XX	XX	XX
(c) Time and costs required for maintenance/repair	XX	XX	XX	XX	XX	XX
Information available on request from users that is written in attachment or catalogues of the product .Related to Certification Criteria (7)						
(d) Expected annual power generation, its basis and calculating condition and possibility that the actual power generation might vary in case of the different standard condition.	XX*1					
(e) Installation and usage conditions	XX	XX	XX	XX	XX*2	XX
(f) Description of the performance and structure	XX*3	XX*4	XX*4		XX*5	XX
(g) Information on the types of secondary batteries, recovery requests, replacement guidelines and requests for cooperation in recycling (only for products using secondary batteries)	XX	XX*6	XX	XX*6		
(h) Information for consumables (only for products with consumables, for example, type/replacement of primary battery or bulb)	XX	XX	XX	XX	XX	XX
(i) Warranty period	XX*7	XX	XX	XX	XX	XX
(j) Contact addresses and methods for obtaining the information	XX	XX	XX	XX	XX	XX
(k) Explanation concerning non-liability in designing a total system for photovoltaic power generation, the combination of equipment, and the installation					X*8	X*8
(l) Precautions for disposing of the product	XX*9	XX*10	XX*10	XX*10	XX*9	XX*9
(m)Maintenance/repair service system, information of (a)-(c), contact address or methods for obtaining these information	XX*11	XX*11	XX*11	XX*11	XX*11	XX*11

XX: Required X: Desirable for providing information or not required Blank: not necessarily required

*1: The following information regarding photovoltaic power generation systems shall be provided; “Expected annual power generation”, “basis and calculating standard [used data of amount of solar radiation, loss of photovoltaic cells and power conditioners, and the other loss (dirt on acceptance surface, loss of wiring/circuit, etc.)]”. In addition, the following statement shall be notified; “Power generation might be different value in case that the conditions of weather, location and installation are different from the standard condition”.

*2: Residential photovoltaic power generation systems shall satisfy 4-1-2 Category E(11). For other types of products, depending on each application, the installation and usage conditions shall be included for those who design or produce photovoltaic power generation systems. The information should include installation conditions, conditions for installing the final products, and safety installation and dismounting (including precautions against electric shocks and burns.)

*3: As for the display of the performance and structure of the photovoltaic battery arrays used for residential photovoltaic power generation systems, the system performance shall be described according to Table 1 in “JIS C 8952 1996 (how to describe photovoltaic battery arrays)”

*4: Products corresponding to stand-alone type photovoltaic power generation systems shall include descriptions of their performance according to Table 4 of “JIS C 8905 1993 (rules for stand-alone type photovoltaic power generation systems) Mobile power generators or chargers under Category B, however, shall be excluded.

*5: Descriptions according to either “JIS C 8918 1998 (crystalline photovoltaic modules)” or “JIS C 8939 1995 (amorphous photovoltaic modules)” shall be provided.

*6: Description example for cases where the secondary batteries can be removed and recovered: “This product uses a lithium battery as a secondary battery. Refer to page xx in the instruction manual for replacement. Bring the used battery to a local recycling station for recycling scarce materials.”

*7: Detailed information regarding required procedures for warranty shall be provided for users; for instance, application method, presence or absence of contract application for maintenance/repair service, options, etc.

*8: Eco Mark applicants cannot be responsible for designing the combination of equipment and installation using products that will be certified as photovoltaic modules or power conditioners alone. This explanation may be clearly written in the instruction manual to notify the users, if required.

*9: Description example: “Please inquire of the shop about dismantlement and the removal so that there are fears of electric shocks and accidents.” (Category A), “Please take care not to be electric shocked at the time of dismantlement of the products.”(Category E)

*10: Description example: “Take out any alkaline button batteries before disposing of the product. Take the battery to a button battery recycling box or station.” “This product can be disposed of after each component has been being separated and sorted according to the material used.” “Properly dispose of the waste oil generated when disposing of this product as industrial waste.” “When disposing of this product, follow the disposal methods designated by the local government.”

*11: Description example: “Maintenance and repair services are available. Please contact xx department at the following phone number xxx-xxxx for maintenance and repair coverage, time and costs. Please also contact our web site www.xxxx.shuri.co.jp.”

4-1-2. Category F: Power conditioners for small-output photovoltaic power generation

(9) The power conditioner shall be designed and manufactured so that 90% or more of its efficiency will be maintained for a service period of five years or longer for the rated load efficiency and partial load efficiency with half of the load. (Requirement for the Design for Long-use)

The calculation of the rated load efficiency and the partial load efficiency before shipment shall follow the description in JIS C 8961 1993 (how to measure the efficiency of power conditioners for photovoltaic power generation systems.)

[Certification Procedure] [Issuer of the certificate: Quality management or the manufacturing plant for the final product]
Compliance with this item shall be indicated in the Attached Certificate.
Operating conditions that were assumed in designing the power conditioner, the installation conditions, combination with photovoltaic modules, etc. shall be described, stating that the system was adequately designed and manufactured to maintain 90% or more of its ratio before shipment for a service period of five years or longer (Entry Table 135-4.)

4-2. Quality Criteria and Certification Procedure

(10) Products shall satisfy one of the following quality conditions.

1. Products covered by an official quality standard, such as JIS, shall satisfy that quality standard.
2. If the product is not covered by the standard in 1 above, the product shall meet the standard voluntarily defined by the related industry.
3. If the product is not categorized under 1 or 2, individual quality standards shall be established to sufficiently control the quality..

[Certification Procedure]
A certificate (Example: 135-6 or 135-7) shall be submitted showing compliance with the laws, JIS standards, or voluntary standards that are applicable to the product. Or, a certificate issued by JET (Japan Electrical Safety Environment Technology Laboratories) may be submitted instead.

5. Considerations

In manufacturing products, it is desirable to consider the following, although they are not requirements for certification. The conformance to the individual criteria item shall be indicated in Attached Certificates.

(1) Instruction manuals (user manuals) provided to users shall conform to the following "a." to "c." and d

a. The binding method shall not impede waste paper recycling. However, use of hot melt adhesive is approved.
b. Chlorine gas shall not be used in the bleaching process of waste paper pulp.
c. The percentage of waste paper in the pulp mixture shall be over 70%.
   However, for the documentation printed overseas, "a" and either "b" or "d" below shall be considered.
d. The percentage of waste paper in the pulp mixture shall be over 30%.

6. Product Classification, Indication and Others

(1) Product certification is classified into A-F as shown in Table 1 and is classified according the product function (about 4 figures, based on the Japan Standard Commodity

Classification) with brand names. The certification is not classified according to color or size.

(2) The environmental information shown below shall be indicated below the mark. However, the indication of Eco Mark and certification information (Type B indication) can be allowed by following "Guide to Eco Mark usage" (enforced on March 1, 2011). The location and details of the Eco Mark to be indicated shall be submitted when applying for Eco Mark product certification and use.
The environmental information shall be indicated as "Power conditioners for photovoltaic power generation" enclosed in a rectangular box.

(3) Omitted.

Figure 2 Example of Eco Mark Display

March 15, 2006	Established (Version1.0)
August 3, 2006	Revised (Version1.1)
October 19, 2006	Revised (Version1.2)
February 14, 2008	Revised (Mixing of waste paper pulp, etc., (Version1.3))
August 21, 2008	Revised (4-1-1(1)) (Version1.4)
March 1, 2011	Revised (Version1.5)
October 1, 2011	Revised (5, Version1.6)
October 1, 2012	Revised (6(4), (5) deleted, Version1.7)
March 29, 2018	Extension of expiration
March 31, 2024	Expiration date

These Certification Criteria and/or the product category will be revised or abolished when necessary.

Attachment 1

Substances regulated in 4-1-1(3)

Specific chlorofluoro-carbon (Five CFCs)	Trichlorofluoromethane	Hydrochloro-fluorocarbon (HCFC)	Pentachlorofluoropropane
	Dichlorodifluoromethane		Tetrachlorodifluoropropane
	Trichlorotrifluoroethane		Trichlorotrifluoropropane
	Dichlorotetrafluoroethane		Dichlorotetrafluoropropane
	Chloropentafluoroethane		Chloropentafluoropropane
Other CFCs	Chlorotrifluoromethane		Tetrachlorofluoropropane
	Pentachlorofluoroethane		Trichlorodifluoropropane
	Tetrachlorodifluoroethane		Dichlorotrifluoropropane
	Heptachlorofluoropropane		Chlorotetrafluoropropane
	Hexachlorodifluoropropane		Trichlorofluoropropane
	Pentachlorotrifluoropropane		Dichlorodifluoropropane
	Tetrachlorotetrafluoropropane		Chlorotrifluoropropane
	Trichloropentafluoropropane		Dichlorofluoropropane
	Dichlohexafluoropropane		Chlorodifluoropropane
	Chloroheptafluoropropane		Chlorofluoropropane
	Carbon tetrachloride		
	1,1,1-trichloroethane		
Hydrochloro–fluorocarbon (HCFC)	Dichlorofluoromethane		
	Chlorodifluoromethane		
	Chlorofluoromethane		
	Tetrachlorofluoroethane		
	Trichlorodifluoroethane		
	Dichlorotrifluoroethane		
	Chlorotetrafluoroethane		
	Trichlorofluoroethane		
	Diclorodifluoroetahne		
	Chlorotrifluoroethane		
	Dichlorofluoroethane		
	Chlorodifluoroethane		
	Chlorofluoroethane		
	Hexachlorofluoropropane		
	Pentachlorodifluoropropane		
	Tetrachlorotrifluoropropane		
	Trichlorotetrafluoropropane		
	Dichloropentafluoropropane		
	Chlorohexafluoropropane		