

SEMI PV101-0823

GUIDE FOR SCRAP JUDGEMENT OF PHOTOVOLTAIC MODULES IN BUILDING

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NOTICE: The section symbol (§) is used to reference a numbered section, paragraph, or header and all subordinate paragraphs, headers, and embedded material (i.e., EXCEPTIONs, lists) therein. The paragraph symbol (§) is used to reference a particular numbered paragraph and embedded material therein. When duplicated (i.e., §§ and §§) the symbols are used to reference more than one section or paragraph, respectively.

NOTICE: Paragraphs entitled ‘NOTE:’ are not an official part of this Standard or Safety Guideline and are not intended to modify or supersede the official Standard or Safety Guideline. These have been supplied by the global technical committee to enhance the usage of the Standard or Safety Guideline.

1 Purpose

1.1 This Standard provides the scrap judgment basis and procedures for photovoltaic modules in building.

2 Scope

2.1 This Standard is applicable to the scrap rejection of photovoltaic modules that have been installed on buildings.

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

3 Limitations

3.1 None.

4 Referenced Standards and Documents

4.1 *IEC® Standards*¹

IEC 61215-1 — Terrestrial Photovoltaic (PV) Modules – Design Qualification and Type Approval Part 1: Test Requirements

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

5 Terminology

5.1 Definitions

5.1.1 *concession use* — the defect does not affect the safety and expected use function, and can be used continuously.

NOTE 1: It refers to the continued use in the original position, not the degraded use after being scrapped.

5.1.2 *photovoltaic modules in building* — photovoltaic modules installed on buildings to meet building safety and performance requirements, including crystalline silicon and thin film photovoltaic modules. Hereinafter referred to as modules or photovoltaic modules.

NOTE 2: Photovoltaic modules used in buildings referred to in this Standard only include photovoltaic modules consisting of batteries, laminates and wiring terminals, excluding frames and other fixed and decorative components.

5.1.3 *scrap judgment* — failed to meet performance indexes or continued use requirements after evaluation.

¹ International Electrotechnical Commission, 3 rue de Varembe, Case Postale 131, CH-1211 Geneva 20, Switzerland; Telephone: +41.22.919.02.11, <http://www.iec.ch>. IEC trademark is owned by International Electrotechnical Commission.

6 Application Specific

6.1 This Standard is only applicable to the scrap judgment of building photovoltaic modules that are accepted and put into operation.

6.2 Photovoltaic modules referred to in this Standard only include cells, laminates and wiring terminals, excluding frames and other fixed and decorative components. That is, when the frame and other fixed and decorative components used for module installation are damaged, they shall be repaired or replaced according to the relevant standards of building components, or the basis provided by the module supplier. If the damage of these components leads to the damage of the photovoltaic module, check and scrap the module in accordance with this Standard.

6.3 If the maintenance or replacement of building photovoltaic modules must be removed or replaced together with frames and other fixed and decorative components such, the frames and other fixed and decorative components should be disassembled, recycled, or discarded in accordance with the relevant standards of building components, or the basis provided by component suppliers.

6.4 This Standard applies to BIPV and BAPV and does not apply to rooftop independent photovoltaic systems installed on the roofs of buildings that do not perform building functions, but may be referred to this document if necessary.

7 Scrap Judgment Basis

7.1 If the photovoltaic modules has serious appearance defects that cannot meet or continue to meet the requirements of electrical safety and building structure safety, and cannot be repaired, or the cost of repair is greater than the cost of replacement, scrap immediately upon discovery.

7.1.1 External surface breakage, cracking or tearing, including self-explosion and cracking of surface packaging glass, and tearing of surface packaging materials of flexible components.

7.1.2 The disturbance value of bending deformation or the displacement between each packaging layer has exceeded the allowable value of normal use.

NOTE 3: The permissible value of normal use usually appears in the project document of building photovoltaic system—structural calculation sheet or product specification. If the above documents or data are missing, after the component deformation or displacement is found, it is recommended that the component supplier or a third-party testing organization issue instructions and handling opinions.

7.1.3 A continuous bubble or delamination channel is formed between the edge of the modules and the circuit.

7.1.4 The total area of bubbles reaches the value as defined in IEC 61215-1 when the mechanical integrity of the modules is dependent on lamination or other bonding methods and the installation is in the form of bonding without other effective mechanical fixation methods.

7.1.5 Presence of charred melted sealant, front plate, back plate, diode.

7.1.6 Cracked/broken cells which can remove more than 10% of the cells photovoltaic active area from the electrical circuit of the crystalline silicon module. The effective power generation area of crystalline silicon module is reduced by more than 10% due to cracked/broken cells.

7.1.7 Voids in or visible corrosion of any of the layers of the active (live) circuitry of the crystalline silicon module extending over more than 10% of any cell.

7.1.8 The damage of any layer of the membrane module will reduce more than 20% of the effective power generation area of the module.

7.1.9 Any short-circuited live parts or exposed live electrical parts.

7.1.10 Water vapor invasion and condensation occur on the bonding surface or hollow layer, affecting electrical safety or building thermal insulation function.

7.2 For building photovoltaic integrated modules that affect building safety and use function, such as photovoltaic daylighting roof and photovoltaic curtain wall, if they must be returned to the factory for maintenance after being removed to meet the requirements of continuous use, it is recommended to directly scrap and replace them with new modules; if it can be repaired without removal, but the power generation is still lower than more than 15% of the normal value after repair or after evaluation, which is recommended to directly scrap and replace with new modules.

NOTE 4: Normal value refers to the power value after normal attenuation has been taken into account.

7.3 If the components have defects that do not affect the electrical and structural safety, and the electrical performance and building function are not affected under normal use, they can be used in concession.

7.4 If the temperature difference in the cell area of the same modules is greater than 20K and local high temperature failure occurs, scrap the cell. If the temperature difference in the cell area of the same modules is less than or equal to 20K, combined with electroluminescence imaging detection, when the defective cell area of the crystalline silicon modules is more than 10% and the defective cell area of the thin-film modules is more than 20%, the scrap treatment shall be carried out.

7.5 Test insulation resistance on modules or strings. The detection voltage value and limit requirements are shown in Table 1. Individual modules (combined with infrared scanning) that cause the final leakage in the series lower than the insulation resistance limit should be scrapped.

Table 1 Insulation Resistance Test Voltage and Insulation Resistance Limits

<i>System Voltage^{#1}</i> <i>V</i>	<i>Test Voltage</i> <i>V</i>	<i>Insulation Resistance Limit</i> <i>MΩ</i>
U < 120	250	0.5
120 ≤ U < 500	500	1
500 ≤ U < 1000	1000	1
1000 ≤ U ≤ 1500	1500	1

#1 The above 15 kWp group pv string when pv set the insulation resistance between the string and not meet the requirements of Table 1, also can be a single string and multiple group (group list of the total capacity is not higher than 15 kWp) insulation resistance testing, testing voltage value according to the group list of voltage values according to Table 1, test results meet the threshold requirements of Table 1.

7.6 If the difference between the average current of a branch in the system and that of other branches in the same combiner box exceeds 5%, locate the faulty modules according to §§ 7.1 through 7.5. If the faulty module reaches the scrap threshold, scrap it.

7.7 If the energy yield of a combiner box in the system is 15% or more lower than that of other combiner boxes in the same inverter, locate the faulty module according to §§ 7.1 through 7.6. If the faulty module reaches the scrap threshold, scrap it.

8 Procedure

8.1 *Check Contents* — Perform the check according to §§ 7.1 through 7.7, and fill in Appendix 1, Component Rejection Checklist.

8.2 *Check Method* — Check the modules for rejection as described below.

8.2.1 Visually inspect the defects as described in § 7.1 of the photovoltaic modules on sunny days with good visibility or cloudy days that with illumination ≥500 lux.

8.2.2 Detect the temperature difference mentioned in § 7.4 by infrared scanning under the condition as below.

8.2.2.1 The modules of the photovoltaic system are in normal working mode.

8.2.2.2 The module surface shall be cleaned or free of dirt and cover, or light dust level.

8.2.2.3 Irradiance ≥600 W/m².

8.2.2.4 The wind speed ≤28 km/h.

8.2.2.5 Cloud coverage ≤2 okta (cumulus cloud covers a quarter of the sky).