POWER LOSS PHOTOVOLTAIC MODULE DETECTION METHOD BY TWO STEPS

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ABSTRACT

It is very useful method for maintenance in the field to easily figure out the power loss photovoltaic module (PVM). The most frequent failures of the crystalline silicon type PVM are disconnection of internal circuit and increase of resistance. When these failures occur, at least 33 % of electric generating capacity is lost. The method to detect this power loss PVM was experimentally studied. As a narrow down step, measure the impedance instead of resistance and open circuit voltage of the PVM string. The impedance of the string containing the power loss PVM is higher than the other strings. The open-circuit voltage of the string contains interconnect disconnection decreases by about 10 V. As a single out step, check magnetic field intensity emitted by current flow in internal circuit. The magnetic field intensity does not appear from the interconnector in the open state. This detection method was carried out at a photovoltaic power plant that had been operating for 15 years. Every PVM that were determined as a power loss PVM has come out losing power generation capacity under the evaluation of a solar simulator. 13 power loss Photovoltaic modules are found by this detection method. All Output power data of 13 modules that is evaluated by a solar simulator is below power warranty.[2] As the result of cross section analysis, solder layer between interconnector and cell has fatigue fracture.

EXPERIMENT

An LCR meter is not designed for impedance measurement of a PVM under the sun in the field and has a withstand voltage of about 30 V. [1] Solament® - Z that is our product name is developed to measure impedance of PVM strings and to determine their DC-voltage operable under 1000 V.

A gauss meter is not designed to check magnetic field intensity of PVMs. It is too far for a gauss meter to touch the surface of a PVM over there. Solament® - iS that is also commercial is developed to check magnetic field intensity without terrestrial magnetism and to get long about 3 meter.

This detection method is carried out at a photovoltaic power plant that had been operating for 15 years. It consists of 30 PVMs and 6 strings.

1. Narrow down step
   Measure the impedance and open circuit voltage of each PVM string
2. Single out step
   Check magnetic field intensity emitted by current flow in internal circuit
3. Evaluate power generation capacity for each PVM by a solar simulator
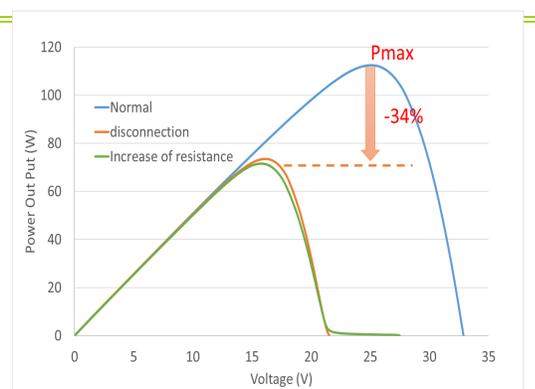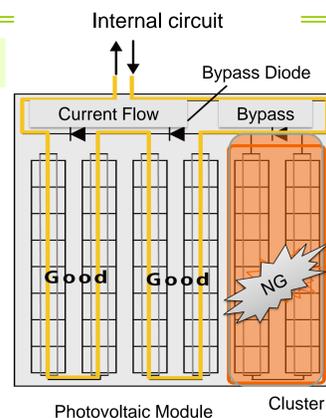4. Cross section analysis of the interconnector on bad cell

Fig.1 What is a Power Loss Photovoltaic Module ?
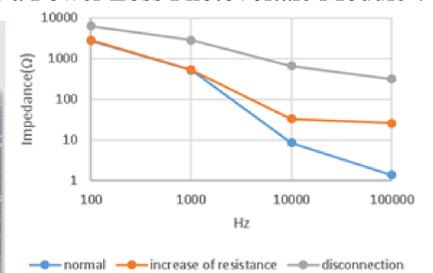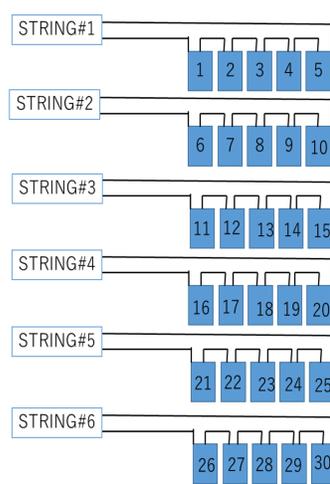

Fig.2 Two steps

Fig.3 Impedance of false failure in Module

RESULTS

1. Result of narrow down step

string	Z(Ω)	Voc(V)	judgment
#1	33	146	NG
#2	>1000	0	NG
#3	610	141	NG
#4	>1000	0	NG
#5	160	141	NG
#6	7	155	OK

2. Result of single out step

Fig.5 Cross section analysis

The greater part between solder and silver is clearance, soldered joint is a little.
B part clearance crack
Striation shows fatigue fracture.
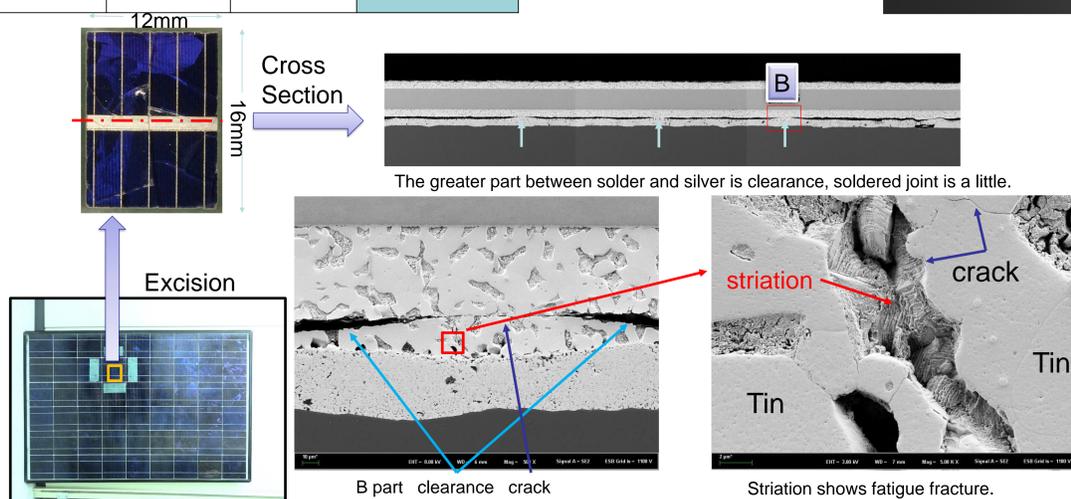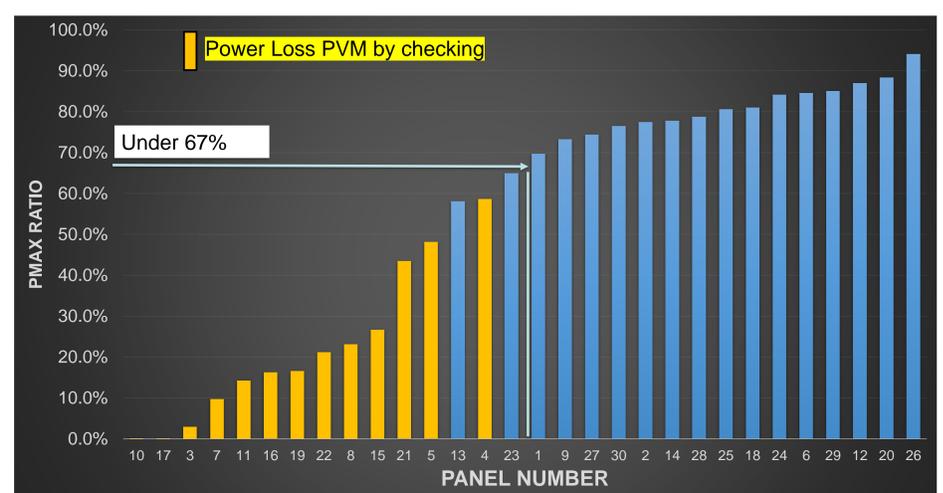
Fig.4 Solar simulator data of #13, #23 module

Rs of #13 and #23 is not as high as Rs of good PV module.
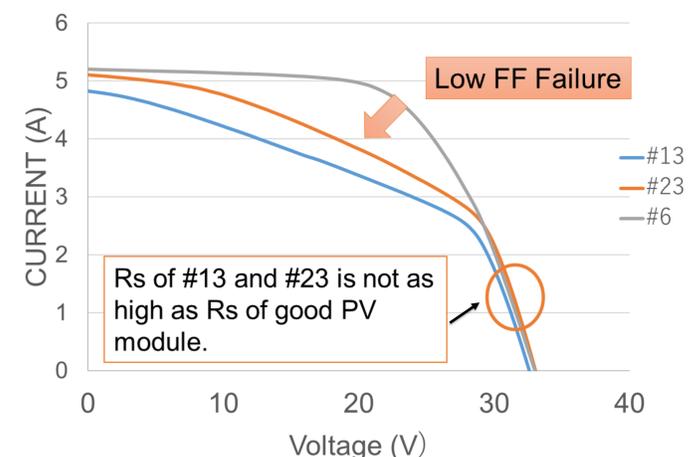
SUMMARY

Solar simulator must be accurate at data of output power, but only solar panel manufactures have it. However, a power loss PVM because of disconnection or increase of resistance can be found by this easily detection method in the field without removing a PVM.

REFERENCES

1. Operation manual LCR METER Model:9183
2. Home page of the soar panel manufacture