

Introduction of PV related business of Japan Electrical Safety & Environment Technology Laboratories (JET)

2015 PV Module Reliability Workshop

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JET's History



Established in 1963

1990

2000

2010

1963

Testing, Inspection and Certification services of electrical appliances



1995

S-JET mark Testing, Inspection and Certification services as a third party



Safety

1977

Testing, Inspection and Certification services of electrical components



Testing services on Request (EMC, LED, etc.)



Renewable Energy

2003

PV modules Certification services



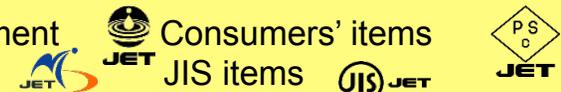
1993

Certification services of Power Conditioners



Certification based on Laws

Water Supply equipment
 Medical equipment
 Wireless equipment wearable to household equipment



Management System

1993

ISO9001, ISO14001, ISO50001, OHSAS18001, etc.

Japan Electrical Safety & Environment Technology Laboratories (JET) has supported **Safety, Quality and Environment Conservation** of electrical equipment and facilities.

JET has the largest share of electrical appliances certification services with about 60% of S mark certification, and covered all of the categories in Japan.

JET's PV modules certification has been required for Government's subsidies as the most reliable one. Its labels are attached to most of household PV modules.

JET has been acting as NCB and CBTL since 1998.

JET has the large share of certification services on dental electrical equipment and electronic massager.

JET is the first on certification of Li-ion battery with the largest share.

JET is the first and only one as testing body that is registered by JNLA on LED light performance test.



< PV Certification Related >

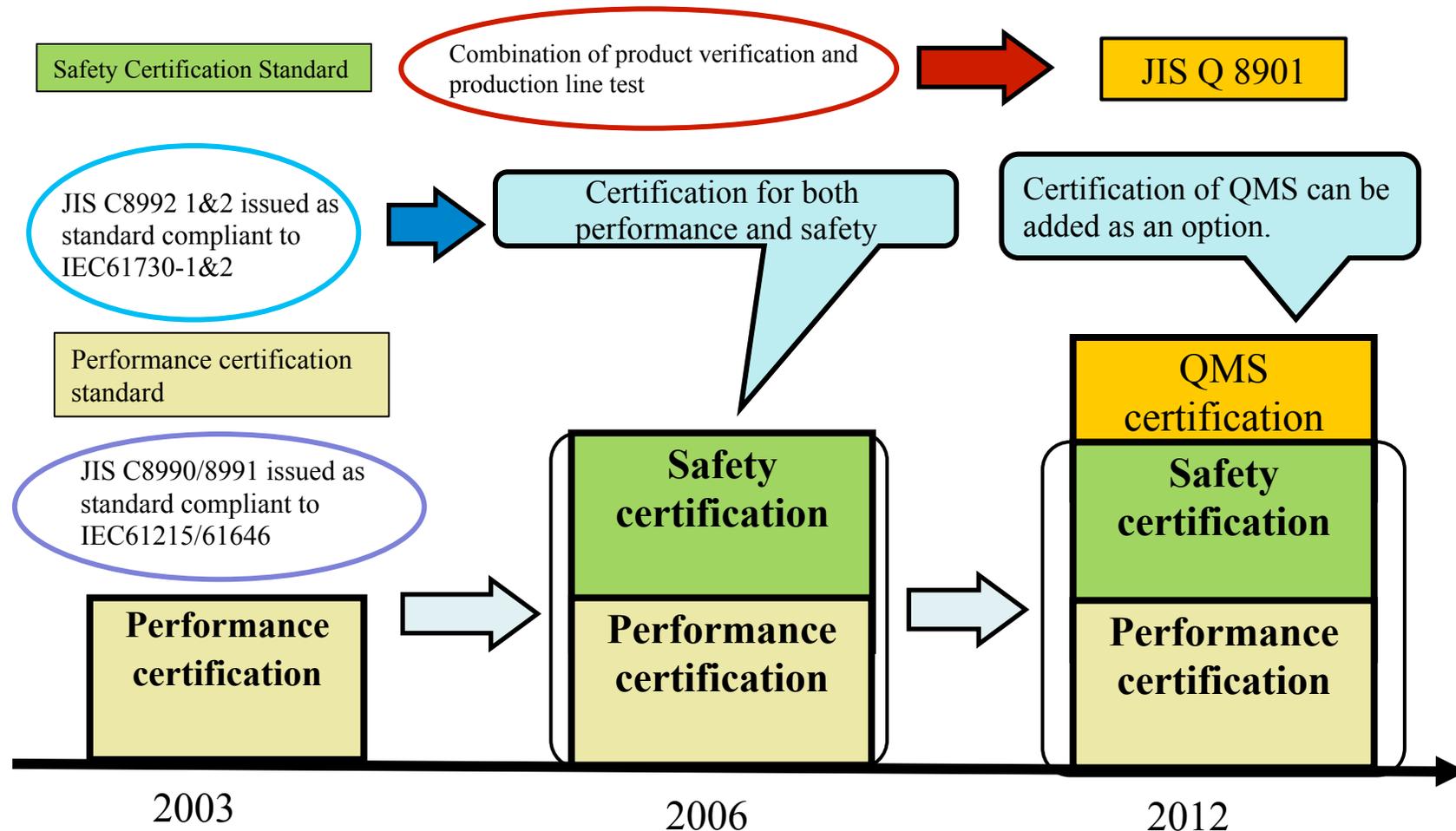
- Grid Connection Certification (1993 -)
 - Confirmation service for domestic grid connection requirements (Low pressure interconnection)
 - Regarding Solar Cells, JET is in process to transfer to new system (multiple interconnection)
- Provision of Basic Devices (2002 -)
 - Supports to assure the traceability of Solar Cell output measurement values.
 - Bridging role for AIST toward national standard regarding cell/module output
- Module Certification (2003 -)
 - National & International certification by IEC standard
 - Rapid growth of overseas customers while mainly dealing with Japanese companies
- QMS Certification (2012-)
 - Under the objective to assure the long term quality of PV modules, JET added QMS certification (JIS Q8901) in 2012.

< Research Business (National project) >

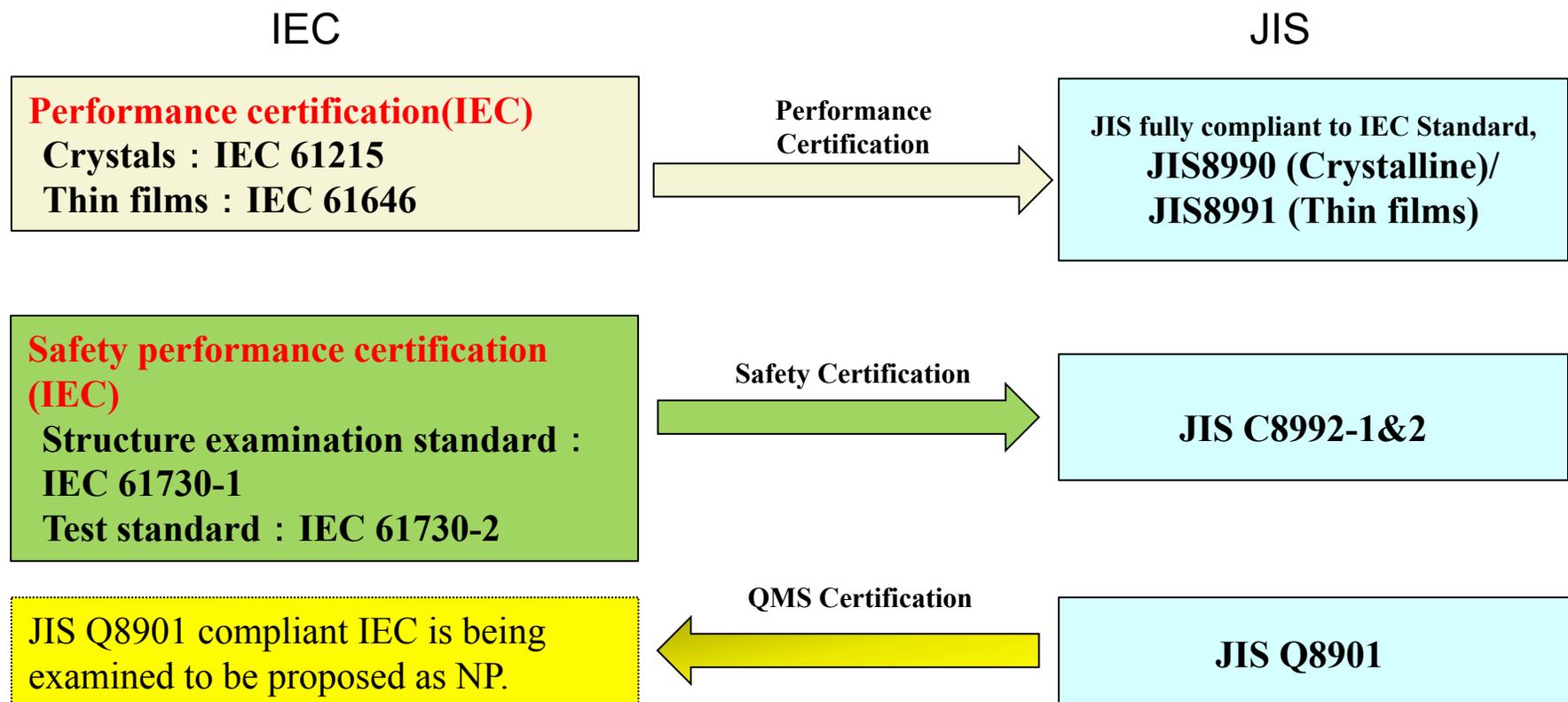
- Data collection regarding long term reliability (2001-)
 - Long term outdoor exposure data/indoor test data
 - Started to participate NEDO commissioned business and METI subsidized business

Short History of JET's PVm Certification

JET added safety certification to their JETPVm certification series in 2006. Then in 2012, they added QMS certification (JIS Q8901) for assuring the long term quality of PV modules.



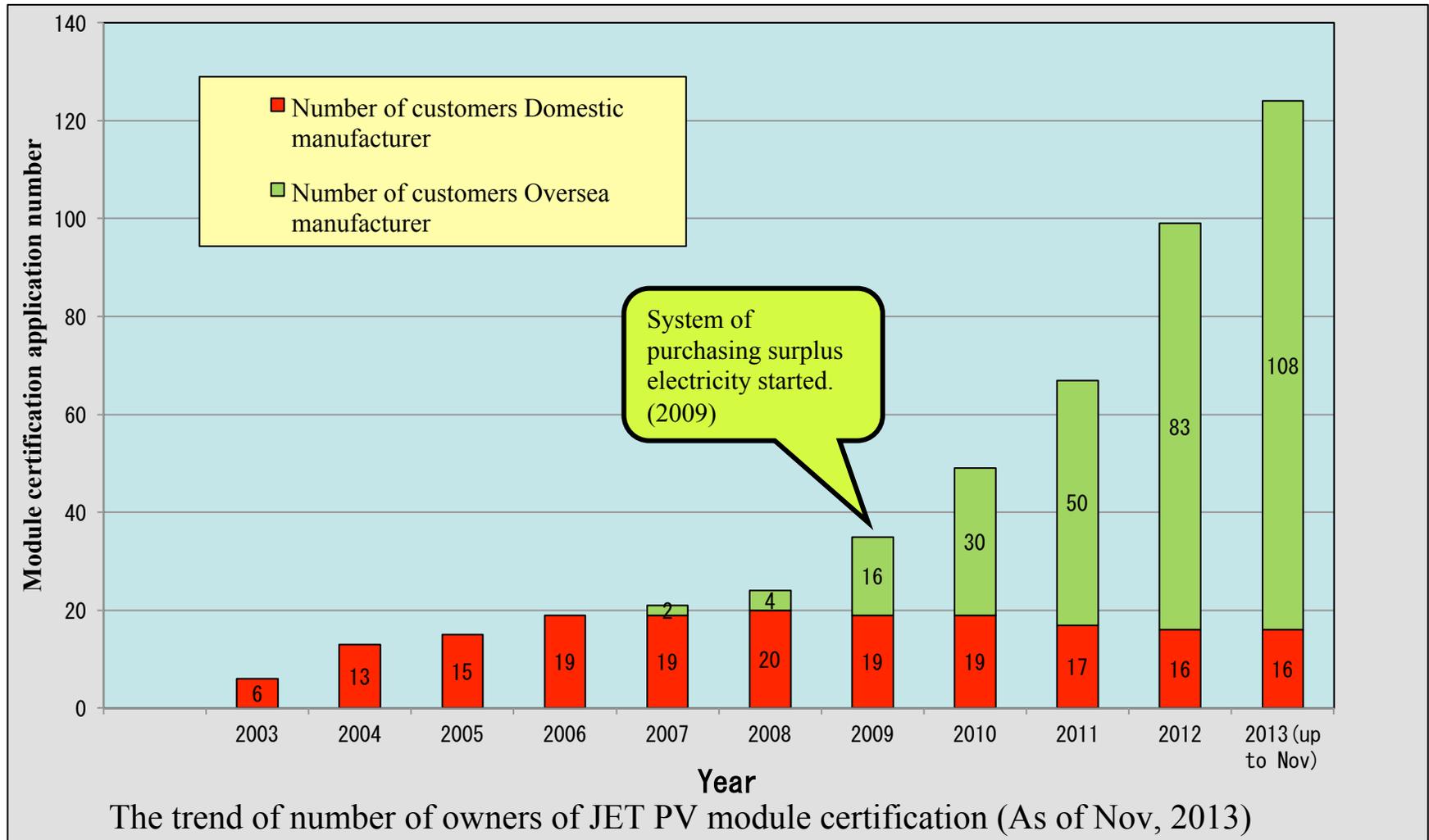
Correspondence of IEC standards and JIS standard is as follows.



Trend of Number of JET Certification Owners for PV Modules



PV awards by JET are largely influenced by the government policy toward PV. The number of overseas customers requesting JETPVm has increased since 2009.



PV Module Certification Test standard and Equipment

<Test standard>

International Certification Standards Applicable to PV Modules

- Performance Certification:
JIS C8990 (IEC61215), 8991 (IEC61646)
- Safety Certification:
JIS C8992-1, 2 (IEC61730-1, 2)
- QMS Certification: (JIS Q8901)

<Certification Test Equipment>

Test Items for Performance Certification Standard (IEC 61215)

| カテゴリー(Category) | 規格に定められた試験項目(Test items defined in the standard) | |
|-----------------------------------------------------------------------|--------------------------------------------------|------------------------------------------|
| 機能チェック (Functional check) | 10.1 | 目視検査(Visual inspection) |
| | 10.2 | 最大出力の決定(Pmax determination) |
| | 10.3 | 絶縁試験(Insulation test) |
| | 10.15 | 湿潤漏れ電流試験(Wet leakage test) |
| 特性 (Characteristics) | 10.4 | 温度係数(temperature coefficients)の測定 |
| | 10.5 | 公称動作セル温度(NOCT)の測定 |
| | 10.6 | 基準状態(STC)及びNOCTにおける特性 |
| | 10.7 | 低放射照度(low irradiance)における特性 |
| 前処理／予備的試験 (Preconditioning/Preliminary test) | 10.10 | 紫外線照射試験(UV preconditioning test) |
| | 10.8 | 屋外曝露試験(Outdoor exposure test) |
| 長期耐久性 (Long term durability) | 10.11 | 温度サイクル試験(Thermal cycling test) |
| | 10.12 | 結露凍結試験(Humidity freeze test) |
| | 10.13 | 高温高湿試験(Damp heat test) |
| さまざまな運用ストレスに 対する耐久性 (Durability to various operating stress) | 10.18 | バイパスダイオード温度試験(Bypass diode thermal test) |
| | 10.9 | ホットスポット耐久試験(Hot spot endurance test) |
| | 10.14 | 端子強度試験(Termination robustness test) |
| | 10.16 | 機械的荷重試験(Mechanical load test) |
| | 10.17 | 降雹試験(Hail test) |

Test Items for Safety Certification Standard (IEC61730-2)

| カテゴリー(Category) | 規格に定められた試験項目(Test items defined in the standard) | |
|-------------------------------|--------------------------------------------------|------------------------------------------|
| 感電危険(Electrical shock hazard) | 10.2 | 接近性試験(Accessibility test) |
| | 10.3 | 切断性試験(Cut susceptibility test) |
| | 10.4 | 接地連続性試験(Ground continuity test) |
| | 10.5 | インパルス電圧試験(Impulse voltage test) |
| | 10.6 | 耐電圧試験(Dielectric withstand test) |
| | 火災危険(Fire hazard) | 10.7 |
| 10.8 | | 火災試験(Fire test) |
| 10.9 | | 逆電流過負荷試験 (Reverse current overload test) |
| 機械的ストレス(Mechanical stress) | 10.10 | 衝撃破壊試験(Module breakage test) |
| 部品(Component) | 11.1 | 部分放電試験(Partial discharge test) |
| | 11.2 | 配線管曲げ試験(Conduit bending) |
| | 11.3 | 端子ボックスノックアウト試験(Terminal box knock out) |

10.9 through 13 and 10.16 and 17 of Performance Certification Test items (environment test/mechanical strength test) are conducted as the preprocessing of 10.2, 3 and 5 of Safety Certification Test.

10.11 Thermal cycling test (IEC61215)

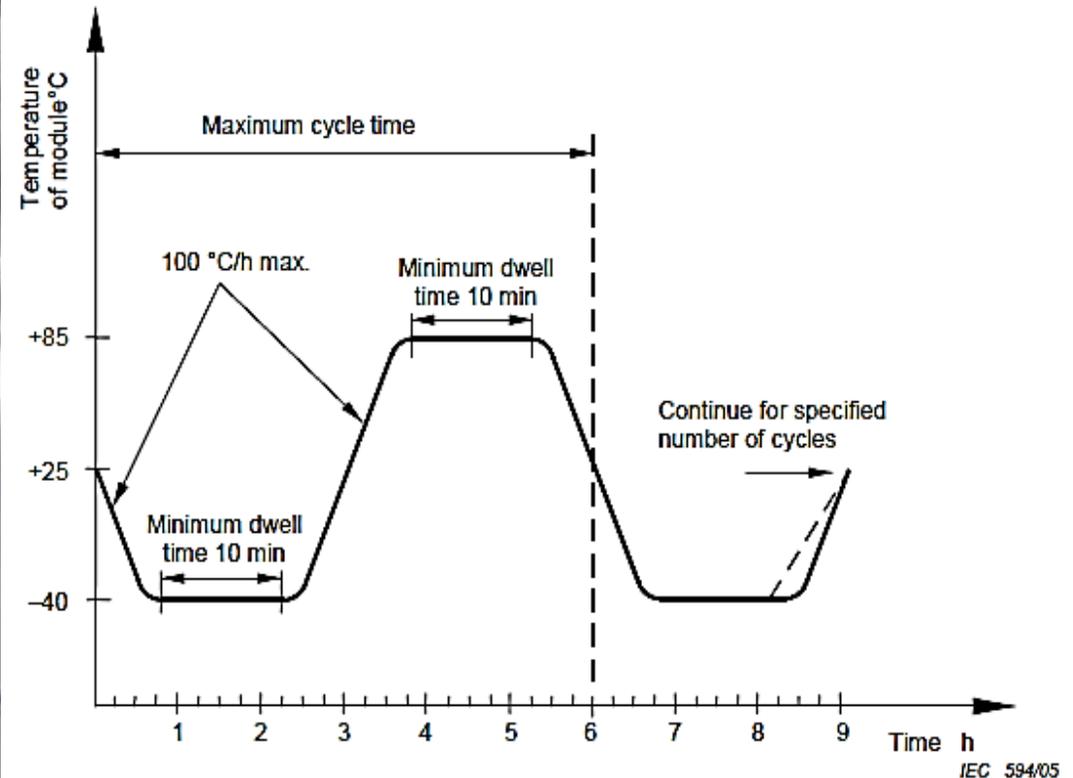


Figure 11 – Thermal cycling test

Temperature cycling test from -40°C to +85°C is conducted for 50 times and 200 times.

*In this cycle test, crystal samples shall receive STC peak output current for 200 times.

10.12 Humidity freeze test (IEC61215)



Condensation/Freezing Chamber
(-40°C ↔ 85°C, 85%RH)

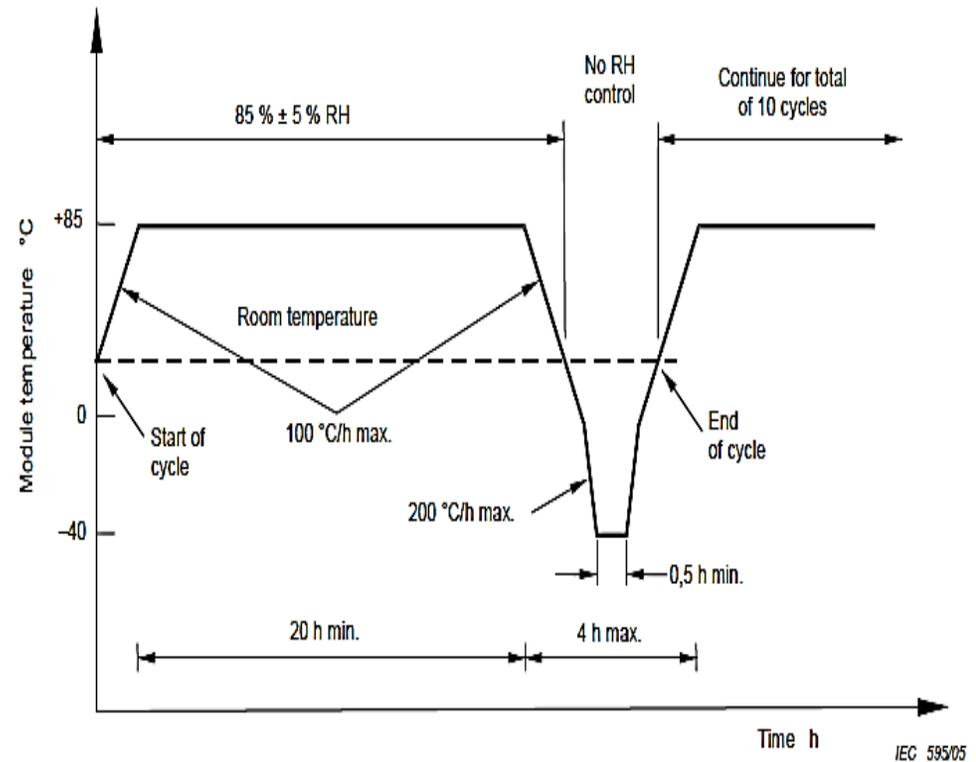


Figure 12 – Humidity-freeze cycle

10.10 UV preconditioning test (IEC61215)

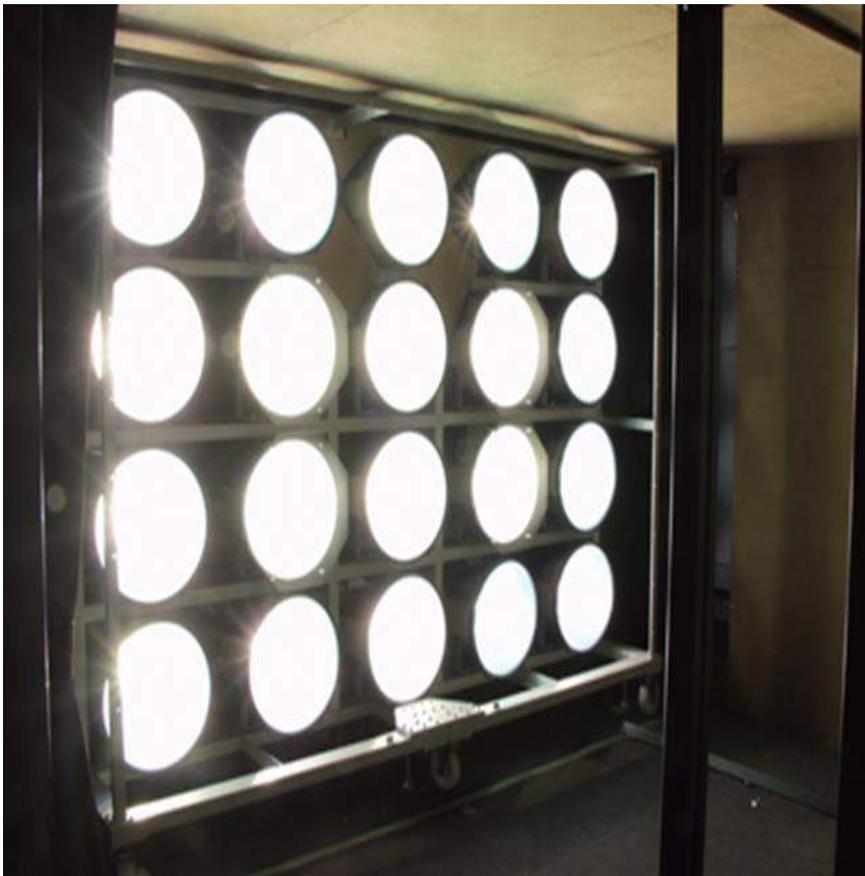


10.10.1 Purpose: To precondition the module with UV radiation before thermal cycle / humidity freeze tests

10.10.3 Procedure:
Wavelength range: 285–385 nm and $< 250 \text{ W}\cdot\text{m}^{-2}$ (i.e. ≈ 5 suns)
Module temperature: $60 \text{ }^\circ\text{C} \pm 5 \text{ }^\circ\text{C}$
Total irradiation: $15 \text{ kWh}\cdot\text{m}^{-2}$ and $\geq 5 \text{ kWh}\cdot\text{m}^{-2}$ at 280–320 nm

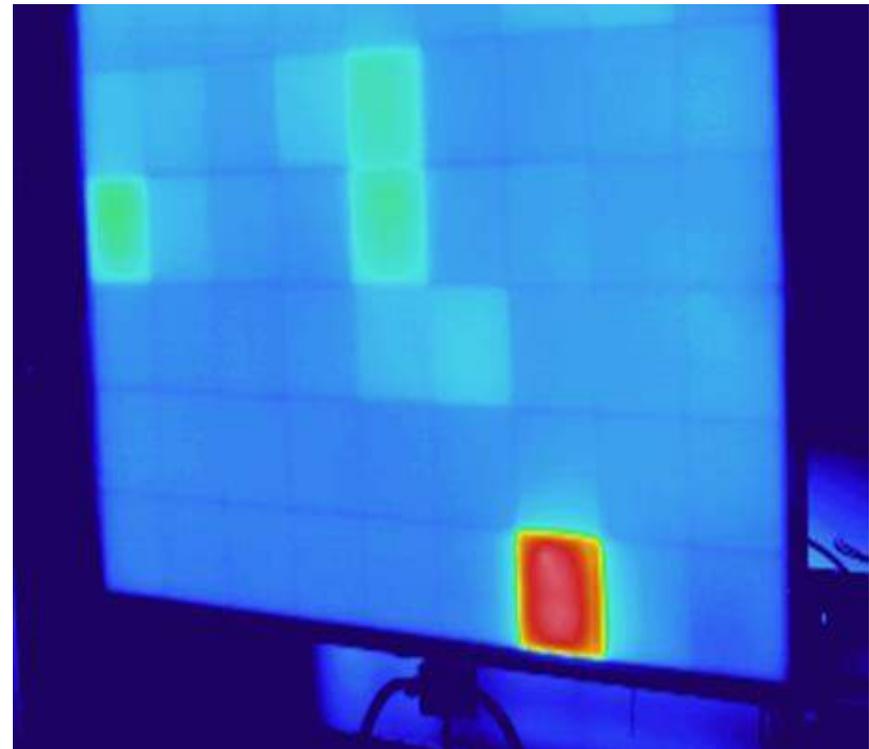


10.7 Temperature test(IEC61215)



Ambient light solar simulator

10.9 Hot spot endurance test(IEC61730-2)



Shielding the cells

When there is uneven cell output, leaves stay on a module, or building shadow is cast to a module, cells will be in a severe condition. The test reproduces such conditions and examines the resistance of the module.

10.17 Hail test (IEC61215)



10.10 Module breakage test(IEC61730-2)



Impactor: 45.5 kg Height: 30, 45, 122 cm

10.13 Damp heat test (IEC61215)



+85°C. 85%RH for 1000h

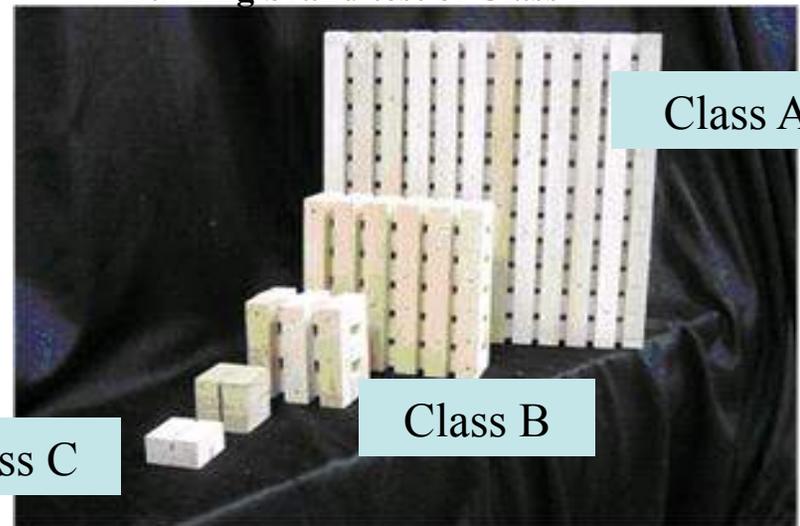
10.8 Fire test(IEC61730-2)



Spread of flame test of Class C



Burning brand test of Class B



Class A

Class B

Class C

This Certification is for Reliability Assurance System for Ground Mounting. The scheme largely contributes to **long term reliability of PV by configuration and operation of quality management system** in three-phases such as design, manufacturing and after-sales services. This leads to winning the reliability and expectation of customers through such issues as long-term indebtedness.

QMS Certification (JIS Q 8901)

The manufacturer has the following liabilities.

- (1) Functional service life (designed target period during which a PV module exhibits the specified performance under the specified conditions) and Assured performance period (period in which a PV module exhibits the assured performance by such services as module replacement, compensation in money and repair) can be confirmed (by the corroborating test methods or documents) in the product.
- (2) Manufacturing of PV modules conforming to JIS Q9001 is maintained.
- (3) The integrity of Functional service life, Assured performance period and actual Output performance assurance is secured, and the service system is in place.

Aims of JIS Q8901 Certification

JIS Q8901 Certification was initiated in July, 2012, in accordance with FIT system in Japan. This certification can provide several competitive advantages to PV module manufacturers.

JIS Q 8901 Certification Overview

- (1) Additional requirements to existing IEC61215, IEC61646 certification
- (2) To be conducted by expanding the factory audit of IEC61215, IEC61646
- (3) Assumed as Third Party Certificate in FIT scheme.



This was enacted in June, 2012, and following four organizations support the certification.

JET
UL Japan

TÜV Rheinland Japan
VDE Global Service Japan

IEC Standard

- Construction/safety requirements of PV system: IEC TS 62548 (Enacted), IEC60363-9-1(CDV) is being examined in TC64.
- Cables: 20/1441/NP (Electric cables for Photovoltaic system) is being examined in TC20
- Connectors: No standard. There is some movement intending to bring EN standard (EN 50521) to fast track.

Current status of local standards

<North America>

- System: NEC (National Electrical Code)
- Cables: UL 854, UL Subject 4703
- Connectors: UL 1703/489

<Europe>

- System: Requirements vary by country
- Cables: EN standard, VDE-AR-E 2283-4:2011-10 (Established as Requirements for cable for PV systems.)
- Connectors: EN 50521

<Japan>JET Certificate cables Connectors, Back sheet, Junction box

- Systems : JIS C 8954 (Electric circuit design standard for PV arrays), 8955 (the same as above, Supporter design standard), 8956 (Structure system design and construction method for residential solar cell arrays (for roof top type))
- Cables : JCS 4517 (Japanese Electric Wire & Cable Makers' Association Standard), Electric Appliance and Material Safety Law, Electric Utilities Industry Law
- Connectors : Substantially using the requirements for module components (IEC 61730-1 Section 7.3.)
- Back sheet(IEC 61730-1 Section 5.1/5.4) ▪ Junction Box(61730-1 Section 5/7/10)

Grid Connection Certification

⇒ Confirmation service for domestic grid connection requirements(Low pressure interconnection)

IEC Standard

- Product safety standard : IEC 62109-1&2 (Recently enacted (2010/4 and 2011/6))
- EMC Standard : IEC 61000 Series
- Grid connection standard : IEC 61727 (General requirements : Specific requirements accept the local rules.)

Current status of local standards

<North America>

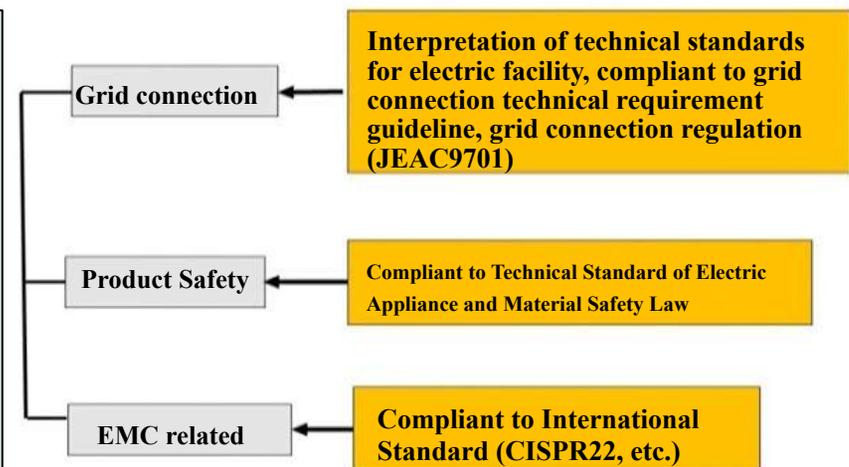
- Product safety standard : UL 1740
- EMC standard : FCC Standard (IEC(CISPR)integrated)
- Grid connection standard : IEEE 1547-1&2, Rule21

<Europe>

- Product safety standard : EN 50178 (IEC 62103 : General requirements for power electronics products)
- EMC standard : EN 61000 Series
- Grid connection standard: Subject to requirements of each country (Germany: DIN/VDE 0126-1-1, UK : Distribution Code / Engineering Recommendation G83/1 etc.)

<Japan>

- ① **Grid connection standard** : Grid connection rule (JEAC 9701), Interpretation of electric facility engineering standard, technical requirement guideline for grid connection related to power quality
- ② **Product safety standard** : Chapter 8 of Technical criteria for electric products is used in JET certification.
- ③ **EMC standard** : JIS 61000 Series



Certified Cases for Grid Connection



Applied tests

Product afts: Such tests as structure test, insulation performance test, ambient environment resistance test and durability test are conducted.

Protection function tests necessary for grid connection: Confirms that voltage and frequency are normal, and checks if protection level and operation time of single operation prevention are within specified limits.

Other tests (including EMC):

Confirms that product will not adversely affect environment or wiring system, and will not malfunction by influence from environment or wiring system through such tests as stationary characteristics test, transient response test, external accident test, environmental adaptation test and electric environment resistance test.

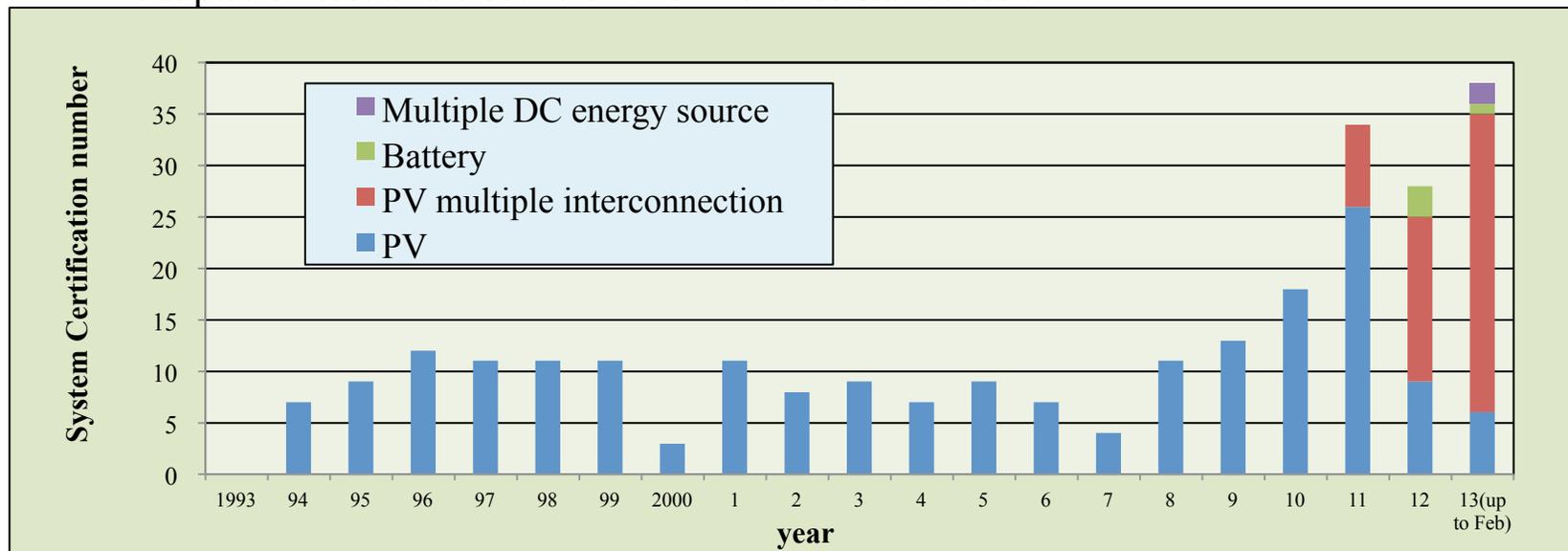


Figure: Grid connection achievement

Single unit 9: 90 models installation, multi units: 50 models installation (as of the end of Jan, 2014)

Thank you for your attendance.
