TÜV Rheinland PTL LLC

Test Report

Photovoltaic module qualification
according to IEC 61730-1: 2004, First Edition
“Photovoltaic (PV) module safety qualification – Part 1: Requirements for construction”
&
IEC 61730-2: 2004, First Edition
“Photovoltaic (PV) module safety qualification – Part 2: Requirements for testing”

Certification Report No: 31483730.002

Tempe Arizona,
February 2015

Testing Certificates 0921-01 & 0921-02

Test Report No.: *Prüfbericht - Nr.:*	Certification Report No.: 31483730.002
Client **(Customer no. and address):** *Auftraggeber* *(Kunden-Nr. u. Adresse):*	IUSASOL SA de CV (Client No.:804119) Av. Paseo de la Reforma 2608, P.H., Col. Lomas Altas, Del. Miguel Hidalgo, México D.F. C.P. 11950
Test item: *Gegenstand der Prüfung:*	Photovoltaic (PV) Module(s)
Module type designation / family: *Modultypen-Bezeichnung:*	IUSASOL-PV-01-xxx (xxx=235-260) (For details see Constructional Data Form (CDF) no. CDF_31483730.001)
Order No.: *Auftragsnummer:*	TRM140506, TRM141029
Date of receipt: *Eingangsdatum:*	30Oct2014
Testing Location: *Prüfort:*	TÜV Rheinland PTL, LLC 2210 S Roosevelt St, Tempe, AZ 85282 Tel.: +1 (480) 966-1700, Fax: +1 (775) 314-6458
Test Specification: *Prüfgrundlage:*	☒ **IEC 61730-1: 2004**, EN 61730: 2007 “Photovoltaic (PV) module safety qualification – Part 1: Requirements for construction” ☒ **IEC 61730-2: 2004**, EN 61730: 2007 “Photovoltaic (PV) module safety qualification – Part 2: Requirements for testing”
Test Result: *Prüfergebnis:*	**Based on the review of the test procedures and results documented in this report, the PV modules tested in this program have met the testing requirements of the above test specification.**

Compiled By: *Erstellt:*			**Reviewed By:** *Kontrolliert:*		
10Feb2015	Bo Li	Bo Li	10Feb2015	Samantha Doshi	
Date *Datum*	**Title/Name** *Titel/Name*	**Signature** *Unterschrift*	**Date** *Datum*	**Title/Name** *Titel/Name*	**Signature** *Unterschrift*

Address(es) of the Manufacturing Site(s)

Name / Description:	IUSASOL S.A. DE C.V.
Street:	Km. 109 Carr. Panamericana Mex-Qro.
Postcode / City:	C.P. 50700 Jocotitlan
Country:	Estado de Mexico
Type of Production:	Photovoltaic (PV) modules
Inspection Report No:	Q0803906.001

Name / Description:	
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Postcode / City:	
Country:	
Type of Production:	
Inspection Report No:	

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History of Certification

Revision Number (Project No.)	Revision	Model Name	Reference Report Number	Reference Certificate Number	Certificate Date
0 (TRM140506)	Base	IUSASOL-PV-01-xxx (xxx=235-260)	31483730.002	pending	pending
1 (TRM141029)	Addition of cell and frame	IUSASOL-PV-01-xxx (xxx=235-260)	31483730.002	pending	pending
Supplementary information: None.					

Summary of Test Locations
All tests were performed at TUV Rheinland PTL in Tempe, Arizona.

Summary of Deviations from the Standard
TÜV Rheinland reserves the right to impose more demanding requirements and select superior tests, which may reflect worst-case scenarios in the interest of product safety liability.

The first reference for qualification testing is EN 61730-2:2007. All tests of the IEC 61730:2004 standard were passed* according to its regulations of the pass criteria. As in the adoption of this standard to the European version (EN 61730:2007) the test criteria (IEC 61730-2) were not changed, the results of this qualification can cover both standards, as long as Application Class A is used. The changes from IEC to EN version are listed in the annex of this report.

General Report Information

Test Item Particulars	
Accessories and detachable parts included in the evaluation	N/A
Mounting system used	N/A
Other options included	N/A
Possible Test Case Verdicts	
Test case does not apply to the test object	N/A
Test object does meet the requirement	P (Pass)
Test object does not meet the requirement	F (Fail)
Test was not required for this particular program	NR
Abbreviations Used in the Report	
Fill factor	FF
Open circuit voltage	Voc
Short circuit current	Isc
Maximum power voltage	Vm
Maximum power current	Im
Maximum power	Pm
Module Safety Test	MST
Relative Thermal Index	RTI
Standard Test Conditions	STC
Comparative Tracking Index	CTI
Thermal Cycling	TC
Humidity Freeze	HF

General Remarks

- This report shall not be reproduced, except in full, without the written approval of the testing laboratory.
- The test results presented in this report relate only to the item(s) tested.
- "(see remark #)" refers to a remark appended to the report.
- "(see Annex #)" refers to an annex appended to the report.
- "(see appended table)" refers to a table in the test Report.
- Throughout this report a point is used as the decimal separator.

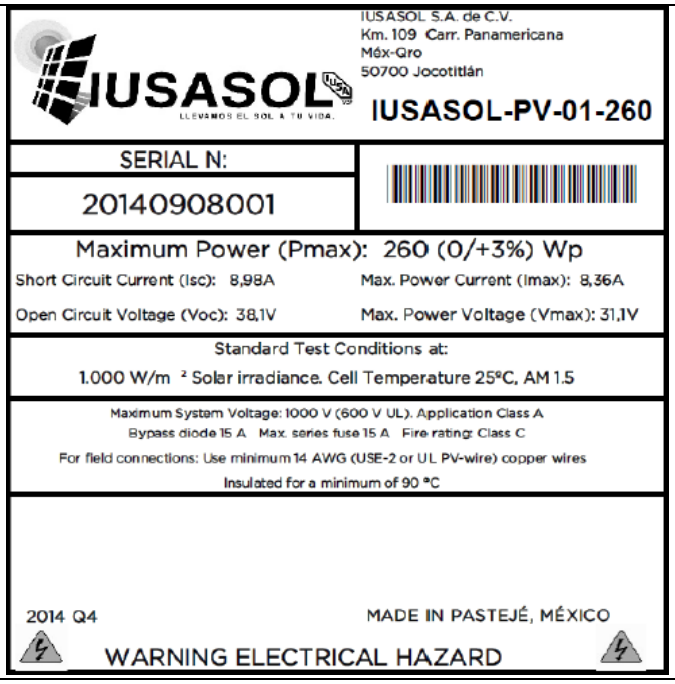
General Product Information

General Information	
Manufacturer	IUSASOL S.A. DE C.V.
Model Number	IUSASOL-PV-01-xxx (xxx=235-260)
Module Technology	Poly Crystalline
Product Electrical Ratings at STC	
Nominal Maximum Power, Pmax (W)	235-260
Nominal Open-circuit Voltage, Voc (V)	37-38.1
Nominal Short-circuit Current, Isc (A)	8.35-8.98
Nominal Maximum Power Voltage, Vpm (V)	30-31.1
Nominal Maximum Power Current, Ipm (A)	7.85-8.36
Product Safety Ratings	
Maximum System Operating Voltage (V)	1000
Maximum Over-current Protection Rating (A)	15
Safety Application Class	A
Fire Safety Class	C

Marking Requirements

Requirement	Comments	Verdict
Name, monogram, or symbol of manufacturer	Verified through visual inspection	P
Type or model number	Verified through visual inspection	P
Isc, Voc, Im, Vm, Pm	Verified through visual inspection	P
Serial number	Verified through visual inspection	P
Polarity of terminals or leads	Verified through visual inspection	P
Maximum system voltage	Verified through visual inspection	P
The date of manufacture	Verified through visual inspection	P
The place of manufacture	Verified through visual inspection	P
Maximum overcurrent protection rating	Verified through visual inspection	P
Application class	Verified through visual inspection	P
Fire class	Verified through visual inspection	P

Copy of Nameplate



Supplementary information:
None.

Testing Procedure

Scope of Testing

Sampling	
☒	Random sampling from production
	☒ The modules tested (modules and laminate) were taken at random from a production batch and subjected to manufacturer's normal quality control and inspection for safety testing.
	☐ The modules tested (modules and laminate) were supplied by the manufacturer.
☐	Prototype submitted by client

Program	
☒	New module type
☒	Modifications (if yes, please choose the applicable modification according to the Retesting Guideline)
	Original test report ref. no.:
	☒ Change in cell technology
	☐ Modification to encapsulation system
	☐ Modification to superstrate
	☐ Increase in module size
	☐ Modification to back sheet / substrate
	☒ Modification to frame and / or mounting structure
	☐ Modification to junction box / electrical termination
	☐ Change in cell interconnect materials or technique
	☐ Change in electrical circuit of an identical package
	☐ Higher or lower power output (by 10%) in the identical package including size and using the identical cell process
	☐ Qualification of a frameless module after the design has received certification as a framed module
	☐ Change in bypass diode or number of diodes
	☐ Increase in overcurrent protection (series fuse) rating
	☐ Change in grounding means
	☐ Change of label material or label adhesive
	☐ Change or inclusion of use of fixing tape used to hold cells for lamination
	☐ Other….

Description of similarity (differences) between the applied model and the previously tested model:

Testing program is base qualification with addition of cell from Bluecell and frame from Consorcio Industrial.
Consorcio Industrial frame has no change of cross section, material, coating and therefore no test is needed for frame change.

Module Group Assignment

Sample ID	Serial Number	Type / Model Number	Remarks	Seq. No.
TRM1036	20141001036	IUSASOL-PV-01-250	No defects	Spare
TRM1054	20141001054	IUSASOL-PV-01-250	No defects	Spare
TRM1068	20141001068	IUSASOL-PV-01-250	No defects	Spare
TRM2170	20141002170	IUSASOL-PV-01-255	No defects	E1
TRM2173	20141002173	IUSASOL-PV-01-255	No defects	E2
TRM2188	20141002188	IUSASOL-PV-01-255	No defects	D
TRM2192	20141002192	IUSASOL-PV-01-255	No defects	B1
TRM2267	20141002267	IUSASOL-PV-01-255	No defects	Spare
TRM3147	20141003147	IUSASOL-PV-01-255	No defects	C1/G
TRM6062	20141006062	IUSASOL-PV-01-250	No defects	Spare
TRM6386	20141006386	IUSASOL-PV-01-255	No defects	C2/G
TRM6403	20141006403	IUSASOL-PV-01-255	No defects	B2
TRM6416	20141006416	IUSASOL-PV-01-255	No defects	A
TRM6453	20141006453	IUSASOL-PV-01-255	No defects	D
TRM6474	20141006474	IUSASOL-PV-01-255	No defects	G
TRM7124	20141007124	IUSASOL-PV-01-255	No defects	D
TRM7125	20141007125	IUSASOL-PV-01-255	No defects	Spare
TRM5357	1141007195357	IUSASOL-PV-01-255	No defects	B1/F
TRM4507*	1141008154507	IUSASOL-PV-01-245	No defects	B1
TRM3252*	1141008203252	IUSASOL-PV-01-245	No defects	B1
TRM2430	1141009002430	IUSASOL-PV-01-245	No defects	Spare
TRM1434	1141009021434	IUSASOL-PV-01-250	No defects	Spare
TRM3421	1141009033421	IUSASOL-PV-01-250	No defects	Spare
TRM4908	1141010074908	IUSASOL-PV-01-245	No defects	Spare

Supplementary Information:
Note: * samples for qualification by similarity: cell and frame addition

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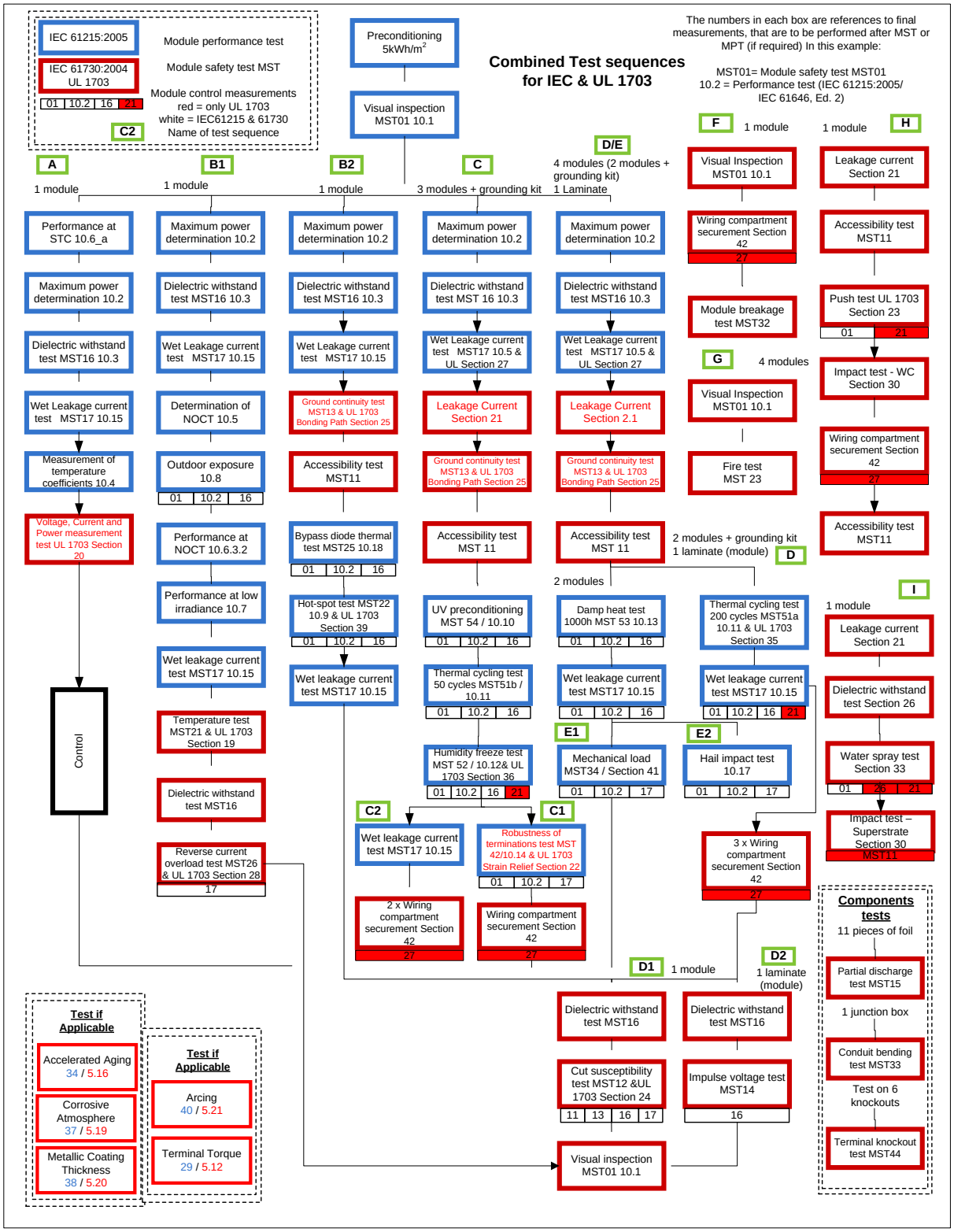
Test Program – Full Qualification

Note: Deviations from test sequence are possible but must be documented.



Required Tests Depending on the Application Class

			Module Safety Test
A	**B**	**C**	
			Preconditioning Tests:
X	X	X	MST 51 Thermal Cycling (TC50 or TC200)
X	X	X	MST 52 Humidity Freeze
X	X	X	MST 53 Damp Heat
X	X	X	MST 54 UV Resistance
			General Inspection Test:
X	X	X	MST 01 Visual Inspection
			Electrical Shock Hazard Tests:
X	X	-	MST 11 Accessibility Test
X	X	-	MST 12 Cut Susceptibility Test
X	X	X	MST 13 Ground Continuity Test
X	X*	-	MST 14 Impulse Voltage Test
X	X*	-	MST 16 Dielectric Withstand Test
X	X	-	MST 17 Wet Leakage Current Test
X	X	X	MST 42 Robustness of Terminations
			Fire hazard tests:
X	X	X	MST 21 Temperature Test
X	X	X	MST 22 Hot Spot Test
X**	-	-	MST 23 Fire Test
-	X	-	MST 25 Bypass Diode thermal Test
X	X	-	MST 26 Reverse Current Overload Test
			Mechanical Stress Tests:
X	X	X	MST 32 Module Breakage Test
			Component Tests:
X	-	-	MST 15 Partial Discharge Test
X	X	-	MST 33 Conduit Bending
X	X	X	MST 44 Terminal Box Knockout Test

X	Test required
-	Test not required
*	Different test levels for application class A and B
**	Minimum fire resistance class C is necessary for building roof-mounted modules

Overview of MST Items for Each Test Sample – Part 1

MST Item	Sample No												
	TRM6416	TRM2188	TRM7124	TRM3147	TRM6386	TRM6474	TRM2170	TRM2173	TRM2192	TRM6403	TRM6453	TRM5357	TRM2267
Control Module	X												
MST 01 – Visual Inspection	X	X		X	X	X	X	X	X	X	X	X	X
MST 11 – Accessibility		X		X			X						
MST 12 – Cut Susceptibility			X	X			X						
MST 13 – Ground Continuity		X		X			X						
MST 14 – Impulse Voltage											X		
MST 15 – Partial Discharge													
MST 16 – Dielectric Withstand	X	X	X	X	X		X	X		X	X	X	
MST 17 – Wet Leakage Current	X	X	X	X	X		X	X		X	X	X	
MST 21 – Temperature									X				
MST 22 – Hot Spot Endurance										X			
MST 23 – Fire				X	X								
MST 25 – Bypass Diode Thermal Test										X			
MST 26 – Reverse Current Overload												X	
MST 32 – Module Breakage												X	
MST 33 – Conduit Bending													
MST 34 – Mechanical Load							X						
MST 42 – Robustness of terminations													
MST 44 – Terminal Box Knock Out													
MST 51a – Thermal Cycling (TC50)				X	X								
MST 51b – Thermal Cycling (TC200)		X	X								X		
MST 52 – Humidity Freeze (HF10)				X	X								
MST 53 – Damp Heat (DH1000)							X	X					
MST 54 – UV Preconditioning				X	X								
Legend: X Test Performed													

Overview of MST Items for Each Test Sample – Part 2

MST Item	Sample No												
	TRM7125	TRM4507	TRM3252										
Control Module													
MST 01 – Visual Inspection	X												
MST 11 – Accessibility													
MST 12 – Cut Susceptibility													
MST 13 – Ground Continuity													
MST 14 – Impulse Voltage													
MST 15 – Partial Discharge													
MST 16 – Dielectric Withstand													
MST 17 – Wet Leakage Current													
MST 21 – Temperature			X										
MST 22 – Hot Spot Endurance													
MST 23 – Fire													
MST 25 – Bypass Diode Thermal Test													
MST 26 – Reverse Current Overload		X											
MST 32 – Module Breakage													
MST 33 – Conduit Bending													
MST 34 – Mechanical Load													
MST 42 – Robustness of terminations													
MST 44 – Terminal Box Knock Out													
MST 51a – Thermal Cycling (TC50)													
MST 51b – Thermal Cycling (TC200)													
MST 52 – Humidity Freeze (HF10)													
MST 53 – Damp Heat (DH1000)													
MST 54 – UV Preconditioning													
Legend: X Test Performed													

Testing Summary

Section No.	Test Name	Test Location	Verdict
MST 01	Visual Inspection	TÜV Rheinland PTL	P
MST 11	Accessibility Test	TÜV Rheinland PTL	P
MST 12	Cut Susceptibility Test	TÜV Rheinland PTL	P
MST 13	Ground Continuity Test	TÜV Rheinland PTL	P
MST 14	Impulse Voltage Test	TÜV Rheinland PTL	P
MST 16	Dielectric Withstand Test	TÜV Rheinland PTL	P
MST 17	Wet Leakage Current Test	TÜV Rheinland PTL	P
MST 21	Temperature Test	TÜV Rheinland PTL	P
MST 22	Hot-spot Test	TÜV Rheinland PTL	P
MST 23	Fire Test	TÜV Rheinland PTL	P
MST 25	Bypass Diode Thermal Test	TÜV Rheinland PTL	P
MST 26	Reverse Current Overload Test	TÜV Rheinland PTL	P
MST 32	Module Breakage Test	TÜV Rheinland PTL	P
MST 34	Mechanical Load Test	TÜV Rheinland PTL	P
MST 42	Robustness of terminations	TÜV Rheinland PTL	P
MST 51a	Thermal Cycling (TC 50)	TÜV Rheinland PTL	P
MST 51b	Thermal Cycling (TC 200)	TÜV Rheinland PTL	P
MST 52	Humidity Freeze (HF10)	TÜV Rheinland PTL	P
MST 53	Damp Heat (DH 1000)	TÜV Rheinland PTL	P
MST 54	UV Preconditioning test	TÜV Rheinland PTL	P
MST 15	Partial Discharge Test	N/A	N/A
MST 33	Conduit Bending Test	N/A	N/A
MST 44	Terminal Box Knockout Test	N/A	N/A
Supplementary Information: • None.			

Tables Part 1 (IEC 61730-1)

Application Classes (Clause 3)

The Module has been evaluated for the following Application Class:

- ☒ Class A
- ☐ Class B
- ☐ Class C

Construction Requirements (Clause 4)

General Requirements (Clause 4.1)

Sec.	Description	Tests	Verdict
4.1.1	It is stated that the module is able to operate under environmental condition type AB8 according to IEC 60364-5-51.	Document verification: Installation manual	N/A
4.1.2	The module/s is/are completely assembled when shipped from the factory. The module is provided in subassemblies.	Visual inspection;	P
4.1.3	Incorporation of a module into the final assembly does not require any alteration of the module from its originally evaluated form. If YES, specific details describing necessary modification(s) are provided in the installation instructions.	Visual inspection; Document verification: Installation manual	P
4.1.4	If the module must bear a definite relationship to another module, it is constructed to permit incorporation into the final assembly without the need for alteration.	Visual inspection;	P
4.1.5	The construction of the module is such that ground continuity is not interrupted by installation.	Visual inspection;	P
4.1.6	Parts of the module are prevented from loosening or turning, if such loosening or turning may result in a risk of fire, electric shock, or injury to persons.	Visual inspection; BL: Latching connectors	P
4.1.7	Friction between surfaces is not used as the sole means to inhibit the turning or loosening of a part.	Visual inspection; BL: no such part	N/A
4.1.8	Any adjustable or movable structural part is provided with a locking device to reduce the likelihood of unintentional movement.	Visual inspection; BL: no such part	N/A

Metal Parts (Clause 4.2)

Sec.	Description	Tests	Verdict
4.2.1	Metals used in locations that are exposed to moisture shall not be employed alone or in combinations that could result in deterioration, such that the product would not comply with the requirements in this standard.	Visual inspection; Document verification: Material properties Remarks: Anodized Al frame.	P
4.2.2	Iron or mild steel serving as a necessary part of the module but not exposed to the weather are plated, painted, or enamelled for protection against corrosion.	Visual inspection; BL: No such part	N/A
4.2.3	Simple sheared or cut edges and punched holes are not required to be additionally protected.	Visual inspection;	N/A

Polymeric Materials (Clause 5)

General (Clause 5.1)

Sec.	Description	Tests	Verdict
5.1	Polymers are classified into four operational categories: • Polymers serving as an enclosure for live metal parts (such as junction boxes); • Polymers serving as a support of live metal parts (such as integrated terminals); • Polymers serving as the outer surface for the module (such as the superstrate or substrate); • Barriers. Exception: Encapsulation materials are not required to meet these requirements. All polymeric materials shall have a minimum relative thermal index (electrical and mechanical as defined by IEC 60216-5) of 20°C above the maximum measured operating temperature of said material in application, as measured during the Temperature Test (IEC 61730-2, MST 21). Note: Polymers serving as a superstrate or substrate have additional requirements, as specified in 5.3 and 5.4	Test: Temperature Test; Remarks: Successfully completed at TUV-PTL. Backsheet temp. = 78.55 °C RTI = 105 °C	P

Polymers Serving as an Enclosure for Live Parts (Clause 5.2)

Sec.	Description	Tests	Verdict
5.2	A polymeric material serving as the enclosure of a part involving a risk of fire or electric shock shall comply with the following requirements: • 5-V flammability rating, either by materials test or testing in the end-product design (IEC 60695-1-1); • 50V flammability rating, after water immersion and exposure of the end-product (IEC 6069-1-1); • Ultraviolet radiation resistance (if exposed to direct sunlight in the application), as determined in accordance with ANSI/UL 746C, and • A minimum resistance to hot wire ignition rating of 30 (IEC 60695-1-1).	Certificate Verification: • JBox: R50280547 • Connector: R50175587 • Cable: R50188841	P

Polymers Serving to Support Live Parts (Clause 5.3)

Sec.	Description	Tests	Verdict
5.3	A Information is provided that polymers serving to support live parts comply with: • Flammability classification and high-current arc ignition rating (IEC 60695-1-1 as given in Table 1 of IEC 61730-1 • Comparative Tracking Index (CTI) ≥ 250 V • Comparative Tracking Index (IEC 60112 or • Inclined plane tracking rating of 1 h, using the time to track method at 2.5 kV (ASTM D2303), if the maximum system operating voltage rating is in the range 600 – 1500 V. • Ultraviolet radiation resistance (ANSI/UL 746C/ISO 4892)	Certificate Verification: • JBox: R50280547 • Connector: R50175587 • Cable: R50188841 Remarks: Maximum system voltage = 1000 V	P

Polymers Serving as an Outer Surface (Clause 5.4)

Sec.	Description	Tests	Verdict
5.4.1	Information is provided that polymeric substrates or superstrates used in the module have: • A thermal index, both electrical and mechanical, as determined in accordance with IEC 60216-5 of at least 90°C. • A thermal index of at least 20°C above the maximum measured operating temperature of the material as measured during the Temperature Test MST21 of IEC61730-2.	See CDF 31483730.001 Document verification: Installation manual	P
5.4.2	Polymeric materials that serve as the outer enclosure for a module that (1) is intended to be installed in a multi-module or -panel system or (2) have an exposed surface area greater than 1 m² or a single dimension larger than 2 m, has a maximum flame spread index of 100 as determined under ASTM E162.	See CDF 31483730.001 Document verification: Installation manual	P
5.4.3	If exposed to direct sunlight in the application, the polymeric material has been evaluated for ultraviolet (UV) radiation resistance as determined in accordance with ANSI/UL 746C (or ISO 4892).	Test: UV Exposure; Remarks: Successfully completed at TUV-PTL	P
5.4.4	Polymeric materials intended for use as a superstrate or substrate, without appropriate IEC insulation pre-qualification, comply with the requirements of the Partial Discharge Test MST 15 of IEC 61730-2.	Test: Partial Discharge; Remarks: Maximum permissible voltage = 1018 V	P

Polymers Serving as Barriers (Clause 5.5)

Sec.	Description	Tests	Verdict
5.5a	Insulation barriers are of adequate thickness and of a material appropriate for the application, as defined by IEC 61140.	Certificate Verification: • JBox: R50280547 • Connector: R50175587 • Cable: R50188841 Visual inspection	P
5.5b	Barriers or liners are held in place and are not adversely affected	Visual inspection	N/A

Polymers Serving as Structural Glazing Materials (Clause 5.6)

Sec.	Description	Tests	Verdict
5.6	Polymers serving as structural glazing materials comply with the requirements for safety glazing by material certification (ANSI Z97.1-93) or by testing in accordance with Module Breakage Test MST 32 of IEC 61730-2.	Test: Module Breakage; Remarks: Successfully completed at TUV-PTL	P

Internal Wiring and Current-Carrying Parts (Clause 6)

Sec.	Description	Tests	Verdict
6.0	Any current-carrying part and wiring has the mechanical strength and current-carrying capacity necessary for its application.	Visual inspection. Remarks: 12 AWG	P

Internal Wiring (Clause 6.1)

Sec.	Description	Tests	Verdict
6.1.1	Wiring used within a module has an insulation rating for a minimum of 90°C, with a gauge and voltage rating acceptable for the application as defined by the requirements of IEC 60189-2.	Test: Reverse current overload test; Remarks: Successfully completed at TUV-PTL	P
6.1.2	The wiring of a module is located so that after installation of the module in the intended manner the insulation is not exposed to degrading effects of direct sunlight.	Certificate Verification: • JBox: R50280547 • Connector: R50175587 • Cable: R50188841	P

Splices (Clause 6.2)

Sec.	Description	Tests	Verdict
6.2	Splices are insulated equivalent to that required for the wiring involved.	Document verification BL: No such part	N/A

Mechanical Securement (Clause 6.3)

Sec.	Description	Tests	Verdict
6.3.1	Joints or connections are mechanically secure and provide electrical contact without strain on connections and terminals.	Test: Robust of termination; Remarks: Successfully completed at TUV-PTL	P
6.3.2	Uninsulated live parts are secured to its supporting surface so that they are prevented from turning or shifting in position.	Test: Robust of termination; Remarks: Successfully completed at TUV-PTL	P

Connections (Clause 7)

Field Connections – General Requirements (Clause 7.1)

Sec.	Description	Tests	Verdict
7.1.1	The module is provided with wiring terminals, connectors, or leads to accommodate current-carrying conductors of the load circuit.	Visual Inspection	P
7.1.2	Field connections are rated for exposure to direct sunlight as defined in Clause 5 of IEC 61730-1. Field connections are exposed to the degrading effects of direct sunlight.	Certificate Verification: • JBox: R50280547 • Connector: R50175587 • Cable: R50188841	P

Wiring Terminals (Clause 7.2)

Sec.	Description	Tests	Verdict
7.2.1	Field wiring terminal blocks are rated for the appropriate voltage and current for the application and constructed in compliance with IEC 60947-1.	See CDF 31483730.001	N/A
7.2.2	Wiring terminals integral to the construction of the terminal enclosure comply with the following requirements:	Remarks: Statement	--
7.2.2.1	Screws and nuts which clamp external conductors have a thread conforming with ISO 261 or ISO 262 (or comparable standards). The screws and nuts used for field wiring do not serve to fix any other component.	See CDF 31483730.001 Document verification: Installation manual	N/A
7.2.2.2	Terminal screws have a minimum nominal thread diameter a shown in Table 2 of IEC 61730-1. Stud terminals are provided with nuts and washers.	See CDF 31483730.001 Document verification: Installation manual	N/A
7.2.2.3	Terminals are designed that they clamp the conductor between metal surfaces with sufficient contact pressure and without damage to the conductor. Terminals are designed or located that the conductor cannot slip out when the clamping screws or nuts are tightened. Terminals are fixed suitably when the means of clamping the conductor is tightened or loosened: • The terminal itself does not work loose, • Internal wiring is not subjected to stress, • Creepage distances and clearances are not reduced below the values specified in clause 9 of IEC 61730-1.	Visual Inspection;	N/A

Connectors (Clause 7.3)

Sec.	Description	Tests	Verdict
7.3.1	The connector intended for use in the output circuit of the module is rated for the appropriate voltage and current, as per the requirements of the IEC 60130 series. Connectors comply with the requirements of Clause 5 of IEC 61730-1, with respect to flammability, comparative tracking index and relative thermal index for the support of live parts.	See CDF 31483730.001 Certificate Verification: • Connector: R50175587	P
7.3.2	The connector has been appropriately evaluated for disconnect overload performance.	Certificate Verification: • Connector: R50175587	P
7.3.3	Connectors intended for exposure to the outdoor environment are enclosed by material which complies with the following: • UV resistance in accordance with the requirements of Clause 5 • Resistance to inclusion of water acc. to IEC60529 (equivalent to IP55) • Steel ball impact test acc. to IEC 61721 • Accessibility Test MST 11 of IEC 61730-2	Certificate Verification: • Connector: R50175587	P
7.3.4	Separable multi-pole connectors are polarised. If two more separable connectors are provided, they are configured or arranged so that the other will not accept the mating connector for one.	Certificate Verification: • Connector: R50175587	P
7.3.5	For a connector incorporating a grounding member, the grounding member is the first to make and the last to break contact with the mating connector.	Visual Inspection	N/A
7.3.6	Connectors that can be separated without the use of a tool do not have accessible conductive parts, as determined under the Accessibility Test MST 11 of IEC 61730-2.	Certificate Verification: • Connector: R50175587	P

Output lead or cable (Clause 7.4)

Sec.	Description	Tests	Verdict
7.4	Leads extending from the module are rated for the appropriate system voltage, ampacity, wet locations, temperature and sunlight resistance.	Certificate Verification: • Cable: R50188841	P

Bonding and Grounding (Clause 8)

Sec.	Description	Tests	Verdict
8.1A	Throughout Clause 8, the term “grounding” shall be replaced with the term “bonding”.	Remarks: Clarification for CSA	--
8.2	If the module is rated as Safety Class II and provided with provisions for functional grounding, the functional grounding is isolated from live parts by reinforced insulation (subclause 7.3.2.2 of IEC 61140).	Tests: Leakage current and Dielectric Voltage Withstand; Remarks: Successfully completed at TUV-PTL	P
8.3	Each exposed conductive part of the module, that is assessable during normal operation, is bonded together, as verified by Ground Continuity Test MST 13 of IEC 61730-2. *Note: If conductive materials are used only as fasteners for installation and separated from the conductive components of the module by both appropriate insulation and spacings, they are not required to be bonded.*	Tests: Ground Continuity; Remarks: Successfully completed at TUV-PTL	P
8.4	Routine maintenance of the module does not involve breaking or disturbing the bonding path. A bolt, screw, or other part used for bonding purposes is not intended for securing the complete device.	Document verification: Installation Manual	P
8.5	Bonding is by a positive means, such as clamping, riveting, bolted or screwed connections, or welding, soldering or brazing. The bonding connection penetrates all nonconductive coatings, such as paint, anodized coatings or vitreous enamel.	Visual Inspection; Document verification: Installation Manual	P
8.6	All joints in the bonding path are mechanically secure.	Visual Inspection; Tests: Bonding Path after TC200; Remarks: Successfully completed at TUV-PTL	P
8.7	If the bonding connection depends upon screw threads, two or more screws or two full threads of a single screw engage the metal.	Visual Inspection; Remarks: Torque specified.	P
8.8	The diameter of the grounding screw or bolt is sized appropriately to the gauge of the bonding conductor, as per Table 2 of IEC 61730-1.	Remarks: Diameter = 4 mm	P
8.9	Ferrous metal parts in the grounding path are protected against corrosion by metallic or non-metallic coatings.	Visual Inspection; Document verification: Installation Manual	N/A
8.10	The module has metal-to-metal multiple-bearing pin-type hinges. These are considered to be an acceptable means for bonding.	Visual Inspection;	N/A

Sec.	Description	Tests	Verdict
8.11	A wiring terminal or bonding location is identified with the appropriate symbol (IEC 60417-5019) or has a green-coloured part. No other terminal or location is identified in this manner.	Visual Inspection; 	P
8.12	If a marking is used to identify an equipment grounding terminal, it is located on or adjacent to the terminal or on a wiring diagram affixed to the module or panel near the terminal.	Visual Inspection;	P

Creepage and Clearance Distances (Clause 9)

Sec.	Description	Tests	Verdict
9.1	Creepage and clearance distances between uninsulated live parts not of the same potential and between a live part and an accessible metal part, are not less than the values specified in Tables 3 and 4 of IEC 61730-1. Minimum measured creepage and clearance distances between field wiring terminals (mm). Minimum measured clearance distances between internal current carrying parts and accessible points 13.26 (mm)	Certificate Verification: • JBox: R50280547 • Connector: R50175587 • Cable: R50188841	P
9.2	Creepage and clearance distances at field wiring terminals have been judged on module open-circuit voltage (V_{oc}). If additional unmarked terminals exist in the terminal block, or if wiring terminals are marked specifically for grounding, the creepage and clearance distances have been judged on the basis of the maximum system operating voltage.	Certificate Verification: • JBox: R50280547 • Connector: R50175587 • Cable: R50188841	P
9.3	The spacings at a field-wiring terminal have been measured with and without wire connected to the terminal. If the terminal will properly accommodate it, and if the product was not marked to restrict its use, the wire is one size larger than that required, otherwise, the wire is of the required size.	Certificate Verification: • JBox: R50280547 • Connector: R50175587 • Cable: R50188841	P
9.4	Surfaces separated by a gap of 0.4 mm or less have been considered to be in contact with each other.	Remarks: Statement	--

Junction Boxes (Clause 10)

General (Clause 10.1)

Sec.	Description	Tests	Verdict
10.1	If the module is designed for the application of a permanently attached wiring system by an installer in the field, it is to be provided with an enclosed wiring compartment.	Certificate Verification: • JBox: R50280547 is not for field wiring	N/A

Wall Thickness (Clause 10.2)

Sec.	Description	Tests	Verdict
10.2	If the wiring compartment is intended for the attachment of a field-applied permanent wiring system, the minimum wall thickness for the material complies with Table 5 of IEC 61730-1.	Certificate Verification: • JBox: R50280547 is not for field wiring	N/A

Internal Volume (Clause 10.3)

Sec.	Description	Tests	Verdict
10.3	The internal volume for each intended conductor complies with the requirements of Table 6 of IEC 61730-1. In the space comprising the minimum required volume, no enclosure dimension is less than 20 mm.	Certificate Verification: • JBox: R50280547 is not for field wiring	N/A

Openings (Clause 10.4)

Sec.	Description	Tests	Verdict
10.4	All openings are provided with appropriate coverings, whose functions comply with the requirements of: • Subclause 5.2.1. of IEC 61730-1 • Wet leakage Current test of Subclause 10.20 of IEC 61646 or 10.17 of IEC 61215 Ed. 2 • Accessibility test TST 11 of IEC 61730-2 • Coverings can only be removed by the use of a tool	Certificate Verification: • JBox: R50280547 is not for field wiring	N/A

Gaskets and Seals (Clause 10.5)

Sec.	Description	Tests	Verdict
1035	Gaskets and seals do not deteriorate beyond limits during accelerated ageing, and are not used where they may be subject to flexing during normal operation. Reference IEC 60216-1 or CAN/CSA-C22.2 No. 94.2, Clause 7.7.1	Certificate Verification: • JBox: R50280547 is not for field wiring	N/A

Strain Relief (Clause 10.6)

Sec.	Description	Tests	Verdict
10.6	Any strain relief is provided so that stress on a lead intended for field connection, or otherwise likely to be handled in the field, including a flexible cord, is not transmitted to the electrical connection inside the module. *Note: Mechanical securement means which comply with Subclause 10.14 (Robustness of Terminations Test) of IEC 61215 meet this requirement.*	Jbox: R50280547 is not for field wiring	N/A

Sharp Edges (Clause 10.7)

Sec.	Description	Tests	Verdict
10.7.1	The enclosure is smooth and free from sharp edges, burrs, or the like that may damage insulation or conductors.	Jbox: R50280547 is not for field wiring	N/A
10.7.2	The inner edges of conduit openings and knockouts are smooth and free from sharp edges, burrs, or the like that may damage insulation or conductors.	Jbox: R50280547 is not for field wiring	N/A

Conduit Applications – Metallic (Clause 10.8)

Sec.	Description	Tests	Verdict
10.8.1	Any threaded hole in a metal wiring compartment intended for the connection of rigid metal conduit is reinforced to provide metal not less than 6.4 mm thick.	Visual Inspection; Remarks: N/A	N/A
	Any threaded hole is tapered unless a conduit end stop is provided.	Visual Inspection; Remarks: N/A	N/A
10.8.2	If threads for the connection of conduit are rapped all the way through a hole in a compartment wall, there are not less than 3.5 nor more than 5 threads in the metal.	Visual Inspection; Remarks: N/A	N/A
	The construction is such that a conduit bushing can be attached as intended.	Visual Inspection; Remarks: N/A	N/A
10.8.3	If threads for the connection of conduit are not tapped all the way through a hole in a compartment wall, there are not less than 5 full threads in the metal and there was a smooth, rounded inlet hole for the conductors.	Visual Inspection; Remarks: N/A	N/A
10.8.4	For a non-threaded opening in a metal wiring compartment intended to accommodate rigid metallic conduit, a flat surface of sufficient area is provided around the opening to accept the bearing surfaces of the bushing and lock washer.	Visual Inspection; Remarks: N/A	N/A
10.8.5	Conduit complies with the Conduit bending test MST 33 of IEC 61730-1.	Visual Inspection; Remarks: N/A	N/A

Conduit Applications – Non Metallic (Clause 10.9)

Sec.	Description	Tests	Verdict
10.9.1	The thickness of sides, end walls, and bottom of a non-metallic wiring enclosure specified for conduit applications is not less than the values specified in Table 7 of IEC 61730-1.	Visual Inspection; Remarks: N/A	N/A
10.9.2	A non-metallic wiring compartment intended to accommodate non-metallic conduit fulfils the following requirements. • It has one or more unthreaded conduit-connection sockets; • It has one or more threaded or unthreaded openings for a conduit-connection socket, or one or more knockouts that comply with the requirements of Knockout Test MST 44 of IEC 61730-2; • It complies with the Conduit Bending Test MST 33 of IEC61730-2, if intended for rigid non-metallic conduit	Visual Inspection; Remarks: N/A	N/A
10.9.3	Sockets for the connection of non-metallic conduit provide a positive end stop for the conduit.	Visual Inspection; Remarks: N/A	N/A
	The socket diameters, the throat diameter at the entrance to the box, the socket depths and the wall thickness of the socket are within the limits specified in the applicable conduit system.	Visual Inspection; Remarks: N/A	N/A
10.9.4	A knockout or opening in a non-metallic wiring compartment intended to accommodate rigid non-metallic conduit complies with the dimensional requirements of the applicable conduit system.	Visual Inspection; Remarks: N/A	N/A

Marking (Clause 11)

Sec.	Description	Tests	Verdict
11.1	The module includes the following clear and indelible markings: • Name, monogram or symbol of manufacturer • Type or model number • Serial number • Polarity of terminals or leads • Maximum system voltage • Safety class (IEC 61140) • The date and place of manufacture are marked on the module or are traceable from the serial number. • International symbols are used where applicable	Visual Inspection;	P
11.2	The following additional markings are applied to either the module or placed into the instruction and installation data (required documents): • Maximum over-current protection rating, as verified by the Reverse Current Overload Test MST 26 of IEC 61730-2 • Recommended maximum series /parallel module configurations • Application class • All electrical data are given relative to Standard Test Conditions (1000W/m² at 25°C)	Visual Inspection;	P
11.3	Connectors suitable only for field assembly of modules are marked “Do not disconnect under load”	Visual Inspection;	P
11.4	For modules with open –circuit voltage in excess of 50 V, and / or modules rated for maximum system voltage in excess of 50 V, a highly visible warning label regarding the shock hazard is applied near the means of connection to the module.	Visual Inspection; 	P

Requirements for Supplied Documents (Clause 12)

Sec.	Description	Tests	Verdict
12.1	The module or panel is supplied with installation instructions describing the methods of electrical and mechanical installation and the electrical ratings of the module	Document verification: Installation Manual	P
	The instructions state the application class under which the module was qualified and any specific limitations required for that application class.	Document verification: Installation Manual	P
12.2	When the fire rating is dependent on a specific mounting structure, specific spacing, or specific means of attachment to the roof or structure, details of the specific parameter or parameters are included in the instructions.	Document verification: Installation Manual	P
12.3	The electrical installation instructions include a detailed description of the wiring method. The description of the wiring method includes the following information: Grounding method Size, type, and temperature rating of the conductors Recommended maximum series/parallel module configurations Type of over-current protection and diode bypassing to be used Minimum cable diameters when the wiring method is cable Any limitations on wiring methods that apply to the wiring compartment or box	Document verification: Installation Manual	P
12.4	The mechanical installation instructions for roof mounting include: • A statement indicating the minimum mechanical means for securing the module or panel to the roof • A statement that the assembly is to be mounted over a fire resistant roof covering rated for the application (only for non-integral modules or panels) • Indication of any slope required for maintaining a fire class rating	Document verification: Installation Manual	P
12.5	The installation instructions include a statement advising that artificially concentrated sunlight shall not be directed on the module or panel.	Document verification: Installation Manual	P
12.6	Assembly instructions are provided with a product shipped in subassemblies, and are detailed and adequate to the degree required to facilitate total assembly of the product.	Remarks: N/A	N/A
12.7	The installation instructions include the proposed statement given in this sub-clause (or equivalent) to allow for increased output of the module resulting from certain conditions of use.	Document verification: Installation Manual	P

Tables Part 2 (IEC 61730-2)

Visual Inspection (Initial, MST 01)

Test date [DD/MM/YYYY]	Sample No.	Details / Comments	Verdict
30/10/2014	TRM1036	No major visual defects.	P
30/10/2014	TRM1054	No major visual defects.	P
30/10/2014	TRM1068	No major visual defects.	P
30/10/2014	TRM2170	No major visual defects.	P
30/10/2014	TRM2173	No major visual defects.	P
30/10/2014	TRM2188	No major visual defects.	P
30/10/2014	TRM2192	No major visual defects.	P
30/10/2014	TRM2267	No major visual defects.	P
30/10/2014	TRM3147	No major visual defects.	P
30/10/2014	TRM6062	No major visual defects.	P
30/10/2014	TRM6386	No major visual defects.	P
30/10/2014	TRM6403	No major visual defects.	P
30/10/2014	TRM6416	No major visual defects.	P
30/10/2014	TRM6453	No major visual defects.	P
30/10/2014	TRM6474	No major visual defects.	P
30/10/2014	TRM7124	No major visual defects.	P
30/10/2014	TRM7125	No major visual defects.	P
30/10/2014	TRM5357	No major visual defects.	P
30/10/2014	TRM4507*	No major visual defects.	P
30/10/2014	TRM3252*	No major visual defects.	P
30/10/2014	TRM2430	No major visual defects.	P
30/10/2014	TRM1434	No major visual defects.	P
30/10/2014	TRM3421	No major visual defects.	P
30/10/2014	TRM4908	No major visual defects.	P
Supplementary information: * samples for qualification by similarity, cell change.			

Certification Report No.: 31483730.002

Dielectric Withstand Test (Initial, MST 16)

Test date [DD/MM/YYYY]			14/11/2014, 17/11/2014			
Maximum system voltage [V_{DC}]			1000			
Test voltage 1* / Test voltage 2** [V]			3000		6000	
Module area [m²]			1.65			
Sample No.	Measured [µA]	Calculated [GΩ]	Result*** [GΩxm²]	Evidence of breakdown / arching? TV 1	Evidence of breakdown / arching? TV 2	Verdict
TRM6416	0.1	10	16.5	No	No	P
TRM2188	0.1	10	16.5	No	No	P
TRM7124	0.1	10	16.5	No	No	P
TRM3147	0.1	10	16.5	No	No	P
TRM6386	0.1	10	16.5	No	No	P
TRM2170	0.1	10	16.5	No	No	P
TRM2173	0.1	10	16.5	No	No	P
TRM2192	0.1	10	16.5	No	No	P
TRM6403	0.1	10	16.5	No	No	P
TRM6453	0.1	10	16.5	No	No	P
TRM5357	0.1	10	16.5	No	No	P
TRM4507	0.1	10	16.5	No	No	P
TRM3252	0.1	10	16.5	No	No	P

Supplementary information:

*IEC 61646: Dielectric withstand at 1000 V dc + twice the maximum systems voltage.

**IEC 61730: The maximum test voltage shall be equal to 2000 V plus four times the maximum system voltage for application-class A and equal to 1000V plus two times the maximum system voltage for application-class B.

*** Minimum requirement according to IEC 61215 is 0.04 GΩ*m²

TV stands for “test voltage applied”

Certification Report No.: 31483730.002

Wet Leakage Current Test (Initial, MST 17)

Test Voltage applied [V]	1000
Solution resistivity [Ω cm]	< 3,500 Ω cm
Surface tension [Nm^{-2}]	< 0,003 Nm^{-2}
Solution temperature [°C]	22 ± 3°C

Test date [DD/MM/YYYY]	Sample No.	Measured [µA]	Calculated [MΩ]	Area [m²]	Result* [MΩxm²]	Verdict
17/11/2014	TRM6416	12.0	83.3	1.65	137.5	P
17/11/2014	TRM2188	11.7	85.4	1.65	141	P
17/11/2014	TRM7124	12.3	81.3	1.65	134	P
14/11/2014	TRM3147	16.4	60.9	1.65	100.6	P
14/11/2014	TRM6386	17.5	57.1	1.65	94.2	P
14/11/2014	TRM2170	16.4	60.9	1.65	100.6	P
14/11/2014	TRM2173	15.9	62.8	1.65	103.6	P
17/11/2014	TRM2192	11.4	87.7	1.65	144.7	P
17/11/2014	TRM6403	12.2	81.9	1.65	135.2	P
17/11/2014	TRM6453	12.7	78.7	1.65	129.9	P
17/11/2014	TRM5357	12.4	80.6	1.65	133	P
17/11/2014	TRM4507	10.2	98	1.65	161.7	P
17/11/2014	TRM3252	11.1	90	1.65	148.6	P

Supplementary information:
* Minimum requirement acc. to the standard is 40 MΩ*m²

Accessibility Test (Initial, MST 11)

Test Date [DD/MM/YYYY]		14/11/2014, 17/11/2014	
Maximum System Voltage [V_{DC}]		1000	
Sample No	Position in Test Sequence	Result [MΩ]	Verdict
TRM3147	UV Sequence	∞	P
TRM2170	Damp Heat Sequence	∞	P
TRM2188	TC 200 Sequence	∞	P
TRM6453	TC 200 Sequence	∞	P
Supplementary Information: None.			

Ground Continuity Test (Initial, MST 13)

Maximum Over-Current Protection Rating [A]		15		
Current Applied [A]		37.5		
Location of Designated Grounding Point		Frame		
Location of Second Contacting Point		Frame		
Test date		14/11/2014, 17/11/2014		
Sample No	Position in Test Sequence	Voltage [mV]	Resistance [Ω]	Verdict
TRM3147	UV Sequence	31.6	0.0008	P
TRM2170	Damp Heat Sequence	28.5	0.0007	P
TRM2188	TC200 Sequence	38.2	0.001	P
TRM6453	TC200 Sequence	40.5	0.001	P
Supplementary Information: None.				

Certification Report No.: 31483730.002

Bypass diode thermal test (MST 25)

Test start and end date [DD/MM/YYYY]	21/11/2014					
Sample No.	TRM6403					
Module temperature [°C]	70					
Number of diodes in junction box	3					
Diode manufacturer / type designation	JMTHY		THY2550			
Max. permissible junction temperature (Tj_{max}) [°C]*	200					
	Diode 1		Diode 2		Diode 3	
Test current 1 (Isc) [A]	8.86		8.86		8.86	
Max. diode surface temperature [°C]	117.9		124.2		117.0	
Voltage drop [V]	0.6*		0.6*		0.6*	
Power dissipation [W]	5.316		5.316		5.316	
Thermal resistance junction to case (R_{THJC}) [K/W]	2*		2*		2*	
Calculated max. junction temp. (Tj_{calc}) [°C]	128.5		134.8		127.6	
Is $Tj_{calc} < Tj_{max}$?	☒ Yes	☐ No	☒ Yes	☐ No	☒ Yes	☐ No
Test current 2 (1.25 x Isc) [A]	11.08		11.08		11.08	
Max. diode surface temperature [°C]	129.2		138.3		132.4	
Diode functional?	☒ Yes	☐ No	☒ Yes	☐ No	☒ Yes	☐ No
Supplementary information: * According to the manufacturer's diode datasheet						

Visual inspection after bypass diode thermal test (MST 01)

Test date [DD/MM/YYYY]	Sample No.	Details / Comments	Verdict
02/12/2014	TRM6403	No major visual defects.	P
Supplementary information: None.			

Dielectric / Insulation test after bypass diode test (MST 16)

Test date [DD/MM/YYYY]			02/12/2014			
Maximum system voltage [V_{DC}]			1000			
Test voltage 1* / Test voltage 2** [V]			3000		6000	
Module area [m²]			1.65			
Sample No.	Measured [µA]	Calculated [GΩ]	Result*** [GΩxm²]	Evidence of breakdown / arching? TV 1	Evidence of breakdown / arching? TV 2	Verdict
TRM6403	0.1	10	16.5	No	No	P
Supplementary information: *IEC 61646: Dielectric withstand at 1000 V dc + twice the maximum systems voltage. **IEC 61730: The maximum test voltage shall be equal to 2000 V plus four times the maximum system voltage for application-class A and equal to 1000V plus two times the maximum system voltage for application-class B. *** Minimum requirement according to IEC 61215 is 0.04 GΩ*m² TV stands for "test voltage applied"						

Wet leakage current test after bypass diode test (MST 17)

Test Voltage applied [V]		1000				
Solution resistivity [Ω cm]		< 3,500 Ω cm				
Surface tension [Nm^{-2}]		< 0,003 Nm^{-2}				
Solution temperature [°C]		22 ± 3°C				
Test date [DD/MM/YYYY]	Sample No.	Measured [µA]	Calculated [MΩ]	Area [m^2]	Result* [MΩxm^2]	Verdict
02/12/2014	TRM6403	12.2	81.9	1.65	135.1	P

Supplementary information:
* Minimum requirement acc. to the standard is 40 MΩ*m^2
**STI5017 and STI5021 as Damp Heat re-test passed.

Hot-spot endurance test (MST 22)

Test date [DD/MM/YYYY]	14/01/2015		
Sample No.	TRM6403		
Cell interconnection circuit	☒ S	☐ SP	☐ SPS
Module temperature at thermal equilibrium [°C]	18.6		
Maximum measured cell temperature at worst case cell [°C]	82.3		
Shading rate* [%]	12.5		

Supplementary information:

The hot-spot endurance test is performed according to a draft for IEC 61215 ed.3: since test experience shows that one five-hour-long cycle does not lead to additional information, separate cycles of one hour with different cells shaded are performed instead.

Visual inspection after Hot-spot endurance test (MST 01)

Test date [DD/MM/YYYY]	Sample No.	Details / Comments	Verdict
15/01/2015	TRM6403	No major visual defects.	P

Supplementary information: None.

Dielectric / Insulation test after Hot-spot endurance test (MST 16)

Test date [DD/MM/YYYY]			15/01/2015			
Maximum system voltage [V_{DC}]			1000			
Test voltage 1* / Test voltage 2** [V]			3000		6000	
Module area [m²]			1.65			
Sample No.	Measured [µA]	Calculated [GΩ]	Result*** [GΩxm²]	Evidence of breakdown / arching?		Verdict
				TV 1	TV 2	
TRM6403	0.1	10	16.5	No	No	P

Supplementary information:

None.

Wet leakage current test after Hot-spot endurance test (MST 17)

Test Voltage applied [V]			1000			
Solution resistivity [Ω cm]			< 3,500 Ω cm			
Surface tension [Nm^{-2}]			< 0,003 Nm^{-2}			
Solution temperature [°C]			22 ± 3°C			
Test date [DD/MM/YYYY]	Sample No.	Measured [µA]	Calculated [MΩ]	Area [m²]	Result* [MΩxm²]	Verdict
15/01/2015	TRM6403	8.9	112.4	1.65	186.5	P

Supplementary information:

* Minimum requirement acc. to the standard is 40 MΩ*m²

**STI5017 and STI5021 as Damp Heat re-test passed.

UV preconditioning test (MST 54)

Test start / test end [DD/MM/YYYY]	14/11/2014 to 18/11/2014
Module temperature [°C]	60
Ratio of UV-B irradiation (280 – 320 nm) [%]	5.77
UV irradiation dose (280 – 400 nm) [kWh/m²]	15.235

Sample No.	Details / Comments	Verdict
TRM3147	No major visual defects.	P
TRM6386	No major visual defects.	P

Supplementary information: None.

Visual inspection after UV preconditioning test (MST 01)

Test date [DD/MM/YYYY]	Sample No.	Details / Comments	Verdict
02/12/2014	TRM3147	No major visual defects.	P
02/12/2014	TRM6386	No major visual defects.	P

Supplementary information: None.

Dielectric / Insulation test after UV preconditioning test (MST 16)

Test date [DD/MM/YYYY]			02/12/2014			
Maximum system voltage [V_{DC}]			1000			
Test voltage 1* / Test voltage 2** [V]			3000		6000	
Module area [m²]			1.65			
Sample No.	Measured [µA]	Calculated [GΩ]	Result*** [GΩxm²]	Evidence of breakdown / arching?		Verdict
				TV 1	TV 2	
TRM3147	0.1	10	16.5	No	No	P
TRM6386	0.1	10	16.5	No	No	P

Supplementary information:

*IEC 61646: Dielectric withstand at 1000 V dc + twice the maximum systems voltage.

**IEC 61730: The maximum test voltage shall be equal to 2000 V plus four times the maximum system voltage for application-class A and equal to 1000V plus two times the maximum system voltage for application-class B.

*** Minimum requirement according to IEC 61215 is 0.04 GΩ*m²

TV stands for “test voltage applied”

Thermal cycling 50 test (51)

Test start / test end [DD/MM/YYYY]	18/11/2014 to 26/11/2014
Total cumulative cycles	50

Sample No.	Details / Comments	Verdict
TRM3147	No major visual defects.	P
TRM6386	No major visual defects.	P

Supplementary information: None.

Visual inspection after Thermal cycling 50 test (MST 01)

Test date [DD/MM/YYYY]	Sample No.	Details / Comments	Verdict
02/12/2014	TRM3147	No major visual defects.	P
02/12/2014	TRM6386	No major visual defects.	P
Supplementary information: None.			

Insulation test after Thermal cycling 50 test (MST 16)

Test date [DD/MM/YYYY]			02/12/2014			
Maximum system voltage [V_{DC}]			1000			
Test voltage 1* / Test voltage 2** [V]			3000		6000	
Module area [m²]			1.65			
Sample No.	Measured [µA]	Calculated [GΩ]	Result*** [GΩxm²]	Evidence of breakdown / arching? TV 1	Evidence of breakdown / arching? TV 2	Verdict
TRM3147	0.1	10	16.5	No	No	P
TRM6386	0.1	10	16.5	No	No	P

Supplementary information:

*IEC 61646: Dielectric withstand at 1000 V dc + twice the maximum systems voltage.

**IEC 61730: The maximum test voltage shall be equal to 2000 V plus four times the maximum system voltage for application-class A and equal to 1000V plus two times the maximum system voltage for application-class B.

*** Minimum requirement according to IEC 61215 is 0.04 GΩ*m²

TV stands for “test voltage applied”

Thermal cycling 200 test (51)

Test start / test end [DD/MM/YYYY]	18/11/2014 to 22/12/2014	
Total cumulative cycles	200	
Sample No.	Details / Comments	Verdict
TRM2188	No open circuit	P
TRM7124	No open circuit	P
TRM6453	No open circuit	P
Supplementary information: None.		

Visual inspection after Thermal cycling 200 test (MST 01)

Test date [DD/MM/YYYY]	Sample No.	Details / Comments	Verdict
23/12/2014	TRM2188	No major visual defects.	P
23/12/2014	TRM7124	No major visual defects.	P
23/12/2014	TRM6453	No major visual defects.	P
Supplementary information: None.			

Insulation test after Thermal cycling 200 test (MST 16)

Test date [DD/MM/YYYY]			23/12/2014			
Maximum system voltage [V_{DC}]			1000			
Test voltage 1* / Test voltage 2** [V]			3000		6000	
Module area [m²]			1.65			
Sample No.	Measured [µA]	Calculated [GΩ]	Result*** [GΩxm²]	Evidence of breakdown / arching?		Verdict
				TV 1	TV 2	
TRM2188	0.1	10	16.5	No	No	P
TRM7124	0.1	10	16.5	No	No	P
TRM6453	0.1	10	16.5	No	No	P

Supplementary information:

*IEC 61646: Dielectric withstand at 1000 V dc + twice the maximum systems voltage.

**IEC 61730: The maximum test voltage shall be equal to 2000 V plus four times the maximum system voltage for application-class A and equal to 1000V plus two times the maximum system voltage for application-class B.

*** Minimum requirement according to IEC 61215 is 0.04 GΩ*m²

TV stands for “test voltage applied”

Humidity freeze test (52)

Test start / test end [DD/MM/YYYY]	02/12/2014 / 12/12/2014	
Total cumulative cycles	10	
Sample No.	Details / Comments	Verdict
TRM3147	No open circuit	P
TRM6386	No open circuit	P
Supplementary information: None.		

Visual inspection after Humidity freeze test (MST 01)

Test date [DD/MM/YYYY]	Sample No.	Details / Comments	Verdict
12/12/2014	TRM3147	Bubbled backsheet. No major visual defects	P
12/12/2014	TRM6386	Bubbled backsheet. No major visual defects	P
Supplementary information: None.			

Insulation test after Humidity freeze test (MST 16)

Test date [DD/MM/YYYY]			12/12/2014			
Maximum system voltage [V_{DC}]			1000			
Test voltage 1* / Test voltage 2** [V]			3000		6000	
Module area [m²]			1.65			
Sample No.	Measured [µA]	Calculated [GΩ]	Result*** [GΩxm²]	Evidence of breakdown / arching?		Verdict
				TV 1	TV 2	
TRM3147	0.2	5	8.25	No	No	P
TRM6386	0.3	3.3	5.45	No	No	P

Supplementary information:

*IEC 61646: Dielectric withstand at 1000 V dc + twice the maximum systems voltage.

**IEC 61730: The maximum test voltage shall be equal to 2000 V plus four times the maximum system voltage for application-class A and equal to 1000V plus two times the maximum system voltage for application-class B.

*** Minimum requirement according to IEC 61215 is 0.04 GΩ*m²

TV stands for “test voltage applied”

Damp heat test (MST 53)

Test start / test end [DD/MM/YYYY]	14/11/2014 / 29/12/2014	
Total cumulative cycles	1000 hours	
Sample No.	Details / Comments	Verdict
TRM2170	Bubbled backsheet. No major visual defects	P
TRM2173	Bubbled backsheet. No major visual defects	P
Supplementary information: None.		

Visual inspection after Damp heat test (MST 01)

Test date [DD/MM/YYYY]	Sample No.	Details / Comments	Verdict
29/12/2014	TRM2170	Bubbled backsheet. No major visual defects	P
29/12/2014	TRM2173	Bubbled backsheet. No major visual defects	P
Supplementary information: None.			

Insulation test after Damp heat test (MST 16)

Test date [DD/MM/YYYY]			29/12/2014			
Maximum system voltage [V_{DC}]			1000			
Test voltage 1* / Test voltage 2** [V]			3000		6000	
Module area [m²]			1.65			
Sample No.	Measured [µA]	Calculated [GΩ]	Result*** [GΩxm²]	Evidence of breakdown / arching?		Verdict
				TV 1	TV 2	
TRM2170	0.1	10	16.5	No	No	P
TRM2173	0.1	10	16.5	No	No	P

Supplementary information:

*IEC 61646: Dielectric withstand at 1000 V dc + twice the maximum systems voltage.

**IEC 61730: The maximum test voltage shall be equal to 2000 V plus four times the maximum system voltage for application-class A and equal to 1000V plus two times the maximum system voltage for application-class B.

*** Minimum requirement according to IEC 61215 is 0.04 GΩ*m²

TV stands for “test voltage applied”

Wet leakage current test after Damp heat test (MST 17)

Test Voltage applied [V]		1000				
Solution resistivity [Ω cm]		< 3,500 Ω cm				
Surface tension [Nm^{-2}]		< 0,003 Nm^{-2}				
Solution temperature [°C]		22 ± 3°C				
Test date [DD/MM/YYYY]	Sample No.	Measured [µA]	Calculated [MΩ]	Area [m^2]	Result* [MΩxm^2]	Verdict
29/12/2014	TRM2170	8.2	121.9	1.65	202.4	P
29/12/2014	TRM2173	8.1	123.5	1.65	205.0	P
Supplementary information: * Minimum requirement acc. to the standard is 40 MΩ*m^2 **STI5017 and STI5021 as Damp Heat re-test passed.						

Robustness of terminations test (MST 42)

Test date [DD/MM/YYYY]	15/12/2014	
Sample No.	TRM3147	
Applied force in all directions [N]	40	
Types of termination	☒ Type A: wire or flying lead	
	☐ Type B: tags, threaded studs, screws, etc.	
	☒ Type C: connector	
Evidence of mechanical damage?	☐ Yes	☒ No
Section 10.2 satisfied?	☒ Yes	☐ No
Section 10.3 satisfied?	☒ Yes	☐ No
Verdict	☒ Pass	☐ Fail
Supplementary information: None.		

Visual inspection after Robustness of terminations test (MST 01)

Test date [DD/MM/YYYY]	Sample No.	Details / Comments	Verdict
16/12/2014	TRM3147	No major visual defects.	P
Supplementary information: None.			

Insulation test after Robustness of terminations test (MST 16)

Test date [DD/MM/YYYY]			16/12/2014			
Maximum system voltage [V_{DC}]			1000			
Test voltage 1* / Test voltage 2** [V]			3000		6000	
Module area [m²]			1.65			
Sample No.	Measured [µA]	Calculated [GΩ]	Result*** [GΩxm²]	Evidence of breakdown / arching?		Verdict
				TV 1	TV 2	
TRM3147	0.1	10	16.5	No	No	P

Supplementary information:

*IEC 61646: Dielectric withstand at 1000 V dc + twice the maximum systems voltage.

**IEC 61730: The maximum test voltage shall be equal to 2000 V plus four times the maximum system voltage for application-class A and equal to 1000V plus two times the maximum system voltage for application-class B.

*** Minimum requirement according to IEC 61215 is 0.04 GΩ*m²

TV stands for "test voltage applied"

Mechanical load test (MST 34)

Test date [DD/MM/YYYY]	13/01/2015, 14/01/2015, 15/01/2015	
Sample No.	TRM2170	
Pressure mechanical load applied [Pa]	2400	
Tensile mechanical load applied [Pa]	N/A	
Open circuits observed?	☐ Yes	☒ No
Verdict	☒ Pass	☐ Fail

Supplementary information:

Load was applied pneumatically; mounting on existing frame holes.

Visual inspection after Mechanical load test (MST 01)

Test date [DD/MM/YYYY]	Sample No.	Details / Comments	Verdict
16/01/2015	TRM2170	No major visual defects.	P

Supplementary information: None.

Insulation test after Mechanical load test (MST 16)

Test date [DD/MM/YYYY]			16/01/2015			
Maximum system voltage [V_{DC}]			1000			
Test voltage 1* / Test voltage 2** [V]			3000		6000	
Module area [m²]			1.65			
Sample No.	Measured [μA]	Calculated [GΩ]	Result*** s[GΩxm²]	Evidence of breakdown / arching?		Verdict
				TV 1	TV 2	
TRM2170	0.1	10	16.5	No	No	P

Supplementary information:

*IEC 61646: Dielectric withstand at 1000 V dc + twice the maximum systems voltage.

**IEC 61730: The maximum test voltage shall be equal to 2000 V plus four times the maximum system voltage for application-class A and equal to 1000V plus two times the maximum system voltage for application-class B.

*** Minimum requirement according to IEC 61215 is 0.04 GΩ*m²

TV stands for “test voltage applied”

Wet leakage current test after Mechanical load test (MST 17)

Test Voltage applied [V]		1000				
Solution resistivity [Ω cm]		< 3,500 Ω cm				
Surface tension [Nm^{-2}]		< 0,003 Nm^{-2}				
Solution temperature [°C]		22 ± 3°C				
Test date [DD/MM/YYYY]	Sample No.	Measured [μA]	Calculated [MΩ]	Area [m²]	Result* [MΩxm²]	Verdict
16/01/2015	TRM2170	12	83.3	1.65	137.8	P

Supplementary information:

* Minimum requirement acc. to the standard is 40 MΩ*m²

**STI5017 and STI5021 as Damp Heat re-test passed.

Cut Susceptibility Test (MST 12)

Applied Force [N]		2 lbs
Test Date [DD/MM/YYYY]		17/12/2014, 15/01/2015, 27/01/2015
Sample No	Remarks:	Verdict
TRM3147 TRM7124 TRM2170	☒ No visual evidence that the superstrate or substrate have been cut ☒ No exposure of active circuitry of the module ☒ Requirement of MST 13, MST 16, MST 17 are met (see appended tables 10.4, 10.6, MST 17)	P P P
Supplementary Information: None.		

Dielectric Withstand Test After Cut Susceptibility Test (MST 16)

Test date [DD/MM/YYYY]			17/12/2014, 21/01/2015, 30/01/2015		
Maximum system voltage [V_{DC}]			1000		
Test voltage 1* / Test voltage 2** [V]			3000	6000	
Module area [m²]			1.65		
Sample No.	Measured [µA]	Calculated [GΩ]	Result*** s[GΩxm²]	Evidence of breakdown / arching? TV 1	TV 2	Verdict
TRM3147	0.1	10	16.5	No	No	P
TRM7124	0.1	10	16.5	No	No	P
TRM2170	0.1	10	16.5	No	No	P
Supplementary information: None.						

Wet Leakage Current Test After Cut Susceptibility Test (MST 17)

Test Voltage applied [V]		1000				
Solution resistivity [Ω cm]		< 3,500 Ω cm				
Surface tension [Nm^{-2}]		< 0,003 Nm^{-2}				
Solution temperature [°C]		22 ± 3°C				
Test date [DD/MM/YYYY]	Sample No.	Measured [µA]	Calculated [MΩ]	Area [m²]	Result* [MΩxm²]	Verdict
17/12/2014	TRM3147	10.6	94.34	1.65	156.6	P
21/01/2015	TRM7124	10.6	94.34	1.65	156.6	P
30/01/2015	TRM2170	12.5	80	1.65	132	P
Supplementary information: None.						

Accessibility Test After Cut Susceptibility Test (MST 11)

Test Date [DD/MM/YYYY]		17/12/2014, 22/01/2015, 30/01/2015	
Maximum System Voltage [V_{DC}]		1000	
Sample No	Position in Test Sequence	Result [MΩ]	Verdict
TRM3147	UV Sequence	∞	P
TRM7124	TC 200 Sequence	∞	P
TRM2170	Damp Heat Sequence	∞	P
Supplementary information: None.			

Ground Continuity Test After Cut Susceptibility Test (MST 13)

Test Date [DD/MM/YYYY]		17/12/2014, 22/01/2015, 30/01/2015		
Maximum Over-Current Protection Rating [A]		15		
Current Applied [A]		37.5		
Location of Designated Grounding Point		Frame		
Location of Second Contacting Point		Frame		
Sample No	Position in Test Sequence	Voltage [mV]	Resistance [mΩ]	Verdict
TRM3147	UV Sequence	57.8	0.001	P
TRM7124	TC 200 Sequence	33.6	0.00089	P
TRM2170	Damp Heat Sequence	75.8	0.002	P
Supplementary information: None.				

Impulse Voltage Test (MST 14)

Test Date [DD/MM/YYYY]	15/01/2015	
Maximum System Voltage [V]	1000	
Impulse Voltage [V]	8000	
Thickness of Conductive Foil [mm]	0.06	
Sample No	Remarks	Verdict
TRM6453	☒ No Evidence of Dielectric Breakdown or Surface Tracking Observed	P
	☒ No Evidence of Major Visual Defects (see appended table 10.1)	P
Supplementary Information: See Impulse Voltage Test Record in Annex 1.		

Dielectric Withstand Test After Impulse Voltage Test (MST 16)

Test date [DD/MM/YYYY]			16/01/2015			
Maximum system voltage [V_{DC}]			1000			
Test voltage 1* / Test voltage 2** [V]			3000		6000	
Module area [m²]			1.65			
Sample No.	Measured [µA]	Calculated [GΩ]	Result*** s[GΩxm²]	Evidence of breakdown / arching?		Verdict
				TV 1	TV 2	
TRM6453	0.1	10	16.5	No	No	P
Supplementary information: None.						

Certification Report No.: 31483730.002

Temperature Test (MST 21)

Sample ID		TRM2192		
Reference solar irradiance (W/m²)		1000		
Reference ambient temperature (°C)		40		
Module Open-Circuited		Date: (DD/MM/YYYY) 02/01/2015		
Measuring Location	Component Temp., T_{obs} (°C)	Normalised Temp., T_{con} (°C)	Component Temp. Limit (°C)	Verdict
Front glass above center cell	10.7	39.94	N/A	N/A
Back sheet behind center cell	42.7	72.01	105	P
J-box inside surface	32.9	62.17	85	P
Ambient air within J-box	32.3	61.59	85	P
Positive terminal	10.2	39.46	85	P
Field wiring	30.9	60.18	85	P
Diode 1	35.4	64.65	200	P
Diode 2	34.6	63.82	200	P
Diode 3	36.5	65.81	200	P
Module Short-Circuited		Date: (DD/MM/YYYY) 02/01/2015		
Measuring Location	Component Temp., T_{obs} (°C)	Normalised Temp., T_{con} (°C)	Component Temp. Limit (°C)	Verdict
Front glass above center cell	13.9	45.55	N/A	N/A
Back sheet behind center cell	46.9	78.55	105	P
J-box inside surface	37.1	68.68	85	P
Ambient air within J-box	36.6	68.27	85	P
Positive terminal	18.2	49.87	85	P
Field wiring	34.9	66.57	85	P
Diode 1	40.5	72.17	200	P
Diode 2	39.0	70.63	200	P
Diode 3	42.0	73.59	200	P
Supplementary information: $T_{con} = T_{obs} + (40°C – T_{AMB})$.				

Certification Report No.: 31483730.002

Temperature Test (MST 21)

Sample ID		TRM3252		
Reference solar irradiance (W/m²)		1000		
Reference ambient temperature (°C)		40		
Module Open-Circuited		Date: (DD/MM/YYYY) 06/02/2015		
Measuring Location	Component Temp., T_{obs} (°C)	Normalised Temp., T_{con} (°C)	Component Temp. Limit (°C)	Verdict
Front glass above center cell	73.8	78.3	N/A	N/A
Back sheet behind center cell	75	79.5	105	P
J-box inside surface	68.8	73.4	85	P
Ambient air within J-box	69.4	74	85	P
Positive terminal	66.9	71.4	85	P
Field wiring	62	66.5	85	P
Diode 1	71.8	76.3	200	P
Diode 2	70.4	74.9	200	P
Diode 3	71.6	76.2	200	P
Module Short-Circuited		Date: (DD/MM/YYYY) 05/02/2015		
Measuring Location	Component Temp., T_{obs} (°C)	Normalised Temp., T_{con} (°C)	Component Temp. Limit (°C)	Verdict
Front glass above center cell	77.5	85.2	N/A	N/A
Back sheet behind center cell	78.2	85.9	105	P
J-box inside surface	67.9	75.6	85	P
Ambient air within J-box	70.3	77.9	85	P
Positive terminal	69.6	77.3	85	P
Field wiring	64.2	71.9	85	P
Diode 1	71.3	79	200	P
Diode 2	71.6	79.3	200	P
Diode 3	73.1	80.8	200	P

Supplementary information:

- $T_{con} = T_{obs} + (40°C – T_{AMB})$.
- Module is part of the combined Qualification by Similarity testing program for addition to cell and frame.

Fire Test (MST 23)

Test Date [DD/MM/YYYY]	16/01/2015	
Module Fire Resistance Class (A, B, C)	C	
No of Modules Provided to Create the Test Assembly	2	
Sample No	Remarks	Verdict
TRM3147	☒ The Module Complies with the Requirements for the Fire Resistance Class	P
TRM6386	☒ The Module Complies with the Requirements for the Fire Resistance Class	P
Supplementary Information: None.		

Reverse Current Overload Test (MST 26)

Test Date [DD/MM/YYYY]	14/01/2015, 20/01/2015	
Module Over-Current protection Rating (A)	15	
Test Current [A]	20.25	
Range of Applied Voltage [V]	39.8	
Test Duration	2 hours	
Sample No	Remarks	Verdict
TRM5357 TRM4507*	☒ No Flaming of the Module	P
	☒ No Flaming or Charring of the Cheesecloth	P
	☒ No Flaming of the Tissue Paper	P
	☒ MST 17 Requirements Fulfilled (see appended table MST17)	P
Supplementary Information: *Module part of Qualification by Similarity Program for addition of cell and frame.		

Wet Leakage Current Test After Reverse Current Test (MST 17)

Test Voltage applied [V]	1000					
Solution resistivity [Ω cm]	< 3,500 Ω cm					
Surface tension [Nm^{-2}]	< 0,003 Nm^{-2}					
Solution temperature [°C]	22 ± 3°C					
Test date [DD/MM/YYYY]	Sample No.	Measured [µA]	Calculated [MΩ]	Area [m^2]	Result* [MΩxm^2]	Verdict
27/01/2015	TRM5357	10.5	95.24	1.65	158.1	P
30/01/2015	TRM4507**	10.1	99.0	1.65	164.4	P
Supplementary information: * Minimum requirement acc. to the standard is 40 MΩ*m^2 **Module part of Qualification by Similarity Program for addition of cell and frame.						

Certification Report No.: 31483730.002

Module Breakage Test (MST 32)

Test Date [DD/MM/YYYY]		06/02/2015
Weight of Impactor [kg]		45.5±0.5
Mounting Technique Used		Mounting holes
No. of Mounting Holes/ Clamps Applied		4
Module Breakage		☐ No Breakage ☐ Breakage at 300 mm ☐ Breakage at 450 mm ☒ Breakage at 1220 mm
Sample No	Remarks	Verdict
TRM5357	☒ Breakage Occurred, but no Shear or Opening Large Enough for a 76 mm Diameter Sphere to Pass Freely has Developed.	P
	☐ Disintegration Occurred, but the Ten Largest Crack-Free Particles Selected 5 min Subsequent to the Test did not Weigh More in Grams than 16 Times the Thickness of the Sample in Millimetres.	
	☐ Breakage Occurred, but no Particles Larger than 6.5 cm² have been Ejected from the Sample.	
Supplementary Information: None.		

Partial Discharge (MST 15)

Test Date [DD/MM/YYYY]	N/A	
Sample ID	N/A	
Verdict	☐ Pass	☐ Fail
Supplementary Information: VED test report 5012644-3972-0000/172090.		

Terminal Box Knockout Test (MST 44)

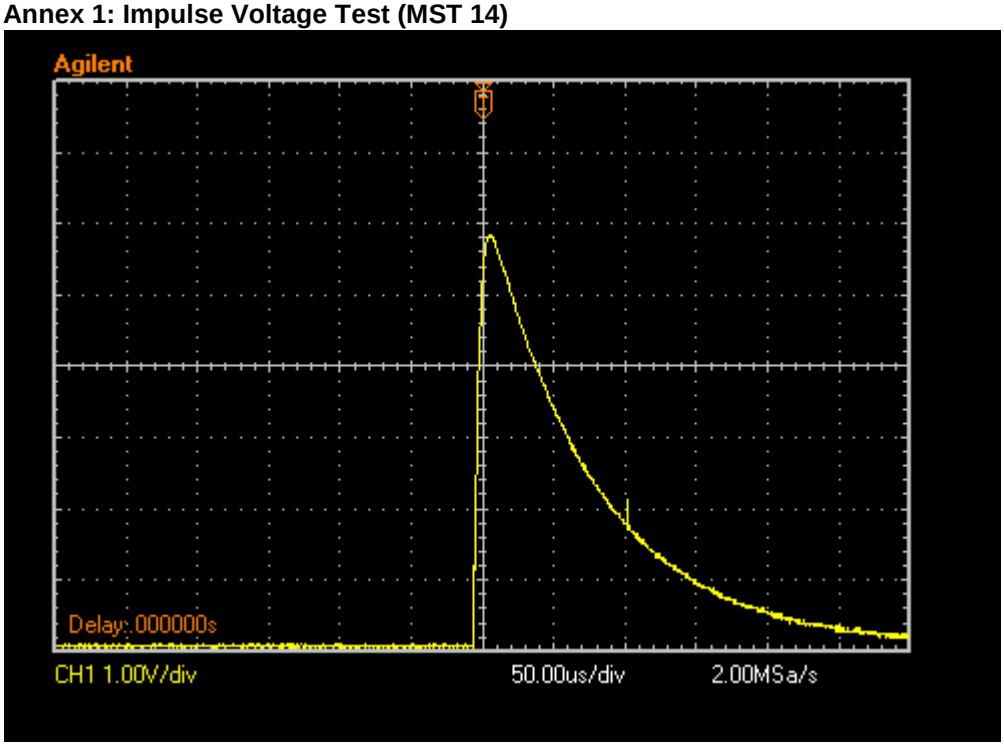
Test Date [DD/MM/YYYY]			N/A		
Applied Force for one Minute			N/A		
“As Received” Temperature			N/A		
“Conditioned” Temperature / Time			N/A		
Sample No	Displacement (< 0.75mm)	Easily Removed	No Sharp Edges	No Damage to Box	Verdict
N/A	N/A	N/A	N/A	N/A	N/A
Supplementary Information: Junction box IEC listed, therefore not applicable.					

Conduit Bending Test (MST 33)

Test Date [DD/MM/YYYY]	N/A	
Force	N/A	
Sample No	Remarks	Verdict
N/A	☐ Junction box walls do not rupture or separate from the conduit.	N/A
Supplementary Information: Junction box IEC listed, therefore not applicable.		

ANNEXES

Annex 1: Impulse Voltage Test (MST 14)



Annex 2: Equipment List

Equipment ID	Equipment Type	Last Cal. Date	Test Date	Next Cal. Date	Test Procedure
A45	Shunt	24/01/2014 20/01/2015	14/11/2014, 17/11/2014, 17/12/2014, 14/01/2015, 20/01/2015, 22/01/2015, 30/01/2015	24/01/2015 20/01/2016	13, 26
A98	Thermometer	15/04/2014	21/11/2014	15/04/2015	25
A103	Chamber 7	29/04/2014	14/11/2014 to 29/12/2014	29/04/2015	53
A233	Weight 2 lbs	09/12/2013	17/12/2014, 15/01/2015	09/12/2015	12
A234	Weight 2 lbs	09/12/2013	27/01/2015	09/12/2015	12
A239	Anemometer	25/04/2013	16/01/2015	25/04/2016	23
A241	DMM	15/04/2014	14/11/2014, 17/11/2014, 13/01/2015, 14/01/2015, 15/01/2015	15/04/2015	11, 13, 34
A244	DMM	21/04/2014	17/12/2014, 22/01/2015, 22/01/2015, 30/01/2015	21/04/2015	11, 13
A245	DMM	21/04/2014	21/11/2014, 17/12/2014	21/04/2015	11, 25
A246	DMM	21/04/2014	14/11/2014, 17/11/2014, 17/12/2014, 14/01/2015, 20/01/2015, 22/01/2015, 30/01/2015	21/04/2015	13, 26
A248	Shunt	24/01/2014	21/11/2014	24/01/2015	25
A255	Chamber 4	14/03/2014	02/12/2014 to 12/12/2014	14/03/2015	52
A256	Chamber 5	01/05/2014	18/11/2014 to 26/11/2014 18/11/2014 to 02/12/2014	01/05/2015	51
A260	Timer	21/02/2014	27/01/2015	21/02/2015	12
A275	DAS	14/02/2013	02/01/2015, 14/01/2015, 05/02/2015, 06/02/2015	14/02/2015	21, 22
A280	Timer	03/02/2014	14/11/2014, 15/01/2015	03/02/2015	12, 13
A281	Timer	03/02/2014	16/01/2015	03/02/2015	23
A282	Timer	02/03/2014	14/01/2015, 20/01/2015, 22/01/2015	02/03/2015	13, 26
A294	Scale	18/09/2013	15/12/2014, 13/01/2015	18/09/2015	34, 42
A310	Probe	23/10/2014	14/11/2014, 17/11/2014, 17/12/2014, 22/01/2015	23/10/2015	11
A311	Oscilloscope	24/02/2014	15/01/2015	24/02/2015	14
A312	Pulse generator	NR	15/01/2015	NR	14
A320	Chamber 1	19/02/2014	02/12/2014 to 22/12/2014	19/02/2015	51
A323	Probe	23/10/2014	30/01/2015	23/10/2016	11
A330	Breakage tester	NR	06/02/2015	NR	32
A353	Thermometer	10/03/2014	16/01/2015	10/03/2015	23

Equipment ID	Equipment Type	Last Cal. Date	Test Date	Next Cal. Date	Test Procedure
A372	Dielectric tester	27/02/2014	14/11/2014, 17/11/2014, 02/12/2014, 12/12/2014, 16/12/2014, 17/12/2014, 23/12/2014, 29/12/2014, 15/01/2015, 16/01/2015, 21/01/2015, 27/01/2015, 30/01/2015	27/02/2015	16, 17
A411	Cut tester	NR	17/12/2014, 15/01/2015, 27/01/2015	NR	12
A412	Motor	NR	17/12/2014, 15/01/2015, 27/01/2015	NR	12
A425	Power supply	NR	14/11/2014, 17/11/2014, 22/01/2015, 30/01/2015	NR	13
A504	UV chamber	11/09/2014	14/11/2014 to 18/11/2014	11/09/2016	54
A803P	Reference cell	25/08/2014	02/01/2015, 05/02/2015, 06/02/2015	25/08/2015	21
A823P	Reference cell	25/08/2014	14/01/2015	25/08/2015	22
A944	Wind sensor	08/04/2013	14/01/2015, 05/02/2015, 06/02/2015	08/04/2016	21, 22
A985	Timer	16/04/2014	15/12/2014, 17/12/2014, 13/01/2015, 14/01/2015, 15/01/2015	16/04/2015	12, 13, 34, 42
A986	Timer	16/04/2014	17/11/2014, 21/11/2014, 30/01/2015	16/04/2015	13, 25
A988	14 gauge thermocouple	07/01/2015	16/01/2015	07/01/2016	23
A989	14 gauge thermocouple	07/01/2015	16/01/2015	07/01/2016	23
PS1	Power supply	NR	14/01/2015, 20/01/2015	NR	26
PS31	Power supply	NR	21/11/2014	NR	25
PS100	Power supply	NR	17/12/2014	NR	13
T05	Thermocouple	13/08/2014	02/01/2015	13/08/2015	21
T61	Thermocouple	13/08/2014	02/01/2015, 05/02/2015, 06/02/2015	13/08/2015	21
T91	Thermocouple	13/08/2014	02/01/2015	13/08/2015	21
T92	Thermocouple	13/08/2014	02/01/2015	13/08/2015	21
T134	Thermocouple	13/08/2014	05/02/2015, 06/02/2015	13/08/2015	21
T143	Thermocouple	13/08/2014	02/01/2015	13/08/2015	21
T156	Thermocouple	13/08/2014	05/02/2015, 06/02/2015	13/08/2015	21
T159	Thermocouple	13/08/2014	02/01/2015, 05/02/2015, 06/02/2015	13/08/2015	21
T164	Thermocouple	13/08/2014	21/11/2014, 14/01/2015	13/08/2015	22, 25
T208	Thermocouple	13/08/2014	05/02/2015, 06/02/2015	13/08/2015	21
T218	Thermocouple	13/08/2014	21/11/2014	13/08/2015	25
T238	Thermocouple	13/08/2014	14/01/2015	13/08/2015	22
T251	Thermocouple	13/08/2014	21/11/2014, 05/02/2015, 06/02/2015	13/08/2015	21, 25
T253	Thermocouple	13/08/2014	02/01/2015	13/08/2015	21

Equipment ID	Equipment Type	Last Cal. Date	Test Date	Next Cal. Date	Test Procedure
T279	Thermocouple	13/08/2014	05/02/2015, 06/02/2015	13/08/2015	21
T290	Thermocouple	13/08/2014	02/01/2015	13/08/2015	21
T297	Thermocouple	13/08/2014	21/11/2014, 05/02/2015, 06/02/2015	13/08/2015	21, 25
T303	Thermocouple	13/08/2014	05/02/2015, 06/02/2015	13/08/2015	21
T310	Thermocouple	13/08/2014	14/01/2015	13/08/2015	22
T313	Thermocouple	13/08/2014	02/01/2015, 05/02/2015, 06/02/2015	13/08/2015	21
T315	Thermocouple	13/08/2014	05/02/2015, 06/02/2015	13/08/2015	21

Annex 3: Pictures of Test Samples

Fig. 1: Front view of test sample

Fig. 2: Rear view of test sample

Fig. 3: Detail view of solar cell

Fig. 4: Detail view of type label

Fig. 5: Detail view of closed junction box

Fig. 6: Detail view of cables

Fig. 7: Detail view of connections

Fig. 8: Detail view of frame corner

Fig. 9: Detail view of grounding mark

Fig. 10: Detail view of serial number label

End of Report