

Prüfbericht-Nr.: <i>Test Report No.:</i>	21223935.001	Auftrags-Nr.: <i>Order No.:</i>	21223935	Seite 1 von 1 <i>Page 1 of 1</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	3287094	Auftragsdatum: <i>Order date:</i>	7 January 2014	
Auftraggeber: <i>Client:</i>	Sun Integration S.A.S., ZA de l'aérodrome, 2 Rue Maryse Bastié, 67500 HAGUENAU, France			
Prüfgegenstand: <i>Test item:</i>	Pitched Roof Installation Kits			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	Sun IntegPV®-Universell			
Auftrags-Inhalt: <i>Order content:</i>	Qualification of PV-mounting system according to MCS 012 / TS EN 15601:2012			
Prüfgrundlage: <i>Test specification:</i>	TS EN 15601:2012 "Hydrothermal performance of buildings – Resistance to wind-driven rain of roof coverings with discontinuously laid small elements"			
Wareneingangsdatum: <i>Date of receipt:</i>	04 April 2014	Dokumenten-Check (keine Fotodokumentation erforderlich) Document check (no photo documentation required)		
Prüfmuster-Nr.: <i>Test sample No.:</i>	N/A			
Prüfzeitraum: <i>Testing period:</i>	21 July 2014 – 31 July 2014			
Ort der Prüfung: <i>Place of testing:</i>	Cologne			
Prüflaboratorium: <i>Testing laboratory:</i>	Solar Energy Assessment Center			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
26 August 2014 X.Ji / Project Manager		26 August 2014 L. Jakisch / Business Field Manager		
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>
Sonstiges / Other:		N/A		
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Details im vorherigen Abschnitt <i>Details in the previous section</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

TS EN 15601:2012

Table of content	
Summary of testing	2
General information	2
Testing procedure	3
Details of the test specimens and installation	4
Details of the tests carried out	4
Tables	6
Weather tightness test: climate zone Northern Europe / Coast	6
Test type D	6
Test type B	7
Weather tightness test: climate zone Southern Europe	9
Test type D	9
Test type B	10
Weather tightness test: climate zone Central Europe	11
Test type D	12
Test type B	13
Annex 1: List of measuring equipment	15
Annex 2: Photo documentation	15
Annex 3: Installation manual	17

ANLAGE zum Prüfbericht-Nr.: 21223935.001
APPENDIX to Test Report No.:

Seite 2 von 22
Page 2 of 22

TS EN 15601:2012

Summary of testing

This report describes the tests performed to determine the weather tightness of the Sun IntegPV®-Universell pitched roof mounting system from Sun Integration in accordance with MCS012.

The weather tightness of the Sun IntegPV®-Universell system as tested with

- one fixing element (Roof hook/Hanger bolt),
 - one supporting profile Fix plus T (fixed with rivets and EDPM FIX TT),
- single layer profile, PV-module and module clamps (end-clamp) and a minimum roof pitch of 25° as described in this report was passed, no leaking was detected or the result was the same or less than the reference roof covering.

The mounting system was installed on

- "Nelskamp" a profiled tile (concrete, size 420 x 332 mm).

This represents different profile or flat single lapped tiles.

The tiles were placed on battens with 35x55 mm which are mounted on rafters with dimension of 80x100 mm.

Remarks:

The test results presented in this report are only applicable to the Sun IntegPV®-Universell system mounting system as tested. The tests have been performed under three Climate zones: Northern Europe/Coast, South and Central.

Summary of test locations:

All tests were performed at the *Solar Energy Assessment Center Cologne*.

Summary of deviations from the standard:

- N/A

General information

Possible test case verdicts:

- test case does not apply to the test object.....: N/A
- test object does meet the requirement.....: Passed (P)
- test object does not meet the requirement: Failed (F)

Date(s) of performance of tests: 26.07.2014 – 07.07.2014

General remarks:

The test verdicts presented in this report relate only to the object tested.

This report shall not be reproduced, except in full, without the written approval of the issuing testing laboratory.
“(see Enclosure #)” refers to additional information appended to the report.

“(see appended table)” refers to a table appended to the report.

Throughout this report a point is used as the decimal separator.

ANLAGE zum Prüfbericht-Nr.: 21223935.001
APPENDIX to Test Report No.:

Seite 3 von 22
Page 3 of 22

TS EN 15601:2012

Testing procedure

Mounting system assignment:

Model Number / Name	Model Reference	Size [mm] LxWxD	Material
Rails Aluminium	FISCHER – 900 001	2100x113.8x30	EN AW 6063 T6
Colorvis 6.3x40	ETANCO – 100 001	6.3x40	Steel + EPDM
Crochet Bas + Vis marteau et é crous	MP – 600 001	250x50x2	Steel
Crochet Inter.	FISCHER – 600 002	50x40x2	EN AW 6063
Crochet ext. Haut	FISCHER – 600 003	50x40x2	EN AW 6063
InterPV – A	MP – 1 100 001	2100x570x0.75	Magnélis ZM 350
InterPV –B	MP – 1 100 002	2100x570x0.75	Magnélis ZM 350
InterPV – Abergement Standard	MP – 1 200 001	2100x670x0.75	Magnélis ZM 350
Bavette basse	MP – 1 300 001	3500x350x0.7	ZInc

Module assignment:

Manufacturer	Module Number / Name	Serial number	Size [mm] LxWxD
KD Energy	KD E 250-M60-VE TN	11089	1661x997x40
KD Energy	KD E 250-M60-VE TN	11089	1661x997x40

TS EN 15601:2012

Details of the test specimens and installation

The test specimen shall be constructed in accordance with the manufacturer's laying specifications (complete with tiles or the outer roof covering elements) but without the roofing underlay present, so that any water entry may be observed and collected. The tiles or roofing elements used shall be established in the marked with known satisfactory field performance.

The test specimen comprises fixing elements (roof hook) as described in the summary of testing.

Details of the system and installation procedures are included in Annex 2. Figure 1 shows a photo of the system installed in the TÜV Rheinland test rig.

Details of the tests carried out

The test will be performed in course of the qualification for MCS 012 "Pitched Roof Installation Kits" according to TS EN 15601:2004 which is a test method originally designed for test of roof tiles and slates with discontinuously laid small elements.

The tests are carried out on a simulated roof structure comprising rafters at a minimum roof pitch of 15° - 45°. Figure 2 shows the TÜV Rheinland test rig with the installed system ready for test.

The test samples were laid on the test rig as they would be installed on a roof. If penetration of the roof covering needs to prepare the tiles, this will be done in accordance to the installation manual.

The test requirements are given from the standards as below:

- EN 15601 test type B for North Europe/Coast: High rainfall with high wind speed
Water is sprayed at a rate equivalent to rainfall of 60 mm/hr over the test area (1 m²) plus the run-off bar with a flow equivalent to 60 mm/hr over 5 m roof. The wind speed was 13 m/s. The test last for five minutes with under pressure beneath roofing and an observer for checking for leaks. This represents conditions that on average will only occur once in any 50 year period in Northern Europe/Coast.
- EN 15601 test type D for North Europe/Coast: Deluge – simulating maximum rainfall with no wind
Water was sprayed onto the roof, with no wind, at a rate equivalent to a rainfall of 225 mm/hr over the test area (1 m²). The run-off spray bar at the top of the test section simulated a rainfall of 225 mm/hr over 5 m roof. The test lasts for two minutes with an observer checking for leaks. This represents conditions that on average will only occur once in any 50 year period in Northern Europe/Coast.
- EN 15601 test type B for Central Europe: High rainfall with high wind speed
Water is sprayed at a rate equivalent to rainfall of 130 mm/hr over the test area (1 m²) plus the run-off bar with a flow equivalent to 130 mm/hr over 5 m roof. The wind speed was 10 m/s. The test last for five minutes with under pressure beneath roofing and an observer for checking for leaks. This represents conditions that on average will only occur once in any 50 year period in Central Europe.
- EN 15601 test type D for Central Europe: Deluge – simulating maximum rainfall with no wind
Water was sprayed onto the roof, with no wind, at a rate equivalent to a rainfall of 300 mm/hr over the test area (1 m²). The run-off spray bar at the top of the test section simulated a rainfall of 300 mm/hr over 5 m roof. The test lasts for two minutes with an observer checking for leaks. This represents conditions that on average will only occur once in any 50 year period in Central Europe.
- EN 15601 test type B for Southern Europe: High rainfall with high wind speed
Water is sprayed at a rate equivalent to rainfall of 166 mm/hr over the test area (1 m²) plus the run-off bar with a flow equivalent to 166 mm/hr over 5 m roof. The wind speed was 8 m/s. The test last for five minutes with under pressure beneath roofing and an observer for checking for leaks. This represents conditions that on average will only occur once in any 50 year period in Southern Europe.
- EN 15601 test type D for Southern Europe: Deluge – simulating maximum rainfall with no wind
Water was sprayed onto the roof, with no wind, at a rate equivalent to a rainfall of 415 mm/hr over

TS EN 15601:2012

the test area (1 m²). The run-off spray bar at the top of the test section simulated a rainfall of 415 mm/hr over 5 m roof. The test lasts for two minutes with an observer checking for leaks. This represents conditions that on average will only occur once in any 50 year period in Southern Europe.

Above roof systems: Provided all unprotected gaps caused by the mounting and installation arrangement are no greater than those pre-existing in the roof covering before installation of the solar panels, then only the weather tightness of the outer surface penetration (and the underlay penetration) needs to be tested:

- Perform test type D on the outer surface roof covering with one or more penetrations installed but without PV-modules in place
- (if applicable the underlay penetration shall be tested with test type D but with less rainfall rate (50 mm/hr) and no direct rainfall)

Roof integration systems: If the installation of the system creates unprotected gaps larger than those pre-existing then, as a minimum, wind-rain combination test type B and D must be tested. Test type A and C are optional.

- Perform test type C on the outer surface covering with the complete system installed including PV modules.
- Perform test type D on the outer surface roof covering with one or more penetrations installed but without PV modules in place

Wind

The wind speed is horizontal to the ground. For the testing the relevant value is recalculated to use the wind direction parallel to the surface of the test sample. The calculation follows the standard.

Suction chamber

For creating a stable pressure between “outside/inside” a suction chamber is installed. The chamber is placed and tightened behind the relevant testing area.

Reference

Beside the located test point, there is the standard installation of the roof covering without any penetration. This position is used as reference to compare the occurred leakage of the test item to the original roof covering.

ANLAGE zum Prüfbericht-Nr.: 21219041.001
APPENDIX to Test Report No.:

Seite 6 von 22
Page 6 of 22

TS EN 15601:2012

Tables

Weather tightness test: climate zone Northern Europe / Coast

Test date:	26.06.2014
Examiner:	Kolter
Index Number of test rick:	3068
Climate zone:	Northern Europe / Coast
Roof pitch [°]:	25
Tiles/Sheets type, (LxWxD) [mm]:	Nelskamp
High bead (HxW ₁ xW ₂) [mm]:	35x55
High bead distance [mm]:	250

Test type D

Test:	D (maximum rainfall with no wind)
Test duration [min]	2
Rain fall [mm/h/m²]	225
Rainfall [l/min/m²]	4.85
Run-off water [l/min/m]	24.23
Wind speed (horizontal) [m/s]	None
Wind speed (parallel) [m/s]	None
Pressure difference (outside/inside) [Pa]	N/A
Verdict	Passed, no leakage detected
Remarks: none	

ANLAGE zum Prüfbericht-Nr.: 21219041.001
APPENDIX to Test Report No.:

Seite 7 von 22
Page 7 of 22

TS EN 15601:2012

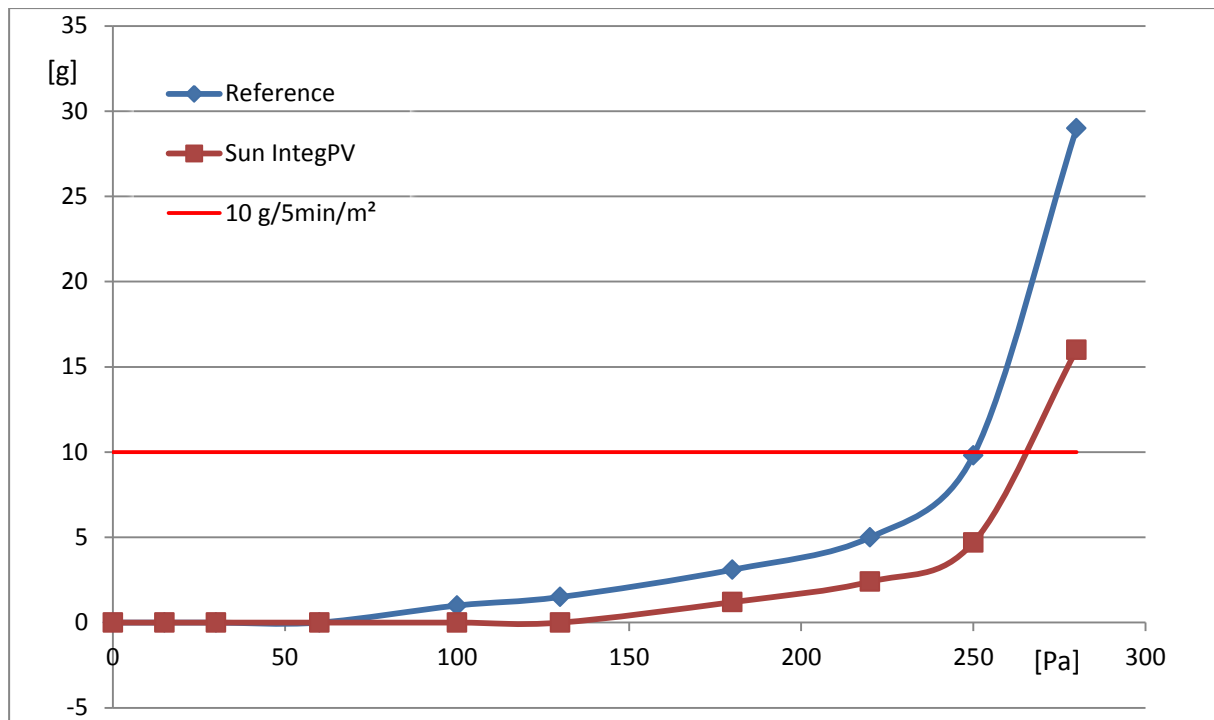
Test type B

Test:	B (High rainfall with high wind speed)	
Test duration [min]	5	
Rain fall [mm/h/m²]	60	
Rainfall [l/min/m²]	1.35	
Run-off water [l/min/m]	6.5	
Wind speed (horizontal) [m/s]	13	
Wind speed (parallel) [m/s]	11.05	
Pressure difference (outside/inside) [Pa]	N/A	
Verdict	Passed	
	Under pressure [bar]	Leakage [g/5min/m²]
	0	0
	15	0
	30	0
	60	0
	100	0.3
	130	1.2
	180	2.1
	220	4.8
	250	6.3
	280	14
Remarks: The leakage was less or the same as the reference roof. The following diagram will show the comparison of both.		

ANLAGE zum Prüfbericht-Nr.: 21219041.001
APPENDIX to Test Report No.:

Seite 8 von 22
Page 8 of 22

TS EN 15601:2012



ANLAGE zum Prüfbericht-Nr.: 21219041.001
APPENDIX to Test Report No.:

Seite 9 von 22
Page 9 of 22

TS EN 15601:2012

Weather tightness test: climate zone Southern Europe

Test date:	03.07.2014
Examiner:	Kolter
Index Number of test rick:	3068
Climate zone:	South
Roof pitch [°]:	25
Tiles/Sheets type, (LxWxD) [mm]:	Nelskamp
High bead (HxW ₁ xW ₂) [mm]:	35x55
High bead distance [mm]:	250

Test type D

Test:	D (maximum rainfall with no wind)
Test duration [min]	2
Rain fall [mm/h/m²]	225
Rainfall [l/min/m²]	4.85
Run-off water [l/min/m]	24.23
Wind speed (horizontal) [m/s]	None
Wind speed (parallel) [m/s]	None
Pressure difference (outside/inside) [Pa]	N/A
Verdict	Passed, no leakage detected
Remarks: none	

ANLAGE zum Prüfbericht-Nr.: 21219041.001
APPENDIX to Test Report No.:

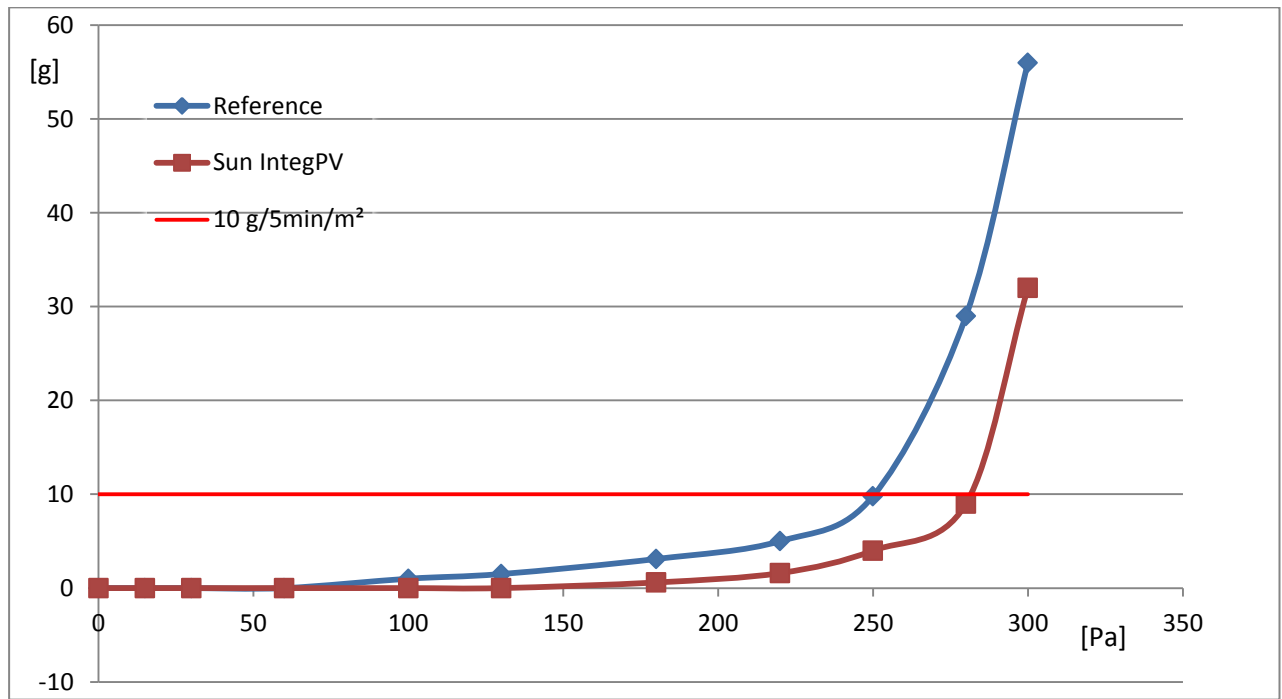
Seite 10 von 22
Page 10 of 22

TS EN 15601:2012

Test type B

Test:	B (High rainfall with high wind speed)	
Test duration [min]	5	
Rain fall [mm/h/m²]	60	
Rainfall [l/min/m²]	1.35	
Run-off water [l/min/m]	6.5	
Wind speed (horizontal) [m/s]	13	
Wind speed (parallel) [m/s]	11.05	
Pressure difference (outside/inside) [Pa]	N/A	
Verdict	Passed	
	Under pressure [bar]	Leakage [g/5min/m²]
	0	0
	15	0
	30	0
	60	0
	100	0
	130	0
	180	0.6
	220	1.6
	250	4.0
	280	9.1
	300	32
Remarks: The leakage was less or the same as the reference roof. The following diagram will show the comparison of both.		

TS EN 15601:2012



ANLAGE zum Prüfbericht-Nr.: 21219041.001
APPENDIX to Test Report No.:

Seite 12 von 22
Page 12 of 22

TS EN 15601:2012

Weather tightness test: climate zone Central Europe

Test date:	07.07.2014
Examiner:	Ji
Index Number of test rick:	3068
Climate zone:	Central
Roof pitch [°]:	25
Tiles/Sheets type, (LxWxD) [mm]:	Nelskamp
High bead (HxW ₁ xW ₂) [mm]:	35x55
High bead distance [mm]:	250

Test type D

Test:	D (maximum rainfall with no wind)
Test duration [min]	2
Rain fall [mm/h/m²]	225
Rainfall [l/min/m²]	4.85
Run-off water [l/min/m]	24.23
Wind speed (horizontal) [m/s]	None
Wind speed (parallel) [m/s]	None
Pressure difference (outside/inside) [Pa]	N/A
Verdict	Passed, no leakage detected
Remarks: none	

ANLAGE zum Prüfbericht-Nr.: 21219041.001
APPENDIX to Test Report No.:

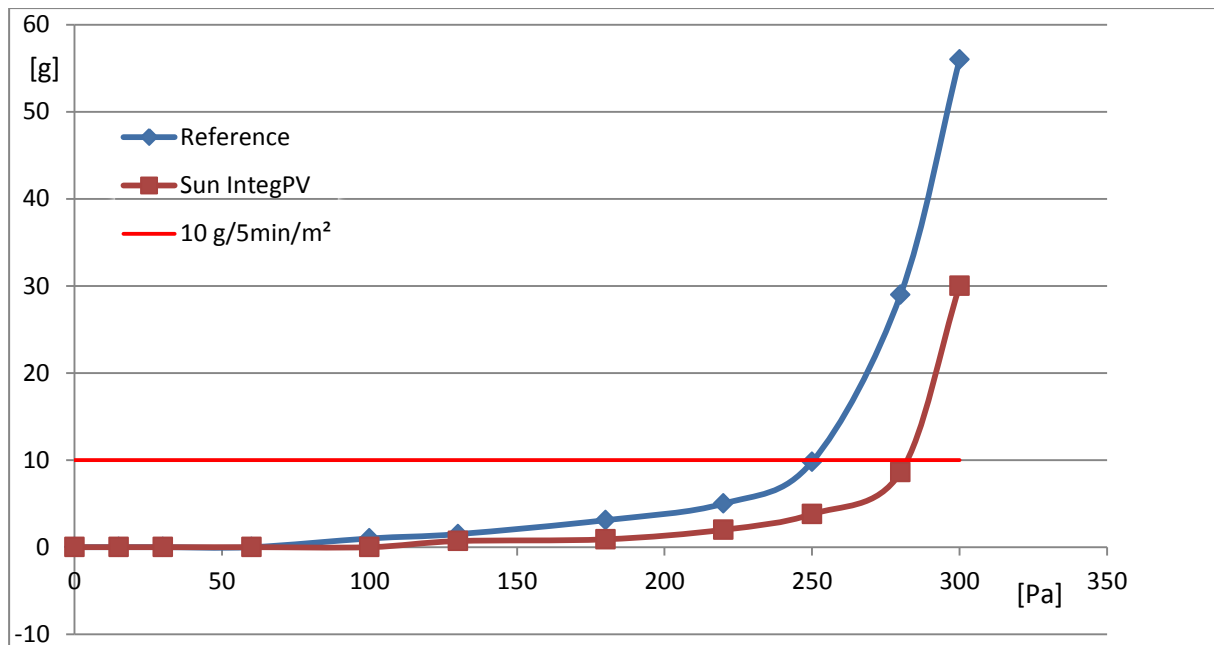
Seite 13 von 22
Page 13 of 22

TS EN 15601:2012

Test type B

Test:	B (High rainfall with high wind speed)	
Test duration [min]	5	
Rain fall [mm/h/m²]	60	
Rainfall [l/min/m²]	1.35	
Run-off water [l/min/m]	6.5	
Wind speed (horizontal) [m/s]	13	
Wind speed (parallel) [m/s]	11.05	
Pressure difference (outside/inside) [Pa]	N/A	
Verdict	Passed	
	Under pressure [bar]	Leakage [g/5min/m²]
	0	0
	15	0
	30	0
	60	0
	100	0
	130	0.7
	180	0.9
	220	2.0
	250	3.8
	280	8.7
	300	30
Remarks: The leakage was less or the same as the reference roof. The following diagram will show the comparison of both.		

TS EN 15601:2012



ANLAGE zum Prüfbericht-Nr.: 21219041.001
APPENDIX to Test Report No.:

Seite 15 von 22
Page 15 of 22

TS EN 15601:2012

Annex 1: List of measuring equipment

Type	Index	Last calibration	Next calibration
Weather tightness test	3068	04/2013	05/2014

Annex 2: Photo documentation



Fig. 1: system installed on test rig



Fig. 2: system installed on test rig

TS EN 15601:2012



Fig. 3: system installed on test rig



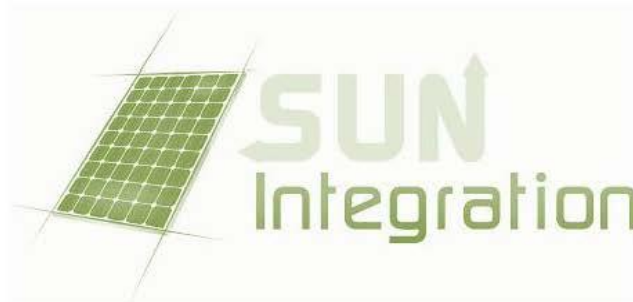
Fig. 4: system installed on test rig

ANLAGE zum Prüfbericht-Nr.: 21219041.001
APPENDIX to Test Report No.:

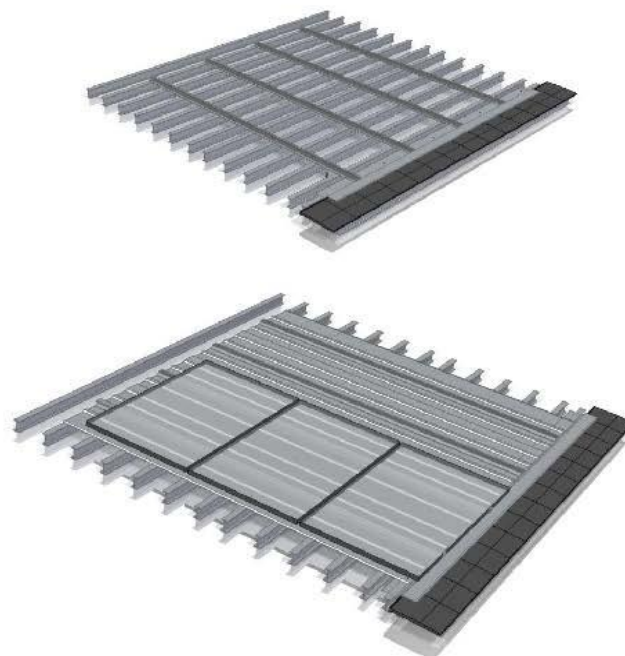
Seite 17 von 22
Page 17 of 22

TS EN 15601:2012

Annex 3: Installation manual



DESCRIPTION & TECHNICAL DRAWS



Contact :












Geoffrey Limmacher

Phone: +33 (0)3 88 93 75 54 — glimmacher@sun-integration.com

ANLAGE zum Prüfbericht-Nr.: 21219041.001
APPENDIX to Test Report No.:

Seite 18 von 22
Page 18 of 22

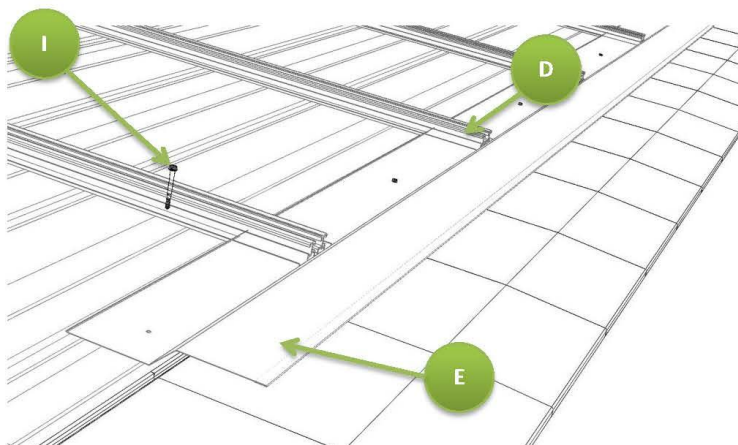
TS EN 15601:2012

Product	Element	Picture
IntegPV - A	A	
IntegPV - B	B	
IntegPV - Abergement Standard	C	
Rails Aluminium	D	
Bavette basse	E	
Crochet Bas + Vis marteau et é crous	F	
Crochet Inter.	G	
Crochet ext. Haut	H	
Colorvis 6,3 x 40	I	
Joint compri-band	J	
Couvre-joint	K	

TS EN 15601:2012

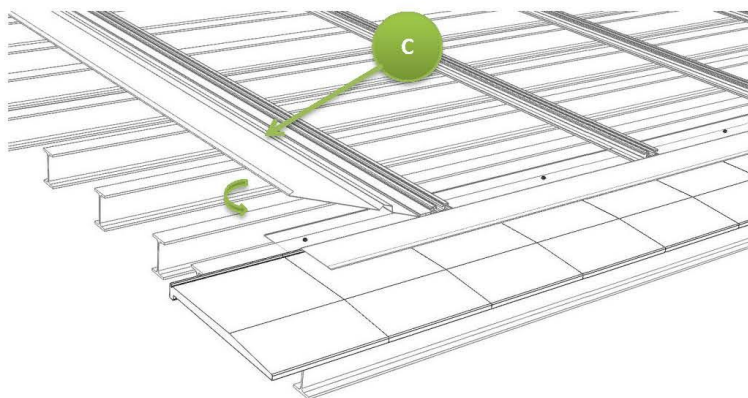
I. First Step:

- Remove all tiles except the first rank
- Fixed the sheet metal 'E' in order to cover the first rank of tiles.
- Fixed Aluminum profiles 'D' to the lathing with self-drilling screws 'I' - Secure all 1 meter



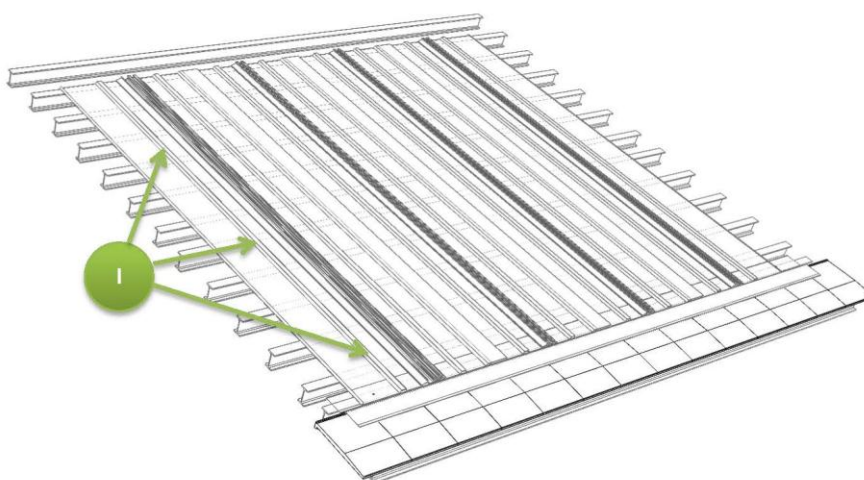
II. Place the roof metal cover:

- Insert the sheet metal 'C' in the side portions of the aluminum rail 'D'

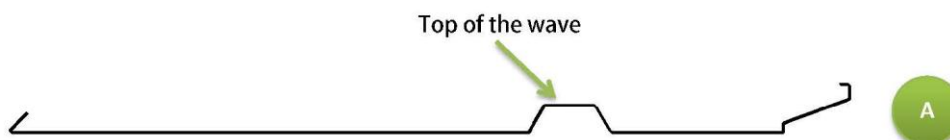


TS EN 15601:2012

- Do the same for all of the other sheet metal 'A' & 'B' and the last side of the photovoltaic field 'C'



- Fixed the sheet metal every 1 meter by the top of wave with self-drilling screws :
- Example:

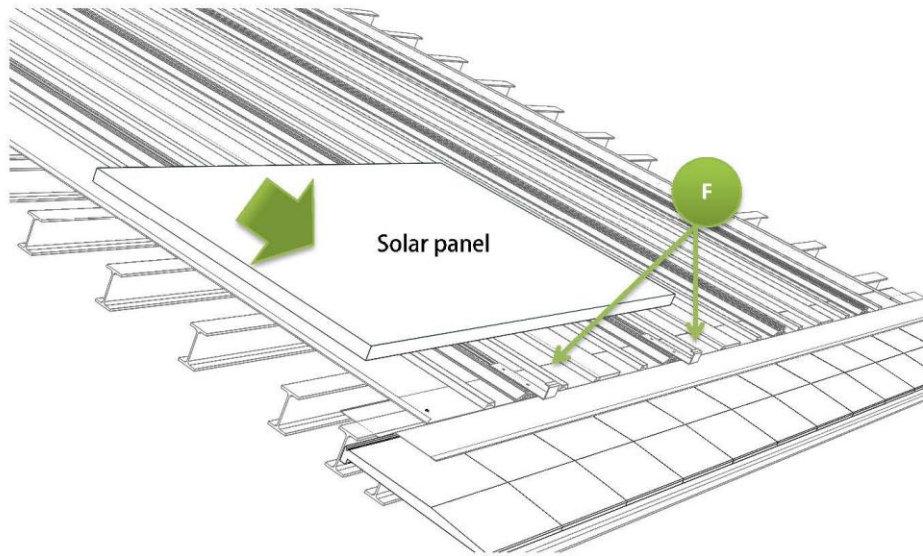


When all the field is cover: place end-clamps to start photovoltaic modules installation

III. End-clamp, middle-clamp



TS EN 15601:2012



- When end-clamps are locked. Move down the solar panel into the clamp.

Do the same operation for all the first rank of panels and clamps.

- Place the intermediary clamp against the panel and continue to place the rest to cover the sheet metal

Picture: Middle-clamp



or



IV. "Couvre-joint" - Join-Cover

When all solar panels are fixed, place the last piece of the system: 'Join-Cover'

TS EN 15601:2012

