



<b>Prüfbericht-Nr.:</b> <i>Test report no.:</i>	<b>DE25E613 001</b>	<b>Auftrags-Nr.:</b> <i>Order no.:</i>	30010 2929	Seite 1 von 18 Page 1 of 18
<b>Kunden-Referenz-Nr.:</b> <i>Client reference no.:</i>	1719906	<b>Auftragsdatum:</b> <i>Order date:</i>	2025-06-30	
<b>Auftraggeber:</b> <i>Client:</i>	3SUN S.r.l. (for add. information see page 3)			
<b>Prüfgegenstand:</b> <i>Test item:</i>	Photovoltaik Module			
<b>Bezeichnung / Typ-Nr.:</b> <i>Identification / Type no.:</i>	3SHBGA [internally 3SUN B48] (representative for various additional module types)			
<b>Auftrags-Inhalt:</b> <i>Order content:</i>	Hail impact test with the aim of recommendation/classification for VFK "Hagelregister"			
<b>Prüfgrundlage:</b> <i>Test specification:</i>	according to / following VKF - Prüfbestimmung *** "Nr. 25 "Photovoltaik Module" - Version 1.03 (01/11/2016) following IEC 61215-2 "Terrestrial photovoltaik modules - Design qualification and type approval - Part 2: Test procedures			
<b>Wareneingangsdatum:</b> <i>Date of sample receipt:</i>	2025-07-07			
<b>Prüfmuster-Nr.:</b> <i>Test sample no.:</i>	see "List of test samples"			
<b>Prüfzeitraum:</b> <i>Testing period:</i>	2025-07-07 – 2025-09-08			
<b>Ort der Prüfung:</b> <i>Place of testing:</i>	Am Grauen Stein, 51105 Köln, Cologne			
<b>Prüflaboratorium:</b> <i>Testing laboratory:</i>	TÜV Rheinland Solar GmbH			
<b>Prüfergebnis*:</b> <i>Test result*:</i>	Siehe Sonstiges / See Other			
<b>geprüft von:</b> <i>tested by:</i>	<input checked="" type="checkbox"/> 	<b>genehmigt von:</b> <i>authorized by:</i>	<input checked="" type="checkbox"/> 	
<b>Datum:</b> <i>Date:</i> 2025-09-25	Signiert von: Juergen Sommer	<b>Ausstellungsdatum:</b> <i>Issue date:</i> 2025-09-25	Signiert von: Ulrich Fritzsich	
<b>Stellung / Position:</b>	Sachverständige(r)/Expert	<b>Stellung / Position:</b>	Sachverständige(r)/Expert	
<b>Sonstiges / Other:</b>	Recommendation only; *** VKF (Vereinigung Kantonalen Feuerversicherungen) /// Additional test specifications: - Prüfbestimmung Nr 00a – Allgemeiner Teil A - Version 1.03 (01/03/2018) - Prüfbestimmung Nr 00b – Allgemeiner Teil B - Version 1.01 (01/12/2018) - Beschlussammlung HSR – formal - Version 31 (11/12/2024) - Beschlussammlung HSR - technisch - Version 19 (13/09/2018)			
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>			
* Legende: P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet				
* Legend: P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
<b>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.</b> <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>				

V05

Prüfbericht-Nr.: DE25E613 001  
 Test report no.:

Seite 2 von 18  
 Page 2 of 18

**Anmerkungen**  
*Remarks*

<b>A</b>	<p>Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben.</p> <p>Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</p> <p><i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system.</i></p> <p><i>Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i></p>																				
<b>B</b>	<p>Wie vertraglich vereinbart, wurde dieses Dokument nur digital unterzeichnet. Der TÜV Rheinland hat nicht überprüft, welche rechtlichen oder sonstigen diesbezüglichen Anforderungen für dieses Dokument gelten. Diese Überprüfung liegt in der Verantwortung des Benutzers dieses Dokuments. Auf Verlangen des Kunden kann der TÜV Rheinland die Gültigkeit der digitalen Signatur durch ein gesondertes Dokument bestätigen. Diese Anfrage ist an unseren Vertrieb zu richten. Eine Umweltgebühr für einen solchen zusätzlichen Service wird erhoben.</p> <p><i>As contractually agreed, this document has been signed digitally only. TÜV Rheinland has not verified and unable to verify which legal or other pertaining requirements are applicable for this document. Such verification is within the responsibility of the user of this document. Upon request by its client, TÜV Rheinland can confirm the validity of the digital signature by a separate document. Such request shall be addressed to our Sales department. An environmental fee for such additional service will be charged.</i></p>																				
<b>C</b>	<p>Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.</p> <p><i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report.</i></p> <p><i>Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i></p>																				
<b>D</b>	<p>Die Entscheidungsregel für Konformitätserklärungen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC GC8:2019 und IEC Guide 115:2023, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird.</p> <p><i>The decision rule for statements of conformity in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance to ILAC GC8:2019 and IEC Guide 115:2023, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report.</i></p>																				
<b>E</b>	<p>Wenn auf dem Bericht kein Akkreditierungshinweis aufgebracht ist, wurde der Bericht nicht im akkreditierten Bereich erstellt und ist folglich auch nicht vom EA MLA abgedeckt. Unabhängig davon wurde der Bericht auf Basis der allgemeinen Regeln der ISO/IEC 17000er Reihe erstellt. Mit "#" gekennzeichnete Prüfungen sind nicht Bestandteil der Akkreditierung D-PL-22040-01-00.</p> <p><i>If there is no accreditation notice on the report, the report has not been produced in the accredited area and is consequently not covered by the EA MLA. Regardless of this, the report has been prepared based on the general rules of the ISO/IEC 17000 series. Tests marked with "#" are not covered by the accreditation D-PL-22040-01-00.</i></p>																				
<b>F</b>	<table border="1"> <thead> <tr> <th colspan="4">Revision History</th> </tr> <tr> <th>Revision</th> <th>Date</th> <th>Nature of changes</th> <th>Page</th> </tr> </thead> <tbody> <tr> <td>001</td> <td>2025-09-25</td> <td>Original issue</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Revision History				Revision	Date	Nature of changes	Page	001	2025-09-25	Original issue									
Revision History																					
Revision	Date	Nature of changes	Page																		
001	2025-09-25	Original issue																			

Prüfbericht-Nr.: DE25E613 001  
Test report no.:

Seite 3 von 18  
Page 3 of 18

**Produktbeschreibung**  
*Product description*

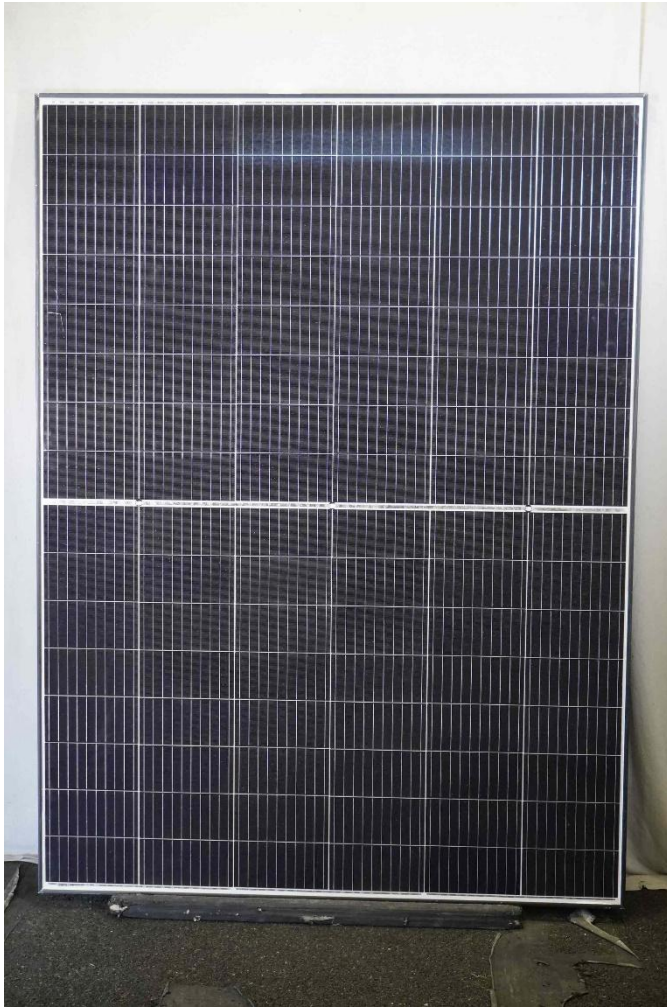
1	<b>Auftraggeber</b> <i>Client</i>	3SUN S.r.l. Contrada Bloco Torrazze snc, Zona Industriale 95121 Catania Italy																																				
2	<b>Produktdetails</b> <i>Product details</i>	<p style="text-align: center;"><b>Allgemeine Informationen ; General Information</b> based on datasheet</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Brand name</td> <td style="width: 50%;">3SUN</td> </tr> <tr> <td>Type name</td> <td>3SHBGA [internally B48]</td> </tr> <tr> <td>Sub-type</td> <td>AF</td> </tr> <tr> <td>Product category</td> <td>PV-module</td> </tr> <tr> <td>Year of production</td> <td>2025</td> </tr> <tr> <td>Power class [W]</td> <td>455</td> </tr> <tr> <td>Cell technology</td> <td>Mono / bifacial (HJT)</td> </tr> <tr> <td>Cell dimension (l / w) [mm]</td> <td>210 / 105 (half-cut)</td> </tr> <tr> <td>No. of cells</td> <td>96</td> </tr> <tr> <td>Max. system voltage [V]</td> <td>1500</td> </tr> <tr> <td>Thickness of glazing [mm]</td> <td>2.0 (front) / 2.0 (back)</td> </tr> <tr> <td>Glazing (front)</td> <td>Heat strengthened, low-reflection white glass</td> </tr> <tr> <td>Glazing (back)</td> <td>Heat strengthened white glass</td> </tr> <tr> <td>Frame material</td> <td>Aluminium</td> </tr> <tr> <td>Frame thickness [mm]</td> <td>30</td> </tr> <tr> <td colspan="2" style="text-align: center;"><b>Dimensionen ; Dimension</b></td> </tr> <tr> <td>Dimension (l / w / h) [mm]</td> <td>1754 / 1303 / 30</td> </tr> <tr> <td>Gross area [m<sup>2</sup>]</td> <td>2.285</td> </tr> </table>	Brand name	3SUN	Type name	3SHBGA [internally B48]	Sub-type	AF	Product category	PV-module	Year of production	2025	Power class [W]	455	Cell technology	Mono / bifacial (HJT)	Cell dimension (l / w) [mm]	210 / 105 (half-cut)	No. of cells	96	Max. system voltage [V]	1500	Thickness of glazing [mm]	2.0 (front) / 2.0 (back)	Glazing (front)	Heat strengthened, low-reflection white glass	Glazing (back)	Heat strengthened white glass	Frame material	Aluminium	Frame thickness [mm]	30	<b>Dimensionen ; Dimension</b>		Dimension (l / w / h) [mm]	1754 / 1303 / 30	Gross area [m <sup>2</sup> ]	2.285
Brand name	3SUN																																					
Type name	3SHBGA [internally B48]																																					
Sub-type	AF																																					
Product category	PV-module																																					
Year of production	2025																																					
Power class [W]	455																																					
Cell technology	Mono / bifacial (HJT)																																					
Cell dimension (l / w) [mm]	210 / 105 (half-cut)																																					
No. of cells	96																																					
Max. system voltage [V]	1500																																					
Thickness of glazing [mm]	2.0 (front) / 2.0 (back)																																					
Glazing (front)	Heat strengthened, low-reflection white glass																																					
Glazing (back)	Heat strengthened white glass																																					
Frame material	Aluminium																																					
Frame thickness [mm]	30																																					
<b>Dimensionen ; Dimension</b>																																						
Dimension (l / w / h) [mm]	1754 / 1303 / 30																																					
Gross area [m <sup>2</sup> ]	2.285																																					
3	<b>Technische Dokumentation</b> <i>Technical documentation</i>	for detailed constructional data see <i>Technical Datasheet</i> "3SUN_B48_LE_3SHBGA-AF-455-460_revision_1.0_28052025" issued by 3SUN "3SUN_B48_LE_3SHBGA-CF-490-500_revision_1.0_28052025" issued by 3SUN																																				
4	<b>Hersteller</b> <i>Manufacturer</i>	3SUN S.r.l.																																				
5	<b>Sonstiges</b> <i>Other</i>	<ul style="list-style-type: none"> <li>- The tested module type might be also available in different powerclasses.</li> <li>- Further the result is applicable to additional types; for more details see "General remarks"</li> <li>- Mounting: Symetric (mounting holes / 327 mm from corner)</li> </ul>																																				
6	<b>Prüfmusterbereitstellung:</b> <i>Test sample obtaining</i>	<input checked="" type="checkbox"/> Sending by customer <input type="checkbox"/> Sampling by TÜV Rheinland Group <input type="checkbox"/> others: randomly chosen from existing test batch																																				

Prüfbericht-Nr.: DE25E613 001  
Test report no.:

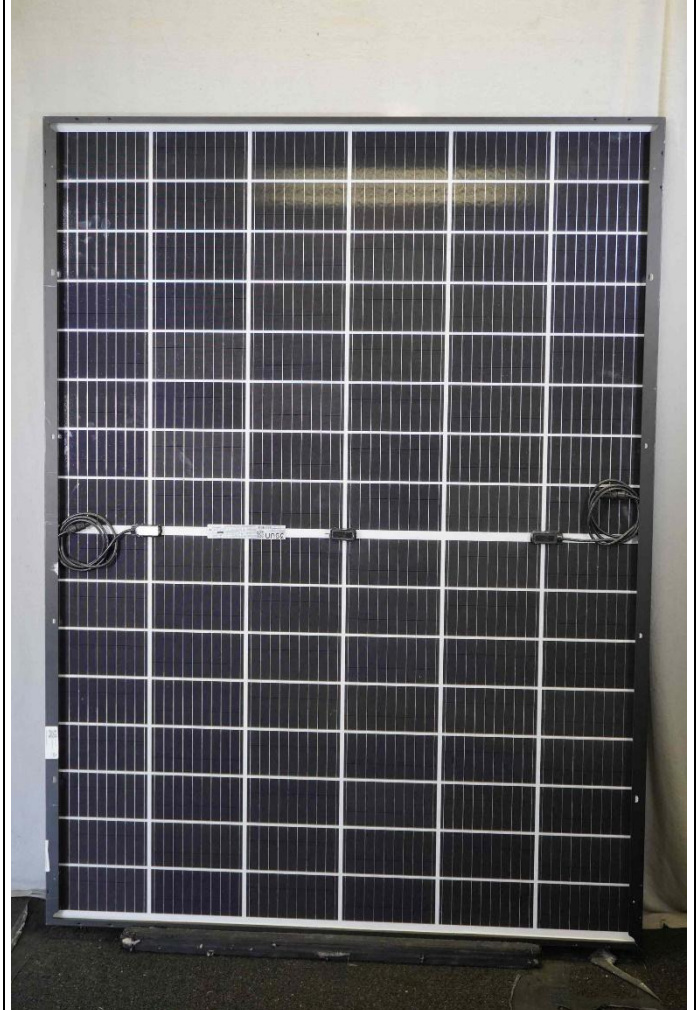
Seite 4 von 18  
Page 4 of 18

**Produktbeschreibung**  
Product description

Sample - Front (example)



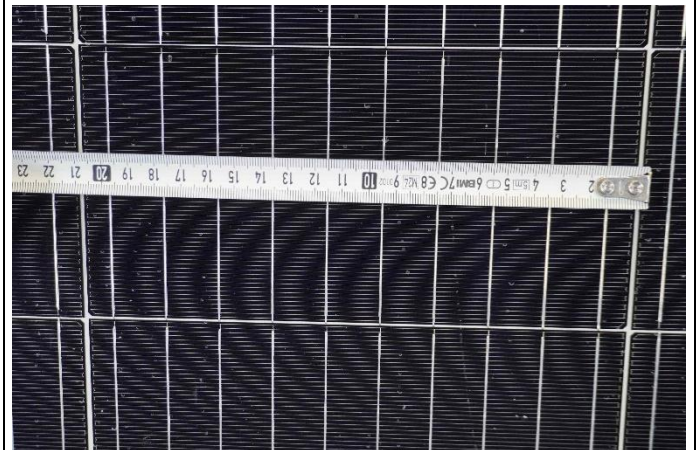
Sample - Back (example)



Example of junction box



Example of cells



Prüfbericht-Nr.: DE25E613 001  
Test report no.:

Seite 5 von 18  
Page 5 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen/ Measuring results - Remarks	Ergebnis Result
------------------	---	--	--------------------

-	<b>Result summary table</b>		
---	-----------------------------	--	--

Test	Date [DD Month YYYY]		Summary of main test results	—
	Initial (1 <sup>st</sup> )	Final (2 <sup>nd</sup> )		
Insulation test	08 July 2025	02 September 2025	-	P
Wet leakage current test	08 July 2025	02 September 2025	-	P
Performance at STC	21 July 2025	03 September 2025	-	P
Electroluminescence images	21 July 2025	03 September 2025	-	P
Impact resistance	01 September 2025		HW3 with 30 mm ice balls passed	P
Final inspection	08 September 2025		see <i>Final evaluation</i>	P

Supplementary information:

- All results are related to the tested sample/s
- According to test procedure the tested PV module is **recommended** to be **classified in HW3**
- No pre-exposure necessary; no relevant plastic parts

	<b>Final evaluation (recommendation of testing laboratory)</b>		
--	--	--	--

In four-eyes principle; by	J. Sommer	U. Fritzsche	
The acceptance of recommendation and final classification is part of FER (Fachkommission Elementarschutzregister)			
Properties of component	Evaluation of hail withstand		
Water tightness	---		
Visual nature / look	HW3		
Mechanics	HW3		
Transmittance	---		
Opacity	---		

Supplementary information: -

Prüfbericht-Nr.: DE25E613 001  
Test report no.:

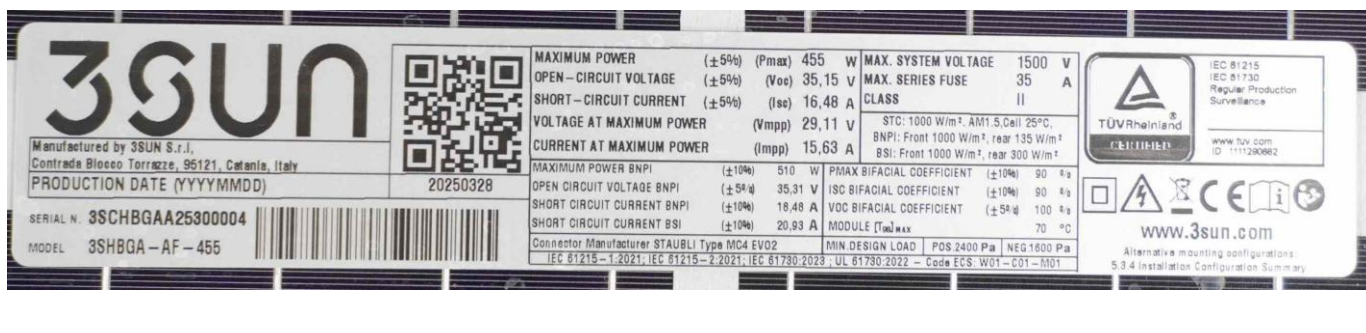
Seite 6 von 18  
Page 6 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen/ Measuring results - Remarks	Ergebnis Result
------------------	---	--	--------------------

-	Visual inspection (Initial)		
Test date [YYYY-MM-DD]		2025-07-08	—
Sample No.	Nature and position of initial findings		—
HV2025001833	No relevant visual defects		P
HV2025001834	No relevant visual defects		P

Supplementary information: -

Type plate (example)



**3SUN**

Manufactured by 3SUN S.r.l.,  
Contrada Biceco Torrazze, 95121, Catania, Italy  
PRODUCTION DATE (YYYYMMDD) 20250328

SERIAL N. 3SCHBGAA25300004  
MODEL 3SHBGA-AF-455

MAXIMUM POWER (±5%) (P <sub>max</sub> )	455 W	MAX. SYSTEM VOLTAGE	1500 V
OPEN-CIRCUIT VOLTAGE (±5%) (V <sub>oc</sub> )	35,15 V	MAX. SERIES FUSE	35 A
SHORT-CIRCUIT CURRENT (±5%) (I <sub>sc</sub> )	16,48 A	CLASS	II
VOLTAGE AT MAXIMUM POWER (V <sub>mpp</sub> )	29,11 V	STC: 1000 W/m <sup>2</sup> , AM1.5, Cell 25°C, BNPI: Front 1000 W/m <sup>2</sup> , rear 135 W/m <sup>2</sup> BSI: Front 1000 W/m <sup>2</sup> , rear 300 W/m <sup>2</sup>	
CURRENT AT MAXIMUM POWER (I <sub>mpp</sub> )	15,63 A	MAXIMUM POWER BNPI (±10%)	510 W
MAXIMUM POWER BNPI (±10%)		PMAX BIFACIAL COEFFICIENT (±10%)	90 %
OPEN CIRCUIT VOLTAGE BNPI (±5%)	35,31 V	ISC BIFACIAL COEFFICIENT (±10%)	90 %
SHORT CIRCUIT CURRENT BNPI (±10%)	18,48 A	VOC BIFACIAL COEFFICIENT (±5%)	100 %
SHORT CIRCUIT CURRENT BSI (±10%)	20,93 A	MODULE (T <sub>cell</sub> ) <sub>max</sub>	70 °C
Connector Manufacturer: STAUBLI Type MC4 EV02		MIN. DESIGN LOAD	POS 2400 Pa   NEG 1600 Pa
IEC 61215-1:2021, IEC 61215-2:2021, IEC 61730:2023, UL 61730:2022 - Code ECS: W01-C01-M01			

www.3sun.com  
Alternative mounting configurations:  
5.3.4 Installation Configuration Summary

-	List of test samples		
Sample No.	Sample S/N	Remarks / constructional characteristics	—
HV2025001833	3SCHBGAA25300004	Main test sample [3SHBGA-AF-455]	—
HV2025001834	3SCHBGAA25400005	Spare [3SHBGA-AF-460]	—

<b>Prüfbericht-Nr.: DE25E613 001</b>								
Test report no.:								
Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests				Messergebnisse – Bemerkungen/ Measuring results - Remarks			Ergebnis Result
-	<b>Maximum power determination (STC)</b>							
General; for all following measurements								—
Module temperature [°C]				corrected to 25				
Irradiance [W/m²]				1000				
Initial / Final*								
Test date [YYYY-MM-DD]				2025-07-21 and *2025-09-03				
Sample No.	P <sub>max</sub> [W]	V <sub>mpp</sub> [V]	I <sub>mpp</sub> [A]	V <sub>oc</sub> [V]	I <sub>sc</sub> [A]	FF [%]	Degradation** [%]	P
HV2025001833	460.0	29.38	15.66	35.09	16.57	79.1	initial	
	459.9	29.38	15.66	35.11	16.55	79.2	-0.02	
Supplementary information: ** if negative only								

-	<b>Insulation test (ISO)</b>							
General; for all following measurements								—
Maximum system voltage [V <sub>DC</sub> ]				1500				
High voltage applied [V <sub>DC</sub> ]			1 <sup>st</sup>	3000				
			2 <sup>nd</sup>	8000				
Insulation resistance measured at [V <sub>DC</sub> ]				1000				
Initial / Final*								
Test date [YYYY-MM-DD]				2025-07-08 and *2025-09-02				
Sample No.	Measured	Area	Result*	Dielectric breakdown				P
	[GΩ]	[m²]	[GΩ × m²]	Yes (description)	No			
HV2025001833	1.0	2.29	2.3	-	x		P	
	1.0	2.29	2.3	-	x		P	
Supplementary information: -								

<b>Prüfbericht-Nr.: DE25E613 001</b>			
Test report no.:			
<b>Absatz</b> Clause	<b>Anforderungen - Prüfungen /</b> Requirements - Tests	<b>Messergebnisse – Bemerkungen/</b> Measuring results - Remarks	<b>Ergebnis</b> Result

-	<b>Wet leakage current test (WL)</b>				
General; for all following measurements				—	
Insulation resistance measured at [V <sub>DC</sub> ]		1000			
Solution resistivity [Ω cm]		< 3.500			
Solution temperature [°C]		22 ± 3			
Initial / Final*					
Test date [YYYY-MM-DD]		2025-07-08 and *2025-09-02			
Sample No.	Measured	Area	Result		
	[MΩ]	[m <sup>2</sup> ]	[MΩ × m <sup>2</sup> ]		
HV2025001833	1000	2.29	2290		P
	1000	2.29	2290		P
Supplementary information: -					

-	<b>Electroluminescence images (EL)</b>				
Analysis of electroluminescence images (see also Annex : Additional information)					
Initial / Final*				—	
Test date [YYYY-MM-DD]		2025-07-21 and *2025-09-03			
Sample No.	Reverse current applied [A]	Attributes			
HV2025001833	10 (@ 400 ms)	No relevant conspicuousness/findings			
	10 (@ 400 ms)	No additional relevant conspicuousness/findings			
Supplementary information: -					

Prüfbericht-Nr.: DE25E613 001  
Test report no.:

Seite 9 von 18  
Page 9 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen/ Measuring results - Remarks	Ergebnis Result
------------------	---	--	--------------------

-	<b>Impact resistance test (general)</b>		
Test date [YYYY-MM-DD] Day code	2025-09-01 <sup>a</sup>		
Sample-No. ID code	HV2025001833 <sup>1833</sup>		
Method used for impact resistance	Nr. 25 "Photovoltaik Module"		
Surface conditioning	none		
Sample tilt angle [° from horizontal]	90		
Direction of shoot [°]	0 (horizontal)		
Impact angle [° from sample surface]	90		
Distance (sample to center of v <sub>0</sub> -meas.) [mm]	500 to 700		
Ice ball production [week of the year]	32 (hermetically sealed)		
Storage temperature of ice ball [°C]	-20		
Ambient conditions (mean) [°C and % RH]	<sup>a</sup> 22.8 and 59.9		
Diameter of ice ball [mm]	30		
Weight of ice ball (mean) [g]	12.7		
Velocity of ice ball (mean) [m/s ]	23.9		
Impact energy (at least) [J]	3.5		

Example of Test Set-up



Measurement of glass-package thickness



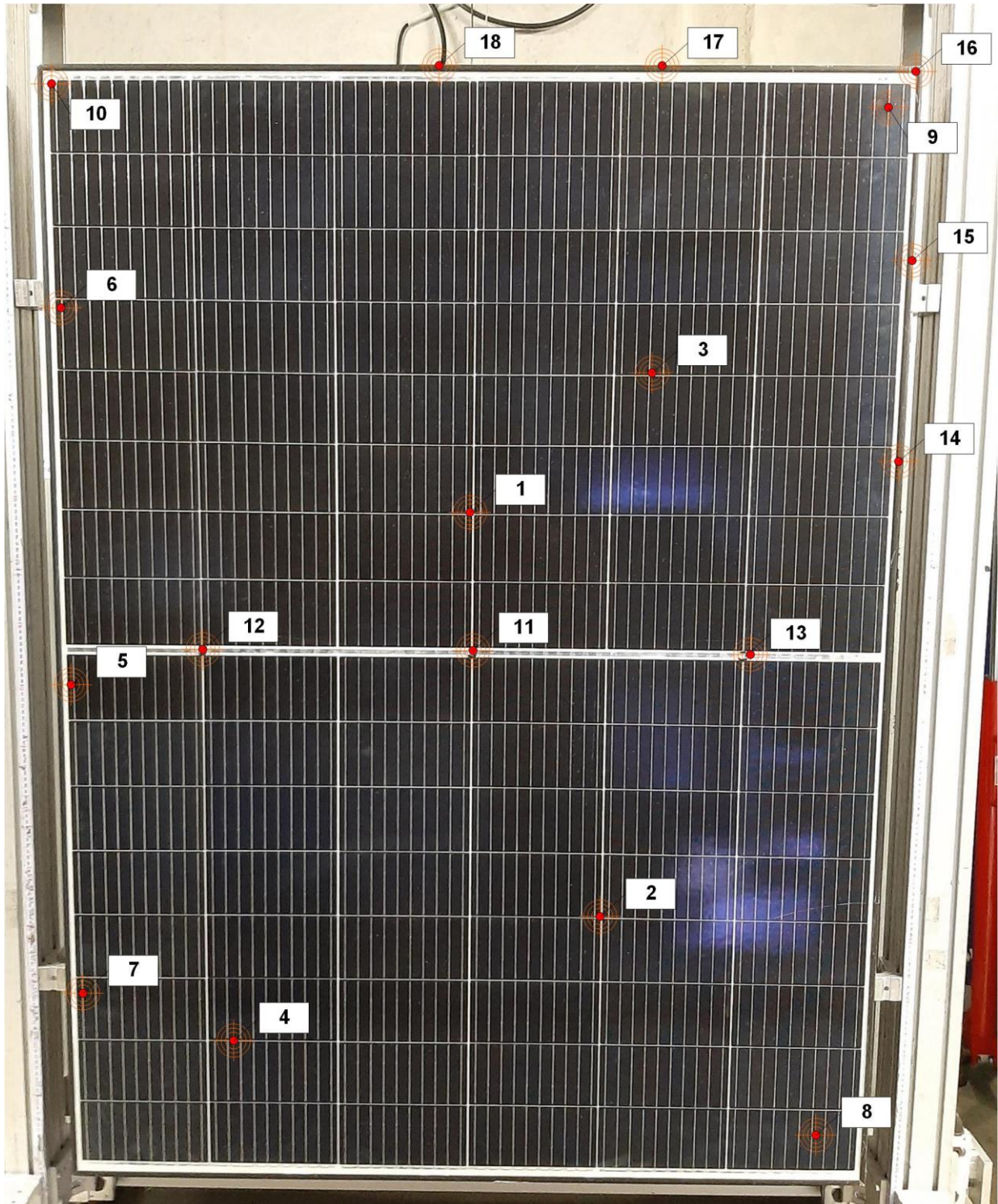
Supplementary information:

Prüfbericht-Nr.: DE25E613 001  
 Test report no.:

Seite 10 von 18  
 Page 10 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen/ Measuring results - Remarks	Ergebnis Result
------------------	---	--	--------------------

Overview of impact positions



Supplementary information: -

Prüfbericht-Nr.: DE25E613 001  
Test report no.:

Seite 11 von 18  
Page 11 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen/ Measuring results - Remarks	Ergebnis Result
------------------	---	--	--------------------

- Impact resistance test – Result table									
Sample ID	Impact information					Mass of ball [g]	Velocity of ball [m/s]	Impact energy [J]	—
	Day	No.	Location & description (cells from left bottom [x/y])	IEC***					
Initial - After initial control measurements (Ice ball diameter = 30 mm)									
1833	a	1	3/10 - 4/11	Over edges of circuit	3	12.55	23.66	3.51	P
		2	4/5 - 5/6	Over edges of circuit	4	12.82	24.44	3.83	P
		3	5/12 - 5/13	Near interconnects	5	12.68	23.79	3.59	P
		4	2/2 - 2/3	Near interconnects	6	12.83	24.37	3.81	P
		5	1/8	Edge of module window	2	12.76	24.12	3.71	P
		6	1/13	Near mounting position	7	12.79	24.27	3.77	P
		7	1/3	Near mounting position	8	12.73	24.04	3.68	P
		8	6/1	Far away from other impacts	9	12.58	23.70	3.53	P
		9	6/16	Far away from other impacts	10	12.90	24.99	4.03	P
		10	1/16	Corner of module window	1	12.63	23.69	3.54	P
		11	3/8 - 4/9	Over the junction box	11	12.68	23.62	3.54	P
		12	1/8 - 2/9	Over the junction box	11	12.73	24.00	3.67	P
		13	5/8– 6/9	Over the junction box	11	12.77	24.17	3.73	P
		14	600 mm from corner	Vertical frame	-	12.62	23.77	3.57	P
		15	300 mm from corner	Vertical frame	-	12.75	24.01	3.68	P
		16	Corner	Tip of frame	-	12.75	24.14	3.71	P
		17	300 mm from corner	Horizontal frame	-	12.81	24.33	3.79	P
		18	600 mm from corner	Horizontal frame	-	12.71	23.98	3.65	P
<b>Change to final measurement and inspection / additional verification of physical result</b>									—

Supplementary information: \*value to low (not valid); \*\*value to high (not valid); \*\*\*location acc. to IEC-standard

Prüfbericht-Nr.: DE25E613 001 Test report no.:			
Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen/ Measuring results - Remarks	Ergebnis Result
-	Final inspection (general)		
Test date [YYYY-MM-DD]		2025-09-08	
Sample-No.	Potential problem	Evaluation <sup>*/**</sup> HW3	—
HV2025001833	Technical problems	HW 3 <b>passed</b> ; <u>with 30 mm</u> NO cracks visible under use of electroluminescence NO power degradation detectable*	P
	Visual problems (distance; > 5 m)	HW 3 <b>passed</b> ; <u>with 30 mm</u> NO cracks visible ; NO dents visible	P
	Visual problems (near; < 0.5 m)	HW 3 passed; <u>with 30 mm</u> NO cracks visible ; NO dents visible	-
NOTE	Individual additional remarks: All results are related to the tested samples. * referred to measuring uncertainty **see also <i>Final evaluation and Annex : Additional information</i>		—
Supplementary information: -			

Prüfbericht-Nr.: DE25E613 001 Seite 13 von 18  
 Test report no.: Page 13 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen/ Measuring results - Remarks	Ergebnis Result
------------------	---	--	--------------------

-	<b>General remarks and subplementary information</b>		
	Measuring uncertainties		
	<b>All results only refer to the test samples that were subjected to testing.</b> The extended total measuring uncertainty for velocity, weight and performance is: $u(k=2) \leq \pm 2.5 \%$		—

Related test reports / certificates / documents		
The construction of the tested samples is documented in the relevant report valid in conjunction with the IEC certificate.		
Document no.	Certificate no.	—
Test report DE25AJG6 002, <i>incl. Annexes</i> <i>issued by TÜV Rheinland</i>	<b>PV 60182587</b> <i>issued by TÜV Rheinland</i>	
Technical data sheets “3SUN_B48_LE_3SHBGA-AF-455-460_revision_1.0_28052025” “3SUN_B48_LE_3SHBGA-CF-490-500_revision_1.0_28052025” <i>issued by 3SUN</i>		

Others - The result of the tested sample is also equivalent to:	
Main Types	
<ul style="list-style-type: none"> <li>● <b>3SHBGA-AF-xxx</b> (tested type)                             <ul style="list-style-type: none"> <li>○ power classes 455 - 460 W (96 cells)</li> <li>○ glass package (2.0 + 2.0 mm)</li> <li>○ cells (mono / half-cut)</li> <li>○ frame color (black)</li> <li>○ backside glazing (white grid)</li> <li>○ encapsulation color (transparent)</li> <li>○ frame thickness (30 mm)</li> <li>○ maximum system voltage (1500 V<sub>DC</sub>)</li> <li>○ dimension (L/W) (1754/1303 mm)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● <b>3SHBGA-CF-xxx</b> <ul style="list-style-type: none"> <li>○ power classes 490 - 500 W (96 cells)</li> </ul> </li> </ul> <p>The relevant and only difference is the production place of solar cell (3SHBGA-AF...= Italy; CF...= China).                      Chinese cell is also tested as type 3SHBGH with different outer dimensions and 120 cells instead of 96 only.                      The results are documented within report DE25Q67W.</p>
The recommendation <b>“HW3”</b> is aplicable to the various power ranges of above listed main types and endings.	

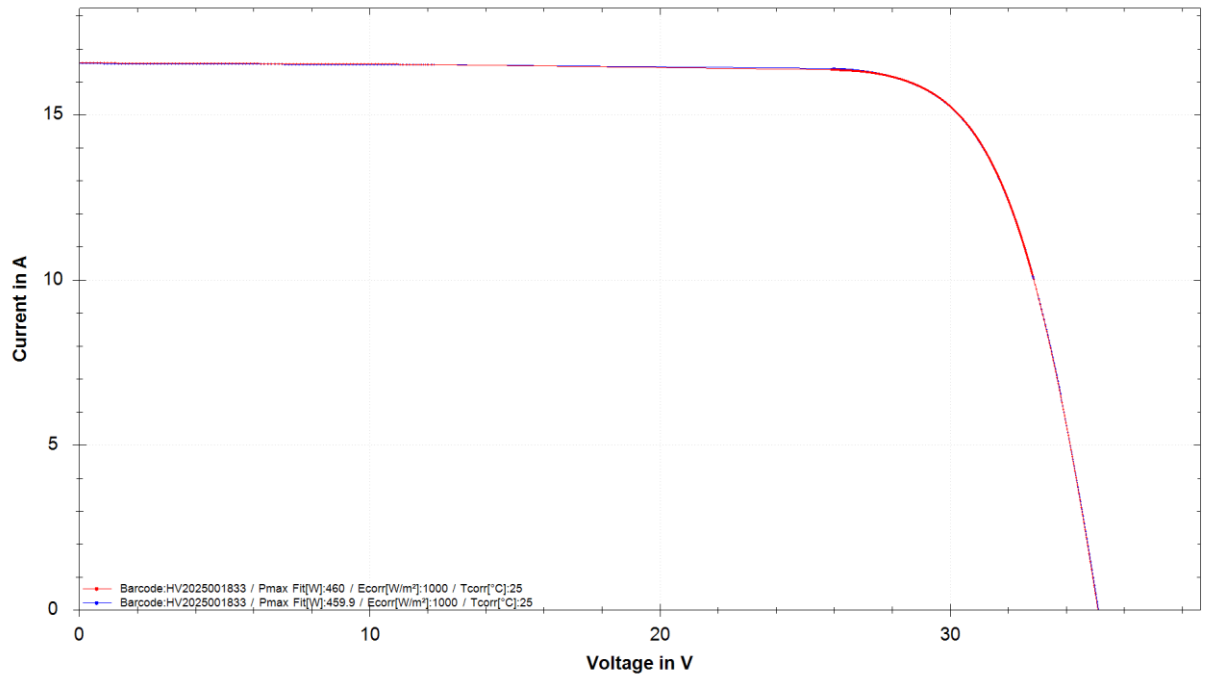
Prüfbericht-Nr.: DE25E613 001  
 Test report no.:

Seite 14 von 18  
 Page 14 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen/ Measuring results - Remarks	Ergebnis Result
------------------	---	--	--------------------

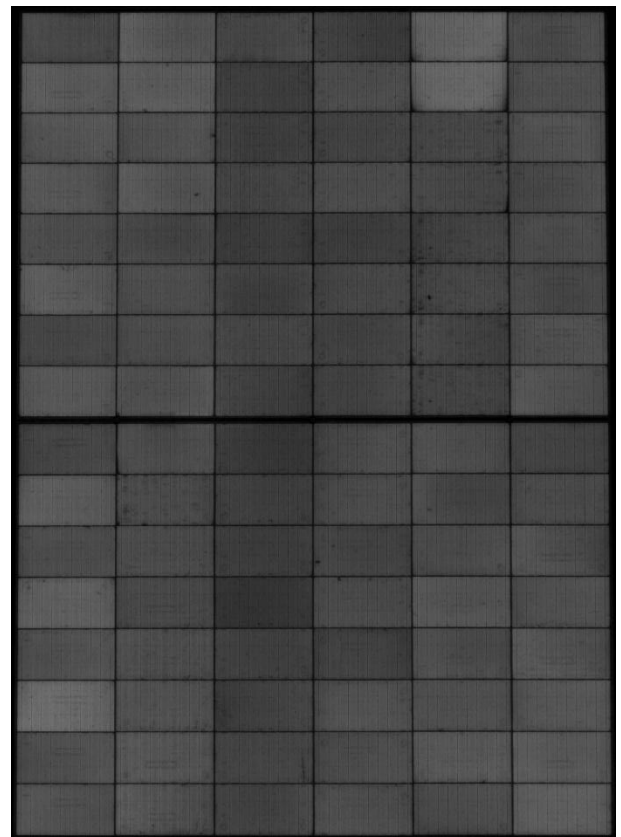
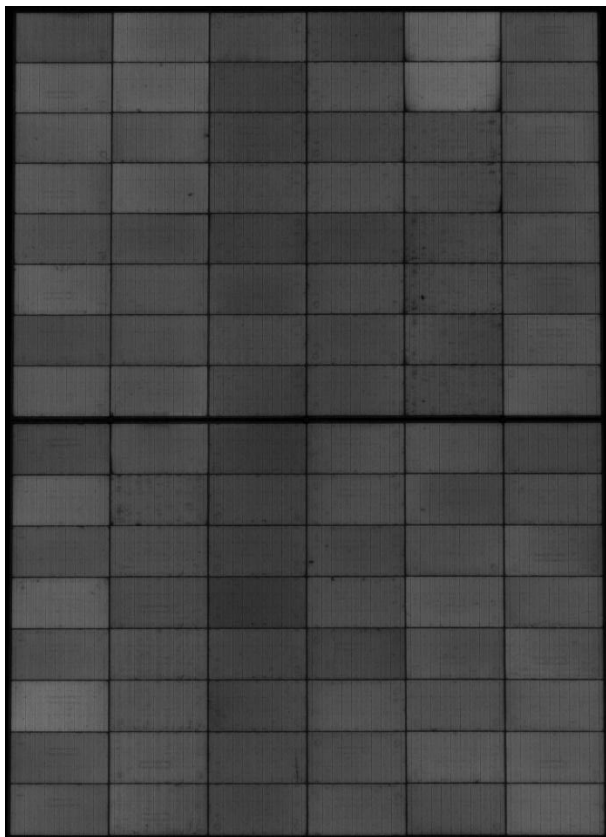
- Annex: Additional information

IV-curve and Electroluminescence image - for 30 mm Hail Impact (initial / final) – HV2025001833



*initial*

*final*



Supplementary information: -

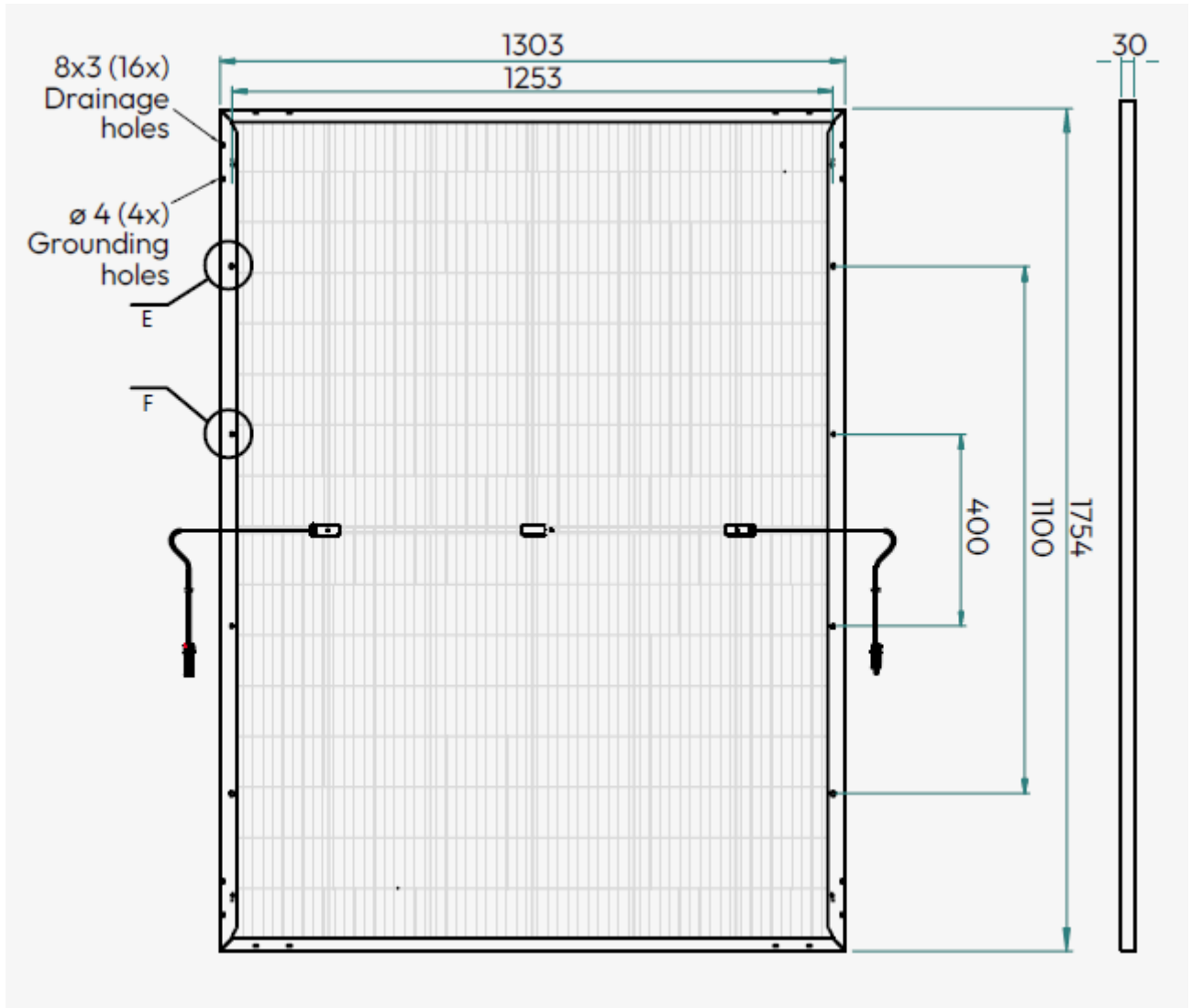
Prüfbericht-Nr.: DE25E613 001  
 Test report no.:

Seite 15 von 18  
 Page 15 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen/ Measuring results - Remarks	Ergebnis Result
------------------	---	--	--------------------

-	<b>Annex: Additional information</b>		
---	--------------------------------------	--	--

Frame - Extract of drawing and datasheet



Supplementary information: -

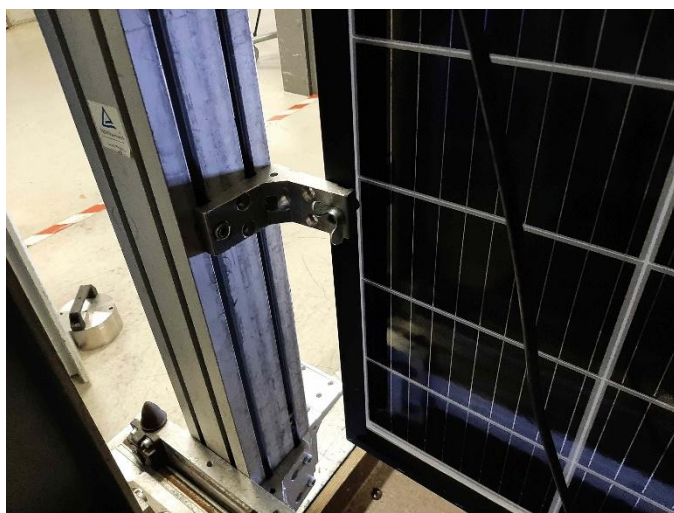
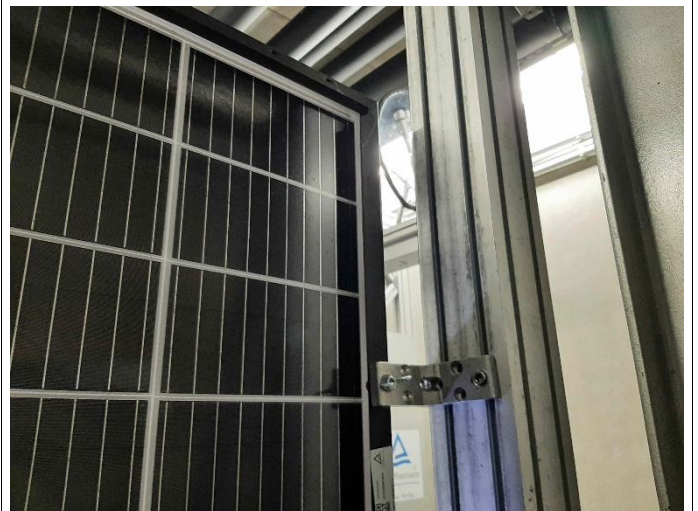
Prüfbericht-Nr.: DE25E613 001  
Test report no.:

Seite 16 von 18  
Page 16 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen/ Measuring results - Remarks	Ergebnis Result
------------------	---	--	--------------------

- Annex: Additional photo documentation

Test Set-up (example)



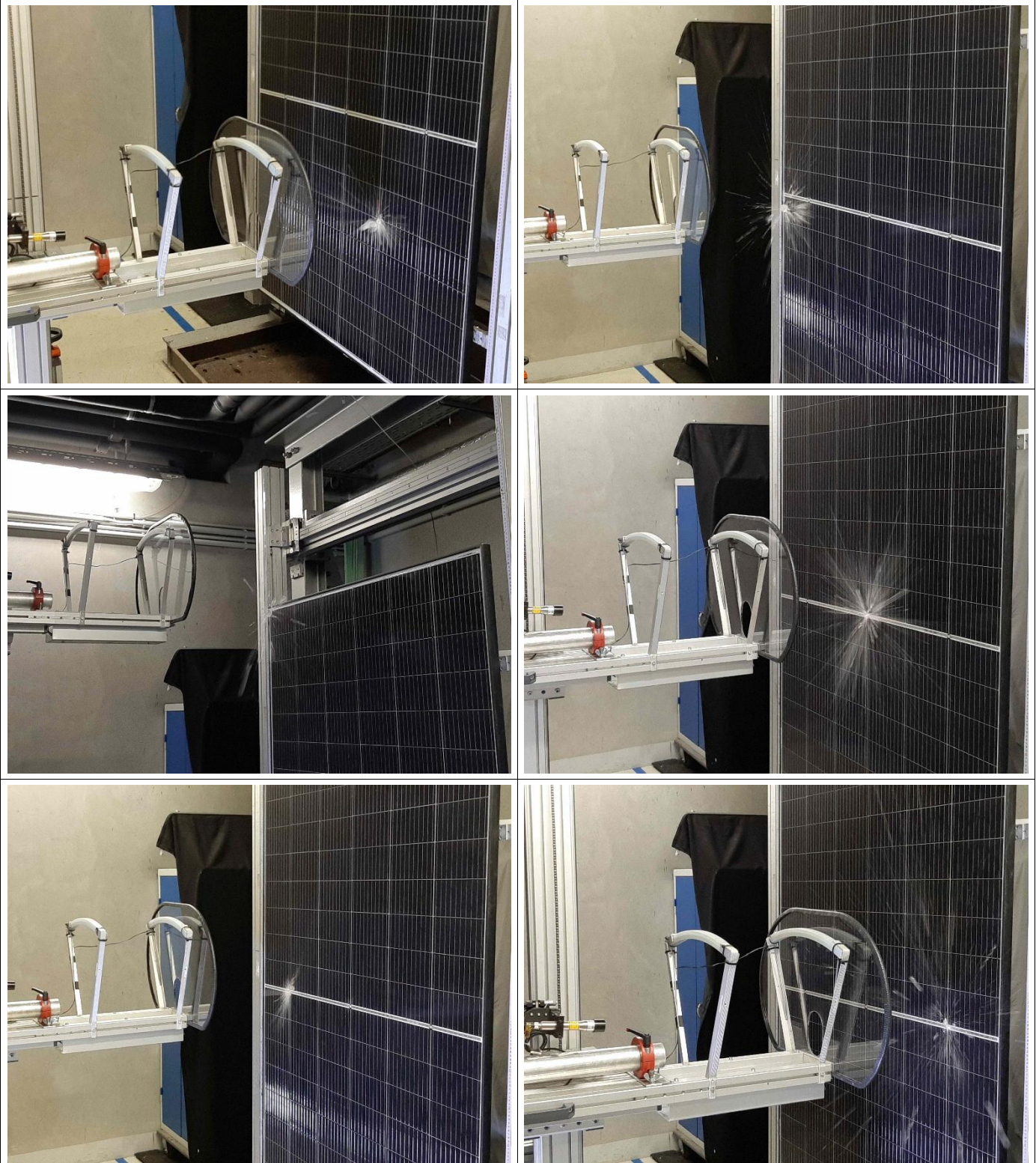
Prüfbericht-Nr.: DE25E613 001  
Test report no.:

Seite 17 von 18  
Page 17 of 18

Absatz Clause	Anforderungen - Prüfungen / Requirements - Tests	Messergebnisse – Bemerkungen/ Measuring results - Remarks	Ergebnis Result
------------------	---	--	--------------------

-	<b>Annex: Additional photo documentation</b>		
---	--	--	--

Example of Impacts on Module (30 mm)



--- Blank page ---

Test report no.: **DE25E613 001**

Page 18 of 18

--- End of report ---