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Anmerkungen
Remarks

A	<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 Prüfbedingungen, 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	<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. TUV 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, TUV 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>																				
C	<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>																				
D	<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>																				
E	<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>																				
F	<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>2025-10-27</td> <td>Original issue</td> <td></td> </tr> <tr> <td>002</td> <td>2025-11-05</td> <td>Correction of cell dimension / Typing error</td> <td>3</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Revision History				Revision	Date	Nature of changes	Page	001	2025-10-27	Original issue		002	2025-11-05	Correction of cell dimension / Typing error	3				
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Produktbeschreibung
Product description

1	Auftraggeber <i>Client</i>	LONGi Solar Technologies GmbH Bockenheimer Landstrasse 51-53 60325 Frankfurt am Main Germany																																		
2	Produktdetails <i>Product details</i>	<p style="text-align: center;">Allgemeine Informationen ; General Information 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%;">LONGi</td> </tr> <tr> <td>Type name</td> <td>LR7-54HJD-495M</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>495</td> </tr> <tr> <td>Cell technology</td> <td>Mono</td> </tr> <tr> <td>Cell dimension (l / w) [mm]</td> <td>182.2 / 96 (half-cut)</td> </tr> <tr> <td>No. of cells</td> <td>108</td> </tr> <tr> <td>Max. system voltage [V]</td> <td>1500</td> </tr> <tr> <td>Thickness of glazing [mm]</td> <td>2.0 (front) / 1.6 (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, low-reflection 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;">Dimensionen ; Dimension</td> </tr> <tr> <td>Dimension (l / w / h) [mm]</td> <td>1800 / 1134 / 30</td> </tr> <tr> <td>Gross area [m²]</td> <td>2.041</td> </tr> </table>	Brand name	LONGi	Type name	LR7-54HJD-495M	Product category	PV-module	Year of production	2025	Power class [W]	495	Cell technology	Mono	Cell dimension (l / w) [mm]	182.2 / 96 (half-cut)	No. of cells	108	Max. system voltage [V]	1500	Thickness of glazing [mm]	2.0 (front) / 1.6 (back)	Glazing (front)	Heat strengthened, low-reflection white glass	Glazing (back)	Heat strengthened, low-reflection white glass	Frame material	Aluminium	Frame thickness [mm]	30	Dimensionen ; Dimension		Dimension (l / w / h) [mm]	1800 / 1134 / 30	Gross area [m ²]	2.041
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3	Technische Dokumentation <i>Technical documentation</i>	for detailed constructional data see <i>Technical Datasheet</i> "LR7-54HJD 495~510M" 20250905 BGV02 issued by LONGi																																		
4	Hersteller <i>Manufacturer</i>	LONGi Solar Technologies GmbH																																		
5	Sonstiges <i>Other</i>	<ul style="list-style-type: none"> - The tested module type might be also available in different powerclasses. - Further the result is applicable to additional types; for more details see "General remarks" - Mounting: Asymmetric (mounting holes / 200 and 325 mm from corner) 																																		
6	Prüfmusterbereitstellung: <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																																		

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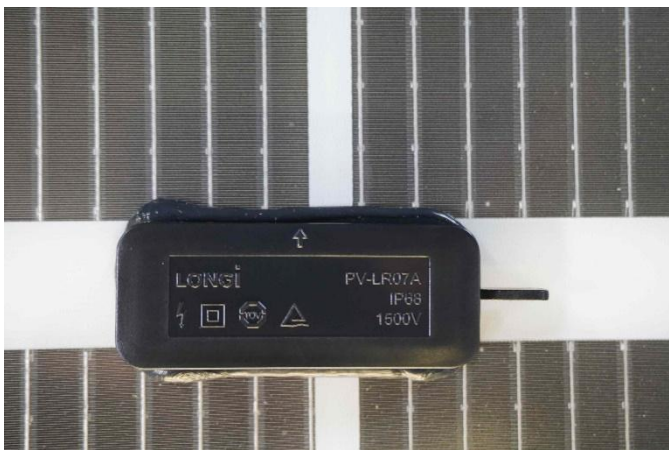
Sample - Front (example)



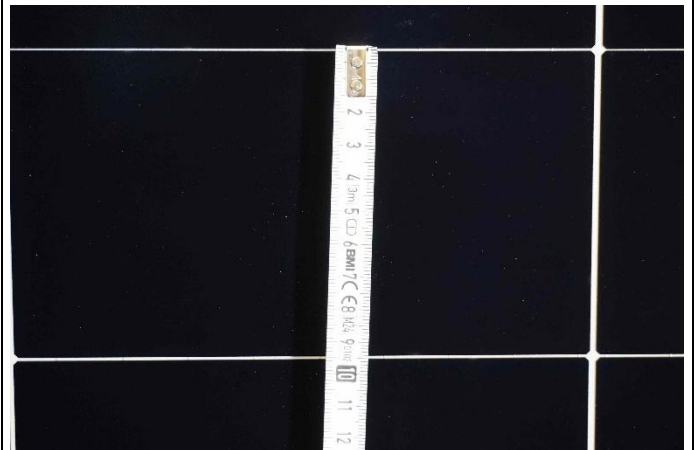
Sample - Back (example)



Example of junction box



Example of cells



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-	Result summary table		
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Test	Date [DD Month YYYY]		Summary of main test results	—
	Initial (1 st)	Final (2 nd)		
Insulation test	25 September 2025	02 October 2025	-	P
Wet leakage current test	25 September 2025	02 October 2025	-	P
Performance at STC	01 October 2025	07 October 2025	-	P
Electroluminescence images	01 October 2025	07 October 2025	-	P
Impact resistance	02 October 2025		HW3 with 30 mm ice balls passed	P
Final inspection	09 October 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

	Final evaluation (recommendation of testing laboratory)		
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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: -

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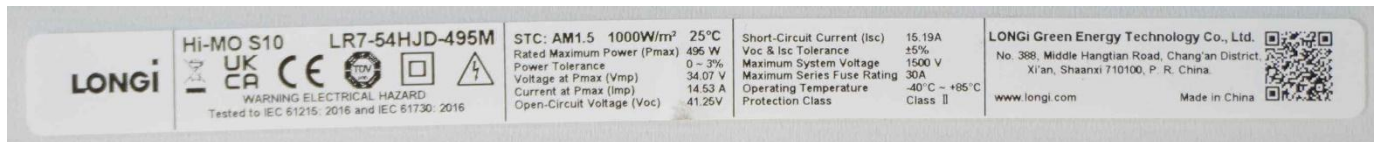
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-	Visual inspection (Initial)		
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Test date [YYYY-MM-DD]	2025-09-25	—
Sample No.	Nature and position of initial findings	
HV2025002372	No relevant visual defects	
HV2025002373	No relevant visual defects	

Supplementary information: -

Type plate (example)



-	List of test samples		
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Sample No.	Sample S/N	Remarks / constructional characteristics	—
HV2025002372	LRR010097250600303998	Main test sample	—
HV2025002373	LRR010097250600301501	Pre-measured Spare	—

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-	Maximum power determination (STC)							
General; for all following measurements								—
Module temperature [°C]				corrected to 25				
Irradiance [W/m ²]				1000				
Initial / Final*								
Test date [YYYY-MM-DD]				2025-10-01 and *2025-10-07				
Sample No.	P _{max} [W]	V _{mpp} [V]	I _{mpp} [A]	V _{oc} [V]	I _{sc} [A]	FF [%]	Degradation** [%]	P
HV2025002372	489.4	35.35	13.84	40.57	14.61	82.6	initial	
	487.4	35.18	13.85	40.41	14.60	82.6	-0.41	
Supplementary information: ** if negative only								

-	Insulation test (ISO)							
General; for all following measurements								—
Maximum system voltage [V _{DC}]				1500				
High voltage applied [V _{DC}]				1 st		3000		
				2 nd		8000		
Insulation resistance measured at [V _{DC}]				1000				
Initial / Final*								
Test date [YYYY-MM-DD]				2025-09-25 and *2025-10-02				
Sample No.	Measured	Area	Result*	Dielectric breakdown				P
	[GΩ]	[m ²]	[GΩ × m ²]	Yes (description)		No		
HV2025002372	1.0	2.04	2.0	-		x		P
	1.0	2.04	2.0	-		x		P
Supplementary information: -								

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-	Wet leakage current test (WL)				
General; for all following measurements				—	
Insulation resistance measured at [V _{DC}]		1000			
Solution resistivity [Ω cm]		< 3.500			
Solution temperature [°C]		22 ± 3			
Initial / Final*					
Test date [YYYY-MM-DD]		2025-09-25 and *2025-10-02			
Sample No.	Measured	Area	Result		
	[MΩ]	[m²]	[MΩ × m²]		
HV2025002372	1000	2.04	2040		P
	1000	2.04	2040		P
Supplementary information: -					

-	Electroluminescence images (EL)			
Analysis of electroluminescence images (see also <i>Annex : Additional information</i>)				
Initial / Final*				—
Test date [YYYY-MM-DD]		2025-10-01 and *2025-10-07		
Sample No.	Reverse current applied [A]	Attributes		
HV2025002372	15 (@ 300 ms)	No relevant conspicuousness/findings		
	15 (@ 300 ms)	No additional relevant conspicuousness/findings		
Supplementary information: -				

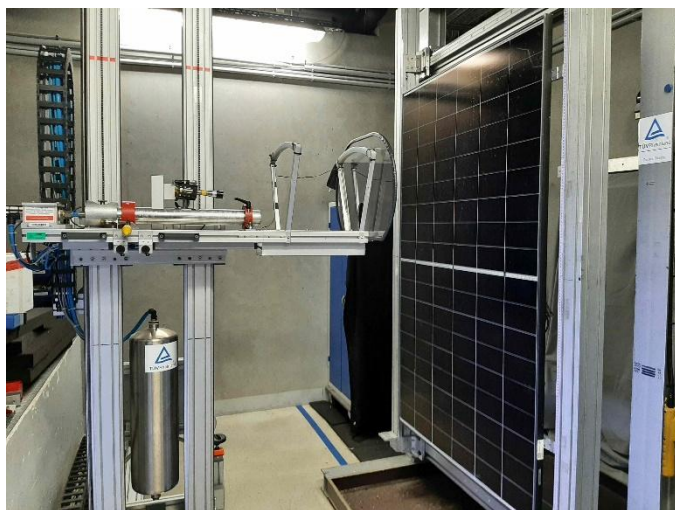
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-	Impact resistance test (general)		
Test date [YYYY-MM-DD] Day code	2025-10-02 ^a		
Sample-No. ID code	HV2025002372 ²³⁷²		
Method used for impact resistance	Nr. 25 "Photovoltaik Module		
Surface conditioning	none		
Sample tilt angle [° from horizontal]	90		
Direction of shoot [°]	0 (horizontal)		
Impact angle [° from sample surface]	90		
Distance (sample to center of v ₀ -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]	^a 23.1 and 47.6		
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



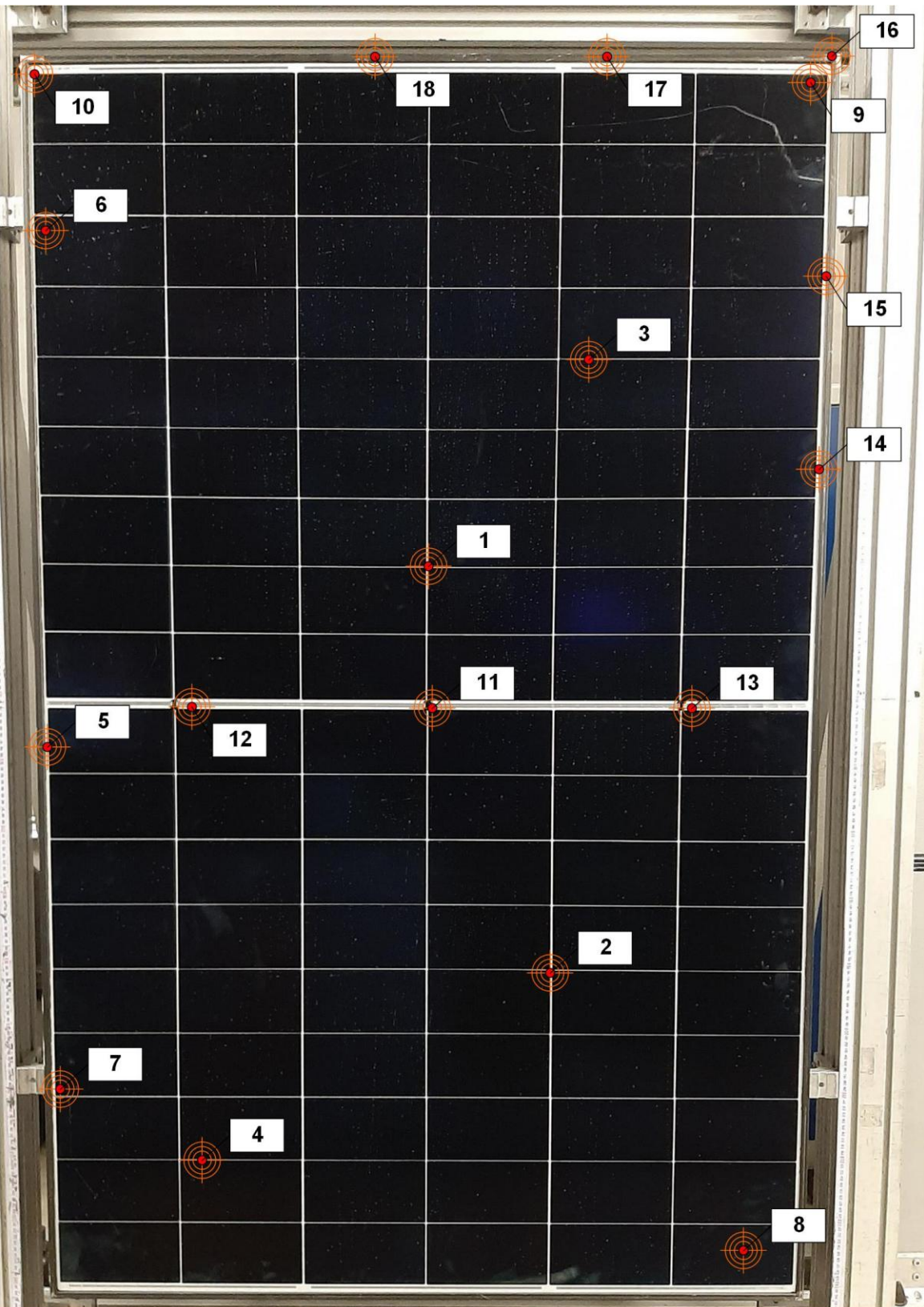
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Overview of impact positions



Supplementary information: -

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- 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)									
2372	a	1	3/11 - 4/12	Over edges of circuit	3	12.53	24.01	3.61	P
		2	4/5 - 5/6	Over edges of circuit	4	12.64	24.36	3.75	P
		3	5/14 - 5/15	Near interconnects	5	12.69	24.39	3.77	P
		4	2/2 - 2/3	Near interconnects	6	12.67	24.48	3.80	P
		5	1/9	Edge of module window	2	12.74	24.82	3.92	P
		6	1/16	Near mounting position	7	12.61	24.27	3.71	P
		7	1/4	Near mounting position	8	12.61	24.14	3.67	P
		8	6/1	Far away from other impacts	9	12.57	24.19	3.68	P
		9	6/18	Far away from other impacts	10	12.55	24.03	3.62	P
		10	1/18	Corner of module window	1	12.70	24.66	3.86	P
		11	3/9 - 4/10	Over the junction box	11	12.63	24.56	3.81	P
		12	1/9 - 2/10	Over the junction box	11	12.66	24.55	3.82	P
		13	5/9 - 6/10	Over the junction box	11	12.70	24.68	3.87	P
		14	600 mm from corner	Vertical frame	-	12.61	24.19	3.69	P
		15	300 mm from corner	Vertical frame	-	12.52	24.07	3.63	P
		16	corner	Tip of frame	-	12.68	24.40	3.77	P
		17	300 mm from corner	Horizontal frame	-	12.71	24.65	3.86	P
		18	600 mm from corner	Horizontal frame	-	12.65	24.33	3.74	P
Change to final measurement and inspection / additional verification of physical result									—

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

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-	Final inspection (general)		
Test date [YYYY-MM-DD]		2025-10-09	
Sample-No.	Potential problem	Evaluation ^{*/**}	—
		HW3	
HV2025002372	Technical problems	HW 3 passed; <u>with 30 mm</u> NO cracks visible under use of electroluminescence NO power degradation detectable*	P
	Visual problems (distance; > 5 m)	HW 3 passed; <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</i> and <i>Annex : Additional information</i>		—

Supplementary information: -

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-	General remarks and subplementary information		
	Measuring uncertainties		
	All results only refer to the test samples that were subjected to testing. 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 CN23DWS9 023, <i>incl. Annexes</i> <i>issued by TÜV Rheinland</i>	PV 50602768 0013 <i>issued by TÜV Rheinland</i>	
Technical data sheets "LR7-54HJD 495~510M" <i>issued by LONGi</i>		

Others - The result of the tested sample is also equivalent to:	
<i>Main Types</i>	
<ul style="list-style-type: none"> • LR7-54HJD-xxxM tested type <ul style="list-style-type: none"> ○ power classes 495 - 510 W (108 cells) ○ glass package (2.0 + 1.6 mm) ○ cells (mono / half-cut) ○ frame color (black) ○ backside glazing (white meshed) ○ encapsulation color (transparent) ○ frame thickness (30 mm) ○ maximum system voltage (1500 V_{DC}) ○ dimension (1800 x 1134 mm) 	
The recommendation " HW3 " is applicable to the various power ranges of above listed main types and endings.	

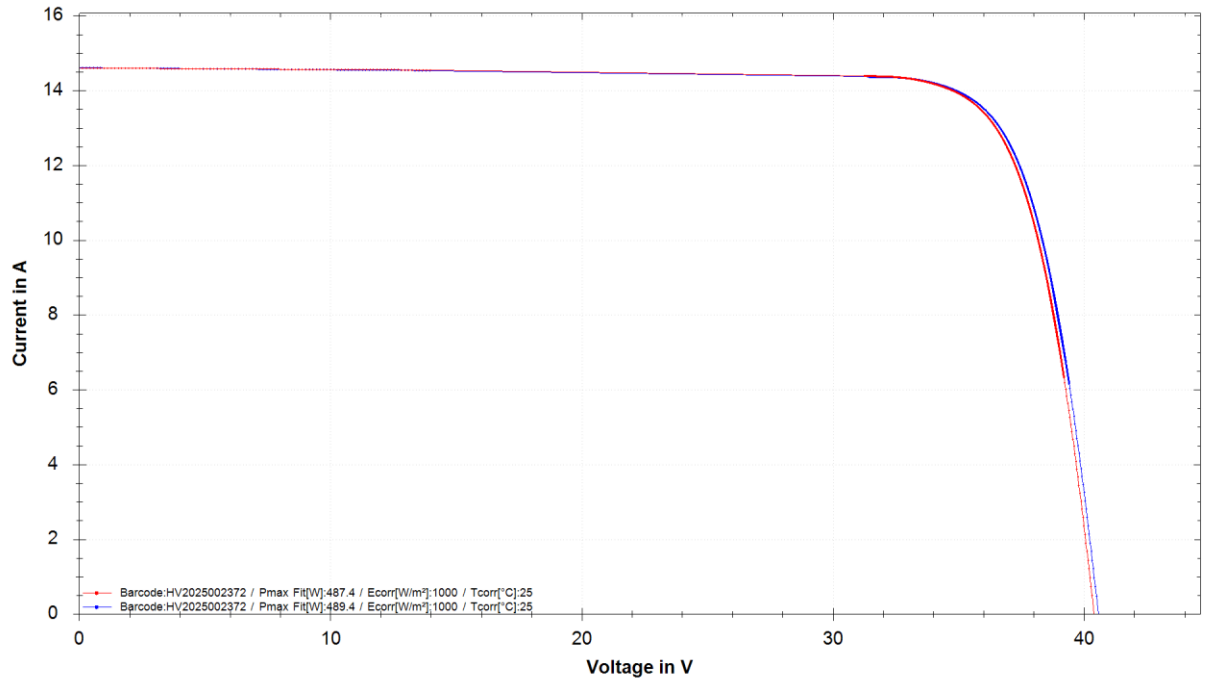
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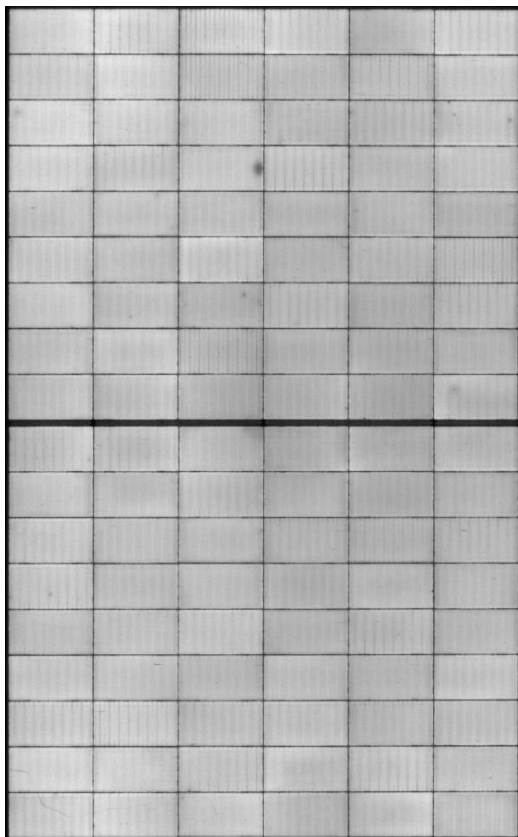
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- Annex: Additional information

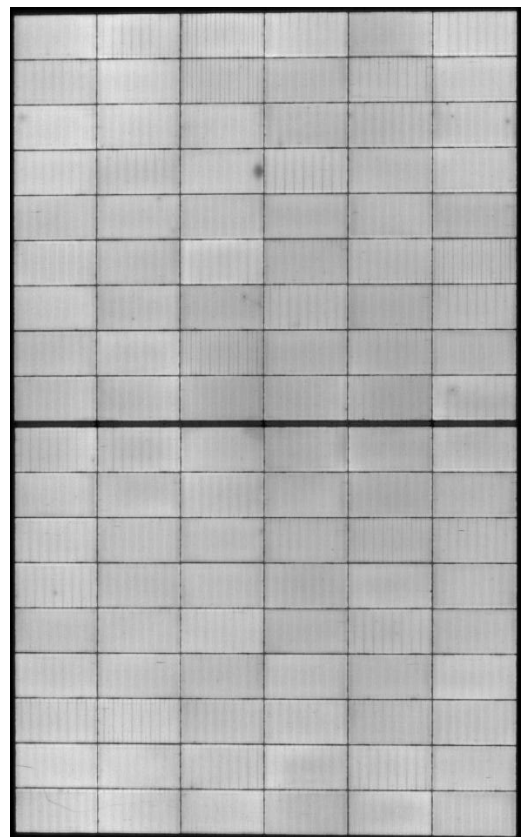
IV-curve and Electroluminescence image - for 30 mm Hail Impact (initial / final)



initial



final



Supplementary information: -

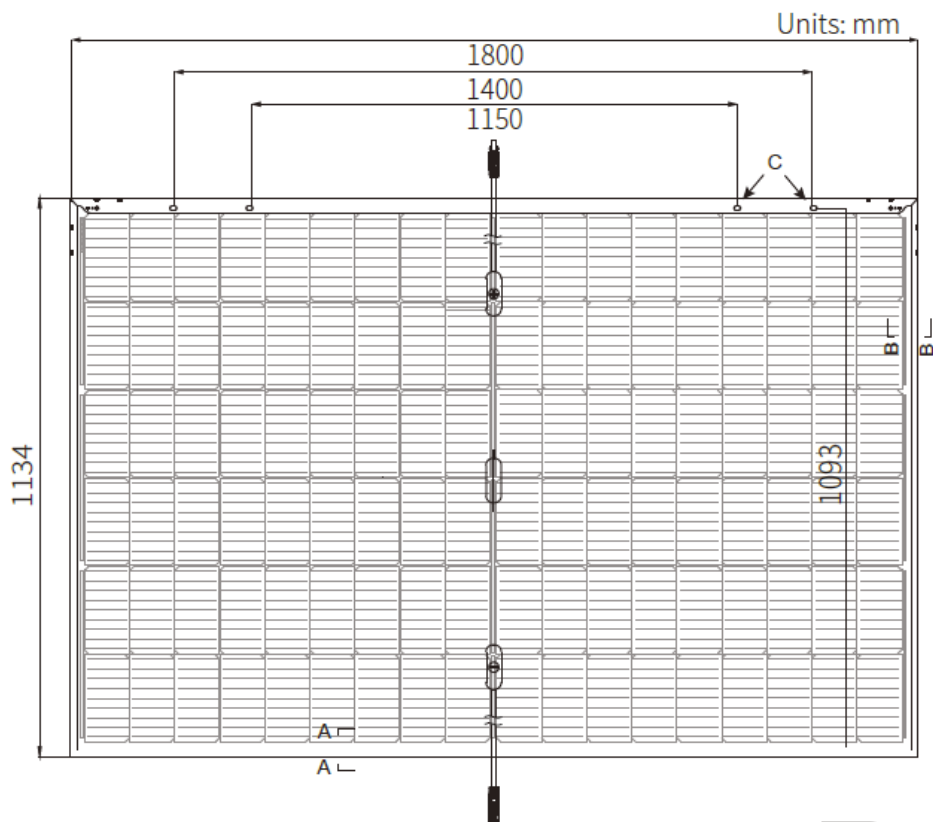
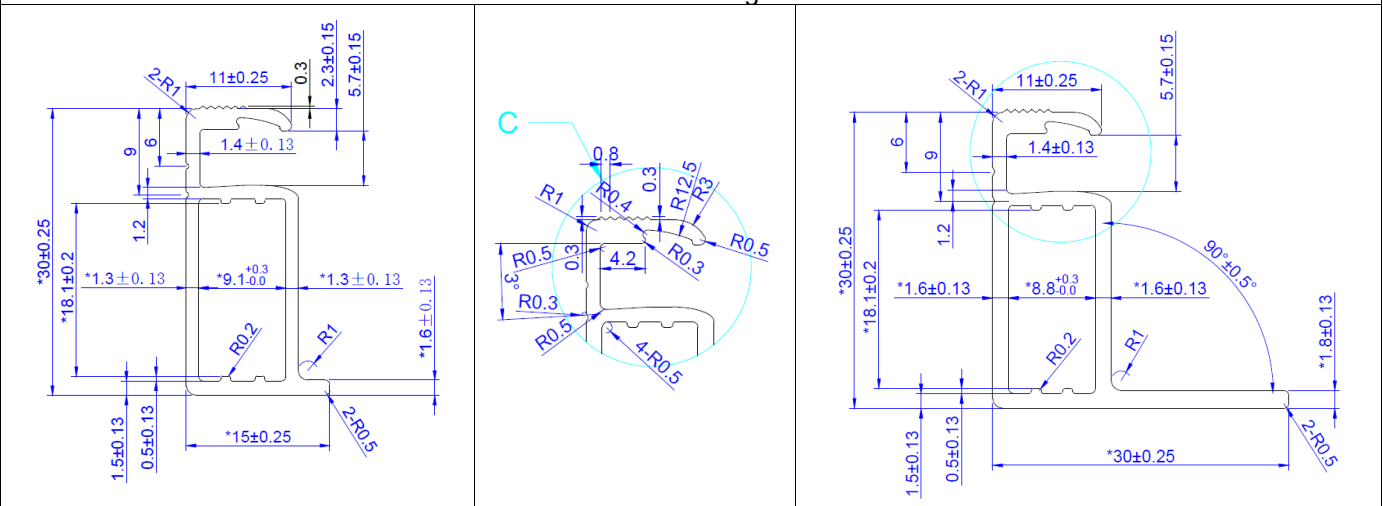
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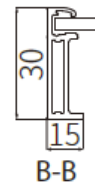
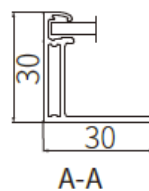
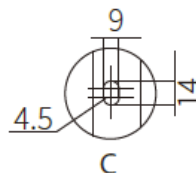
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- Annex: Additional information

Frame - Extract of drawing and datasheet



Tolerance:
Length: ±2mm
Width: ±2mm



Supplementary information: -

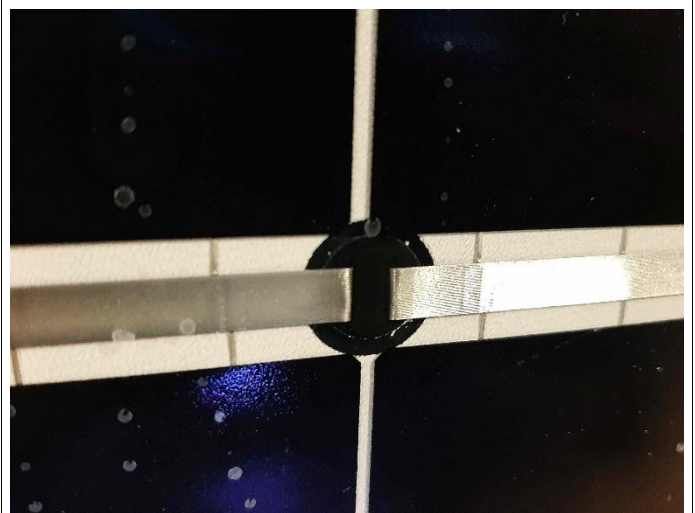
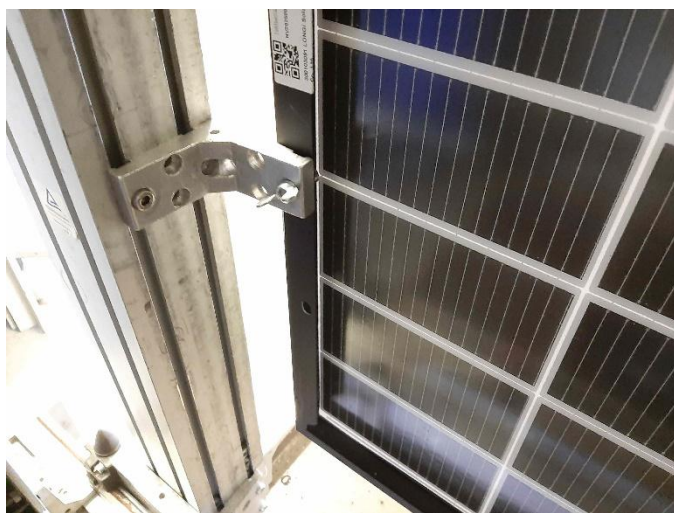
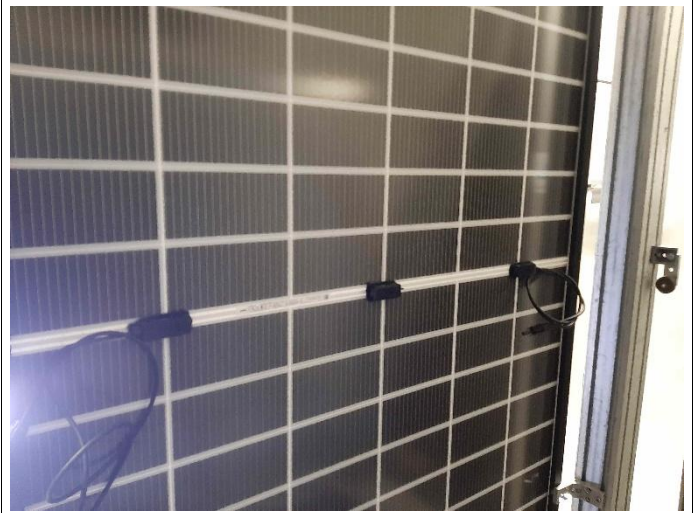
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- Annex: Additional photo documentation

Test Set-up (example)



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- **Annex: Additional photo documentation**

Example of Impacts on Module (30 mm)



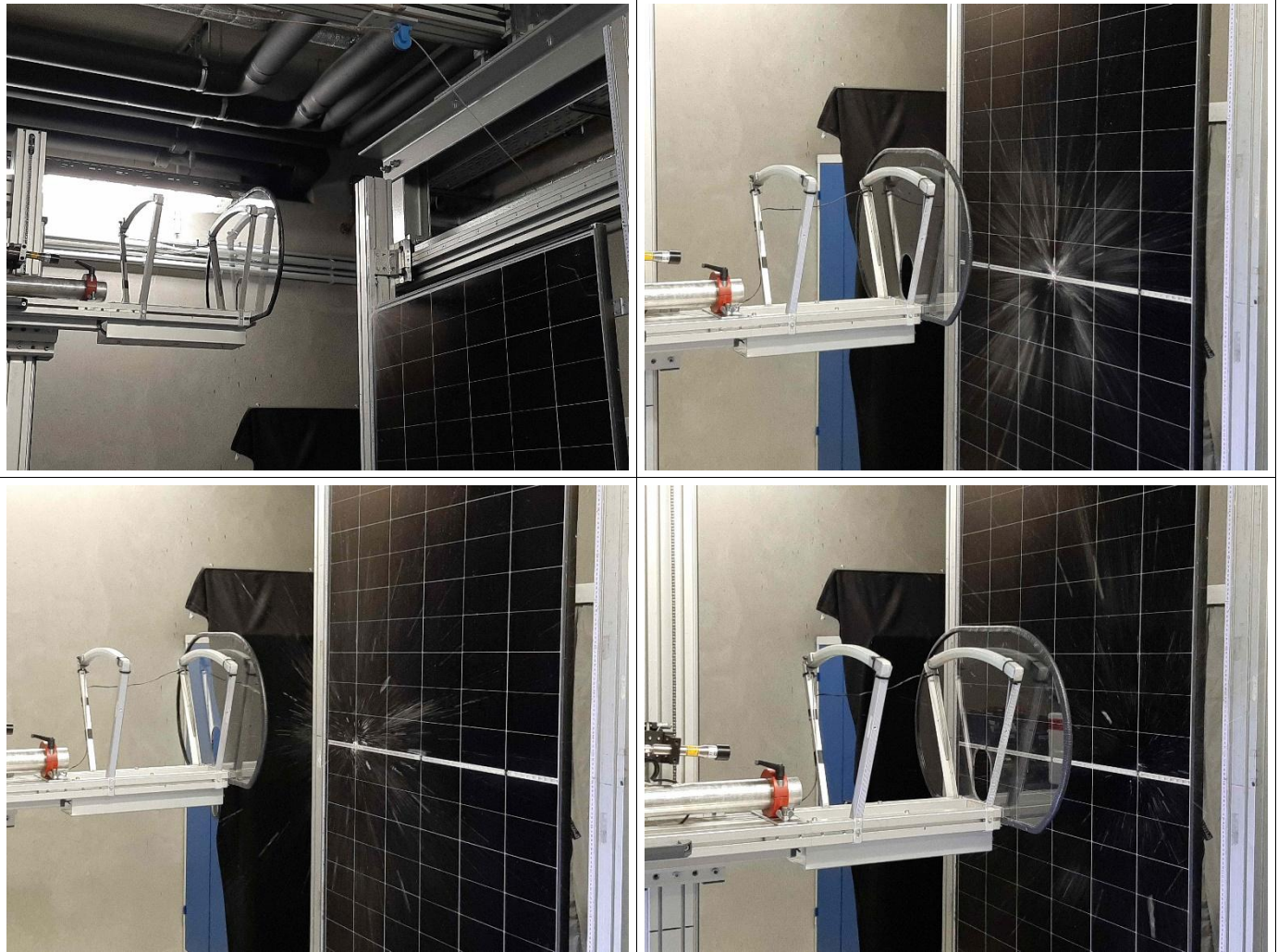
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- Annex: Additional photo documentation

Example of Impacts on Module (30 mm)



Example of Impacts on Frame (30 mm)



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