Prüfbericht-Nr.: *Test Report No.*:	**21221365.016**	**Auftrags-Nr.:** *Order No.*:	21238780	Seite 1 von 9 *Page 1 of 9*
Kunden-Referenz-Nr.: *Client Reference No.*:	223874	**Auftragsdatum:** *Order date*:	22 December 2016	
Auftraggeber: *Client*:	LG Electronics Inc. 168, Suchul-daero, Gumi-si, Gyeongsangbuk-do, 39368, Korea			
Prüfgegenstand: *Test item*:	Crystalline Photovoltaic (PV) modules			
Bezeichnung / Typ-Nr.: *Identification / Type No.*:	LG395N2W-A5			
Auftrags-Inhalt: *Order content*:	Salt mist corrosion testing of photovoltaic (PV) modules			
Prüfgrundlage: *Test specification*:	IEC 61701:2011, EN 61701:2012 severity 6 Salt mist corrosion testing of photovoltaic (PV) modules			

Wareneingangsdatum: *Date of receipt*:	22 December 2016
Prüfmuster-Nr.: *Test sample No.*:	HV2017000862,HV2017000863, HV2017000864
Prüfzeitraum: *Testing period*:	19.01.2017 – 29.03.2017
Ort der Prüfung: *Place of testing*:	Cologne
Prüflaboratorium: *Testing laboratory*:	Solar Energy Assessment Center
Prüfergebnis*: *Test result**:	Pass

Detaillierte Fotodokumentation
siehe Anlage zu diesem Bericht

Detailed photo documentation see appendix to this report

geprüft von / *tested by*:			**kontrolliert von /** *reviewed by*:		
30.03.2017	T. Herbrecht, project engineer		30.03.2017	D. Dopmeier, technical certifier	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other*: N/A

Zustand des Prüfgegenstandes bei Anlieferung:
Condition of the test item at delivery: Prüfmuster vollständig und unbeschädigt
Test item complete and undamaged

* 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*

V04

Prüfbericht-Nr.: 21221365.016
Test Report No.:

Liste der verwendeten Prüfmittel
List of used test equipment

Prüfmittel *Test equipment*	**Prüfmittel-Nr. / ID-Nr.** *Equipment No. / ID-No.*	**Nächste Kalibrierung** *Next calibration*

All equipment used for tests, including equipment for subsidiary measurements having a significant effect on the accuracy or validity of the result of the test is calibrated before being put into service.
The laboratory has an established programme and procedure for the calibration of its equipment according to EN ISO/IEC 17025 (Reg. no.: D-PL-11120-01-00).

Produktbeschreibung
Product description

1	**Produktdetails** *Product details* LG395N2W-A5
2	**Verwendete Materialien** *Used materials* see Constructional Data Form (CDF) in the annex of this test report
3	**Adresse(n) der Fertigungsstätte(n)** *Address(es) of the manufacturing site(s)* 1. LG Electronics Inc. 77, Sanho-daero, Gumi-si, Gyeongsangbuk-do, 39381, Korea 2. LG Electronics Inc. 168, Suchul-daero Gumi-si, Gyeongsangbuk-do 39368, Korea
4	**Zusammenfassung der Prüfergebnisse** *Summary of test results* According to the inquiry the resistance to salt mist of photovoltaic (PV) modules should be assessed in accordance with **IEC 61701:2011 / EN 61701:2012**. For the qualification of the modules to this test initial and final control measurements were performed before and after the salt mist corrosion testing. The measurements included relative power measurements, insulation testing and visual inspections. The maximum permissible power degradation of 5 % must not be exceeded. Furthermore the minimum requirements for the insulation test and wet leakage test as defined in IEC 61215:2005-10.3 and -10.15 have to be met. No major visual defects as defined in IEC 61215:2005 shall occur. The tests of the requirements of **IEC 61701:2011 / EN 61701:2012** were all fulfilled according to its regulations of the pass criteria.

Absatz	**IEC 61701:2011, EN 61701:2012 severity 6**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

-	**List of test samples**

Sample #	Sample S/N	Remarks / constructional characteristics (e.g. cell, back sheet, frame type)	—
HV2017000862	612K5PD1902D	A-Reference	
HV2017000863	612K5EB1905D	Salt mist corrosion test	
HV2017000864	612K5CY1905E	Salt mist corrosion test	

6.2 c)	**Visual inspection (Initial)**	
Sample No.	Nature and position of initial findings	—
HV2017000862	No visual defects	P
HV2017000863	No visual defects	P
HV2017000864	No visual defects	P
Supplementary information: -		

6.2 a)	**Maximum power determination (Initial)**						
Module temperature [°C]			corrected to 25				—
Irradiance [W/m²]			1000				
Sample No.	P_{max} [W]	V_{mpp} [V]	I_{mpp} [A]	V_{oc} [V]	I_{sc} [A]	FF [%]	
HV2017000862	394.7	39.23	10.06	49.41	10.42	76.7	—
HV2017000863	398.1	41.30	9.64	49.47	10.39	77.4	—
HV2017000864	398.1	39.98	9.96	49.41	10.38	77.6	—
Supplementary information: -							

Absatz	**IEC 61701:2011, EN 61701:2012 severity 6**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

6.2 e) Insulation test (Initial)

Maximum system voltage [V_{DC}]				1000		—
High voltage applied [V_{DC}]				3000		
Insulation resistance measured at [V_{DC}]				1000		
Sample No.	Measured	Area	Result*	Dielectric breakdown		
	[GΩ]	[m²]	[GΩ × m²]	Yes (description)	No	
HV2017000862	5.74	2.11	12.1		X	P
HV2017000863	5.08	2.11	10.7		X	P
HV2017000864	3.46	2.11	7.3		X	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: -						

6.2 b) Wet leakage current test (Initial)

Insulation resistance measured at [V_{DC}]		1000		—
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured	Area	Result*	—
	[MΩ]	[m²]	[MΩ × m²]	
HV2017000862	1501.9	2.11	3168.9	P
HV2017000863	1501.9	2.11	3168.9	P
HV2017000864	1501.9	2.11	3168.9	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: -				

Absatz	**IEC 61701:2011, EN 61701:2012 severity 6**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

6.2 d)	**Ground continuity test (Initial)**		
Maximum over-current protection rating [A]		20	—
Current applied [A]		50	
Location of designated grounding point		E	
Location of second contacting point		A	
Sample No.	Voltage [mV]	Resistance [mΩ]	
HV2017000862	545.0	10.9	P
HV2017000863	350.0	7.0	P
HV2017000864	555.0	11.1	P
Supplementary information: -			

7	**Salt mist corrosion test**	
Sample No. 1	HV2017000863	—
Sample No. 2	HV2017000864	
NaCl - concentration [%]	5	
Temperature [°C]	35	
Rel. humidity [%]	approx. 93	
Course of cycle (7 days)	- 2 h / 35°C / reaction of NaCl / ca. 93 % relative humidity (condensation of test items) - 22 h / 40°C / 93 % relative humidity (phase of drying) - after four periods of spraying and storage one storage period under standard atmosphere at 23°C and 45 % - 55 % relative humidity follows for 3 days	
Duration	8 cycles = 56 days	
Supplementary information: -		

9.2 c)	**Visual inspection after salt mist corrosion test**	
Sample No.	Nature and position of findings	—
HV2017000863	No visual defects	P
HV2017000864	No visual defects	P
Supplementary information: -		

Absatz	**IEC 61701:2011, EN 61701:2012 severity 6**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.2 Maximum power determination after salt mist corrosion test

Module temperature [°C]				Corrected to 25 °C				
Irradiance [W/m²]				1000				
Sample #	Pmpp [W]	Vmpp [V]	Impp [A]	Voc [V]	Isc [A]	FF [%]	Degradation [%]	
HV2017000863	391.8	40.99	9.56	49.40	10.25	77.4	-1.6	P
HV2017000864	395.4	41.16	9.61	49.33	10.34	77.5	-0.7	P

Supplementary information: Positive/Negative degradation values indicate the increase/decrease of P_{max}. Maximum allowable P_{max} degradation after this test is -5.0%.

9.2 e) Insulation test after salt mist corrosion test

Maximum system voltage [V_{DC}]				1000		
High voltage applied [V_{DC}]				3000		
Insulation resistance measured at [V_{DC}]				1000		—
Sample No.	Measured	Area	Result*	Dielectric breakdown		
	[GΩ]	[m²]	[GΩ × m²]	Yes (description)	No	
HV2017000863	0.89	2.11	1.9		X	P
HV2017000864	2.42	2.11	5.1		X	P

* Minimum requirement acc. to the standard is 0.04 GΩ × m².

Supplementary information: -

9.2 e) Insulation test after salt mist corrosion test

Maximum system voltage [V_{DC}]				1500		
High voltage applied [V_{DC}]				4000		
Insulation resistance measured at [V_{DC}]				1500		—
Sample No.	Measured	Area	Result*	Dielectric breakdown		
	[GΩ]	[m²]	[GΩ × m²]	Yes (description)	No	
HV2017000863	0.81	2.11	1.7		X	P
HV2017000864	2.12	2.11	4.5		X	P

* Minimum requirement acc. to the standard is 0.04 GΩ × m².

Supplementary information: -

Absatz	**IEC 61701:2011, EN 61701:2012 severity 6**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

9.2 b)	**Wet leakage current test after salt mist corrosion test**			
Insulation resistance measured at [V_{DC}]		1000		—
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured [MΩ]	Area [m²]	Result* [MΩ × m²]	—
HV2017000863	607.2	2.11	1281.1	P
HV2017000864	748.1	2.11	1578.6	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: -				

9.2 b)	**Wet leakage current test after salt mist corrosion test**			
Insulation resistance measured at [V_{DC}]		1500		—
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured [MΩ]	Area [m²]	Result* [MΩ × m²]	—
HV2017000863	467.7	2.11	986.9	P
HV2017000864	583.7	2.11	1231.6	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: -				

9.2 d)	**Ground continuity test after salt mist corrosion test**		
Maximum over-current protection rating [A]		20	—
Current applied [A]		50	
Location of designated grounding point		E	
Location of second contacting point		A	
Sample No.	Voltage [mV]	Resistance [mΩ]	
HV2017000863	105.0	2.1	P
HV2017000864	115.0	2.3	P
Supplementary information: -			

Absatz	**IEC 61701:2011, EN 61701:2012 severity 6**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen / *Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

9.2 f)	**Bypass diode functional test after salt mist corrosion test**			
Number of diodes in junction box		3		—
Diode manufacturer		JMTHY		
Diode type designation		THY2550		
Max. permissible junction temperature Tj_{max} [°C] (according to diode datasheet)		200		
Sample No.	Diode 1	Diode 2	Diode 3	
HV2017000863	OK	OK	OK	P
HV2017000864	OK	OK	OK	P
Supplementary information: -				

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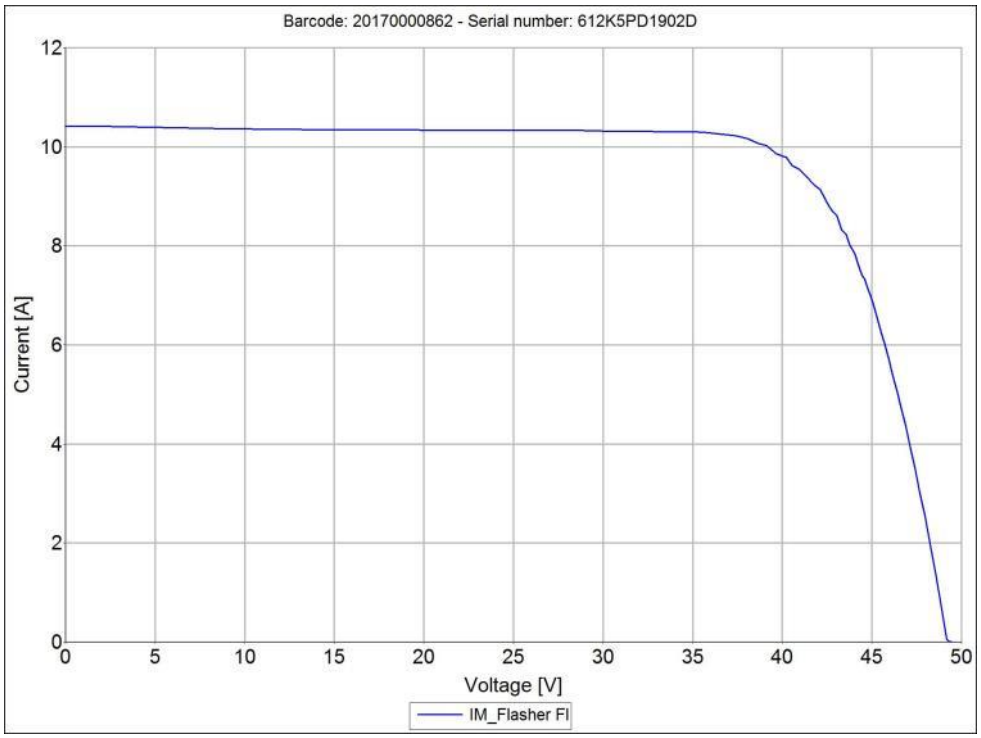
ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

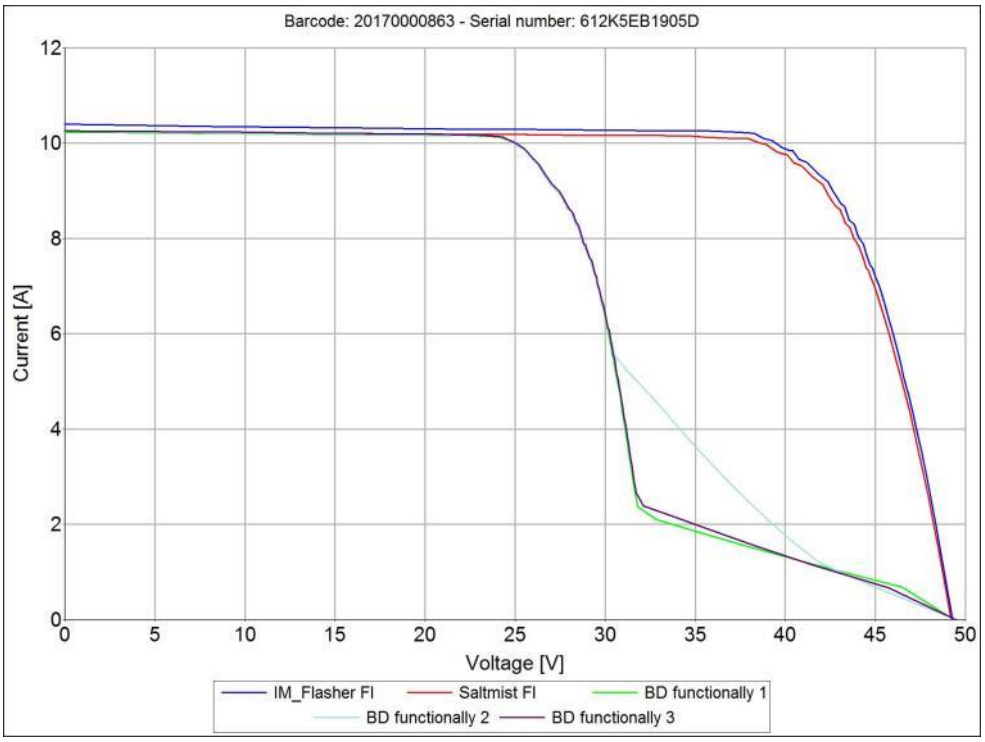
Statement of the estimated uncertainty of the test verdicts

- Electrical performance rating is outside the scope of IEC 61215:2005 qualification testing. The verdicts of performance rating are only related to the test samples that were subjected to the tests. They cannot be generalised to the modules from the series production.
- The calibration to STC was performed with a class AAA solar simulator. The extended measurement uncertainty is:
  - 2σ (P_{mpp}) ≤ ± 2.5 %
  - 2σ (I_{SC}) ≤ ± 2.3 %
  - 2σ (V_{OC}) ≤ ± 1.0 %
- Relative measurements were performed with a flash type solar simulator.
- The accuracy of measurement reproduction with the solar simulator is less than ±1%.

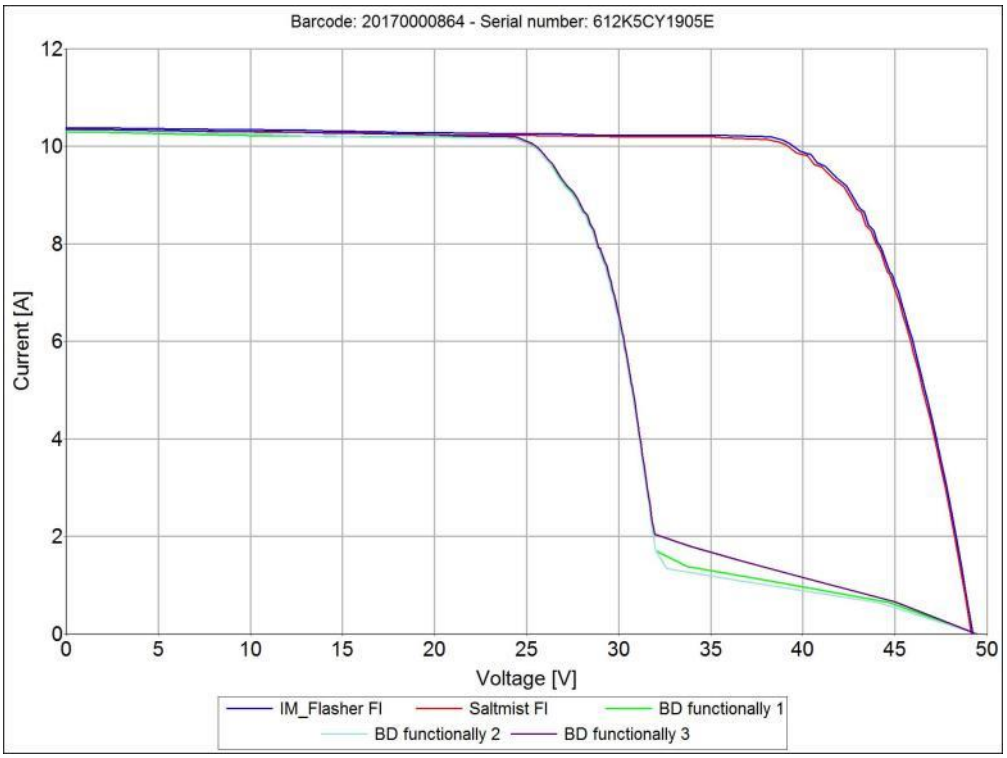
ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

Measurement reports





ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION



ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

Electroluminescence images of modules

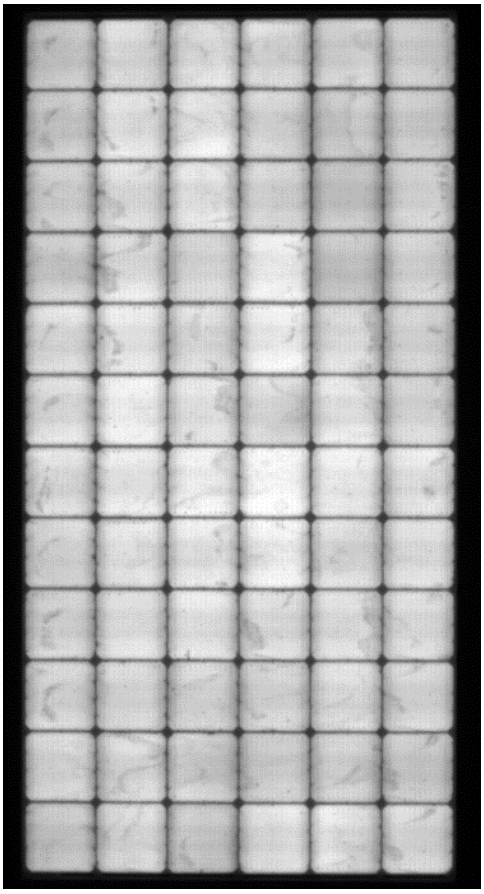


Fig. 1: HV2017000863

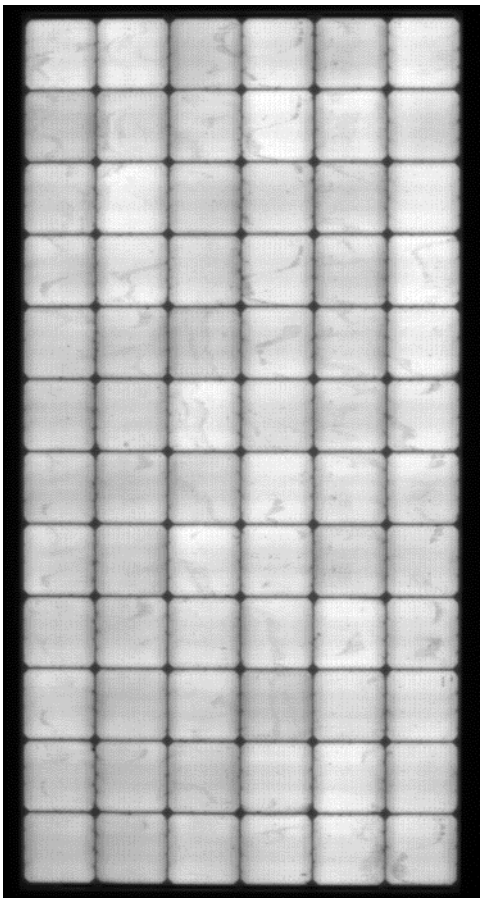


Fig. 2: HV2017000864

ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

Constructional Data Form for Photovoltaic Modules

Object	Manufacturer / trademark	Type / model
Front cover	ACHT	AR-Coated Solar Glass
Rear cover	SKC	BQ3RE 30
Encapsulation material	SKC	EF2T
	SKC	EF2N
Frame parts	HAIHONG	Corner-key
Adhesive (frame)	Dow-Corning	PV-8007
Junction box	JMTHY	JL29x
Bypass diode	JMTHY	THY2550
Cable	JMTHY	PV1500DC-F 1x4.0
Connector	JMTHY	PV-JM601A
Adhesive (junction box)	Dow Corning	PV-804

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FOTO-DOKUMENTATION
PHOTO-DOCUMENTATION

Fig. 1: front view of test sample LG395N2W-A5

Fig. 2: rear view of test sample LG395N2W-A5

Fig. 3: detail view of junction box LG395N2W-A5

Fig. 4: detail view of type label LG395N2W-A5

FOTO-DOKUMENTATION
PHOTO-DOCUMENTATION

Fig. 5: detailed side view to frame after ammonia corrosion test

Fig. 6: detailed left side view to frame after ammonia corrosion test