

Prüfbericht-Nr.: <i>Test Report No.:</i>	21208413.016_Rev2	Auftrags-Nr.: <i>Order No.:</i>	21237994	Seite 1 von 8 Page 1 of 8	
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	223874	Auftragsdatum: <i>Order date:</i>	26.10.2016		
Auftraggeber: <i>Client:</i>	LG Electronics Inc. 168, Suchul-daero, Gumi-si, Gyeongsangbuk-do, 39368, Korea				
Prüfgegenstand: <i>Test item:</i>	Crystalline PV modules				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	LG350S2W-A5				
Auftrags-Inhalt: <i>Order content:</i>	Ammonia corrosion testing of photovoltaic (PV) modules				
Prüfgrundlage: <i>Test specification:</i>	IEC 62716:2013 Photovoltaic (PV) modules - Ammonia corrosion testing				
Wareneingangsdatum: <i>Date of receipt:</i>	25.10.2016	Detaillierte Fotodokumentation siehe Anlage zu diesem Bericht Detailed photo documentation see appendix to this report			
Prüfmuster-Nr.: <i>Test sample No.:</i>	HV2016003700,HV201600370 1,HV2016003702				
Prüfzeitraum: <i>Testing period:</i>	03.11.2016 - 20.12.2016				
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:			
13.01.2017	T. Herbrecht, project engineer	13.01.2017	D. Dopmeier, technical certifier		
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>
Sonstiges / Other: This test report replaces test report no. 21208413.016_Rev1, issued on 09 January 2017. Reason: Correction of Constructional Data Form on page 5 of the Appendix.					
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</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>					

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Liste der verwendeten Prüfmittel
List of used test equipment

Prüfmittel <i>Test equipment</i>	Prüfmittel-Nr. / ID-Nr. <i>Equipment No. / ID-No.</i>	Nächste Kalibrierung <i>Next calibration</i>
<p>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).</p>		

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Produktbeschreibung
Product description

1 Produktdetails
Product details

LG350S2W-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)

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 ammonia of photovoltaic (PV) modules should be assessed in accordance with **IEC 62716:2013**. For the qualification of the modules to this test initial and final control measurements were performed before and after the ammonia 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 62716:2013** were all fulfilled according to its regulations of the pass criteria. The above listed module types have passed all tests of the IEC 61215:2005 standard before ammonia resistance test was applied (see history of certification).

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Absatz	IEC 62716:2013	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)	—
HV2016003700	607K3XD1353J	A-Reference	
HV2016003701	607K3JU1353B	Ammonia Corrosion Test	
HV2016003702	607K3EL1353C	Ammonia Corrosion Test	

6.2 c)	Visual inspection (Initial)		
Sample No.	Nature and position of initial findings		—
HV2016003700	No visual defects		P
HV2016003701	No visual defects		P
HV2016003702	No visual defects		P
Supplementary information: -			

6.2 a)	Maximum power determination (Frontside, 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 [%]	
HV2016003700	352.5	37.03	9.52	46.08	10.00	76.5	—
HV2016003701	351.5	36.91	9.52	46.07	9.94	76.8	—
HV2016003702	350.6	36.93	9.50	46.00	9.95	76.6	—
Supplementary information: -							

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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]	[m ²]	[GΩ × m ²]	Yes (description)	No	
HV2016003700	13.33	2.07	27.59		X	P
HV2016003701	13.33	2.07	27.59		X	P
HV2016003702	13.33	2.07	27.59		X	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m ² .						
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]		[m ²]	[MΩ × m ²]		
HV2016003700	573.5		2.07	1187.1		P
HV2016003701	555.7		2.07	1150.3		P
HV2016003702	559.3		2.07	1157.8		P
* Minimum requirement acc. to the standard is 40 MΩ × m ² .						
Supplementary information: -						

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Absatz	IEC 62716:2013	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]	15		—
Current applied [A]	50.0		
Location of designated grounding point	E		
Location of second contacting point	A		
Sample No.	Voltage [mV]	Resistance [mΩ]	
HV2016003700	80.0	1.6	P
HV2016003701	100.0	2.0	P
HV2016003702	90.0	1.8	P
Supplementary information: -			

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Clause	Anforderungen - Prüfungen / Requirements - Tests	Measuring results - Remarks	Evaluation

7	Ammonia corrosion test		
Sample No. 1	HV2016003701		
Sample No. 2	HV2016003702		
NH ₃ - concentration [ppm]	6667		
Temperature [°C]	60		
Relative humidity [%]	approx. 100 (condensation on the samples)		
One cycle (24 h)	- exposure of NH ₃ for 8 h and 60°C with nearly 100 % condensation on the samples - drying for 16 h at normal atmosphere (23 °C and max. 75 % rel. humidity)		
Duration	20 cycles = 480 h (20 days)		
Comment	according to DIN EN ISO 3231/ DIN EN ISO 6988 DIN 50018		
Supplementary information: -			

9.2 c)	Visual inspection after ammonia corrosion test		
Sample No.	Nature and position of findings		—
HV2016003701	No visual defects		P
HV2016003702	No visual defects		P
Supplementary information: -			

10.2	Maximum power determination after ammonia corrosion test (Frontside)							
Module temperature [°C]				Corrected to 25 °C				-
Irradiance [W/m ²]				1000				
Sample #	Pmpp [W]	Vmpp [V]	Impp [A]	Voc [V]	Isc [A]	FF [%]	Degradation [%]	
HV2016003701	351.6	37.35	9.41	46.05	9.98	76.5	0.0	P
HV2016003702	349.0	36.57	9.54	45.99	9.94	76.4	-0.5	P
Supplementary information: -								

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Clause	Anforderungen - Prüfungen / Requirements - Tests	Measuring results - Remarks	Evaluation

9.2 e)	Insulation test after ammonia 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]	[m ²]	[GΩ × m ²]	Yes (description)	No
HV2016003701	13.33	2.07	26.13		X
HV2016003702	3.72	2.07	7.7		X
* Minimum requirement acc. to the standard is 0.04 GΩ × m ² .					
Supplementary information: -					

9.2 b)	Wet leakage current test after ammonia 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	Area	Result*		—
	[MΩ]	[m ²]	[MΩ × m ²]		
HV2016003701	1424.2	2.07	2948.1		P
HV2016003702	1122.4	2.07	2323.4		P
* Minimum requirement acc. to the standard is 40 MΩ × m ² .					
Supplementary information: -					

9.2 d)	Ground continuity test after ammonia corrosion test				
Maximum over-current protection rating [A]	15				—
Current applied [A]	50.0				
Location of designated grounding point	E				
Location of second contacting point	A				
Sample No.	Voltage [mV]	Resistance [mΩ]			
HV2016003701	110	2.2			P
HV2016003702	115	2.3			P
Supplementary information: -					

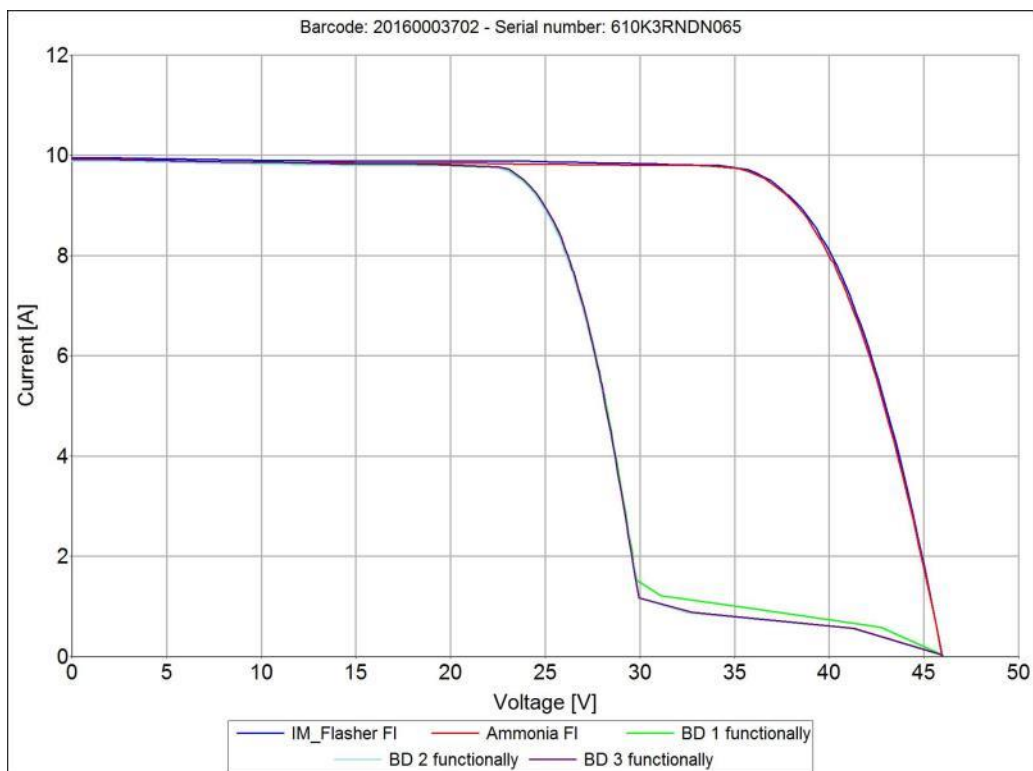
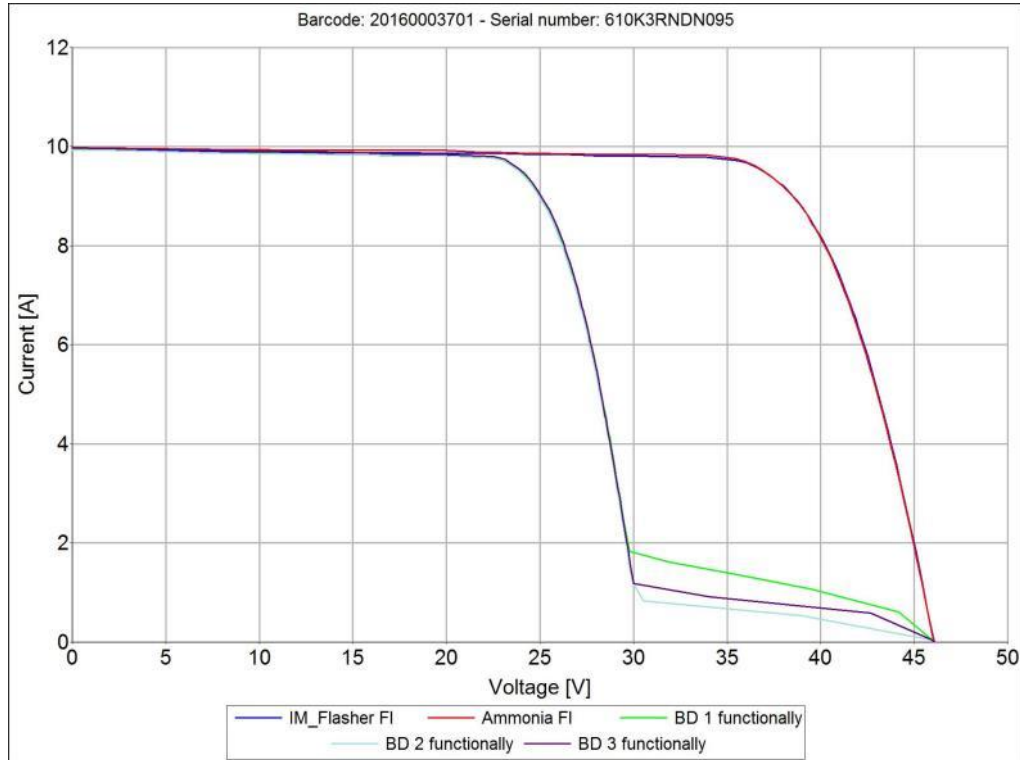
ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

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:
 - o $2\sigma (P_{\text{mpp}}) \leq \pm 2.5 \%$
 - o $2\sigma (I_{\text{SC}}) \leq \pm 2.3 \%$
 - o $2\sigma (V_{\text{OC}}) \leq \pm 1.0 \%$
- Relative measurements were performed with a flash type solar simulator.
- The accuracy of measurement reproduction with the solar simulator is less than $\pm 1\%$.

ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

Measurement reports



ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

Electroluminescence images of modules

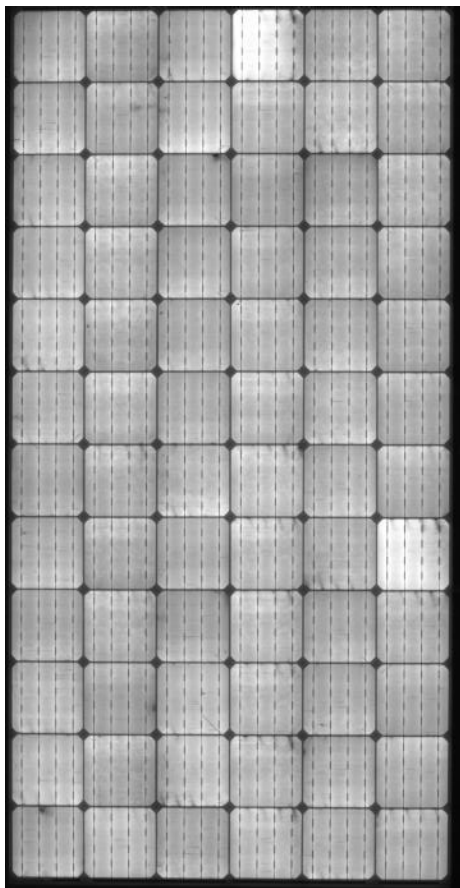


Fig. 1: HV2016003701

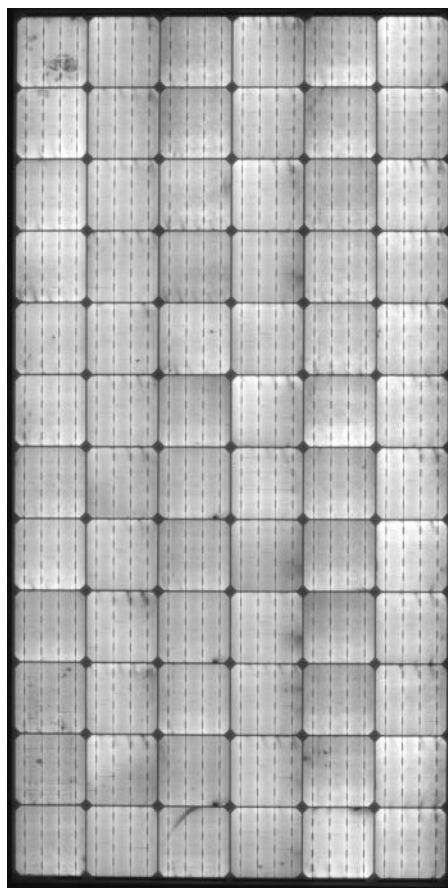


Fig. 2: HV2016003702

ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

Electroluminescence images of modules after ammonia corrosion test

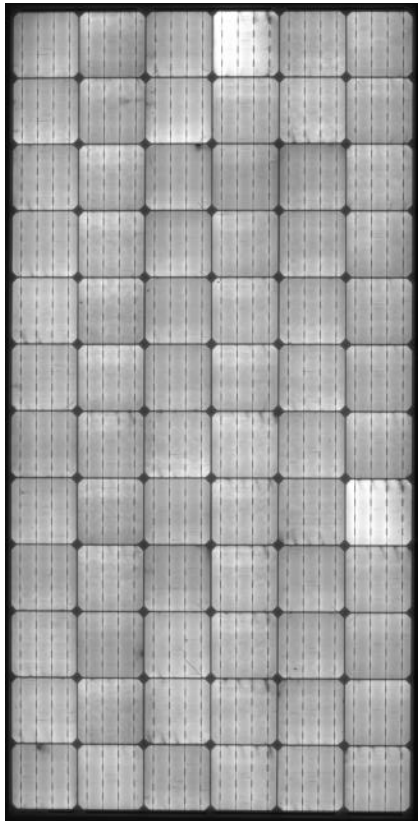


Fig. 3: HV2016003701

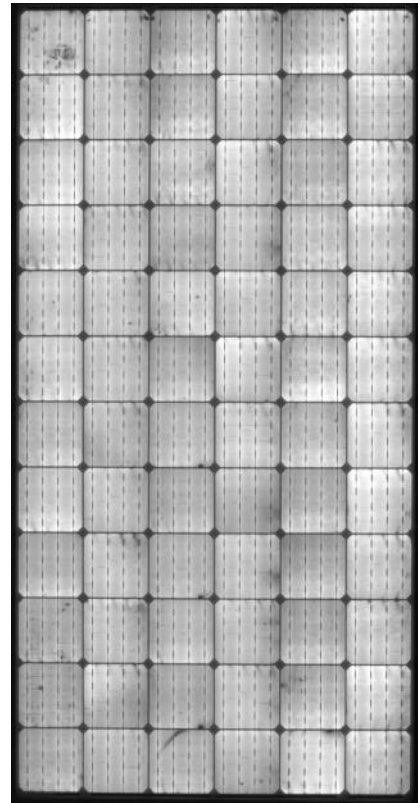


Fig. 4: HV2016003702

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ZUSATZ-DOKUMENTATION
ADDITIONAL DOCUMENTATION

Constructional Data Form for Photovoltaic Modules

Object	Manufacturer / trademark	Type / model
Front cover	ACHT	AR-Coated Solar Glass
Rear cover	DNP	PV-BS VGEW-SQH
Encapsulation material	SKC	EF2T (top)
	SKC	EF2N (bottom)
Frame parts	HAIHONG	Corner Key
Adhesive (frame)	KCC	SS4080
Junction box	JMTHY	JL29x
Bypass diode	JMTHY	THY2550
Cable	JMTHY	PV1500DC-F 1x4.0
Connector	Multi-Contact AG	PV-KST4, PV-KBT4
Adhesive (junction box)	Dow Corning	PV-804

FOTO-DOKUMENTATION
PHOTO-DOCUMENTATION

Fig. 1: front view of test sample



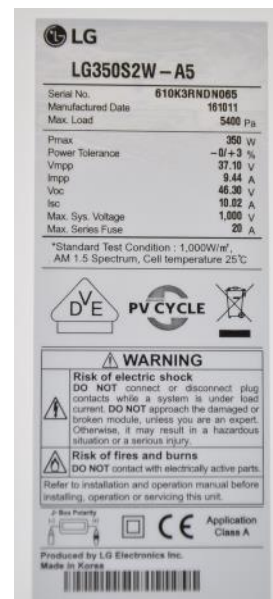
Fig. 2: rear view of test sample



Fig. 3: detail view of junction box LG350S2W – A5



Fig. 4: detail view of type label LG350S2W – A5



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FOTO-DOKUMENTATION
PHOTO-DOCUMENTATION

Fig. 5: detailed right side of frame after ammonia corrosion test



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

