Product Service

TEST REPORT

PPP 58042B:2015 Rev. 01

TÜV SÜD Test report in accordance with IEC TS 62804-1:2015

Photovoltaic (PV) modules – Test methods for the detection of potential-induceddegradation – Part 1: Crystalline silicon

Report No. ..... :	704062210703-02 part 2 of 2
Date of issue ..... :	2022-10-10
Project handler…… ..... :	Yang Xu
TÜV SÜD Branch:..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai
Address ..... :	No. 151 Heng Tong Road, Shanghai 200070, P. R. China
Testing location ..... :	Yangzhou Opto-Electrical Products Testing Institute No.10 West Kaifa Road, Yangzhou, Jiangsu, P.R. China
Client..... :	Trina Solar Co., Ltd.
Client number…… ..... :	070321
Address ..... :	No. 2 TianHe Road, Trina PV Industrial Park, New District, 213031 Changzhou City, Jiangsu Province, P.R. China
Contact person……	Ms. Chun Xu
Standard..... :	This TÜV SÜD test report form is based on the following requirements: PPP 58042B:2015 rev.01/2019-09 according to IEC TS 62804-1:2015
TRF number and revision*:*	TRF 58042B:2015 rev.01/2019-09
TRF originated by..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch, , Mr. Bo Xiangxi
Copyright blank test report..... :	This test report is based on the content of the standard (see above). The test report considered selected clauses of the a.m. standard(s) and experience gained with product testing. It was prepared by TUV SUD Product Service. TUV SUD Group takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.
General disclaimer:	This test report may only be quoted in full. Any use for advertising purposes must be granted in writing. This report is the result of a single examination of the object in question and is not generally applicable evaluation of the quality of other products in regular production.
Scheme ..... :	☒ TUV Mark ☐ without certification ☐ GS Mark ☐ NRTL Mark ☐ EU-Directive
Non-standard test method ..... :	☐ No ☒ Yes, see details under Summary of testing
National deviations..... :	N/A
Number of pages *(Report)* ..... :	24
Number of pages *(Attachments)*..... :	N/A
Compiled by:	Yang Xu *(Printed Name and Signature)* Xu Yang
Approved by:	Guangxia Fu *(Printed Name and Signature)*

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Test sample……..:	5
Type of test object..... :	Mono-Crystalline Silicon Photovoltaic Module
Trademark ..... :	Trinasolar
Model and/or type reference..... :	Refer to P6
Rating(s)..... :	Refer to P6
Manufacturer ..... :	Trina Solar Co., Ltd.
Manufacturer number…..... :	070321
Address ..... :	No. 2 TianHe Road, Trina PV Industrial Park, New District, 213031 Changzhou City, Jiangsu Province, P.R. China
Sub-contractors/ tests (clause)..... :	N/A
Name ..... :	N/A
Order description…..... :	☒ Complete test according to TRF
	☐ Partial test according to manufacturer's specifications
	☐ Preliminary test
	☐ Spot check
	☐ Others:
Date of order…… ..... :	2022-03-23
Date of receipt of test item..... :	2022-04-05
Date(s) of performance of test..... :	2022-04-05 to 2022-04-22

Test item particulars:
See below for details

Purpose of the product (Description of intended use):

Test according to the specifcation

Characteristic data *(not shown on the marking plate)*:

As the Product Electrical Ratings table

Attachments:

Annex 1: List of measurement equipment

Annex 2: Statement of the estimated uncertainty of the test results

Annex 3: EL pictures before and after PID stress test with current Isc

General remarks:

"(see remark #)" refers to a remark 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.*
The test results presented in this report relate only to the object tested.

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Summary of testing:

4.2 Initial measurements:

a) Preconditioning

b) MST 01: Visual inspection

c) MQT 02: Maximum power determination

d) MQT 07: Performance at low irradiance

e) MQT 15: Wet leakage current test

f) Electroluminescence test

g) MST 13: Ground continuity test

4.3 Damp heat test applied with voltage stress

in accordance with IEC TS 62804-1: 2015 method a), except higher temperature, instead of 60°C.

In the test, temperature and humidity condition are 85°C/85% RH, test duration 192h.

4.4 Final measurements:

a) MQT 02: Maximum power determination

b) MQT 07: Performance at low irradiance

c) MQT 15: Wet leakage current test

d) Electroluminescence test

e) MST 01: Visual inspection

☐ deviation(s) found

☒ no deviations found

Additional information on Non-standard test method(s)

Sub clause:	N/A
Page:	N/A
Rational:	N/A

If additional information is necessary, please provide

N/A

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Copy of marking plate:

Picture of the product:

Name and address of factory (ies) *(only if certification is provided)*:

Trina Solar Co., Ltd. (no. 070321)
No. 2 TianHe Road, Trina PV Industrial Park, New District, 213031 Changzhou City,
Jiangsu Province, PEOPLE'S REPUBLIC OF CHINA

Yancheng Trina Solar Guoneng Science & Technology Co., Ltd. (no. 096705)
No. 101, Wutaishan Road, Yancheng Economic Technological Development Zone, 224054 Yancheng City, Jiangsu Province, PEOPLE'S REPUBLIC OF CHINA

Trina Solar Science & Technology (Thailand) Ltd. (no. 096822)
No.7/496 Moo.6, T. Mabyangporn, A. Pluakdang, Rayong 21140, THAILAND

Trina Solar (Suqian) Technology Co.,Ltd. (no. 104940)
1599 Guangzhou Road, Suqian Economic and Technological Development Zone, 223800 Suqian City,

Jiangsu Province, PEOPLE'S REPUBLIC OF CHINA

Shandong Ronma Solar Co.,Ltd (no. 112226)
Room 217, No.39 Weihe Road, Development Zone, 257091 Dongying City, Shandong Province, PEOPLE'S REPUBLIC OF CHINA

Trina Solar Yiwu Technology Co., Ltd. (no. 109402)
No.801, Longqi Road, Suxi Town, 322009 Yiwu City, Zhejiang, PEOPLE'S REPUBLIC OF CHINA

TRINA SOLAR ENERGY DEVELOPMENT COMPANY LIMITED (no. 112194)
Lot CN-14, Yen Binh Industrial Zone, Hong Tien Ward, Pho Yen City, Thai Nguyen Province, Vietnam

Jiangsu Jinko Day Sheng Solar Co., Ltd. (no. 108228)
No. 228 Yuesheng North Road, Industry Center, Fanshui Town, Baoying County, 225819 Yangzhou City, Jiangsu Province, PEOPLE'S REPUBLIC OF CHINA

Trina Solar (Yancheng Dafeng) Co., Ltd. (113926)
No. 19, Tonggang Avenue, Dafeng Port District, Yancheng City Jiangsu Province, PEOPLE'S REPUBLIC OF CHINA

Inner Mongolia Tiansheng New Technology Co., Ltd. (no.117928)
New Energy Technology Industrial Base, Dalu Industrial Park, Zhungeer Economic Development Zone, Zhungeer Banner, Ordos City, Inner Mongolia Autonomous Region, P. R. China

Possible test case verdicts:

test case does not apply to the test object:	N/A (not applicable / not included in the order)
test object does meet the requirement:	P (Pass)
test object does not meet the requirement:	F (Fail)

Possible suffixes to the verdicts:

suffix for detailed information for the client:	C (Comment)
suffix for important information for factory inspection:	M (Manufacturing)

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Test item particulars..... :	
Accessories and detachable parts included in the evaluation ..... :	N/A
Option included ..... :	N/A

Abbreviations used in the report:	
STC – Standard Test Conditions	Vmp – Maximum power voltage
Imp – Maximum power current	Voc – Open circuit voltage
Isc – Short circuit current	Pmp – Maximum power

General product information and considerations:

Product Electrical Ratings:

Type or model number	TSM-670NEG21C.20	
Voc [V] /Tolerance(±3%)	47.0	
Vmp [V]	39.2	
Isc [Adc] /Tolerance(±5%)	18.10	
Imp [Adc]	17.09	
Pmp [W] /Tolerance(±3%)	670	
Maximum system voltage [V]	1500	
Maximum Over-Current Protection Rating [A]	35	

Information for testing sample:

Sample No.	Type	Remark
GDP220295-1	TSM-670NEG21C.20	A12220300100262 (control)
GDP220295-2	TSM-670NEG21C.20	A12220300100303
GDP220295-3	TSM-670NEG21C.20	A12220300100301
GDP220295-4	TSM-670NEG21C.20	A12220300100304
GDP220295-5	TSM-670NEG21C.20	A12220300100299

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Description of module construction: **(Manufactories and part numbers, unless otherwise specified)**	
Sample ..... :	Random sampling from production ☐ Prototype submitted by client ☒
Module	
Front cover ..... :	Trina Solar Co., Ltd. Type: AR-Coating glass Thickness:2.0 mm
Rear cover..... :	Trina Solar Co., Ltd. Type: Tempered glass with PV side white coating Thickness:2.0 mm
Encapsulation material front side.... :	Material Co., LTD Type: F406P Thickness: 0.45±0.05 mm
Encapsulation material back side ... :	Material Co., LTD Type: TF4 Thickness: 0.45±0.05 mm
Frame..... :	Trina Solar Co., Ltd. 6005-T6
Dimensions (l x w x h) [mm]..... :	2384 x 1303 x 35
Module area [m²]..... :	2.61
Adhesives (junction box)..... :	Shanghai Huitian New Material Co., Ltd. Type: HT906Z
Minimum distance between current-carrying parts and module edge [mm]	10.75
Cell	
Cell (include type) ..... :	Trina Solar Co., Ltd. Cell type: TSC-D6GB-18BB , Bifacial, Mono-Si N-topcon
Cells (l x w) [mm]..... :	210 x 105 (1/2 cut)
Cell thickness [µm]..... :	143 ± 14.3
Cell area [cm²]..... :	220.5
Number of cells ..... :	132

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Components	
Cells per bypass diode ..... :	48
Type of bypass diode ..... :	Trina Solar Co., Ltd. Type: TM3045-25
No. of bypass diodes ..... :	3
Cell- and string connectors ..... :	Trina Solar Co., Ltd. Cell connectors : Φ0.27 string connectors: 0.25×4.0/6.0mm Material: Base Cu,Coating Sn60Pb40.
Junction box ..... :	Trina Solar Co., Ltd. Type: TS306x, DC 1500 V
Cable ..... :	Trina Solar Co., Ltd. Type: 62930 IEC 131 1x4.0mm2, HALOGEN FREE LOW SMOKE, 1500V DC
Connectors ..... :	Trina Solar Co., Ltd. Type: TS4, DC 1500V
Adhesives (frame) ..... :	Shanghai Huitian New Chemical Material Co., Ltd. Type: HT906Z
Potting material (junction box) ..... :	Shanghai Huitian New Material Co., Ltd. Type: 5299W-S
Other	
Others..... :	Fixing tap: 3M Type: UV-T

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**
3	**Samples**		P
	– Two representative and identical samples for each polarity of the system voltage that is specified or allowed in the module documentation and one control sample shall be provided		P
	– Two samples for only one voltage polarity with respect to earth ground which is specified in the installation manual and one control sample shall be provided.		N/A
	– PV module provided with means for grounding then they constitute a part of the test sample.		N/A
	MARKING		P
	Name, monogram or symbol of manufacturer :	Trina Solar	P
	Type or model number…….. :	TSM-670NEG21C.20 for example	P
	Serial number…….. :	Provided under superstrate near the top rail of frame	P
	Polarity of terminals or leads	Mark with “+” and “-”	P
	Maximum system voltage	1500 VDC	P
	Nominal and minimum values of maximum output power at STC	670W for example	P
	The date and place of manufacture	Traceable by S/N.	P
4	**Test procedures**		P
	Preconditioning		P
4.2 a)	– All modules, including the control, shall be exposed to sunlight (either real or simulated) to an irradiation to achieve stabilization.	See table 4.2 a)	P
4.2	**Initial Measurements**		P
	– Tests according to IEC 61215-1-1		P
4.2 c)	MQT 02: Maximum power determination	See table 4.2 c)	P
4.2 e)	MQT 15: Wet leakage current test	See table 4.2 e)	P
	– Tests according to IEC 61730-2		P
4.2 b)	MST 01: Visual inspection	See table 4.2 b)	P
4.2 g)	MST 13: Continuity test of equipotential bonding	See table 4.2 g)	P
	– Optional		P
4.2 d)	MQT 07: Performance at low irradiance	See table 4.2 d)	P
4.2 f)	Electroluminescence at *Isc* ~~and 0,1·*Isc*~~	See table 4.2 f) and Annex 3 for pictures	P

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**
4.3	**Damp heat test applied with voltage stress**		P
	– Test according to IEC TS 62804-1:2015	See table 4.3	P
4.4	**Final Measurements**		P
	– Tests according to IEC 61215-1-1		P
4.4 a)	MQT 02: Maximum power determination	See table 4.4 a)	P
	– Tests according to IEC 61730-2		P
4.4 e)	MST 01: Visual inspection	See table 4.4 e)	P
	– Optional		P
4.4 b)	MQT 07: Performance at low irradiance	See table 4.4 b)	P
4.4 c)	MQT 15: Wet leakage current test	See table 4.4 c)	P
4.4 d)	Electroluminescence at *I*sc ~~and 0,1 *I*sc~~	See table 4.4 d) and See Annex 3 for pictures	P
5	**Requirements**		P
	The degradation of maximum output power between initial and final power measurement does not exceed 5%	See table 4.2 c) & 4.4 a)	P
	There is no visual evidence of a major defect, as defined in Clause 8 of IEC 61215-1 and Clause 10.2.3 of IEC 61730-2	See table 4.2 b) & 4.4 e)	P
	The wet leakage current test requirements are met at the end of each sequence	See table 4.2 e) & 4.4 c)	P
	Specific requirements of the individual test components are met	All tables	P

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**

4.2 a)	**TABLE: Preconditioning**		P
Test Date [MM/DD/YYYY] start/end.....:		04/05/2022~04/08/2022	—
Total irradiation dosage [kWh/m^2].....:		10	—
Supplementary information: N/A			

4.2 b)	**TABLE: Visual inspection (Initial)**		P
Test Date [MM/DD/YYYY]…….....:		04/08/2022	—
Sample No.	Nature and position of initial findings – comments or attach photos		Verdict
GDP220295-1	No major visual defects found		P
GDP220295-2	No major visual defects found		P
GDP220295-3	No major visual defects found		P
GDP220295-4	No major visual defects found		P
GDP220295-5	No major visual defects found		P
Supplementary information: N/A			

4.2 c)	**TABLE: Maximum power determination (Initial)**					P
Test Date [MM/DD/YYYY]…….....:			04/08/2022			—
Radiant Source……..:			☒ Solar simulator	☐ Natural Sunlight		
Module temperature [°C].....:			25			—
Irradiance [W/m^2].....:			1000			—
Sample No.	Isc (A)	Voc (V)	Imp(A)	Vmp (V)	Pmp (W)	FF(%)
GDP220295-1-Front	18.013	47.064	17.172	39.339	675.520	79.62
GDP220295-1-Rear	13.557	46.608	12.899	39.315	507.109	80.20
GDP220295-2-Front	18.022	46.868	17.148	39.146	671.263	79.39
GDP220295-2-Rear	13.631	46.431	12.668	39.551	501.042	79.15
GDP220295-3-Front	17.819	47.415	16.957	39.601	671.503	79.39
GDP220295-3-Rear	13.491	46.872	12.558	39.902	501.075	79.22
GDP220295-4-Front	18.244	46.614	17.309	38.995	674.943	79.28
GDP220295-4-Rear	13.801	46.163	12.851	39.304	505.080	79.22
GDP220295-5-Front	18.136	46.694	17.266	38.948	672.476	79.37
GDP220295-5-Rear	13.657	46.607	12.701	39.674	503.893	79.10
Supplementary information: N/A						

Product Service

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**

4.2 d)	**TABLE: Performance at low irradiance (Initial)**						P
Test Date [MM/DD/YYYY]..... :			04/08/2022				—
Ambient air temperature [°C] ..... :			25				—
Irradiance [W/m²](200 W/m²) ..... :			200				—
Module temperature [°C]..... :			25				—
Test method..... :			☐ Data corrected to a 25°C cell temperature and 200 W/m² irradiance ☒ Directly measured				—
Sample #	Isc (A)	Voc (V)	Imp(A)	Vmp (V)	Pmp (W)	FF(%)	
GDP220295-1-Front	3.569	44.361	3.433	37.972	130.352	82.22	
GDP220295-2-Front	3.570	44.133	3.399	37.997	129.152	81.90	
GDP220295-3-Front	3.652	44.166	3.489	37.912	132.253	81.89	
GDP220295-4-Front	3.698	43.744	3.520	37.703	132.715	81.96	
GDP220295-5-Front	3.566	44.303	3.409	38.062	129.733	81.98	
Supplementary information: N/A							

4.2 e)	**TABLE: Wet leakage current test (Initial)**			P
Test Date [MM/DD/YYYY]..... :		04/08/2022		—
Test Voltage applied [V] ..... :		1500		—
Solution resistivity [Ω cm)..... :		< 3,500 Ω cm at 22 ± 3°C	2921	—
Surface tension [Nm⁻²)..... :		< 0.03 Nm⁻² at 22 ± 3°C	—	—
Solution temperature [°C]..... :		22.8		
Sample #	Measured [MΩ]	Limit [MΩ]		Result
GDP220295-1	468.1	12.86		P
GDP220295-2	509.4	12.86		P
GDP220295-3	480.2	12.86		P
GDP220295-4	487.4	12.86		P
GDP220295-5	516.5	12.86		P
Supplementary information: Size of module is 3.11m².				

4.2 f)	**TABLE: Electroluminescence (Initial)**	—
Test Date [MM/DD/YYYY] start/end..... :	04/08/2022	—
Supplementary information: See pictures in annex 3		

4.2 g)	**TABLE: MST 13 – Continuity test of equipotential bonding (Initial)**		P
	Maximum over-current protection rating (A) .....:	35	—

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Clause	**Requirement + Test**	**Result--Remark**	**Verdict**

	Current applied (A) ..... :	87.5	
	Location of designated grounding point.....:	Grounding point of the long edge	—
	Location of second contacting point.....:	The greatest physical displacement of adjacent side	—

Sample No.	Position in test sequence:	Voltage (V)	Resistance (Ω)	Result
GDP220295-1	Initial measurements	0.45	0.006	P
GDP220295-2	Initial measurements	0.375	0.005	P
GDP220295-3	Initial measurements	0.6	0.008	P
GDP220295-4	Initial measurements	0.45	0.006	P
GDP220295-5	Initial measurements	0.45	0.006	P
Supplementary information: N/A				

4.3	**TABLE: Damp heat test applied with voltage stress**	P
Test Date [MM/DD/YYYY] start/end.....:	04/13/2022~04/17/2022	—
Chamber air temperature (°C)..... :	85	—
Chamber relative humidity (% RH)..... :	85	—
Test duration hours (h) ..... :	96	—

Sample #	Applied voltage stress (V) and polarities	—
GDP220295-2	-1500	—
GDP220295-3	-1500	—
GDP220295-4	+1500	—
GDP220295-5	+1500	—
Supplementary information: Method (a) according to standard IEC TS 62804-1:2015 is applied.		

4.4 a)	**TABLE: Maximum power determination (after 96h)**	P
Test Date [MM/DD/YYYY] .....:	04/17/2022	—
Module temperature [°C] .....:	25	—
Irradiance [W/m2] .....:	1000	—

Sample #	Isc (A)	Voc (V)	Imp(A)	Vmp (V)	Pmp (W)	FF(%)	Degradation [%]	Limit [%]
GDP220295-1-Front	18.010	47.065	17.170	39.339	675.451	79.69	-0.01	±1
GDP220295-1-Rear	13.556	46.609	12.898	39.314	507.072	80.25	-0.01	±1
GDP220295-2-Front	18.011	46.854	17.131	39.117	670.113	79.41	-0.17	-5
GDP220295-2-Rear	13.617	46.417	12.646	39.517	499.732	79.06	-0.26	-5
GDP220295-3-Front	17.808	47.401	16.940	39.572	670.350	79.41	-0.17	-5
GDP220295-3-Rear	13.477	46.858	12.536	39.868	499.785	79.14	-0.26	-5

Product Service

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**

GDP220295-4-Front	18.233	46.600	17.292	38.966	673.800	79.30	-0.17	-5
GDP220295-4-Rear	13.787	46.149	12.829	39.270	503.795	79.18	-0.25	-5
GDP220295-5-Front	18.125	46.680	17.249	38.919	671.314	79.34	-0.17	-5
GDP220295-5-Rear	13.643	46.593	12.679	39.640	502.596	79.07	-0.26	-5
Supplementary information:Crystalline silicon module: Pmp degradation after this test ≤ 5%								

4.4 c)	**TABLE: Wet leakage current test (after PID 96H)**		P
Test Date [MM/DD/YYYY]……..…..:	04/17/2022		—
Test voltage applied [V] ……..:	1500		—
Module maximum system voltage rating (V, DC) :		1500	—
Solution resistivity [Ω cm], < 3,500 Ω cm at 22 ± 3 ℃ :		2846	—
Sample No.	Measured [MΩ]	Limit [MΩ]	Verdict
GDP220295-1	453.6	12.86	
GDP220295-2	512.8	12.86	P
GDP220295-3	469.4	12.86	P
GDP220295-4	530.7	12.86	P
GDP220295-5	543.2	12.86	P
Supplementary information: Size of module is 3.11.			

4.4 d)	**TABLE: Electroluminescence (after PID 96H)**	P
Test Date [MM/DD/YYYY] start/end.....:	04/17/2022	—
Supplementary information: See pictures in annex 3		

4.4 e)	**TABLE: Visual inspection (after PID 96H)**	P
Test Date [MM/DD/YYYY]……..…..:	04/17/2022	—
Sample No.	Nature and position of initial findings – comments or attach photos	Verdict
GDP220295-1	No major visual defects found	P
GDP220295-2	No major visual defects found	P
GDP220295-3	No major visual defects found	P
GDP220295-4	No major visual defects found	P
GDP220295-5	No major visual defects found	P
Supplementary information: N/A		

4.3	**TABLE: Damp heat test applied with voltage stress**	P
Test Date [MM/DD/YYYY] start/end.....:	04/18/2022 to 04/22/2022	—
Chamber air temperature (°C)..... :	85	—

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**

Chamber relative humidity (% RH) ..... :	85	—
Test duration hours (h) ..... :	96	—
Sample #	Applied voltage stress (V) and polarities	—
GDP220295-2	-1500	—
GDP220295-3	-1500	—
GDP220295-4	+1500	—
GDP220295-5	+1500	—
Supplementary information: Method (a) according to standard IEC TS 62804-1:2015 is applied.		

4.4 a)	**TABLE: Maximum power determination (Final)**							P
Test Date [MM/DD/YYYY] .....:	04/22/2022							—
Module temperature [°C] .....:	25							—
Irradiance [W/m2] .....:	1000							—
Sample #	Isc (A)	Voc (V)	Imp(A)	Vmp (V)	Pmp (W)	FF(%)	Degradation [%]	Limit [%]
GDP220295-1-Front	17.996	47.042	17.150	39.276	673.583	79.57	-0.29%	±1
GDP220295-1-Rear	13.547	46.594	12.882	39.262	505.773	80.13	-0.26%	±1
GDP220295-2-Front	17.983	46.822	17.091	39.028	667.028	79.22	-0.63%	-5
GDP220295-2-Rear	13.592	46.390	12.608	39.426	497.083	78.84	-0.79%	-5
GDP220295-3-Front	17.791	47.372	16.915	39.518	668.447	79.31	-0.46%	-5
GDP220295-3-Rear	13.466	46.840	12.522	39.820	498.626	79.05	-0.49%	-5
GDP220295-4-Front	18.194	46.550	17.247	38.865	670.305	79.15	-0.69%	-5
GDP220295-4-Rear	13.759	46.109	12.787	39.176	500.944	78.96	-0.82%	-5
GDP220295-5-Front	18.075	46.625	17.181	38.799	666.606	79.10	-0.87%	-5
GDP220295-5-Rear	13.592	46.540	12.603	39.503	497.856	78.70	-1.20%	-5
Supplementary information:Crystalline silicon module: Pmp degradation after this test ≤ 5%								

4.4 b)	**TABLE: Performance at low irradiance (Final)**					P
Test Date [MM/DD/YYYY].....:	04/22/2022					—
Ambient air temperature [°C] .....:	25					—
Irradiance [W/m^2](200 W/m^2) .....:	200					—
Module temperature [°C].....:	25					—
Test method.....:	☐ Data corrected to a 25°C cell temperature and 200 W/m^2 irradiance ☒ Directly measured					—
Sample #	Isc (A)	Voc (V)	Imp(A)	Vmp (V)	Pmp (W)	FF(%)

Product Service

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**

GDP220295-1	3.558	44.349	3.407	37.944	129.275	81.93
GDP220295-2	3.557	44.119	3.368	37.961	127.853	81.47
GDP220295-3	3.633	44.143	3.454	37.858	130.762	81.54
GDP220295-4	3.684	43.720	3.494	37.661	131.588	81.70
GDP220295-5	3.551	44.284	3.387	38.018	128.767	81.89
Supplementary information: N/A						

4.4 c)	**TABLE: Wet leakage current test (Final)**		P
Test Date [MM/DD/YYYY]……..…..:	04/22/2022		—
Test voltage applied [V] ……..:	1500		—
Module maximum system voltage rating (V, DC) :	1500		—
Solution resistivity [Ω cm], < 3,500 Ω cm at 22 ± 3 ℃ :	2962		—
Sample No.	Measured [MΩ]	Limit [MΩ]	Verdict
GDP220295-1	546.8	12.86	P
GDP220295-2	491.3	12.86	P
GDP220295-3	487.9	12.86	P
GDP220295-4	495.2	12.86	P
GDP220295-5	504.4	12.86	P
Supplementary information: Size of module is 3.11.			

4.4 d)	**TABLE: Electroluminescence (Final)**	P
Test Date [MM/DD/YYYY] start/end.....:	04/22/2022	—
Supplementary information: See pictures in annex 3		

4.4 e)	**TABLE: Visual inspection (Final)**	P
Test Date [MM/DD/YYYY]……..…..:	04/22/2022	—
Sample No.	Nature and position of initial findings – comments or attach photos	Verdict
GDP220295-1	No major visual defects found	P
GDP220295-2	No major visual defects found	P
GDP220295-3	No major visual defects found	P
GDP220295-4	No major visual defects found	P
GDP220295-5	No major visual defects found	P
Supplementary information: N/A		

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**

Annex 1: List of measurement equipment

No.	Test Item	Equipment ID	Calibrate until
1	Visual inspection	SB08125	2022.07.01
2	Maximum power determination	SB20019	2021.11.01
3	Wet leakage current test	SB08079	2022.06.30
4	PID test	SB08085	2022.07.29
5	Continuity Test of Equipotential Bonding	SB08047	2022.07.29

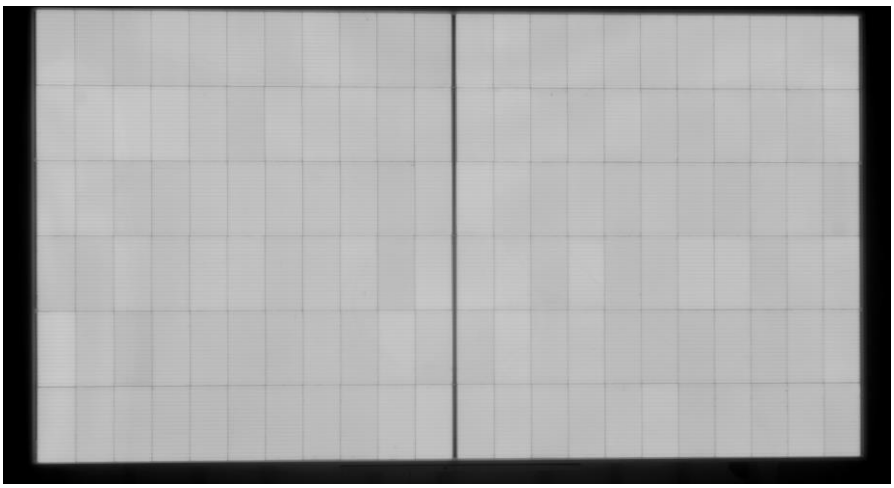
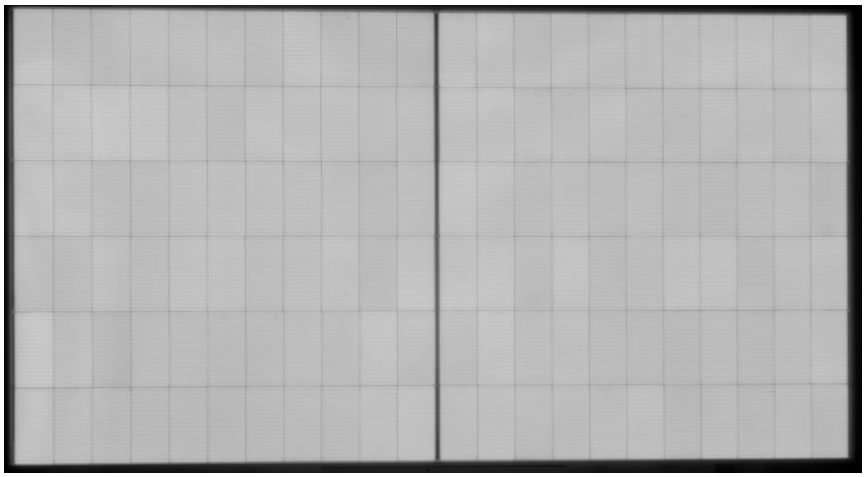
Annex 2: Statement of the estimated uncertainty of the test results

The power measurement uncertainty is 2.12% (K=2).
The Voc measurement uncertainty is 0.98% (K=2).
The Isc measurement uncertainty is 2.26% (K=2).

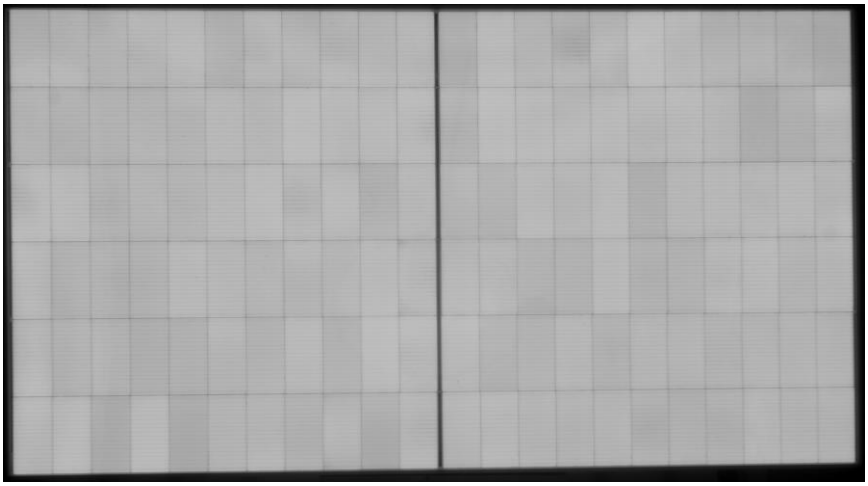
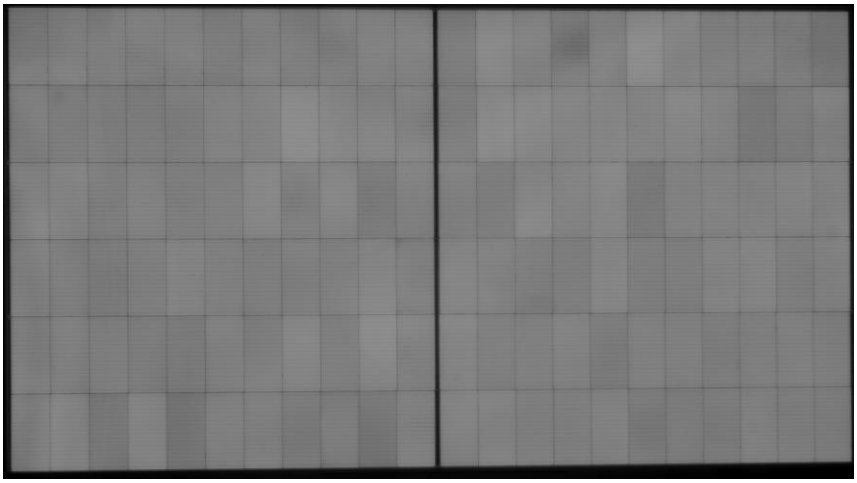
PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**

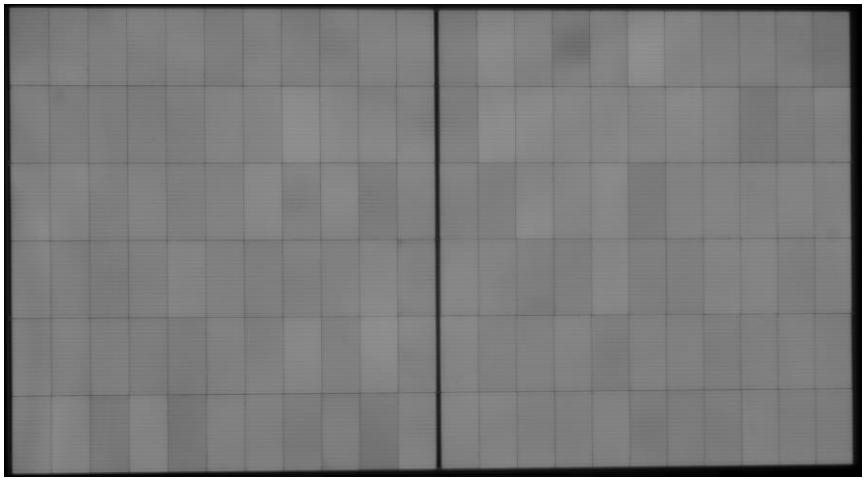
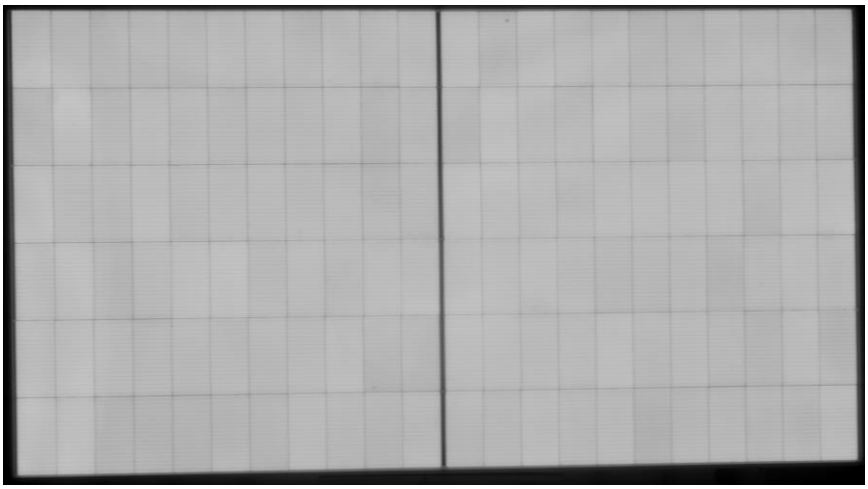
Annex 3: EL pictures before and after PID stress test with current Isc

EL pictures before PID stress test

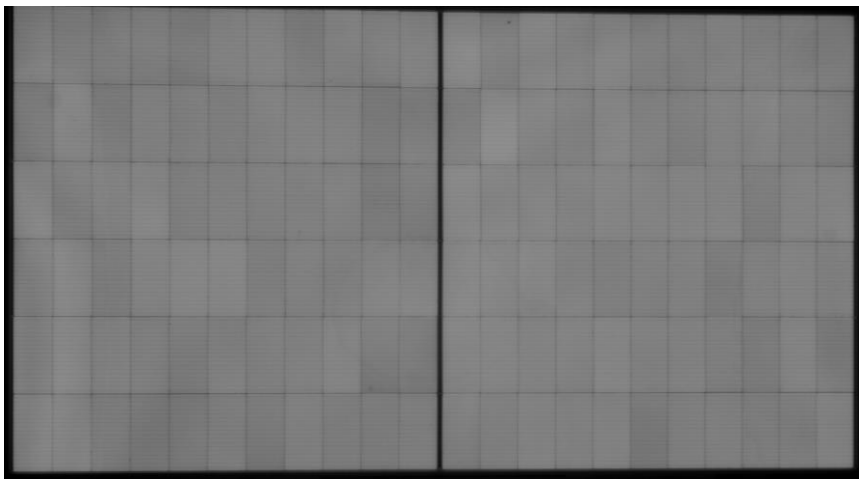
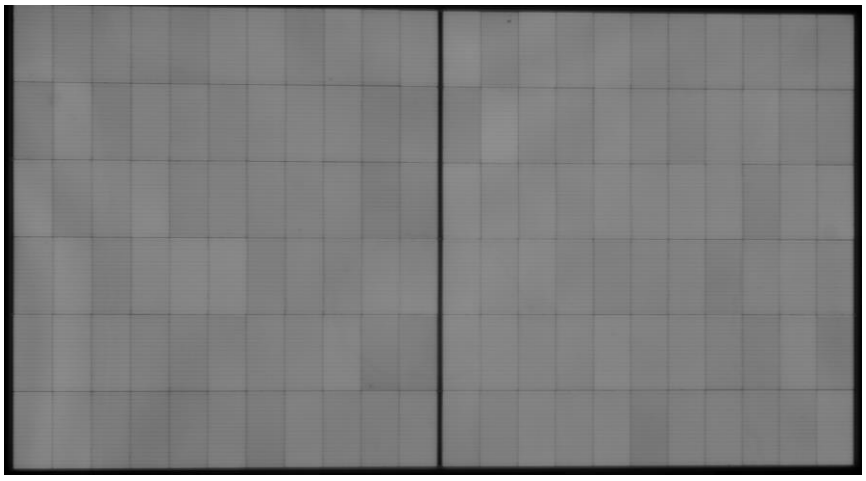
Sample #	Status	picture
GDP220295-1	Initial	
	Final	

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**

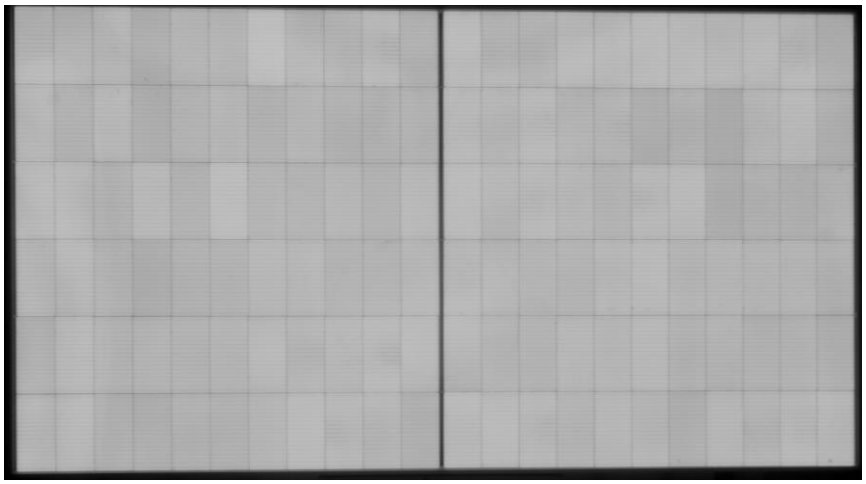
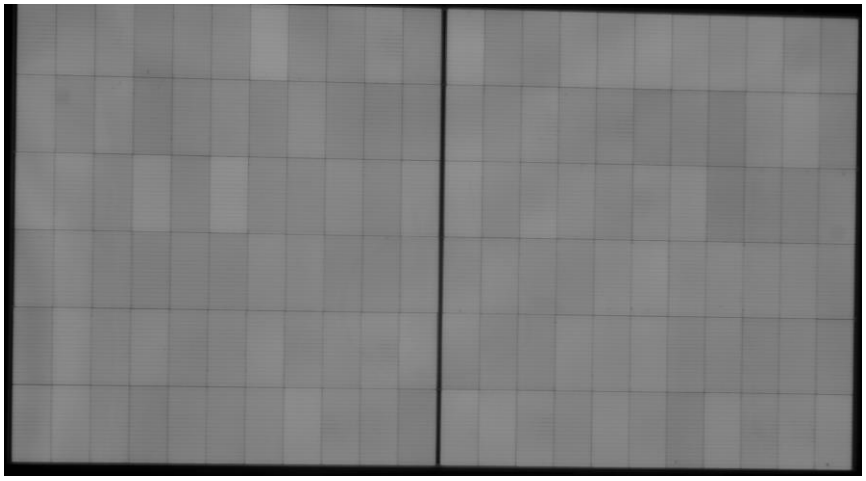
GDP220295-2	Initial	
GDP220295-2	After PID 96H Test	

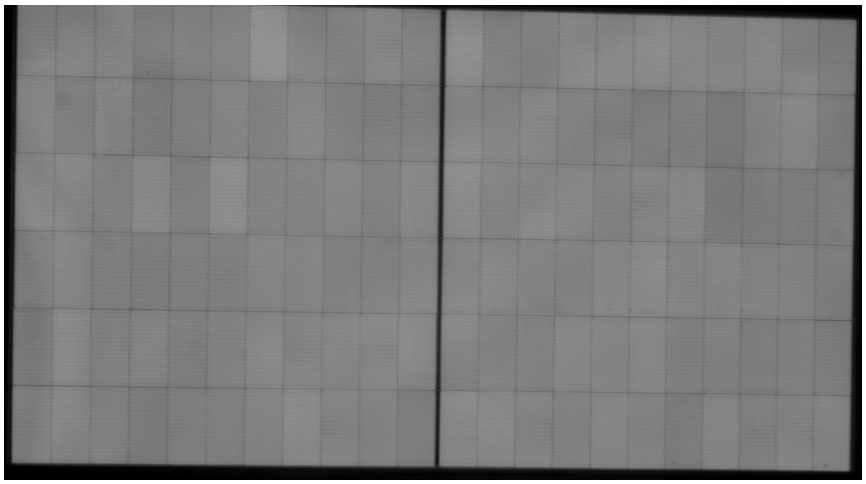
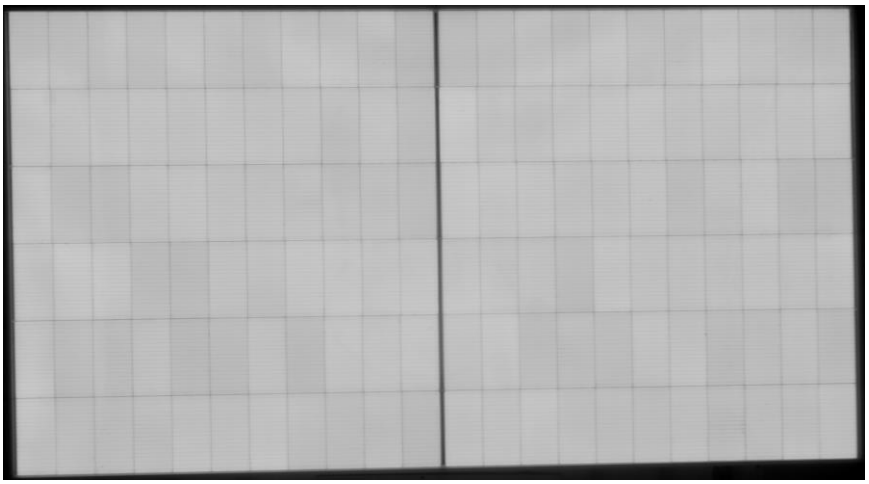
PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**
GDP220295-2	After PID 192H Test		
GDP220295-3	Initial		

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**

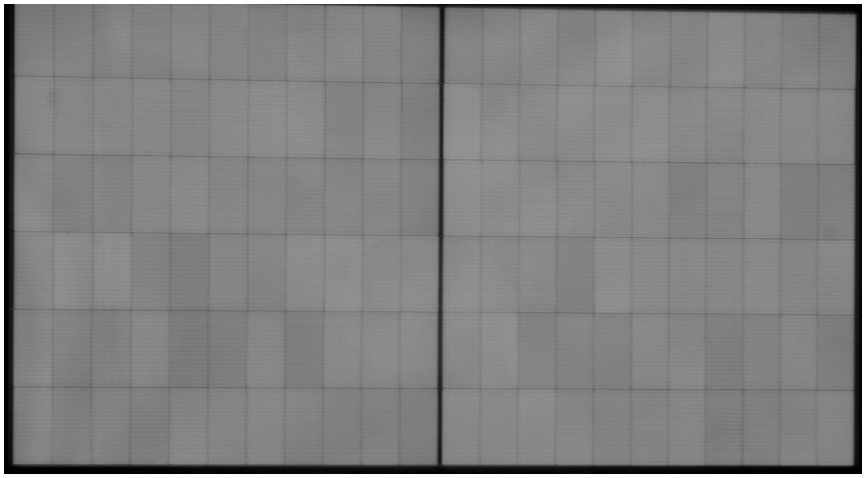
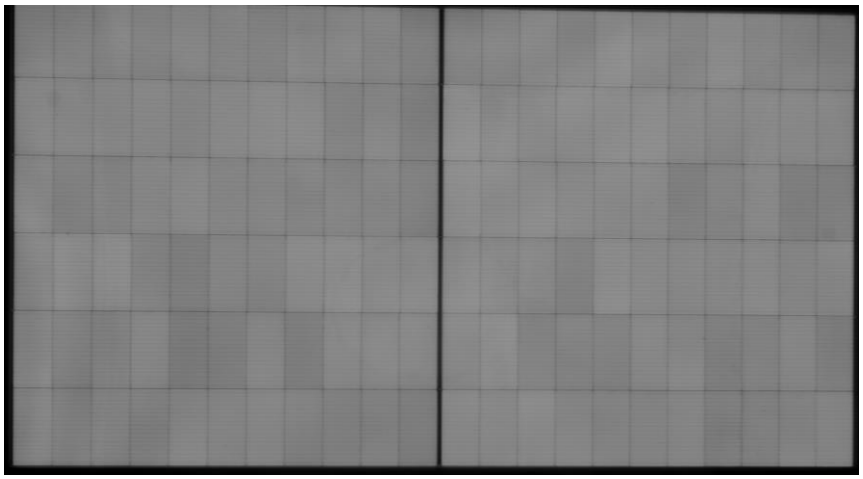
GDP220295-3	After PID 96H Test	
GDP220295-3	After PID 192H Test	

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**

GDP220295-4	Initial	
GDP220295-4	After PID 96H Test	

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**
GDP220295-4	After PID 192H Test		
GDP220295-5	Initial		

PPP 58042B:2015 Rev. 01/2019-09 according to IEC TS 62804-1:2015			
Clause	**Requirement + Test**	**Result--Remark**	**Verdict**

GDP220295-5	After PID 96H Test	
GDP220295-5	After PID 192H Test	
Note	N/A	

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