Prüfbericht-Nr.: *Test Report No.*:	**15038416.181**	**Auftrags-Nr.:** *Order No.*:	154272228 / 154281645 154288390 / 154290075	Seite1von 52 *Page 1 of 52*
Kunden-Referenz-Nr.: *Client Reference No.*:	428877	**Auftragsdatum:** *Order date*:	22.08.2017 / 09.10.2017 06.11.2017 / 13.11.2017	
Auftraggeber: *Client*:	**Jinko Solar Co., Ltd.** No.1 Jinko Road, Shangrao Economic Development Zone, Jiangxi Province 334100, P. R. China			
Prüfgegenstand: *Test item*:	Photovoltaic (PV) modules			
Bezeichnung / Typ-Nr.: *Identification / Type No.*:	Refer to page 3-4 for details			
Auftrags-Inhalt: *Order content*:	Design qualification and type approval of photovoltaic (PV) modules			
Prüfgrundlage: *Test specification*:	IEC 61215:2005, EN 61215:2005			

Wareneingangsdatum: *Date of receipt*:	14/11/2017 – 11/12/2017
Prüfmuster-Nr.: *Test sample No.*:	Refer to page 15-16
Prüfzeitraum: *Testing period*:	14/11/2017- 13/04/2018
Ort der Prüfung: *Place of testing*:	TÜV Rheinland (Shanghai) Co., Ltd. & CCIC Southern Electronic Product Testing (Shenzhne) Co., Ltd.
Prüflaboratorium: *Testing laboratory*:	TÜV Rheinland (Shanghai) Co., Ltd.
Prüfergebnis*: *Test result**:	Pass

Detaillierte Fotodokumentation
siehe Anlage zu diesem Bericht

Detailed photo documentation
see appendix to this report

geprüft von / *tested by*:

Derrick Wang

07.05.2018	Derrick Wang / Project Engineer	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

kontrolliert von / *reviewed by*:

24.05.2018	Kevin Lu / Reviewer	
Datum *Date*	**Name / Stellung** *Name / Position*	**Unterschrift** *Signature*

Sonstiges / *Other*:
- Alternative model types listed in page 3.
- Extension qualification to new solar cells and combination between materials.
- Refer to page 9-11 and Constructional Data Form (CDF) in APPENDIX 1 of this report for details.
- This test report is valid in conjunction with IEC 61730 test report 15038417.188.

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *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*

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-11097-02-01).		

Produktbeschreibung
Product description

1	**Produktdetails** *Product details*

New model types:
With 6" mono c-Si cells:
JKMxxxM-72-MW (xxx=250-405, in steps of 5, 72 cells)
JKMxxxM-60-MW (xxx=210-335, in steps of 5, 60 cells)
JKMxxxM-72B-MW (xxx=250-405, in steps of 5, 72 cells)
JKMxxxM-60B-MW (xxx=210-335, in steps of 5, 60 cells)
JKMSxxxM-72-MX-MW (xxx=250-405, in steps of 5, 72 cells)
JKMSxxxM-60-MX-MW (xxx=210-335, in steps of 5, 60 cells)

With 6" poly c-Si cells:
JKMxxxPP-72-MW (xxx=250-350, in steps of 5, 72 cells)
JKMxxxPP-60-MW (xxx=210-290, in steps of 5, 60 cells)
JKMxxxPP-72B-MW (xxx=250-350, in steps of 5, 72 cells)
JKMxxxPP-60B-MW (xxx=210-290, in steps of 5, 60 cells)
JKMSxxxPP-72-MX-MW (xxx=250-350, in steps of 5, 72 cells)
JKMSxxxPP-60-MX-MW (xxx=210-290, in steps of 5, 60 cells)

Approved model types:
With 6" mono c-Si cells:
JKMxxxM-72; JKMxxxM-72-J; JKMxxxM-72(Plus); JKMSxxxM-72; JKMSxxxM-72-J; JKMSxxxM-72(Plus);
JKMxxxM-72B; JKMSxxxM-72B (xxx=250-405, in steps of 5, 72 cells)
JKMxxxM-72H; JKMxxxM-72HB (xxx=250-405, in steps of 5, 144 cells)
JKMxxxM-60; JKMxxxM-60-J; JKMxxxM-60(Plus); JKMSxxxM-60; JKMSxxxM-60-J; JKMSxxxM-60(Plus);
JKMxxxM-60B; JKMSxxxM-60B (xxx=210-335, in steps of 5, 60 cells)
JKMxxxM-60H; JKMxxxM-60HB (xxx=210-335, in steps of 5, 120 cells)
JKMxxxM-48; JKMxxxM-48-J; JKMSxxxM-48; JKMSxxxM-48-J; JKMSxxxM-48(Plus);
JKMxxxM-48B; JKMSxxxM-48B (xxx=170-250, in steps of 5, 48 cells)
JKMSxxxM-72-MX; JKMSxxxM-72B-MX; JKMSxxxM-72(Plus)-MX (xxx=250-405, in steps of 5, 72 cells)
JKMSxxxM-60-MX; JKMSxxxM-60B-MX; JKMSxxxM-60(Plus)-MX (xxx=210-335, in steps of 5, 60 cells)
JKMSxxxM-48-MX; JKMSxxxM-48B-MX; JKMSxxxM-48(Plus)-MX (xxx=170-250, in steps of 5, 48 cells)
JKMxxxM-72-FS; JKMxxxM-72B-FS (xxx=250-405, in steps of 5, 72 cells)
JKMxxxM-72HB-FS; JKMxxxM-72H-FS (xxx=250-405, in steps of 5, 144 cells)
JKMxxxM-60-FS; JKMxxxM-72B-FS (xxx=210-335, in steps of 5, 60 cells)
JKMxxxM-60H-FS; JKMxxxM-72HB-FS (xxx=210-335, in steps of 5, 120 cells)

With 6" poly c-Si cells:
JKMSxxxPP-72-MX; JKMSxxxPP-72B-MX; JKMSxxxPP-72-J4-MX; JKMSxxxPP-72B-J4-MX
JKMSxxxPP-72(Plus)-MX; JKMSxxxPP-72-W-MX (xxx=250-350, in steps of 5, 72 cells)
JKMSxxxPP-60-MX; JKMSxxxPP-60B-MX; JKMSxxxPP-60-J4-MX; JKMSxxxPP-60B-J4-MX
JKMSxxxPP-60(Plus)-MX; JKMSxxxPP-60-W-MX;
JKMxxxPP-60-J4(Plus) (xxx=210-290, in steps of 5, 60 cells)
JKMSxxxPP-48-MX; JKMSxxxPP-48B-MX; JKMSxxxPP-48-J4-MX; JKMSxxxPP-48B-J4-MX
JKMSxxxPP-48(Plus)-MX; JKMSxxxPP-48-W-MX;
JKMxxxPP-48-J4(Plus) (xxx=170-230, in steps of 5, 48 cells)

Produktbeschreibung
Product description

	JKMxxxP-72; JKMxxxP-72-J; JKMxxxPP-72; JKMxxxPP-72-J; JKMxxxPP-72-J4(Plus); JKMxxxP-72-J4; JKMxxxPP-72-J4; JKMxxxP-72(Plus); JKMxxxPP-72(Plus); JKMxxxPP-72-W; JKMSxxxP-72; JKMSxxxP-72-J; JKMSxxxP-72-J4; JKMSxxxP-72(Plus); JKMSxxxPP-72; JKMSxxxPP-72-J; JKMSxxxPP-72-J4; JKMSxxxPP-72(Plus); JKMSxxxPP-72-W; JKMxxxPP-72(Plus)-J; JKMxxxP-72-J4-J; JKMxxxPP-72-J4-J; JKMSxxxPP-72(Plus)-J;JKMSxxxP-72-J4-J; JKMSxxxPP-72-J4-J; JKMxxxP-72B; JKMxxxPP-72B; JKMxxxP-72B-J4; JKMxxxPP-72B-J4; JKMxxxP-72B-J4-J; JKMxxxPP-72B-J4-J; JKMSxxxP-72B; JKMSxxxPP-72B; JKMSxxxP-72B-J4; JKMSxxxPP-72B-J4; JKMSxxxP-72B-J4-J;JKMSxxxPP-72B-J4-J (xxx=250-350, in steps of 5, 72 cells) JKMxxxPP-72H; JKMxxxPP-72HB; JKMxxxPP-72H-J4 (xxx=250-350, in steps of 5, 144 cells) JKMxxxPP-60H; JKMxxxPP-60HB; JKMxxxPP-60H-J4 (xxx=210-290, in steps of 5, 120 cells) JKMxxxP-60; JKMxxxP-60-J; JKMxxxPP-60; JKMxxxPP-60-J; JKMxxxP-60-J4; JKMxxxPP-60-J4; JKMxxxP-60(Plus); JKMxxxPP-60(Plus); JKMxxxPP-60-W; JKMSxxxP-60; JKMSxxxP-60-J; JKMSxxxP-60-J4; JKMSxxxP-60(Plus); JKMSxxxPP-60; JKMSxxxPP-60-J; JKMSxxxPP-60-J4; JKMSxxxPP-60(Plus); JKMSxxxPP-60-W; JKMxxxPP-60(Plus)-J; JKMxxxP-60-J4-J; JKMxxxPP-60-J4-J; JKMSxxxPP-60(Plus)-J; JKMSxxxP-60-J4-J; JKMSxxxPP-60-J4-J; JKMxxxP-60B; JKMxxxPP-60B; JKMxxxP-60B-J4; JKMxxxPP-60B-J4; JKMxxxP-60B-J4-J; JKMxxxPP-60B-J4-J; JKMSxxxP-60B; JKMSxxxPP-60B; JKMSxxxP-60B-J4; JKMSxxxPP-60B-J4; JKMSxxxP-60B-J4-J;JKMSxxxPP-60B-J4-J (xxx=210-290, in steps of 5, 60 cells) JKMxxxP-48; JKMxxxP-48-J; JKMxxxP-48-J4; JKMxxxPP-48; JKMxxxPP-48-J; JKMxxxPP-48-J4; JKMxxxPP-48(Plus); JKMxxxPP-48-W; JKMSxxxP-48; JKMSxxxP-48-J; JKMSxxxP-48-J4; JKMSxxxP-48(Plus); JKMSxxxPP-48; JKMSxxxPP-48-J; JKMSxxxPP-48-J4; JKMSxxxPP-48(Plus); JKMSxxxPP-48-W; JKMxxxPP-48(Plus)-J; JKMxxxP-48-J4-J; JKMxxxPP-48-J4-J; JKMSxxxPP-48(Plus)-J; JKMSxxxP-48-J4-J; JKMSxxxPP-48-J4-J; JKMxxxP-48B; JKMxxxPP-48B; JKMxxxP-48B-J4; JKMxxxPP-48B-J4; JKMxxxP-48B-J4-J; JKMxxxPP-48B-J4-J; JKMSxxxP-48B; JKMSxxxPP-48B; JKMSxxxP-48B-J4; JKMSxxxPP-48B-J4; JKMSxxxP-48B-J4-J; JKMSxxxPP-48B-J4-J (xxx=170-230, in steps of 5, 48 cells) JKMxxxP-36(xxx=125-140W, in steps of 5, 36 cells) **With 6“ Quasi-mono c-Si:** JKMxxxP-72L (xxx=255-330, in steps of 5, 72 cells); JKMxxxP-60L (xxx=215-275, in steps of 5, 60 cells) **With 5“ mono c-Si:** JKMxxxM-96; JKMxxxM-96-J; JKMSxxxM-96; JKMSxxxM-96-J; JKMxxxM-96B(xxx=210-285, in steps of 5, 96 cells)JKMxxxM-72; JKMxxxM-72-J; JKMSxxxM-72; JKMSxxxM-72-J; JKMxxxM-72B(xxx=160-215, in steps of 5, 72 cells)
2	**Verwendete Materialien** *Used materials*
	Refer to Constructional Data Form (CDF) no. 15038416.181 in APPENDIX 1 of this report

Produktbeschreibung
Product description

3 Adresse(n) der Fertigungsstätte(n)
Address(es) of the manufacturing site(s)

Name / Description:	Jinko Solar Co., Ltd.
Street:	No.1 Jinko Road, Shangrao Economic Development Zone,
Postcode / City, Country:	Jiangxi Province 334100, P.R. China
Type of production:	c-Si PV-module production
Inspection report No:	15033836.010

Remark: Initial manufacturing plant.

Name / Description:	Jiujiang SUNID Tech Co., Ltd.
Street:	No. 1 Jinxiu Road Export Processing Zone
Postcode / City, Country:	332100/Jiujiang, P.R. China
Type of production:	c-Si PV-module production
Inspection report No:	15091680.003

Remark: Alternative manufacturing plant.

Name / Description:	Zhejiang Jinko Solar Co.,Ltd.
Street:	No.35 Haishi Road,Jianshan New District
Postcode / City, Country:	314415/ Haining City, Zhejiang, P.R. China
Type of production:	c-Si PV-module production
Inspection report No:	15094211.003

Remark: Alternative manufacturing plant.

Name / Description:	JINKO SOLAR TECHNOLOGY SDN. BHD. (P2)
Street:	2522, Lorong Perusahaan 4,Kawasan Perusahaan Bebas Perai, Phase 1
Postcode / City, Country:	13600 Perai,Penang,Malaysia
Type of production:	c-Si PV-module production
Inspection report No:	15100723.002

Remark: Alternative manufacturing plant.

Name / Description:	JINKO SOLAR TECHNOLOGY SDN. BHD.
Street:	2481,Tingkat Perusahaan 4, Kawasan Perusahaan Bebas Perai
Postcode / City, Country:	13600 Perai, Penang, Malaysia
Type of production:	c-Si PV-module production
Inspection report No:	15084649.003

Remark: Alternative manufacturing plant.

Produktbeschreibung
Product description

Name / Description:	PROJINKO SOLAR PORTUGAL, UNIPESSOAL LDA
Street:	Polo Tecnologico de Moura, Lote 1
Postcode / City, Country:	7860-076 Moura, Portugal
Type of production:	c-Si PV-module production
Inspection report No:	15067439.004

Remark: Alternative manufacturing plant.

Name / Description:	VINA SOLAR TECHNOLOGY CO., LTD.
Street:	Work shop E12, LOT CN-03, Van Trung Industrial Zone, Viet Yen District
Postcode / City, Country:	Bac Giang Province, Vietnam
Type of production:	c-Si PV-module production
Inspection report No:	15102480.002

Remark: Alternative manufacturing plant.

Name / Description:	BOVIET SOLAR TECHNOLOGY CO., LTD.
Street:	B5-B6, Song Khe-Noi Hoang Industrial zone
Postcode / City, Country:	21000 Bac Giang Province, Vietnam
Type of production:	c-Si PV-module production
Inspection report No:	15100730.002

Remark: Alternative manufacturing plant.

Name / Description:	JINKO SOLAR TECHNOLOGY SDN. BHD. (P3)
Street:	Lot 10085, Plot C & D, Jalan Perusahaan, Mukim 1
Postcode / City, Country:	13600 Seberang Perai Tengah, Penang, Malaysia.
Type of production:	c-Si PV-module production
Inspection report No:	15101577.002

Remark: Alternative manufacturing plant.

Name / Description:	JINKOSOLAR PTY LTD.
Street:	2 Evans Avenue, Epping 1
Postcode / City, Country:	7460 Cape Town, South Africa
Type of production:	c-Si PV-module production
Inspection report No:	15070679.003

Remark: Alternative manufacturing plant.

Produktbeschreibung
Product description

Name / Description:	Zhejiang Jinko Solar Co.,Ltd.
Street:	Yuan Xi Road, Technical Functional Zone, Yuan Hua Town
Postcode / City, Country:	314416/ Haining, Zhejiang, P.R. China
Type of production:	c-Si PV-module production
Inspection report No:	15031265.008

Remark: Alternative manufacturing plant.

Name / Description:	Yuhuan Jinkosolar Co., Ltd.
Street:	At the intersection of Shanghai Road and Taizhou Road in the third issue of Yuhuan economic development Zone
Postcode / City, Country:	Zhejiang province, 317600, P. R. China
Type of production:	c-Si PV-module production
Inspection report No:	50084980.001

Remark: Alternative manufacturing plant.

Name / Description:	HANSOL TECHICS CO., LTD.
Street:	140 Gwahaksaneop 1-ro, Oksan-myeon Heungdeok-gu,
Postcode / City, Country:	Cheongju-si Chungcheongbuk-do, KOREA
Type of production:	c-Si PV-module production
Inspection report No:	50097376.001

Remark: Alternative manufacturing plant.

Name / Description:	Jiangsu Aide Solar Energy Technology Co., Ltd.
Street:	NO.8,Fenghuang Avenue, Economic Development Zone
Postcode / City, Country:	221121 / Xuzhou, Jiangsu Province, P.R. China
Type of production:	c-Si PV-module production
Inspection report No:	50108689.001

Remark: Alternative manufacturing plant.

Name / Description:	Seraphim Solar System Co., Ltd.
Street:	No. 1-2,Hengyao Road, Henglin Town, Wujin District,
Postcode / City, Country:	213101 / Changzhou, Jiangsu Province, P.R. China
Type of production:	c-Si PV-module production
Inspection report No:	50103072.001

Remark: Alternative manufacturing plant.

Produktbeschreibung
Product description

Name / Description:	Jinko Solar Co,.Ltd.(fifth factory)
Street:	NO.1 YingBin Road, Shangrao Economic Development Zone,
Postcode / City, Country:	334100/ Jiangxi Province, P.R. China
Type of production:	c-Si PV-module production
Inspection report No:	50114397.001

Remark: Alternative manufacturing plant.

Name / Description:	Jiangsu Jinko Day Sheng Solar Co., Ltd.
Street:	No. 228, Yuesheng North Road, Fanshui Town, Industrial concentration area, Baoying County, Yangzhou
Postcode / City, Country:	225819 / Jiangsu Province, P.R. China
Type of production:	c-Si PV-module production
Inspection report No:	50112527.001

Remark: Alternative manufacturing plant.

Produktbeschreibung
Product description

4 Zusammenfassung der Prüfergebnisse
Summary of test results
All of the required tests of the IEC 61215:2005 standard were passed according to its regulations of the pass criteria.
Summary of test locations:
Tests of Bom1 (Test sample no.: 1-1 to 1-10) and Bom2 (Test sample no.: 2-1 to 2-10) were performed at TÜV Rheinland (Shanghai) Co., Ltd.
Tests of Bom3 (Test sample no.: 3-1 to 3-7), Bom4 (Test sample no.: 4-1 to 4-7) and Bom5 (Test sample no.: 5-1 to 5-7) were performed in CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd.

This test report includes the following appendices:
Appendix 1: Constructional Data Form (CDF) (102 pages)
Appendix 2: History of certification (13 pages)
Appendix 3: Photo documentation (15 pages)
Appendix 4: Measuring software (3 page)
Appendix 5: Measurement report (36 pages)
Appendix 6: Additional Documentation (13 pages)

Description of similarity (differences) between the applied model and the previously tested model:

- Extension to new model types:
  With 6” mono c-Si cells:
  JKMxxxM-72-MW (xxx=250-405, in steps of 5, 72 cells)
  JKMxxxM-60-MW (xxx=210-335, in steps of 5, 60 cells)
  JKMxxxM-72B-MW (xxx=250-405, in steps of 5, 72 cells)
  JKMxxxM-60B-MW (xxx=210-335, in steps of 5, 60 cells)
  JKMSxxxM-72-MX-MW (xxx=250-405, in steps of 5, 72 cells)
  JKMSxxxM-60-MX-MW (xxx=210-335, in steps of 5, 60 cells
  Remarks: Revelant test was performed on module type JKM365M-72-MW (Bom 2) and the test results were documented within this report.

  With 6” poly c-Si cells:
  JKMxxxPP-72-MW (xxx=250-350, in steps of 5, 72 cells)
  JKMxxxPP-60-MW (xxx=210-290, in steps of 5, 60 cells)
  JKMxxxPP-72B-MW (xxx=250-350, in steps of 5, 72 cells)
  JKMxxxPP-60B-MW (xxx=210-290, in steps of 5, 60 cells)
  JKMSxxxPP-72-MX-MW (xxx=250-350, in steps of 5, 72 cells)
  JKMSxxxPP-60-MX-MW (xxx=210-290, in steps of 5, 60 cells)
  Remarks: Revelant test was performed on module type JKM325P-72-MW (Bom 1) and the test results were documented within this report.

Produktbeschreibung
Product description

- Extension to alternative materials:

A. Solar Cell:

1. Type: 156.75Q-220-5B (with cut process)
   Manufacturer: Jinko Solar Co., Ltd.
   Dimension: 156.75mm x 156.75mm
   Thickness: 220µm ± 20µm
   Remarks: Combine with EVA F406P+ F806. Revelant tests were performed on module type JKM345PP-72-V with half cell size (Bom 5) and the test results were documented within this report. Thus no additional test for full cell size needs to be considered.

2. Type: 156P-M-1275
   Manufacturer: Jinko Solar Co., Ltd.
   Dimension: 156.75mm x 156.75mm
   Thickness: 200µm ± 20µm
   Remarks: Combine with EVA F406P+ F806. Revelant tests were performed on module type JKM325P-72-MW (Bom 1) and the test results were documented within this report.

3. Type: 156M-MP-1275
   Manufacturer: Jinko Solar Co., Ltd.
   Dimension: 156.75mm x 156.75mm
   Thickness: 200µm ± 20µm
   Remarks: Combine with EVA F406P+ F806. Revelant tests were performed on module type JKM365M-72-MW (Bom 2) and the test results were documented within this report.

4. Type: 156M-M-1275
   Manufacturer: Jinko Solar Co., Ltd.
   Dimension: 156.75mm x 156.75mm
   Thickness: 200µm ± 20µm
   Remarks: Combine with EVA F406P+ F806. Revelant tests were performed on module type JKM365M-72-MW (Bom 2) with cell type 156M-MP-1275(Perc) as represent.

B. Cell connectors

1. Coating: Sn 60%Pb40%
   Manufacturer: Suzhou YourBest New Materials Co., Ltd.
   Dimension: Φ0.35mm/ Φ0.40mm
   Remarks: Revelant tests were performed on module type JKM325P-72-MW (Bom 1) and the test results were documented within this report.

2. Coating: Sn 60%Pb40%
   Manufacturer: Changzhou JiuTian New Energy Co., Ltd.
   Dimension: Φ0.35mm/ Φ0.40mm
   Remarks: Revelant tests were performed on module type JKM365M-72-MW (Bom 2) and the test results were documented within this report.

C. Fluxing agent
   Type: Alpha® PV-1702D

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

- Extension to new cell dimension base on 156.75mmx156.75mmx200mm± 20µm:

1. Type: 156M-210 five busbar-8 segment
   Manufacturer: Jinko Solar Co., Ltd.
   Dimension: 158.75mm x 158.75mm
   Thickness: 200µm ± 20µm

2. Type: 156M-210 five gate-8 segment
   Manufacturer: Jinko Solar Co., Ltd.
   Dimension: 158.75mm x 158.75mm
   Thickness: 200µm ± 20µm

Remarks: Cell dimension of type 1 and type 2 are only for module types as below:

Module Type	Dimensions
JKMxxxM-72; JKMxxxM-72-J; JKMxxxM-72(Plus); JKMSxxxM-72; JKMSxxxM-72-J; JKMSxxxM-72(Plus); (xxx=250-405, in steps of 5, 72 cells)	1979x1002x40
JKMxxxM-72H; (xxx=250-405, in steps of 5, 144 cells)	2008x1002x40
JKMxxxM-60; JKMxxxM-60-J; JKMxxxM-60(Plus); JKMSxxxM-60; JKMSxxxM-60-J; JKMSxxxM-60(Plus); (xxx=210-335, in steps of 5, 60 cells)	1665x1002x40 1684x1002x40
JKMxxxM-60H (xxx=210-335, in steps of 5, 120 cells)	1672x992x40
JKMxxxM-72B; JKMSxxxM-72B (xxx=250-405, in steps of 5, 72 cells)	1979x1002x40
JKMxxxM-72HB (xxx=250-405, in steps of 5, 144 cells)	2008x1002x40
JKMxxxM-60B; JKMSxxxM-60B (xxx=210-335, in steps of 5, 60 cells)	1665x1002x40
JKMxxxM-60HB (xxx=210-335, in steps of 5, 120 cells)	1684x1002x40 1672x992x40

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

3. Type: 156P-220 five busbar-8 segment
   Manufacturer: Jinko Solar Co., Ltd.
   Dimension: 158.75mm x 158.75mm
   Thickness: 200μm ± 20μm

4. Type: 156P-B-575
   Manufacturer: Jinko Solar Co., Ltd.
   Dimension: 158.75mm x 158.75mm
   Thickness: 200μm ± 20μm

Remarks: Cell dimension of type 3 and type 4 are only for module types as below:

Module Type	Dimensions
JKMxxxP-72; JKMxxxP-72-J; JKMxxxPP-72; JKMxxxPP-72-J; JKMxxxP-72-J4; JKMxxxPP-72-J4; JKMxxxP-72(Plus); JKMxxxPP-72(Plus); JKMxxxPP-72-W; JKMxxxPP-72(Plus)-J; JKMxxxP-72-J4-J; JKMxxxPP-72-J4-J; JKMxxxPP-72-J4(Plus); JKMSxxxP-72; JKMSxxxP-72-J; JKMSxxxP-72-J4; JKMSxxxP-72(Plus); JKMSxxxPP-72; JKMSxxxPP-72-J; JKMSxxxPP-72-J4; JKMSxxxPP-72(Plus); JKMSxxxPP-72-W; JKMSxxxPP-72(Plus)-J; JKMSxxxP-72-J4-J; JKMSxxxPP-72-J4-J (xxx=250-350, in steps of 5, 72 cells)	1979x1002x40
JKMxxxPP-72H; JKMxxxPP-72H-J4 (xxx=250-350, in steps of 5, 144 cells)	2008x1002x40
JKMxxxP-60; JKMxxxP-60-J; JKMxxxPP-60; JKMxxxPP-60-J; JKMxxxP-60-J4; JKMxxxPP-60-J4; JKMxxxP-60(Plus); JKMxxxPP-60(Plus); JKMxxxPP-60-W; JKMxxxPP-60(Plus)-J; JKMxxxP-60-J4-J;JKMxxxPP-60-J4-J; JKMxxxPP-60-J4(Plus); JKMSxxxP-60; JKMSxxxP-60-J; JKMSxxxP-60-J4; JKMSxxxP-60(Plus); JKMSxxxPP-60; JKMSxxxPP-60-J; JKMSxxxPP-60-J4; JKMSxxxPP-60(Plus); JKMSxxxPP-60-W; JKMSxxxPP-60(Plus)-J; JKMSxxxP-60-J4-J; JKMSxxxPP-60-J4-J (xxx=210-290, in steps of 5, 60 cells)	1665x1002x40 1684x1002x40
JKMxxxM-60H (xxx=210-335, in steps of 5, 120 cells)	1672x992x40
JKMxxxP-72B; JKMxxxPP-72B; JKMxxxP-72B-J4; JKMxxxPP-72B-J4; JKMxxxP-72B-J4-J; JKMxxxPP-72B-J4-J; JKMSxxxP-72B; JKMSxxxPP-72B; JKMSxxxP-72B-J4; JKMSxxxPP-72B-J4; JKMSxxxP-72B-J4-J; JKMSxxxPP-72B-J4-J (xxx=250-350, in steps of 5, 72 cells)	1979x1002x40
JKMxxxPP-72HB (xxx=250-350, in steps of 5, 144 cells)	2008x1002x40
JKMxxxP-60B; JKMxxxP-60B-J4; JKMxxxPP-60B; JKMxxxPP-60B-J4; JKMxxxP-60B-J4-J; JKMxxxPP-60B-J4-J; JKMSxxxP-60B; JKMSxxxP-60B-J4; JKMSxxxPP-60B; JKMSxxxPP-60B-J4; JKMSxxxP-60B-J4-J; JKMSxxxPP-60B-J4-J (xxx=210-290, in steps of 5, 60 cells)	1665x1002x40
JKMxxxPP-60HB (xxx=210-320, in steps of 5, 120 cells)	1684x1002x40 1672x992x40

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

- Extension to new combination between new cells and EVA:

  A. 1. Cell: 156.75Q-220-5B and EVA: F406P+F806, 9110T+9120B, S201MT1+G401W, F406P+F806W, S201MT1+G401W, EV1050G2+EV10500G1
  2. Cell: 156P-M-1275 and EVA: F406P+F806, 9110T+9120B, S201MT1+S201MT2, F406P+F806W, S201MT1+G401W, EV1050G2+EV10500G1
  3. Cell: 156M-M-1275 and EVA: F406P+F806, 9110T+9120B, S201MT1+S201MT2, F406P+F806W, S201MT1+G401W, EV1050G2+EV10500G1
  4. Cell: 156M-MP-1275 and EVA: F406P+F806, 9110T+9120B, S201MT1+S201MT2, F406P+F806W, S201MT1+G401W, EV1050G2+EV10500G1

  Remark: The surface properties of these cells are identical to previous cell types respectively which had restricted combinations with above listed EVA already according to the declarations documented in appendix 6 of this report. Thus no additional test needs to be considered on these extensions.

- Refer to CDF documented within appendix 1 of this report for detail information.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

—	**Test specification**	
Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval	IEC 61215:2005, EN 61215:2005	—

—	**Abbreviations used in the report**
NOCT	Nominal Operating Cell Temperature
STC	Standard Test Conditions
Pmax	Maximum power
Impp	Maximum power point current
Vmpp	Maximum power point voltage
Isc	Short circuit current
Voc	Open circuit voltage
FF	Fill factor
α	Current temperature coefficient
β	Voltage temperature coefficient
γ	Power temperature coefficient
S	Series connection
SP	Series-parallel connection
SPS	Series-parallel-series connection

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}) ≤ ± 3.0 %
  - 2σ (I_{SC}) ≤ ± 2.8 %
  - 2σ (V_{OC}) ≤ ± 0.9 %
- Relative measurements were performed with a flash type solar simulator.
- The accuracy of measurement reproduction with the solar simulator is less than ±1 %.

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

—	**Marking**	
Name, monogram or symbol of manufacturer	Marked on rating label	P
Type or model number	Marked on rating label	P
Serial number	Encapsulated inside module	P
Polarity of terminals or leads	Marked on connectors	P
Maximum system voltage	Marked on rating label	P
Date and place of manufacture	Traceable from serial number	P

—	**List of test samples**		
Sample No.	Sample S/N	Remarks/constructional characteristics (e.g. cell, backsheet, frame type)	—
	Module type: JKM325P-72-MW (BOM1)		
1-1	63820170808110168770007	Tempered glass with external AR coating 4.0mm from Xinyi PV Products (Anhui) Holdings Ltd. + 40mm frame + **156P-M-1275 12BB poly cell from Jinko Solar Co., Ltd.** + (F406P+F806) EVA + 9161 EPE + HT-8258 frame adhesive + UV-1 Fixing Tape + Jolywood TFB-40 Backsheet **+ Alpha® PV-1702D Fluxing agent** + PV-JK06Fxy(x=2 y=2) Junction Box	—
1-2	63820170808110168770011		
1-3	63820170808110168770012		
1-4	63820170808110168770006		
1-5	63820170808110168770008		
1-6	63820170808110168770014		
1-7	63820170808110168770016		
1-8	63820170808110168770019		
1-9	63820170808110168770020		
1-10	63820170808110168770015		
	Module type: JKM365M-72-MW (BOM2)		
2-1	13622017102611018631004	Tempered glass with external AR coating 4.0mm from Xinyi PV Products (Anhui) Holdings Ltd. + 40mm frame + **156M-MP-1275 12BB mono cell from Jinko Solar Co., Ltd.**+ (F406P+F806) EVA + 9161 EPE + HT-8258 frame adhesive + UV-1 Fixing Tape + Jolywood TFB-40 Backsheet + SF56 Fluxing agent + FT20xy(x=4,5,6) Junction Box	—
2-3	13622017102611018631009		
2-4	13622017102611018631010		
2-5	13622017102611018631012		

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*
2-6	13622017102611018631000 3		
2-7	13622017102611018631001 3		
2-8	13622017102611018631000 6		
2-9	13622017102611018631000 7		
2-10	13622017102611018631000 8		
	Module type: JKM330PP-72 (BOM3)		
3-1	13C25717101211018298000 1	Tempered glass with external AR coating 4.0mm from Xinyi PV Products (Anhui) Holdings Ltd. + 40mm frame + ETM6-5BB-XXXX cell + (9110T+9120B) EVA + 9161 EPE + HT-8258 frame adhesive + UV-1 Fixing Tape + Isovoltaic AG ICOSOLAR TPF Backsheet + SF56 Fluxing agent + PV-JK06D Junction Box	
3-3	13C25717101211018298000 3		
3-4	13C25717101211018298000 4		
3-5	13C25717101211018298000 5		
3-6	13C25717101211018298000 6		
3-7	13C25717101211018298000 7		
	Module type: JKM355M-72 (BOM4)		
4-1	1382A11710121101830100 01	Tempered glass with external AR coating 4.0mm from XFX SOLAR CO., LTD + 40mm frame + P15675-5BB106-JK cell + (9110T+9120B) EVA + 9161 EPE + HT-8258 frame adhesive + UV-1 Fixing Tape + TAIFLEX Scientific Co., Ltd Solmate VTPE1RW-P (TPP) Backsheet + SF56 Fluxing agent + PV-JK06D Junction Box	
4-3	1382A11710121101830100 03		
4-4	1382A11710121101830100 04		
4-5	1382A11710121101830100 05		
4-6	1382A11710121101830100 06		
4-7	1382A11710121101830100 07		
	Module type: JKM345PP-72H (BOM5)		
5-1	C38220171104110188450010	Tempered glass with external AR coating 4.0mm from XFX SOLAR CO., LTD + 40mm frame + **156.75Q-220-5B cell+** (F406P+F806) EVA + 9161 EPE + MH-3668 frame adhesive + UV-1 Fixing Tape + Lucky Film TPEw Backsheet + SF56 Fluxing agent + PV-JK09Axy (x=1 or 2,y=H or V) Junction Box	
5-3	C38220171027110186370001		
5-4	C38220171027110186370004		
5-5	C38220171027110186370006		
5-6	C38220171027110186370002		
5-7	C38220171027110186370008		

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*
—	**IEC/EN 61215 - Design qualification and type approval**		
—	**Module type: JKM325P-72-MW (BOM1)**		
10	Preconditioning (min. 5 kWh/m^2)	Performed by manufacturer	—
10.1	Visual inspection	See table 10.1	P
10.2	Maximum power determination	See table 10.2	P
10.3	Insulation test	See table 10.3	P
10.15	Wet leakage current test	See table 10.15	P
10.4	Measurement of temperature coefficients	N/A	N/A
10.6	Performance at STC	See table 10.6	—
10.5	Measurement of Nominal Operating Cell Temperature (NOCT)	N/A	N/A
10.6	Performance at NOCT	N/A	N/A
10.7	Performance at low irradiance	N/A	N/A
10.8	Outdoor exposure test	N/A	N/A
10.18	Bypass diode thermal test	See table 10.18	P
10.9	Hot-spot endurance test	See table 10.9	P
10.10	UV preconditioning test	See table 10.10	P
10.11a	Thermal cycling test (50cycles)	See table 10.11	P
10.12	Humidity-freeze test (10 cycles)	See table 10.12	P
10.14	Robustness of terminations test	N/A	N/A
10.11b	Thermal cycling test (200 cycles)	See table 10.11	P
10.13	Damp heat test	See table 10.13	P
10.16	Mechanical load test	See table 10.16	P
10.17	Hail test	N/A	N/A

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*
—	**IEC/EN 61215 - Design qualification and type approval**		
—	**Module type: JKM365M-72-MW (BOM2)**		
10	Preconditioning (min. 5 kWh/m^2)	Performed by manufacturer	—
10.1	Visual inspection	See table 10.1	P
10.2	Maximum power determination	See table 10.2	P
10.3	Insulation test	See table 10.3	P
10.15	Wet leakage current test	See table 10.15	P
10.4	Measurement of temperature coefficients	N/A	N/A
10.6	Performance at STC	See table 10.6	—
10.5	Measurement of Nominal Operating Cell Temperature (NOCT)	N/A	N/A
10.6	Performance at NOCT	N/A	N/A
10.7	Performance at low irradiance	N/A	N/A
10.8	Outdoor exposure test	N/A	N/A
10.18	Bypass diode thermal test	See table 10.18	P
10.9	Hot-spot endurance test	See table 10.9	P
10.10	UV preconditioning test	See table 10.10	P
10.11a	Thermal cycling test (50cycles)	See table 10.11	P
10.12	Humidity-freeze test (10 cycles)	See table 10.12	P
10.14	Robustness of terminations test	N/A	N/A
10.11b	Thermal cycling test (200 cycles)	See table 10.11	P
10.13	Damp heat test	See table 10.13	P
10.16	Mechanical load test	See table 10.16	P
10.17	Hail test	N/A	N/A

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*
—	**IEC/EN 61215 - Design qualification and type approval**		
—	**Module type: JKM330PP-72 (BOM3)**		
10	Preconditioning (min. 5 kWh/m^2)	Performed by manufacturer	—
10.1	Visual inspection	See table 10.1	P
10.2	Maximum power determination	See table 10.2	P
10.3	Insulation test	See table 10.3	P
10.15	Wet leakage current test	See table 10.15	P
10.4	Measurement of temperature coefficients	N/A	N/A
10.6	Performance at STC	See table 10.6	—
10.5	Measurement of Nominal Operating Cell Temperature (NOCT)	N/A	N/A
10.6	Performance at NOCT	N/A	N/A
10.7	Performance at low irradiance	N/A	N/A
10.8	Outdoor exposure test	N/A	N/A
10.18	Bypass diode thermal test	N/A	N/A
10.9	Hot-spot endurance test	See table 10.9	P
10.10	UV preconditioning test	N/A	N/A
10.11a	Thermal cycling test (50cycles)	N/A	N/A
10.12	Humidity-freeze test (10 cycles)	N/A	N/A
10.14	Robustness of terminations test	N/A	N/A
10.11b	Thermal cycling test (200 cycles)	See table 10.11	P
10.13	Damp heat test	See table 10.13	P
10.16	Mechanical load test	See table 10.16	P
10.17	Hail test	N/A	N/A

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*
—	**IEC/EN 61215 - Design qualification and type approval**		
—	**Module type: JKM355M-72 (BOM4)**		
10	Preconditioning (min. 5 kWh/m^2)	Performed by manufacturer	—
10.1	Visual inspection	See table 10.1	P
10.2	Maximum power determination	See table 10.2	P
10.3	Insulation test	See table 10.3	P
10.15	Wet leakage current test	See table 10.15	P
10.4	Measurement of temperature coefficients	N/A	N/A
10.6	Performance at STC	See table 10.6	—
10.5	Measurement of Nominal Operating Cell Temperature (NOCT)	N/A	N/A
10.6	Performance at NOCT	N/A	N/A
10.7	Performance at low irradiance	N/A	N/A
10.8	Outdoor exposure test	N/A	N/A
10.18	Bypass diode thermal test	N/A	N/A
10.9	Hot-spot endurance test	See table 10.9	P
10.10	UV preconditioning test	N/A	N/A
10.11a	Thermal cycling test (50cycles)	N/A	N/A
10.12	Humidity-freeze test (10 cycles)	N/A	N/A
10.14	Robustness of terminations test	N/A	N/A
10.11b	Thermal cycling test (200 cycles)	See table 10.11	P
10.13	Damp heat test	See table 10.13	P
10.16	Mechanical load test	See table 10.16	P
10.17	Hail test	N/A	N/A

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*
—	**IEC/EN 61215 - Design qualification and type approval**		
—	**Module type: JKM345PP-72H (BOM5)**		
10	Preconditioning (min. 5 kWh/m^2)	Performed by manufacturer	—
10.1	Visual inspection	See table 10.1	P
10.2	Maximum power determination	See table 10.2	P
10.3	Insulation test	See table 10.3	P
10.15	Wet leakage current test	See table 10.15	P
10.4	Measurement of temperature coefficients	N/A	N/A
10.6	Performance at STC	See table 10.6	—
10.5	Measurement of Nominal Operating Cell Temperature (NOCT)	N/A	N/A
10.6	Performance at NOCT	N/A	N/A
10.7	Performance at low irradiance	See table 10.7	—
10.8	Outdoor exposure test	N/A	N/A
10.18	Bypass diode thermal test	N/A	N/A
10.9	Hot-spot endurance test	See table 10.9	P
10.10	UV preconditioning test	N/A	N/A
10.11a	Thermal cycling test (50cycles)	N/A	N/A
10.12	Humidity-freeze test (10 cycles)	N/A	N/A
10.14	Robustness of terminations test	N/A	N/A
10.11b	Thermal cycling test (200 cycles)	See table 10.11	P
10.13	Damp heat test	See table 10.13	P
10.16	Mechanical load test	See table 10.16	P
10.17	Hail test	N/A	N/A

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.1	**Visual inspection (Initial)**	
Sample No.	Nature and position of initial findings	—
1-1	No visual defects	P
1-2	No visual defects	P
1-3	No visual defects	P
1-4	No visual defects	P
1-5	No visual defects	P
1-6	No visual defects	P
1-7	No visual defects	P
1-8	No visual defects	P
1-9	No visual defects	P
1-10	No visual defects	P
2-1	No visual defects	P
2-3	No visual defects	P
2-4	No visual defects	P
2-5	No visual defects	P
2-6	No visual defects	P
2-7	No visual defects	P
2-8	No visual defects	P
2-9	No visual defects	P
2-10	No visual defects	P
3-1	No visual defects	P
3-3	No visual defects	P
3-4	No visual defects	P
3-5	No visual defects	P
3-6	No visual defects	P
3-7	No visual defects	P
4-1	No visual defects	P
4-3	No visual defects	P
4-4	No visual defects	P
4-5	No visual defects	P
4-6	No visual defects	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

4-7	No visual defects	P
5-1	No visual defects	P
5-2	No visual defects	P
5-4	No visual defects	P
5-5	No visual defects	P
5-6	No visual defects	P
5-7	No visual defects	P

10.2 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 [%]	
1-1	335.1	38.04	8.810	45.63	9.293	79.0	
1-2	333.9	37.92	8.805	45.57	9.274	79.0	
1-3	334.2	38.30	8.727	45.61	9.292	78.9	
1-4	334.2	37.97	8.801	45.59	9.280	79.0	
1-5	334.1	38.30	8.723	45.62	9.269	79.0	
1-6	333.9	37.94	8.799	45.63	9.278	78.9	
1-7	335.8	38.02	8.833	45.68	9.280	79.2	
1-8	336.2	38.09	8.825	45.71	9.286	79.2	
1-9	334.6	38.04	8.797	45.64	9.258	79.2	
1-10	335.6	38.08	8.812	45.66	9.308	79.0	
2-1	364.4	39.12	9.315	47.54	9.735	78.7	
2-2	364.3	39.68	9.182	47.51	9.695	79.1	
2-3	363.2	39.45	9.186	47.40	9.698	79.0	
2-4	367.8	39.80	9.243	47.64	9.737	79.3	
2-5	265.9	39.64	9.231	47.57	9.718	79.2	
2-6	364.4	39.59	9.204	47.62	9.706	78.9	
2-7	366.3	39.22	9.339	47.59	9.733	79.1	
2-8	365.4	39.61	9.225	47.55	9.717	79.1	
2-9	336.4	39.66	9.237	47.64	9.729	79.1	
2-10	364.7	39.56	9.219	47.50	9.697	79.2	
3-1	329.9	37.84	8.720	45.74	9.254	78.0	
3-2	329.9	37.65	8.762	45.73	9.245	78.1	

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

3-3	328.7	37.59	8.746	45.71	9.213	78.1	
3-4	330.0	37.68	8.756	45.77	9.246	78.0	
3-5	330.0	37.65	8.764	45.71	9.256	78.0	
3-6	329.2	37.77	8.715	45.71	9.225	78.1	
3-7	329.9	37.78	8.730	45.75	9.240	78.0	
4-1	356.0	39.09	9.108	47.50	9.628	77.9	
4-2	357.2	39.30	9.088	47.47	9.707	77.5	
4-3	357.2	38.75	9.218	47.52	9.667	77.8	
4-4	357.0	38.72	9.219	47.54	9.641	77.9	
4-5	358.0	39.44	9.078	47.63	9.633	78.0	
4-6	354.6	38.55	9.199	47.43	9.676	77.3	
4-7	356.3	39.04	9.127	47.50	9.707	77.3	
5-1	339.5	38.54	8.810	45.67	9.287	80.1	
5-2	350.4	38.89	9.012	46.20	9.432	80.4	
5-3	347.9	38.88	8.947	46.14	9.371	80.5	
5-4	347.5	38.88	8.937	46.17	9.366	80.4	
5-5	347.2	38.90	8.926	46.13	9.368	80.3	
5-6	346.3	38.79	8.926	46.14	9.369	80.1	
5-7	347.5	38.85	8.945	46.15	9.353	80.5	

10.3	**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	
3-1	10.00	1.94	19.40	-	No	P
3-3	10.00	1.94	19.40	-	No	P
3-4	10.00	1.94	19.40	-	No	P
3-5	10.00	1.94	19.40	-	No	P
3-6	10.00	1.94	19.40	-	No	P
3-7	10.00	1.94	19.40	-	No	P
4-1	10.00	1.94	19.40	-	No	P
4-3	10.00	1.94	19.40	-	No	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

4-4	10.00	1.94	19.40	-	No	P
4-5	10.00	1.94	19.40	-	No	P
4-6	10.00	1.94	19.40	-	No	P
4-7	10.00	1.94	19.40	-	No	P
*Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: Insulation tester can measure respective up to 5.00 GΩ and 10.00GΩ.						

10.3 Insulation test (Initial)

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	
1-1	5.00	1.94	9.70	-	No	P
1-2	5.00	1.94	9.70	-	No	P
1-3	5.00	1.94	9.70	-	No	P
1-4	5.00	1.94	9.70	-	No	P
1-5	5.00	1.94	9.70	-	No	P
1-6	5.00	1.94	9.70	-	No	P
1-7	5.00	1.94	9.70	-	No	P
1-8	5.00	1.94	9.70	-	No	P
1-9	5.00	1.94	9.70	-	No	P
2-1	5.00	1.94	9.70	-	No	P
2-3	5.00	1.94	9.70	-	No	P
2-4	5.00	1.94	9.70	-	No	P
2-5	5.00	1.94	9.70	-	No	P
2-6	5.00	1.94	9.70	-	No	P
2-7	5.00	1.94	9.70	-	No	P
2-8	5.00	1.94	9.70	-	No	P
2-9	5.00	1.94	9.70	-	No	P
2-10	5.00	1.94	9.70	-	No	P
5-1	10.00	1.94	19.40	-	No	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

5-2	10.00	1.94	19.40	-	No	P
5-4	10.00	1.94	19.40	-	No	P
5-5	10.00	1.94	19.40	-	No	P
5-6	10.00	1.94	19.40	-	No	P
5-7	10.00	1.94	19.40	-	No	P
*Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: Insulation tester can measure respective up to 5.00 GΩ and 10.00GΩ.						

10.15	**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 [MΩ]	Area [m²]	Result* [MΩ × m²]	—
3-1	6640.0	1.94	12881.6	P
3-3	5760.0	1.94	11174.4	P
3-4	6070.0	1.94	11775.8	P
3-5	3810.0	1.94	7391.4	P
3-6	6530.0	1.94	12668.2	P
3-7	5630.0	1.94	10922.2	P
4-1	4050.0	1.94	7857.0	P
4-3	5600.0	1.94	10864.0	P
4-4	7580.0	1.94	14705.2	P
4-5	3050.0	1.94	5917.0	P
4-6	5690.0	1.94	11038.6	P
4-7	7320.0	1.94	14200.8	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: N/A				

10.15	**Wet leakage current test (Initial)**		
Insulation resistance measured at[V_{DC}]		1500	—

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured [MΩ]	Area [m²]	Result* [MΩ × m²]	—
1-1	5000.0	1.94	9700.0	P
1-2	5000.0	1.94	9700.0	P
1-3	5000.0	1.94	9700.0	P
1-4	5000.0	1.94	9700.0	P
1-5	5000.0	1.94	9700.0	P
1-6	5000.0	1.94	9700.0	P
1-7	5000.0	1.94	9700.0	P
1-8	5000.0	1.94	9700.0	P
1-9	5000.0	1.94	9700.0	P
2-1	5000.0	1.94	9700.0	P
2-3	5000.0	1.94	9700.0	P
2-4	5000.0	1.94	9700.0	P
2-5	5000.0	1.94	9700.0	P
2-6	5000.0	1.94	9700.0	P
2-7	5000.0	1.94	9700.0	P
2-8	5000.0	1.94	9700.0	P
2-9	5000.0	1.94	9700.0	P
2-10	5000.0	1.94	9700.0	P
5-1	9999.0	1.94	19398.1	P
5-2	9999.0	1.94	19398.1	P
5-3	9999.0	1.94	19398.1	P
5-4	9999.0	1.94	19398.1	P
5-5	9999.0	1.94	19398.1	P
5-6	8850.0	1.94	17169.0	P
5-7	9999.0	1.94	19398.1	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: Insulation tester can measure respective up to 5000.0 MΩ and 9999.0 MΩ.				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.6 Performance at STC

Test method	☒ indoor	☐ outdoor	
Ambient temperature [°C]	25 ± 2		
Irradiance [W/m²]	1000		—
Module temperature [°C]	25 ± 0.2		

Sample No.	P_{max}[W]	V_{mpp}[V]	I_{mpp}[A]	V_{oc}[V]	I_{sc}[A]	FF [%]	
1-1	333.4	37.98	8.778	45.68	9.307	78.4	—
2-1	365.0	39.38	9.268	47.53	9.767	78.6	—
3-1	330.1	37.85	8.720	45.76	9.254	77.9	—
4-1	355.9	39.07	9.110	47.50	9.629	77.8	—
5-1	339.4	38.54	8.807	45.67	9.287	80.0	—

Supplementary information: Measurement is performed with a pulsed solar simulator.

10.18 Bypass diode thermal test

Sample No.	1-3			
Module temperature [°C]	75 ± 5			
Number of diodes in junction box	3			
Diode manufacturer	ZJRH			
Diode type designation	PST4020			
	Diode 1	Diode 2	Diode 3	
Diode surface temperature [°C] *	97.3	110.4	104.3	
Thermal resistance junction to case (R_{THJC}) [K/W] (acc. to diode datasheet)	1.5	1.5	1.5	—
Diode current flow applied (Isc) [A]	9.3	9.3	9.3	
Voltage drop across diode [V]	0.308	0.286	0.297	
Power dissipation [W]	2.9	2.7	2.8	
Calculated junction temperature Tj_{calc} [°C] *	101.6	114.4	108.4	
Max. permissible junction temperature Tj_{max} [°C] (according to diode datasheet)	200.00	200.00	200.00	
$Tj_{calc} < Tj_{max}$ (required for passing the test)?	(yes)	(yes)	(yes)	P
Diode current flow applied (1.25 * Isc) [A]	11.6	11.6	11.6	—
Calculated junction temperature Tj_{calc} [°C] *	111.6	125.3	119.4	

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

Diode functional?	(yes)	(yes)	(yes)	P
Remarks: (* related to diode case)				

10.18	**Bypass diode thermal test**			
Sample No.	2-10			—
Module temperature [°C]	75 ± 5			
Number of diodes in junction box	3			
Diode manufacturer	Jiangxi Jinko PV Material Co., Ltd.			
Diode type designation	JKTPD3045			
	Diode 1	Diode 2	Diode 3	
Diode surface temperature [°C] *	118.6	121.3	113.1	
Thermal resistance junction to case (R_{THJC}) [K/W] (acc. to diode datasheet)	2.0	2.0	2.0	
Diode current flow applied (Isc) [A]	9.7	9.7	9.7	
Voltage drop across diode [V]	0.309	0.306	0.311	
Power dissipation [W]	3.0	3.0	3.0	
Calculated junction temperature Tj_{calc} [°C] *	124.6	127.2	119.1	
Max. permissible junction temperature Tj_{max} [°C] (according to diode datasheet)	200.00	200.00	200.00	
$Tj_{calc} < Tj_{max}$ (required for passing the test)?	(yes)	(yes)	(yes)	P
Diode current flow applied (1.25 * Isc) [A]	12.1	12.1	12.1	—
Calculated junction temperature Tj_{calc} [°C] *	129.1	138.1	131.5	
Diode functional?	(yes)	(yes)	(yes)	P
Remarks: (* related to diode case)				

10.1	**Visual inspection after Bypass diode thermal test**	
Sample No.	Nature and position of findings	—
1-3	No visual defects	P
2-10	No visual defects	P
Supplementary information: N/A		

10.2	**Maximum power determination after Bypass diode thermal test**	
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 [%]	Degradation [%]	
1-3	334.8	38.00	8.810	45.60	9.285	79.1	0.16	P
2-10	365.3	39.24	9.309	47.48	9.697	79.3	0.16	P
Supplementary information: Maximum allowable P_{max} degradation after this test is 5 %.								

10.3 Insulation test after Bypass diode thermal 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	
1-3	28.80	1.94	55.87	-	no	P
2-10	78.90	1.94	151.3	-	no	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: N/A						

10.15 Wet leakage current test after Bypass diode thermal test

Insulation resistance measured at [V_{DC}]		1500		—
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured	Area	Result*	—
	[MΩ]	[m²]	[MΩ × m²]	
1-3	13600.0	1.94	26384.0	P
2-10	17200.0	1.94	33368.0	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: N/A				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.9	**Hot-spot endurance test**			
Sample No.	1-2			—
Cell interconnection circuit	☒ S	☐ SP	☐ SPS	
Module temperature at thermal equilibrium [°C]	45.7			
Measurement at 1st worst case cell at edge of module				
Maximum measured cell temperature [°C]	154			
Shading rate [%]	17			
Measurement at 1st worst case cell of complete module				
Maximum measured cell temperature [°C]	135			
Shading rate [%]	15			
Measurement at 2nd worst case cell of complete module				
Maximum measured cell temperature [°C]	146			
Shading rate [%]	15			
Measurement at 3rd worst case cell with lowest leakage current				
Maximum measured cell temperature [°C]	128			
Shading rate [%]	9			
Supplementary information: The Hot-spot endurance test is performed acc. to a draft for IEC 61215 ed.3; since test experience shows, that one five hour long cycle does not lead to additional information, separate cycles of one hour with different cells shaded are performed.				

10.9	**Hot-spot endurance test**			
Sample No.	2-3			—
Cell interconnection circuit	☒ S	☐ SP	☐ SPS	
Module temperature at thermal equilibrium [°C]	43.3			
Measurement at 1st worst case cell at edge of module				
Maximum measured cell temperature [°C]	160			
Shading rate [%]	15			
Measurement at 1st worst case cell of complete module				
Maximum measured cell temperature [°C]	156			
Shading rate [%]	13			
Measurement at 2nd worst case cell of complete module				
Maximum measured cell temperature [°C]	144			
Shading rate [%]	13			

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

Measurement at 3rd worst case cell with lowest leakage current		
Maximum measured cell temperature [°C]	151	
Shading rate [%]	9	
Supplementary information: The Hot-spot endurance test is performed acc. to a draft for IEC 61215 ed.3; since test experience shows, that one five hour long cycle does not lead to additional information, separate cycles of one hour with different cells shaded are performed.		

10.9	**Hot-spot endurance test**			
Sample No.	3-3			—
Cell interconnection circuit	☒ S	☐ SP	☐ SPS	
Module temperature at thermal equilibrium [°C]	48.8			
Measurement at 1st worst case cell at edge of module				
Maximum measured cell temperature [°C]	111.6			
Shading rate [%]	11.1			
Measurement at 1st worst case cell of complete module				
Maximum measured cell temperature [°C]	111.6			
Shading rate [%]	11.1			
Measurement at 2nd worst case cell of complete module				
Maximum measured cell temperature [°C]	118.5			
Shading rate [%]	10.4			
Measurement at 3rd worst case cell with lowest leakage current				
Maximum measured cell temperature [°C]	122.3			
Shading rate [%]	8.6			
Supplementary information: The Hot-spot endurance test is performed acc. to a draft for IEC 61215 ed.3; since test experience shows, that one five hour long cycle does not lead to additional information, separate cycles of one hour with different cells shaded are performed.				

10.9	**Hot-spot endurance test**			
Sample No.	4-3			—
Cell interconnection circuit	☒ S	☐ SP	☐ SPS	
Module temperature at thermal equilibrium [°C]	48.5			
Measurement at 1st worst case cell at edge of module				
Maximum measured cell temperature [°C]	111.8			
Shading rate [%]	10.9			

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

Measurement at 1st worst case cell of complete module	
Maximum measured cell temperature [°C]	111.8
Shading rate [%]	10.9
Measurement at 2nd worst case cell of complete module	
Maximum measured cell temperature [°C]	121.5
Shading rate [%]	10.3
Measurement at 3rd worst case cell with lowest leakage current	
Maximum measured cell temperature [°C]	121.1
Shading rate [%]	8.0
Supplementary information: The Hot-spot endurance test is performed acc. to a draft for IEC 61215 ed.3; since test experience shows, that one five hour long cycle does not lead to additional information, separate cycles of one hour with different cells shaded are performed.	

10.9	**Hot-spot endurance test**		
Sample No.	5-3		
Cell interconnection circuit	☒ S	☐ SP	☐ SPS
Module temperature at thermal equilibrium [°C]	48.9		
Measurement at 1st worst case cell at edge of module			
Maximum measured cell temperature [°C]	116.5		
Shading rate [%]	30.0		
Measurement at 1st worst case cell of complete module			
Maximum measured cell temperature [°C]	116.5		
Shading rate [%]	30.0		
Measurement at 2nd worst case cell of complete module			
Maximum measured cell temperature [°C]	115.2		
Shading rate [%]	21.8		
Measurement at 3rd worst case cell with lowest leakage current			
Maximum measured cell temperature [°C]	112.9		
Shading rate [%]	19.2		
Supplementary information: The Hot-spot endurance test is performed acc. to a draft for IEC 61215 ed.3; since test experience shows, that one five hour long cycle does not lead to additional information, separate cycles of one hour with different cells shaded are performed.			

—

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.1	**Visual inspection after Hot-spot endurance test**	
Sample No.	Nature and position of findings	—
1-2	No visual defects	P
2-3	No visual defects	P
3-3	No visual defects	P
4-3	No visual defects	P
5-3	No visual defects	P
Supplementary information: N/A		

10.2 Maximum power determination after Hot-spot endurance test

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 [%]	Degradation [%]	
1-2	333.9	37.96	8.798	45.53	9.285	79.0	0.00	P
2-3	361.2	38.95	9.274	47.29	9.652	79.1	-0.56	P
3-3	329.2	37.41	8.799	45.71	9.221	78.1	0.15	P
4-3	353.7	38.56	9.175	47.31	9.618	77.7	-0.98	P
5-3	347.4	38.90	8.930	46.14	9.364	80.4	-0.14	P
Supplementary information: Maximum allowable P_{max} degradation after this test is 5 %.								

10.3 Insulation test after Hot-spot endurance 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	
3-3	10.00	1.94	19.40	-	No	P
4-3	10.00	1.94	19.40	-	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: Insulation tester can measure up to 10.00 GΩ.						

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.3	**Insulation test after Hot-spot endurance 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	
1-2	5.00	1.94	9.70	-	No	P
2-3	68.2	1.94	132.3	-	No	P
5-3	10.00	1.94	19.40	-	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: Insulation tester can measure up to 10.00 GΩ.						

10.15	**Wet leakage current test after Hot-spot endurance 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]	[m²]	[MΩ × m²]	
3-3	4250.0	1.94	8245.0	P
4-3	4250.0	1.94	8245.0	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: N/A				

10.15	**Wet leakage current test after Hot-spot endurance test**			
Insulation resistance measured at[V_{DC}]		1500		—
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured	Area	Result*	—
	[MΩ]	[m²]	[MΩ × m²]	
1-2	5000.0	1.94	9700.0	P
2-3	19500.0	1.94	37830.0	P
5-3	6180.0	1.94	11989.2	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

* Minimum requirement acc. to the standard is 40 MΩ × m².
Supplementary information: N/A

10.10	**UV preconditioning test**	
Module temperature [°C]	60 ± 5	—
Ratio of UV-B irradiation (280 – 320 nm) [%]	7	
UV irradiation dose (280 – 400 nm) [kWh/m²]	15	
Sample No.	Open circuits (yes/no)	
1-4	Yes	—
1-5	Yes	—
2-4	Yes	—
2-5	Yes	—
Supplementary information: Sub-clauses 10.10.2 c), 10.10.3 a) and 10.10.3 c) of IEC 61646:2008 was applied for UV preconditioning test as agreed by the standardization committee TC82/WG2.		

10.1	**Visual inspection after UV preconditioning test**	
Sample No.	Nature and position of findings	—
1-4	No visual defects	P
1-5	No visual defects	P
2-4	No visual defects	P
2-5	No visual defects	P
Supplementary information: N/A		

10.2	**Maximum power determination after UV preconditioning test**							
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 [%]	Degradation [%]	
1-4	333.9	38.02	8.784	45.72	9.234	79.1	-0.07	P
1-5	334.9	38.43	8.715	45.77	9.254	79.1	0.23	P
2-4	360.2	39.04	9.226	47.36	9.620	79.1	-2.09	P
2-5	359.6	39.46	9.114	47.36	9.661	78.6	-1.71	P
Supplementary information: Maximum allowable P_{max} degradation after this test is 5 %.								

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.3 Insulation test after UV preconditioning 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	
1-4	5.00	1.94	9.70	-	No	P
1-5	5.00	1.94	9.70	-	No	P
2-4	5.00	1.94	9.70	-	No	P
2-5	5.00	1.94	9.70	-	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: Insulation tester can measure up to 5.00 GΩ.						

10.11 Thermal cycling 50 test

Total number of cycles	50	—
Sample No.	Open circuits (yes/no)	
1-4	no	—
1-5	no	—
2-4	no	—
2-5	no	—
Supplementary information: N/A		

10.1 Visual inspection after Thermal cycling 50 test

Sample No.	Nature and position of findings	—
1-4	No visual defects	P
1-5	No visual defects	P
2-4	No visual defects	P
2-5	No visual defects	P
Supplementary information: N/A		

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.2 Maximum power determination after Thermal cycling 50 test

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 [%]	Degradation [%]	
1-4	334.8	38.21	8.762	45.85	9.228	79.1	0.19	P
1-5	335.5	38.25	8.771	45.87	9.240	79.2	0.41	P
2-4	359.4	39.25	9.156	47.35	9.629	78.8	-2.30	P
2-5	360.3	39.28	9.172	47.47	9.629	78.8	-1.55	P
Supplementary information: Maximum allowable P_{max} degradation after this test is 5 %.								

10.3 Insulation test after Thermal cycling 50 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	
1-4	71.4	1.94	138.5	-	No	P
1-5	68.2	1.94	132.3	-	No	P
2-4	88.2	1.94	171.1	-	No	P
2-5	88.2	1.94	171.1	-	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: N/A						

10.12 Humidity freeze test

Total number of cycles	10	—
Sample No.	Open circuits (yes/no)	
1-4	no	—
1-5	no	—
2-4	no	—

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

2-5	no	—
Supplementary information: According to CTL decision sheet DSH0735, when conducting clause 10.12 Humidity-freeze test per IEC 61215-2005 Ed.2, Figure 12, use clause 10.12 Humidity-freeze test of IEC 61646-2008 Ed.2, Figure 5. There will be no relative humidity (RH) control requirement during temperature transitions between room temperature and 85°C.		

10.1 Visual inspection after Humidity freeze test

Sample No.	Nature and position of findings	—
1-4	No visual defects	P
1-5	No visual defects	P
2-4	No visual defects	P
2-5	No visual defects	P
Supplementary information: N/A		

10.2 Maximum power determination after Humidity freeze test

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 [%]	Degradation [%]	
1-4	331.6	37.93	8.741	45.50	9.220	79.0	-0.97	P
1-5	332.7	37.94	8.767	45.54	9.244	79.0	-0.85	P
2-4	361.8	39.07	9.261	47.40	9.653	79.1	0.69	P
2-5	361.6	39.08	9.253	47.37	9.690	78.8	0.38	P
Supplementary information: Maximum allowable P_{max} degradation after this test is 5 %.								

10.3 Insulation test after Humidity freeze 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	
1-4	62.50	1.94	121.25	-	No	P
1-5	60.00	1.94	116.40	-	No	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

2-4	78.90	1.94	153.07	-	No	P
2-5	83.3	1.94	161.60	-	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: N/A						

10.15	**Wet leakage current test after Humidity freeze test**			
Insulation resistance measured at [V_{DC}]		1500		—
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured	Area	Result*	—
	[MΩ]	[m²]	[MΩ × m²]	
1-4	16000.0	1.94	31040.0	P
1-5	10600.0	1.94	20564.0	P
2-4	32600.0	1.94	63244.0	P
2-5	18100.0	1.94	35114.0	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: N/A				

10.11b	**Thermal cycling 200 test**	
Total number of cycles	200	—
Sample No.	Open circuits (yes/no)	
1-6	No	P
1-7	No	P
2-8	No	P
2-9	No	P
3-4	No	P
3-5	No	P
4-4	No	P
4-5	No	P
5-4	No	P
5-5	No	P
Supplementary information: N/A		

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.1	**Visual inspection after Thermal cycling 200 test**	
Sample No.	Nature and position of findings	—
1-6	No visual defects	P
1-7	No visual defects	P
2-8	No visual defects	P
2-9	No visual defects	P
3-4	No visual defects	P
3-5	No visual defects	P
4-4	No visual defects	P
4-5	No visual defects	P
5-4	No visual defects	P
5-5	No visual defects	P
Supplementary information: N/A		

10.2 Maximum power determination after Thermal cycling 200 test

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 [%]	Degradation [%]	
1-6	330.0	38.16	8.647	45.55	9.225	78.5	-1.16	P
1-7	331.4	38.23	8.670	45.58	9.212	78.9	-1.32	P
2-8	366.5	39.78	9.215	47.76	9.736	78.8	0.05	P
2-9	363.9	39.17	9.289	47.62	9.726	78.6	-0.41	P
3-4	320.0	37.09	8.626	45.36	9.131	77.3	-3.03	P
3-5	323.6	36.70	8.816	45.47	9.200	77.4	-1.94	P
4-4	349.2	38.24	9.133	47.05	9.584	77.5	-2.18	P
4-5	352.7	38.44	9.174	47.41	9.577	77.7	-1.48	P
5-4	344.2	38.61	8.913	46.09	9.338	80.0	-0.95	P
5-5	343.9	38.57	8.915	46.00	9.364	79.8	-0.95	P
Supplementary information: Maximum allowable P_{max} degradation after this test is 5 %.								

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.3	**Insulation test after Thermal cycling 200 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	
3-4	10.00	1.94	19.40	-	No	P
3-5	10.00	1.94	19.40	-	No	P
4-4	10.00	1.94	19.40	-	No	P
4-5	10.00	1.94	19.40	-	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: Insulation tester can measure up to 10.00 GΩ.						

10.3	**Insulation test after Thermal cycling 200 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	
1-6	68.20	1.94	132.31	-	No	P
1-7	68.20	1.94	132.31	-	No	P
2-8	93.70	1.94	181.78	-	No	P
2-9	83.3	1.94	161.60	-	No	P
5-4	10.00	1.94	19.40	-	No	P
5-5	10.00	1.94	19.40	-	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: Insulation tester can measure up to 10.00 GΩ.						

10.15	**Wet leakage current test after Thermal cycling 200 test**	
Insulation resistance measured at[V_{DC}]	1000	—
Solution resistivity [Ω cm]	< 3,500	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

Solution temperature [°C]		22 ± 3		P
Sample No.	Measured	Area	Result*	—
	[MΩ]	[m²]	[MΩ × m²]	
3-4	4740.0	1.94	9195.6	P
3-5	4810.0	1.94	9331.4	P
4-4	6250.0	1.94	12125.0	P
4-5	4320.0	1.94	8380.8	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: N/A				

10.15	**Wet leakage current test after Thermal cycling 200 test**			
Insulation resistance measured at[V_{DC}]		1500		—
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured	Area	Result*	—
	[MΩ]	[m²]	[MΩ × m²]	
1-6	8520.0	1.94	16528.8	P
1-7	9030.0	1.94	17518.2	P
2-8	1690.0	1.94	3278.6	P
2-9	1410.0	1.94	2735.4	P
5-4	2560.0	1.94	4966.4	P
5-5	1390.0	1.94	2696.6	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: N/A				

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.13	**Damp heat test**	
Total duration [h]	1000	—
Sample No.	—	
1-8	—	—
1-9	—	—
2-6	—	—
2-7	—	—
3-6	—	—
3-7	—	—
4-6	—	—
4-7	—	—
5-6	—	—
5-7	—	—
Supplementary information: N/A		

10.1	**Visual inspection after Damp heat test**	
Sample No.	Nature and position of findings	—
1-8	No visual defects	P
1-9	No visual defects	P
2-6	No visual defects	P
2-7	No visual defects	P
3-6	No visual defects	P
3-7	No visual defects	P
4-6	No visual defects	P
4-7	No visual defects	P
5-6	No visual defects	P
5-7	No visual defects	P
Supplementary information: N/A		

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.2 Maximum power determination after Damp heat test

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 [%]	Degradation [%]	
1-8	329.0	38.28	8.594	45.62	9.142	78.9	-2.14	P
1-9	329.2	37.83	8.701	45.59	9.138	79.0	-1.63	P
2-6	360.8	39.61	9.110	47.58	9.609	78.9	-0.97	P
2-7	361.0	39.63	9.110	47.54	9.657	78.6	-1.45	P
3-6	323.2	37.36	8.653	45.71	9.073	78.0	-1.82	P
3-7	323.7	37.45	8.645	45.72	9.098	77.8	-1.88	P
4-6	349.9	39.11	8.947	47.47	9.516	77.5	-1.33	P
4-7	348.1	38.96	8.935	47.32	9.566	76.9	-2.30	P
5-6	342.9	38.68	8.866	46.09	9.322	79.8	-0.98	P
5-7	341.6	38.54	8.864	46.11	9.303	79.7	-1.70	P
Supplementary information: Maximum allowable P_{max} degradation after this test is 5 %.								

10.3 Insulation test after Damp heat 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	
3-6	10.00	1.94	19.40	-	No	P
3-7	10.00	1.94	19.40	-	No	P
4-6	10.00	1.94	19.40	-	No	P
4-7	10.00	1.94	19.40	-	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: Insulation tester can measure up to 10.00 GΩ.						

10.3 Insulation test after Damp heat test

Maximum system voltage[V_{DC}]	1500	—

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

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	
1-8	46.90	1.94	90.97	-	No	P
1-9	41.70	1.94	80.90	-	No	P
2-6	55.50	1.94	107.67	-	No	P
2-7	48.4	1.94	93.9	-	No	P
5-6	10.00	1.94	19.40	-	No	P
5-7	10.00	1.94	19.40	-	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: Insulation tester can measure up to 10.00 GΩ.						

10.15	**Wet leakage current test after Damp heat 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]	[m²]	[MΩ × m²]	
3-6	3610.0	1.94	7003.4	P
3-7	3750.0	1.94	7275.0	P
4-6	2790.0	1.94	5412.6	P
4-7	3440.0	1.94	6673.6	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: N/A				

10.15	**Wet leakage current test after Damp heat test**			
Insulation resistance measured at[V_{DC}]		1500		—
Solution resistivity [Ω cm]		< 3,500		P
Solution temperature [°C]		22 ± 3		P
Sample No.	Measured	Area	Result*	—
	[MΩ]	[m²]	[MΩ × m²]	
1-8	2260.0	1.94	4384.4	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

1-9	2190.0	1.94	4248.6	P
2-6	4300.0	1.94	8342.0	P
2-7	1970.0	1.94	3821.8	P
5-6	5250.0	1.94	1018.5	P
5-7	4860.0	1.94	9428.4	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: N/A				

10.16	**Mechanical load test**	
Pressure mechanical load applied [Pa]	2400 / *5400 (at the 3rd cycle)	—
Tensile mechanical load applied [Pa]	2400	
Sample No.	Open circuits (yes/no)	
1-8	No	P
2-6	No	P
3-6	No	P
4-6	No	P
5-6	No	P
Supplementary information: Load was applied by pneumatically; the module was mounted by 4 clamps (5cm)		

10.1	**Visual inspection after Mechanical load test**	
Sample No.	Nature and position of findings	—
1-8	No visual defects	P
2-6	No visual defects	P
3-6	No visual defects	P
4-6	No visual defects	P
5-6	No visual defects	P
Supplementary information: N/A		

10.2	**Maximum power determination after Mechanical load test**	
Module temperature [°C]	Corrected to 25	—
Irradiance [W/m²]	1000	

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

Sample No.	P_{max}[W]	V_{mpp}[V]	I_{mpp}[A]	V_{oc}[V]	I_{sc}[A]	FF [%]	Degradation [%]	
1-8	328.2	38.11	8.610	45.65	9.109	78.9	-2.38	P
2-6	344.9	38.80	8.890	46.49	9.456	78.5	-4.46	P
3-6	324.9	37.51	8.663	45.68	9.146	77.8	0.53	P
4-6	346.0	38.36	9.021	47.07	9.565	76.9	-1.11	P
5-6	341.0	38.79	8.792	46.08	9.232	80.2	-0.55	P
Supplementary information: Maximum allowable P_{max} degradation after this test is 5 %.								

10.3	**Insulation test after Mechanical load 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	
3-6	10.00	1.94	19.40	-	No	P
4-6	10.00	1.94	19.40	-	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: Insulation tester can measure up to 10.00 GΩ.						

10.3	**Insulation test after Mechanical load 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	
1-8	62.50	1.94	121.25	-	No	P
2-6	36.6	1.94	69.84	-	No	P
5-6	10.00	1.94	19.40	-	No	P
* Minimum requirement acc. to the standard is 0.04 GΩ × m².						
Supplementary information: Insulation tester can measure up to 10.00 GΩ.						

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

10.15	**Wet leakage current test after Mechanical load 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]	—
3-6	2980.0	1.94	5781.2	P
4-6	2510.0	1.94	4869.4	P
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: N/A				

10.15	**Wet leakage current test after Mechanical load 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]	—
1-8	4210.0	1.94	8167.4	P
2-6	3050.0	1.94	5917.0	P
5-6	4680.0	1.94	9079.2	
* Minimum requirement acc. to the standard is 40 MΩ × m².				
Supplementary information: N/A				

10.2 Maximum power determination (final)

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 [%]	Degradation [%]	
1-2	333.9	37.96	8.798	45.53	9.285	79.0	0.00	P
1-3	334.8	38.00	8.810	45.60	9.285	79.1	0.16	P
1-4	331.6	37.93	8.741	45.50	9.220	79.0	-0.97	P
1-5	332.7	37.94	8.767	45.54	9.244	79.0	-0.85	P
1-6	330.0	38.16	8.647	45.55	9.225	78.5	-1.16	P
1-7	331.4	38.23	8.670	45.58	9.212	78.9	-1.32	P
1-8	329.0	38.28	8.594	45.62	9.142	78.9	-2.14	P
1-9	329.2	37.83	8.701	45.59	9.138	79.0	-1.63	P
2-3	361.2	38.95	9.274	47.29	9.652	79.1	-0.56	P
2-4	361.8	39.07	9.261	47.40	9.653	79.1	0.69	P
2-5	361.6	39.08	9.253	47.37	9.690	78.8	0.38	P
2-6	366.5	39.78	9.215	47.76	9.736	78.8	0.05	P
2-7	363.9	39.17	9.289	47.62	9.726	78.6	-0.41	P
2-8	360.8	39.61	9.110	47.58	9.609	78.9	-0.97	P
2-9	361.0	39.63	9.110	47.54	9.657	78.6	-1.45	P
2-10	365.3	39.24	9.309	47.48	9.697	79.3	0.16	P
3-3	329.2	37.41	8.799	45.71	9.221	78.1	0.15	P
3-4	320.0	37.09	8.626	45.36	9.131	77.3	-3.03	P
3-5	323.6	36.70	8.816	45.47	9.200	77.4	-1.94	P
3-6	324.9	37.51	8.663	45.68	9.146	77.8	-1.31	P
3-7	323.7	37.45	8.645	45.72	9.098	77.8	-1.88	P
4-3	353.7	38.56	9.175	47.31	9.618	77.7	-0.98	P
4-4	349.2	38.24	9.133	47.05	9.584	77.5	-2.19	P
4-5	352.7	38.44	9.174	47.41	9.577	77.7	-1.48	P
4-6	346.0	38.36	9.021	47.07	9.565	76.9	-2.43	P
4-7	348.1	38.96	8.935	47.32	9.566	76.9	-2.30	P
5-3	347.4	38.90	8.930	46.14	9.364	80.4	-0.14	P
5-4	344.2	38.61	8.913	46.09	9.338	80.0	-0.95	P

Absatz	**Photovoltaic (PV) modules**	Messergebnisse - Bemerkungen	Bewertung
Clause	Anforderungen - Prüfungen/*Requirements - Tests*	*Measuring results - Remarks*	*Evaluation*

5-5	343.9	38.57	8.915	46.00	9.364	79.8	-0.95	P
5-6	341.0	38.79	8.792	46.08	9.232	80.2	-1.53	P
5-7	341.6	38.54	8.864	46.11	9.303	79.7	-1.70	P
Supplementary information: Maximum allowable P_{max} degradation after this test is 8 %.								

End of Test Report