



Test Report issued under the responsibility of:

NCB TÜV SÜD Product Service GmbH
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Germany



TEST REPORT IEC 61215-series:2016 Terrestrial photovoltaic (PV) modules – Design qualification and type approval	
Report Number.....	: 704061930402-05 part 1 of 2
Date of issue.....	: 2021-02-22
Total number of pages	: 27
TÜV SÜD Branch.....	: TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
Applicant's name	: Jolywood (Taizhou) Solar Technology Co., Ltd.
Address.....	: Kaiyang Rd.Jiangyan Economic Development Zone,Taizhou City,Jiangsu Province,225500,P.R.China
Test specification:	
Standard	: <input checked="" type="checkbox"/> IEC 61215-1:2016 <input checked="" type="checkbox"/> IEC 61215-2:2016 <input checked="" type="checkbox"/> IEC 61215-1-1:2016 <input type="checkbox"/> IEC 61215-1-2:2016 <input type="checkbox"/> IEC 61215-1-3:2016 <input type="checkbox"/> IEC 61215-1-4:2016
Test procedure	: TÜV SÜD Mark
Non-standard test method	: Performance at Effective Irradiance was performed according to IEC 60904-1-2
Test Report Form No.	: IEC61215D_SE
Test Report Form(s) Originator	: TÜV SÜD Product Service GmbH
Master TRF	: 2017-11-30
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Test item description :	Photovoltaic (PV) Module(s)	
Trade Mark :		
Manufacturer :	Jolywood(Taizhou) Solar Technology Co., Ltd. Kaiyang Rd.Jiangyan Economic Development Zone,Taizhou City,Jiangsu Province,225500,P.R.China.	
Model/Type reference :	See page 6 of this report	
Ratings :	See page 6 of this report	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	TÜV SÜD Branch:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
	Location/address :	No. 151 Heng Tong Road, Shanghai 200070, P. R. China
<input checked="" type="checkbox"/>	Associated Testing Laboratory:	Changzhou HuaYang Inspection and Testing Technology Co., Ltd.
	Testing location/address :	NO.8 Lanxiang Road, Wujin Economic Development Zone, Changzhou, Jiangsu, China
	Tested by (name + signature) :	Yang Xu 
	Approved by (name + signature) :	Tao Wang
<input type="checkbox"/>	Testing procedure: TMP/CTF Stage 1:	
	Testing location/address :	
	Tested by (name + signature) :	
	Approved by (name + signature) :	
<input type="checkbox"/>	Testing procedure: WMT/CTF Stage 2:	
	Testing location/address :	
	Tested by (name + signature) :	
	Witnessed by (name + signature) :	
	Approved by (name + signature) :	
<input type="checkbox"/>	Testing procedure: SMT/CTF Stage 3 or 4:	
	Testing location/address :	
	Tested by (name + signature) :	
	Witnessed by (name + signature) :	
	Approved by (name + signature) :	
	Supervised by (name + signature) :	

List of Attachments (including a total number of pages in each attachment):	
	attachment number / number of pages
Installation manual	N/A
Drawings mechanical	see report no.: N/A
Circuit diagram	see report no.: N/A
Photographs	N/A
Component datasheets / certificates	N/A
Others:	
Product Description Sheet (Manufacturers and type references)	Annex 1, _2_ pages
Test table for verifying other stabilization procedure	Annex 2, _N/A_ pages
Lower and higher output power modules	Annex 3, _ N/A _ pages
List of test equipment used	Annex 4, _1_ pages

Summary of testing:	
<p>Tests performed (name of test and test clause): Based on project 704061930402-04, extend the maximum power of JW-HD144N-xxx from 450W to 460W (166 cell module only). Power range extension not more than 10%. Only gate 1 initial stabilization test was performed on the JW-HD144N-460 module: The test sample can cover following models: JW-HD144N-xxx (xxx=430-460, in steps of 5) JW-HD120N-xxx (xxx=360-380, in steps of 5) xxx stands for the rated power at STC.</p>	<p>Testing location: Changzhou HuaYang Inspection and Testing Technology Co., Ltd. NO.8 Lanxiang Road, Wujin Economic Development Zone, Changzhou, Jiangsu, China.</p>
<p>Summary of compliance with National Differences (List of countries addressed): IEC 61215-1:2016 was approved by CENELEC as EN 61215-1:2016 without any modification. IEC 61215-2:2016 was approved by CENELEC as EN 61215-2:2017 without any modification. IEC 61215-1-1:2016 was approved by CENELEC as EN 61215-1-1:2016 without any modification.</p> <p><input checked="" type="checkbox"/> The product fulfils the requirements of _EN 61215-1:2016, EN 61215-2:2017 and EN 61215-1-1:2016(insert standard number and edition and delete the text in parenthesis, leave it blank or delete the whole sentence, if not applicable)</p>	

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by TÜV SÜD Product Service GmbH that own these marks.

		Test conditions	STC	Power Selection	0~+5W
		Rated Max Power(Pmax TOL±3%)	460W	Maximum overcurrent protection rating	25A
Jolywood(Taizhou) Solar Technology Co.,Ltd.		Current at Pmax(Imp)	10.96A	Maximum System Voltage	1500V
Model Type	JW-HD14N-460	Voltage at Pmax(Vmp)	42.0V	PV module classification	Class II
Product Name	Solar Module	Short-Circuit Current(Isc TOL±5%)	11.56A	   	
Address:Kaiyang Rd.Jiangyan Economic Development Zone,Taizhou,Jiangsu,China		Open-Circuit Voltage(Voc TOL±4%)	50.4V		
		STC:AM=1.5 E=1000W/m²Tc=25℃			

(Note: The marking plate represents all models covered by this report except for difference in electrical ratings and model designation. See “General product information” for electrical ratings for all models. As there will be other lower wattages to be covered under same report which follows same back label format.)

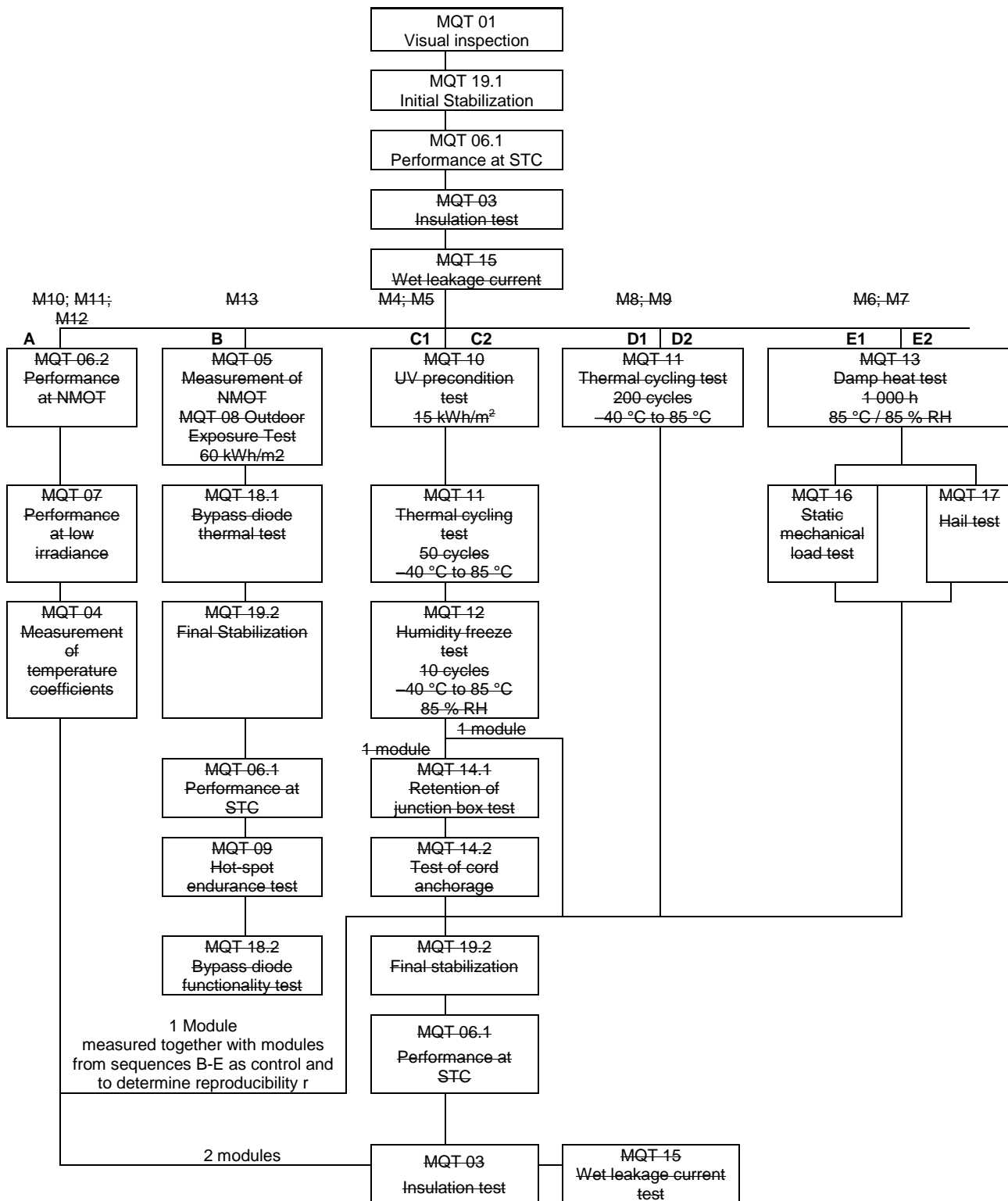
Test item particulars.....	: N/A
Accessories and detachable parts included in the evaluation	: N/A
Mounting system used.....	: Refer to user manual
Other options included.....	: N/A
Possible test case verdicts:	
- test case does not apply to the test object.....	: N/A
- test object does meet the requirement	: P (Pass)
- test object does not meet the requirement	: F (Fail)
Abbreviations used in the report:	
Pmax – Maximum power	HF – Humidity Freeze
Vmp – Maximum power voltage	DH – Damp Heat
Imp – Maximum power current	TC – Thermal Cycling
Isc – Short circuit current	α – Current temperature coefficient
Voc – Open circuit voltage	β – Voltage temperature coefficient
FF – Fill factor	δ – power temperature coefficient
STC – Standard Test Conditions (25°C, 1 000 W/m ²)	NMOT – Nominal Module Operating Temperature (20°C, 800 W/m ²)
MQT – Module Quality Tests	VFM _{rated} – Rated diode(s) forward voltage
VFM – Measured diode(s) forward voltage	NP – Nameplate
m_1 – the measurement uncertainty in % of laboratory for Pmax	m_2 – the measurement uncertainty in % of laboratory for Voc
m_3 – the measurement uncertainty in % of laboratory for Isc	t_1 – the manufacturer's rated lower production tolerance in % for Pmax
t_2 – the manufacturer's rated upper production tolerance in % for Voc	t_3 – the manufacturer's rated upper production tolerance in % for Isc
r – Pmax measurement reproducibility	
Testing Dates (YYYY-MM-DD)	
Date of first test item received	: 2021-02-03
Dates of tests (beginning/end).....	: 2021-02-03 to 2021-02-08


GENERAL REMARKS:				
<p>"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.</p> <p>This TRF has been created in cooperation with CTL ETF-9 and German National Committee (DKE). The originator's responsibility of this TRF in IEC EE CB Scheme has been assigned to TÜV SÜD Product Service GmbH.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p> <p>Manufacturer's Declaration per sub-clause 4.2.5 of IEC EE 02:</p>				
The application for obtaining a TÜV SÜD Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided..... :			<input checked="" type="checkbox"/> Yes <input type="checkbox"/> Not applicable	
When differences exist; they shall be identified in the General product information section.				
Name and address of factory (factories)..... :			Jolywood (Taizhou) Solar Technology Co., Ltd. No.11 Xingyuan Rd, Jiangyan High-tech Zone, Jiangyan District 225500 Taizhou, Jiangsu, PEOPLE'S REPUBLIC OF CHINA Jolywood (Taizhou) Solar Technology Co., Ltd. Kaiyang Rd. Jiangyan Economic Development Zone 225500 Taizhou, Jiangsu, PEOPLE'S REPUBLIC OF CHINA	
PRODUCT ELECTRICAL RATINGS:				
Module type	JW-HD144N-455	JW-HD144N-455	JW-HD120N-380	
Voc [V] /Tolerance(±4%)	50.2	50.4	41.8	
Isc [Adc] /Tolerance(±5%)	11.50	11.56	11.54	
Vmp [V]	41.8	42.0	34.9	
Imp [Adc]	10.89	10.96	10.89	
Pmp [W] /Tolerance(±3%)	455	460	380	
Maximum system voltage [V]	1500	1500	1500	
Maximum Over-Current Protection Rating [A]	25	25	25	
Note: N/A				
GENERAL PRODUCT INFORMATION AND OTHER REMARKS:				
<u>Modifications:</u>				
<input type="checkbox"/> Initial module design qualification				

<input checked="" type="checkbox"/> Extension of module design qualification	
<input checked="" type="checkbox"/> Original test report ref. No. : 704061930402-04	
<u>Model differences and modification:</u>	
<input checked="" type="checkbox"/> Test programs for crystalline silicon PV modules	<input type="checkbox"/> Test programs for thin-film PV modules
<input type="checkbox"/> 4.2.1 Modification to frontsheet	<input type="checkbox"/> 4.3.1 Modification to frontsheet
<input type="checkbox"/> 4.2.2 Modification to encapsulation system	<input type="checkbox"/> 4.3.2 Modification to encapsulation system
<input type="checkbox"/> 4.2.3 Modification to cell technology	<input type="checkbox"/> 4.3.3 Modification to front contact (e. g. TCO)
<input type="checkbox"/> 4.2.4 Modification to cell and string interconnect material or technique	<input type="checkbox"/> 4.3.4 Modification to cell technology
<input type="checkbox"/> 4.2.5 Modification to backsheet	<input type="checkbox"/> 4.3.5 Modification to cell layout
<input type="checkbox"/> 4.2.6 Modification to electrical termination	<input type="checkbox"/> 4.3.6 Modification to back contact
<input type="checkbox"/> 4.2.7 Modification to bypass diode	<input type="checkbox"/> 4.3.7 Modification to edge deletion
<input type="checkbox"/> 4.2.8 Modification to electrical circuitry	<input type="checkbox"/> 4.3.8 Modification to interconnect material or technique
<input type="checkbox"/> 4.2.9 Modification to edge sealing	<input type="checkbox"/> 4.3.9 Modification to backsheet
<input type="checkbox"/> 4.2.10 Modification to frame and/or mounting structure	<input type="checkbox"/> 4.3.10 Modification to electrical termination
<input type="checkbox"/> 4.2.11 Change in PV module size	<input type="checkbox"/> 4.3.11 Modification to bypass diode
<input type="checkbox"/> 4.2.12 Higher or lower output power (by 10 % or more) with the identical design and size and using the identical cell process	<input type="checkbox"/> 4.3.12 Modification to edge sealing
<input type="checkbox"/> 4.2.13 Increase of over-current protection rating	<input type="checkbox"/> 4.3.13 Modification to frame and/or mounting structure
<input type="checkbox"/> 4.2.14 Increase of system voltage	<input type="checkbox"/> 4.3.14 Change in PV module size
<input type="checkbox"/> 4.2.15 Change in cell fixing tape	<input type="checkbox"/> 4.3.15 Higher or lower output power (by 10 % or more) with the identical design and size
<input checked="" type="checkbox"/> Others (See summary of testing)	<input type="checkbox"/> 4.3.16 Increase of over-current protection rating
	<input type="checkbox"/> 4.3.17 Increase of system voltage
Note: The clause references modifications extracted from IEC 62915	

MODULE GROUP ASSIGNMENT:				
Sample #	Sample Group ID	Type/model	Sample S/N	Remark
HA2021TL-095-001X	–	JW-HD144N-460	JW294521010203000655	–
HA2021TL-095-002X	–	JW-HD144N-460	JW294521010203000691	–
Supplementary information: N/A				
Note (1)	Use the “General product information” field to give any information on model differences within a product type family covered by the test report and to describe the range of electrical and safety ratings, if the TRF covers a type family of modules.			
Note (3)	Use Annex 1 to list the used materials and components of the module (manufacturer/supplier and type reference).			
Note (4)	The module numbers/identifiers are set in accordance to IEC 62915 Photovoltaic (PV) modules – Retesting for type approval, design and safety qualification, Annex A3			

IEC 61215-1			
Clause	Requirement + Test	Result - Remark	Verdict
11	TEST FLOW (if it is not a full test, strikethrough non-performed test) Note: Deviations from test sequence are possible but must be documented.		



IEC 61215-1			
Clause	Requirement + Test	Result - Remark	Verdict
5. MARKING AND DOCUMENTATION			P
5.1	Name Plate		
	All electrical data is shown as relative to standard test conditions (1 000 W/m ² , 25 °C, AM 1,5 according to IEC TS 61836).	Marked on label	P
	International symbols are used where applicable.	Marked on label	P
	The module includes clear and indelible markings:		—
	a. Name, registered trade name or registered trade mark of manufacturer		P
	b. Type or model number designation	JW-HD144N-460	P
	c. Serial number (unless marked on other part of product)	Provided under superstrate near the top rail of frame	P
	d. Date and place of manufacture, alternatively serial number allowing to trace the date and place of manufacture;	serial number allowing to trace the date and place of manufacture	P
	e. Maximum system voltage	1500V DC	P
	f. Class of protection against electrical shock	Class II	P
	g. Voltage at open-circuit or Voc including tolerances.	50.4V ± 4% for example	P
	h. Current at short-circuit or Isc including tolerances	11.56A ± 5% for example	P
	i. Module maximum power or Pmax including tolerances	460W ± 3% for example	P
5.2	Documentation		
5.2.1	Minimum requirements		
	Modules are supplied with documentation describing the methods of electrical and mechanical installation as well as the electrical ratings of the module		P
	The documentation states the class of protection against electrical shock under which the module has been qualified and any specific limitations required for that class.		P
	The documentation assures that installers and operators receive appropriate and sufficient documentation for safe installation, use, and maintenance of the PV modules.		P
5.2.2	Information given in the documentation		P
	a. All information required under 5.1 e) to i)	Refer to manual document	P
	b. Overcurrent protection device type and rating are e.g. given in IEC 60269-6	Refer to manual document	P

IEC 61215-1			
Clause	Requirement + Test	Result - Remark	Verdict
	Maximum series/parallel module configuration is recommended		P
	c. Manufacturer's stated tolerance for Voc, Isc and maximum power output under standard test conditions		P
	d. Temperature coefficient for voltage at open-circuit		P
	e. Temperature coefficient for maximum power		P
	f. Temperature coefficient for short-circuit current		P
	All electrical data mentioned above shown as relative to standard test conditions (1 000 W/m ² , 25 °C, AM 1,5 according to IEC TS 61836)		P
	g. Nominal module operating temperature (NMOT) is specified		N/A
	h. Performance at NMOT (MQT 06.2) is specified		N/A
	i. Performance at low irradiance (MQT 07) is specified		P
	International symbols used where applicable		P
	Compliance checked by inspection and MQT 04 through MQT 07		P
	The electrical documentation includes a detailed description of the electrical installation wiring method to be used		—
	j. The minimum cable diameters for modules intended for field wiring		P
	k. Any limitations on wiring methods and wire management that apply to the wiring compartment or box;		P
	l. The size, type, material and temperature rating of the conductors to be used		P
	m. Type of terminals for field wiring		N/A
	n. Specific PV connector model/types and manufacturer to which the module connectors are mated		P
	o. The bonding method(s) to be used (if applicable); all provided or specified hardware is identified in the documentation	Refer to manual document	P
	p. The type and ratings of bypass diode to be used (if applicable)	Refer to manual document	P
	q. limitations to the mounting situation (e.g., slope, orientation, mounting means, cooling)	Refer to manual document	P

IEC 61215-1			
Clause	Requirement + Test	Result - Remark	Verdict
	r. A statement indicating the fire rating(s) and the applied standard and the limitations to that rating (e.g., installation slope, sub-structure or other applicable installation information)		P
	s. A statement indicating the design load per each mechanical means for securing the module as evaluated during the static mechanical load test according to MQT 16. At discretion of the manufacturer the test load and/or the safety factor γ_m may be noted, too		P
	The installation instructions include relevant parameters specified by manufacturer or the following statement or the equivalent: <i>"Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of Isc and Voc marked on this module should be multiplied by a factor of 1,25 when determining component voltage ratings, conductor current ratings, and size of controls connected to the PV output."</i>		P
5.2.3	Assembly instructions		N/A
	Provided with a product shipped in subassemblies, detailed and adequate to the degree required to facilitate complete and safe assembly of the product		N/A
Supplementary information: N/A			

7. PASS CRITERIA					P
7.2	Power output and electric circuitry				P
7.2.1	Verification of rated label values (Gate No. 1)				P
	Manufacturer's tolerances and Laboratory uncertainties				P
		t ₁	t ₂	t ₃	—
	manufacturer's rated lower/upper production tolerance in %	3	3	3	
		m ₁	m ₂	m ₃	
	measurement uncertainty in % of laboratory	2.12	0.98	2.26	
	Laboratory reproducibility r	N/A			
	After stabilization, each individual module meets the requirements				N/A
	P _{max}	See Table 03			N/A
	V _{oc}	See Table 03			N/A
	I _{sc} :	See Table 03			N/A

IEC 61215-1			
Clause	Requirement + Test	Result - Remark	Verdict
	After stabilization the arithmetic average \bar{P}_{\max} of all modules meet the requirements.	See Table 03	N/A
7.2.2	Maximum power degradation during type approval testing (Gate #2)		N/A
	At the end of each test sequence or for sequence B after bypass diode test, each test sample meets the requirements for P_{\max}		N/A
7.2.3	Electrical circuitry		P
	Samples do not exhibit an open-circuit during the tests		P
7.3	Visual defects		P
	There is no visual evidence of a major defect.		P
7.4	Electrical safety		P
	The insulation test (MQT 03) requirements are met after the tests		P
	The wet leakage current test (MQT 15) requirements met at the beginning and at the end of each sequence		P
	Specific requirements of the individual tests are met		N/A
Supplementary information: N/A			

IEC 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

4. TESTING OVERVIEW			P
	Initial examination	All modules	P
4.1	Visual inspection (MQT 01))	See Table 01	P
4.19.5	Initial stabilization (MQT 19.1)	See Table 02	N/A
4.6	Performance at STC (MQT 06.1)	See Table 03	N/A
4.3	Insulation test (MQT 03)	See Table 04	N/A
4.15	Wet leakage current test (MQT 15)	See Table 05	N/A

Sequence A	3 Modules	Samples M10, M11, M12;	N/A
4.6	Performance at NMOT (MQT 06.2)	See Table 06	N/A
4.7	Performance at low irradiance (MQT 07).....	See Table 07	N/A
4.4	Measurement of temperature coefficients (MQT 04)	See Table 08	N/A

Sequence B	1 Module	Sample M13	N/A
4.5	Measurement of nominal module operating temperature (NMOT, °C) (MQT 05)	See Table 09	N/A
4.8	Outdoor exposure test (MQT 08)	See Table 10	N/A
4.18.1	Bypass diode thermal test (MQT 18.1)		N/A
	Maximum allowed junction temperature	See Table 11	—
	Calculated junction temperature	See Table 11	—
	Final measurements.....	See Table 11	N/A
4.18.2	Bypass diode functionality test (MQT 18.2)	See Table 12	N/A
4.19.6	Final stabilization (MQT 19.2)	See Table 12.1 – 12.3	N/A
4.9	Hot spot endurance test (MQT 09)	See Table 13.1 - 13.7	N/A

Sequence C	2 Modules	Sample M4, M5	N/A
4.10	UV preconditioning test (MQT 10)	See Table 14.1 - 14.4	N/A
4.11	Thermal cycling test 50 cycles (MQT 11).....	See Table 15.1 - 15.4	N/A
4.12	Humidity-freeze test (MQT 12).....	See Table 16.1 - 16.4	N/A

Sequence C1	1 Module	Sample M4	N/A
4.14	Robustness of terminations test (MQT 14)		N/A

IEC 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict
4.14.2	Retention of junction box on mounting surface (MQT 14.1)	See Table 17.1 - 17.7	N/A
4.14.3	Test of cord anchorage (MQT 14.2)		N/A
4.14.3.1	This test omitted if junction box is qualified to IEC 62790	See list of attachments	N/A
4.14.3.2.1	Junction boxes intended to be used with cables specified by the manufacturer.....	See Table 17.4	N/A
4.14.3.2.2	Junction boxes intended to be used with generic cables.....	See Table 17.4	N/A
Sequence D	2 Modules	Sample M8; M9	N/A
4.11	Thermal cycling test 200 cycles (MQT 11)	See Table 18.1 - 18.2	N/A
Sequence E	2 Modules	Samples M6, M7	N/A
4.13	Damp heat test (MQT 13)	See Table 19.1 - 19.4	N/A
Sequence E1	1 Module	Sample M7	N/A
4.16	Static mechanical load test (MQT 16).....	See Table 19.5 - 19.7	N/A
Sequence E2	1 Module	Sample M7	N/A
4.17	Hail test (MQT 17)	See Table 19.8 - 19.10	N/A
	Final measurement	All modules for Sequence C, D, E; Control module for Sequence A	N/A
4.19.6	Final stabilization (MQT 19.2)	See Table 20.1 - 20.2	N/A
4.6	Performance at STC (MQT 06.1)	See Table 20.3	N/A
4.3	Insulation test(MQT 03)	See Table 21	N/A
4.15	Wet leakage current test(MQT 15)	See Table 22	N/A

IEC 61215-2			
Clause	Requirement + Test	Result - Remark	Verdict

TABLE 01: MQT 01 ini: Initial Visual inspection			P
Test Date [YYYY-MM-DD]..... :		2021-02-03	—
Sample #	Nature and position of initial findings – comments or attach photos		—
HA2021TL-095-001X	No major visual defects found		P
HA2021TL-095-002X	No major visual defects found		P
Supplementary information: N/A			

TABLE 02: MQT 19.1 ini: Initial stabilization								—
TABLE 02.1: MQT 06.1 ini: Performance at STC before initial stabilization								—
Test Date [YYYY-MM-DD]..... :		2021-02-03						—
Test method..... :		<input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight						—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result	
HA2021TL-095-001X-Front	11.438	49.783	10.889	41.927	456.555	80.18	—	
HA2021TL-095-001X-Rear	8.827	49.310	8.390	42.121	353.411	81.20	—	
HA2021TL-095-002X-Front	11.428	49.706	10.900	41.848	456.135	80.30	—	
HA2021TL-095-002X-Rear	8.811	49.268	8.314	42.167	350.578	80.76	—	
Supplementary information: N/A								

TABLE 02.2: MQT 19.1 ini: Initial Stabilization procedure								P
Light exposure method..... :		<input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight						
Abbreviation: Regarding light source “S” for Solar simulator and “N” for Natural sunlight								
Stabilization criterion x per IEC 61215-1-x..... :		1						
Sample #	HA2021TL-095-001X	Test Date (YYYY-MM-DD) start/end.....			2021-02-03/2021-02-08			
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} – P _{min} / P _{average} (%)	Stable (Yes/No)	
Initial	—	—	—	—	456.555	—	—	
1	5	Above 800	50	3.9	454.850	—	—	
2	5	Above 800	50	3.9	453.898	0.58	Yes	

IEC 61215-2							
Clause	Requirement + Test				Result - Remark		Verdict
Sample #	HA2021TL-095-002X	Test Date (YYYY-MM-DD) start/end			2021-02-03/2021-02-08		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} - P _{min} / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	456.135	—	—
1	5	Above 800	50	3.9	454.952	—	—
2	5	Above 800	50	3.9	453.859	0.50	Yes
Sample #	N/A	Test Date (YYYY-MM-DD) start/end			—		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} - P _{min} / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
<input type="checkbox"/> Other stabilization procedures							
Sample #	Test Date (YYYY-MM-DD) start/end						
—	—						
Test method description: N/A							
Supplementary information: N/A							

TABLE 02.2: MQT 19.1 ini: Initial Stabilization procedure (Rear)							P
Light exposure method					<input checked="" type="checkbox"/> Simulator	<input type="checkbox"/> Natural sunlight	
Abbreviation: Regarding light source "S" for Solar simulator and "N" for Natural sunlight							
Stabilization criterion x per IEC 61215-1-x					1		
Sample #	HA2021TL-095-001X	Test Date (YYYY-MM-DD) start/end			2021-02-03/2021-02-08		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} - P _{min} / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	353.411	—	—
1	5	Above 800	50	5.0	352.160	—	—
2	5	Above 800	50	5.0	350.471	0.84	Yes
Sample #	HA2021TL-095-002X	Test Date (YYYY-MM-DD) start/end			2021-02-03/2021-02-08		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} - P _{min} / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	350.578	—	—

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Clause	Requirement + Test				Result - Remark		Verdict
1	5	Above 800	50	5.0	349.250	—	—
2	5	Above 800	50	5.0	348.009	0.74	Yes
Sample #	N/A	Test Date (YYYY-MM-DD) start/end			—		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} - P _{min} / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
<input type="checkbox"/> Other stabilization procedures							
Sample #	Test Date (YYYY-MM-DD) start/end						
—	—						
Test method description: N/A							
Supplementary information: N/A							

TABLE 03: MQT 06.1 ini: Performance at STC after initial stabilization (Front)										P
Test Date [YYYY-MM-DD]					2021-02-08					—
P _{max} (lab) lower limit (W)					See table below: P _{max} [W] – Min calc.					—
$\bar{P}_{max}(Lab)$ lower limit (W)					450.450					—
Voc(lab) upper limit (V)					See table below: Voc [V] Max. calc.					—
Isc (lab) upper limit (A)					See table below: Isc [A] Max. calc.					—
Test method					<input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight					—
Sample #	Isc [A]		Voc [V]		Imp [A]	Vmp [V]	P _{max} [W]		FF [%]	Result
	Meas.	Max. calc.	Meas.	Max. calc.			Meas.	Min. calc.		
HA20 20T- 837- 001X- Front	11.343	11.870	49.735	51.907	10.832	41.904	453.898	436.937	80.46	P
HA20 20T- 837- 002X- Front	11.364	11.870	49.666	51.907	10.858	41.799	453.859	436.937	80.41	P
Average	—						453.878	450.450	—	—
Supplementary information: The limit values are calculated considering manufacturer's tolerances t of rated nameplate values and laboratory measurement uncertainties m .										

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Clause	Requirement + Test					Result - Remark				Verdict
TABLE 03: MQT 06.1 ini: Performance at STC after initial stabilization (Rear)										—
Test Date [YYYY-MM-DD]..... :					2021-02-08					—
Pmax(lab) lower limit (W)					See table below: Pmax [W] – Min calc.					—
$\bar{P}_{max}(Lab)$ lower limit (W)					—					—
Voc(lab) upper limit (V)					See table below: Voc [V] Max. calc.					—
Isc (lab) upper limit (A)					See table below: Isc [A] Max. calc.					—
Test method..... :					<input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight				—	
Sample #	Isc [A]		Voc [V]		Imp [A]	Vmp [V]	Pmax [W]		FF [%]	Result
	Meas.	Max. calc.	Meas.	Max. calc.			Meas.	Min. calc.		
HA20 20T- 837- 001X- Rear	8.757	—	49.268	—	8.327	42.087	350.471	—	81.23	—
HA20 21T- 095- 002X- Rear	8.743	—	49.215	—	8.265	42.104	348.009	—	80.87	—
Average	—				—	—	—	—	—	—
Supplementary information: The limit values are calculated considering manufacturer's tolerances t of rated nameplate values and laboratory measurement uncertainties m .										

TABLE 03: MQT 06.1 ini: Performance at equivalent irradiance after initial stabilization										—
Test Date [YYYY-MM-DD]..... :					2021-02-08					—
Pmax(lab) lower limit (W)					See table below: Pmax [W] – Min calc.					—
$\bar{P}_{max}(Lab)$ lower limit (W)					—					—
Voc(lab) upper limit (V)					See table below: Voc [V] Max. calc.					—
Isc (lab) upper limit (A)					See table below: Isc [A] Max. calc.					—
Test method..... :					<input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight				—	
Sample #	Isc [A]		Voc [V]		Imp [A]	Vmp [V]	Pmax [W]		FF [%]	Result
	Meas.	Max. calc.	Meas.	Max. calc.			Meas.	Min. calc.		
HA20 21TL- 095- 001X	12.511	—	49.940	—	11.859	42.044	498.605	—	79.99	—
HA20 21TL-	12.473	—	49.932	—	11.857	42.045	498.525	—	80.04	—

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Clause	Requirement + Test						Result - Remark			Verdict
095-002X										
Average	—						—	—	—	—
Supplementary information: The limit values are calculated considering manufacturer's tolerances t of rated nameplate values and laboratory measurement uncertainties m . Frontside with equivalent irradiance $(1000+\varphi*135)W/m^2$, 25 °C, AM 1.5, $\varphi =74\%$);										

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Annex 1: Product Description Sheet (Manufacturers and type references)

A1.1	MODULE TYPE/S
	JW-HD144N-xxx (xxx=430-460, in steps of 5)

A1.2	MODULE DESIGN
	Module dimensions (L x W x H) [mm]: 2111×1046×30 mm
	Weights.....: 28 kg(approx)
	Front/Rear cover bonding classification: <input type="checkbox"/> rigid/flexible <input checked="" type="checkbox"/> rigid/rigid <input type="checkbox"/> flexible/flexible

A1.3	SOLAR CELL
	Cell type reference: Jolywood (Taizhou) Solar Technology Co., Ltd. Cell type: NM69B, mono, N type
	Cell dimensions L x W x T (± %) [mm]: 166x83 (Half cut)
	Cell thickness [μm]: 170±17
	Cell area [cm ²]: 137.075

A1.4	IDENTIFICATION OF MATERIALS
	Front cover.....: FLAT GLASS GROUP CO., LTD. Type: Heat strengthened glass with external AR coating Thickness: 2.0mm
	Rear cover: FLAT GLASS GROUP CO., LTD. Type: Heat strengthened glass with inside white ceramic glaze Thickness: 2.0 mm
	Encapsulation material front side: Jolywood (Suzhou) Sunwatt Co., Ltd. Type: JW P-3 Thickness: 0.65 (-0.13~0.3)mm
	Encapsulation material back side: Jolywood (Suzhou) Sunwatt Co., Ltd. Type: JW P-3 Thickness: 0.65 (-0.13~0.3)mm
	Frame parts: Jolywood (Jiangsu) New Material Technology Co., Ltd. 6063-T5
	Mounting parts.....: N/A
	Adhesive for frame: Suzhou Tonsan Adhesive Ltd. Type: 1527
	Edge sealing: N/A
	Internal wiring: N/A

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	Cell connector.....	Suzhou YourBest New Materials Co., Ltd. Type: ϕ 0.32mm for 9BB Material: Copper belt with tin plated Coating :Sn60%Pb40%
	String connector	Suzhou YourBest New Materials Co., Ltd. Cross section: Width = 4.0/ 7.0mm, Thickness = 0.3mm Material: Copper belt with tin plated Coating: Sn60%Pb40%
	Soldering material.....	N/A
	Fluxing agent	Costar Electronic Material Co., Ltd. Type: FD-309
	Junction box.....	Zhejiang Renhe Photovoltaic Technology Co., Ltd. Type: FT50xy (x=1, 2, 3 or 4, y= B, D or F)
	Cable	Zhejiang Renhe Photovoltaic Technology Co., Ltd. Type: H1Z2Z2-K, 1500V DC
	Connector	Zhejiang Renhe Photovoltaic Technology Co., Ltd. Type: 05-8, DC 1500V
	Bypass diode	Zhejiang Renhe Photovoltaic Technology Co., Ltd. Type: FMK5040D (for x=4) If=40A, Tj max = 200°C
	Potting material.....	Suzhou Tonsan Adhesive Ltd. Type: 1521
	Adhesive for junction box	Suzhou Tonsan Adhesive Ltd. Type: 1527
	Additional material (e. g. fixing tape, insulation tape).....	Fixing tap: 3M COMPANY Type: UV-1

A1.5	MODULE DESIGN - MINIMUM DISTANCES	
	Between cells.....	2±0.5mm
	Between cell and accessible surfaces.....	13.5mm
	Between any current carrying part and accessible surfaces	12.5mm

A1.6	MODULE DESIGN - ELECTRICAL CONFIGURATION	
	Total number of cells	144
	Serial-parallel connection of cells	SP
	Cells per bypass diode	48
	No. of bypass diodes	3

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Clause	Requirement + Test	Result - Remark	Verdict

Annex 2: Test table for verifying other alternative stabilization procedure

Step 1: Alternative stabilization									N/A
Test Date (YYYY-MM-DD) start/end:									—
Test method description:									—
									—
Power before alternative stabilization (W)									—
Power after alternative stabilization (W)									—
Supplementary information:									
Step 2: Light exposure									
<input type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight									
Abbreviation: Regarding light source "S" for Solar simulator and "N" for Natural sunlight									
Sample M10		Test Date (YYYY-MM-DD) start/end..... :							
Test cycle	Light source	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} - P _{min} / P _{average} (%)	Stable (Yes/No)	
Initial	—	—	—	—	—		—	—	
1							—	—	
2									
Supplementary information:									
Sample M11		Test Date (YYYY-MM-DD) start/end..... :							
Test cycle	Light source	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} - P _{min} / P _{average} (%)	Stable (Yes/No)	
Initial	—	—	—	—	—		—	—	
1							—	—	
2									
Supplementary information:									
Sample M12		Test Date (YYYY-MM-DD) start/end..... :							
Test cycle	Light source	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} - P _{min} / P _{average} (%)	Stable (Yes/No)	
Initial	—	—	—	—	—		—	—	
1							—	—	
2									
Supplementary information:									

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Clause	Requirement + Test	Result - Remark			Verdict
Step 3: Stabilization determination					
				Result	
	Stable power P_{max1} after alternative stabilization (W)				
	Stable power P_{max2} after light exposure (W)				
	Power change P_{max2} to P_{max1} (%)				
	Allowed power change P_{max2} to P_{max1} (%)				
	Is alternative stabilization method valid? (Yes/No)				
Supplementary information:					

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Clause	Requirement + Test	Result - Remark	Verdict

Annex 3: Lower and higher output power modules

TABLE A.4.1 Performance at STC before initial stabilization							N/A
Test Date [YYYY-MM-DD]..... :				—			—
Test method..... :				<input type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight			—
Sample #	Isc [A]	Voc [V]	Imp [A]	Vmp [V]	Pmax [W]	FF [%]	Result
Low 1	—	—	—	—	—	—	—
Low 2	—	—	—	—	—	—	—
High 1	—	—	—	—	—	—	—
High 2	—	—	—	—	—	—	—
Supplementary information: N/A							

TABLE A.4.2: MQT 19.1 ini: Initial Stabilization procedure							—
Light exposure method				<input type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight			—
Abbreviation: Regarding light source “S” for Solar simulator and “N” for Natural sunlight							
Stabilization criterion x per IEC 61215-1-x ..				—			—
Sample #	Low 1	Test Date (YYYY-MM-DD) start/end			—		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} – P _{min} / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
Sample #	Low 2	Test Date (YYYY-MM-DD) start/end			—		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} – P _{min} / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
Sample #	High 1	Test Date (YYYY-MM-DD) start/end			—		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} – P _{min} / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—

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Clause	Requirement + Test				Result - Remark		Verdict
2	—	—	—	—	—	—	—
Sample #	High 2	Test Date (YYYY-MM-DD) start/end			—		
Test cycle	Integrated irradiation (kWh/m ²)	Irradiance (W/m ²)	Module temperature (°C)	Resistive load	P _{max} (W) at the end of cycle	P _{max} - P _{min} / P _{average} (%)	Stable (Yes/No)
Initial	—	—	—	—	—	—	—
1	—	—	—	—	—	—	—
2	—	—	—	—	—	—	—
Supplementary information: N/A							
<input type="checkbox"/> Other stabilization procedures							
Sample #	Test Date (YYYY-MM-DD) start/end			—			
Low 1				—			
Low 2				—			
High 1				—			
High 2				—			
Test method description: —							
Supplementary information: N/A							

TABLE A.4.3: MQT 6.1 Performance at STC after initial stabilization							—
Test Date [YYYY-MM-DD]		—					—
		Lower end power class		Higher end power class		—	
P _{max} (lab) (W)		≥ _____		≥ _____		—	
$\bar{P}_{max}(Lab)$ (W)		≥ _____		≥ _____		—	
Voc(lab) (V)		≤ _____		≤ _____		—	
Isc (lab) (A)		≤ _____		≤ _____		—	
Test method		<input type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight				—	
Sample #	Isc [A]	Voc [V]	I _{mp} [A]	V _{mp} [V]	P _{max} [W]	FF [%]	Result
Low 1	—	—	—	—	—	—	—
Low 2	—	—	—	—	—	—	—
High 1	—	—	—	—	—	—	—
High 2	—	—	—	—	—	—	—
Supplementary information: The limit value is calculated through considering the tolerance of rated label values and lab measurement uncertainty.							

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Annex 4: List of measurement equipment

Clause	Measurement / testing	Testing / measuring equipment / material used, (Equipment ID)	Range used	Last Calibration date	Calibration Cycle
MQT01	—	HYJC-YS-033	—	2020.09.11	12 months
MQT01	—	HYJC-YS-070	—	2020.06.12	12 months
MQT02	—	HYJC-YS-021	—	2020.12.09	12 months

----- End of TRF No. IEC61215 series-----