

QUALITY CONTROLLED PV (QCPV) – 2Pfg 2715/11.19

*How Q CELLS and TÜV Rheinland aim to set new global benchmarks
in PV module quality and durability*

R&D | THA | 10.12.2020

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Daniel Felsch-Kruse (Director, Global Quality Management)

WHAT IS A CERTIFICATION?

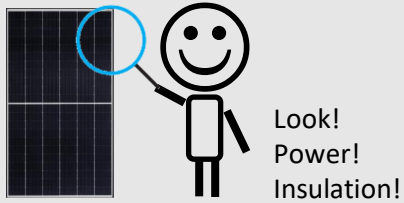
PROCESS done or supervised by an independent third party (e.g. TÜV, VDE)

Conducted in order to verify a STANDARD fulfillment

Successful certification is verified by a CERTIFICATE

Certification process

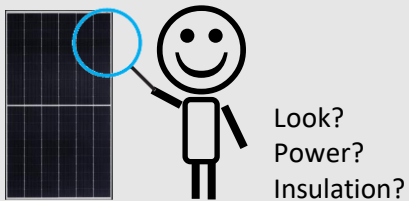
Initial module characterization



Module tests according to standard



Final module characterization



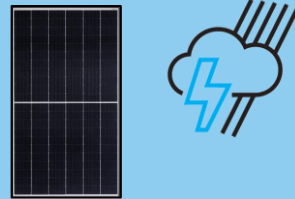
IEC Standards* for PV

***Recommendations & Regulations** defined by International Electrotechnical Commission (IEC)

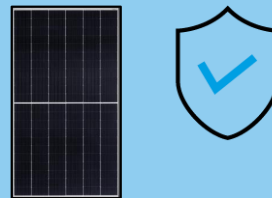
Describe:

- characterization methods e.g. performance, insulation
- test methods e.g. climate chamber, mechanical load

IEC 61215: Focus on performance tests



IEC 61730: Focus on safety tests



Certificate



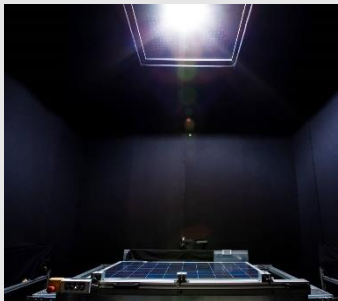
WHAT IS A STANDARD IEC CERTIFICATION ABLE TO DO

Standard IEC certification can align

IEC certification aligns power rating



→ Defines performance measurement procedure



ENGINEERED, DESIGNED AND QUALITY TESTED BY Q CELLS IN GERMANY			
Q.PEAK DUO ML-G9 405			
PERFORMANCE AT STANDARD TEST CONDITIONS*			
Nominal Power* (P _{max}) [W]	P _{max}	[W]	405
Short circuit current* (I _{sc}) [A]	I _{sc}	[A]	10.80
Open circuit voltage* (V _{oc}) [V]	V _{oc}	[V]	45.17
Current at maximum power (I _{mp}) [A]	I _{mp}	[A]	10.43
Voltage at maximum power (V _{mp}) [V]	V _{mp}	[V]	38.82
Maximum system voltage (V _{sys}) [V]	V _{sys}	[V]	1000
Weight [kg/lb]	M	[kg/lb]	19.5/43.0
*Measurement tolerances: P _{max} ±3%, I _{sc} , V _{oc} ±0.5% at STC: 1000W/m², 25 ±2 °C, AM 1.5 according to IEC 60904-3. Data given are rated (nominal) values.			
Q CELLS Made in China CAUTION Risk of electric shock! DO NOT connect or disconnect plug contacts while system is under load current. Refer to the Installation and Operation Manual before installing, operating or servicing this unit. DANGER Risque de choc électrique! NE PAS connecter ou déconnecter les contacts lorsque le système est en charge. Consultez le manuel d'installation et d'utilisation avant installation, utilisation et entretien du produit. Fire Rating: Class C / Type 2 Design life: 25 years Fuse Rating: 20 A For field connections, use minimum No.12 AWG copper wires insulated for a minimum of 90 °C			

Standard IEC certification can protect

IEC certification requires basic protections



→ Mechanical load test
→ Hot Spot test



Standard IEC certification can guarantee basic performance & durability

IEC certification proves basic suitability



→ Successful certification



First year(s)



WHAT IS A STANDARD IEC CERTIFICATION NOT ABLE TO DO

Cannot verify long term reliability

Field behavior unknown



First year(s)

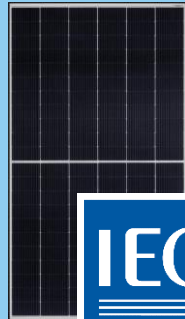


After 25 years

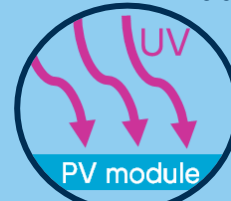


Cannot test regarding recent failure modes observed in the industry

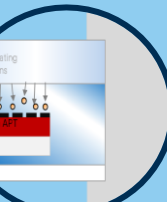
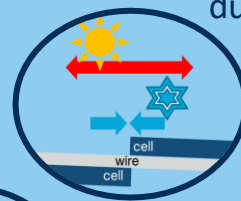
No PID, LETID, backsheet/solder-durability tests



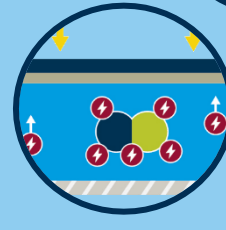
Backsheet durability



Solder durability



PID

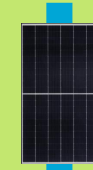


LETID



Cannot monitor production quality

No assessment of production module

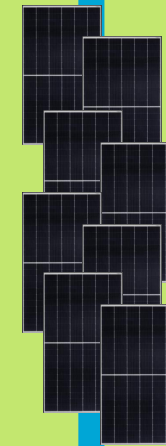


Small number of prototypes

Pass of IEC certification



Years of mass production without recheck of product quality



Q CELLS MEASURES TO ASSURE OUTSTANDING QUALITY & PERFORMANCE

Implementation of an additional test and surveillance program



Quality
Controlled PV

www.tuv.com
ID 1111232615

FROM NOW ON STARTING WITH
G9 SOLAR MODULES:

TÜV Rheinland Certified
Quality Controlled PV (QCPV)



UNIQUE IN THE PV INDUSTRY:

- Continuous monthly monitoring of mass production
- Continuous monitoring of material & supplier
- All conducted or supervised by TÜV representative on site

COMPONENT I: Initial Qualification Tests

Realistic and harsh tests

Up to
IEC × 3

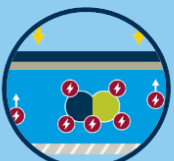
Following
IEC TS 63209

Recent failure modes are tested

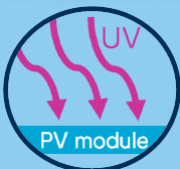
Backsheet durability



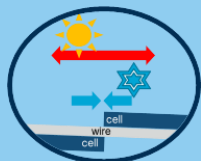
PID



LETID



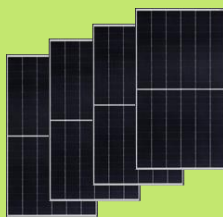
PV module



Solder durability

COMPONENT II: Monitoring of production

Testing of mass production



Monthly
random sampling
&
testing

COMPONENT III: Monitoring of material & supplier

Ensuring incoming material quality

Special test methods to find &
monitor material footprint



MATERIAL-



Continuous material & supplier
monitoring
during mass production



Q CELLS MEASURES TO ASSURE OUTSTANDING QUALITY & PERFORMANCE

Implementation of an additional test and surveillance program

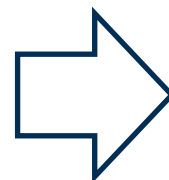


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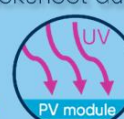
Backsheet durability



PID



LETID



PV module



Solder durability

COMPONENT II: Monitoring of production

Testing of mass production



Monthly
random sampling
&
testing

COMPONENT III: Monitoring of material & supplier

Ensuring incoming material quality

Special test methods to find &
monitor material footprint



MATERIAL-



Continuous material & supplier
monitoring
during mass production



Long term
suitability of
product verified

Modules will
meet warranty
promises

High quality of
production
verified

All supplied
modules have
same high quality

High quality of
used material
verified

No unexpected
issues in the field



Customer

COMPONENT I: INITIAL QUALIFICATION TESTS



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DAMP HEAT [DH]

Tested: 2000 hours (2 × IEC)



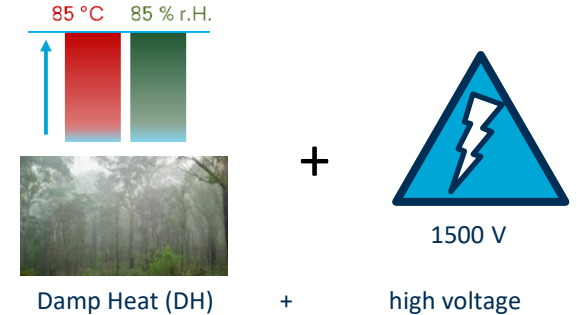
THERMAL CYCLING [TC]

Tested : 600 cycles (3 × IEC)



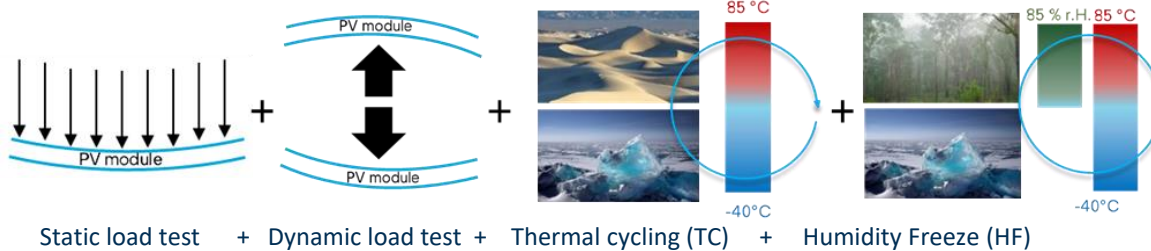
POTENTIAL INDUCED DEGRADATION [PID]

Tested: 85 % rel. humidity at 85 °C
(IEC TS 62804 = 60 °C)



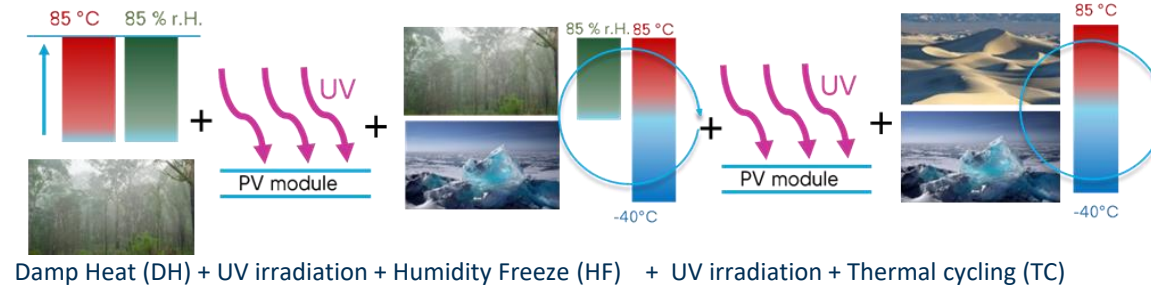
MECHANICAL LOAD TEST SEQUENCE

Tested: combination of static & dynamic load stress with climate-stress



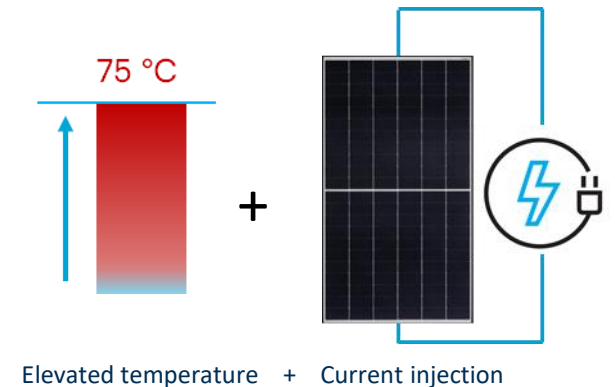
UV-TEST SEQUENCE [Backsheet resistance test]

Tested: combination of UV-stress and climate-stress



LIGHT and ELEVATED TEMPERATURE INDUCED DEGRADATION (LETID)

Tested: 300 hours (TÜV RH standard 2PfG 2689/04.19)



LEARNING PROGRAM
Extensions & Adaptions
planned for the future

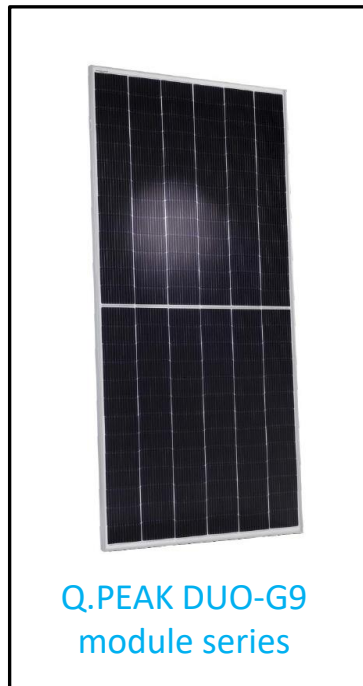


COMPONENT I: TESTING OF NEW Q.PEAK DUO-G9



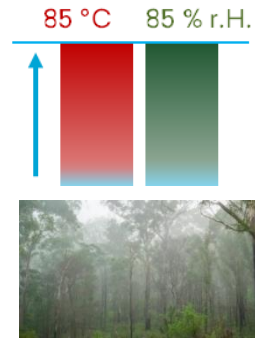
Quality
Controlled PV

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DAMP HEAT [DH]

Tested: 2000 hours (2 × IEC)



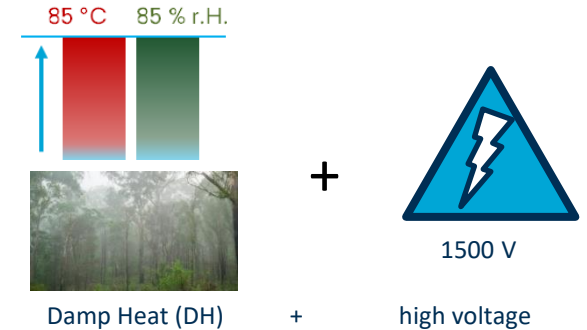
THERMAL CYCLING [TC]

Tested : 600 cycles (3 × IEC)



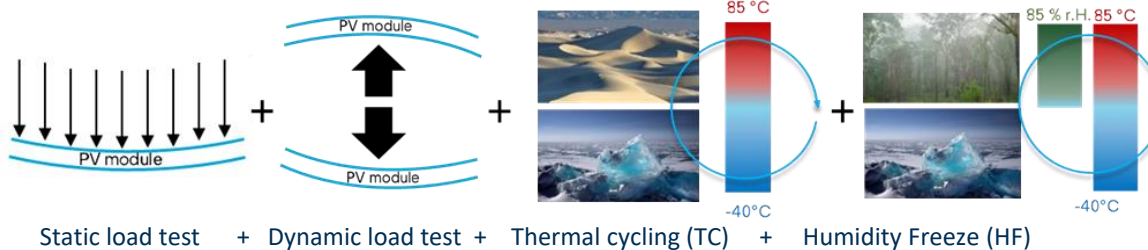
POTENTIAL INDUCED DEGRADATION [PID]

Tested: 85 % rel. humidity at 85 °C (IEC = 60 °C)



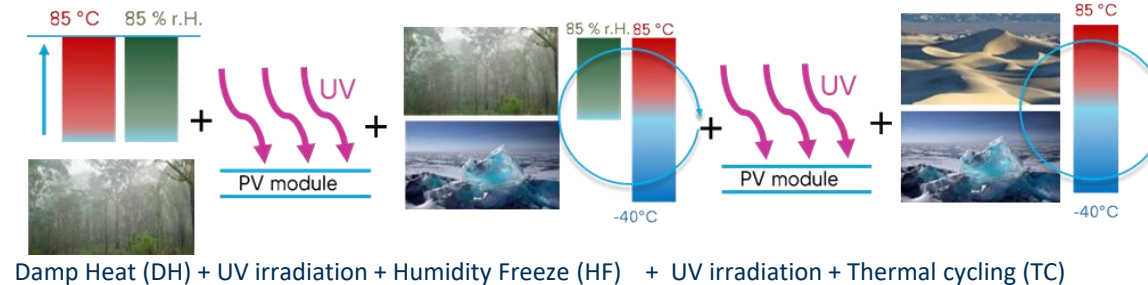
MECHANICAL LOAD TEST SEQUENCE

Tested: combination of static & dynamic load stress with climate-stress



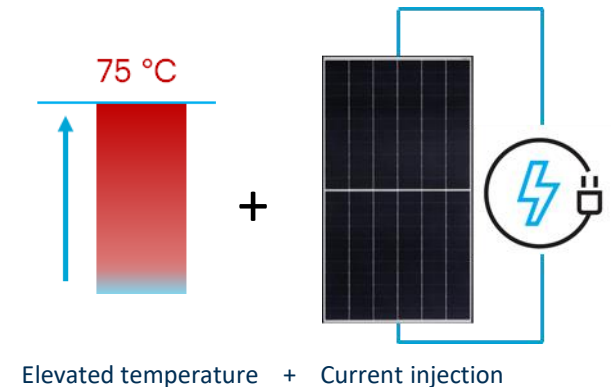
UV-TEST SEQUENCE [Backsheet resistance test]

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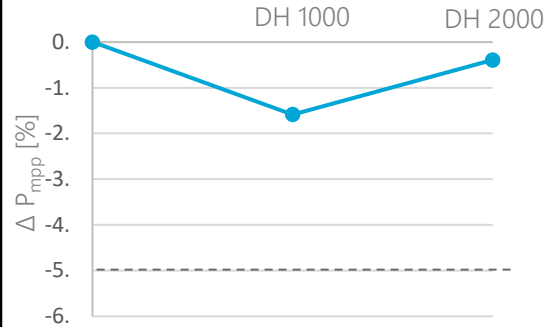


COMPONENT I: TESTING OF NEW Q.PEAK DUO-G9 – WITH OUTSTANDING RESULTS



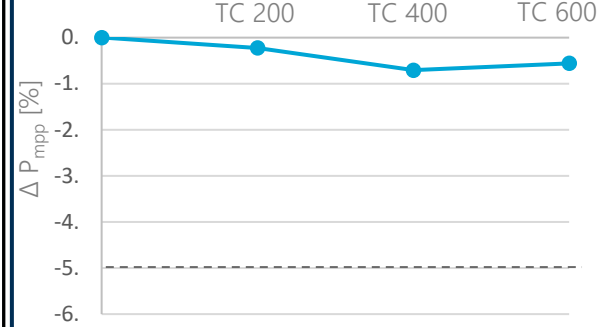
DAMP HEAT [DH]

Tested: 2000 hours (2 × IEC)



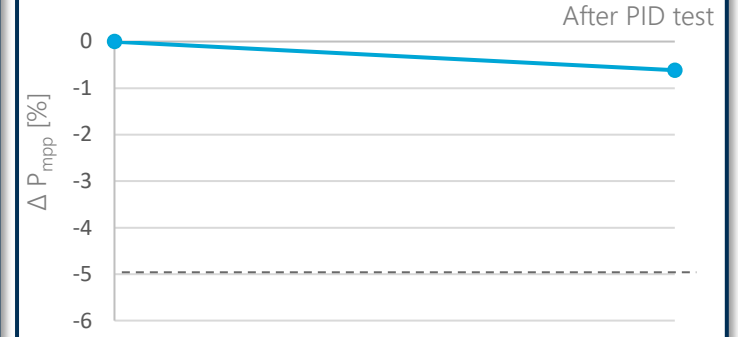
THERMAL CYCLING [TC]

Tested : 600 cycles (3 × IEC)



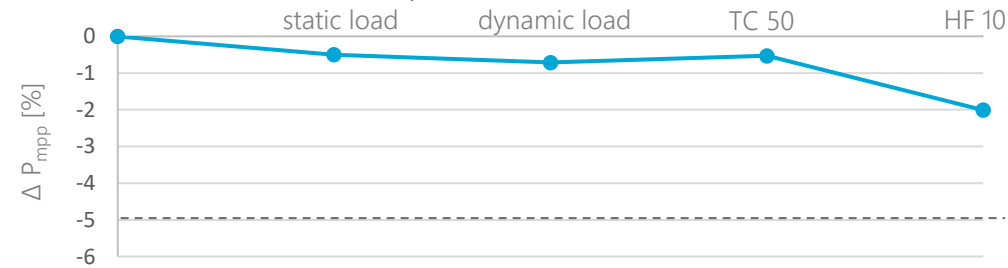
POTENTIAL INDUCED DEGRADATION [PID]

Tested: 85 % rel. humidity at 85 °C (IEC = 60 °C)



MECHANICAL LOAD TEST SEQUENCE

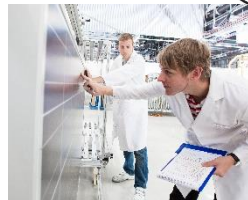
Tested: combination of static & dynamic load stress with climate-stress



UV-TEST SEQUENCE [Backsheet resistance test]

Tested: combination of UV-stress and climate-stress

Visual inspection



Insulation test



Wet leakage test



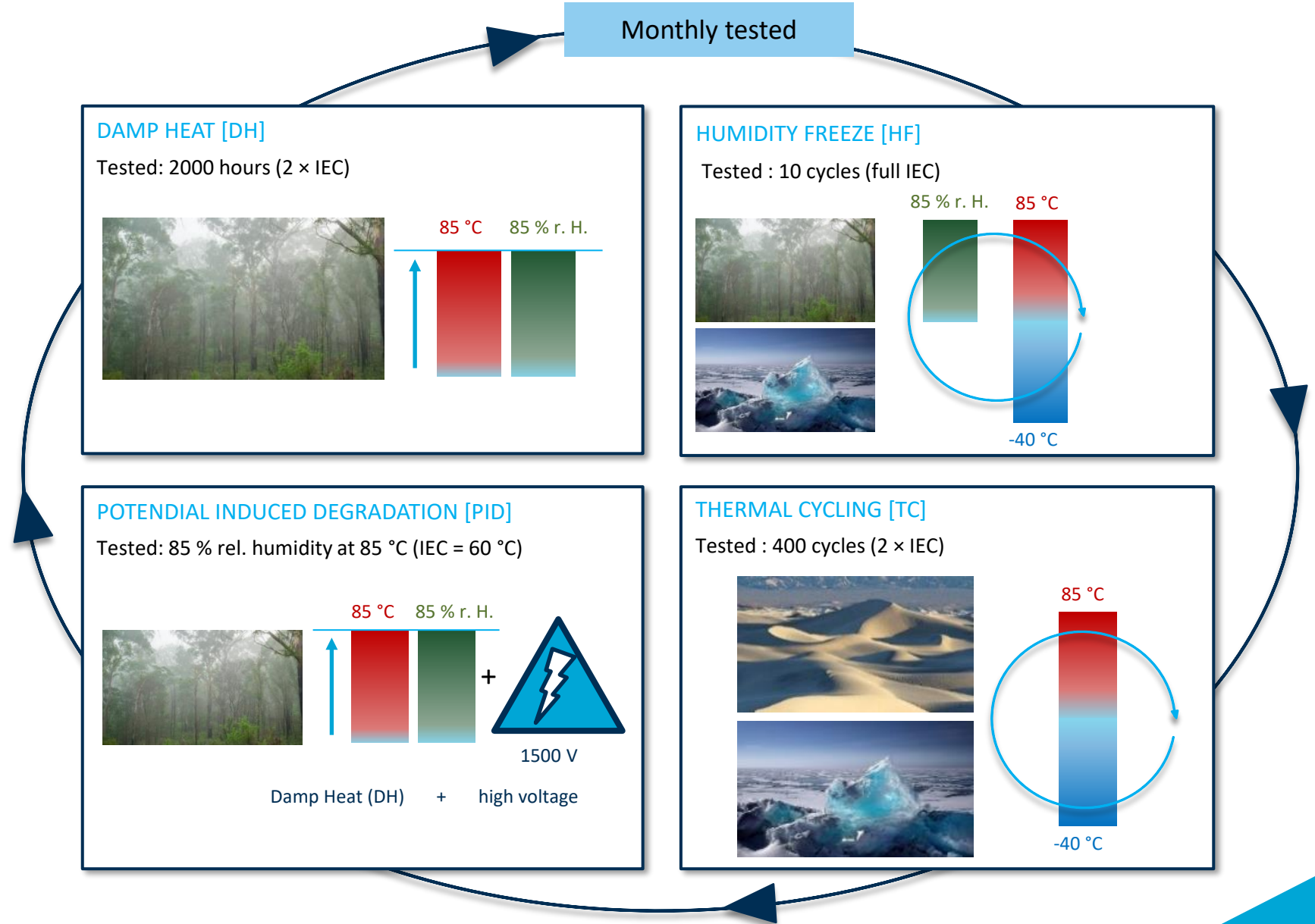
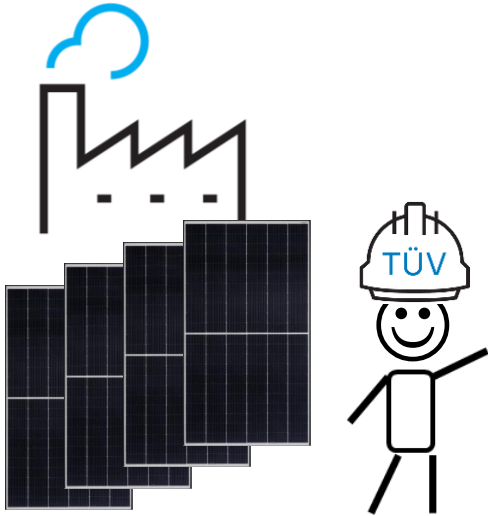
LIGHT and ELEVATED TEMPERATURE INDUCED DEGRADATION (LETID)

Tested: 300 hours (TÜV RH standard 2PfG 2689/04.19)



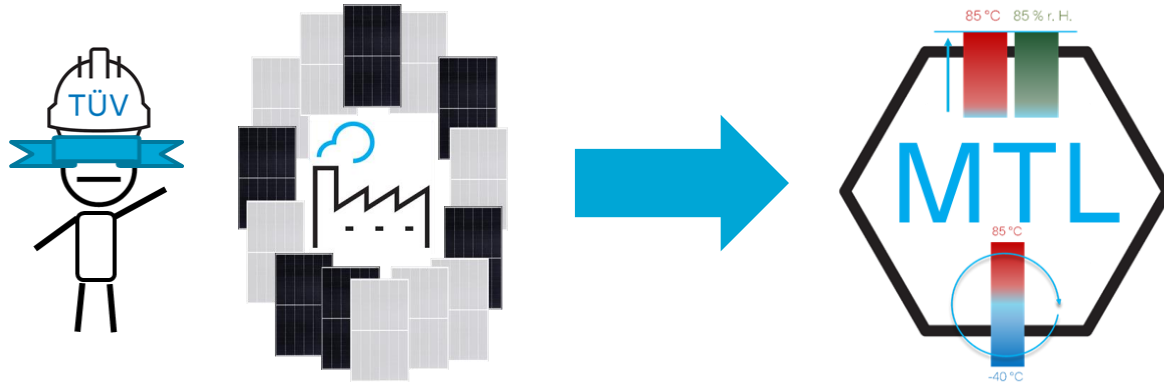
COMPONENT II: MONITORING OF PRODUCTION

Unique in the industry

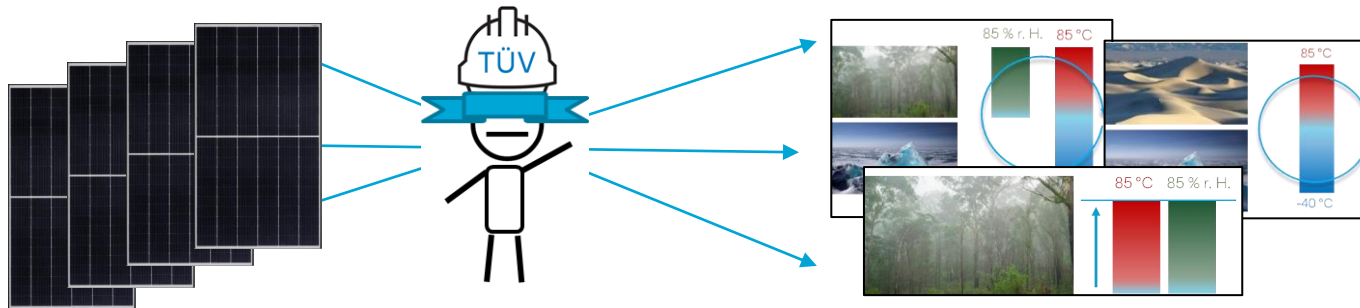


Q CELLS monthly procedure:

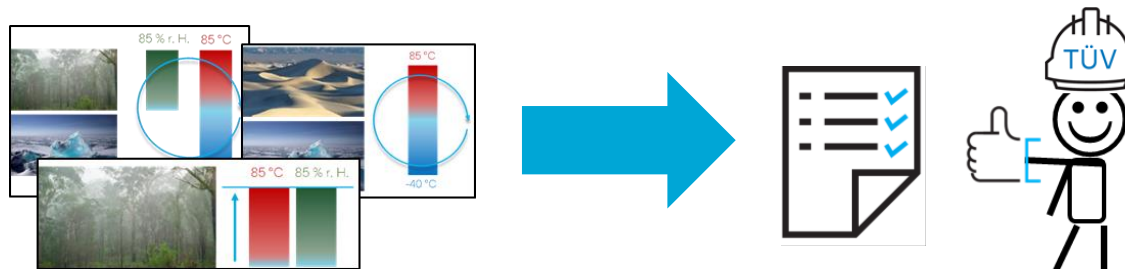
1. Random sampling at every production site by TÜV Rheinland(RH) representative. These are sent to Q CELLS certified Module Test Lines(MTL)



2. Before test start, the TÜV RH representative randomly assigns each module to one of the monitoring test sequences

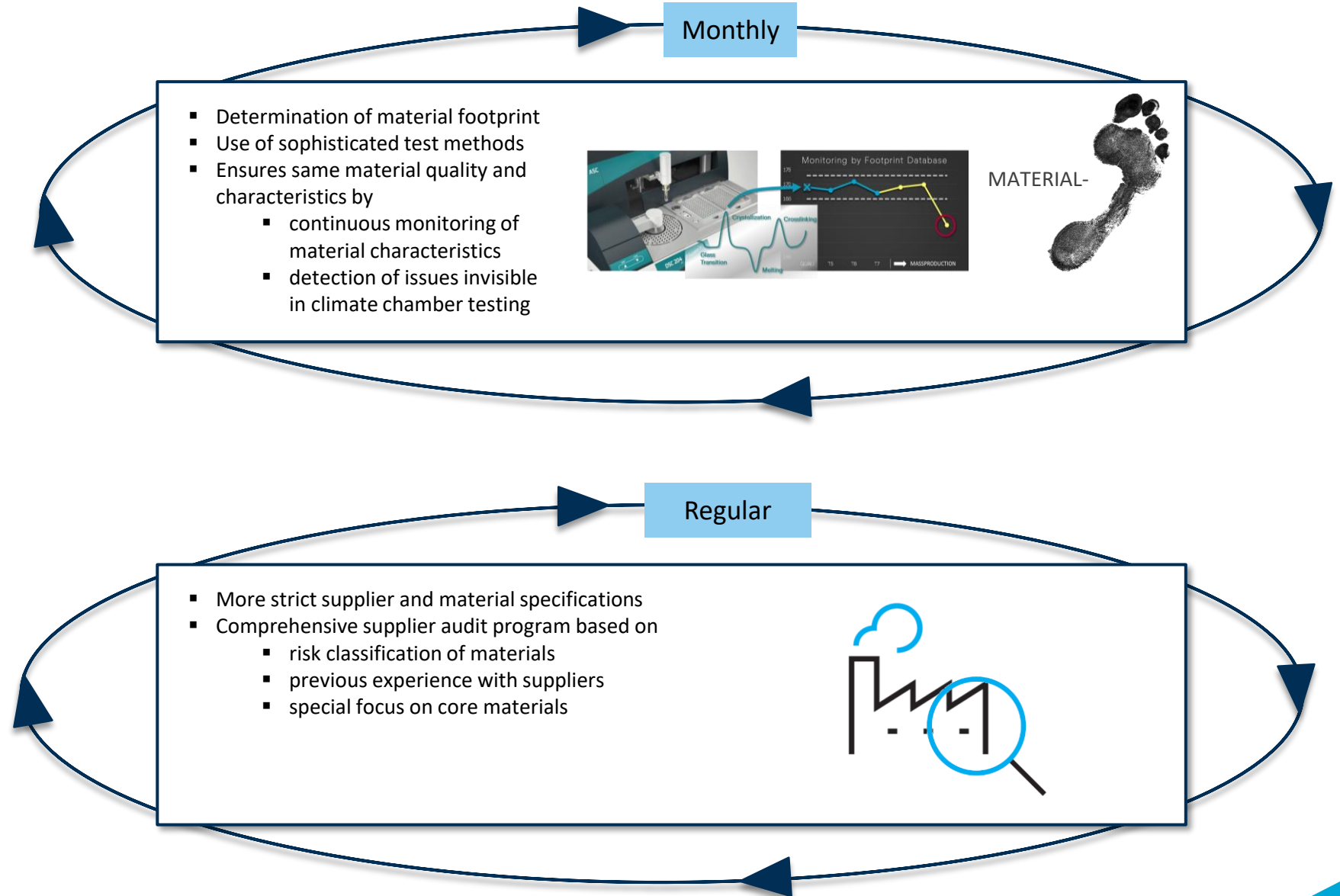
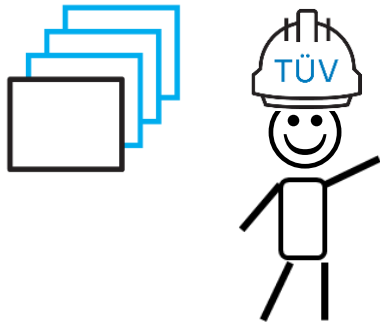


3. The tests are done at the MTL, a standardized test report is created and TÜV RH checks and confirms the report



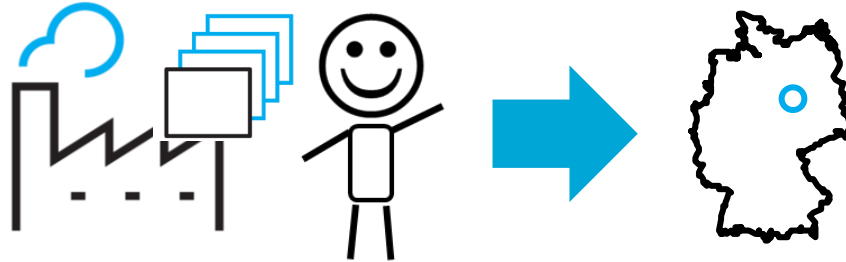
COMPONENT III: MONITORING OF MATERIAL & SUPPLIER

Unique in the industry

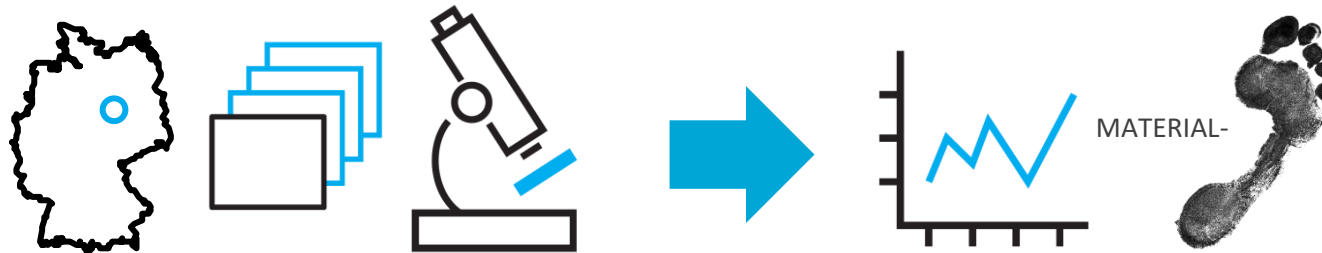


Q CELLS monitoring procedure for backsheet material:

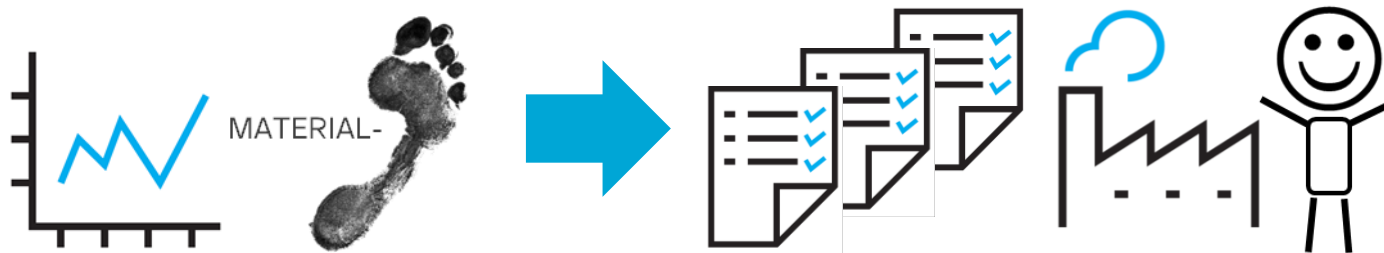
1. Production site prepares samples monthly from current production lot and sends them to Thalheim (Germany) for testing



2. Laboratory in Thalheim uses Differential scanning calorimetry (DSC) for footprint characterization

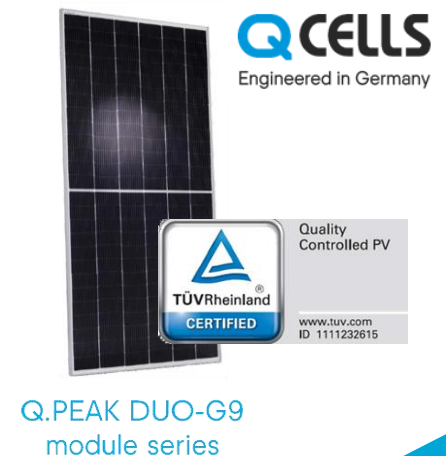


3. Results are uploaded in material footprint database and shared with local production sites



CONCLUSION

- Standard IEC certification
 - is able to align methods and guarantee basic suitability
 - is not able to assess PV module reliability as well as quality of mass production
- Quality Controlled PV (QCPV) is the only certification in the entire industry to
 - include most extensive and stringent testing scheme available to date
 - involve independent and random onsite testing of running mass production
 - conduct regular material testing by material footprint analysis and monitoring
 - be dynamically and regularly updated in the future
- Q CELLS
 - is the first mover in the Quality Controlled PV program
 - had the unique opportunity to bring in its own experience
 - Q.PEAK DUO-G9 series is the first product passing QCPV with outstanding results
 - will continue to test & monitor modules and materials according to QCPV and beyond that.



THANK YOU