

# Quality Controlled PV – 2 PfG 2715/11.19

Quality Control System for Crystalline Silicon  
Photovoltaic (PV) Module Manufacturing



# Overview Webinar

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2	Why Quality Controlled PV by TÜV Rheinland	
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# Introduction TÜV Rheinland

Offering tailor-made solutions for manufacturers, EPCs and investors along the value chain globally.

More than **35** years of experience in PV.

Power plant inspections since **1990.**

More than **500** locations in **59** countries worldwide.

**8,000** m<sup>2</sup> of lab testing areas

**250+** PV experts worldwide.



# Introduction Speaker



Lukas Jakisch

- Business Field Manager PV Modules and Solarthermal
- Dipl.-Ing. Electrical Engineering
- Expertise in PV Module quality assurance and risk minimization, standardization and certification
- Focus on electrical safety of PV Modules
- Working for TÜV Rheinland since 2007



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# Why Quality Controlled PV by TÜV Rheinland

## Market needs

- Manufacturers wish to differentiate their products
- Investors / Insurers wish to evaluate their investments
- Appropriate testing scheme to assess long-term PV-module reliability

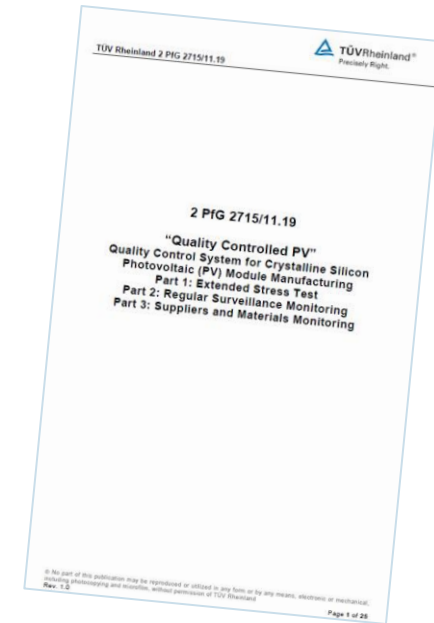
## What is TÜV Rheinland going to do?

- Extended stress testing following IEC TS 63209-1 to ensure that quality surpasses standard type approval and safety qualification
- Verifying manufacturers' regular quality and surveillance measures at the production sites
- Confirming manufacturers' material and supplier-monitoring programs for all critical materials, including supplier change control

## Targets and Benefits

- Risk mitigation: reveal deficiencies and detection of possible field failures with testing
- Higher quality: confidence in consistency or quality control of production with regular monitoring

*QC PV, as independent testing and certification program from TÜV Rheinland, is the most progressive program on the market to continuously monitor on product quality and durability in mass production!*

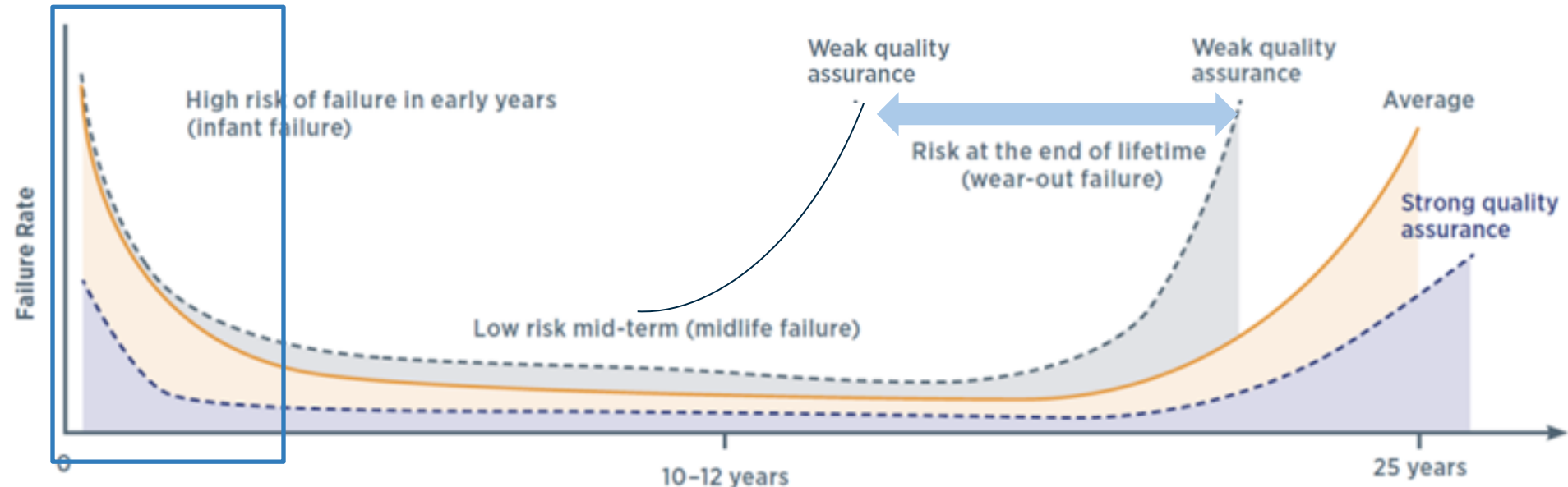


The keyword **Quality Controlled PV** confirms the certified PV modules has passed extended stress testing and undergo a regular quality surveillance monitoring.

# Why Quality Controlled PV by TÜV Rheinland

## Failure Systematics in PV

Type approval acc. to standards

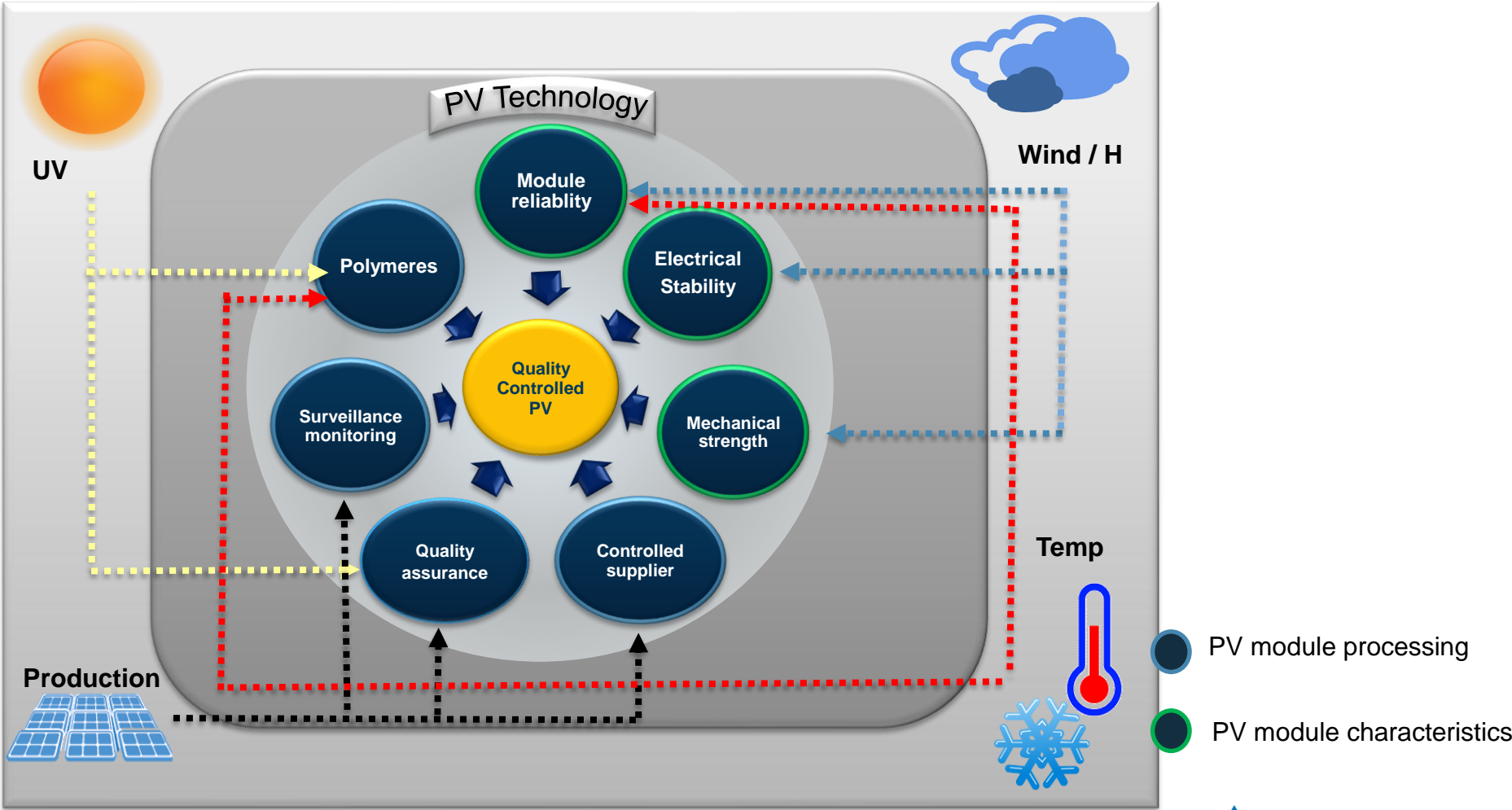


- Approval and certification acc. to (inter-)national standards is the minimum criteria of type approval and safety for market access; Testing acc. to standards identifies failures of the early years life cycle only!
- Fulfilling standards for type approval and safety by certification is no evidence for a 10 year product- or 25 year performance guarantee!
- Confidence in reliability of PV Modules leads to risk minimization of mid-term- and end of lifetime failures
- Regular surveillance of production site is crucial in order to quality stability



# Why Quality Controlled PV by TÜV Rheinland

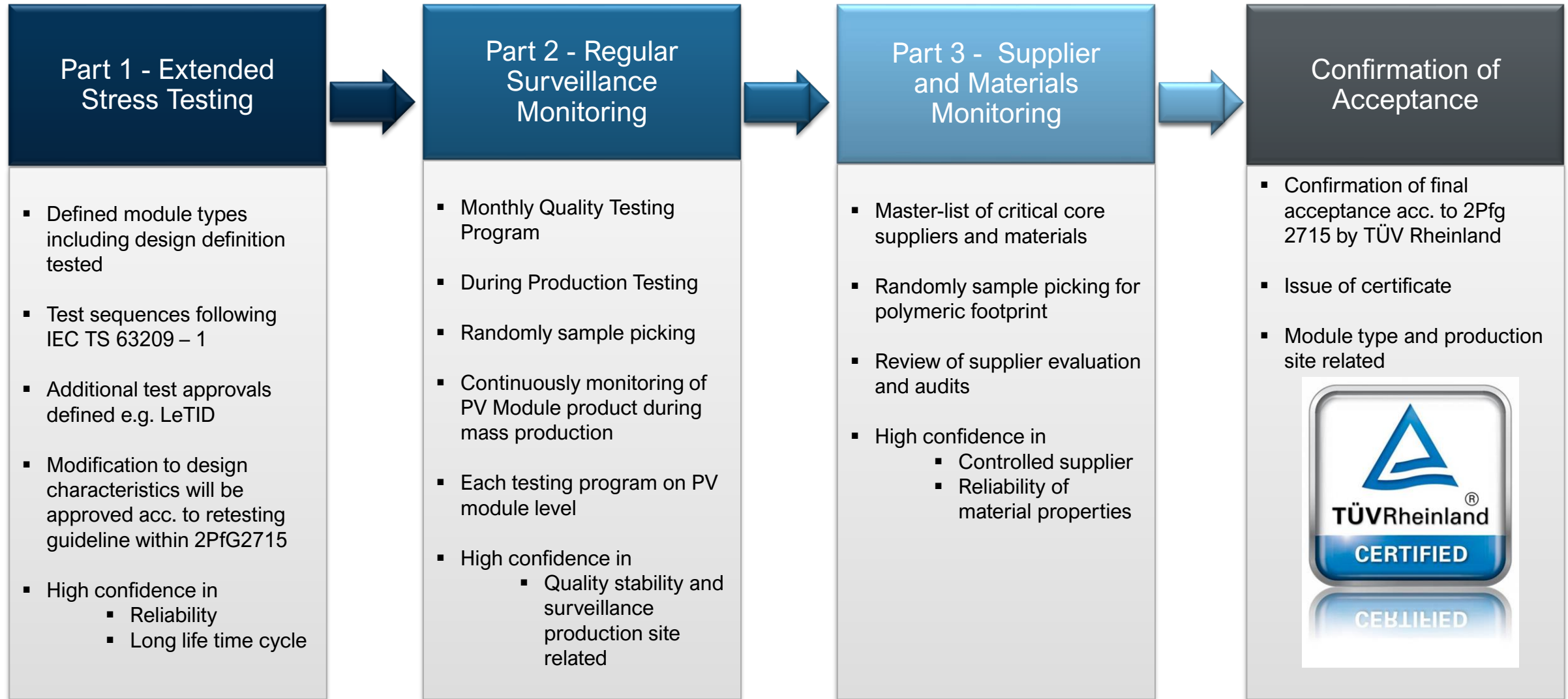
## Factors of influence



# Overview Webinar

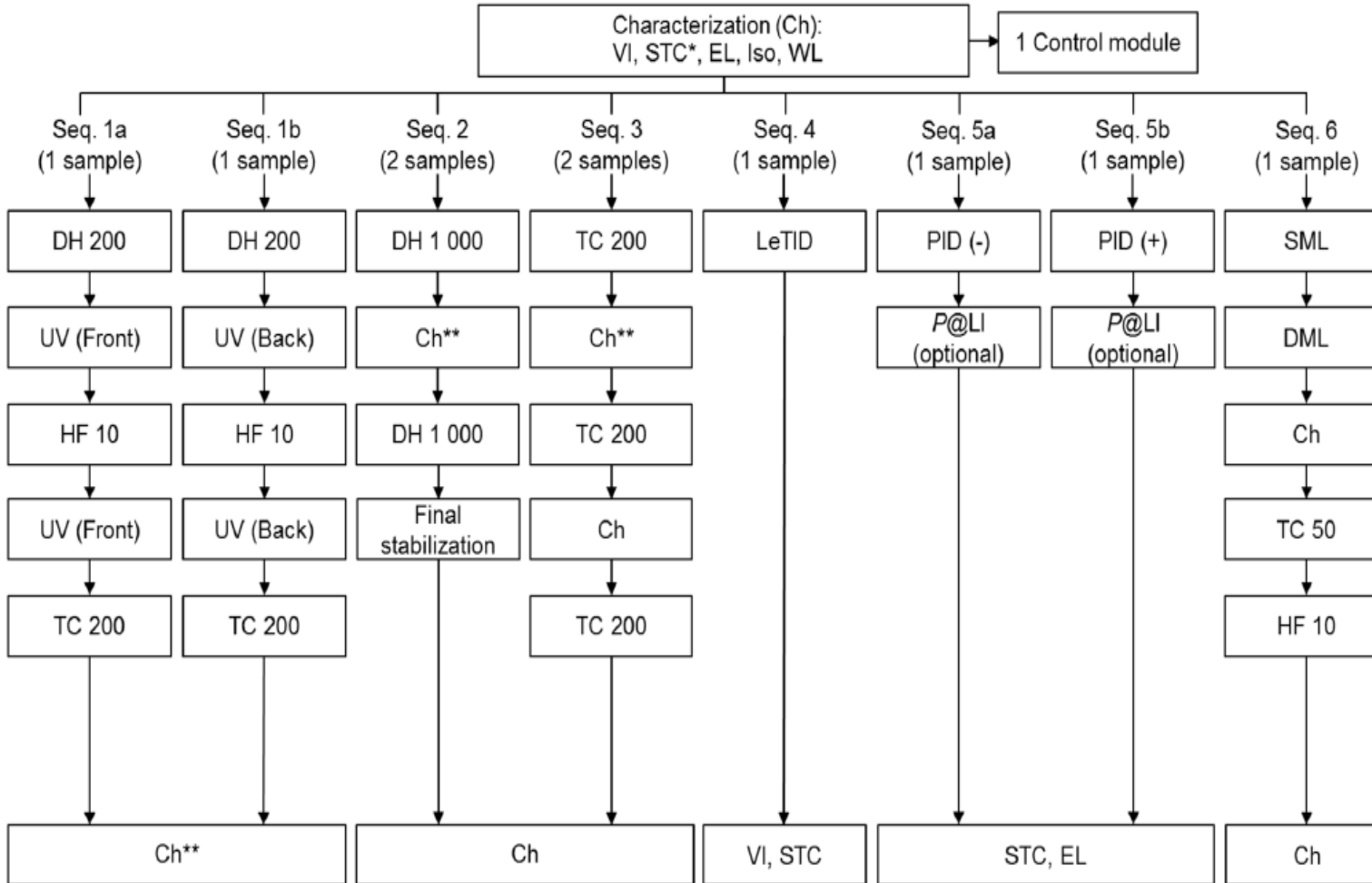
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# What is in 2 PfG 2715/11.19 - Quality Controlled PV



# What is in 2 PfG 2715/11.19 - Quality Controlled PV

## Part 1 - Extended Stress Test



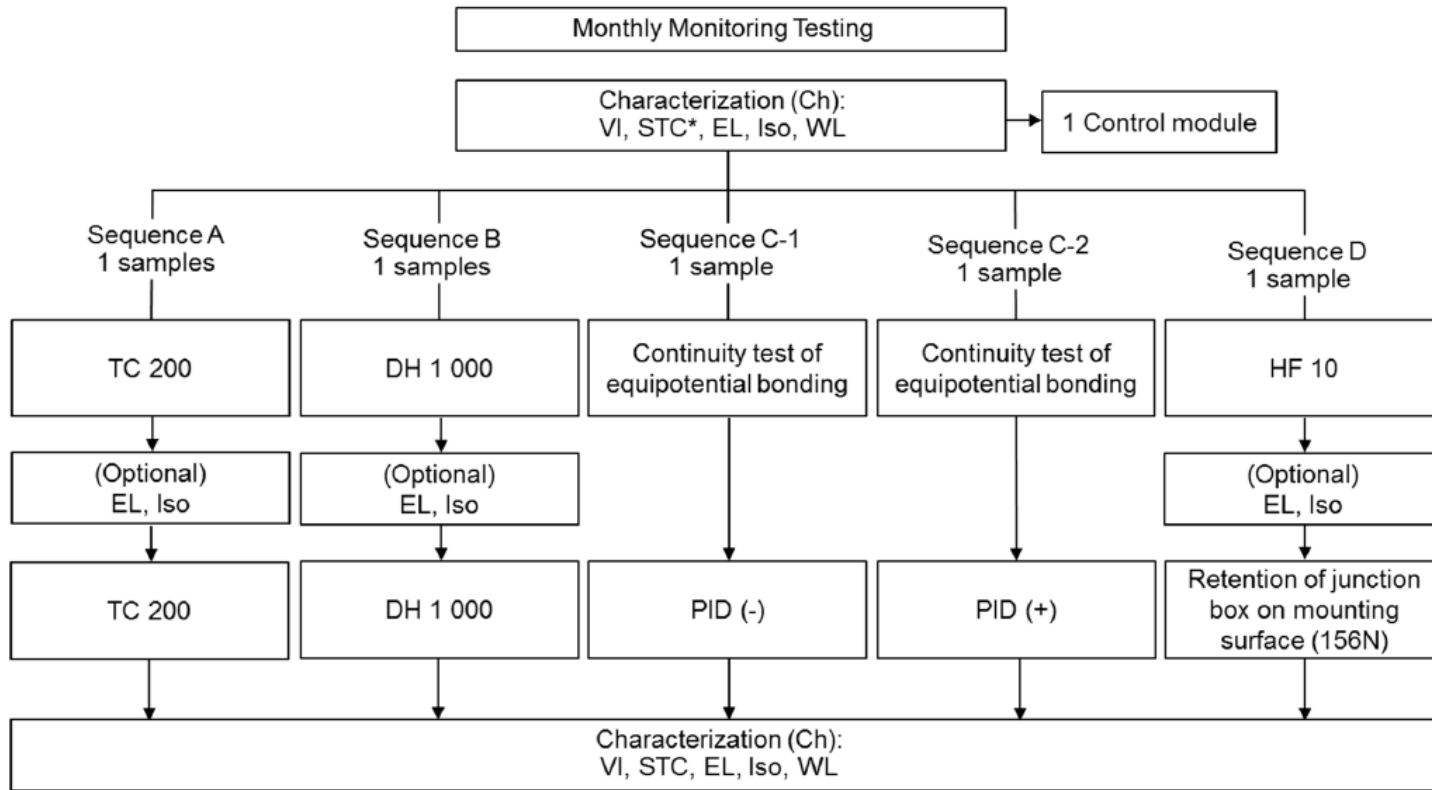
\* Initial stabilization required, except Seq. 4  
 \*\* No requirement on performance

- Test procedure based on draft status of **IEC TS 63209-1 Extended-stress testing of photovoltaic modules for risk analysis**
- Eleven samples are necessary as the minimum requirements for testing; it is allowed to provide more samples to increase confidence in test results
- LeTID: following 2 PfG 2689/04.19
  - $2 \times (I_{SC} - I_{MPP}) / 75 \text{ °C} / 300 \text{ hours (max.)}$
- PID: following method 1-B or 1-C of 2 PfG 2387/01.18
  - $85 \text{ °C} / 85\% \text{ RH} / 96 \text{ hours (chamber)}$
  - $25 \text{ °C} / < 60\% \text{ RH} / 168 \text{ hours (dry/Al-foil)}$
- SML: 2400 Pa for tensile and pressure regardless of the designed load specified
- DML: following IEC 62782 (1 000 Pa x 1 000 times)



# What is in 2 PfG 2715/11.19 - Quality Controlled PV

## Part 2 - Regular Surveillance Monitoring - *Monthly Quality Testing Program*



\* Initial stabilization required

- Monthly sample picking at each production site from out of Quality Controlled PV certified module types
- The lot size of sample selection = No. of required test samples x factor 10 (minimum)
- Random selection of required test samples from this lot by TÜV Rheinland staff
- Selection of each Quality Controlled PV certified module type minimum every three years

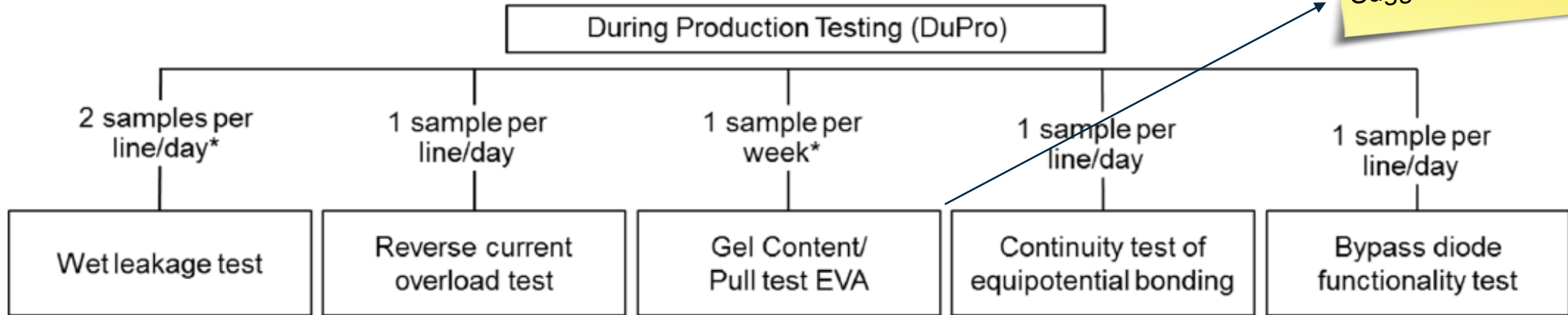
### Pass criteria

- Maximum power output drop less than 5% after testing
- VI, Iso, WL following IEC 61215-2
- Monthly monitoring and review of test protocols by TÜV Rheinland



# What is in 2 PfG 2715/11.19 - Quality Controlled PV

## Part 2 - Regular Surveillance Monitoring - *During Production Testing*



\* In case of multiple laminators per line, a daily change of laminators is required.

- Daily/weekly sample picking at each production site out of Quality Controlled PV certified module types
- Requirements acc. to IEC 61215-2 and IEC 61730-2 after testing
- Selection of each Quality Controlled PV certified module type minimum every three years
- Monthly monitoring and review of test protocols by TÜV Rheinland staff

# What is in 2 PfG 2715/11.19 - Quality Controlled PV

## Part 3 - Suppliers and Materials Monitoring

### Master List of Suppliers

- Definition of a master list of suppliers including supplier evaluation (material risk assessment)
- Confirmation letters of all CORE materials from suppliers are required

Core materials are rated as critical or major according to the material risk assessment

### Polymeric Footprint

- Material analysis or identification measures, e.g. GC MS (Gas chromatography with mass spectrometry) / DSC (differential scanning calorimetry) or other microsection analysis methods
- ONE test sample from a minimum of TWO suppliers per month

### Regular Supplier Audit

- minimum ONE supplier audit per year for core materials
- supplier to be audited shall be changed every year

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# Confirmation of Acceptance

## Requirements for Certification

- Test samples meet all criteria of each individual test in Part 1, 2, and 3
- A CDF (Constructional Data Form) is necessary for verification
- Requirements for Monitoring, Review of test protocols and Assessments satisfied
- IEC 61730 TÜV Rheinland safety certification covering yearly factory inspection

### In case of failures

- A failure analysis report and a corrective action plan are required
- repetition of test sequence with minimum 2 samples per sequence
- Both sample shall pass the retest



Quality Controlled PV  
2 PfG 2715/11.19

Quality Control System for  
Crystalline Silicon Photovoltaic  
(PV) Module Manufacturing

Zertifikat

Certificate



Zertifikat Nr. Certificate No. PV 60153211 Blatt Sheet 0001

Ihr Zeichen Client Reference 0001--21290613 001 Unser Zeichen Our Reference 0001--21290613 001 Ausstellungsdatum Date of Issue 26.11.2020 (day/mo/yr)

Genehmigungsinhaber License Holder Hanwha Q CELLS GmbH Sonnenallee 17-21 06766 Bitterfeld-Wolfen Germany Fertigungsstätte Manufacturing Plant Refer to latest revision of the annex list of factories

Prüfzeichen Test Mark Geprüft nach Tested acc. to 2 Pfg 2715/11.19



Zertifiziertes Produkt (Geräteidentifikation) Certified Product (Product Identification) Lizenzentgelte - Einheit License Fee - Unit

PV Module

Type with 156 half cut solar cells (6"): Q. PEAK DUO XL-G9.3 XXX Q. PEAK DUO XL-G9.2 XXX Q. PEAK DUO XL-G9 XXX (XXX = 415 - 460 in steps of 5)

Type with 132 half cut solar cells (6"): Q. PEAK DUO ML-G9 XXX Q. PEAK DUO ML-G9+ XXX Q. PEAK DUO BLK ML-G9 XXX Q. PEAK DUO BLK ML-G9+ XXX (XXX = 370 - 395 in steps of 5)

Type with 120 half cut solar cells (6"): Q. PEAK DUO-G9 XXX Q. PEAK DUO-G9+ XXX Q. PEAK DUO BLK-G9 XXX Q. PEAK DUO BLK-G9+ XXX (XXX = 330 - 360 in steps of 5)

continued on page 2

Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde. Das Produkt entspricht den o.g. Anforderungen, die Herstellung wird überwacht. This certificate is based on our Testing and Certification Regulation. The product fulfills above mentioned requirements, the production is subject to surveillance.

TÜV Rheinland LGA Products GmbH, Tillystraße 2, 90431 Nürnberg Tel.: +49 221 806-1371 e-mail: cert-validity@de.tuv.com Fax: +49 221 806-3935 http://www.tuv.com/safety



supplier change control.

The PV module and its performance  
The use of the keyword "Quality Control"

19 10-Dec-20 Beyond Standar

Dem Zertifikat liegt unsere Prüf- und Zertifizierungsordnung zugrunde. Das Produkt entspricht den o.g. Anforderungen, die Herstellung wird überwacht. This certificate is based on our Testing and Certification Regulation. The product fulfills above mentioned requirements, the production is subject to surveillance.

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Hanwha Q Cells **First Mover** – certificate!



Zeichen Our Reference 0001--21290613 001 Ausstellungsdatum Date of Issue 26.11.2020 (day/mo/yr)

Fertigungsstätte Manufacturing Plant Refer to latest revision of the annex list of factories

Geprüft nach Tested acc. to PFG 2715/11.19

Lizenzentgelte - Einheit License Fee - Unit

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ättenliste  
Factories

1. Hanwha Solution Corporation  
1329 Daegeum-ro, Geumwang-eup  
Bumseong-Gun 27632  
Republic of Korea

4. Hanwha Q CELLS (Qidong) Co., Ltd.  
888 Linyang Road  
Qidong City  
226200 Jiangsu  
P.R. China



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# Summary

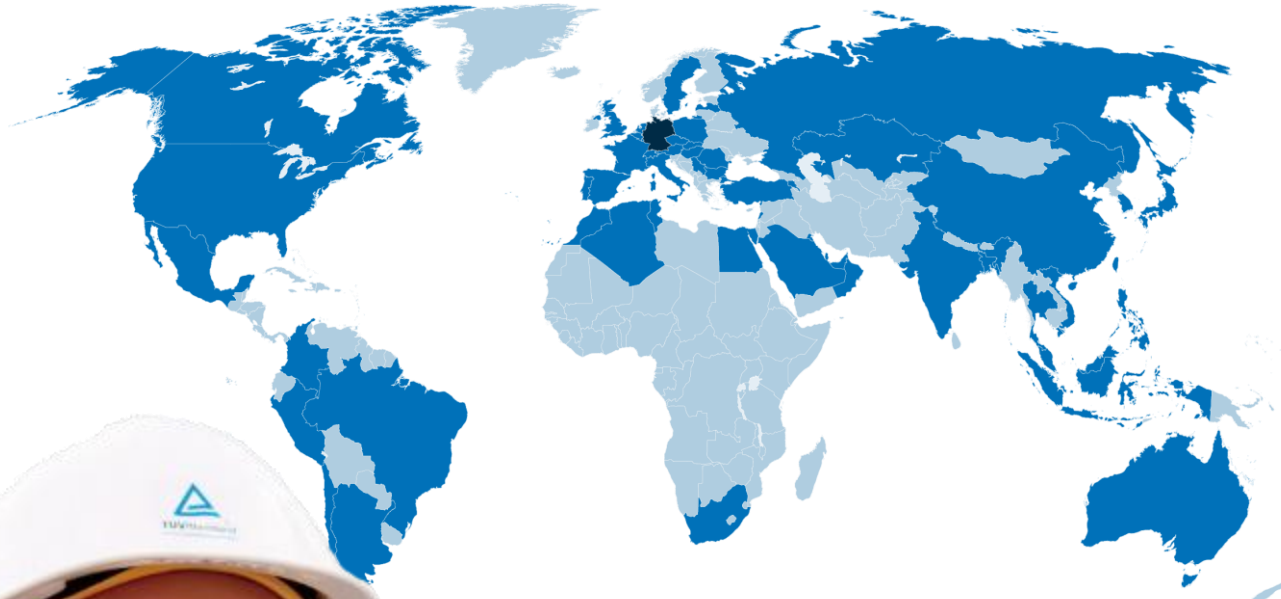
## Quality Controlled PV - 2 PfG 2715/11.19

- Quality Controlled PV standard for c-Si Photovoltaic Module Manufacturer is a high-level USP on their Quality Control System
- High manufacturer's efforts in implementing QC PV leads to increased confidence in reliability and risk minimization of PV Modules
- Driven by the market to differentiate their products for manufacturers and to evaluate their investments for investors, this test specification was developed based on IEC TS 63209-1 focused for reliability testing beyond IEC 61215 and IEC 61730
- Quality stability is crucially given by regular surveillance monitoring of the production site in this program
- 2 PfG 2715 need to be performed through three levels Part1, 2 & 3 traceable per module type & design
- Quality Controlled PV is market recognized already – see CEC Australia:

PV MODULE ENHANCED LISTING CHECKLIST (APPLIES FROM 10-2020)

### PV MODULE ENHANCED LISTING CHECKLIST

	Items to check	OK
<b>A</b>	<b>VDE Quality Tested or TÜV Rheinland Quality Controlled PV (QCPV)</b>	
1	Check validity of VDE QT or QCPV certificate on certifier website	
2	Check certifier is also the certifier of the manufacturer	
3	Company names and factories match	
4	Model numbers match	
5	Expiry date is valid. Note QT Certificate is re-issued yearly but does not affect CEC listing	
<b>G</b>	<b>Light and elevated Temperature Induced Degradation (LeTID)</b>	
1	Check the certificate on the certifier website (may be to Certifier standard eg TÜV RH 2PfG 2689 04.19)	



Certipedia PV



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we are at your side.

Your TÜV Rheinland Solar team

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