

# JinkoSolar N-type TOPCon Module Outperforms in PVEL Test in Every Category

According to the results of PVEL's module reliability test as part of its Product Qualification Program (PQP), the JinkoSolar's N-type TOPCon bifacial modules (JKM555N-72HL4-BDV) have been proven excellent and outstanding in every category, especially in the test results of "LID+LETID" under DH2000/BO, and are awarded the title of "Top Performer" in module reliability test.

According to the results of PVEL's DH2000 test on hundred of modules from various brands, average degradation was 1.2%-1.7% across different technologies (PERC, TOPCon, HJT, CdTe), while the result of JinkoSolar's N-type TOPCon bifacial modules (JKM555N-72HL4-BDV) was 0.55%, the lowest among all.

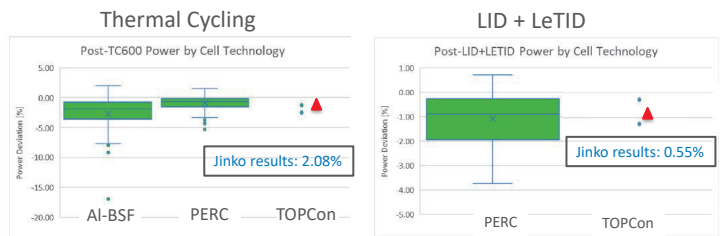
PVEL's Damp Heat (DH) test simulates long-term degradation and failure modes that are typical in high temperatures and high humidity conditions where moisture and heat can weaken the materials binding the PV module together. When the adhesiveness of these materials weakens due to low-quality components and/or substandard lamination processes, moisture can enter the laminate and corrode internal materials. The result is potential performance loss and safety issues.

DH2000 is the reliability test subjecting modules to a constant 85 ° C and 85% relative humidity in an environmental chamber for two periods of 2000hours . This test is -two times the duration required for IEC certification in order to identify additional module failure modes where the combination of high heat and intense moisture stresses the PV module layers.

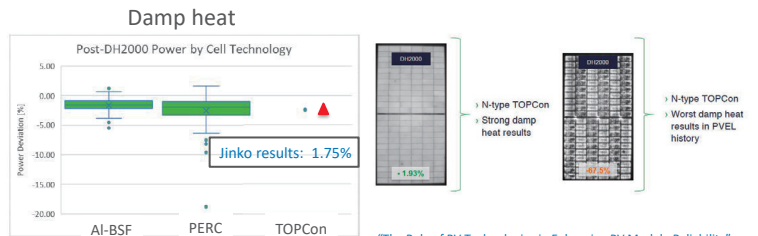
Environments with high temperatures can lead to a destabilization of PV cell boron-oxygen (BO) complexes. This leads to power loss in boron-doped PERC cells, but is less of a concern for non-boron-doped cells, such as N-type TOPCon.

PQP Test Result						
Average Post-stress Change in P <sub>MAX</sub> Relative to Initial Measurement [%]						
Model	TC600	DH2000/BO	MSS/HF10	PID192(-)	PID192(+)	LeTID
JKM555N-72HL4-BDV	-0.25	-0.55	-0.29	-0.87	-0.54	•
Wet Leakage Insulation Resistance Meets IEC 61215-1:2016 Requirements <sup>1</sup>						
JKM555N-72HL4-BDV	Yes	Yes	Yes	Yes	Yes	•
Visual Inspection Findings <sup>2</sup>						
JKM555N-72HL4-BDV	None	None	None	None	None	•

<sup>1</sup>Note-as per PVEL PQP: BOM Test Requirements, this test is not required for this BOM. Contact PVEL for more information on the representative results from other BOMs from the same manufacturer.



PVEL report "Demonstration durability in n-type modules", Tristan Erion-Lorico, PV Mag. Webinar Aug. 30, 2022



"The Role of PV Technologies in Enhancing PV Module Reliability" Mohammed Saady Dweik, Jinko Solar PV Mag. Webinar Aug. 30, 2022

\*Source: NREL, Degradation Mechanisms in TOPCon/POLO Solar Cells

Factory Witness, Characterizations and Light-Induced Degradation Measurement								
Thermal Cycling	Damp Heat	Backsheet Durability Sequence	Mechanical Stress Sequence	Hail Stress Sequence	Potential-Induced Degradation	LETID Sensitivity	PAN File & IAM Profile	Field Exposure
TC 200	DH 1000	DH 1000	Static Mechanical Load	Hail	85 °C, 85%RH, 1000 hrs (6 and/or -) 192 hrs	LETID 162 hrs (75 °C, 1sc-imp)	PAN File	Field Exposure 6 Months
Characterization	Characterization	UV 65 kWh/m <sup>2</sup>	Characterization	Characterization	Characterization	Characterization	IAM Profile	Characterization
TC 200	DH 1000	Characterization	Dynamic Mechanical Load	Dynamic Mechanical Load	Characterization	LETID 162 hrs (75 °C, 1sc-imp)	Characterization	Field Exposure 6 Months
Characterization	Characterization	TC 50 + HF 10	Characterization	Characterization	Characterization	Characterization	Characterization	Characterization
TC 200	Stabilization 80 °C, 1sc, 48 hrs	UV 65 kWh/m <sup>2</sup>	Characterization	TC 50 + HF 10	TC 50 + HF 10	LETID 162 hrs (75 °C, 1sc-imp)	Characterization	Characterization
Characterization	Characterization	Characterization	Characterization	Characterization	Characterization	Characterization	Characterization	Characterization
		TC 50 + HF 10	Characterization	Characterization	Characterization	Characterization	Characterization	Characterization
		UV 65 kWh/m <sup>2</sup>	Characterization	Characterization	Characterization	Characterization	Characterization	Characterization

## About PVEL

As the world's leading independent laboratory, PVEL tests solar modules from leading solar manufacturers as part of its Product Qualification Program (PQP), and publishes the PV Module Reliability Scorecard based on these test results.

PVEL has rigorously reviewed the modules produced in the factory in the past 18 months, and conducted the test to determine the performance of the modules. PQP covers multiple test contents such as thermal cycle, damp heat, dynamic mechanical load, PID and PAN file.

