TÜV NORD (Hangzhou) Co., Ltd.

5th floor, No.50, Jiu Huan Road
Hangzhou City, Zhejiang Province
310019, P.R. China

Phone: +86 (0) 571 8538 6989
Fax: +86 (0) 571 8538 6986

hzpcert@tuv-nord.com
www.tuev-nord.com

Test Report
No. TRSHV03052/18/01

Performance Measurement
about Coated Glass Used in PV Modules

Applicant: **ZNShine PV-tech Co., Ltd.**
#1 Zhixi Industry Zone
Jintan City, Jiangsu Province, 213251, P.R. China

File No.: SHV03052/18

Designed: May. 23rd. 2018 by: Anderson Ruan

Reviewed: May 23rd. 2018 by: Shanree Wei

Applicant ..... :	**ZNShine PV-tech Co., Ltd.** #1 Zhixi Industry Zone Jintan City, Jiangsu Province, 213251, P.R. China
Manufacturer ..... :	**ZNShine PV-tech Co., Ltd.** #1 Zhixi Industry Zone Jintan City, Jiangsu Province, 213251, P.R. China
Order No. ..... :	QT-SHV03052/18
Date of Application ..... :	03/13/2018
Product ..... :	Coated glass for PV modules
Model type(s) ..... :	3.2mm
Sample quantity ..... :	21 pcs
Type of examination ..... :	Conformity test according to the requirements of coated glass used in PV modules
Standards used ..... :	JC/T 2170-2013
Testing Period ..... :	03/26/2018 - 05/23/2018
Testing Laboratory ..... :	**National Center of Supervision & Inspection on Solar Photovoltaic Products Quality** Suite A-10F, No. 5 Xinhua Road, Wuxi New District Wuxi City, Jiangsu Province, 214028, P.R. China

Test results listed in this test report refer exclusively to the mentioned test sample.

List of contents

1. Setting of tasks

Performance measurements on 21 pcs of coated glass used in PV modules according to JC/T 2170-2013

2. General remarks

Possible test case verdicts:	
Test case does not apply to the test object.....:	Not Applicable (N/A)
Test object does meet the requirement.....:	Pass (P)
Test object does not meet the requirement.....:	Fail (F)

Other Remarks:

The test verdicts presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, with the written approval of the issuing testing laboratory.

"(see Annex #)" refers to additional information appended to the report.
"(see Table #)" refers to a table appended to the report.

Throughout this report a point is used as the decimal separator.

THE REQUIREMENTS OF COATED GLASS USED IN PV MODULES			
Clause	Requirement + Test	Result - Remark	Verdict

3. Test results

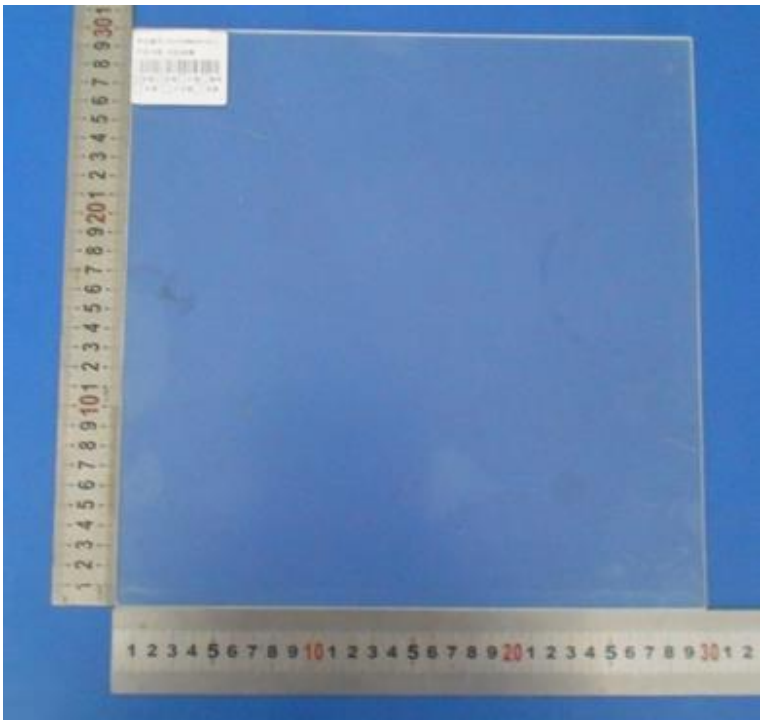
6.2	Appearance: Coating should be uniform, with no stains, no scratches, no spots, no clusters or pinholes.	All samples: No visual defects	P
6.7	Scrub resistance test: 400 cycles of scrub resistance test are applied with 0.5% mass concentration and pH 9.5-11.0 of washing powder solution. The transmittance degradation after scrub resistance test (ΔT) should be no more than 1.00%.	1#: Before: T_{b1}: 94.13% After: T_{a1}: 93.72% ΔT_1: -0.44% 2#: Before: T_{b2}: 94.06% After: T_{a2}: 93.66% ΔT_2: -0.43% 3#: Before: T_{b3}: 94.09% After: T_{a3}: 93.66% ΔT_3: -0.46%	P
6.8	Acid resistance test: 24 hours of acid soak are applied with 1 mol/L HCl solution at 23±2°C. The transmittance degradation after acid resistance test (ΔT) should be no more than 1.00%.	4#: Before: T_{b4}: 93.50% After: T_{a4}: 93.66% ΔT_4: -0.17% 5#: Before: T_{b5}: 93.90% After: T_{a5}: 93.81% ΔT_5: -0.10% 6#: Before: T_{b6}: 93.80% After: T_{a6}: 93.67% ΔT_6: -0.14%	P
6.9	Salt-mist spray test: 96 hours of salt-mist spray are applied with 5±1% NaCl solution. The transmittance degradation after salt-mist spray test (ΔT) should be no more than 1.00%.	7#: Before: T_{b7}: 93.80% After: T_{a7}: 93.54% ΔT_7: -0.28% 8#: Before: T_{b8}: 93.71% After: T_{a8}: 93.37% ΔT_8: -0.36% 9#: Before: T_{b9}: 93.86% After: T_{a9}: 93.45% ΔT_9: -0.44%	P
6.10	Thermal cycling test: 200 cycles of thermal cycling test are applied. The transmittance degradation after thermal cycling test (ΔT) should be no more than 1.00%.	10#: Before: T_{b10}: 93.85% After: T_{a10}: 93.45% ΔT_{10}: -0.43% 11#: Before: T_{b11}: 93.75% After: T_{a11}: 93.25% ΔT_{11}: -0.53% 12#: Before: T_{b12}: 93.80% After: T_{a12}: 93.38% ΔT_{12}: -0.43%	P

THE REQUIREMENTS OF COATED GLASS USED IN PV MODULES			
Clause	Requirement + Test	Result - Remark	Verdict
6.11	Humidity-freeze test: 10 cycles of humidity-freeze test are applied. The transmittance degradation after humidity-freeze test (ΔT) should be no more than 1.00%.	13#: Before: T_{b13}: 93.85% After: T_{a13}: 93.23% ΔT_{13}: -0.66% 14#: Before: T_{b14}: 93.68% After: T_{a14}: 93.16% ΔT_{14}: -0.56% 15#: Before: T_{b15}: 93.85% After: T_{a15}: 93.17% ΔT_{15}: -0.72%	P
6.13	UV irradiance test: 15kWh/m^2 of UV irradiance (280nm - 400nm) is applied with 3%-10% of UVB (280nm - 320nm) at 60±5°C. The transmittance degradation after UV irradiance test (ΔT) should be no more than 1.00%.	16#: Before: T_{b19}: 93.86% After: T_{a19}: 93.47% ΔT_{19}: -0.42% 17#: Before: T_{b20}: 93.84% After: T_{a20}: 93.55% ΔT_{20}: -0.31% 18#: Before: T_{b30}: 93.78% After: T_{a30}: 93.43% ΔT_{30}: -0.37%	P
6.14	Sand and dust test: 6 hours of sand and dust test are applied. The transmittance degradation after sand and dust test (ΔT) should be no more than 1.00%.	19#: Before: T_{b22}: 93.77% After: T_{a22}: 93.56% ΔT_{22}: -0.22% 20#: Before: T_{b23}: 93.52% After: T_{a23}: 93.23% ΔT_{23}: -0.31% 21#: Before: T_{b24}: 93.60% After: T_{a24}: 93.23% ΔT_{24}: -0.20%	P
Remarks:	The pass criteria on transmittance difference before and after each test sequence are set according to JC/T 2170:2013 requirements of coated glass used in PV modules.		

Annex 1: List of measurement equipment

No.	Equipment	Identification	Next calibration date
1	Transmittance tester	OS20-02	11/02/2018
2	Temperature chamber	TT20-04	09/03/2018
3	Drying chamber	TT21-31	03/05/2019
4	Sand and dust test chamber	ES21-346	07/28/2018
5	Salt-mist corrosion test chamber	TT20-17	06/05/2018

Annex 2: Photos



Overview

---------- End of test report ----------