

Prüfbericht-Nr.: <i>Test Report No.:</i>	IN22X6N1 001	Auftrags-Nr.: <i>Order No.:</i>	146683158	Seite 1 von 06 <i>Page 1 of 06</i>	
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	2429639	Auftragsdatum: <i>Order date:</i>	2022-05-24		
Auftraggeber: <i>Client:</i>	Filmtec Solar Pvt. Ltd Survey No. 1847/1, Khadki Dungri road, Dungri Village, Vapi, Valsad, Gujarat, 396185				
Prüfgegenstand: <i>Test item:</i>	Solar PV Encapsulation Film				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	PROTEC EP UV				
Auftrags-Inhalt: <i>Order content:</i>	Comparative tracking indices of solid insulating materials				
Prüfgrundlage: <i>Test specification:</i>	IEC 60112:2020				
Wareneingangsdatum: <i>Date of receipt:</i>	2022-05-18				
Prüfmuster-Nr.: <i>Test sample No.:</i>	A003270318-001				
Prüfzeitraum: <i>Testing period:</i>	2022-05-30 to 2022-06-03				
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland (India) Pvt. Ltd. 27/B, 2nd Cross Road, Electronic City Phase I, Bangalore – 560100, India.				
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (India) Pvt. Ltd. 27/B, 2nd Cross Road, Electronic City Phase I, Bangalore – 560100, India.				
Prüfergebnis*: <i>Test result*:</i>	The test item passed the test specification(s).				
geprüft von / tested by:	2022-06-13 Manoj S / Junior Engineer				
Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name / Stellung <i>Name / Position</i>	Unterschrift <i>Signature</i>
Sonstiges/ Other Aspects: Group: Plastic and Plastic products Discipline : Mechanical Considering measurement uncertainty at 95% confidence level.					
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>			Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested					
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>					

IEC 60112:2020			
Clause	Requirement + Test	Result - Remark	Verdict

IEC 60112 - Tracking test			
Clause	Requirement – test	Result - Remark	Verdict
5	Test specimen		P
	The thickness of the test specimen shall be 3 mm or more. Individual pieces of material may be stacked to obtain the required thickness of at least 3 mm.	See Table 1	P
	Flat surfaces of not less than 20 mm × 20 mm are used to reduce the probability of electrolyte flows away from the test electrodes although smaller sizes can be used, subject to no electrolyte loss, e.g. ISO 3167, 15 mm × 15 mm multi-purpose test specimens.	30 x 30 mm	P
	Test specimens shall have uniformly smooth and untextured surfaces which are free from surface imperfections such as scratches, blemishes, impurities, etc, unless otherwise stated in the product standard. If this is impossible, the results shall be reported together with a statement describing the surface of the specimen because certain characteristics on the surface of the specimen could add to the dispersion of the results	Flat surfaces (No scratches)	P
6	Test specimen condition		P
6.1	Environmental condition		P
	Unless otherwise specified, the test specimens shall be conditioned for a minimum of 24 h at 23 °C ± 5 K, with (50 ± 10) % RH.	23.0-24.0°C, 50%RH	P
7	Test apparatus		P
7.1	Electrodes		P
	Two electrodes of platinum with a minimum purity of 99 % shall be used (see Annex C). The two electrodes shall have a rectangular cross-section of (5 ± 0,1) mm × (2 ± 0,1) mm, with one end chisel-edged with an angle of (30 ± 2)° (see Figure 1).	Width: 5.01mm (Both) Thickness: 2.01mm (left) 2.00mm(Right) Angle: 29.8° (Both)	P
	At the start of the test, the electrodes shall be symmetrically arranged in a vertical plane, the total angle between them being (60 ± 5)° and with opposing electrode faces approximately vertical on a flat horizontal surface of the test specimen (see Figure 2).	60°	P
	Their separation along the surface of the test specimen at the start of the test shall be (4,0 ± 0,1) mm.	3.99mm	P
	A thin metal rectangular slip gauge shall be used to check the electrode separation. The electrodes shall move freely and the force exerted by each electrode on the surface of the test specimen at the start of the test shall be (1,00 ± 0,05) N. The design shall be such that the force can be expected to remain at the initial level during the test	1.00N	P
7.2	Test circuit		P
	The over-current device shall operate when a current with an RMS value of (0,50 ± 0,05) A has persisted for (2,00 ± 0,20) s.	2.01s	P

IEC 60112:2020			
Clause	Requirement + Test	Result - Remark	Verdict
7.3	Test solutions		P
	Solution A: Dissolve approximately 0,1 % by mass of analytical reagent grade anhydrous ammonium chloride (NH ₄ Cl), of a purity of not less than 99,8 %, in de-ionized water to give a resistivity of (3,95 ± 0,05) Ωm at (23 ± 1) °C.	Resistivity = 3.94 Ωm	P
	Solution B: Dissolve approximately 0,1 % by mass of analytical reagent grade anhydrous ammonium chloride, of a purity of not less than 99,8 %, and (0,500 ± 0,002) % by mass of sodium-di-butyl naphthalene sulfonate in de-ionized water to give a resistivity of (1,98 ± 0,05) Ωm at (23 ± 1) °C.		N/A
	Solution C: Dissolve approximately 0,2 % by mass of analytical reagent grade anhydrous ammonium chloride (NH ₄ Cl), of a purity of not less than 99,8 %, and (0,5 ± 0,02) % by mass of a non-ionic surfactant (t-octylphenoxypolyethoxyethanol, CAS Registry Number 9002-93-1) in de-ionized water to give a resistivity of (1,98 ± 0,05) Ωm at (23 ± 1) °C and a surface tension of < 40 mN/m according to ISO 304		N/A
7.4	Dropping device		P
	The mass of a sequence of 50 drops shall lie between 0,997 g and 1,147 g. The mass of a sequence of 20 drops shall lie between 0,380 g and 0,480 g.	0.430g	P
8	Basic test procedure		P
8.1	General		P
	Tests shall be made at an ambient temperature of (23 ± 5) °C.	23.0-24.0°C	P
8.2	Preparation		P
	After each test, clean the electrodes with an appropriate solvent and then rinse and dry them with de-ionized water. If necessary, restore their shape, polish if necessary, and give a final rinse and dry before the next test		P
9	Determination of erosion		P
	Erosion depths	See Table 1	P
10	Proof tracking index test (PTI)		N/A
10.1	50 drop tests conducted in accordance with Clause 8, the specified voltage		N/A
	The proof voltage shall be an integer multiple of 25 V		N/A
11	Determination of comparative tracking index (CTI)		P
11.1	General		P
	comparative tracking index requires the determination of the maximum voltage at which five specimens withstand the test period for 50 drops without failure		P
	If this is not the case, the maximum 100 drop		N/A
11.2	Screening test		P
	For the unknown behaviour of the material, a screening test shall start with at least three specimens at a maximum starting voltage of 300 V with a minimum of 50 drops	Initial tested voltage is 300V	P

IEC 60112:2020			
Clause	Requirement + Test	Result - Remark	Verdict
	Material withstands the initial test without tracking failure and without a persistent flame, always using three specimens	Complies	P
	Voltage increased by 100V steps until a tracking failure or a persistent flame occurs	See Table 1	P
	Then reduce the test voltage by 50 V	See above	N/A
	Finally increase or reduce the test voltage by 25 V to identify the maximum test voltage for the determination of the comparative tracking index	See above	N/A
	If the material fails at the initial test voltage, reduce the test voltage by 100 V		N/A
	Then reduce the test voltage by 50 V		N/A
	Finally increase or reduce the test voltage by 25 V to identify the maximum test voltage for the determination of the comparative tracking index		N/A
11.3	Determination of the 50 drop point		P
	By inference from the 100 drop data, repeat the test procedure at an appropriate test voltage, using a new site/specimen and determine whether the specimen withstands the test for the period up to at least 25s after the 50th drop has fallen	See Table 1	P
11.4	Determination of the 100 drop point		N/A
	Using the basic procedure described in IEC 60112 clause 8, set the voltage at a selected level and make the test until at least 25s elapsed after the one hundredth drop has fallen or until previous failure occurs		N/A

IEC 60112:2020			
Clause	Requirement + Test	Result - Remark	Verdict

Table 1

Test Voltage (V)	Sample set 1	Sample set 2	Sample set 3	Sample set 4	Sample set 5	Test solution A [No of drops]	Erosion depth [mm]	Result
300	No Flame, No Track failure	No Flame, No Track failure	No Flame, No Track failure	N/A	N/A	50 drops	0.0	Pass
400	No Flame, No Track failure	No Flame, No Track failure	No Flame, No Track failure	N/A	N/A		0.0	Pass
500	No Flame, No Track failure	No Flame, No Track failure	No Flame, No Track failure	N/A	N/A		0.0	Pass
600	No Flame, No Track failure	No Flame, No Track failure	No Flame, No Track failure	No Flame, No Track failure	No Flame, No Track failure		0.0	Pass

Remark:

1. Test solution A : Ammonium chloride
2. For each test voltage, 3 different test specimens are tested from the sample sets. For 600V, 5 test specimens are tested.
3. 6 samples are stacked during testing to achieve thickness > 3mm.
Total thickness of 6 stacked material is approximately 3.16mm.
4. No erosion occurred during and after the application.

Construction (structure) details:		
1.	Part:	Back EVA sheet
2.	Material:	Ethylene vinyl acetate
3.	Colour:	Transperent
4.	Total thickness:	0.54mm
5.	Air side layer (Thickness):	N/A
6.	Middle layer / Core Layer (Thickness)::	N/A
7.	Cell side layer (Thickness):	N/A

List of test equipment used:

Testing / measuring equipment / material used, (Equipment ID)	Range used	Last Calibration date	Calibration due date
CTI Tracking Tester / G1827867	0-600V	2021-12-27	2022-12-27
Vernier Caliper / G1827556	0-200mm	2022-03-07	2023-03-07
Digital Multimeter / G1827414	600V, 10A	2021-11-16	2022-11-16
Weighing scale / G1827434	500g, least count: 0.01g	2022-03-07	2023-03-06
Hygrometer / G1827452	-10 to 50°C, 10-99%RH	2021-11-15	2022-11-14

*****End of test Report*****