


TEST REPORT
IS 14286: 2010
Crystalline Silicon Terrestrial Photovoltaic (PV) Modules
Design Qualification and Type Approval

Report Reference No:	SC25SPI00947_1
Date of issue :	11/06/2025
Total number of pages	80
Testing Laboratory	URS PRODUCTS AND TESTING PRIVATE LIMITED
Address	A-29, Sector 5, Noida-201301, India
Applicant's name :	ARMY SOLAR ENERGY PRIVATE LIMITED
Address	NEW BLOCK NO. 119, MOLVAN KARANJ, MOLVAN PANETHA ROAD, SURAT, GUJARAT, 394110
Test specification:	
Standard	IS 14286: 2010
Test procedure	Compliance Report
Non-standard test method	N/A
Test Report Form No:	IS 14286_V1.0
Test Report Form(s) Originator	Bureau of Indian Standards
Master TRF	Dated: 19.02.2018
Test item description:	Crystalline Silicon Terrestrial Photovoltaic (PV) Modules (Si Wafer Based)
Trade Mark	
Manufacturer	ARMY SOLAR ENERGY PRIVATE LIMITED
Factory	NEW BLOCK NO. 119, MOLVAN KARANJ, MOLVAN PANETHA ROAD, SURAT, GUJARAT, 394110
Model/Type reference	Model Tested: AS-156TG-650 (Representative & retested Model) (156 Cut cell family)
	<p>Series Model:</p> <p>156 Cut cell family with 1500V system voltage: AS-156TG-645, AS-156TG-640, AS-156TG-635, AS-156TG-630, AS-156TG-625, AS-156TG-620, AS-156TG-615, AS-156TG-610, AS-156TG-605,</p> <p>144 Cut cell family with 1500V system voltage: AS-144TG-600, AS-144TG-595, AS-144TG-590, AS-144TG-585, AS-144TG-580, AS-144TG-575, AS-144TG-570, AS-144TG-565, AS-144TG-560, AS-144TG-555, AS-144TG-550, AS-144TG-545, AS-144TG-540</p> <p>132 Cut cell family with 1500V system voltage: AS-132TG-535, AS-132TG-530, AS-132TG-525, AS-132TG-520, AS-132TG-515, AS-132TG-510, AS-132TG-505, AS-132TG-500, AS-132TG-495, AS-132TG-490</p> <p>120 Cut cell family with 1500V system voltage: AS-120TG-485, AS-120TG-480, AS-120TG-475, AS-120TG-470, AS-120TG-465, AS-120TG-460, AS-120TG-450, AS-120TG-445, AS-120TG-440</p>
Ratings	See copy of Marking label and General product information.



Dated : 11/06/2025

Testing procedure and testing location:	
Testing Laboratory	URS PRODUCTS AND TESTING PRIVATE LIMITED
Testing location/ address	A-29, Sector 5, Noida-201301, India
Tested by (name + signature).....	<p style="text-align: center;"><u>Vikas</u></p> <p>Vikas , Analyst</p>
	
Approved by (+ signature)	<p style="text-align: center;">  Paras Singh , Vice President (Technical) </p>
Issued by (+ signature)	<p style="text-align: center;">  Paras Singh , Vice President (Technical) </p>

Dated : 11/06/2025

Summary of testing:	
Tests performed (name of test and test clause):	Testing location:
	A-29, Sector 5, Noida-201301, India
10.1 Visual Inspection	
10.2 Maximum Power Determination	
10.3 Insulation Test	
10.4 Measurement of Temperature Coefficients.	
10.5 Measurement of NOCT	
10.6 Performance at STC and NOCT	
10.7 Performance at low irradiance.	
10.8 Outdoor exposure test	
10.9 Hot-spot endurance test	
10.10 UV preconditioning	
10.11 Thermal cycling test	
10.12 Humidity freeze test	
10.13 Damp heat test	
10.14 Robustness of termination test	
10.15 Wet leakage current test	
10.16 Mechanical load test	
10.17 Hail test	
10.18 Bypass diode thermal test	

Clause	Requirement+ Test	Result-Remark	Verdict
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GENERAL INFORMATION	
Test item particulars:	Crystalline Silicon Terrestrial Photovoltaic (PV) Modules (Si Wafer Based)
Accessories and detachable parts included in the evaluation	N/A
Options included	N/A
Abbreviations used in the report:	
HF – Humidity Freeze	TC – Temperature Cycling
DH – Damp Heat	Vmp – Maximum power voltage
I _{mp} – Maximum power current	V _{oc} – Open circuit voltage
I _{sc} - Short circuit current	FF – Fill Factor
P _{mp} – Maximum power	α – Current temperature coefficient
NOCT – Nominal Operating Cell Temperature	β – Voltage temperature coefficient
STC – Standard Test Conditions	δ – power temperature coefficient
Possible test case verdicts:	
- test case does not apply to the test object	N/A (Not Applicable)
- test object does meet the requirement	Pass (P)
- test object does not meet the requirement	Fail (F)

General Remarks

The test results presented in this report relate only to the object tested.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

"(See Enclosure #)" refers to additional information appended to the report.

"(See appended table)" refers to a table appended to the report.

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

Clause	Requirement+ Test	Result-Remark	Verdict
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General Product Information:

PV module type reference.....:	AS-156TG-650 (Representative & retested Model)
Product Electrical Ratings at STC	
Nominal maximum power (Pmax).....:	650W
Nominal open circuit voltage at (Voc).....:	57.00V
Nominal short circuit current at (Isc).....:	14.83A
Nominal maximum power voltage (Vpm).....:	46.09V
Nominal maximum power current (Ipm).....:	14.11A

Product Safety Ratings	
Maximum system voltage.....:	1500V
Maximum over-current protection rating.....:	30A
Safety application class.....:	Class A
Safety class in accordance with IS 61140.....:	Class II
Fire safety class.....:	Class C
Recommended maximum series/parallel module configurations.....	24 Pcs each series

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Description of module construction:


A1.1	MODULE TYPE/S
	Model Tested: AS-156TG-650(Representative & retested Model)

A1.2	MODULE DESIGN –DIMENSIONS				
	Module dimensions (L x W x H) [mm].....: <table border="0" style="float: right; margin-left: 20px;"> <tr> <td>2466* 1134*30 for 156 Half cut cell family</td> </tr> <tr> <td>2278* 1134*30 for 144 Half cut cell family</td> </tr> <tr> <td>2092* 1134*30 for 132 Half cut cell family</td> </tr> <tr> <td>1908* 1134*30 for 120 Half cut cell family</td> </tr> </table>	2466* 1134*30 for 156 Half cut cell family	2278* 1134*30 for 144 Half cut cell family	2092* 1134*30 for 132 Half cut cell family	1908* 1134*30 for 120 Half cut cell family
2466* 1134*30 for 156 Half cut cell family					
2278* 1134*30 for 144 Half cut cell family					
2092* 1134*30 for 132 Half cut cell family					
1908* 1134*30 for 120 Half cut cell family					

A1.3	SOLAR CELL												
	<table border="0" style="width: 100%;"> <tr> <td style="width: 40%;">Cell type reference.....:</td> <td style="width: 40%;"> Main: CZJT-182M-16D1(F172R174), N-type TOPCon Manufactured by: JTPV Alternate: M18316BTP50, Monocrystalline Bifacial TOPCon Solar Cell Manufactured by: SolarSpace Technology Co., Ltd </td> <td style="width: 20%; text-align: center;">BOM 1</td> </tr> <tr> <td>Cell dimensions L x W x T (± %) [mm].....:</td> <td> Main: 91.1mm *183.75mm (±0.5 mm) Alternate: 91.1mm *183.75mm (±0.25 mm) </td> <td style="text-align: center;">BOM 1 BOM 2</td> </tr> <tr> <td>Cell thickness [µm].....:</td> <td> Main: 130 ± 13 µm Alternate: 130 ± 13 µm </td> <td style="text-align: center;">BOM 1 BOM 2</td> </tr> <tr> <td>Cell area [cm²].....:</td> <td> Main: 167.39 Alternate: 167.39 </td> <td style="text-align: center;">BOM 1 BOM 2</td> </tr> </table>	Cell type reference.....:	Main: CZJT-182M-16D1(F172R174), N-type TOPCon Manufactured by: JTPV Alternate: M18316BTP50, Monocrystalline Bifacial TOPCon Solar Cell Manufactured by: SolarSpace Technology Co., Ltd	BOM 1	Cell dimensions L x W x T (± %) [mm].....:	Main: 91.1mm *183.75mm (±0.5 mm) Alternate: 91.1mm *183.75mm (±0.25 mm)	BOM 1 BOM 2	Cell thickness [µm].....:	Main: 130 ± 13 µm Alternate: 130 ± 13 µm	BOM 1 BOM 2	Cell area [cm²].....:	Main: 167.39 Alternate: 167.39	BOM 1 BOM 2
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Cell thickness [µm].....:	Main: 130 ± 13 µm Alternate: 130 ± 13 µm	BOM 1 BOM 2											
Cell area [cm²].....:	Main: 167.39 Alternate: 167.39	BOM 1 BOM 2											

A1.4	IDENTIFICATION OF MATERIALS		
	<table border="0" style="width: 100%;"> <tr> <td style="width: 30%;">Front cover.....:</td> <td> High transmission low iron tampered AR Coated glass, Thickness: 2.0mm±0.20mm, Manufactured by XINYI SOLAR (MALAYSIA) SDN BHD. Alternate manufacturer: <ol style="list-style-type: none"> 1. VISHAKHA GLASS PRIVATE LIMITED 2. BOROSIL RENEWABLES LIMITED 3. FLAT GLASS GROUP CO., LTD 4. CSG HOLDING CO., LTD 5. HENAN ANCAI HI-TECH CO. LTD 6. Shenzhen topray solar 7. Zhejiang Ninghai KIBING 8. SS GROW TECHNOCRATS 9. Gold Plus Float Glass Private Limited 10. WUJIANG CSG 11. FLAT VIETNAM CO. LTD 12. SBH KIBING SOLAR NEW MATERIALS M SDN BHD 13. XINYI SOLAR MALAYSIA SDN BHD 14. HENAN ANCAI HI TECH CO LTD 15. XINYI SOLAR HONGKONG LTD </td> </tr> </table> <p>Note: Alternate Front cover having same materials,same production process, and</p>	Front cover.....:	High transmission low iron tampered AR Coated glass, Thickness: 2.0mm±0.20mm, Manufactured by XINYI SOLAR (MALAYSIA) SDN BHD. Alternate manufacturer: <ol style="list-style-type: none"> 1. VISHAKHA GLASS PRIVATE LIMITED 2. BOROSIL RENEWABLES LIMITED 3. FLAT GLASS GROUP CO., LTD 4. CSG HOLDING CO., LTD 5. HENAN ANCAI HI-TECH CO. LTD 6. Shenzhen topray solar 7. Zhejiang Ninghai KIBING 8. SS GROW TECHNOCRATS 9. Gold Plus Float Glass Private Limited 10. WUJIANG CSG 11. FLAT VIETNAM CO. LTD 12. SBH KIBING SOLAR NEW MATERIALS M SDN BHD 13. XINYI SOLAR MALAYSIA SDN BHD 14. HENAN ANCAI HI TECH CO LTD 15. XINYI SOLAR HONGKONG LTD
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Clause	Requirement+ Test	Result-Remark	Verdict
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	Rear cover.....:	<p>same quality level, only change in manufacturer name as per declared by manufacturer.</p> <p>High transmission low iron tempered glass, Thickness: 2.0mm±0.20mm, Manufactured by XINYI SOLAR (MALAYSIA) SDN BHD.</p> <p>Alternate manufacturer:</p> <ol style="list-style-type: none"> VISHAKHA GLASS PRIVATE LIMITED BOROSIL RENEWABLES LIMITED FLAT GLASS GROUP CO., LTD CSG HOLDING CO., LTD HENAN ANCAI HI-TECH CO. LTD Shenzhen topray solar Zhejiang Ninghai KIBING SS GROW TECHNOCRATS Gold Plus Float Glass Private Limited WUJIANG CSG FLAT VIETNAM CO. LTD SBH KIBING SOLAR NEW MATERIALS M SDN BHD XINYI SOLAR MALAYSIA SDN BHD HENAN ANCAI HI TECH CO LTD XINYI SOLAR HONGKONG LTD <p>Note: Alternate Rear cover having same materials,same production process, and same quality level, only change in manufacturer name as per declared by manufacturer.</p>	
	Encapsulation material.....:	<p>Main: Front: EP304, Ultra-clear PID free, Thickness: 0.50±0.10mm, Back: F406PS, Ultra-clear PID free, Thickness: 0.50±0.10mm Manufactured by HANGZHOU FIRST APPLIED MATERIAL CO., LTD</p>	BOM 1
		<p>Alternate: Front: Vishakha EPE, Thickness: Thickness: 0.50±0.10mm, Back: Vishakha EPE, Thickness: Thickness: 0.50±0.10mm Manufactured by VISHAKHA RENEWABLES PRIVATE LIMITED</p>	BOM 2
	Frame parts.....:	<p>6005-T6, Anodized Aluminium Alloy, Thickness: 30mm, Manufactured by Anhui Xinbo Technology Co., Ltd</p> <p>Alternate manufacturer:</p> <ol style="list-style-type: none"> JIANGYIN TINZE NEW ENERGY TECHNOLOGY CO., LTD JIANGSU SULV NEW MATERIAL TECHNOLOGY CO., LTD FUZHOU ANTONG NEW MATERIAL TECHNOLOGY CO.,LTD Sudarshan Aluminium India Limited Regal Allufin Industries Regal Aluminum company Vishakha Metals Pvt. Ltd. J.M. Industries WUXI U PLUS TECHNOLOGY CO., LTD. Jiangyin Enor New Material Technology Co.,Ltd. (Lufang) Fujian Fenan Aluminium Co. LTD Jiangsu Dinghao Aluminium Technology Co., Ltd. 	

Clause	Requirement+ Test	Result-Remark	Verdict
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13. Jiangyin Tianmu Green Energy Technology Co.,Ltd
 14. jiangyin PV Tech Chaoyang
 15. Yonz Technology Co., Ltd
 16. Mr Industries
 17. Zhejiang Jianxing Taihe New Energy Technology Co., Ltd.
 18. Shandong Tianqu Aluminum Co. Ltd
 19. Galco Extrusions Pvt. Ltd
 20. Changzhou Lifeng Energy Technology Co; Ltd.
 21. Vinitech Metal Private Limited
 22. Dharmik Industries
 23. Jia Yue Group Co Ltd
 24. Jiangyin Optimal Metal Technology Co.,Ltd
 25. Jiangyin New Sulv Technology Co Ltd
 26. Vima Engineering Company
 27. Chizhou Anan Aluminum Co., Ltd.
 28. Suzhou Sentong Photovoltaic Co., Ltd.
 29. PanAsia enterprises(Nanyang)company limited
 30. Jiangyin Renyu Metal products co.Ltd
 31. Hebei Xindongrui alloy material Tech. Co. Ltd
 32. Orin Metals Private Limited
 33. Angel extrusion pvt ltd
 34. Y S metal
 35. SS GROW TECHNOCRATS
Note: Alternate Frame having same Cross section, same framing material, same mounting technique, only change in manufacturer name as per declared by manufacturer.

Mounting parts.....: As per installation manual

Adhesive for frame.....: HT906Z, High-performance RTV sealant, White paste, Manufactured by Shanghai Huitian New Material Co., Ltd.
Alternate manufacturer:
 1. TONSAN Adhesive, Inc.
 2. Adarsha Specialty Chemicals Pvt Ltd
 3. Fasto Advance Materials India Pvt. Limited
 4. Sikasil
 5. Huitian
 6. Silande
Note: Alternate Adhesive for frame having same technical specification & same material, only manufacturer name change as Declared by manufacturer.

Cell connector.....: Sn60%Pb40%, PV Ribbon (Round wire), ϕ 0.26mm, Manufactured by TaiCang JuRen PV Material Co.,Ltd
Alternate manufacturer:
 1. Valeo Products LLP
 2. A B INDUSTRIES
 3. Suzhou YourBest New-type Materials Co., Ltd
 4. VIDYA WIRES PVT LTD
 5. RAPID WIRE

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		<p>6. Xi'an Telison New Materials Co., Ltd. 7. Jiangsu Fier New Energy 8. Jiangsu Fier New energy company 9. KOS Limited 10. Gadhpat Energy pvt.ltd 11. Ferron industries 12. Shanghai Sunby Solar Technologies Co., Ltd, 13. TAICANG JUREN PHOTOVOLATAIC MATERIAL CO., LTD</p> <p>Note: Alternate Cell connector having same interconnect material, same bonding technique, same number of interconnects, same number of solder bonds per cell, and flux, only change in thickness (tolerance) as per declared by manufacturer.</p>	
String connector.....:		<p>Sn60%Pb40%, Copper component: ≥99.99%, Dimension: 0.40 ±0.010mm*4±0.10mm, Manufactured by TaiCang JuRen PV Material Co.,Ltd</p> <p>Alternate manufacturer:</p> <p>1. Valeo Products LLP 2. A B INDUSTRIES 3. Suzhou YourBest New-type Materials Co., Ltd 4. VIDYA WIRES PVT LTD 5. RAPID WIRE 6. Xi'an Telison New Materials Co., Ltd. 7. Jiangsu Fier New Energy 8. Jiangsu Fier New energy company 9. KOS Limited 10. Gadhpat Energy pvt.ltd 11. Ferron industries 12. Shanghai Sunby Solar Technologies Co., Ltd, 13. TAICANG JUREN PHOTOVOLATAIC MATERIAL CO., LTD</p> <p>Note: Alternate String connector having same interconnect material, same bonding technique, same number of interconnects, same number of solder bonds per cell, and flux, only change in thickness(tolerance) as per declared by manufacturer.</p>	
Fluxing agent.....:		<p>952-S, Low-Solids No-Clean Flux, Manufactured by Kester</p> <p>Alternate manufacturer:</p> <p>1. superior 2. asahi 3. Arbital Solutions Private Limited 4. Henkel Corporation 5. METAL CHEM 6. ALPHA Telecore 7. Reality chemicals 8. HuaiHui 9. KHANNA BOND SOLDER MANUFACTURERS PVT LTD 10. Fasto 11. cooksun india pvt ltd 12. National Products</p> <p>Note: Alternate Fluxing agent having same technical specification & same material,</p>	

Clause	Requirement+ Test	Result-Remark	Verdict
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	Junction box.....	<p>only manufacturer name change as Declared by manufacturer.</p> <p>Main: PV-HT021x, Rated Voltage: 1500VDC, Current: 30A, IP68, Ambient temperature: -40°C to +85°C, Manufactured by Jiangsu Haitian Microelectronics Corp. Tested by TUV SUD, Certificate no.: B 096995 0002</p>	BOM 1
		<p>Alternate: DSJB12y (y=c), Rated Voltage: 1500VDC, Current: 30A, IP68, Ambient temperature: -40°C to +85°C, Manufactured by Dhash PV Technologies Private Limited Tested by TUV Rheinland, Certificate no.: R 50535496</p>	BOM 2
	C a b l e	<p>62390 IEC 131, 1x4.0mm², HALOGEN FREE LOW SMOKE, Rated Voltage: 1500VDC, Ambient temperature: -40°C to +90°C, Max. Temperature at Conductor:120°C, Manufactured by Jiangsu Haitian Microelectronics Corp. Tested by TUV Rheinland, test report no. 50308660 001</p>	BOM 1
		<p>Alternate: 62390 IEC 131, 1x4.0mm², Rated Voltage: 1500VDC, Ambient temperature: -40°C to +90°C, Max. Temperature at Conductor:120°C, Manufactured by Dhash PV Technologies Private Limited Tested by TUV Rheinland, Certificate no.: R 50520444</p>	BOM 2
	Connector.....	<p>PV-HT03x(x= 0 or 1), Rated Voltage: 1500VDC, Rated current: 45A, IP68, Ambient temperature: -40°C to +85°C, Manufactured by Jiangsu Haitian Microelectronics Corp. Tested by TUV SUD, Certificate no.: B 096995 0003</p>	BOM 1
	Bypass diode.....	<p>Alternate: DS01, Rated Voltage: 1500VDC, Rated current: 35A, IP68, Ambient temperature: -40°C to +85°C, Manufactured by Dhash PV Technologies Private Limited Tested by TUV Rheinland, Certificate no.: R 60152493</p>	BOM 2
	Potting material.....	<p>MK5045, IF(AV)=35A, V_{RRM}= 45V, T_j = -55°C to +200°C, RθJ-C: 1°C/W, Manufactured by Jiangsu Haitian Microelectronics Corp.</p> <p>5299W-S, RTV silicone potting compound, White, Manufactured by Shanghai Huitian New Material Co., Ltd.</p> <p>Alternate manufacturer:</p> <ol style="list-style-type: none"> 1. TONSAN Adhesive, Inc. 2. Adarsha Specialty Chemicals Pvt Ltd 3. Fasto Advance Materials India Pvt. Limited 4. Sikasil 5. Huitian 6. Silande <p>Note: Alternate Potting material having same technical specification & same material, only manufacturer name change as Declared by manufacturer.</p>	
	Adhesive for junction box.....	<p>HT906Z, High-performance RTV sealant, White paste, Manufactured by Shanghai Huitian New Material Co., Ltd.</p> <p>Alternate manufacturer:</p>	



Clause	Requirement+ Test	Result-Remark	Verdict
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		<ol style="list-style-type: none"> 1. TONSAN Adhesive, Inc. 2. Adarsha Specialty Chemicals Pvt Ltd 3. Fasto Advance Materials India Pvt. Limited 4. Sikasil 5. Huitian 6. Silande <p>Note: Alternate Adhesive for junction box having same technical specification & same material, only manufacturer name change as Declared by manufacturer.</p>	
	Additional material (e. g. insulation tape)...:	<p>Soldering Wire: NO CLEAN FLUX CORED SOLDER WIRE, Manufactured by Kester LLC</p> <p>Alternate manufacturer:</p> <ol style="list-style-type: none"> 1. HYBRID METALS PVT LTD 2. Stannol 3. superior 4. Persang alloy industries pvt ltd 5. KOTHARI METSOL PVT. LTD. 6. Khanna Traders & Engineers <p>Note: Alternate Soldering wire having same technical specification & same material, only manufacturer name change as Declared by manufacturer.</p>	

A1.5	MODULE DESIGN - MINIMUM DISTANCES	
	Between cells.....:	1.5mm
	Between cell and edge of laminate.....:	15mm
	Between any current carrying part and edge of laminate...:	26.5mm

A1.6	MODULE DESIGN - ELECTRICAL CONFIGURATION	
	Total number of cells.....:	156 for 156 Half cut cell family 144 for 144 Half cut cell family 132 for 132 Half cut cell family 120 for 120 Half cut cell family
	Serial-parallel connection of cells.....:	Series-parallel
	Cells per bypass diode.....:	52 for 156 Half cut cell family 48 for 144 Half cut cell family 44 for 132 Half cut cell family 40 for 120 Half cut cell family
	No. of bypass diodes.....:	3

Note: Bill of material are same for all series family models.