

F. No. 41/3/2018-SPV Division
Government of India / भारत सरकार
Ministry of New & Renewable Energy / नवीन एवं नवीकरणीय ऊर्जा मंत्रालय


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Lodhi Road, Near CGO Complex
New Delhi -110003
Date: 09-06-2023

Office Memorandum

Subject: Standard format of the Test Report of Solar PhotoVoltaic (SPV) water pumping system.

Ministry has issued the updated specifications and testing procedure for the Solar PV water pumping systems to be used in the agriculture sector on 22.03.2023. So far, different labs follow different formats for the test report of the SPV Water Pumping system. In order to standardize the format across all the labs in the country, a standard format of the Test Report (attached as Annexure) is being issued which is to be followed by all the labs testing Solar Water Pumping system under the PM-KUSUM scheme, with the immediate effect.

2. This issue with the approval of the Competent Authority.


(Dr. Nikhil Gakkhar) 9/6/23

Scientist-C

To:

All concern.

DRAFT OF TEST REPORT

ON

SOLAR PHOTOVOLTAIC WATER PUMPING SYSTEM

(.....HP; AC/DC; Surface/Submersible; Dynamic Head....m; Shut off Head....m; Model No)

Sample Number	
Date of Sample Submission	
SPV Pump System Submitted By	
Motor & Pump Manufacturer Name	
Controller Manufacturer Name	
Module Manufacturer Name	
No. of Stages in the Pump	
Diameter of Stage of the Pump	
Gross weight of Motor & Pump	

1.	Service Request No.	
2.	Requested By (Name & Address of the organization)	
3	Trademark of Customer(Photograph Of Logo of company)	
4.	Details of the test item	
	System Type (AC/DC) and (Surface/Submersible)	
	Type (Oil Filled/Water Filled)	
	Capacity of the System	-- HP
	Total Dynamic Head	-- m
	Total Shut-off Head	-- m
	Test Model Number as per MNRE Specification	Model----- of Annexure----
	SPV Array Capacity wrt Model as per MNRE Specification	-----Wp
	Peak power output of SPV module under STC. By using AAA sun simulator	---- Wp
	I. Motor-Pump	
	a) Sample Number	
	b) Capacity/Rating	-- HP
	c) Capacity/Rating of Motor	---kW (it should be approximately equal to 0.746*...HP)
	d) Manufactured By	
	e) Model / Type No.	
	f) Number of stages in the pump	----
	g) Height of Each Stage	----mm
	h) Outer Diameter of pump	----mm
	i) Serial No. Of Pump	
	j) Serial No. Of Motor	
	k) Attach the specification of Motor-Pump set	Annexure.... (along with the curve for the pump-set wrt to the BEP)
	II. Controller	
	a) Sample Number	
	b) Capacity/Rating	-----W
	c) Operation Voltage Range	-----V to -----V
	d) Manufactured By	
	e) Model / Type No.	
	f) Serial No.	
	g) Attach the specification of Controller	Annexure
	III. Module	
	a) Sample Number	
	b) Capacity/Rating	-----Wp for all the modules (0/+3%)
	c) Number of Modules	

	d) Type of Modules (Mono/Multi/PERC/HJT/Topcon)	
	e) Manufactured By	
	f) Model/Type No.	
	g) Serial No. of all the Modules	
	h) Attach the specification of Modules	Annexure.....
	i) For Detail refer to Annexure-A	
5.	Testing Procedure and Testing Parameters	
6.	Condition of samples on receipt	
7.	Date of Completion of Tests	

NOTE:

- The results reported in the Test Report are valid at the time of and under the stipulated conditions of measurements.

MAJOR EQUIPMENTS USED

S.No.	Equipment Used	Model	Last calibration date
1			
2			
3			
4			

Abbreviations used in this Report

STC	- Standard Test Conditions
MNRE	- Ministry of New & Renewable Energy
AC	- Alternating Current
DC	- Direct Current
BLDC	- Brushless Direct Current
PMSM	- Permanent Magnet Synchronous Motor
SRM	- Switched Reluctance Motor
PV	- Photo Voltaic
IEC	- International Electrotechnical Commission
IS	- Indian Standard
IP	- Ingress Protection
P_{max}	- Maximum Power
V_{max}	- Voltage at Maximum Power
I_{max}	- Current at Maximum Power
V_{oc}	- Open-Circuit Voltage
I_{sc}	- Short-Circuit Current
F.F.	- Fill Factor
M. Eff.	- Maximum Efficiency
BEP	- Best Efficiency Point
ALMM	-Approved List of Module Manufacturer

(Lab: Test Detailed Report with Annexures (If Any))

S.no	Claus e no.	Test Description	As per MNRE specifications, Annexure-A of Circular No. F. No. 41/3/2018-SPV Division dated 22/03/2023(Which to be updated from time to time)	Results	Remarks
1	3	Constructional features			
1.1	3.4.1	Pump set:	i) submersible pumps or ii) Surface pumps	Visually check	
1.2	3.4.2	Motor	i) AC induction motor or ii) DC motor/PMSM /SRM	Visually check	
1.3	3.2.2	SPV Controller			
1.4	3.2.3	Whether it is checked controller assigned with an unique serial number	Controller must be assigned with a unique serial number and its live status must be observed remotely on online portal through login credentials.	S.No.....	
1.5	3.2.2	Controller power capacity	Controller Power Capacity should be at-least equal to Solar Panels Power Capacity (Wp), not Pump Capacity. Example: For 5HP pumps, the pump capacity will be 3750W as per MNRE Specs, the solar panel capacity will be at-least 4800Wp the controller capacity should match the solar panel capacity.Wp	

1.6	3.2.2	Whether it is checked MPPT functioning properly	Should track power only and not Voltage at Maximum power point.	Yes	
1.7	3.2.2	Whether it is checked controller fitted with Remote Monitoring System	Controller shall be integrated with Remote Monitoring System with GSM/GPRS and Geo tagging.	Visually check ,Yes	Declaration from vendor. (To be attached with the report)
1.8	3.6.6	The parameters available on the controller display/screen	The various parameters should be present on the SPV Pump Controller display/screen such as:- Pump On/Off status, Array Input DC Voltage, DC/AC output Current & voltage, operating frequency, Latest RMS Latitude, Latest RMS Longitude, Pump Capacity (HP), PV Module Capacity (KW), Pump Status, Current Generation (kW), Today Solar Generation (kWh), Cumulative Solar Generation (kWh), Today Runs Hours (Hrs.), Cumulative Pump Run Hours (Hrs.), Cumulative Water Discharged (Litres), Total Water Discharged (Litres), Peak Power (kW) supplied by the controller to Motor-Pump Set.	<ol style="list-style-type: none"> 1. Pump On/Off status..... 2. Array Input DC Voltage..... 3. DC/AC output Current & voltage..... 4. Operating frequency..... 5. Latest RMS Latitude..... 6. Latest RMS Longitude..... 7. Pump Capacity (HP)..... 8. PV Module Capacity (KW)..... 9. Pump Status, Current Generation (kW)..... 10. Today Solar Generation (kWh)..... 11. Cumulative Solar Generation (kWh)..... 12. Today Runs Hours (Hrs.)..... 13. Cumulative Pump Run Hours (Hrs.)..... 	Visually check, fill details of parameter.

				14. Cumulative Water Discharged (Litres)..... 15. Total Water Discharged (Litres)..... 16. Peak Power (kW) supplied by the controller to Motor-Pump Set.....	
1.9	3.2.3 (d)	Whether it is checked Controller shall have a back up to store the data locally(at least for 1 year)	Controller shall have a back up to store the data locally(at least for 1 year)	Yes, May check for storage capacity.	Declaration from vendor. (To be attached with the report)
2.0	3.2.3 (c)	Whether it is checked the parameters of the SPV water pumping system available on the portal	The parameter shall be logged at an interval of 10min to the portal	Yes; The value of parameters should be same as it is available on the controller display/screen.	Attach the screenshot of the parameters from the portal at an interval of minimum 11 min gap as mentioned in Annexure B of this test report.
2.1	Annexure I – a(iv)	Whether it is checked the provision for analog and digital input available with the controller/RMS.	RMS should have provision for at least two Analog and Digital inputs.	Visually check availability for ports. Yes/No	
2.2	Annexure I – a(ii)	The Remote connectivity available with the RMS	RMS of SWPS should use GSM/GPRS/2G/3G/4G cellular connectivity.	Available Network in the controller at the time of testing : GSM/GPRS/2G/3G/4G	Declaration from vendor regarding modem. (To be attached with the report)

2.3	Annexure I – a(iii)	The local connectivity available with the RMS	Ethernet/Bluetooth/Wi-Fi connectivity to configure parameters, notifications, communication interval, set points etc. or to retrieve locally stored data	Which connectivity is offered for local data transfer: (Ethernet/Bluetooth/Wi-Fi)	Declaration from vendor regarding local connectivity (To be attached with the report)
2.4.	Annexure I – d	The Latitude and Longitude	Real time latitude and longitude should be captured with mismatch of less than 10m horizontal.	Lat _____ (deg); Long _____ (deg)	The mismatch between Lat Long Coordinates of testing facility and Lat Long pushed by RMS system should be less than 10m Horizontal. Attach the screen shot of the comparison between Lat Long Coordinates of testing facility and Lat Long pushed by RMS.(Refer to Annexure B of this Test Report)
S.no.	Clause no.	Test Description	As per MNRE specifications, Annexure-A of Circular No. F. No. 41/3/2018-SPV Division dated 22/03/2023 (Which to be updated from time to time)	Results	Remarks
2.	3.3	Solar Photo Voltaic Array (SPV)			
2.1	3.3.1	1.SPV array Open Circuit Voltage 2.SPV array Max Peak Voltage		_____ V _____ V	
2.2	3.3.5	Whether it is checked SPV array Open circuit voltage is more	Module must qualify to IS 17210(Part I)	Yes/No; If Yes Certificate against IS 17210.	Copy of Certificate

		than 600VDC			
2.3	3.3.2	Whether it is checked the certificate against IS 14286/IEC 61215	Modules should have qualification Test Certificate as per 14286/IEC 61215	Yes	Copy of Certificate
2.4	3.3.3	Whether it is checked the certificate against IS/IEC 61730 Part I & Part II	Modules must qualify to IS/IEC 61730 Part I & Part II	Yes	Copy of Certificate
2.5	3.3.6	Is the certificate against IEC/IS 61701 is available	Modules must qualify to IEC/IS 61701 for use in coastal areas	Yes/No	Copy of Certificate
2.6	3.3.1	Array Capacity at STC, Watt peak (Wp) Type of modules	For e.g.: -Should be.....Wp under STC as per Model-.....of Annexure..... (Mono/Multi/PERC/HJT/Top con)-Crystalline Silicon	----Wp Crystalline Silicon	
2.7	3.3.4	Module efficiency Fill Factor	Should be minimum 19 % Shall be more than 75%% %	
2.8	3.3.7	Name plate	Shall conform the IS 14286: 2010/ IEC 61215	Yes/No	
2.9	3.3.8	Module to module wattage mismatch	The SPV array mismatch shall be with in ± 3 percent	\pm%	
2.10		Module to module voltage mismatch	Voc Vmp	\pm% \pm%	
2.11		Module to module Current mismatch	Isc Imp	\pm% \pm%	
2.12	3.3.9	Variation in overall SPV array wattage from the specified wattages	Any array capacity above the minimum array wattage requirement as specified in these specifications for various models of Solar%, more than the specified.	

			Pumping systems is allowed.		
2.14	3.3.11	Is RFID Tag available	RFID Tag shall be placed inside the glass laminate of the SPV Module	Visually check, Yes	Inside the glass
4.	Electronics and Protections				
4.1	3.6.2	IP 65 Protection	The SPV Controller with RMS must have IP (65) protection	Report with no.....” for the IP certification is attached at Annexure-.....	
4.2	3.6.3	SPV controller protections			
		a) Dry running b) Open circuit c) Accidental output short circuit d) Under voltage e) Reverse polarity f) Surge protection to arrest high current surge	Required	a) Provided/Not Provided b) Provided/Not Provided c) Provided/Not Provided d) Provided/Not Provided e) Provided/Not Provided	
5	TESTS FOR HYDRAULIC AND ELECTRICAL PERFORMANCE OF PUMPSET				
5.1	5.1	Testing of the Motor pump set for hydraulic & Electrical performance.	The AC motor-pump set shall be tested independently for hydraulic and electrical performance as per the relevant IS specification including the following test a) Constructional requirements/features b) General requirements c) Design features d) Insulation resistance test e) High voltage test f) Leakage current test In case of the DC motor-pump	Report from NABL accredited labs with no.....” for the hydraulic & Electrical performance is attached at Annexure-.....	Declaration to be attached with the report

			<p>set for (a), (b), (c) declaration will be given by the vendor</p> <p>and for (d), (e), (f) the relevant clause of IS 9283:2013 will be followed for testing until BIS notifies the Standard about it. Once the Standard gets released, then it will be effective for</p> <p>DC motor-pump set from its Date of notification.</p>		
<p>Simulator Methods (Annexure-___) of MNRE Circular No. F. No. 41/3/2018-SPV Division dated 22/03/2023</p>					
		<p>Estimated output in litres per watt STC/day at an Irradiation of 7.15 kWh/m² and at a Total dynamic head of __ meters in Hot Profile.</p>	<p>Litre/Wp</p>	<p><i>Litre/Wp</i></p>	
		<p>Estimated Total water output in litres per/day at an Irradiation of 7.15 kWh/m² and at a Total dynamic head of __ meters in Hot Profile.</p>	<p>Litres</p>	<p><i>Litres</i></p>	
		<p>Estimated output in litres per watt STC/day at an Irradiation of 7.15 kWh/m² and at a Total dynamic head of __ meters in Cold Profile.</p>	<p>Litre/Wp</p>	<p><i>Liter/Wp</i></p>	
		<p>Estimated Total water output in litres per/day at an Irradiation of 7.15 kWh/m² and at a Total dynamic head of __ meters in Cold Profile.</p>	<p>Litres</p>	<p><i>Liters</i></p>	

Outdoor Condition using sun radiation:					
		Estimated output in litres per watt STC/day at an Irradiation of 7.15 kWh/m ² and at a Total dynamic head of __ meters in Outdoor Condition using sun radiation (Dawn to Dusk).	Litre/Wp	<i>Litre/Wp</i>	
		Estimated Total water output in litres per/day at an Irradiation of 7.15 kWh/m ² and at a Total head of __ meters in Outdoor Condition using sun radiation. (Dawn to Dusk).	Litres	<i>Litres</i>	

Test Results: The Water pumping System sample was tested at this Laboratory as per standard test procedure *Specified by MNRE at Annexure-B of Circular No. F. No. 41/3/2018-SPV Division dated 22/03/23.*

*SPV Water pumping system **meet/did not meet the requirements** as per MNRE specifications, Annexure-A of Circular No. F. No. 41/3/2018-SPV Division dated 22/03/23, against model no _____; of _____ HP; Surface /Submersible ;AC/DC; Pump*

Calculate the given below parameters as per cold profile

- Water flow started at XX W/m² and stopped at XX W/m²
- The average (Wire to Water) efficiency of the System over the day at XX meter head is ...%.
- The average efficiency of the MPPT wrt its input power and output power from start to the end of the water flow from the pump over the day at XX meter head is at-least YY% .
- This “Test Report” is valid for the period of **three years** from the date of issue of the report.

Calculate the given below parameters as per hot profile

- Water flow started at XX W/m² and stopped at XX W/m²
- The average (Wire to Water) efficiency of the System over the day at XX meter head is
- The average efficiency of the MPPT wrt its input power and output power from start to the end of the water flow from the pump over the day at XX meter head is at-least YY% .
- This “Test Report” is valid for the period of **three years** from the date of issue of the report.

Remarks:

- *Specify the decision rule used during the testing.*
- *Specify the % of uncertainty in the measuring equipment used during the testing.*
- *Mention the formulae used for calculation of the parameters mentioned in the test report.*
- *The guidelines issued by NABL regarding test report format to be compiled by the lab.*
- *Additional remarks, if any.*

Signature with Stamp

Name of the person

Name of the Testing Lab

NABL certification no. of the Lab

Date:

Place:

Annexure A

Peak Wattages of Individual PV Modules tested at _____, vide report no.: _____, Dated: _____

Model: _____

PV Module Model as per ALMM (Yes/No): _____

PV Module model as per DCR (Yes/No): _____

Summary of Array								
S.no.	Module Sr. No.	Voc (V)	Isc (A)	Pmax (W)	Vmax (V)	Imax (A)	M. EFF. (%)	F.F. (%)
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								
13.								
14.								
15.								

Total P_{max} =

Total V_{max} =

I.B- Computation

I.B- Computation	
Module Model No.	
Manufacture Name Plate Peak Power	__W _p
P _{max} total (Peak wattage of __ Modules PV array)	W _p
P _{max} mean (Mean of __ Modules)	W
V _{oc} mean (Mean of __ Modules)	V
V _{oc} total (Sum of __ Modules)	V
V _{mp} total (Sum of __ Modules)	V
I _{sc} minimum (Minimum of __ Modules)	A
I _{mp} minimum (Minimum of __ Modules)	A
Fill Factor (Minimum among __ Modules)	%
Module efficiency (Minimum among __ Modules)	%
Power Mismatch among the __ PV Modules	± %

Annexure B

PHOTOGRAPHS OF THE SYSTEM

- a) PV Module & Name Plate
- b) Controller & Name Plate
- c) Motor & Name Plate
- d) Pump & Name Plate
- e) RFID tag of SPV Module
- f) RMS Screenshots from the portal at the minimum interval of 11 min
- g) Comparison between Lat Long Coordinates of testing facility and Lat Long pushed by RMS.