

SCOPE OF WORK

A) The scope of work involves Design, supply, installation, testing and commissioning of ONGRID Solar roof top plants **10 kWp Capacities** complete with all associated accessories such as a) Solar Modules – minimum 250 Wp, b) structures and hardware, c) inverter and communication box, d) required No. of earths and lightning arrestors e) cables (DC & AC), Net metering etc. and the specifications as mentioned below. The cost includes necessary Civil works like provision of concrete structures. Installation, testing and commissioning complete.

GENERAL:

The work has its own particular requirements. Tenderer has to execute the work as per specifications.

- i. All electrical works should comply with Indian Electricity Act 2003 and Indian Electricity Rules 1956.
- ii. All components used in installation shall be of appropriate ratings of voltage, current and frequency.
- iii. All minor items viz. hardware items, foundation bolts, termination lugs for electrical connections etc. as required and necessary for proper working of the equipment shall be deemed to have been included in the tender, whether such items are specifically mentioned in the tender documents or not.
- iv. The work shall be carried out under the supervision of the concerned SSE/E/M/DHNE (Site engineer).
- v. The tenderer must inspect the site thoroughly before quoting rates, later on no claim shall be accepted in connection with inspection of site.
- vi. It is the responsibility of the contractor to process for inspection of the material by RITES / RDSO / NABL accredited laboratory/Consignee as per the relevant clause given in the tender booklet.

DEFINITION:

- Grid Tied Solar Rooftop Photo Voltaic (SPV) power plant consists of **Mono PERC crystalline Modules and Framed Dual Glass Mono PERC Bifacial Solar Modules** -minimum 250 Wp, Module Mounting Structure, Power Conditioning Unit (PCU) consisting of Maximum Power Point Tracker (MPPT) & Inverter and Controls & Protections, interconnect cables, Junction boxes, Distribution boxes and switches. PV Array is mounted on a suitable structure. Grid tied SPV system is without battery and should be designed with necessary features to supplement the grid power during day time.
- Components and parts used in the SPV power plants including the PV modules, metallic structures, cables, junction box, switches, PCUs etc., should conform to the BIS or IEC or international specifications, wherever such specifications are available and applicable. Solar PV system shall consist of following equipment/components.

Technical Specifications of Major Components of Solar PV Power Plant

- Solar PV modules and array
- Module mounting structure
- Junction Boxes
- Power Conditioning Unit
- DC & AC Switches
- Cables and installation accessories
- Earthing and lightning protection.

TECHNICAL SPECIFICATIONS

A) 1/5/8/10/20/25 kWp Capacity Solar plants panels:

Electrical Properties: STC*

Sl. No.	Description	Model		
1.	Peak Power (Pmax) (W)	550	570	575
2.	MPP Voltage (Vmp) (V)	42.0	42.8	43.00
3.	MPP Current (Imp) (A)	13.10	13.32	13.38
4.	Open circuit Voltage (Voc) (V)	50.00	14.24	14.30
5.	Short Circuit Current (Isc) (A)	14.00	14.24	14.30
6.	Module Efficiency (%)	21.40	22.07	22.30

*STC: Irradiance 1000 W/sq.m, Cell temperature 25° C, AM1.5

The data above is for reference only and the actual data is in accordance with the practical testing
Power measurement Tolerance $\pm 3\%$

Electrical Properties: NOTC*

Sl. No.	Description			
1.	Peak Power (Pmax) (W)	417	432	436
2.	MPP Voltage (Vmp) (V)	39.5	40.2	40.4
3.	MPP Current (Imp) (A)	10.56	10.74	10.79
4.	Open circuit Voltage (Voc) (V)	48.0	48.7	48.9
5.	Short Circuit Current (Isc) (A)	11.18	11.38	11.42

*NOTC: Irradiance 800 W/sq.m, Cell temperature 20° C, Wind speed 1 m/s

Operating Properties:

Sl. No.	Description			
1.	Operating Temperature (° C)		-40 °C ~+85 °C	
2.	Maximum System Voltage (V)		1500V DC (IEC)	
3.	Maximum Series Fuse Rating (A)		30	
4.	Power Tolerance		0 ~ +5W	
5.	Bi-faciality*		80%	

* Bi-faciality = Pmax rear (STC) /Pmax front (STC), Bi-faciality tolerance: $\pm 5\%$

Temperature Co-efficient:

Sl. No.	Description			
1.	Temperature Co-efficient of Pmax*		-0.300%/ °C	
2.	Temperature Co-efficient of Voc*		-0.250%/ °C	
3.	Temperature Co-efficient of Isc*		-0.045%/ °C	
4.	Nominal operating Cell Temperature (NOCT)		42±2 °C	
5.	Bi-faciality*		80%	

* Temperature Co-efficient of Pmax: $\pm 0.003\%$ / °C

Mechanical Properties:

Sl. No.	Description	
1.	Cells size	182.00mm*91.0 mm
2.	Number of Cells	144 pcs (12*12)
3.	Module Dimension	2278mm*1134mm*30mm
4.	Weight	32.5 kg (Approx.)
5.	Front/Rear Glass*	2.00 mm/2.00 mm
6.	Frame	Anodized Aluminium Alloy
7.	Junction Box	IP68(3 diodes)
8.	Size & Length of cable	4.0 sq.mm, +300mm/-180mm (cable length can be as per site requirement)

* Temperature Co-efficient of Pmax: $\pm 0.003\%$ / °C

3-Φ INVETERS Specification (5/8/10/15KW)

Sl. No.	Description	Capacity			
		5KW	8 KW	10KW	15 KW
I	Input (DC)				
1	Max. Peak DC Input Power (KW)	6.5KW	10.4 KW	13KW	19.5KW
2	Max. DC I/P (V dc)	1000V DC			
3	Max. MPPT I/P Current (A)	20A+20A			21A+21A
4	Max. Short Circuit Current (A)	30A+30A			32A+32A
5	MPPT Tracking Voltage (Vdc)	120-850V			
6	Min. Start Voltage (V)	250V			
7	Number of MPPT Tracker	2			

8	String per MPPT Trackers	1	1	1	2
II	OUTPUT (AC)				
1	Rated Output Power (KW)	5	8	10	15
2	Max. Peak Output Power	5.5	8.8	11	16.5
3	Operating Grid Voltage (V)	320V-480V (This can vary with grid standards)			
4	Rated Grid Voltage (V)	440V			
5	Nominal Grid freq. (HZ)	50Hz			
6	Max. output current AC (A)	8	11.6	15.9	23.9
7	AC Connection (with PE)	3L + N + PE			
8	THD (%)	<2%			
9	Output Power Factor (%)	>99.99%			
III	Efficiency				
1	Max. Conversion eff. (%)	96			
2	Max. MPPT Efficiency (%)	>99%			
IV	Physical Parameters				
1	Dimensions (LXHXW) mm	330x530 x150	593X282 X195	553X715X228	
2	Weight (Kg)	15			
	General Data				
1	Operating temperature	-25° C to +65° C			
2	Operating Surrounding Humidity	0-100%			
3	Design Life	Over 25 Years			
4	Night Con. (W)/Noise Level	<0.2/<30d B			
5	Heat Dissipation	Natural Convection			Intelligent redundant fan cooling
6	RH / Max. Altitude	0% to 98%. No Condensation /<2000 without power derating			
7	Display	Graphical –LED with LCD Display			
8	DC/AC Connectors (IP-65)	MC-4			
9	Communication Interface	Wifi/GPRS/GSM/RS 485/RS 232/ ETHERNET LAN			
10	Standard Warranty	5 Years			

V	Standard, Safety & Protections				
1	DC Switch	DC Switch available			
2	SPD (Surge Protection Device)	Type-2 DC MOV			
3	Protection class	1			
4	Efficiency	IEC 61683			
5	Safety Standard	IEC 62109-1 & 2			
6	EMC Standard	IEC 62109-1 & 2			
7	Environment Protection	IEC 60068-2-1/2/14/30			
8	Anti -Islanding	IEC-62116			
9	Ingress Protection	IP 65			
10	Utility Interface	IEC-61727			
11	Protection & Safety	-String Input Reverse Polarity	-DC input short circuit	-DC O/V & U/V	
		- Insulation Resistance detection	-Output Over/Under voltage	-Output Over current	
		-Output Over/ Under frequency	-Over temperature	-GDI for input & output	
		-Zero export protection	-Anti –Islanding		
12	Monitoring application	The solar inverter should have the facility to monitor and control the inverter remotely via Web application and mobile application. Contractor will be liable for all communication charges of GPRS/GSM mode for period of two years.			

General requirements of Inverters:

S. No.	Parameter		Specifications
1.	Rated output power of inverter (Kw)	:	1/2/3/5/8/10/15/20/25/40/50
2.	Switching device	:	IGBT
3.	No. of Phase (in Nos.)	:	3 for 3 phase and 1 for a single phase
4.	Inverter output wave form	:	Pure sine wave
5.	No. of MPPT per inverter (in Nos.)	:	As above.
6.	No. of string at input side of inverter (input port +ve and -ve) (hint: 1 set contains 1 +ve and 1 -ve port)	:	2 Sets
7.	Maximum power point tracker	:	Integrated in the PCU/inverter to maximize energy drawn from the array
8.	Operating Voltage Range of Inverter	:	200 V to 1000 V
9.	Over load support at Input side, DC	:	20% of Maximum Input Voltage for 3 phase system
10.	Maximum input current for each MPPT (in A)	:	As required
11.	Service condition	:	Indoor
12.	Ingress protection rating of inverter	:	IP 65 (for outdoor use)
13.	Cooling medium for inverter	:	Nature air cooled
14.	Manual switch for disconnecting DC supply	:	Yes
15.	Inverter mounting type	:	Wall Mounted /Plinth mounted (As per site requirement)
16.	Warranty on Inverters	:	5 years from date of commissioning.
16.	A Grid Tied Photo Voltaic (SPV) power plant consists of	:	SPV array, Module Mounting Structure, Power Conditioning Unit (PCU) consisting of Maximum Power Point Tracker (MPPT), Inverter, and Controls and Protections, interconnect cables and switches.
17.	PV Array Mounting	:	Mounted on a suitable structure
18.	Grid tied SPV system is	:	Without battery and designed with necessary features to supplement the grid power during day time.
19.	Installation and testing for complete system	:	Yes, including Civil Work, Designing, Fabrication, Cabling Work with suitable Bolts, Nuts, Clamps, Connectors and testing etc.
20.	Maximum current for 3 phase/ 1 phase inverter (in A)	:	As per Inverter Capacity
21.	Output voltage (in V)	:	415 for 3 phase/ 230V for single phase
22.	Invert auto trip at output side	:	Lower : at 304 V, Higher : at 460 V with adjustable(3 phase). Lower at 174V and Higher at 276V
23.	Overload protection	:	110% for 1 Minute

24.	Over temperature protection	:	Yes at 65 Deg. C Cooling Fan will auto switch ON
25.	Surge protection	:	Metal Oxide Varistor (MOV)

PROTECTION FOR INVERTERS

1.	Output over current protection	:	Yes
2.	Output over voltage protection	:	Yes
3.	Short circuit protection	:	Yes
4.	Overload protection	:	110% for 1 Minute
5.	Over temperature protection	:	Yes at 65 Deg. C Cooling Fan will auto switch ON
6.	Surge protection	:	Metal Oxide Varistor (MOV)
7.	Insulation Resistance Monitoring	:	Yes
8.	Grid Monitoring protection	:	Yes
9.	THD (in %)	:	< 3%
10.	Power factor at rated output power	:	0.8
11.	Inverter body material	:	Aluminium Casting

SERVICE CONDITION

1.	Operating temperature	:	-25 to +60 deg. C
2.	Relative Humidity (in %)	:	> 95 % non-condensing
3.	Maximum altitude above sea level (in m)	:	4000

DISPLAY FEATURES ON INVERTER

1.	Type of display	:	LCD
2.	Display parameters	:	DC Voltage, DC Current, AC Voltage, AC Current, Output frequency, Power Factor
3.	Display for Generating power data	:	Daily, Weekly, Monthly, yearly with total generation
4.	Interface facility for transmitting the generating power data for cloud storage	:	Inbuilt Wi-Fi Enabled
5.	Net meter	:	Approved by Government of India/State Government authority concerned for connecting to Grid

Add On Items - DC DISTRIBUTION BOARD

S. No.	Parameter	:	Specifications
1.	DC Distribution panel to receive the DC output from the array field	:	Yes, with surge arrestors
2.	Ingress protection (Enclosure protection) of DC Distribution Box	:	IP65
3.	Material of bus bar and Size	:	Copper, size as per inverter rating
4.	Circuit Breaker for input side (DC side) for each inverter	:	MCB 15 A

Add On Items - CABLE FOR INPUT

1.	ISI Marked Connecting cables according to Inverter rating for each system	:	PV Module to Inverter DC
2.	Electric Cable for Input	:	1C x 6 Sq. mm, Copper Cable (as per IS:694:2010 latest)

3.	Cable Length for PV Module to Inverter, DC (in m)	:	25
Add On Items - AC DISTRIBUTION BOARD			
1.	AC Distribution Panel Board (DPB) for controlling the AC power from PCU/inverter	:	3 Phase 415 Volt +/- 10%, 50 HZ +/- 3 Hz
2.	Panel construction	:	Metal clads, totally enclosed, floor mounted, air insulated, cubical type with changeover +switch
3.	Ingress protection (Enclosure protection) of AC Distribution Box	:	Minimum IP65 for outdoor
4.	All switches and the circuit breakers, connectors should conform to	:	IS:60947 part I, II and III.
5.	Panels designed for minimum expected ambient temperature	:	45 deg. C
6.	Circuit Breaker for output side (AC side) for each inverter	:	MCB 32 A
Add On Items - CABLE FOR OUTPUT			
1.	ISI marked Connecting cables according to Inverter rating for each system	:	From Inverter to Net Meter
2.	Conformity of the specification for cable	:	3.5C x 6 Sq. mm, Copper Cable (as per IS:694:2010 latest)
3.	Cable length for output side (from inverter to Net Meter for each system) (in m)	:	25
Other Add on Items			
1.	Cabling work at input side for each system	:	With PVC Conduit pipe with necessary clamps and screws
2.	Cabling work at Output side for each system	:	With G.I. Cable Tray with fitment accessories
3.	Lightning arrestor for each unit	:	Yes
4.	Earthing for each inverter	:	G.I. Pipe, G.I. Wires and earthing as per IS:3043-1987
5.	Danger boards and signages	:	3 No.
PV Module			
1.	PV Module manufactured in	:	India
2.	PV Module conforming to	:	As per IEC 61215/IS:14286 latest for mono PERC Crystalline silicon terrestrial or latest
3.	PV Modules Construction, Testing and Safety requirements	:	as per IEC 61730 (Part 1) and (Part 2) latest
4.	PV Modules shall comply Salt Mist Corrosion testing	:	as per IEC:61701/IS:61701 or latest
5.	PV Module rating (in Wp)	:	515 Wp or above

6.	Tolerance for rated output power of PV Module	:	+/-3%
7.	No. of PV Module for each solar power plant system	:	As required
8.	The peak-power point voltage and the peak power point current of any supplied module	:	not vary by more than 2 %
9.	Protective devices against surges at the PV module	:	Yes
10.	Material for Module Frame (Corrosion resistant)	:	Anodized aluminum
11.	Each PV Module supply with	:	IV Curve sheet at STC
12.	Each PV Module shall supply with RF ID tag with complete information about PV Modules	:	Yes

ARRAY STRUCTURE

1.	Material of mounting structure	:	Hot dip galvanized MS mounting structures
2.	Angle of inclination as per the site conditions to take maximum isolation	:	Yes, for each mounting structure
3.	Material of mounting structure for mounting the modules/ panels/arrays	:	Structural Steel, Grade: E300 (as per IS:2062:2011 latest)
4.	Galvanization of the mounting structure	:	as per IS:4759 latest
5.	Structural material shall be corrosion resistant and electrolytically compatible	:	Module frame, fasteners, nuts and bolts
6.	Material of fasteners	:	Steel as per IS:1367 (Pt.1):2002 latest
7.	The structures design	:	Designed to allow easy replacement of any module
8.	Civil structures	:	As per the load bearing capacity of the roof and the suitable structures based on the quality of roof
9.	The total load of the structure (when installed with PV modules)	:	Less than 60 kg/m2. on the terrace
10.	Minimum clearance of the structure from the roof level	:	300 mm

JUNCTION BOXES

1.	The junction boxes	:	Provided in the PV array for termination of connecting cables
2.	Junction Box on PV Module	:	Sealed type
3.	Material of Junction Box	:	FRP (Fibre reinforced plastics)
4.	Ingress protection (Degree of Protection) for	:	IP65
5.	Wires/cables termination	:	Through Cable Lugs
6.	Input and output termination	:	Through single or double compression cable glands.
7.	Copper bus bars/terminal blocks housed in the junction box with suitable termination threads	:	Yes

8.	Provision of earthing	:	Yes
9.	Surge protection device for each junction box	:	Yes
Wind Load			
1.	The Mounting structure shall be so designed to withstand the speed for the wind zone of the location where a PV system is proposed to be installed	:	Yes
2.	Compliance to wind velocity test for the Mounting structure of PV System	:	as per IS 875:1987 part 3 latest
3.	Regional wind withstand capacity which the Mounting structure of PV system support is suitable to withstand (in Km/Hour)	:	150-200
WARRANTY & GUARANTEE			
1.	Minimum guarantee for maintain of output peak watt capacity	:	> / = 90% at the end of 10 years and >= 80% at the end of 25 years.
2.	Warranty for PV Modules from the date of supply as per MNRE specification	:	>=25 Years.
3.	The Warranty Card	:	Contain the details of the system and information about the system and conditions of warranty
4.	OPERATION and MAINTENANCE MANUAL for each solar PV module shall be furnish to the buyer / consignee	:	Yes
5.	Minimum area required for installation Solar panels (sq. mt) – Must declare in Sq. Mtr.	:	185
6.	Minimum area required for installation of Solar Inverter (sq. mt) - - Must declare in Sq. Mtr.	:	2
7.	Minimum area required for installation of Net Meter (sq. mt) - - Must declare in Sq. Mtr.	:	0.5
8..	In case of Grid failure, or low or high voltage	:	Solar PV system out of synchronization and disconnected from the Grid
9..	Provision for Isolation of inverter output with respect to the Grid	:	Provided with 4 Pole Isolator
10.	Locking facility for isolation switch	:	Yes
CERTIFICATIONS			
1.	PV Modules shall comply with BIS compulsory registration scheme and certificates shall furnish to buyer / consignee on demand		Yes
2.	BIS CRS Certificate for PV Module		As per IS:14286 (for PERC Mono Crystalline PV modules/ Framed Dual glass mono PERC Bifacial solar modules)

3.	BIS CRS Number – Must declare	IEC61215, IEC61730
4.	Availability of type test reports of Wind Load withstand test for Mounting structure including calculation sheet from Central Govt., Lab/NABL/ILAC accredited lab to prove conformity of the specification and agreed to furnish test reports and certificate	Yes
5.	Availability of type test reports for PCU/Inverter, PV Module to prove the conformity of the specification from	NABL Accredited LAB
6.	Report Number – Must declare	181224118GZU-002
7.	Report date – Must declare	15.042019
8.	Name of Lab – Must declare	Intertek
9.	Address of lab – Must declare	Intertek E Blk CHINA
10.	Agreed to furnish all the test reports and certification to buyer /consignee on demand	Yes

INSPECTION CLAUSE

(Authority CEE/SC Lr.No. E.29/P/Vol.XI Dt.27.09.2017)

RITES/RDSO Inspection clause in the works contract for which supply items value is more than Rs.
5.0 lakhs on par with stores supply items

RITES / CONSIGNEE INSPECTION – ANNEXURE			
SN	Brief Description of the item.	Inspection authority RDSO / RITES / Consignee	
1	Supply, Installation, Testing & Commissioning of rooftop On Grid Solar plant of capacities 50KWp- 1 KWp	<ul style="list-style-type: none">• Solar PV Modules• Solar Inverter• Module Mounting Structure	BIS/ NABL/RDSO/ RITES Inspection
		<ul style="list-style-type: none">• DC DB• Array Junction Box• AC DB• Solar Cables• Other Accessories	Consignee

- (a) RITES/RDSO inspection clause in the works contract for which supply items value is more than Rs.5 lakhs on par with stores supply items.
- (b) For consignee inspection, the firm should submit Guarantee/ Warrantee certificate, Test certificate from OEM.
(Authority CEE/SC Lr.No. E.29/P/Vol.XI Dt.27.09.2017).
- (c) For ISI marked products even if the value of the schedule item as per the accepted rates is more than Rs.5 lakhs, if the order is placed on ISI certified manufacturer, the material shall be accepted on firm's WTC
(Authority: Railway Board Lr.No.2017/Trans/01/policy/Pt-S, Dt.16.08.2018).
