

	PURCHASE SPECIFICATION	BDC1718-00301	
Rudrapur	GROUP : BDC	Rev no	00

BDC1718-00301

SPECIFICATIONS FOR SUPPLY OF BOS, ERECTION & COMMISSIONING OF 1X3 KWP SPV ROOF TOP OFF GRID POWER SYSTEM ON PORTA CABIN AT 2X800 MW UPPER THERMAL POWER PLANT, RAMANATHAPURAM, TAMIL NADU WITH 05 YEAR WARRANTY.

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1. INTRODUCTION:

This specification defines the scope of the Bidder in **specifications for supply of balance of system (BoS), erection & commissioning of Off Grid solar power system of total capacity 1X3 kWp on PORTA CABIN (SIZE 18sq.m) at 2X800 MW UPPER THERMAL POWER PLANT, RAMANATHAPURAM, TAMIL NADU.**

1.1 Site Details:

Site is located at RAMANATHAPURAM and well connected through road and railway.

Sr. NO	Description	Details
1	Ambient Temperature	Minimum= 23 DegC Maximum=35 DegC
2	Atmospheric Condition	Tropical wet and dry climate
3	Latitude	9.4071° N
4	Longitude	78.7023° E

Total 3 KWp systems at Porta cabin roof tops as per below mentioned capacity are to be installed:

Sl. No	Location	Type of SPV Modules (Shall be supplied by BHEL)	SPV Capacity KWp
1	Porta Cabin-1	Mono Crystalline	3

Bidders are advised that they should visit the site before quoting to fully understand the site conditions.

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2. BIDDER'S SCOPE:

2.1 System 1: 3 KWp System at Porta cabin-1&2

- a. Erection and commissioning of 320 Wp, 09 Nos.(Approx) SPV Modules supplied by BHEL (Specifications as per SPV Module drawing- 3-679-02-00404 and SPV Module Data Sheet – CD-4-4001-1).
- b. Supply, Erection and commissioning of solar module mounting structure along with all accessories.
- c. Supply, Erection and commissioning of AJB.
- d. Supply, Erection and commissioning of Hybrid Inverters with Batteries.
- e. Supply, Erection and commissioning of MCCB.
- f. Supply, Erection and commissioning of DC Cu Cables with accessories for connection between Modules, AJB and Hybrid Inverters.
- g. Supply, Erection and commissioning of AC Cu Cables with accessories for connections between hybrid Inverters and MCCB.
- h. Supply, Erection and commissioning of AC Cables, GI bars with accessories for connections for earthing.
- i. Supply, Erection and commissioning of Miscellaneous Equipment (Control cables, insulation tapes, ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors etc.) and Civil Works.
- j. Freight & Transit insurance.
- k. Warranty of Supplied item and work for 05 Years.

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List of Items for Supply & E&C for System 1: 3 KWp System at Porta cabin-1&2

Sl. No.	ITEM DESCRIPTION	Qty	SUPPLY	E & C	MAKE/ REMARKS
1.	Mono Crystalline Solar PV Module 320 Wp (09 Nos approx)	9 Nos	x	✓	SPV Modules shall be provided by BHEL.
2.	Module Mounting Structure	1 Lot	✓	✓	Bidder shall ensure the structure stability and shall submit the structure wind load calculations. Test reports confirming to relevant standards shall be submitted.
3.	AJB for each Hybrid inverter	1 Lot	✓	✓	Make- Reputed makes Test reports confirming to relevant standards shall be submitted.
4.	Hybrid Inverter with batteries	1 Lot	✓	✓	Make; Enertech / Sukam, Statcon/ Emerson or reputed make Test reports confirming to relevant standers shall be submitted.
5	MCCB	1 Lot	✓	✓	Make of Switchgear- L&T, Schneider, Siemens or reputed make
6	1.1kV grade heavy duty PVC insulated, Double sheathed, UV protected DC grade XLPO stranded copper cables as per IS: 7098 (Part I & II) – 1976 or IS 1554 or IS9537 From Modules, array junction box and Hybrid Inverters (a). 1 core 4 sq. mm unarmored red cable from series Hybrid to Hybrid inverter for +ve side	1 Lot	✓	✓	Reputed makes viz., Unistar/ Finolex/ Polycab/ LAPP. Test reports confirming to IS should be submitted
	(b). 1 core 4 sq. mm Unarmored black cable from series Hybrid to Hybrid inverter for –ve side	1 Lot	✓	✓	

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7	1.1kV grade heavy duty insulated galvanized strip/wire XLPE stranded 3.5 core AC Cu conductor cables as per IS: 694 (Part I & II) or IS 1554 or IS9537 of suitable size for connection between Hybrid Inverter to MCCB	1 Lot	✓	✓	Reputed makes viz., Unistar/ Finolex/ Polycab/ LAPP. Test reports confirming to IS should be submitted
8	Miscellaneous Equipment (Control cables, insulation tapes, , ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, for synchronization, earthing strips, Clamps, Safety Signs, project Schematic, Project information Signage, MC4 connectors, etc.) and Civil Works required for E&C.	1 Lot	✓	✓	Quantities as required for project completion, Bidder has to organize without any additional cost.

Note:

- Such Items, not listed but required for completion of the Project shall deemed to have been included in the scope of this contract.
- SPV Modules shall be supplied by BHEL; However, I&C of SPV modules shall be in scope of Bidder.
- The technical particulars, installation procedures and drawings of the bought out items Listed above clause 2.1 shall be submitted for approval to BHEL before procuring.
- Bidder has to procure materials as per listed make. Whenever equivalent make has to be procured prior approval has to be taken from BHEL submitting the make and technical particulars of the component.
- Test Certificates of BOS material and dimensional test reports of structures confirming to IS should be submitted to BHEL after finalization of order.

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3. Technical Specification of BoS

3.1 Solar PV Modules

Around 09 Nos. SPV Modules shall be supplied by BHEL. Specifications of SPV modules is as per SPV Module drawing 3-679-02-00404 and SPV Module Data Sheet CD-4-4001-1. Erection and commissioning of SPV Modules shall lie in Bidder's Scope.

3.2 MODULE MOUNTING STRUCTURE:

- I. The modules shall be mounted on the flat roof of porta cabin. The structure design shall be appropriate and innovative. The structure shall be designed to allow easy replacement and approach to any module, its cleaning and maintenance. The panels shall not be installed on FRP transparent sheets.
- II. Design drawings with material selected and their standards shall be submitted for prior approval of Employer within 10 days of issuance of PO.
- III. **The recommended safe load of roof is 15 kg/m² (frame & Purlin). The SPV Module weight is 12.5 kg/m². The mounting structure should be designed so that the total load of module + structure and accessories should not exceed 15 kg/m².**
- IV. The mounting structure design & foundation shall be designed with reference to Base Wind speed of 160 kmph . For estimation of Design wind speed risk factors k1, k2, k3 shall each be taken as minimum 1.0. The structure must be designed with considering appropriate factor of safety. The bidder must provide the detail design and calculation for the structure design.
- V. The SPV modules should be fixed on the structure by using anodized aluminum or GI (70 Micron) channels. It shall support SPV modules at a given orientation & tilt, absorb and transfer the mechanical loads to the ground properly. Welding of structure at site shall not be allowed.
- VI. The structure shall be fixed to roof purlins using tek screw, suitable clamps and anodized extrusion. Nut & bolts, washers (packing and spring) supporting structures including Module Mounting Structures shall have to be adequately protected from rusting. Fasteners and washers to be used for erection of mounting structures could be of SS 304/UNS S 20430 or equivalent; however fasteners used for fixing modules over structures shall be of stainless steel of grade SS 316 or equivalent, and must sustain the adverse climatic conditions to ensure the life of structure for 25 years. Zinc rich spray paint shall be applied in scratches of the structures for preventing corrosion.
- VII. The array structure shall be grounded properly using maintenance free earthing kit.
- VIII. Cable should pass from Pipes/ cable Trays. Cable-ties shall be used to hold and guide the cables/wires from the modules/module mounting structure.
- IX. The installation of module mounting structure shall be waterproofed using waterproofing compound. No leakage/seepage of water should occur from the

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roof. Also during the course of installation of the structure on the roof, no damage to existing water proofing of the roof shall be made. Any damage to the waterproofing found during the above should be rectified to the existing roof condition by Bidder on his own cost.

Note: Bidder shall ensure the structure stability and shall submit the structure wind load calculations report along with drawings after finalization of order.

3.3 AJB/ DC Combiner Box:

Array junction box:

- A DC Combiner Box shall be used to combine the DC cables of the solar module arrays with DC fuse protection for the outgoing DC cable(s) to the DC Distribution Box.
- DC disconnect switch should be as per IEC 60947-3, DC fuse rating conform to IEC 60269-1, 2, 6.
- DC disconnect switch provide safety and protection against over currents in any DC voltage photovoltaic applications and PV solar modular.
- DC fuse protects against reverse currents in dedicated to PV application.
- Incoming positive and negative DC cables from the DC Combiner Box.
- DC circuit breaker, 2 pole (the cables from the DC Combiner Box will be connected to this circuit breaker on the incoming side).
- DC surge protection device (SPD), class 2 as per IEC 60364-5-53.
- Outgoing positive and negative DC cables to the solar Hybrid inverter.

3.4 Hybrid Inverter:

Hybrid inverter able to cater total 03 KWp power rating shall be supplied. Individual inverter capacity shall not be less than 03 KWp. Bidder should ensure compatibility of inverter with SPV modules and system. The technical particulars of the inverter have to be submitted to BHEL for approval before procurement.

Sl. No	Technical parameter	Specification
1.	Type	True Hybrid
2.	Make	Enertech / Sukam, Statcon/ Emerson or reputed make
3.0	Power Output	
3.1	Output voltage	3KVA
3.2	Phase	1 Phase
3.3	Output Voltage	230V AC

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3.4	Output frequency	50Hz
3.5	MPPT Charger Input	3Kwp
4.0	Battery	
4.1	Battery voltage	48V
4.2	Battery Capacity	200Ah
4.3	Battery Technology	SMF/GEL
5	INVERTER	
5.1	Remote web Monitoring	Yes
5.2	MMPT charger Efficiency	>95%
6.0	Test report.	Relevant test reports shall be provided by bidder.
7.0	Protection	
7.1	DC Side	1. Disconnection device 2. Reverse polarity protection 3. Reverse current to PV array protection over voltage, under voltage over current protection. 4. Short circuit protection: PV fuse 5. Surge protection: SPD type II
7.2	AC Side	1. Short circuit protection 2. Over voltage, under voltage over current protection over and under Grid frequency protection. 3. Anti Islanding protection 4. AC surge protection
7.3	Ground fault / Grid Monitoring	Yes
7.4	Over Temperature protection	Yes
8.0	Display	
8.1	Display type	LCD/LED
8.2	Display parameter	Voltage, current, power, line status, grid voltage grid frequency, export power and export energy.
9.0	Communication	
9.1	Communication port	RS485, port for web based remote monitoring system and should match with data logger.
10.0	General	
10.1	Operating Temperature	-10 Deg. C to + 60De. C
10.2	Dimensions	Shall be provided by the Bidder.
10.3	Weight	Shall be provided by the Bidder.

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10.4	Cooling	Cooling arrangement (if any) details shall be furnished by the Bidder.
10.5	Ingress protection (IP)	IP 65 or better (Out Door Installation)
10.6	Maximum altitude	Bidder to mention up to what altitude above sea level inverters will work without de-rating.
10.7	Noise level	<70dBA

Note:

if short circuit and surge protection of AC/DC side is not inbuilt in the hybrid inverter than separate protection shall be provided by bidder is also acceptable. Bidder shall provide for installation & commissioning of the Hybrid inverters. Bidder shall depute their service engineer to site during E&C of the Hybrid inverters. If Bidder engineers are not competent, Bidder has to arrange engineers from Inverter supplier during commissioning of the plant.

3.5 MCCB

An MCCB box shall be mounted close to the Hybrid inverter. The AC distribution box shall be of IP65 DIN rail mounting type and shall comprise the following components and cable terminations:

- Incoming 3-core / 3.5-core cable from the solar grid-tie inverter.
- AC circuit breaker / isolator, 4-pole.
- AC surge protection device (SPD), class 2 as per IEC 60364-5-53.
- Outgoing cable to the grid / DG interconnection.

All switches and the circuit breakers, connectors should confirm to IEC 60947, part I, II and III or EN 50521 standards

Note:

- All steel works used in the construction of the DC & AC distribution boxes shall have undergone a suitable rigorous metal treatment process so as to remove oxide scales and rust formation and to facilitate a durable coating of the paint on the metal surfaces and also to prevent the spreading of rust, in the event of the paint film being mechanically damaged.
- Two coats of anti-corrosive primer followed by a finishing coat of epoxy powder coating of the shade 631 of IS: 5 (ie Siemens grey) shall be given. The total thickness of paint shall not be less than 25 micron.

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3.6 Cables

a. Procedure of cable laying:

1. Before the commencement of cable laying, it shall be ensured that only the specified cables are used. It shall be the responsibility of the contractor to check the soundness and correctness of the size of the cable. If any defects are noticed during the process of laying, it shall be brought to the notice of the BHEL representative.
2. While laying the cable, care shall be taken to avoid formation of kinks and also damage to the cable. In the case of cable bends, it shall not have bent radius lesser than 12 times the overall diameter of the cable.
3. A power cable loop of about five meters length shall be provided at the following locations.
 - a) Near the termination points
 - b) Near to the straight through joint
4. Identification tags indicating the size of the cable and feeder designation shall be securely attached at both ends of the cable. Such tags shall also be attached to the cable at intervals of 50 Meters. The material of the tags shall be 25x3mm, Al strip. In case of Al strip, the details should be punched. Cable route markers shall be provided at the intervals of 20M with a minimum of one number route marker. The details of the route markers shall be as per the IS standard. At the locations of straight through joints, necessary joint-markers shall be provided.
5. When cable runs vertically, it shall be clamped on proper GI cable trays or angle iron frames fixed on walls and are spaced at such intervals as to prevent buckling of the cables. All steel work shall be painted with two coats of red oxide primer after thorough cleaning of surfaces and thereafter finished with suitable anticorrosive paints and provided with appropriate earthing as per IS.
6. While removing the cable from the drum, it shall be ensured that the cable drum is supported on suitable jacks and the drum is rotated to unwind the cable from the drum. The cable should never be pulled while unwinding from the drum. It shall be ensured that the cables are pulled over the wooden rollers placed in the trench at intervals not exceeding 2 meters. At no point of time the cable should touch the ground while pulling, it should be always on the Rollers. Contractor should use latest equipments for unrolling and laying the cable.
7. All cable jointing / termination materials such as straight through joint kits, cable glands, cable lugs, insulation tapes etc. shall be in scope of bidder.
8. Cable terminations should be done using suitable double compression gland, crimping with copper lugs.
9. Cable glands for armoured cables shall include a suitable armor clamp for receiving and securely attaching the armoring of the cable in a manner such that no movement

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of the armor occurs when the assembly is subjected to tension forces.

10. The cable gland shall not impose on the armoring; cable bending radius shall not be less than 12 times the diameter of the cable. The clamping ring shall be solid and of adequate strength.
11. Provision shall be made for attachment of an external earthing bond between the metallic covering of the cable and the metallic structure of the apparatus to which the cable is attached.

12. Testing

- Once cable is laid, following tests shall be conducted in the presence of BHEL representative, before energizing the cable:
- Insulation resistance test with 500V megger between the cores and all the cores to earth (Armor) and the results are to be recorded.
- Sheathing continuity test.
- Continuity and conductor resistance test.
- Tests conducted shall be as per IS and National Electrical Code

3.7 LA and EARTHING

LA Shall be provided as per the attached drawing No: 3-679-05-00037.

The earthing for lightning arrestor, plant equipment and LT power system shall be required as per provisions of IS: 3043.

Earth stations and Earthing System:

- I. Earthing Pit with Pipe Electrode: Earthing with 50 mm dia. GI pipe 3.64 mm thick x 3Mts. long to be filled with bitumen partly under the ground level and partly above ground level driven to an average depth of 3.65 Mts. below the ground level & restoring surface duly rammed.
- II. Masonry enclosure with the earth pit of size not less than 600 mm X 600 mm X 500 mm (depth) complete with cemented brick work (1:6) of minimum 150mm width duly plastered with cement mortar (inside) shall be provided. Hinged inspection covers of size not less than 300 mm X 300 mm with locking arrangement shall be provided. Suitable handle shall be provided on the cover by means of welding a rod on top of the cover for future maintenance.
- III. Earthing system must be interconnected through GI Strip 25mmx5mm to arrive equipotential bonding.
- IV. Equipment grounding (Earthing) will connect all non-current carrying metal receptacles, electrical boxes, appliance frames, chassis and PV panel mounting structures in one long run. The grounding wire should not be switched, fused or interrupted.
- V. Connecting the equipments to earth busbar including S & F GI (Hot Dip) wire of size as below on wall/floor with staples buried inside wall/floor as required and

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making connection to equipments with bolts, nuts, washers, cable lugs etc. as required and mending good damages Solid GI wire of 8 SWG.

- VI. Each Array Structure row must be connected to the earth minimum two separate point with S&F 25 mm x 5 mm galvanized (Hot Dip) MS flat on wall/floor with GI saddles as required and connection to equipments incl. drilling holes, with bolts, nuts, washers etc.
- VII. The complete earthing system will be electrically connected to provide return to earth from all equipment independent of mechanical connection.
- VIII. Test point will be provided for earth pits.

3.8 Miscellaneous Equipment

Miscellaneous items like Control cables, insulation tapes, ferrules, Lugs, Cable Glands, cable trays, cable ties, pipe, Clamps, Safety Signs, project Schematic, Project information Signage boards, MC4 connectors etc.), control & communication cables and Civil Works required for E&C shall be provided by the bidder. Such Items, not listed but required for completion of the Project shall deemed to have been included in the scope of the Bidder.

4 Special Terms and conditions:

4.1 Freight & Transit insurance:

Price quoted by the bidder for each system is inclusive of the freight.

The Bidder shall take Insurance for transit of materials to the site and for the installation period.

Insurance of work at site

The Goods supplied by Bidder shall be insured fully against loss or damage incidental to manufacture or acquisition, transportation, storage, and delivery.

Bidder shall also take storage insurance for BHEL supplied items (PV Module).

Insurance during installation at site:

The Bidder shall so far as reasonably practicable insure against the Bidder's liability in respect of any loss or damage occurring whilst the Bidder is at EMPLOYER'S site for the purpose of making good a defect or carrying out the tests on completion during the installation & commissioning of the equipment at employer's site or for the purpose of completing any outstanding work and against any loss or damage arising during the defects liability period from a cause occurring prior to the taking over of new solar PV plant by the employer. For all practical purpose such insurance, during Defect Liability Period, shall be from an Indian Insurance Company.

4.2 System Warranty

The bidder must ensure that the goods supplied under the contract are new, unused and of most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the contract.

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The complete BoS items supplied, workmanship for each system shall be under warranty of 60 **calendar** months from the date of successful commissioning. The equipment or components, or any part thereof of the Power Plant, if so found defective during warrantee period, the bidder will remain liable to repair or replace immediately under warrantee obligation to the satisfaction of the Purchaser in order to ensure trouble free operation of the Power Plant. Within the scope of warranty, the Bidder will repair or replace of any defective part of the Plant & Equipment supplied, Works done and services rendered under the Contract and render periodic maintenance as a preventive measure to up keep performance of the power plant and also to attend breakdown maintenance as and whenever needed.

4.3 Inspection

Major BoS items (Inverter etc) shall be inspected by BHEL during manufacture and in assembled condition prior to dispatch.

4.4 Testing and commissioning

The testing and commissioning for all electrical equipment at site shall be according to the procedures listed below:

- All electrical equipment shall be tested, installed and commissioned in accordance with the latest relevant standards and code of practices published by Indian Standards Institution wherever applicable and stipulations made in relevant general specifications.
- The testing of all electrical equipment as well as the system as a whole shall be carried out to ensure that the equipment and its components are in satisfactory condition and will successfully perform its functional operations. The inspection of the equipment shall be carried out to ensure that all materials, workmanship and installations conform to the accepted design, engineering and construction standards, as well as accepted code of practices and stipulations made in the relevant general specifications.
- BHEL or its authorized representative reserves the right to witness tests conducted by the contractor using contractor's own calibrated instruments, testing equipment as well as qualified testing personnel.
- The results of all tests shall conform to the specification requirements as well as any specific performance data guaranteed during finalization of the contract.
- After completion of the installation at site and for the preparation of plant commissioning, the contractor shall check all the equipment and installation in accordance with the agreed standards, latest relevant code of practices of Indian Standards and specific instructions furnished by the particular equipment manufacturer as well as BHEL Engineer In-Charge.
- Checking required to be made on all equipment and installations at site shall comprise, but not limited to, the following:
 - Physical inspection for removal of any foreign bodies, external defects, such as damaged insulators, loose connecting bolts, loose foundation bolts etc.

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- Check for tightness of all cable joints and busbar termination ends as well as earth connections in the main earthing network
- Check for clearance of live bus bars and connectors from the metal enclosure
- Check for proper alignment of all draw out devices, if any
- Continuity checks in case of power and control cables
- Check for proper connection to earth network of all non-current carrying parts of the equipment and installation

4.5 O&M Manual and test certificates

The complete documentation should be as per IEC 62446 and submitted to BHEL

- One set of operation manuals complete with drawing, parts list (with part codes) circuit diagrams with list ratings of components and list of do's and don'ts for the main equipment as well as the sub-systems should be submitted to BHEL
- One set of maintenance manuals with full information on drawings, circuit diagrams, list and suppliers addresses for bought out parts, troubleshooting charts, programs of built in controllers etc. for the main equipments as well as for the sub-system.
- These manuals should be in the form of hard (printed) copy in English Language as well as in electronic storage form (disc pen drive etc.)
- A certificate for the adequacy of the manuals should be obtained and provided with the manuals. The QA engineer of the manufacturer must sign such certificate.
- The Installer shall supply the following documentation also:
 - System description with working principles.
 - System single line diagram.
 - Solar PV array lay-out.
 - Routing diagram of cables and wires.
 - Data sheets and user manuals of the solar PV panels and the solar grid-tie inverter.
 - A system operation and maintenance manual.
 - Name, address, mobile number and email address of the service centre to be contacted in case of failure or complaint.
 - Warranty cards.
 - Maintenance Register.
- Test Certificates / Reports from IECQ / NABL accredited laboratory or MNRE approved test centers for relevant IEC / equivalent BIS standard for quoted components shall be furnished.

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- Type Test Certificates shall be provided for the solar modules and the solar grid inverters to provide evidence of compliance with standards as specified in relevant articles of this Technical Specification.
- BHEL reserves the right to ask for additional test certificates or (random) tests to establish compliance with the specified standards.

Note:

- 1. It is advised that bidder should visit site and ascertain what type of equipment/machines needed at site for execution.**
- 2. Supply shall be made directly to the site.**
3. Contractor has to make his own arrangement for supply of water / power. At no point of time the execution activity should stop or slow down due to non availability of water / power.
- 4. Space for Storage of supplied material as well as BHEL supplied materials (09 Nos PV Module) shall be arranged by the bidder.**
5. The Unloading and shifting of all the materials viz., BHEL supplied material and Bidder supplied materials from stores/storage location to the site (building rooftop) lies in the scope of Bidder.
6. All tools and tackles, like power drilling machine, cutting machine, digging tools, complete set of crimping tools etc, required for installation, wiring, crimping, assembly, digging of cable trenches, if required, earth pits & Megger for checking insulation resistance of cable prior to commissioning etc., have to be organized by the bidder.
7. The storage, watch & ward responsibility of all the materials including BHEL supplies at site will be in Bidder's scope until the commissioning of the plant. Any deficit occurring due to misplacement/mishandling will be borne by the Bidder at no extra cost. The shifting of all the materials to the roof-top from storage location for erection will be in the scope of the Bidder and he has to make necessary arrangements for the same.
8. Before mounting the PV modules on to the structures, each PV module have to be tested during peak sunshine period. Short circuit current (Isc) & Open circuit voltage (Voc) of the module has to be checked & recorded using multimeter and Clamp meter. Ensure the modules are electrically OK. Special crimping tools required for crimping to be arranged by Bidder as per this specification, have to be used to crimp 4 sq.mm cables to quick connects for connecting output of series to Hybrids INVERTER/junction Box. **This crimping tool has to be kept at site permanently even after completion of project.**
9. Each Hybrid Open circuit Voltage & Short Circuit Current (with a testing jig having appropriate load) to be checked and recorded as directed by the BHEL site engineer at site.
10. All the terminations required for SPV plant viz., at the inverter and DB panel etc., will be in the scope of the Bidder. The necessary lugs and hardware required for the termination have to be arranged by the Bidder. Bidder has to ensure that terminations have been made

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without any tension.

Note: Bidder have to carefully measure twice the exact length of cables required for the connection before cutting the cable from cable drum. Any short fall in length of cable arising out of Bidder works should be borne by the Bidder. Bidder is required to assist BHEL and associate with the other Bidder's technical team during pre-commissioning checks and in commissioning of the power plant.

4.6 TOOLS, TACKLES AND SPARES

The Installer shall keep ready stock of tools, tackles and essential spares that will be needed for the day-to-day maintenance of the solar PV system. This shall include but not be limited to, the following:

- Screw driver suitable for the junction boxes and combiner boxes.
- Screw driver and / or Allen key suitable for the connectors, power distribution blocks, Circuit breaker terminals and surge arrestor terminals.
- Spanners / box spanners suitable for the removal of solar PV modules from the solar PV module support structure.
- Solar panel mounting clamps.
- Cleaning tools for the cleaning of the solar PV modules.
- Spare fuses.

4.7 Delivery Schedule

For Supply of BOQ and E&C: The total time period for Supply and E&C is within 30 days from the date of PO.

5 **GENERAL TERMS AND CONDITIONS:**

- 1) Bidder's responsibility, right and liabilities under this project will commence from the date of acceptance of the purchase order.
- 2) The installation activity will have to be carried out in such a manner that will not cause any inconvenience to the other agencies working in the site. Any permits from the customer, if required, are to be arranged by the Bidder for his personnel.
- 3) After completion of the E&C, the entire site/area will be cleaned of debris etc. by the Bidder prior to handing over of the site to BHEL.
- 4) All the materials brought to site has to have proper paper work like DC, Invoice etc. duly verified & signed by BHEL/BHEL's customer to be submitted to BHEL for payment.
- 5) Any damage to the buildings/structures/area made by Bidder's work men or by Bidder's agent will be made good by Bidder at Bidder's cost.
- 6) Bidder shall take work permit before commencement of all types of non-routine works as per the statutory procedures followed at the work place.
- 7) Bidder shall explain the job, associated hazards and precautions to his workmen.
- 8) Bidder shall ensure deployment of at least one person who should have the skill, knowledge and experience of performing the allotted task and shall be able to guide his team.
- 9) Insurance – Contractor's All Risk (CAR) Policy shall be purchased by Bidder.

Signature and seal of Bidder

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- 10) Bidder shall ensure safe procedure is followed during execution of the job.
- 11) Bidder shall ensure that his workmen wear appropriate safety Personal Protective Equipment.
- 12) Bidder shall ensure adequate supervision of the activity by his supervisor.
- 13) Bidder has to adhere to necessary legal/safety requirements and BHEL shall be kept indemnified against any untoward events taking place during the course of work.
- 14) No child labor should be employed for executing the project.
- 15) In case project is not completed as per BHEL scope due to reasons arising out of materials from BHEL end/Bidder's end, bidder has to complete the job at later stage without any extra charges. No overrun charges shall be paid in case of extension of project schedules.
- 16) Any miscellaneous materials that have not been mentioned specifically in the specification/tender which are required for E&C of the plant shall be deemed to be included in the specification and shall be supplied by the Bidder without any extra charges. Any scope of activities which are not specifically mentioned in this specification but required for the completion of the E&C of the SPV plant for safe, trouble free, normal operation shall be provided at no extra cost by the Bidder, unless explicitly excluded in the specification.
- 17) Bidder must meet statutory/HSE compliance as per Annexure C enclosed along with this tender document.**
- 18) The design and operational features of the equipment offered shall also comply with the provisions of latest issue of the Indian Electricity Rules and other statutory regulations.
- 19) **Statutory obligation:** Bidder is required to meet all the statutory obligations/ legal requirement with regard to workmen deployed by Bidder for the project such as ESI, PF, Minimum wage act, Work man compensation act/Accident/medical insurance, Income Tax act, Employees Insurance act etc.
- 20) The installation should strictly conform to this specification. All the works shall be executed strictly as per the direction of BHEL engineer at site.

6 LIST OF ENCLOSURES:

Following enclosure makes the part of BDC1718-00301.

- 6.1 SPV Module drawing- 3-679-02-004040
- 6.2 SPV Module Data Sheet – CD-4-4001-1
- 6.3 LA Drawing- 3-679-05-00037.
- 6.4 Annexure – A includes Qualifying Criteria, Payment terms, bidder's information, and declaration by Bidder etc.
- 6.5 Annexure – B format for certificate by chartered accountant
- 6.6 Annexure – C Statutory compliance by Bidder.

Signature and seal of Bidder