



ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड

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Bharat Heavy Electricals Limited

(A Government of India Undertaking)

ELECTRONICS DIVISION


P. B. No 2606, Mysuru Road, Bengaluru - 560 026

An ISO 9001, ISO 14001, OHSAS 18001 & ISO/IEC 27001:2005 Company

The Quotations are invited under two part bid system for Supply of BOS items and I&C of 10MWp SPV power plant GSFC at Charanka Solar park Gujarat Project through e-procurement route.

RFQ NO and date	TGPBOS0016 dated 08.08.2018 (e-tender)
RFQ due date & time	22.08.2018 up to 13.00 hrs (IST)
Date, Time & Venue of Part-I Bid Opening	22.08.2018 after 13.30 hrs (IST) E-tender) – Website - https://bhel.abcprocure.com
Date, Time & Venue of Price Bid opening	Will be intimated later for technically accepted vendors
Address for Communication & Contact Person in BHEL	Mr. T.G.Pragadeesh (09742576787)/ Mr. G Ponnugurupackiam (09449869617), SC&PV MM Department, BHEL Electronics Division, PB NO 2606, Mysuru road, Bengaluru-560 026. INDIA Email: pragadeeshtg@bhel.in ponnuguru@bhel.in Telephone number: +91 80 26998377, +91 80 26998669.

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: TGPBOS0016 RFQ DATE : 08.08.2018	Due Date/Day: 22.08.2018 WED Time : 13:00 HRS Tender Box : Reception Area Opening Venue: NEW ENGG. BLDG
MMI:PU:RF:003			
(address for communication) :		(for all correspondence) Purchase Executive : TG Pragadeesh Phone : 080 26998377 Fax : E-mail: pragadeeshtg@bhel.in	

PREQUALIFICATION CRITERIA

- 1) Vendor should have executed contracts of indoor/outdoor electrical installations of 33KV minimum in power plants or sub-stations in India with scope including both supply and erection for a cumulative value of Rs. 3.0 Crores with such individual contract values not less than Rs. 1.0 Crores within last 3 years from date of tender opening. As evidence for this, vendor shall submit (a) certification from clients for completion of supply and erection (b) copies of purchase orders from the clients.
- 2) Vendor should have achieved annual average financial turnover of Rs. 3 Crores in last three financial years (2015-16, 16-17 and 17-18). Vendor shall submit the audited balance sheets for all the 3 years. In case, for FY 2017-18, audited balance sheet is not available, unaudited balance sheet is acceptable.
- 3) Vendor shall submit an undertaking on his letterhead that "All electrical installation works will be carried out by a licensed electrical contractor qualified to carry out such electrical works as per CEIG norms of Gujarat state".
- 4) During technical evaluation, credentials of vendors will be submitted to end customer for approval. Only the price bids of those vendors, who are technically qualified and Approved by end customer before price bid opening, will be considered for further procurement processing.

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	PS0679077812 Supply of BOS items * HSN/SAC : 8544 Test Certificate For GSFC 10MW as per BHEL spec PS-439-1225	1	ST	1	07.11.2018
2	PS0679077820 I&C of 10MWp SPV plant * HSN/SAC : 9954 For GSFC 10MW As per PS-439-1225	1	AU	1	31.12.2018

Total Number of Items - 2

- 1.
- 2.

TWO PART BID - SUBMIT TECHNICAL AND PRICE BID IN SEPARATE SEALED COVERS

NOTES :

- 1.This RFQ is Governed by :
 - a)INSTRUCTIONS TO BIDDERS/SELLERS(Doc No :BHEL:EDN:ITB-SHOP) available at **www.bheledn.com (RFQ-PO Terms & Conditions)**
 - b)GENERAL CONDITIONS OF CONTRACT FOR PURCHASE(Doc no :BHEL:EDN:GCC-SHOP) available at **www.bheledn.com (RFQ-PO Terms & Conditions)**
 - c)Any other specific Terms and Conditions mentioned.
 2. Bidders / Representatives who would like to be present during opening of offers are required to furnish authorization letter for the same .
- * The HSN/SAC no mentioned against the line items in the RFQ are indicative only.

For and On behalf of BHEL.

TG Pragadeesh
Semiconductors & Pho

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	PURCHASE SPECIFICATION: SUPPLY OF BOS ITEMS, I&C FOR 10MW(AC) SOLAR PV POWER PLANT FOR GUJURAT STATE FERTILIZERS AND CHEMICALS LIMITED AT CHARANKA SOLAR PARK, GUJARAT	PS-439-1225
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Technical specification
for
Supply of Balance of System items, Installation & Commissioning
of
10MW (AC) Solar Photovoltaic Grid-connected Power plant for Gujarat
State Fertilizers and Chemicals Limited at
Charanka Solar Park, Gujarat

Revision details: Rev:00	Prepared	Approved:	Date:
	GLN Murthy / Vipindas	CMH	04.08.2018

	PURCHASE SPECIFICATION: SUPPLY OF BOS ITEMS, I&C FOR 10MW(AC) SOLAR PV POWER PLANT FOR GUJURAT STATE FERTILIZERS AND CHEMICALS LIMITED AT CHARANKA SOLAR PARK, GUJARAT	PS-439-1225
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1.0 Introduction

1.1 Overall project outline of 10MW (AC) solar photovoltaic power plant

Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up a 10MW (AC) solar photovoltaic (SPV) power plant for GSFC at Charanka Solar Park, Gujarat.

Solar PV modules employed at the plant generates DC electricity that in turn shall be inverted to AC in the range 300-400V. Output of each solar block (5MW) with independent inverter room (IR) / transformer yards shall be stepped up to 33kV. Solar plant comprises of 1 no. of Inverter room with associated array and **1 no. of Inverter cum Main Control Room (CMCS)**. Output of 5MW Inverter room and 5MW **Inverter cum Main Control Room** is combined at **Inverter cum Main Control Room (CMCS)** at 33KV level. Combined AC output is stepped up to 66kV using 12.5MVA power transformer. At these out goer levels, there is one outdoor switchyard bay with necessary gantries/ towers/ beams/ Cables to facilitate 66kV transmission.

Power generated at the above SPV plant shall be transported to GETCO substation using 66kV underground cables from the bay. Distance between SPV plant and substation is **3.5K.M.** Approximately.

The plant is envisaged to have several other infrastructural support systems such as module cleaning system for SPV modules, plant illumination system, fire alarm system, boundary fencing, approach roads, pathways, drainage system etc.

1.2 Scope of this tender specification

Vendor scope includes supply, installation, testing and commissioning of certain identified activities of the solar photovoltaic power plant.

This scope includes activities but not limited to obtaining approval from BHEL / GSFC for the datasheets / drawings / MQP, manufacture / testing / inspection at manufacturer's works, packing, supply, transportation, transit insurance, delivery to site, unloading, storage, installation and commissioning of certain AC and DC side activities of power plant identified under this specification.

Note: The above is only a broad outline of vendor scope for the sake of introduction. The detailed vendor scope is elaborated under various other sections of this specification.

1.3 Enclosures to this tender specification (Tender purpose only)

1	Overall map of project site
2	Tentative AC single line diagram of overall Solar PV power plant
3	Tentative SPV plant layout with solar array, control / inverter rooms, switchyards
4	Tentative layout of main control room
5	Tentative layout of inverter room
6	Indicative drawing of Module Mounting Structure
7	Datasheet of solar PV module
8	Soil report
9	Approved vendor list for procurement of BOS items.

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1.4 Location/ address of power plant:

10MW (AC) Solar Photovoltaic Power Plant ,
Gujarat State Fertilizers & Chemicals Limited (GSFC),
Gujarat Solar Park,
Village: Charanka, Taluka: Patan,
District: Patan, Gujarat.

2.0 Scope of Work

2.1 Vendor scope of supply, Installation and Commissioning

The table below briefly indicates the scope of work for the vendor, as briefly outlined. Vendor shall submit the offer (in two part bids) as per this list and quantity.

Vendor shall dispatch the Items on priority basis. List of priority Items are mentioned below.

#	Vendor scope of work (as briefly outlined)	Qty
1	Supply of MC4 connectors, Y-connectors, cable ties, HDPE DWC pipes with couplers/joints/bends etc. for 1Cx10sq.mm copper cable, HDPE pipes for RS485 cables, GI pipes for road crossings, cable lugs, cable glands, ferrules, nuts, bolts, hardwares, for Inverter room, CMCS room and its associated solar array as per clauses 5.7 – 5.11.	1 set (as required basis)
2	Supply of earthing cable i.e. unarmoured copper cables (earthing electrodes with chemical compound, GI strips/flats are BHEL scope of supply.), termination hardware, earth chamber items including lids, SMB/SPD earthing cable etc as per clauses 5.31 5.32,5.33,5.37	1 set (as required basis)
3	Supply of items for module cleaning system such as surface pumps, pressure regulating tanks, UPVC pipes/ couplers/ joints, hume pipes at road crossings, valves of different types, hose pipes, pressure gauges, level gauges for UG tank, electrical cables with cable accessories, all related fittings/hardware as per clauses 5.34	1 set (as required basis)
4	Supply of aux. control cables and lighting cables, cable installation accessories such as cable trays/ cable ties/ casing / capping/ glands/ lugs/ trefoil clamps etc, DC/LT/HT/control cable termination hardware, HT cable termination kits, LT/HT straight through jointing kits, HDPE DWC conduit pipes, hume pipes below plinth etc as per clauses 5.18, 5.19, 5.20, 5.22, 5.23.	1 set (as required basis)
5	Supply of 100KVA auxiliary transformer with accessories 1 no, ACDB panel with accessories 1no. , DB boards of all types with MCBs with all related accessories/ hardware etc (as required) as per clauses 5.24 to 5.26	As mentioned
6	Supply of items for peripheral lighting system / plant lighting system such as street light poles, bend pipes, luminaires, lamps, junction boxes, cable conduits, foundation items and all related accessories, hardware etc as per clause 5.33.	1 set (as required basis)
7	Supply of miscellaneous items such as cable tags, cable ties, cable ferrules, cable route markers, hoarding board, sign boards, danger boards, display boards, plant Layout boards, electrical insulation mat, checkered plates, air conditioners (AC), Fridge, tool kits, measuring instruments, office furniture, items for remote connectivity of SCADA, (OH Tank BHEL scope of supply) items for sump tank to OH tank connection etc as per clauses 5.16,5.30,5.35,5.39-5.45	1 set (as required basis)

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8	Supply of safety related items including fire alarm systems for buildings, fire extinguishers, sand buckets, safety gadgets etc as per clauses 5.38	1 set
9	Supply of spare items as per clauses 5.48	1 set
10	Supply of weather monitoring system (WMS) as per clause 5.29.	1 set
11	I&C: Interconnection of SPV modules, installation of SMBs, laying/ termination/ ferruling of solar array 1Cx10sqmm cable including related underground trench / conduit works as per clauses 5.7-5.11. Note: 1 AU= activity equivalent to installation of 1.25MW measured pro-rata on total quantity of SMBs for 10 MW.	8 AU
12	I&C: Underground cable trench works for DC power 1Cx400sqmm cable and RS485 cable from SMBs to inverter rooms as per clause 5.12. Note: 1 AU= activity equivalent to one inverter room measured pro-rata on total quantity of two rooms (Considering one inverter room attached with CMCS room).	2 AU
13	I&C: Laying/ termination of DC power 1Cx400sqmm cable at SMB and PCU ends, laying of RS485 cable from SMBs to SCADA panels in inverter rooms (excluding underground cable trench works) and their terminations at both ends as per clauses 5.13-5.14. Note: 1 AU= activity equivalent to one inverter room measured pro-rata on total quantity of two rooms (Considering one inverter room attached with CMCS room).	2 AU
14	I&C: Earthing system for solar array MMS structures and SMBs including laying of underground earth mat and interconnection to MMS structures, SMB earthing, earth chamber construction, earthing terminations etc as per clause 5.31. Note: 1 AU= activity equivalent to one inverter room measured pro-rata on total two rooms (Considering one inverter room attached with CMCS room).	2 AU
15	I&C: Erection of indoor electrical panels (PCUs, VCB panels, DB boards of all types, UPS/ FCBC/ battery bank, SCADA panels etc) in the individual inverter rooms including grouting of panels, laying/fixing of cable trays, routing/terminations of cables at the electrical panels and up to LV side of transformers in the switchyard as per clauses 5.17-5.20. Note:- 1 AU = Work proportionate to one of two inverter rooms (Considering one inverter room attached with CMCS room)..	2 AU
16	I&C: Erection of 33kV transformer yards (attached to individual inverter rooms) with necessary land leveling/ grading within the yard, construction of foundations / erection of inverter transformers and aux. transformer, stone jellies, fencing/ gates, RCC cable trench/ cable trays, drains/ drain pipes etc as per clause 5.21. Note: 1 AU= activity equivalent to installation of 2.50MW measured pro-rata on total quantity of SMBs for 10 MW.	4 AU
17	I&C: Erection of indoor electrical panels (VCB panels, AC/DC DB boards/panels, UPS system, FCBC/ battery banks, SCADA panels etc) in the main control room including grouting of panels, laying/fixing of cable trays, routing/terminations of LT/HT power/control cables to the electrical panels and upto 33kV connecting point at 66KV metering yard etc as per clauses 5.17-5.22.	1 AU
18	I&C: Erection of 100KVA aux transformer, laying/termination of 33kV/LT cables between aux transformer and control room panels as per clause 5.21, 5.24.	1 AU
19	I&C: Underground cable trenches and laying of cables for Aux AC/DC power cables, HT (33kV) cables, control/ data / instrumentation/ OFC cables as per clause 5.23. Note: 1 AU = 2.5MW as certified by BHEL site in-charge.	4 AU
20	I&C: Installation and commissioning of SCADA system by integrating the data cables from all the electrical and weather monitoring system equipments (WMS) of the	1 AU

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	power plant at the data logger/ PLC panel / HMI computer control desk at main control room etc as per clause 5.29-5.30.	
21	I&C: Erection of aux AC/DC system: ACDB panel, DB boards, UPS panels, FCBC/ Battery banks including cable interconnections as per clause 5.25-5.26. Note:-1AU = completion of work for 1 IR or 1 CR +IR	2 AU
22	I&C: Earthing system for inverter rooms, main control room (CMCS room) and 33kV transformer yards including laying of underground earth mat grids, earth chambers with lids, laying/termination of earthing strips from all electrical equipments to earth mat grid etc as per clause 5.32. Note:-1AU =completion of work for 1 IR or 1 CR	2 AU
23	I&C: Module cleaning system including underground water tanks, underground trenches/ laying of UPVC pipes/ couplers/ joints/ valves etc, erection of surface pumps, pressure regulated tanks, pressure gauges, electrical cabling works etc as per clause 5.34.	1 AU
24	I&C of peripheral lighting system / plant lighting system including outdoor cable laying, cable terminations at poles / lights as well as DB boards of inverter rooms / main control room (CMCS room) etc as per clause 5.33	1 AU
25	I&C of miscellaneous and safety items such as cable tags, cable markers, hoarding board, sign boards, danger boards, display boards, electrical insulation mat, checkered plates, air conditioners, office furniture, fire extinguishers, fire alarm system, weather monitoring system, items for remote connectivity of SCADA, connection from sump tank to OH tank, identification markings using painting etc as per clauses 5.30,5.35,5.38-5.44.	1 AU
26	I&C: Pre-commissioning inspections/ checks/tests, MRT tests, coordination/liaison with state /central departments/CEIG etc for necessary approvals/clearances for commissioning, synchronization with grid/ plant commissioning as per clauses 5.47 Note:-1AU =completion of work for for 5MW	2 AU
27	One round of water wash to all the modules and one round of grass cutting to be done by BOS vendor for final handover of the plant.	1AU

2.2 List of Items to be dispatched on priority as per serial no.

1. Aux. transformer
2. MC4 connectors and Y connectors and HDPE pipes
3. Termination kits and jointing Kits
4. Supply of weather monitoring system (WMS)
5. Copper cable for earthing.
6. Aux. control cables and lighting cables
7. Cable trays/ cable ties/ casing / capping/ glands/ lugs/ trefoil clamps with hardware
8. Safety gadgets
9. Spares as per clause.5.48 for commissioning and O&M for 10years of above equipments.
10. Tool Kits

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3.0 BHEL scope of supplies and works (I&C in vendor scope)

For clarity to the vendor, other items and activities within BHEL scope of solar PV plant end of the project are listed below:

1	Supply and erection of solar PV modules (40 per MMS set)	~ 39,760Nos
2	Supply of 1C x 10 sqmm Solar Cable	~90KM
3	Supply of DC cable, 1C x 400sq mm, Al, XLPE, armoured as per IS: 7098 (from SMB to PCU)	~40KM
4	Supply of LT cable, 1C x 630, Al, XLPE, armoured as per IS: 7098 (from PCUs to Inverter transformers)	~2.5 KM
5	Supply of 33kV HT cable, 1C x 300, Al, XLPE, armoured as per IS: 7098 (for all 33kV connections within plant including Aux transformer HV side)	~2KM
6	Supply of 66kV HT cable, 1C x 300, Al, XLPE, armoured as per IS: 7098	15.4K.M.
7	Supply of OFC cables along with termination kits. Also, termination of the cables at both ends (SCADA panels of inverter rooms, SCADA panels of main control room and at SMBs)	As required
8	Supply of power conditioning units (PCUs) of 1250 kW with ducts	8 Sets
9	Supply of String Monitoring Box (SMB)	75 Nos
10	Supply of inverter transformer 2.7MVA, 33kV/350-350 V, ONAN	4 Nos
11	Supply and erection of 12.5MVA Power Transformer	1
12	Supply of 33kV breaker panels	2 Sets
13	Supply of SCADA system including PLC panels, computers, software systems and related peripherals & accessories.	3 panels
14	Supply of UPS with battery bank	2 Nos
15	Supply of FCBC and Battery	2 Nos
16	Supply and Installation of Lightning arrestor for PV array	1 Set
17	Supply and installation of CCTV system	1 Set
18	Supply of Earthing material for PV array, IR and CMCS	1 Set
19	Supply and Installation of Module mounting structure including module mounting	~994 Sets
20	Supply and Installation of 66KV switchyard	1 Set
21	Unloading / movement / storage / security for BHEL supplied items.	-
22	Construction of PEB inverter rooms, PEB main control room (CMCS), PEB security room, PEB watchman cabins and PEB Toilet except those vendor scope supply/I&C activities defined under this specification.	1 + 1 +1+4 +1 rooms
23	Construction of civil works such as foundation upto plinth protection of IR and CMCS room approach roads, pathways, drains, overall plant boundary fencing, soak pit, septic tank.	-
24	Supply and erection of solar array module mounting structures (MMS)	~ 994 sets

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4.0 Instructions to vendors on bid submission:

4.1	Offer shall be submitted in two-parts (Two part-bid). Both parts shall be in separate sealed envelopes as per instructions in tender. The individual envelopes shall be enclosed in a common bigger envelope with markings (address etc) on the envelope as per instructions provided in tender.
4.2	First-part shall be techno-commercial bid. Following details shall be furnished: Technical offer with covering letter expressing acceptance to BHEL tender specification Separate list clause-wise in case of deviations, if any Filled-up enclosures as per BHEL formats (meant for first-part) provided in tender.
4.3	Second-part shall be price bid with filled up enclosures as per BHEL formats provided in tender.
4.4	In addition to the above instructions, tender document provides detailed instructions for bid submission. Vendor shall submit the bid based on instructions in tender document.

5.0 Technical specification for supply, installation and commissioning

#	BHEL purchase specification
5.1	Temporary site office for vendor use Vendor shall make necessary office arrangements such as porta cabin, furniture, electrical points/ fittings etc. on their own for their use/ occupation at site during the period of project execution. Note: Site offices for BHEL and GSFC shall be arranged by BHEL.
5.2	Electrical power / water for construction Vendor shall organize, on their own, necessary electrical power supply such as DG sets and water supply etc. required for construction activities and drinking water for their own use.
5.3	Construction of temporary yards for safe storage of vendor supplied items (a) Vendor shall, at a suitable location at the site, as decided based on discussions with BHEL site engineer, construct temporary yards for safe storage of vendor supplied items. These sheds shall have suitable water-proof roof and side walls so to ensure that there are no pin holes or joints through which rain water entry is possible. Also, these sheds shall be designed to withstand heavy wind loads. Lockable door shall be provided to ensure safety of these items. (b) Separate closed shed shall be constructed for storage of civil construction items such as cement bags etc. (c) Similarly, open yards shall be constructed with suitable fencing all around and lockable gate for storage of vendor-supplied items such as stone aggregate, sand, bricks, steel materials such as GI chain link fence/ gate for transformer yard, checkered plates etc. (d) Area of all storage yards/sheds shall be selected based on sizes of items. Vendor shall, at the time of starting their activities at site, submit drawings/ sketches/ dimensions etc to obtain approval from BHEL. (e) Safety and security of all the vendor-supplied items shall be within vendor scope. Accordingly, vendor shall ensure adequate security watch and ward for these items round the clock. BHEL appointed security will not be responsible for watch and ward of vendor supplied items.

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5.4	<p>Unloading, safe storage and movement of supply items received at site:</p> <p>A. Items supplied by vendor</p> <ol style="list-style-type: none"> (1) Vendor shall organize all necessary resources such as labour, machinery and tools (cranes, hydra, forklifts, transportation trucks/ trolleys, lifting accessories etc.) for unloading the items (supplied by the vendor) received at site and subsequent movement to storage yards. (2) Similar arrangements shall also be made by vendor for movement of the stored items from storage yards to the exact construction locations within the project site. (3) Vendor shall maintain proper documentation / compilation of all the records related to shipping (invoices, LRs, delivery challans, material receipt certificates etc.) and shall take approval from BHEL site engineer for every consignment. The documents shall be suitably preserved for further handing over to BHEL. (4) Registers shall be maintained for the yard to keep track of incoming/outgoing items. (5) Safety of items shall be in vendor scope. Accordingly, suitable watch and ward shall be deployed on round-the-clock basis. <p>B. All other items (supplies from BHEL and other vendors)</p> <ol style="list-style-type: none"> (1) Receipt, unloading, storage, security guards shall be in scope of BHEL/ other vendors. (2) However, movement of these items from their respective storage locations to the points of construction is in scope of vendor. Accordingly, vendor shall organize all necessary resources such as labour, machinery and tools (cranes, hydra, forklifts, transportation trucks/ trolleys, lifting accessories etc.) for this purpose.
5.5	<p>Series interconnection of SPV modules to form strings</p> <p>Supply of SPV modules is in BHEL scope. Type of module and rating: (325Wp).</p> <p>Total quantity = ~39,875 No.s.</p> <p>Vendor shall interconnect the SPV modules as follows:</p> <ol style="list-style-type: none"> (a) Each module is fitted integrally with a junction box having positive and negative polarity cables (4 sq-mm). (b) Positive cable of one module shall be connected to the negative cable of alternate module. The cables have MC4 type of connectors. One polarity cable has male type connector, while the other has female type connector. (c) This way, 20 modules shall be connected in series. Each set of connections is called as a series string. (d) Each Module mounting structure (MMS) contains 40 nos of SPV modules. Thus from each MMS, two sets of series strings (top row forms one string and bottom row forms other string) will be formed via leap-frog method. These two strings will be paralleled at MMS itself using Y-connectors to form a combined output and will be terminated at the input side of SMB as a single input. After placing the purchase order on vendor, BHEL will provide layout drawings that will describe the exact way in which the series strings are formed. Vendor shall implement the interconnection as per these drawings. (e) Thus, a total of 994 strings shall be connected to achieve $994 \times (20 \times 2) \times 325 \text{Wp} = \sim 12.922 \text{ MWp}$.
5.6	<p>Installation of SMBs including erection of SMB mounting structures</p> <ol style="list-style-type: none"> (1) Supply of string monitoring boxes (SMB), 75 sets, is in BHEL scope. These are 16-in/1- out type. (2) Vendor shall install the SMBs on the module mounting structures. Provision will be provided in the Module mounting structure legs to mount the SMB. However, necessary hardwares like nuts, bolts, washers etc. and canopy of SMB shall be in the vendor scope of supply. Details of canopy shall be submitted to BHEL for approval. (3) All necessary labour, tools, machinery etc. for erection work shall be in vendor scope.

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5.7	Interconnection of SPV module strings to 1Cx10sq.mm. cable (1) Vendor shall connect two series strings of 40 SPV modules to 1Cx10sqmm cable (copper, XLPO insulation cable) using Y-connector and MC4 connectors. Y-connectors shall have female/male parts of MC4 type suitable for 1Cx10sq.mm. cable (2) SPV module is provided with positive and negative cables 1Cx4sqmm having male and female parts of MC4 type connectors. (3) Vendor shall supply 1000sets (1 set = 2 nos) each of Y-connectors and MC4 connectors for array associated with each Inverter room that include (a) 1000 sets to complete the installation. Vendor shall ensure that there shall not be any shortage during execution time. (4) Y-Connectors and MC4 connectors shall have rating of 1000VDC (IEC), rated current of 30A (min), type approved by TUV Rheinland for product safety. (5) Approved make: Multicontact, Bizlink, Sunlont or other reputed equivalent subject to BHEL/GSFC approval during detailed engineering. (6) Required tools and tackles for crimping of cable etc. shall be arranged by vendor. This shall include crimping plier MC4, open end spanner set MC4, stripping plier MC4, socket wrench insert to tighten, socket wrench insert to secure, inserts for both 1Cx4 and 1Cx10 (of both pliers).
5.8	Ferruling for 1Cx10sq.mm cable 1) For 1Cx10 sqmm DC solar array cable, vendor shall provide UV resistant ferrules printed with source/destination identification of cable. Printing details shall be submitted for BHEL/GSFC approval during detailed engineering. Printing shall be of appropriate size to ensure readability. 2) Supply of ferrule shall be in vendor scope. 3) Ferrules shall be provided on both the termination ends: module end and SMB end.
5.9	Routing of 1Cx 10sq.mm cable below the SPV modules (1) 1Cx10 sq-mm cables connecting the SPV module strings to SMBs shall be suitably routed below the SPV modules and along the horizontal C-lip purlin member of MMS structure. Also, the cables shall be fastened to the purlin using UV resistant cable ties. (2) Cable ties shall be in vendor scope of supply. Width of the cable ties shall be minimum 4.5 mm. (3) Cable ties, nylon polyamide 6.6 UV stabilized black, UL94 flammability rating V2, operating temperature up to 85 deg C, shall be used to arrest any possibility of movement or sagging. Cable ties shall be of make: 3M, Phoenix contact, Weidmuller, Hellermannntyton, Panduit or other reputed equivalent subject to BHEL/GSFC. Width and Length shall be so appropriate as to ensure that the bunched cables are held firmly to the mounting structure. During detailed engineering, BHEL/GSFC approval shall be obtained for the selected brand and sizes of cable tie. (4) Spacing between two adjacent cable ties shall be so appropriate as to ensure that there is no loose hanging of cables.
5.10	Routing of 1Cx10sq.mm cable in pipes underground between the rows of solar array (1) Where 1Cx10sq.mm cables run between two rows of structure (or) where the cables cross over the pathway separation between two adjacent solar array blocks, HDPE double walled corrugated (DWC) pipe shall be provided to route the cables underground from one row/ block to the other. HDPE DWC pipe together with necessary HDPE couplers/ joints (T-joints, elbows, bends etc) shall be within scope of vendor supply. (2) Specification of HDPE DWC pipe: As per relevant IS; ID shall be selected to accommodate the number of 1Cx10sq.mm cables to be guided. ID shall be minimum 63mm. However, exact ID shall be selected to ensure that only a maximum of 60% of the ID space is occupied by the cables. Make, part number, sizes/ dimensions shall be submitted for BHEL/GSFC approval during detailed engineering. (3) Cables with HDPE pipe (and couplers/joints etc.) shall be directly buried underground as per IS: 1255.

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	<p>a. Trench depth = 400 mm minimum</p> <p>b. Trench width = As per conduit size and number of conduits</p> <p>c. HDPE conduit with cables shall be laid in the trench.</p> <p>d. Trench shall, then, be filled with refill soil and compacted.</p> <p>(4) Total length of HDPE DWC pipe and quantity of couplers/joints shall be as required.</p> <p>(5) Bending radii for cables shall be as per IS: 1255.</p> <p>(6) At road crossings, cables shall be routed through GI pipe of appropriate size that shall be in vendor scope of supply and technical details/ brand etc. shall be submitted for BHEL/ GSFC approval during detailed engineering.</p> <p>(7) All cable entry openings of conduit pipes, after laying/ termination of the cables, shall be sealed using appropriate sealant (single component thermoplastic insulating compound) to ensure water proof tightness.</p> <p>(8) Vendor shall take care to follow cable laying procedure and deploy necessary sand and bricks during the laying of cable. Vendor shall request BHEL site incharge / BHEL Site Engineer to inspect the cable laying and shall be allowed to close cable trench only upon written approval by site incharge</p>
5.11	<p>Termination of 1Cx10sq.mm. Copper cables on input side of SMBs</p> <p>(1) 1Cx10sq.mm cables of positive and negative polarities originating from SPV module strings shall be terminated at the input side of SMBs using suitable lugs.</p> <p>(2) Vendor scope includes removal of sleeve at the cable end, crimping with suitable cable lug of appropriate type/size and connecting the lugged end to the terminal block (connector) within the SMB. Cables shall enter the SMB through the cable glands that are provided as part of the SMBs supplied by BHEL.</p> <p>(3) Cable lug shall be in vendor scope of supply. Type of lug (pin type etc.) shall be in accordance with the termination arrangement within the SMB. Quantity required shall be appropriately selected by the vendor (cable lug + any other hardware if required).</p> <p>(4) Any other hardware, if necessary for fulfilling the connection, such as bolts, nuts, screws, washers etc. shall be in vendor scope of supply. All hardware shall be of SS304.</p> <p>(5) All necessary tools such as pliers, strippers, MC4 crimping tools etc. shall be within vendor scope.</p>
5.12	<p>Underground cable trenches and laying of 1Cx400sq.mm. Al cable and RS485 and OFC cables in solar array field</p> <p>(1) DC power cable 2run of 1Cx400sq.mm (from SMB to PCU), data cable RS485 (for looping between SMBs to SMBs) and OFC cable (from SMBs to SCADA) shall be laid underground by way of direct burying as per IS:1255. Supply of above the cables shall be in BHEL scope. Cable laying shall be carried out as per “Cable installation methodology” defined in this specification.</p> <p>(2) Typical trench details/dimensions are below only for tender purpose.</p> <p>(a) Total trench depth = 750 mm minimum</p> <p>(b) Trench width = As per number of cables laid.</p> <p>(c) Trench shall have layers one over the other as below (from bottom to top):</p> <ol style="list-style-type: none"> 1. Bottom layer shall be sand of IS: 383 with 75mm minimum thickness 2. 2run of 1Cx400 cable shall be laid over the sand layer 3. Another layer of sand of 75 mm minimum thickness. 4. Then, 300mm backfilled with soil. 5. Layer of sand of IS:383 with 75mm minimum thick 6. OFC cables shall be laid in HDPE pipe. Supply of HDPE pipe for OFC cables is in BHEL scope. 7. Layer of sand of IS:383 with 75mm minimum thick 8. Single layer of brick as protective cover

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	<p>9. Trench shall, then, be filled with refill soil and compacted</p> <p>(3) Data communication (RS 485) cables shall be laid between SMBs to form daisy chain loop (Not more than 10 SMBs in one loop) and from the end SMB of each loop, optical fiber cable shall be laid to the SCADA panel in the inverter room / control room.</p> <p>(4) Bending radii for cables shall be as per IS:1255. At road crossings, cables shall be routed through GI pipe of appropriate size that shall be in vendor scope of supply and technical details / brand etc. shall be submitted for BHEL/GSFC approval. It shall be ensured that a maximum of 60% of inner space of GI pipe shall be occupied by cables.</p> <p>(5) Vendor shall take utmost care in laying the cables in order to prevent wastages and damages on outer sheath and inner insulation. In case cables found to be damaged/ cut after the laying in trenches, vendor shall implement suitable corrective action such as cable jointing, or re-lay a new cable in consultation with BHEL.</p> <p>(6) Vendor shall take care to follow cable laying procedure and deploy necessary sand and bricks during the laying of cable. Vendor shall request BHEL site incharge /BHEL Site Engineer to inspect the cable laying and shall be allowed to close cable trench only upon written approval by site incharge.</p>
5.13	<p>Laying of 2run of 1Cx400sq.mm Al cable / OFC cables in inverter rooms, inverter cum control room(CMCS) and terminations at PCU/SCADA</p> <p>(1) 2run 1Cx400sq.mm cables (Al conductor, XLPE insulation, armoured: BHEL scope of supply) and OFC (unarmoured, BHEL scope of supply) running from SMBs (through outdoor cable trenches) shall be routed into the respective inverter rooms and laid on the cable trays therein. Supply and laying of cable trays within the rooms shall be in vendor scope of supply. Vendor shall route/lay/dress the cables neatly on the trays. Cable ties shall be in vendor scope of supply, shall be of 4.5mm minimum thickness and with adequate length of tying. OFC Cable shall be laid inside the HDPE pipe.</p> <p>(2) Vendor shall carry out drilling of holes in cable gland plates of the PCUs for the 9 positive and 9 negative DC inputs of 2RX1Cx400 cable for 7PCUs and 8 positive and 8 negative DC inputs of 2RX1Cx400 cable for 1PCU. Similarly, drilling of holes will be carried out for entry of OFC cables into SCADA panels. Gas cutting method is strictly not allowed. Vendor shall organize hole-saw cutters of appropriate size for this purpose. All necessary drilling machines / tools etc. shall be made available at site.</p> <p>(3) Prior to termination, each cable shall be checked for continuity and megger. In case any cable found defective, vendor shall implement suitable corrective action such as cable jointing, replacement/re-laying of cable etc. as applicable.</p> <p>(4) Vendor shall carry out glanding of the cables following which the glands shall be fitted to the respective holes of gland plates.</p> <p>(5) Vendor shall carry out the 2RX1Cx400 cable terminations for the 9 positive and 9 negative inputs and 8 positive and 8 negative DC inputs of 2RX1Cx400 cable for 1PCU that include tasks such as unsleeving, crimping, connecting to the tinned copper bus bars, tightening using torque wrench etc. Lugs and glands for power cable termination at PCU is in BHEL scope of supply.</p> <p>(6) Cable glands (metallic, single compression) for OFC cable termination is in vendor scope of supply.</p> <p>(7) Vendor shall arrange torque wrench of appropriate range. Torque setting shall be as per the bolt size and property class. For the setting, approval shall be obtained from BHEL site engineer.</p> <p>(8) Vendor shall submit details of cable glands/lugs/ties/hardware (Make, part number, size, quantity etc.). Glands shall be of COMET or 3D make. Other than these makes shall not be accepted.</p> <p>(9) Cable lugs shall be of Dowell or COMET or 3D make. Other than these makes shall not be accepted.</p>

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	(10) All tools/accessories such as crimping tools etc. required to carry out the termination shall be within scope of vendor.
5.14	Termination of 2Run 1Cx400 DC power cables and RS 485 cables at SMBs (1) Cables of 2Run 1Cx400 (Al conductor, XLPE insulation, armoured) shall be terminated at the output side of SMBs (positive, negative terminals). Supply of this cable is in BHEL scope. (2) Vendor scope includes removal of sleeve at the cable end, crimping with suitable cable lug of appropriate type/size and connecting the lugged end to the tinned copper bus bar within the SMB. Cables shall enter the SMB through the metallic cable glands that are also supplied by BHEL along with SMBs. (3) Cable lug with bimetallic washers shall be in vendor scope of supply. Make shall be Dowell or COMET or 3D make. Other than these makes shall not be accepted. (4) SS304 bolts/ nuts/ plain washers and Zinc/epoxy coated spring washers shall be in vendor scope of supply. (5) Quantity of lug and hardware shall also include contingency requirements arising out of shortage due to various reasons (damage, theft etc) during installation. (6) All necessary tools such as pliers, strippers, crimping tool etc shall be within vendor scope. (7) Similarly, vendor shall carry out RS485 cable terminations at SMBs. Supply of Cable glands is in BHEL scope as part of SMBs. Cable lugs, connecting hardware shall be in vendor scope of supply for which details of make, part number, size etc. shall be submitted for BHEL/GSFC approval during detailed engineering. Shield of the RS485 cables shall be suitably earthed at SMB end.
5.15	Laying and Termination of 1Cx630sq.mm LT AC power cables at PCU and Inverter Transformer (1) LT Cables 4 runs of 1C x 630 sqmm shall be laid between AC side of the PCU and the LT side of the Inverter transformer as per “ Cable installation methodology ” defined in this specification. Supply of this cable is in BHEL scope. (2) Vendor scope includes removal of sleeve at the cable end, crimping with suitable cable lug of appropriate type/size and connecting the lugged end to the tinned copper bus bar within the PCU and Transformer. Cables shall enter the PCU and Transformer through the metallic cable glands. Supply of Lugs and Glands for PCU side termination is in BHEL scope. Supply of Lugs and Glands required for Inverter Transformer side termination shall be in vendor's scope. (3) Cable lug make shall be Dowell,COMET or 3D. Other than these makes shall not be accepted. (4) Cable gland metallic type shall be of COMET or 3D make. Other than these makes shall not be accepted. (5) Quantity of lug and hardware shall also include contingency requirements arising out of shortage due to various reasons (damage, theft etc.) during installation. (6) All necessary tools such as pliers, strippers, crimping tool etc. shall be within vendor scope.
5.16	Identification marking of cables using cable tags 1) Cable tags shall be provided on all power cables at both ends just before entering the equipment enclosure. 2) Cable tags shall be of rectangular shape. 3) Cable tag shall be of 2mm thick aluminum with number punched (embossed) on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. 4) Vendor shall submit the technical details of cable tags, ID numbering scheme for BHEL/ GSFC approval during detailed engineering.

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5.17	<p>Installation of electrical panels within inverter rooms and main control room cum inverter room(CMCS)</p> <p>Panel installation within inverter room: Vendor shall organize necessary resources such as labour, cranes, hydra, forklifts, transportation trucks / trolleys and other accessories for movements and positioning of the panels as below (Quantities mentioned are per inverter room):</p> <ul style="list-style-type: none"> (a) 1250 kW PCU panels: 4 sets (b) 33kV VCB panels: 1 sets (2 incomers + 1 outgoer) (c) Distribution boards: UPSDB, IRDB (room utilities), DCDB, FCBC DB, PLDB (Plant lighting): 1 No. each + any extra boards as required (d) SCADA panel: 1 No. (e) UPS with battery bank: 1 Set (f) FCBC battery charger – 1 No. (g) Battery bank – 1 No. <p>Panel installation within main control room cum inverter room(CMCS):</p> <ul style="list-style-type: none"> (a) 33kV VCB panels: 1 set (3incomers + 1 outgoer + 1 Aux TRF outgoer+ 1Bus PT) (b) ACDB main panel: 1 set (c) Distribution boards (wall mounted): DCDB, UPS DB, CR DB (room utilities), FCBCDB, PLDB (plant lighting), PDB (power DB): 1 No. each + any extra boards as required (d) SCADA panel: 2 No.s (e) HMI SCADA control desk with PCs and accessories: 1 set (f) UPS with battery bank – 2 No. (g) FCBC battery charger – 1 No. (h) Battery bank – 1 No. <p>(1) Panels shall be moved to the respective positions and placed over the cable trenches in control room, in the exact sequence and locations as per drawings approved by BHEL/GSFC.</p> <p>(2) PCUs, VCB panels shall be placed on cable trench of inverter / main control rooms, with cable entry openings to match cable trench on bottom side.</p> <p>(3) Panels shall be suitably grouted using welding / bolting methods as per relevant standards. BHEL approval shall be obtained for the grouting arrangement. All necessary hardware for the same shall be within vendor scope of supply. Each panel shall be double earthed to the earth mat grid of the room.</p>
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5.18	<p>Installation of cable trays, cable laying/dressing etc. in inverter rooms / main control room cum inverter room(CMCS)</p> <p>A. Installation of cable trays</p> <ol style="list-style-type: none"> (1) Vendor shall supply and install cable trays, fittings and accessories within control room for laying 33kV HT, DC/AC LT, control, communication cables etc as per “Cable installation methodology” section of this specification. Cables trays shall be ladder type with horizontal corner bend pieces. 750mm minimum width, 3mm minimum thickness and appropriate height. Drawings/ make/ part number of these shall be submitted for BHEL/GSFC approval. (2) Vendor shall place and fit these cable trays over steel support structure (angles, sections etc.) that are provided in the cable trenches of inverter/ main control room cum inverter room (CMCS) by BHEL. (3) Cable trays shall be in three vertical layer arrangements: bottom for 33kV cables, middle for LT AC/DC cables and top for control/data/ communication cables. (4) Suitable cut outs, wherever applicable, shall be made in the cable trays to provide path for the cable to reach the panel. (5) Adjacent cable trays shall be interconnected using suitable hardware items that shall be in vendor scope of supply. (6) Cable trays shall be double earthed to the earth mat grid of the room. <p>B. Cable routing, laying, dressing</p> <ol style="list-style-type: none"> (1) Cables entering into the inverter/ main control room cum inverter room(CMCS) from outside (solar array/ transformer yards) shall be bunched appropriately DC/ LT/ HT/ control/ communication(OFC) category wise. The multiple bunches shall be routed through PVC conduit pipes of appropriate type, diameter and length that shall be fixed below the plinth beam of room. (2) Cables (DC/ HT, LT, communication(OFC), control etc.) shall be laid on cable trays in separate tiers with appropriate spacing as per IS: 1255. (3) Control/ data/ instrumentation cables that run from inverter rooms to marshalling box of inverter transformers shall be routed through HDPE DWC conduit pipes of appropriate size. These pipes shall in turn be routed below plinth level. (4) Cables shall be dressed using appropriate cable ties at appropriate intervals to ensure firmness of their position over the trays. (5) Trefoil clamps shall be used wherever single core cables are used for three phase system. These clamps shall be at appropriate intervals to ensure firmness of bunching of cables. (6) All cable entry openings of conduit pipes, after laying/ termination of the cables, shall be sealed using appropriate sealant to ensure water proof tightness. (7) All cable accessories such as cable conduits/pipes, ties, trefoil clamps, sealants etc for the above purpose shall be in vendor scope of supply. (8) All the supply and installation works as mentioned above shall be as per “Cable installation methodology” section of this specification and as per drawings approved by BHEL/ GSFC during detailed engineering.
5.19	<p>Laying, termination of LT/ HT/ aux supply cables in inverter/ main control room cum inverter room(CMCS)</p> <ol style="list-style-type: none"> (1) For all electrical panels viz. PCUs/ VCB panels, UPS/ FCBC battery charger/ battery bank /DB boards and inverter transformers of the inverter rooms as well as main control room cum inverter room(CMCS) and ACDB & aux transformer of main control room(CMCS), laying and termination of LT/HT/Aux power cables within the room and up to 33kV side of power transformers shall be in vendor scope, laying and termination of LT/ HT/ Aux power cables shall be in vendor scope. Exception: supply, laying and termination of aux supply cables for C&R panel and 66kV switchyard shall be in BHEL scope.

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	<p>(2) Cable glands, cable lugs, 33kV HT cable termination kits (indoor/ outdoor types as applicable), Cable jointing kits, bolts, nuts, washers etc. shall be in vendor scope of supply (except for the cable lugs and glands for AC & DC side of the PCU which is BHEL scope of supply). Cable glands make shall be COMET or 3D. Cable lugs make shall be Dowell or COMET or 3D. Other than these makes shall not be accepted.</p> <p>(3) For power terminations of Inverter transformer LV side, bimetallic (Cu/Al) lugs shall be provided by the vendor. Other lugs shall be Cu or Al as applicable</p> <p>(4) For marshalling box of transformer/ UPS/ SCADA/ DB boards, single compression nickel plated brass glands shall be provided by vendor. Make shall be COMET or 3D.</p> <p>(5) HT termination kits (indoor/ outdoor as applicable) shall be Raychem or 3M make. HT termination shall be carried out by certified jointers. Credentials / certification of experience from Raychem or 3M for the proposed jointers shall be submitted for BHEL/GSFC approval during detailed engineering.</p> <p>(6) All cables other than those listed under section “BHEL scope” of this specification shall be in vendor scope of supply.</p> <p>(7) All aux. cables shall be in vendor scope of supply. Sizing shall be as per design calculations. Aux. cables shall be KEC/ LAPP/ KEI/ Havells/ Universal make. Other than these makes shall not be accepted.</p> <p>(8) Lengths of all aux. cables shall be assessed by vendor based on indicative layouts of inverter room/ main control room cum inverter room enclosed with the tender.</p> <p>(9) Quantity of 33KV End termination and straight through jointing kits shall be supplied by vendor as follow: a. 33KV End termination kit for 1Cx300 sqmm (E) cable = 15 nos (for Inverter room) b. 33KV End termination kit for 1Cx300 sqmm (E) cable = 27 nos (for Inverter cum Control room)</p> <p>(10) Vendor shall make appropriate holes in the gland plates of PCUs, HT VCB panels, UPS panel, Distribution boards etc. for fixing the cable glands. Gas cutting is strictly prohibited. Hole-saw cutters of appropriate sizes with suitable drilling machines shall be made available at site for this purpose.</p> <p>(11) Terminations with M10 nuts and bolts and above shall be tightened using torque wrench. Torque setting shall be as per size, property class of bolt. BHEL approval shall be obtained for the settings prior to tightening.</p> <p>(12) All resources such as labour, machinery, tools and accessories to carry out the above electrical works shall be in vendor scope.</p> <p>(13) All applicable/relevant clauses under “General specification of LT cables” and “Cable installation methodology” sections of this specification shall be adopted for all aspects of these cables such as technical specifications (ratings, sizes, calculations etc.), cable selection, tests on cables, cable installation, cable accessories etc.</p> <p>Note: For Power cable size/ number of runs per phase/ required for quantity estimation. Vendor shall refer the SLD enclosed.</p>
5.20	<p>Laying and installation of Control / data / instrumentation / OFC cables</p> <p>(1) BHEL shall supply all the SCADA related data communication cables All the cable installation accessories such as cable trays, cable conduits, cable glands, cable lugs, ferrules, cable ties, bolts, nuts, washers etc. shall be in vendor scope of supply. Cable laying and cable terminations shall be in vendor scope. All necessary resources such as labour, tools and accessories required to carry out laying and termination works etc. shall be in vendor scope.</p> <p>(2) OFC cable along with HDPE conduit, termination kits shall be in BHEL scope of supply. Vendor scope includes laying of the OFC cable underground in the conduit from inverter</p>

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	<p>room SCADA panels to main control room SCADA panel. Termination of the OFC cables at both the ends shall be in BHEL scope.</p> <p>(3) All the other cables such as (i) control cables from inverter transformer marshalling boxes to relay circuits in VCB panels (transformer trip signals), (ii) control cables from inverter transformer marshalling boxes to SCADA (transformer alarm signals), (iii) control cables from SCADA panels to relay circuits in VCB panels (VCB on/off status, VCB close/open command signals), (iv) instrumentation cables from inverter transformer marshalling boxes to SCADA panels (4-20mA signals, WTI/OTI values) shall be in vendor scope of supply.</p> <p>(4) Cable laying and cable terminations shall be in vendor scope. Make shall be shall be KEC/ LAPP/ KEI/ Havells/ Universal. Other than these makes shall not be accepted. Design calculations for cable selection together with GTP/datasheet particulars shall be submitted for BHEL/ GSFC approval. number of cores, length requirements shall be appropriately assessed by the vendor.</p> <p>(5) Vendor shall lay and terminate the RS485 cables to SCADA from (a) MFM meters of VCB panels, (b) MFM meters of ACDB panel, (f) Weather monitoring station. These cables shall be laid between the panels of respective inverter/ main control rooms.</p> <p>(6) Vendor shall lay and terminate the Ethernet cables to SCADA from (a) PCUs, (b) numerical relays of VCB panels. These cables shall be laid between the panels of respective inverter/ main control rooms.</p> <p>(7) All necessary resources such as labour, tools and accessories required to carry out laying and termination works etc shall be within scope of vendor.</p> <p>(8) All applicable/ relevant clauses under “Cable installation methodology” sections of this specification shall be adopted for all aspects of these cables such as technical specifications (ratings, sizes, calculations etc), cable selection, tests on cables, cable installation, cable accessories etc.</p>
5.21	<p>Erection of 33kV transformer yards attached to inverter room and main control cum inverter room(CMCS) and aux. transformer.</p> <p>(1) Inverter room and main control cum inverter room(CMCS) is attached to two transformer yards each having one inverter transformer.</p> <p>(2) Aux transformer 100kVA, 33kV/415V shall be placed at an appropriate location near Main Control room. Supply of aux. transformer is in vendor scope. Make of aux. transformer is Voltamp/ Kotson/ Danish/ Melcon. Other than these makes shall not be accepted.</p> <p>(3) Construction of RCC foundations, fencing and gates for all transformer yard is in BHEL scope.</p> <p>(4) Vendor shall erect the transformers on RCC foundation as per transformer GA details. RCC foundation is BHEL scope of work. Vendor scope of I&C of transformers shall include:</p> <ol style="list-style-type: none"> Movement of transformers and its accessory parts such as radiators, cable boxes, hardware etc from storage yard and placement on foundation pedestal. Assembly of transformer parts. Cable laying and terminations at LV/HV/Marshalling boxes of transformers. The 33KV cable from Main outgoer panel to the LV side of the 12.5 MVA transformer shall be laid on the Cable tray support structure. For this required material like cable tray, support structure, hardware etc. is in vendor scope of supply. All activities applicable to oil filling and filtration including measurement of oil BDV and PPM in NABL accredited laboratory. Particularly for inverter transformers, filtration of oil shall be carried out to such an extent as to obtain the desired BDV (>60 kV) and PPM (< 15ppm) values. Testing of transformers as per “pre-commissioning checks” section of this section.

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	<p>(5) After installation of transformers at the transformer yards of each inverter / main control room, vendor shall level/ compact the ground with an appropriate magnitude and direction of slope to facilitate draining of rain water away from transformer yard. Accordingly, to prevent stagnation of water within transformer yard, vendor shall implement suitable civil works in and around the transformer yard. This shall include filling up the land (wherever necessary) with suitable soil and compact the filled-up portions either manually or with rollers, as applicable, as per site conditions, to achieve required compaction/slope.</p> <p>(6) Vendor shall provide the 100 mm layer of stone gravels in transformer yards as per relevant IS standards / CBIP/ CEIG requirements etc. Also, PVC pipes shall be provided at appropriate locations along the periphery of transformer yard fencing for draining out of water from the yard. PVC of appropriate size shall be in vendor scope of supply.</p> <p>(7) Vendor shall provide applicable earthing connections to transformers, fencing / gates etc. in the yard as per relevant clauses under the “Earthing system” section of this specification.</p> <p>(8) All other items (if any, other than the above) that are required to meet the technical requirements of transformer yard as per applicable standards / electricity rules shall be incorporated by the vendor.</p>
5.22	<p>33KV HT cable Laying and termination from Control room to power transformer at 66KV switchyard</p> <p>The 33KV KV HT cable laying and termination work at main out goer and power transformer shall be in the scope of the vendor executing the control room I&C works.</p> <p>For 12. 5MVA transformer, 1Rx1Cx300 sqmm/ph shall be laid and terminated at both ends</p> <p>Note: These cables shall be laid on the cable trays from Control room to Power transformers. For this vendor to provide the necessary cable support structure. Supply of cable tray, support structure and necessary hardware is in vendor’s scope of supply and installation.</p>
5.23	<p>Underground cable trenches and laying of HT/ LT/ Control/ Instrumentation/ OFC cables:</p> <p>Applicable / relevant clauses under “Cable installation methodology” section of this specification shall be adopted for burying the cables underground.</p> <p>Accordingly, following cables shall be laid underground by way of direct burying using appropriate layers of sand (75mm each layer), brick layers, refill soil etc to appropriate excavation depth below the ground level as per relevant Indian standards (IS:1255), Indian Electricity rule, CEIG/CBIP norms etc related to cable installation practices and procedures. HT cable shall be at 1000mm minimum depth from ground level, whereas LT cables in middle layer, and control / instrumentation / OFC cables in top layer.</p> <ol style="list-style-type: none"> 1) AC aux supply cables from ACDB panel in main control room cum inverter room to DB boards in inverter room. 2) AC aux supply cables from DB board of the nearest inverter / main control room cum inverter room to (i) the plant lighting poles, and booster pumps according to the requirements. 3) AC aux supply / Instrumentation / data communication cables, as applicable, from weather monitoring station data logger to SCADA room in main control room cum inverter room. 4) OFC cables (in PLB HDPE pipes) from SCADA in main control room to SCADA panel of inverter room. 5) HT cables (33kV) from inverter room to main control room cum inverter room. 6) Any other cables (other than the above) to meet the underground cable laying requirements. <p>Vendor shall avoid jointing of cut pieces of LT/HT cables to form the required length between two termination ends. However, in case of unavoidable situations due to longer routes, vendor shall join the cut pieces using LT/HT straight through joints of appropriate size. Jointing shall be</p>

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	<p>carried out by certified jointers whose credentials shall be submitted for BHEL / GSFC approval during detailed engineering. Make of jointing kits shall be 3M / Raychem. Other than these make shall not be accepted.</p> <p>Also, cable trench layouts and cross section drawings shall be submitted to BHEL/ GSFC for approval.</p>																																																																
5.24	Specification of auxiliary transformer 100kVA, 33kV/415V, Dyn11, Outdoor, ONAN																																																																
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	21	Loading Capability	Continuous operation at rated KVA on any tap with voltage variation of +/-10%. Transformer shall be capable of being loaded in accordance with IS: 6600 / IEC 60076-7.
	22	Ambient temperature	Max 50 deg C
	23	Temperature rise	For top oil: Max. 50 deg C by thermometer method For winding: Max. 55 deg C by resistance method Both rises shall be over an ambient temperature of 50 deg C irrespective of tap position.
	24	Flux density	Not to exceed 1.9 Wb/sq.m at any tap position with +/-10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following over-fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds Vendor shall furnish over-fluxing characteristics up to 150%
	25	Air Clearance	As per CBIP
	26	Load loss principal tap at 75°C, with IS tolerance	This shall be provided by vendor.
	27	No Load loss at rated voltage on principal tapping and at rated frequency, with IS tolerance	This shall be provided by vendor.
	28	No load current at rated voltage and rated frequency	This shall be provided by vendor. To be indicated as percentage.
	29	Efficiency at 75°C, UPF	As per IS 1180 and CBIP
	30	Regulation at full load, 75 °C	< 2 % for UPF For 0.8 PF lagging, to be indicated by vendor.
	31	Harmonics	Shall be designed to suppress harmonics especially 3 rd & 5 th .
	32	Vibration & noise	Noise level shall be according to NEMA TR-1 standard
	33	Highest system voltage	LV side: 1.1kV HV side: 36 kV
	34	Insulation levels as per IS:2026 Rated Lightning Impulse withstand voltage / Short duration power	LV side: -- kVp / 3 kV rms HV side: 170kVp / 70kV rms

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		frequency withstand voltage	
	35	Overall dimensions in mm Length x Breadth x Height	This shall be provided by vendor.
	36	Oil capacity (in Litres)	This shall be provided by vendor.
	37	Weight of transformer in Kg	This shall be provided by vendor.
	38	Painting	Shade 631 of IS:5
	39	Constructional features	As per relevant clause of this specification
	40	Fittings and accessories	As per relevant clause of this specification
	2.0	Tests on auxiliary transformer	
	2.1	Routine Tests: As per IS: 1180 – MQP shall be submitted for approval.	
	2.2	<p>Type Tests</p> <p>(a)Temperature rise test</p> <p>This test shall be performed as a type test on one sample of transformer. This is a mandatory test and shall be witnessed by BHEL/GSFC. Vendor shall include the price for this test in the price of auxiliary transformer.</p> <p>This temperature rise test shall be carried out at a tap corresponding to maximum losses as per IS: 1180. Test report shall be furnished to BHEL.</p> <p>(b) Valid type test report for all other type tests on similar rating transformers shall be submitted during detailed engineering.</p>	
	3.0 Constructional features and details of transformer components		
	3.0	<p>Transformer shall be constructed in accordance with IS: 2026 and IS: 3639 or equivalent international standard. All materials / components used shall be of best quality and class most suitable for working under the conditions specified.</p> <p>These shall withstand the variations of temperature and atmospheric conditions, overload, over-excitation, short-circuits as per specified standards without distortion or deterioration, without development of stresses in any part and also without</p>	

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	affecting the strength and suitability of the various parts for the work that they have to perform.
3.1 Tank	
3.1.1	The transformer tank and cover shall be fabricated from high grade low carbon plate steel of tested quality. The tank and cover shall be of welded construction and there should be provision for lifting by crane.
3.1.2	Suitable inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be sufficient size to afford easy access to the lower ends of the bushings, terminals etc.
3.1.3	The exterior of tank and other steel surfaces exposed to the weather shall be thoroughly cleaned and have a priming coat of zinc chromate applied. The second coat shall be of an oil and weather-resistant nature, preferably of distinct colour from the prime and finish coats. The final coat shall be of a glossy, oil and weather resistant non-fading paint of specified shade.
3.1.4	The interior of the tank shall be cleaned by sand blasting and painted with two coats of heat resistant and oil insoluble paint.
3.1.5	Steel bolts and nuts exposed to atmosphere shall be galvanized. All bolted connections to the tank shall be fitted with suitable oil-tight gaskets that shall give satisfactory service under the operating conditions for complete life of the transformer, if not opened for maintenance at site.
3.1.6	<p>The tank together with radiators, conservator, bushings and other fittings shall be designed to withstand the following conditions without permanent distortion:</p> <ul style="list-style-type: none"> (i) Full vacuum of 760 mm of Hg, for filling with oil by vacuum. Internal gas pressure of 0.35 Kg/cm² (5 lbs/sq.in) with oil as at operating level. (ii) The transformer shall have conservator tank of adequate capacity to accommodate oil preservation system and volumetric expansion of total transformer oil. The conservator shall be bolted into position so that it can be removed for cleaning purposes. (iii) The conservator shall be of single compartment type. The top of the conservator shall be connected to the atmosphere through a transparent type silica gel breather. (iv) The tank cover shall be suitably sloped so that it does not retain rain water. The material used for gaskets shall be cork, neoprene or approved equivalent.
3.2 Core	

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	3.2.1	The magnetic circuit shall be of core type. The core shall be constructed from non-ageing, cold rolled, super grain oriented silicon steel laminations (CRGOS) equivalent to M4 grade steels or better.
	3.2.2	The insulation structure of the core to clamp plates shall be such that it withstands a voltage of 2kV (rms) for one minute in air.
	3.2.3	Adequate lifting lugs will be provided to enable the core & windings to be lifted.
	3.3 Windings	
	3.3.1	Windings shall be of electrolytic grade copper free from scales and burrs.
	3.3.2	Windings shall be subjected to a shrinking and seasoning process so that no further shrinkage occurs during service.
	3.3.3	Windings shall have uniform insulation.
	3.3.4	Tapping shall be so arranged as to preserve the magnetic balance of the transformer at all voltage ratios.
	3.3.5	The completed core and coil assembly shall be dried in vacuum and shall be immediately impregnated with oil after the drying process to ensure elimination of air and moisture within the insulation.
	3.3.6	Windings shall be made in dust proof and conditioned atmosphere. Vendor shall indicate those details of facilities (as available at the winding works) that will ensure meeting this requirement.
	3.4 Internal earthing	
	3.4.1	The frame work and clamping arrangements of core and coil shall be securely earthed inside the tank by copper strip connection to the tank.
	3.5 Bushings	
	3.5.1	Bushings shall be designed and tested to comply with the applicable standards. Bushings rated for 400A and above shall have non-ferrous flanges and hardware. Bushings shall be supplied with terminal connector clamp suitable for connecting the cables.
	3.5.2	Neutral bushings of the star-connected LV winding shall be brought out to separate bushing terminals. The neutral bushings shall be provided on the tank at such a location that facilitates connecting earth conductor down to the ground level. Tank-mounted pin-type support insulators shall be provided for supporting the neutral earthing bar of specified section, along its run from the neutral bushing to ground level.
	3.6 Cables boxes and disconnecting chambers	

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	3.6.1	Cable boxes shall be supplied with gland plates having holes to suit cables provided.						
	3.6.2	Cable boxes / disconnecting chambers shall be provided with body earth terminals.						
	3.6.3	LV cable boxes shall be provided with necessary LV bushings, bus bars, bus bar supports for making cable terminations.						
	3.6.4	HV cable boxes shall be provided with necessary HV bushings and terminals for making cable terminations.						
	3.6.5	Cable boxes shall be provided with suitable gaskets to ensure the specified protection class requirement (IP55).						
	3.6.6	Cable boxes / disconnecting chambers shall be provided with necessary arrangements to prevent entry of rain water into the same.						
	3.6.7	Disconnecting chambers: (1) Disconnecting chambers shall be provided to enable the transformer to be removed without unsealing the cables or draining oil from the main tank. (2) Disconnecting chamber shall be air insulated and complete with seal-off bushings, removable flexible connectors / links and removable covers. (3) Phase-to-phase and Phase-to-ground clearances within the chamber shall be such as to enable either the transformer or cable to be subject separately to HV tests. Clearances shall be subject to BHEL approval.						
3.7 Transformer oil								
	3.7.1	Transformers shall be supplied complete with transformer oil. The new insulating oil before pouring into the transformer shall conform to the requirement of IS: 335. No inhibitors shall be used in the oil. The oil samples taken from the transformer at site shall conform to requirements of IS: 1866.						
	3.7.2	10% extra oil, in non-returnable sealed containers, shall be sent along with main consignment to avoid any shortage of oil at the time of topping up of oil at the site. This oil quantity shall be over and above the specified mandatory spares requirement.						
3.8 Fittings and accessories								
Following fittings per transformer shall be provided. Vendor shall indicate compliance (Yes / No) for each line item. In case of non-compliance or deviation, vendor shall indicate and provide comments.								
	<table border="1"> <thead> <tr> <th>#</th><th>Nomenclature of fitting / accessory</th><th>Qty</th></tr> </thead> <tbody> <tr> <td>1</td><td>Oil conservator with equalizer pipe and drain plug</td><td>1 set</td></tr> </tbody> </table>	#	Nomenclature of fitting / accessory	Qty	1	Oil conservator with equalizer pipe and drain plug	1 set	
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	2	HV cable box	1 set
	4	LV cable box	1 set
	6	Off circuit tap changing switch (OCTC) with operating knob, tap position marking and locking facility, with warning plate “Tap switch to be operated only with the transformer de-energized”.	1 set
	7	Neutral bushings for earthing of LV winding	1 No
	8	Earthing terminals for cable boxes, tank etc.	2 Sets
	9	Radiators (detachable type) with drain value at the bottom, relief valve at the top, air plug, shut-off valves at every point of connection to the tank and lifting lugs.	4 sets
	10	Silica gel dehydrating breather with oil cup	1 set
	11	Prismatic / toughened glass oil level gauge for transformer and tap changer chamber with min and max markings.	1 set
	12	Explosion vent (double diaphragm) with sight glasses and equalizing pipe connection to conservator	1 set
	13	Inspection window with cover	1 set
	14	Cover lifting lugs / eyes	2 Nos
	15	Tank lifting lugs / eyes for the entire transformer	4 Nos
	16	Bi-directional flat rollers	4 sets
	17	Base channel with towing holes / lugs	2 sets
	18	Air release hole with plug	1 No
	19	Oil filling hole with cap	1 No
	20	Top filter valve with threaded male adapter (blanking plug)	1 No
	21	Drain cum sampling valve	1 No
	22	Rating and diagram plates made of stainless steel or anodized aluminium.	1 No
	23	Terminal marking plates	1 Set
	24	Stem type thermometer mounted on top of tank	1 No

4.0 Inspection and testing of transformers at vendor works

4.0	Vendor shall provide inspection call to BHEL for the type and routine tests. Prior to the call, vendor shall submit the routine test results as per Manufacturing Quality Plan (MQP) for scrutiny of BHEL/BEL/SECI.
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5.0 Tests

5.1	Routine Tests: As per IS: 2026.
5.2	Type Tests (a) Temperature rise test as per IS: 2026

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	<p>This test shall be performed as a type test on one sample of transformer. This is a mandatory test and shall be witnessed by BHEL/BEL/SECI. In case extra charges are required, the same shall be indicated separately in the offer on per-transformer basis.</p> <p>This temperature rise test shall be carried out at a tap corresponding to maximum losses as per IS: 2026. Test report shall be furnished to BHEL.</p> <p>(b) Valid type test report for other type tests on similar rating transformers shall be submitted during detailed engineering.</p>
6.0 Documents to be submitted after receipt of purchase order	
6.1	<p>Following documents shall be submitted for BHEL approval within seven days from date of purchase order.</p> <p>(1) GA drawings including foundation details</p> <p>(2) GTP</p> <p>(3) MQP</p> <p>(4) Valid type test report as above</p>
7.0 Documents to be submitted along with consignment	
7.1	<p>Following documents shall be submitted to BHEL at the time of delivery of the consignment:</p> <p>(1) As built drawings of transformer</p> <p>(2) Routine test reports on transformer</p> <p>(3) Type test reports on transformer</p> <p>(4) Test certificate for transformer oil</p> <p>(5) Operations and maintenance manual of transformer</p>
5.25	<p>Auxiliary AC/DC power supply system</p> <p>Vendor shall establish an auxiliary AC supply system for (a) various utility power consumption purposes such as inverter room / main control room lights, ceiling fans, exhaust fans, booster pumps, plant lighting, air-conditioner, other electric appliances, auxiliary power supply to PCUs, VCB panels, transformers etc and also, for (b) powering the battery chargers that in-turn charge the battery banks for 110V DC supply.</p> <p>Vendor shall submit detailed SLD diagram of Aux AC/DC system with ELR/CBCT, MCCB, MCB types (TPN, DP, SP)/ Amp/kA ratings for incoming/ outgoing feeders for various electrical loads/ utilities for BHEL/GSFC approval during detailed engineering.</p> <p>i. Following DB boards for application in main control room shall be in vendor scope of supply, installation and commissioning:</p> <p>ACDB, UPS DB for 230V AC UPS supply to SCADA, PCUs (control circuits), VCB(control circuits), weather monitoring system, fire alarm system, emergency loads, nitrogen fire protection system, CCTV system, DCDB, CR DB (room utilities), FCBC DB, PLDB (plant lighting), PDB (power DB) - 1 Sets</p> <p>ii. Following DB boards (wall mounted, 1 No each) for each inverter room shall be in vendor scope of supply, installation and commissioning:</p>

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	<p>UPSDB 230V UPS supply for SCADA, PCUs (control circuits), VCB(control circuits), fire alarm system panel, emergency loads, IRDB(Room utility) DCDB, FCBC DB, PLDB(Plant Lighting) and other electrical fitting etc.</p> <p>iii. Above DB boards shall also provide for any other feeders, if necessary, to meet functional requirements. In addition, at least two spare feeders shall be provided in each of the above DB boards. Further, any extra DB boards to meet functional requirements of Aux AC/DC system shall be provided by the vendor.</p> <p>iv. Above DBs shall be wall-mounted board, of reputed make such as Legrand, Siemens, Schneider or any other reputed make as approved by BHEL/GSFC.</p> <p>v. DB boards shall be provided with incoming/ outgoing MCB as applicable (based on rating requirements) with spare feeders as shall be approved by BHEL/GSFC.</p> <p>vi. Installation of all the above items including all necessary cable terminations/ installation shall be in vendor scope.</p> <p>The system shall comprise of following items:</p> <p>(a) An auxiliary transformer (1 No) 100kVA, 33kV/415V, Dyn11, Outdoor, Oil-immersion / ONAN type shall be installed in the 66kV metering yard attached to main control room. Supply and installation of aux transformer, erection of transformer, all necessary cable terminations, cable installation and cable interconnections with VCB panel (on HV side) and with ACDB panel (on LV side) shall be in vendor scope. Both the HV (33kV) and LV cables shall be in vendor scope of supply. Detail specification as per clause 5.23 .</p> <p>(b) ACDB floor-mounted panel, 1 No (fed by 3ph, 4-wire 415V auxiliary transformer supply) distributes the AC power to various utility applications in main control room cum inverter room (CMCS) and inverter room. The panel shall be supplied, installed and commissioned in main control room by the vendor. It shall have incoming feeder supply from aux transformer and outgoing feeders for main control room utility and inverter room.</p> <p>Constructional features of the panel shall be as per clause “LT switchgear panels”</p> <p>Feeders as below:</p> <p>(i) Incoming feeder – 3ph from ACDB panel in control room</p> <p>(ii) Outgoing feeders</p> <ul style="list-style-type: none"> - To DCDB boards - To CRDB (Control Room Utility)board - To IRDB (Inverter Room Utility) board - To PDB boards - FCBC Boards - PLDB Boards - PDB Boards - UPS DB To UPS panel 5kVA - At least two spare feeders <p>Detailed constructional specification of the ACDB panel shall be as per separate clause “LT switchgear panels”. LT switchgear component of reputed make such as L&T, Siemens, ABB or Schneider . Other than these vendors shall not be accepted.</p>
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	<p>Incoming feeder as well as each of the outgoing feeders shall have separate MFM meter with RS485 communication feature to facilitate SCADA connections.</p> <p>(c) Battery banks, Float-cum-boost charger, UPS in main control room (BHEL scope of Supply): Vendor shall install and commission 2 No.s each of Battery bank, Float-cum-boost charger, UPS in main control room.</p> <ol style="list-style-type: none"> Battery bank shall be supplied by BHEL. Battery bank is for backing up the FCBC panel which is also supplied by BHEL Float-cum-boost-charger with boost current and boost voltage : Battery charger as well as their automatic regulators shall be of static type. Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e. Trickle charging the associated DC Batteries while supplying the DC loads. The chargers is designed to operate, as mentioned above, at an ambient air temperature of 50°C. Battery chargers have a selector switch for selecting the battery charging mode i.e. whether Trickle or Boost charging. During automatic boost charging, the Battery chargers shall operate on constant current mode. UPS panel, 5kVA with battery back up : (BHEL scope of Supply): <ul style="list-style-type: none"> Incoming feeder – from either ACDB panel or Battery charger panel Outgoing feeder – To UPSDB board At least one spare feeder Make shall be Hitachi, Consul Neowatt or reputed equivalent subject to BHEL/BEL approval Constructional features of the panel shall be as per clause “LT switchgear panels” <p>(d) UPS/BC/Battery bank panel : 1 set for the inverter room: (BHEL scope of Supply): Vendor shall install and commission UPS/BC/Battery bank panel 5kVA with battery bank ~100Ah. Incoming feeder – from main supply DB (SDB) of inverter room <ul style="list-style-type: none"> Built-in outgoing feeders for both AC (230V) and DC (110V) </p>
5.26	<p>LT switchgear panels</p> <p>The LT switchgear panels (ACDB, DCDB etc wherever applicable) shall be designed as per the relevant IS codes and as per the approved design for the panel. All the parts of the panels must be rated as per the relevant rated voltage level. All the panels must have multifunction meters (MFM) flushed with the surface of the panels.</p> <p>The ACDB panels in main control room shall be rated for the maximum output of the Aux transformer feeding the system which can fulfill the load requirement of main control room cum inverter room (CMCS) as well as inverter room. The short circuit withstand rating (1 sec) at rated voltage of the switchgear shall be relevant to the existing electrical system short circuit ratings.</p> <p>(1) LT switchgear panels (Construction)</p>

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	<p>(i) Single front / compartmentalized, modular design, degree of protection IP52 with provision of extension on both sides.</p> <p>(ii) Incomer feeders: mains incomer - Electrically operated draw out type Air Circuit Breakers (ACBs)/ Vacuum Circuit breakers (VCBs), as applicable.</p> <p>(iii) Outgoing feeders: Moulded Case Circuit Breakers (MCCBs)/ electrically operated draw out type Air Circuit Breakers (ACBs) / Vacuum Circuit Breakers (VCBs), as applicable. Make of MCCB shall be oh Siemens, ABB, Schnieder or L&T. Other than these vendors shall not be accepted.</p> <p>(iv) The colour finish shade of switchgear enclosure for interior shall be glossy white & for exterior it shall be light grey, semi glossy shade 631 of IS: 5. if a different exterior shade is desired by the Employer, the same shall be intimated to the supplier.</p> <p>(v) The LT switchgear panel shall be fabricated out of CRGO sheet steel; 2 mm thick for the outer shall all-round. The internal walls and separators shall be of 1.6 mm thick CRGO sheet steel</p> <p>(vi) The gland plates shall be 3 mm thick</p> <p>(2) Control Circuit</p> <p>(a) Air Circuit Breaker spring charge motor – 230 V AC, 1 phase as per requirement</p> <p>(b) Moulded Case Circuit Breakers – 230 V AC, 1 phase as per requirement</p> <p>(c.) Space heater, sockets, etc. – 230 V AC, 1 phase as per requirement</p> <p>(d) Control supply for breaker closing / tripping - 110V DC as per requirement</p> <p>(e) Indications, annunciation – 110V DC as per requirement</p> <p>(3) Bus Bar & Cable Cavity</p> <p>(a) The material for main bus bars and tap off bus bars shall be electrolytic grade aluminium with properly colour coded HR PVC sleeved insulation.</p> <p>(b) Bus bars shall be suitable for short circuit rating and current suitable for all connected load.</p> <p>(c) Cable entry for incoming and outgoing cables shall be from Bottom.</p> <p>(d) A suitable gland plate shall be supplied for termination of power, control and instrumentation cables.</p> <p>(e) Whenever feeders are housed in multi-tier configuration, these tiers shall be segregated by sheet metal barriers.</p> <p>(f) Earthing: Earthing bus bar shall be terminated at both ends of the switchgear to suit the connections to outside earthing conductor. All components inside the module are required to be earthed individually and are to be looped and connected to the horizontal earth bus. All the non-current carrying parts of the panels, e.g., enclosure, must be connected to earth as per the regulations.</p> <p>(4) Terminals</p> <p>(a) CT circuit - Isolating link type terminals with shorting facility</p> <p>(b) PT circuit – clip on type terminals</p> <p>(c) Spare contacts shall be wired up to terminal block. 10% spare terminals shall be provided for each module</p> <p>(5) Specific requirements</p> <p>(a) All ACBs/ MCBs, as applicable, shall be 4 pole, electrically operated, draw-out type, with closing coil, spring charge motor, trip coil, TNC switch for close and trip, manual closing and tripping push buttons, door I/L, test and service position micro switches, emergency P.B., safety shutters, etc. The circuit breaker shall be provided with anti-pumping feature.</p>
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	<p>(b) ACBs/ VCBs, as applicable, shall be complete with microprocessor release and shall be provided with over current, short circuit and earth fault protections.</p> <p>(c) Minimum 10% spare feeders of each rating shall be provided in the switchgear.</p> <p>(d) All current transformers shall have 5/1A secondary and all meters shall be suitable for 5/1A operation.</p> <p>(e) All indicating lamps shall be of LED cluster type. ACB feeders shall be provided with ON, OFF, AUTOTRIP, SPRING CHARGED, TEST, SERVICE, TRIP CIRCUIT HEALTHY indications</p> <p>(f) All indicating instruments, including MFM, shall be flush mounting, Digital type and of standard size.</p> <p>(g) Window annunciator with hooter and accept, test, reset button shall be provided.</p> <p>(h) Necessary auxiliary relays for contact multiplication shall be provided in the panel.</p> <p>(i) The maximum temperature of the bus bars, droppers and contacts at continuous current rating under site reference ambient temperature of 50° C shall not exceed 105° C.</p> <p>(j) Instrumentation: Switchgear instrumentation shall be provided as follows:</p> <ol style="list-style-type: none"> 1. Mains Incomer – Voltmeter with selector switch 2. Ammeter with selector switch 3. Power Factor meter 4. Frequency meter 5. TVM + MD meter 6. Potential indicating lamps 7. Outgoing Feeders 8. Ammeter with selector switch on all feeders <p>(6) General Technical Specifications (LT Switch gear Panel)</p> <p>(a) The panel shall be self-supporting, free standing, floor mounted, modular type with construction having degree of protection of IP 54 as per IS 2147.</p> <p>(b) The panel shall be fabricated from 14 SWG CRCA sheet steel for frame & load bearing surfaces. Partitions may be fabricated from 16 SWG CRCA if no components are mounted on them.</p> <p>(c) The panel shall be painted with 2 coats of primer after pre-treatment and 2 coats of Polyurethane / epoxy paint with shade as decided by the Owner</p> <p>(d) Stiffeners shall be provided at corners & between modules to make panel rugged. The stiffeners will necessarily be required for relay compartments or doors where heavy components are mounted.</p> <p>(e) The openable covers will be provided with lift off type hinges, quarter turn door locks and flexible copper wire for earth connection.</p> <p>(f) The panel shall be dust and vermin proof. Synthetic or neoprene gaskets shall be provided at all openings.</p> <p>(g) The panel shall be of dead front construction suitable for front operated and back maintained functioning.</p> <p>(h) Panel shall be provided with fluorescent lamp of 20W capacity operated by door operated limit switch. Panel shall also have space heaters and thermostat arrangement.</p> <p>(i) Panel shall be provided with 3 pin switch socket combined unit of 5 Amp capacity.</p> <p>(j) Lifting hooks shall be provided at the top of the panel.</p> <p>(k) The hardware components used in the panel shall be hot dipped galvanized.</p> <p>(l) The control components shall be fixed on mounting plate by drilling & tapping.</p> <p>(m) Al anodized legend plates shall be provided for all the components. For components mounted on front face, legend plate from inside shall also be provided.</p> <p>(n) Pre-treatment by 7 tank process shall be done before painting / powder coating the panel.</p>
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	<ul style="list-style-type: none"> (o) Panel shall have provision of drawing pocket. (p) The panel shall be designed to ensure maximum safety during operation inspection, connection of cables and maintenance. Inside panel, checking and removal of components shall be possible without disturbing other units. (q) Cable entries will be from bottom. The opening of cable entry shall be covered by 3 mm thick gland plates. (r) The panel shall be provided with all necessary components / devices and instruments as per the recommended schematic diagram and functional requirements. (s) The components such as protective relays, auxiliary relays, push buttons, switches, instruments shall be flush mounted on the front side of a panel. (t) The control wiring shall be done with PVC insulated flexible copper wire. For CT secondary circuits 2.5 sq.mm wire shall be used. For control wiring 1.5 sq.mm wire will be used. (u) Earthing bus bar of suitable cross section shall be provided throughout the length of panel. (v) The panel shall be fully wired all the terminals shall be brought out for cable connections. 10% spare terminals shall be provided on each terminal block. Separate terminal block shall be provided for different voltages. All wire shall have P.V.C. ferrules as per wiring diagram. (w) Proper shrouding to incoming and outgoing terminals shall be provided to ensure safety during operation, inspection and maintenance. (x) Indicating lamps shall be with multiple LEDs & shall be suitable for the voltage specified. (y) All the components in the panel shall be properly labeled. The labels shall be made of non-rusting metal or engraved PVC material properly fixed by screws. (z) The panel layout shall be made in such a way that it will always facilitate easy removal and reconnection of control cables without disturbing other wiring. (aa) Centre lines of control switches, push buttons and indicating lamps shall be matched so as to give neat appearance. Similarly top lines of indicating instruments and relays shall also be matched. (bb) The panel shall be provided with electrolytic grade Al bus bar of suitable cross section so as to maintain max current density of 0.8 AMP/ Sq.mm. (cc) Bus bars shall be provided with colour coded heat shrinkable insulating sleeves. (dd) Bus bars shall be supported by high quality epoxy insulators provided at specified distances so as to withstand to the given fault level. (ee) The bus bar chambers shall be provided with suitable ventilation arrangements so as to limit the maximum temperature of 85°C while carrying rated current. (ff) Proper clearance of minimum 25 mm shall be maintained between phase bus bars and between bus bars. (gg) The panel shall be inspected at manufactures works before dispatch to site at the discretion of Employer. (hh) All routine tests shall be carried out on the panel in presence of Employer or their representative or its representative. These tests shall include following: <ul style="list-style-type: none"> (i) Verification of components ratings and operation. (ii) High voltage measurement test. (iii) Insulation Resistance measurement. (iv) Control testing
5.27	Electrical works in PEB inverter room and and main control cum inverter room (CMCS)

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	<p>Vendor scope includes complete electrical works for the inverter room. Erection of electrical panels (PCUs, VCB panels, SCADA/ FCBC/ IRDB/ DCDB/ UPS panels etc, Laying / interconnection of power/ control cables between these panels in the inverter rooms are elaborated elsewhere in this specification.</p> <p>Similarly vendor scope includes complete electrical works for the main control cum inverter room (CMCS). Erection of electrical panels (PCUs, VCB panels, ACDB/ SCADA/ FCBC/ CRDB/ DCDB/ UPS panels/ Battery room/ Pantry/ Toilet/ Store room and Conference room etc, Laying / interconnection of power/ control cables between these panels in the main control cum inverter room (CMCS) are elaborated elsewhere in this specification.</p> <p>This clause is particularly on electrical works related to supply and installation of all electrical appliances / utilities of the inverter room and main control cum inverter room (CMCS) such as lights / light fittings, ceiling fans, exhaust fans, ventilators, switchboards, MCB boxes, wiring/routing of cables for these, termination of electrical cables at both ends (appliances and ACDB panel), electrical conduits/pipes/casing etc.</p> <p>Vendor shall submit the design of electrical layout for these PEB inverter room and PEB main control cum inverter room (CMCS) for BHEL/GSFC approval. For this, BHEL will submit approved GA drawings of PEB inverter room as well as PEB main control cum inverter room (CMCS) to the vendor after placement of purchase order. However, typical layout of PEB inverter room and PEB main control cum inverter room (CMCS) (for tender purpose only) are enclosed herewith. Electrification of PEB inverter room and PEB main control cum inverter room (CMCS) shall be carried out as per IS:732-1989, IS:4648-1968, NBC 2016 and other relevant standards.</p> <p>List of electrical items for one PEB inverter room:</p> <ol style="list-style-type: none"> 1) Industrial twin FTL luminaire with 2x28W each T5 lamps: 12 sets 2) Industrial single FTL luminaire with 28W each T5 lamps: 6 sets (fitted inside the room) 3) Domestic ceiling fan 240V 1200mm sweep: 3 No 4) Fan regulator: 3 No 5) Exhaust fan (450mm min): 2 No 6) 3-pin 6A socket with switch: 2No 7) 5-pin 6/16A socket with switch: 1 No 8) 6A modular type switches: as required 9) Light distribution boards: Quantity as required to meet the above requirements. 10) Electrical cables Copper conductor PVC FRLS shall be of appropriate size / rating 11) Electrical conduits/casings etc shall be of heavy duty type that as approved by BHEL/GSFC during detailed engineering. 12) All necessary fixtures, fittings and accessories for mounting the appliances (lights, fans etc) shall be provided by vendor. <p>List of electrical items for one PEB main control room cum inverter room (CMCS):</p> <ol style="list-style-type: none"> 1) Industrial twin FTL luminaire with 2x28W each T5 lamps: 20 sets 2) Industrial single FTL luminaire with 28W each T5 lamps: 10 sets (fitted inside the room) 3) Domestic ceiling fan 240V 1200mm sweep: 5 No 4) Fan regulator: 5 No
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	<p>5)Industrial Exhaust fan (450mm min): 8 No</p> <p>6)3-pin 6A socket with switch: 4No.s</p> <p>7)5-pin 6/16A socket with switch: 3 No.s</p> <p>8)6A modular type switches: as required</p> <p>9)Light distribution boards: Quantity as required to meet the above requirements.</p> <p>10)Electrical cables Copper conductor PVC FRLS shall be of appropriate size / rating</p> <p>11)Electrical conduits/casings etc shall be of heavy duty type that as approved by BHEL/GSFC during detailed engineering.</p> <p>12)All necessary fixtures, fittings and accessories for mounting the appliances (lights, fans etc) shall be provided by vendor.</p> <p>13)Normal Exhaust fan (450mm min): 2 No.s</p> <p>Make : For above mentioned items shall be Philips/Bajaj/Wipro/Havells/ make subject to BHEL/GSFC approval. Other than these vendors shall not be accepted.</p>
5.28	<p>Electrical works in Security room and watchman cabin</p> <p>This scope pertains to vendor executing the supply and installation works for Security room and watchman cabin.</p> <p>In addition to Inverter room and main control room cum inverter room, power plant consist of 1 Security room and 4 watchman cabins.</p> <p>This clause is particularly on electrical works related to security room supply and installation of all electrical appliances / utilities of the security room inverter room such as lights / light fittings, ceiling fans, exhaust fans, ventilators, switchboards, MCB boxes, wiring/routing of cables for these, termination of electrical cables at both ends (appliances and ACDB panel), electrical conduits/pipes/casing etc.</p> <p>List of items for one PEB security room:</p> <ol style="list-style-type: none"> 1) 2X18W CFL wall/ surface mounting luminaire: 2 sets 2) 2x11W CFL wall/surface mounting luminaire: 2 Nos 3) 1x9W bulkhead luminaire: 1 No 4) Ceiling fan: 1 No 5) MCB Junction box with feeders: 1 Nos 6) Fan regulator: 1 No 7) 6A modular type switches: 5 Nos 8) 6/16A 5Pin switched socket outlet modular type: 2 Nos 9) Exhaust fan: 1 No 10) Electrical cables Copper conductor PVC FRLS shall be of appropriate size / rating 11) Electrical conduits/casings etc shall be of heavy duty type that as approved by BHEL/GSFC during detailed engineering. 12) All necessary fixtures, fittings and accessories for mounting the appliances (lights, fans etc) shall be provided by vendor. <p>List of items for one watchman cabin:</p> <ol style="list-style-type: none"> 1) 2X18W CFL wall/ surface mounting luminaire: 1 sets 2) 2x11W CFL wall/surface mounting luminaire: 1 Nos 3) 1x9W bulkhead luminaire: 1 No 4) MCB Junction box with feeders: 1 Nos 5) 6A modular type switches: 3 Nos 6) 6/16A 5Pin switched socket outlet modular type: 1 Nos 7) Electrical cables Copper conductor PVC FRLS shall be of appropriate size / rating

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	<div>8) Electrical conduits/casings etc shall be of heavy duty type that as approved by BHEL/GSFC during detailed engineering.</div> <div>9) All necessary fixtures, fittings and accessories for mounting the appliances (lights, fans etc) shall be provided by vendor.</div> <div>Make : For above mentioned items shall be Philips/Bajaj/Wipro/Havells/ make subject to BHEL/GSFC approval. Other than these vendors shall not be accepted.</div>																																							
5.29	<div>Supply and installation of Weather monitoring system</div> <div>Weather Monitoring system shall be installed on an independent structure/platform of 3.6 metres height at suitable location near main control room cum inverter room (CMCS) for installation of Weather Monitoring system. As part of weather monitoring system (WMS), vendor shall supply, install and commission the following measuring instruments with all necessary software and hardware such as data logger, power supply/ control/ data/ communication cables etc. required to integrate with SCADA.</div> <div>Scope of vendor shall also include supply and erection of all the mounting arrangements including all necessary civil works/ foundations etc. as recommended by manufacturer. Communication cables shall be laid and terminated at both SCADA station at main control room and data logger at weather monitoring station end. Similarly, power supply cables shall be laid between WMS and DB boards in main control room.</div> <div>Exact location of the weather monitoring station shall be decided during detailed engineering. Vendor shall submit all necessary GTP/ GA drawings of instruments and installation arrangement, installation manual, make/ model number/ part number etc. for BHEL/GSFC approval during detailed engineering.</div> <div>Pyranometer (3 Nos)</div> <div>Vendor shall provide 3 Nos Class II pyranometers for measuring the incidental solar radiation at horizontal and inclined plane of array. Out these, 2 shall be mounted horizontally and one shall be mounted in tilt position. Hence one no. adjustable tilt mounting plate shall be provided by the vendor</div> <div>Specification of the pyranometer shall be as follows:</div> <table><tr><td>1</td><td>Spectral response</td><td>0.31 to 2.8 micron</td></tr><tr><td>2</td><td>Sensitivity</td><td>Approx. 9 micro-volt / W/ m2</td></tr><tr><td>3</td><td>Time response (95%)</td><td>Max 15s</td></tr><tr><td>4</td><td>Nonlinearity</td><td>+/- 0.5%</td></tr><tr><td>5</td><td>Temperature response</td><td>+/- 2%</td></tr><tr><td>6</td><td>Tilt error</td><td>< +/- 0.5%</td></tr><tr><td>7</td><td>Zero off-set thermal radiation</td><td>+/- 7 W/m2</td></tr><tr><td>8</td><td>Zero off-set temperature change</td><td>+/- 2 W/m2</td></tr><tr><td>9</td><td>Operating temperature range</td><td>-40 deg to +80 deg</td></tr><tr><td>10</td><td>Uncertainty (95% confidence level)</td><td>Hourly- Max 3%, Daily-Max 2%</td></tr><tr><td>11</td><td>Non stability</td><td>Max +/-0.8%</td></tr><tr><td>12</td><td>Resolution</td><td>Min +/- 1W/m2</td></tr><tr><td>13</td><td>Input power for instrument and peripherals</td><td>230V AC (if required)</td></tr></table>	1	Spectral response	0.31 to 2.8 micron	2	Sensitivity	Approx. 9 micro-volt / W/ m2	3	Time response (95%)	Max 15s	4	Nonlinearity	+/- 0.5%	5	Temperature response	+/- 2%	6	Tilt error	< +/- 0.5%	7	Zero off-set thermal radiation	+/- 7 W/m2	8	Zero off-set temperature change	+/- 2 W/m2	9	Operating temperature range	-40 deg to +80 deg	10	Uncertainty (95% confidence level)	Hourly- Max 3%, Daily-Max 2%	11	Non stability	Max +/-0.8%	12	Resolution	Min +/- 1W/m2	13	Input power for instrument and peripherals	230V AC (if required)
1	Spectral response	0.31 to 2.8 micron																																						
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5	Temperature response	+/- 2%																																						
6	Tilt error	< +/- 0.5%																																						
7	Zero off-set thermal radiation	+/- 7 W/m2																																						
8	Zero off-set temperature change	+/- 2 W/m2																																						
9	Operating temperature range	-40 deg to +80 deg																																						
10	Uncertainty (95% confidence level)	Hourly- Max 3%, Daily-Max 2%																																						
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	<p>Each instrument shall be supplied with necessary cables. Calibration certificate with calibration traceability to World Radiation Reference (WRR) or World Radiation Centre (WRC) shall be furnished along with the equipment. The signal cable length shall not exceed 20m. Vendor shall provide Instrument manual in hard and soft form.</p> <p>Thermometers Vendor shall provide two thermometers (one for ambient temperature measurement with shielding case and other for module temperature measurement). The thermometers shall be RTD/ semiconductor type measuring instrument. Instrument shall have a range of -5°C to 60°C. The instrument shall have valid calibration certificate.</p> <p>Anemometer and wind vane Vendor shall supply double cup anemometer on tubular type made up of hot dipped Galvanized Iron. Velocity range upto 65 m/s, accuracy limit of 0.1 m/s. the anemometer shall have valid calibration certificates which should be produced during one month of the installation.</p> <table border="1"> <tr> <td>1) Velocity range with accuracy limit</td><td>+/- 0.10 m/s</td></tr> <tr> <td>2) Wind direction range with accuracy limit</td><td>0 to 360 deg with accuracy +/- 4 deg.</td></tr> </table> <p>Note : Each instrument shall be supplied with necessary cables. Calibration certificate with calibration traceability to World Radiation Reference (WRR) or World Radiation Centre (WRC) shall be furnished along with the equipment.</p> <p>Data Logger Vendor shall provide 1 no. of data logger with internal reliable battery backup and data storage capacity.</p>	1) Velocity range with accuracy limit	+/- 0.10 m/s	2) Wind direction range with accuracy limit	0 to 360 deg with accuracy +/- 4 deg.
1) Velocity range with accuracy limit	+/- 0.10 m/s				
2) Wind direction range with accuracy limit	0 to 360 deg with accuracy +/- 4 deg.				
5.30	<p>Installation and commissioning of SCADA integration systems</p> <p>(1) SCADA system, supply of which shall be in BHEL scope, comprises of data station panels and PC based control desks with software to collect, store, process and report the data parameters of power plant and also to control the operations of the power plant by integrating the various equipment at the segments as follows:</p> <ul style="list-style-type: none"> (a) String monitoring boxes (71 Nos) in solar array field (b) Weather monitoring equipment: Pyranometers for solar irradiation (3 Nos), thermometer for ambient temperature (1 No), thermometer for module surface temperature (1 No), anemometer for wind speed and direction (1 no). (c) Power conditioning units (8 Nos): DC input / AC output parameters of inverters, grid data, fault status and events logged, etc. (d) Inverter transformers (4 Nos): Alarm/Trip signals, WTI/OTI temperature values. (e) 33kV VCB breaker panels (as per SLD): status of VCB breakers, status of protection relays of transformers, oil / winding temperatures, AC parameters at every 5MW level of the plant. (f) ACDB multifunction meters (2 Nos): AC auxiliary utility consumption parameters (g) Fire alarm system (all inverter/ main control rooms): status signals <p>(2) BHEL scope of SCADA:</p> <ul style="list-style-type: none"> (a) Data station panels with necessary data loggers / PLCs and other accessories such as power supply etc to integrate the data signals as listed below. This includes main panel at main control room and intermediate (linking) panels at inverter room. 				

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	<p>(b) Desktop PCs (HMI control desks) provided with necessary software packages and remote monitoring features.</p> <p>(c) Supply of SCADA related communication/ data / LAN cables as brought out in other clauses of this specification.</p> <p>(3) Vendor scope of supply and installation of SCADA system:</p> <p>(a) Vendor shall install the BHEL supplied SCADA system in the air-conditioned SCADA room in main control room. Vendor shall also install SCADA panels in each of the inverter rooms.</p> <p>(b) Cable laying/ terminations of all SCADA cables at respective panels / equipments shall be in vendor scope of supply. BHEL will provide the necessary cabling schedule during detailed engineering.</p> <p>(4) Data signals for SCADA integration are described as below: Following is the list of signals from the five major segments of the power plant as above.</p> <p>4.1 String monitoring boxes in solar array field: 71 Nos</p> <p>(a) RS485 Modbus (RTU) cables from string monitoring boxes of solar array field, whereby each box provides data signals viz. max 16 string currents, 1 box voltage, 1 box temperature, 1 load break switch status, 1 SPD status. And, 1 SPV module temperature shall be from any one of the string monitoring boxes.</p> <p>(b) Vendor shall draw appropriate number of such RS485 Modbus communication cables from solar array field to SCADA room, based on the daisy-chain grouping of string monitoring box RS485 Modbus (RTU) outputs.</p> <p>4.2 Weather monitoring equipment – 6 Nos Analog signals from the weather monitoring equipment viz. pyranometer (3 Nos), anemometer (1 No), ambient temperature sensor (1 No), module temperature sensor (1No).</p> <p>4.3 Power conditioning units (PCUs) 1250kW: 8 Nos RS485 modbus (RTU) signals from these PCUs comprising of DC /AC side / grid parameters such as current, voltage, frequency, phase, power factor, power (VA, Watt, Var), energy (VA-h, Watt-h, Var-h), fault details, other event logs with dates and times etc.</p> <p>4.4 LT and HT equipments (Transformers, VCB panels, ACDB panel, ABT metering panel etc)</p> <p>a) Inverter transformer oil temperature value: 4-20mA analog signal.</p> <p>b) Inverter transformer winding temperature value: 4-20mA analog signal.</p> <p>c) Inverter transformer protection fault signals: Buchholz alarm, Low oil level alarm, PRD alarm, OTI alarm, WTI alarm: potential free NO contact, Digital.</p> <p>d) Power transformer oil temperature value: 4-20mA analog signal.</p> <p>e) Power transformer winding temperature value: 4-20mA analog signal.</p> <p>f) Power transformer protection fault signals: Buchholz alarm, Low oil level alarm, PRD alarm, OTI alarm, WTI alarm: potential free NO contact, Digital.</p> <p>g) HT Panels: VCB On/Off status, open/command signals: potential free NO contact, Digital.</p> <p>h) Numerical relays of VCB panels of inverter room: Ethernet cables from relays to SCADA panel</p> <p>i) HT VCB panels: multifunction meters: RS485 data</p> <p>j) ACDB panel multifunction meters: RS485 data</p> <p>k) Aux transformer (1 No): OTI value, WTI value, Buchholz alarm, low oil level alarm, PRD alarm, OTI alarm, WTI alarm: potential free NO contact, Digital.</p> <p>l) ABT meter at 66kV side (2 panels, 3 Meters in both panels put together): RS485 data (AC energy generation parameters)</p> <p>j) Fire alarm system: Status signals</p> <p>k) CCTV : Status signals</p>
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	l)DC Battery Charger: Status signals m) UPS : Status signals n) 66KV isolators and Breakers : Status signals
5.31	<p>Earthing for solar array structures and SMBs</p> <p>The solar array MMS structures, SMBs and various electrical equipments installed by the vendor shall be provided with appropriate earthing for protection against faults as guided by IEC 60364.</p> <p>The earthing electrodes for solar array shall be of 3m minimum long, 50 mm minimum diameter, perforated GI pipe, chemical compound filled, double walled. Each electrode shall be connected to the solar array earth mat grid. For each electrode, earth chamber shall be constructed using brick masonry. Electrodes shall be of reputed brand such as Ashlok, Poewrtrac, ERICO . Other than these vendors shall not be accepted.</p> <p>Vendor shall install the earthing system for solar array, MMS structures, SMBs and various other electrical equipment's installed by the vendor. The Material for eathing like GI strips, Earth electrode with back fill compound etc. will be part of BHEL scope of supply. The Material for eathing like, earthing cable i.e. copper (unarmored) green cable and all necessary hardwares like nut, bolts, lugs etc. shall be in vendor's scope of supply.</p> <p>Vendor has to provide the earth chamber precast/ prefab type for each earth electrode with following details.</p> <p>(a) Minimum Inner diameter shall be 300mm. Exact size shall be chosen to ensure ease of maintenance operation using spanners etc.</p> <p>(b) Projection of chamber above FGL = 150mm minimum</p> <p>(c) Top of electrode shall have minimum clearance of 100 mm below cover plate.</p> <p>(d) Cover plate with suitable lifting hooks and padlocking arrangement.</p> <p>Supply and installation of all materials related to Earth chambers shall be in vendor scope.</p> <p>Earth mat grid shall have following dimensions:</p> <p>(1) Earth mat grid shall be buried 600mm minimum below ground level. Where it crosses trenches, pipes, ducts, channels etc, it shall be at least 300mm below them. Back filling soil to be placed over buried conductors shall be free from stones and harmful mixtures. Back filling shall be placed in layers of 150 mm. Backfilled surface shall be well compacted.</p> <p>(2) Outer grid shall be with GI flat 25x6 mm (Supply of GI strip by BHEL).</p> <p>(3) Inner branches (along the solar array rows) with GI flat 25x3mm (Supply of GI strip by BHEL).</p> <p>(4) Inner branches shall be welded to outer grid.</p> <p>(5) Electrode shall be bolted to a horizontal GI flat 25x6 that in turn bolted (M10 minimum) to two GI flat 25x6 raisers on either side of horizontal flat. Raisers shall be connected to outer grid of earth mat by way of welding.</p> <p>(6) Total No. of electrodes for solar array is approx. 8 No.s. (Earthing electrodes are BHEL scope of supply)</p> <p>Earthing of MMS structures shall be as follows:</p> <p>(a) Solar array MMS structure shall be connected to Inner branch of earth mat using GI flat 25x3 mm minimum; Bolting on structure (M10 minimum), Welding on earth mat end.</p> <p>(b) Adjacent structures shall be connected to one another using GI flat 25x3 mm minimum. Both ends shall be bolted (M10 minimum).</p>

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	<p>(c) Wherever the clear distance between the adjacent structure is more than 1m, 25x3 GI strip shall be laid below the ground</p> <p>Earthing of SMBs shall be as follows:</p> <p>(a) SPD earth point shall be earthed using 1Cx16 flexible copper (unarmoured) green cable. Both ends of cable shall be suitably lugged and connected using matching hardware.</p> <p>(b) Data card of the SMB shall be earthed using 1Cx2.5 flexible copper (unarmoured) green cable. Both ends of cable shall be suitably lugged and connected using matching hardware.</p> <p>(c) Earthing cable and lugs for these cable shall be in vendor's scope of supply.</p> <p>General points:</p> <p>(a) GI bolts, nuts, plain washers shall be used. Spring washers shall be zinc/epoxy coated.</p> <p>(b) Welding for GI flats shall be using electric arc welding. Both the flats shall be overlapped for the full width where they are in perpendicular direction in same plane. Where the connection is along same line, both flats shall be overlapped for a minimum of 50mm. L-bend with weld length of 50mm minimum shall be adopted wherever overlap length to be ensured.</p> <p>(c) Resistance of welded joint shall not be more than that of GI flat.</p> <p>(d) Welds shall be treated with red lead for rust protection and then coated with bitumen compound for corrosion protection.</p> <p>(e) While laying earthing electrodes, adding/mixing of chemical compound and water around the electrode in the dug hole shall be as per instructions of OEM.</p> <p>In compliance to Rule 11 and 61 of Indian Electricity Rules, 1956 (as amended up to date), all non-current carrying metal parts shall be earthed with two separate and distinct earth continuity conductors to an efficient earth electrode.</p>
5.32	<p>Earthing system for inverter room, main control room cum inverter room and 33kV transformer yards</p> <p>(1) Vendor shall install and commission earthing system for protection against faults as guided by IEC 60364 for the inverter rooms, main control room cum inverter room and 33kV transformer yards.</p> <p>(3) Earthing electrodes of 3m minimum long, 17.2 mm minimum diameter, copper bonded MS, chemical compound filled will be supplied by BHEL. Quantity of Earth electrode in each IR = 17 Nos. and for CMCS = 20 Nos.</p> <p>(4) Water supply for construction shall be made by vendor on the earth for insertion of such chemical earthing electrodes with filling of mix of chemical compound and water around. Inverter rooms and main control room cum inverter room shall be provided with separate earth mat grids.</p> <p>(5) Earthing connections to electrical panels within the inverter room / main control room cum inverter room.:</p> <p>Flats GI 65x8 (BHEL scope of supply) shall be provided for double earthing of 33kV VCB panels, UPS/ FCBC/ Battery banks, C&R panel, ABT metering panels, cable trays. The earthing for PCU shall be done through 1Cx70sq.mm flexible copper cable and for SCADA through 1Cx 16 sqmm copper cable.</p> <p>(6) Earthing of inverter transformers in the transformer yards of inverter rooms / Aux transformer in 66kV switchyard near main control room:</p> <p>(a) Flats GI 65x8 minimum shall be provided for interconnecting various parts of the inverter transformer (for body earthing) viz tank, conservator, disconnecting chambers, cable boxes, marshaling box, radiators etc.</p> <p>(b) Such interconnected local grid shall be double earthed to the main earth mat grid running underground through GI flats 65x8</p> <p>(c) Flats shall be bolted on transformer side and overlap welded to earth mat grid. Two earth pits shall be located close to each transformer for body earthing.</p>

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	<p>(d) Shield earthing of inverter transformers shall be separate and connected to two earth pits using GI flat 65x8.</p> <p>(e) Neutral of aux transformer shall be connected to two earth pits using GI flat.</p> <p>(6) Transformer yard fencing shall be earthed at two different locations using GI flats 65x8 minimum. Gate shall be looped to the fencing mesh by way of GI wire of suitable size.</p> <p>(7) Earth mat grid shall be buried underground up to a depth of 600mm minimum from FGL. Back filling soil to be placed over buried conductors shall be free from stones and harmful mixtures. Back filling shall be placed in layers of 150 mm. Backfilled surface shall be well compacted.</p> <p>(8) Vendor has to provide the earth chamber precast / prefab type for each earth electrode with following details</p> <ol style="list-style-type: none"> Minimum Inner diameter shall be 300mm. Exact size shall be chosen to ensure ease of maintenance operation using spanners etc. Projection of chamber above FGL = 150mm minimum Top of electrode shall have minimum clearance of 100 mm below cover plate. Cover plate with suitable lifting hooks and padlocking arrangement. <p>(9) Supply and installation of all materials related to Earth chambers shall be in vendor scope.</p> <p>(10) Earth electrode shall be bolted to a horizontal GI flat 65x8 minimum that in turn bolted (M10 minimum) to two GI flat 65x8 minimum raisers on either side of horizontal flat. Raisers shall be connected to earth mat grid by way of overlap welding.</p> <p>General points:</p> <ol style="list-style-type: none"> All earthing electrodes, GI flats is in vendor scope of supply All hardware etc shall be in vendor scope of supply. GI bolts, nuts, plain washers shall be used. Spring washers shall be zinc/epoxy coated. Welding for GI flats shall be using electric arc welding. Both the flats shall be overlapped for the full width where they are in perpendicular direction in same plane. Where the connection is along same line, both flats shall be overlapped for a minimum of 50mm. L-bend with weld length of 50mm minimum shall be adopted wherever overlap length to be ensured. Resistance of welded joint shall not be more than that of GI flat. Welds shall be treated with red lead for rust protection and then coated with bitumen compound for corrosion protection. While laying earthing electrodes, adding/mixing of chemical compound and water around the electrode in the dug hole shall be as per instructions of OEM.
5.33	<p>Technical specification for peripheral infrastructure systems of power plant</p> <p>Plant Lighting System</p> <p>Vendor shall supply, install and commission plant lighting system (for areas listed below) that includes all necessary items such as luminaires, LED lamps, GI poles, bend pipes, junction boxes with MCBs/TBs/ glands/ provisions for earthing, conduit pipes for aux supply cables above ground level up to junction box for street light poles, conduit pipes for cables above ground level up to luminaire for street light poles, casing/capping wherever applicable, GI earth wires, aux supply cables (multicore, 1.1kV, Al/Cu, XLPE / PVC, armoured, PVC FRLS as per IS:1554, appropriate sizing) up to junction box, cables (1.1kV, Al/Cu, XLPE / PVC, unarmoured, unsheathed, as per IS: 694, appropriate sizing) from junction box to luminaires, cable glands, cable lugs, termination hardware etc. Scope also includes civil foundation works for street lighting poles. The lighting poles shall be concreted with 600 mm coping above ground level for pole protection and 1 metre below ground with minimum reinforcement as per IS.</p> <p>Cables shall be laid underground as per IS: 1255 with reference the section “cable installation methodology” of this specification. Cables shall be terminated at both the lighting end and PLDB(Plant Lighting Distribution Board) board end in respective inverter/ main control rooms.</p>

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XLPE / PVC insulated armoured Cu / Al cables of adequate size shall be used for interconnection and supply of power lighting systems.

Spacing between poles/ lamps shall satisfy the lux requirements of the respective areas. AC supply shall be from the PDB distribution boards from the inverter rooms/ main control room.

Vendor shall submit detail layout for plant lighting system. Vendor shall submit lux calculations, lighting layout, single line diagram for aux supply from PDB boards, GA drawings of lighting poles, GA drawings of civil foundation for street light poles, bill of materials with make/ GTPs/ model number/ part number/ rating/ applicable IS standards/ quantity etc for BHEL / GSFC approval during detailed engineering. For all the items, reputed brand shall be procured after approval from BHEL / GSFC. Cable schedule shall also be submitted. LED lighting shall be of the make of CGL / Wipro / Bajaj / Panasonic / Philips. Lighting fixture /system shall be of the make Philips / CGL / Bajaj / Havells. Other than these vendors shall not be accepted.

Vendor shall also supply 15-20W (230V) LED lamps for emergency purpose: (a) 4 Nos in electrical panel room of main control room cum inverter room, (b) 1 No each in battery room, conference room area and corridor.

Areas of plant lighting systems for vendor scope:

- Street lighting poles (10 lux minimum) as per NBC 2016.
 - By the side of peripheral boundary fencing of SPV power plant
 - By the side of pathways from inverter rooms to main control room
- Street lighting poles systems as applicable (20 lux minimum)
 - on pillars of main entrance gate of power plant
 - in front of main control room (from main gate to control room)
 - for 33kV transformer yards of the inverter room and main control room cum inverter room.
 - for 66kV metering yard near main control room

General technical requirements:

- All LED luminaires shall be supplied with proper diffuser to avoid direct visibility of LED with proposer thermal management for longer life.
- The lighting level shall take into account appropriate light output ratio of luminaires, coefficient of utilization maintenance factor (of 0.7 or less) to take into account deterioration with time and dust deposition.

(3) LED luminaires shall meet the following parameters

1	Input voltage	170-260V
2	Input frequency	50 +/- 1 Hz
3	Power factor	0.95 minimum
4	Power efficiency	>96%
5	LED efficacy	>130 lumens per watt
6	Dispersion angle	Minimum 120 deg
7	Usage hours	Dusk to dawn
8	Total harmonic distortion	<15%
9	Working temperature	-5 deg to +50 deg C
10	Working humidity	10% - 90% RH (preferably hermetically sealed unit)
11	Index of protection level	Minimum IP65

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12	Lamp casing	Powder coated metal/ Aluminium
13	Life	> 50,000 Hrs
14	LED type	Power LEDs from reputed make
15	Colour temperature	2800 deg K / 3000 deg K
16	Colour rendering	>75
17	Junction temperature	< 60 deg C
18	Electrical connector	Lead wire with 2m long (or) as required by customer at site
19	Expected life of components	Passive electronic components life greater than > 1,00,000 hrs
20	Moisture protection in case of casing damage	IP 65 (preferably totally encapsulated)

(4) Control gear specification

EN 61347-2-13: Particular requirements for DC/AC supplied electronic control gear for LED module

EN 62384: DC/AC supplied electronic control gear for LED modules

(5) Luminaire EMC specification

EN 61000-3-2: Electromagnetic compatibility (EMC). Limits for harmonic current emissions (Equipment input current < 16 A per phase)

EN 61000-3-3: Limitation of voltage fluctuation and flicker in low voltage supply systems for equipment with rated current < = 16 A

(6) Additional information for LED luminaire

The LED luminaire housing, heat sink, pole mounting bracket, individual LED reflectors and front heat resistant tempered glass should be provided.

The LED luminaire housing should be made of non-corrosive high pressure die cast aluminium and the housing should be powder coated grey, so as to ensure good weatherability.

Each individual LED source should be provided with asymmetrical distribution high reflectance aluminized reflector, which should ensure that the light distribution of the luminaire is suitable for road lighting applications (wide beam distribution) and should ensure high pole to pole spacing.

The luminaire should be provided with in built power unit and electronic driver. The luminaire should be so constructed to ensure that the gear and LED modules are replaceable, if required.

The luminaire should be suitable for both standard street light poles with a typical pole diameter of 50 mm – 60 mm and should be suitable for both side entry and bottom entry (post top).

(7) Junction Boxes, Conduits, Fitting & Accessories

Junction boxes for street lighting poles as applicable shall be deep drawn or fabricated type made of min 1.6 mm thick CRCA Sheet. The box shall be hot dip galvanized. The degree of protection shall be IP55.

All switches and receptacles up to 16A shall be modular type. These shall be provided with pre-galvanized/ galvanized modular switchbox & plate.

Conduits, Pipes and Accessories Galvanized heavy duty steel conduits for normal area and

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	<p>galvanised heavy duty steel conduits with an additional epoxy coating for corrosive area shall be offered. Alternatively glass reinforced epoxy conduits with comparable compressive and impact strength with that of heavy duty steel conduits may be offered.</p> <p>Rigid steel conduits shall be heavy duty type, hot dip galvanized conforming to IS: 9537 Part-I & II shall be suitable for heavy mechanical stresses, threaded on both sides and threaded length shall be protected by zinc rich paint. Conduits shall be smooth from inside and outside.</p> <p>Flexible conduit shall be water proof and rust proof made of heat resistant lead coated steel.</p> <p>Pull out boxes shall be provided at suitable interval in a conduit run. Boxes shall be suitable for mounting on Walls, Columns, Structures etc. Pull-out boxes shall have cover with screw and shall be provided with good quality gasket lining. Pull out boxes used outdoor shall be weather proof type suitable for IP55 degree of protection and those used indoor shall be suitable for IP52 degree of protection. Pull out box & its cover shall be hot dip galvanized.</p> <p>(8) Lighting Poles Street Light system and peripheral lighting shall be designed generally in line with design guidelines. Height of the GI poles should be so chosen as not to affect working of Solar panels (shadow effects). The maximum height of pole shall be 2 meters. The poles shall be hot-dip galvanized as per relevant IS: 2629/ IS: 2633/ IS: 4759. The average coating thickness of galvanizing shall be min 70 micron. The system shall be capable of withstanding the appropriate wind load etc as per IS: 875 considering prevailing soil/ site condition considering all accessories mounting on pole.</p> <p>Street light poles shall have loop-in / loop-out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB.</p> <p>(9)Earthing Lighting poles etc shall be earthed by two separate and distinct connections with earthing system. Distribution boards, junction boxes, lighting fixtures etc shall be earthed by means of separate earth continuity conductor. The earth continuity conductor 14 SWG GI wire shall be run along with each conduit run. Cable armours shall be connected to earthing system at both the ends.</p>
5.34	<p>Water washing system for SPV modules (Module cleaning system)</p> <ol style="list-style-type: none"> 1) Vendor shall supply, install and commission permanent arrangement for module washing in the SPV Plant taking into account all related site conditions. 2) Vendor shall estimate the water requirements for cleaning the SPV modules at least once in every week at the rate of 1.5L consumption per module during every cleaning cycle. 3) Vendor shall submit detail layout of module cleaning system , design and drawing for BHEL / GSFC approval. Vendor shall submit detail BOQ for the module cleaning system for BHEL / GSFC approval 4) The system shall essentially include the following minimum components: <ol style="list-style-type: none"> a) Minimum two booster pump of rating 5HP each to be installed in the under ground tank, electrical cabling etc as described under separate clause of this specification. b) Underground RCC sump storage tank 2no.s are to be made. Each storage tank capacity is approximately 75000 litres. One tank is near control cum inverter room (CMCS) and another is near Inverter room.(Construction of storage tank is in BHEL Scope of work).Total capacity all tanks put together 1,50,000 Litres minimum. c) Vendor shall employ armoured electrical cables of suitable size / rating for all electrical connections. Cables with cable accessories (glands/ lugs/ termination hardware etc)

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	<p>shall be in vendor scope of supply and installation. Cabling to the pumps shall be from DB panels in the nearest inverter/control rooms. Cables shall be laid underground as per IS: 1255. All cable terminations including the ones at DB panels shall be in vendor scope.</p> <p>d) In addition to operating from inverter / control rooms, outdoor type switch box with MCB etc shall also be provided to switch ON/OFF the pump directly from solar field. Such components shall be suitably mounted within the housing chamber.</p> <p>e) Water pressure gauge of appropriate size/rating shall be installed at every tank location.</p> <p>f) UPVC pipes as per relevant IS standards, heavy duty, 6 Kg/sqcm: pump suction/ header pipes (40NB minimum), Feeder pipes (25NB minimum).</p> <p>g) UPVC elbows, Tees, bends, couplers as applicable, as per relevant IS standards, for jointing and leak-proof pressurized pipe fittings.</p> <p>h) UPVC pipes shall be directly buried in ground at least 300mm below FGL. GI/ Hume pipes (75NB minimum) shall be used at road and drain crossings.</p> <p>i) UPVC raiser pipes with ball valves (25NB minimum, metal body, IS marked) and reducer nozzles for fitting hose pipes, at every delivery point. Every raiser pipe shall be fixed in the soil using concrete (PCC) pedestal construction with foundation depth of 200mm minimum.</p> <p>j) Delivery points shall be made available in the space between every two rows of solar array with max 30m spacing between delivery points. Accordingly, number of delivery points shall be provided for cleaning of the entire solar array.</p> <p>k) Air release valve fittings (metal body, IS marked) for header pipes at appropriate locations.</p> <p>l) Air release valve fittings (metal body, IS marked) for feeder pipes at appropriate locations.</p> <p>m) Control gate valve for header pipes; for maintenance (IS marked) at appropriate locations.</p> <p>n) Control gate valve for feeder pipes; for maintenance (IS marked) at appropriate locations.</p> <p>o) Non-returnable valves (NRV) shall be provided wherever applicable.</p> <p>p) Hose pipes, heavy duty 25NB minimum: 10 rolls each of 50m (minimum) long</p> <p>q) All necessary hardware items such as GI clamps/ screws/ bolts/ nuts/ plain washers/ spring washers etc wherever applicable.</p> <p>r) Any other items as required to complete the technical/ operational requirements of module washing system.</p>
5.35	<p>Connection of RCC sump tank to Overhead water tank</p> <p>SPV plant shall have two RCC underground sump tanks for storage of water for use for water cleaning of SPV modules (BHEL scope) and all utilities of power plant. Similarly, facility of overhead (OH) tank near main control room shall have one syntax overhead (OH) tank (supply of OH tank is BHEL scope) of 1000L capacity placed on steel platform.</p> <p>Installation and commissioning of OH tank (supply of OH tank is BHEL scope) shall be in vendor scope. Vendor shall make all necessary plumbing arrangements connecting these two facilities. Accordingly, vendor shall construct a 1HP pump house with suitable civil foundation, steel roof/walls, canopy etc near sump tank (~200m away from main control room) and make connections through GI pipelines of appropriate size with couplers/ joints/ bends, valves etc as applicable up to the OH tank. Similarly, electrical connections shall be made to the pump from main control room. All supply items in this regard shall be in vendor scope.</p>
5.36	EMPTY / NOT APLICABLE
5.37	EMPTY / NOT APLICABLE



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5.38

Firefighting systems

Firefighting systems: Fire extinguishers and sand buckets

Vendor shall provide fire extinguishers/ sand buckets as follows for fighting fire of oils, solvents, gases, paints, varnishes, electrical wiring, live machinery fires and flammable liquid/ gas as per recommendation by relevant fire safety authority and as per relevant standards IS: 2171 and IS: 10658 marked. Make shall be Safex/ Ceasefire/ Vintex/ Unicore fire safety or any other reputed equivalent subject to BHEL/GSFC approval.

- DCP type (ABC) **10 Kg** designed/tested IS 15683 with safety release valve, NRV and CE approved valve. Dry powder IS 14609 with standard accessories.
- CO2 type **Hand 9 Kg with wheel**. Designed/tested IS 2878 complete with hose, screw valve, **CO2 gas IS 1522, cylinder IS 7285, valve IS 3224**. Tested at **250 Kgf/cm²**.
- Foam type **hand 9Kg**, squeeze grip CO2 cartridge type, throw period 35s, range of Jet 6m, designed/tested IS:15683, Gas cartridge IS:4947.
- Sand bucket should be wall mounted made from at least 24 SWG sheet with bracket fixing on wall conforming to IS 2546 at strategic locations.

Quantity requirements:

Type of extinguisher	DCP type (ABC) 10 Kg	CO2 type Hand 9 Kg	Foam type hand 9 Kg	Sand buckets
Main control room cum Inverter room (CMCS)	1	4	2	4
Inverter room	1	2	1	2
Each transformer yard of inverter room (total 4 yards) and CMCS (1 yard)	1	1	1	2
Security room(1 No)	-	1	-	2

1.0 INTRODUCTION:

This technical specification provides BHEL's requirement for supply, installation and commissioning of Fire Alarm System in 10 MW Solar Photovoltaic (SPV) power plant for M/s GSFC at Charanka Solar Park, Gujarat. Independent / Stand Alone Fire alarm systems shall be installed in 1 No. Main Control room and 1 No. Inverter rooms (Pre-engineered buildings). These Fire alarm systems of each room shall be connected to SCADA panels at respective rooms via RS-485 Modbus protocol. There will be no cabling requirement between rooms.

2.0 SCOPE OF SUPPLY AND INSTALLATION:

Sl.	Item Description	Quantity
1.	Supply of Fire Alarm system for Control Room	1 ST
2.	Supply of Fire Alarm system for Inverter Room	1 ST
3.	Installation and Commissioning of Fire Alarm system for Control Room	1 ST
4.	Installation and Commissioning of Fire Alarm system for Inverter Room	1 ST

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3.0 TECHNICAL DETAILS:

Fire Alarm system at each room shall consist of following components:

3.1 Fire Alarm Panel: Integrated Fire Detection, Alarm and Control System with Voice Evacuation (EVAC) of UL listed Microprocessor based networkable analogue addressable Main Fire Alarm Control having required loop capacity, each loop having capacity of 159 addressable detectors and 159 addressable devices. Panel capacity can be expanded to additional loops by addition of modules or integrating multiple panels. Panel costs to include power supply, 24VDC power supply automatic battery charger, 24 volts sealed lead acid batteries sufficient for 24 hours normal working and then be capable of operating the system for 2 hours during emergency conditions. The system should be complete with user-friendly programming and configuration tools, front panel operating with a full QWERTY keypad and alphanumeric 640 character LCD display. The Panel as well as detectors and devices shall be UL 9th edition Approved/Listed and in conformance with international standards such as NFPA 72 2010 edition National Fire Alarm and Signalling Code for Human Life Safety. The complete system as a solution must be supplied from the same make/OEM manufacturer components conforming to these standards. The panel shall have the capability to integrate with SCADA on open protocol (MODBUS) and shall be addressable & communicable with SCADA. Provision for displaying Alarms in SCADA shall be available. In case of fire, exhaust fan operation to be controlled by Fire Alarm Panel as per NFPA & NBC guideline.

3.2 Smoke Detector: Analog Addressable Multi-Criteria Sensing Type Detector or Heat Detector as per application must be with mounting based LED, Address Switch inclusive of detector base and complete as required. All Detectors must be UL Listed & FM Approved.

3.3 Sounder: UL Listed Directional Sounders with 20 hz to 20 khz operating frequency with minimum 8 distinct sound patterns to indicate corridors, Exit doors, Move upward, move down ward etc. to direct Occupants for fast & safe Evacuation as specified in NFPA 72 - 2007 edition complete as per all requirements of technical specifications & contracts works. Lighting strobe also to be provided.

3.4 Manual Call Point / Glass Break Device: UL listed, Flush or surface mounted Manual Call Point in manufacturers prescribed matching red enamel outlet box complete. All components must be of same manufacturing origin.

3.5 Monitor, Control Modules & Fault Isolators: UL listed, modules complete with mounting arrangement on North American junction box as per requirements of contract works.

3.6 Cables: All Cables required for operation of Fire alarm system shall be supplied and installed by vendor. This includes cable from Building auxiliary distribution panel to Fire alarm panel, cable between Fire alarm panel and detectors, manual call points, Hooter, Strobe etc. Specification of cable shall be as per relevant standards and as per recommendations of manufacturers. Details of Cables used for Fire system shall be indicated in layout. Conduit required for laying of cables shall also be supplied by vendor.

3.7 Installation requirements: The installation practices adopted for fire detection and alarm system shall comply with NFPA and NBC norms. Cabling shall be concealed in conduits for aesthetic view.

3.8 Commissioning: After completion of installation, vendor shall commission the system and demonstrate the operation of complete system to BHEL/ Customer representatives at site.

4.0 Documents to be submitted along with offer

1. Bill of material along with datasheets of all types of items.
2. Vendor shall confirm NIL deviation to BHEL specification.

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5.39	Identification marking of electrical items using painting <p>Following items shall be identified by way of artistic painting in black letters with yellow background. For danger symbol/text, white letters in red background. Identification number/ text to be painted shall be submitted for BHEL/GSFC approval during detailed engineering for the following.</p> <ol style="list-style-type: none"> (1) Solar array structures: ~994 Nos (2) String monitoring boxes: 71 Nos (3) Size/ source/ destination of DC cable 1Cx400 with arrow mark (power flow direction) to be painted on SMBs and PCUs (4) PCUs front side: PCU ID number (1 to 8) with rating 1250kW, AC chamber/ DC chamber, Danger text/symbol. (5) PCUs DC chamber back side: SMB ID numbers, cable size (1Cx400 +,-) with upward arrow mark, danger text/symbol (6) PCUs AC chamber back side: Inv Trnfmr ID, cable size (4Rx1Cx630 / ph) with downward arrow mark, danger text/symbol (7) Same way as above, the corresponding panel ID with rating, cable destination with arrow mark in power flow direction, danger text/symbol shall be painted for all VCB panels, Inverter transformers (HV and LV sides), Aux transformer (HV and LV sides), ACDB panel. (8) For UPS/ FCBC/ SCADA/ ABT metering panels, C&R panel, all DB boards/ fire alarm panels / N2 fire protection panel, ID number shall be painted. Cable size/ destination/ arrow marks not required to be painted as cable tags shall be adequate. (9) For earth chambers of inverter rooms and main control room cum inverter room(CMCS), ID number shall be painted. (10) All switchboards shall be painted with ID number.
5.40	Cable markers and cables tags <ol style="list-style-type: none"> (1) Cable markers and joint markers for underground cables shall be provided along the route of the cables as per section “Cable installation methodology” of this specification. (2) Cable tags shall be provided at either of the cable (at the entry point to the panel / equipment to which it is connected / terminated) shall be provided as per section “Cable installation methodology” of this specification. (3) Vendor shall submit the respective schemes of marking and tagging for BHEL/GSFC approval during detailed engineering.

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5.41	Display boards and sign boards			
	Sl. No	Description	Qty for Inverter room	Qty for Control room
	1	Board displaying instruction chart for restoration from Electric Shock	1 No	1 No
	2	Board displaying instruction chart for artificial respiration	1 No	1 No
	3	Board displaying dos and don'ts.	1 No	1 No
	4	Board displaying fire extinguishers details and operations	1 No	1 No
	5	"No smoking" board	2 Nos	3 Nos
	6	Danger boards: 33000V with danger symbol in Hindi, Gujrati, English	As required	As required
	7	Identification boards, of suitable sizes, within and outside control room such as Inverter room, Main control room cum inverter room(CMCS), Executive lounge, Store room, Gents toilet, Ladies toilet, SCADA room, Battery room, Pantry room and conference room etc. BHEL will provide list.	1 No	As required
(a) 5mm thick sun board with LG make vinyl sticker (computerized cutting and pasting) shall be used for SI Nos 5, 6 and 7.				
(b) For others, flex banner with design & printing shall be used.				
Note: In addition to the above, requirement of hoarding board as well as direction board for the overall power plant shall be fabricated in consultation with BHEL/BEL and installed at a suitable location near the main entrance gate of the plant.				
5.42	Electrical insulation mat			
(1) Vendor shall supply electrical insulating mats as follows:				
(a) Reputed make as shall be approved by BHEL/ GSFC				
(b) As per IS: 15652:2006				
(c) Class B				
(d) Thickness 2.5 mm minimum				
(e) Size = 2m x 1m minimum, exact size shall be as approved by BHEL/GSFC during detailed engineering.				
(f) Colour: to be approved by BHEL/GSFC				
(g) Max use voltage = 33 kV				
(h) Marking of IS standard on the mat				
(2) Test certificate shall be provided by vendor				
(3) Vendor shall lay the mats in front of all the indoor electrical panels viz. PCUs, VCB panels, ACDB panels, SCADA panels, UPS panels, FCBC battery charger, battery banks etc.				
5.43	Checkered plates			
Vendor shall supply and install checkered plates made of MS for closing the cable trenches (a) behind/ in front, as applicable, of the panels such as PCUs, LT panels, ACDB panels etc in inverter rooms / main control room to cover up the cable trench and also (b) all other open trench areas.				
(1) MS plates shall have a suitable handle (welded to the plate) to facilitate ease of lifting and movements.				
(2) Plate thickness = 8 mm minimum				

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	(3) Width and length of checkered plates shall be selected so that the cable trenches are neatly sealed without any gaps. (4) Plates shall be red oxide coated followed by black painting. (5) BHEL/GSFC approval shall be obtained for overall arrangement of checkered plate.																																																												
5.44	Supply and Installation Miscellaneous Items for Control Room (1) Split Air conditioner of 1.5 tonne (2Nos) of split type for SCADA room, conference room of Voltas/ Hitachi/ Samsung/LG make. (2) Furnitures for SCADA room as below <ul style="list-style-type: none">• Table with drawer for desktop PC – 2 Nos• Executive table complete with draws/ side racks: 1 Set• Chair, industry standard, revolving type, with wheels, arm rest, provisions for adjustment of height (hydraulic/ gas lift):4 Nos• Storage almirah: 2 No• Filing cabinet: 2 No• Printer table: 1 No (3) Furniture for Conference Room <ul style="list-style-type: none">• 1 number of LED TV of 48 inch of Sony/ Phillips / Samsung make,• 1 number of 150 Ltr Refrigerator of Voltas/Godrej/Wirlpool make.• 1 No of projector with 2x2 m screen• 1 no of conference table of 10 person equipped power sockets and 10 chairs revolving type with wheels.• 1 Set of Sofa 3+1+1 Note : Make of the above mentioned furniture shall be Godrej/Duraim/Zuari/Usha/Lexus. Other than these vendors shall not be accepted.																																																												
5.45	Tool kits and instruments : Vendor executing shall supply 1 set of the following tool kits and measuring instruments: A. Measuring instruments <table><tr><td>1</td><td>Digital Earth Resistance Tester</td><td>Cambridge Instruments</td><td>DET-2000</td><td>2 Nos</td></tr><tr><td>2</td><td>Digital multimeter</td><td>Reputed make</td><td></td><td>2 Nos</td></tr><tr><td>3</td><td>AC-DC Clamp Meter Amp range</td><td>Lutron</td><td>DM-6506</td><td>2 Nos</td></tr><tr><td>4</td><td>AC-DC clamp meter mA range</td><td>Lutron</td><td></td><td>2 Nos</td></tr><tr><td>5</td><td>Thermometer, Laser Beam</td><td>Fluke</td><td>62 Mini</td><td>2 Nos</td></tr><tr><td>6</td><td>Digital thermometer (wall hanging)</td><td>Reputed Make</td><td></td><td>2Nos</td></tr><tr><td>7</td><td>Digital megger – 5KV type</td><td>Reputed Make</td><td></td><td>2Nos</td></tr><tr><td>8</td><td>Digital megger – 1KV type</td><td>Reputed Make</td><td></td><td>1Nos</td></tr><tr><td>9</td><td>Electrical Tester</td><td>Reputed Make</td><td></td><td>2 Nos</td></tr></table> Note: Make / model number etc shall be approved by BHEL/GSFC prior to procurement. B. Tool kits <table><tr><td>1</td><td>Double ended spanner Set of sizes 10-11, 12-13, 14-15, 16-17, 17-18</td><td>1 No each</td></tr><tr><td>2</td><td>Screwdriver Set</td><td>1 Set</td></tr><tr><td>3</td><td>Crimping tool with Dye range 50-630sq-mm cable, mechanical gear power, hand operated</td><td>1 Set</td></tr><tr><td>4</td><td>Crimping tool up to 10 sq-mm cable</td><td>1 set</td></tr><tr><td>5</td><td>Drilling machine AC, hand operated, with bit size up to 20 mm</td><td>1 set</td></tr></table>	1	Digital Earth Resistance Tester	Cambridge Instruments	DET-2000	2 Nos	2	Digital multimeter	Reputed make		2 Nos	3	AC-DC Clamp Meter Amp range	Lutron	DM-6506	2 Nos	4	AC-DC clamp meter mA range	Lutron		2 Nos	5	Thermometer, Laser Beam	Fluke	62 Mini	2 Nos	6	Digital thermometer (wall hanging)	Reputed Make		2Nos	7	Digital megger – 5KV type	Reputed Make		2Nos	8	Digital megger – 1KV type	Reputed Make		1Nos	9	Electrical Tester	Reputed Make		2 Nos	1	Double ended spanner Set of sizes 10-11, 12-13, 14-15, 16-17, 17-18	1 No each	2	Screwdriver Set	1 Set	3	Crimping tool with Dye range 50-630sq-mm cable, mechanical gear power, hand operated	1 Set	4	Crimping tool up to 10 sq-mm cable	1 set	5	Drilling machine AC, hand operated, with bit size up to 20 mm	1 set
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	6	Measuring Tape, 5m	2 No
	7	Measuring Tape, 50 m	2No
	8	Allen Key set	1 Set
	9	Adjustable spanner 2-inch size	1 No
	10	Hammer	2 No
	11	Rough file kit	1 Set
	12	Platform balance, 50Kg range	1 No
	13	Cutting Pliers	2 No
	14	Nose Pliers	2 No
	15	Vacuum cleaner, of industrial type, for control room sweeping / cleaning.	1 No
	16	Blowers for cleaning the panels	1 No
	Note: Prior to procurement, vendor shall obtain approval from BHEL for the make and specification of the items.		
	5.46 Cable installation Methodology		
	1. CODES AND STANDARDS		
	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards/ codes as applicable.		
	IS:513	Cold rolled low carbon steel sheets and strips.	
	IS:802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.	
	IS:1079	Hot Rolled carbon steel sheet & strips	
	IS:1239	Mild steel tubes, tubulars and other wrought steel fittings	
	IS:1255	Code of practice for installation and maintenance of power cables upto and including 33 KV rating	
	IS:1367 Part-13	Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners).	
	IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control gear	
	IS:2309	Code of Practice for the protection of building and allied structures against lightning.	
	IS:2629	Recommended practice for hot dip galvanizing of iron & steel	
	IS:2633	Method for testing uniformity of coating on zinc coated articles.	
	IS:3043	Code of practice for Earthing	
	IS:3063	Fasteners single coil rectangular section spring washers.	
	IS:6745	Methods for determination of mass of zinc coating on zinc coated iron & steel articles.	
	IS:8308	Compression type tubular in- line connectors for aluminium conductors of insulated cables	
	IS:8309	Compression type tubular terminal ends for aluminium conductors of insulated cables.	
	IS:9537	Conduits for electrical installation.	
	IS:9595	Metal - arc welding of carbon and carbon manganese steels - recommendations.	
	IS:13573	Joints and terminations for polymeric cables for working voltages from 6.6kv up to and including 33kv performance requirements and	

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	<p>type tests.</p> <p>BS:476 Fire tests on building materials and structures</p> <p>IEEE:80 IEEE guide for safety in AC substation grounding</p> <p>IEEE:142 Grounding of Industrial & commercial power systems</p> <p>DIN 46267 (Part-II) Non tension proof compression joints for Aluminium conductors.</p> <p>DIN 46329 Cable lugs for compression connections, ring for Aluminium conductors</p> <p>VDE 0278 Tests on cable terminations and straight through joints</p> <p>BS:6121 Specification for mechanical Cable glands elastomers and plastic insulated cables.</p> <p>Indian Electricity Act</p> <p>Indian Electricity Rules.</p> <p>Equipment complying with other internationally accepted standards such as IEC, BS, DIN, USA, VDE, NEMA etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.</p> <p>2. DESIGN AND CONSTRUCTIONAL FEATURE</p> <p>Inter Plant Cabling</p> <p>Interplant cabling for main routes shall be laid in Cable trenches/duct banks. Cables from main plant to control room shall be laid in Cable trenches/duct banks. In case of Duct banks, pull-pits shall be filled with sand and provided with a PCC covering. Directly buried cables, if essential ,shall not have concentration of more than 4 cables in one route. All buried cables shall be armoured.</p> <p>Trenches</p> <p>PCC flooring of built up trenches shall be sloped for effective drainage with sump pits and sump pumps.</p> <p>No subzero level cable vault/trenches shall be provided below control building/switchgear rooms in plant.</p> <p>General</p> <p>The cable slits to be used for motor/equipment power/control supply shall be sand filled & covered with PCC after cabling.</p> <p>Sizing criteria, derating factors for the cables shall be met as per respective chapters. However for the power cables, the minimum conductor size shall be 6 sq.mm. for aluminium conductor and 2.5 sq.mm. for copper conductor cable.</p> <p>Conscious exceptions to the above guidelines may be accepted under special conditions but suitable measures should be taken at such location to:</p> <ul style="list-style-type: none"> • Meet all safety requirements • Safeguard against fire hazards, mechanical damage, flooding of water, oil accumulation, electrical faults/interferences, etc <p>3. Cable accessories</p>
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3.1 Cable trays, Fittings & Accessories

- Cable trays shall be ladder/perforated type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power & control cables and perforated for instrumentation cables.
- Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per relevant IS.
- Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be 3 mm.
- Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip galvanised as per relevant IS. Troughs shall be standard width of 50 mm & 75 mm with depth of 25 mm.

3.2 Support System for Cable Trays

- Cable tray support system shall be pre-fabricated similar or equivalent to "Unistrut make".
- Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types: (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The support system shall be the type described hereunder:
 - Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc.
 - The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares, fittings and accessories shall be prefabricated factory galvanised.
 - The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvanised surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied.
 - All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drilling and other machining operation.
 - Support system shall be able to withstand
 - weight of the cable trays
 - weight of the cables (75 Kg/ Metre run of each cable tray)
 - Concentrated load of 75 Kg between every support span.
 - Factor of safety of minimum 1.5 shall be considered.

3.3 Pipes, Fittings & Accessories

- Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the

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- pipe shall be selected on the basis of maximum 40% fill criteria
- b) GI Pipes shall be of medium duty as per IS:1239
 - c) Duct banks shall be High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.
 - d) Hume pipes shall be NP3 type as per IS 458.

3.4 Junction Boxes

- a) Junction Boxes with IP:55 degree of protection, shall comprise of a case with hinged door constructed from cold rolled sheet steel of thickness 2mm. Top of the boxes shall be arranged to slope towards rear of the box. Gland plate shall be 3mm thick sheet steel with neoprene/synthetic rubber gaskets. All junction boxes shall be of adequate strength and rigidity, hot dip galvanised as per relevant IS, and suitable for mounting on wall, columns, structures etc. The boxes shall include brackets, bolts, nuts, screws M8 earthing stud etc. required for installation.
- b) Terminal blocks shall be 1100V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side two (2) nos. stranded copper conductors of size upto 2.5 sq mm each. All internal wiring shall be of minimum 1.5 sq. mm cu. Conductor PVC wire.

3.5 Terminations & Straight Through Joints

- a) Termination and jointing kits for 33kV, 11kV, 6.6 kV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be pre-moulded type, taped type or heat shrinkable type. 33kV, 11kV and 6.6 kV grade joints and terminations shall be type tested as per IS: 13573. 3.3kV grade joints and terminations shall be type tested as per VDE0278. Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the aluminium solderless crimping type cable lugs & ferrule as per DIN standard.
- b) Straight through joint and termination shall be capable of withstanding the fault level for the system.
- c) 1.1 KV grade Straight Through Joint shall be of proven design and make shall be approved by BHEL.

3.6 Cable glands

Cable shall be terminated using double compression type cable glands. Cable glands shall conform to BS: 6121 and be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating. Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.

3.7 Cable lugs/ferrules

Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve

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and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to relevant standard.

3.8 Trefoil clamps

Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength to withstand the forces generated by the peak value of maximum system short circuit current.

3.9 Cable Clamps & Straps

The cable clamps required to clamp multicore cables on vertical run shall be made up of Aluminium strip of 25x3 mm size. For clamping the multicore cables, self-locking, de-interlocking type nylon clamps/straps shall be used. The clamps/straps shall have sufficient strength and shall not get affected by direct exposure to sun rays and outdoor environment.

3.10 Receptacles

Receptacles boxes shall be fabricated out of MS shet of 2mm thickness and hot dipped galvanized or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break, AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polyimide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with inbuilt ELCB rated for suitable mA sensitivity.

3.11 Galvanising

- Galvanising of steel components and accessories shall conform to IS: 2629, IS: 4759 & IS: 2633. Additionally galvanising shall be uniform, clean smooth, continuous and free from acid spots.
- The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS: 1367 . The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified.

3.12 Welding

The welding shall be carried out in accordance with IS: 9595. All welding procedures and welders qualification shall also be followed strictly in line with IS: 9595.

4. CABLE INSTALLATION

4.1 Cable tray and Support System Installation

- a) Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.

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- b) Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings. Vendor shall design the support system along with tray, spacing etc in line with relevant standard.
- c) The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated.
- d) The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M 8 X 50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer. Make of anchor fasteners subject to QA approval.
- e) All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/ stenciled with identification numbers at every floor.
- f) In certain cases it may be necessary to site fabricate portions of trays, supports and other non- standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the installation complete at site shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.

4.2 Conduits/ Pipes/ Ducts Installation

- a) The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall / cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor.
- b) GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.
- c) Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material.
- d) Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise

Conduit /pipe size (dia).	Spacing
Upto 40 mm	1 M
50 mm	2.0 M
65-85 mm	2.5 M

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	<p>100 mm and above 3.0 M</p> <p>e) For bending of conduits, bending machine shall be arranged at site by the contractor to facilitate cold bending. The bends formed shall be smooth.</p> <p>4.3 Junction Boxes Installation Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.</p> <p>4.4 Cable Installation</p> <p>a) Cable installation shall be carried out as per IS: 1255 and other applicable standards.</p> <p>b) For Cable unloading , pulling etc following guidelines shall be followed in general :</p> <ul style="list-style-type: none"> • Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture. • While laying cable, ground rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables. If any particular cable is damaged, the same shall be repaired or changed to the satisfaction of Project Manager. <p>c) Cables shall be laid on cable trays strictly in line with cable schedule</p> <p>d) Power and control cables shall be laid on separate tiers in line with approved guidelines/drawings. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, HT cables shall be laid on topmost tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every two meter. All multi core cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/support with self locking type nylon cable straps with de-interlocking facilities. For horizontal trays arrangements, multi core power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multi core power cables and control cables shall be secured at every one meter by nylon cable strap. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by aluminium strips at every five meter interval and at every bend.</p> <p>e) Bending radii for cables shall be as per manufacturer's recommendations and IS: 1255.</p> <p>f) Where cables cross roads/rail tracks, the cables shall be laid in hume pipe/ HDPE pipe.</p>
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- g) No joints shall be allowed in trip circuits, protection circuits and CT/PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly procure the cable drum length.
- h) In each cable run some extra length shall be kept at suitable point to enable one LT/two HT straight through joints to made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.
- i) Wherever few cables are branching out from main trunk route troughs shall be used.
- j) Wind loading shall be considered for designing support as well Cable trays wherever required.
- k) Where there is a considerable risk of steam, hot oil or mechanical damage cable routes shall be protected by barriers or enclosures.
- l) The installation work shall be carried out in a neat workman like manner & areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every day. Contractor shall replace RCC/Steel trench covers after the Installation work in that particular area is completed or when further work is not likely to be taken up for some time.

4.5 Separation

At least 300mm clearance shall be provided between :

- HT power & LT power cables,
- LT power & LT control/instrumentation cables,

4.6 Segregation

- a. Segregation means physical isolation to prevent fire jumping.
- b. All cables associated with the unit shall be segregated from cables of other units.
- c. Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire. Power and control cables for AC drives and corresponding emergency AC or DC drives shall be laid in segregated routes. Cable routes for one set of auxiliaries of same unit shall be segregated from the other set.
- d. In switchyard, control cables of each bay shall be laid on separate racks/trays.

4.7 Minimum number of spare cores required to be left for interconnection in control cables shall be as follows:

No. of cores in cable	No. of spare cores
2C,3C	NIL
5C	1
7C-10C	2
14C and above	3

4.8 Directly Buried Cables

- a) Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS: 1255. Reference drawing for buried cables is included as a tender drawing and enclosed with this specification.
- b) RCC cable route and RCC joint markers shall be provided wherever required. The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an

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	<p>additional inscription "Cable Joint". The marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road crossings and drain crossings. Top of cable marker/joint marker shall be sloped to avoid accumulation of water/dust on marker.</p> <p>4.9 Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry, and at every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags.</p> <p>4.10 While crossing the floors, unarmoured cables shall be protected in conduits upto a height of 500 mm from floor level if not laid in tray.</p> <p>5. Cable Terminations & Connections</p> <p>a) The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings and/or as directed by Project Manager. Cable jointer shall be qualified to carryout satisfactory cable jointing/termination. Contractor shall furnish for review documentary evidence/experience reports of the jointers to be deployed at site.</p> <p>b) Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Project Manager.</p> <p>c) The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.</p> <p>d) Control cable cores entering control panel/switchgear/MCC/miscellaneous panels shall be neatly bunched, clamped and tied with self-locking type nylon cable ties with de interlocking facility to keep them in position.</p> <p>e) All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, -etc along with cable numbers and coiled up after end sealing.</p> <p>f) All cable terminations shall be appropriately tightened to ensure secure and reliable connections.</p>				
5.47	<p>Pre-commissioning inspections/ checks/tests, MRT tests, coordination/liaison with state /central departments/CEIG etc. for necessary approvals/clearances for commissioning, synchronization with grid/ plant commissioning:</p> <table border="1"> <thead> <tr> <th>#</th><th>Scope description</th></tr> </thead> <tbody> <tr> <td>1</td><td>Pre-commissioning inspections / checks / tests, MRT tests and coordination /</td></tr> </tbody> </table>	#	Scope description	1	Pre-commissioning inspections / checks / tests, MRT tests and coordination /
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1	Pre-commissioning inspections / checks / tests, MRT tests and coordination /				



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		liaison activities with state / central departments / Transco/ DISCOM/ CEIG etc for necessary approvals / clearances for commissioning, synchronization with grid and post-commissioning operation of the plant. (Clearances shall include obtaining prior approvals for all applicable drawings/ documents etc from concerned state / central departments / Transco/ DISCOM/ CEIG etc.)	
	A	Basic checks	
	A1	Tightness checks:	
		1) Terminations of AC/DC power cables at SMBs, PCUs, Inverter transformers, Aux transformer, ACDB panel, UPS/ FCBC/ Battery banks, Aux AC/DC DB boards, ABT metering panel, 33kV VCB panels, 33kV LV side of Power transformer, SCADA panels etc. 2) Terminations of Control/ Instrumentation/ Data/ Communication cables wherever applicable. 3) Terminations of earthing at all electrical equipment/ panels of inverter rooms/ control room 4) Terminations of earthing of inverter transformers, aux transformer 5) Terminations of earth chambers of vendor scope. Note: For M10 and above, torque wrench settings shall be followed for reference.	
	A2	Electrical continuity checks	
	A3	Megger (5kV) checks for all HT (33kV) cables	
	A4	Hi-pot testing for all HT (33kV) cables prior to connection to the panels/ transformers.	
	A5	Megger (1kV) checks for all 1.1kV grade cables	
	A6	AC/DC supply checks at TBs of all electrical panels/ DBs/ Transformers.	
	B	Pre-commissioning electrical tests:	
	B1	Power conditioning units (with the support of PCU service engineer at site)	
		1) DC side open circuit voltage and verification with SMB side measurements 2) Vendor to provide technician support to PCU service engineer for all other pre-commissioning tests as per OEM checklist 3) Functioning of duct fans (operation, direction of rotation)	
	B2	Inverter transformers and Aux transformer	
		1) Oil filtration: Equipment of adequate evacuation/ heating/ oil circulation capacity shall be deployed at site for this purpose. Filtration shall be carried out adequately in order to achieve the BDV, ppm, tan delta values within the limits as per relevant standards and as measured by NABL accredited laboratory. The machine shall have built-in BDV measuring set up for in-situ checking of BDV during filtration process. DG if required for oil filtration shall be arranged by vendor. 2) IR tests LV-HV, HV-E, LV-E 3) Vector group 4) Voltage ratio 5) Magnetizing current	

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			6) Magnetic balance 7) Winding resistance at all taps 8) Fault simulation checks (at VCB breaker panels): Buchholz, OTI, WTI, PRV, LOLA etc 9) Alarm, trip settings (S1, S2) for WTI, OTI 10) Oil level at conservator (to be topped up, if required)	
	B3		Indoor CTs 33kV	
			1) IR tests (all cores): Pri-Sec, Sec-Sec, Pri-E, Sec-E 2) Ratio tests / primary injection	
	B4		Indoor PTs 33kV including Bus PTs	
			1) IR tests (all cores): Pri-Sec, Sec-Sec, Pri-E, Sec-E 2) Voltage ratio test 3) Polarity test	
	B5		Indoor VCB breakers 33kV	
			IR tests Contact resistance measurement (CRM) Timing test: close/ open/ close-open Functional checks: breaker open/close, spring-charged motor Remote operation from SCADA panels: open/close, command/ status, lamp indications	
	B6		Numerical relays at VCB breaker panels	
			1) Relay calibration using applicable kit/ software 2) IDMT, DT curves with timing/pickup settings in all relays based on gradation across from downstream to upstream taking into account settings at STU substation 3) Overcurrent/ earth fault pickup/ tripping time tests	
	B7		CT ratio / PT ratio to be set in meters/relays	
			i. All MFM meters ii. ABT meters iii. Protection relays	
	B8		ACB breaker settings (with the help of PCU service engineer)	
			1) Over load, Short time fault, ground fault	
	B9		Earth resistance measurements for all chambers of vendor scope	
			1) With electrode connected to grid 2) Without connecting electrode to grid	
	B10		UPS/ FCBC charger/ Battery banks	
			1) All functional checks: battery charging/ discharging, FCBC/ battery output parameters etc. as per OEM checklists	
	C		Testing agency	
			Credentials of testing agency shall be submitted to BHEL for approval prior to awarding of work.	
	D		Coordination and Liaison activities to be carried out by vendor:	
			1) Vendor shall suitably support the upstream contractor of BHEL executing the 66kV switchyards (at SPV, Substation ends) and transmission lines in the process of obtaining approval from Transco/ DISCOM/ CEIG/ CEA etc as applicable for line charging/ grid synchronization/ plant commissioning.	

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			<p>2) Liaison responsibility for getting the approvals rests with the respective vendors for their scope of works. However, wherever technical clarifications are required by the approving agencies with regard to SPV portions (including solar array) up to 33kV side of power transformer, vendor shall suitably coordinate/liaison with the concerned state/central approving agencies to make the approval process successful. Accordingly, vendor shall participate in direct discussions with the approving agency whenever necessary. Also, all the necessary payments/expenditures to be incurred with ref to such coordination/ liaison in this regard shall be borne by the respective vendor.</p> <p>3) For solar array details including earth mat grid, vendor shall suitably coordinate with the respective downstream contractor of BHEL for mobilization of inputs from them necessary for the approval process.</p> <p>4) Following are the areas of approval, as applicable, for the SPV-side portions including solar array and up to 33kV side of power transformers.</p> <p>(a) GTP/ datasheets/ GA drawings/ Bill of materials, MQP etc of supply items.</p> <p>(b) Site test reports of transformers, transformer oil, VCB breakers, CTs, PTs, resistance of earth mat grids etc</p> <p>(c) Interaction with supervising/ inspection agency such as MRT departments, Transco, CEIG, CEA etc, as applicable, for applying to them/ inviting them for supervision/ inspection at site.</p> <p>(d) Interaction/ coordination with customer (GSFC) in the above process as and when required.</p> <p>(e) All necessary testing kits/ instruments shall be arranged as per the requirements of inspection agency. Basic instruments such as digital multimeter, 5kV digital megger with PI feature, earth resistance meter, VCB open/close timing test kit, clamp meters etc shall be organized at site at the time of inspection. Competent electrical technician shall also be made available at the site.</p> <p>(f) Subsequent to site inspection by the concerned agency, vendor shall obtain the clearance for grid synchronization of their respective.</p> <p>(g) Vendor shall implement all the observations of CEIG related to SPV-side portion including solar array and up to 33kV side of 16MVA transformer.</p>	
		E	Commissioning of power plant	
			<p>1) Vendor shall organize all necessary tools/ measuring instruments required to operate the various electrical equipment at the time of commissioning: Digital megger 5KV with PI feature, Earth resistance tester, Phase sequence meter, Clamp meters etc., discharge rods, PPE safety gadgets (helmets, shoes etc.).</p> <p>2) It is the responsibility of the vendor to interact technically with upstream/ downstream contractors for successful charging of 66kV grid line followed by charging of 33/66kV transformer at SPV plant end and grid synchronization of inverters/ plant commissioning.</p> <p>3) Vendor shall participate actively in the commissioning until it is established that there is successful export of power from all the PCUs and through the 66kV transmission line/ switchyards of power plant.</p>	

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5.48	Spares required to be supplied along with main consignment: Spares on DC side <ol style="list-style-type: none"> 1) Fuses of all types: 1 % of total population of respective items 2) MCB of all types: 1% of total population of respective items 3) Indicating lamp set of all types: 1% of total population of respective items 4) Surge protection devices/ MOV: 1% of total population of respective items 5) Room lighting LED lamps: 5% each type. 6) Y-connectors: 100 Sets (1 set = 2 nos) 7) MC4 connectors: 100 sets (1 set = 2 nos) 8) Bimetallic (Cu/Al) cable lug 300 sqmm (at SMB side): 20 Nos 9) Bimetallic (Cu/Al) cable lug 300 sqmm (at PCU side): 20 Nos 10) Indicating lamp set of all types: 1% of total population of respective items 11) Straight-through jointing kit for 1.1kV 1Cx300 cable (Al, XLPE, armoured, PVC): 10 kits for DC side. 12) Module cleaning system items: <ol style="list-style-type: none"> a) Valve at delivery point: 5 Nos b) All other valves: 2 Nos each type c) Surface pump(booster pump) 5HP: 2 Nos d) Surface pump (booster pump)1HP: 1 No e) Pressure gauge: 2 Nos f) Level gauge : 1 No.
	Spares on AC side <ol style="list-style-type: none"> 13) Spares of aux transformers: <ol style="list-style-type: none"> a) HV bushings with metal parts and gaskets: 1 set of 3phases b) LV bushings with metal parts and gaskets: 1 set of 3phases c) Neutral bushing with met metal parts an gaskets: 1 set of 3phases d) Gaskets : 2 sets e) Silica gel breather with charge: 2 set f) Diaphragm of explosion vent: 1 set g) Prismatic oil level gauge: 1 set h) Valves: 1 set 14) 33kV termination kit for 1Cx300 cable: 15 Nos 15) 33kV straight through jointing kit for 1Cx300 cable: 9 Nos 16) Fuses of all types: 10% of total population of respective items 17) MCCB, MCB of all types: 10% of total population of respective items 18) Indicating lamp set of all types: 10% of total population of respective items 19) Surge protection devices/ MOV: 10% of total population of respective items 20) Plant lighting LED lamps: 5% each type. 21) Current transformer each type used 1 no. 22) Coils for tripping and closing 1no. 23) Breaker Position Switch each type and rating 1 no. 24) Contactor of each type used 4no.s of each type. 25) Relay of each type used 2no.s of each type. 26) Circuit Breaker of each type 2no.s of each type <p>Notes:</p> <ol style="list-style-type: none"> (a) 1 set refers to total quantity of the item used in one transformer. (b) In case quantity arrived based on percentage is a decimal figure, it shall be rounded off to next higher integer. (c) Vendors shall supply the above mentioned item as applicable in their scope.

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6.0 General conditions applicable during supply, installation and commissioning phase

6.1	As already mentioned in previous clauses, vendor shall organize power supply on their own. Accordingly, DG sets of suitable capacity shall be deployed by the vendor for construction works.
6.2	Similarly, water required for construction works shall be organized by vendor (tankers etc).
6.3	All machinery such as cranes, hydra, JCBs, forklifts, transport trucks, trolleys etc necessary for movement and installation of materials / panels / equipment etc shall be organized by the vendor.
6.4	All necessary tools and tackles such as crimping tool (including heavy duty tools for crimping copper/ aluminium cables up to 630 sq-mm), screw driver set, power screw drivers, cutting pliers, nose pliers, spanner sets, adjustable spanners, hole-saw cutter set, bending tools, torque wrenches, hack saw blades, pipe wrenches, flat / round files, HV termination tools, drilling machines, welding machines, concrete mixers, steel bar bending tools / templates/ shuttering materials for RCC works, spade, shovel, hammer etc shall be organized by the vendor.
6.5	All necessary measuring instruments such as digital multimeters, measuring tapes, vernier calipers, electrical testers, digital meggers (1kV, 2.5kV, 5kV), earth resistance meters, clamp meters, transformer oil BDV kit, relay testing kit (secondary injection), primary injection kit, infrared thermal imaging handheld temperature meter etc. All these instruments shall possess valid calibration certificate issued from approved NABL laboratory.
6.6	Vendor shall make their own arrangements for necessary food, drinking water and accommodation for their labour and employees posted at the site. Similarly, food and drinking water required at the site, during the construction operations, shall also be in scope of vendor.
6.7	Vendor shall organize all necessary steps to meet statutory requirements such as labour license, PF, ESI etc and also ensure compliance with relevant acts such as minimum wages act, income tax act, employee insurance act etc for their labour deployed at site.
6.8	Vendor shall maintain updated labour register, with name, age, qualification, salary, attendance details etc. at the site.
6.9	Vendor shall use danger boards, wherever required, to ensure safety of the persons during the work at site.
6.10	Vendor shall adhere to all necessary safety norms such as use of helmet, goggles, hand gloves, gumboots, aprons etc. It is the ultimate responsibility of the vendor in all respect to prevent accidents at the site and safeguard their labour from accidents.
6.11	Vendor shall, at the completion of every work, clear off the debris, which resulted out of the work. In case of excavation work such as cable trench etc, vendor shall finish the land neatly with necessary leveling, rolling etc.
6.12	Vendor shall carry out the work without causing inconvenience to other contract groups at the site. In case of conflicts with other groups, vendor shall ensure that the matter is resolved at once amicably so that the progress of work is not affected.
6.13	65% of the jobs created due to the project in the supervisory and managerial cadres & 80% of the jobs that will be created in other cadres shall be filled in by employing local persons. The expression “Local person” shall mean a person domiciled in Gujarat State for 15 years prior to applying for employment to vendor.
6.14	Before engaging the labour in to work, vendor should get the NOC from labours’ native police station as well as NOC from Santhalpur, Gujarat police station.
6.15	Any damages on the building, structures etc. attributable to the acts of labour / employees of vendor shall be rectified and made good by the vendor at their own cost.
6.16	No child labour shall be employed for execution of the present contract.

	PURCHASE SPECIFICATION: SUPPLY OF BOS ITEMS, I&C FOR 10MW(AC) SOLAR PV POWER PLANT FOR GUJURAT STATE FERTILIZERS AND CHEMICALS LIMITED AT CHARANKA SOLAR PARK, GUJARAT	PS-439-1225
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6.17	Any miscellaneous materials, which are found essential for technical completion of the contract but not mentioned explicitly in this specification, shall be deemed to be included in the specification. Accordingly, such materials shall be included by the vendor as part of the offer.
6.18	Special instruction for earthing: In compliance with Rule 33 and 61 of Indian Electricity Rules, 1956 (as amended up to date), all non-current carrying metal parts shall be earthed with two separate and distinct earth continuity conductors to an efficient earth electrode. Accordingly, all cases such as cable support structures, cable ladders, cable trays (control room) etc. shall be earthed.
6.19	BHEL/GSFC shall witness routine/ acceptance/ type tests performed at manufacturer works for the items supplied by vendor. Vendor shall accordingly provide inspection call to BHEL with submission of quality assurance plan in advance. For the items bought out from dealers, test certificates, as per relevant IS / IEC standards, as issued by manufacturer shall be submitted to BHEL. However, prior approval shall be obtained from BHEL/GSFC for procurement of the item from dealers.
6.20	Field Quality Plan / Quality control system (if applicable) Vendor shall set up a field quality control laboratory with full set up to facilitate testing of all construction materials in accordance with FQP (Field quality control plan) as approved by BHEL/GSFC. Vendor shall deploy a well experienced quality control engineer to monitor all QC activities at site as per approved FQP. Specifically with reference to civil works, vendor shall submit all concrete mix designs and bituminous mix designs for BHEL/GSFC approval before starting of the work. All the third party testing should be conducted in NABL approved laboratories only. Vendor shall submit the FQP for the civil construction works before starting of the works for approval of BHEL/GSFC.
6.21	Any deviations shall be discussed with BHEL/GSFC site engineers and implementation shall be taken up only after approval from BHEL /GSFC.
6.22	Vendor shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.
6.23	Vendor shall, as and when required by BHEL/GSFC, participate in the review meetings conducted by BHEL/GSFC at project site, BHEL-EDN (Bangalore), BHEL-Corporate office (New Delhi), GSFC office (Vadodara) etc.
6.24	General Guidelines a) Any civil or electrical work which is not mentioned or included in this tender document but necessary for functional requirements of the plant shall be carried out by vendor. b) Vendor shall prepare all designs / drawings based on the specifications given in the tender and in light of relevant BIS/IS/ equivalent standard. c) Vendor shall provide type test reports and datasheet/ GTP for all equipments covered under vendor scope of supply. d) BHEL reserves right to modify the design at any stage to meet local site conditions / project requirements. e) All work shall be carried out in accordance with the latest edition of the Indian Electricity Act and rules formed thereunder and as amended from time to time.

7.0 Documents to be submitted for BHEL/GSFC approval during detailed engineering

7.1	BHEL / GSFC approval shall be obtained for the following technical documents, which shall be submitted to BHEL in phased manner based on priority sequence of activities during detailed engineering (after receipt of purchase order from BHEL).
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	PURCHASE SPECIFICATION: SUPPLY OF BOS ITEMS, I&C FOR 10MW(AC) SOLAR PV POWER PLANT FOR GUJURAT STATE FERTILIZERS AND CHEMICALS LIMITED AT CHARANKA SOLAR PARK, GUJARAT	PS-439-1225
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7.2	Name of vendor/ make, model number/ part number, specification/ sizes/ dimensions/ drawings/ datasheets shall be submitted for approval to BHEL / GSFC for the items which cases vendors name is not mentioned.
7.3	<p>Design calculations/ general arrangement drawings/ single line diagrams/ GTP particulars/ datasheets/ schemes/ layouts/ bill of materials etc., as applicable, shall be submitted for the following:</p> <ol style="list-style-type: none"> (1) MC4 Connectors, GI cable trays for internal cable trench, cable ties, HDPE DWC conduits, 33kV termination kits, 33kV straight through jointing kits, cable glands, cable lugs, (2) Earth chambers of solar array / inverter / main control rooms cum inverter room (CMCS): GA, cross section, BoM with GTP/ datasheets etc. (3) Room lighting system: lux calculations, lighting layouts, GA drawings of these, SLD, BoM with GTP/ datasheets etc. (4) Fire extinguisher datasheets (5) Weather Monitoring system BoM with GTP/ datasheets etc. (6) Module cleaning system: design calculations, layouts, BoM, electrical circuit diagram, water circuit diagram etc. (7) LT straight through jointing kits, 33kV termination kits, 33kV straight through jointing kits. (8) Plant lighting system: lux calculations, lighting layouts, GA drawings of street light pole/ wall-mounted / column-mounted/ fence-mounted systems, SLD, BoM with GTP/ datasheets etc. (9) Fire detection/ alarm system: Layouts in inverter rooms, layout in main control room, overall layout with zones/ sensor/ hooter/ control panel locations, BoM with GTP/ datasheets etc. (10) Any other designs/ schemes/ layouts etc as applicable as per BHEL / GSFC requirements that will be discussed during detailed engineering.
7.4	Manufacturing Quality Plans for all the vendor supplied items
7.5	Field quality plan for the field work: civil works, electrical works
7.6	Detailed activity-time chart for project implementation
7.7	Detailed manpower deployment schedule
7.8	Installation manuals for MC4 connectors, fire alarm systems, surface pumps for UG tanks and overhead tank etc.
7.9	Operation and maintenance manuals of MC4 tool kits, fire alarm systems, surface pumps for UG tanks and overhead tank etc.



ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड

Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division

PB 2606 , Mysore Road Bangalore , 560026 INDIA

SCPV: BOS: ITB - Rev 01

INSTRUCTIONS TO BIDDERS (ITB)

Bidders are requested to read the instructions carefully and submit their quotations covering all the points:

A. GENERAL INSTRUCTIONS:

1. Any Purchase Order resulting from this enquiry shall be governed by the Instructions to Bidders (document reference: SCPV: BOS: ITB – Rev 01), General Conditions of Contract (document reference: SCPV: BOS: GCC - Rev 01) and Special Conditions of Contract (document reference: SCPV: BOS: SCC: I - Rev 01/ SCPV: BOS: SCC: F - Rev 01), if any, of the enquiry.
2. Any deviations from or additions to the “General Conditions of Contract” or “Special Conditions of Contract” require BHEL’s express written consent. The general terms of business or sale of the bidder shall not apply to this tender.
3. Bidders (also includes the term suppliers / contractors wherever used in this document) are instructed to quote their most competitive price and best delivery, etc. in the offer. Prices should be indicated in both figures & words. **(Please also refer clause 11 under section B)**
4. Regret letter (either through post or by mail) indicating reasons for not quoting must be submitted without fail, in case of non-participation in this tender. If a bidder fails to respond against 3 consecutive tenders for the same item, he will be liable for removal as a registered vendor of BHEL.
5. Procurement directly from the manufacturers shall be preferred. However, if the OEM / Principal insist on engaging the services of an agent, such agent shall not be allowed to represent more than one manufacturer / supplier in the same tender. Moreover, either the agent could bid on behalf of the manufacturer / supplier or the manufacturer / supplier could bid directly but not both. In case bids are received from the manufacturer / supplier and his agent, bid received from the agent shall be ignored.
6. Consultant / firm (and any of its affiliates) shall not be eligible to participate in the tender/s for the related goods for the same project if they were engaged for consultancy services for the same project.
7. If an Indian representative / associate / liaison office quotes on behalf of a foreign based bidder, such representative shall furnish compulsorily the following documents:
 - a. Authorization letter to quote and negotiate on behalf of such foreign-based bidder.
 - b. Undertaking from such foreign based bidder that such contract will be honored and executed according to agreed scope of supply and commercial terms and conditions.
 - c. Undertaking shall be furnished by the Indian representative stating that the co-ordination and smooth execution of the contract and settlement of shortages / damages / replacement / repair of imported scope till system is commissioned and handed over to customer will be the sole responsibility of the Indian representative / associates / agent / liaison office.
8. In case of imported scope of supply, customs clearance & customs duty payment will be to BHEL account after the consignment is received at Indian Airport / Seaport. Bidders must provide all original documents required for completing the customs clearance along with the shipment. Warehousing charges due to incomplete or missing documentation will be recovered from the supplier’s bill. All offers for imported scope of supply must be made from any of the gateway ports (within the country) indicated. **(Refer Annexure I)**
9. The offers of the bidders who are on the banned list and also the offers of the bidders, who engage the services of the banned firms, shall be rejected. The list of the banned firms is available on BHEL website: **www.bhel.com**.

10. Business dealings with bidders will be suspended if they are found to have indulged in any malpractices / misconduct which are contrary to business ethics like bribery, corruption, fraud, pilferage, cartel formation, submission of fake/false/forged documents, poor quality, certificates, information to BHEL or if they tamper with tendering procedure affecting the ordering process or fail to execute a contract, or rejection of 3 consecutive supplies or if their firms / works are under strike / lockout for a long period.

B. GUIDELINES FOR PREPARATION OF OFFER:

1. Quotation shall be submitted in Single Part Bid, Two Part Bid or Three Part Bid, as called for in the tender:
 - **SINGLE PART BID:** Technical and Commercial Bid with prices along with price summary & filled in BHEL Standard Commercial terms and conditions in a single sealed envelope.
 - **TWO PART BID:** Unpriced offer i.e. "Techno-commercial Bid" with filled in BHEL Standard Commercial terms and conditions in a sealed envelope **along with the copy of the "Price Bid" without the prices** should be enclosed in one cover and the cover must be super scribed "**Techno-commercial offer** and Priced offer i.e. "Price Bid" containing price summary in a separate sealed envelope and must be super scribed "**Price Bid**". Both these envelopes shall be enclosed in a single sealed envelope super scribed with enquiry number, due date of tender and any other details as called for in the tender document.
 - **THREE PART BID:** Pre-qualification Bid (Part-I), Techno Commercial Bid with filled in BHEL Standard Commercial terms and conditions (Part-II), and Price Bid (Part-III). All three envelopes shall be enclosed in a single sealed envelope super scribed with enquiry number due date of tender and any other details as called for in the tender document.

If any of the offers (Part I, Part II or Part III) are not submitted before the due date and time of submission at the venue/place specified or if any part of the offer is incomplete the entire offer of the bidder is liable for rejection.

2. Supplier shall ensure to super scribe each envelope with RFQ number, RFQ Date, RFQ Due date and time, Item Description and Project clearly & boldly. Also mention on the envelope whether it is "Techno Commercial Bid" or "Price Bid" or "Pre-Qualification Bid". Please ensure complete address, department name and purchase executive name is mentioned on the envelope (before dropping in the tender box or handing over) so that the tender is available in time for bid opening.
3. BHEL standard Commercial Terms and Conditions shall be duly filled, signed & stamped and must accompany Technical-Commercial offer without fail and should be submitted in original only. Photocopy will not be accepted. All documents submitted along with the offer shall be signed and stamped in each page by authorized representative of the bidder.
4. Any of the terms and conditions not acceptable to supplier, shall be explicitly mentioned in the Techno-Commercial Bid. If no deviations are brought out in the offer it will be treated as if all terms and conditions of this enquiry are accepted by the supplier without any deviation.
5. Deviation to this specification / item description, if any, shall be brought out clearly indicating "DEVIATION TO BHEL SPECIFICATION" without fail, as a part of Techno-Commercial Bid. If no deviations are brought out in the offer it will be treated as if the entire specification of this enquiry is accepted without deviation.
6. Suppliers shall submit one set of original catalogue, datasheets, bill of materials, dimensional drawings, mounting details and / or any other relevant documents called in purchase specification as part of Technical Bid.
7. "Price Bid" shall be complete in all respects containing price break-up of all components along with all applicable taxes and duties, packing & forwarding charges (if applicable), freight charges (if applicable) etc. Once submitted no modification / addition / deletion will be allowed in the "Price Bid." Bidders are advised to thoroughly check the unit price, total price to avoid any discrepancy.
8. In addition, bidder shall also quote for erection & commissioning charges (I&C charges), documentation charges, service charges, testing charges (type & routine), training charges, service tax, etc. wherever applicable. The price summary must indicate all the elements clearly.
9. Vendors should indicate "lump sum" charges (including To & Fro Fare, Boarding, Lodging, Local Conveyance etc.) for Supervision of Erection, Commissioning and handing over to customer. The quotation shall clearly indicate scope of work, likely duration of commissioning, pre-commissioning checklist and service tax (if any).
10. Wherever bidders require PAC (Project Authority Certificate) for import of raw materials, components required for Mega

Power Projects, Export Projects, MNRE Concession or other similar projects wherein supplies are eligible for customs duty /Excise duty benefits, lists and quantities of such items and their values (CIF) has to be mentioned in the offer. Prices must be quoted taking into account of such benefits.

11. All quotations shall be free from corrections /overwriting. Corrections if any should be authenticated with signature and seal. Any typographical error, totaling mistakes, currency mistake, multiplication mistake, summing mistakes etc. observed in the price bids will be evaluated as per **Annexure VI** "Guidelines for dealing with Discrepancy in Words & Figures – quoted in price bid". BHEL decision will be final.

C. GUIDELINES FOR OFFER SUBMISSION:

1. Offers / Quotations must be dropped in tender box before 13.00 Hrs. on or before due date mentioned in RFQ. The offers are to be dropped in the proper slot of the Tender Box kept in our reception area with caption "CE, SC&PV, DEFENCE." Tenders are opened on 3 days in a week (Monday/Wednesday/Friday). Tender must be deposited in the slot corresponding to the day (Monday - Box no.4/Wednesday - Box no. 6 /Friday - Box no.8) while depositing the offer. **(This clause will not be applicable for e-tenders).**
2. E-Mail / Internet / EDI offers received in time shall be considered only when such offers are complete in all respects. In case of offers received through E-mail, please send the offer to the email IDs within time of submission of tender.
3. In cases where tender documents are bulky, or due to some reasons tender documents are required to be submitted by hand or through posts/couriers, the offers are to be handed over to purchase officers.
4. Tenders will be opened on due date, time and venue as indicated in the RFQ in the presence of bidders at the venue indicated in the RFQ. In case of e-procurement, bidders can see tender results till seven days after due date and time.
5. Vendor will be solely responsible:
 - a. For submission of offers before due date and time. Offers submitted after due date and time will be treated as "Late offers" and will be rejected.
 - b. For submission of offers in the correct compartment of the tender box based on the day of due date (Monday/Wednesday/Friday). Please check before dropping your offer in the correct tender box.
 - c. For depositing offers in proper sealed condition in the tender box. If the bidder drops the tender in the wrong tender box or if the tender document is handed over to the wrong person BHEL will not be responsible for any such delays.
 - d. For offers received through email/courier etc., suppliers are fully responsible for lack of secrecy on information and ensuring timely receipt of such offers in the tender box before due date & time.
 - e. In case of e-tender, all required documents should be uploaded before due date and time. Availability of power, internet connections, etc. will be the sole responsibility of the vendor. Wherever assistance is needed for submission of e-tenders, help line numbers and executives of service provider of BHEL may be contacted.
Service provider: M-junction
Website address: <https://bheleps.buyjunction.in/>
Helpline no.: 033-66106426/6217/6013/6046/6176 (9:30 am to 5:30 pm)
9163348283/9163348284/9163348285/9163348286/8584008116 (5:30 pm to 8:30 pm)

Purchase Executive / BHEL will not be responsible for any of the activities relating to submission of offer.

D. PROCESSING OFFERS RECEIVED:

1. Any discount / revised offer submitted by the supplier on its own shall be accepted provided it is received on or before the due date and time of offer submission (i.e. Part-I bid). The discount shall be applied on pro-rata basis to all items unless specified otherwise by the bidder.
2. Changes in offers or Revised offers given after Part-I bid opening shall not be considered as a part of the original offer unless such changes / revisions are requested by BHEL.
3. In case there is no change in the technical scope and / or specifications and / or commercial terms & conditions by BHEL, the supplier will not be allowed to change any of their bids after Technical bids are opened (after the due date and time of tender opening of Part-1 Bid).

4. In case of changes in scope and/ or technical specifications and/ or commercial terms & conditions by BHEL and it accounts for price implications from vendors, all techno-commercially acceptable bidders shall be asked by BHEL (after freezing the scope, technical specifications and commercial terms & conditions) to submit the impact of such changes on their price bid. Impact price will be applicable only for changes in technical specification / commercial conditions by BHEL. The impact price must be submitted on or before the cut-off date specified by BHEL and the original price bid and the price impact bid will be opened together at the time of price bid opening. Impact price means only for those items which have been impacted by addition / deletion / changes in the technical specifications or commercial conditions. The impact may be +/- incremental value of the currency in which originally quoted. The impact price bid to be submitted on the cut-off date, time & venue as specified by BHEL. The impact price bid shall be opened along with original price bid.
5. Un-opened bids (including price bids) will be returned to the respective bidders after release of PO and receipt of order acknowledgement from the successful bidder.
6. After receipt of Purchase Order, supplier should submit required documents like drawings, bill of materials, datasheets, catalogues, quality plan, test procedure, type test report , O & M Manuals and / or any other relevant documents as per Specification / Purchase Order, as and when required by BHEL / Customer.
7. Any deviation to the terms and conditions not mentioned in the quotation by supplier in response to this enquiry will not be considered, if put forth subsequently or after issue of Purchase Order, unless clarification is sought for by BHEL EDN and agreed upon in the Purchase Order.
8. Evaluation shall be on the basis of delivered cost (i.e. "Total Cost to BHEL"). As per RFQ terms.
"Total Cost to BHEL" shall include total basic cost, packing & forwarding charges, taxes and duties, inspection charges, freight charges, test charges, insurance, service tax for services, any other cost indicated by vendor for execution of the contract and loading factors (for non-compliance to BHEL Standard Commercial Terms & Conditions). Benefits arising out of Nil Import Duty on Mega Projects, Physical Imports or such 100% exemptions & MNRE Exemptions (statutory benefits), customer reimbursements of statutory duties (like Excise Duty, CST, VAT) will also be taken into account at the time of tender evaluation. (Wherever applicable and as indicated in SCC document of tender)
9. For evaluation of offers in foreign currency, the exchange rate (TT selling rate of SBI) shall be taken as under:

Single part bids:	Date of tender opening
Two/three part bids:	Date of Part-I bid opening
Reverse Auction:	Date of Part-I bid opening

In case of Performance Bank Guarantee (PBG) also, exchange rate will be considered as mentioned above for converting foreign currency to Indian currency and vice versa.

If the relevant day happens to be a bank holiday, then the exchange rate as on the previous working day of the bank (SBI) shall be taken.
10. Ranking (L-1, L-2 etc.) shall be done only for the techno-commercially acceptable offers and on the basis or evaluation of Total Cost to BHEL.

E. INFORMATION ON PAYMENT TERMS:

1. All payments will be through Electronic Fund transfer (EFT). Vendor has to furnish necessary details as per BHEL standard format (**Refer Annexure IV**) for receiving all payments through NEFT. (Applicable for Indian vendors only)
2. Statutory deductions, if any, will be made and the deduction certificate shall be issued. In case vendor does not provide PAN details, the TDS deduction shall be at the maximum percentage stipulated as per the provisions of Income Tax Act. (Applicable for Indian vendors only). Foreign vendors shall submit relevant details of their bankers like Swift Code, Banker's Name & Address etc.
3. Vendors must submit bills & invoices along with required supporting documents in time. Incomplete documentation / delayed submission of invoice / documents will result in corresponding delay in payment.

F. STANDARD PAYMENT TERMS OF BHEL-EDN**Purchase Orders for indigenous procurement****(a) SUPPLY WITH I&C/SUPERVISION:****Supply:**

- 1) 80% of basic Supply value + 100% of taxes, duties and freight charges will be paid with 45 days credit from the receipt of material at site or 15 days credit from the date of submission of complete set of documentation whichever is later.
- 2) 10% of basic supply value will be paid on completion of I&C against submission of supplementary invoice along with proof of completion of I&C along with I&C charges (if any).
- 3) Balance 10% (retention money) against submission of supplementary invoice along with PBG valid for Warranty Period+3 months Claim Period from BHEL Consortium Bank.

I&C/Supervision: 100% on completion of I&C/Supervision and certification line item wise on pro-rata basis.

O&M: 100% O&M charges are payable as per RFQ terms against report certified by BHEL.

(b) SUPPLY ONLY:

- 1) 100% of Basic value with taxes, duties and freight will be paid with 45 days credit from the receipt of material at site or 15 days credit from the date of submission of complete set of documentation whichever is later)+ submission of PBG valid for Warranty Period+ 3 months Claim Period from BHEL Consortium Bank ,if applicable.

Purchase orders for import procurement:**(c) SUPPLY WITH I&C/SUPERVISION:****Supply:**

- 1) 80% of the basic value (excluding I&C charges) will be paid with 45 days credit, against Sight draft, from the date of AWB/BOL on submission of complete set of documents as in PO.
- 2) 10% of basic supply value will be paid on completion of I&C against submission of supplementary invoice along with proof of completion of I&C along with I&C charges (if any).
- 3) Balance 10% (retention money) against submission of supplementary invoice along with PBG valid for Warranty Period+3 months Claim Period from BHEL Consortium Bank.

I&C: 100% on completion of I&C/Supervision and certification line item wise on pro-rata basis.

(d) SUPPLY ONLY:

- 1) 100% of PO value will be paid against Sight draft with 45 days Credit from the date of dispatch or 15 days credit from the date of submission of complete set of documents whichever is later)+ submission of PBG valid for Warranty Period+3 months Claim Period from BHEL Consortium Bank ,if applicable.

Note for (a), (b), (c) and (d): In exceptional cases, if vendor fails to submit PBG after supplies, vendors can also accept for the final 10% payment, payable after the warranty period + 3 months of claim period against supplementary invoice subject to the completion of commissioning (if applicable) as PBG is linked to Warranty period.

G. LOADING FACTORS FOR PAYMENT TERMS & DELAYED DELIVERY:

Loading factors as detailed below will be added to the quoted price (basic) to evaluate the lowest quote for non-compliance of BHEL standard commercial term.

SI No	Deviation on	Nature of Deviation / Offered Terms	Loading %
1.	Payment Terms	For Purchase within India :-	
		1) Credit period less than 45 days	15
		* For Foreign Purchase :-	
		1) Payment through At Sight Letter of Credit	10
		2) Payment through Letter of Credit with usance credit of 45 days	5
		3) Sight Draft with credit period less than 45 days	5
2.	Penalty for Delayed Delivery	1) Non – Acceptance	10
		2) Partial Acceptance (X%)	(10 – X)

*** All bank charges shall be to seller's account. If bank charges of BHEL banker are to BHEL's account then additional loading of 2% on the quoted basic value is applicable.**

Offer/s with payment terms other than the standard payment terms indicated at Clause No.F or Deviated Payment Terms with loading indicated at Clause No.G above are liable for rejection.

NOTES:

1. ADVANCE PAYMENT/LC: Quotations with "Advance payment/Inland LC" shall be rejected.
2. Basic value of Purchase Order mentioned above will include all components of the purchase order and will exclude only taxes, duties, freight and I&C charges (wherever applicable).
3. Wherever the Purchase Order is split into import portion and indigenous portion of supply the retention money will be 10% (as applicable) of both purchase order values put together.
4. Non-Compliance of Warranty terms. Offers not complying with Warranty terms as per RFQ Terms is liable for rejection.
5. SALE IN TRANSIT/ LOCAL VAT: Sale in transit under section 6(2) of CST is allowed if movement of goods is interstate. In case intra state movement of goods, benefit of sale in transit is not available.
6. In case of intrastate movement i.e. supply within same state and VAT is applicable, the vendor shall furnish the respective BHEL's nodal agency TIN no. and address in their invoice. (Refer **Annexure IX**)

H. BANK GUARANTEE (BG) / PERFORMANCE BANK GUARANTEE (PBG):

1. Bank guarantee (BG) / Performance bank guarantee (PBG) will be applicable as called in the tender documents. Such PBG shall be valid for a period of Warranty Period + claim period of 3 months for a value equal to 10 % of the basic value of the purchase order. No deviation for the duration of PBG / BG will be permitted.
 - a. PBG shall be from any of the BHEL consortium of bankers (**refer Annexure V**).
 - b. PBGs from nationalized banks are also acceptable.

- c. PBG should be sent directly by the bank to the dealing executive mentioned in the purchase order located at the address mentioned in the purchase order. PBG should be in the format indicated. **(Refer Annexure III)**. No deviation to these formats will be allowed.
- d. Confirmation from any of the BHEL consortium of banks or any of the Indian Public Sector Banks is essential for the acceptance of PBGs issued by foreign banks (located outside India).
- e. Expired BGs / PBGs will be returned only after expiry of the claim period or on completion of the contractual obligation.
- f. In case vendor does not accept for submission of PBG, the vendor is liable for rejection on commercial grounds.

I. DOCUMENTS (TRIPLICATE COPIES) REQUIRED AT THE TIME OF DISPATCH FOR PROCESSING OF BILL:

1. FOR INDIGENOUS SCOPE OF SUPPLY:

For Supply: Invoice in Triplicate, Lorry receipt (LR) copy, Packing List, PSI Call Letter Copy, Proof of delivery such as MRC (Material Receipt Certificate)/ original acknowledged LR, Insurance intimation Letter and Warranty Certificate. Note that document pertaining to Proof of delivery shall clearly mention number of boxes/panels etc which shall be in line with the Packing list.

For I&C: Supplementary Invoice in Triplicate with copy of I&C Certificate (Proof of Completion of I&C).

For PBG: Supplementary Invoice in Triplicate with copy of PBG. However, PBG should reach concerned Purchase Officer directly from the Bank.

2. FOR IMPORTED SCOPE OF SUPPLY:

For Supply: Invoice in Triplicate, Air Way Bill/Bill of Lading, Packing List, PSI Call Letter Copy, and Warranty Certificate.

For I&C: Supplementary Invoice in Triplicate with copy of I&C Certificate (Proof of Completion of I&C).

For PBG: Supplementary Invoice in Triplicate with copy of PBG. Both PBG & supplementary invoice should reach concerned Purchase Officer directly from the Bank.

J. PROVISIONS APPLICABLE FOR MSE VENDORS (MICRO AND SMALL ENTERPRISES)

Vendors who qualify as MSE vendors are requested to submit applicable certificates (as specified by the Ministry of Micro, Small and Medium Enterprises) at the time of vendor registration. Vendors have to submit any of the following documents along with the tender documents in the Part I / Technical bid cover to avail the applicable benefits.

- a. Valid NSIC certificate or
- b. Entrepreneur's Memorandum part II (EM II) certificate (deemed valid for 2 years).
- c. EM II certificate with CA certificate **(in the prescribed format given in Annexure VIII)** applicable for the year certifying that the investment in plant and machinery of the vendor is within permissible limits as per the MSME Act 2006 for relevant status where the deemed validity is over.
- d. Documents submitted for establishing the credentials of MSE vendors must be valid as on the date of part I / technical bid opening for the vendors to be eligible for the benefits applicable for MSE vendors. Documents submitted after the Part I / Technical bid opening date will not be considered for this tender.

PURCHASE PREFERENCE FOR MSE VENDORS:

- e. MSE vendors quoting within a price band of L1 + 15% shall be allowed to supply up to 20% of the requirement against this tender provided.
 - 1. The MSE vendor matches the L1 price.
 - 2. L1 price is from a non MSE vendor.
 - 3. L1 price will be offered to the nearest vendor nearest to L1 in terms of price ranking (L2 - nearest to L1). In case of non-acceptance by the MSE vendor (L2) next ranking MSE vendor will be offered who is within the L1 + 15% band (if L3 is also within 15% band).
 - 4. 20% of the 20% (i.e. 4% of the total enquired quantity) will be earmarked for SC/ST owned MSE firms provided conditions as mentioned in (1) and (2) are fulfilled.
 - 5. In case no vendor under SC / ST category firms are meeting the conditions mentioned in (1) and (2) or have not participated in the tender, in such cases the 4% quantity will be distributed among the other eligible MSE vendors who have participated in the tender.

6. Serial no. 1 to 5 will not be applicable wherever it is not possible to split the tendered quantity / items on account of customer contract requirement, or the items tendered are systems. Such information that tendered quantity will not be split will be indicated in the SCC.

K. INTEGRITY COMMITMENT IN THE TENDER PROCESS, AND EXECUTION OF CONTRACTS:

1. Commitment by BHEL:

BHEL commits to take all measures necessary to prevent corruption in connection with the Tender process and execution of the Contract. BHEL will, during the tender process, treat all bidder / suppliers in a transparent and fair manner, and with equity.

2. Commitment by Bidder(s)/ Contractor(s):

- a. The Bidder(s)/ Contractor(s) commit(s) to take all measures to prevent corruption and will not directly or indirectly try to influence any decision or benefit which he is not legally entitled to.
- b. The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any undisclosed agreement or understanding or any actions to restrict competition.
- c. The Bidder(s)/ Contractor(s) will not commit any offence under the relevant Acts. The Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain or pass on to others, any information or document provided by BHEL as part of business relationship.
- d. The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract and shall adhere to the relevant guidelines issued from time to time by Government of India/ BHEL.

If the Bidder(s) / Contractor(s), before award or during execution of the Contract commit(s) a transgression of the above or in any other manner such as to put his reliability or credibility in question, BHEL is entitled to disqualify the Bidder(s) / Contractor (s) from the tender process or terminate the contract and/ or take suitable action as deemed fit.

L. FRAUD PREVENTION POLICY:

The bidder along with its associate/collaborators/sub-contractors/sub-vendors/consultants/service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website <http://www.bhel.com> and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice. Fraud Prevention policy and List of Nodal Officers shall be hosted on BHEL website, vendor portals of Units/regions intranet.

PURCHASE EXECUTIVE



ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड

Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division

PB 2606 , Mysore Road Bangalore , 560026 INDIA

SCPV: BOS: GCC - Rev 01

GENERAL COMMERCIAL CONDITIONS FOR CONTRACT (GCC)

These 'General Commercial Conditions for Contract for Purchase' hereinafter referred to as GCC apply to all enquiries, tenders, requests for quotations, orders, contracts and agreements concerning the supply of goods and the rendering of related services (hereinafter referred to as "deliveries") to Bharat Heavy Electricals Limited and any of its units, regions or divisions (hereinafter referred to as "BHEL" or the Purchaser) or its projects / customers.

Any deviations from or additions to these GCC require BHEL's express written consent. The general terms of business or sale of the vendor shall not apply to BHEL. Acceptance, receipt of shipments or services or effecting payment shall not mean that the general terms of business or sale of the vendor have been accepted.

Orders, agreements and amendments thereto shall be binding if made or confirmed by BHEL in writing. Only the Purchasing department of BHEL is authorized to issue the Purchase Order or any amendment thereof.

Definitions: Throughout these conditions and in the specifications, the following terms shall have the meanings assigned to them, unless the subject matter or the context requires otherwise.

- a) 'The Purchaser' means Bharat Heavy Electricals Limited, Electronics division, Mysore road, Bangalore 560 026, a Unit of Bharat Heavy Electricals Limited (A Govt. of India Undertaking) incorporated under the Companies Act having its registered office at BHEL House, Siri Fort, New Delhi-110049, India and shall be deemed to include its successors and assigns. It may also be referred to as BHEL.
- b) 'The vendor' means the person, firm, company or organization on whom the Purchase Order is placed and shall be deemed to include the vendor's successors, representative heirs, executors and administrator as the case may be. It may also be referred to as Seller, Contractor or Supplier.
- c) 'Contract' shall mean and include the Purchase Order incorporating various agreements, viz. tender/ RFQ, offer, letter of intent / acceptance / award, the General Conditions of Contract and Special Conditions of Contract for Purchase, Specifications, Inspection / Quality Plan, Schedule of Prices and Quantities, Drawings, if any enclosed or to be provided by BHEL or his authorized nominee and the samples or patterns if any to be provided under the provisions of the contract.
- d) 'Parties to the Contract' shall mean the 'The Vendor' and the Purchaser as named in the main body of the Purchase Order.
- e) "Bidder" shall mean duly established reputed organisation, manufacturer etc. having requisite financial and technical capability and experience of participating in the bid invited by the purchaser for the tender.
- f) Bid- The term "bid" or "bidding" can also relate to the documented Offer submitted in response to a request for quotation (RFQ) /Tender.

Interpretation:

In the contract, except where the context requires otherwise:

- a) words indicating one gender include all genders;
- b) words indicating the singular also include the plural and words indicating the plural also include the singular;
- c) provisions including the word "agree", "agreed" or "agreement" require the agreement to be recorded in writing, and
- d) "Written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record.

Applicable Conditions:

1. **Price Basis:** All prices shall be firm until the purchase order is executed / completed in all respects. No price variations / escalation shall be permitted unless otherwise such variations / escalations are provided for and agreed by BHEL in writing in the purchase order.
2. **Validity:** The offer will be valid for a period of 90 days from the date of technical bid opening date. Validity beyond 90 days, if required, will be specified in the SCC (special conditions of contract).
3. **Taxes & Duties:** Taxes as mentioned in the Contract Price or Price Schedule shall be paid to the Contractor subject to the Contractor complying with all the statutory requirements and furnishing the relevant documents including error free invoices containing detailed break-up of the taxes. Any duties, levies or taxes not mentioned in Contract Price or Price Schedule but applicable as per any statute(s) shall be deemed to be included in the Contract price and shall be to the account of the Contractor.
The Contractor shall bear and pay all the costs, liabilities, levies, interest, penalties in respect of non-compliances of any legal requirements as per various statutory provisions. The contractor shall keep the owner indemnified at all times from any tax liability, interest, penalties or assessments that may be imposed by the statutory authorities for non-compliances or non-observation of any statutory requirements by the Contractor.
4. **Ordering and confirmation of Order:** Vendor shall send the order acceptance on their company letter head within two weeks from the date of Purchase Order or such other period as specified / agreed by BHEL. BHEL reserves the right to revoke the order placed if the order confirmation differs from the original order placed. The acceptance of goods/services/supplies by BHEL as well as payments made in this regard shall not imply acceptance of any deviations.
The purchase order will be deemed to have been accepted if no communication to the contrary is received within two weeks (or the time limit as specified / agreed by BHEL) from the date of the purchase order.
5. **Documentation:** After receipt of Purchase Order, vendor should submit required documents like drawings, bill of materials, datasheets, catalogues, quality plan, test procedure, type test report , O & M Manuals and/or any other relevant documents as per Specification/Purchase Order, as and when required by BHEL/Customer.
At any stage within the contract period, the vendor shall notify of any error, fault or other defect found in BHEL's documents /specifications or any other items for reference. If and to the extent that (taking account of cost and time) any vendor exercising due care would have discovered the error, fault or other defect when examining the documents/specifications before submitting the tender, the time for completion shall not be extended. However if errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the vendor's documents, they shall be corrected at his cost, notwithstanding any consent or approval.
6. **TERMS OF DELIVERY:**
FOR IMPORTED PURCHASE:
Price offered shall be for goods packed and delivered CIF Seaport/ International Airport (FCA) including packing, forwarding, Handling, Ancillary charges like processing of Sight Draft, negotiation charges of bank, Export declaration, Certificate of origin etc.
Packing shall be Air/Sea worthy, best suitable for trans-shipment and to take care of transit damages. If containerized, no. of containers & size of container shall be mentioned. Packing weight (gross & net) Packing dimensions shall be given prior to shipment to ascertain whether the consignment can be carried on standard cargo in contract or as ODC.
Wooden packing material for all the foreign consignments should be treated as per ISPM-15 & Fumigation / Phytosanitary certificate to be submitted to the freight forwarders/ BHEL along with the invoice, B/L, packing list etc.
Vendors shall indicate the name of International Airport/Seaport. The consignment shall be handed over to BHEL approved freight forwarder as mentioned in PO.

FOR INDIGENOUS PURCHASE:

Equipment shall be delivered on "FOR SITE" basis, inclusive of freight, packing, insurance & forwarding charges.

Packing shall be Road / Rail / Air / Sea worthy, best suitable for transshipment and to take care of transit damages. Smaller consignments can be dispatched through Courier services/ RPP with the prior approval of the purchasing Executive.

Deviation for the delivery term is liable for rejection.

7. Penalty:

For delay in delivery: In the event of delay in agreed contractual delivery as per Purchase Order, penalty @ 0.5 % (half percent) per week or part thereof but limited to a max of 10% (ten percent) value of undelivered portion (basic material cost) will be applicable. Delivery will commence from the date of document approval by customer / BHEL or date of issue of manufacturing clearance, whichever is later. The date for which Inspection call is issued by vendor along with test certificates / test reports / Certificate of Conformance / calibration reports, as proof of completion of manufacturing will be treated as date of deemed delivery for penalty calculation. In the absence of furnishing such document indicated above as proof of completion of manufacturing along with inspection call, actual date of inspection will be considered as date of deemed delivery and BHEL will not be responsible for delay in actual date of inspection.

Penalty for delayed delivery, if applicable, shall be deducted at the time of first payment. If penalty is applicable for duration of less than a week, penalty @ 0.5% (half percent) of the basic material value will be deducted.

8. **Contract variations (Increase or decrease in the scope of supply):** BHEL may vary the contracted scope as per requirements at site. If vendor is of the opinion that the variation has an effect on the agreed price or delivery period, BHEL shall be informed of this immediately in writing along with technical details. Where unit rates are available in the Contract, the same shall be applied to such additional work. Vendor shall not perform additional work before BHEL has issued written instructions / amendment to the Purchase Order to that effect. The work which the vendor should have or could have anticipated in terms of delivering the service(s) and functionality (i.e.) as described in this agreement, or which is considered to be the result of an attributable error on the vendor's part, shall not be considered additional work.
9. **Reverse Auction:** BHEL reserves the right to go for Reverse Auction (RA) (Guidelines as available on www.bhel.com) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. Bidders to give their acceptance with the offer for participation in RA. Non-acceptance to participate in RA may result in non- consideration of their bids, in case BHEL decides to go for RA.

Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit 'Process compliance form' (to the designated service provider) as well as 'Online sealed bid' in the Reverse Auction. Non-submission of 'Process compliance form' or 'Online sealed bid' by the agreed bidder(s) will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines for suspension of business dealings with suppliers/ contractors (as available on www.bhel.com).

The bidders have to necessarily submit online sealed bid less than or equal to their envelope sealed price bid already submitted to BHEL along with the offer. The envelope sealed price bid of successful L1 bidder in RA, if conducted, shall also be opened after RA and the order will be placed on lower of the two bids (RA closing price & envelope sealed price) thus obtained. The bidder having submitted this offer specifically agrees to this condition and undertakes to execute the contract on thus awarded rates.

If it is found that L1 bidder has quoted higher in online sealed bid in comparison to envelope sealed bid for any item(s), the bidder will be issued a warning letter to this effect. However, if the same bidder again defaults on this count in any subsequent tender in the unit, it will be considered as fraud and will invite

action by BHEL as per extant guidelines for suspension of business dealings with suppliers/ contractors (as available on www.bhel.com).

10. **Pre Shipment Inspection:** Prior written notice of at least one week shall be given along with internal test certificates / COC and applicable test certificates. Materials will be inspected by BHEL-EDN-QS/CQS or BHEL nominated Third Party Inspection Agency (TPIA) or BHEL authorized Inspection Agency or Customer / Consultant or jointly by BHEL & Customer / consultant. All tests have to be conducted as applicable in line with approved Quality plan or QA Checklist or Purchase specification and original reports shall be furnished to BHEL-EDN, Bangalore for verification / acceptance for issue of dispatch clearance.
All costs related to inspections & re-inspections shall be borne by vendor. Whether the Contract provides for tests on the premises of the vendor or any of his Sub-contractor/s, vendor shall be responsible to provide such assistance, labour, materials, electricity, fuels, stores, apparatus, instruments as may be required and as may be reasonably demanded to carry out such tests efficiently. Cost of any type test or such other special tests shall be borne by BHEL only if specifically agreed to in the purchase order.
11. **Transit Insurance:** Transit insurance coverage between vendor's works and project site shall be to the account of BHEL, unless specifically agreed otherwise. However, vendor shall send intimation directly to insurance agency through fax/courier/e-mail, immediately on dispatch of goods for covering insurance. A copy of such intimation sent by vendor to insurance agency shall be given to BHEL along with dispatch documents. Dispatch documents will be treated as incomplete without such intimation copy. BHEL shall not be responsible for sending intimations to insurance agency on behalf of the vendor.
12. **Packaging and dispatch:** The Seller shall package the goods safely and carefully and pack them suitably in all respects considering the peculiarity of the material for normal safe transport by Sea / Air / Rail / Road to its destination suitably protected against loss, damage, corrosion in transit and the effect of tropical salt laden atmosphere. The packages shall be provided with fixtures / hooks and sling marks as may be required for easy and safe handling. If any consignment needs special handling instruction, the same shall be clearly marked with standard symbols / instructions. Hazardous material should be notified as such and their packing, transportation and other protection must conform to relevant regulations.
The packing, shipping, storage and processing of the goods must comply with the prevailing legislation and regulations concerning safety, the environment and working conditions. Any Imported/Physical Exports items packed with raw / solid wood packing material should be treated as per ISPM – 15 (fumigation) and accompanied by Phytosanitary / Fumigation certificate. If safety information sheets (MSDS – Material Safety Data Sheet) exist for an item or the packaging, vendor must provide this information without fail along with the consignment.
Each package must be marked with Consignee name, Purchase order number, Package number, Gross weight and net weight, dimensions (L x B x H) and Seller's name. Packing list of goods inside each package with PO item number and quantity must also be fixed securely outside the box to indicate the contents of each box. Total number of packages in the consignment must also be indicated.
Separate packing & identification of items should be as follows.
 1. Main Scope - All items must be tagged with part no. & item description.
 2. Commissioning spares - All items must be tagged with part no. & item description.
 3. Mandatory spares - All items must be tagged with part no. & item description.
13. **Assignment of Rights & Obligations; Subcontracting:** Vendor is not permitted to subcontract the delivery or any part thereof to third party or to assign the rights and obligations resulting from this agreement in whole or in part to third parties without prior written permission from BHEL. Any permission or approval given by the BHEL shall, however, not absolve the vendor of the responsibility of his obligations under the Contract.
14. **Progress report:** Vendor shall render such report as to the progress of work and in such form as may be called for by the concerned purchase officer from time to time. The submission and acceptance of such reports shall not prejudice the rights of BHEL in any manner.
15. **Non-disclosure and Information Obligations: Vendor** shall provide with all necessary information pertaining to the goods as it could be of importance to BHEL. Vendor shall not reveal confidential information that may be divulged by BHEL to Vendor's employees not involved with the tender/ contract &

its execution and delivery or to third parties, unless BHEL has agreed to this in writing beforehand. Vendor shall not be entitled to use the BHEL name in advertisements and other commercial publications without prior written permission from BHEL.

16. **Cancellation / Termination of contract:** BHEL shall have the right to completely or partially terminate the agreement by means of written notice to that effect. Termination of the Contract, for whatever reason, shall be without prejudice to the rights of the parties accrued under the Contract up to the time of termination.
BHEL shall have the right to cancel/foreclose the Order/ Contract, wholly or in part, in case it is constrained to do so, on account of any decline, diminution, curtailment or stoppage of the business.
17. **Risk Purchase Clause:** In case of failure of supplier, BHEL at its discretion may make purchase of the materials / services NOT supplied / rendered in time at the RISK & COST of the supplier. Under such situation, the supplier who fails to supply the goods in time shall be wholly liable to make good to BHEL any loss due to risk purchase.
In case of items demanding services at site like erection and commissioning, vendor should send his servicemen /representatives within 7 days from the service call. In case a vendor fails to attend to the service call, BHEL at its discretion may also make arrangements to attend such service by other parties at the **RISK & COST** of the supplier. Under such situation the supplier who fails to attend the service shall be wholly liable to make good to BHEL any loss due to risk purchase / service including additional handling charges due to the change.
18. **Shortages:** In the event of shortage on receipt of goods and/or on opening of packages at site, all such shortages shall be made good within a reasonable time that BHEL may allow from such intimation and free of cost.
Transit Damages: In the event of receipt of goods in damaged condition or having found them so upon opening of packages at site, Supplier shall make good of all such damages within a reasonable time from such intimation by BHEL.
19. **Remedial work:** Notwithstanding any previous test or certification, BHEL may instruct the vendor to remove and replace materials/goods or remove and re-execute works/services which are not in accordance with the purchase order. Similarly BHEL may ask the vendor to supply materials or to execute any services which are urgently required for any safety reasons, whether arising out of or because of an accident, unforeseeable event or otherwise. In such an event, Vendor shall provide such services within a reasonable time as specified by BHEL.
20. **Indemnity Clause:** Vendor shall comply with all applicable safety regulations and take care for the safety of all persons involved. Vendor is fully responsible for the safety of its personnel or that of his subcontractor's men / property, during execution of the Purchase Order and related services. All statutory payments including PF, ESI or other related charges have to be borne by the vendor. Vendor is fully responsible for ensuring that all legal compliances are followed in course of such employment.
21. **Product Information, Drawings and Documents:** Drawings, technical documents or other technical information received by Vendor from BHEL or vice versa shall not, without the consent of the other party, be used for any other purpose than that for which they were provided. They may not, without the consent of the Disclosing party, otherwise be used or copied, reproduced, transmitted or communicated to third parties. All information and data contained in general product documentation, whether in electronic or any other form, are binding only to the extent that they are by reference expressly included in the contract.
Vendor, as per agreed date/s but not later than the date of delivery, provide free of charge information and drawings which are necessary to permit and enable BHEL to erect, commission, operate and maintain the product. Such information and drawings shall be supplied in as many numbers of copies as may be agreed upon.
All intellectual properties, including designs, drawings and product information etc. exchanged during the formation and execution of the Contract shall continue to be the property of the disclosing party.
22. **Intellectual Property Rights, Licenses:** If any Patent, design, Trade mark or any other intellectual property rights apply to the delivery (goods / related service) or accompanying documentation shall be the exclusive

property of the Vendor and BHEL shall be entitled to the legal use thereof free of charge by means of a non-exclusive, worldwide, perpetual license. All intellectual property rights that arise during the execution of the Purchase Order/ contract for delivery by vendor and/or by its employees or third parties involved by the vendor for performance of the agreement shall belong to BHEL. Vendor shall perform everything necessary to obtain or establish the above mentioned rights. The Vendor guarantees that the delivery does not infringe on any of the intellectual property rights of third parties. The Vendor shall do everything necessary to obtain or establish the alternate acceptable arrangement pending resolution of any (alleged) claims by third parties. The Vendor shall indemnify BHEL against any (alleged) claims by third parties in this regard and shall reimburse BHEL for any damages suffered as a result thereof.

23. **Force Majeure:** Notwithstanding anything contained in the purchase order or any other document relevant thereto, neither party shall be liable for any failure or delay in performance to the extent said failures or delays are caused by the "Act of God" and occurring without its fault or negligence, provided that, force majeure will apply only if the failure to perform could not be avoided by the exercise of due care and vendor doing everything reasonably possible to resume its performance.

A party affected by an event of force majeure which may include fire, tempest, floods, earthquake, riot, war, damage by aircraft etc., shall give the other party written notice, with full details as soon as possible and in any event not later than seven (7) calendar days of the occurrence of the cause relied upon. If force majeure applies, dates by which performance obligations are scheduled to be met will be extended for a period of time equal to the time lost due to any delay so caused.

Notwithstanding above provisions, in an event of Force Majeure, BHEL reserves for itself the right to cancel the order/ contract, wholly or partly, in order to meet the overall project schedule and make alternative arrangements for completion of deliveries and other schedules.

24. **Guarantee / Warranty:** Wherever required, and so provided in the specifications / Purchaser Order, the Seller shall guarantee that the stores supplied shall comply with the specifications laid down, for materials, workmanship and performance. The guarantee / warranty period as described shall apply afresh to replaced, repaired or re-executed parts of a delivery. If the vendor fails to take proper corrective action to repair/replace defects satisfactorily within a reasonable period, Purchaser shall be free to take corrective action as may be deemed necessary at vendor's risk and cost after giving notice to the vendor, including arranging supply of goods from elsewhere at the sole risk and cost of the vendor. Unless otherwise specifically provided in the Purchase Order, Vendor's liability shall be co terminus with the expiration of the applicable guarantee / warranty period.

25. **Limitation of Liability:** Vendor's liability towards this contract is limited to a maximum of 100% of the contract value and consequential damages are excluded. However the limits of liability will have no effect in cases of criminal negligence or wilful misconduct.

The total liability of Vendor for all claims arising out of or relating to the performance or breach of the Contract or use of any Products or Services or any order shall not exceed the total Contract price.

26. **Liability during guarantee / warranty:** Vendor shall arrange replacement / repair of all the defective materials / services under its obligation under the guarantee / warranty period. The rejected goods shall be taken away by vendor and replaced / repaired. In the event of the vendor's failure to comply, BHEL may take appropriate action including disposal of rejections and replenishment by any other sources at the cost and risk of the vendor.

In case, defects attributable to vendor are detected during first time commissioning or use, vendor shall be responsible for replacement / repair of the goods as required by BHEL at vendor's cost. In all such cases expiry of guarantee / warranty will not be applicable.

27. **Liability after guarantee / warranty period:** At the end of the guarantee / warranty, the Vendor's liability ceases except for latent defects (latent defects are defects / performance issues noticed after the guarantee / warranty has expired). The Contractor's liability for latent defects warranty for the plant and equipment including spares shall be limited to a period of six months from the end of the guarantee / as specified in RFQ.

28. **Compliance with Laws:** Vendor shall, in performing the contract, comply with all applicable laws. The vendor shall make all remittances, give all notices, pay all taxes, duties and fees, and obtain all permits, licences and approvals, as required by the laws in relation to the execution and completion of the contract and for remedying of any defects; and the Contractor shall indemnify and hold BHEL harmless against and from the consequences of any failure to do so.
29. **Settlement of Disputes:** Except as otherwise specifically provided in the Purchase Order, decision of BHEL shall be binding on the vendor with respect to all questions relating to the interpretation or meaning of the terms and conditions and instructions herein before mentioned and as to the completion of supplies/work/services, other questions, claim, right, matter or things whatsoever in any way arising out of or relating to the contract, instructions, orders or these conditions or otherwise concerning the supply or the execution or failure to execute the order, whether arising during the schedule of supply/work or after the completion or abandonment thereof. Any disputes or differences among the parties shall to the extent possible be settled amicably between the parties thereto, failing which the disputed issues shall be settled through arbitration. Vendor shall continue to perform the contract, pending settlement of dispute(s).
30. **Arbitration Clause:** In case amicable settlement is not reached in the event of any dispute or difference arising out of the execution of the Contract or the respective rights and liabilities of the parties or in relation to interpretation of any provision in any manner touching upon the Contract, such dispute or difference shall (except as to any matters, the decision of which is specifically provided for therein) be referred by either party to the sole arbitration of an Arbitrator appointed by the Executive Director/ General Manager of the purchasing unit/ region/ division of BHEL. Vendor shall have no objection even if the Arbitrator so appointed is an employee of BHEL or has ever dealt/ had to deal with any matter relating to this Contract. Subject as aforesaid the provisions of the Arbitration and Conciliation Act, 1996 of India or any statutory modification or re-enactment thereof and the rules made there under and for the time being in force shall apply to the arbitration proceedings under this clause. It is a term of contract that the party initiating arbitration shall specify the dispute or disputes to be referred to arbitration under this clause together with the amount or amounts claimed in respect of each such dispute. The venue for the arbitration shall be Bangalore, India. The award of the arbitrator shall be a speaking award and shall be final, conclusive and binding on all parties to this contract.
The cost of arbitration shall be borne equally by the parties. Notwithstanding the existence of any dispute or difference or any reference for the arbitration, the vendor shall proceed with and continue without hindrance the performance of the work under the contract with due diligence and expedition in a professional manner.
31. **Applicable Laws and Jurisdiction of Courts:** Prevailing Indian laws both substantive and procedural, including modifications thereto, shall govern the Contract. Subject to the conditions as aforesaid, the competent courts in BANGALORE alone shall have jurisdiction to consider over any matters touching upon this contract.
32. **General Terms:** That any non-exercise, forbearance or omission of any of the powers conferred on BHEL and /or any of its authorities will not in any manner constitute waiver of the conditions hereto contained in these presents.
That the headings used in this agreement are for convenience of reference only.
That all notices etc., to be given under the Purchase order shall be in writing, type script or printed and if sent by registered post or by courier service to the address given in this document shall be deemed to have been served on the date when in the ordinary course, they would have been delivered to the addressee.

ANNEXURE - I
LIST OF INTERNATIONAL GATEWAY AIRPORTS

SCHEDULE NO	COUNTRY	CURRENCY CODE	AIRPORT
D01	UK	GBP	LONDON (HEATHROW)
D02	UK	GBP	NEW CASTLE
D03	UK	GBP	OXFORD. CHETLAM
D04	UK	GBP	BRISTOL. WELLINGBOROUGH
D05	UK	GBP	BIRMINGHAM
D06	UK	GBP	EAST MIDLANDS
D07	UK	GBP	MANCHESTER
D08	UK	GBP	LEEDS
D09	UK	GBP	GLASGOW
D10	FRANCE	EURO	PARIS (ROISSY) & LYON
D11	SWEDEN	EURO	STOCKHOLM
D12	SWEDEN	EURO	GOTHENBERG & MALMO
D13	ITALY	EURO	ROMA, MILAN
D14	ITALY	EURO	TURIN, BOLOGNA, FLORENCE
D15	NETHERLANDS	EURO	AMSTERDAM, ROTTERDAM
D16	AUSTRIA	EURO	VIENNA, LINZ, GRAZ
D17	BELGIUM	EURO	ANTWERP, BRUSSELS
D18	DENMARK	DKK	COPENHAGEN
D19	JAPAN	JPY	TOKYO, OSAKA
D20	SINGAPORE	SGD	SINGAPORE
D21	CANADA	CAD	TORONTO
D22	CANADA	CAD	MONTREAL
D23	USA	USD	NEW YORK, BOSTON
D24	USA	USD	CHICAGO
D25	USA	USD	SAN FRANCISCO, LOS ANGELES
D26	USA	USD	ALANTA, HOUSTON
D27	GERMANY	EURO	MUNICH, KOLN, DUSSELDORF, HANNOVER, HAMBURG, STUTTGART, DAMSTADT, MANIHIEM, NURUMBERG
D28	GERMANY	EURO	FRANKFURT
D29	GERMANY	EURO	BERLIN
D30	SWITZERLAND	SFR	BASLE, ZURICH, GENEVA
D31	SPAIN	EURO	BARCELONA
D32	AUSTRALIA	AUD	SYDNEY
D33	AUSTRALIA	AUD	MELBOURNE
D34	AUSTRALIA	AUD	PERTH
D35	CZECH	EURO	PRAGUE
D36	HONG KONG	HKD	HONG KONG
D37	NEW ZELAND	NZD	AUCKLAND
D38	RUSSIA	USD	MOSCOW
D39	SOUTH KOREA	USD	KIMPO INTERNATIONAL, INCHEON
D40	FINLAND	EURO	HELSINKI
D41	ROMANIA	EURO	BUCHAREST
D42	NORWAY	EURO	OSLO
D43	IRELAND	EURO	DUBLIN
D44	ISRAEL	USD	TEL AVIV
D45	UAE	USD	DUBAI
D46	OMAN	USD	MUSCAT
D47	EGYPT	USD	CAIRO
D48	TAIWAN	USD	TAIPEI
D49	UKRAINE	USD	KIEV
D50	CHINA	USD	SHANGHAI, SHENZHEN
D51	PHILIPINES	USD	MANILA
D52	MALAYSIA	USD	KUALALUMPUR, PE NANG
D53	CYPRUS	USD	LARNACA
D54	SOUTH AFRICA	USD	JOHANNESBERG, DURBAN
D55	SLOVAKIA	EURO	BARTISLOVA
D56	SAUDI ARABIA	SAR	RIYADH
D57	TURKEY	EURO	ISTANBUL
D58	THAILAND	USD	BANGKOK
D59	BRAZIL	USD	SAO PAULO, RIO DE JANEIRO

ANNEXURE - II
REQUEST FOR C FORM

NAME OF VENDOR :

VENDOR CODE ALLOTTED BY BHEL :

E mail id for c form correspondence :

BHEL PO NO	INVOICE NO	INVOICE DATE	INVOICE AMOUNT	SUPPLY FROM - STATE	SUPPLY TO - STATE	CST TIN NUMBER (SUPPLIER)	INVOICE AMOUNT EXCLUDING FREIGHT	C FORM QTR	YEAR	SUPPLY TO BHEL EDN / SITE
---------------	---------------	-----------------	-------------------	---------------------------	-------------------------	-------------------------------------	---	---------------	------	---------------------------------

Please note that one 'C' form will be issued for a quarter.

Any modification and cancellation of c form is not possible from our end since it is generated online therefore include all invoices pertaining to quarter in your request
Also check the data are correct in all respect

General Instruction:

1. C form request should be given only in this file.
2. Amount should be 100% of Invoice value but should Not include freight, Insurance etc.
3. PO No. should be numeric, starting with 4 and has 10 digits
4. For every quarter separate file to be provided
5. All Invoices pertaining to the relevant quarter to be included.
6. No corrections will be entertained once c-form is issued.

BANK GUARANTEE FOR PERFORMANCE SECURITY

Bank Guarantee No:

Date:

To

NAME

& ADDRESSES OF THE BENEFICIARY

Dear Sirs,

In consideration of Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at _____¹ through its Unit at _____ (name of the Unit) having awarded to (Name of the Vendor / Contractor / Supplier) with its registered office at _____² hereinafter referred to as the 'Vendor / Contractor / Supplier', which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns), a contract Ref No _____ dated _____³ valued at Rs _____⁴ (Rupees -----)/FC _____ (in words _____) for _____⁵ (hereinafter called the 'Contract') and the Vendor / Contractor / Supplier having agreed to provide a Contract Performance Bank Guarantee, equivalent to _____ % (_____ . Percent) of the said value of the Contract to the Employer for the faithful performance of the Contract,

we, _____, (hereinafter referred to as the Bank), having registered/Head office at _____ and inter alia a branch at _____ being the Guarantor under this Guarantee, hereby, irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer any sum or sums upto a maximum amount of Rs -- -----⁶ (Rupees -----) without any demur, immediately on first demand from the Employer and without any reservation, protest, and recourse and without the Employer needing to prove or demonstrate reasons for its such demand.

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Vendor / Contractor / Supplier in any suit or proceeding pending before any Court or Tribunal, Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment thereunder and the Vendor / Contractor / Supplier shall have no claim against us for making such payment.

We the _____ bank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract/satisfactory completion of the performance guarantee period as per the terms of the Contract and that it shall continue to be enforceable till

all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged.

We, _____ BANK further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said Vendor / Contractor / Supplier from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Vendor / Contractor / Supplier and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Vendor / Contractor / Supplier or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Vendor / Contractor / Supplier or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Vendor / Contractor / Supplier and notwithstanding any security or other guarantee that the Employer may have in relation to the Vendor / Contractor / Supplier 's liabilities.

This Guarantee shall remain in force upto and including _____⁷ and shall be extended from time to time for such period as may be desired by Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Vendor / Contractor / Supplier but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof.

Unless a demand or claim under this guarantee is made on us in writing on or before the _____⁸ we shall be discharged from all liabilities under this guarantee thereafter.

We, _____ BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed _____⁶
- b) This Guarantee shall be valid up to _____⁷
- c) Unless the Bank is served a written claim or demand on or before _____⁸ all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of
(Name of the Bank)

Dated _____ .

Place of Issue _____ .

¹ NAME AND ADDRESS OF EMPLOYER I.e Bharat Heavy Electricals Limited

² NAME AND ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.

³ DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE

⁴ CONTRACT VALUE

⁵ PROJECT/SUPPLY DETAILS

⁶ BG AMOUNT IN FIGURES AND WORDS

⁷ VALIDITY DATE

⁸ DATE OF EXPIRY OF CLAIM PERIOD

ANNEXURE - IV

Electronic Funds Transfer (EFT) OR Paylink Direct Credit Form

Please Fill up the form in **CAPITAL LETTERS** only.

TYPE OF REQUEST(Tick one): _____ CREATE _____ CHANGE

BHEL Vendor / Supplier Code:	
Company Name :	
Permanent Account Number(PAN):	
Address	

City: _____	PINCODE _____	STATE _____	_____
-------------	---------------	-------------	-------

Contact Person(s)	
Telephone No:	
Fax No:	
e-mail id:	

1 Bank Name:	
2 Bank Address:	
3 Bank Telephone No:	
4 Bank Account No:	
5 Account Type: Savings/Cash Credit	
6 9 Digit Code Number of Bank and branch appearing on MICR cheque issued by Bank	
7 Bank swift Code(applicable for EFT only)	
8 Bank IFSC code(applicable for RTGS)	
9 Bank IFSC code(applicable for NEFT)	

- A I hereby certify that the particulars given above are true, correct and complete and that I, as a representative for the above named Company, hereby authorise BHEL, EDN, Bangalore to electronically deposit payments to the designated bank account.
- B If the transaction is delayed or not effected at all for reasons of incomplete or incorrect information, I would not hold BHEL / transferring Bank responsible.
- C This authority remains in full force until BHEL, EDN, Bangalore receives written notification requesting a change or cancellation.
- D I have read the contents of the covering letter and agree to discharge the responsibility expected of me as a participant under ECS / EFT.

Date:

Authorised Signatory:

Designation:

Telephone NO. with STD Code

Company Seal

Bank Certificate

We certify that _____ has an Account No _____ with us and we confirm that the bank details given above are correct as per our records.

Date: _____ (.....)

Place: _____ Signature

Please return completed form along with a blank cancelled cheque or photocopy thereof to:

Bharath Heavy Electricals Ltd,

Attn:

Electronics Division, Mysore Road,

BANGALORE - 560 026

In case of any Query, please call : 080-26998xxx / 2674xxxx or fax no. 080-2674xxxx

ANNEXURE-V
BHEL MEMBER BANKS (LIST OF CONSORTIUM BANKS)

BANK GUARANTEE (BG) SHALL BE ISSUED FROM THE FOLLOWING BANKS ONLY:

	Nationalised Banks		Nationalised Banks
1	Allahabad Bank	19	Vijaya Bank
2	Andhra Bank		Public Sector Banks
3	Bank of Baroda	20	IDBI
4	Canara Bank		Foreign Banks
5	Corporation Bank	21	CITI Bank N.A
6	Central Bank	22	Deutsche Bank AG
7	Indian Bank	23	The Hongkong and Shanghai Banking Corporation Ltd. (HSBC)
8	Indian Overseas Bank	24	Standard Chartered Bank
9	Oriental Bank of Commerce		
10	Punjab National Bank	26	J P Morgan
11	Punjab & Sindh Bank		Private Banks
12	State Bank of India	27	Axis Bank
13	State Bank of Hyderabad	28	The Federal Bank Limited
14	Syndicate Bank	29	HDFC Bank
15	State Bank of Travancore	30	Kotak Mahindra Bank Ltd
16	UCO Bank	31	ICICI Bank
17	Union Bank of India	32	IndusInd Bank
18	United Bank of India	33	Yes Bank

Note:

- All BGs must be issued from BHEL consortium banks listed above.
- BHEL may accept BG from other Nationalised Banks also which are not listed above.
- BG will not be accepted from Scheduled Banks and Co-operative Banks.
- In case BG is issued from a bank located outside Indian territory and is issued in foreign currency, the BG must be routed through and confirmed by any one of the above mentioned consortium banks or any of the Indian Public Sector Banks.
- This list is subject to changes. Hence vendors are requested to check this list every time before issuing BGs.

ANNEXURE - VI

DISCREPANCY IN WORDS & FIGURES – QUOTED IN PRICE BID

Following guidelines will be followed in case of discrepancy in words & figures-quoted in price bid:

- (a) If, in the price structure quoted for the required goods/services/works, there is discrepancy between the unit price and the total price (which is obtained by multiplying the unit price by the quantity), the unit price shall prevail and the total price corrected accordingly, unless in the opinion of the purchaser there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price corrected accordingly.
- (b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and
- (c) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.
- (d) If there is such discrepancy in an offer, the same shall be conveyed to the bidder with target date upto which the bidder has to send his acceptance on the above lines and if the bidder does not agree to the decision of the purchaser, the bid is liable to be ignored.

ANNEXURE - VII

BENEFITS FOR MSE SUPPLIERS AS PER MSMED ACT 2006 AND PUBLIC PROCUREMENT POLICY 2012

MSE suppliers can avail the intended benefits only if they submit along with the offer, attested copies of either EM II certificate having deemed validity (five years from the date of issue of Acknowledgement in EM II).

Or

Valid NSIC certificate or EM II certificate along with attested copy of CA certificate (Format enclosed: ANNEXURE VIII) where deemed validity of EM II certificate of five years has expired) applicable for the relevant financial year (latest audited).

Date to be reckoned for determining the deemed validity will be the date of bid opening (Part 1 in case of two part bid).

Non-submission of such documents will lead to consideration of their bid at par with other bidders.

No benefit shall be applicable for this enquiry if any deficiency in the above required documents are not submitted before price bid opening. If the tender is to be submitted through e-procurement portal, then the above required documents are to be uploaded on the portal. Documents should be notarized or attested by a Gazette officer.

ANNEXURE - VIII
CERTIFICATE BY CHARTERED ACCOUNTANT ON LETTER HEAD

This is to certify that M/s
.....(Hereinafter referred to as 'Company') having
its registered office at is registered under MSMED Act 2006, (Entrepreneur
Memorandum No ((Part-II) dtd Category:
(Micro/Small). (Copy enclosed).

Further verified from the Books of Accounts that the investment of the company as per the
latest audited financial year **as per MSMED Act 2006 is as follows:**

1. For Manufacturing Enterprises: Investment in plant and machinery (i.e., original cost excluding land
and building and the items specified by the Ministry of Small Industries vide its notification No.S.O.1722
(E) dated October 5, 2006:

Rs.Lacs.

2. For Service Enterprises: Investment in equipment (original cost excluding land and building
and furniture, fittings and other items not directly related to the service rendered or as may be
notified under the MSMED Act, 2006:

Rs.Lacs.

The above investment of Rs. Lacs in within permissible limit of Rs..... Lacs
for.....Micro / Small (Strike off which is not applicable) Category under MSMED
Act 2006.

(or)

The company has been graduated from its original category (Micro/Small) (Strike off which is not
applicable) and the date of graduation of such enterprise from its original category is
.....(dd/mm/yy) which is within the period of 3 years from the date of graduation of such enterprise
from its original category as notified vide S.O.No.3322(E) dated 01.11.2013 published in the gazette
notification dated 04.11.2013 by Ministry of MSME.

Date:

(Signature)

Name -

Membership Number -

Seal of Chartered Accountant

ANNEXURE - IX

In case of intrastate movement i.e. supply within same state and VAT is applicable, the vendor shall furnish the respective BHEL™s nodal agency TIN no. and address in their invoice.

List of Statewise Nodal Officers with Contact Details

Region	State	Nodal Unit responsible for all other units except those in column 4	Contact Details- Landline No.	E-mail	TIN No.	CST No.
1	2	3		7	8	9
Norther States	Jammu & Kashmir	PSNR	0120-2510488/2416452	rahulb@bhelspsnr.co.in / a.chadha@bhelspsnr.co.in	01291101313	
	Himachal Pradesh	PSNR			02011000622	
	Punjab	PSNR			03451148722	
	Haryana	PSNR			06962606884	
	Rajasthan	PSNR			08232903345	
	Uttar Pradesh	PSNR	0120-2416536	rahulb@bhelspsnr.co.in / smittal@bhelspsnr.co.in	09365800914	
	Uttarakhand	Hardwar	01334-285449	alok@bhelhwr.co.in	05001757277 Dated 30th Sep 2005	5000030 Dated 13/03/1965
	Delhi	TBG	0120-6748429	skjindal@bhel.in	07472001760	07472001760
Western States	Madhya Pradesh	Bhopal	0755-2503231	meeta@bhelbpl.co.in	23573600001 (HEL/05/01/0001/S dated 15/11/1979 under MPCT)	HEL/05/01/0004/C dated 15/11/1979
	Chattisgarh	PSWR	0712-3048609	mgupta@bhelspswr.co.in	22173202974	
	Gujarat	PSWR	0265-2370321	bhavin@bhelspswr.co.in	24190101571	
	Maharashtra	ROD Mumbai	022-22126061/22187850	mahajani@bhel.in	27060300130V	27060300130C
	Daman & Diu	EDN	080-26998724 / 26998830	theerthagiri@bheledn.co.in	25000009902	
Southern States	Orissa	PSSR	044-28286773	sparida@bhelspsr.co.in . lakshmi@bhelspsr.co.in	21031301916	
	Tamil Nadu	Trichy	0431-2577757/ 2577229	msrao@bheltry.co.in / bharaths@bheltry.co.in	33243560005	239383 dt.11.6.91
	Kerala	PSSR	044-28286773	lakshmi@bhelspsr.co.in	32072043622	
	Karnataka	EDN	080-26998724 / 26998830	theerthagiri@bheledn.co.in	29180069268	00850081
	Telangana	HPEP RC, Puram	040-23185406/ 040-23182238	chand@bhelhyd.co.in / sbsv@bhelhyd.co.in	36360151179	
	Andhra Pradesh	HPVP, Vizag	0891-6681298	sarmaass@bhpvl.com	37418632431	
	Puducherry	PSSR				
Eastern States	West Bengal	PSER	033-23216130-3238	amitavac@bhelsper.co.in	19200936019	19200936213
	Bihar	PSER	0612-2231275	rakesh@bhelsper.co.in	10010994046	10010994046
	Jharkhand	PSER	06549-266351(Sh. Parmanand Swaroop)/06534-292179 (Sh. K.K. Ajeet)	pswaroop@bhelsper.co.in (Bokaro) kk.ajit@bhelsper.co.in (Koderma/Abhijeet/North Karanpura) manishk.jain@bhelsper.co.in (Chandrapura)/ kpsubbu@bhelsper.co.in	20352205642 (Bokaro) 20082005255 (Maithon) 20512405410 (Koderma) 20122200394 (Chandrapura) 20620905730(Adhunik) 20650507026(Abhijeet) 20452110016 (North Karanpura)	TG-729(C)
	Mizoram	PSER	033-23216130-3249	anindya@bhelsper.co.in	15501465017	
	Arunachal Pradesh	PSER	033-23216130-3249	anindya@bhelsper.co.in	12020122182	Not Applied
	Assam	PSER	033-23216130-3249	anindya@bhelsper.co.in	18790101415	18179903204
	Tripura	PSER	03821-265209	mkmahato@bhelsper.co.in	16060947071	16060947273
	Sikkim	PSER				
	Meghalaya	PSER				
	Manipur	PSER				
	Nagaland	PSER				

List of Documents to be submitted by Vendors/Subcontractors for SPV Contracts.		Confirmation on submission
IR Documents (Type - A): For all Civil & I&C & O&M		
Sl No.	Documents	
1	Wage Sheet (Form 17)	YES
2	Attendance Register (w.r.t Sl No.1)	YES
3	Workman Policy & Additional Insurance (Automotive Liability, Group Servis Insuarnc Policy et	YES
4	PF Challan	YES
5	ESI (Employee State Insurance)	NO
6	ECR (Electronic Challan Receipt)	YES
7	Bank Statement for PF deposit	YES
8	RCS (Remittance Confirmation Slip)	YES
Quality Documents (Type - B): For all MMS Civil Works		
Sl No.	Documents	
1	FQA (Field Quality Assuarance)	NA
2	Field Content, Slump Test	NA
3	Gradation of Aggregate (10mm, 20mm)	NA
4	Fine Aggregate Test (for Sand)	NA
5	Cube Test Registered	NA
6	Material Test Certificate for Steel & Cement	NA
7	Consumption Register for Steel & Invoice	NA
8	Pour Card for Concreting purpose	NA
9	Royalty Reports (10mm, 20mm, Sand)	NA
10	Sand Soundess Test Reports	NA
11	Slump Test Register	NA
12	Sieve Analysis, Flakiness Index, Elongation Index - Register to be maintained	NA
13	Moisture Content Coarse and Fine Aggregate - Register to be maintained	NA
14	Water Test Report for Concrete	NA
15	Design Mix Report for Concrete	NA
Quality Documents (Type - B): For all Civil related Works		
Sl No.	Documents	
1	FQA (Field Quality Assuarance)	NA
2	Field Content, Slump Test	NA
3	Gradation of Aggregate (10mm, 20mm)	NA
4	Fine Aggregate Test (for Sand)	NA
5	Cube Test Registered	NA
6	Material Test Certificate for Steel & Cement	NA
7	Consumption Register for Steel & Invoice	NA
8	Pour Card for Concreting purpose	NA
9	Royalty Reports (10mm, 20mm, Sand)	NA
10	Sand Soundess Test Reports	NA
11	Warpage of Bricks Test Reports	NA
12	Core Cutting (Compaction Test) - Roads & Pathways	NA
13	Slump Test Register	NA
14	Sieve Analysis, Flakiness Index, Elongation Index - Register to be maintained	NA
15	Moisture Content Coarse and Fine Aggregate - Register to be maintained*	NA
16	Brick Test Reports	NA
17	Plastering profile and thickness	NA
18	Compaction test beneath floor of all buildings. - Reports	NA
19	Test Certificates for Paint, Glan, Glazing, etc.	NA
20	Test Certificates Aluminium Section for doors and windows (Anodisation Certificates also)	NA
21	BBS for Buildings	NA
22	Water Test Report for Concrete	NA
23	Design Mix Report for Concrete	NA

Quality Documents: for Electrical & Mechanical Installation Works (BOS)		
Sl No.	Documents	
1	FQA (Field Quality Assurance)	YES
2	Inspection Reports	YES
3	Guarantee Certificates	YES
4	Factory Acceptance Test Reports	YES
5	Commissioning Reports	YES

NOTE:

* This list of documents is indicative and intended towards all Solar Projects.

* Apart from the above, any other document required by the Customer and which are mandatory for Billing by BHEL to the Customer, the same respective vendors.

[illegible]

needs to be provided by the