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TECHNICAL CONDITIONS OF CONTRACT (TCC) FOR Restoration Works of PCSS-4 AT 65 MW SOLAR POWER PLANT OF NLC, NEYVELI, TAMILNADU.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD

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TECHNICAL CONDITIONS OF CONTRACT (TCC)
Contents

Sl. No.	Description	Chapter
Volume-IA	**Part-I: Contract specific details**	
1	Project Details	Chapter-I
2	Scope of Works	Chapter-II
3	Facilities in the scope of Contractor/BHEL (Scope Matrix)	Chapter-III
4	T&Ps to be deployed by Contractor	Chapter-IV
5	Time Schedule	Chapter-V
6	Taxes and other Duties	Chapter-VI
Volume-IA	**Part-II : Technical Specifications**	
7	General	Chapter-I
8	Supply, I&C and O&M Scope for BOS works	Chapter-II
9	General Technical Specifications	Chapter-III
10	Technical specification for design, supply, installation and commissioning	Chapter - IV
11	General Conditions	Chapter-V
12	Document Submission	Chapter-VI
13	Preamble to the schedule of Qtys	Chapter-VI
14	Annexures	Chapter-VIII

1.0 Project Details BHEL has established 2 blocks of 65MW (AC) Grid Interactive Solar PV Plant on EPC basis at Neyveli, Cuddalore District, Tamil Nadu.			
1	Customer	:	M/s Neyveli Lignite Corporation Limited.
2	Project Information	:	1x65 MW (AC) Grid Interactive Solar PV Power Plant Area of 65MW block is divided into two sub blocks of 40MW and 25MW. The distance between these blocks is around 8kM.
3	Location	:	At Neyveli, Cuddalore District, Tamil Nadu. The site is 200 KM from Chennai.
4	Address Detail	:	Neyveli, Cuddalore District, Tamil Nadu.
5	Nearest Railway Station	:	Neyveli,
6	Road Approach	:	State Highway connecting Vridhachalam-Cuddalore and is about 18 KMs East of Vridhachalam and about 43 KMs South West of Cuddalore on Eastern Coast.
7	Nearest Air Port	:	Chennai
11	Ambient Air Temperature (Average)	:	a) Maximum : 40.0^0 C b) Minimum : 18.4^0 C
12	Average Relative Humidity	:	28-96 %
13	Climatic Condition	:	Tropical Climate

Bidder is advised to visit the project site and appraise himself about the local conditions and infrastructure available in the area for fulfilling their commitments under the contract. BHEL will not admit any claims whatsoever on account of Contractor's non-familiarization of local conditions.

1.1	**Project Details**
1.2	**Project Information of 65MWp solar photovoltaic power plant:** Bharat Heavy Electricals Limited (BHEL), PE&SD, Hyderabad has set up a 65MWp solar photovoltaic (SPV) power plant at Neyveli, TN for NLC. The plant has two locations one of 40 MW at NLCIL Town ship and the other of 25 MW located at Koliruppu village, 12 kms apart from each other in Neyveli of Cuddalore district. An overview outline of the project is as follows: (a) The SPV modules employed at the power plant generates DC electricity that in turn is inverted to 3-phase AC with ~ 350V. The voltage is further stepped up to 33kV using 2.7MVA transformers. Twenty six such transformers are employed to achieve 65MWp. In which 16 nos. transformers are associated with 40MW block and 10 nos. transformers are associated with 25 MW (b) String monitoring boxes (SMBs, 549nos.) are employed to monitor the DC parameters of the strings of solar array. The DC power outputs from the SMBs are fed to 52 Nos of 1250kW grid-interactive power conditioning units (inverters) that are housed in a distributed manner among 11 PCSS rooms/inverter rooms and two PESS buildings/central control rooms. The PCSS room, each generating 5MWp, are placed at different locations of the power plant. Each such room is associated with a 33kV transformer yard, employing two oil-immersion transformers each of 2.7MVA, 33kV/350-350 V (one HV and two LV windings). Each LV winding voltage is expected to be in the range ~350V-380V. The 33KV output of 2 Nos of 2.7MVA transformers are fed to 33KV Switch boards with (2 I/C &1 O/G) vacuum circuit breaker (VCBs) indoor panels are also placed in each PCSS room. The 33kV outgoing feeder from each PCSS will feed the 33kV switchboard at PESS. From PESS power generated is exported through Metering yard, Gantry to Grid. Thus, 7 PCSS rooms & 1 PESS room put together will generate 40MW in 40MW block and 4 PCSS rooms & 1PESS room put together will generate 25MW in 25MW block. (c) As per the above major equipment pertaining 40MW block and 25MW block are listed broadly below **For 40MW block** 333 SMBs, 32 PCUs, 7 PCSS, 1 PESS building, 16 Nos 2.7 MVA Transformer and 1Metering yard (2bays) & gantry. **For 25MW block** 216 SMBs, 20 Inverters, 4 Inverter rooms, 1 PESS building, 10 Nos 2.7 MVA Transformer and 1Metering yard (1bay) & gantry. i. Generated power from 40MW block will be exported through two-transmission line, each is sized for 40MW and Generated power from 25MW block will be exported through one transmission line. Each feeder line is supported by a 33kV metering yard comprising of outdoor-mounted equipment viz. CTs, PTs, surge arrestors, GOS isolators, earth switches, support structures, ACSR conductors etc. Each feeder line is provided with three ABT meters (main, check and standby) that are housed in independent panels kept in PESS room. ii. The parameters (DC solar array, LT AC inverter level, HT 33kV transformer level) of solar power plant are monitored using SCADA system.

	iii. Power plant is provided with underground earth mat grid system for various electrical installations such as Solar array structures, string monitoring boxes, Inverter/PESS room electrical panels, Transformer yards, Metering yard and other installations. iv. 415V AC power for power plant auxiliaries is derived from 415V ACDBs located in PCSS room & PESS building. These ACDB will be further fed from 2x100% 350V/433V Auxiliary transformers. These Auxiliary transformers derive the power from output terminals of inverter. v. 110V DC supply for various electrical equipment such as protection relays, indication lamps etc. is derived from set of battery banks of Battery charger in PESS and PCSS rooms. The power supply to Battery charger is fed from auxiliary ACDB distribution panels. vi. 230V UPS power supply for various electrical equipment such as SCADA, PCUs, emergency lighting etc. is provided and are located in PESS and PCSS rooms. The power supply to UPS is fed from auxiliary ACDB distribution panels. vii. The plant has several other infrastructural support systems such as bore wells (for water supply), underground water pipeline network system for cleaning of SPV modules, lighting system for illumination of plant, fire alarm system for the inverter / PESS rooms, Inert gas fire protection system for SCADA, IP based telephone system, fire extinguishers, tools and instruments for operations and maintenance etc.

2.0 SCOPE OF WORK

The scope of works under this contract shall be restoration of PCSS-4 at 40MW site of 65MW NLC Project. For detailed scope, please refer to the part II of TCC, and schedule of quantities in price bid format.

2.1.0 GENERAL

2.1.1 The drawings enclosed with this tender are intended to give the tenderer a general idea of the type and extent of work involved. The drawings are as such only indicative and not to be considered as the exact construction drawings.

Further, this is to be noted that the drawings and the documents furnished along with this specification are the sole property of BHEL. It must not be used directly or indirectly in any way detrimental to the interest of the company.

2.1.2 The scope of work will also include such other related works although they may not be specifically mentioned in the above paragraph and all such incidental items not specified but reasonably imply and necessary for completion of the job as a whole all as desired and as directed by the engineer.

2.2.0 ALSO INCLUDED IN THE SCOPE

Unless otherwise specified, the work to be provided by the contractor for the items mentioned in the "Schedule of items", shall include but not be limited to the following.

2.2.1 Furnishing all labour, materials, supervision, construction plans, equipment, supplies, transport, to and from the site, fuel, electricity, compressed air, water, and all other incidental items and temporary works not shown on specified but reasonably implied or necessary for the proper completion, maintenance and handling over the works, except in accordance with the stipulations laid down in the contract documents and additional stipulations as may be provided by the engineer during the course of works.

2.2.2 Giving all notices, paying all fees, taxes etc., in accordance with the general conditions of contract, that are required for all works including temporary works.

2.2.3 Providing all incidental items not shown or specified but reasonably implied or necessary for the successful completion of the work in accordance with contract.

2.3.0 WORK BY OTHERS

No work under the specification will be provided by any agency other than the contractor unless specifically mentioned elsewhere in the contract.

FOR FURTHER DETAILED SCOPE OF WORKS REFER RELEVANT TECHNICAL SPECIFICATIONS PROVIDED IN THE SUBSEQUENT CHAPTERS IN THE TCC

S. No.	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
3.1	**ESTABLISHMENT**			
3.1.1	**FOR CONSTRUCTION PURPOSE**:			
A	Open space for office (as per availability)	Yes		
B	Open space for storage (as per availability)	Yes		
C	Construction of bidder's office, canteen and storage building including supply of materials and other services		Yes	
D	Bidder's all office equipments, office / store / canteen consumables		Yes	
E	Canteen facilities for the bidder's staff, supervisors and engineers etc		Yes	
F	Firefighting equipments like buckets, extinguishers etc		Yes	
G	Fencing of storage area, office, canteen etc of the bidder		Yes	
3.1.2	**FOR LIVING PURPOSES OF THE BIDDER**			
A	Open space for labour colony (as per availability)	Yes		Can be provided as per availability
B	Labour Colony with internal roads, sanitation, complying with statutory requirements		Yes	
3.2.0	**ELECTRICITY**			
3.2.1	Electricity For construction purposes		Yes	Electricity shall be provided by BHEL at one point on chargeable basis (Flat Rs. 8/ unit). Further distribution from the feeder point shall be done by the contractor. No separate payment for downstream power distribution shall be made. Contractor shall install a calibrated energy meter at feeder point for billing purpose.
3.2.2	Electricity for the office, stores, canteen etc. of the bidder		Yes	
3.2.3	Electricity for living accommodation of the bidder's staff, engineers, supervisors etc		Yes	

S. No.	Description PART I	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
3.3.0	**WATER SUPPLY**			
3.3.1	For construction purposes		Yes	Water shall be provided at one point on chargeable basis. Further distribution shall be done by contractor. Further distribution from supply point shall be done by contractor. No separate payment for downstream water distribution shall be made**.**
3.3.2	Water supply for bidder's office, stores, canteen etc		Yes	
3.3.3	Water supply for Living Purpose		Yes	
3.4.0	**LIGHTING**			
A	For construction work (supply of all the necessary materials) 1. At office/storage area 2. At the preassembly area 3. At the construction site /area		Yes	
B	For construction work (execution of the lighting work/ arrangements) 1. At office/storage area 2. At the preassembly area 3 At the construction site /area		Yes	
C	Providing the necessary consumables like bulbs, switches, etc during the course of project work		Yes	
D	Lighting for the living purposes of the bidder at the colony / quarters		Yes	
3.5.0	**COMMUNICATION FACILITIES FOR SITE OPERATIONS OF THE BIDDER**			
A	Téléphone, fax, internet, intranet, e-mail etc.		Yes	
3.6.0	**COMPRESSED AIR wherever required for the work**		Yes	
3.7.0	**Demobilization of all the above facilities**		Yes	
3.8.0	**TRANSPORTATION**			

S. No.	Description **PART I**	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
A	For site personnel of the bidder		Yes	
B	For bidder's equipments and consumables (T&P, Consumables etc)		Yes	

Sl. No	Description PART II 3.9.0 CONSTRUCTION FACILITIES	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
3.9.1	**Engineering works for construction:**			
A	Providing the construction drawings for all the works covered under this scope	Yes		
B	Drawings for construction methods	Yes	Yes*	*For package being designed by vendor
C	As-built drawings – where ever deviations observed and executed and also based on the decisions taken at site- example – routing of small bore pipes		Yes	In consultation with BHEL
D	Shipping lists etc. for reference and planning the activities		Yes	In consultation with BHEL
E	Preparation of construction (Concreting B/W, etc.) schedules and other input requirements		Yes	In consultation with BHEL
F	Review of performance and revision of site construction schedules in order to achieve the end dates and other commitments	Yes	Yes	In consultation with BHEL
G	Weekly construction schedules based on S. No. e. hard copy to Construction manager, by email to HO.		Yes	In consultation with BHEL
H	Daily construction / work plan based on S. No. g. hard copy to Construction manager, by email to HO.		Yes	In consultation with BHEL
I	Periodic visit of senior official of the bidder to site to review the progress so that works are completed as per schedule. It is suggested this review by the senior official of the bidder should be done once in every two Weeks.		Yes	
J	Arranging the materials required for Work		Yes	

Sl. No	Description PART II 3.9.0 CONSTRUCTION FACILITIES	Scope / to be taken care by		*Remarks*
		BHEL	**Bidder**	
K	Coordination for inspection & checking and getting clearance from customer		Yes	
L	Preparation of formats for completion of activities		Yes	

4.0. LIST OF TOOLS AND PLANT:

The following tools and equipment but not limited to, are required for the efficient execution of the BOS works. The contractor shall make them available for construction purposes, including all consumables likely to be used at his own cost at the time of mobilization.
These tools and tackles shall be maintained by vendor at 40MW block and 25MW block separately during the erection & commissioning activities.

BHEL will not provide any tool, plants or any testing facility/apparatus for the work. It will be contractor's responsibility to arrange all required tools, plants and other testing apparatus, etc. at their own cost. The prices quoted & finalized are inclusive of the charges towards providing such T&P. No extra payment will be entertained on account of this.

S.No.	Description	Minimum Quantity	Remarks
1	Hydra	1	Need based
2	JCB	1	Need based
3	Tractor	1	Need based
4	Cable unwinding Machines, rollers etc	1 No	Need based
5	MC4 connector tool kit containing (1) crimping plier MC4, (2) open end spanner set MC4, (3) stripping plier MC4, (4) socket wrench insert to tighten, (5) socket wrench insert to secure, inserts for both 4 sq-mm and 6-sqmm (of both pliers).	2 Set	Need based
6	Electrical measuring Instruments		
	a) Megger-500V	1No	Need based
	b) HV Tester-5000V	1No	Need based
	d) Logic probe	1No	Need based
	e) Modbus communication check kits	1No	Need based
	f) Digital Multi meter	3 No	Need based
7	Tong Testers	3 No	Need based
8	Digital power meters	1 No	Need based
9	Phase sequence meter	1 No	Need based
10	OFC termination kit, Splicing kits	1 Set	Need based
11	Primary /secondary injection kit	1 No each	Need based Need based
12	Transformer oil filtration unit	1 No	Need based
13	Earth resistance measurement kit	1 No	Need based
14	Lugs, glands as in scope of supply	1 set	Need based
15	Transmission line stringing equipment	1 No	Need based
16	Cable jointing kit and associated tools	2 Set	Need based
17	Welding equipment	1 No	Need based

18	Flood lights	5 No	Need based
19	Set of screw drivers	1 Set	Need based
20	Set of Allen keys (mm & inch)	1 Set	Need based
21	Small size hacksaw & fraksaw	1 Set	Need based
22	Cutting pliers	2 No	Need based
23	Nose pliers	2No	Need based
24	Insulation stripers	2No	Need based
25	Dry cable jointer	1 No	Need based
26	Number punches	1 No	Need based
27	Alphabet punch	1 No	Need based
28	Embossing machine with cassettes (Numbers and alphabets)	1 No	Need based
29	Portable drilling machine up to 1-1/2”	1 Set	Need based
30	Soldering gun	1 No	Need based
31	Soldering Iron	1 No	Need based
32	Continuity tester	5 No	Need based
33	Double ended spanner Set of sizes 10-11, 12-13, 14-15, 16-17, 17-18	2 Nos each	Need based
34	Screwdriver Set	1 Set	Need based
35	Crimping tool with Dye range 50-400sq-mm cable, mechanical gear power, hand operated	1 Set	Need based
36	Crimping tool up to 6 sq-mm cable	1 set	Need based
37	Drilling machine AC, hand operated, with bit size up to 20 mm	1 set	Need based
38	Measuring Tape, 5m	2 Nos	Need based
39	Measuring Tape, 50 m	2 Nos	Need based
40	Allen Key set	1 Set	Need based
41	Adjustable spanner 2-inch size	1 No	Need based
42	Hammer	2 Nos	Need based
43	Rough file kit	1 Set	Need based
44	Cutting Pliers	2 Nos	Need based
45	Nose Pliers	2 Nos	Need based
46	Vacuum cleaner, of industrial type, for control room sweeping / cleaning.	1 No	Need based
47	Blowers for cleaning the panels	2 Nos	Need based

5.0 TIME SCHEDULE

5.1.1
The entire work in the Tender Specification shall be completed within 4 (Four) months from the date of commencement of work at site.

5.1.2
During the total period of contract, the contractor has to carry out the activities in a phased manner as required by BHEL and the program of milestone events.

5.1.3
The work shall be commenced on the mutually agreed date between the bidder and BHEL engineer and shall be deemed as completed in all respect only when the unit is in operation. The decision of BHEL in this regard shall be final and binding on the contractor. The scope of work under this contract is deemed to be completed only when so certified by the site Engineer.

5.2 COMMENCEMENT OF CONTRACT PERIOD

The date of commencement of contract period shall be the mutually agreed date between the bidder and BHEL engineer to start the work. In case of discrepancy the decision of BHEL engineer will be final.

5.3 MOBILISATION

5.3.1
The activities of Erection & Commissioning works, etc. shall be started as per directions of the Construction manager of BHEL.

5.3.2
The contractor should mobilize man power in order to complete the work in 4 (Four) months for the complete scope of works in this contract.

5.3.3
Requisite Material, men and machinery should be arranged in order to complete the project within stipulated time period.

5.3.4
The contractor has to augment his resources in such a manner that following major milestones of the project are achieved on specified schedules:

5.4 CONTRACT PERIOD

For the purpose of contract, the period shall be taken as 4 (Four) months for the complete scope of works in this contract . Completion of the work shall be as per BHEL Bar Charts revised from time to time. In order to expedite the work, the contractor has to deploy manpower on two-shift basis during erection and during pre-commissioning and commissioning period manpower should be provided round the clock basis as per site requirement without any extra cost to BHEL.

5.5 PROTECTION OF WORK

The contractor shall have total responsibility for protecting his works till it is taken over by the Employer. No claim will be entertained by the Employer or the representative of the Employer for any damage or loss to the Contractor's works and the Contractor shall be responsible for complete restoration of the damaged works to original conditions to comply with the specification and drawings. Should any such damage to the Contractor's
Works occur because of other party not being under his supervision or control, the Contractor shall make his claim directly with the party concerned.

If disagreement or conflict or dispute develops between the Contractor and the other party or parties concerned regarding the responsibility for damage to the Contractor's Works the same shall be rectified. The Contractor shall not cause any delay in the repair of such damaged Works because of any delay in the resolution of such disputes. The Contractor shall proceed to repair the Work immediately and no cause thereof will be assigned pending resolution of such disputes.

The progressive payment for the work on accepted price of contract value will be released on the basis of running account bills & other bills as per the provisions of relevant clauses of GCC and SCC.

BUILDING & OTHER CONSTRUCTION WORKERS (REGULATION OF EMPLOYMENT AND CONDITIONS OF SERVICE) ACT, 1996 (BOCW Act) AND RULES OF 1998 READ WITH BUILDING & OTHER CONSTRUCTION WORKERS CESS Act, 1996 & CESS RULES, 1998.

In case any portion of work involves execution through building or construction workers, then compliance to the above titled Acts shall be ensured by the contractor and contractor shall obtain license and deposit the cess under the Act. In the circumstances it may be ensured as under:-

i. It shall be the sole responsibility of the contractor in the capacity of employer to forthwith (within a period of 15 days from the award of work) apply for a license to the Competent Authority under the BOCW Act and obtain proper certificate thereof by specifying the scope of its work. It shall also be responsibility of the contractor to furnish a copy of such certificate of license / permission to BHEL within a period of one month from the date of award of contract.

ii. It shall be the sole responsibility of the contractor as employer to ensure compliance of all the statutory obligations under these act and rules including that of payment / deposit of 1% cess on the extant of work involving building or construction workers engaged by the contractor within a period of one month from the receipt of payment.

iii. It shall be the responsibility of the sub-contractor to furnish the receipts / challans towards deposit of the cess together with the number, name and other details of beneficiaries (building workers) engaged by the sub-contractor during the preceding month.

iv. It shall be the absolute responsibility of the sub-contractor to make payment of all statutory payments & compensations to its workers including that is provided under the Workmen's Compensation Act,1

TCC Part II

Technical Specifications

1.1
The work covered under this specification is of highly sophisticated nature, requiring the best quality of workmanship for construction, engineering and construction management. The Bidder should ensure timely completion of work. The Bidder must have adequate quantity of tools, construction aids, equipment's etc., in his possession. He must also have on his rolls adequate, trained, qualified and experienced supervisory staff and skilled personnel.

1.2
The work shall be executed under the usual conditions affecting industrial construction and in conjunction with numerous other operations at site. The Bidder and his personnel shall co-operate with the personnel of other agencies, co-ordinate his work with others and proceed in a manner that shall not delay or hinder the progress of work as a whole.

1.3
All the work shall be carried out as per the instructions of BHEL engineer. BHEL engineer's decision regarding the correctness of the work and method of working shall be final and binding on the Bidder.

1.4
The Bidder shall at his cost perform any services, tests etc, although not specified but nevertheless required for the completion of work.

1.5
Contractor shall execute the work as per sequence prescribed by BHEL at site. The sequence of activities, methodology will be decided by the BHEL engineers depending upon the availability of material, drawings, work fronts etc. No claims for extra payment from the Contractor will be entertained on the grounds of deviation from the methods and sequence of construction advised and agreed by BHEL engineer or for any reasons whatsoever.

1.6
All the necessary certificates and licenses required to carry out this work are to be arranged by the Contractor expeditiously at his cost.

1.7
The work to be carried out under the scope of these specifications covers, temporary storing of contractor's own construction material, using the same in the work, carrying out all other activities, viz. survey, excavation, backfilling, erection, commissioning and all the other activities as defined in the scope of work enumerated in chapter-2, Part-I of TCC document, Bill of Quantities and elsewhere till handing over of the entire work. The work shall conform to dimensions and tolerances specified in the various drawings, documents etc. That will be provided during the course of construction. If any portion of the work is found to be defective in workmanship or not conforming to drawings or other specifications, the Contractor shall dismantle and re-do the work duly replacing the defective materials at his cost failing which the work will be got done by BHEL at the cost and risk of the contractor.

1.8
The terminal points as decided by BHEL shall be final and binding on the Contractor.

1.9
During the course of execution of this work, certain rework/ modification/ rectification/ repairs/ fabrication/dismantling etc. will be necessary on account of feedback from customer/BHEL on account of design discrepancies and manufacturing defects and site operation/maintenance requirements. Contractor shall carryout such rework/ modification/rectification/fabrication/repairs etc., promptly and expeditiously. Claims of contractor, if any, for such works will be dealt as per relevant clauses of General Conditions of Contract.

1.10
Daily log sheets indicating the details of work carried out, man-hours, consumables used etc, shall be maintained by the Contractor and got signed by BHEL engineer every day.

1.11
All tools and tackles, fixtures, equipment, materials, manpower, supervisors/ engineers, consumables etc. required for this scope of work shall be provided by the Contractor. All expenditure including taxes and incidentals in this connection will have to be borne by him unless otherwise specified in the relevant clause.

1.12
The contractor shall make adequate security arrangements including employment of security personnel and ensure protection from theft, fire, pilferage, damage and loss of materials/equipments issued to him for the work. Special care will have to be taken to guard against pilferage / theft of steel and/or cables, conductors other materials/equipments.

1.13
Contractor shall ensure proper housekeeping and remove all scrap materials periodically from various work area covered in the scope and deposit the same at the place earmarked for this purpose. In case of contractor’s failure to do the same, BHEL reserves the right to remove scrap at contractor's cost and risk.

1.14
Access to site for inspection by BHEL and customer engineers shall be made available by the contractor at all times.

1.16
Site Inspection: The owner / employer or his authorized agents may inspect various stages of work during the execution of the contract awarded to him. The contractor shall make necessary arrangements for such inspection and carry out the rectification pointed out by the owner / employer without any extra cost to the owner / employer. No cost whatsoever such duplication of inspection of work be entertained.

1.17
BHEL will not supply any materials unless otherwise specified.

1.18
Makes of supply of steel, miscellaneous items, safety items, painting materials etc., which are in Vendor scope of supply, shall be as per approved material list by NLC/BHEL.

1.19
The Contractor shall carry the work as per the Field Quality Plan issued by BHEL/NLC.

1.20
Calibration of equipment's should be done by NABL/NPL accredited laboratories.

1.21
Welding procedure to be followed as per Field Quality plan. (Welding procedure and prequalification of welder required to be produced)(If required).

1.22
Field Quality Assurance Formats: It is the responsibility of the contractor to collect and fill up the relevant concrete pour card/FQA Log sheets and present the same to BHEL after carrying out the necessary checks as per the log sheets and obtaining the signature of BHEL / Customer in token of their acceptance. Monthly Running Bill Payment to the contractor will be linked with the submission of these Log sheets.

SCOPE

The scope of works under this contract shall be restoration of PCSS-4 at 40MW site of 65MW NLC Project.

1. The PCSS (Inverter Room)-4 is part of the 40MW site of the 65MW NLC Project. The scope of this contract is to restore the PCSS-4. The major activities for this restoration included (But not limited to) shall be as followed:
   i. Dismantling, and removal of existing equipment from the PCSS room, transportation to the designated place (within the plant boundary), Material handling, Erection and Testing, and Commissioning of the following items (Free supply by BHEL) in the PCSS:
      (a) Power Conditioning Unit including base channel
      (b) 33kV VCB Panel including base channel
      (c) 415V ACDB including base channel
      (d) 110V DC VRLA Battery including base channel
      (e) 110V DC 15A Battery charger including base channel
      (f) SCADA RTU Panel including base channel
      (g) 230V 5KVA UPS including base channel
      (h) 230V 5KVA UPS Battery including base channel
      (i) FDA Items (Annexure-II)

   ii. Erection & Testing of Cables of various sizes, and types, including glanding, and termination (Including removal of the existing damaged cables, terminations etc.). The supply of various types of cable glands, termination kits, lugs, will be in the scope of BHEL.
   iii. Dismantling, removal, transportation of existing items to the designated place (within the plant boundary), Supply and Installation of the various Miscellaneous boards, signs, fire safety items etc. including material handling.
   iv. Dismantling, removal, and disposal of the PEB, and steel structures.
   v. Testing of inverter transformers including oil filtration ,and other incidental activities
   vi. Supply, receipt, unloading, preservation, handling, and installation of the Pre Engineered Building (PEB) as per BHEL specifications, and drawings, and as per the directions of BHEL Engineer.
   vii. The material handling of all the materials pertaining to this work shall be in the scope of the contractor. The rate quoted by the contractor shall include the material handling also. The material handling scope shall include Receipt, Unloading, Material Handling from Trucks / Trailers / Transport carriers etc., transportation to site / site stores & storage yard, verification, stacking, documentation / updating in computer system for various stages of works & preservation of materials, including providing all necessary crane (Pick and carry, forklift) equipment, manpower viz, T&P consumables all complete as per instruction and direction of BHEL Engineer.
   viii. Installation, testing, and commissioning of fire, alarm and detection system.
2. Coordination / liaison activities (related to clearance / approval) with concerned state / central authorities such as CEIG/ CEA etc.

3.0 General technical requirements

3.1	Introduction This part covers technical requirements which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical requirements brought out in the Technical Specifications and the Technical Data Sheets.
3.2	Brand name Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable BHEL to determine that the products proposed are equivalent to those named.
3.3	Codes and standards In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following: (a) Bureau of Indian Standards (BIS) (b) Indian electricity act (c) Indian electricity rules (d) Indian Explosives Act (e) Indian Factories Act and State Factories Act (f) Regulations of the Central Pollution Control Board, India (g) Regulations of the Ministry of Environment & Forest (MoEF), Government of India (h) Pollution Control Regulations of Department of Environment, Government of India (i) State Pollution Control Board. (j) Rules for Electrical installation by Tariff Advisory Committee (TAC). (k) Any other statutory codes / standards / regulations, as may be applicable. Unless covered otherwise by Indian codes & standards and in case nothing to the contrary is specifically mentioned elsewhere in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply: (a) National Fire Protection Association (NFPA) (b) International Electro-Technical Commission (IEC) Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to BHEL / NLC approval, for which the vendor shall furnish, along with the offer, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases the vendor shall furnish specifically the variations and deviations from the standards mentioned elsewhere in this specification

	together with the complete word to word translation of the standard that is normally not published in English. As regards highly standardized equipment such as transformer etc., National /International standards such as JIS, DIN, VDI, ISO, SEL, SEW, VDE, IEC & VGB shall also be considered as far as applicable for Design, Manufacturing and Testing of the respective equipment. In addition, these standards shall be referred for the design of machine foundations, wherever specifically mentioned in the specifications. However, for those of the above equipment not covered by these National / International standards, established and proven standards of manufacturers shall also be considered. In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern. In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, BHEL / NLC shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the vendor to bring to the notice of BHEL such changes and advise on the resulting effect.

4.0 Technical specification for supply, installation and commissioning

S. No	BHEL specification
4.1	**IP based Telephone system:** **Design & Supply:** BHEL Scope **Erection and commissioning:** Erection of cables pertaining to IP based telephone system. Any minor civil work shall be done by vendor. Erection of IP based telephone exchange at PESS building is in the scope of vendor.
4.2	**Cable markers and cables tags** **Supply, E&C:** Supply, erection and commissioning of the following are in vendor's scope. (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. Vendor shall submit the respective schemes of marking and tagging for BHEL approval during detailed engineering.
4.3	**Electrical insulation mat** **Supply, E&C:** Supply, erection and commissioning of the following are in vendor's scope. Electrical insulating mats as per below specifications is in bidders scope. (a) Reputed make as shall be approved by BHEL. (b) Insulating Mat Material including composition, Design, Workmanship & Finish, Physical Properties and all other features shall be strictly comply with the IS 15652. (c) Class-A, Thickness: 2.0mm (Min), Voltage up to 3.3kV ac (rms), Qty: 50 no.'s (d) Class-C, Thickness: 3.0mm (Min), Voltage up to 33kV ac (rms) (i.e >11kV & < 33kV) Qty: 17 no.'s (e) Size = 10M (L) X 1M (W) Sheet. To be confirmed by BHEL during details engg. (f) Category: Category-III, Acid, alkali, oil and low temperature resistance (g) Preferred Color: to be confirmed by BHEL during detail engg.

	(h) The Insulating mat should be marked with the BIS Standard Mark Valid test report as per IS-15652 which are listed below, not older than 5yrs, from CPRI/ERDA/NABL accredited testing laboratories shall be submitted for review along with the offer. In case any valid test reports are not available, same shall be conducted without any time and cost to BHEL. (i) Adhesive of reputed make for fixing Insulating mat. These mats shall laid in front of all the indoor electrical panels' viz. PCUs, VCB panels, ACDB / DCDB panels, SCADA panels, UPS panels, battery banks etc.
4.4	**Fire proof sealing material: Mortar Seal** **1) Supply** BHEL scope **2) Erection and commissioning** • All entry and exit openings for cables passing through GI/PVC conduits /Cable trenches in substation, control room etc. shall be provided with fire barrier. • Erection and commission shall be carried out strictly as per manufacturer recommendation.
4.5	**Structural Steel for panel supports on trenches** **Supply:** In the scope of the vendor **E&C:** E&C of above structural material is in the scope of vendor.
4.6	**Unloading, safe storage and movement of supply items received at site:** **A. Items supplied by vendor, and BHEL** (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 verification and approval from BHEL site engineer for every consignment. The documents shall be suitably preserved for further handing over to BHEL/NLC. (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.

4.7	**Installation (indoor) of electrical panels within PCSS 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 PCSS room): (a) 1250 kW PCU panels : 4 sets (b) 33kV VCB panels: 1 sets (2 incomers + 1 outgoer) for in PESS room (c) 415V ACDB and 110V DCDB power supply distribution boards/converter panels (wall mounted or floor mounted as the case may be) – 1 No each (d) SCADA panel – 1 No (e) 230V UPS with battery bank / Isolation box / UPSDB (for PCU control circuit/SCADA / emergency utilities support) – 1 no. (f) 110V DC Battery and Battery charger - 1 no. (g) Fire alarm panels-1 no. & DCP type Fire extinguisher-1 no. (h) Power supply panel- 1 set
4.8	**Cable laying/dressing etc. in PCSS room** **A. Cable routing, laying, dressing** (1) Cables entering into the control rooms from outside shall be bunched appropriately. The multiple bunches shall be routed through conduit pipes (PVC/hume pipes etc.) of appropriate type, diameter and length that shall be fixed below the plinth level. (2) Cables (HT, LT, communication, control etc.) shall be laid on cable trays in separate tiers with appropriate spacing. HDPE pipes of appropriate type and size shall be used all along the length of control and communication cables for routing up to panel entry. (3) Cables shall be dressed using appropriate cable ties at appropriate intervals to ensure firmness of their position over the trays. (4) 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. (5) All cable entry openings of conduit pipes, after laying/ termination of the cables, shall be sealed using fireproof sealing material. (6) All cable accessories such as cable conduits/pipes, ties, trefoil clamps, sealants etc. for the above purpose shall be in vendor scope of supply. (7) All the supply and above installation works as mentioned above shall be as per "**Cable installation methodology**" section of this specification and as per drawings approved by BHEL during detailed engineering.

4.9	**Termination of 1Cx240 sq-mm DC power cables at PCUs in PCSS room** (1) On DC side, for each PCU, vendor shall carry out the cable terminations for 10 positive and 10 negative inputs connections including unsleeving, crimping and connecting. (2) BHEL shall supply the DC cables (1Cx240 sq-mm aluminium, armoured, XLPE insulation, PVC sheath). Also, cable glands (double compression type), cable lugs, bolts, nuts and washers shall be in BHEL scope of supply. (3) Vendor shall carry out drilling/punching of holes in cable gland plates of the PCUs. Gas cutting method shall not be adopted. For this purpose, all necessary machines / tools shall be made available at site by vendor. (4) Cables glands shall be fixed on the gland plate holes. Cables shall be routed through the glands that shall in turn be tightened to hold the cables firmly in place. (5) All tools and accessories required to carry out the termination shall be within scope of vendor. All applicable/relevant clauses under "**Cable installation methodology**" section of this specification shall be adopted.
4.10	**Termination of AC power cables at PCUs, 2.7MVA transformers, VCB breaker panels, aux transformer, UPS / Battery / ACDB/ DCDB panels etc.** All applicable/relevant clauses under **"Cable installation methodology"** sections of this specification shall be adopted for all aspects of these cables cable installation, cable accessories etc. **(1)** Supply of all cable accessories (for the above requirements) such as ferrules, nuts/bolts/washers, cable dressing ties etc. shall be in vendor scope. **(2)** Laying of above cables, fixing of cable glands, and cable termination at the respective terminal bus bars shall be in the scope of vendor. **(3)** All resources such as labour, machinery, tools and accessories to carry out the above electrical works shall be within scope of vendor.
4.12	Scope of Control / data / instrumentation / OFC cables and terminations 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. (1) All the cable installation accessories such as cable conduits, cable glands, ferrules, cable ties, bolts, nuts, washers etc. shall be in vendor scope of supply, based on cable size details that will be provided from BHEL at an appropriate time after placement of PO on vendor. 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 within scope of vendor.

(2) All the other Cable laying and cable terminations such as (i) control cables from inverter transformer marshaling 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 marshaling boxes to SCADA panels (WTI, OTI values), shall be within vendor scope :

(a) All the cable installation accessories such as cable glands, bolts, nuts, washers etc. shall be in vendor scope of supply. Cable laying and cable terminations shall be in vendor scope. Make shall be as per NLC approved vendor list.

(b) All necessary resources such as labour, tools and accessories required to carry out laying and termination works etc shall be within scope of vendor.

4.13 Cable installation Methodology (Whatever is applicable to this contract shall be used)

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 fItting s
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 galvanising 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 upto and including 33kv performance requirements and type tests.
BS:476	Fire tests on building materials and structures
IEEE:80	IEEE guide for safety in AC substation grounding
IEEE:142	Grounding of Industrial & commercial power Systems
DIN 46267 (Part-II)	Non tension proof compression joints for Aluminium conductors.
DIN 46329	Cable lugs for compression connections, ring type ,for Aluminium conductors
VDE 0278	Tests on cable terminations and straight through Joints
BS:6121	Specification for mechanical Cable glands for elastomers and plastic insulated cables. Indian
	Electricity Act.
	Indian Electricity Rules.

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.

2. Cable accessories

2.1 Cable glands for communication cables

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.

2.2 Cable lugs/ferrules

Cable ferrules for control and signal cables shall be supplied by vendor. The ferrules shall conform to relevant standard.

2.3 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.

2.4 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.

2.5 Galvanising

a) 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.

b) 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

2.6 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.

3. CABLE INSTALLATION

3.1 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.

b) Cable tray mounting structure shall be welded to the plate inserts or to steel structural beams/members. Welding of cable tray mounting structure to steel structural beams/members shall be done with prior approval of BHEL/NLC.

c) Wherever embedded plates or steel structural beams/members are not available for welding the cable tray mounting structure, electrical contractor shall supply the M.S. plate and fix it to floor slab by four anchor fasteners of minimum 16 mm dia. with holding power of at least 5000 kg.

d) Spacing between cable tray mounting structures shall be 2000 mm for horizontal straight run of cable trays unless otherwise noted.

e) Spacing between horizontal support arms of vertical cable tray runs shall be 1000 mm unless otherwise noted.

f) Width of the horizontal arms of the mounting structures shall be same as the tray widths required in the cable layout drawings plus length required for welding to the vertical supports.

g) 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.

h) 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 aluminum paint.

3.2 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
100 mm and above	3.0 M

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.

3.3 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.

3.4 Cable Installation

a) Cable installation shall be carried out as per IS: 1255 and other applicable standards.

b) For Cable unloading , pulling etc following guidelines shall be followed in general :

- 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.

c) Cables shall be laid on cable trays strictly in line with cable schedule

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, Cables shall be laid as voltage grades on as per approved layouts. 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.

e) Bending radii for cables shall be as per manufacturer's recommendations and IS: 1255.

f) Where cables cross roads/rail tracks, the cables shall be laid in hume pipe/HDPE pipe.

~~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.

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) Where there is a considerable risk of steam, hot oil or mechanical damage cable routes shall be protected by barriers or enclosures.

k) 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.

3.5 Separation

At least 300mm clearance shall be provided between:

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

3.6 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.

3.7 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

3.8 **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 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.

3.9 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.

3.10 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.

4. Cable Terminations & Connections

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.

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.

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.

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. 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. f) All cable terminations shall be appropriately tightened to ensure secure and reliable connections.
4.14	UPS system for SCADA and emergency utility loads Vendor shall install and commission UPS systems – one for each PCSS room and one for each PESS room. Thus, there shall be a total of 13 UPS systems. Indicative capacity of UPS shall be 5kVA for PCSS room and 10kVA for PESS room. **SITE TESTS TO CARIED OUT BY VENDOR ON UPS SYSTEMS** The Contractor shall also carry out the site tests on equipments/systems as specified below. However, these shall not be limited to this specification only and in case any other site test is required to be conducted as a standard practice of the Contractor or deemed necessary by the Employer and mutually agreed between the Contractor and the Employer, the same shall also be carried out. **Functional Test** On completion of installation and commissioning of the equipment the following tests/checks shall be carried out with the max. available load, which does not exceed the rated continuous load. These tests/checks shall include but not limited to the tests as indicated below. The details of the tests are as indicated below: **1. Light Load Test** This test is carried out to verify that the UPS is correctly connected and all functions operate properly. The load applied is limited to some percent of rated value. The following points should be checked: (a) Output voltage, frequency and the correct operation of meters; (b) Operation of all control switches and other means to put units into operation. (c) Functioning of protective and warning devices. (d) Operation of remote signaling and remote control devices. **2. Checking of Auxiliary Devices**

The functioning of auxiliary devices, such as lighting, cooling, pumps, fans, annunciation, etc., should be checked, if convenient, in conjunction with the preliminary light load test.

3. Synchronization Test

If possible, frequency variation limits should be tested by use of a variable frequency generator, otherwise, by simulation of control circuit conditions. If applicable the rate of change of frequency during synchronization shall be measured.

4. AC Input Failure Test

The test is performed with a fully charged battery and is carried out by tripping input circuit breakers or may be simulated by switching off all UPS rectifiers and bypass feeder as at the same time. Output voltage variations are to be checked for specified limits with an oscilloscope or equivalent. Frequency variation is defined as the steady state frequency of the UPS with and without AC input. The rate of change of frequency is measured by the time it takes to reach steady-state values.

5. AC Input Return Test

AC input return test is performed by closing AC input circuit breakers, or is simulated by energizing rectifiers and bypass feeders.

Proper operation of rectifier starting and voltage and frequency variations are to be observed.

Note: This test is normally performed with a fully ~~of~~ or partially charged battery.

6. Simulation of Parallel Redundant UPS Fault

This test is applicable for UPS with parallel redundant connections. Faults of rectifier or inverter units may be carried out by simulation. Output transients are to be observed.

7. Transfer Test

This test is applicable for UPS with bypass, particularly in the case of an electronic bypass switch. Transients shall be measured during load transfer to bypass caused by a simulated fault and load retransfer after clearing of the fault.

8. Full load test

Load tests are performed by connecting the actual load to UPS output.

Large UPS in parallel connection may be load tested by testing the individual UPS units separately. Load tests are necessary for testing output voltage and frequency, rated stored energy, recharge time, ventilation, temperature rise and determination of efficiency. Load tests are performed to prove transient voltage deviations specified under step load conditions.

9. Efficiency

Efficiency should be determined by the measurement of the active power at input and output.

10. Actual Load Test

Conditions under actual load may differ from those with a dummy load. Steady-state generation of current and voltage harmonics and transients at load switching conditions should be observed

11. Current Division in Parallel

Load sharing between the Modular DC power supply rectifier banks& UPS units shall be measured with actual load under conditions of parallel operation.

12. Rated Stored Energy Time (Battery Test)

This test is a load test to prove the actual possible time of battery operation.

If rated load is not available in the case of large UPS, it is possible to apply a partial load to check the actual battery discharge characteristics and compare these with characteristics specified by the battery manufacturer. Discharge time with rated load shall then be calculated. The test shall be performed with a fully charged battery and also may be done under other battery conditions to be specified, if so agreed. Active power output of the UPS and the battery voltage shall be recorded during the test.

Since new batteries often do not provide full capacity during a starting up period, the discharge test may be repeated after a reasonable recharge time if the original test has failed.

13. Rated Restored Energy Time

Restored energy depends on the charging capacity of the rectifiers and the battery characteristics. If a certain recharging rate is specified, it shall be provided by repeating the discharge test after the specified charging period.

14. Battery Ripple Current

If battery ripple currents are specified, then the ripple current which depends on UPS operation shall be checked under normal operating conditions. Rough measuring methods are sufficient.

15. On site Ventilation Test

The test is performed with the actual load. Temperature conditions of all Modular DC power supply rectifiers & UPS cubicles are to be observed.

16. Overload Capability Test

Overload capability test is a load test. Specified values of short time overload or starting up sequences of actual load are to be applied for the time interval specified. Specified values of voltage and current are to be recorded.

17. Short Circuit Current Capability

If short-circuit current capability is specified, it may be tested by applicable of a short circuit to UPS output if necessary, via a suitable fuse, Short-circuit current is to be recorded.

18. Short Circuit Fuse Test

Fuse tripping capability of a UPS shall be tested, by short-circuiting the UPS output via a fuse of specified type.

	The test shall be repeated to ensure against fuse non-uniformity and switching time during the cycle. The test is carried out at an appropriate UPS load, under normal operation, if not otherwise specified by Employer. **19. Restart** Automatic or other restart means are to be tested after a completed shut-down as specified. **20. Output Over voltage** Output over voltage protection is to be checked. **21. Periodic output voltage modulation** When this test is specified, it may be checked by voltage recording at different loads and operating conditions. **22. Harmonic Components** Harmonic components of output voltage shall be checked with the actual load. Methods of specification and checking shall be subject to Employer's approval. **23. Earth Fault Test** If the DC Power Supply/ UPS output is isolated from earth, then an earth fault can be applied to any output terminal. DC Power Supply/ UPS output transients (if any) shall be measured. If the battery is isolated from earth, then an earth fault can be applied to any output terminals. DC Power Supply/ UPS output transient (if any) shall be measured. **The arrangement of Load bank for Load tests is in vendor scope**
4.15	Battery & Battery Charger in PCSS and PESS Rooms: Vendor shall install and commission 110V Battery and Battery charger – one for each PCSS room and one for each PESS room. Thus, there shall be a total of 13 Battery and Battery chargers. Indicative capacity of Battery and Battery charger will be as per the below ▪ PCSS room: 20A Battery charger & 55AH Battery (VRLA) ▪ PESS room 25MW:30A Battery Charger & 105AH Battery (VRLA) ▪ PESS room 40MW:50A Battery charger & 165AH Battery (VRLA) **SITE TESTS** The Contractor shall also carry out the site tests on equipment/systems as specified below. However, these shall not be limited to this specification only and in case any other site test is required to be conducted as a standard practice of the Contractor or deemed necessary by

	the Employer and mutually agreed between the Contractor and the Employer, the same shall also be carried **On Battery Charger** 1) Complete physical examination 2) Checking of proper operation of annunciation system 3) Insulation resistance test 4) Automatic voltage regulator operation 5) Load limiter operation 6) Updation of charger status in DC Battery Health Monitoring system **Battery** The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out. 7) Visual examination as per IS-15549/IEC 8) Checking of dimension as per manufacturer's drawing 9) Test for capacity (C10 and C1 capacity) 10) Test for capacity and test for voltage during discharge (C10 and C1 capacity). **The arrangement of Load bank for Load tests is in vendor scope**
4.16	**Pre-commissioning inspections / checks / tests and coordination with state departments for necessary approvals and clearances for commissioning, synchronization with grid and post-commissioning operation of the plant:** 1. Vendor shall carry out following minimum pre-commissioning checks: (1) Verification of firmness of terminations in all electrical equipment: SMBs, PCUs/LT panels, UPS, Battery, Charger, VCB panels, transformers, SCADA stations, weather monitoring equipment. (2) Verification of earthing for all these electrical equipment. (3) Measurement and verification of parameters at string monitoring boxes at solar array field: string current, voltage, combined SMB output current, module temperature, SMB temperature. (4) Measurement and verification of parameters on DC input side of PCUs: DC current and voltage; Vendor shall support the PCU engineer on these tests. (5) Checks on Battery: Checks on Battery: Physical Examination, Dimensions, Mass & layout, Marking ,Polarity and absence of short circuit, Ampere - hour capacity, Retention of charge,

Insulation Resistance, Test for capacities for 10 hrs discharge rate along with the test for voltage during discharge

(6) Insulation resistance measurements (HV megger tests) for all the electrical equipment of control room and switchyard.

(7) Functional checks for LT panels (Air circuit breakers): ACB on/off operations, spring charging, LED indications, etc.

(8) Functional checks for PCUs: Vendor shall support the PCU commissioning engineer during the pre-commissioning tests.

(9) Functional checks for transformer marshalling box:

(a) Availability of AC power supply, (b) Responses of the relays at VCB panels by simulating the alarm / trip of Buchholz, PRV, WTI, OTI, LOLA at marshalling box.

(10) Checks for HT Switchgear: Tightness checks of all clamps, bolts and connecting terminals, Earthing connections, cleanliness of insulator and bushings, space heater checks, HT test of complete board, alignment of busbars with insulator, interchangeability of breakers, continuity and IR value of space heaters, earth continuity for complete switchgear board.

(11) Checks for Circuit Breakers: Alignment of trucks for free movement, correct operation of shutters, Control wiring for correctness of connections, continuity and IR values, Manual operation of breakers completely assembled, Power closing /opening operation manually and electrically, Closing and tripping time. Trip free and anti-pumping operation, IR values, resistance and minimum pick up voltage of coils, Simultaneous closing of all the three phases, Check electrical and mechanical interlocks provided, Checks on spring charging motor, correct operation of limit switches and time of charging

(12) Functional checks for VCB panels:

(a) Availability of AC/DC power supplies, (b) VCB on/off, (c) spring charging, (d) LED indications, (e) functioning of numerical relays, (f) responses at numerical relays of VCB panels to remote operations from SCADA station.

(b) Verification of interlock operations related to incomer and outgoer VCBs.

(13) Verification of parameters at SCADA station: (a) DC/AC parameters from SMBs, PCUs, VCB panels, ACDB panels, Metering panels, (b) status of ACB/VCB breakers and transformer protection relays, (c) weather monitoring parameters.

(14) Functional checks on SCADA software: mimic diagrams, trend graphs, remote accessibility etc.

(15) Earth resistance measurements for solar array, control room panels and switchyard equipment.

2. Pre-commissioning tests on transformers, CTs, PTs, Lightning arrestors, vacuum circuit breakers, relays, etc.:

(1) Usually performed tests are indicated as below. However, exact type of tests required to be conducted at site prior to commissioning shall be in line with concerned state electricity board / CEA / CEIG requirements.

(a) Inverter transformers, Auxiliary transformers: IR tests, voltage ratio, winding resistance in all taps, magnetizing current, magnetic balance, vector group, tan delta (bushing, winding, oil etc.),Measurement of no load losses and current at 90%, 100% & 110% of rated voltage, Load Loss & Short Circuit Impedance measurement on principal & Extreme Taps, Separate Source Voltage Withstand Test, Induced overvoltage test, Repeat no load current/loss & IR after completion of all electrical test,

	Oil leakage test on completely assembled transformer along with radiators, Jacking test followed by D.P. test, IR measurement on wiring of Marshaling Box. (a) Indoor 33kV vacuum circuit breaker panels: IR tests and continuity tests for panels, IR values for CTs/PTs, secondary injection tests on CTs, primary injection tests for CTs, polarity test for CTs/PTs, ratio test for CTs/PTs, Magnetisation characteristics & secondary winding resistance for CTs. Shorting of spare CT cores, contact resistance measurement for VCB breakers, breakers on/off, breakers opening/closing commands, mechanical interlocks, electrical interlocks etc. (a) Relays in VCB panels: relay calibration / primary injection tests, fault simulation tests (Transformer faults, OF/EF, OV/UV etc.) (b) Outdoor CTs/PTs: IR tests, Polarity tests, Ratio tests, Burden tests, Winding resistance tests, Primary injection tests, excitation tests. (c) Lightning arrestors: IR tests, leakage current tests. (d) Cable megger values (2) Appropriate testing agency shall be arranged for the tests. (3) Vendor shall coordinate/liaison with concerned state/central electricity board departments / CEA / CEIG etc., as the case may be, to fix up test schedules and witness by their representatives. (4) Vendor shall prepare and submit the reports to concerned departments and obtain their approval through necessary liaison activities. 3. Vendor shall coordinate and liaison with concerned state / central electricity departments / CEA/ CEIG etc., as the case may be, prepare and submit the applications with necessary enclosures on behalf of BHEL/NLC and obtain their approval: (a) Approval for drawings (b) Approval for synchronization of plant with grid (c) CEA/CEIG inspection of power plant (d) Provisional CEA/CEIG clearance to proceed with commissioning 4. Vendor shall implement corrective steps on the observations of CEIG, follow-up with them and obtain final clearance for licensed operation of the plant on a continuous basis. **Note:** Scope of coordinating with concerned state / central electricity departments, CEA/CEIG to get the clearances / approvals for licensed / statutory operation of the power plant on a continuous basis includes all transactions required for successful liaison and clearances. Application fees and renewal fees (say, in the form of DD) to be enclosed with application / renewal documents shall be in the scope of BHEL / NLC. All other expenses in the above process shall be in the scope of vendor.
4.17	**INSPECTION, TESTING AND ACCEPTANCE**
	1. Inspection procedure shall be as per approved quality plan by BHEL/NLC. 2. Before raising inspection call, manufacturer shall submit all the test reports/ certificates for the equipment. 3. During fabrication, the all the supply major items like switchyard items, Module cleaning system etc shall be subjected to inspection by Owner or by an agency authorized by the Owner. Manufacturer shall furnish all necessary information concerning the supply to Owner's inspectors. Owner/BHEL may make multiple visits during manufacturing and testing for review of progress, quality documents verification, verification of materials in compliance to

	specifications/standards. Owner/BHEL may make final visit for final inspection and verification of shipment documents. The same shall be included in the manufacturing quality assurance plan. Actual visits and inspection shall be as per the approved manufacturing quality assurance plan. 4. All routine and acceptance tests as per IS standards and Standard Manufacturing Quality Plan shall be carried out at manufacturer's works under his care and expense. 5. All equipments supplied by vendor shall be of proven design and shall be type tested as per IS standards. The requisite type test certificates shall be submitted during technical bid submission and type test certificates shall not be older than 5 years from the date of bid submission. In case valid test certificates are not available or are older than 5 years, vendor shall conduct tests free of cost and without any delivery implications. 6. For loose items such as (HDPE conduits, cable ties, trefoil clamps, PVC pipes etc.) test shall be carried out by vendor/sub vendor at their works and test certificate/COC shall be submitted to BHEL before dispatching the material and to obtain dispatch clearance from BHEL.

5.0 General conditions applicable during supply, installation and commissioning phase

5.1	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.
5.2	All necessary tools and tackles such as crimping tool (including heavy duty tools for crimping copper/aluminium cables up to 300 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 for RCC works, spade, shovel, hammer etc shall be organized by the vendor.
5.3	All necessary measuring instruments such as digital multimeters, electrical testers, digital meggers (1kV, 2.5kV, 5kV), lamp load testers for solar array string measurements, earth resistance meters, weighing machines, water level indicators etc shall be organized by the vendor.
5.4	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.
5.5	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.
5.6	Vendor shall maintain updated labour register, with name, age, qualification, salary, attendance details etc at the site.
5.7	Vendor shall use danger boards, wherever required, to ensure safety of the persons during the work at site.
5.8	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.
5.9	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.
5.10	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.
5.11	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.
5.12	No child labour shall be employed for execution of the present contract.
5.13	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.
5.14	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.
5.15	Field Quality Plan / Quality control system 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/NLC. Vendor shall

	deploy a well experienced quality control engineer to monitor all QC activities at site as per approved FQP.
5.16	Any deviations shall be discussed with BHEL / NLC site engineers and implementation shall be taken up only after approval from BHEL / NLC.
5.17	Vendor shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.
5.18	Vendor shall, as and when required by BHEL/NLC, participate in the review meetings conducted by BHEL/NLC at project site, NLC head offices (New Delhi/Noida), BHEL offices (New Delhi / Bangalore).

7.0 Document submission

7.1	**Documents to be submitted along with the offer**: ➢ Signed and stamped No deviations schedule ➢ Signed and stamped Un price schedule format ➢ Type test reports (as applicable)
7.2	**Documents to be submitted after award of Purchase order:** Following documents shall be submitted by vendor after the placement of order. ➢ Field quality plan for the field work ➢ Detailed activity-time chart for project implementation. ➢ Detailed manpower deployment schedule. ➢ Operation and maintenance manuals of various panels and equipments supplied by vendor – such as tool kits, measuring instruments, lightning protection system, 33KV metering yard equipments, and 33kV Over Head transmission line equipments, fire extinguishers, etc. ➢ As built documents

PREAMBLE TO THE SCHEDULE OF QTS.

1) Details of the items in this Schedule shall be read in conjunction with the corresponding NLC specifications, drawings and other documents and shall have precedence over any contrary statement mentioned anywhere in this document.

2) The work shall be carried out as per BHEL approved drawings, specifications, the description of the items in this schedule and/or Engineer's instructions., Drawings enclosed with these documents are only indicative giving some idea of the type of work involved. Final drawings will be issued progressively during the execution of the work.

3) Items of work provided in this schedule but not covered in the specifications shall be executed strictly as per instructions of the Engineer.

4) Unless specifically mentioned otherwise in the contract, the bidder shall quote his rates for the finished items and shall provide for the complete cost towards fuel, tools, tackle, equipment, constructional plant , temporary works, labour materials, levies , taxes , transport, layout, repairs, rectification, maintenance till handing over, supervision, shops, establishments, services , , revenue expenses, contingencies, overheads, profits and all incidental items not specifically mentioned but reasonably implied and necessary to complete the works according to the contract.

5) Rates shall be quoted both in figures and in words in clear legible writing. No over writing is allowed. All scoring and cancellation should be counter signed by the bidder. In case of illegibility, the interpretation of the engineer shall be final. All entries shall be in English language.

6) Engineers decision shall be final and binding on the contractors regarding clarification of items in this schedule with respect to the other section of the contract.

7) In case of any discrepancy between item descriptions, relevant drawing and/ or specification clarification shall be sought at tender stage itself. Otherwise it shall be assumed that the bidder has quoted for the more stringent requirement.

HIERARCHY

In case of any conflict/deviations amongst various documents, the order of precedence shall be as follows

- Statutory Regulations
- NLC specification
- Items in Schedule of quantities

- IS/BS/IEC standards
- BHEL's standard specification (with prior approval of Engineer-in-charge).

NOTE: The above technical specification is not exhaustive. In case for any item of work, technical specification is not available, such items of works will be carried out in conformance to technical specification of manufacturer's recommendations/best engineering practice. In case of any dispute between two specifications or non-availability of specifications, customer's specification will prevail. Decision on applicability of any particular specifications will rest with BHEL engineer and his decision in the matter will be final & binding on the contractor. Contractor has to make himself well conversant with the Customer specification.

1. **Annexure-I:** LIST OF DRAWINGS

S.No	Title
1.	Typical PCSS room equipment layout
2.	PCSS earthing layout
3.	PEB Drawing

2. **Annexure-II:** LIST OF FDA ITEMS BEING SUPPLIED BY BHEL
