

- Shall supports the new compression methods; MPEG4, ASP, MxPEG and H.264, besides MJPEG and MPEG4
- Dual streaming: Two independent configurable video streams, one for live viewing, and one for recording.
- Built-in Video Motion Detection: Independent of camera model and supporting up to min. 64 cameras simultaneously per server
- Independent Playback: Instant and independent playback function to independently playback recorded video for one or more cameras, while in live viewing or playback mode
- Smart Search: Shall quickly gather and refine evidence by searching for changes or objects in the video
- Fast evidence export: Seamlessly export video in various formats, including video from multiple cameras with viewer, logs and user notes included
- Mobile : Should support IOS & Android devices and also have video push service from mobile devices for immediate live viewing & recording for incident management
- Remote operations
- Live view and playback : From PDA and full client, or local clients supporting up to 64 cameras from multiple servers at the same time
- Advanced views layout : Work with private and shared server-stored camera views containing up to 8x8 layouts, Hotspot, Matrix and Carousel elements, static and active HTML maps, all distributed across multiple computer monitors and windows
- Multi-channel audio : Listen-in and recording with instant playback.
- Search, export and secure data

- Evidence export : JPEG, AVI, WAV and native database formats with stand-alone recording viewer, data encryption and logs, user notes and report printing
- Post-recording processing : Smart Search, Digital PTZ with optional image smoothing, or IPIX post-recording PTZ

**h) Management & Recording Server for Video Management and Recording**

01. Processor	:	Inbuilt processor of minimum 2.8GHz Octa Core Intel Xeon or higher
02. Memory	:	8 GB or better
03. Hard Disc drive storage	:	Min. 1 TB SATA
04. Operating system	:	Latest Windows version.
05. Network	:	Interface Card
06. Windows	:	Operating system as available at the time of supply but not later than Windows 2012 server edition or latest. All software shall be licensed version and license fee certificate shall be produced before product approval.
07. Gigabit Ethernet	:	NIC (10/100/1000 Base T), The video management server shall have two number of Gigabit Ethernet Card to ensure continuous streaming of video
08. Ports	:	Min. 4 USB, 1 Serial, 1 Parallel, 1 VGA

09. Graphics card	:	Latest with minimum of 4GB
10. Accessories	:	Keyboard, optical mouse, DVD RW
11. Monitor	:	24" LED colour monitor, as applicable with viewing angle minimum 160 degree

The following features shall also be present in Server:

- i. The video management server shall be preloaded with 64 recording licenses.
- ii. The video management server shall be server grade device(COTS) & not a proprietary network recorder..
- iii. The video management server shall be capable of handling a minimum 2 Gb/s aggregate throughput at any given point of time.
- iv. The video management shall have the capability to stream a minimum 64 channels at 1080p, 25fps resolution, a minimum of 4096 Kbps throughput per major stream for streaming and display purpose on 24x7 basis.
- v. The video management server & the client viewing station shall be separate.
- vi. The video management server shall be preloaded with the following modules
  - The streaming management module
  - The data base management module
  - The recording management module
  - The failover management module
  - The admin management module
- vii. The video management server shall be compatible with external storage drives like DAS, NAS, SAN.

**i) Power Supply Unit**

a) The system will be powered from a suitable Central UPS system under the scope of the Bidder. The power distribution board, MCB, power supply cable and other sundry items required for powering the equipment shall be provided by the Bidder.

Extending the UPS power supply from the distribution boards up to the equipment and providing all cables, distribution boards, MCB etc shall be under the scope of the Bidder.

b) The distribution board, 3 core, 2.5 sqmm power supply cable and protection device such as MCB etc. shall be provided by the Bidder.

Extending the power supply upto the point of installation of equipment, providing power supply cable, MCB etc. shall fall under the scope of works of the Bidder.

- j)** The Bidder shall provide the earthing of the system as per their industry standard. The CCTV earth shall be connected to the electronic earthing system by the Bidder under their scope.

**(D) CONTROL DESK & FURNITURE**

- i) Bidder shall provide control desk & chairs for engineering and operator's workstations, printer and associated equipment of ergonomic design from reputed manufacturer especially designed for computer peripherals. Also control desks & chairs shall be provided for CCTV server and associated equipment.
- ii) All the above furniture shall have permanent Modular type power receptacles of ISI standard having five Plug points (15Amps rated) with individual isolation switches. Permanent I/O receptacles shall be provided.
- iii) All devices mounted on the control desks shall be flush type. Devices shall be so mounted that the removal and replacement can be accomplished individually without interruption of services to others.
- iv) Aesthetic, ergonomics and room illumination shall be considered while positioning of the desk and panels in control room.

- v) Control desk shall be free standing floor mounting type table top design for placing computer monitor and other hardwares. Desk shall be of latest technology aesthetic design and constructed from aluminium with high density fiber. All workstations, printer etc. shall be mounted on the desk.
- vi) Crating of the desks shall be suitable for protection against shock, vibration, inappropriate handling and inclement weather conditions during transportation and warehousing and all panel mounted equipment shall have adequate protection against damage during handling, transit and storage. Suitable desiccant shall be used inside the packing case.
- vii) Workstations and other application terminals mounted on the control desk shall be powered from UPS feeders and each feeder shall be provided with MCB at the upstream of the permanent Power receptacles.
- viii) Technical Specification of Unit Control Desk
  - a) The frame / structure should be minimum 2mm thick Powder Coated Extruded Aluminum profile.
  - b) The Table Top / Work Surface shall be 36mm thick, Medium Density Fiber (MDF) board with high pressure laminate or Acrylic Plastic Solid Surface (APSS). Top surface shall be finished with anti-scratch material.
  - c) Foot extension shall be of Cast Aluminum & painted.
  - d) Foot Leveler shall be injection molded glass filled nylon foot with steel insert.
  - e) END Caps & Extruded PVC Caps shall be provided where required.
  - f) Front edge shall be extruded PVC or rounded post-formed laminate
  - g) Concealed cable tray shall be powder coated steel.
  - h) Design shall include Earthing bolts on left side end and right side end of the Workstation Desk / Rack.
  - i) Retractable keyboard tray in the control desk shall be provided.
  - j) Retractable tray with telescopic slide for CPU/PC block shall be provided.
  - k) Front and Rear door shall be considered.

**(E) CABINETS / ENCLOSURE / PANELS**

01. Material of construction : Cold rolled steel sheet

- |     |                            |   |  |
|-----|----------------------------|---|--|
| 02. | Thickness of Sheet         | : | <p>a) 3.0 mm for faces supporting instruments / terminals. Mounting plate shall also be 3.0 mm.</p> <p>b) 2.0 mm for other sides inclusive of top.</p> |
| 03. | Construction               | : | Welded throughout as per (metallic parts) approved National Standards.   |
| 04. | Panel height               | : | 2300 mm maximum  |
| 05. | i) Corners                 | : | 7 mm inner radius  |
|     | ii) Dimensional Tolerances | : | <p>a) In height &amp; length - 3 mm</p> <p>b) In height between adjacent sections - 2 mm.</p> <p>c) Total for a group - 6 mm</p>                       |
| 06. | Doors                      | : | Double, recessed, turned back edges. Doors shall have 4 point IP Lock  |
|     | i) Thickness of Sheet      | : | 2 mm   |
|     | ii) Hinges                 | : | Stainless steel  |
|     | iii) Door latches          | : | Three point type   |
|     | iv) Door gaskets           | : | Neoprene rubber on fixed frame to result dust proof/weatherproof enclosure.  |
|     | v) Opening of the doors    | : | Outward. Door swing shall be Min. 110-120 Degree   |
|     | vi) Louvers                | : | With removable wire mesh to ensure dust and vermin proof.  |

07. Color of interior : Brilliant white (Approval shall be accorded by owner during detail engineering)
08. Colour external : RAL 7032  
(Approval shall be accorded by Owner during engineering)
09. Painting : Epoxy powder coated or better.  
Minimum Paint thickness shall be 80-100 microns
10. Gland plates : Removable 4 mm thick (bottom)
11. Cable entry : Bottom
12. Hardware : a) Anti vibration pad- 15 mm  
b) Predrilled base channel ISMC – 100 or equivalent for all sides.  
c) Lifting hook / Eye bolt  
d) Drawing pocket  
e) Door switch, lamps, thermostat, heaters and fans
13. Enclosure Protection :  
a) Panels, cabinets, desks, distribution boxes, racks, junction boxes, terminal boxes, instruments and all other field mounted equipment / enclosures shall suit the environmental condition of the area and shall not be inferior than the requirement indicated in the following table.

Sl.no.	Location	Enclosure type
1.	Indoor type non- ventilated enclosure in non-hazardous area	IP-54
2.	Indoor type ventilated enclosure in non-hazardous area	IP -42

- |    |                                     |   |
|----|-------------------------------------|---|
| 3. | Enclosure in Air conditioned area   | IP-32 with suitable canopy at top to prevent ingress of dripping water. |
| 4. | Outdoor type in non-hazardous Areas | IP-65 with anticorrosion coating.                                       |
| 5. | Outdoor in hazardous areas          | As per requirements of the NEC Code for the location                    |

b) The construction of electrical enclosures located in areas subject to conditions classified in the National Electrical Code (NEC) as hazardous shall be of a type designated suitable for the environment in which they are located.

**(F) UNINTERRUPTED POWER SUPPLY (UPS)**

UPS system to be provided to meet the power requirement of bidder supplied SCADA system, HMI peripherals as well as CCTV system etc.

UPS alarms shall be monitored remotely from working stations in control room.

UPS system shall have with 2x100% configuration, normally both will run in parallel mode sharing 50% load. On failure of any UPS, its load shall automatically get transferred to the other healthy UPS.

The UPS system shall meet the following minimum specifications.

1.	<b>Type</b>	:	IGBT based high frequency PWM technology of latest proven design.
2.	<b>Configuration</b>	:	2 X 100% parallel redundant chargers and inverters, (2 X 100%) battery bank, bypass line transformers & voltage stabilizers, static switch, manual bypass switch and power distribution board.
3.	<b>Charger</b>	:	Solid state silicon controlled full wave rectifier designed for single and parallel operation with battery and shall have automatic voltage regulator, current limiter and filter circuits.



			Charger shall have provision for float, equalizing and boost charging.
4.	<b>Charger output Regulation</b>	:	$\pm 1\%$ from no load to full load with input power supply variation of 10 % to -15% in voltage and $\pm 5\%$ in frequency with output ripple content less than 2%.
5.	<b>Battery</b>	:	Ni-Cd vented type, pocket plate high discharge battery of adequate capacity to meet the requirement of UPS, generally conforming to IS-10918. Sizing calculation shall be furnished
6.	<b>Backup time</b>	:	1 hour in case of input power fail.
7.	<b>Inverter capacity</b>	:	To be decided by bidder. 25% extra capacity margin to be considered.
8.	<b>Overload capacity</b>	:	a) 125% for 10 minutes b) 150% for 60 seconds
9.	<b>Sizing</b>	:	a) Environmental temperature 0 to 50 degC. b) Power factor of load - 0.8 c) Adequate I <sup>2</sup> t capability to clear fault in the maximum rated branch circuit. d) UPS shall be capable to operate without DC battery in circuit and under all conditions of load. e) In case of failure of a charger / input power, other charger whose input supply is healthy shall be capable to charge the battery and as well supply input power to inverter. No discharge of battery is allowed. f) Inrush current
10.	<b>Inverter Output Regulation</b>	:	a) Voltage- 240V $\pm 1\%$ b) Frequency- $\pm 0.5\%$ c) Power factor of load - 0.8 d) Transient voltage regulation (on application /removal of 100%load) – better than $\pm 20\%$ . e) Recovery time from transient to normal – 50 msec.
11.	<b>Harmonic</b>	:	a) Sine wave output b) Total harmonic content- 5% (maximum) c) Content of single harmonic- 3% (maximum)
12.	<b>Efficiency</b>	:	a) 100% Full load- 85% b) 50% load-80%
13.	<b>Synchronization limit</b>	:	Between inverter & standby AC source shall be within 47 Hz to 53 Hz field adjustable. Inverter shall remain synchronized with the AC mains.

14.	<b>Inverter protection</b>	:	Overload, short circuit and 100% loss of load.
15.	<b>Load sharing</b>	:	50% by each inverter in normal parallel operation. In case of failure of either inverter, 100% load shall automatically transfer to other inverter without any degradation of the UPS power quality.  Power shall be transferred to the standby AC power without a break in synchronization if within limit in case of failure of both inverters.  Asynchronous transfer to standby AC source in case inverters are being out of synchronism limit with AC mains.
16.	<b>Static switch</b>	:	Transfer UPS load to standby AC power in case of failure of both inverters.  Transfer UPS load to standby AC power in case of failure of a inverter.
17.	<b>Voltage stabilizer &amp; Transformer</b>	:	Solid state with regulation $\pm 1\%$ with efficiency greater than 95%.  Overload capacity of transformer / stabilizer shall not be less than 300% of steady state for 200 msec.
18.	<b>Diagnostic alarms</b>	:	On panel & potential free contacts for interface to PLC
19.	<b>Spare feeders</b>	:	25%
20.	<b>Accessories</b>	:	Power distribution board, Voltage & current meters, power factor meter, KVA, frequency, panel alarms, switches etc.

**(G) INSTRUMENTATION CABLE**

Multi-paired Instrumentation cables

- |                          |   |   |
|--------------------------|---|---|
| 01. Conductor type       | : | Multi-stranded annealed tinned high conductivity copper   |
| 02. Conductor size       | : | 0.5 / 1.0 / 1.5 Sq.mm (as required)   |
| 03. Conductor resistance | : | 39 $\Omega$ /Km/ 18 $\Omega$ /Km/ 12 $\Omega$ /Km   |
| 04. Conductor Insulation | : | Extruded PVC meeting the requirements of VDE 0207 Part 4 compound Y I3.<br><br>Insulation thickness for individual core shall be between 0.28 and 0.35 mm for 0.5 mm <sup>2</sup> |

- |                             |   |  |
|-----------------------------|---|--|
|                             |   | cables, 0.5 to 0.6 mm for 1.0 mm <sup>2</sup> cables and 0.8 to 0.9 for 1.5 mm <sup>2</sup> cable.   |
| 05. Voltage Grade           | : | 225 V (peak value)   |
| 06. Twisting                | : | Twin twisted with lay of 50 mm (max)   |
| 07. Twisting Direction      | : | All pairs in the same direction. Lapped to form bunch with mylar tape.   |
| 08. Screen (Pair & Overall) | : | Aluminium mylar tape with a thickness of 28 µm (min.) for individual pair screen and 60 µm (min.) for overall screen with 100% coverage and 25% overlapped edges. Over the individual pair screening tape two laps of 0.05 mm thick (min.) polyester tape shall be applied with minimum overlap of 25%. Metallic side of the screen shall be in contact with drain wire.<br>Analog signals - Individual pair & overall shield.<br>Binary signals - overall shield. |
| 09. Drain wire              | : | Annealed tinned copper wire, stranded. Size 0.5 Sq. mm. (No. of strands / size:- 7 / 0.3mm). Separate drain wire for individual pair shield (wherever applicable) as well as overall shield.   |
| 10. Inner Sheath            | : | Extruded PVC (compound YM1) as per VDE 0207 Part 5 (anti rodent, anti termite & moisture resistant properties) and shall be of flame retardant low smoke (FRLS) type   |
| 11. Fillers                 | : | Non metallic flame & moisture retardant  |
| 12. Armouring               | : | GI wire / strip  |
| 13. Outer Sheath            | : | Extruded PVC (compound YM1) as per VDE 0207 Part 5 and shall be of flame retardant low smoke (FRLS) type   |
| 14. Temperature Range       | : | 70OC (continuous) except for high temperature resistant Teflon insulated cables which shall be suitable for continuous operation at 205OC  |
| 15. Sheath colour           | : | Inner- Black and Outer- Sky Blue   |
| 16. Tests on outer sheath   | : | a) Oxygen Index: Min.29% at room temp. (ASTMD-2863)  |

- b) Acid Gas Gen.: Max.20% by weight as per IEC 754 Part-I
- c) Temp Index : Min 2500 C (ASTMD-2863)
- d) Smoke Density Rating :Max.60% (ASTMD-2843).
- e) Complete cable assembly shall pass Swedish Chimney Test- as per SEN-4241475 AND Flammability Test as per IEEE-383.
17. High voltage test :
- a) Core to core - 1.5 KV for 1 min.
- b) Core to screen - 1.0 KV for 1 min.
- c) Screen to Armour - 1.0 KV for 1 min.
18. Rodent & Termite repulsion test: Presence of lead shall be confirmed
19. Colour of core insulation for Instrumentation Cable

Pair	Core	Color
1st	1st	Blue
1st	2nd	Red
2nd	1st	Gray
2nd	2nd	Yellow
3rd	1st	Green
3rd	2nd	Brown
4th	1st	White
4th	2nd	Black

Above 4 Pairs, 4 Pairs making a unit shall have indelible printed colour coded bands like Pink for 1st unit, Orange for 2nd unit and Violet for 3rd unit and so on. In addition band marking, for example single band for 1st unit, double band for 2nd unit and so on, shall be provided on each conductor for identification of unit. Band marking on individual core shall be provided at regular intervals not exceeding 50 mm.

**(H) OPTICAL FIBER CABLE**

- i) This specification defines the minimum general requirements for the Design, manufacture, supply, inspection, installation, testing & commissioning of optical fiber cables and accessories, such as fiber distribution (patch) panels, adapters,

connectors, joint boxes, pigtails and other components, as required to complete the system. Bidder shall consider all related activities, such as cable stripping, cable entry in boxes and panels, cable fiber splicing/fusion, cable performance testing and other services, to achieve a properly documented and operational cable network. all Fibre Optic cables shall be Single Mode type.

- ii) Fiber Optic Cables shall be installed on cable tray, duct bank, cable trench installation as necessary. For outdoor applications the cable shall be armoured with Poly Ethylene sheathing. In all cases cable shall be routed through suitable grade HDPE permanently lubricated protection pipe as per IS 4984, IS 12235 & TEC.G/CDS-08 /01 of suitable size @ 53% fill factor. Permanent route marking in FRP (Fibre Reinforced Plastic) material shall be provided at intervals not exceeding 5 meters for all FO cables laid outdoor buried under the ground.
- iii) The Optical Fiber core shall be of ultra pure fused silica glass coated with UVcured acrylate suitable to withstand temperature of about 80°C (continuous).
- iv) Fiber optic cable shall be of loose tube design. Typically, fibers shall be housed in-groups of 6 (minimum) within gel-filled buffer tubes to protect against ingress of moisture and vibration. The tubes shall be manufactured with industry standard material like Poly-Butylenes Terathylate (PBT). They shall be colored for easy identification. Buffer tubes shall be approachable with industry standard tools and practices. The buffer tubes shall be stranded around the Central Strength Member utilizing Reverse Oscillating Lay (ROL). Blank fillers shall be used as necessary to maintain circular cable structure. The fiber optic cable shall withstand water penetration when tested with a one meter static head or equivalent continuous pressure applied at one end of a one meter length of filled cable for one hour. No water shall leak through the open cable end.
- v) The central strength member of the cable shall be Fiberglass Reinforced Plastic (FRP) or other material with equivalent mechanical strength to provide both tensile and anti buckling strength to the cable.
- vi) In addition to central strength member, additional strengthening substance like aramid yarns shall be helically applied over the cable core to provide additional tensile strength to the cable.
- vii) The cable shall be of dual jacket & armoured. Inner sheath consists of a medium density polyethylene (MDPE) jacket extruded over the cable core.

- viii) Two highly visible ripcords are placed under the jacket to aid in sheath removal. A co-polymer coated steel tape is corrugated and wrapped around the inner jacket to provide additional cable compression strength and rodent protection. The armor is covered with an outer black FRLS MDPE jacket. A ripcord is also placed underneath the armor for easy outer jacket removal.
- ix) Minimum bending radius shall be equal or more to 15 D (D= Diameter). A continuous strength member shall be provided for the entire length of the cables. Every tube and fiber shall be colour coded to provide easy identification. The outer sheath shall be marked to show fiber type and cable classification at suitable intervals.
- x) The entire length of each cable shall be marked with the following items:
  - Manufacturer's Name
  - Month and year of manufacturing
  - Coded description of the cable based on Telcordia's (Bellcore) SR-2014 Suggested Optical Cable Code (SOCC).
  - Sheath Identification Number
  - Sequential Length Marking in meter
  - A Telephone Handset symbol to distinguish communication from power cable as per NESC section –35 G.
- xi) Fiber optic cable shall provide a long life expectancy of minimum 25 years and shall meet the industrial standard of operation at temperature of 55 deg C and humidity to 100% without degradation to optical or mechanical performance.
- xii) Optical fiber used in the plant shall generally conform to the following specification.

**i. Specification for G.652 monomode fiber**

ATTRIBUTES	VALUE
1. Cladding Diameter	: 125µm ± 1.0µm
2. Cladding non-circularity	: ≤ 1.0%
3. Attenuation Coefficient at	

- |   |                  |
|---|------------------|
| (a) 1290 nm to 1340 nm                  | : < 0.36 dB/km   |
| (b) 1525 nm to 1575 nm                  | : < 0.25 dB/km   |
|   |                  |
| 4. Chromatic Dispersion Coefficient at  |                  |
| (a) 310 nm                              | : < 3.5 ps/nm.km |
| (b) 1550 nm                             | : < 18 ps/nm     |
|   |                  |
| 5. Polarization Mode Dispersion (PMD)   | : ≤ 0.5 ps/√km   |
|   |                  |
| 6. Mode Field Diameter at               |                  |
| (a) 1310 nm                             | : 9.2 ± 0.4 μm   |
| (b) 1550 nm                             | : 10.50 ± 1.0 μm |
|   |                  |
| 7. Mode Field Concentricity Error       | : ≤ 0.5 μm       |
|   |                  |
| 8. Proof Test                           | : ≥ 1%           |
|   |                  |
| 9. Fiber Curl (ROC)                     | : ≥ 4.0 m        |
|   |                  |
| 10. Macro-bend Test on Fiber at 1550 nm | : ≤ 0.1 dB       |

**ii. Cable assembly**

**Optical Fiber Environmental Splice Enclosure**

Optical fiber environmental splice joint enclosures shall be re-enterable and rack / wall mountable. The interior splice case shall be equipped to mechanically accommodate single-mode optical fibers connected by the fusion method. Splice case shall be equipped to organize the splice trays and the required service loops of buffered incoming optical fibers and outgoing 'pigtailed' in such a way that allows each completed splice and associated optical fiber to be maintained in an unstrained configuration. Splice enclosure shall be dust and weather proof.

**iii. Fiber Optic Distribution Patch Panel**

Fiber optic distribution panels shall be provided as required. The fiber optic distribution panels shall be of a standard wall mounted sheet metal enclosure type. Fiber optic distribution panels shall be equipped to secure optical fiber patch cables and pigtails to prevent damage during all

operation and maintenance functions. In general splice enclosure are envisaged. However,

If no optical fiber splice enclosures are implemented, then the fiber optic distribution panels shall be equipped with splice trays for storage and protection of fusion splice connections of single-mode fiber optic cable and pigtails. Each fiber optic distribution panel shall be fully equipped with 'SC' type bulk head connector sleeves or equivalent. Unused sleeve ports shall be equipped with reusable caps to prevent the intrusion of dust.

**iv. Pigtail and Patch Cord**

All pigtails shall be factory SC-connectorized, and satisfy specified performance for optical links. All unused pigtails (including spares) shall be terminated with the connector to a bulkhead connector sleeve, protected by a reusable cap on the opposite sleeve port, to prevent the intrusion of foreign material or dust. All necessary connectorized pigtails shall be provided in the lengths required.

**v. Tests**

Following minimum test as per any approved standards shall be carried out on the cables

- a. Attenuation and Dispersion Characteristics Tests
  - b. Proof Tests
  - c. Macro-Bend Resistance Test
  - d. Mechanical Tests
  - e. Low And High Temperature Cable Bend Test
  - f. Impact Resistance Test
  - g. Compressive Strength Test
  - h. Tensile Strength Test
  - i. Cable Twist Test
  - j. Cable Cyclic Flexing Test
  - k. Environmental Characteristics Test
  - l. Temperature Cycling Test
  - m. Color Permanence Test Cable Aging Test
  - n. Water Penetration Test
  - o. Lightning Test
  - p. Routine Test / Sample Test
- Site Test (Like Continuity & Attenuation)



#### **5.13.14.4 APPROVAL**

The Detailed Design Report submitted by the contractor to WBPDCCL must contain but not limited to the following details of the data acquisition and monitoring system:

- Detailed scheme
- Details of panels, metering system
- Necessary drawings for the scheme etc.

Drawings and scheme submitted by the contractor will be subjected to approval of the owner.

#### **5.13.15 CABLES & CONDUCTOR:**

##### **5.13.15.1 SCOPE**

The scope of work under these specification covers the Design, Manufacture, Assembly, Shop Testing, Delivery at site, transit insurance, Storage, Erection, Testing & Commissioning of power, control and instrumentation cables (complete with cable terminals and all accessories for making the systems complete and for warranting a trouble free and safe operation).

The scope shall also include supply of all material, fabrication and erection of cable supporting structure, cable trance, cable racks & trays as well as laying of cables on cable racks.

The scope of supply shall also include necessary spares required for a period of 5 (five) years & special tools & plants required for erection & maintenance.

##### **5.13.15.2 STANDARDS**

The equipment covered under this chapter shall comply with the requirement of latest edition of following IS/BS/IEC specifications as amended up to date except where specified otherwise.

<b>Sl. No.</b>	<b>Standards</b>	<b>Description</b>
<b>1.</b>	IEC 60529/IEC 60502	All cables that are submerged or in contact with water should be with IP 68 rating.
<b>2.</b>	IS: 7098 – Part 1	Cross linked polyethylene insulated PVC sheathed cables for working voltage up to and including 1.1kV
<b>3.</b>	IS: 7098 – Part 2	Cross linked polyethylene insulated PVC sheathed cables for working voltage from 3.3kV up to and including 33kV
<b>4.</b>	IS 10418	Drums for cables

Sl. No.	Standards	Description
5.	IS 8130	Conductors for insulated electric cables and flexible cords
6.	IS 8308	Compression type tubular inline connectors for aluminium conductors
7.	IS 8309	Compression type tubular terminals for aluminium conductors
8.	IS 8438	Moulds of cast resin based straight joints of cable up to including 1.1kV
9.	IS 11967	Specifications for co-axial cables
10.	IS : 2062	Structural Steel (Standard Quality)
11.	IS : 513	Cold rolled low carbon steel sheets & strips
12.	IS : 277	Galvanized sheet steel
13.	IS : 808	Rolled Steel Beam, Channels and Angle section
14.	IS : 2629	Recommended practice for hot dip galvanizing of iron and steel.
15.	IS : 2633	Method of testing uniformity of coating on zinc coated articles.
16.	IS : 800	Specification for use of structural steel in general building construction.

Cables and other accessories complying with other internationally accepted standards such as IEC, IEEE, BS, etc. will also be accepted if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case the Contractor shall clearly indicate the standard/standards adopted and furnish a copy of English version of the latest revision of the standard(s) along with the Bid and the salient features of comparison shall be brought out.

#### **5.13.15.3 GENERAL REQUIREMENTS**

**Minimum requirements are mentioned hereunder.**

- The cables shall be of type and design with proven record of similar power station installations.
- The colours of the cables (both AC & DC) should be so selected that there should not be any problem for identification of cables used for various circuits during inspection & testing.
- To facilitate easy identification of cores, multi-core control and instrumentation cables shall be colour coded by using PVC insulation of red, black, yellow, blue and grey colours in accordance with IS 1554 (Part I).

- Cable lengths shall be considered in such a way that straight through cable joint is avoided. However no cable joint is allowed in DC cable from module to SMB and from SMB to PCU / Inverters.
- Cable terminations shall be made with suitable cable lugs & sockets etc, crimped properly and passed through brass compression type cable glands at the entry & exit point of the cubicles.
- Cables shall be shipped in non-returnable drums, adequately braced, and with cable ends adequately sealed to prevent ingress of moisture.
- The contractor shall ensure that no bimetallic action takes place between the Aluminium conductor of the cable and the cable connecting lugs by filling the lugs with suitable compound.
- For the main cable ways, a system of cable racks and trays as well as cable ducts and trenches shall be provided. The power and the control cables will run on separate trays. The cables for emergency lighting, fire alarm systems, etc., shall run on separate trays. The power cables shall be laid on the uppermost rack to prevent spread of fire.
- In indoor installations, the cables must be laid through PVC conduit or GI pipe. In case of using metallic pipe as conduit proper grounding of the conduit must be done.
- Different voltage grade cables will be laid in separate trays when trays are run in tier formation. Power cables will normally be on top trays and control/instrumentation cable on bottom trays.
- Exposed cables, wherever, used, shall preferable have UV resistant jacket besides being water resistant.
- Cables for each equipment must be tagged with permanent metal tag of impregnated cable number as per drawings at MCC/switchgear end and equipment terminal end as well as in the mid portion of the cables at certain distances as instructed by the owner or his authorized representative.
- The loop length shall be provided for various cables as per the relevant Indian Standard.
- All types of control as well as instrumentation cables shall have at least 10% spare cores.
- Cables shall be properly clamped at regular intervals with the help of non magnetic/molded fiber glass strip clamps/PVC sleeved clamps, of suitable size.

- When power cables are laid in the proximity of communication cables, the minimum horizontal and vertical separation between them may be 300 mm.
- Proper sealing arrangements at the points of cables entering the enclosures should be incorporated. Although not mandatory, manufacturers are however encouraged that the cables entering into the enclosures be sealed with modular EPDM based cable sealing and protection system based on multi-diameter technology.
- Cable selection criteria: In cable sizing the following are to be taken into consideration.
  - Short circuit current and duration
  - Continuous current.
  - Installation conditions.
  - Voltage drop under normal running and starting condition.
- Cable identification: Cable identification shall be provided by embossing on every meter

#### **5.13.15.4 TECHNICAL REQUIREMENTS FOR CABLES AND CONDUCTOR**

**Minimum Technical requirements are mentioned below:**

- All cables and connectors for use for installation of solar field must be of solar grade which can withstand harsh environment conditions including High temperatures, UV radiation, rain, water, humidity, dirt, burial and attack by moss and microbes for 25 years and voltages as per latest IEC standards.
- The cables used in module/ array wiring shall be TUV 2Pfg 1169/08.2007 or VDE EPV 01:2008-02 or UL4703/ EN 50618certified.
- Temp. Range 0°C to +90°C. Cable must be able to withstand this ambient temp range while carrying max current. Maximum and minimum withstand temperature of cable must be mentioned in engineering drawing for approval of purchaser with documentary proof.
- Fulfils IEC 60332-1 requirements. Accredited lab test report/Manufacturer's test report shall be attached.
- Conductor class IEC 60228 class 5. Accredited lab test report/Manufacturer's test report shall be attached. Only Copper conductor is to be used.
- All cables shall be Fire Retardant Low Smoke (FRLS) type. The cables shall be sized based on the following considerations:
  - Rated current of the equipment

- The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during running condition, shall be limited to 3% of the rated Voltage
- Overload protection is to be provided. Design Overload capacity for 10 sec of 125% of continuous rating. The principle aim in this protection is to reduce the over voltage to a tolerable value before it reaches the PV or other subsystem components. The source of over voltage can be lightning or any other atmospheric disturbance.
- Short circuit withstand capability De-rating factor for various conditions of installations shall be considered while selecting the cable size
- Variation in ambient temperature for cables laid in air
- Grouping of cable
- Variation in ground temperature and soil resistivity for buried cables
- HT cable shall be designed based on the short circuit conditions and LT cable shall be sized based on the voltage drop.
- For breaker protected circuits minimum size will be determined by short circuit rating.
- Size of aluminium power cable shall in no case be less than 16 mm<sup>2</sup> and copper power cable shall not be less than 4 mm<sup>2</sup>. Where there is requirement of cables less than the above mentioned values, copper cable of appropriate size but not less than 4 mm<sup>2</sup> may be used.
- Minimum size of the control cable for CT circuit shall be 2.5 mm<sup>2</sup> and that for potential circuit shall be 2.5 mm<sup>2</sup>.
- The cables shall be capable of satisfactory operation under a power supply system voltage variation of  $\pm 10\%$  and frequency variation of  $\pm 5\%$  and a combined frequency voltage variation of 10% (absolute sum). The cables shall have heat and moisture resistant properties.
- DC and LT Power cable Voltage drop criteria: From Module to Inverter end before connection individual voltage drop shall be limited to maximum 1.5 % of rated voltage. From Inverter to AC Grid interfacing panel i.e. Indoor HT Switchgear should be less than 2.5%.
- For all other LT cable, maximum voltage drop shall be limited to 2.5 % at rated voltage.
- All XLPE cables shall be rated at 90 deg C conductor temperature for AC voltage drop calculation and 80 deg C for DC Voltage calculation.
- The short circuit withstand temperature shall be 250°C and 160°C for XLPE and PVC cables respectively.

- All cables shall be suitably derated as per the laying condition for carrying the required load current and fault current. For derating the ambient temperature for directly buried cables or laid in air shall be taken as 50 deg C.
- All Power cables shall be XLPE, FRLSH.
- The Jointing Boxes shall comply in all aspects with the provision of the latest issue of relevant standards.
- The control cables shall be multi-core, colour coded, annealed, stranded high conductivity copper, single conductor, insulated with HR-PVC insulation, PVC sheathed, unarmored FRLS type conforming to IS 1554 (part I & II)/relevant IEC. The outer sheath is of specially formulated PVC compound.
- The instrumentation cables in addition to meeting the requirements of control cables shall be provided with electrostatic shielding by aluminium tape and screening by annealed tinned copper wire.
- Multipair, individual pair & overall screened, twisted pair instrumentation cable shall be provided for analog signals with stranded copper conductor.
- Multipair, overall screened & twisted pair instrumentation cable shall be provided for binary signals with stranded copper conductor.
- For connecting solar modules with solar inverter via array junction box, three winding transformer output with 33 kV Indoor Switchgear (33 kV) and 33 kV Indoor Switchgear (33 kV) with the 33 kV Switchyard (33 kV), cables of suitable size shall be provided.
- Cabling from Control Room to adjacent 33 kV Switchyard to be made through Cable Trench of suitable size as per relevant standard.
- Cable to be routed in standard manner through cable trays & cable marker to be placed for future identification.
- Cable route along the Oil pipe or crossing the Oil pipe line inside plant premises shall be as per statutory safety rules and NIT drawing.
- For physical protection of unarmoured cables (wherever used) suitable conduit to be provided wherever necessary. Armoured cable is to be used wherever required.
- The communication confined within the control/equipment room shall be through Shielded twisted Pair cable (STP) CAT 6.
- Single mode FO cable will be preferred, wherever FO cable is required.

- Dual redundant Optical Fiber Communication (OFC) cable shall be considered, wherever possible. Necessary ports/converters/hardware/software shall be provided.
- Separate system will have dedicated FO cable (as applicable).

### **RATINGS & REQUIREMENT OF POWER & CONTROL CABLE**

#### **HV POWER CABLES 33/36 kV GRADE**

1.0      33000/36000 V grade 90 Deg.C rating heavy duty XLPE power cable suitable for use in 33000V non-effectively earthed system conforming to following requirement and in line with IS-7098, IS:8130 &IS:5831, IS:3975.

- |     |                     |   |  |
|-----|---------------------|---|--|
| 1.1 | Conductor           | : | Stranded and compacted aluminium conductor of grade H2 and class 2 for all sizes, generally conforming to IS:8130.   |
| 1.2 | Conductor Screen    | : | Extruded semi-conducting compound.   |
| 1.3 | Insulation          | : | Extruded cross linked polyethylene (XLPE) conforming to IS:7098  |
| 1.4 | Insulation Screen   | : | Extruded semi-conducting compound with a layer of non-magnetic metallic tape. For single core armoured cables, the armouring shall constitute the metallic part of screening. The semi-conducting tape shall be easily strippable. |
| 1.5 | Core Identification | : | By coloured strips applied on (For three core cables) cores or by numerals.  |
| 1.6 | Inner Sheath        | : | Extruded PVC compound conforming to type ST2 of IS:5831 for three core cables.<br><br>Single core cables shall have no inner sheath. Filler material shall also be of type ST2 PVC.  |
| 1.7 | Armour              | : | Galvanised single round steel wire armour for twin and multicore cables.   |

Non-magnetic hard drawn aluminium  
single round wire conforming to H4  
grade of IS:8130 for single core cables.

1.8 Overall Sheath : Extruded FRLS PVC compound  
conforming to type ST2 of IS:5831.

**• L.V. POWER CABLES 1100 V GRADE**

1.0 1100 V grade, 900 C rating, heavy duty, XLPE power cable conforming to following requirement and in line with IS-1554, IS-5831, IS-8130 & IS-3975, 7098

- 1.1 Conductor : Stranded and compacted plain aluminium of  
grade H2 and class 2/stranded, high  
conductivity annealed plain copper as per  
Annexure, generally conforming to IS:8130.
- 1.2 Insulation : Extruded Cross Linked polyethylene  
(XLPE) conforming to IS:7098(Part-3).
- 1.3 Inner Sheath : Extruded PVC compound conforming to  
type ST2 of IS:5831 for multicore cable.  
Single core cables shall have no inner sheath.
- 1.4 Armour : Galvanised single round steel wire armour  
for twin and multicore cables.  
  
Non-magnetic hard drawn aluminium single  
round wire conforming to H4 grade for single  
core cables.
- 1.5 Overall Sheath : Extruded FRLSH PVC compound  
conforming to type ST2 of IS:5831.
- 1.6 Core Identification : By color coding
- 1.7 Overall Sheath : Extruded FRLS PVC compound conforming to  
type ST2 of IS:5831. having improved fire  
performance category and type as stated below.
- | Category | Type  |
|----------|---|
| C2 FRLSH | (Fire Retardant Low<br>smoke and halogen evolution) |
- 1.8 Drum : Conforming to IS-10418(Wooden Drum)
- FRLSH : Fire Retardant Low smoke and halogen



### Evolution

#### CONTROL CABLES 1100 V GRADE

2.0            1.0    1100 V grade, 700 C rating, heavy duty, PVC Control cable conforming to following requirement and in line with IS-1554, IS-8130, IS-5831 & IS-3975.

1.1	Conductor	:	Stranded, non-compacted & circular, high conductivity annealed plain copper, generally conforming to IS:8130.				
1.2 of	Insulation	:	Extruded PVC compound conforming to type A of IS:5831.				
1.3	Inner sheath	:	Extruded PVC compound conforming to type ST1 of IS:5831 for multicore cables. Single core cables shall have no inner sheath.				
1.4	Armour	:	Galvanised single round steel wire for twin and multicore cables.				
1.5	Overall sheath	:	Extruded FRLSH PVC compound conforming to type ST1 of IS:5831.				
1.6	Core Identification	:	By color coding and numbering at interval of 100mm or less				
1.7	Overall Sheath	:	Extruded FRLS PVC compound conforming to type ST2 of IS:5831. having improved fire performance category and type as stated below. <table><tr><td>Category</td><td>Type</td></tr><tr><td>C2</td><td>FRLSH (Fire Retardant Low smoke and halogen evolution)</td></tr></table>	Category	Type	C2	FRLSH (Fire Retardant Low smoke and halogen evolution)
Category	Type						
C2	FRLSH (Fire Retardant Low smoke and halogen evolution)						
1.8	Drum	:	Conforming to IS-10418(Wooden Drum)				
1.9 evolution	FRLSH	:	Fire Retardant Low smoke and halogen evolution				

#### **5.13.15.5 TECHNICAL REQUIREMENTS OF CABLE RACKS AND TRAYS**

**Minimum technical requirements for cable racks and trays are mentioned below:**

- The contractor shall fabricate and supply the mounting arrangement for the support and installation of all the cable trays on hot dip galvanized steel structure including channels, angles, rods etc at requisite spacing in the

suspended cable trays, cable trenches. Supporting structures wherever necessary, shall be provided by the contractor.

- The contractor shall provide embedment/anchor fasteners for fixing the supporting structures.
- These supporting structures shall be fabricated from structural steel members (channels, angles and rods) of the required size.
- The vertical member of the support will be of ISRO12 threaded rod or ISMC100 channel. The horizontal member of the support will be of angle ISA 50X50X6. For the threaded rod support configuration the horizontal member shall be fixed by bolting whereas for channel configuration the horizontal member shall be fixed by welding to the channel.
- Trays shall be of ladder type. The trays shall be fabricated from Hot Rolled Carbon Mild Steel (conforming to IS 1079, Grade "O", of chemical composition (C, Si, Mn, S, Ph) sheet of proper thickness as per IS.
- Cable trays shall be fixed with support by hold-down clamps. The clamps shall be fabricated from MS sheet of appropriate thickness and Hot Dip Galvanized.
- The contractor shall supply various tray fittings and accessories like coupler plate with fasteners, horizontal tees, vertical and horizontal elbows, vertical and horizontal adjustable connectors required for the mentioned trays. All accessories, fittings, elbows and tees shall be Hot Dip Galvanized. The nuts, bolts and washers shall be cadmium plated or electrolytically galvanized.
- Proper earthing of the trays and continuity between tray components must be ensured by the contractor.
- The contractor shall install the cable trays in accordance with relevant standards.
- The cable trays shall conform to bending & galvanization tests as per the relevant standards.

#### **5.13.15.6 TECHNICAL REQUIREMENTS OF BURIED CABLE**

Cable from the Inverter to SMB placed at Floaters:

- i) From Control room to pond Embankment: DC cable to be laid on pedestal with cable tray.
- ii) Cable shall be laid as concrete cable duct over the embankment.
- ii) From embankment to SMB: Over the floaters dressed and laid with proper tags. Bidder shall provide dedicated floaters for cable laying. During detail

engineering necessary extra loop of cable to be kept so that cable should not be tear or break due to water level change.

- **Outdoor area over Pond embankment: DC Cable shall be laid with a minimum 500 mm depth from finished level of the embankment. Cable duct shall be filled with sand. For detail please refer NIT Drawing ST-FSLP-DWG-E-002, Sht 2.**
- 33kV new outgoing feeder cable from 33kV Floating Solar Main Switchgear cum Control Room to be laid down as per the specification shown in the tender drawing No. **ST-FSLP-DWG-E-002, Sht 1** and approximate distance would be 1.2 km.
- **Buried cable route shall be finalized after details engineering in line with the NIT drawing.**

#### **5.13.15.7 APPROVAL**

The Detailed Design Report Submitted by the contractor to WBPDC must contain but not limited to the following details of the Cables and conductor and the accessories for their installation:

- Detailed design and specification of all the items.
- All necessary drawings
- Calculations for choosing cable size
- Type test reports and necessary certificates etc.

Before dispatch, sample pieces of the cable shall be subjected to type, routine, acceptance and FRLS tests at the manufacturer's works as stipulated in IS 1554 (Part I)/IEC in the presence of owner or his representative. Routine tests and acceptance tests as per relevant standards shall be carried out on each type of cable in presence of the owner or his representative.

Before commissioning of complete system all cabling system shall be checked as per cable schedule and complete report shall be prepared by Contractor and shall be submitted.

Prior to the delivery of the product, the contractor shall submit but not limited to the following documents:

- Guarantees
- Cable routing and layout drawings
- Detailed procedure adopted for the earthing of the trays
- Type test certificates for cable trays etc.

The contractor can deliver the product to the site only after receipt of such approval against their prayer in writing from WBPDC.

#### **5.13.16 DATA LOGGER:**

- a) Web enable data logging system may be an integral part of the inverter or a separate unit.
- b) The data logger should have required transducer to monitor and record the required system parameters.
- c) The data Logger, where the weather monitoring station shall be connected, shall keep record of **Global Solar Radiation, PV module temperature and ambient temperature and associated electrical parameters** at different stages to study performance of system as well as to study status of the system at a particular instant.
- d) The Data logger shall continuously send data to the Web server.
- e) If the Power Plants shall installed in distributed manner and at more than two buildings then necessary arrangement shall have to be provided so that compiled data shall be uploaded to the Website against each site.
- f) The data logger shall have reliable data storage capacity (of minimum four months) to record all sorts of data simultaneously round the clock.
- g) **SPD (surge protection device) Type II suitable for communication network, as much number at suitable locations are required must be provided with the system**

#### **5.13.17 WEATHER MONITORING STATION**

- i) Weather Monitoring Station comprised of the following:
  - a) **Solar Irradiance:** An integrating Pyranometer (Class II or better) shall be provided, with the sensor mounted in the plane of the array. Readout shall be integrated with data logging, system.
  - b) **Wind Speed:** An integrated wind speed measurement unit shall be provided.
  - c) **PV module temperature sensor, ambient temperature:** Temperature probes for recording the PV Module temperature and ambient temperature shall be provided.
- ii) The components of the Weather Monitoring Station shall be matched with the Data Logger system and Web based Monitoring system and connected with the Data logger.

- iii) The data from the Weather Monitoring station shall be sent to the Web server through Data logger and shall be downloaded from the remote server from anywhere.
- iv) Weekly cleaning also to be done on WMS system.
- v) More than one separate WMS system to be connected with data logger. All the WMS should be calibrated one by one by the bidder yearly from Govt. approved reputed Lab during comprehensive O&M period without any extra cost to WBPDC.

#### **5.13.18 WEB BASED ON LINE REMOTE MONITORING SYSTEM:**

- a) Web based Remote Monitoring system must be compatible with data logger (s).
- b) The system(s) shall be provided with suitable modem and required SIM card for wireless communication or connection from internet service provider (Wire system)
- c) The Modem shall be interconnected with all the locations of installation of PV power Plants at different buildings of the site through wires / wireless system/ or any other technology so that Beneficiary wise composite and for individual power plant data shall be observed and downloaded from the remote server through web.
- d) The contractor shall provide the website address and password to the purchaser for access the data from the remote server.
- e) If there is communication signal at the site is weak, necessary antenna or any other suitable instrument as may be required must be provided with the communication system.
- f) The Data logger shall continuously send data to the Web server.
- g) The other required accessories, hardware and compatible software shall have to be provided as an integrated part of the system to monitor the real time data (maximum 20 minutes delay) through web server.
- h) The system can be monitored from anywhere through internet without installing any special application software. The server shall be arranged by the contractor.
- i) The rental and other costs of the SIM cards, IP address, Server charge (storage, access charge and other charges if any), Rental charge of data communication for remote monitoring system for a period of five (05) years shall be within the contract value.
- j) If more than one data logger and web based monitoring system shall with different PV Power Plant installed at different location within a same

campus, consolidated data and graphical representation of the parameters including the weather monitoring report shall be obtained through web.

- k) The Web based monitoring system should have the provision of graphical representation of the data shall include but not limited to the following:

Sl. No.	Operating Parameter	Desired specification
1.0	Input data	PV Power PV Energy
2.0	Meteorological data	Global solar Radiation Module Temperature Ambient Temperature Wind Speed
3.0	Output data	
3.1	Inverter	Export Power Export energy

- l) All data shall be recorded chronologically date wise. The data file should be MS Excel/XML/or any readable form compatible and should have the facility of easy downloads from the website and onsite.

#### **5.13.19 EXPORT IMPORT ENERGY METER:**

**3 phase whole current Export Import Energy Meter.** The Meter to be supplied must be tested. This Export- Import meter shall be installed to measure the total energy to be imported and exported from the PV power Plant. The export Import Energy meter shall be installed at the following Panels:

- a) The export Import Energy meters (Class 2S) shall be installed at  
Outgoing feeder of Indoor 33 kV Switchgear to Switchyard.
- b) SAS panel for 33 kV power evacuation near Bhojodih Switchyard.

#### **5.13.20 ILLUMINATION SYSTEM**

##### **5.13.20.1 SCOPE**

The scope of work under this specification covers design, manufacture, assembly, shop testing, delivery, site erection, testing & commissioning of Illumination system comprising of main Illumination switchboards, distribution boards, sub distribution boards, switchboards, lighting fixtures, convenience and power outlets, conduits & fittings, cabling, outdoor lighting including mounting

structures & poles, lighting for control rooms, security cabin, watch tower, access road, ~~across the embankment (maximum 15 m between two adjacent lamps).~~

The illumination system shall be designed as per relevant Indian Standard / Guideline for different location of the plant. The lighting arrangement should be LED Based.

The scope of supply shall also include necessary spares required for normal operation & maintenance of illumination equipment for a period of 5 (five) years & special tools & plants required for erection & maintenance. Corresponding parts of all the equipment & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable.

#### **5.13.20.2 STANDARDS**

The material, equipment and its installation under the scope shall comply with all applicable provisions of the latest Indian standards and codes of practice. Some of the relevant standards are given below:

<b>Sl. No.</b>	<b>Standards</b>	<b>Description</b>
1	IS: 3646	Code of practice for interior Illumination (Part I, II, III)
2	IS: 6665	Code of Practice for Industrial Lighting
3	IS: 732	Code of Practice for Electrical wiring installations
4	IS: 9537	Conduits for Electric installations
5	IS: 2418	Tubular fluorescent lamps for general lighting service
6	EN 61347-2-13	Particular requirements for D.C. or A.C. supplied electronic control gear for LED modules
7	EN 62384	D.C. or A.C. supplied electronic control gear for LED modules
8	EN 61000-3-2	Electromagnetic compatibility (EMC). Limits for harmonic current emissions (Equipment input current < 16 A per phase)
9	EN 61000-3-3	Limitation of voltage fluctuation and flicker in low voltage supply systems for equipment with rated current < = 16 A

The installation shall generally be carried out in conformity with the requirements of Indian Electricity Act 1910 (latest Amendment) & Indian Electricity Rules.

#### **5.13.20.3 REQUIREMENT**

The lighting system for outdoor and indoor areas of Solar Power Plant shall be designed in such a way that uniform illumination is achieved.

In outdoor yard equipment / bus bar areas and the peripheral wall are to be illuminated and luminaires shall be aimed for clear view.

#### **5.13.20.4 LIGHTING LEVELS**

The complete switchyard shall be lightened with an average illumination level of 100 lux.

Lighting in other areas such as control room, office rooms and battery room & other areas (i.e. street light) shall be such that the average LUX level to be maintained shall be as under:

<b>Sl No.</b>	<b>Area</b>	<b>LUX</b>
1	Control Room and conference rooms	400
2	33 kV Switchyard	100
3	Battery & other rooms	150
4	Outdoor areas including embankment	20
5	H – pole and metering point	20
6	Equipment room	250
7	Transformer yard	100

#### **5.13.20.5 EMERGENCY LIGHT POINTS**

Light points using LED lamps at 220 V shall also be provided as per requirement of the following area:

- All emergency light shall be from 220 V DC Battery.
- Control room and equipment room, Battery room, UPS Room/ Office, Corridor, Local Inver cum Control Room or any other place where light is required for clear vision.
- These lights shall operate on AC/DC changeover supply from the DC distribution Board. Separate wiring and distribution board shall be provided from these lights.
- Battery room shall be corrosion proof type lamp and fixtures.

#### **5.13.20.6 APPROVAL**

The Detailed Design Report submitted by the contractor to WBPDC must contain but not limited to the following details of the illumination system:

- Detailed scheme and specification
- Illumination calculations for arriving at the number of lighting fixtures for different areas & rooms considering the required lux level as per relevant IS Code.
- Necessary drawings etc.



Drawings and scheme submitted by the contractor will be subjected to approval of the owner.

The contractor can deliver the product to the site only after receipt of such approval against their prayer in writing from WBPDC.

## **viii) MISCELLANEOUS WORKS:**

### **5.13.21 FIRE PROTECTION SYSTEM**

#### **5.13.21.1 SCOPE**

The scope of work under this specification covers design, engineering, quality assurance, manufacture, shop testing, transport, transit insurance, delivery to site, storage at site, site erection, testing & commissioning of fire protection system (fire extinguisher (type shall be selected as per requirement), fire buckets, fire alarms at all control rooms etc.) complete with all accessories.

The scope of supply shall also include necessary spares required for normal operation & maintenance of illumination equipment for a period of 5 (five) years & special tools & plants required for erection & maintenance. Corresponding parts of all the equipment & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable.

#### **5.13.21.2 STANDARDS**

All equipment covered under this section will conform to the latest edition of following Indian Standards:

<b>Sl. No.</b>	<b>Standards</b>	<b>Description</b>
1	IS: 3034	Code of Practice for Fire Safety of Industrial buildings: Electrical generating and distributing stations.
2	IS: 3844	Code of Practice for installation of internal fire hydrants in multi-storied buildings
3	IS: 1646	Code of Practice for fire safety of buildings (General) Electrical Installations
4	IS: 2878	Specification for fire Extinguishers – Carbon dioxide type
5	IS: 2171	Specification for fire Extinguishers – Dry Powder type
6	IS: 933	Specification for fire Extinguishers – Foam type
7	IS: 2175	Specification for heat sensitive fire detectors for use in automatic electrical fire alarm system
8	IS: 2189	Code of Practice for installation of automatic fire alarm system using heat sensitive type fire detectors

#### **5.13.21.3 APPROVAL**

The Detailed Design Report submitted by the contractor to WBPDC must contain but not limited to the following details of the fire protection system:

- Detailed scheme and technical specification
- Placing and type of fire extinguisher with justification
- Necessary drawings related to the system etc.

Drawings and scheme submitted by the contractor will be subjected to approval of the owner.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDC.

### **5.13.22 VENTILATION SYSTEM**

#### **5.13.22.1 SCOPE**

The scope of work under this specification covers design, manufacture, shop testing, supply, transportation, delivery, storage at site, erection, testing and commissioning of ventilation system complete with all accessories at each Inverter cum control rooms, store room etc.

The Scope shall include supply of all blower fans, GS ducting, air plenum, exhaust fans air dampers etc as required to make the ventilation system complete in all respects for satisfactory operation.

The scope of supply shall also include necessary spares required for normal operation & maintenance of ventilating equipment for a period of 5 (five) years and special tools & plants required for erection & maintenance.

Corresponding parts of all the equipment & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable. All the material & workmanship shall be of suitable commercial quality as have proven successful in their respective uses in similar services & under similar condition.

#### **5.13.22.2 DESIGN:**

To prevent the maximum permissible temperature in the inverter room from being exceeded because of internal heat emission of inverters and other auxiliaries in the inverter room, the inverter room in the PV plant shall be adequately ventilated. The Ventilation plant capacity and air quality of inverter room shall be as per inverter and other auxiliary's system manufacturer's recommendations. Filters at the air inlet of the inverter room shall be provided to prevent dust ingress. Bidder shall furnish peak power consumption of cooling system of the PCU along with the data sheet.

Ventilation shall be designed in such a way that the temperature rise of the inverter rooms doesn't exceed the maximum designed temperature of Inverters and other auxiliary equipment's placed inside the inverter room. Accordingly the

air velocity through the filter shall be suitably chosen to remove the heat from the inverter room. All exhaust and fresh air fans shall be provided with thermostat control.

#### **5.13.22.3 STANDARDS**

The ventilating equipment shall comply with the requirement of the latest edition of relevant Indian standards or equivalent British Standards. Some of the relevant standards are given below:

<b>Sl. No.</b>	<b>Standards</b>	<b>Description</b>
1	IS : 3103	Code of Practice for industrial ventilation
2	IS : 2312	Specifications for propeller type A.C. Ventilating fans.
3	IS: 4894	Centrifugal fans

#### **5.13.22.3 APPROVAL**

The Detailed Design Report submitted by the contractor to WBPDCCL must contain but not limited to the following details of the fire protection system:

- Detailed scheme and technical specification
- Calculations showing air requirements at various locations
- Necessary drawings etc.

The successful bidder required to produce all necessary test certificates and approvals of the product as per relevant standard with the Detailed Design Report.

Drawings and scheme submitted by the contractor will be subjected to approval of the owner. The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDCCL.

- Additional requirement:
  - 100% redundant corrosion proof exhausts fans to be provided at Battery room.
  - Equipment rooms shall be having forced air ventilation.
  - All fans shall be of industrial type.

#### **5.13.23 AIR CONDITIONING SYSTEM**

##### **5.13.23.1 SCOPE**

The scope of work under this specification covers design, manufacture, testing, supply, transportation, transit insurance, delivery, storage at site, erection, testing and commissioning of Air conditioning system with control and accessories at the operator's work station, SCADA room and UPS room with 100% redundancy at

main control building. Bidder shall submit heat load calculation before finalization of AC system for control room and conference room considering all parameters.

#### **5.13.23.2 STANDARDS**

Equipment shall conform to the latest Indian standards or equivalent British Standards.

<b>Sl. No.</b>	<b>Standards</b>	<b>Description</b>
1	IS: 659	Safety code for Air conditioning
2	IS: 660	Safety code for Mechanical Refrigeration
3	IS: 655	Metal Air ducts

#### **5.13.23.3 APPROVAL**

The successful bidder required to produce all necessary test certificates and approvals of the product as per relevant standard with the Detailed Design Report.

The Detailed Design Report submitted by the contractor to WBPDC must contain but not limited to the following details of the Air Conditioning system:

- Detailed scheme and technical specification
- Necessary drawings etc.

Drawings and scheme submitted by the contractor will be subjected to approval of the owner. The contractor can deliver the product to the site only after receipt of such approval against their prayer in writing from WBPDC.

### **5.13.24 DRINKING WATER**

#### **5.13.24.1 SCOPE**

The scope of supply under this section shall cover the design, manufacture, shop testing, supply, transportation, delivery, storage at site, erection, testing and commissioning of drinking water system with water purifier unit and other related plumbing arrangement and accessories etc. for drinking water supply for the personnel at the Control Building. A drinking water point will be provided (within 500m from control building) and the contractor to draw pipelines to the requisite location.

#### **5.13.24.2 STANDARDS**

The whole system shall conform to the latest edition of relevant Indian Standard.

#### **5.13.24.3 APPROVAL**

The Detailed Design Report submitted by the contractor to WBPDC must contain but not limited to the following details of the water purification unit:

- Detailed Technical specification
- Necessary drawings etc.

Specification submitted by the contractor will be subjected to approval of the owner. The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDC.

### **5.13.25 SIGNAGE:**

#### **5.13.25.1 Project information Signage:**

The Signage will be made up of metallic base of minimum size 3'x 2'. The Signage provide with detail of the project as approved by WBPDC. The font size on the signage has to be big enough so that everyone can read it easily. The Signage will be fixed **up two (02)** prominent place of the project area.

#### **5.13.25.2 SCHEMATIC DIAGRAM SIGNAGE:**

Schematic Diagram of Installation must be provided on a display board of minimum size 3'x 2' made up of metallic base. The schematic diagram must be fixed up at any prominent place of installation.

#### **5.13.25.3 SAFETY SIGNAGE:**

Safety Signage must be provided indicating the level and type of voltage and symbols as per IE Rule at different position as may be required. In the safety signage Voltage level and type of voltage must be mentioned

**Each set of Safety Signage contain minimum 06 (six) nos. safety signage:**

<b>Location</b>	<b>Quantity</b>
PV Array Field	Minimum 2 nos.
On PV Array JB each	01 No. (Sticker)
Near each Inverters	01 No
On Inverter Interfacing HT Panel	01 no. (Sticker)
On Switchyard	01 No (Sticker)

### **5.13.26 FIRE BUCKETS AND HOLDING STANDS**

Each set of Fire Buckets and Fire Bucket Holding Stand shall have four (04) Fire Buckets and one (01) Double Tier Fire Bucket Holding Stand with an

arrangement of holding of minimum four (04) Fire Buckets. The Fire Bucket Stand shall be installed at the suitable location.

The minimum technical specification is as follows:

BIS Specification	IS 2546 (with latest amendments)
Fire Bucket Capacity	10 liters
Fire Bucket Body Material	Mild Steel Sheet

#### **FIRE EXTINGUISHERS**

Minimum three (3) nos DCP type dry power portable fire extinguishers of minimum capacity 5 kg shall be provided. Standard of Fire Extinguisher BIS 2171 (with latest amendments).

#### **5.13.27 KIOSK**

Some small outdoor Panels (if required) shall be installed in suitable locations in Metallic Kiosks. The kiosks must be of a suitable design, painted for avoiding rust, covered with a door and locking arrangement with good air circulation. The Kiosks must have security arrangement against theft, manhandling etc. Minimum clearance of the lower edge of the equipment from floor should be 1.0 m. There must be a suitable clearance from the front door of the Kiosk with any of the equipment / panel within the Kiosk.

Necessary civil work as required to construct / fixing the Kiosks (s) shall be done by the contractor. If any civil construction is required for installing the whole arrangement, as and where required, it will be within the cost of contract value.

#### **5.13.28 TOOLS, TACKLES AND SPARES**

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

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

- viii. One 20HP flattered Boat one paddle boat.
- ix. Mandatory Spares for each equipment.

### **5.13.29 OTHER CONDITIONS**

The work includes necessary excavation, concreting, flooring, platform, necessary finishing, painting, back filling, shoring & shuttering, cable laying, location of installation of different component of PV Power Plant etc. if any , required for completion of the project in all respect shall be as per direction of Engineer-in-Charge.

**NOTE:**

***Any item/equipment not mentioned in the Technical Specification, but required for successful completion of the project shall be deemed to be a part of the scope of the work and the same shall be included by the bidder in their Billing Break Up (BBU).***

### **ix) APPROVED VENDOR LIST FOR BOIs:**

<b>Equipment</b>	<b>List of Vendor for various BOIs</b>
SOLAR PANELS	Any Solar PV Manufacturer in India having MNRE Certification
INVERTERS	ABB/ HITACHI/SMA/ DELTA
132 / 33 kV TRANSFORMER	BHEL / GE / ABB/ ALSTOM/AREVA T & D INDIA LIMITED NAINI / ABB
INVERTER AND AUX, TRANSFORMER	SUDHIR/VOLTAMP/BHEL/AREVA
POWER CABLES	KEI/ FINOLEX /POLYCAB /APAR
CONTROL CABLES	KEI / DELTON/ FINOLEX /POLYCAB /APAR
LT SWITCHGEAR	L&T / SIEMENS / SCHNEIDER/ABB
STEEL MEMBERS	TATA / VIZA STEEL/SAIL (GI coating done) or any equivalent ISI Mark
EARTHING/ LIGHTNING	CG Power/ELPRO INT. LTD/OBLUM
WEATHER MONITORING STATION	KIPP & ZONNEN / EPPLEY / EKO INSTRUMENTS /SOLAR L /GREEN POWER Monitoring
LT POWER PANEL	L&T / SIEMENS / SCHNEIDER/GE POWER

<b>Equipment</b>	<b>List of Vendor for various BOIs</b>
JUNCTION BOX	L&T / PYROTECH / SCHNEIDER
ENERGY METER	SECURE METERS/IMP/BHEL/RISHABH(L&T)
SCADA System	ABB, GE, ROCKWELL
33 kV INDOOR SWITCHGEAR	BHEL / SCHNEIDER / SIEMENS
UPS	EMERSON / HITACHI-HIREL / MERLINEGERINE / AEG (SAFT)
220 V DC Battery	EXIDE
220 V DC Battery Charger	CHLORIDE POWER SYSTEMS AND SOLUTIONS LTD. / STATCON POWER LTD./ CHHABI / HBL POWER
UPS BATTERY (Ni-Cd)	HBL POWER SYSTEM
INDUSTRIAL PC ALONGWITH CRT (EWS/ OWS/ SERVER/ HISTORIAN)	DELL / HP (Pavilion )
PRINTER	HP
ETHERNET SWITCH	CISCO / MOXA
CONTROL DESK/ LOCAL PANEL	PYROTECH / RITTAL / SCHEINDER / CONTROL & SWITCHGEAR / CONTROL DEVICE / SWITCHING CIRCUIT
OPTICAL FIBRE CABLE	TYCO / MOLEX / BIRLA ERICSSON / HFCL
CCTV camera	BOSCH/PELCO/HONEYWELL
36 kV Outdoor VCB	SIEMENS LTD. / ABB INDIA LTD. / SCHNEIDER ELECTRIC / TOSHIBA T&D SYSTEMS (INDIA) / CG POWER & INDUSTRIAL SOLUTION LTD. (FORMERLY KNOWN AS CROMPTON GREAVES LTD.)
ISOLATOR	SIEMENS / ELPRO

## **ii) List of Mandatory Spares**

<b>Sl. No.</b>	<b>Equipment/Package Name</b>	<b>Quantity</b>
1.00.00	Inverter Transformer (33/0.38 kV)	
1.01.00	Bushing	
(i)	HV Bushing with metal parts, connectors and gaskets	1No.
(ii)	LV bushing with metal parts, connectors and gaskets	1No.



**SECTION: V TECHNICAL SPECIFICATION**  
For 5MW Floating Solar PV Power Plant at STPS of WBPDC

(iii)	Neutral bushing with metal parts, connectors and gaskets	1No.
(iv)	CT at Transformer each type and rating	1No.
1.02.00	33 kV Surge Arrestor complete with insulating base and surge monitor	1Set.
1.03.00	33KV Switchyard	
1.03.01	33KV Breaker	
(i)	Closing Coil with resistor	6Nos.
(ii)	Tripping Coil with resistor	12Nos.
(iii)	Breaker Auxiliary Contact	2Sets
(iv)	Set of O-ring	3Sets
(v)	Set of Seals	3Sets
1.03.02	33 kV Isolator	
(i)	Complete set of motor operating mechanism box with all accessories including motor.	1Set for each type and rating
(ii)	Limit Switch	3 sets for each type and rating
(iii)	Copper contact fingers for female & male contacts	3Sets for each type and rating
(iv)	Drive Motor with gear	1No for each type and rating
1.03.03	33 kV CT	1No. for each type, rating & application
1.03.04	33 KV Switch yard Protection and Substation Automation System	
(i)	Numerical Relays	1 No of each make, type & range & rating.
1.04.00	33 kV SWITCHGEAR	
1.04.01	Pole of breaker of each type & rating	1 set (1set is complete for 3 phases)
1.04.02	Spring charging motor complete	2 nos of each type
1.04.03	Trip coil	10 nos of each type
1.04.04	Closing Coil	05 nos of each type
1.04.05	Current transformer	1 nos of each type and ratio
1.04.06	Fuse for Potential transformer of each type & ratio	3 no of each type
1.04.07	Relays	2 no of each type

**SECTION: V TECHNICAL SPECIFICATION**  
For 5MW Floating Solar PV Power Plant at STPS of WBPDC

1.04.08	Limit switches of each type	5 nos.
1.04.09	Operating mechanism rod for each rating	2 nos
1.04.10	Ammeter of each type & range	1 no of each type & range
1.04.11	Voltmeter of each type & range	1 no of each type & range
1.04.12	Indicating lamps	5 nos. each type
1.05.00	Inverter	
1.05.01	Control Unit	2 nos. Each Type and Rating and make.
1.05.02	Protection Switch	2 nos. Each Type and Rating and make.
1.05.03	Control Panel	2 nos. Each Type and Rating and make.
1.05.04	AC Fuse	5 nos. Each Type and Rating and make.
1.05.05	Fuse link	2 nos. Each Type and Rating and make.
1.05.06	I/O module	2 nos. Each Type and Rating and make.
1.05.07	AC Breaker	1 no. Each Type and Rating and make.
1.05.08	AC and DC Contactor	2 nos. Each Type and Rating and make.
1.05.09	ARRESTER	2 nos. Each Type and Rating and make.
1.05.10	FAN	2 nos. Each Type and Rating and make.
1.05.11	SPD	2 nos. Each Type and Rating and make.
1.06.00	PV Module	
1.06.01	PV Module	100 nos each type and rating.
1.07.00	Floater	
1.07.01	Complete set of floaters with all accessories	50 Nos. each type and size

Bidder shall arrange and supply all the items during execution of the project to their site store and under Bidder's custody. Finally, all the above items shall be handed over to WBPDC store after completions of defect liability period i.e. end of the O&M contract.

# **SECTION – VI**

## **FORMS**

<b>Sl No</b>	<b>Form Name</b>	<b>Form No</b>
01.	Check List	Form-1
02.	Forwarding Letter for submission of Bid Security and Tender Fee	Form -2
03.	Bid Form	Form-3
04.	Bid security (Bank Guarantee format)	Form- 4
05.	Summary Statement Of Yearly Turnover And Net Worth	Form-5
06.	Capability status	Form-6
07.	Statement of similar type of order orders executed as on date of issuance of the NIT	Form-7
08.	Curriculum Vitae Of Key Personnel	Form-8
09.	Format For Submission Of Pre-Bid Queries	Form- 9
10	Proposed modifications	Form-10
11	Joint Venture/Consortium Agreement	Form-11
12	Power of Attorney	Form-12
13	Declaration for Net Minimum Guaranteed Generation	Form-13

## FORM-1: CHECK LIST: FORM

Sl. No.	Scanned Copy of Documents to be uploaded	Name of folder	To be submitted in cover	Submitted (Y/N)	If Y the File name or serial no.
1.	Tender Fee <b>(Scanned copy)</b>	Drafts	Statutory Cover (Technical proposal)		
2.	Bid Security <b>(Scanned copy)</b>	Drafts	Statutory Cover (Technical proposal)		
3.	Check List <b>(Form - 1)</b>	Forms	Statutory Cover (Technical proposal)		
4.	Forwarding Letter for submission of Bid Security and Tender Fee <b>(Form - 2) ( Scanned copy)</b>	Forms	Statutory Cover (Technical proposal)		
5.	Bid Form/Undertaking including time schedule <b>(Form - 3)</b>	Forms	Statutory Cover (Technical proposal)		
6.	Summary statement of yearly turnover and net worth <b>(Form 5)</b>	Forms	Statutory Cover (Technical proposal)		
7.	Capability Status <b>(Form 6)</b>	Forms	Statutory Cover (Technical proposal)		
8.	Statement of similar type of order orders executed as on date of issuance of the NIT <b>(Form 7)</b>	Forms	Statutory cover (Technical proposal)		
9.	Curriculum Vitae of Key Personnel <b>(Form 8)</b>	Forms	Statutory Cover (Technical proposal)		
10.	Net Minimum Generation Guarantee <b>(Form 13)</b>	Forms	Statutory Cover (Technical proposal)		
11.	Copy of the CST / VAT / TIN Certificate	Certificates	Non-Statutory cover (Technical proposal)		
12.	Copy of the Service Tax Registration Certificate	Certificates	Non-Statutory cover (Technical proposal)		
13.	Copy of the PAN certificate/ PAN Card	Certificates	Non-Statutory cover (Technical proposal)		

Sl. No.	Scanned Copy of Documents to be uploaded	Name of folder	To be submitted in cover	Submitted (Y/N)	If Y the File name or serial no.
14.	Declaration of PF Registration Number <b>or</b> Proof of PF Registration	Certificates	Non-Statutory cover (Technical proposal)		
15.	MNRE Chancel partner certificate under “Grid Connected Ground Mounted and Small Solar Power Plants Programme” / Website Download copy from MNRE Website as a proof of enlistment	Certificates	Non-Statutory cover (Technical proposal)		
16.	Copy of the Registration Certificate under Company Act (Company Incorporation Certificate) <b>or</b> copy of the Registered Deed for Partnership Firm	Company Details	Non-Statutory cover (Technical proposal)		
17.	Copy of the Order(s)/ Contract Agreement(s) with the Purchaser / any other Proof of Purchase, as primary agency  <b>AND</b> Corresponding Copy of the Completion Certificate(s) /Commissioning report signed by the Purchaser / Ordering Authority to substantiate the proof of completion of the Solar PV Power Plant(s). <b>(As per declaration in Form-6)</b>	Credential (Technical)	Non-Statutory cover (Technical proposal)		
18.	Copy of the Audited Balance Sheet and Statement of Profit and Loss Account / Tax Audit report as per NIT	(Financial)	Non-Statutory cover (Technical proposal)		
19.	Copy Income Tax return Acknowledgement for assessment years as per NIT	(Financial)	Non-Statutory cover (Technical proposal)		
	<b>Finance Proposal</b>				

Sl. No.	Scanned Copy of Documents to be uploaded	Name of folder	To be submitted in cover	Submitted (Y/N)	If Y the File name or serial no.
20.	BOQ (Financial proposal)	Bill of Quantities (BOQ)	Financial Proposal		
21.	Mode Of Transaction Statement Of Materials and Equipment	Mode of Transaction	Financial Proposal		

Date : (Printed Name).....

Place : (Designation).....

**Signed and Upload**

### **FORM-2: FORWARDING LETTER FOR BID SECURITY AND TENDER FEE**

Date:

Bidder's Name and address

To

**The Deputy General Manager-IC(M&C)**  
**The West Bengal Power development Corporation Limited**  
Bidyut Unnayan Bhaban,  
Plot No. 3/C LA-Block,  
Sector-III, Bidhannagar,  
Kolkata-700 106

**Subject :** Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 5 MW Grid Connected Floating Solar Photovoltaic Power Plant on Raw Water Pond No. 1 in Santaldih Thermal Power Station (STPS), Purulia, West Bengal including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance.

**Reference : NIT No:**

Dear Sir,

We are enclosing the following:

1. Account payee Demand draft / Bankers Cheque (No. ....[insert No.]..... dated ..... [insert date]..... drawn on .....[insert name of the bank on which drawn]..... for ..... [insert amount in Rs. and words]....., drawn in favor of "**The West Bengal Power Development Corporation Ltd (WBPDC)**," payable at Kolkata **towards Tender Fee.**