TECHNICAL SPECIFICATION OF PLCC

1. *GENERAL INFORMATION:*

1.1 *SCOPE:*

This specification provides for Frequency Planning, Co-ordination with other suppliers' equipment, design, manufacture, inspection, testing at manufacturers works packing and supply at site including transportation, erection, testing and commissioning of equipment as specified herein for Power Line Carrier Communication equipment complete for speech communication in dialing mode and / or through 4 wire Express Telephone, data communication and transmission line protections including coupling equipment, Battery & Battery Charger for for 400 KV, 220KV& 132KV Transmission Lines as mentioned in Annexure-AI and as per schematic/layout drawing. All communication equipment shall be suitable for good quality voice communication among all new & existing Sub- Stations & SLDC Howrah and also data communication with SLDC Howrah. Brief scope of work as mentioned in Annexure AI is also under scope of work of vendor.Regarding the stations where PLCC equipment are already in operation, the contractor shall be responsible for co-ordinating the equipment supplied by them with the existing PLCC equipment in the said stations. However, any other work not specified but felt necessary for successful commissioning of trouble free operation of carrier aided protection, speech & data communication system as per approved scheme are also within the scope of the work.

1.2 *CLIMATIC CONDITION*:

The equipment to be supplied under this specification shall be suitable for satisfactory operation under following climatic condition:

a) Maximum Ambient Temperature in shade	:	50º C
b) Maximum Temperature under hot Sun	:	60º C
c) Minimum Ambient Temperature in shade	:	4º C
d) Daily Average Ambient Temperature	:	45º C
e) Average no. of thunder storm days per annum	:	75
f) Average rainfall per annum	:	2000 mm
g) Maximum relative humidity	:	100%
h) Height above sea level	:	1000 meters
i) Maximum Wind Pressure	:	150 Kg/m^2
j) Basic horizontal seismic co-efficient	:	0.04
k) Average number of months during which tropical monsoon conditions prevail	:	4 1/2 months

1.2.1. The atmosphere is to be considered as laden with industrial and town gas and dust in suspension during dry months. Fog, smoke and mild acid are also present.

1.3 *STANDARDS :*

The equipment shall conform to the following latest Edition of the Indian Standards as amended up to date and as per latest relevant I.E.Cs. :

The details are given below :

1.	I.E.C. Publication No.353	for line trap.
2.	IS Publication No.8792	for line trap.
3.	I.E.C. Publication No.481	for coupling devices.

4.	I.E.C. Publication No.495	for power line carrier terminals.
5.	I.S. Publication No.8997	for coupling devices.
6.	I.S. Publication No.3156	for C.V.T.
7.	I.E.C. Publication No.358	for C.C. & CVT
8.	I.S. Publication No.9348	for coupling capacitor.
9.	I.S. Publication No.11967	for Co-axial Cable
10.	I.E.C. Publication No.663	for Planning of SSB PLCC system.
11.	I.E.C. Publication No.99	for Surge Arrestors
12.	I.E.C. Publication No.96	for HF Cable
13.	I.E.C. Publication No.834-I Part-I	for Performance and Testing of Tele-protection equipment.
14.	I.S. Publication No.9428	for Characteristic values of Inputs and outputs of single side band PLC terminals.
15.	I.S. Publication No.9528	for frequency planning of power line carrier equipments.

1.4 ***LOCATION OF EQUIPMENT:***

1.4.1. The PLCC equipment and Wave Traps shall be installed at the respective ends of the transmission lines as stated in section 1.1. The contractor shall be responsible for co-coordinating the equipment supplied by them with the already existing carrier equipment at the respective Sub-Station.

1.5. ***PROPOSED ARRANGEMENT:***

1.5.1. The power line carrier communication equipment required by the owner is to provide primarily efficient, secure and reliable information link for carrier aided protection for both direct and permissive tripping of remote-end breaker and also for speech & data communication between 400KV, 220KV & 132KV Sub-Stations.

It shall include separate terminals for speech and protection purpose. Provision for superimposing channels for telemetering& protection signals shall be made on the speech terminals.

1.5.2. The proposed 400KV lines shall have connected shunt reactors if necessary at one/both ends. The switching off of local breaker keeps the reactor and line charged. In the event of reactor fault both the breakers must be tripped immediately and as fast as possible to save not only the system but also the equipment. Further opening of 400KV remote end breakers would cause severe voltage rise in dynamic condition and may cause damage due to ferro-resonance. This will require immediate opening of local breaker under carrier aided direct tripping command from remote end.

1.5.3. For security reasons each 400KV transmission line shall be protected as given below:

Main-I: Numerical distance protection with permissive inter-tripping.
Main-II: Numerical distance protection of a relay with permissive inter-tripping.

Thus, there shall be 2 (two) pairs of PLC Terminals with protection couplers for each circuit.

Further, there shall be 1 (one) pair of PLC terminals for speech and telemetering for each circuit of the D/C line.

1.5.4. For list of equipment Quantity Schedule may be referred to.

1.5.5. The protection signaling equipment shall be suitable for direct and permissive tripping of remote end breaker. It shall provide transmission and reception facilities for minimum of 2 (two) protection signals per terminal.

1.5.6. The equipment for protection signals shall have high degree of reliability and speed. It shall be guaranteed to function reliably in the presence of noise impulse caused by isolator or breaker operation. The equipment shall be suitable for direct tripping of remote end breaker for fault in unswitched 400KV shunt Reactor & operation of Buchholz relays of reactor. It shall also be possible to effect direct tripping of breaker of sending end when receiving end breaker opens cut either manually or by relays such as Bus fault relay etc.

1.5.7. The time interval between receipt of a trip command by the carrier relay on the transmit side, & giving command to the trip relays at the distant end shall not exceed 25 m Sec. even for the longest line section. The above timing is inclusive of operating time for auxiliary relays and interposing relays, if any, included in the PLCC equipment.

1.5.8. The requirement of protection signaling channel, is such that security against incorrect signals being received shall be at least two orders higher than reliability against a signal not being received.

1.5.9. Requirement under speech and data communication elaborated in clause-6.

1.5.10. For reasons of reliability and because of relatively long line section, phase to phase coupling between adjacent phase i.e. either R-Y or Y-B shall be employed throughout. This shall, however, be fully confirmed by Bidder after conducting detailed computer study taking into account the transposition of 400KV lines for optimum coupling mode over these line sections. The coupling arrangement shall be fully optimized by the bidder after conducting detailed computer range study of every line section individually, taking into account the temperature variations, transpositions, earth resistivity, conductor configuration and other relevant details. Line attenuation shall be calculated at different frequencies for the following values of earth resistivity.

i)	30 Ohm	-	metre
ii)	100 Ohm	-	metre
iii)	200 Ohm	-	metre
iv)	300 Ohm	-	metre
v)	1000 Ohm	-	metre

1.5.11. The bidder shall have to check and prove through field test for phase combination in addition to his computer studies that attenuation due to transposition in the line is minimum out of all possible phase combinations within limits and the offered equipment will perform satisfactorily within limits of attenuation..

1.5.12. Further more, the bidder shall submit curves illustrating “failure to trip probability “ plotted against corona noise level in the presence of impulse noise due to switching of isolator and circuit breaker etc. Details of field tests and laboratory test for successful operation of this equipment under such adverse condition shall be furnished by the Bidder. These are to be related to end to end signaling and shall take into account the type of communication link. Details of field test and laboratory test for successful operation of the equipment under the above circumstances shall be submitted by the bidder illustrating the above parameters.

1.6 ***FREQUENCY PLANNING;***

1.6.1 The contractor shall be responsible for doing the carrier frequency planning for these PLC links.

1.6.2 The equipment to be supplied by the contractor shall be complete with H.F hybrid permitting adjacent channel working.

1.6.3 The carrier frequency plan should be prepared within one month of receipt of the frequency details of the existing PLCC Network from the Board. The contractor will submit detailed calculations with his frequency plan and also the recommendations regarding the line traps based upon his frequency planning.

1.6.4 The carrier frequency plan recommended by the contractor will be submitted for approval of Wireless Adviser/PTCC, New Delhi if required as per existing rules. In case any change is proposed by those authorities in the recommended carrier frequency plan, the contractor will have to modify his studies and proposal accordingly to suit their requirement.

1.7 ***INTERCONNECTION DETAILS FOR TELE-PROTECTION****:*

1.7.1 Contractor should provide interconnection details between the protection coupler and the existing distance protection system at concerned sub-station.

1.8 GUARANTEED TECHNICAL PARTICULARS:

The bidder shall submit the Guaranteed Technical Particulars of the equipment in accordance with 'Guaranteed Technical Particulars Format' furnished by WBSETCL separately.

2 DRAWINGS AND TECHNICAL LITERATURE AND SPARES :

2.1 ***DRAWINGS AND TECHNICAL LITERATURE :***

For the purpose of submission of Tender, the following Drawings and Technical Literature in Triplicate shall be submitted by the bidder along with the Tender:

a) Detailed Drawing of each equipment showing Block Diagram, Plan, Elevation and Side view with all dimensions and weight.
b) Schematic drawing of complete installation of equipment at each substation.
c) Technical Literature covering details of erection, operation, maintenance and technical particulars of each equipment.
d) Technical Literature furnishing principle of operation and detailed Circuit Diagrams of Equipment wherever applicable.

2.2 ***SPARES:***

Bidder to ensure that for all equipment, provision for supply of spares in future will be at least for another 15(fifteen) years.

3 TECHNICAL SPECIFICATION OF PLCC EQUIPMENT:

3.1 **LINE TRAPS:**

Line traps are used in high voltage transmission line to minimize undue loss of the carrier signal in the power station networks. Its impedance shall be negligible at power frequency (50 HZ) so as not to disturb the power transmission but must be relatively high over any frequency band appropriate to carrier transmission.

The coil of line trap shall be designed to tolerate the short circuit current of the line for a short period and shall withstand the mechanical stress resulting from it. HF tuning elements shall be placed in a separate sealed unit.

Line traps are to be tuned for a carrier frequency band which will depend upon the operating carrier frequency pair. Line traps are to be supplied of broad band tuned type.

A resistor shall be added in the tuning elements of the Trap. The resistive component of impedance of the line trap within its bandwidth shall not be less than 450 ohms. for lines with twin conductor per phase (400 KV lines) and shall not be less than 570 ohms. for lines with single conductor per phase (220 KV &132KV lines).

The line trap shall be provided with a protective device which will be designed and arranged so that neither significant alternation in its protective function nor physical damage shall result from either temperature rise of the magnetic field of the main coil at continuous rated current or rated short time current. The protective device shall neither enter into operation or remain in operation following transient actuation by the power frequency voltage developed across the line trap by the rated short time current. The protective devices in the form of lightning arrestor shall be shunt connected to the main coil and the tuning device.
For proper co-ordination with the lightning arrestors installed in the substation the line traps shall be provided with protective device with normal discharge current of 10 KA.

Short duration current rating of the wave trap is the maximum rms. values of the current in KA whose thermal effect, the wave trap shall withstand for a period of one second following a continuous loading at normal rating under standard thermal conditions. The asymmetrical peak value of the first half wave of the rated short time current shall be assumed to be 2.55 times the rms. value. Line traps should conform to the following short time ratings: -

		400 KV	***220 KV***	***132KV***
(a)Normal rating in Amps.	*2000/3150 (for* One & a Half Breaker GIS)		*1250*	*1250*
(b)Short duration current in KA	*50*		*40*	*40*
(c)First current amplitude in KA	*125*		*100*	*100*

The line trap should be outdoor type suitable for being mounted on the top of an insulated structure for 400 KV& 220KV lines and suspension mounted for 132KV lines. This should be mechanically strong to withstand the stresses due to maximum wind pressure of 1500 pa. The insulated structure for 400KV & 220KV lines and suspension mounting arrangementfor 132KV lines should be included in offer.

Line traps shall also conform to the following technical particulars:

		400 KV	220 KV	132KV
(a)	Normal system voltage (KV)	400	220	132
(b)	Maximum system voltage on which line traps are to be used (KV)	420	245	145
(c)	Rated continuous current (Amps)	2000/3150	1250	1250
(d)	Minimum resistive components of Impedance within the Bandwidth (ohms)	450	570	570
(e)	Rated inductance (nett) in mH.	1	1	1
(f)	Visual corona Extinction Voltage (KV rms).	320	-	-
(g)	Radio Interference voltage	Not exceeding 500 uV		
(h)	Blocking Band	(50-500 KHz)		

The bidder shall provide clamps suitable for connecting the line trap to the appropriate ACSR conductor of the H.T. line and substation equipment.

The bidder shall provide clamps suitable for connecting the line trap to the appropriate ACSR conductor of the HT line and substation equipment.

The bidder shall offer 1 mH line traps and shall specify various band width for minimum resistive component of impedance being not less than 450 ohms.(for 400 KV lines) & 570 ohms.(for 220 KV& 132KV lines).

The bidder shall also specify the bandwidth of the untuned line traps within which the tapping loss shall not exceed 2.6 dB. For this tapping loss the characteristic impedance of the H.T. line (phase to earth of a single conductor line) may be assumed to be 320 ohms. for 400 KV, 220KV & 132KV lines.

The tuning device shall be arranged to permit interchange without removing the line trap.

The line trap shall be equipped with bird barrier.
The line trap shall conform to I.E.C. Publication No.353 and I.S. Publication No. 8792.

Suitable terminal connectors as per layout requirement shall be provided for Line Traps. The terminal connectors shall conform to IS: 5561.

4.0 COUPLING DEVICES (LINE MATCHING UNIT AND PROTECTIVE DEVICES) :

"COUPLING DEVICES" for power line carrier circuit, are devices interposed between the coupling capacitors or coupling voltage transformers and the connection line (Co-axial Cable) to the PLC terminals and in conjunction with the coupling capacitor/coupling voltage transformer ensures :

a) The efficient transmission of signals from the connection line to the high voltage line and vice versa.

b) The safety of personnel and protection of low voltage parts of the installation against the effects of power frequency voltage and over voltages. Phase to Phase coupling is to be adopted.

The coupling devices shall be designed to perform the following functions. The coupling device may form a single assembly or be divided into several separate components.

COUPLING FILTERS :

Coupling filter in conjunction with the capacitance of the coupling capacitors/capacitor voltage transformers shall constitute a broad band pass type filter. It should match the characteristic impedance of the high tension line with impedance of the connection line for PLC transmitter/Receiver. The phase to earth characteristic impedance of the high tension line may be assumed to be 320 Ohms for 400 KV lines ,220 KV lines and 132 KV lines.

DRAINAGE OF CHARGING CURRENT:

The primary of the coupling unit shall have a low impedance for operating frequency of the power line (50 Hz) so that the charging current of the coupling capacitor is grounded.

INSULATION :

The matching transformer of the coupling device shall introduce a galvanic isolation between the input and output circuits of the device and should be able to withstand a test voltage of at least 3 KV rms. for 1 minute.

The coupling device shall also be provided with a protective device which shall protect the carrier equipment against excess voltage which may occur when the coupling capacitor becomes defective or the ground connection to the coupling unit is interrupted.

A lightning arrester shall be connected as directly as possible between the primary and earth terminals and shall be capable of protecting the coupling device and the carrier frequency connection.

The lightning arrester shall have power frequency spark over voltage coordinated with the equipment ahead of it.

The coupling device shall conform to the following carrier frequency operating characteristics and apply to phase earth coupling units:

a) Nominal line side impedance (Phase to Earth)	:	320 Ohms (for 400 KV, 220KV & 132KV lines)
b) Nominal equipment side	:	150 ohms for balanced impedance secondary circuit or 75 ohms for unbalanced secondary circuit .
c) Max. Composite loss.	:	Not more than 2 dB.
d) Transmission band.	:	78 to 500 KHz for broad band tuned type.
e) Return loss.	:	The line side and equipment side return losses shall not be less than 12 dB over the whole of the available bandwidth of the coupling device.
f) Nominal peak envelope power (for inter modulation product 80 db down)	:	Not less than 650 watts.

The bidders may note that composite loss is the power loss occurring in the carrier signal after passing through the coupling unit complete with CCs or CVTs. Coupling unit is supposed to be loaded with its primary and secondary impedance while capacitor is assumed to have no loss.

The bidders shall specify the capacitance of the coupling capacitors/CVTs with which the coupling unit may be used for the above transmission band.

Two nos. phase to earth coupling units should be capable of being used to form inter phase or interline coupling. In case any separate matching transformer or matching unit is required the same shall be offered.

The bidder shall also offer suitable earthing switches for grounding the low voltage terminals of the CC/CVT for carrying out maintenance, dismantling of coupling device assembly or any other works on coupling unit. The earth switch shall have to be mounted on the structure separately. Separate Drainage Coil should be incorporated in the coupling device.

The coupling device should be suitable for outdoor mounting and shall be fitted on the steel structure which shall also be used for mounting CCs/CVTs. Temperature of metallic equipment mounted outdoor is expected to rise up to 65.6^{o}C during maximum ambient temperature of 50^{o}C specified. The equipment offered shall satisfactorily operate under these conditions.

The coupling device shall conform to the IEC publication No.481 and I.S.No.8997.

The connection between coupling device and CC/CVT shall be done by means of 6 sq.mm. copper conductor taped with 11 KV insulation.

5.0 HIGH FREQUENCY CABLE :

High frequency cable shall be offered to connect coupling unit installed in the switchyard to the PLC terminals installed indoors. The high frequency cable to be offered by the bidders shall be suitable for being laid directly to the ground or in trenches or in ducts. The cable shall be lead sheathed and steel armoured. The capacitance of the cable shall be low so as to minimize attenuation at the carrier frequency range. The impedance of the cable shall be so as to match with the output impedance of PLC terminals and secondary impedance of the coupling units. The cable shall be insulated to withstand a test voltage of 4 KV rms. for one minute between conductor & outer sheath. The bidder shall offer Co-axial H.F. cable with 75 Ohms impedance (unbalanced.)

The bidders shall furnish the values of attenuation per KM for the high frequency cables offered at various values of carrier frequencies in the range of 40 KHZ to 500 KHZ.

The maximum attenuation at various frequencies shall be as follows:

Frequency in KHz	Attenuation in dB /Km
10	1.2
60	1.8
300	3.9
500	5.5

High frequency cable shall be required to be supplied on drums containing lengths of 500 or 1000 metres of continious length.

The H.F.cable shall conform to the I.S. Publication No.11967.

6.0 POWER LINE CARRIER TERMINALS:

Single side band PLC terminals of latest I.C. version equipped for fixed frequency duplex system working shall be offered for speech and superimposed channels (multipurpose) and for protection purpose. The PLC terminals shall be complete with H.F. Hybrid & filters and shall have necessary frequency stability so that adjacent channel working is possible.

The PLC terminal shall be mounted in a floor mounting, vermin proof, sheet metal cubicle. The construction shall be modular in nature and the terminal shall be provided with sufficient test points on various printed circuit boards and built in indicating instruments to check up important voltages and dB levels in various parts of the PLC terminals. The fuses shall be so mounted as to allow their easy identification, inspection and replacement. Suitable supervision and alarm facilities and potential free contacts for repeat purposes shall be provided to enable these to be used for annunciation on the main control panels. All individual parts of the carrier terminals shall be accessible from the front so that erection of various cabinets side by side and back to back will be possible. All component parts of the PLC terminals shall be suitably tropicalised and protected against harmful effects of humidity, fungus etc. The cabinet shall be suitable for bottom cable entry. Screw clamp type terminals shall be provided for interconnection wiring. The terminal should be provided with proper ventilating arrangement and locking arrangement for prevention of wrong insertion of printing card.

The input and output parameters shall be in accordance with the recommended values of IEC : 495 for an ambient temperature range of 0-50^0 C. The equipment shall be capable to withstand 55^0 C for six hours continuously.
PLC terminals shall conform to the following electrical characteristics :

a)	Mode of transmission	: Single side band amplitude modulation.
b)	H.F. range	: 40 to 500 KHz.
c)	Nominal carrier frequency band	: 1 x 4 KHz for single channel sets. 2 x 4 KHz for twin channel sets.
d)	Effectively transmitted speech frequency band or signal frequency band when only speech or signal is transmitted	: 300 Hz to 3400 HZ or more.
e) i)	Effectively transmitted, speech plus signal frequency band in case of multipurpose use	: Speech : 300 to 2000 Hz : Signal : 2160 to 3400 Hz or more.
ii)	The Transit Band Pass filter should be of wide band (2000-3400 Hz)	
f)	Nominal Impedance	:
i)	Carrier Frequency Side	: 75 ohms unbalanced or 150 ohms balanced.
ii)	VF side	: 600 ohms.
iii)	Return loss within the carrier frequency band.	: shall not be less than 14 dB Suitable strapping should be provided for 75 ohms and 150 ohms.
g)	Nominal carrier frequency power (peak envelope power available at line output terminal of the equipment at a resistive load equal to the nominal load impedance for voice and data transmission).	: Adequate to maintain S/N ratio under adverse conditions.
h)	Supply voltage	: 48 V.D.C.(+ 15% - 10%) with +ve pole earthed. The PLC terminal shall provide protection against short circuit of the output terminals of power supply units to ensure that the unit is switched off from supply without causing any damage to the power supply unit itself.
i)	Frequency difference between voice frequency band transmitter and receiver in a pair of PLC terminals.	: as per relevant IEC specifications
j)	Stability of carrier frequency from its nominal value.	: +/- 5 Hz

k) Effectively transmitted speech and data signal frequency band Should be within. : 0.3 to 3.76 KHz.

l) Relative levels (VF side) : Across 600 ohms
a) 4 Wire transmit : 0 to 17 dBr.
b) 4 Wire receive : - 3.5 dBr. to + 8 dBr.
c) 2 Wire transmit : 0 dBr.
d) 2 Wire receive : - 7 dBr.

m) Level regulations control (Automatic Gain Control) : In case of a 30 dB change in the carrier frequency signal level within the regulation range, the change in voice frequency receiver levels of both speech & signals shall be less than 1 dB.

n) Telephone signaling channel : i) By frequency shift keying suitable for both 2-wire and 4-wire mode of communication.

: ii) The signaling channel shall be operated by a potential free open or closed contact of the relays at the transmit side and provide a potential free change over contact at the receiver side of the relays. All relays to be provided in the speech circuits shall be hermetically sealed.

o) Permissible limits for variation of overall loss (attenuation) of the speech channel relative to 800 HZ for back to back operation of one pair of terminals without compander.

300 - 400 Hz : - 0.9 to + 3.0 dB
400 - 600 Hz : - 0.9 to + 1.8 dB
600 - 1600 Hz : - 0.9 to + 0.9 dB
1600 - 2000 Hz : - 0.9 to + 1.8 dB
2000 - 2400 Hz: - 0.9 to + 1.8 dB

} or +/-1.5 dB for the complete band of 300 to 2400Hz (without compander)

p) R.F. sensitivity : - 43 dBm

q) Noise performance : i) Noise generated within the terminals. The weighted telephone noise level measured at the speech output of a pair of PLC terminals without companders shall not exceed -60 dBm. OP, measurement shall be carried out as per I.E.C. specification No.495 of 1974.

: ii) Signal to noise ration (as per report committee no.14 Tele transmission of CIGRE of 1962) for voice communication referred to 1 mW at a relative level of zero : 35 dB.

The bidder shall offer voice frequency companders to be used in conjunction with the PLC terminals for speech as moduler items. The terminal shall also be provided with Jack Telephones and 4-wire Extension Desk Telephones with signaling facilities for point to point communication.

The PLC terminals shall be provided with emergency call facilities from the carrier sets for point to point carrier communication and complete with telephone suitable for hanging inside the cabinet.

The PLC terminals should be of vermin proof and provided with a ventilating fan. Necessary socketing arrangement for connection of the H.F. cable from the coupling device shall have to be provided.

Additional accessories (Dummy Load , Laptop with necessary software etc.) wherever necessary are to be provided with the PLCC carrier such that the Transmitter of the PLCC can be looped back to its own Receiver in order to carry out local testing of the PLCC terminal.

Print Extender should be provided along with each PLCC carrier to have the testing facility of PLCC prints at site.

The following tests shall be carried out :

i) " Voltage withstand tests indicated in relevant IEC/IS – Specification. The bidder shall however have to clearly indicate the voltage withstand value of the equipment."
ii) The carrier link shall be set up by connecting two terminals with an intermediate circuit simulating actual worst conditions of maximum loss, white loss, noise spikes. The system shall perform satisfactorily for all combinations of inputs. This test shall be carried out for a period of 3 days.
iii) Before and after the above test measurements of input and output values will be made and the results shall satisfy the requirements indicated in IEC-495.
iv) All modules and sub assemblies shall be energized and tested individually as well as in assembled form at the factory.

The bidder shall submit the guaranteed technical particulars of PLC terminals in accordance with guaranteed technical particulars furnished separately.

7.0 VOICE FREQUENCY TRANSMISSION EQUIPMENT FOR TELE PROTECTION :

Voice Frequency Telemetering Equipment/MODEM is required for telemetering purpose for direct interfacing of Remote Terminal Unit's (RTU) data i.e. digital data to PLCC Panel.

The F.M. voice frequency transmission equipment for protection signaling is required for transferring the trip commands from one end of the line to the other for remote tripping of breaker as indicated in Para 1.5.3,1.5.7, 1.5.8,1.5.9. These channels shall be provided on the multipurpose PLC terminals for protection of each 400 KV & 220KV circuit. One single channel tele- protection equipment should be capable to provide 400 &220KV KV double circuit protection.

The equipment shall be of modular construction and of plug in type using solid state components/integrated circuits and shall be mounted in vermin proof steel cabinets. The equipment shall be provided with sufficient test points on the printed circuit Board and

built in indicating instruments to check up important voltages and currents in various circuits. The fuse shall be so mounted as to allow their easy identification, inspection and replacement. Suitable supervision and alarm facilities and potential free contacts for repeat alarm purpose shall be provided.

All individual parts of the equipment shall be accessible from front so that the equipment can be mounted back to back against wall. The equipment shall be suitably tropicalised and protected against the harmful effects of humidity, fungus etc. The cabinet shall be suitable for top or bottom entry. Screw clamp terminals shall be provided for interconnection with relaying equipment.

It shall be possible to test the reliability of the protection channels end to end with the equipment remaining fully operational to ensure that the genuine trip command will be transmitted during testing. Counters to register the number of trip commands transmitted/received shall be provided at both ends**.**

The voice frequency transmission equipment shall be insensitive to corona noise and shall remain unaffected by impulse type noises generated by the operation of switchgear equipment or by short circuit arcs. The bidder shall clearly explain the measures adopted to make the equipment insensitive to corona noise and impulse type of noise of amplitude greater than the level of the trip signal. The equipment shall have reliability and high security within the stipulated transmission time.

The speed of trip circuit transfer channel shall be such that the time interval measured from the point of energisation of transmitter(through transmission of the signal over carrier link) and closing of the output contact at the receiver end shall not exceed 25 ms. It is presumed that the output contact provided in the receiver is capable of making and breaking the trip coil circuit of 400 KV & 220KV breaker whose rating is 220 V DC 200 W per trip coil per phase. In case however, an additional auxiliary relay is needed to be included for providing the contact of desired rating, the above mentioned trip transfer time of 25 ms shall be inclusive of the operating time of the auxiliary relay.

Protection signaling equipment shall be suitable for direct and permissive tripping of remote end breaker. It shall provide transmission and reception facility for minimum of two protection signal. The protection equipment offered by the bidder shall include minimum two sets of protection couplers; one as a back up of other connected with two nos. carrier channels so that in case of failure of either of the carrier channel or protection coupler the system is taken care off by the second one.

The protection equipment offered by the bidder shall include 2 Nos. of change over contacts as spares for use by the protection relaying scheme. In addition to those, 4 nos. of spare change over contacts shall be provided for each of the supervision contacts provided in this protection equipment.

The protection equipment shall work of supply voltage of 48V (+ pole earthed) with +15% to - 10% voltage variation and necessary power supply modules if the equipment is working of other voltage shall be supplied duly wired.

It has to be ensured that under no circumstances protection channel should share the power. Each protection channel shall be able to transmit power for which the system is designed. Speech and superimposed data signals, in the same protection terminal should get disconnected momentarily during the operation of protection channels.

The type tests and routine tests as indicated in the relevant IEC or applicable standard shall be done in presence of the purchaser or his authorized representative. The equipment will be despatched only after the test reports are approved.

For all telemetering purpose including data communication screened armoured type copper cable of suitable dimension and specification as per relevant IS/IEC shall have to be used.

8.0 ELETRONIC PRIVATE AUTOMATIC EXCHANGE (Microprocessor Based):

The EPAX will serve as a network node or terminating exchange for carrier telephone, for trunk dialing system on PLCC. It should handle both local and long distance traffic. Electronic PAX of latest design should be offered with suitable programmable features. The electronic PAX offered should be capable of operating along with the existing carrier terminals and existing EPAX. Also it should, if necessary eliminate the use of existing EPAX at the station where it is installed. All functions of the existing EPAX should be handled by the offered electronic type PAX. Fully automatic operation among the local subscriber of the exchange and any outgoing direction over the carrier channel should be possible.

The EPAX should be suitable for connection with new PLCC panel or existing PLCC panel and Fibre Optic panel simultaneously at any station wherever required whatever be the make of PLCC panels and Fibre Optic Panels.

The exchange should be of modular construction, housed in sheet steel cabinet, floor mounting type and available for operation on 48V DC (+15% - 10%). The EPAX should employ TDM-PCM technology with a fully non-blocking switching system. It should support 16 local extensions and 24 E&M Trunk Lines. The EPAX should be provided with conventional modern facilities like dial, busy, ringing, ring back and also additional tones such as carrier tones, interrupted tones etc. In addition, the EPAX must be equipped with priority within the exchange and priority over Trunk Lines and to Transit calls at the distant end. The EPAX should have Barred Access to Trunk Lines and to Transit calls. The EPAX should be able to find 5 alternative switching routes other than the main route. The EPAX must have both 2-digit and 3-digit station- numbering facility. It should have programmable selection facility for number of out pulse digit. The EPAX should be equipped with modern self-checking diagnostic and monitoring facilities. Adequate protective devices should be incorporated wherever necessary. Provision for minimum 8 E&M Trunk Lines and 16 local extensions shall have to be kept in the EPAX for future use.

The Push Button Telephone should be as per DOT norms and should match with the EPAX.

The bidder shall be responsible to provide workable interconnection of the EPAX with all PLCC panels. Telephone signal from EPAX shall have to be taken to control desk and other locations as required in good quality.

Only screened armoured type telephone cable should be supplied for all type of two wire & four wire connections.

9.0 LEAD ACID STORAGE BATTERY:

TECHNICAL SPECIFICATION :

i) POWER SUPPLY :

The equipment shall conform to the requirement of the latest edition of relevant I.E.C/I.S. specification as mentioned below :

IS - 226 of Sulphuric Acid
IS - 1652 of Lead Acid Battery with plante positive plates.
IS - 2206 of HRC cartridge fuses.
IS - 1069 of Water for storage battery (General)

D.C. Power supply shall comprise of Battery and Battery charger in parallel operation. In this mode, the charger shall be required not only to continuously feed a variable load but also deliver trickle / quick charge current for the battery.

Normally the battery shall float across the charger in a fully charged condition at a voltage corresponding to 2.15 V/Cell to 2.25 V/Cell depending on trickle current requirements of the battery. When floated as above, internal losses of the Battery shall be fully compensated and it shall not be necessary to raise its voltage beyond 2.4 V/Cell at any time during its service time. For first charge, however, when load shall not be connected across the charger, the battery shall require a voltage of up to 2.75 V/Cell for forming the plates.

Battery charger shall be designed to have a current limiting feature such that its output voltage falls rapidly with increase in output current beyond the rated capacity.

Note : Rated load current requirement of all equipment is normally fed from the battery charger.

ii) LEAD ACID STATIONARY BATTERY :

Bidder shall quote for 24 cell lead acid Plante Type Battery. Battery shall have adequate capacity to feed the rated load for a period of approximately ten hours after the mains fails. For the above purpose, it may be assumed that battery is in the fully charged condition when mains failure occurs. Furthermore for estimating required ampere hours capacity of the battery the following derated factors and margin shall be taken into account.

a) Derating factor on account of ageing of the battery : 90% i.e., a factor of 1.11
b) Derating factor on account of decrease in ambient temperature 1.0% per degree centrigade.
c) 10% margin in capacity.

Note : It may be assumed that in winter months room temperature shall not fall below $0^{o}C$. Tenderer shall give detailed calculation in his bid.

Refer Schedule enclosed for Battery accessories.

Battery shall be completed with acid stand, inter-row and inter-tier connectors. The battery may either be assembled and given the first charge at site or it may comprise performed enclosed type cells designed for stationary telephone exchange.

BATTERY RACK/STAND:

The wooden rack shall be made of good quality wood. They shall be free standing type mounted on porcelain band rubber insulators. The arrangement shall be subject to the approval of the Employer/owner. Battery racks and wooden supports for cable termination shall be coated with three (3) coats of anti-acid paint of approved shade. Numbering tags for each cell shall be attached on to the battery racks.

Batteries shall conform to all type tests as per latest IS.

All acceptance tests as required by relevant Indian standard shall be carried out at site after completion of installation. The capacity tests shall be carried out for 10 hour discharge rating.

BATTERY ACCESSPROES:

Each battery is to be provided with the following set of accessories:

1.	Syringe type Hydrometer	2 Nos
2.	Thermometer	2 Nos
3.	Specific gravity correction chart	1 No
4.	Digital Multimeter	1 No
5.	Rubber Apron	2 Nos
6.	Rubber Gloves	2 Pairs
7.	Wall mounting poly holder for Hydrometer	1 Set
8.	Spanner	2 sets
9.	Cell lifting straps	2 Nos
10.	Glass/Plastic Funnel	2 Nos
11.	Rubber Syphon	2 Nos
12.	Acid resisting jug	2 Nos
13.	Rubber boots (knee high)	2 Pairs
14.	Rubber syringe	2 Nos
15.	Any other accessories/device required for the battery	
16.	Maintenance instructions.	

11. BATTERY CHARGER (48V) :

11.1 SCOPE :

11.1.1 This specification covers the design, manufacture, assembly, testing at manufacturer's works, supply, delivery, erection and commissioning at site of battery charger in 400/220/132/33KV, 220/132/33KV & 132/33KV sub-station with provisions of both float and boost charging of battery. The battery will be procured separately as per specification of battery.

11.1.2 The minimum ampere-hour ratings of battery for 400/220/132/33KV S/stn.shall be 300 AH. The voltage rating of 300AH battery shall be 48 +/- 10% volt. For 220/132/33KV S/stn&132/33KVS/stnthe minimum ampere-hour rating of battery Shall be 200AH.The voltage rating of 200AH battery shall be 48± 10% volt. D.C. system shall consists of two no. Battery Charger of 48V, 300AH for 400/220/132/33KV S/stn.and one no. Battery Charger of 48V, 200AH for 220/132/33KV S/stn&132/33KVS/stn For 400KV S/stn there shall be two sets of battery having ampere-hour rating of 300AH and for all other voltage class one no. Battery set having rating of 200AH.

11.2STANDARDS :

11.2.1 The equipment covered by this specification shall unless otherwise stated, be designed, constructed and tested in accordance with the applicable sections of the latest Indian Standard specification and Indian Electricity Rules.

IS :2026	Power Transformer
IS :2959	AC Contactors for voltages not exceeding 1000 Volts.
IS :1248	Indicating instruments
IS : 2208	HRC Fuses
IS :13947(P-3)	Airbreak switches, disconnectors& fuse combination units for voltage not exceeding 1000 V AC or 1200 V DC.
IS :2147	Degree of protection provided by enclosures for low voltage swichgear& control gear
IS :3231	Electrical relays for Power System Protection
IS :3842	Electrical relays for A C System Protection
IS :5	Colours for ready mix paint

11.3 DEVIATIONS :

11.3.1 Normally the offer should be as per Technical Specification without any deviation. But any deviation felt necessary to improve performance, efficiency and utility of equipment must be mentioned in the Deviation Schedule with reasons duly supported by documentary evidence and advantages of such deviations. Deviations suggested may or may not be accepted. But deviations not mentioned in Deviation Schedule will not be considered.

11.4 MINIMUM RATING OF THE BATTERIES :

It shall be possible to set the charger to the following voltages across its battery terminals by means of a switch on the front of panel.

i) Trickle Charge : A preset voltage corresponding to 2.15 V/Cell
to 2.25 V/Cell as required.

ii) Quick Charge (during failure of main Float Charger) : A preset voltage corresponding to
2.4 V/Cell.

iii) Boost Charger : Continuously variable between 2.45 V/Cell
and 2.75 V/Cell as required.

iv) Provision of dropper diode should be kept in order to limit the load voltage within specification during quick mode of operation.

11.5 LOAD IMPOSED ON CHARGERS :

The following load will be imposed on the chargers :

Under normal operating conditions the charger should give a D.C. outputto PLCC Terminals, Protection Coupler Units, Fiber Optic Terminals, EPAXes etc. as and when required as well as float charging current of the battery.

11.6 RATING OF THE CHARGERS :

The float charger and the float-cum-Boost Charger shall have adjustable output current 60 Amps D.C. for 300 AH for float charging and 60 Amps DC for boost charging. Charger shall have 20% spare capability. The float charger and float cum-boost charger shall have adjustable current 50Amps DC for 200AH for float charging and 50Amps DC for boost charging. Charger shall have 20% spare capacity.

11.7 GENERAL DESCRIPTION FOR CHARGERS OF 48 V, 300 AH BATTERY AND 48V ,200AH BATTERY :

11.7.1 The charger shall be enclosed in a sheet steel enclosure made of 14 gauge cold rolled sheet steel, dust and vermin proof, floor mounted type with ventilating louvers with fine wire copper mesh on two sides and with rear access doors. The charger shall be suitable for indoor installation in a clean but hot and humid tropical atmosphere. Removable gland plates for all cables and lugs for power cables shall be within the scope of bidder. The lugs for power cable shall be made of electrolytic copper with tin coat. The charger shall have hinged double leaf doors provided on front and on backside for adequate access to the inside of the charger. All charger cubicle doors shall be properly earthed.

11.7.2 All the elements used in the battery charging scheme shall be suitably rated for the duty involved. The fuses shall be of HRC link type and of proper rating of the circuit to be protected. All the instruments, switches and control equipment shall be from reputed manufacturer and be of best quality and shall conform to the relevant I.S. Specification. The switch shall be complete with position indicators. The switches and

indicating lamps shall be flush/semiflush type mounted on the front panel and shall be provided with name plate of approved type. The meter shall be of 96 mm X 96 mm square dial and shall be flush mounted on the front panel. All the semi conductor devices shall be from reputed manufacturer and shall be protected with power transient suppressor circuit. In addition necessary fuses shall be provided for short circuit protection. The rectifier transformer shall be continuously rated, dry air cooled (AN) of class B insulation type. The rating of the transformer shall have 10% overload capacity. The transformer shall be of suitable rating to comply with maximum output with minimum input voltage. The maximum temperature attained by any part of the equipment of the battery charger at specified rating should not exceed the permissible limits as stipulated in relevant I.S.S. The designing of the equipment shall be made taking 50^{o}C as ambient temperature of the site.

11.7.3 The wiring shall be complete in all respect with PVC insulated stranded copper wire and the size of the wire shall not be less than 2.5 sq.mm. Each wire shall be continuous from end to end and shall not have any joint within itself. The insulation grade of the wiring shall be 1100 V grade. The colour of 3 Phase, 4 Wire AC.supply shall be red, yellow, blue and black for phases and neutral. The D.C.wiring shall be of the colour other than the above (preferably grey) with the +ve and -ve marking in the ferrule. Terminal ends of all the wires shall be provided with numbered ferrules, suitably coloured as mentioned for wires above. All spare contacts of relays and switches shall be wired upto the terminal block. At least 20 % spare terminals shall be provided for control. The insulation of all circuits except the low voltage electronic circuits shall withstand test voltage of 2 KV AC for one minute. An air clearance of at least 10 mm shall be maintained throughout right up to terminal lugs. Whenever this clearance is not available, the live parts shall be insulated or shrouded.

11.7.4 The input terminals of the battery charger shall be marked "R,Y,B,N" for AC. supply. The terminals where battery will be connected shall be marked as -ve (24), -ve (tap cell) and +ve common. There shall be five load terminals each of which shall be of 6A rating, one load terminal of 10A rating and one load terminal equal to the full load capacity of the charger. **Charger shall be wired such that positive poles of both charger and the battery shall be earthed.**

Charger output shall be substantially free from switching surges, transients and hunting etc. Output circuit of the charger shall have proof against short circuit on the load side.

11.7.5 The interior and the exterior of the battery charger cabinet shall be properly painted conforming to the latest issue of relevant ISS. The finishing coat on the exterior of the panels shall be deep grey, polished cellulose enamel or equivalent, sprayed to present delightful appearance while on interior faces, the finishing coat shall be of light grey shaded paint (Shade - 631 of IS:5), sprayed to give a contrasting effect with the cubicle wiring and shall be according to ISS. The degree of protection of charger enclosure shall be at least IP-42 as per IS:2147.

11.7.6 Calculation for the ratings of the transformer and other particulars of the elements considered in the battery charging scheme are to be furnished by the successful bidder during detailed engineering indicating the basic design data.

11.7.7 Copper Earth bus of suitable cross section shall have to be used in the charger for earthing purpose.

11.8 SYSTEM DESCRIPTION FOR CHARGERS OF 48V, 300 AH, &48V ,200AH BATTERY :

11.8.1 The charger shall be suitable for charging the battery and supplying the load simultaneously. The entire charger scheme shall be divided in two sections, "float charger section" and "float-cum-boost charger section". The float-cum-booster charger shall be suitably operated either in float mode or in boost-cum-standby float charger mode.

11.8.2 Under normal operating condition, with the input AC supply present, the float charger section' shall supply the DC load and also float the battery by trickle charging and the "float cum boost charger section" shall be kept off.

11.8.3 In the event of main AC supply failure, the battery shall supply DC power to the Sub-station DC Load. The battery thus discharged shall be charged after resumption of AC. supply by the boost charger. Now, the `float-cum-boost charger section' shall be kept in boost mode through float/ Boost selector switch at the specified current needed for the battery. During this operation, `the float charger section' shall supply the load current only while boost charger section of float cum boost charger shall boost charge the battery and the load supply shall be disconnected from the battery through a contact of a contactor. If the `float charger' fails during this period**,** the Float cum Boost charger will change its mode of operation to quick charge mode and charge the battery bank at constant voltage (i.e. At a preset voltage corresponding to 2.4 V/cell) with current limit (finishing rate at battery terminal) method and simultaneously take care of connected DC load thru dropper diodes, without any interruption. Load terminal voltage is kept within 48V+/-10% limits. Manual quick charge selection facility shall be provided in the charger. So that Float cum Boost charger shall suitably rated to take care of load as well as charging current of the Battery. In boost mode the charger shall be capable of quick charging the battery upto 2.75 Volts per cell and also capable of restoring fully discharged battery to a state of full charge in eight hours with 25% spare margin over maximum charging rate.

11.8.4 If there is any trouble in " float charger section ",i.e**.** When converter kept at off/standby mode, If Main Float fails, this section will immediately switched on at float mode and take over the function of Main Float without any interruption. Normally Battery shall be kept parallel with load bus thru D.C. contactor.Suitable arrangement shall be provided at the charger output circuit for isolation of battery during maintenance.

11.8.5 For accommodation of these two sections, separate compartments shall be used so that maintenance or rectification work can be carried out in one section while the other remains in service.

11.8.6 The "float charger section" & the "float cum boost charger section" are detailed below :

Float charger section : The AC input supply, 400 volts ± 10%, 3 phase, 4 wire, 50 Hz, shall be provided through suitably rated switches and fuses/MCCB & contactor having thermal over load and short circuit protection. This section is capable of supplying the DC load while floating the battery. The thermal overload contacts shall be used for isolation of charger circuitry from input AC. supply as well as to give audio and visual alarm. The incoming supply shall be fed to a three phase, double wound step down transformer, secondary of which shall be connected to a three phase, full wave thyristor bridge rectifier unit with suitable surge suppressor circuit. An automatic voltage controller unit shall control the output voltage of the float charger by adjusting the firing angle of the thyristors. Provision shall also be kept for manual operation by adjustment of potentiometer through an auto/manual selector switch. Automatic voltage regulation shall be provided to maintain the float charger DC output voltage within ±1% from no load to full load and or AC line voltage variation of ±10%. Suitable choke and filter circuit shall be provided to get stabilised and to limit ripple content within 5mV psophometricat full load with battery disconnected. The DC output voltage shall be connected to the load bus through blocking diode at the positive pole of the output circuit to prevent reverse current flow from battery into the charger and a set of fuses.

11.8.7 Four numbers indicating lamps shall be provided, three for AC. supply ON indication and one for float charger ON indication. One ammeter with necessary shunt, for measuring float charger output current, shall be provided.

11.8.8 All fuses shall be of HRC link type. Necessary number of fuses of proper ratings shall be provided at the output of the transformer and rectifier. Fuse failure alarm both audio and visual shall be provided for battery fuse, rectifier fuse and charger output fuse. One charger failure relay after charger output fuse shall be provided to give audible as well as visual alarm, in case of failure of float charger.

11.8.9 Float cum boost charger section : The AC input supply, 400 Volts +/-10%, 3 phase 4 wire, 50 Hz shall be provided through switches and fuses/MCCB & contactor of suitable rating with thermal over load and short circuit protection . This section is capable of either supplying the DC load while charging the battery in float mode or in boost mode for quick charge the battery after heavy drainage through a suitable Float/boost selector switch. An automatic voltage controller for float charging and automatic current controller for boost charging shall control the output voltage and current of the float and boost charge respectively by adjusting the firing angle of the thyristor. The thermal overload relay contacts shall be used for isolation of charger circuitry from input supply as well as to give audible and visual alarm. The incoming supply shall be fed to a three phase, double wound step down transformer. The voltage variation and the battery charging current variation can also be carried out by manual adjustment of potentiometer through Auto/manual selector switch, for both the float and boost charge mode of operation in addition to normal load supply. The secondary of the transformer shall be connected to a three phase full wave thyristor-bridge rectifier unit with suitable surge suppressor circuit. Suitable choke and filter circuit shall be provided to getstabilised and to bring down the ripple at the output within the specified limit (5mV psophometric at float mode with battery disconnected).The DC output voltage shall be connected to the load bus through a blocking diode at the positive pole of the output circuit to prevent reverse current flow from battery into the charger & a set of fuses. When operated in float mode the charger

should have automatic voltage regulation to maintain the float charger DC output voltage within ±1% from no load to full load and or AC line voltage variation of ±10%.

When battery voltage drops below a set value, the charger is switch ON in the boost mode and charging starts automatically at a starting rate and will be maintained constant current up to 2.35v/cell which is automatically monitored by the electronic current controller unit. Once the battery voltage reaches up to 2.35v/cell, the charging current will be reduced to the finishing rate automatically by the current controller circuit. The finishing rate will be maintained up to 2.75v/cell and there after the converter will be transferred to standby mode automatically. However, if power supply fails, while boost charging operation is in progress, the battery shall be connected to the load bus through the DC contactor immediately to avoid any interruption. A Tap Cell diode should be incorporated between an intermediate cell and the load bus to provide an uninterrupted DC supply to the load bus.

11.8.10 Four nos.indicating lamps shall be provided, three for AC. supply `ON' indication and one for "float cum boost charger" `ON' indication. Three nos. ammeter with shunt shall be provided for measuring boost, on demand float charger output currentand battery current (centre zero) . Adequate no.of fuses of proper ratings shall be provided at the output of the rectifier unit. Fuse failure alarm both audio and visual shall be provided for rectifier fuse, Filter capaciter, charger output fuse over current fuse, battery isolation fuse etc.

11.8.11 One charger failure relay after charger output fuse shall be provided to give audible as well as visual alarm, in case of failure of charger.

11.8.12 For all charger scheme, one voltmeter with fuse and voltmeter selector switch (RY-YB-BR-OFF) shall be provided for measuring the AC. input supply. Another voltmeter with fuse and suitable voltmeter selector switch with provision of OFF position shall be provided to measure the float charger output voltage (load), float cum boost charger output voltage (load), battery voltage at 24 and 'TapCell' and the load voltage. The battery shall be connected to the DC output of the charger through a continuous duty triple pole 100 amp switch, lockable in both ON and OFF position with battery isolation fuses. For the entire charger scheme, the annunciation scheme having audio and visual alarm with common bell and accept reset and test push buttons and separate windows shall be provided for the following types of fault occurrence :

i) AC Input fail
ii) Wrong phase sequence
iii) Over and under voltage at DC output for variation of DC voltage more than +/- 10% of the rated value
iv) Under voltage of AC input,
v) Individual charger failure,
vi) Individual charger thermal overload,
vii) Earth fault of the DC bus and
viii) Battery Earth Fault (+ ve) and (- ve).
ix) Rectifier fuse fail
x) Filter capaciter fuse fail
xi) Charger output fuse fail

xii) Charger over current
xiii) Battery isolation fuse fail

The charger shall be provided with an over voltage mains release, alarm (remote) and indication (local) whenever voltage across load terminals exceeds 55 volts.

The charger shall give an indication locally and make a potential free contact available for operating a bell at a remote point whenever main fails or charger develops a fault and load is supplied by the battery.

Note : In the above condition the load shall be fed by the battery even after the main has been disconnected.

11.8.13 Suitable audio and visual alarm shall be provided for failure of load fuse. One space heater with thermostat and ON-OFF switch and fuse, one cubicle illumination fluorescent tube (230 V, single phase AC), operated from door switch and one D.C. emergency lamp with switch shall be provided for the charger panel.

11.8.14 Other instruments and devices, required to complete the total scheme shall also be supplied.

11.8.15 The detailed circuit diagram of the entire scheme as well as separate circuit diagrams of each of the various modules used for the system shall be furnished by the successful bidder.

The terminal numbers and ferrule numbers must be clearly furnished in the drawing.

11.9 PACKING :

All equipments shall have to be despatched suitably and securely, packed in wooden crates, suitable for handling during transit by rail and/or road.

11.10 GUARANTEE :

Electrical characteristics shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, WBSETCL shall have right to reject the material. Guaranteed Technical Particulars are to be submitted by successful bidder during detailed engineering alongwith submitted drawings/documents. However format for submission of GTP shall be handed over to intending bidders at the time of sale of tender documents.

11.11 CONTACT DRAWINGS, CATALOGUE AND MANUALS :

In the event of placement of Letter of Award, general arrangement drawing and schematic drawing, manuals and catalogue of different equipment of charger are to be submitted in six (6) copies to the Chief Engineer, Engineering, WBSETCL, VidyutBhavan (9^{th} floor), Salt Lake, Kolkata-700 091,as per schedule of submission of drawings for our approval. After the drawings are approved, ten(10) copies of contract drawings, approved G.T.P., and catalogue of each type of charger shall be submitted. The contract drawings shall cover the following :

i) General arrangement drawing for the chargers and dimensional details and erection arrangement of the charger.
ii) Schematic diagram for the charger and detailed circuit diagram of the modules used for the system.
iii) Wiring diagrams of the charger. The master copy/original plates of all the final contract drawings shall have to be supplied thereafter.
iv) Other drawings, operation and maintenance manuals for each charger describing therein service and maintenance instructions for the chargers, list of equipment and their particulars provided in the charger, their function and detailed write-up of the method of operation shall also be submitted.

11.12 TESTS AT MANUFACTURER'S WORKS AND TEST CERTIFICATES :

11.12.1 Battery Chargers shall conform to all types tests as per relevant Indian Standard. Performance tests on the chargers shall be carried out as per specification. Rectifier transformer shall conform to all type tests specified in IS : 4540 and short circuit test as per IS :2026.

11.12.2 The supplier may be required to demonstrate to WBSETCL that the chargers conform to the specification particularly regarding continuous rating, ripple free output, voltage regulation and load limiting characteristics before despatch as well as after installation at site.

The following tests shall be carried out in the presence of WBSETCL's representative, and six (6) copies of test certificates for each set of charger shall be submitted to the Chief Engineer (Tr. Proj.), for approval.

i) Checking of wiring and continuity of circuits.
ii) High voltage test on the equipment with accessories – All equipments and wiring shall be tested for withstanding the power frequency voltage of 3 KV (rms) to earth for 1 minute.
iii) Insulation Resistance of each circuit before and after high voltage test.
iv) Performance test and temperature rise test.
v) Checking of Load Limiting Features.
vi) Line Regulation and Load Regulation Test.
vii) Checking of relay operation and annunciation
viii) Routine tests according to the relevant *national standards on the transformers, rectifiers, instruments and other devices.*

WBSETCL reserve the right to reject any equipment/auxiliaries or finished product if the same is not found to comply with the requirements of relevant IS/tests and this specification. The entire cost of acceptance and routine tests that are to be carried out as per relevant IS shall be treated as included in quoted price of the battery chargers. Contractor shall give at least 21 (twenty one) days advance notice intimating the actual date of inspection and details of all tests that are to be carried out.

SPECIFIC TECHNICAL PARAMETERS

SNO	DESCRIPTION	*FOR 132/33KV S/stn.*	*FOR 220/132/33KV S/stn.*	*FOR 400/220/132/33KV S/stn.*

1.	D. C. Voltage (V)	**48 +/-10%**	**48 +/-10%**	**48 +/-10%**
2.	Minimum Ampere Hour (AH) rating of battery	200	200	300
3.	No. of cells (No.)	24	24	24
4.	Ratings of voltage/cell a) Trickle charge (V) b) Quick charge (V)	2.15 to 2.25 1.85 to 2.75	2.15 to 2.25 1.85 to 2.75	2.15 to 2.25 1.85 to 2.75
5	Steady demand load (A)	50	50	60
6	Charger current rating a) Float (A) b) Float cum boost (A)	50 50	50 50	60 60
7.	Sheet steel thickness (SWG)	14	14	14
8.	Dial size of flush mounted Metres (mm^2)	96	96	96
9.	Ambient Temperature	50^oC	50^oC	50^oC
10.	a) Control Wiring Size (sqmm) b) Insulation Grade(V)	Cu 2.5 1100	Cu 2.5 1100	Cu 2.5 1100
11.	AC Input Supply	400 V ±10% 3ph, 50 Hz	400 V ±10% 3ph, 50 Hz	400 V ±10% 3ph, 50 Hz
12.	Float voltage of Plante Cell (V)	2.15	2.15	2.15
13.	Ampere-hour rating capacity of battery based on discharge rate at 27^oC for (hour)	10	10	10

Battery charger shall be suitable for continuous parallel operation and have a constant current, constant voltage characteristic.

12 **DCDB :**

DC Distribution Bus :

Each Sub-Station shall have one DC Distribution Bus for PLCC. The DC Distribution Bus shall have the following provisions:

a) The DC output from each of the two charger shall be in the range of 48 volt to 55 volt which would be connected through a switch with suitable fuse / MCB to a separate Distribution bus. Each Distribution bus shall have a total of 24 nos. 48V DC outlets, out of which 20 nos. outlets shall be suitable for connecting PLC Terminal / EPAX. Each of the other four nos. 48V DC outlets shall be suitable for

connecting a DC load of 10 amperes. Switches and fuses for all the said 48V DC outlets shall be provided accordingly.

b) There should be another suitable switch for interconnecting the two Distribution buses so that in case of any one charger going out of service the other charger may feed both the distribution buses, in which the total no. of outlets shall be restricted to a maximum of 16 nos.

Connection between battery charger to battery, battery charger to DC Distribution Bus and DC Distribution Bus to different PLCC loads shall have to be done by copper cable of adequate capacity to avoid voltage drop in the associated line. DC bus shall also be of copper of suitable cross section.

The AC. Supply to the battery charger shall also be of copper cable of suitable rating as per relevant IS/IEC.

Separate Earhing for PLCC Equipments have to be done during execution of work at site.